Bell Quarry Rehabilitation Project

Volume 1 - Environmental Impact Statement

August 2018

Submission of Environmental Impact Statement

Prepared under the *Environmental Planning and Assessment Act 1979*, Section 4.10

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	In respect of:	Bell Quarry Rehabilitation Project		

Development Application	Applicants' name:	Bell Quarry Rehabilitation Project Pty Ltd
	Applicants' address:	Level 1, Suite 1, 181 Macquarie Street Parramatta NSW 2150
	Land to be developed:	The Project is to be carried out within the former Bell Quarry as shown in the Environmental Impact Statement
	Lot no, DP/MPS, vol/fol etc	DP 751631
Environmental Impact Statement	An Environmental Impact Statement is attached.	

Certificate

I certify that I have prepared the contents of this Environmental Impact Statement and to the best of my knowledge:

- It is in accordance with the requirements of Part 4;
- It contains all available information that is relevant to the Environmental Impact Statement of the development; and
- That the information contained in the Environmental Impact Statement is neither false nor misleading.

Signature:			
Name:	Karl Rosen	Anthony Dixon	Dane Stewart
Date:	22/08//2018	22/08/2018	22/08/2018

Executive summary

Introduction

Bell Quarry Rehabilitation Project Pty Ltd (BQRP) seeks to rehabilitate Bell Quarry, approximately 10 kilometres east of Lithgow in NSW. A final rehabilitated landform will be achieved via importation of virgin excavated natural material (VENM), excavated natural material (ENM) and other clean fill material sourced from earthworks projects across Sydney and the local regional area (the Project).

The rehabilitation process will involve:

- Importation of approximately 1.2 million cubic metres of VENM, ENM and other clean fill material (subject to specific resource recovery exemptions)
- Vehicle haulage at a rate of up to 140,000 tonnes per annum (tpa)
- Emplacement and compaction of soil material within the existing quarry voids
- Shaping of fill to closely represent the pre-quarry landform and to allow surface water drainage across the final landform
- Development of a water management system to control surface water discharges throughout the rehabilitation program and from the final landform
- Revegetation of the site with locally endemic species to provide effective integration with the surrounding landscape.

Importing of material for the purpose of filling a quarry void, falls within the definition of a resource management facility under the State Environmental Planning Policy (Infrastructure) 2007 (Infrastructure SEPP). Clause 121 (3) of the Infrastructure SEPP allows for the disposal of VENM or clean fill with development consent on land where industries, extractive industries or mining are permitted with consent under any environmental planning instrument. Extractive industries are permissible at the site under the State Environmental Planning Policy (Mining, Petroleum Production and Extractive Industries) 2007 (Mining SEPP). The project is therefore permissible and a DA is required in accordance with Part 4 of the *Environmental Planning and Assessment Act, 1979* (EP&A Act).

Resource management facilities which meet a size and capacity threshold or are located in an environmentally sensitive location constitute 'Designated Development' which requires preparation of an Environmental Impact Statement (EIS) to accompany the DA for the project. The site is located in close proximity to sensitive environments within the Blue Mountains National Park and is considered to trigger designated development provisions.

Need for the project

Rehabilitation requirements

There is considered to be a significant opportunity to achieve superior rehabilitation outcomes than required under the existing consent. The project will rehabilitate the site to a condition closely representing the original landform and that of the adjoining Blue Mountains National Park. The project will optimise resource recovery through the beneficial reuse of clean fill material and include revegetation of the site with locally endemic species to provide effective integration with the surrounding landscape.

Infrastructure SEPP

State Environmental Planning Policy (Infrastructure) 2007 (Infrastructure SEPP) aims to facilitate the effective delivery of infrastructure across NSW and amongst other things allows for development for the purpose of recycling of construction and demolition material or the disposal of virgin excavated natural material or clean fill to be permitted with consent anywhere mining or extractive industries are permitted to be undertaken.

The policy recognises the enhanced rehabilitation outcomes that can be achieved through importation of clean fill to sites previously disturbed by extractive operations. The project is consistent with the aims and objectives of the policy and will allow for recycling and beneficial reuse of fill material.

Resource Recovery Exemptions

The Protection of the Environment Operations (Waste) Regulation 2014 (2014 Waste Regulation) has introduced a series of resource recovery orders and resource recovery exemptions. These allow some wastes to be beneficially and safely re-used independent of the usual NSW laws that control applying waste to land.

Orders and exemptions are only appropriate if the re-use

- is genuine, rather than a means of waste disposal
- is beneficial or fit-for-purpose, and
- will not cause harm to human health or the environment

The excavated natural material exemption 2014 applies to excavated natural material that is intended to be applied to land as engineering fill or in earthworks and exempts the requirement to obtain an Environment Protection Licence (EPL) for a scheduled activity, to track waste, incur the waste levy and miscellaneous reporting requirements to the EPA.

All emplacement material brought to the site as part of the rehabilitation works will meet the requirements of the excavated natural material order or a specific resource recovery order issued by the EPA for the site. VENM would also be brought to site and this material is subject to other exemptions under the Protection of the Environment Operations Act 1997.

Project objectives

The key objectives for the project include:

- Rehabilitate the site to a condition more closely representing the original landform and that of the adjoining Blue Mountains National Park
- Maximise resource recovery through diversion of VENM, ENM and other clean fill materials away from landfill for beneficial reuse in site rehabilitation activities
- Undertake the rehabilitation works to be sympathetic to the surrounding land-use and environmental setting
- Provide ongoing local employment opportunities

Alternatives

The options alternatives considered for this project involve final landform, filling strategy and capacity.

Final landform – A range of potential landforms were considered as part of the development of the project. A final landform closely replicating the original topography was selected as the preferred option alternative to best integrate with the adjoining protected areas within the Blue

Mountains National Park and control surface run-off and drainage through the site. Alternatives considered during the development of the project included creation of a level site suitable to facilitate future development opportunities. Future development of the site was not considered consistent with the objectives of the applicable E3 Environmental Management land zoning or in keeping with the values of the surrounding protected areas.

The do nothing option involves leaving the site in the existing disturbed state with large voids and near vertical batters. There is considered to be a significant opportunity to achieve superior rehabilitation outcomes for the site and the do-nothing option would also not realise the environmental and economic benefits associated with the beneficial reuse of increased recycling of construction materials and diversion of clean fill away from landfills material in the form of resource recovery waste.

Filling strategies – A number of strategies were investigated for the filling of the quarry void. This included:

- the types of material used for fill
- the manner in which the material was managed on site
- the timing/staging of the emplacement activities
- the management of the water resources existent within the quarry.

Capacity – The rate of filling was considered during the development of the project. A maximum fill emplacement rate of 140,000 tonnes per year was selected for the project, to be consistent with the quarry's existing consent and not increase the potential for disturbance to surrounding residential receivers.

Environmental Interactions

Soil and water resources

Bell Quarry is located within the upper reaches of the Wollangambe River catchment, which forms part of the broader Hawkesbury-Nepean catchment area. An ephemeral tributary of the Wollangambe River runs in a north-easterly direction through the project site, with its headwaters in the vicinity of the rail line upstream of the site. The quarry now contains three large voids which are partially filled with water through a combination of surface water run-off and groundwater seepage. Water is discharged from the site through an established sediment basin on the eastern edge of the site and discharges into an unnamed tributary within the Blue Mountains National Park.

The tributary passes through a swamp where flows are predominantly subsurface under baseflow conditions and continues for approximately 1.5 kilometres before the confluence with the Wollangambe River. The Wollangambe River winds eastwards through narrow canyons and is one of four major tributaries of the Colo River.

A detailed assessment of the potential impacts of the project on water resources has been undertaken as part of this EIS. The project will restore the flow regime to be representative of natural run-off conditions from before the commencement of extractive operations. During the rehabilitation activities there will be a temporarily reduction to the frequency of low flows and more frequent moderate flows for stages requiring dewatering. The changes to the flow regime are relatively minor and are not anticipated to significantly impact upon downstream geomorphological processes due to the natural stream profile and thick and well established vegetation in the immediate receiving waters.

All emplacement material brought to the site will be clean fill and meet the acceptance criteria for bringing material to the site in line with the ENM Resource Recovery Order. Detailed water

quality modelling demonstrates that both surface water discharges and groundwater are expected to have minimal potential to impact upon the immediate receiving waters in the downstream tributary and swamp located approximately 200 metres from the site.

Biodiversity

A detailed assessment of impacts upon biodiversity values within the site and the adjoining Blue Mountains National Park has been undertaken as part of this EIS. The majority of the site has been previously disturbed, with some areas of revegetation undertaken to assist with the stabilisation of soils and some limited remnant vegetation around the periphery of the site. A total of 2.48 ha of planted vegetation and 0.13 ha of remnant vegetation will be temporarily removed and reininstated with progressive revegetation undertaken as part of each stage of the Project.

The project would not directly impact any threatened ecological communities or threatened flora species. The final landform would be revegetated progressively and result in a more natural environment in the long-term.

The project will result in minor impacts to the foraging and shelter resources for common native fauna and is unlikely to result in the isolation of any areas of native vegetation or fauna habitats in the locality.

There will be no direct clearance of native vegetation within the GBMWHA. Weed management measures will be implemented to control existing weeds and prevent the introduction of weeds to the site through importing fill material to the site.

The rehabilitation works will result in minor changes to the hydrological regime and surface water and groundwater quality in the unnamed tributary immediately downstream of the site. The changes will be minor and are likely to be within the range of conditions tolerated by species within the downstream area and are unlikely to modify the composition of the vegetation or place any species at risk of extinction.

Following completion of the rehabilitation works and revegetation with locally endemic species, the site and the adjacent areas of the national park are likely to improve given reduced edge effects and other indirect impacts associated with the former use of the site for extractive operations.

Benefical Reuse of Waste

The project is seeking to rehabilitate the existing quarry pit through the importation of virgin VENM, ENM and other clean fill material sourced from earthworks projects across Sydney and the local regional area. It is estimated that approximately 1.2 million cubic metres of clean fill material would be required to fill the site over a period of approximately 15 years.

The beneficial reuse of waste material to achieve the optimum rehabilitation outcomes through returning the site to a condition closely representing the original landform and that of the adjoining Blue Mountains National Park is considered to be in line with the reuse provisions of the Infrastructure SEPP, POEO Act and Waste Avoidance and Resource Recovery Act 2001. The proposed use of the waste is bona-fide, fit-for-purpose use with minimal potential to cause harm to the environment or human health as demonstrated through the preparation of this EIS and ENM Order and Exemption. All material brought to site will be subject to strict acceptance criteria prior to transport to site and minimal residual waste is anticipated to be generated by the project.

Air quality

The project has potential to generate dust through the rehabilitation activities and vehicle haulage along Sandham Road.

The site is located in a rural environment and periodically experiences high level of background dust generated from surrounding landuse including nearby mining and quarry operations and vehicles travelling on unsealed roads. The project is anticipated to have a small incremental impact on dust emissions in the immediate vicinity of the quarry. All impacts will fall within the relevant EPA air quality criteria and is not anticipated to significantly impact upon any sensitive receivers.

Dust will also be generated by haulage vehicles travelling along unsealed sections of Sandham Road which is used for access to the site. Detailed air quality modelling demonstrates that adoption water spraying along Sandham Road in dry and windy conditions will limit the potential for dust impacts upon the local community and comply with EPA criteria.

Noise

All noise generating works associated with the Project are predicted comply with the project noise trigger levels at surrounding residential receivers.

The maximum noise emission levels from the site are not greater than LAeq 50 dBA (NPI's recommended amenity noise level for passive recreational area) when calculated to either 200 metres south, north-east or north of the site boundary. The national park areas beyond 200 metres from the site will likely receive noise levels from the quarry site below LAeq 50 dBA.

Noise levels due to the use of heavy vehicles along Sandham Road is the greatest at residential dwellings within 20 metres of Sandham Road. The predicted increase in traffic noise levels during maximum operation is less than 55 dBA and complies with the EPA's Road Noise Policy at all receivers

Typical vibration levels from activities such as excavation are generally negligible at distances greater than 50 metres. Therefore, given the nearest receiver is 250 metres from the quarry site, vibration levels from equipment use within the quarry is not anticipated to adversely impact receivers.

Aboriginal heritage

All rehabilitation activities will be undertaken with the existing quarry footprint and haulage to the site will utilise the existing public road network. There is considered minimal potential to disturb natural ground surface of culturally modified trees. The site has been disturbed during the previous extraction activities and there is no evidence that the site was previously used intensively by Aboriginal people.

The target resource for the original quarry was a weathered sandstone and no sandstone outcrops suitable for Aboriginal occupations have been identified in the area. The landform was previously steep and lacked permanent water making it unsuitable for a large camp site. There were no AHIMS records located in the vicinity of the ephemeral drainage line which is well vegetated and resistant to any geomorphological change.

Historical heritage

There are no local or state listed historic heritage items in the immediate vicinity of the site. The closest listed items are located more than 400 metres from the site and are not located in the primary haulage route for the operations and will not be directly or indirectly impacted by the project.

World Heritage

The site is located adjacent to the Blue Mountains National Park which forms part of the Greater Blue Mountains Area listed on the UNESCO World Heritage List and the National Heritage List. The project will result in minor indirect impacts to the land immediately adjoining the site during rehabilitation operations. Overall the project will restore the landscape to be more representative of the original landform and will be complementary to the conservation values of the Greater Blue Mountains Area.

Traffic and transport

The emplacement material will be sourced from earthworks projects throughout the Sydney basin and the local region and will be transported to site using truck and trailers of up to 42.5 tonne capacity. Traffic generated by the project is anticipated to be an average of 37 heavy vehicle movements per day, which is equivalent in number to the previous quarry operations and the existing consent for the site.

Sandham Road currently experiences low volumes of traffic and primarily services rural residential properties in Bell following the cessation of the quarry operations. The additional haulage traffic for the rehabilitation activities will therefore represent a relatively large proportional increase to existing background conditions based upon the vehicle counts undertaken following the completion of active extraction operations. The project proposes to limit haulage to within the maximum extraction volumes for the quarry and the heavy vehicle movements will therefore be representative of the number of movements permitted in accorcance with the existing consent. The haulage traffic represents a relatively small proportional increase to background traffic on the wider regional road network. The minor increases to traffic are not considered to impact upon the safety or capacity of the road network.

Intersection modelling has been undertaken and indicates key intersections on the haulage routes including Darling Causeway / Bells Line of Road and Sandham Road / Bells Line of Road currently operate at a satisfactory performance with spare capacity in both AM and PM peak periods. There are negligible changes in traffic performance between the base and traffic operation scenarios for both the AM and PM peak periods. Given the expected low increase in heavy vehicle movements associated with the project, it is likely that traffic generation would result in minimal traffic impacts to the operation of the local road network.

Visual

Visibility of the quarry is largely restricted to the perimeter fence and a small section of Sandham Road immediately adjacent to the site.

Rehabilitation of the site will involve emplacement of clean fill within the existing footprint to enable the site to be returned to a condition closely representing the original landform and be visually integrated with the adjoining Blue Mountains National Park. The final landform would be progressively revegetated with locally endemic species to provide effective control or erosion and integration with the surrounding landscape.

Bushfire risk

The site is designated as bushfire prone due to the presence of bushfire prone land within and adjoining the site. The project will be developed in accordance with the aims and objectives of Planning for Bush Fire Protection (NSWRFS 2016) and pose minimal risk to the safety of workers at the site or the surrounding environment.

Economic considerations

This project will see the direct employment of staff from the local area during the site establishment phase of works, and then throughout the life of the project with respect to emplacement works. There will also be a material contractor contribution to the project, with respect to activities such as vehicle maintenance, site surveying, ongoing rehabilitation of filled quarry cells, environmental monitoring, road maintenance (for Sandham Road). The employment revenue generated by the conduct of these activities represents an additional economic contribution to the region.

The progressive rehabilitation of Bell Quarry will support also continued long term investment in the Lithgow LGA. Long term secure employment and supplier contracts for local residents will also be of benefits to the region.

Justification and conclusion

The project involves importing of clean fill material for the purpose of rehabilitation of an existing quarry. The project is permissible with consent and a DA would be required in accordance with Part 4 of the EP&A Act. The site is located in close proximity to sensitive environments within the Blue Mountains National Park and is therefore considered to trigger designated development provisions.

As such, an assessment of the short, medium and long term impacts of the Project, taking into account the principles of ESD, has been undertaken in this EIS.

Many of the potential issues identified in the initial risk assessment of the project have been effectively managed/eliminated through rehabilitation design and operational procedures. The EIS identifies a range of mitigation measures that would be implemented during establishment and operation of the project to minimise environmental impacts.

The EIS has demonstrated that the project would not have significant impact on the environment with implementation of the proposed mitigation measures and is consistent with the principles of ESD.

The project would result in an improved environment outcome by rehabilitating the existing Bell quarry, resulting in a landform with the ecological and visual character of the surrounding bushland and national park areas.

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Appendix E – Traffic Impact Assessment

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Appendix H – Bushfire Assessment

1. Introduction

1.1 Background

The Bell Quarry is located on Sandham Road in Newnes Junction approximately 10 kilometres east of Lithgow in NSW. Extraction operations commenced in 1967 and operated under existing use rights until 1994, when a Development Application (DA) was lodged with Lithgow City Council to provide for the continued operation of the quarry. Extraction operations continued at the site in accordance with DA 108/94 issued by Lithgow City Council and an Environment Protection Licence (EPL) for extractive operations issued by the NSW Environment Protection Authority (EPA). Active quarry operations at the site have now ceased and the EPL No. 3218 for the operation of the quarry was surrendered to the EPA on the 24th October, 2014.

The former Bell Quarry has been purchased and Bell Quarry Rehabilitation Project Pty Ltd (BQRP) are seeking to rehabilitate the site through the importation of virgin excavated natural material (VENM), excavated natural material (ENM) and other clean fill material (subject to specific resource recovery exemptions) sourced from earthworks projects across Sydney and the local regional area (the Project).

Rehabilitation of the site will involve emplacement of clean fill within the existing footprint to enable the site to be returned to a condition closely representing the original landform and that of the adjoining Blue Mountains National Park. It is estimated that approximately 1.2 million cubic metres of fill material would be required to fill the site and return it to be representative of the original landform characteristics.

This Environmental Impact Statement (EIS) has been prepared to assess the potential environmental impacts associated with the Project to accompany a development application (DA) under Part 4 of the *Environmental Planning and Assessment Act, 1979* (EP&A Act).

1.2 Project overview

1.2.1 Objectives

The key objectives for the Project include:

- Rehabilitate the site to a condition closely representing the original landform and that of the adjoining Blue Mountains National Park
- Maximise resource recovery through diversion of VENM, ENM and other clean fill materials away from landfill for beneficial reuse in site rehabilitation activities
- Undertake the rehabilitation works to be sympathetic to the surrounding land-use and environmental setting
- Provide ongoing local employment opportunities.

1.2.2 The Project

The Project is seeking to rehabilitate the Bell Quarry through the importation of VENM, ENM and other clean fill, generated from earthworks projects across Sydney and the local regional area. The rehabilitation process will involve:

- Importation of approximately 1.2 million cubic metres of VENM, ENM and other clean fill material
- Vehicle haulage at a rate of up to 140,000 tonnes per annum (tpa)

- Emplacement and compaction of soil material within the existing quarry voids
- Shaping of fill to closely represent the pre-quarry landform and to allow surface water drainage across the final landform
- Development of a water management system to control surface water discharges throughout the rehabilitation program and from the final landform
- Revegetation of the site with locally endemic species to provide effective integration with the surrounding landscape.

1.2.3 The Proponent

The proponent for the development is Bell Quarry Rehabilitation Project Pty Ltd.

1.3 Project approval process

The EIS has been prepared in accordance with the EP&A Act, Schedule 2 of the Environmental Planning and Assessment Regulation 2000 and the Secretary's Environmental Assessment Requirements (SEARS) issued by the Department of Planning and Environment (DP&E) in November 2016 (included in Appendix A).

Importing of material for the purpose of filling a quarry void, falls within the definition of a resource management facility under the State Environmental Planning Policy (Infrastructure) 2007 (Infrastructure SEPP). Clause 121 (3) of the Infrastructure SEPP allows for the disposal of VENM or clean fill with development consent on land where industries, extractive industries or mining are permitted with consent under any environmental planning instrument. Extractive industries are permissible at the site under the State Environmental Planning Policy (Mining, Petroleum Production and Extractive Industries) 2007 (Mining SEPP). The Project is therefore permissible and a DA is required in accordance with Part 4 of the *Environmental Planning and Assessment Act, 1979* (EP&A Act).

Resource management facilities which meet a size and capacity threshold or are located in an environmentally sensitive location constitute 'Designated Development' which requires preparation of an EIS to accompany the DA for the Project. The site is located in close proximity to sensitive environments within the Blue Mountains National Park and is considered to trigger designated development provisions.

The Project is also defined as regional development and would be notified and assessed by City of Lithgow Council for determination by a Joint Regional Planning Panel.

Further detail of the statutory and legislative framework is provided in Chapter 5 of this report.

1.4 Document purpose and structure

This Environmental Impact Statement (EIS) has been prepared by GHD Pty on behalf of Bell Quarry Rehabilitation Project Pty Ltd to support a development application for the project.

The EIS has been prepared using a risk-based assessment approach to identify and evaluate environmental, social and economic aspects associated with the project. This has been achieved through a process of ongoing engagement with stakeholders from government agencies and the community, risk assessments to identify and scope key environmental assessments and development of applicable mitigation and management measures for the project.

The EIS is presented in two volumes. Volume 1 includes the main EIS document including a detailed description of the proposed development and consideration of potential impacts upon environmental aspects potentially impacted by the Project. Volume 1 is informed by a wide

range of specialist environmental assessments undertaken to assess key environmental aspects for the Project. The structure and content of the EIS is presented in Table 1-1.

Table 1-1 Structure and content of EIS

Volume 1 – Environmental Impact Statement		
1	Introduction	Discusses the project background, the project and the applicant. Outlines the approval process.
2	Site setting and context	Describes the project application area, land use and environmental setting.
3	Project need and alternatives	Outlines the reason for the project, the design process and selection of the preferred strategy.
4	Project description	Provides a detailed description of the Project.
5	Legislative and planning framework	Discusses the relevant local, state and Commonwealth planning considerations
6	Stakeholder and community engagement	Discusses the engagement strategies for the project and the consultation outcomes.
7	Soil and water	Considers the impact of the Project on water resources in the catchment
8	Biodiversity	Provides an outline of the biodiversity values for the Project application area and the potential for the Project to impact upon those values.
9	Traffic	Considers impacts during construction and operational for traffic and transport on the local road network
10	Air quality	Considers the impacts from dust generation resulting from emplacement activities and vehicle haulage along Sandham Road
11	Noise and vibration	Considers the impact associated with noise and vibration arising from emplacement activities and vehicle haulage
12	Other environmental aspects	Summarises heritage, socioeconomic, visual, waste and other environmental aspects which have not been assessed within the preceding chapters.
13	World heritage	Considers the impacts of the project on the world heritage values of the adjoining Greater Blue Mountains World Heritage Area
14	Environmental management and commitments	Provides an outline of the proposed environmental management framework and a consolidated list of mitigation measures to be applied during construction and operation of the project.
15	Justification and conclusions	Provides an overview of the conclusions from the assessment process and discusses the project's justification in terms of environmental, social and economic costs and benefits.

Volume 1 – Environmental Impact Statement		
	References	Lists references used in this document
	Glossary and abbreviations	Expands on abbreviations and defines terms in this document.

Volume 2 – Appendices	
A	Secretary's Environmental Assessment Requirements
B	Site survey and staging plans
C	Water Resources Assessment
D	Biodiversity
E	Traffic
F	Air Quality
G	Noise and Vibration
H	Bushfire Management

2. Site setting and context

2.1 Site location

2.1.1 Local setting

The Bell Quarry is located on Sandham Road in Newnes Junction approximately 10 kilometres east of Lithgow in NSW. The site is located to the east of Chifley Road (continuation of Bells Line of Road) and the Main Western Railway line as shown on Figure 2-1.

The project site covers a total area of 13.7 ha and can be considered as two parcels of land divided by the Main Western Railway. The northern parcel of land of rectangular shape covers an area of 9.5 ha and formed the basis of the previous quarry operations. The southern parcel of land is a triangular shape with an area of approximately 4.2 ha and has not been previously developed or subject to extraction operations. Rehabilitation activities will be restricted entirely to the former quarry site on the northern parcel of land on the western side of the Main Western Railway.

2.1.2 Surrounding land use

Newnes Junction is located approximately 250 metres to the north-west of the site and contains a small number of residential dwellings. Dargan and Clarence are located on the western side of Chifley Road and the Main Western Railway line approximately one kilometre to the south and west of the site, respectively. Bell is located approximately four kilometres to the south and there are a small number of residential receptors located along Sandham Road.

The Clarence Colliery pit top, rail loop and loading facilities are located around 750 metres to the north and the Hansen Quarry is located to the west of the mining operations. The approved Newnes Kaolin Mine is located between the colliery and the northern extent of Bell Quarry, however mining operation at this site have not commenced.

The Blue Mountains National Park is located to the east of Clarence Colliery and is one of the eight protected areas making up the World Heritage Listed Greater Blue Mountains Area (UNESCO 2013). The Newnes State Forest is located to the north and west of the site.

The Bell Quarry is located within the upper reaches of the Wollangambe River catchment. This river drains towards the east where it eventually drains into the Colo River which forms part of the broader Hawkesbury-Nepean catchment area. All water drains to the Wollongambe River catchment and the site (northern parcel and subject to this DA) does not form part of Sydney's drinking water catchment area.

2.1.3 Land zoning

The existing quarry is located within zone E3 Environmental Management in accordance with the Lithgow Local Environmental Plan 2014 as shown on Figure 2-2. The objectives of the zone are:

- To protect, manage and restore areas with special ecological, scientific, cultural or aesthetic values
- To provide for a limited range of development that does not have an adverse effect on those values
- To facilitate the management of environmentally sensitive lands and riparian areas
- To protect and conserve the vegetation and escarpment landscape surrounding Lithgow
- To maintain or improve the water quality of receiving water catchments

The Project is considered consistent with the objectives of Zone E3 land zoning.

LEGEND

- Bell Quarry
- Reserves and State Forests
- Waterways
- Rail
- Roads

Paper Size A4

0 200 400 800

Metres

Map Projection: Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 MGA Zone 56

N

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Remedial Civil Solutions Pty Ltd
Bell Quarry Rehabilitation Project
Environmental Impact Statement

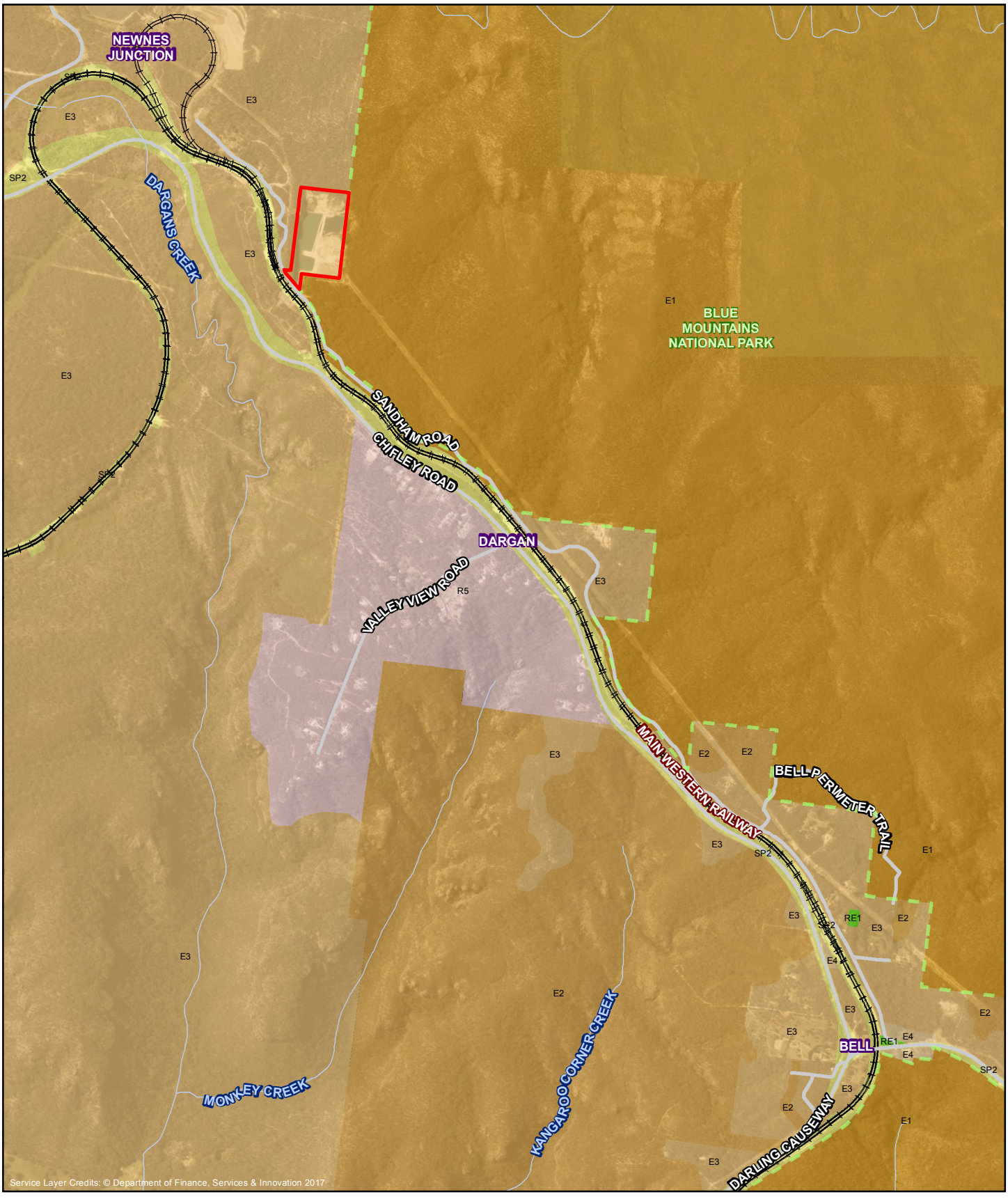
Job Number 21-25774
Revision A
Date 29 May 2018

Site area map

Figure 2-1

\\ghdnet\ghd\AU\Sydney\Projects\21\25774\GIS\Maps\Deliverables\EIS\21_25774_Z001_EIS_SiteLocation.mxd Level 15, 133 Castlereagh Street Sydney NSW 2000 **T** 61 2 9239 7100 **F** 61 2 9239 7199 **E** sydmail@ghd.com.au **W** www.ghd.com.au

Data source: Aerial imagery - sixmaps 2016, Inset map - Geoscience Australia, General topo - NSW LPI DTDB 2012, Mining Titles: Geology Survey NSW. Created by:afoddy



LEGEND

- Bell Quarry
- Reserves and State Forests
- Waterways
- Rail
- Roads

Zoning

- E1 National Parks and Nature Reserves
- E2 Environmental Conservation
- E3 Environmental Management
- E4 Environmental Living
- R5 Large Lot Residential
- RE1 Public Recreation
- SP2 Infrastructure

Paper Size A4

0 200 400 800

Metres

Map Projection: Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 MGA Zone 56

N

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Date 29 May 2018

Land use zoning map

Figure 2-2

G:\21\25774\GIS\Maps\Deliverables\EIS\21_25774_Z002_EIS_Zoning.mxd

Level 15, 133 Castlereagh Street Sydney NSW 2000 **T** 61 2 9239 7100 **F** 61 2 9239 7199 **E** sydmail@ghd.com.au **W** www.ghd.com.au

Data source: Aerial imagery - sixmaps 2016, Inset map - Geoscience Australia, General topo - NSW LPI DTDB 2012, SILEP Zoning: NSW DPE 2017. Created by:afoddy

2.1.4 Mining title

The project site and surrounding area have been the subject of sand, clay, stone and coal exploration and extraction activities for most of the site history since settlement. There is an active exploration title for Group 5 minerals (bentonite, clay/shale, kaolin, structural clay) that covers most of the project area, held by Newnes Kaolin Pty Ltd that expires on 24 Dec 2018.

2.2 Environmental setting

2.2.1 Geology

The NSW 1:250,000 geological series sheet S1 56-5 (1966) indicates that the soil landscape in the project area is underlain by bedrock of the Banks Wall Formation, a prominent Triassic Sandstone Unit of Early Triassic Age. It is described by Corkery (1994) as comprising friable medium-grained to pebbly quartzose sandstone with extensive thin limonite (hydrated iron oxide) concentrations or bands, with frequent thin lenses and interbeds of claystone and fine grained sandstone. The claystone generally occurs in thin lenses < 0.5 metres thick. The sandstone is highly weathered with the weather extending to depths in excess of 60 metres below ground level in places (Corkery 1994).

Clay-rich friable sandstone was the primary resource extracted from the project area during previous quarrying activities. The friable sandstone generally comprised 4.75 mm to 0.0625 mm size fractions containing 99% silica with minor quantities of iron oxide. Clay constituted approximately 17% of the total material excavated (Corkery 1994).

2.2.2 Soils

A search of the NSW government 'eSPADE 2' website (OEH 2016) was conducted to establish the existing soil landscapes in the vicinity of the Site. The site and the surrounding areas are composed of the following three soil landscapes:

- Disturbed terrain – comprises the majority of the Site due to the historical quarrying activities. The original soil has been removed, greatly disturbed, or buried. The original vegetation has been completely cleared.
- Medlow Bath – comprises the northern area of the Site, where there are moderately deep (<100 cm) yellow earths and earthy sands on the sideslope. Acidic soils with a high potential for aluminium toxicity.
- Wollangambe – comprises the area to the north east of the Site, where there are moderately deep (<100 cm) earthy sands, yellow earths and red earths on the sideslope to the north of the tributary of the Wollangambe River.

2.2.3 Topography

The study area is located on the southern edge of the Newnes Plateau (within the Sydney Basin) and adjacent to the Lithgow Valley. The Newnes Plateau is characterised by gentle to moderate slopes and undulating topography. Towards the edge of the plateau, the landscape is typically rugged with steep cliffs adjacent to watercourses, talus slopes and near vertical relief. This is typical of many erosional sections of the Newnes Plateau, which are often associated with deep gullies, pagoda rock formations, creeks, gullies, gorges and bottleneck valleys. Elevation of the study area ranges from 900 to 1,200 metres above sea level (Department of Commerce 2004).

2.2.4 Water resources

The existing quarry pit contains a number of water-filled voids. Due to the depths of the site voids, seepage of groundwater into the voids results in the surface water and groundwater environments at the site being interrelated. Groundwater from upstream of the site influences the water quality and quantity in the voids, and likewise, any impact on the quality of the surface water at the site is predicted to influence the groundwater quality downstream.

An ephemeral tributary of the Wollangambe River runs in a north-easterly direction from the project site. The quarry intersected this tributary's catchment, which has its headwaters in the vicinity of the rail line upstream of the site. Surface flows from this area of the catchment now enter the site at the western edge of the north void, where some erosion from high flow events is evident.

Approximately 200 metres downstream of the water-filled voids the drainage line enters a swamp where under dry weather conditions, flows are predominantly subsurface. The swamp occupies the majority of the drainage line upstream of the confluence with a similar tributary, which runs to the north of the site. Downstream of this confluence the tributary enters a meandering reach which is somewhat confined by sandstone outcropping, which continues for approximately 1.5 kilometres before the confluence with the Wollangambe River.

2.2.5 Ecology

The project footprint comprises highly modified landforms, with most vegetation present the result of previous rehabilitation activities. Modified native vegetation is also present outside the project site within the adjacent national park. Some intact native vegetation is present within the project site, located around the perimeter. Extensive tracts of intact native vegetation are present in the surrounding area.

2.3 Quarry operations

2.3.1 Development history

Understanding the history of the Bell quarry site is a key element in assessing the continued evolution of development at the site. The review of the development history undertaken was primarily based upon previous consent and management plan documentation for the site. This included the Statement of Environmental Effects for the Continued Operation of the Bell Sand Quarry (RW Corkery & Co Pty Ltd, 1994) and the Draft Management Plan for the Sand Quarry at Newnes Junction near Bell (RW Corkery & Co Pty Ltd, 1989).

The site has been used for sand extraction since 1967, before planning controls were required. The site and its surrounds were zoned Rural 1(a) under the Interim Development Order No. 1 (Shire of Blaxland) in 1969, under which quarrying and associated industries were permissible without development consent. In 1973, Maxmin Pty Ltd purchased the land from the Commonwealth Oil Corporation and in 1976 (pre EP&A Act) they entered into a quarrying agreement with Australian Aggregates NSW Pty Ltd, who quarried the site until 1988.

Amatek Ltd were granted possession of the quarry on 16 August 1988, when they also entered an agreement with Maxmin Pty Ltd allowing them to continue quarrying the site. In November 1988, Amatek Ltd prepared a draft Management Plan for the ongoing operation and progressive rehabilitation of the quarry. In February 1989, Amatek Ltd submitted the draft plan to the Greater Lithgow City Council and relevant Government authorities. From this time, the quarry was operated in accordance with the plan. In 1991, Amatek Ltd began to operate their quarries under the name Rocla Quarry Products. The site's final Management Plan was submitted in October 1992 following liaison with the NSW National Parks and Wildlife Service.

On 16 June 1993, the State Environmental Planning Policy No. 37 – Continued Mines and Extractive Industries (SEPP 37) was gazetted to cover mines and extractive industries which began before planning controls were in force, without development consent. The quarry was registered under the SEPP on 17 September 1993 as a 'continuous operation' and needed consent to allow lateral expansion or intensification. Rocla Quarry Products, R.W. Corkery & Co (environmental consultants) and relevant Government authorities met on 12 November 1993 to discuss the quarry Project. From this Council advised that the development application should be submitted as an 'advertised development'.

A Statement of Environmental Effects (SEE) was submitted in August 1994 by R.W. Corkery & Co. on behalf of Rocla Quarry Products to support a DA for the continued operation of the Bell Sand Quarry. Development consent for DA 108/94 was granted in November 1994 by the Manager of Environmental Planning Services of Lithgow City Council under Section 90 of the EP&A Act (current at the time of the consent).

Active quarry operations at the site continued intermittently before ceasing and the EPL No. 3218 for the operation of the quarry was approved by the EPA to be surrendered on the 24th October, 2014.

At this stage the obligations under the Protection of the Environment Operations Act 1997 associated with the quarry passed to Lithgow Council, and the quarry operations were considered to be concluded. The landform as it currently stands is considered to be 'final', in terms of the obligations of the original development consent (DA 108/94).

2.3.2 Approved activities

Development overview

The development described in the DA 108/94 for the "Continued Operation of the Bell Sand Quarry" included:

- Continued extraction of friable sandstone from areas of existing disturbance within the quarry site
- Continued extension of the quarry into two areas of relatively undisturbed bushland totalling approximately 2.1 ha
- Progressive increase in quarry production to a maximum level of 142,800 tpa.

The layout of the quarry was to be developed in a series of eight cells of between 0.8 ha and 1.5 ha each isolated from adjacent cells by in-situ sandstone barriers.

The proposed extraction sequence provided for continued extraction of sandstone for an indicative period of 27 years, which allowed for continued operation to 2022 based upon the date of the consent. The SEE also included a detailed description of proposed quarrying and processing equipment, hours of operation and services for the site.

A separate DA (159/94) was approved in December 1994 for building works associated with the extension of the processing plant at the site in December 1994.

Product Transport

Product transportation and transport routes were described as part of the SEE. When operating at full capacity the quarry would operate at an average of 37 truck movements per day with a maximum of 54 truck movements per day and an additional 20 light vehicle movements per day. About 85% (about 45 per day) of truck travel was via the Bells Line of Road to Sydney, with the remainder to Sydney via the Great Western Highway.

Vehicles were required to travel below 20 km/h on Sandham Road in Bell township and 50 km/h away from Bell. Operation hours were confined to 4.30am – 10pm Monday to Friday and 4.30am – 12 noon Saturday for product transport. No vehicles were allowed on Sandham Road between 10pm and 4.30am in accordance with Condition 5 of DA 108/94.

Rehabilitation

Conditions 11 – 17 stipulate requirements for the progressive rehabilitation of the quarry which is also described in detail as part of the Project Description in the SEE.

The main aim of rehabilitation was to prevent erosion and help retain all materials within the quarry site. Rehabilitation aimed to progressively provide a landform vegetated by locally occurring grasses, shrubs and trees suitable for a range of land uses. Vegetation was to be selected in consultation with the National Parks and Wildlife Service and Royal Botanic Gardens and revegetation monitored annually by a specialist. The final standard of the rehabilitation was to be to a standard agreed by Council, the Soil Conservation Service and Rocla Quarry Products.

The rehabilitation schedule aimed to have started the upper surfacing of all cells by about 2024 (30 years from the SEE). The Eastern Sedimentation Pond would remain as a wetland filter for any discharges from the quarry site after rehabilitation. Rehabilitation of the pond and 20 m strip of the neighbouring Blue Mountains National Park was to be to the satisfaction of the National Parks and Wildlife Service (with specific concerns regarding slope stability).

All cleared native vegetation was to be used as bush matting, mulched or used as ground cover.

The Soil Conservation Service was to be consulted for erosion protection during topsoils stripping and stockpiling and before construction of runoff diversion, erosion and sediment control works and sediment dams.

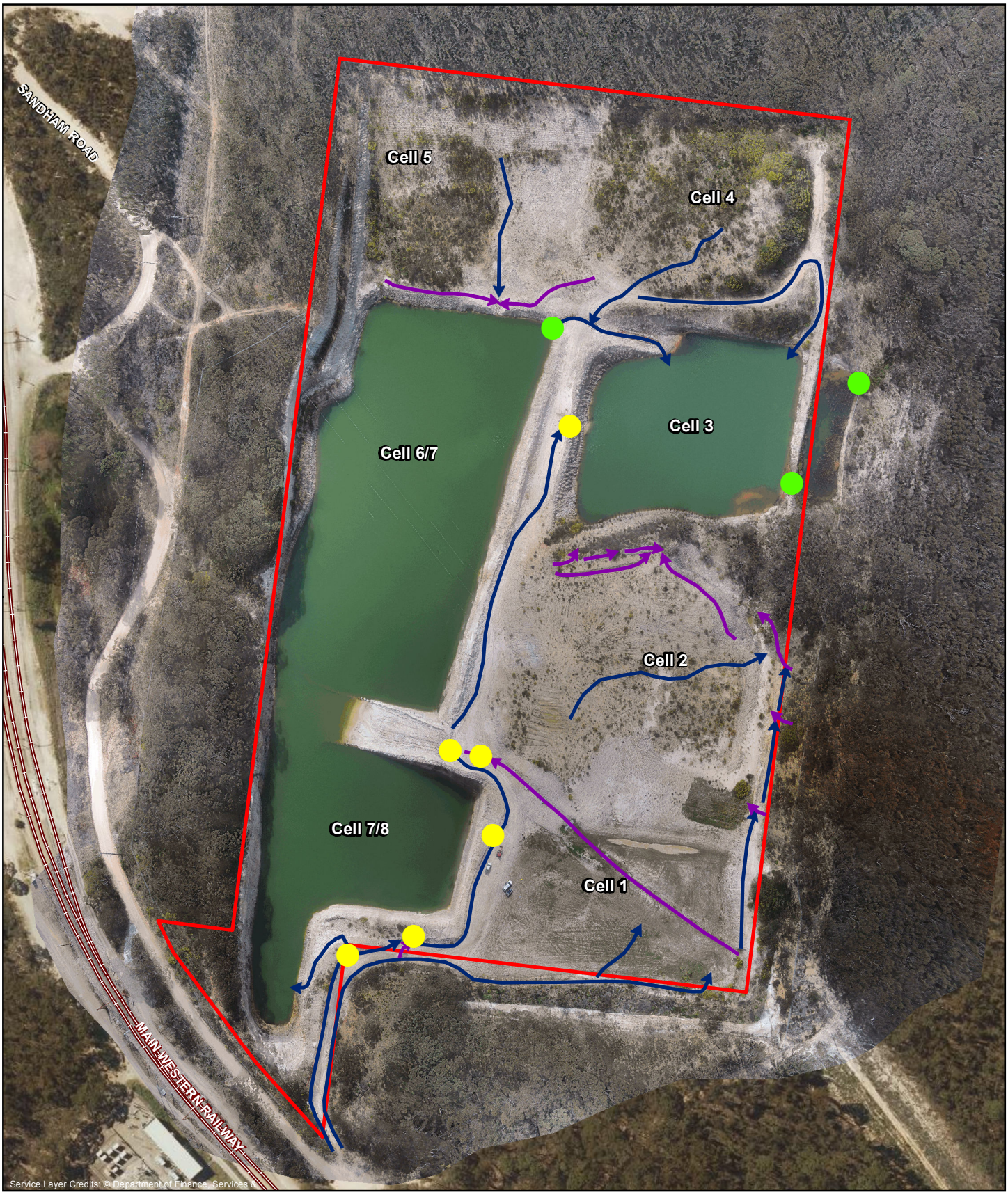
Final landform

The approved final landform at the conclusion of quarrying was dependent upon the volume of sand extracted from each cell and final void space created, based upon an assumed limit to extraction of 1018 m AHD. It was to involve building up bench layers using compacted fines generated at the site and grading to create a more stable and consistent batter slope.

2.4 Current landform

A textured three-dimensional model of the existing quarry site showing relief is shown in Figure 2-3. The quarry currently contains three large voids that are partially filled with water and drainage directs surface flows internally towards the voids in Cell 3, Cell 6/7 or Cell 7/8 as shown in Figure 2-4.

Figure 2-3 Textured model of existing site



LEGEND

Discharge point

Culverts

Diversion Bank

Flow Line

Rail

Paper Size A4

0 15 30 60

Metres

Map Projection: Transverse Mercator

Horizontal Datum: GDA 1994

Grid: GDA 1994 MGA Zone 56

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Bell Quarry Rehabilitation Project

Environmental Impact Statement

Existing site layout

Job Number	21-25774
Revision	A
Date	29 May 2018

Figure 2-4

\\ghdnet\ghd\AU\Sydney\Projects\21\25774\GIS\Maps\Deliverables\21_25774_Z003_ExistingSiteLayout.mxd Level 15, 133 Castlereagh Street Sydney NSW 2000 **T** 61 2 9239 7100 **F** 61 2 9239 7199 **E** sydmail@ghd.com.au **W** www.ghd.com.au

Data source: Aerial imagery - AStute 2015 & sixmaps 2016, Inset map - Geoscience Australia, General topo - NSW LPI DTDB 2012, Landuse zoning - SILEP LZN. Created by:afoddy

3. Project need and alternatives

3.1 Need for the project

3.1.1 Rehabilitation requirements

The project site is an end of life quarry and progressive rehabilitation of the site is required in accordance with the conditions of the existing consent. While progressive rehabilitation was required throughout the operational life of the quarry, the majority of the rehabilitation effort is typically undertaken towards the end of the quarry life cycle. The final standard of the rehabilitation was to be agreed by Council, the Soil Conservation Service and Rocla Quarry Products.

The conclusion of active quarrying operations and sale of the site indicates that rehabilitation activities have essentially been completed by the previous quarry operators. The quarry has been subject to some progressive revegetation and is at varying stages across the site with several areas still subject to active erosion. It is noted that the Soil Conservation Service of NSW has prepared the Bell Sand Quarry Closure Review (2014) and implemented some limited improvements to ground cover and drainage at the site.

This situation is summarised in the Approval of the Surrender of a Licence Notice (No DOC 14/248111) issued to Rocla Pty Limited on 24 October 2014. This Notice states:

A. The EPA received the application on 13-Oct-2014.

B. Prior to receiving this application, the EPA carried out an inspection of the premises on 08 September 2014 in the company of the licensee's representatives and staff of City of Lithgow Council to determine the status of the premises, the status of the rehabilitation, and any resulting environmental risks.

C. The EPA identified that the quarry is no longer operating, that plant and equipment has been removed, that the Soil Conservation Service has implemented improved erosion and sediment control practices across the premises to prevent/minimise the movement of soil and materials across the premises, and that revegetation is occurring as a result, which should improve further over time i.e. succession.

D. Furthermore, the City of Lithgow Council Development Approval is still in effect which covers such issues as ongoing revegetation and rehabilitation.

E. The EPA is therefore satisfied that the licence can be surrendered and that the premises will be regulated by City of Lithgow Council in future.

There is considered to be a significant opportunity to achieve superior rehabilitation outcomes than required under the existing consent. The project will rehabilitate the site to a condition closely representing the original landform and that of the adjoining Blue Mountains National Park. The project will optimise resource recovery through the beneficial reuse of clean fill material and include revegetation of the site with locally endemic species to provide effective integration with the surrounding landscape.

Consistent with the existing consent requirements, the eastern sedimentation pond will remain as a wetland filter for any discharges from the quarry site after rehabilitation. Rehabilitation of the pond and 20 m strip of the neighbouring Blue Mountains National Park will be completed to the satisfaction of the National Parks and Wildlife Service.

3.1.2 Infrastructure SEPP

State Environmental Planning Policy (Infrastructure) 2007 (Infrastructure SEPP) aims to facilitate the effective delivery of infrastructure across NSW and amongst other things allows for development for the purpose of recycling of construction and demolition material or the disposal

of virgin excavated natural material or clean fill to be permitted with consent anywhere mining or extractive industries are permitted to be undertaken.

The policy recognises the enhanced rehabilitation outcomes that can be achieved through importation of clean fill to sites previously disturbed by extractive operations. The project is consistent with the aims and objectives of the policy and will allow for recycling and beneficial reuse of fill material.

3.1.3 Resource Recovery Exemptions

The Protection of the Environment Operations (Waste) Regulation 2014 (2014 Waste Regulation) has introduced a series of resource recovery orders and resource recovery exemptions.

As stated by the EPA, '*resource recovery orders and resource recovery exemptions allow some wastes to be beneficially and safely re-used independent of the usual NSW laws that control applying waste to land. These orders are only appropriate if the reuse:*

- *is genuine, rather than a means of waste disposal*
- *is beneficial or fit-for-purpose, and*
- *will not cause harm to human health or the environment*

Orders and exemptions are two separate documents that the EPA issues together, as a package. A ***resource recovery waste*** *means a waste that has a resource recovery order and exemption*'.

The excavated natural material exemption 2014 applies to excavated natural material that is intended to be applied to land as engineering fill or in earthworks and exempts the requirement to obtain an EPL for a scheduled activity, to track waste, incur the waste levy and miscellaneous reporting requirements to the EPA. Application of the exemption is subject to the following conditions:

- At the time the excavated natural material is received at the premises, the material must meet all chemical and other material requirements (via stringent sampling and testing) for excavated natural material which are required before the supply of excavated natural material under 'the excavated natural material order 2014'.
- The excavated natural material can only be applied to land as engineering fill or for use in earthworks.
- The consumer must keep a written record of the following for a period of six years:
  - the quantity of any excavated natural material received; and
  - the name and address of the supplier of the excavated natural material received
- The consumer must make any records required to be kept under this exemption available to authorised officers of the EPA on request.
- The consumer must ensure that any application of excavated natural material to land must occur within a reasonable period of time after its receipt.
- The rehabilitation works will be undertaken in accordance with the excavated natural material exemption and all fill material entering the site will meet the requirements of the excavated natural material order or a specific resource recovery order issued by the EPA for the site.

3.2 Alternatives

The alternatives considered for this project involve final landform, filling strategy and capacity.

3.2.1 Final landform

A range of potential landforms were considered as part of the development of the project. A final landform closely replicating the original topography was selected as the preferred alternative to best integrate with the adjoining protected areas within the Blue Mountains National Park and control surface run-off and drainage through the site.

Extensive modelling activities were undertaken to develop a final landform that replicates the original landform as accurately as possible. The modelling of the various landform options commenced with a survey of the site, including a bathymetric survey to estimate the location of the base of the areas currently storing water, and hence calculate the volume of water being stored on the site.

The 1989 Quarry Management Plan was then used as a basis for the topography of the northern parts of the site as this area had not been quarried then and therefore represented the original site topography.

The 1994 SEE includes an existing site layout which was assumed to represent the topography of the site at the time. The 2 m contours included in this plan show the extent of disturbance by quarrying works had increased since 1989.

The Department of Primary Industries (DPI) also provided a 1961 aerial photograph of the Newnes Junction and a topographic map (20 m contours) extract of Newnes Junction. The available historical site layouts were digitised and combined with the available 20 m GIS contours to develop a three dimensional model of the landform surface using modelling software, 12D.

The original site contours show that the site topography generally falls from west to east. The site is located within a gully such that there would have been water flow through the middle of the site. This surface appears to be consistent with the aerial photography received for 1961 surface. The adjusted potential final landform has been developed based on the existing surface, the interpreted original topography and to allow for surface water to flow to the discharge point into the sediment pond on the eastern boundary of the site.

Alternatives considered during the development of the project included creation of a level site suitable to facilitate future development opportunities and the do-nothing option of leaving the site in current disturbed state.

Development of a level site to allow for future residential or recreational facilities (sporting fields etc) was not considered consistent with the objectives of the applicable E3 Environmental Management land zoning or in keeping with the values of the surrounding protected areas.

The do-nothing option would leave the site in the existing disturbed state with large voids and near vertical batters. There is considered to be a significant opportunity to achieve superior rehabilitation outcomes for the site and the do-nothing option would also not realise the environmental and economic benefits associated with the beneficial reuse of earthworks material in the form of resource recovery waste.

3.2.2 Filling strategies

A number of strategies were investigated for the filling of the quarry void. This included:

- the types of material used for fill
- the manner in which the material was managed on site

- the timing/staging of the emplacement activities
- the management of the water resources existent within the quarry.

As the need for the project is identified as the beneficial reuse of clean fill generated from earthworks associated with earthworks projects, characterising the type of materials to be used was straightforward. Only clean fill consisting of VENM and ENM or material permitted under a specific resource recovery order and associated exemption will be accepted on site.

The fill is proposed to be progressively placed within the quarry void to achieve the final landform for the project. A range of alternative staging strategies for the emplacement activities were considered based upon achieving ongoing safe access to the pits and progressive rehabilitation and dewatering requirements.

The staging strategy involved limiting the area of active emplacement activities to manage the level of exposure of fill material to rainfall and control surface water run-off from the site. The need for progressive dewatering of the voids was also considered as part of the staging strategy with the aim of mimicking natural flow patterns in the receiving waters and retaining water on site for use in dust suppression and compaction of the emplaced material.

3.2.3 Capacity

The overall capacity of the site to accept clean fill is driven by the final landform as described in section 3.2.1, which has an overall capacity of approximately 1.2 million cubic metres. The rate of filling to achieve the final landform was considered during the development of the project having consideration to the potential for disturbance to nearby sensitive residential receivers during haulage operations.

A maximum fill emplacement rate of 140,000 tonnes per year was selected for the preferred project. All fill will be transported to site using truck and trailers and sourced from construction projects throughout the Greater Sydney area, the Central Tablelands and the Central Western Slopes and Plains. This rate is consistent with the quarry's existing consent, which allowed a maximum extraction level of 142,800 tpa. This will ensure a similar effect upon the local road network as experienced during the previous extraction operations in terms of road capacity, noise and vehicle emissions.

3.3 Conclusion

The need and justification for the project has been assessed against strategic planning objectives and with consideration to feasible alternatives and the 'do nothing' option. The project would help meet clean fill reuse requirements of earthworks projects across the region. The project is considered to offer the potential for an enhanced site rehabilitation program and is considered of long term environmental benefit as it will return the site to a condition closely representing the original landform and that of the adjoining Blue Mountains National Park.

4. Project description

4.1 Overview

The project is seeking to rehabilitate the Bell Quarry through the importation of clean fill material consisting of VENM and ENM generated by earthworks related to projects across Sydney and the local regional area. The rehabilitation process will involve:

- Importation of up to 1,204,600 million cubic metres (approx. 2.2 million tonnes) of clean fill consisting of VENM and ENM (or material permitted under a specific resource recovery order and associated exemption). These materials are exempted from the waste licensing framework under the PoEO Act as they represent a low risk of causing environmental impact and to enable their reuse for beneficial activities
- Vehicle haulage of clean fill material at a rate of up to 140,000 tpa
- Emplacement and consolidation of clean fill material within the existing quarry voids to closely represent the pre-quarry landform
- A water management system to control surface water discharges throughout the rehabilitation program
- Revegetation of the site with locally endemic species to provide effective integration with the surrounding landscape and Blue Mountains National Park.

