Dubbo Project

Modification 1 Report

State Significant Development 5251

March 2022

Prepared by:

R.W. CORKERY & CO. PTY. LIMITED

Description of Photos

Photo 1	Oblique aerial image of ore body
Photo 2	Railway bridge and surface water sampling
Photo 3	Regenerating White box woodland in Biodiversity Offset Area
Photo 4	Pink-tailed Worm-lizard survey
Photo 5	Indigenous knowledge sharing
Photo 6	Metal pour from furnace
Source: Australian Strategic Materials (Holdings) Ltd	

Dubbo Project

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EXECUTIVE SUMMARY

This *Modification Report* has been prepared by RW Corkery & Co. Pty. Limited on behalf of Australian Strategic Materials (Holdings) Ltd (the Applicant) to support an application to modify State Significant Development (SSD) 5251 for the Dubbo Project (the Proposed Modification).

The Proposed Modification seeks consent for the following.

- Construction and operation of:
  - a Chlor-alkali Plant for the production of hydrochloric acid and sodium hydroxide for use in on-site processing operations;
  - a Brine Concentrator to maximise water recovery; and
  - a conveyor between the Processing Plant and Administration Area and the relocated Salt Encapsulation Cells.
- Relocation of:
  - the Salt Encapsulation Cells from the approved location southwest of the Open Cut to the approved location of the Liquid Residue Storage Facility Area 3;
  - the Solid Residue Storage Facility from the approved location west of the Waste Rock Emplacement to the approved location of the Liquid Residue Storage Facility Area 5; and
  - the Rail Container Laydown and Storage Area from the approved location to an area immediately to the west of the approved location.
- Reclassification of various approved disturbance areas to permit alternate uses.
- Realignment of sections of the approved Macquarie River Water Pipeline, located entirely within the Project Site, and an approximately 600m extension of the pipeline to allow for connection to a water supply bore.
- A range of adjustments to the approved Project Site layout.
- Extended construction hours for non-linear infrastructure to 24-hours per day, seven days per week.
- Extension of the Project life by eight years from 31 December 2037 to 31 December 2045.

The Proposed Modification is required to:

- permit additional processing and value adding activities to ensure the efficient production of metal oxide and raw feed products required to support the Applicant's integrated critical metals business;
- permit on site reagent production, thereby minimising safety and environmental hazards associated with hazardous chemical transportation and reducing reliance upon third-party supply of reagents;

- maximise water recovery and minimise potential water supply constraints identified in the original development application for the Project;
- optimise the Project Site layout to ensure efficient construction, processing, transportation and rehabilitation operations over the life of the Project; and
- accommodate critical Project deadlines and a revised Project schedule, including a two to three year construction and site establishment period and a 20 year mining period.

This application is being made under Section 4.55(2) of the *Environmental Planning and Assessment Act 1979*. The Proposed Modification complies with all preconditions for granting approval, including being substantially the same as the development as originally approved under SSD-5251.

Assessments undertaken for Proposed Modification determined the following.

- Air quality – the Proposed Modification would not result in significant increases in particulate matter concentrations, exceedances of relevant criteria for nitrogen dioxide, sulphur dioxide, hydrogen chloride and chlorine or odour, or significant impacts on greenhouse gas emissions generated by the Project. As a result, the Proposed Modification is unlikely to significantly impact air quality in the vicinity of the Project Site.
- Noise – the Proposed Modification would not result in exceedances of the relevant noise criteria at surrounding receivers and, as a result, the Proposed Modification is unlikely to increase noise-related impacts in the vicinity of the Project Site.
- Lighting and Sky Glow – the Proposed Modification would result in light production commencing slightly earlier in the Project’s life (i.e. during the construction phase rather than the operational phase), however, it would not increase the total lumens emitted to the sky.
- Visual amenity – the proposed modifications to the Project Site include a reduction in the total area to be disturbed as well as reduced final elevations for structures including the Solid Residue Storage Facility and Salt Encapsulation Cells. Consequently, the Proposed Modification would not materially impact on the visual amenity of surrounding residences.

All other environmental aspects are unlikely to be affected by the Proposed Modification.

The Applicant contends that the Proposed Modification would be in the public interest as it would allow the Applicant to operate the Project in an efficient and economically viable manner, providing increased employment opportunities and economic contributions without significant additional environmental impacts.

1. INTRODUCTION

1.1 SCOPE

This *Modification Report* has been prepared by RW Corkery & Co. Pty. Limited on behalf of Australian Strategic Materials (Holdings) Ltd (the Applicant), a subsidiary of Australian Strategic Materials Ltd, to support an application to modify development consent State Significant Development (SSD) 5251 for the Dubbo Project (the Proposed Modification).

The approved Dubbo Project (the Project), previously referred to as the Dubbo Zirconia Project, is located largely to the east of the village of Toongi and approximately 25km south of Dubbo, NSW (**Figure 1**). The approved Project Site layout and the approved Processing Plant and Administration Area layout are shown on **Figure 2** and **Figure 3** respectively.

The Project Site boundary entirely encompasses Mining Lease (ML) 1724 and also includes approved biodiversity offset areas as well as part of an approved growth medium stockpile area immediately east of the ML 1724 boundary.

The Project, classified as State Significant Development in accordance with *State Environmental Planning Policy (State and Regional Development) 2011*, was approved under State Significant Development (SSD) Consent SSD-5251 by the Planning Assessment Commission as delegate of the Minister for Planning on 28 May 2015. The development consent for the Project has not previously been modified.

The Proposed Modification seeks consent for the following. **Figure 7** and **Figure 8** (presented in Section 3) show the proposed modifications to Project Site and the Processing Plant and Administration Area layouts respectively.

- Construction and operation of:
  - a Chlor-alkali Plant for the production of hydrochloric acid and sodium hydroxide for use in on-site processing operations;
  - a brine concentrator to maximise water recovery; and
  - a conveyor between the Processing Plant and Administration Area and the Salt Encapsulation Cells.
- Relocation of:
  - the Salt Encapsulation Cells from the approved location southwest of the Open Cut to the approved location of the Liquid Residue Storage Facility Area 3;
  - the Solid Residue Storage Facility from the approved location west of the Waste Rock Emplacement to the approved location of the Liquid Residue Storage Facility Area 5; and
  - the Rail Container Laydown and Storage Area from the approved location to an area immediately to the west of the approved location.
- Reclassification of various approved disturbance areas to permit alternate uses.

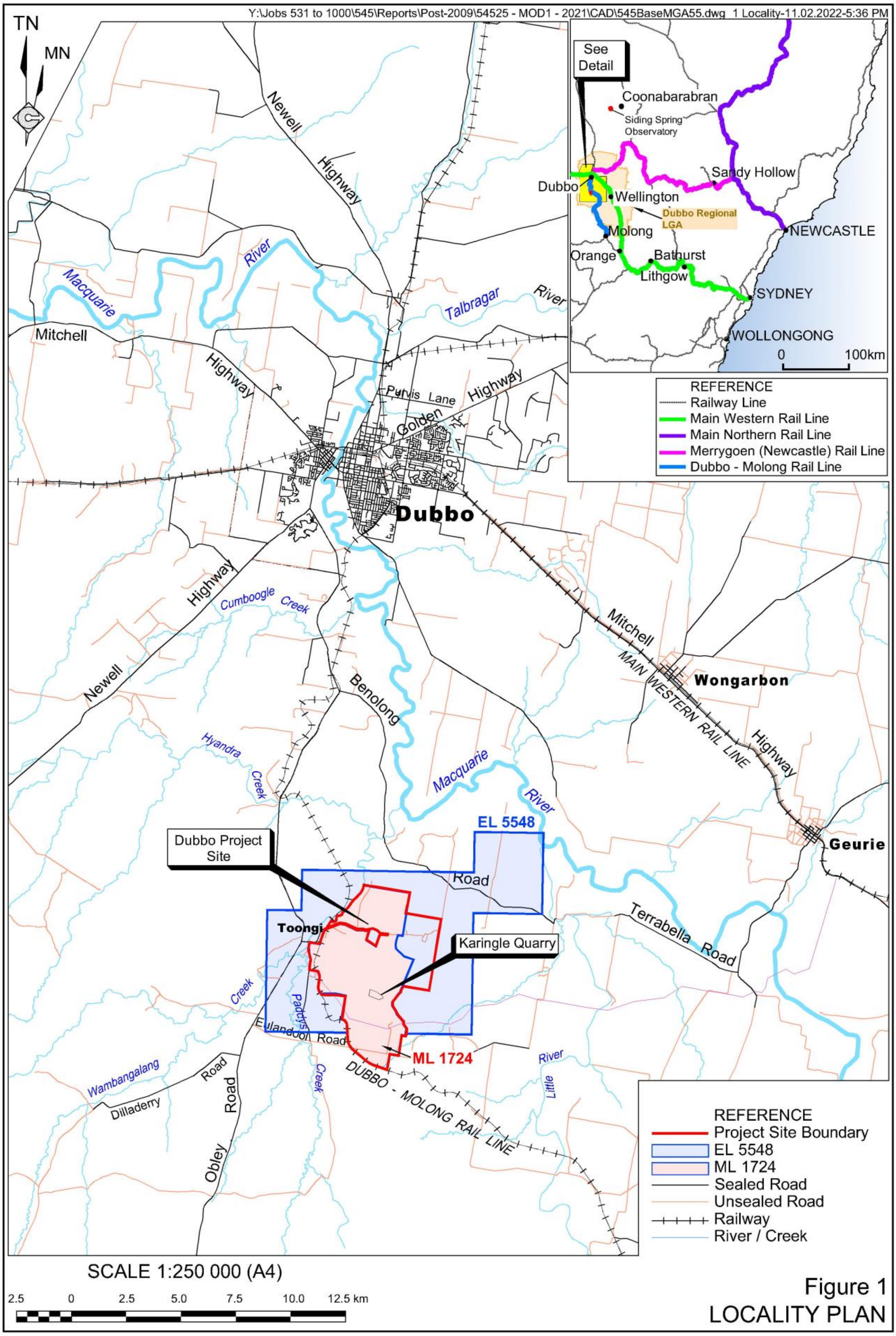


Figure 1
LOCALITY PLAN

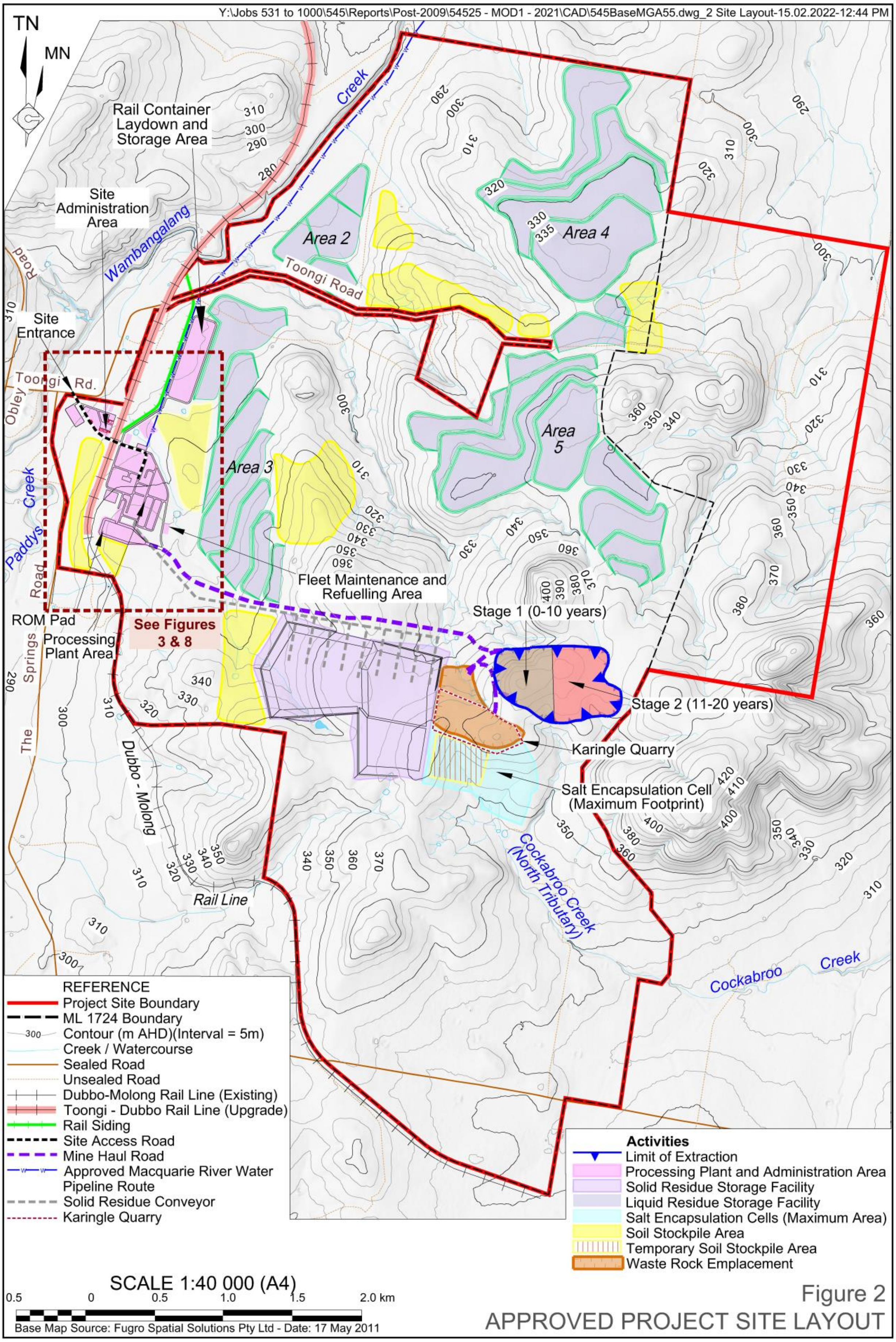
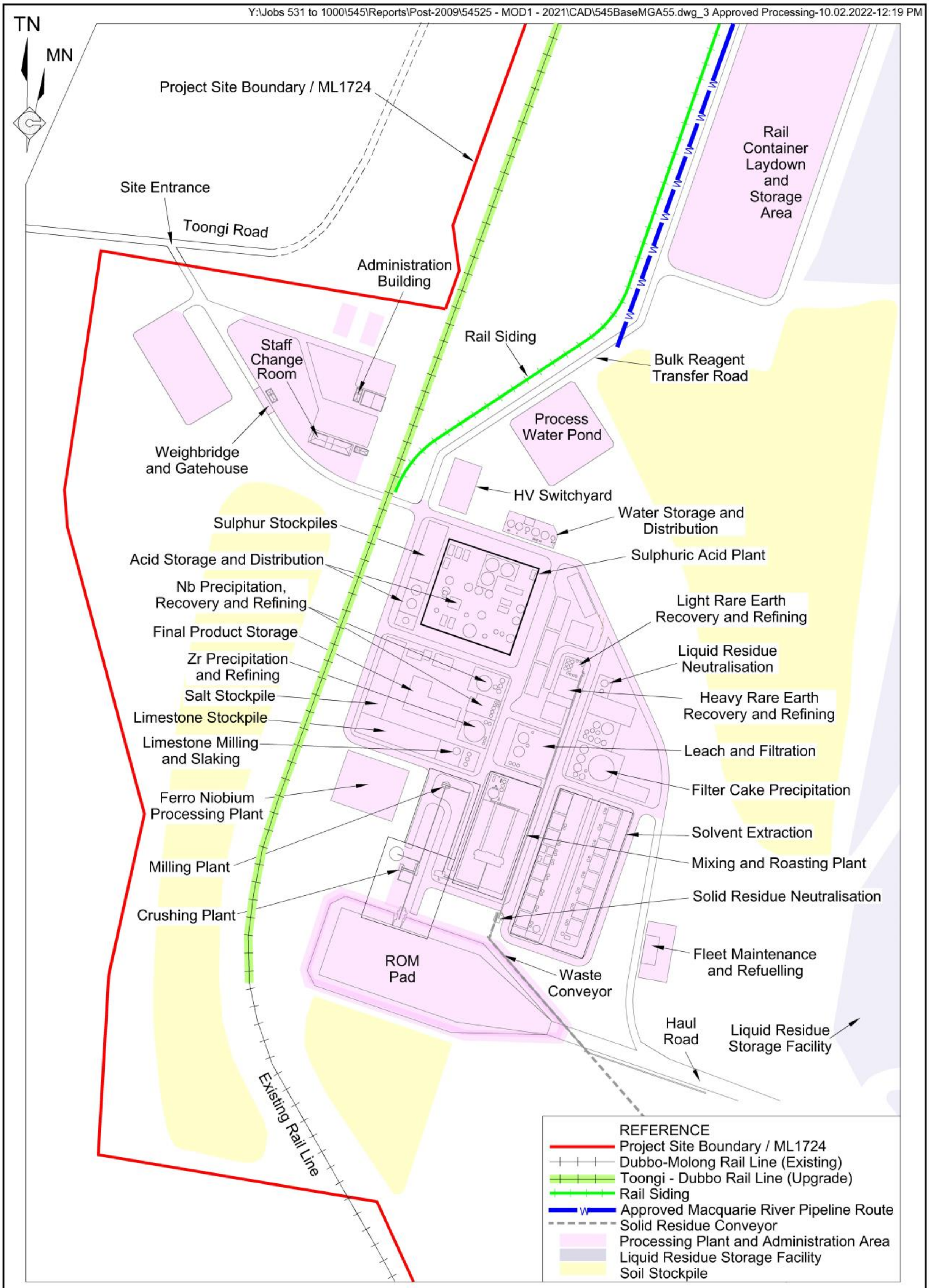


Figure 2
APPROVED PROJECT SITE LAYOUT



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100 0 100 200 300 400 m

Source: EPMS

Figure 3
APPROVED PROCESSING PLANT
AND ADMINISTRATION AREA LAYOUT

- Realignment of sections the approved Macquarie River Water Pipeline, located entirely within the Project Site.
- A range of adjustments to the approved Project Site layout.
- Extended construction hours for non-linear infrastructure to 24-hours per day, seven days per week.
- Extension of the Project life by eight years from 31 December 2037 to 31 December 2045.

In addition, the Applicant would seek separate approval for realignment of the following (see **Figure 4** for the approved locations).

- A section of the approved 132kV Electricity Transmission Line.
- The approved gas pipeline to remove the pipeline from the Dubbo – Molong Railway corridor.

The application to modify SSD-5251 is made under Section 4.55(2) of the *Environmental Planning & Assessment Act 1979 (EP&A Act)*. This *Modification Report* has been prepared to support that application and is generally consistent with the *State Significant Development Guidelines* (version dated July 2021) (SSD Guidelines) (DPIE, 2021a) and specifically Appendix E to the SSD Guidelines: *State Significant Development – Preparing a Modification Report.*

No formal assessment requirements were issued by the Department of Planning, Industry and Environment (DPIE) in response to the Briefing Paper submitted on 19 August 2021 which outlined the Proposed Modification. Details of consultation undertaken with government agencies and the community as part of the Proposed Modification are provided in Section 5.

1.2 THE APPLICANT

The Applicant, Australian Strategic Materials (Holdings) Ltd, is a wholly-owned subsidiary of Australian Strategic Materials Ltd (ASM). ASM was demerged from Alkane Resources Limited (Alkane) in July 2020. ASM is an emerging integrated producer of critical metals for advanced and clean technologies. The Company has a “mine to metal” strategy to extract, refine and manufacture high-purity metals, alloys and powders, supplying direct to global manufacturers in clean energies, electric vehicles, aerospace, electronics and communications. The Dubbo Project is proposed to supply value added raw materials for further processing at the Company’s metals plant in South Korea.

ASM is led by a highly experienced Board comprising well respected mining, business and technical experts. The Board is supported by an executive leadership team with broad experience in constructing and managing large scale mining and other projects.

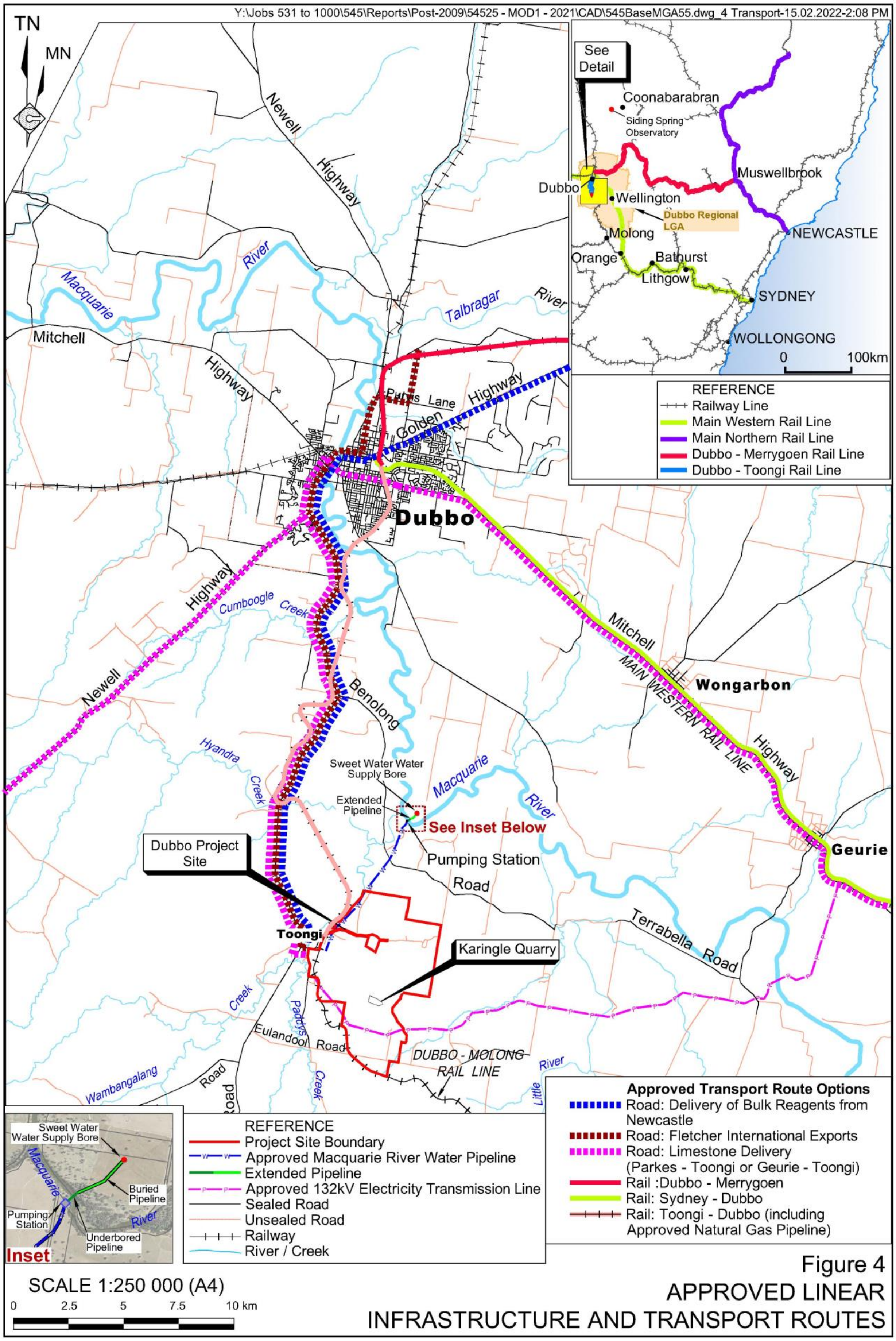


Figure 4
APPROVED LINEAR INFRASTRUCTURE AND TRANSPORT ROUTES

1.3 BACKGROUND

1.3.1 Approved Activities

Activities approved under SSD-5251, include the following (**Figure 2** and **Figure 3**).

- Mining and extraction of approximately 19.5Mt of ore at a maximum rate of 1 million tonnes per annum (Mtpa) from an Open Cut developed to a maximum depth of 32m (355m AHD) until 31 December 2037.
- Extraction and placement of approximately 3.5Mt of waste rock within a small Waste Rock Emplacement to the southwest of the Open Cut.
- Haulage of ore to a Run-of-Mine (ROM) Pad and crushing and grinding of that material.
- Processing of the crushed and ground ore using the following methodology.
  - Production of sulphuric acid, sulphation roast of ore and leaching to dissolve sulphated metals.
  - Solvent extraction, precipitation, thickening, washing and drying of the various rare metals and rare earth element products.
- Construction and operation of a rail siding from the Toongi-Dubbo Rail Line and a Rail Container Laydown and Storage Area for the unloading and temporary storage of reagents and loading of products for despatch.
- Transportation by rail, including up to 3 trains from the site per week.
- Transportation by road via the public road network, with Obley Road and Toongi Road to be upgraded (approximately 22km length) to accommodate heavy vehicle traffic (**Figure 4**). Receipt and despatch of up to 75 laden trucks to or from the Project Site per day and up to 16 laden trucks per hour.
- Mixing and neutralisation of solid residues produced by the processing of ore with crushed limestone and transportation via a conveyor to a Solid Residue Storage Facility.
- Pumping of water used in processing operations, which cannot be recycled, to a Liquid Residue Storage Facility, comprising a series of terraced and lined crystallisation cells.
- Recovery and disposal of an estimated 6.7Mt of salt, which would accumulate within the Liquid Residue Storage Facility, within a series of Salt Encapsulation Cells adjoining the Waste Rock Emplacement and Solid Residue Storage Facility.
- Other ancillary activities including equipment maintenance, clearing, and stripping of the areas to be disturbed and rehabilitation activities.
- Construction of the Macquarie River Water Pipeline and associated infrastructure including a pumping station (**Figure 4**).
- Construction of a natural gas pipeline between the Central West Pipeline at Purvis Lane, Dubbo, and the Project Site (**Figure 4**).

- Construction of a 132kV Electricity Transmission Line (approximately 30km length) between a substation located to the south of Geurie and the Project Site (**Figure 4**).
- Refurbishment of an approximately 27km length of the Dubbo – Molong Railway to a Class 1 track and replacement, upgrade or reinstatement of associated infrastructure (e.g. bridges, culverts, level crossings) (**Figure 4**).

Table 1 lists the approved hours of operation for Project.

Table 1
Approved Hours of Operation

Activity	Operating Hours
Mining operations (excluding operation of the ore processing facility).	7:00am to 6:00pm, Monday to Friday. 8:00am to 5:00pm, Saturday. No activities on Sundays or Public Holidays.
Operation of the ore processing facility. Receipt of processing reagents.	24 hours per day, 7 days per week.
Construction of linear infrastructure.[1]	7:00am to 6:00pm, Monday to Friday. 8:00am to 1:00pm, Saturday. No activities on Sundays or Public Holidays.
Other construction activities.	7:00am to 6:00pm, Monday to Friday. 8:00am to 1:00pm, Saturday. No activities on Sundays or Public Holidays unless noise from these activities does not result in any exceedances of relevant noise criteria[2] at any privately-owned residence.
Dispatch of refined ore products. Receipt of limestone products.	6:00am to 10:00pm, Monday to Friday. 8:00am to 5:00pm, Saturday. No activities on Sundays or Public Holidays.

Note 1: Linear infrastructure includes the rail line upgrade, construction of water and gas pipelines, and road-realignment and upgrades.

Note 2: Relevant noise criteria identified under Condition 4 of Schedule 3 of SSD-5251 include 35 dB(A) ($L_{Aeq(15\ min)}$) during day, evening and night periods and 45 dB(A) ($L_{A1(1\ min)}$) during the night period.[3]

Note 3: Day: the period from 7:00am to 6:00pm, Monday to Saturday, and 8:00am to 6:00pm, Sundays and Public Holidays.
Evening: the period from 6:00pm to 10:00pm.
Night: the period from 10:00pm to 7:00am, Monday to Saturday, and 10:00pm to 8:00am, Sundays and Public Holidays.

Source: Condition 3 of Schedule 3 of SSD-5251.

In order to compensate for the approved vegetation disturbance, the Applicant has established a Biodiversity Offset Area as follows (**Figure 5**).

- NSW EP&A Act Biodiversity Offset – comprising an area of 1 021ha secured under Conservation Property Vegetation Plan (PVP 00199) prepared in satisfaction of Condition 32 of Schedule 3 of SSD-5251.
- EPBC Act Biodiversity Offset – comprising a subset of the PVP 00199 specifically to account for clearing of up to 35.3ha of *Aprasia parapulchella* (Pink-tailed Worm-lizard, also known as the Pink-tailed Legless Lizard) habitat, approved under approval EPBC 2012/6625.

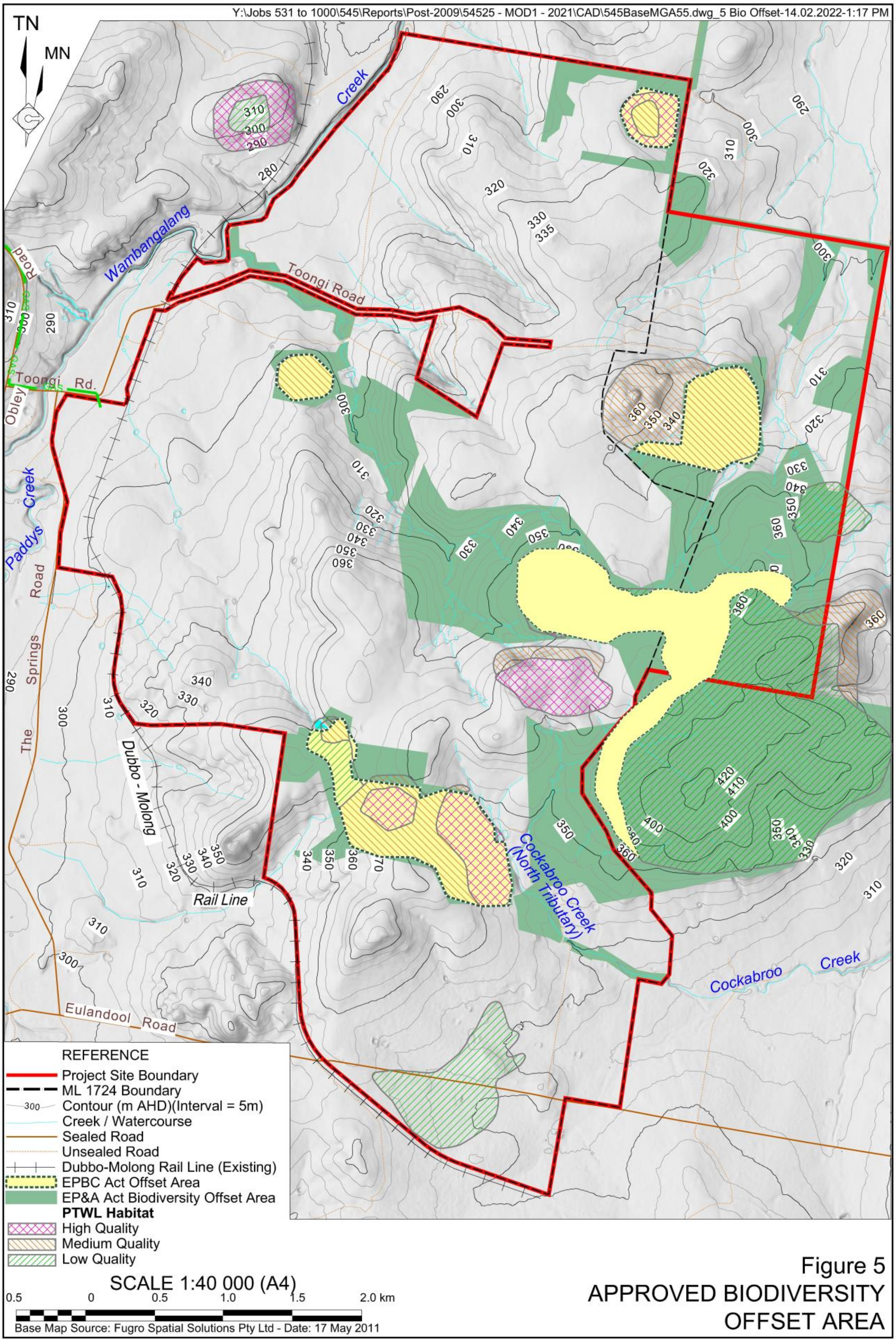


Figure 5
APPROVED BIODIVERSITY OFFSET AREA

Fencing of the Biodiversity Offset Area was completed by 30 June 2019 and management of that area is ongoing.

The Applicant also owns and will operate the Karingle Basalt Quarry (DA D2016-70) (**Figure 2**), located within the Project Site. Basalt from the Karingle Basalt Quarry will be used for on-site construction, Obley Road upgrade works and as railway ballast for the Toongi-Dubbo Rail Line refurbishment works.

1.3.2 Construction and Operation of the Project

Construction of the approved Dubbo Project is proposed to physically commence on 1 March 2022 with the commencement of civil works and construction of a Site Office. The site office to be used for the management of construction operations, including housing the site management and supervision team. Substantive construction operations are expected to commence in early 2023 and will require slightly more than 2 years to complete (i.e. 2023 to 2025).

Following completion of construction, mining and processing operations would commence and are expected to require a further 20 years (i.e. 2025 to 2045).

1.3.3 Sensitive Receivers

Figure 6 shows sensitive receivers, including residential and recreational receivers, in the vicinity of the Project Site. Individual receiver IDs presented in the original Environmental Impact Statement for the Project, hereafter referred to as RWC (2013), have been retained to permit comparison of potential environmental impacts. Receivers R1 – R3, R48, R49A, R49B, R51, R54 – R56, and R58 are considered Project-related receivers as they are owned or controlled by the Applicant or under agreement for sale to the Applicant.

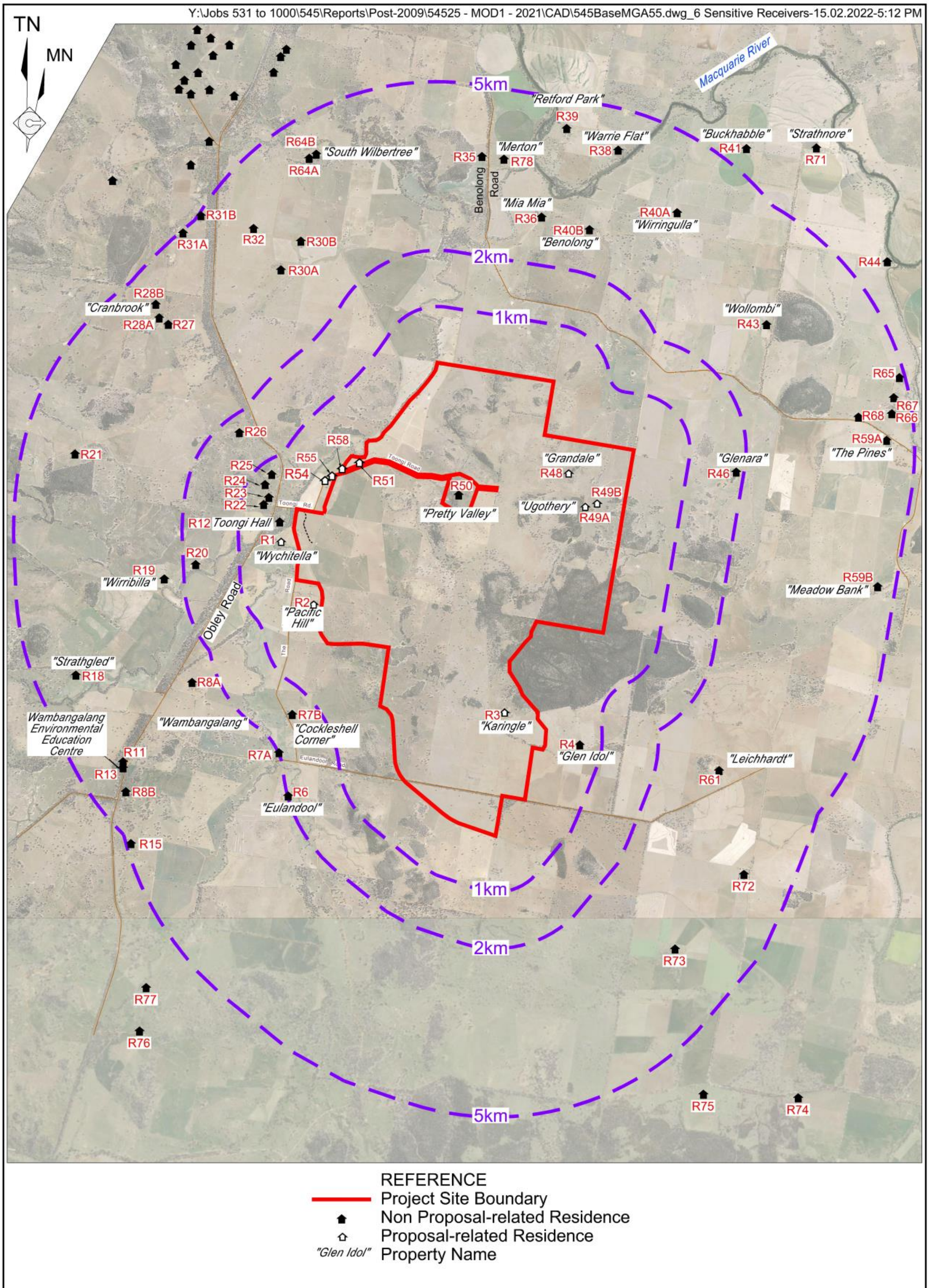
The Applicant also has an option to purchase Lot 312 DP595631 which includes receiver R50 upon the landowner’s request.

1.4 NEED FOR THE MODIFICATION

1.4.1 Introduction

Following the granting of SSD-5251 on 28 May 2015, the Applicant has undertaken a range of studies and investigations targeting the optimising of the design and operation of the Project. Studies and investigations which have informed the need for the Proposed Modification include the following.

- *Optimised Feasibility Study (draft stage)* (Australian Strategic Materials (Holdings) Ltd, August 2021).
- Geotechnical Investigation – Dubbo Zirconia Project (Macquarie Geotech, November 2014).
- Solid Residue Storage Facility Review and Concept Design (GHD, February 2017).



SCALE 1:100 000 (A4)

1 0 1 2 3 4 5 km

Base Photo Source: LPI - October 2009

Figure 6
SENSITIVE RECEIVERS

- *Karingle Basalt Quarry* (Macquarie Geotech, August 2017).
- *Karingle Basalt Quarry and Haul Road* (Tomingley Gold Operations, January 2018).
- Obley Road Upgrade – Impact of 110km/hour Design Speed Requirement (Constructive Solutions, November 2017).
- ASM Sourcing Reagents Logistics Report (R. Shepherd, March 2021a).
- *Road Rail Reagent Summary* (version 22) (R. Shepherd, June 2021c).
- Dubbo to Toongi Improvement Project (Railway Refurbishment) (CR Rail, April 2021).
- Natural Gas Supply Study (Enscope, March 2021).
- *MHE Hardscape Design and Use* (R. Shepherd, July 2021d).
- *Chlor-alkali Plant Option* (W. Dicinoski, August 2021).

As a result of the above studies and investigations, the Applicant has identified a number of adjustments to the approved Project Site layout and operations which are required in order to maximise the efficiency of mining, processing and transportation operations on site.

1.4.2 Integration into the Applicant's Supply Chain

The Applicant has developed a "mine to metal" strategy to extract, refine and manufacture high-purity metals and alloys, supplying direct to global technology manufacturers. The Company states that its integrated critical metals business is founded on a proprietary metallisation process that converts oxides into high-purity metals. Following a successful commercial piloting phase, the Applicant has constructed a metals plant in Ochang Province, South Korea to supply a range of critical metals including rare earths (e.g. neodymium, praseodymium and dysprosium), zirconium and titanium. This will pave the way for further metals plants in globally strategic locations.

The Project is a key sustainable and secure source of critical metal oxides and raw feed for the Applicant's proposed metal plant(s). However, in order to ensure efficient and effective implementation of the Applicant's growth strategy, the final products produced by the Project require further processing and value adding. The additional processing requirements requires that the Proposed Modification be approved to permit those activities.

1.4.3 Adjustments to Processing Plant Area and Water Recovery

Processing Plant and Brine Concentrator

The Applicant is seeking consent to modify the approved processing plant layout, including the installation of a brine concentrator. The approved processing plant would recover rare metals and rare earth elements for further processing off site. Modifications to the processing plant layout would enable the Applicant to further value add the products produced on site. The installation of the brine concentrator would maximise water recovery from the processing operations by dewatering the brine waste and collecting fresh water in the process (see **Figure 7** in Section 3.1).

Relocation of the Rail Container Laydown and Storage Area

The Applicant is seeking consent to relocate and make adjustments to the approved Rail Container Laydown and Storage Area (**Figures 2** and **7**). This modification is required for the following reasons (Shepherd, 2021b).

- The approved rail siding would not be constructed. The relocated location would facilitate unloading and storage of containers adjacent to the upgraded Dubbo – Molong railway line.
- The proposed Rail Container Laydown and Storage Area location is adjacent to the proposed Chlor-alkali Plant and would allow for reduced movement of imported reagents once on site.

Relocation of Growth Medium Stockpile Areas

The relocation of Growth Medium Stockpile Areas would be required to accommodate the proposed Site Layout and to minimise transportation distances during site preparation and rehabilitation activities.

1.4.4 Construction of Chlor-alkali Plant

The approved processing operations require large volumes hydrochloric acid (HCl) and sodium hydroxide (NaOH). The reliability of third-party supply of such large quantities is a serious constraint to the Project (Bob Shepherd Consulting, 2021).

An on-site Chlor-alkali Plant would reduce the complex logistics requirements of transporting large volumes of HCl and NaOH. The Proposed Modification would guarantee supply and minimise safety and environmental risks associated with hazardous chemical transport (Bob Shepherd Consulting, 2021).

1.4.5 Relocation of the Salt Encapsulation Cells and Solid Residue Storage Facility

Modifications to the water recovery processes through the installation of a brine concentrator would result in changes to the residue produced by the processing plant and the following modifications to the Salt Encapsulation Cells and Solid Residue Storage Facility.

- Relocation of the salt encapsulation cells to be closer to the processing plant.
- Decrease in the total area of Liquid Residue Storage Facility and to allow for the relocation of the Solid Residue Storage Facility and to account for reductions in wastewater generated by the Project.

1.4.6 Project Life Extension and Change to Construction Operating Hours

Extension of the Project Life

Extending the Project life is required to allow for:

- construction operations are only commencing in 2022, not 2015 when the Project was originally approved;

- a two to three-year construction and site establishment period (i.e. 2022 to 2024); and
- a 20-year mining operations period (i.e. 2025 to 2045).

As a result, the Project life is proposed to be extended by eight years from 31 December 2037 to 31 December 2045.

Change to Construction Operations Hours

The Applicant is seeking to modify the approved construction hours for non-linear infrastructure (i.e. 'other' construction activities identified in **Table 1**) to allow construction to occur 24-hour per day, seven days per week. This modification is needed to ensure construction of the processing plant and site infrastructure would be completed expeditiously and in line with critical project deadlines.

1.5 ALTERNATIVES CONSIDERED

1.5.1 Introduction

In preparing the Proposed Modification, the Applicant considered a range of alternatives. This section presents an overview of the feasible alternatives considered and rejected during the planning phase of the Proposed Modification.

1.5.2 Solar Crystallisation vs Brine Crystallisation Plant

Section 3.4.2 presents a description of the approved and modified brine crystallisation process. In summary, the approved process relied on very large Liquid Residue Storage Facilities that would evaporate the liquid residue to produce a salt that would then be encapsulated. This would:

- disturb approximately 413ha of land;
- result in evaporation and loss of a substantial quantity of water, requiring larger volumes of makeup water than would otherwise be the case; and
- require management during periods of elevated rainfall to ensure nil discharge.

The proposed brine concentrator would minimise the impact of each of the above issues. It would, however, require additional power consumption. The Applicant would, seek to minimise impacts associated with increased power consumption through purchase of renewable power or other mechanisms.

As a result, the proposed Brine Crystallisation Plant is considered to be the preferable alternative.

1.5.3 Importation of HCl and NaOH vs Chlor-Alkali Plant

Section 3.4.3 presents a description of the approved reagent importation regime, as well as the proposed Chlor-alkali Plant. The approved reagent importation scheme would require substantial volumes of hydrochloric acid and sodium hydroxide (both dangerous goods) be imported to site, whereas the proposed Chlor-alkali Plant would require importation of salt only.

Given the reduction in the requirement to transport Dangerous Goods to site, the proposed Chlor-alkali Plant is considered to be the preferable alternative.

1.5.4 Filtered vs Pumped Solid Residue

Section 3.4.4 presents the approved and proposed solid residue management regime. Test work subsequent to the granting of SSD-5251 identified that filtration of the solid residue was unlikely to be practicable. As a result, pumping the solid residue as a slurry to the relocated Solid Residue Storage Facility and recovering water from that Facility is considered to be a preferable alternative.

1.5.5 No Product Refinement or Value Adding

Section 1.4.2 describes how the Proposed Modification would facilitate integration of the Project into the Applicant’s supply chain. As well as maximising the value adding component of the metal production process within NSW, the Project would be unlikely to receive financing without assurance that a long-term, secure market exists for the products to be produced.

1.5.6 Revised Project Site Layout

The Proposed Modification includes a range of revisions to the approved Project Site layout. The revised Project Site layout has been carefully designed to:

- minimise the distance that materials are required to be transported;
- maximise the area of non-native or disturbed vegetation that would be removed and maximise retention of higher quality native vegetation and habitat; and
- minimise potential impacts associated with surface water drainage, including moving approved components away from watercourses.

