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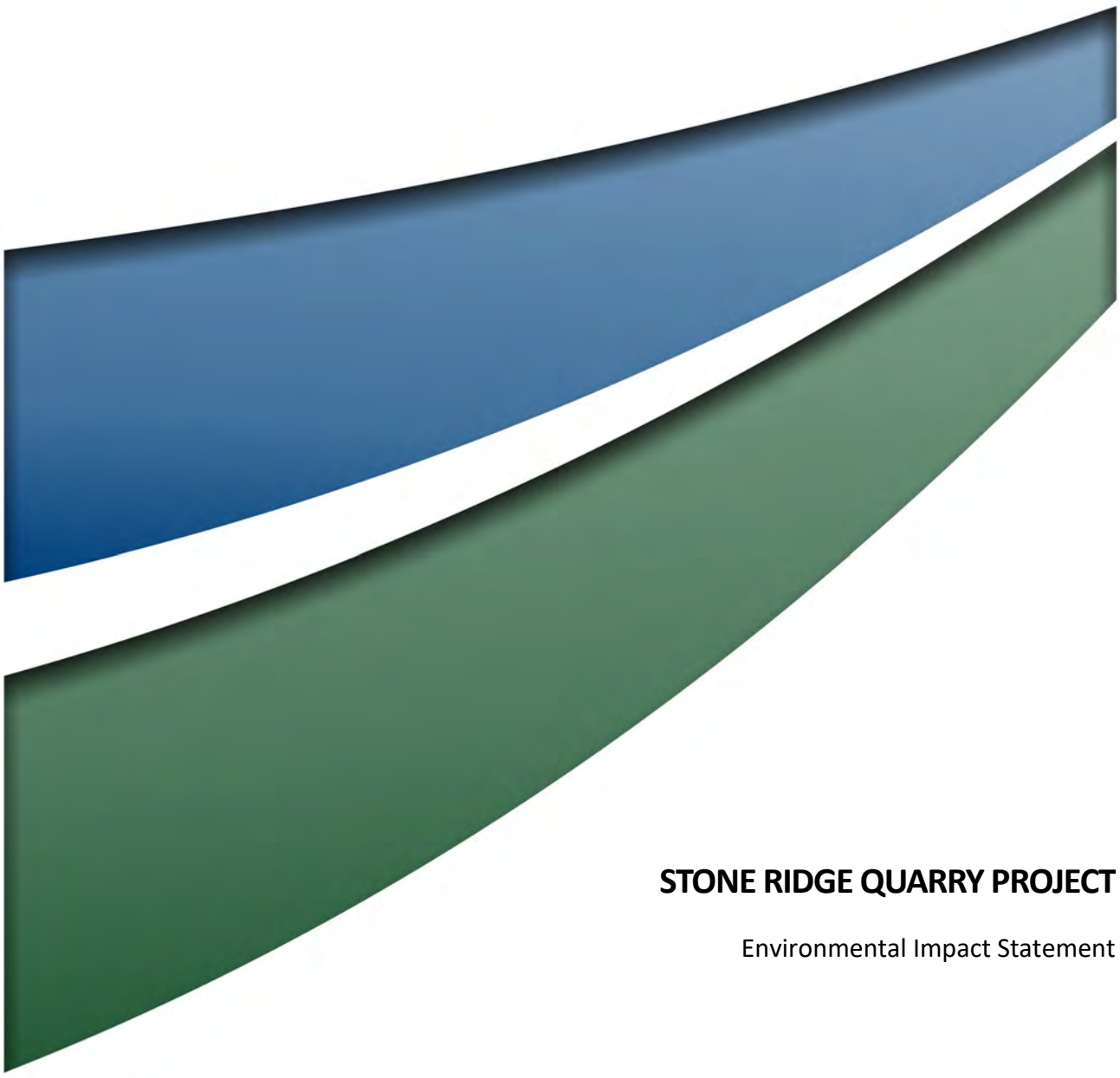

STONE RIDGE QUARRY PROJECT

Environmental Impact Statement

FINAL

May 2023

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Environmental Impact Statement

FINAL

Prepared by
Umwelt (Australia) Pty Limited
on behalf of
Australian Resource Development Group Pty Limited

Project Director:	David Holmes
Project Manager:	Penelope Williams
Report No.	4158 / R06
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Newcastle
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This report was prepared using Umwelt's ISO 9001 certified Quality Management System.

Acknowledgement of Country

Australian Resource Development Group and Umwelt would like to acknowledge the traditional custodians of the Port Stephens area and pay respect to their cultural heritage, beliefs, and continuing relationship with the land.

Australian Resource Development Group and Umwelt would also like to acknowledge the post-contact experiences of Aboriginal people who have attachment to the Port Stephens area.

We pay our respect to the Elders – past, present, and future.

Document Status

Rev No.	Reviewer		Approved for Issue	
	Name	Date	Name	Date
Final	David Holmes	25/05/2023	David Holmes	25/05/2023

Summary

What is the Project?

Australian Resource Development Group Pty Limited (ARDG) is seeking to develop a new hard rock quarry, known as Stone Ridge Quarry (the Project), located within Wallaroo State Forest at Balickera NSW, approximately 30 km north of Newcastle (refer to **Figure S1**).

The Project is seeking to access a high quality, hard rock resource suitable for producing a wide range of quarry products for the Lower Hunter, Central Coast and northern Sydney construction materials markets. The Project would produce up to 1.5 million tonnes per annum (Mtpa) of saleable quarry product with approval sought for an initial 30-year quarrying period.

The Project has been designed through a comprehensive process that incorporates community and stakeholder feedback, and the findings of environmental and social studies to maximise positive social, economic and environmental outcomes while avoiding and/or minimising adverse impacts to sensitive environmental features and neighbouring landholders.

The Project Area occupies 139 ha of land within the Wallaroo State Forest, which is managed by the Forestry Corporation of NSW (FCNSW). ARDG holds a Deed of Agreement (Deed) for a Forest Materials Licence (FML) with FCNSW which allows them to seek approval for the operation of a hard rock quarry within a defined Licence Area within the State Forest (refer to **Figure S2**). Should the Project be approved, ARDG will obtain a FML from FCNSW over the Project Area which will govern management of the area and include a requirement for the payment of royalties to FCNSW on quarry materials extracted by the Project.

A summary of the key aspects of the Project is provided in **Table S1**.

Table S1 Summary of Key Project Aspects

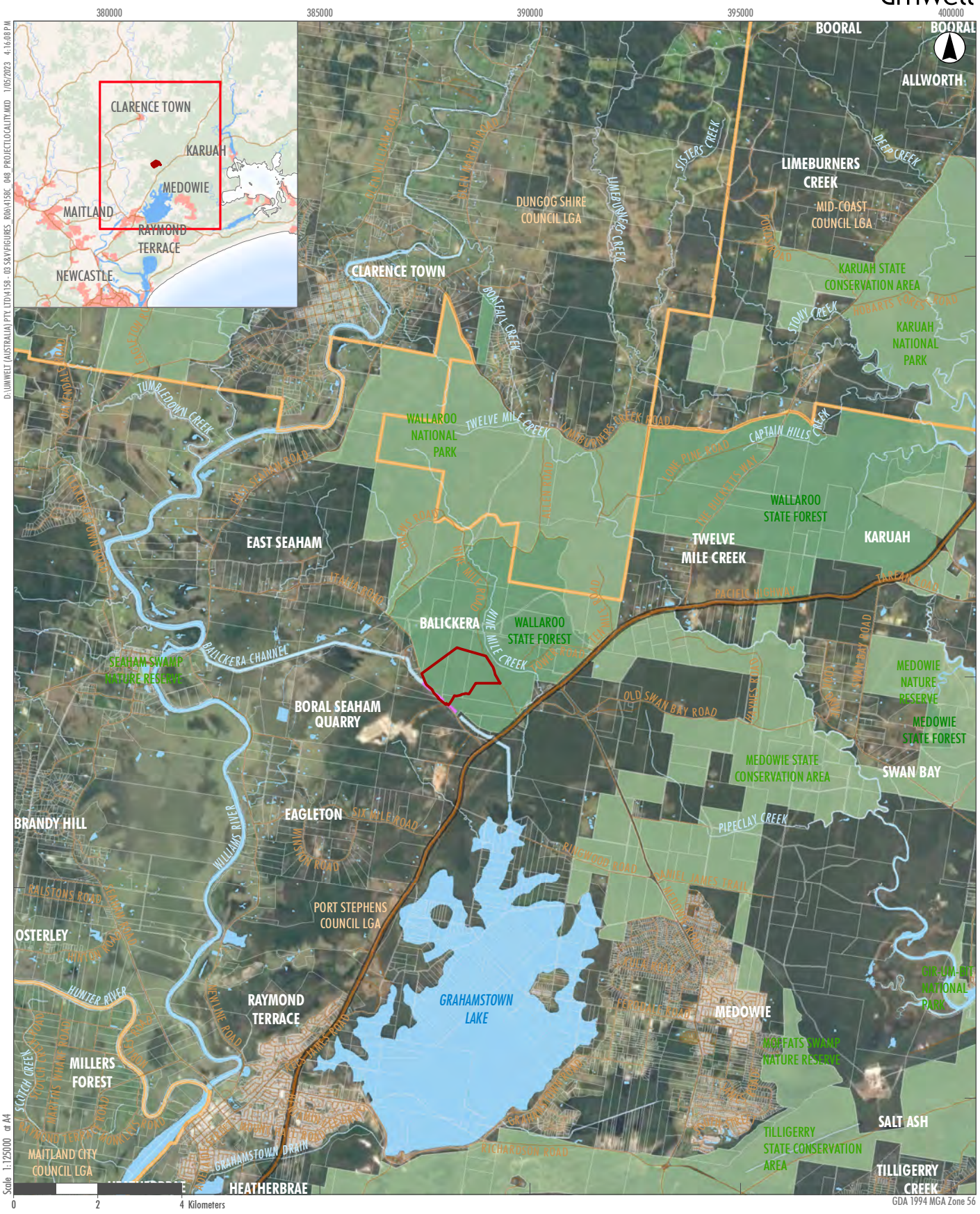
Aspect	Proposed for the Project
Life of Extraction	30 years from the commencement of extraction. Some processing activities, decommissioning and rehabilitation activities will occur beyond the date extraction is completed.
Limits of production	Up to 1.5 Mtpa of quarry product/sales per year.
Project Area	Approximately 139 ha (including extraction, processing, stockpiling area and buffers), with a disturbance area of approximately 79 ha.
Extraction method	Drill, blast, load and haul.
Material processing	Processing on site with provision for both mobile crushing and screening plant, as well as modular/fixed processing plant.
Overburden management	Overburden will be minimal and any topsoil and overburden will be stockpiled on site for use in rehabilitation and/or water management structures and bunds.
Products	Concrete, asphalt and sealing aggregates, gabion, armourstone, roadbase and other crushed rock products.
Resource Estimate	Approximately 49 Mt in situ resource. Approximately 45 Mt product.

Aspect	Proposed for the Project
Product transport	Road transport of up to 1.5 Mtpa of product via the Pacific Highway. 1.5 Mtpa equates to average of 334 heavy vehicle movements (167 inbound and 167 outbound) each day (based on the transportation of materials using truck and dog combinations with a typical capacity of around 30 tonnes).
Site access	Single site access point on Italia Road. No truck traffic on Italia Road west of the site access towards East Seaham. All trucks will turn right into the site from Italia Road and left out of the site onto Italia Road and left out of Italia Road onto the Pacific Highway. No trucks will turn right out of Italia Road onto the Pacific Highway.
Employment	Construction: 10 to 15 full time employees. Operation: Up to 10 full time employees, 3 to 5 part-time employees.
Hours of operation	Construction: • 7.00 am to 6.00 pm Monday to Friday. • 8.00 am to 1.00 pm Saturday. • No work on Sunday or Public Holidays. Operation: • Quarrying and processing – 7.00 am to 6.00 pm Monday to Friday, and 7.00 am to 3.00 pm Saturdays. • Truck loading, product transport and maintenance – 6.00 am to 10.00 pm Monday to Friday, and 7.00 am to 3.00 pm Saturdays. • No operation on Sundays or Public Holidays apart from maintenance activities as required.
Rehabilitation and final landform	Rehabilitation will be undertaken progressively where appropriate in the context of further resources remaining available in the Project Area at the end of the planned 30-year approval life. A conceptual final landform will be prepared for the Project.

Key components of the Project include:

- an extraction area (North Pit and Main Pit)
- processing and stockpiling area
- storage area for overburden/plant and equipment
- product loading area
- surface water management infrastructure
- weighbridge and administration area (offices, parking, amenities)
- site access and internal roadways
- buffer areas.

Figure S2 provides a conceptual layout of the proposed Project.



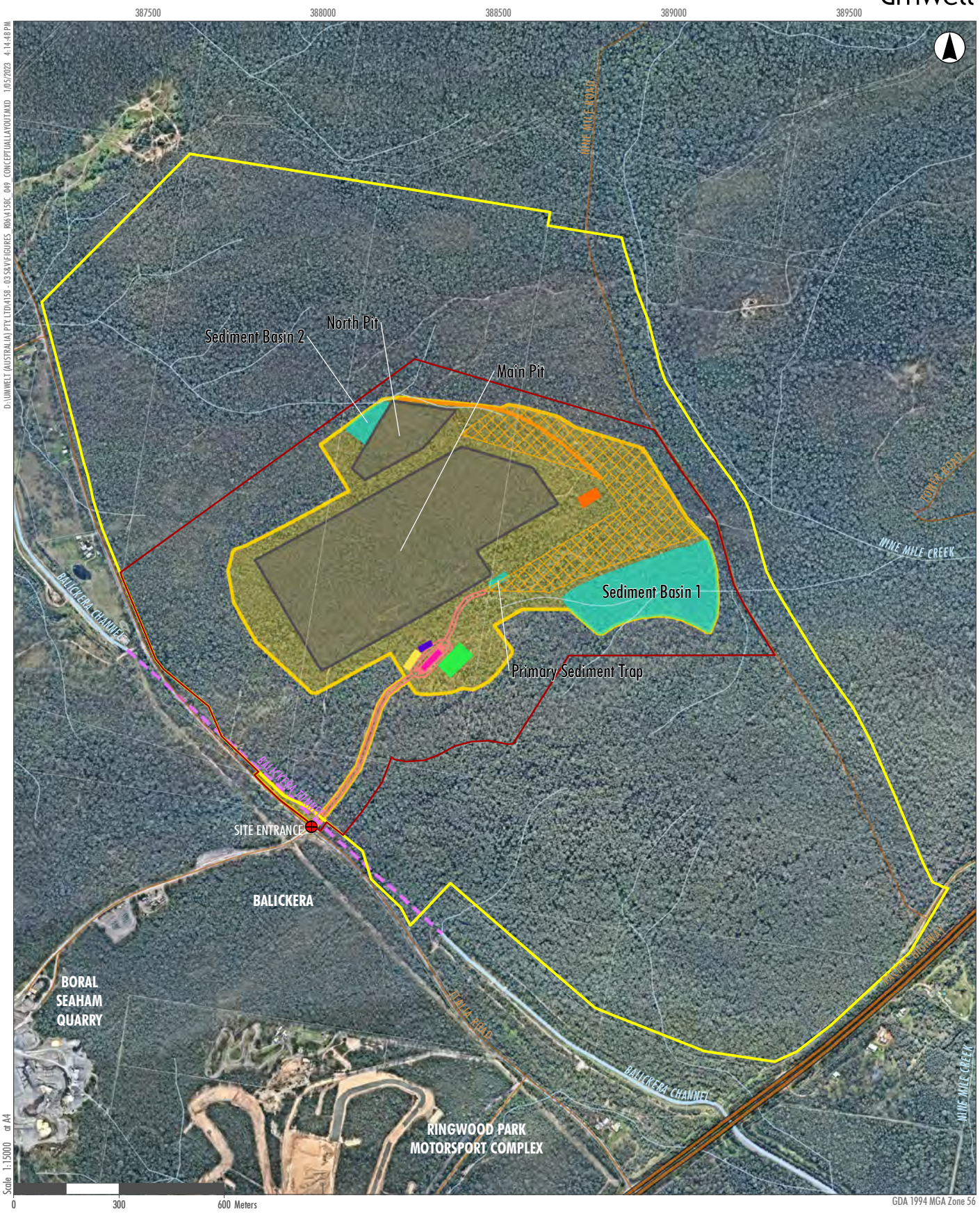
Legend

- Project Area
- LGA Boundary
- National Park / SCA / Nature Reserve
- State Forest
- Pacific Highway
- Road
- Balickera Tunnel
- Drainage Line
- Waterbody
- Lot Boundaries

Image source: ESRI Basemap (2021) Data source: NSW FSDF (2022)

FIGURE S1

Project Locality



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Scale 1:15000 at A4

Legend

- Project Area
- Disturbance Area
- Licence Area
- Pacific Highway
- Road
- Balickera Tunnel
- Drainage Line
- Lot Boundaries
- Pit Outlines (Stage 9)
- Office
- Weighbridge
- Access Road
- Northern Haul Road
- Workshop
- Truck Parking
- Light Vehicle Parking
- Stockpile and Plant Area
- Dams

Image Source: Nearmap (2022) Data source: NSW FSDF (2022)

FIGURE S2

Conceptual Project Layout

Why is the Project needed?

The forecast population growth and proposed investment in infrastructure in the Lower Hunter and Central Coast (LHCC) region over the next twenty years will increase the baseline market need for high quality quarry products to service the demand for building and construction materials. The existing supply of hard rock quarry products to the region is currently serviced by several large quarries, some of which are in the latter stages of their development lives, as well as from several relatively smaller operations with either comparatively short resource lives and/or sub-optimal resource quality. As a result, significant supply-side issues are affecting current construction projects in the region. If these are not addressed through the development of replacement resources to meet forecast demand for high quality quarry products, this will result in significant cost and delivery time pressures on projects, with a flow on of negative productivity and inflationary pressures to the broader local and regional economy. It is in this context that a detailed desktop and field assessment program was undertaken by ARDG to assess opportunities and constraints in the LHCC region for a replacement large, high quality quarry resource.

The proposed Stone Ridge Project Area represents a rare opportunity within the LHCC region to develop a large tonnage, quarry operation on geology that is demonstrated to be favourable for production of the full range of high-quality quarry products (including concrete, asphalt and sealing aggregates, gabion and crushed rock and armourstone). The proximity of the Project Area to key markets and existing State Road infrastructure (i.e., the Pacific Highway) would enable the Project to significantly ameliorate the existing and forecast medium to long term supply-side pressures of quarry materials for the LHCC region, as well as provide direct access to the Sydney market if required. The quarry would also generate long-term revenue to the State through royalties payable on quarry products sold from the site.

What other alternatives were investigated?

Alternative locations:

ARDG undertook a detailed desktop and targeted field assessment and extensive constraints analysis (i.e., market/geological/planning/environmental) of all potential high quality resource opportunities in the LHCC region. Several sites with favourable attributes were identified and subsequently subjected to preliminary field investigations (e.g., surface sampling/mapping, geophysics, drilling and testing). However, none of these sites had either the necessary resource quality or quantity to warrant a commitment to further investigation.

Project design alternatives:

Several refinements were incorporated into the design and layout of the Project to avoid and/or minimise impacts to sensitive environmental features and neighbouring landholders. These refinements have been implemented as an outcome of ongoing consultation with landholders, targeted ecological surveys conducted across the Project Area, the findings of the detailed environmental and cultural heritage assessments for the EIS and in response to community and stakeholder feedback received during the preparation of the EIS. The design refinements included:

- reducing the proposed Disturbance Area from approximately 95 ha to 79 ha, including modifications to reduce impacts to known records of the threatened orchid *Pterostylis chaetophora* and to optimise surface water management
- cutting the quarry into the existing ground surface level and designing the sequence of extraction to increase acoustic shielding to the nearest sensitive receivers

- locating the site entrance as far as practicable from the nearest sensitive receivers and incorporating upgrades to improve public road safety.

What is the planning and approval process?

The Project requires approval under both NSW and Commonwealth environmental and planning legislation.

The Project is defined under NSW planning legislation as a State Significant Development (SSD) as it is development for the purpose of an extractive industry, which extracts more than 500,000 tonnes per annum of extractive material and extracts from a resource of more than 5 million tonnes. As such it requires development consent under Part 4 of the NSW *Environmental Planning and Assessment Act 1979* (EP&A Act).

The Project also requires assessment and approval under the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) due to potential impacts on Matters of National Environmental Significance (MNES) in relation to Commonwealth listed threatened species and communities. The Project will be assessed under the Bilateral Agreement between the State and the Commonwealth.

An Environmental Impact Statement (EIS) has been prepared to accompany the development application to provide the necessary information to allow the consent authority to make an informed decision on the overall merits of the Project. The EIS provides an assessment of the environmental, social and economic impacts of the Project as well as its benefits. The consent authority will be the NSW Minister for Planning and Public Spaces or the Independent Planning Commission (IPC) if at least 50 public objections to the Project are made; if any reportable political donations are made by the Proponent; and/or the local council of the area within which the development is to be carried out objects to the Project.

How has ARDG engaged with stakeholders?

In recognition of the importance of early and open engagement, ARDG has been liaising with stakeholders regarding the Project since 2017. Ongoing consultation has also been undertaken with local, State and Commonwealth government agencies, infrastructure and service providers, local businesses and various community organisations and interest groups, including a comprehensive engagement process undertaken with the Aboriginal community, refer to **Figure S3**. The stakeholder engagement process has afforded opportunities for ARDG to effectively assess and integrate social outcomes within the detailed Project planning, design, and assessment phases.

ARDG is committed to maintaining genuine partnerships with all stakeholders, working with the community to develop a Project that can co-exist with the local community, and communicating openly, honestly and in a transparent manner with all stakeholders. Engagement will continue to include a range of mechanisms (such as website content, media releases, project information sheets, community information sessions, personal interviews and meetings and feedback forms) designed to provide opportunities for the community to be involved and will be ongoing for the life of the Project.

Figure S3 Stakeholder Groupings

Environmental, social and economic assessment outcomes

The identification of key environmental and community issues to be considered in the EIS was based on identification of:

- the scoping phase of the EIS which considered the environmental and planning context for the locality
- outcomes of the stakeholder engagement process
- the Secretary's Environmental Assessment Requirements (SEARs) for the Project (including the requirements of both NSW and Commonwealth agencies)
- specialist assessments completed as part of the preparation of this EIS.

Specialist environmental assessments were undertaken for a range of issues and the key outcomes are summarised in the sections below.

Noise and Vibration

Noise and vibration were assessed separately for the construction and operational phases of the Project. Assessments of traffic noise impacts and potential cumulative noise were also undertaken. Blasting was assessed separately (see section below). Noise and vibration assessment results are as follows:

- Results from each **construction** scenario are predicted to comply with the daytime (standard hours) noise management level at all receivers.
- The **operational** noise levels are predicted to comply during the daytime at all sensitive receivers under standard meteorological conditions, and during the morning shoulder period (6.00 am to 7.00 am) and evening period (6.00 pm and 10.00 pm) when truck loading and movements may occur under both standard and noise-enhancing meteorological conditions.
- The quarry will not operate during the night-time so **sleep disturbance** impacts were only assessed for the morning shoulder period. The Project is predicted to comply with the sleep disturbance criteria at all receivers under both standard and noise-enhancing meteorological conditions during the 6.00 am to 7.00 am morning shoulder period.
- **Road traffic** noise levels at the nearest and potentially most affected receiver location are predicted to comply during both construction and operational phases of the Project.
- Results show there will be no exceedances of the **cumulative noise** criteria.
- ARDG will adopt feasible and reasonable noise mitigation and management strategies to minimise noise as much as possible throughout all stages of the Project in accordance with best practice. These will be documented in the Construction Environmental Management Plan (CEMP) and Operational Environmental Management Plan (OEMP) for the Project and will include compliance and validation monitoring.

Blasting

The Project will require blasting approximately once a fortnight. Blasting will only be undertaken Monday to Friday between 9.00 am and 5.00 pm (excluding public holidays). A Blasting Impact Assessment was prepared to assess the potential impact of blasting on sensitive receptors including private residences, buildings, heritage sites, animals, and significant natural features. Results are as follows:

- Compliance with **ground vibration** and **airblast overpressure** criteria at all private residential receptors can be achieved provided that blast management measures (i.e., the application of reduced charge masses) are employed in a limited area in the north-western corner of the quarry pit during Stages 6 to 9 of quarry development. At all other times and locations restrictions are not necessary to ensure compliance.
- **Flyrock** impact on adjacent residences is considered to be fully managed, and potential risks mitigated, through the application of appropriate exclusion zones in conjunction with flyrock impact management on Italia Road. These will be managed under the Road Closure Management Plan.
- Blasting impacts on **public infrastructure** (including the nearby heritage listed Balickera House), **animals** and **significant natural features** (e.g., Wallaroo National Park) are within criteria for ground vibration, airblast overpressure and flyrock, with no additional blast control measures required.

- A separate assessment was undertaken to determine any impacts on the Balickera Channel, Balickera Tunnel and associated **Hunter Water Corporation (HWC) infrastructure** (including pumping station, electrical substation, pipelines and bridge). Following a detailed assessment of the history, design and structural condition of the infrastructure components, in addition to vibration modelling, the assessment concluded that there would be no significant blast vibration impacts for and the risk of damage from airblast and flyrock is also considered low/negligible or not applicable.

- A range of blast emission control measures will be implemented for the Project to minimise blasting impacts and includes the use of appropriate blast design parameters, installation of a blast monitoring system, pre-blast assessment protocols, Road Closure Management Plan, residence notification systems and liaison with adjacent quarries to prevent cumulative blasting impacts.

Air Quality

The key air quality issue for the Project was identified as dust (particulate matter) generated during quarry operations, in the form of PM_{10}, $PM_{2.5}$, TSP and deposited dust. This was the focus of the assessment, along with the potential emissions from post-blast fume (NO_2), diesel exhaust, crystalline silica due to rock crushing, and greenhouse gas emissions. Emissions during construction and transportation were also assessed. Results are as follows:

- Construction and operational **dust emissions** are not expected to cause adverse air quality impacts at the nearby sensitive receptors based on the results of air dispersion modelling which showed that predicted impacts are well below the EPA assessment criteria.

- No exceedances of the EPA's NO_2 criteria from **diesel exhaust** emissions (either on site or on public roads) or from **blasting**.

- No adverse air quality impacts at locations outside the Project Area with respect to **crystalline silica**. The proponent will implement and maintain a dust management plan for the Project that will ensure that it complies with all statutory and regulatory requirements including those of the NSW Resources Regulator relating to work health and safety.

- While the Project is not expected to cause any adverse air quality impacts, a range of mitigation and management measures will be implemented, including consideration of meteorological conditions prior to blasting and quarry operations, use of water sprays and enclosures, minimising the area of disturbed land and the stabilisation of stockpiles, regular targeted maintenance of vehicles and machinery and improving energy efficiency both on site and in associated supply chains.

- **Greenhouse gas** emissions were calculated in accordance with the principles of the Greenhouse Gas Protocol. The estimated maximum (0.017 Mt CO_2-e) and average (0.0053 Mt CO_2-e) annual Scope 1, 2 and 3 emissions from the Project represent less than 0.0035% of Australia's and 0.013% of NSW's 2020 emissions respectively. As the Project is required to meet existing and projected demand for quarry products, similar or possibly higher levels of greenhouse gas emissions would be expected from any alternative sources of quarry materials should the Project not proceed. A range of measures to further reduce greenhouse gas emissions will be implemented and/or investigated over the life of the Project.

Surface Water

The Project Area is within the Grahamstown Dam catchment and the Williams River catchment, both of which are part of the Hunter Water Corporation (HWC) drinking water catchment. A conceptual operational Water Management System (WMS) has been developed for the Project and uses a series of clean water drains, sediment basins and standard erosion and sediment controls to:

- direct undisturbed catchment runoff around disturbed operational areas, where practicable
- contain and reuse as much 'dirty' water runoff from disturbed operational areas as possible to minimise water import demands
- minimise the volume and frequency of controlled discharges from the WMS to the receiving environment
- minimise the risk of uncontrolled discharges from the WMS in high rainfall events
- treat water prior to controlled discharge to maintain water quality.

Surface water quality monitoring and modelling have informed the surface water impact assessment for the Project. Key findings in relation to water quantity and water quality are:

- The Project will have an adequate and reliable **water source** (i.e., captured rainfall runoff and groundwater bore) for all stages of the Project.
- There is a predicted overall loss of **catchment yield** during Stage 1 of the Project and during dry years of Stage 9 of the Project, however, on average catchment yields are expected to increase as a result of the Project during the intermediate and latter operational stages due to the increased runoff and the requirement to manage surplus rainfall runoff through controlled discharges. The loss of catchment yield during dry years and early-stage operations will have a negligible impact on overall Grahamstown Dam and Williams River catchment yields.
- The Project will have no impact on local or broader catchment **flood regimes**.
- Potential **stream stability** issues associated with discharges are expected to be manageable and any required mitigation measures (e.g., scour protection, discharge flow rate limits) will be informed by the hydrologic and hydraulic assessment undertaken prior to construction.
- As the Project is located within the HWC drinking water catchment (i.e., Grahamstown Dam and the Williams River) a Neutral or Beneficial Effects (NorBE) assessment was undertaken. The assessment determined that the Project can satisfy NorBE requirements with the implementation of the proposed management measures.

Groundwater

The Project is located within the New England Fold Belt Coast Groundwater Source, a generally low-yielding fractured aquifer system where groundwater is contained within fractures in the rock that have occurred due to folding and faulting of the rock formations. There are four private water supply bores (stock and domestic) within 5 km of the Project and the nearest high priority groundwater dependent ecosystems (GDEs) are wetlands located near the Williams River to the north and east of Seaham approximately 8 km and 5 km from the Project respectively.

The Project is predicted to result in the drawdown in the water table from Stage 5 onwards when extraction depth goes below the existing water table level. This drawdown effect is localised, and no groundwater drawdown is expected to occur at any private bores. The predicted groundwater impacts are not expected to have any impacts on potential GDEs as a result of the Project and recognised high priority GDEs will not be impacted by the Project. The Project is not expected to cause any significant change in groundwater quality or impact the beneficial use of the groundwater. Following the cessation of quarrying, the water table will recover as pit lakes fill the voids through a combination of rainfall, runoff and groundwater inflows. Water quality within the pit lakes is predicted to be better than or similar to the existing groundwater and no adverse impacts on groundwater quality are predicted post closure.

A groundwater monitoring program will be implemented as part of the Project to validate predictions and enable operations to be adjusted before adverse impacts occur at private bores if impacts are greater than predicted.

Biodiversity

As the Project is located within Wallaroo State Forest, the removal of vegetation and associated impacts on fauna habitat are an inevitable consequence of the Project. ARDG has sought to avoid and minimise biodiversity impacts in the first instance as part of the Project design and has preferentially sited the Disturbance Area away from known records of threatened species and areas of higher ecological value. The Project will result in the direct disturbance of approximately 79 ha of vegetation over the life of the Project. The Biodiversity Development Assessment Report (BDAR) provides an assessment of the biodiversity values of the Project Area, documents the application of the avoid, minimise and offset framework and assesses the likely biodiversity impacts of the Project. The BDAR included detailed biodiversity field survey across the Project Area, including both terrestrial and aquatic habitats. The progressive results of the flora and fauna surveys (including targeted threatened species surveys) and vegetation mapping were used to refine the Project design.

Management measures will be implemented by ARDG to further mitigate impacts to biodiversity, including workforce education and training, implementation of vegetation protection zones for retained vegetation, ecologist pre-clearance survey and supervision of work, weed management and fauna exclusion fencing.

The Project will result in residual direct impacts to native vegetation communities and threatened species habitats within the Disturbance Area as a result of vegetation clearing. This includes impacts to the following threatened ecological communities and species:

- rusty greenhood (Pterostylis chaetophora)
- squirrel glider (Petaurus norfolcensis)
- brush-tailed phascogale (*Phascogale tapoatafa*)
- koala (Phascolarctos cinereus)
- River-flat Eucalypt Forest on Coastal Floodplains of the NSW North Coast, Sydney Basin and South East Corner bioregions endangered ecological community (EEC) as listed under the BC Act (approximately 1.21 ha) Subtropical Coastal Floodplain Forest of the NSW North Coast bioregion EEC as listed under the BC Act (approximately 3.91 ha)

- the two BC Act listed EECs also meet the listing criteria for the EPBC Act Subtropical eucalypt floodplain forest and woodland of the New South Wales North Coast and South East Queensland bioregions EEC (5.12 ha in total).

For impacts to biodiversity that cannot be avoided, the NSW biodiversity assessment process requires use of the NSW Government online calculator to generate biodiversity credits. These credits are generated by inputting the results of the survey and impact areas. All credits then need to be offset prior to the impact occurring, with the system designed to result in a no-net-loss in biodiversity value for NSW. In accordance with the EPBC Act requirements, offsets associated with impacts to threatened species habitat will be subject to like-for-like offsetting requirements.

Aboriginal Heritage

The Project Area is located within the traditional homelands of the Buraigal ngurra, an inland clan group of the Worimi people, the earliest inhabitants of the Balickera area. An Aboriginal Cultural Heritage Assessment (ACHA) was undertaken in consultation with the Aboriginal community to identify any cultural values within the landscape so that those values can be recognised and incorporated into the Project's management recommendations. Assessment methodologies included desktop review and field investigations undertaken by archaeologists with assistance from Registered Aboriginal Parties (RAPs).

No new Aboriginal archaeological sites, objects or areas of archaeological potential were identified during the survey of the Project Area. This reflects the lack of reliable permanent water sources, the steepness of the land, the absence of suitable geological features, the relatively shallow soils and the impacts of previous disturbance activities within the Project Area.

Based on the criteria for the assessment of archaeological potential the Project Area is deemed to have low archaeological potential across its entirety. The Project is not expected to result in impacts to Aboriginal sites. No areas of high Aboriginal cultural value were identified by RAPs consulted as part of the ACHA process.

Historic Heritage

The Project Area has a history of commercial forestry activity, with the Wallaroo State Forest being gazetted as a State Forest in 1922. Searches of Commonwealth, State and local heritage registers did not identify any registered heritage items located within the Project Area, however the locally listed 'Balickera' House (a nineteenth century convict-built homestead) is located over 1,100 m to the west.

The historic heritage assessment concluded that archaeological remnants of nineteenth century land use activities are unlikely to be present within the Project Area due to the level of disturbance caused during the active management and logging of the State Forest. Overall, the Project is not considered to have an adverse impact on significant heritage fabric, views to, or the setting of any places or items of historical heritage significance within the Project Area or its vicinity.

Blasting assessments also confirmed that no additional blast control measures are required to comply with the ground vibration criteria for nearby heritage sites.

Traffic and Transport

The Project Area is accessed directly from Italia Road, which joins the Pacific Highway approximately 1.2 km from the site entrance. A new access point is proposed directly opposite the existing Boral Seaham Quarry access road on Italia Road. A Channelised Right Turn (CHR) treatment would be provided for right turns into the site, proposed in consultation with relevant Council officers. The proposed access point treatment addresses the traffic generated by this proposal based on current Italia Road usage, which also includes that of the existing Boral Seaham Quarry.

The Pacific Highway provides the major transport route for the Project and no quarry-associated heavy vehicles will be permitted to travel west on Italia Road past the quarry access point toward Seaham, either to or from the quarry. At the Italia Road-Pacific Highway intersection, all heavy vehicles associated with the quarry will turn left onto the Pacific Highway, utilising the existing Tarean Road interchange (approximately 11 km to the north) should a southbound journey be required.

It is understood that a separate development application will be lodged by Boral for an upgrade of the existing Italia Road-Pacific Highway intersection to meet TfNSW requirements. The upgrades the subject of the separate development application will include an extension to the northbound deceleration lane for left turns into Italia Road, prioritisation of the right turn into Italia Road, and a northbound acceleration lane for left turns onto the Pacific Highway.

Based on the transportation of materials using truck and dog combinations with a typical capacity of approximately 30 tonnes, the Traffic Impact Assessment estimated there would be a total of 334 heavy vehicle movements (167 inbound and 167 outbound) each day. The assessment assumed that 18% of the daily movements would occur during peak hours, equivalent to 30 inbound and 30 outbound movements. Light vehicle movements would comprise a total of 30 light vehicle movements per day (15 inbound and 15 outbound).

Traffic modelling identified that while future traffic growth is expected to have some impact on the capacity of the Italia Road-Pacific Highway intersection, the impact of the Project (in isolation) on the intersection is minimal. The proposed intersection upgrades will generally improve its safety, as well as performance by reducing delays, despite the increased heavy vehicle traffic generated by the Project.

Cumulative traffic assessments also concluded that the road network can comfortably accommodate the level of additional traffic from both the proposed Eagleton Quarry and the Project, together with the existing traffic from the Boral Seaham Quarry. The proposed upgrades to the Italia Road-Pacific Highway intersection will also be designed to accommodate cumulative traffic from all three local quarries.

Land Resources

A detailed assessment of the potential impacts of the Project on soils and land capability (including potential erosion and land contamination), landforms (particularly long-term geotechnical stability) and the compatibility of the development with other land uses in the vicinity was undertaken.

The assessments concluded that:

- As an extractive industry, the Project will impact on the land resources within the Project Area by changing the existing topography and relocating soil and geological resources.

- Land within the Disturbance Area has moderate to severe land capability limitations which preclude agricultural use in its present state. The proposed final land use for the majority of the Project Area outside the final voids (pit lakes) is to be rehabilitated with woodland vegetation similar to the surrounding forest, with the final voids able to provide a water supply suitable for firefighting purposes.

- The use of the Project Area as a quarry operation would not be likely to impact on the viability of any future forestry activities in the surrounding parts of the State Forest, and potential impacts associated with the Project can be appropriately managed to allow the Project to coexist with the surrounding agricultural and non-agricultural land uses in the region.

- The conceptual operational WMS design is specifically designed to manage risks associated with erosion and sediment within run-off water. Should the Project be approved, a detailed Soil and Water Management Plan (SWMP) will be prepared to facilitate implementation of best practice erosion and sediment controls during all stages of the Project.

Waste Management

ARDG is committed to the management of waste streams in accordance with the principles of the waste hierarchy, where emphasis is placed upon reducing, reusing and/or recycling prior to disposal of remaining wastes. All wastes will be stored in appropriate containers/receptacles that are lidded where practical, within designated waste storage areas prior to collection for reuse/recycling/disposal by appropriately licensed waste contractors.

Hazards

A **bushfire risk** assessment was prepared for the Project given it will be surrounded by Wallaroo State Forest. Through the implementation of appropriate bushfire protection measures, the Project will not increase the potential for, or the severity of bushfires within the locality, the risk of onsite activities igniting fire or the spread of bushfire across the Project Area.

The proposed infrastructure will be located within cleared areas where asset protection zones (APZ) will be applied to provide a separation between the infrastructure and the bushfire hazard and a defendable space for firefighting. An appropriate dedicated water supply for bushfire protection will be provided on site and all-weather access for firefighting vehicles will be available via the site access road and haul roads.

A Bushfire Emergency Management Plan will be developed for the Project in consultation with the Rural Fire Service, Department of Planning and Environment, FCNSW and National Parks and Wildlife Service.

A **preliminary risk screening** was undertaken for the Project to identify and assess the storage of specific dangerous goods classes that have the potential for significant off-site effects. Based on the quantities and types of materials to be stored on site, or transported to the site, the preliminary risk screening concluded that none of the hazardous materials are above screening thresholds and further assessment is not required.

Visual Amenity

Proposed quarrying activities will essentially remove the ridge of 'Stone Ridge' and replace it with a quarry void. Substantial areas of existing regrowth and remnant vegetation will be retained around the proposed Disturbance Area to shield views of operations from surrounding public and private property viewing locations. In addition, the Project has been designed such that there will be topographic shielding of quarry operations from nearby receivers to the west and north-west. As a result, the quarry extraction and

infrastructure areas are not likely to be visible from public or private viewing locations, including Italia Road, Nine Mile Road, the Pacific Highway or private residences.

Given the relative remoteness of the operations, and the intervening vegetation and topography, lighting required for operations up until 10 pm is also not expected to significantly or adversely affect the amenity of residences in the area.

Social

Engagement is a key component of a Social Impact Assessment (SIA) program, and affords opportunities to effectively identify, integrate and address social impacts within the detailed Project planning, design, and assessment phases. ARDG has been consulting with local landholders and stakeholders since 2017, including local, State and Commonwealth government agencies, infrastructure and service providers, local businesses and various community organisations and interest groups, including a comprehensive engagement process undertaken with the Aboriginal community. The stakeholder engagement process has provided opportunities for ARDG to effectively assess and integrate social outcomes within the detailed Project planning, design, and assessment phases. Concerns and feedback relating to the Project have been considered by ARDG and have been used to inform the refinement of the Project design and the development of the EIS including proposed management and mitigation measures.

Social impacts associated with the Project that are considered significant include cumulative traffic movements and road safety, local impacts to biodiversity (specifically loss of habitat) and a potential decline in property values. The SIA identified that any negative social impacts of the Project can be mitigated or managed to reduce their significance, with the Project's positive impacts enhanced if appropriate measures are put in place. In addition to the management and mitigation measures developed as part of the various specialist studies ARDG will also implement a Community Engagement Strategy to complement the ongoing engagement through the established Community Consultative Committee (CCC), and an Employment, Training and Procurement Strategy to maximise local employment and sourcing for the Project's construction and operational needs.

Economics

A Cost Benefit Analysis of the Project indicated that it would have net production benefits to NSW of $290 M (present value at 7% discount rate). This estimate includes the costs of water access licences, biodiversity offsets, road intersection upgrades and road pavement maintenance costs. It also includes the costs of mitigation, monitoring and management of other potential impacts.

The Project is estimated to provide the following annual direct and indirect annual effects to the local economy:

- $102 M in output (direct and indirect to regional economy)
- $58 M in value-added to regional economy
- $14 M in gross wages
- 176 jobs (47 direct and 129 indirect).

Consequently, the Project is estimated to have net social benefits to NSW and the local and regional economy, and hence is desirable and justified from an economic efficiency perspective.

Rehabilitation and Final Landform

ARDG is committed to the effective rehabilitation and closure of the quarry at the cessation of operations. The overarching objective for the site is that the final landform is safe, stable and non-polluting having regard to the proposed end land use for the site and surrounding areas.

Rehabilitation at the quarry will address the long-term stabilisation of both quarried and disturbed areas, including rehabilitation of the upper quarry benches and available areas within and surrounding the quarry pit, with two final voids (Main Pit and North Pit) to remain after closure as water storages. All final landform slopes (including retained highwalls) will be assessed for long term geotechnical stability having regard to the risk profile presented by the final landform and potential access to the site. It is anticipated that all operational water storages will be decommissioned, and the landform outside of the Main Pit and North Pit will be shaped to be free draining. All infrastructure not required by FCNSW for post-closure land uses will be removed.

The exact timing of individual rehabilitation works will be dependent upon on the rate of resource extraction and any future plans to seek approval for the continuation of extraction beyond the initial 30-year approval term currently proposed.

Conclusion

A comprehensive resource assessment program was undertaken by ARDG which confirmed that the Project Area represents a rare opportunity within the LHCC region to develop a large tonnage, quarry operation on geology that is demonstrated to be favourable for production of the full range of high-quality quarry products that are demanded by the market. The close proximity of the Project Area to key markets and existing State Road infrastructure network (i.e., the Pacific Highway) would enable the Project to significantly ameliorate the existing and forecast medium to long term supply-side pressures of quarry materials for the LHCC region, as well as provide direct access to the Sydney market if required. The quarry would also generate long-term revenue to the State through royalties payable to FCNSW on quarry products sold from the site.

In economic terms, the Project is predicted to have net benefits to the State of NSW of approximately $290 million in NPV terms at a 7% discount rate. The Project is predicted to have significant economic benefits to NSW under different discount rates tested and sensitivities to different price and costs assumptions. The Project is estimated to provide the following annual direct and indirect annual effects to the local economy:

- $102 M in output (direct and indirect to regional economy).
- $58 M in value-added to regional economy.
- $14 M in gross wages.
- 176 jobs (47 direct and 129 indirect).

The main environmental impacts associated with the Project are internalised into the production costs of ARDG via mitigation, offset and compensation costs. Residual local environmental impacts after mitigation, offset and compensation are likely to be immaterial.

The Project has been assessed against the principles of ecologically sustainable development as required by NSW planning legislation. This assessment has indicated that while the Project, like any large-scale extractive development, would have impacts, these impacts can be effectively managed, mitigated and offset and the development will result in significant economic benefits.

EIS Declaration

Project Details	
Project Name	Stone Ridge Quarry
Application Number	SSD-10432
Address of the land in respect of which the development application is made	Corner of Italia Road and Hamburger Trail, Balickera NSW 2324
Applicant Details	
Applicant Name	Australian Resource Development Group Pty Limited
Applicant Address	69 Ross St, Belmont NSW 2280
Details of person by whom this EIS was prepared	
Name	Penelope Williams
Address	Umwelt (Australia) Pty Limited, 75 York St, Teralba NSW 2284
Professional Qualifications	Bachelor of Science
Declaration by Registered Environmental Assessment Practitioner	
Name	David Holmes
Registration Number	R80035
Organisation registered with	EIANZ
Address	Umwelt (Australia) Pty Limited, 75 York St, Teralba NSW 2284
Professional Qualifications	Bachelor of Natural Resource (Hons)/ Bachelor of Laws (Hons)
Declaration	The undersigned declares that this EIS: • has been prepared in accordance with the Environmental Planning and Assessment Regulation 2021; • contains all available information relevant to the environmental assessment of the development, activity or infrastructure to which the EIS relates; • does not contain information that is false or misleading; • addresses the Planning Secretary's environmental assessment requirements (SEARs) for the project; • identifies and addresses the relevant statutory requirements for the project, including any relevant matters for consideration in environmental planning instruments; • has been prepared having regard to the Department's State Significant Development Guidelines - Preparing an Environmental Impact Statement; • contains a simple and easy to understand summary of the project as a whole, having regard to the economic, environmental and social impacts of the project and the principles of ecologically sustainable development; • contains a consolidated description of the project in a single chapter of the EIS; • contains an accurate summary of the findings of any community engagement; and • contains an accurate summary of the detailed technical assessment of the impacts of the project as a whole.
Signature	
Date	26 May 2023

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Figures

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Appendices

1.0 Introduction

Australian Resource Development Group Pty Limited (ARDG) is seeking to develop a new hard rock quarry, known as Stone Ridge Quarry (the Project), located within Wallaroo State Forest at Balickera NSW, approximately 30 km north of Newcastle (refer to **Figure 1.1**).

The Project is seeking to access a high quality, hard rock resource suitable for producing a wide range of quarry products for the Lower Hunter, Central Coast and northern Sydney construction materials markets. The Project would produce up to 1.5 million tonnes per annum (Mtpa) of saleable quarry product with approval sought for an initial 30-year quarrying period.

1.1 Background

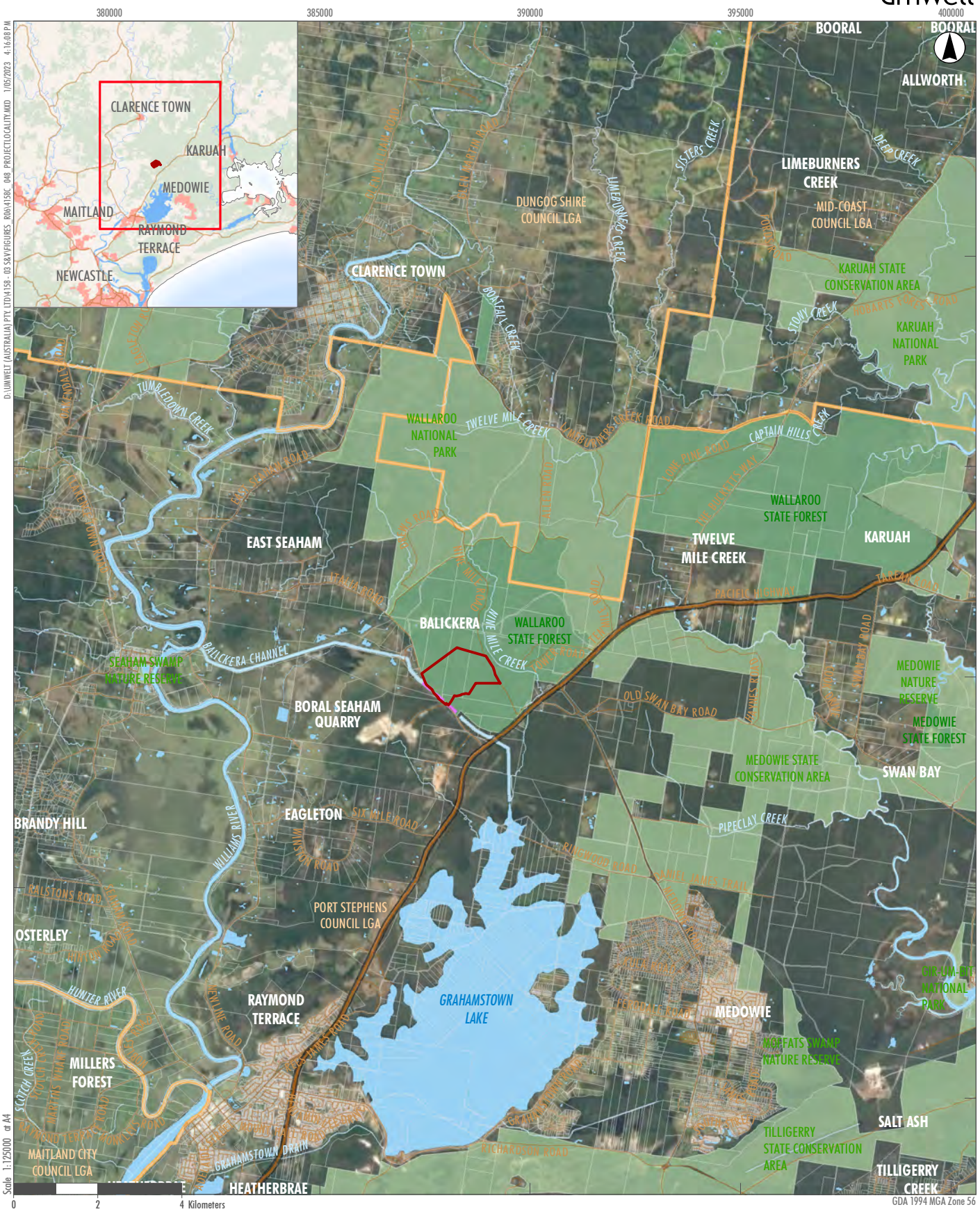
The Project Area occupies approximately 139 ha and is located wholly within Wallaroo State Forest at Balickera NSW, within the Port Stephens Local Government Area (LGA). Wallaroo State Forest is located on the northern side of the Pacific Highway, and extends from Italia Road in the west, to the Karuah River in the east.

The Project Area is located on land managed by Forestry Corporation of New South Wales (FCNSW) and ARDG holds a Deed of Agreement (Deed) for a Forest Materials Licence (FML) with FCNSW under section 42 of the *Forestry Act 2012* (Forestry Act).

The Project is a State Significant Development (SSD-10432) under the *State Environmental Planning Policy (Planning Systems) 2021* (Planning Systems SEPP) as it is development that extracts more than 500,000 tpa of extractive material and also extracts from a resource of more than 5 million tonnes. A development application (DA) for the Project is required to be submitted under Part 4 of the *Environmental Planning and Assessment Act 1979* (EP&A Act).

This Environmental Impact Statement (EIS) has been prepared in accordance with the *State Significant Development Guidelines – Preparing an Environmental Impact Statement* (DPE, 2022) and assesses the potential impacts associated with the Project in accordance with the Secretary's Environmental Assessment Requirements (SEARs), issued on 1 June 2020. **Appendix 1** provides an outline of the SEARs and where these have been addressed in the EIS. It is noted that more than two years has elapsed since the SEARs were originally issued. Email correspondence received from DPE on 2 January 2023 has confirmed an extension of validity of the SEARs until 1 July 2023.

On 8 December 2022, the Project was also determined to be a Controlled Action, requiring approval under the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* due to its potential impact on listed threatened species and ecological communities. The Project will therefore be assessed under the bilateral agreement between the Commonwealth and NSW Governments. The Commonwealth Department of Climate Change, Energy, the Environment and Water (DCCEEW) has issued its assessment requirements which have been incorporated into the SEARs for the Project.



Legend

- Project Area
- LGA Boundary
- National Park / SCA / Nature Reserve
- State Forest
- Pacific Highway
- Road
- Balickera Tunnel
- Drainage Line
- Waterbody
- Lot Boundaries

Image source: ESRI Basemap (2021) Data source: NSW FSDF (2022)

FIGURE 1.1

Project Locality

1.2 Proponent

The proponent for the Project is Australian Resource Development Group Pty Limited (ARDG) (ABN 77 611 489 804).

ARDG is a Newcastle-based business with specialist expertise in identifying and developing quarry resources to supply the construction materials requirements of renewable energy projects and major construction materials markets. Its principals have over 50 years combined professional experience in the resource and planning sectors, with extensive experience in the extractive industries sector.

Since 2016, ARDG has undertaken extensive desktop and field investigations in relation to a new hard rock quarry to service the Lower Hunter and surrounding regions. It has also obtained approval for 12 quarry operations that have supplied construction materials to major NSW renewable energy projects, including the Sapphire Wind Farm Project, Crudine Ridge Wind Farm Project and Rye Park Wind Farm Project.

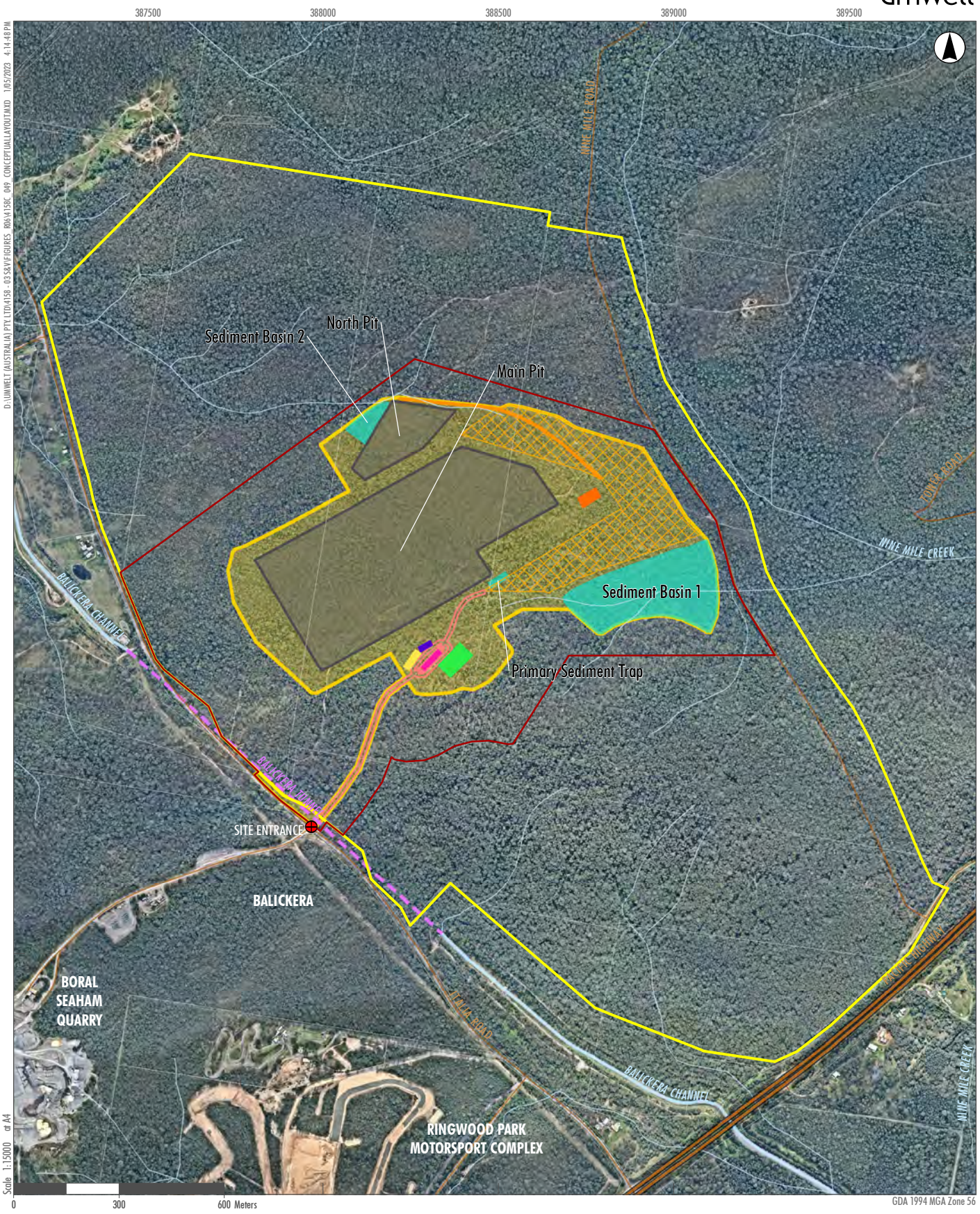
1.3 Project Overview

Key components of the Project include:

- an extraction area
- processing and stockpiling area
- storage area for overburden/plant and equipment
- product loading area
- surface water management infrastructure
- weighbridge and administration area (offices, parking, amenities)
- site access and internal roadways
- buffer areas.

The Project will have capacity to supply up to 1.5 Mtpa of product over a 30-year extraction period.

Figure 1.2 provides a conceptual layout of the proposed Project.



Legend

- Project Area
- Disturbance Area
- Licence Area
- Pacific Highway
- Road
- Balickera Tunnel
- Drainage Line
- Lot Boundaries
- Pit Outlines (Stage 9)
- Office
- Weighbridge
- Access Road
- Northern Haul Road
- Workshop
- Truck Parking
- Light Vehicle Parking
- Stockpile and Plant Area
- Dams

Image Source: Nearmap (2022) Data source: NSW FSDF (2022)

FIGURE 1.2

Conceptual Project Layout

1.4 Impact Avoidance

Site selection for resource projects such as quarries is limited by the location of the target resources. While the location of the resource cannot be moved, impacts associated with resource extraction can be managed through both selecting resources with lower levels of impacts (site selection) and project design features. Avoidance and mitigation measures have been implemented throughout the development of the Project, beginning with site selection and design.

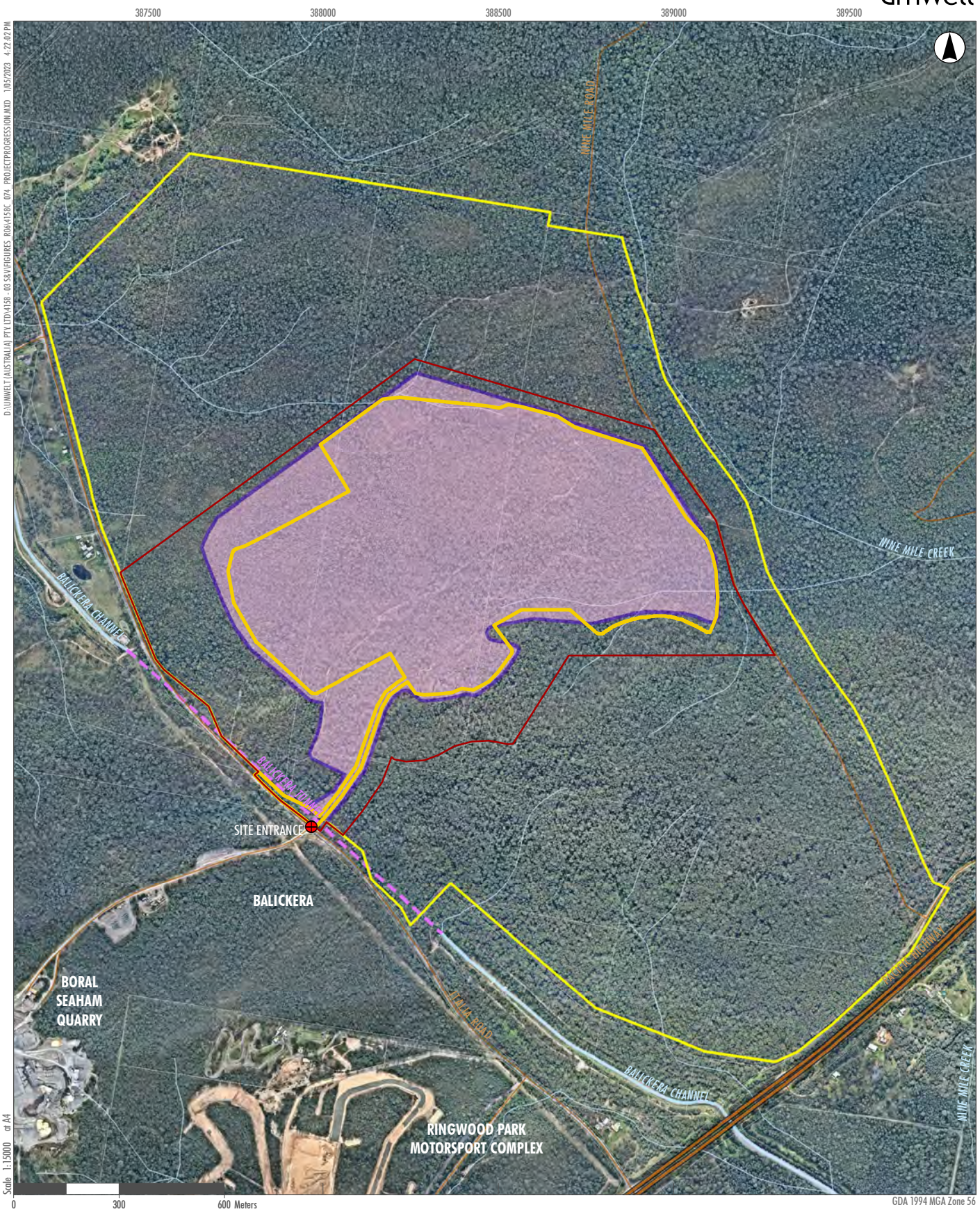
The Project is located in Wallaroo State Forest and is located approximately 1.5 km north-east of the existing extraction area of the Boral Quarry. The site is located close to the Pacific Highway and the proposed heavy vehicle haulage arrangements for the Project will avoid heavy vehicle movements on the local road network other than the approximately 1.4 km section of Italia Road between the Project Access Point and the Pacific Highway. ARDG have agreed to share costs with two other quarry operators for the upgrade of the intersection of Italia Road and the Pacific Highway to improve intersection performance and safety[1]. The design of the pit has had regard to potential impacts from blasting on surrounding infrastructure including the Balickera Channel and Tunnel.

Following the lodgement of the Scoping Report to the Department of Planning and Environment (DPE) in early 2020 (ARDG, 2020), several refinements have been incorporated into the design and layout of the Project to avoid and/or minimise impacts to other sensitive environmental features and neighbouring landholders. These refinements have been implemented as an outcome of ongoing consultation with landholders, targeted ecological surveys conducted across the Project Area, the findings of detailed environmental and cultural heritage assessments for the EIS and in response to community and stakeholder feedback during the preparation of the EIS.

Project refinements since the submission of the Scoping Report have included the following:

- reduction of the proposed Disturbance Area from approximately 95 ha to 79 ha (refer to **Figure 1.3**)
- cutting the processing area and the initial relative height of the North Pit into the existing surface level to increase acoustic shielding to the nearest sensitive receivers (refer to **Section 6.2.5**)
- locating the entrance to the Project Area as far as practicable from the nearest sensitive receivers (refer to **Section 6.2.5**)
- designing the sequence of extraction in 15 m bench heights, to always maintain a face between the nearest sensitive receivers and the extraction area (refer to **Section 6.2.5**)
- continuing investigations into the establishment of biodiversity offset areas within Wallaroo State Forest to compensate for biodiversity impacts of the Project (refer to **Section 6.6**)
- modification of the Disturbance Area to reduce impacts to known records of the threatened orchid *Pterostylis chaetophora* and reduce the area of koala (*Phascolarctos cinereus*) habitat impacted by the Project (refer to **Section 6.6**)
- commitments to upgrade the site access point to establish appropriate lines of sight and limit heavy vehicle turning movements to improve public road safety (refer to **Section 1.6**).

