Newman Quarrying Pty Ltd

Proposed Quarry Expansion at Lot 2 DP 1055044, Tullymorgan-Jackybulbin Road, Mororo

Environmental Impact Statement

May 2015

Submission of an Environmental Impact Statement (EIS)

Prepared under the Environmental Planning and Assessment Act 1979 Section 78A(8)

EIS Prepared by

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Address:	230 Harbour Drive, Coffs Harbour, 2450
In Respect of	GHD Pty Ltd

Development Application

Applicant Name:	Newman Quarrying Pty Ltd
Applicant address:	PO Box 70, Woodburn, 2472
Lot No. DP No. and Address of Land to be Developed:	Lot 2 DP 1055044, Tullymorgan-Jackybulbin Road, Mororo, NSW

Environmental Impact Statement

Section 5 of the EIS assesses the potential environmental impact of the proposed development.

Certificate

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

- It has been prepared in accordance with Schedule 2 of the *Environmental Planning and Assessment Regulation 2000.*
- It contains all available information that is relevant to the environmental assessment of the development to which the statement relates.
- The information contained in this Statement is neither false nor misleading.

Signature: 

Name Ben Luffman

Date: 04 May 2015

Glossary of terms	
Acoustic	Relating to hearing, noise and sound.
Ambient	Surrounding, background or existing.
dB(A)	A unit of sound measurement which has its frequency modified by an A-weighted filter so that results are more like the frequency response of the human ear.
Emission	The release of material into the environment (eg dust).
Flora and Fauna	Plants and animals
Hydrology	The science dealing with water on the land or under the surface and its properties, distribution and other characteristics
$L_{A10\ (Time)}$	The sound pressure level that is exceeded for 10% of the time for which the given sound is measured.
$L_{Aeq\ (Time)}$	Equivalent sound pressure level: the steady sound level that, over a specified period of time, would produce the same energy equivalence as the fluctuating sound level actually occurring.
$L_{A90\ (Time)}$	The A-weighted sound pressure level that is exceeded for 90 per cent of the time over which a given sound is measured. This is considered to represent the background noise e.g. $L_{A90\ (15\ min)}$.
Particulate	Small particles, usually occurring in suspension.
Putrescible	Capable of biological decomposition.
State Environmental Planning Policy	A planning instrument made by the Minister for Urban Affairs and Planning that deals with matters of significance for environmental planning in NSW.
Threatened species	Species of flora and fauna that are listed as endangered species or vulnerable species under the *Threatened Species Conservation Act 1995*.

List of Abbreviations	
AHD	Australian Height Datum
AHIMS	Aboriginal Heritage Information Management System
DA	Development Application
DCP	Development Control Plan
DGB	Densely Graded Base
DGS	Densely Graded Sub-base
DPE	Department of Planning and Environment (formerly Department of Planning and Infrastructure)
ECRTN	Environmental Criteria for Road Traffic Noise
EIS	Environmental Impact Statement
EMP	Environmental Management Plan
ENCM	Environment Noise Control Manual
EP&A Act	*Environmental Planning and Assessment Act 1979*
EP&A Regulation	*Environmental Planning and Assessment Regulation 2000*
EPBC Act	*Environment Protection and Biodiversity Conservation Act 1999*
EPL	Environment Protection Licence
ESD	Ecologically Sustainable Development
FFMP	Flora and Fauna Management Plan
GDE	Groundwater dependant ecosystems
INP	Industrial Noise Policy
KTP	Key threatening process
LALC	Local Aboriginal Land Council
LEP	Local Environmental Plan
LOS	Level of service
mgbs	Meters below ground surface
MHRDC	Maximum Harvestable Rights Dam Capacity
MNES	Matters of National Environmental Significance
NPI	National Pollution Inventory
OEH	NSW Office of Environment and Heritage
PEA	Preliminary Environmental Assessment
POEO Act	*Protection of the Environment Operations Act 1997*
Roads and Maritime	NSW Roads and Maritime Service
SEARs	Secretary Environmental Assessment Requirements
SEPP	State Environmental Planning Policy
SIS	Species Impact Statement
SISD	Safe Intersection Sight Distance
TEC	Threatened Ecological Community
tpa	Tonnes per annum
TSC Act	*Threatened Species Conservation Act 1995*
vtpd	Vehicle trips per day
WIRES	Wildlife Information Rescue and Education Service
WMP	Waste Management Plan

Executive summary

Newman Quarrying Pty Ltd (Newman Quarrying) proposes to expand its operations at Sly's Quarry (the proposal) which is located at Lot 2 DP 1055044, Tullymorgan-Jackybulbin Road, Mororo, NSW. The proposed expansion would include the following:

- expanding the approved sandstone quarry pit by 11.1 hectares
- extracting a total resource of 7 million tonnes
- increasing the maximum extraction rate of sandstone to 500,000 tonnes per year
- importing mulch and topsoil for rehabilitation
- closing and rehabilitating two other existing quarry pits

The primary purpose of the quarry would be to supply substantial quantities of quarry materials required for current and proposed Pacific Highway works, and for supply to local councils and contractors.

Statutory position

The proposed quarry is considered to be State Significant Development (by virtue of Clause 7 of Schedule 1 of *State Environmental Planning Policy* (SEPP) *(State and Regional Development) 2011* and would require development consent from the Minister of Planning pursuant to Part 4 of the *Environmental Planning and Assessment Act 1979* (EP&A Act). To obtain consent, the development application (DA) needs to be accompanied by this environmental impact statement (EIS).

The provisions of SEPP *(State and Regional Development) 2011*, *Mining Petroleum and Extractive Industries SEPP 2007* and *Clarence Valley Local Environmental Plan 2011* permits the proposed development subject to development consent. An Environmental Protection Licence (EPL) to undertake the scheduled activity is also required under the *Protection of the Environment Operation Act, 1997,* as is a licence under Part 5 of the *Water Act 1912,* for the installation of a groundwater monitoring well.

Under the provisions of the EPBC Act, the proposed development is also being referred to the Department of the Environment in relation to the impacts on the identified *Hibbertia marginata* population.

Consultation

Consultation with a range of government agencies and community stakeholders was undertaken as part of the EIS 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.

The only concern raised by the community was the increase in the number of trucks, the speed of the trucks and the maintenance of Tullymorgan-Jackybulbin Road. These issues have been addressed in the relevant assessments.

Land resources

The area surrounding the quarry is undulating with an elevation ranging from approximately 40 m Australian Height Datum (AHD) (near Tullymorgan-Jackybulbin Road) to approximately 229 m AHD at the peak of Mount Doubleduke, outside the northern boundary of the quarry site.

The geology of the area is 'Kangaroo Creek' sandstone formations. The existing quarry produces both solid and blended crushed sandstone products that can be used in a variety of engineering and construction applications.

The area generally has poor soils of sandy composition, mostly derived from the underlying sandstone. In lower-lying areas soils may be derived from stream deposition.

The area immediately surrounding the quarry is heavily vegetated, with rural-residential properties to the west, south and east.

The proposed expansion of the quarry would change the topography of the site, and may limit future land use options following closure and rehabilitation. It is not possible or practical to avoid the impacts of a quarry on the landform, geology, soils or land use of the site, however, this EIS provides a number of measures that would be implemented to mitigate potential impacts.

Surface and groundwater

The site is located within the Clarence River catchment with unnamed ephemeral drainage lines flowing in a southwest direction to Tabbimoble Creek.

Based on limited data, groundwater at the site is expected to be relatively deep and is unlikely to be intercepted by the proposed quarry.

The proposed quarry expansion could potentially impact on surface water by:

- Altering the local topography and drainage patterns
- Entraining sediment in runoff from disturbed areas
- Increasing runoff volumes
- Contaminating water with chemicals or hydrocarbons from site operations
- Using water during site operations

Detailed mitigation measures have been provided to minimise these potential impacts through:

- Erosion and sedimentation control
- Material storage and management
- Monitoring

Noise

Eleven potential sensitive receivers in the vicinity of the quarry have been identified from aerial imagery, however some of these may not be residential receivers. The nearest identified sensitive receiver is located approximately 1.5 km from the quarry boundary.

Site observations at the monitoring locations indicated that the primary noise sources in the area were:

- Road traffic from the Pacific Highway
- Natural sources such as insect and bird noise and wind noise in foliage

Model results indicate that noise levels generated from quarry operations are predicted to comply with the Industrial Noise Policy daytime noise criterion at all receivers.

The predicted growth in traffic due to quarry operations during peak daily production is expected to comply with the Road Noise Policy criteria.

The estimated ground vibration and airblast levels from blasting suggest that the recommended limits of 5 mm/s and 115 dB(L) would be achieved at a minimum distance of approximately 250

m and 650 m respectively from the blast location. As the nearest sensitive receiver is 1.5 km away, the blasting guidelines should be met at all receivers.

It is proposed the predicted noise and blasting levels be verified through compliance monitoring. If an exceedance is measured, control measures should be negotiated and agreed to by Newman Quarrying and the affected land owners.

Air

Few sensitive air receivers were noted in the vicinity of the quarry, with the nearest residence located approximately 1.5 km from the quarry boundary.

An ambient level of particulate matter up to 10 micrometres in size (PM_{10}) of 15 μ/m^3 has been assumed for the area. Predicted results indicate compliance with the 24-hour average PM_{10} criterion at all receptors for both average and peak production rates.

While dust impacts from quarry operations are not expected to be an issue, some mitigation measures are proposed in order to minimise the potential for impacts.

Ecology

The site consists of two plant communities:

- Blackbutt - bloodwood dry heathy open forest on sandstones of the northern North Coast (NR114)
- Blackbutt - Turpentine dry heathy open forest on sandstones of the lower Clarence of the North Coast (NR123)

The proposal includes the clearing of approximately 10.5 hectares of native vegetation, which comprises 4.23 hectares of Blackbutt - Bloodwood dry heathy open forest and 6.27 hectares of Blackbutt - Turpentine dry heathy open forest.

The following is a summary of the threatened communities and species to be impacted by the proposal:

- No threatened ecological communities
- One threatened flora species - Bordered Guinea Flower (Hibbertia marginata), and the possibility of a further two EPBC Act listed flora species.
- No threatened fauna species have been recorded within the study area; however potential habitat for three EPBC Act and 23 TSC Act threatened fauna species exists.
- One EPBC Act migratory bird species (Rainbow Bee-eater) was recorded during surveys and there is also potential habitat for three other migratory species.
- No aquatic threatened biota listed under the FM Act or their habitats are likely to occur in the study area or to be affected by the project.

The mitigation of adverse effects arising from the proposal has been presented according to the hierarchy of avoidance, mitigation and offsetting of impacts.

In regards to offsetting the impacts, it was calculated that a total of 768 ecosystem credits and 17,437 species credits would be required to offset the impacts of the project. A preliminary assessment of a potential biobank site, south of Jackybulbin Road, revealed that the vegetation types and condition are comparable with those identified within the proposed quarry footprint.

Due to the potential impact on the *Hibbertia marginata* population, the proposal has also been referred to the Department of the Environment for approval.

Traffic

Tullymorgan-Jackybulbin Road is a two-way single carriageway road and provides access from the Pacific Highway to Sly's Quarry and other rural/residential properties. The access to the quarry is located approximately 2.6 kilometres west of the Pacific Highway.

There have been no crashes recorded in the vicinity of the quarry access or on Tullymorgan-Jackybulbin Road.

Accounting for the background growth in traffic volumes on the Tullymorgan-Jackybulbin Road and Pacific Highway plus the increase in the volume of truck activity at the quarry, both intersections are likely to be suitable for many years to come.

The sight distances in both directions at both intersections meet and exceed the Austroads Guide to Road Design Part 4A.

The quarry site is remote from any source of vulnerable road user (pedestrians and cyclists) activity.

Based on the findings of the assessment, a Road Safety Audit is considered unnecessary.

To minimise any other potential traffic related impacts of the quarry, it is proposed that the access road be maintained, vehicle numbers minimised and a code of conduct implemented.

Heritage

During the field survey and Aboriginal community consultation process, no Aboriginal objects or Aboriginal places were identified and the site was characterised as highly disturbed.

The possibility of isolated Aboriginal objects being located within the site cannot be totally ruled out. However, it is considered highly unlikely that scientifically or culturally significant Aboriginal cultural deposits remain within the site.

There are no potentially significant historic (non-Indigenous) places or objects identified within the site.

Mitigation measures have been identified in regard to discovery of unexpected heritage items.

Visual amenity

The existing and proposed quarry is visually obscured from the majority of the surrounding area by the topography, viewing distance and surrounding vegetation.

The visual assessment concluded there would not be a significant impact on visual amenity as a result of the proposal.

Waste

The types of waste generated from the proposed quarry would include construction and excavation waste, vegetative matter, packaging materials and liquid wastes. The volumes of solid wastes would be relatively small as most waste would be reused or recycled on site e.g. excavation waste and vegetation waste.

All waste would continue to be managed in accordance with the requirements of the *Waste Avoidance and Resource Recovery Act* 2001, the *Protection of the Environment Operations Act* 1997, the OEH *Waste Classification Guidelines* 2009 and the principles of the waste management hierarchy.

Risk and hazards

The existing and proposed quarry site is subject to various risks and hazards, including:

- Contamination and dangerous goods
- Bushfire
- Safety

The risk assessment has found that all risks for the selected factors can be mitigated to achieve a residual ranking of "Low" or "Medium" provided the identified mitigation measures are implemented.

Socio-economic

The socio-economic impacts of the proposed expansion are generally considered to be positive. The proposal would provide a valuable resource to the upgrade of the Pacific Highway which is shown to significantly reduce travel times, crashes and fatalities.

The proposal would also have economic benefits via the provision of direct and indirect employment and contributions to Clarence Valley Council for the improvement of the local road infrastructure.

The potential adverse impacts associated with the expansion, in relation to traffic, noise and air have been assessed and appropriate mitigation measures presented.

Cumulative impacts

At a local scale, the proposed upgrade of the Pacific Highway is the only project known to potentially create cumulative or synergistic impacts with the proposal. Cumulative or synergistic impacts are likely in relation to water, noise, air, ecology, traffic and socio-economic but no additional mitigation measures are considered necessary.

Environmental management

A summary of the mitigation measures are provided as a basis for an Environmental Management Plan (EMP), which would be prepared to provide an overall framework for the management of environmental impacts that could potentially arise from the proposed quarry expansion.

Project justification

Project alternatives were considered as part of the EIS. The reasons for justifying the final proposal are presented having regard to biophysical, economic and social considerations and the principles of ecologically sustainable development (ESD).

Conclusion

The EIS has examined and taken into account to the fullest extent possible all matters affecting or likely to affect the environment by reason of the proposed activity. The proposal, as described in the EIS, best meets the project objectives but would still result in some impacts on biodiversity via vegetation clearing, soil and water via erosion, noise, dust and traffic via the increased vehicle movements. Mitigation measures, as detailed in this EIS, would ameliorate or minimise these expected impacts. The proposal would also provide sustained employment and provide a local source of suitable material for the Pacific Highway upgrade with few impacts. On balance the proposal is considered justified.

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1. Introduction

1.1 Project overview

Newman Quarrying Pty Ltd (Newman Quarrying) proposes to expand its operations at Sly's Quarry (the proposal) in Mororo, NSW. The sandstone quarry is located at Lot 2 in DP 1055044, on land with frontage to the Tullymorgan-Jackybulbin Road. The site is approximately 2.6 kilometres west of the Pacific Highway.

The location of the quarry and current quarry sites (A, B and C) are shown in Figure 1-1. The quarry is located in the Clarence Valley Local Government Area (LGA).

The proposed expansion of Sly's Quarry would include the following:

- expanding the approved sandstone quarry pit by 11.1 hectares
- extracting a total resource of 7 million tonnes
- increasing the maximum extraction rate of sandstone to 500,000 tonnes per year
- importing mulch and topsoil for rehabilitation
- closing and rehabilitating the existing quarry pits Site B and Site C

The primary purpose of the quarry would be to supply a portion of the substantial quantity of quarry materials required for current and proposed Pacific Highway works, and for supply to local councils and contractors.

The Secretary's Environmental Assessment Requirements (SEARs) for the project have been issued (application SSD 6624), and this Environmental Impact Statement (EIS) assesses the environmental impacts associated with the project. This EIS is necessary to support an application for the proposed quarry expansion as it constitutes State Significant Development (SSD), as discussed in Section 3.2.2.

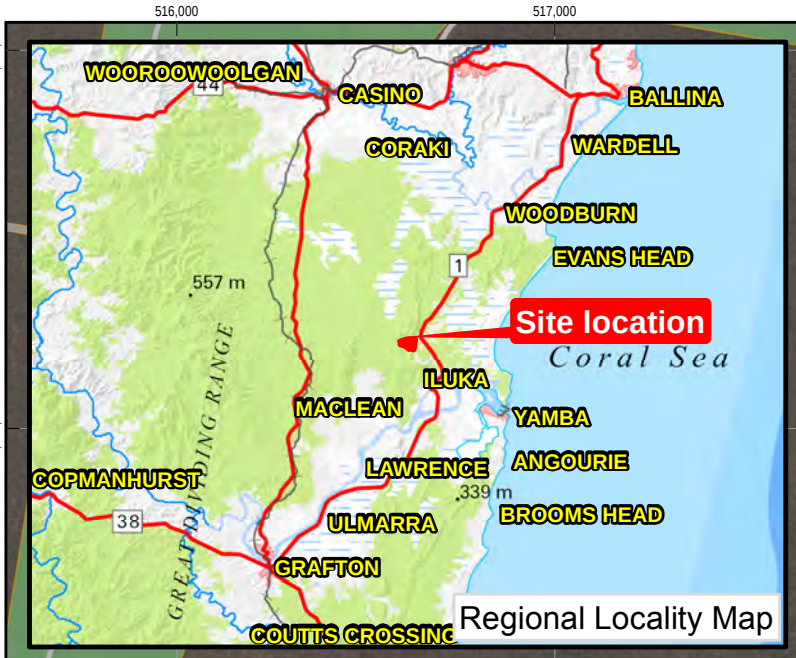
Section 2 provides a detailed description of the project.

1.2 Background

The site has reportedly been used as a quarry since the 1950's. In 1995, Maclean Shire Council (now Clarence Valley Council) granted development consent (1995/128) to the operation according to *State Environmental Planning Policy* (SEPP) *No. 37 – Continued Mines and Extractive Industries*. A further consent (1997/011) was granted by Maclean Shire Council in 1997.

The approvals were appealed (Appeals 10220, 10274, 10373 and 10377) and heard in the Land and Environment Court in 1998. On 29 January 1999, the court ordered (in part):

> 2. That Appeal No. 10377 of 1998 be upheld in part and development consent be granted to sand extraction in Sites B and C and rock quarrying in Site A on Lot 26 DP 755629 Jackybulbin Road, Tabbimoble, Maclean Shire, as shown on Exhibit 1 up to 100,000 tonnes per annum maximum extraction rate in each, all subject to and as modified by the Conditions in the attached Schedule.



BUNDJALUNG StateConservationArea

BUNDJALUNG NationalPark

SLYS ROAD

PACIFIC HIGHWAY

TULLYMORGAN-JACKYBULBIN ROAD

TABBIMOBLE CREEK

A

B

C

MCMAHONS TRAIL

MORORO STATE FOREST

GIBBERAGEE STATE FOREST

Source: Esri, DigitalGlobe, GeoEye, i-cubed, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo, and the GIS User Community

516,000 517,000 518,000 519,000 520,000 521,000

6,761,000 6,760,000 6,759,000 6,758,000 6,757,000 6,756,000 6,755,000

LEGEND

- Current Quarry Areas
- Lot 2 DP 1055044
- Road
- Lot
- Waterways
- Waterbody
- Natural Parks
- State Forest

Paper Size A3

0 100 200 400 600 800

Metres

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

N

Newman Quarrying
Sly's Quarry Environmental Impact Statement

Job Number 22-17528
Revision A
Date 11 Dec 2014

Site location

Figure 1-1

N:\AU\Coffs Harbour\Projects\22\17528\GIS\Maps\Deliverables\22_17528_Z006_Lot2_Site_location.mxd

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

Data Source: NSW Department of Lands: Cadastre - Jan 2014; Geoscience Australia: 250k Data - Jan 2014; NSW Department od Primary Industry - Jan 2014; ESRI imagery Jan 2014. Created by: qjchung

Following the court decision, Newman Quarrying prepared an Environmental Management Plan (EMP) which was approved by Maclean Shire Council. The EMP outlined, in detail, the proposed operations, including a site plan with designated areas for Sites A, B and C. Sites A, B and C from the EMP are shown on Figure 1-1.

Site A is an area of approximately 22 hectares which contains the sandstone quarry, Site B is a sand extraction operation approximately 5 hectares in area south of Tullymorgan-Jackybulbin Road and Site C is a sand extraction area approximately 44 hectare in area, on the western section of Lot 2 on the northern side of Tullymorgan-Jackybulbin Road.

Site A is currently active and the layout of the area is shown in Figure 1-2. Historic sand extraction has been carried out in Site C and Site B. Site C is still currently active but Site B is no longer active.

Newman Quarrying obtained development consent separately to import and deposit fill at Site C in the areas where sand has been extracted previously. The Development Consent 2004/439 was issued by Clarence Valley Council (CVC) on 8 September 2004. The fill was clean material mainly sourced from Pacific Highway construction sites where it is surplus to requirements or unsuitable for other uses. The filling of the Site C excavation areas is now approximately 80% complete.

A Planning Proposal was submitted to CVC by a third party to change the *Clarence Valley Local Environmental Plan 2011* (CVLEP) 2011 to permit an explosives depot, machinery storage and an ammonium nitrate emulsion mixing plant within the cleared area of Site C. This Planning Proposal has since been withdrawn. No further consideration has therefore been given to the interactions between the proposed quarry expansion and explosives depot.

1.3 EIS scope

This EIS has been undertaken to assess the significance of the potential environmental impacts associated with expansion of Sly's Quarry. The EIS has been prepared in accordance with the *Environmental Planning and Assessment Act, 1979* (*EP&A Act),* the *Environmental Planning and Assessment Regulation 2000 (EP&A Regulation)* and other relevant legislation.

The proposed quarry is considered to be State Significant Development (by virtue of Clause 7 of Schedule 1 of *State Environmental Planning Policy (State and Regional Development)* 2011 and would require development consent from the Minister of Planning pursuant to Part 4 of the EP&A Act. To obtain consent, the development application (DA) needs to be accompanied by this EIS.

In this instance, the development would be notified and assessed by the NSW Department of Planning and Environment (DPE) and determined by the Minister.

The EIS must comply with the requirements in Clauses 6 and 7 of Schedule 2 of the EP&A Regulation.

The EIS has been prepared to accord with the SEARs developed by the DPE in conjunction with a range of other government agencies. The EIS has been prepared using conservative scenarios for assessments to develop a range of acceptable environmental and social parameters within which the quarry can operate.

SLYS ROAD

SLYS ROAD

Quarry pit

Mulch & topsoil
Stockpiles area

Washplant & Stockpile area

Site Office, Shed, Fuel
Bowser, Weighbridge

Quarry
Access

TULLYMORGAN-JACKYBULBIN ROAD

LEGEND

Lot 2 DP 1055044

Road

Lot

Groundwater Wells

Stockpiles

Sediment ponds

Waterways

Open Drain

Paper Size A3

0 25 50 100 150 200

Metres

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

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GHD

Newman Quarrying
Sly's Quarry Environmental Impact Statement

Job Number 22-17528
Revision A
Date 18 Feb 2015

Existing Sandstone Quarry Layout

Figure 1-2

N:\AU\Coffs Harbour\Projects\22\17528\GIS\Maps\Deliverables\22_17528_Z007_Lot2_Quarry_Area.mxd

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

Data Source: NSW Department of Lands: Cadastre - Jan 2014; Geoscience Australia: 250k Data - Jan 2014; NSW Department od Primary Industry - Jan 2014; ESRI imagery Jan 2014. Created by: qjchung

1.4 Disclaimer

This report: has been prepared by GHD for Newman Quarrying Pty Ltd and may only be used and relied on by Newman Quarrying Pty Ltd for the purpose agreed between GHD and the Newman Quarrying Pty Ltd as set out in section 1.3 of this report.

GHD otherwise disclaims responsibility to any person other than Newman Quarrying Pty Ltd arising in connection with this report. GHD also excludes implied warranties and conditions, to the extent legally permissible.

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

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

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

2. Description of the project

2.1 Project overview

Newman Quarrying proposes to expand a sandstone quarry at Lot 2 DP 1055044, Tullymorgan-Jackybulbin Road, Mororo, known as Sly's Quarry. The project is to expand one portion (Site A) of the approved sandstone quarry by 11.1 hectares, close and rehabilitate two portions (Sites B and C) and increase the extraction rate up to 500,000 tonnes per annum from a total resource of 7 million tonnes. Compared to the currently approved quarry, the net area of the quarry would reduce by 49 hectares and the rate of extraction would increase from 100,000 tonnes per annum.

The primary purpose of the quarry, following the proposed expansion, would be to supply substantial quantities of quarry materials required for current and proposed Pacific Highway works, and for supply to CVC and local contractors. Current Government plans in the region of the quarry are for the Pacific Highway to be upgraded to dual carriageway from Woolgoolga to Ballina which will involve works over a distance of approximately 150 kilometres.

The quarry is located approximately 2.6 kilometres west of the Pacific Highway. The close proximity to the Highway and isolation means that Sly's Quarry presents economic and environmental benefits to supply material for the Pacific Highway upgrade.

Maintaining the current Pacific Highway and the constructing the proposed Pacific Highway upgrade will require a considerable volume of imported quarry materials. Depending on a range of factors, including funding, these works could extend over a period of approximately five years. After completion of the Highway works, the quarry would continue to supply material for maintenance of the Pacific Highway as well as to CVC and private contractors.

To assist with the rehabilitation of Site B, Site C and the proposed quarry expansion, it is also intended to import unsuitable virgin excavated natural material (VENM), excavated natural material (ENM) and mulch from the highway upgrade works.

2.2 Objectives of the project

The objectives of the proposal are to:

- Establish a quarry operation to extract sandstone materials for delivery to highway works projects, local Councils and local industry.
- Operate the quarry so as to minimise any potential environmental impacts and comply with all relevant legislation and guidelines.
- Rehabilitate the extraction area upon exhaustion of the resource to minimise any long term impacts.

2.3 Resource characteristics

A summary of the results from a geotechnical investigation by Hensel Geosciences (2014) suggests the presence of a variety of arenaceous rock types and several, very minor, lithologically distinct interbeds. The sandstone ranges from medium grained to coarse-grained. The former tends to have a pale pinkish colour and is distinctly cross-bedded. The majority of beds are less than 1 m in thickness. In contrast, there are several prominent beds of the coarser sandstone between 2 m and 3 m thick. The general colour of the coarse-grained sandstone is medium to light-grey.

Separating the beds are thin layers of fine sandstone, siltstone and carbonaceous material.

Hensel Geosciences (2014) is confident the sandstone exposed in the existing quarry are continuous into the area of the proposed quarry extension and all the sedimentological characteristics of the exposed sandstone are expected to be present in the areas proposed for extension. This also includes the interbeds. Hensel Geosciences (2014) indicates that the bed sequence (stratigraphy) will not be any different from what is exposed and there is no indication that there has been any structural dislocation of the strata to modify the resource.

The existing quarry produces both solid and blended crushed sandstone products that can be used in a variety of engineering and construction applications. Hensel Geosciences (2014) reports testing has shown that the sandstone is highly siliceous and with only very small amounts of phyllosilicates (mica, illite, chlorite) and carbonaceous material. This virtually categorises the sandstone as inert chemically and physically under most normal natural conditions. It is shown to be well-cemented and quite strong. The proposed extension is very likely to represent a resource that is continuous with the present quarry resource.

2.4 Products and demand

The quarry products sold from the site are all derived from the excavated sandstone. The products include:

- Road base
- Boulders to pebble sized rock
- Sand
- Washed sand

In the past, the quarry's main customers have included:

- NSW Roads and Maritime Services (Roads and Maritime) for major road construction (e.g. recently the Pacific Highway Upgrades at Devils Pulpit and Pimlico).
- John Holland, Lend Lease and Leightons, as Roads and Maritime contractors.
- Property developers for subdivision fill and road base supply.
- CVC for roadbase and rock supply for all road types.
- The National Parks and Wildlife Service (NPWS) for roadbase and rock for retaining walls, flood mitigation, and for riverbank stabilisation works.
- Local contractors and landscapers for all local fill jobs and driveway works.

It is anticipated that the above customers would continue to be the main sources of demand for the proposed expansion, with an emphasis on the Pacific Highway upgrade works. To service these customers in the past, the rate of extraction from the quarry has been between 59,069 and 324,328 tonnes per year as shown in Table 2-1.

Table 2-1 Sly's Quarry past extraction rates

Year	Sales Volume (tonnes)*
1999	113,520
2000	111,604
2001	61,232
2002	83,420
2003	59,069
2004	109,816
2005	114,662
2006	176,185
2007	183,930
2008	108,252
2009	139,522
2010	152,636
2011	287,656
2012	324,328
2013	215,822
2014	80,271

* This is tonnes sold, not extracted. The volume sold may include material stockpiled from previous years. The volumes are reported to CVC and EPA annually.

Excluding 2011 to 2013, when the quarry was supplying the Devils Pulpit Pacific Highway upgrade, the above sale rates represent baseline sales for the quarry. The Pacific Highway upgrade is likely to result insignificant additional demand, as the 2011 to 2013 years indicate.

The Woolgoolga to Ballina Pacific Highway Upgrade EIS estimates that 4 million tonnes of materials will need to be obtained from local quarries to supply the project. This would comprise an estimated 1.23 million tonnes of road base, about 0.79 million tonnes of sand and about 1.4 million tonnes of aggregate for the construction of drainage structures and pavements, spray sealing works and for the production of concrete and asphalt. In the EIS a further 0.5 to 0.6 million tonnes of earthworks material is also assumed to be required.

The Woolgoolga to Ballina Pacific Highway Upgrade EIS provides a list of the potential quarry sources and their approved extraction limits. In total, the potential quarry sources have an approved extraction limit of 1.4 million tonnes per annum. One million tonnes of this total are located to the north of Ballina and it is unknown if all the quarries listed have material that meet strict RMS specifications. The list includes Sly's Quarry which is one of the only quarries within the region between Woodburn and Harwood (a distance of about 45km).

As it is unlikely that all the quarries listed will have material suitable for the highway upgrade, it is likely there will be a shortfall of suitable quarry material, especially in the region where Sly's Quarry is located. Sly's Quarry consists of material that achieves the RMS specifications and is in a location where there are few alternative sources, it is therefore expected that it will provide a significant source of material for the highway upgrade. Site characteristics

The site is accessed from Tullymorgan-Jackybulbin Road via a gravel access road that travels in a northerly direction. A site office and weighbridge are located approximately 200 m along the access road with a car parking area and maintenance shed located to the east. A generator and fuel storage/fuel bowser are also in this location.

The centre of the existing and proposed quarry is located approximately 150 m north of the site office. This area is also the main stockpiling area, with an additional stockpile area located to the east. The proposed quarry will extend in a northerly and southerly direction from the centre of the current quarry.

The current floor of the quarry is approximately 44 m Australian Height Datum (AHD) with a second level to the east at approximately 58 m AHD. The centre of the existing quarry has active faces to the north, east and west, as shown in the photograph below.

Figure 2-1 Existing Quarry

Another stockpile area is located to the south west of the quarry which also includes a bunded oil storage shed, generator and wash plant.

Stormwater from the quarry is directed to the south into a settling pond and overflows into an open drain that leads to the main sediment basin, located to the south. Runoff from the wash plant travels through a series of small basins located west of the entrance road before entering the main sediment basin. The sediment basin discharges to a wetland to the south.

A plan of the current layout is provided in Figure 1-2.

2.5 Proposed method of extraction

The quarry operation would be carried out in stages and in response to demand. It is therefore difficult to predict exactly how the extraction would progress. In general, the extraction is proposed to move north and east initially, to the extent of the currently approved quarry. The eastern extent of the excavation would remain 10 m from the road reserve located along the eastern boundary and a safety fence would be installed. A 5 m wide buffer would be established around the remaining perimeter of the quarry to cater for access and stormwater controls. The excavation would be to the current floor level of 44 m AHD. Stage 1 would cover an area of 6.9 hectares and extract approximately 2.3 million tonnes. Stage 1 encompasses the area previously approved for a quarry.

Stage 2 would involve expanding the quarry to the north and south and to a depth of 44 m AHD. This would expand the quarry by 5.7 hectares and involve the extraction of approximately 2.8 million tonnes of material. Stage 2 (south) would be exhausted prior to Stage 2 (north) being developed.

Stage 3 would be the final stage and would expand the quarry further north and south. Stage 3 would involve an expansion of 5.4 hectares to a depth of 44 m AHD. This would involve extracting approximately 1.8 million tonnes of material. Stage 3 (south) would be exhausted prior to Stage 3 (north) being developed.

A summary of the area and volumes of each stage are presented in Table 2-2 and the proposed extraction plans are provided in Appendix A. The extraction plans include extraction area, cross sections, long sections, site layout and final levels.

Table 2-2 Quarry area and extraction volumes

Stage	Area (Ha)	Volume (tonnes)
1 (previously approved)	6.9	2,300,000
2 (north)	2.7	1,600,000
2 (south)	3.0	1,200,000
3 (north)	2.2	720,000
3 (south)	3.2	1,040,000
Total	**18.0**	**6,880,000**

The extraction of all stages would progress in 10 m by 10 m benches to a final depth of 44 m AHD.

Following extraction, the material would be crushed, screened and where necessary blended with other materials from the quarry, or material imported to the quarry. The materials would be stockpiled on the quarry floor in numbered stockpiles of approximately 4,000 tonnes each. Samples from each stockpile would be analysed for compliance with Roads and Maritime specifications before being transported offsite. This process takes approximately 20 days, per stockpile.

The quarry would operate as efficiently and effectively as possible to maximise the returns of the investment to the operator. It is anticipated that none of the extracted material would be wasted, with the material either sold in its raw state or blended with other products to generate a suitable product for the market. The proposed sequence of operations for each stage would generally be:

- Establish the sediment and erosion control measures and other environmental safeguards.
- Clear vegetation, if necessary. The bulk of cleared vegetative wastes would be piled in a suitable location, clear of adjacent vegetated areas and mulched for future revegetation works.
- Strip and stockpile topsoil and protect it against erosion for use in revegetation works.
- Excavate the weathered rock material, where possible. The deeper layers would be excavated in a similar manner but would also include blasting. Blasting is anticipated to be carried out at a frequency of between two blasts per month to one blast per year, depending on demand and the material encountered. The blasting would be undertaken by a specialist contractor in accordance with regulatory requirements.
- Rock hammer where required, to break large rocks into smaller pieces.
- Crush the rock using an excavator and a jaw crusher. The crusher produces an output of various sizes of fill or aggregate which are separated by a screening machine into various piles based on size. Sand is also produced in this process. The crusher and screener are moved around the quarry floor as necessary to be close to the quarry face and accumulated, excavated stone.
- Load the material directly from the stockpile onto trucks for removal from site.

- Continued excavation, as described above, within each stage until it reaches the ultimate depth of 44 m AHD. During the excavation, 10 m high by 10 m wide benches are established at the quarry face. At the top of each bench, a safety bund/wall is constructed to prevent people or machinery falling over the bench. The benches and quarry floor would be graded to the sediment basin located in the south-western end of the quarry area.
- Rehabilitation once the extraction is complete. Topsoil would be respread on the disturbed areas and revegetated, where possible. The established erosion and water control measures would be maintained until the rehabilitated surface is adequately stabilised.
- Other details relating to quarry operations include:
  - If there is a special order for large boulders, for example for breakwater or river or sea wall repair or construction, these are set aside and transported as such.
  - Occasionally, in order to comply with Roads and Maritime specifications, materials won from the quarry would be blended with other materials won from the quarry, or with imported materials (e.g., sand, clay), prior to being stockpiled on the floor of the quarry.
  - Some sand is transported to the onsite wash plant for processing.

A detailed list of equipment to be used in the operation is provided in Section 2.9 (type of machinery) below.

2.5.1 Imported materials

As outlined above, following the extraction of the raw material from the quarry and screening, additional material may be required for blending to satisfy client specifications. This material may need to be imported to the quarry and could include rock, sand, clay, topsoil or landscaping products. The quantity of this material would be dependent upon the material's end use and is difficult to predict. It is likely that some of the blending materials would be stockpiled on site.

To rehabilitate Area B, Area C and the proposed quarry, topsoil and mulch would be imported to site from the Pacific Highway upgrade works. The topsoil would consist of VENM or ENM that is of an unsuitable quality for use on the highway and the mulch would be from the clearing of native vegetation during highway works. The volumes of topsoil and mulch to be imported and stored onsite are presently unknown but is estimated to be in the order of:

- Topsoil - 10,000 tonnes per year
- Mulch – 5,000 m^3 per year

The blending material, topsoil and mulch would be brought to site via trucks returning from their delivery of quarried materials and stored in the same location where it is currently stored, as shown on Figure 1-2. The area would have appropriate sediment erosion controls and tannin management measures installed and maintained.

2.6 Proposed extraction rate and project life

2.6.1 Extraction rate

It is difficult to accurately estimate the annual extraction rate of materials from the quarry in order to service the demand from the Pacific Highway upgrade works because detailed design has not been completed. It may be necessary to extract and process up to 500,000 tonnes per annum although this rate of extraction is expected to be uncommon. It is more likely that the annual extraction rate during the upgrade of the Pacific Highway would be around 250,000 to

300,000 tonnes per annum. After the Highway upgrade is complete, the annual extraction rate is anticipated to reduce to about 100,000 to 150,000 tonnes per annum.

Extraction rates would also be influenced significantly by the type of product in demand. This is because general fill and select materials can be produced at up to four times the rate of aggregates. The various stages of road projects would also influence product needs.

Based on the assessment of the underpinning demand, and allowing for downtime from wet weather etc (about 40%), it is realistic to project a maximum daily extraction and haul rate of about 4,000 tonnes with an average daily win and haul of about 1,500 tonnes. At the other extreme, there will be periods when no materials are extracted or transported from the site. The average daily win and haul rate would reduce significantly following the completion of the highway upgrade.

2.6.2 Project life

Estimated quarry reserves are in the order of 7.4 million tonnes. If extraction was carried out at a rate of 500,000 tonnes per annum, the site would have an extractive life of about 15 years. As mentioned above, it is likely that demand will be high during the current highway upgrade works (about 5 years) and then slow down, resulting in the life of the extraction operation extending to 30 to 40 years.

The life of the quarry and the annual extraction rate are dependent upon the following:

- the timing of Government funding for the Pacific Highway upgrade projects.
- the quantity of materials needed to satisfy that upgrade, and the timeframe within which those materials are needed.
- the total quantity of materials available from the quarry.

2.7 Hours of operation

The hours of operation would depend on demand with some periods of high activity and other times when activity is limited to the occasional loading of haulage trucks. The proposed hours of operation are:

- Weekdays – 6:30am - 6.00pm
- Saturdays – 6:30am - 4.00pm
- Sundays or public holidays - No work

Excavation, crushing or loading would not commence until after 7am. Blasting would only occur on weekdays between the hours of 10am and 4pm.

2.8 Type of machinery

Table 2-3 identifies the items of plant and equipment that are necessary for the operation of the quarry.

Table 2-3 Plant and equipment

Type	Typical Make/Model	Approx. Number	Typical Frequency of use	Description
Excavators	Komatsu pc350 – 8 Komatsu pc710-5	2 1	12- 40hrs/ week	Excavating material and stockpiling Clearing and grubbing of vegetation and stripping of topsoil
Screen	Sandvik qe440 Sandvik qa340	1 1	20 - 40hrs/ week	Aggregate/gravel production and overburden screening
Front-end Loader	Komatsu wa400-3 Komatsu wa470-3 Kawazaki 90zv	1 1 1	10hrs/week 30hrs/week 45hrs/week	Loading material onto the haul trucks and stockpiling material within the pit floor
Crusher	McCloskey j50 Komatsu br380jg-1	1 1	20 - 40hrs/ week	Crushing rock main jaw crusher Crushing rock spare jaw crusher
Haul Trucks	Truck and dog Contractors	1 Up to 125/day	45hrs/week Up to 125/day	Delivery of materials to customers and stockpiling in pit if needed and carting unsuitable to rehabilitation areas.
Water Cart	Isuzu	1	10hrs/week	Water haul roads and stockpiles
Water Pump	Honda	3	10hrs/week	Dewater excavation/basin and to fill watercart from standpipe Water stockpiles and put moisture in products
Generator	Cummins Able	1 1	5hrs/week 9hrs/day	Provide electricity to washplant and dam pump Provide power to weighbridge and fuel pump
Hand tools	Various	5	2hrs/week	General activities maintaining plant

It is anticipated that not all of the equipment listed above would be operational on-site at any one time.

2.9 Employment

Currently there are three employees at the existing quarry. If approved, the quarry is anticipated to require a further five full time employees during periods of maximum extraction. Haulage of the material would also provide employment for truck drivers. Haulage trucks would be engaged and operated by contractors external to the quarry operations.

Additional off site employment would also be generated, in the maintenance and support services for equipment and machinery.

2.10 Access and traffic volumes

The majority of traffic to and from the quarry would access the site from the Pacific Highway and Tullymorgan-Jackybulbin Road via an existing, formed gravel access road that runs to the quarry pit. The layout of the quarry provides a loop that allows, trucks and machinery to enter the quarry, load and exit, all while travelling in a forward direction.

Less than 10 deliveries per year would be to the west of the quarry along Tullymorgan-Jackybulbin Road.

2.10.1 Traffic generation

Workforce traffic

During operation it is likely that there would be a maximum of twelve construction workers or plant operators on the site at any one time. This would yield a daily workforce traffic generation in the order of 24 vehicle trips per day (vtpd). It is assumed the majority of the workforce would arrive between 6:30 am and 7:30 am and depart generally between 3:00 pm and 6:30 pm.

Heavy vehicle traffic

Truck and dog trailer combinations have a capacity of about 32 tonnes. At an average daily production, which would generate a win and haul rate of approximately 1,500 tonnes, the quarry is expected to generate about 50 truck and dog loads or 100 truck movements per day. At its peak, the quarry is expected to win and haul about 4,000 tonnes per day which would involve about 125 truck and dog loads or 250 truck movements per day. When the quarry is not in operation, no truck movements would be generated by the quarry.

Once the Pacific Highway upgrade is complete, the demand for quarried material is expected to decrease, as would the number of truck movements. It is anticipated that no more than 150,000 tonnes annually would be won and hauled from the quarry, which would generate, on average, about 750 tonnes per day, over a 200 day working year. This would result in about 25 truck and dog loads or 50 truck movements per day. However, there is no average requirement for materials hence truck numbers may exceed this number for short periods and at other times, no trucks would be operating.

2.11 Site facilities

The site currently consists of a small site office, machinery shed, bunded oil shed, weighbridge, 12,000 L TransTank fuel bowser and pump-out toilet. Water for the site office and amenities is supplied via water tanks and electricity via a generator. No addition or alteration to the existing facilities is proposed as part of this application.

The existing sediment basins would continue to treat stormwater runoff and provide water for dust control, crusher sprinklers and screen. Any excess water would be treated, as required by the Environmental Protection Licence, prior to discharge to the wetland. No water would be extracted from the ephemeral waterways traversing the site for any reason in respect of the operation of the quarry.

A plan of the current layout is provided in Appendix A.

Figure 2-2 Machinery Shed

2.12 Rehabilitation

A rehabilitation plan has been developed and is provided in Appendix A. The rehabilitation plan aims to improve the environmental conditions of the site after quarrying activities have ceased. The proposed approach to the rehabilitation of the extraction area includes:

- Fencing the perimeter of the final contoured (benched) quarry
- Ripping the surface to a depth of 250 mm to key in topsoil
- Spreading the topsoil stripped from the site prior to the quarry operations commencing to form a minimum 100 mm deep layer
- Hydromulching or hand seeding and mulching with a mix of natives and sterile cover crop
- Maintaining sediment and erosion controls until the site is stable

More details on planting, species, maintenance and timing are provided in the Rehabilitation Plan in Appendix A.

In addition to the rehabilitation of the proposed quarry expansion area, Area B and Area C would be rehabilitated if this proposal is approved. The rehabilitation of Area B and Area C would be done in accordance with the applicable approval. Also, 140 hectares of the site have been reserved to offset the ecological impacts of the current proposal, according to the BioBanking methodology (refer to Section 5.5 for more information).

2.13 Capital investment

No major new capital investment in infrastructure, machinery or equipment is required to commence the proposed development. The quarry output can be increased substantially with existing machinery and equipment, which will be replaced and upgraded from time to time as necessary. There is no “construction phase” as the proposal is for the expansion of an existing quarry and new site works would be implemented as output increases. However, site works for mitigation measures are estimated at this stage to require an investment cost of around $300,000.

3. Statutory legislation

The SEAR's require an assessment of how the EIS has considered the relevant planning, land use and development matters (including relevant strategic matters). This chapter outlines the statutory framework applicable to the project at the state, Commonwealth, regional and local levels. It details the relevant legislation and planning policies that have been addressed in the preparation of this EIS.

3.1 Commonwealth legislation

3.1.1 Environmental Protection and Biodiversity Conservation Act 1999

The *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) prescribes the Commonwealth's role in environmental assessment, biodiversity conservation and the management of protected areas and species, populations and communities, and heritage items. Under the EPBC Act, the approval of the Commonwealth Minister for the Environment is required for the following controlled actions:

- An action which has, would have, or is likely to have a significant impact on matters of national environmental significance, these being:
  - The World Heritage values of a declared World Heritage property
  - The National Heritage values of a listed National Heritage place
  - The Great Barrier Reef Marine Park
  - The ecological character of a declared Ramsar wetland of international importance
  - Listed threatened species and ecological communities
  - Listed migratory species
  - The Commonwealth marine environment
  - Nuclear actions
  - A water resource, in relation to coal seam gas development and large coal mining development
- An action by the Commonwealth or a Commonwealth agency which has, would have, or is likely to have a significant impact on the environment.
- An action which has, would have or is likely to have a significant impact on the environment of Commonwealth land, no matter where it is to be carried out.

Under section 68(1) of the EPBC Act, 'a person proposing to take an action that the person thinks may be or is a controlled action must refer the proposal to the Minister for the Minister's decision whether or not the action is a controlled action.'

In regards to EPBC listed threatened communities and species at the site, there are:

- No threatened ecological communities
- One threatened flora species (Bordered Guinea Flower (Hibbertia marginata) within the study area and the possibility that a further two flora species may occur.
- No threatened fauna species have been recorded within the study area; however potential habitat for three threatened fauna species exists.
- One migratory bird species (Rainbow Bee-eater) was recorded during surveys and there is also potential habitat for four other migratory species.

Under the provisions of the EPBC Act, the proposed development is being referred to the Department of the Environment in relation to the impacts on the identified *Hibbertia marginata* population. Other potential impacts on EPBC listed species have been addressed through the FBA and its associated BioBanking assessment.

Under the environmental assessment provisions of the EPBC Act, the following matters of national environmental significance (MNES) and impacts on Commonwealth land are required to be considered to assist in determining whether the project should be referred to the Department of the Environment.

Factor	Impact
a. Any impact on a World Heritage property? The site is not located near any World Heritage areas.	Nil
b. Any impact on a National Heritage place? The project would not have any impact on a National Heritage place.	Nil
c. Any impact on a wetland of international importance? The project would not have any impact on a wetland of international importance.	Nil
d. Any impact on a listed threatened species or communities? The project contains known or potential habitat for three threatened flora species, three threatened fauna species and four migratory bird species listed under the EPBC Act. It is proposed that the proposal be referred to the Federal Minister for the Environment for approval under the EPBC Act, based on the potential to impact *Hibbertia marginata*. Other potential impacts on EPBC listed species have been addressed through the FBA and its associated BioBanking assessment.	Medium
e. Any impacts on listed migratory species? The project would not impact on any Commonwealth listed migratory species.	Nil
f. Any impact on a Commonwealth marine area? The project would not impact on a Commonwealth marine area.	Nil
g. Does the Proposal involve a nuclear action (including uranium mining)? The project does not involve a nuclear action.	Nil
h A water resource, in relation to coal seam gas development and large coal mining development The proposal is not associated with coal seam gas or large coal mining development, nor would it have a significant impact on any water resource.	NA
i. Additionally, any impact (direct or indirect) on Commonwealth land? No Commonwealth land would be impacted by the project.	Nil

3.2 State legislation and policies

3.2.1 Environmental Planning and Assessment Act

All development in NSW is assessed in accordance with the provisions of the EP&A Act and the EP&A Regulation. The EP&A Act institutes a system for environmental planning and assessment, including approvals and environmental impact assessment requirements for proposed developments. Implementation of the EP&A Act is the responsibility of the Minister for Planning, statutory authorities and local councils.

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 councils, 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 EIS must comply with the requirements in Clauses 6 and 7 of Schedule 2 of the EP&A Regulation.

For the purposes of the EP&A Act, development is classified as State Significant Development (SSD) where:

- It is declared to be SSD by the *State Environmental Planning Policy (State and Regional Development) 2011* (the SRD SEPP).
- It is otherwise called in by the Minister.

The proposed quarry expansion will require development consent from the Minister of Planning pursuant to Part 4 of the EP&A Act and constitutes SSD (see Section 3.2.2 for more information) as it meets criteria concerning scale or impacts such that the development application is required to be assessed by DPE and determined by the Minister. The SEARs for the project have been issued (application SSD 6624) and are contained in Appendix B.

To obtain consent, the development application needs to be accompanied by this EIS.

The need or otherwise for development consent is set out in environmental planning instruments including State Environmental Planning Policies (SEPPs) and Local Environmental Plans (LEPs) which are discussed below.

3.2.2 State Environmental Planning Policy State and Regional Development 2011

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

Part 2 of the SRD SEPP declares development to be SSD if:

- By operation of another environmental planning instrument, it is permissible with development consent.
- It is also included in Schedule 1 or 2 of the SRD SEPP.

The proposed development is not complying development such as to exclude it from being SSD. Also the proposed development is not to be carried out as part of other development that is SSD.

Part 2 of the SRD SEPP (first dot point), and the assessment in Section 3.2.3 below, confirms that extractive industries are permissible with consent on the subject land.

Schedule 1 of the SRD SEPP identifies classes of development which are SSD, based on thresholds such as capital investment, location or some quantifiable criteria. The proposed quarry is therefore considered to be SSD (by virtue of Clause 7 of Schedule 1 of SRD):

Extractive industries

(1) Development for the purpose of extractive industry that:

(a) extracts more than 500,000 tonnes of extractive materials per year, or

(b) extracts from a total resource (the subject of the development application) of more than 5 million tonnes, or

(c) extracts from an environmentally sensitive area of State significance.

(2) Subclause (1) (c) does not apply to extraction:

(a) by a public authority in maintenance dredging of a tidal waterway, or

(b) in maintenance dredging of oyster lease areas, or adjacent areas, in Wallis Lake.

(3) Development for the purpose of extractive industry related works (including processing plants, water management systems, or facilities for storage, loading or transporting any construction material or waste material) that:

(a) is ancillary to or an extension of another State significant development project, or

(b) has a capital investment value of more than $30 million.

(4) This clause does not apply to development for the purpose of extractive industry or extractive industry related works that is part of a single proposed development if any other part of the development is State significant infrastructure.

In respect of these criteria, the proposed sandstone quarry including its expansion:

- Will have a maximum extraction rate of 500,000 tonnes per year.
- Extracts from a total resource of more than 5 million tonnes.
- Is not concerned with dredging as referred to in Clause 7 (2).
- It is not concerned solely with extractive industry related works as referred to in Clause 7 (3).
- It is not part of any other development that is State significant infrastructure

3.2.3 State Environmental Planning Policy Mining Petroleum and Extractive Industries 2007

The aims of the *Mining Petroleum and Extractive Industries SEPP 2007* (MPEI SEPP), in recognition of the importance to New South Wales of mining, petroleum production and extractive industries, are:

(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 MPEI SEPP, extractive industries may be carried out with consent on any land for which agriculture or industry is permitted with or without consent. The proposed site is predominantly zoned RU2 Rural Landscape under CVLEP 2011, where 'extensive agriculture' is permissible without consent.

All of the existing sandstone quarry operation and the area of its proposed expansion are located in the RU2 zone.