2. STRATEGIC CONTEXT

2.1 STRATEGIC PLANS

2.1.1 Central West and Orana Regional Plan 2036

The *Central West and Orana Regional Plan 2036* (the Plan) published by the NSW Department of Planning and Environment in June 2017 sets out the NSW Government's blueprint for the future of the Central West and Orana Regions to 2036. The Plan covers an area including Nyngan and Condobolin in the west, Cowra in the South, Oberon and Lithgow in the east and Coonamble and Coonabarabran in the north. The Plan identifies four goals, each with multiple sub-goals or directions, as follows. The following identifies how the Proposed Modification is consistent with each of those goals.

Goal 1 – The most diverse regional economy in NSW

The Plan identifies that agriculture, manufacturing and mining are the Regions' traditional industries. However, health, education and tourism sectors present new opportunities for economic growth. The Proposed Modification would be consistent with the following Directions.

- Direction 1: Protect the region's diverse and productive agricultural land.

  The Proposed Modification would not result in an increase in the area of disturbance of agricultural land reduced agricultural productivity.

- Direction 6: Expand education and training opportunities

  The Proposed Modification would permit the Applicant to employ additional apprentices and trainees and contribute to training programs for the local community.

- Direction 8: Sustainably manage mineral resources.

  The Proposed Modification would maximise the economic and other benefits arising from the identified resource through value adding processing operations on site.

Goal 2 – A stronger, healthier environment and diverse heritage

The Plan identifies that the Regions have some of Australia's most unique ecological systems and that achieving environmentally sustainable development will balance rural and urban compatibility issues. The Proposed Modification would be consistent with the following Directions.

- Direction 13: Protect and manage environmental assets

  The Proposed Modification would not result in an increase in the total disturbance area associated with the Project.

- Direction 14: Manage and conserve water resources for the Environment

  The Proposed Modification would not result in increased risk of adverse impacts to water quality or quantity and would not impact on existing control and management measures.

- Direction 16: Respect and protect Aboriginal heritage assets

  The Proposed Modification would not result in disturbance of additional Aboriginal objects.

Goal 3 – Quality freight, transport and infrastructure networks

The Plan identifies that the Central West and Orana regions are a major exporter of agricultural, mining and other value-added products and rely on efficient freight and transport infrastructure. The Proposed Modification would, not result in additional road traffic compared with the approved Project and would bring forward the approved upgrading and commissioning of the Dubbo – Molong railway between Dubbo and Toongi.

Goal 4 – Dynamic, vibrant and healthy communities

The Plan identifies that Central West and Orana is home to some of the most diverse communities in NSW. Population growth will not be evenly distributed, with larger towns such as Orange, Bathurst, Mudgee and Dubbo expected to grow, while the population of other smaller towns and villages is likely to remain relatively stable or in some cases decline. These smaller communities can grow and prosper by leveraging economic opportunities and jobs from an increasing number of value-adding investments.

The Proposed Modification would be consistent with the following Directions.

- Direction 23: Build the resilience of towns and villages.

  The Proposed Modification would ensure continued operation of the Mine at least until 31 December 2045. This would help support the small villages and towns surrounding the Project Site, including Toongi, Wambangalang, Tomingley, Obley and Dubbo, and provide additional economic activity in those communities.

- Direction 24: Collaborate and partner with Aboriginal communities.

  The Applicant, through its prior association with Alkane Resources Ltd, and since has a long history of collaborating with the Dubbo Aboriginal community including the Dubbo Aboriginal Community Working Party, Three Rivers Regional Assembly, Dubbo Local Aboriginal Land Council and Elders. The Proposed Modification would provide the resources for that ongoing collaboration to continue.

2.1.2 Dubbo Region Community Strategic Plan 2040

The *Dubbo Regional Community Strategic Plan 2040* provides the community vision and aspirations for the future of the Dubbo Region and a long-term framework to guide and influence delivery of that vision. Developed through feedback with the community, the Plan identifies a number of guiding themes. The following also identifies how the Proposed Modification is consistent with several of those themes.

Theme 2 – Infrastructure

The Proposed Modification would ensure investment in public infrastructure upgrades benefiting the village of Toongi, the refurbishment of a section of the Molong-Dubbo Rail line, and natural gas pipeline construction. In addition, the Proposed Modification would provide increased opportunities for the use of renewable energies consistent with action 2.1.

Theme 3 – Economy

The Proposed Modification would ensure the operations of the Mine until 31 December 2045. This is consistent with the expectations of the community for the support of business, industry and mining and the opportunity to attract skilled professionals to the region.

Theme 5 – Liveability

The Proposed Modification would be consistent with the actions identified under this theme including support for the surrounding villages as detailed in action 5.1. Protecting sensitive environments and endangered ecological communities (action 5.10) is supported by the detailed environmental assessment process that the Project has undergone.

Noise, dust, lighting, and traffic impacts associated with the Proposed Modification have been assessed and determined to remain below the relevant assessment criteria. There would be no additional impacts to heritage, surface water, groundwater, visual amenity, or other environmental impacts. As a result, the Proposed Modification would be consistent with this theme identified in the Plan.

2.2 COMMUNITY VIEWS

Section 5.2 provides an overview of the community engagement that has been undertaken by the Applicant in relation to the Mine, the Proposed Modification and associated activities. In summary, no issue or concerns have been received in relation to the Proposed Modification.

2.3 ECONOMIC AND SOCIAL TRENDS

The Australian Bureau of Statistics provides a range of data in relation to economic and social trends within the Dubbo Statistical Area. This area includes the towns of Narromine, Dubbo, Wellington, Gilgandra and Coonabarabran, as well as the village of Toongi. That data identifies the following economic and social trends surrounding the Project Site.

- Industry - agriculture is an important industry employing 10.8% of the workforce in 2016, down from 11.3% in 2011. Mining, while employing 1.1% of the workforce in 2016, up from 0.9% in 2011 is an important and growing contributor to the economy. As a result, the Proposed Modification, particularly the extended life of the Project, would continue to support the local economy through the provision of jobs in this important industry.
- Income – the median income, excluding welfare payments, within the Dubbo Statistical Area was $44,078 in 2016. This compares with substantially higher salaries paid by the Applicant to its workers, the majority of whom live locally. As a result, the Proposed Modification would extend the time that the Applicant is able to support the local economy through the provision of wages and other benefits.

Anecdotally, the Applicant understands that despite the end of the drought, challenging agricultural conditions of past years are continuing to have a significant impact on rural communities surrounding the Project Site, including reduced employment, consumption and economic activity and the associated social impacts that entails. The Proposed Modification would ensure that the Applicant is able to employ local workers and contribute to a local, diverse economy for many years. Should the Applicant cease to proceed with the development of the Project there would be substantial economic and social advantages lost.

2.4 ENVIRONMENTAL TRENDS

The Applicant notes that the recent end of the 2019 and 2020 drought has resulted in substantial improvement in the health of the surrounding environment. Through considered design of the Project, the Applicant is aiming to demonstrate that mining, agriculture and biodiversity conservation activities can be integrated successfully at the Project Site. The Proposed Modification would not result in significant environmental impacts and those impacts that would occur would be within relevant criteria and, in the case of biodiversity-related impacts, would be offset in accordance with the relevant requirements.

2.5 STRATEGIC SUPPORT FOR THE PROJECT

The Dubbo Project was selected by the NSW Government to launch its Critical Minerals and High-tech Metals Strategy in November 2021. The Commonwealth Government has also established a Critical Minerals Facilitation Office to help establish Australia as a global leader in the ethical and environmentally responsible supply of critical minerals.

In light of the above, the Applicant contends that there is strong strategic support for the operation of the Mine and, therefore, for the Proposed Modification.

3. DESCRIPTION OF THE MODIFICATION

3.1 INTRODUCTION

The Proposed Modification seeks consent for the construction and operation of a range of additional plant, the relocation and realignment of a range of approved Project components, an increase on the approved reagent transportation rate and an extension of the life of the Project. The Proposed Modification would not result in any other changes to the approved Project. The following subsections describe the Proposed Modification.

3.2 OVERVIEW OF THE PROPOSED MODIFICATION

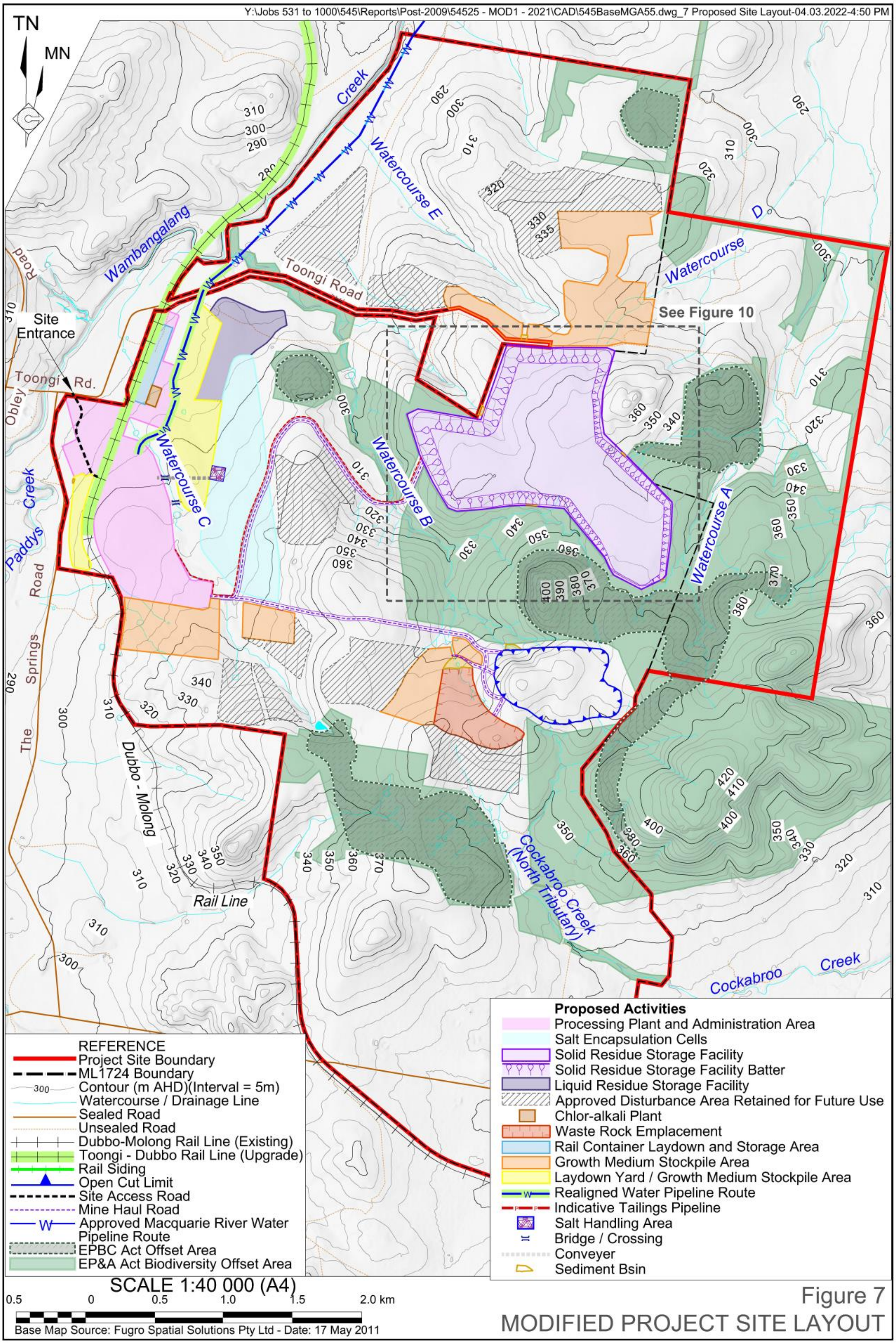
Table 2 presents a comparison of the approved Project and the Proposed Modification. **Appendix 1** presents a consolidated project description for the Project which incorporates the changes outlined under the Proposed Modification. **Appendix 2** provides an updated table of mitigation measures for the Project under the Proposed Modification.

3.3 MODIFIED PROJECT SITE LAYOUT

3.3.1 Introduction

The approved Project Site layout and Processing Plant and Administration Area layout for the Project are shown on **Figure 2** and **Figure 3** respectively. The proposed Project Site layout and Processing and Administration Area layout are shown on **Figure 7** and **Figure 8** respectively. Key changes to the Project Site layout under the Proposed Modification include the following.

- Modified Processing Plant and Administration Area, including the addition of:
  - a Chlor-Alkali Plant (see Section 3.4.3); and
  - a Brine Concentrator (see Section 3.4.2).
- The relocation of approved infrastructure areas within the Project Site, including the Solid Residue Storage Facility, Salt Encapsulation Cells, and the Rail Container Laydown and Storage Yard.
- Reclassification of approved disturbance areas to facilitate efficient usage during construction and operational phases of the Project.
- Reclassification of areas which will not be disturbed under the Proposed Modification.



Base Map Source: Fugro Spatial Solutions Pty Ltd - Date: 17 May 2011

Figure 7
MODIFIED PROJECT SITE LAYOUT

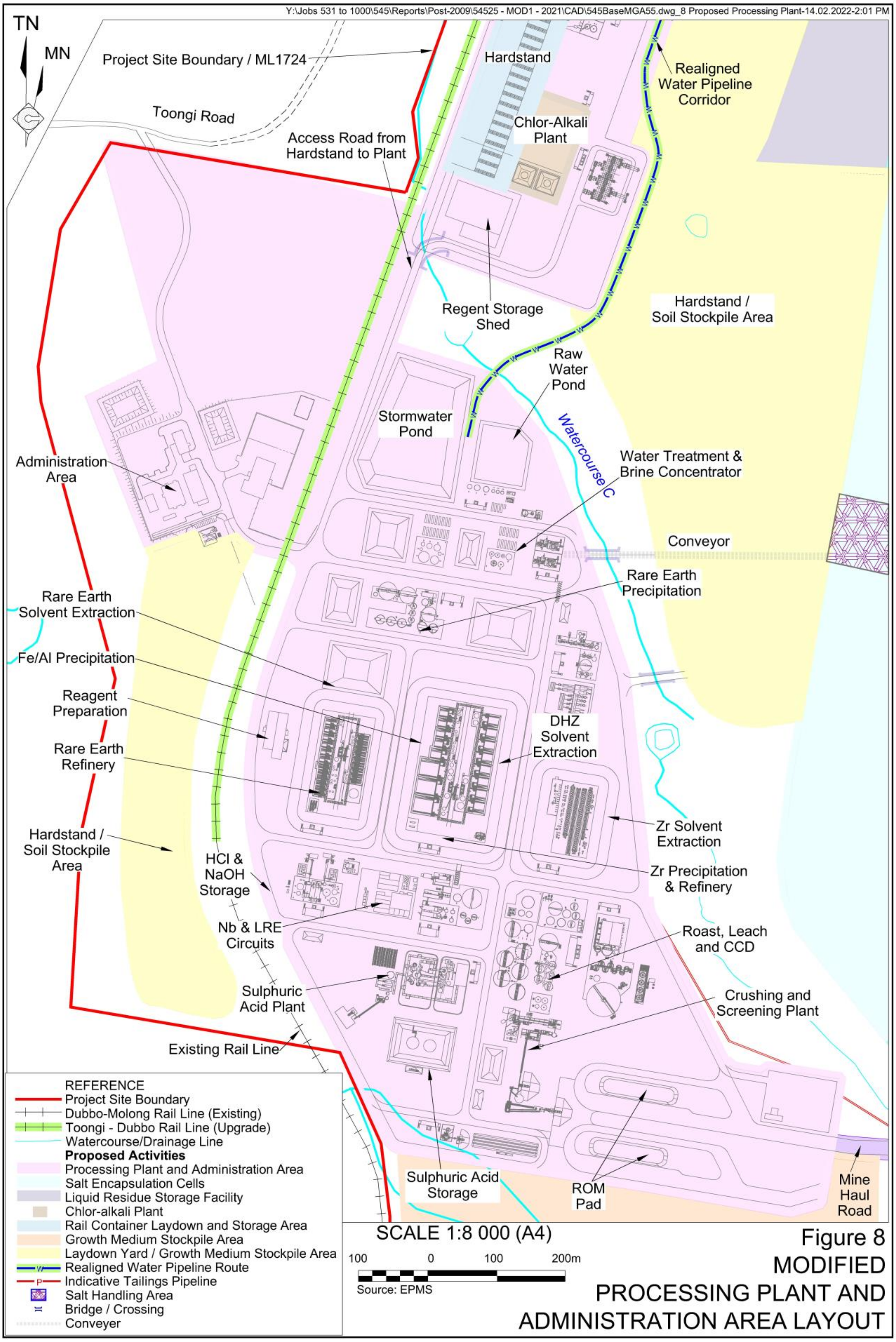


Figure 8
MODIFIED PROCESSING PLANT AND ADMINISTRATION AREA LAYOUT

Table 2
Overview of the Proposed Modification

Page 1 of 3

<table>
<tr><th>Component</th><th>Approved Project
(SSD-5251)</th><th>Proposed Modification
(MOD 1)</th></tr>
<tr><td>Project Life</td><td>• Mining operations until 31 December 2037.</td><td>• Mining operations until 31 December 2045.</td></tr>
<tr><td>Operational Hours</td><td>
<table>
<tr><th></th><th>Monday to Friday</th><th>Saturday</th><th>Sunday and Public Holidays</th></tr>
<tr><td>Mining</td><td>7am - 6pm</td><td>8am - 5pm</td><td>nil</td></tr>
<tr><td>Processing</td><td colspan="3">24-hours</td></tr>
<tr><td>Construction – linear infrastructure</td><td>7am - 6pm</td><td>8am - 1pm</td><td>nil</td></tr>
<tr><td>Construction – other</td><td>7am - 6pm</td><td>8am - 1pm</td><td>Nil unless noise compliant</td></tr>
<tr><td>Dispatch of products/receipt of limestone</td><td>6am – 10pm</td><td>8am – 5pm</td><td>nil</td></tr>
</table>
</td><td>
<table>
<tr><th></th><th>Monday to Friday</th><th>Saturday</th><th>Sunday and Public Holidays</th></tr>
<tr><td>Mining</td><td colspan="3" rowspan="3">No change</td></tr>
<tr><td>Processing</td></tr>
<tr><td>Construction – linear infrastructure</td></tr>
<tr><td>Construction – other</td><td colspan="3">24-hours</td></tr>
<tr><td>Dispatch of products/receipt of limestone</td><td colspan="3">No change</td></tr>
</table>
</td></tr>
<tr><td>Site Layout</td><td>• See Figures 2 and 3</td><td>• See Figures 7 and 8</td></tr>
<tr><td rowspan="2">Mining Operations</td><td>• Extraction and processing of up to 1 million tonnes of ore per calendar year.</td><td>• No change.</td></tr>
<tr><td>• Development of a single Open Cut to a maximum depth of 360 m AHD.</td><td>• No change.</td></tr>
<tr><td>Waste Rock Management</td><td>• Construction of a single Waste Rock Emplacement to a maximum height of 42m above existing ground level.</td><td>• No change.</td></tr>
<tr><td>Processing Operations</td><td>• Ore stockpiling at the ROM Pad
• Crushing and grinding circuit
• Sulphuric acid production
• Roasting circuit
• Solvent extraction circuit
• Limited refining</td><td>• Construction and operation of a brine concentrator.
• Construction and operation of a Chlor-alkali Plant for the production of hydrochloric acid and sodium hydroxide.</td></tr>
</table>

Table 2 (Cont'd)
Overview of the Proposed Modification

Page 2 of 3

Component	**Approved Project (SSD-5251)**	**Proposed Modification (MOD 1)**
Solid Residue Management	• Solid Reside Storage Facility. • Semi-dry solid residue as filter cake (neutral pH) conveyed to the Solid Residue Storage Area. • 20 million cubic metres (Mm^3) of solid residue waste generated over the life of the Project.	• Relocated Solid Residue Storage Facility. • Solid residue as slurry (neutral pH) pumped to the Solid Residue Storage Facility for drying and consolidation. • 22.3Mm^3 of solid residue waste generated over the life of the Project.
Liquid Residue / Salt Management	• Four terraced Liquid Residue Storage Facilities and one Salt Encapsulation Cell. • Liquid residue pumped to Liquid Residue Storage Facilities for evaporation. • Crystallised salts excavated from Liquid Residue Storage Facilities following evaporation of water and transported to the Salt Encapsulation Cell. • Between 6Mt and 7Mt of salt waste generated over the life of the Project.	• One Liquid Residue Storage Facility and a relocated Salt Encapsulation Cell. • Liquid residue processed using the brine concentrator to produce crystalised salt. • Liquid residue pumped to Liquid Residue Storage Facility for evaporation. • Crystallised salts conveyed and/or trucked to the Salt Encapsulation Cells. • Between 6Mt and 7Mt of salt waste generated over the life of the Project.
Water Management	• Use of up to 4.05GLpa of water to be sourced from a range of licenced sources.	• Use of up to 2GLpa of water sourced from licenced sources within the Macquarie River and the Upper Macquarie Alluvial Aquifer • Re-use of water from the proposed Brine Concentrator. • Extension of the Water Supply Pipeline
Transportation	• Site access via Toongi Road. • Road – up to 75 laden movements day or 16/hour • Rail – up to 3 trains per week	• No change to site access point. • No change to proposed road or rail movements. • Approved rail transportation to the Project Site to be bought forward to Project commencement.

Table 2 (Cont'd)
Overview of the Proposed Modification

Page 3 of 3

Component	**Approved Project (SSD-5251)**	**Proposed Modification (MOD 1)**
Linear Infrastructure	• Construction and use of a water pipeline from the Macquarie River to the Project Site. • Construction and use of a gas pipeline with the rail corridor for the Dubbo – Molong Railway from the Central West Natural Gas Pipeline to the Project Site. • Upgrading of a 27km section of the disused Dubbo-Molong Rail Line. • Construction of a 3m high, 1km long road noise barrier on land owned by Taronga Western Plains Zoo.	• Realignment of an approximately 1 500m section of the approved water pipeline within the Project Site and extension of the northern section of the pipeline to link with an approved water supply bore. • Construction and use of a gas pipeline with the rail corridor for the Dubbo – Molong Railway is no longer proposed, with separate approval to be sought for a new alignment. • Implementation of noise mitigation measures, in consultation with the Taronga Western Plains Zoo, to achieve a road noise reduction in the vicinity of Taronga Western Plains Zoo equivalent to that provided by a road noise barrier. • No further changes to linear infrastructure.
	• Upgrading of selected sections of Obley and Toongi Roads between the Newell Highway and the Project Site and construction of the site entrance and access road.	• Upgrading of selected sections of Obley and Toongi Roads between the Newell Highway and the Project Site and construction of the site entrance and access road.
Employment	• Employment of between 300 and 400 personnel during the construction and site establishment phase.	• Employment of an average of 625 personnel, and a peak of 1 000 personnel, during the construction and site establishment phase.
	• Employment of 250 full-time equivalent personnel during the operational phase.	• Employment of 274 full-time equivalent personnel during the operational phase.

- Other adjustments required to accommodate the above changes, optimise the functionality of the Project Site, and minimise the Project's disturbance footprint, including:
  - minor adjustments to the approved haul road route;
  - the addition of a haul road connecting relocated Solid Residue Storage Facility and the approved haul road;
  - minor adjustments to a length of the approved Macquarie River Water Pipeline (approximately 1 500m) within the Project Site; and
  - the consolidation of adjacent approved infrastructure areas into contiguous disturbance footprints to allow vehicle movement between isolated areas and minimise habitat fragmentation.

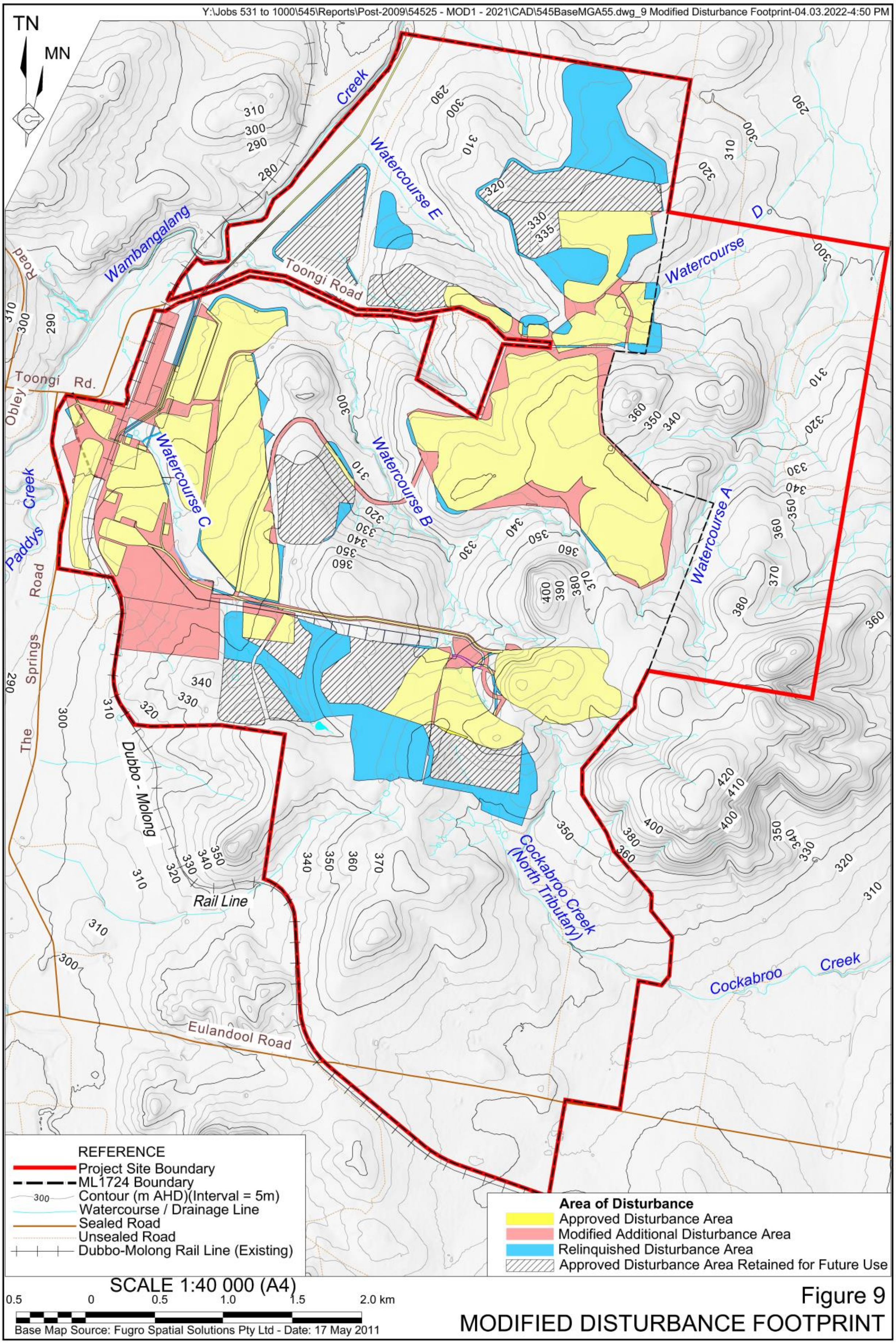
With the exception of the extension of the northern end of the approved Macquarie River Water Pipeline (see Section 3.6.2), the Proposed Modification does not include any additional disturbance or works outside of the approved Project Site boundary.

3.3.2 Disturbance Footprint

Table 3 provides a comparison of approved and proposed disturbance areas presented on **Figures 2, 3, 7** and **8**. Modifications to the approved disturbance areas are summarised on **Figure 9**.

The Applicant has adjusted the modified disturbance area to ensure that the total area of proposed disturbance is less than the total area of approved disturbance and that where relevant, vegetation communities have been taken into account to ensure that the revised areas of vegetation to be disturbed are equivalent to the approved areas of vegetation to be disturbed. An assessment of biodiversity impacts associated with the proposed changes to the Site Layout is presented in Section 6.7

In addition, the Applicant proposes to retain a number of areas approved to be disturbed that are not currently required under the Proposed Modification for future use. These areas have been previously assessed in relation to biodiversity and heritage-related impacts in particular and biodiversity offsets have been established and secured in perpetuity under a Conservation Property Vegetation Plan dated May 2017 to compensate for disturbance of those areas. As a result, those areas will be retained for future use and are referred to hereafter as "approved disturbance areas retained for future use".



Base Map Source: Fugro Spatial Solutions Pty Ltd - Date: 17 May 2011

Figure 9
MODIFIED DISTURBANCE FOOTPRINT

Table 3
Approved and Proposed Project Disturbance Footprint

Infrastructure Area Type / Component	Approved Disturbance Footprint[1] (ha)	Proposed Disturbance Footprint[2] (ha)	Net Disturbance Footprint Change (ha)
Open Cut	40.34	40.34	0
Waste Rock Emplacement	20.36	20.36	0
Processing Plant and Administration Area	42.72[3]	89.08[4]	+46.36
Solid Residue Storage Facility	102.09	171.71	+69.62
Salt Encapsulation Cells	34.96	63.39	+28.43
Growth Medium Stockpile Area	128.88	110.25	-18.63
Laydown Yard / Growth Medium Stockpile Area	-	43.44	+43.44
Liquid Residue Storage Area	413.13	21.23	-391.90
Chlor-alkali Plant	-	1.06	+1.06
Haul Road	5.24	17.15	+11.91
Sediment Basins	Not Defined	7.16	+7.16
Macquarie River Water Pipeline	3.68	3.68	0
Tailings Pipeline	-	0.68	+0.68
Approved Disturbance Areas Retained for Future Use	-	191.22	+191.22
Total[5]	786.16	780.75	-5.41

Note 1: Based on layout presented on **Figure 2** and Figure 1 General Site Layout in Appendix 2 of SSD-5251.

Note 2: Based on layout presented on **Figure 7**.

Note 3: This area includes the footprint of the approved rail siding.

Note 4: This area includes the disturbance footprint for the Rail Container Laydown and Storage Area and the proposed conveyor between the Processing Plant and Administration Area and the Salt Encapsulation Cells.

Note 5: Note that the magazine is not shown on **Figure 2** or **Figure 7** and has therefore not been included in this table. The Proposed Modification would not alter the size or location of the approved magazine.

3.3.3 Processing Plant and Administration Area

The Applicant proposes to expand the footprint of the Processing Plant and Administration Area by approximately 52ha (**Figure 8**). The expansion of the Processing Plant and Administration Area is primarily required provide adequate space for the construction and safe operation of the approved processing plant components. In addition, detailed design work following granting of development consent identified the need to reorganise the processing plant components in order to optimise processing operations.

In addition the following key changes and additions have also contributed to the expansion of this area.

- The proposed addition of a Chlor-alkali Plant (1.06ha not included in the Processing Plant and Administration Area footprint) and associated reagent and raw material storage structures (see Section 3.4.3).

- The proposed addition of a Brine Concentrator, including an ancillary water treatment circuit (see Section 3.4.2).
- The proposed relocation of the Railway Container Laydown and Storage Area to abut the existing Toongi-Dubbo Rail Line and remove the need to construct a separate rail siding and run around loop (see Section 3.3.7).

3.3.4 Salt Encapsulation Cells

The approved Project Site layout includes Salt Encapsulation Cells which occupy an area of approximately 34.53ha and are located immediately to the south of the Waste Rock Emplacement (**Figure 2**). The approved Salt Encapsulation Cells included the following.

- Up to six individual cells lined with double high density polyethylene (HDPE) liners, including an intra-layer leak detection system.
- Cell embankments constructed using in situ material excavated from each cell footprint and/or non-sulphidic mine waste rock to a final height of approximately 17m above the natural surface level, with final embankment crest widths of 6m and downstream face slopes of 1:2 (W:H) and upstream (lined) face slopes of 1:1.5 (V:H).

The Proposed Modification seeks to relocate the Salt Encapsulation Cells to the approved disturbance footprint of Liquid Residue Storage Facility Area 3 (**Figures 2** and **7**). The proposed location minimise the distance between the proposed Brine Concentrator and the Salt Encapsulation Cells.

The relocated Salt Encapsulation Cells would conform to the design criteria for the approved Salt Encapsulation Cells, with the following amendments.

- Cell embankments would be constructed to a final height of approximately 13m above existing ground level.
- The number and size of individual cells would be tailored to accommodate the amount of salt generated by the Project, with all cells to be confined to the footprint shown on **Figure 7**.
- A Salt Handling Area would be constructed within the Salt Encapsulation Cells area footprint. This area would be used for the temporary stockpiling of salt transported by conveyor from the Brine Concentrator. This material would be loaded into haul trucks for placement into the Salt Encapsulation Cells.

3.3.5 Solid Residue Storage Facility

The approved Solid Residue Storage Facility occupies an area of approximately 101.98ha and is located immediately to the west of the Waste Rock Emplacement **(Figure 2**). The approved location of the Solid Residue Storage Facility was selected in order to:

- minimise the distance solid waste would need to travel via conveyor from the Processing Plant and Administration Area;

- minimise surface runoff accumulation against the Solid Residue Storage Facility embankments; and
- take advantage of the underlying Wongarbon and Ballimore soil landscapes which are characterised by a relatively deep, compact layer of clay suitable for residue storage facility construction.

Key design criteria for the approved Solid Residue Storage Facility include the following.

- Three separate, adjoining cells (Cells A, B and C) providing a combined storage volume of 20Mm^3.
- Maximum elevations of 385m AHD (Cell A), 390m AHD (Cell B) and 370m AHD (Cell C), with maximum embankment heights of approximately 40m above the natural surface level.
- A combined upper surface area of approximately 81ha.
- External (downstream) embankment slopes of approximately 1:3 (V:H) and internal (upstream) embankment slopes of approximately 1:1.5 (V:H).
- Crest width of 5m for the initial Stage 1 embankments of individual cells, with crest widths reduced to 4m for subsequent lifts.
- Embankments to be progressively raised (2m lifts) using the upstream construction method.
- Storage cells and upstream faces would be double-lined, with the upper layer consisting of a HDPE liner (or material with equivalent permeability) and the lower layer consisting of either HDPE or compacted clay.
  - Permeability of each liner layer would not exceed 1x10^{-9}m/s over 900mm (or equivalent).
  - Embankment lifts would not be lined as there would be no phreatic surface within the stored compacted residue, and therefore no hydrostatic loading on the peripheral embankments.
- Installation of a leak detection system between the upper and lower liner layers.
- Maintenance of freeboard (between the top of the embankment and the residue surface) to accommodate rainfall from a 1:10 000 year event (460mm).
- Pushing and spreading of solid residue deposited by conveyor within the cells, with compaction in 300mm layers.
- Pumping of leachate, decant water and incident rainfall runoff to the Liquid Residue Storage Areas.

The Proposed Modification seeks to relocate the Solid Residue Storage Facility to the approved disturbance footprint of Liquid Residue Storage Facility Area 5 (**Figures 2** and **7**). The proposed relocation of this infrastructure component would further minimise surface runoff accumulation against the Solid Residue Storage Area embankments while also avoiding surface water run-on from adjacent areas. Additionally, the proposed location would similarly take advantage of the relatively deep, compact clay layer which characterises the underlying Wongarbon soil landscape under the proposed relocated Solid Residue Storage Facility.

The relocated Solid Residue Storage Facility has been designed conceptually by GHD (2017) based on the following guideline documents. Detailed designs, taking into consideration updated guideline requirements would be prepared and relevant approvals and certifications for the detailed designs would be obtained prior to construction.

- *ANCOLD Guidelines on the Consequence Categories for Dams* (ANCOLD, 2012a).
- *ANCOLD Guidelines on Tailings Dams* (ANCOLD, 2012b).
- *NSW Dam Safety Committee Tailings Dams guideline DSC3F, June 2012* (NSW DSC, 2012).
- *ANCOLD Guideline on Selection for Acceptable Flood Capacity for Dams* (ANCOLD, 2000).

The proposed relocated Solid Residue Storage Facility would conform to the design criteria for the approved Solid Residue Storage Facility, with the following amendments (**Figure 10**).

- Construction of two cells in four stages, in addition to a Water Dam which would be used to collect and store decant water.
- Maximum embankment height of 368.5m AHD or up to 35m above the natural land surface.
- A combined storage volume of approximately 27.7Mt or 22.3Mm^3.
- Minimum embankment crest width of 7.2m.
- Initial embankments constructed using with embankment slopes of 1:3 (V:H).
- Subsequent raises constructed using upstream construction method, with maximum lift heights of 2m and downstream batter slopes of 1:3 (V:H).

Table 4 presents the approximate tailings residue storage volumes for each stage.

Table 4
Solid Residue Storage Facility – Stages 1 to 4

Stage	Description	Tailings Storage (Mm^3) per Stage
1	Cell 1 raise to 350m RL.	3.58
2	Cell 1 raise to 358m RL.	4.57
3	Cell 2 raise to 358m RL.	2.04
4	Cell 1 and 2 raise to 368.5 RL.	12.1
	Total	**22.3**

Source: GHD (2017) – Table 4.

3.3.6 Growth Medium Stockpile Areas

The approved site layout (**Figure 2**) includes several designated Soil Stockpile Areas which cover a total area of approximately 129ha.

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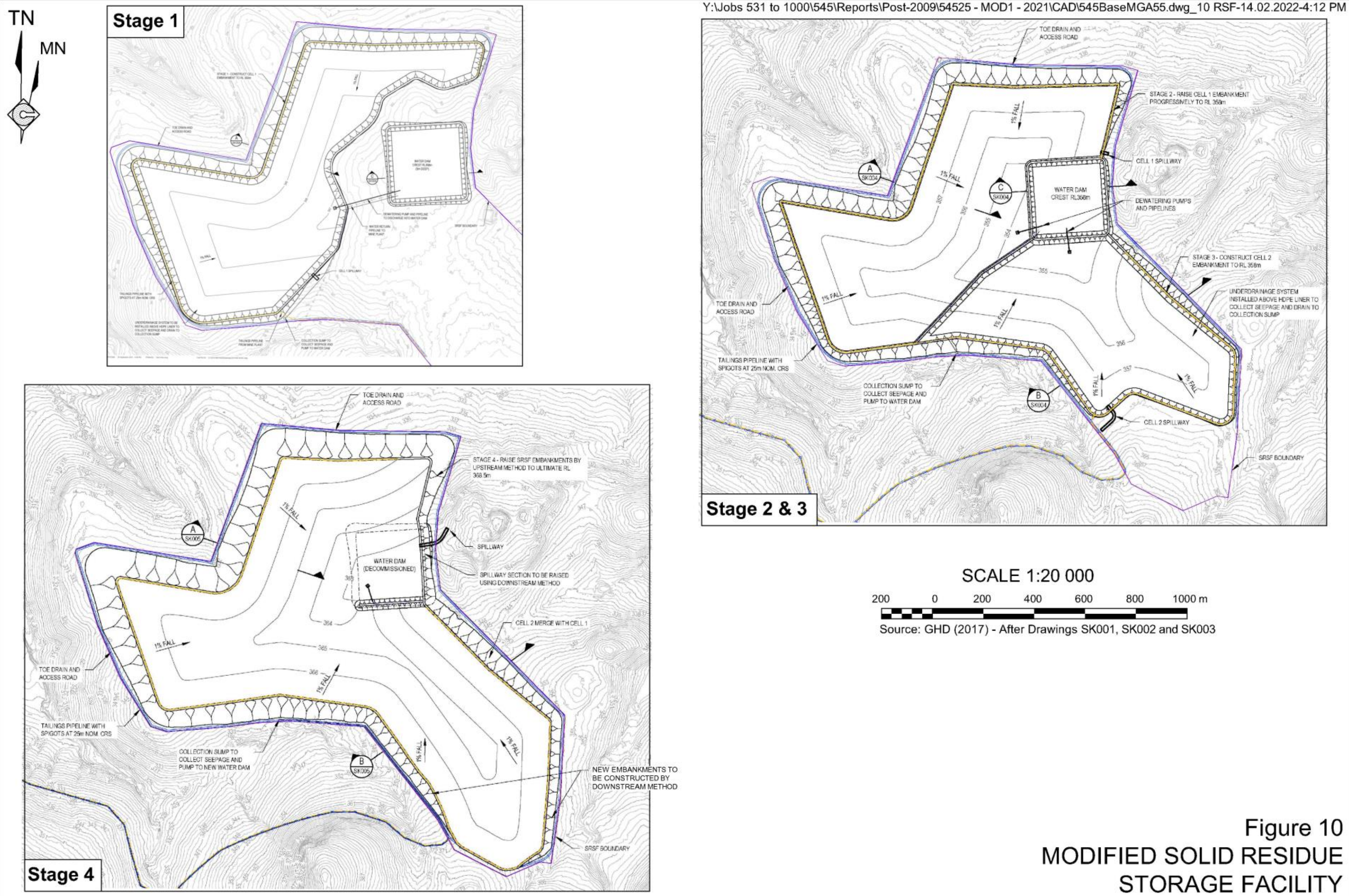


Source: GHD (2017) - After Drawings SK001, SK002 and SK003

Figure 10
MODIFIED SOLID RESIDUE STORAGE FACILITY

The proposed site layout (**Figure 7**) includes several Growth Medium Stockpile Areas which cover a total area of approximately 110ha. Additionally, the proposed site layout includes two areas designated as Laydown Yard / Growth Medium Stockpile Areas which cover a total area of approximately 44ha. Approximately 50% of these areas will be utilised for growth medium stockpiling while the remaining 50% will be used for general laydown and construction material storage activities.

The Proposed Modification would include approximately 132ha for growth medium stockpiling, a larger area than the approved Project. This area represents the maximum area required to stockpile anticipated growth medium volumes in accordance with the stockpiling procedures and design criteria outlined in this subsection. **Table 5** presents a summary of anticipated topsoil and subsoil volumes to be stripped at the Project Site based underlying soil landscapes (**Figure 11**) and recommended stripping depths provided in SSM (2013).

Table 5
Growth Medium Stripping Volumes

Soil Landscape[1]	**Topsoil Stripping**		**Subsoil Stripping**[3]		**Stripped Volume (m^3)**	
	Area (ha)	**Depth (m)**[2]	**Area (ha)**	**Depth (m)**[2]	**Topsoil**	**Subsoil**
Arthurville	43.98	0.15	3.62	0.15	65 965	5 430
Bald Hill	2.33	0.15	0.21	0.60	3 502	1 260
Ballimore	158.19	0.15	79.27	0.50	237 290	396 358
Bellowrie	85.72	0.15	23.95	0.50	128 581	119 744
	-	-	40.34	0.30	0	121 012
Mitchell Creek	1.02	0.15	-	-	1 532	0
Splitters Hill	19.39	0.15	-	-	29 085	0
Wongarbon	277.92	0.15	160.54	0.60	416 884	963 228
	-	-	18.95	0.35	0	66 311
Total	**588.56**	**-**	**326.87**	**-**	**882 839**	**1 673 343**

Note 1: See **Figure 11**.

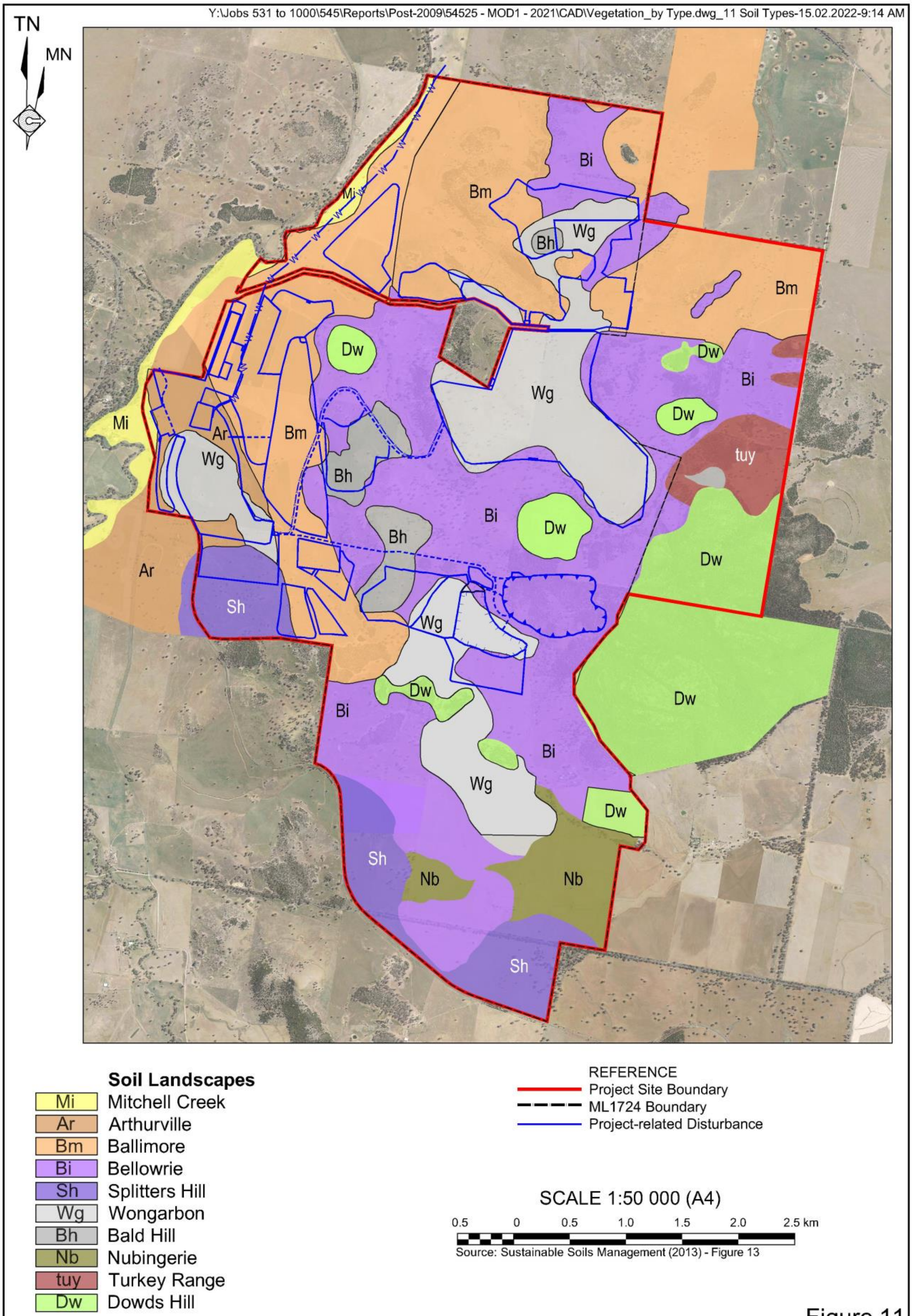
Note 2: Stripping depth recommendations as per SSM (2013).