[1] This intersection will be the subject of a separate development application and does not form part of this Project. Refer to **Section 1.6** for further details.



Legend

- Project Area
- Disturbance Area
- Previous Disturbance Area
- Licence Area
- Pacific Highway
- Road
- Balickera Tunnel
- Drainage Line
- Lot Boundaries

FIGURE 1.3

Project Alternatives

Image Source: Nearmap (2022) Data source: NSW FSDF (2022)

1.5 Objectives

The objectives of the Project are to:

- design, build and operate an economically viable extractive industry project that makes efficient use of the hard rock resource while meeting current environmental and operating standards
- conduct quarrying in an environmentally responsible manner to minimise Project specific and cumulative environmental, social and cultural impacts
- provide a long-term, secure supply of a range of high-quality quarry products to meet the demands of the Lower Hunter, Central Coast and northern Sydney construction markets and renewable energy sector
- provide a royalty stream for FCNSW (effectively, the State of NSW) and local employment and economic benefits over the 30-year life of the Project.

1.6 Related Development

ARDG has consulted extensively with Transport for NSW (TfNSW) regarding access to the Pacific Highway from Italia Road (refer to **Section 5.0** for consultation details). As a result, and in conjunction with two other existing/proposed quarry operators using Italia Road (Boral and Eagleton Rock Syndicate), TfNSW has accepted in-principle a proposal by the three parties to improve road safety at the existing Italia Road and Pacific Highway intersection via construction of a dedicated left-turn northbound acceleration lane onto the Pacific Highway, which will remove the current left-turn merge movement with a safer downstream merge movement. This movement must be used by all quarry trucks. In addition, the northbound deceleration lane into Italia Road will be lengthened to improve safety.

Following detailed consultation during 2022 between TfNSW, ARDG, Boral, Eagleton Rock Syndicate and Port Stephens Council, it has been determined that a separate Development Application will be lodged by Boral for an upgrade of the existing Italia Road-Pacific Highway intersection to meet TfNSW requirements. No quarry product will be transported from the Project Area until these intersection works are completed to the satisfaction of Port Stephens Council/TfNSW.

Further details on traffic movements associated with the Project are provided in **Section 3.3.5** and **Section 6.9**.

1.7 Site Restrictions

The Project is located on land managed by FCNSW. In accordance with section 11 of the *Forestry Act 2012* (Forestry Act), FCNSW is responsible for "carrying out or authorising the carrying out of forestry operations on Crown-timber land or land owned by the Corporation". An additional function of FCNSW under section 11 of the Forestry Act is to "take or authorise the taking of forest materials" from this land. Forest materials are defined in the Forestry Act as "rock, stone, clay, shell, earth, sand, gravel or any like material". At present there are over 20 licensed quarry operations on FCNSW land in NSW, all of which pay FCNSW a royalty for materials taken from the relevant land.

ARDG holds a Deed of Agreement (Deed) for a Forest Materials Licence (FML) with FCNSW under section 42 of the Forestry Act. The Project Area where quarry operations are proposed is approximately 139 ha and is located wholly within the boundary of the Licence Area under the Deed (refer to **Figure 1.2**). Should development consent for the Project be granted, FCNSW will issue a FML to ARDG that will enable the company to develop and operate the Project. Under the terms of the FML, ARDG will pay FCNSW a royalty for each tonne of quarry product sold from the Project.

2.0 Strategic Context

2.1 Project Justification

The construction sector, supported by an efficient construction materials supply chain, is a key contributor to NSW economic growth. In addition to providing the essential raw materials required by the construction sector, quarries stimulate local communities through investment and by providing jobs.

Demand for quarry products is driven by a combination of public infrastructure development (government spending on roads, rail, ports, schools, housing and hospitals), and private investment (commercial and industrial development and residential construction).

The Hunter Regional Plan 2041 estimates that the Hunter's population of 860,000 will increase to nearly 950,000 by 2041, requiring an additional 101,800 dwellings across the region (DPE, 2022). In addition, revised forecasts in the NSW Metropolitan Plan for Sydney 2036 predict an increase in Sydney's population of 1.7 million people by 2036. Also considering the expected growth on the Mid North Coast, NSW could potentially see an increase in these three regions of over 1.8 million people by 2036. The infrastructure needed to support this growth is significant.

The NSW Government will continue to invest in an infrastructure program over the next four years, with a record infrastructure pipeline of $112.7 billion announced in the 2022-23 Budget to ensure the delivery of projects across the State, including:

- transport and infrastructure projects
- hospitals and health facilities
- schools and education facilities.

Commonwealth, State and regional strategy documents recognise that Australia will require significant investment in infrastructure to maintain and increase productivity. As part of Australia's recovery from the COVID-19 pandemic both the Commonwealth and NSW governments have emphasised support for infrastructure and construction.

Furthermore, over the past two years NSW has experienced unprecedented widespread damage to public and private infrastructure caused by flooding. Both Commonwealth and State governments have committed to significant recovery packages which include rebuilding and, in some cases, relocating critical infrastructure, adding to both the short- and long-term demand for construction materials.

Examples of major infrastructure and growth projects planned for the Lower Hunter and Central Coast (LHCC) region in the short to medium term are listed below:

- Newcastle Inner City Bypass
- Hexham Straights Project
- M1 to Raymond Terrace – South and North

- Muswellbrook Bypass
- Singleton Bypass
- Tomago Gas Plant
- Newcastle Container Terminal
- numerous residential land releases
- local Council infrastructure upgrades and in particular, repairs, in response to recent flood events
- various solar and wind renewables projects.

In the immediate vicinity of the Project (10–20 km south), short-term demand for quarry products from major infrastructure projects alone is estimated to be in excess of 3 million tonnes, with the breakdown as follows:

- Hexham Straights – approximately 125,000 tonnes.
- M1 North – approximately 1.22 million tonnes.
- M1 South – approximately 1.67 million tonnes.

The forecast growth and proposed investment in infrastructure in the Hunter will increase the baseline market need for high quality quarry products to service the demand for public and private building and construction materials. The existing supply of hard rock quarry products to the LHCC region is currently serviced by several large quarries, some of which are in the latter stages of their development lives, as well as from several relatively smaller operations with either comparatively short resource lives and/or sub-optimal resource quality.

As a result, in the short to medium term, construction associated with forecast population growth and associated planned infrastructure projects in the LHCC region will be likely to experience significant supply-side pressure for high quality quarry products (including concrete, asphalt and sealing aggregates, gabion and crushed rock and armourstone) unless alternate quarry resources can be located and developed. These pressures manifest as a range of issues that are currently adversely affecting supply in the LHCC region.

These significant supply-side issues are affecting current construction projects in the region, and if not addressed through the identification, development and release to market of additional resources to meet forecast demand, this will result in significant cost and delivery time pressures on projects, with a flow on of negative productivity and inflationary pressures to the broader local and regional economy. Existing proposed quarry developments and extensions of existing projects (including the proposed Eagleton Quarry and the proposed modification to Boral Seaham Quarry) are not projected to fully meet this future demand.

It is in this context of supply-side pressures that a detailed desktop and field assessment program was undertaken by ARDG to assess opportunities and constraints in the LHCC region for a replacement large, high quality quarry resource. Based on the outcomes of this assessment, opportunities for such a resource were found to be extremely limited, due to significant constraints relating to the co-occurrence of prospective geology and suitable planning, environmental, social and transportation factors that would allow the feasible development of a large, high-quality quarry.

Notwithstanding, following identification of the Project Area and a preliminary feasibility assessment, a comprehensive resource assessment program was undertaken by ARDG (detailed in **Section 2.3**) which confirmed that the site represents a rare opportunity within the LHCC region to develop a large tonnage, quarry operation on geology that is demonstrated to be favourable for production of the full range of high-quality quarry products. The close proximity of the Project Area to key markets and the State Road network (i.e., the Pacific Highway) would enable the Project to significantly ameliorate the existing and forecast medium to long term supply-side pressures of quarry materials for the LHCC region, as well as provide direct access to the Sydney market if required. The quarry would also generate long-term revenue to the State through royalties payable to FCNSW on quarry products sold from the site.

2.2 Local and Regional Planning Context

The Hunter Regional Plan 2041 (Regional Plan) is the NSW Government's strategic long-term plan for guiding planning and land use decisions for the Hunter region over the next 20 years. The Hunter has the largest share of both population and employment in regional NSW and is located in the State's fastest growing development corridor. The Regional Plan sets the strategic land use framework for continued economic growth and diversification in one of Australia's most diverse and liveable regions.

The Regional Plan aims to unlock sustainable growth opportunities and investments, as well as housing choice and lifestyle opportunities to retain the Hunter's position as a leading regional economy in Australia. The Regional Plan specifically identifies the need for a reliable supply of construction materials to support this continued growth including sand and gravel, crushed rock, and aggregates.

On a local level, the Port Stephens Local Strategic Planning Statement (LSPS) outlines the 20-year vision for land use planning in the Port Stephens LGA. The LSPS is aligned with the Hunter Regional Plan 2036, Greater Newcastle Metropolitan Plan 2036 and Port Stephens Community Strategic Plan and is the tool that gives local-level effect to State government regional plans by informing local statutory plan making and development controls.

The LSPS has identified planning priorities to guide the future strategic planning work in the region, many of which focus on the provision of infrastructure including housing and transportation to support communities and drive economic growth. The Project will provide a key resource for the provision of the infrastructure necessary to support this growth and planned development.

2.3 Resource Context

As part of the preliminary feasibility assessment undertaken by ARDG, a review of historical geological investigations in the surrounding area and a detailed resource assessment program of the Licence Area under the Deed was undertaken by ARDG between 2016 and 2020. A detailed description of the geology of the Project Area and investigations undertaken by ARDG is presented in the Report on Quarry Resource Assessment Investigations (December 2022) provided in full in **Appendix 4**.

The comprehensive quarry resource assessment program undertaken by ARDG comprised a range of targeted investigations including detailed literature review, geological mapping supported by detailed petrographic analysis, high-resolution ground magnetic survey, extensive diamond core drilling, downhole geophysical surveys and thin-section petrography. The following section summarises the key findings from this assessment with further details on the objectives, methodology and findings of the program provided in **Appendix 4**.

2.3.1 Geological Setting

The Zone 56 Seamless Geology digital dataset produced by the Geological Survey of NSW (2015) indicates that the Project Area straddles the contact between the Carboniferous-age Eagleton Volcanics and overlying Mount Johnstone Formation (refer to Figure 4 of **Appendix 4**). Both Formations form part of a bedded sequence of sedimentary and volcanic rocks that dip in a south easterly direction at angles up to 50°.

The Eagleton Volcanics hosts the Stone Ridge Quarry resource and comprises toscanitic, dellentitic and rhyolitic volcaniclastic and pyroclastic rocks with minor intermediate (andesitic or dacitic) tuffs and minor volcanic breccias and tuffaceous sediments. The term 'toscanite' is a now superseded term that was originally used for a volcanic rock of rhyodacitic composition with a glassy groundmass. Similarly, the term 'dellenite' is a now disused term for a volcanic rock intermediate in composition between rhyolite and dacite and roughly synonymous with rhyodacite.

The lower part of the Mount Johnstone Formation conformably overlies the Eagleton Volcanics and is dominated by conglomerate with subordinate rhyolitic tuff and ignimbrite. Within the Project Area, the lower Mount Johnstone Formation was previously known as the Balickera Conglomerate.

2.3.2 Project Area Geology and Structure

The important interpreted geological and structural attributes of the Project Area, is presented in Section 7 of **Appendix 4**. An interpretation of surface geology and structure based on the outcomes of ARDG's resource assessment investigations is illustrated in **Figure 2.1**, while the interpreted subsurface geology is illustrated in cross-sectional format in **Appendix 4**.

Three main stratigraphic sequences within the Eagleton Volcanics have been identified within the Project Area:

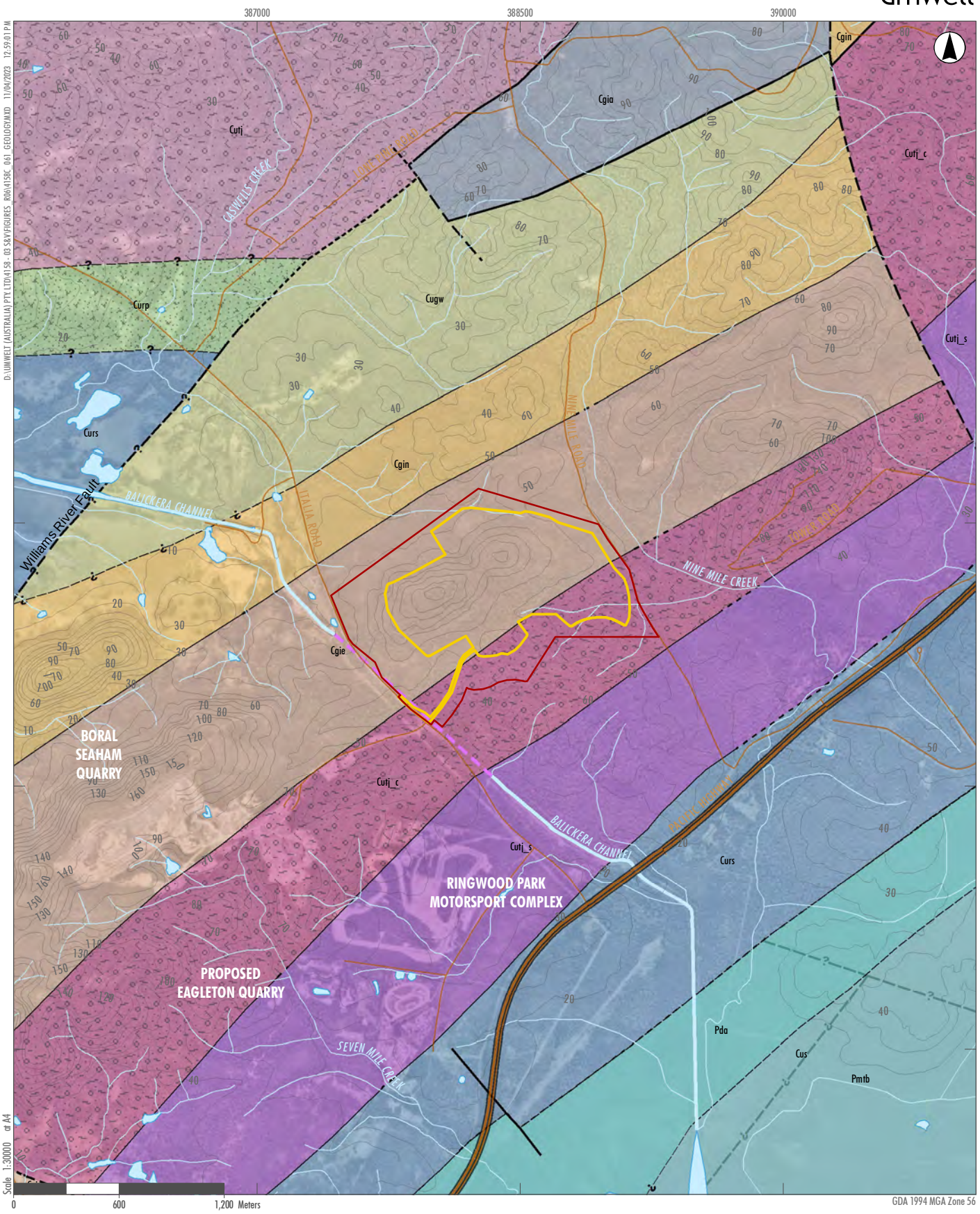
- **Lower stratigraphic sequence (Dacitic to Andesitic Volcanics)** – dominated by hornblende-biotite dacite, with lesser andesitic lithic fragmental tuff, volcanic breccia and rhyolitic vitric-crystal tuff. Outcrop exposure of these units is confined to areas of low topographic relief beyond the northwest flank of Stone Ridge. They can be mapped over a distance normal to the regional strike in excess of 480 m, from near the interpreted base of rhyodacite, through to the interpreted lower contact of the Eagleton Volcanics with the underlying Newtown Formation (Geological Survey of NSW, 2015). Based on the interpreted 35° southeast dip of the volcanic stratigraphy (Rattigan, 1966), these units are interpreted to underlie the rhyodacite and extend to depth beneath the axis of Stone Ridge. It is estimated that the Lower Stratigraphic Sequence has an overall thickness of approximately 280 m.

- **Middle stratigraphic sequence (Rhyodacitic Volcanics)** – the best exposed volcanic rocks within the Eagleton Volcanics are coherent tuffs and lavas of rhyodacitic composition. These outcrop extensively across Stone Ridge above an elevation of approximately 50 m AHD. The rhyodacite has been mapped along the full length of the ridge and over a distance normal to the ridge axis and bedding that ranges from 350–480 m. Drilling has confirmed that the stratigraphy dips at approximately 35° to the southeast and the true thickness of this unit is interpreted to range from 200–275 m.

  Where unoxidized, rhyodacitic rocks within the Project Area are generally massive, dark grey to brown-grey rocks. They contain a significant component of feldspar and quartz phenocrysts up to 3 mm across, with smaller amounts of dark ferromagnesian grains and occasional dark grey to dark red-brown lithic and or vitric fragments. Close to surface, the rhyodacite is typically a pink-brown colour due to weak oxidation associated with supergene effects. Where unoxidized at depth, the rhyodacites commonly exhibit weak patchy red-brown hematite alteration (pigmentation), although this increases significantly in intensity (along with laumontite alteration) within several m of the lower contact with underlying rocks of the Lower Stratigraphic Sequence.

- **Upper stratigraphic sequence (Volcanic Sandstone, Siltstone, Tuff and Conglomerate)** – a strongly interbedded sequence of volcanic sandstone, siltstone, tuff and minor conglomerate, capped by an upper rhyolitic vitric-crystal tuff horizon. At surface, only the rhyolitic vitric-crystal tuff outcrops and this can be traced for 1200 m, parallel to the length of Stone Ridge. It outcrops over a horizontal distance of up to 90 m and based on the interpreted southeast dip of the volcanic stratigraphy (Rattigan, 1966), would have a true thickness of up 50 m. The upper contact of the rhyolitic vitric-crystal tuff is overlain by highly weathered pebbly conglomerate and sandstone that comprises the base of the Mount Johnstone Formation.

The Eagleton Volcanics stratigraphy within the Project Area has been overprinted by several prominent fault structures that have been the focus of localised late (possibly Tertiary-age) dolerite dyke emplacement and enhanced oxidation and weathering of the surrounding geology. Diamond drilling undertaken by ARDG across the Project area has revealed that rhyodacite and dacite units away from the main fault zones are typically massive to weakly or moderately jointed. In contrast, the geological units within fault zones are typically strongly to intensely fractured, brecciated, and healed by laumontite ± calcite.



Legend

- Project Area
- Disturbance Area
- Pacific Highway
- Road
- Balickera Tunnel
- Drainage Line
- Waterbody
- Contour (10m Interval)
- Geological boundary, position accurate
- Geological boundary, position approximate
- Geological boundary, inferred
- Geological boundary, concealed
- Fault, concealed
- Fault, inferred
- Fault, position accurate
- Fault, position approximate
- Conglomerate
- Pyroclastic rock
- Pda Dalwood Group
- Pmtb Branxton Formation
- Cgia Ararat Formation
- Cgie Eagleton Volcanics
- Cgin Newtown Formation
- Cugw Wallaringa Formation
- Curp Paterson Volcanics
- Curs Seaham Formation
- Cus Ungrouped Carboniferous units
- Cutj Mount Johnstone Formation
- Cutj_c Mount Johnstone Formation (lower)
- Cutj_s Mount Johnstone Formation (upper)

FIGURE 2.1

Geology

Image source: Nearmap (2022) Data source: NSW FSDF (2022), GSNSW (2022)

2.3.3 Project Area Resource Estimation

Estimation of the resource within the Project Area has been undertaken in accordance with the Australasian Code for Reporting of Exploration Results, Mineral Resources and Ore Reserves 2012 (the JORC Code). The JORC Code provides minimum standards, recommendations and guidelines to ensure transparency, materiality and competence in the public reporting in Australasia of exploration results, mineral resources and ore reserves (refer Section 10 of **Appendix 4**).

ARDG's resource assessment program has confirmed the geological, structural and rock quality characteristics of the rhyodacite and dacite to a high level of confidence and predictability. Critically, detailed geotechnical testing has confirmed that with the exception of overburden and topsoil, all other materials extracted from within the Stage 9 footprint of conceptual quarry development (refer to **Figure 3.3**) could be processed by a future quarry operation to produce a wide range of quarry products required by the Lower Hunter, Central Coast and Greater Sydney construction materials markets.

Accordingly, with exception of topsoil and negligible quantities of overburden, all other materials extracted from within the Stage 9 footprint of conceptual quarry development are classified as a Measured Resource. Given that the main rhyodacite resource extends to depth below, and along strike of the proposed Stage 9 footprint, significant additional Indicated Resources exist within the Project Area. The Measured and Indicated Resource figures determined by ARDG for the Project Area are summarised below.

- Measured Resources:
    - Rhyodacite: 47.3 Mt (constrained by Stage 9 pit shell, Main Pit).
    - Dacite: 1.67 Mt (constrained by Stage 6 pit shell, North Pit).
    - Total Measured Resources: 48.97 Mt.
- Indicated Resources:
    - Rhyodacite and Dacite: 87 Mt (constrained by conceptual pit design to RL-62 m AHD).
- Topsoil and overburden:
    - Main Pit: 239,460 t.
    - North Pit: 19,975 t.

Should consent be granted for the Project, the Measured and Indicated Resources quoted above would convert to 'Proved Reserves' and 'Probable Reserves', respectively, as defined by the JORC Code.

Thirty-one bulk samples of diamond core from ten holes drilled across the Project Area (refer Section 8 in **Appendix 4**) were tested for geotechnical properties relevant to different product suitability requirements. All samples were tested by Coffey Testing, with test results confirming that dacite and rhyodacite of the lower and middle stratigraphic sequence is suitable for producing a full suite of high-quality quarry products, including:

- concrete aggregates (coarse and fine, including manufactured sand) – AS2758.1 – 2014
- High Polished Aggregate Friction Value (PAFV) Asphalt aggregates (coarse and fine, including manufactured sand) – AS2758.5 – 2000 and RMS 3152
- sealing aggregates – AS2758.2 – 2009 and RMS 3151
- railway ballast – AS2758.7 – 2015
- armourstone – AS2758.6 – 2008
- aggregates for gabion baskets and wire mattresses – AS2758.4 – 2017
- roadbase materials – RMS 3051.

2.4 Environmental and Social Context

The Project Area occupies approximately 139 ha and is located wholly within Wallaroo State Forest at Balickera NSW, within the Port Stephens LGA. The Project Area is zoned RU3 – Forestry under the *Port Stephens Local Environmental Plan 2013* (Port Stephens LEP) (refer to **Figure 2.2**). The Project Area occupies land within Lots 36 and 65 DP 753200, Lot 1 DP 724372 and Lot 540 DP 1207159, refer to Schedule of Land attached as **Appendix 17**.

Wallaroo State Forest extends beyond the Project Area, to the north, east and south, while Italia Road lies to the west. Land on the western side of Italia Road is occupied by a number of commercial and extractive industry land uses including the Boral Seaham Quarry, which has been in operation since 1991, Port Stephens Gardenland, Ringwood Park Motorsport Complex, Circuit Italia (under construction), Hunter Valley Paintball, and the proposed Eagleton Quarry (SSD-7332). The Pacific Highway is located approximately 1.6 km to the south-east of the proposed processing area, while beyond that, the land to the south is either privately-owned or in the ownership of Hunter Water Corporation (refer to **Figure 2.3**).

The closest residences are located approximately 1 km to the north-west of the Project Area, along Italia Road and to the south-east along Nine Mile Creek Road. The residential area of Seaham is located approximately 7 km to the west of the Project Area, while the larger townships of Clarence Town, Raymond Terrace and Medowie are located approximately 9 km north-west, 10 km south-west and south-east of the Project Area respectively (refer to **Figure 1.1**).

Historically, the Wallaroo State Forest has been subject to extensive vegetation disturbance associated with commercial logging practices since the 1920s, however no timber harvesting has occurred since 1986. The Project Area has been subject to numerous fires which have also been a major source of damage to Wallaroo State Forest, with six severe fires experienced between the 1928 and 1968 fire seasons. Increased hazard reduction burning has reduced the incidence of such fires since then, with the last major fire occurring in 2016. Vegetation cover on ridges and ridge flanks within the Project Area is dominated by dry sclerophyll forest types, with several forestry tracks located in the north, south and east of the Project Area. The majority of vegetation can be broadly described as 'forestry regrowth' that has occurred following historical logging operations. Vegetation cover at lower elevations transitions to wetter forest types in the northeast and south.

'Stone Ridge' is the main topographic feature within the Project Area, running for approximately 1.2 km and comprising two rocky hills with elevations of 107.5 m AHD and 83 m AHD separated by a low saddle. More gently undulating topography to the north-west and south-east of the Project Area is associated with more weathered volcano-sedimentary geology that typically ranges in elevation from 20 to 60 m AHD. A prominent broad low ridge ('South Ridge') extends at a maximum elevation of approximately 62 m AHD from the central south-eastern flank of Stone Ridge to the Pacific Highway (refer to **Figure 2.3**).

The Project Area is within the Grahamstown Dam catchment and the Williams River catchment, both of which are part of the Hunter Water drinking water catchment. Grahamstown Dam is the major potable water source for the lower Hunter. Water is received by Grahamstown Dam via catchment rainfall runoff inflows as well as extraction from the Williams River via the Seaham Weir Pumps and the Balickera Pump Station, which transfers water within Balickera Channel to Grahamstown Dam. The Balickera Channel is primarily an open canal approximately 2.7 km long cut into the surrounding land to the south-west of the Project Area. A 1,230 m section of the Channel is enclosed underground in the Balickera Tunnel, from the Italia Road crossing south, which also traverses approximately 8 m beneath the proposed site access from Italia Road into the Project Area (refer to **Figure 2.3**).

The Project Area is accessed directly from Italia Road, which is a local road, fully sealed and providing one traffic lane in each direction. Italia Road joins the Pacific Highway approximately 1.2 km from the proposed site entrance. The section of Italia Road between the Pacific Highway and the access road (and Boral Seaham Quarry access road) is an approved B-Double route. The Pacific Highway is an important freight corridor along the east coast and is accordingly approved for use by heavy vehicles (including B-doubles) without specific permit conditions. The existing intersection of Italia Road and Pacific Highway is a seagull type intersection, with short right turn and left turn deceleration lanes. The intersection features a long acceleration lane for southbound vehicles turning right onto the Pacific Highway which forms a third lane on the Highway until it merges approximately 1.4 km south of the intersection.

The Project Area is located within the Worimi Local Aboriginal Land Council (LALC) area. There are no current registered or determined native title claims over the Project Area. One locally listed heritage item is located approximately 1.1 km to the north-west of the Project Area. This site is known as 'Balickera House' (item ID I3, Port Stephens LEP 2013), a built heritage item which is a former farmhouse, currently forming part of the private residential buildings located at 303 Italia Road (Lot 530, DP 1128672).

2.5 Potential Cumulative Impacts

The Project is located approximately 2 km north of the existing Boral Seaham Quarry and the proposed Eagleton Quarry, both located on the south side of Italia Road (refer to **Figure 2.3**). The access road for the Boral Seaham Quarry off Italia Road is located directly opposite the proposed access road for the Project. The proposed access to the Eagleton Quarry off Italia Road is Killaloe Lane to the east of the Circuit Italia/Ringwood Motor Complex, approximately 400 m from the Pacific Highway intersection.

The Ringwood Park Motor Complex and Circuit Italia are both motor racing tracks located south of Italia Road. The Circuit Italia track is currently under construction. The access points for both complexes are off Italia Road approximately 450 to 500 m east of the Pacific Highway Intersection (refer to **Figure 2.3**).

Brandy Hill Quarry (approved in 1983 and operated by Hanson since 2001) is located approximately 12 km west of the Project Area, on Clarence Town Road.

Cumulative impacts with respect to noise, blasting, air quality, traffic and socio-economic impacts have been assessed in the relevant sub-sections of **Section 6.0**.

2.6 Partnerships

No Voluntary Planning Agreements or private-landowner agreements have been entered into by the proponent at this stage other than the Deed with FCNSW (refer to **Section 1.7**).

ARDG has consulted with Port Stephens Council regarding contributions for heavy vehicle road haulage for loaded truck movements on Italia Road, as required under the *Port Stephens Section 94 Development Contributions Plan 2007*.

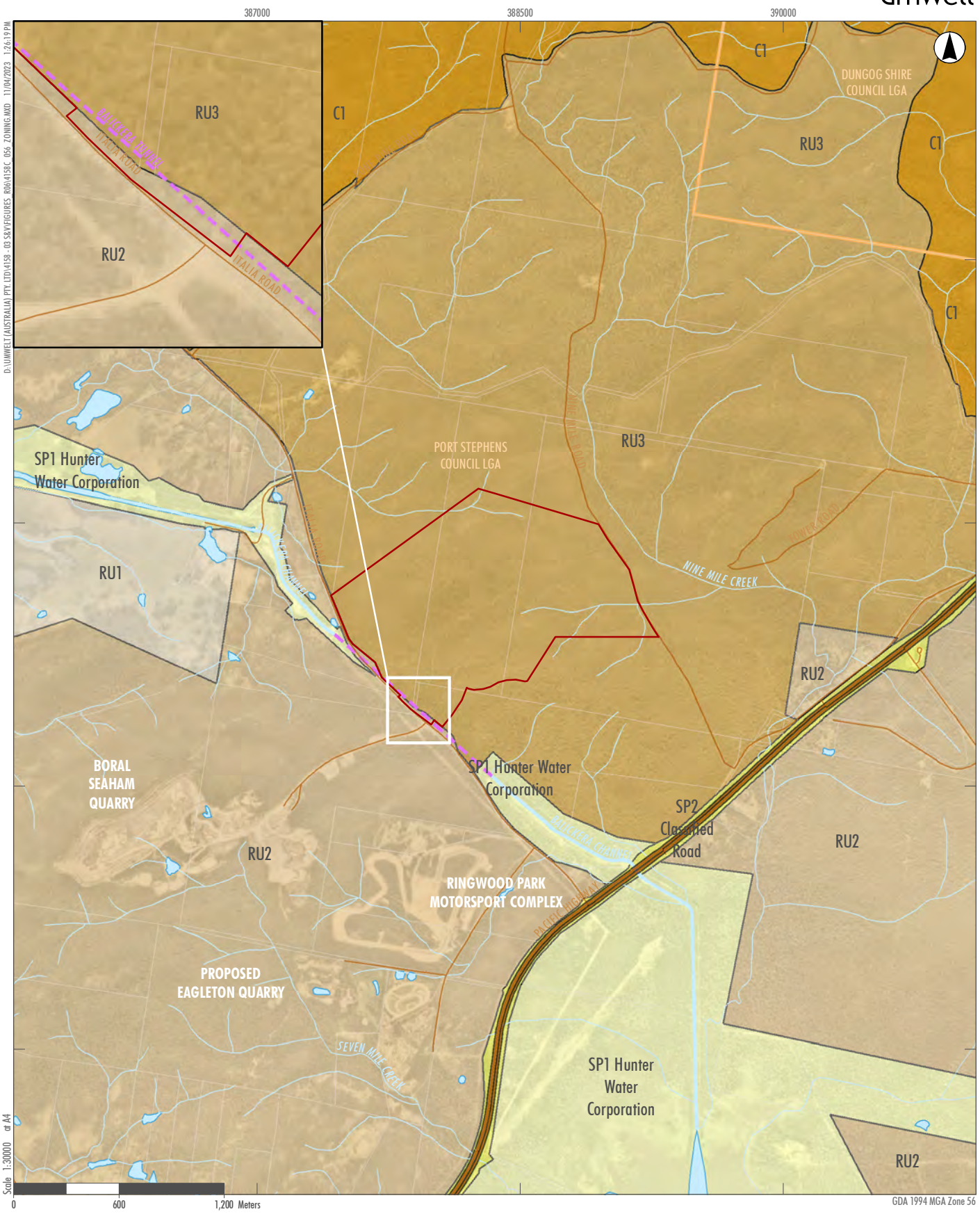


FIGURE 2.2

Zoning

Image source: Nearmap (2022) Data source: RES Australia (2021), NSW FSDF (2022), DPE (2022)

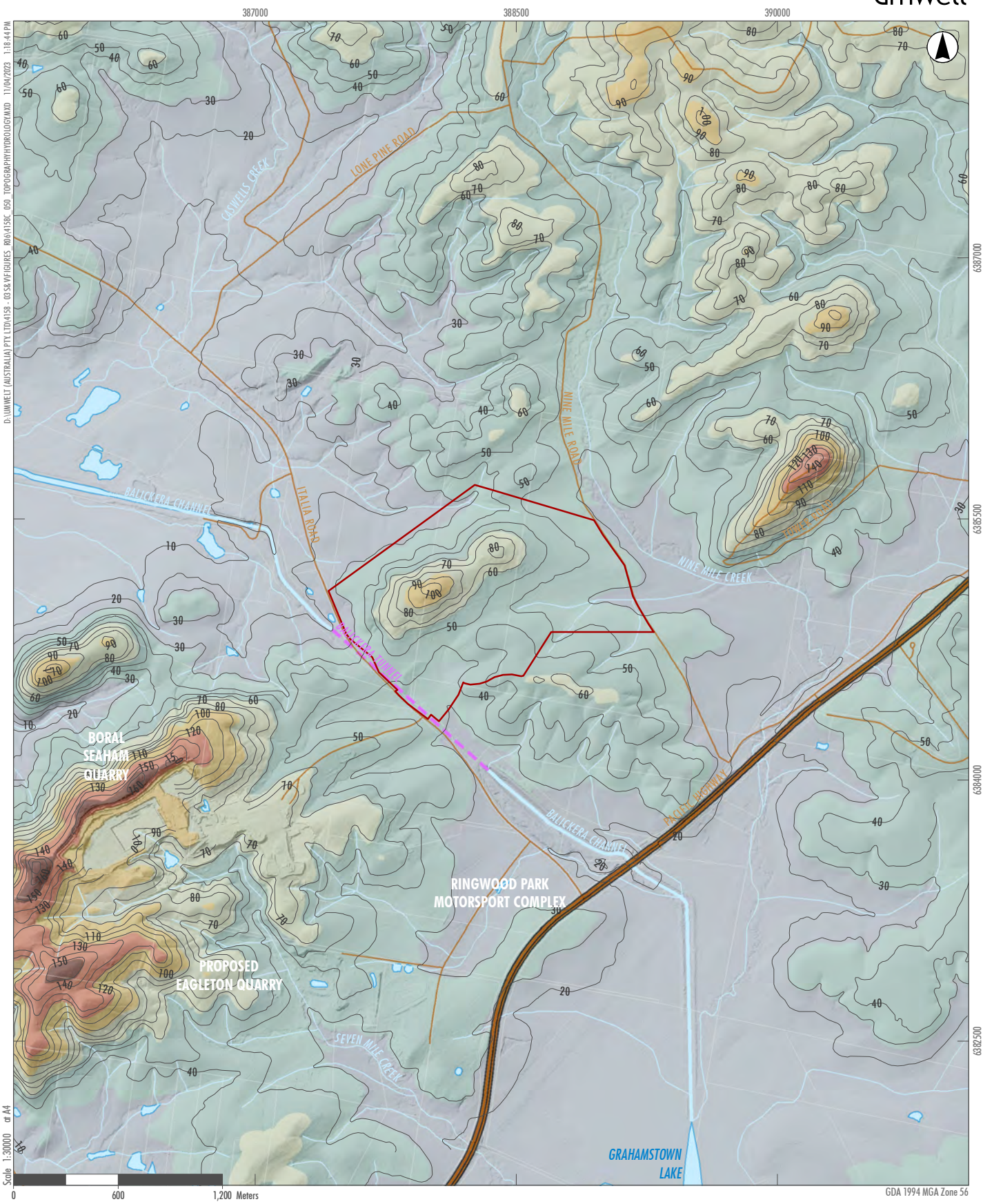
Legend

- Project Area
- Local Government Boundary
- Pacific Highway
- Road
- Balickera Tunnel
- Drainage Line
- Waterbody
- Lot Boundaries

FIGURE 2.3

Local Setting

Image source: Nearmap (2022) Data source: RES Australia (2021), NSW FSDF (2022), DPE (2022)



Legend

- Project Area
- Pacific Highway
- Road
- Balickera Tunnel
- Drainage Line
- Waterbody
- Lot Boundaries
- Contour (10m Interval)

Elevation (m AHD)

- 0 - 30
- 30 - 60
- 60 - 90
- 90 - 120
- 120 - 150
- 150- 180

FIGURE 2.4

Topography and Hydrology

Data source: RES Australia (2021), NSW FSDF (2022)

2.7 Alternatives

2.7.1 Alternative Locations

ARDG has undertaken a detailed desktop and targeted field assessment and extensive constraints analysis (i.e., market/geological/planning/environmental) of all potential high quality resource opportunities in the LHCC region. Several sites with favourable attributes were identified and subsequently subjected to preliminary field investigations (e.g., surface sampling/mapping, geophysics, drilling and testing). None of these sites, however, had either the necessary resource quality or quantity to warrant a commitment to further investigation.

As indicated in **Section 2.1**, the Project represents a rare opportunity within the lower Hunter region to develop a large tonnage, greenfield quarry operation on geology that is demonstrated to be favourable for production of the full range of high-quality quarry products, with close proximity to key markets, approved B-double haulage routes and existing State road infrastructure. As such it represents an ideal site to meet medium- and long-term demand for high quality aggregates in the region.

2.7.2 'Do Nothing' Alternative

As outlined in **Section 2.1**, the supply of high-quality quarry products to the construction sector in the LHCC region in the medium term is characterised by quarries that are generally in the latter stages of their development lives, and/or operations with either comparatively short resource lives and/or sub-optimal resource quality. The Project represents a rare opportunity within the lower Hunter region to develop a large tonnage, quarry operation on geology that is demonstrated to be favourable for production of the full range of high-quality quarry products, with close proximity to key markets and existing State Road infrastructure.

If the Project does not progress or access to new resources are not identified and brought to market, the growth areas of the LHCC will experience significant supply-side pressure for high-quality quarry products, with negative flow-on effects in terms of increased costs throughout the entire construction sector value chain.

3.0 Project Description

The conceptual design for Stone Ridge Quarry (the Project) has evolved throughout the environmental assessment process in response to preliminary environmental, social and cultural investigations, background monitoring, exploration and geological modelling, constraints and impacts identified during technical specialist studies. Project design has also taken into consideration the outcomes of stakeholder engagement undertaken during the scoping phase and EIS preparation. A detailed description of the features of the Project is included in this section.

3.1 Project Overview

A summary of the key aspects of the Project is provided in **Table 3.1**.

Table 3.1 Summary of Key Project Aspects

Aspect	Proposed for the Project
Life of Extraction	30 years from the commencement of extraction. Some processing activities and decommissioning and rehabilitation activities will occur beyond the date extraction is completed.
Limits of production	Up to 1.5 Mtpa of quarry product/sales per year.
Project Area	Approximately 139 ha (including extraction, processing and stockpiling area and buffers), with a disturbance area of approximately 79 ha.
Extraction method	Drill, blast, load and haul.
Material processing	Processing on site with provision for both mobile crushing and screening plant, as well as modular/fixed processing plant.
Overburden management	Overburden will be minimal and any topsoil and overburden will be stockpiled on site for use in rehabilitation and/or water management structures and bunds.
Products	Concrete, asphalt and sealing aggregates, gabion, armourstone, roadbase and other crushed rock products.
Resource Estimate	Approximately 49 Mt in situ resource. Approximately 45 Mt product.
Product transport	Road transport of up to 1.5 Mtpa of product via the Pacific Highway. 1.5 Mtpa equates to average of 334 heavy vehicle movements (167 inbound and 167 outbound) each day (based on the transportation of materials using truck and dog combinations with a typical capacity of around 30 tonnes).
Site access	Single site access point on Italia Road. No truck traffic on Italia Road west of the site access towards East Seaham. All trucks will turn right into the site from Italia Road and left out of the site onto Italia Road. No trucks will turn right out of Italia Road onto the Pacific Highway.
Employment	Construction: 10 to 15 full time employees. Operation: Up to 10 full time employees, 3 to 5 part-time employees.

Aspect	Proposed for the Project
Hours of operation	Construction: • 7.00 am to 6.00 pm Monday to Friday. • 8.00 am to 1.00 pm Saturday. • No work on Sunday or Public Holidays. Operation: • Quarrying and processing – 7.00 am to 6.00 pm Monday to Friday, and 7.00 am to 3.00 pm Saturdays. • Truck loading, product transport and maintenance – 6.00 am to 10.00 pm Monday to Friday, and 7.00 am to 3.00 pm Saturdays. • No operation on Sundays or Public Holidays apart from maintenance activities as required.
Rehabilitation and final landform	Rehabilitation will be undertaken progressively where appropriate in the context of further resources remaining available in the Project Area at the end of the planned 30-year approval life. A conceptual final landform will be prepared for the Project.

3.1.1 Project Area

Wallaroo State Forest comprises three separate areas of land that have a combined area in excess of 3,600 ha. As noted in **Section 1.1** and shown on **Figure 1.2**, the Project Area (139 ha) is located within a Licence Area (391 ha) inside the boundaries of the western part of Wallaroo State Forest.

3.1.2 Project Layout

The conceptual layout of the Project Area is shown in **Figure 1.2** and comprises the following key features:

- an extraction area with sufficient resources to support the extraction and processing of material to enable the transport of approximately 1.5 Mtpa over a 30-year period
- processing and stockpiling/loading area, which includes provision for storage of mulched vegetation, soils and overburden
- surface water management infrastructure (including surface irrigation areas)
- weighbridge and administration area (offices, parking, amenities)
- site access and internal roadways
- buffer areas.

3.1.3 Disturbance Area

The Disturbance Area of the Project (i.e., those areas where physical disturbance of soils and vegetation may occur) occupies approximately 79 ha of the Project Area, with the remainder of the Project Area to remain as vegetated buffer areas. All disturbance associated with the Quarry operations will be contained with the Disturbance Area identified in **Figure 1.2** except where otherwise approved under *Forestry Act 2012* processes where further development consent is not required.

3.2 Quarrying Process

The quarrying process for the Project will consist of six principal operational activities:

1. site preparation
2. clearing and topsoil stripping and stockpiling
3. overburden removal and emplacement
4. blasting, loading and haulage of primary raw material
5. processing (crushing, screening and stockpiling)
6. decommissioning and rehabilitation.

These operational activities are described further below.

3.2.1 Clearing and Topsoil Stripping

The quarrying process will commence with clearing of vegetation and stripping of topsoil. Vegetation clearing will typically be undertaken using a dozer and/or excavator with all cleared material stockpiled for later re-use in habitat enhancement, water management and rehabilitation works. Larger woody material may be emplaced in adjoining areas of the Wallaroo State Forest for habitat enhancement purposes (refer to **Section 6.16.3**).

Soil profile development over the Eagleton Volcanics is very poor to non-existent, and rhyodacite (the dominant rock type) outcrops extensively along the crest and flanks of Stone Ridge. Soils in these areas are generally less than 0.3 m in depth and are typically weakly structured, sandy loams. Soil profiles developed at lower elevations (generally below 50 m AHD), over less resistant volcanic and sedimentary rock types are more developed and are typically moderately structured, sandy light clays.

Where present, topsoil will be stripped using a dozer and then loaded into a haul truck for stockpiling. The proposed location of the stockpiling area is shown in **Figure 1.2**. Topsoil will remain in stockpiles until required for rehabilitation of the final landform. Topsoil stockpiles will have a maximum height of 3 m and will be planted with a cover crop if they are to remain in place for longer than 6 months. Where possible, freshly stripped topsoil will be placed directly onto areas identified for rehabilitation or earthworks areas requiring stabilisation, to reduce the potential for exposure of unconfined disturbed subsoil material and to make best use of soil seed stores. **Section 6.16.3** contains further details regarding soil management for rehabilitation purposes.

3.2.2 Site Preparation

As the proposed quarry is a greenfield project, construction and initial site preparation works are required to prepare the Project Area for quarrying activities. The construction phase is expected to last 6–12 months and will including the following key activities:

- construction of the site access from Italia Road (an upgrading of the existing forestry road and intersection with Italia Road) is required
- installation of security fencing and gates to ensure public safety and security for the quarry operations
- removal of existing vegetation and topsoil along the access road, within the areas of initial extraction, the initial surface water infrastructure area, and processing, loading and administration areas (refer to **Section 3.2.1**)
- stockpiling of vegetation and topsoil material for future re-use (refer to Section 3.2.1 and Section 6.16)
- removal and stockpiling of any surface rock considered suitable for eventual processing to produce quarry products
- construction of surface water management infrastructure necessary to support construction activities, administrative and processing areas and early extraction activities including stockpile and material handling areas
- construction of processing and loading areas
- construction of remaining facilities including administration area, visitor parking, equipment parking area, site roads, workshop and weighbridge.

3.2.3 Overburden Removal

The target resource is overlain by a very thin veneer of variably weathered rock that in almost all cases will require blasting and is suitable for processing to produce saleable quarry products. Any minor quantity of material deemed as being unsuitable for processing will be loaded by excavator into haul trucks and transported to an overburden emplacement within the stockpile area, in advance of being used for site earthworks (e.g., water management dams and bunds) or rehabilitation.

3.2.4 Blasting, Loading and Haulage

3.2.4.1 Blasting

The target resource will be drilled and blasted to allow the rock to be broken into sizes which can be readily handled and transported to the processing area. Blasting may also be required for the construction of site facilities and the access road due to the shallow rock. Drilling and blasting will be conducted using experience drill and blast contractors. No explosives would be stored on site, with all explosives transported to the site from licensed suppliers and/or magazines as needed and loaded directly into the drill holes.

Blasting will only be undertaken Monday to Friday between 9.00 am and 5.00 pm (excluding public holidays). Drilling activities will be undertaken during normal quarrying hours i.e. Monday to Friday between 7.00 am and 6.00 pm, and Saturdays from 7.00 am to 3.00 pm. It is anticipated that one to two blasts per fortnight will be required with an allowance for additional blasts where there are misfires or blasting activities are restricted by meteorological conditions. To avoid any cumulative impacts of blasting on the adjacent community, coordination with neighbouring quarry operations will be undertaken to ensure that no simultaneous blasting occurs (refer to **Section 6.3.3**).

A detailed design and predictive model will be completed for each blast to ensure that vibration and blast overpressure limits are met. Typically, the blasting operation sequence would commence with a bench survey and bench drilling using a drill rig. A typical bench is rectangular in shape with a uniform drilling pattern. The drill holes are loaded with explosive material and the top of the holes filled with a gravel material (stemming) to contain the energy release and to ensure a low air blast emission is achieved. The loaded explosives are then initiated through electronic detonators connected to each hole to provide the maximum level of control over the explosive charge. A delay system allows for single hole initiation with a small delay between each blasted hole to control the ground and air vibration impacts allowing lower environmental impact. The above techniques reflect current quarry industry practice for the use of emulsion or water gel products however other blast products may be developed over the life of the Project which provide more optimal blast performance and/or reduced environmental impacts and these may require slightly different blast practices. Blasting methods used at the quarry will be detailed in the Blast Management Plan prepared for the Project and, in the event of any proposed changes to blast practices, the Blast Management Plan will be updated to reflect the updated practices to be adopted.

3.2.4.2 Material Handling

Once blasted, rock material will be loaded by front-end loaders or excavators into haul trucks at the quarry face and transported to the processing area for the commencement of the crushing and screening processes. Should the blasting result in the formation of oversize rock fragments, where possible these will be broken up using an excavator with a rock hammer prior to being loaded onto trucks. Dozers will be used periodically to move blasted material within the pit to improve the efficiency of loading activities and will also be used for the construction of haul roads and loading areas within the pits and water carts will be used to manage dust impacts associated with handling and haulage activities.

3.2.5 Product Processing

Following extraction, quarry material will be processed through a series of crushers to reduce the rock into various sized fragments. A series of screens will then be used to sort the crushed rock into various sized categories, resulting in a number of different crushed rock products. The production cycle consists of a three-stage crushing and screening process (primary, secondary and tertiary stages), with each stage producing finer quarry products.

Products will be stockpiled in readiness for dispatch in nominated product-specific stockpile areas. Quarry products will be produced to meet market demand and will include:

- concrete aggregates
- asphalt aggregates
- sealing aggregates

- railway ballast
- armourstone
- aggregates for drainage, gabion baskets and wire mattresses
- roadbase materials.

3.2.6 Rehabilitation

The exact timing of specific rehabilitation works will be dependent upon on the rate of resource extraction and any future plans to seek approval for the continuation of extraction beyond the initial 30-year approval term currently being sought. Any inactive disturbed areas surrounding the active extraction and processing areas where quarrying, processing, stockpiling or other management activities are not proposed would be subject to progressive rehabilitation once it is identified that areas will not be required for ongoing operations.

A detailed Quarry Closure Plan will be developed approximately 3 years prior to cessation of quarrying activities. The Quarry Closure Plan will describe the proposed operational and progressive rehabilitation procedures for the remainder of the quarry life and following quarry closure. The final land use option proposed is focused on promoting the surrounding forest landscape by re-establishing pockets of woodland species across the benches consistent with endemic vegetation types.

Further detail on the proposed rehabilitation objectives and methodology are provided in **Section 6.16**.

3.3 Physical Layout and Design

3.3.1 Conceptual Quarry Development Sequence

Conceptual staged quarry development plans (refer to Section 9 of **Appendix 4**) have been prepared for the Project Area to illustrate the proposed progression of quarry extraction activities to support the production and sale of up to 1.5 Mtpa of quarry products over a 30-year operational period, from a hard rock resource of approximately 49.5 Mt.

The conceptual plans comprise ten extraction stages that cover initial site establishment (Stage 0), followed by development of the main rhyodacite resource associated with Stone Ridge (the Main Pit), as well as development of a satellite pit (North Pit) on the northern side of Stone Ridge to access the upper dacite unit of the Lower Stratigraphic Sequence (Stages 1–9). The conceptual development sequence integrates with quarry processing and stockpiling activities located on the southern side of Stone Ridge. Three main stages are presented in **Figure 3.1**, **Figure 3.2** and **Figure 3.3** to illustrate the early (Stage 1), mid (Stage 5) and late (Stage 9) extraction stages of the quarry that relate to the 30-year development horizon.

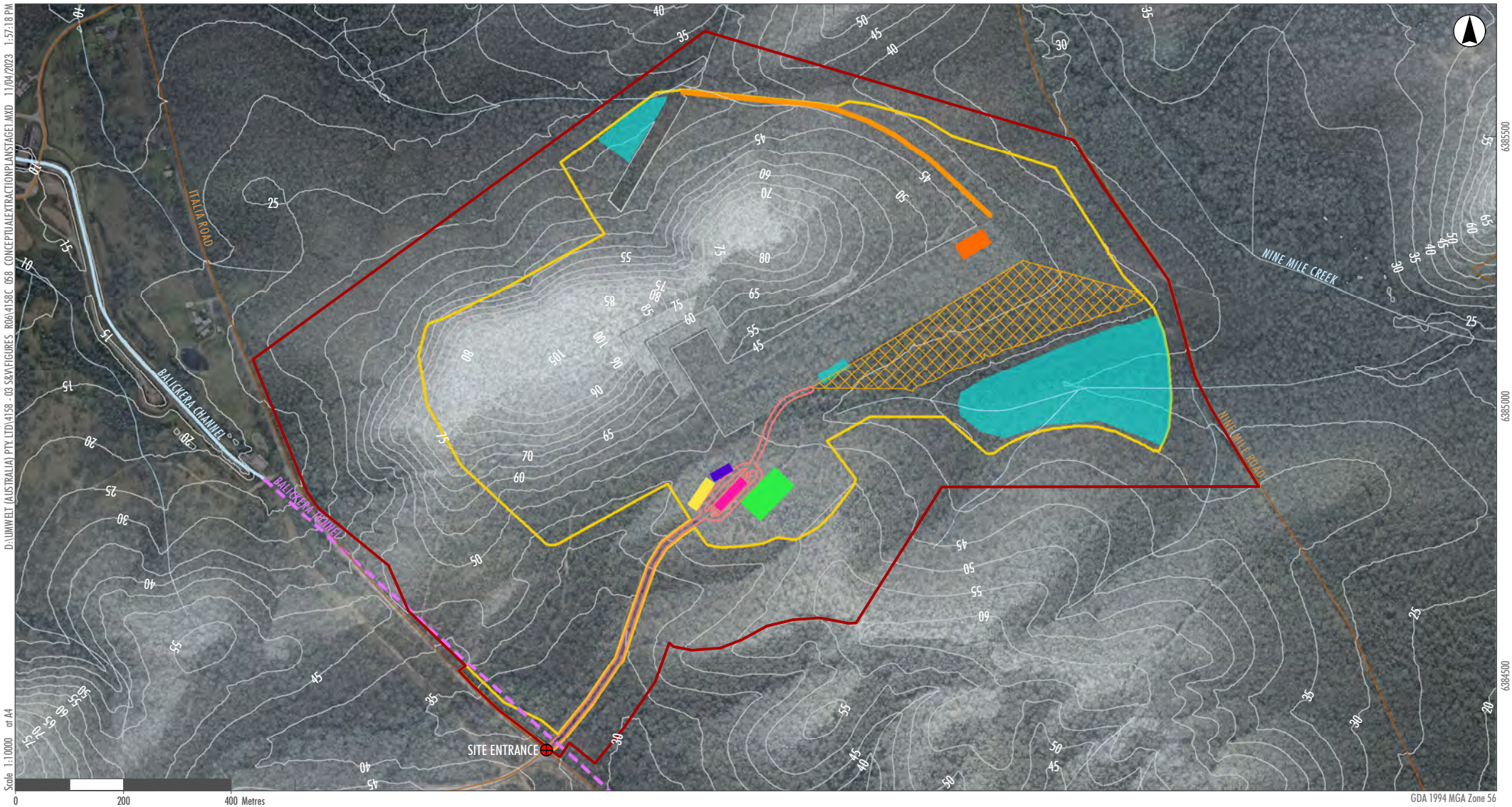
The quarry face design parameters reflected in the conceptual plans are summarised in Table 9-1 of **Appendix 4**, along with other design parameters that would be adopted relating to terminal berm widths and haul roads.

The progression of quarrying activities depicted in the conceptual mine plans shown in **Figure 3.1**, **Figure 3.2** and **Figure 3.3**, and as described in in this EIS, represent the most likely extraction plans for the Project, however these conceptual plans are subject to change throughout the life of the Project due to a range of variables such as geological and geotechnical conditions, variations in product quality and market conditions, and changes to mining equipment and available technology.

The retention of 30-m wide benches at the completion of each stage of quarry development (versus development of narrow terminal width benches) reflects ARDG's intention to maintain operational width benches at all stages of quarry development to facilitate:

- maximum operational flexibility across multiple quarry faces and at different levels within the quarry by maintaining access to all bench levels
- safe and stable quarry face conditions at all stages of development, achieved by the design parameters considered highly conservative as they retain an overall face slope angle of between 24˚ and 25˚
- use of the lower level of quarry when required for surface water storage to meet the requirements of the quarry's surface water management system (refer to **Section 6.5.1.2**).

Should the quarry not be extended following the currently proposed 30-year life of operations, the wider benches also provide more opportunities for the rehabilitation of pit areas including revegetation on benches and/or battering of internal slopes. Closure planning options are considered further in **Section 6.16**.



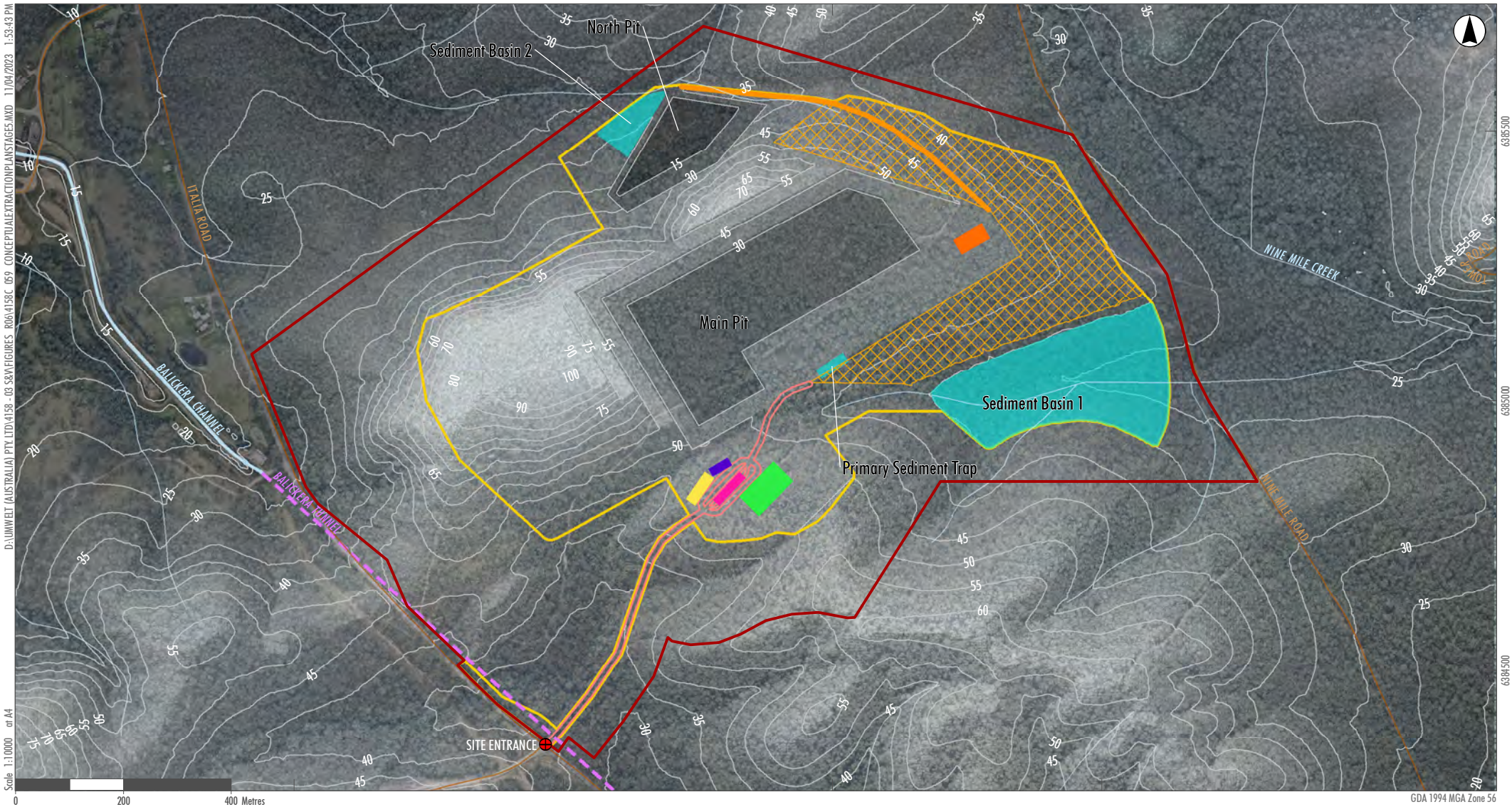
Legend

- Project Area
- Disturbance Area
- Road
- Balickera Tunnel
- Drainage Line
- Contour Line
- Office
- Weighbridge
- Northern Haul Road
- Workshop
- Truck Parking
- Light Vehicle Parking
- Access Road
- Stockpile and Plant Area
- Dams

Image Source: Nearmap (2022) Data source: NSW FSDF (2022)

FIGURE 3.1

Conceptual Extraction Plan – Stage 1



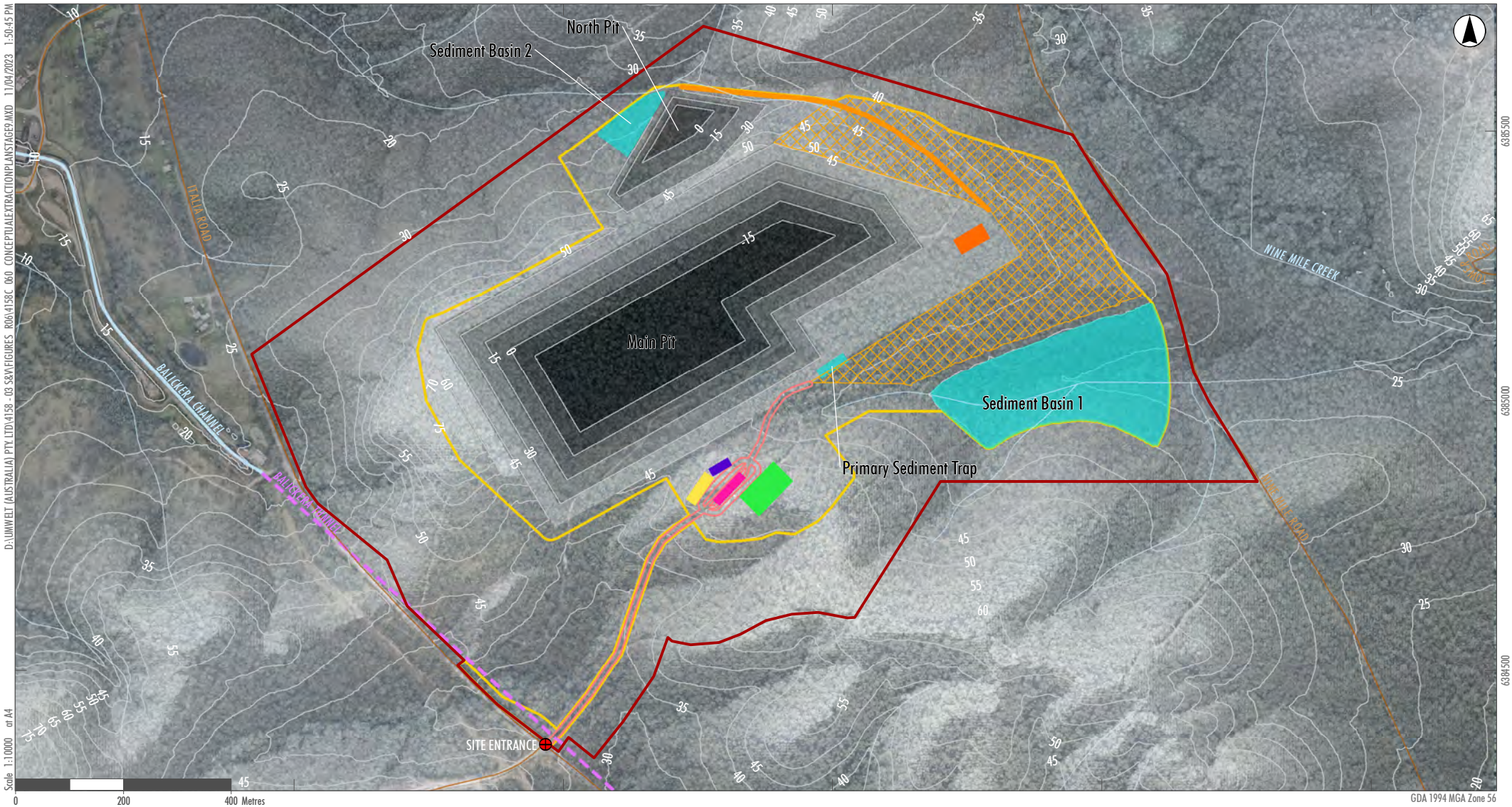
Legend

- Project Area
- Disturbance Area
- Road
- Balickera Tunnel
- Drainage Line
- Contour Line
- Office
- Weighbridge
- Northern Haul Road
- Workshop
- Truck Parking
- Light Vehicle Parking
- Access Road
- Stockpile and Plant Area
- Dams

Image Source: Nearmap (2022) Data source: NSW FSDF (2022)

FIGURE 3.2

Conceptual Extraction Plan – Stage 5



Legend

- Project Area
- Disturbance Area
- Road
- Balickera Tunnel
- Drainage Line
- Contour Line
- Office
- Weighbridge
- Northern Haul Road
- Workshop
- Truck Parking
- Light Vehicle Parking
- Access Road
- Stockpile and Plant Area
- Dams

Image Source: Nearmap (2022) Data source: NSW FSDF (2022)

FIGURE 3.3

Conceptual Extraction Plan – Stage 9

3.3.2 Extraction Volumes

Table 9-2 of **Appendix 4** presents the expected material volume/tonnage schedule for the conceptual development sequence.