Extractive industries, as defined in the dictionary of the CVLEP 2011, are not listed in the Land Use Table for the RU2 zone. However, the permissibility of the proposed development is determined by the MPEI SEPP which prevails over the LEP. Refer to Sections 3.2.2 and 3.3.1 for more discussion on permissibility.

A sandstone quarry falls within the definition of extractive industry in the MPEI SEPP as being:

*"… the winning or removal of extractive materials (otherwise than from a mine) by methods such as excavating, dredging, 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:*

(a) turf farming, or

(b) tunnelling for the purpose of an approved infrastructure development, or

(c) cut and fill operations, or the digging of foundations, ancillary to approved development, or

(d) the creation of a farm dam if the material extracted in the creation of the dam is used on site and not removed from the site."

Part 2 Permissible development of the MPEI SEPP provides in Clause 7(3):

"(3) Extractive industry

Development for any of the following purposes may be carried out with development consent:

*(a) extractive industry on land on which development for the purposes of **agriculture** or industry may be carried out (with or without development consent),*

(b) extractive industry in any part of a waterway, an estuary in the coastal zone or coastal waters of the State that is not in an environmental conservation zone."

On this basis the MPEI SEPP permits extractive industries with development consent on the land in the RU2 zone.

The MPEI SEPP establishes specific requirements for the assessment of development permissible under the SEPP. These include (in this case with respect to an extractive industry):

- Consideration of the compatibility of the proposal with the existing uses and approved uses of land in the vicinity, potential impacts on preferred land uses in the vicinity, a comparison of the public benefits of these land uses with the proposal, and measures to avoid or minimize incompatibility.
- Consideration of conditions to be imposed on consents to ensure extractive industries are carried out in an environmentally responsible manner in respect of water resources, biodiversity and greenhouse gas emissions.
- Resource recovery aspects of the proposed extractive industry.

- The transport impacts of the proposal, including impacts and management of truck movements on public roads, taking into account advice from the Roads and Maritime.
- The need for conditions concerning rehabilitation

This EIS has been prepared to support a DA and includes an assessment of all matters for consideration prescribed within MPEI SEPP.

3.2.4 State Environmental Planning Policy (Rural Lands) 2008

The aims of the *Rural Lands SEPP* are as follows:

(a) to facilitate the orderly and economic use and development of rural lands for rural and related purposes

(b) to identify the Rural Planning Principles and the Rural Subdivision Principles so as to assist in the proper management, development and protection of rural lands for the purpose of promoting the social, economic and environmental welfare of the State

(c) to implement measures designed to reduce land use conflicts

(d) to identify State significant agricultural land for the purpose of ensuring the ongoing viability of agriculture on that land, having regard to social, economic and environmental considerations

(e) to amend provisions of other environmental planning instruments relating to concessional lots in rural subdivisions

The project involves the expansion of a quarry operation that is on land currently zoned RU2 Rural Landscape under the CVLEP 2011. The proposed extension area is vegetated and has limited agricultural value (as discussed in Section 5.1). This is supported by the Mid North Coast Regional Farmland Mapping project 2008, which maps the site as "Other Rural Land".

3.2.5 State Environmental Planning Policy 33 – Hazardous and Offensive Development

Clause 3 of the *Hazardous and Offensive Development SEPP* defines a 'Potentially Hazardous Industry' as:

"a development for the purposes of any industry which, if the development were to operate without employing any measures (including, for example, isolation from existing or likely future development on other land) to reduce or minimise its impact in the locality or on the existing or likely future development on other land, would pose a significant risk in relation to the locality:

(a) to human health, life or property, or

(b) to the biophysical environment, and includes a hazardous industry and a hazardous storage establishment.

Clause 3 of the SEPP defines a 'Potentially Offensive Industry' as:

***potentially offensive industry** means a development for the purposes of an industry which, if the development were to operate without employing any measures (including, for example, isolation from existing or likely future development on other land) to reduce or minimise its impact in the locality or on the existing or likely future development on other land, would emit a polluting discharge (including for example, noise) in a manner which would have a significant adverse impact in the locality or on the existing or likely future development on other land, and includes an offensive industry and an offensive storage establishment*.

The very nature of extractive industries suggests there is the potential for such uses to be hazardous or offensive to the local environment if not appropriately managed.

However, all appropriate site management controls and environmental impact mitigation measures would be implemented and monitored during the site's operations.

Additionally, given the location of the site, its separation from neighbours, and the intended management, mitigation and monitoring measures proposed to be implemented, no such detrimental impacts are anticipated to occur. A preliminary hazard analysis is provided in Section 5.10. In summary, if all mitigation measures provided in this EIS are implemented:

- There would be limited potential for polluting discharge from the site which would pose a significant risk to human health, life or property.
- There would be limited potential for polluting discharge from the site which would pose a significant risk to the biophysical environment.

3.2.6 State Environmental Planning Policy 44 – Koala Habitat Protection

State Environmental Planning Policy No. 44 – Koala Habitat Protection (SEPP 44) aims to encourage the proper conservation and management of areas of natural vegetation that provide habitat for Koalas. SEPP 44 also aims to ensure a permanent free-living population of Koalas over their present range, and reverse the current trend of Koala population decline by:

- Requiring the preparation of plans of management before development consent can be granted in relation to areas of core Koala habitat.
- Encouraging the identification of areas of core Koala habitat.
- Encouraging the inclusion of areas of core Koala habitat in environment protection zones.

Despite the presence of 'potential' Koala habitat as defined by SEPP 44, the limited number of recent records within close proximity to the site suggests that the site does not provide 'core' Koala habitat. Although the Clarence Valley Comprehensive Koala Plan of Management does not cover the site, using the definitions outlined in the plan, the site is classified as 'preferred Koala habitat: secondary (class A)' due to the presence of listed primary (Tallowwood) and secondary food tree species (Red Mahogany and Pink Bloodwood).

Based on this information, the presence of the Koala was considered likely on a transient basis and consequently this species has been included in the BioBanking assessment credit calculations ., refer to Section 5.5 and Appendix F.

3.2.7 State Environmental Planning Policy No 55—Remediation of Land

State Environmental Planning Policy No. 55 - Remediation of Land (SEPP 55) provides a state-wide planning approach to the remediation of contaminated land and states that all remediation work must be carried out in accordance with:

- The contaminated land planning guidelines
- Any guidelines in force under the Contaminated Land Management Act 1997
- In the case of remediation work defined as category 1 remediation work under SEPP 55, a plan of remediation approved by the consent authority and prepared in accordance with the contaminated land planning guidelines

Clause 7(1) of the Policy states that 'a consent authority must not consent to the carrying out of any development on land unless:

a) it has considered whether the land is contaminated

b) if the land is contaminated, it is satisfied that the land is suitable in its contaminated state (or will be suitable, after remediation) for the purpose for which the development is proposed to be carried out

c) if the land requires remediation to be made suitable for the purpose for which the development is proposed to be carried out, it is satisfied that the land will be remediated before the land is used for that purpose.'

The quarry has not been identified to be contaminated and the proposal is not changing the current land use. It is therefore considered that the site is suitable for the proposed use in respect to contamination.

3.2.8 State Environmental Planning Policy - North Coast Regional Environmental Plan

The following clauses of the *North Coast Regional Environmental Plan SEPP* are relevant to the proposal:

Clause 12

Clause 12 prevents the approval of an application unless it has considered its impact on adjoining or adjacent agricultural land and whether or not the development would cause a loss of prime crop or pasture land.

The adjacent and adjoining land is heavily vegetated, steep and with relatively poor soils for agriculture. This is supported by the area not being considered to be "Regionally Significant Farmland" as mapped by the NSW Government *Mid North Coast Regional Farmland Mapping project 2008*. The project is therefore not expected to negatively impact on adjoining or adjacent agricultural properties.

Clause 18

Clause 18 prevents the approval of a development application for an extractive industry unless it includes any necessary conditions of consent to require implementation both during and after extractive operations of an erosion and sediment control plan and rehabilitation plan.

As described in Section 2 the project includes rehabilitation and erosion and sediment controls.

3.2.9 Protection of the Environment and Operations Act 1997

The objectives of the *Protection of the Environment and Operations Act 1997* (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 EPLs from the Environment Protection Authority (EPA). These activities are called 'scheduled activities' and are listed in Schedule 1 of the Act.

Extractive industries including crushing, grinding and separating is defined as an activity that requires an EPL when the operations exceed 30,000 tonnes per year. As the proposal involves the extraction of up to 500,000 tonnes per year, an EPL would be required for the operation of the quarry. The current operation on the subject land already has such a licence (Licence 11649) and this would be reviewed for the proposed expansion.

The importing and reuse of topsoil and mulch would also be considered a scheduled activity by virtue of Clause 39 of Schedule 1 of the PoEO Act and require an EPL.

The EPL would include requirements for the protection against water, air and noise pollution, waste disposal and incident reporting requirements for actual or potential pollution incidents.

3.2.10 Water Act 1912

The *Water Act 1912* (Water Act) governs access, trading and allocation of licences associated with both surface and underground water sources, where a Water Sharing Plan (WSP) has not been put in place. The elements to which the Water Act applies include extraction of water from a river, extraction of water from underground sources, aquifer interference and capture of surface runoff in dams.

The groundwater assessment (Section 5.2) indicates the project is unlikely to intercept the aquifer, therefore a licence under Part 5 of the Water Act is not required. However, it is proposed that a monitoring well is installed and this will require a licence.

3.2.11 Water Management Act 2000

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 formal means for the protection and enhancement of the environmental qualities of waterways and their in-stream uses as well as to provide for protection of catchment conditions.

The site is not currently covered by a WSP, although a draft WSP for Clarence Unregulated and Alluvial Water Sources is currently being prepared by NSW Office of Water (NOW). This WSP is expected to commence in 2015.

The water collected in the sediment basins may be in excess of the "maximum harvestable right dam capacity" (MHRDC) for the site, however a Water Access Licence (WAL) would not be required because under the WM Act sediment basins do not require a licence. It is also envisaged that a Controlled Activity Approval (CAA) will not be required because the proposal does not impact any drainage lines that meet the definition of a "river" under this Act.

3.2.12 Roads Act 1993

Section 138 of the *Roads Act, 1993* sets out the requirement for approval to carry out certain works undertaken within the vicinity of a road. Under Section 138 a person must not, without consent of the appropriate roads authority:

- erect a structure or carry out a work in, on or over a public road
- dig up or disturb the surface of a public road
- remove or interfere with a structure, work or tree on a public road
- pump water into a public road from any land adjoining the road
- connect a road (whether public or private) to a classified road

The proposal does not involve any of the above works and therefore a Section 138 approval is not required.

3.2.13 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.

As discussed in Section 5.7, it is considered highly unlikely that scientifically or culturally significant Aboriginal cultural deposits remain at the site.

3.2.14 Rural Fires Act 1997

The Act requires referral to the Rural Fire Service where land is bushfire prone land identified by a "Bushfire Prone Land Map" prepared under Section 146 of the EP&A Act.

CVC has mapped the site as 'Vegetation Category 1' bushfire prone land.

To demonstrate compliance with *Planning for Bush Fire Protection* (NSW RFS, 2006), as required by Section 79BA of the EP&A Act, a bushfire risk assessment has been presented in Table 3-1.

Table 3-1 Bush Fire Risk Assessment

Performance Criteria	Response
Asset Protection Zones (APZ)	In the location of the site office, machinery shed and fuel storage, the site is relatively level with very little vegetation. However the site is surrounded by established forest on all sides. An assessment of the site office and shed based on a Bushfire Attack Level (BAL) 29 and AS3959-2009 indicates APZ required is: North – 0 m East – 21 m South - 27 m West – 0 m The required APZ is achievable without the need for vegetation clearing. The fuel storage area is at least 100 m from any bushfire hazard and would have a BAL of 12.5. Based on advice from RFS, this is acceptable protection.
Siting and design	The site office and shed are metal structures, as shown in Figure 2-2. They are located and designed appropriately in terms of bushfire protection.
Construction standards	AS3959-2009 construction standards are not applicable to Class 10 buildings, however, it is considered the site office and shed comply with BAL 29.
Access	The access is within 200 m of Tullymorgan Jackybulbin Road.

Performance Criteria	Response
Services	Electricity would be provided via a generator. Water would be provided by rainwater. The dedicated water supply for firefighting purposes would be the water in the sediment basins. This is supplied by runoff from the quarry and is considered a reliable water source.
Landscaping	The landscaping would be maintained, in accordance with Appendix 5 of NSW RFS (2006)

3.2.15 NSW Threatened Species Conservation Act 1995

The *Threatened Species Conservation Act 1995* (TSC Act) lists a number of threatened species, populations or ecological communities to be considered in deciding whether there is likely to be a significant impact on threatened biota, or their habitats. If a species of flora or fauna listed in Schedule 1 or 2 of the TSC Act is identified, a review must be undertaken of the factors set out to establish if there is likely to be a significant effect on that species, population, ecological community or habitat. If any of these could be impacted by the proposal, an assessment of significance that addresses the requirements of Section 5A of the EP&A Act must be completed to determine the significance of the impact. If a significant impact on a threatened species, population or ecological community is likely, a Species Impact Statement (SIS) must be completed including consultation with the NSW Office of Environment and Heritage (OEH).

As discussed in Section 5.5, the project may result in direct and indirect impacts on threatened biota listed under the TSC Act including the removal of occurrences of the threatened plant, *Hibbertia marginata;* the removal of habitat for up to 24 threatened fauna species that may occur in the study area and the removal of native vegetation within the local occurrence of Swamp sclerophyll forest. Impacts on threatened biota listed under the TSC Act have been assessed through the BioBanking calculations included in Section 5.5 and Appendix F.

3.2.16 Native Vegetation Act 2003

The *Native Vegetation Act 2003* (NV Act) and *Native Vegetation Regulation 2005* guide the way native vegetation is managed in NSW by preventing broad scale clearing, unless it improves or maintains environmental outcomes.

Under Section 89(J) of the EP&A Act, because the proposal is considered SSD, an authorisation referred to in section 12 of the NV Act to clear native vegetation is not required.

3.3 Local Environmental Plans

LEPs are prepared by Councils to guide planning decisions in their LGAs and establish the requirements for the use and development of land. The CVLEP 2011 is the current LEP for the LGA.

3.3.1 Clarence Valley Local Environmental Plan 2011

The subject land is zoned RU2 Rural Landscape pursuant to CVLEP 2011. The objectives for this zone are as follows:

- To encourage sustainable primary industry production by maintaining and enhancing the natural resource base.

- To maintain the rural landscape character of the land.
- To provide for a range of compatible land uses, including extensive agriculture.
- To provide land for less intensive agricultural production.
- To prevent dispersed rural settlement.
- To minimise conflict between land uses within the zone and with adjoining zones.
- To ensure that development does not unreasonably increase the demand for public services or public facilities.
- To ensure development is not adversely impacted by environmental hazards.

One small area in the north portion of the land parcel is zoned E3 Environmental Management. This is located adjacent to the northern edge of Lot 2, and applies to the steeper slopes leading up to Mt Doubleduke.

Figure 3-1 displays the current land use zoning of the site.

All of the existing sandstone quarry operation and the area of its proposed expansion are located in the RU2 zone.

Extractive industries, as defined in the Dictionary of the CVLEP 2011, are not listed in the Land Use Table for the RU2 zone. However, the permissibility of the proposed development is determined by the MPEI SEPP which prevails over the LEP, as explained in Section 3.2.3.

Lot 2 is not in or in the vicinity of any land designated in the CVLEP 2011 as a drinking water catchment, flood planning area, coastal risk area or urban release area. The CVLEP 2011 does not identify any of Lot 2 as reserved for future acquisition. No part of Lot 2 or its surrounding area is classified as containing acid sulfate soils under the CVLEP 2011.

Lot 2 (on which the quarry is located), and large areas to the south and south west of Lot 2 are subject to a 40 ha minimum subdivision lot size, while land to the north and west has a 200 ha minimum lot size.

As outlined is section 3.2.3, the MPEI SEPP permits extractive industries on any land for which agriculture or industry is permitted with or without consent, and therefore extractive industries are considered to be permissible with development consent.

Other relevant clauses of the CVLEP 2011 include:

Clause 5.9 - Preservation of trees or vegetation

The objective of this clause is to preserve the amenity of the area, including biodiversity values, through the preservation of trees and other vegetation.

This clause applies to species or kinds of trees or other vegetation that are prescribed for the purposes of this clause by a development control plan made by the Council.

A development control plan may prescribe the trees or other vegetation to which this clause applies by reference to species, size, location or other manner. The vegetation clearing associated with the proposal has been assessed in Section 5.5.

LEGEND

- Subject site
- Study area
- cadastre
- roads
- Waterways
- Waterbody

Land use zone

- E3, Environmental Management
- RU2, Rural Landscape
- RU3, Forestry

Paper Size A3

0 50 100 200 300 400

Metres

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

N

GHD

Newman Quarrying
Sly's Quarry Environmental Impact Statement
Biodiversity Assessment

Job Number	22-17528
Revision	A
Date	18 Feb 2015

Land Use Zoning

Figure 3-1

N:\AU\Coffs Harbour\Projects\22\17528\GIS\Maps\Deliverables\22_17528_Z010_Zoning.mxd
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

Data Source: NSW Department of Lands: Cadastre - Jan 2014; Geoscience Australia: 250k Data - Jan 2014; NSW Department od Primary Industry - Jan 2014; ESRI image Jan 2014. Created by: qjchung

Clause 5.10 – Bush fire hazard reduction

Bush fire hazard reduction work authorised by the *Rural Fires Act 1997* may be carried out on any land without consent. The *Rural Fires Act 1997* also makes provision relating to the carrying out of development on bush fire prone land. See Section 3.2.14 above.

Clause 7.2 – Earthworks

The objective of this clause is to ensure that earthworks for which development consent is required would not have a detrimental impact on environmental functions and processes, neighbouring uses, cultural or heritage items or features of the surrounding land.

The impact of the excavation is assessed in detail in Section 5.1. This indicates that while the project would have some negative impacts resulting from excavation, with the implementation of the mitigation measures, these impacts would be minimised.

3.3.2 Development Control Plans and other plans or policies

Development Control Plan 2011 – Rural Zones

The aim of Clarence Valley Council Development Control Plan (DCP) - *Development in Rural Zones* is to encourage development of land in rural zones that complements the rural character of a locality and is at an appropriate scale and form to minimise land use conflicts.

The Clarence Valley Rural Zones DCP applies to land zoned RU2 Rural Landscape under CVLEP.

The proposed quarry is considered to be SSD and by virtue of Clause 11 of the SRD SEPP, it is therefore excluded from the provisions of the DCP.

3.4 Statutory position

The provisions of the SRD SEPP, MPEI SEPP and CVLEP 2011 allow the proposed development to be permissible with consent as discussed in sections 3.2.1, 3.2.2 and 3.3.1.

The proposed quarry is considered to be SSD (by virtue of Clause 7 of Schedule 1 of SRD SEPP) and will require development consent from the Minister of Planning pursuant to Part 4 of the EP&A Act. To obtain consent, the DA needs to be accompanied by this EIS.

This EIS has been prepared to accord with the SEAR's developed by DPE in conjunction with a range of other government agencies.

The project would require additional licences and approvals under a range of applicable NSW legislation and is therefore also considered to be integrated development. An EPL to undertake a schedule activity under the POEO Act would also be required as would a licence under Part 5 of the *Water Act 1912* for the groundwater monitoring well.

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.

Under the provisions of the EPBC Act, the proposed development is being referred to the Department of the Environment in relation to the impacts on the identified *Hibbertia marginata* population.

4. Consultation

4.1 Introduction

The SEAR's require consultation with community groups and affected landholders during the preparation of the EIS.

A consultation strategy was formulated as a part of the EIS process to assist in the identification of key stakeholders and issues for consideration. Consultation with a range of government agencies 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.

This chapter provides a description of the government and community consultation activities undertaken and outlines the key issues identified and where they are addressed in this document.

It is considered that the proposed expansion of the quarry does not meet criteria of complexity or scale of impacts that would warrant a Planning Focus Meeting (PFM) being held prior to the DPE issuing the SEARs.

4.2 Consultation with government agencies

Prior to preparation of the preliminary assessments, the proponent consulted the CVC Development Management Unit concerning the permissibility of the proposal. The Unit advised of the range of issues that would need to be addressed in a development application and the appropriate approach to community consultation.

During the preparation of the EIS, regular consultation was maintained with State government agencies and CVC, where there was uncertainty on what was required. Consultation has been both formal and informal and has been used to refine the proposal and develop the assessment methodology. A summary of the consultation is provided in 1.

Table 4-1 Agency Consultation

Date	Agency	Details
February 2015	CVC	Confirming that we had sufficiently addressed the items raised in their requirements in the SEARs, especially in relation to the road safety audit
18th March 2015	OEH	Requesting clarification as to how the FBA process links with the referral requirements under the EPBC Act and confirmation as to whether the proposed bilateral agreement has been approved
23rd March 2015	OEH	Advising that the bilateral agreement between the NSW and Australian Government has not yet been agreed.
2nd April 2015	OEH	Requesting confirmation as to whether the bilateral agreement has been approved and advice as to whether SEPP 44 applies to SSD when using the FBA.
7th April 2015	OEH	Advising that the assessment bilateral has now been approved and a referral will still need to be made to determine whether the bilateral applies to the project. Also advised that the FBA does not disable SEPP 44 and will still need to be addressed in the report.

4.2.1 Secretary's environmental assessment requirements

The SEARs for the preparation of this EIS were provided by the DPE following submission of the Preliminary Environmental Assessment (PEA) and subsequent agency consultation. A summary of key issues raised in the SEARs and the section of the EIS where they are addressed is provided in Table 4-2. An unabridged copy of the SEARs and associated agency submissions are provided in Appendix B.

Table 4-2 Secretary's Environmental Assessment

Issue category	Requirement	Section addressed in EIS
General Requirements	• A detailed description of the proposal including: – Resource identification/extraction (having regard to DRE's requirements) – Site layout and extraction plan – Processing activities – Waste (overburden, leachate, etc.) management strategy – Water management strategy (having regard to EPA and Department of Primary Industry (DPI) requirements) – Rehabilitation strategy (key principles in the Strategic Framework for Mine Closure) – likely interactions between the development and any other existing, approved or proposed extractive industry development in the vicinity of the site, including the proposed explosives depot	Section 2
	• a list of any approvals that must be obtained before the development may commence	Section 3.4
	• an assessment of the likely impacts of the development on the environment, focussing on the specific issues identified below, including: – a description of the existing environment likely to be affected by the development, using sufficient baseline data – an assessment of the likely impacts of all stages of the development, including any cumulative impacts – a description of the measures that would be implemented to mitigate and/or offset the likely impacts of the development, and an assessment of: o whether these measures are consistent with industry best practice, and represent the full range of reasonable and feasible mitigation measures that could be implemented o the likely effectiveness of these measures o whether contingency plans would be necessary to manage any residual risks	Section 5

Issue category	Requirement	Section addressed in EIS
	– a description of the measures that would be implemented to monitor and report on the environmental performance of the development if it is approved – a consolidated summary of all the proposed environmental management and monitoring measures, identifying all the commitments in the EIS – consideration of the development against all relevant environmental planning instruments (including Part 3 of the State Environmental Planning Policy (Mining, Petroleum Production and Extractive Industries) 2007) – the reasons why the development should be approved having regard to biophysical, economic and social considerations, including the principles of ecologically sustainable development	
	• In addition to the matters set out in schedule I of the EP&A Regulation 2000, the development application must be accompanied by a signed report from a suitably qualified expert that includes an accurate estimate of the: – capital investment value (as defined in Clause 3 of the EP&A Regulation 2000) of the development, including details of all the assumptions and components from which the capital investment value calculation is derived – jobs that would be created during each stage of the development	Section 2.10 and 2.14
Key issues	The EIS must address the following specific matters:	
	Noise and Blasting	Section 5.3 and Appendix D
	• an assessment of the likely operational noise impacts of the development under the NSW Industrial Noise policy, paying particular attention to the obligations in Chapters I and 9 of the policy	
	• if a claim is made for specific construction noise criteria for certain activities, then this claim must be justified and accompanied by an assessment of the likely construction noise impacts of these activities under the Interim Construction Noise Guideline	
	• an assessment of the likely road noise impacts of the development under the NSW Road Noise Policy	

Issue category	Requirement	Section addressed in EIS
	• an assessment of the likely blasting impacts of the development on people, animals, buildings, and infrastructure, and significant natural features, having regard to the relevant ANZEC guidelines	
	Water	Section 5.2 and Appendix C
	• an assessment of the likely impacts of the development on the quantity and quality of the region's surface and groundwater resources, having regard to the EPA's and DPI's requirements	
	• an assessment of the likely impacts of the development on aquifers, watercourses, riparian land, water-related infrastructure, and other water users	
	• the development of a Stormwater Management Plan	
	Social and Economic	Section 5.11
	• Including an assessment of the likely social and economic impacts of the development, paying particular attention to: – the significance of the resource – economic benefits of the project for the State and region – the demand for the provision of local infrastructure and services	
	Traffic and transport	Section 5.6 and Appendix G
	• an assessment of the likely traffic impacts of the development on the capacity, condition, safety and efficiency of the local and State road network, having regard to any requirements of the Roads and Maritime and Council's requirements	
	• consideration of access arrangements for the proposed development, as well as the proposed explosives depot	
	Biodiversity	Section 5.5 and Appendix F
	• an assessment of the likely biodiversity impacts of the development, having regard to OEH's requirements	
	• a biodiversity offset strategy to ensure the development would maintain or improve the biodiversity values of the region in the medium to long term	
	Hazards	Section 5.10
	• a consideration of the associated local development	

Issue category	Requirement	Section addressed in EIS
	proposal for the explosives depot • the potential for bushfire	
	Visual • including an assessment of any visual impacts of the development on nearby private landowners and key vantage points in the public domain, including potential lighting impacts	Section 5.8
	Heritage • including an assessment of the likely Aboriginal and historic heritage (cultural and archaeological) impacts of the development, having regard to the Heritage Council's and OEH's requirements	Section 5.7 and Appendix H
	Land – an assessment of the compatibility of the development with other land uses in the vicinity of the development in accordance with the requirements in Clause 12 of the MPEI SEPP	Section 5.1
	Air Quality - including an assessment of the likely air quality impacts of the development in accordance with the Approved Methods for the Modelling and Assessment of Air Pollutants	Section 5.4
Consultation	During the preparation of the EIS, you must consult with relevant local, State or Commonwealth Government authorities, infrastructure and service providers, Aboriginal stakeholders, community groups and affected landowners. The EIS must describe the consultation that was carried out, identify the issues raised during this consultation, and explain how these issues have been addressed in the EIS	Section 4 and Appendix A

In addition to the SEARs, additional key issues raised by statutory agencies through formal correspondence are summarised in Table 4-3 together with the relevant chapter/section of the environmental assessment which addresses that issue.

Table 4-3 Key issues raised by statutory agencies

Agency	Issues raised	Location in EIS
NSW Department of Primary Industries	**Agriculture NSW** advise that a DPI guideline, Agriculture issues for extractive industry development, sets out the relevant agricultural issues to consider in the preparation of an EIS for an extractive industry development.	Section 5
	Fisheries NSW advise the proponent to note that Tabbimobile Creek (located on the same lot as the proposal, south of the Tullymorgan-Jackybulbin Road), is considered a key fish habitat.	Section 5.2.2 and 5.5

Agency	Issues raised	Location in EIS
	Crown Lands advise the following issues: • The eastern boundary of the proposed quarry expansion comprises a Crown Public road that is excluded from the development proposal (as shown on the site survey plan and referred to in final paragraph of Site). Location & Land Uses on PB of the Preliminary Environmental Assessment • The EIS should recognise the status of the Crown Public road and acknowledge legal rights of public access under the *Roads Act 1993* • There should be no obstruction of legal public access along the Crown Public road • The EIS should address potential Impacts and risks associated with the Crown Public road • The necessity for a fence along the road boundary should be addressed • The Crown road is not subject to an enclosure permit administered by Crown Lands. It should therefore be fenced out of the adjoining Lot 2 DP 1055044 owned by Noel & Kerry Newman • It is inappropriate for the limits of extraction to extend to the Crown Public road boundary as shown in the PEA. The EIS should adjust the boundary of the proposed extraction limit and provide an appropriate buffer zone and batters to protect the road reserve and address any risks to public rights of access • Alternatively, the option of applying to close and purchase the road should be considered. Contact Crown Lands for further details	Appendix A
	The NSW Office of Water (NOW) requested the following: • Details of water proposed to be taken (including through inflow and seepage) from each surface and groundwater source as defined by the relevant water sharing plan • Assessment of any volumetric water licensing requirements (including those for ongoing water take following completion of the project) • The identification of an adequate and secure water supply for the life of the project and confirmation that water can be sourced from an appropriately authorised and reliable supply. This is to include an assessment of the current market depth where water entitlement is required to be purchased • A detailed and consolidated site water balance • A detailed assessment against the *NSW Aquifer Interference Policy (2012)* using the NOW's assessment framework • Assessment of impacts on surface and ground water sources (both quality and quantity), related infrastructure, adjacent licensed water users, basic landholder rights, watercourses, riparian land, and groundwater dependent ecosystems, and	Section 5.1, Section 5.2 and Appendix C

Agency	Issues raised	Location in EIS
	measures proposed to reduce and mitigate these impacts • Full technical details and data of all surface and groundwater modelling, and an independent peer review • Proposed surface and groundwater monitoring activities and methodologies • Proposed management and disposal of produced or incidental water • Details surrounding the final landform of the site, including final void management (where relevant) and rehabilitation measures • Assessment of any potential cumulative impacts on water resources, and any proposed options to manage the cumulative impacts • Consideration of relevant policies and guidelines • A statement of where each element of the SRs is addressed in the EIS (i.e. in the form of a table)	
	NOW noted the proponent's comments about groundwater. If the proposal will not interfere with an aquifer, then it may not be an aquifer interference activity, however this would need to be demonstrated through adequate on-site studies	Section 5.2 and Appendix C
	The southern and eastern sections of the property contain upriver alluvials which are currently embargoed from new water licences.	Noted
	Additional Comment by NOW: • The EIS should take into account the objects and regulatory requirements of the Water Act and WM Act, and associated regulations and instruments, as applicable:	Section 3.2.10 and Section 3.2.11
	WM Act key points: • Volumetric licensing in areas covered by water sharing plans • Works within 40 m of waterfront land • SSD & SSI projects are exempt from requiring water supply work approvals and controlled activity approvals as a result of the EP&A Act • No exemptions for volumetric licensing apply as a result of the EP&A Act • Basic landholder rights, including harvestable rights dams • Aquifer interference activity approval and flood management work approval provisions have not yet commenced and are regulated by the Water Act 1912 • Maximum penalties of $2.2 million plus $264,000 for each day an offence continues apply under the WM Act	
	Water Act key points: • Volumetric licensing in areas where no water sharing plan applies • Monitoring bores	

Agency	Issues raised	Location in EIS
	• Aquifer interference activities that are not regulated as a water supply work under the WMA 2000 • Flood management works • No exemptions apply to licences or permits under the Water Act as a result of the EP&A Act • Regulation of water bore driller licensing	
	Water Management (General) Regulation 2011 Key points: • Provides various exemptions for volumetric licensing and activity approvals • Provides further detail on requirements for dealings and applications	
	• Water Sharing Plans - these are considered regulations under the WM Act – The proposed quarry expansion is not located within an area covered by a WSP, therefore any licensing requirements are under the Water Act. Once a WSP is gazetted for the area, on site groundwater and/ or surface water would be regulated by the WM Act. – A WSP for the area is currently targeted for commencement in 2015. • Access Licence Dealing Principles Order 2004	
	The EIS should take into account the following policies (as applicable): • *NSW Guidelines for Controlled Activities on Waterfront Land* (NOW, 2012) • *NSW Aquifer Interference Policy* (NOW, 2012) • *Risk Assessment Guidelines for Groundwater Dependent Ecosystems* (NOW, 2012) • *Australian Groundwater Modelling Guidelines* (NWC, 2012) • *NSW State Rivers and Estuary Policy* (1993) • *NSW Wetlands Management Policy* (1996) • *NSW State Groundwater Policy Framework Document* (1997) • *NSW State Groundwater Quality Protection Polley* (1998) • *NSW State Groundwater Dependent Ecosystems Policy* (2002) • *NSW Water Extraction Monitoring Policy* (2007)	Appendix C
	Licensing Considerations The EIS is required to provide: • Identification of water requirements for the life of the project in terms of both volume and timing (including predictions of potential ongoing groundwater take following the cessation of operations at the site - such as evaporative loss from open	Section 5.2 and Appendix C

Agency	Issues raised	Location in EIS
	voids or inflows). • Details of the water supply source(s) for the proposal including any proposed surface water and groundwater extraction from each water source as defined in the relevant Water Sharing Plan/s and all water supply works to take water. • Explanation of how the required water entitlements will be obtained (i.e. through a new or existing licence/s, trading on the water market, controlled allocations etc). • Information on the purpose, location, construction and expected annual extraction volumes including details on all existing and proposed water supply works which take surface water, (pumps, dams, diversions, etc). • Details on all bores and excavations for the purpose of investigation, extraction, dewatering, testing and monitoring. All predicted groundwater take must be accounted for through adequate licensing. • Details on existing dams/storages (including the date of construction, location, purpose, size and capacity) and any proposal to change the purpose of existing dams/storages. • Details on the location, purpose, size and capacity of any new proposed dams/storages. • Applicability of any exemptions under the *Water Management (General) Regulation 2011* to the project.	
	• Water allocation account management rules, total daily extraction limits and rules governing environmental protection and access licence dealings also need to be considered. • The Harvestable Right gives landholders the right to capture and use for any purpose 10 % of the average annual runoff from their property. The Harvestable Right has been defined in terms of an equivalent dam capacity called the Maximum Harvestable Right Dam Capacity (MHRDC). The MHRDC is determined by the area of the property (in hectares) and a site-specific run-off factor. The MHRDC includes the capacity of all existing dams on the property that do not have a current water licence. Storages capturing up to the harvestable right capacity are not required to be licensed but any capacity of the total of all storages/dams on the property greater than the MHRDC may require a licence.	Section 3.2.11
	Dam Safety Where new or modified dams are proposed, or where new development will occur below an existing dam, the NSW Dams Safety Committee should be consulted in relation to any safety issues that may arise. Conditions of approval may be recommended to ensure safety in relation to any new or existing dams.	NA

Agency	Issues raised	Location in EIS
	<u>Surface Water Assessment</u> The predictive assessment of the impact of the proposed project on surface water sources should include the following: • Identification of all surface water features including watercourses, wetlands and floodplains transected by or adjacent to the proposed project. • Identification of all surface water sources as described by the relevant water sharing plan. • Detailed description of dependent ecosystems and existing surface water users within the area, including basic landholder rights to water and adjacent/downstream licensed water users. • Description of all works and surface infrastructure that will intercept, store, convey, or otherwise interact with surface water resources. • Assessment of predicted impacts on the following: – flow of surface water, sediment movement, channel stability, and hydraulic regime, – water quality, – flood regime, – dependent ecosystems, – existing surface water users, and – planned environmental water and water sharing arrangements prescribed in the relevant water sharing plans.	Section 5.2 and Appendix C
	<u>Groundwater Assessment</u> To ensure the sustainable and integrated management of groundwater sources, the EIS needs to include adequate details to assess the impact of the project on all groundwater sources including • Works likely to intercept, connect with or Infiltrate the groundwater sources. • Any proposed groundwater extraction, including purpose, location and construction details of all proposed bores and expected annual extraction volumes. • Bore construction information is to be supplied NOW by submitting a "Form A" template. NOW will supply "GW" registration numbers (and licence/approval numbers if required) which must be used as consistent and unique bore identifiers for all future reporting. • A description of the water table and groundwater pressure configuration, flow directions and rates and physical and chemical characteristics of the groundwater source (including connectivity with other groundwater and surface water	Section 5.2 and Appendix C

Agency	Issues raised	Location in EIS
	sources). • Sufficient baseline monitoring for groundwater quantity and quality for all aquifers and groundwater dependent ecosystems (GDEs) to establish a baseline incorporating typical temporal and spatial variations. • The predicted impacts of any final landform on the groundwater regime. • The existing groundwater users within the area (including the environment), any potential impacts on these users and safeguard measures to mitigate impacts. • An assessment of groundwater quality, its beneficial use classification and prediction of any impacts on groundwater quality. • An assessment of the potential for groundwater contamination (considering both the impacts of the proposal on groundwater contamination and the impacts of contamination on the proposal). • Measures proposed to protect groundwater quality, both in the short and long term. • Measures for preventing groundwater pollution so that remediation is not required. • Protective measures for any GDEs. • Proposed methods of the disposal of waste water and approval from the relevant authority. • The results of any models or predictive tools used	
	Where potential impact/s are identified the assessment will need to identify limits to the level of impact and contingency measures that would remediate, reduce or manage potential impacts to the existing groundwater resource and any dependent groundwater environment or water users, including information on: • Any proposed monitoring programs, including water levels and quality data. • Reporting procedures for any monitoring program including mechanism for transfer of information. • An assessment of any groundwater source/aquifer that may be sterilised from future use as a water supply as a consequence of the proposal. • Identification of any nominal thresholds as to the level of impact beyond which remedial measures or contingency plans would be initiated (this may entail water level triggers or a beneficial use category). • Description of the remedial measures or contingency plans	

Agency	Issues raised	Location in EIS
	proposed. • Any funding assurances covering the anticipated post development maintenance cost, for example on-going groundwater monitoring for the nominated period.	
	<u>Groundwater Dependent Ecosystems</u> The EIS must consider the potential impacts on any GDEs at the site and in the vicinity of the site and: • Identify any potential impacts on GDEs as a result of the proposal including: – the effect of the proposal on the recharge to groundwater systems; – the potential to adversely affect the water quality of the underlying groundwater system and adjoining groundwater systems in hydraulic connections; and – the effect on the function of GDEs (habitat, groundwater levels, connectivity). • Provide safeguard measures for any GDEs.	Section 5.2 and Appendix C
	<u>Watercourses, Wetlands and Riparian Land</u> The EIS should address the potential impacts of the project on all watercourses likely to be affected by the project, existing riparian vegetation and the rehabilitation of riparian land. It is recommended the EIS provides details on all watercourses potentially affected by the proposal, including: • Scaled plans showing the location of: – wetlands/swamps, watercourses and top of bank – riparian corridor widths to be established along the creeks – existing riparian vegetation surrounding the watercourses (identify any areas to be protected and any riparian vegetation proposed to be removed) – the site boundary, the footprint of the proposal in relation to the watercourses and riparian areas – proposed location of any asset protection zones. • Photographs of the watercourses/wetlands and a map showing the point from which the photos were taken. • A detailed description of all potential impacts on the watercourses/riparian land. • A detailed description of all potential impacts on the wetlands, including potential impacts to the wetlands hydrologic regime; groundwater recharge; habitat and any species that depend on the wetlands. • A description of the design features and measures to be	Appendix A, Section 5.2 and Appendix C

Agency	Issues raised	Location in EIS
	incorporated to mitigate potential impacts. • Geomorphic and hydrological assessment of water courses including details of stream order (Strahler System), river style and energy regimes both in channel and on adjacent floodplains.	
	Drill Pad, Well and Access Road Construction • Any construction activity within 40 m of a watercourse, should be designed by a suitably qualified person, consistent with the *NSW Guidelines for Controlled Activities on Waterfront Land* (July 2012). • Construction of all wells must be undertaken in accordance with the *Minimum Construction Requirements for Water Bores in Australia* (3rd edition 2012) by a driller holding a bore drillers' licence valid in New South Wales. • The length of time that a core hole is maintained as an open hole should be minimised.	Appendix C
	Landform rehabilitation (including final void management) The Environmental Impact Statement report should include: • Justification of the proposed final landform with regard to its impact on local and regional surface and groundwater systems; • A detailed description of how the site would be progressively rehabilitated and integrated into the surrounding landscape; • Outline of proposed construction and restoration of topography and surface drainage features if affected by the project; • Detailed modelling of potential groundwater volume, flow and quality impacts of the presence of an inundated final void (where relevant) on identified receptors specifically considering those environmental systems that are likely to be groundwater dependent; • An outline of the measures to be put In place to ensure that sufficient resources are available to implement the proposed rehabilitation; and • The measures that would be established for the long-term protection of local and regional aquifer systems and for the ongoing management of the site following the cessation of the project.	Section 2.13 and Appendix A
Roads and Maritime Services	Roads and Maritime would like the following issues to be included in the transport and traffic impact assessment of the proposed development: • The total impact of existing and proposed development on the state road network with consideration for a 10 year horizon.	Section 5.6 and Appendix G

Agency	Issues raised	Location in EIS
	• The volume and distribution of traffic generated • Intersection sight distances at key intersections along the primary haulage route • Existing and proposed access conditions • Details of improvements for road intersections with consideration for the current Austroads Guidelines, particularly; – The intersection of Tullymorgan- Jackybulbin Road with the Pacific Highway. • Detail of servicing and parking arrangements • Traffic Management for construction and operational phases of the proposed development • Impact on public transport (public and school bus routes) and consideration for alternative transport modes, eg. cyclists and pedestrians • Impacts of road traffic noise and dust generated along the primary haulage route. • Consideration for Clause 16(1) of the MPEI SEPP regarding; – Impact on School Zones and Residential areas. – Truck Management Plan – Code of Conduct for Haulage Operators – Road Safety Assessment of key haulage routes	
	Where any road safety assessment of the key haulage routes identifies potential safety concerns, Roads and Maritime recommends that the traffic impact assessment be supported by a road safety audit undertaken by suitably qualified persons	
	The current Austroads Guidelines, Australian Standards and Roads and Maritime Services supplements are to be adopted for any proposed works on the classified road network. The Developer would be required to enter into a 'Works Authorisation Deed' (WAD) with Roads and Maritime for any works deemed necessary on the Pacific Highway. The developer would be responsible for all costs associated with the works and administration for the WAD.	
Office of Environment and Heritage	**Environmental impacts of the project** Impacts related to the following environmental issues need to be assessed, quantified and reported on: • Aboriginal cultural heritage • Historic heritage • Biodiversity • OEH Estate - Land reserved or acquired under the NPW Act	

Agency	Issues raised	Location in EIS
	• Water and Soils - Acid sulfate soils, Flooding and coastal erosion, Water quality EIS should address the specific requirements outlined under each heading below and assess impacts in accordance with the relevant guidelines mentioned. A full list of guidelines is at Attachment	
	<u>Aboriginal cultural heritage</u> The EIS report should contain: • A description of the Aboriginal objects and declared Aboriginal places located within the area of the proposed development. • A description of the cultural heritage values, including the significance of the Aboriginal objects and declared Aboriginal places , that exist across the whole area that will be affected by the proposed development, and the significance of these values for the Aboriginal people who have a cultural association with the land. • A description of how the requirements for consultation with Aboriginal people as specified in clause SOC of the National Parks and Wildlife Regulation 2009 have been met. • The views of those Aboriginal people regarding the likely impact of the proposed development on their cultural heritage. If any submissions have been received as a part of the consultation requirements, then the report must include a copy of each submission and your response. • A description of the actual or likely harm posed to the Aboriginal objects or declared Aboriginal places from the proposed activity, with reference to the cultural heritage values identified. • A description of any practical measures that may be taken to protect and conserve those Aboriginal objects or declared Aboriginal places. • A description of any practical measures that may be taken to avoid or mitigate any actual or likely harm, alternatives to harm or, if this is not possible, to manage (minimise) harm. • A specific Statement of Commitment that the proponent will complete an Aboriginal Site Impact Recording Form and submit it to the Aboriginal Heritage Information Management System (AHIMS) Registrar, for each AHIMS site that is harmed through the proposed development. In addressing these requirements, the proponent must refer to the following documents: • *Draft Guidelines for Aboriginal Cultural Heritage Impact Assessment and Community Consultation* (Department of Planning, 2005). These guidelines identify the factors to be considered in Aboriginal cultural heritage assessments for	Appendix H

Agency	Issues raised	Location in EIS
	development proposals under Part 3A of the EP&A Act. • *Aboriginal Cultural Heritage Consultation Requirements for Proponents 2010* (DECCW, 2010). This document further explains the consultation requirements that are set out in clause SOC of the NPW Regulation 2009. The process set out in this document must be followed and documented in the EIS • *Code of Practice for the Archaeological Investigation of Aboriginal Objects in New South Wales* (DECCW, 2010)	
	<u>Biodiversity</u> • The EIS report should include a detailed biodiversity assessment, including assessment of impacts on threatened biodiversity, native vegetation and habitat. This assessment should address the matters included in the following sections. • A field survey of the site should be conducted and documented in accordance with relevant guidelines , including: the *Threatened Species Survey and Assessment Guidelines: Field Survey Methods for Fauna -Amphibians* (DECCW, 2009) *Threatened Biodiversity y Survey and Assessment : Guidelines for Developments and Activities - Working Draft* (DEC , 2004), and *Threatened species survey and assessment guideline information on* www .environment.nsw .gov.au • If a proposed survey methodology is likely to vary significantly from the above methods, the proponent should discuss the proposed methodology with OEH prior to undertaking the EA, to determine whether OEH considers that it is appropriate. • Recent (less than five years old) surveys and assessments may be used. However, previous surveys should not be used if they have: – been undertaken in seasons, weather conditions or following extensive disturbance events when the subject species are unlikely to be detected or present – utilised methodologies, survey sampling intensities, timeframes or baits that are not the most appropriate for detecting the target subject species • unless these differences can be clearly demonstrated to have had an insignificant impact upon the outcomes of the surveys. If a previous survey is used, any additional species listed under the TSC Act since the previous survey took place, must be surveyed for. Determining the list of potential threatened species for the site must be done in accordance with the *Threatened Biodiversity Survey and Assessment: Guidelines for Developments and Activities - Working Draft* (DEC, 2004) and the *Guidelines for Threatened Species Assessment* (Department of Planning 2005). The OEH Threatened Species website and the Atlas of NSW Wildlife database must be	Appendix F

Agency	Issues raised	Location in EIS
	the primary information sources for the list of threatened species present. The BioBanking Threatened Species Database, the Vegetation Types databases and other data sources (e.g. PlantNET, Online Zoological Collections of Australian Museums, previous or nearby surveys etc.) may also be used to compile the list. • The EIS should contain the following information as a minimum: – The requirements set out in the Guidelines for Threatened Species Assessment (Department of Planning 2005). – Description and geo-referenced mapping of study area (and spatial data files), e.g. overlays on topographic maps, satellite images and /or aerial photos, including details of map datum, projection and zone, all survey locations, vegetation communities (including classification and methodology used to classify), key habitat features and reported locations of threatened species, populations and ecological communities present in the subject site and study area. – Description of survey methodologies used, including timing, location and weather conditions. – Details, including qualifications and experience of all staff undertaking the surveys, mapping and assessment of impacts as part of the EA. – Identification of national and state listed threatened biota known or likely to – occur in the study area and their conservation status. – Description of the likely impacts of the proposal on biodiversity and wildlife corridors, including direct and indirect and construction and operation impacts. Wherever possible, quantify these impacts such as the amount of each vegetation community or species habitat to be cleared or impacted, or any fragmentation of a wildlife corridor. – Identification of the avoidance, mitigation and management measures that will be put in place as part of the proposal to avoid or minimise impacts, including details about alternative options considered and how long term management arrangements will be guaranteed. – Description of the residual impacts of the proposal. If the proposal cannot adequately avoid or mitigate impacts on biodiversity, then a biodiversity offset package is expected. – Provision of specific Statement of Commitments relating to biodiversity. • An assessment of the significance of direct and indirect impacts of the proposal must be undertaken for threatened biodiversity known or considered likely to occur in the study area based on	

Agency	Issues raised	Location in EIS
	the presence of suitable habitat. This assessment must take into account: – the factors identified in s.5A of the EP&A Act, and – the guidance provided by *The Threatened Species Assessment Guideline - The Assessment of Significance* (DECCW, 2007) • OEH recommends that the SEARs address the offsetting principles and policy as set out below. This requires the use of the Biobanking Assessment Methodology (BBAM) to assess biodiversity impacts arising from the proposal. The NSW Government is currently developing a new whole of government draft Biodiversity Offsets Policy for Major Projects which will be used in assessing impacts to biodiversity and determining acceptable offsets for state significant development and state significant infrastructure projects. This policy has been recently publicly exhibited and submissions are now being considered. In the interim, the following advice is provided.	
	<u>Biodiversity Offsetting Principles</u> Projects must avoid and minimise impacts and offset any remaining impacts in accordance with the following seven offsetting principles: – Before offsets are considered, impacts must first be avoided and unavoidable impacts minimised through mitigation measures. Only then should offsets be considered for the remaining impacts. – Offset requirements should be based on a reliable and transparent assessment of losses and gains. – Offsets must be targeted to the biodiversity values being lost or to higher conservation priorities. – Offsets must be additional to other legal requirements. – Offsets must be enduring, enforceable and auditable. – Supplementary measures can be used in lieu of offsets. – Offsets can be discounted where significant social and economic benefits accrue to NSW as a consequence of the proposal. • During this transitional phase OEH is willing to provide assistance to applicants to ensure they meet their offsetting obligations. • Where appropriate, likely impacts (both direct and indirect) on any adjoining and/or nearby OEH estate reserved under the NPW Act or any marine and estuarine protected areas under the FM Act or the Marine Parks Act 1997 should be considered. Refer to the Guidelines for developments adjoining land and water managed by the Department of Environment, Climate Change and Water (DECC, 2010).	Appendix F

Agency	Issues raised	Location in EIS
	• With regard to the EPBC Act, the assessment should identify any relevant MNES and whether the proposal has been referred to the Commonwealth or already determined to be a controlled action	
	<u>Historical Heritage</u> The EIS report should address the following: • The heritage significance of the site and any impacts the development may have upon this significance should be assessed. This assessment should include natural areas and places of Aboriginal, historic or archaeological significance. It should also include a consideration of wider heritage impacts in the area surrounding the site. • The Heritage Council maintains the State Heritage Inventory which lists some items protected under the *Heritage Act 1977* and other statutory instruments. In addition, lists maintained by the National Trust, any heritage listed under the Australian Government's EPBC Act and the local council should be consulted in order to identify any known items of heritage significance in the area affected by the proposal. These lists are constantly evolving and items with potential heritage significance may not yet be listed • Non-Aboriginal heritage items within the area affected by the proposal should be identified by field survey. This should include any buildings, works, relics (including relics underwater), gardens, landscapes, views, trees or places of non-Aboriginal heritage significance. A statement of significance and an assessment of the impact of the proposal on the heritage significance of these items should be undertaken. Any policies/measures to conserve their heritage significance should be identified. This assessment should be undertaken in accordance with the guidelines in the NSW Heritage Manual. The field survey and assessment should be undertaken by a qualified practitioner/consultant with historic sites experience.	Appendix H
	Water and Soils <u>Acid sulfate soils</u> • The potential impacts of the development on acid sulfate soils must be assessed in accordance with the relevant guidelines in the *Acid Sulfate Soils Manual* (Stone et al. 1998) and the *Acid Sulfate Soils Laboratory Methods Guidelines* (Ahern et al. 2004). • Describe mitigation and management options that will be used to prevent, control, abate or minimise potential impacts from the disturbance of acid sulfate soils associated with the project and to reduce risks to human health and prevent the degradation of	Section 5.1

Agency	Issues raised	Location in EIS
	the environment. This should include an assessment of the effectiveness and reliability of the measures and any residual impacts after these measures are implemented.	
	<u>Flooding and coastal erosion</u> The EIS should include an assessment of the following referring to the relevant guidelines in Attachment 2: • The potential effect of coastal processes and coastal hazards including potential impacts of climate change such as sea level rise: – on the proposed development; and – arising from the proposed development. • Whether the proposal is consistent with any coastal zone management plans. • Whether the proposal is consistent with any floodplain risk management plans. • Whether the proposal is compatible with the flood hazard of the land. • Whether the proposal will significantly adversely affect flood behaviour resulting in detrimental increases in the potential flood affectation of other development or properties. • Whether the proposal will significantly adversely affect the environment or cause avoidable erosion, siltation, destruction of riparian vegetation or a reduction in the stability of river banks or watercourses. • Whether the proposal incorporates appropriate measures to manage risk to life from flood. • Whether the proposal is likely to result in unsustainable social and economic costs to the community as a consequence of flooding. The EIS should take into account the considerations set out in the *NSW Government Floodplain Development Manual*. The implications of flooding over the full range of potential flooding, including the probable maximum flood , should be considered	Section 5.2 and Appendix C
	<u>Water</u> Describe Proposal • Describe the proposal including position of any intakes and discharges, volumes, water quality and frequency of all water discharges. • Demonstrate that all practical options to avoid discharge have been implemented and environmental impact minimised where discharge is necessary.	