4.2 Project activities

4.2.1 Fill importation

Clean fill importation activities involve sourcing and transport of the material for emplacement within the Bell Quarry void.

Acceptance Criteria

All clean fill material will meet the definition of either VENM, ENM or material permitted under a specific resource recovery order and associated exemption. The PoEO Act defines virgin excavated natural material (VENM) as 'natural' material (such as clay, gravel, sand, soil or rock fines):

a. *that has been excavated or quarried from areas that are not contaminated with manufactured chemicals, or with process residues, as a result of industrial, commercial, mining or agricultural activities, and*

b. *that does not contain any sulfidic ores or soils or any other waste.*

ENM refers naturally occurring rock and soil (including but not limited to materials such as sandstone, shale, clay and soil) that has:

a. *been excavated from the ground, and*

b. *contains at least 98% (by weight) natural material, and*

c. *does not meet the definition of Virgin Excavated Natural Material in the Act.*

Excavated natural material does not include material located in a hotspot; that has been processed; or that contains asbestos, Acid Sulfate Soils (ASS), Potential Acid Sulfate soils (PASS) or sulfidic ores.

Acceptance criteria for material imported to the site is included in Table 4-1.

Table 4-1 Limiting concentrations in ENM as per the ENM order (EPA 2014b)

Chemicals and other attributes	Maximum average concentration for characterisation (mg/kg 'dry weight' unless otherwise specified)	Absolute maximum concentration (mg/kg 'dry weight' unless otherwise specified)
1. Mercury	0.5	1.0
2. Cadmium	0.5	1.0
3. Lead	50	100
4. Arsenic	20	40
5. Chromium (total)	75	150
6. Copper	100	200
7. Nickel	30	60
8. Zinc	150	300
9. Electrical Conductivity	1.5 dS/m	3 dS/m
10. pH *	5 to 9 pH units	4.5 to 10 pH units
11. Total PAHs	20	40
12. Benzo(a)pyrene	0.5	1.0
13. Benzene	NA	0.5
14. Toluene	NA	65
15. Ethyl-benzene	NA	25
16. Xylene	NA	15
17. TPH C10-C36	250	500
18. Rubber, plastic, bitumen, paper, cloth, paint and wood	0.05 %	0.10 %

* The ranges given for pH are for the minimum and maximum acceptable pH values in the excavated natural material.

Haulage

The Project involves importation of clean fill material at a maximum rate of 140,000 tpa, using truck and trailer combinations of up to 42.5 tonne capacity. This clean fill material will be sourced from projects throughout the Greater Sydney area, the Central Tablelands and the Central Western Slopes and Plains.

Transport routes to the site will depend upon the origin of the clean fill material and will vary based upon the source of material over the life of the project. The use of the following regional transport routes is intended for this project:

- Clean fill material sourced from Sydney's western, southern and south-western suburbs will be transported via the Great Western Highway to Mount Victoria and Darling Causeway to Bell.
- Clean fill material sourced from Sydney's northern and north-western suburbs would use the Bells Line of Road to Bell
- Clean fill material sourced the Central Western Slopes and Plains to the west of the site would utilise Chifley Road (Bells Line of Road) between Lithgow and Bell.

Access to the quarry via the Sandham Road from Bells Line of Road as shown on Figure 2-1. Sandham Road passes through the village of Bell and runs parallel to arterial road Chifley Road on the western side of the Main Western Railway Line and follows a north-western alignment to the access point to the quarry. An average of 37 haulage vehicle movements per day are predicted to occur along Sandham Road as a result of haulage activities for the project.

4.2.2 Emplacement activities

Site establishment

The rehabilitation works will be located entirely within the existing footprint of the former Bell Quarry and has minimal requirements for site establishment.

The existing haul road will be regraded at the commencement of site operations to provide safe entry and exit to the site for haulage vehicles.

A portable site office and amenities building will be established in the central portion of the site as shown on Figure 4-1. The site office caters for staff requirements and single administration / first aid area and amenities area. The amenities area would be serviced with a pump-out sewerage system with the sewage to be disposed off-site.

A stockpile area will be developed adjacent to the site office to allow unloading of clean fill prior to placement in the active rehabilitation cell by suitable earthmoving plant.

Surface water infrastructure will be required to be installed to divert clean offsite water from some areas around the site, outside of the rehabilitation footprint. Stormwater collection drains will also be formalised and developed to promote drainage to designated water storage areas within the existing void.

Stripping of planted regrowth vegetation in the Stage 1 filling area will also be required as part of the initial site establishment activities. The stripped vegetation and any remaining topsoil will be retained and used during the progressive rehabilitation of the site.

A detailed survey of the site boundary has been undertaken during the preparation of this EIS. The disturbance footprint of the previous extractive operations has extended beyond the surveyed site boundary at two locations which is likely to be a function of the accuracy of survey data at the time of establishment of the quarry. The edge of the main quarry void along the western boundary extends as a thin strip of approximately two metres onto Crown Land. The haul road into the site also bisects a small portion of land within the NPWS estate at the entrance to the site as shown in Appendix B.

Rehabilitation at the site will be undertaken entirely within the existing disturbance footprint of the quarry. It will be necessary to fill marginally beyond the surveyed boundary of the site to encompass the entire disturbance area to provide effective stability and stormwater management for the final landform. Filling to the extent of the near vertical existing batters will be required to prevent pooling and uncontrolled discharge of stormwater from the site and the rehabilitation strategy is consistent with the requirement to undertake rehabilitation within a 20 metre strip of the adjoining Blue Mountains National Park within the existing consent.

BQRP propose to adjust haul road to allow safe entry to the site following the completion of filling and compaction of the southern void during Stage 2 of the project. The access road currently skirts around the edge of the southern void which comprises an approximate 30 metre near vertical drop. The existing access road and adjacent disturbed land will be rehabilitated and the fenceline adjusted to reflect the updated boundary survey of the site.

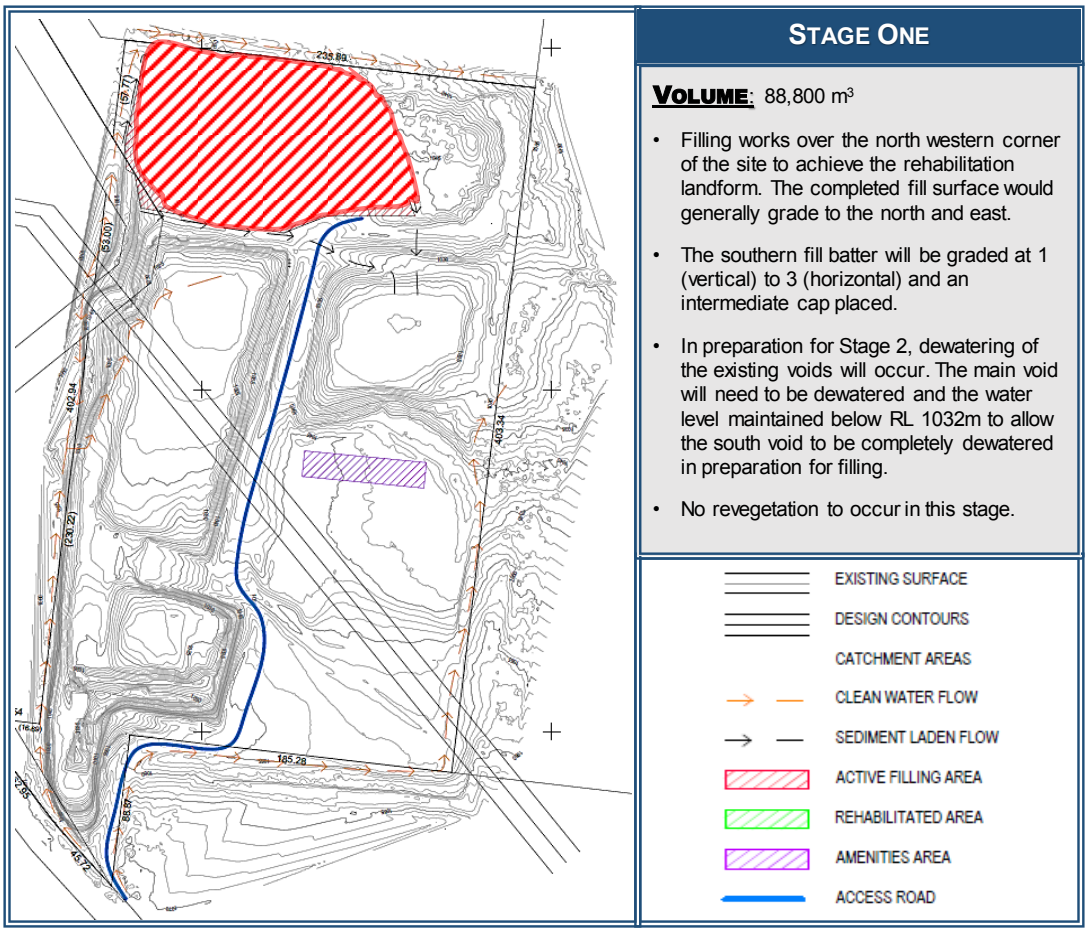
The western boundary of the site will be adjusted following the completion filling the main void during Stage 5 of the proposed development.

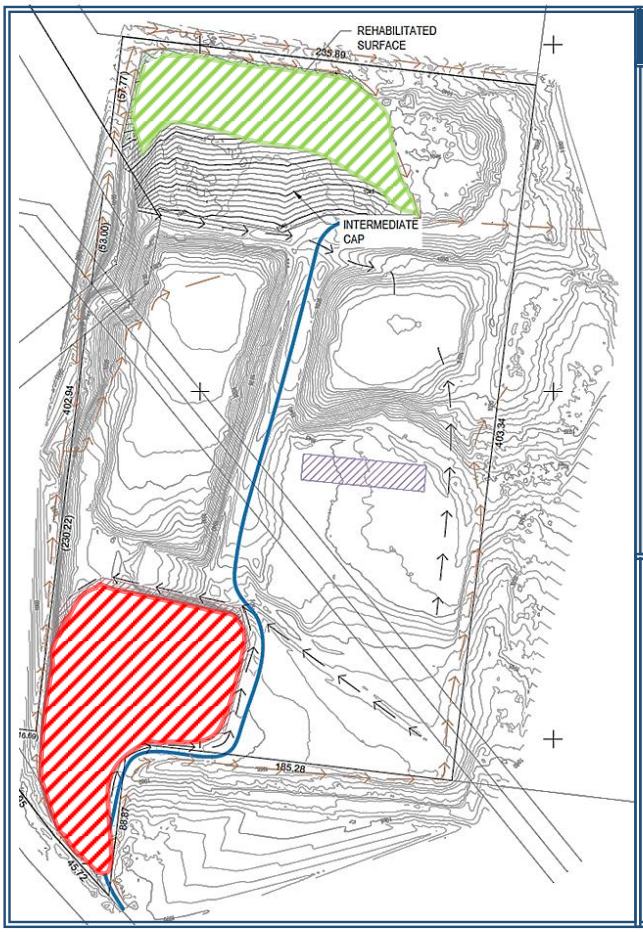
Fill emplacement

Conceptual staging of the rehabilitation of the site has been developed based on the following objectives:

- The continued provision of safe access across the site
- Limiting the disturbed areas to minimise erosion potential
- Dewatering of voids and discharge of water offsite
- The provision of stormwater management infrastructure to control and divert water flows
- The provision of environmental controls for sediment management
- Progressive rehabilitation of the site.

It is estimated that 1,204,600 cubic metres (approx. 1.2 million m^3 or 2.2 million tonnes) of fill material would be required to achieve the pre-quarry landform surface. The indicative staging plan is shown on Figure 4-1 with detailed plans included in Appendix B.



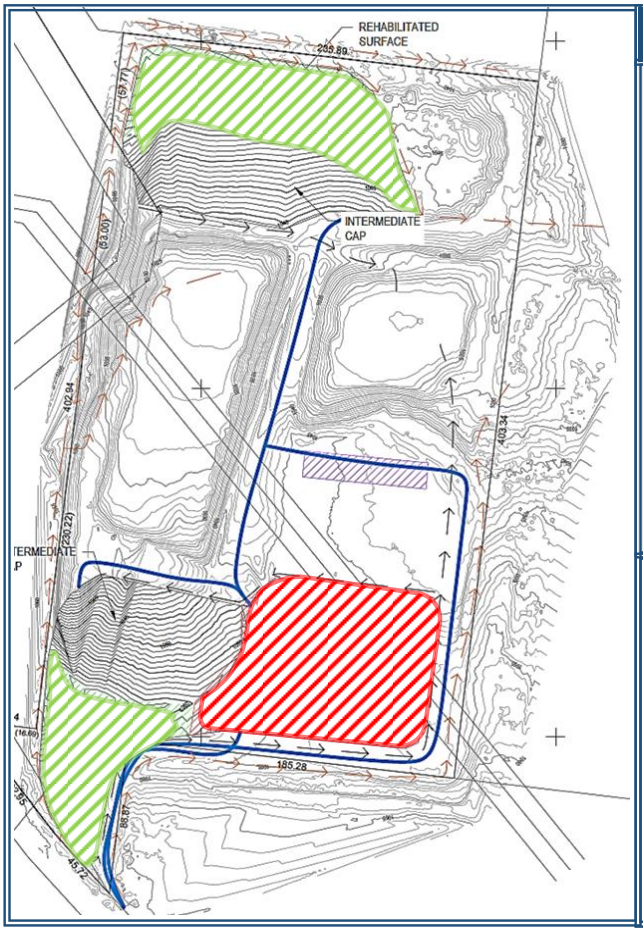


STAGE TWO

VOLUME: 271,700 m³

- Filling works in the south void to the south of the access ramp. Once above the surrounding ground level, surface water runoff will be directed to the main void. The completed fill surface will have a central ridge line, allowing water to drain to the east and west. The northern batter of filling in Stage 2 is shaped at 1 (vertical) to 3 (horizontal) and will be capped.
- Areas of Stage 1 at final levels revegetated.
- Development access road and extension of the stormwater drainage system to divert around the south eastern corner of the site, in preparation for Stage 3

EXISTING SURFACE
DESIGN CONTOURS
CATCHMENT AREAS
CLEAN WATER FLOW
SEDIMENT LADEN FLOW
ACTIVE FILLING AREA
REHABILITATED AREA
AMENITIES AREA
ACCESS ROAD

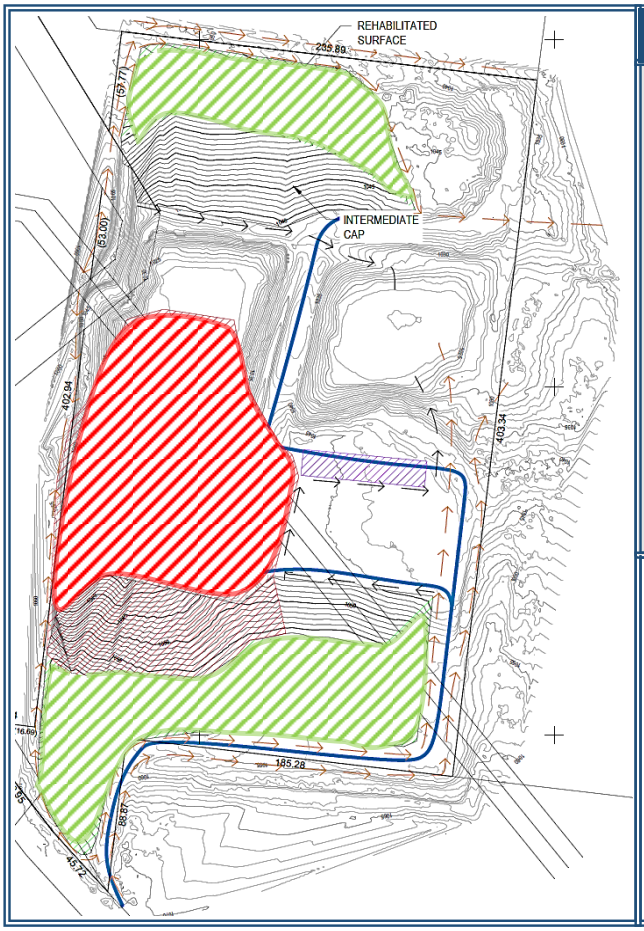


STAGE THREE

VOLUME: 52,000 m³

- Filling undertaken in the south eastern corner of the site, to the south of the east void. The filled surface will have a ridgeline near the southern extent, such that the southern portion falls to the south and the northern area will flow to the north. The western batter of filling in Stage 3 would be shaped at 1 (vertical) to 3 (horizontal) and an intermediate cap placed.
- Areas filled in Stage 2 at final levels will be revegetated.
- The main void will be dewatered in preparation for filling. A temporary sump installed in the north east corner of the main void will manage stormwater.

EXISTING SURFACE
DESIGN CONTOURS
CATCHMENT AREAS
CLEAN WATER FLOW
SEDIMENT LADEN FLOW
ACTIVE FILLING AREA
REHABILITATED AREA
AMENITIES AREA
ACCESS ROAD



STAGE FOUR

VOLUME: 357,600 m³

- Stage 4 filling is anticipated to be in the southern portion of the main void. The filled area would fall to the north and east. The northern batter of filling in Stage 4 would be shaped at 1 (vertical) to 3 (horizontal) and an intermediate cap placed.
- Stage 4 fill works will allow the surface water running onto the site from the west to flow over the fill area. Appropriate erosion and sediment controls will be installed along this drainage line.
- During the filling of Stage 4, areas of Stage 3 which have reached final levels would be revegetated.

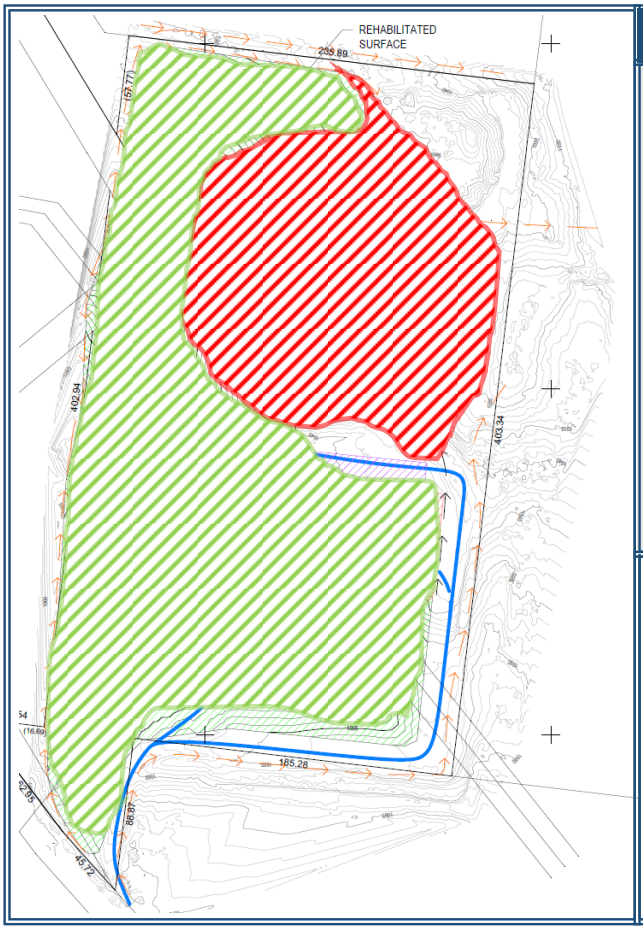
EXISTING SURFACE
DESIGN CONTOURS
CATCHMENT AREAS
CLEAN WATER FLOW
SEDIMENT LADEN FLOW
ACTIVE FILLING AREA
REHABILITATED AREA
AMENITIES AREA
ACCESS ROAD

STAGE FIVE

VOLUME: 293,800 m³

- The northern portion of the main void will be filled in Stage 5. The final fill surface in this area will generally fall to the east. The eastern batter of filling in Stage 5 would be shaped at 1 (vertical) to 3 (horizontal) and an intermediate cap placed.
- During the filling of Stage 5, areas of Stage 4 which have reached final levels would be revegetated.
- To prepare Stage 6 for filling, the east void will require dewatering and desilting.

EXISTING SURFACE
DESIGN CONTOURS
CATCHMENT AREAS
CLEAN WATER FLOW
SEDIMENT LADEN FLOW
ACTIVE FILLING AREA
REHABILITATED AREA
AMENITIES AREA
ACCESS ROAD



STAGE SIX

VOLUME: 140,500 m^3

- The final area of filling would be the east void to create a surface which generally falls to the east. Throughout the filling of this stage, temporary sumps will need to be maintained in the fill area to allow for the collection and treatment of sediment laden surface water
- During the filling of Stage 6, areas of Stage 5 which have reached final levels would be revegetated. Upon completion of filling of Stage 6, the remaining areas will be revegetated.

EXISTING SURFACE
DESIGN CONTOURS
CATCHMENT AREAS
CLEAN WATER FLOW
SEDIMENT LADEN FLOW
ACTIVE FILLING AREA
REHABILITATED AREA
AMENITIES AREA
ACCESS ROAD

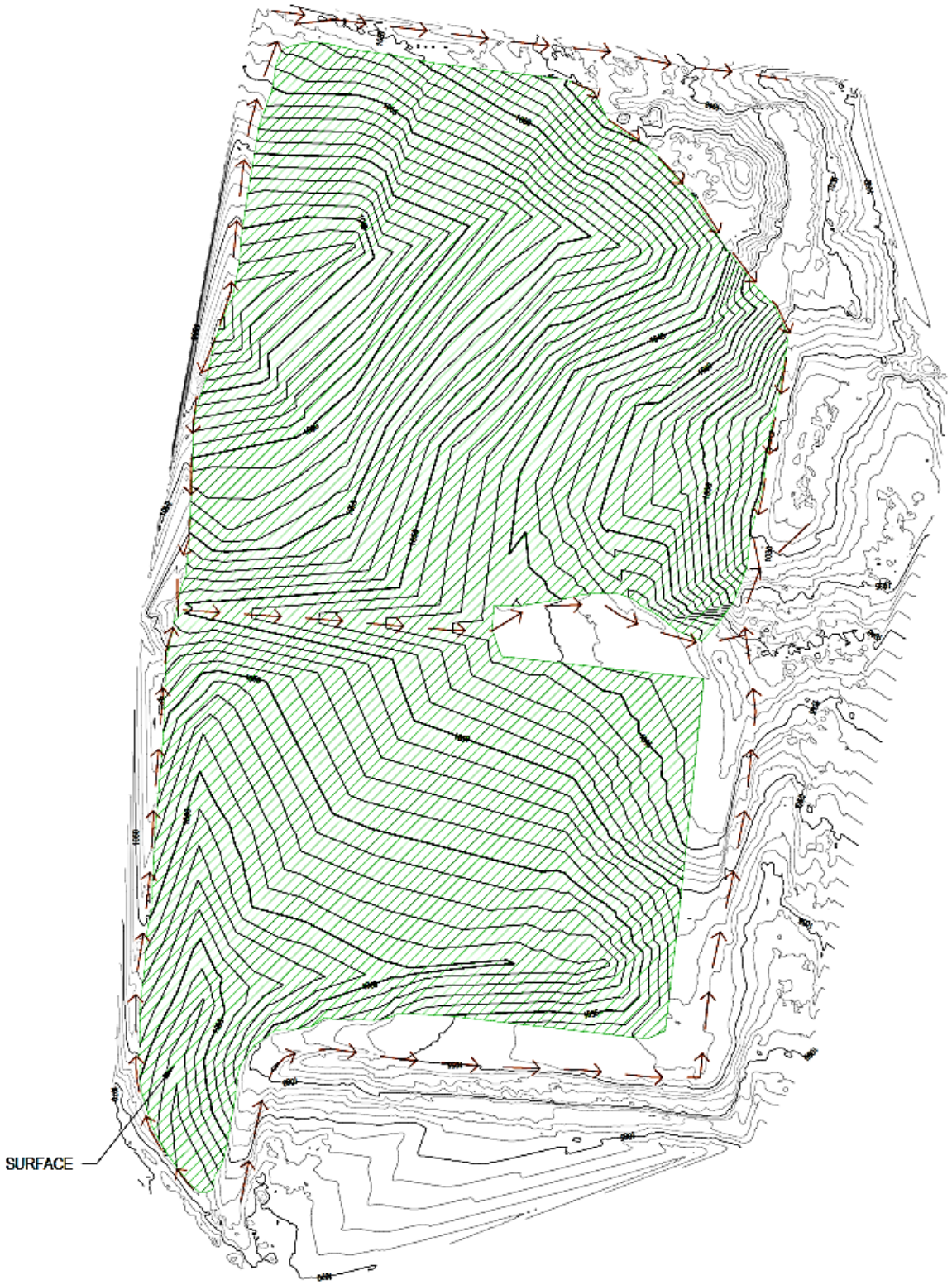


Figure 4-1 Final landform topography

4.2.3 Water management

Management of surface water and groundwater resources across the quarry site will be of high importance throughout the project life. The following activities will form the basis of the strategy for water management for the project:

- Progressive dewatering of voids
- Discharge of void watering varied rates to minimise downstream geomorphic impacts.
- Ongoing surface and groundwater monitoring
- Erosion and sediment control strategies:
  - Minimisation of the extent and duration of disturbed areas, and prompt topsoiling and revegetation following the completion of each project stage
  - Ongoing filling works will maintain landforms which minimise the erosion hazard
  - Runoff from the site will be diverted around active filling areas and toward the voids in a manner which minimises erosion
  - Temporary control measures such as geotextile sediment fencing and straw bale filters

4.2.4 Revegetation

The final landform would be progressively revegetated with locally endemic species to provide effective control or erosion and integration with the surrounding landscape so that the site becomes sympathetic with the adjoining Blue Mountains National Park.

Rehabilitation activities aim to progressively provide a landform vegetated by locally occurring grasses, shrubs and trees suitable for a range of land uses. Vegetation would be selected in consultation with the National Parks and Wildlife Service and Royal Botanic Gardens and revegetation monitored annually by a specialist. The aim of the final standard of the rehabilitation is provide a revegetated landform which matches (as closely as possible) the site before land disturbance and quarrying activities commenced.

4.3 Project resources

4.3.1 Equipment

Project Activity	Equipment	Plant
Fill import		Up to 42.5 tonne truck and trailer haulage vehicles
Emplacement activities	Generator, site office / amenities building spill kits, refuelling/spill bunds,	1 grader, 1 tipper truck, 1 dozer, 2 front end loaders, Roller, Fuel delivery truck, water truck
Water management system	Submersible and centrifugal pumps	
Revegetation activities	Mechanical and electrical equipment,	Hydro-seeding (and planting of tubestock)

4.3.2 Workforce

The workforce required to operate the site is anticipated to be 4 – 6 employees in addition to haulage drivers.

4.3.3 Operational hours

Operation hours for the proposed rehabilitation works will be in accordance with Table 4-2. Rehabilitation activities and haulage to the site will be restricted to the hour of 7.00 am to 6.00 pm Monday to Friday and 7.00 am to 1.00 pm on Saturdays. Minor site preparation activities involving the use of a grader and roller to prepare the site for haulage vehicles is proposed between 6.00 am and 7.00 am Monday to Saturday.

Table 4-2 Operating hours

Activity	Day of week	Time	Assessment period
Rehabilitation related activities and transport of materials	Monday-Friday	7:00 am to 6:00 pm	Day
	Saturday	7:00 am to 1:00 pm	Day
	Sunday and Public Holidays	None	-
Preparation of ground on-site for haul trucks	Monday-Friday	6:00 am to 7:00 am	Night
	Saturday	6:00 am to 7:00 am	Night
	Sunday and Public Holidays	None	-

5. Legislative and planning framework

5.1 Introduction

This chapter sets out the key planning and environmental regulatory framework applicable to the Project, including the identification of relevant environmental planning instruments and the approval pathway. Both NSW and Commonwealth legislation are identified and will be further considered in the EIS.

5.2 Commonwealth legislation

The *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) is the Australian Government's central piece of environmental legislation that provides a legal framework to protect and manage environmental values considered to be of national environmental significance.

The EPBC Act requires approval from the Commonwealth Minister for the Environment and Resources for actions that may have a significant impact on listed matters of national environmental significance (MNES). These matters include:

- World heritage properties
- National heritage places
- Wetlands of international importance (listed under the Ramsar Convention)
- Listed threatened species and ecological communities
- Migratory species protected under international agreements
- Nuclear actions
- Commonwealth marine areas
- The Great Barrier Reef Marine Park
- A water resource, in relation to a coal seam gas or large coal mining developments.

The project is considered an "action" which is broadly defined under the EPBC Act to include a project, development, undertaking, activity or series of activities. It is the responsibility of the applicant proposing to undertake an action to initially consider whether the Project is likely to have a significant impact on any MNES. If the applicant considers there is potential for significant impacts upon any matters protected under the EPBC Act, then a referral is required to be submitted to the Minister for the Environment. Developments considered likely to result in significant impacts are defined as "controlled actions" and require assessment and approval under the EPBC Act.

The project site is located adjacent to the Greater Blue Mountains Area which is also listed on the United Nations Educational, Scientific and Cultural Organization (UNESCO) World Heritage List and is also listed as a national heritage place on the National Heritage List. Detailed consideration of the impact upon the world heritage, national heritage and other values of the Greater Blue Mountains has been undertaken in chapter 13 of this EIS. There will be no direct impacts upon world heritage values and rehabilitation of the site to achieve a landform that is contiguous with the surrounding landscape is considered complementary to the values of the area.

Consideration of potential impacts upon listed threatened species and communities and any other MNES potentially impacted by the Project has been undertaken in chapter 9. The site has been previously cleared and will not impact upon any MNES.

5.3 New South Wales legislation

5.3.1 Environmental Planning and Assessment Act 1979

The EP&A Act contains three parts that impose requirements for planning approval. These are generally as follows:

- Part 4 provides for control of 'development' that requires development consent from the local council, a regional planning panel or the state government.
- Part 5 provides for control of 'activities' that do not require approval or development consent under Part 4.
- Part 5.1 provides for control of State Significant Infrastructure.

The need or otherwise for consent for a new development application is set out in environmental planning instruments including State Environmental Planning Policies (SEPPs) and Local Environmental Plans (LEPs).

Lithgow Local Environmental Plan 2014

Land use objectives

The Lithgow LEP 2014 (Lithgow LEP) provides development controls for works within the Lithgow local government area. The existing quarry is located within Zone E3 Environmental Management in accordance with the LEP zoning maps as described in section 2.1.3.

The objectives of the zone are:

- To protect, manage and restore areas with special ecological, scientific, cultural or aesthetic values.
- To provide for a limited range of development that does not have an adverse effect on those values.
- To facilitate the management of environmentally sensitive lands and riparian areas.
- To protect and conserve the vegetation and escarpment landscape surrounding Lithgow.
- To maintain or improve the water quality of receiving water catchments.

The project is seeking to rehabilitate the site through the emplacement of clean fill within the existing quarry footprint to enable the site to be returned to a condition closely representing the original landform and that of the adjoining Blue Mountains National Park. The project involves the restoration of environmental values of the locality and is considered to meet the objectives for Zone E3 Environmental Management.

Permissibility

The project can potentially be defined as a number of developments types in accordance with the Lithgow LEP. All potential development types are permissible developments at the site.

Environmental Protection Works

The Lithgow LEP defines environmental protection works as works associated with the rehabilitation of land towards its natural state or any work to protect land from environmental degradation, and includes bush regeneration works, wetland protection works, erosion protection works, dune restoration works and the like, but does not include coastal protection works.

The project involves restoring of land towards its natural state and is considered to meet the definition of environmental protection works. Environmental protection works are permissible with consent in the Zone E3 Environmental Management Zone.

Extractive Industry

The Lithgow LEP defines an extractive industry as the winning or removal of extractive materials (otherwise than from a mine) by methods such as excavating, dredging, tunnelling or quarrying, including the storing, stockpiling or processing of extractive materials by methods such as recycling, washing, crushing, sawing or separating, but does not include turf farming. It is noted that extractive industries are not a type of industry in accordance with the Lithgow LEP.

The site has been used for sand extraction since 1967 and retains a consent for operation of an extractive industry issued by Lithgow City Council in 1994 (DA 108/94). Site rehabilitation is a key component of any extractive industry and the existing DA includes specific requirements for rehabilitation of the quarry. The project will be undertaken entirely within the existing quarry footprint and will be undertaken, at least initially within the timeframe of the original development consent and is considered to meet the definition of an extractive industry.

However, it is noted that a key element of the definition of extractive industries is the continual winning or extraction of materials from the site and importing of the proposed volumes of VENM, ENM and other clean fill material for rehabilitation purposes did not form part of the initial development application. The project is therefore not considered to be substantially the same development as originally approved and will be subject to a new development application.

Extractive industries are not permitted with or without consent within the E3 Environmental Management Zone under the Lithgow LEP. However, extensive agriculture is permitted without consent within the zone and the project is therefore permissible in accordance with the Mining SEPP as described below.

Resource Management Facility

The Lithgow LEP defines a waste or resource management facility means any of the following:

(a) a resource recovery facility,

(b) a waste disposal facility,

(c) a waste or resource transfer station,

(d) a building or place that is a combination of any of the things referred to in paragraphs (a)–(c).

A waste disposal facility means a building or place used for the disposal of waste by landfill, incineration or other means, including such works or activities as recycling, resource recovery and other resource management activities, energy generation from gases, leachate management, odour control and the winning of extractive material to generate a void for disposal of waste or to cover waste after its disposal.

While the project is restricted to emplacement of VENM, ENM and other clean fill material, it is considered to meet the definition of a waste or resource management facility as it involves the placement of waste on land. As discussed in Section 5.3.3 the EPA's excavated natural material exemption 2014 applies to excavated natural material that is intended to be applied to land as engineering fill or in earthworks and exempts the requirement to obtain an EPL for a scheduled activity, to track waste, pay the waste levy and miscellaneous reporting requirements to the EPA.

Waste and Resource Management Facilities are not permitted with or without consent within the E3 Environmental Management Zone under the Lithgow LEP. However, extensive agriculture is

permitted without consent within the zone and the project is therefore permissible in accordance with the Mining SEPP and Infrastructure SEPP as described below.

Additional local provisions

The Lithgow LEP includes local provisions regarding earthworks which aims to ensure that earthworks for which development consent is required will not have a detrimental impact on environmental functions and processes, neighbouring uses, cultural or heritage items or features of the surrounding land.

Development consent is generally required for earthworks unless the earthworks are exempt development or are ancillary to a development permitted without consent or for which development consent has been given. In considering whether to grant consent for earthworks (or for development involving ancillary earthworks), the consent authority must consider the following matters:

a) the likely disruption of, or any detrimental effect on, drainage patterns and soil stability in the locality of the development,

b) the effect of the development on the likely future use or redevelopment of the land,

c) the quality of the fill or the soil to be excavated, or both,

d) the effect of the development on the existing and likely amenity of adjoining properties,

e) the source of any fill material and the destination of any excavated material,

f) the likelihood of disturbing relics,

g) the proximity to, and potential for adverse impacts on, any waterway, drinking water catchment or environmentally sensitive area,

h) any appropriate measures proposed to avoid, minimise or mitigate the impacts of the development,

i) the proximity to, and potential for adverse impacts on, any heritage item, archaeological site or heritage conservation area.

These matters have been taken into consideration and addressed through the preparation of this EIS.

The site is not located within a dedicated environmentally sensitive, flood planning or designated buffer area in accordance with the Lithgow LEP mapping and further local provisions are not considered applicable to the project.

State Environmental Planning Policy Mining Petroleum and Extractive Industries 2007

The aims of the Mining SEPP are, in recognition of the importance to New South Wales of mining, petroleum production and extractive industries:

(a) to provide for the proper management and development of mineral, petroleum and extractive material resources for the purpose of promoting the social and economic welfare of the State,

(b) to facilitate the orderly and economic use and development of land containing mineral, petroleum and extractive material resources, and

(c) to establish appropriate planning controls to encourage ecologically sustainable development through the environmental assessment, and sustainable management, of development of mineral, petroleum and extractive material resources.

Under the SEPP, extractive industries may be carried out with consent on any land for which agriculture or industry is permitted with or without consent. Development applications are required to take into consideration a number of factors including:

- Compatibility with other surrounding land-uses (including other extractive industries).
- Natural resource and environmental management.
- Resource recovery.
- Transport.
- Rehabilitation.

Extensive agriculture is permitted with consent in accordance with the Lithgow LEP 2014 as described above. Extractive industries are therefore permissible with consent at the site in accordance with the Mining SEPP.

State Environmental Planning Policy (Infrastructure) 2007

The Infrastructure SEPP aims to facilitate the effective delivery of infrastructure across NSW and allows for a range of developments to be permitted with and without consent.

Division 23 of the Infrastructure SEPP includes definitions and consent requirements of Waste or Resource Management facilities.

In accordance with Clause 121 (3) of the Infrastructure SEPP:

Development for the purpose of the recycling of construction and demolition material, or the disposal of virgin excavated natural material (as defined by the PoEO Act) or clean fill, may be carried out by any person with consent on land on which development for the purpose of industries, extractive industries or mining may be carried out with consent under any environmental planning instrument.

Extractive industries are permissible within the E3 Environmental Management zoning in accordance with the Mining SEPP as described above. Importing of VENM, ENM and other clean fill material for the purpose of site rehabilitation is considered permissible with consent in accordance with the Infrastructure SEPP.

State Environmental Planning Policy State and Regional Development

The aim of this policy is to identify development that is State Significant Development (SSD) or State Significant Infrastructure (SSI) and to confer functions on joint regional planning panels to determine development applications.

Development for the purpose of waste and resource management facilities which meet criteria in Clause 23 of Schedule 1 are considered SSD. The Minister for Planning is the consent authority for SSD and the project would be assessed by preparation of an EIS for assessment through the DP&E.

Clause 23 of Schedule 1 defines Waste and Resource Management Facilities as:

(1) Development for the purpose of regional putrescible landfills or an extension to a regional putrescible landfill that:

(a) has a capacity to receive more than 75,000 tonnes per year of putrescible waste, or

(b) has a capacity to receive more than 650,000 tonnes of putrescible waste over the life of the site, or

(c) is located in an environmentally sensitive area of State significance.

(2) Development for the purpose of waste or resource transfer stations in metropolitan areas of the Sydney region that handle more than 100,000 tonnes per year of waste.

(3) Development for the purpose of resource recovery or recycling facilities that handle more than 100,000 tonnes per year of waste.

(4) Development for the purpose of waste incineration that handles more than 1,000 tonnes per year of waste.

(5) Development for the purpose of hazardous waste facilities that transfer, store or dispose of solid or liquid waste classified in the Australian Dangerous Goods Code or medical, cytotoxic or quarantine waste that handles more than 1,000 tonnes per year of waste.

(6) Development for the purpose of any other liquid waste depot that treats, stores or disposes of industrial liquid waste and:

(a) handles more than 10,000 tonnes per year of liquid food or grease trap waste, or

(b) handles more than 1,000 tonnes per year of other aqueous or non-aqueous liquid industrial waste.

The project is not considered to meet the criteria for SSD in accordance with Clause 23 of Schedule 1 in the State and Regional Development SEPP and therefore development consent is required from City of Lithgow Council.

The project will be restricted to receiving VENM, ENM and other clean fill subject to a resource recovery order and exemption. The project will not accept general solid waste (putrescible) and is not development for the purpose of a putrescible landfill.

The project is not development for the purpose of a waste or resource transfer station in metropolitan Sydney.

The project is not development for the purpose of resource recovery or recycling facilities that handle more than 100,000 tonnes per year of waste. A resource recovery facility is defined in the Infrastructure SEPP and the Standard Instrument as:

resource recovery facility means a facility for the recovery of resources from waste, including such works or activities as separating and sorting, processing or treating the waste, composting, temporary storage, transfer or sale of recovered resources, energy generation from waste gases and water treatment, but not including re-manufacture of material or goods or disposal of the material by landfill or incineration

The development will accept clean fill material under the terms of a resource recovery order and exemption which is applied to the land as engineering fill or in earthworks and is not in itself a resource recovery facility. The development does not involve processing or sorting of waste for transfer or sale of recovered resources and all material will be applied to the site to restore the original landform as part of the rehabilitation works.

The project is not for the purpose of waste incineration and not development for the purpose of a hazardous waste facility.

Under Section 20 of the State and Regional Development SEPP, a regional panel may exercise consent authority functions for determination of certain development applications under Part 4 of the EP&A Act. If the proposal is considered a designated development (not state significant) for an extractive industry or waste management facility, it is also defined as regional development under Clause 7 of Schedule 7 or the State and Regional Development SEPP and would be determined under a Joint Regional Planning Panel.

State Environmental Planning Policy No. 33 – Hazardous and Offensive Development

State and Environmental Planning Policy No 33 – Hazardous and Offensive Development (SEPP 33) requires the consent authority to consider particular matters in determining a development application for a project that is a potentially hazardous industry or potentially offensive industry.

An application guideline (Applying SEPP33) was prepared to support SEPP 33 by providing guidance regarding the identification and assessment of potentially hazardous industry.

The Applying SEPP33 guideline states that the first step in determining whether SEPP 33 applies to a project is to determine whether the proposed use falls within the definition of 'industry' adopted by the planning instrument which applies.

The project does not meet the definition of industry under the Lithgow LEP as it does not involve a building or place on which an industrial activity will be undertaken. Under the Lithgow LEP industrial activity which means the manufacturing, production, assembling, altering, formulating, repairing, renovating, ornamenting, finishing, cleaning, washing, dismantling, transforming, processing, recycling, adapting or servicing of, or the research and development of, any goods, substances, food, products or articles for commercial purposes. The project is not an industry and therefore cannot be considered a hazardous or offensive industry and SEPP 33 does not apply to the development application.

Additionally the project will not require the transport or storage or dangerous goods in sufficient volumes to trigger the requirement for a Preliminary Hazard Analysis (PHA) if SEPP 33 was applied to the project.

Dangerous goods will be limited to storage of fuels and oils for equipment and machinery operating within the site. Storage, handling and use of dangerous goods and substances would be in accordance with the Occupational Health and Safety Act 2000 (OHS Act) and the Storage and Handling of Dangerous Goods Code of Practice (WorkCover NSW, 2005). Secure, bunded areas would be provided around storage areas for oils, fuels and other hazardous liquids. Impervious bunds would be of sufficient capacity to contain at least 110% of the volume of the largest stored container.

State Environmental Planning Policy (Sydney Drinking Water Catchment) 2011

State Environmental Planning Policy (Sydney Drinking Water Catchment) 2011 (the Sydney Drink Water Catchment SEPP) applies to land within Sydney's Drinking Water Catchment. The aims of the policy are:

(a) to provide for healthy water catchments that will deliver high quality water while permitting development that is compatible with that goal, and

(b) to provide that a consent authority must not grant consent to a proposed development unless it is satisfied that the proposed development will have a neutral or beneficial effect on water quality, and

(c) to support the maintenance or achievement of the water quality objectives for the Sydney Drinking Water Catchment.

The policy requires any development within the Sydney Drinking Water Catchment area to incorporate Water NSW's current recommended practices and standards or demonstrate how any alternative practices and standards will achieve equivalent or improved outcomes.

The project site is located entirely within the Wollangambe River catchment and does not form part of the Sydney Drinking Water Catchment and the Sydney Drinking Water SEPP therefore does not apply to the project.

Potential impacts to receiving water quality have been comprehensively assessed as part of the EIS due to the sensitivity of the Wollangambe River catchment.

5.3.2 State Environmental Planning Policy 55 – Remediation of Land

SEPP 55 provides for a statewide planning approach to the remediation of contaminated land and aims to promote the remediation of contaminated land for the purpose of reducing the risk of harm to human health or any other aspect of the environment by:

(a) specifying when consent is required, and when it is not required, for a remediation work,

(b) by specifying certain considerations that are relevant in rezoning land and in determining development applications in general and development applications for consent to carry out a remediation work in particular,

(c) by requiring that a remediation work meet certain standards and notification requirements.

In determining a development application a consent authority is required to consider if the land is contaminated and if contamination is identified is the land suitable in its contaminated state for the purpose for which the development is proposed to be carried out and if any remediation is required to make the land suitable for that purpose.

The site has been used for sand extraction since 1967 and the project represents a continuation and evolution of the current land-use.

Evidence of site contamination has not been identified in any historical investigations or in soil and water investigations undertaken as part of the preparation of EIS. Remediation of the site is not considered to be required to allow the site to transfer to the final rehabilitation phase of the extractive operations. All emplacement material will meet the definition of either VENM, ENM or material permitted under a specific resource recovery order and associated exemption and be rigorously tested against the acceptance criteria prior to transport to site for use in site rehabilitation.

5.3.3 Other relevant NSW legislation

Protection of the Environment Operations Act

The objectives of the PoEO Act are to protect, restore and enhance the quality of the environment, in recognition of the need to maintain ecological sustainable development.

The PoEO Act provides for an integrated system of licensing and contains a core list of activities requiring Environmental Protection Licences (EPL) from the Environmental Protection Authority (EPA). These activities are called 'scheduled activities' and are listed in Schedule 1 of the PoEO Act.

Application of waste to land is considered to be a scheduled activity in accordance with Clause 39 of Schedule 1 of the PoEO Act. However, under the Protection of the Environment Operations (Waste) Regulation 2014 (2014 Waste Regulation), the EPA has the power to grant exemption from the requirement for an EPL and to pay the waste levy, where it can be demonstrated that the use of the waste is bona-fide, fit-for-purpose and causes no harm to the environment or human health, rather than a means of waste disposal.

The 2014 waste regulation has introduced a series of resource recovery orders and resource recovery exemptions which can in specific circumstances remove the need to obtain an EPL and payment of the waste levy. Each order includes conditions which generators and processes of exempt waste must meet to supply the waste for land application and each exemption includes conditions for the consumers of exempt waste to apply to land.

The excavated natural material exemption 2014 applies to excavated natural material that is intended to be applied to land as engineering fill or in earthworks and exempts the requirement to obtain an EPL for a scheduled activity, to track waste, pay the waste levy and miscellaneous reporting requirements to the EPA.

All fill material entering the site will meet the requirements of the excavated natural material order or a specific resource recovery order issued by the EPA for the site.

The PoEO Act also is the relevant legislation in regard to the discharge of waters. Section 120 of the PoEO makes a blanket statement that it is an offence to pollute waters. Detailed water balance and geochemical analysis has been undertaken as part of the EIS, and the emplacement activities are not anticipated to have a detrimental impact upon receiving waters.

Water Management Act

The Water Management Act 2000 (WM Act) is intended to ensure that water resources are conserved and properly managed for sustainable use benefitting both present and future generations. It is also intended to provide a formal means for the protection and enhancement of the environmental qualities of waterways and their catchments.

The WM Act controls the extraction and use of water, the construction of works such as dams and weirs, and the carrying out of activities in or near water sources in NSW. 'Water sources' are defined very broadly to include any river, lake, estuary or place where water occurs naturally on or below the surface of the ground and NSW coastal waters.

Part 2 of the WM Act applies to the requirement to obtain a licence for the "taking of water" from a water source. An access licence entitles its holder to specified shares in the available water within a specified water management area or from a specified water source. It enables the licence holder to take water from the environment in accordance with specified rates and conditions under the terms of the licence.

The licencing provision apply to areas of New South Wales that have a water sharing plan (WSP). Provisions within WSPs provide water to support the ecological processes and environmental needs of groundwater dependent ecosystems (GDEs) and waterways. WSPs also provide how the water available for extraction is shared between the environment, basic landholder rights, town water supplies and commercial uses.

The following two WSPs made under Section 50 of the WM Act are relevant to the Project:

- Greater Metropolitan Region Unregulated River Water Sources WSP (GMRU WSP).
- Greater Metropolitan Region Groundwater Sources WSP (GMR WSP).

Greater Metropolitan Region Unregulated River Water Sources Water Sharing Plan

For surface water, the site is located within the GMRU WSP, which became operational in July 2011. This WSP covers six water sources which are made up of a total of 87 management zones. The Project is located within the Colo River Management Zone.

Greater Metropolitan Region Groundwater Sources Water Sharing Plan

For groundwater, the site is located within the GMR WSP, which became operational in July 2011. This WSP covers 13 groundwater sources on the east coast of NSW. The Project is located within the Sydney Basin Richmond Groundwater Source.

Part 3 of the WM Act specifies approval requirements for water use, water management works approvals and activity approvals. There are two kinds of activity approvals including controlled activity approvals and aquifer interference approvals.

Controlled activity approvals confer a right for the holder to carry out a specified controlled activity on waterfront land which is defined as land within 40 metres of a river, lake, estuary or shoreline. The definition of controlled activities include the deposition of material (whether or not extractive material) on land and the definition of a river includes 'any watercourse, whether perennial or intermittent and whether comprising a natural channel or a natural channel artificially improved'.

The project involves emplacing clean fill material within 40 metres of an intermittent drainage channel and therefore triggers the need for a controlled activity approval under Section 91(2) of the WM Act. .

An aquifer interference approval confers a right on its holder to carry out one or more specified aquifer interference activities at a specified location, or in a specified area, in the course of carrying out specified activities. An aquifer interference activity includes any works that involve:

a. the penetration of an aquifer;

d. the interference with water in an aquifer;

e. the obstruction of the flow of water in an aquifer;

f. the taking of water from an aquifer in the course of carrying out mining, or any other activity prescribed by the regulations;

g. the disposal of water from an aquifer as referred to in paragraph (d).

The historical quarry operations have previously extended below the groundwater levels and therefore involved penetration of an aquifer. The Project involves filling the existing voids to return the aquifer to be representative of conditions prior to extraction. However, dewatering of voids will be required during active emplacement operations and will result in the taking of water from the aquifer.

A water licence is required (unless an exemption applies or water is being taken under basic landholder right) where an aquifer interference activity causes the removal of water from a water source of the transfer of water from one water source to another. A water licence will need to be obtained for water take under Section 56 of the WM Act. Detailed water balance investigations have been undertaken and reported in Appendix C to outline the anticipated water take for the Project.

Threatened Species Conservation Act 1995

The *Threatened Species Conservation Act 1995 (TSC Act)* provides legal status for biota of conservation significance in NSW. The TSC Act aims to, amongst other things, 'conserve biological diversity and promote ecologically sustainable development'. It provides for:

- The listing of 'threatened species, populations and ecological communities', with endangered species, populations and communities listed under Schedule 1, 'critically endangered' species and communities listed under Schedule 1A, and vulnerable species and communities listed under Schedule 2
- The listing of 'Key Threatening Processes' under Schedule 3
- The preparation and implementation of Recovery Plans and Threat Abatement Plans
- Requirements or otherwise for the preparation of a SIS.

A detailed biodiversity assessment has been undertaken as part of the EIS to assess the potential impacts of the project on threatened species, populations and ecological communities in accordance with the TSC Act and Section 5A of the EP&A Act.

Note that the TSC Act was repealed on August 25 2017, and replaced with the *Biodiversity Conservation Act 2016* (Biodiversity Conservation Act). The development application process for the project commenced in October 2016 including the issue of SEARs in November 2016. The ecological field work completed in December 2016 in accordance with the SEARs and the will continue to be assessed under the TSC Act under the transitional arrangements.

Section 5A of the EP&A Act lists seven factors that must be taken into account when determining the significance of potential impacts of a proposed activity on threatened species, populations or ecological communities (or their habitats) listed under the TSC Act and the FM Act. The 'seven-part test' is used to assist in the determination of whether a Project is 'likely' to impose 'a significant effect' on threatened biota and thus whether a species impact statement (SIS) is required. Seven part tests have been prepared for threatened biota that would be potentially impacted by the project.

Fisheries Management Act 1994

The objects of the *Fisheries Management Act 1994 (FM Act)* are to conserve, develop and share the fishery resources of the State for the benefit of present and future generations. It provides for:

- The listing of threatened species, populations and ecological communities, with endangered species, populations and communities listed under Schedule 4, critically endangered species and communities listed under Schedule 4A, vulnerable species and communities listed under Schedule 5
- The listing of 'Key Threatening Processes' under Schedule 6
- Diseases affecting fish and marine vegetation under Schedule 6B
- Noxious fish and noxious marine vegetation under Schedule 6C
- The preparation and implementation of Recovery Plans and Threat Abatement Plans
- Requirements or otherwise for the preparation of a SIS.

One of the objectives of the FM Act is to 'conserve key fish habitats ' which includes aquatic habitats that are important to the maintenance of fish populations generally and the survival and recovery of threatened aquatic species. To assist in the protection of key fish habitats, DPI has produced the *Policy and guidelines for fish habitat conservation and management* (2013 update).

The FM Act has been addressed as part of the biodiversity assessment within this EIS through consideration of potential impacts upon aquatic habitats and listed threatened species, populations and ecological communities.

Biosecurity Act 2015

The *Biosecurity Act 2015* provides for modern, flexible tools and powers that allow effective, risk-based management of biosecurity in NSW. It provides a streamlined statutory framework to protect the NSW economy, environment and community from the negative impact of pests, diseases and weeds. The primary object of the Act is to provide a framework for the prevention, elimination and minimisation of biosecurity risks posed by biosecurity matter, dealing with biosecurity matter, carriers and potential carriers, and other activities that involve biosecurity matter, carriers or potential carriers.

In NSW, all plants are regulated with a general biosecurity duty to prevent, eliminate or minimise any biosecurity risk they may pose. Any person who deals with any plant, who knows (or ought to know) of any biosecurity risk, has a duty to ensure the risk is prevented, eliminated or minimised, so far as is reasonably practicable.

One priority weed was recorded in the study area. Legal requirements to minimise the potential for the introduction and/or spread of weeds as a result of the Project are discussed in Chapter 8 of this EIS.

National Parks and Wildlife Act 1974

The *National Parks and Wildlife Act 1974* (NPW Act) provides for the protection of Aboriginal objects (sites, objects and cultural material) and Aboriginal places. Under the NPW Act, an Aboriginal object is defined as: any deposit, object or material evidence (not being a handicraft for sale) relating to indigenous and non-European habitation of the area that comprises New South Wales, being habitation both prior to and concurrent with the occupation of that area by persons of European extraction, and includes Aboriginal remains.

An Aboriginal place is defined under the NPW Act as an area which has been declared by the Minister administering the Act as a place of special significance for Aboriginal culture. It may or may not contain physical Aboriginal objects.

It is an offence under Section 86 of the NPW Act to 'harm or desecrate an object the person knows is an Aboriginal object'. It is also a strict liability offence to 'harm an Aboriginal object' or to 'harm or desecrate an Aboriginal place', whether knowingly or unknowingly. Section 87 of the NPW Act provides a series of defences against the offences listed in Section 86 which includes if the harm was authorised by and conducted in accordance with the requirements of an Aboriginal Heritage Impact Permit (AHIP) under Section 90 of the NPW Act.

The potential for impacts upon Aboriginal cultural heritage has been considered in the EIS. No Aboriginal heritage items have been previously recorded in the immediate vicinity of the site and the rehabilitation activities will be undertaken entirely within the existing disturbance footprint of the quarry.

Heritage Act 1977

The *Heritage Act 1977* is concerned with all aspects of heritage conservation ranging from basic protection against indiscriminate damage and demolition of buildings and sites, through to restoration and enhancement.

Heritage places and items of particular importance to the people of NSW are listed on the State Heritage Register. Approval under section 60 of the *Heritage Act 1977* is required for any direct impacts on a state listed heritage item. Approval from the NSW Heritage Council under section 139 of the *Heritage Act 1977* is required prior to the activities likely to disturb a relic while section 140 of the *Heritage Act 1977* provides for the application for a permit.

The project will not directly impact upon the heritage significance of any listed items and the overall impact of the development is expected to be minor.

5.3.4 Statutory pathway

The project involves rehabilitating an existing quarry site and meets the definition of a resource management facility in accordance with the Lithgow LEP.