Note 3: Subsoil would only be stripped from areas including the Waste Rock Emplacement, Solid Residue Storage Facility, Salt Encapsulation Cells, Sediment Basins, Liquid Residue Storage Facility, and Open Cut.

Where practical, the Growth Medium Stockpile Areas have been located within the existing disturbance footprints of approved Soil Stockpile Areas (**Figure 2**). However, several areas have been expanded or relocated in order to:

- minimise erosion and resource loss by avoiding areas of relatively high slope and/ or watercourses and drainage lines within the Project Site; and
- minimise growth medium transport distances during site establishment and rehabilitation activities.

It is anticipated that a significant portion of those areas set aside for general laydown purposes would be progressively rehabilitated following the initial construction phase of the Project once they are no longer required.



Source: Sustainable Soils Management (2013) - Figure 13

Figure 11
SOIL MAPPING

Growth medium stripping and stockpiling procedures would be consistent with approved procedures for the Project. Stripping and stockpile management measures would include the following.

- Strip topsoil and subsoil in each area to the depths identified in Table 2.1 of RWC (2013).
- Ensure that soil material is slightly moist during stripping, with no stripping to be undertaken during excessively wet or dry conditions.
- Grade or push soil material into wind rows using graders or dozers for later loading into trucks by front-end loaders to minimise soil compaction.
- Where practical, apply stripped soil material directly to areas undergoing progressive rehabilitation.
- Construct stockpiles in accordance with the following design criteria.
  - Maximum top surface width of 5m.
  - Maximum height of 3m for subsoil and 2m for topsoil.
  - Maximum side slopes of 1:5 (V:H).
- Minimise, as far as practicable, the operation of machinery on soil stockpiles to minimise soil.
- Ensure that top and side surface of wind rows are rough to encourage runoff penetration and seed retention.
- Establish vegetative cover on soil stockpiles where they are expected to be retained in place for more than 3 months.
- Where practical and safe to do so and under appropriate weather conditions, allow stock to graze vegetated soil stockpiles to encourage natural return of organic materials. Stock would be removed where ground cover falls below 60% to minimise erosion and encourage survival and regrowth of cover vegetation.

3.3.7 Relocated Rail Container Laydown and Storage Area

The approved Project includes construction of a rail siding and associated Rail Container Laydown and Storage Area (**Figures 2** and **3**), with the Macquarie River Water Pipeline running between the siding and the Storage Area.

The Applicant no longer proposes to construct the approved rail siding. As a result, the approved Rail Container Laydown and Storage Area would be moved to the west, adjacent to the Dubbo – Molong Railway to permit convenient access for loading and unloading of trains. As a result, the approved Macquarie River Water Pipeline would also be relocated from the western side of the Storage Area to the eastern side of that area.

3.3.8 Approved Disturbance Area Retained for Future Use

The Proposed Modification, should it be approved, would result in the installation of a Brine Concentrator within the Processing Plant and Administration Area. This would significantly reduce the amount of liquid residue generated by the Project (see Section 3.3). Consequently, the Proposed Modification would reduce the area occupied by Liquid Residue Storage Facilities by approximately 94% from approximately 335ha. The addition of the proposed to approximately 21 ha.

Notwithstanding this, and in accordance with Condition 31 of Schedule 3 of SSD-5251 and requirements under EPBC 2012/6625, the Applicant has implemented a Biodiversity Offset Strategy and developed a Biodiversity Offset Management Plan for the Project. The resulting EPBC Act Offset Area and EP&A Act Offset Areas have been established and the relevant biodiversity offsets retired (**Figure 5**).

To ensure that areas of approved disturbance which have already been offset by the Applicant are retained for potential future use, these areas are proposed to be retained as ‘Approved Disturbance Areas retained for future use’ (**Figure 7**). In the event that additional areas of disturbance are required for the Project in the future, the Applicant would either seek a further modification to SSD-5251 or seek a separate development consent to disturb those areas. Such disturbance would, however, not require further biodiversity offsets.

3.4 MODIFIED PROCESSING AND RESIDUE MANAGEMENT OPERATIONS

3.4.1 Introduction

Since the receipt of development consent in 2015, the Applicant has sought to optimise the Project to maximise recovery of the identified resource and integrate the Project into the downstream processing markets. In particular, the Applicant has signed a number of commercial agreements that have resulted in development and construction of a metalisation plant in South Korea to produce high purity metal (see Section 1.4.2).

In order to provide suitable feed stock for the Applicant’s South Korean operations, as well as other customers, a range of modifications to the approved processing operations are required. The Applicant has recently completed an Optimisation Study and the following subsections present an overview of the principal components of the approved processing operations that would be modified.[1] **Figures 12** and **13** present the approved and proposed process flow sheets.

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[1] ASX Announcement dated 7 December 2021 – available https://asmd.irmau.com/site/PDF/7d89a7c9-fbde-4e03-b9e4-6856775b3985/DubboProjectOptimisationDeliversStrongFinancials.

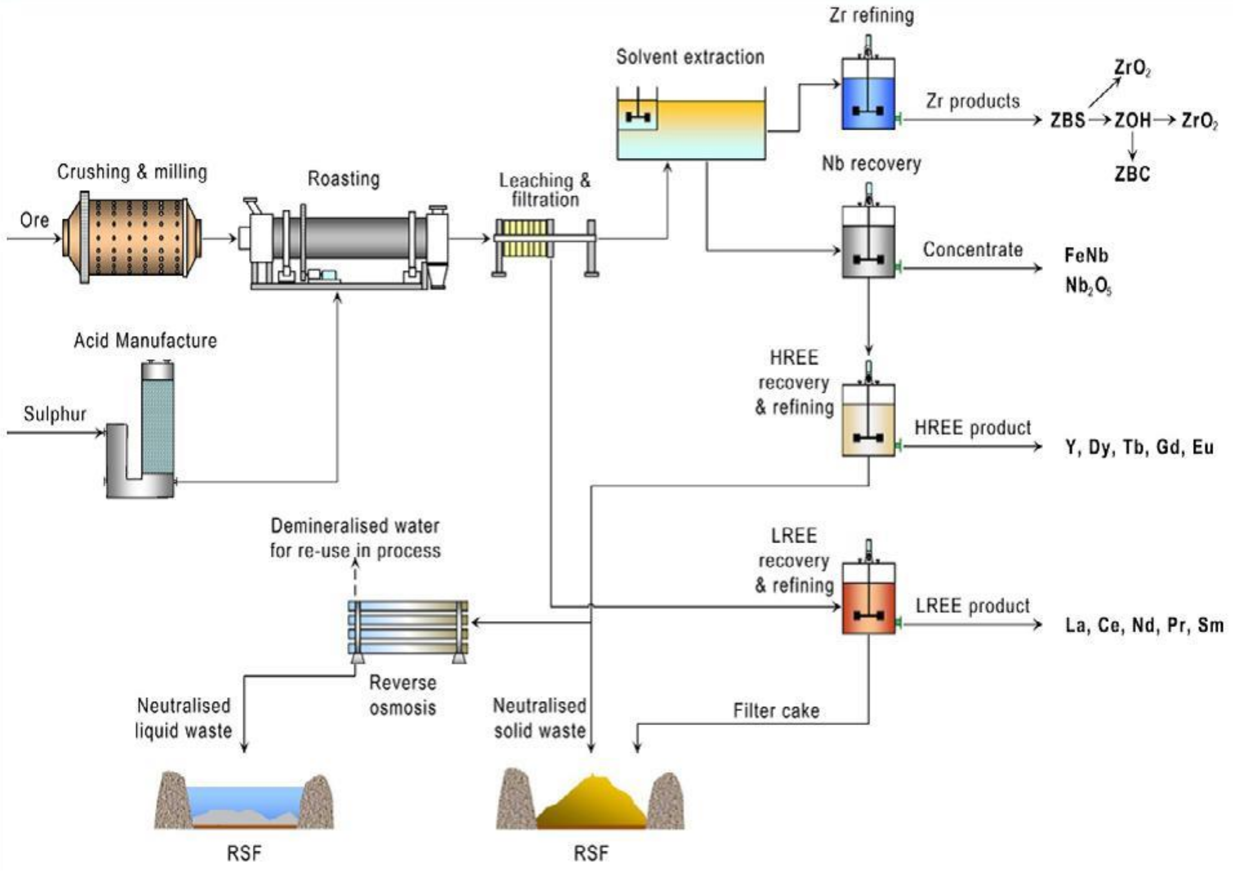


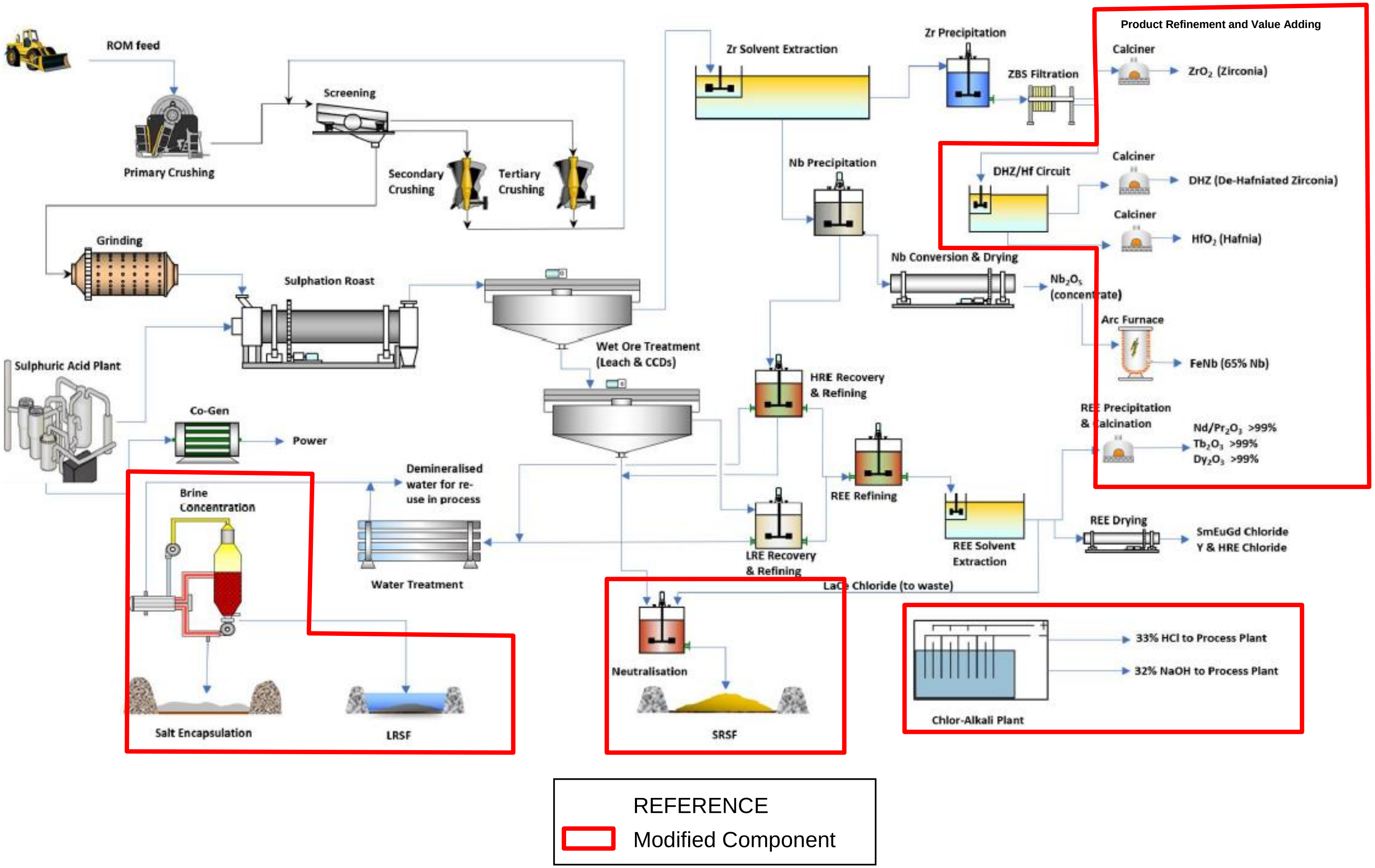
Figure 12
APPROVED PROCESS FLOWSHEET

Source - RWC (2013) – Figure 2.11

3.4.2 Brine Concentrator and Salt Management

Both the approved and modified processing flowsheet would result in a range of liquid residues being produced. The Project as approved would pass those liquid residues through a Reverse Osmosis Plant to generate demineralised water for reuse in the processing plant and a brine solution that would pass to the Liquid Residue Storage Facilities from where the water would be permitted to evaporate and the resulting salt collected for encapsulation within the Salt Encapsulation Cell.

The Proposed Modification would add a Brine Concentrator to further recover water from the brine produce by the Reverse Osmosis plant, as well as liquid residues from other components of the processing plant (**Figure 7**). The Brine Concentrator would recover additional water for processing operations and would produce a solid, largely dewatered salt product. The waste salts would be transferred to the Salt Handling Area via conveyor, from where they would be trucked to the active section of the Salt Encapsulation Cell for encapsulation.



Source: Optimisation Study Report –Figure 9

Figure 13
MODIFIED PROCESS FLOWSHEET

A small bleed of the liquid residue processed through the Brine Concentrator and would be passed to the modified Liquid Residue Storage Facility where the liquid fraction would be permitted to evaporate and the salt recovered as per the approved Project.

3.4.3 Chlor-alkali Plant

The approved Project required importation of substantial volumes of hydrochloric acid (HCl) and sodium hydroxide (NaOH). The Applicant undertook an assessment of supply options for these reagents and determined that the existing suppliers would be unable to supply the required volumes. In addition, long-distance transportation of HCl is logistically very challenging. As a result, the Applicant proposes to construct a Chlor-alkali Plant to produce these reagents on site (**Figure 7**).

The proposed Chlor-alkali Plant would use ion exchange membrane electrolysis to produce chlorine (Cl_2) from salt (NaCl), which would then be converted to HCl, and NaOH. The process uses an electrolyser cell, to pass an electric current through purified NaCl and dilute caustic soda solutions, separated by an ion exchange membrane. The electrolysis separates water and salt to produce NaOH and Cl_2.

The Applicant anticipates importing approximately 65 000tpa of salt to the Project Site for use in the Chlor-alkali Plant to produce approximately 100 000tpa of 34% HCl solution and 95 000tpa of 32% NaOH solution. As the ratio of HCl to NaOH produced by the Chlor-alkali Plant is fixed and more NaOH than HCl is required for processing operations, the Chlor-alkali Plant would produce 100% of the HCl and approximately 60% of the NaOH required for on-site ore processing operations. As a result, additional NaOH would be imported to the Project Site.

Consistent with the approved Project, the Applicant would ensure that the Chlor-alkali Plant:

- would be constructed within a sealed bunded area and that reagents, products and incident rainfall is not permitted to be discharged from the plant area; and
- would comply with the requirements of the *Protection of the Environment Operations (Clean Air) Regulation 2021*.

Finally, the Applicant would ensure that robust environmental and safety management systems are developed and implemented throughout the life of the Project to ensure that the Chlor-alkali Plant does not result in adverse environmental impacts.

3.4.4 Solid Residue Management

The approved and modified Project would result in the production of a solid residue as described in Section 2.9.2 of RWC (2013). The Proposed Modification would not result in a change in the nature, composition or characteristics of the solid residue. The approved Project would filter the solid residue following neutralisation and transfer that material to the Solid Residue Storage Facility using a conveyor.

Since the receipt of development consent for the Project, the Applicant has determined that filtering the solid residue is unlikely to be practicable. As a result, the Applicant proposes:

- to relocate the Solid Residue Storage Facility to an alternate location; and
- transfer the solid residue to that facility as a slurry for settling and dewatering.

Section 3.3.5 describes the design and construction of the modified Solid Residue Storage Facility. The following provides a brief overview of the solid residue management procedures that would be implemented for the Proposed Modification.

- Following thickening and neutralisation, the solid residue would be pumped to the Solid Residue Storage Facility as a slurry via a bunded pipeline equipped with leak detection and automatic shutoff systems.
- The slurry would be discharged from a slurry pipeline around the perimeter of the Facility from where it would form a beach. Given the nature of the solid residue, the Applicant anticipates facilitating dewatering and consolidation of the solid residue through the use of an Archimedes Screw Tractor or similar.
- Water released from the slurry would flow towards a decant structure from where it would be pumped to a lined water storage dam for reuse within the processing plant or transfer to the Liquid Residue Storage Facility.

Following completion of processing operations, the solid residue would be permitted to continue to dewater and consolidate. Once sufficiently consolidated, the upper surface of the facility would be shaped to form a free draining landform and rehabilitated in a manner that is consistent with the approved Solid Residue Storage Facility, namely installation of:

- a capillary break consisting of coarse material that is typically fine to minimise capillary rise of leachate from the solid residue into the capping material;
- a layer of selected waste rock (approximately 2m thick) containing clay to silt sized particles which would capture and store rainfall moisture; and
- a layer of up to 500mm of subsoil and 100mm of topsoil which would function as a growth medium for vegetation.

3.4.5 Product Refinement and Value Adding

In order to maximise the efficiency of the Applicant’s integrated supply chain, including its South Korean operations, a range of product refinement and value adding steps in addition to those approved are required. These include the following.

- Zirconium Basic Sulphate would be either:
  - calcined (roasted in the presence of oxygen) to produce Zirconia (ZrO_2); or
  - passed to a dehafniated zirconia (DHZ) and hafnium (Hf) circuit using solvent extraction to produce products that are also calcine to produce dehafniated zirconia (DHZ) and Hafnia (HfO_2).
- Niobium pentoxide (Nb_2O_5) produced by the approved Niobium circuit would be passed to an arc furnace with iron to produce ferroniobium metal.
- A proportion of the Rare Earth Element solutions produced by the approved solvent extraction circuit would be passed to individual rare earth element Precipitation and Calcination Circuits where a range of high purity rare earth element oxides would be produced.

As for the approved processing plant, the Applicant would ensure that the modified product refinement and value adding circuits would:

- be constructed within a sealed bunded area and that reagents, products and incident rainfall is not permitted to be discharged from the plant area; and
- comply with the requirements of the *Protection of the Environment Operations (Clean Air) Regulation 2021*.

In addition, the Applicant would ensure that robust environmental and safety management systems are developed and implemented throughout the life of the Project to ensure that the modified product refinement and value adding circuits do not result in adverse environmental impacts.

3.5 TRANSPORTATION

3.5.1 Transportation Option

Figure 4 presents the approved transportation routes for the Project. RWC (2013) identified three transportation options for the Project, as presented in **Table 6**.

The Applicant was, at the time of finalisation of RWC (2013), unable to commit to implementation of Option A, namely rail transportation to the Project Site with select materials transported by road. Notwithstanding this, the Applicant committed to undertaking a review of the feasibility of each of the proposed transport options within three years of commencing the development.

Table 6
Transportation Scenarios

Scenario	Transportation Method(s)
Preferred Option A – Rail (to Toongi) and Minor Road	• Rail transportation of reagents direct to the Project Site. • Rail transportation of selected reagents to the Fletcher International Exports Terminal north of Dubbo, and transportation to the Project Site by truck. • Road transportation of remaining reagents (including limestone), fuels and other materials to the Project Site by road using B-doubles, semi-trailers, specialised tankers or other road registered vehicles.
Contingency Option B – Rail (to Dubbo) / Road (to Toongi)	• Rail transportation of all bulk reagents to the Fletcher International Exports Terminal north of Dubbo and transportation to the Project Site by truck (excluding B-double configurations as the road network from the Fletchers International Exports Terminal was at the time unsuitable for B-double trucks).
Contingency Option C – Road	• Road transportation of reagents and other materials to the Project Site using B-doubles, specialised tankers, semi-trailers and other road registered arrangements.
Source: RWC (2013) – Section 2.12.	

In light of the above, Condition 42 of Schedule 3 of SSD-5251 were imposed. That condition requires completion of a review of transport options in consultation with relevant government agencies and infrastructure managers, to investigate the reasonable and feasible options to maximise the use of rail and minimise the use of public roads to transport materials to and from the Project Site. The review must be completed within 3 years of commencement of the Project.

The Applicant elected to undertake the required transport options review in accordance with the above Condition prior to commencing the Project. That review determined that Option A was not only feasible but also the preferred option.

As a result, the Applicant would implement the approved transport Option A as described in Section 2.12 of RWC (2013), including:

- upgrading an approximately 27km section of the disused Dubbo-Molong Rail Line between Dubbo and the Project Site to a Class 1 rail line to allow the maximum gross weight per wagon to be 92t; and
- utilising rail to transport materials to and from the Project Site.

Material that cannot practicable be transported by rail, such as limestone products from locally sources limestone mines or smaller quantities of reagents or other materials would be transported by road.

No change is proposed to the approved limits on the number of truck and train movements, nor the approved hours of transportation.

3.5.2 Road Noise Barrier

Condition 2 of Schedule 3 of SSD-5251 requires the Applicant to construct, in consultation with the Taronga Western Plains Zoo, a 3m high, 1km long road noise barrier on land owned by the Zoo, to the satisfaction of the Secretary. The Applicant has consulted with representatives of Zoo several times since the granting of development consent and has discussed the possibility of adopting alternative road noise mitigation measures which would:

- provide for equivalent or improved noise reduction (5dBA to 10dBA);
- avoid visual impacts associated with a 3m high, 1km long road noise barrier;
- not require construction activities to be undertaken on Taronga Western Plains Zoo land; and
- reduce the financial cost of implementing the necessary noise mitigation measure(s).

One such alternative noise mitigation measure which has been explored is resurfacing of the road section in the vicinity of the Zoo. Based on road surface noise levels outlined in the *Roads and Traffic Authority Environmental Noise Management Manual*, MAC (2022) indicates that upgrading the existing road surface in the vicinity of the Taronga Western Plains Zoo to open graded asphaltic concrete would provide a reduction of up to 5dBA for trucks compared to dense graded asphalt (i.e. equivalent to the reduction afforded by the road noise barrier).

The Proposed Modification seeks to amend Condition 2 of Schedule 3 to permit the implementation of alternative noise mitigation measures, in consultation with Taronga Western Plains Zoo, which would provide for noise reduction equivalent to that provided by the conditioned road noise barrier (5dBA to 10dBA).

3.6 MODIFIED WATER REQUIREMENT AND SUPPLY

3.6.1 Water Requirements

Section 2.8.1 of RWC (2013) identified that the water annual makeup water requirement for the Project would be approximately 4 050L of water for each tonne of ore processed, or an annual requirement for 4.05GL of water. That water was to be sourced from a range of sources including:

- the Macquarie River (high and general security water);
- the shallow alluvial aquifers associated with the Macquarie River;
- fractured rock aquifers associated with the Lachlan Fold Belt; and
- water harvested under the Applicant's harvestable right.

In order to further reduce the Project's water requirements, the Applicant would modify the Project as follows.

- The installation of the Brine Concentrator.

  The Brine Concentrator would significantly decrease water loss by improving the recovery of water from brine produced by the Reverse Osmosis plant and other liquid residues. Recovered water would be reused for processing operations, with water loss by evaporation significantly reduced as only a small proportion of the liquid residue produced by the processing plant directed to the remaining Liquid Residue Storage Facility.

- Construction of decant and water reclaim infrastructure on the Solid Residue Storage Facility.

  The Applicant anticipates that solid residue would be discharged to the Solid Residue Storage Facility with a moisture content of approximately 43%. Water would be released from the solid residue through natural settling of the residue and through mechanical release through the use of an Archimedes Screw Tractor or similar. Released water would flow to the Decant Pond and would be returned to the processing plant for reuse, with approximately 60.9% of contained water in solid residue recovered.

The Applicant estimates that the Proposed Modification would result in the water requirement for the Project being reduced to approximately 2GLpa, a reduction of approximately 50%.

3.6.2 Water Supply

Table 7 presents an overview of water access licences held for the Project. In summary, the Applicant has secured 3 008MLpa of water allocation, with 2 258MLpa comprising high security or reliable groundwater supply. Combined with water that would be collected and used under the Applicant's harvestable rights, there would be sufficient water allocation to support processing operations for the life of the Project.

Table 7
Water Access Licences and Allocations

Approval	Source	Allocation (MLpa)	Comment
WAL9191	Macquarie and Cudgegong Regulated Rivers Water Source downstream of the upper limit of Lake Burrendong.	218	High security licence.
WAL30259		750	General security licence.
WAL19994		22	High security licence.
WAL3396		282	High security licence.
WAL3412		34	High security licence.
WAL36409		300	High security licence.
WAL37691	Upper Macquarie Alluvial Groundwater Source (to be associated with water supply work approval 80WA726382).	1 402	Approved to extract up to 1 250ML per annum under 80WA726382.
	Total	**3 008**	

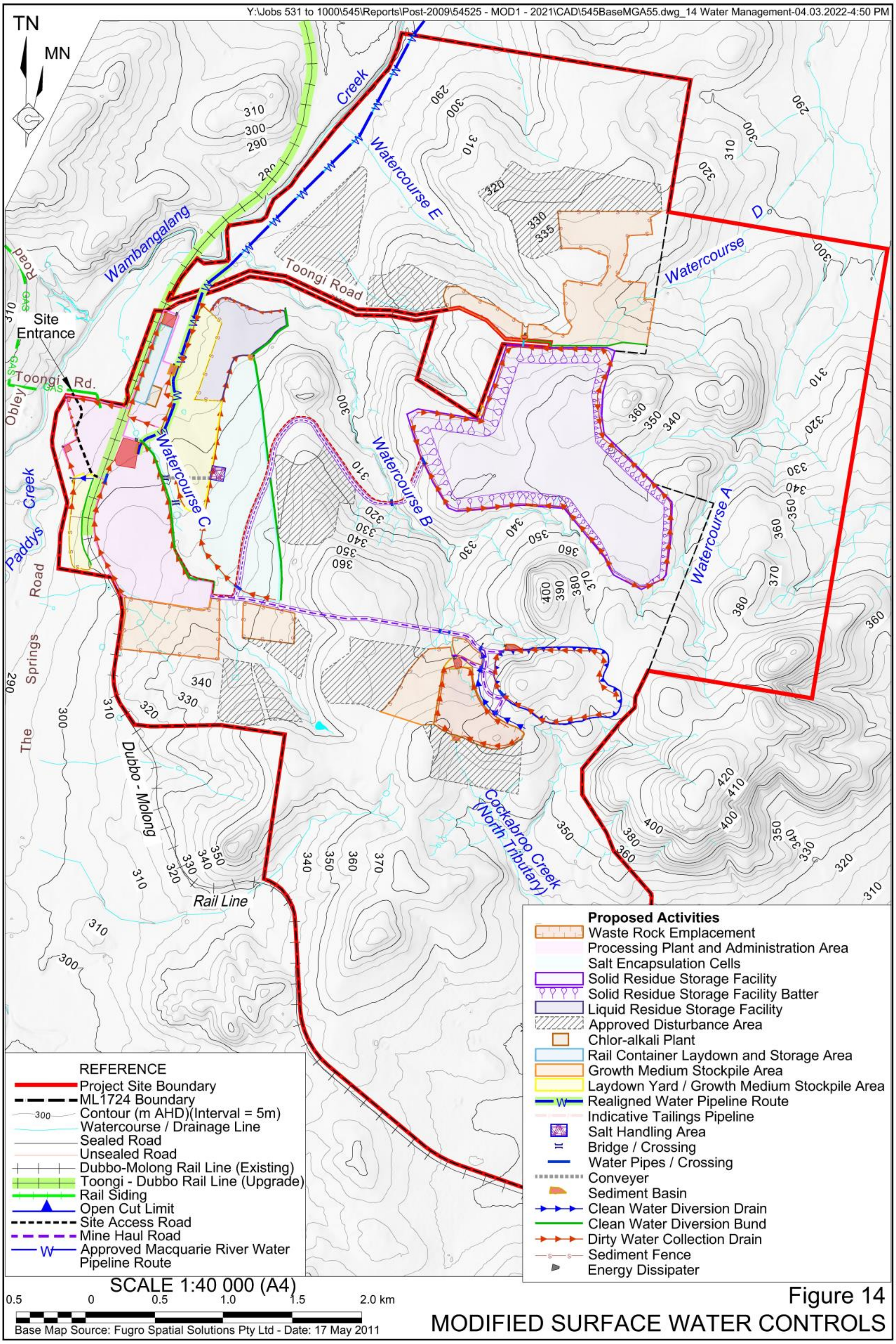
In addition, the Applicant has secured an easement to permit construction of the Macquarie River Water Pipeline from the Project Site to the approved pumping station on the southern bank of the Macquarie River (**Figure 4**). The Applicant proposes to extend that pipeline from the approved pumping station to the proposed “Sweet Water” supply bore, approved under water supply work approval 80WA726382. The proposed extended pipeline would be constructed in two segments as follows.

- The southern section, under the Macquarie River would be installed using underboring techniques. The underbored section would commence at the approved pumping station south of the Macquarie River and would finish within cleared agricultural land on the northern side of the River. The underboring would be undertaken in consultation with Water NSW and all required approvals and permits would be obtained. The proposed underbored pipeline would not intersect with or impact upon the river or its bed or banks and all surface disturbance would be located within areas approved to be disturbed or previously disturbed for agricultural activities.
- The northern section of the pipeline would be constructed as described in Section 2.2.2.1 of RWC (2013). In summary, the pipeline would be buried within a trench and covered to permit the ongoing agricultural use of the land. The proposed pipeline and trench would be established within cleared agricultural (cropping) land and there would be no biodiversity of heritage-related impacts.

Table A1.2 and Figure A1.1 of **Appendix 1** present the additional land associated with the proposed pipeline.

3.6.3 Water Management

Figure 14 presents the modified surface water controls which would be implemented to manage surface water runoff and run-on within the Project Site. These controls have been adapted to accommodate the proposed modifications to the Project Site layout but remain largely consistent with those outlined in the approved *Water Management Plan* and *Erosion and Sediment Control Plan* for the Project. A revised *Water Management Plan*, including a revised *Erosion and Sediment Control Plan*, would be prepared and implemented prior to the commencement of construction activities at the Project Site.



Base Map Source: Fugro Spatial Solutions Pty Ltd - Date: 17 May 2011

Figure 14
MODIFIED SURFACE WATER CONTROLS

3.7 PROJECT LIFE AND HOURS OF OPERATION

3.7.1 Project Life

Condition 5 of Schedule 2 of SSD-5251 grants approval for the Applicant to undertake mining operations at the Project Site until 31 December 2037. This condition provided for a 22-year Project Life following the granting of SSD-5251 on 28 May 2015, including a two-year construction and site establishment period and a further 20 years of mining operations.

The Proposed Modification seeks an 8-year extension to the approved project life from 31 December 2037 to 31 December 2045 based on the fact that the Project is expected to formally commence in 2022, with an initial construction and site establishment phase occurring from 2022 to 2024 and mining operations occurring for the following 20 years from 2025 to 2045. This proposed extension to the Project life would therefore account for delays to commencement since development consent was originally granted and provide for the same Project life as originally granted.

3.7.2 Hours of Operation

Condition 3 of Schedule 3 of SSD-5251 identifies the approved hours of operation for the Project (see **Table 1**). Approved hours for ‘other’ construction activities, excluding the construction of linear infrastructure (i.e. rail line upgrade, construction of water and gas pipelines, road realignment and upgrades), include the following.

- 7:00am to 6:00pm, Monday to Friday.
- 8:00am to 1:00pm, Saturdays.
- No activities on Sundays or Public Holidays unless noise from these activities does not exceed relevant noise criteria at any privately-owned residence.

The Applicant proposes to extend the hours of operation for ‘other’ construction hours to 24-hours per day, seven days per week. The proposed extension of approved hours for ‘other’ construction activities is required in order to accommodate activities such as large concrete pad pours as well as complex construction operations for selected processing plant components that cannot be completed on day-shift only. It is anticipated that ‘other’ construction activities undertaken outside of the above hours would occur infrequently and would indicatively be limited to the following areas within the Project Site.

- Processing Plant and Administration Area
- Chlor-alkali Plant
- Rail Container Laydown and Storage Area
- Laydown Yards / Growth Medium Stockpile Area

Assessments of potential noise and lighting impacts associated with the proposed extension of ‘other’ construction activities are presented in Sections 6.3 and 6.4 respectively.

3.8 EMPLOYMENT

Table 8 provides a summary of anticipated changes to employment during the construction and site establishment phase and the operational phase of the Project under the Proposed Modification.

Table 8
Approved and Proposed Employment

Project Phase	**Project Employees (Full-time Equivalent) per Day**	
	Approved Operations[1]	**Proposed Modification**[2]
Construction and Site Establishment	Average of 300 to 400	Average of 625 Peak of up to 1 000
Operational	250	274

Note 1: Source: RWC (2013) – Section 2.15
Note 2: Source: Australian Strategic Materials (Holdings) Ltd

It is noted that the anticipated increase in the construction workforce is primarily a reflection of more detailed construction planning for the initial two-year construction and site establishment phase rather than a result of the Proposed Modification. The Applicant anticipates that the construction workforce would be preferentially sourced from the local area. Technical specialists and consultants from outside the local area would reside in hotels, motels, caravan parks or rental accommodation for the duration of their activities. On-site accommodation would not be established to accommodate the construction workforce.

As a result of the Proposed Modification, the operational workforce employed by the Project would increase from 250 to 274 full-time equivalent positions. As anticipated for the approved Project, it is estimated that approximately 85% to 90% of positions (i.e. 230 to 243 positions) would be filled by existing residents within Dubbo and surrounding areas. It is estimated that approximately 10% to 15% of positions (i.e. 27 to 40 positions) would be specialist or technical in nature and would likely require import of personnel from outside of the local area.

3.9 REHABILITATION AND FINAL LAND USE

3.9.1 Introduction

The Proposed Modification would not alter the existing rehabilitation objectives, rehabilitation methods and procedures, or rehabilitation management and monitoring commitments as outlined in Section 2.17 of RWC (2013). Additional detail regarding rehabilitation objectives, rehabilitation completion criteria, and the management of rehabilitation operations over the life of the Project will be provided in the following documents required under Division 3 of Part 2 of the *Mining Amendment (Standard Conditions of Mining Leases – Rehabilitation) Regulation 2021*.

- Rehabilitation Objectives Statement
- Rehabilitation Completion Criteria Statement
- Rehabilitation Management Plan
- Final Landform and Rehabilitation Plan

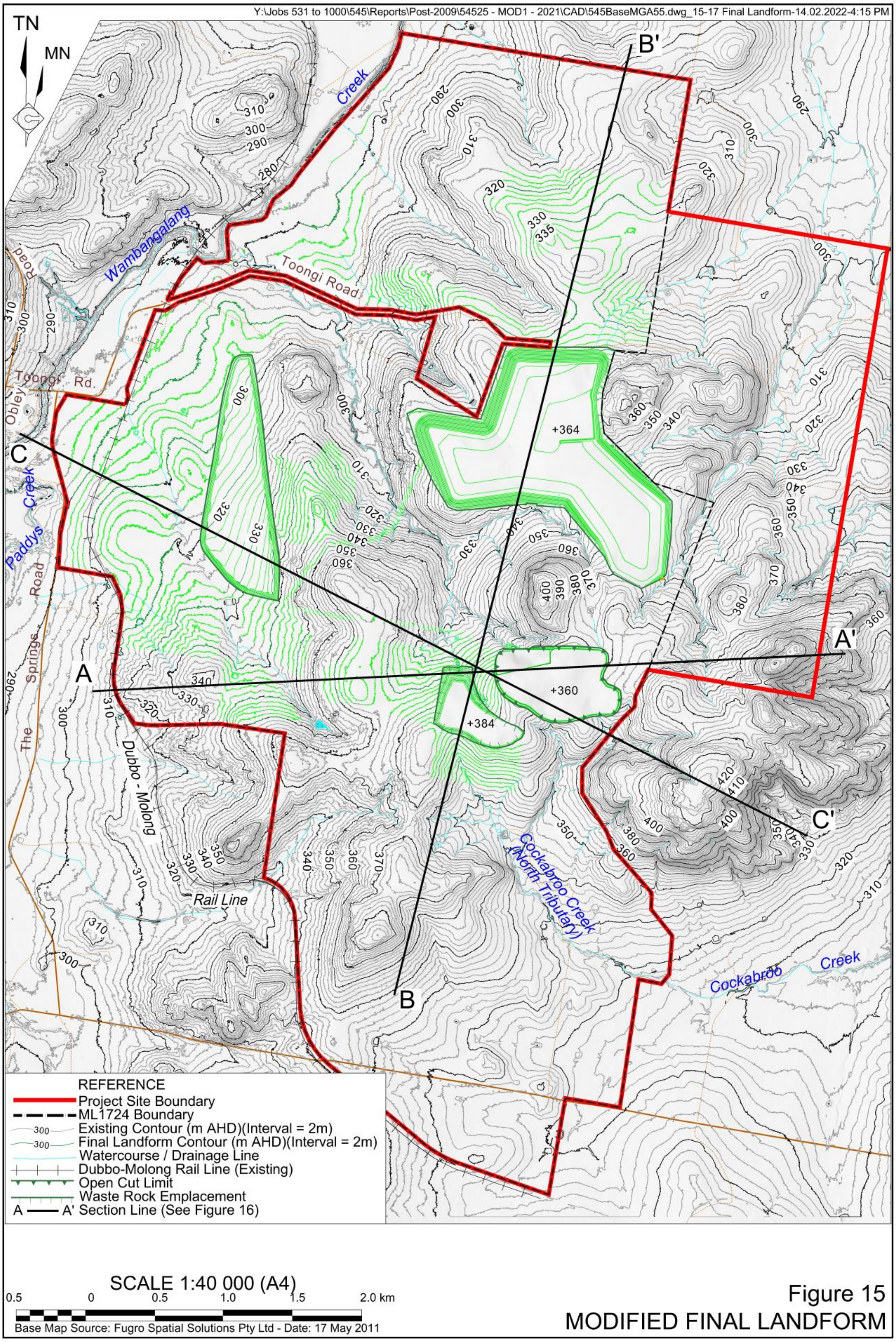
These documents will be developed in consultation with relevant government agencies and stakeholders prior to the commencement of the site establishment and construction phase of the Project.

The Proposed Modification would not alter the existing Biodiversity Offset Area which the Applicant will continue to manage in accordance with the existing *Biodiversity Management Plan*, *Pink-tailed Worm -lizard Management Plan* and *Pink-tailed Worm-lizard Biodiversity Offset Management Plan* for the Project.

3.9.2 Final Landform

Figure 15 presents the indicative final landform for the Project Site and **Figure 16** shows selected final landform sections for the Project Site. The final landform would be largely consistent with the approved final land use and would include the following.

- A reshaped Processing plant and Administration Area with the processing plant, offices and ancillary infrastructure, including concrete pads (unless required for a future land use) removed and the area profiled to re-establish the pre-mining landform.
- A single appropriately bunded, fenced and signed final void with a final depth of 360m AHD.
- A shaped and revegetated Waste Rock Emplacement comprising an undulating upper surface, outer faces with maximum slopes of approximately 18º or 1:3 (V:H) and appropriately located and designed surface water control structures to minimise the risk of erosion and sedimentation.
- A shaped, capped and revegetated Solid Residue Storage Facility comprising free draining upper surface, outer faces with maximum slopes of approximately 18º or 1:3 (V:H) and appropriately located and designed surface water control structures to minimise the risk of erosion and sedimentation.
- Shaped and revegetated Salt Encapsulation Cell comprising undulating upper surfaces, outer faces with maximum slopes of approximately 18º 1:3 (V:H) and appropriately located and designed surface water control structures to minimise the risk of erosion and sedimentation.
- A reshaped Liquid Residue Storage Facility, with the liner removed and disposed of off-site and the embankments profiled to re-establish the pre-mining landform.
- would be respread to re-establish the pre-mining landform and the rehabilitated area would be revegetated.
- A reshaped Growth Medium Stockpiles and Laydown Yard / Growth Medium Stockpiles, with the hardstand material removed and disposed of off site and the area profiled to re-establish the pre-mining landform.
- Vegetated bunds and surface water infrastructure, including sediment basins, would be retained for the final land use.



Base Map Source: Fugro Spatial Solutions Pty Ltd - Date: 17 May 2011

Figure 15
MODIFIED FINAL LANDFORM

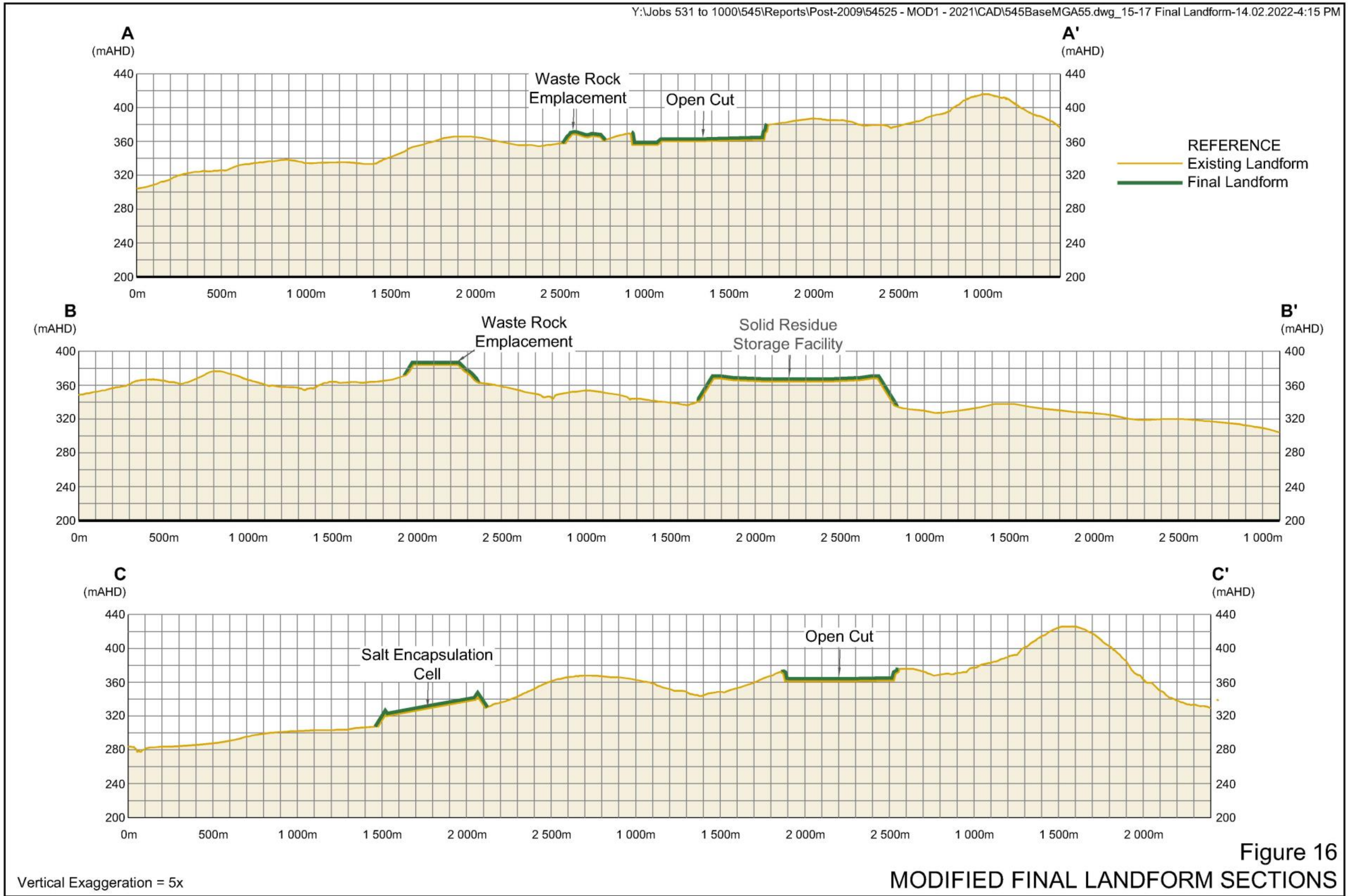


Figure 16
MODIFIED FINAL LANDFORM SECTIONS

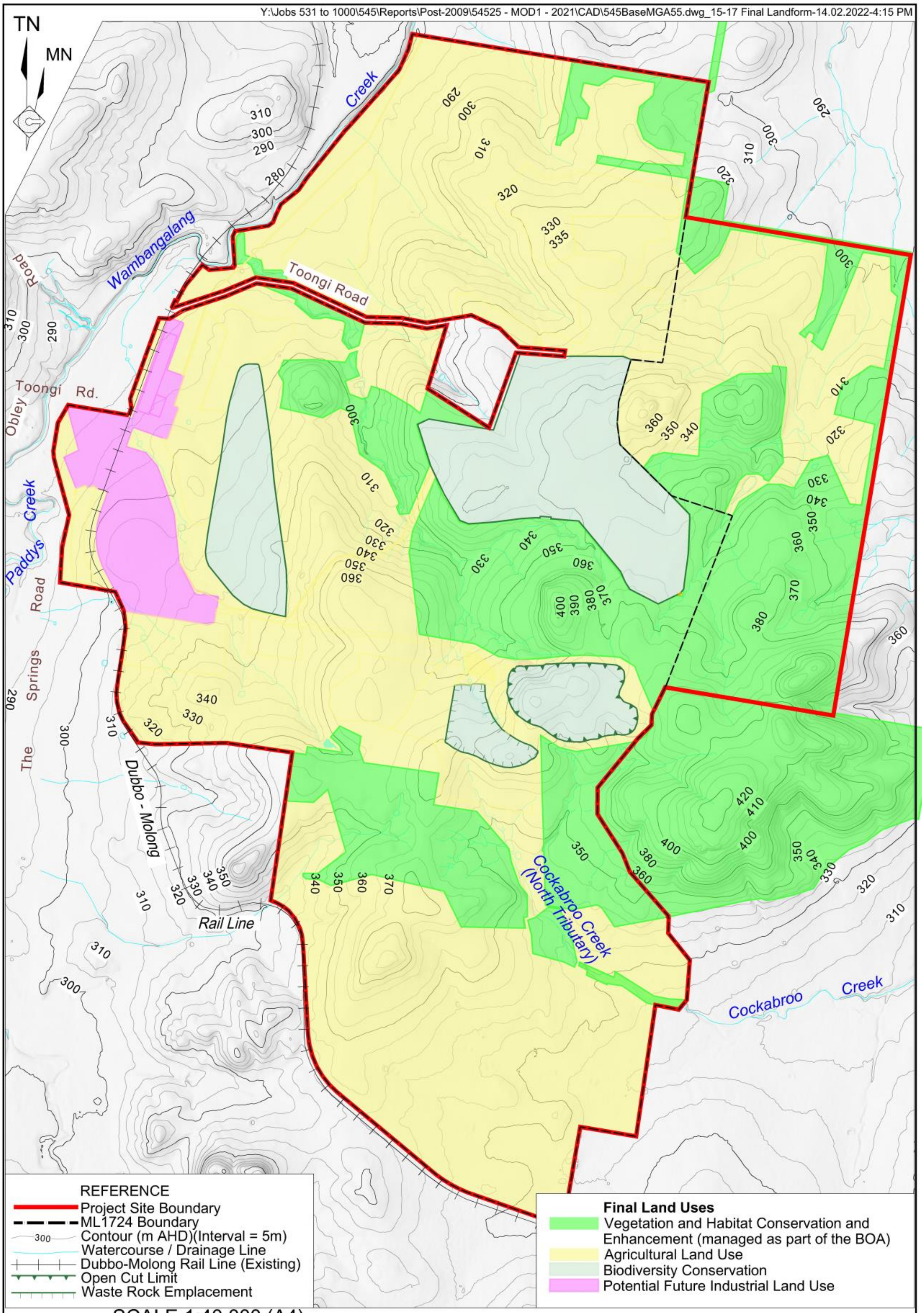
- The Macquarie River Water Pipeline and Natural Gas Pipeline would either be excavated and removed or retained depending on the preference of future landowners and infrastructure managers.
- The rail line infrastructure would be retained.