Agency	Issues raised	Location in EIS
	• Where relevant include a water balance for the development including water requirements (quantity, quality and source(s)) and proposed storm and wastewater disposal, including type, volumes, proposed treatment and management methods and re-use options. Background Conditions: • Describe existing surface and groundwater quality. An assessment needs to be undertaken for any water resource likely to be affected by the proposal. • State the Water Quality Objectives for the receiving waters relevant to the proposal. These refer to the community's agreed environmental values and human uses endorsed by the NSW Government as goals for ambient waters. Where groundwater may be impacted the assessment should identify appropriate groundwater environmental values. • State the indicators and associated trigger values or criteria for the identified environmental values. This information should be sourced from the ANZECC (2000) Guidelines for Fresh and Marine Water Quality. • State any locally specific objectives , criteria or targets which have been endorsed by the NSW Government Impact Assessment: • Describe the nature and degree of impact that any proposed discharges will have on the receiving environment. • Assess impacts against the relevant ambient water quality outcomes. Demonstrate how the proposal will be designed and operated to: – protect the Water Quality Objectives for receiving waters where they are currently being achieved – contribute towards achievement of the Water Quality Objectives over time where they are not currently being achieved • Where a discharge is proposed that includes a mixing zone, the proposal should demonstrate how wastewater discharged to waterways will ensure the ANZECC (2000) water quality criteria for relevant chemical and non-chemical parameters are met at the edge of the initial mixing zone of the discharge, and that any impacts in the initial mixing zone are demonstrated to be reversible. • Assess impacts on groundwater and GDEs • Describe how stormwater will be managed both during and after construction. The EIS needs to identify all site drainage, stormwater quality devices and erosion/sedimentation control measures. The EIS should also detail the onsite treatment of	

Agency	Issues raised	Location in EIS
	stormwater and effluent runoff and predicted stormwater discharge quality from the development Monitoring • Describe how predicted impacts will be monitored and assessed over time	
Heritage Council	**The EIS should contain the following:** • The heritage significance of the site and any impacts the development may have upon this significance should be assessed. This assessment should include natural areas and places of Aboriginal, historic or archaeological significance. It should also include a consideration of wider heritage impacts in the area surrounding the site. • The Heritage Council maintains the State Heritage Inventory which lists some items protected under the *Heritage Act, 1977* and other statutory instruments. • In addition, you should consult lists maintained by the National Trust, any heritage listed under the EPBC Act and the local council in order to identify any identified items of heritage significance in the area affected by the proposal. • Non-Aboriginal heritage items within the area affected by the proposal should be identified by field survey. This should include any buildings, works, relics (including relics underwater), gardens, landscapes, views, trees or places of non-Aboriginal heritage significance. A statement of significance and an assessment of the impact of the proposal on the heritage significance of these items should be undertaken. Any policies/measures to conserve their heritage significance should be identified. This assessment should be undertaken in accordance with the guidelines in the NSW Heritage Manual. The field survey and assessment should be undertaken by a qualified practitioner/consultant with historic sites experience. The proposal should have regard to any impacts on places, items or relics of significance to Aboriginal people. Where it is likely that the project will impact on Aboriginal heritage, adequate community consultation should take place regarding the assessment of significance, likely impacts and management/mitigation measures.	Appendix H
Clarence Valley Council	**Planning** • The quarry is in existence and has approval to operate over three areas on the land (sites A, B and C) to a capacity of 100,000 tonne per annum (DA1977/111). At a recent pre-lodgement meeting, the owners advised that they have an EPA	Section 1.2 and Section 5

Agency	Issues raised	Location in EIS

licence to extract up to 500,000 tonne per annum (Council has not sighted that licence).

- It is noted that a planning proposal to allow an explosives depot is also proposed (by a separate applicant) on the same lot as the quarry extraction.
  - The quarry area has considerable separation from the area of lot sought be used for the explosives depot, which is still subject to the planning proposal/rezoning process. The explosives depot is not part of the sandstone quarry and has no operational relationship to the quarry. The company intending to operate the explosives depot provides blasting services to many other quarries in the Northern Rivers area, including the subject quarry. This process has been delayed pending resolution by the proponent of post-exhibition issues
  - We note that the PEA document acknowledges the planning proposal/rezoning process for the proposed explosives depot. We request that any proposal for expansion of the extractive area consider the explosives depot proposal and note any conflicts or impacts.
  - In particular, the proposed explosives depot intends to utilise the existing quarry entrance and internal quarry access road to the existing quarry site office & weighbridge, and the existing track west from that point to quarry site C being the chosen site for the proposed explosives depot. Assuming the expanded quarry will use the existing quarry entrance and internal quarry roads, it is considered that an EIS for the expanded quarry should address access arrangements for both enterprises and associated traffic management arrangements see further comment under 'engineering' below).
  - It should be noted that the site is covered by the Bushfire Prone Land Overlay and is referrable to the NSW Rural Fire Service as Integrated Development.
- The effects on the existing water course should be addressed in any application, as well as proposals for remediation of the site post development.
- If Council were assessing the application, Section 94 contributions would apply to any approval. The calculation used is as per the table below, and we ask that this requirement be kept in mind when the application is decided.

Clarence Valley Contributions Plan 2011 Section 94A Levy Rates for Development	
Development Type*	Levy Rate
Proposed cost of carrying out the development is up to and	Nil

Agency	Issues raised	Location in EIS
	<table><tr><td>Proposed cost of carrying out the development is more than $100,000 and up to and including</td><td>$ (Value of Development) x 0.005 =</td></tr><tr><td>Proposed cost of carrying out the development is more than More than $200,000</td><td>$ (Value of Development) x 0.01 = $</td></tr></table> There is also a Section 94 Plan specific to maintenance of quarry roads for this area. Details can be provided to the Director General at a later date	
	Engineering • A Traffic Impact Assessment and Road Safety Audit should be provided that lists a number of relevant issues. This would consider the intersection servicing the quarry site off Tullymorgan-Jackybulbin Road, and Tullymorgan- Jackybulbin Road and the intersection with the Pacific Highway. The report should include an assessment of; – Conflict/potential for conflict between the quarry operation and the proposed explosives depot (should it be approved); i.e., traffic movements (as mentioned above); and – The suitability of internal access roads including widths, drainage and pavement to safely accommodate both activities. • A stormwater management plan should be included.	
	Building From the documents submitted there doesn't appear to be any buildings proposed to be constructed on the site so no Construction Certificates will be required. However, if buildings are proposed for site management, etc, the location of those structures should be included on the plans. If employees/contractors are based on the site then appropriate sanitary facilities and associated waste water management facilities will need to be provided on site for their use. This should be addressed.	
	Environmental Health Council's Environmental health section has requested that the following matters be fully addressed: • Noise issues - noise will be a major consideration. Noise from drilling, blasting, trucks, crushing, transport and machinery etc • Air quality - dust emissions • Surface water run off • Ground water impacts and monitoring • Vibrations from processes • Sediment and erosions controls - during building phase and	

Agency	Issues raised	Location in EIS
	ongoing during operation • Trade waste and adequate environmental management of commercial operation by- products, such as fuel storage, oils Correct waste management procedures from persons on site, also from unwanted commercial by-products etc.	

4.3 Community consultation

A program of community consultation was developed and implemented, focused on landowners and occupiers likely to be impacted by the proposed development, as well as any local community group that may exist and are relevant.

The location of the quarry is relatively isolated, so large scale community consultation was considered unnecessary. The two neighbours to the east and the nearest neighbour to the west have been consulted. During the consultation, the residents were shown a copy of the plans for proposed quarry, a description of the proposal and the preliminary results of the detailed assessments.

The only concern raised was the increase in the number of trucks, the speed of the trucks and the maintenance of Tullymorgan-Jackybulbin Road. The neighbour to the west did not want to complete the Community Consultation Record because they were tenants. They did not raise any concerns regarding the proposal.

Newman Quarrying have had informal discussions with most of the immediate neighbours to the quarry over the past couple of months. The neighbours have not raised any concerns regarding the proposal.

The Jackybulbin Progress Association have existed in the past and have raised concerns regarding the quarry but we understand the association no longer exists.

5. Environmental assessment

5.1 Land resources

5.1.1 Introduction

This section provides a description of the landform, geology, soils and land use of the site. The descriptions were based on existing information. The predicted impacts were identified with mitigation measures identified to minimise or avoid these impacts.

5.1.2 Existing conditions

Landform

The area surrounding the quarry is undulating with an elevation ranging from approximately 40 m AHD (near Tullymorgan-Jackybulbin Road) to approximately 229 m AHD at the peak of Mount Doubleduke outside the northern boundary of the quarry site.

The quarry site is located on a generally south-facing slope with Mt Doubleduke lying to the north of the existing quarry. The land slopes south, with the Pacific Highway to the east. The quarry site drains from north to south via a number of intermittent waterways. The existing quarry has altered the natural topography by excavating the centre of the site to form an amphitheatre shape. The current floor of the quarry is approximately 44 m AHD with a second level to the east at approximately 58 m AHD. The centre of the existing quarry has active faces to the north, east and west ranging up to approximately 20 m in height.

Geology and soils

Reference to the local and regional geological maps (DMR, 1971) indicates the site is located in the foothills of the Richmond Range. The geology of the area is 'Kangaroo Creek' sandstone formations, which are believed to date from the mid-to-late Jurassic or possibly mid-to-late Cretaceous periods. The area has a variety of arenaceous rock types and several, very minor, lithologically distinct interbeds. The sandstone ranges from medium grained to coarse-grained. The former tends to have a pale pinkish colour and is distinctly cross-bedded. The majority of beds are less than 1m in thickness. In contrast, there are several prominent beds of the coarser sandstone between 2 and 3m thick. The general colour of the coarse-grained sandstone is medium to light-grey.

Separating the beds are thin layers of fine sandstone, siltstone and carbonaceous material.

The existing quarry produces both solid and blended crushed sandstone products that can be used in a variety of engineering and construction applications.

The area generally has poor soils of sandy composition, mostly derived from the underlying sandstone. In lower-lying areas soils may be derived from stream deposition.

CVC mapping indicates the site does not contain acid sulfate soils.

Land use

An assessment of the surrounding land uses has been undertaken in accordance with Clause 12 of the SEPP Mining, Petroleum Production and Extractive Industries 2007.

As shown by Figure 3-1, the site and surrounding area is zoned RU2 Rural Landscape, RU3 Forestry and E3 Environmental Management. The area immediately surrounding the quarry is heavily vegetated, with rural-residential properties to the west, south and east. The Pacific Highway is 2.6 km to the east of the site, whilst the adjoining areas to the south, west and north are heavily vegetated. The site has been operated as a quarry since the 1950's and the proposed site is dominated by the excavation from previous quarrying.

Some of the adjacent lots are large enough to be eligible for a dwelling or subdivision because they are over the minimum lot size of 40 hectares. Consultation with CVC revealed that there are no current or pending approvals for a dwelling or subdivision in the area.

5.1.3 Potential impacts

The proposed quarry would change the topography of the site, and may limit future land use options following closure and rehabilitation.

The proposal would increase the area of the current excavation by approximately 10.9 hectares and to a depth of approximately 44 m AHD. The amphitheatre shape of the excavation would be consistent with the current conditions, although larger. The floor of the quarry would be level with the surrounding land, allowing for drainage.

Soil would be removed and stockpiled for use in the rehabilitation of the site. Erosion of the soil would also be a possible impact of the proposal, if not appropriately stored and protected. The removal of this material would expose the remaining rock to weathering and ultimately inundation with water but this is expected to only impact the surface of the rock.

The landform of the final quarry would allow drainage of the site. The benches of the quarry would be rehabilitated but it is unlikely that mature vegetation could be established for many years and only for species which could adapt to the quarry conditions. As the area is not actively logged or suitable for any other agricultural pursuit, this impact is not considered to be significant.

Although there is the potential for the subdivision of adjacent properties, due to their heavily vegetated condition, it is considered unlikely that there would be any development intensification in the area. Even if some development does occur, the quarry is about 300 m to 1km from the nearest boundary, which would provide sufficient buffer to mitigate any offsite impacts associated with the operation.

5.1.4 Mitigation measures

It is not possible or practical to avoid the impacts of a quarry on the landform, geology, soils or land use of the site. However, there are a number of measures that would be implemented to mitigate potential impacts, including:

- Extract the resource in stages to minimise the area of disturbance at any one time
- Remove soil and stockpile for use in the rehabilitation works
- Implement erosion and sediment controls in accordance with Managing Urban Stormwater Soils and Construction – Volume 2e Mines and quarries (DECC, 2008)
- Implement the rehabilitation plan in Appendix A.

5.2 Surface water and groundwater

5.2.1 Introduction

The impact of the proposed quarry on surface water and groundwater has been assessed in the *Surface and Groundwater Assessment* (GHD, 2015a) in Appendix C.

The scope of the assessment included:

- An assessment, review and description of the existing hydrological conditions, both related to surface and ground water.

- An assessment of potential surface and groundwater quantity/quality impacts associated with the proposed quarry, including an annual site water balance and water budget. In addition, local and regional flood conveyance matters were considered.
- Nomination of management measures to mitigate any potential impacts associated with the proposed quarry, which may arise.

A summary of the *Surface and Groundwater Assessment* (GHD, 2015a) is provided below.

5.2.2 Existing conditions

Surface water

The site is located within the Clarence River catchment with unnamed ephemeral drainage lines flowing in a southwest direction to Tabbimoble Creek. Tabbimoble Creek drains via the Bundjalung National Park marshes to the Clarence River near Iluka. A SEPP 14 Coastal Wetland No. 153a is located on Tabbimoble Creek, about 1 km to the east of the Pacific Highway.. The Woolgoolga to Ballina Pacific Highway Upgrade EIS (RMS, 2014) determined that Tabbimoble Creek is key fish habitat with the potential for threatened species habitat, although it has not been mapped as such or found (through field survey) to contain Oxleyan Pygmy Perch.

The ephemeral drainage lines in the vicinity of the site are diverted around the works area and bypass the site sediment basins, discharging to Tabbimoble Creek under Tullymorgan-Jackybulbin Road.

Within the works area, the pit floor and stockpiled areas discharge to an initial sediment pond (approx.. 2.4 ML), this overflows to the main sediment basin (7m deep, appox.12.6 ML). The main sediment basin is the discharge point from the site. The site office, weighbridges, wash plant and other outbuildings along the site discharge to three smaller sediment basins (total approx. 0.55 ML). These basins discharge to the main sediment basin.

Limited water quality information is available, however RMS (2014) notes that existing data indicates that the majority of the waterways in the area have a history of water quality problems, with conditions commonly found to be below the standards required for protection of aquatic ecosystems. The occurrence of poor water quality can be attributed to a number of factors, including modification of channel structure, macrophyte and weed growth, soil erosion, acid sulfate soils and nutrient enrichment as a result of runoff from agricultural land. Samples taken from Tabbimoble Creek in 2009 failed to meet the ANZECC guidelines for electrical conductivity and dissolved oxygen (RTA, 2010). Furthermore, Tabbimoble Creek was found to have high concentrations of aluminium, which could be a result of aluminium leaching from soils due to the effects of acid sulfate soils.

Some grab samples were collected as part of the EPL requirements of the existing quarry operation. The samples were collected from the main sediment basin and analysed at Environmental Analysis Laboratory, Southern Cross University. The results are presented in Table 5-1 along with the ANZECC (2000) guidelines for upland rivers and the preceding 48 hours of rainfall. This shows the water quality is fresh, with neutral pH and low to moderate suspended solids.

Table 5-1 Water quality results

Parameter	ANZECC	18/04/2013	20/06/2014	21/08/2014
Prior 48 hour rainfall (mm)*		2.2	4.4	4.6
pH	6.5-7.5	6.89	7.3	7.0
Total Suspended Solids (mg/L)	50*	28	14	18
Turbidity (NTU)	2-25			25
Electrical Conductivity (µS/m)	30-350			740
Oil & Grease	Not visible*			<2

* * BOM New Italy Station 58097
http://www.bom.gov.au/jsp/ncc/cdio/weatherData/av?p_nccObsCode=136&p_display_type=dailyDataFile&p_startYear=2013&p_c=-675071962&p_stn_num=058097

** EPL Requirements

Groundwater

The primary aquifers in the vicinity of the site are the Quaternary alluvial / colluvial groundwater source and the porous and fractured rock groundwater source.

The alluvial/colluvial groundwater source in the site forms a shallow, unconfined aquifer with reported thickness up to 17 metres to the east of the site.

Bores located to the east of the site within the alluvial groundwater source indicate that depth to groundwater is in the order of 2 m below ground level (bgl). This suggests the groundwater elevation in the alluvial aquifer is approximately 23 m AHD. These bores are located down gradient of the site and therefore alluvial / colluvial groundwater would be anticipated to be slightly higher in the vicinity of the site.

Porous and fractured rock aquifer underlies the alluvial/colluvial aquifer and outcrops across the site. Groundwater levels in the porous and fractured groundwater source in the vicinity of the site are expected to be slightly greater than 0 m AHD.

The level of extraction in the existing quarry pit has reached a level of 44 m AHD and the quarry has reportedly remained free from groundwater inflows. This indicates that the water table is below a level of 44 m AHD.

A summary of groundwater monitoring results is shown in Table 5-2. The results suggest the groundwater has a neutral pH and is relatively fresh.

Table 5-2 Groundwater monitoring results

Date	pH	EC (µS/cm)
8/10/2014	7.4	591

A search of the NSW Groundwater Bore Database was undertaken to identify registered bores within a 5 km radius of the site. The search identified six bores, with three bores being registered as domestic stock or stock, two bores registered as monitoring bores and one bore registered for oil exploration.

The potential GDEs within the vicinity of the site have been mapped in the GDE Atlas (BOM, 2014). Potential GDEs in the vicinity of the site include the following vegetation communities:

- Northern Open Grassy Blackbutt
- Coastal Range Bloodwood-Mahogany
- Paperbark
- Narrowleaved White Mahogany - Red Mahogany - Grey Ironbark - Grey Gum
- Needlebark Stringybark
- Foothill Grey Gum-Ironbark-Spotted Gum
- Swamp Oak
- Grey Gum - Grey Ironbark - White Mahogany
- Blackbutt - Spotted Gum
- Blackbutt - Bloodwood / Apple
- Scribbly Gum – Bloodwood
- Lowlands Scribbly Gum
- Stringybark – Bloodwood
- Clarence Lowlands Spotted Gum
- Lowland Red Gum winter flowering

5.2.3 Potential impacts

Surface water

The proposed quarry expansion could potentially have impacts on surface water:

- The proposed works would alter the local topography at the site, which would affect the drainage of surface water. It is likely that surface water from beyond the proposed works area would be diverted around the works, which could lead to a concentration and discharge of flows rather than distributed discharges. The impact of this could be increased risk of erosion and sedimentation if not adequately managed.
- Day to day operations would require the handling of chemicals or hydrocarbons, and other contaminates. If management practices are not adequately implemented, then risk of accidental spillage with potential contamination of surface water could exist.
- The proposed operation would potentially expose a larger proportion of rock areas and other impervious areas compared with the existing site. This could lead to increased runoff volumes during rain events and larger runoff peaks during storm events.
- Surface water quantity has been assessed for the existing and developed scenarios. The proposed increase in sediment basin volume is expected to adequately manage the increased runoff from the expanded quarry footprint, resulting in marginally less flow being discharged from the site on an annual basis. The volume of water captured by the sediment basins is expected to be more than sufficient to meet the water demand of the site.
- Surface water quality has been assessed for both the existing and developed scenarios. The results indicate that the mean concentrations are unlikely to change substantially. The downstream sediment basin appears adequately to treat TSS runoff from the site for

both the existing and developed cases, with the TSS discharge from the site remaining below the trigger values outlined in the current EPL for the site.

- TP and TN mean concentrations appear to exceed the ANZECC trigger values under both the existing and developed cases., however it is noted that water quality results for this area documented in the Woolgoolga to Ballina Pacific Highway Upgrade EIS indicate that the majority of the waterways tested (including Tabbimoble Creek) have a history of water quality problems, with conditions commonly found to be below the standards required for the protection of aquatic ecosystems. In addition, in considering the MUSIC model applicability to urban stormwater, it is argued that these values need to be treated with caution, when applied to a quarry operation. It is further noted that while the largest of the sediment basins has been modelled in MUSIC, other on-site treatment measures and management practices are likely to provide an additional level of control of site runoff above that considered in this MUSIC model assessment.

Groundwater

The proposed quarry would extract material to a level of 44 m AHD. As outlined, groundwater is expected to remain below this level. The project is not anticipated to intercept groundwater.

There would be no change to access routes, buildings or facilities as part of the project therefore it is assumed that there would be minimal impact on recharge due to any change in impervious area. There may be a slight increase in recharge in the fractured and porous aquifer due to removal of overlying rock strata.

As the project is not anticipated to intercept groundwater, the project will not require any groundwater licences under the *Water Act 1912.*

5.2.4 Mitigation measures

Surface water

- An EPL will be obtained for the quarry. All relevant conditions relating to soil and water management will be implemented as required by the licence.
- Where available, and of appropriate quality, the quarry operation will use recycled runoff for quarry activities.
- Erosion and sediment controls are to be implemented in accordance with *Managing Urban Stormwater Soils and Construction – Volume 2e Mines and quarries* (DECC, 2008)
- The volume of the existing sediment basin would need to be doubled.
- Designated, impervious bunded facilities will be provided for cleaning and/or maintenance of vehicles, plant or equipment. These facilities will be located at least 20 metres away from natural and built drainage lines.
- All chemicals and fuels associated with the quarry will be stored in roofed and bunded areas. Spill kits will be provided at all chemical storage facilities/compound sites and staff trained in their use.
- Where refuelling on site is required, the following management practices will be implemented:
  - Refuelling will be undertaken on level ground, within the designated refuelling areas with appropriate bunding and/or absorbent material, at least 20 metres from drainage lines, waterways and/or environmentally sensitive areas
  - Refuelling will be via a designated refuelling truck that is attended at all times

  - Spill kits will be readily available and personnel trained in their use. A spill kit will be kept on the refuelling truck at all times
  - Hand tools will be refuelled within lined trays of site vehicles wherever possible
  - An emergency spill kit (such as oil absorbent material) will be available on site at all times to contain and clean up any accidental hydrocarbon spills
  - Any contaminated material will be disposed at an appropriately licensed facility and used spill kit materials replaced
- Regular checks of vehicles working at the quarry will be conducted to ensure that no oils or fuels are leaking.
- Erosion and sediment controls will be inspected at least weekly (with maintenance and/or modifications made as necessary). Inspections and/or maintenance during wet-weather may be increased where necessary. All sediment basin discharge points will be clearly identified and access made available at all times for inspections or management. A typical monitoring program is provided in Table 5-3.

Table 5-3 Typical monitoring program

Aspect	Frequency	Details	Responsibility
Erosion and sediment controls	Following rain	Erosion and sediment controls are to be monitored following rain events and maintained, as required.	Site Manager
Sediment basin	Following rain	The volume of water in the sediment basin is to be monitored following rain.	Site Manager
Basin capacity	Following rain	The volume of sediment is to be monitored (e.g. via a permanent stake in the dam with a mark showing depth of sediment) and removed to maintain an 80% capacity.	Site Manager
Spill kit	Monthly	The spill kit is to be checked and any missing materials to be replaced.	Site Manager

Groundwater

It is proposed that a monitoring bore be constructed in the mapped alluvial aquifer to the south west of the proposed quarry footprint, in a similar location as the existing monitoring wells.

New and existing monitoring bores should be monitored quarterly throughout the life of the project for groundwater level, pH and electrical conductivity. Groundwater monitoring should be undertaken in general accordance with '*A Practical Guide for Groundwater Sampling*' (Jiwan & Gates, 1992).

All new and existing monitoring bores require licencing under Part 5 of the *Water Act 1912.*

5.3 Noise

5.3.1 Introduction

A *Noise Impact Assessment* (NIA) (GHD, 2015b) report was prepared to address the overall noise impacts from the proposed quarry. The scope of work for the NIA involved:

- Reviewing the surrounding study area to gain an understanding of local site features and the location and nature of potential sensitive receivers.

- Reviewing existing environmental studies, as applicable.
- Undertaking noise monitoring at two noise sensitive receiver locations indicative of the local ambient noise environment.
- Establishing project specific noise and vibration goals for the proposal with consideration to the following OEH publications
  - Industrial Noise Policy (OEH, 2000) (INP)
  - Road Noise Policy (OEH, 2011) (RNP)
- Reviewing site operations to identify principal noise sources during operation and their corresponding sound power levels.
- Undertaking two operational noise modelling scenarios using Computer Aided Noise Abatement (CadnaA) software to predict sound pressure levels emanating from the site based on current quarry configuration and after expansion. For each scenario, off-site noise levels resulting from typical extraction rate and peak extraction rate were investigated.
- Undertaking a desktop assessment of potential road traffic noise impacts from heavy vehicles entering/exiting the site on public roads.
- Providing noise mitigation measures, where exceedances are predicted.

A summary of the NIA is provided below and a copy of the NIA report is provided in Appendix D.

5.3.2 Existing conditions

Eleven potentially sensitive receivers in the vicinity of the quarry were identified from aerial imagery. Aerial imagery available did not clearly identify whether R3 and R6 are in fact residential receivers, but have been included in this assessment as a conservative measure.

The nearest identified sensitive receiver was located approximately 1.5 km from the quarry boundary.

Sensitive receivers identified in the vicinity of the site are detailed in Table 5-4. Figure 5-1 shows a site aerial image and the location of identified noise sensitive receivers. These receivers were identified to represent those with the greatest potential for adverse noise impact.

Table 5-4 Identified noise sensitive receivers

Receiver	Receiver type	Approximate distance to nearest boundary(m)
R1	Residential	1600
R2	Residential	1700
R3	Residential	1500
R4	Residential	2600
R5	Residential	2700
R6	Residential	2800
R7	Residential	3200
R8	Residential	3600
R9	Residential	3300
R10	Residential	3500
R11	Residential	3000

1. Distance measured to the nearest boundary of operations for stage 1 configuration

Existing noise environment

Background noise monitoring was undertaken by GHD at two locations between 13 November 2014 and 21 November 2014. Logger locations are shown in Figure 5-1.

Figure 5-1 Unattended logger locations

A summary of the attended noise monitoring results are provided in Table 5-5.

Table 5-5 Summary of attended noise monitoring results dB(A)

Monitoring location	Date	Measurement time		Measured noise levels dB(A)			Observations (instantaneous dB(A))
		Start	Stop	L_{Aeq}	L_{A90}	L_{A10}	
Logger 1	13/11/2014	12:22	12:37	50	42	51	• Quarry inaudible. • No audible industry noise • Pacific Hwy dominant noise source. • Birds and insects noted. • Three instances of quarry traffic passby noted, LAmax approximately 66 – 69 dB(A). Slight breeze SE-ESE, 23 degrees, cloudy.
Logger 2	21/11/2014	10:15	10:30	40	36	43	• Quarry inaudible. • No audible industry noise. • Mostly natural noise sources, wind in foliage, birds and insects. • Three instances of aircraft flyover noted. • Still to 2 m/s NE wind speed, 29 – 33 degrees, 3/8 cloud coverage.

5.3.3 Potential impacts

Noise criteria

Operational industrial noise criteria are derived from the NSW Industrial Noise Policy (INP). The INP rural residential category has been adopted for all identified receivers to determine the applicable amenity criteria.

Table 5-6 Project specific operational noise criteria – daytime dB(A)

Criterion	Logger 1 (Lot 100 Tullymorgan-Jackybulbin Rd)	Logger 2 (Funnels Rd)
Rating background level, LA90(Period)	40	29[1]
Intrusiveness criteria, LAeq(15min)	45	35
Amenity criteria (rural), LAeq(period)	50	50
Project specific criterion, LAeq (15min)	**45**	**35**

Note 1: The NSW INP notes that "where the rating background level is found to be less than 30 dB(A), then it is set to 30 dB(A).

Traffic on public roads

The quarry has the potential to create additional traffic noise on Tullymorgan-Jackybulbin Road.

Given the quarry access road is located on the site and is not a public road, noise from the access road is assessed under the INP.

The NSW *Road Noise Policy* (OEH, 2011) (RNP) provides non-mandatory road traffic noise target levels for land use developments with potential to create additional traffic on public roads.

Tullymorgan-Jackybulbin Road has been considered a local road. The road traffic noise target levels are presented in Table 5-7.

Table 5-7 RNP traffic noise target levels at residential receivers – dB(A)

Type of Development	Day (7 am – 10 pm)	Night (10 pm – 7 am)
Existing residences affected by additional traffic on existing local roads generated by land use developments.	$LAeq_{(1\ hour)}$ 55 (external)	$LAeq_{(1\ hour)}$ 50 (external)

Modelled Impacts

The following two operational scenarios have been modelled and assessed:

- **Scenario 1**: Proposed operations with current quarry shape (considered to represent a worst-case scenario as equipment would be most exposed to sensitive receivers).
- **Scenario 2**: Proposed operations with final quarry shape

For both Scenario 1 and Scenario 2, the noise impact of the quarry on surrounding receivers has been assessed at:

- Average daily production, which is expected to generate about 50 truck and dog loads (100 movements) per day.
- Peak daily production, which would require about 125 truck and dog loads (250 truck movements) per day.

The predicted noise levels for daytime site operations are shown in Table 5-8.

Table 5-8 Predicted operational noise levels

Sensitive Receiver	Noise criterion Leq dB(A)	Predicted noise level Leq dB(A)							
		Scenario 1 – Existing quarry configuration				Scenario 2 – Final quarry configuration			
		Average daily production without rock breaking	Average daily production with rock breaking	Peak daily production without rock breaking	Peak daily production with rock breaking	Average daily production without rock breaking	Average daily production with rock breaking	Peak daily production without rock breaking	Peak daily production with rock breaking
R1	45	26	26	28	28	26	26	28	29
R2	45	25	26	27	28	26	26	28	28
R3	35	32	33	34	35	30	31	32	33
R4	35	23	25	25	26	21	22	23	24
R5	35	23	24	25	25	20	21	22	23
R6	35	22	23	24	25	20	21	22	23
R7	35	21	22	22	23	18	19	21	21
R8	35	19	20	21	22	17	18	19	20
R9	35	20	21	22	23	18	18	20	21
R10	35	20	21	21	22	17	18	19	20
R11	35	21	22	23	24	19	20	21	22

Model results indicate that noise levels generated from quarry operations are predicted to comply with the INP daytime noise criteria at all sensitive receivers. It is noted that off-site noise levels at R3 are close to the criteria, and the use of the rock hammer during peak daily production may cause an exceedance depending on the location of equipment.

Predictions under Scenario 2 indicate that the changing the quarry shape will make little difference to the receiver levels.

This assessment is considered conservative as it has not considered the potential screening benefits of equipment operating behind stockpiles.

It should be noted that the noise modelling is based on worst case operating conditions with conservative assumptions regarding site operations and equipment sound power levels. This conservative approach is likely to result in predicted operational noise levels being slightly higher than actual noise levels.

Figure 5-2 to Figure 5-3 shows the predicted operational noise contour plots for Scenario 1 and Scenario 2 at peak production with rock hammering (i.e. the worst case scenario).

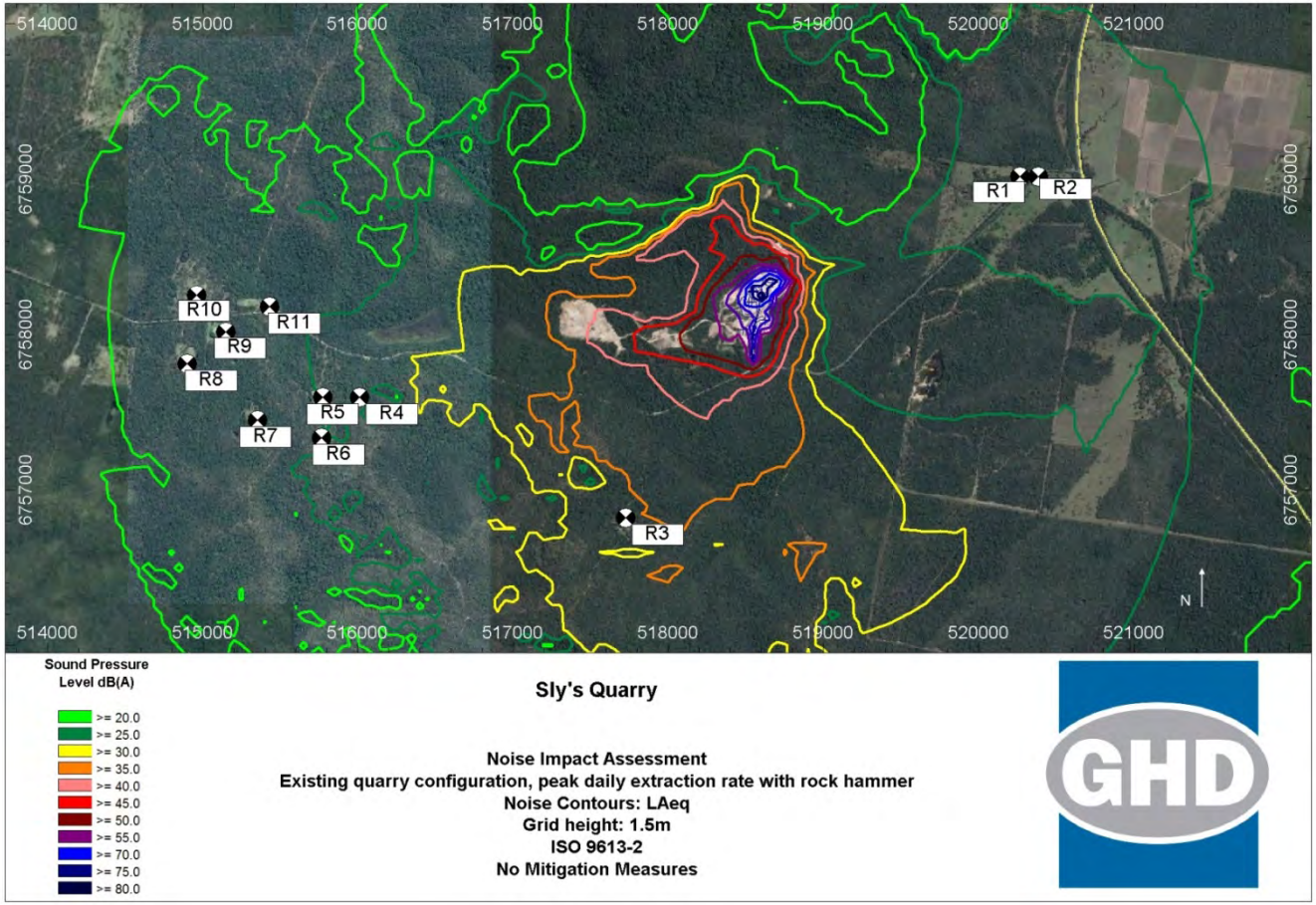


Figure 5-2 Predicted operational noise levels – Scenario 1 (existing quarry configuration) – Peak daily production with rock hammer

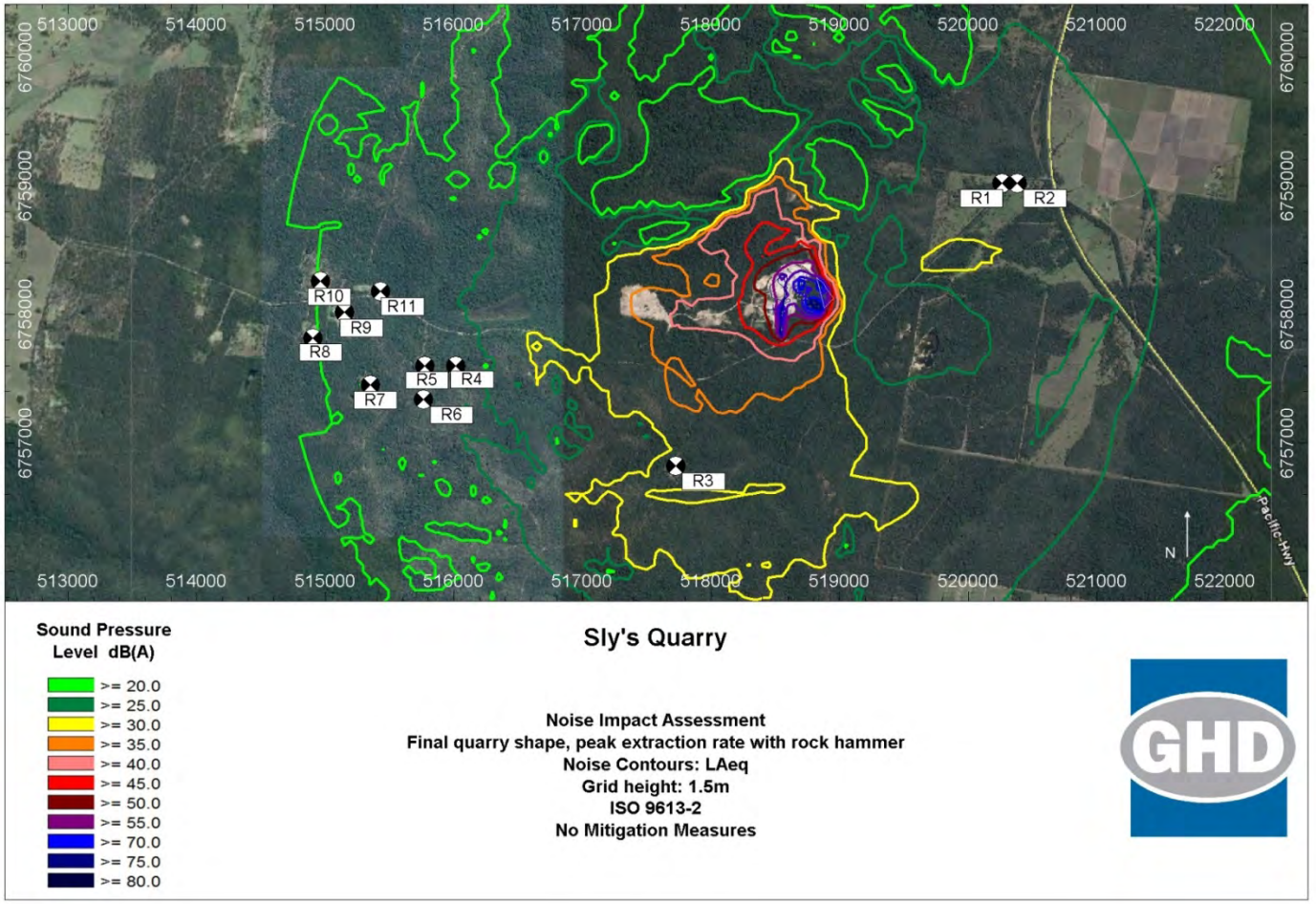


Figure 5-3 Predicted operational noise levels – Scenario 2 – Peak daily production with rock hammer

Traffic noise

Table 5-9 summarises the predicted road traffic noise level for when the quarry is operating at peak daily production, and compares the predicted levels against the RNP criteria.

Table 5-9 Predicted road traffic noise level during peak daily production

Roadway	Generated heavy vehicle movements per day (average daily production)	Generated heavy vehicle movements per day (peak daily production)	RNP criteria Day (7 am – 10 pm)	Predicted road noise level	
				Average daily production $LAeq_{(1\ hour)}$ dB(A)	Peak daily production $LAeq_{(1\ hour)}$ dB(A)
Jackybulbin Rd	100 (50 loads)	250 (125 loads)	$LAeq_{(1\ hour)}$ 55 (external)	49	52

1. Predicted results have received a 2.5 dB(A) façade correction

Table 5-9 shows that road traffic noise along Tullymorgan-Jackybulbin Road during peak daily production is expected to comply with the RNP criteria.

However, the increase in heavy vehicle traffic is expected to be noticeable to receivers R1 and R2, and have the potential to generate annoyance. In particular, bumps, pot holes or other irregularities in the roadway can cause short-term increased noise during vehicle passbys.

Blast criteria

The ANZECC *Guidelines to Minimise Annoyance due to Blasting Overpressure and Ground Vibration* has been adopted for assessment of blasting noise and vibration impacts in this report. This guideline specifies recommended human comfort criteria for blasting activities.

The ANZECC recommended maximum level for airblast overpressure is 115 dB(L) peak. This level may be exceeded on up to 5% of the total number of blasts over a period of 12 months. However, the airblast overpressure must not exceed 120 dB(L) peak for any blast.

Ground-borne vibration level should not exceed 5 mm/sec Peak Particle Velocity (PPV). The recommended PPV level may be exceeded by up to 5% of the total number of blasts over a period of 12 months. However, the level should not exceed 10 mm/sec at any time.

Blast monitoring

Blast monitoring was conducted during a blast event at Sly's Quarry on the 13 November 2014. The aim of the monitoring was to measure ground vibration and overpressure results during a typical blast event and determine site constants for the area which can be used for blast predictions.

Blast monitoring was conducted by GHD at one location in the vicinity of residential sensitive receptor R2 during the blast event and supplemented with monitoring conducted by the blasting contractor. The blasting contractor recorded overpressure and ground vibration levels at two locations as shown on Figure 5-4 below.

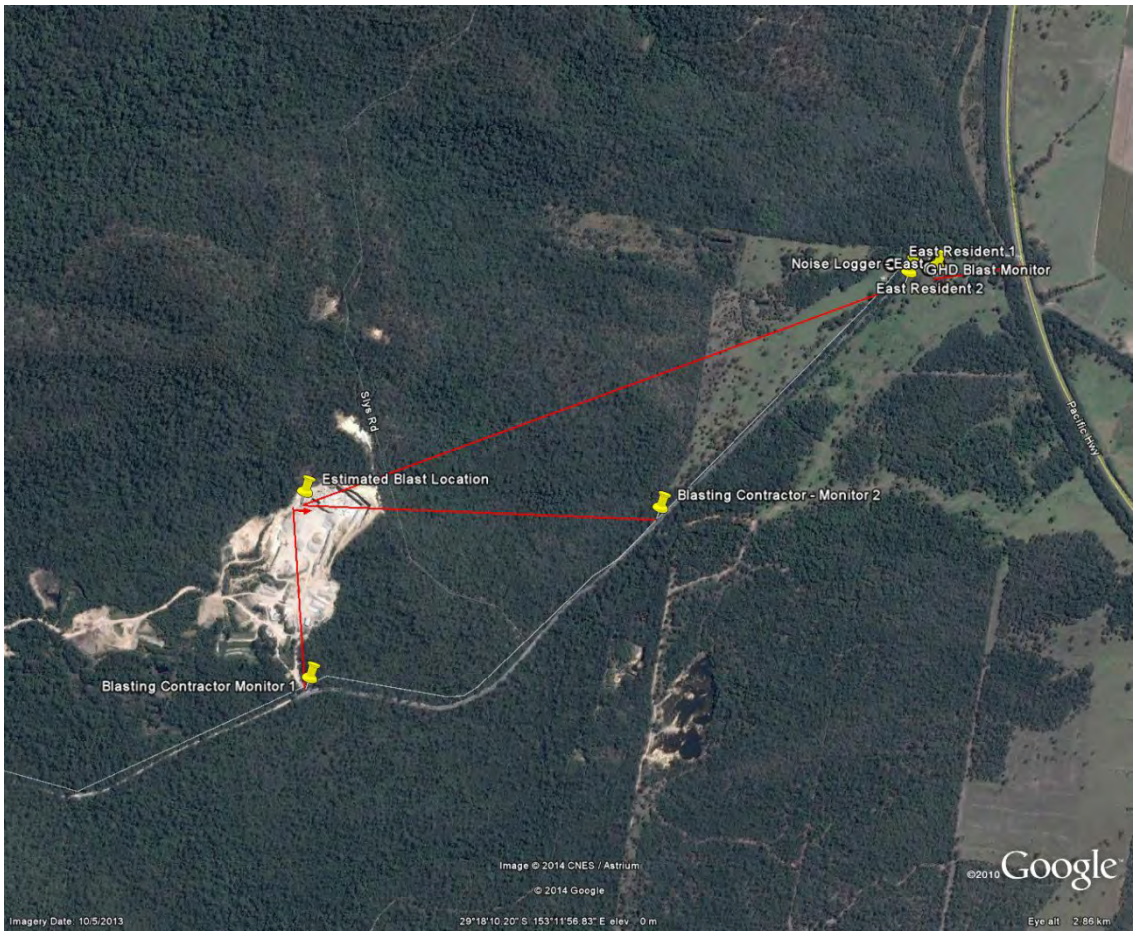


Figure 5-4 Blast monitoring locations

Blast monitoring results

A summary of the vibration measurement results recorded at the site are presented in Table 5-10.

Table 5-10 Blast monitoring results

Parameter	Approximate distance and direction to blast source	PPV (mm/s) Criteria: 5 mm/s	Overpressure dB(L) Criteria: 115 dBL
Location 1 (Blasting Contractor monitor near gate to quarry)	530 metres North	0.78	88[a]
Location 2 (Blasting Contractor monitor near Jackybulbin Road)	1030 metres West	0.17	112
Location 3 (GHD monitor near sensitive receiver R2)	1860 metres West-southwest	0.13	101

[a] This result is not considered valid as it is the noise floor of the instrument, therefore has not been used in this assessment.

The above results indicate the criteria are met at all monitoring locations for both ground vibration and airblast overpressure.

Predicted results

Figure 5-5 displays a plot of airblast overpressure and ground vibration against distance from the blast.

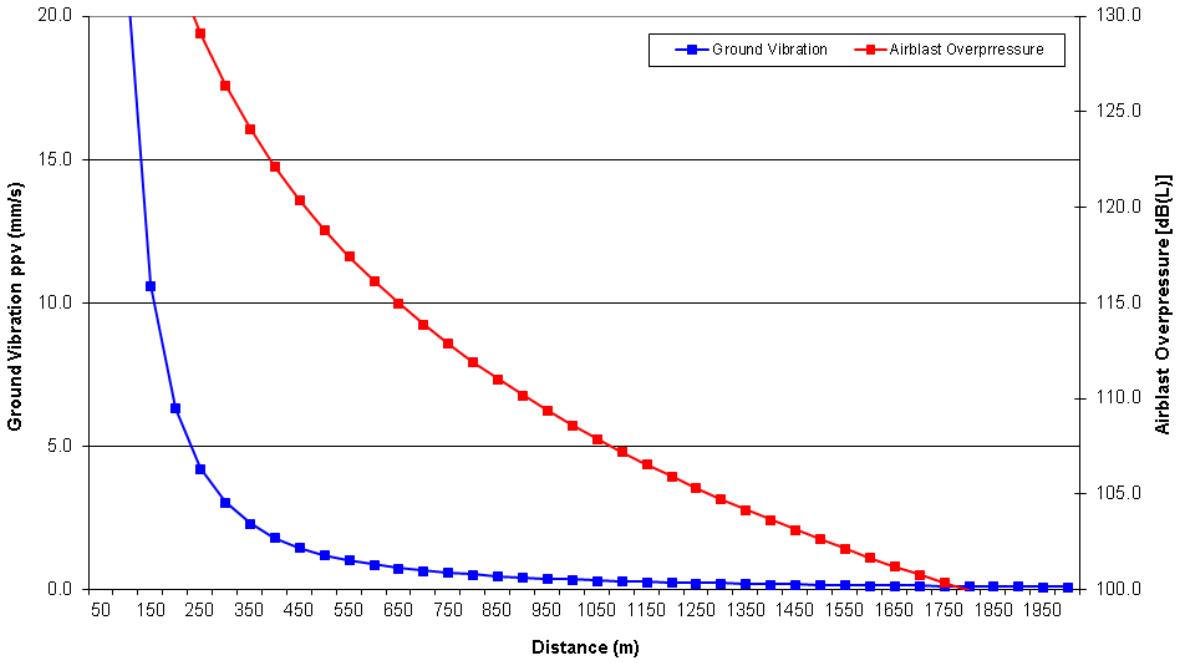


Figure 5-5 Estimated ground vibration and airblast overpressure levels from blasting

The estimated ground vibration and airblast levels from blasting suggest that, on average, the recommended limits of 5 mm/s and 115 dB(L) would be achieved at a minimum distance of approximately 250 m and 650 m respectively from the blast location. The nearest receivers are located approximately 1500 m from potential blasting locations. Therefore it is expected that the blasting guidelines should be met at all receivers if blasting techniques are similar to those used during the blast in which measurement data was recorded at Sly's Quarry on 13 November 2014.

Predicted blasting buffer distances

Air blast overpressure and ground vibration has been predicted for a range of charge masses and are shown in Figure 5-6 and Figure 5-7 for varying distances and assuming average blasting parameters. The distance to comply with the *Technical Basis for Guidelines to Minimise Annoyance due to Blasting Overpressure and Ground Vibration* (ANZECC, 1990) are also shown.

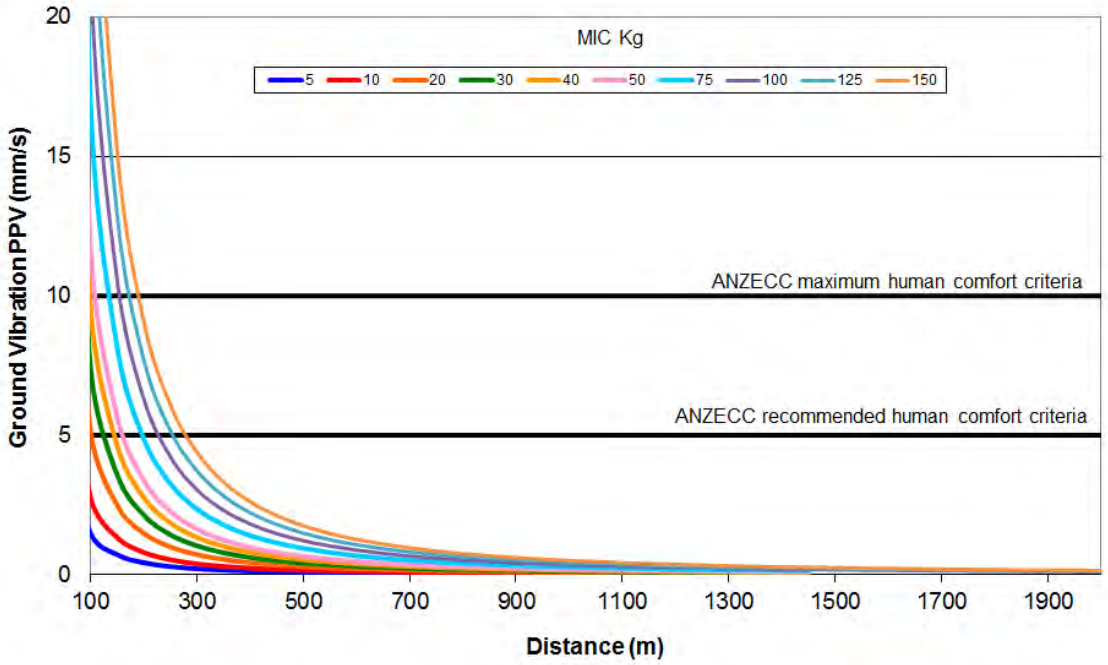


Figure 5-6 Ground vibration predictions for different charge masses and distances

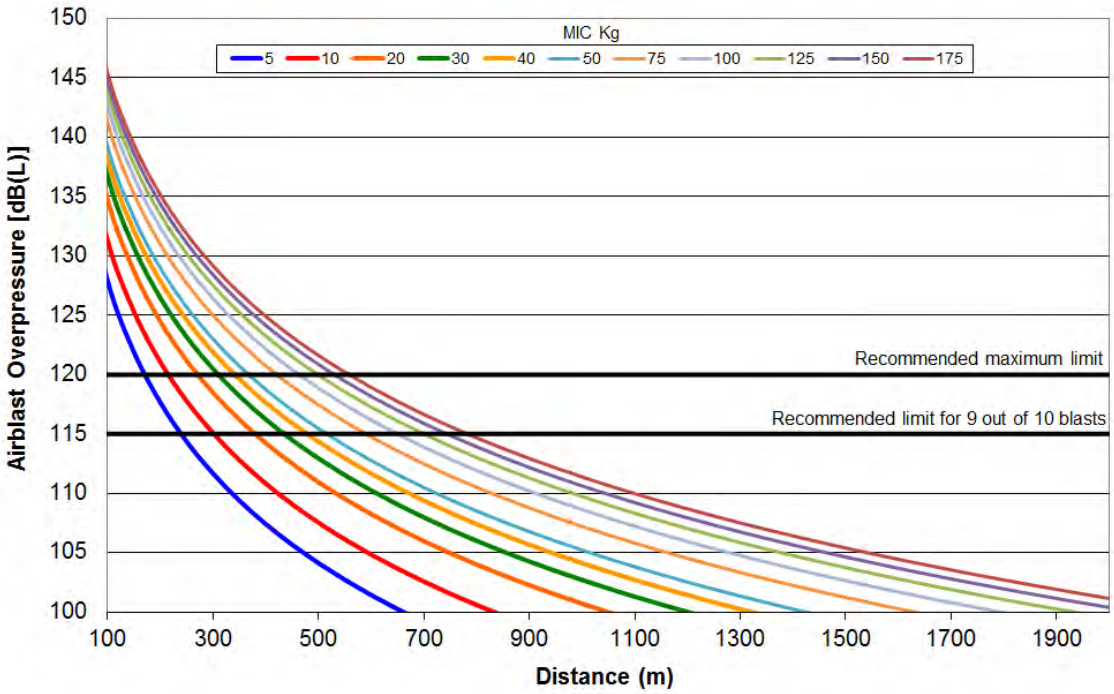


Figure 5-7 Air blast overpressure predictions for different charge masses and distances

Assessment of blasting impacts

The predicted results shown in Figure 5-6 and Figure 5-7 indicate that blasting would be restricted by the air blast overpressure rather than the ground vibration levels.