Clause 121 (3) of the Infrastructure SEPP allows for the disposal of VENM or clean fill with development consent on land where industries, extractive industries or mining are permitted with consent under any environmental planning instrument. Extractive industries are permissible at the site under the Mining SEPP. The Project is therefore permissible and a DA would be required in accordance with Part 4 of the EP&A Act.

Resource management facilities which meet a size and capacity threshold or are located in an environmentally sensitive location constitute a 'Designated Development' which requires an EIS to be prepared to support the Development Application.

Clause 32 of Schedule 3 in the EP&A Regulation defines designated development as including waste management facilities that are:

(d) that are located:

(i) in or within 100 metres of a natural waterbody, wetland, coastal dune field or environmentally sensitive area, or

(ii) in an area of high watertable, highly permeable soils, acid sulphate, sodic or saline soils, or

(iii) within a drinking water catchment, or

(iv) within a catchment of an estuary where the entrance to the sea is intermittently open, or

(v) on a floodplain, or

(vi) within 500 metres of a residential zone or 250 metres of a dwelling not associated with the development and, in the opinion of the consent authority, having regard to topography and local meteorological conditions, are likely to significantly affect the amenity of the neighbourhood by reason of noise, visual impacts, air pollution (including odour, smoke, fumes or dust), vermin or traffic.

The location of the site within close proximity of environmental sensitive Blue Mountains National Park is considered to trigger designated development provisions for the rehabilitation works.

If the Project is considered a designated development for a resource management facility, it is also defined as regional development under Clause 7 of Schedule 7 of the State and Regional Development SEPP. The development will therefore be notified and assessed by the local Council, however the consent authority is the Joint Regional Planning Panel.

A Project which requires additional licences and approvals under a range of applicable NSW legislation (e.g. an Aboriginal Heritage Impact Permit under the *National Parks and Wildlife Act, 1974*) will also be considered to be integrated development. Prior to granting development consent for the Project, the consent authority must obtain general terms of approval from each relevant approval body administering the relevant legislation.

The project requires activity approvals under Section 91 of the WM Act and is therefore considered integrated development.

6. Identification of key issues

6.1 Overview

Key issues for consideration and assessment in the EIS were identified through reviewing the Project in the context of the existing environmental setting of the site, engagement with government and community stakeholders and through a preliminary environmental risk assessment process.

6.2 Stakeholder and community engagement

A stakeholder engagement strategy has been developed for the Project and presents a framework to identify and appropriately consult with stakeholders that may be influenced by or have an interest in the Project. Consultation with a range of government and community stakeholders was incorporated into the strategy to both inform the stakeholders of the Project and to allow any issues of concern to be raised at an early stage of the planning process and incorporated into the EIS.

Key stakeholders include:

- City of Lithgow Council
- local community
- Government authorities
- Holders of surrounding mining leases.

Consultation and liaison with government agencies has been integral in refining the Project and development of the assessment method for the completion of the EIS. The Project has been developed to address government agency and community submissions in regards to development of the project.

6.2.1 Overview of stakeholder engagement

Consultation to be undertaken as part of the Project will include:

- General information provision via a community newsletter during preparation of the EIS
- A community e-mail address, for community contact and input
- Face to face meetings with government stakeholders.

The consultation undertaken to date is summarised in Table 6-1 below.

Table 6-1 Summary of consultation undertaken to date

Activity	Date	Discussion
Lithgow City Council briefing	29/09/2016	Representatives of Bell Quarry Rehabilitation Project Pty Ltd and GHD met with Lithgow City Council to introduce the Project and provide a brief background to the history of the site and the approvals pathway for the proposed development. Key issues discussed included an outline of the statutory approvals pathway, the proposed final landform, management of water discharges from the site and a need to obtain accurate boundary surveys as the land adjoins Blue Mountains National Park.
Request for SEARs	20/10/2016	Submission of Request for Secretary's Environmental Assessment Requirements and accompanying Preliminary Environmental Assessment (PEA) to the Department of Planning and Environment (DP&E). The PEA was distributed to a range of government stakeholders to provide an overview of the development and to gain input into the assessment requirements for the EIS.
OEH liaison	13/09/2017	OEH were contacted by telephone to discuss their input into the SEARs and to obtain and relevant site contacts from the National Parks and Wildlife Service (NPWS) who are responsible for management of the adjoining Blue Mountains National Park. The scale of assessment proposed to address biodiversity and Aboriginal heritage for the EIS was discussed with OEH and an invitation extended for a site briefing.
Community Newsletter	19/09/2017	A community newsletter was distributed to residents in Bell, Newnes Junction and Dargan. The newsletter was used to inform the local community of the proposed development and included contact details for further enquiries. Community feedback to the newsletter raised queries in regards to the safety, capacity and maintenance of Sandham Road, impacts upon the adjoining national park and world heritage areas, local employment opportunities, dust and the source screening requirements of the emplacement material. Issues raised in community submissions have been addressed throughout the EIS.
Blue Mountains City Council	28/09/2017	Blue Mountains City Council were notified of the proposed development as the primary haulage route along Sandham Road extends between Lithgow and Blue Mountains local government areas. Blue Mountains City Council were provided a copy of the PEA which had been distributed to other agencies as part of the request for SEARs and were invited to the government stakeholder site briefing outlined below.
Government stakeholder site briefing	10/10/2017	A site briefing was coordinated to provide government stakeholders the opportunity to view the site and provide initial feedback on the proposed development. Invitations were issued to the NPWS, OEH, EPA, Lithgow City Council and Blue Mountains City Council. NPWS and Lithgow City Council representatives attended the briefing. NPWS provided constructive comments on the project and noted the works were required to be maintained within the quarry site to avoid encroaching into NPWS land, need for comprehensive weed control program, the use of local providence seeds and plants in the

Activity	Date	Discussion
		rehabilitation program and consideration of the impact on water resources from importing fill from outside the area. Lithgow City Council raised questions in regards to the statutory planning pathway for the development and the re-iterated the need for a detailed survey of the site boundary. These issues have been addressed as part of the EIS.
Blue Mountains Councillor	20/10/2017	Telephone discussion with a Blue Mountains City Councillor who had been informed of the proposed development by constituents on Sandham Road in Bell. The discussion focused on matters including project capacity, truck movements, haulage routes, origin of the emplacement material and the timing and process for the DA submission.
Kaolin Pty Ltd	09/11/2017	A letter advising of the project and a copy of the community newsletter was issued to holder of Mining Lease 1654 and Mineral Exploration Licence 7674
Hartley Vale Coal Pty Ltd	09/11/2017	A letter advising of the project and a copy of the community newsletter was issued to holder of Coal Authorisation 307
Coalex Pty Ltd	09/11/2017	A letter advising of the project and a copy of the community newsletter was issued to holder of Mining Lease 1583

Consultation with the community and other stakeholders on the Project would be ongoing. The local community would also be asked to take part in the assessment process through the public exhibition process, whereby the community would be invited to make formal submissions on the Project EIS.

6.2.2 Secretary's Environmental Assessment Requirements

The SEARs for the preparation of an EIS for the Bell Quarry Rehabilitation Project (SEAR1105) were issued by the DP&E on the 18th of November, 2016. An outline of the key issues raised in the SEARs, together with an outline of where each issue has been addressed in the EID is presented in Table 6-2. Full consideration of the SEARS and all government agency submissions is provided in Appendix A.

Table 6-2 Secretary's Environmental Assessment Requirements

Category	Secretary's requirements	Where addressed in EIS
General	• EIS must meet the minimum form and content requirements in clauses 6 and 7 of Schedule 2 of the Environmental Planning and Assessment Regulation 2000 • assess all potential impacts of the proposed development on the existing environment (including cumulative impacts if necessary) and develop appropriate measures to avoid, minimise, mitigate and/or manage these potential impacts.	Throughout Chapter 7 to 14

Category	Secretary's requirements	Where addressed in EIS
Planning	assess the Project against the relevant environmental planning instruments, including but not limited to: – State Environmental Planning Policy (Infrastructure) 2007; – State Environmental Planning Policy (Mining, Petroleum Production and Extractive Industries) 2007; – State Environmental Planning Policy No. 33 Hazardous and Offensive Development; – State Environmental Planning Policy No. 55 Remediation of Land; – Lithgow Local Environmental Plan 2014; and – relevant development control plans and section 94 plans.	Chapter 5
Strategic context	• a detailed justification for the Project and suitability of the site for the development • a demonstration that the Project is consistent with all relevant planning strategies, environmental planning instruments, development control plans (DCPs), or justification for any inconsistencies • a list of any approvals that must be obtained under any other Act or law before the development may lawfully be carried out.	Chapter 16 Chapter 5 Chapter 5
Consultation	• consult the relevant local, State and Commonwealth government authorities, service providers and community groups, and address any issues they may raise in the EIS. In particular, you should consult with the: – Environment Protection Authority; – Office of Environment and Heritage; – Department of Primary Industries; – Roads and Maritime Services; – Water NSW; – NSW National Parks and Wildlife Services; – Lithgow City Council; – holder of Mining Lease 1654 and Mineral Exploration Licence 7674 (Kaolin Pty Ltd); – holder of Coal Authorisation 307 (Hartley Vale Coal Pty Ltd); – holder of Mining Lease 1583 (Coalex Pty Ltd); and – the surrounding landowners and occupiers that are likely to be impacted by the proposal.	Chapter 6

Category	Secretary's requirements	Where addressed in EIS
	– details of the consultation carried out and issues raised must be included in the EIS.	
Waste management	• details of the type, quantity and classification of waste to be received at the site • details of the resource outputs and any additional processes for residual waste • details of how the proposal would meet the EPAs Excavated Natural Material Order and Exemption 2014 if relevant • details of waste handling including, transport, identification, receipt, stockpiling and quality control • the measures that would be implemented to ensure that the proposed development is consistent with the aims, objectives and guidelines in the NSW Waste Avoidance and Resource Recovery Strategy 2014-21.	Chapters 4 and 14
Air quality	• a description of all potential sources of air and odour emissions • an air quality impact assessment in accordance with relevant Environment Protection Authority Guidelines • a description and appraisal of air quality impact mitigation and monitoring measures.	Chapter 10
Noise and vibration	• a description of all potential noise and vibration sources during construction and operation, including road traffic noise • a noise and vibration assessment in accordance with the relevant Environment Protection Authority Guidelines • a description and appraisal of noise and vibration mitigation and monitoring measures.	Chapter 11

Category	Secretary's requirements	Where addressed in EIS
Soil and water	• a description of local soils, topography, drainage and landscapes • an assessment of potential impacts on the quality and quantity of surface and groundwater resources • details of fill material to be imported to the site, including quantity and its waste classification • details of sediment and erosion controls • a detailed site water balance • details of the proposed stormwater and wastewater management systems (including sewage), water monitoring program and other measures to mitigate surface and groundwater impacts • a description and appraisal of impact mitigation and monitoring measures.	Chapter 7
Traffic and transport	• details of road transport routes and access to the site; • road traffic predictions for the development during construction and operation • assessment of impacts to the safety and function of the road network; and the details of any road upgrades required for the development.	Chapter 9
Biodiversity	• accurate predictions of any vegetation clearing on site or for any road upgrades • a detailed assessment of the potential impacts on any threatened species, populations, endangered ecological communities or their habitats, groundwater dependent ecosystems and any potential for offset requirements • a detailed description of the measures to avoid, minimise, mitigate and offset biodiversity impacts	Chapter 8
Visual	• an impact assessment at private receptors and public vantage points.	Chapter 14
Heritage	• consideration of Aboriginal and non-Aboriginal heritage	Chapter 12 and 13

6.3 Environmental risk assessment

A preliminary environmental risk assessment process was undertaken in conjunction with the stakeholder consultation process, with an initial assessment included in the PEA for the Project.

The analysis was undertaken in the form of a desktop review of environmental risks that may result from the activities associated with the project, then undertaking an assessment of the

risks identified. The risk assessment provided guidance on the focus of the environmental impact assessment process, and helped to streamline the level of assessment required.

Table 6-3 provides the preliminary risk assessment for the project with the following framework:

- A summary of the potential key impacts/risks
- Consideration of the priority for the assessment
- A discussion regarding the findings of the risk assessment.

Table 6-3 Preliminary environmental risk screening results

Environmental aspect	Source of risk	Potential impact	Risk rating	Discussion
Air emissions	Air emissions (dust and exhaust) during haulage and emplacement of material to the site.	Dust and exhaust emissions causing nuisance to sensitive receptors.	Moderate	Air emissions are unlikely to be more than those caused by previous quarrying activities. Implementing a management plan (covering loads, dust reduction and wetting), would minimise potential impacts on air quality. Dust and emissions would be considered as part of further assessment.
	Cumulative air emissions from the proposal site and surrounding land uses including Clarence Colliery Pit top, the Hanson Quarry.	Dust emissions causing health issues for sensitive receptors.	Moderate	The cumulative impacts of the Project in conjunction with other nearby land uses would be determined as part of further assessment. Air modelling would compare the potential emissions against the EPA's Approved Methods for the Modelling and Assessment of Air Pollutants in New South Wales (DEC, 2005). If exceedances are predicted, additional controls would be incorporated into the Project to ensure that the relevant criteria is met.
Traffic and transport	Movement of heavy vehicles during site rehabilitation activities	Increase in traffic as a result of operation impacting safety and traffic along the local road network.	High	The Project is seeking vehicle haulage of up to 140,000 tpa which is less than the approved limit for the historical quarry operations. Haulage to the site will be undertaken using "truck and trailers" with a capacity of around 30 tonnes and will result in a similar number of movements to the previous extraction operations. Haulage may be undertaken in campaigns based upon the supply of VENM and ENM from earthworks projects. The EIS will include a traffic impact assessment which considers the potential impact of the Project on the local and regional road network.
Noise	Operation of vehicles in the quarry.	Noise emissions exceeding noise limits and affecting sensitive receptors.	Moderate	Heavy machinery would be needed for the movement and shaping of fill within the quarry. Filling and shaping of pits would be within the existing quarry and shielded from sensitive receivers. Further modelling of noise impacts in accordance with the EPA's Industrial Noise Policy will be undertaken to support the EIS.

Environmental aspect	Source of risk	Potential impact	Risk rating	Discussion
	Increased movement of heavy vehicles on local roads.	Noise emissions exceeding noise limits and affecting sensitive receptors.	Moderate	Further assessment in accordance with the EPA's Road Noise Policy will be undertaken to support the EIS.
Heritage	Impacts on items of Aboriginal and non-Aboriginal heritage significance.	Encounter and disturb items of cultural heritage during construction and operation.	Negligible	Impacts on previously unidentified cultural heritage items are considered highly unlikely due to the level of disturbance at the site. In the unlikely event that items of potential heritage significance are encountered, mitigation procedures would be implemented.
	Proximity to the Blue Mountains National Park, a World Heritage site.	Works on site could negatively impact the National Park.	Moderate	The fill and rehabilitation of the quarry site would require discussions with the National Parks and Wildlife Service to prevent significant impacts beyond the existing site boundary
Chemical usage and storage	Chemicals used during the proposal (e.g. fuel).	Chemical spill or leak during transport or usage, impacting on soil, groundwater or stormwater.	Low	The proposed development is not anticipated to result in impacts from chemical or fuel usage. Standard incident management procedures would be required to address potential spills or leaks from vehicles or equipment
Soil	Erosion of soils during construction.	Sedimentation of drainage lines, erosion of the area or neighbouring National Park.	Moderate	There is potential to increase erosion due to the proposed filling of the quarry. Fill and management of the site and soil stockpiles would have to be managed to prevent potential for offsite erosion or sedimentation.
Water	Dewatering quarry voids.	Impacts upon surface water or groundwater during or after rehabilitation.	High	A water management system will be developed as part of the ongoing design of the final landform. Water in the quarry voids requires management throughout the rehabilitation process and following the establishment of the final landform. Water will be retained on site for as long as possible for use during compaction to create a stable surface and dust suppression. Appropriate management of the flow and quality of all discharges will be required as a result of the sensitive downstream environmental receivers. Detailed surface and groundwater investigations will be undertaken as part of the EIS.

Environmental aspect	Source of risk	Potential impact	Risk rating	Discussion
	Bushfire hazard.	Removal of the water source within the quarry may impact firefighting abilities	Moderate	The quarry was identified as a valuable water source for helicopter bombing during the 1994 fires in the region.
Flora and fauna	Damage to flora and fauna from equipment, vehicles, site sheds during operation.	Degradation to landscape.	High	The site has been highly modified and no endangered species have been previously identified on site. The Project would enhance the rehabilitation outcomes for the site. Downstream impacts on flora and fauna would be considered due to the proposal's changes in water movement through the site (as above). Potential presence of the Newnes Plateau Hanging Swamp downslope of the site which is classified as an endangered ecological community in accordance with State and Commonwealth legislation. Further biodiversity assessments will be undertaken as part of the EIS
Socio-economic	Import of fill.	Impacts to local community through increased noise and traffic.	Moderate	Consideration of the impacts to the local community, particularly on Sandham Road as part of an EIS. Economic justification and analysis for the proposal will also be undertaken as part of the EIS.
Visual amenity	Visibility of the proposal.	Impacts to the visual amenity of the surrounding area.	Negligible	The Project would fill and rehabilitate the site and return the landform to a condition more representative of its original condition.

7. Soil and water resources

A specialist water resources assessment has been undertaken to determine the potential impacts of the Project on soil and water resources and is presented in Appendix C. The identification of conceptual pathways that have potential to result in impacts to water resources enabled the development of a targeted assessment methodology, measures to avoid or mitigate impacts, and the monitoring programs required for the Project. The following potential impacts to surface water and groundwater systems were identified:

- Impacts to the flow regimes downstream of the site associated with altered runoff and discharge patterns from the site
- Impacts to the stability and geomorphology of the tributary of the Wollangambe River located downstream of the Site through alteration of flow regimes
- Impacts to surface water and groundwater quality downstream of the associated with rainfall and run-off coming into contact with emplaced material prior to discharging from the site or infiltration to groundwater.

7.1 Existing environment

7.1.1 Soils

A search of the NSW government 'eSPADE 2' website (OEH 2016) was conducted to establish the existing soil landscapes in the vicinity of the site. The site and the surrounding areas are composed of the following three soil landscapes:

- Disturbed terrain – comprises the majority of the site due to the historical quarrying activities. The original soil has been removed, greatly disturbed, or buried. The original vegetation has been completely cleared.
- Medlow Bath – comprises the northern area of the site, where there are moderately deep (<100 cm) yellow earths and earthy sands on the sideslope. Acidic soils with a high potential for aluminium toxicity.
- Wollangambe – comprises the area to the north east of the site, where there are moderately deep (<100 cm) earthy sands, yellow earths and red earths on the sideslope to the north of the tributary of the Wollangambe River.

7.1.2 Hydrology

The site is located within the upper reaches of the Wollangambe River catchment. This river drains towards the east where it eventually drains into the Colo River which forms part of the broader Hawkesbury-Nepean catchment area.

The quarry was progressively developed in a series of eight cells, isolated from adjacent cells by *in-situ* sandstone barriers. The quarry now contains three large voids which are partially filled with water as shown in . The north and the south voids are connected, forming one large water body which overflows to the east void.

The voids receive a mixture of runoff from adjacent areas and groundwater inflows, as evidenced by seepage from the void walls. Surface runoff in some areas of the site is diverted away from the voids towards the east.

LEGEND

- Bell Quarry site
- Rail
- Waterways
- Flow Duration and Flow Proportion Assessment Locations
- Flow Proportion Assessment Locations

Paper Size A4

0 40 80 160 240 320 400

Metres

Map Projection: Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 MGA Zone 56

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Receiving Waters

Figure 7-1

Level 3, GHD Tower, 24 Honeysuckle Drive, Newcastle NSW 2300 **T** 61 2 4979 9999 **F** 61 2 4979 9988 **E** ntlmail@ghd.com **W** www.ghd.com.au

G:\21\25774\GIS\Maps\Deliverables\21_25774_Z012_EIS_WaterAssessmentLocs.mxd

Data source: LPI: Aerial imagery, 2015. Commonwealth of Australia (Geoscience Australia): 250K Topographic Data Series 3, 2006. LPI: DTDB, 2015. Created by: tmorton, gmcdiarmid

An ephemeral tributary of the Wollangambe River runs in a north-easterly direction through the project site, with its headwaters in the vicinity of the rail line upstream of the site. Surface flows from this area of the catchment now enter the site at the western edge of the north void, where some erosion from high flow events is evident. Water is discharged from the site through an established sediment basin on the eastern edge of the site. The sediment basin contains considerable reed growth and aquatic vegetation and discharges into a drainage line that forms a continuation of the ephemeral tributary downstream of the site.

Approximately 200 metres downstream of the site the drainage line enters a swamp where flows are predominantly subsurface under dry weather conditions. The swamp occupies the majority of the drainage line upstream of the confluence with a similar tributary, which runs to the north of the site. Downstream of this confluence the tributary enters a meandering reach which is somewhat confined by sandstone outcropping, which continues for approximately 1.5 kilometres before the confluence with the Wollangambe River.

Water from this drainage line eventually enters the Wollangambe River, about 1.5 kilometres from the project site. The Wollangambe River winds eastwards through narrow canyons and is one of four major tributaries of the Colo River.

The Wollangambe River, between its confluences with Bungleboori Creek and Colo river, forms part of the declared Colo Wild River (DECC 2008). The upper reaches of the Wollangambe River near Clarence Colliery are not part of the declared area as these areas have been disturbed by historic mining (DECC 2008).

7.1.3 Groundwater

Due to the depths of the site voids, seepage of groundwater into the voids results in the surface water and groundwater environments at the site being interrelated. Groundwater from upstream of the site influences the quality and quantity of water in the voids, and likewise, the quality of the surface water at the site is predicted to influence the groundwater quality downstream of the site.

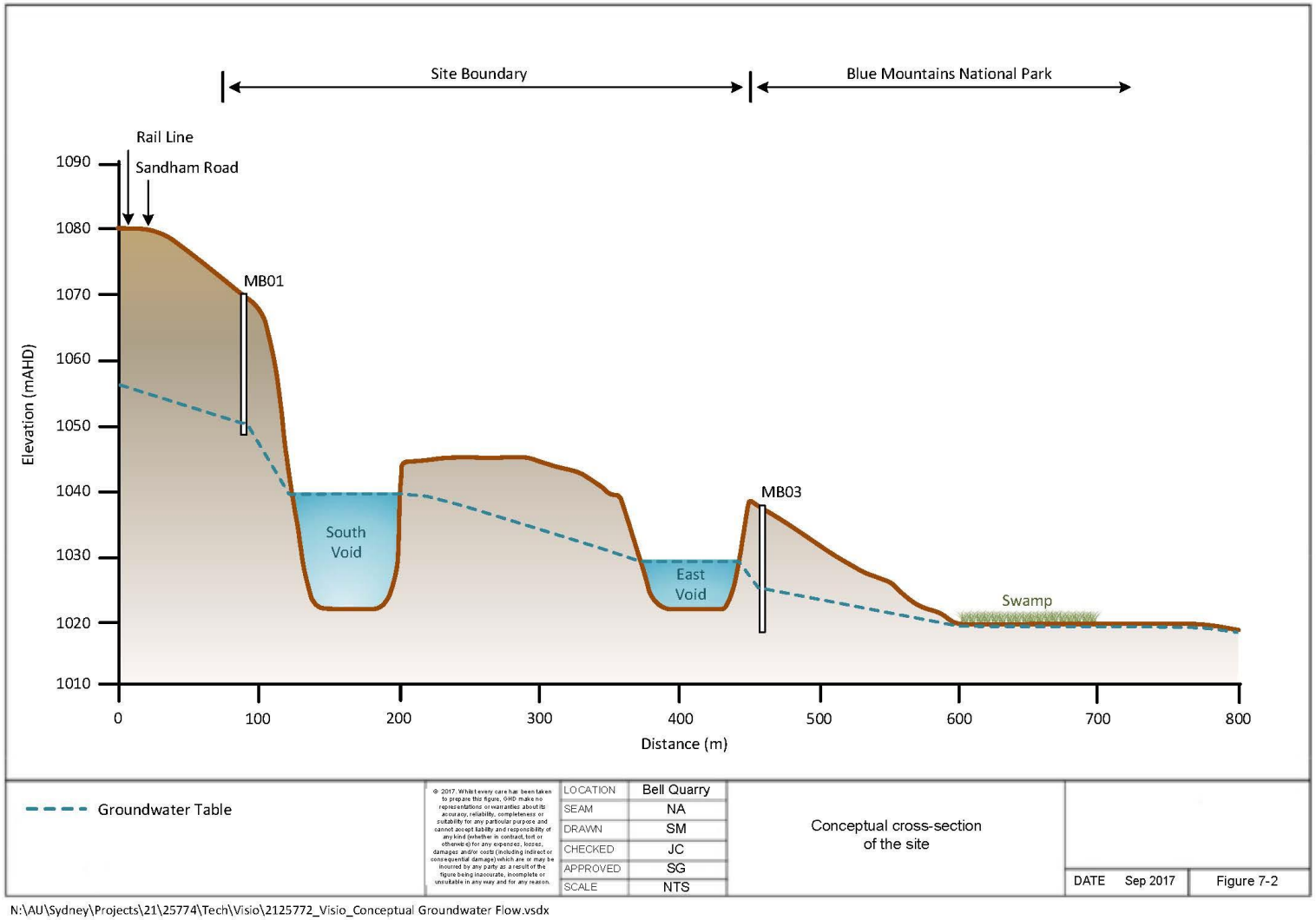
Three groundwater wells were installed on the site on the 15 and 31 August 2017. Groundwater elevations calculated based on surface elevation and gauged depth to water are presented in Table 7-1 (in mAHD). These data indicate groundwater at the site flows to the north east, in the direction of the tributary as shown on the conceptual cross section on Figure 7-2.

The water level observed in MB01 was higher than the surface water level in the north and south voids (approximately 1041 m AHD), which indicates that the site voids intercept groundwater from upgradient areas. Hydraulic gradients between MB01 and the south void, and the east void and MB03 were estimated to be 0.11 and 0.51 respectively.

Table 7-1 Groundwater levels, 15 and 31 August 2017

Site	Surface elevation (m AHD)	Total depth (m BGL)	Standing Water Level (m BGL)	Groundwater Elevation (m AHD)
MB01	1067.6	21.5	19.3	1048.3
MB02	1043.8	28.0	17.5	1026.3
MB03	1038.1	23.3	12.8	1025.3

Figure 7-2 Conceptual cross section of the site



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NSW bore database search

A search of the NSW bore database revealed two registered bores within a 1 km radius of the site. These bores lie to the north west and north of the site and available information for these bores, including the standing water level (SWL) and water bearing zone (WBZ) is presented in Table 7-2.

Minimal data was available on the bore to the north of the site, which was designated as a monitoring bore. The data for GW103734, which lies approximately 600 metres to the north west of the site, indicate that groundwater in the general area is likely to be accessible at around 21 mBGL, though with a low yield (0.25 L/s).

Table 7-2 Registered groundwater bores within 1 km of the site.

Bore	Depth (m)	Purpose	SWL (mBGL)	Yield (L/s)	WBZ	Screened depth (mBGL)
GW103734	104	Stock, domestic	21	0.25	100-104	100-104
GW113278	-	Monitoring bore	-	-	-	-

Groundwater dependant ecosystems

Groundwater Dependent Ecosystems (GDEs) mapped by BoM (2017) in the vicinity of the site are shown in Figure 7-3. The following terrestrial GDEs are present within 3 kilometres of the site:

- Exposed Blue Mountains Sydney Peppermint - Silver-top Ash Shrubby Woodland
- Newnes Sheltered Peppermint – Brown Barrel Shrubby Forest
- Newnes Plateau Narrow-leaved Peppermint – Silver-top Ash Layered Open Forest
- Newnes Plateau Shrub Swamp
- Tableland Mountain Gum – Snow Gum – Daviesia Montane Open Forest.

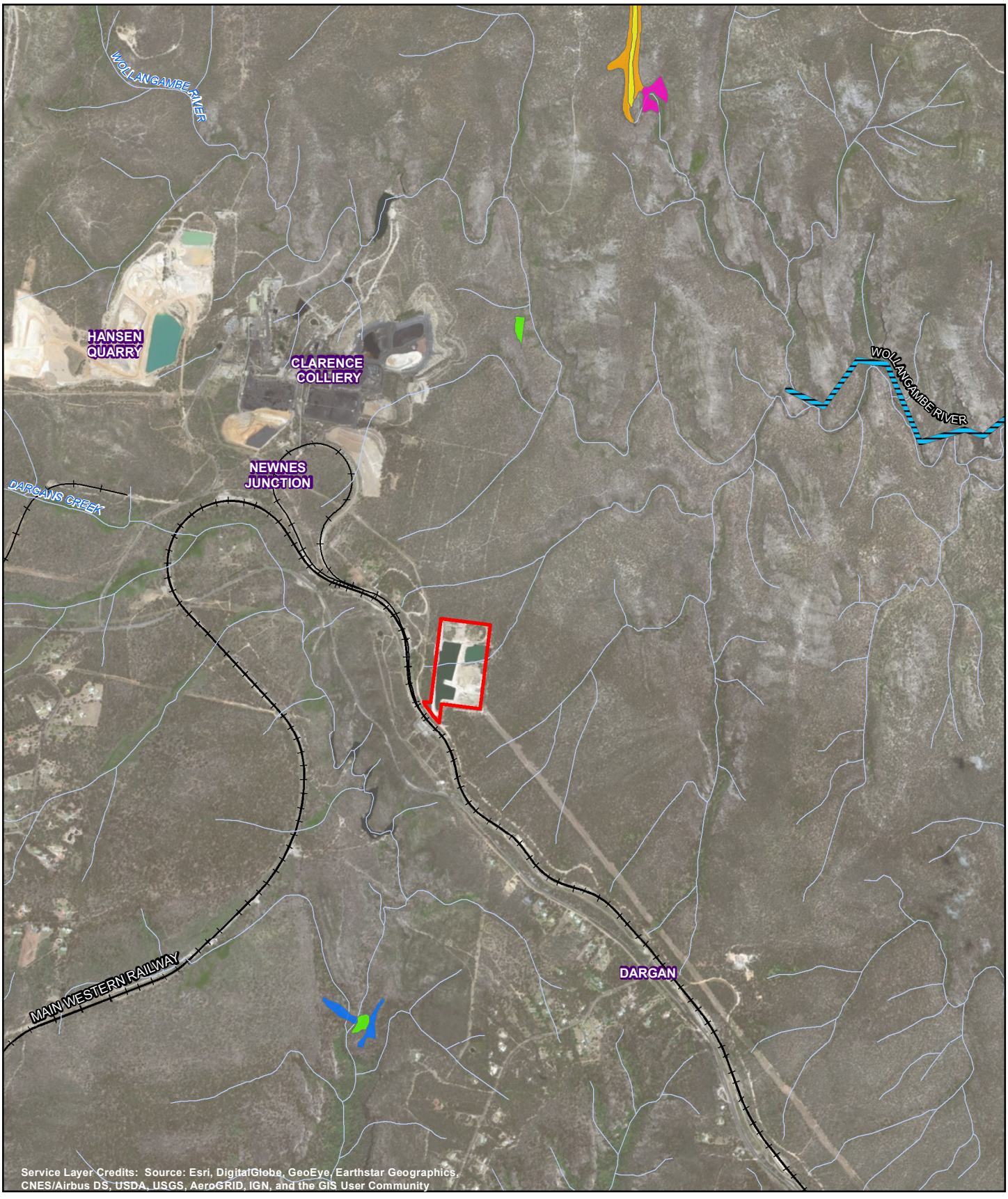
The Wollangambe River is mapped as an aquatic GDE downstream of the confluence of the tributary which receives runoff from the site. Other GDE's included on the BOM (2017) mapping are not located in the same catchment and are therefore not considered to have potential to interact with groundwater from the Bell Quarry site.

It is noted that the Biodiversity assessment completed as part of this EIS has identified the swamp area located 200 metres downstream of the site to be representative of the Newnes Plateau Shrub Swamp. The swamp has therefore been considered as a GDE for the purpose of this assessment.

7.1.4 Geomorphic condition

The current quarry configuration intercepts surface water and groundwater within the voids, which are subject to evaporation losses and discharges to the downstream tributary. There is currently no management of the voids with respect to water and discharge from the site only occurs when the balance of rainwater, groundwater flow and evaporation are such that the voids are full and overflowing.

Prior to the commencement of quarry operations, rainfall would result in regular run-off from the site as natural catchment runoff. However, run-off from the existing site is intermittent, only occurring approximately 50% as the existing quarry voids will capture all run-off from small to moderate rainfall events. However, during very high rainfall periods runoff from the existing site is greater than the natural condition as when the quarry voids are full of water, it results in a higher proportion of rainfall being converted to runoff and discharge from the site than under natural conditions.



LEGEND

- Bell Quarry site
- Rail
- Waterways

Groundwater dependent ecosystem

- Exposed Blue Mountains Sydney Peppermint - Silver-top Ash Shrubby Woodland
- Newnes Sheltered Peppermint - Brown Barrel Shrubby Forest
- Newnes Plateau Narrow-leaved Peppermint - Silver-top Ash Layered Open Forest
- Newnes Plateau Shrub Swamp
- Tableland Mountain Gum - Snow Gum - Daviesia Montane Open Forest
- Aquatic

Paper Size A4

0 95 190 380 570 760 950

Metres

Map Projection: Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 MGA Zone 56

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Groundwater Dependent Ecosystems

Figure 7-3

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Level 3, GHD Tower, 24 Honeysuckle Drive, Newcastle NSW 2300 **T** 61 2 4979 9999 **F** 61 2 4979 9988 **E** ntlmail@ghd.com **W** www.ghd.com.au

Data source: LPI: Aerial imagery, 2015. Commonwealth of Australia (Geoscience Australia): 250K Topographic Data Series 3, 2006. LPI: DTDB, 2015. Created by: tmorton, gmcdiarmid

A site inspection of the waterways downstream of the site was undertaken by a GHD water resources engineer to review the general condition of the waterway. The site inspection revealed that the downstream waterways are generally undisturbed by land disturbance activities with natural stream bed formation, bank formation and thick and well established vegetation. One exception to the above is in the area immediately downstream of the site where historical filling, clearing and revegetation processes appear to have been undertaken, however this disturbance appears to extend only a short distance (less than 100 metres) downstream of the site.

Reaches consist of swamp areas, often with a small, defined, naturally incised channel surrounded by a larger swamp area with shallow groundwater flow and moisture evident. Other areas consist of steeper overbank areas with smaller swamp areas and a defined, naturally incised channel. No significant waterway erosion was observed and bedrock controls were identified in some locations.

Shallow pools were observed and in some locations were flowing at the time of the site inspection. This flow is likely to be due to discharge of shallow groundwater into the waterways from upstream swamp areas.

In general, downstream reaches were found to be in very good condition with regards to waterway stability. They are anticipated to have a relatively high resistance to geomorphologic change due to a stable stream profile and thick, established vegetation throughout.

7.1.5 Water Quality

Wollangambe River catchment

Existing baseline water quality in receiving waters is influenced by the surrounding landuse in the catchment. Surrounding land uses influencing water quality include the villages of Newnes Junction, Dargan and Clarence, Chifley Road, the Main Western Railway, the Clarence Colliery pit top, rail loop and loading facilities and the Hanson Kables Sand Quarry.

The existing surface water quality in the Wollangambe River upstream of the site was established using water quality data reported in OEH (2015). OEH assessed the impact of the Clarence Colliery discharge on the Wollangambe River based on water quality sampling at locations upstream and downstream of the discharge. Key results from OEH (2015) have been presented in Table 7-3, with Site W1 located approximately 1.2 km upstream of the Clarence Colliery discharge and site W10 is approximately 1.9 km downstream of the discharge.

The Wollangambe River becomes substantially more saline downstream of the Clarence Colliery discharge, with EC increasing by a factor of ten. The ionic balance changes from that observed upstream, from ionically dilute water dominated by sodium and chloride, to calcium sulfate dominated water. Chloride and sodium concentrations decreased between W1 and W10. There were multiple exceedances of the adopted ANZECC (2000) Guideline Values (GVs), though many were due to the Level of Recording (LORs) of the analysis methodologies that were used by OEH (2015). These 'default' exceedances were observed for both sites for concentrations of dissolved arsenic, cadmium, chromium, and total nitrogen. Additionally, the LOR for nitrate, and nitrite plus nitrate nitrogen (NO_X) exceeded the relevant GV, though the concentration observed at W10 was at this LOR.

The concentration of dissolved aluminium exceeded the GV at W1, and dissolved iron concentration was also elevated at this location. This may have been an influence of the local sandstone, or potentially from the nearby Hanson Kables Sand Quarry, noting that that site holds an EPL allowing for a discharge to water. Dissolved aluminium at W10 also exceeded the GV, though it is noted that the concentration was below the LOR. Dissolved iron was also below the LOR at W10. Dissolved concentrations of nickel and zinc exceeded the relevant GVs at

W10. Dissolved zinc also exceeded the GV at W1, though at a concentration less than a third of that observed at W10.

These results indicate that the principal impacts of the surrounding land use on water quality in the Wollangambe River are:

- Increased salinity
- Increased concentrations of the major ions bicarbonate, sulfate, calcium, magnesium and potassium.
- Decreased concentrations of the major ions chloride and sodium
- Increased concentrations of heavy metals nickel and zinc
- Decreased concentrations of metals aluminium and iron.

Table 7-3 Water quality data for the Wollangambe River upstream and downstream of the Clarence Colliery discharge (OEH 2015).

Analyte/analyte grouping	Units	W1 13/11/2014	W10 13/11/2015	ANZECC (2000) GVs
Physicochemical parameters				
EC	µS/cm	32	320	30 - 350
Major cations and anions				
Total Alkalinity as $CaCO_3$	mg/L	<6	29	NA
Sulfate as SO_4	mg/L	1.1	120	NA
Chloride	mg/L	7.1	3.9	NA
Calcium	mg/L	0.48	37	NA
Magnesium	mg/L	0.57	11	NA
Sodium	mg/L	3.9	3.1	NA
Potassium	mg/L	0.2	3.6	NA
Dissolved metals				
Aluminium	mg/L	**0.06**	**<0.04**	0.027
Arsenic	mg/L	**<0.001**	**<0.001**	0.0008 (AsV)
Cadmium	mg/L	**<0.0001**	**<0.0001**	0.00006
Chromium	mg/L	**<0.001**	**<0.001**	0.00001 (CrVI)
Copper	mg/L	<0.0005	<0.0001	0.001
Iron	mg/L	1.4	<0.03	NA
Lead	mg/L	<0.0001	<0.0005	0.001
Manganese	mg/L	0.25	0.24	1.2
Nickel	mg/L	0.0015	**0.037**	0.008
Zinc	mg/L	**0.0056**	**0.019**	0.0024
Mercury	mg/L	<0.00005	<0.00005	0.00006
Nutrients				
Ammonia as N	mg/L	0.02	0.01	0.32
NOx	mg/L	**<0.02**	**0.02**	0.015
TKN	mg/L	<0.2	0.02	NA
Total nitrogen as N	mg/L	**<0.3**	**<0.3**	0.25
Total phosphorous as P	mg/L	<0.015	<0.015	0.02
Reactive phosphorous as P	mg/L	<0.003	0.004	0.015

Orange bold denotes exceedances of the ANZECC (2000) GVs

Bell quarry and tributary

The existing surface water quality at the site and immediate receiving waters was established based on sampling performed during a site visit on 9 March 2017. The following sites were sampled:

- North void – grab samples were collected at the northeast corner of the north void, where it discharges to the east void.
- East void – grab samples were collected at the southeast corner of the east void, where it discharges to a small pond.
- Site discharge – grab samples were collected at the northeast corner of the sediment basin where water is discharged from the site into the tributary of the Wollangambe River.
- Tributary – grab samples were collected from the tributary approximately 100 m downstream of the site discharge, upstream of the swamp
- Tributary DS – grab samples were collected for the tributary downstream of its confluence with a similar tributary which has headwaters to the north of the site.

Water quality results are presented Table 7-4 and show that the water at all sites sampled was ionically dilute, with all EC values being below 35 µS/cm. The exposed rock surfaces at the site and the contribution of groundwater seepage to surface water flow appears to slightly increase salinity in the catchment, as the site Tributary DS, which receives inputs from the relatively unimpacted tributary to the north, had the lowest EC of all sites.

The pH results indicated that surface water in the catchment is naturally slightly acidic, with all sites except the North void having a pH below the lower ANZECC (2000) GV.

TSS was below the LOR at each site, indicating that little sediment is transported by surface flows in the catchment under baseflow conditions.

Dissolved metal concentrations were generally low and there were no exceedances of the ANZECC (2000) GVs for the protection of 99 percent of aquatic species. Aluminium was elevated at sites Tributary and Tributary DS, indicating the influence of the local lithology, though as pH was below 6.5 at these sites there was no exceedance of the GV.

Table 7-4 Surface water quality results, 9 March 2017.

Analyte/analyte grouping	Units	LOR	North void	East void	Site discharge	Tributary	Tributary DS	ANZECC (2000) GVs
Physicochemical parameters								
pH	pH unit	0.01	7.19	**6.33**	**6.22**	**5.36**	**5.73**	6.5 – 8.0
EC	µS/cm	1	32.4	32.3	32.0	34.3	**29.5**	30 - 350
TSS	mg/L	5	<5	<5	<5	<5	<5	NA
Major cations and anions								
Total Alkalinity as $CaCO_3$	mg/L	1	5	3	4	2	2	NA
Sulfate as SO_4	mg/L	1	2	2	2	2	2	NA
Chloride	mg/L	1	5	5	3	4	4	NA
Calcium	mg/L	1	<1	<1	<1	<1	<1	NA
Magnesium	mg/L	1	<1	<1	<1	<1	<1	NA
Sodium	mg/L	1	3	3	3	3	3	NA
Potassium	mg/L	1	<1	<1	<1	<1	<1	NA
Dissolved metals								
Aluminium	mg/L	0.005	0.007	<0.005	<0.005	0.068	0.048	0.027
Arsenic	mg/L	0.0002	0.0003	0.0002	0.0002	<0.0002	<0.0002	0.0008 (AsV)
Cadmium	mg/L	0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	0.00006
Chromium	mg/L	0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	0.00001 (CrVI)
Copper	mg/L	0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	0.001
Iron	mg/L	0.002	0.025	0.014	0.135	0.025	0.034	NA
Lead	mg/L	0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	0.001
Manganese	mg/L	0.0005	0.0021	0.0046	0.143	0.0024	0.0027	1.2
Nickel	mg/L	0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	0.008
Zinc	mg/L	0.001	<0.001	<0.001	0.001	<0.001	<0.001	0.0024
Mercury	mg/L	0.00004	<0.00004	<0.00004	<0.00004	<0.00004	<0.00004	0.00006
Nutrients								
Ammonia as N	mg/L	0.01	0.04	0.02	<0.01	<0.01	0.02	0.32
Nitrite as N	mg/L	0.01	<0.01	<0.01	<0.01	<0.01	<0.01	NA
Nitrate as N	mg/L	0.01	**0.04**	**0.03**	**0.02**	**0.03**	**0.04**	0.017
NOx	mg/L	0.01	**0.04**	**0.03**	**0.02**	**0.03**	**0.04**	0.015
TKN	mg/L	0.1	0.2	0.1	0.2	<0.1	<0.1	NA

Analyte/analyte grouping	Units	LOR	North void	East void	Site discharge	Tributary	Tributary DS	ANZECC (2000) GVs
Total nitrogen as N	mg/L	0.1	0.2	0.1	0.2	<0.1	<0.1	0.25
Total phosphorous as P	mg/L	0.01	<0.01	<0.01	<0.01	<0.01	<0.01	0.02
Reactive phosphorous as P	mg/L	0.01	<0.01	<0.01	<0.01	<0.01	<0.01	0.015
Other								
DOC	mg/L	1	5	4	4	1	1	NA
PAHs								
Naphthalene	mg/L	0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.0025
Sum of PAHs	mg/L	mg/L	0.0005	<0.0005	<0.0005	<0.0005	<0.0005	NA
Total Petroleum Hydrocarbons								
C10 - C36 Fraction (sum)	mg/L	0.05	<0.05	<0.05	<0.05	<0.05	<0.05	NA
Total Recoverable Hydrocarbons								
>C10 - C40 Fraction (sum)	mg/L	0.1	<0.1	<0.1	<0.1	<0.1	<0.1	NA
BTEXN								
Benzene	mg/L	0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.600
meta- & para-Xylene	mg/L	0.002	<0.002	<0.002	<0.002	<0.002	<0.002	0.140 (p-xylene)
ortho-Xylene	mg/L	0.002	<0.002	<0.002	<0.002	<0.002	<0.002	0.200
Sum of BTEXN	mg/L	0.001	<0.001	<0.001	<0.001	<0.001	<0.001	NA

- **Orange bold** denotes exceedances of the ANZECC (2000) GVs

Nutrient concentrations were generally low, though the concentrations of nitrate (a potential toxicant) and NOx (considered a chemical stressor) exceeded the relevant ANZECC (2000) GVs at all sites. This is likely to be a result of habitation of the voids by bird species and decomposition of stream detritus in the downstream tributary.

Within the site footprint, this may have been indicative of inhabitation of the standing water bodies by bird species, and also some algal activity, noting that the limited shading of the voids may at times lead to eutrophication. Downstream of the Site, the observed nitrate concentrations are more likely to have been the result of the decomposition of stream detritus.

There were no detectable (> LOR) concentrations of PAHs, TPH/TRH, or BTEXN at any site, indicating that there is no pre-existing contamination of the Site with organic toxicants.

Groundwater

Sampling of the groundwater was undertaken in March 2018 to gain representative groundwater data at the site. Samples were only able to be obtained from MB02 and MB03 as MB01 was dry at the time, with the water quality results are presented in Table 7-5. In summary, the results indicate background groundwater to be:

- Slightly acidic pH ranging 5.0-6.0
- Freshwater quality (<100 µS/cm)
- Low alkalinity (<50 mg/L as $CaCO_3$)
- Soft water (<50 mg/L as $CaCO_3$)
- Low metal concentrations with detection of aluminium, copper, manganese and zinc attributed to the host sandstone rock.

Table 7-5 Groundwater quality results, March 2018

Analyte/analyte grouping	Units	LOR	MB01	MB02	MB03	ANZECC (2000) GVs
pH (field)	pH units	0.01	-	**5.91**	**5.05**	6.5 - 8.0
pH (lab)	pH units	0.01	-	6.74	**5.92**	6.5 - 8.0
EC (field)	µS/cm	1	-	55.1	45.5	30 - 350
EC (lab)	µS/cm	1	-	65	52	30 - 350
Bicarbonate Alkalinity as $CaCO_3$	mg/L	1	-	21	8	NA
Total Alkalinity as $CaCO_3$	mg/L	1	-	21	8	NA
Sulfate as SO_4	mg/L	1	-	3	3	NA
Chloride	mg/L	1	-	5	5	NA
Calcium	mg/L	1	-	2	<1	NA
Magnesium	mg/L	1	-	<1	<1	NA
Sodium	mg/L	1	-	7	3	NA
Potassium	mg/L	1	-	1	2	NA
Aluminium	mg/L	0.005	-	0.011	0.019	0.027
Iron	mg/L	0.002	-	0.042	0.018	NA
Arsenic	mg/L	0.0002	-	<0.0002	<0.0002	0.0008 (AsV)
Cadmium	mg/L	0.00005	-	<0.00005	0.00006	0.00006
Chromium	mg/L	0.0002	-	<0.0002	<0.0002	0.00001
Copper	mg/L	0.0005	-	**0.0024**	**0.0089**	0.001
Lead	mg/L	0.0001	-	<0.0001	0.0002	0.001
Manganese	mg/L	0.0005	-	0.192	**1.66**	1.2
Nickel	mg/L	0.0005	-	0.001	0.0025	0.008

Analyte/analyte grouping	Units	LOR	MB01	MB02	MB03	ANZECC (2000) GVs
Zinc	mg/L	0.001	-	**0.039**	**0.043**	0.0024
Mercury	mg/L	0.0001	-	**0.00007**	**0.00027**	0.00006

Orange bold denotes exceedances of the ANZECC (2000) GVs

7.2 Impact assessment

7.2.1 Scope of Assessment

Methodology

The scope of the water resources assessment is to determine the potential impacts on surface water and groundwater resources in the vicinity of the proposed rehabilitation activities. The detailed methodology and assumptions is included in Section 3 of Appendix C of the EIS, with an overview of the basis of the assessment described below.

Water balance investigations were undertaken to assess the transfer of water flows within the site and the volume of water being discharged for each stage of the rehabilitation project. The water balance modelling was used as the basis for considering potential impacts upon the instream geomorphology of the receiving water and to determine the proportion of water that would be able to potentially come into contact with emplaced material as input to the water quality modelling.

Water quality modelling was subsequently undertaken to determine the potential for impacts upon surface and groundwater quality associated with importing clean fill material for use in the rehabilitation of the quarry site. The analysis was undertaken using the maximum average concentrations from Table 4 of the NSW ENM order (EPA 2014b), which forms the acceptance criteria for material brought to site as shown in Table 7-6.

Table 7-6 Limiting concentrations in ENM as per the ENM order (EPA 2014b)

Chemicals and other attributes	Maximum average concentration for characterisation (mg/kg 'dry weight' unless otherwise specified)	Absolute maximum concentration (mg/kg 'dry weight' unless otherwise specified)
1. Mercury	0.5	1.0
2. Cadmium	0.5	1.0
3. Lead	50	100
4. Arsenic	20	40
5. Chromium (total)	75	150
6. Copper	100	200
7. Nickel	30	60
8. Zinc	150	300
9. Electrical Conductivity	1.5 dS/m	3 dS/m
10. pH *	5 to 9 pH units	4.5 to 10 pH units
11. Total PAHs	20	40
12. Benzo(a)pyrene	0.5	1.0
13. Benzene	NA	0.5
14. Toluene	NA	65
15. Ethyl-benzene	NA	25
16. Xylene	NA	15
17. TPH C10-C36	250	500
18. Rubber, plastic, bitumen, paper, cloth, paint and wood	0.05 %	0.10 %

* The ranges given for pH are for the minimum and maximum acceptable pH values in the excavated natural material.

The potential surface water discharge quality from the site during the rehabilitation stages was estimated using the USEPA soil-water partition equation (USEPA 1996), which is an industry standard equation for estimating the potential migration of inorganic and organic substances in soils.

The modelling is noted to be conservative as it accounted only for the effect of mixing, and not for that of attenuation of substance concentrations through reactions such as oxidation, precipitation and adsorption.

Representative samples of soil / rock from a range of geological landscapes in the Sydney region were also analysed using Australian Standard Leaching Potential (ASLP) tests and used as input into the geochemical modelling. The ASLP tests are also considered conservative and the leachate would not be considered representative of run-off from the emplacement material due to the exposure time and agitation involved in the test method.

Geochemical modelling of groundwater was also undertaken to predict the migration of water quality parameters to the swamp located down the hydraulic gradient from the site. Modelling was undertaken using both the calculated soil: water partition concentrations and the average ADE ASLP data in accordance with the assessment of surface water discharges.

Following the completion of the geochemical modelling, an additional analytical fate and transport model, coupled with a mass flux assessment, was completed as a further line of evidence to understand the potential for impacts on the down gradient swamp water quality.

Guidelines

Water quality results obtained from the water quality modelling were compared against the ANZECC (2000) Guideline Values and the NSW Aquifer Interference Policy.

The Australian and New Zealand Guidelines for Fresh and Marine Water Quality (ANZECC 2000) is a benchmark document of the NWQMS which provides a guide for assessing and managing ambient water quality in a wide range of water resource types and according to specified environmental values, such as aquatic ecosystems, primary industries, recreation and drinking water. ANZECC (2000) provide a framework for determining appropriate guideline values or performance criteria to evaluate the results of water quality monitoring programs.

The ANZECC Guidelines present numerical guidelines which can be used as a basis to assess the impact of the rehabilitation of Bell Quarry against defined objectives or values for the receiving waters.

The core concept of the ANZECC Guidelines relates to managing water quality for environmental values. For each environmental value, the guidelines identify particular water quality characteristics or 'indicators' that are used to assess whether the condition of the water supports that value. The environmental values expressed as water quality objectives provide goals to assist in the selection of the most appropriate management options within a catchment.

The environmental values expressed as water quality objectives provide goals to assist in the selection of the most appropriate management options within a catchment. The ANZECC Guidelines also advocate an 'issues-based' approach to assessing ambient water quality, rather than the application of rigid numerical criteria without an appreciation of the context. This means that the guidelines focus on:

- the environmental values we are seeking to achieve or maintain;
- the outcomes being sought; and
- the ecological and environmental processes that drive any water quality problem.

It should also be noted that the environmental values and respective numerical indicator values apply to ambient background water quality and are not intended to be applied to stormwater discharges or mixing zones associated with a release from a final sediment basin for an industry. Discharges from the Bell Quarry site therefore need to be considered in recognition of other land uses within the catchment which also influence water quality.

Default ANZECC Guidelines trigger values for physical and chemical stressors applicable to the Bell Quarry site and adopted in this assessment are shown in Table 7-7. It is emphasised that these default trigger values are guideline values or water quality objectives only, and are not compliance standards.

Table 7-7 ANZECC (2000) GVs applicable to the Bell Quarry site.

Parameter	Units	ANZECC (2000) GV
Default GVs for physical and chemical stressors		
Total phosphorous	mg/L	0.020
Reactive phosphorous	mg/L	0.015
Total nitrogen	mg/L	0.250
Nitrite and Nitrate	mg/L	0.015
Ammonia	mg/L	0.013
Dissolved Oxygen	% saturation	90 - 110
pH	pH unit	6.5 – 8.0
Default GVs for conductivity and turbidity		
EC	µS/cm	30 - 350
Turbidity	NTU	25
GVs for substances at the 99% protection level.		
Aluminium	mg/L	0.027
Arsenic	mg/L	0.0008
Cadmium	mg/L	0.00006
Chromium	mg/L	0.00001
Copper	mg/L	0.001
Lead	mg/L	0.001
Manganese	mg/L	1.2
Nickel	mg/L	0.008
Zinc	mg/L	0.0024
Mercury	mg/L	0.00006
Ammonia	mg/L	0.32
Naphthalene	mg/L	0.0025
Benzene	mg/L	0.600
Meta- & para-Xylene	mg/L	0.140
Ortho-Xylene	mg/L	0.200

The NSW Aquifer Interference Policy states that any change in the groundwater quality should not lower the beneficial use category of the groundwater source beyond 40 m from the activity. It is considered that the beneficial use category of groundwater at the site is environmental protection. Therefore, a change in groundwater quality is acceptable provided that it does not result in water quality impacts to surface water receptors. The immediate receptor has been identified as a swamp located approximately 200 m down-hydraulic gradient from the site.