3.9.3 Final Land Use

Figure 17 presents the modified final land uses for the Project Site. The proposed final land uses would be largely consistent with the approved final land use and would include the following.

- Vegetation and Habitat Conservation and Enhancement – managed as part of the Biodiversity Offset Area.
- Biodiversity Conservation – rehabilitated to native vegetation consistent with local vegetation communities.
- Agricultural Land Use - including cropping and grazing.
- Potential Future Industrial Land Use – includes areas, concrete pads, structures and infrastructure which may be suitable for future industrial land uses (subject to future approval).

The proposed final land uses are generally consistent with those approved for the current Project, with changes to the extent of final land uses required to account for the relocation of infrastructure components within the Project Site.



SCALE 1:40 000 (A4)

0.5 0 0.5 1.0 1.5 2.0 km

Base Map Source: Fugro Spatial Solutions Pty Ltd - Date: 17 May 2011

Figure 17
INDICATIVE FINAL LAND USE

4. STATUTORY CONTEXT

4.1 EXISTING APPROVALS

Table 9 presents the approvals, leases and licences held for the Project.

Table 9
Current Consents, Authorisations and Licenses

Page 1 of 2

Number	Granted by	Grant Date	Expiry Date	Purpose
NSW Development Consent				
SSD-5251	Planning and Assessment Commission	28 May 2015	31 December 2037	Construction and operation of the Dubbo Project.
D2017-70	Western Joint Regional Planning Panel	7 July 2016		Construction and operation of the Karingal Quarry (see **Figure 2**).
Commonwealth EPBC Act Approval				
EPBC 2012/6625	Cth Minister for the Environment	24 August 2015	31 December 2045	EPBC Act Approval for the Dubbo Project.
Mineral Authorities (see **Figure 2**)				
ML1724	Minister for Industry, Resources and Energy	18 December 2015	18 December 2036	Mining activities within the Project Site.
EL5548	Minister for Mineral Resources	21 January 1999	21 January 2027	Exploration activities.
Other Approvals				
EPL20702	Environment Protection Authority	14 March 2016	Renewed annually	Regulation of noise, dust and water emissions from the Project Site.
80WA726382	Natural Resources Access Regulator	16 June 2021	15 June 2031	Authority to construct and use a water supply bore (“Sweet Water”) (1 250ML per annum).
WAL9191		-	-	High security licence to take up to 218MLpa from the Macquarie and Cudgegong Regulated Rivers Water Source downstream of the upper limit of Lake Burrendong.
WAL30259		-	-	General security licence to take up to 750MLpa from the Macquarie and Cudgegong Regulated Rivers Water Source downstream of the upper limit of Lake Burrendong.
WAL19994		-	-	High security licence to take up to 22MLpa from the Macquarie and Cudgegong Regulated Rivers Water Source downstream of the upper limit of Lake Burrendong.
WAL3396		-	-	High security licence to take up to 282MLpa from the Macquarie and Cudgegong Regulated Rivers Water Source downstream of the upper limit of Lake Burrendong.

Table 9 (Cont'd)
Current Consents, Authorisations and Licenses

Page 2 of 2

Number	Granted by	Grant Date	Expiry Date	Purpose
Other Approvals (Cont'd)				
WAL3412		-	-	High security licence to take up to 34ML/pa from the Macquarie and Cudgegong Regulated Rivers Water Source downstream of the upper limit of --Lake Burrendong.
WAL36409		-	-	High security licence to take up to 300MLpa from the Macquarie and Cudgegong Regulated Rivers Water Source downstream of the upper limit of Lake Burrendong.
WAL37691		-	-	Groundwater licence to take up to 1402MLpa from the Upper Macquarie Alluvial Groundwater Source.
Conservation Property Vegetation Plan (PVP) 00199	Local Land Services		In perpetuity	Establishment of a Biodiversity Offset Area for the Project.
Construction Certificate C2021-826	Dubbo Regional Council	20 December 2021	-	Approval to construct site office on Lot 35 in DP 753220.
Section 138 Road Act Approval	Dubbo Regional Council	10 December 2021	-	Approval to construct access/driveway to Lot 35 DP753220, 4R The Springs Road.
Section 99 Approval	Dubbo Regional Council	4 January 2021	-	Permission to install Sewage management system.

Source: Australian Strategic Materials (Holdings) Ltd

4.2 POWER TO MODIFY THE CONSENT

The Dubbo Project, classified as State Significant Development in accordance with *State Environmental Planning Policy (State and Regional Development) 2011*, was approved under State Significant Development (SSD) Consent SSD-5251 which was granted on 28 May 2015. This application is therefore made under Section 4.55(2) of the *Environmental Planning and Assessment Act 1979*.

Section 4.55(2) of the *Environmental Planning and Assessment Act 1979* states the following.

> *A consent authority may, on application being made by the applicant or any other person entitled to act on a consent granted by the consent authority and subject to and in accordance with the regulations, modify the consent …*

Clause 8A(2) of the *State Environmental Planning Policy (State and Regional Development) 2011* states the following.

> *The Independent Planning Commission is also declared, under section 4.5(a) of the Act, to be the consent authority in respect of an application to modify a development consent that is made by a person who has disclosed a reportable political donation under section 10.4 of the Act in connection with the modification application.*

As the Applicant has not made a reportable political donation, the Minister for Planning and Homes, or their delegate, is the consent authority and has the power to modify SSD-5251.

4.3 PERMISSIBILITY

The Project Site lies within land zoned RU 1 – Primary Production under the *Dubbo Local Environment Plan 2011* ("Dubbo LEP").

All land that would be disturbed by the Proposed Modification is zoned RU1. Open cut mining is permissible with consent within that zone. The Proposed Modification would be considered to be ancillary to open cut mining and is therefore permissible.

4.4 OTHER APPROVALS

Table 9 presents the existing approvals held for the Project. **Table 10** identifies where modifications to those approvals would be required or where new approvals would be necessary.

Table 10
Existing Approvals

Approval	Modification/ New Approval Required?	Justification/Comment
EPL20702	Modification	Additional scheduled activity for chemical production on site of HCl and NaOH. Changes to environmental monitoring locations.
ML1724	No	No changes to the approved mining activities.
WAL9191 WAL30259 WAL19994 WAL3396 WAL3412 WAL36409 WAL37691	No	No changes to the approved water supply system.
EPBC 2021/6625	No	No changes to the approved disturbances listed (EPBC Act) threatened species and communities.
D2016-70	No	No changes to the approved extract of basalt resources for use on the mine site.
Groundwater Works Approval 80WA726382 (Upper Macquarie Alluvial Groundwater Source)	No	No changes to the approved water supply system.
Conservation PVP0019	No	No changes to the nominated biodiversity offset for the Project.

4.5 PRE-CONDITIONS TO GRANTING APPROVAL

Table 11 presents the pre-conditions that apply to the Proposed Modification.

Table 11
Preconditions to the Granting of Approval

Section/ Clause	Precondition	Relevance
Environmental Planning and Assessment Act 1979		
4.55(2)	A consent authority may, … modify the consent if (a) it is satisfied that the development to which the consent as modified relates is substantially the same development as the development for which consent was originally granted and before that consent as originally granted was modified (if at all), and	The Proposed Modification would be substantially the same as the approved Dubbo Project for the following reasons. • The Mine would continue to be an open cut mining operation developed to a maximum depth of 32m (355m AHD) with a processing plant producing various rare metals and rare earth element products. • The proposed modifications to the processing plant and administration area including the installation of a brine concentrator to maximise water recovery would not alter or radically transform the approved mine. • The proposed extension of the life of the mine by 8 years from 31 December 2037 to 31 December 2045 would not materially alter or radically transform the approved mine. • The construction of a Chlor-alkali Plant to produce reagents for on-site processing would not be a significant alteration of transformation of the approved mine. • Increasing reagent transportation via rail, an increase in the number of full-time equivalent personnel and extended construction hours would not materially alter or radically transform the approved mine. • Relocation and realignment of several approved areas of disturbance would not increase the approved area of disturbance and would not be a significant alteration or radical transformation the approved mine.
	(b) it has consulted with the relevant [government authorities]	This is a matter for the Department of Planning and Environment.
	(c) it has notified the application in accordance with— i) the regulations, if the regulations so require, or ii) [not relevant]	This is a matter for the Department of Planning and Environment.
	(d) it has considered any submissions made …	This is a matter for the Department of Planning and Environment, however, the Proponent anticipates preparing a *Submissions Report* to provide a response to any submissions received.

4.6 MANDATORY MATTERS FOR CONSIDERATION

Table 12 presents the mandatory matters for consideration that apply to the Proposed Modification.

Table 12
Mandatory Matters for Consideration

Page 1 of 6

Section/ Clause	Matter for Consideration	Relevance/Comment
Environmental Planning and Assessment Act 1979		
1.3	Relevant objects of the Act • to promote the social and economic welfare of the community and a better environment by the proper management, development and conservation of the State's natural and other resources,	The Proposed Modification would promote the social and economic welfare of the community by permitting extraction of a known, State-owned resource, with the associated economic benefits to the community and State. These benefits would be achieved without additional adverse significant social or environmental impacts.
	• to facilitate ecologically sustainable development by integrating relevant economic, environmental and social considerations in decision-making about environmental planning and assessment,	Section 7.5.2 addresses matters relevant to Ecologically Sustainable Development.
	• to promote the orderly and economic use and development of land,	The Proposed Modification would be undertaken in an orderly way to maximise the economic benefit to the community and State while minimising other adverse outcomes.
	• to protect the environment, including the conservation of threatened and other species of native animals and plants, ecological communities and their habitats,	The Proposed Modification would not result in significant adverse environmental outcomes. Section 6 presents a detailed analysis of the key environmental aspects that may be affected by the Proposed Modification.
4.15	Relevant environmental planning instruments	See below.
	Relevant development control plans	In accordance with Clause 11(a) of the *State Environmental Planning Policy (State and Regional Development) 2011*, development control plans are not relevant to SSD applications.
	Any planning agreement	A Planning Agreement exists between the Applicant and Dubbo Regional Council. The Applicant proposes to amend the Planning Agreement in consultation with Dubbo Regional Council to extend the life of the agreement without materially changing the other terms of the agreement.
	The regulations	The Regulations have been considered throughout this document.

Table 12 (Cont'd)
Mandatory Matters for Consideration

Page 2 of 6

Section/ Clause	Matter for Consideration	Relevance/Comment
***Environmental Planning and Assessment Act 1979* (Cont'd)**		
4.15 (Cont'd)	The likely impacts of that development, including environmental impacts on both the natural and built environments, and social and economic impacts in the locality,	Section 6 presents an assessment of relevant impacts on the natural and built environment and social and economic impacts.
	The suitability of the site for the development,	The Project Site is an approved Mine and is suitable for the development.
	Any submissions made in accordance with this Act or the regulations,	This is a matter for Department of Planning and Environment, however, the Proponent anticipates preparing a *Submissions Report* following completion of the exhibition period.
	The public interest.	This is addressed in Section 7.7. In summary, however, the Proponent contends that the Proposed Modification is in the public interest
State Environmental Planning Policy (Mining, Petroleum Production and Extractive Industries) 2007		
12AB	**Non-discretionary development standards for mining** Cumulative noise level The development does not result in a cumulative amenity noise level greater than the acceptable noise levels, as determined in accordance with Table 2.2 of the Noise Policy for Industry, for residences that are private dwellings	The Noise Assessment (see Section 6.3) determined that anticipated noise emissions would be less than the relevant criteria.
	Cumulative air quality level The development does not result in a cumulative annual average level greater than 25µg/m^3 of PM_{10} or 10µg/m^3 of $PM_{2.5}$ for private dwellings.	The Air Quality Assessment (see Section 6.2) determined that the anticipated PM_{10} emissions would be less than the relevant criterion.
	Airblast overpressure Airblast overpressure caused by the development does not exceed: (a) 120 dB (Lin Peak) at any time, and (b) 115 dB (Lin Peak) for more than 5% of the total number of blasts over any period of 12 months, measured at any private dwelling or sensitive receiver.	The Proposed Modification would not alter blasting operations.
	Ground vibration Ground vibration caused by the development does not exceed: (a) 10mm/sec (peak particle velocity) at any time, and (b) 5mm/sec (peak particle velocity) for more than 5% of the total number of blasts over any period of 12 months, measured at any private dwelling or sensitive receiver.	The Proposed Modification would not alter blasting operations.

Table 12 (Cont'd)
Mandatory Matters for Consideration

Page 3 of 6

Section/ Clause	Matter for Consideration	Relevance/Comment
***State Environmental Planning Policy (Mining, Petroleum Production and Extractive Industries) 2007* (Cont'd)**		
12AB (Cont'd)	Aquifer interference Any interference with an aquifer caused by the development does not exceed the respective water table, water pressure and water quality requirements specified for item 1 in columns 2, 3 and 4 of Table 1 of the Aquifer Interference Policy for each relevant water source listed in column 1 of that Table.	No significant changes to the approved groundwater and aquifer interference impacts are anticipated.
12	Consideration is given to: • the existing uses and approved uses of land in the vicinity of the development;	The existing and approved use of the Project is mining and rural land use. The Proposed Modification is consistent with that use.
	• the potential impact on the preferred land uses (as considered by the consent authority) in the vicinity of the development; and	Section 6 presents an assessment of relevant impacts on the natural and built environment and social and economic impacts surrounding the Project Site. The Proposed Modification would not significantly impact on those land uses.
	• any ways in which the development may be incompatible with any of those existing, approved or preferred land uses.	The Proposed Modification would not be inconsistent with existing approved land use within the Project Site or with surrounding land uses.
	The respective public benefits of the development and the existing, approved or preferred land uses are evaluated and compared.	The Proposed Modification would permit the construction and operation of the Project with improved efficiency of mining, processing and transportation operations on site resulting in public benefit arising from the development. The Proposed Modification not adversely impact on the public benefit associated with the surrounding uses.
	Measures proposed to avoid or minimise any incompatibility are considered.	Section 6 presents measures proposed to avoid or minimise any incompatibility.
13	Consideration is given to whether the development is likely to have a significant impact on current or future mining, petroleum production or extractive industry and ways in which the development may be incompatible. Measures taken by the Proponent to avoid or minimise any incompatibility are considered. The public benefits of the development and any existing or approved mining, petroleum production or extractive industry must be evaluated and compared.	Clause 13 is not considered relevant on the basis that the Mine has already been approved and as such the compatibility of the Mine with other mining, petroleum production or extractive industry has already been considered. Furthermore, the Proponent has considered the mineral perspectivity of the Proposed Modification footprint and is satisfied that the Proposed Modification would not sterilise resources.

Table 12 (Cont'd)
Mandatory Matters for Consideration

Page 4 of 6

Section/ Clause	Matter for Consideration	Relevance/Comment
***State Environmental Planning Policy (Mining, Petroleum Production and Extractive Industries) 2007* (Cont'd)**		
14	Consideration is given to ensuring that the development is undertaken in an environmentally responsible manner, including conditions to ensure: • impacts on significant water resources, including surface and groundwater resources, are avoided or minimised;	Section 6.9 address matters related to surface water and groundwater respectively.
	• impacts on threatened species and biodiversity are avoided or minimised; and	Section 6.6 addresses matters related to biodiversity.
	• greenhouse gas emissions are minimised and an assessment of the greenhouse gas emissions (including downstream emissions) of the development is provided.	The Proposed Modification would not materially alter the Mine's greenhouse gas emissions.
15	The efficiency of resource recovery, including the reuse or recycling of material and minimisation of the creation of waste, is considered	The Proposed Modification would ensure that the maximum benefit is obtained from a State-owned resource within the approved life of the Mine.
16	The following transport-related issues are considered. • The transport of some or all of the materials from the site by means other than public road. • Limitation of the number of truck movements that occur on roads within residential areas or roads near to schools. The preparation of a code of conduct for the transportation of materials on public roads.	Section 3.5 addresses matters related to transport-related matters.
17	The rehabilitation of the land affected by the development is considered including: • the preparation of a plan that identifies the proposed end use and landform of the land once rehabilitated; • the appropriate management of development generated waste; • remediation of any soil contaminated by the development; and • the steps to be taken to ensure that the state of the land does not jeopardise public safety, while being rehabilitated or at the completion of rehabilitation.	The Proposed Modification would not result in an additional area that would be required to be rehabilitated. The Proposed Modification would not result in generation of waste, require remediation of contaminated soil or jeopardise public safety.

Table 12 (Cont'd)
Mandatory Matters for Consideration

Page 5 of 6

Section/ Clause	Matter for Consideration	Relevance/Comment
Dubbo Local Environmental Plan 2011		
7.2	**Natural resource – Biodiversity** (3) Development consent must not be granted to development on land to which this clause applies, unless the consent authority has taken into consideration the following matters—	Section 6.6 addresses matters related to biodiversity.
	a) identification of any potential adverse impact of the proposed development on any of the following-	The Proposed Modification would result in disturbance of the following plant vegetation community types.
	i) a native vegetation community ii) the habitat of any threatened species, population or ecological community iii) a regionally significant species of plant, animal or habitat iv) a habitat corridor v) a wetland vi) the biodiversity values within a reserve, including a road reserve or a stock route b) a description of any proposed measures to be undertaken to ameliorate any such potential adverse impact.	The Proposed Modification would not result in additional disturbance to any native vegetation communities.
	(4) Development consent must not be granted to development on land to which this clause applies unless the consent authority is satisfied that— a) the development is designed, sited and will be managed to avoid any significant adverse environmental impact, or	The Proposed Modification would avoid significant adverse environmental impact.
	b) if potential adverse impact cannot be avoided—the development is designed and sited so as to have minimal adverse impact, and incorporates effective measures so as to have minimal adverse impact, and mitigates any residual adverse impact through the restoration of any existing disturbed or modified area on the site.	

Table 12 (Cont'd)
Mandatory Matters for Consideration

Section/ Clause	Matter for Consideration	Relevance/Comment
Biodiversity Conservation Act 2016		
7.14(2)	The Minister for Planning, when determining in accordance with the Environmental Planning and Assessment Act 1979 any such application, is to take into consideration under that Act the likely impact of the proposed development on biodiversity values as assessed in the biodiversity development assessment report. The Minister for Planning may (but is not required to) further consider under that Act the likely impact of the proposed development on biodiversity values	An assessment of Biodiversity impacts is presented in Section 6.6.

5. ENGAGEMENT

5.1 GOVERNMENT AGENCY CONSULTATION

A consultation log providing details of the Applicant's consultation with various government agencies is provided in **Appendix 3**.

Department of Planning, Industry and Environment

A *Briefing Paper* outlining the Proposed Modification was provided to Department of Planning and Environment on 19 August 2021 via the Planning Portal with a request for a Scoping Meeting. This was followed by a videoconference with the Department on 2 September 2021 during which the Applicant provided the Department with a briefing on the proposed activities and a range of matters to be addressed in the Modification Report were discussed. No formal environmental assessment requirements were issued for the Proposed Modification.

Mining, Exploration and Geoscience

A *Briefing Paper* was provided to Mining, Exploration and Geoscience (MEG) on 4 November 2021 with a request for a meeting. A videoconference with MEG was held on 4 November 2021 during which the Applicant presented a briefing on the proposed activities to be addressed by the Modification Report. MEG provided a letter on 12 November 2021 which confirmed that no issues had been identified as a result of the presentation and indicating that MEG considers the Proposed Modification to assist in providing social and economic benefits to the State and local area (**Appendix 3**).

Dubbo Regional Council

Representatives of the Applicant met with representatives of Dubbo Shire Council on several occasions to discuss the status of the approved Project and likely changes under the Proposed Modification. These discussions centred around potential impacts to linear infrastructure (i.e. Toongi to Dubbo rail, roads) construction and upgrade works and the outcomes of a rail transportation feasibility study for the Project. Other matters discussed with Dubbo Regional Council included the timeline for commencement, approvals required to commence construction works, and potential economic and social impacts on the Dubbo area as a consequence of the Project and the Proposed Modification.

5.2 COMMUNITY CONSULTATION

The Applicant has engaged in extensive community consultation in relation to the approved activities, the Karingle Basalt Quarry, and the Proposed Modification. Consultation has included the following.

- Community newsletters[2], with the most recent edition (January 2022) providing an overview of the Proposed Modification and next steps for the Application.

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[2] Community newsletters are available at https://asm-au.com/sustainability/community/dubbo-project-community-updates/

- Community Consultative Committee[3], with the Proposed Modification discussed at the December 2022 meeting of the committee, with no comments received.
- Discussions with community members at the Dubbo Regional Show where the Applicant maintained a staffed display.
- Face to face meetings, with at least 20 meetings with surrounding landholders between December 2020 and December 2021. Discussions addressed a range of matters including the Project and the Proposed Modification. During these meetings, no concerns or issues with the Proposed Modification were raised.
- Telephone conversations with relevant Project Site neighbours regarding the Proposed Modification during the week of 24 January 2022, with no concerns expressed.
- Ad-hoc community engagement, with no comments received.

A consultation log providing details of the Applicant's consultation with various community stakeholders is provided in **Appendix 3**.

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[3] CCC meeting minutes are available at https://asm-au.com/sustainability/community/community-resources/ccc-archive/

6. ASSESSMENT OF IMPACTS

6.1 INTRODUCTION

This section provides an assessment of the impacts associated with those features of the local environment which could potentially be affected by the Proposed Modification. The assessment includes a description of the proposed design and/or operational safeguards that are proposed to be implemented and an assessment of the level of impact the Proposed Modification may have when compared with the approved Project after implementation of those safeguards.

This Section also presents those environmental aspects that would not be impacted by the Proposed Modification and a justification for why that is the case.

6.2 AIR QUALITY AND GREENHOUSE GAS

6.2.1 Introduction

Northstar Air Quality Pty Ltd (Northstar) prepared an Air Quality Impact Assessment for the Proposed Modification. The resulting report, referred to hereafter as Northstar (2022), is presented as **Appendix 4**. The following sub-sections draw on information presented in that report and describes the existing air quality environment, predicted changes to that environment as a result of the Proposed Modification, the proposed management and mitigation measures and an assessment of air quality-related impacts.

6.2.2 Local Setting and Environmental Performance

6.2.2.1 Meteorological Data

For air quality modelling purposes, Northstar (2022) relied on meteorological data sourced from the Bureau of Meteorology (BoM) Automatic Weather Station (Station No. 065070) located at Dubbo Airport, approximately 30km north of the Project Site.

Data from the year 2015 was selected to provide an approximation of representative conditions surrounding the Project Site based on an examination of the meteorology and background air quality conditions for the period 2015 to 2020.

6.2.2.2 Background Air Quality

As there is no specific air quality monitoring data available in the immediate vicinity of the Project Site, Northstar (2022) utilised results from various NSW DPIE operated air quality monitoring stations located in regional centres to represent air quality in the vicinity of the Project Site. A summary of the background air quality concentrations adopted by Northstar (2022) are provided in **Table 13**.

Table 13
Summary of Background Air Quality

Air Quality Monitoring Station	Pollutant	Averaging Period	Measured Value	Comments
Bathurst	TSP	Annual µg/m³	30.1	Estimated using a TSP:PM_{10} ratio of 2.2434:1
Bathurst	PM_{10}	24-hour µg/m³	Daily Varying	The 24-hour maximum for PM_{10} in 2015 was 94.6µg/m³
		Annual µg/m³	13.4	
Wagga Wagga North	$PM_{2.5}$	24-hour µg/m³	Daily Varying	The 24-hour maximum for $PM_{2.5}$ in 2015 was 24.2µg/m³
		Annual µg/m³	7.6	
Bargo	Nitrogen dioxide (NO_2)	1-hour µg/m³	98.4	Hourly max 1-hour average in 2015
		Annual µg/m³	10.9	Annual average in 2015
Bargo	Sulphur Dioxide (SO_2)	10-minute	36.9	Calculated from hourly data
		1-hour µg/m³	25.8	Hourly max 1-hour average
		24-hour µg/m³	Daily Varying	The 24-hour maximum for SO_2 in 2015 was 5.72 µg/m³
		Annual µg/m³	0.7	Annual average in 2015

Source: Northstar (2022) – modified after Table 10

Background air quality monitoring of other pollutants assessed by Northstar (2022), such as HCl, Cl_2 and odour is not routinely performed in NSW. As a result, no data for these parameters was available, therefore, it was assumed that background concentrations would be negligible. Northstar (2022) notes that this approach is commonplace in NSW and is consistent with *Approved Methods for the Sampling and Analysis of Air Pollutants in NSW* (EPA, 2017a).

6.2.3 Potential Sources of Air Contaminants

The following potential sources of emissions resulting from Project construction, operations and processing activities were considered by Northstar (2022).

- Topsoil removal.
- Drilling and blasting.
- Materials handling.
- Loading of haul trucks, transport, unloading, and storage of topsoil, ore material and overburden.
- Processing of ore material and storage of refined ore.
- Loading product trucks with refined ore material and haulage offsite.
- Wind erosion of stripped areas and topsoil storage locations.
- Emissions from vehicle and equipment exhaust.

6.2.4 Assessment Methodology and Criteria

6.2.4.1 Assessment Methodology

Using the site-specific meteorological file generated, air dispersion modelling was used to simulate the dispersion of particulate matter associated with the sources outlined in Section 6.2.3. A range of emissions controls, including the use of a water truck to dampen roads during dry conditions, were included in the modelling assessment. Modelling was performed using the NSW EPA approved CALPUFF atmospheric dispersion model in 3-dimensional (3-D) mode.

An assessment of the impacts of activities at the Project Site was undertaken to characterise the likely day-to-day operation of the Proposed Modification. This assessment relied upon average operational characteristics to assess the Project against longer term (annual average) and shorter-term (24-hour) criteria for particulate matter. In assessment of emissions from processing activities, emissions data provided by the Applicant were adopted to assess against both long- and short-term criteria.

Two scenarios were selected for dispersion modelling (construction and operation) and are presented in **Figures 18** and **19** respectively. Northstar (2022) notes that the peak activity rates are likely to be similar to average activity rates, and therefore, comparison of potential impacts against short term air quality criteria is also considered appropriate.

As the background data for annual average $PM_{2.5}$ used for the assessment is considered to be high (i.e. background levels are at approximately 95% of the criteria, regardless of the operation of the Project), Northstar (2022) assessed particulate matter using the Level 2 Contemporaneous Assessment Method provided in the *Approved Methods for the Modelling and Assessment of Air Pollutants in New South Wales* (EPA, 2017a).

Consistent with the *Air Quality Impact Assessment* prepared by Pacific Environment Limited (PEL) (hereafter referred to as PEL, 2013)) in support of the EIS for the Project (RWC, 2013), odour emissions are anticipated to be released from waste produced by ore processing operations. Liquid wastes would be contained within the modified Liquid Residue Storage Facility, while solid wastes would be contained within the modified Solid Residue Storage Facility. As outlined in PEL (2013), odour samples from each waste stream were collected from an analogue site located in Lucas Heights. The specific odour emission rate for liquid waste was determined to be $0.15OUm^3/m^2/s^{-1}$ and for solid waste was determined to be $0.08OUm^3/m^2/s^{-1}$. Northstar (2022) notes that odour emissions decrease rapidly with time, and a range of assumptions were adopted in PEL (2013) to allow for an appropriate representation of odour emissions from the Project Site. These assumptions included adoption of a diluted specific odour emission rate ($0.01OUm^3/m^2/s^{-1}$) from the Liquid Residue Storage Facility, an approach which was also adopted in Northstar (2022). In addition, Northstar (2022) applied odour emissions to the maximum area of the Liquid Residue Storage Facility and Solid Residue Storage Facility which results in a greater total odour emissions rate from the Project Site when compared with PEL (2013).

Consistent with the approach taken in PEL (2013), emissions of radon (Rn) were assessed in Northstar (2022) during year 15 of Project operations. Rn emissions rates were determined by the radiation assessment prepared by JRHC Enterprises Pty Ltd (JRHC, 2013) in support of RWC (2013), with all emissions modelled as area sources with the exception of those which may be released by the Ore Mill Exhaust Vent within the Processing Plant.

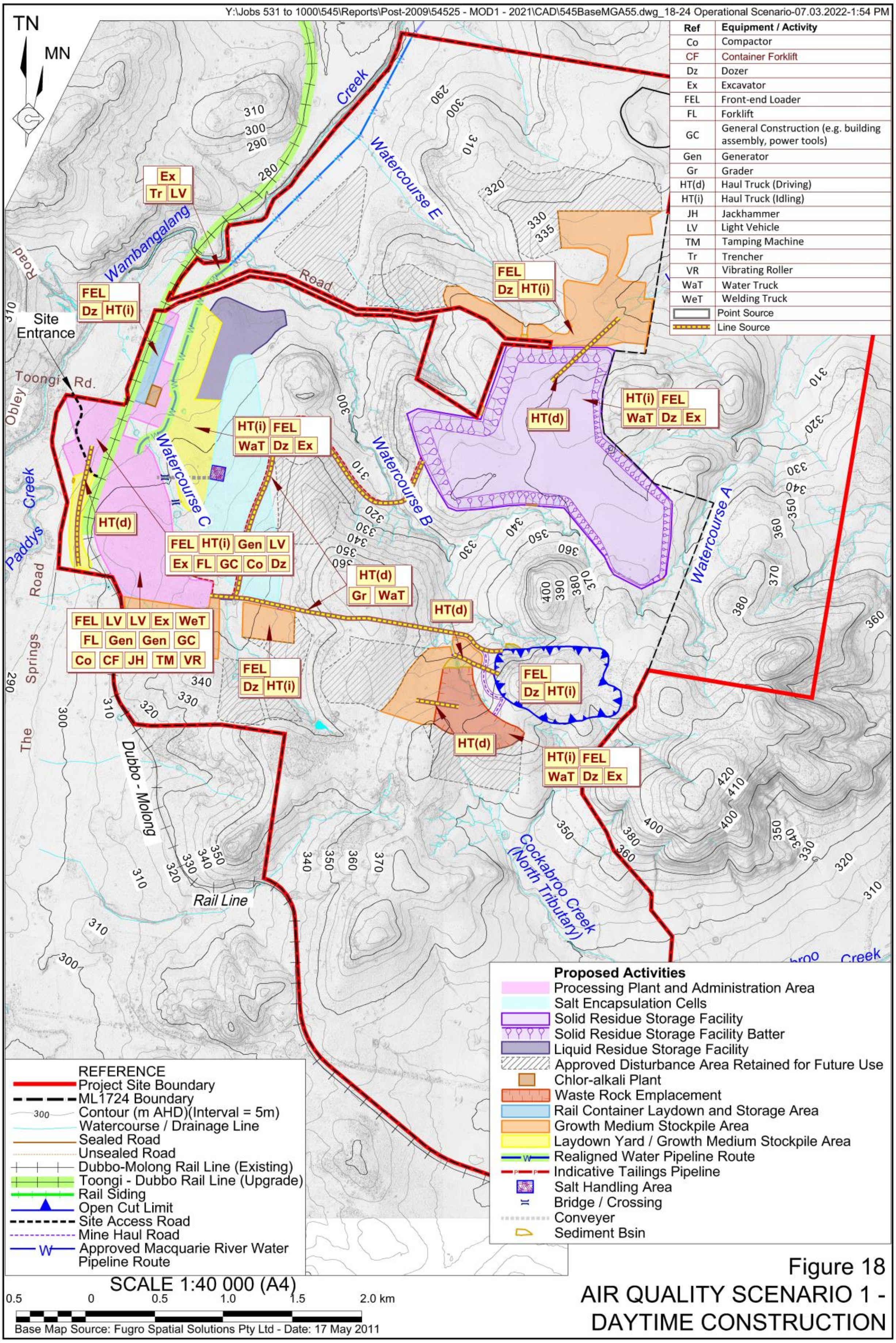

Figure 18
AIR QUALITY SCENARIO 1 -
DAYTIME CONSTRUCTION

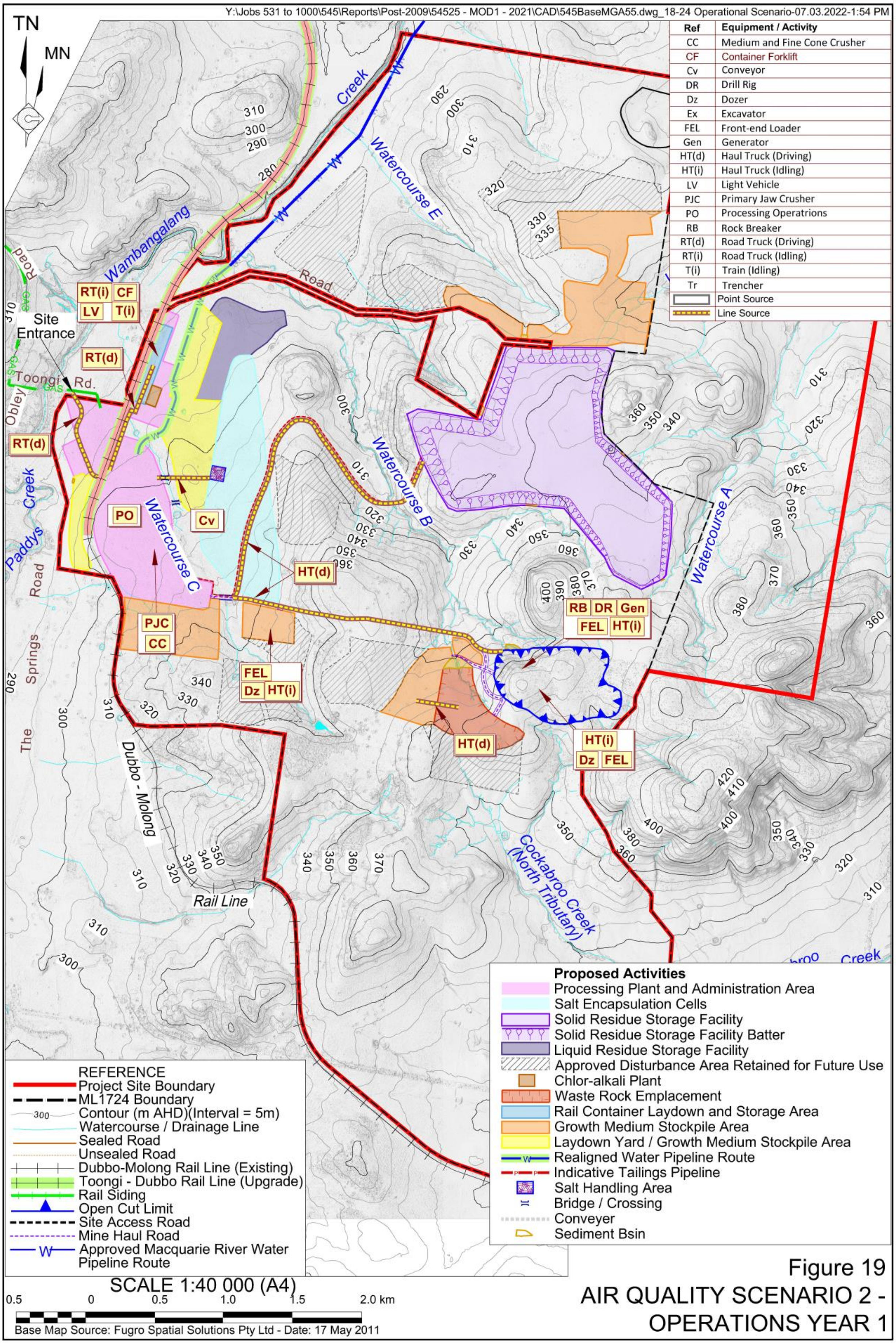

Figure 19
AIR QUALITY SCENARIO 2 - OPERATIONS YEAR 1

Other pollutants anticipated to be released during Project operations including SO_2, NO_2, HCl and Cl_2 were also assessed in Northstar (2022). Parameters for emission sources, emission rates and locations were provided by the Applicant and presented as Appendix D to Northstar (2022).

6.2.4.2 Assessment Criteria

Table 14 presents the air quality criteria listed in the *Approved Methods for the Modelling and Assessment of Air Pollutants in NSW* (EPA, 2017a) which were adopted by Northstar (2022). It is noted that the criteria are intended to minimise any potential impacts to human health and amenity.

Table 14
Air Quality Assessment Criteria

Pollutant	Averaging Period	Criterion (μg/m^3)		Comments
Sulphur dioxide (SO_2)	10 minutes	712		N/A
	1 hour	570		
	24 hours	228		
	Annual	60		
Nitrogen dioxide (NO_2)	1 hour	246		Numerically equivalent to the AAQ NEPM^{*1} standards and goals
	Annual	62		
PM_{10}	24 hours	50		
	Annual	25		
$PM_{2.5}$	24 hours	25		
	1 year	8		
TSP	Annual	90		N/A
Deposited dust	1 year	(g/m^2/month)		Defined by AS 3580.10.1
		2^{*2}	4^{*3}	

Note 1: National Environment Protection (Ambient Air Quality) Measure
Note 2: Maximum total increase in deposited dust level
Note 3: Maximum total deposited dust level

Source: Northstar (2022) – modified after Table 3

Consistent with PEL (2013), an odour impact assessment criterion of 6OU was adopted in Northstar (2022).

6.2.5 Management and Mitigation Measures

6.2.5.1 Site Establishment

In addition to the air quality management and mitigation measures identified in Section 4.3.6.2 of RWC (2013), the following additional management and mitigation measure would be implemented during the site establishment phase of the Project.

- Application of water to haulage routes.

6.2.5.2 Operations

In addition to the air quality management and mitigation measures identified in Section 4.3.6.3 of RWC (2013), the following additional management and mitigation measures would be implemented during the operational phase of the Project.

- Ensure the top surface of Solid Residue Storage Facility maintains a high moisture content to avoid generation of wind blown dust.
- Employ water sprays on materials during screening operations.
- Preparation and implementation of an *Air Quality Management Plan* in accordance with Condition 23 of Schedule 3 of SSD-5251.

6.2.5.3 Processing Plant

In addition to the air quality management and mitigation measures identified in Section 4.3.6.4 of RWC (2013), the following additional management and mitigation measure would be implemented during processing plant operations for the Project.

- The use of spray curtains at all crushers and miscellaneous transfer points not already located within enclosures.

6.2.6 Assessment of Impacts

6.2.6.1 Construction Scenario

Predicted annual average particulate matter emissions for the construction scenario are presented in **Table 15**. In summary, results indicate that predicted incremental concentrations of particulate matter at non-Project related residential receiver locations are as follows.

- < 8.1% of the annual average TSP criterion.
- ≤ 19.8% of the annual average PM_{10} criterion.
- ≤ 9.9% of the annual average $PM_{2.5}$ criterion.
- < 10.8% of the annual average deposited dust criterion.

Similarly, the assessment results for this scenario indicate that the addition of incremental impacts to background concentrations results in the following cumulative impacts, as a maximum.

- 41.5% of the annual average TSP criterion.
- 73.4% of the annual average PM_{10} criterion.
- 104.9% of the annual average $PM_{2.5}$ criterion.
- 80.4% of the annual average deposited dust criterion.

Table 15 identifies that the annual average $PM_{2.5}$ criterion is predicted to be exceeded at six receiver locations, namely R12, R22, R23, R24, R25 and R50, however, Northstar (2022) notes that these exceedances are principally a result of high background particulate matter concentrations. In particular, background concentrations of $PM_{2.5}$ are approximately 95% of the annual average criterion. It is considered that changes to particulate matter concentrations directly attributable to the Proposed Modification are minor.

The predicted maximum 24-hour average PM_{10} and $PM_{2.5}$ concentrations are presented in detail in Section 6.1.1 of Northstar (2022). In summary, cumulative impacts are generally not predicted to be in exceedance of the relevant criterion during the construction phase of the Proposed Modification, with the exception of one exceedance at receiver R12. As above, Northstar (2022) notes that this exceedance is a result of high background concentrations.

6.2.6.2 Operational Scenario

6.2.6.2.1 Particulate Matter

Predicted annual average particulate matter emissions for the operational scenario are presented in **Table 16**. In summary, results indicate that predicted incremental concentrations of particulate matter at non-Project related residential receiver locations are as follows.

- 9.9% of the annual average TSP criterion.
- 27.8% of the annual average PM_{10} criterion.
- 15.8% of the annual average $PM_{2.5}$ criterion.
- 7.2% of the annual average deposited dust criterion.

Similarly, the assessment results for this scenario indicate that the addition of incremental impacts to background concentrations results in the following cumulative impacts.

- 43.3% of the annual average TSP criterion.
- 81.4% of the annual average PM_{10} criterion.
- 110.8% of the annual average $PM_{2.5}$ criterion.
- 78.6% of the annual average deposited dust criterion.

Table 16 identifies that the annual average $PM_{2.5}$ criterion is predicted to be exceeded at receiver locations, namely R12, R19, R20, R22, R23, R24, R25 and R50, however, as with the construction scenario, Northstar (2022) notes that these exceedances are principally a result of high background particulate matter concentrations. It is considered that changes to particulate matter concentrations directly attributable to the Proposed Modification are minor.

The predicted maximum 24-hour average PM_{10} and $PM_{2.5}$ concentrations for the operation scenario are presented in detail in Section 6.2.1 of Northstar (2022). In summary, cumulative impacts are generally not predicted to be in exceedance of the relevant criterion during the operational phase of the Proposed Modification, with the exception of two exceedances of the $PM_{2.5}$ criterion at receiver R23 and two exceedances of the PM_{10} criteria at R50. As above, Northstar (2022) notes that these exceedances are a result of high background concentrations.