Although the exact location of blasting is not known at this stage of the project, if it were to occur it would most likely be located in areas moving further away from sensitive receptors than currently experienced. The nearest sensitive receivers are over 1,200 metres away, therefore blasting impacts based on the above parameters are expected to comply with the blasting criteria.

5.3.4 Mitigation measures

Compliance noise monitoring

Due to the marginal level of compliance at R3, it is proposed that compliance noise monitoring be undertaken during quarry operations to verify noise model predictions and confirm compliance with the adopted noise criterion. Compliance noise monitoring should also be undertaken following receipt of a complaint relating to noise emissions from the site.

The results of compliance noise monitoring would be used to determine the requirement to implement or increase noise mitigation measures such noise barriers consisting of earth mounds/shipping containers. Noise monitoring would be undertaken with consideration to the NSW INP.

Noise monitoring should be conducted following any change in operating conditions that are likely to increase noise emissions from the site (such as a sudden increase in production rate or heavy vehicle movements) or move noise sources significantly closer to noise sensitive receivers.

Blasting

It is proposed that all sensitive receivers be informed when blasting is to be undertaken. Reducing charge mass and increasing distance is the most effective way of reducing blasting impacts. Blasting should only occur from 10 am to 4 pm, Monday to Friday and should not generally take place more than once per day.

Due to variability in blasting impacts, it is proposed that monitoring be undertaken during initial blasts at the site to confirm predictions and assess compliance with the ground vibration and airblast overpressure limits.

Work ethics

All site workers would be sensitised to the potential for noise impacts on local residents and encouraged to take practical and reasonable measures to minimise the impact during the course of their activities. This would include:

- Where practical, machines would be operated at low speed or power and switched off when not being used rather than left idling for prolonged periods.
- Keep truck drivers informed of designated vehicle routes, parking locations and delivery hours.
- Avoid dropping materials from height and avoid metal to metal contact on material.
- All engine covers would be kept closed while equipment is operating.

Community relations

Consultation and cooperation with the neighbours to the site would assist in minimising uncertainty, misconceptions and adverse reactions to noise. It is proposed the following community relation measures be implemented:

- The quarry manager would erect a sign at the entrance of the quarry with a phone number and permanent site contact so that noise complaints can be received and addressed in a timely manner.
- Upon receipt of a noise complaint, noise monitoring would be undertaken and reported as soon as possible. If exceedances are detected, the situation would be reviewed in order to identify means to attempt to reduce the impact to acceptable levels (i.e. 45 dB(A) or 35 dB(A), depending on the receiver location).

5.4 Air

5.4.1 Introduction

The quarry has the potential to impact the local air quality, especially via generation of dust. To assess this impact an *Air Quality Impact Assessment* (AQIA) (GHD, 2015c) was prepared with a focus on dust and in accordance with the following scope:

- Desktop review of site plans, aerial photographs and topographic maps to gain an understanding of the existing environment in terms of local terrain, existing/proposed operations and sensitive receptors within the study area.
- A review of available ambient air quality monitoring data to gain an understanding of existing air quality in the vicinity of the quarry.
- Determining applicable dust criteria with consideration to the Approved Methods for the Modelling and Assessment of Air Pollutants in New South Wales (DEC, 2005).
- Synthesis of a site-representative meteorological data file with which to gain an understanding of the local wind climate and use as model input for conducting atmospheric dispersion modelling.
- Deriving a dust emission inventory for the proposed quarry operations with which to identify significant sources of air pollution, in particular dust emissions, and estimate the emission rates for each item of equipment used on the quarry site. The primary focus of developing an emissions inventory for the site was to identify the primary sources of dust emissions in order to target dust mitigation measures. The next focus was as an input to the dispersion modelling (next dot point).
- Dust modelling using the regulatory atmospheric dispersion model Ausplume to predict the incremental dust impact from quarry operations at surrounding residences.
- Proposing targeted mitigation and management measures to reduce dust impacts from the site and, if warranted, consideration of a dust monitoring programme.

A summary of the AQIA is provided below and the full report is provided in Appendix E.

5.4.2 Existing conditions

Sensitive receivers

There are few sensitive receivers in the vicinity of the quarry. The nearest residences are located approximately 1.5 km from the quarry boundary.

Sensitive receivers identified in the vicinity of the site are detailed in Table 5-11.

Figure 5-8 shows a site aerial image and the location of identified isolated rural residence sensitive receivers. These receivers have been identified to represent those with the greatest potential for adverse dust impact (viz. any receptors in the same general direction but further away have a lesser impact).

Table 5-11 Identified sensitive receivers

Receiver	Receiver type	Approximate distance to nearest activity (m)
R1	Residential	1600
R2	Residential	1700
R3	Residential	1500
R4	Residential	2600
R5	Residential	2700
R6	Residential	2800
R7	Residential	3200
R8	Residential	3600
R9	Residential	3300
R10	Residential	3500
R11	Residential	3000

An ambient level of PM_{10} of 15 $\mu g/m^3$ has been assumed for rural coastal NSW areas away from the drier inland, industrial sources and urbanised environments.

GHD are not aware of any complaints regarding dust emissions from current quarry operations.

Figure 5-8 Site location and identified sensitive receptors

Local meteorology

The local meteorology largely determines the pattern of off-site dust impact on receptors (such as residential housing, even in rural settings with isolated dwellings on acreage). The effect of wind on dust dispersion patterns can be examined using the wind and stability class distributions at the site from the dataset that is produced by CALMET.

The annual average wind rose for the entire data period of August 2012 to July 2013 is shown in Figure 5-9. This indicates that for the specific location of the quarry, the winds on an annual basis are mostly from the west-south-west and east. This is due to distinct seasonal patterns in summer where coastal winds bring in a high proportion of easterly winds while in winter cool-air drainage off the slopes to the west and pre- and post-frontal westerly winds funnels the western component of the winds arriving from the north-west and south-west sectors. Due to the location of the site being in a valley and surrounded by bushland (the latter exerting a drag on wind flows), both the summer coastal winds and winter drainage flows consist mostly of light winds. The lightest winds (indicated by grey shading in the wind rose) are common from all directions with the favourability of the easterly summer winds and west-south-westerly winter flows.

Autumn and spring have the same general pattern as the annual pattern, with less dominant ocean winds and drainage flows still making up dominant wind directions. Autumn also has a distinctive south to south-easterly component.

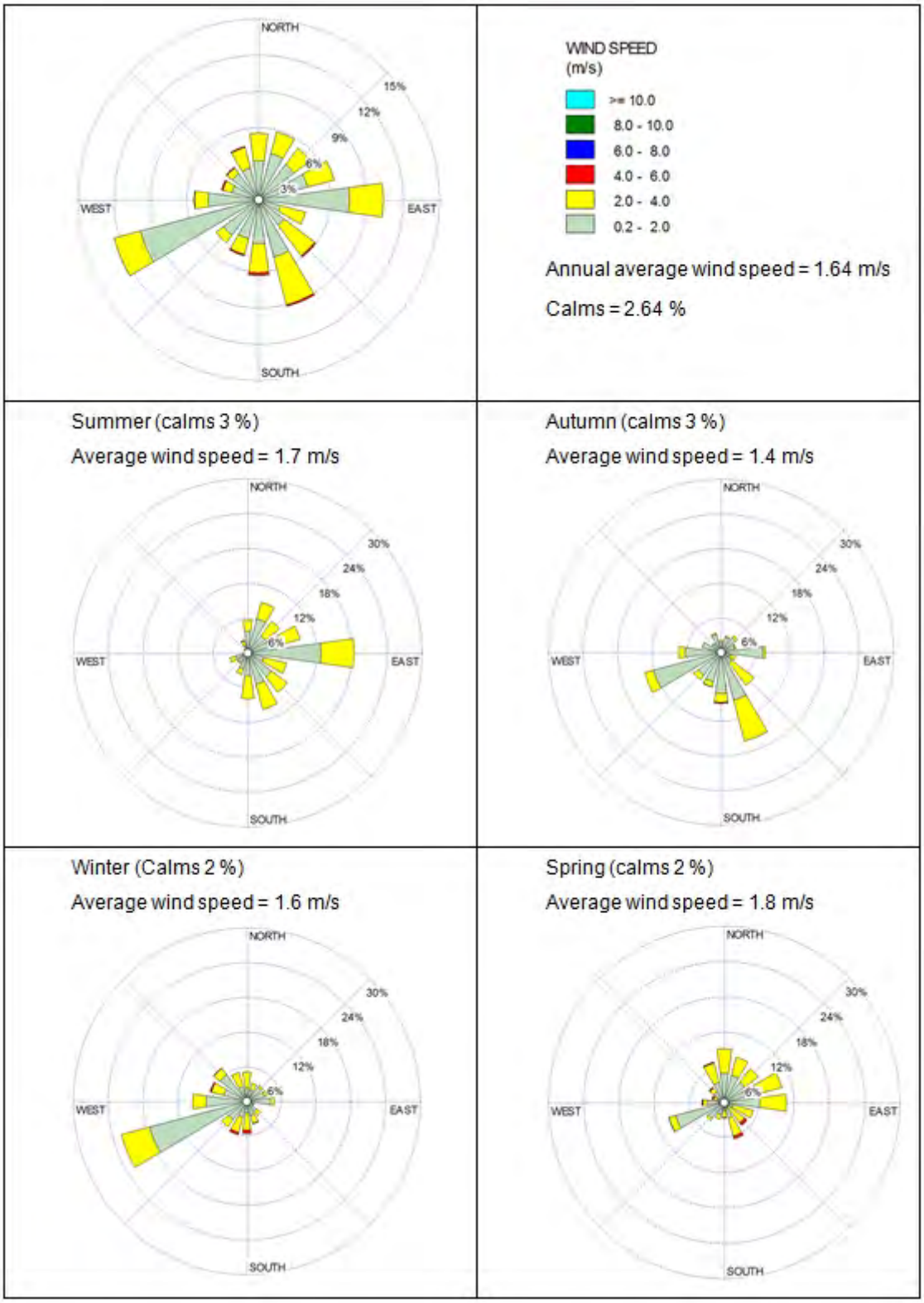


Figure 5-9 CALMET predicted annual and seasonal variability wind roses, Mororo

Patterns of atmospheric stability

Atmospheric stability substantially affects the capacity of a pollutant such as particulate matter, to disperse into the surrounding atmosphere upon discharge and is a measure of the turbulent energy in the atmosphere. For a quarry, particulate emissions will have greatest impact downwind during stable conditions, reducing to a minimum impact during unstable conditions.

There are six Pasquill–Gifford classes (A-F) used to describe atmospheric stability and these classes are grouped into three general stability categories; stable (classes E-F), neutral (class D), and unstable (classes A-C). The climate parameters of wind speed, cloud cover and solar insolation are used to define the stability category, and as these parameters vary diurnally, there is a corresponding variation in the occurrence of each stability category. Stability is most readily displayed by means of a stability rose plot, giving the frequency of winds from different directions for various stability classes A to F.

Figure 5-10 shows the frequency of stability class for all hours of the 12 month dataset from August 2012 to July 2013 from the model generated dataset and Figure 5-11 shows the stability rose for the entire data period. Noting that a neutral atmosphere (D) is usually the dominant stability state of the atmosphere, due to the high frequency of light winds in this dataset, D stability only occurs about 5% of the time. Stable atmospheres (E and F class stabilities) occur about 48% of the time and are predicted to be the most frequent at the site, with stability class F contributing most of these stable flows. Figure 5-11 shows that stable winds (annually) are relatively consistent from all directions. Due to the highest frequency of winds from the east (in summer) and west-southwest (in winter) most of these stable flows occur from these directions.

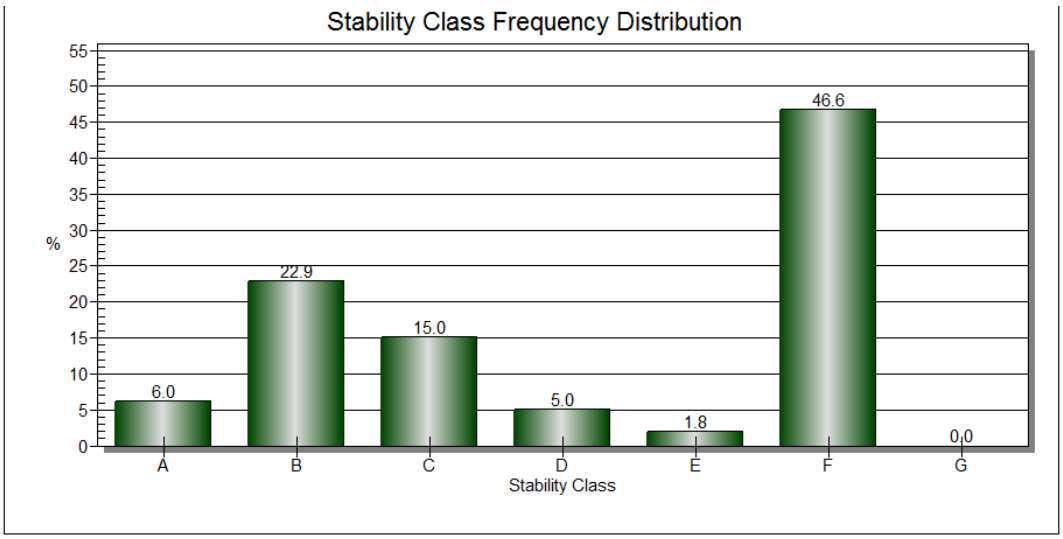


Figure 5-10 CALMET predicted annual stability frequency

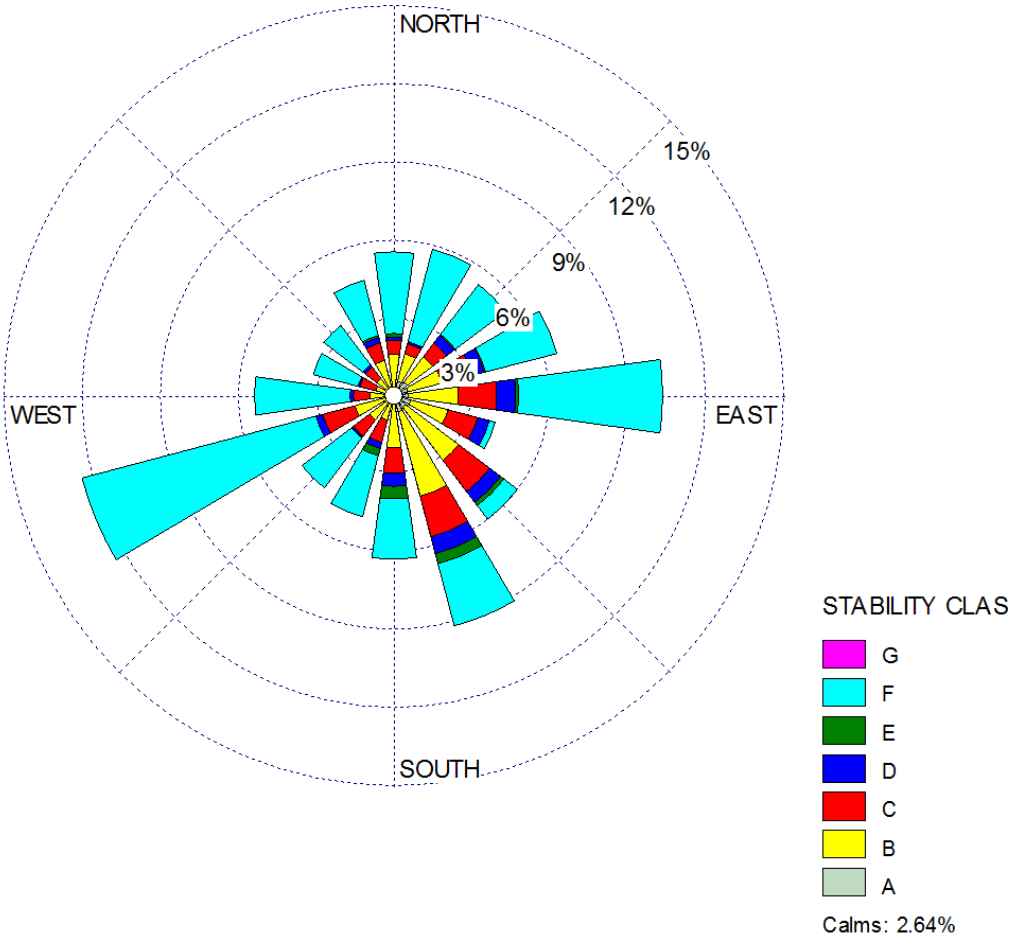


Figure 5-11 CALMET predicted annual stability rose

5.4.3 Potential impacts

Assessment criteria

Air quality impact assessment criteria are prescribed within the NSW OEH *Approved Methods*.

To ensure the environmental outcomes are achieved, dust emissions from a site must be assessed against the assessment criteria given in Table 5-12.

Table 5-12 Dust assessment criteria

Pollutant	Averaging period	Criterion
PM_{10}	24 hours	50 µg/m^3
	Annual	30 µg/m^3
TSP	Annual	90 µg/m^3
Dust deposition (insoluble fraction)	Annual	2 g/m^2/month*

** Maximum Increment. Maximum allowable cumulative impact of 4 g/m^2/month.*

The above criteria are provided as cumulative (incremental plus background) concentration levels.

Impact assessment

An analysis of the predicted results from dispersion modelling is presented below.

Maximum predicted ground level concentrations and deposition rates at each of the identified receptors have been predicted and added to the adopted background levels to determine the cumulative impact, which can then be compared against the assessment criteria.

In addition to the conservative approach taken in the dispersion modelling, it is acknowledged that tall, thick vegetation surrounds the site in all directions. This would assist to dampen wind speeds (the meteorological models used do account substantially to this 'drag' on the wind speeds) and filter airborne dust as it travels from the site. These conditions cannot be fully represented in the dispersion model and therefore adds a level of conservatism to model predictions.

Table 5-13 displays the predicted 24-hour average PM_{10} concentrations at each receptor – highest one-day event in the year. Predicted results indicate compliance with the 24-hour average PM_{10} criterion at all receptors for both average and peak production rates.

Table 5-13 Predicted PM_{10} 24-hour average ground level concentration ($\mu g/m^3$)

Receiver	Cumulative criterion	Adopted background	Adopted incremental impact criterion	Peak production rate		Average production rate	
				No controls	With controls	No controls	With controls
R1	50	15	35	10	2	4	1
R2				10	3	4	1
R3				6	2	2	<1
R4				5	1	2	<1
R5				5	1	2	<1
R6				3	1	1	<1
R7				4	1	1	<1
R8				5	1	2	<1
R9				5	1	2	<1
R10				3	1	1	<1
R11				4	1	2	<1

PM_{10} concentration levels over an annual average are well below the adopted criterion.

Figure 5-12 and Figure 5-13 shows the maximum predicted ground level concentration contours for quarry operations at peak production of 364 tonnes per hour with and without dust control measures.

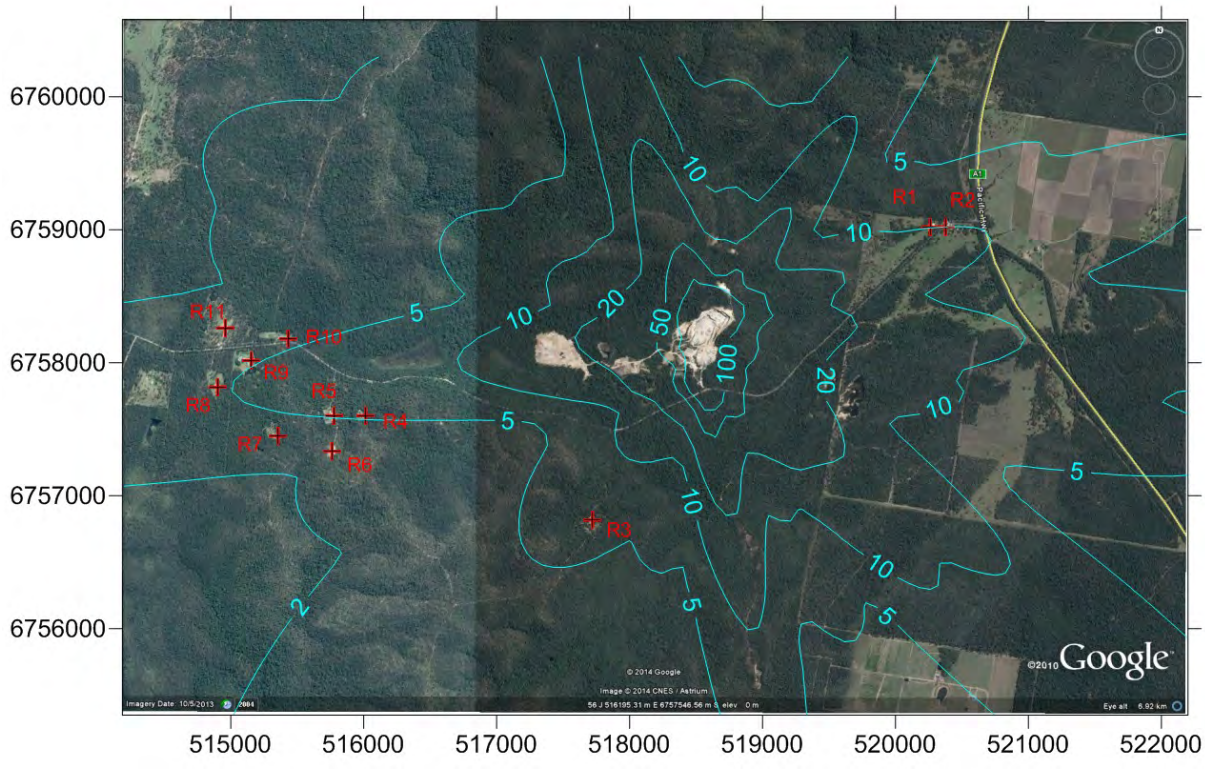


Figure 5-12 PM_{10} 24-hour average highest concentrations, no controls (µg/m^3)

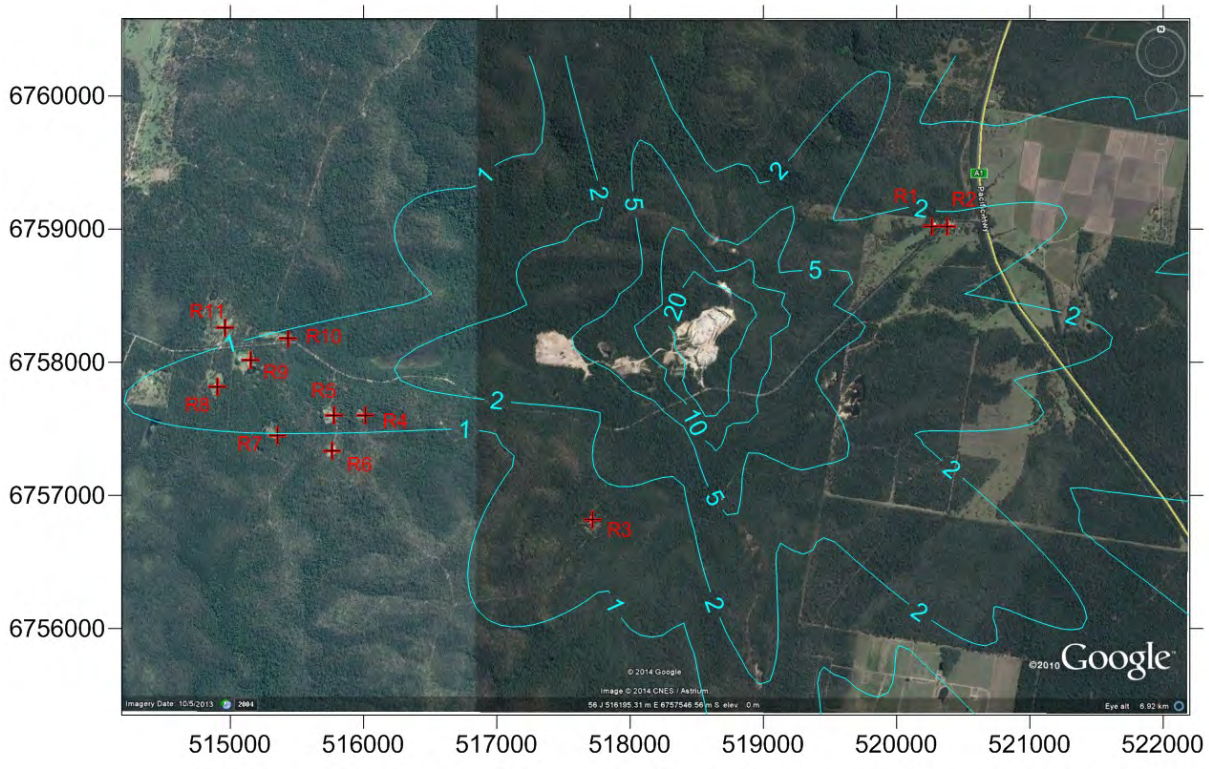


Figure 5-13 PM_{10} 24-hour average highest concentrations, with controls (µg/m^3)

Total suspended particles (TSP)

Predictions of maximum ground level TSP concentrations have been made based on peak production rates without dust control measures.

Table 5-14 shows the maximum predicted ground level TSP concentration levels, which indicate that even without dust control measures, the predicted incremental impact at the most exposed sensitive receptor is well below the TSP annual average criterion of 90 μg/m^3. It is also evident from the results that even with the addition of a typical TSP background concentration of 30 μg/m^3, the total (cumulative) impact would still be well below the assessment criterion.

Table 5-14 Predicted TSP annual average concentrations at peak production rate

Receptor	TSP concentration (μg/m3)
R1	3
R2	3
R3	2
R4	1
R5	<1
R6	<1
R7	<1
R8	<1
R9	<1
R10	<1
R11	<1

Dust deposition

Predictions of dust deposition rates have been made based on the peak production rate.

In the absence of site-specific dust deposition data, a conservative background dust deposition level of 2 g/m^2/month was adopted. Table 5-15 shows the maximum predicted incremental dust deposition rates at sensitive receptors for emissions with no controls. The incremental dust deposition criterion of 2 g/m^2/month is expected to be comprehensively met at all identified receptors.

Table 5-15 Predicted dust deposition rates at peak production rate

Receptor	Dust deposition (g/m^2/month)
R1	0.02
R2	0.02
R3	0.02
R4	0.01
R5	0.01
R6	0.01
R7	0.01
R8	0.01
R9	0.01
R10	0.01
R11	0.01

Greenhouse gas

The greenhouse gas (GHG) assessment estimated the emissions associated with construction activities and quarry operation (including downstream emissions) based on previous similar projects.

The following scopes of emissions were considered:

- Scope 1: Emissions from direct energy use.
- Scope 2: Indirect energy use from imports and exports of electricity, heat or steam.
- Scope 3: Limited to emissions associated with Scope 1 and 2 emissions and downstream emissions from the transportation of material from the quarry.

The greenhouse gas estimate considered emissions from the major emission sources during construction and operation activities as follows:

- Construction emission sources:
  - Fuel consumption during construction activities.
  - Vegetation removal.
- Operation emission sources:
  - Fuel consumption during operation of the plant.
  - Transport of product 50 km off site.

The greenhouse gas emissions are estimated to be approximately 44,500 t CO_2-e over a 20 year life (approximately 2,225 t CO_2-e per annum on average). Emissions associated with the transportation of material from the facility were estimated to be about 66% of emission for the proposal. The next greatest source of emissions at 32% was fuel consumption during operations.

The proposal's likely emissions are minor compared with Australia's and NSW total GHG emissions. In 2011/12 Australia's greenhouse gas emissions were estimated as 554.6 Mt CO_2-e and New South Wales' greenhouse gas emissions were 154.7 Mt CO_2-e. The emissions from the proposal per annum would be approximately 0.001% of New South Wales' total greenhouse gas emissions and 0.0004% of Australia's total GHG emissions in 2010/11. Emissions during peak operation could be as high as double the average annual emissions. These high emissions would still be minor compared with total emissions for NSW and Australia.

5.4.4 Mitigation measures

While dust impacts from quarry operations are not expected to exceed the adopted assessment criteria, the following mitigation measures would be implemented in order to minimise the potential for impacts:

- Water sprays on crushing and screening plant.
- Haul truck routes will be watered as required, particularly during peak periods of high frequency vehicle movements and extended dry spells.
- If off-site dust impacts are noted as being an issue (e.g. complaints from neighbours or visible and extensive dust plumes), dust monitoring and visual observations of dust plumes should be conducted during quarry operations.

The following mitigation measures are to be implemented to assist in minimising the off-site dust impacts from blasting at the quarry.

- Identified sensitive receptors should be notified when blasting is planned to occur.
- Where possible, blasting should not occur during times when winds are in the direction of the nearest receptors, and should preferably occur during times when winds are calm or blowing away from the nearest receptors.
- Water sprays should be used as dust suppression just before and during the blast.
- Blast mats such as hessian or rubber matting may be used to suppress impacts from blasting, including flyrock and particulate emissions.

Mitigation measures to reduce greenhouse gas emissions are:

- Opportunities for the use of biodiesel should be investigated and used where possible.
- Efficient plant and vehicles would be used where reasonable and feasible to do so.
- Turn off engines when not in use.

5.5 Ecology

5.5.1 Objectives

The biodiversity assessment report has been prepared to assess the potential ecological impacts of the proposal and determine suitable offsets. Specifically, the objectives of this assessment are to:

- Address the SEARs for the proposal.
- Outline the methods used in the biodiversity assessment.
- Describe the existing environment of the study area in terms of its ecological values, including type and condition of vegetation communities and terrestrial and aquatic habitats.
- Identify flora and fauna species and ecological communities within the study area that have the potential to be impacted by the proposal.
- Provide a description of the proposal, including potential impacts on biodiversity values and measures to avoid or mitigate impacts.
- Present the data used to perform the Framework for Biodiversity Assessment (FBA) assessment and credit calculations for the proposal.
- Calculate the number and type of biodiversity credits using BioBanking Assessment Methodology (BBAM) 2014 that would be required to offset impacts of the proposal and outline a Biodiversity Offset Strategy.
- Provide concluding statements to demonstrate that the proposal would 'improve or maintain' biodiversity values.

A summary of the assessment is provided below and a full copy of the report is in Appendix F.

5.5.2 Existing conditions

Flora species

A total of 101 flora species were recorded within the study area. All of these species are native other than one exotic species (*Lantana camara*). The diversity of species present in the study area is likely to be greater than this list, as the cryptic nature of some species means detection is only possible at certain times of year and following specific weather events such as rainfall.

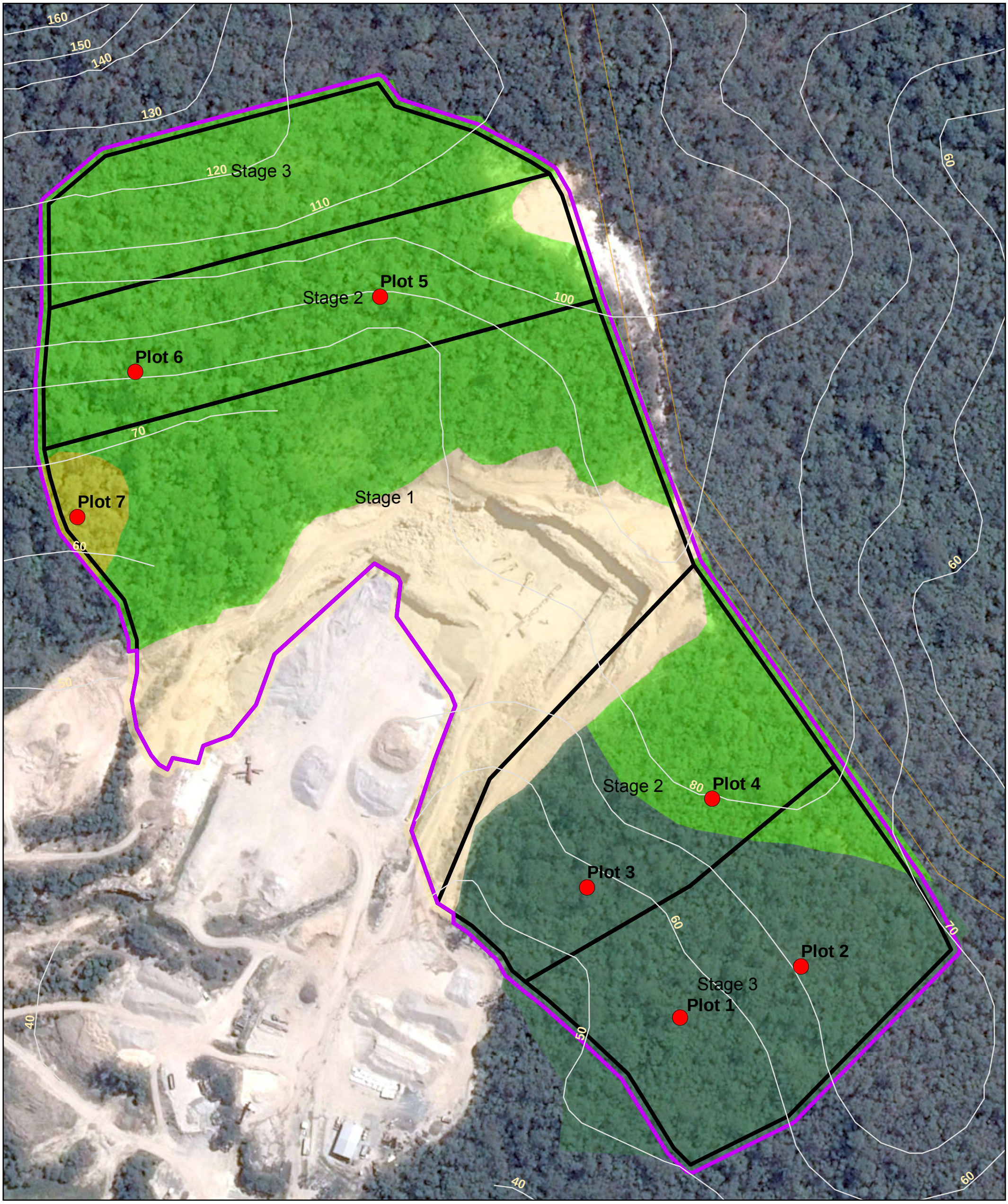
Plant community types

Two plant communities occur within Stages 2 and 3 study area (Stage 1 was not considered because this area has an existing approval), these communities are described below and their location is shown on Figure 5-14.

Blackbutt - bloodwood dry heathy open forest on sandstones of the northern North Coast (NR114)

Blackbutt-bloodwood dry heathy open forest is a tall open forest that occurs on deep sands of old dune systems along the NSW North Coast.

This community is dominated by Pink Bloodwood (*Corymbia intermedia*), Tallowwood (*Eucalyptus microcorys*), Blackbutt (*Eucalyptus pilularis*) and *Angophora paludosa* to 25 metres tall. Over a tall shrub layer to 10 metres dominated by *Acacia leiocalyx*, Red Ash (*Alphitonia excelsa*), Logon Apple (*Acronychia imperforata*) and Salwood (*Acacia disparrima*). A lower layer of shrubs includes Coffee Bush (*Breynia oblongata*), Cheese Tree (*Glochidion ferdinandi*) and Tree Heath (*Trochocarpa laurina*). The ground storey consists of a dense layer of leaf litter with a sparse cover (< 3%) of herbs and grasses. Common species within the ground layer include Many-flowered Mat-rush (*Lomandra multiflora*), Blue Flax Lily (*Dianella cerulea var. producta*), Rough Saw Sedge (*Gahnia aspera*), Spear Grass (*Austrostipa pubescens*) and Creeping Beard Grass (*Oplismenus imbecillis*) (refer to Figure 5-15).



LEGEND

- biobanking plot/transects
- Subject site
- Stages
- 10m contour
- cadastre
- Blackbutt - Turpentine dry heathy open forest on sandstones
- Blackbutt - bloodwood dry heathy open forest on Quaternary sands
- Swamp Mahogany swamp forest of the coastal lowlands
- Cleared

Paper Size A3

0 10 20 40 60 80

Metres

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

N

GHD

Newman Quarrying
Sly's Quarry Environmental Impact Statement
Biodiversity Assessment

Job Number 22-17528
Revision A
Date 20 Mar 2015

Vegetation types and survey locations

Figure 5-14

N:\AU\Coffs Harbour\Projects\22\17528\GIS\Maps\Deliverables\22_17528_Z002_Vegetation_zones_RevB.mxd

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

Data Source: NSW Department of Lands: Cadastre - Jan 2014; Geoscience Australia: 250k Data - Jan 2014; NSW Department od Primary Industry - Jan 2014; Google image Jan 2014. Created by: qjchung

This vegetation type covers approximately 4.23 hectares of the study area.

Figure 5-15 Blackbutt - bloodwood dry heathy open forest in the south west of the study area

Blackbutt - Turpentine dry heathy open forest on sandstones of the lower Clarence of the North Coast (NR123)

Blackbutt-Turpentine dry heathy forest is a tall open forest that occurs on sandstone geologies of the Clarence-Moreton Basin from the southern Richmond Range east to the Coast Range.

Within the study are this plant community is dominated by Blackbutt (*Eucalyptus pilularis*), Turpentine (*Syncarpia glomerata*), Red Mahogany (*Eucalyptus resinifera*) and *Angophora woodsiana* to 25 metres tall with a cover of approximately 40%. The midstorey consists of a tall shrub layer to 8 metres dominated by *Acacia leiocalyx*, Red Ash (*Alphitonia excelsa*), Tree Heath (*Trochocarpa laurina*), Flaky-barked Tea-tree (*Leptospermum trinervium*) *Persoonia conjuncta*, Cheese tree (*Glochidion ferdinandiana*) and Blackthorn (*Bursaria spinosa*) over a dense low shrublayer to 2 metres dominated by Handsome Flat Pea (*Platylobium formosum*), *Hibbertia marginata*, *Leucopogon lanceolatus* and Coffee Bush (*Breynia oblongata*). The groundlayer is dominated by Wire Grass (*Entolasia stricta*), Grass Trees (*Xanthorrhoea* sp), Spiny-headed Mat-rush (*Lomandra longifolia*), Rough Saw-sedge (*Gahnia aspera*), Common Bracken (*Pteridium esculentum*), Crinkle Bush (*Lomatia silaifolia*), Blue Flax-lily (*Dianella cerulea*) and *Lepidosperma laterale*. This community also contains a variety of vines and climbers including Wonga Wonga Vine (*Pandorea pandorana*), Lawyer vine (*Smilax australis*), Sweet Sarsaparilla (*Smilax glyciphylla*), Molucca Bramble (Rubus moluccanus var. trilobus) and Stiff Jasmine (*Jasminum volubile*).

This vegetation type covers approximately 6.27 hectares of the study area.

Figure 5-16 Blackbutt - Turpentine dry heathy open forest in the north of the study area

Noxious and environmental weeds

One flora species declared as noxious under the NW Act occurs within the study are. This species (Lantana (*Lantana camara*)) is a class 4 noxious weed which in accordance with the NW Act must be managed in a manner that continuously inhibits the ability of the plant to spread.

Within the study area Lantana occurs as small isolated patches scattered through the site.

Fauna and fauna habitats survey results

Fauna species

A total of 20 fauna species were recorded within the study area including 19 birds and one reptile. These species were recorded incidentally during the site visit and no targeted surveys for fauna were undertaken. It is likely that the site would be utilised by a range of other fauna species not recorded during the survey.

Fauna habitat

The main fauna habitats that occur within the subject site are associated with the dry open forest communities.

The study area would be expected to support a moderately high diversity of native fauna species. Habitat values within the study area are somewhat lower than might be given the previous selective logging that has occurs at the site. There are, however, scattered mature-age trees which were likely retained throughout the logging process: these occur across the study area. There are also other ongoing habitat disturbances such as noise from quarry operations.

The study area contains a range of habitat features which would provide shelter and foraging resources for a variety of native fauna, including:

- Myrtaceous trees and shrubs, including preferred feed tree species for threatened birds and arboreal mammals and a tall midstorey of *Allocasuarina* spp., which would provide foraging resources for granivorous birds including the threatened Glossy Black-cockatoo.
- Small patches of dense, low shrubs, mainly the exotic Lantana, which provide shelter and foraging habitat for a range of small woodland birds and terrestrial mammals.
- Moderate density of woody debris and fallen logs which would provide shelter and foraging habitat for a range of native reptiles, and foraging substrate for native insectivorous birds and mammals.
- A moderate density of hollow-bearing trees with a range of hollow sizes and positions, including trees with hollows at ground level, limb hollows, trunk fissures and dead trees (stags). These would provide potential roost sites for several native birds, arboreal and terrestrial mammals and microbats.
- Small ephemeral drainage lines which would provide foraging and breeding habitat for a range of native frogs, reptiles and birds.
- The quarry face itself, which is uneven and may provide basking, shelter and foraging resources for native reptiles, and potential shelter habitat for small terrestrial mammals or birds as well as diurnal roosts for microbats.

5.5.3 Potential impacts

Clearing of vegetation

Stages 2 and 3 includes approximately 10.5 hectares of native vegetation, which comprises 4.23 hectares of Blackbutt - Bloodwood dry heathy open forest and 6.27 hectares of Blackbutt - Turpentine dry heathy open forest. Vegetation clearing in these communities would involve removal of a moderately diverse range of non-threatened native plants, including mature trees, as well as potential habitat for threatened biota. The extent of proposed clearing of each vegetation community is summarised in Table 5-16.

Table 5-16 Proposed removal of native vegetation within the proposal site

Plant Community	TSC Act Status	EPBC Act Status	Condition	Area Impacted (ha)
Blackbutt - Bloodwood dry heathy open forest	-	-	Moderate/ good	4.23
Blackbutt - Turpentine dry heathy open forest	-	-	Moderate/ good	6.27
TOTAL				**10.5**

Clearing of native vegetation is listed as a Key Threatening Process under both the NSW TSC Act and the Commonwealth EPBC Act. Under the TSC Act, native vegetation is made up of plant communities, comprising primarily indigenous species. Clearing is defined as the destruction of a sufficient proportion of one or more strata layers within a stand or stands of native vegetation so as to result in the loss, or long-term modification, of the structure, composition and ecological function of a stand or stands (NSW Scientific Committee 2001).

Removal of habitat resources

The development would require the clearing of habitat for native fauna, including native vegetation within the site footprint and important habitat resources (hollow-bearing trees) for native biota. The proposed clearing of this habitat has potential to have impacts on local fauna populations within the site, including displacement or mortality of individuals and removal of habitat resources within sites. The magnitude of these 'likely' impacts is assessed below. The development would require the clearing of 10.5 hectares of native vegetation as a result of direct surface disturbance during construction.

A range of native bird species that could potentially occupy the site would be affected by the removal of native vegetation and other habitat resources. The majority of these species are mobile, widespread and common, the exception being Powerful Owl (*Ninox strenua*), Masked Owl and Barking Owl which may forage in the area occasionally as part of a wider area of occupation. Further, there are large quantities of equivalent habitat and resources in the locality. Overall, it is likely that the impact on local populations of native birds would be minor.

Potential foraging habitat for Grey-headed Flying-fox (*Pteropus poliocephalus*), Squirrel Glider (*Petaurus norfolcensis)*, Yellow-Bellied Glider (*Petaurus australis)*, Brush Tailed Phascogale (*Phascogale tapoatafa)* and Koala (*Phascolarctos cinereus*) occurs within the study area. Construction would clear an area of potential foraging habitat for these species, however given the potential alternative foraging resources in the local area, the loss of this potential habitat is considered to be minor.

Large mobile mammals that may occur within the site (ie. Swamp Wallabies (*Wallabia bicolor*)) could readily evade injury as there is ample opportunity to escape into alternative habitats to the north, east or south of the site. There is the potential for adverse effects on smaller or less mobile terrestrial mammals, reptiles or frogs sheltering within the native vegetation at the time of removal, as a result of direct surface disturbance during the construction. Smaller species may be sheltering in dense vegetation or beneath woody debris during construction.

Potential foraging and denning habitat occurs onsite for arboreal mammals. A number of common and potentially threatened microbats may occur at the site and may forage across the entire site and potentially roost within the hollow-bearing trees onsite. The proposed works would remove foraging habitat for these species as well as a large number of potential roost sites. It is likely that individuals would be adversely affected during clearing, particularly individuals sheltering in tree hollows. Mitigation measures outlined in Section 5.5.4 would partially ameliorate impacts on these species. The removal of hollow-bearing trees is important because of the time it takes for these resources to develop in regenerating vegetation. However given the extensive areas of alternative habitat surrounding the site, this development would affect a minor proportion of available habitat resources for hollow-dependant fauna in the locality.

A range of native reptiles have the potential to occupy the site. These species are likely to be widespread and common. No threatened reptiles are likely to occur within the site. It is possible that individuals would be adversely affected during clearing, particularly those which burrow or shelter beneath woody debris. Mitigation measures outlined in Section 5.5.4 would partially ameliorate these impacts.

There are likely to be ongoing impacts on fauna utilising adjacent areas of habitat associated with noise and other disturbances as quarrying is already conducted at the site although resident fauna are likely to be adapted to these disturbances.

Fragmentation and barrier effects

The proposal will not result in the isolation or fragmentation of any areas of native vegetation. The proposal would, however, slightly reduce connectivity of vegetation within the study area by removing vegetation from around the area once used as a quarry. Given the extensive area of native vegetation surrounding the site connectivity would not be significantly impacted.

Vegetation outside the boundary of the study area (to the north, south and east) will allow fauna movement around the boundary of the study area, despite removing vegetation from the central portion of the site. The proposal would not affect local or migratory movements of any native fauna species outside of the study area.

The site is located to the south and east of a number of state forests that are included within a key regional habitat corridor and is also immediately adjacent to land mapped as key fauna habitat. Any existing movements of mobile fauna species and ecosystem processes through this area would be largely unaffected by the proposal.

Fauna injury and mortality

The proposed works present an inherent risk of injury and mortality to native fauna. Specific risks include:

- During construction when vegetation and habitats are being cleared
- Through machinery and plant
- Operational traffic

Remnant native vegetation would have greater habitat value for native fauna and there is an increased risk of injury or mortality of native fauna which may be sheltering in this habitat during the construction period. There is considerable scope for native fauna to evade injury and/or seek alternative habitat in an extensive area of native vegetation surrounding the site.

Mitigation measures have been proposed in Section 5.5.4 to minimise the risk of vegetation clearing activities resulting in the injury or mortality of resident fauna.

Degradation of aquatic habitats

There are no aquatic habitats within the subject site, but small drainage lines do occur which would provide water to creeks in the surrounding locality during periods of high rainfall. Aquatic habitats could provide breeding and shelter resources for common frog and reptile species.

Potential sources of impacts to surface water within the site include:

- Runoff from areas stripped of vegetation
- Runoff from hardstand areas, including roads, processing areas and site facilities
- Leakage or spillage of hydrocarbon products from vehicles, wash down areas and workshops
- Refuelling bays and fuel, oil and grease storages

Indirect impacts

Indirect impacts as a result of the proposal would include:

- Edge effects
- Introduction or spread of weeds
- Pests and pathogens
- Erosion, dust generation and sedimentation
- Soil and water pollution
- Noise and vibration
- Artificial lighting

Aquatic impacts

The proposal has the potential to indirectly impact on aquatic habitats through alterations to hydrology in the study area, including changes to surface and groundwater flows and increased sedimentation or contamination in runoff.

The potential for water quality impacts on Tabbimoble Creek are considered to be low given the distance of the creek from the subject site. Notwithstanding potential water quality impacts would be managed through the implementation of mitigation measures, including the use of sedimentation basins.

No endangered aquatic communities, aquatic fauna or marine vegetation listed under the FM Act or EPBC Act occur in the study area and no significant impacts on riparian vegetation or habitats downstream of the proposal site are anticipated as a result of the proposal. There would be no impact on Key Fish Habitat as a result of the proposal.

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.

There are currently 38 KTPs listed under the TSC Act and eight listed under the FM Act. A number of KTPs are listed under more than one Act. Those potentially relevant to this proposal are listed in Table 5-17 below.

Table 5-17 Key Threatening Processes of relevance to the proposal

KTP	Status	Comment
Clearing of native vegetation	TSC Act EPBC Act	Clearing of native vegetation has occurred historically within and around the site though selective logging and associated with the existing quarry. This has resulted in a variety of impacts on the remaining native vegetation including increased weed invasion due to soil disturbance and edge effects. This KTP would be exacerbated by the removal of 10.5 hectares of native vegetation within the site.

KTP	Status	Comment
Clearing of hollow-bearing trees	TSC Act	Past clearing at the site is likely to have resulted in a loss of hollow-bearing trees. At present there is a mixture of mature and immature vegetation within the site. This KTP would be exacerbated by the removal of numerous hollow-bearing trees within the site.
Removal of dead wood and dead trees	TSC Act	The vegetation to be removed has a lower density of dead wood and dead trees than other areas of vegetation which would be retained within the study area, however still contains a low-moderate density of dead wood and dead trees.
Invasion and establishment of exotic vines and scramblers	TSC Act	Vegetation within the study area has the potential to be invaded by exotic vines and scramblers, particularly within areas of TEC vegetation. Vehicles and plant have the potential to introduce propagules of exotic vines and scramblers, as could soil disturbance during quarry expansion activities.
Invasion establishment and spread of *Lantana camara*	TSC Act	The site has been subject to historical disturbance and consequently Lantana has invaded areas of the site. This KTP is likely to be exacerbated onsite without the implementation of weed management.
Invasion of plant communities by perennial exotic grasses	TSC Act	Parts of the study area have been subject to historical forestry activities, and as a result, there are exotic weed species in some areas of the study area. Weeds have also been introduced in edge areas associated with the existing cleared area. Vehicles and plant could further spread exotic grass species, as could soil disturbance during quarry activities and vegetation clearing. There is the potential for perennial exotic grasses to invade retained and adjacent native vegetation through disturbance during quarry expansion activities.
Introduction and establishment of Exotic Rust Fungi of the order Pucciniales pathogenic on plants of the family Myrtaceae	TSC Act	Quarry expansion activities have the potential to introduce Myrtle Rust to the study area.
Infection of frogs by amphibian chytrid causing the disease chytridiomycosis	TSC Act; EPBC Act	Quarry expansion activities have the potential to introduce amphibian chytrid to the study area, which could lead to death of local frogs. This is unlikely, however, given no works would be undertaken within the drainage line or major dams.
Predation by the European Red Fox	TSC Act; EPBC Act	Evidence of foxes was observed in the study area. The proposal is unlikely to increase the incidence of this species.

Impacts on threatened biota listed under NSW legislation

The proposal may result in direct and indirect impacts on threatened biota listed under the TSC Act including the removal of occurrences of the threatened plant, *Hibbertia marginata;* the removal of habitat for up to 23 threatened fauna species that may occur in the study area. Impacts on threatened biota listed under the TSC Act have been assessed through the FBA calculations included in Appendix F.

No aquatic threatened biota listed under the FM Act or their habitats are likely to occur in the study area or to be affected by the proposal.

Impacts on Matters of National Environmental Significance

Threatened ecological communities

There are no threatened ecological communities listed under the EPBC Act within the subject site.