Stage 0 of the conceptual development sequence relates to site establishment works (i.e., creation of access road, office and weighbridge area, etc) and would require approximately 228 kt of topsoil and overburden to be removed. Topsoil would be stockpiled for future remediation works, whereas overburden would be either stockpiled or used for the creation of onsite tracks and works areas.

Development of the Main Pit would require the staged stripping and stockpiling of approximately 240 kt of topsoil and overburden over the 30-year life of quarrying operations in order to provide access to approximately 47 Mt of rhyodacite (primary raw feed). At an estimated production yield of 90%, rhyodacite extracted from the Main Pit would produce approximately 43 Mt of saleable quarry products over the 30-year quarrying period.

Development of the North Pit would require the staged stripping and stockpiling of approximately 20 kt of topsoil and overburden to provide access to approximately 1.7 Mt of dacite (primary raw feed). At an estimated production yield of 90%, dacite extracted from the North Pit would produce approximately 1.5 Mt of saleable quarry products over the 30-year quarrying period.

3.3.3 Extraction Depths

The maximum extraction depth in the Main Pit is approximately -15 m AHD with the maximum depth in the North Pit being approximately -2 m AHD. Slighter deeper extraction will be required in each pit to establish sumps to enable operations to occur in the floor of the pit.

3.3.4 Plant and Equipment

The Project will utilise a fleet of mobile earthmoving plant and equipment for initial and ongoing site operations. The type of mobile equipment used at the site may change during the life of the Project to meet operational demands and reflect changes in technology. Locations of plant and equipment across the quarry will also change as extraction progresses through each stage.

The Project will initially commence crushing and screening operations with mobile plant and transition to include modular/fixed plant in accordance with production demand.

Potential impacts associated with all earthmoving, mobile plant and crushing and screening plant have been assessed in this EIS. A list of typical plant and equipment is provided in **Table 3.2**.

Table 3.2 Summary of Typical Plant and Equipment

Typical Activity	Typical Plant and Equipment
Clearing, topsoil stripping, overburden removal, bench development, shaping emplacement areas, on site haulage, vegetation mulching	Front-end loader, dozer, grader, excavator, dump truck (rigid body and articulated), tub grinder
Drilling for blasting activities	Blast hole drill rig

Typical Activity	Typical Plant and Equipment
Product processing	Mobile and modular/fixed crushing, screening and blending plant, pre-coat plant
Stockpiling and dispatch loading	Wheel loader
Road haulage	Road trucks (e.g., B-double, semi-trailer/truck and trailer)
Dust suppression, miscellaneous jobs	Watercarts, water pumps, light 4WD vehicles, maintenance and servicing trucks
Power supply	Diesel generators
Truck wheel washing	Wheel wash

3.3.5 Product Loading and Transportation

Product haulage will be undertaken using road trucks. Depending on the product and customer, different truck configurations (with different payloads) may be used including rigid, truck and dog, semi-trailer and B-double configurations.

The vast majority of inbound truck movements would turn left into Italia Road from the Pacific Highway to access the quarry. The Project includes a new site access point located directly opposite the existing Boral Seaham Quarry on Italia Road. A Channelised Right Turn (CHR) treatment would be provided for right turns into the site from Italia Road. The access point would be Stop controlled, complete with all statutory line marking and signage, including Truck Warning signage. A strip of vegetation would be cleared on the north-west side of the junction to provide sufficient safe intersection sight distance in accordance with the *Austroads Guide to Road Design Part 4A: Unsignalised and Signalised Intersections* (2021).

All outbound trucks will exit the site via a left turn towards the Pacific Highway. No heavy vehicles hauling quarry products will be permitted to travel west on Italia Road past the quarry access point toward Seaham (either to or from the quarry site). At the Italia Road-Pacific Highway intersection, all heavy vehicles associated with the quarry will turn left onto the Pacific Highway. Should heavy vehicles have a destination to the south, after turning left out of Italia Road onto the Pacific Highway these vehicles would utilise the existing Tarean Road interchange (approximately 11 km to the north) to undertake a U-turn before continuing their journey south. This approach to accessing the Pacific Highway from Italia Road has the in-principle agreement of TfNSW.

As described in **Section 1.6** a separate Development Application will be lodged by Boral for an upgrade of the existing Italia Road-Pacific Highway intersection to meet TfNSW requirements. The upgrades will include an extension to the northbound deceleration lane for left turns into Italia Road, prioritisation of the right turn into Italia Road, and a northbound acceleration lane for left turns onto the Pacific Highway which will essentially remove the current merged left-turn movement with a safer downstream merge movement. As noted above, all heavy vehicles associated with the quarry will turn left onto the Pacific Highway with right turns (southbound) out of Italia Road restricted to light vehicles only.

Internal quarry access roads are shown on **Figure 1.2**. As part of the quarry development, all internal access roads would be either constructed or upgraded from their current condition to accommodate quarry vehicle traffic and to enable one-way circulation throughout the site. Road trucks will be loaded from the stockpiles using wheeled loaders prior to exiting the site via the weighbridge and wheel wash.

During operations, based on the transportation of materials using truck and dog combinations (approximate capacity of 30 tonnes) there would be an average of 334 heavy vehicle movements (167 inbound and 167 outbound) per day generated by the quarry. These heavy vehicle movements would generally be spread across the day, however during busy periods it is expected that up to 18% of the average daily movements might occur during the peak operating hours, equivalent to 30 inbound and 30 outbound movements. Light vehicle traffic would generate up to 30 vehicle movements per day, most likely 15 inbound in the AM peak and 15 outbound in the PM peak. It should also be noted, however, that Italia Road is a designated B-double route between the Pacific Highway and the site access on Italia Road. The use of B-double or semitrailer trucks would result in a reduction in heavy vehicle movements given their larger capacity.

Noting the requirements of site establishment, traffic generated during the construction phase of the Project is expected to be limited.

3.3.6 Other Infrastructure

Lockable gates and fencing will be provided on the main access road to prevent unauthorised access. Any forest tracks that access the Project Area will be closed at the Project Area boundary, modified to prevent unauthorised access and signposted accordingly. Fencing will be installed progressively around all extraction areas and modified in line with staged quarry development to ensure site security and safety. Appropriate signage will be provided to warn against unauthorised access and safety hazards associated with the quarry.

As the Project will primarily utilise mobile processing equipment, infrastructure to be established on site would be minimal, consisting of an administration office, plant and equipment workshop facility (approximately 25 m x 30 m) and 30 m fixed weighbridge. Administration buildings would initially be of demountable construction and any other fixed buildings (e.g. sheds) would be approved/certified (if required) through Port Stephens Council.

Lighting will be required in the stockpile area due to the requirement for early morning and evening product loading. Lighting will be kept to the minimum required for operational needs and safety. All lights will have shields and be directed down onto working areas to ensure that fugitive light emissions are limited in compliance with Australian Standard *AS4282 - 1997 Control of the obtrusive effects of outdoor lighting*.

Separate parking areas will be provided for light and heavy vehicles to ensure that no vehicle parking or queuing on Italia Road will occur.

3.4 Services and Utilities

The Project Area is not currently serviced by electricity, telecommunications, water or sewerage infrastructure. Electricity for the Project will initially be provided by two 420 kVA diesel generators to be located in proximity to the administration and workshop areas. Notwithstanding, ARDG has commenced the process of consulting with the relevant authorities regarding connection to the Ausgrid network, located adjacent to the Pacific Highway. Future connection to the network would provide for the most efficient operation of the quarry however solar panels and small-scale batteries may also be used to supply power to buildings.

Telecommunications would be managed through mobile network connection.

Potable water for amenities use will be supplied to the site by water tanker and stored in tanks on site. A rainwater tank will also collect roof runoff to be utilised for non-potable water demands (e.g., toilet flushing). Wastewater from the amenities will be collected in a tank and removed from the site by a licensed waste contractor as required.

Operational water requirements for the Project will include:

- dust suppression on haul roads, exposed areas and stockpiles as required
- operation of the crushing and screening plant (anticipated to be approximately 1.73 ML/year during Stage 1 and 2.70 ML/year during Stage 9).

Operational water requirements will be sourced via surface water runoff captured in the Water Management System (WMS) (refer to **Section 6.5.1.2**) and supplemented by a groundwater bore. Water balance modelling indicates that the maximum groundwater import demand could be up to approximately 134 ML/year. Further details on the proposed WMS and operational water balance are provided in **Section 6.5**.

Fuelling would be undertaken at one or more refuelling stations located on the hard stand area in the general vicinity of the workshop and truck parking areas. Equipment servicing would also be undertaken in hardstand areas. Storage areas would comprise up to 20,000 litre diesel storage tanks and a grease and oil storage area for the storage of grease drums and intermediate bulk containers (IBC) for engine oils. These storage areas, refuelling areas and equipment servicing areas would be fully bunded and fitted with oil water separators to process any petrochemical spills. All waste products would be stored within dedicated IBC that are emptied periodically by licensed waste contractors.

Mobile plant may also be refuelled using a portable diesel fuel tank mounted on the rear of a quarry service vehicle.

3.5 Hours of Operation

3.5.1 Construction Phase

The proposed construction hours will be in accordance with the *Interim Construction Noise Guidelines* (DECC, 2009) which identify standard hours for construction activities in NSW:

- Monday to Friday: 7.00 am to 6.00 pm.
- Saturday: 8.00 am to 1.00 pm.
- Sunday and Public Holidays: no work.

3.5.2 Operational Phase

The proposed hours of operation for the key quarry activities are shown in **Table 3.3.**

Table 3.3 Operational Phase Hours of Operation

Activity	Hours of Operation
Blasting	9.00 am to 5.00 pm Monday to Friday Anticipated need for 1 to 2 blasts per fortnight
Quarrying and processing	7.00 am to 6.00 pm Monday to Friday 7.00 am to 3.00 pm Saturday
Truck loading, product transport and maintenance	6.00 am to 10.00 pm Monday to Friday 7.00 am to 3.00 pm Saturdays
No operation on Sundays or Public Holidays apart from maintenance activities as required	

3.6 Workforce

3.6.1 Construction

The construction/site establishment phase of the Project is expected to run for approximately six to twelve months. During this time, the size of the construction workforce will vary depending on the construction activities being undertaken at the time, however it is anticipated to generate approximately 10–15 full time equivalent (FTE) jobs.

3.6.2 Operations

During operations, the Project will employ up to 10 FTE employees and 3–5 part time employees.

In addition, specialist contractors will also be required to complete specific maintenance tasks and to provide other specialist services to the quarry including blasting. Road transport will be undertaken by external transport companies under contract arrangements, and this is expected to generate employment for approximately 40–60 persons at full production.

3.7 Environmental Management

ARDG will develop and implement an Environmental Management Strategy (EMS) as part of the Project to provide the strategic framework for environmental management of all components of the Project. The EMS would:

- incorporate a Construction Environmental Management Plan (CEMP) and Operational Environmental Management Plan (OEMP), including all required sub-plans, protocols, management and mitigation measures proposed in this EIS
- identify all relevant statutory approvals
- establish roles, responsibilities, authority and accountability of all key personnel involved in the environmental management of the Project

- establish procedures for consulting with the local community and relevant stakeholders about the operation and environmental performance of the Project
- establish procedures for handling of complaints, disputes, non-compliances and emergency response.

Appendix 3 provides a consolidated summary of the management measures to be implemented during the construction and operation of the Project to manage, mitigate and/or monitor potential impacts identified within this EIS.

4.0 Statutory Context

The statutory provisions applying to the Project with respect to environmental assessment and planning approval at Commonwealth, State and local level, and the roles these play in the Project's assessment and determination, are outlined in **Table 4.1** below. In addition, reference tables of the relevant statutory requirements for the Project, and where these are addressed in the EIS, are provided in **Appendix 2**.

Table 4.1 Statutory Context

Category	Relevant statutory requirements
Permissibility *Port Stephens LEP 2013* and *State Environmental Planning Policy (Resources and Energy) 2021*	The Project Area is located in the Port Stephens Local Government Area and is subject to the provisions of the *Port Stephens Local Environmental Plan 2013* (2013 LEP). As noted above, the Project comprises development for the purposes of an extractive industry. The bulk of the Project Area is zoned RU3 Forestry under the 2013 LEP (refer to **Figure 2.2**). The Project also includes the construction of an intersection for the Access Road. These road works include land within the RU2 Rural Landscape zone. The 2013 LEP provides that 'uses authorised under the *Forestry Act 2012*' are permitted *without* consent on land zoned RU3. The *Forestry Act 2012* defines rock, stone, earth and gravel as 'forest material'. The taking of forest material can be carried out in accordance with a Forest Materials Licence (FML) under section 42 of the *Forestry Act 2012*. Therefore, the use of the site within the RU3 zone for the purposes of taking such forest material is permissible *without* consent under the 2013 LEP. In relation to the proposed road works for the Access Road, 'roads' and 'extractive industries' are uses permitted *with* consent in the RU2 zone under the 2013 LEP. Notwithstanding this, clause 2.9(3) of the *State Environmental Planning Policy (Resources and Energy) 2021* (Resources and Energy SEPP) also provides that development for the purpose of an extractive industry may be carried out with consent on land on which development for the purposes of agriculture is permissible (with or without consent). Use of land zoned RU3 for the purposes of 'aquaculture' is permitted with consent under the 2013 LEP. The term 'aquaculture' falls within the definition of 'agriculture', being a type of agriculture, as defined in the 2013 LEP. As the provisions of the Resources and Energy SEPP prevail to the extent of any inconsistency with the 2013 LEP (section 3.28 of the EP&A Act), it follows that use of land within the RU3 zone for the purpose of extractive industry is permissible *with* consent, requiring development consent under Part 4 of the EP&A Act. On this basis development consent for the Project is sought.
Power to grant approval ***Environmental Planning and Assessment Act 1979*** (EP&A Act) and **State Environmental Planning Policy (Planning Systems) 2021** (Planning Systems SEPP)	Section 4.36 of the EP&A Act provides for the declaration of a project as SSD. Under the EP&A Act, the declaration of a project as SSD can be made by meeting the requirements of a SEPP or by being so declared by the Minister for Planning and Public Places. Clause 7(1) of Schedule 1 of *State Environmental Planning Policy (Planning Systems) 2021* (Planning Systems SEPP) prescribes that development for the purpose of extractive industries is declared to be SSD if it extracts more than 500,000 tonnes per annum of extractive material or extracts from a resource of more than 5 million tonnes. Both of these preconditions are satisfied by the Project and accordingly the development application will be subject to the requirements of Division 4.7 of the EP&A Act. The development application will be lodged with the Planning Secretary of the Department of Planning and Environment (DPE).

Category	Relevant statutory requirements
	The consent authority for SSD projects is either the Minister for Planning and Public Places or, if certain conditions are satisfied, the NSW Independent Planning Commission (IPC). Section 4.5(a) of the EP&A Act provides that the IPC is the consent authority for SSD where it is declared to be the consent authority under an environmental planning instrument (EPI). Under clause 2.7 of the Planning Systems SEPP, the IPC is declared to be the consent authority for SSD development in the following circumstances: • where the Council of the relevant area within which the Project is proposed has objected to the development within the exhibition period; • where at least 50 submissions objecting to the development have been made within the exhibition period; or • where the applicant has made a reportable political donation under section 10.4 of the EP&A Act. ARDG has not made a reportable political donation.
Consistent approvals (section 4.42 of the EP&A Act)	***Protection of the Environment Operations Act 1997*** **(POEO Act)** An Environment Protection Licence (EPL) will be required for the operation of the Project which meets the definition of an extractive industry under clause 19(3) of Schedule 1 of the POEO Act, as it involves the extraction or processing of more than 30,000 tonnes of extractive materials per year. Section 4.42(1)(e) of the EP&A Act applies to SSD projects and requires that the granting of an EPL must not be refused if the development work or activities to be the subject of the EPL are necessary for carrying out an approved project and is to be substantially consistent with the consent. ***Roads Act 1993*** **(Roads Act)** The consent of the relevant roads authority is required under section 138 of the Roads Act for works or structures that disturb the surface of a public road or connect a road to a classified road. However, section 4.42(1)(f) of the EP&A Act applies to SSD projects and requires that a consent under section 138 of the Roads Act must not be refused, if the works are necessary for carrying out an approved project and are substantially consistent with the consent. The Project will require the establishment of site access off Italia Road and hence a consent under section 138 of the Roads Act will be required. Upgrade works at the intersection of Italia Road and the Pacific Highway will also be required and would also trigger a requirement for a section 138 consent, however these upgrade works are being undertaken via a separate Development Application as detailed in **Section 1.6**.
Commonwealth approvals	***Environment Protection and Biodiversity Conservation Act 1999*** **(EPBC Act)** Under the EPBC Act, the approval of the Commonwealth Minister for the Environment is required for any action that may have a significant impact on prescribed matters of national environmental significance (MNES). On 8 December 2022, the Project was determined to be a Controlled Action, requiring approval under the EPBC Act due to its potential impact on listed threatened species and ecological communities. The Project will therefore be assessed under the bilateral agreement between the Commonwealth and NSW Governments.
Other legislation	***Forestry Act 2012*** **(Forestry Act)** The Project is located within the Wallaroo State Forest on land managed by FCNSW. Under section 11 of the Forestry Act, FCNSW is authorised to take, or authorise the taking of forest materials from this land. Forest materials are defined in the Forestry Act as 'rock, stone, clay, shells, earth, sand, gravel or any like material'.

Category	Relevant statutory requirements
	As detailed in **Section 1.7**, ARDG has entered into a Deed of Agreement for a FML with FCNSW under section 42 of the Forestry Act. ***Water Management Act 2000* (WM Act)** The Aquifer Interference Policy (AIP) requires that, where an activity will take water from a source covered by a water sharing plan (WSP), a water access licence is required under the WM Act to account for this loss of water. The Project has been designed to remain well within the limits of the low permeability hard rock resource, thereby limiting potential for interaction with groundwater. Notwithstanding, a detailed Groundwater Impact Assessment has been prepared to meet the requirements of the AIP (refer to **Section 6.5.2** and **Appendix 10**). A Surface Water Impact Assessment has also been prepared to assess licensing requirements in relation to surface water resources (refer to **Section 6.5.1** and **Appendix 9**). Section 4.41 of the EP&A Act identifies authorisations that are not required for SSD. Under these provisions, the Project does not require a water use approval under section 89; a water management work approval under section 90; or an activity approval under section 91. ***Hunter Water Act 1991* (HW Act)** The Project Area is located within the direct hydrological catchment of the Grahamstown Dam, which forms part of the Hunter Water drinking water catchment. (refer to **Section 6.5.1** and **Appendix 9**). Section 51 of the HW Act requires the consent authority to provide notice to Hunter Water in the event that a proposed development may significantly damage or adversely affect Hunter Water's works, operations or the quality of water provided. The Project is located within the vicinity of Hunter Water infrastructures. Hunter Water has developed *Guidelines for Development in Drinking Water Catchments* (Hunter Water, 2017) to inform proponents regarding expectations for development in the Hunter Water drinking water catchment areas. The Project is not anticipated to have any material impacts on Hunter Water's works or operations, including the Neutral or Beneficial Effects test in relation to potential impacts on Water Quality (refer to **Section 6.5.1** and **Appendix 9**). ARDG has consulted with Hunter Water in respect of the Project (refer to **Section 5.2**). ***Biodiversity Conservation Act 2016* (BC Act)** Under the BC Act, biodiversity assessment in accordance with the Biodiversity Assessment Method (BAM) is required for any SSD project. The Project (as SSD) triggers the need to prepare a Biodiversity Development Assessment Report (BDAR) in accordance with the BAM which must be *considered* by the consent authority before development consent may be granted (refer to **Section 6.6** and **Appendix 11**). ***National Parks and Wildlife Act 1974* (NPW Act)** Under section 86 of the NPW Act, it is an offence to harm an Aboriginal object, except where authorised by an Aboriginal heritage impact permit issued under section 90 of the Act. As SSD, pursuant to section 4.41 of the EP&A Act, it is not necessary for the Project to obtain an Aboriginal heritage impact permit under the provisions of section 90 of NPW Act, however assessment of potential impacts on Aboriginal cultural heritage is still required and an Aboriginal Cultural Heritage Assessment (ACHA) has been completed for the Project (refer to **Section 6.7** and **Appendix 12**).

Category	Relevant statutory requirements
	Heritage Act 1977 **(Heritage Act)** An approval under Part 4 and/or an excavation permit under section 139 of the Heritage Act would typically be required for impacts to heritage items or relics. As SSD, pursuant to section 4.41 of the EP&A Act, it is not necessary for the Project to obtain such approvals, however assessment of potential impacts on heritage is still required (refer to **Section 6.8**). **Local Government Act, 1993 (LG Act)** Section 68 of the LG Act prescribes the installation of a waste treatment device or human waste storage facility as an activity that requires the prior approval of the local Council. Before an on-site sewage treatment or storage facility can be installed an application must be submitted to Port Stephens Council for assessment and determination. ***Environmentally Hazardous Chemicals Act 1985*** **(EHC Act)** Under the EHC Act a licence is required for any storage, transport or use of prescribed chemicals. The storage, transport and management of chemicals triggering this requirement is not currently proposed. Should such a licence be required under the EHC Act during the life of the Project, ARDG or the relevant contractor will obtain a licence prior to the storage, transport or use of prescribed chemicals. ***Explosives Act 2003*** **(Explosives Act)** Under the Explosives Act a licence is required for any storage of explosives. Explosives will not be stored on site and, as such, a licence for the storage of explosives is not required. The transport and management (including all licensing requirements) of all explosives used on site will be managed by the relevant contractor.
Pre-conditions (refer to Appendix 2 for details)	State Environmental Planning Policy – (Resources and Energy) 2021 Chapter 2 – Mining, Petroleum Production and Extractive Industries. State Environmental Planning Policy (Biodiversity and Conservation) 2021 – Chapter 3 Koala Habitat Protection. State Environmental Planning Policy (Resilience and Hazards) 2021 – Chapter 3 Hazardous and Offensive Development. State Environmental Planning Policy (Transport and Infrastructure) 2021 – Chapter 2 Infrastructure. The relevance of each of these SEPPs to the Project is discussed in **Appendix 2**.
Mandatory matters (refer to Appendix 3 for details)	Section 1.3 EP&A Act – Objectives of the EP&A Act. Section 4.15(1) EP&A Act – Matters for consideration by the consent authority in assessing the SSD application. Clause 192 of the EP&A Regulation – Content of an EIS.

5.0 Engagement

In recognition of the importance of early and open engagement, ARDG has been liaising with stakeholders regarding the Project since 2017. Ongoing consultation has also been undertaken with local, State and Commonwealth government agencies, infrastructure and service providers, local businesses and various community organisations and interest groups, including a comprehensive engagement process undertaken with the Aboriginal community. The stakeholder engagement process has afforded opportunities for ARDG to effectively assess and integrate consultation outcomes within the detailed Project planning, design, and assessment phases.

ARDG is committed to maintaining genuine partnerships with all stakeholders, working with the community to develop a Project that can co-exist with the local community, and communicating openly, honestly and in a transparent manner with all stakeholders. Engagement will continue to include a range of mechanisms designed to provide opportunities for the community to be involved and will be ongoing for the life of the Project.

This section provides an overview of the engagement program including stakeholder identification, engagement undertaken to date, the outcomes of the consultation process and proposed future engagement. Further detail is provided in the Social Impact Assessment (SIA) (refer to **Appendix 15**).

5.1 Stakeholder Identification

Effective engagement involves the participation and collaboration of all stakeholders who have an interest in, or those that are affected by, a project. Stakeholders may include affected groups or individuals that:

- live, work, or recreate near the Project
- have an interest in the proposed action or change
- use or value a resource associated with the Project
- are affected by the Project.

A stakeholder identification process was undertaken during the scoping phase of the Project to support the planning and delivery of community consultation and stakeholder engagement. Key stakeholders identified during this process are listed in **Table 5.1**.

Table 5.1 Stakeholder Identification

Stakeholder Group	Stakeholders
Near Neighbours	Residents of Italia Road, East Seaham (southeast of Caswells Creek) Residents of Nine Mile Creek Road, Ferodale
Wider Community	Residents of the state suburbs of Balickera, East Seaham, Eagleton and Ferodale
Aboriginal Groups	Worimi Local Aboriginal Land Council, Registered Aboriginal Parties

Stakeholder Group	Stakeholders
Local Businesses	Local businesses within 2 km of the Project site: • Boral Seaham Quarry • Port Stephens Gardenland • MG Car Club • Hunter Valley Paintball • MX Central – Motor Cross • Ringwood Park Motorsport Complex/Circuit Italia. Other interested local businesses in East Seaham, Ferodale and Eagleton
Service Providers	Seaham Rural Fire Service Essential Energy Hunter Water Corporation
Local Government	Port Stephens Council (PSC)
State Government	Department of Planning and Environment (DPE) Forestry Corporation of NSW (FCNSW) DPE-Resource Regulator Environment Protection Authority (EPA) Department of Primary Industries (DPI) – Water Transport for NSW (TfNSW) Other Government agencies (as required)
Commonwealth Government	Department of Environment, Energy, Climate Change and Water (DEECCW)
Employees	ARDG employees Contractors

5.2 Agency Consultation

A summary of the Government agency and authority consultation undertaken to date is included in **Table 5.2**. Consultation with Government agencies has been undertaken through various mechanisms throughout the assessment process to keep agencies informed of progress and outcomes of the Project.

No significant issues were raised during consultation with any of the Agencies or Authorities, however, guidance was provided on matters to be assessed in this EIS. Consultation included Project briefings, discussion of the scope of the specialist assessments and SEARs requirements and reporting of results of the specialist assessments.

Table 5.2 Summary of Consultation with Agencies and Authorities

Agency/Authority	Consultation	Comment
PSC	16/04/2019	Meeting – General Project briefing / site access at Italia Road
	29/01/2020	Meeting – Project briefing
	1/06/2022	Meeting – Traffic Engineering Briefing to inform design (site access at Italia Road)
	26/10/2022	Email Correspondence Community information Sheet No. 3
	23/11/2022	Project update briefing prior to lodgement of EIS – key comments re: traffic
	29/11/2022	Pre-lodgement meeting to confirm Council contribution requirements
PSC and TfNSW	25/11/2022	Pre-lodgement meeting for Development Application for Pacific Highway/Italia Road Intersection
Hunter Water	21/11/2022	Meeting - Project update / Site Water Balance presentation and discussion re: NorBE requirements
Hunter Water	1/12/2022	Meeting – Site Water Balance update
TfNSW	18/12/2017	Meeting – Project briefing and Pacific Highway / Italia Road intersection
	5/06/2018	Meetings – Pacific Highway / Italia Road intersection solution
	30/10/2018	
	29/03/2019	
	22/07/2019	
	29/08/2019	
	2/07/2020	
	1/10/2020	
	18/01/2021	
	18/08/2021	
TfNSW/DPE/FCNSW	27/08/2021	Meeting – Pacific Highway / Italia Road intersection proposal
TfNSW	5/10/2021	Meetings – Pacific Highway / Italia Road intersection solution
	26/10/2021	
	6/12/2021	
	22/02/2022	
	20/01/2023	
BCD	27/09/2022	Meeting – Present Biodiversity survey results and project overview
DCCEEW	6/09/2022	Meeting – Project briefing for EPBC referral
EPA	26/10/2022	Email – meeting request, EPA declined via email

Agency/Authority	Consultation	Comment
DPE	9/10/2018	Meeting – Project Scoping / pre SEARS Meeting
	17/09/2021	Meeting – Update on Pacific Highway / Italia Road intersection
	21/01/2021	Meeting – Update on Pacific Highway / Italia Road intersection
	13/12/2021	Meetings – Project updates and discussion re approach
	9/02/2022	
	19/10/2022	
	14/12/2022	
	18/01/2023	
DPE, FCNSW and [then] RMS [now TfNSW]	21/03/2019	Meeting – discuss safety issues associated with Pacific Highway/Italia Road intersection
DPE Water	2/09/2022	Meeting – present groundwater assessment method/results review
Department of Regional NSW/ DPE / TfNSW	25/11/2020	Meeting – Pacific Highway/Italia Road intersection Proposal
Department of Regional NSW (Geological Survey of NSW)	Jun-20	Phone call – project briefing (phone meeting with Paul Dale)
Mining, Exploration and Geoscience (Geological Survey of NSW)	26/10/2022	Email – meeting request, no response received

5.3 Stakeholder Engagement

5.3.1 Methodology

Stakeholder and community engagement has been undertaken in accordance with the requirements of NSW Government guidelines and assessment standards including, but not limited to, the *Undertaking Engagement Guidelines for State Significant Projects* (DPIE, 2021a) (Engagement Guideline), and the *Social Impact Assessment Guideline for State Significant Projects* (DPIE, 2023) (SIA Guideline), while also addressing the requirements of the SEARs.

The engagement of stakeholders and community groups has included a combination of:

- consultation and engagement to facilitate stakeholder involvement in the identification of issues/impacts, areas of interest/concern and strategies to address the issues raised
- information provision to improve knowledge and awareness of ARDG and its activities, the Project, and key issues/impacts as they arise.

Various methods were used to engage with the different stakeholder groups based on the type of information being conveyed, level of feedback required, understanding of the stakeholder needs regarding engagement and identified stakeholder engagement preferences. This included a range of mechanisms and materials such as website content, media releases, project information sheets, community information sessions, personal interviews and meetings and feedback forms.

Engagement to date has been undertaken in two phases, aligned with the key stages of the assessment process, i.e., during the project scoping phase to allow for the identification of key issues related to the Project and potential impacts, and during the environmental assessment phase to inform the technical studies and the formulation of appropriate strategies to seek to further minimise the environment and community impacts. A Stakeholder Engagement Strategy (SES) was prepared in January 2020, prior to the submission of the Scoping Report and the issuing of the SEARs. The SES outlined the objectives, approach, and implementation program for engaging and consulting with the community and stakeholders during the Project's planning and assessment phase. The mechanisms used to engage with local landholders, key stakeholders and the wider community during the two consultation phases are defined in **Table 5.3**.

Table 5.3 Project Engagement Mechanisms – Scoping Phase

Mechanism	Targeted Stakeholder	Description	First Round of Consultation (scoping)	Second Round of Consultation (SIA / EIS phase)
Community Information Sheets	Near Neighbours Businesses Broader Community	Community information sheet detailing the proposed Project and contact details for the project team. Delivered to mailboxes of near neighbours and business stakeholders. Three businesses received the Community information sheet via email communications.	**No. 1** – Project overview, overview of the assessment process and invitation to participate in the SIA. Distributed in February 2020. Information sheet distributed to 19 neighbouring households.	**No. 2** – Provide a Project update and validate the feedback received from community received during the scoping phase. Distributed in August 2022. **No. 3** – Provide a Project update and disseminate key findings from the technical assessment studies. Overview of the assessment process and invitation to participate in the SIA. Distributed in October 2022.
Door Knocking	Near Neighbours	Door knocks undertaken to inform near neighbours of the Project and invite them to participate in a SIA personal interview.	19 households	Two follow up phone calls received from community members following Community Information Session held on 2 November 2022.
Telephone calls to invite participants to participate in personal interviews	Near Neighbours	Proactive contact with landholders/residents (where contact details were available). Scheduling of personal interviews (face-to-face or telephone) according to stakeholder preference. Individual meetings held in person or via telephone, utilising a semi-structured interview guide/questionnaire (refer to **Appendix 15**).	Follow up phone calls completed with households who were unavailable at the door knocking. Six (6) surveys completed over the telephone.	Follow up phone calls completed with near neighbours (19 near neighbours). Near neighbours were also notified of the Community Information Session and Information Sheet 3 at this time.
Personal Meetings and Project Briefings	Federal Government Local Government State Government	Targeted meetings and briefings with key local and state government agencies as required	Project briefings were held, including: DPE Hunter Water Port Stephens Council TFNSW	Project briefings were held, including: DPE DCCEEW Hunter Water Port Stephens Council TFNSW

Mechanism	Targeted Stakeholder	Description	First Round of Consultation (scoping)	Second Round of Consultation (SIA / EIS phase)
			FCNSW	FCNSW BCD DPE Water
Project phone number/email	Broader Community	ARDG have a dedicated project phone number and email address to enable community members to obtain information and/or provide feedback on the project.		Four phone calls with members of the community. Six email interactions with members of the community.
Community Information Session (Drop-in Session)	Broader community Community groups Local businesses and service providers	Multi-hour time period when stakeholders can drop in to speak to the Project team and experts, view documents and plans and ask questions.	Not held due to COVID-19 restrictions.	One session held at Seaham School of Arts Hall on 2 November 2022 between 3.00 pm and 6.00 pm to summarise the draft results of the technical studies and seek input into the SIA. Twenty (20) stakeholders attended the session. Surveys were made available for attendees to complete as this session with many taking away surveys / link to online survey for this purpose but choosing not to complete.
Online Survey	Broader Community	Online or offline surveys to validate social impacts and mitigation measures, obtain input and feedback on Project decision-making, as well as specific information about the needs, desires and impacts on stakeholders related to the Project. A link to an online survey was included in Community Information Sheet No. 3.	Not held at scoping phase.	4 completed online surveys. (9 commenced but not completed).
Community Consultative Committee (CCC)	CCC Members	CCC established and to undertake ongoing meetings to discuss and monitor social impacts.	Not required at scoping phase.	First meeting held 23 February 2023. Meeting Chair determined that meetings to be held on a quarterly basis.

5.4 Key Community Issues

Quantitative and qualitative information collected through the scoping phase engagement process was analysed to inform the preliminary analysis of perceived social impacts (both negative and positive) associated with the Project.

Traffic impacts were the most frequently raised negative issue, and primarily related to traffic safety as a result of increased traffic movements and individual property access. Social amenity concerns including noise and dust were also frequently raised, followed by health and wellbeing impacts, personal and property rights, impacts on surface and ground water and ecological (flora and fauna) impacts. One near neighbour did not express any concerns with the Project.

Employment was raised most frequently as a potential benefit of the Project, with one business owner suggesting that the Project may result in an improved intersection on the Pacific Highway and Italia Road. Regional benefits relating to employment and procurement and the opportunities associated with extraction of quarry materials for infrastructure development were also noted.

During the second round of engagement in the EIS phase, the key points of concern raised were the potential for the Project to cause impacts on local road conditions, (in particular, deterioration in road safety conditions at the Pacific Highway/Italia Road intersection), biodiversity impacts and social amenity impacts (noise, air quality and water). In relation to the benefits of the Project procurement and employment opportunities were seen as the key benefits. There was also recognition of the improvements to the Italia Road and Pacific Highway intersection that will result from the associated upgrade words [2].

Further detail and analysis of the perceived social impacts is provided in Section 4 of the SIA, refer to **Appendix 15**.

5.5 Ongoing Engagement

This EIS will be publicly exhibited by the DPE in accordance with the requirements of the EP&A Act and community members will be provided an opportunity to formally comment on the development applications though this formal consultation processes.

Throughout the following assessment period and, if approved, construction and operational phases of the Project, ARDG will continue to engage with community stakeholders. Stakeholders will include all relevant groups and individuals outlined in **Section 5.2**, plus any additional stakeholders identified during the development process.

Engagement activities will include:

- regular updates to the Project website
- distribution of information sheets, fact sheets and/or FAQs to the local community (as required)

[2] Subject to a separate DA process.

- face-to-face meetings and Project briefings
- regular community surveys
- operation of a community enquiry line/complaints line and the provision of timely responses to feedback, enquiries and complaints
- ongoing meetings with the CCC.

Opportunities for continued stakeholder consultation in relation to ongoing rehabilitation and closure planning will include, but not be limited to, the following:

- ongoing meetings with the CCC
- periodic review and revision of the quarry Biodiversity Rehabilitation and Management Plan (BRMP)
- submission of annual reporting documents
- ongoing meetings with government and community stakeholders
- development of a conceptual and subsequently a detailed Quarry Closure Plan.

6.0 Assessment and Mitigation of Impacts

6.1 Preliminary Environmental Risk Analysis

Following on from the scoping process, the identification of key environmental and community issues to be considered in this EIS was refined based on:

- the environmental and strategic context for the locality (refer to **Section 2.0** and **Section 4.0**)
- outcomes of the stakeholder engagement process
- the SEARs for the Project (refer to **Appendix 1**)
- specialist assessments completed as part of the preparation of this EIS
- a risk analysis of potential environmental and social impacts.

The preliminary environmental risk analysis undertaken for the scoping phase identified a range of key issues requiring further detailed assessment as part of the EIS process:

- Noise and vibration – The Project has the potential to cause noise and vibration impacts for surrounding residents during construction, operations and transportation, and an assessment of cumulative noise impacts was also undertaken (refer to **Section 6.2**).
- Blasting – The use of explosives during the quarrying process has the potential to impact sensitive receptors including private residences, buildings, heritage sites, animals and significant natural features (refer to **Section 6.3**).
- Air quality – The assessment of potential air quality impacts associated with the Project focused on dust emissions but also included consideration of diesel exhaust emissions, NO_2 emissions from blasting, impacts from associated road transport activities and the effects of crystalline silica (refer to **Section 6.4**).
- Water – Changes to the landform of the Project Area have the potential to result in impacts to water resources (both surface water and groundwater) including changes to flow regimes, water quality and water availability. Additionally, the location of the Project Area within the gazetted Grahamstown Dam Drinking Water Special Area requires the demonstration of a 'Neutral of Beneficial Effect' (NorBE) on water quality (refer to **Section 6.5**).
- Biodiversity - The Project will result in direct impacts to native vegetation and potential loss of habitat for native species, and therefore requires assessment under the NSW Biodiversity Assessment Method (BAM) (refer to **Section 6.6**).
- Traffic and transport – Increase in road traffic (particularly heavy vehicles) resulting from the Project will have an impact on the local road network, including the performance of the key local intersection of Italia Road and the Pacific Highway (refer to **Section 6.9**).
- Social – The Project has the potential to result in both positive and negative impacts for the community (refer to **Section 6.14**).

Other issues deemed as requiring a standard level of assessment included heritage, land resources, waste management, hazards, visual amenity, economics and rehabilitation.

Assessments for each of the identified environmental and social aspects are provided throughout the remainder of **Section 6.0**.

6.2 Noise and Vibration

A Noise Impact Assessment (NIA) has been prepared by Umwelt to address the noise and vibration impacts associated with the construction, operation and transportation phases of the Project. Consistent with the requirements of the SEARs, the NIA has been prepared in accordance with the following policies and guidelines:

- Interim Construction Noise Guideline (ICNG) (DECC, 2009).
- Noise Policy for Industry (NPfI) (EPA, 2017).
- NSW Road Noise Policy (RNP) (DECCW, 2011).
- Assessing Vibration: A Technical Guideline (DEC, 2006).
- Australian Standard 1055-2018 Acoustics – Description and measurement of environmental noise (Standards Australia, 2018).
- Voluntary Land Acquisition and Mitigation Policy for State Significant Mining, Petroleum and Extractive Industry Developments (VLAMP) (NSW Government, 2018).

The NIA has also considered and addressed specific advice accompanying the SEARs from the NSW Environment Protection Authority (EPA), TfNSW and Port Stephens Council in relation to noise.

A summary of the NIA, including existing noise environment, assessment criteria and methodology, assessment results and proposed noise mitigation and management measures is provided in this section with the full report provided in **Appendix 5**.

6.2.1 Existing Environment

The Project is located within a rural environment with typically low background noise levels. Existing noise sources include local road traffic, traffic on the Pacific Highway, agricultural activities and industrial contributions from Boral Seaham Quarry and Ringwood Park Motorsport Complex. The Circuit Italia motorway (currently under construction) would also be expected to contribute to background conditions once operational.

A review of land ownership and receiver locations in proximity to the Project Area was undertaken using aerial imagery. The closest residential receivers are located on Italia Road at Balickera, approximately 400–1,100 m from the Disturbance Area. Residential receivers surrounding the Project Area were grouped into Noise Assessment Groups (NAGs) which were determined based on areas of similar background noise levels. This process assists with the assessment and allocation of the appropriate Project Noise Trigger Levels (PNTL) or Noise Management Levels (NML) for each receiver (refer to **Figure 6.1**).

Existing noise levels in the area surrounding the Project were determined by background noise monitoring. Unattended long-term noise monitoring was carried out over 10 days and supplemented with attended noise monitoring for short time periods at the three closest residential receiver locations shown in **Figure 6.1**. The monitoring locations were selected to be representative of the potentially affected residential noise receivers within the respective NAGs. Background monitoring at industrial/recreational receiver locations (e.g., Boral Seaham Quarry (R26) and the Ringwood Park Motorsport Complex (R25)) was not considered to be warranted given the nature of occupation at those sites and the noise generation nature of development permitted at those sites.

At all monitoring locations, the measured background noise levels were considered typical of those of a rural environment with natural noise sources and transportation noise contributions associated with Italia Road and the Pacific Highway.

6.2.2 Assessment Criteria

6.2.2.1 Construction Noise

The EPA recognises that construction activities potentially generate higher noise levels than those of an industrial operation. The ICNG provides noise management criteria for construction activities which are intended to guide the need for, and selection of, feasible and reasonable work practices to minimise construction noise impacts.

Noise Management Levels (NML) for the assessment of construction noise were determined based on the measured background noise levels (or Rating Background Levels (RBL) for each NAG and non-residential receiver types (refer to Section 3.2 of the NIA in **Appendix 5** for further detail). The resulting NML ($L_{Aeq,15min}$) for the assessment of construction noise for residential receivers are shown in **Table 6.1**.

Table 6.1 Construction Noise Management Levels for Residential Receivers

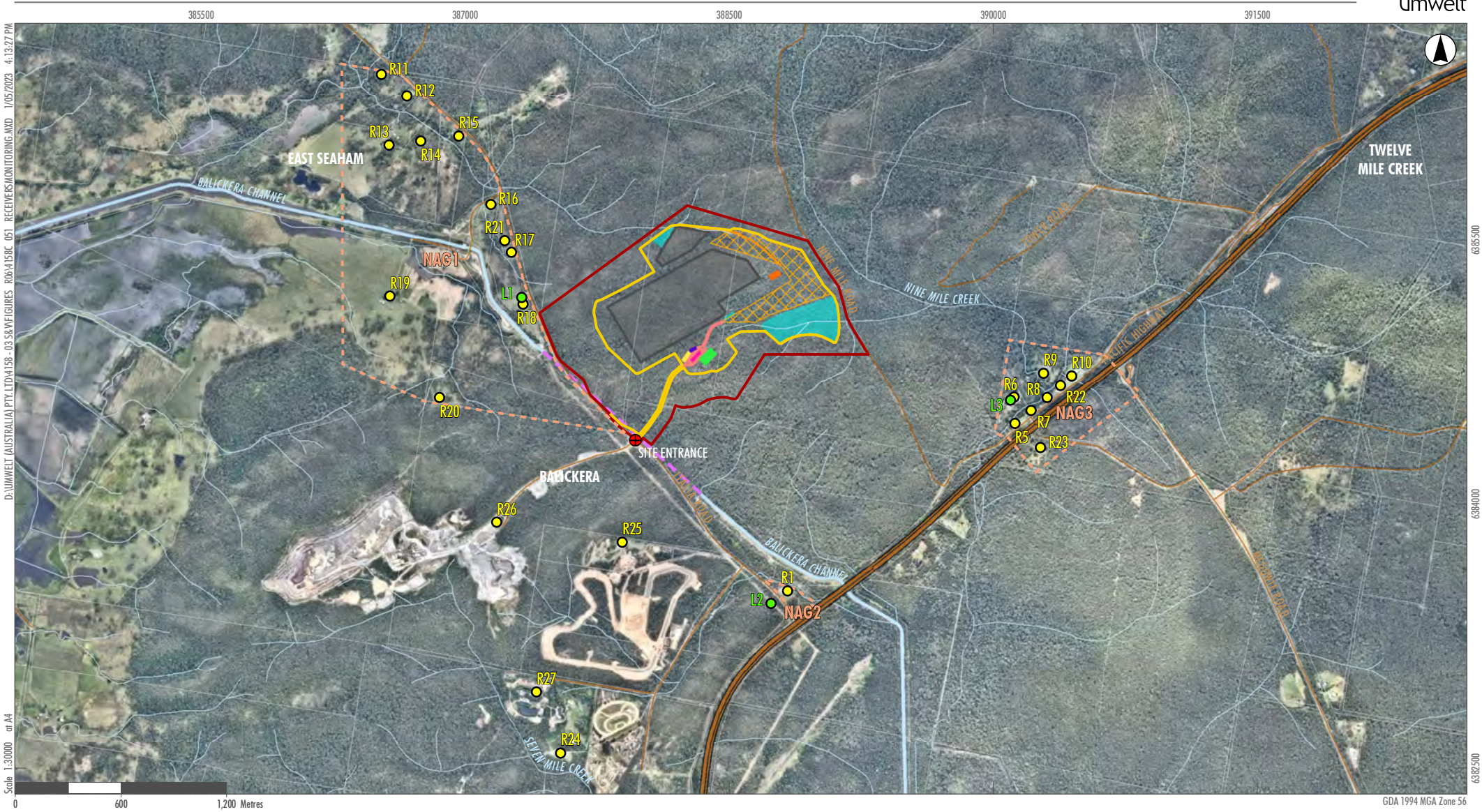
NAG	RBL (day/evening/night)	Recommended Standard Hours [1]		Outside Recommended Standard Hours
		RBL + 10	Highly noise affected	RBL + 5
NAG 1	35/31/30	45	75	36/35
NAG 2	50/49/39	60	75	54/44
NAG 3	50/49/42	60	75	54/47

Note: [1] Recommended Standard Hours: Monday to Friday 7.00 am–6.00 pm; Saturday 8.00 am–1.00 pm; No work on Sundays or Public Holidays.

Construction noise management levels for sensitive land uses (other than residences) are shown in **Table 6.2**.

Table 6.2 Construction Noise Management Levels for Sensitive Land Uses (Other Than Residences)

Land use	Management level, $L_{Aeq(15min)}$ (applies when properties are being used)
Active recreation – Hunter Valley Paintball	External noise level 65 dB(A)
Commercial – Ringwood Park Motorsport Complex	External noise level 70 dB(A)
Industrial – Boral and Eagleton Quarry	External noise level 75 dB(A)



Legend

- Project Area
- Disturbance Area
- Pacific Highway
- Road
- Balickera Tunnel
- Drainage Line
- Lot Boundaries
- Noise Assessment Groups
- Noise Monitor Locations
- Sensitive Receivers
- Pit Outlines (Stage 9)
- Office
- Weighbridge
- Northern Haul Road
- Workshop
- Truck Parking
- Light Vehicle Parking
- Access Road
- Stockpile and Plant Area
- Dams

Image Source: Nearmap (2022) Data source: NSW FSDF (2022)

FIGURE 6.1

Noise Receivers and Monitoring Locations

6.2.2.2 Operational Noise

The operational noise criteria applicable to the Project have been derived in accordance with the NPfI, based on measured background noise levels.

The NPfI sets out two noise criteria to assess the potential noise impacts resulting from industrial activity. The first is used to control short-term intrusive noise and its impacts on residences, while the second is used to protect against cumulative noise impacts and maintain noise level amenity for particular land uses including residences.

The Project Noise Trigger Levels (PNTLs) derived in accordance with the NPfI are the lower (that is, the more stringent) values of the Project Intrusiveness Noise Level (PINL) and Project Amenity Noise Level (PANL) in terms of $L_{Aeq,15\ min}$ noise levels. Applying the more stringent of the two as the PNTL ensures that intrusive noise is limited, and amenity is protected and that no single industry can unacceptably change the noise level of an area.

The PNTLs provide a benchmark or objective for assessing a proposal or site. The PNTL is a level that, if exceeded, would indicate a potential noise impact on the community, and so 'trigger' a management response, for example, further investigation of mitigation measures.

The PNTL, feasible and reasonable mitigation, and consideration of residual noise impacts are used together to assess noise impact and manage the noise from a proposal or site. The PNTLs for the different receivers assessed are shown in **Table 6.3**.

Table 6.3 Project Noise Trigger Levels, $L_{Aeq,15min}$ (dB(A))

Receiver	Period [1]	PINL [3]	PANL	PNTL [4]
NAG 1	Day	40	48	**40**
	Evening	36	43	**36**
	Night	35	38	**35**
	Morning shoulder [2]	40	43	**40**
NAG 2	Day	55	53	**53**
	Evening	54	46	**46**
	Night	44	43	**43**
	Morning shoulder	47	48	**47**
NAG 3	Day	55	53	**53**
	Evening	54	44	**44**
	Night	47	42	**42**
	Morning shoulder	47	48	**47**
R24	When in use	-	53	**53**
R25	When in use	-	63	**63**
R26 and R27	When in use	-	68	**68**

Notes: [1] Day period is 7.00 am–6.00 pm Monday-Saturday and 8.00 am–6.00 pm Sunday and Public Holidays; evening period is 6.00 pm–10.00 pm and night period is 10.00 pm to commencement of morning shoulder or day period. Morning shoulder period is 6.00 am–7.00 am Monday-Saturday and 7.00 am–8.00 am Sunday and Public Holidays.

[2] *The shoulder period has been established as the background noise levels are steadily rising during these early morning hours. The objectives have been based upon the established intrusiveness and amenity noise levels.*

[3] *PINL not applicable for non-residential receivers.*

[4] *PNTL is only applicable for non-residential receivers when the receiver is in use.*

The *Voluntary Land Acquisition and Mitigation Policy for State Significant Mining, Petroleum and Extractive Industry Developments* (NSW Government, 2018) (VLAMP) describes the NSW Government's policy for voluntary mitigation and land acquisition to address noise impacts from State significant mining, petroleum and extractive industry developments. Where the noise impacts cannot achieve the PNTL, both the NPfI and VLAMP provide guidelines for the assessment of the residual noise impacts.

The potential for sleep disturbance from maximum noise level events from the Project during the night-time period also needs to be considered. The Project is not proposed to operate during the night-time period, so potential sleep disturbance impacts are only relevant to the morning shoulder period (between 6.00 am and 7.00 am). Noise sources that could lead to sleep disturbance are typically transient noise. No rock excavation or processing activities will occur during the morning shoulder period. Sleep disturbance assessment levels for each NAG are provided in **Table 6.4**.

Table 6.4 Sleep Disturbance Assessment Levels

NAG	Assessment Level	
	LAeq,15min	LAFmax
NAG 1	40 [1]	52 [2]
NAG 2	47 (42 +5)	57 (42 +15)
NAG 3	47 (42 +5)	57 (42 +15)

Notes: [1] As per NPfI Section 2.5, minimum sleep disturbance assessment level is the greater of LAeq, 15minute 40 dB(A) or RBL + 5dB. In this case RBL + 5 is lower than 40 dB.

[2] As per NPfI Section 2.5, minimum sleep disturbance assessment level is the greater of LAFMax 52 dB(A) or RBL + 15dB. In this case RBL + 15 is lower than 52 dB.

6.2.2.3 Road Traffic Noise

The RNP sets out criteria for road traffic noise through the provision of a framework that addresses traffic noise issues associated with new developments, new or upgraded road developments, or planned building developments.

The primary road haul route to and from the quarry will be via Italia Road and the Pacific Highway, noting the proponent's commitment that no quarry trucks will travel to or from the quarry north along Italia Road past the site entrance point towards Seaham. **Table 6.5** outlines the road traffic noise criteria for residential land uses along the primary road haul route. Under the road category definitions provided in the RNP, Italia Road is classified as a sub-arterial road.

Table 6.5 Road Traffic Noise Assessment Criteria for Residential Land Uses

Road Category	Type of Project/Land Use	Assessment Criteria dB(A)	
		Day (7.00 am to 10.00 pm)	Night (10.00 pm to 7.00 am)
Freeway/arterial/ sub-arterial road	Existing residences affected by additional traffic on existing freeways/arterial/sub-arterial roads generated by land use developments	L_{Aeq}, (15 hour) 60 (external)	L_{Aeq}, (9 hour) 55 (external)

6.2.2.4 Cumulative Noise

The other industries in the local area that have the potential to contribute to noise levels include Ringwood Park Motorsport Complex, Boral Seaham Quarry, Eagleton Quarry (proposed) and Circuit Italia (under construction) all of which are all located on the western side of Italia Road. Operational noise from Hunter Valley Paintball, which is located approximately 1.5 km south-west of Italia Road, is expected to be negligible.

As specified in the NPfI, the recommended amenity noise levels represent the objective for total industrial noise at a receiver location, whereas the PANL represents the objective for noise from a single industrial development at a receiver location. For this Project, adopting a PANL that is 5 dB below the recommended amenity noise level ensures that industrial noise levels from up to three or four industrial noise sources (as is the case for this Project) remain within the recommended amenity noise level for an area.

For NAG 2 and NAG 3, for the periods controlled by high traffic noise an adjustment of 15 dB lower than the road traffic L_{Aeq} was applied. No further reduction is required, as this already allows for cumulative noise from three or four industrial noise sources. In accordance with the NPfI, predicted compliance with the established PANL will consequently address cumulative noise. The cumulative noise limits are provided below in **Table 6.6**.

Table 6.6 Cumulative noise criteria – $L_{Aeq(15min)}$, dB(A)

NAG	Period [1]	PANL or Cumulative noise criteria
NAG 1	Day	48
	Evening	43
	Night	38
	Morning shoulder	43 [2]
NAG 2	Day	53
	Evening	46
	Night	43
	Morning shoulder	48 [2]
NAG 3	Day	53
	Evening	44
	Night	42
	Morning shoulder	48 [2]

NAG	Period [1]	PANL or Cumulative noise criteria
R24 - Hunter Valley Paintball	When in use	53
R25 – Ringwood Park Motor Complex	When in use	63
R26 – Boral Quarry R27 – Eagleton Quarry	When in use	68

Notes: *[1] Day period is 7.00 am–6.00 pm Monday-Saturday and 8.00 am–6.00 pm Sunday and Public Holidays, evening period is 6.00 pm–10.00 pm and night period is 10.00 pm to commencement of morning shoulder or day period. Shoulder period is 6:00 am–7:00 am Monday-Saturday and 7:00 am–8.00 am Sunday and Public Holidays.*

[2] Whilst shoulder period PNTL in accordance with NPfI Section A3 is assigned based upon the intrusiveness noise level only, for cumulative noise criteria, it has been adopted as the midpoint between day and night period PANL.

6.2.2.5 Vibration

Due to the large separation distances between the Project Area and the nearest affected receivers (greater than 320 m), potential structural damage and human annoyance from vibration-inducing operational and construction equipment/activities is anticipated to be negligible and is not addressed further in the NIA. A separate Blast Impact Assessment has been prepared to address potential blasting impacts (refer to **Section 6.3**).

6.2.3 Methodology

Construction and operational noise levels were predicted using the CadnaA (Version 2021 MR 2) proprietary environmental noise modelling software package, using the CONCAWE noise calculation methodology.

Construction noise levels were predicted for seven different construction scenarios (refer to **Section 6.2.4.1** below).

The operational noise assessment was undertaken by modelling a scenario representative of reasonable worst-case noise emissions from quarry operations during four stages: Stages 0, 1, 5 and 9. Noise predictions were undertaken for the day, morning shoulder and evening periods and incorporated the noise control and mitigation measures committed to by ARDG (refer to **Section 6.2.5**). In accordance with the NPfI, the modelling incorporated both standard and noise-enhancing meteorological conditions into the noise predictions.

Road traffic noise calculations were performed with CadnaA (Version 2021 MR 2), using the Calculation of Road Traffic Noise (CoRTN) algorithms. The traffic noise impacts were assessed based on existing traffic volume data measured in 2022 for the Traffic Impact Assessment undertaken for the Project (refer to **Section 6.9**).

6.2.4 Impact Assessment

6.2.4.1 Construction Noise Assessment

Construction noise levels were predicted for each of the following construction scenarios under standard meteorological conditions:

- Scenario 1 – Italia Road site entrance/intersection.
- Scenario 2 – Site access road – Italia Rd to weighbridge area.
- Scenario 3 – Office/weighbridge pad and assembly of buildings.
- Scenario 4 – Site access road – weighbridge area to pit.
- Scenario 5 – Stockpile area.
- Scenario 6 – Northern haul road.
- Scenario 7 – Initial Stage 1 pit stripping.

The predictions are considered conservative as they assume all equipment associated with each scenario is operating simultaneously and equipment is spread throughout the specific works area, both of which are unlikely to occur. An additional worst-case scenario (Scenario 8) was modelled based on all construction stages occurring concurrently. While some aspects of each stage may occur simultaneously through the progression of the construction program, this scenario is considered very conservative and is unlikely to occur.

Results from each construction scenario are predicted to comply with the daytime (standard hours) noise management level at all receivers (refer to **Table 6.7** and Figure 5.1 of **Appendix 5**). Nevertheless, ARDG will adopt feasible and reasonable noise mitigation and management strategies to minimise construction noise as much as possible in accordance with best practice.

Table 6.7 Predicted Construction Noise Levels (Standard Hours), dB(A)

Receiver	NAG	NML	Construction Scenario							
			1	2	3	4	5	6	7	8
R1	NAG 2	60	26	25	25	20	<20	<20	23	32
R5	NAG 3	60	<20	<20	24	24	30	25	31	35
R6	NAG 3	60	<20	<20	27	26	31	27	30	36
R7	NAG 3	60	<20	<20	25	25	30	26	27	34
R8	NAG 3	60	<20	<20	26	25	30	26	28	35
R9	NAG 3	60	<20	<20	27	26	36	31	30	38
R10	NAG 3	60	<20	<20	26	25	34	30	29	37
R11	NAG 1	45	<20	<20	<20	<20	<20	20	25	27
R12	NAG 1	45	<20	<20	<20	<20	<20	23	27	29
R13	NAG 1	45	<20	<20	<20	<20	<20	25	28	30

Receiver	NAG	NML	Construction Scenario							
			1	2	3	4	5	6	7	8
R14	NAG 1	45	<20	<20	<20	<20	21	27	33	34
R15	NAG 1	45	<20	<20	<20	<20	21	27	31	33
R16	NAG 1	45	<20	<20	<20	<20	21	31	36	37
R17	NAG 1	45	22	<20	<20	<20	20	31	35	37
R18	NAG 1	45	26	23	20	<20	<20	30	36	37
R19	NAG 1	45	21	20	<20	<20	<20	28	32	34
R20	NAG 1	45	22	22	24	<20	<20	<20	24	30
R21	NAG 1	45	21	<20	<20	<20	20	31	36	38
R22	NAG 3	60	<20	<20	26	26	32	28	29	36
R23	NAG 3	60	<20	<20	25	25	34	28	29	37
R24	-	65	<20	<20	<20	<20	<20	<20	<20	24
R25	-	70	32	31	29	24	21	<20	26	36
R26	-	75	36	39	37	27	24	<20	31	43
R27	-	75	<20	20	20	<20	<20	<20	<20	26

6.2.4.2 Operational Noise Assessment

The operational noise assessment was undertaken by modelling a scenario representative of reasonable worst-case noise emissions from quarry operations during four stages: Stages 0, 1, 5 and 9. These stages were chosen as they had the greatest potential to cause impact and cover the progression of the life of operations (i.e., production progressively increasing as the extraction area expands and deepens) and are consistent with the modelling undertaken as part of the Air Quality and Greenhouse Gas Assessment (refer to **Section 6.4** and **Appendix 8**).

Noise predictions were undertaken for the day, morning shoulder and evening periods and incorporated the noise control and mitigation measures described below in **Section 6.2.5**. A full list of plant and equipment and sound power levels modelled for each scenario is provided in Table 4.1 of the NIA in **Appendix 5**.

Meteorological analysis concluded that the following noise-enhancing meteorological conditions are a significant feature of the area (i.e., occur for more than 30% of the time):

- wind speeds up to 3 m/s during the night-time period
- atmospheric stability class condition 'F' during the evening and night-time periods in winter months.

In accordance with the NPfI, the noise assessment incorporated these noise-enhancing meteorological conditions into the noise predictions for the night-time period. Additionally, noise predictions were also undertaken assuming standard meteorological conditions (i.e., calm winds, atmospheric stability class 'D') during the day, evening and night-time periods, to include the possible case where this meteorological condition may constitute the worst-case condition at some receivers.

Daytime (7.00 am to 6.00 pm) noise contours for each modelled stage under standard meteorological conditions are presented in **Figure 6.2** to **Figure 6.5**. The operational noise levels are predicted to comply with the daytime PNTLs at all sensitive receivers under standard meteorological conditions.

Modelling was also undertaken for Stages 1, 5 and 9 during the morning shoulder period (6.00 am to 7.00 am) and evening period (6.00 pm and 10.00 pm), to assess the impact of the loading and movement of up to 30 road registered trucks per hour. The noise levels at each receiver are presented in Table 4.4 of **Appendix 5** and are predicted to comply with the morning shoulder and evening PNTLs at all sensitive receivers under both standard and noise-enhancing meteorological conditions.

As operational noise levels are predicted to comply with the established PNTLs at all sensitive receivers, the VLAMP guidance is not considered applicable for the Project. Furthermore, the assessment has found that the Project would not trigger any of the voluntary mitigation rights conditions.

The quarry is not proposed to operate during the night-time, so potential sleep disturbance impacts are only relevant to the morning shoulder period. Sleep disturbance events were modelled during the morning shoulder period under both standard and noise-enhancing meteorological conditions for the following specific activities:

- loading of product trucks using front end loader (L_{Amax} 126 dB(A)) at the processing area
- product truck air brake release and acceleration (L_{Amax} 116 dB(A)) at the processing area, the weighbridge and at the site entrance when leaving site.

The maximum noise level at all the receivers was predicted to be L_{Amax} 37 dB(A) at receiver R9 (located within NAG 3), which is significantly less than sleep disturbance L_{Amax} criteria of 52 dB (NAG 1) and 57 dB (NAG 2 and NAG 3). Accordingly, the Project is predicted to comply with the sleep disturbance criteria at all receivers under both standard and noise-enhancing meteorological conditions. As the standard LAmax sleep disturbance screening criteria of 52 dB is set based on a level of impact that is unlikely to have sleep disturbance impacts, the Project is not predicted to have any sleep disturbance impacts at any residences during the morning shoulder period.

The proposed operational noise criteria for the Project are set out in **Table 6.8** and are based on the PNTLs established for each receiver/NAG and the calculated NPfI sleep disturbance screening criteria.

Table 6.8 Proposed Noise Criteria for Project

Receiver	Period Criteria (dB LA_{15Min})				Night – Sleep Disturbance (dB LA_{Max})
	Day	Evening	Night	Morning Shoulder (6.00 am– 7.00 am)	
NAG 1	40	36	35	40	52
NAG 2	53	46	43	47	57
NAG 3	53	44	42	47	57
Any other residential Receiver (Hwy influence)	53	44	42	47	57
Any other Residential Receiver -Rural	40	35	35	47	52

Receiver	Period Criteria (dB LA_{15Min})				Night – Sleep Disturbance (dB LA_{Max})
	Day	Evening	Night	Morning Shoulder (6.00 am– 7.00 am)	
Industrial Receivers[2]	68 (When in use)				N/A
Active Recreational Receiver	53 (When in use)				N/A

Notes: *[1] Day period is 7.00 am–6.00 pm Monday-Saturday and 8.00 am–6.00 pm Sunday and Public Holidays, evening period is 6.00 pm–10.00 pm and night period is 10.00 pm to commencement of morning shoulder or day period. Shoulder period is 6:00 am–7:00 am Monday-Saturday and 7:00 am–8.00 am Sunday and Public Holidays.*

[2] Includes Quarries and Motor Sports facilities including the Ringwood Park Motorsport Facility and the Circuit Italia.