7.2.2 Water Balance

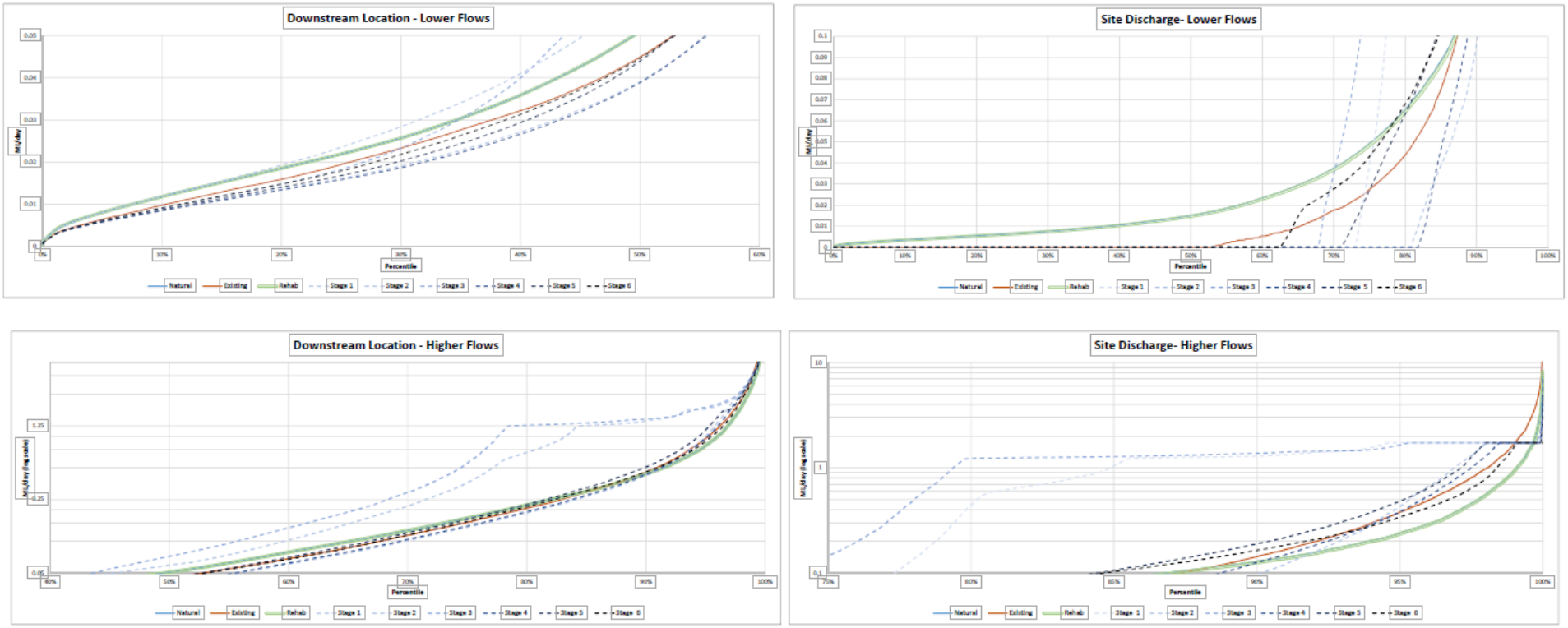
The volumetric results of the water balance for each stage of the rehabilitation project are shown in Section 5 in Appendix C of this EIS. The results include minimum, average and maximum volumes correspond to the different simulations for different rainfall series, thereby providing an indication of the range of potential values depending on the actual rainfall conditions. Key outcomes of the results are as follows:

- Direct rainfall on the voids, catchment runoff and groundwater inflow occur throughout the different stages at varying volumes depending primarily on catchment areas. Evaporation also occurs throughout the stages generally at a similar rate to direct rainfall.
- A net groundwater inflow occurs in all stages of operations, and at a greater rate during stages where void water levels are maintained low.
- Dust suppression is a significant outflow from the system, particularly for voids with a larger application area, such as the East Void during later stages.
- Key features of each stage are as follows:
  - Stage 1: The dewatering of South Void and partial dewatering of the Main Void with a net excess of outflows over inflows propagating through the system to the discharge point.
  - Stage 2: The South Void is maintained empty to allow extraction. The Main Void and East Void are generally maintained at their current level.
  - Stage 3: The dewatering of the Main Void with a net excess of outflows over inflows propagating through the system to the discharge point.
  - Stage 4: The Main Void is maintained empty to allow extraction. The East Void is maintained at its current level.
  - Stage 5: The Main Void is maintained empty to allow extraction. The dewatering of the East Void with a net excess of outflows over inflows propagating through the system to the discharge point.
  - Stage 6: The East Void is maintained empty to allow extraction.

A flow duration assessment was undertaken to determine the impact of the water transfers within the site on flow rates at the site discharge and downstream in the tributary as shown in Figure 7-4. For the purpose of clarity the results are separated into lower flows and higher flows, with higher flows indicated on a logarithmic scale.

Figure 7-4 Flow duration results

Figure 7-4: Flow Duration Results



Key results from the flow duration assessment are as follows for the site discharge location:

- The flow regimes after rehabilitation of the area generally restore natural conditions.
- The existing conditions result in less frequent flows than the natural scenario, with peak flows during heavy rainfall increasing compared to the natural scenario.
- The occurrence of flow is less frequent for all stages than for the existing or natural/rehabilitated scenarios. This is due to dewatering during the project reducing the overflow frequency from the system compared to existing. This impact is most significant during stages where voids are maintained empty such as Stage 4 when no flow occurs approximately 86% of the time.
- Moderate flows are more regular during stages involving dewatering (particularly Stage 3). This is due to dewatering and discharge occurring at a higher frequency than the existing or natural discharges. The existing voids will be dewatered at moderate flow rates of between 1 and 2 ML/day, which is considerably less than current discharges associated with storm flows during wet weather events of up to 10 ML/day.
- All of the effects subside considerably for the downstream location, which receives flows from a wider catchment area

In summary, the proposed project will alter the flow regimes temporarily, including less frequent low flows and more frequent moderate flows, during the life of the project. However, after completion of the project and rehabilitation flows will generally be restored to natural conditions and will be significantly closer to natural conditions than is currently the case.

7.2.3 Geomorphic conditions

The tributary downstream from the site discharge point has a relatively high resistance to geomorphologic change as a result of the thick and well established vegetation surrounding the natural creek formation. The temporary increase in moderate flows associated particularly with Stages 1 and 3 does result in limited potential for scouring and modification to downstream creek formations. In particular, long periods of a highly regular flow rate, in contrast to varying natural flow regimes, could result in erosive stresses being applied continuously at the same level and result in some isolated downstream scour. The risk is considered to be low as the discharge will typically be limited to around 10 to 15% of existing storm flows associated with wet weather events and regular fluctuation of discharge regimes would greatly reduce the potential for this impact. Implementation of an appropriate discharge strategy will prevent impacts upon downstream geomorphology.

7.2.4 Flow proportions

The water balance was extended to allow an assessment of the proportions of flows that have come into contact with emplaced material. The results were analysed for each of the stages and the different rainfall simulations to provide a range of potential proportions which were then adopted in the subsequent water quality assessment.

The flow proportion of water that has come into contact with emplaced material was also reviewed at a downstream location and in the Wollangambe River as indicated on Figure 7-1. This was undertaken by delineating external catchment areas draining to these locations. This catchment was then represented (as a natural vegetated catchment) in the runoff model within the water balance model.

Table 7-8 shows the predicted median proportions of the total flow that come in contact with emplaced material for each stage. These results were considered in the consideration of potential impacts on water quality as outlined below.

Table 7-8 Flow Proportion Results

Stage	Discharge	Downstream	Wollangambe River
1	4.8%	2.8%	0.7%
2	2.1%	0.7%	0.05%
3	6.6%	5.1%	1.5%
4	16.1%	5.7%	0.3%
5	19.6%	7.9%	0.4%
6	31.6%	12.3%	0.7%

7.2.5 Surface water quality

Surface water modelling

The predicted ENM soil water quality based on the use of maximum average in the ENM order, the USEPA (1996) soil-water partition equation, and the major ion concentrations from Bartrop (2014) is presented in Table 7-9. The results shows that water equilibrating with the (theoretical) poorest acceptable quality ENM is predicted to exceed the ANZECC (2000) GVs for the following parameters: EC, cadmium, copper, arsenic, zinc, chromium, naphthalene, ortho-xylene, and para-xylene. As this water will mix with runoff which has not interfaced with ENM prior to discharge from the site, the quality of discharged water has been assessed below.

Table 7-9 Predicted ENM soil water quality based on maximum acceptable concentrations as per the ENM order

Parameter	Units	ENM soil water	ANZECC (2000) GV
pH	pH unit	8.0	6.5 – 8.0
EC	µS/cm	**1436**	30 - 350
Alkalinity as $CaCO_3$	mg/L	412.5	NA
Sulfate as SO_4	mg/L	20	NA
Chloride	mg/L	435	NA
Calcium	mg/L	60	NA
Magnesium	mg/L	67.5	NA
Sodium	mg/L	210	NA
Potassium	mg/L	12.5	NA
Cadmium	mg/L	**0.000063**	0.00006
Copper	mg/L	**0.002**	0.001
Nickel	mg/L	0.002	0.008
Lead	mg/L	0.00032	0.001
Arsenic	mg/L	**0.0008**	0.0008 (AsV)
Zinc	mg/L	**0.0048**	0.0024
Mercury	mg/L	0.00001	0.00006
Chromium	mg/L	**0.588**	0.00001 (CrVI)
Naphthalene	mg/L	**0.0032**	0.0025
Benzo(a)pyrene	mg/L	0.00004	NA
Benzene	mg/L	0.103	0.600
Toluene	mg/L	10.057	NA
Ethylbenzene	mg/L	2.294	NA
ortho-xylene	mg/L	**0.319**	0.200
meta-xylene	mg/L	0.950	NA

Parameter	Units	ENM soil water	ANZECC (2000) GV
para-xylene	mg/L	**0.317**	0.140
TPH C10-C36	mg/L	14.120	NA

Orange bold denotes exceedances of the ANZECC (2000) GVs

The results in Table 7-9 and the results for the site discharge were used as inputs for the water quality modelling and are presented below in Table 7-10. The modelling indicates there are no exceedances of the ANZECC (2000) GVs for metals predicted for any stage for the project.

pH is predicted to remain slightly acidic during all stages except stage 6, with all predicted pH values being above those which were observed during the site visit on 9 March 2017.

EC is predicted to remain below the ANZECC (2000) GV for upland rivers for all stages except stage 6, though it is noted that the EC analysis method prescribed by the ENM order does not give results which indicate the likely salinity of runoff from the material. As such, the modelled EC values presented in Table 7-10 are for indicative purposes only, considering that the assumed EC of ENM soil water was close to that of the ENM order limit, and adopted for all runoff interfacing with the ENM stockpiles.

The assessment predicted that concentrations of naphthalene, benzene and ortho- and para-xylene in the site runoff would remain below the relevant ANZECC (2000) GVs during all stages. There is no ANZECC (2000) GV for the most prevalent xylene isomer, meta-xylene.

Representative VENM and ENM samples

A series of representative samples of ENM from construction projects throughout Sydney were also assessed to review the results of the water quality modelling using the soil-water partition equation.

Results of the soil/rock testing of the nine samples indicated there were no exceedances of the ENM order maximum average concentrations, with the exception of pH for the Glenorie and Lucas Heights samples, which had pH values lower than the minimum average pH as per the ENM order. The pH of these samples however, was not lower than the absolute minimum pH (4.5 pH units). For the theoretical mix of the nine samples, the average pH was 5.58, which is within the ENM order average range.

Leachate water quality results for the soil / rock samples showed exceedances of ANZECC (2000) for arsenic, cadmium, chromium, copper, lead, zinc, total nitrogen, total phosphorous and pH. There was generally good agreement between the leachate results and the results of the USEPA (1993) partition equation when using the soil/rock testing results (Table 7-9).

Some variability was observed, particularly for the metals lead, nickel and zinc, which had higher concentrations in the leachate than predicted by the partition equation but were with the range predicted by the literature.

Similar water quality to that of the leachate samples is not expected in runoff from emplaced ENM, as interfacing times between the ENM and rainfall runoff will be lower than that of the ASLP tests, which involves tumbling the soil/rock sample with water for 18 hours.

Regardless, the average leachate water quality data were used as inputs for further water quality modelling to assess the potential risk associated with the discharge of water which has equilibrated with a theoretical mix of the nine samples.

Table 7-10 Water quality modelling results for the site discharge.

Parameter	Units	ANZECC (2000) GV	Stage 1 discharge	Stage 2 discharge	Stage 3 discharge	Stage 4 discharge	Stage 5 discharge	Stage 6 discharge
ENM soil water to site runoff ratio			0.048:0.952	0.021:0.979	0.066:0.934	0.161:0.839	0.196:0.804	0.316:0.684
pH	pH unit	6.5–8.0	**5.70**	**5.42**	**5.82**	**6.21**	**6.30**	6.57
EC	µS/cm	30-350	87	48	114	252	302	**476**
Arsenic	mg/L	0.0008	0.0002	0.0002	0.0002	0.0003	0.0003	0.0004
Copper	mg/L	0.001	0.0003	0.0003	0.0004	0.0005	0.0006	0.0008
Nickel	mg/L	0.008	0.0003	0.0003	0.0004	0.0005	0.0006	0.0008
Zinc	mg/L	0.0024	0.0007	0.0006	0.0008	0.0012	0.0017	0.0018
Mercury	mg/L	0.00006	0.00002	0.00002	0.00002	0.00003	0.00003	0.00004
Cadmium	mg/L	0.00006	0.00003	0.00003	0.00003	0.00003	0.00003	0.00004
Lead	mg/L	0.001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001
Chromium (VI)	mg/L	0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001
Naphthalene	mg/L	0.0025	0.0002	0.0001	0.0002	0.0005	0.0006	0.0010
Benzene	mg/L	0.6	0.005	0.002	0.007	0.017	0.020	0.033
Ortho-xylene	mg/L	0.2	0.015	0.007	0.021	0.051	0.062	0.101
Meta-xylene	mg/L	NA	0.046	0.020	0.063	0.153	0.186	0.300
Para-xylene	mg/L	0.14	0.015	0.007	0.021	0.051	0.062	0.100

Orange bold denotes exceedances of the ANZECC (2000) GVs

The results indicate that reducing the area of exposed ENM within active placement would assist to achieve ANZECC (2000) GVs in receiving waters. Restriction of the area of exposed ENM in each stage to the areas outlined in Table 7-11 would achieve acceptable receiving water quality based upon a conservative modelling using the ASLP results.

Table 7-11 Maximum Exposed ENM Areas

Stage	Maximum Exposed ENM Area (m2)
1	No restriction on areas developed for staging plans
2	No restriction on areas developed for staging plans
3	8,500
4	16,800
5	11,400
6	8,900

Table 7-12 indicates that no exceedances of the ANZECC (2000) GVs are predicted at the site discharge assuming the average leachate water quality, with the exceptions of pH and zinc. pH is naturally low at the site and in the receiving environment. Minor exceedances of the GV for zinc were predicted for all Stages except Stage 2, however the model does not allow for zinc complexation with organic matter. Studies have shown 60% to 98% of free Zn2+ to bind in organic complexes. Levels of dissolved organic matter found in most freshwaters are generally sufficient to remove zinc toxicity and organic matter within the site sediment basin and the swamp are therefore expected to considerably reduce the availability of zinc. The minor exceedances were also below the zinc concentration observed by OEH (2015) in the Wollangambe River at a point upstream of the Clarence Colliery discharge. As such, the predicted zinc concentrations presented in Table 7-12 would not have limited potential for adverse impact in the receiving environment.

Water quality was also modelled for the site Tributary DS using the average leachate water quality, the results for which are presented in Table 7-13. These results indicate that no elevated metal concentrations are predicted at Tributary DS, despite the conservative assumption that that all runoff from emplaced ENM would have water quality equivalent to that of the leachate samples reported in ADE Consulting Group (2017).

In practice, similar water quality to that of the leachate samples is not expected in runoff from emplaced ENM, as interfacing times between the ENM and rainfall runoff will be considerably lower. All water will also continue to pass through the final sediment basin, which contains considerable aquatic vegetation and effectively acts as an artificial wetland providing further treatment of stormwater discharging from the site.

The results of the water quality modelling using the most conservative assumptions show the receiving waters achieve default ANZECC 2000 GVs within 200 metres following a small mixing zone, through the active restriction of the area of active placement to the areas in Table 7-11. This provides an effective management tool if ongoing water quality monitoring indicates the site discharge is not performing in accordance with the predicted results in Table 7-10.

Table 7-12 Water quality modelling results for the Site discharge, assuming average leachate water quality.

Parameter	Units	ANZECC (2000) GV	Stage 1 discharge	Stage 2 discharge	Stage 3 discharge	Stage 4 discharge	Stage 5 discharge	Stage 6 discharge
Average leachate to site runoff ratio			0.046:0.954	0.02:0.98	0.053:0.947	0.107:0.893	0.096:0.904	0.102:0.898
pH	pH unit	6.5–8.0	**4.96**	**4.96**	**4.97**	**4.97**	**4.97**	**4.97**
EC	µS/cm	30-350	73.0	41.5	81.4	146.7	133.4	140.6
Arsenic	mg/L	0.0008	0.0002	0.0002	0.0002	0.0002	0.0002	0.0002
Copper	mg/L	0.001	0.0004	0.0003	0.0004	0.0005	0.0005	0.0005
Nickel	mg/L	0.008	0.0003	0.0003	0.0003	0.0004	0.0004	0.0004
Zinc	mg/L	0.0024	**0.0027**	0.0015	**0.0030**	**0.0056**	**0.0051**	**0.0054**
Mercury	mg/L	0.00006	0.00002	0.00002	0.00002	0.00002	0.00002	0.00002
Cadmium	mg/L	0.00006	0.00003	0.00003	0.00003	0.00004	0.00004	0.00004
Lead	mg/L	0.001	0.0002	0.0001	0.0002	0.0004	0.0003	0.0004
Chromium (VI)	mg/L	0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001

Orange bold denotes exceedances of the ANZECC (2000) GVs

Table 7-13 Water quality modelling results for Tributary DS, assuming average leachate water quality.

Parameter	Units	ANZECC (2000) GV	Stage 1 discharge	Stage 2 discharge	Stage 3 discharge	Stage 4 discharge	Stage 5 discharge	Stage 6 discharge
Average leachate to site runoff ratio			0.027:0.973	0.007:0.993	0.04:0.96	0.037:0.963	0.036:0.964	0.039:0.961
pH	pH unit	6.5–8.0	**4.96**	**4.97**	**4.96**	**4.96**	**4.96**	**4.96**
EC	µS/cm	30-350	50.0	25.8	65.7	62.1	60.9	64.5
Arsenic	mg/L	0.0008	0.0002	0.0002	0.0002	0.0002	0.0002	0.0002
Copper	mg/L	0.001	0.0003	0.0003	0.0004	0.0004	0.0003	0.0004
Nickel	mg/L	0.008	0.0003	0.0003	0.0003	0.0003	0.0003	0.0003
Zinc	mg/L	0.0024	0.0018	0.0008	0.0024	0.0023	0.0022	0.0024
Mercury	mg/L	0.00006	0.00002	0.00002	0.00002	0.00002	0.00002	0.00002
Cadmium	mg/L	0.00006	0.00003	0.00003	0.00003	0.00003	0.00003	0.00003
Lead	mg/L	0.001	0.0001	0.0001	0.0002	0.0002	0.0002	0.0002
Chromium (VI)	mg/L	0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001

Orange bold denotes exceedances of the ANZECC (2000) GVs

7.2.6 Groundwater quality

Groundwater modelling

Groundwater quality modelling was undertaken on the assumption that the swamp located adjacent to the site is hydraulically connected to and receiving groundwater passing through the site.

Due to the different times of emergence of ENM affects, the groundwater and surface impacts assessments have been treated as separate impacts that do not overlap. This conclusion will be proactively confirmed during site operations via monitoring of water quality and quantity and a review of the modelled predictions for the future stages of the project, to identify if additional adaptive management controls need to be implemented to meet the GVs. The predicted metal concentrations at the swamp located 200 m from the site boundary was assessed based on geochemical simulations (SIM1-3), representing existing baseline groundwater quality, soil: water partition concentrations and the average ASLP data respectively. The results of the geochemical analysis are shown in Table 7-14.

Simulated concentrations of groundwater seeping into the swamp at 200 m from the site boundary under existing conditions (SIM 1) exceeds actual concentrations in the tributary (sampled in March 2017) for Cu, Ni, Zn and Hg. This suggests that metal attenuation along the migration pathway and within the swamp is greater than simulated by the model. Calculated attenuation factors for Cu, Ni, Zn and Hg are 12, 4, 41 and 5 respectively as shown in Table 7-14. Attenuation factors were not calculated for the other metals since their predicted groundwater concentrations for SIM 1 were less than the actual concentrations in the tributary.

Simulated concentrations of groundwater seeping into the swamp under proposed conditions (i.e. including input of ENM leachate at the voids) are represented as SIM 2 and SIM 3 and compared to ANZECC (2000) GVs. The concentrations of Cu and Zn are predicted to exceed the GV for SIM 2 and Cu, Zn and Cd are predicted to exceed the GV for SIM 3. It should be noted that Cu concentrations in background groundwater are above ENM leachate concentrations so Cu is not a metal of concern. In addition, since the GV for Cr applies to the Cr VI species, this species has been reported rather than total dissolved chromium.

Table 7-14 PhreeqC predicted metal concentrations 200 m down-gradient of site boundary

Parameter	Units	ANZECC (2000) GV	Tributary [a]	SIM 1	SIM 2	SIM 3	AF [b]
Arsenic	mg/L	0.0008	<0.0002	0.0001	0.0003	0.0002	NA
Copper	mg/L	0.001	<0.0005	0.006	**0.005**	**0.005**	12
Nickel	mg/L	0.008	<0.0005	0.002	0.002	0.002	4
Zinc	mg/L	0.0024	<0.001	0.041	**0.031**	**0.063**	41
Mercury	mg/L	0.00006	<0.00004	0.0002	0.000003	0.00001	5
Cadmium	mg/L	0.00006	<0.00005	0.000043	0.00005	**0.00009**	NA
Lead	mg/L	0.001	<0.0001	0.0001	0.0002	0.0009	NA
Chromium (VI)	mg/L	0.00001[c]	<0.0002	0.0001	< 0.00001	< 0.00001	NA

Orange bold denotes exceedances of the ANZECC (2000) GVs (for SIM 2 and SIM 3 only)

(a) Results for the downstream tributary (swamp) from sampling undertaken in March 2017

(b) Attenuation factor (SIM 1:tributary concentration ratio)

(c) GV for Cr (VI)

Attenuation factors were applied to Cu and Zn concentrations and results are shown in Table 7-15. Predicted concentrations of Cu and Zn in groundwater seepage into the swamp were below the GV for both SIM 2 and SIM 3 when attenuation factors were applied. Therefore, the only exceedance remaining is a minor exceedance of Cd for SIM 3 based upon conservative ASLP analysis. .

Table 7-15 PhreeqC predicted metal concentrations with attenuation applied

Parameter	Units	ANZECC (2000) GV	SIM 2 (AF)	SIM 3 (AF)	AF
Copper	mg/L	0.001	0.0004	0.0004	12
Zinc	mg/L	0.0024	0.0008	0.002	41
Cadmium	mg/L	0.00006	0.00005	**0.00009**	NA

Orange bold denotes exceedances of the ANZECC (2000) GVs

The geochemical modelling indicated that the concentration of groundwater discharge into the swamp currently exceeds the concentrations within the swamp for Cu, Ni, Zn and Hg. Since Cu and Hg concentrations in groundwater currently exceed the concentrations in the swamp and the project is not expected to increase these concentrations in groundwater, no further assessment of Cu and Hg was undertaken. Further geochemical modelling predicted that the concentrations of As, Cr (VI), Pb and Ni in groundwater discharge to the swamp will be less than the GV under proposed conditions and therefore these metals do not pose a risk of impact to water quality within the swamp.

The predicted concentration of zinc in groundwater discharge to the swamp was found to be less than the GV after application of an attenuation factor based on the ratio of the existing groundwater concentration to the existing swamp concentration.

Based on the results of the geochemical modelling, it was considered that additional fate and transport modelling should be undertaken as a further line of evidence to assess the potential impact of Cd migration through groundwater on the surface water receptor. The additional modelling incorporated adsorption onto the solid phase using Kd values calculated from the ADE ASLP results, since attenuation via adsorption was not considered in the geochemical modelling. Zinc was also included in this additional modelling, although the predicted concentration of Zn at the swamp was found to be below the GV after the application of the attenuation factors. The fate and transport model results are presented in Table 7-16.

Table 7-16 Fate and transport model results

Parameter	Source concentration (mg/L)	Concentration at 200 m (mg/L)	Simulation time	Attenuation factor
Zinc	0.12	0.000013	10,000 yrs	92,308
		2	Steady State	1.0
Cadmium	0.00017	0.0	10,000 yrs	> 10,000
		0.00017	Steady State	1.0

The results of the fate and transport modelling suggest that the steady state groundwater concentrations at the swamp would only be slightly lower than the source leachate concentrations when they reach the swamp, however it would take more than 10,000 years to arrive at the receptor and to achieve steady state conditions. The mass flux assessment utilised the steady state concentrations as a conservative assumption and had results as follows:

- The concentration of zinc in the swamp would increase by 0.00053 mg/L over one year due to groundwater discharge, assuming no additional surface water inputs or rainfall

inputs to the swamp. This increase in concentration is approximately 22% of the GV concentration of 0.0024 mg/L.

- The concentration of cadmium in the swamp would increase by $1.9x10^{-08}$ mg/L over one year due to groundwater discharge, assuming no additional surface water inputs or rainfall inputs to the swamp. This increase in concentration is approximately 0.3% of the GV concentration of 0.00006 mg/L.

The mass flux assessment suggests that the project will result in a very minor increase to the zinc concentration within the swamp under very conservative conditions of zero additional rainfall or surface water inputs. Overall, the lines of evidence from the modelling suggests that the project will results in a very minor change (if any) to zinc concentrations in the swamp and will not result in a change to the beneficial use of groundwater as a source of water to the surface water environment.

In the same way, additional fate and transport modelling was undertaken for Cd to assess the migration of Cd between the backfilled voids and the swamp when natural attenuation (adsorption) is considered. As for zinc, the fate and transport model suggests that the concentration of Cd in groundwater discharge will approach the ENM leachate source concentration under steady state conditions, however this will take over 10,000 years to occur. Based on this steady state concentration, the mass flux assessment suggests that the project will result in a very minor increase to the Cd concentration within the swamp under very conservative conditions of zero additional rainfall or surface water inputs. Overall, the lines of evidence from the modelling suggests that the project will results in a very minor change (if any) to Cd concentrations in the swamp and will not result in a change to the beneficial use of groundwater as a source of water to the surface water environment.

Overall a conservative assessment of groundwater geochemistry and solute fate and transport has been undertaken to assess potential impacts of the project to the beneficial use of groundwater. The beneficial use of groundwater is not expected to be lower as a result of the project and it is therefore considered that the project satisfies the Level 1 minimal impact criterion under the NSW Aquifer Interference Policy. The slow travels times simulated suggest that a suitably designed monitoring program would be appropriate for monitoring the development of groundwater quality influences and triggering the implementation of mitigation measures if required.

7.3 Mitigation and monitoring requirements

7.3.1 Erosion and sediment controls

An erosion and sediment control plan (ESCP) will be developed for the site prior to the commencement of filling. The ESCP will be developed following the guidance of *Managing urban stormwater: soils and construction, volume 2E – mines and quarries* (DECC 2008).

Erosion and sediment control strategies will comprise the following:

- Minimisation of the extent and duration of disturbed areas, and prompt topsoiling and revegetation following the completion of each project stage.
- Ongoing filling works will maintain landforms which minimise the erosion hazard.
- Runoff from the site will be diverted around active filling areas and toward the site discharge pond in a manner which minimises erosion.
- Temporary control measures such as geotextile sediment fencing and straw bale filters.

The ESCP will detail the monitoring and maintenance required, such as inspections following significant rainfall events, and the removal of trapped sediments from control structures.

7.3.2 Dewatering strategy

Dewatering rates should be regularly varied to minimise downstream geomorphic impacts. This will be undertaken by varying the dewatering pumping rate on a daily basis. The required average daily pumping rate shall be calculated before a period of pumping is required and the pumping rate adjusted on each consecutive day such that the average pumping requirement is achieved and a variation between maximum and minimum pumping rates of at least 100 percent is achieved.

7.3.3 Surface water monitoring

During active filling and rehabilitation, it is proposed that the site discharge, the downstream tributary, and a reference site on the tributary to the north of the site be monitored monthly (during discharge), the pit water monthly and runoff from clean fill and other areas monthly (when there is rainfall) (or for these events less frequent if demonstrated to be consistent in quality over time and agreed with Lithgow City Council and NPWS) for the following parameters:

- **Physicochemical parameters**: pH, EC, turbidity, TSS, TDS, O&G.
- **Cations:** sodium, calcium, potassium, magnesium.
- **Anions:** alkalinity, sulfate, chloride.
- **Metals (dissolved)**: aluminium, arsenic, cadmium, chromium, copper, iron, lead, manganese, mercury, nickel, zinc
- **Nutrients**: ammonia, nitrate, nitrite, NO_x, TKN, TN, TP, RP
- **Organic compounds:** BTEX, naphthalene, benzo(a) pyrene, TPH (C10-C36)**.**

Results from this monitoring will be compared to the ANZECC (2000) GVs relevant to the site. In the case that an exceedance of these GVs is observed in two consecutive monitoring rounds at either the site discharge or the downstream tributary, and the exceedance is not observed at the reference tributary site, a review will be undertaken. This review would involve a review of the water balance and water quality modelling following the decision tree frameworks as recommended by ANZECC (2000).

Should this review indicate that significant impacts on water quality were occurring as a result of the Project, a mitigation measure of limiting the exposed areas of emplaced ENM would successfully reduce the concentrations of potential substances in the receiving waterway to concentrations below the ANZECC (2000) GVs.

7.3.4 Groundwater monitoring

Groundwater quality will initially be established from a minimum of four seasonally variable groundwater monitoring events (GMEs), relying on the installed monitoring network onsite (MB01-MB03) and by installing an additional deeper bore beside MB01. Baseline GMEs will represent a minimum of two post summer and two post winter periods during the initial operation of the project. Groundwater will be assessed for the same suite as surface water.

Ongoing groundwater monitoring will then be undertaken on potentially an annual basis or more frequently should the baseline GME conclude variability in the groundwater quality or levels at the site. Scheduling of the frequency of the ongoing GME will be determined following review of initial monitoring data and if seasonal trends are observed. In such case, the GME may be undertaken in the determined concentration high period.

Groundwater quality will be assessed in comparison to the established baseline, the GVs and the surface water data obtained at the site's discharge location and downstream of the site.

7.3.5 Review

A review of the potential for impacts of the emplacement of VENM and ENM (or other clean fill material)) on water quality, volumes and levels is to be undertaken every two years (and at least for each rehabilitation stage) during operations, or specifically as a result of:

- Any statutory or regulatory requirements.
- More than two consecutive exceedances of the ANZECC (2000) 99 percent protection level GVs observed at the site discharge or the downstream tributary located within the swamp and the during the monitoring program as described in Sections 6, 7.3.3 and 6.1.3.
- Any incident that requires reporting.

The review will also be undertaken of all previous monitoring data and sampling of surface water run-off directly from emplaced ENM and other relevant areas and the dewatered pits and by measuring site rainfall, catchment, dewatered and discharged volumes. The results will be used to predict the discharge quality in the later stages of the operation and compare the results against the predicted modelling work undertaken within the WRA to identify if additional adaptive management controls need to be implemented to meet the GVs before emplacement activities commence in the future stages.

Post closure management will be developed at the commencement of Stage 6 for approval by Lithgow City Council and NPWS including an agreed ongoing monitoring program based upon the previous operational performance of the project.

8. Biodiversity

8.1 Introduction

This chapter assesses the potential for the Project to impact on ecological values, with particular emphasis on threatened ecological communities, populations and species listed under the NSW Threatened Species Conservation Act 1995 (TSC Act) and Fisheries Management Act 1994 (FM Act), and Matters of National Environmental Significance (MNES) listed under the Commonwealth Environment Protection and Biodiversity Conservation Act 1999 (EPBC Act).

The assessment is derived from a full technical report completed by GHD that can be found in Appendix D. The assessment aims to:

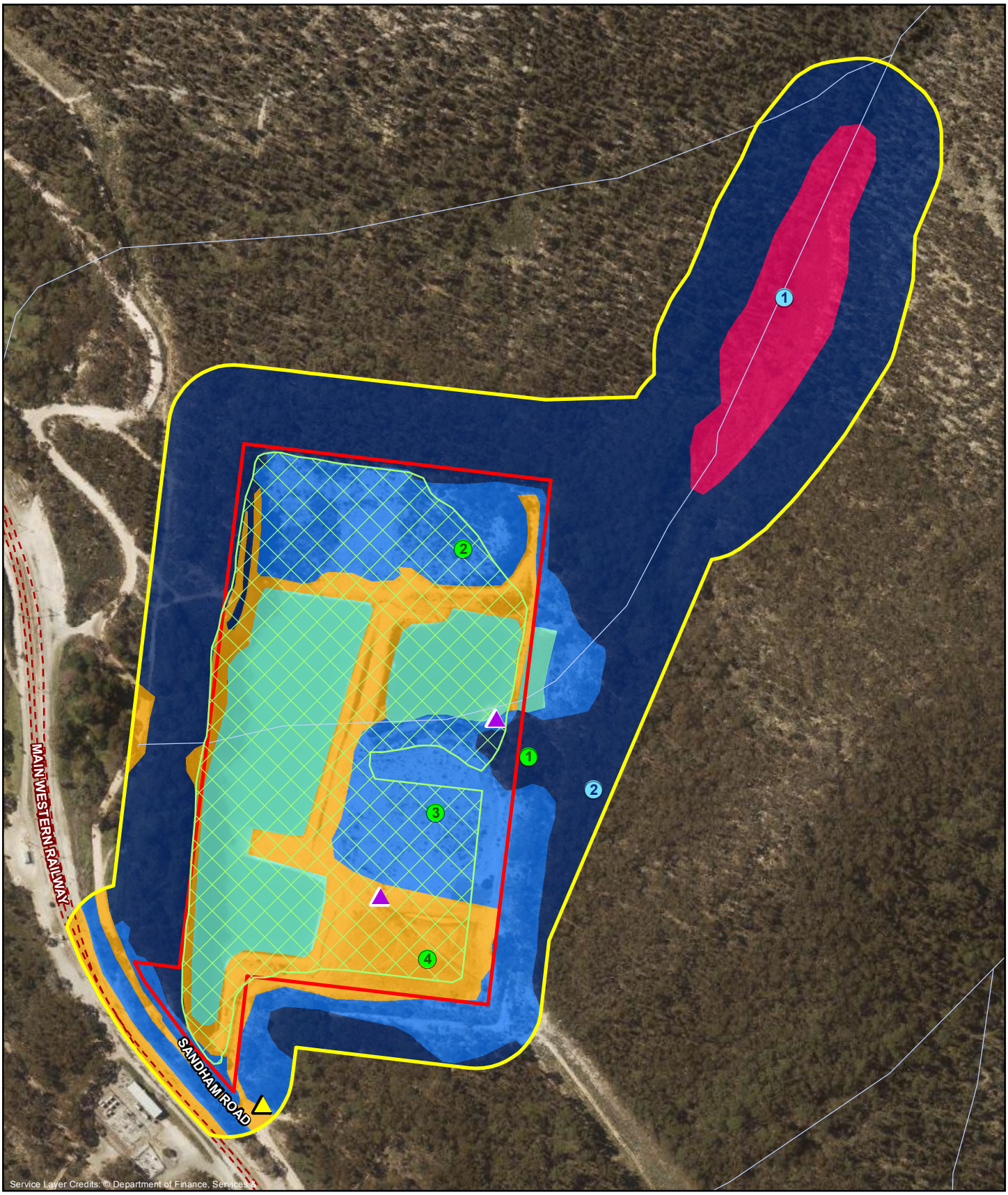
- Describe the existing environment of the study area, including the results of the desktop assessment and site surveys
- Identify the presence or likely presence of threatened species, populations and ecological communities and their habitats listed under the TSC Act and FM Act
- Assess the potential for any MNES listed under the EPBC Act to occur within the site and/or to be affected by the project
- Identify the potential impacts of the project on biodiversity values including threatened biota and their habitats
- Recommend mitigation and environmental management measures to avoid or minimise adverse impacts on threatened biota and biodiversity values
- Assess the likely significance of impacts on threatened biota listed under the TSC Act and EPBC Act that would be affected by the project
- Assess the requirement for a biodiversity offset.

8.2 Existing environment

8.2.1 Flora and vegetation

Flora species

A total of 105 flora species from 38 families comprising 95 native and 10 exotic species were recorded within the study area encompassing the Project area within the existing quarry footprint and the surrounding bushland and drainage line flowing from the site as shown on Figure 8-1. Proteaceae (shrubs, 13 species, 12 native), Myrtaceae (flowering shrubs and trees, 12 species, all native), Poaceae (grasses, 10 species, 8 native) and Fabaceae (9 species, 7 native) were the most diverse families recorded. The full list of species recorded is presented in Appendix D. Species recorded are discussed below in relation to the vegetation types occurring within the study area.



LEGEND

- Bell Quarry site
- Study area
- Project area
- Waterways
- Rail
- Plot/transect
- Area search
- Anabat
- Call playback

Vegetation zones

- 1, Sydney Peppermint - Silvertop Ash heathy open forest
- 2, Poor condition Sydney Peppermint - Silvertop Ash heathy open forest
- 3, Cleared land
- 4, Artificial wetland
- 5, Prickly Tea-tree - sedge wet heath

Paper Size A4

0 25 50 100

Metres

Map Projection: Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 MGA Zone 56

N

GHD

Remedial Civil Solutions Pty Ltd
Bell Quarry Rehabilitation
Biodiversity Assessment

Job Number	21-25774
Revision	A
Date	29 May 2018

Vegetation and survey effort

Figure 8-1

\\ghdnet\ghd\AU\Sydney\Projects\21\25774\GIS\Maps\Deliverables\Biodiversity\21_25774_Z006_Biodiversity_Vegetation.mxd Level 15, 133 Castlereagh Street Sydney NSW 2000 **T** 61 2 9239 7100 **F** 61 2 9239 7199 **E** sydmail@ghd.com.au **W** www.ghd.com.au

Data source: Aerial imagery - AStute 2015 & sixmaps 2016, Inset map - Geoscience Australia, General topo - NSW LPI DTDB 2012, Landuse zoning - SILEP LZN. Created by:afoddy

Weeds

Only one priority weed listed under the Biosecurity Act for the Lithgow LGA was recorded in the project site (see Table 8-1).

Table 8-1 Noxious weeds

Scientific name	Common name	Control measures
Cytisus scoparius subsp. scoparius	English Broom	Mandatory Measure: must not be imported into the State or sold Regional Recommended Measure: land managers should mitigate the risk of new weeds being introduced to their land

English Broom is also a weed of national significance. English Broom is spread solely by seeds, which are ejected explosively as the pods dry out on warm, sunny days during summer. Most of the seeds fall within a few metres of the parent plant. They are further dispersed by water (particularly if near streams), mud on machinery, vehicles and footwear (DEE 2017). Mitigation measures to prevent the spread of this species into the adjacent national park are provided in section 8.8.3.

A low incidence of other environmental weeds was recorded throughout the project area.

Vegetation

The project footprint comprises highly modified landforms, with most vegetation present the result of previous rehabilitation activities. Modified native vegetation is also present outside the project site within the adjacent national park. Some intact native vegetation is present within the project site, located around the perimeter. Extensive tracts of intact native vegetation are present in the surrounding area.

Field surveys confirmed the presence and distribution of two NSW vegetation types within the study area. One of these vegetation types occurs as intact vegetation in Moderate/good-high condition as well as partially cleared or regrowth vegetation in poor condition and so there are three native vegetation zones. Areas of cleared dry land and artificial wetlands have also been mapped as separate vegetation zones. Vegetation zones at the study area are shown on Figure 8-1, summarised in Table 8-2 and described below.

One vegetation zone at the study area (downstream of the project site) comprises a local occurrence of a threatened ecological community (TEC) listed under the TSC Act and a related TEC listed under the EPBC Act.

The distribution of vegetation zones in the study area is mainly tied to geomorphic position and associated soil type and frequency and duration of inundation.

Table 8-2 Vegetation zones in the study area

Plant Community Type	Veg Type ID	Condition	TEC Status
Sydney Peppermint - Silvertop Ash heathy open forest	HN600	Moderate/good-high	Not listed
Poor condition Sydney Peppermint - Silvertop Ash heathy open forest	HN600	Moderate/good-poor	Not listed
Prickly Tea-tree - sedge wet heath	HN563	Moderate/good	Newnes Plateau Shrub Swamp (EEC under the TSC Act) and Temperate Highland Peat Swamps on Sandstone (EEC under the EPBC Act)
Artificial wetland		Moderate/good	NA
Cleared land	Formerly HN630	Cleared	

8.2.2 Groundwater dependent ecosystems

No groundwater-dependent ecosystems (GDEs) are mapped in the study area on the national atlas. Sydney Peppermint - Silver-top Ash Shrubby Woodland is identified as being a low potential GDE (BOM 2017). Hanging and upland swamps in the Blue Mountains are identified as being high probability groundwater dependent wetland communities (Kuginis et al 2012). As such, the Prickly Tea-tree - sedge wet heath downstream of the project site is likely to be a GDE.

8.2.3 Fauna and fauna habitats

A total of 55 native fauna species were positively recorded during field survey, including 28 bird species, four terrestrial mammal species, three bat species, seven reptile species, six frog species and six dragonfly species. Two additional bat species were possibly recorded using echolocation call analysis, including one threatened species, the Eastern Bentwing Bat (*Miniopterus schreibersii oceanensis*), but poor data quality and/or interspecific call similarities precluded reliable identification of this species. No introduced species were recorded during the survey.

Fauna habitats in the study area are described in Table 8-3-Table 8-7

Table 8-3 Fauna habitats: Regenerating and planted vegetation

Fauna habitats: Regenerating and planted vegetation	
Habitat values	Parts of the project site contain regenerating and planted vegetation, and areas of exotic grassland planted to stabilise loose surfaces. These contain a combination of low shrubs and some immature trees. In some areas logs have been placed to help stabilise soils, and more dense plantings occur. In these areas leaf litter and trailing groundcover species are also present. Other areas contain sparse planting and loose rubble.
Typical fauna species	The most commonly recorded woodland bird recorded at the site was the Superb Fairy-wren (*Malurus cyaneus*). Other bird species recorded in this habitat type included the New Holland Honeyeater (*Phyllidonyris novaehollandiae*) and Brown Thornbill (*Acanthiza pusilla*). Welcome Swallows (*Hirundo neoxena*) and Tree Martins (*Petrochelidon nigricans*) were observed foraging on the wing above these areas.

Fauna habitats: Regenerating and planted vegetation	
	A Swamp Wallaby (*Wallabia bicolor*) was observed and scats were present throughout parts of this habitat type. Microchiropteran bats typical of open habitats may forage in this area from time to time. This habitat provides habitat for a range of reptile species. The Jacky Dragon (*Amphibolorus muricatus*), Southern Forest Cool-skink (*Niveoskincus coventryi*) and the Dark-flecked Garden Sunskink (*Lampropholis guichenoti*) were observed in association with leaf litter and logs. The Smooth Toadlet (*Uperoleia laevigata*) was heard calling from revegetation areas near the lower dam and individuals observed.
Threatened or migratory biota	Threatened fauna such as the Eastern Bentwing Bat (*Miniopterus schreibersii oceanensis*) may forage in these areas on occasion.

Table 8-4 Aquatic habitats: Quarry voids

Aquatic habitats: quarry voids	
Description	Three water-filled quarry voids are present in the Project area. The two larger ones have little fringing vegetation. A small artificial drainage line runs from the main void to the east void. This is mainly rocky with some plants present. The lower void or sediment basin has a large area of Typha growing. There is also fringing vegetation on the boundary with the middle void. Water flows from the middle void to the lower void via a small waterfall (about 1.5 m high). The lower void flows into a creek in the Blue Mountains National Park. This eventually flows through a swamp about 200 m from the Project area. The voids are not key fish habitat.
Typical fauna species	Little Black Cormorants (*Phalacrocorax sulcirostris*), Australian Wood Ducks (*Chenonetta jubata*) and Pacific Black Ducks (*Anas superciliosa*) were observed in the two larger voids. An Australasian Grebe (*Tachybaptus novaehollandiae*) was observed foraging in the lower void. Peron's Tree Frog (*Litoria peronii*) and Verreaux's Frog (*Litora verreauxii*) were heard calling from the two larger voids. A number of metamorph Eastern Banjo Frogs (*Limnodynastes dumerilii*) were observed in the drainage line between the two upper voids. This species was also heard calling from the lower void, as was Peron's Tree Frog. A Tyler's Tree Frog (*Litoria tyleri*) was observed on the rocks near the lower void. Snakes and turtles may also occur, particularly in the lower void which has more emergent vegetation. Fish were possibly observed in the middle void. This void is separated from the bottom void and creek in the adjacent National Park by the small waterfall. About five species of dragonfly were observed at the lower swamp. These included the Red and Blue Damsel (*Xanthagrion erythroneurum*), Eastern Pygmyfly (*Nannophya dalei*), Blue Skimmer (*Orthetrum caledonicum*) and various ringtails (*Austrolestes* spp.).
Threatened biota	The Large-footed Myotis (*Myotis macropus*) may forage in over the voids on occasion. It is possible that the Giant Burrowing Frog (*Heleioporus australiacus*) could occur at the lower void, although it is not preferred habitat. This species occurs infrequently in semi-permanent to permanent constructed dams with a sandy silt or clay base (DoEE 2016b). The Giant Dragonfly would not breed in the project site due to the rocky substrate of the void. The species does not utilise areas of standing water wetland, although it may utilise suitable boggy areas adjacent to open water wetlands. Eggs are normally laid into moss, under other soft ground layer vegetation, and into moist litter and humic soils, and larvae dig long burrows under swamps (OEH 2016b).

Table 8-5 Fauna habitats: Intact native vegetation

Fauna habitats: intact native vegetation	
Description	Forested areas are present outside the site, in the adjacent National park, as well as on the margins of the site in the north. Poorer quality forest is present where this vegetation has been subject to disturbance, such as clearing for tracks and electricity easements. Forested areas exhibit high habitat complexity, with a canopy of eucalypts over a typically dense and floristically diverse shrub layer, with a groundcover of native herbs, grasses and occasionally ferns. Flowering and nectar-producing trees and shrubs are present which provide a range of foraging resources throughout the year for a variety of fauna. Hollow-bearing trees and stags, which could provide potential nesting habitat for arboreal mammals or birds, are present throughout the forested area. A range of hollow sizes and shapes are present, catering for a variety of native fauna species. Around 300 native vertebrate fauna species use tree hollows and shedding bark in Australia, and the shelter provided by these habitat features is essential for the survival of many of these species (Gibbons and Lindenmayer 2002). The understorey of the forest habitat is generally composed of low shrubs, which provide refuge for small birds, mammals and reptiles. Fallen timber and leaf litter in the study area would provide habitat resources for a range of native reptiles and small mammals. Occasional termite mounds were recorded throughout the study area and would provide potential habitat and a food resource for a range of fauna, including threatened species such as Rosenberg's Goanna (*Varanus rosenbergi*) which lays its eggs in termite mounds (OEH 2012). Rock outcrops are present, providing shelter habitat for reptiles and small mammals. Large rock outcrops may provide shelter habitat for larger species such as the threatened Spotted-tailed Quoll (*Dasyurus maculatus*).
Typical fauna species	A range of bird species were recorded in this habitat type. These included the large Yellow-tailed Black-cockatoo (*Calyptorhynchus funereus*), observed foraging in forest along the road, and the Wedge-tailed Eagle (*Aquila audax*), observed high above the study area. Few honeyeaters were recorded, likely due to the low incidence of flowering eucalypts. Those recorded included the Eastern Spinebill (*Acanthorhynchus tenuirostris*) and Yellow-faced Honeyeater (*Lichenostomus chrysops*). Small birds included the Grey Shrike-thrush (*Colluricincla harmonica*), Rufous Whistler (*Pachychephala rufiventris*), Grey Fantail (*Rhipidura albiscapa*), White-throated Treecreeper (*Cormobates leucophaea*) and Spotted Pardalote (*Pardalotus punctatus*). The Superb Lyrebird (*Menura novaehollandiae*) was also heard. Mammals recorded included the Red-necked Wallaby (*Macropus rufogriseus*) and Eastern Grey Kangaroo (*Macropus giganteus*), as well as the Wombat (*Vombatus ursinus*). No possums were observed, however the forest is likely to support a variety of possums and gliders. Hollow-bearing trees would provide nesting habitat for a range of species, including microchiropteran bats.
Threatened or migratory biota	There is potential for many threatened fauna to occur in this habitat. These may include Rosenberg's Goanna and the Spotted-tailed Quoll, as mentioned above. Various threatened woodland birds, owls and parrots are likely to occur. Migratory woodland birds would also occur on occasion.

Table 8-6 Aquatic habitats: Drainage line

Aquatic habitats: drainage line	
Description	A narrow drainage lines runs from the lower void through the Blue Mountains National Park. It drains through the swamp, eventually to the Wollangambe River. This drainage line is about 60 cm wide, with steep sided banks near the project site. A wide, shallow pool is present about 100 m from the project site. The drainage line then narrows as it approaches the swamp. Fringing vegetation is present, although no emergent aquatic vegetation was observed. Leaf litter covers the bottom of the creek.
Typical fauna species	An Eastern Water Dragon (*Intellegama lesueurii*) and a Yellow-bellied Water Skink were observed on rocks in the upper portion of the creek. The Common Eastern Froglet (*Crinia signifera*) was heard calling. A number of tadpoles of the Eastern Banjo Frog were observed in the pool. Various smaller tadpoles were also observed, likely species of *Litoria* or *Crinia.*
Threatened biota	Tadpoles of the Giant Burrowing Frog could occur in this creek. Eggs are usually laid in ephemeral pools, or slow or standing water such as small soaks formed in eroded sandstone drainage lines. These can then be flushed downstream with tadpoles occurring in semi-permanent to ephemeral sand or rock based streams (DoEE 2016b). There are records of this species in the locality.

Table 8-7 Aquatic habitats: Swamp

Aquatic habitats: swamp	
Description	A large swamp is located about 200 metres downstream of the lower void. Water from the project site drains through this swamp. During the time of survey there was little standing water in the swamp. A narrow drainage line (about 30 cm wide) with water was observed in the lower portion, while the remainder of the drainage line appeared to be dry. The remainder of the swamp did not appear to be boggy. Parts of the swamp appear to have deep peaty soils, however little leaf litter is present.
Typical fauna species	The New Holland Honeyeater was observed foraging in the Hakeas in the swamp. A Black-bellied Swamp (Marsh) Snake (*Hemisaspis signata*) and a Pale-flecked Garden Sunskink (*Lampropholis guchenoti*) were also observed. A number of tracks were observed through the swamp, likely from the Swamp Wallaby or Red-necked Wallaby (*Macropus rufogriseus*). No frogs were heard calling at this swamp during the survey.
Threatened biota	The Blue Mountains Water Skink (*Eulamprus leuraensis*) could occur at this swamp, although it does not appear to be preferred habitat. This species is restricted to of sedge and shrub swamps that have boggy soils and appear to be permanently wet (OEH 2016b). The soil appeared to be mostly dry at the time of the survey, with only a short, narrow area of open water present in the drainage line through the middle. The Giant Dragonfly (*Petalura gigantea*) could occur at this swamp, although the general lack of free water may make this swamp unsuitable.

Habitat connectivity

Limited habitat connectivity is present within the project site. Revegetated areas provide some connectivity in the project site. The adjacent national park and other areas are predominantly intact native vegetation and provide connectivity for flora and fauna around the site.

8.2.4 Conservation Significance

Threatened ecological communities

No threatened ecological communities are present in the project area.

A patch of Prickly Tea-tree - sedge wet heath occurs along the drainage line approximately 200 metres downslope from the project area. This community is commensurate with the Newnes Plateau Shrub Swamp EEC listed under the TSC Act and with the Temperate Highland Peat Swamps on Sandstone EEC listed under the EPBC Act.

Threatened flora species

No threatened plants were recorded in the Project area or in the broader study area.

Database searches indicate 26 threatened plant species listed under the TSC Act and/or EPBC Act which have been previously recorded, or are predicted to occur in the locality. An assessment of broad habitat requirements for these threatened species indicates that up to three threatened flora species are likely to occur in the study area based on the presence of suitable habitat and known populations in the locality (see Table 8-8). None of these species were observed in the Project area or are likely to occur as adult individuals given the highly modified nature of the majority of the site and that they were not detected despite the survey effort employed within the 0.13 ha of native vegetation with natural soil profiles. There is a chance that these species could be present in the soil seed bank or may colonise the Project area in the future. On this basis the Project would remove potential habitat for these species in the Project area and may affect habitat downstream of the site through factors such as changes to surface or groundwater flow regimes or through mobilisation of sediments.

Table 8-8 Threatened plant species with potential habitat in the Project area

Scientific Name	Common Name	EPBC Act Status	TSC Act Status
Veronica blakelyi	-	-	Vulnerable
Boronia deanei	Deane's Boronia	Vulnerable	Vulnerable
Persoonia hindii	-	-	Endangered

There is broadly suitable habitat for a further 11 species in the study area (see Appendix D). There is a very low risk of impacts to any of these species because there is not any evidence of a population in the Project area or in the locality.

Threatened fauna species

Database searches indicate that there are 45 fauna species listed under the TSC Act and/or EPBC Act which have been previously recorded, or are predicted to occur in the locality. An assessment of the broad habitat requirements for these threatened species indicates that there is potential for 33 threatened fauna species to occur within the study area (see Appendix D).

One threatened fauna species, the Eastern Bentwing Bat (*Miniopterus schreibersii oceanensis*) was recorded at the site. This is a wide ranging species that forages over forested and cleared areas. No roosting or breeding habitat is present in the project site.

Most threatened fauna species that may occur are highly mobile species, and would only occur in the project area on a transient basis if at all given the highly disturbed nature of the site. Lack of suitable hollows limits breeding habitat in the project area.

Species with the potential to be impacted by the proposal are those that are dependent on watercourses or swamps for breeding. These are detailed in Table 8-9.

Table 8-9 Threatened fauna species that may be impacted by the proposal

Scientific Name	Common Name	EPBC Act Status	TSC Act Status
Petalura australis	Giant Dragonfly		Endangered
Heleioporus australiacus	Giant Burrowing Frog	Vulnerable	Vulnerable
Pseudophryne australis	Red-crowned Toadlet		Vulnerable
Litoria littlejohni	Littlejohn's Tree Frog	Vulnerable	Vulnerable
Eulamprus leuraensis	Blue Mountains Water Skink	Endangered	Endangered

Migratory species

Database searches identified migratory species that have either been recorded or are predicted to occur within this locality area. Based on a desktop review of known habitat associations, five migratory species listed under the EPBC Act were considered to have the potential to occur within the study area, at least on occasion (see Appendix D).

Important habitat for these migratory birds is defined in the significance criteria for listed migratory species (DotE 2013) as follows:

- Habitat utilised by a migratory species occasionally or periodically within the region that supports an ecologically significant proportion of the population of the species.
- Habitat that is of critical importance to the species at particular life-cycle stages.
- Habitat utilised by a migratory species which is at the limit of the species range.
- Habitat within an area where the species is declining.

Habitat in the project site is not considered important for these migratory species as it is highly disturbed and modified and extensive areas of high quality habitats are present in the adjacent national park. The study area would only ever support a small number of individuals of any migratory species and never an ecologically significant proportion of the population of any species.

Greater Blue Mountains World Heritage Area

The Greater Blue Mountains World Heritage Area (GBMWHA) is located along the eastern boundary of the project site. A significant proportion of the Australian continent's biodiversity occurs in the area (UNESCO 2015). The GBMWHA protects a large number of pristine and relatively undisturbed catchment areas, including the Colo Wild River (DECC 2009).

Areas of the Blue Mountains National Park adjacent to the project site have been disturbed through edge effects, clearing for the boundary fence, disturbance from historical quarrying, and electricity easements.

8.3 Impacts of emplacement activities

8.3.1 Direct impacts

Clearing of vegetation

The majority of the project is to be undertaken in areas which have previously been disturbed. Portions of the land have previously been revegetated to assist with stabilisation of soils. Remnant native vegetation is present around the edges of the project area. In total, 0.13 ha of remnant vegetation would be removed and 2.48 ha of planted vegetation would be removed (Table 8-10). Clearing of vegetated areas would be temporary as the staging process allows for clearing of vegetation followed soon after by reprofiling and revegetation.

Table 8-10 Vegetation to be removed as part of the project

Plant Community Type	Project Site (ha)	Rehabilitation Area (ha)
Sydney Peppermint - Silvertop Ash heathy open forest	0.96	0.13
Poor condition Sydney Peppermint - Silvertop Ash heathy open forest	3.16	2.48
Artificial wetland	3.18	3.19
Cleared land	2.72	2.41
Total clearing of vegetation		**2.61**

The project would not directly impact any threatened ecological communities or threatened flora species.