Threatened flora species

One threatened flora species (Bordered Guinea Flower (*Hibbertia marginata*) listed under the EPBC Act occurs within the study area. Based on the presence of suitable habitat there is also a possibility that a further two flora species listed under this Act may occur. These include:

- Leafless Tongue Orchid (*Cryptostylis hunteriana*)
- A Grass (*Paspalidium grandispiculatum*)

Bordered Guinea Flower (Hibbertia marginata)

Bordered Guinea Flower is restricted to the southern Richmond Range between Casino and Grafton and grows in grassy or shrubby dry open eucalypt forest at low altitudes on sandstone. A total of 1,190 individuals of Bordered Guinea Flower were identified within the subject site during targeted searches for the species. The locations where this species was identified is shown on Figure 5-17.

Leafless Tongue Orchid (Cryptostylis hunteriana)

Cryptostylis hunteriana is a small perennial terrestrial orchid that lacks leaves. In NSW, the species occurs between Batemans Bay and Nowra with additional records in Nelson Bay, Wyee, Washpool National Park, Nowendoc State Forest, Ku-Ring-Gai Chase National Park, Ben Boyd National Park, the Catherine Hill Bay area, Dolphin Point and Bulahdelah. There are no records of the species in the locality of the proposal; however it is predicted to occur within the locality.

The flowering period for this species in NSW is generally from December to February (OEH 2014a).

The species was not recorded during the field survey; however potential habitat exists for this species in the 10.5 hectares of native vegetation that may be impacted by the proposal

A Grass (Paspalidium grandispiculatum)

In NSW, is known from the north of Grafton in the Mount Neville, Gibberagee and Doubleduke vicinities. It is likely to be restricted to poor sandy soils on sandstone. It has been found in open forest of Turpentine (*Syncarpia glomulifera*) on undulating topography as well as in drier forest types on ridges.

Within the study area there is suitable habitat for this species within the 4.23 hectares of Blackbutt - bloodwood dry heathy open forest

There are two records for this species in the locality, both occur approximately 8 km north of the subject site.

518,500

6,758,500

Stage 3
2.1ha

Stage 2
2.7ha

Stage 1
6.9ha

Stage 2
3ha

Stage 3
3.1ha

160 150 140 130 120 110 100 90 80 70 60 50 40

6,758,000

518,500

LEGEND

- Subject site
- Stages
- cadastre
- 10m contour
- Hibbertia Marginata

Paper Size A3

0 10 20 40 60 80

Metres

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

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GHD

Newman Quarrying
Sly's Quarry Environmental Impact Statement
Biodiversity Assessment

Threatened species recorded within study area

Job Number	22-17528
Revision	A
Date	18 Feb 2015

Figure 5-17

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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

Data Source: NSW Department of Lands: Cadastre - Jan 2014; Geoscience Australia: 250k Data - Jan 2014; NSW Department od Primary Industry - Jan 2014; Google image Jan 2014. Created by: qjchung

Threatened fauna species

No threatened fauna species as listed under the EPBC Act have been recorded within the study area; however potential habitat for three threatened fauna species listed under the Act exists within the study area. These include:

- Grey-headed Flying Fox (*Pteropus poliocephalus)*
- Koala (*Phascolarctos cinereus*)
- Spotted Tailed-quoll (*Dasyurus maculatus*)

Grey-headed Flying Fox

The Grey-headed Flying-fox is predicted to occur within 10 km of the subject site (DoE 2014). The Grey-headed Flying-fox may forage on occasion in the proposal site when eucalypts are in flower. The proposal would not directly or indirectly affect any roost camps. Construction for the proposal would remove 10.5 hectares of foraging habitat including all remnant and regrowth species in the proposal site. Large expanses of foraging habitat are available in the locality. Habitat to be removed comprises a negligible proportion of the available habitat present in the locality.

Koala

Feed trees of Koalas are present at the site as Tallowwood (*Eucalyptus microcorys),* Red Mahogany (*E. resinifera)* and Pink Bloodwood. The presence of these species indicates that the majority of vegetation at the site would qualify as 'potential' Koala habitat. Despite the presence of 'potential' Koala habitat as defined by SEPP 44, the limited number of recent records within close proximity to the site suggests that the site does not provide 'core' Koala habitat as defined by the Policy. Although the Clarence Valley CKPoM does not cover the site, using the definitions outlined in the plan, the site is classified as 'preferred Koala habitat: secondary (class A)' due to presence of listed primary (Tallowwood) and secondary food tree species (Red Mahogany and Pink Bloodwood).

Based on this information, the presence of the Koala was considered likely on a transient basis and consequently this species has been included in the credit calculations accordingly.

Spotted-tailed Quoll

Spotted-tailed Quolls use hollow-bearing trees, fallen logs, small caves, rock crevices, boulder fields and rocky-cliff faces as den sites (OEH 2014a). According to a study conducted in Limeburners Creek, quolls used hollows in trees and logs with medium to large circumferences (typically greater than 50 cm dbh for logs and greater than 70 cm dbh for trees), and entrances between 16-41 cm diameter (average 26.13) in logs and between 7-27 cm (average 15.85cm) in tree hollows (Andrews 2005).

Habitat value for the Spotted-tailed Quoll would be somewhat reduced within the study area by the effects of historic logging. Shelter habitats for this species are still present with hollow-bearing trees (including trees with ground-level hollows), logs and other woody debris. The species may forage throughout the study area, although woody debris and other shelters for prey species such as small mammals, frogs and reptiles are also concentrated in lower slopes and gully areas.

Migratory species

One migratory bird species (Rainbow Bee-eater) listed under the EPBC Act was recorded during surveys. There is also potential habitat for the Fork-tailed Swift, White-throated Needletail and Satin Flycatcher.

The Fork-tailed Swift and White-throated Needletail are both predominantly aerial species that may fly over the site or use the study area for foraging on occasion. It is unlikely that the proposal area would provide any significant habitat for these birds and any individuals that may occur would occur on a transient basis only.

The proposal would remove up to 10.5 hectares of known and potential foraging habitat for the remaining three woodland bird species. Individuals of these species may also breed within the study area or locality. The vegetation that would be removed makes up a very small proportion of similar habitats present within the locality, which includes over 6000 hectares in conservation reserves.

The study area is not considered important habitat for any of these species, according to the significant impact criteria for migratory species (DotE 2013). This is due to the fact that potential habitat in the study area would not support an ecologically significant proportion of the population of these species, is not of critical importance to these species at particular life-cycle stages, is not at the limit of these species ranges, and is not within an area where these species are declining. Based on the above considerations, the proposal is unlikely to impose “a significant effect” on any of the listed migratory fauna species predicted to occur within the locality.

5.5.4 Mitigation measures

The mitigation of adverse effects arising from the proposal has been presented according to the hierarchy of avoidance, mitigation and offsetting of impacts.

Avoidance of impacts

The proposal is for the expansion of an existing quarry. The majority of the proposed quarry extension area falls within land that has been modified by historical land uses, including logging and past quarry activities. As a result, impacts on native flora and fauna are somewhat less than would be associated with a less disturbed site.

Results of the field survey were used to identify ecological constraints within the study area. This information informed the detailed design phase of the proposal, which entailed modification of the original plans so as to avoid areas of high ecological constraint, namely the identified areas of TEC vegetation and some occurrences of the threatened species Bordered Guinea Flower (*Hibbertia marginata*). This alteration to the original plans has reduced the overall area of planned quarry in order to avoid direct impacts on these areas.

Siting of construction compounds and other construction infrastructure in already cleared areas would also avoid impacts on native biodiversity values.

Mitigation of impacts

The proposal will impact native vegetation communities and habitat for threatened flora and fauna. In order to minimise the potential impacts of the proposal on biodiversity, the mitigation measures detailed below are proposed:

- During the detailed design process, the impact of the proposal on areas with high biodiversity values should be minimised wherever possible

- Prepare an Environment Management Plan (EMP)
- Prepare a Flora and Fauna Management Plan (FFMP) including:
  - Minimising vegetation clearance and habitat loss
  - Pre-clearance surveys
  - Phytophthora management
  - Chytrid fungus management
  - Myrtle rust management
- Prepare a weed management plan including:
  - Type and location of weeds of concern (including noxious weeds) within the proposal disturbance footprint
  - Sensitive receivers (such as native vegetation and waterways) within or adjacent to the proposal disturbance footprint
  - Measures to prevent the spread of weeds, including hygiene procedures for equipment, footwear and clothing
  - Proposed weed control methods and targeted areas
  - Weed disposal protocols

Managing vehicle movements

The proposal would increase the risk of injury or mortality of native fauna due to vehicle strike by increasing the rate of vehicle visitation to the site. This risk would be reduced by:

- Restricting vehicle movements to operational (daylight) hours
- Implementing and enforcing appropriate speed limits for vehicles traversing the site

Groundcover clearance protocol

Groundcover substrate, in particular fallen logs, provides important habitat for native fauna, including threatened species. A groundcover clearance protocol would be incorporated into the FFMP, including the following measures:

- Remove large woody debris and rock fragments using excavator grabs or manual handling if practicable
- Place intact large woody debris within adjacent areas of intact vegetation
- Scrape and stockpile leaf litter and topsoil separately from deeper fill material

Tree-dwelling fauna management protocol

A plan for the management of impacts on tree-dwelling species, in particular those that utilise tree-hollows would be developed. A hollow-bearing/habitat tree clearance protocol would be incorporated into the FFMP, including the following measures:

- Pre-clearing surveys undertaken by a suitably qualified ecologist or wildlife handler.
- Installation of suitable nest boxes in adjacent vegetation will be considered prior to clearing to provide a safe location for hollow-dwelling fauna to be transferred to during clearing operations. The number of hollow-bearing trees and types of hollows identified during pre-clearance surveys should be used to determine the number and types of nest boxes installed.

- Protocols for the safe inspection of trees and tree-hollows for fauna and methods to encourage fauna to vacate trees with minimal potential for distress or harm, including clearing surrounding vegetation prior to felling hollow-bearing trees.
- Protocols for the management and release of captured animals, including consideration of the appropriate management of injured or deceased individuals.
- Wildlife should not be handled wherever possible. Quarry staff should only handle wildlife in an emergency situation. Uninjured wildlife should be gently encouraged to leave the site by the ecologist/ wildlife specialist. Injured wildlife would be taken to a local WIRES carer or veterinarian for treatment and care if necessary.
- Capture and relocation or captive rearing of less mobile fauna (such as Koalas or nestling birds) by a trained fauna handler and with assistance from Wildlife Information Rescue and Education Service (WIRES) as required.
- Targeted pre-clearing surveys for hollow-dwelling fauna species including but not limited to microbats, arboreal mammals and birds.

Offsetting

The data from the fieldwork and mapping was entered into Version 4.1 of the BioBanking credit calculator as a 'Major Project' assessment to determine the number and type of biodiversity credits that would be required to offset impacts at the proposal site.

A total of 768 ecosystem credits would be required to offset the impacts of the proposal as shown in Table 5-18.

Table 5-18 Ecosystem credits required to offset impacts of the proposal

Vegetation Zone	Area (ha)	Current site value score	Future site value score	Change in landscape value score	Ecosystem credits required
NR 123	6.27	100	0	100	283
NR 114	4.23	85.94	0	85.94	485
TOTAL					**768**

A total of 17,437 species credits would be required to offset the impacts of the proposal as shown in Table 5-19.

Table 5-19 Species credits required to offset impacts of the proposal

Common name	Scientific name	Extent of impact (individuals)	Species credits required
Bordered guinea flower	*Hibbertia marginata*	1,190	16,660
Koala	*Phascolarctos cinereus*	10.5 ha	273
Common planigale	*Planigale maculata*	10.5 ha	273
Squirrel glider	*Petaurus norfolcensis*	10.5 ha	231
Total			**17,437**

The Biodiversity Offset Strategy for the proposal would include the purchase and retirement of the following biodiversity credits as calculated in accordance with the FBA:

- 485 ecosystem credits for Blackbutt-Turpentine dry heathy open forest (NR 123)
- 283 ecosystem credits for Blackbutt-Bloodwood dry heathy open forest (NR 114)

- 16,660 species credits for *Hibbertia marginata*
- 273 species credits for the Koala
- 231 species credits for the Squirrel glider
- 273 species credits for the Common planigale

A preliminary investigation of a potential biobank site located to the south of Tullymorgan-Jackybulbin Road (refer Figure 5-18), was undertaken to identify and map vegetation communities.

Preliminary investigations confirmed the presence of the following five vegetation types:

- Blackbutt-Bloodwood dry heathy open forest on Quaternary sands (NR 114)
- Blackbutt-Turpentine dry heathy open forest on sandstones (NR 123)
- Swamp Mahogany swamp forest of the coastal lowlands (NR 254)
- Paperbark swamp forest of the coastal lowlands (NR 217)
- Spotted Gum-Grey Ironbark-Pink Bloodwood open forest of the Clarence Valley lowlands (NR 246)

Broad-scale mapping of these vegetation types is provided at Figure 5-18. The approximate area of each vegetation type within the biobank site is provided in Table 5-20.

Table 5-20 Areas of vegetation types within the BioBank site

Vegetation Type	Vegetation Type ID	Area (ha)
Blackbutt-Bloodwood dry heathy open forest on Quaternary sands	NR 114	74.4
Blackbutt-Turpentine dry heathy open forest on sandstones	NR 123	13.5
Swamp Mahogany swamp forest of the coastal lowlands	NR 254	30
Paperbark swamp forest of the coastal lowlands	NR 217	15.1
Spotted Gum-Grey Ironbark-Pink Bloodwood open forest of the Clarence Valley lowlands	NR 246	1.9
Total		134.9

It is anticipated that results from the detailed biobanking assessment associated with establishing a biobank site would inform consultation with OEH to agree on the minimum size and final shape of the biobank site. Initial calculations indicate that less than 134.9 hectares will be required to adequately offset the ecosystem credits however, as mentioned, consultation with OEH will be required to agree on the final credits to adequately offset all of the proposals impacts in accordance with the trading guidelines associated with the FBA.

Preliminary assessment of the potential biobank site revealed that the vegetation types and condition are comparable with those identified within the proposed quarry footprint. Occurrences of the threatened plant, *Hibbertia marginata*, were also identified (refer Figure 5-18) suggesting that the proposed biobank site provides suitable habitat for this species.

Based on these initial findings it is proposed that a BioBanking assessment be undertaken for the potential biobank site, subject to approval of the proposed expansion.

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6,759,000 6,758,500 6,758,000 6,757,500 6,757,000 6,756,500

LEGEND

- Hibbertia Marginata
- Subject site
- Study area
- 10m contour
- cadastre
- Spotted Gum - Grey ironbark - Pink Bloodwood Open Forest
- Paperbark swamp forest of the coastal lowlands
- Blackbutt - Turpentine dry heathy open forest on sandstones
- Blackbutt - Bloodwood dry heathy open forest on Quaternary sands
- Swamp Mahogany swamp forest of the coastal lowlands

Paper Size A3

0 50 100 200 300 400

Metres

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

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Newman Quarrying
Sly's Quarry Environmental Impact Statement
Biodiversity Assessment

Job Number	22-17528
Revision	A
Date	18 Feb 2015

Proposed Biobank Site: Vegetation Types

Figure 5-18

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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

Data Source: NSW Department of Lands: Cadastre - Jan 2014; Geoscience Australia: 250k Data - Jan 2014; NSW Department od Primary Industry - Jan 2014; Google image Jan 2014. Created by: qjchung

5.6 Traffic

5.6.1 Introduction

The proposal would result in an increase in the number of vehicle movements using the local road network. To assess the impact of the increased vehicle numbers a *Traffic Impact Assessment* (GHD, 2015e) (Appendix G) has been prepared in accordance with the requirements of CVC and RTA *Guide to Traffic Generating Developments* (October 2002) (GTGD).

5.6.2 Existing conditions

Tullymorgan-Jackybulbin Road

Tullymorgan-Jackybulbin Road is a two-way single carriageway road and provides access from the Pacific Highway to Sly's Quarry and other rural/residential properties. There is no sign posted speed-limit, and as such the default speed limit for non-built up areas of 100 km/h applies. However, due to the width and curves of the road, it is not expected that vehicles would travel at this speed, with lower operating speeds likely. The road is sealed from the highway to the existing quarry access road and is unsealed further west of this point. The roadway is approximately 6.5-7.5 m wide, generally with grassed verges and no road shoulders.

Pacific Highway

The Pacific Highway in the vicinity of Tullymorgan–Jackybulbin Road is a two-way single carriageway road. The sign posted speed limit is 100 km/h. The Pacific Highway is a major transport corridor between Sydney and Brisbane. This section of the highway will be upgraded to be dual-carriageway with two lanes in each direction, as part of the Pacific Highway upgrade program.

Currently, Tullymorgan-Jackybulbin Road meets the Pacific Highway in a T intersection for a single carriageway. The refined concept design for the Pacific Highway upgrade proposal shows that a Seagull T intersection for a dual carriageway will be implemented at the intersection with Tullymorgan-Jackybulbin Road.

Sly's Quarry access

The access to the existing Sly's Quarry is located on Tullymorgan-Jackybulbin Road, approximately 2.6 kilometres west of the Pacific Highway. The access road is approximately four metres wide and 400 m long from the intersection to the site office. There is an onsite speed limit of 20 km/h. The site access is gated. Figure 5-19 below shows the site access point.

Figure 5-19 Site Access Road and Gate

Daily traffic volumes

Tullymorgan-Jackybulbin Road

There are no traffic counts that exist for Tullymorgan-Jackybulbin Road. For this reason, the existing traffic flow (not including existing quarry traffic) was calculated based on the RTA (now Roads and Maritime) *Guide to Traffic Generating Developments (*2002) using the following assumptions:

- Tullymorgan-Jackybulbin Road continues west, and then south towards the town of Ashby. It was assumed that the residents of dwellings more than 10 km from the quarry would continue via Ashby to access the Pacific Highway. Dwellings within this 10 km zone would likely access the highway by passing the quarry.
- There are 12 lots with residential dwellings with this 10 km zone of Tullymorgan-Jackybulbin Road.
- The RTA Guide to Traffic Generating Developments (2002) suggests that there are 9.0 daily vehicle trips per dwelling.
- It was assumed that 10% of traffic is heavy vehicles on this section.

The existing traffic generated by Sly's quarry is known to fluctuate substantially depending on demand for the quarry products. During busy periods where the extraction rate is 100,000 tonnes/annum, there are approximately 80 truck movements per day. The existing workforce at the quarry consists of seven employees, generating 14 light vehicle movements per day.

This calculated traffic was added to the traffic known to be generated by Sly's Quarry and is summarised in Table 5-21 below.

Table 5-21 Traffic volumes

Traffic Generation source	Light Vehicles (v/d)	Heavy Vehicles(v/d)	Total
Residential dwellings	97	11	108
Sly's Quarry	14	80	94
Total	111	91	202

There have been no crashes recorded in the vicinity of the quarry access or on Tullymorgan-Jackybulbin Road.

Pacific Highway

Roads and Maritime has provided traffic data for the Pacific Highway in two locations on the Pacific Highway. These are:

- Station HWDSTC, 200 m south of Yamba Road. This site is approximately 20 km south of Tullymorgan-Jackybulbin Road.
- Station 04233 at New Italy. This site is approximately 18 km north of Tullymorgan-Jackybulbin Road.

The average daily traffic for each of these sites is shown in Table 5-22.

Additional information provided by Roads and Maritime showed that at the Yamba Road counting station, heavy vehicles represented 18% of all traffic.

Table 5-22 Pacific Highway traffic volume data

Year	Location	ADT
2012	200 m south of Yamba Road, 20 km south of Tullymorgan-Jackybulbin Road - Northbound	5750
2012	200 m south of Yamba Road, 20 km south of Tullymorgan-Jackybulbin Road - Southbound	5750
2012	200 m south of Yamba Road, 20 km south of Tullymorgan-Jackybulbin Road – Total	11,500
2011	New Italy, 18 km north of Tullymorgan-Jackybulbin Road – Northbound	6000
2011	New Italy, 18 km north of Tullymorgan-Jackybulbin Road – Southbound	6000
2011	New Italy, 18 km north of Tullymorgan-Jackybulbin Road – Total	12,000

Source: Roads and Maritime

To apply this traffic data to the current year, a 2% p.a. traffic growth on the Pacific Highway was assumed to 2014. It was also assumed that the volume at Tullymorgan-Jackybulbin Road is an average of the two locations. Using these assumptions the traffic volumes shown in Table 5-23 were calculated.

Table 5-23 Pacific Highway calculated traffic volumes 2014

Direction	Light Vehicles (v/d)	Heavy Vehicles(v/d)	Total
Northbound	5060	1110	6170
Southbound	5059	1111	6170
Total	10,119	2221	12,340

Other transport modes

Northern Rivers Bus Lines operates a public bus service (route 695) between Grafton and Lismore which runs on the Pacific Highway past the Tullymorgan-Jackybulbin Road intersection. Each weekday there is one service to Lismore in the morning and one service to Grafton in the afternoon. The closest stop to the proposed development is approximately 7 km south of Tullymorgan-Jackybulbin Road in Woombah Woods.

School bus services use Tullymorgan-Jackybulbin Road as a U-turn facility after picking up/dropping off school children. This occurs during the morning and afternoon.

5.6.3 Potential impacts

At its peak, the quarry would be expected to generate 250 truck movements per day, and 24 staff movements. Current levels of activity are around 80 truck movements per day.

As a result of the proposal, daily traffic volumes on Tullymorgan-Jackybulbin Road would be expected to increase from the existing average of 202 vehicles per day to 382 vehicles per day. This level of activity would represent an increase of some 89% on the current traffic volumes on Tullymorgan-Jackybulbin Road. The proportion of heavy vehicles would increase from 45% currently to approximately 68%, as shown in Table 5-24.

Table 5-24 Impacts on traffic volumes on Tullymorgan-Jackybulbin Road

Scenario	Total Vehicles	Light Vehicles	Heavy Vehicles	% HV
Existing	202	111	91	45%
Plus Proposal	274	24	250	
Less current quarry activities	94	14	80	
Future	382	121	261	68%

The increase in traffic volume on Tullymorgan-Jackybulbin Road would also result in an increase in traffic on the Pacific Highway. Table 5-25 outlines the expected increase in traffic volumes due to the proposed development.

Table 5-25 Impacts on traffic volumes on the Pacific Highway

Scenario	Total Vehicles	Light Vehicles	Heavy Vehicles	% HV
Existing	12,340	10,119	2221	18%
Plus Proposal	274	24	250	
Less current quarry activities	94	14	80	
Future	12,520	10,129	2391	19%

The daily traffic volumes on the Pacific Highway are expected to increase by 1.5% as a result of the proposal. This small increase in traffic (which is less than the assumed annual growth rate) is not expected to have any significant impact on the Pacific Highway in the vicinity of the proposed development. The percentage of heavy vehicles on this section of the Pacific Highway is also expected to increase from 18% to 19% as a result of this proposed development.

The existing access road is relatively narrow, however it does allow for inbound and outbound vehicles to pass each other without leaving the formed roadway. Due to the potential increase in heavy vehicles and the unsealed road surface, the road condition may deteriorate at a faster rate than it does currently.

Site access intersection

Haulage trucks would enter and exit the site using the existing access onto Tullymorgan-Jackybulbin Road. It is expected that almost all truck movements will be to and from the east (Pacific Highway), with right turns into the site and left turns out onto Tullymorgan-Jackybulbin Road.

It is expected that the peak design hour would contain approximately 10% of truck movements into and out of the quarry (13 trucks turning in, 13 trucks turning out). It can also be estimated that the design peak hour would contain 10% of the total average daily traffic which would indicate a peak hourly volume of 38 vehicles on Tullymorgan-Jackybulbin Road.

Even with background growth in traffic volumes on the Tullymorgan-Jackybulbin Road, or with an increase in the volume of truck activity at the quarry, this type of intersection is likely to be suitable for many years to come.

The sight distance in both directions from the site access road exceeds the Austroads *Guide to Road Design Part 4A* of 179 m with 220 m to the east and 200 m to the west.

Pacific Highway / Tullymorgan-Jackybulbin Road intersection

Haulage trucks would enter and exit the site using the existing access onto Tullymorgan-Jackybulbin Road. It is expected that almost all truck movements would be to and from the east (Pacific Highway), with right turns into the site and left turns out onto Tullymorgan-Jackybulbin Road.

It is expected that the peak design hour would contain approximately 10% of truck movements into and out of the quarry (13 trucks turning in, 13 trucks turning out). Traffic count data provided by Roads and Maritime shows that the peak hour volume on the Pacific Highway in the vicinity of Tullymorgan-Jackybulbin Road can be estimated as 1234 veh/h (10% of the ADT).

There is not expected to be a large growth in traffic on Tullymorgan-Jackybulbin Road in the foreseeable future and as such this intersection is likely to be suitable for at least a 10 year horizon. The proposed arrangements for the upgrade of this intersection as part of the Pacific Highway upgrade program should be sufficient for the volumes described above.

The site distance at the Pacific Highway/Tullymorgan-Jackybulbin Road intersection exceeds the required 248 m in both directions with approximately 370 m to the north and 500 m to the south.

Haulage of quarry materials would primarily be between the site and the Pacific Highway via Tullymorgan-Jackybulbin Road, for distribution onto the wider network. Precise routes will depend on the location of works utilising quarry outputs.

It is unlikely that a formal road safety audit process would identify any major issues with this section of road.

The quarry site is remote from any source of vulnerable road user (pedestrians and cyclists) activity. Given the relatively low traffic volumes on the road, the scale of traffic increase expected, and the physical characteristics of the road that provide for good forward sight distance, there is not expected to be any deterioration in safety for pedestrians or cyclists. Similarly, there will be no direct impact on any existing bus stops, or bus services.

The quarry area will be accessed via the existing access road. A site office and amenities block is located approximately 400 m north of Tullymorgan-Jackybulbin Road. At this location, there is sufficient space for the manoeuvring and parking of staff vehicles, and other site vehicles as required.

Traffic movement within the quarry would depend on the area being excavated at the time. Vehicle access paths would be established to suit the specific activities being undertaken.

5.6.4 Mitigation measures

To minimise potential impacts to traffic and access due to the proposal, the following measures are proposed:

- The maintenance of the site access road should be reviewed and if necessary, frequency of maintenance should be increased to cope with the increased heavy vehicle movements generated by the proposed development.
- Vehicles should conform to a code of conduct for the transport of materials on public roads.
- Where practicable, haulage vehicles should be back-loaded to carry loads on both inward and outward journeys, to minimise total vehicle movements.

5.7 Heritage

5.7.1 Introduction

Everick Heritage Consultants Pty Ltd (Everick) prepared a *Cultural Heritage Due Diligence Assessment* (Everick, 2014) for the proposed Sly's Quarry. The assessment was undertaken in order to address the SEARs. The assessment, contained in Appendix H and summarised below, addressed both historic (non- Indigenous) and Aboriginal cultural heritage.

5.7.2 Existing conditions

Aboriginal Cultural Heritage

A Due Diligence Assessment was carried out in accordance with the relevant administrative and legislative standards for NSW. The methods employed in the assessment included:

- Searches of applicable Indigenous heritage registers
- A review of current and historic satellite imagery
- Archaeological survey of the proposed quarry area
- Desktop assessment
- Assessment of the proposed quarry area in accordance with the Due Diligence Code
- Reporting of findings and recommending management strategies

As a result of the desktop study and field inspection of the proposed expansion to the Sly's Quarry extraction areas and consultation with Yaegl local Aboriginal land council (LALC) Sites Officer Dale Mercy, the following were agreed to.

- No Indigenous cultural heritage sites or relics were identified within the proposed expansion areas of Sly's Quarry.
- No areas have been identified that are considered to potentially contain subsurface deposits of significant Aboriginal heritage.
- All of the proposed quarry has been disturbed in a manner which constitutes 'disturbance' within the meaning of the Due Diligence Code and is consistent with the Due Diligence Code.
- The Yaegl LALC representative agreed in discussion that no further Aboriginal cultural heritage investigation was required.

Historic cultural heritage

The desktop review concluded that no historically significant cultural heritage sites were located in the vicinity of the quarry. The following heritage databases were reviewed on 05 October 2014 to assess the potential for non-Indigenous heritage attributes within the Clarence Valley LGA and specifically for the Mororo area:

- The World Heritage List: Contains no historic heritage listings within or within close proximity to the proposal.
- Register of the National Estate: returned four (4) historic heritage listings all of which were located in Woodburn, with the closest being the Broadwater National Park, situated northeast of the proposal.
- Commonwealth Heritage List (Australian Heritage Council): Contains no historic heritage listings within or within close proximity to the proposal.
- The National Heritage List (Australian Heritage Council): Contains no historic heritage listings within or within close proximity to the proposal.
- The National Trust Register: Contains no historic heritage listings within or within close proximity to the proposal.
- The State Heritage Register (NSW Heritage Office): Contains no historic heritage listings for Mororo. One historic heritage item was listed for Evans Head under Section 1 (Heritage Council) and will not be impacted by the proposal. Section 2 (Local Councils, Shires and State Agencies) lists one item for Evans Head and seven listings for Woodburn, none of which will be impacted by the proposal.
- CVLEP 2012: Contains no historic heritage listings for the Mororo area. 17 items are listed for Evans Head and 12 items are listed for Woodburn, none of which will be impacted by the proposal.

There were also no places of historic heritage found within the proposed quarry area as a result of the field survey.

5.7.3 Potential impacts

A potential impact exists for previously unrecorded Aboriginal sites uncovered during the excavation activities however the potential impact on potential Aboriginal sites in that area is deemed to be extremely low.

The desktop review concluded that no historically significant cultural heritage sites would be impacted by the proposal.

5.7.4 Mitigation measures

The following mitigation measures are to be implemented:

- If it is suspected that Aboriginal material has been uncovered as a result of earth working activities within the Project Area:
  - Work in the surrounding area is to stop immediately.
  - A temporary fence is to be erected around the site, with a buffer zone of at least 10 m around the known edge of the site.
  - An appropriately qualified archaeological consultant is to be engaged to identify the material.
  - If the material is found to be of Aboriginal origin, the Aboriginal community is to be consulted in a manner as outlined in the OEH guidelines: *Aboriginal Cultural Heritage Consultation Requirements for Proponents* (2010).
- If Aboriginal cultural materials are uncovered as a result of development activities within the Project Area, they are to be registered as Sites in the AHIMS database managed by the OEH. Any management outcomes for the site will be included in the information provided to the OEH.
- If human remains are located at any stage during earthworks within the Project Area, all works must halt in the immediate area to prevent any further impacts to the remains. The location where they were found should be cordoned off and the remains themselves should be left untouched. The nearest police station, the Yaegl LALC, and the OEH Regional Office (Coffs Harbour) are to be notified as soon as possible. If the remains are found to be of Aboriginal origin and the police release the scene, the Aboriginal community and the OEH should be consulted as to how the remains should be dealt with. Work may only resume after agreement is reached between all notified parties, provided it is in accordance with all parties' statutory obligations.
- In the unlikely event that Aboriginal cultural heritage is identified during Project works, it is proposed that all effort must be taken to avoid any impacts on Aboriginal Cultural Heritage values. Should a situation arise where impacts to Aboriginal cultural heritage is unavoidable, mitigation measures should be negotiated between the Proponent, OEH and the Aboriginal Community.

No mitigation measures are proposed in relation to historic heritage. The proposal does not impact on places of historic heritage significance.

5.8 Visual

A visual impact assessment investigates the potential visual impacts of the proposed quarry on the surrounding environment. This assessment reviewed the existing visual character of the site and its surrounds and the expected impacts of the quarry on the existing visual character of the surrounds, nearby existing residences and publicly accessible locations. More specifically, the visual assessment considered the following:

- Existing views to the proposed site
- The visual character of the surrounding landscape

- The sensitivity of the landscape to alteration by the proposal
- The visual character and extent of the proposed quarry
- Viewer sensitivity to alteration of the environment by the proposal

5.8.1 Existing conditions

The natural topography of the site would be described as undulating but this has been altered by the previous quarrying activities.

The existing and proposed extent of the quarry is obscured from the majority of the surrounding area by topography and vegetation.

Figure 5-20 shows the visual envelope in which areas may be impacted by the proposed quarry which has been determined based on contours surrounding the site. As shown, vegetation would obscure or screen views to public and private locations and the vegetation would play a part in screening the proposed quarry extension.

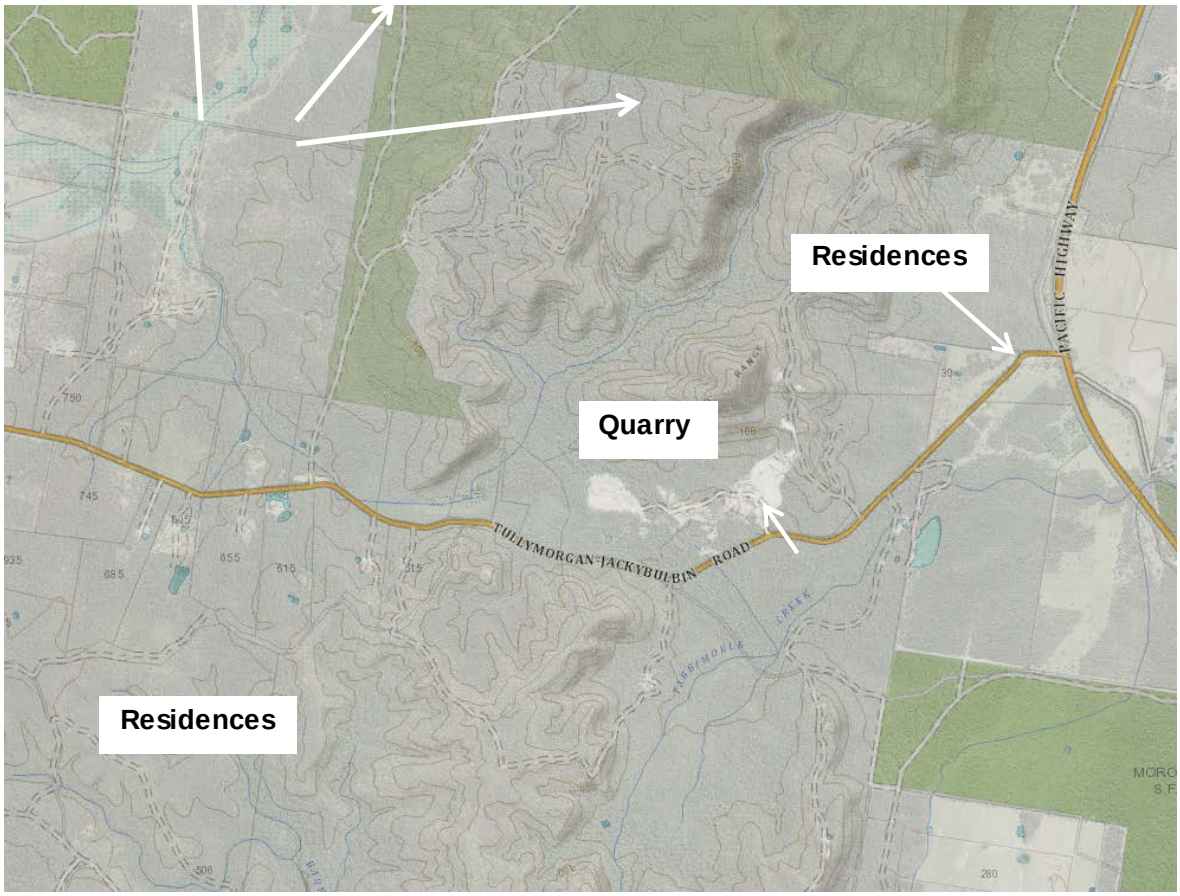


Figure 5-20 Project site and surrounding residents

5.8.2 Potential impacts

The visual assessment considered the extent of the quarry and its location to both public and private locations.

The assessment found that the landscape around the proposed development generally has a high visual absorption capacity due to the existing terrain and the dense vegetation. This high visual absorption capacity corresponds directly with the generally low significance of impact to views from the proposal.

Table 5-26 provides an overview of each of the affected locations and the visual impact in relation to the quarry extent. The overall rating has been provided for each of the potentially affected properties. This rating has been achieved by reviewing the summary of findings for each of the properties and making an assessment as to how each property rated relative to the sensitivity and magnitude of the impact on the view.

The quarry only operates during day light hours, so impacts from lighting are not expected. If lights are used, the distance from the nearest residents and the screened location of the quarry mean, lighting is unlikely to cause an adverse impact.

Table 5-26 Visual assessment

Viewing Site	Summary of Findings	Potential Visual Impact
Tullymorgan-Jackybulbin Road	• No long term visual impacts • The quarry extent would not interrupt views to landscape features or be viewed against the sky • The quarry extent would be unlikely to detract from visual amenity of the existing rural context. • Vegetation buffers would mostly screen any view to the quarry extent. • Expansion would remain 30 m from the road reserve.	Low
Pacific Highway	• Vegetation, distance and topography restrict views to project site. • Not possible to view the project site	Negligible
Northern properties	• Views would be available from Mount Doubleduke but there is currently no development and unlikely to have future development. The quarry would unlikely detract from the existing visual amenity.	Low
Eastern properties	• Vegetation and topography restricts views to project site from dwellings. Not possible to view the project site from dwellings and therefore no or little impact	Low
Southern properties	• Vegetation restricts views to project site from dwellings. Not possible to view the project site from dwelling and therefore no or little impact	Low
Western properties	• No views from residential dwellings due to vegetation and topography, therefore no or little impact. • The quarry would be visible from high points where there is currently no development and unlikely to have future development.	Low

The proposed quarry would not be visible from any of the sensitive receivers and therefore the visual impact is considered to be low.

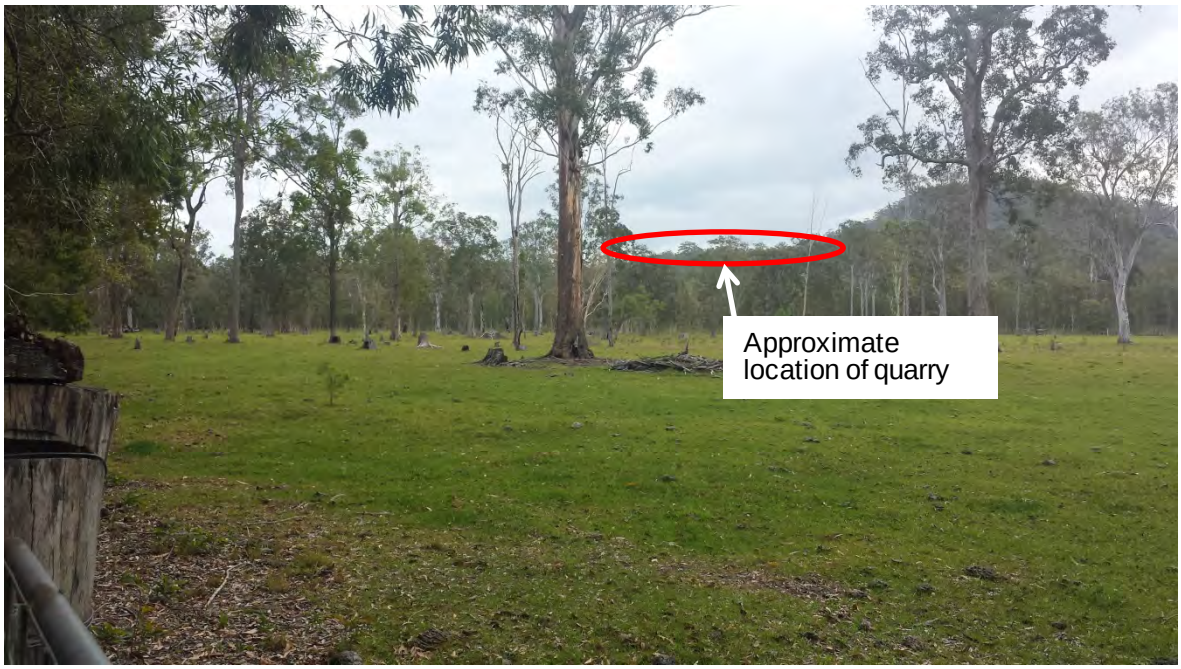


Figure 5-21 View from east towards quarry

5.8.3 Mitigation measures

Whilst the visual impact from the proposed quarry extension is considered to be low, the following mitigation measures are proposed to minimise future visual impacts:

- Maintain and enhance the existing vegetation between the project site and property boundaries to provide ongoing screening to the quarry.
- Maintain the site in a clean and tidy condition at all times.
- Progressively revegetate all areas where quarrying is completed.
- Locate stockpiles within existing pits or locations that are screened from views from adjoining properties. Plant and equipment should also be located in positions which are naturally screened from views from dwellings.

5.9 Waste

5.9.1 Introduction

The proposal has the potential to generate waste from quarry activities and general site use.

This section describes the type and classification of waste that would be handled/stored/disposed of at the site. The potential impacts of the proposal in regard to waste generation during the establishment, operation and decommissioning of the quarry has also been assessed.

A description of the measures that would be implemented to avoid, minimise, mitigate, offset, manage and/ or monitor the potential impacts associated with the waste generated, as a result of the proposal, are provided.

5.9.2 Existing environment

The existing quarry would generate various waste streams including construction and excavation waste, vegetation waste, packaging materials and liquid wastes. The volumes of solid wastes are expected to be relatively small as most waste would be reused or recycled on site e.g. excavation waste and vegetation waste. General construction waste is likely to be the most significant and this is currently managed, where possible, in accordance with the waste management hierarchy of avoid, reuse, recycle and dispose.

Liquid wastes consist of oil, paint, lubricants, glue and stormwater. The oil, paint, lubricants and glue are minor sources of waste. Significant volumes of stormwater would be generated from the site and is addressed in Section 5.2.

5.9.3 Potential impacts

Quarrying involves the stripping and emplacement of topsoil and overburden, extraction, screening and stockpiling of the raw materials and product loading and distribution. The types of waste generated are not expected to change as a result of the quarry but the volumes of some wastes would increase.

The operation of the proposal would generate the following waste types:

- Excavated material (topsoil and overburden not suitable for sale)
- Domestic waste
- Green waste
- Construction waste
- Effluent from staff ablutions facilities
- Used lubricants and oils
- Contaminated soil
- Runoff from disturbed areas and the processing plant

The classification and description of each of the general waste types to be potentially generated by the proposal is summarised in Table 5-27.

Table 5-27 Potential waste description

Waste Type	Waste Classification1	Details
Excavated material	General Solid Waste (non-putrescible)	Excavated material waste is likely to consist of rock, gravel and silt. The volume of waste excavated material would be small as excess excavated material would generally be utilised on-site as backfill or for rehabilitation and other site works.
Green Waste	General Solid Waste (non-putrescible)	Clearing would be limited to an area of 19 hectares. All cleared vegetation would be mulched and stockpiled on site for revegetation works.
Construction waste	General Solid Waste (non-putrescible)	Waste from construction would include excess concrete, metal, timber, fittings and packaging. Waste would be collected and disposed of appropriately. All attempts would be made to reuse or recycle building products hence the volume of construction material waste is expected to be minimal.
Liquid waste	Liquid Waste	A limited amount of liquid waste is expected to be generated by the proposal. The waste is expected to consist of oil, paint, lubricants, glue etc. Liquid wastes would be stored and disposed of appropriately.
Contaminated Soil	To be determined	Any spills of chemicals or fuel could result in contaminated soil that would require disposal in an appropriately licenced landfill or trade waste facility.
Wastewater	Liquid Waste	Wastewater may be generated as a result of dewatering of pits and sediment basins. Management of this wastewater is outlined in Section 5.2.
Biological waste (Sewage)	Liquid Waste and General Solid Waste (putrescible)	The site would be equipped with a toilet that is pumped out on an as needs basis by a licensed contractor.
Domestic waste	General Solid Waste (non-putrescible and putrescible)	The limited general waste generated on-site would be collected and disposed of appropriately (in Council bins and/or landfills). Waste would consist of everyday items such as paper, aluminium cans, plastics, packaging and other material generated by onsite staff.

Potential impacts from the production and inappropriate disposal of waste generated from the proposal includes:

- Contamination of land
- Pollution of waterways
- Air pollution
- Overuse of scarce resources
- Human and animal health impacts

[1] As per Waste Classification Guidelines (EPA, 2014)

5.9.4 Mitigation measures

All waste would continue to be managed in accordance with the requirements of the *Waste Avoidance and Resource Recovery Act 2001*, the *PoEO Act* 1997, the *Waste Classification Guidelines* (EPA, 2014) and the principles of the waste management hierarchy.

Mitigation measures are summarised in Table 5-28 for the types of wastes likely to be produced on site. These measures would be used as the basis for a Waste Management Plan (WMP) to be prepared for the site. The WMP would be communicated to all employees and contractors during site induction, prior to commencing works at the site and a copy should remain on-site for reference purposes during operation.

Table 5-28 Proposed waste management measures

Waste Type	Waste Management Hierarchy		
	Avoid	Reuse/ Recycle/Recover	Dispose
Excavated material	Avoid excess excavation	Use excess material on site as fill and/or in rehabilitation works	Excess excavated material to be classified and disposed in accordance with the Waste Classification Guidelines
Green waste	Minimise clearing	Mulch cleared vegetation and use on site	Excess material to be classified and disposed in accordance with the Waste Classification Guidelines
General construction waste	Materials to be sourced and ordered in appropriate quantities	Reuse excess material on-site wherever possible. All recyclables (including aluminium, paper & cardboard, steel, glass, rigid plastic, organics) to be collected and recycled accordingly	Excess material to be classified and disposed in accordance with the Waste Classification Guidelines
Contaminated soil	Proper storage of all chemicals and fuels (e.g. bunded areas with 110% capacity)	Utilise bioremediation for large quantities of fuel-impacted soil. Tracking during transportation would be carried out where required	Disposed in accordance with the Waste Classification Guidelines
Liquid waste	Materials to be sourced and ordered in appropriate quantities	Reuse excess material on-site wherever possible e.g. store and reuse lubricants	Excess material to be classified and disposed in accordance with the Waste Classification Guidelines
Wastewater	Divert clean water from the site	Waste water to be pumped to a holding pond and used on-site e.g. for dust suppression/ plant watering etc	Discharge wastewater, in accordance with EPL requirements
Biological (sewage) waste	Minimise use of site facilities e.g. toilets	Consider using composting toilet	Sewage waste to be disposed at an appropriately licensed facility
Domestic waste	Materials to be sourced and ordered in appropriate quantities	Reuse excess material on-site wherever possible. All recyclables (including aluminium, paper & cardboard, steel, glass, rigid plastic, organics) to be collected and recycled accordingly	Excess material to be classified and disposed in accordance with the Waste Classification Guidelines

5.10 Risks and hazards

5.10.1 Introduction

A risk and hazard assessment provides a framework for identifying and analysing potential environmental impacts of the proposal. This section describes the measures that would be implemented to avoid, minimise, mitigate, offset, manage and/or monitor the potential impacts from hazards and risks, including any storage of dangerous goods.

Risks generated in relation to traffic and transport, soil and water, flooding, flora and fauna, noise, air quality, heritage, visual amenity, waste management, and social and economic impacts, along with measures to avoid, minimise, mitigate, offset, manage and/or monitoring the potential impacts are addressed in each relevant section of the EIS. Selected hazard and risk factors have been addressed in this Section to address the overall hazard and risk management strategy.

5.10.2 Existing environment

The existing quarry site is subject to various risks and hazards, including:

- **Contamination and Dangerous Goods** – The use of heavy machinery at the site presents the risk of contamination as a result of spills from the machinery and during refuelling and maintenance.
- **Bushfire** - The site is surrounded by large areas of vegetation and bushfire poses a potential risk to the site. Bushfire could damage structures and impact on safety of employees and visitors to the site.
- **Safety** – The quarry presents various safety risks to employees and subcontractors working at the site. Safety risks include large drops over benches, uneven surface, heavy machinery and traffic and storage, handling and use of explosives.

5.10.3 Impact assessment

Table 5-29 identifies the potential environmental hazards for the proposal and assesses the risk involved before and after implementation of proposed mitigation measures.

Table 5-29 Environmental risk assessment

Issue	Hazard	Preliminary Risk			Proposed Control Measures	Residual Risk		
		Consequence	Likelihood	Rank		Consequence	Likelihood	Rank
Contamination and dangerous goods	Contamination of the site could occur as a result of spills from machinery, refuelling or dangerous goods storage	B	3	Medium	Store dangerous goods in an appropriately bunded area. Keep and maintain appropriate spill control kit and ensure all staff are trained in its use.	B	1	Low
Bushfire	The site is surrounded by large areas of vegetation and bushfire poses a potential risk to the proposal. Bushfire could damage structures and impact on safety of employees and visitors to the site. The proposal also presents a risk of being the source of a bushfire.	D	3	High	Refer to Section 3.2.14	C	2	Medium
Safety	The site presents various safety hazards including large drops over benches, uneven surface, heavy machinery and traffic and storage, handling and use of explosives.	E	3	High	Prepare and implement a Health and Safety Plan	C	2	Medium

Table 5-30 Risk assessment matrix

RISK ASSESSMENT MATRIX		CONSEQUENCE				
		MINOR	MAJOR	SEVERE	CRITICAL	CATASTROPHIC
LIKELIHOOD		A	B	C	D	E
VERY UNLIKELY	1	Low	Low	Medium	Medium	Medium
UNLIKELY	2	Low	Low	Medium	Medium	High
POSSIBLE	3	Low	Medium	High	High	High
LIKELY	4	Medium	Medium	High	High	Extreme
ALMOST CERTAIN	5	Medium	High	High	Extreme	Extreme

Safety, Health and Environment Consequence (C)		Likelihood (L)		
		Safety		Environment
A	First Aid / Limited direct ecosystem harm.	1	Occurs > 100 jobs	Highly unlikely, but could occur in very exceptional occasions.
B	Medical treatment/minor injury/ Localised environmental impact	2	Occurs in 0-100 jobs	Not expected to occur but there is a slight possibility that the impact could occur on some occasions.
C	Lost time injury / Significant impact environmental with reversible impacts	3	Occurs in 1-10 jobs	It is possible that the impact could occur
D	Sever irreversible damage/impairment/health effects/ disabling illness/ Serious long term environmental Impact	4	Occurs 1 per job	The impact will probably occur in most circumstances
E	Fatality /Ecosystem Collapse	5	Occurs < 1 per job	The impact is expected to occur in most circumstances

5.10.4 Mitigation measures

The risk assessment has found that all risks for the selected factors can be mitigated to achieve a residual ranking of "Low" or "Medium" provided the following mitigation measures are implemented:

- Store dangerous goods in an appropriately bunded area
- Keep and maintain appropriate spill control kit and ensure all staff are trained in its use
- Use an approved fuel dispenser, for refuelling
- Maintain a register of dangerous goods on site
- If available, use a safe alternative to the dangerous good
- Prepare and implement a Health and Safety Plan

5.11 Socio-economic

5.11.1 Introduction

The following section describes the social and economic impacts of the proposed quarry expansion. The potential social and economic impacts requiring assessment are as follows:

- Alteration of social activities or employment due to employment generation and capital expenditure
- Perceived or real impacts on local amenity of neighbouring properties
- Implications of the increased workforce on the need for services and infrastructure
- Actual or perceived reduction in quality of life

The statistical data referenced in this section is drawn from the census data compiled by the Australian Bureau of Statistics (ABS) for 2011.

5.11.2 Existing conditions

Geographic location

The site is accessed from Tullymorgan-Jackybulbin Road via a gravel access road that travels in a northerly direction. A quarry currently occupies the site which is the subject of this proposal. The site is bounded to the south by the Tullymorgan-Jackybulbin Road and to the north, east and west by timber vegetation. The Pacific Highway is 2.6 km to the east of the site.

Rural properties are located along Tullymorgan-Jackybulbin Road to the east, south and west of the site. The nearest residence is approximately 1.5 km away and the site is surrounded by vegetation to the north.

Social characteristics

Results of the 2011 Census found there were 49,665 people in the Clarence Valley LGA, of these 49.4% were male and 50.6% were female. Aboriginal and Torres Strait Islander people made up 5.7% of the population, more than twice the national average.

The median age of people in the Clarence Valley was 46 years; some nine years older than the national median. Children aged between 0 and 14 years made up 18.6% of the population and people aged 65 years and over made up 21.3% of the population. Of people in the area aged 15 years and over, 49.3% were married and 14.6% were either divorced or separated.