6.2.4.3 Road Traffic Noise Assessment

The primary road haul route to and from the Project will be via the Pacific Highway and Italia Road. No Project-related heavy vehicles will travel along Italia Road north of the site access point (i.e., towards Seaham). The nearest and potentially most affected road traffic noise receiver has been identified as 16 Italia Road, Balickera (R1, NAG 2)) which is located approximately 50 m from the carriageway of Italia Road and 155 m from the carriageway of the Pacific Highway. This is the only residential receiver located along the Italia Road section of the proposed haulage route. Given the existing traffic volumes on the Pacific Highway, Project-related traffic noise impacts at all other receivers along the Pacific Highway are anticipated to be negligible.

The assessment of operational road traffic noise levels at R1 is provided in **Table 6.9**. As the operational road traffic noise levels are predicted to comply with the RNP criteria, it is also assumed that the noise levels associated with the lower volumes of construction road traffic will also comply.

Table 6.9 Operational Road Traffic Noise Assessment, R1

Time period [1]	RNP criteria	Existing traffic noise [2]	Predicted Project traffic noise	Combined traffic noise	Noise level change due to Project	Comply/ Exceed
Day LAeq(15 hour)	60	60	52	60	N/A [3]	Complies
Night LAeq(9 hour)	55	58	43	58	N/A [3]	Complies

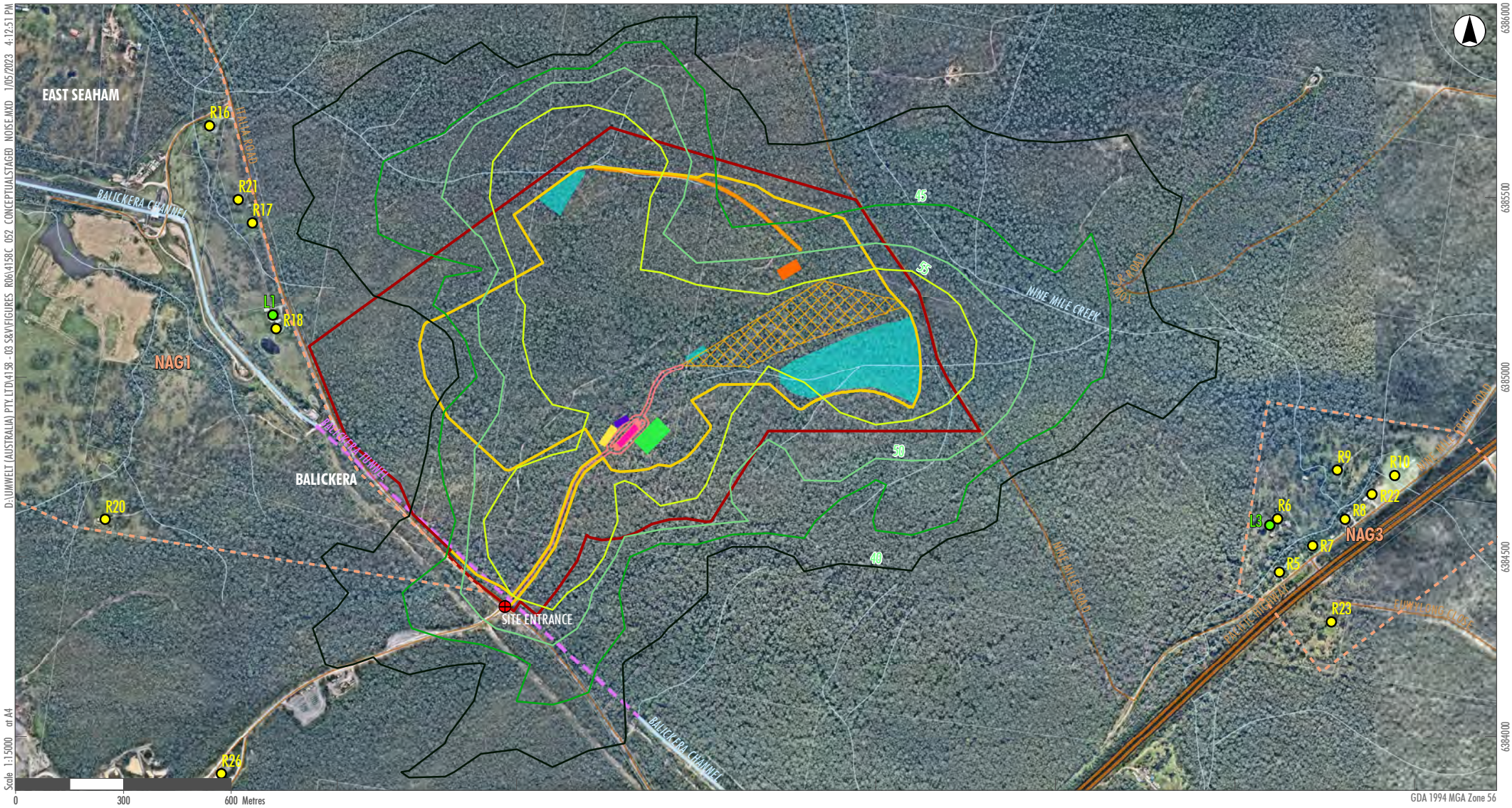
Notes: *1 Daytime is 7.00 am–10.00 pm and Night is 10.00 pm–7.00 am.*

2 Based on measured road traffic noise levels (refer to Table 2.4 of the NIA).

3 Change in noise level assessment is not applicable if the predicted noise level is below the noise limit.

6.2.4.4 Cumulative Noise Assessment

As discussed in **Section 6.2.2.4**, predicted compliance with the established PANL is used to address cumulative noise. Results show there will be no exceedances of the cumulative noise criteria provided in **Table 6.6**.



Legend

- Project Area
- Disturbance Area
- Pacific Highway
- Road
- Balickera Tunnel
- Drainage Line
- Lot Boundaries
- Noise Assessment Groups
- Noise Monitor Locations
- Sensitive Receivers
- Office
- Weighbridge
- Northern Haul Road
- Workshop
- Truck Parking
- Light Vehicle Parking
- Access Road
- Stockpile and Plant Area
- Dams

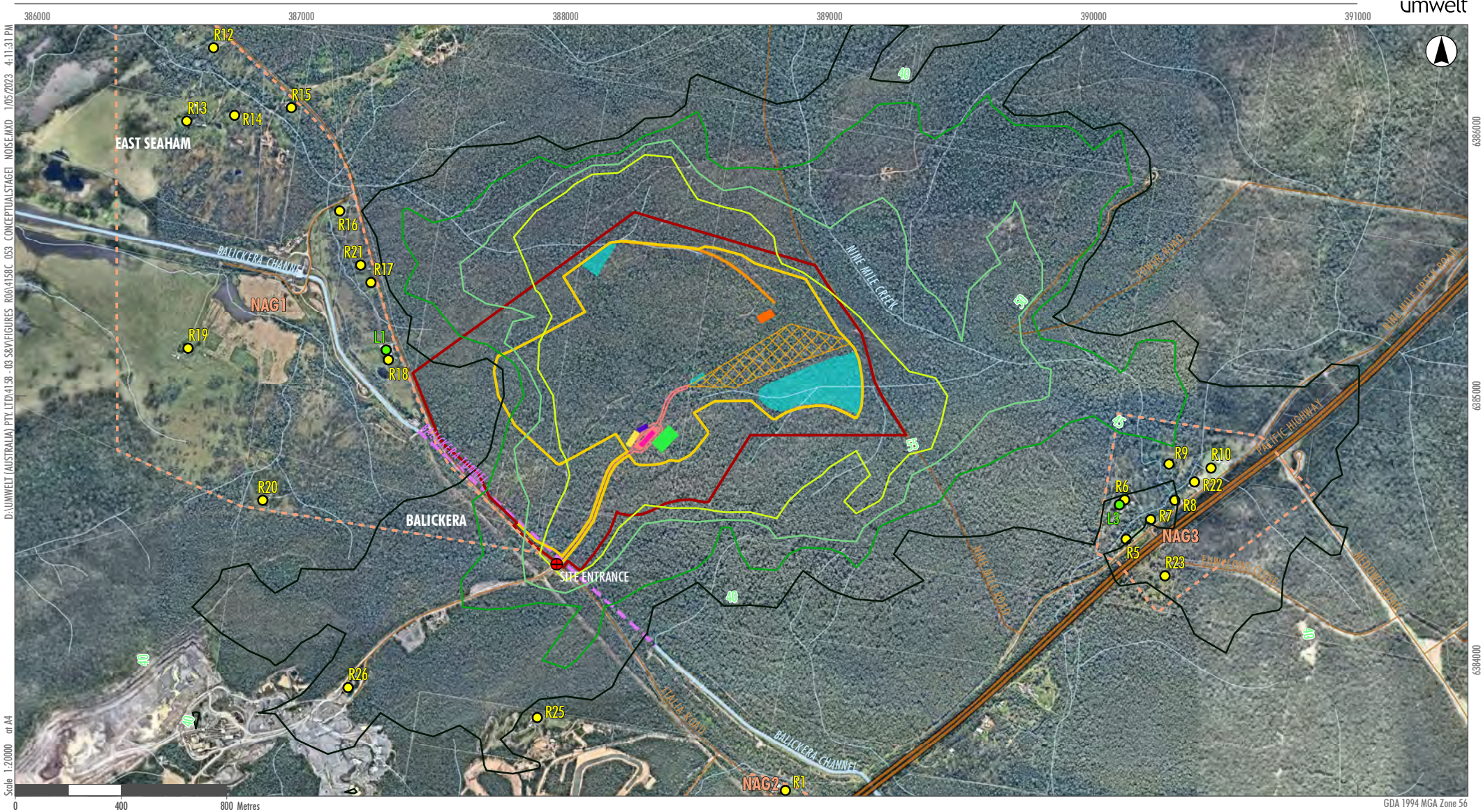
Predicted Noise Levels (db)

- 40
- 45
- 50
- 55

Image Source: Nearmap (2022) Data source: NSW FSDF (2022)

FIGURE 6.2

Predicted Project Daytime Operational Noise Levels – Stage 0



Legend

- Project Area
- Disturbance Area
- Pacific Highway
- Road
- Balickera Tunnel
- Drainage Line
- Lot Boundaries
- Noise Assessment Groups
- Noise Monitor Locations
- Sensitive Receivers
- Office
- Weighbridge
- Northern Haul Road
- Workshop
- Truck Parking
- Light Vehicle Parking
- Access Road
- Stockpile and Plant Area
- Dams

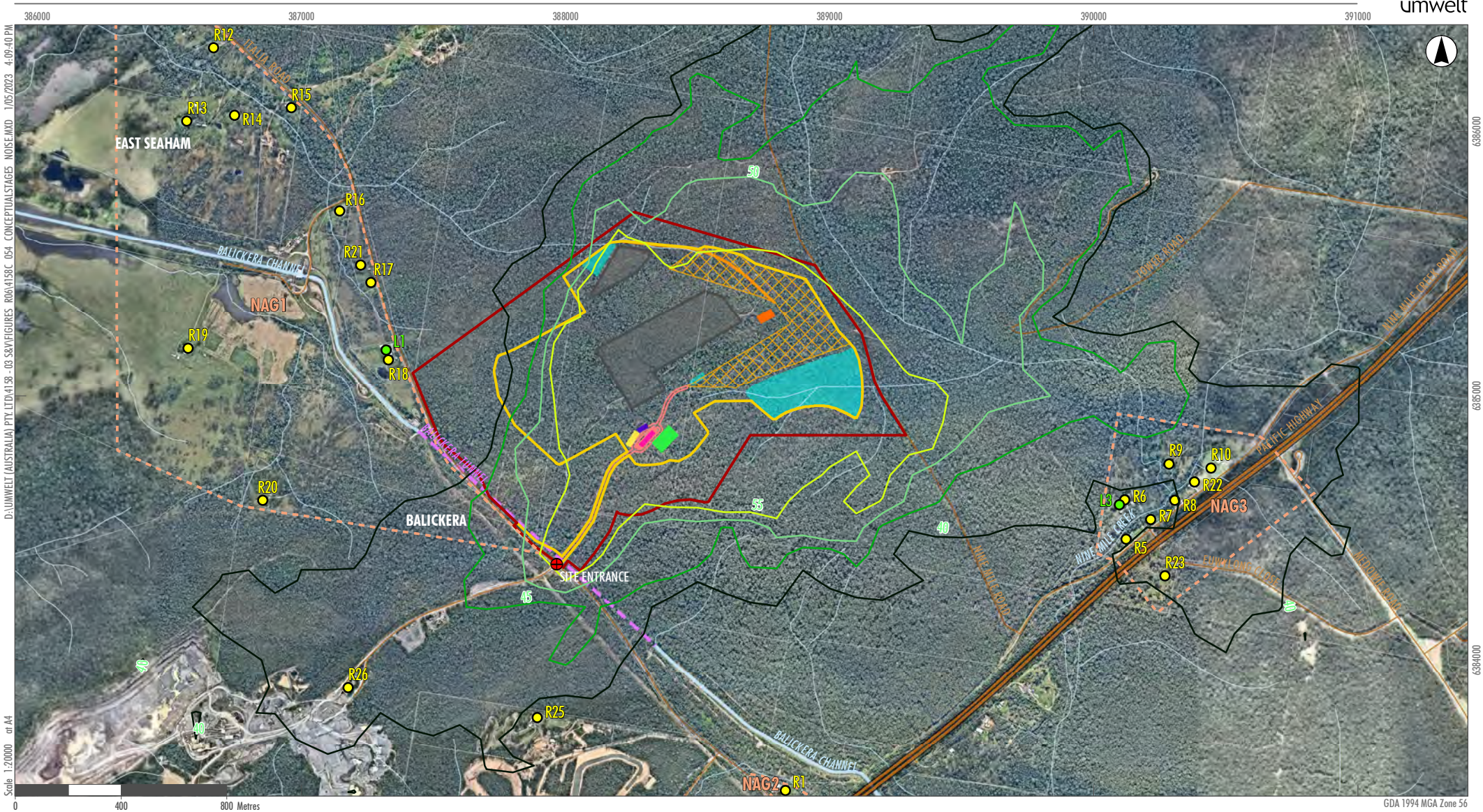
Predicted Noise Levels (db)

- 40
- 45
- 50
- 55

Image Source: Nearmap (2022) Data source: NSW FSDF (2022)

FIGURE 6.3

Predicted Project Daytime Operational Noise Levels – Stage 1



Legend

- Project Area
- Disturbance Area
- Pacific Highway
- Road
- Balickera Tunnel
- Drainage Line
- Lot Boundaries
- Noise Assessment Groups
- Noise Monitor Locations
- Sensitive Receivers
- Pit Outlines (Stage 5)
- Office
- Weighbridge
- Northern Haul Road
- Workshop
- Truck Parking
- Light Vehicle Parking
- Access Road
- Stockpile and Plant Area
- Dams

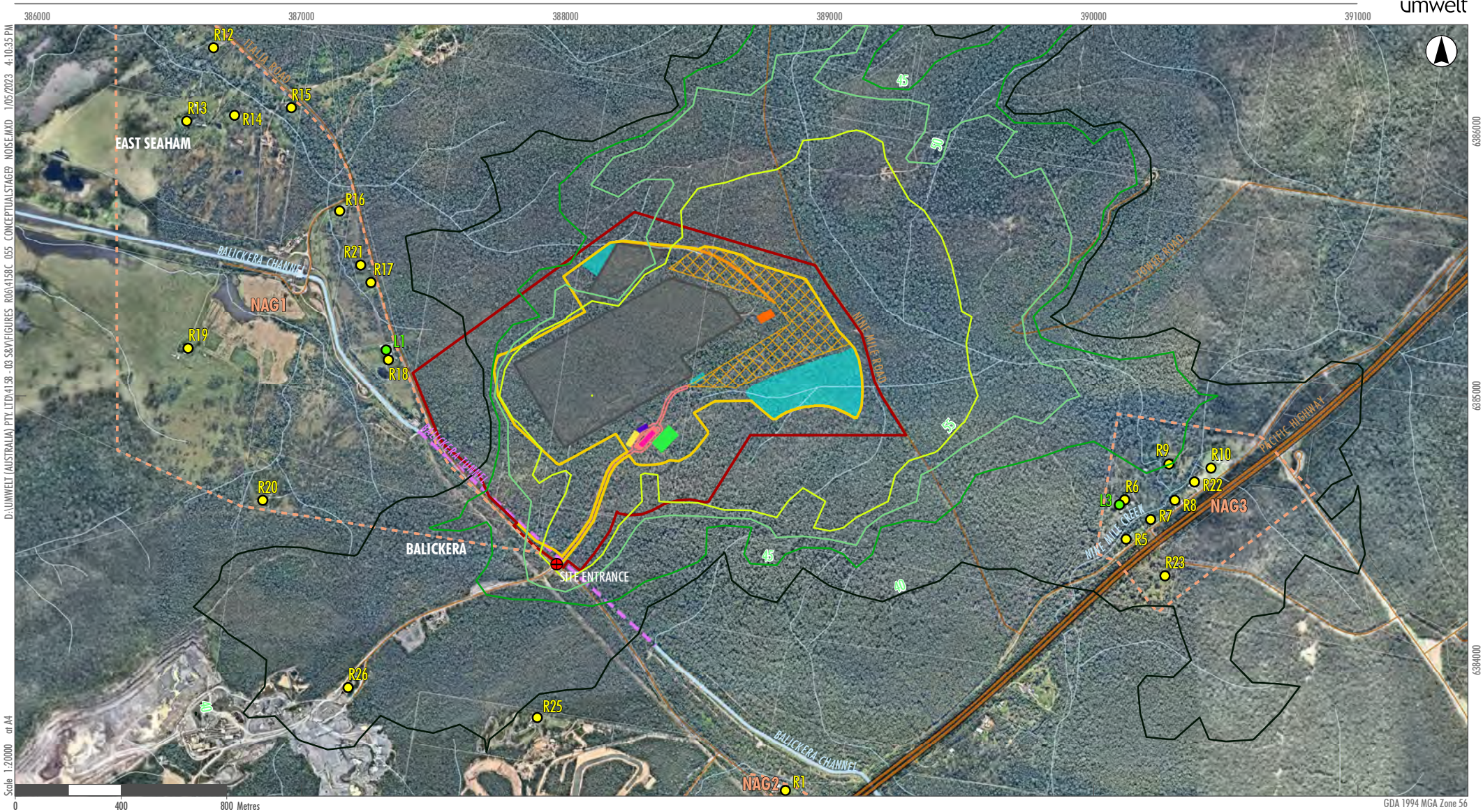
Predicted Noise Levels (db)

- 40
- 45
- 50
- 55

Image Source: Nearmap (2022) Data source: NSW FSDF (2022)

FIGURE 6.4

Predicted Project Daytime Operational Noise Levels – Stage 5



Legend

- Project Area
- Disturbance Area
- Pacific Highway
- Road
- Balickera Tunnel
- Drainage Line
- Lot Boundaries
- Noise Assessment Groups
- Noise Monitor Locations
- Sensitive Receivers
- Pit Outlines (Stage 9)
- Office
- Weighbridge
- Northern Haul Road
- Workshop
- Truck Parking
- Light Vehicle Parking
- Access Road
- Stockpile and Plant Area
- Dams

Predicted Noise Levels (db)

- 40
- 45
- 50
- 55

Image Source: Nearmap (2022) Data source: NSW FSDF (2022)

FIGURE 6.5

Predicted Project Daytime Operational Noise Levels – Stage 9

6.2.5 Mitigation and Management Measures

6.2.5.1 Construction Mitigation and Management Measures

The construction noise levels are predicted to comply with the nominated NMLs. Nevertheless, the following reasonable and feasible noise management and mitigation strategies have been recommended by the NIA, and while it is not essential to adopt these measures, in accordance with the ICNG it is considered best practice to minimise construction noise as much as possible:

- All sensitive receivers likely to be affected should be notified at least 7 days prior to commencement of any works associated with the activity that may have an adverse noise or vibration impact.
  The notification should include:
  - details of the Project
  - the construction period and construction hours
  - contact information for project management staff
  - complaint and incident reporting
  - how to obtain further information.
- All employees, contractors and subcontractors are to receive an environmental induction.
  The induction must include at a minimum, all applicable mitigation measures; hours of work; any limitations on high noise-generating activities; location of nearest sensitive receivers; designated parking areas; relevant approval conditions and incident procedures.
- Non-operational noise should be kept to a minimum, including limiting the use of loud stereos/radios, shouting on site and car door slams. Where practical, no dropping of materials from height or throwing of metal items should be undertaken.
- The noise levels of plant and equipment should have operating sound power levels consistent with those nominated in Table 5.1 of the NIA (**Appendix 5**).
- Noise emitting plant should be directed away from sensitive receivers and to be throttled down or shut down when not in use.
- Non-tonal reversing beepers should be fitted and used on construction vehicles and mobile plant used regularly on site and for any out of hours work.
- The use of engine compression brakes should be limited.

6.2.5.2 Operation Mitigation and Management Measures

ARDG has committed to a comprehensive suite of noise control measures to minimise noise emissions, and these have been incorporated into the modelling process.

Throughout the development of the conceptual quarry plan, consultation with the design team was undertaken to identify, design and optimise the operational and engineered noise controls that can be implemented. This process was undertaken to inform the operational constraints to the Project that may be required to meet noise criteria. This process resulted in the following design and operational outcomes:

- cutting the processing area and the initial relative height of the North Pit into the existing surface level to increase acoustic shielding to the nearest sensitive receivers
- locating the site entrance as far as practicable from the nearest sensitive receivers
- the sequence of extraction in 15 m bench heights, to always maintain a face between the nearest sensitive receivers and the extraction area
- commitment to only undertake product loading, transportation and maintenance activities during the morning shoulder and evening periods i.e., no extraction or processing to be undertaken during these times
- regular equipment and internal road maintenance
- strategic placement of stockpiles along the southern side of the processing area.

6.2.5.3 Management Plans

A Construction Environmental Management Plan (CEMP) and Operational Environmental Management Plan (OEMP) will be developed and implemented for the Project and will include the following monitoring and management controls to manage potential noise impacts associated with construction activities and site operations:

- noise objectives and targets consistent with the Project approval
- noise management measures in place at the site
- provision of general noise awareness training for key operational staff
- noise monitoring processes implemented at the site to provide for ongoing noise management, including:
    - monitoring and determination of compliance with relevant noise criteria provided in the Project approval
    - stakeholder consultation
    - complaint/enquiry handling process including maintenance of a 24-hour community contact line
    - a roles and responsibilities matrix, with responsibilities being clearly defined through all levels within the operation.

6.2.5.4 Monitoring

Noise monitoring for the Project will take the form of compliance monitoring and validation monitoring. Compliance monitoring will be undertaken annually via attended monitoring at defined locations. Attended monitoring for compliance assessment will be undertaken at three locations surrounding the Project Area that are considered to be representative of the most sensitive noise receivers, with one in each NAG. The attended noise monitoring locations will be reviewed periodically to ensure monitoring is undertaken at appropriate representative locations. Any changes will be reflected in amendments to the OEMP prior to being implemented.

Annual validation monitoring will also be undertaken to confirm the noise model predictions and accuracy of the noise model. For efficiency purposes, it is likely that compliance monitoring and validation monitoring will be undertaken concurrently.

Given compliance with the PNTLs is predicted during the day period and readily predicted during the morning shoulder and evening period, performance-based management monitoring (including real-time monitoring) is not considered to be necessary and has not been recommended by the NIA unless compliance and validation monitoring indicates that performance-based management monitoring is required to achieve the applicable PNTLs for the Project established in accordance with the NPfI.

6.3 Blasting

A Blasting Impact Assessment (BIA) has been prepared by Enviro Strata Consulting (ESC) to assess the potential impact of blasting within the Project's extraction area on sensitive receptors, including private residences, buildings, heritage sites, animals, and significant natural features. The BIA has been prepared to address the SEARs for the Project, which require a detailed assessment of the likely blasting impacts of the development (including ground vibrations, overpressure, flyrock, visual and fumes/odour), in addition to an assessment of cumulative impacts, having regard to the relevant ANZECC guidelines. A full copy of the BIA is provided in **Appendix 6** with the outcomes of the assessment summarised in the section below.

A detailed assessment of potential blasting impacts on the Balickera Channel, Balickera Tunnel, and any related infrastructure is contained in a separate report by ESC, which is also attached in **Appendix 7**.

6.3.1 Methodology

The BIA followed the guidelines presented in the Australian and New Zealand Environment and Conservation Council (ANZECC) guideline *Technical Basis for guidelines to minimise annoyance due to blasting overpressure and ground vibration* (ANZECC, 1990) and *Australian Standard AS 2187.2-2006 Explosives – Storage and use* and covered a 2 km radius of impact representing the likely range of impacts.

6.3.1.1 Receivers

The BIA has identified 19 privately owned residential receptors within 2 km of the Project Area, predominantly grouped within two community clusters (Balickera and Ferodale):

- Balickera is the closest cluster, located within a 420 m to 1,760 m range to the north-west and west of the Project
- the Ferodale cluster is located adjacent to the Pacific Highway within a 1,270 m to 1,540 m range to the south-east of the Project
- in addition to the Balickera and Ferodale clusters, one isolated residence lies 1,510 m to the south of the Project.

Residences located in excess of 2 km from the Project were not assessed, as significant impacts are considered highly unlikely beyond this distance, based on the maximum charge mass proposed for use. Residential receivers were identified using the same numbering as the noise assessment (refer to **Figure 6.1**).

Numerous items of public and private infrastructure that have potential to be impacted by vibration and/or overpressure impacts from blasting were also identified in the vicinity of the Project Area within a 270 m to 2,280 m range of the proposed extraction area. The public and private infrastructure facilities, heritage sites and significant natural features that were assessed in the BIA are listed in **Table 6.10**.

Table 6.10 Non-Residential Receivers, Blasting

Type	Receiver
Public roads and bridges	Italia Road, Pacific Highway, Nine Mile Road (unsealed) Four bridges on the above roads
Private infrastructure	Hunter Water Corporation (HWC) infrastructure in Balickera including a tunnel, channel, pumping station, bridge, pipelines, electrical sub-station and 33 kV powerlines
	Underground lines and various operator's telecommunication towers
	Quarries, including Boral's Seaham Quarry and the proposed Eagleton Quarry
	Port Stephens Gardenland (landscaping supplies)
	Port Stephens Boarding Kennels (dog boarding facility)
	Ringwood Park Motorsport Complex (an outdoor motor sport complex with racing tracks)
	Circuit Italia (outdoor motor sport complex under construction)
	Hunter Valley Paintball (outdoor paintball venue)
	Kids Amusements (party equipment rental service)
Heritage sites	Balickera House, a historic heritage site located at 303 Italia Road (locally listed heritage item ID I3, Port Stephens LEP 2013)
Natural features	Wallaroo National Park

6.3.1.2 Project Staging

The geology of the Project Area has been extensively surveyed using detailed surface mapping, surface and downhole geophysics and a diamond drilling program undertaken by ARDG (refer to **Appendix 4**). From a quarrying perspective, the dominant rock formations targeted in this Project are rhyodacite and dacite. The geological assessment model determined a requirement for bench sizes in the order of 15 m with steeply designed highwalls. The Project is expected to operate for 30 years over nine operational stages with extraction taking place in two quarry pits (Main Pit and North Pit) (refer to **Section 3.3.1** for further details).

Blasting will be undertaken Monday to Friday (between 9.00 am and 5.00 pm) while drilling activities will be undertaken Monday to Friday (between 7.00 am and 6.00 pm), and on Saturdays (from 7.00 am to 3.00 pm). It is anticipated that on average, one blast will be fired per fortnight and the timing of blasting will be managed to avoid simultaneous blasting with neighbouring quarries.

The representative stages of the Project selected for the blasting assessment are Stages 1, 2, 6, 8 and 9. The selected stages are considered to be representative of the key features of the proposed extraction activities and quarry progression in view of blasting impacts, as outlined below:

- During the initial stages (Stages 1 and 2) the Project commences (in the Main Pit and the North Pit) in the eastern section of the extraction area and advances to the south-west towards Italia Road and Balickera community.
- During Stage 6, the Main Pit advances further towards Italia Road and Balickera community and increased blasting impact on the Balickera community is to be expected.
- During Stages 8 and 9 the Project will further expand towards Italia Road and Balickera residences. The main quarrying activity will however take place in the central and eastern part of the Main Pit reaching into deeper sections of the rock strata. As the pit advances into deeper layers, it is expected that some topographical shielding will take place which will assist with airblast overpressure impact management on the local community.

6.3.1.3 Modelling

For assessment purposes, a ground vibration predictive model was used. The model was originally developed in 2020 when a series of single hole test blasts were conducted (ESC, 2020). The single hole study was undertaken in the Project Area and relied on controlled explosion of variable charge masses using explosives in pre-drilled holes. The method mimics (simulates) the future blasting practice in the area, although larger charge masses will be used. The blast induced ground vibrations were recorded using a number of vibration monitors and the data was utilised to develop a ground vibration predictive model (i.e., site law model) representative of the Project.

Due to the nature of the single hole test blasts, an airblast overpressure model specific to Project conditions was not able to be developed. Notwithstanding, a model from a small coal mine using blasting parameters comparable to those proposed by the Project (i.e., charge masses in the order of 42 to 225 kg and monitoring stations positioned within 70 to 1,100 m from the blasting area) has been utilised.

The modelling undertaken for the BIA involved a set of four simulations, incorporating a range of charge masses (37.5, 75, 98.4 and 122 kg) derived from the blasting parameters proposed to be employed by the Project. The modelling accounted for the worst-case scenario (i.e., blasting from the edge of the proposed extraction area), which corresponds to the minimum distance between the blasting area and the receptors. Results therefore highlight the maximum ground vibration and airblast overpressure levels that would be generated at these receptors over the lifetime of the Project.

6.3.1.4 Blast Emission Criteria

A summary of blast emission criteria used in the assessment is presented in **Table 6.11**. Further detail on the sources and rationale is provided in Section 5.2 of the BIA in **Appendix 6**.

Table 6.11 Summary of Blast Emission Criteria

Aspect	Vibration Criteria (mm/s)	Airblast Criteria (dBL)
Private residences [1]	5 (for 95% of blasts) 10 (not to be exceeded)	115 (for 95% of blasts) 120 (not to be exceeded)
Historic heritage site	5	133
Balickera Tunnel and Balickera Channel	>200	N/A
Occupied infrastructure [2]	25	125
Unoccupied infrastructure (public roads and bridges, timber power poles, buried communication cables and telecommunication towers)	100	N/A
Electrical substation	25	N/A

Note: 1 Applies to buildings and sheds only (after ANZECC (1990)).

2 Occupied non-sensitive sites such as factories and commercial premises (after AS2187.2-2006).

6.3.2 Assessment Results

6.3.2.1 Community

Ground Vibration

All potential ground vibration exposure results were below the applicable private residential receptor limits specified as 5 mm/s (for 95% of blasts) and 10 mm/s (not to be exceeded) under all modelled blast scenarios with the exception of R17 and R18 (during Stages 6 to 9).

The predicted maximum ground vibration exposures for receptors R17 and R18 are 5.0 and 7.7 mm/s respectively, when blasting with the maximum charge mass of 122 kg. Compliance with the vibration criteria at these receptors can be achieved with the use of reduced charge masses for any blasting within 600 m of these receptors. For example, blasting at the minimum distance of 420 m (an overall worst-case scenario) using a deck charge of 37.5 kg will generate vibrations in the order of 3.0 mm/s at these receptors, which is below the applicable limits. These restrictions on charge masses would only apply to a limited area in the north-western corner of the quarry pit and would only be relevant in Stages 6 to 9 of quarry development. The use of electronic delays on firing each smaller charge can minimise the need for increased numbers of blast events during these later stages of the operations.

Airblast Overpressure

All potential airblast overpressure results were below the applicable private residential receptor limits specified as 115 dBL (for 95% of blasts) and 120 dBL (not to be exceeded) under all modelled blast scenarios with the exception of R17 and R18.

The predicated maximum airblast overpressure exposures for receptors R17 and R18 are 116 and 119 dBL respectively, when blasting with the maximum charge mass of 122 kg. Compliance with the airblast overpressure criteria can be achieved at these receptors with the introduction of limited blast management measures via the application of reduced charge masses. As with the restrictions on blasts associated with potential ground vibration impacts at these properties the requirement for reduced charge mass sizes would need to be implemented for blasting within 600 m of these receptors. The identified maximum instantaneous charges identified as being necessary to meet ground vibration criteria will also enable airblast overpressure criteria to be me at these receivers.

As the Project reaches greater depths, some topographical shielding will emerge due to the change in the contours of the area. This will assist with impacts associated with airblast overpressure and lessen the impacts on the surrounding community.

Flyrock

Flyrock impact on adjacent residences is considered to be fully managed, and potential risks mitigated, due to the application of appropriate exclusion zones. The closest private receptors in the later stages of the Project are located over 400 m from the proposed extraction area (R17, R18 and R21). It is noted that flyrock management for these residences will coincide with flyrock impact management on Italia Road (public road) under the umbrella of the Road Closure Management Plan (refer to **Section 6.3.3**). Therefore, it is concluded that the flyrock risks for residential receptors will be managed adequately through the controls also necessary under the road closure management plan processes.

6.3.2.2 Infrastructure and Heritage Sites

Ground Vibration

All maximum estimated vibration exposures for infrastructure and heritage sites are below the vibration limits specified in **Table 6.11** for all blast scenarios considered. This includes potential impacts on the Balickera Tunnel and Channel which is considered further in **Section 6.3.2.5**. As a result, no additional blast control measures are required to comply with the ground vibration criteria for infrastructure and heritage sites.

Airblast Overpressure

Unoccupied infrastructure facilities are generally not assessed in terms of airblast overpressure exposure as the levels required to inflict damage are not applicable and/or not reached. In the case of occupied infrastructure, results show that the impact of airblast overpressure on potentially occupied infrastructure using the maximum charge mass are in the range of 98-112 dBL, which is below the applicable limit of 125 dBL.

The airblast overpressure exposure for Balickera House (the closest listed heritage item) does not exceed 106 dBL, which is below the applicable criteria for heritage sites of 133 dBL.

No additional blast control measures are required to comply with the airblast overpressure criteria for the applicable infrastructure and heritage sites.

Flyrock

As described in **Section 6.3.2.1** above, the Project will operate using an appropriate exclusion zone for managing flyrock risk. The closest infrastructure facilities susceptible to flyrock are Italia Road, Nine Mile Road and powerlines, located within 200-300 m of the proposed extraction area. To manage blast impacts on these infrastructure facilities, a Road Closure Management Plan will be developed (refer to **Section 6.3.3**). Due to sufficient distances, flyrock impact for other infrastructure is considered to be fully managed and potential risks are considered low and/or negligible.

The closest heritage site, Balickera House, will be located approximately 1,170 m from the proposed extraction area and therefore the flyrock risk is negligible.

6.3.2.3 Animals

There are no known major farms with cattle or other breeding animals, nor any major grazing land areas within a 2 km radius of the Project, although some grazing cattle have been observed within property R19. The predicted ground vibration and airblast overpressure impacts for R19 are below the ANZECC guideline limits.

ANZECC guideline limits which apply to private residences are designed to protect human comfort and, as such, it can be inferred that blasting impacts will be fully managed in relation to cattle and pets/animals within these properties. Studies undertaken to assess potential impacts from blasting on feedlots have identified that blasting impacts have little to no impact on domestic stock and, that while blasts can result in an immediate noise disruption, so does passing traffic (Nelson, 2011). Similar effects would be expected for native fauna and, anecdotally, it is noted that many fauna species have been recorded adjacent to active mining operations where larger and more frequent blasts than those proposed for the Project are undertaken. Due to the periodic nature of blasting proposed, blasting associated with the Project is not anticipated to have any significant impacts on domestic or native fauna.

6.3.2.4 Significant Features

Wallaroo National Park has been identified as a significant natural feature located 1,730 m from the Project's blasting boundary. At this distance, the maximum estimated ground vibration and airblast overpressure levels for the worst-case scenario are well below the ANZECC guideline limits and generally below human perception levels. Therefore, it can be inferred that animals or any features of the Wallaroo National Park will not be negatively impacted. The risk of flyrock at this distance is considered negligible.

6.3.2.5 Balickera Channel, Tunnel and Associated Infrastructure

ESC was engaged to undertake a separate review of risks and a detailed assessment of potential blasting impacts related to the Project on the adjacent HWC infrastructure.

The assessed infrastructure system comprises of the Balickera Channel, Balickera Tunnel and associated infrastructure (including pumping station, electrical substation, pipelines and bridge). All are considered as critical infrastructure to supply water to Grahamstown Dam, the Hunter's largest drinking water storage.

Following a detailed assessment of the history, design and structural condition of the infrastructure components, in addition to vibration modelling, the assessment concluded that the impact of ground vibrations on the HWC critical infrastructure (Balickera Channel and Balickera Tunnel) is well below the damage criteria for the infrastructure items, hence the risk is considered to be low. The risk of damage from flyrock and airblast overpressure is considered either not applicable (for Balickera Tunnel as an underground facility) or low (for Balickera Channel as it is located beyond the exclusion zone area).

Modelling also confirmed there would be no significant blast vibration impacts for any associated HWC infrastructure items. The risk of damage from airblast and flyrock is also considered low/negligible or not applicable.

The BIA also considers potential vibration impacts to the Balickera Tunnel associated with traffic movements. Such impact could arise as a result of increased traffic due to transport of rock material from the proposed quarry. To assess the impact a vibration monitoring study of ground vibrations generated from passing traffic was undertaken in the vicinity of the Balickera Tunnel in 2020. The monitoring site was located on Italia Road above Balickera Tunnel and captured vibrations due to passing traffic including heavy transport vehicles servicing the Boral Seaham Quarry.

The study confirmed low vibration impact from the passing traffic (including heavy vehicles) on the surrounding environment and Balickera Tunnel. The range of vibrations recorded varied from 0.1 to 2.5 mm/s (corresponding to a distance of 3 to 5 m) which is well below the assessment limits for Hunter Water and other adjacent infrastructure.

In summary, the BIA concluded an absence of any significant risks to HWC infrastructure from blasting and traffic vibration activities associated with the Project.

6.3.3 Mitigation and Management Measures

The recommended blast emission control measures for the Project to minimise blasting impacts (including ground vibration, airblast overpressure and flyrock impacts) on the surrounding environment are as follows:

- Use of ground vibration and airblast predictive models to estimate potential impacts for critical receptors.
- Use of appropriate charge mass design and avoidance of overcharging holes.
- Use of an appropriate initiation sequence to minimise the possibility of hole interactions, ideally aiming for single hole initiation.
- Application of appropriate quality stemming material and stemming height to facilitate explosives confinement and therefore minimise airblast overpressure emissions, stemming ejection and/or flyrock incidents.
- Maintain appropriate burden specification for the front row holes to avoid face bursts and related flyrock incidents.

- Other management measures to be implemented will include the following:
    - Blast Monitoring System – consisting of three monitoring stations to capture ground vibration and airblast overpressure impacts from blasting at the Project site. The BIA recommends that the stations are located to the north-west (representative of private residences in the Balickera area, HWC infrastructure and Balickera House), south-east (representative of private residences in the Ferodale area) and south of the Project (in the vicinity of R1).
    - Pre-Blast Assessment Protocol – to manage blasting and to minimise the impacts on the surrounding area. The protocol would be reviewed on a regular basis to address the physical changes in the quarry.
    - Road Closure Management Plan – to be developed in consultation with the relevant road authorities and PSC to manage blasting impacts on public roads which, depending on the operational stage of the quarry, will be located within 0.5 km of the extraction area.
    - Residence Notification System – to provide information on the dates and times of proposed blasting to the private residences in close proximity.
    - Liaison with adjacent quarries – to prevent concurrent blasting times to avoid cumulative blast impacts and to minimise impact on the local community.

6.4 Air Quality and Greenhouse Gases

An Air Quality and Greenhouse Gas Assessment (AQGGA) has been prepared by Jacobs Group (Australia) Pty Limited (Jacobs) to assess the potential air quality and greenhouse gas impacts of the Project by identifying the key air quality issues, characterising the existing environment, quantifying emissions to air and modelling the potential impact of the Project on local air quality. The AQGGA has been prepared to address the SEARs, which require a detailed assessment of potential construction, operational and transportation air quality impacts of the development including an assessment of cumulative impacts and mitigation, monitoring and management measures (including consideration of real-time air quality monitoring). The assessment of air quality impacts associated with particulate matter and nitrous oxide emissions was undertaken in accordance with the *Approved Methods for the Modelling and Assessment of Air Pollutants in NSW* (Approved Methods) (EPA, 2022).

A full copy of the AQGGA is provided in **Appendix 8**, with the outcomes of the assessment summarised below.

6.4.1 Existing Environment

Meteorological data collected by DPE (Beresfield) and the Bureau of Meteorology (Williamtown) and ambient air quality data from the DPE Lower Hunter Air Quality Monitoring Network were reviewed to characterise existing local conditions and background air quality with the following conclusions:

- Meteorological conditions do not vary significantly from year to year and conditions in 2021 were considered as representative of the long-term conditions near the Project Area and appropriate for use in air quality modelling as required by the Approved Methods (based on high data capture rate, meeting the EPA's requirement for a 90% complete dataset, and average wind speeds closest to the long-term average from all years).

- Air quality conditions are strongly correlated to the climatic conditions and there was a deterioration in air quality across NSW between 2017 and early 2020, heavily influenced by drought, dust storms and bushfires.
- Concentrations of key air quality indicators are expected to be lower near the Project Area than those measured at DPE monitoring stations at Beresfield, Newcastle and Wallsend due to the lower population density and fewer dust sources.
- **Table 6.12** shows the assessed background levels, based on the review of available air quality data, that apply at sensitive receptors. These background levels have been added to Project contributions to determine the potential cumulative impacts, in accordance with the Approved Methods (EPA, 2022).

Table 6.12 Background Levels for Key Air Quality Indicators that apply to Sensitive Receptors

Air Quality Indicator	Averaging Time(s)	Background Level	Notes
Particulate matter (PM_{10})	24-hour	Variable by day	Measured PM_{10} concentrations from Beresfield in the representative year, 2021
	Annual	16 µg/m^3	
Particulate matter ($PM_{2.5}$)	24-hour	Variable by day	Measured $PM_{2.5}$ concentrations from Beresfield in the representative year, 2021
	Annual	5.9 µg/m^3	
Total Suspended Particulates (TSP)	Annual	40 µg/m^3	Estimated annual average concentration for Beresfield in the representative year, 2021
Deposited dust	Annual	1.8 g/m^2/month	Estimated annual average deposited dust level
Nitrogen dioxide (NO_2)	1-hour	70 µg/m^3	Maximum measured NO_2 concentrations from Beresfield in the representative year, 2021
	Annual	12 µg/m^3	Measured NO_2 concentrations from Beresfield in the representative year, 2021

Note: PM_{10} – Particulate matter with equivalent aerodynamic diameter of 10 microns or less.

$PM_{2.5}$ – Particulate matter with equivalent aerodynamic diameter of 2.5 microns or less.

As previously discussed in **Section 6.2** and **Section 6.3** there are several privately-owned residences within 2 km of the Project Area, predominantly grouped within two community clusters (Balickera and Ferodale). For consistency, residences have been numbered identically between the noise, blasting and air quality assessments.

6.4.2 Assessment Criteria

The EPA has developed criteria for a range of air quality indicators, outlined in the Approved Methods (EPA, 2022). Most of the EPA criteria referred to in the air quality assessment have been drawn from national standards for air quality set by the National Environment Protection Council of Australia (NEPC) as part of the National Environment Protection Measures (NEPMs) (NEPC, 1998). These criteria are outlined in **Table 6.13** and apply to sensitive receptors such as privately owned residences.

Table 6.13 EPA Air Quality Assessment Criteria

Air quality indicator	Averaging time	EPA Criterion
Particulate matter (PM_{10})	24-hour	50 µg/m^3
	Annual	25 µg/m^3
Particulate matter ($PM_{2.5}$)	24-hour	25 µg/m^3
	Annual	8 µg/m^3
Particulate matter (TSP)	Annual	90 µg/m^3
Deposited dust	Annual (maximum increase)	2 g/m^2/month
	Annual (maximum total)	4 g/m^2/month
Nitrogen dioxide (NO_2)	1-hour	164 µg/m^3
	Annual	31 µg/m^3
Carbon monoxide (CO)	1-hour	30 mg/m^3
	8-hour	10 mg/m^3

The EPA air quality assessment criteria relate to the total concentration of pollutants in the air (that is, cumulative) and not just the contribution from Project-specific sources. Therefore, some consideration of background levels needs to be made when using these criteria to assess the potential impacts. In situations where background levels are elevated the proponent must "*demonstrate that no additional exceedances of the impact assessment criteria will occur as a result of the proposed activity and that best management practices will be implemented to minimise emissions of air pollutants as far as is practical*" (EPA, 2022).

The AQGGA also considered the *Voluntary Land Acquisition and Mitigation Policy* (VLAMP) (NSW Government, 2018) which provides the NSW Government's policy for voluntary mitigation and land acquisition to address dust (particulate matter) impacts from state significant mining, petroleum and extractive industry developments.

In the absence of NSW criteria for crystalline silica, the assessment adopted the Victorian EPA annual average crystalline silica criterion of 3 µg/m^3.

6.4.3 Methodology

The key air quality issue for the Project was identified as dust (particulate matter) generated during quarry operations, in the form of PM_{10}, $PM_{2.5}$, TSP and deposited dust. This was the focus of the assessment, along with the potential emissions from post-blast fume (NO_2), diesel exhaust (PM_{10}, $PM_{2.5}$ and NO_2), crystalline silica due to rock crushing, and greenhouse gas emissions. Emissions during construction and transportation were also assessed.

6.4.3.1 Construction Dust

The potential significance and impacts of construction dust were determined from a qualitative review which considered the intensity, scale, location and duration of the proposed construction works. Estimated emissions associated with construction activities were determined using guidance from *National Pollutant Inventory Emission Estimation Technique Manual for Mining Version 3.1* (Commonwealth of Australia, 2012) and the *Compilation of Air Pollutant Emission Factors, AP-42* (United States Environmental Protection Agency, 1995 and updates).

6.4.3.2 Operational Dust and Post-Blast Fume

Operational dust emissions were quantified by modelling, using the CALPUFF model to predict ground-level particulate matter concentrations and deposition levels due to the Project and other sources at sensitive receptor locations for comparison with relevant air quality assessment criteria.

Total dust emissions were estimated for selected operational scenarios using the material handling schedule, equipment listing, and quarry plans combined with appropriate emission factors (as above for construction dust). Three future operational scenarios were selected for modelling (Stage 1, 5 and 9). These years address the maximum material handling quantities, maximum haul distances, varying proximities to local communities, and combined interactions with other existing or approved quarrying operations. All activities were modelled as occurring between 7.00 am and 6.00 pm (i.e., operational hours) except product truck loading and haulage (6.00 am to 10.00 pm) and wind erosion (all hours). Full details on the emission calculations, including assumptions, emission controls and allocation of emissions to modelled locations are provided in the AQGGA in **Appendix 8**.

Post-blast fume was also quantified using the CALPUFF model, with a single volume source in the centre of the current active pit for each modelled quarrying Stage.

6.4.3.3 Operational Diesel Exhaust

The modelling for operational dust (described in **Section 6.4.3.2** above) has considered emission factors that represent the contribution from both wheel-generated particulates and exhaust particulates (as PM_{10} and $PM_{2.5}$).

Emissions of NO_x from diesel exhausts have been estimated using fuel consumption data, provided by ARDG, and emission factors from *Emission Estimation Technique Manual for Combustion Engines Version 3.0* (Commonwealth of Australia, 2008). The NO_x emission estimates for Stage 9 have been explicitly modelled to provide an indication of the off-site NO_2 concentrations due to diesel exhaust emissions from site-operated plant and equipment.

6.4.3.4 Road Transport

The air quality screening tool, Tool for Roadside Air Quality (TRAQ), developed for the former NSW Roads and Maritime Services, was used to assess the effects of diesel emissions from trucks transporting quarry products along public roads. The model considers conservative, worst-case conditions, using inputs based on traffic volumes, road design, meteorology and emission factors, to determine the potential for impacts. Results were then assessed by comparing predictions with relevant assessment criteria.

6.4.3.5 Crystalline Silica

The assessment of potential crystalline silica impacts resulting from quarrying activities have been assessed by comparing the annually averaged $PM_{2.5}$ predictions (conservatively assuming all $PM_{2.5}$ as crystalline silica) with the health-based air pollution assessment criterion adopted from VIC EPA's Publication 1961.

6.4.3.6 Odour

Potential odour impacts associated with the on-site emulsion road chip precoating plant, were similarly evaluated using the CALMET/CALPUFF model. Odour may arise from the tank used to store the heated emulsion product that is applied, and during the process of coating the road chip. Further detail is provided in the AQGGA, refer to **Appendix 8**.

6.4.3.7 Greenhouse Gas

Greenhouse gas (GHG) is a collective term for a range of trace gases that are known to absorb terrestrial infrared radiation in the atmosphere, where they cause a planetary greenhouse effect. It is common practice to aggregate the emissions of these gases to the equivalent emission of carbon dioxide, providing a simple figure for comparison of emissions against targets. The resulting number is expressed as carbon dioxide equivalent (or CO2-e).

GHG emissions that form an inventory can be split into three categories known as 'scopes' which are defined by the Greenhouse Gas Protocol (GHG Protocol) and can be summarised as:

- Scope 1 – Direct emissions from sources that are owned or operated by the organisation (e.g., combustion of diesel in company owned vehicles or on-site generators),
- Scope 2 – Indirect emissions associated with the import of energy from another source (e.g., importation of electricity),
- Scope 3 – Other indirect emissions (other than Scope 2 energy imports) which are a direct result of the operations of the organisation but from sources not owned or operated by them (e.g., product usage).

The purpose of differentiating between the scopes of emissions is to avoid the potential for double counting, where two or more organisations assume responsibility for the same emissions.

The *National Greenhouse and Energy Reporting (Measurement) Determination 2008* (Measurement Determination) provides methods, criteria and measurement standards for calculating and reporting greenhouse gas emissions and energy data under the *National Greenhouse and Energy Reporting Act 2007*.

Table 6.14 outlines the emission sources and methodologies used in the assessment.

Table 6.14 GHG emission sources and estimation methodologies

Activity	Description	Scope	Emission estimation methodology
Diesel usage	Combustion of diesel fuel from mobile and stationary plant and equipment (including diesel generators used prior to grid connection).	1, 3	Emission factors from National Greenhouse Accounts (NGA) Factors (2023).
Blasting	Detonation of explosives used for blasting.	1	Emission factors from NGA Factors (2008).
Vegetation	Loss of carbon sink due to removal of vegetation.	1	Calculated using 'Carbon Gauge' developed by the Transport Authorities Greenhouse Group (TAGG, 2013) and based on clearing areas per year over the life of the Project provided by ARDG.

Activity	Description	Scope	Emission estimation methodology
Construction materials	Embodied energy contained in construction materials.	3	Calculated using "Carbon Gauge" based on the estimated quantities of materials expected to be used.
Electricity	Indirect emissions from sources used to generate electricity used at the site.	2,3	Emission factors from National Greenhouse Accounts (NGA) Factors (2023).

6.4.4 Air Quality Impact Assessment

6.4.4.1 Construction Dust

Air quality impacts during construction would largely result from dust generated during vegetation clearing, earthworks and construction as a result of wind erosion and excavated materials transport/handling. Estimated emissions during construction would equate to approximately 27% or less of emissions estimated and assessed for operations (refer to **Section 6.4.4.2** below). Noting the outcomes below for operations, it is considered unlikely that the construction phase of the Project would cause any exceedance of relevant assessment criteria. Nonetheless, measures to minimise and effectively control emissions during construction will be implemented (refer to **Section 6.4.6**).

6.4.4.2 Operational Dust

Particulate Matter PM_{10}

The Project is not predicted to result in any exceedance of the applicable annual average or maximum 24-hour average PM_{10} criteria at any private sensitive receivers (refer to **Table 6.15**). The cumulative concentrations conservatively consider the worst-case background concentrations (i.e., highest 2021 DPE Beresfield measured values of 36 µg/m^3 for annual average PM_{10} and 16 µg/m^3 for maximum 24-hour average PM_{10}) rather than applicable time-varying concentration. The predicted maximum contribution from the Project for PM_{10} and 24-hour average $PM_{2.5}$ concentrations are displayed as ground-level concentration contour plots in **Figure 6.6** and **Figure 6.7** respectively.

Table 6.15 Predicted Results, PM_{10}

Receiver ID	Criteria	Project contribution (µg/m^3)			Cumulative concentration (µg/m^3)		
		Stage 1	Stage 5	Stage 9	Stage 1	Stage 5	Stage 9
Annual average PM_{10}							
R1	25	0.2	0.2	0.2	16.2	16.2	16.2
R5	25	0.3	0.4	0.5	16.3	16.4	16.5
R6	25	0.3	0.4	0.5	16.3	16.4	16.5
R7	25	0.3	0.4	0.5	16.3	16.4	16.5
R8	25	0.3	0.4	0.4	16.3	16.4	16.4
R9	25	0.3	0.4	0.4	16.3	16.4	16.4
R10	25	0.2	0.3	0.3	16.2	16.3	16.3
R11	25	0.1	0.1	0.1	16.1	16.1	16.1
R12	25	0.1	0.1	0.2	16.1	16.1	16.2

Receiver ID	Criteria	Project contribution (µg/m^3)			Cumulative concentration (µg/m^3)		
		Stage 1	Stage 5	Stage 9	Stage 1	Stage 5	Stage 9
R13	25	0.1	0.2	0.2	16.1	16.2	16.2
R14	25	0.1	0.2	0.2	16.1	16.2	16.2
R15	25	0.2	0.2	0.2	16.2	16.2	16.2
R16	25	0.2	0.3	0.3	16.2	16.3	16.3
R17	25	0.3	0.4	0.4	16.3	16.4	16.4
R18	25	0.3	0.4	0.5	16.3	16.4	16.5
R19	25	0.1	0.2	0.2	16.1	16.2	16.2
R20	25	0.2	0.3	0.3	16.2	16.3	16.3
R21	25	0.3	0.3	0.4	16.3	16.3	16.4
Maximum 24-hour average PM_{10}							
R1	50	2.0	2.4	2.5	38	38.4	38.5
R5	50	2.2	2.7	3.0	38.2	38.7	39
R6	50	2.2	2.9	3.1	38.2	38.9	39.1
R7	50	1.9	2.4	2.7	37.9	38.4	38.7
R8	50	1.9	2.4	2.7	37.9	38.4	38.7
R9	50	2.0	2.5	2.8	38	38.5	38.8
R10	50	1.6	2.1	2.3	37.6	38.1	38.3
R11	50	1.0	1.2	1.3	37	37.2	37.3
R12	50	1.1	1.4	1.5	37.1	37.4	37.5
R13	50	1.5	2.0	2.1	37.5	38	38.1
R14	50	1.6	2.1	2.1	37.6	38.1	38.1
R15	50	1.5	1.9	2.0	37.5	37.9	38
R16	50	2.6	3.3	3.6	38.6	39.3	39.6
R17	50	3.2	4.3	5.4	39.2	40.3	41.4
R18	50	4.2	5.4	7.2	40.2	41.4	43.2
R19	50	1.4	1.8	2.1	37.4	37.8	38.1
R20	50	2.5	3.0	3.3	38.5	39	39.3
R21	50	2.7	3.7	4.5	38.7	39.7	40.5

An assessment of 'combined cumulative impacts' was also completed consistent with guidance presented in 'Cumulative Impact Assessment Guidelines for State Significant Projects' (DPE, 2022) which included specific consideration of predicted incremental impacts from the Brandy Hill Quarry, Boral Seaham Quarry and the proposed Eagleton Quarry. This assessment estimated that resulting annual average and 24-hour PM10 air quality impacts from the Project, as well as from nearby existing and proposed developments (including background conditions) would not result in overall pollutant levels in excess of the relevant assessment criteria.

Particulate Matter $PM_{2.5}$

The Project is not predicted to result in any exceedance of the applicable annual average or maximum 24-hour average $PM_{2.5}$ criteria at any private sensitive receivers (refer to **Table 6.16**). As for PM_{10}, the cumulative concentrations conservatively consider the worst-case background concentrations (i.e., highest 2021 DPE Beresfield measured values of 5.9 µg/m^3 for annual average $PM_{2.5}$ and 19 µg/m^3 for maximum 24-hour average $PM_{2.5}$) rather than applicable time-varying concentration.

The highest predicted contribution from the Project to annual average $PM_{2.5}$ levels (0.07 µg/m^3 at R5 and R6 during Stage 9) was less than 1% of the 8 µg/m^3 criterion, demonstrating the negligible expected effect of the Project operations on local annually averaged $PM_{2.5}$.

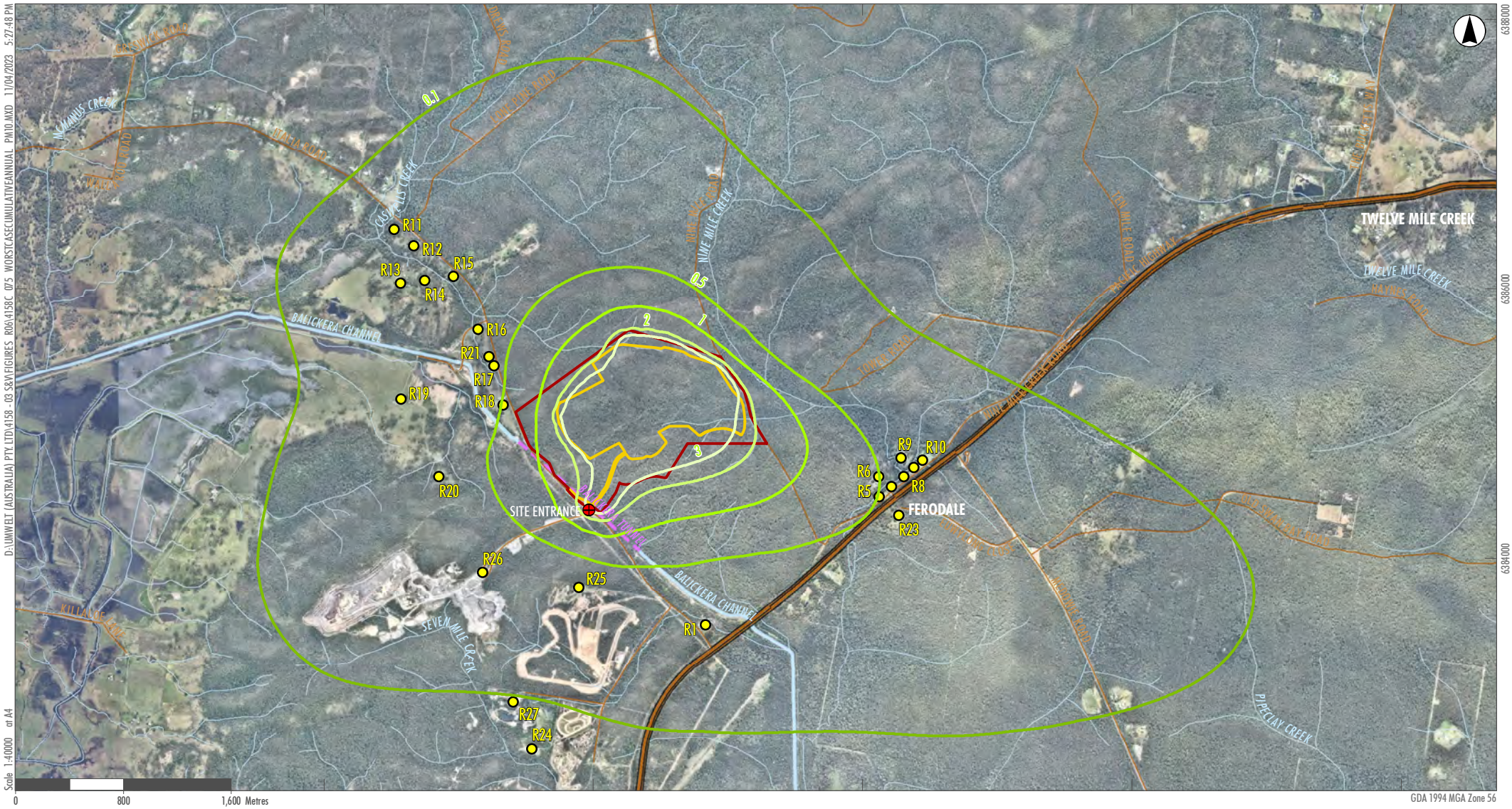
The predicted maximum contribution from the Project for $PM_{2.5}$ and 24-hour average $PM_{2.5}$ concentration are also displayed as ground-level concentration contour plots in **Figure 6.8** and **Figure 6.9** respectively.

Table 6.16 Predicted Results, $PM_{2.5}$

Receiver ID	Criteria	Project contribution (µg/m^3)			Cumulative concentration (µg/m^3)		
		Stage 1	Stage 5	Stage 9	Stage 1	Stage 5	Stage 9
Annual average $PM_{2.5}$							
R1	8	0.03	0.03	0.04	<6.0	<6.0	<6.0
R5	8	0.04	0.06	0.07	<6.0	<6.0	<6.0
R6	8	0.05	0.06	0.07	<6.0	<6.0	<6.0
R7	8	0.04	0.05	0.06	<6.0	<6.0	<6.0
R8	8	0.04	0.05	0.06	<6.0	<6.0	<6.0
R9	8	0.04	0.05	0.05	<6.0	<6.0	<6.0
R10	8	0.03	0.04	0.05	<6.0	<6.0	<6.0
R11	8	0.01	0.02	0.02	<6.0	<6.0	<6.0
R12	8	0.02	0.02	0.02	<6.0	<6.0	<6.0
R13	8	0.02	0.02	0.02	<6.0	<6.0	<6.0
R14	8	0.02	0.02	0.02	<6.0	<6.0	<6.0
R15	8	0.02	0.02	0.03	<6.0	<6.0	<6.0
R16	8	0.03	0.03	0.04	<6.0	<6.0	<6.0
R17	8	0.04	0.04	0.05	<6.0	<6.0	<6.0
R18	8	0.04	0.05	0.06	<6.0	<6.0	<6.0
R19	8	0.02	0.02	0.02	<6.0	<6.0	<6.0
R20	8	0.03	0.03	0.04	<6.0	<6.0	<6.0
R21	8	0.03	0.04	0.04	<6.0	<6.0	<6.0

Receiver ID	Criteria	Project contribution (µg/m³)			Cumulative concentration (µg/m³)		
		Stage 1	Stage 5	Stage 9	Stage 1	Stage 5	Stage 9
Maximum 24-hour average $PM_{2.5}$							
R1	25	0.3	0.3	0.3	19.3	19.3	19.3
R5	25	0.3	0.3	0.4	19.3	19.3	19.4
R6	25	0.3	0.3	0.4	19.3	19.3	19.4
R7	25	0.3	0.3	0.3	19.3	19.3	19.3
R8	25	0.2	0.3	0.3	19.2	19.3	19.3
R9	25	0.2	0.3	0.3	19.2	19.3	19.3
R10	25	0.2	0.2	0.3	19.2	19.2	19.3
R11	25	0.1	0.1	0.1	19.1	19.1	19.1
R12	25	0.1	0.2	0.2	19.1	19.2	19.2
R13	25	0.2	0.2	0.2	19.2	19.2	19.2
R14	25	0.2	0.2	0.2	19.2	19.2	19.2
R15	25	0.2	0.2	0.2	19.2	19.2	19.2
R16	25	0.3	0.3	0.3	19.3	19.3	19.3
R17	25	0.4	0.5	0.5	19.4	19.5	19.5
R18	25	0.5	0.6	0.7	19.5	19.6	19.7
R19	25	0.2	0.2	0.2	19.2	19.2	19.2
R20	25	0.3	0.3	0.3	19.3	19.3	19.3
R21	25	0.3	0.4	0.5	19.3	19.4	19.5

An assessment of 'combined cumulative impacts' which included specific consideration of predicted incremental impacts from the Brandy Hill Quarry, Boral Seaham Quarry and the proposed Eagleton Quarry. This assessment estimated that resulting annual average and 24-hour PM2.5 air quality impacts from the Project, as well as from nearby existing and proposed developments (including background conditions) would not result in overall pollutant levels in excess of the relevant assessment criteria.