This reduction in the extent of native vegetation in the locality as a result of reprofiling would not threaten the persistence of local populations of native plants. The proposal would remove a small number of individuals of plant species. Flora populations would persist within adjoining areas of alternative habitat outside the site. This temporary reduction in extent is also highly unlikely to affect the viability of remnant vegetation in the study area or locality or reduce the extent of habitat below a minimum size required for any fauna species. Further, much of the vegetation is disturbed, and has a much lower diversity than the adjacent intact native vegetation. The final landform would be revegetated progressively during the project, which would result in a more natural environment in the long-term.

Removal of terrestrial habitat resources

The proposal footprint contains mainly foraging and shelter resources for common native fauna. The 2.61 ha of native and planted vegetation that would be removed for reprofiling provides foraging, breeding, roosting and nesting resources for a range of fauna species. The majority of vegetation to be removed consists of shrubs and groundcover, with only a small canopied area to be removed. Small shrubs would provide shelter and nesting habitat for small birds and lizards. Eucalypts would provide some foraging and nesting habitat for common birds. No hollow-bearing trees would be removed. The proposal would remove fallen logs, rocky areas and leaf litter, which would lead to the loss of foraging and shelter habitat for small ground-dwelling species such as lizards and ground frogs. The magnitude of impact is likely to be low given extensive areas of good quality habitat in the adjacent national park.

Removal of aquatic habitats

The importation of fill will progressively remove the two large waterbodies at the site (3.19 ha in area). This will result in the loss of breeding and foraging habitat for a number of common frog species, as well as foraging habitat for a variety of waterbirds. The waterbody within the

sediment basin on the eastern side of the project site with emergent vegetation would be retained.

Fauna injury and mortality

As described above, the proposal footprint provides habitat resources for native fauna species and would contain mainly foraging and shelter resources for common native fauna. Groundcover vegetation, leaf litter and woody debris would provide shelter and foraging substrate for mammals, reptiles, frogs and invertebrates. Construction is likely to result in the injury or mortality of some individuals of these less mobile fauna species and other small terrestrial fauna that may be sheltering in vegetation within the proposal footprint during clearing activities. There no hollow-bearing trees in the proposal footprint which reduces the risk of injury or mortality of arboreal mammals or hollow-nesting birds. Alternative habitat resources and refuge from construction activities is available in native vegetation adjoining the site. The potential injury or mortality of individuals within a maximum of 8.2 hectares of habitat (including only 2.61 ha of vegetation), is highly unlikely to affect an ecologically significant proportion of any local populations.

The draining of the two large waterbodies within the quarry voids is likely to result in the mortality of eggs and tadpoles of common frog species. Habitat will be retained in the sediment basin to the east of the project site.

Recommendations have been made in section 8.8.3 to minimise the risk of vegetation clearing activities resulting in the injury or mortality of resident fauna.

Fragmentation or isolation of habitat

The project is located in a highly disturbed portion of land, with large expanses of native vegetation surrounding it. Vegetation at the site is predominantly planted. The importation of fill is unlikely to result in the isolation of any areas of native vegetation or fauna habitats. Revegetation in the future following reprofiling will improve connectivity in the area (see section 8.4).

8.3.2 Indirect impacts

Surface water

GHD (2017) has predicted ENM soil water quality in order to assess potential impacts on water quality downstream of the site. The pH is predicted to remain slightly acidic, but could range up to pH 8 depending on the material present. The Project is predicted to result in minimal influence on water quality with limited potential to exceed the ANZECC (2000) guideline values for any parameters of concern associated with emplacement of clean fill material within the Project.

Dewatering during the Project will reduce the overflow frequency from the system compared to current conditions as the water will be temporarily stored in the remaining void areas. This impact will be most significant during stages where voids are maintained empty such as Stage 4 when no flow will occur approximately 86% of the time over a period of around 4-6 years.

Moderate discharges will be more regular during stages involving significant dewatering (particularly Stage 3, which would last less than one year). This is due to discharges occurring at a higher rate than the existing conditions to allow water to be progressively pumped from the existing voids to allow for the emplacement of fill. After completion of the Project, rehabilitation flows will generally be restored to natural conditions and will be significantly closer to natural conditions than is currently the case (GHD 2017).

Changes in flows would impact fauna that occur in the drainage line. High flow conditions may not be suitable for all species, and small fauna such as tadpoles and frogs may be flushed further downstream. The existing voids will be progressively dewatered at moderate flow rates of between 1 and 2 ML/Day. This is considerably less than the current site discharges associated with storm flows during wet weather events of up to 10 ML/day and are unlikely to substantially alter local geomorphology or otherwise have a significant negative effect on the community.

In the long-term, with the return to pre-quarry natural conditions, the habitat conditions would improve along the drainage line. This return to natural conditions should improve habitat within the swamp downstream of the project site in the long-term.

Groundwater impacts

Groundwater at the site flows to the northeast, in the direction of the tributary. Borehole surveys found that the voids appear to gain groundwater faster than it is lost to the receiving environment. Groundwater inflow will occur in all stages of the Project, and at a greater rate during stages where void water levels are maintained low. Groundwater will be discharged along with catchment run-off during dewatering activities and rainfall events as discussed above. The project is not anticipated to result in significant impacts groundwater quality or levels in adjacent habitats.

Weed invasion and edge effects

'Edge effects' refers to factors including increased noise and light, weed invasion, tree failure or erosion and sedimentation at the interface of intact vegetation and cleared areas. Edge effects can result in impacts such as changes to vegetation type and structure, increased growth of exotic plants, increased predation of native fauna or avoidance of habitat by native fauna.

Edge effects have occurred previously as a result of operation of the quarry, including provision of a boundary tracks along the perimeter fence. Native vegetation occurs on the edges of the project site. Some of this would be removed as part of the reprofiling of the site. Edge effects currently occur within the adjacent national park and other vegetated areas. There would be limited increase in edge effects as there is only limited additional clearing. Revegetation works will improve conditions within and adjacent to the project site in the long term.

Pests and pathogens

Construction activities within the proposal footprint have the potential to introduce or spread pathogens such as Phytophthora (*Phytophthora cinnamomi*), Myrtle Rust (*Uredo rangelii*) and Chytrid fungus (*Batrachochytrium dendrobatidis*) into adjacent native vegetation through vegetation disturbance and increased visitation. There is little available information about the distribution of these pathogens within the locality, and no evidence of these pathogens was observed during surveys. Phytophthora and Myrtle Rust may result in the dieback or modification of native vegetation and damage to fauna habitats. Chytrid fungus affects both tadpoles and adult frogs and can cause 100% mortality in some populations once introduced into an area.

Mitigation measures would be included in the CEMP to prevent the introduction or spread of disease that could potentially impact threatened biota in the study area (see section 8.8.3).

Dust generation

Dust as a result of wind and vehicle movement may currently affect native vegetation located adjacent to the existing site, however there was little evidence of dust in adjacent vegetation. Dust is likely to be generated during clearing, filling and reprofiling activities. High dust levels

could reduce habitat quality for flora and fauna species by reducing plant and animal health in areas of retained vegetation.

Mitigation measures would be included in the CEMP to minimise impacts of dust (section 8.8.3). Dust is unlikely to substantially impact habitat for any threatened biota due to the mitigation measures proposed.

Rehabilitation of the final landform would substantially reduce dust generation at the project site in the long-term.

Noise

There would be noise impacts during the construction phase as a result of the movement of vehicles and operation of plant during importation of fill and reprofiling activities. The proposal footprint previously operated as a quarry and surrounding land was subject to noise from quarrying activities. Currently, noise is generated by vehicle movement along the nearby road, the rail line and operation of the Clarence Colliery.

There is the potential for individuals that nest in trees that are close to the proposal edge abandoning their nests as a result of noise during construction. Noise may also affect general fauna activity in these areas. Given the existing noise levels in the vicinity of the proposal, any localised and temporary increase in noise levels during the rehabilitation activities are unlikely to substantially impact on native biota.

Following rehabilitation activities, noise levels would substantially reduce at the site.

Vibration

Vibration impacts may result from works associated with the proposal, such heavy vehicle movement and construction and operational activities. Vibration may deter native fauna from using the area surrounding the source of vibration. This may potentially interrupt dispersal within the locality if an individual is unwilling to travel through an area where vibration is detectable, or may cause some species to abandon an area in search of areas where vibration is not detectable.

The proposal has the potential to increase vibration throughout the proposal footprint and adjacent areas during construction. Typical vibration levels from activities such as use of a vibratory roller are generally negligible at distances greater than 100 metres and would have minor impacts upon habitat values surrounding the site.

8.4 Operational impacts

Following reprofiling of the quarry, the new surface would be progressively revegetated with native plant species that are representative of the native vegetation communities adjoining the Project area and using local provenance seed. Rehabilitation activities would aim to progressively provide a landform vegetated by locally occurring grasses, shrubs and trees suitable for a range of land uses. Vegetation would be selected in consultation with the National Parks and Wildlife Service and Royal Botanic Gardens and revegetation monitored annually by a specialist.

There would be few, if any, operational impacts within the Project area as the site would be returned to a natural landform and vegetated with native woodland and forest. Operational impacts may include further generation of dust or erosion and sedimentation before vegetation becomes fully established or if there are failures in mitigation measures. These risks are more likely in the event of severe storms and/or prolonged dry periods. There is a possible residual risk of weeds becoming established on the post rehabilitation landform and spreading into

adjoining native vegetation. Monitoring of the rehabilitated areas and active management of any detected risks or impacts would minimise the duration, extent and severity of any impacts.

In the long-term, with the return to pre-quarry natural conditions, the habitat conditions would improve along the drainage line as a result of more frequent flows. This return to natural conditions should improve habitat within the swamp downstream of the Project area in the long-term. Notably, the post rehabilitation conditions would include increased frequency and duration of low flow events which would be expected to have a positive effect on the moisture-dependant plant species that characterise this community, and thus would also improve habitat for fauna dependent on this community.

8.5 Cumulative impacts

The proposal would temporarily increase the extent of vegetation clearing in the locality, and increase the removal of habitats for flora and fauna species. In the long-term, the proposal would improve vegetation and terrestrial fauna habitats at the site. There would be a permanent loss of aquatic habitat resulting from the infill of the quarry voids. Future road works, extractive industries, rail upgrades or power line easement upgrades could result in loss of native vegetation. Given that much of the surrounding locality is national park, flora and fauna habitats in the locality are protected.

8.6 Impacts on listed biota and protected areas

8.6.1 Key threatening processes

A key threatening process (KTP) is defined in the TSC Act as an action, activity or proposal that:

- Adversely affects two or more threatened species, populations or ecological communities
- Could cause species, populations or ecological communities that are not currently threatened to become threatened

KTPs potentially relevant to the proposal are listed in Table 8-11.

Table 8-11 Key Threatening Processes of relevance to the proposal

KTP	Status	Comment
Clearing of native vegetation	TSC Act EPBC Act	The proposal includes the temporary clearing of 2.61 ha of native vegetation, much of which is the result of revegetation. Vast areas of intact native vegetation are present in the locality. This temporary reduction in extent is highly unlikely to affect the viability of remnant vegetation in the study area or locality or reduce the extent of habitat below a minimum size required for any fauna species. The proposal includes the rehabilitation of the final landform to a natural landscape, which would improve flora and fauna habitat in the long-term. Mitigation measures are proposed to minimise impacts on surrounding vegetation during the reprofiling and rehabilitation phases.
Removal of dead wood and dead trees	TSC Act	The project footprint contains areas of fallen timber. The project will result in the removal of this timber during the rehabilitation activities. The implementation of habitat management procedures is recommended to limit impacts on fauna and their habitats.
Invasion of plant communities by perennial exotic grasses	TSC Act	The project footprint features large areas of exotic grassland. There is the potential for perennial exotic grasses to invade adjacent native vegetation through disturbance during rehabilitation activities and a shift of the disturbed edge into intact native vegetation. The

KTP	Status	Comment
		proposal includes the rehabilitation of the final landform to a natural landscape. Mitigation measures are proposed to prevent the spread of weeds into surrounding vegetation during the reprofiling and rehabilitation phases.
Infection of native plants by *Phytophthora cinnamomi*	TSC Act; EPBC Act	Construction activities have the potential to introduce Phytopthora into the study area, through the transport and movement of plant, machinery and vehicles, as well as through any landscaping works following construction. The proposal would include environmental management measures, including specific consideration of measures to reduce potential impacts on soil, water and native vegetation.
Introduction and establishment of Exotic Rust Fungi of the order Pucciniales pathogenic on plants of the family Myrtaceae	TSC Act	Construction activities have the potential to introduce Myrtle Rust to the study area. The proposal would include environmental management measures, including specific consideration of measures to reduce potential impacts on soil, water and native vegetation.
Infection of frogs by amphibian chytrid causing the disease chytridiomycosis	TSC Act; EPBC Act	Construction activities have the potential to introduce amphibian chytrid to the study area, which could lead to death of local frogs. The proposal would include environmental management measures including specific consideration of measures to reduce potential impacts on soil, water and native vegetation.
The degradation of native riparian vegetation along NSW water courses	FM Act	The proposal will change the flow of water across the project site and into the surrounding area. There are unlikely to be direct impacts on riparian vegetation outside the project site. Mitigation measures are recommended to limit the potential for indirect impacts resulting from reprofiling.
Alteration to the natural flow regimes of rivers and streams and their floodplains and wetlands	TSC Act; FM Act	The hydrology of the study area is already substantially modified by the existing quarry. The proposal would alter the landform through placement of fill and modify surface water flows. The final landform has been designed to provide natural flows along the drainage lines leading from the project site. Mitigation measures are recommended to limit the potential for adverse impacts on aquatic habitats.
Human-caused climate change	TSC Act EPBC Act	Combustion of fuels associated with construction and operation of the proposal would contribute to anthropogenic emissions of greenhouse gases. The increase in greenhouse gases could impact average temperatures, rainfall patterns and bushfires, which can impact vegetation and habitats for flora and fauna.

8.6.2 Impacts on threatened biota listed under the TSC Act

Identification of affected species

The project site is highly modified as a result of previous quarrying activities, and little intact native vegetation is present. Most vegetation at the project site is the result of previous revegetation activities. As such, little habitat for threatened biota is present.

There would be no direct impacts on any threatened ecological communities. One threatened ecological community, Newnes Plateau Shrub Swamp is located downstream of the project and may be indirectly impacted by the project. An assessment of significance pursuant to Section 5A of the EP&A Act has been prepared for this community and is discussed further in Appendix D.

Assessments of Significance pursuant to Section 5A of the EP&A Act have been prepared for those fauna species for which a moderate level of impact is likely. These include species that may be impacted by changes to water quality and flows, and include threatened frogs, the Giant Dragonfly and the Blue Mountains Water Skink.

A number of other mobile threatened fauna species such as birds and bats may occur on occasion in the project site. Potential habitat in the project site is of poor quality given its disturbed nature and limited breeding resources present. Potential habitat in the project area represents a negligible proportion of available foraging habitat in the locality for these wide ranging species. The loss of a very small area of predominantly regrowth and planted habitat adjacent to the national park would have a very minor potential for adverse impact upon these species. No assessments of significance are considered necessary for these species.

Threatened ecological communities

There is an approximately 1.5 hectare occurrence of Newnes Plateau Shrub Swamp downstream and around 200 metres to the northeast of the Project area. The occurrence of the ecological community in the study area is associated with alluvial flats along an unnamed first order drainage line that drains the pit void and flows to the northeast.

The Project would not clear any vegetation within an occurrence of this community, but will modify the existing hydrological regime. Changes to environmental conditions as a result of the Project are likely to be within the range of conditions tolerated by species within the ecological community and are unlikely to modify the composition of the ecological community or alter habitat such that its local occurrence is likely to be placed at risk of extinction.

The post-rehabilitation hydrological regime is expected to more closely match natural catchment conditions and as such is likely to comprise suitable environmental conditions for maintenance of the community. Notably, the post rehabilitation conditions would include increased frequency and duration of low flow events which would be expected to have a positive effect on the moisture-dependant plant species that characterise this community.

The Project is unlikely to have a significant negative effect on the local occurrence of Newnes Plateau Shrub Swamp.

Threatened flora species

Deanes Boronia (*Boronia deanii*) grows on the margins of high altitude swamps, in wet heath on sandstone, and in drier open forest (OEH 2016b). There are relatively abundant populations of this species associated with Newnes Plateau Shrub Swamp communities similar to the occurrence in the study area throughout the locality of Bell, Clarence and the Newnes Plateau. There is potential habitat for this species in native vegetation throughout the study area, though the most likely habitat is around the margins of the Newnes Plateau Shrub Swamp downstream of the Project area.

Persoonia hindii is restricted to the Newnes Plateau region and mostly occurs as discrete populations of clonal, suckering populations (OEH 2016b). Within this range it is frequently associated with Sydney Peppermint - Silvertop Ash heathy open forest on sandstone-derived soils equivalent to that within the study area.

Veronica blakelyi is restricted to the western Blue Mountains, and occurs as patchy and generally small populations. It occurs in eucalypt forest, often in moist and sheltered areas (OEH 2016b). There is potential habitat for this species in native vegetation throughout the study area, though the most likely habitat is associated with Sydney Peppermint - Silvertop Ash heathy open forest on more sheltered aspects such as lower slopes adjoin the unnamed drainage line that flows northeast from the Project area.

None of these threatened plant species were observed in the Project area or are likely to occur given the highly modified nature of the site and the survey effort employed within the 0.13 ha of native vegetation with natural soil profiles. The Project would remove 0.13 ha of potential habitat for these species in the Project area and may affect habitat downstream of the site through factors such as changes to surface or groundwater flow regimes or through mobilisation of sediments.

The Project is unlikely to have a significant impact on local populations of these species should they occur, as: no individual plants or known occupied habitat would be removed; the Project would have a minor and localised effect on habitat with moderate value; and the post-Project environment would closely resemble natural conditions and in the longer term would improve the extent and connectivity of habitat in the locality.

Threatened fauna species

The Giant Burrowing Frog (*Heleioporus australiacus*), listed as a vulnerable species under the TSC Act, is known to occur in the locality (OEH 2017a, DECC 2007). Preferred breeding habitat includes ephemeral pools and soaks formed in eroded sandstone drainage lines, and the species is rarely associated with permanent ponds or streams (Mahony 1993, Watson & Martin 1973). Giant Burrowing Frog breeding sites are generally in the upper parts of the topography where slopes are gentle (6-11°). Flat areas and steep sections were not found to be inhabited by this species (Stauber 2006). Little open water was observed at the swamp in the study area, however it may represent breeding habitat. Tadpoles have been recorded in clear water with a pH between 4.3 and 6.5 (Recsei 1997). The Giant Burrowing Frog spends the majority of the year away from breeding areas, burrowing under leaf litter in the forest floor (Stauber 2006). The Giant Burrowing Frog is likely to shelter in deep leaf litter in the national park adjacent to the project site, but is not likely to shelter in the project site given the lack of suitable habitat present. Individuals may forage in the project site on occasion. During the rehabilitation process flow magnitudes will vary, with moderate flows occurring in early stages. This may impact suitability of breeding habitat for the species in the short term. In the long-term, the proposal is likely to improve potential breeding habitat in the swamp downstream of the project site, with flows returning to natural conditions.

The Red-crowned Toadlet (*Pseudophryne australis*), listed as a vulnerable species under the TSC Act, generally breeds in soaks and depressions in the upper parts of the topography where slopes are gentle (6-11°) and within 200 m of cliffs. Flat areas and steep sections such as gullies were not found to be inhabited by this species (Stauber 2006). Red-crowned Toadlets are sensitive to environmental changes, and require a pH range between 5.5 and 6.5 (OEH 2015b). Red-crowned Toadlet aggregations show fidelity to leaf litter piles, and will move with the leaf litter as it is washed down a drainage line. The species is also known to shelter under rocks (Stauber 2006). This species could occur in small drainage lines and soaks adjacent to the project site. During the rehabilitation process flow magnitudes will vary, with moderate flows occurring in early stages, which could result in flushing of tadpoles, eggs or frogs further downstream, and also mortality of individuals. In the long-term, the proposal is likely to improve potential breeding habitat in the swamp downstream of the project site, with flows returning to natural conditions. pH levels are likely to remain within a suitable range.

Littlejohn's Tree Frog (*Litoria littlejohni*), listed as a vulnerable species under the TSC Act, is often found in creeks draining upland swamps. It was not recorded during targeted surveys for the Wollangambe and Upper Wolgan area (DECC 2009), but is known to occur on the Newnes Plateau (OEH 2017a). This species is notoriously difficult to detect and is one of the least recorded frogs in NSW for this reason (Lemckert 2005, in DECC 2009). Littlejohn's Tree Frog attaches clusters of eggs to submerged twigs, stems or branches, often near the banks of still pools in clear, slowly flowing streams. Potentially suitable breeding habitat for this species is

present along the drainage line running from the project area. During the rehabilitation process flow magnitudes will vary, with moderate flows occurring in early stages. This may impact suitability of breeding habitat for the species in the short term. This could result in flushing of tadpoles and eggs further downstream, and also mortality of individuals. In the long-term, the proposal is likely to improve potential breeding habitat, with flows returning to natural conditions.

The Blue Mountains Water Skink (*Eulamprus leuraensis*), listed as a vulnerable species under the TSC Act, has been recorded at a number of locations near Clarence (OEH 2017a) and may occur in swamps located near the Wollangambe River. The Blue Mountains Water Skink is a high elevation species and is restricted to an isolated and naturally fragmented habitat of sedge and shrub swamps (NPWS 2001a) that have boggy soils and appear to be permanently wet (LeBreton, 1996). The vegetation in these swamps typically takes the form of a sedgeland interspersed with shrubs, but may be a dense shrub thicket. The species appears to prefer sites with deeper leaf litter and moister soil (LeBreton, 1996). This species could occur in the swamp near the project site, although none were observed during the survey. During the rehabilitation process flow magnitudes will vary, with moderate flows occurring in early stages. In the long-term, the proposal is likely to improve potential breeding habitat in the swamp downstream of the project site, with flows returning to natural conditions. This may improve habitat quality for this species, as it prefers sites that are permanently wet.

The Giant Dragonfly (*Petalura gigantea*), listed as a vulnerable species under the TSC Act, occurs in swamps in the Blue Mountains area, and has been recorded from near Clarence and Bell (OEH 2017a). Giant Dragonflies live in permanent swamps and bogs with some free water and open vegetation. Potential breeding swamps include Newnes Plateau Shrub Swamps, particularly those with wetter perennial swamp vegetation and organic-rich or peaty substrate (Baird, 2012). The majority of the ovipositing or emergence locations occur in lower gradient valley floor mires (<5°), rather than steeper slope mires or hanging swamps. Adults spend most of their time settled on low vegetation on or adjacent to the swamp hunting for flying insects. Females lay eggs into moss or other soft vegetation bordering swamps. Larvae dig long branching burrows under the swamp leaving their burrows at night to feed on insects and other invertebrates on the surface and also use underwater entrances to hunt for food in the aquatic vegetation. The hanging swamp along the impacted drainage line could represent breeding habitat for this species. During the rehabilitation process flow magnitudes will vary, with moderate flows occurring in early stages. In the long-term, the proposal is likely to improve potential breeding habitat in the swamp downstream of the project site, with flows returning to natural conditions. This may improve habitat quality for this species.

Assessments of significance pursuant to Section 5A of the EP&A Act have been prepared for these species. The proposal is unlikely to have a significant impact on any of these species given that no habitat will be cleared, and conditions along the drainage line should improve in the long-term.

8.7 Impacts on matters of national environmental significance

8.7.1 Threatened ecological communities

The 1.5 hectare occurrence of Newnes Plateau Shrub Swamp downstream and around 200 metres to the northeast of the Project area also comprises an occurrence of the related Temperate Highland Peat Swamps on Sandstone, which is listed as an EEC under the EPBC Act. The Project is unlikely to have a significant impact on this ecological community.

No other threatened ecological communities listed under the EPBC Act occur in the study area or are likely to be affected by the Project.

8.7.2 Threatened flora

Boronia deanii is listed as a vulnerable species under the EPBC Act. The Project is unlikely to have a significant impact on *Boronia deanii*.

No other threatened flora species listed under the EPBC Act are likely to occur in the study area or to be affected by the Project.

8.7.3 Threatened fauna

The Giant Burrowing Frog and Littlejohn's Tree Frog are listed as vulnerable species under the EPBC Act and the Blue Mountains Water Skink is listed as an endangered species under the EPBC Act. The Project is unlikely to have a significant impact on these species.

No other threatened fauna species listed under the EPBC Act are likely to occur in the study area or to be affected by the Project.

8.7.4 Migratory fauna

The project site is not considered important habitat for any migratory species, according to the significant impact criteria for migratory species (DEWHA 2009b). The removal of a small area of highly modified vegetation is unlikely to have a significant impact any of these species. Revegetation of the final landform in the future would improve habitat for these species at the site. No assessments of significance have been prepared for these species.

8.8 Mitigation and management measures

8.8.1 Introduction

The general principle to minimise impacts to biodiversity, should in order of consideration, endeavour to:

- Avoid impacts on habitat, through the planning process
- Mitigate impacts on habitat, though the use of a range of mitigation measures
- Offset any residual impact that cannot be avoided or mitigated.

8.8.2 Avoidance of impacts

The proposal will fill an existing quarry and return it to a natural landform. Most impacts have previously occurred at the quarry site.

8.8.3 Mitigation of impacts

Construction

In order to address the potential impacts of the proposal on biodiversity as discussed in Chapter 5, the mitigation and management measures outlined in Table 8-12 would be implemented as part of the Construction Environment Management Plan (CEMP) for the site.

Table 8-12 Mitigation measures (construction)

Impact	Mitigation
General	Ensure all workers are provided an environmental induction prior to starting work on site. This would include information on the ecological values of the site, protection measures to be implemented to protect biodiversity and penalties for breaches. Prepare a flora and fauna management sub-plan as part of the CEMP, incorporating recommendations below, and expanding where necessary. Measures to suppress dust would be put in place during clearing, construction and operation.
Vegetation clearing	Limit disturbance of vegetation to the minimum necessary to construct the project. Vehicles must be appropriately washed prior to work on site to prevent the potential spread of Cinnamon Fungus (Phytophthora cinnamomi) and Myrtle Rust (Pucciniales fungi) in accordance with the national best practice guidelines for Phytophthora (DEH 2006) and the Myrtle Rust factsheet (DPI 2011c) for hygiene control. Where the proposal footprint adjoins native vegetation mark the limits of clearing and install fencing around the construction footprint area prior to the commencement of construction activities to avoid unnecessary vegetation and habitat removal. Stockpiles of fill or vegetation should be placed within existing cleared areas (and not within areas of adjoining native vegetation). Sediment fences should be installed to prevent transfer of sediments into adjacent vegetation.
Weeds	Develop weed management actions to manage weeds during the construction phase of the proposal. This would include the management and disposal of the weeds that were recorded within the proposal footprint, including the priority weeds listed in Table 8-1 in accordance with the Biosecurity Act. Vehicles and other equipment to be used on site should be cleaned to minimise seeds and plant material entering the site to prevent the introduction of further exotic plant species or disease. Incorporate control measures in the design of the proposal to limit the spread of weed propagules downstream of study area. Sediment control devices, such as silt fences, would assist in reducing the potential for spreading weeds. Exposed soil should be sown with native seed immediately to prevent colonisation by weeds. Locally endemic species typical for the area should be used for rehabilitation.
Fauna habitat	Protocols to prevent introduction or spread of chytrid fungus should be implemented following Office of Environment and Heritage Hygiene protocol for the control of disease in frogs (DECCW, 2008). A trained ecologist should be present during the clearing of native vegetation or removal of potential fauna habitat to avoid impacts on resident fauna and to salvage habitat resources as far as is practicable. Clearing surveys should include: Any hollow-bearing trees to be felled should be marked prior to clearing of vegetation. The removal of hollow bearing trees is to be undertaken in accordance with a hollow-bearing tree management protocol and would include the presence of a qualified ecologist or wildlife expert experienced in the rescue of fauna. Habitat features (fallen logs and tree hollows) removed from site would be salvaged and relocated within adjacent areas of vegetation. Inspections of native vegetation for resident fauna and/or nests or other signs of fauna occupancy

Impact	Mitigation
	Deferral of vegetation removal and associated construction activity in areas occupied by more mobile threatened fauna until the fauna has vacated the proposal footprint
Water Quality and aquatic habitats	Erosion and sediment control plans should be prepared in accordance with Volume 2E of Managing Urban Stormwater: Soils and Construction (DECC 2008). The erosion and sediment control plans would be established prior to the commencement of construction and be updated and managed throughout as relevant to the activities during the construction phase. Erosion and sediment control measures should be established prior to construction. Erosion and sediment control measures would be regularly inspected, particularly following rainfall events, to ensure their ongoing functionality. Stabilised surfaces should be reinstated as quickly as practicable after construction. Water should be applied to exposed surfaces that are causing dust generation. Surfaces may include unpaved roads, stockpiles, hardstand areas and other exposed surfaces (for example recently graded areas). Vehicles must follow appropriate speeds to limit dust generation. All stockpiled material should be stored in bunded areas and kept away from waterways to avoid sediment entering the waterway. Spill kits would be made available to construction vehicles. A management protocol for accidental spills would be put in place.

Rehabilitation

Following reprofiling of each stage rehabilitation activities would commence to stabilise the soil and return the landform to a natural environment. Mitigation measures proposed for biodiversity following rehabilitation of the project site are provided in Table 8-13.

Table 8-13 Mitigation measures (post closure)

Impact	Mitigation
Vegetation and weeds	Ongoing management of priority weeds according to legislative requirements. Ongoing management of environmental weeds according to best practice methods. Monitoring of rehabilitation outcomes.

8.8.4 Improve or maintain

The project is located in an already highly disturbed site that has been subject to many years of quarrying. Little intact native vegetation is currently present. Most vegetation present is the result of previous rehabilitation activities. The proposal includes reprofiling following emplacement of fill to create a more natural landform, and the revegetation of the final landform with locally endemic species to create a more natural forest environment. As such, the project will improve native vegetation and flora or fauna habitats at the site. At the end of the project flows will return to natural conditions (improved from existing conditions).

Residual impacts of the importation of fill will be compensated for by the revegetation program. No formal offsets are considered necessary.

9. Traffic

9.1 Introduction

A Traffic Impact Assessment (TIA) has been undertaken for the Project with reference to *Guide to Traffic Generating Development* (Roads and Maritimes Services 2002), and is used as the basis for this chapter of the EIS. The TIA can be found in full as Appendix E of this report.

The assessment criteria adopted for this report is outlined in the following sections:

This Traffic Impact Assessment report discusses the following:

- Existing conditions – a review of existing road features, traffic volumes and crash data;
- Proposed traffic – a review of additional traffic generated by the site for an average traffic operation scenario case and a worst case traffic operation scenario; and
- Operational traffic impact – assessment of the performance of the existing intersections and future case scenarios with and without the operation of the site.

9.2 Existing road network characteristics

Access to the site is via Sandham Road which extends from Bells Line of Road and the regional road network as shown on Figure 9-1.

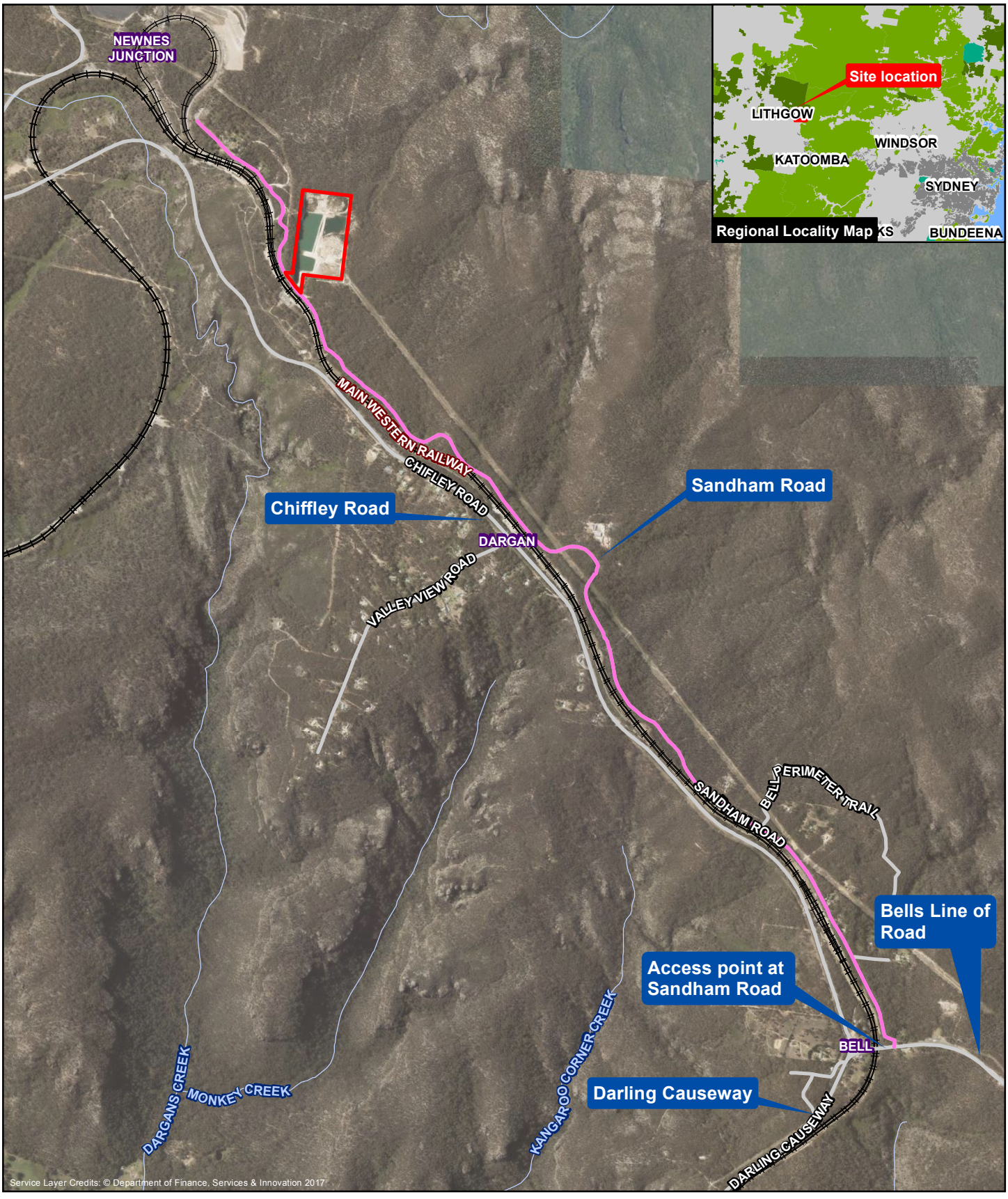
Sandham Road passes through the village of Bell and runs parallel to arterial road Chifley Road on the western side of the Main Western Railway Line and follows a north-western alignment to the access point to the quarry. The following sections provide an overview of the main road network used to gain access to the site.

9.2.1 Project area roads

Bells Line of Road / Chifley Road

Bells Line of Road is a collector road which provides an alternate route through the Blue Mountains between Richmond in the east and Bell, and joins with Chifley Road west in the Blue Mountains. Bells Line of Road has the following key features within proximity of the site:

- It is generally a two lane two-way divided carriageway with overtaking lanes
- It is a sealed road with shoulders and road line markings
- It typically carries about 3,200 vehicles per day (RMS Traffic Volume Viewer – Station ID T0384)
- It operates at 60 km/h in the vicinity of Sandham Road and Darling Causeway
- The Automatic Tube Count Survey (ATC) shows that 85 percentile speed is 74 km/h westbound and 72 km/h eastbound.



LEGEND

- Bell Quarry
- Sandham Road
- Waterways
- Rail
- Roads

Paper Size A4

0 200 400 800

Metres

Map Projection: Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 MGA Zone 56

N

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Remedial Civil Solutions Pty Ltd
Traffic Impact Assessment

Job Number 21-25774
Revision A
Date 29 May 2018

Study Area

Figure 9-1

G:\21\25774\GIS\Maps\Deliverables\21_25774_Z0011_TrafficLocation.mxd

Level 15, 133 Castlereagh Street Sydney NSW 2000 **T** 61 2 9239 7100 **F** 61 2 9239 7199 **E** sydmail@ghd.com.au **W** www.ghd.com.au

Data source: Aerial imagery - sixmaps 2016, Inset map - Geoscience Australia, General topo - NSW LPI DTDB 2012, Mining Titles: Geology Survey NSW. Created by:afoddy

Sandham Road

Sandham Road is a local road that intersects on the northern side of Bells Line of Road, located about 150 m east of Darling Causeway. Sandham Road runs parallel to Chifley Road and provides access to the Bell Quarry. Sandham Road has the following key features:

- Two - way carriageway (one lane each way) of approximately seven metres in width
- Combination of sealed and unsealed road surface
- Posted speed limit of 50 km/h
- No road line markings
- Automatic Tube Count Survey (ATC) shows that average speed is approximately 52 km/h.

Darling Causeway

Darling Causeway is an arterial road that links Bell in the north at Bells Line of Road, with Mount Victoria in the south at the Great Western Highway. It is an alternate road route to Bells Line of Road for vehicles to travel between Sydney and towns of Bell and Lithgow. The road has the following key features.

- Two - way carriageway (one lane each way) of approximately seven metres in width
- Sealed road with shoulders and road line markings
- Posted speed limit of 80 km/h.

Great Western Highway

Great Western Highway (route A32) is a state road that is approximately 200 kilometres long. The highway is a major road route that links Sydney to Bathurst. The Great Western Highway links with Darling Causeway at Mount Victoria, which provides an alternate road route to the site access at Bell. The Great Western Highway has the following key features:

- Two - way carriageway (one lane each way) of approximately seven metres in width
- Sealed road with shoulders and road line markings
- Posted speed limit of 60 km/h
- typically carries about 11,350 vehicles per day near Mount Victoria (RMS Traffic Volume Viewer – Station ID 6188).

9.2.2 Crash statistics

Crash statistics within the vicinity of the site was taken from the NSW Centre for Road Safety website. Crashes for a five year period were reviewed (2011 – 2016). A total of seven crashes occurred within proximity to the local road network.

A summary of crashes are as follows:

- One fatal crash caused by a vehicle leaving left off the carriageway and hitting an object at the Darling Causeway / Chifley Road intersection
- Two serious injury crashes caused by:
  - A vehicle coming off the road on a left bend on Sandham Road, about 3 km north west of the Sandham Road / Bells Line of Road intersection. (not shown in Figure 9-1).
  - A vehicle leaving left off the carriageway and hitting an object at the southern approach of Darling Causeway / Chiefly Road intersection.

- Two moderate injury crashes caused by:
  - An animal strike on Bells Line of Road east of Sandham Road.
  - U-turn at the north approach to Bells Line of Road / Darling Causeway intersection.
- Two minor injury crashes caused by:
  - a vehicle leaving left off the carriageway and hitting an object on Bells Line of Road east of Sandham Road
  - a head on collision at the Bells Line of Road / Darling Causeway intersection

The location of the crashes are shown in Figure 9-2.

Figure 9-2 Crashes map

Source: NSW Centre for Road Safety

9.2.3 Existing peak hour volumes

Traffic surveys were undertaken by Matrix Traffic and Data Solutions on Wednesday 30 November 2016 at the following intersections:

- Bells Line of Road / Chifley Road / Darling Causeway; and
- Bells Line of Road / Sandham Road.

The survey results identified the weekday AM peak hour occurred between 8:00 am to 9:00 am with the PM peak hour occurred between 4:00 pm to 5:00 pm. A summary of peak hour survey is shown in Table 9-1 and Table 9-2 respectively.

Table 9-1 2016 peak volumes Bells Line of Road / Chifley Road / Darling Causeway

Location	8:00 to 9:00 AM		4:00 to 5:00 PM	
	Light Vehicles (veh/h)	Heavy Vehicles (veh/h)	Light vehicles (veh/h)	Heavy Vehicles (veh/h)
Bells Line of Road – Eastbound	70	8	78	10
Bells Line of Road – Westbound	77	8	71	6
Darling Causeway – Northbound	27	9	40	6
Darling Causeway – Southbound	26	11	42	6
Chifley Road – Northbound	77	8	86	7
Chifley Road – Southbound	75	11	77	11

Table 9-2 2016 peak volumes Sandham Road / Bells Line of Road

Location	8:00 to 9:00 AM		4:00 to 5:00 PM	
	Light Vehicles (veh/h)	Heavy Vehicles (veh/h)	Light Vehicles (veh/h)	Heavy Vehicles (veh/h)
Sandham Road – Northbound	3	0	5	1
Sandham Road – Southbound	4	0	1	2
Bells Line of Road – Eastbound	68	8	76	9
Bells Line of Road – Westbound	74	8	69	4

The existing weekday traffic volumes show that traffic is generally higher on Bells Line of Road, while AM and PM peak flows are generally similar.

A seven-day tube data count was also undertaken from 1 December 2016 to 7 December 2016 on Bells Line of Road (east of Sandham Road) and on Sandham Road. Traffic volumes over a 24 hour period on Bells Line of Road for eastbound and westbound directions are shown in Figure 9-2 and Figure 9-3 respectively. The graphs show that Sunday traffic volumes travelling eastbound on Bells Line of Road are significantly higher, with peak volumes of approximately 330 vehicles per hour at 2:00 pm, when compared to weekday five day average volumes, which peak at approximately 110 vehicles per hour.at 3:00 pm. Westbound tube counts on Bells Line of Road tend to be lower in comparison to the eastbound direction, with peak volumes at

approximately 190 vehicles per hour at 12:00 pm on Saturday and 100 vehicles per hour at 3:00 pm on an average weekday.

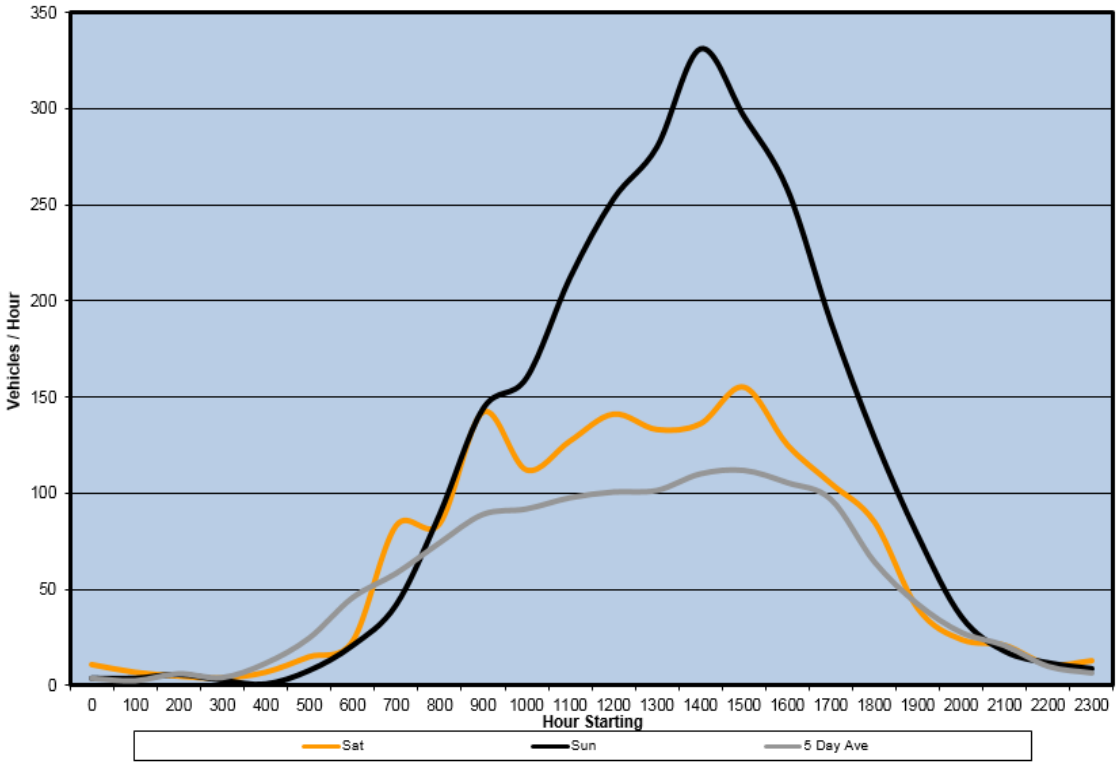

Figure 9-3 Eastbound count Bells Line of Road (east of Sandham Road)

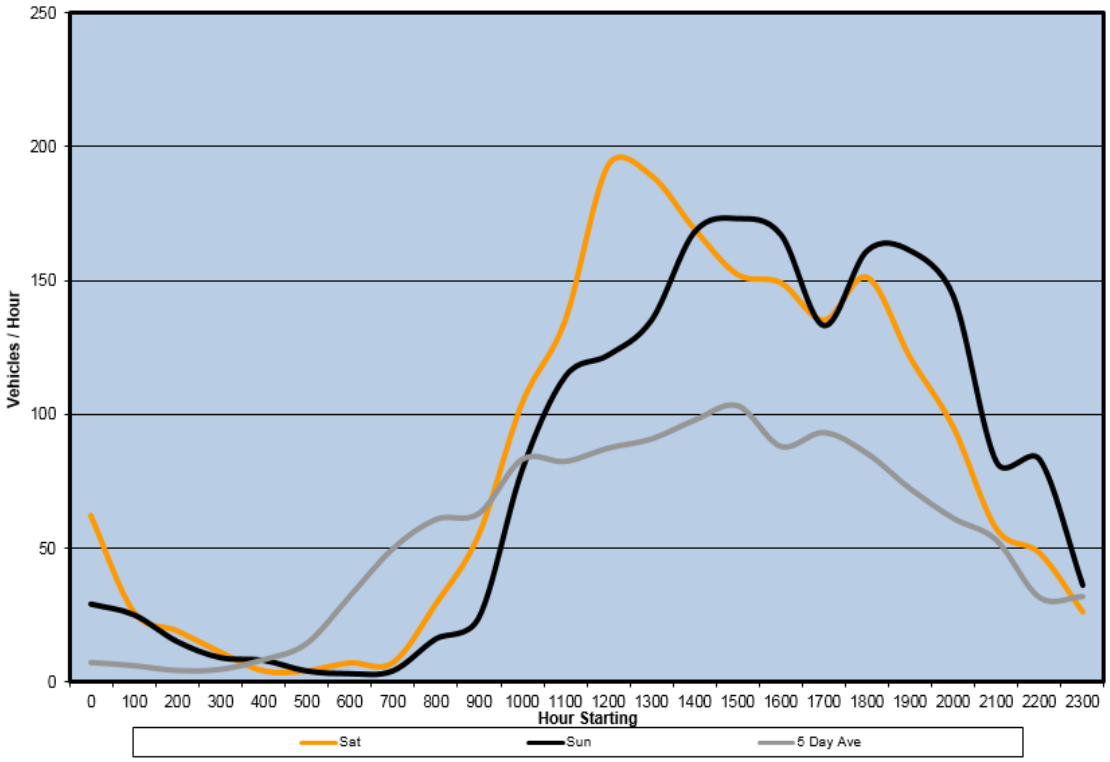

Figure 9-4 Westbound count Bells Line of Road (east of Sandham Road)

Figure 9-3 and Figure 9-4 show the daily traffic count profile on Sandham Road for the northbound and southbound directions respectively. The graphs show that daily volumes on Sandham Road are low for both Saturday and the 5 day weekday average traffic counts. Peak periods for the weekday generally occur between 7:00 am – 8:00 am and 4:00 pm – 5:00 pm. The Saturday traffic count shows that traffic volumes have multiple peaks and troughs throughout the day for the northbound and southbound directions.

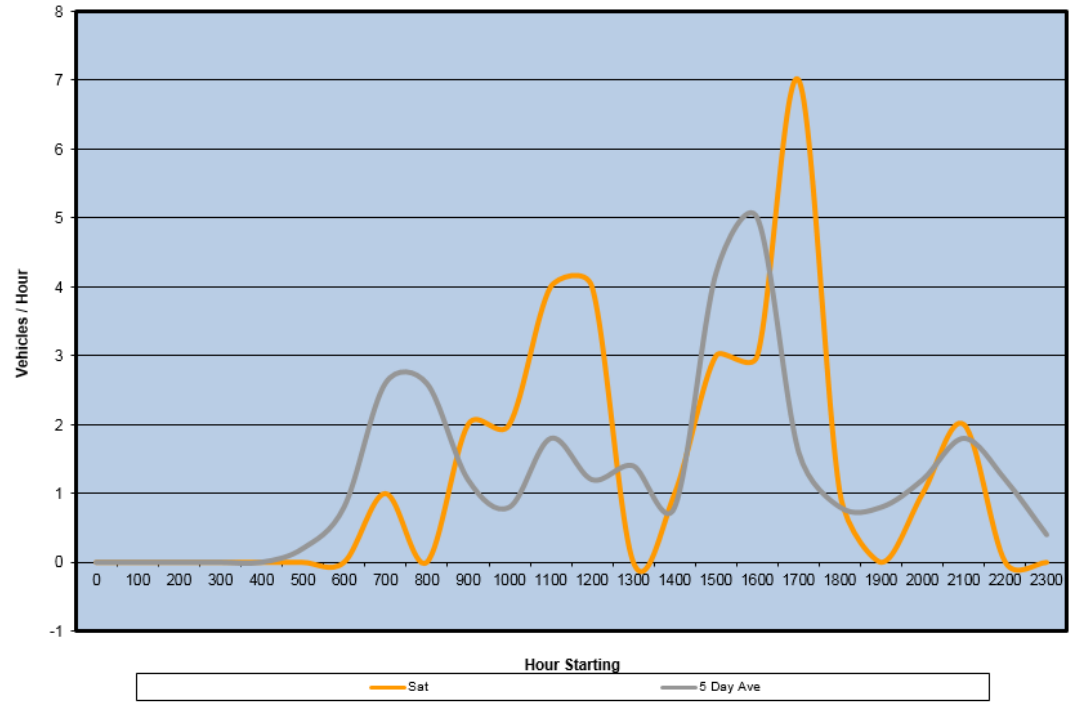

Figure 9-5 Northbound tube count Sandham Road

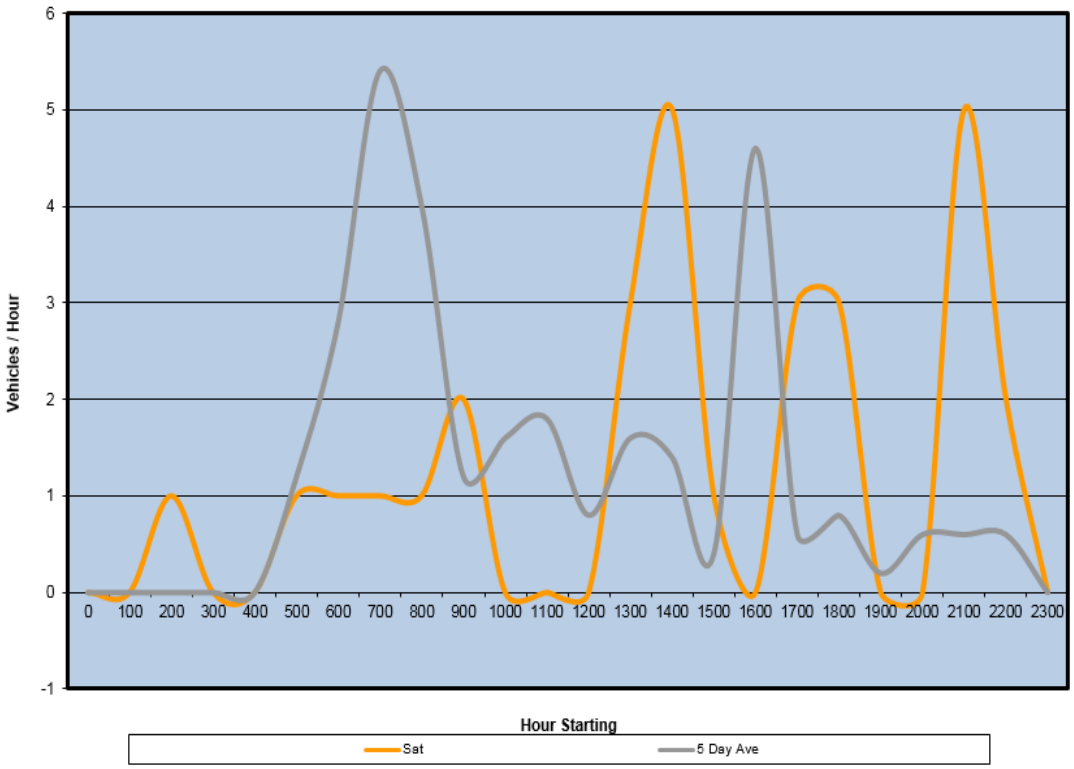

Figure 9-6 Southbound tube count Sandham Road

A review of the vehicle classification was also undertaken to identify vehicle types on Bells Line of Road east of Sandham Road. Table 9-3 outlines the percentage of vehicle types and shows that the majority of vehicles during the weekday are vehicle type C1 (light vehicles) at 85% and vehicle type C2 (car and trailer) at 5% of the total volume of vehicles along Bells Line of Road. Vehicle type C3 (two axle truck or bus) account for 4%, while vehicle type C4 (three axle truck or bus) account for 1% of vehicle volumes.

Table 9-3 Weekday classification - Bells Line of Road east of Sandham Road

Vehicle Type	Vehicle Class	Combined %	Eastbound %	Westbound%
Light	C1	85	85	85
	C2	5	5	5
Medium	C3	4	4	3
	C4	1	2	1
	C5	0	0	0
Heavy	C6	0	0	0
	C7	0	0	0
	C8	0	0	0
	C9	2	2	3
	C10	1	1	2
	C11	0	0	0
	C12	0	0	0

9.2.4 Existing intersection performance

The performance of the existing road network is largely dependent on the operating performance of key intersections, which are critical capacity control points on the road network. SIDRA intersection modelling software was used to assess the proposed peak hour operating performance of intersections on the surrounding road network at key intersections within proximity of the site. The criteria for evaluating the operational performance of intersections is provided by the *Guide to Traffic Generating Developments (Roads and Maritime Services 2002)* and reproduced in Table 9-4. The criteria for evaluating the operational performance of intersections is based on a qualitative measure (i.e. Level of Service), which is applied to each band of average vehicle delay.

Table 9-4 Level of service criteria for intersections

Level of Service	Average Delay per Vehicle (secs/veh)	Traffic Signals, Roundabouts	Give Way & Stop Signs
A	< 14	Good operation	Good operation
B	15 to 28	Good with acceptable delays & spare capacity	Acceptable delays & spare capacity
C	29 to 42	Satisfactory	Satisfactory, but accident study required
D	43 to 56	Operating near capacity	Near capacity & accident study required
E	57 to 70	At capacity; at signals, incidents will cause excessive delays Roundabouts require other control modes	At capacity, requires other control mode
F	> 70	Over Capacity Unstable operation	Over Capacity Unstable operation

Source: Guide to Traffic Generating Developments (Roads and Maritime 2002)

Notes:

A.1 *The average delay for priority-controlled intersections is selected from the movement on the approach with the highest average delay.*

A.2 *The level of service for priority-controlled intersections is based on the highest average delay per vehicle for the most critical movement.*

A.3 *The degree of saturation is defined as the ratio of the arrival flow (demand) to the capacity of each approach.*

The 2016 traffic flows were analysed using SIDRA Intersection 7 modelling software to obtain the current operation of the intersections near the site access. The results of the SIDRA assessment are summarised in Table 9-5, with detailed SIDRA outputs are provided in Appendix E. Table 9-5 indicates that both the intersections at Darling Causeway / Bells Line of Road / Chifley Road and Sandham Road / Bells Line of Road were operating at satisfactory level with spare capacity in both the AM and PM peak periods.