The median weekly income for residents within the Clarence Valley was significantly below the national average, being one of the factors that place parts of the Clarence Valley in an area of social disadvantage.

The population of New Italy (i.e. the area surrounding the site) during the 2011 Census was 295 and comprised of 48.1% females and 51.9% males. The median/average age of the New Italy population was 46 years of age. Other social indicators for New Italy included the following:

- Within New Italy 58.0% are employed full time, 25.9% are working on a part time basis. New Italy has an unemployment rate of 11.6%.
- The main occupations of people from New Italy are Technicians and Trades Workers 24.7%, Professionals 19.6%, Managers 13.4%, Labourers 13.4%, Community and Personal Service Workers 12.4, Machinery Operators and Drivers 9.3%, Sales Workers 4.1%, Clerical and Administrative Workers 3.1%.
- The median individual income is $376.00 per week and the median household income is $763.00 per week.
- 47.6% of homes are fully owned, and 39.0% are in the process of being purchased by home loan mortgage. 10.5% of homes are rented.
- The median rent in New Italy is $140 per week and the median mortgage repayment is $867 per month.

The Mid North Coast's population is expected to increase over the next 25 years by up to 28%, with an average annual increase of 1.1%, according to the Mid-North Coast Regional Strategy. This would result in a projected 7,100 new dwellings required in the Clarence Valley. The key driver of population growth is in-migration, to be accommodated mainly in urban growth.

Economic characteristics

Clarence Valley Gross Regional Product (GRP) is estimated at $1.26 billion. Clarence Valley contributes 10.8% of the Mid North Coast's GRP (Regional Development Australia, 2013).

It is estimated that 19,429 people have a job in Clarence Valley with the largest number of people employed in the Health Care and Social Assistance industry (14.9% of total employment, 2,323 people).

The mining industry between 2006 and 2011 had significant growth in the LGA with a 168% growth in the number of person employed in this sector (from 19 persons in 2006 to 32 in 2011). Agriculture had a large decline with 14% less people employed in this sector.

The unemployment rate in September 2014 in the Clarence Valley Council area was 8.11% which increased since 2013 from 6.73%.

5.11.3 Potential impacts

Social

Extraction of gravel materials from the site has been occurring since the 1960's with minimal negative impacts to the local community. The noise, vibration, air quality and traffic impacts of the proposed expansion, on the surrounding community, would be minimal as shown in other sections of this EIS.

The site is a significant distance from scattered rural residential dwellings, with the nearest residence over 1 km from the site. The location of the quarry has been successfully protected in the past from the encroachment of incompatible land uses, such as residential development.

In addition, natural vegetation buffers and other management measures for noise, dust, traffic and other amenity factors, associated with the quarry's operation, would be well established. Access and transport networks are well established. The longer the quarry can remain in production, the greater the likely benefits to the community with respect to efficient use of a scarce economic resource and the greater the likelihood of conserving greenfield areas.

A related positive social impact of the proposal is the upgrade of the Pacific Highway. The proposal would not be occurring if it was not for the large demand, from the upgrade of the Pacific Highway, for suitable material, which Sly's Quarry contains. The proposal would provide a valuable resource to this major infrastructure project which is significantly reducing travel times, crashes and fatalities (Roads and Maritime, 2013). The relatively close proximity of the site to the Pacific Highway is also a benefit to the wider community because it avoids transporting materials over a longer distance and potentially impacting on a greater number of people.

Economic

To operate the quarry, it is anticipated that twelve full time employees would be required during periods of maximum extraction. Haulage of the material would also provide employment for truck drivers. Additional off site employment would also be generated, in the maintenance and support services for equipment and machinery.

Employees working at the quarry would have an economic impact through expenditures from their weekly earnings. Similarly, spending by construction workers during the time of quarry re-development would have a beneficial impact on the local economies. Expenditure by workers from their wages would largely occur in the town where they reside and in nearby towns.

The market for these materials in NSW areas derives largely from demand within the construction and building industries, driven by population growth, economic activity and specific infrastructure projects particularly the Pacific Highway upgrade.

Given the sites location to the highway this would be a significant source of material. The relatively short transport distance to the Pacific Highway, compared to other quarries located further away, would reduce the cost of the upgrade works which would ultimately benefit Australian tax payers.

Residential development would be a significant driving force in the area over the next ten to 15 years for quarry materials. Clarence Valley Council has identified several release areas in particular a demand for rural residential development as demonstrated in the *Draft Rural Residential Strategy* (CVC, 2013). These developments would bring with them complementary development, such as shopping centres, health and community facilities and schools, as well as related road and other urban infrastructure.

The Institute of Quarrying Australia estimates that construction of a typical brick veneer house requires around 100 tonnes of aggregate, including driveway and landscaping. In addition, Cement Concrete and Aggregates Australia estimate that one kilometre of suburban road requires 1,200 tonnes of asphalt and concrete and 5,000 tonnes of crushed rock.

The quarry is well positioned to supply part of the demand for several up-coming committed and planned major residential, commercial and infrastructure projects within its core supply area.

A second significant impact on the local economy comes from expenditure on materials and equipment by the quarry - everything other than expenditure on labour. The term "materials" covers items including equipment and materials for site preparation, conveyors and other earth moving equipment, contractors, transport and marketing, and the ongoing use of materials such as repairs and replacement parts, fuel and explosives. The expenditure on materials during both

the construction and operations phases is spread more widely than expenditure by employees. This is to be expected with materials and equipment being sourced from outside of New Italy and the surrounding area, and outside of NSW.

The quarry would likely pay a road levy to CVC which would contribute to the maintenance of the local roads for the benefit of the local communities.

State Governments can expect economic benefits to continue from the quarry at an enhanced level, including revenue from taxes and payments for service from statutory bodies.

A potential negative impact which may be perceived by some adjoining landowners is the degradation of the road from truck movements and creation of potholes. It is anticipated that this impact would be minimal as the operation currently exists and the quarry would pay a levy for the maintenance of the road.

5.11.4 Mitigation measures

Mitigation strategies are processes, programs or plans designed to address the perceived issues and impacts stakeholders raised during the assessment program. The strategies may serve to enhance the positive impacts associated with a proposal, or mitigate or ameliorate negative impacts.

The mitigation measures to address socio-economic issues include the following:

- Employ locals, where possible and ensure local residents are aware of upcoming employment opportunities by advertising vacant positions in the local paper.
- Employ a 'buy local' practice whereby goods and services are purchased from local businesses provided that they are competitive in terms of quality and price.
- Traffic, visual, noise and vibration impacts which may affect the quality of life of nearby residents are discussed in detail in other sections of this EIS. Any mitigation measures associated with these assessments should be implemented.

5.12 Cumulative and synergistic impacts

Cumulative impacts can be described as the effect caused by successively adding the same impact to produce an accumulated effect. Synergistic impacts can be described as the effect of two or more impacts working together to produce effects that were not predicted.

At a local scale, the proposed upgrade of the Pacific Highway is the only project known to potentially create cumulative or synergistic impacts with the proposal. This impact would be particularly relevant to those residents near the Jackybulbin-Tullymorgan Road and Pacific Highway intersection. Table 5-31 assesses the likely cumulative and synergistic impacts and provides some mitigation measures, where necessary.

Table 5-31 Cumulative and synergistic impacts and mitigation

Aspect	Cumulative or synergistic impact	Mitigation
Land Resources	Both the Pacific Highway and the proposal would involve significant earthworks which would alter the natural topography. As the two projects are separated by over 1 km and visually isolated, it is considered unlikely that there would be a cumulative or synergistic impact.	NA

Aspect	Cumulative or synergistic impact	Mitigation
Surface water and Groundwater	The proposal would alter surface water drainage and water quality, as would the Pacific Highway upgrade. Both projects would manage/mitigate these impacts onsite and therefore there would not be a cumulative or synergistic impact.	Implement mitigation measures in Section 5.2.4
Noise	The residents near the intersection of Jackybulbin-Tullymorgan Road and Pacific Highway would be particularly exposed to the noise impacts associated with the Pacific Highway upgrade. As the noise impacts from the proposal are within the assessment criteria and are likely to have less impact than the Pacific Highway upgrade, the cumulative or synergistic impact as a result of the proposal are considered insignificant.	Implement mitigation measures in Section 5.3.4
Air	As with noise, the cumulative or synergistic impact as a result of the proposal are considered insignificant compared to the Pacific Highway upgrade.	Implement mitigation measures in Section 5.4.4
Ecology	Both the proposal and the Pacific Highway upgrade would have an impact on ecology. As indicated, the proposal would offset its impacts onsite and the Pacific Highway is also required to offset their ecological impacts. At the broader scale, the clearing associated with the proposal is insignificant.	Implement mitigation measures in Section 5.5.4
Traffic	A clear synergistic and cumulative impact is associated with traffic generated by the proposal and Pacific Highway upgrade. The quarry would not be expanding if it was not for the upgrade works and both would result in an increase in heavy vehicles on the road. As assessed in Section 5.6, the local roads are able to accommodate the additional traffic numbers. The highway upgrade is likely to result in short-term impacts and once complete, traffic numbers would reduce significantly in the area.	Implement mitigation measures in Section 5.6.4
Heritage	There would be no cumulative or synergistic impact on heritage as a result of the proposal.	NA
Visual	As the proposal is obscured from most vantage points, it is unlikely that both projects could be seen from the one location. It is	NA

Aspect	Cumulative or synergistic impact	Mitigation
	therefore considered unlikely that there would be any cumulative or synergistic impact.	
Waste	Any waste associated with the proposal would be very minor and therefore it is considered unlikely that there would be any cumulative or synergistic impact.	NA
Risks and hazards	The risks and hazards associated with the proposal are very localised and therefore it is considered unlikely that there would be any cumulative or synergistic impact.	NA
Socio-economic	There would be cumulative and synergistic impacts on the socio-economic characteristics of the area as a result of the two projects in relation to water, noise, air and traffic impacts. These have been considered above. Both projects would contribute to the safer and improved Pacific Highway and increased employment opportunities during construction.	Implement mitigation measures in Section 5.11.4

6. Environmental management

6.1 Introduction

Environmental management at Sly's Quarry would be undertaken in accordance with an Environmental Management Plan (EMP), which would be prepared to provide an overall framework for the management of environmental impacts that could potentially arise from the proposed extension of the quarry. All mitigation measures identified throughout this EIS would be incorporated into the EMP, which would provide:

- An environmental operations manual for Sly's Quarry staff and contractors throughout construction and operation of the quarry.
- Identification of potential impacts of the proposed quarry and the measures proposed to mitigate these impacts as described in the preceding chapters of this EIS.
- Details of how environmental safeguards are to be implemented.
- Details of the timing of the implementation of the mitigation measures.
- Clearly defined allocations of environmental responsibilities of all staff and contractors.
- Monitoring and reporting requirements to demonstrate compliance with licensing and approval requirements.
- Procedures for review and updating of the EMP.

Adherence to the EMP would enable environmental safeguards and mitigation measures to be effectively implemented and sustainable work practices adopted throughout the duration of the project. This would demonstrate Newman Quarrying's intent to comply with relevant environmental legislation, prevent environmental pollution and minimise the impact of the proposal on the environment.

6.2 Summary of environmental controls

Environmental safeguards outlined in this document are to be incorporated into the EMP. The safeguards would minimise any potential adverse impacts arising from the proposed works on the surrounding environment. The safeguards and management measures are summarised in Table 6-1.

Table 6-1 Summary of site specific environmental safeguards

No.	Impact	Environmental safeguards	Responsibility	Timing
L1	Land Resources	Extract the resource in stages to minimise the area of disturbance at any one time.	Quarry Manager	Operation
L2		Remove soil and stockpile for use in the rehabilitation works.	Quarry Manager	Operation
L3		Implement erosion and sediment controls in accordance with *Managing Urban Stormwater Soils and Construction – Volume 2e Mines and quarries* (DECC, 2008).	Quarry Manager	Operation
L4		Implement the rehabilitation plan in Appendix A.	Quarry Manager	Operation
SW1	Surface water	An EPL will be obtained for the quarry. All relevant conditions relating to soil and water management will be implemented as required by the licence.	Quarry Manager	Operation
SW2		Where available, and of appropriate quality, the quarry operation will use recycled runoff for quarry activities.	Quarry Manager	Operation
SW3		Erosion and sediment controls are to be implemented in accordance with *Managing Urban Stormwater Soils and Construction – Volume 2e Mines and quarries* (DECC, 2008).	Quarry Manager	Operation
SW4		The volume of the existing sediment basin would need to be doubled.	Quarry Manager	Construction
SW5		Designated, impervious bunded facilities will be provided for cleaning and/or maintenance of vehicles, plant or equipment. These facilities will be located at least 20 metres away from natural and built drainage lines.	Quarry Manager	Operation
SW6		All chemicals and fuels associated with the quarry will be stored in	Quarry Manager	Operation

No.	Impact	Environmental safeguards	Responsibility	Timing
		roofed and bunded areas. Spill kits will be provided at all chemical storage facilities/compound sites and staff trained in their use.		
SW7		Where refuelling on site is required, the following management practices will be implemented: – Refuelling will be undertaken on level ground, within the designated refuelling areas with appropriate bunding and/or absorbent material, at least 20 metres from drainage lines, waterways and/or environmentally sensitive areas – Refuelling will be via a designated refuelling truck that is attended at all times – Spill kits will be readily available and personnel trained in their use. A spill kit will be kept on the refuelling truck at all times – Hand tools will be refuelled within lined trays of site vehicles wherever possible – An emergency spill kit (such as oil absorbent material) will be available on site at all times to contain and clean up any accidental hydrocarbon spills – Any contaminated material will be disposed at an appropriately licensed facility and used spill kit materials replaced	Quarry Manager	Operation
SW8		Regular checks of vehicles working at the quarry will be conducted to ensure that no oils or fuels are leaking.	Quarry Manager	Operation
GW1	Groundwater	A monitoring bore is to be constructed in the mapped alluvial aquifer to the south west of the proposed quarry footprint, in a similar location as the existing monitoring wells.	Quarry Manager	Operation
GW2		New and existing monitoring bores should be monitored quarterly throughout the life of the project for groundwater level, pH and	Quarry Manager	Operation

No.	Impact	Environmental safeguards	Responsibility	Timing
		electrical conductivity. Groundwater monitoring should be undertaken in general accordance with '*A Practical Guide for Groundwater Sampling'* (Jiwan & Gates, 1992).		
GW3		All new and existing monitoring bores require licencing under Part 5 of the *Water Act 1912.*	Quarry Manager	Operation
N1	Noise	It is proposed that compliance noise monitoring be undertaken during quarry operations to verify noise model predictions and confirm compliance with the adopted noise criterion.	Quarry Manager	Operation
N2		Compliance noise monitoring should also be undertaken following any change in operating conditions that are likely to increase noise emissions.	Quarry Manager	Operation
N3		Where practical, machines would be operated at low speed or power and switched off when not being used rather than left idling for prolonged periods.	Quarry Manager	Operation
N4		Keep truck drivers informed of designated vehicle routes, parking locations and delivery hours.	Quarry Manager	Operation
N5		Avoid dropping materials from height and avoid metal to metal contact on material.	Quarry Manager	Operation
N6		All engine covers would be kept closed while equipment is operating.	Quarry Manager	Operation
N7		The quarry manager would erect a sign at the entrance of the quarry with a phone number and permanent site contact so that noise complaints can be received and addressed in a timely manner.	Quarry Manager	Operation
N8		Upon receipt of a noise complaint, noise monitoring would be undertaken and reported as soon as possible. If exceedances are	Quarry Manager	Operation

No.	Impact	Environmental safeguards	Responsibility	Timing
		detected, the situation would be reviewed in order to identify means to attempt to reduce the impact to acceptable levels (i.e. 45 dB(A) or 35 dB(A), depending on the receiver location).		
A1	Air	Water sprays are to be used on crushing and screening plant.	Quarry Manager	Operation
A2		Haul truck routes will be watered as required, particularly during peak periods of high frequency vehicle movements and extended dry spells.	Quarry Manager	Operation
A3		If off-site dust impacts are noted as being an issue (e.g. complaints from neighbours or visible and extensive dust plumes), dust monitoring and visual observations of dust plumes should be conducted during quarry operations.	Quarry Manager	Operation
B1	Blasting	Identified sensitive receptors should be notified when blasting is planned to occur.	Quarry Manager	Operation
B2		Blasting should only occur from 10 am to 4 pm, Monday to Friday and should not generally take place more than once per day.	Quarry Manager/Blasting Constractor	Operation
B3		It is proposed that monitoring be undertaken during initial blasts at the site to confirm predictions and assess compliance with the ground vibration and airblast overpressure limits.	Quarry Manager/Blasting Constractor	Operation
B4		Where possible, blasting should not occur during times when winds are in the direction of the nearest receptors, and should preferably occur during times when winds are calm or blowing away from the nearest receptors.	Quarry Manager/Blasting Constractor	Operation
B5		Water sprays should be used as dust suppression just before and during the blast.	Quarry Manager/Blasting Constractor	Operation

No.	Impact	Environmental safeguards	Responsibility	Timing
B6		Blast mats such as hessian or rubber matting may be used to suppress impacts from blasting, including flyrock and particulate emissions.	Quarry Manager/Blasting Constractor	Operation
G1	Greenhouse Gas	Opportunities for the use of biodiesel should be investigated and used where possible	Quarry Manager	Operation
G2		Efficient plant and vehicles would be used where reasonable and feasible to do so.	Quarry Manager	Operation
G3		Turn off engines when not in use.	Quarry Manager/Operators	Operation
E1	Ecology	During the detailed design process, the impact of the proposal on areas with high biodiversity values should be minimised wherever possible.	Quarry Manager	Operation
E2		Prepare a Flora and Fauna Management Plan (FFMP) including: – Minimising vegetation clearance and habitat loss – Pre-clearance surveys – Phytophthora management – Chytrid fungus management – Myrtle rust management	Quarry Manager	Pre-operation
E3		Prepare a weed management plan including: – Type and location of weeds of concern (including noxious weeds) within the proposal disturbance footprint. – Sensitive receivers (such as native vegetation and waterways) within or adjacent to the proposal disturbance footprint. – Measures to prevent the spread of weeds, including hygiene procedures for equipment, footwear and clothing.	Quarry Manager	Pre-operation

No.	Impact	Environmental safeguards	Responsibility	Timing
		– Proposed weed control methods and targeted areas. – Weed disposal protocols.		
E4		Manage potential vehicle impacts by: – Restricting vehicle movements to operational (daylight) hours. – Implementing and enforcing appropriate speed limits for vehicles traversing the site.		
E5		Prepare a groundcover clearance protocol that includes: – Remove large woody debris and rock fragments using excavator grabs or manual handling if practicable. – Place intact large woody debris within adjacent areas of intact vegetation. – Scrape and stockpile leaf litter and topsoil separately from deeper fill material.	Quarry Manager	Pre-operation
E6		Prepare a hollow-bearing/habitat tree clearance protocol, including the following measures: – Pre-clearing surveys undertaken by a suitably qualified ecologist or wildlife handler. – Installation of suitable nest boxes in adjacent vegetation will be considered prior to clearing to provide a safe location for hollow-dwelling fauna to be transferred to during clearing operations. The number of hollow-bearing trees and types of hollows identified during pre-clearance surveys should be used to determine the number and types of nest boxes installed. – Protocols for the safe inspection of trees and tree-hollows for fauna and methods to encourage fauna to vacate trees with minimal potential for distress or harm, including clearing surrounding vegetation prior to felling hollow-bearing trees.	Quarry Manager	Pre-operation

No.	Impact	Environmental safeguards	Responsibility	Timing
		– Protocols for the management and release of captured animals, including consideration of the appropriate management of injured or deceased individuals. – Wildlife should not be handled wherever possible. Quarry staff should only handle wildlife in an emergency situation. Uninjured wildlife should be gently encouraged to leave the site by the ecologist/ wildlife specialist. Injured wildlife would be taken to a local WIRES carer or veterinarian for treatment and care if necessary. – Capture and relocation or captive rearing of less mobile fauna (such as Koalas or nestling birds) by a trained fauna handler and with assistance from Wildlife Information Rescue and Education Service (WIRES) as required. – Targeted pre-clearing surveys for hollow-dwelling fauna species including but not limited to microbats, arboreal mammals and birds.		
E7		Prepare a Biodiversity Offset Strategy for the project which includes the purchase and retirement of the biodiversity credits as calculated in accordance with the FBA	Quarry Manager	Pre-operation
T1	Traffic	The maintenance of the site access road should be reviewed and if necessary, frequency of maintenance should be increased to cope with the increased heavy vehicle movements generated by the proposed development.	Quarry Manager	Operation
T2		Vehicles should conform to a code of conduct for the transport of materials on public roads.	Quarry Manager	Operation
T3		Where practicable, haulage vehicles should be back-loaded to carry loads on both inward and outward journeys, to minimise total vehicle	Quarry Manager	Operation

No.	Impact	Environmental safeguards	Responsibility	Timing
		movements		
H1	Heritage	If it is suspected that Aboriginal material has been uncovered as a result of earth working activities within the Project Area: – Work in the surrounding area is to stop immediately. – A temporary fence is to be erected around the site, with a buffer zone of at least 10 m around the known edge of the site. – An appropriately qualified archaeological consultant is to be engaged to identify the material. – If the material is found to be of Aboriginal origin, the Aboriginal community is to be consulted in a manner as outlined in the OEH guidelines: *Aboriginal Cultural Heritage Consultation Requirements for Proponents* (2010).	Quarry Manager	Operation
H2		If Aboriginal cultural materials are uncovered as a result of development activities within the Project Area, they are to be registered as Sites in the AHIMS database managed by the OEH. Any management outcomes for the site will be included in the information provided to the OEH.	Quarry Manager	Operation
H3		If human remains are located at any stage during earthworks within the Project Area, all works must halt in the immediate area to prevent any further impacts to the remains. The location where they were found should be cordoned off and the remains themselves should be left untouched. The nearest police station, the Yaegl LALC, and the OEH Regional Office (Coffs Harbour) are to be notified as soon as possible. If the remains are found to be of Aboriginal origin and the police release the scene, the Aboriginal community and the OEH should be consulted as to how the remains should be dealt with. Work may only resume after agreement is reached between all notified parties, provided it is in accordance with all parties' statutory	Quarry Manager	Operation

No.	Impact	Environmental safeguards	Responsibility	Timing
		obligations		
H4		In the unlikely event that Aboriginal cultural heritage is identified during Project works, it is proposed that all effort must be taken to avoid any impacts on Aboriginal Cultural Heritage values. Should a situation arise where impacts to Aboriginal cultural heritage is unavoidable, mitigation measures should be negotiated between the Proponent, OEH and the Aboriginal Community	Quarry Manager	Operation
V1	Visual	Maintain and enhance the existing vegetation between the project site and property boundaries to provide ongoing screening to the quarry.	Quarry Manager	Operation
V2		Maintain the site in a clean and tidy condition at all times.	Quarry Manager	Operation
V3		Progressively revegetate all areas where quarrying is completed.	Quarry Manager	Operation
V4		Locate stockpiles within existing pits or locations that are screened from views from adjoining properties. Plant and equipment should also be located in positions which are naturally screened from views from dwellings.	Quarry Manager	Operation
W1	Waste	Management measures for excavated material are: – Avoid excess excavation – Use excess material on site as fill and/or in rehabilitation works – Excess excavated material to be classified and disposed in accordance with the Waste Classification Guidelines	Quarry Manager	Operation
W2		Management measures for green waste are: – Minimise clearing – Mulch cleared vegetation and reuse on site	Quarry Manager	Operation

No.	Impact	Environmental safeguards	Responsibility	Timing
		– Excess material to be classified and disposed in accordance with the Waste Classification Guidelines		
W3		Management measures for general construction waste are: – Materials to be sourced and ordered in appropriate quantities – Reuse excess material on-site wherever possible. All recyclables (including aluminium, paper & cardboard, steel, glass, rigid plastic, organics) to be collected and recycled accordingly – Excess material to be classified and disposed in accordance with the Waste Classification Guidelines	Quarry Manager	Operation
W4		Management measures for contaminated waste are: – Proper storage of all chemicals and fuels (e.g. bunded areas with 110% capacity) – Utilise bioremediation for large quantities of fuel-impacted soil. Tracking during transportation would be carried out where required. – Disposed in accordance with the Waste Classification Guidelines	Quarry Manager	Operation
W5		Management measures for liquid waste are: – Materials to be sourced and ordered in appropriate quantities – Reuse excess material on-site wherever possible e.g. store and reuse lubricants – Excess material to be classified and disposed in accordance with the Waste Classification Guidelines	Quarry Manager	Operation
W6		Management measures for wastewater are: – Divert clean water from the site – Waste water to be pumped to a holding pond and used on-site e.g. for dust suppression/ plant watering etc.	Quarry Manager	Operation

No.	Impact	Environmental safeguards	Responsibility	Timing
		– Discharge wastewater, in accordance with EPL requirements		
W7		Management measures for biological waste are: – Minimise use of site facilities e.g. toilets. – Consider using composting toilet. – Sewage waste to be disposed at an appropriately licensed facility	Quarry Manager	Operation
W8		Management measures for domestic waste are: – Materials to be sourced and ordered in appropriate quantities. – Reuse excess material on-site wherever possible. All recyclables (including aluminium, paper & cardboard, steel, glass, rigid plastic, organics) to be collected and recycled accordingly – Excess material to be classified and disposed in accordance with the Waste Classification Guidelines	Quarry Manager	Operation
R1	Risk and Hazards	Store dangerous goods in an appropriately bunded area.	Quarry Manager	Operation
R2		Keep and maintain appropriate spill control kit and ensure all staff are trained in its use.	Quarry Manager	Operation
R3		Use an approved fuel dispenser, for refuelling.	Quarry Manager	Operation
R4		Maintain a register of dangerous goods on site.	Quarry Manager	Operation
R5		Maintain appropriate buffers from bushfire hazards	Quarry Manager	Operation
R6		Prepare and implement a Health and Safety Plan.	Quarry Manager	Pre-Operation
SE1	Socio-economic	Employ locals, where possible and ensure local residents are aware of upcoming employment opportunities by advertising vacant positions in the local paper.	Quarry Manager	Operation
SE2		Employ a 'buy local' practice whereby goods and services are purchased from local businesses provided that they are competitive in terms of quality and price.	Quarry Manager	Operation

6.1 Licensing and approvals

Licences, approvals or other requirements from stakeholders are presented in Table 6-2.

Table 6-2 Licencing, approvals and other requirements

Statutory Authority	Licence, approval or other requirement
EPA	Environmental Protection Licence under POEO Act 1997
NOW	A licence under Part 5 of the *Water Act 1912* for the groundwater monitoring well

7. Project justification

7.1 Introduction

This chapter provides an overview of the alternatives which were considered in the development of the proposed quarry operations and throughout the preparation of the EIS. The reasons for justifying the final proposal are presented, having regard to biophysical, economic and social considerations and the principles of ecologically sustainable development (ESD).

7.2 Justification/need for the extraction operation

7.2.1 Socio-economic

The North Coast Region of New South Wales has been experiencing steady growth over the past few decades and this is expected to continue into the future. This growth results in increased demands for new dwellings, both urban and rural residential, which in turn leads to an increase in the need for the provision of new infrastructure and the upgrading of existing services and roads.

This growth is also reflected in increase in commercial, tourist and industrial developments and associated industries which are vital for the continued employment of the expanding population, the local economy and to the future growth of the region. By providing a local source of rock, the proposal would help to reduce the costs of development in the area whilst minimising environmental impacts.

The proposal would provide a valuable resource required for the upgrade of the Pacific Highway which is designed to significantly reduce travel times, crashes and fatalities (Roads and Maritime, 2013). The relatively close proximity of the site to the Pacific Highway is also a benefit to the wider community because it avoids transporting materials over a longer distance and potentially impacting on a greater number of people (through increased traffic). The relatively short haulage distance to the highway also has associated economic and environmental benefits to the community.

7.2.2 Demand for products

It is reported that the upgrade of the Pacific Highway has a demand of several million tonnes of material alone. The material required for the upgrade of the Pacific Highway needs to meet strict Roads and Maritime specifications and local sources are limited. Sly's Quarry is located relatively close to the Pacific Highway and the material is compliant with the Roads and Maritime specifications. This is demonstrated by the quarry previously supplying the Pacific Highway upgrade works.

In addition to the demand from the Pacific Highway upgrade, local development is anticipated to require about 100,000 – 150,000 tonnes per annum. Although local demand is significantly less than the Pacific Highway upgrade, it would be sustained over a longer timeframe.

The existing quarry is located in close proximity to existing demand centres within CVC, whilst maintaining effective isolation from populated areas. The quarry would be able to provide an affordable, high quality material sought by Government Authorities and private developers.

Sly's Quarry is referred to in the EIS as a potential source of materials for the Woolgoolga to Ballina Upgrade (Table 6.14 and Figure 6-44 - it is called the Tullymorgan Quarry). To win a contract to supply the upgrade, quarry operators will need to demonstrate compliance with a range of criteria, including development consents and licences for the quarry operations.

Conditions applying to licences and consents that are relevant to successful tendering, include annual extraction limits, the number of truck movements permitted per day, and controls on access or operating hours. Established extraction site

The site is currently operated as a quarry. Many of the environmental protection measures have been effective during past operations. The site has a proven record of minimal impact on adjacent landholders and the environment. The proposal would avoid establishing a new site which may have potentially more significant impacts.

7.3 Project alternatives

Alternatives to the proposal are summarised in the following subsections.

7.3.1 Extraction from alternative resource

Extracting another resource (quarry) may have similar or greater impacts than the current proposal and establishing a new quarry would also add higher level of uncertainty of impacts in comparison to an established source. A new quarry may require clearing, create water quality issues or add heavy vehicles to a road that was previously used mainly by light vehicles. The site of the current proposal has been used sporadically as a quarry since the 1960's with limited environmental or community impacts, suggesting it is a suitable site for a quarry.

Sly's Quarry is also located in close proximity to the Pacific Highway upgrade projects and can supply material suitable for those projects. Alternative resource extraction locations would likely require additional travel distances when supplying the Pacific Highway projects and the suitability of the material would be less certain.

7.3.2 Reduced extraction rate

A reduced extraction rate is an alternative. A reduced rate of extraction is sufficient to meet the demand of local development but may not meet the demand from the Pacific Highway upgrade. This could result in additional quarries being needed to be established which may have greater impacts than the proposed.

The proposed maximum extraction rate of 500,000 tonnes per annum is considered a balance between accommodating the demand from the Pacific Highway upgrade and what the site is capable of providing whilst minimising potential environmental and social impacts.

7.3.3 Avoiding hibbertia marginata

The proposal is an expansion of an existing quarry in an area that has been used historically as a quarry, so its location is fundamentally limited by the location of the extractive resource. The majority of the proposed quarry extension area falls within land that has been modified by historical land uses, including logging and past quarry activities. As a result, impacts on native flora and fauna are somewhat less than would be associated with a less disturbed site.

The ecology survey identified the ecological constraints within the study area. This information was used during the detailed design phase of the proposal, which entailed modification of the original plans so as to avoid areas of high ecological constraint, namely the identified areas of TEC vegetation and some of the identified occurrences of the threatened species Bordered Guinea Flower (*Hibbertia marginata*).

Figure 7-1 shows the original quarry area proposed. Amendments to the quarry footprint included removing both the north east and south west corners of the extraction area where a large population of *Hibbertia marginata* occurs. This alteration to the original plans has reduced the overall area of planned quarry expansion, reduced the impact to *Hibbertia marginata* and has seen the proposed quarry expansion area be repositioned in order to minimise direct impacts on these areas.

Unfortunately, the *Hibbertia marginata* is located on the bulk of the resource due to previous minor disturbance (access tracks and the like) as this species prefers habitats subject to disturbance. It is considered unfeasible to modify the layout of the quarry further as it would limit the amount of resource that could be accessed to meet demand. It would also impact on the functionality and efficiency of the quarry. To the west and south the volume and quality of the resource is not suitable and expansion to the east is restricted by the Crown Land road reserve.

To limit the impact on the *Hibbertia marginata*, the quarry is proposed to be developed in stages, with Stage 1 containing few individuals. Stage 2 (south) would be excavated next which has less *Hibbertia marginata* than Stage 2 (north). Stage 1 and Stage 2 (south) contain over half the total resource, so depending on the demand, the quarry may never proceed past these stages. If Stage 3 is extracted, Stage 3 (south) would be extracted first which would avoid impacting the *Hibbertia marginata*, within Stage 3 (north), until absolutely necessary.

7.3.4 Do nothing

The “do nothing” option would negate the need for any further clearing of the existing vegetation and reduce the established environmental impacts at the site but would also have the following consequences:

- The high quality resources, identified at the subject site, would not be utilised.
- The potential economic and social benefits would not be realised.
- There may be pressure to establish new quarries that contain less suitable resources with greater environmental consequences or uncertainties.

7.4 Ecologically sustainable development

7.4.1 Introduction

The Commonwealth of Australia (1992) defines ESD as “*using, conserving and enhancing the community’s resources so that the ecological processes, on which life depends, are maintained and the total quality of life, now and in the future, can be increased*”.

The main thrust behind ESD is that current and future generations should leave a natural environment that functions as well or better than the one inherited. Each of the principles of ESD are considered in the following subsections.

7.4.2 Precautionary principle

Interpretation

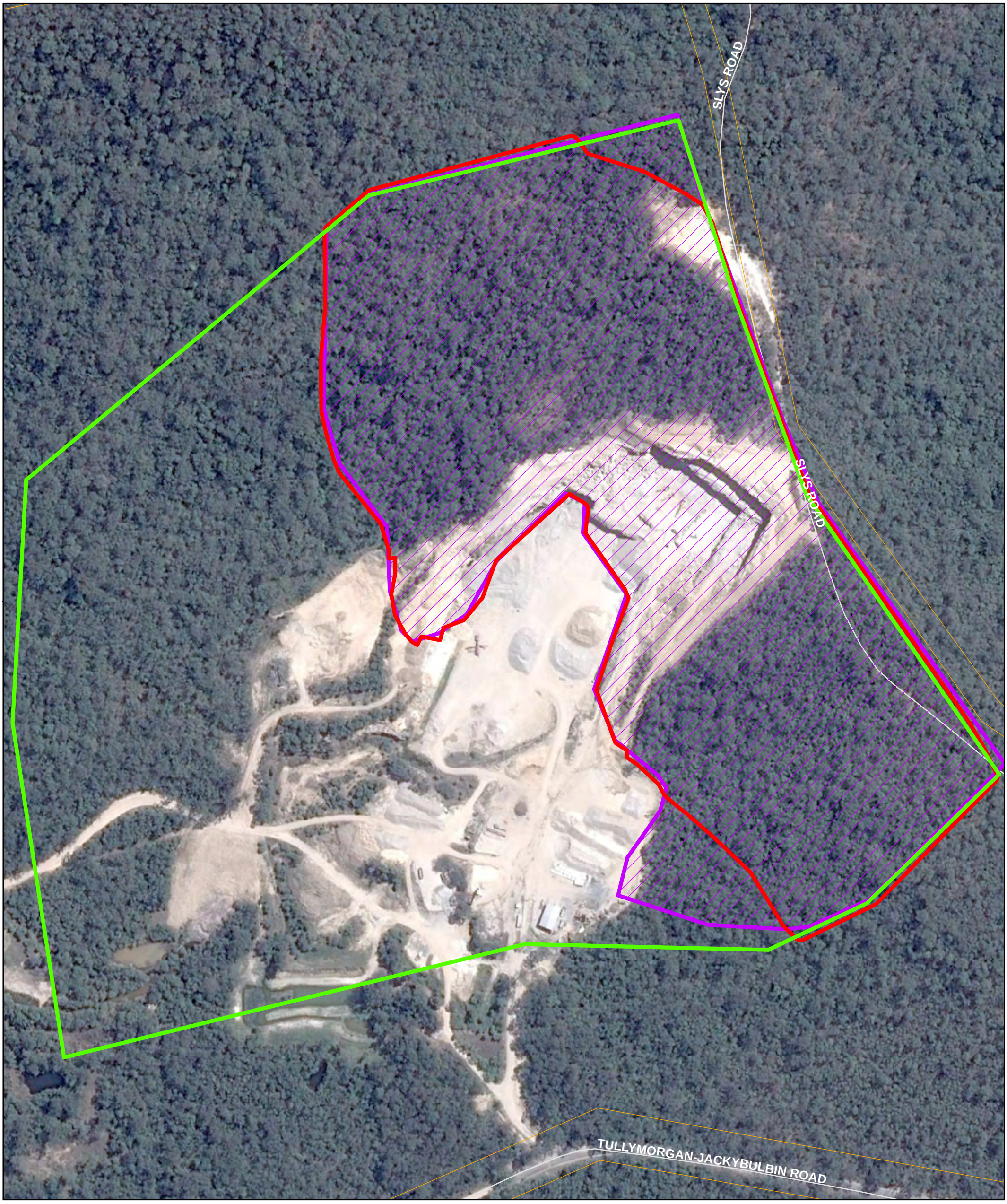
According to the *PoEO Act*, 1991, the precautionary principle means that if there are threats of serious or irreversible damage, lack of full scientific certainty should not be used as a reason for postponing measures to prevent environmental degradation.

This principle was developed in response to difficulties in interpreting scientific data. The scientific method produces results based on confidence limits. These are controlled by the scope of data acquisition, interpretation methods and general understanding within a particular scientific discipline. This has been used as a way of validating a lack of response to a potential threat of serious or irreversible environmental degradation.

In the application of this principle:

- Careful application should always be undertaken to avoid serious or irreversible environmental damage
- An assessment of consequences of various options should be undertaken in formulating a proposal

ESD requires that uncertainty and the associated risk level be considered in decision making.



LEGEND

Original Quarry
Revised Quarry
Final Quarry
roads
cadastre

Paper Size A3

0 25 50 100

Metres

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

N

GHD

Newman Quarrying
Sly's Quarry Environmental Impact Statement

Job Number 22-17528
Revision A
Date 27 Apr 2015

Quarry Options

Figure 7-1

N:\AU\Coffs Harbour\Projects\22\17528\GIS\Maps\Deliverables\22_17528_Z013_Quarry_Options.mxd
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

Data Source: NSW Department of Lands: Cadastre - Jan 2014; Geoscience Australia: 250k Data - Jan 2014; NSW Department od Primary Industry - Jan 2014; Google image Jan 2014. Created by: qjchung

Justification

The environmental consequences of the proposed quarry have been assessed as accurately as possible using appropriate specialists in relevant disciplines where required. The assessment process involved computer modelling, scientific analysis and interpretation of the potential environmental impacts associated with the proposed operations. This process has enabled impacts of the proposal to be predicted within a reasonable degree of certainty. All predictions, however, contain a degree of variability, which reflects the nature of the environment. Where there has been any uncertainty in the prediction of impacts throughout the EIS process, a conservative approach was adopted to ensure the worst case scenario was predicted in the assessment of impacts.

The proposal is consistent with the precautionary principle to the extent that all potential threats to the environment have been identified and appropriate mitigation measures have been developed to minimise such impacts. Environmental monitoring would be undertaken as a precautionary measure to reduce any uncertainty regarding the potential for environmental damage.

7.4.3 Social equity including inter-generational equity

Interpretation

Social equity involves value concepts of justice and fairness so that the basic needs of all sectors of society are met and there is a fair distribution of costs and benefits to improve the well-being and welfare of the community, population or society. Social equity does not imply equality but there should be equal access to opportunities for improved welfare, with a bias towards benefiting the least well-off sectors of society.

Social equity includes inter-generational equity, which requires that the present generation should ensure that the health, diversity and productivity of the environment is maintained or enhanced for the benefit of future generations.

Justification

The proposal is consistent with the principles of social equity and inter-generational equity through the efficient use of a resource that provides a number of benefits to society.

Sly's Quarry has an identified and proven resource which would allow for the provision of materials for the Pacific Highway upgrade and local demand. The proposed mitigation measures would ensure resources are extracted sustainably and would not disadvantage any part of the community or future generations.

7.4.4 Conservation of biological diversity and maintenance of ecological integrity

Interpretation

Biological diversity refers to the diversity of genes, species, populations, communities and ecosystems, and the linkages between them. Biological resources provide food, medicines, fibres and industrial products. They are also responsible for vital ecological services such as maintaining soil fertility and the supply of clean and fresh water. Maintaining biological diversity safeguards life support functions and can be considered a minimal requirement for intergenerational equity.

Justification

The proposal would require the clearing of approximately 10.9 hectares of vegetation. This clearing has been assessed and it is considered unlikely that this would result in a significant impact on any threatened species, populations or ecological communities or their habitats. The

proposal also includes the revegetation of the site at the completion of the extraction which would restore some of the biodiversity lost during the clearing. It is therefore considered that the proposal would not have a significant impact upon biological diversity or maintenance of ecological integrity in the locality.

7.4.5 Improved valuation and pricing of environmental resources

Interpretation

The environment has conventionally been considered a free resource, with the true cost to the environment not factored into cost of production or use of that resource. This principle involves placing a monetary or social value on the environment that ultimately increases its value so as to decrease future exploitation. Pollution and future exploitation can be controlled under the 'polluter pays' principle, whereby polluters who degrade the natural environment are responsible and accountable for returning it to its previous condition.

Justification

Sly's Quarry would require licences and approvals for the protection of the environment to ensure the ongoing sustainability of the operations. The cost of licences together with the cost of implementing a range of mitigation and monitoring requirements, as part of the proposal, demonstrates accountability and places a monetary value on environmental protection.

8. Conclusion

The proposed quarry at Lot 2 DP 1055044, Tullymorgan-Jackybulbin Road, Mororo, known as Sly's Quarry is subject to assessment under Part 4 of the EP&A Act. This EIS has examined and taken into account to the fullest extent possible all matters affecting or likely to affect the environment by reason of the proposed activity.

A number of potential environmental impacts from the proposal have been avoided or reduced during the concept design development and options assessment. The proposal, as described in the EIS, best meets the project objectives but would still result in some impacts on biodiversity via vegetation clearing, soil and water via erosion and noise, dust and traffic via the increased vehicle movements. Mitigation measures as detailed in this EIS would ameliorate or minimise these expected impacts. The proposal would also provide sustained employment and provide a local source of suitable material for the Pacific Highway upgrade with manageable impacts. On balance the proposal is considered justified.

Under the TSC Act, the potential impact on the *Hibbertia marginata* population is being addressed through the FBA and the associated BioBanking assessment. However, under the provisions of the EPBC Act, the proposed development is being referred to the Department of the Environment for approval.

General terms of approval are also required from the EPA because the proposal is a scheduled activity and NoW due to the proposed installation of groundwater monitoring wells.

9. References

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Appendix A Quarry Plans

No	Revision	Note: * indicates signatures on original issue of drawing or last revision of drawing	Drawn	Job Manager	Project Director	Date

GHD
Level 8, 180 Lonsdale Street, Melbourne VIC 3000 Australia
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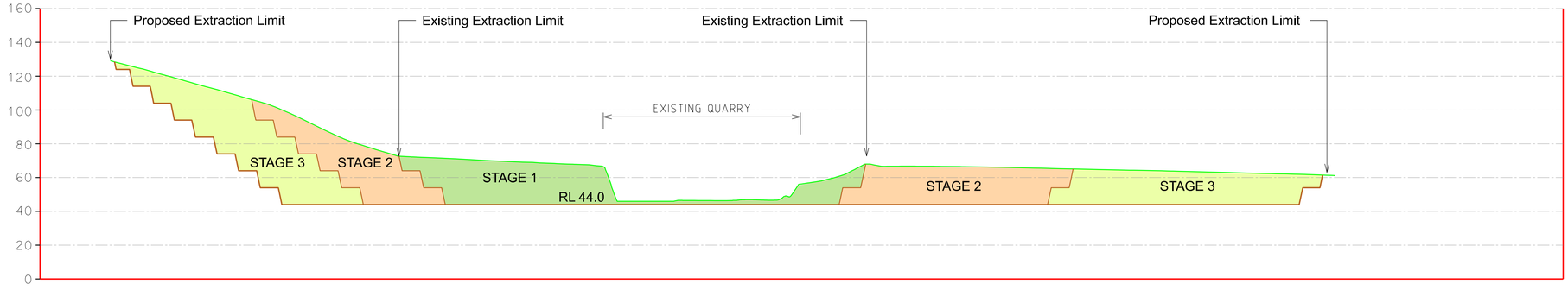
DO NOT SCALE

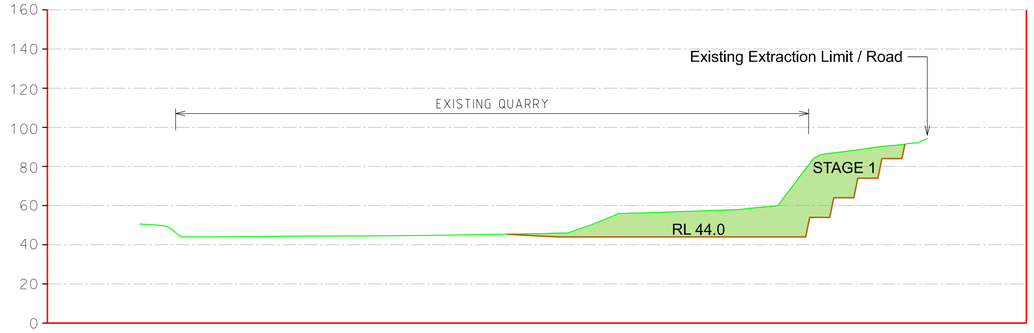
Drawn	S. Verhellen	Designer	
Drafting Check		Design Check	
Approved (Project Director)			
Date			
Scale	AS SHOWN	This Drawing must not be used for Construction unless signed as Approved	

Client: Newman Quarrying
Project: Slys Quarry
Title: Proposed Quarry Expansion

Original Size: A1
Drawing No: 22-17528-001
Rev:



SECTION A - A



SECTION B - B

50m 0 100 200m

Horizontal & Vertical Scale 1:1,500

No	Revision	Note: * indicates signatures on original issue of drawing or last revision of drawing	Drawn	Job Manager	Project Director	Date

GHD
Level 8, 180 Lonsdale Street, Melbourne VIC 3000 Australia
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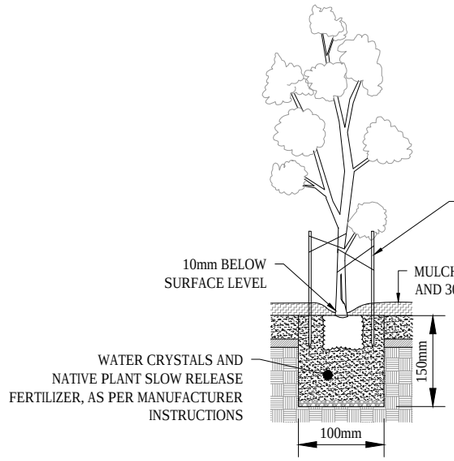
E melmail@ghd.com.au W www.ghd.com

Drawn	S. Verhellen	Designer	
Drafting Check		Design Check	
Approved (Project Director)			
Date			
Scale	AS SHOWN	This Drawing must not be used for Construction unless signed as Approved	

Client	Newman Quarrying
Project	Slys Quarry
Title	Proposed Quarry Expansion
Original Size	A1
Drawing No:	22-17528-002
Rev:	



PLANTING DETAILS

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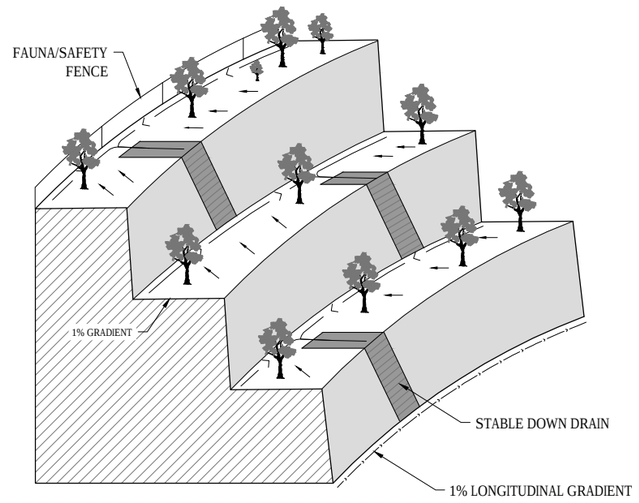
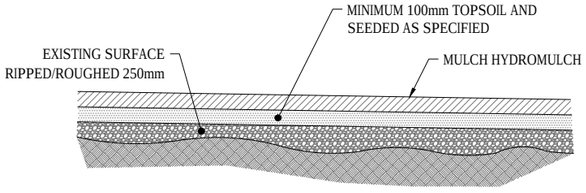


REHABILITATION BENCHING DETAILS

SCALE : NTS



SITE PREPARATION DETAILS

SCALE : NTS

0 50 100 150m

SCALE 1:5000 AT ORIGINAL SIZE

ZONE A

ZONE B

PRECISION INDUSTRIES PTY LTD
NEWMANS QUARRY

REHABILITATION PLAN

Job Number 22-17528
Revision A
Date FEB. 2015

Figure 01

230 Harbour Drive Coffs Harbour NSW 2450 Australia **T** 61 2 6650 5600 **F** 61 2 6650 5601 **E** cfsmail@ghd.com **W** www.ghd.com

Plot Date: 17 February 2015 - 4:22 PM Plotted by: Ian Gould Cad File No: G:\22\17528\CADD\Drawings\22-17528-FIG 01 & 02.dwg

Rehabilitation Plan

Aim

To provide a plan to improve the environmental condition of the site after quarrying activities have ceased.

Objectives
The objectives of the rehabilitation plan are to:

- Describe topsoil stripping and stockpiling methods
- Describe the site preparation, revegetation and weed control methods required
- Describe the maintenance activities
- Provide a schedule for the proposed works

Topsoil Stripping and Stockpiling
The following measures should be adopted for soil stripping and stockpiling:

- Soils should be stripped in a slightly moist condition (neither too dry nor wet) thus reducing dust generation and deterioration in topsoil quality
- Topsoil should be stockpiled only when disturbed areas are not available for immediate rehabilitation
- Soil stockpiles should be constructed to minimise the stockpile area in a discrete two metre high (maximum) pile, with a working face battered down at 30 degrees
- Stockpiles should be trimmed, deep ripped to 500 mm, immediately sown with permanent pasture species, and fertilised

Site Preparation

- The perimeter of the quarry should be fenced for safety and to exclude fauna. Fencing should include 'one-way fauna gates' which allow fauna to escape from the former quarry area
- To delineate the restoration area, temporary fencing should be installed until restoration is completed. No machines will be allowed inside the restoration area other than for works associated with planting and weeding
- Benches should be constructed with in fall drainage, a non-erodible longitudinal grade (approximately 1%) and stable down drains
- The benches are to be ripped/roughed to a depth of 250mm to key in topsoil
- Topsoil stripped from the site prior to the quarry operations commencing should be respread across the benches to form a minimum of 100mm deep layer
- Sediment and erosion controls should be maintained until the site is stable

Revegetation
The area to be revegetated has been divided into two zones:

- Zone A is the disturbed area to be revegetated following the completion of the quarry.
- Zone B is swampy disturbed area to be revegetated following the completion of the quarry.

The extent of the two zones is to be confirmed onsite based on site conditions, prior to commencing revegetation works. Revegetation in Zones A and B will be via a mix of planting tube stock or hiko cells and seeding.

Seeding and planting details are provided below. The desired density of each stratum is provided in the species table. This may be altered in consultation with CVC.

Seeding

Seed is to be purchased from local suppliers or collected locally. All seed collection, management, cleaning and storage will be in accordance with *Guideline 5: Seed Collection from Woody Plants for Local Revegetation (FloraBank, 1999)*.

Seeding should be done prior to planting. Seed broadcasting is to be done by hand or mechanical means at the sowing rates indicated below. The seed should be raked following sowing to cover the seed and improve success rates. The seed should be watered weekly until established.

Planting

Ideally, planting should be done at the start of autumn but due to the mild climate of the area, planting at any time during the year should not cause a significant problem. The tube stock, where possible, should be sourced from nurseries that use local seed stock, ideally from within the Clarence Valley area.

The planting method includes:

- Soak all plants before planting.
- Make a hole large enough for the tube stock.
- Add water crystals and a slow release fertiliser suitable for native species.
- Remove the plant from the container being careful not to damage the roots.
- Insert the plant into the hole so that the base of the stem is a little below the surrounding ground
- Firm the soil around the root ball to remove air gaps.
- Water the plant with at least 2L of water
- Mulch the plant using native tree mulch, weed mats or saw dust. Make sure the mulch is not against the stem of the plant.
- Install a protective guard using wooden/bamboo stakes or milk carton.
- Water weekly for the first month. Further watering may be required if there is no rain.