Legend

- Project Area
- Disturbance Area
- Pacific Highway
- Road
- Balickera Tunnel
- Drainage Line
- Sensitive Receivers

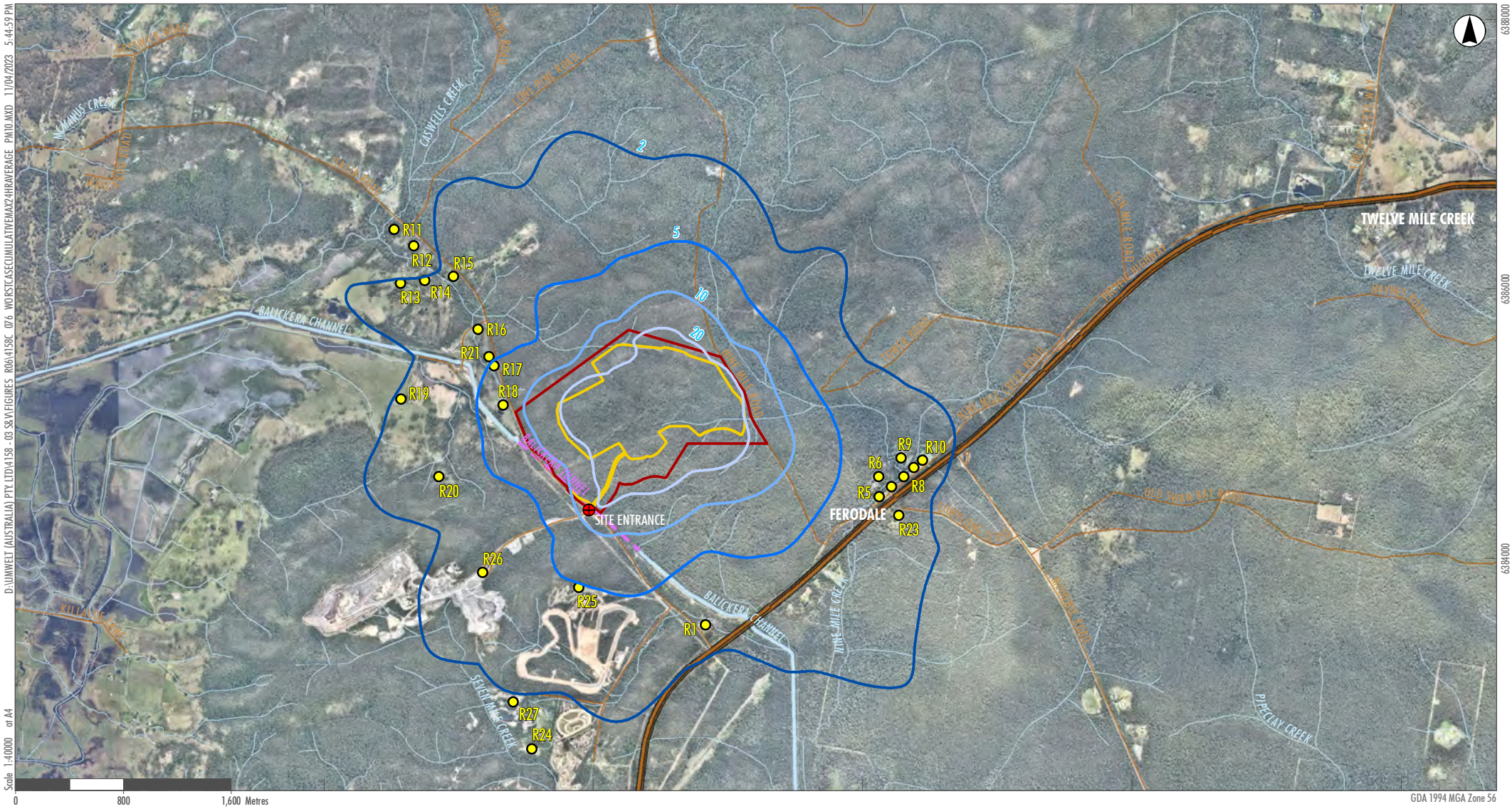
Particulate Matter (PM_{10}) - Annual Average

- 0.1 $\mu g/m^3$
- 0.5 $\mu g/m^3$
- 1 $\mu g/m^3$
- 2 $\mu g/m^3$
- 3 $\mu g/m^3$

Image Source: Nearmap (2022) Data source: NSW FSDF (2022)

FIGURE 6.6

Maximum Project Annual Average PM_{10} Contribution (All Years)



Legend

- Project Area
- Disturbance Area
- Pacific Highway
- Road
- Balickera Tunnel
- Drainage Line
- Sensitive Receivers

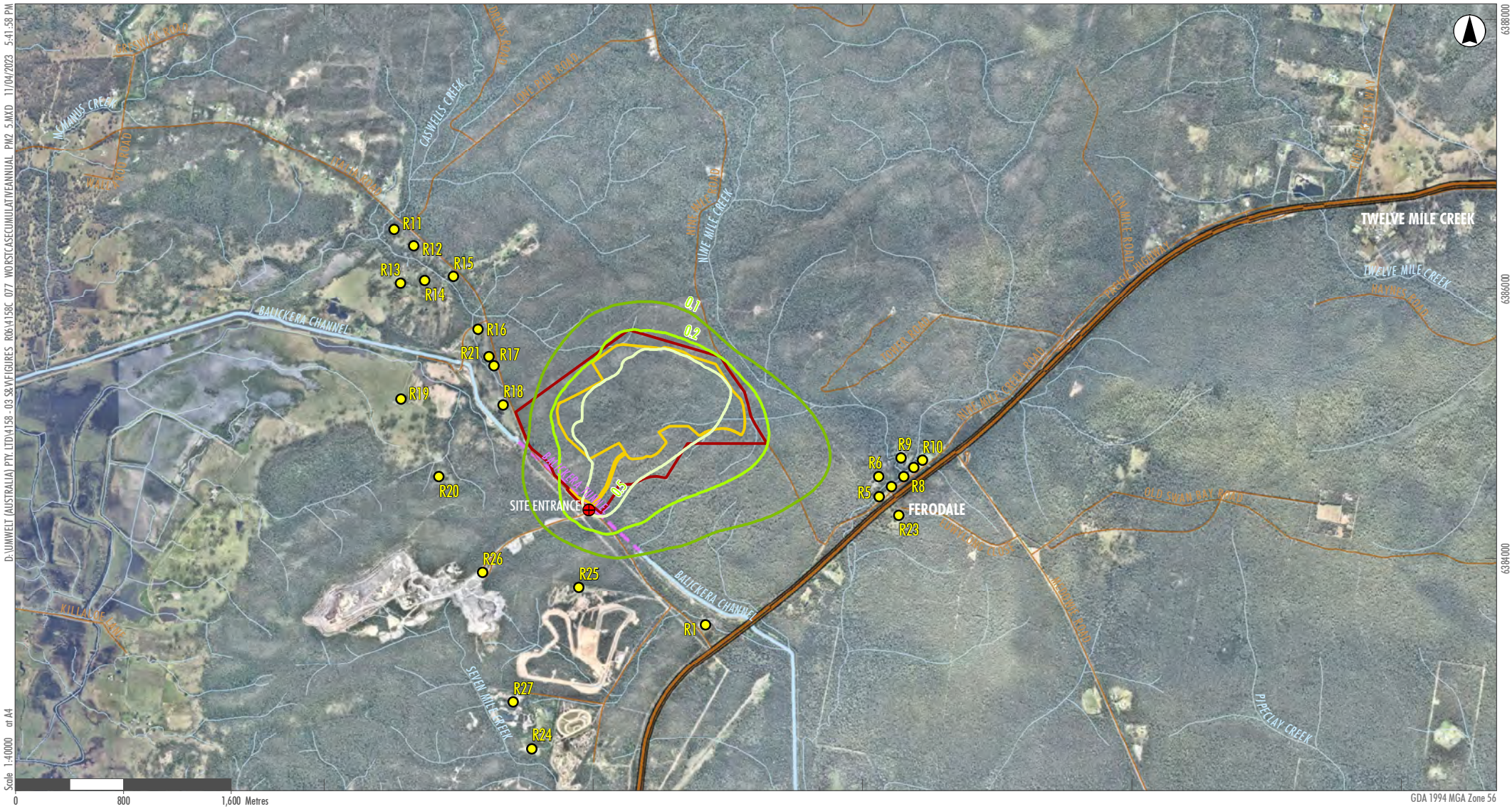
Particulate Matter (PM_{10}) Maximum 24-hour Averaged Concentration

- 2 $\mu g/m^3$
- 5 $\mu g/m^3$
- 10 $\mu g/m^3$
- 20 $\mu g/m^3$

Image Source: Nearmap (2022) Data source: NSW FSDF (2022)

FIGURE 6.7

Maximum Project 24-hour Average PM_{10} Contribution (All Years)



Legend

- Project Area
- Disturbance Area
- Pacific Highway
- Road
- Balickera Tunnel
- Drainage Line
- Sensitive Receivers

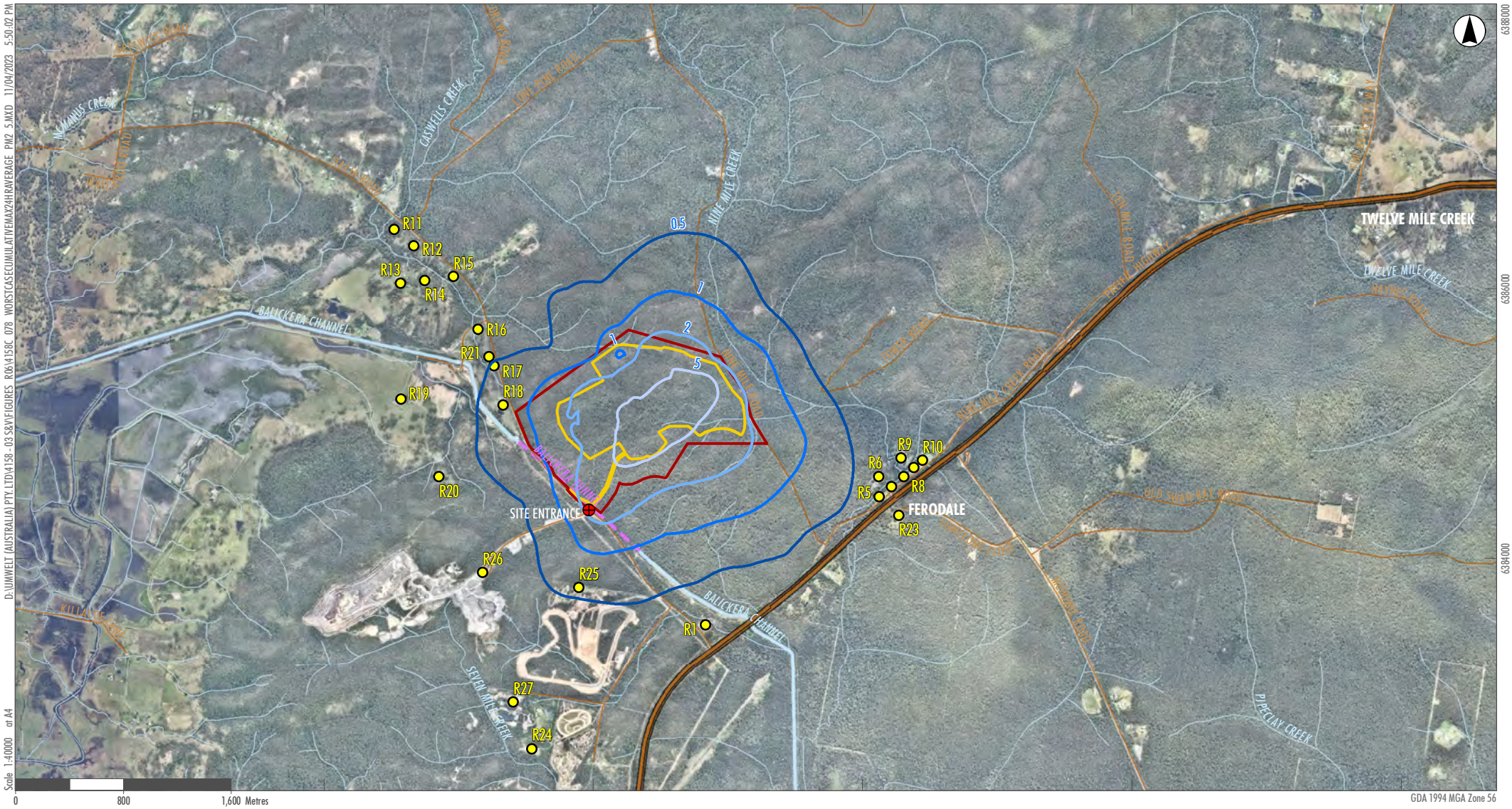
Particulate Matter ($PM_{2.5}$) - Annual Average

- 0.1 $\mu g/m^3$
- 0.2
- 0.5 $\mu g/m^3$

Image Source: Nearmap (2022) Data source: NSW FSDF (2022)

FIGURE 6.8

Maximum Project Annual Average $PM_{2.5}$ Contribution (All Years)



Legend

- Project Area
- Disturbance Area
- Pacific Highway
- Road
- Balickera Tunnel
- Drainage Line
- Sensitive Receivers

Particulate Matter ($PM_{2.5}$) Maximum 24-hour Averaged Concentration

- 0.5 $\mu g/m^3$
- 1 $\mu g/m^3$
- 2 $\mu g/m^3$
- 5 $\mu g/m^3$

Image Source: Nearmap (2022) Data source: NSW FSDF (2022)

FIGURE 6.9

Maximum Project 24-hour Average $PM_{2.5}$ Contribution (All Years)

Particulate Matter TSP

Cumulative annually averaged TSP concentrations at all surrounding sensitive receivers were predicted to remain well below the EPA's 90 µg/m^3 impact assessment criterion for all modelled stages of the Project. The incremental annual average TSP predictions for all modelled stages of the Project are shown in Figure 6.5 of the AQGGA in **Appendix 8**.

Deposited Dust

Cumulative annually averaged deposited dust concentrations at all surrounding sensitive receivers were predicted to remain below the EPA's 4 g/m^2/month impact assessment criterion at all modelled stages of the Project. Incremental contributions due to the Project are also predicted to be well below the incremental 2 g/m^2/month criteria with the predicted contributions being less than 10% of this criterion at most assessed residences and the highest predicted increment being just 0.24 g/m^2/month. The Project's contributions to monthly deposited dust predictions for all modelled stages of the Project are shown in Figure 6.6 of the AQGGA in **Appendix 8**.

VLAMP Assessment

The VLAMP specifies that voluntary acquisition rights may apply where, even with best practice management, the development contributes to exceedances of criteria at any residence or workplace on privately owned land, or on more than 25% of any privately owned land where there is an existing dwelling or where a dwelling could be built under existing planning controls. All model results were compliant with VLAMP criteria and therefore the Project will not trigger the VLAMP process.

6.4.4.3 Operational Post-Blast Fume

Figure 6.8 of the AQGGA (refer to **Appendix 8**) shows the predicted maximum 1-hour average NO_2 concentrations due to post-blast fume under a worst-case level 3 blast fume generation event. These results indicated that, even under worst-case meteorological conditions, the predicted maximum 1-hour average NO_2 concentrations at the nearest sensitive receivers are less than 5 µg/m^3. With the addition of maximum background levels (70 µg/m^3 in 2021) the results demonstrate that predicted NO_2 concentrations are less than half the EPA's 164 µg/m^3 criterion. As can be seen from Figure 6.8 of the AQGGA (refer to **Appendix 8**), maximum predicted (cumulative) 1-hour average NO_2 concentrations due to post-blast fume under a worst-case level 3 blast fume generation event are predicted to be less than 90 µg/m^3 at the Project Boundary under the worst case assumed background concentrations. The modelling therefore suggests that blasting associated with the Project will not cause adverse health impacts at any location outside the Project boundary.

6.4.4.4 Operational Diesel Exhaust

The modelling results for operational particulate matter (described in **Section 6.4.4.2** above) include emission factors that take into consideration diesel exhaust emissions from operational activities.

Cumulative annually averaged NO_2 concentrations associated with NO_2 emissions associated with diesel combustion on site were predicted to remain below the EPA's 31 µg/m^3 impact assessment criterion at all surrounding sensitive receivers. Similarly, maximum cumulative 1-hour averaged NO_2 concentrations associated with diesel combustion are predicted to be less than 77.5 µg/m^3 at all assessed receiver locations which is less than 50% of the EPA's 164 µg/m^3 impact assessment criterion.

As operations at the Project will effectively halt during blasts and following blasts, there is no chance of a peak impact from diesel combustion and a level 3 blast fume event occurring at any assessed receiver location within a 1-hour period. Based on these findings, it was determined that diesel exhaust emissions from the Project are unlikely to present an unacceptable risk. Nonetheless, measures to ensure that all plant and equipment are operated in a proper and efficient manner in order to preserve this outcome will be implemented (refer to **Section 6.4.6**).

6.4.4.5 Road Transport

The predictions of the TRAQ model were combined with adopted background concentrations to predict resulting changes in cumulative roadside air quality as a result of the additional quarry-related transportation. These concentrations were evaluated by comparing the results against the applicable EPA assessment criteria for carbon monoxide, nitrogen dioxide and PM_{10}. Results provided in Table 6.12 and Table 6.13 of the AQGGA (**Appendix 8**) show that diesel exhaust emissions from Project-generated traffic along on public roads will not lead to any exceedances of the EPA's impact assessment criteria. On this basis it is considered that additional traffic associated with the Project is unlikely to result in carbon monoxide, nitrogen dioxide and PM_{10} concentrations above relevant EPA assessment criteria.

6.4.4.6 Crystalline Silica

Respirable crystalline silica is noted as being a subset of PM2.5. Concentrations further from the site boundary, including at sensitive receivers, will therefore be lower than the estimated predictions of incremental PM2.5. The highest annually averaged PM2.5 concentration at a surrounding sensitive receiver was less than 0.1 µg/m3. This does not exceed the 3 µg/m3 annual average criterion noted by the Victorian EPA. This criterion is based on human health impacts associated with extended periods of exposure (e.g., residency) to crystalline silica. Predicted concentrations at the Project boundary are also below the 3 µg/m3 annual average criterion noted by the Victorian EPA. Accordingly, people passing close to the Project boundary for short periods would not be exposed to crystalline silica levels that present a health risk. The Project is therefore unlikely to cause adverse health impacts with respect to crystalline silica at locations outside the Project Area.

6.4.4.7 Odour

Modelling results indicate that the 99th and 100th percentile, 1-hour averaged odour concentrations both within the Project Area, and at surrounding sensitive receivers will be well below the stringent 2 OU criterion from the EPA's Approved Methods. This result applies to all locations within the onsite processing area where the precoating plant may be located, with sensitivity testing undertaken to determine that actual odour emissions would need to be more than two orders of magnitude (i.e., 100 times higher) before concentrations approaching 2 OU were predicted at off-site sensitive receivers.

6.4.5 Greenhouse Gas Assessment

Annual Scope 1 greenhouse gas emissions for the Project were predicted to range from 4,111 t CO_2-e/year (Year 17 to Year 22) to a maximum of 16,743 t CO_2-e/year in year 1. Lost carbon sinks associated with vegetation clearing were the predominant source of Scope 1 emissions in year 1 and year 2. This, in combination with emissions from diesel use in plant and equipment were all significant contributors from Year 3 to Year 10. These Scope 1 emission estimates are likely to overstate actual net emissions as they do not take into account carbon sequestration associated with biodiversity gains in offset areas.

Scope 2 emissions from off-site electricity generation remained a consistent source of emissions from Year 3 when on-site energy needs are planned to be transitioned from on-site generators to the grid. It is noted however that the Scope 2 emission factors are based on current emissions factors associated with electricity use and greenhouse gas emissions from off-site electricity generation are expected to decline over the life of the Project as fossil fuel fired electricity generation is progressively phased out and renewable energy sources comprise an increasing percentage of electricity generation. The Scope 2 emissions estimated are therefore likely to overstate the total Scope 2 emissions associated with the Project.

The estimated maximum (0.017 Mt CO_2-e) and average (0.0053 Mt CO_2-e) annual Scope 1, 2 and 3 emissions from the Project represent less than 0.0035% of Australia's and 0.013% of NSW's 2020 emissions respectively. As noted above, these estimates likely overpredict the total and average annual emissions due to the emission factors not taking into account sequestration associated with biodiversity offsets and the decline in carbon intensity in electricity supplies.

6.4.6 Mitigation and Management Measures

6.4.6.1 Particulate Matter Management

Modelling predicted that the dust concentrations and deposited dust levels due to the Project will not cause exceedances of the relevant EPA assessment criteria at the nearest sensitive receivers. These predictions include consideration of the application of the control measures outlined in **Table 6.17**, which will be implemented during operations.

Table 6.17 Emission Management Measures

Activity	Emission Management Measures	Assumed emission control (%)
Drilling rock	Water sprays Minimising activities when excessive visible dust is generated	70%
Hauling on roads	Watering of unsealed haul routes/roads Restricting vehicle speeds Clearly marked haul routes	50%
Crushing and screening	Enclosures Water sprays (as required)	70%
Conveyors between process units	Water sprays (as required)	50%
Wind erosion	Water sprays Minimising activities when excessive visible dust is generated Stabilising and minimising the extent of materials stored on-site Progressive rehabilitation of exposed areas	50 to 65%

The following standard measures will also be considered in the CEMP and OEMP:

- minimising the area of disturbed land at any one time, in line with an approved Quarry Operations Plan
- implementation of timely progressive rehabilitation
- review of meteorological conditions prior to blasting
- consideration of meteorological conditions in planning the loading and unloading of overburden and product materials
- minimising fall distance during loading and unloading of materials.
- the use of reactive management (real time) monitoring of particulates and other contaminants was not identified as a recommended measure due to the low risk of exceedance of criteria identified by AQGGA.

6.4.6.2 Blast Fume Management

Although the assessment determined that the Project will not cause adverse post-blast fume impacts, the AQGGA recommended the development of a Blast Management Plan to manage blasting activities during operations. This plan would define the allowable times of the day when blasting can occur, the weather conditions that may lead to higher potential risks, and the process that would be implemented to avoid or otherwise effectively manage blasting during these conditions.

6.4.6.3 Diesel Exhaust Management

Although the assessment determined that the Project will not cause adverse diesel exhaust emission impacts, the following measures have been identified as being both reasonable and feasible and will be implemented as part of the Project:

- servicing machinery in accordance with maintenance contracts and adopting original equipment manufacturer recommendations for maintenance
- additional maintenance where needed to ensure equipment remains fit for purpose over its whole life cycle
- defining failure modes to help minimise potential equipment failure.

The plant and equipment-related measures to reduce greenhouse gas emissions in **Section 6.4.6.4** would also be expected to reduce diesel exhaust emissions.

6.4.6.4 Greenhouse Gas Emissions Management

The following measures will be implemented by the Project to reduce the level of future greenhouse gas emissions.

- ensuring that mobile plant and equipment are maintained and operated in an efficient manner so that unnecessary fuel usage is avoided, including the shutting down of plant and equipment when not in use and ensuring they are operated in the most efficient mode

- minimising the extent of vegetation clearance and implementing revegetation and regeneration of completed areas as soon as practicable
- raising awareness of climate change issues amongst all stakeholders.

The feasibility of introducing lower emission equipment will be investigated during the replacement cycle for machinery.

These management measures will be included in the CEMP and OEMP developed for the Project.

6.5 Water Resources

The effective management of water resources has been a key consideration in Project planning and environmental assessment. The SEARs for the Project require the EIS to address the following key issues in relation to water:

- Aa detailed site water balance, including a description of site water demands, water disposal methods (inclusive of volume and frequency of any water discharges), water supply infrastructure and water storage structures.
- Identification of any licensing requirements or other approvals under the *Water Act 1912* and/or *Water Management Act 2000.*
- Demonstration that water for the construction and operation of the development can be obtained from an appropriately authorised and reliable supply in accordance with the operating rules of any relevant Water Sharing Plan (WSP).
- A description of the measures proposed to ensure the development can operate in accordance with the requirements of any relevant WSP or water source embargo.
- An assessment of any likely flooding impacts of the development.
- An assessment of the likely impacts on the quality and quantity of existing surface and groundwater resources, including a detailed assessment of proposed water discharge quantities and quality against receiving water quality and flow objectives.
- An assessment of the likely impacts of the development on aquifers, watercourses, riparian land, water-related infrastructure, the Grahamstown Dam drinking water catchment, Balickera Channel, Balickera Tunnel and any other related infrastructure, and other water users.
- A detailed description of the proposed water management system (including sewage), water monitoring program and other measures to mitigate surface and groundwater impacts.

Additional assessment requirements were also provided by DPE-Water and the Natural Resources Access Regulator (NRAR) in relation to water supply, water quality and quantity impacts, proposed monitoring and consideration of relevant legislation, policies and guidelines.

Assessments were undertaken separately for surface water and groundwater, and the results are detailed in the sections below.

6.5.1 Surface Water

A Surface Water Impact Assessment (SWIA) was undertaken by Umwelt (refer to **Appendix 10**) to assess the potential impacts of the Project on surface water. As required by the SEARs the SWIA included the preparation of a site water balance and consideration of potential licensing and WSP requirements, flooding impacts, water quality and quantity impacts, and impacts on water-related infrastructure, the Grahamstown Dam drinking water catchment, Balickera Channel, Balickera Tunnel and any other related infrastructure and other water users. The SWIA also includes a detailed description of the proposed water management system, water monitoring program and other measures to mitigate surface water impacts.

6.5.1.1 Existing Environment

The Project Area is within the Grahamstown Dam catchment and the Williams River catchment, both of which are part of the Hunter Water drinking water catchment. Grahamstown Dam is the major potable water source for the Lower Hunter. Water is received by Grahamstown Dam via catchment rainfall runoff inflows as well as extraction from the Williams River via the Seaham Weir Pumps and the Balickera Pump Station, which transfers water within Balickera Channel to Grahamstown Dam. The Balickera Channel is primarily an open canal approximately 2.7 km long cut into the surrounding land to the south-west of the Project Area.

The north-western part of the Project Area drains either directly to Balickera Channel or to ephemeral tributaries of Caswells Creek, which subsequently drains to Balickera Channel. Runoff from the eastern part of the Project Area drains to Nine Mile Creek, a fourth order stream that flows under Nine Mile Road and the Pacific Highway before discharging into Grahamstown Dam approximately 2 km south-east of the Project Area (refer to **Figure 2.3**). Both Balickera Channel and Nine Mile Creek drain into the northern extent of Grahamstown Dam.

The Project is located within the area regulated by the Hunter Unregulated and Alluvial Water Sources Water Sharing Plan (WSP). WSPs are developed under the *Water Management Act 2000* to protect the environmental health of water sources, whilst securing sustainable access to water for all users. The WSPs specify maximum water extractions and allocations and provide licensed and unlicensed water users with a clear picture of water availability. The south-eastern portion of the Project is located within the Newcastle Water Source of the Greater Hunter Extraction Management Unit while the north-western portion is located within the Seaham Weir Management Zone of the Williams River Water Source.

Licensed surface water users potentially impacted by the Project are located within the Newcastle Water Source and Williams River Water Source. A search of the NSW Water Register indicates that for the 2021/2022 financial year there were ten Water Access Licences (WALs) with a total of 100,571 unit shares allocated in the Newcastle Water Source area. HWC holds 100,000 shares for the major utility while all but one of the other WALs are predominantly for irrigation and associated with land outside of Grahamstown Dam catchment. The one WAL associated with land within the Grahamstown Dam catchment is for horticulture and applies to land in Medowie approximately 2.5 km from the eastern bank of Grahamstown Dam.

A search of the NSW Water Register for the 2021/2022 financial year indicates that there are 162 WALs with a total of 57,131.2 unit shares within the Williams River Management Zone of the Williams River Water Source. A search of the properties between the Project Area and Balickera Channel in the NSW Water Register did not identify any licensed water users in the Williams River Management Zone. The only water user immediately downstream of the quarry that could be impacted is HWC, which holds a WAL for major utility with a 50,000 unit share entitlement in the Williams River Management Zone and a 189,000 unit share entitlement in the Seaham Weir Management Zone of the Williams River Water Source.

ARDG has undertaken water quality monitoring at three locations within Nine Mile Creek since January 2020 to establish a baseline for receiving water quality. The recorded water monitoring data was compared to the NSW Water Quality Objectives (WQO), which are based on measurable environmental values for protecting aquatic ecosystems, recreation, primary industries, drinking water and industrial water (ANZECC and ARMCANZ, 2000). In the absence of catchment specific WQOs for the Grahamstown Dam or Williams River catchments, the Hunter River WQOs were considered an appropriate surrogate to apply to the receiving waters in the Project Area catchments. The monitoring results are provided in Section 2.3.2 of **Appendix 9** and were used to inform the assessment of NorBE required for development in drinking water catchments.

6.5.1.2 Proposed Water Management System

A conceptual operational Water Management System (WMS) has been developed for Stage 1 and Stage 9 of the Project. The conceptual WMS strategy is to:

- direct undisturbed catchment runoff around disturbed operational areas, where practicable, to minimise the quantity of water runoff captured and managed within the dirty water management system
- contain and reuse as much dirty water runoff from disturbed operational areas as possible to minimise import demands
- minimise the volume and frequency of controlled discharges from the WMS to the receiving environment
- minimise the risk of uncontrolled discharges from the WMS in storm events
- treat water prior to controlled discharge to ensure the average total pollutant loads (i.e. total suspended solids (TSS), total nitrogen (TN) and total phosphorus (TP)) have a NorBE on water quality when compared to pre-development Project Area runoff pollutant loads.

The conceptual WMS incorporates the key components described in **Table 6.18** with the Stage 9 WMS shown in the schematic in **Figure 6.10**.

During all stages of the Project, including the construction phase, erosion and sediment controls will be established in general accordance with *Managing Urban Stormwater – Soils and Construction Volume 1* (Landcom, 2004) *and Volume 2E: Mines and quarries* (the Blue Book) (Department of Environment and Climate Change, 2008). Erosion hazard and soil loss assessments have determined that the site has a high erosion hazard. However, the potential for this high erosion rate is limited to short periods during initial stripping of soils with high erodibility during high rainfall events. Following stripping, these soils will be stockpiled and stabilised in general accordance with the Blue Book and the exposed surfaces will consist of heavily trafficked and compacted surfaces with a much lower erodibility.

Sediment basins (as described in **Table 6.18**) will be established in the early stages of the quarry development and have been designed with capacity exceeding the sediment basin design criteria required by the Blue Book. Sumps will be established in the low points of pit areas to drain water away from operational areas of the pit and provide a deeper point from which water captured within the pits can be pumped. During extreme and/or extended rainfall events, the pits provide surge storage capacity for surplus water from storage basins where water does not meet quality requirements for discharge. This will minimise the likelihood of uncontrolled discharges with elevated pollutant concentrations (primarily suspended solids) in high or prolonged rainfall events to achieve an overall NorBE on water quality.

Table 6.18 Conceptual Water Management System Components

Item	Functional Description	Proposed Capacity	
		Stage 1	Stage 9
Main Pit Sump	Captures runoff from the Main Pit and receives overflows from the Primary Sediment Trap. Serves as surge storage capacity during wet periods (i.e., will receive transfers of surplus water from sediment basins).	100.0 ML	100.0 ML
North Pit Sump	Captures runoff from the North Pit. To be constructed prior to Stage 9 as the pit progresses to an extraction depth below ground level (likely to be soon after Stage 1).	-	5.0 ML
Primary Sediment Trap	Operates as a flow through sediment trap to capture coarse sediment in runoff from the eastern portion of the Main Pit, processing plant area and upslope undisturbed catchment before it drains to Sediment Basin 1 (SB1). Additional sediment traps may be constructed in the processing and stockpile areas to reduce SB1 sediment loads if required.	0.2 ML	0.2 ML
Sediment Basin 1 (SB1)	Primary site water storage and supply for operational demands to be constructed on ephemeral first and second order tributaries of Nine Mile Creek. Captures runoff from the stockpile areas and carpark, office/amenities and weighbridge. Sized to minimise the risk of uncontrolled discharges in storm events not exceeding the 24-hour duration, 0.2% AEP storm event. Water inventory to be managed through supply of operational demands (material processing and dust suppression), irrigation of undisturbed Project Area catchments (at a rate that does not result in runoff to local drainage lines) and controlled discharges.	100 ML	130 ML
Sediment Basin 2 (SB2)	Captures runoff from the haul road and adjacent disturbed areas and pumped inflows from North Pit. Sized to minimise the risk of uncontrolled discharges in storm events not exceeding the 24-hour duration, 0.2% AEP storm event. Will be managed to be minimise inventory to reduce frequency of uncontrolled discharges by transferring to SB1.	9.7 ML	9.7 ML
Clean Drains	Direct runoff from undisturbed catchment areas around operational areas.	To be determined during detailed design	

Item	Functional Description	Proposed Capacity	
		Stage 1	Stage 9
Licensed Groundwater Bore	Supplies water to meet operational demands during dry periods.	Up to 119 ML/yr	Up to 34 ML/yr
Water Treatment Plant	Removal of suspended solids and nutrients prior to controlled discharge (technology to be confirmed during Project detailed design phase).	Up to 220 ML/yr	Up to 220 ML/yr

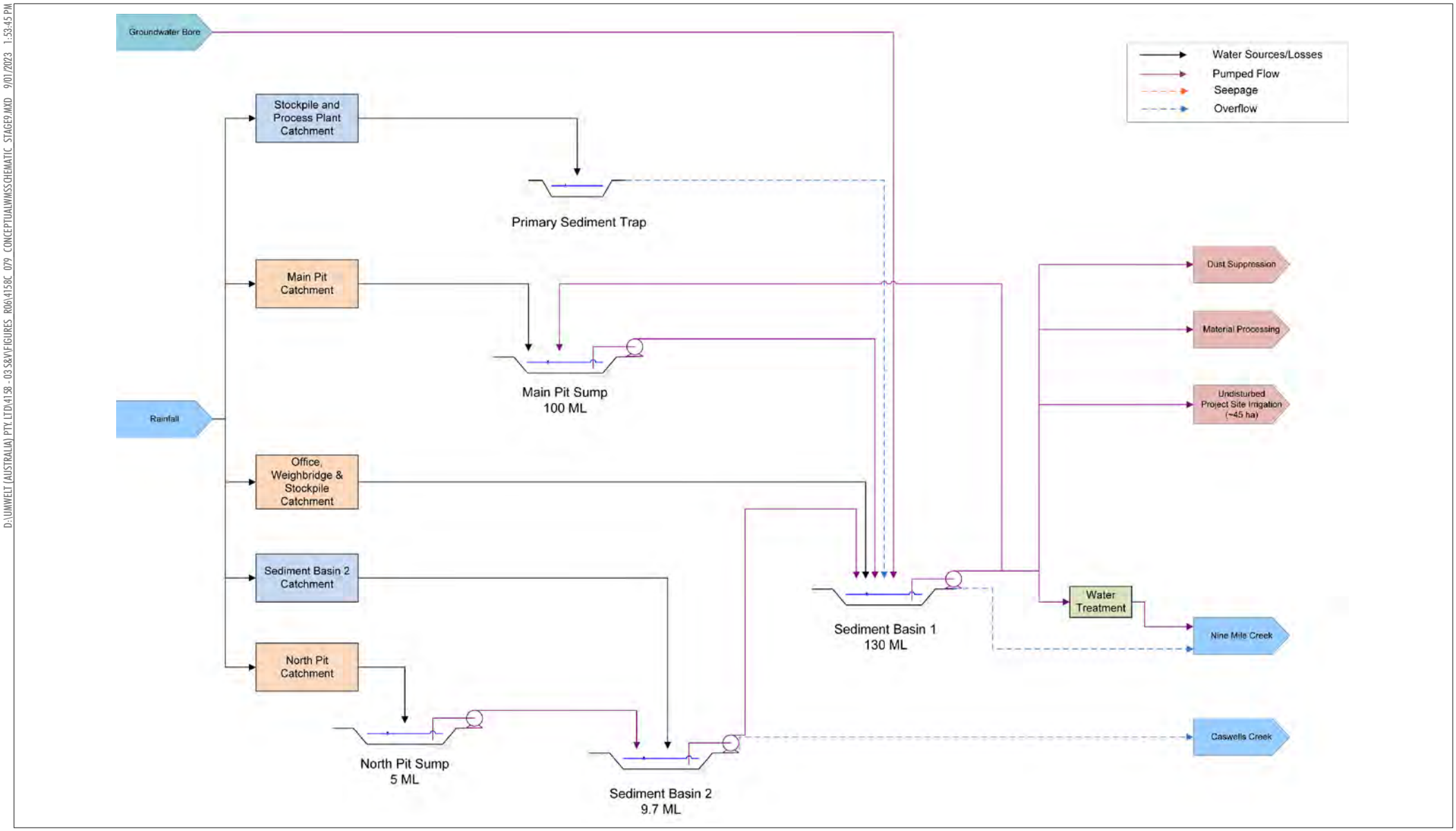


FIGURE 6.10

Conceptual Stage 9 WMS Schematic

During operations, potable water for the amenities use will be supplied to the site by water tanker. A rainwater tank(s) will also collect roof runoff to be utilised for non-potable water demands (e.g., toilet flushing). Wastewater from the amenities will be collected in a tank and removed from the site by a licensed waste contractor as required.

The conceptual final landform for the Project will include two final voids, the Main Pit and the North Pit. All other water storages (SB1, SB2 and any other sediment traps/basins) will be decommissioned and the landform outside of the Main Pit and North Pit will be free draining.

6.5.1.3 Water Balance

A water balance model was developed to simulate the performance of the conceptual Stage 1 and Stage 9 WMS. Stage 1 represents a period where there is no available in-pit storage other than the Main Pit Sump to accommodate surplus rainfall runoff during wet periods resulting in an increased likelihood of uncontrolled discharges from the WMS. Stage 9 represents the maximum WMS catchment area and therefore the stage in which the largest volumes of rainfall runoff will require management through reuse and controlled discharges. As indicated in **Section 6.5.1.2,** controlled discharges of surplus water will be treated as required to reduce pollutant concentrations (i.e. TSS, TN and TP).

Water sources included in the model were WMS catchment runoff and direct rainfall on water storages, groundwater inflows to the pits and a groundwater bore as a supplementary supply.

Modelled quarry water demands and losses include dust suppression on haul roads, exposed areas and stockpiles, material processing, evaporation from water storage surfaces, evaporation of groundwater inflow seepage and undisturbed catchment irrigation (to contribute to disposal of surplus rainfall runoff captured in the WMS).

Gross water balance results indicate that the quarry is likely to have:

- a water deficit and a requirement for imports to meet operational demands in dry years for both modelled stages
- limited requirements for discharge in Stage 1 during median rainfall years, and surplus water and a requirement for controlled discharges for Stage 1 during wet rainfall years to manage surplus rainfall runoff captured in the WMS
- surplus water and a requirement for controlled discharges for Stage 9 during both median and wet rainfall years to manage surplus rainfall runoff captured in the WMS
- no uncontrolled discharges for either Stage 1 or Stage 9 for the modelled historical climate data set, with the water storages within the conceptual WMS sized to minimise the risk of uncontrolled discharge.

Detailed water balance results are provided in Section 4.4 of the SWIA in **Appendix 9**. Water balance modelling results have been used to inform the NorBE on water quality assessment (refer to Section 2.3.3 and Section 6.1 of **Appendix 9**) as well as WMS design (e.g., water storage capacity requirements, water treatment and disposal requirements).

6.5.1.4 Impact Assessment

Water Quality

As the Project is located within the Hunter Water drinking water catchment (i.e., Grahamstown Dam and the Williams River) the *Guidelines for Development in Drinking Water Catchments* (Hunter Water, 2017) (Hunter Water Catchment Guidelines) provide Hunter Water's expectations for development within the Grahamstown Dam catchment. The Hunter Water Catchment Guidelines identify that it expected that all development within the drinking water catchment have a Neutral or Beneficial Effect (NorBE) on water quality. The Drinking Water Catchment Guidelines provide that a development is considered to have a NorBE on water quality if the development:

a. has no identifiable potential impact on water quality, or

b. will contain any water quality impact on the development site and prevent it from reaching any watercourse, waterbody or drainage depression on the site, or

c. will transfer any water quality impact outside the site where it is treated and disposed of to standards approved by the consent authority.

The pollutants of concern associated with the Project are Total Suspended Solids (TSS) and nutrients (Total Nitrogen and Total Phosphorus).

The assessment provided in Section 6.1 of the SWIA in **Appendix 9** showed that the Project can, on average, achieve a NorBE on water quality provided that:

- adequate water storage capacity is available for all stages of the quarry operation
- an appropriate water treatment system is installed and operated to design specifications to ensure controlled discharge water quality targets are achieved, and
- appropriate water inventory management is implemented to minimise the volume and frequency of uncontrolled discharges.

Water treatment methods that would adequately reduce pollutant concentrations in controlled discharges from the Project were identified by Beca Hunter H2O. These water treatment methods are discussed further in Appendix A of the SWIA in **Appendix 9**).

Water Quantity

Water balance modelling indicates that rainfall runoff and groundwater bore extraction will provide an adequate and reliable supply of water to meet operational water demands for all stages of the Project (primarily required during dry years). An assessment of the availability of groundwater source entitlements in the New England Fold Belt Coast Groundwater Source indicates that sufficient shares should be obtainable. In the event of any temporary restrictions on access to groundwater entitlements, the Project would scale operations to an appropriate level to reduce operational water demands while, as far as practicable, ensuring environmental controls are maintained (i.e., dust suppression).

Catchment Yields

The Project WMS will occupy a maximum of 75 ha, of which approximately 52 ha is in the Grahamstown Dam catchment and 23 ha is in the Williams River catchment, equating to approximately 0.45% and 0.02% of the respective total catchment areas of the Grahamstown Dam and Williams River catchments.

There will be an average decrease in catchment yield during Stage 1 of the Project (of approximately 25 ML/year) and during drier years of Stage 9 of the Project (of approximately 20 ML/year), however on average catchment yields are expected to increase during the intermediate and latter operational stages of the Project due to the increased runoff potential of the developed quarry site and the requirement to manage surplus rainfall runoff through controlled discharges. Loss of catchment yield during dry years is considered to have a negligible impact on overall Grahamstown Dam and Williams River catchment yields.

Water Security

Water balance modelling indicates that rainfall runoff and groundwater bore extractions will provide an adequate and reliable supply of water to meet operational water demands for all stages of the Project (refer to Section 4.0 of the SWIA in **Appendix 9**). As noted above, an assessment of the availability of groundwater source entitlements in the New England Fold Belt Coast Groundwater Source [3] indicates that sufficient shares should be obtainable. In the event of any temporary restrictions on access to the groundwater entitlements, the quarry will scale operations to an appropriate level to reduce operational water demands to meet the available supply while, as far as practicable, ensuring environmental controls are maintained (i.e., dust suppression).

Flow Regimes and Stream Stability

As the quarry will be located on a ridgeline and will only intercept first and second order ephemeral streams, significant impacts to the flow regimes of downstream higher order watercourses (i.e., Nine Mile Creek to the east and Caswells Creek to the north-west) are considered unlikely.

Potential stream stability issues associated with discharges are expected to be manageable and any required mitigation measures (e.g., scour protection, discharge flow rate limits) will be informed by a hydrologic and hydraulic assessment to be undertaken prior to construction.

Flooding

Flood mapping in the Port Stephens LEP 2013 indicates that the Project Area, including the quarry access off Italia Road, is not located in a flood planning area. Flooding does not represent a risk to employees entering or leaving the Project site.

The Project site is located on a ridgeline with no upslope catchment and therefore no local flooding issues are expected either on-site or downstream of the Project. There is no risk of the quarry pit voids being inundated through inflows from flooding in surrounding areas.

[3] Further details regarding the New England Fold Belt Coast Groundwater Source are contained in **Section 6.5.2.1**.

6.5.1.5 Management Measures

In addition to the water management design principles described in **Section 6.5.1.2** the following general erosion, sediment and water quality management strategies will be implemented for the Project:

- To minimise ground disturbance, construction and operational activities including vehicle and machinery movements, stockpiling, temporary vehicle parking and material laydown will be restricted to designated work areas. The disturbance boundary is to be clearly delineated with construction fencing or barrier tape.
- All fuels, chemicals and liquids will be stored in an impervious bunded area, a minimum of 50 m away from drainage lines or waterways and all refuelling of plant and equipment is to be undertaken within this area.
- Emergency spill kits will be kept on site at all times. All workers will be made aware of the location of the spill kits and trained in their use.
- Any concrete washout undertaken on site will be in a bunded area that is not on waterfront land and at least 10 m from drains.
- Where possible, topsoil will be stripped and handled only when it is moist (not wet or dry) to avoid decline of soil structure.
- Topsoil stockpiles will be stabilised with vegetation (seeded) if they are to be inactive for long periods.
- Stockpiles of erodible material that have the potential to cause environmental harm if displaced will be located away from concentrated surface flow and excessive up-slope stormwater surface flows.
- Wherever reasonable and practicable, 'clean' surface waters will be diverted away from sediment control devices and any untreated, sediment-laden waters.
- All runoff from the works will pass through sediment controls which will be located as close to the source of the sediment as practicable.
- Sediment control devices will be de-silted and made fully operational as soon as reasonable and practicable after a sediment-producing event. Sediment traps will be maintained to ensure that no more than 30% of their design capacity is lost to accumulated sediment.
- Sediment removed from any trapping device will be disposed of in locations where further erosion and consequent pollution to downslope lands and waterways will not occur.
- Temporary soil and water management structures will be removed only after the Project Area is stabilised appropriately.

6.5.1.6 Licensing, Monitoring and Reporting

Licensing

The Project will be required to hold an Environment Protection Licence (EPL) for carrying out a premises-based activity listed in Schedule 1 of the *Protection of the Environment Operations Act 1997* (i.e., extractive activities greater than 30,000 tonnes/year and crushing, grinding separating works). ARDG will include a request for at least one licensed discharge point in the EPL application to allow controlled discharges of surplus water from the quarry WMS.

All surface water storages within the WMS are required to prevent the contamination of a water source and are therefore considered as excluded works under Schedule 1 of the *Water Management (General) Regulation 2018*. A water access licence is therefore not required.

Water balance modelling indicates that the maximum surface water takes based on runoff from an undisturbed catchment of equivalent size to the total final voids catchment area (approximately 37.5 ha) is 205.3 ML/year. Following completion of extractive activities and at the time that the final landform is established (i.e. after all rehabilitation activities are complete), ARDG will purchase and hold sufficient licence entitlements within the Newcastle Water Source and the Williams River Water Source to comply with contemporary surface water licensing legislation (with consideration of harvestable rights provisions and any applicable water returns policy to account for spill volumes) associated with rainfall into the voids.

A licence will also be required for the proposed groundwater bore in the New England Fold Belt Coast Groundwater Source to supplement surface water runoff captured in the WMS as required during dry conditions to meet operational water demands. Water balance modelling indicates that the maximum groundwater import demand, additional to incidental groundwater take associated with inflows to the quarry pits, could be up to approximately 134 ML/year. Based on an assessment of water trades, controlled allocations and usage within the New England Fold Belt Coast Groundwater Source (refer to Section 7.1.3 of the SWIA in **Appendix 9**) it is expected that ARDG will be able to secure sufficient groundwater entitlement to supplement operational demands.

Monitoring

The proposed surface water quality monitoring program would include a continuation of monitoring in the three receiving waters reference sites in Nine Mile Creek (as discussed in **Section 6.5.1.1**) plus an additional downstream site in a tributary of Caswells Creek, adjacent to Italia Road. Monitoring of water quality would also be undertaken within Sediment Basin 1, Sediment Basin 2, Main Pit Sump and the quarry licensed discharge point.

Stored water volumes and discharge flow rates and volumes would also be monitored across the WMS and an automatic weather station installed to provide continuous recording of rainfall depth.

Routine stream stability monitoring will be undertaken as recommended in the baseline stream stability assessment that will be completed prior to construction.

An inspection and water quality testing program for potable water stored in tanks on site will also be implemented to ensure amenities water quality meets the relevant Australian Drinking Water Guidelines.

Reporting

ARDG will be required to complete and submit an Annual Return to the NSW Environment Protection Authority (EPA) which will likely include a summary of water discharges, monitoring, complaints and a statement of compliance with EPL conditions.

A summary of the quarry WMS performance will also be provided in the Annual Review to DPE and include the annual site water balance results, receiving water and discharge water quality monitoring results and details of any incidents or complaints.

Should an environmental incident involving surface water occur at the quarry, the relevant authorities (including DPE, EPA and Hunter Water) will be notified in accordance with the POEO Act, and reports provided as required.

6.5.2 Groundwater

A Groundwater Impact Assessment (GWIA) was undertaken by GHD Pty Ltd (GHD) (refer to **Appendix 10**) in accordance with the SEARs for the Project and with reference to the *Groundwater Assessment Toolbox for Major Projects in NSW – Overview Document* (DPE, 2022).

6.5.2.1 Existing Environment

Regional Hydrogeology

The Project is located within the New England Fold Belt Coast Groundwater Source which is managed by the Water Sharing Plan (WSP) for the North Coast Fractured and Porous Rock Groundwater Sources. The New England Fold Belt Coast Groundwater Source is a fractured aquifer system with groundwater contained within and moving through fractures in the rock that have occurred due to folding and faulting of the rock formations (NSW Department of Primary Industries (NSW DPI), 2016). Yields within the groundwater source are generally low, around 1 L/s, however, yields up to 10 L/s may be obtained from highly fractured fault systems (NSW DPI, 2016).

Regional groundwater flow in the fractured rock aquifers is anticipated to be south-east towards Grahamstown Dam and the South Pacific Ocean, and regional gradients in the aquifers are typically less than 1% (URS Australia, 2014). The local flow system occurs in unconfined and confined fractured rock aquifers within the Eagleton Volcanics. Where the fractured rock unit outcrops and where surficial clay layers are thin, the aquifer is unconfined. To the south-east of the Project Area, depending on the lateral continuity of the clay layer, the fractured rock may behave as a confined aquifer.

Groundwater Dependent Ecosystems

Areas of probable vegetation Groundwater Dependent Ecosystems (GDEs) within the maximum predicted zone of drawdown have been mapped as part of the Probable Vegetation Groundwater Dependant Ecosystems – Hunter / Central Rivers dataset (DPE 2022).

Areas in the centre of the radius of drawdown, where the greatest drawdown is predicted, are within the Project Disturbance Area. Accordingly, there will be no vegetation present within this area to be impacted by these effects. In the areas outside the Disturbance Area only the northern extent of drawdown has potential to impact areas of vegetation mapped as having a high probability of being a GDE. This vegetation is associated with the unnamed first and second order tributary of Caswells Creek. This tributary and associated riparian vegetation has not been mapped as a high ecological value aquatic ecosystem (HEVAE) by DPIE-Water.

The GIA identifies that the average depth to groundwater within the areas around the Project varies between 7.31 and 23.3 m below ground level. Groundwater levels in the area where the high probability GDE is present within the maximum extent of predicted drawdown are between approximately 7 and 13 metres below ground level. Drawdown (assuming these most conservative drawdown predictions) in the area of the high probability GDEs would be in the order of 0 – 5 m, however it is noted that these predictions relate to drawdown within the bedrock and weathered layer resource, and it is likely that in colluvial/alluvial systems (which are likely associated with the vegetation in this area) groundwater availability for terrestrial vegetation would be more influenced by localised recharge effects from the creeks and rainfall. The terrestrial vegetation in these areas that do have groundwater dependence would be less impacted by drawdown effects induced in the bedrock and weathered layers. Accordingly, even drawdowns in the regional water table of up to 5 metres in this area would likely not have a material impact on vegetation associated with colluvial and alluvial systems which are primarily influenced by rainfall and surface flow rechange.

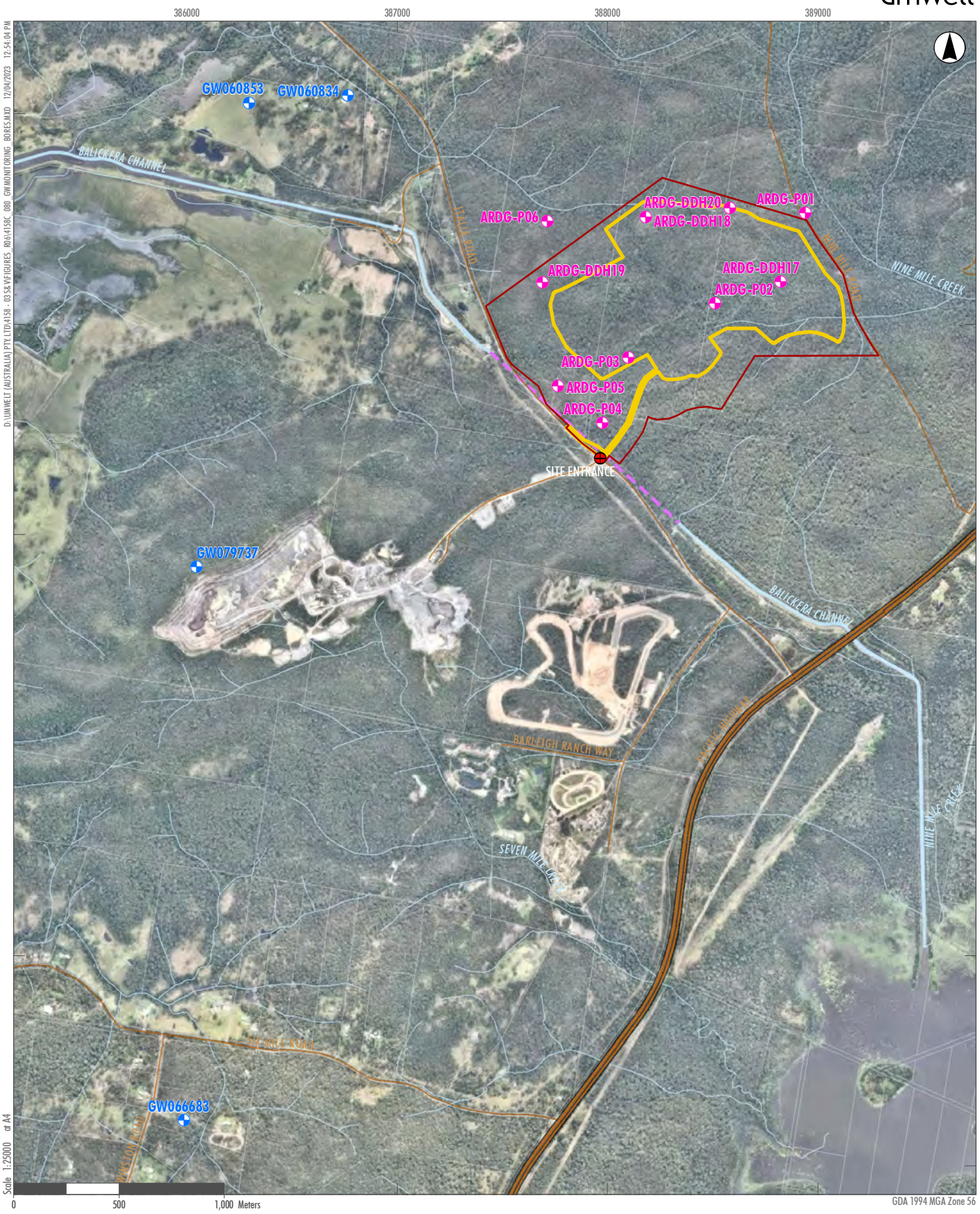
Groundwater Bores

Four bores have been identified within a 5 km radius of the Project, as shown in **Figure 6.11**. GW060834, GW060853 and GW066683 were reported to be water supply bores (stock and domestic) and are likely to have been established under basic landholder rights. The nearest bore (GW0360834) is located approximately 1.7 km from the Project Area. Registered bore details are summarised in **Table 6.19**.

Table 6.19 Registered Private Bores within 5 km of the Project

Bore ID	GW060834	GW060853	GW066683	GW079737
Depth	30.5	24.3	35.0	20.0
Purpose	Water supply (stock and domestic)			Unknown
Drilled date	01/02/1985	01/02/1985	06/02/1991	20/10/1999
Screened interval (m depth)	Unknown	6.9-18	15-22	Unknown
Water bearing zone	12.2–12.6	11.2–12.4	14–15, 20–21	Unknown
Yield (L/s)	0.70	0.63	0.90	Unknown
Distance from the Project	1,720	2,110	4,550	2,550
Electrical conductivity (EC) (µS/cm)	8,000	1,255	Unknown	Unknown
Average depth to groundwater	3.7	4.15	Unknown	Unknown

The Groundwater assessment also includes consideration of monitoring bores installed for the Boral Seaham Quarry and the proposed Eagleton Quarry.



Legend

- Project Area
- Disturbance Area
- Groundwater Monitoring Bores
- Landholder Bores
- Pacific Highway
- Road
- Balickera Tunnel
- Drainage Line
- Lot Boundaries

FIGURE 6.11

Groundwater Monitoring Network and Registered Bores

Image Source: Nearmap (2022) Data source: NSW FSDF (2022)

Project Groundwater Monitoring Network

Ten groundwater monitoring bores were installed within the Project Area by ARDG in 2019 and 2020 (refer to **Figure 6.11**), screened in different lithologies within the Eagleton Volcanics, as detailed in **Table 6.20**. Groundwater levels have been monitored manually by ARDG since June 2019 in ARDG-DDH bores and since March 2020 in ARDG-P bores. Average groundwater levels range from 12.7 m AHD at ARDG-P06 to 28.2 m AHD at ARDG-P02. Groundwater levels generally reflect rainfall conditions, with an increasing trend observed over the last few years as a result of above average rainfall.

Groundwater levels generally reflect topography, with the highest groundwater levels observed where the ground surface is elevated, and lower groundwater levels occurring at relatively lower elevations. Groundwater flow is controlled by topography, with Stone Ridge and South Ridge acting as local groundwater divides. Groundwater flows from topographically elevated areas towards lower lying areas.

Groundwater was sampled by ARDG at monitoring bores ARDG-DDH17, ARDG-DDH18, ARDG-DDH20, ARDG-P01, ARDG-P02 and ARDG-P06 on 28 July 2022 and analysed for major ions, nutrients, dissolved metals, pH and Electrical Conductivity (EC). Measured pH varied between 5.64 and 7.83, with an average value near neutral (6.88). EC varied between 198 µS/cm at ARDG-P02 and 5,820 µS/cm at ARDG-P01. The low EC at ARDG-P02 may be a result of the high degree of fracturing at this location, and potentially increased rainfall recharge through the fracture network. ARDG-P01 is located near Nine Mile Creek and groundwater at this location may be influenced by leakage from the creek. The majority of dissolved metal concentrations were below the limit of reporting, however manganese had reportable concentrations for all monitoring bores.

Slug testing was also undertaken to determine hydraulic conductivity within the aquifer. The interpreted hydraulic conductivity estimates were within the range of literature values reported for fractured igneous and metamorphic rocks.

Table 6.20 ARDG Monitoring Bore Details

Bore ID	Screened lithology	Elevation (top of casing) (m AHD)	Hole depth	Screened elevation (m AHD)	Average groundwater level (m AHD)	Average depth to groundwater (m bgl)
ARDG-DDH17	Conglomerate, sandstone and siltstone	41.41	39.60	4.81 to 7.81	23.88	17.53
ARDG-DDH18	Dacite and volcanic breccia	32.34	54.65	-19.31 to -16.31	19.26	13.08
ARDG-DDH19	Volcanic breccia	36.77	36.00	3.77 to 6.77	20.01	16.76
ARDG-DDH20	Sandstone and siltstone	40.65	36.50	7.15 to 10.15	22.21	18.44
ARDG-P01	Dacite	29.86	21.00	11.86 to 14.86	22.38	7.48
ARDG-P02	Dolerite	45.13	24.40	23.73 to 26.73	28.20	16.93
ARDG-P03	Rhyodacite	46.60	24.50	25.1 to 28.1	25.24	21.36

Bore ID	Screened lithology	Elevation (top of casing) (m AHD)	Hole depth	Screened elevation (m AHD)	Average groundwater level (m AHD)	Average depth to groundwater (m bgl)
ARDG-P04	Tuff	34.23	23.80	13.43 to 16.43	15.17	19.06
ARDG-P05	Rhyodacite	49.46	23.80	28.66 to 31.66	26.14	23.32
ARDG-P06	Dacite	20.06	21.00	-0.94 to 2.06	12.75	7.31

6.5.2.2 Assessment Methodology

A conceptual groundwater model was developed for the Project based on groundwater monitoring data, lithology logs and core photographs provided by ARDG, interpreted geology and previous hydrogeological assessments for the nearby Eagleton (proposed) and Seaham quarries.

The conceptual hydrogeological model consisted of three hydrostratigraphic layers:

- Clay layer, up to 11 m thick, discontinuous across the Project Area.
- Unconfined fractured rock aquifer (Eagleton Volcanics).
- Confined fractured rock aquifer (Eagleton Volcanics).

Quantification of likely groundwater inflow rates and the radius of drawdown was undertaken using a steady-state analytical model. Based on the distance to the few registered landholder bores (greater than 1 km), the low hydraulic conductivity of the aquifer, and the lack of GDEs due to deep groundwater levels through the rhyodacite resource, it is considered that the risk to groundwater receptors due to the Project is low and therefore the level of complexity of analytical equations is therefore appropriate to assess this risk.

6.5.2.3 Impact Assessment

Impacts on the groundwater system are not predicted until the pit depths go below the water table. This is not predicted to occur until Stage 5 when the North Pit is predicted to quarry below the depth of the water table. Main Pit is not predicted to go below the water table until Stage 6.

As Stage 8 represents the maximum extent and depth of quarry operations, this will also be the Stage with the highest impact on the water table and have the highest groundwater take. Using a range of hydraulic conductivity estimates obtained from slug testing and averaged literature values for unfractured igneous and metamorphic rock, Stage 8 groundwater inflows (take) for Main Pit were predicted to range from 26.7 ML/year to 183.9 ML/year, and the radius of drawdown was predicted to be between 445 m and 691 m from the centre of the quarry pit. Stage 8 groundwater inflows (take) for North Pit were predicted to range from 6.1 ML/year to 42.4 ML/year, and the radius of drawdown was predicted to be between 173 m and 352 m from the centre of the quarry pit. However, as the North Pit is within the predicted zone of drawdown for the Main Pit, both the estimate of take and radius of drawdown for the North Pit are likely to be conservative and cumulative take would be expected to be lower than the sum of the predicted inflows for the two pits.

Based on the more likely inflow predictions for Main Pit and North Pit in Stage 8, ARDG would be required to obtain a Water Access Licence (WAL) for approximately 33 – 57 ML/year. Based on recent (2021/2022) trades within the New England Fold Belt Coast Groundwater Source there is sufficient market depth for ARDG to obtain a licence for these predicted inflow volumes. As these inflows are not predicted to occur until Stage 5 for the North Pit and Stage 6 for the Main Pit, licences for this take are not required to be obtained until at least Stage 5 of the Project.

The most conservative predicted radius of drawdown for the Project Stage 8 (i.e., 691 m) was used to assess the impacts to existing groundwater users and GDEs. Both existing users and the high ecological value aquatic ecosystem GDEs identified in **Section 6.5.2.1** are well outside the Project's radius of drawdown. No drawdown is therefore expected to occur at any of the private bores, or at the high ecological value aquatic ecosystem GDEs as a result of the Project.