Table 15
Predicted Annual Average Particulate Matter Concentrations – Construction Scenario

Page 1 of 2

Receiver ID[1]	Annual Average Concentration ($\mu g/m^3$)											
	TSP			PM_{10}			$PM_{2.5}$			Deposited Dust		
	Incremental Impact	Background	Cumulative Impact	Incremental Impact	Background	Cumulative Impact	Incremental Impact	Background	Cumulative Impact	Incremental Impact	Background	Cumulative Impact
Criterion	**90**			**25**			**8**			**2**	**-**	**4**
N1	<0.1	30.1	30.2	<0.1	13.4	13.5	<0.1	7.6	7.7	<0.1	3	3.1
N2	0.3	30.1	30.4	0.3	13.4	13.7	<0.1	7.6	7.7	<0.1	3	3.1
N3	0.4	30.1	30.5	0.3	13.4	13.7	<0.1	7.6	7.7	<0.1	3	3.1
R11	0.3	30.1	30.4	0.3	13.4	13.7	<0.1	7.6	7.7	<0.1	3	3.1
R32	0.4	30.1	30.5	0.3	13.4	13.7	<0.1	7.6	7.7	<0.1	3	3.1
R64	0.3	30.1	30.4	0.3	13.4	13.7	<0.1	7.6	7.7	<0.1	3	3.1
R65	0.2	30.1	30.3	0.1	13.4	13.5	<0.1	7.6	7.7	<0.1	3	3.1
R12	7.3	30.1	37.4	4.9	13.4	18.3	0.8	7.6	**8.4**	0.2	3	3.2
R13	0.3	30.1	30.4	0.3	13.4	13.7	<0.1	7.6	7.7	<0.1	3	3.1
R18	0.5	30.1	30.6	0.4	13.4	13.8	<0.1	7.6	7.7	<0.1	3	3.1
R19	1.4	30.1	31.5	1	13.4	14.4	0.2	7.6	7.8	<0.1	3	3.1
R20	1.9	30.1	32	1.4	13.4	14.8	0.2	7.6	7.8	<0.1	3	3.1
R21	0.8	30.1	30.9	0.7	13.4	14.1	0.1	7.6	7.7	<0.1	3	3.1
R22	4.8	30.1	34.9	3.5	13.4	16.9	0.6	7.6	**8.2**	0.1	3	3.1
R23	4.8	30.1	34.9	3.4	13.4	16.8	0.6	7.6	**8.2**	0.1	3	3.1
R24	4	30.1	34.1	2.9	13.4	16.3	0.5	7.6	**8.1**	<0.1	3	3.1
R25	3.9	30.1	34	2.9	13.4	16.3	0.5	7.6	**8.1**	<0.1	3	3.1
R26	1.7	30.1	31.8	1.3	13.4	14.7	0.2	7.6	7.8	<0.1	3	3.1
R27	0.5	30.1	30.6	0.4	13.4	13.8	<0.1	7.6	7.7	<0.1	3	3.1
R28A	0.5	30.1	30.6	0.4	13.4	13.8	<0.1	7.6	7.7	<0.1	3	3.1
R28B	0.4	30.1	30.5	0.4	13.4	13.8	<0.1	7.6	7.7	<0.1	3	3.1
R30A	0.5	30.1	30.6	0.4	13.4	13.8	<0.1	7.6	7.7	<0.1	3	3.1
R30B	0.5	30.1	30.6	0.4	13.4	13.8	<0.1	7.6	7.7	<0.1	3	3.1
R31A	0.3	30.1	30.4	0.2	13.4	13.6	<0.1	7.6	7.7	<0.1	3	3.1
R31B	0.3	30.1	30.4	0.3	13.4	13.7	<0.1	7.6	7.7	<0.1	3	3.1
R35	0.4	30.1	30.5	0.3	13.4	13.7	<0.1	7.6	7.7	<0.1	3	3.1
R36	0.5	30.1	30.6	0.4	13.4	13.8	<0.1	7.6	7.7	<0.1	3	3.1
R38	0.3	30.1	30.4	0.3	13.4	13.7	<0.1	7.6	7.7	<0.1	3	3.1
R4	0.3	30.1	30.4	0.2	13.4	13.6	<0.1	7.6	7.7	<0.1	3	3.1
R40A	0.4	30.1	30.5	0.3	13.4	13.7	<0.1	7.6	7.7	<0.1	3	3.1
R40B	0.5	30.1	30.6	0.4	13.4	13.8	<0.1	7.6	7.7	<0.1	3	3.1
R41	0.3	30.1	30.4	0.2	13.4	13.6	<0.1	7.6	7.7	<0.1	3	3.1
R43	0.4	30.1	30.5	0.3	13.4	13.7	<0.1	7.6	7.7	<0.1	3	3.1
R44	0.2	30.1	30.3	0.2	13.4	13.6	<0.1	7.6	7.7	<0.1	3	3.1
R46	0.4	30.1	30.5	0.3	13.4	13.7	<0.1	7.6	7.7	<0.1	3	3.1

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Table 15 (Cont'd)
Predicted Annual Average Particulate Matter Concentrations – Construction Scenario

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Receiver ID[1]	Annual Average Concentration (µg/m^3)											
	TSP			PM$_{10}$			PM$_{2.5}$			Deposited Dust		
	Incremental Impact	Background	Cumulative Impact	Incremental Impact	Background	Cumulative Impact	Incremental Impact	Background	Cumulative Impact	Incremental Impact	Background	Cumulative Impact
Criterion	**90**			**25**			**8**			**2**	**-**	**4**
R50	7.1	30.1	37.2	4.5	13.4	17.9	0.7	7.6	8.3	0.2	3	3.2
R59A	0.2	30.1	30.3	0.1	13.4	13.5	<0.1	7.6	7.7	<0.1	3	3.1
R59B	0.1	30.1	30.2	0.1	13.4	13.5	<0.1	7.6	7.7	<0.1	3	3.1
R6	0.4	30.1	30.5	0.3	13.4	13.7	<0.1	7.6	7.7	<0.1	3	3.1
R61	0.1	30.1	30.2	0.1	13.4	13.5	<0.1	7.6	7.7	<0.1	3	3.1
R66	0.2	30.1	30.3	0.2	13.4	13.6	<0.1	7.6	7.7	<0.1	3	3.1
R67	0.2	30.1	30.3	0.2	13.4	13.6	<0.1	7.6	7.7	<0.1	3	3.1
R68	0.2	30.1	30.3	0.2	13.4	13.6	<0.1	7.6	7.7	<0.1	3	3.1
R7A	0.6	30.1	30.7	0.5	13.4	13.9	<0.1	7.6	7.7	<0.1	3	3.1
R7B	0.9	30.1	31	0.7	13.4	14.1	0.1	7.6	7.7	<0.1	3	3.1
R8A	0.7	30.1	30.8	0.5	13.4	13.9	<0.1	7.6	7.7	<0.1	3	3.1
R8B	0.3	30.1	30.4	0.2	13.4	13.6	<0.1	7.6	7.7	<0.1	3	3.1

Note 1: Sensitive receiver locations shown on **Figure 6**.

Note 2: **Bold text** – exceedance of relevant criterion.

Source: Northstar (2022): modified after Tables 13 and 14

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Table 16
Predicted Annual Average Particulate Matter Concentrations – Operation Scenario

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Receiver ID[1]	Annual Average Concentration ($\mu g/m^3$)											
	TSP			PM_{10}			$PM_{2.5}$			Deposited Dust		
	Incremental Impact	Background	Cumulative Impact	Incremental Impact	Background	Cumulative Impact	Incremental Impact	Background	Cumulative Impact	Incremental Impact	Background	Cumulative Impact
Criterion	**90**			**25**			**8**			**2**	**-**	**4**
N1	<0.1	30.1	30.2	<0.1	13.4	13.5	<0.1	7.6	7.7	<0.1	3.0	3.1
N2	0.4	30.1	30.5	0.3	13.4	13.7	<0.1	7.6	7.7	<0.1	3.0	3.1
N3	0.4	30.1	30.5	0.4	13.4	13.8	<0.1	7.6	7.7	<0.1	3.0	3.1
R11	0.4	30.1	30.5	0.4	13.4	13.8	0.1	7.6	7.7	<0.1	3.0	3.1
R32	0.5	30.1	30.6	0.4	13.4	13.8	0.1	7.6	7.7	<0.1	3.0	3.1
R64	0.4	30.1	30.5	0.3	13.4	13.7	<0.1	7.6	7.7	<0.1	3.0	3.1
R65	0.2	30.1	30.3	0.2	13.4	13.6	<0.1	7.6	7.7	<0.1	3.0	3.1
R12	4.3	30.1	34.4	3.5	13.4	16.9	0.7	7.6	**8.3**	<0.1	3.0	3.1
R13	0.4	30.1	30.5	0.4	13.4	13.8	0.1	7.6	7.7	<0.1	3.0	3.1
R18	0.6	30.1	30.7	0.5	13.4	13.9	0.1	7.6	7.7	<0.1	3.0	3.1
R19	1.4	30.1	31.5	1.2	13.4	14.6	0.4	7.6	8.0	<0.1	3.0	3.1
R20	1.8	30.1	31.9	1.5	13.4	14.9	0.5	7.6	**8.1**	<0.1	3.0	3.1
R21	0.9	30.1	31.0	0.8	13.4	14.2	0.2	7.6	7.8	<0.1	3.0	3.1
R22	3.7	30.1	33.8	3.0	13.4	16.4	0.6	7.6	**8.2**	<0.1	3.0	3.1
R23	3.8	30.1	33.9	3.1	13.4	16.5	0.6	7.6	**8.2**	<0.1	3.0	3.1
R24	3.3	30.1	33.4	2.7	13.4	16.1	0.6	7.6	**8.2**	<0.1	3.0	3.1
R25	3.3	30.1	33.4	2.7	13.4	16.1	0.6	7.6	**8.2**	<0.1	3.0	3.1
R26	1.7	30.1	31.8	1.5	13.4	14.9	0.3	7.6	7.9	<0.1	3.0	3.1
R27	0.6	30.1	30.7	0.5	13.4	13.9	0.2	7.6	7.8	<0.1	3.0	3.1
R28A	0.6	30.1	30.7	0.5	13.4	13.9	0.2	7.6	7.8	<0.1	3.0	3.1
R28B	0.5	30.1	30.6	0.5	13.4	13.9	0.1	7.6	7.7	<0.1	3.0	3.1
R30A	0.6	30.1	30.7	0.5	13.4	13.9	0.1	7.6	7.7	<0.1	3.0	3.1
R30B	0.6	30.1	30.7	0.5	13.4	13.9	0.1	7.6	7.7	<0.1	3.0	3.1
R31A	0.4	30.1	30.5	0.3	13.4	13.7	<0.1	7.6	7.7	<0.1	3.0	3.1
R31B	0.4	30.1	30.5	0.3	13.4	13.7	<0.1	7.6	7.7	<0.1	3.0	3.1
R35	0.4	30.1	30.5	0.4	13.4	13.8	<0.1	7.6	7.7	<0.1	3.0	3.1
R36	0.5	30.1	30.6	0.5	13.4	13.9	0.1	7.6	7.7	<0.1	3.0	3.1
R38	0.4	30.1	30.5	0.3	13.4	13.7	<0.1	7.6	7.7	<0.1	3.0	3.1
R4	0.4	30.1	30.5	0.3	13.4	13.7	<0.1	7.6	7.7	<0.1	3.0	3.1
R40A	0.4	30.1	30.5	0.4	13.4	13.8	<0.1	7.6	7.7	<0.1	3.0	3.1
R40B	0.5	30.1	30.6	0.5	13.4	13.9	0.1	7.6	7.7	<0.1	3.0	3.1
R41	0.3	30.1	30.4	0.3	13.4	13.7	<0.1	7.6	7.7	<0.1	3.0	3.1
R43	0.4	30.1	30.5	0.4	13.4	13.8	<0.1	7.6	7.7	<0.1	3.0	3.1
R44	0.2	30.1	30.3	0.2	13.4	13.6	<0.1	7.6	7.7	<0.1	3.0	3.1
R46	0.5	30.1	30.6	0.4	13.4	13.8	<0.1	7.6	7.7	<0.1	3.0	3.1

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Table 16 (Cont'd)
Predicted Annual Average Particulate Matter Concentrations – Operation Scenario

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Receiver ID[1]	Annual Average Concentration (µg/m³)											
	TSP			PM_{10}			$PM_{2.5}$			Deposited Dust		
	Incremental Impact	Background	Cumulative Impact	Incremental Impact	Background	Cumulative Impact	Incremental Impact	Background	Cumulative Impact	Incremental Impact	Background	Cumulative Impact
Criterion	**90**			**25**			**8**			**2**	**-**	**4**
R50	8.9	30.1	39.0	7.0	13.4	20.4	1.3	7.6	**8.9**	0.1	3.0	3.1
R59A	0.2	30.1	30.3	0.2	13.4	13.6	<0.1	7.6	7.7	<0.1	3.0	3.1
R59B	0.2	30.1	30.3	0.2	13.4	13.6	<0.1	7.6	7.7	<0.1	3.0	3.1
R6	0.5	30.1	30.6	0.4	13.4	13.8	<0.1	7.6	7.7	<0.1	3.0	3.1
R61	0.2	30.1	30.3	0.2	13.4	13.6	<0.1	7.6	7.7	<0.1	3.0	3.1
R66	0.2	30.1	30.3	0.2	13.4	13.6	<0.1	7.6	7.7	<0.1	3.0	3.1
R67	0.2	30.1	30.3	0.2	13.4	13.6	<0.1	7.6	7.7	<0.1	3.0	3.1
R68	0.3	30.1	30.4	0.2	13.4	13.6	<0.1	7.6	7.7	<0.1	3.0	3.1
R7A	0.6	30.1	30.7	0.6	13.4	14.0	0.1	7.6	7.7	<0.1	3.0	3.1
R7B	0.9	30.1	31.0	0.8	13.4	14.2	0.2	7.6	7.8	<0.1	3.0	3.1
R8A	0.8	30.1	30.9	0.7	13.4	14.1	0.2	7.6	7.8	<0.1	3.0	3.1
R8B	0.4	30.1	30.5	0.3	13.4	13.7	0.1	7.6	7.7	<0.1	3.0	3.1

Note 1: Sensitive receiver locations shown on **Figure 6**.

Note 2: **Bold text** – exceedance of relevant criterion

Source: Northstar (2022) modified after Tables 18 and 19

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6.2.6.2.2 Nitrogen Dioxide

Predicted 1-hourly and annual average NO_2 concentrations are presented in detail in Section 6.2.2 of Northstar (2022). In summary, results indicate that predicted cumulative impacts do not exceed the relevant assessment criterion at any receiver location, with predicted maximum cumulative impacts as follows.

- 81.5% of the 1-hour criterion.
- 19.5% of the annual average criterion.

6.2.6.2.3 Sulphur Dioxide

Predicted 10-minute, 1-hourly, 24-hourly and annual average SO_2 concentrations are presented in detail in Section 6.2.3 of Northstar (2022). In summary, results indicate that predicted cumulative impacts do not exceed the relevant assessment criterion at any receiver location, with predicted maximum cumulative impacts as follows.

- 35.4% of the 10-minute criterion.
- 31.3% of the 1-hour criterion.
- 7.9% of the 24-hour criterion.
- 2.9% of the annual average criterion.

6.2.6.2.4 Hydrogen Chloride and Chlorine

Predicted 1-hour average HCl and Cl_2 concentrations are presented in detail in Section 6.2.4 of Northstar (2022). In summary, results indicate that predicted incremental impacts do not exceed the relevant assessment criterion at any receiver location, with predicted maximum incremental impacts as follows.

- 9.2% of the HCl criterion.
- <0.1% of the Cl_2 criterion.

6.2.6.2.5 Odour

Predicted 99th percentile 1-second average odour concentrations are presented in detail in Section 6.2.5 of Northstar (2022). In summary, predicted concentrations are anticipated to be <32% of the relevant criteria at all receiver locations.

6.2.6.2.6 Radon

Predicted maximum hourly, 24-hour and annual radon concentrations are presented in detail in Section 6.2.6 of Northstar (2022). In summary, predicted maximum radon concentrations are expected to be well below the recommended reference levels for both households (200Bq/m^3) and workplaces (1 000Bq/m^3) at all receiver locations.

6.2.6.3 Greenhouse Gas Emissions

Section 4.3.7.10 of RWC (2013) identifies the greenhouse gas emissions associated with the approved Project. Separate estimates were prepared for Transport Options A, B and C (see Section 3.5). The anticipated, approved annual greenhouse gas emissions for transport Option A (as proposed for the Proposed Modification) are as follows.

- Scope 1 Emissions 140 040t CO2-e
- Scope 2 Emissions 120 560t CO2-e
- Scope 3 Emissions 1 107t CO2-e
- Scope 1 and 2 Emissions 260 600t CO2-e
- All Scope Emissions 261 707t CO2-e

It is noted that estimated Scope 1 greenhouse gas emission calculations completed for the approved Project did not include emissions generated as a result of ore processing

Table 17 presents the annual greenhouse gas emissions predicted to occur as a result of the Proposed Modification. In summary, the Project is predicted to result in direct (Scope 1) greenhouse gas emissions of 324 217.6t CO_2-e per year. The Project would therefore generated greenhouse gas emissions equivalent to 0.24% of the emissions generated by NSW in 2019 (136 579 000t CO_2-e per year) or 0.06% of the total emissions generated by Australia in 2019 (529 298 000t CO_2-e per year).

Table 17
Calculated Project Greenhouse Gas Emissions

Scope		**Activity Rate**	**Units**	**Emission Factor**		**CO_2-e (t/yr)**
1	Process emissions of CO_2	-	-	-	-	226 082
	Natural gas	1 863 067	GJ/year	51.53	kg CO_2-e/GJ	96 003.8
	Diesel fuel in plant	786.7	kL/year	2 709.7	kg CO_2-e/kL	2 131.7
Scope 1 Subtotal						**324 217.6**
2	Electricity consumption	317 925	MWh/year	0.78	kg CO_2-e/kWh	247 981.5
Scope 2 Subtotal						**247 981.5**
3	Natural gas	1 863 067	GJ/year	14.0	kg CO_2-e/GJ	26 082.9
	Diesel fuel in plant	786.7	kL/year	3.6	kg CO_2-e/kL	2.8
	Electricity consumption	317 925	MWh/year	0.07	kg CO_2-e/kWh	22 254.8
	Employee travel	1.7	kL/year	123.1	kg CO_2-e/kL	0.2
	Raw material transport to site	-	-	-	-	16 332
	Product transport from site	-	-	-	-	456
Scope 3 Subtotal						**65 128.7**
Scopes 1 and 2 Total						**572 199.1**
All scopes Total						**637 327.8**
Source: Northstar (2022) – modified after Table 32						

Compared to the Scope 1 greenhouse gas emissions predicted to occur as a result of the approved Project (140 040t CO_2-e per year), the Proposed Modification would represent an increase in greenhouse gas emissions of approximately 132%. However, estimated Scope 1 greenhouse gas emission calculations completed for the approved Project did not include emissions generated as a result of ore processing in accordance with the guidelines applicable at the time. Ore processing operations account for approximately 70% of the Scope 1 emissions predicted to occur as a result of the Project under the Proposed Modification (Northstar, 2022). Applying this factor to the 2013 Scope 1 emissions estimate results in revised Scope 1 emissions of approximately 466 800t CO_2-e. As a result, the Proposed Modification is not expected to significantly impact the greenhouse gas emissions generated by the approved Project.

Notwithstanding the above, the Applicant has publicly committed to investigate ways to ensure that the Project could operate net zero carbon.[4] That work is ongoing, and further updates will be provided via the Applicant's public statements on its website.

6.3 NOISE

6.3.1 Introduction

Muller Acoustic Consulting Pty Ltd (MAC) prepared a Noise Impact Assessment for the Proposed Modification. The resulting report, referred to hereafter as MAC (2022), is presented as **Appendix 5**. The following sub-sections draw on information presented in that report and describe the existing noise environment, predicted changes to that environment as a result of the Proposed Modification, the proposed management and mitigation measures, and an assessment of potential noise-related impacts.

6.3.2 Local Setting, Environmental Performance and Assessment Criteria

6.3.2.1 Sensitive Receivers

Figure 6 shows the locations of Project-related (i.e. residences owned or controlled by the Applicant) and non-Project related sensitive receivers in the vicinity of the Project Site. The closest receiver to the processing plant is R2 'Pacific Hill', a Project-related residence located approximately 656m southwest of the Processing Plant and Administration Area. The closest receiver to the Open Cut is R3 'Karingle', a Project-related residence located within the southern portion of the Project Site. All receivers within the Project Site, in addition to several residences within Toongi village, are Project-related.

6.3.2.2 Background Noise Levels and Meteorological Conditions

In accordance with Section 2.3 of the *Noise Policy for Industry* (NPI) (EPA, 2017b), MAC (2022) adopted the minimum assumed Rating Background Noise Levels (**Table 18**).

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[4] See https://asm-au.com/sustainability/

Table 18
Adopted Rating Background Noise Levels

Period[1]	Adopted Rating Background Noise Levels (dB LA_{90})
Day	35
Evening	30
Night	30

Note 1: Day: period from 7:00am – 6:00pm, Monday to Saturday, or 8:00am – 6:00pm on Sundays and public holidays.
Evening: period from 6:00pm – 10:00pm.
Night: all other periods.

Source: MAC (2022) – modified after Table 7.

Noise enhancing conditions identified in RWC (2013) were adopted by MAC (2022) (**Table 19**).

Table 19
Modelled Meteorological Parameters

Assessment Condition[1]	Temperature (˚C)	Wind Speed[2] / Direction	Relative Humidity (%)	Stability Class
Day – Wind	20	3m/s 270˚ (west)	50	D
Evening – Wind	10	3m/s all directions	50	D
Night – Wind	10	3m/s all directions	50	D
Night – Inversion	10	0.5m/s all directions	50	F

Note 1: Day: period from 7:00am – 6:00pm, Monday to Saturday, or 8:00am – 6:00pm on Sundays and public holidays.
Evening: period from 6:00pm – 10:00pm.
Night: all other periods.
Note 2: Implemented using CONCAWE meteorological corrections.

Source: MAC (2022) – modified after Table 16

6.3.2.3 Assessment Criteria

6.3.2.3.1 Operational Noise Criteria

Table 20 presents the Project Intrusiveness Noise Level criteria adopted by MAC (2022) for the Noise Impact Assessment based on the Rating Background Noise Levels plus 5dBA. These criteria only apply to residential receivers.

Table 21 presents the Project Amenity Noise Level criteria adopted by MAC (2022) for the Noise Impact Assessment for residential and other receiver types.

Table 20
Project Intrusiveness Noise Level Criteria

Receiver Type	Period[1]	Adopted Rating Background Noise Levels (dB LA_{90})	Project Intrusiveness Noise Level (dB $LA_{eq(15\ min)}$)
Rural Residential	Day	35	40
	Evening	30	35
	Night	30	35

Note 1: Day: period from 7:00am – 6:00pm, Monday to Saturday, or 8:00am – 6:00pm on Sundays and public holidays.
Evening: period from 6:00pm – 10:00pm.
Night: all other periods.

Source: MAC (2022) – modified after Table 8

Table 21
Project Amenity Noise Level Criteria

Receiver Type	Noise Amenity Area	Assessment Period[1]	NPI Recommended Amenity Noise Level (dB $LA_{eq(period)}$)	Amenity Noise Level (dB $LA_{eq(period)}$)[2]	Project Amenity Noise Level (dB $LA_{eq(15\ min)}$)[3]
Residential	Rural	Day	50	45	48
		Evening	45	40	43
		Night	40	35	38
Active Recreational	All	When in Use	55	50	53

Note 1: Day: period from 7:00am – 6:00pm, Monday to Saturday, or 8:00am – 6:00pm on Sundays and public holidays.
Evening: period from 6:00pm – 10:00pm.
Night: all other periods.
Note 2: PANL is equal to the Amenity Noise Level minus 5dB as there is other industry in the area.
Note 3: Includes a +3dB adjustment to the amenity period level to convert to a 15-minute assessment period in accordance with Section 2.2 of the NPI.

Source: MAC (2022) – modified after Table 9.

Table 22 presents the Project Noise Trigger Level criteria adopted by MAC (2022) for the Noise Impact Assessment. The Project Noise Trigger Level represent the lower of either the Project Intrusiveness Noise Level or the Project Amenity Noise Level.

Table 22
Project Noise Trigger Levels

Receiver Type	Noise Amenity Area	Assessment Period[1]	PINL (dB $LA_{eq(15\ min)}$)	PANL (dB $LA_{eq(15\ min)}$)	PNTL (dB $LA_{eq(15\ min)}$)
Residential	Rural	Day	40	48	40
		Evening	35	43	35
		Night	35	38	35
Active Recreation	All	When in Use	N/A	53	53

Note 1: Day: period from 7:00am – 6:00pm, Monday to Saturday, or 8:00am – 6:00pm on Sundays and public holidays.
Evening: period from 6:00pm – 10:00pm.
Night: all other periods.

Source: MAC (2022) – modified after Table 10

Table 23 presents the maximum noise trigger level criteria adopted by MAC (2022) for the Noise Impact Assessment. These trigger levels are applied to residential receivers for transient noise events that have the potential to disturb sleep and are based on the maximum value of the night time Rating Background Noise Levels and trigger levels in accordance with Section 2.5 of the NPI.

Table 23
Maximum Noise Trigger Levels[1]

$LA_{eq(15\ min)}$		LA_{max}	
40dB $LA_{eq(15\ min)}$ or RBL _ 5dB		52dB LA_{max} or RBL + 15dB	
Trigger	40	Trigger	52
RBL +5dB	35	RBL +15dB	45
Highest = 40		Highest = 52	

Note 1: Apply during night periods, including 10:00pm – 7:00am, Monday to Saturday and 10:00pm – 8:00am, Sundays and public holidays.

Source: MAC (2022) – modified after Table 11

6.3.2.3.2 Construction Noise Criteria

Table 24 presents the Noise Management Levels adopted by MAC (2022) for the Construction and Site Establishment phase of the Project.

Table 24
Construction Noise Management Levels

Receiver Type	Assessment Period[1]	Adopted Rating Background Noise Levels (dB LA_{90})	Noise Management Levels (dB $LA_{eq(15\ min)}$)
Rural Residential	Standard Hours[2]	35	45 (RBL + 10dBA)
	Out of Hours[3]	30	35 (RBL + 5dBA)
			52dB LA_{max}
Active Recreation	When in Use	N/A	65 (external)

Note 1: Day: period from 7:00am – 6:00pm, Monday to Saturday, or 8:00am – 6:00pm on Sundays and public holidays.
Evening: period from 6:00pm – 10:00pm.
Night: all other periods.

Note 2: Recommended standard hours for construction include 7:00am – 6:00pm, Monday to Friday, and 8:00am – 1:00pm, Saturdays, in accordance with the Interim Construction Noise Guidelines (DECCW 2009).

Note 3: All other hours, including Sundays and public holidays.

Source: MAC (2022) – modified after Table 12

As the *Interim Construction Noise Guideline* (DECC, 2009) does not specify criteria for sleep disturbance, MAC (2022) adopted the maximum noise trigger levels (see **Table 23**) as the relevant construction noise sleep disturbance criteria.

6.3.2.3.3 Construction Vibration

MAC (2022) completed a qualitative assessment of potential vibration impacts associated with the Project and determined that, due to the nature of the works proposed and distances to sensitive receivers, vibration impacts would be negligible.

The key vibration generating source proposed to be used for the Project is a vibratory roller used for road construction and upgrade works. The *Construction Noise and Vibration Strategy* (TfNSW, 2019) sets a safe working distance of 100m for a large vibratory roller to achieve the residential human response criteria for continuous vibration. As the nearest receiver to the

Project are located more than 100m from the Project Site, human exposure to vibration is expected to be minimal. Satisfaction of the human response criteria for continuous vibration also ensures that structural or cosmetic criteria for sensitive receivers will be achieved (MAC, 2022).

6.3.3 Assessment Methodology

MAC (2022) developed a computer model, including a three-dimensional digital terrain map, using DGMR (iNoise, Version 2021.1) noise modelling software to quantify Project noise emissions at sensitive receivers in the vicinity of the Project Site. Scenarios modelled conservatively assume the maximum number of plant and equipment operating simultaneously at their typical noise emission level and are therefore considered to represent worst-case scenarios.

MAC (2022) assessed noise impacts under the following two construction scenarios which represent worst-case noise emissions at the Project Site during the construction and site establishment phase.

- Scenario 1 – Construction during standard hours (i.e. hours identified in **Table 1** for ‘other construction activities’) across the entire Project Site (**Figure 20**).
- Scenario 2 – Out of hours construction (i.e. all hours outside of those identified in **Table 1** for ‘other construction activities’) (**Figure 21**).
  - Out of hours construction activities are limited to up to three teams (i.e. a generator, lighting set, welder, forklift / telehandler, crane, and power tools) within the Processing Plant and Administration Area, Rail Container Laydown and Storage Area, and Chlor-alkali Plant.

MAC (2022) also assessed noise impacts under the following three scenarios which represent worst-case noise emissions at various stages of mining, processing and transportation during the operational phase of the Project.

- Scenario 3 – Mining, processing and transportation activities across the Project Site during operational Year 1 (**Figure 22**).
- Scenario 4 – Mining, processing and transportation activities across the Project Site during operational Year 5 (**Figure 23**).
- Scenario 5 – Mining, processing and transportation activities across the Project Site during operational Year 15 (**Figure 24**).

Assumed sound power levels for construction and operational noise sources are listed in Tables 13, 14 and 15 of MAC (2022).

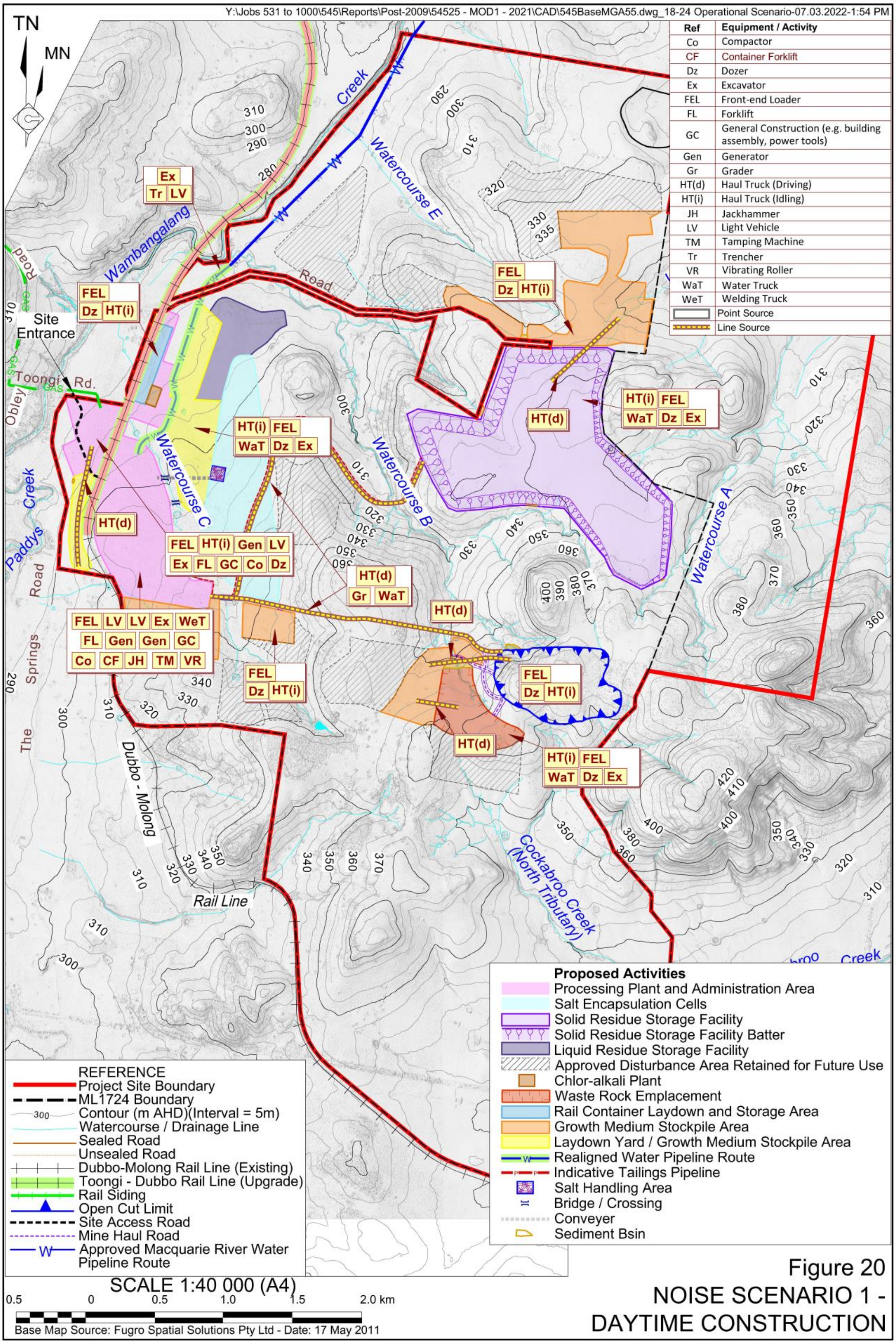


Figure 20
NOISE SCENARIO 1 - DAYTIME CONSTRUCTION

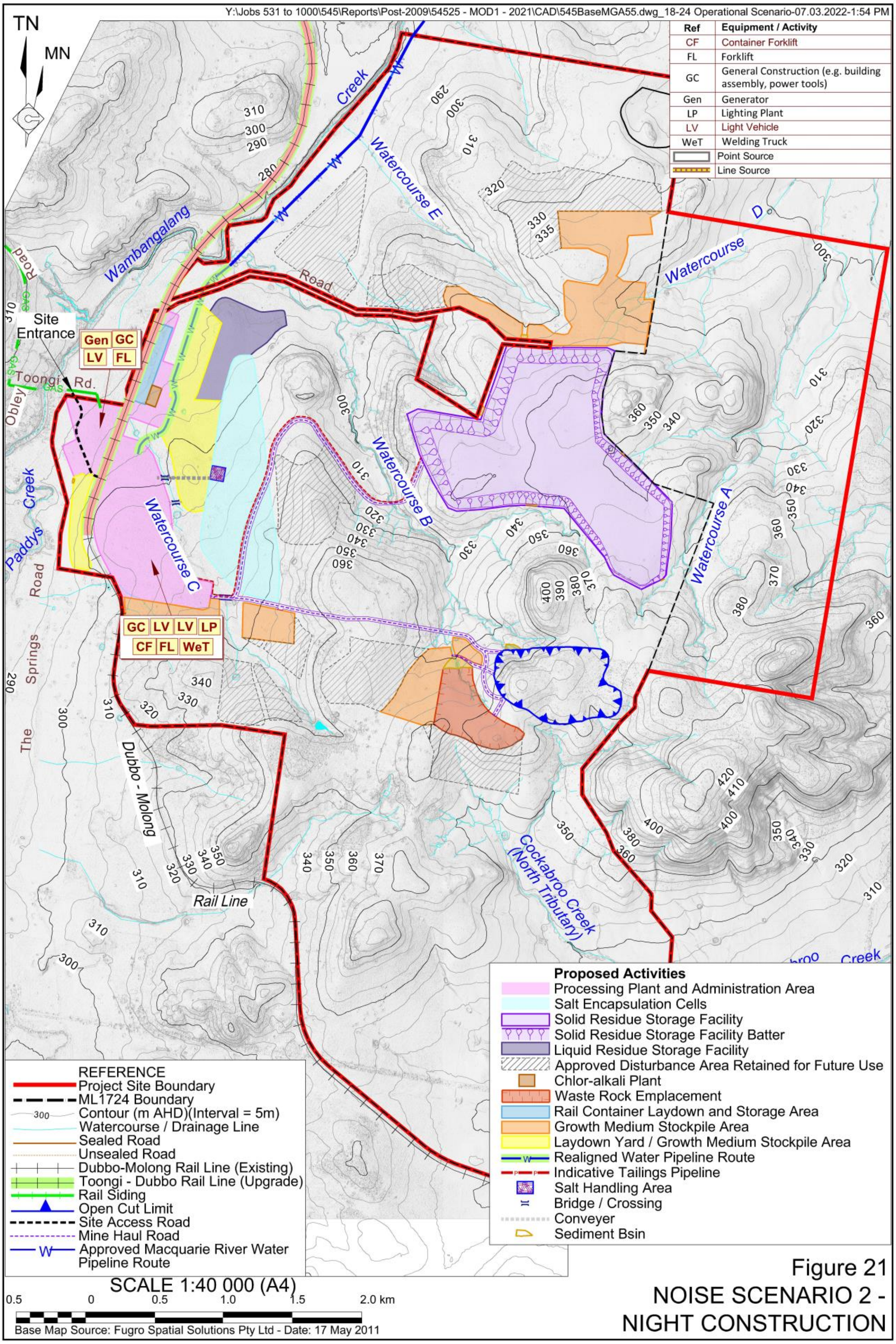


Figure 21
NOISE SCENARIO 2 -
NIGHT CONSTRUCTION

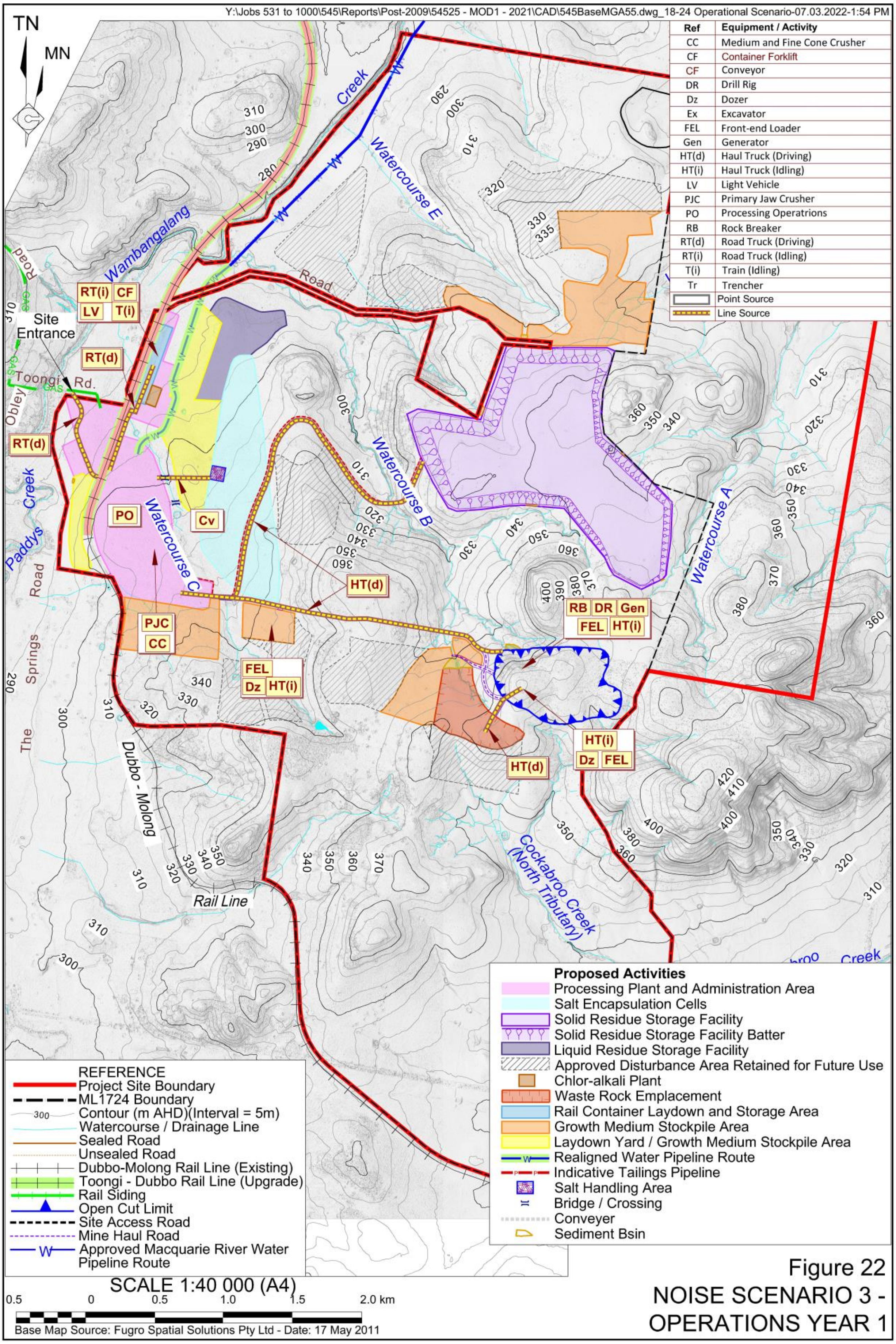
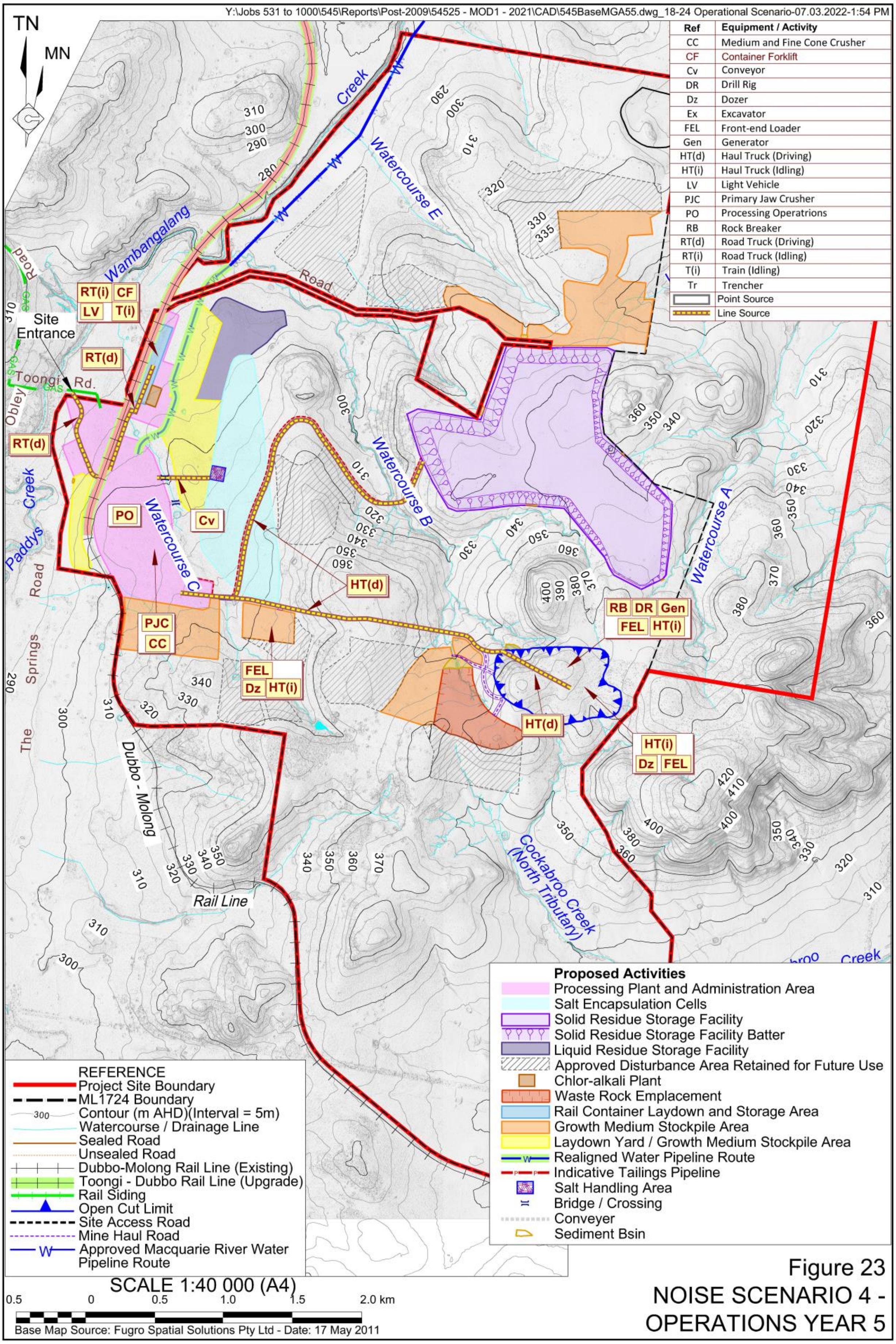
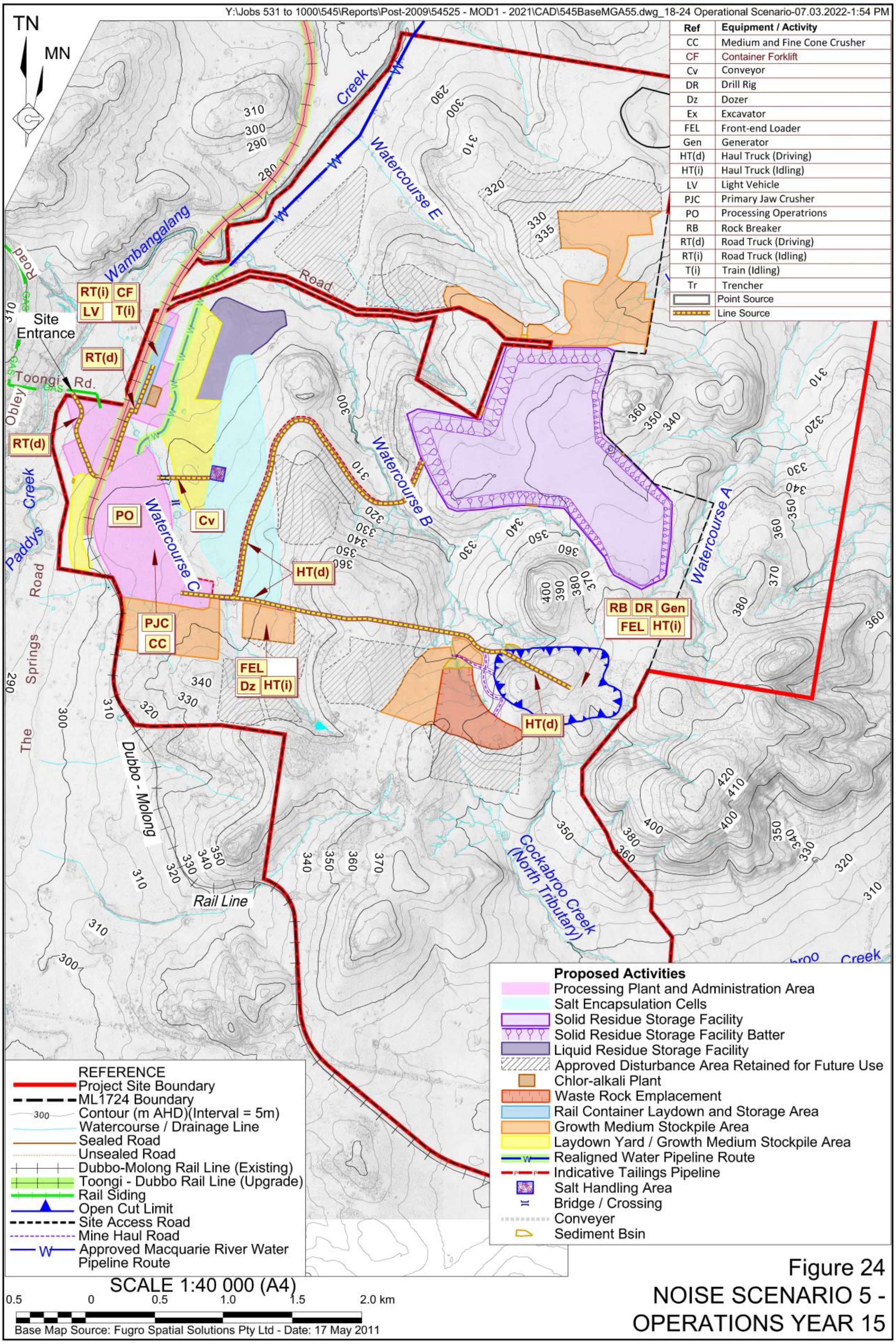


Figure 22
NOISE SCENARIO 3 - OPERATIONS YEAR 1



Ref	Equipment / Activity
CC	Medium and Fine Cone Crusher
CF	Container Forklift
Cv	Conveyor
DR	Drill Rig
Dz	Dozer
Ex	Excavator
FEL	Front-end Loader
Gen	Generator
HT(d)	Haul Truck (Driving)
HT(i)	Haul Truck (Idling)
LV	Light Vehicle
PJC	Primary Jaw Crusher
PO	Processing Operatrions
RB	Rock Breaker
RT(d)	Road Truck (Driving)
RT(i)	Road Truck (Idling)
T(i)	Train (Idling)
Tr	Trencher
▭	Point Source
▬	Line Source

Figure 23
NOISE SCENARIO 4 - OPERATIONS YEAR 5



Ref	Equipment / Activity
CC	Medium and Fine Cone Crusher
CF	Container Forklift
Cv	Conveyor
DR	Drill Rig
Dz	Dozer
Ex	Excavator
FEL	Front-end Loader
Gen	Generator
HT(d)	Haul Truck (Driving)
HT(i)	Haul Truck (Idling)
LV	Light Vehicle
PJC	Primary Jaw Crusher
PO	Processing Operatrions
RB	Rock Breaker
RT(d)	Road Truck (Driving)
RT(i)	Road Truck (Idling)
T(i)	Train (Idling)
Tr	Trencher
▭	Point Source
▬	Line Source

Figure 24
NOISE SCENARIO 5 - OPERATIONS YEAR 15

6.3.4 Management and Mitigation Measures

The Applicant would implement all management and mitigation measures identified in Section 4.2.6 of RWC (2013). In addition, MAC (2022) assumed the following noise mitigation measures during noise modelling.