Species List
Recommended species and planting densities are provided below. The recommended species are based on those to be removed. If the recommended species are unavailable consult CVC for suitable replacement species

Recommended Species for Zone A

Species List	Seed Rate[1]	Plant Number[1, 2]	Desired Density[1]
Upper storey/canopy			
Blackbutt *(Eucalyptus pilularis)*	2 kg/ha	2030	1/15m^2
Red Mahogany (*Eucalyptus resinifera*)			
Pink Bloodwood (*Corymbia intermedia*)			
Turpentine *(Syncarpia glomerata)*			
Mid storey	2 kg/ha	3040	1/10m^2
Black Wattle *(Acacia leiocalyx)*			
Red Ash (*Alphitonia excelsa*)			
Cheese Tree (*Glochidion ferdinandi*)			
Lower storey/groundcover	4 kg/ha	6080	1/5m^2
Blue Flax-lily (*Dianella caerulea*)			
Rough Saw Sedge (*Gahnia aspera*)			
Many-flowered Mat-rush *(Lomandra multiflora)*			
Sterile Cover Crop	10 kg/ha	NA	NA
Rye *(Lolium rigidum)*			
Japanese Millet *(Echinochloa esculenta)*			

[1] This relates to the storey not the individual species.
[2] This assumes the desired density will be achieved by seeding and natural regeneration.

Recommended Species for Zone B

Species List	Seed Rate[1]	Plant Number[1, 2]	Desired Density[1]
Upper storey/canopy			
Swamp Mahogany *(Eucalyptus robusta)*	2 kg/ha	125	1/15m^2
Brush box *(Lophostemon suaveolens)*			
Broad Leaved-paperbark *(Melaleuca quinquenervia)*			
Turpentine *(Syncarpia glomerata)*			
Mid storey	2 kg/ha	190	1/10m^2
Cheese Tree *(Glochidion ferdinandi)*			
Lily Pilly *(Acmena smithii)*			
Cabbage Palm *(Livistona australis)*			
Red Ash *(Alphitonia excelsa)*			
Lower storey/groundcover	4 kg/ha	380	1/5m^2
Saw-sedge *(Gahnia clarkii)*			
Rainbow Fern *(Calochlaena dubia)*			
Harsh Ground Fern *(Hypolepis muelleri)*			
Sterile Cover Crop	10 kg/ha	NA	NA
Rye *(Lolium rigidum)*			
Japanese Millet *(Echinochloa esculenta)*			

[1] This relates to the storey not the individual species.
[2] This assumes the desired density will be achieved by seeding and natural regeneration.

Maintenance and Monitoring
Regular maintenance activities will include:

- Follow-up watering
- Repairing damaged tree guards
- Monitoring survival rates and installing replacement plants where required to achieve the densities above
- Weed control and continued follow-up spot spraying, hand removal, etc as required

Weed Control
Weed control is vital to the success of the revegetation. The noxious and environmental weed species likely to be at the site and their recommended control method are provided below.

Scientific Name	Common Name	Noxious	Control Methods				
			Cut and paint[1]	Scape and Paint[1]	Direct Inject[1]	Spot Spraying[1]	Manual Remove
Ageratina adenophora	Crofton Weed	Class 4				v[2, (4+7)]	v
Ageratum houstonianum	Blue Billy Goat Weed					v	v
Baccharis halimifolia	Crounsel Bush	Class 3	v[4]			v[7]	v[3]
Bidens pilosa	Farmers Friends					v	v
Cinnamomum camphora	Camphor Laurel	Class 4	v		v		
Eragrostis curvula	African Love Grass	Class 4				v	
Ipomoea indica	Morning Glory			v[4]		v	v
Lantana camara	Pink/Red Lantana	Class 4	v			v	v
Ligustrum lucidum	Large Leaf Privet	Class 4	v[4]		v[4]	v[7, 8]	v[7]
Ligustrum sinense	Small Leaf Privet	Class 4	v[4]		v[4]	v[7, 8]	v[7]
Pennisetum clandestinum	Kikuyu					v	
Rubus fruticosus	Blackberry	Class 3				v[8]	
Senecio madagascariensis	Fireweed					v[11]	v
Senna pendula var. glubrata	Eastern Cassia/Senna		v		v[4]	v[4]	
Solanum mauritianum	Tobacco Bush		v				

[1] Glyphosphate unless specified; [2] Seedlings; [3] Saplings; [4] Mature plants; [5] Large infestations; [6] Small infestations; [7] Grazon; [8] Metsulfuron-methyl; [9] Glyphosate & Metasulfuron-methyl mix, [10] Penetrant, [11] Bromoxynil

Reporting
Reporting may be required at the following stages:

- Completion of initial planting
- After each maintenance and monitoring period
- At completion of 5 year maintenance and monitoring period

Revegetation Schedule
The following table provides an indicative schedule for the revegetation works. Revegetation works commence at the completion of the proposed quarry. Completion of the revegetation works is the responsibility of the landowner but it is recommended that a qualified bush regenerator contractor be engaged to do the works.

Task*	Year 1				Year 2				Year 3				Year 4				Year 5			
Site Preparation																				
Seeding/Planting																				
Maintenance/Monitoring																				

* See details for requirements of each task

PRECISION INDUSTRIES PTY LTD
NEWMANS QUARRY

CONCEPT REHABILITATION NOTES

Job Number 22-17528
Revision A
Date FEB. 2015

Figure 02

230 Harbour Drive Coffs Harbour NSW 2450 Australia **T** 61 2 6650 5600 **F** 61 2 6650 5601 **E** cfsmail@ghd.com **W** www.ghd.com

Plot Date: 18 March 2015 - 10:44 AM Plotted by: Ian Gould Cad File No: G:\22\17528\CADD\Drawings\22-17528-FIG 01 & 02.dwg

Appendix B Secretary's Environmental Assessment Requirements

Secretary's Environmental Assessment Requirements

Section 78A(8A) of the *Environmental Planning and Assessment Act 1979*

Application Number	SSD 6624
Proposal	The proposed Sly's Quarry Expansion Project includes: • expanding the existing main quarry pit; • closing and rehabilitating two other quarry pits; • increasing the maximum extraction rate of sandstone to 500,000 tonnes a year; and • increasing the quarry's hours of truck dispatch, Monday to Friday.
Location	Tullymorgan-Jackybulbin Road, Mororo NSW 2469
Applicant	Newman Quarrying Pty Ltd
Date of Issue	21 August 2014
General Requirements	The Environmental Impact Statement (EIS) for the development must comply with the requirements in Clauses 6 and 7 of Schedule 2 of the *Environmental Planning and Assessment Regulation 2000.* In particular, the EIS must include: • a full description of the development, including: – the resource to be extracted, demonstrating efficient resource recovery within environmental constraints, and having regard to DRE's requirements (see Attachment 2); – the site layout and extraction plan; – processing activities; – a waste (overburden, leachate, etc.) management strategy; – a water management strategy, dealing with the EPA's and Department of Primary Industries' requirements (see Attachment 2); – a rehabilitation strategy, having regard to the key principles in the *Strategic Framework for Mine Closure;* and – the likely interactions between the development and any other existing, approved or proposed extractive industry development in the vicinity of the site, including the proposed explosives depot; • a list of any approvals that must be obtained before the development may commence; • an assessment of the likely impacts of the development on the environment, focussing on the specific issues identified below, including: – a description of the existing environment likely to be affected by the development, using sufficient baseline data; – an assessment of the likely impacts of all stages of the development, including any cumulative impacts, taking into consideration any relevant laws, environmental planning instruments, guidelines, policies, plans and industry codes of practice; – a description of the measures that would be implemented to mitigate and/or offset the likely impacts of the development, and an assessment of: o whether these measures are consistent with industry best practice, and represent the full range of reasonable and feasible mitigation measures that could be implemented; o the likely effectiveness of these measures; and o whether contingency plans would be necessary to manage any residual risks; and – a description of the measures that would be implemented to monitor and report on the environmental performance of the development if

	it is approved; • a consolidated summary of all the proposed environmental management and monitoring measures, identifying all the commitments in the EIS; • consideration of the development against all relevant environmental planning instruments (including Part 3 of the *State Environmental Planning Policy (Mining, Petroleum Production and Extractive Industries) 2007)*; and • the reasons why the development should be approved having regard to biophysical, economic and social considerations, including the principles of ecologically sustainable development. While not exhaustive, Attachment 1 contains a list of some of the environmental planning instruments, guidelines, policies, and plans that may be relevant to the environmental assessment of this development. In addition to the matters set out in Schedule 1 of the *Environmental Planning and Assessment Regulation 2000*, the development application must be accompanied by a signed report from a suitably qualified expert that includes an accurate estimate of the: • capital investment value (as defined in Clause 3 of the *Environmental Planning and Assessment Regulation 2000*) of the development, including details of all the assumptions and components from which the capital investment value calculation is derived; and • jobs that would be created during each stage of the development.
Key Issues	The EIS must address the following specific matters: • **Noise and Blasting** – including: – an assessment of the likely operational noise impacts of the development under the *NSW Industrial Noise Policy*, paying particular attention to the obligations in Chapters 8 and 9 of the policy; – if a claim is made for specific construction noise criteria for certain activities, then this claim must be justified and accompanied by an assessment of the likely construction noise impacts of these activities under the *Interim Construction Noise Guideline*; – an assessment of the likely road noise impacts of the development under the *NSW Road Noise Policy*; and – an assessment of the likely blasting impacts of the development on people, animals, buildings, and infrastructure, and significant natural features, having regard to the relevant ANZEC guidelines; • **Water** – including: – an assessment of the likely impacts of the development on the quantity and quality of the region's surface and groundwater resources, having regard to the EPA's and DPI's requirements (see Attachment 2); – an assessment of the likely impacts of the development on aquifers, watercourses, riparian land, water-related infrastructure, and other water users; and – the development of a Stormwater Management Plan; • **Social & Economic** – including an assessment of the likely social and economic impacts of the development, paying particular attention to: – the significance of the resource; – economic benefits of the project for the State and region; and – the demand for the provision of local infrastructure and services; • **Traffic** – including: – an assessment of the likely traffic impacts of the development on the capacity, condition, safety and efficiency of the local and State road network, having regard to any requirements of the RMS and Council's requirements (see Attachment 2); and – consideration of access arrangements for the proposed development, as well as the proposed explosives depot;

	• **Biodiversity** – including: – an assessment of the likely biodiversity impacts of the development, having regard to OEH's requirements (see Attachment 2); and – a biodiversity offset strategy to ensure the development would maintain or improve the biodiversity values of the region in the medium to long term; • **Hazards** – including: – a consideration of the associated local development proposal for the explosives depot; and – the potential for bushfire; • **Visual** – including an assessment of any visual impacts of the development on nearby private landowners and key vantage points in the public domain, including potential lighting impacts; • **Heritage** – including an assessment of the likely Aboriginal and historic heritage (cultural and archaeological) impacts of the development, having regard to the Heritage Council's and OEH's requirements (see Attachment 2); • **Land** – an assessment of the compatibility of the development with other land uses in the vicinity of the development in accordance with the requirements in Clause 12 of *State Environmental Planning Policy (Mining, Petroleum Production and Extractive Industries) 2007*; and • **Air** – including an assessment of the likely air quality impacts of the development in accordance with the *Approved Methods for the Modelling and Assessment of Air Pollutants in NSW*.
Consultation	During the preparation of the EIS, you must consult with relevant local, State or Commonwealth Government authorities, infrastructure and service providers, Aboriginal stakeholders, community groups and affected landowners. The EIS must describe the consultation that was carried out, identify the issues raised during this consultation, and explain how these issues have been addressed in the EIS.

ATTACHMENT 1

Environmental Planning Instruments, Policies, Guidelines & Plans	
Traffic	
	Guide to Traffic Generating Development (RMS)
	Road Design Guide (RMS) & relevant Austroads Standards
Noise & Blasting	
	NSW Industrial Noise Policy and associated Application Notes (EPA)
	NSW Road Noise Policy (EPA)
	Interim Construction Noise Guideline (EPA)
	Technical basis for guidelines to minimise annoyance due to blasting overpressure and ground vibration (ANZEC)
Air	
	Approved Methods for the Modelling and Assessment of Air Pollutants in NSW (EPA)
	Approved Methods for the Sampling and Analysis of Air Pollutants in NSW (EPA)
Land	
	Agricultural Issues for Extractive Industries (DPI)
	State Environmental Planning Policy No. 55 – Remediation of Land
	State Environmental Planning Policy Rural Lands 2008
Biodiversity	
	Draft NSW Biodiversity Offsets Policy (OEH)
	BioBanking Assessment Methodology (OEH)
	NSW State Groundwater Dependent Ecosystem Policy 2002 (NOW)
	State Environmental Planning Policy No.44 – Koala Habitat Protection
	Threatened Species Survey and Assessment Guidelines: Field Survey Methods for Fauna – Amphibians (OEH)
	Threatened Biodiversity Survey and Assessment: Guidelines for Developments and Activities – Working Draft (OEH)
	Threatened Species Assessment Guideline – The Assessment of Significance (OEH)
	Guidelines for Threatened Species Assessment 2005
	Risk Assessment Guidelines for Groundwater Dependent Ecosystems 2012 (NOW)
Heritage	
	Aboriginal Cultural Heritage Consultation Requirements for Proponents (OEH)
	Code of Practice for the Archaeological Investigation of Aboriginal Objects in NSW (OEH)
	Draft Guidelines for Aboriginal Cultural Heritage Impact Assessment and Community Consultation 2005
	Guide to Investigating, Assessing and Reporting on Aboriginal Cultural Heritage in NSW (OEH)
Water	
Groundwater	NSW State Groundwater Policy Framework Document 1997 (NOW)
	NSW State Groundwater Quality Protection Policy 1998 (NOW)
	NSW Water Extraction Monitoring Policy 2007 (NOW)
	Groundwater Monitoring and Modelling Plans - Information for prospective mining and petroleum exploration activities (NOW)
	NSW Aquifer Interference Policy 2012 (NOW)
	Australian Groundwater Modelling Guidelines 2012 (Commonwealth)
	National Water Quality Management Strategy Guidelines for Groundwater

	Protection in Australia (ARMCANZ/ANZECC)
	Guidelines for the Assessment & Management of Groundwater Contamination (EPA)
Surface Water	NSW Government Water Quality and River Flow Objectives (EPA)
	Using the ANZECC Guideline and Water Quality Objectives in NSW (EPA)
	National Water Quality Management Strategy: Australian Guidelines for Fresh and Marine Water Quality (ANZECC/ARMCANZ)
	National Water Quality Management Strategy: Australian Guidelines for Water Quality Monitoring and Reporting (ANZECC/ARMCANZ)
	Approved Methods for the Sampling and Analysis of Water Pollutants in NSW (EPA)
	Managing Urban Stormwater: Soils & Construction (Landcom) and associated Volume 2E: Mines and Quarries (EPA)
	Managing Urban Stormwater: Treatment Techniques (EPA)
	Managing Urban Stormwater: Source Control (EPA)
	Technical Guidelines: Bunding & Spill Management (EPA)
	Environmental Guidelines: Use of Effluent by Irrigation (EPA)
	NSW Guidelines for Controlled Activities on Waterfront Land 2012 (NOW)
	NSW State Rivers and Estuaries Policy 1993 (NOW)
	NSW Wetlands Management Policy 1996 (NOW)
Waste	
	Waste Classification Guidelines (EPA)
Hazards	
	State Environmental Planning Policy No.33 – Hazardous and Offensive Development
	Explosives Act 2003
	Explosives Regulations 2005
Rehabilitation	
	Mine Rehabilitation – Leading Practice Sustainable Development Program for the Mining Industry (Commonwealth)
	Mine Closure and Completion – Leading Practice Sustainable Development Program for the Mining Industry (Commonwealth)
	Strategic Framework for Mine Closure (ANZMEC-MCA)
Environmental Planning Instruments - General	
	State Environmental Planning Policy (Mining, Petroleum Production and Extractive Industries) 2007
	State Environmental Planning Policy (State and Regional Development) 2011
	State Environmental Planning Policy (Infrastructure) 2007
	The Clarence Valley Local Environmental Plan 2011
Development Control Plans	
	The North Coast Regional Environmental Plan
	Clarence Valley Local Environmental Plan 2011
	The Clarence Valley Council DCP – Development in Rural Zones
	Clarence Valley Contributions Plan 2011
	The Mid North Coast Regional Strategy (DPI)
	The Clarence Valley Settlement Strategy

clarence
VALLEY COUNCIL

8 August 2014

Reference: Dws 1325911
Contact: Cheryl Sisson

Major Projects Section
Department of Planning & Environment
GPO Box 39
SYDNEY NSW 2001

Attention: Thomas Watt

Dear Sir

Secretary's Requirements for Sly's Quarry Extension Project (SSD6624) – Jackybulbin Road, Tullymorgan – lot 2 DP1055044

Reference is made to your email dated 29 July 2014, attaching the Preliminary Environmental Assessment (PEA) and seeking Council's input into the request for requirements. Our comments are summarised below.

1. Planning

(a) As you would be aware, the quarry is in existence and has approval to operate over three areas on the land (sites A, B and C) to a capacity of 100,000 tonne per annum (DA1977/111). At a recent pre-lodgement meeting, the owners advised that they have an EPA licence to extract up to 500,000 tonne per annum (Council has not sighted that licence).

(b) It is noted that a planning proposal to allow an explosives depot is also proposed (by a separate applicant) on the same lot as the quarry extraction.

The quarry area has considerable separation from the area of lot sought be used for the explosives depot, which is still subject to the planning proposal/rezoning process. The explosives depot is not part of the sandstone quarry and has no operational relationship to the quarry. The company intending to operate the explosives depot provides blasting services to many other quarries in the Northern Rivers area, including the subject quarry. This process has been delayed pending resolution by the proponent of post – exhibition issues

We note that the PEA document acknowledges the planning proposal/rezoning process for the proposed explosives depot. We request that any proposal for expansion of the extractive area consider the explosives depot proposal and note any conflicts or impacts.

In particular, the proposed explosives depot intends to utilise the existing quarry entrance and internal quarry access road to the existing quarry site office & weighbridge, and the existing track west from that point to quarry site C being the chosen site for the proposed explosives depot. Assuming the expanded quarry will use the existing quarry entrance and internal quarry roads, it is considered that a

DA/EIS for the expanded quarry should address access arrangements for both enterprises and associated traffic management arrangements see further comment under 'engineering' below).

It should be noted that the site is covered by the Bushfire Prone Land Overlay and is referrable to the NSW Rural Fire Service as Integrated Development.

(c) The effects on the existing water course should be addressed in any application, as well as proposals for remediation of the site post development.

(d) If Council were assessing the application, Section 94 contributions would apply to any approval. The calculation used is as per the table below, and we ask that this requirement be kept in mind when the application is decided.

Clarence Valley Contributions Plan 2011 Section 94A Levy Rates for Development Other Than Residential Accommodation.		
Development Type*	Levy Rate	
Proposed cost of carrying out the development is up to and including $100,000	Nil	
Proposed cost of carrying out the development is more than $100,000 and up to and including $200,000	$ (Value of Development) x 0.005 = $	
Proposed cost of carrying out the development is more than More than $200,000	$ (Value of Development) x 0.01 = $	

There is also a Section 94 Plan specific to maintenance of quarry roads for this area. Details can be provided to the Director General at a later date.

2. Engineering

A Traffic Impact Assessment and Road Safety Audit should be provided that lists a number of relevant issues (*'Section 5.1.5 Traffic & Access'*). This would consider the intersection servicing the quarry site off Tullymorgan-Jackybulbin Road, Tullymorgan-Jackybulbin Road and the intersection with the Pacific Highway. The report should include an assessment of;

a) Conflict/potential for conflict between the quarry operation and the proposed Explosives Depot (should it be approved); ie, traffic movements (as mentioned above); and
b) The suitability of internal access roads including widths, drainage and pavement to safely accommodate both activities.

A Stormwater management plan (*'Section 5.1.7 Water Resources*) should be included.

3. Building

From the documents submitted there doesn't appear to be any buildings proposed to be constructed on the site so no Construction Certificates will be required. However, if buildings are proposed for site management, etc, the location of those structures should be included on the plans.

If employees/contractors are based on the site then appropriate sanitary facilities and associated waste water management facilities will need to be provided on site for their use. This should be addressed.

4. Environmental health

Council's Environmental health section has requested that the following matters be fully addressed:

a) Noise issues – noise will be a major consideration. Noise from drilling, blasting, trucks, crushing, transport and machinery etc.
b) Air quality – dust emissions
c) Surface water run off
d) Ground water impacts and monitoring
e) Vibrations from processes
f) Sediment and erosions controls – during building phase and ongoing during operation
g) Trade waste and adequate environmental management of commercial operation by- products, such as fuel storage, oils
h) Correct waste management procedures from persons on site, also from unwanted commercial by-products etc.

We thank you for this opportunity to comment and be involved and will look forward to assisting with input or comment as the project progresses.

If you require further information please contact me on telephone 02 66430224.

Yours faithfully

Cheryl Sisson
Development Services Coordinator

NSW GOVERNMENT | Department of Primary Industries

OUT14/26002

Mr Thomas Watt
Mining Projects
NSW Department of Planning and Environment
GPO Box 39
SYDNEY NSW 2001

22 AUG 2014

Thomas.Watt@planning.nsw.gov.au

Dear Mr Watt,

Sly's Quarry Extension Project [SSD_6624]
Request for input into Secretary's Environmental Assessment Requirements

I refer to your email dated 29 July 2014 to the Department of Primary Industries in respect to the above matter.

Comment by Agriculture NSW
Agriculture NSW advise that a DPI guideline, *Agriculture issues for extractive industry development,* sets out the relevant agricultural issues to consider in the preparation of an EIS for an extractive industry development. Refer to the guideline at (http://www.dpi.nsw.gov.au/agriculture/resources/lup/development-assessment/extractive-industries).

For further information contact Selina Stillman, Resource Management Officer (Wollongbar office) on 6626 1215 or at selina.stillman@dpi.nsw.gov.au.

Comment by Fisheries NSW
Fisheries NSW advise the proponent to note that Tabbimobile Creek located on the same lot as the proposal, south of the Tullymorgan-Jackybulbin Road, is considered a key fish habitat.

For further information please contact Patrick Dwyer, Fisheries Conservation Manager (Wollongbar Office), on 6626 1397 or at patrick.dwyer@dpi.nsw.gov.au.

Comment by Crown Lands
Crown Lands advise the following issues;

- The eastern boundary of the proposed quarry expansion comprises a Crown Public road that is excluded from the development proposal (as shown on the

site survey plan and referred to in final paragraph of Site, Location & Land Uses on P8 of the Preliminary Environmental Assessment.)

- The EIS should recognise the status of the Crown Public road and acknowledge legal rights of public access under the Roads Act 1993.
- There should be no obstruction of legal public access along the Crown Public road.
- The EIS should address potential impacts and risks associated with the Crown Public road.
- The necessity for a fence along the road boundary should be addressed. The Crown road is not subject to an enclosure permit administered by Crown Lands. It should therefore be fenced out of the adjoining Lot 2 DP 1055044 owned by Noel & Kerry Newman.
- It is inappropriate for the limits of extraction to extend to the Crown Public road boundary as shown by the Preliminary Environmental Assessment. The EIS should adjust the boundary of the proposed extraction limit and provide an appropriate buffer zone and batters to protect the road reserve and address any risks to public rights of access.
- Alternatively, the option of applying to close and purchase the road should be considered. Contact Crown Lands for further details at http://www.lpma.nsw.gov.au/crown_lands/roads

For further information please contact Peter Baumann, Natural Resource Management Project Officer, (Grafton Office) on 6640 3401 or at peter.baumann@crownland.nsw.gov.au.

Comment by NSW Office of Water

The NSW Office of Water (Office of Water) has reviewed the supporting documentation accompanying the request for Secretary's Requirements (SRs) and provides the following comments below, and further detail in Attachment A.

It is recommended that the EIS be required to include:

- Details of water proposed to be taken (including through inflow and seepage) from each surface and groundwater source as defined by the relevant water sharing plan.
- Assessment of any volumetric water licensing requirements (including those for ongoing water take following completion of the project).
- The identification of an adequate and secure water supply for the life of the project. Confirmation that water can be sourced from an appropriately authorised and reliable supply. This is to include an assessment of the current market depth where water entitlement is required to be purchased.
- A detailed and consolidated site water balance.
- A detailed assessment against the NSW Aquifer Interference Policy (2012) using the NSW Office of Water's assessment framework.
- Assessment of impacts on surface and ground water sources (both quality and quantity), related infrastructure, adjacent licensed water users, basic landholder rights, watercourses, riparian land, and groundwater dependent ecosystems, and measures proposed to reduce and mitigate these impacts.

- Full technical details and data of all surface and groundwater modelling, and an independent peer review.
- Proposed surface and groundwater monitoring activities and methodologies.
- Proposed management and disposal of produced or incidental water
- Details surrounding the final landform of the site, including final void management (where relevant) and rehabilitation measures.
- Assessment of any potential cumulative impacts on water resources, and any proposed options to manage the cumulative impacts.
- Consideration of relevant policies and guidelines.
- A statement of where each element of the SRs is addressed in the EIS (i.e. in the form of a table).

The Office of Water notes the proponent's comments about groundwater. If the proposal will not interfere with an aquifer, then it may not be an aquifer interference activity, however this would need to be demonstrated through adequate on-site studies.

The southern and eastern sections of the property contain upriver alluvials which are currently embargoed from new water licences.

For further information please contact Christie Jackson, Water Regulation Officer, (Tamworth office) on (02) 6701 9652 or at christie.jackson@water.nsw.gov.au.

Yours sincerely

Kristian Holz
Director Policy, Legislation and Innovation

Attachment A

Sly's Quarry Extension Project [SSD_6624]
Request for Input into Secretary's Environmental Assessment Requirements
Additional Comment by NSW Office of Water

The following detailed assessment requirements are provided to assist in adequately addressing the assessment requirements for this proposal.

For further information visit the NSW Office of Water website, www.water.nsw.gov.au.

Key Relevant Legislative Instruments

This section provides a basic summary to aid proponents in the development of an Environmental Impact Statement (EIS), and should not be considered a complete list or comprehensive summary of relevant legislative instruments that may apply to the regulation of water resources for a project.

The EIS should take into account the objects and regulatory requirements of the *Water Act 1912* (WA 1912) and *Water Management Act 2000* (*WMA 2000*), and associated regulations and instruments, as applicable.

Water Management Act 2000 (WMA 2000)
Key points:

- Volumetric licensing in areas covered by water sharing plans,
- Works within 40m of waterfront land,
- SSD & SSI projects are exempt from requiring water supply work approvals and controlled activity approvals as a result of the *Environmental Planning & Assessment Act 1979 (EP&A Act)*,
- No exemptions for volumetric licensing apply as a result of the *EP&A Act*,
- Basic landholder rights, including harvestable rights dams,
- Aquifer interference activity approval and flood management work approval provisions have not yet commenced and are regulated by the *Water Act 1912,*
- Maximum penalties of $2.2 million plus $264,000 for each day an offence continues apply under the *WMA 2000,*

Water Act 1912 (WA 1912)
Key points:

- Volumetric licensing in areas where no water sharing plan applies,
- Monitoring bores,
- Aquifer interference activities that are not regulated as a water supply work under the *WMA 2000*,
- Flood management works,
- No exemptions apply to licences or permits under the *WA 1912* as a result of the *EP&A Act*,
- Regulation of water bore driller licensing.

Water Management (General) Regulation 2011
Key points:

- Provides various exemptions for volumetric licensing and activity approvals,
- Provides further detail on requirements for dealings and applications.

Water Sharing Plans – these are considered regulations under the *WMA 2000*

Access Licence Dealing Principles Order 2004

Harvestable Rights Orders

Water Sharing Plans

The proposed quarry expansion is not located within an area covered by a Water Sharing Plan, therefore any licensing requirements are under the *Water Act 1912*. Once a Water Sharing Plan is gazetted for the area, on site groundwater and/ or surface water would be regulated by the *Water Management Act 2000.*

A water sharing plan for the area is currently targeted for commencement in 2015.

Relevant Policies and Guidelines

The EIS should take into account the following policies (as applicable):

- NSW Guidelines for Controlled Activities on Waterfront Land (NOW, 2012),
- NSW Aquifer Interference Policy (NOW, 2012),
- Risk Assessment Guidelines for Groundwater Dependent Ecosystems (NOW, 2012),
- Australian Groundwater Modelling Guidelines (NWC, 2012),
- NSW State Rivers and Estuary Policy (1993),
- NSW Wetlands Management Policy (1996),
- NSW State Groundwater Policy Framework Document (1997),
- NSW State Groundwater Quality Protection Policy (1998),
- NSW State Groundwater Dependent Ecosystems Policy (2002),
- NSW Water Extraction Monitoring Policy (2007).

Office of Water policies can be accessed at the following links:
http://www.water.nsw.gov.au/Water-management/Law-and-policy/Key-policies/default.aspx
http://www.water.nsw.gov.au/Water-licensing/Approvals/Controlled-activities/default.aspx

An assessment framework for the NSW Aquifer Interference Policy can be found online at: http://www.water.nsw.gov.au/Water-management/Law-and-policy/Key-policies/Aquifer-interference.

Licensing Considerations

The EIS is required to provide:

- Identification of water requirements for the life of the project in terms of both volume and timing (including predictions of potential ongoing groundwater take following the cessation of operations at the site – such as evaporative loss from open voids or inflows).
- Details of the water supply source(s) for the proposal including any proposed surface water and groundwater extraction from each water source as defined in the relevant Water Sharing Plan/s and all water supply works to take water.
- Explanation of how the required water entitlements will be obtained (i.e. through a new or existing licence/s, trading on the water market, controlled allocations etc).
- Information on the purpose, location, construction and expected annual extraction volumes including details on all existing and proposed water supply works which take surface water, (pumps, dams, diversions, etc).
- Details on all bores and excavations for the purpose of investigation, extraction, dewatering, testing and monitoring. All predicted groundwater take must be accounted for through adequate licensing.
- Details on existing dams/storages (including the date of construction, location, purpose, size and capacity) and any proposal to change the purpose of existing dams/storages.
- Details on the location, purpose, size and capacity of any new proposed dams/storages.

- Applicability of any exemptions under the *Water Management (General) Regulation 2011* to the project.

Water allocation account management rules, total daily extraction limits and rules governing environmental protection and access licence dealings also need to be considered.

The Harvestable Right gives landholders the right to capture and use for any purpose 10 % of the average annual runoff from their property. The Harvestable Right has been defined in terms of an equivalent dam capacity called the Maximum Harvestable Right Dam Capacity (MHRDC). The MHRDC is determined by the area of the property (in hectares) and a site-specific run-off factor. The MHRDC includes the capacity of all existing dams on the property that do not have a current water licence. Storages capturing up to the harvestable right capacity are not required to be licensed but any capacity of the total of all storages/dams on the property greater than the MHRDC may require a licence.

For more information on Harvestable Right dams, including a calculator, visit: http://www.water.nsw.gov.au/Water-licensing/Basic-water-rights/Harvesting-runoff/Harvesting-runoff

Dam Safety

Where new or modified dams are proposed, or where new development will occur below an existing dam, the NSW Dams Safety Committee should be consulted in relation to any safety issues that may arise. Conditions of approval may be recommended to ensure safety in relation to any new or existing dams.

See www.damsafety.nsw.gov.au for further information.

Surface Water Assessment

The predictive assessment of the impact of the proposed project on surface water sources should include the following:

- Identification of all surface water features including watercourses, wetlands and floodplains transected by or adjacent to the proposed project.
- Identification of all surface water sources as described by the relevant water sharing plan.
- Detailed description of dependent ecosystems and existing surface water users within the area, including basic landholder rights to water and adjacent/downstream licensed water users.
- Description of all works and surface infrastructure that will intercept, store, convey, or otherwise interact with surface water resources.
- Assessment of predicted impacts on the following:
    - flow of surface water, sediment movement, channel stability, and hydraulic regime,
    - water quality,
    - flood regime,
    - dependent ecosystems,
    - existing surface water users, and
    - planned environmental water and water sharing arrangements prescribed in the relevant water sharing plans.

Groundwater Assessment

To ensure the sustainable and integrated management of groundwater sources, the EIS needs to include adequate details to assess the impact of the project on all groundwater sources including:

- Works likely to intercept, connect with or infiltrate the groundwater sources.
- Any proposed groundwater extraction, including purpose, location and construction details of all proposed bores and expected annual extraction volumes.
- Bore construction information is to be supplied to the Office of Water by submitting a "Form A" template. The Office of Water will supply "GW" registration numbers (and licence/approval numbers if required) which must be used as consistent and unique bore identifiers for all future reporting.
- A description of the watertable and groundwater pressure configuration, flow directions and rates and physical and chemical characteristics of the groundwater source (including connectivity with other groundwater and surface water sources).
- Sufficient baseline monitoring for groundwater quantity and quality for all aquifers and GDEs to establish a baseline incorporating typical temporal and spatial variations.
- The predicted impacts of any final landform on the groundwater regime.
- The existing groundwater users within the area (including the environment), any potential impacts on these users and safeguard measures to mitigate impacts.
- An assessment of groundwater quality, its beneficial use classification and prediction of any impacts on groundwater quality.
- An assessment of the potential for groundwater contamination (considering both the impacts of the proposal on groundwater contamination and the impacts of contamination on the proposal).
- Measures proposed to protect groundwater quality, both in the short and long term.
- Measures for preventing groundwater pollution so that remediation is not required.
- Protective measures for any groundwater dependent ecosystems (GDEs).
- Proposed methods of the disposal of waste water and approval from the relevant authority.
- The results of any models or predictive tools used.

Where potential impact/s are identified the assessment will need to identify limits to the level of impact and contingency measures that would remediate, reduce or manage potential impacts to the existing groundwater resource and any dependent groundwater environment or water users, including information on:

- Any proposed monitoring programs, including water levels and quality data.
- Reporting procedures for any monitoring program including mechanism for transfer of information.
- An assessment of any groundwater source/aquifer that may be sterilised from future use as a water supply as a consequence of the proposal.
- Identification of any nominal thresholds as to the level of impact beyond which remedial measures or contingency plans would be initiated (this may entail water level triggers or a beneficial use category).
- Description of the remedial measures or contingency plans proposed.
- Any funding assurances covering the anticipated post development maintenance cost, for example on-going groundwater monitoring for the nominated period.

Groundwater Dependent Ecosystems

The EIS must consider the potential impacts on any Groundwater Dependent Ecosystems (GDEs) at the site and in the vicinity of the site and:

- Identify any potential impacts on GDEs as a result of the proposal including:

- the effect of the proposal on the recharge to groundwater systems;
- the potential to adversely affect the water quality of the underlying groundwater system and adjoining groundwater systems in hydraulic connections; and
- the effect on the function of GDEs (habitat, groundwater levels, connectivity).

- Provide safeguard measures for any GDEs.

Watercourses, Wetlands and Riparian Land

The EIS should address the potential impacts of the project on all watercourses likely to be affected by the project, existing riparian vegetation and the rehabilitation of riparian land. It is recommended the EIS provides details on all watercourses potentially affected by the proposal, including:

- Scaled plans showing the location of:
  - wetlands/swamps, watercourses and top of bank;
  - riparian corridor widths to be established along the creeks;
  - existing riparian vegetation surrounding the watercourses (identify any areas to be protected and any riparian vegetation proposed to be removed);
  - the site boundary, the footprint of the proposal in relation to the watercourses and riparian areas; and
  - proposed location of any asset protection zones.
- Photographs of the watercourses/wetlands and a map showing the point from which the photos were taken.
- A detailed description of all potential impacts on the watercourses/riparian land.
- A detailed description of all potential impacts on the wetlands, including potential impacts to the wetlands hydrologic regime; groundwater recharge; habitat and any species that depend on the wetlands.
- A description of the design features and measures to be incorporated to mitigate potential impacts.
- Geomorphic and hydrological assessment of water courses including details of stream order (Strahler System), river style and energy regimes both in channel and on adjacent floodplains.

Drill Pad, Well and Access Road Construction

- Any construction activity within 40m of a watercourse, should be designed by a suitably qualified person, consistent with the NSW *Guidelines for Controlled Activities on Waterfront Land* (July 2012).
- Construction of all wells must be undertaken in accordance with the *Minimum Construction Requirements for Water Bores in Australia* (3rd edition 2012) by a driller holding a bore drillers' licence valid in New South Wales.
- The length of time that a core hole is maintained as an open hole should be minimised.

Landform rehabilitation (including final void management)

The Environmental Impact Statement report should include:

- Justification of the proposed final landform with regard to its impact on local and regional surface and groundwater systems;
- A detailed description of how the site would be progressively rehabilitated and integrated into the surrounding landscape;
- Outline of proposed construction and restoration of topography and surface drainage features if affected by the project;

- Detailed modelling of potential groundwater volume, flow and quality impacts of the presence of an inundated final void (where relevant) on identified receptors specifically considering those environmental systems that are likely to be groundwater dependent;
- An outline of the measures to be put in place to ensure that sufficient resources are available to implement the proposed rehabilitation; and
- The measures that would be established for the long-term protection of local and regional aquifer systems and for the ongoing management of the site following the cessation of the project.

End Attachment A

Sophie Butcher

Subject: FW: Heritage Council's Requirements for Sly's Quarry Extension Project 9SSD 6624)

Dear Thomas,

The Heritage Division received your request for Secretary's Requirements for the Sly's Quarry Extension Project (SSD 6624) sent via email on Tuesday the 29th July. After consideration of the documentation provided it is requested that the Secretary's Requirements should contain the following:

- The heritage significance of the site and any impacts the development may have upon this significance should be assessed. This assessment should include natural areas and places of Aboriginal, historic or archaeological significance. It should also include a consideration of wider heritage impacts in the area surrounding the site.

- The Heritage Council maintains the State Heritage Inventory which lists some items protected under the Heritage Act, 1977 and other statutory instruments. This register can be accessed through the Heritage Division home page on the internet (http:/www.heritage.nsw.gov.au).

- In addition, you should consult lists maintained by the National Trust, any heritage listed under the Australian Government's Environment Protection and Biodiversity Conservation Act 1999 and the local council in order to identify any identified items of heritage significance in the area affected by the proposal. Please be aware, however, that these lists are constantly evolving and that items with potential heritage significance may not yet be listed.

- Non-Aboriginal heritage items within the area affected by the proposal should be identified by field survey. This should include any buildings, works, relics (including relics underwater), gardens, landscapes, views, trees or places of non-Aboriginal heritage significance. A statement of significance and an assessment of the impact of the proposal on the heritage significance of these items should be undertaken. Any policies/measures to conserve their heritage significance should be identified. This assessment should be undertaken in accordance with the guidelines in the NSW Heritage Manual. The field survey and assessment should be undertaken by a qualified practitioner/consultant with historic sites experience. The Heritage Division can provide a list of suitable consultants.

- The proposal should have regard to any impacts on places, items or relics of significance to Aboriginal people. Where it is likely that the project will impact on Aboriginal heritage, adequate community consultation should take place regarding the assessment of significance, likely impacts and management/mitigation measures.

Regards,

Katrina Stankowski
A/Senior Team Leader
Archaeological Heritage - Conservation Section
Heritage Division

A: 3 Marist Place, Parramatta, NSW, 2150
M: Locked Bag 5020, Parramatta, NSW, 2150
E: Katrina.Stankowski@environment.nsw.gov.au
P: 9873 8569

NSW GOVERNMENT | Office of Environment & Heritage

Your reference: SSD 6674
Our reference: DOC14/146947
Contact: Krister Waern (02)66402503

Mr Thomas Watt
Planning Officer - Mining Projects
Department of Planning & Environment
GPO Box 39
SYDNEY NSW 2001

Dear Mr Watt

Re: Request for Secretary's Environmental Assessment Requirements – Sly's Quarry Extension Project (SSD 6674)

Thank you for your email of 29 July 2014 inviting input from the Office of Environment and Heritage (OEH) for the preparation of Secretary's Environmental Assessment Requirements (SEARs) for the above proposal. I appreciate the opportunity to provide input.

OEH notes that the project will be assessed in accordance with Part 4 of the *Environmental Planning and Assessment Act 1979* (EP&A Act). The SEARs provided by OEH are limited to Aboriginal cultural heritage, historic heritage, biodiversity, acid sulphate soils, flooding and coastal erosion, stormwater, and OEH estate.

The proponent should ensure that the Environmental Assessment (EA) will be sufficiently comprehensive to enable unambiguous determination of the extent of the direct and indirect impact(s) of the proposal. The EA should include an appropriate assessment of the potential impacts likely to occur on or near the subject site. OEH considers that this information is necessary to assess an EA for the proposal.

The full list of OEH requirements that may need to be addressed in the EA is provided in **Attachment 1**. In preparing the EA, the proponent should refer to the relevant guidance material listed in **Attachment 2.** If you require any further information or clarification regarding this matter please contact Krister Waern, Senior Operations Officer, on (02) 66402503.

Yours sincerely

Dimitri Young 11 August 2014

DIMITRI YOUNG
Senior Team Leader Planning, North East Region
Regional Operations

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File No: NTH13/00051 CR2014/003955

Mr Thomas Watt
Planning Officer Mining Projects
Department of Planning & Environment.
thomas.watt@planning.nsw.gov.au

Attention: Sophie Butcher

Dear Sir

Secretary's Requirements Input Request – Sly's Quarry Extension Project (SSD 6624).

I refer to your email of 29 July 2014 requesting Roads and Maritime Services to provide details of key issues and assessment requirements regarding the abovementioned development for inclusion in the environmental assessment (EA) requirements.

Roles & Responsibilities

The key interests for Roads and Maritime are the safety and efficiency of the road network, traffic management, the integrity of infrastructure assets and the integration of land use and transport.

In accordance with *State Environmental Planning Policy (Mining, Petroleum Production and Extractive Industries) 2007* Clause 16(3), Roads and Maritime is given the opportunity to review and provide comment on the subject development application.

Roads and Maritime Response

Roads and Maritime would like the following issues to be included in the transport and traffic impact assessment of the proposed development:

- The total impact of existing and proposed development on the state road network with consideration for a 10 year horizon.
- The volume and distribution of traffic generated
- Intersection sight distances at key intersections along the primary haulage route
- Existing and proposed access conditions
- Details of improvements for road intersections with consideration for the current Austroads Guidelines, particularly;
  - The intersection of Jacky Bulbin Road with the Pacific Highway.
- Detail of servicing and parking arrangements
- Traffic Management for construction and operational phases of the proposed development

- Impact on public transport (public and school bus routes) and consideration for alternative transport modes, eg. cyclists and pedestrians
- Impacts of road traffic noise and dust generated along the primary haulage route.
- Consideration for Clause 16(1) of the *State Environmental Planning Policy (Mining, Petroleum Production and Extractive Industries) 2007* regarding;
    - Impact on School Zones and Residential areas.
    - Truck Management Plan
    - Code of Conduct for Haulage Operators
    - Road Safety Assessment of key haulage routes

Where any road safety assessment of the key haulage routes identifies potential safety concerns, Roads and Maritime recommends that the traffic impact assessment be supported by a road safety audit undertaken by suitably qualified persons.

The current Austroads Guidelines, Australian Standards and Roads and Maritime Services supplements are to be adopted for any proposed works on the classified road network.

The Developer would be required to enter into a 'Works Authorisation Deed' (WAD) with Roads and Maritime for any works deemed necessary on the Pacific Highway. The developer would be responsible for all costs associated with the works and administration for the WAD.

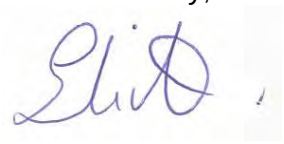
Further information on undertaking private developments adjacent to classified roads can be accessed at:

http://www.rms.nsw.gov.au/roadprojects/community_environment/private_developments.html

It is recommended that developers familiarise themselves with the requirements of the WAD process and contact our office to obtain further advice where necessary.

If you require further information please contact Mr Michael Baldwin on 6640 1362 or email Development.Northern@rms.nsw.gov.au.

Yours sincerely,



6 August 2014

for Monica Sirol
Network & Safety Manager, Northern Region

CC:
ENC:

Attachment 1

OEH's Recommended Secretary's Environmental Assessment Requirements (SEARs)

Sly's Quarry Extension Project (SSD 6674)

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1. Environmental impacts of the project

Impacts related to the following environmental issues need to be assessed, quantified and reported on:

- Aboriginal cultural heritage
- Historic heritage
- Biodiversity
- OEH Estate
    - Land reserved or acquired under the NPW Act
- Water and Soils
    - Acid sulfate soils
    - Flooding and coastal erosion
    - Water quality

Environmental assessments (EAs) should address the specific requirements outlined under each heading below and assess impacts in accordance with the relevant guidelines mentioned. A full list of guidelines is at **Attachment 2**.

2. Aboriginal cultural heritage

The EA report should contain:

1. A description of the Aboriginal objects and declared Aboriginal places located within the area of the proposed development.

2. A description of the cultural heritage values, including the significance of the Aboriginal objects and declared Aboriginal places, that exist across the whole area that will be affected by the proposed development, and the significance of these values for the Aboriginal people who have a cultural association with the land.

3. A description of how the requirements for consultation with Aboriginal people as specified in clause 80C of the National Parks and Wildlife Regulation 2009 have been met.

4. The views of those Aboriginal people regarding the likely impact of the proposed development on their cultural heritage. If any submissions have been received as a part of the consultation requirements, then the report must include a copy of each submission and your response.

5. A description of the actual or likely harm posed to the Aboriginal objects or declared Aboriginal places from the proposed activity, with reference to the cultural heritage values identified.

6. A description of any practical measures that may be taken to protect and conserve those Aboriginal objects or declared Aboriginal places.

7. A description of any practical measures that may be taken to avoid or mitigate any actual or likely harm, alternatives to harm or, if this is not possible, to manage (minimise) harm.

8. A specific Statement of Commitment that the proponent will complete an Aboriginal Site Impact Recording Form and submit it to the Aboriginal Heritage Information Management System (AHIMS) Registrar, for each AHIMS site that is harmed through the proposed development.

In addressing these requirements, the proponent must refer to the following documents:

a) *Draft Guidelines for Aboriginal Cultural Heritage Impact Assessment and Community Consultation* (Department of Planning, 2005). These guidelines identify the factors to be considered in Aboriginal cultural heritage assessments for development proposals under Part 3A of the EP&A Act.

b) *Aboriginal Cultural Heritage Consultation Requirements for Proponents 2010* (DECCW, 2010) - http://www.environment.nsw.gov.au/licences/consultation.htm. This document further explains the consultation requirements that are set out in clause 80C of the National Parks and Wildlife Regulation 2009. The process set out in this document must be followed and documented in the Environmental Assessment Report.

c) *Code of Practice for the Archaeological Investigation of Aboriginal Objects in New South Wales* (DECCW, 2010) - http://www.environment.nsw.gov.au/licences/archinvestigations.htm. The process described in this Code should be followed and documented where the assessment of Aboriginal cultural heritage requires an archaeological investigation to be undertaken.

Notes:

1. An Aboriginal Site Impact Recording Form (http://www.environment.nsw.gov.au/licences/DECCAHIMSSiteRecordingForm.htm) must be completed and submitted to the Aboriginal Heritage Information Management System (AHIMS) Registrar, for each AHIMS site that is harmed through archaeological investigations required or permitted through these environmental assessment requirements.

2. Under section 89A of the *National Parks and Wildlife Act* 1974, it is an offence for a person not to notify OEH of the location of any Aboriginal object the person becomes aware of, not already recorded on the Aboriginal Heritage Information Management System (AHIMS). An AHIMS Site Recording Form should be completed and submitted to the AHIMS Registrar (http://www.environment.nsw.gov.au/contact/AHIMSRegistrar.htm), for each Aboriginal site found during investigations.

3. Biodiversity

1. The EA report should include a detailed biodiversity assessment, including assessment of impacts on threatened biodiversity, native vegetation and habitat. This assessment should address the matters included in the following sections.

2. A field survey of the site should be conducted and documented in accordance with relevant guidelines, including:
   - the *Threatened Species Survey and Assessment Guidelines: Field Survey Methods for Fauna -Amphibians* (DECCW, 2009)
   - *Threatened Biodiversity Survey and Assessment: Guidelines for Developments and Activities - Working Draft* (DEC, 2004), and
   - Threatened species survey and assessment guideline information on www.environment.nsw.gov.au/threatenedspecies/surveyassessmentgdlns.htm.

   If a proposed survey methodology is likely to vary significantly from the above methods, the proponent should discuss the proposed methodology with OEH prior to undertaking the EA, to determine whether OEH considers that it is appropriate.

   Recent (less than five years old) surveys and assessments may be used. However, previous surveys should not be used if they have:
   - been undertaken in seasons, weather conditions or following extensive disturbance events when the subject species are unlikely to be detected or present, or
   - utilised methodologies, survey sampling intensities, timeframes or baits that are not the most appropriate for detecting the target subject species,

   unless these differences can be clearly demonstrated to have had an insignificant impact upon the outcomes of the surveys. If a previous survey is used, any additional species listed under the TSC Act since the previous survey took place, must be surveyed for.

   Determining the list of potential threatened species for the site must be done in accordance with the *Threatened Biodiversity Survey and Assessment: Guidelines for Developments and Activities - Working Draft* (DEC, 2004) and the *Guidelines for Threatened Species Assessment* (Department of Planning, July 2005). The OEH Threatened Species website http://www.environment.nsw.gov.au/threatenedspecies/ and the *Atlas of NSW Wildlife* database must be the primary information sources for the list of threatened species present. The BioBanking Threatened Species Database, the Vegetation Types databases (available on OEH website at http://www.environment.nsw.gov.au/biobanking/biobankingtspd.htm and http://www.environment.nsw.gov.au/biobanking/vegtypedatabase.htm, respectively) and other data sources (e.g. PlantNET, Online Zoological Collections of Australian Museums (http://www.ozcam.org/), previous or nearby surveys etc.) may also be used to compile the list.

3. The EA should contain the following information as a minimum:
   a. The requirements set out in the *Guidelines for Threatened Species Assessment* (Department of Planning, July 2005).
   b. Description and geo-referenced mapping of study area (and spatial data files), e.g. overlays on topographic maps, satellite images and /or aerial

photos, including details of map datum, projection and zone, all survey locations, vegetation communities (including classification and methodology used to classify), key habitat features and reported locations of threatened species, populations and ecological communities present in the subject site and study area.

c. Description of survey methodologies used, including timing, location and weather conditions.
d. Details, including qualifications and experience of all staff undertaking the surveys, mapping and assessment of impacts as part of the EA.
e. Identification of national and state listed threatened biota known or likely to occur in the study area and their conservation status.
f. Description of the likely impacts of the proposal on biodiversity and wildlife corridors, including direct and indirect and construction and operation impacts. Wherever possible, quantify these impacts such as the amount of each vegetation community or species habitat to be cleared or impacted, or any fragmentation of a wildlife corridor.
g. Identification of the avoidance, mitigation and management measures that will be put in place as part of the proposal to avoid or minimise impacts, including details about alternative options considered and how long term management arrangements will be guaranteed.
h. Description of the residual impacts of the proposal. If the proposal cannot adequately avoid or mitigate impacts on biodiversity, then a biodiversity offset package is expected (see the requirements for this at point 5 below).
i. Provision of specific Statement of Commitments relating to biodiversity.

4. An assessment of the significance of direct and indirect impacts of the proposal must be undertaken for threatened biodiversity known or considered likely to occur in the study area based on the presence of suitable habitat. This assessment must take into account:
   a. the factors identified in s.5A of the EP&A Act, and
   b. the guidance provided by *The Threatened Species Assessment Guideline – The Assessment of Significance (DECCW, 2007)* which is available at: http://www.environment.nsw.gov.au/resources/threatenedspecies/tsaguide07393.pdf

5. OEH recommends that the SEARs address the offsetting principles and policy as set out below. This requires the use of the Biobanking Assessment Methodology (BBAM) to assess biodiversity impacts arising from the proposal. The NSW Government is currently developing a new whole of government draft *Biodiversity Offsets Policy for Major Projects* which will be used in assessing impacts to biodiversity and determining acceptable offsets for state significant development and state significant infrastructure projects. This policy has been recently publicly exhibited and submissions are now being considered. In the interim, the following advice is provided.