Terrestrial ecosystems which may have some groundwater dependence which are located within the zone of drawdown. Groundwater levels in the area where the high probability GDEs are mapped as being present within the maximum extent of predicted drawdown are between approximately 7 and 13 metres below ground level. Incremental Drawdown (assuming these most conservative drawdown predictions) in the area of the high probability GDEs would be in the order of 0–5 m, however it is noted that these predictions relate to drawdown within the bedrock and weathered layer resource, and it is likely that in the overlying colluvial/alluvial systems (which are likely associated with the vegetation in this area) groundwater availability for terrestrial vegetation would be more influenced by localised recharge effects from the creeks and rainfall. The terrestrial vegetation in these areas that do have groundwater dependence would be less impacted by drawdown effects induced in the bedrock and weathered layers. Accordingly, even drawdowns in the regional water table of up to 5 metres in this area would likely not have a material impact on vegetation associated with colluvial and alluvial systems which are primarily influenced by rainfall and surface flow rechange. It is noted that impacts on the areas mapped as having a higher probability of being a terrestrial GDE would not occur until the later stages of the project and drawdown impacts would reduce following cessation of quarry activities in these areas first due to these areas being at the extent of the predicted radius of drawdown.

The depth to water table in the Stone Ridge area, where the greatest drawdown is predicted, is already well below the effective rooting depth of most tree species and the two bores with the shallowest water table (ARDG-P01 and ARDG-P06 – approximately 7.3–7.5 m) are both located close to drainage lines where there overlying clay material would be of greater depth and impacts on the water table in these areas would likely be lower due to both distance from the point of depressurisation and the localised effects of groundwater movement within the colluvium.

Any impacts on vegetation associated with groundwater drawdown would be a reduction in species abundance of species with higher groundwater dependence and a succession towards drier vegetation communities such as those present in the higher elevation areas away from the shallow slope areas. Such changes would be temporary with communities transitioning back to those currently present as the water table recovers.

The Project is not expected to cause any significant change in groundwater quality or in the beneficial use of the groundwater.

Potential biodiversity impacts associated with any changes in groundwater would likely be temporary and localised and be unlikely to have a significant impact on overall biodiversity values.

The potential impacts of the Project therefore meet the NSW Aquifer Interference Policy (AIP) Level 1 Minimal Impact Considerations for landholder bores, GDEs and groundwater quality.

Modelling indicates that following the cessation of quarrying after 30 years, the groundwater table will be locally depressed to -2 m AHD. Depending on groundwater inflows post closure, and the rainfall and evaporation rates, a pit lake may form, which will act as a localised groundwater sink. Any post closure impacts to groundwater quality should therefore be contained within the Project itself. With time, groundwater levels in the aquifer surrounding the Project will equilibrate, however during the recovery stage groundwater inflows will occur, and a WAL will still be required in the initial post closure phase of the Project. Groundwater inflows during this post extraction phase will be no higher than the Stage 8 predictions and will decrease over time as water levels in the void increase until the water levels in North Pit and Main Pit reach the floor levels of Stages 5 and 6 respectively at which point the water table will be in equilibrium with pre mining levels. As the pit rises above this level, the water table will mound around the voids relative to pre-mining conditions and the pits would become a point of recharge to the local groundwater system. Any rechange to groundwater from the voids would be expected to have a lower EC than the pre-mining conditions. No adverse changes to groundwater quality are anticipated as a result of groundwater recharge via the quarry voids.

6.5.2.4 Mitigation and Management Measures

A groundwater monitoring program will be detailed in the CEMP and OEMP. The purpose of the groundwater monitoring plan is to:

- inform estimates of groundwater inflow into the pit (noting that a significant percentage is likely to evaporate on pit walls and in sumps and is not directly measurable)
- assess potential impacts to groundwater levels and quality on other groundwater users in the vicinity
- identify groundwater issues such as higher than predicted drawdowns that may impact receptors as early as possible
- provide data which can be used to calibrate the analytical model and update the groundwater inflow predictions
- measure groundwater level recovery post-closure and provide data which can be used to predict the length of time a WAL may be required after the Project is completed.

An additional monitoring bore will be installed approximately 1 km from the Project Area, to the north-west, to confirm drawdown predictions in the GWIA and inform ARDG of any higher than predicted impacts on drawdown which may affect private bores before the pit depth reaches a point at which it may impact those bores. The precise location of this bore will be identified in the OEMP and will be installed, and monitoring commissioned prior to the development quarrying below the water table. Other than this additional bore, all other aspects of the monitoring program will be implemented prior to commencement of extraction. The groundwater monitoring program will include regular monitoring of water levels and water quality. Given access to some bores may be difficult in very wet weather data, loggers will be installed in at least two monitoring bores outside of the final quarry footprint, to provide a continuous record. Estimates of groundwater inflows will be obtained through an interpretation of rainfall, evaporation, bore data and pumping data from the pit.

Impacts to high probability GDEs are not predicted to occur until after Stage 5 and impacts associated with the Project may not be material due to the nature of the groundwater systems utilised by the GDEs in question. It is therefore considered unlikely that the Project would have any material impacts on GDEs. Notwithstanding, additional survey and investigation work will be undertaken to determine the nature and extent of groundwater dependency of vegetation (or conservative assumptions made regarding dependency) within the zone of predicted drawdown. Additionally, predictions of groundwater drawdown will be updated prior to quarry activities progressing below the water table (i.e., Stage 5). These predictions will be informed by ongoing groundwater monitoring undertaken as discussed above. A GDE monitoring and management plan will be developed prior to the pit floor within the main pit (but not the sump) progressing below 28 m AHD. The monitoring plan will be designed to identify the magnitude of drawdown impacts to the north of the Project Footprint as quarry operations in North Pit and Main pit progress below the interpolated water table. The monitoring plan will also identify baseline and ongoing vegetation monitoring requirements (refer to **Appendix 10**). Bores ARDG-P06 and ARDG – DDH18 are both ideally located to identify potential drawdown impacts that may impact the areas mapped as high probability GDEs and these bores will be used as monitoring locations to set triggers for additional monitoring of vegetation conditions in the areas mapped as probable GDEs. Bores outside of the area of predicted drawdown will be used as reference points to inform both triggers and management responses.

As noted in **Section 6.5.2.3** licences for predicted take will be obtained prior to this take occurring.

6.6 Biodiversity

The Project SEARs require the assessment of biodiversity including:

- accurate predictions of any vegetation clearing on site
- a detailed assessment of the likely biodiversity impacts of the development, paying particular attention to threatened species, populations and ecological communities and groundwater dependent ecosystems, undertaken in accordance with the Biodiversity Assessment Method (BAM) and documented in a Biodiversity Development Assessment Report (BDAR)
- a strategy to offset any residual impacts of the development in accordance with the Biodiversity Offsets Scheme.

Additionally, on 8 December 2022, a delegate of the Minister for the Environment determined that the Project is a controlled action under the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) based on likely impacts to threatened species and communities listed under that Act.
The Project will be assessed under the Bilateral Agreement between the State and the Commonwealth. As such the Commonwealth has also provided its assessment requirements for the Matters of National Environmental Significance (MNES) relevant to the Project.

A BDAR has been prepared for the Project by Umwelt and is contained in **Appendix 11**. The BDAR provides an assessment of the biodiversity values of the Project Area, documents the application of the avoid, minimise and offset framework and assesses the likely biodiversity impacts of the Project. The BDAR also includes a specific assessment of predicted impacts on EPBC Act listed threatened species and communities having regard to relevant Commonwealth assessment requirements. A summary of key outcomes is provided in the following sections.

6.6.1 Landscape Features and Site Context

The Project Area is located within the NSW North Coast Interim Biogeographic Regionalisation for Australia (IBRA) bioregion and occurs on the boundary of the Upper Hunter and Karuah Manning IBRA subregions.

The Project Area supports ephemeral tributaries of Caswells Creek and Nine Mile Creek which are part of the Grahamstown Dam drinking water catchment and Williams River catchment. The RAMSAR listed Hunter Estuary Wetlands – Kooragang Nature Reserve is downstream of both the Grahamstown Dam spillway and the Williams River.

The Project Area is surrounded by large areas of intact native vegetation within the Wallaroo State Forest, with direct connection to Wallaroo National Park, Karuah National Park and Karuah State Conservation Area. The Fauna Corridors for North-East NSW dataset (DPE 2010) shows the Project Area as being within this broader regional fauna corridor, which narrows beyond the site to the south-west.

No karst, caves, crevices, cliffs, rocks or other geological features of significance were observed within the Project Area. The Project Area does not contain any areas of outstanding biodiversity value, as identified under the BC Act.

The Pacific Highway separates the Wallaroo State Forest and the Project Area from other local conservation areas to the east of the Pacific Highway, such as parts of the Karuah National Park, the Medowie State Conservation Area, the Medowie Nature Reserve, Moffats Swamp Nature Reserve and Tilligerry State Conservation Area.

Vegetation within the Disturbance Area has been mostly assessed as dry sclerophyll forest and grassy woodland formations with a smaller area of regenerating forested wetland. Further details are provided in **Section 6.6.3** below.

6.6.2 Methodology

The BDAR was prepared in accordance with the BAM (2020) and the Biodiversity Assessment Method Operational Manual - Stage 1 (DPIE, 2020). Broadly, the methods used in preparing the BDAR were:

- Landscape features and site context – desktop review of appropriate data sources including relevant mapping products, aerial photography and GIS layers in accordance with Section 3.1 of the BAM.
- Native vegetation assessment – including literature and database review, digital aerial photo interpretation, floristic and vegetation integrity surveys, and meandering transects to inform vegetation mapping, Plant Community Types (PCT) allocation and threatened ecological communities (TEC) delineation.
- Threatened species assessment – including literature and database review, ecosystem-credit and species-credit species assessments, habitat constraints assessments, and targeted diurnal fauna surveys.

The BAM has been endorsed as the assessment method for MNES under the Bilateral Agreement made under the EPBC Act.

Further detail regarding the methodology, including detailed survey information, is included in the BDAR (refer to **Appendix 11**).

6.6.3 Assessment

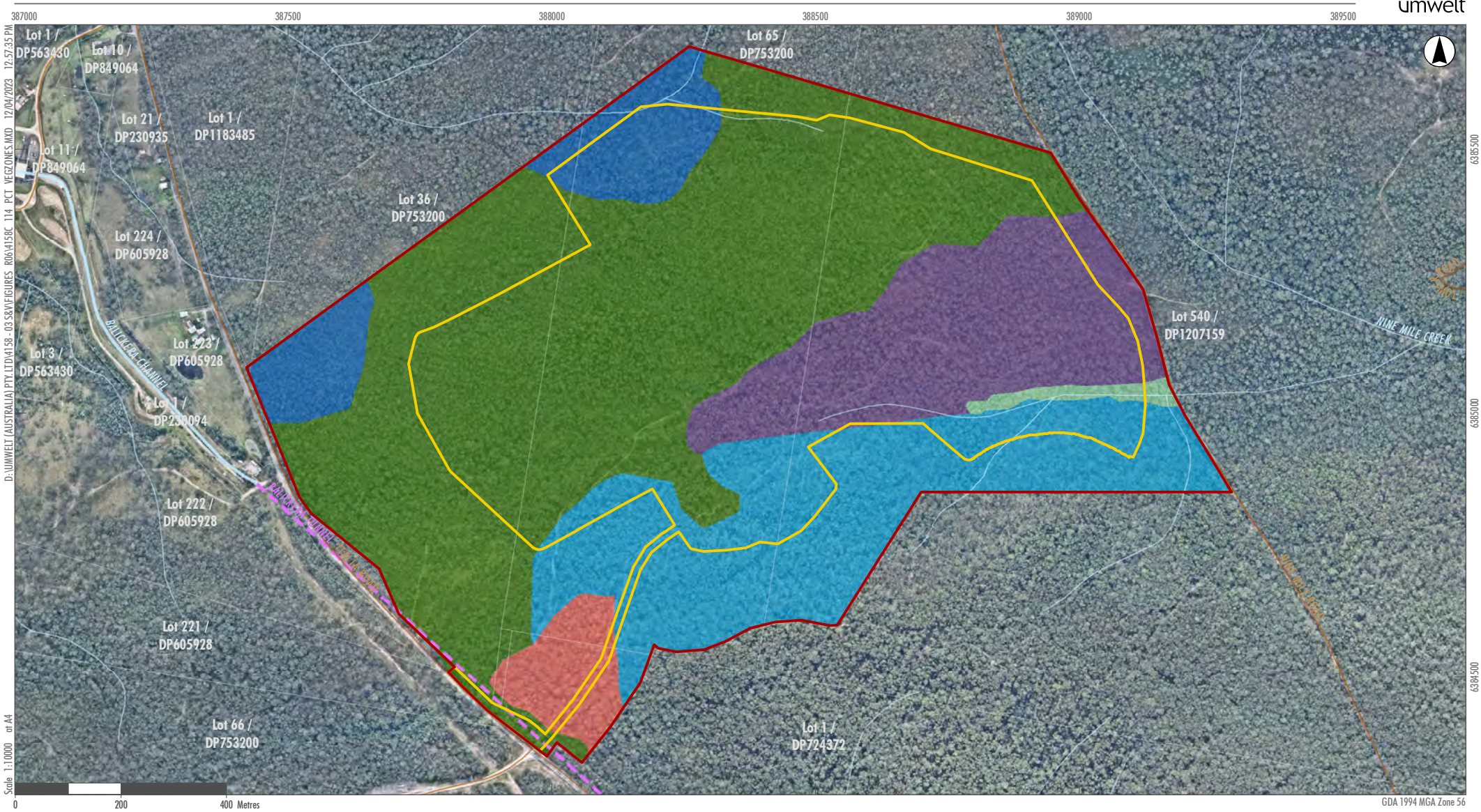
6.6.3.1 Native Vegetation Assessment

Surveys of the Disturbance Area identified five PCTs which have been split into six native vegetation zones based on condition types. Details of the vegetation zones and associated PCTs are listed in **Table 6.21** and illustrated in **Figure 6.12**.

Table 6.21 Vegetation Zones

Zone	PCT ID	PCT Name	Condition	Area
1	762	Cabbage Gum open forest or woodland on flats of the North Coast	Intact	0.33
2	1590	Spotted Gum - Broad-leaved Mahogany - Red Ironbark shrubby open forest	Intact	45.63
3	1618	Smooth-barked Apple - White Stringybark - Red Mahogany - *Melaleuca sieberi* shrubby open forest on lowlands of the lower North Coast	Intact	0.88
4	1619	Smooth-barked Apple - Red Bloodwood - Brown Stringybark - Hairpin Banksia heathy open forest of coastal lowlands	Intact – Apple variant	19.52
5			Intact – Apple-Ironbark forest variant	8.75
6	1716	Prickly-leaved Paperbark Forest on Coastal Lowlands of the Central Coast and Lower North Coast	Regenerating	3.91
			Total area	**79.02 ha**

Detailed descriptions of each PCT and further details on the number of BAM plots (floristic and vegetation integrity survey plots) required and completed for each vegetation condition zone are provided in the BDAR (refer to **Appendix 11**) along with vegetation integrity scores.



Legend

- Project Area
- Disturbance Area
- Road
- Balickera Tunnel
- Drainage Line

Plant Community Types

- PCT762, Cabbage Gum open forest or woodland on flats of the North Coast - Intact
- PCT1590, Spotted Gum - Broad-leaved Mahogany - Red Ironbark shrubby open forest - Intact
- PCT1618, Smooth-barked Apple - White Stringybark - Red Mahogany - Melaleuca sieberi shrubby open forest on lowlands of the lower North Coast - Intact
- PCT1619, Smooth-barked Apple-Red Bloodwood-Brown Stringybark-Hairpin Banksia heathy open forest of coastal lowlands - Intact / Apple variant
- PCT1619, Smooth-barked Apple-Red Bloodwood-Brown Stringybark-Hairpin Banksia heathy open forest of coastal lowlands - Intact / Apple-Ironbark variant
- PCT1716, Prickly-leaved Paperbark Forest on Coastal Lowlands of the Central Coast and Lower North Coast – Regenerating

Image Source: Nearmap (2022) Data source: NSW FSDF (2022), Umwelt (2023)

FIGURE 6.12

Plant Community Types and Vegetation Zones

6.6.3.2 Threatened Ecological Communities

A detailed analysis of the potential occurrence of TECs within the Disturbance Area was undertaken against the relevant approved conservation advice and key diagnostic characteristics. The assessment determined that 5.12 ha of the broader 79 ha Disturbance Area conform with one Commonwealth listed and two State listed TECs occur within the Disturbance Area[4]. Details are provided in **Table 6.22** below and illustrated in **Figure 6.13**.

Table 6.22 Threatened Ecological Communities

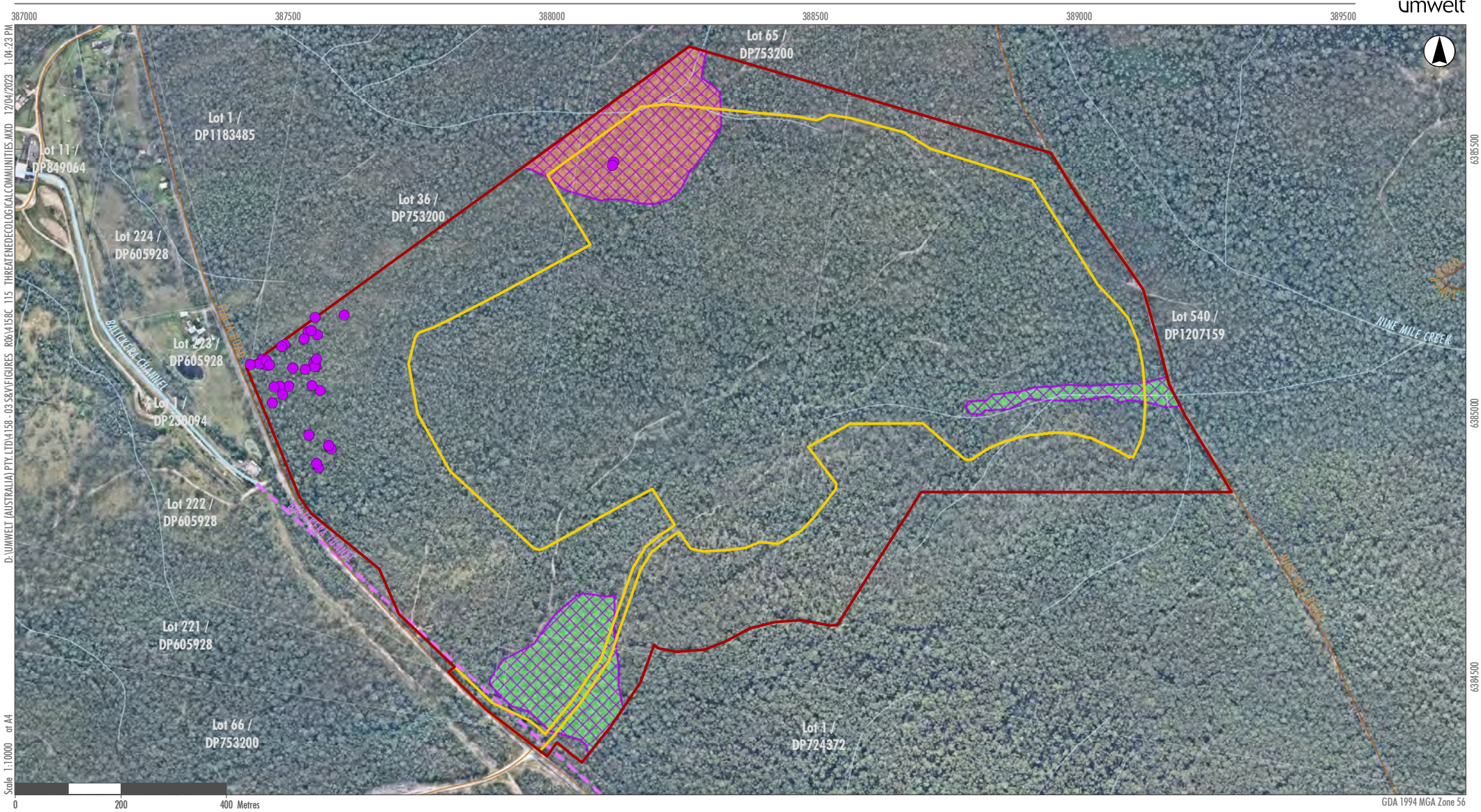
TEC Name	Act and Listing Status	Associated PCTs within the Disturbance Area	Area
River-Flat Eucalypt Forest on Coastal Floodplains of the New South Wales North Coast, Sydney Basin and South East Corner Bioregions	EEC listed under the BC Act	PCT 762 – Intact (0.33 ha)	1.21 ha
		PCT 1618 – Intact (0.88 ha)	
Subtropical Coastal Floodplain Forest of the New South Wales North Coast Bioregion	EEC listed under the BC Act	PCT 1716 – Regenerating	3.91 ha
Subtropical eucalypt floodplain forest and woodland of the New South Wales North Coast and South East Queensland Bioregions	EEC listed under the EPBC Act	PCT 762 – Intact (0.33 ha)	5.12 ha
		PCT 1618 – Intact (0.88 ha)	
		PCT 1716 – Intact (3.91 ha)	

6.6.3.3 Threatened Species Assessment

The NSW BAM categorises threatened species as either ecosystem-credit species or species-credit species. Credits are required for impacts on species-credit species but not for ecosystem-credit species as they are considered to be already covered by credits generated for impacts on native vegetation and, in some cases, drive the calculation of credits calculated for impacts to vegetation communities due to their presence. The BAM calculator used for the BDAR predicts the species-credit species that may occur and requires consideration of these species in the assessment. A full list of the ecosystem-credit species and the species-credit species predicted to occur by the BAM Calculator and/or the literature review and consideration of their likelihood of occurrence in the vegetation zones within the Project Area is provided in the BDAR (provided in **Appendix 11**). Targeted surveys were undertaken for all candidate threatened flora and fauna species across the Project Area with focus on the proposed disturbance area. The completion of surveys and assessments identified that the Project would impact the following species-credit species listed within the BC Act and/or the EPBC Act:

- rusty greenhood (Pterostylis chaetophora)
- squirrel glider (Petaurus norfolcensis)
- brush-tailed phascogale (*Phascogale tapoatafa*)
- koala (Phascolarctos cinereus).

[4] The 3 PCTs meeting the two State TECs listing Criteria also conform with the EPBC Act Listed EEC Subtropical eucalypt floodplain forest and woodland of the New South Wales North Coast and South East Queensland Bioregions



Legend

- Project Area
- Disturbance Area
- Road
- Balickera Tunnel
- Drainage Line
- Rusty Greenhood (*Pterostylis chaetophora*) Observation Location

EPBC TEC

- Subtropical eucalypt floodplain forest and woodland of the New South Wales North Coast and South East Queensland bioregions

BC TEC

- River Flat Eucalypt Forest on Coastal Floodplains of the New South Wales North Coast, Sydney and South East Corner Bioregions
- Subtropical Coastal Floodplain Forest of the New South Wales North Coast Bioregion

Image Source: Nearmap (2022) Data source: NSW FSDF (2022), Umwelt (2023)

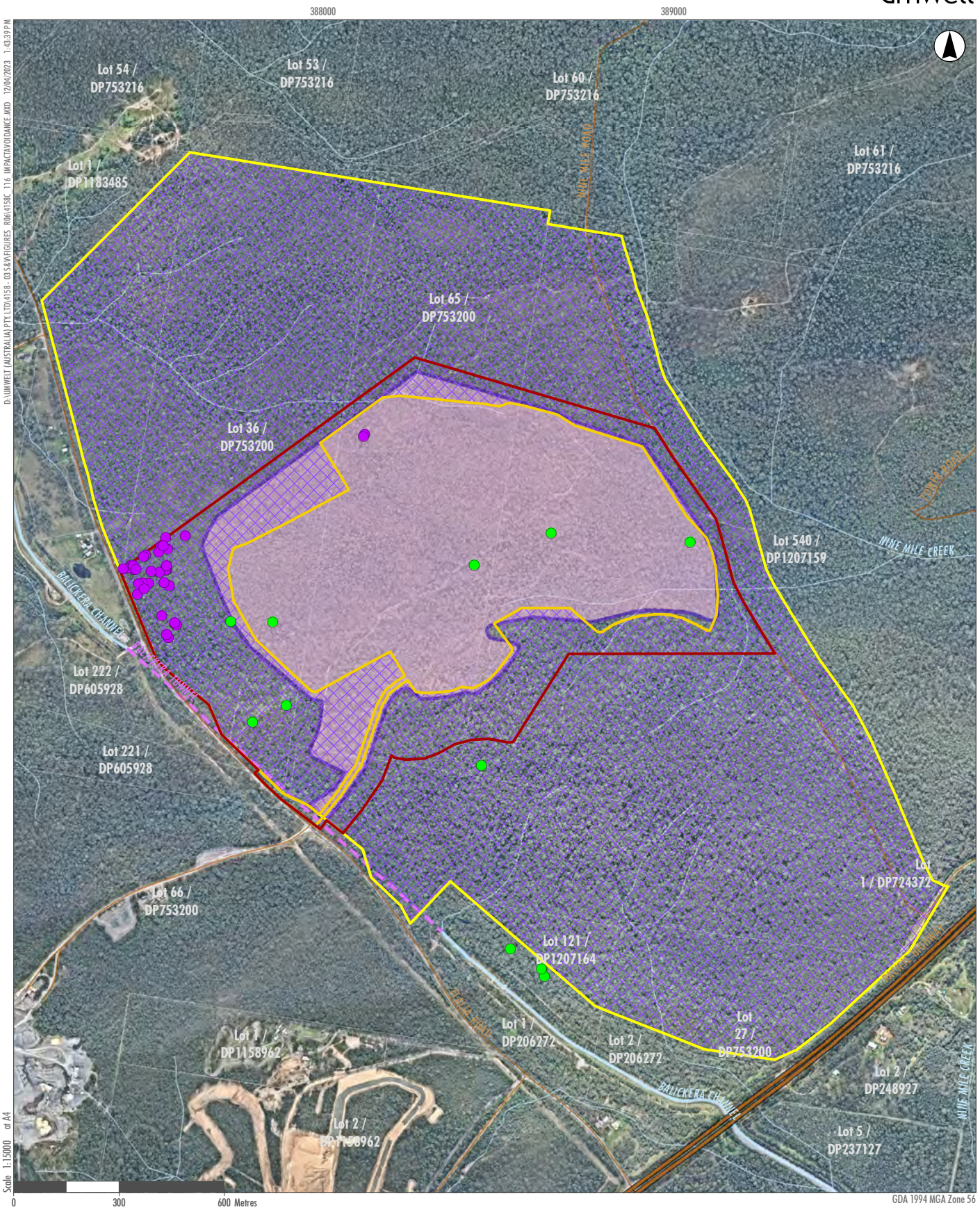
FIGURE 6.13

Threatened Ecological Communities and Flora Species

6.6.4 Avoidance of Impacts

The biodiversity assessment commenced during the early Project design stage, allowing the Disturbance Area to be refined and minimised to reduce/avoid biodiversity impacts, particularly in areas with higher ecological value. The following impact avoidance and minimisation strategies are noted:

- The current Disturbance Area has been substantially refined twice. The first refinement resulted in the avoidance of the main areas of occupied habitat for the threatened orchid species, *Pterostylis chaetophora*. The second refinement was undertaken to consolidate the Disturbance Area to areas with the target resource and further minimise impacts to PCTs and threatened species habitats generally, including habitats for the threatened fauna species recorded, refer to **Figure 6.4**.
- The Project has been designed to make use of the existing access track from Italia Road and is located to reduce the extent of excavation required to access the quarry resource.
- Areas which provide suitable wildlife corridors around the development footprint and along the Italia Road interface will be retained.



Legend

- Project Area
- Disturbance Area
- Licence Area
- Impact Avoidance Area
- Previous Disturbance Area
- Pacific Highway
- Road
- Balickera Tunnel
- Drainage Line
- Lot Boundaries

Threatened Flora Records

- Netted Bottlebrush (*Callistemon linearifolius*) Observation Location
- Rusty Greenhood (*Pterostylis chaetophora*) Observation Location

Image Source: Nearmap (2022) Data source: NSW FSDF (2022)

FIGURE 6.14

Impact Avoidance and Minimisation Areas

6.6.5 Impact Assessment

6.6.5.1 Direct Impacts

The Project will result in direct impacts to native vegetation communities and threatened species habitats within the Disturbance Area as a result of clearing works for infrastructure and quarry establishment as detailed in **Table 6.23**.

Table 6.23 Direct Impacts on Biodiversity

PCT/TEC/EEC or threatened species and their habitat	BC Act status	EPBC Act status	Timing of impact	Total direct impact area
PCT 762 Cabbage Gum open forest or woodland on flats of the North Coast River-flat Eucalypt Forest on Coastal Floodplains of the NSW North Coast, Sydney Basin and South East Corner bioregions EEC	EEC	EEC	Progressive staged clearing	0.33 ha
PCT 1590 Spotted Gum - Broad-leaved Mahogany - Red Ironbark shrubby open forest	Not listed	Not listed	Progressive staged clearing	45.63 ha
PCT 1618 Smooth-barked Apple - White Stringybark - Red Mahogany - *Melaleuca sieberi* shrubby open forest on lowlands of the lower North Coast Subtropical Coastal Floodplain Forest of the NSW North Coast bioregion EEC	EEC	EEC	Progressive staged clearing	0.88 ha
PCT 1619 Smooth-barked Apple - Red Bloodwood - Brown Stringybark - Hairpin Banksia heathy open forest of coastal lowlands - Apple variant	Not listed	Not listed	Progressive staged clearing	19.52 ha
PCT 1619 Smooth-barked Apple - Red Bloodwood - Brown Stringybark - Hairpin Banksia heathy open forest of coastal lowlands - Apple-Ironbark Forest variant	Not listed	Not listed	Progressive staged clearing	8.75 ha
PCT 1716 Prickly-leaved Paperbark Forest on Coastal Lowlands of the Central Coast and Lower North Coast Subtropical Coastal Floodplain Forest of the NSW North Coast bioregion EEC	EEC	EEC	Progressive staged clearing	3.91 ha
rusty greenhood (*Pterostylis chaetophora*)	Vulnerable	Not listed	Progressive staged clearing	2 individuals / 3.91 ha of suitable habitat
squirrel glider (*Petaurus norfolcensis*)	Vulnerable	Not listed	Progressive staged clearing	79.02
brush-tailed phascogale (*Phascogale tapoatafa*)	Vulnerable	Not listed	Progressive staged clearing	75.11
koala (*Phascolarctos cinereus*)	Endangered	Endangered	Progressive staged clearing	79.02

6.6.5.2 Indirect Impacts

Potential indirect impacts are anticipated as a result of the following:

- increased site occupation which is likely to result in a reduction in habitat suitability for threatened fauna in adjoining areas
- reduced habitat connectivity due to loss of vegetation and installation of security fencing
- light spill impacts which may result in alteration to fauna behaviour
- noise impacts which are likely to result in a reduction in habitat suitability for noise-sensitive fauna
- air quality impacts due to dust which may result in physical injury to airways of fauna species and short-term reduced photosynthetic capacity for impacted flora
- vibration impacts which may disrupt microbat roosting behaviour in Balickera Tunnel
- water impacts due to altered hydrology and sedimentation, although these will be appropriately managed through erosion and sediment controls and retention of intercepted water
- weed invasion, particularly in edge areas adjoining disturbance
- increase in presence of pest animal species.

6.6.5.3 Prescribed Impacts

All prescribed impacts, as listed within the BC Regulation, have been assessed for the Project (refer to Section 8.3 of the BDAR in **Appendix 11**). The prescribed impacts considered relevant to the Project are:

- Impacts to minor areas of rock outcropping – No threatened species have been recorded utilising these habitats and no significant consequences are predicted to occur.
- Impacts to human made structures – No human made structures will be directly impacted by the Project however there is potential for blasting vibration and heavy vehicle traffic to disrupt microbat roosting in Balickera Tunnel. The potential for blasting to impact on the tunnel structure has been assessed by ESC as low (refer to **Section 6.3.2.5**).
- Impacts to habitat connectivity – The Project has potential to reduce but not totally remove habitat connectivity for flora and fauna species, particularly between the Wallaroo State Forest and areas to the west of Italia Road, where an approximately 250 m wide corridor of native vegetation will be retained. Due to the nature and layout of the site, which is surrounded by undeveloped land, there will be no significant changes to landscape connectivity for wildlife movement.
- Impacts to water – The surface water assessment (refer to **Section 6.5.1**) has identified potential impacts including a reduction in downstream flows due to the capture of surface runoff. The reduced catchment area will reduce flows following rainfall events in the watercourses immediately downstream of the Disturbance Area however impacts are unlikely to be outside of natural variability in higher order watercourses due to the location of the Project in the catchment. The proposed management measures have a high degree of risk control effectiveness in terms of managing downstream water quality impacts and the Project is assessed as satisfying NorBE principles in terms of water quality. The potential for impacts to downstream environments is therefore considered to be low.

- Impacts due to vehicle strikes – The Project has been designed to minimise the length of the site access from Italia Road. It is considered that the potential for vehicle strikes to occur is low due to the quarry operation hours, site fencing to be installed and proximity to existing high traffic public roads.
- Potential impacts to Groundwater Dependent Ecosystems are discussed in **Section 6.5.2.3.**

6.6.5.4 Serious and Irreversible Impacts

No potential Serious and Irreversible Impact (SAII) entities were observed during surveys.

Breeding habitat for the Eastern Cave Bat, Little Bent-winged Bat and the Eastern Bent-winged Bat is a potential SAII entity. Both species of the Bent-winged Bats are known to roost in the Balickera Tunnel, however the females are reported as absent during summer indicating that the tunnel is not used as breeding habitat (Eco Logical Australia 2021). The tunnel has also not been reported as providing roost or breeding habitat for the Eastern Cave Bat.

The Balickera Tunnel will not be directly impacted by the Project. As discussed in **Section 6.3**, the blast impact assessment concluded that the impact of ground vibrations on the Balickera Tunnel is well below the damage criteria for the infrastructure items, hence the risk is considered to be low. The risk of damage from flyrock and airblast overpressure is not applicable to the potential habitat within the Balickera Tunnel.

6.6.6 Matters of National Environmental Significance

The additional assessment requirements provided by DCCEEW consider that there is likely to be a significant impact on the following threatened species and communities:

- koala (*Phascolarctos cinereus*) (combined populations of Queensland, New South Wales and the Australian Capital Territory) – Endangered
- grey-headed flying-fox (*Pteropus poliocephalus*) – Vulnerable
- Coastal Swamp Sclerophyll Forest of New South Wales and South East Queensland – Endangered.

The DCCEEW also noted that the following species may be significantly impacted by the Project:

- swift parrot (*Lathamus discolor*) – Critically Endangered
- spotted-tail quoll (southeastern mainland population) (*Dasyurus maculatus maculatus*) – Endangered
- yellow-bellied glider (south-eastern) (*Petaurus australis australis*) – Vulnerable
- New Holland mouse (*Pseudomys novaehollandiae*) – Vulnerable
- south-eastern glossy black cockatoo (*Calyptorhynchus lathami lathami*) – Vulnerable.

DCCEEW also noted that the list of species may be incomplete and that it is the responsibility of the proponent to ensure any protected matters under this controlling provision are assessed for the Commonwealth decision-maker's consideration.

The DCCEEW noted the key likely and potential significant impacts to EPBC listed threatened species and ecological communities associated with the Project will result from the clearing of native vegetation and terrain manipulation within the Project footprint, and the potential for indirect impacts resulting from Project activities. The DCCEEW noted that the Project will clear suitable foraging or breeding habitat that is critical to the survival of the nominated threatened species and may fragment and functionally lose the Coastal Swamp Sclerophyll Forest endangered ecological community.

The DCCEEW detailed assessment requirements are outlined in **Appendix 1** and have been addressed in detail in the BDAR (refer to **Appendix 11**), with the results of the assessment of significance summarised in **Section 6.6.6.1**.

6.6.6.1 Assessment of Significance

The following EPBC Act listed species and communities have been identified as having the potential to occur or be impacted by the Project, based on previous records or determination of suitable habitat existing within the proposed Disturbance Area.

Critically Endangered or Endangered Ecological Communities:

The Project Area does not contain any critically endangered ecological communities listed under the EPBC Act.

One endangered ecological community listed under the EBPC Act has been recorded within the proposed Disturbance Area, Subtropical eucalypt floodplain forest and woodland of the New South Wales North Coast and South East Queensland bioregions.

Critically Endangered and Endangered Species:

- spotted-tailed quoll (*Dasyurus maculatus maculatus*) (SE mainland population)
- koala (*Phascolarctos cinereus*) (combined populations of Qld, NSW and the ACT)
- swift parrot (Lathamus discolor).

Vulnerable Species:

- grey-headed flying-fox (*Pteropus poliocephalus*)
- white-throated needletail (*Hirundapus caudacutus*)

Migratory Species Listed under International Conventions:

- white-throated needletail (*Hirundapus caudacutus*) (also addressed under vulnerable species assessment)
- rufous fantail (Rhipidura rufifrons)
- black-faced monarch (*Monarcha melanopsis*).

These species have been further assessed in accordance with the EPBC Act Matters of National Environmental Significance Significant Impact Guidelines 1.1 (DoE 2013b) in the BDAR, refer to **Appendix 11**, with a summary provided in **Table 6.24** below.

Table 6.24 Summary of Impacts on MNES

MNES	Area of species impact	Significance of impact
Subtropical eucalypt floodplain forest and woodland of the New South Wales North Coast and South East Queensland bioregions	5.121 ha	Not significant
spotted-tailed quoll (*Dasyurus maculatus maculatus*) (SE mainland population)	79.02 ha	Not significant
koala (*Phascolarctos cinereus*) (combined populations of Qld, NSW and the ACT)	79.02 ha	**Significant**
swift parrot (*Lathamus discolor)*	79.02 ha	Not significant
grey-headed flying-fox (*Pteropus poliocephalus*)	79.02 ha	Not significant
white-throated needletail (*Hirundapus caudacutus*)	79.02 ha	Not significant
large-eared pied bat (*Chalinolobus dwyeri*)	33.39 ha	Not significant
white-throated needletail (*Hirundapus caudacutus*) (addressed under vulnerable species assessment)	79.02 ha	Not significant
rufous fantail (*Rhipidura rufifrons)*	79.02 ha	Not significant
black-faced monarch *(Monarcha melanopsis)*	79.02 ha	Not significant

Koala

The Project Area is mapped as Marginal Habitat on the Koala Habitat Planning Map prepared by Port Stephens Council (2001). Under the BAM, suitable koala habitat is defined as habitat the species is expected to occur in or periodically use and is defined as the presence of a koala use tree species in any vegetation zone of a PCT associated with koala. Species polygons under the BAM are required to include the vegetation zone in which the species was detected and all continuous suitable habitat with the vegetation zone, which in this instance includes the entire Project Area (DPE 2022).

The koala has been recorded within the proposed Disturbance Area during survey via remote camera and has also been recorded within the adjoining areas of the Wallaroo State Forest and Wallaroo National Park. The proposed Disturbance Area is situated within the Central NSW Coast Koala Management Bioregion and contains several tree species identified as locally important to the koala. All PCTs within the proposed Disturbance Area are considered to provide suitable habitat for the koala.

The assessment indicates the Project will lead to a long-term decrease of suitable koala habitat. The Project is not likely to result in an impact which will directly reduce the size of a population of the koala, however a population decrease may occur indirectly in association with the clearing of occupied koala habitat. Therefore, the assessment indicates the Project will likely have a significant impact on the koala (*Phascolarctos cinereus*). However, there are larger areas of suitable habitat available for this species in the locality, including within the Wallaroo National Park (2,780 ha), the Karuah National Park (3,534 ha), the Medowie State Conservation Area (2,851 ha), the Karuah State Conservation Area (74 ha), the Medowie Nature Reserve (238 ha) and the Karuah Nature Reserve (824 ha), all of which have long term conservation status which protect them from future development.

No koala breeding activity has been observed within the Disturbance Area and it is therefore considered that the Project is not likely to disrupt the breeding cycle of an important population of this species.

The overall goal as stated in the National Recovery Plan for the EPBC Act listed Koala (DAWE 2022) is to stop the trend of decline in population size, by supporting resilient, connected and genetically healthy metapopulations across its range, and to increase the extent, quality and connectivity of habitat occupied. The Project involves the removal of 79 ha of koala habitat which will reduce the extent of habitat occupied.

As outlined in **Section 6.6.4**, the biodiversity assessment commenced during the early Project design stage, allowing the Disturbance Area to be refined and minimised to reduce/avoid biodiversity impacts particularly in areas with higher ecological value. Additionally, a range of mitigation measures are proposed to reduce any potential impacts to the koala, as outlined in **Section 6.6.7**. Additionally direct offsets following the like-for-like credit rules and no-net-loss principle will also be provided, as outlined in **Section 6.6.9**.

Threatened Ecological Communities

The endangered ecological community *Subtropical eucalypt floodplain forest and woodland of the New South Wales North Coast and South East Queensland bioregions* is present within the disturbance area as it is considered that PCTs 762, 1618 and 1716 all correspond to the EEC. The area to be impacted is relatively small (5.12 ha), therefore the Project is unlikely to have a significant impact and direct offsets for this EEC will be provided.

Other threatened fauna species

The spotted-tailed quoll (*Dasyurus maculatus maculatus*) (SE mainland population), swift parrot (*Lathamus discolor*), grey-headed flying-fox (*Pteropus poliocephalus*), white-throated needletail (*Hirundapus caudacutus*) and the large-eared pied bat (*Chalinolobus dwyeri*) will not be significantly impacted by the Project.

There are larger areas of suitable habitat available for these species in the locality, including within the Wallaroo National Park (2,780 ha), the Karuah National Park (3,534 ha), the Medowie State Conservation Area (2,851 ha), the Karuah State Conservation Area (74 ha), the Medowie Nature Reserve (238 ha) and the Karuah Nature Reserve (824 ha).

The proposed reduction in habitat associated with the Project is considered unlikely to result in a long-term impact that may result in the fragmentation or decrease in the size of the regional population or individuals from a collection of local populations. Although the Project will remove potential foraging habitat, the impacts proposed are considered to be inconsequential to any regional populations or individuals from a collection of local populations and are unlikely to impact breeding cycles. Direct offsets will be provided, as outlined in **Section 6.6.9**, to compensate for the loss of habitat.

Migratory Species

In relation to migratory species the Project is unlikely to result in a significant impact as the Disturbance Area does not contain important habitat for any of the identified migratory species listed in **Table 6.24**, and therefore the Project is not likely to substantially modify or destroy important migratory species habitat. Similarly, the Project will not seriously disrupt the lifecycle of an ecologically significant proportion of the population of a migratory species; or result in an invasive species that is harmful to migratory species becoming established within the Disturbance Area.

6.6.7 Mitigation of Residual Impacts

The CEMP and OEMP will include the following management measures to mitigate the residual impacts (direct, indirect and prescribed) associated with the Project, further detail is provided in Section 8.4 of the BDAR, refer to **Appendix 11**.

- **Workforce Education and Training** – to create awareness of the key ecological issues, understand policies being implemented to protect biodiversity and responsibilities relating to weed management.
- **Vegetation Protection Zones for retained vegetation** – appropriate fencing and clear and visible signage.
- **Ecologist pre-clearance survey and supervision of work** – pre-clearing relocation survey for fauna, staged clearing work, management of koalas during clearing, ecologist supervision of all hollow tree felling and nest box installation.
- **Erosion and Sediment Control** – minimising disturbance, erosion and sediment control structures, surface water management structures and stabilisation of disturbed areas.
- **Weed Management** – survey and treatment of invasive weeds, ongoing inspections and treatment, cleaning of machinery prior to entering the site.
- **Fencing, access control and fauna exclusion** – security fencing will assist with limiting fauna access to operational areas.

6.6.8 Biodiversity Credit Impact Summary

The NSW BAM requires the use of an online calculator and project specific survey and impact data to calculate the number of biodiversity credits that account for the impact of a project on biodiversity. The proponent must offset these credits as part of progressing the development if it is approved.

Following the application of appropriate avoidance and mitigation measures, the BAM assessment identified that the biodiversity credits listed in **Table 6.25** are required to offset the biodiversity impacts of the Project.

Table 6.25 Biodiversity Offset Credits

PCT/Species credit	Credit type	No. credits required
PCT 762 Cabbage Gum open forest or woodland on flats of the North Coast	Ecosystem	13
PCT 1590 Spotted Gum - Broad-leaved Mahogany - Red Ironbark shrubby open forest	Ecosystem	1268
PCT 1618 Smooth-barked Apple - White Stringybark - Red Mahogany - *Melaleuca sieberi* shrubby open forest on lowlands of the lower North Coast	Ecosystem	34
PCT 1619 Smooth-barked Apple - Red Bloodwood - Brown Stringybark - Hairpin Banksia heathy open forest of coastal lowlands	Ecosystem	782
PCT 1716 Prickly-leaved Paperbark Forest on Coastal Lowlands of the Central Coast and Lower North Coast	Ecosystem	131

PCT/Species credit	Credit type	No. credits required
rusty greenhood (*Pterostylis chaetophora*)	Species	149
squirrel glider (*Petaurus norfolcensis*)	Species	2929
brush-tailed phascogale (*Phascogale tapoatafa*)	Species	2929
koala (*Phascolarctos cinereus*)	Species	2929

6.6.9 Biodiversity Offset Strategy

The retirement of biodiversity credits is proposed to be undertaken following a staged approach, to match the areas of proposed staged clearing as shown in Table 11.3 of the BDAR. At present there is no specific proposal to fund a biodiversity conservation action or conduct ecological rehabilitation to generate biodiversity credits for the Project. Notwithstanding, the proponent will be consulting with relevant stakeholders during preparation of the Biodiversity Offset Strategy to determine opportunities relating to biodiversity conservation actions / ecological rehabilitation in the local area.

In addition, the Proponent has committed to further investigate the retirement of biodiversity credits through the establishment of a Biodiversity Stewardship Site within the Wallaroo State Forest. Where credits are not generated and retired within the Wallaroo State Forest they will be purchased from the market or a payment will be made to the Biodiversity Conservation Fund. The like-for-like credit rules will be followed for nationally listed entities which require credits. The like-for-like or variation rules will be followed for all other entities which require credits.

6.7 Aboriginal Heritage

The SEARs for the Project require the assessment of potential impacts on Aboriginal heritage (cultural and archaeological), including evidence of appropriate consultation with relevant Aboriginal communities/parties. An Aboriginal Cultural Heritage Assessment (ACHA) was prepared by Umwelt in collaboration with Registered Aboriginal Parties (RAPs).

The ACHA was prepared in accordance with the requirements of the National Parks and Wildlife Regulation 2019 (NPW Regulation), the *Guide to Investigating, Assessing and Reporting on Aboriginal Cultural Heritage in NSW* (OEH, 2011), with all consultation undertaken in accordance with Clause 60 of NPW Regulation and the *Aboriginal Cultural Heritage Consultation Requirements for Proponents* (the ACHCRs) (DECCW, 2010). The ACHA incorporates required archaeological technical information in accordance with the *Code of Practice for Archaeological Investigation of Aboriginal Objects in New South Wales* (the Code of Practice) (DECCW, 2010).

A summary of the key findings of the ACHA is presented in this section with the full report provided in **Appendix 12**.

6.7.1 Cultural Context

A detailed review of the Aboriginal cultural context of the Project Area and surrounds was undertaken to gain an understanding of the potential Aboriginal cultural heritage values that may occur within and surrounding the Project Area. The term cultural context encompasses both ethnographic information regarding how Aboriginal people lived in the region during the period of non-European settlement and the archaeological context relating to physical evidence.

The Project Area is located within the traditional homelands of the Buraigal ngurra, an inland clan group of the Worimi people, the earliest inhabitants of the Balickera area. The Worimi are primarily considered to be a coastal dwelling people, and the Port Stephens area remains important for the Worimi and contains many sites of Aboriginal heritage significance.

The first recorded meeting between the Worimi and European settlers is reported to have occurred in 1795, when five escaped convicts from Sydney came across the Worimi during their escape. As new colonists settled in the area throughout the 1800s, cedar getters moved into the Worimi lands, having exhausted timber supplies around Sydney, the Hawkesbury River and the Hunter River (Berzins, 1988). This wave of settlement was followed by approximately 1 million acres of land being granted to the Australian Agricultural Company (AACo), which encompassed much of the Worimi territory (Atchison and Gray, 1974). The AACo employed Aboriginal people as stockmen, sailors, constables and domestic servants. After European settlement, the Worimi population declined due to the spread of disease, conflict, and displacement of the Worimi from their traditional lands.

Limited historical archaeological information is available for the Project Area, as studies conducted in the coastal areas around Newcastle and Port Stephens are not directly applicable to the Balickera area.

Searches of the Aboriginal Heritage Information Management System (AHIMS) database identified two previously recorded Aboriginal archaeological sites within 1 km of the Project Area. Both sites are located on land associated with the Boral Seaham Quarry (adjacent to the southern side of the quarry access road) and both are listed as isolated artefact sites. The closest site is located approximately 220 m to the south-west of the Project Area.

To supplement the data available via AHIMS and to contribute to the understanding of the archaeological context of the Project Area, relevant heritage assessment reports for the broader region were also reviewed. These reports identified an additional five sites within 15 km of the Project Area including stone artefact scatters, axe grinding grooves and a rock shelter. The potential presence of scarred trees was also identified although locations were not recorded.

6.7.2 Methodology

6.7.2.1 Consultation

A major aim of the ACHA was to identify any cultural values within the landscape in which the Project is located so that those values can be recognised and incorporated into the Project's management recommendations. Consultation with the Aboriginal community was undertaken in accordance with the relevant aspects of the NPW Regulation and the ACHCRs. Full details of the consultation process are contained in Section 3.0 of **Appendix 12**.

Consultation was undertaken in four main stages:

- **Stage 1 – Notification and Registration of Interest:** Individual targeted letters were sent to people or groups who had previously registered for other projects in the area and government agencies and public advertisement of the Project was undertaken to identify, notify and register Aboriginal people who hold cultural knowledge relevant to the Project Area. Aboriginal people or groups who registered through these processes are referred to as the Registered Aboriginal Parties (RAPs) for the Project.
- **Stage 2 – Presentation of Information:** Consultation was continued by Umwelt during Stage 2 to provide information about the Project and the proposed assessment methodology to all RAPs who registered an interest in Stage 1.
- **Stage 3 – Gathering Information about Cultural Significance:** Information about Aboriginal cultural values was gathered through RAP consultation and field work.
- **Stage 4 – Review of the Draft ACHA:** A copy of the draft ACHA was provided to all RAPs with an invitation to review and comment on all aspects of the document, noting that information on cultural significance and any recommendations provided from an Aboriginal cultural perspective would be documented in the final ACHA. No objections to the content of the proposed ACHA were received.

RAPs registered an interest in the Project and were part of an active consultation process in relation to identifying and assessing the significance of the Aboriginal cultural heritage values/Aboriginal objects and/or places and determining and carrying out appropriate strategies to mitigate impacts upon Aboriginal heritage. Throughout all stages of the assessment process, the RAPs were invited to identify how they would like to participate in the Project's ACHA process, including what cultural information they wanted to share to inform the assessment process, and what information (if any) should remain non-disclosed in the assessment and reporting process.

The understanding of significance and the management recommendations provided by the RAPs have informed ARDG in its development of cultural heritage management recommendations for the Project.

6.7.2.2 Survey

A survey of the Project Area was conducted by Umwelt archaeologists and four representatives of the RAPs on 19 June 2020. During the survey, information was recorded in relation to:

- landform
- vegetation
- geomorphology and soils
- average ground surface visibility
- extent of any exposures
- any information provided by the RAPs in relation to cultural values
- occurrence of Aboriginal resources (food and medicine plants, prey animals, stone resources, water).

The aim of the survey was, as far as practical, to record sufficient information to satisfy Requirements of the Code of Practice (and in particular Requirement 5) and to provide the RAPs participating in the survey with an opportunity to discuss the archaeological and Aboriginal cultural significance of the Project Area.

Descriptions of the survey units and the information required to calculate effective coverage for survey units are provided in Table 6.2 of **Appendix 12** and images showing typical conditions within survey units are provided in Table 6.3 of **Appendix 12**.

The level of effective coverage within the Project Area was generally very low due to dense vegetation cover (leaf litter, grass), and stone outcropping and exfoliation/stone lag obscuring the topsoil. Areas with the highest levels of effective coverage included modified landforms with significant disturbance, primarily within the access track corridors, in locations of former drilling and coring pads and along the top of the ridgeline, however, the topsoil in these locations was still obscured by extensive stone outcropping.

6.7.3 Assessment

6.7.3.1 Survey Results

No new Aboriginal archaeological sites, objects or areas of archaeological potential were identified during the survey of the Project Area. The absence of identified Aboriginal archaeological sites or areas of Aboriginal archaeological potential within the Project Area reflects the following:

- the lack of reliable permanent water sources within the Project Area
- the steepness of land in some portions of the Project Area
- the absence of suitable geological features that support the occurrence of some site types (such as grinding grooves and rock shelters)
- the relatively shallow nature of the soils within the Project Area and their susceptibility to erosion
- the impacts of previous disturbance activities (primarily logging but also access track establishment and use).

Based on the criteria for the assessment of archaeological potential the Project Area is deemed to have low archaeological potential across its entirety.

6.7.3.2 Significance Assessment

Cultural significance is defined by the Australian ICOMOS Burra Charter 1999 (the Burra Charter) in terms of aesthetic, scientific, historic and social values. In NSW, Aboriginal cultural heritage is typically assessed according to its social and scientific significance in accordance with the *Guide to Investigating, Assessing and Reporting on Aboriginal Cultural Heritage in NSW* (OEH 2011).

Social or Cultural Value

It is not always possible to achieve consensus about the cultural value of a place as people experience places and events differently. Cultural significance can only be determined by Aboriginal people and is identified through Aboriginal community consultation. It was requested that the RAPs provide information regarding the cultural value of the Project Area in response to the draft ACHA report. No specific comments were provided.

Scientific Value

The primary criteria for determining archaeological significance relate to the rarity and representativeness of a site, as well as its integrity, intactness, and overall research potential. Due to the landforms present across the site and the lack of suitable archaeological material/objects identified during the site survey, the archaeological significance of the Project Area was rated as low.

Historic Value

The assessment of significance for areas of archaeological potential (within which there are no visible Aboriginal objects) is inherently difficult as any such assessment can only be based on the nature of the evidence that the area may contain. Areas of low archaeological potential have a provisional assessment of low archaeological significance. This is applicable to the Project Area as a whole.

Aesthetic Value

Aesthetic value refers to the sensory and perceptual experience of a place. It may consider form, scale, texture and material of the fabric of the landscape and may also include smell and sounds associated with the place (OEH, 2011). None of the Aboriginal parties provided any additional information regarding the aesthetic values of the Project Area.

6.7.3.3 Assessment of Risk of Harm

No Aboriginal objects or areas of archaeological potential were identified during the survey, and the entirety of the Project Area is considered to be of low archaeological potential. As such, the Project is not expected to result in impacts to Aboriginal sites.

6.7.4 Management and Mitigation

Considering the archaeological context of the region, the findings of previous archaeological assessments of the Project Area, the potential impacts of the proposed works, and the outcomes of consultation with the RAPs, the ACHA recommended that the proposed works could proceed without a requirement to undertake further archaeological investigation.

ARDG also commits to the following management measures as recommended by the ACHA:

- ARDG will ensure that all parties involved in the Project (through induction processes) are aware that it is an offence under Section 86 of the *National Parks and Wildlife Act 1974* (NPW Act) to harm or desecrate an Aboriginal object (unless otherwise approved under the NPW Act or a development consent for SSD issued under the EP&A Act.
- in the unlikely event that an Aboriginal object is exposed during works, all works in the vicinity of the object should cease and advice should be sought from an archaeologist and the RAPs in regard to management of the object(s).

No additional recommendations were provided by the RAPs in response to their review of the draft ACHA.

6.8 Historic Heritage

An assessment of the potential impacts of the Project on historic heritage values was undertaken by Umwelt in accordance with the SEARs which require the identification of any historic heritage within the vicinity of the Project Area and the assessment of the likelihood and significance of any potential impacts.

6.8.1 Methodology

The historic heritage assessment was undertaken in accordance with guidelines set out in the *NSW Heritage Manual 1996* (Heritage Office and Department of Urban Affairs and Planning). It was also prepared with consideration of the best practice principles contained in:

- The Burra Charter: The Australian ICOMOS Charter for Places of Cultural Significance 1999 (Australia ICOMOS. 2000) (The Burra Charter).
- NSW Heritage Branch (now Heritage NSW), Department of Planning 2009, Assessing Significance for Historical Archaeological Sites and 'Relics'.
- NSW Heritage Office (now Heritage NSW), Department of Planning 2006, The Historical Archaeology Code of Practice.

6.8.2 Historical Context

European exploration of the area began in the early nineteenth century. From 1801, the Williams River was traversed by timber getters from the recently established coal mining enterprise in the area that is now Newcastle (City Plan Services 2018: 51). Although the first official land grant in the area to AACo would not occur until 1825, within the next decade small squatters' holdings began to appear along the banks of the Williams River (City Plan Services 2018: 51). In 1832, Clarence Town was formally gazetted, and land was settled in earnest. The earliest leasehold in proximity to Wallaroo State Park was advertised in 1838 (OEH 2016: 13).

The Wallaroo State Forest was gazetted on 25 August 1922. Initially the logging taking place within the forest was targeted to produce saw logs for the local mills, where the raw timber could then be further reduced to produce a variety of forms. By the mid-1920s, however, the forest was already considered to be 'cut out' of high quality, old growth trees suitable for this practice (OEH 2016: 13). As such, forest management rapidly shifted to focus on removing low quality stands to create space for regrowth (OEH 2016: 13). In order to facilitate the quantity of timber required, swathes of the surrounding land were reclaimed for the State Forest — by the early 1940s, it encompassed an area of 8,000 ha (Newcastle Morning Herald and Miners' Advocate 14 November 1941: 13).

In the 1930s, demand for timber suitable for pit props and other mining operations meant that active management of the State Forest had to commence to ensure a continuous supply of suitable timber. In 1938, the Minister for Mines and Forests announced a 'reafforestation' program for the Wallaroo State Forest (Newcastle Sun 23 August 1938: 8). This resulted in the establishment of a dedicated nursery area for the growth of new saplings (Raymond Terrace Examiner 13 November 1941: 2):

The nursery beds, where seed sown in spring of ironbark, tallow wood, grey gum, swamp mahogany, cypress pine, etc … are located in a substantial shed where the direct rays of the sun are broken up, and also a shelter from frosts, as some of the seedlings are susceptible to frosts … There are on hand 250,000 tubes, and plants are being tubed and planted out by thousands each season, 400 to 450 a day.

In 1941, approximately 35 people were employed to care for the nursery, maintain the State Forest, and burn charcoal. They were accommodated on site in a number of huts 'located away from the nursery area about 400 or 500 yards' (Raymond Terrace Examiner, 13 November 1941: 2). The exact location of the nursery and accommodation huts are not recorded. It is unknown whether any further structures were established to support the enterprise.

The success of the Wallaroo State Forest continued throughout the 1950s, however, it then began to rapidly decline. In the late 1960s, a quarry was established in the southern extent of the State Forest (Nota 5 August 1994: 5). Logging ceased in 1986 (Australian Resource Development Group Pty Ltd 2020: 6) and, in 1999, a portion of the State Forest was dedicated as the Wallaroo Nature Reserve under the *National Park Estate (Land Transfers) Act 1998* (OEH 2016: 1). This was subsequently reclassified as the Wallaroo National Park in 2007 under the *National Park Estate (Lower Hunter Region Reservations) Act 2006* (OEH 2016: 1).

6.8.3 Identification of Historical Heritage Items

To identify if any historical heritage items are located within or in the vicinity of the Project Area, searches of all relevant heritage databases were undertaken, including the:

- Commonwealth Heritage List (CHL).
- National Heritage List (NHL).
- State Heritage Inventory.
- s170 State Agency Register.
- Port Stephens LEP (2013).

There are no registered heritage items located within the Project Area.

One registered heritage item is located over 1,100 m west of the Project Area. This consists of the locally listed 'Balickera' House (LEP I3), a nineteenth century convict-built homestead located at 303 Italia Road (Lot 530 DP1128672) (shown as R19 on **Figure 6.1**).

A targeted survey of the Project Area for unregistered historic heritage items was not undertaken, although no such potential items were identified during surveys undertaken as part of the ACHA. Remains of the nursery and accommodation precinct were not located during the survey and if present may be located elsewhere within the State Forest or neighbouring Wallaroo National Park.

6.8.4 Assessment

No registered heritage items are located within the Project Area. No unregistered potential heritage items were identified during surveys undertaken as part of the ACHA preparation. 'Balickera' House (LEP I3) is located outside of the Project Area and would not be directly impacted by the Project. The blasting assessment undertaken for the Project confirmed that predicted vibration and overpressure levels associated with the Project would be unlikely to adversely affect the structure or heritage values. No additional blast control measures are required to comply with the ground vibration criteria for heritage sites (refer to **Section 6.3.2**).

Archaeological remnants of nineteenth century land use activities are unlikely to be present due to the level of disturbance caused during the active management and logging of the State Forest. There is a low potential for isolated occupational deposits and/or items associated with logging activities to be present throughout the Project Area, however, if present, these are likely to be ephemeral in nature and unlikely to provide new information about the history of the Project Area.

Overall, the Project is not considered to have an adverse impact on significant heritage fabric, views to, or the setting of any places or items of historical heritage significance within the Project Area or its vicinity.

6.8.5 Management and Mitigation

The following management and mitigation measures for historic heritage will be implemented as recommended by the Historic Heritage Assessment:

- An unexpected finds protocol will be established and followed in the event that any unexpected historical archaeological deposits, artefacts, or structures of potential heritage significance are identified.
- All Project team members and construction contractors will undergo a heritage-specific induction to support the use of the unexpected finds protocol prior to undertaking any activities within the Project Area.
- In the unlikely event that unexpected finds are encountered during the Project, all work in the area will cease and a suitably qualified archaeologist will be contacted to determine an appropriate course of action. Depending on the extent and/or significance of the finds encountered, consultation with Heritage NSW may also be required prior to the re-commencement of works.

6.9 Traffic and Transport

A Transport Impact Assessment (TIA) has been prepared by GHD in accordance with the SEARs to assess the potential transport impact of the Project in relation to the capacity, condition, safety and efficiency of the public road network. The TIA undertook a review of existing traffic conditions and site access arrangements, assessed traffic and transport impacts arising from the construction and operation of the Project, and determined measures to mitigate and manage any adverse impacts to existing road users and road infrastructure. The TIA also includes an assessment of cumulative traffic impacts, having regard to other approved, operating or proposed developments in the locality. A full copy of the TIA is provided in **Appendix 13** with the outcomes of the assessment summarised below.

6.9.1 Existing Environment

6.9.1.1 Road Network

The Project Area is accessed directly from Italia Road, which joins the Pacific Highway approximately 1.2 km from the site entrance. The Pacific Highway provides the major transport route for the Project. Key roads in the public road network to be used by Project traffic are identified and described in **Table 6.26** and shown on **Figure 1.1**.

Table 6.26 Existing Road Network Description

Road	Description
Pacific Highway	Forms part of the M1 Pacific Motorway arterial road providing an important freight corridor along the east coast of NSW, approved for use by heavy vehicles including 25/26 m B-doubles without specific permit conditions. Two lanes are provided in each direction adjacent to the Italia Road intersection, with the acceleration lane in the southbound direction from Italia Road providing a third lane for approximately 1.2 km. Sealed shoulders with a width of 2.2–2.5 m are provided on both sides. No car parking or bicycle lanes are provided in the vicinity of the Project Area. A posted speed limit of 100 km/h applies at the intersection of Italia Road and the Pacific Highway. The posted speed limit on the M1 to the south of Italia Road is 110km/hr. The 100km/h speed limits applies to both north and southbound lanes on the M1 until the intersection with Buckets Way to the north, after which it returns to 110km/hr which is the posted speed limit at the Tarean Road intersection.
Italia Road	Local road running north-west from the Pacific Highway for approximately 8.5 km to the intersection with East Seaham Road. Fully sealed road providing one traffic lane in each direction. No parking or bicycle lanes are provided along the length of Italia Road. Posted speed limit of 90 km/h applies to Italia Road. Approved for B-double traffic between the Pacific Highway and the Boral Seaham Quarry access road (opposite the proposed access road for the Project).
Italia Road/ Pacific Highway intersection	Existing intersection is a seagull type intersection, with short right turn and left turn deceleration lanes. The intersection features a long acceleration lane for southbound vehicles turning right onto the Pacific Highway which forms a third lane on the Highway until it merges approximately 1.2 km downstream of the intersection.
Tarean Road	Local road running generally east-west through the town of Karuah, linking to the Pacific Highway at each end. The southern interchange with the Pacific Highway provides for access to and from Tarean Road for areas south and west of the interchange only. Two-lane two-way undivided road, with sealed shoulders. Posted speed limit of 80 km/h near the Pacific Highway, reducing to 60 km/h through Karuah and at the Highway merge points. No provision for car parking or cycle lanes in the vicinity of the Pacific Highway.