Table 9-5 Existing intersection performance modelling results (2016)

Intersection	Priority Type	AM peak				PM peak			
		LoS	Ave. Delay (s)	Queue (m)	Deg of Sat.	LoS	Ave. Delay (s)	Queue (m)	Deg of Sat.
Darling Causeway / Bells Line of Road	Give-way	A	6.7	1 (S)	0.038	A	6.4	1 (N)	0.04
Sandham Road / Bells Line of Road	Give-way	A	9.0	1 (N)	0.047	A	9.3	1 (N)	0.04

Notes:

1. *The average delay (Ave. Delay) for priority-controlled intersections is selected from the movement on the approach with the highest average delay, given in seconds per vehicle.*
2. *The level of service (LoS) for priority-controlled intersections is based on the highest average delay per vehicle for the most critical movement.*
3. *The degree of saturation (Deg of Sat) is defined as the ratio of the arrival flow (demand) to the capacity of each approach.*

9.3 Impact identification

This section assesses the operational impacts of the traffic generated by the proposed Bell Quarry Rehabilitation Site.

9.3.1 Background traffic growth

Roads and Maritime Services Traffic Volume viewer was used to determine traffic growth trends on Bells Line of Road (Traffic counter ID T0384). Average Annual Daily Traffic volumes (AADT) have increased by 160 vehicles per day over the last three years. This equates to a background traffic growth rate of approximately 2% per year.

This growth rate has been applied to the existing traffic volumes on the local road network to calculate the opening year and future year horizon background traffic volumes.

9.3.2 Projected traffic generation

The project involves importation of approximately 1.2 million cubic metres of clean fill over a period of approximately 15 years with a maximum haulage rate of 140,000 tpa. The emplacement material will be sourced from major construction projects throughout the Sydney basin and the local region and will be transported to site using truck and trailers of up to 42.5 tonne capacity.

It is estimated that haulage will occur for around 250 days per year accounting for wet days and reduced haulage on weekends with an average capacity of 30 tonne. The resulting traffic generated based on this assumption is an average of 37 heavy vehicle movements per day, which is equivalent in number to the previous quarry operations.

It is likely that at some stages, haulage to site may occur in campaigns corresponding to generation of excess VENM and ENM from major construction projects throughout the region. This has potentially double the haulage movements for a restricted period of time and generate up to 74 heavy vehicle movements per day. Any temporary increase in haulage during campaign operations would be followed by a period of reduced haulage to maintain the capacity of the site to accept 140,000 tpa. To ensure a conservative assessment, two traffic generation scenarios have been considered:

- An average haulage – 37 heavy vehicle movements per day; and
- A worst case haulage – double average haulage (74 vehicle movements per day).

It has been assumed that 10% of the daily heavy vehicle movements in the average and worst case scenarios account for the peak hour traffic (morning and afternoon) as shown in Table 9-6.

Table 9-6 Peak hour traffic generation

Traffic Scenario	Light Vehicles (veh/h)		Heavy Vehicles (veh/h)		Total vehicles (veh/h)	
	Inbound	Outbound	Inbound	Outbound	Inbound	Outbound
Average Haulage	2	2	2	2	4	4
Double Average Haulage	2	2	4	4	6	6

The proposed heavy vehicle traffic generated by the site that access / egress Sandham Road / Bells Line of Road intersection have been modelled as being distributed to the local road network according to the following assumptions:

- 45% of inbound and outbound heavy vehicle movements use Bells Line of Road to access / egress Sandham Road.
- 45% of inbound and outbound heavy vehicle movements use Darlings Causeway to access / egress Sandham Road.
- 10% of inbound and outbound heavy vehicle movements use Chifley Road to access / egress Sandham Road.

A diagram of traffic distribution and future projected traffic volumes is shown in Appendix E.

Vehicle movements generated by the project will increase the volume of traffic along key roads and intersections on the haulage route. The predicted increase in traffic on key roads on the haulage route is shown in Table 9-7.

Table 9-7 Predicted traffic increases

Road	Existing Traffic (vpd)	Average haulage (vpd)	Increase (%)	Maximum (vpd)	Increase (%)
Sandham Road	30	37	123	74	247
Bells Line of Road (east of Sandham Road)	1310	17	1.3	34	2.6
Bells Line of Road (west of Sandham Road)	1310	21	1.6	42	3.2
Darling Causeway	500[1]	17	3.4	34	6.8
Chifley Road	1830[1]	4	0.2	8	0.4

Notes:

*1 * the daily traffic volume for these roads has been estimated based on assumption that the peak hour traffic flow is approximately 10% of these daily traffic volume.*

*2. *** (vpd) = vehicles per day*

Sandham Road currently experiences low volumes of traffic and primarily services rural residential properties in Bell following the cessation of the quarry operations. The additional haulage traffic for the rehabilitation activities will therefore represent a relatively large proportional increase to existing background conditions based upon the vehicle counts undertaken following the completion of active extraction operations. The project proposes to limit haulage to within the maximum extraction volumes during the operation of the quarry and the heavy vehicle movements will therefore be representative of the number of movements during the previous quarry operations.

The haulage traffic represents a relatively small proportional increase to background traffic on the wider regional road network. The minor increases to traffic are not considered to impact upon the safety or capacity of the road network.

9.3.3 Intersection performance

Table 9-8 shows the intersection performance at Darling Causeway / Bells Line of Road and Sandham Road / Bells Line of Road for the year of opening (2018) with background traffic growth.

Table 9-8 Intersection performance with background traffic growth 2018

Intersection	Priority Type	AM peak				PM peak			
		LoS	Ave. Delay (s)	Queue (m)	Deg of Sat.	LoS	Ave. Delay (s)	Queue (m)	Deg of Sat.
Darling Causeway / Bells Line of Road	Give-way	A	6.7	1 (S)	0.04	A	6.6	1 (N)	0.04
Sandham Road / Bells Line of Road	Give-way	A	8.8	1 (N)	0.05	A	10.6	1 (N)	0.04

Notes:

1. *The average delay (Ave. Delay) for priority-controlled intersections is selected from the movement on the approach with the highest average delay, given in seconds per vehicle.*
2. *The level of service (LoS) for priority-controlled intersections is based on the highest average delay per vehicle for the most critical movement.*
3. *The degree of saturation (Deg of Sat) is defined as the ratio of the arrival flow (demand) to the capacity of each approach.*

Table 9-8 indicates that both Darling Causeway / Bells Line of Road and Sandham Road / Bells Line of Road currently operate at a satisfactory performance with spare capacity in both AM and PM peak periods.

The life of the quarry rehabilitation project is anticipated to take approximately 15 years. Therefore a future 2033 scenario was also review for intersection performance. These future year scenarios were tested in SIDRA intersection to determine the likely performance with 2% per year background traffic applied.

Table 9-9 shows the SIDRA results summary at Darling Causeway / Bells Line of Road for future year scenarios with and without the operation of the site.

Table 9-9 Darling Causeway / Bells Line of Road SIDRA results summary

Intersection	AM Peak		PM Peak	
	Delay (s)	LOS	Delay (s)	LOS
2018 Base	6.7	A	6.6	A
2018 Average Haulage	6.8	A	6.7	A
2018 Double Average Haulage	6.9	A	6.7	A
Future Base (2033)	7.0	A	6.7	A
Future Average Haulage (2033)	7.1	A	6.8	A
Future Double Average Haulage (2033)	7.1	A	6.9	A

Table 9-9 shows that for Darling Causeway / Bells Line of Road intersection scenarios tested in 2033, the intersections perform satisfactorily with spare capacity. There are negligible changes in traffic performance between the base and traffic operation scenarios for both the AM and PM peak periods. Given the expected low increase in heavy vehicle movements associated with each scenario, it is likely that traffic generation would result in minimal traffic impacts to the operation of the local road network. This small increase in traffic is expected to fall within typical daily traffic variations for the roads surrounding the site.

Table 9-10 shows the SIDRA results summary at Sandham Road / Bells Line of Road intersection.

Table 9-10 Sandham Road / Bells Line of Road SIDRA results summary

Intersection	AM Peak		PM Peak	
	Delay (s)	LOS	Delay (s)	LOS
2018 Average Haulage	9.7	A	10.9	A
2018 Double Average Haulage	10.5	A	11.1	A
Future Base (2033)	8.9	A	10.8	A
Future Average Haulage (2033)	9.8	A	11.1	A
Future Double Average Haulage (2033)	10.6	A	11.3	A

Similar to Darling Causeway / Bells Line of Road intersection, Table 9-10 also shows that Sandham Road / Bells Line of Road has satisfactory performance for all scenarios in 2033. The small increase in traffic is expected to fall within typical daily traffic variations for the roads surrounding the site.

9.3.4 Road safety

The automatic tube count survey undertaken on Bells Line of Road recorded that the 85th percentile speed was 74 km/h in the westbound direction and 72 km/h eastbound in the eastbound direction. This is higher than the posted speed limit of 60 km/h, however the review of crash data indicates that no accidents have occurred at the Sandham Road / Bells Line of Road intersection in the last five year recorded period (2011-2016). It is assumed therefore the intersection of the quarry access road operates safely.

A desktop sight distance review utilising google streetview images was undertaken at the existing intersection of Sandham Road / Bells Line of Road in reference to the recorded 85th percentile speed. The Austroads Guide to Road Design Part 3: Geometric Design (Table 5.5: Truck stopping sight distances) specifies that (accounting for a reaction time of two seconds) speeds of up to 80 km/h, a minimum sight distance of 130 metres should be provided. The desktop review indicates that that this sight distance is currently achieved from Sandham Road.

The existing intersection provides a basic intersection treatment, which meet Austroads Guide to Traffic Management requirements.

9.4 Mitigation measures

The following mitigation measures will be undertaken as part of the Project.

- A heavy vehicle speed limit of 40 km/hour will be adopted for all trucks utilising Sandham Road
- Heavy vehicles will have a maximum capacity of 42.5 tonnes
- A maximum of 37 heavy vehicles per day (74 movements to or from site) will be permitted to haul emplacement material to the site.
- All trucks hauling emplacement material should be covered before entering the public road network and should maintain a reasonable amount of vertical space between the top of the load and top of the trailer

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10. Air quality

10.1 Introduction

This chapter presents an assessment of the potential air quality impacts associated with the Project. It is based upon a full Air Quality Impact Assessment (AQIA), prepared by GHD as part of the impact assessment process and appended to this EIS (Appendix F). The methodology to complete the assessment involved:

- A desktop review to discern local terrain, proposed operations and sensitive receivers
- Reviewing available ambient air quality monitoring data, to define existing conditions
- Reviewing air quality criteria (with consideration to the *Approved Methods for the Modelling and Assessment of Air Pollutants in NSW* (EPA, 2016) (the Approved Methods'))
- Undertaking meteorological modelling of local wind climate
- Deriving the emission inventory to identify sources and rates of dust emission
- Dispersion modelling using CALPUFF based on proposed worst-case operations
- Recommendation of in-principle mitigation and management measures to reduce impacts.

Air quality may be impacted by a number of substances, each of which has different emission sources and effects on human health and the environment. The air quality assessment of the Project is focused on the highest-risk impacts which have the potential to occur during the rehabilitation activities. There is the potential for impacts as a result of emissions of total suspended particulate matter in the form of airborne particulate matter less than 10 microns in size (PM_{10}), particulate matter less than 2.5 microns in size ($PM_{2.5}$) and dust deposition.

Fine particle emissions associated with exhausts from mobile plant and stationary engines used during construction activities are accounted for in the emission factors for earthmoving and handling used in the air quality assessment. Engine emission sources during operation are expected to be discontinuous, transient, and mobile.

10.2 Existing environment

The nearest identified sensitive receivers located in the vicinity of the site and the unpaved portion of Sandham Road are shown in Figure 10-1 below.

10.2.1 Ambient air quality

The NSW OEH operates ambient air quality monitoring stations in selected areas around NSW. The nearest stations to the site are Richmond which is approximately 50 km to the east and Bathurst which is 60 km to the west. Richmond has air quality sampling data for fine particles including both PM_{10} and $PM_{2.5}$, and has a higher yearly average PM_{10} concentration than Bathurst and has therefore been conservatively used in the assessment. There were no exceedances of PM_{10} and $PM_{2.5}$ criteria in Richmond for the data year (2014).

LEGEND

- Residential buildings
- Bell Quarry
- Reserves and State Forests
- Waterways
- Rail
- Roads

Paper Size A4

0 200 400 800

Metres

Map Projection: Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 MGA Zone 56

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Remedial Civil Solutions Pty Ltd
Air Quality Assessment

Job Number	21-25774
Revision	A
Date	29 May 2018

Air quality sensitive receivers near site and Sandham Road

Figure 10-1

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Level 15, 133 Castlereagh Street Sydney NSW 2000 **T** 61 2 9239 7100 **F** 61 2 9239 7199 **E** sydmail@ghd.com.au **W** www.ghd.com.au

Data source: Aerial imagery - sixmaps 2016, Inset map - Geoscience Australia, General topo - NSW LPI DTDB 2012, Mining Titles: Geology Survey NSW. Created by:afoddy

The Clarence Colliery Air Quality Assessment (SLR, 2013) has been reviewed in order to identify whether cumulative air quality impacts are likely. The nearest receivers to both projects are identified as Receivers R1, R2 and R3, which are located between the Bell Quarry site and the other major sources of dust in the local area, so it is unlikely that maximum cumulative impacts would occur where the particulate levels are at maximum at these receivers from each source on the same day. For example if there was a northwesterly wind, particulate from Clarence Colliery and Hansen Quarry may be dispersed in the direction of Receivers R1, R2 and R3, however particulate from Bell Quarry site would disperse away from receivers R1, R2 and R3 towards the south east.

10.2.2 Meteorology

A comprehensive analysis of meteorological data was undertaken for the years from 2012 to 2016 at the closest BoM site at Mount Boyce AWS ID 063292, located approximately 20 kilometres from the site. The analysis shows that the year 2014 is the most representative year based on a review of temperature, humidity, wind speed and wind direction. This year was also identified as not being excessively wet or dry and was selected for use in detailed meteorological modelling for the project site.

The TAPM prognostic model was run to obtain a coarse meteorological 3D gridded dataset for the site for the selected year of 2014. This dataset is based on synoptic observations, local terrain and land use information with a resolution of 1000 m. Upon completion of the broad scale TAPM modelling runs, a CALMET simulation was set up to run for the modelled year, combining the three dimensional gridded data output from the TAPM at a higher resolution of 400m to gain a better understanding of the effect of local terrain on wind speed and atmospheric stability.

The local meteorology largely determines the pattern of off-site air quality impact on receptors. The effect of wind on dispersion patterns can be examined using the wind and stability class distributions at the site. The winds at a site are most readily displayed by means of wind rose and stability distribution plots included in Appendix F.

The features of particular interest for the assessment of air quality impacts for the project include:

- Annual average wind speed of 3.01 m/s
- Winds are most prevalent from the western sectors
- Winds are least prevalent for the south and eastern sectors
- Light winds (< 1.5 m/s) are more prevalent from the southeast and northwest

The observed wind speed distribution indicates that the largest proportion of high wind speeds (> 6 m/s) are from the west, with a small portion of high wind speeds (> 6 m/s) from the north, east and south.

Atmospheric stability substantially affects the capacity of a substance such as gas, particulate matter or odour to disperse into the surrounding atmosphere upon discharge and is a measure of the amount of turbulent energy in the atmosphere.

There are six Pasquill–Gifford classes (A-F) used to describe atmospheric stability, and these classes are grouped into three stability categories; stable (classes E-F), neutral (class D), and unstable (classes A-C). At the Bell Quarry site, stable atmospheres (E and F) occur for 43% of the total time period. Unstable atmospheres (A, B and C) occur 35% of the total time period while neutral conditions (D) occur 21% of the total time period. The dominant state of the atmosphere is stable or neutral (D, E and F).

10.3 Impact Assessment

10.3.1 Basis of assessment

Compliance Criteria

Air quality impact assessment criteria are prescribed by the *Approved Methods (EPA, 2016).* .

The National Environment Protection Council of Environmental Ministers, now the National Environment Protection Council (NEPC), set uniform national standards for ambient air quality in February 2016. These are known as the *National Environment Protection (Ambient Air Quality) Measure* ('the Air NEPM'). The Air NEPM sets non-binding standards and ten-year goals (for 2026). The goal for the Air NEPM is a PM_{10} of 50 micrograms per cubic metre (µg/m^3) as a 24-hour average (no exceedances per year) and a $PM_{2.5}$ goal of 25 µg/m^3 as a 24-hour average.

The Air NEPM standards apply to regional air quality as it affects the general population. The standards do not apply in areas impacted by localised air emissions, such as industrial sources, construction activity, and heavily trafficked streets and roads.

Background concentrations of air pollutants are ideally obtained from ambient monitoring data collected at a Project site in accordance with the Approved Methods. The Approved Methods recognises that this data is rare, and that data is typically obtained from monitoring sites as close as possible to a Project site, where sources of air pollution resemble the existing sources at the Project site.

The Approved Methods for the Modelling and Assessment of Air Pollutants in New South Wales ('the Approved Methods') (EPA, 2016) lists the statutory methods for modelling and assessing emissions of air pollutants from stationary sources in NSW. The assessment criteria for pollutants is applied at the nearest existing or likely future off-site sensitive receptor.

The criteria for particulate matter (PM_{10} and $PM_{2.5}$) and total suspended particles (TSP) are prescribed by the Air NEPM and the Approved Methods respectively. PM_{10}, which has a 24-hour assessment criteria, is most relevant for assessing construction impacts. Dust deposition criteria are mainly used to assess the potential for amenity impacts. These criteria should be met at existing or future off-site sensitive receptors. Particulate and dust deposition levels are provided as cumulative impacts, where the predicted impact of the proposal is added to the adopted background levels.

To ensure that dust environmental outcomes are achieved, emissions from the proposal must be assessed against the assessment criteria shown in Table 10-1. The criteria are provided as cumulative (incremental plus background) concentration levels.

Table 10-1 Impact assessment criteria

Pollutant	Averaging period	Concentration (µg/m3)
Total suspended particulates (TSP)	Annual	90
PM10	24 hours	50
	Annual	25
PM2.5	24 hours	25
	Annual	8
Dust deposition	Annual	2 g/m2/month*

Emissions overview

The air quality assessment focuses on dust, particulate matter being the primary emission to air from the quarry rehabilitation with potential for off-site impact. The fractions of interest assessed in this report are airborne concentrations of TSP and fine particulate matter as well as total deposited dust. Weather conditions that cause maximum dust impact are generally consistent winds in the direction of the nearest sensitive receivers throughout the daytime period outside of rain events.

The rehabilitation processes that may generate significant amounts of particulate matter (dust) were identified to be:

- Importation of up to 1.2 million cubic metres (2.2 million tonnes) of clean fill consisting of VENM and ENM
- Vehicle haulage of clean fill material at a rate of up to 140,000 tpa
- Emplacement and consolidation of clean fill material within the existing quarry voids to closely represent the pre-quarry landform.

Emission rates from naturally wind-borne dust and mechanically induced dust were characterised using Emission Factors (EFs) provided in the National Pollutant Inventory (NPI) Emission Estimation Technique Manual (EETM) for Mining. The techniques used to estimate emissions from mining operations are based primarily on activity rate (e.g. tonnes per hour).

Other air emissions such as combustion products (e.g. vehicle exhaust) will also be present within the quarry site, however due to the small number of vehicles, the potential for impact from these emissions is negligible. Therefore, vehicle exhaust emissions have not been considered further in this assessment.

Project site activities

Rehabilitation of the quarry will have a typical material throughput of up to 1,110 tonnes per day, which equates, on average, to 111 tonnes per hour (TPH) over an 10 hour day (assume 1 hour of breaks in total), 6 days per week. Although it is not expected that the quarry will operate at 111 TPH consistently, this production rate has been chosen to represent a worst-case scenario to derive emission rates.

Table 10-2 provides a summary of the quarry equipment considered in this assessment.

Table 10-2 On-site equipment summary

Equipment Type	Number of Units
Grader	1
Tipper truck (at any time)	1
Roller	1
Bulldozer	1
Wheeled loader	2
Water truck	1
Haul trucks – Daily movements on site	74

The following assumptions were made in calculating the dust emission rates for quarry activities:

- Where there was more than one item of the same equipment, the total throughput was split between each item. For example, if there were two loaders operating at once, it was assumed that each loader would have a throughput of 55.5 tonnes per hour.
- The use of a water truck and roller has been assumed not to generate dust emissions, as its use will act to suppress emissions. Therefore, the water truck and roller are not included in the emissions inventory.

- GHD has assumed that the existing quarry pit area will be rehabilitated or used for water storage, and wind erosion will be minimal.

Observations made on similar sites compare well with the rank of primary dust emission sources as detailed in Table 10-3, which identifies vehicle movements and bulldozers to be the primary contributors to site dust emissions.

Table 10-3Ranking of primary dust emission sources

Equipment		Default TSP Emission Factor	Default PM_{10} Emission Factor	Default $PM_{2.5}$ Emission Factor	Unit	Application	TSP Emission Rate (kg/hr)	PM_{10} Emission Rate (kg/hr)	$PM_{2.5}$ Emission Rate (kg/hr)
Trucks within site to drop-off and back		4.23	1.25	0.19	kg/VKT	37 trucks in and out per day. Drop off area approximately 270 m from site entry.	4.2	1.2	0.2
Front end loaders		0.025	0.012	0.0018	kg/t	2 loaders, 55.5 tonnes per hour for each loader over a 10 hour day	2.8	1.3	0.2
Grader		0.19	0.085	0.01275	kg/VKT	1 grader, travelling 40 km per day onsite	0.8	0.3	0.1
Dump Truck - dumping		0.012	0.0043	0.00065	kg/t	Dumping 111 tonnes per hour	1.3	0.5	0.1
Bulldozer		17	4.1	0.615	kg/hr	1 bulldozer operating for 10 hours in the day. Assumed level 2 watering on days with high dust potential	4.3	1.0	0.2
Incoming spoil stockpile		0.4	0.2	0.03	kg/ha/hr	40 m^2, 2 m high incoming waste stockpile based on two days of waste stockpiled at any one time	0.0064	0.0032	0.00048

Sandham Road

Sandham Road is an unpaved road that leads from Bells Line Road to the site. The project involves importation of approximately 1.2 million cubic metres of clean fill over a period of approximately 15 years with a maximum haulage rate of 140,000 tpa using trucks with an average capacity of 30 tonnes.

It is estimated that haulage will occur for around 250 days per year accounting for wet days and reduced haulage on weekends. The resulting traffic generated based on this assumption is around 18 trucks travelling to the site resulting in an average of 37 heavy vehicle movements per day along Sandham Road.

It is also likely that at some stages, haulage to site may occur in campaigns corresponding to generation of excess VENM and ENM from construction projects throughout the region. This has potentially double the haulage movements for a restricted period of time and generate up to 74 heavy vehicle movements per day along Sandham Road. Any temporary increase in haulage during campaign operations would be followed by a period of reduced haulage to maintain the capacity of the site to accept 140,000 tpa.

To ensure a conservative assessment the worst case truck movement scenario has been assessed to determine dust emissions to sensitive receivers along Sandham Road. The site is open for 11 hours Monday to Friday (7 am to 6 pm) however to be conservative it has been assumed that trucks will be limited to travel 10 hours a day when determining an average per hour.

The unpaved section is approximately 3.7 km to the site entry. Particulate emissions ($PM_{2.5}$ and PM_{10}) have been assessed using the following assumptions Table 10-4.

Table 10-4 Sandham Road particulate emissions

Truck movement detail	Assumption
Trucks deliveries per day	37
Total truck numbers on Sandham Road	74
Trucks per hour	7.4
Truck frequency (minutes)	8.1
Unpaved section of Sandham Road	3.7 km
Total vehicle km per hour	27.4 km
TSP (4.23 kg/VKT)	115.9 kg/hr for entire unpaved road
PM10 (1.25 kg/VKT)	34.2 kg/hr for entire unpaved road
PM2.5 (0.1875 kg/VKT)	5.13 kg/hr for entire unpaved road

Emissions from the road can be modelled as a number of volume sources spaced evenly along the road alignment, or by modelling representative sections of road.

10.3.2 Impacts from site emplacement activities

A summary of the predicted particulate concentrations during rehabilitation activities at the site are presented in Table 10-5 to Table 10-7. These results predict the top four ranked days at the nearest six sensitive receivers and show that the levels drop considerably after the two highest predicted days at the nearest two receivers. The values in these tables are the incremental impact from the rehabilitation activities only and do not include the background.

Table 10-5 Top ranked incremental 24 hour PM_{10} impact (Criteria 50 µg/m^3)

Receptor	Rank 1	Rank 2	Rank 3	Rank 4
R1	27.6	25.0	16.5	15.4
R2	20.4	18.1	10.2	10.1
R3	22.8	17.2	9.9	9.6
R4	4.4	4.2	3.7	3.3
R5	2.7	2.7	2.2	1.9
R6	2.5	2.4	2.3	2.1

Table 10-6 Top ranked incremental 24 hour $PM_{2.5}$ impact (Criteria 25 µg/m^3)

Receptor	Rank 1	Rank 2	Rank 3	Rank 4
R1	9.3	9.1	8.5	7.2
R2	5.8	5.7	5.6	4.8
R3	6.6	5.8	5.8	5.0
R4	1.9	1.5	1.3	1.2
R5	1.2	1.1	1.0	0.8
R6	1.2	1.0	1.0	0.9

Table 10-7 Predicted annual concentration (µg/m^3)

Receptor / Criteria	TSP (90 ug/m3	PM10 (25ug/m3)	PM2.5 (8 ug/m3)	Deposited Dust (2 g/m2/month)
R1	19.5	1.4	0.7	0.59
R2	11.0	0.8	0.4	0.25
R3	11.1	0.8	0.5	0.23
R4	3.6	0.2	0.1	0.06
R5	2.9	0.1	0.1	0.04
R6	2.6	0.1	0.1	0.04

A contemporaneous assessment has been undertaken at the nearest receiver in accordance with the Approved Methods to predict PM10 and PM2.5 levels from the Project site. The maximum measured background, site increment and total for PM10 and PM2.5 is shown in Table 10-6 and Table 10-7 below. Results show compliance with the criteria of 50 µg/m^3 and 25 µg/m^3 for both PM_{10} and $PM_{2.5}$. It should be noted that the background and incremental levels will not sum up to the provided total levels as the maximum background, incremental and total impacts occur on different days.

Table 10-8 Summary of highest measured and predicted PM_{10} levels (R1)

Date	PM_{10} background	Date	PM_{10} increment	Date	PM_{10} Total
10/02/2014	40	23/03/2014	27.6	23/03/2014	40.1
17/12/2014	36.6	20/08/2014	25.0	10/02/2014	40.0
31/12/2014	34.9	10/06/2014	16.5	26/11/2014	38.0
23/11/2014	34.5	25/08/2014	15.4	17/12/2014	36.6
27/10/2014	33.6	12/08/2014	14.6	20/08/2014	35.8
25/05/2014	33.5	05/09/2014	14.1	31/12/2014	34.9
15/11/2014	33.1	09/06/2014	12.9	23/11/2014	34.5
06/08/2014	32	11/05/2014	11.2	27/10/2014	33.6
26/11/2014	30.7	21/01/2014	11.0	25/05/2014	33.5
01/02/2014	30.6	14/04/2014	10.6	15/11/2014	33.1

Table 10-9 Summary of highest measured and predicted $PM_{2.5}$ levels (R1)

Date	PM2.5 background	Date	PM2.5 increment	Date	PM2.5 Total
06/08/2014	24.7	31/12/2014	9.3	06/08/2014	24.7
25/05/2014	22.1	20/09/2014	9.3	25/05/2014	22.1
08/06/2014	19.4	10/06/2014	9.1	31/12/2014	20.0
03/08/2014	17.8	02/04/2014	8.5	08/06/2014	19.6
04/07/2014	17.6	21/02/2014	7.2	03/08/2014	17.9
03/07/2014	16.8	20/08/2014	7.0	04/07/2014	17.6
27/07/2014	16.6	03/04/2014	6.9	22/07/2014	17.4
22/05/2014	16.1	30/03/2014	6.8	10/06/2014	17.1
25/10/2014	14.5	20/07/2014	6.6	03/07/2014	16.8
24/11/2014	14.4	23/03/2014	6.4	03/04/2014	16.8

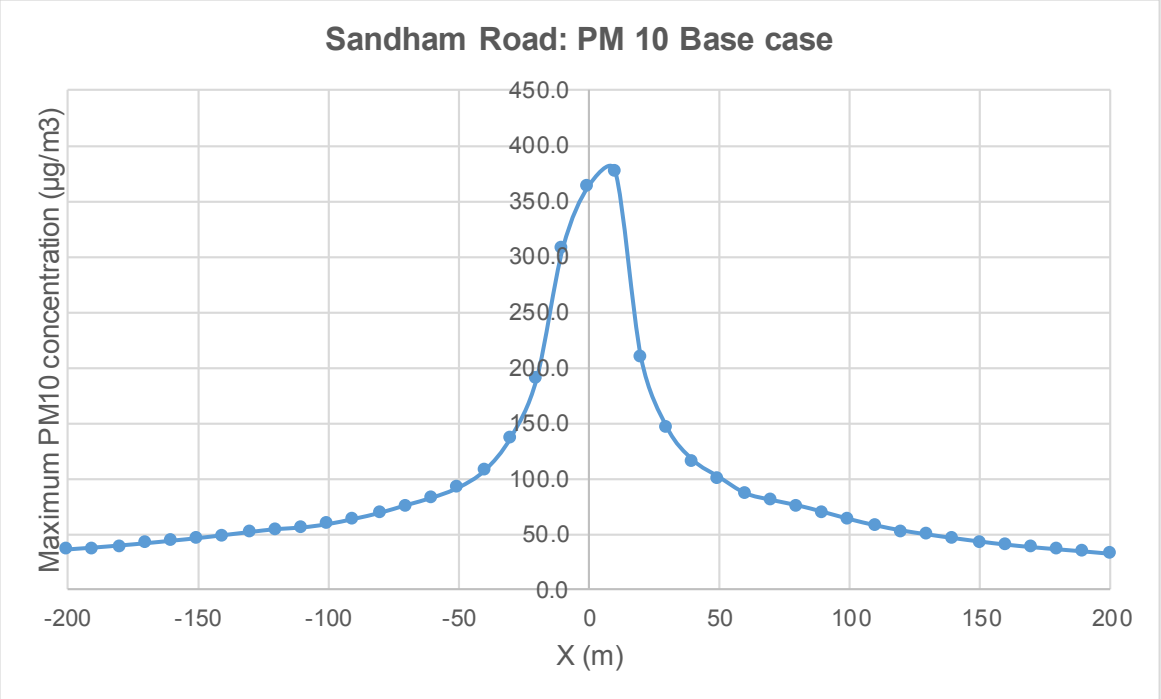
10.3.3 Sandham Road impacts

Worst case (100th percentile) PM_{10} emissions have been modelled in order to gain an understanding of potential dust impacts. Three scenarios have been assessed:

- Worst case predicted 24 hour PM_{10} concentration with no mitigation
- Worst case predicted 24 hour PM_{10} concentration with level 1 watering (2 litres/m^2/hr)
- Worst case predicted 24 hour PM_{10} concentration with level 2 watering (>2 litres/m^2/hr)

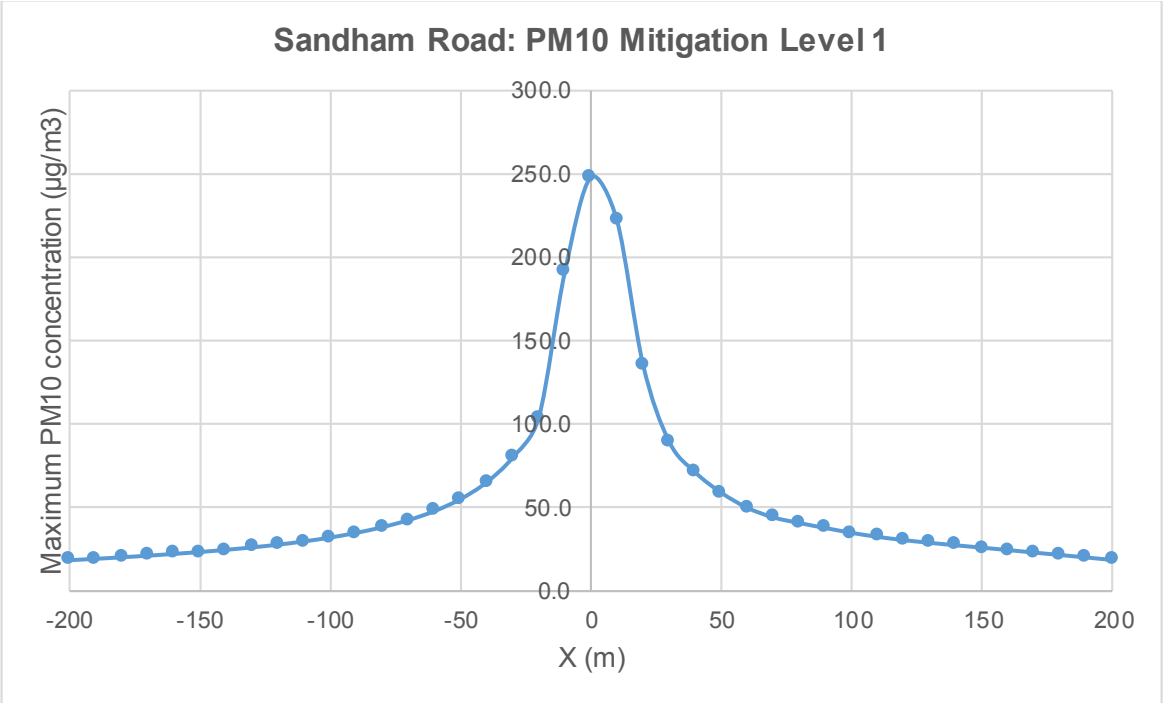
Results in Figure 10-2 show that on the worst case day of the year, PM_{10} emission would exceed the criteria up to a distance of 120 m from the road (the nearest house is approximately 80 m from Sandham Road). Dust mitigation would be needed on these worst-case days as the predicted increment from the road is above the 24 hour criteria of 50 µg/m^3 (i.e. Mitigation is needed when visible dust plumes are observed to be blowing in the direction of affected receivers).

Figure 10-2 Predicted 100th percentile PM_{10} emissions from Sandham Road, no mitigation



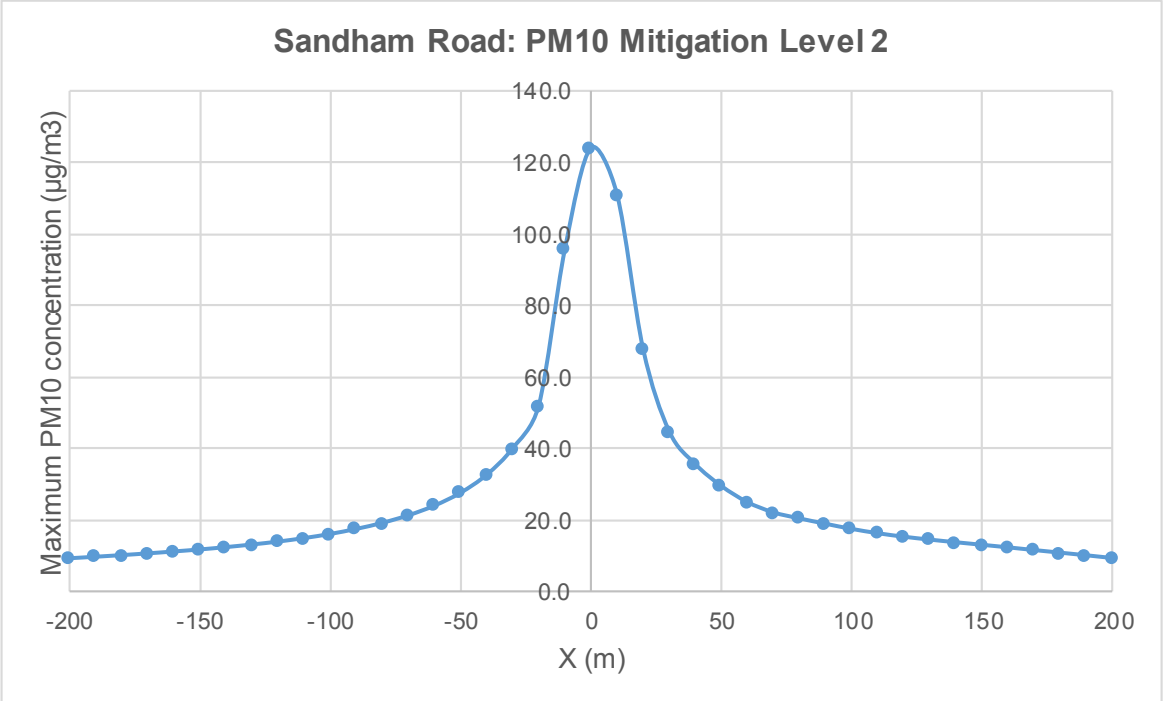
Modelling assuming level 1 watering applied to Sandham Road when visible dust plumes are observed to be dispersing in the direction of nearby receivers has been undertaken with a worst-case cross section of PM_{10} levels from Sandham Road presented in Figure 10-3. Results show that PM_{10} emission would exceed the criteria up to a distance of 60 m from the road.

Figure 10-3 Predicted 100th percentile PM_{10} emissions from Sandham Road, with level 1 mitigation



Modelling assuming level 2 watering applied to Sandham Road when visible dust plumes are observed to be dispersing in the direction of nearby receivers has been undertaken with a worst-case cross section of PM_{10} levels from Sandham Road presented in Figure 10-4. Results show that PM_{10} emission would exceed the criteria up to a distance of 30 m from the road.

Figure 10-4 Predicted 100th percentile PM_{10} emissions from Sandham Road, with level 2 mitigation



A contemporaneous assessment in accordance with the Approved Methods has been undertaken at the nearest receiver to predict the highest PM_{10} impacts from Sandham Road for

both dust mitigation scenarios. The contemporaneous assessment for Mitigation 1 in Table 10-10 shows one day in the year where predicted PM_{10} levels marginally exceed the 24 hour criteria of 50 µg/m^3. This is at the nearest receiver only (R28) and it not expected at any other receivers.

Table 10-10 Summary of highest measured and predicted PM_{10} levels at nearest receiver (R28) to Sandham Road (Mitigation 1)

Date	PM10 background	Date	PM10 increment	Date	PM10 Total
10/02/2014	40	18/06/2014	39.1	18/06/2014	52.0
17/12/2014	36.6	14/08/2014	30.5	10/02/2014	49.9
31/12/2014	34.9	11/06/2014	23.7	14/08/2014	45.1
23/11/2014	34.5	05/06/2014	23.0	17/12/2014	42.9
27/10/2014	33.6	22/07/2014	21.6	21/05/2014	42.3
25/05/2014	33.5	21/09/2014	18.7	06/08/2014	41.8
15/11/2014	33.1	08/06/2014	16.6	25/05/2014	40.0
06/08/2014	32	22/06/2014	16.6	31/12/2014	39.3
26/11/2014	30.7	21/05/2014	16.5	15/11/2014	38.2
01/02/2014	30.6	31/08/2014	14.9	22/07/2014	38.1

An additional dust mitigation scenario has been considered, to be applied to the portion of Sandham Road directly adjacent to R28 when visible dust plumes are observed to be dispersing in that direction. Results are shown in Table 10-11 and show compliance with the 24 hour criteria of 50 µg/m^3.

Table 10-11 Summary of highest measured and predicted PM_{10} levels at nearest receiver (R28) to Sandham Road (Mitigation 2)

Date	PM10 background	Date	PM10 increment	Date	PM10 Total
10/02/2014	40	18/06/2014	19.6	10/02/2014	45.0
17/12/2014	36.6	14/08/2014	15.2	17/12/2014	39.7
31/12/2014	34.9	11/06/2014	11.8	31/12/2014	37.1
23/11/2014	34.5	05/06/2014	11.5	06/08/2014	36.9
27/10/2014	33.6	22/07/2014	10.8	25/05/2014	36.7
25/05/2014	33.5	21/09/2014	9.4	15/11/2014	35.7
15/11/2014	33.1	08/06/2014	8.3	23/11/2014	34.8
06/08/2014	32	22/06/2014	8.3	27/10/2014	34.3
26/11/2014	30.7	21/05/2014	8.2	21/05/2014	34.0
01/02/2014	30.6	31/08/2014	7.5	18/06/2014	32.5

10.4 Mitigation measures

10.4.1 Sandham Road

Dust dispersion modelling identified haul trucks operating on unsealed surfaces are a significant source of dust. In order to control potential dust impacts from Sandham Road, and to meet the project criteria, Level 1 (2L/m^2/hr) water spraying should be undertaken on Sandham Road whenever visible plumes of dust are observed to be blowing towards nearby receivers (specifically R18 and R28). This should be undertaken during daytime weather conditions that assist dust dispersion (dry and windy).

10.4.2 General dust mitigation measures

While general quarry operations are not expected to exceed air quality goals at nearby private receptors, the following mitigation measures will be undertaken as part of the Project.

- Aim to minimise the size of storage piles where possible
- Limit cleared areas of land and clear only when necessary to reduce fugitive dust emissions
- Control on-site traffic by designating specific routes for haulage and access and limiting vehicle speeds to below 25 km/hr
- All trucks hauling emplacement material should be covered before entering the public road network and should maintain a reasonable amount of vertical space between the top of the load and top of the trailer
- Material spillage on sealed roads should be cleaned up as soon as practicable
- Operations conducted in areas of low moisture content material should be suspended during high wind speed events or water sprays should be used
- These measures will assist in reducing impact on all areas off-site.

11. Noise and vibration

11.1 Introduction

This chapter presents an assessment of the potential noise and vibration impacts arising from the Project. It is based upon a specialist noise assessment included in Appendix G, which assesses the potential noise impacts of emplacement activities at the site and the additional truck movements to and from the site. The assessment included the following tasks:

- An initial desk top review to identify environmental noise and vibration sensitive receivers from aerial photography and a site visit.
- Background noise monitoring for one week at two noise receiver locations identified as being indicative of the local ambient noise environment.
- Establish project specific noise trigger levels and vibration criteria for the operation of the quarry with consideration to the guidelines and standards mentioned below.
- Identify the likely principal noise and vibration sources during the proposed operations.
- Undertake noise modelling to predict operational noise levels at the nearest identified noise receivers to the quarry.
- Calculate the noise level at the nearest receptors due to noise generating equipment and plant movements at the site during the early and later stages of the rehabilitation
- The scope of work above has been conducted with consideration to the following guidelines:
  - Noise Policy for Industry (NPI) (EPA, 2017).
  - Road Noise Policy RNP (DECCW 2011).
  - Assessing Vibration: A Technical Guideline (DEC 2006).
- Assessing noise impacts from the increase in traffic movements associated with material transport on Sandham Road. The potential noise impacts associated with the traffic movements were assessed with consideration of the *Road Noise Policy* (NSW DECCW, 2011).

11.2 Existing environment

Background noise is representative of the rural environment with surrounding noise sources including nearby mining operations and associated rail loop and coal loader, the Main Western Railway, Chifley Road and Sandham Road. The nearest identified sensitive receivers located in the vicinity of the quarry site and the haulage route along Sandham Road are detailed in Figure 11-1 and Figure 11-2 respectively.

Meteorology data was obtained from the Bureau of Meteorology's Mount Boyce Automatic Weather Station for this assessment, situated approximately 5 km to the south east. Data collected at this location is considered to be representative of meteorological conditions at the subject site for the purpose of this assessment.

Legend

- Bell Quarry site
- Residential buildings
- Background Noise Monitoring Locations

Paper Size A4

0 75 150 300

Metres

Horizontal Datum: GDA 1994
Grid: GCS GDA 1994

N

Remedial Civil Solutions Pty Ltd
Bell Quarry Rehabilitation

Location of site, sensitive receivers and noise monitoring locations

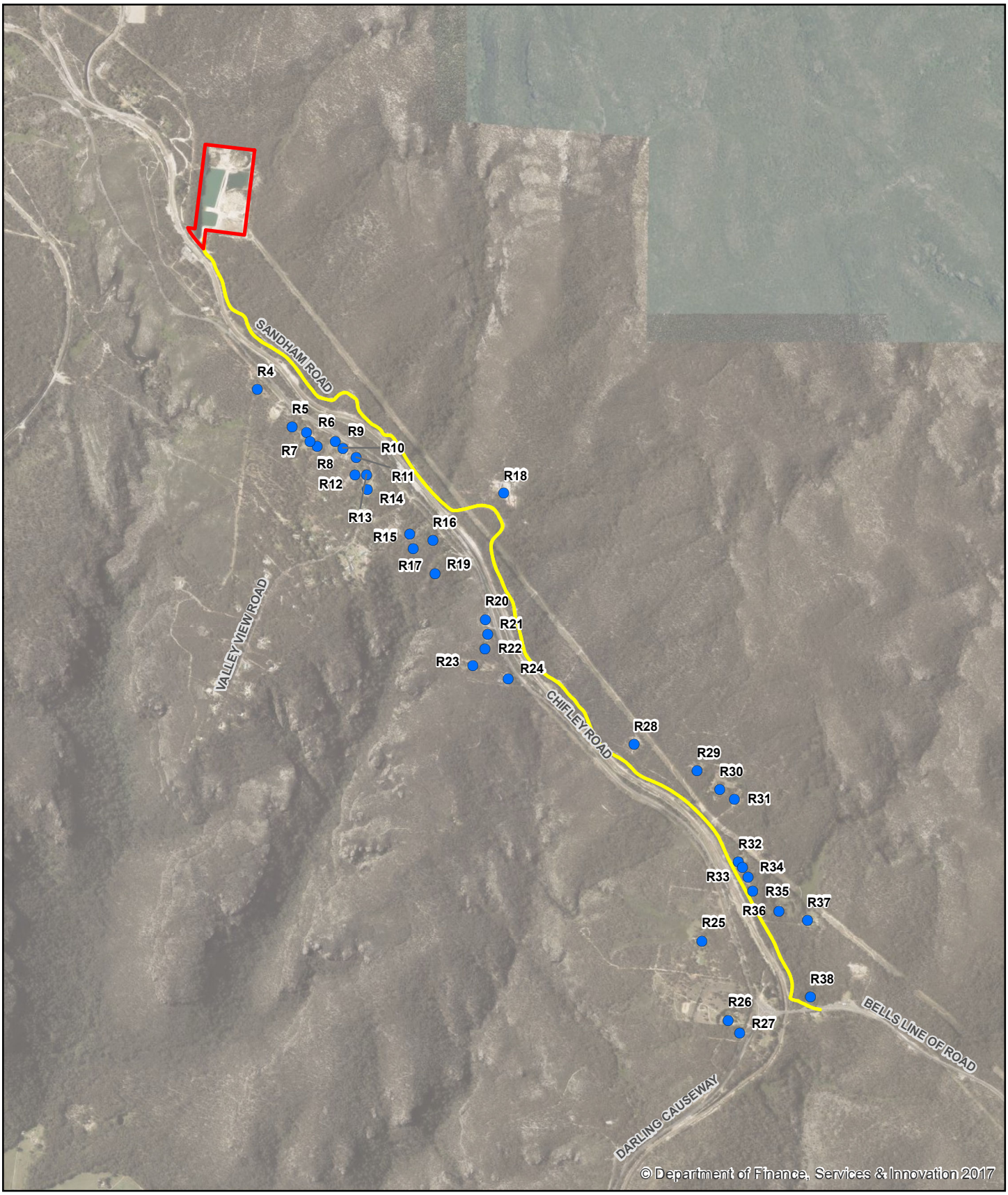
Job Number	21-25774
Revision	A
Date	29 May 2018

Figure 11-1

Level 15, 133 Castlereagh Street, Sydney NSW 2000 Australia **T** 61 2 9239 7100 **F** 61 2 9239 7199 **E** sydmail@ghd.com **W** www.ghd.com

G:\21\25774\GIS\Maps\Deliverables\21_25774_Z008_NoiseSiteLocation.mxd (SMA record: 1)

Data source: Aerial Imagery: Sixmaps (2017 NSW LPI); General Topo: NSW LPI DTDB 2012. Created by:afoddy



Legend

- Bell Quarry site
- Residential buildings
- Sandham Road

Paper Size A4

0 200 400 800

Metres

Map Projection: Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 MGA Zone 56

N

Remedial Civil Solutions Pty Ltd
Bell Quarry Rehabilitation

Senstive residential receivers along Sandham Road

Job Number	21-25774
Revision	A
Date	29 May 2018

Figure 11-2

Level 15, 133 Castlereagh Street, Sydney NSW 2000 Australia **T** 61 2 9239 7100 **F** 61 2 9239 7199 **E** sydmail@ghd.com **W** www.ghd.com

G:\21\25774\GIS\Maps\Deliverables\21_25774_Z009_NoiseReceivers.mxd (SMA record: 2)

Data source: Aerial Imagery: Sixmaps (2017 NSW LPI); General Topo: NSW LPI DTDB 2012. Created by:afoddy

Noise logging was conducted from Thursday 27th July 2017 to Monday 7th August 2017 at two locations to determine noise levels in the vicinity of the quarry site and the proposed haulage route along Sandham Road. A summary of the noise monitoring results are presented in Table 11-1

Table 11-1 Summary of noise monitoring results, dBA

Location	Background noise descriptors LA90(Period)			Ambient noise descriptors LAeq(period)		
	Day	Evening	Night	Day	Evening	Night
Northern boundary of Bell quarry site	23	22	18	38	36	39
Western boundary of 310 Sandham Road	24	15	14	43	42	41

Wind conditions at the Bell Quarry site are based on meteorological modelling conducted for GHD's air quality assessment (derived from weather data obtained from Mount Boyce AWS). Analysis of the seasonal wind rose data indicates that winds up to 3 m/s do not occur more than 30% of the time in the direction of nearest sensitive receivers to the north-west.

11.3 Impact assessment

11.3.1 Guidelines

Site Operations

The Noise Policy for Industry (NPI) provides guidance on the assessment of operational noise impacts. The guideline includes both intrusiveness and project amenity noise levels that are designed to protect receivers from noise significantly louder than the background level, and to limit the total noise level from industry near a receiver.

The NPI project noise trigger levels provide an objective for assessing a proposal and are not mandatory limits required by legislation. The project noise trigger levels assist the regulatory authorities to establish licensing conditions. Where project noise trigger levels are predicted to be exceeded, feasible and reasonable noise mitigation strategies should be considered. In circumstances where noise criteria cannot be achieved, residual noise impacts are used to assess noise impacts and manage noise from the site in negotiation between the regulatory authority and community. The regulatory authority then sets statutory compliance levels that reflect the achievable and agreed noise limits from the development.

The intrusiveness noise level controls the relative audibility of operational noise compared to the background level at residential receivers. The amenity noise level limit the total level of extraneous noise for all receiver types.

For residential receivers, the project noise trigger levels are provided in Table 11-2. The project noise trigger levels reflect the most stringent noise level requirements derived from the intrusiveness and project amenity noise level. Daytime and night time project noise trigger levels should aim to be achieved since the quarry will operate during this time periods. Project noise trigger levels at the sensitive receivers are determined based on the respective logger location, however in this instance the Rating Background Level (RBL) was below the minimum threshold at all logger locations.

Table 11-2– Project noise trigger levels – residential noise receivers, dBA

Criteria LAeq(15min)	Residential Receivers		
	Day	Evening	Night
Intrusiveness noise level	40	35	35
Project amenity noise level (rural)	48	43	38
Project noise trigger levels	40	35	35

Notes:

- The NPI defines Day as 7 am to 6 pm Monday to Friday and 8 am to 1 pm Sunday and Public Holidays, Evening 6pm to 10 pm and Night as the remaining periods.
- In accordance with the NPI, the minimum assumed Rating Background Level (RBL) during the daytime is 35 dBA and 30 dBA for the evening and night periods (measured background noise levels are lower than these RBLs)
- Noise from the site is to be measured at the most affected point within the residential boundary, or at the most affected point within 30 metres of the dwelling where the dwelling is more than 30 metres from the boundary, to determine compliance with the project noise trigger levels, except where otherwise specified below.
- The Blue Mountains National Park area directly to the south and east of the site is classified as a passive recreation area with a recommended amenity noise level of L_{Aeq} 50 dB (when in use). However, the national park area to the south and east of the site is not easily accessible by the public.

Sleep disturbance

The OEH's *Noise Guide for Local Government* (NGLG) provides guidelines for assessing sleep disturbance from short-term noise events. To assess potential disturbance during night-time hours (6:00 am to 7.00 am), Section 2.4.5 of the NGLG recommends that $L_{A1,1min}$ levels outside a bedroom window should not exceed the background level by more than 15 dBA.

Table 11-3 below summarises the background noise level at the nearby residential receivers and the sleep disturbance criterion.

Table 11-3 Sleep disturbance criteria, $L_{A1(1min)}$ dBA

Receiver Type	Night-time shoulder LA90 Background Noise Level	Criterion LA1(1min)
Nearby Residential Receivers	30	45

Road traffic noise criteria

The *Road Noise Policy* (RNP) (DECCW), 2011) provides traffic noise criteria for residential receivers in the vicinity of existing roads, shown in Table 11-4. The criteria is applied to operational and construction traffic on public roads to identify potential road traffic impacts and the requirement for reasonable and feasible mitigation measures.

The RNP application notes state that *"for existing residences and other sensitive land uses affected by additional traffic on existing roads generated by land use developments, any increase in the total traffic noise level as a result of the development should be limited to 2 dB above that of the noise level without the development. This limit applies wherever the noise level without the development is within 2 dB of or exceeds, the relevant day or night noise assessment criterion."*

If road traffic noise increases from the development are within 2 dBA of current levels then the objectives of the RNP are met and no specific mitigation measures are required.

Table 11-4 Road traffic noise criteria, $L_{Aeq(period)}$ dBA

Type of Development	Day 7 am to 10 pm	Night 10 pm to 7 am
Existing residence affected by additional traffic on existing local roads generated by land use developments	55 Leq(1hr)	50 Leq(1hr)

11.3.2 Basis of assessment

The rehabilitation process will be completed in six (6) stages, with each stage localised to a specific area of the quarry. For each stage, tipper trucks will transport material to the quarry site, where loaders and dozers will distribute the material throughout the fill area. Rollers and graders will be used to compact the material as the quarry is filled and a water cart will be used for dust suppression. Water pumps will be required to progressively dewater the existing quarry voids. A fuel truck will be also required on site to deliver fuel to the plant described above.

Site operations are proposed from 6:00 am to 6:00 pm Monday to Friday and 6.00 am to 1 pm on Saturdays. Between 6:00 am and 7:00 am there will be restricted operations on site including a grader and a roller will compact the internal haulage road to prepare the site for the tipper trucks transporting material to the quarry. There will be no heavy vehicle haulage along Sandham Road or filling activities undertaken at the site prior to 7 am.

Acoustic modelling was undertaken using CadnaA 2017 noise modelling software to predict the effects of industrial noise generated by the proposed quarry rehabilitation site. A separate model was created using the noise intrusion modelling software CadnaA in order to determine the effects of the trucks on receivers along Sandham Road. Road traffic noise propagation was calculated according to the *Calculation of Road Traffic Noise* (CoRTN) 1998 standard.

The NPI states that when there is greater than a 30% occurrence of wind of up to 3 m/s, in any period (day, evening, night) in any season, from source to receiver, wind should be considered in noise prediction calculations. Analysis indicates that winds up to 3 m/s do not occur more than 30% of the time in the direction of nearest sensitive receivers to the north-west.

The noise predictions are therefore considered conservative as the model takes into account a moderate temperature inversion and favourable wind conditions to sound propagation.

11.3.3 Operational noise

The site operation, consisting of plant and equipment within the quarry, was modelled with the above assumptions and is based on the scenarios at the quarry site detailed above with further details of the methodology and assumptions included in Appendix G.

The resulting noise levels at sensitive receivers is shown in Table 11-1 below. Results show that all stages of the rehabilitation process will comply with the project noise trigger levels at all sensitive receivers. Noise emission maps of each stage are provided in Appendix G.