- Partial enclosure/screen of the crushing and ore handling circuit.
- Semi-enclosed barrier/screen adjacent to the western side of the primary crusher and ore handling circuit.

These mitigation measures are consistent with those which were outlined in RWC (2013). Additionally, the Applicant would ensure that out of hours construction activities, including all construction activities undertaken outside of those identified in **Table 1** for ‘other construction activities’, would be limited to:

- a maximum of three teams, consisting of a generator, lighting set, welder, forklift / telehandler, crane, and power tools, or equivalent, at any one time; and
- activities within the Processing Plant and Administration Area, Rail Container Laydown and Storage Area, and Chlor-alkali Plant only.

6.3.5 Assessment of Impacts

6.3.5.1 Construction Noise

6.3.5.1.1 Construction Noise Assessment

Predicted noise levels during the construction and site establishment phase of the Project are shown as noise contours for Scenario 1 and Scenario 2 on **Figure 25** and **26** respectively. In summary, predicted noise levels under Scenario 1 and Scenario 2 would satisfy the relevant noise management level criteria at all receivers.

6.3.5.1.2 Construction Sleep Disturbance

Table 25 presents the predicted noise levels from LA_{max} events at the nearest sensitive receivers. In summary, MAC (2022) concluded that the maximum noise trigger level criteria would be satisfied at the nearest sensitive receivers and therefore at more distant receivers.

Table 25
Maximum Construction Noise Level Assessment (Night)[1]

Receiver	Predicted Noise Level (dB LA_{max})	Maximum Trigger Levels (dB LA_{max})	Compliant
R19	<35	52	Yes
R20	<35	52	Yes
R22	<35	52	Yes
R23	<35	52	Yes
R24	<35	52	Yes
R25	<35	52	Yes

Note 1: Night period is 10:00pm – 7:00am, Monday to Saturday, and 10:00pm – 8:00am, Sundays and public holidays.

Source: MAC (2022) – modified after Table 20.

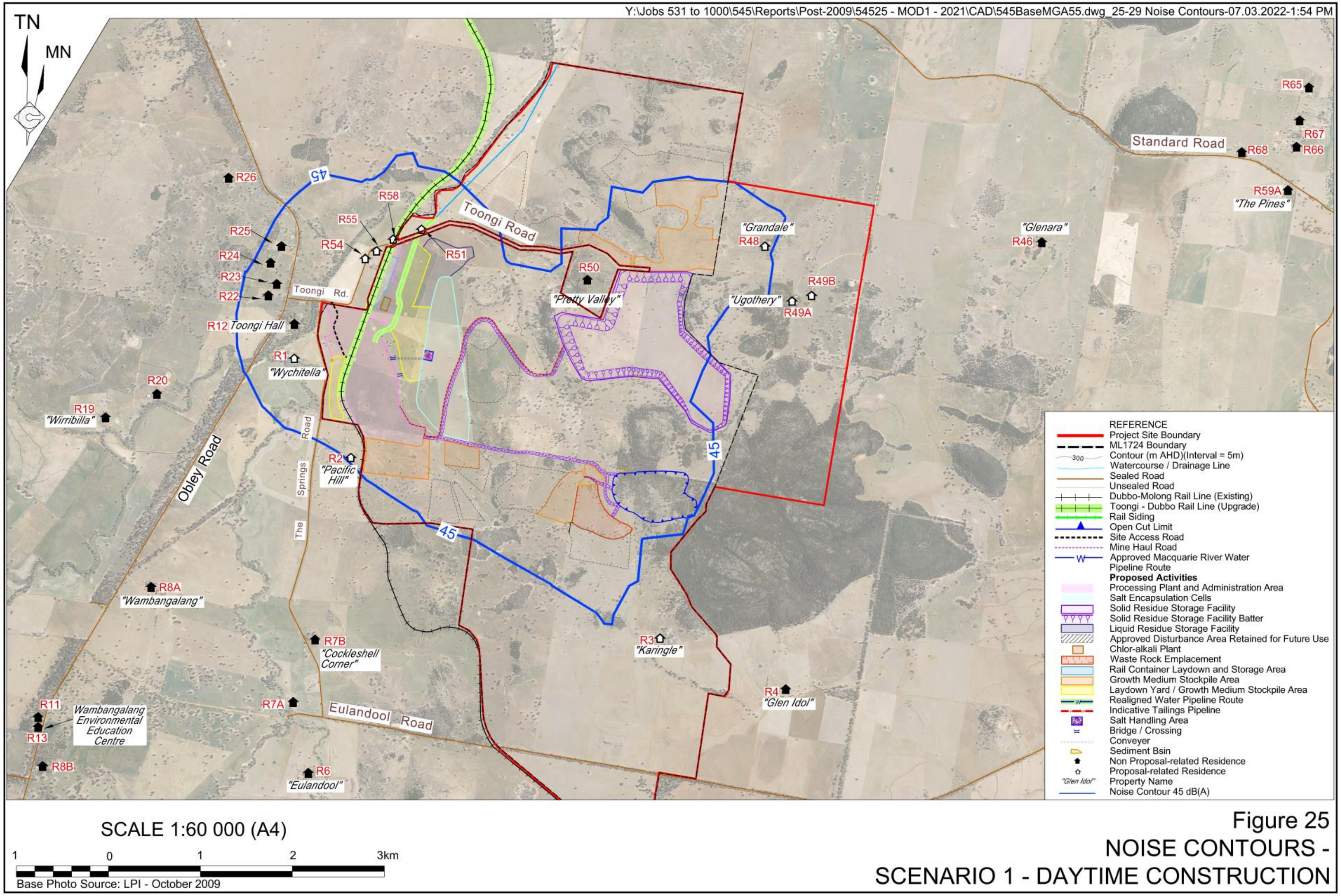


Figure 25
NOISE CONTOURS -
SCENARIO 1 - DAYTIME CONSTRUCTION

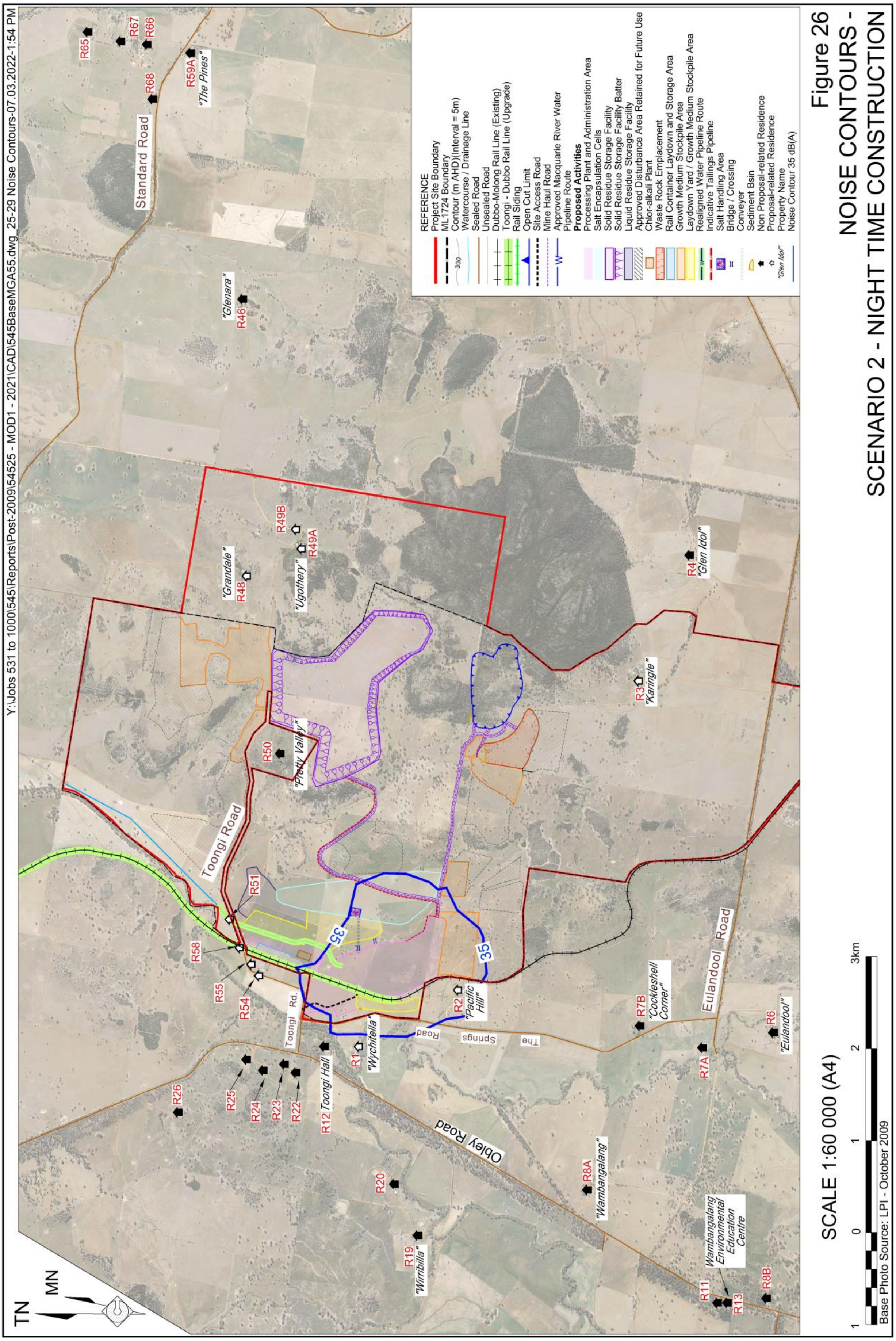


Figure 26
NOISE CONTOURS -
SCENARIO 2 - NIGHT TIME CONSTRUCTION

6.3.5.2 Operational Noise

6.3.5.2.1 Operational Noise Assessment

Predicted operational noise levels are expected to satisfy the relevant Project Noise Trigger Levels (see **Table 22**) at all sensitive receivers within 5km of the Project Site under noise enhancing meteorological conditions for each of the operational noise scenarios (Scenarios 3 to 5). Predicted noise emissions are shown as noise contours for Scenario 3, Scenario 4 and Scenario 5 on **Figures 27**, **28** and **29** respectively.

6.3.5.2.2 Maximum Noise Level Assessment

Table 26 presents predicted noise levels from $LA_{eq(15\ min)}$ and LA_{max} events for the nearest sensitive receivers. MAC (2022) concluded that the maximum noise trigger level criteria would be satisfied at the nearest receivers and therefore at more distant receivers.

Table 26
Maximum Noise Level Assessment Results (Night)[1]

Receiver	Predicted Noise Level		Maximum Trigger Levels		Compliant
	dB $LA_{eq(15\ min)}$	dB LA_{max}	dB $LA_{eq(15\ min)}$	dB LA_{max}	
R7B	<30	<35	40	52	Yes
R8A	<30	<35	40	52	Yes
R19	<30	<35	40	52	Yes
R20	<30	<35	40	52	Yes
R23	35	43	40	52	Yes
R26	<30	<35	40	52	Yes
R27	<30	<35	40	52	Yes
R28	<30	<35	40	52	Yes

Note 1: Night period is 10:00pm – 7:00am, Monday to Saturday, and 10:00pm – 8:00am, Sundays and public holidays.

Source: MAC (2022) – modified after Table 19.

6.3.5.2.3 Voluntary Land Acquisition and Mitigation Policy

Based on the noise contours for each operational scenario (see **Figures 27**, **28** and **29**), MAC (2022) concluded that predicted Project noise levels would not exceed the *Voluntary Land Acquisition and Mitigation Policy* (VLAMP) criteria (40dB $LA_{eq(15min)}$ daytime or 35dB $LA_{eq(15\ min)}$ night time) at any receiver location. Furthermore, predicted Project noise levels would not exceed the relevant VLAMP criteria (50dB $LA_{eq(period)}$ daytime or 40dB $LA_{eq(period)}$ night time) on any privately owned vacant lands. Mitigation and acquisition rights outlined under the VLAMP are therefore not applicable to the Project under the Proposed Modification.

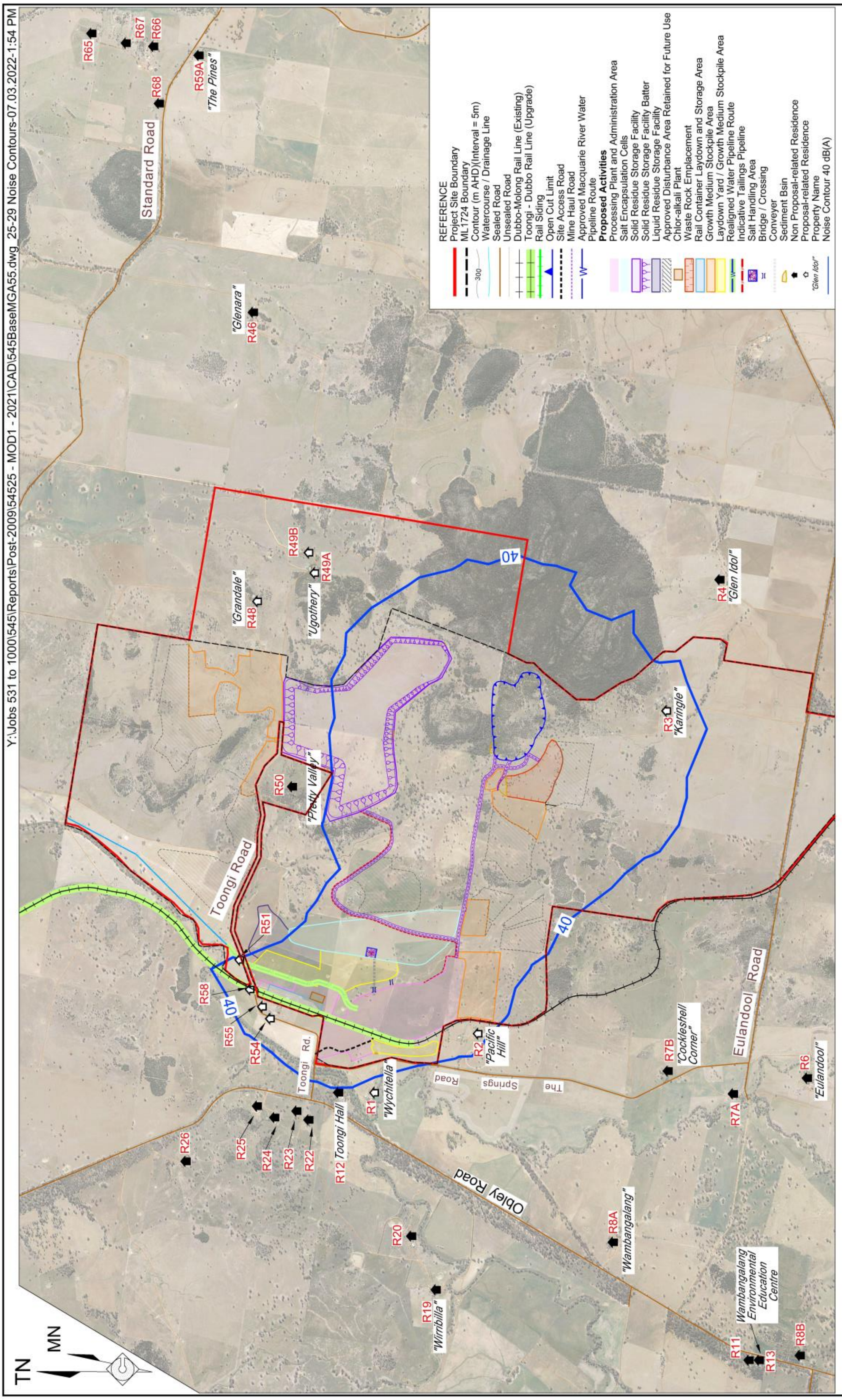


Figure 27

NOISE CONTOURS - SCENARIO 3 - DAYTIME OPERATION YEAR 1

SCALE 1:60 000 (A4)

1 0 1 2 3km

Base Photo Source: LPI - October 2009

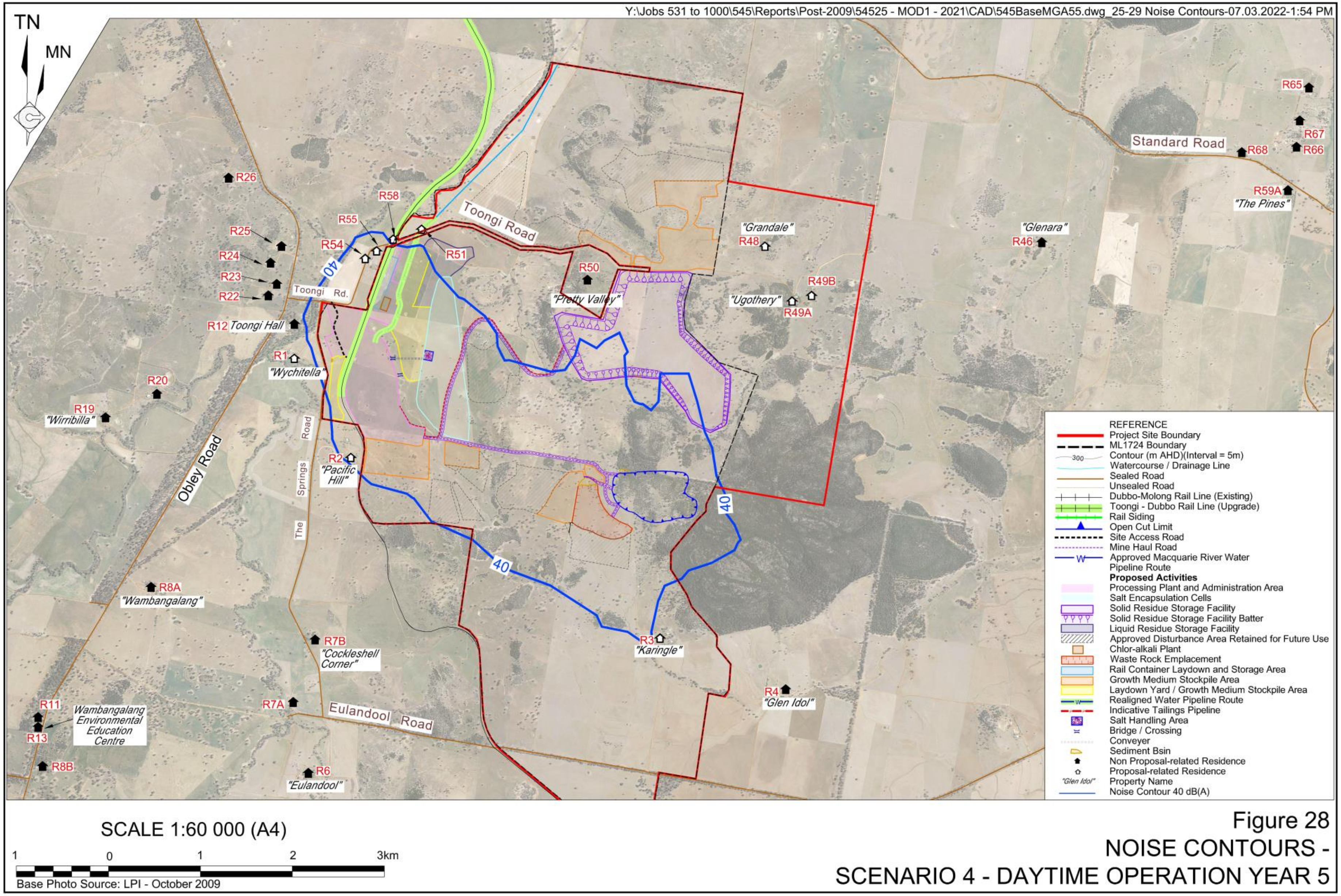
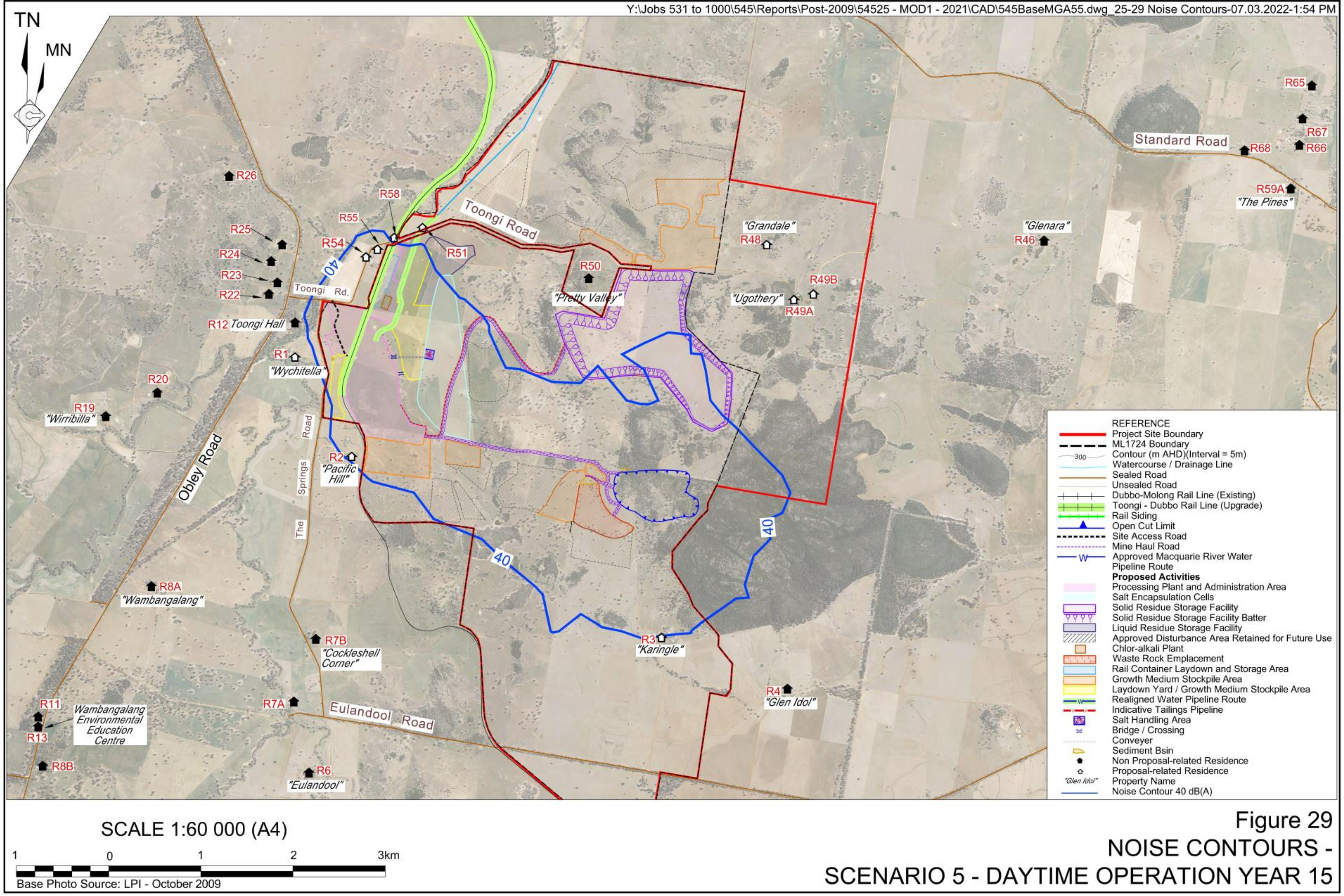


Figure 28
NOISE CONTOURS -
SCENARIO 4 - DAYTIME OPERATION YEAR 5



Base Photo Source: LPI - October 2009

Figure 29
NOISE CONTOURS -
SCENARIO 5 - DAYTIME OPERATION YEAR 15

6.3.5.3 Road Traffic Noise

6.3.5.3.1 Operational Traffic – Alternative Road Noise Mitigation Measures

Whilst no changes to operational traffic are proposed, MAC (2022) note that alternate mitigation measures other than the construction of a road noise barrier on land owned by the Taronga Western Plains Zoo may provide equally or more effective noise mitigation. Based on road surface noise levels outlined in the *Roads and Traffic Authority Environmental Noise Management Manual*, MAC (2022) indicate that upgrading the existing road surface in the vicinity of the Taronga Western Plains Zoo to open graded asphalt concrete would provide a reduction of up to 5dBA for trucks compared to dense graded asphalt (i.e. equivalent to the reduction afforded by the road noise barrier).

6.3.5.4 Construction Traffic

Table 27 presents the predicted daytime road traffic noise during the construction and site establishment phase of the Project. These results represent the proposed increase in construction traffic from 400 light vehicle movements per day to 625 light vehicle movements per day, with no changes to heavy vehicle movements. This is to account for the additional employment levels that the Proposed Modification would generate compared with the approved Project. In summary, MAC (2022) concluded that predicted daytime road traffic noise during the construction and site establishment phase would satisfy the relevant criteria at all receivers along Obley Road.

Table 27
Construction Road Traffic Noise - Daytime

Road Section	Distance from Road[1] (m)	Criteria (dB $LA_{eq(15\ hr)}$)	Existing Traffic Noise (dB $LA_{eq(15\ hr)}$)	Calculated Project Traffic Noise (dB $LA_{eq(15\ hr)}$)	Future Combined Traffic Noise (dB $LA_{eq(15\ hr)}$)	Difference (Future – Existing) (dB $LA_{eq(15\ hr)}$)
1	355	60	42.9	34.6	43.5	0.6
2	225	60	43.4	37.0	44.3	0.9
3	65 (zoo)	60	50.0	43.7	50.9	0.9
4	65	60	42.4	43.7	46.1	2.4
Note 1: Minimum distance for sensitive receivers.						
Source: MAC (2022) – modified after Table 23						

Table 28 presents the predicted night time road traffic noise during the construction and site establishment phase of the Project, representing noise associated with an estimate 50 light vehicles during this period. In summary, MAC (2022) concluded that predicted night time road traffic noise during the construction and site establishment phase would satisfy the relevant criteria at all receivers along Obley Road.

Table 28
Construction Road Traffic Noise – Night Time

Road Section	Distance from Road[1] (m)	Criteria (dB $LA_{eq(15\ hr)}$)	Existing Traffic Noise (dB $LA_{eq(15\ hr)}$)	Calculated Project Traffic Noise (dB $LA_{eq(15\ hr)}$)	Future Combined Traffic Noise (dB $LA_{eq(15\ hr)}$)	Difference (Future – Existing) (dB $LA_{eq(15\ hr)}$)
1	355	55	42.7	27.6	42.8	0.0
2	225	55	42.7	30.6	43.0	0.3
3	65 (zoo)	55	49.9	36.5	50.1	0.2
4	65	55	46.8	36.5	47.2	0.4
Note 1: Minimum distance for sensitive receivers.						
Source: MAC (2022) – modified after Table 23.						

6.4 LIGHTING AND SKY GLOW

6.4.1 Introduction

The Siding Spring Observatory is located on the edge of the Warrumbungle National Park near Coonabarabran, NSW and is the premier optical and infrared astronomical observatory in Australia. The Project Site is located approximately 135km from the Siding Spring Observatory and falls within the Observatory's Dark Sky Region. This region comprises the land within a 200km radius of the Siding Spring Observatory near Coonabarabran that was established under the *Dark Sky Planning Guideline* (DPE, 2016) to ensure lighting impacts from significant developments do not unreasonably disrupt the operation of the Observatory.

In addition to the Siding Spring Observatory, there are other observatories within a similar distance to the Project Site that are included on the Australian Astronomical Society List of Significant Observatories. The closest of these is a Significant Amateur Society/Private Observatory in the Bathurst area and is not significantly closer to the Project Site than Siding Spring.

A *Light and Sky Glow Assessment* was undertaken by Lighting, Art and Science Pty Limited (LAS). The full *Light and Sky Glow Assessment* is presented in **Appendix 6** and is hereafter referred to as LAS (2022).

6.4.2 Local Setting and Environmental Performance

The Standards Australia *AS/NZS4282:2019 - Control of the Obtrusive Effects of Outdoor Lighting* nominates 11 zones to describe environmental settings. **Table 29** presents the environmental zones as outlined in the Standard.

The Siding Spring Observatory is classified as Zone A0 - Intrinsically dark. LAS (2022) has classified the existing environment at the Project Site as Environmental Zone A2 - Low district brightness. The Project Site is located in a rural area. The dominant night-time lighting features include the following.

- Light from vehicles using Obley Road and surrounding local roads.
- Lights associated with rural residences and street and other lighting within the village of Toongi.

Table 29
Environmental Zones

Zones	Description
A0	Intrinsically dark. No road lighting unless specifically required by road authority. e.g. Dark Sky Parks, Major optical observatories.
A1	Dark. Relatively uninhabited rural areas. No road lighting unless specifically required by road authority.
A2	Low district brightness. Sparsely inhabited rural and semi-rural areas.
A3	Medium district brightness. Suburban areas in towns and cities.
A4	High district brightness. Town and city centres and other commercial areas, residential areas abutting commercial areas.
TV	High district brightness. Vicinity of major sports stadium during TV broadcasts.
V	Residences near traffic routes.
R1	Residences near local roads with significant setback.
R2	Residences near local roads.
R3	Residences near a roundabout or a local area traffic management device.
RX	Residences near a pedestrian crossing.

Source: LAS (2022) as identified in AS/NZS 4282:2019.

LAS (2022) describes sky glow is the brightening of the night sky that results from the reflection of radiation (visible and non-visible) scattered from the constituents of the atmosphere (gas molecules, aerosols and particulate matter) in the direction of observation. Sky glow comprises of the following components.

- Natural sky glow attributable to radiation from celestial sources and luminescent processes in the Earth's upper atmosphere.
- Man-made sky glow attributable to anthropogenic sources of radiation (such as artificial outdoor lighting), including radiation that is emitted directly upwards and radiation that is reflected from the surface of Earth.

Dubbo Project

Twenty-four-hour operations for the Project have been approved. The modification proposes to bring forward the time when light starts to be produced by the Project to the construction period by proposing 24-hour construction activities.

6.4.3 Management and Mitigation Measures

In order to mitigate lighting impacts on the local environment and at the Siding Spring Observatory, the following measures would be adopted.

- Ensure all construction lighting within the Project Site would be designed to meet the criteria of Zone A2 in AS/NZS 4282:2019.
- Ensure all light sources would have a correlated colour temperature of 3 000K or less.

- Ensure streetlights and catwalk lights would be full cut-off fittings with zero tilt.
- Ensure all fixed floodlights would be forward throw luminaries with a maximum upcast of five degrees. Wherever possible the upcast would be zero.
- Ensure lights with diffusing covers or visible bare lamps that emit light above the horizontal plan would not be used on the outside of buildings or structures.
- Ensure where lighting towers are used, they would have a maximum upcast of 5 degrees and use a forward throw distribution.

6.4.4 Assessment of Impacts

Lighting within the local environment would principally be controlled by the requirements of *AS/NZS 4282:2019 – Control of Obtrusive Effects of Outdoor Lighting* which recommends limits for specific light technical parameters based on the ambient lighting conditions. The following assumptions have been made with respect to the lighting design for the modification.

- All roads on the site would be used by heavy vehicles, thereby being illuminated as V category roads to AS/NZS1158.3.1.
- The light poles would be spaced at an average of 40 metres and have a 150 Watt LED streetlight with an efficiency of 100 lumens per Watt.
- The streetlights would have full cut off and zero tilt ensuring no light is emitted above the horizontal.
- The administration area would have floodlighting of the open areas and local area lights mounted on the façade of the buildings.
- Processing plant structures would be enclosed and have an assumed average illuminance on the horizontal plane of 50 lux.
- All luminaires would emit no light above the horizontal plane and would be mounted with a minimum upcast.

Clause 5.14(7) of Dubbo LEP 2011 refers to development on land 18km or more from the Siding Spring Observatory and states:

> "The consent authority must not (except with the concurrence of the Planning Secretary) grant development consent on land that is 18 kilometres of more from the Siding Spring Observatory if the consent authority considers that the development is likely to result in the emission of light of 1,000,000 lumens or more."

The approved Project and proposed modification would not exceed 1 000 000 lumens and LAS (2022) state there is no need for the modification to exceed the approved lighting requirements.

LAS (2022) consider the impacts of lighting associated with the proposed modification (24 hour construction activities) would not increase the total lumens emitted into the sky, but rather bring forward in time when the light starts to be produced, that is, during the construction period rather than the approved operational period.

6.5 VISUAL AMENITY

6.5.1 Local Visual Amenity

The existing visual amenity surrounding the Project Site is typical of rural areas in the central west of NSW, with the outlook from most rural residences and other vantage points including land used for agriculture, transportation or other infrastructure, as well as patches of remnant native vegetation. Outlooks from residences within the local setting include views of paddocks (grazed and cropped), irrigation infrastructure, remnant vegetation (predominately within the road easement of Obley Road, the riparian corridor of Wambangalang Creek and on Dowds Hill), occasional buildings, local roads and the Toongi – Dubbo Rail Line.

The rural landscape surrounding the Project Site is flat to moderately undulating and has been largely cleared of remnant native vegetation. In cleared areas, visual amenity changes with the seasons from red-brown fallowed paddocks to green growing crops and straw-coloured harvest residues. Livestock, predominately sheep, area a common feature depending on availability of feed. Remnants of native vegetation remain in the landscape and are generally associated with road easements, the riparian corridor of local creeks, and steep slopes on Dowds Hill. These patches and corridors of native vegetation limit the extent of views that may be obtained surrounding the Project Site.

The approved Project includes the following measures to mitigate the visual impacts on the surrounding areas.

- Orientation of stockpile areas and vegetated amenity bunds to screen the processing plant and processing operations from various vantage points on Toongi Road, The Springs Road and, to a lesser extent, Obley Road.
- The establishment of vegetation cover on, and progressive rehabilitation of, the embankments of the Solid Residue Storage Facility, Waste Rock Emplacement, Liquid Residue Storage Area, and Salt Encapsulation Cells.
- The establishment of vegetation cover on growth medium stockpiles.
- Implementation of the Biodiversity Offset Area, including the enhancement of native vegetation within and surrounding the Project Site.
- Construction of the processing plant and other infrastructure within the Processing Plant and Administration Area from non-reflective, neutral coloured materials.
- Selection and placement of permanent and temporary lights that do not point towards surrounding residences, minimise the ‘lumens’ generated, and do not impact on the vision of motorists using the Newell Highway (during linear infrastructure upgrade works).

In addition to the above measures, the Applicant has committed to considering any reasonable request by a potentially affected resident for assistance to create a visual screen adjacent to their residence. It is envisaged that visual screens would be created in consultation with landowners through the planting of fast-growing vegetation and/or landscaping, where such a screen would effectively reduce the visual impact of activities throughout the life of the Project.

6.5.2 Assessment of Impacts

The Proposed Modification would alter the visual amenity impacts of the following key infrastructure areas within the Project Site.

- Relocation of various components of the Processing Plant and Administration Area. There would be no increase in maximum height of the approved Sulphuric Acid Plant stack height, namely 90m.
- Relocation of the Solid Residue Storage Facility within the Project Site, including a change in the maximum elevation from the approved Liquid Residue Storage Facility (Area 5) of approximately 360m AHD to a maximum elevation of the proposed Solid Residue Storage Facility of 368.5m AHD, or 8.5m.
- Relocation of the approved Salt Encapsulation Cell and Solid Residue Storage Facility from elevated sections of the Project Site. In particular, the proposed relocated Salt Encapsulation Cell would be located at a substantially lower elevation and would therefore be less visible from outside the Project Site.
- Reduction in the total area of the Project Site to be disturbed by approximately 127.5ha (including areas classified as ‘Approved Disturbance Area Retained for Future Use’).
- Use of lighting rigs during the night period (i.e. hours outside of those approved for ‘other construction activities’ in **Table 1**), when required during the construction and site establishment phase (see Section 6.4).

Figures 30 to **37** provide section views across the Project Site from selected nearby residences. These section views show views of key landforms within the Project Site at the final elevations. The following summarises those sections of the proposed landform that would be visible from each of the assessed residences. It is noted that the following assessment does not take into account obscuring of views of the Project Site as a result of vegetation or other factors. As a result, the following presents a worst-case scenario assessment of visual amenity impacts associated with the Proposed Modification.

- Residence R4 (**Figure 30**) – this residence would be shielded from views of the active sections of the Project Site by intervening topography. As a result, the Proposed Modification would not materially impact on the visual amenity of this residence.
- Residence R7B (**Figure 31**) – This residence will have views from the south of the existing approved Processing Plant Area. Those views would remain largely unchanged as a result of the Proposed Modification, with the exception of the fact that the Processing Plant area will move slightly closer, from 3.5km for the approved Project to 3.1km for the Proposed Modification. This residence would be shielded from views of the other active sections of the Project Site by intervening topography. As a result, the Proposed Modification would not materially impact on the visual amenity from this residence.