6.9.1.2 Traffic Volumes

The Pacific Highway has an average daily traffic volume of approximately 15,000–16,000 vehicles based on actual peak hour traffic count data factored up to a daily estimate (two-way northbound and southbound combined) with around 2,000 over those being trucks.

Publicly available daily traffic count data is highly variable for the Pacific Highway, with no recent data available near this location. The latest 7-day count data at Twelve Mile Creek from 2018, shows southbound only traffic volumes of around 10,700 vehicles and at Taree, some 30,000 vehicles two-way per day in 2023. Over the last seven years, the Pacific Highway traffic volumes have seen approximately 2–3% growth per annum.

Two 7-day tube counts were undertaken in two locations on Italia Road in June 2022 as part of the TIA. Based on the tube count results, Italia Road carries approximately 1,376 vehicles per day on weekdays, including approximately 108 vehicles per hour in the AM peak and approximately 114 vehicles per hour in the PM peak. Heavy vehicles make up approximately 20–30% of the traffic stream.

Turning movement count surveys were also undertaken at the intersection of Italia Road and the Pacific Highway to determine peak turning volumes for use in the assessment. Details are provided in Section 3.4.2 of the TIA (**Appendix 13**).

6.9.1.3 Road Safety

A road safety review was undertaken based on data from the TfNSW Centre for Road for the five-year recording period (2016 to 2020). Within the analysis period a total of 10 road crash incidents were recorded, six of which occurred at midblock locations with the remaining four occurring at the intersection with Italia Road. While there were no fatal crashes, there was one serious injury crash and five moderate and minor injury crashes. All but one of the crashes occurred during daylight conditions.

6.9.2 Project Traffic Parameters

6.9.2.1 Traffic Generation

Traffic generated during the construction phase of the Project is expected to be limited and would not exceed the movements generated during the operations phase. As such, it is considered appropriate to assess only the operational phase of the Project.

Light vehicles

The Project would be operated by 10 full time and up to five part time staff. While this level of staffing would be spread over six workdays, the TIA assumed that 15 staff may travel to and from the site each day (conservatively assumed as 15 vehicles arriving in the AM peak and departing again in the PM peak) for a total of 30 light vehicle movements per day. With due consideration to the housing density in surrounding towns, and in the interest of assessing a conservative scenario, modelling has assumed that 70% of light vehicle movements would be directed to/from the south via the Italia Road-Pacific Highway intersection with the remaining 30% directed to/from the north.

Heavy vehicles

Based on the transportation of materials using truck and dog combinations with a typical capacity of approximately 30 tonnes, the TIA estimated there would be a total of 334 heavy vehicle movements (167 inbound and 167 outbound) each day. The assessment assumed that 18% of the daily movements would occur during peak hours, equivalent to 30 inbound and 30 outbound movements. The TIA noted that the use of larger vehicles (e.g., B-doubles or semi-trailers) would reduce the overall level of heavy vehicle traffic to and from the site, therefore the assessment has considered a conservative or 'worst case' scenario.

As discussed in **Section 3.3.5**, modelling has assumed that all inbound heavy vehicle movements would turn left into Italia Road from the Pacific Highway to access the Project Area. No associated heavy vehicles will be permitted to travel west on Italia Road past the quarry access point toward Seaham. Similarly, modelling has assumed all outbound heavy vehicles will exit the Project Area via a left turn only and will turn left onto the Pacific Highway at the Italia Road-Pacific Highway intersection, travelling to the Tarean Road interchange approximately 11 km to the north to undertake a U-turn movement before resuming a southbound journey, as shown below in **Figure 6.15**.

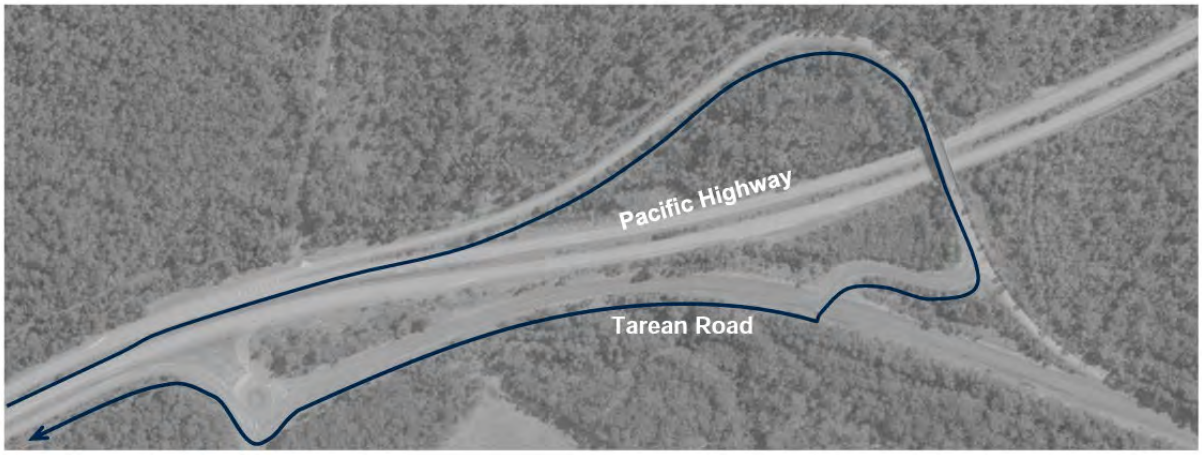


Figure 6.15 Proposed Tarean Road U-Turn Movement

Image source: MetroMap, accessed June 2022.

6.9.3 Methodology

The TIA was prepared in accordance with the following relevant legislation, policy and guidelines:

- Roads and Related Facilities EIS Guideline (Department of Urban Affairs and Planning, 1996).
- Guide to Traffic Generating Developments (Roads and Maritime Services, 2002).
- Austroads Guide to Traffic Management Part 12: Integrated Transport Assessments for Developments (Austroads, 2020).
- Austroads Guide to Road Design Part 4A: Unsignalised and Signalised Intersections (Austroads, 2021).
- Austroads Guide to Road Design Part 3: Transport Study and Analysis Methods (Austroads, 2020).

SIDRA modelling was undertaken to assess the Pacific Highway-Italia Road intersection under three scenarios:

- Scenario 1: existing surveyed conditions.
- Scenario 2: existing conditions plus 20% growth (forecast 2032 traffic volumes).
- Scenario 3: existing conditions plus 20% growth plus Project-generated traffic.

The third scenario included the Italia Road-Pacific Highway intersection upgrades proposed (refer to **Section 1.6** and **Section 3.3.5**), including an extension to the northbound deceleration lane for left turns into Italia Road and a northbound acceleration lane for left turns onto the Pacific Highway, noting that these upgrades are the subject of a separate joint development application process with the two other existing/proposed quarry operators using Italia Road.

In addition to the Italia Road-Pacific Highway SIDRA modelling, previous modelling has also been undertaken at the Tarean Road interchange, where heavy vehicles would be required to undertake a U-turn movement in order to travel south from the Project. The previous modelling assessed the interchange under three scenarios:

- Scenario 1: existing surveyed conditions.
- Scenario 2: existing conditions plus an additional 50 articulated trucks undertaking a U-turn movement.
- Scenario 3: existing conditions plus 20% growth (forecast 2032 traffic volumes) plus an additional 100 articulated trucks undertaking a U-turn movement.

6.9.4 Impact Assessment

SIDRA modelling demonstrates that the modelled 2032 traffic growth is expected to have some impact on the capacity of the Italia Road-Pacific Highway intersection, while the impact of the Project (in isolation) on the intersection is minimal.

The proposed intersection upgrades generally improve its performance, reducing delays through the prioritisation of the right turn into Italia Road over left turns into Italia Road which give-way as part of the channelised treatment. Under this scenario the performance of the left turn out of Italia Road improves, despite the increased heavy vehicle traffic generated by the Project.

It is noted that the SIDRA modelling has included conservative estimates of projected heavy vehicle movements from the Project. In practice, some B-doubles may be used to transport material out of the site, which would reduce the number of heavy vehicle movements based on the greater carrying capacity of those vehicles.

The modelling demonstrates that under all three scenarios the Tarean Road interchange would operate at a satisfactory level. Noting the Project is only expected to generate 30 outbound heavy vehicle movements per hour, the future conditions are expected to perform better than the modelled future scenarios.

As there are no public transport routes or pedestrian or cycle paths along Italia Road or the Pacific Highway in the vicinity of the Project Area, and based on the surrounding land uses, there is not expected to be a high demand for pedestrian or cycle movements along these roads. As a result, the Project is not expected to impact any pedestrian, cyclist or public transport users.

6.9.5 Cumulative Impact Assessment

The cumulative impacts of heavy vehicle movements generated by the Project, the Boral Seaham Quarry and the proposed Eagleton Quarry were considered in the assessment.

The Boral Seaham Quarry is currently in operation and therefore any associated traffic movements have been included in the traffic surveys and assessment described above for Italia Road and the Italia Road-Pacific Highway intersection.

The traffic assessment for the proposed Eagleton Quarry, prepared by GHD in 2016, projected a total of 170 heavy vehicle trips per day with 20 of those trips occurring during the peak hours, equally split between inbound and outbound movements. Based on the Tarean Road interchange traffic modelling outlined above, which considered an additional 100 articulated trucks, it is considered that the external road network can comfortably accommodate the level of additional traffic from both the proposed Eagleton Quarry and the Project. The proposed upgrades to the Italia Road-Pacific Highway intersection will also be designed to accommodate cumulative traffic from all three quarries.

6.9.6 Mitigation and Management Measures

To address any impacts to traffic associated with the Project, ARDG has committed to the implementation of the following management and mitigation measures:

- No quarry product will be transported from the site until the Italia Road-Pacific Highway intersection works (the subject of a separate development application process by Boral as referred to in **Section 1.6** and **Section 3.3.5**) are completed to the satisfaction of Port Stephens Council/TfNSW.
- No heavy vehicles associated with the Project would be permitted to travel west on Italia Road past the quarry access point (toward Seaham) either to or from the quarry site.
- A new site access point would be constructed directly opposite the existing Boral Seaham Quarry on Italia Road. Following consultation with Council, a Channelised Right Turn (CHR) treatment is to be provided on Italia Road at the site access, to enable safe right turns into the Project Area.
- To prevent conflicts on the road network, heavy vehicles would only be permitted to turn left out of Italia Road onto the Pacific Highway. An acceleration lane is to be provided onto the Pacific Highway (as part of a separate development application process), essentially removing the left-turn movement in favour of a downstream merge movement.

6.10 Land Resources

The SEARs for the Project require a detailed assessment of the following in relation to land resources:

- potential impacts on soils and land capability (including potential erosion and land contamination) and the proposed mitigation, management and remedial measures (as appropriate)
- potential impacts on landforms (topography), paying particular attention to the long-term geotechnical stability of any new landforms (such as overburden dumps, bunds etc)
- the compatibility of the development with other land uses in the vicinity of the development in accordance with the requirements in Clause 12 of *State Environmental Planning Policy (Mining, Petroleum Production and Extractive Industries) 2007* [now the *State Environmental Planning Policy – (Resources and Energy) 2021 Chapter 2 – Mining, Petroleum Production and Extractive Industries*], paying particular attention to the agricultural land use in the region.

Erosion and sedimentation were assessed as part of the Surface Water Impact Assessment which is discussed in **Section 6.5.1** and included in full in **Appendix 9**. A Geotechnical Stability Review was undertaken by GHD to evaluate the long-term stability of the proposed quarry batters and considers both kinematically (structurally) controlled and rock mass controlled (overall) stability. The full report is provided in **Appendix 14**. Relevant elements of these assessments are discussed in relation to impacts on land resources in the following sections.

6.10.1 Soils, Land Capability and Land Use

6.10.1.1 Existing Environment

Topography

As described in **Section 2.3.3**, the main topographic feature within the Project Area is 'Stone Ridge' which runs for approximately 1.2 km and comprises two rocky hills with elevations of 107.5 m AHD and 83 m AHD separated by a low saddle. More gently undulating topography to the north-west and south-east of the Project Area is associated with more weathered volcano-sedimentary geology that typically ranges in elevation from 20 to 60 m AHD. A prominent broad low ridge ('South Ridge') extends at a maximum elevation of approximately 62 m AHD from the central south-eastern flank of Stone Ridge to the Pacific Highway (refer to **Figure 2.3**).

Soils

The Newcastle Soils Landscape Series Sheet 9232 (Matthei, 1995) indicates that the Project is located within the Ten Mile Road and the Nungra Soil Landscapes (refer to **Figure 6.16)**.

The Ten Mile Road Soil Landscape is described as undulating low hills on carboniferous sediments and acid volcanics in the Medowie Lowlands and Clarence Town Hills regions (Matthei, 1995). It has a high-water erosion hazard, localised shallow soils, high run on and seasonal waterlogging and strongly to extremely acid soils of low fertility (Matthei, 1995).

The Nungra Soil Landscape is located within the eastern region of the Project Area and is described as long, smooth and gently inclined "Quaternary alluvium and deep silty footslope deposits eroded from surrounding hills and overlying Carboniferous rock strata" (Matthei, 1995). The soil types are relatively uniform; however the depth of topsoil is often shallow or absent on cleared footslopes. Total soil depth commonly exceeds 200 cm with the following qualities and limitations: water erosion hazard, salinity (localised), high run-on, seasonal waterlogging, flood hazard (localised) and foundation hazard (Matthei, 1995).

Within the Project Area, soil profile development over the Eagleton Volcanics is very poor to non-existent, and rhyodacite (the dominant rock type) outcrops extensively along the crest and flanks of Stone Ridge. Soils in these areas are generally less than 0.3 m in depth and are typically weakly structured, sandy loams. Soil profiles developed at lower elevations (generally below 50 m AHD), over less resistant volcanic and sedimentary rock types are more developed and are typically moderately structured, sandy light clays.

During a site inspection on 9 November 2022 the steeper Project Area slopes were observed to be dominated by weathered rock and shallow soils, while the lower slopes at the eastern end of the site exhibited deeper fine sandy soils with a light brown colour as well as bands of whiter clayey soils.

Acid sulfate soil mapping does not show any areas of acid sulfate soil risk within the Project Area and none is expected based on the elevation of the Project area and geology.

Land Capability

Land capability refers to the inherent physical capacity of land to sustain a range of land uses and management practices in the long term without degradation to soil, land, air and water resources.
The NSW regional maps of Land and Soil Capability (LSC) use the biophysical features of the land and soil to derive detailed ratings for a range of land and soil hazards. The LSC scheme consists of eight classes, which classify the land based on the severity of long-term limitations. Class 1 land has an extremely high capability for all agricultural land uses and land management practices, while Class 8 land is considered incapable of sustaining any land use apart from nature conservation.

Regional mapping indicates that the Project Area occurs on areas of Class 4, 5 and 6 lands (refer to **Figure 6.17**), which have limitations for high impact agricultural land uses. According to the *Land and Soil Capability Assessment Scheme (Second Approximation)* (OEH, 2012) (LSC Guideline), Class 4 land has moderate capability to sustain grazing and limited cropping activities, Class 5 land has high limitations for high impact land uses, while Class 6 land is suited to less productive grazing, forestry and nature conservation. Due to the shallow soils over much of the Project Area, it is likely that the regional mapping is overly conservative, and the bulk of the Project Area would be Class 6-8 land and is generally unsuited to agriculture other than low intensity grazing. The Project Area and surrounding land has been used for forestry activities since the 1920s, although logging ceased in 1986.

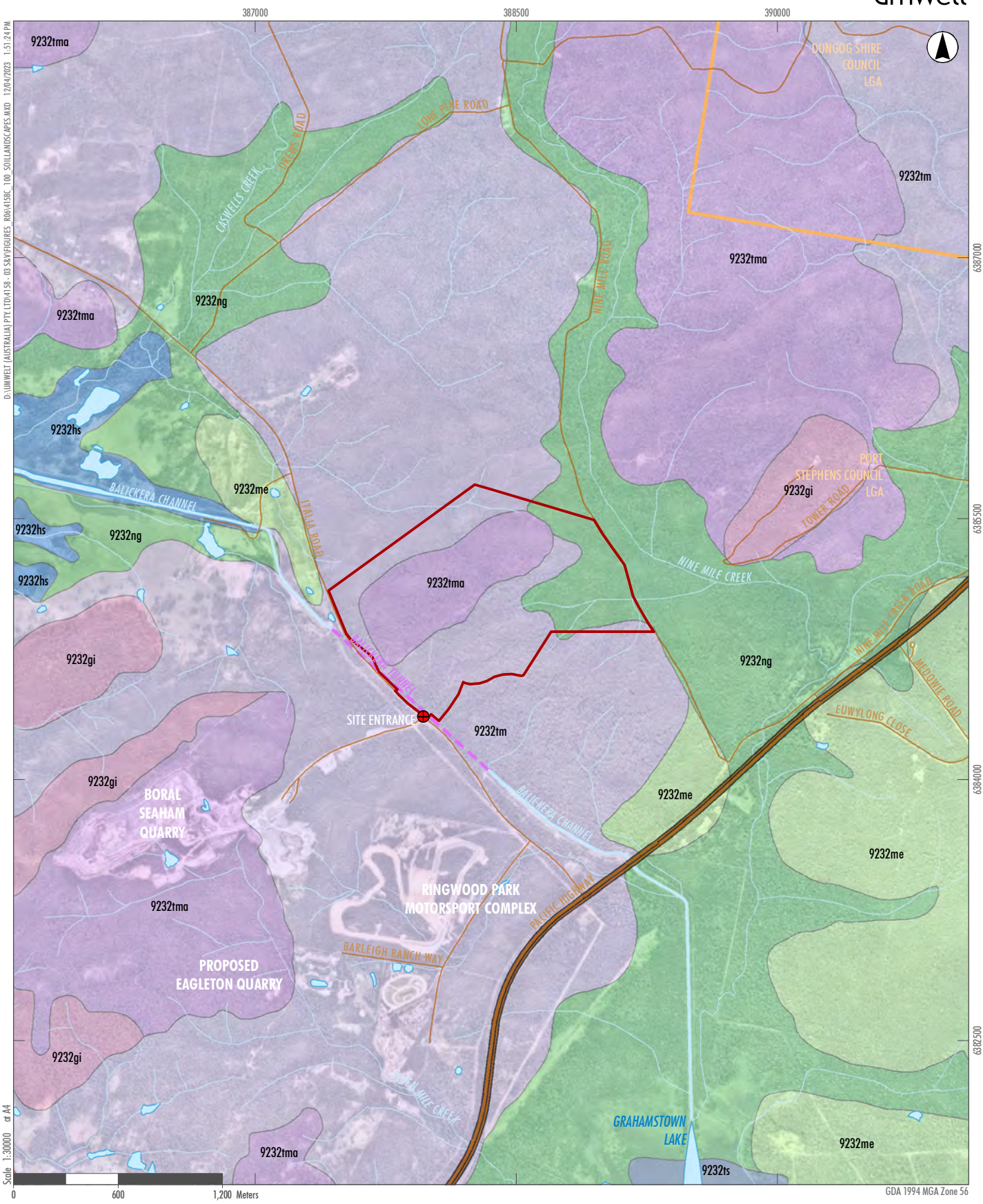
Contaminated Land

A search of the EPA's NSW Contaminated Lands Public Record Register did not identify any areas of contaminated land within the Project Area or surrounds. The Project Area has been used for forestry activities since the 1920s and there are no known areas of contamination within the Project Area, or any identified contamination risks based on past land uses.

Land Use

The Project Area is located wholly within Wallaroo State Forest and is zoned RU3 – Forestry under the Port Stephens LEP (refer to **Figure 2.2**). Wallaroo State Forest extends beyond the Project Area, to the north-west, north and east, while Italia Road lies to the west. The land has historically been used for forestry (refer to **Section 6.8.2** however has not been actively logged for many years. The site has been identified as having potential for quarry operations and ARDG has entered into the Deed with the FCNSW regarding the development of the quarry resource. Land on the west/south-western side of Italia Road is occupied by a number of commercial and extractive industry land uses including the Boral Seaham Quarry, which has been in operation since 1991, Ringwood Park Motorsport Complex and Circuit Italia (under construction), Hunter Valley Paintball, and the proposed Eagleton Quarry. The Pacific Highway is located approximately 1.6 km to the south-east of the proposed processing area, while beyond that, the land to the south is either privately-owned or in the ownership of Hunter Water Corporation (refer to **Figure 2.2**). Land to the north and east forms part of the National Park Estate and provides a range of informal recreation opportunities with a moderate level of visitor usage.

The closest residential areas are located approximately 1 km to the north-west of the Project Area, along Italia Road and to the south along Nine Mile Creek Road. The residential area of Seaham is located approximately 7 km to the west of the Project Area, while the larger townships of Raymond Terrace and Medowie are located approximately 10 km south-west and south-east of the Project Area respectively (refer to **Figure 1.1**).



Legend

- Project Area
- Local Government Boundary
- Pacific Highway
- Road
- Balickera Tunnel
- Drainage Line
- Waterbody

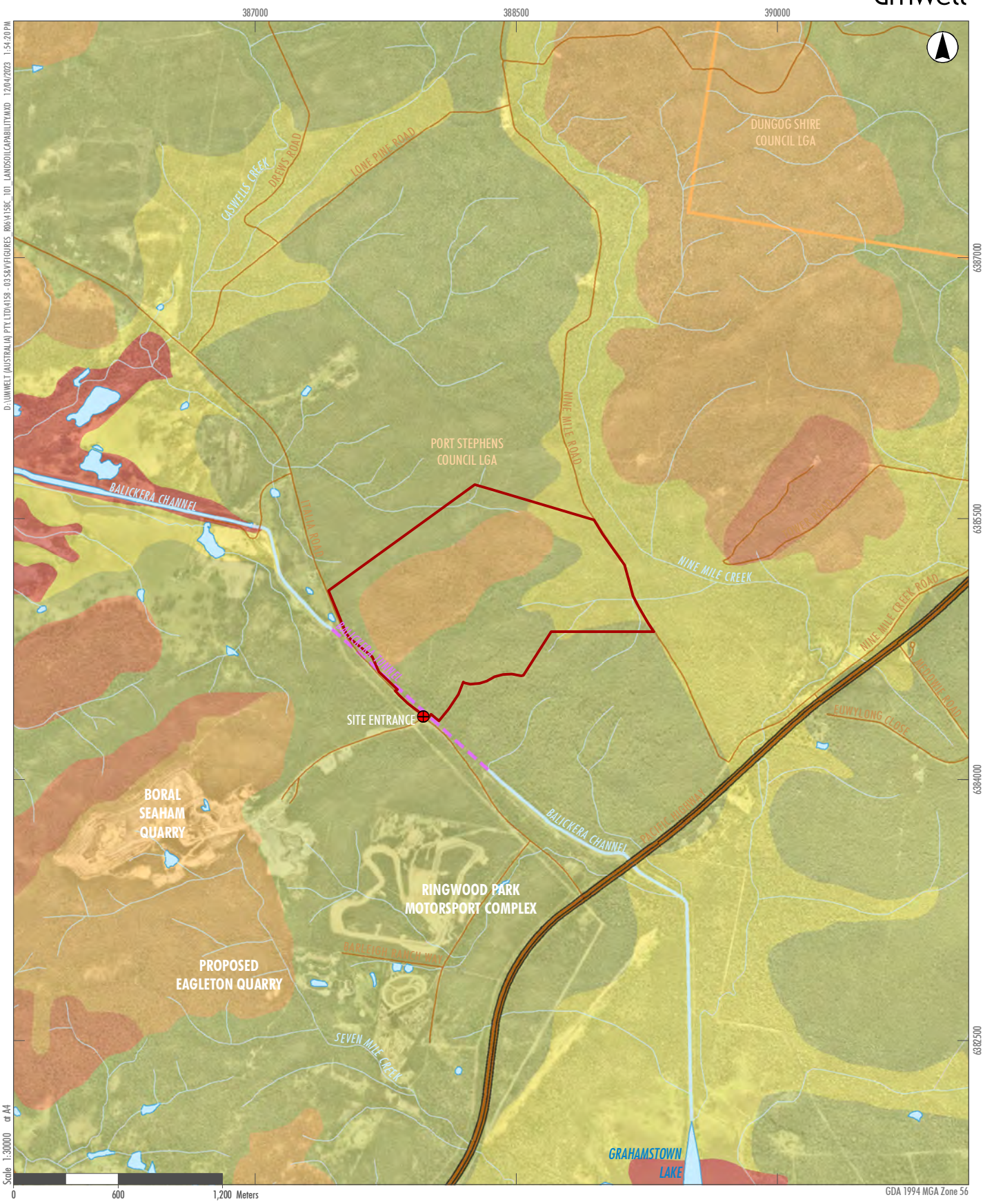
Soil Landscapes

- 9232me, Medowie
- 9232gi, Gilmore Hill
- 9232tm, Ten Mile Road
- 9232tma, Ten Mile Road variant a
- 9232ng, Nungra
- 9232hs, Hexham Swamp
- 9232ts, Tacoma Swamp

FIGURE 6.16

Soil Landscapes

Image source: Nearmap (2022) Data source: NSW FSDF (2022)



Legend

- Project Area
- Local Government Boundary
- Pacific Highway
- Road
- Balickera Tunnel
- Drainage Line
- Waterbody

Most Limiting LSC

- 4 - Moderate to severe limitations
- 5 - Severe limitations
- 6 - Very severe limitations
- 7 - Extremely severe limitations
- 8 - Extreme limitations

FIGURE 6.17

Land and Soil Capability

Image source: Nearmap (2022) Data source: NSW FSDF (2022)

6.10.1.2 Impact Assessment

As an extractive industry, the Project will impact on the land resources within the Project Area by changing the existing topography and relocating soil and geological resources. As described in **Section 3.2.1**, while most of the Project Area has limited, shallow soil resources, quarrying will commence with the stripping and stockpiling of available topsoil until required for use in rehabilitation of the final landform.

All of the land within the proposed Disturbance Area has moderate to severe land capability limitations to agricultural use in its present state. It is noted that following rehabilitation the majority of the Project Area could be returned to a LSC Class 6 with the final void areas being LSC Class 8. The proposed final land use for the majority of the Project Area outside the final void is to be rehabilitated with woodland vegetation similar to the surrounding forest, with the final voids able to provide a water supply suitable for fire-fighting and/or biodiversity purposes. Further detail on the proposed final landform is provided in **Section 6.16**.

An erosion hazard assessment was undertaken for the Project Area in accordance with Chapter 4.4.1 of Volume 1 of *Managing Urban Stormwater – Soils and Construction Volume 1* (Landcom, 2004) and *Volume 2E: Mines and quarries* (the Blue Book) (Department of Environment and Climate Change, 2008)). Given the estimated high soil loss rate and the large area of disturbance associated with the Project, two sediment basins have been incorporated into the conceptual operational Water Management System design, as described in **Section 6.5.1.2** and detailed in the Surface Water Impact Assessment (refer to **Appendix 9**). The general erosion and sediment control strategy is described below in **Section 6.10.3**.

As required by clause 2.17 of the Resources and Energy SEPP, when considering a development application for an extractive industry project, the consent authority must have regard to land use compatibility, in particular the aspects identified in **Table 6.27** below.

Table 6.27 Resources and Energy SEPP Land Use Compatibility Assessment

Aspect	Assessment
The existing uses and approved uses of land in the vicinity of the development	The Project Area has been used for forestry activities since the 1920s (although logging ceased in 1986) and is surrounded by land zoned RU3 – Forestry. Land on the opposite side of Italia Road is zoned RU2 – Rural Landscape and is occupied by a number of commercial enterprises including an existing quarry which has been operating since 1991. As discussed in **Section 1.7**, the Project is located on land managed by FCNSW, and ARDG holds a Deed for a Forest Materials Licence (FML) which allows ARDG to seek approval for the operation of a hard rock quarry in the Licence Area.
Whether or not the development is likely to have a significant impact on the uses that, in the opinion of the consent authority having regard to land use trends, are likely to be the preferred uses of land in the vicinity of the development	Traffic and amenity issues associated with the Project (including potential cumulative impacts) have been assessed (refer to **Section 6.2** – noise, **Section 6.3** – blasting, **Section 6.4** – air quality, **Section 6.9** – traffic and transport and **Section 6.13** – visual). The assessments concluded that any potential noise, vibration, air quality, traffic or visual impacts can be appropriately managed to avoid significant impact on surrounding residential, commercial and rural land uses. Should FCNSW wish to resume active forestry operations within the Wallaroo State Forest, the use of the Project Area as a quarry operation would not be likely to impact on the viability of forestry activities in the surrounding parts of the State Forest. The Project will provide a local source for quarry materials which will support the planned development of other areas in the Lower Hunter Region and the construction and maintenance of infrastructure necessary to support this development.

Aspect	Assessment
Any ways in which the development may be incompatible with any of those existing, approved or likely preferred uses	The assessment of land use interactions is a key component of the environmental assessments presented in this EIS, with assessments of impacts on other land uses through health and amenity impacts (e.g., dust, noise, blasting, visual) and physical impacts (e.g., water, soils, topography, biodiversity etc.). Following completion of detailed assessments of each of these matters, it is concluded that potential impacts associated with the Project can be appropriately managed for the Project to be able to coexist with the surrounding agricultural and non-agricultural land uses in the region.
Evaluate and compare the respective public benefits of the development and the land uses referred to above	The benefits of the Project are evaluated in **Section 7.4**. Under the terms of the FML, ARDG will pay FCNSW a royalty for each tonne of quarry product sold from the Project, thus providing an economic benefit to the State of NSW. Forestry operations ceased at the site in 1986 so the Project Area is not currently returning any financial benefit to FCNSW under its current land use. The Project will also make a significant contribution to the local community through the direct and flow on effects of workforce and operational expenditure and through development contributions to be paid to PSC for the transportation of quarry product on Council roads.
Evaluate any measures proposed by the applicant to avoid or minimise any incompatibility	The proposed measures to avoid or minimise any incompatibility are summarised in **Appendix 3**, and include measures to minimise the noise, blasting, air quality, water, traffic and transport and visual impacts of the Project (amongst others), provide a sustainable final landform and land use, and maximise the economic benefits of the Project.

6.10.2 Geotechnical Stability

6.10.2.1 Assessment Methodology

To assess geotechnical stability performance of the proposed quarry, a geotechnical domain model was compiled by GHD from four component models (geological, structural, hydrogeological and rock mass (material properties)) along with critical instability mechanisms (refer to **Appendix 14** for further detail on model parameters).

RocScience's Limit Equilibrium software suite was used to assess long-term slope stability performance of the proposed quarry pit geometry in terms of the kinematic (structural) stability at the individual bench scale and the overall slope scale. Slope stability performance was measured against nominated Design Acceptance Criteria in line with accepted industry practice as outlined in the NSW Resource Regulator's *Guide – Health and Safety at Quarries* (2018). The Design Acceptance Criteria define the minimum requirements and limits for 'acceptable' risk and consequence levels with respect to the Factor of Safety (FoS) and Probability of Failure (PoF) which were nominated as:

- Slope category 1 for the kinematic stability analyses at the individual bench scale (design FoS = 1.2, design PoF = 10%).
- Slope category 2 for the overall slope scale (design FoS = 1.5, design PoF = 1%).

The kinematic assessment considered the orientation of the quarry walls relative to the mapped geological structures as per the available drilling data and was undertaken to assess and inform the minimum batter-berm configuration of the quarry. Stability analyses were also undertaken to assess the overall long-term stability of slopes with additional sensitivity assessments undertaken to assess the stability implications of seismic events, elevated phreatic conditions and the influence of final pit lake level.

The proposed pit geometry analysed for the geotechnical assessment is as follows:

- the total depth of extraction is expected to be approximately 95 m below the current surface level of approximately +78 m AHD, with the proposed floor and sump at -2 m AHD and -17 m AHD respectively
- individual benches are to be formed at 15 m high with bench widths of 20 to 30 m
- nominal face angles of 70 degrees for individual benches.

6.10.2.2 Impact Assessment

Kinematic Analyses

The kinematic analyses were undertaken under 'expected' conditions, which are the in-situ stress conditions known, or likely, to exist at the time of the 2019 drilling campaigns. Results are as follows:

- Under expected conditions, the north, east and south walls of the proposed quarry are comparatively more sensitive to planar sliding than the western wall. The minimum bench width was calculated (to the nearest m) to be 16 m.
- Under expected conditions, the south and west walls of the proposed quarry were calculated to be comparatively more sensitive to tetrahedral wedge sliding compared to other walls. The minimum bench width was calculated (to the nearest m) to be 13 m. The volume of instability was calculated to be of limited scale/volume where good blasting and scaling practices are employed.
- The rock toppling assessment determined that a minimum bench width of 16 m is required to ensure there is adequate catch capacity to retain potentially dislodged material to a single bench.

Based on the above results, a minimum bench width of 16 m is required to ensure there is adequate catch capacity to retain potentially dislodged material to a single bench. The proposed pit design incorporates 20 to 30 m benches at the individual bench scale, which satisfies the minimum bench width requirements.

Slope Stability Analyses

Results of the slope stability analyses are as follows:

- Under expected conditions the stability performance at individual batters and overall slope scales satisfy the nominated Design Acceptance Criteria for stability.
- Under a 1:500-year seismic loading event, the stability performance was calculated to satisfy the design performance objectives.
- A reduction in the slope stability performance was calculated under 'worst case' fully saturated conditions compared to 'expected' conditions. At the overall slope scale, the stability performance was calculated to be FoS > 1 for all stability sections.

- The stability performance of rehabilitated slopes, incorporating a recovered pit lake, were calculated to satisfy the Design Acceptance Criteria associated with a 'Serious Consequence of Failure' category when considering the overall slope scale.

Potential Erodibility

Key outcomes of the erosion assessment are as follows:

- The erosion potential of the excavated batters is considered 'Very Low' (< 150 t/ha/yr) and satisfies the Commonwealth guidelines, *Mine Rehabilitation, Leading Practice Sustainable Development Program for the Mining Industry* (2016) after approximately 20 months of perennial grass coverage.
- The susceptibility to erosion within these units is largely controlled by the topographic factor and ability to apply cover. Erosion in these areas is expected to be ongoing which is likely to result in some minor sloughing of the excavated face. It is anticipated that in the long-term, erosion of these faces would not pose a significant geotechnical risk.

6.10.3 Mitigation and Management Measures

6.10.3.1 Erosion and Sediment Controls

Should the Project be approved, a detailed Soil and Water Management Plan (SWMP) will be prepared and incorporated into the CEMP/OEMP, by a suitably qualified person to facilitate implementation of best practice erosion and sediment controls during all stages of the Project. As detailed in **Section 6.5.1,** all erosion and sediment controls will be installed, managed and maintained in general accordance with the Blue Book (Landcom, 2004) to:

- divert clean water around site
- prevent sediment moving off-site and sediment laden water entering any watercourse, drainage line, or drain inlet
- reduce water velocity and capture sediment on site
- minimise the amount of material transported from site to surrounding pavement surfaces.

The proposed water management measures described in **Section 6.5.1.5** will also assist in the management of erosion risks and downstream impacts.

6.10.3.2 Geotechnical Stability Controls

The following measures will be incorporated into the quarry operations:

- When quarrying commences, regular site inspections will be undertaken to observe for signs of adverse geotechnical conditions. Furthermore, where site conditions are observed to deviate from those outlined in the Geotechnical Stability Review, additional intrusive investigation and/or defect mapping would be undertaken. This may include core sampling of key stratigraphic units, and laboratory testing to confirm the geomechanical properties and strength parameters of the material.
- Ongoing groundwater monitoring of the Project Area will be undertaken. Where site conditions are observed to deviate from those outlined in the Geotechnical Stability Review, a full suite of stability analyses with the benefit of additional data obtained from the intrusive hydrological studies would be undertaken.

6.11 Waste Management

ARDG is committed to the management of waste streams in accordance with the principles of the waste hierarchy, where emphasis is placed upon reducing, reusing and/or recycling prior to disposal of wastes. The SEARs require an assessment of quantity and nature of waste streams for the Project and the measures that would be implemented to minimise, manage or dispose of them.

6.11.1 Waste Streams

The Project will generate only limited volumes of both production and non-production wastes (during both construction and operational phases). **Table 6.28** summarises the approximate predicted waste streams and proposed management methods. These volumes are an estimate only and will be confirmed through the development of the Waste Management Plan, to be developed should the Project be approved. Wastes have been classified according to the *Waste Classification Guidelines – Part 1: Classifying Waste* (NSW EPA, 2014).

Table 6.28 Predicted Waste Streams

Material	Waste Classification	Approx. volume per annum	Storage/Use/Disposal
Vegetation	General solid waste (non-putrescible)	100,000 t in Stage 0	Stockpiled in emplacement areas within the quarry prior to mulching/grinding and use in progressive site rehabilitation. Some larger timber material may be relocated to adjoining areas of Wallaroo State Forest for habitat enhancement purposes (refer to **Section 3.2.1**).
Topsoil and overburden	General solid waste (non-putrescible)	230,000 t in Stage 0 and 10,000 t per annum for remainder of operations	Stockpiled in emplacement areas within the quarry prior to use in progressive site rehabilitation or used in sediment dam and bund construction (refer to **Section 3.2.1** and **Section 3.2.2**).
General waste	General solid waste (putrescible and non-putrescible)	Up to 70 m^3	Stored in covered bins or skips located within office and workshop areas as required. Where located in open areas, the bins would be fitted with animal-proof lids. Collected on a regular basis by a licensed waste contractor and transported to a licensed waste disposal/recycling facility.
General recyclables	General solid waste (non-putrescible)	Up to 25 m^3	
Waste oil/ grease	Liquid waste	Up to 1 kL	Placed within bunded tank(s) within the workshop area. Where required, smaller, temporary storage containers may be positioned closer to work areas, with the contents of those containers transferred to a larger storage tank prior to collection. Collected on a regular basis by a licensed waste contractor and transported to an appropriately licensed facility for recycling.

Material	Waste Classification	Approx. volume per annum	Storage/Use/Disposal
Batteries	Hazardous waste	12–24	Used batteries would be placed within a covered and marked storage area until removed from site. Used batteries would be collected for recycling on a regular basis by an appropriately licensed contractor.
Tyres	Special waste	12–36 tyres	Tyres would be placed within a marked storage area until removed from site or used for another purpose. Used tyres would be collected on a regular basis by a licensed contractor and transported to a licensed recycling facility.
Scrap metals	General solid waste (non-putrescible)	Up to 60 t	Scrap metals would be contained within a marked storage area until removed from site. Collected on a regular basis by a licensed contractor and transported to an appropriately licensed facility for recycling.
Sewage	Liquid waste	Up to 24 kL	Wastewater from the amenities will be collected in licensed pump out septic system and removed from the site by a licensed waste contractor as required.

6.11.2 Mitigation and Management Measures

The following measures will be implemented to ensure that wastes are appropriately managed for the life of the Project:

- Waste streams will be classified and managed in accordance with the principles of the waste management hierarchy and EPA guidelines.
- All wastes will be stored in appropriate containers/receptacles that are lidded where practical, within designated waste storage areas.
- All wastes will be collected for reuse/recycling/disposal by appropriately licensed waste contractors.
- Site inductions for employees and contractors will include waste management information.
- Appropriate signage will be provided at all waste storage areas to clearly identify waste segregation and recycling procedures.

6.12 Hazards

The SEARs require an assessment of the likely risks to public safety from the Project, with particular reference to potential bushfire risks and the transport, handling and use of any hazardous or dangerous goods. Hazard assessments are described in the sections below.

6.12.1 Bushfire

The Project Area is identified as bushfire prone land by the Port Stephens Council bushfire prone land mapping (2022) (refer to **Figure 6.18**). This section provides a bushfire risk assessment in accordance with the NSW Rural Fire Service (RFS) *Planning for Bushfire Protection 2019* (PBP 2019) (NSW RFS, 2019) and the SEARs, including an assessment of potential bushfire hazard applicable to the Project Area and the proposed bushfire management for the Project to protect public safety.

6.12.1.1 Existing Environment

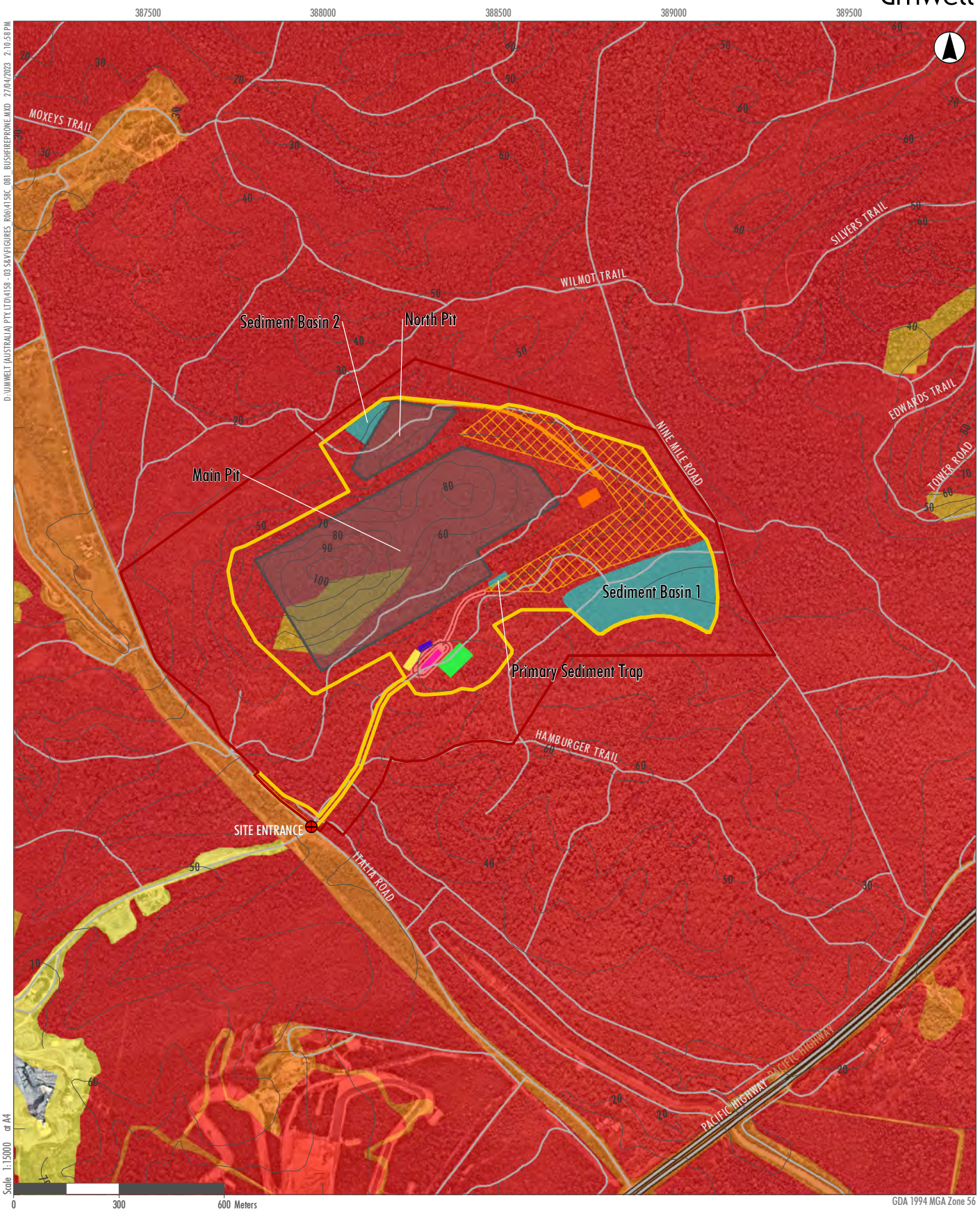
The Project Area is predominantly mapped as Category 1 vegetation on the Port Stephens Council Bushfire Prone Land mapping (as required by section 10.3 of the EP&A Act) with the exception of a small area on the western side of the Project Area which is mapped as Category 2 vegetation. The land surrounding the Project Area associated with the Wallaroo State Forest is also mapped as Category 1 vegetation. Category 1 vegetation is considered to be the highest risk in relation to bushfire. This vegetation category carries the highest fuel load and is associated with areas of forest, woodland, heaths and timber plantations. Areas mapped as Category 2 vegetation have lower combustibility and/or limited fire potential due to size, geography or management practices, and are associated with rainforest vegetation or vegetation parcels with lower risk of ignition.

While the surrounding vegetation represents a potential bushfire threat to the Project the land is managed by FCNSW and National Parks and Wildlife Service (NPWS) to prevent bushfire threat and to provide for planned emergency response to bushfire events. The Project Area was most recently burnt during the 2016-17 bushfire season, while other smaller areas within the State Forest were also burnt during the 2017-18 bushfire season.

The Wallaroo State Forest is managed by FCNSW who operate under the Forestry Corporation Fire Management Plan. The Fire Management Plan provides a framework for the management of all forestry land within NSW to minimise fire risk to FCNSW assets, to adjoining land uses and the surrounding community. Fire management includes both fire prevention and suppression activities. Fire prevention can include fuel reduction including prescribed burning, grazing and mechanical treatment (harvesting, slashing etc). Fire trails are maintained, and monitoring is undertaken to inform bushfire planning.

The adjoining Wallaroo National Park is managed by NPWS subject to the Karuah, Medowie and Wallaroo Group Plan of Management (OEH, 2016) and the Fire Management Strategy (OEH, 2015). The Fire Management Strategy identifies the key assets within and adjoining the National Park, relevant fire management zones, bushfire prevention methods and fire control assets (water supply and fire trails). NPWS undertakes management in consultation with adjoining landowners to ensure a cooperative approach to fuel management and information sharing.

As discussed in Section 2.4, the topography across the Project Area varies. The north-west and south-east is gently undulating and typically ranges in elevation from 20 to 60 m AHD. The Project Area generally slopes up towards Stone Ridge which runs approximately 1.2 km across the northern side of the Project Area and comprises two rocky hills with elevations of 107.5 m AHD and 83 m AHD separated by a low saddle. The proposed associated infrastructure will generally sit within locations upslope from surrounding vegetation.



Legend

- Project Area
- Disturbance Area
- Pacific Highway
- Road
- Contour (10m Interval)
- Pit Outlines (Stage 9)
- Office
- Weighbridge
- Access Road
- Northern Haul Road
- Workshop
- Truck Parking
- Light Vehicle Parking
- Stockpile and Plant Area
- Dams

Bush Fire Prone Land

- Vegetation Category 1
- Vegetation Category 2
- Vegetation Category 3
- Vegetation Buffer

FIGURE 6.18

Bushfire Prone Land Mapping

Image Source: Nearmap (2022) Data source: NSW FSDF (2022)

6.12.1.2 Bushfire Threat Assessment

The extractive industry is considered to fall within 'other development' under Section 8 of PBP 2019. In order to comply with PBP 2019 development must satisfy the aims and objectives of PBP 2019, consider any specific requirements and propose an appropriate combination of bushfire protection measures.

The aim of PBP 2019 is to provide for the protection of human life and minimise impacts on property from the threat of bush fire, while having due regard to development potential, site characteristics and protection of the environment. The objectives are to:

- afford buildings and their occupants protection from exposure to a bush fire
- provide for a defendable space to be located around buildings
- provide appropriate separation between a hazard and buildings which, in combination with other measures, prevent the likely fire spread to buildings
- ensure that appropriate operational access and egress for emergency service personnel and occupants is available
- provide for ongoing management and maintenance of bushfire protection measures
- ensure that utility services are adequate to meet the needs of firefighters.

The Project will not increase the potential for, or the severity of bushfires within the locality. The risk of onsite activities igniting fire is only slightly elevated through activities such as exhausts but can be effectively avoided through the implementation of appropriate bushfire protection measures. The clearing associated with the Project is likely to act as a barrier to the spread of bushfire across the Project Area. There is only minor infrastructure associated with the Project which will be located within a cleared area located on the lower slopes of the Project Area. Appropriate bushfire emergency management undertaken within the adjoining State Forest and Wallaroo National Park will also inform the emergency management response applied during Project operation.

The proposed infrastructure includes an office, workshop and weighbridge all of which will be located within cleared areas where asset protection zones (APZ) will be applied to provide a separation between the infrastructure and the bushfire hazard and a defendable space for firefighting. The workshop will be located with a separation distance greater than 100 m to surrounding vegetation. The proposed stockpiles are to be located surrounding the workshop. The office and weighbridge also sit within the light vehicle and truck parking area with a separation distance greater than 50 m to surrounding vegetation. The processing equipment will also be located close to the quarry pit within an area to be cleared of vegetation. Any vegetation retained within the operational area associated with the Project will also be maintained to reduce fuel loads to prevent the spread of bushfire across the operational area.

The site will be accessed directly via Italia Road. This will include all weather access with appropriate width to allow for firefighting vehicles and will improve fire management access to this area of Wallaroo State Forest. Proposed haul roads will also provide access for firefighting across the operational areas should it be required. Italia Road provides two-way access/egress to the north (towards Seaham) and to the south (to the Pacific Highway). The State Forest and National Park also have active maintained fire trails which provide access through the adjoining vegetation for both hazard reduction management and firefighting activities.

An appropriate dedicated water supply for bushfire protection will be provided on site. Additional water will also be available on site via the surface water management system if required.

6.12.1.3 Mitigation and Management

A Bushfire Emergency Management Plan will be developed for the Project and incorporated into the CEMP and OEMP, in accordance with PBP 2019 and in consultation with the RFS, DPE, FCNSW and NPWS. The plan will identify all relevant bushfire risks and mitigation measures associated with the construction and operation of the Project, including:

- detailed measures to prevent or mitigate fires igniting, outlining:
    - APZ locations and management requirements
    - access locations, passing bays (if required) and any alternate emergency access
    - water supply and any other bush fire suppression systems.
- work that should not be carried out during total fire bans
- availability of fire-suppression equipment
- storage and maintenance of fuels and other flammable materials
- notification of the local NSW RFS Fire Control Centre for any works that have the potential to ignite surrounding vegetation, proposed to be carried out during a bush-fire fire danger period to ensure weather conditions are appropriate
- appropriate bush fire emergency management and relevant evacuation plan developed with consideration of the emergency response applicable to the surrounding State Forest.

With the implementation of a Bush Fire Emergency Management Plan and continued consultation with FCNSW and NPWS, it is considered that potential bushfire risk associated with the Project can be appropriately managed.

6.12.2 Hazardous Materials

A preliminary risk screening was undertaken for the Project in accordance with Chapter 3 of the *State Environmental Planning Policy (Resilience and Hazards) 2021* (Resilience and Hazards SEPP). The preliminary risk screening involves identification and assessment of the storage of specific dangerous goods classes that have the potential for significant off-site effects. A development is considered 'potentially hazardous' and requires a Preliminary Hazard Analysis (PHA) if the storage or transport of hazardous substances exceeds specific screening thresholds.

Table 6.29 provides a list of the hazardous materials to be stored within the Project Area, dangerous goods classes of the materials, storage quantities and screening thresholds. Based on the quantities listed in **Table 6.29** none of the hazardous materials to be stored at the Project are above screening thresholds and a PHA is not required. Vehicle movements for the transport of hazardous materials to the site will also be well below transportation screening thresholds.

Table 6.29 Hazardous Materials Inventory

Material	Storage Type and Location	ADG Code[1] Class	Quantity	Screening Threshold	PHA required?
Diesel	Above ground self-bunded tank (Infrastructure Area)	C1	1 x 20 kL[2]	No screening thresholds for combustible liquids	No
Unleaded petrol	Packages (Maintenance and Services Area)	3 (II)	200 kg	< 5 tonne – screening distance does not apply	No
Engine and hydraulic oils	Packages (Hydrocarbon Storage Area)	C2	3,000 kg	No screening thresholds for combustible liquids	No
LPG	Cylinders (Maintenance and Services Area)	2.1	100 kg	10 tonne	No
Welding gases (e.g. acetylene)	Cylinders (Maintenance and Services Area)	2.1	30 kg	10 tonne	No
Aerosols	Packages (Maintenance and Services Area)	2.1	50 kg	10 tonne	No
Paints and solvents	Packages (Maintenance and Services Area)	3 (III)	50 kg	< 5 tonne – screening distance does not apply	No

Notes: [1] *Australian Dangerous Goods Code.*

[2] *20 kL of diesel has a mass of approximately 17,200 kg.*

Explosives and explosive precursors will not be stored on site and therefore do not trigger screening requirements.

6.13 Visual Amenity

The SEARs require an assessment of the likely visual impacts of the Project on private landholders and key public vantage points. A qualitative visual impact assessment was undertaken for the Project and involved an assessment of the local visual environment, potential impacts of the Project and proposed mitigation measures.

6.13.1 Existing Environment

The Project Area is located within Wallaroo State Forest and is surrounded by large areas of native forest/woodland vegetation, both within the State Forest itself and through its direct connections to Wallaroo National Park, Karuah National Park and Karuah State Conservation Area. These forested areas provide a range of informal recreation opportunities including bushwalking, camping, four-wheel driving, motorbike riding, cycling/mountain biking, horse riding with a moderate level of visitor usage.

The landscape of the surrounding locality is characterised by a mix of forest remnants, rural-residential properties, commercial enterprises (quarrying, motorsport, landscaping supplies) and infrastructure (roads, water reticulation and power/telecommunications infrastructure).

'Stone Ridge' is the main topographic feature within the Project Area, running for approximately 1.2 km and comprising two rocky hills with elevations of 107.5 m AHD and 83 m AHD separated by a low saddle. More gently undulating topography to the north-west and south-east of the Project Area is associated with more weathered volcano-sedimentary geology that typically ranges in elevation from 20 to 60 m AHD. A prominent broad low ridge ('South Ridge') extends at a maximum elevation of approximately 62 m AHD from the central south-eastern flank of Stone Ridge to the Pacific Highway (refer to **Figure 2.3**).

6.13.2 Assessment

Proposed quarrying activities will essentially remove the ridge of 'Stone Ridge', down to approximately 73 m AHD, and replace it with a quarry void (refer to conceptual Stage 9 extraction plan provided in **Figure 3.3**).

Substantial areas of existing regrowth and remnant vegetation will be retained around the proposed Disturbance Area which will shield views of operations from surrounding public and private property viewing locations. Vegetation along Italia Road will shield views of all aspects of the Project other than the access road (noting that this will be similar in nature to the Boral Seaham Access Road located directly opposite). In addition, the Project has been designed such that there will be topographic shielding of quarry operations from nearby receivers to the west and north-west.

The visual assessment included radial topographic analysis technique to identify any areas potentially visible from the proposed operational areas, based on ground topography alone and the preparation of visual transects (based on topography and vegetation cover). This analysis indicated that the visibility of the operations (based on topography) will be very limited. Two visual transects were then prepared to provide an indication of the likely visual impacts of the Project from nearby residences and transport routes (refer to **Figure 6.19**). The visual transects were based on the Stage 9 conceptual extraction plan to provide a conservative 'worst case' assessment. **Photo 6.1** shows the existing view from receiver R18 looking east-south-east towards the Project Area while **Photo 6.2** shows the existing view from the Boral Seaham Quarry entrance looking north-north-east towards the proposed site entrance.

The transects indicate that due to both topographic shielding and intervening forest vegetation, the quarry extraction and infrastructure areas are not likely to be visible from public or private viewing locations, including Italia Road, Nine Mile Road, the Pacific Highway or private residences.

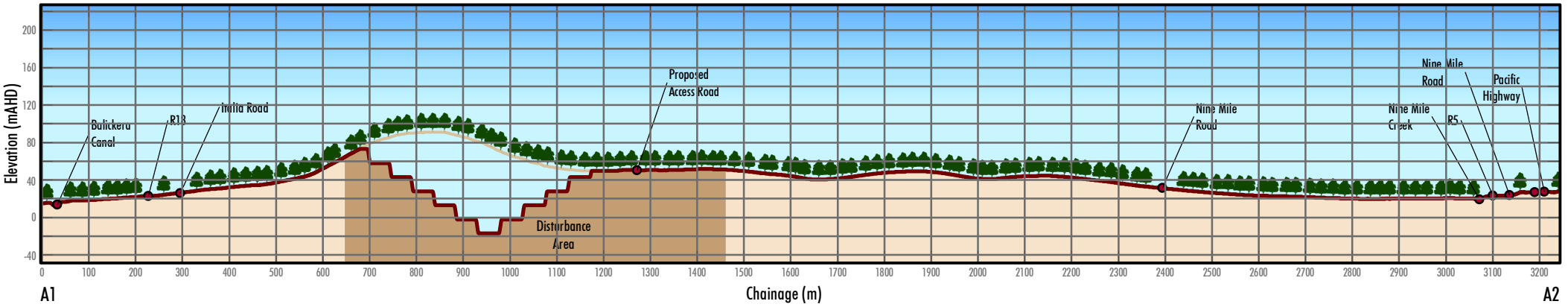
Visual impacts are likely to be limited to possible indirect glow associated with lighting for mobile equipment and the loading/operations area of the quarry which would be operational up until 10 pm Monday to Friday. Given the relative remoteness of the operations, and the intervening vegetation and topography, lighting is not expected to significantly or adversely affect the amenity of any residences in the area.

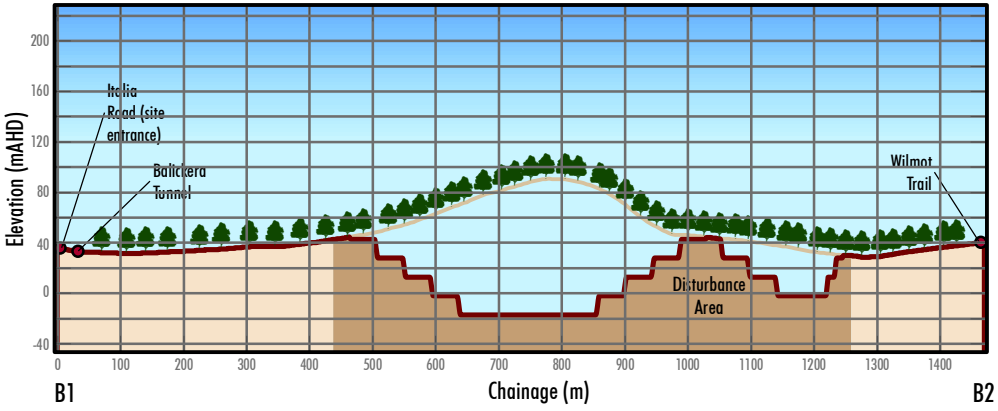
The potential for any adverse visual impacts associated with the Project is therefore considered limited.

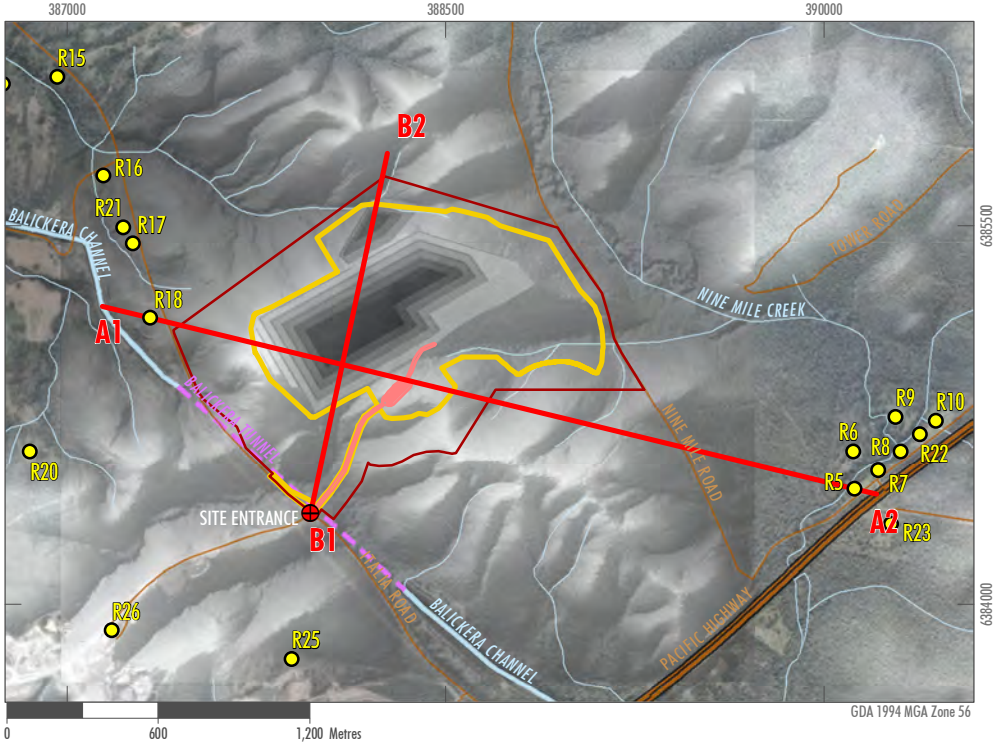
6.13.3 Mitigation and Management Measures

The Project has been designed to minimise the potential visual impacts on surrounding viewing locations, however the following mitigation and management measures will further reduce impacts:

- To the greatest extent practicable, the Project Area will be quarried in a manner that enables mobile equipment to remain shielded behind the active face as the ridge is removed.
- Vegetated buffers will be retained around the Disturbance Area and along road frontages.
- Lighting will be directed downwards and away from residential areas and public roads in accordance with relevant Australian Standards (*AS 4282 – Control of the Obtrusive Effects of Outdoor Lighting*).
- The Project Area will be maintained in a clean and tidy condition at all times.







Legend

- Existing Landform
- Final Landform

0 200 400 Metres — Vertical Scale

0 100 200 Metres — Horizontal Scale

Legend

- Project Area
- Disturbance Area
- Pacific Highway
- Road
- Balickera Tunnel
- Drainage Line
- Sensitive Receivers
- Transect

FIGURE 6.19

Visual Transects

Note: DEM and sections based on Stage 9 conceptual quarry layout

Photo 6.1 View looking east-south-east from R18 towards the Project Area

Photo 6.2 View looking north-north-east from Boral Seaham Quarry entrance towards the Project Area

6.14 Social

The Project SEARs require a detailed assessment of the potential social impacts of the development that builds on the findings of the Social Impact Assessment (SIA) Scoping Report in accordance with the Social Impact Assessment Guideline for State significant mining, petroleum production and extractive industry development, paying particular consideration to how the development might affect people's way of life, community, access to and use of infrastructure, services and facilities, culture, health and wellbeing, surroundings, personal and property rights, decision-making systems and fears and aspirations.

The SIA has been prepared by Umwelt in accordance with the NSW Government's Social Impact Assessment Guideline (DPIE, 2023) (SIA Guideline) for SSD. The 2023 SIA Guideline is the latest version of the SIA Guideline which updates the previous 2017 SIA Guideline for State significant mining, petroleum production and extractive industry development released by the then DPE and referred to in the SEARs. Aspects of the SIA undertaken prior to release of the SIA Guideline were undertaken in accordance with the 2017 SIA Guidelines.

6.14.1 SIA Methodology

The SIA process involves three key phases, as outlined in **Figure 6.20**.