Table 11-5 Noise levels at sensitive receivers from onsite operation – day, $L_{Aeq(15min)}$ dBA

Stage	Receiver	Predicted noise level	Project noise trigger level	Compliance
Stage 1A	R1	34	40	Yes
	R2	37	40	Yes
	R3	37	40	Yes
	R4	29	40	Yes
	R5	29	40	Yes
	R6	28	40	Yes
Stage 1B	R1	39	40	Yes
	R2	39	40	Yes
	R3	40	40	Yes
	R4	30	40	Yes
	R5	29	40	Yes
	R6	29	40	Yes
Stage 2A	R1	32	40	Yes
	R2	33	40	Yes
	R3	33	40	Yes
	R4	24	40	Yes
	R5	23	40	Yes
	R6	22	40	Yes
Stage 2B	R1	35	40	Yes
	R2	36	40	Yes
	R3	36	40	Yes
	R4	28	40	Yes
	R5	28	40	Yes
	R6	27	40	Yes
Stage 3A	R1	36	40	Yes
	R2	36	40	Yes
	R3	37	40	Yes
	R4	27	40	Yes
	R5	27	40	Yes
	R6	26	40	Yes
Stage 3B	R1	38	40	Yes
	R2	37	40	Yes
	R3	37	40	Yes
	R4	30	40	Yes
	R5	29	40	Yes
	R6	28	40	Yes
Stage 4A	R1	33	40	Yes
	R2	33	40	Yes
	R3	33	40	Yes
	R4	25	40	Yes
	R5	25	40	Yes
	R6	24	40	Yes
Stage 4B	R1	34	40	Yes
	R2	35	40	Yes
	R3	36	40	Yes
	R4	30	40	Yes
	R5	29	40	Yes
	R6	28	40	Yes
Stage 5A	R1	32	40	Yes
	R2	33	40	Yes
	R3	34	40	Yes
	R4	27	40	Yes
	R5	27	40	Yes
	R6	25	40	Yes
Stage 5B	R1	35	40	Yes
	R2	36	40	Yes

Stage	Receiver	Predicted noise level	Project noise trigger level	Compliance
	R3	37	40	Yes
	R4	30	40	Yes
	R5	29	40	Yes
	R6	28	40	Yes
Stage 6A	R1	35	40	Yes
	R2	36	40	Yes
	R3	36	40	Yes
	R4	27	40	Yes
	R5	27	40	Yes
	R6	26	40	Yes
Stage 6B	R1	39	40	Yes
	R2	38	40	Yes
	R3	38	40	Yes
	R4	30	40	Yes
	R5	29	40	Yes
	R6	28	40	Yes

Table 11-6 Noise levels at sensitive receivers from onsite operation - night $L_{Aeq(15min)}$ dBA

Scenario	Receiver	Predicted noise level	Project noise trigger level	Compliance
Site preparation (6:00 am to 7:00 am) Monday to Saturday	R1	33	35	Yes
	R2	34	35	Yes
	R3	34	35	Yes
	R4	21	35	Yes
	R5	20	35	Yes
	R6	19	35	Yes

The results presented in Table 11-5 indicate that noise emission from the site will be the greatest as works near completion at Stage 1 and at Stage 6. These stages of the project are in the closest proximity to the sensitive receivers to the north and do not have the benefit of acoustic shielding provided by the existing walls of the quarry. Noise levels are lower during Stage 2, Stage 3, Stage 4 and Stage 5 works due to the larger distance between the works and the sensitive receivers and the acoustic shielding provided by the existing quarry wall. All noise generating works associated with the Project during the daytime will likely comply with the project noise trigger levels.

The results presented in Table 11-6 indicate that the noise levels due to site preparation works between 6 am and 7 am are predicted to achieve compliance with the night-time project noise trigger levels at all nearby residential receiver locations.

Note should be made that the Blue Mountains National Park area directly to the south, north-east and east of the site is classified as a passive recreation area in accordance with the NPI. However, the national park areas directly adjacent to the site are not easily accessible by the public and as such, this area should not be deemed as a sensitive receiver.

Nevertheless, the maximum noise emission levels from the site are not greater than L_{Aeq} 50 dBA (NPI's recommended amenity noise level for passive recreational area) when calculated to either 200 metres south, north-east or north of the site boundary. The national park areas beyond 200 metres from the site will likely receive noise levels from the quarry site below L_{Aeq} 50 dBA.

It should also be noted that the noise impacts from the rehabilitation works will utilise similar equipment and will be equivalent or less than experienced within the existing consent for the quarry operations.

11.3.4 Traffic noise

The impact on traffic levels and resulting noise at sensitive receivers along Sandham Road was modelled using CadnaA as outlined above. The noise impact was assessed against the noise criteria for a local road of 55 dBA $L_{Aeq(1hr)}$. The existing traffic counts along Sandham Road are provided in Table 11-7, the additional traffic associated with the quarry site is presented in Table 11-8 and the predicted traffic counts during peak hour is presented in Table 11-9. The resulting noise levels at sensitive receivers are shown in Table 11-10.

Noise emission maps for the existing and predicted road traffic noise along Sandham Road are also provided in Appendix G.

Table 11-7 Existing traffic counts used for modelling - peak hour

Location	Traffic count per hour	
	Cars	Trucks
Sandham Road Northbound	5	1
Sandham Road Southbound	1	2

Table 11-8 Additional traffic counts used for modelling – peak hour

Location	Traffic count per hour	
	Cars	Trucks
Sandham Road Northbound	2	4
Sandham Road Southbound	2	3

Table 11-9 Predicted traffic counts used for modelling – peak hour

Location	Traffic count per hour	
	Cars	Trucks
Sandham Road Northbound	7	4
Sandham Road Southbound	3	5

Table 11-10 Noise levels at sensitive receivers from vehicles along Sandham Road

Receiver	Noise levels from existing traffic	Proposed development LAeq(1hr) dBA	Criteria, dBA	Compliance
R4	33	37	55	Yes
R5	31	35	55	Yes
R6	32	36	55	Yes
R7	28	32	55	Yes
R8	29	33	55	Yes
R9	36	40	55	Yes
R10	37	41	55	Yes
R11	37	41	55	Yes
R12	32	36	55	Yes
R13	38	42	55	Yes
R14	34	37	55	Yes
R15	36	40	55	Yes
R16	38	42	55	Yes
R17	33	37	55	Yes
R18	40	44	55	Yes
R19	29	33	55	Yes
R20	38	42	55	Yes
R21	37	41	55	Yes

Receiver	Noise levels from existing traffic	Proposed development LAeq(1hr) dBA	Criteria, dBA	Compliance
R22	36	40	55	Yes
R23	32	36	55	Yes
R24	41	44	55	Yes
R25	29	33	55	Yes
R26	33	37	55	Yes
R27	33	37	55	Yes
R28	43	46	55	Yes
R29	35	39	55	Yes
R30	35	39	55	Yes
R31	33	37	55	Yes
R32	50	54	55	Yes
R33	49	53	55	Yes
R34	48	52	55	Yes
R35	50	55	55	Yes
R36	41	46	55	Yes
R37	35	39	55	Yes
R38	50	54	55	Yes

Noise levels due to the use of heavy vehicles along Sandham Road is the greatest at residential dwellings within 20 metres of Sandham Road, being R32 – R36 and R38. However, the increase in traffic noise levels during maximum operation is less than 55 dBA and complies with the Road Noise Policy at all receivers

Haul trucks entering and leaving the quarry will use Darling Causeway and Bells Line of Road to access Sandham Road. Vehicle numbers along these roads are high (over 3,000 vehicles per day with 12% heavy vehicles – RMS Traffic Volume Viewer, Station ID T0384) and therefore the additional 74 truck movements per day (as predicted in the GHD Traffic Impact Assessment) generated from the quarry activity will be negligible and is not expected to cause adverse noise impacts.

The increase in noise levels due to the use of heavy vehicles on Sandham has been compared to the road conditions in the absence of quarry operations. The Project has adopted a maximum fill emplacement rate of 140,000 tonnes per year, which is less than the maximum extraction level of 142,800 tonnes per year in the existing consent. Noise levels will therefore be equivalent in scale to the existing consented operations at the site.

11.3.5 Vibration impacts

Typical vibration levels from activities such as excavation are generally negligible at distances greater than 50 metres. Therefore, given the nearest receiver is 250 metres from the quarry site, vibration levels from equipment use within the quarry is not anticipated to adversely impact receivers.

11.4 Mitigation measures

The proposed development is predicted to comply with the project noise trigger levels on the assumption that the following noise mitigation and management measures are implemented:

- All activities on site should be confined between the hours: daytime hours of 7:00 am to 6:00 pm from Monday to Friday and 7:00 am to 1:00 pm on Saturday, with the exception of site preparation works between 6:00 am and 7:00 am Monday to Saturday. In particular, haul trucks should not arrive on site (or depart) before 7:00 am.

- Site preparation works should not occur between the hours of 6:00 pm and 6:00 am.
- All personnel on site should be made aware of the potential for noise impacts and should aim to minimise impact or elevated noise levels, where possible.
- All engine covers should be kept closed while equipment is operating.
- Vehicles should be kept properly serviced and fitted with appropriate mufflers. The use of exhaust brakes should be eliminated, where practicable.
- Machines found to produce excessive noise compared to industry best practice should be removed from the site or stood down until repairs or modifications can be made.
- All trucks entering and exiting the quarry should keep at or below 40 km/hr for haulage on Sandham Road.

12. Cultural heritage

12.1 Introduction

The project involves the rehabilitation of an existing quarry through importation of clean fill for placement within the quarry void. Rehabilitation activities will be restricted to previously disturbed terrain within the existing quarry footprint and haulage to the site will utilise the existing public road network. The project is therefore considered to have minimal potential for disturbance of either Aboriginal or historic heritage values of the locality.

A due diligence approach has therefore been undertaken to identify Aboriginal and historic heritage values of the locality and to consider the potential impacts from the project upon these values. The assessment has been undertaken in accordance with the NSW Department of Environment, Climate Change & Water (DECCW) Due Diligence Code of Practice for the Protection of Aboriginal Objects in New South Wales (DECCW, 2010) and the heritage management principles of the Burra Charter.

12.2 Existing environment

12.2.1 Aboriginal heritage

Regional context

A number of Aboriginal archaeological investigations have previously been undertaken on the Newnes Plateau and the wider Blue Mountains area.

A regional based study of the Newnes Plateau area was undertaken by Gollan (1987) on behalf of NPWS to provide a comprehensive assessment of the archaeological resources of the plateau and their regional and local significance. The report found that the overall Newnes Plateau area being relatively flat-lying and gently sloping provided suitable resources for Aboriginal occupation. Artefact scatters and isolated finds are likely to be found on the fringes of swamps as lithic material and food resources were available in these areas. There was also evidence of grinding groove sites and shelters with rock art were also found in the vicinity of suitable rock types such as pagodas. The forested upland areas as having had the potential to provide substantial resources for an upland hunter/ gatherer economy.

At a regional level, the Blue Mountains area was able to provide shelter and a resource-rich habitat, as evidenced by the distribution of sites in the gently sloping and relatively flat swamp margins, low-lying crest areas, flat-lying ridge tops, and along the rocky outcrops lining the various water courses.

Local context

A number of archaeological investigations have also been undertaken for nearby mining developments including the original DA for the Bell Quarry, the previously proposed Newnes Kaolin Mine adjoining the project site to the north and the Clarence Colliery and rail loop located approximately 600 metres to the north-east of the project site.

An archaeological investigation of the Bell Quarry site was undertaken by Dr James Kohen as part of the SEE of the Continued Operation of the Bell Quarry (Corkery, 1994). The study included a review of previous records, consultation with the Windradyne Local Aboriginal Land Council and a detailed survey of the area. The study found that although Aboriginal sites are relatively common in the Newnes Plateau, none had previously been recorded within 4 kilometres of the site. Dr Kohen found no evidence of Aboriginal occupation at the site and no signs of intentional modification of raw materials for the manufacture of stone artefacts was

observed. No scar trees or stone arrangements were found and there were no sandstone outcrops likely to contain grinding grooves or rock shelters likely to contain archaeological deposits identified at the site. The study concluded that there was little evidence of the area being used intensively by Aboriginal people.

An archaeological investigation of the Newnes Kaolin mine site adjoining the Bell Quarry was undertaken by Robyn Mills Archaeological and Heritage Services in 2000 and reported as part of the Newnes Kaolin Aboriginal Cultural Heritage Management Plan (RPS, 2012). All landform units were targeted in the survey including hill slopes and the ephemeral drainage lines and gullies in the study area. The sandstone in the study area was predominantly weathered, medium grained and no sandstone outcrops suitable for Aboriginal occupation were noted in the area. No Aboriginal sites or areas of archaeological sensitivity were identified in the study area and the absence of sites was considered likely due to the absence of permanent water and steep terrain that would not have been suitable for large campsites. More advantageous locations for Aboriginal campsites were available in adjacent localities in association with the Wollongambe River and Dargan Creek.

A number of archaeological investigations have been undertaken by RPS Australia East Pty Ltd (RPS) for development associated with Clarence Colliery including a Cultural Heritage Assessment for the Reject Emplacement Area VI located approximately 650 m north-east of the Bell Quarry site (RPS 2013). No Aboriginal sites or areas of archaeological sensitivity were identified during the survey, which was attributed to both the extent to which the study area had been previously disturbed, as well as to the absence of archaeologically sensitive landscape features including rock outcrops, shelters, water courses and mature trees suitable for scarring/cultural modification. The ephemeral drainage line identified on the site was minor, and no evidence of Aboriginal cultural heritage material was identified in association with this landscape feature.

Aboriginal Heritage Information Management System (AHIMS)

A search was undertaken of the OEH Aboriginal Heritage Information Management System (AHIMS) was undertaken on 26 September, 2017 and did not identify any sites within 400 metres of the project area.

A detailed search was subsequently undertaken on 27 September 2017 encompassing a 10 kilometre radius of the site to understand the broader regional context. The AHIMS search identified 35 Aboriginal heritage sites within the overall locality which includes considerable tracts of the Blue Mountains National Park and surrounding areas. The frequency of occurrence of each recorded Aboriginal site type is outlined in Table 12-1.

Table 12-1 AHIMS recorded sites in locality

Site Type	Frequency
Artefact	8
Art (Pigment or Scarred)	1
Scarred Tree	2
Shelter with Art	1
Shelter with Deposit	5
Shelter with Art and Deposit	8
Open Camp Site	5
Stone Arrangement	2
Axe Grinding Groove	1
Potential Archaeological Deposit (PAD)	2
Totals	35

The results of the database searches confirm the findings of the previous studies that whilst the wider Newnes Plateau area was suitable for Aboriginal occupation, there has been no evidence recorded in the immediate surrounds of the Bell Quarry site

12.2.2 Historic Heritage

Historical context

Lithgow Valley's first European settlers arrived in 1824, and the valley was named in 1827 by William Hume in honour of William Lithgow, the auditor general of NSW. Lithgow began to thrive after 1869, when the western railway line was extended to the town. Construction of the railway line into the Lithgow Valley occurred between 1866 and 1869 and the Zig Zag Railway was acclaimed as a major engineering feat.

In 1868, the construction of the railway line through the Valley spread workmen who built their campsites close to the cuttings, embankments and viaducts throughout the length of the Lithgow valley. The mining industry developed in the region, initially to supply the needs of cooking fires and heating during the construction of the railway and subsequently to supply coal to the railways to run their locomotives.

Following the arrival of the railway, other heavy industries began appearing in the area, such as iron-making, copper-smelting and brickworks. These industries brought more workers to the town, who in turn brought with them services such as banking, medicine supplies, breweries and other food and drink suppliers (Cremin 1989).

The population peaked in 1929 at 18,000 people, making it the fourth-largest town in New South Wales, behind Sydney, Newcastle and Broken Hill. Housing was still an issue, increasing the impact of the Great Depression. This led to open spaces becoming shanty towns, as the homeless and unemployed gathered. The outbreak of the Second World War further exacerbated the problem, as although it led to employment at the Small Arms Factory and collieries, existing housing could not accommodate the incoming labour force (Cremin 1989).

Database Searches

A review available historic heritage registers was undertaken to determine the presence of registered heritage sites in proximity to the Bell Quarry. Searches included the World Heritage List, National Heritage List, Commonwealth Heritage List, State Heritage Register, Heritage and Conservation registers for State government agencies (known as Section 170 registers), local environmental plans, the National Heritage List and the Register of the National Estate.

The following items were located in close proximity to the site:

- Blue Hills are residential dwellings located at 588-602 Sandham Road in Newnes Junction approximately 400 metres to the northwest of the quarry is listed as a local heritage item on the Lithgow LEP
- Dargan Railway dams are located off Chifley Road approximately 400 metres to the southwest of the quarry and are listed as an archaeological item of local significance
- The Zig Zag Railway and station are located approximately 2.8 kilometres to the west of the quarry site and is listed on the state heritage inventory
- The Greater Blue Mountains Area is listed on the UNESCO World Heritage List and the National Heritage List. The Greater Blue Mountains Area covers an area of 1.03 million hectares of landscape and comprises eight protected areas including the Blue Mountains National Park which adjoins the quarry site.

A detailed analysis of the heritage values of the Greater Blue Mountains Area is included in Chapter 13 of this EIS.

12.2.3 Impact assessment

Aboriginal heritage

The due diligence process in accordance with Section 8 of the Due Diligence Code of Practice for the Protection of Aboriginal Objects in New South Wales (DECCW, 2010) has been followed in undertaking the cultural heritage assessment.

The project involves the rehabilitation of an existing quarry through importation of clean fill for placement within the quarry void. The rehabilitation process will involve disturbance of the ground surface through the use of traditional excavation equipment such as front end loaders, graders and rollers during the placement of the clean fill material. All rehabilitation activities will be undertaken with the existing quarry footprint and haulage to the site will utilise the existing public road network. There is therefore considered minimal potential to disturb natural ground surface of culturally modified trees.

While the overall Newnes Plateau and wider Blue Mountains area is known to be rich in Aboriginal sites, there has been no records of Aboriginal cultural material being located at the site of the immediate locality. The site has been disturbed during the previous extraction activities and there is no evidence that the site was previously used intensively by Aboriginal people. This is supported by previous investigations in the surrounding area and the absence of any identified AHIMS records within 400 metres of the site.

The target resource for the original quarry was a weathered sandstone and no sandstone outcrops suitable for Aboriginal occupations have been identified in the area. The landform was previously steep and lacked permanent water making it unsuitable for a large camp site.

There were no AHIMS records located in the vicinity of the ephemeral drainage line which is well vegetated and resistant to any geomorphological change. Dewatering of the existing voids will be fluctuated and will typically be limited to 10 to 15% of the existing storm flows and is not anticipated to impact upon downstream geomorphology. Restoring the landform to be representative of its original topography will return the site to more natural run-off and flow conditions at the conclusion of the project.

In accordance with the Due Diligence Code of Practice for the Protection of Aboriginal Objects in New South Wales an AHIP application is not necessary and the project may proceed with caution. The project will not impact upon any Aboriginal Cultural Heritage Values and therefore consultation under Aboriginal cultural heritage consultation requirements for proponents (DECCW 2010) is not applicable.

Historic heritage

There are no listed historic heritage items in the immediate vicinity of the site. The closest listed items are located more than 400 metres from the site and are not located in the primary haulage route for the operations and will not be directly or indirectly impacted by the project.

The site is located adjacent to the Blue Mountains National Park which forms part of the Greater Blue Mountains Area listed on the UNESCO World Heritage List and the National Heritage List. The project will result in minor indirect impacts to the land immediately adjoining the site during rehabilitation operations. Overall the project will restore the landscape to be more representative of the original landform and will be complementary to the conservation values of the Greater Blue Mountains Area. Potential impacts on the Greater Blue Mountains Area are considered in detail in Chapter 13 of this EIS.

12.3 Mitigation measures

The proposed development is predicted to have minimal impact upon heritage values with the implementation of the following mitigation measures:

- The rehabilitation activities will remain within the disturbed footprint of the quarry.
- An unanticipated finds protocol will be developed as part of the CEMP to provide guidance for the unlikely event that an Aboriginal object or historical relic are unidentified within the site.

13. World heritage

13.1 Introduction

This chapter considers the potential impacts of the Project on the World Heritage and National Heritage values and other values of the Greater Blue Mountains World Heritage Area (GBMWHA) and National Heritage place. The chapter draws upon detailed impact assessments undertaken for the proposed activities and presented elsewhere in this EIS.

The location of the site within close proximity of environmental sensitive GBMWHA is considered a key sensitivity for the site and was the key trigger of designated development provisions requiring preparation of an EIS for the Project.

The assessment of impact on the GBMWHA involved:

- Identification of the property's World Heritage and National Heritage values, as outlined in the Statement of Outstanding Universal Value;
- Identification of other values that complement and interact with the property's World Heritage and National Heritage values;
- Assessment of impacts on World Heritage and Natural Heritage values and integrity of the World Heritage property based on the EPBC Act Significant Impact Guidelines 1.1 – Matters of National Environmental Significance (DoE 2013a) and the property's Statement of Outstanding Universal Value;
- Assessment of impacts on other values of the Greater Blue Mountains Area; and a statement of significance of the identified impacts.

13.2 Existing environment

GBMWHA covers 1.03 million hectares of sandstone plateaus, escarpments and gorges dominated by temperate eucalypt forest (UNESCO 2015) as shown on Figure 13-1. The GBMWHA constitutes one of the largest and most intact tracts of protected bushland in Australia and is noted for its representation of the evolutionary adaptation and diversification of the eucalypts in post-Gondwana isolation on the Australian continent (UNESCO 2015). The Greater Blue Mountains Area was inscribed on the World Heritage List in 2000.

13.2.1 Outstanding universal value

The Greater Blue Mountains Area was inscribed on the World Heritage List because it satisfies two of the criteria for natural values of outstanding universal value. While the criteria for outstanding universal value have changed over time, the underlying concepts have remained constant (UNESCO 2015). The two criteria for which the property is listed are criterion ix and criterion x.

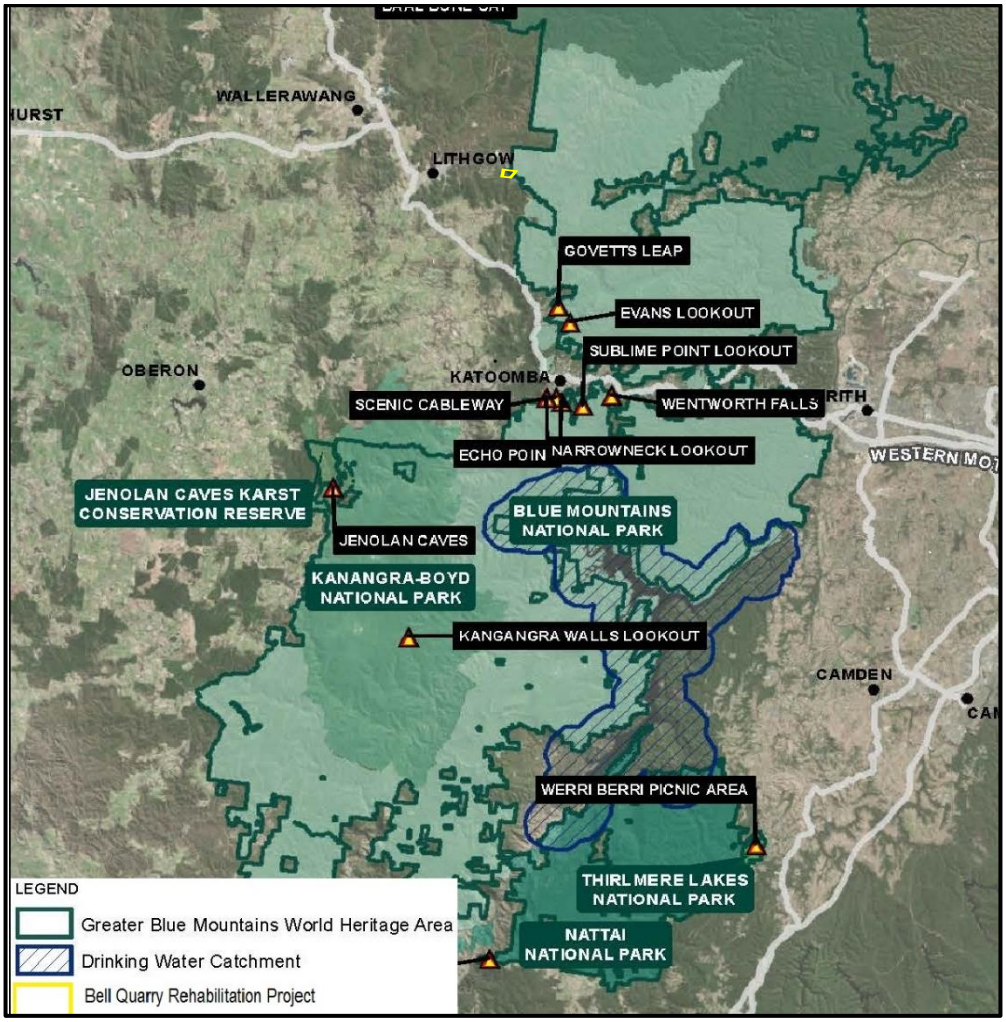


Figure 13-1 Greater Blue Mountains World Heritage Area

Criterion ix

Criterion ix is defined in the Operational Guidelines for the Implementation of the World Heritage Convention (UNESCO 2015) as follows:

> *"…to be outstanding examples representing significant on-going ecological and biological processes in the evolution and development of terrestrial, fresh water, coastal and marine ecosystems and communities of plants and animals."*

The GBMWHA includes outstanding and representative examples of the evolution and adaptation of the genus *Eucalyptus* and eucalypt-dominated vegetation in a relatively small area of the Australian continent (UNESCO 2015). It is a centre of diversification for Australian scleromorphic flora, including significant aspects of eucalypt evolution and radiation (UNESCO 2015). The GBMWHA includes primitive species of outstanding significance to the evolution of the planet's plant life such as the Wollemi pine and the Blue Mountains pine (*Pherosphaera fitzgeraldii*). These are examples of ancient, relict species with Gondwanan affinities that have survived past climatic changes and demonstrate the highly unusual juxtaposition of Gondwanan taxa with the diverse scleromorphic flora (UNESCO 2015).

Criterion x

Criterion x is defined in the Operational Guidelines for the Implementation of the World Heritage Convention (UNESCO 2015) as follows:

> *"…to contain the most important and significant natural habitats for in-situ conservation of biological diversity, including those containing threatened species of outstanding universal value from the point of view of science or conservation."*

The GBMWHA includes an outstanding diversity of habitats and plant communities and a significant proportion of the Australian continent's biodiversity, especially its scleromorphic flora, (UNESCO 2015). As described above, the GBMWHA includes primitive and relict species with Gondwanan affinities and supports many plants of conservation significance including 114 endemic species and 177 threatened species (UNESCO 2015). Habitat diversity has also resulted in an outstanding representation of Australian fauna with more than 400 vertebrate taxa recorded (of which 40 are threatened) including 52 native mammals, 265 bird species (one third of the Australian total), 63 reptile species and more than 30 frog species (UNESCO 2015).

Integrity

In addition to meeting at least one of the criteria for outstanding universal value, a World Heritage property listed for natural values also needs to meet conditions of integrity. Integrity is a measure of the 'wholeness and intactness' of the natural heritage and its attributes (UNESCO 2015). Examining the condition of integrity requires assessing the extent to which the property:

- Includes all elements necessary to express its outstanding universal value;
- Is of adequate size to ensure the complete representation of the features and processes that convey the property's significance; and
- Suffers from adverse effects of development and/or neglect (UNESCO 2015).

The Statement of Outstanding Universal Value for the GBMWHA states that the eight protected areas that comprise the listed property are of sufficient size to protect the biota and ecosystem processes, although the boundary has several anomalies that reduce the effectiveness of its one million hectare size. These anomalies are explained by historical patterns of clearing,

private land ownership and topography such as escarpments that act as barriers to potential adverse impacts from adjoining land (UNESCO 2015).

A number of historical land uses have affected the integrity of the area in the past including Warragamba Dam, cattle grazing, logging, land clearing, coal mining, oil shale mining, military activities and fire regimes (IUCN 1999). However, active management has reduced these impacts and the landscape is in recovery (IUCN 1999).

The World Heritage property is largely protected by adjoining public lands of State forests and State conservation areas. Additional regulatory mechanisms serve to further protect the integrity of the GBMWHA. These include the statutory wilderness designation of over 65 per cent of the property, part of the closed and protected catchment for Lake Burragorang (Warragamba Dam) and additions to the conservation reserves that comprise the area (UNESCO 2015).

The plant communities and habitats within the GBMWHA occur almost entirely as an extensive, mostly undisturbed matrix almost entirely free of structures, earthworks and other human intervention (UNESCO 2015). Because of its size and connectivity to other protected areas, the area will continue to provide opportunities for adaptation and shifts in range for flora and fauna species within it. The area's integrity depends upon the complexity of its geological structure, geomorphology and water systems, which have created the conditions for the evolution of its outstanding biodiversity (UNESCO 2015).

Aboriginal people from six language groups continue to have a custodial relationship with the area through ongoing practices that reflect both traditional and contemporary presence (UNESCO 2015). Sites of Aboriginal occupation, including important rock art provide physical evidence of the longevity of the strong Aboriginal cultural connections with the land. The conservation of these associations contributes to the integrity of the GBMWHA (UNESCO 2015).

Protection and management

All properties inscribed on the World Heritage List must have adequate protection and management mechanisms in place, the nature of which can vary so long as they are effective (DSEWPC 2012). In most cases, both the Australian and State or Territory governments are responsible for managing and protecting Australia's World Heritage properties, with State and Territory agencies taking responsibility for on-ground management where relevant.

World Heritage properties are protected under the *Environment Protection and Biodiversity Conservation Act 1999 (Cth)* (EPBC Act) and are considered 'matters of national environmental significance'. The EPBC Act provides for the development and implementation of management plans for world heritage properties, which describe aspects of the property and how it will be managed.

The New South Wales Office of Environment and Heritage manages the GBMWHA. The GBMWHA is protected and managed primarily under the following State legislation:

- National Parks and Wildlife Act 1974 (NSW), and
- Wilderness Act 1987 (NSW).

Other relevant legislation includes the New South Wales *Biodiversity Conservation Act 2016*, the *Environmental Planning and Assessment Act 1979* and the *Heritage Act 1977*.

The Greater Blue Mountains World Heritage Area Strategic Plan (DECC 2009c) provides a framework for the property's integrated management, protection, interpretation and monitoring. The key management objectives set out in the Strategic Plan provide the philosophical basis for the management of the area and guidance for operational strategies, in accordance with equirements of the World Heritage Convention and its Operational Guidelines (UNESCO 2015).

These objectives are also consistent with the Australian World Heritage management principles, contained in regulations under the EPBC Act (UNESCO 2015).

The Strategic Plan (DECC 2009c) identifies the following threats to the integrity of the area:

- Uncontrolled and inappropriate use of fire
- Inappropriate recreation and tourism activities, including development of tourism infrastructure
- Invasion by pest species including weeds and feral animals
- Loss of biodiversity and geodiversity
- Impacts of human enhanced climate change
- Lack of understanding of heritage values.

13.2.2 National Heritage place

The Greater Blue Mountains Area was one of 15 World Heritage properties included in the National Heritage List in 2007. The National Heritage values identified for the listing are the same as the values recognised for the World Heritage area. As such, the following assessment against the World Heritage values is taken to address both the World Heritage and National Heritage values of the Greater Blue Mountains Area.

13.2.3 Other values of the Greater Blue Mountains Area

In addition to the attributes recognised by the World Heritage Committee as having World Heritage value, the Greater Blue Mountains Area has a number of other important values that complement and interact with its World Heritage values (DECC 2009c). Protection of these values is considered to be integral in managing individual protected areas and the GBMWHA as a whole (DECC 2009c). Table 13-1 provides a summary of the values, identified by the NPWS in the GBMWHA Strategic Plan that contribute to the overall values of the area.

Table 13-1 Other values of the Greater Blue Mountains Area

Value	Description
Geodiversity	The area also has a diversity of landscapes and geological features including the most extensive sandstone canyon system in eastern Australia, karst landscapes with several cave systems, basalt-capped peaks, quaternary alluvial deposits and perched perennial freshwater lakes.
Water catchment	The GBMWHA protects a large number of pristine and relatively undisturbed catchment areas.
Indigenous heritage values	Aboriginal sites within the area are widespread, diverse and include landscape features of spiritual significance and rock art sites. There is high potential for the discovery of further significant Aboriginal sites.
Historic heritage values	The GBMWHA includes numerous places of historic significance some of which date back to the early years of European settlement and exploration in Australia. Recorded sites demonstrating post-1788 human use are associated with rural settlement, pastoral use, timber getting, mining, transport routes, tourism and recreation.
Recreation and tourism	The GBMWHA has high recreational values due to the area's intrinsic beauty, natural features and accessibility from major population centres.
Wilderness	The high wilderness quality of much of the GBMWHA constitutes a vital and highly significant contribution to its World Heritage values and has ensured the integrity of its ecosystems and the retention and protection of its heritage value.

Value	Description
Social and economic	The regional economy surrounding the GBMWHA is increasingly supported by tourism. The reserves within the GBMWHA have considerable social and economic value and contribute directly and indirectly to the employment, income and output of the regional economy.
Research and education	The GBMWHA is ideal for research and educational visits due to the variety of ecological communities, landscape and associated cultural sites.
Scenic and aesthetic	Dramatic scenery within the GBMWHA includes striking vertical cliffs, waterfalls, ridges, escarpments, uninterrupted views of forested wilderness, extensive caves, narrow sandstone canyons and pagoda rock formations.
Bequest, inspiration, spirituality and existence	Combining a number of the above values, the GBMWHA offers attributes that promote inspiration, serenity and rejuvenation of the human mind and spirit. These feelings are valued by individuals and society and inspire a number of creative endeavours including philosophy, painting, literature, music and photography. The contributions have, and continue to, promote a sense of place for Australians who desire such places to be protected.

13.2.1 Wilderness areas

Wilderness areas comprise one of the key features of the GBMWHA. These areas are located primarily in the northern section of the property. The National Wilderness Inventory (AHC 2003) identifies 83.5 per cent of the GBMWHA as wilderness area.

The identified wilderness areas exclude the northern portions of both the Blue Mountains National Park and Kanangra-Boyd National Park associated with the Katoomba region.

13.2.2 Land use and cumulative impacts

Historical uses have had a cumulative impact on the Greater Blue Mountains Area. These include cattle grazing, logging, coal and oil shale mining, military activities, and clearing for farming and roads. Construction of Warragamba Dam created Lake Burragorang, which supplies approximately 70 per cent of Sydney's water requirements and covers an area of about 75 km^2. The reservoir does not form part of the World Heritage property. While there remains evidence of these past activities, associated impacts are being reduced by active management and landscape recovery.

The GBMWHA is split in two by a central corridor of urban development, including a major highway and rail infrastructure that connects the region and areas further west to Greater Sydney. The majority of the city's 80,000-strong population resides along the spine of development either side of the Great Western Highway. Blue Mountains City Council predicts that the city's population will grow to 82,869 by 2036, an increase of over 5 per cent (Blue Mountains City Council 2016).

The GBMWHA Strategic Plan states that the property's mostly rugged terrain and close proximity to urban development adds to the difficulty of implementing on-ground measures to control strategic threats to its World Heritage values. These include measures such as fire management, pest animal and weed control, storm water control and the regulation of access.

A large number of freehold properties adjoin the GBMWHA. Land uses adjacent to or near the World Heritage property include tourism facilities, grazing, forestry, agriculture, manufacturing and mining. The GBMWHA Strategic Plan identifies siltation of streams, pesticide drift from aerial spraying, fire, straying cattle and companion animals and the spread of exotic plants and animals as potential threats posed by these land uses.

State agencies and local government implement management measures such as monitoring, restoration, pollution reduction and pest control strategies to reduce the impact of surrounding land uses on the GBMWHA.

13.2.3 Key sensitive tourist and recreation areas

In 2015, the Blue Mountains received 843,000 domestic overnight visitors, 102,000 international overnight visitors, and nearly 2.6 million domestic daytrip visitors (Destination NSW 2016).

The Great Western Highway provides the primary access to a majority of lookouts and other destinations included in the table. These areas and attractions are also potentially accessed by other transport infrastructure including rail and Katoomba airfield and numerous smaller sealed and unsealed roads.

13.3 Assessment of impacts

13.3.1 Direct impacts

There will be no direct impacts upon the GBMWHA. Rehabilitation activities will be restricted entirely to the existing disturbance footprint for the quarry will not directly impact upon any values of the adjoining protected areas.

13.3.2 Indirect impacts

Bell Quarry is located immediately adjoining the GBMWHA, with the southern and eastern portions of the site sharing a boundary with the Blue Mountains National Park. The proximity of the site results in the potential for a number of indirect impacts associated with rehabilitation activities at the site. These impacts relate to water resources, noise, air quality, visual and biodiversity.

Water Resources

Bell Quarry is located within the upper reaches of the Wollangambe River catchment, which flows through the GBMWHA and forms part of the broader Hawkesbury-Nepean catchment area. An ephemeral tributary of the Wollangambe River runs in a north-easterly direction through the project site, with its headwaters in the vicinity of the rail line upstream of the site. The quarry now contains three large voids which are partially filled with water through a combination of surface water run-off and groundwater seepage. Water is discharged from the site through an established sediment basin on the eastern edge of the site and discharges into an unnamed tributary within the Blue Mountains National Park.

The tributary passes through a swamp where flows are predominantly subsurface under baseflow conditions and continues for approximately 1.5 kilometres before the confluence with the Wollangambe River. The Wollangambe River winds eastwards through narrow canyons and is one of four major tributaries of the Colo River. The Wollongambe forms part of the declared Colo Wild River (DECC 2008), between its confluences with Bungleboori Creek and Colo river. The upper reaches of the Wollangambe River near the site are not part of the declared area as these areas have been disturbed by historic mining (DECC 2008).

A detailed assessment of the potential impacts of the project on water resources has been undertaken in Chapter 7 and Appendix B. The project has potential to impact upon receiving waters within the adjoining protected areas through the following processes:

- Changes to the flow regimes downstream of the site associated with altered runoff and discharge patterns from the site.
- Impacts to the stability and geomorphology of a tributary of the Wollangambe River located with the GBMWHA through alteration of flow regimes.
- Impacts to surface water and groundwater quality downstream of the site associated with rainfall and run-off coming into contact with emplaced material prior to discharging from the site or infiltration to groundwater.

The project will restore the flow regime to be representative of natural run-off conditions from before extractive operations began. During the rehabilitation activities there will be a temporarily reduction to the frequency of low flows and more frequent moderate flows for stages requiring dewatering. The changes to the flow regime are relatively minor and are not anticipated to significantly impact upon downstream geomorphological processes due to the natural stream profile and thick and well established vegetation in the immediate receiving waters.

All emplacement material brought to the site will be clean fill and meet the acceptance criteria for bringing material to the site in line with the ENM Resource Recovery Order. Detailed water quality modelling has been undertaken and shows that both surface water discharges and groundwater are expected to have minimal potential to impact upon the immediate receiving waters in the downstream tributary and swamp located approximately 200 metres from the site. Further downstream the site will have minimal influence on stream flow or water quality as the receiving waters are subject to an increasingly broad catchment area.

Noise

The Bell Quarry site has operated as an extractive industry adjoining the Blue Mountains National Park since 1967. The quarry operations represent an existing approved land-use that pre-dated the Greater Blue Mountains area listing on the World Heritage List in 2000 and the National Heritage List in 2007.

Rehabilitation of the site will involve the use of haul trucks for delivery of emplacement material mobile extractive industry plant and equipment which have potential to generate noise and vibration representative of the previous extractive operations at the site.

Detailed acoustic modelling has been undertaken to determine the impacts associated with noise generated throughout the rehabilitation processes and reported in Chapter 11 and Appendix G. The Blue Mountains National Park is classified as a passive recreation area, although it is noted that the national park in immediate vicinity of the Bell Quarry is not located in proximity to any key tourist attractions or wilderness walking trails and is rarely accessed by the public.

Noise levels surrounding the site will be analogous to the previous quarry operations and restricted to daylight hours associated with the site operations. Following rehabilitation activities, noise levels would substantially reduce at the site.

The maximum noise emission levels from the site are predicted to be less than L_{Aeq} 50 dBA (NPI's recommended amenity noise level for passive recreational area) when calculated to either 200 metres of the site boundary as shown in the noise contour plots for each stage presented in Appendix G. Elevated noise levels will be restricted to the immediate surroundings of the quarry and will affect only a very small proportion of the 1.03 million ha that comprises the GBMWHA.

Elevated noise levels (typically above 65 dBA) have been shown to have a variety of impacts on fauna. Noise levels above 65 dBA will primarily occur within the site boundary and are unlikely to permanently alter foraging or breeding behaviour of any fauna species. There is potential for any individuals that nest in trees near the site boundary to abandon their nests as a result of the rehabilitation activities. Any impacts would be localised, with impacts occurring in the immediate vicinity of the quarry and the majority of fauna within the vast GBMWHA would not be impacted by the project. As such, noise would not result in a loss of biodiversity and would not interfere with the ecological viability and capacity for ongoing evolution of species within the GBMWHA.

Air Quality

The project has potential to generate dust through the rehabilitation activities and vehicle haulage along Sandham Road as described in Chapter 10 and Appendix F. The site is located in a rural environment and periodically experiences high level of background dust generated from surrounding landuse including nearby mining and quarry operations and vehicles travelling on unsealed roads.

The project is anticipated to have a small incremental impact on dust emissions in the immediate vicinity of the quarry as shown in the dust contour plots included in Appendix F. All impacts will fall within the respective air quality criteria prescribed by the Approved Methods (EPA, 2016) and the Air NEPM and is not anticipated to significantly impact upon the conservation significance of the GBMWHA or the Blue Mountains National Park.

Visual

The Bell Quarry site adjoins a relatively remote section of the GBMWHA and has limited visibility from surrounding areas as a result of the steep to undulating landform and dense vegetation. The site is not visible from any key tourist destinations or sensitive areas such as walking trails that are regularly utilised by users of the national park.

Visibility of the quarry is largely restricted to the perimeter fence and a small section of Sandham Road immediately adjacent to the site.

Rehabilitation of the site will involve emplacement of clean fill within the existing footprint to enable the site to be returned to a condition closely representing the original landform and be visually integrated with the adjoining Blue Mountains National Park. The final landform would be progressively revegetated with locally endemic species to provide effective control or erosion and integration with the surrounding landscape.

Biodiversity

A detailed assessment of impacts upon biodiversity values within the site and the adjoining Blue Mountains National Park is included in Chapter 8 and Appendix D. There will be no direct clearance of native vegetation within the GBMWHA and weed management measures will be implemented to control existing weeds and prevent the introduction of weeds to the site through importing fill material to the site.

The rehabilitation works will result in minor changes to the hydrological regime and surface water and groundwater quality in the unnamed tributary immediately downstream of the site. The changes will be minor and are likely to be within the range of conditions tolerated by species within the downstream area and are unlikely to modify the composition of the vegetation or place any species at risk of extinction.

Following completion of the rehabilitation works and revegetation with locally endemic species, the site and the adjacent areas of the national park are likely to improve given reduced edge effects and other indirect impacts associated with the former use of the site for extractive operations.

13.3.3 Outstanding universal value

Activities associated with the BQRP would have no direct impact on the outstanding universal value of the GBMWHA. Indirect effects on GBMWHA are discussed above and are not considered to have any impacts upon the property's outstanding universal value.

The assessment of significance is based on the requirements of the EPBC Act Significant Impact Guidelines 1.1 – Matters of National Environmental Significance, which state that an

action is likely to have a significant impact on the World Heritage values of a declared World Heritage property if there is a real chance or possibility that it will cause:

- One or more of the World Heritage values to be lost,
- One or more of the World Heritage values to be degraded or damaged, or
- One or more of the World Heritage values to be notably altered, modified, obscured or diminished.

The project is not considered to have potential for a significant impact upon the world heritage values of the declared GBMWHA.

14. Other Environmental Matters

14.1 Visual

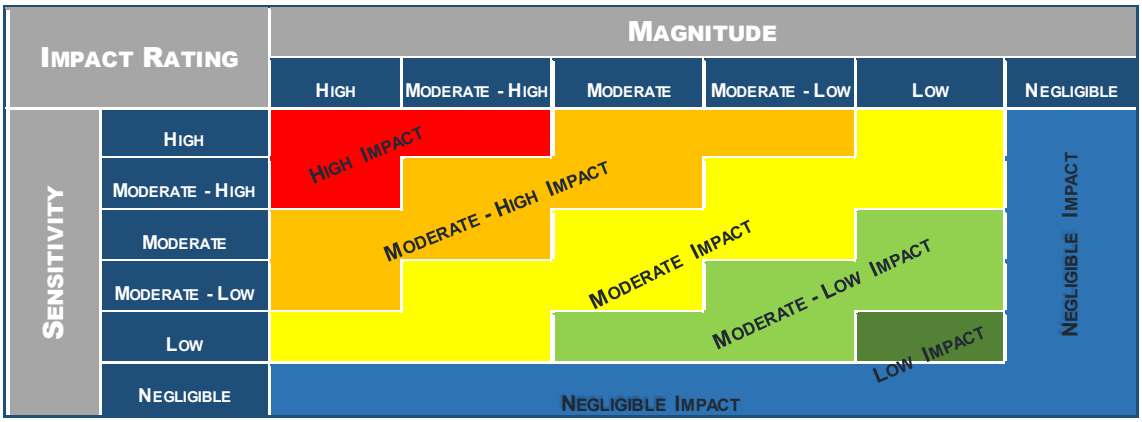
14.1.1 Approach to the assessment

This section includes an overview of the visual and landscape values of the project application area. The assessment considers the visibility of the existing quarry pit and the final vegetated landform following completion of rehabilitation from key vantage points in the surrounding area and the potential impacts on the localities visual character. This section addresses the key requirement of the SEARs to provide "an impact assessment at private receptors and public vantage points".

This assessment focuses on the Project's impact on visual amenity from specific vantage points with public access as well as from private receptors. The method was adapted from *Environmental Impact Assessment Practice Note – Guideline for Landscape Character and the Visual Impact Assessment and Guidelines for Landscape Visual Impact Assessment (RMS 2013).* This establishes a process for determining visual impact by referring to the sensitivity of any area and the magnitude of the Project's impact in that location.

The sensitivity of an area relates to its character, the view's quality and how any changes would be viewed from various locations. The visual magnitude is the degree of contrast between the development and the pre-existing landscape. Table 14-1 shows how the visual impact is determined by combining the sensitivity of receivers and the magnitude of the impact. The visual impact assessment considers the visibility of the quarry pit, the rehabilitated landform from representative viewpoints, assigns a sensitivity and assesses the impact.

Table 14-1 Landscape character and visual impact matrix



14.1.2 Site Visibility

Views of the existing quarry site are very limited from surrounding areas as a result of the undulating landform and dense vegetation around the perimeter of the site. The existing quarry pits have been excavated into the ridgeline on the edge of a plateau to the east of Sandham Road, the Main Western Rail Line and Chifley Road (continuation of Bells Line of Road). The site is predominantly shielded from views from private residences and publically accessible areas. The southern and eastern boundary of the site adjoins the Blue Mountains National Park. The quarry is not visible from any key tourist destinations within the national park or located in proximity to walking trails that are regularly used by users of the national park.

Key locations with potential visual impacts include:

Residential properties along Sandham Road

The existing quarry footprint is not visible from any residential property along Sandham Road. Residential properties in Newnes Junction Village are shielded from views of the quarry by an intervening ridge. The closest residential property located on Sandham Road in Bell is located approximately 1.8 kilometres from the site and is shielded by intervening topography and dense vegetation.

Views of the existing quarry pit are limited to fleeting views from vehicles travelling along Sandham Road near the site entrance as represented in Photograph 14-1.

Photograph 14-1 View of Bell Quarry from site entrance on Sandham Road

Quarry perimeter fence

The landform in the vicinity of the Bell Quarry is steep to undulating and dominated by dense vegetation. The existing pit has been not been altered appreciably since the conclusion of quarrying operations. It is sparsely vegetated, with large voids partially filled with water and ramps providing access into the former quarry pits as shown on Photograph 14-2.

The site adjoins the Blue Mountains National Park, but is located away from areas regularly accessed by the public. Only people specifically accessing the site would typically have visibility of the existing pits.

The rehabilitation of the quarry void with clean fill material over the life of the Project will see the area gradually become visually integrated with the surrounding landform and original visual character of native bushland.

Train passengers on Lithgow line

The area is dominated by bushland areas in the Newnes State Forest to the north, the coal mining operations of Clarence Colliery to the northwest, and the Blue Mountains National Park to the east of the quarry. A number of other extractive industries are located in proximity to the rehabilitation area including the Hanson Quarry to the west and the proposed Newnes Kaolin Project to the east.

Fleeting views of the quarry site are likely to be available to passengers using the Main Western Railway to and from Lithgow. The train also passes in close proximity to a number of mining and quarry operations in the locality.

Photograph 14-2 View of main pits from within the quarry boundary

14.1.3 Impact assessment

Potential impacts associated with the rehabilitation works on landscape and visual character are considered in Table 14-2

Table 14-2 Visual impact assessment

Viewpoint	Assessment	Visual Impact
Sandham Road residence	**Sensitivity: High** Residential receivers located on Sandham Road are likely to place a high value on scenic qualities as a result of the quiet rural character and proximity to Blue Mountains National Park. Local residents are therefore considered likely to be highly sensitive to any changes in landscape character of the locality. **Magnitude: Low** The magnitude of change for residential receivers is considered low. There are no direct views of the quarry pit from any residential receivers and only passing glimpses for vehicles along Sandham Road. Plant and machinery used in the rehabilitation works will be analogous to the former quarry operations and will not change the character of the area. The site will be progressively rehabilitated to be visually integrated with the surrounding bushland	Medium
Quarry boundary fence	**Sensitivity: Low** The site adjoins the Blue Mountains National Park but is not visible from any areas regularly frequented by the public. The sensitivity to change in visual character for people who approach the fence line is minor as they would typically be staff or contractors visiting	Low

Viewpoint	Assessment	Visual Impact
	the site. Site amenities and slow filling of stage fill zones will only be visible from the fence line, and then only from certain areas that are difficult to access due to vegetation. **Magnitude: Low** The magnitude of change is considered low as the rehabilitation operations will form an extension of the existing land-use. In the long term the site will be progressively rehabilitated to be visually integrated with the surrounding bushland	
Lithgow line train passengers	**Sensitivity: Low** Passing commuters are considered to have low visual sensitivity due to short duration of views. **Magnitude: Negligible** The rehabilitation activities will form an extension of the exiting landuse and will have minimal visibility from the train line	Negligible

14.1.4 Mitigation measures

The following mitigation measures will be adopted to mitigate impacts to visual amenity throughout emplacement and revegetation activities:

- Maintenance of visual buffers currently in place around pit boundaries
- Revegetation with plant species representative of native vegetation in the local area to integrate with the surrounding landscape so that the site becomes sympathetic with the adjoining Blue Mountains National Park.

14.2 Waste

14.2.1 Introduction

The project is seeking to rehabilitate the existing quarry pit through the importation of virgin VENM, ENM and other clean fill material sourced from earthworks projects across Sydney and the local regional area.

Rehabilitation of the site will involve emplacement of clean fill within the existing quarry footprint. It is estimated that approximately 1.2 million cubic metres of clean fill material would be required to fill the site over a period of approximately 15 years.

The project is seeking to provide for the beneficial reuse of waste material in earthworks to achieve the optimum rehabilitation outcomes through returning the site to a condition closely representing the original landform and that of the adjoining Blue Mountains National Park. The proposed use of the waste is bona-fide, fit-for-purpose use with minimal potential to cause harm to the environment or human health as demonstrated through the preparation of this EIS and in accordance with the ENM oder and exemption. All material brought to site will be subject to strict acceptance criteria prior to transport to site and minimal residual waste is anticipated to be generated by the project.

This section of the EIS presents the proposed waste management framework for the project in accordance with the SEARs. An outline of the material to be accepted at the site and residual waste generated by the development is described together with an outline of how the project fits within the context of the strategic waste management framework in NSW.

14.2.2 Emplacement material

The NSW EPA has introduced a series of resource recovery orders and resource recovery exemptions which allow some wastes to be beneficially and safely reused independent of the usual laws that control applying waste to land, using waste as a fuel or using waste in connection with a process for thermal treatment. Orders and exemptions are appropriate if the reuse:

- Is genuine, rather than a means of waste disposal.
- Is beneficial or fit for purpose.
- Will not cause harm to human health or the environment.

Orders and exemptions are two separate documents that the EPA issues together, as a package. A resource recovery waste means a waste that has a resource recovery order and exemption. Each order includes conditions which generators and processes of exempt waste must meet to supply the waste for land application and each exemption includes conditions for the consumers of exempt waste to apply to land.

The excavated natural material exemption 2014 applies to excavated natural material that is intended to be applied to land as engineering fill or in earthworks and exempts the requirement to obtain an EPL for a scheduled activity, to track waste, pay the waste levy and miscellaneous reporting requirements to the EPA. Application of the exemption is subject to the following conditions:

- At the time the excavated natural material is received at the premises, the material must meet all chemical and other material requirements (via stringent sampling and testing) for excavated natural material which are required before the supply of excavated natural material under 'the excavated natural material order 2014'.
- The excavated natural material can only be applied to land as engineering fill or for use in earthworks.
- The consumer must keep a written record of the following for a period of six years:
  - the quantity of any excavated natural material received; and
  - the name and address of the supplier of the excavated natural material received
- The consumer must make any records required to be kept under this exemption available to authorised officers of the EPA on request.
- The consumer must ensure that any application of excavated natural material to land must occur within a reasonable period of time after its receipt.

All fill material entering the site will meet the requirements of the excavated natural material order or a specific resource recovery order issued by the EPA for the site. Written records will be maintained in accordance with the requirements of the ENM exemption and applied as fill within the existing quarry voids.

All sampling and analysis requirements specified in the ENM Order will be undertaken at the source of the emplacement material prior to transport to the site. This includes soil analysis at each source site in accordance with a written sampling plan which includes a description of sample preparation and storage procedures for the excavated natural material. Sampling will be undertaken in accordance with the sampling plan and may be undertaken from either stockpiled material or in-situ in accordance with the specifications of the ENM Order.

Emplacement material will not be accepted within the site if it exceeds the acceptance criteria for the site as shown in Table 14-3. The acceptance criteria has incorporated the chemical concentration and other attributes from the ENM Order (or specific resource recovery order) and

will be applied to all emplacement material (including VENM) to ensure suitable quality prior to transport to site.

Table 14-3 Acceptance criteria as per the ENM order (EPA 2014b)

Chemicals and other attributes	Maximum average concentration for characterisation (mg/kg 'dry weight' unless otherwise specified)	Absolute maximum concentration (mg/kg 'dry weight' unless otherwise specified)
1. Mercury	0.5	1.0
2. Cadmium	0.5	1.0
3. Lead	50	100
4. Arsenic	20	40
5. Chromium (total)	75	150
6. Copper	100	200
7. Nickel	30	60
8. Zinc	150	300
9. Electrical Conductivity	1.5 dS/m	3 dS/m
10. pH *	5 to 9 pH units	4.5 to 10 pH units
11. Total PAHs	20	40
12. Benzo(a)pyrene	0.5	1.0
13. Benzene	NA	0.5
14. Toluene	NA	65
15. Ethyl-benzene	NA	25
16. Xylene	NA	15
17. TPH C10-C36	250	500
18. Rubber, plastic, bitumen, paper, cloth, paint and wood	0.05 %	0.10 %

* The ranges given for pH are for the minimum and maximum acceptable pH values in the excavated natural material.

All testing of samples will be undertaken by analytical laboratories accredited by the National Association of Testing Authorities (NATA) or equivalent and undertaken in accordance with the test methods in the ENM order.

The generator must keep a written record of the following for a period of six years:

- The sampling plan required to be prepared under clause 4.1.1;
- All characterisation sampling results in relation to the excavated natural material supplied;
- The volume of detected hotspot material and the location;
- The quantity of the excavated natural material supplied; and
- The name and address of each person to whom the generator supplied the excavated natural material

Emplacement material will be transferred to site at a maximum rate of 140,000 tpa, using truck and trailer combinations of up to 42.5 tonne capacity. Haulage vehicles will enter the site and place material either directly within the active rehabilitation cell for each stage of the development or for temporary storage in a central stockpile area. The fill would then be transferred to the active rehabilitation cell by on-site earthmoving equipment.