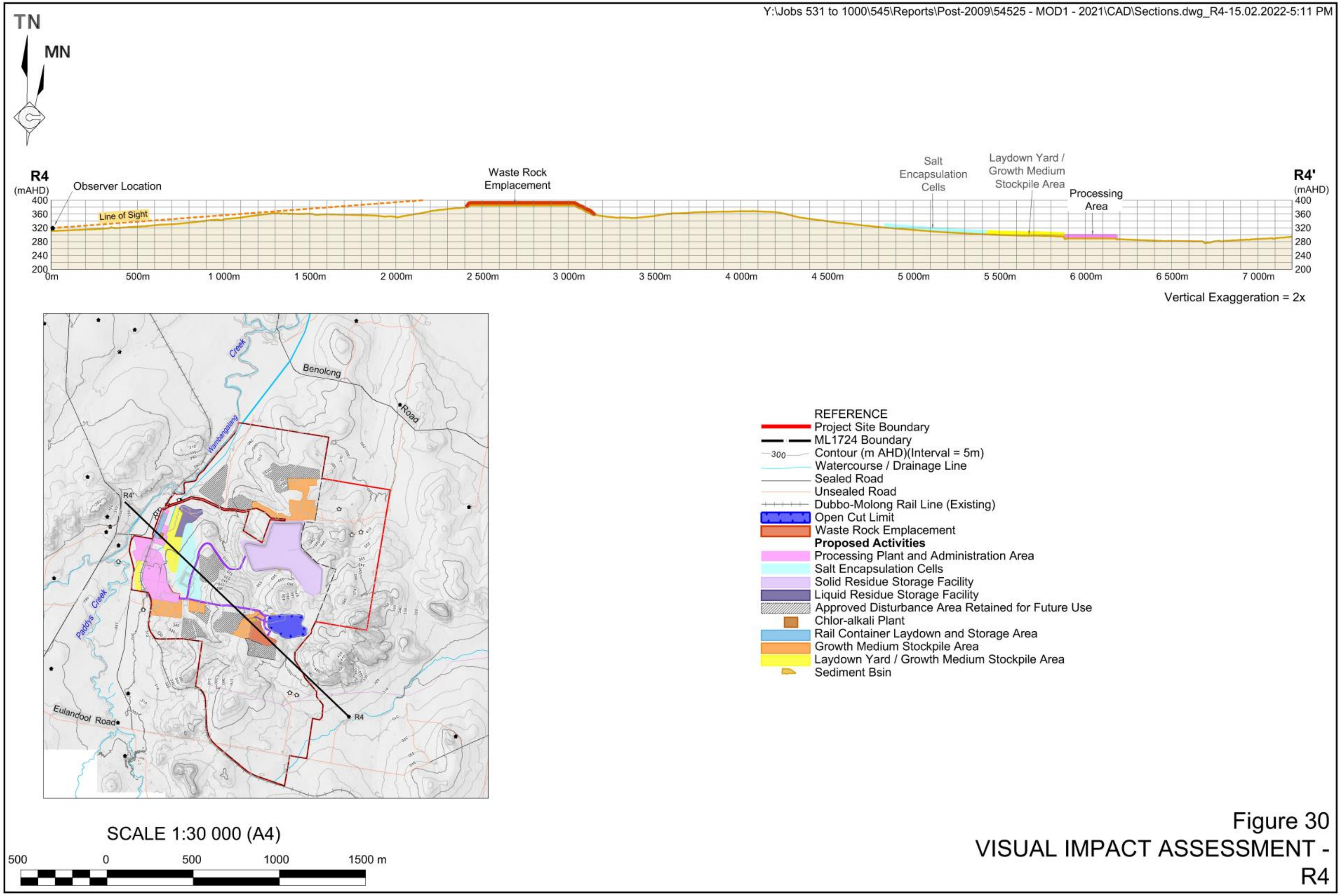


Figure 30
VISUAL IMPACT ASSESSMENT - R4

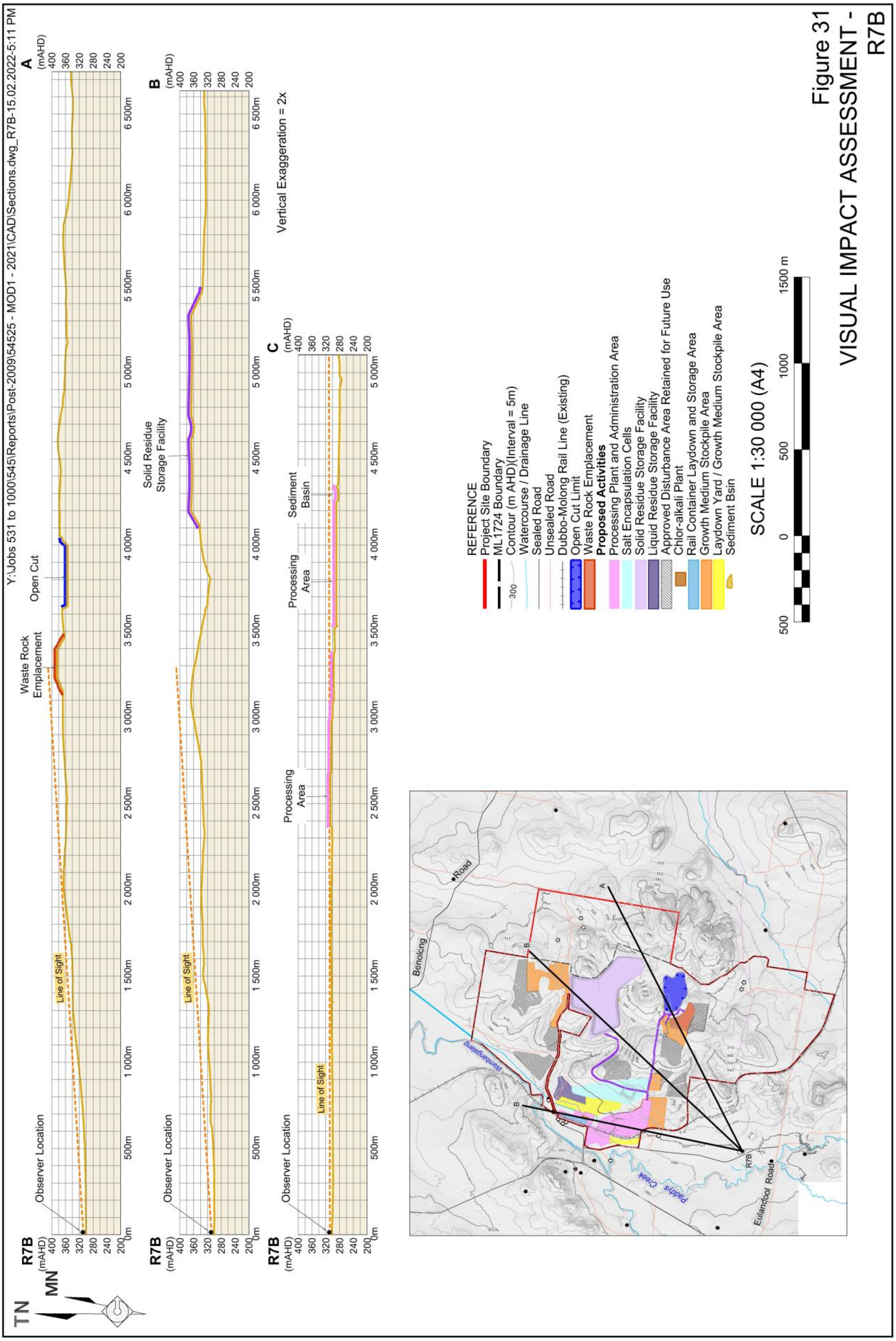


Figure 31
VISUAL IMPACT ASSESSMENT - R7B

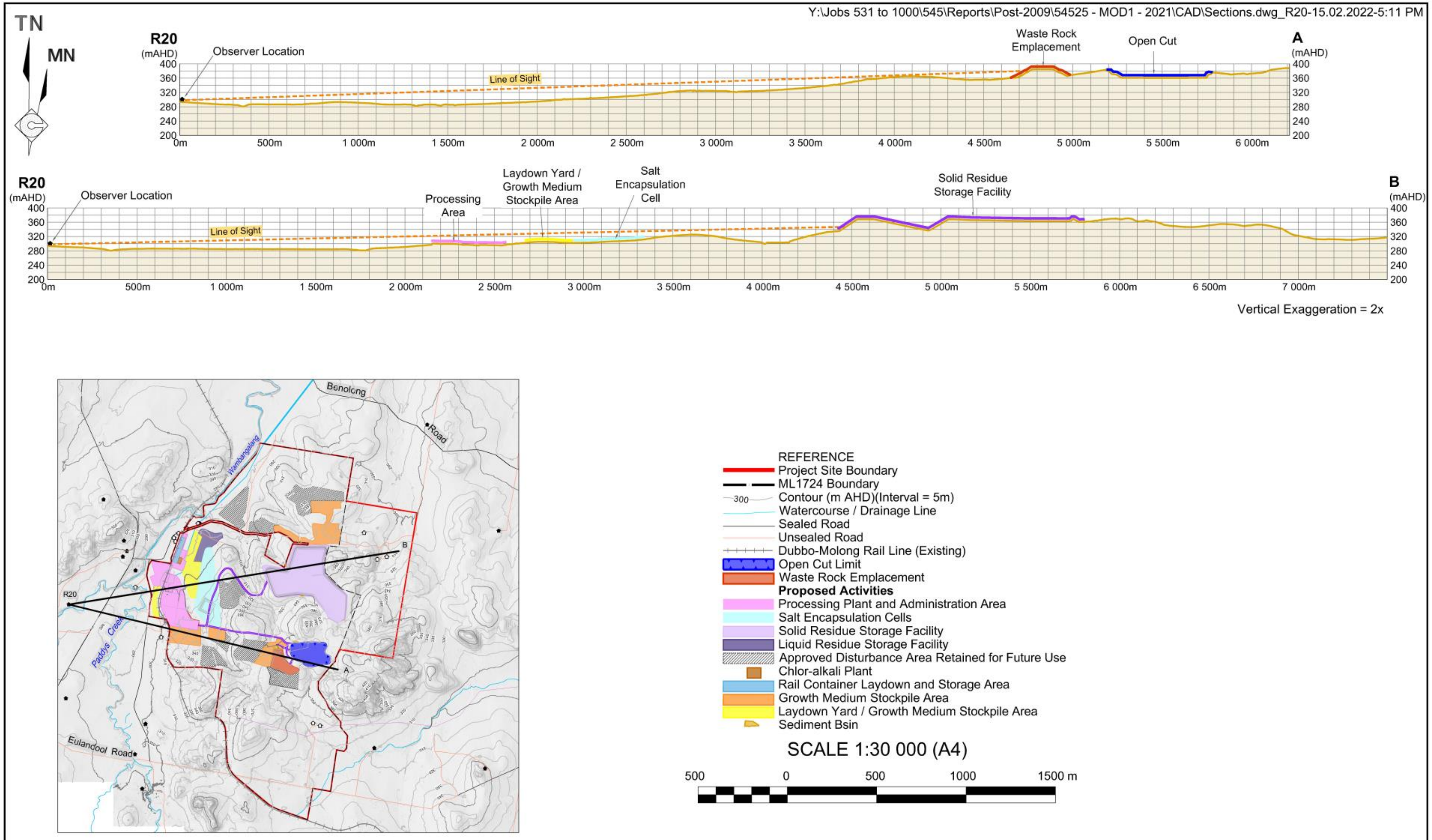


Figure 32
VISUAL IMPACT ASSESSMENT - R20

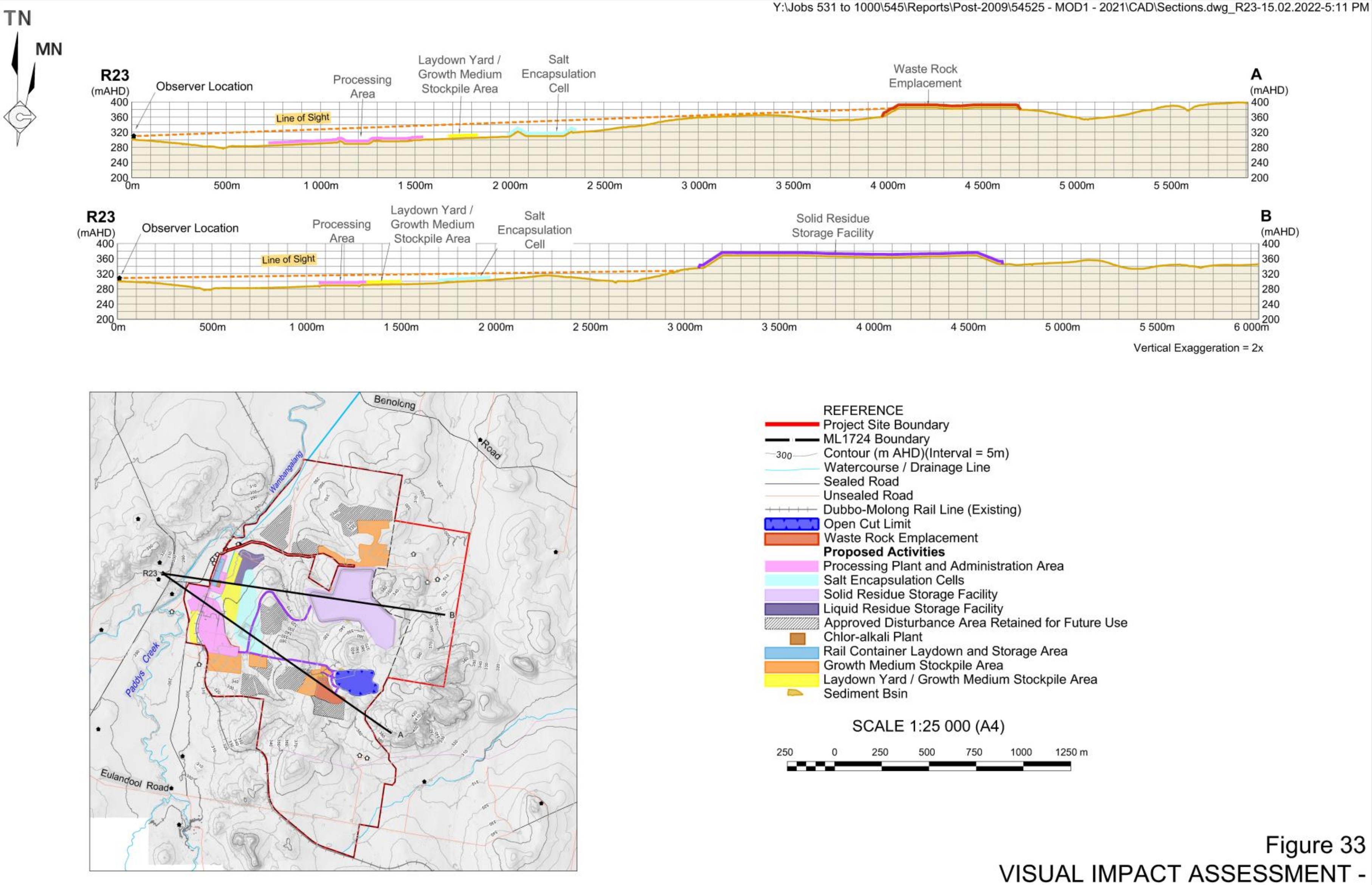


Figure 33
VISUAL IMPACT ASSESSMENT - R23

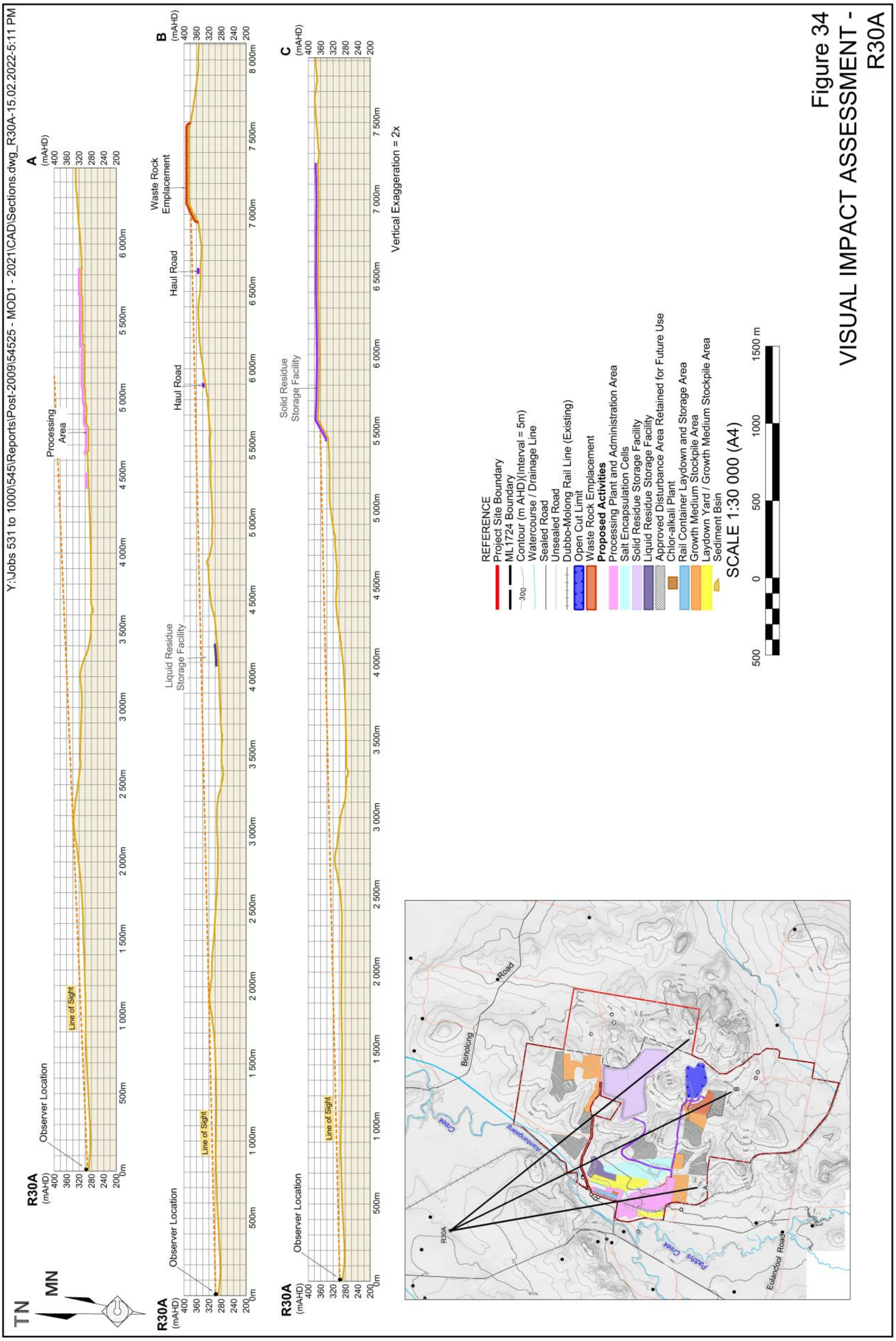


Figure 34
VISUAL IMPACT ASSESSMENT - R30A

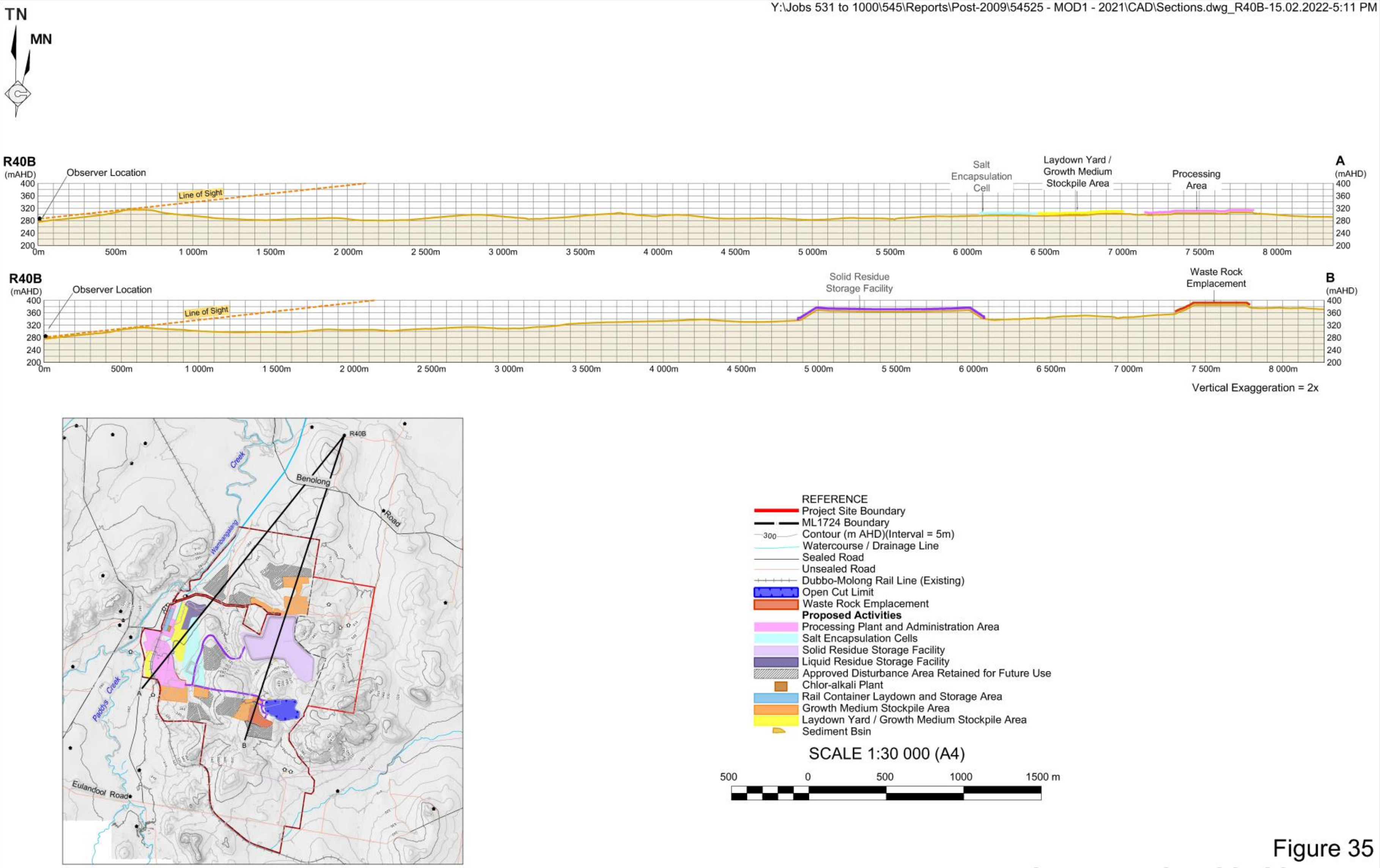


Figure 35
VISUAL IMPACT ASSESSMENT - R40B

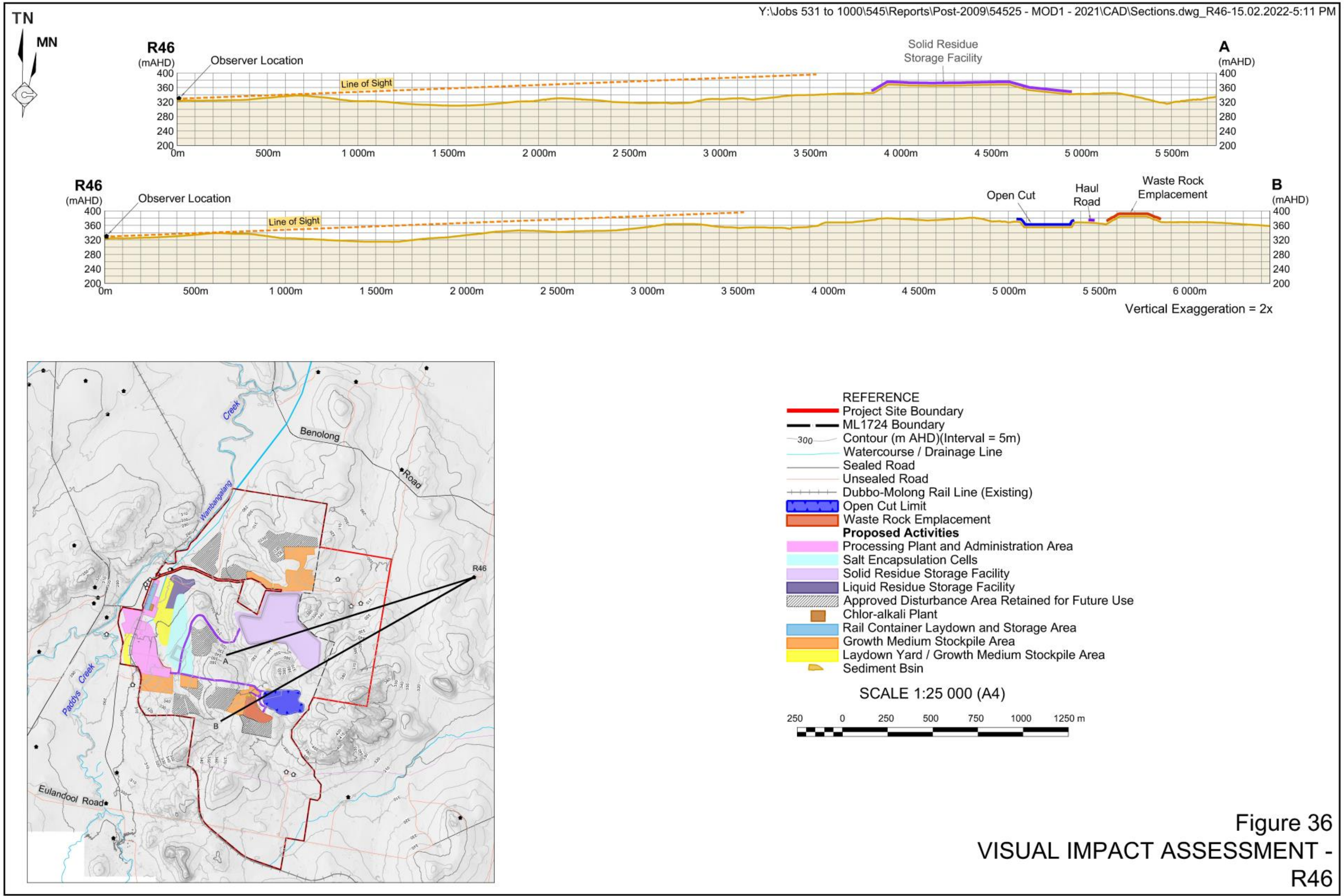


Figure 36
VISUAL IMPACT ASSESSMENT - R46

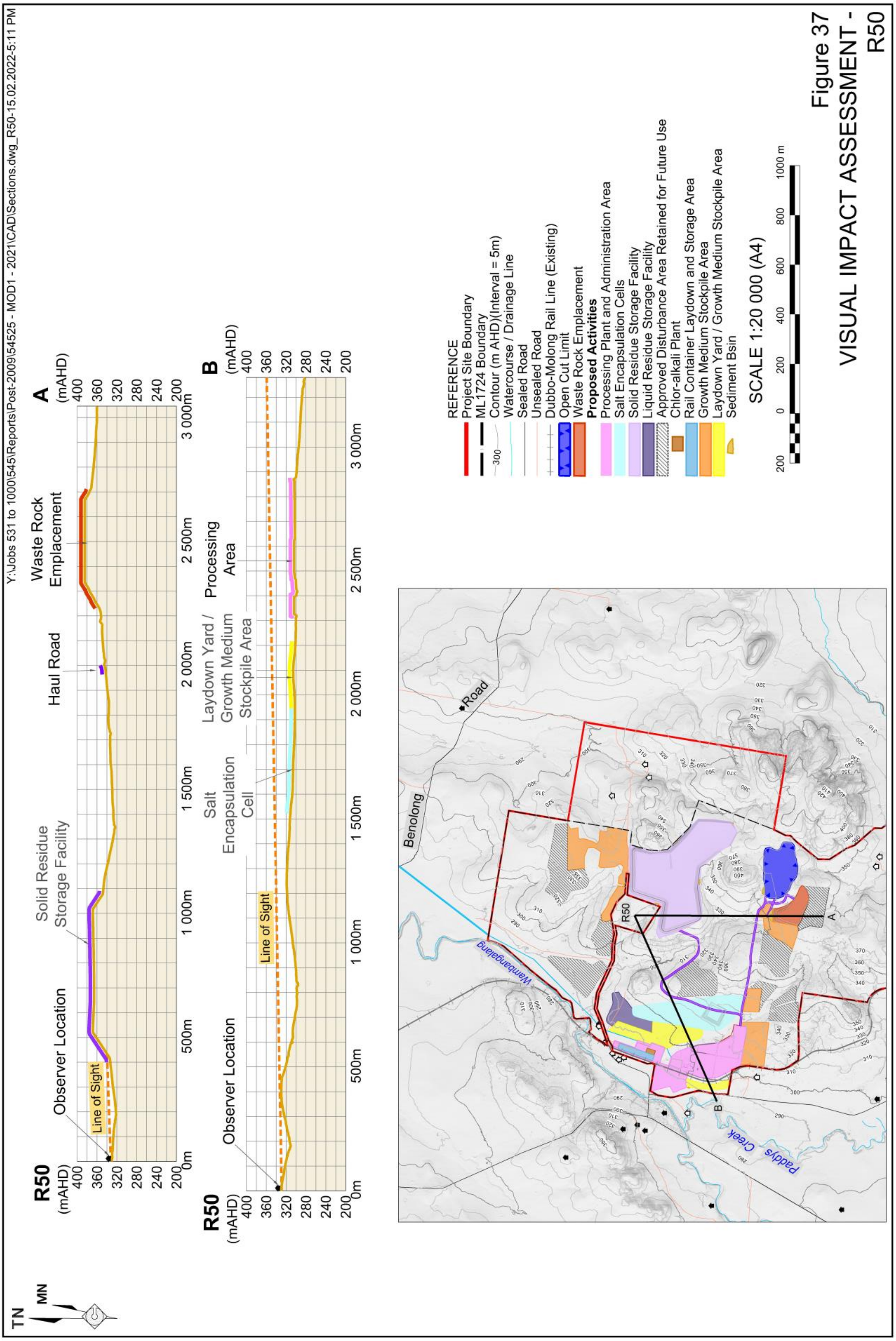


Figure 37
VISUAL IMPACT ASSESSMENT - R50

- Residence R20 (**Figure 32**) – This residence will continue to have views of the Processing Plant and Administration Area, however, the residence is located at roughly the same elevation and 2km from the Processing Plant and Administration Area and views are likely to be largely obscured by native vegetation. The Proposed Modification would result in relocation of the Solid Residue Storage Facility which would no longer be visible from Residence R20, however, the Waste Rock Emplacement, which is not proposed to be modified, would be visible. As a result, the Proposed Modification would not materially impact on the visual amenity of this residence.
- Residence R23 (**Figure 33**) – This Residence would be unlikely to have views of the Processing Plant and Administration Area as that area would be at a lower elevation and would likely be obscured by native vegetation. The top of the Sulphuric Acid Plant stack may continue to be visible. This residence will currently have views of the approved Liquid Residue Storage Facility (Area 5) at a distance of approximately 3.25km. The approved Liquid Residue Storage Facility will have a maximum elevation of approximately 360m AHD. The Proposed Modification would result in the Solid Residue Storage Facility being constructed in that location, with a maximum elevation of 368.5m AHD, or 8.5m higher, a change that would not be perceptible at a distance of 3.25km. As a result, the Proposed Modification would not materially impact on the visual amenity of this residence.
- Residence 30A (**Figure 34**) – This residence will currently have views of the uppermost sections approved Liquid Residue Storage Facility (Area 5) at a distance of approximately 5km. As for Residence R23, the proposed increase in height of the Solid Residue Storage Facility of 8.5m would not be perceptible at a distance of 5km. As a result, the Proposed Modification would not materially impact on the visual amenity of this residence.
- Residence R40B (**Figure 35**) – this residence would be shielded from views of the active sections of the Project Site by intervening topography. As a result, the Proposed Modification would not materially impact on the visual amenity of this residence.
- Residence R46 (**Figure 36**) – this residence would be shielded from views of the active sections of the Project Site by intervening topography. As a result, the Proposed Modification would not materially impact on the visual amenity of this residence.
- Residence R50 (**Figure 37**) – This residence is located approximately 225m from the toe of the approved Liquid Residue Storage Facility (Area 5). The lowermost terrace of the approved Facility, closest to this residence, will have a maximum elevation of approximately 340m AHD. That facility would be replaced with the proposed Solid Residue Storage Facility which would have a maximum elevation in approximately the same location of 368.5m AHD, or 28.5m higher than the approved Facility. At a distance of approximately 225m, this represents an increase of 7.2° in the field of view of an observer at Residence R50. This is likely

to represent a material change in the visual amenity at this residence. The Applicant has previously consulted with the owner of that residence who indicated a preference not to be consulted. Notwithstanding this, the Applicant has attempted to contact the owner during preparation of this document and has not received a response. The Applicant has previously offered to purchase the property and acknowledges that the acquisition provisions embodied in Condition 4 of Schedule 4 of SSD-5251 apply to this residence.

The Applicant contends that changes to visual amenity from other surrounding vantage points under the Proposed Modification would be negligible for the following reasons.

- There would be no change in the maximum stack height within the Processing Plant and Administration Area.
- The relocation of Salt Encapsulation Cell would reduce the maximum elevation of this feature compared to the approved Project Site layout.
- The reduction in the total disturbance footprint for the Project would improve visual amenity compared to the approved Project Site layout.
- The use of lighting rigs during night time construction operations would not increase the total lumens emitted into the sky, but would rather bring forward in time the period during which light would be emitted (i.e. during the constriction and site establishment phase) (see Section 6.4).
- Local topography and remnant vegetation patches would continue to visually shield components of the Project Site from many of the surrounding residences.
- The Applicant has committed to considering the creation of visual screens, upon request, for any residents who would potentially experience visual amenity impacts as a result of the Project.

6.6 BIODIVERSITY

6.6.1 Approved Biodiversity Impacts and Biodiversity Offsetting Area

A *Terrestrial Ecology Assessment* was originally undertaken for the approved Project by OzArk Environment and Heritage Management Pty Limited (OzArk) and included an assessment of the entire Project Site. That assessment, hereafter referred to as OzArk (2013a), was undertaken in accordance with the following guidelines applicable at the time.

- *Threatened Biodiversity Survey and Assessment: Guidelines for Developments and Activities – Working Draft* (DECC, 2004).
- *Draft Guidelines for Threatened Species Assessment* (DECC and DPI, 2005).
- *BioBanking Assessment Methodology (BBAM)* and *Credit Calculator Operational Manual* (DECC, 2008).

- *Threatened Species Assessment Guidelines: the Assessment of Significance* (DECC, 2007).
- *EPBC Act Policy Statement 1.1 Significant Impact Guidelines Matters of National Environmental Significance, May 2006* (DEWHA, 2006).

OzArk (2013a) determined that the Project would result in residual impacts on biodiversity values and adopted the BioBanking Assessment methodology (BBAM) and BioBanking Credit Calculator (Version 2) applicable at the time to calculate the credits required to offset these impacts.

Table 30 provides a summary of the vegetation communities impacted by the approved Project, the ecosystem credits and equivalent offset areas required to offset those impacts, and the maximum available area and ecosystem credits generated by the subsequently approved Biodiversity Offset Area (**Figure 5**). In summary, OzArk (2013a) determined that the Biodiversity Offset Area provided a surplus of Tier 1 and Tier 2 ecosystem credits to directly account for disturbance to vegetation communities CW112, CW121, CW138, CW143 and CW212. Furthermore, OzArk (2013a) determined that the Biodiversity Offset Area provided for an adequate Tier 3 outcome (i.e. 2:1 ha offset ratio when considering allowable vegetation types) when variation rules were applied to offset disturbance to vegetation communities CW213 and CW 145.

Table 30
Vegetation Ecosystem Credits and Offsetting Requirements

Page 1 of 2

	Approved Project			Biodiversity Offset Area		
Vegetation Community	**Impacted Area (ha)**	**Ecosystem Credits Required**	**Offset Area Required (Tier 1 / Tier 2)[1] (ha)**	**Maximum Available Area (ha)**	**Ecosystem Credits Generated**	**Offset Area Surplus / Deficit (ha)[2]**
CW112 Blakely's Red Gum – Yellow Box grassy woodland of NSW South West Slopes Bioregion	0	-	-	39.2	374	39.2
CW121 Bulloak – White Cypress Pine woodland mainly in the NSW South West Slopes Bioregion	0	-	-	3.9	404	3.9
CW138 Fuzzy Box – Inland Grey Box on alluvial brown loam soils of the NSW South West Slopes Bioregion	0.1	17	1.8 / 2.8	21.9	238	21.7
CW143 Heathy Shrublands on rocky outcrops of the western slopes	0	-	-	25.5	237	25.5
CW212 White Box – Tumbledown Gum woodland on fine-grained sediments on the Central West slopes	27.1	1 448	155.7 / 241.3	256.1	4 067	201.9

Table 30 (Cont'd)
Vegetation Ecosystem Credits and Offsetting Requirements

Page 2 of 2

Vegetation Community	**Approved Project**			**Biodiversity Offset Area**		**Offset Area Surplus / Deficit (ha)[2]**
	Impacted Area (ha)	**Ecosystem Credits Required**	**Offset Area Required (Tier 1 / Tier 2)[1] (ha)**	**Maximum Available Area (ha)**	**Ecosystem Credits Generated**	
CW213 White Box – White Cypress Pine – Inland Grey Box woodland on the central western slopes of NSW	457.7	-	-	613.3	6 185	-241.0
• Quality Remnants	43.7	890	96 / 148			
• Derived Grasslands (>50% weeds, rotational cropping)	414	8 010	861 / 1 335			
CW145 Inland Grey Box tall grassy woodland on alluvial loam and clay soils in the South Western Slopes and Riverina Bioregions[3]	1.1	62	6.7 / 10.3	0	0	-2.16

Note 1: Tier 1 = 9.3 credits per hectare, Tier 2 = 6 credits per hectare.

Note 2: Hectare surplus / deficit accounts for Tier 1, 2 and 3 credits available.

Note 3: Vegetation community CW145 only impacted by approved works along Obley Road outside of the project Site.

Source: RWC (2013) – modified after Table 2.22 and Table 2.23. Originally modified after Table 17 and Table 16 of OzArk (2013a).

Table 31 provides a summary of the fauna species impacted by the approved Project, the species credits required to offset those impacts, and the credits available in the Biodiversity Offset Area.

Table 31
Species Credits and Offsetting Requirements

Scientific Name	**Common Name**	**Approved Project**	**Biodiversity Offset Area**	**Species Credit Surplus / Deficit**
		Species Credits Required	**Species Credits Generated**	
Falco hypoleucos	Grey Falcon	6 473	6 126	-347
Hieraaetus morphnoides	Little Eagle	6 473	6 126	-347
Chalinolobus picatus	Little Pied Bat	1 844	6 126	4 282
Aprasia parapulchella	Pink-tailed Worm-lizard	1 286	1 434	148
Lophoictinia isura	Square-tailed Kite	6 473	6 126	-347

Source: OzArk (2013) – modified after Table 17

In summary, OzArk (2013a) determined that the Biodiversity Offset Area provided a surplus of species credits for the Pink-tailed Worm-lizard and the Little Pied Bat. A deficit of 347 Tier 1 species credits was identified of three raptor species, including the Grey Falcon, Little Eagle and Square-tailed Kite. OzArk (2013a) noted that the identified species credit deficit for the raptor species was a common outcome of the BBAM due to the large home ranges of these species and their use of a wide range of vegetation communities for feeding, breeding and roosting. OzArk (2013a) concluded that the Biodiversity Offset Area would adequately account for potential impacts to the three raptor species under the 'Variation of the Offset Rules' as follows.

- Ecosystem credits in the most productive habitats for the raptor species would achieve a Tier 1 or Tier 2 outcome.
- Creation of a 1 021ha Biodiversity Offset Area would significantly increase the habitat value of this land by promoting the occurrence of favoured prey species.

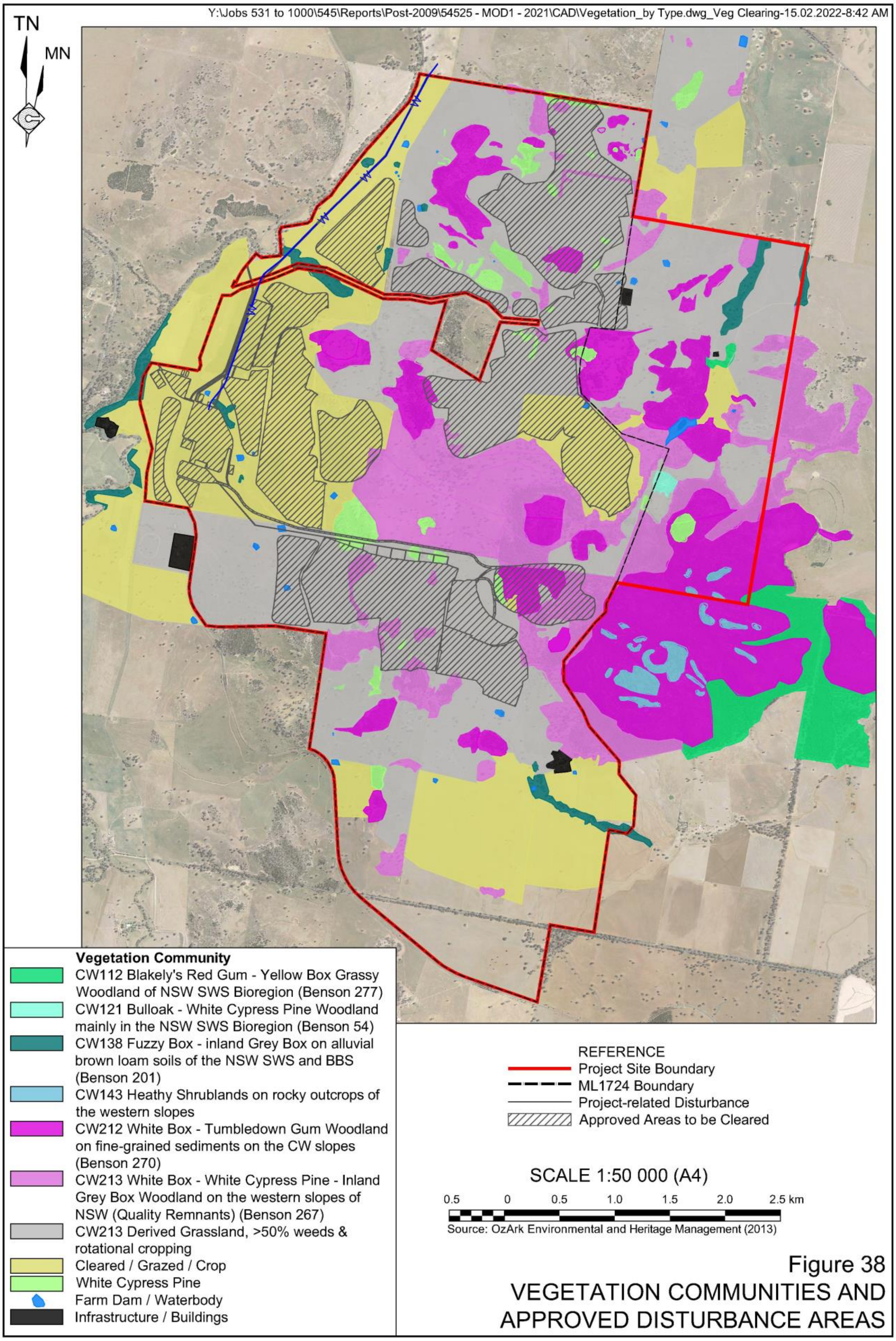
The approved Biodiversity Offset Strategy has been implemented by the Applicant and the Biodiversity Offset Area secured under the following agreements (**Figure 5**).

- NSW EP&A Act Biodiversity Offset – comprising an area of 1 021ha secured under Conservation Property Vegetation Plan (CPVP 00199) prepared in satisfaction of Condition 32 of Schedule 3 of SSD-5251.
- EPBC Act Biodiversity Offset – comprising a subset of the PVP 00199 specifically to account for clearing of up to 35.3ha of *Aprasia parapulchella* (Pink-tailed Worm-lizard, also known as the Pink-tailed Legless Lizard) habitat, approved under approval EPBC 2012/6625

6.6.2 Proposed Biodiversity Impacts

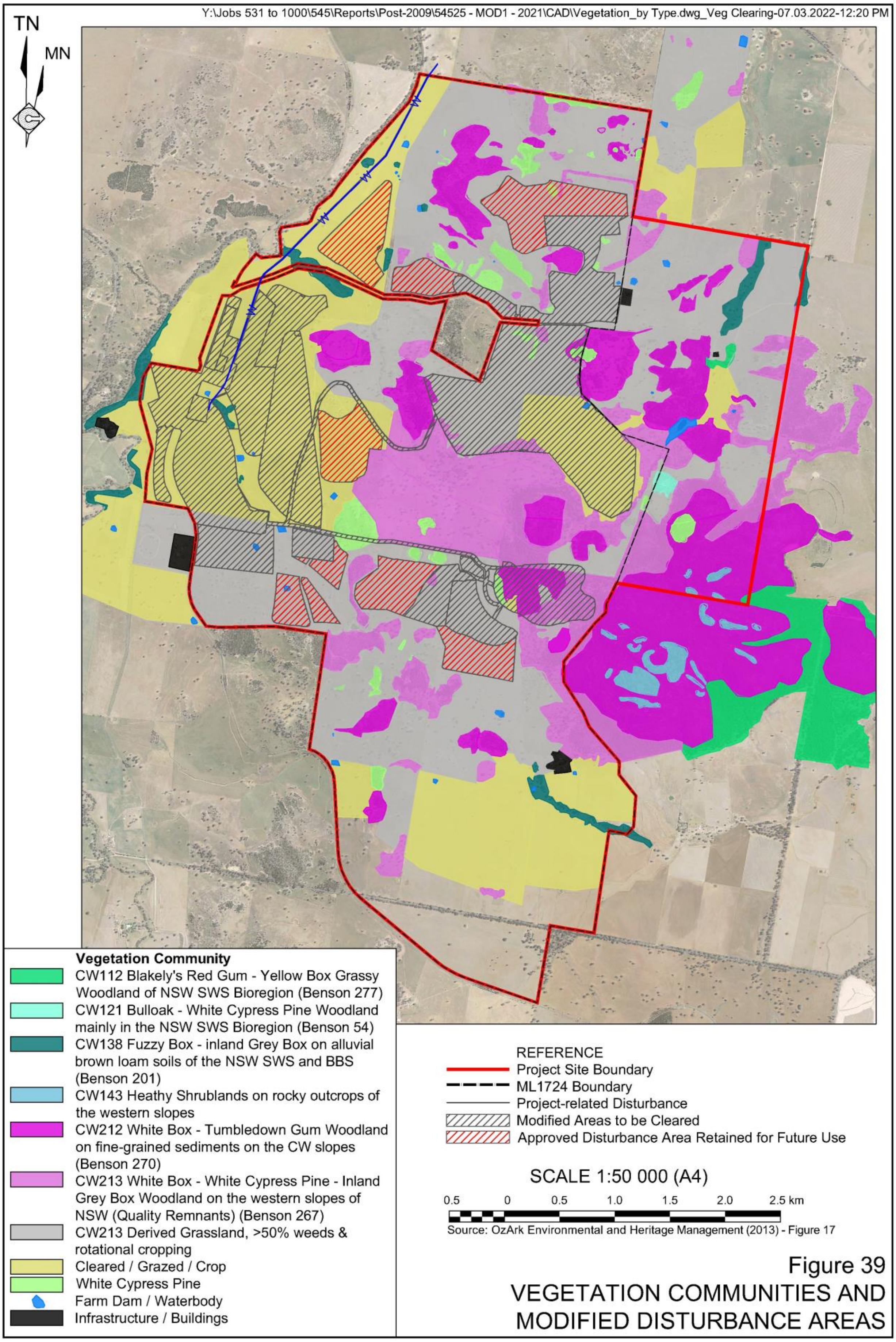
Figure 38 presents the vegetation communities mapped by OzArk (2013a) within the Project Site as well as the proposed clearing which would be required to accommodate the modified Project Site layout. **Table 32** identifies the areas of each vegetation community within the Project Site which would be disturbed under the approved Project (**Figure 38**) and the Proposed Modification (**Figure 39**). In summary, changes to the Project Site layout under the Proposed Modification would result in:

- a reduced clearing of areas classified as CW212, CW213 (quality remnants and derived grasslands), white cypress pines, farm dams / waterbodies, and existing infrastructure / buildings;
- an increase in clearing of areas classified as cleared / grazed / cropped and unclassified areas: and
- no net change to clearing of areas classified as CW138.



Source: OzArk Environmental and Heritage Management (2013)

Figure 38
VEGETATION COMMUNITIES AND APPROVED DISTURBANCE AREAS



Source: OzArk Environmental and Heritage Management (2013) - Figure 17

Figure 39
VEGETATION COMMUNITIES AND MODIFIED DISTURBANCE AREAS

Table 32
Comparison of Approved and Proposed Biodiversity Impacts

Vegetation Community / Land Use	Area Impacted (ha)[1] Approved Project	Area Impacted (ha)[1] Proposed Modification	Net Change in Disturbance (ha)
CW138 Fuzzy Box – Inland Grey Box on alluvial brown loam soils of the NSW South West Slopes Bioregion	0.3	0.3	0.0
CW212 White Box – Tumbledown Gum woodland on fine-grained sediments on the Central West slopes	27.0	22.0	-5.0
CW213 White Box – White Cypress Pine – Inland Grey Box woodland on the central western slopes of NSW[2]	43.7	30.1	-13.6
CW213 Derived Grassland, >50% weeds and rotational cropping[3]	407.9	362.9	-45.0
Cleared / Grazed / Cropped	301.7	357.6	+55.9
White Cypress Pine (exotic)	9.9	6.6	-3.3
Farm Dam / Waterbody	0.7	0.7	0.0
Existing Infrastructure / Buildings	0.1	0.0	-0.1
Unclassified[4]	0.2	0.6	0.4
Total	**791.5**	**780.8**	**-10.7**

Note 1: All disturbance areas calculated based on approved Project Site layout shown on **Figure 2** and proposed Project Site layout shown on **Figure 6**, including “Approved Disturbance Areas Retained for Future Use.”.

Note 2: Equivalent to CW213 ‘quality remnants’ in **Table 30**.

Note 3: Equivalent to CW213 ‘derived grasslands’ in **Table 30**.

Note 4: Unclassified areas consist of areas which were not allocated as either a vegetation community or other existing land use in the spatial data prepared for OzArk (2013a).

The Proposed Modification would therefore represent a net reduction in biodiversity impacts within the Project Site as the proposed changes to the Project Site layout would either decrease or not change the area of each native vegetation community (i.e. CW138, CW212 and CW213) required to be cleared. In addition, a range of areas identified as “Approved Disturbance Areas Retained for Future Use” would not be immediately disturbed, resulting in retention of the associated biodiversity values pending identification of a future use for those areas, subject to further modification of SSD-5251 or a new development consent.