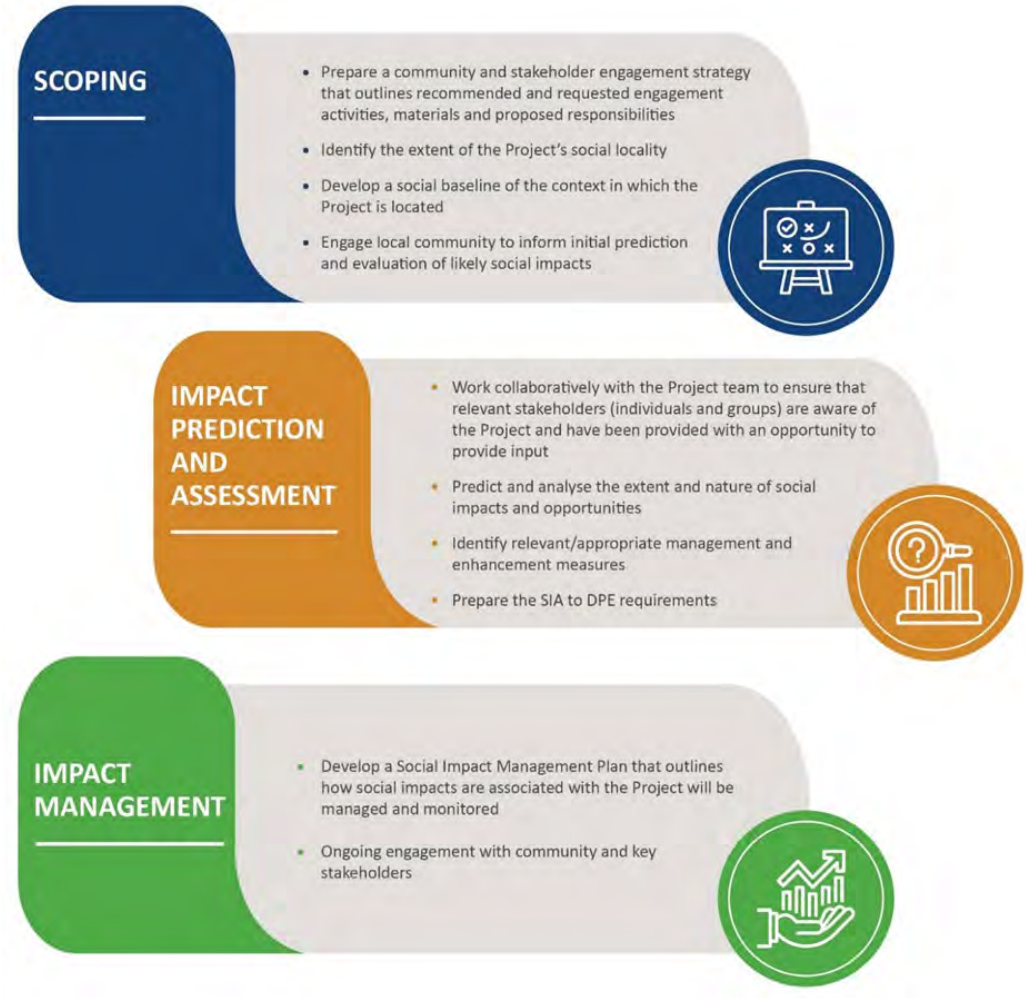


Figure 6.20 SIA Program Phases

A social baseline profile gathers knowledge from both primary and secondary data sources to inform an understanding of the existing social environment in which a project is proposed and of potentially affected communities. The social baseline profile provides the basis for which social impacts associated with the Project may be predicted, assessed, monitored, and managed over time.

Key components of a social baseline profile include:

- the scale and nature of the project
- who may be affected, including identification of any vulnerable or marginalised groups
- any built or natural features on or near the project
- relevant social, cultural, and demographic trends and other change processes
- the history of the proposed project and/or development in the area, including community response to previous change.

Data for the social baseline profile has been gathered and summarised from publicly available secondary datasets, including the most recent Australian Census (2021), as well as through a review of local media, government plans and strategies and other literature as it relates to the social locality. The social impact evaluation is based on quantitative and qualitative information collected through engagement activities and informs the identification and assessment of the Project's potential or perceived social impacts and the identification of mitigation and/or enhancement measures to reduce negative impacts and enhance positive impacts. The impact evaluation assesses and ranks the Project's social impacts according to defined criteria, as outlined in the SIA Guideline (DPE, 2023) with the inclusion of perceived social risk, as identified through stakeholder consultation.

6.14.2 Social Baseline

A baseline social profile gathers knowledge from both primary and secondary data sources to understand the existing social environment in which the Project is proposed, and of the potentially affected communities. The social baseline provides the foundation from which social impacts associated with the Project may be assessed and predicted, with the following components considered:

- Development context – a review of the recent history of communities, including cultural characteristics and community values.
- Geographic and spatial – identification of communities and relevant stakeholders.
- Socio-political setting – an understanding of the relevant governance structures, including those of Traditional Owners and Local Aboriginal Land Councils, and local, State and Federal government authorities.
- Community capital/assets – an assessment of the social, cultural, and demographic characteristics of the communities and their resilience and adaptive capacity to respond to change.
- Key community values, issues, and concerns – documentation of current community issues as identified in key strategic planning documents, regional plans and/or community studies, as well as through analysis of local and regional media sources.

To better understand the communities of interest to the Project and to evaluate their resilience and adaptive capacity to change, the social baseline has utilised the Sustainable Livelihoods Approach (U.K. Department for International Development (DFID, 2001), and the community capitals outlined in the IAIA SIA Guidance (IAIA, 2015), refer to **Figure 6.21**.

The social baseline is outlined in detail in Section 3 of the SIA and has informed the development of key development challenges and opportunities currently being experienced across the social locality relevant to the Project. These have been grouped according to the community capitals framework and summarised in **Table 6.30**.

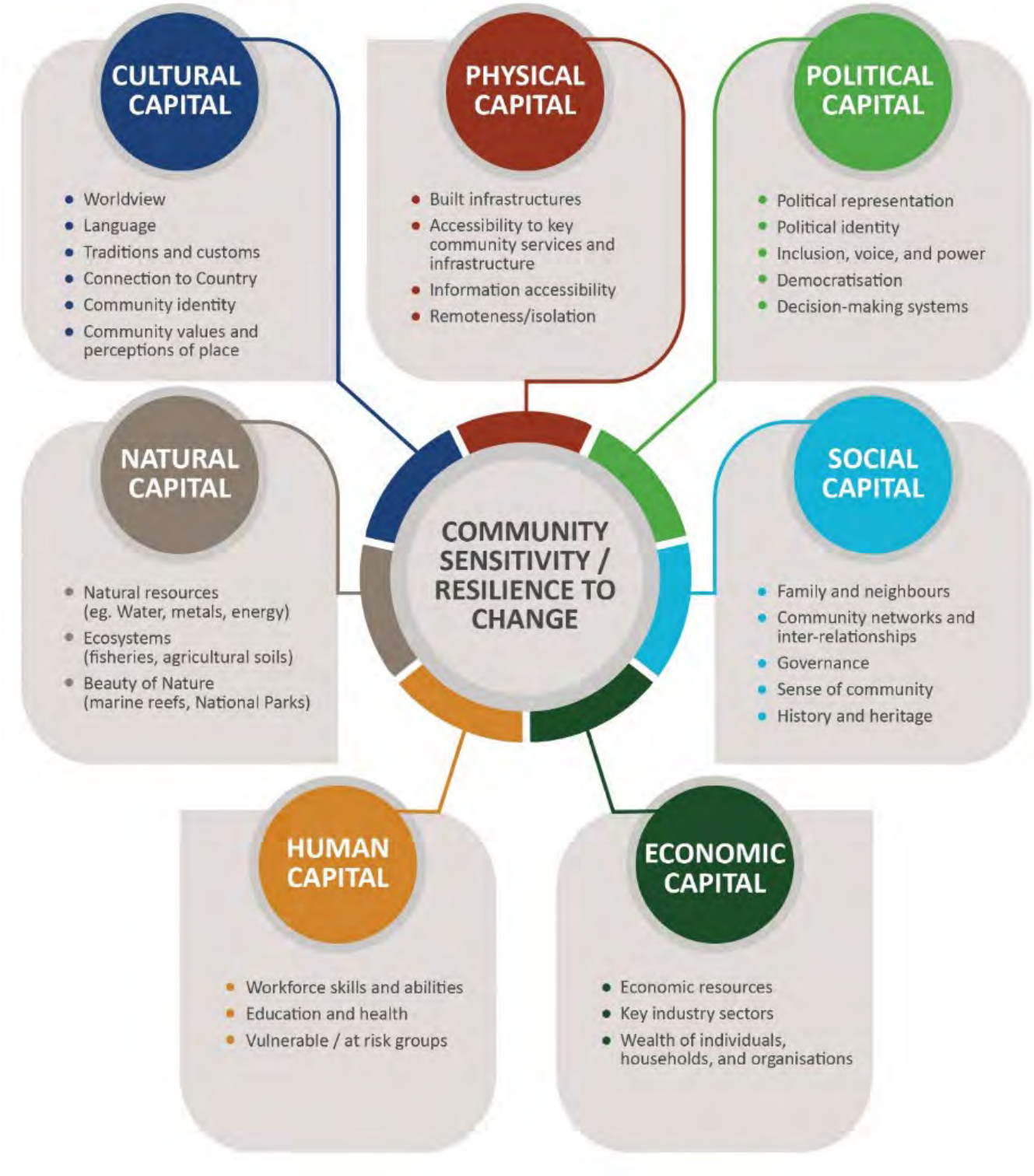


Figure 6.21 Community Capitals Framework

Table 6.30 Challenges and Opportunities for Local Development

Challenges	Capital	Opportunities
• Shifting levels of community acceptance for new projects.	**Political**	• Government support for a general Economy growth.
• Social locality and broader region vulnerable to natural disasters such as drought, flooding, and bushfires. • Cumulative impacts of numerous existing quarry operations on natural environment.	**Natural**	• Area has a variety of recreational and tourist attractions. • Strong community values associated with the natural environment and rural landscape. • Access to National Park for recreational uses. • Area is rich in natural resources.
• Ageing population. • Area has high rates of selected long-term health conditions, when compared with the broader NSW.	**Human**	• Proportion of residents undertaking certificate level accreditation is increasing.
• Increasing number of Quarry projects could cause a sense of loss of community.	**Social**	• Strong sense of community with high levels of volunteerism. • Council focus on providing facilities and learning options for children and families • Established and less transient residents resulting in sustained sense of community. • Strong ties to community groups and local engagement.
	Cultural	• Strong desire of local government to support and promote local cultural activities.
• Potential difficulty and sourcing local workforce due to a low unemployment rate. • Increasing retirement-age population leading to decrease in skilled employee base. • Constraints on supply of construction materials which have potential to delay development and/or increase construction costs.	**Economic**	• Region has a strong industry including mining, construction and retail trade. • High median weekly household income resulting in a potential spending in the local economy. • Investment into public recreational infrastructure targeting tourism.
• Limited range of community services, including primary and secondary school, health services and retail shops. • Limited public transport. • Road infrastructure requiring repairs.	**Physical**	• Highly valued rural character of region.

In summary, the key social challenges faced by the area include the need to increase access to services for the local population and to address concerns regarding road infrastructure and the potential risk on the natural environment. On the other hand, the expansion of resourcing projects, place the Port Stephens LGA in a good position to further grow the local and regional economy and address the challenges presented by existing supply constraints for construction materials.

To further support regional development, issues such as the emerging strain on local service provision need to be addressed, as well as upgrades to road infrastructure. Some of these identified constraints are already being considered by the Port Stephens Council.

Further detail regarding the Social Baseline and SIA methodology is provided in the SIA, refer to **Appendix 15.**

6.14.3 Social Impact Evaluation

The SIA includes an evaluation of the perceived social impacts identified in relation to the Project, with the aim of assessing the anticipated changes to the current social baseline. As discussed in **Section 5.4**, a range of perceived social impacts have been identified in relation to the Project, key concerns relate to Traffic Safety (including cumulative traffic impacts), Social Amenity (noise, air quality and water) and Ecological Impacts.

Table 5.1 in the SIA (**Appendix 15**) presents a complete summary of the social impact evaluation with the justification and proposed management and enhancement strategies to address the associated impact with resulting significance rating. Majority of the perceived social impacts are rated low when the relevant management and mitigation measures are applied with the exception of the following impacts (rated medium):

- cumulative traffic movements and road safety
- impacts to biodiversity (specifically loss of habitat)
- potential decline in property values.

The SIA also notes that the residual social risk ratings represent the risk post implementation of mitigation measures, with additional proposed mitigation and enhancement strategies proposed in the SIA to address the residual social impacts.

Potential cumulative traffic movements will be addressed through the implementation of management and mitigation measures as outlined in **Section 6.9.6**. It is acknowledged that the evaluation indicates there is still potential for medium impact in relation to perceived cumulative traffic impacts however through the application of the relevant management and mitigation the significance of the impact is reasonably mitigated, and impacts will largely be limited to the eastern end of Italia Road.

Additionally, ARDG has committed the implementation of comprehensive biodiversity management and mitigation measures to minimise the unavoidable direct and indirect impacts to biodiversity associated with the Project. Any unavoidable impacts will be addressed through the implementation of a Biodiversity Offset Strategy which will be based on a like-for-like basis and no-net-loss principle.

In relation to property values, it is difficult from a social impact perspective, to specifically ascertain the risks of the Project on property values, and the direct impacts of the Project, however the SIA indicates that recent assessments of property value in a mining context report that there is evidence to suggest that detrimental impacts on property prices occur as a result of mining operations. However, this impact appears to be limited to the areas where social amenity is impacted by development, through factors such as noise and air quality exceeding environmental standards and criteria and require acquisition, (Tew 2019; Knight Frank Newcastle 2019). Predicted noise and air quality impacts are well below accepted nuisance (dust deposition) and health-based impact and blasting impacts can be managed to meet relevant criteria at all residences. The Project will not be visible from any residences located in the surrounding areas. Appropriate management and mitigation measures are proposed to protect the social amenity of surrounding landholders, these management measures will be developed and implemented through the CEMP and OEMP and will be applied through the construction and operational phases of the Project.

The evaluation also indicates the positive impacts will be enhanced through the implementation of an Employment, Training and Procurement Strategy.

6.14.4 Social Management Mitigation and Enhancement Strategies

In addition to the management and mitigation measures developed as part of the various specialist studies the following social impact management measures will be implemented:

Community Engagement Strategy – ARDG will develop and implement a Community Engagement Strategy comprising project-specific stakeholder analysis, mechanisms or methods to be utilised, periodic action plans, targets, and responsibilities for implementation. The strategy would also outline the development of a monitoring and evaluation framework throughout the life of the Project, which will complement the ongoing engagement through the established Community Consultative Committee (CCC).

Employment, Training and Procurement Strategy – this Strategy will contain initiatives to proactively enable the maximisation of local employment and sourcing for the Project's construction and operational needs and could include investigation of options for prioritising the employment of local workers, supplier and servicing opportunities for local businesses and jobs, supplier, and servicing opportunities that target partnerships with local and enhancement strategies.

The SIA concludes that identified negative social impacts of the Project can be reasonably mitigated or managed to reduce their significance, with positive impacts increasing in significance if appropriate enhancement measures are put in place.

6.15 Economic

The SEARs which require an Economic Assessment including a detailed assessment of the likely economic impacts of the development, paying particular attention to:

- the significance of the resource
- the costs and benefits of the development
- identifying whether the development as a whole would result in a net benefit to NSW, including consideration of fluctuation in commodity markets and exchange rates; and
- the demand on local infrastructure and services.

Section 6.15.1 below considers the significance of the resource.

An Economic Impact Assessment (EIA) has been prepared by Gillespie Economics to address the other SEARs related to economic benefits. The key findings of the EIA are discussed in **Section 6.15.2**, **Section 6.15.3** and **Section 6.15.4** and the full report is provided in **Appendix 16**.

6.15.1 Significance of the Resource

As discussed in **Section 2.3**, a comprehensive geotechnical testing program has been undertaken to confirm the suitability of different rock types within the Project Area for producing a range of typical quarry products. This testing confirmed that the source rock will support the extraction and processing of material to enable the transport of approximately 1.5 Mtpa, within the conceptual design of the proposed extraction area. This would be considered a 'measured resource' in accordance with the Australasian Code for Reporting of Exploration Results, Mineral Resources and Ore Reserves (the 'JORC Code'). Given the limited extent of weathering of rhyodacite and dacite across the project area, there is also no significant quantity of overburden.

Hard rock materials derived from the Project Area are a significant and important input for the production of aggregates to produce ready mixed concrete and a range of road pavement and armourstone products. The EIA indicates demand for aggregates and road pavement materials is driven by population growth and the resulting need for additional housing, land subdivision, provision of trunk infrastructure, major landscaping projects, upgrading of road, rail and other transport networks, additional commercial and industrial development and the development of community, cultural and recreational infrastructure. Armourstone and gabion products are used for a variety of uses including erosion protection works. The largest individual market for aggregates in NSW is the Greater Sydney Region. All crushed rock supply for this region is sourced from surrounding areas, as all quarries historically producing crushed rock products with the Greater Sydney region have closed. Quarries surrounding the Greater Sydney region also supply local and/or other regional markets.

While there is strong and growing demand for hard rock materials, their supply in proximity to Sydney is limited to specific areas where the required geological formations exist, and it is economic to extract. The Project is well positioned to meet this demand.

6.15.2 Cost Benefit Analysis

There are no specific economic assessment guidelines for extractive industries, however the *Guidelines for Economic Assessment of Mining and Coal Seam Gas Proposals* (NSW Government, 2015) (Economic Assessment Guidelines) and the *Technical Notes Supporting the Guidelines for the Economic Assessment of Mining and Coal Seam Gas Proposals* (NSW Government, 2018) (Technical Notes), provide guidance on the economic assessment techniques that are appropriate for considering the costs and benefits of the Project and the net benefit of the development as a whole to NSW. The EIA has therefore been prepared having regard to these guidelines.

As required by the Economic Assessment Guidelines, the Cost Benefit Analysis (CBA) and consideration of benefits to NSW considers the incremental costs and benefits of a project relative to the base case of the project not proceeding. In the case of the Project, the incremental case comprises the extraction and sale of extractive materials from the Project but also includes the costs and benefits associated with the delivery of saleable products to customers, as the assessment of road transport impacts and the demand on local infrastructure (including roads) are a specific requirement of the SEARs.

Relative to the base case ("without" the Project scenario – continued use as forestry), the Project may have the potential incremental economic benefit and cost categories shown in **Table 6.31**. The analysis includes consideration of production costs, and benefits of the sale of quarry products, costs and benefits from product transport and external costs and benefits. Further detail is provided in **Appendix 16**.

Table 6.31 Potential Incremental Economic Benefits and Costs of the Project

Category	Costs	Benefits
Net production benefits from extraction and processing	• Opportunity cost of forestry land. • Opportunity cost of capital. • Capital costs. • Operating costs at quarry gate. • Decommissioning and rehabilitation costs at cessation of the Project.	• Sale value of quarry product at quarry gate. • Residual value of capital and land at the end of the project.
Net production benefits from ex-quarry transport	• Capital and operating costs.	• Revenues.
Potential environmental, social and cultural impacts of extraction, processing and transportation, after mitigation, offsetting and compensation	• Air quality impacts. • Greenhouse gas generation. • Noise and blasting impacts. • Road transport impacts. • Groundwater impacts. • Surface water impacts. • Biodiversity impacts. • Aboriginal heritage impacts. • Historic heritage impacts. • Visual impacts. • Net public infrastructure costs. • Loss of surplus to other industries.	• Economic benefits to existing landholders. • Economic benefits to suppliers. • Wage benefits to employment. • Nonmarket employment benefits.

The CBA was undertaken in 2022 real values, with discounting at 7% and sensitivity testing at 3% and 10%. The analysis period is 31 years (Project duration plus one year pre-commencement) Costs occurring after the period are included in the final year of the analysis as a terminal value which is a conservative approach as it reduces the impacts of discounting that would apply to costs incurred beyond this period.

Environmental, cultural, and social impacts were estimated using market data and benefit transfer incorporated into an estimate of the net social benefit of the Project. This estimated net social benefit of the Project provides another threshold value that any residual or non-quantified economic costs would need to exceed to make the Project questionable from an economic efficiency perspective.

6.15.2.1 Operational costs and production benefits

The estimated present value of production costs and benefits for both quarrying activities and product, using a 7% discount rate, is provided in **Table 6.32**. Production costs and benefits are calculated on three different scales, Global, National and State. The key difference between the three scales is the apportionment of calculated company tax benefits based on Project profitability.

Table 6.32 Estimated operational costs and production benefits from Project ($M 2022)

	Quarrying	Ex Quarry Transport	Total
Costs			
Opportunity cost of land	$0		
Opportunity cost of capital	$0		
Capital costs	$33		
Operating cost	$101	$236	
Sub-total	**$134**	**$236**	**$369**
Benefits			
Revenue	$467	$250	
Residual value of land and capital equipment	$0		
Sub-total	**$467**	**$250**	**$717**
Global Net Production Benefits	**$334**	**$14**	**$348**
Community Payments	$1		
Royalties	$35		
Company Tax	$81	$4	
Residual Net Production Benefits	$217	$10	
Global Net Production Benefits	**$334**	**$14**	**$348**
Community Payments	$1		
Royalties	$35		
Company Tax	$81	$4	
Residual Net Production Benefits	$217	$10	
Australian Net Production Benefits	**$334**	**$14**	**$348**
Community Payments	$1		
Royalties	$35		
Company Tax	$26	$1	
Residual Net Production Benefits	$217	$10	
NSW Net Production Benefits	**$278**	$12	**$290**

**Differences in totals are due to rounding.*

The net production and transport benefits apportioned to NSW are estimated at $290 M (present value at 7% discount rate) based on ARDG being 100% NSW owned, an assumption that transport providers are 100% NSW owned, and company tax benefits (at a rate of 27.5%) accruing to NSW based on its population share (32%). The net production benefits of the Project that accrue to Australia are estimated at $348 M (present value at 7% discount rate).

The estimated net production benefits that accrue to Australia and NSW can be used as a minimum threshold value or reference value against which the relative value of the residual environmental impacts of the Project, after mitigation, may be assessed. This threshold value is the opportunity cost to society of not proceeding with the Project. It is a minimum threshold value as it does not include any potential wage benefits, any potential benefits to suppliers, nor any allowance for real price rises for quarry products as future demand outstrips limited supply.

Provided the value of the residual environmental impacts of the Project, to Australian and NSW households, after mitigation, do not exceed the respective net production threshold values, then the Project will have net benefits to the Australian and NSW communities.

6.15.2.2 Environmental and Social Costs and Benefits

The EIA includes consideration of material environmental, cultural, and social impacts of the Project. Many of the potential impacts associated with the Project are mitigated to levels which are below accepted NSW impact assessment criteria. As the setting of impact criteria for noise and air quality impacts include consideration of both the acceptability of impacts and the economic costs to NSW associated with impacts up to the accepted criteria, a calculation of externality costs from these impacts has not been undertaken. Similarly, the setting of extraction limits on surface and groundwater take include a level of acceptable impact. Costs associated with implementing mitigation measures to achieve these levels of impact and the acquisition of water allocations and relevant water licensing fees are fully internalised. The cost of contributing to the NSW Biodiversity Conservation Fund as a means of meeting relevant biodiversity credits requirements under the NSW BAM are also included in operating costs. **Table 6.33** summarises the results of the consideration of how environmental and social costs are considered in the cost benefit analysis. As can be seen from **Table 6.33**, only GHG costs are separately costed as an externality. Only GHG impacts differ between the Australian and NSW scope due to the method adopted for apportioning climate change related impacts to each jurisdiction based on the Project's predicted global contribution.

Table 6.33 Environmental and Social Impacts of the Project ($M Present Values at 7% Discount Rate)

Benefits	Australia	NSW
Wage benefits to employment	Unquantified	
Economic benefits to existing landholders	No benefit - lease payment to FNSW assumed to reflect opportunity cost	
Economic benefits to suppliers	Unquantified	
Costs		
Greenhouse gas emissions (Scope 1 and 3)	$0.03	$0.01
Air quality	Meets relevant criteria – no residual material impact	
Noise and blasting	Meets relevant criteria – no residual material impact	

Benefits	Australia	NSW
Road transport	Cost of intersection upgrade included in capital costs Cost of local road pavement damage payment included in operating costs Cost of arterial road pavement damage included in heavy vehicle transport registration costs No material residual impact	
Surface water	No material residual impact	
Groundwater	Cost of WALs included in capital costs No material residual impact	
Biodiversity	Impacts on biodiversity are offset – cost of offsets included in capital costs	
Aboriginal heritage	No impact	
Historic heritage	No impact	
Visual	No material residual impact	
Net public infrastructure costs	No impact	
Loss of surplus to other industries	No impact	

The EIA concludes that the main potential impacts of the Project are internalised into the production costs of the Project through mitigation measures, compensation payments, offsets and purchase of water allocations. Other quantified costs not already included in the production costs of the Project are associated with greenhouse gas emission costs, however the results indicate it is evident that these impacts to Australia and NSW are small or immaterial.

The Project will result in increased employment opportunities within NSW and the supply of goods and services to enable production and transport of quarry products would be expected to provide additional benefits to the NSW economy relative to the base case. Conservatively, these additional benefits have not been quantified in the CBA.

6.15.2.3 Net Benefits to NSW and Sensitivity Testing

Overall, the Project is estimated to have significant net social benefits to both Australia and NSW, and hence is desirable and justified from an economic efficiency perspective. Any additional unquantified environmental, cultural or social impacts would need to be valued at greater than approximately $348 M and $290 M (at a 7% discount rate) for the Project to be questionable from an Australian and NSW economic efficiency perspective, respectively.

The EIA also tested the sensitivity of the CBA results for NSW to a 20% change to the following variables at a 4%, 7% and 10% discount rate:

- quarry capital costs
- quarry operating costs
- quarry revenue

- net transport revenue
- greenhouse gas emission costs.

Under all tested scenarios, the sensitivity analysis identified the Project would have significant net social and environmental benefits to NSW (refer to Section 3.8 in **Appendix 16**). The analysis indicated that CBA results were most sensitive to reductions in the value of hard rock products and increases in operating costs. The strong demand for aggregates, armourstone and road pavement materials that underpins the Project, together with limits on alternative financially viable suppliers in proximity to major markets, suggest that any sustained reductions in hard rock product value is highly unlikely. Additionally, unlike some resource projects, there is increased capacity for quarries to pass on increased operating costs due to the speciality nature of products and the nature of the domestic market which would typically result in all competitors also being subject to the same operating cost pressures. The sensitivity analysis has not included provision for passing on increased operating costs through charging higher prices for product or transport costs. The sensitivity of the benefits to NSW associated with a reduction in quarry product value and/or increased operating costs is therefore likely overstated.

6.15.3 Local Effects Analysis

A local effects analysis (LEA) measures the impacts of the Project in its locality as required by section 4.15 of the EP&A Act. The LEA provides an assessment of the effects of the Project on the local economy, focusing on the operational phase of the Project.

The local area is defined as the Port Stephens, Newcastle, Lake Macquarie, Cessnock, Maitland, and the Central Coast LGAs, being the region considered likely to be main source of labour and non-labour sources for the Project.

The project will provide a total 47 full time equivalent (FTE) direct jobs, comprising 12 (FTE) quarry jobs and 35 (FTE) ex-quarry transport jobs. The EIA assumes that those that already reside in the local area would have otherwise been already employed and conservatively assumes that job vacancies created by these people filling the Project jobs remain unfilled (i.e., no job chain effects). The incremental disposable wage value accruing to the region from Project is $0.7 M per annum. This is equivalent to 9 direct full time equivalent (FTE) jobs. The expenditure by employees who reside in the region, and non-labour expenditure that is captured by the local area, provides flow-on economic activity to the local economy. The Project is not expected to result in any substantial in-migration of workers and their families and consequently the impact on housing prices is expected to be negligible.

Standard regional economic impact assessment using input-output analysis is not restricted to a focus on the existing labour force in the local area and does not assume an absence of job chain effects. In this framework, the Project is estimated to provide the following annual direct and indirect annual effects to the local economy:

- $102 M in output (direct and indirect to regional economy).
- $58 M in value-added to regional economy.
- $14 M in gross wages.
- 176 jobs (47 direct and 129 indirect).

As discussed above in relation to the CBA, the main local environmental impacts are internalised into the production costs of ARDG via mitigation, offset and compensation costs. Residual local environmental impacts after mitigation, offset and compensation are likely to be immaterial.

Demand for local infrastructure and services arises from the production process as well as demands of the workforce and their families. The Project will fully fund any demand it has for local infrastructure and services for the production process, such as road maintenance and intersection upgrades. It will not result in any changes in population levels in the local area and therefore will not generate any additional community demand for local infrastructure and services.

Full details of the LEA are contained in Section 5 of **Appendix 16**.

6.15.4 Economic Management Measures

The construction and operation of the Project will have net positive impacts on the level of economic activity in the region. ARDG proposes to work in partnership with Port Stephens Council and the local community to help maximise the projected economic regional benefits while minimising any potential impacts. Proposed economic management measures include:

- Employment of regional residents preferentially where they have the required skills and experience and can demonstrate a cultural fit with the organisation.
- Participating, as appropriate, in business group meetings, events or programs in the regional community.
- Locally sourcing non-labour inputs to production where local producers can be cost and quality competitive.
- Provision of community grants through various initiatives and programs within the local community, including the education, arts, sporting and culture sectors.

6.16 Rehabilitation and Final Landform

The Project SEARs require the documentation of the proposed rehabilitation strategy for the site having regard to the key principles in the *Strategic Framework for Mine Closure* (Australian and New Zealand Minerals and Energy Council Minerals Council of Australia, 2000) and including:

- rehabilitation objectives, methodology, monitoring programs, performance standards and proposed completion criteria
- nominated final land use, having regard to any relevant strategic land use planning or resource management plans or policies
- the potential for integrating this strategy with any other rehabilitation and/or offset strategies in the region.

ARDG is committed to the effective rehabilitation and closure of the quarry at the cessation of operations. The overarching principle to be applied is the development of a safe, stable and non-polluting landform. Rehabilitation at the quarry will address the long-term stabilisation of both quarried and disturbed areas, including rehabilitation of the upper quarry benches and available areas within and surrounding the quarry pit, with two final voids (Main Pit and North Pit) to remain after closure as water storages. It is anticipated that all other water storages (SB1, SB2 and any other sediment traps/basins) will be decommissioned, all infrastructure removed, and the landform outside of the Main Pit and North Pit will be free draining. This proposed rehabilitation and end landform has been developed in consultation with FCNSW.

Due to the nature of the pit design (which is dictated by the geology of the resource) and the location of processing and handling infrastructure, there are limited opportunities for progressive rehabilitation of the site. Additionally, the location of the resource within the Wallaroo State Forest limits the post-closure land use options for the site to those permitted within the State Forest and consistent with the underlying object of being safe, stable and non-polluting.

The ability to return the entire site to a viable native forest is limited due to both the shallow rock depth, limited topsoil resources and likelihood that the voids will hold water. Despite these limitations, the quarry site can be rehabilitated to provide enhanced biodiversity habitat values associated with the resulting pit lakes, retained and/or battered highwalls, vegetated benches and processing area. The formation of pit lakes within the voids would also provide additional end land use opportunities associated with the water storages including emergency bushfire fire-fighting water supply opportunities. As the target geological resource extends beyond the currently proposed quarry footprint, the opportunity to extend the life and size of the quarry in the future is also a likely longer term land use opportunity and the proposed rehabilitation of the site is designed to avoid unnecessarily constraining this opportunity.

A conceptual final landform and life of operations rehabilitation management strategy relevant to achieving this landform will be outlined within the OEMP. A Detailed Quarry Closure Plan will be developed 3 years prior to planned cessation of quarrying activities. Both the conceptual closure plan in the OEMP and the Detailed Quarry Closure Plan will be based on a final land use focused on promoting the surrounding forest landscape by re-establishing pockets of woodland species across the benches consistent with endemic vegetation types with retained access opportunities to the voids/lakes for safety purposes and future uses consistent with management objectives for the State Forest. Alternative land uses will be investigated as part of the development of the Detailed Quarry Closure Plan and will include consultation with FCNSW, Hunter Water, Port Stephens Council and DPE. Where further development consent is required for the proposed ongoing use of the site, this would need to be obtained prior to being reflected in the Detailed Quarry Closure Plan. The biodiversity management requirements of the OEMP are discussed further in **Section 6.6.4**.

The exact timing of individual rehabilitation works will be dependent upon on the rate of resource extraction and any future plans to seek approval for the continuation of extraction beyond the initial 30-year approval term currently being sought. Any areas surrounding the active extraction and processing areas, where quarrying is not proposed, would be subject to earlier rehabilitation where it is identified that areas will not be required for ongoing operations.

6.16.1 Strategic Context

The *Strategic Framework for Mine Closure* is structured around a set of objectives and principles grouped under six key areas (stakeholder involvement, planning, financial provision, implementation, standards and relinquishment). These strategic objectives are provided in **Table 6.34**, along with the relevant section where they are addressed in this EIS.

Table 6.34 Key Objectives from the Strategic Framework for Mine Closure

Objective	Relevant Section of EIS
Stakeholder involvement – To enable all stakeholders to have their interests considered during the mine closure process.	**Section 5.5** and **Section 6.16**
Planning – To ensure the process of closure occurs in an orderly, cost-effective and timely manner.	**Section 6.16**
Financial provision – To ensure the cost of closure is adequately represented in company accounts and that the community is not left with a liability.	**Section 6.16.5**
Implementation – To ensure there is clear accountability, and adequate resources, for the implementation of the closure plan.	**Section 6.16.3**
Standards – To establish a set of indicators which will demonstrate the successful completion of the closure process.	**Section 6.16.4**
Relinquishment – To reach a point where the company has met agreed completion criteria to the satisfaction of the Responsible Authority.	**Section 6.16.4**

Each of these objectives will be reviewed throughout the life of the Project and will be informed by various external factors based on stakeholder feedback and regulatory requirements which may be applicable at the time of closure. During the life of the quarry, changing circumstances and community expectations may alter preferences for the final land use. As the rehabilitation objectives (and associated closure criteria) will be closely linked to the agreed final land use of the site, these will initially be based on the conceptual post closure land uses identified above and, if necessary, rehabilitation objectives will be refined to align with post-closure land use goals.

6.16.2 End Land Use/Rehabilitation Objectives

The conceptual end land use opportunities identified for the quarry have been developed in consideration of the objectives of the Hunter Regional Plan 2041 and the Port Stephens LEP as well as land uses permitted under the *Forestry Act 2012*. As noted in **Section 2.3.3** and **Figure 2.2**, the Project Area is zoned RU3 – Forestry under the Port Stephens LEP. The objectives of the RU3 zone are:

- to enable development for forestry purposes, and
- to enable other development that is compatible with forestry land uses.

Rehabilitation at the quarry will therefore focus on re-establishing vegetation that is consistent with the surrounding Wallaroo State Forest, within the constraints presented by the voids and resulting pit lakes. Opportunities to enhance vegetation within the retained voids (including battering high walls and use of stockpiled soil material will be considered however these would necessitate additional impact on surrounding vegetation post-closure, to batter back upper highwalls to achieve a landform that enables forest development. The *additional* disturbance associated with battering that would be required to achieve a return of the disturbed area to equivalent vegetation communities as those that exist at present is not considered to be warranted given the relatively small area of disturbance. Instead, the proposed conceptual land use is the revegetation of the processing area to woodland vegetation types, vegetation of benches with endemic species suited to growing in shallow soil environments and the retention of access to the void for emergency purposes, including accesses to the developing pit lakes for water access purposes. A bund will be installed at the top of any retained highwalls to prevent inadvertent access to steep slopes. Any amendments that may occur to the Port Stephens LEP and approved uses under the *Forestry Act 2012* during the life of the Project, and opportunities for other complementary final land uses, will be evaluated as part of ongoing revisions to the quarry's post-closure planning process, including the development of the Detailed Quarry Closure Plan.

The Hunter Regional Plan 2041 recommends the early consideration of alternative land uses when planning for rehabilitation and closure of existing mines, and this equally applies to quarries. The Regional Plan also advocates the use of strategies such as the repurposing of voids and the promotion of biodiversity corridors in post-closure land uses. The conceptual land use proposed is consistent with these recommendations and the potential for alternative uses will be considered in consultation with relevant stakeholders during the development of the Detailed Quarry Closure Plan. Due to the nature of the proposed quarry and limited post-closure opportunities, progressive rehabilitation or earlier consideration of alternate post-closure options is not considered warranted.

6.16.2.1 Rehabilitation Objectives

ARDG is committed to the effective rehabilitation and closure of the quarry at the cessation of operations. The overarching objective for the site is that the final landform is safe, stable and non-polluting having regard to the proposed end land use for the site and surrounding areas.

Rehabilitation at the quarry will address the long-term stabilisation of both quarried and disturbed areas, including rehabilitation of the upper quarry benches and available areas within and surrounding the quarry pit, with two final voids (Main Pit and North Pit) to remain after closure as water storages. All final landform slopes (including retained highwalls) will be assessed for long term geotechnical stability having regard to the risk profile presented by the final landform and potential access to the site. It is anticipated that all operational water storages (SB1, SB2 and any other sediment traps/basins) will be decommissioned, and the landform outside of the Main Pit and North Pit will be shaped to be free draining. All infrastructure not required by FCNSW for post-closure land uses will be removed.

The Detailed Quarry Closure Plan will describe the key requirements of final landform design, revegetation, water drainage and the future sustainability of the site. There are a number of key considerations to be taken into account in designing the rehabilitation objectives, including safety, legal requirements, key physical constraints (such as climate, location, topography, soils) and community and stakeholder input.

Based on the consideration of these factors, and in particular the site's location within a State Forest, the rehabilitation objectives for the Project are:

- creation of a safe, stable and non-polluting landform
- decommissioning and removal of all surface infrastructure (unless retention is approved by the detailed closure planning process as agreed with FCNSW)
- enhancement of biodiversity values through revegetation of ancillary areas and upper benches with local endemic plant species (having regard to constraints presented by the different domain areas)
- retention of two final voids which will develop pit lakes available for biodiversity and water use purposes
- retain vehicle access to the final voids for future use and emergency access purposes.

6.16.2.2 Final Landform

The proposed conceptual final landform will consist of vertical/steep face slopes, horizontal benches, flat or gently sloping surrounds and two pit void lakes (Main Pit and North Pit) as illustrated in **Figure 6.22**. Opportunities for selected battering of high walls will be considered as part of the detailed quarry closure processes but will be subject to safety, biodiversity and future land use constraint considerations. Localised geological conditions (geotechnical and quality) and resultant adjustments to the development of the quarry may result in changes to the pit design which would result in a different landform to that shown in **Figure 6.22** however the broad principles associated with benches, highwalls/slopes and the surrounding flatter areas will remain appropriate to different pit designs.

Legend

- Project Area
- Disturbance Area
- Road
- Balickera Tunnel
- Drainage Line
- Contour Line
- Access Road
- Pit Lakes
- Revegetation Area

FIGURE 6.22

Conceptual Final Landform

Image Source: Nearmap (2022) Data source: NSW FSDF (2022)

6.16.3 Proposed Rehabilitation Methodology

The total surface area available for rehabilitation at any one point in time will be limited due to the nature of extractive operations at the quarry, the progressive vertical expansion of the active quarry pit and stepped development of benches. The upper benches and ancillary areas will generally not become available for rehabilitation until active operations have fully exhausted resources in that area and ancillary areas for processing, stockpiling and laydown activities are not required. All disturbance associated with the Quarry operations will be contained with the approved disturbance footprint except where otherwise approved under *Forestry Act 2012* processes where further development consent is not required.

At the end of the proposed operational life of the quarry, onsite infrastructure and associated facilities not required for the post-closure land use will be decommissioned and removed from the site. Closure monitoring and maintenance works will continue until it can be demonstrated that all completion criteria have been achieved (refer to **Section 6.16.4**).

Rehabilitation practices will be detailed in the BRMP and will include the following key management measures to be implemented throughout the quarry establishment and operational stages:

- **Topsoil management –** Topsoil material for rehabilitation will be sourced from soil stored on-site which has been stockpiled as part of the initial site preparation processes, although it is noted that the soil resource across the Disturbance Area is limited, and importation of additional material may be required at the time of rehabilitation. Where practicable, mulched vegetation will also be included to promote on-site growth medium availability. Prior to use for rehabilitation purposes, topsoil material will be analysed at a NATA registered laboratory to determine the application requirements for any soil ameliorants, if necessary.

- **Habitat enhancement –** The salvage of hollow bearing trees, hollow logs, and fallen timber will be undertaken, where practical, during the vegetation clearing process. These resources will be stockpiled adjacent to the Disturbance Area along with topsoil stockpiles, with both being spread across flatter areas of the shaped landform once complete. The relocation of these habitat resources into post-quarrying rehabilitation areas is aimed at increasing habitat complexity, in order to make these areas more habitable for native species. With the approval of FCNSW, hollow logs, felled hollow bearing trees, and fallen timber material may also be emplaced within adjoining areas of the State Forest for habitat enhancement purposes where it is considered that the habitat benefits of the features unlikely to be retained for on-site rehabilitation purposes following extended stockpiling periods.

- **Weed and pest management –** Weed and pest species may be inadvertently introduced to the Project Area through vehicle movements or could invade naturally into disturbed areas following the removal of native vegetation. Weed and pest management strategies will be detailed in the BRMP to ensure populations are appropriately controlled throughout the Project life.

- **Revegetation –** A major issue to be considered in the revegetation of the upper quarry benches and surrounding ancillary areas is the shallow rock underlying the entire site. Topsoil and substrate depth and/or the ability of plant root systems to penetrate the subsoil is crucial to ensure plant survival, to allow access to water and support for root systems, especially for canopy species. If the roots of planted vegetation cannot reach sufficient depth, they may be susceptible to toppling as they age. Revegetation of quarry benches will therefore focus on the establishment of vegetation species suited to shallow rooting depth, providing a vegetated transition between the final void water storages and

the surrounding forest. Other areas of the site with shallow soil material (e.g., outcrop areas or shallow rock) may also be subject to similar revegetation constraints and will have similar revegetation treatment to benches. Areas of the voids expected to be flooded within 10 years of closure will not be actively revegetated however natural regrowth in these areas (other than weeds) will not be discouraged as the presence of sucker material within the pit lakes can enhance long term biodiversity values.

6.16.4 Monitoring and Completion Criteria

The scope of the rehabilitation monitoring program will be detailed within the Detailed Quarry Closure Plan and in the BRMP (where progressive rehabilitation is proposed or required by the BRMP). Any baseline monitoring of reference areas relevant to quarry closure criteria will also be specified in the BRMP however it is noted that this monitoring need not commence until the latter stages of the quarry development. Weed monitoring requirements will be detailed within the BRMP. The rehabilitation monitoring program will define responsibilities, record keeping requirements, inspection requirements and timing and include an annual rehabilitation monitoring program, which will be linked to TARPS (Trigger Action Response Plans) contained within the quarry BRMP.

The key objectives of rehabilitation monitoring will be to:

- include regular inspections of rehabilitated areas
- assess progression towards the rehabilitation objectives of the Project
- inform the timely implementation of TARPS which cover unexpected deviations from the expected successional pathways in rehabilitation areas.

Preliminary completion criteria will be used to demonstrate achievement of rehabilitation objectives and performance standards as outlined in **Table 6.35**.

Table 6.35 Preliminary Closure and Rehabilitation Completion Criteria

Aspect	Preliminary completion criteria
Decommissioning	Removal of all infrastructure that does not have a potential post-quarrying use
	All demolition work has been undertaken in accordance with *AS2601-2001: The Demolition of Structures*, or its latest version
	Implementation of appropriate security measures to minimise the potential for unauthorised access during the transition period to the intended final land use
Landform	No significant erosion is present that would constitute a safety or water quality issue
	Contour banks are stable and there is no evidence of overtopping or significant scouring as a result of runoff
	Surface is free of any hazardous materials
	Landform survey confirms constructed landform is generally in accordance with the approved landform design, including heights detailed in the relevant approval documentation
	Rehabilitated areas are designed to be free draining (excluding the catchment areas of final voids)

Aspect	Preliminary completion criteria
Water	Runoff and discharge water quality complies with any documented EPL requirements
Vegetation	Revegetation areas contain flora species assemblages characteristic of the desired native vegetation communities
	There is no significant weed infestation, such that weeds do not comprise a significant proportion of species in any stratum
	More than 75% of trees are healthy and growing as indicated by rehabilitation monitoring
	Second generation tree seedlings are present, or are likely to be, based on monitoring in comparable older rehabilitation sites (i.e., evidence of fruiting of native species observed)

Dependent upon the outcomes of the rehabilitation monitoring, the scope of post-closure rehabilitation care and maintenance activities will include the following:

- weed and feral animal control
- erosion and sediment control
- revegetation (direct planting and/or reseeding) of rehabilitation areas that may have failed or not achieve desired species density
- maintenance fertilising
- watering/irrigation
- repair of fence lines, safety measures, access tracks and other general related land management activities.

6.16.5 Financial Security

There are a range of mechanisms which are utilised to provide financial security to ensure that rehabilitation is undertaken at the quarry in accordance with the requirements of any Development Consent.

Contemporary requirements include, for example, the establishment of a rehabilitation bond, which is a security deposit required that would be established by ARDG to provide funds that are available for the completion of rehabilitation at the quarry. In the event that rehabilitation undertaken by ARDG does not meet the requirements of the NSW Government, the security deposit can be drawn upon to undertake rehabilitation works.

Notwithstanding, under the terms of the proposed Forest Material Licence (FML) with FCNSW, ARDG is required to undertake rehabilitation works at its own cost as directed by FCNSW. As such, it is appropriate that any long-term rehabilitation costs risks (including any requirement for financial security) to the State be managed through the contractual arrangements between FCNSW and ARDG, rather than the development consent.

6.16.6 Integration with Other Rehabilitation and Offset Plans

The potential for integration of rehabilitation plans for the Project with other rehabilitation and offset plans in the region is limited, based on the unique forestry zoning and land use applicable to the Project site. The site is not contiguous with any other development sites that could benefit from the integration of rehabilitation and offset plans.

The proposed rehabilitation plan will be integrated with management plans for the Wallaroo State Forest that are applicable at the time of closure, and ongoing consultation with FCNSW will ensure that final plans are consistent with strategic objectives.

7.0 Justification

This section provides a conclusion to the EIS. It includes discussion of the justification for the Project, taking into consideration the associated environmental and social impacts and the suitability of the site, to assist the consent authority to determine whether or not the Project is in the public interest.

7.1 Environmental, Social and Economic Impacts

As detailed in **Section 6.0** the environmental, social and economic impacts of the Project have been identified and are the subject of a detailed assessment based on:

- assessment of the environmental and social setting of the Project Area
- engagement with local community and other relevant stakeholders
- focused consultation with key government agencies
- application of the principles of ecologically sustainable development, including the precautionary principle, inter-generational equity and conservation of biological diversity and ecological integrity, and
- expert technical assessment.

The key issues identified, including those required by the SEARs, were the subject of extensive specialist assessment of the potential impacts of the Project on the existing environment. The results of these assessments are detailed in Section 6.0 and the appendices to this EIS. **Table 7.1** provides a summary of the key outcomes of the environment and social impact assessments associated with the Project.

Table 7.1 Key Outcomes of the Environmental Assessments

Aspect	Summary
Noise and vibration	No exceedances of construction, operational, sleep disturbance, road traffic or cumulative noise criteria are predicted at any nearby residential or industrial/recreational receivers.
Blasting	Compliance with ground vibration and airblast overpressure criteria at all private residential receptors can be achieved provided that blast management measures (i.e., the application of reduced charge masses) are employed in a limited area in the north-western corner of the quarry pit during Stages 6 to 9 of quarry development. At all other times and locations restrictions are not necessary to ensure compliance. No predicted impacts due to blasting on public infrastructure, animals or significant natural features.
Air quality	Construction and operational dust emissions are not expected to cause adverse air quality impacts at the nearby sensitive receptors based on the results of air dispersion modelling. There will be no exceedances of the EPA's NO_2 criteria from diesel exhaust emissions (either on site or on public roads) or from blasting, and no adverse air quality impacts at locations outside the Project Area with respect to crystalline silica.

Aspect	Summary
Surface water	The Project will have an adequate and reliable water source for all stages of the Project. Any changes to catchment yield will have a negligible impact on overall receiving catchment yields and the Project will have no impact on local or broader catchment flood regimes or stream stability issues. NorBE requirements will be satisfied with the implementation of the proposed management and mitigation measures.
Groundwater	The Project is predicted to cause drawdown in the water table from Stage 5 onwards when extraction depth goes below the existing water table level, however the effect will be localised, and no groundwater drawdown is expected to occur at any private bores nor impact any nearby GDEs. The Project is not expected to cause any significant change in groundwater quality or impact the beneficial use of groundwater. Water licences associated with groundwater inflows to the pit and any extraction from bores for operational supply purposes will be obtained prior to take occurring.
Biodiversity	ARDG has sought to avoid and minimise biodiversity impacts in the first instance as part of the Project design and has preferentially sited the Disturbance Area away from known records of threatened species and areas of higher ecological value. However, the Project will result in residual direct impacts to native vegetation communities and threatened species habitats as a result of vegetation clearing. Where impacts cannot be avoided, biodiversity credits will be generated to result in no-net-loss in biodiversity value for NSW.
Aboriginal heritage	No new Aboriginal archaeological sites, objects or areas of archaeological potential were identified during surveys, and the Project Area is deemed to have low archaeological potential across its entirety. The Project is not expected to result in impacts to Aboriginal sites or cultural values.
Historic heritage	The Project is not considered to have an adverse impact on significant heritage fabric, views to, or the setting of any places or items of historical heritage significance within the Project Area or its vicinity. Blasting assessments also confirmed that no additional blast control measures are required to comply with the ground vibration criteria for nearby heritage sites.
Traffic and transport	The impact of the Project (in isolation) on the Italia Road-Pacific Highway intersection is expected to be minimal. Cumulative traffic assessments also concluded that the road network can comfortably accommodate the level of additional traffic from both the proposed Eagleton Quarry and the Project, while the proposed upgrades to the Italia Road-Pacific Highway intersection (subject to a separate approval) will also be designed to accommodate cumulative traffic from all three local quarries.
Land resources	The use of the Project Area as a quarry operation would not be likely to impact on the viability of any future forestry activities in the surrounding parts of the State Forest, and potential impacts can be managed to allow it to coexist with the surrounding agricultural and non-agricultural land uses in the region.
Waste management	Waste management will focus on reducing, reusing and/or recycling prior to disposal of wastes. All wastes will be stored appropriately prior to collection for reuse/recycling/disposal by appropriately licensed contractors.
Hazards	Through the implementation of appropriate bushfire protection measures, the Project will not increase the potential for, or the severity of bushfires within the locality, the risk of onsite activities igniting fire or the spread of bushfire across the Project Area. Based on the quantities and types of materials to be stored on site, or transported to the site, the preliminary risk screening concluded that none of the hazardous materials are above screening thresholds.

Aspect	Summary
Visual amenity	As a result of topographic shielding and intervening vegetation the quarry extraction and infrastructure areas are not likely to be visible from public or private viewing locations, including Italia Road, Nine Mile Road, the Pacific Highway or private residences.
Social	Social impacts associated with the Project that are considered significant include cumulative traffic movements and road safety, local impacts to biodiversity (specifically loss of habitat) and a potential decline in property values. The SIA identified that any negative social impacts of the Project can be mitigated or managed to reduce their significance, with positive impacts enhanced if appropriate measures are put in place.
Economics	The Project is estimated to provide the following annual direct and indirect annual effects to the local economy: • $102 M in output. • $58 M in value-added. • $14 M in gross wages. • 176 jobs. Consequently, the Project is estimated to have net social benefits to NSW and the local and regional economy, and hence is desirable and justified from an economic efficiency perspective.
Rehabilitation and final landform	Rehabilitation at the quarry will address the long-term stabilisation of both quarried and disturbed areas, including rehabilitation of the upper quarry benches and available areas within and surrounding the quarry pit, with two final voids (Main Pit and North Pit) to remain after closure as water storages. All infrastructure not required by FCNSW for post-closure land uses will be removed.

7.2 Justification for the Project

The proposed Project Area represents a rare opportunity within the LHCC region to develop a large tonnage, quarry operation on geology that is demonstrated to be favourable for production of the full range of high-quality quarry products (including concrete, asphalt and sealing aggregates, gabion and crushed rock and armourstone). The proximity of the Project Area to key markets and existing State Road infrastructure (i.e., the Pacific Highway) would enable the Project to significantly ameliorate the existing and forecast medium to long term supply-side pressures of quarry materials for the LHCC region, as well as provide direct access to the Sydney market if required.

With the possible exception of potential impacts on biodiversity values, the Project will have relatively minor environmental and social impacts. While the Project will necessitate the removal of vegetation and habitat for threatened species, these impacts will be fully offset in accordance with the NSW biodiversity offsetting requirements which are based on a no-net-loss principle and impacts on koala habitat will be subject to a like-for-like offsetting requirements. Accordingly, the localised impacts on vegetation and fauna should be fully mitigated through offsetting requirements. It is noted that there are few opportunities for obtaining the quarry material necessary to meet the demand for quarry products which would not also require disturbance of similar or even larger areas of vegetation and potential threatened species habitat. Accordingly, the Project's impacts on biodiversity are largely unavoidable regardless of where the source of material is obtained.

The Project therefore provides a large economically viable hard rock resource to meet existing and projected demand for quarry products with limited or fully mitigated environmental impacts. Having regard to the costs associated with impact mitigation and potential externalities, the Project is predicted to have significant social benefits to the State of NSW and local region.

7.3 Suitability of the Site

The location of potential quarry projects is dictated by the location, scale and quality of rock material. The Stone Ridge resource is a large and high-quality hard rock resource suited to a wide range of quarry products which are in high demand. The Project is located close to areas with high demand for quarry product and its close proximity to the Pacific Highway means it is able to readily transport product to customers with minimal impacts on the local road network.

The Project is located in close proximity to other existing and proposed quarry projects and these operations will jointly share the costs of upgrades to the Pacific Highway which will reduce transport related impacts associated with the Project and these other operations.

While the Project will have impacts on biodiversity values, any alternative source (or sources) of quarry material on the scale of the proposed Project would also be expected to have similar or greater impacts on biodiversity values. All other social and environmental impacts associated with the Project are considered to meet accepted impact criteria and can be effectively managed. The site is therefore considered to be ideally suited to the Project.

7.4 Benefits of the Project

The Project has two key benefits:

- Supply of a wide range of 'in demand' quarry products which will reduce supply constraints and help mitigate construction timeframes and/or costs.
- Economic benefits to the State of NSW through additional employment, economic activities and revenue.
- In economic terms, the Project is predicted to have net benefits to the State of NSW of approximately $290 million in NPV terms at a 7% discount rate. The Project is predicted to have significant economic benefits to NSW under different discount rates tested and sensitivities to different price and costs assumptions. The Project is estimated to provide the following annual direct and indirect *annual* effects to the local economy:
    - $102 M in output.
    - $58 M in value-added.
    - $14 M in gross wages.
    - 176 jobs.
- The main environmental impacts associated with the Project are internalised into the production costs of ARDG via mitigation, offset and compensation costs. Residual local environmental impacts after mitigation, offset and compensation are likely to be immaterial.

7.5 Ecologically Sustainable Development

An objective of the EP&A Act is to encourage ecologically sustainable development (ESD) within NSW. This section provides an assessment of the Project in relation to the principles of ESD.

To justify the Project with regard to the principles of ESD, the benefits of the Project in an environmental and socio-economic context should outweigh any negative impacts. The principles of ESD encompass the following:

- the precautionary principle
- inter-generational equity
- conservation of biological diversity, and
- valuation and pricing of resources.

Essentially, ESD requires that current and future generations should live in an environment that is of the same or improved quality than the one that is inherited.

7.5.1 The Precautionary Principle

The EP&A Regulation defines the precautionary principle as:

> *'if there are threats of serious or irreversible environmental damage, lack of full scientific certainty should not be used as a reason for postponing measures to prevent environmental degradation. In the application of the precautionary principle, public and private decisions should be guided by:*
>
> *(i) careful evaluation to avoid, wherever practicable, serious or irreversible damage to the environment, and*
>
> *(ii) an assessment of the risk-weighted consequences of various options.'*

In order to achieve a level of scientific certainty in relation to the potential impacts associated with the Project, this EIS has undertaken an extensive evaluation of all the key components of the Project. Detailed assessment of all key issues and necessary management procedures has been conducted and is comprehensively documented in this EIS.

The preparation of this EIS has involved a detailed analysis of the existing environment (refer to **Section 2.0** and **Section 6.0**), and the use of engineering and scientific modelling to assess and determine potential impacts as a result of the Project. To this end, there has been careful evaluation as part of the project design and assessment process to avoid, where possible, irreversible damage to the environment. Specialist studies were undertaken to provide accurate information to assist with the evaluation and development of the Project. Mitigation measures are provided in **Appendix 3**. The BDAR prepared for the Project (**Appendix 11**) includes a specific consideration of serious and irreversible impacts on biodiversity values and concludes that the Project is unlikely to have serious or irreversible impact on any threatened species or communities. The Project design, together with the implementation of the proposed mitigation and management measures (refer to **Appendix 3**) incorporates precautionary elements and will ensure that the Project does not result in serious or irreversible impacts to the environment.

The decision making process for the design, impact assessment and development of management processes has been transparent in the following respects:

- Government authorities, landholders potentially affected by the Project, the local community, the Aboriginal community and other stakeholders were extensively consulted during EIS preparation (refer to **Section 5.0** and **Appendix 15**). This enabled comment and discussion regarding potential environmental impacts and proposed environmental management procedures.
- The community has been comprehensively engaged throughout the development and assessment of the Project through a range of mechanisms including face to face meetings, presentations and community newsletters to inform Project design and proposed management of key issues (refer to **Section 5.0** and **Appendix 15**), which provided stakeholders with both information and the opportunity to influence Project outcomes.
- ARDG will develop and implement a CEMP and OEMP, which will implement best practice management and will incorporate all identified mitigation and management measures identified in this EIS. Additionally, the Project will be subject to an independent auditing and verification process consistent with relevant requirements for SSD projects. The CEMP and OEMP will incorporate the additional controls committed to in this EIS (refer to **Appendix 3**).

7.5.2 Intergenerational Equity

The EP&A Regulation defines the principal of intergenerational equity as:

> *'that the present generation should ensure that the health, diversity and productivity of the environment are maintained or enhanced for the benefit of future generations.'*

Intergenerational equity refers to equality between generations. It requires that the needs and requirements of today's generations do not compromise the needs and requirements of future generations in terms of health, biodiversity and productivity.

The Project is consistent with the principle of intergenerational equity in that the benefits provided by the Project to either the current generation or future generations are not at the expense of either.

The Project has relatively few environmental and social impacts to the present generation due to the proposed mitigation, offset and compensation provided. The benefits provided by the Project relate to both the use of the products from the quarry (many of which will be used for the construction of infrastructure or other developments that will service both the current and future generations) and the economic benefits to the local and broader community, which assist the present generation but also support the continued economic development of the local region and State which will benefit future generations.

In particular, the Project will:

- Provide construction material that will support the construction and maintenance of roads and commercial development that will provide benefits to many future generations.
- Generate royalties (and other taxes) to the State which can be used to provide services to present generations and infrastructure which supports both present and future generations.

- A range of environmental management and mitigation measures (summarised in **Appendix 3**) have been developed and evaluated to minimise the impact on the environment as far as practicable. The design of the Project and commitment to the management of environmental issues as outlined in this EIS will maintain the health, diversity and productivity of the environment for future generations.

7.5.3 Conservation of Biological Diversity and Ecological Integrity

The EP&A Regulation identifies that the principle of conservation of biological diversity and ecological integrity should be a fundamental consideration in the decision-making process. The conservation of biological diversity refers to the maintenance of species richness, ecosystem diversity and health and the links and processes between them. All environmental components, ecosystems and habitat values potentially affected by the Project are described in this EIS (refer to **Section 6.6**) and measures to ameliorate any negative impacts are outlined in **Appendix 11**). The NSW biodiversity offsetting scheme established under the *Biodiversity Conservation Act 2016* is specifically designed to ensure the conservation of biological diversity and ecological integrity.

The conceptual layout has been developed to maximise the use of existing disturbed areas and avoid and minimise impact to identified biodiversity. Following the application of avoidance and mitigation measures, the BAM assessment has identified the biodiversity credit requirement to offset the impacts of the residual impacts of the Project and the required management and mitigation measures to be implemented. The principle of Conservation of Biological Diversity is therefore considered to be satisfied.

7.5.4 Improved Valuation and Pricing of Environmental Resources

The goal of improved valuation of natural capital has been included in Agenda 21 of Australia's Intergovernmental Agreement on the Environment. The principle has been defined in the EP&A Regulation as:

> *'that environmental factors should be included in the valuation of assets and services, such as:*
>
> *(i) polluter pays, that is, those who generate pollution and waste should bear the cost of containment, avoidance or abatement,*
>
> *(ii) the users of goods and services should pay prices based on the full life cycle of costs of providing goods and services, including the use of natural resources and assets and the ultimate disposal of any waste,*
>
> *(iii) environmental goals, having been established, should be pursued in the most cost-effective way, by establishing incentive structures, including market mechanisms, that enable those best placed to maximise benefits or minimise costs to develop their own solutions and responses to environmental problems'.*

The environmental consequences of the Project have been assessed in this EIS (refer to **Section 6.0**) and mitigation measures identified for factors with potential for adverse impact (**Appendix 3**). Implementing the mitigation measures would impose an economic cost on the proponent, increasing both the capital and operating costs of the Project. This signifies those environmental resources have been given appropriate valuation.

The Project has been designed with the objective of minimising potential impacts on the receiving environment. This indicates that the design for the Project has been developed with an environmental objective in mind.

The aims, structure and content of this EIS have incorporated these ESD principles. The mitigation measures in **Appendix 3** provide an auditable environmental management commitment to these parameters. The Project would be considered ecologically sustainable, due to the social, economic and environmental benefits identified in **Section 6.14** and **Section 6.15** and the mitigation measures put in place to protect from adverse impacts on the environment.

7.6 Conclusion

As outlined in **Section 7.5**, the Project has been assessed against the principles of ecologically sustainable development as required by the EP&A Act and EP&A Regulation. This assessment has indicated that while the Project, like any large-scale development, would have impacts, these impacts can be effectively managed, mitigated and offset and the development will result in significant economic benefits to both the local and regional area as as well as the State of NSW.

In economic terms, the Project is predicted to have net benefits to the State of NSW of approximately $290 million in NPV terms at a 7% discount rate. The Project is predicted to have significant economic benefits to NSW under different discount rates tested and sensitivities to different price and costs assumptions. The Project is estimated to provide the following annual direct and indirect annual effects to the local economy:

- $102 M in output.
- $58 M in value-added.
- $14 M in gross wages.
- 176 jobs.

The main environmental impacts associated with the Project are internalised into the production costs of ARDG via mitigation, offset and compensation costs. Residual local environmental impacts after mitigation, offset and compensation are likely to be immaterial.

The assessment therefore concludes that the Project is consistent with the principles of ESD.

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9.0 Abbreviations

Abbreviation	Meaning
ARDG	Australian Resource Development Group Pty Limited
CEMP	Construction Environment Management Plan
DA	Development application
DPE	Department of Planning and Environment
EIS	Environmental Impact Statement
EMS	Environmental Management Strategy
EP&A Act	*Environmental Planning and Assessment Act 1979* (NSW)
EPBC Act	*Environment Protection and Biodiversity Conservation Act 1999* (Cth)
FCNSW	Forestry Corporation of New South Wales
FML	Forest Materials Licence
Forestry Act	*Forestry Act 2012* (NSW)
FTE	Full time equivalent
ha	hectares
km	kilometres
kt	kilotonne
Mtpa	million tonnes per annum
MNES	Matters of National Environmental Significance
OEMP	Operational Environmental Management Plan
Planning Systems SEPP	State Environmental Planning Policy (Planning Systems) 2021
SEARs	Secretary's Environmental Assessment Requirements
SSD	State Significant Development
the Project	Stone Ridge Quarry
tpa	tonnes per annum

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