14.2.3 Waste generation

All waste generated by the Project would be classified and managed in accordance with the NSW EPA (2014) 'Waste Classification Guidelines' and relevant regulatory requirements of the *Waste Avoidance and Resource Recovery Act 2001* (WARR Act) and POEO Act.

In accordance with the WARR Act, waste management during construction of the Project would adopt the principles of the waste hierarchy. The hierarchy provides guidance on the most preferable approach to managing waste as follows:

- Waste avoidance
- Waste re-use
- Waste recycling/re-processing/treatment
- Waste removal and disposal.

Limited waste is anticipated to be generated through undertaking the project which is anticipated to consist of:

- Cleared vegetation and landscaping materials
- General waste from site personnel (such as food scraps, cans, glass bottles, plastic and paper containers, paper, cardboard and other office wastes)
- Wastewater from onsite amenities.

The limited vegetation required to be cleared from within the existing quarry footprint will be retained for use as part of the rehabilitation of the site with the exception of priority weeds which will be disposed off-site in accordance with legislative requirements.

General waste will be collected and transported off-site for recycling and disposal.

Wastewater from staff amenities will be collected in a pump out system and transported off-site for disposal.

14.2.4 State waste policy

The NSW strategic policy framework for waste management incorporates policy to drive waste reduction and resource recovery. The framework has been strengthened with legislation to streamline development of waste management infrastructure and a strategy to provide for increasing resource recovery. These include the *Waste Avoidance and Resource Recovery Act 2001* and associated 'Waste Avoidance and Resource Recovery Strategy 2014-21'.

'NSW 2021: A plan to make NSW number one' is a 10 year plan for NSW. The plan identifies reducing waste generation and keeping materials circulating within the economy as priorities for NSW. A state-wide waste avoidance and resource recovery strategy is prepared every five years to address this priority. The latest strategy is the 'NSW Waste Avoidance and Resource Recovery Strategy 2014-21', which provides the framework for maximising conservation of natural resources and minimising environmental harm from waste management and disposal of solid waste. The strategy proposes long-term directions for waste in NSW and includes targets for, amongst other things:

- Avoiding and reducing waste generation
- Increasing recycling
- Diverting more waste from landfill.

Relevant to the Project are the following targets:

- By 2021-22, increasing recycling rates for construction and demolition waste to 80 percent
- By 2021-22, increase waste diverted from landfill to 75 percent.

The Project is consistent with the *NSW Waste Avoidance and Resource Recovery Act 2001* and 'Waste Avoidance and Resource Recovery Strategy 2014-21' as it is built around the diversion of waste. The Project would also assist the State in achieving the increased recycling rates and landfill diversion targets listed above.

14.3 Bushfire

A detailed bushfire risk assessment was carried out for the Project area and is included as Appendix H.

14.3.1 Existing environment

The site is located 10 kilometres east of Lithgow and 2.7 kilometres north of Bell NSW. It is within Lithgow City Council that is within the 'Central Ranges' and has a corresponding FDI rating of 80 (NSWRFS 2006).

The site is currently zoned as E3 Environmental Management.

The site bounded to the:

- South and west by Sandham Road (an all-weather two-wheel drive partially unsealed access road) and the western railway; and
- East and north by an undeveloped dry sclerophyll forest.

Access to the subject land is via Sandham Road (2.7km) from the Great Western Highway at Bell or informally from the north through the Clarence Colliery (emergency access only).

Vegetation classification

The identification of bush fire prone areas is required under Section 146 of the Environmental Planning and Assessment Act (1979). The site is designated as bushfire prone due to the presence of bushfire prone land within and adjoining the site as shown on Figure 14-1.

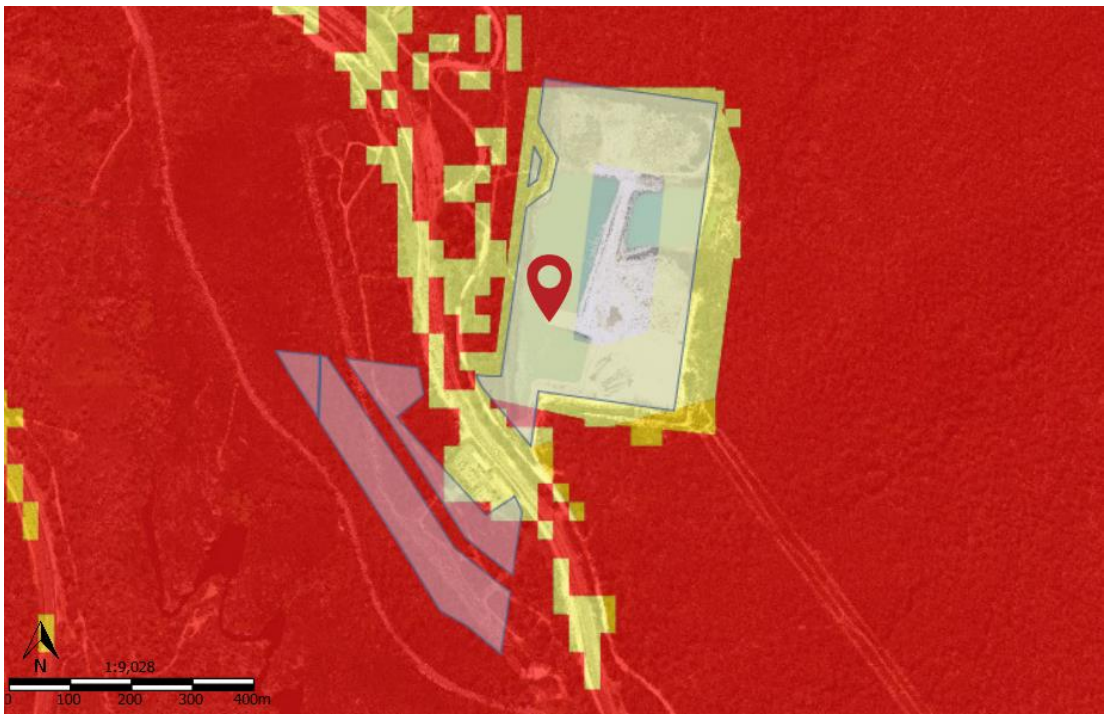


Figure 14-1 Bushfire prone land

This vegetation formation can support high intensity bushfires, most likely burning as a crown fire in forest formations and as a faster moving surface fire in open woodland communities without a shrubby understorey. The locality has been subject to high intensity bushfires in the past, including most recently in October 2013.

Slope description

"Effective Slope" in accordance with Planning for Bush Fire Protection (NSWRFS 2006) within the vegetation hazard immediately adjoining this site is >0 -5 degrees downslope. There are some areas adjoining the Project area where the slope is upslope - 0 degrees, as well as steeper sections, however the >0 -5 degrees downslope slope class is most likely to influence fire behaviour.

Significant environment values

The site adjoins Blue Mountains National Park on the eastern boundary. Newnes State Forest is located to the north of the property.

Threatened fauna and threatened flora

No threatened ecological communities or threatened flora are recorded within the site. Further details are provided in Chapter 8 of this EIS.

Aboriginal Cultural Heritage sites present

There is no Aboriginal object (within the meaning of the National Parks and Wildlife Act 1974) or Aboriginal place (within the meaning of that Act) that is known to be situated on the property. Further details are provided in Chapter 12 of this EIS.

14.3.2 Bushfire protection assessment

The following section provides an assessment of the extent to which the proposed development conforms to the aims and objectives of Planning for Bush Fire Protection (NSWRFS 2016).

The extent to which the development is to provide for setbacks, including asset protection zones

Asset Protection Zones (APZ) are determined based on vegetation and slope. APZ's for the site shall be applied from the office and amenities building wall outwards and accommodated entirely within the lot. They must comprise of Inner Protection Area (IPA) and an Outer Protection Area (OPA) of the dimensions shown in the table below. The APZ widths in Table 2 are in accordance with Appendix 2 of the PBP (NSWRFS 2006).

Table 14-4 Protection area dimensions

Vegetation	Slope Class	APZ	IPA	OPA
Forest	0-5 degrees	20 m	10 m	10 m

Inner Protection Area (IPA)

The IPA will extend from the building line. It is contained within the lot and will be maintained in accordance with PBP (NSWRFS 2006):

An IPA should provide a tree canopy cover of less than 15% and should be located greater than 2 m from any part of the roofline of a dwelling. Garden beds of flammable shrubs are not to be located under trees and should be no closer than 10 m from an exposed window of door. Trees should have lower limbs removed up to a height of 2 metres above ground.

The site manager is responsible for the maintenance of the IPA.

Outer Protection Area (OPA)

The OPA will extend from the IPA (i.e. from the building line) towards the hazard. The landholder is responsible for the OPA contained within the subject land. Parts of the OPA may comprise an all-weather access road or fire trail managed. The OPA is to be maintained in accordance with PBP (NSWRFS 2006) as a minimum requirement:

An OPA should provide a tree canopy cover of less than 30% and should have understorey managed (mowed) to treat all shrubs and grasses on an annual basis in advance of the fire season (usually September).

Maintenance of bushfire fuel

Within the IPA and OPA fuels are to be managed in accordance with the Standards for Asset Protection Zones (NSWRFS 2005), this requires;

(1) ***Raking or manual removal of fine fuels:*** Ground fuels such as fallen leaves, twigs (less than 6 mm in diameter), and bark should be removed on a regular basis.

(2) ***Mowing of grass:*** Grass needs to be kept short (<100mm) and where possible, green.

(3) ***Removal or pruning of trees, shrubs and understorey***: Prune or remove trees so that there is discontinuous canopy leading from the hazard to the asset. Separate tree crowns by at least two to five metres. A canopy should not overhang within two to five metres of any building.

Native shrubs and trees should be retained as clumps or islands and should maintain a covering of no more than 20% of the area.

Performance Criteria Summary:

APZs established, managed and maintained adjacent to the administration / amenities building to reduce the potential for fire spread

APZ maintenance is practical, soil stability is not compromised and the potential for crown fires is negated.

Utility Services are adequate to meet adequacy of water supply – non reticulated

A dedicated tank water will be supplied for the administration/amenities building and will include dedicated water tanks for fire fighting:

- Of 10,000 litre capacity
- Located within the IPA (but away from the structure)
- Fitted with a 65mm Storz outlet (and gate or ball valve fitted)
- Manufactured of concrete or metal (for above ground tanks), with shielding where located on the hazard side of the building
- With associated external piping and taps made of metal.

Where located, underground tanks must have an access hole of 200 mm to allow tankers to direct fill from the tank, and a hardened ground surface for truck access within four metres of the hole.

Electricity

Electricity lines within the site and servicing the proposed development will be either underground or overhead lines with the powerline owner responsible for installing, inspecting and completing powerline vegetation clearance works which comply with required regulatory requirements.

Gas

In order to comply with the Rural Fires Regulation, all bottled gas will be installed and maintained in accordance with AS/NZS 1596 – 2014

Performance Criteria Summary:

For the administration building, a dedicated accessible water supply for firefighting must be:

- Of 10,000 litre capacity
- Located within the IPA (but away from the structure)
- Fitted with a 65mm Storz outlet (and gate or ball valve fitted)
- Manufactured of concrete or metal (for above ground tanks), with shielding where located on the hazard side of the building
- With associated external piping and taps made of metal
- Where located, underground tanks must have an access hole of 200 mm to allow tankers to direct fill from the tank, and a hardened ground surface for truck access within four metres of the hole.

Any gas and electricity services to the site must be installed appropriately to limit the potential for ignition to bushland.

Adequacy of arrangements for access to and egress from the development site for an emergency response

The site is accessed from the Bells Line of Road from Sandham Road and Clarence Colliery Road (emergency access only).

The existing public roads are two way, two-wheel drive, all weather roads (comprised of sealed and unsealed sections) and are of sufficient width to allow fire fighting vehicles to work. The width of the road complies with Table 4.1 of Planning for Bushfire Protection 2006.

The public road network provides suitable access and egress for fire management and emergency response purposes.

Performance Criteria Summary:

- Two-way all weather access to the site is provided for fire fighters and evacuating staff
- Road capacity is sufficient to carry a fully loaded fire vehicle

Adequacy of bush fire maintenance plans and fire emergency procedures for the development site

An emergency evacuation plan should be prepared from the commencement of construction and during operations. An emergency response and evacuation plan is recommended as a condition of consent.

Performance Criteria Summary:

- An emergency response and evacuation plan will be prepared for the site

Construction standards to be used for building elements in the development

The National Construction Code does not provide for any bush fire specific performance requirements for Class 5 to 8 buildings. As such, the Australian Standard AS 3959 (Construction of buildings in bush fire prone areas) and the NASH standard, are not considered as a set of 'deemed to satisfy' provisions for construction, and do not apply.

14.3.3 Mitigation measures

The following bushfire protection measures are made for the subject land on Sandham Road, Dargan, 2786 (Lot / Plan no. 23/DP751631). Application of these measures allows the development to conform to the aim and objectives of *Planning for Bush Fire Protection (NSWRFS 2006)*.

Asset protection zones

From the commencement of rehabilitation and in perpetuity, the administration building shall incorporate a 20m APZ, including an Inner Protection Area and Outer Protection Area, in accordance with the dimensions identified in Table A2.5 in Appendix 2 of PBP, and the NSW RFS document 'Standards for asset protection zones'.

The IPA should provide a tree canopy cover of less than 15% and should be located greater than 2 m from any part of the roofline of a dwelling. Garden beds of shrubs are not to be located under trees and should be no closer than 10 m from an exposed window of door. Trees should have lower limbs removed up to a height of 2 metres above ground.

An OPA should provide a tree canopy cover of less than 30% and should have understorey managed (mowed) to treat all shrubs and grasses on an annual basis in advance of the fire season (usually September).

Water supplies and services

For the administration building, a dedicated firefighting water supply must be:

- Provided at 10,000 litre capacity
- Located within the IPA (but away from the structure)
- Fitted with a 65mm Storz outlet (and gate or ball valve fitted)
- Manufactured of concrete or metal (for above ground tanks), with shielding where located on the hazard side of the building
- With associated external piping and taps made of metal.

Where located, underground tanks must have an access hole of 200 mm to allow tankers to direct fill from the tank, and a hardened ground surface for truck access within four metres of the hole.

Electricity will be supplied via either underground or overhead power lines with 30 m pole spacing and in accordance with Energy Australia specifications (NS179, 2002) and maintained according to National distribution network standards.

Bottled Gas supplies, where installed, will be in accordance with AS/NZS 1596 (2014).

Emergency and evacuation planning

An emergency evacuation plan is to be prepared as a condition of consent to cover the construction and operation of the site.

Construction Standard

The National Construction Code does not provide for any bush fire specific performance requirements for Class 5 to 8 buildings and therefore they do not apply to the development.

14.4 Social and economic analysis

14.4.1 Existing environment

Socio-economic profile

Population

According to the most recent Australian Bureau of Statistics (ABS) Census (2016), the Lithgow LGA population was 21,090, representing a 4.4% increase since 2011. The majority of the population reside in Lithgow urban area (5,201 people), Wallerawang (1,980 people) and Portland (2,424 people). The remainder of the population (approximately 55%) live in smaller villages, hamlets and rural localities across the LGA. Table 7–1 summarises the population characteristics of the LGA between 2006 and 2016.

Table 14-5 LGA population summary

Selected medians	2006	2011	2016
Population	19,756	20,161	21,090
Median age of persons (years)	40	42	45
Median total personal income ($ weekly)	$356	$455	$510
Median total family income ($ weekly)	$1,027	$1,190	$1,328
Median total household income ($ weekly)	$751	$894	$984
Median mortgage repayment ($ monthly)	$1,083	$1,452	$1,387
Median rent ($ weekly)	$135	$170	$230
Average household size (persons)	2.4	2.3	2.3

Economic Profile

Lithgow has a long history of mining, quarrying and power generation. The energy and resources sector continues to be a primary economy in the Lithgow area, making a significant contribution to retail, industrial services and accommodation via direct and indirect employment opportunities. The largest sectors in the Lithgow community by total output include:

- Mining
- Construction
- Electricity
- Public Administration
- Manufacturing

The Lithgow economy represents around 16% of the NSW Central West regional economy. For the period June 2013-14 Lithgow had a Gross Regional Product of $1,541 million, an indicator annual growth of 3.3%. The following sectors contributed the most to Lithgow's GRP: Mining, Construction, Electricity, Gas, Water and Waste Services, Public Administration and Safety and Manufacturing.

14.5 Impact identification

Economic effects

Direct employment

This project will see the direct employment of staff from the local area during the site establishment phase of works, and throughout the life of the project with respect to the rehabilitation and emplacement activities.

Contractor contribution

A range of contractors will be required to contribute to the project. Vehicle maintenance, site surveying, landscaping, environmental monitoring, road maintenance (for Sandham Road), site amenity hire (office, equipment storage, ablutions, fencing will be sourced locally where possible and contribute to the local economy.

Long term business investment

The progressive rehabilitation of Bell Quarry will support continued long term investment in the Lithgow LGA. Long term secure employment and supplier contracts for local residents and businesses means it is more likely that people will remain in the Lithgow LGA on a permanent basis, resulting in the following benefits:

- Investment in housing (i.e. purchasing rather than renting suggesting a stable population)
- Long term planning for the future through access to education, growth in families, etc.
- Participation in social activities and maintenance of social ties

Social effects

Amenity and environmental considerations

The following provides a summary of the environmental considerations of the Project as it relates to amenity and social effects.

Visual

The existing quarry site has limited visibility from surrounding areas as a result of the steep to undulating landform and dense vegetation. Visibility of the quarry is largely restricted to the perimeter fence and a small section of Sandham Road immediately adjacent to the site.

Rehabilitation of the site will involve emplacement of clean fill within the existing footprint to enable the site to be returned to a condition closely representing the original landform and be visually integrated with the adjoining Blue Mountains National Park. The final landform would be progressively revegetated with locally endemic species to provide effective control or erosion and integration with the surrounding landscape.

Traffic

The project involves haulage of emplacement material to the site utilising the existing local and regional road network. Road safety has been identified as key issue for members of the local community, particularly residents living along Sandham Road in Bell.

Sandham Road currently experiences low volumes of traffic and primarily services rural residential properties following the cessation of the quarry operations. The additional haulage traffic for the rehabilitation activities will therefore represent a relatively large proportional increase to existing background conditions based upon the vehicle counts undertaken following the completion of active extraction operations.

The project proposes to limit haulage to fall within the maximum extraction volumes during the operation of the quarry. The use of heavy vehicle movements will therefore be representative of the number of movements experienced during the previous quarry operations and traffic modelling indicates the proposed vehicle movements will not impact upon the capacity or performance of the road network.

Noise and vibration

Rehabilitation of the site will involve the use of haul trucks for delivery of emplacement material mobile extractive industry plant and equipment which have potential to generate noise that can impact upon near-bye receivers. It is recognised that the noise emissions generated by the operation of haul trucks along Sandham Road is a particular concern for local residents living in Bell.

The project has been limited to transport of a maximum of 140,000 tpa of emplacement material and falls within the extraction limits for the existing consent applying to the site. Noise generated

will be comparable to the noise experienced during the previous extraction operations and all site and road haulage noise emissions will comply with relevant project specific noise criteria developed in accordance with the Noise Policy for Industry and the Road Noise Policy.

Rehabilitation activities and haulage to the site will be restricted to daylight hours of 7.00 am to 6.00 pm Monday to Friday and 7.00 am to 1.00 pm on Saturdays, which will limit the potential for sleep disturbance created by the project. Minor site preparation activities involving the use of a grader and roller to prepare the site for haulage vehicles prior to daily operations and will fall within the night criteria for nearby receivers at Newnes Junction.

Air quality

Haulage vehicles and the use of mobile equipment at the quarry site has potential to generate dust and impact upon the amenity of the local community. Dust generated by haulage vehicles travelling along unsealed sections of Sandham Road was identified as a key issue for the local community.

Detailed air quality modelling has been undertaken for the project and demonstrates that adoption of Level 1 (2 L/m^2/hr) water spraying along Sandham Road in dry and windy conditions will limit the potential for dust impacts upon the local community and comply with EPA criteria.

15. Environmental management

The project will be undertaken in accordance with a comprehensive suite of environmental mitigation measures and controls, designed to minimise the impact of the proposal on the environment. These measures would be documented in a Environmental Management Plan (EMP).

The EMP would be developed and implemented by BQRP and be prepared in accordance with the principles of *AS/NZS ISO 140001 Environmental management systems – specification with guidance for use*.

The key objective of the EMP would be to ensure all environmental commitments made in this EIS (including the Appendices), and any conditions included as part of the development consent are implemented throughout the rehabilitation works. The EMP would include the following information:

- Objectives of the EMP.
- Procedures to provide understanding for all personnel of the principles of environmental management.
- List of approvals to be obtained prior to work commencing.
- Accountability (roles and responsibility of personnel).
- Management strategies to guide actions to make sure environmental obligations are met. This would include detailed procedures to facilitate the implementation of appropriate environmental management measures.
- Objectives for each area of potential environmental impact, based on a desirable outcome.
- Actions for meeting environmental objectives based on the mitigation measures identified in this EIS and any statutory or regulatory obligations.
- Procedures for management of emergencies and other unforeseen circumstances.
- Stakeholder consultation and complaint handling procedures.
- Environmental monitoring and review requirements.

Table 15-1 provides a consolidated summary of the proposed environmental management and mitigation measures for the project.

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Table 15-1 Environmental management and monitoring requirements

Issue	Impact	Mitigation measures
Soil and water	Water discharge	• The maximum emplaced areas in accordance with the staging plans and if required will be limited to the areas provided Table 7-11 above. These may be adjusted if a higher area can be adopted whilst still satisfying discharge limits. • Dewatering rates will be regularly varied to minimise downstream geomorphic impacts. This will be undertaken by varying the dewatering pumping rate on a daily basis. The required average daily pumping rate shall be calculated before a period of pumping is required and the pumping rate adjusted on each consecutive day such that the average pumping requirement is achieved and a variation between maximum and minimum pumping rates of at least 100 percent is achieved. • Before any pumped discharge from site, due either to management of recent rainfall or dewatering requirements, the turbidity of the water at the proposed pumping point would be tested and only discharged if a turbidity criteria is satisfied. This testing would be undertaken weekly during discharge or daily during discharge if rainfall has occurred during that day. • The discharge criteria is proposed to be initially 25 NTU. Based on sampling of current water quality in the voids this is expected to be readily achievable, without treatment, during the early stages before significant emplacement of material. During later stages, if ongoing discharge quality monitoring indicates this criteria may not be satisfied a low impact potential flocculant such as gypsum may be utilised and the discharge criteria may be reviewed based on a greater availability of monitoring data than is currently available.
	Erosion and sediment controls	• An erosion and sediment control plan (ESCP) will be developed for the site prior to the commencement of filling. • The ESCP will be developed following the guidance of Managing urban stormwater: soils and construction, volume 2E – mines and quarries (DECC 2008). • Erosion and sediment control strategies will comprise the following: – Minimisation of the extent and duration of disturbed areas, and prompt topsoiling and revegetation following the completion of each project stage. – Ongoing filling works will maintain landforms which minimise the erosion hazard. – Runoff from the site will be diverted around active filling areas and toward the site discharge pond in a manner which minimises erosion. – Temporary control measures such as geotextile sediment fencing and straw bale filters. • The ESCP will detail the monitoring and maintenance required, such as inspections following significant rainfall events, and the removal of trapped sediments from control structures.
	Surface water monitoring	• During active filling and rehabilitation, it is proposed that the site discharge be monitored monthly (during discharge) for the following parameters:

Issue	Impact	Mitigation measures
		– Physicochemical parameters: pH, EC, turbidity, TSS, O&G. – Cations: sodium, calcium, potassium, magnesium. – Anions: alkalinity, sulfate, chloride. – Metals (dissolved): aluminium, arsenic, cadmium, chromium, copper, iron, lead, manganese, mercury, nickel, zinc. – Nutrients: ammonia, nitrate, nitrite, NOx, TKN, TN, TP, RP. – Organic compounds: BTEX, naphalene, benzo(a) pyrene, TPH (C10-C36).
	Review	A review of the potential for impacts of the emplacement of VENM and ENM (or other clean fill material)) on water quality, volumes and levels is to be undertaken every two years (and at least for each rehabilitation stage) during operations, or specifically as a result of: • Any statutory or regulatory requirements. • More than two consecutive exceedances of the ANZECC (2000) 99 percent protection level GVs observed at the site discharge or the downstream tributary located within the swamp and the during the monitoring program as described in Sections 6, 7.3.3 and 6.1.3. • Any incident that requires reporting. • The review will also be undertaken of all previous monitoring data and sampling of surface water run-off directly from emplaced ENM and other relevant areas and the dewatered pits and by measuring site rainfall, catchment, dewatered and discharged volumes. The results will be used to predict the discharge quality in the later stages of the operation and compare the results against the predicted modelling work undertaken within this WRA to identify if additional adaptive management controls need to be implemented to meet the GVs before emplacement activities commence in the future stages
Biodiversity	General	• Ensure all workers are provided an environmental induction prior to starting work on site. This would include information on the ecological values of the site, protection measures to be implemented to protect biodiversity and penalties for breaches. • Prepare a flora and fauna management sub-plan as part of the CEMP, incorporating recommendations below, and expanding where necessary.

Issue	Impact	Mitigation measures
		• Measures to suppress dust would be put in place during clearing, construction and operation.
	Vegetation clearing	• Limit disturbance of vegetation to the minimum necessary to construct the Project. • Vehicles must be appropriately washed prior to work on site to prevent the potential spread of Cinnamon Fungus (Phytophthora cinnamomi) and Myrtle Rust (Pucciniales fungi) in accordance with the national best practice guidelines for Phytophthora (DEH 2006) and the Myrtle Rust factsheet (DPI 2011c) for hygiene control. • Where the Project footprint adjoins native vegetation mark the limits of clearing and install fencing around the construction footprint area prior to the commencement of construction activities to avoid unnecessary vegetation and habitat removal. • Stockpiles of fill or vegetation should be placed within existing cleared areas (and not within areas of adjoining native vegetation). • Sediment fences should be installed to prevent transfer of sediments into adjacent vegetation.
	Weeds	• Develop weed management actions to manage weeds during the construction phase of the Project. This would include the management and disposal of the weeds that were recorded within the Project footprint, including the priority weeds listed in Table 8-1 in accordance with the Biosecurity Act. • Vehicles and other equipment to be used on site should be cleaned to minimise seeds and plant material entering the site to prevent the introduction of further exotic plant species or disease. • Incorporate control measures in the design of the Project to limit the spread of weed propagules downstream of study area. Sediment control devices, such as silt fences, would assist in reducing the potential for spreading weeds. • Exposed soil should be sown with native seed immediately to prevent colonisation by weeds. • Locally endemic species typical for the area should be used for rehabilitation. • Ongoing management of priority weeds according to legislative requirements. • Ongoing management of environmental weeds according to best practice methods.

Issue	Impact	Mitigation measures
		• Monitoring of rehabilitation outcomes.
	Fauna habitat	• Protocols to prevent introduction or spread of chytrid fungus should be implemented following Office of Environment and Heritage Hygiene protocol for the control of disease in frogs (DECCW, 2008). • A trained ecologist should be present during the clearing of native vegetation or removal of potential fauna habitat to avoid impacts on resident fauna and to salvage habitat resources as far as is practicable. Clearing surveys should include: – Any hollow-bearing trees to be felled should be marked prior to clearing of vegetation. The removal of hollow bearing trees is to be undertaken in accordance with a hollow-bearing tree management protocol and would include the presence of a qualified ecologist or wildlife expert experienced in the rescue of fauna. – Habitat features (fallen logs and tree hollows) removed from site would be salvaged and relocated within adjacent areas of vegetation. – Inspections of native vegetation for resident fauna and/or nests or other signs of fauna occupancy – Deferral of vegetation removal and associated construction activity in areas occupied by more mobile threatened fauna until the fauna has vacated the Project footprint
	Water quality and aquatic habitats	• Erosion and sediment control plans should be prepared in accordance with Volume 2D of Managing Urban Stormwater: Soils and Construction (DECC 2008). The erosion and sediment control plans would be established prior to the commencement of construction and be updated and managed throughout as relevant to the activities during the construction phase. • Erosion and sediment control measures should be established prior to construction. • Erosion and sediment control measures would be regularly inspected, particularly following rainfall events, to ensure their ongoing functionality. • Stabilised surfaces should be reinstated as quickly as practicable after construction. • Water should be applied to exposed surfaces that are causing dust generation. Surfaces may include unpaved roads, stockpiles, hardstand areas and other exposed surfaces (for example recently graded areas).

Issue	Impact	Mitigation measures
		• Vehicles must follow appropriate speeds to limit dust generation. • All stockpiled material should be stored in bunded areas and kept away from waterways to avoid sediment entering the waterway. • Spill kits would be made available to construction vehicles. A management protocol for accidental spills would be put in place.
Air quality	Sandham road	• Dust dispersion modelling identified haul trucks operating on unsealed surfaces are a significant source of dust. In order to control potential dust impacts from Sandham Road, and to meet the project criteria, Level 1 (2L/m2/hr) water spraying should be undertaken on Sandham Road whenever visible plumes of dust are observed to be blowing towards nearby receivers (specifically R18 and R28). This should be undertaken during daytime weather conditions that assist dust dispersion (dry and windy).
	Operational activities	• Aim to minimise the size of storage piles where possible • Limit cleared areas of land and clear only when necessary to reduce fugitive dust emissions • Control on-site traffic by designating specific routes for haulage and access and limiting vehicle speeds to below 25 km/hr • All trucks hauling emplacement material should be covered before entering the public road network and should maintain a reasonable amount of vertical space between the top of the load and top of the trailer • Material spillage on sealed roads should be cleaned up as soon as practicable • Operations conducted in areas of low moisture content material should be suspended during high wind speed events or water sprays should be used • These measures will assist in reducing impact on all areas off-site.
Traffic and transport	Operational activities	• A heavy vehicle speed limit of 40 km/hour will be adopted for all trucks utilising Sandham Road • Heavy vehicles will have a maximum capacity of 42.5 tonnes • A maximum of 37 heavy vehicles per day (74 movements to and from site) will be permitted to haul emplacement material to the site.

Issue	Impact	Mitigation measures
		• All trucks hauling emplacement material should be covered before entering the public road network and should maintain a reasonable amount of vertical space between the top of the load and top of the trailer
Noise and vibration	Operational activities	• All activities on site should be confined between the hours: daytime hours of 7:00 am to 6:00 pm from Monday to Friday and 7:00 am to 1:00 pm on Saturday, with the exception of site preparation works between 6:00 am and 7:00 am Monday to Saturday. In particular, haul trucks should not arrive on site (or depart) before 7:00 am. • Site preparation works should not occur between the hours of 6:00 pm and 6:00 am. • All personnel on site should be made aware of the potential for noise impacts and should aim to minimise impact or elevated noise levels, where possible. • All engine covers should be kept closed while equipment is operating. • Vehicles should be kept properly serviced and fitted with appropriate mufflers. The use of exhaust brakes should be eliminated, where practicable. • Machines found to produce excessive noise compared to industry best practice should be removed from the site or stood down until repairs or modifications can be made. • All trucks entering and exiting the quarry should keep at or below 40 km/hr for haulage on Sandham Road.
Other environmental issues	Visual and landform	• Maintenance of visual buffers currently in place around pit boundaries • Revegetation with plant species representative of native vegetation in the local area to integrate with the surrounding landscape so that the site becomes sympathetic with the adjoining Blue Mountains National Park.
	Beneficial Reuse of Waste	• At the time the excavated natural material is received at the premises, the material must meet all chemical and other material requirements (via stringent sampling and testing) for excavated natural

Issue	Impact	Mitigation measures
		material which are required before the supply of excavated natural material under 'the excavated natural material order 2014'. • The consumer must keep a written record of the following for a period of six years: • the quantity of any excavated natural material received; and • the name and address of the supplier of the excavated natural material received • The consumer must make any records required to be kept under this exemption available to authorised officers of the EPA on request. • The consumer must ensure that any application of excavated natural material to land must occur within a reasonable period of time after its receipt. • All fill material entering the site will meet the requirements of the excavated natural material order or a specific resource recovery order issued by the EPA for the site. Written records will be maintained in accordance with the requirements of the ENM exemption and applied as fill within the existing quarry voids. • All sampling and analysis requirements specified in the ENM Order will be undertaken at the source of the emplacement material prior to transport to the site. This includes soil analysis at each source site in accordance with a written sampling plan which includes a description of sample preparation, storage and transfer procedures for the excavated natural material. Sampling will be undertaken in accordance with the sampling plan and may be undertaken from either stockpiled material or in-situ in accordance with the specifications of the ENM Order. • Emplacement material will not be accepted within the site if it exceeds the acceptance criteria for the site as shown in Table 14-4. The acceptance criteria has incorporated the chemical concentration and other attributes from the ENM Order and will be applied to all emplacement material (including VENM) to ensure suitable quality prior to transport to site. • All testing of samples will be undertaken by analytical laboratories accredited by the National Association of Testing Authorities (NATA) or equivalent and undertaken in accordance with the test methods in the ENM order.

Issue	Impact	Mitigation measures
		• The generator must keep a written record of the following for a period of six years: • the sampling plan required to be prepared under clause 4.1.1; • all characterisation sampling results in relation to the excavated natural material supplied; • the volume of detected hotspot material and the location; • the quantity of the excavated natural material supplied; and • the name and address of each person to whom the generator supplied the excavated natural material • Emplacement material will be transferred to site at a maximum rate of 140,000 tpa, using truck and trailer combinations of up to 42.5 tonne capacity. Haulage vehicles will enter the site and place material either directly within the active rehabilitation cell for each stage of the development or for temporary storage in a central stockpile area. The fill would then be transferred to the active rehabilitation cell by on-site earthmoving equipment.
	Bushfire management	• From the commencement of rehabilitation until completion of the project, the administration building shall incorporate a 20m APZ, including an Inner Protection Area and Outer Protection Area, in accordance with the dimensions identified in Table A2.5 in Appendix 2 of PBP, and the NSW RFS document 'Standards for asset protection zones'. • The IPA should provide a tree canopy cover of less than 15% and should be located greater than 2 m from any part of the roofline of a dwelling. Garden beds of shrubs are not to be located under trees and should be no closer than 10 m from an exposed window of door. Trees should have lower limbs removed up to a height of 2 metres above ground. • An OPA should provide a tree canopy cover of less than 30% and should have understorey managed (mowed) to treat all shrubs and grasses on an annual basis in advance of the fire season (usually September). • For the administration building, a dedicated firefighting water supply must be: — Provided at 10,000 litre capacity — Located within the IPA (but away from the structure)

Issue	Impact	Mitigation measures
		— Fitted with a 65mm Storz outlet (and gate or ball valve fitted) — Manufactured of concrete or metal (for above ground tanks), with shielding where located on the hazard side of the building — With associated external piping and taps made of metal. • Where located, underground tanks must have an access hole of 200 mm to allow tankers to direct fill from the tank, and a hardened ground surface for truck access within four metres of the hole. • Electricity will be supplied via underground or overhead power lines with 30 m pole spacing and in accordance with Energy Australia specifications (NS179, 2002) and maintained according to National distribution network standards. • Bottle gas supplies, where installed, will be in accordance with AS/NZS 1596 (2014). • An emergency evacuation plan is to be prepared as a condition of consent to cover the construction and operation of the site. • The National Construction Code does not provide for any bush fire specific performance requirements for Class 5 to 8 buildings and therefore they do not apply to the development.

16. Justification and conclusions

16.1 Findings of the environmental impact statement

16.1.1 Introduction

The EP&A Regulation requires that an EIS include:

"the reasons for justifying carrying out the development or activity in the manner proposed, having regard to biophysical, economic and social considerations and the principles of ecologically sustainable development."

The principles of Ecologically Sustainable Development (ESD) in relation to the project are considered in Section 16.2 of this EIS. The following sections provide an overview of the main findings of the EIS having regard to biophysical, social and economic considerations.

16.1.2 Biophysical considerations

Soil and water resources

Bell Quarry is located within the upper reaches of the Wollangambe River catchment, which forms part of the broader Hawkesbury-Nepean catchment area. An ephemeral tributary of the Wollangambe River runs in a north-easterly direction through the project site, with its headwaters in the vicinity of the rail line upstream of the site. The quarry now contains three large voids which are partially filled with water through a combination of surface water run-off and groundwater seepage. Water is discharged from the site through an established sediment basin on the eastern edge of the site and discharges into an unnamed tributary within the Blue Mountains National Park.

The tributary passes through a swamp where flows are predominantly subsurface under baseflow conditions and continues for approximately 1.5 kilometres before the confluence with the Wollangambe River. The Wollangambe River winds eastwards through narrow canyons and is one of four major tributaries of the Colo River.

A detailed assessment of the potential impacts of the project on water resources has been undertaken as part of this EIS. The project will restore the flow regime to be representative of natural run-off conditions from before the commencement of extractive operations. During the rehabilitation activities there will be a temporarily reduction to the frequency of low flows and more frequent moderate flows for stages requiring dewatering. The changes to the flow regime are relatively minor and are not anticipated to significantly impact upon downstream geomorphological processes due to the natural stream profile and thick and well established vegetation in the immediate receiving waters.

All emplacement material brought to the site will be clean fill and meet the acceptance criteria for bringing material to the site in line with the ENM Resource Recovery Order. Detailed water quality modelling has been undertaken and shows that both surface water discharges and groundwater are expected to have minimal potential to impact upon the immediate receiving waters in the downstream tributary and swamp located approximately 200 metres from the site. Further downstream the site will have minimal influence on stream flow or water quality as the receiving waters are subject to an increasingly broad catchment area.

Biodiversity

A detailed assessment of impacts upon biodiversity values within the site and the adjoining Blue Mountains National Park has been undertaken as part of this EIS. The majority of the site has been previously disturbed, with some areas of revegetation undertaken to assist with the

stabilisation of soils and some limited remnant vegetation around the periphery of the site. A total of 2.48 ha of planted vegetation and 0.13 ha of remnant vegetation will be temporarily removed and reininstated with progressive revegetation undertaken as part of each stage of the Project.

The project would not directly impact any threatened ecological communities or threatened flora species. The final landform would be revegetated progressively and result in a more natural environment in the long-term.

The project will result in minor impacts to the foraging and shelter resources for common native fauna and is unlikely to result in the isolation of any areas of native vegetation or fauna habitats in the locality.

There will be no direct clearance of native vegetation within the GBMWHA. Weed management measures will be implemented to control existing weeds and prevent the introduction of weeds to the site through importing fill material to the site.

The rehabilitation works will result in minor changes to the hydrological regime and surface water and groundwater quality in the unnamed tributary immediately downstream of the site. The changes will be minor and are likely to be within the range of conditions tolerated by species within the downstream area and are unlikely to modify the composition of the vegetation or place any species at risk of extinction.

Following completion of the rehabilitation works and revegetation with locally endemic species, the site and the adjacent areas of the national park are likely to improve given reduced edge effects and other indirect impacts associated with the former use of the site for extractive operations.

Benefical Reuse of Waste

The project is seeking to rehabilitate the existing quarry pit through the importation of virgin VENM, ENM and other clean fill material sourced from earthworks projects across Sydney and the local regional area. It is estimated that approximately 1.2 million cubic metres of clean fill material would be required to fill the site over a period of approximately 15 years.

The beneficial reuse of waste material to achieve the optimum rehabilitation outcomes through returning the site to a condition closely representing the original landform and that of the adjoining Blue Mountains National Park is considered to be in line with the reuse provisions of the Infrastructure SEPP, POEO Act and Waste Avoidance and Resource Recovery Act 2001. The proposed use of the waste is bona-fide, fit-for-purpose use with minimal potential to cause harm to the environment or human health as demonstrated through the preparation of this EIS and ENM Order and Exemption. All material brought to site will be subject to strict acceptance criteria prior to transport to site and minimal residual waste is anticipated to be generated by the project.

16.1.3 Social considerations

Air quality

The project has potential to generate dust through the rehabilitation activities and vehicle haulage along Sandham Road as described in Chapter 10 and Appendix F. The site is located in a rural environment and periodically experiences high level of background dust generated from surrounding landuse including nearby mining and quarry operations and vehicles travelling on unsealed roads.

The project is anticipated to have a small incremental impact on dust emissions in the immediate vicinity of the quarry as shown in the dust contour plots included in Appendix F. All

impacts will fall within the respective air quality criteria prescribed by the Approved Methods (EPA,2016) and the Air NEPM and is not anticipated to significantly impact upon sensitive receivers.

Dust will also be generated by haulage vehicles travelling along unsealed sections of Sandham Road which is used for access to the site. Detailed air quality modelling demonstrates that adoption of Level 1 (2 L/m^2/hr) water spraying along Sandham Road in dry and windy conditions will limit the potential for dust impacts upon the local community and comply with EPA criteria.

Noise

All noise generating works associated with the Project are predicted comply with the project noise trigger levels. The maximum noise emission levels from the site are not greater than LAeq 50 dBA (NPI's recommended amenity noise level for passive recreational area) when calculated to either 200 metres south, north-east or north of the site boundary. The national park areas beyond 200 metres from the site will likely receive noise levels from the quarry site below LAeq 50 dBA.

Noise levels due to the use of heavy vehicles along Sandham Road is the greatest at residential dwellings within 20 metres of Sandham Road.. The predicted increase in traffic noise levels during maximum operation is less than 55 dBA and complies with the EPA's Road Noise Policy at all receivers

Typical vibration levels from activities such as excavation are generally negligible at distances greater than 50 metres. Therefore, given the nearest receiver is 250 metres from the quarry site, vibration levels from equipment use within the quarry is not anticipated to adversely impact receivers.

Aboriginal heritage

All rehabilitation activities will be undertaken with the existing quarry footprint and haulage to the site will utilise the existing public road network. There is considered minimal potential to disturb natural ground surface of culturally modified trees. The site has been disturbed during the previous extraction activities and there is no evidence that the site was previously used intensively by Aboriginal people.

The target resource for the original quarry was a weathered sandstone and no sandstone outcrops suitable for Aboriginal occupations have been identified in the area. The landform was previously steep and lacked permanent water making it unsuitable for a large camp site. There were no AHIMS records located in the vicinity of the ephemeral drainage line which is well vegetated and resistant to any geomorphological change.

In accordance with the Due Diligence Code of Practice for the Protection of Aboriginal Objects in New South Wales an AHIP application is not necessary and the project may proceed with caution.

Historical heritage

There are no listed historic heritage items in the immediate vicinity of the site. The closest listed items are located more than 400 metres from the site and are not located in the primary haulage route for the operations and will not be directly or indirectly impacted by the project.

World Heritage

The site is located adjacent to the Blue Mountains National Park which forms part of the Greater Blue Mountains Area listed on the UNESCO World Heritage List and the National Heritage List.

The project will result in minor indirect impacts to the land immediately adjoining the site during rehabilitation operations. Overall the project will restore the landscape to be more representative of the original landform and will be complementary to the conservation values of the Greater Blue Mountains Area.

Traffic and transport

The emplacement material will be sourced from earthworks projects throughout the Sydney basin and the local region and will be transported to site using truck and trailers of up to 42.5 tonne capacity. It is estimated that haulage will occur for around 250 days per year accounting for wet days and reduced haulage on weekends with an average capacity of 30 tonne. The resulting traffic generated based on this assumption is an average of 37 heavy vehicle movements per day, which is equivalent in number to the previous quarry operations and the existing consent for the site.

Sandham Road currently experiences low volumes of traffic and primarily services rural residential properties in Bell following the cessation of the quarry operations. The additional haulage traffic for the rehabilitation activities will therefore represent a relatively large proportional increase to existing background conditions based upon the vehicle counts undertaken following the completion of active extraction operations. The project proposes to limit haulage to within the maximum extraction volumes for the quarry and the heavy vehicle movements will therefore be representative of the number of movements permitted in accordance with the existing consent. The haulage traffic represents a relatively small proportional increase to background traffic on the wider regional road network. The minor increases to traffic are not considered to impact upon the safety or capacity of the road network.

Intersection modelling has been undertaken and indicates key intersections on the haulage routes including Darling Causeway / Bells Line of Road and Sandham Road / Bells Line of Road currently operate at a satisfactory performance with spare capacity in both AM and PM peak periods. There are negligible changes in traffic performance between the base and traffic operation scenarios for both the AM and PM peak periods. Given the expected low increase in heavy vehicle movements associated with the project, it is likely that traffic generation would result in minimal traffic impacts to the operation of the local road network. Visibility of the quarry is largely restricted to the perimeter fence and a small section of Sandham Road immediately adjacent to the site.

Rehabilitation of the site will involve emplacement of clean fill within the existing footprint to enable the site to be returned to a condition closely representing the original landform and be visually integrated with the adjoining Blue Mountains National Park. The final landform would be progressively revegetated with locally endemic species to provide effective control or erosion and integration with the surrounding landscape.

Bushfire risk

The site is designated as bushfire prone due to the presence of bushfire prone land within and adjoining the site. The project will be developed in accordance with the aims and objectives of Planning for Bush Fire Protection (NSWRFS 2016) and pose minimal risk to the safety of workers at the site or the surrounding environment.

16.1.4 Economic considerations

This project will see the direct employment of staff from the local area during the site establishment phase of works, and then throughout the life of the project with respect to emplacement works. There will also be a material contractor contribution to the project, with respect to activities such as vehicle maintenance, site surveying, ongoing rehabilitation of filled quarry cells, environmental monitoring, road maintenance (for Sandham Road). The employment revenue generated by the conduct of these activities represents an additional economic contribution to the region.

The progressive rehabilitation of Bell Quarry will support also continued long term investment in the Lithgow LGA. Long term secure employment and supplier contracts for local residents and businesses means it is more likely that people will remain in the Lithgow LGA on a permanent basis, resulting in the following benefits:

- Investment in housing (i.e. purchasing rather than renting suggesting a stable population)
- Long term planning for the future through access to education, growth in families, etc.
- Participation in social activities and maintenance of social ties

16.2 Ecologically sustainable development

ESD is an objective of the EP&A Act under Section 5(a)(vii) and is a required assessment consideration under Schedule 2, Part 3, clause 7(4) of the Environmental Planning and Assessment Amendment (Part 3A Repeal) Regulation 2011.

ESD can be achieved through the implementation of the following principles:

- The precautionary principle, namely, that if there are threats of serious or irreversible environmental damage, lack of full scientific certainty should not be used as a reason for postponing measures to prevent environmental degradation
- Intergenerational equity, namely, 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
- Conservation of biological diversity and ecological integrity, namely, that conservation of biological diversity and ecological integrity should be a fundamental consideration
- Improved valuation, pricing and incentive mechanisms, namely, those environmental factors should be included in the valuation of assets and services.

The overall objectives of ESD are to use, conserve and enhance natural resources. This ensures that ecological processes are maintained facilitating improved quality of life, now and into the future.

BQRP is committed to the principles of ESD and understands that social, economic and environmental objectives are interdependent. The principles of ESD have been applied in Project design, planning and assessment through:

- Incorporation of risk assessment and analysis at various stages in the project design and environmental assessment and with decision-making processes
- Thorough consideration of the project design in consideration of the physical, hydrological and ecological interactions
- Numerous design iterations to minimise and where possible avoid impacts to the environment and community

- Robust, scientific assessments of potential environmental and socio-economic impacts associated with the project
- Optimisation of the economic benefits to the community arising from the development of the project.

16.2.1 Precautionary principle

The precautionary principle reinforces the need to take risk and uncertainty into account, particularly in relation to threats of irreversible environmental damage. In the application of the precautionary principle for the project, decisions have been guided by careful evaluation to avoid, wherever practicable, serious or irreversible damage to the environment, and by an assessment of the risk-weighted consequences of various options.

The environmental consequences of the project have been assessed as accurately as possible using appropriate specialists in relevant disciplines. The assessment process involved computer modelling, scientific analysis and interpretation of the potential environmental impacts associated with the project. This process has enabled the impacts of the project to be predicted with a reasonable degree of certainty. All predictions, however, contain a degree of uncertainty, which reflects the variable nature of the environment. Where there has been any uncertainty in the prediction of impacts throughout the assessment process, a conservative approach was adopted to ensure a reasonable worst-case scenario was considered in the assessment of impacts, combined with an ongoing set of robust checks via monitoring and reviewing of actual and future environmental performance.

The project would not result in any significant environmental impacts and will result in environmental benefits by restoring the landform of the quarry to similar to the original, while ensuring beneficial reuse of ENM and VENM clean fill materials and avoiding their disposal in landfill.

A construction and environmental management plan will be prepared for the project. These management plans include requirements for environmental monitoring as a precautionary measure to reduce uncertainty regarding the potential for environmental impact due to the project.

16.2.2 Social equity including intergenerational equity

Social equity is defined by intergenerational equity, which is centred on the concept 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. The primary objective for the Project is the beneficial reuse of clean fill materials in the restoration of the Bell Quarry landform to a landform similar to the original.

The project is considered consistent with the principle of social equity and intergenerational equity through returning the site to be representative of the environment prior to commencement of extractive operations. The productivity of the environment will therefore be enhanced for future generations.

16.2.3 Conservation of biological diversity and maintenance of ecological integrity

The principle of conservation of biological diversity and ecological integrity holds that it should be a fundamental consideration for development projects.

There is considered to be a significant opportunity to achieve superior rehabilitation outcomes than required under the existing consent. The project will rehabilitate the site to a condition closely representing the original landform and that of the adjoining Blue Mountains National

Park. The project will optimise resource recovery through the beneficial reuse of clean fill material and include revegetation of the site with locally endemic species to provide effective integration with the surrounding landscape.

16.2.4 Improved valuation and pricing of environmental resources

The principle of improved valuation, pricing and incentive mechanisms deems that environmental factors should be included in the valuation of assets and services, and that those who generate the pollution and waste should bear the cost of containment, avoidance or abatement. The cost associated with impact on (or use of) an environmental resource together with remediation costs is seen as a cost incurred to protect that resource.

The assessment has identified the environmental consequences of the project and has identified mitigation measures where appropriate to manage any adverse impacts. The construction and operation of the project would be in accordance with relevant legislation and environmental management plans.

The project is placing a value on the use of clean fill for reuse as part of the rehabilitation of a former quarry site and is achieving the economic benefit of diverting clean fill material from landfill.

16.3 Conclusion

The Project involves importing of clean fill material for the purpose of rehabilitation of an existing quarry, Clause 121 (3) of the Infrastructure SEPP allows for the disposal of VENM or clean fill with development consent on land where industries, extractive industries or mining are permitted with consent under any environmental planning instrument. Extractive industries are permissible at the site under the Mining SEPP. The Project is therefore permissible and a DA would be required in accordance with Part 4 of the Environmental Planning and Assessment Act, 1979 (EP&A Act). The site is located in close proximity to sensitive environments within the Blue Mountains National Park and is therefore considered to trigger designated development provisions.

As such, an assessment of the short, medium and long term impacts of the Project, taking into account the principles of ESD, has been undertaken in this EIS.

Many of the potential issues identified in the initial risk assessment of the project have been effectively managed/eliminated through rehabilitation design and operational procedures. The EIS identifies a range of mitigation measures that would be implemented during establishment and operation of the project to minimise environmental impacts.

The EIS has demonstrated that the project would not have significant impact on the environment with implementation of the proposed mitigation measures and is consistent with the principles of ESD.

The project would result in an improved environment outcome by rehabilitating the existing Bell quarry, resulting in a landform with the ecological and visual character of the surrounding bushland and world heritage national park areas.

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GLOSSARY OF TERMS AND ACRONYMS

Term	Description
AADT	Annual Average Daily Traffic
ABL	Assessment Background Level (ABL) is defined in the INP as a single figure background level for each assessment period (day, evening and night). It is the tenth percentile of the measured L90 statistical noise levels.
ABS	Australian Bureau of Statistics
AHD	Australian Height Datum
AHIMS	Aboriginal Heritage Information Management System
AMG	Australian Map Grid
ANZECC	Australian and New Zealand Environment Conservation Council
ARI	Average Recurrence Interval
ARMCANZ	Agriculture and Resource Management Council of Australia and New Zealand
ARTC	Australian Rail Track Corporation
BATEA	Best Available Technology Economically Available
BMP	Best Management Practice
BCSC	Blue Circle Southern Cement
BoM	Bureau of Meteorology
CEMP	Construction Environmental Management Plan
dB(A) ear.	Noise is measured in units called decibels (dB). There are several scales for describing noise, the most common being the 'A-weighted' scale. This attempts to closely approximate the frequency response of the human
dB(LinPeak)	The peak sound pressure level (not RMS) expressed as decibels with no frequency weighting.
DEC	Department of Environment and Conservation
DEH	Department of the Environment and Heritage
DGRs	Director-General's Requirements
DNR	Department of Natural Resources
DO	Dissolved Oxygen
DPI	Department of Primary Industries
DoP	Department of Planning
EA	Environmental Assessment
EAR	Environmental Assessment Report
EC	Electrical Conductivity
EIA	Environmental Impact Assessment
EMP	Environmental Management Plan
EMS	Environmental Management System
ENM	Environmental Noise Model
EPA	Environmental Protection Authority
ERM	Environmental Resources Management (Australia) Pty Ltd
ESD	Ecologically Sustainable Development
FEL	Front End Loader
glc	Ground level concentration
HAS	Holmes Air Sciences
HRC	Healthy Rivers Commission
HVCS	Heavy Vehicle Checking Station
INP	Industrial Noise Policy

INTANAL	Intersection Analysis of signals
ISC	Industrial Source Complex Dispersion Model
ISO	International Standards Organisation
L1	The noise level exceeded for 1 % of a measurement period.
L10	A noise level which is exceeded 10 % of the time. It is approximately equivalent to the average of maximum noise levels.
L90	Commonly referred to as the background noise, this is the level exceeded 90 % of the time.
Leq	The summation of noise over a selected period of time. It is the energy average noise from a source, and is the equivalent continuous sound pressure level over a given period.
LEP	Local Environment Plan
LGA	Local Government Area
Lmax	The maximum root mean squared (rms) sound pressure level received at the microphone during a measuring interval.
LoS	Level of service
MIC8MS	Maximum Instantaneous Charge (with a minimum 8 milli-sec delay).
MSQ	Marulan South Quarry
mtpa	Million tonnes per annum
NATA	National Association of Testing Authorities
NP	National Park
NPWS	National Parks and Wildlife Service
OEMP	Operational Environmental Management Plan
PFM	Planning Focus Meeting
PM2.5 r	Particulate Matter less than 2.5 microns in diamete
PM10	Particulate Matter less than 10 microns in diameter
ppv	Peak Particle Velocity. The maximum velocity of a particle of the transmission medium, used in assessment of vibration.
RBL a	The Rating Background Level (RBL) is an overall single figure background level representing each assessment period over the whole monitoring period. The RBL is used to determine the intrusiveness criteria for noise ssessment purposes and is the median of the ABL's.
RTA	NSW Roads and traffic Authority
RAGRAV	Road Assessment Guidelines for Restricted Access Vehicles
RMS	Root Mean Square which is a measure of the mean displacement (velocity or acceleration) of a vibrating particle.
RNE	Register of the National Estate
RTA	NSW Roads and Traffic Authority
SEPP	State Environmental Planning Policy
SEPP-MP	State Environmental Planning Policy – Major Projects
SI	Still isothermal (SI) refers to calm weather conditions (defined as no wind and standard temperature gradients).
sigma-theta (σθ)	The standard deviation of horizontal wind fluctuation.
SPCC	State Pollution Control Commission
SRA	State Conservation Area
SWL	Static Water Level
TMP	Traffic Management Plan
tpa	tonnes per annum
TSP	Total Suspended Particulates
US EPA	The United State Environmental Protection Agency

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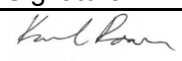
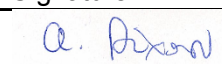
Version 0	Dane Stew art	Karl Rosen		Anthony Dixon		29/08/2018

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