As the Proposed Modification would not result in increased biodiversity-related impacts, no changes to the existing Biodiversity Offset Area are proposed as part of the Proposed Modification.

The Proposed Modification would not alter impacts to identified high, medium and low quality Pink-tailed Worm-lizard habitat areas (**Figure 5**). The Applicant would continue to implement management measures identified under the *Pink-tailed Worm-lizard Biodiversity Offset Management Plan* for the Project.

6.7 HAZARDS

6.7.1 Introduction

A hazards assessment for the EIS (RWC, 2013) encompassing hazards associated with operation of the processing plant, bush fires, traffic incidents and assessment of potential contaminated lands within the Project Site prior to the commencement of the Project was compiled based on the following assessments. The following also includes a justification of those aspects that would not be affected by the Proposed Modification.

- An assessment of potential bush fire hazards was undertaken by R. W. Corkery & Co. Pty Limited (RWC, 2013).
  - As there is no significant change to the area of disturbance, the Proposed Modification would have no additional impact on potential bush fire hazards.
- A traffic impact assessment of the Project was undertaken by Constructive Solutions Pty Ltd. The full assessment is presented in Part 11 of the *Specialist Consultant Studies Compendium* of the EIS (RWC, 2013).
  - As there is no increase in traffic change in the nature of the approved transportation, the Proposed Modification would have no additional impact on traffic incident hazards.
- A contaminated lands assessment for a property adjoining the Project Site and the Dubbo-Molong Rail Line (considered the only likely source of land contamination locally) was undertaken by Ground Doctor Pty Ltd. The full assessment is present as Appendix 10 of the EIS (RWC, 2013).
  - As the Project has not yet commenced, the Proposed Modification would have no additional impact on the preliminary contamination assessment.

6.7.2 Reagent and Product Management

An assessment of the applicability of the *State Environmental Planning Policy 33 – Hazardous and Offensive Development* (SEPP 33) was undertaken by Sherpa Consulting Pty (2013). The full assessment is presented as Appendix 4 of the EIS (RWC, 2013).

Table 33 summarises the approved hazardous materials to be used at the processing plant and their storage arrangements.

Table 34 summarises the hazardous materials that would be used at the processing plant and their storage arrangements under the Proposed Modification.

The Proposed Modification removes the requirement for anhydrous ammonia and includes the addition of SX diluent Shellsol 2046. Used in solvent subtraction processes, this product would be transported to the Project Site by road or rail in specially designed tanks. On entry to the Project Site, the road tankers would be marshalled and directed to the appropriate storage area where the solvent would be pumped into the storage vessels by compressor/ containers unloaded onto concrete bunded pads. Approximately 36t would be stored within the Project Site. The Australian Dangerous Goods Code does not classify this material as dangerous.

Table 33
Approved Hazardous Materials

Material	**DG Class**	**Total Quantities (tonnes)**	**Storage Arrangements**
Hydrochloric acid (33wt%)	8PG II	900	Imported ISOtainers pumped to a storage tank.
Sulphuric acid (98%)	8PG II	9 000	Road tankers and / or output from the Sulphuric Acid Plant pumped to two bunded 2 420m^3 storage tanks.
Sodium sulphide (Na2S)	8PG II	20	Bulk bags undercover.
Sodium hydroxide (NaOH)	8PG II	1 200 in tank 900 in ISOtainers	Imported ISOtainers pumped to a storage tank.
Anhydrous ammonia	2.3	200	Onsite storage with a capacity of 200t, comprising 2 tanks of 100t each.
Potable water treatment chemicals (chlorine)	9PG II	0.43	-
SX Organic (Alamine 336)	9PG II	20	Containers stored on bunded and covered concrete pads.
Diesel fuel	9PG II	794	-
Source: Sherpa (2013)			

Table 34
Proposed Hazardous Materials

Material	**DG Class**	**Total Quantities (tonnes)**	**Storage Arrangements**
Hydrochloric acid (33wt%)	8PG II	900	Output from Chlor-alkali Plant pumped to a storage tank.
Sulphuric acid (98%)	8PG II	9,000	Road tankers and / or output from the Sulphuric Acid Plant pumped to two bunded 2 420m^3 storage tanks.
Sodium sulphide (Na2S)	8PG II	20	Bulk bags undercover.
Sodium hydroxide (NaOH)	8PG II	1 200 in tank 900 in ISOtainers	Output from Chlor-alkali Plant and / or imported ISOtainers pumped to a storage tank.
Potable water treatment chemicals (chlorine)	9PG II	0.43	-
SX Organic (Alamine 336)	9PG II	20	Containers stored on bunded and covered concrete pads.
SX Diluent (Shellsol 2046)	Not Dangerous	36	Storage bullets stored on bunded concrete pads.
Diesel fuel	9PG II	794	-
Source: ASM (Holdings) (2021)			

As the Proposed Modification would not increase the range or quantities of Dangerous Goods transported to, stored within or used at the Project Site, there would be no adverse change to the approved hazards associated with the Project. Furthermore, the Proposed Modification would allow the Applicant to produce reagents on site at the proposed Chlor-alkali Plant, thereby minimising potential hazards associated with reagent transportation by reducing hydrochloric acid and sodium hydroxide transportation requirements by up to 100% and 60% respectively.

6.8 HERITAGE

6.8.1 Aboriginal Heritage

All areas of the Project Site were assessed as part of the Aboriginal Heritage Assessment completed for the approved Project (OzArk, 2013b). **Figure 40** shows the locations of recorded Aboriginal heritage sites within the Project Site in relation to the approved Project Site layout. The approved Project included unavoidable direct impacts to 14 known Aboriginal heritage sites which were either completely or partially within the approved Project's disturbance footprint. A further 12 known Aboriginal heritage sites were located adjacent to the approved disturbance footprints and therefore required careful management to avoid impacts.

Figure 41 shows the locations of recorded Aboriginal heritage sites within the Project Site in relation to the modified Project Site layout. The Proposed Modification would not result in any additional disturbance to recorded Aboriginal heritage sites within the Project Site. Disturbance to one Aboriginal heritage site which would otherwise have been impacted directly, site PH-IF1 (isolated lithic artefact) located within the approved Solid Residue Storage Facility footprint, would not occur as a result of the Proposed Modification.

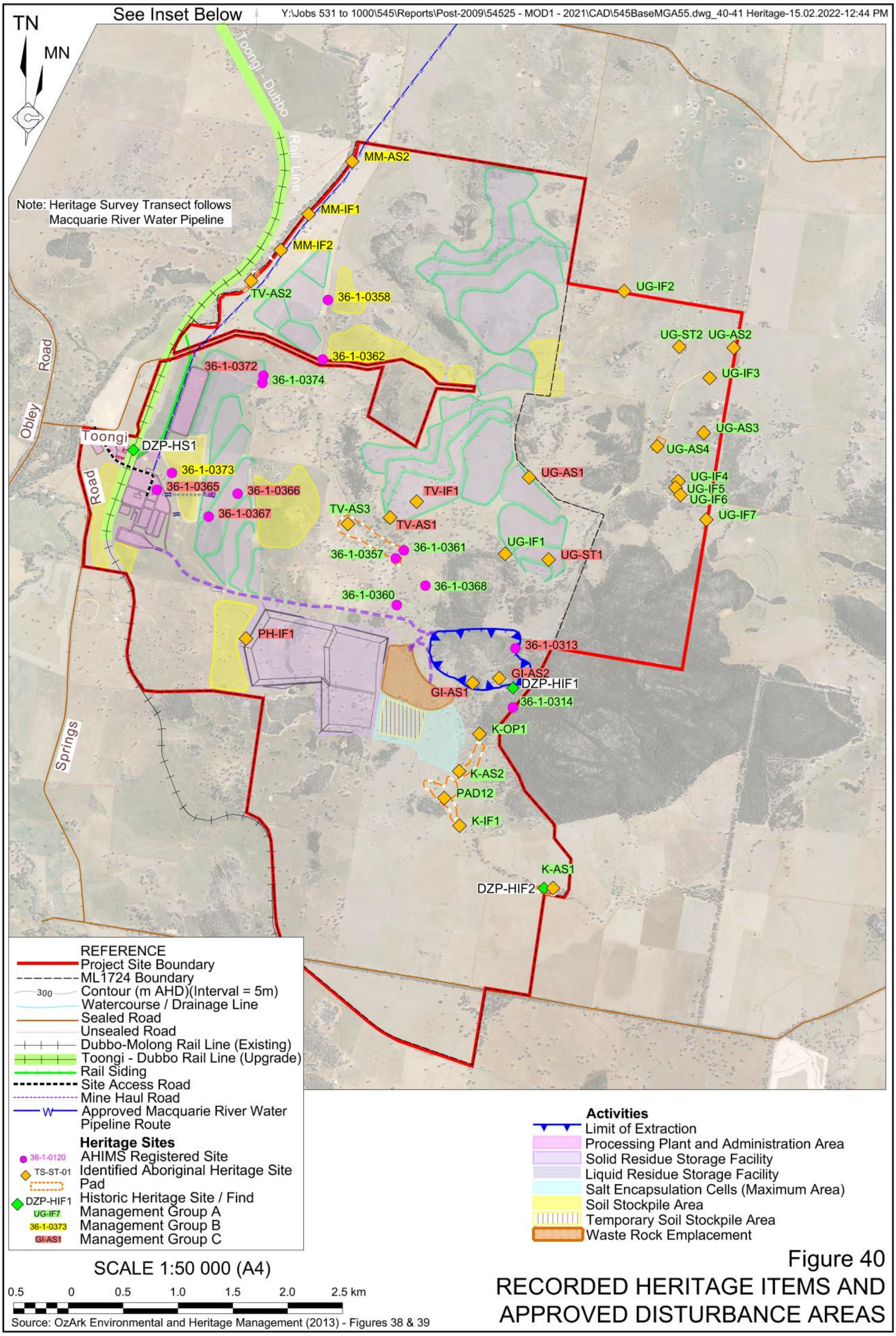
One additional Aboriginal heritage site, site TV-AS3, would be located in close proximity to the proposed tailings pipeline and haul road (**Figure 41**). Site TV-AS3, including an associated Potential Archaeological Deposit (PAD) area, includes a lithic scatter consisting of core, flakes and grinding stone with an approximate density of four artefacts per square metre (OzArk 2013b). To ensure that potential impacts to this site are avoided, construction of the haul road in the vicinity of the site would only be undertaken following the installation of permanent, high visibility markers at minimum 10m spacings where the boundary of the site and associated PAD occur within 25m of the proposed haul road.

No additional Aboriginal heritage sites would be located in close proximity to disturbance areas proposed as part of the modified Project Site layout and therefore no additional sites would warrant careful management to ensure avoidance of impacts.

6.8.2 Historic Heritage

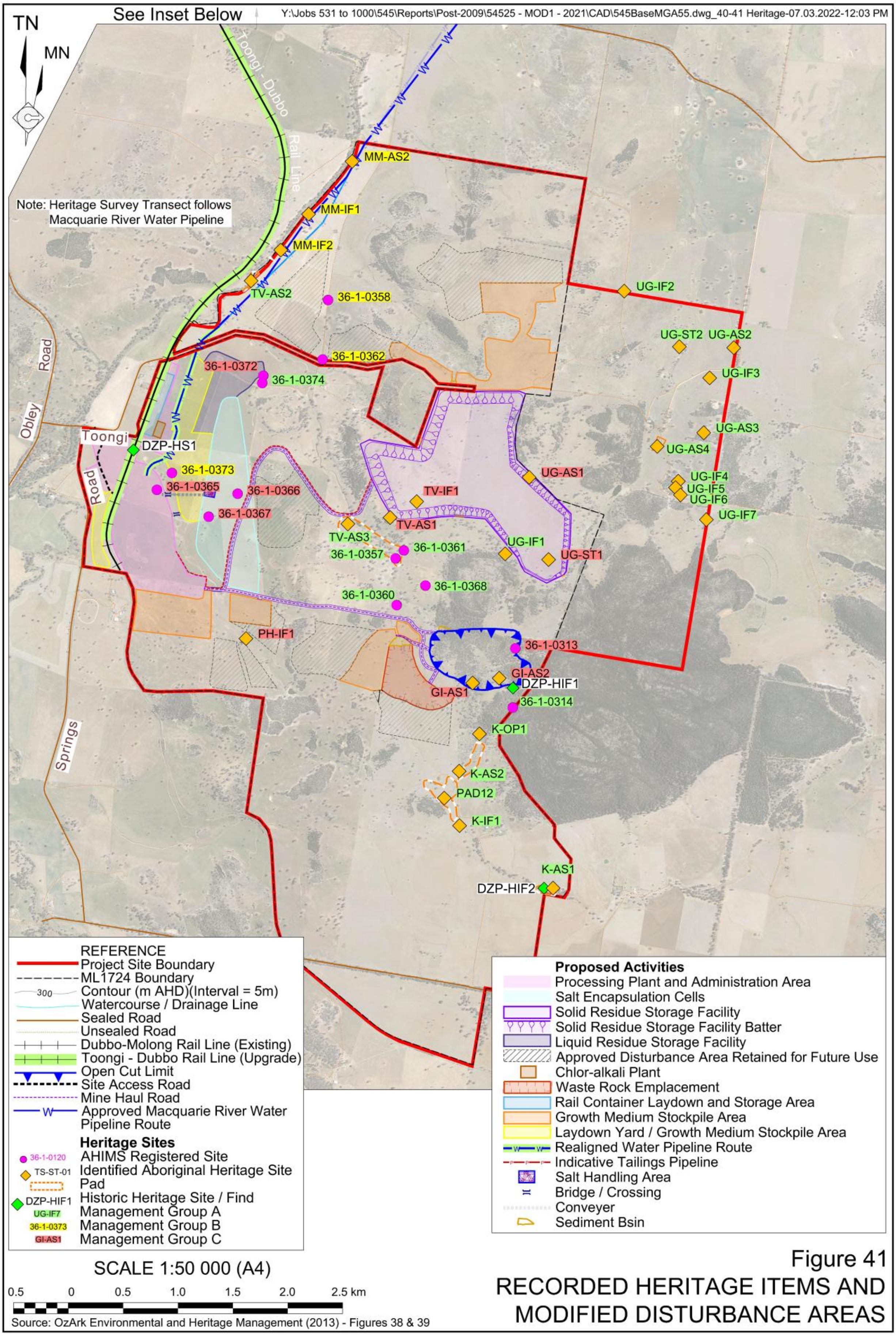
The majority of the Project Site, including all areas of approved disturbance and all areas which would be disturbed under the Proposed Modification, was surveyed as part of the Historic Heritage Assessment completed for the approved Project (OzArk, 2013c). **Figure 40** shows the locations of recorded historic heritage sites within the Project Site in relation to the approved Project Site layout.

Figure 41 shows the locations of recorded historic heritage sites within the Project Site in relation to the modified Project Site layout. The Proposed Modification would not result in any additional disturbance to recorded historic heritage sites within the Project Site.



Source: OzArk Environmental and Heritage Management (2013) - Figures 38 & 39

Figure 40
RECORDED HERITAGE ITEMS AND APPROVED DISTURBANCE AREAS



Source: OzArk Environmental and Heritage Management (2013) - Figures 38 & 39

Figure 41
RECORDED HERITAGE ITEMS AND MODIFIED DISTURBANCE AREAS

6.9 SOCIAL AND ECONOMIC

6.9.1 Introduction

The Socio-economic Impact Assessment for the Proposed Modification was prepared by RWC. This assessment has been prepared in accordance with the NSW Government's *Social Impact Assessment Guideline for State Significant Projects* (the SIA Guideline) (DPIE, 2021b). While the Socio-economic Impact Assessment primarily addresses social issues, it has been informed by the outcomes of technical assessments in relation to the predicted environmental impacts of the Proposed Modification, including cumulative impacts, where relevant.

The social impacts of a development include any issues that affect or concern people, whether directly or indirectly, as a result of that development[5]. Any real or perceived impact may have social consequences and therefore the assessment of these impacts needs to look beyond the technical assessments undertaken when considering environmental impacts. The SIA Guideline provides a guide to categorising social impacts that may be expected, which are summarised below.[6]

- Way of life: how people live, work, play or interact with each other on a daily basis.
- Community: people's sense of place, how the community functions, composition, cohesion, and resilience.
- Accessibility: people's access to and use of public infrastructure, services and facilities.
- Culture: including shared beliefs, customs, values and stories, and connections to land, waterways, places, and buildings.
- Health and wellbeing: including physical health and mental wellbeing, especially for people vulnerable to substantial change or social exclusion.
- Surroundings: including a community's surroundings or environment including ecosystem services such as shade, access to the environment, amenity impacts such as noise, air quality, visual outlook, public safety and security.
- Livelihoods: the capacity for people to sustain themselves through employment or business.
- Decision-making systems: the extent to which people are involved in decisions that affect their lives and their access to grievance mechanisms.

Social impacts are therefore broadly defined, do not have specific criteria against which they can be assessed and relate to the specific sensitivity or situation of an individual and/or community. It is recognised that some aspects of development will be experienced differently by different stakeholders. What may cause concern or fear in one person may be perceived with indifference by another and vice versa.

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[5] Modified after Vanclay et al. (2015). Social Impact Assessment: Guidance for assessing and managing the social impacts of projects.

[6] This summary is modified after Section 4.3 of the SIA Guidelines.

Social impacts are also influenced by an individual's perception of risks resulting from an activity. Risk perception also varies from person to person dependent on that person's background, experience with the activity and education or source of information on the activity. This is particularly relevant for the consideration of physical amenity impacts that may be assessed technically by a specialist trained in that discipline but remain a perceived or real impact for impacted individuals.

Methodology

The Socio-economic Impact Assessment reviewed the social and economic setting of the approved Project and, where negative socio-economic impacts were identified as a result of the Proposed Modification, assessed the impact in relation to the following five dimensions of impact magnitude.

- Extent of the impact
- Duration of the impact
- Severity or scale of the impact
- Intensity or importance of the impact
- Level of concern/interest of the people to the impact

Impacts were also considered from a cumulative perspective, taking into account the presence of existing mining operations in the region.

The methodology used for the Socio-economic Impact Assessment is generally consistent with the SIA Guideline and the author's experience preparing impact assessments. The methodology adopted for the Socio-economic Impact Assessment involved the following.

1. A review of the existing socio-economic context including a description of the social locality and social baseline of the local setting together with available data on demographic and social trends.
2. Direct research through stakeholder engagement.
3. Identification and assessment of potential impacts and opportunities using a qualitative social risk review.
4. Recommendations for social mitigation and management measures.

6.9.2 Social Locality and Social Baseline

6.9.2.1 Social Locality

A comprehensive Socio-Economic Impact Assessment was prepared for the original Environmental Impact Statement (RWC, 2013) by Diana Gibbs and Partners (DGP, 2013). The DGP (2013) assessment details the socio-economic characteristics of the Dubbo Region and Toongi local setting.

Geographic Context

The Project Site is located approximately 25km to the south of Dubbo in the Orana Region of NSW and is located within the Australian Bureau of Statistics-defined Toongi State Suburb, which occurs in the Dubbo LGA. The Dubbo LGA is located in central NSW, with the city of Dubbo being the major commercial and urban centre. The Dubbo Regional LGA also includes a number of smaller population centres including Wellington, Eumugerie, Brocklehurst, Geurie and Stuart Town.

Governance

The Dubbo LGA is administered by the Dubbo Regional Council (Council). Council have developed key plans and strategies for the governance of the LGA including the:

- *Dubbo Local Environmental Plan 2011*; and
- *Dubbo Regional Community Strategic Plan 2040*.

In addition to the above, the *Central West and Orana Regional Plan 2036* was prepared by the NSW State Government to guide land use, development and infrastructure funding decisions in the Central West and Orana Regions of NSW.

These plans are further discussed in Sections 2.1 and 4.3 of this document.

Cultural and Historic Context

At the time of first contact with Europeans, land in the vicinity of the approved Project Site was occupied by Aboriginal people of the Wiradjuri language group (OzArk, 2013b). Several places of significance nearby to the approved Project Site are listed on the Australian Heritage Information Management System Database, including an Indigenous Place at Brocklehurst (bora ground) and an Indigenous Place at “Toongi Valley” (carved tree). “The Springs” at Toongi is noted as an important place for Aboriginal and early settler contact (OzArk, 2013b).

European involvement in the Dubbo region commenced with the grant of land in the 1820s for pastoral enterprises, with the first successful and permanent run occupied approximately 8km south of the current city of Dubbo. With the gold rushes of the 1850s, the area was opened up to new cattle markets with long-distance droving routes being established. Following the demise of the gold rush, the subsequent increasing labour supply saw sheep and wool production become dominant. Dubbo prospered throughout the late nineteenth century and in particular during the 1880s following the arrival of the railway in 1881, making it a central hub for transport routes.

The Toongi Village itself was settled relatively late in comparison to other areas in the district with a ‘Settlement Lease’ taken up by James Ower on 4 November 1897. The village of Toongi was notified on 6 March 1931 to service the Toongi siding on the Dubbo-Molong Railway line which was constructed between 1920 and 1925. At that time, the village notification consisted of a recreation reserve and school site, with village lots opened up for purchase on 17 April 1931 (Hickson and Kass, 2002). The Wambangalang School, opened in 1928 and continues to provide educational services (as the Wambangalang Environmental Education Centre).

A government-operated grain storage and distribution siding location was previously located on the Dubbo-Molong Rail Line which runs adjacent to the village. It is likely that operations on that location have involved grain bagging, storage and bulk loading on to trains. Operations ceased in 1993 following the closure of the rail line (circa 1987). A rail motor operated on the Dubbo-Molong line for some years but that service ceased in 1974. Dismantling of the southern grain storage occurred between 1988 and 1995 and dismantling of the northern storage occurred between 1995 and 2000. In 2012, the site consisted of a concrete floor remnant of the northern storage and an asphalt floor remnant of the southern storage.

Economic Context

Dubbo is the established service centre for the wider Orana region and was estimated by the *Dubbo Regional Council Economic Report March 2019*[7] to have had a Gross Regional Product (GRP) (total value of goods and services within the region) of $3.415 billion in 2019. For the past ten years, the Dubbo Region has experienced positive growth in GRP. The output, or gross revenue generated by activity, of the Dubbo Region economy is estimated at $6.624 billion. The main sources of this economic activity were construction ($1.05 billion), manufacturing ($890 million), rental, hiring and real estate services ($654 million), health care and social assistance ($490 million). The agriculture, forestry and fishing sector contributed $361 million to this value of output, representing 5.4% of the total Dubbo economic output.

Social Baseline

Dubbo

The key trends identified in the Dubbo Region may be summarised as follows.

- The Dubbo Regional Council (2021)[8] reports the population of the Dubbo regional area at over 54 000 people. The annualised growth rate from 2016-2020 is reported to be 1.26% and the population is projected to increase to 60 800 by 2036[9].
- The proportion of the community in the Dubbo LGA who identify as Aboriginal or Torres Strait Islander is 6%, with the proportion increasing to 14.6% in the Dubbo State Suburb.
- The median age in the Dubbo LGA of 36 is 2 years lower than the median across NSW of 38.
- The most common population cohort in the Dubbo region is young children under the age of 10 years. Of the adult population, the 50–59 years cohort has the greatest number of people, followed by the 20–29 years cohort.
- The population in Dubbo LGA work predominantly in health care, retail trade, education, and construction with public administration and food services also featuring.

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[7] *Dubbo Regional Council Economic Report (March 2019).*

[8] Australian Bureau of Statistics (2016) as cited by Dubbo Regional Council (2021). Retrieved from https://app.remplan.com.au/dubboregionalcouncil/community/population/age?state=nE80IE!8VWbuARzxTnDqQbsmwa1XSMTbFEo7T1FRF2F71u7FluAxEf3j5 22 September 2021.

[9] *Dubbo Regional Council Economic Report March 2019* retrieved from https://www.dubbo.nsw.gov.au/ArticleDocuments/373/2019%20Dubbo%20Region%20Economic%20Profile.pdf.aspx?Embed=Y 22 September 2021.

- Residents in the Dubbo LGA have a median weekly personal income higher than the median NSW weekly income but a lower family and household median weekly income compared to NSW.
- People within the Dubbo LGA have good access to community infrastructure services such as childcare, primary schools and pharmacies, secondary education and medical services. Tertiary education is limited with one regional university campus and TAFE.
- The data collected for the ABS review of the Socio-economic Indexes for Areas (SEIFA) indicates that the Dubbo LGA is not overly disadvantaged, and has relatively moderate access to resources, education and employment opportunities compared to other regions in Australia.

Toongi

The key trends identified in Toongi may be summarised as follows.

- The Dubbo Regional Council (2021) reports the population of Toongi at 60 people.
- The proportion of the community in Toongi who identify as Aboriginal or Torres Strait Islander is 6.67% (4 persons).
- The median age in Toongi of 55 is 17 years higher than the median across NSW of 38. This potentially reflects fewer economic and employment opportunities for those in the earlier stages of their working life.
- The most common population cohort in Toongi is the 50-59 years cohort has the greatest number of people, followed by the 60-69 years cohort and then the 20-29 years cohort. All other age cohorts are not represented in Toongi.
- The working population in Toongi work predominantly in agriculture and education. However, the largest proportion of the population (40%) do not classify themselves within the employment categories provided by the Census.
- Residents in Toongi have a median weekly personal income on par with the median NSW weekly income and a very similar household median weekly income compared to NSW.
- There are no unoccupied dwellings in Toongi.
- People within Toongi have no immediate access to community infrastructure services such as childcare, primary schools and pharmacies, secondary education and medical services within the village. Community infrastructure is available approximately 25km away at Dubbo. There is no public transport available between Toongi and Dubbo.
- The data collected for the ABS review of the SEIFA indicates that Toongi has very low disadvantage, and has relatively moderate access to resources, education and employment opportunities at Dubbo, compared to other regions in Australia.

6.9.2.2 Stakeholder Engagement

Stakeholder engagement has relied upon the long-standing, existing relationships of the Applicant with the community. The Socio-economic Impact Assessment (DGP, 2013) prepared for the EIS identified the following.

> "The Applicant has already adopted a detailed communication strategy for [the Project], whereby the community (and different groups within the general community) have all been kept informed of the nature of the Proposal, and of progress with the development of the Proposal.
>
> The local Toongi community has been aware of the existence of the ore body for more than 13 years [since 2000], as several exploration programs have been undertaken to quantify the nature and size of the resource.
>
> Several…meetings have been held at Toongi for local residents, to inform them of the [Project], and progress/likely timing of the Proposal. In addition a regular newsletter is provided to anyone who wishes to be added to the mailing list.
>
> These consultations have been well received by the local community, who appreciate that their views are important to the Applicant. It is proposed to continue with this form of consultation (i.e. individual meetings, community meetings, and the newsletter) as the basis of a communication strategy as the Proposal proceeds into construction and operational phases.
>
> The Applicant has also engaged in communications with Regional Training Operations and local educational institutions over several years with the aim of preparing Dubbo to supply a locally skilled workforce. This communication is proposed to continue."

The communication strategies outlined in the DGP (2013) assessment have continued since development application and approval. Community newsletters[10] continue to be published on a regular basis and a Community Consultation Committee[11] continues to meet and discuss the approved Project and the Proposed Modification.

The stakeholders most likely to be impacted by the Proposed Modification include landholders in the vicinity of the Project Site. Section 5.2 presents the consultation undertaken with surrounding stakeholders.

Residents of Dubbo and surrounds would likely experience indirect impacts associated with the proposed increase to the workforce, with the Project workers residing in these communities. Potential positive impacts include additional employment opportunities (direct or indirect) and additional population resulting in increased support for new or retained services. Potential negative impacts include increased demand for services, increased housing or business costs and community dislocation though new residents disrupting existing or other networks.

The local Aboriginal community has an intimate knowledge and attachment to the land and has primarily been consulted through both the heritage assessment process and the Community

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[10] Community newsletters are available at https://asm-au.com/sustainability/community/dubbo-project-community-updates/

[11] CCC meeting minutes are available at https://asm-au.com/sustainability/community/community-resources/ccc-archive/

Consultative Committee. Additionally, cultural awareness training has been delivered at the Project Site to several groups of visitors over the past 12 months. The Applicant acknowledges its obligations to this community and will ensure that a place on the Community Consultative Committee is reserved for a representative of the Aboriginal community. The Applicant has also committed to work with the Aboriginal community to foster training, employment and business opportunities for the community.

6.9.3 Management and Mitigation Measures

Social and economic impact enhancement, mitigation and residual impacts

The Applicant would continue to implement the following relevant management and mitigation measures.

- Engage the community surrounding the Project Site in regular dialogue in relation to the operation of the Mine and maintain an “open door” policy for any member of the community who wishes to discuss any aspect of the Project.
- Proactively and regularly consult with those residents most likely to be adversely impacted by the Project.
- Actively engage with the existing Community Consultative Committee.
- Advertise and maintain a community complaints telephone line (02 6882 2866 or after hours 0427 691 733).
- Give preference when engaging new employees, where practicable, to candidates who live within the Dubbo Local Government Area.
- Encourage the involvement of the local Aboriginal community in the workforce.
- Encourage and support participation of locally based employees and contractors in appropriate training or education programs that would provide skills and qualifications that may be of use following completion of the Project.
- Give preference, where practicable, to suppliers of equipment, services or consumables located within the Dubbo Local Government Area.
- Assist community members and others, as appropriate, to establish complimentary businesses in the vicinity of the Project Site.
- Assist surrounding Councils, namely the Dubbo and Narromine Councils, to promote and encourage economic development.
- Ensure that infrastructure and services installed for the Project, including the water supply bores and pipeline, electricity transmission line, appropriate buildings and hardstand areas, remain available for alternative uses following completion of the Project (provided that such uses are consistent with the final land uses identified in the EIS or any subsequent approval).

- Encourage and support, in consultation with the local community, the provision of services to the community. These may include health, education, transportation and other services.
- Continue to manage weeds, pests and bushfire risks in consultation with surrounding landholders.

6.9.4 Assessment of Impacts

A review of existing socio-economic context and the outcomes of community engagement have been used to inform the evaluation of potential social impacts. Potential impacts were evaluated taking into account the current perception of impacts from the local community and the unmitigated Project Modification outcomes. Impacts were evaluated in terms of the extent, duration, severity, intensity and level of concern of each impact to affected stakeholder groups and at different periods throughout the life of the Project.

Each of the potential impacts was further assessed through a social risk review that considered the potential impact in terms of the social risk consequences and the likelihood of occurrence against a social risk matrix developed in accordance with the Department of Planning, Industry and Environment *Social Impact Assessment Guideline Technical Supplement July 2021* impact analysis. The risk outcomes were considered in terms of the mitigated risk assessed for the Project Modification and the community expectation of risk outcomes.

Table 35 presents a summary of the risk outcomes identified through the Socio-economic Impact Assessment and the risk outcomes expected by the community.

Social impacts

Considering the previously addressed impacts on air quality, noise, lighting and night glow, visual amenity, biodiversity and hazards, the Proposed Modification would be unlikely to have an unacceptable impact on residents or the environment within or surrounding the Project Site. As a result, adverse socio-economic impacts are likely to be negligible. The additional workforce required as a result of the Proposed Modification could potentially have a negative impact on housing accessibility and affordability in the Dubbo Region, however, recruitment of people already living in the region will help to lessen this impact. In addition, Dubbo Regional Council has a delivery program and operational plan to accommodate and service a population of 100 000 people in the not-too-distant future, accommodating for a growing population and economy.

Economic impacts

The Proposed Modification would provide direct full-time employment for an additional 24 people during the operational life of the Project, with additional personnel required during the construction phase. This would have a positive impact on the livelihood and wellbeing of the community through increased employment opportunities and meaningful participation in the local economy.

The Proposed Modification would contribute approximately $41 per year in wages and associated benefits to employees which would largely be spent within the Dubbo Regional Council Area. Additionally, the Proposed Modification would contribute at least $131 million each year to the public sector in the form of taxes and royalties.

As a result, assessment of the potential socio-economic impacts demonstrates that the beneficial impacts of the Proposed Modification far outweigh any minor adverse impacts associated with the operations.

Table 35
Summary of Social Risk Mitigation

Potential Impact or Risk	Impact evaluation	Standard Mitigation Measures	Project Specific Mitigation Measures	Residual Impact Significance
Modifications to processing plant causes a decline in surroundings and health and wellbeing for neighbouring residents through noise and air quality effects.	C3 – Medium	• Workforce education. • Discussion of noise at Community Consultative Committee meetings. • 24-hour complaint hotline and follow-up.	• Noise attenuated plant and equipment. • Real-time noise monitoring, reporting and response protocol. • Relocated noise monitors in discussion with the community.	D2 – Low Negative
Modification to non-linear construction hours causes a decline in surroundings and health and wellbeing for neighbouring residents through noise and air quality effects.	B3 – High	• Workforce education. • Discussion of noise at Community Consultative Committee meetings. • 24-hour complaint hotline and follow-up.	• Noise attenuated plant and equipment. • Real-time noise monitoring, reporting and response protocol. • Relocated noise monitors in discussion with the community. • Assess noise levels using 24-hr operations criteria instead of construction criteria.	D2 – Low Negative
Modification to the number of FTE jobs causes a decline in accessibility and community through pressure on housing availability and prices, infrastructure and services.	C3 – Medium	• Consultation with Council and business. • Dubbo Regional Council Delivery Program and Operational Plan regarding housing and infrastructure planning.	• Consultation with Dubbo Regional Council and local businesses. • Recruitment from local community and region.	D2 – Low Negative
Modification to the number of jobs causes improvements livelihood and health and wellbeing through increased opportunities for employment and meaningful participation in the local economy.	B4 – High	• Consultation with schools, training providers and business.	• Recruitment from local community and region. • Work with education providers to increase training and education opportunities for local people.	A4 – Very High Positive

6.10 OTHER ENVIRONMENTAL ASPECTS

Table 36 presents a summary of those environmental aspects which would either be unaffected by or experience minimal impacts as a result of the Proposed Modification, and a justification for those conclusions.

Table 36
Summary of Other Environmental Aspects

Environmental Aspect	Justification
Blasting and Vibration	The Proposed Modification would not result in any modification to the approved blasting operations.
Traffic and Transportation	The Proposed Modification would not alter train and truck movements approved for the Project under SSD-5251. The Proposed Modification would result in immaterial additional light vehicle movements during the construction and site establishment phase.
Surface Water	The Proposed Modification would not significantly alter anticipated surface water impacts, control structure types, management measures or monitoring strategies associated with the Project. The existing *Water Management Plan* and *Erosion and Sediment Control Plan* would be updated to account for the proposed changes to the Project Site layout.
Groundwater	The Proposed Modification would not significantly alter anticipated surface water impacts, control structure type, management measures or monitoring strategies associated with the Project. The existing *Water Management Plan* would be updated to account for the proposed changes to the Project Site layout.
Soil and Land Capability	The Proposed Modification would not significantly alter the soil stripping and management procedures to be employed at the Project Site. The Proposed Modification would not alter the target final land uses following the life of the Project. Detailed rehabilitation objectives, completion criteria and rehabilitation methodologies would be provided in a *Rehabilitation Management Plan* for the Project.
Waste (Non-production)	The Proposed Modification would not materially alter the volume of non-production waste generated by the Project or the waste management strategies employed to dispose of that waste.

7. JUSTIFICATION OF MODIFIED PROJECT

7.1 ACTION TAKEN TO AVOID / MINIMISE IMPACTS

The following presents the actions that have been or would be taken to avoid or minimise impacts associated with the Proposed Modification.

- The Applicant proposes to install a Brine Concentrator that would very substantially reduce Project-related water consumption and the area required for Liquid Residue Storage Facilities.
- The Applicant proposes to proceed with Transportation Option A, namely rail transportation direct to the Project Site.
- The Proposed Modification would result in previously approved disturbance areas not being disturbed.

7.2 CONSISTENCY WITH STRATEGIC CONTEXT

The Proposed Modification is consistent with the Goals of the *Central West and Orana Regional Plan 2036* in that it would allow for:

- continued diversification of the local and regional economy, providing valuable non-agricultural income and economic activity;
- the ongoing protection of agricultural lands;
- sustainable management of mineral resources; and
- the continued provision of education and training opportunities.

Similarly, the Proposed Modification is consistent with each of the Principles of the *Dubbo Regional Community Strategic Plan 2040*, in particular, investment in infrastructure, growing the local economy and protecting the local environment.

7.3 COMPLIANCE WITH STATUTORY REQUIREMENTS

The Proposed Modification is made under Section 4.55(2) of the *Environmental Planning and Assessment Act 1979* and the Minister for Planning, or their delegate, or the Independent Planning Commission, is the consent authority. Sections 4.4 and 4.5 identify the preconditions to granting approval and the matters that must be considered by the Consent Authority prior to doing so. In summary, however, the Proposed Modification meets all preconditions to granting of development consent and this application addresses all matters to be considered by the Consent Authority.

7.4 CONSISTENCY WITH COMMUNITY VIEWS

Sections 5.1 and 5.2 present an overview of the engagement carried out for the Proposed Modification and the views of the community surrounding the Project Site. Overall, the Applicant contends that the Community has very little interest in the Proposed Modification and views it as simply a continuation of the approved Project.

The Proposed Modification would not adversely impact on the community. Indeed, the Proposed Modification would ensure the initial construction and future operation of the Mine until 31 December 2045, with the resulting community benefits over that time.

7.5 SCALE AND NATURE OF ANTICIPATED IMPACTS

7.5.1 Introduction

The following subsections present an overview of how the Proposed Modification is consistent with the principles of ecologically sustainable development, a brief summary of the anticipated biophysical, social and economic impacts of the Project assuming the implementation of proposed mitigation and management measures.

7.5.2 Ecologically Sustainable Development

7.5.2.1 The Precautionary Principle

In order to satisfy this principle of Ecologically Sustainable Development (ESD), emphasis must be placed on anticipation and prevention of environmental damage, rather than reacting to it.

Throughout the development of the Proposed Modification, the Applicant, RWC and the specialist consultant team have adopted an anticipatory approach to impacts by undertaking an analysis of the risks posed by the Proposed Modification. Examples of matters relating to the precautionary principle that were considered during the various stages of the Proposed Modification are listed below.

- The design of the Proposed Modification was prepared in accordance with the relevant guidelines.
- The modified processing plant layout was designed by experts in their respective fields to minimise environmental impacts, energy consumption and disturbance to land not already the subject of prior disturbance.
- Recognised experts in the fields of noise, air quality, and lighting and nightglow were engaged by the Applicant to ensure that potential adverse impacts were well understood and, therefore, were capable of being mitigated to the greatest extent practicable.

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

7.5.3 Social Equity

Social equity embraces value concepts of justice and fairness so that the basic needs of all sectors of society are met and there is a fair distribution of costs and benefits to the community. Social equity includes for both inter-generational (between generations) and intra-generational (within generations) equity considerations.

As demonstrated throughout Section 6, the Proposed Modification would have little effect on those considerations. On this basis, it is not considered there would be any change to impacts on social equity of the Mine as a result of the Proposed Modification.

7.5.4 Conservation of Biological Diversity and Ecological Integrity

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

As identified in Section 6.6, the Proposed Modification would not result in any additional disturbance of remnant vegetation communities.

Therefore, the Proposed Modification would not result in any unacceptable reduction in biodiversity values or ecological integrity.

7.5.5 Improved Valuation and Pricing of Environmental Resources

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

The Applicant has committed to continual improvement in the quality and quantity of outputs generated by the processing operations. Since the approval of SSD-5251, further research and reviews of the approved operations have been conducted to identify methods to minimise waste generation. The adjustments to the processing plant would accommodate these improvements. The Applicant has also committed investigate ways to ensure that the Project could operate net carbon zero.

The value placed by the Applicant on environmental resources is evident by the considerable resources invested in the continual improvement in the design of outputs generated by the processing operations and the Proposed Modification. On balance, it is assessed that the Proposed Modification provides for the planned and approved recovery of rare metals and rare earth elements, while not significantly increasing impacts on the environment.

7.5.6 Biophysical Considerations

Potential biophysical impacts of the Proposed Modification have been assessed in Section 6. The following provides a brief overview of the residual biophysical impacts of the Proposed Modification.

- Air Quality – the Proposed Modification would result in minor increases in particulate matter concentrations, with rare exceedances of relevant criteria attributed to high background concentrations. The Proposed Modification would not result in exceedances of relevant criteria for nitrogen dioxide, sulphur dioxide, hydrogen chloride and chlorine or odour. The Proposed Modification would not significantly impact greenhouse gas emissions generated by the approved Project.

- Noise – the Proposed Modification would not result in any exceedances of the relevant noise criteria during either the construction and site establishment phase or the operational phase of the Project. Consequently, the Proposed Modification is unlikely to increase noise-related impacts surrounding the Project Site.
- Lighting and Sky Glow – the Proposed Modification would not result in significant changes to approved lighting requirements and would not increase the total lumens emitted to the sky.
- Visual Amenity – the proposed modifications to the layout of the Project Site include a reduction in the total area to be disturbed as well as reduced final elevations for structures including the Solid Residue Storage Facility and Salt Encapsulation Cells. Consequently, the Proposed Modification would not materially impact on the visual amenity of surrounding residences.
- Biodiversity – the proposed changes to the Project Site layout would either decrease or not change the area of each native vegetation community to be cleared. Consequently, the Proposed Modification would not materially impact on biodiversity values within the Project Site.
- Hazards – the Proposed Modification would not increase the range or quantities of Dangerous Goods transported to, stored within or used at the Project Site. Consequently, the Proposed Modification would not change the approved hazards associated with the Project.
- Heritage – the Proposed Modification would not result in additional direct impacts to recorded Aboriginal or historic heritage sites within the Project Site and would avoid direct impacts to one recorded Aboriginal heritage site. Consequently, the Proposed Modification would not materially impact on Aboriginal or historic heritage values within the Project Site.
- Social and Economic – the Proposed Modification would be unlikely to result in an unacceptable impact on surrounding residents or the environment and therefore adverse socio-economic impacts are likely to be negligible. Potential adverse impacts on housing affordability and accessibility in the Dubbo Region associated with additional workforce requirements would be outweighed by the positive impacts of increased employment opportunities and increased economic contributions.

All other environmental aspects are unlikely to be affected by the Proposed Modification.

7.5.7 Socio-Economic Considerations

The Proposed Modification would result in:

- employment of additional personnel, many of whom would be residents of the Dubbo LGA;
- expenditure by Mine personnel in commercial facilities of Dubbo and other towns;

- contribution to the Dubbo LGA and surrounding economies through payments for goods and services and contributions via taxes, royalties, rates and the existing Planning Agreement with Council; and
- the indirect flow-on benefits associated with the afore-mentioned employment and economic contributions.

On the basis of the above and the fact that the Proposed Modification could be undertaken without affecting the amenity of surrounding residents it would have a positive influence on the socio-economic conditions of the village of Toongi and surrounding region. As a result, it is considered that on balance the Proposed Modification would provide for a net socio-economic benefit.

7.6 COMPLIANCE MONITORING AND COMMUNICATION

The Applicant would continue to monitor and report on the environmental performance of its operations and compliance with the relevant conditional requirements of all approvals, licences and consents in accordance with current procedures

7.7 REMAINING UNCERTAINTIES

Given the rigour of the engineering and environmental studies undertaken for the Proposed Modification, the remaining uncertainties are considered to be negligible.

7.8 CONSEQUENCE OF NOT PROCEEDING

The consequences of not proceeding with the Project Modification include the following.

- The opportunity for full value capture of critical metals on site would be foregone.
- The opportunity to reduce the need to import large volumes of hydrochloric acid and sodium hydroxide would be foregone.
- The opportunity to increase the number of operational full-time jobs would be forgone.
- The opportunity to integrate the Project into the Applicant’s downstream processing operations would be forgone and, would potentially result in the Project not proceeding because it would not be able to attract adequate funding.

The consequences of not proceeding with the Project would include the following.

- The recoverable rare metal and rare earth elements resource, globally important as critical to the ongoing development of ‘green technology’, would not be mined.
- The opportunity to create up to 1 000 construction and 274 operational full-time jobs would be forgone.

- A capital cost of approximately $1 678 million, to be spent on the construction and establishment of the Project, would be forgone.
- The economic contribution generated by an annual operating cost of approximately $287 million, of which an anticipated $41 million per year would be spent within the local and regional economy through wages, would be forgone.
- The contribution of approximately $131 million each year to the public sector, in the form of taxes and royalties, along with the additional income tax and rates generated, would be foregone.
- The upgrade of local road and rail infrastructure would not occur.
- The training opportunities that would be provided would be foregone. The opportunity to provide for the goals and directions in the *Central West and Orana Regional Plan 2036* and the themes in the *Dubbo Region Community Strategic Plan 2040* to encourage and develop the economy, infrastructure, employment and the sustainable management of mineral resources would be foregone.
- The opportunity to support the NSW Government's Critical Minerals and High-tech Metal Strategy launched in November 2021.
- Minor impacts on the local biophysical environment would not eventuate.

7.9 THE PUBLIC INTEREST

In concluding this document, the Applicant contends that the Proposed Modification would be in the public interest for the following reasons. Each of the benefits identified would continue until the end of 2045.

- Direct employment for up to approximately 1 000 people during construction and 274 people during operation, with wages and salaries of approximately $41 million per year.
- Injection of approximately $287 million per year into the local, regional and State economy. This expenditure is likely to generate additional economic activity and flow on effects, providing further employment opportunities.
- Payment of approximately $131 million per year in taxes, royalties, rates and other contributions.
- Substantial reduction in the approved area of disturbance and water consumption.
- Infrastructure upgrades, including implementation of rail transportation to the Project Site.
- Economic activity in a rural area in a time of recent significant drought and hardship for the surrounding community.
- Continued extraction of a State-owned resource in a manner that does not result in significant additional environmental impacts.

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