Biodiversity Offsetting Principles

Projects must avoid and minimise impacts and offset any remaining impacts in accordance with the following seven offsetting principles:

a. Before offsets are considered, impacts must first be avoided and unavoidable impacts minimised through mitigation measures. Only then should offsets be considered for the remaining impacts.
b. Offset requirements should be based on a reliable and transparent assessment of losses and gains.

c. *Offsets must be targeted to the biodiversity values being lost or to higher conservation priorities.*
d. *Offsets must be additional to other legal requirements.*
e. *Offsets must be enduring, enforceable and auditable.*
f. *Supplementary measures can be used in lieu of offsets.*
g. *Offsets can be discounted where significant social and economic benefits accrue to NSW as a consequence of the proposal.*

During this transitional phase OEH is willing to provide assistance to applicants to ensure they meet their offsetting obligations.

6. Where appropriate, likely impacts (both direct and indirect) on any adjoining and/or nearby OEH estate reserved under the *National Parks and Wildlife Act 1974* or any marine and estuarine protected areas under the *Fisheries Management Act 1994* or the *Marine Parks Act 1997* should be considered. Refer to the *Guidelines for developments adjoining land and water managed by the Department of Environment, Climate Change and Water* (DECC, 2010).

7. With regard to the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999*, the assessment should identify any relevant Matters of National Environmental Significance and whether the proposal has been referred to the Commonwealth or already determined to be a controlled action.

4. Historic heritage

The EA report should address the following:

1. The heritage significance of the site and any impacts the development may have upon this significance should be assessed. This assessment should include natural areas and places of Aboriginal, historic or archaeological significance. It should also include a consideration of wider heritage impacts in the area surrounding the site.

2. The Heritage Council maintains the State Heritage Inventory which lists some items protected under the Heritage Act 1977 and other statutory instruments. This register can be accessed through the Heritage Branch home page on the internet (http:www.heritage.nsw.gov.au). In addition, lists maintained by the National Trust, any heritage listed under the Australian Government's Environment Protection and Biodiversity Conservation Act 1999 and the local council should be consulted in order to identify any known items of heritage significance in the area affected by the proposal. These lists are constantly evolving and items with potential heritage significance may not yet be listed

3. Non-Aboriginal heritage items within the area affected by the proposal should be identified by field survey. This should include any buildings, works, relics (including relics underwater), gardens, landscapes, views, trees or places of non-Aboriginal heritage significance. A statement of significance and an assessment of the impact of the proposal on the heritage significance of these items should be undertaken. Any policies/measures to conserve their heritage significance should be identified. This assessment should be undertaken in accordance with the guidelines in the NSW Heritage Manual. The field survey and assessment should be undertaken by a qualified practitioner/consultant with historic sites experience. The Manager, OEH Heritage Division Conservation Team, can be contacted on telephone (02) 9873 8599 for a list of suitable consultants.

5. Water and soils

Acid sulfate soils

1. The potential impacts of the development on acid sulfate soils must be assessed in accordance with the relevant guidelines in the *Acid Sulfate Soils Manual* (Stone *et al.* 1998) and the *Acid Sulfate Soils Laboratory Methods Guidelines* (Ahern *et al.* 2004).

2. Describe mitigation and management options that will be used to prevent, control, abate or minimise potential impacts from the disturbance of acid sulfate soils associated with the project and to reduce risks to human health and prevent the degradation of the environment. This should include an assessment of the effectiveness and reliability of the measures and any residual impacts after these measures are implemented.

Flooding and coastal erosion

The EA report should include an assessment of the following referring to the relevant guidelines in Attachment 2:

1. The potential effect of coastal processes and coastal hazards including potential impacts of climate change such as sea level rise:
   - on the proposed development; and
   - arising from the proposed development.

2. Whether the proposal is consistent with any coastal zone management plans.

3. Whether the proposal is consistent with any floodplain risk management plans.

4. Whether the proposal is compatible with the flood hazard of the land.

5. Whether the proposal will significantly adversely affect flood behaviour resulting in detrimental increases in the potential flood affectation of other development or properties.

6. Whether the proposal will significantly adversely affect the environment or cause avoidable erosion, siltation, destruction of riparian vegetation or a reduction in the stability of river banks or watercourses.

7. Whether the proposal incorporates appropriate measures to manage risk to life from flood.

8. Whether the proposal is likely to result in unsustainable social and economic costs to the community as a consequence of flooding.

The EA should take into account the considerations set out in the NSW Government Floodplain Development Manual (see Attachment 2). The implications of flooding over the full range of potential flooding, including the probable maximum flood, should be considered.

Water

Describe Proposal

1. Describe the proposal including position of any intakes and discharges, volumes, water quality and frequency of all water discharges.

2. Demonstrate that all practical options to avoid discharge have been implemented and environmental impact minimised where discharge is necessary.

3. Where relevant include a water balance for the development including water requirements (quantity, quality and source(s)) and proposed storm and wastewater disposal, including type, volumes, proposed treatment and management methods and re-use options.

Background Conditions

4. Describe existing surface and groundwater quality. An assessment needs to be undertaken for any water resource likely to be affected by the proposal.

5. State the Water Quality Objectives for the receiving waters relevant to the proposal. These refer to the community's agreed environmental values and human uses endorsed by the NSW Government as goals for ambient waters (http://www.environment.nsw.gov.au/ieo/index.htm). Where groundwater may be impacted the assessment should identify appropriate groundwater environmental values.

6. State the indicators and associated trigger values or criteria for the identified environmental values. This information should be sourced from the ANZECC (2000) Guidelines for Fresh and Marine Water Quality (http://www.mincos.gov.au/publications/australian_and_new_zealand_guidelines_for_fresh_and_marine_water_quality).

7. State any locally specific objectives, criteria or targets which have been endorsed by the NSW Government.

Impact Assessment

8. Describe the nature and degree of impact that any proposed discharges will have on the receiving environment.

9. Assess impacts against the relevant ambient water quality outcomes. Demonstrate how the proposal will be designed and operated to:
    - protect the Water Quality Objectives for receiving waters where they are currently being achieved; and
    - contribute towards achievement of the Water Quality Objectives over time where they are not currently being achieved.

10. Where a discharge is proposed that includes a mixing zone, the proposal should demonstrate how wastewater discharged to waterways will ensure the ANZECC (2000) water quality criteria for relevant chemical and non-chemical parameters are met at the edge of the initial mixing zone of the discharge, and that any impacts in the initial mixing zone are demonstrated to be reversible.

11. Assess impacts on groundwater and groundwater dependent ecosystems.

12. Describe how stormwater will be managed both during and after construction. The EA needs to identify all site drainage, stormwater quality devices and erosion/sedimentation control measures. The EA should also detail the onsite treatment of stormwater and effluent runoff and predicted stormwater discharge quality from the development.

Monitoring

13. Describe how predicted impacts will be monitored and assessed over time.

Attachment 2 – Guidance Material

Title	Web address
Relevant Legislation	
Coastal Protection Act 1979	http://www.legislation.nsw.gov.au/maintop/view/inforce/act+13+1979+cd+0+N
Commonwealth Environment Protection and Biodiversity Conservation Act 1999	http://www.austlii.edu.au/au/legis/cth/consol_act/epabca1999588/
Floodplain Development Manual	http://www.environment.nsw.gov.au/floodplains/manual.htm
Environmental Planning and Assessment Act 1979	http://www.legislation.nsw.gov.au/maintop/view/inforce/act+203+1979+cd+0+N
Fisheries Management Act 1994	http://www.legislation.nsw.gov.au/maintop/view/inforce/act+38+1994+cd+0+N
Marine Parks Act 1997	http://www.legislation.nsw.gov.au/maintop/view/inforce/act+64+1997+cd+0+N
National Parks and Wildlife Act 1974	http://www.legislation.nsw.gov.au/maintop/view/inforce/act+80+1974+cd+0+N
Protection of the Environment Operations Act 1997	http://www.legislation.nsw.gov.au/maintop/view/inforce/act+156+1997+cd+0+N
Threatened Species Conservation Act 1995	http://www.legislation.nsw.gov.au/maintop/view/inforce/act+101+1995+cd+0+N
Water Management Act 2000	http://www.legislation.nsw.gov.au/maintop/view/inforce/act+92+2000+cd+0+N
Aboriginal Cultural Heritage	
Guidelines for Aboriginal Cultural Heritage Impact Assessment and Community Consultation (2005)	Available from DPI.
Aboriginal Cultural Heritage Consultation Requirements for Proponents (DECCW, 2010)	http://www.environment.nsw.gov.au/licences/consultation.htm
Code of Practice for the Archaeological Investigation of Aboriginal Objects in New South Wales (DECCW, 2010)	http://www.environment.nsw.gov.au/licences/archinvestigations.htm
Aboriginal Site Impact Recording Form	http://www.environment.nsw.gov.au/licences/DECCAHIMSSiteRecordingForm.htm
Aboriginal Heritage Information Management System (AHIMS) Registrar	http://www.environment.nsw.gov.au/contact/AHIMSRegistrar.htm
Biodiversity	
BioBanking Assessment Methodology (DECC, 2008)	http://www.environment.nsw.gov.au/resources/biobanking/08385bbassessmethod.pdf
BioBanking Assessment Methodology and Credit Calculator Operational Manual (DECCW, 2008)	http://www.environment.nsw.gov.au/biobanking/operationalmanual.htm

Title	Web address
Threatened Species Survey and Assessment Guidelines: Field Survey Methods for Fauna -Amphibians (DECCW, 2009)	http://www.environment.nsw.gov.au/resources/threatenedspecies/09213amphibians.pdf
Threatened Biodiversity Survey and Assessment: Guidelines for Developments and Activities - Working Draft (DEC, 2004)	http://www.environment.nsw.gov.au/resources/nature/TBSAGuidelinesDraft.pdf
Guidelines for Threatened Species Assessment (Department of Planning, July 2005)	Draft available from DPI
DECCW Threatened Species website	http://www.environment.nsw.gov.au/threatenedspecies/
Atlas of NSW Wildlife	http://wildlifeatlas.nationalparks.nsw.gov.au/wildlifeatlas/watlas.jsp
BioBanking Threatened Species Database	http://www.environment.nsw.gov.au/biobanking/biobankingtspd.htm
Vegetation Types databases	http://www.environment.nsw.gov.au/biobanking/vegtypedatabase.htm
PlantNET	http://plantnet.rbgsyd.nsw.gov.au/
Online Zoological Collections of Australian Museums	http://www.ozcam.org/
Threatened Species Assessment Guideline - The Assessment of Significance (DECCW, 2007)	http://www.environment.nsw.gov.au/resources/threatenedspecies/tsaguide07393.pdf
Principles for the use of biodiversity offsets in NSW	http://www.environment.nsw.gov.au/biocertification/offsets.htm
OEH Estate	
Land reserved or acquired under the NPW Act	
List of national parks	http://www.environment.nsw.gov.au/NationalParks/parksearchatoz.aspx
OEH Revocation of Land Policy	http://www.environment.nsw.gov.au/policies/RevocationOfLandPolicy.htm
Guidelines for developments adjoining land and water managed by the Department of Environment, Climate Change and Water (DECCW, 2010)	http://www.environment.nsw.gov.au/resources/protectedareas/10509devadjdeccw.pdf
Water and Soils	
Acid sulphate soils	
Acid Sulfate Soils Planning Maps	http://canri.nsw.gov.au/download/
Acid Sulfate Soils Manual (Stone et al. 1998)	Manual available for purchase from: http://www.landcom.com.au/whats-new/the-blue-book.aspx Chapters 1 and 2 are on DPI's Guidelines Register at: Chapter 1 Acid Sulfate Soils Planning Guidelines: http://www.planning.nsw.gov.au/rdaguidelines/documents/NSW%20Acid%20Sulfate%20Soils%20Planning%20Guidelines.pdf Chapter 2 Acid Sulfate Soils Assessment Guidelines: http://www.planning.nsw.gov.au/rdaguidelines/documents/NSW%2

Title	Web address
	0Acid%20Sulfate%20Soils%20Assessment%20Guidelines.pdf
Acid Sulfate Soils Laboratory Methods Guidelines (Ahern et al. 2004)	http://www.derm.qld.gov.au/land/ass/pdfs/lmg.pdf This replaces Chapter 4 of the Acid Sulfate Soils Manual above.
Flooding and Coastal Erosion	
Reforms to coastal erosion management	http://www.environment.nsw.gov.au/coasts/coastalerosionmgmt.htm
Floodplain development manual	http://www.dnr.nsw.gov.au/floodplains/manual.shtml
Coastline management manual	http://www.environment.gov.au/coasts/publications/nswmanual/index.html **Note:** To be replaced by the Guidelines for preparing coastal zone management plans, due for release by end of 2010. This document will be available on OEH's website – draft currently available at http://www.environment.nsw.gov.au/coasts/coastalmgtdocs.htm.
Estuary management manual	Available on request from OEH or on interlibrary loan **Note:** To be replaced by the Guidelines for preparing coastal zone management plans, due for release by end of 2010. This document will be available on OEH's website – draft currently available at http://www.environment.nsw.gov.au/coasts/coastalmgtdocs.htm.
Water	
Water Quality Objectives	http://www.environment.nsw.gov.au/ieo/index.htm
ANZECC (2000) Guidelines for Fresh and Marine Water Quality	http://www.mincos.gov.au/publications/australian_and_new_zealand_guidelines_for_fresh_and_marine_water_quality
Applying Goals for Ambient Water Quality Guidance for Operations Officers – Mixing Zones	http://deccnet/water/resources/AWQGuidance7.pdf
Approved Methods for the Sampling and Analysis of Water Pollutant in NSW (2004)	http://www.environment.nsw.gov.au/resources/legislation/approvedmethods-water.pdf

Appendix C Surface and Groundwater Assessment

Newman Quarrying Pty Ltd

Proposed Sandstone Quarry Expansion at Tullymorgan-Jackybulbin Road, Mororo, NSW

Surface and Groundwater Assessment

May 2015

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Appendices

1. Introduction

1.1 Background

GHD Pty Ltd (GHD) was engaged by Newman Quarrying Pty Ltd (Newman Quarrying) to prepare a Surface Water and Groundwater Impact Assessment report to address the potential surface water and groundwater impacts from the proposed expansion of a sandstone quarry at Lot 2 DP 1055044, Tullymorgan-Jackybulbin Road, Mororo, known as Sly's Quarry.

The proposal involves the expansion of the existing sandstone quarry by 11.1 hectares and an increase in the extraction rate up to 500,000 tonnes per annum. The primary purpose of the quarry would be to supply substantial quantities of quarry materials required for current and proposed Pacific Highway works, and for supply to Clarence Valley Council (CVC) and local contractors.

It is estimated that the quarry would have an available resource of about 7 million tonnes which would allow extraction for a period of between 30 and 40 years, depending on demand.

1.2 Aim

This assessment considers surface and groundwater impacts associated with the proposal. The assessment provides management approaches on how any potential impacts could be avoided or minimised.

1.3 Scope

The scope of the assessment included:

- An assessment, review and description of the existing hydrological conditions, both related to surface and ground water.
- An assessment of potential surface and groundwater quantity/ quality impacts associated with the proposed works, including an annual site water balance and water budget. In addition, local and regional flood conveyance matters are considered.
- Nomination of management measures to mitigate any potential impacts associated with the proposed works, which may arise.

1.4 Limitations

This report has been prepared by GHD for Newman Quarrying Pty Ltd and may only be used and relied on by Newman Quarrying Pty Ltd for the purpose agreed between GHD and the Newman Quarrying Pty Ltd.

GHD otherwise disclaims responsibility to any person other than Newman Quarrying Pty Ltd arising in connection with this report. GHD also excludes implied warranties and conditions, to the extent legally permissible.

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

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

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

2. Secretaries environmental assessment requirements

The Secretary's Environmental Assessment Requirements (SEARs) in relation to surface water and groundwater are shown in Table 2-1, along with where they are addressed in this report.

Table 2-1 Surface water and Groundwater SEARs

	Conditions (Summarised)	Where addressed in this report
The EIS must address the following:	An assessment of the likely impacts of the development on the quantity and quality of the region's groundwater resources, having regard to the EPA's and DPI's requirements.	Section 7.2
	An assessment of the likely impacts of the development on aquifers, watercourses, riparian land, water-related infrastructure, and other water users	Section 6.2 and 7.2
NSW Office of Water		
It is recommended that the EIS be required to include:	Details of water proposed to be taken (including through inflow and seepage) from each surface and groundwater source as defined by the relevant water sharing plan.	Section 3.1.2
	Assessment of any volumetric water licencing requirements (including those for ongoing water take following completion of the project).	Section 7.2
	A detailed assessment against the NSW Aquifer Interference Policy (2012) using the NSW Office of Water's assessment framework.	Section 7.2
	Assessment of impacts on surface and ground water sources (both quality and quantity), related infrastructure, adjacent licensed water users, basic landholder rights, watercourses, riparian land, and groundwater dependent ecosystems and measures proposed to reduce and mitigate these impacts.	Section 6.2 and 7.2
	Full technical details and data of all surface and groundwater modelling and an independent peer review.	Section 6.5
	Proposed surface and groundwater monitoring activities and methodologies.	Section 7.3
The EIS is required to provide:	Identification of water requirements for the life of the project in terms of both volume and timing (including predictions of potential ongoing groundwater take following the cessation of operations at the site – such as evaporative loss from open voids or inflows).	Section 6.5
	Details of the water supply source(s) for the proposal including any proposed surface water and groundwater extraction from each water source as defined in the relevant Water Sharing Plan/s and all water supply works to take water.	Section 3.1.2 and 6.5
	Explanation of how the required water entitlements will be obtained (i.e. through a new or existing licence/s, trading on the water market, controlled allocations etc.)	NA
	Details on all bores and excavations for the purpose of investigation, extraction, dewatering, testing and monitoring. All predicted groundwater take must be accounted for through adequate licencing.	Section 7.1.4 and 7.3
The EIS needs to include	Works likely to intercept, connect with or infiltrate the groundwater sources.	Section 7.2

	Conditions (Summarised)	Where addressed in this report
adequate details to assess the impact of the project on all groundwater sources including:	Any proposed groundwater extraction, including purpose and location and construction details of all proposed bores and expected annual extraction volumes	Section 7.3
	Bore construction information is to be supplied to the Office of Water by submitting a "Form A" template. The Office of Water will supply "GW" registration numbers (and licence approval numbers if required) which must be used as consistent and unique bore identifiers for all future reporting.	Section 7.3
	A description of the watertable and groundwater pressure configuration, flow directions and rates and physical and chemical characteristics of the groundwater source (including connectivity with other groundwater and surface water sources).	Section 7.1
	Sufficient baseline monitoring for groundwater quantity and quality for all aquifers and GDEs to establish a baseline incorporating typical temporal and spatial variations.	Section 7.1.4
	The predicted impacts of any final landform on the groundwater regime	Section 7.2
	The existing groundwater users within the area (including the environment), any potential impacts on these users and safeguard measures to mitigate impacts.	Section 7.1.5 and 7.2
	An assessment of groundwater quality, its beneficial use classification and prediction of any impacts on groundwater quality.	Section 7.1.4 and 7.1.5
	An assessment of the potential for groundwater contamination (considering both the impacts of the proposal on groundwater contamination and the impacts of contamination on the proposal).	Section 7.3.2
	Measures proposed to protect groundwater quality, both in the short and long term.	Section 7.3.2
	Measures for preventing groundwater pollution so remediation is not required.	Section 7.3.2
	Protective measures for any groundwater dependant ecosystems (GDEs).	Section 7.3
	Proposed methods for the disposal of waste water and approval from the relevant authority.	Section 6.5
	The result of any models or predictive tools used.	Section 6.5
The EIS must consider the potential impacts on any Groundwater Dependent Ecosystems (GDEs) at the site and in the vicinity of the site and:	Identify any potential impacts on GDEs as a result of the proposal including:	
	The effect of the proposal on the recharge to groundwater systems	Section 7.2
	The potential to adversely affect the water quality of the underlying groundwater system and adjoining groundwater systems in hydraulic connections; and	Section 7.2
	The effect of the function of GDEs (habitat, groundwater levels, conductivity).	Section 7.2
	Provide safeguard measures for any GDEs.	Section 7.3
The Environmental Impact Statement	Detailed modelling of potential groundwater volume, flow and quality impacts of the presence of a final void (where relevant) on identified receptors specifically considering those environmental systems that are likely to be groundwater dependent	Section 7.2

	Conditions (Summarised)	Where addressed in this report
report should include:	The measures that would be established for the long term protection of local and regional aquifer systems and for the ongoing management of the site following the cessation of the project.	Section 7.3

3. Legislation and policy

3.1 Legislation

3.1.1 Water Act 1912

The *Water Act 1912* governs access, trading and allocation of licences associated with both surface and underground water for water sources where a Water Sharing Plan (WSP) has not been put in place. The elements to which the Water Act 1912 applies include extraction of water from a river, extraction of water from underground sources, aquifer interference and capture of surface runoff in dams.

At this point in time, the *Water Act 1912* applies to groundwater interference, bore installation and extraction of groundwater within the Project Application Area. Currently the site does not have a licence to extract groundwater under the *Water Act 1912*. Any interference and/or removal of groundwater as a result of the Project will need to be licenced under the *Water Act 1912*.

3.1.2 Water Management Act 2000

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 formal means for the protection and enhancement of the environmental qualities of waterways and their in-stream uses as well as to provide for protection of catchment conditions.

The Project Application Area is not currently covered by a WSP, although a draft WSP for the North Coast Fractured and Porous Rock Groundwater Sources is currently being prepared by NSW Office of Water (NOW) and will regulate extraction and interference of groundwater from the fractured and porous rock groundwater source within the WSP boundary. This WSP will include the Project Application Area and is anticipated to commence in July 2015. Additionally a draft WSP for the Clarence Unregulated and Alluvial Water Sources is currently being prepared by NOW and will regulate extraction and interference of groundwater from the alluvial groundwater source within the WSP boundary. This WSP will cover alluvial sediments within the Project Application Area and is expected to commence in 2015.

In the vicinity of the Project Application Area; the granting of new licences for extraction of groundwater from alluvial sediments is currently embargoed for areas regulated by the WM Act and the *Water Act 1912.*

At this point in time any interference and extraction of fractured and porous rock groundwater throughout the Project Application Area will generally not require a Water Access Licence (WAL) under the WM Act. Groundwater licences granted under the *Water Act 1912* will be converted to licences under the WM Act once the relevant WSP commences.

3.2 Policy

3.2.1 NSW Aquifer Interference Policy

The NSW Aquifer Interference Policy (AIP) was finalised in September 2012 and clarifies the water licencing and approval requirements for aquifer interference activities in NSW, including the taking of water from an aquifer in the course of carrying out mining. Many aspects of this Policy will be given legal effect in the future through an Aquifer Interference Regulation. Stage 1 of the Aquifer Interference Regulation commenced on 30 June 2011.

This Policy outlines the water licensing requirements under the Water Act 1912 and WM Act. A WAL is required whether water is taken for consumptive use or whether it is taken incidentally by the aquifer interference activity (such as groundwater filling a void) even where that water is not being used consumptively as part of the activity's operation. Under the WM Act, a WAL gives its holder a share of the total entitlement available for extraction from the groundwater source. The WAL must hold sufficient share component and water allocation to account for the take of water from the relevant water source at all times.

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

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

The level 1 minimal impact considerations for Less Productive Fractured and Porous and Fractured Rock Groundwater Sources have been adopted for this groundwater impact assessment and are as follows:

- Water table: less than or equal to 10% cumulative variation in the water table, allowing for typical climatic 'post-water sharing plan' variations, at a distance of 40 m from any high priority groundwater dependent ecosystem or high priority culturally significant site listed in the schedule of the relevant WSP. A maximum of a 2 m water table decline cumulatively at any water supply work.
  - If more than 10% cumulative variation in the water table, allowing for typical climatic "post-water sharing plan" variations, 40m from any high priority groundwater dependent ecosystem; or high priority culturally significant site; listed in the schedule of the relevant water sharing plan then appropriate studies (including the hydrogeology, ecological condition and cultural function) will need to demonstrate to the Minister's satisfaction that the variation will not prevent the long-term viability of the dependent ecosystem or significant site. If more than 2 m decline cumulatively at any water supply work then make good provisions should apply.
- Water pressure: a cumulative pressure head decline of not more than a 2 m decline at any water supply work.
  - If the predicted pressure head decline is greater than the requirement above, then appropriate studies are required to demonstrate to the Minister's satisfaction that the decline will not prevent the long-term viability of the affected water supply works unless make good provisions apply.
- Water quality: Any change in the groundwater quality should not lower the beneficial use category of the groundwater source beyond 40 m from the activity.
  - If any change in groundwater quality lowers the beneficial use category beyond 40 m of the activity then appropriate studies will need to demonstrate to the Minister's satisfaction that the change in groundwater quality will not prevent the long-term viability of the dependent ecosystem, significant site or affected water supply works.

3.2.2 NSW State Groundwater Policy

The objective of the NSW State Groundwater Policy Framework Document (NSW Government 1997) is to manage the State's groundwater resources so that they can sustain environmental, social and economic uses for the people of NSW. NSW groundwater policy has three component parts:

- NSW Groundwater Quantity Protection Policy.
- NSW Groundwater Quality Protection Policy.
- NSW Groundwater Dependent Ecosystems Policy.

NSW Groundwater Quantity Protection Policy

The principles of this policy include:

- Maintain total groundwater use within the sustainable yield of the aquifer from which it is withdrawn.
- Groundwater extraction shall be managed to prevent unacceptable local impacts.

All groundwater extraction for water supply is to be licensed. Transfers of licensed entitlements may be allowed depending on the physical constraints of the groundwater system.

NSW Groundwater Quality Protection Policy

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

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

NSW Groundwater Dependent Ecosystems Policy

This policy was designed to protect ecosystems which rely on groundwater for survival so that, wherever possible, the ecological processes and biodiversity of these dependent ecosystems are maintained or restored for the benefit of present and future generations.

4. Site description

4.1 Location

The Quarry is located on land with frontage to the Tullymorgan-Jackybulbin Road, about 2 km west of its intersection with the Pacific Highway, Mororo NSW. The land on which Sly's Quarry is located is Lot 2 in DP 1055044. Slys Road is located along the eastern boundary of the site which forms the watershed. The quarry is operated by Newman Quarrying Pty Ltd.

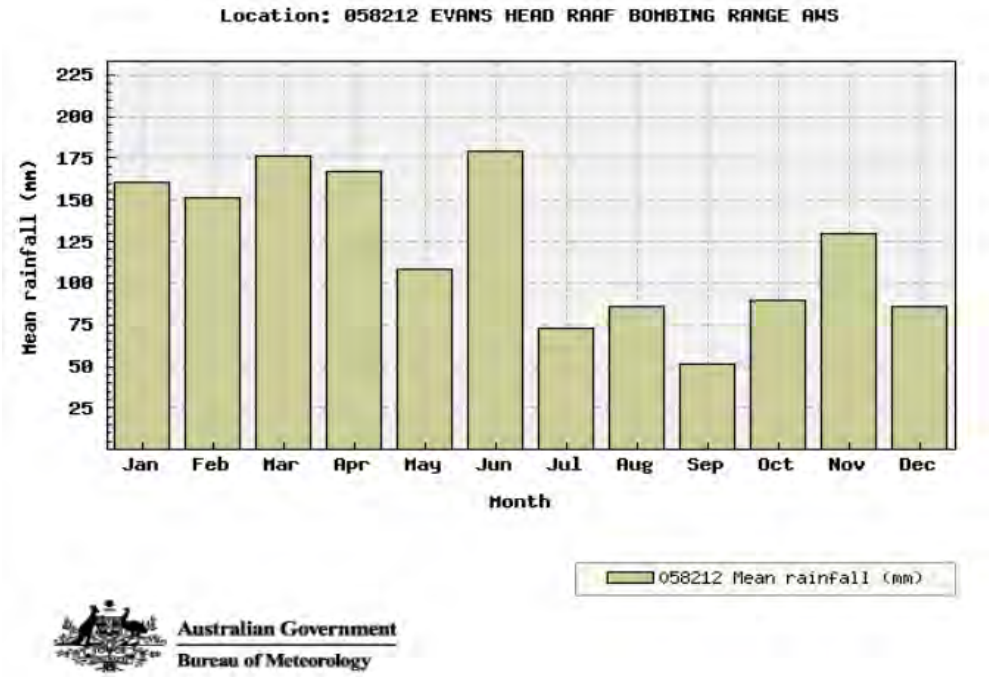
4.2 Climate

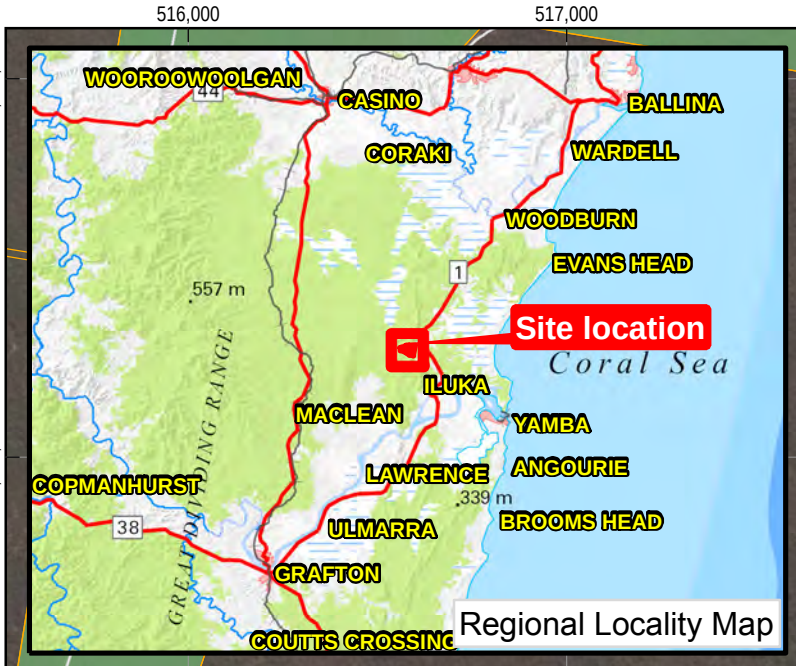
The region is considered to be sub-tropical with warm, wet summers and dry, mild winters.

Using the Evans Head RAAF Bombing Range Weather Station (BOM 058212) as a reference, mean summer temperatures range from a maximum of approximately 29°C and a minimum of approximately 20°C. Mean winter temperatures range from a maximum of approximately 20 °C and a minimum of approximately 10 °C. The mean annual rainfall is 1472mm, and Table 4-1 below lists typical rainfall data. Rainfall falls relatively evenly for the first four calendar months, with March having the highest mean monthly rainfall of 171 mm. Rainfall then eases during May to September (with exception of June) before slowly increasing again from October onwards. Evaporation at the site is estimated at 730mm per annum.

Table 4-1 Typical rainfall data (after BOM 058212)

Description	Rainfall (mm)
Average	1464.8
Typical dry rainfall year (2002)	903.8
Typical wet rainfall year (1999)	2080.2
Typical average rainfall year (2012)	1554.0





BUNDJALUNG NationalPark

SLYS ROAD

PACIFIC HIGHWAY

TULLYMORGAN-JACKYBULBIN ROAD

TABBIMOBLE CREEK

MCMAHONS TRAIL

MORORO STATE FOREST

GIBBERAGEE STATE FOREST

Source: Esri, DigitalGlobe, GeoEye, i-cubed, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo, and the GIS User Community

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LEGEND

- Subject site
- Lot 2 DP 1055044
- cadastre
- roads
- Waterways
- Waterbody
- Natural Parks
- State Forest

Paper Size A3

0 95 190 380 570 760

Metres

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

N

GHD

Newman Quarrying
Sly's Quarry Environmental Impact Statement
Biodiversity Assessment

Job Number	22-17528
Revision	A
Date	18 Feb 2015

Site location

Figure 4-1

N:\AU\Coffs Harbour\Projects\22\17528\GIS\Maps\Deliverables\22_17528_Z001_Site_location_RevB.mxd

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

Data Source: NSW Department of Lands: Cadastre - Jan 2014; Geoscience Australia: 250k Data - Jan 2014; NSW Department od Primary Industry - Jan 2014; ESRI image Jan 2014. Created by: qjchung

4.3 Topography

The natural topography of the site falls in a south westerly direction, and has been altered by the existing quarry activities. This site catchment is located within the southern foothills of Mount Doubleduke.

A ridgeline runs along the northern and eastern boundary of the site. The ridgeline starts at the northern end of the site at an elevation of about 100 m Australian Height Datum (AHD) and falls towards the southern extent of the site to about 42 m AHD. The existing quarry floor is relatively level at 44 m AHD.

A number of unnamed ephemeral tributaries drain around the site, being diverted around the works area, and discharge to Tabbimoble Creek. Tabbimoble Creek drains via the Bundjalung National Park marshes to the Clarence River near Iluka

In the centre of the site the existing quarry has altered the natural topography by excavating the rock from the southern slopes of Mount Doubleduke.

4.4 Geology and soils

The site area generally has poor soils of sandy composition mostly derived from the underlying sandstone. In lower-lying areas, soils may be derived from stream deposition. It is located in the southern end of the Clarence-Moreton Basin in northern NSW includes extensive deposits of quartzose sandstone. The sandstone exists in the Kangaroo Creek Formation and related geological structures. In the locality of the quarry, these sandstone deposits are generally well-exposed and quite accessible. They are easily worked to produce a principal product of medium- to coarse-grained siliceous sandstone that is used in a number of engineering applications, particularly road works.

The Kangaroo Creek sandstone is estimated to range in thickness from 150 m to 500 m. At the existing quarry face, the sandstone exists in a series of beds ranging in thickness from less than 1 m to up to 3 m (Newman, 2014). The site falls entirely within the Euroka soil landscape (Atkinson, 1999), which is characteristic of much of the low hills south of the Macleay River floodplain. Soils within the Euroka landscape are typically shallow (100cm) comprising of Red, Yellow and Brown Podzolic soils. The soils generally have low permeability and can be susceptible to water logging.

4.5 Surrounding land use

The quarry site is largely screened from view in every direction by its location, the topography and/or the forest cover. Maintenance of the roadside vegetative buffer mostly screens the quarry operation from view on the Tullymorgan-Jackybulbin Road.

The lower slopes of Lot 2 north of Tullymorgan-Jackybulbin Road have been extensively cleared of vegetation although there is a substantial treed buffer of dry schlerophyl forest along most of the road frontage. The clearing may have resulted from a long history of selective logging on the site and in the area. It is also associated with the sand extraction and quarrying activities approved for Lot 2 in the past (Newman, 2014).

The higher slopes of the quarry site retain extensive vegetation cover of open dry schlerophyl forest that includes dense under storey and many large native trees dominated by blackbutt, angophora and syncarpia species. Vegetation arising from a wetter microclimate lies along the lines of watercourses (Newman, 2014).

5. Project description

Plans of the existing and proposed expansion works are provided in Appendix A. The quarry operation would be carried out in stages and in response to demand. It is therefore difficult to predict exactly how the extraction would progress. In general, the extraction is proposed to move north and east initially, to the extent of the currently approved quarry. The eastern extent of the excavation would remain 10 m from the road reserve located along the eastern boundary. The excavation would be to the current floor level of 44 m AHD.

Stage 1 would cover an area of 6.9 hectares and extract approximately 2.3 million tonnes.

Stage 2 would involve expanding the quarry to the north and south and to a depth of 44 m AHD. This would expand the quarry by 5.7 hectares and involve the extraction of approximately 2.8 million tonnes of material. Stage 2 (south) would be exhausted prior to Stage 2 (north) being developed.

Stage 3 would be the final stage and would expand the quarry further north and south. Stage 3 would involve an expansion of 5.4 hectares to a depth of 44 m AHD. This would involve extracting approximately 1.8 million tonnes of material. Stage 3 (south) would be exhausted prior to Stage 3 (north) being developed.

The extraction of all stages would progress in 10 m by 10 m benches to a final depth of 44m AHD. Following extraction, the material would be crushed, screened and where necessary blended with other materials from the quarry, or material imported to the quarry. The materials would be stockpiled on the quarry floor in numbered stockpiles of approximately 4,000 tonnes each. Samples from each stockpile would be analysed for compliance with RMS specifications before being transported offsite. This process takes approximately 20 days.

The proposed sequence of operations for each stage would generally be:

- Establish the sediment and erosion control measures and other environmental safeguards.
- Clearing vegetation, if necessary. The bulk of cleared vegetative wastes would be piled in a suitable location, clear of adjacent vegetated areas and mulched for future revegetation works.
- Topsoil would be stripped, stockpiled and protected against erosion for use in revegetation works.
- Excavation of the weathered rock material, where possible. The deeper layers would be excavated in a similar manner but would also include blasting. Blasting is anticipated to be carried out at a frequency of between two blasts per month to one blast per year, depending on demand and the material encountered. The blasting would be undertaken by a specialist contractor in accordance with regulatory requirements.
- If the rock is too large, a rock hammering, where required to break large rocks into smaller pieces.
- The rock is collected by an excavator and feed into a jaw crusher. The crusher produces an output of various sizes of fill or aggregate which are separated by a screening machine into various piles based on size. Sand is also produced in this process. The crusher and screener are moved around the quarry floor as necessary to be close to the quarry face and accumulated, excavated stone.
- Loading of the material directly from the stockpile onto trucks for removal from site.

- The excavation continues, as described above, within each stage until it reaches the ultimate depth of 44m AHD. During the excavation, 10 m high by 10 m wide benches are established at the quarry face. At the top of each bench, a safety bund/wall is constructed to prevent people or machinery falling over the bench. The benches and quarry floor would be graded to the sediment basin located in the south-western end of the quarry area.
- Once the extraction is complete, topsoil would be respread on the disturbed areas and revegetated, where possible. The established erosion and water control measures would be maintained until the rehabilitated surface is adequately stabilised.

Other details relating to quarry operations include:

- If there is a special order for large boulders, for example for breakwater or river or sea wall repair or construction, these are set aside and transported as such.
- Occasionally, in order to comply with RMS specifications, materials won from the quarry would be blended with other materials won from the quarry, or with imported materials (eg, sand, clay), prior to being stockpiled on the floor of the quarry.
- Some sand is transported to the onsite wash plant for processing.

6. Surface water

6.1 Existing conditions

The site is located within the Clarence River catchment with unnamed ephemeral drainage lines flowing in a southwest direction to Tabbimoble Creek. Tabbimoble Creek drains via the Bundjalung National Park marshes to the Clarence River near Iluka. On Tabbimoble Creek, about 1 km to the east of the Pacific Highway, is the SEPP 14 Coastal Wetland No. 153a. The Woolgoolga to Ballina Pacific Highway Upgrade EIS (RMS, 2014) determined that the Tabbimoble Creek is key fish habitat with the potential for threatened species habitat, although it has not been mapped as such or found to contain Oxleyan Pygmy Perch.

The ephemeral drainage lines in the vicinity of the site are diverted around the works area and bypass the site water dams, discharging to Tabbimoble Creek under Tullymorgan-Jackybulbin Road.

Within the works area, the pit floor and stockpiled areas discharge to an initial sediment pond (approx.. 2.4 ML), this overflows to the main sediment basin (7m deep, appox.12.6 ML). The main sediment basin is the discharge point from the site. The site office, weighbridges, wash plant and other outbuildings along the site discharge to three smaller sediment basins (total approx. 0.55 ML). These basins discharge to the main sediment basin.

6.1.1 Water quality

Limited water quality information is available, however RMS (2014) notes that existing data indicates that the majority of the waterways in the area have a history of water quality problems, with conditions commonly found to be below the standards required for protection of aquatic ecosystems. The occurrence of poor water quality can be attributed to a number of factors, including modification of channel structure, macrophyte and weed growth, soil erosion, acid sulfate soils and nutrient enrichment as a result of runoff from agricultural land. Samples taken from Tabbimoble Creek in 2009 failed to meet the ANZECC guidelines for electrical conductivity and dissolved oxygen (RTA, 2010). Furthermore, Tabbimoble Creek was found to have high concentrations of aluminium, which could be a result of aluminium leaching from soils due to the effects of acid sulfate soils.

Some grab samples were collected as part of the EPL requirements of the existing quarry operation. The samples were collected from the main sediment basin before it exits the site and analysed at Environmental Analysis Laboratory, Southern Cross University. The results are presented in Table 6-1 along with the ANZECC (2000) guidelines for upland rivers and the preceding 48 hours of rainfall. This shows the water quality is fresh, with neutral pH and low to moderate suspended solids.

Table 6-1 Water quality results

Parameter	ANZECC	18/04/2013	20/06/2014	21/08/2014
48 hour rainfall (mm)*		2.2	4.4	4.6
pH	6.5-7.5	6.89	7.3	7.0
Total Suspended Solids (mg/L)	50**	28	14	18
Turbidity (NTU)	2-25			25
Electrical Conductivity (µS/m)	30-350			740
Oil & Grease	Not visible*			<2
Total Phosphorus (mg/L)	0.05	Not Tested	Not Tested	Not Tested
Total Nitrogen (mg/L)	0.50	Not Tested	Not Tested	Not Tested

* BOM New Italy Station 58097
http://www.bom.gov.au/jsp/ncc/cdio/weatherData/av?p_nccObsCode=136&p_display_type=dailyDataFile&p_startYear=2013&p_c=-675071962&p_stn_num=058097

** EPA Requirements

6.2 Impact assessment

In order to assess the potential impacts on water quality and quantity discharging from the site due to the proposed works, a MUSIC stormwater model was developed to assess the pre-development and post-development conditions at the site. While this model is best used to manage stormwater from urban developments, it can be applied to assess runoff and Total Suspended Solids impacts associated with the proposal.

6.2.1 Modelling Parameters

MUSIC node parameters were adopted from the Draft NSW MUSIC Modelling Guidelines in order to best represent the surface types and conditions present on the site.

For the purpose of this assessment, parameters adopted are based on the site being rural in nature, with the majority of surfaces best described as unsealed road and eroding gullies. The parameters adopted are shown in the tables below.

Table 6-2 Adopted Music Node Parameters (Source Nodes > 10Ha)

Parameters	Value (Mean Annual Rainfall > 1000mm)
Impervious Area Parameters	
- Daily Rainfall Threshold Values (mm)	1.5
Pervious Area Parameters	
- Soil Storage Capacity (mm)	175
- Initial Storage (% of capacity)	30
- Field Capacity (mm)	55
- Infiltration Capacity Coefficient – a	215
- Infiltration Capacity Coefficient - b	2.4
Groundwater Properties	
- Initial Depth (mm)	10
- Daily Recharge Rate (%)	55
- Daily Base Flow Rate (%)	10
- Daily Deep Seepage Rate (%)	0

Table 6-3 Adopted Music Node Pollutant Parameters (mg/L –$\log_{10}$)

	TSS		TP		TN	
	Mean	**St. Dev**	**Mean**	**St. Dev**	**Mean**	**St. Dev**
Unsealed Roads & Disturbed Gullies						
Base Flow	1.20	0.17	-0.85	0.19	0.11	0.12
Storm Flow	3.00	0.32	-0.30	0.25	0.34	0.19
Forest/ Natural vegetation						
Base Flow	0.78	0.13	-1.52	0.13	-0.52	0.13
Storm Flow	1.60	0.20	-1.10	0.22	-0.05	0.24

6.2.2 Catchment characteristics

Under existing conditions surface runoff from a natural catchment area (17.36 Ha) upstream of site is diverted around the quarry area and discharges into the downstream receiving waterway, bypassing the existing large sediment basin on site.

The proposed works will expand the quarry footprint to include some of these upstream areas which will become part of the operating quarry footprint. These areas will then discharge to the the existing large sediment basin on site, instead of bypassing the basin. In order to mitigate the expected increase inflow from the proposed larger catchment under developed conditions, the existing large sediment basin is proposed to be expanded. The expansion would require doubling the existing basin volume in order to manage runoff volumes discharging from the site. Catchment characteristics are summarised below in Table 6-4.

To model the existing and proposed scenarios, both the existing and developed quarry footprints are assumed to have limited hardstand areas, however a portion of the quarry footprint is likely to be impervious exposed sandstone and therefore some impervious surfaces would be present within the quarry. The existing large sediment basin was included in the model for both scenarios, however in the proposed scenario the basin volume was doubled. The basin configuration details were based on findings from site inspections, details provided by existing quarry operators and the basin footprint area calculated from aerial imagery.

Table 6-4 Catchment Characteristics

	Existing Scenario	Developed Scenario
Catchment Area (Ha)	12.73 (+17.36 Ha undeveloped)	30.08
Impervious Area (%)	15	15
Basin footprint (m^2)	2,700	5,700
Estimated Basin Capacity (m^3)	12,590	25,000
Basin Depth (m)	7	7
Basin outlet (diam.)	N/A	N/A
Basin weir length (m)	20	20

6.2.3 MUSIC Modelling Results

The MUSIC model was simulated over a period of 10-years from 2000 to 2010 as per recommendations in the Draft NSW MUSIC Modelling Guidelines. Water quality and quantity results from the MUSIC modelling for the existing and proposed scenarios are shown below in Table 6-5. The results show that the increased runoff is effectively managed through the enlargement of the existing sediment basin. While the TSS is likely to increase slightly under post development conditions, the concentrations are well below the EPL criteria of 50mg/L.

TP and TN are simulated to exceed ANZECC guidelines for both pre- and post- development scenarios, however it is noted that water quality results for this area documented in the Woolgoolga to Ballina Pacific Highway Upgrade EIS indicate that the majority of the waterways tested (including Tabbimoble Creek) have a history of water quality problems, with conditions commonly found to be below the standards required for the protection of aquatic ecosystems. In addition, in considering the MUSIC model applicability to urban stormwater, it is argued that these values need to be treated with caution, when applied to a quarry operation. It is further noted that while the largest of the sediment basins has been modelled in MUSIC, other on-site treatment measures and management practices are likely to provide an additional level of control of site runoff above that considered in this MUSIC model assessment.

Table 6-5 MUSIC Modelling Results

	ANZECC	Discharge from Site	
		Pre-Development	Post-Development
Flow (ML/yr)		92	90
TSS Mean Concentration (mg/L)	50*	15.5	21.1
TP Mean Concentration (mg/L)	0.05	0.09	0.13
TN Mean Concentration (mg/L)	0.5	0.97	1.41

* EPA Requirements

6.2.4 Discussion

The proposed quarry expansion could potentially have the following impacts on surface water:

- The proposed works would alter the local topography at the site, which would affect the drainage of surface water. It is likely that surface water from beyond the proposed works area would be diverted around the works, which could lead to a concentration and discharge of flows rather than distributed discharges. The impact of this could be increased risk of erosion and sedimentation if not adequately managed.
- Day to day operations would require the handling of chemicals or hydrocarbons, and other contaminates. If management practices are not adequately implemented, then risk of accidental spillage with potential contamination of surface water could exist.
- The proposed operation would potentially expose a larger proportion of rock areas and other impervious areas compared with the existing site. This could lead to increased runoff volumes during rain events and larger runoff peaks during storm events.
- Surface water quantity has been assessed for the existing and developed scenarios. The proposed increase in sediment basin volume is expected to adequately manage the increased runoff from the expanded quarry footprint, resulting in marginally less flow being discharged from the site on an annual basis. The volume of water captured by the sediment basins is expected to be more than sufficient to meet the water demand of the site.
- Surface water quality has been assessed for both the existing and developed scenarios. The results indicate that the mean concentrations are unlikely to change substantially. The downstream sediment basin appears adequately to treat TSS runoff from the site for both the existing and developed cases, with the TSS discharge from the site remaining below the trigger values outlined in the current EPL for the site.
- TP and TN mean concentrations appear to exceed the ANZECC trigger values under both the existing and developed cases., however it is noted that water quality results for this area documented in the Woolgoolga to Ballina Pacific Highway Upgrade EIS indicate that the majority of the waterways tested (including Tabbimoble Creek) have a history of water quality problems, with conditions commonly found to be below the standards required for the protection of aquatic ecosystems. In addition, in considering the MUSIC model applicability to urban stormwater, it is argued that these values need to be treated with caution, when applied to a quarry operation. It is further noted that while the largest of the sediment basins has been modelled in MUSIC, other on-site treatment measures and management practices are likely to provide an additional level of control of site runoff above that considered in this MUSIC model assessment.

6.3 Management measures

6.3.1 General

- An environmental protection licence will be obtained for the quarry. All relevant conditions relating to soil and water management will be implemented as required by the licence.
- An Environmental Management Plan will be compiled for the works which will contain a Soil and Erosion Management Plan. Training will be provided to all quarry staff including relevant sub-contractors on erosion and sediment control practices and the requirements of the Plans through inductions, toolboxes and targeted training.

- If any works encroach within the riparian zone of the unnamed ephemeral drainage line (in accordance with the Water Management Act 2000) consideration of a controlled activity approval would be required.
- Where available, and of appropriate quality, the quarry operation will use recycled runoff for quarry activities. A site water balance has been undertaken, with estimates of operational water requirements (amenities, road/site dust control and crushers) provided in Table 6-6. The extraction rates are based on an annual extraction of 500,000 t/year achieved under maximum production and average production over a full year. The latter requiring significantly more water for dust control over a longer time frame.

  The results in Table 6-6 show that sufficient runoff would be generated from the quarry operational area to meet operational water requirements. In addition, surplus water captured in the settling basin on site will need to be discharged to remove excess runoff.

Table 6-6 Quarry operational site water balance

Extraction Rate	Runoff from proposed quarry operational area	Discharge from site	Water Demand
4000 t/day (maximum production i.e. 125 days operation)	136.16 ML/year (average year) 11.40 ML/year (dry year) 292.90 ML/year (wet year)	92.05 ML/year (average year) 0.65 ML/year (dry year) 248.23 ML/year (wet year)	4.05 ML/year
1500 t/day (production over a full year)			6.81 ML/year

6.3.2 Erosion and sedimentation control

Erosion and sediment controls are to be implemented in accordance with *Managing Urban Stormwater Soils and Construction – Volume 2e Mines and quarries* (DECC, 2008) and include, as a minimum:

- Quarry activities will be programed to minimise the extent and duration of disturbance to vegetation. This will include leaving clearing and initial earthworks in future quarrying areas, until extraction is about to commence.
- Catchment and construction/operational areas runoff will be separated to avoid contamination. This will be achieved by diverting catchment runoff drains around the operational area. The operational exposed areas will be minimised and all operational runoff will be treated before discharge from site.
- Runoff from construction/operational areas will be collected and treated in a similar manner as per the current operation. For the future works area the main sediment and other basins provide sufficient storage. Runoff collected in the basin will be used for onsite purposes (dust suppression and operational water) in the first instance. Any additional water will be pumped and discharged to the unnamed ephemeral drainage line after appropriate treatment.
- Catch drains, contour and diversion drains across exposed areas will be installed, immediately following clearing, and maintained until the site is stabilised. Key areas of flow concentration will be provided with rock protection to prevent erosion.
- The active work areas and access roads will be stabilised and maintained. Runoff from these areas will be directed to drains that lead to buffer strips. Loose rock, soil, debris etc. will be removed from road surfaces (including sweeping of the road), when required.

- Long term soil stockpiles e.g. those not accessed for greater than 30 days, access tracks, disturbed areas will be protected from erosion by the implementation of appropriate measures including, but not limited to:
  - Seeding with cover crops.
  - Covering with tarp or similar.
- Hardstand material, rumble grids or similar will be provided at exit points to minimise the tracking of soil and particulates by vehicles.
- Disturbed areas where work has been completed will be rehabilitated, as soon as possible.

6.3.3 Basins, drainage lines and flooding

- The volume of the existing sediment basin would need to be doubled.
- Drainage lines will be stabilised against erosion by appropriate selection of channel dimensions, slope and lining, and the inclusion of drop structures and energy dissipaters, as necessary. Drainage lines will incorporate check dams or native vegetation to act as a sediment control.
- The works areas may require bunding at a number of locations around the perimeter of the works area, to prevent overflow from the adjacent unnamed ephemeral drainage line during severe rainfall events.

6.3.4 Material storage and management

- Designated impervious bunded facilities will be provided for cleaning and/or maintenance of vehicles, plant or equipment. These facilities will be located at least 20 metres away from natural and built drainage lines.
- All chemicals and fuels associated with the quarry will be stored in roofed and bunded areas. Spill kits will be provided at all chemical storage facilities/compound sites.
- Where refuelling on site is required, the following management practices will be implemented:
  - Refuelling will be undertaken on level ground and at least 20 metres from drainage lines, waterways and/or environmentally sensitive areas
  - Refuelling will be undertaken within the designated refuelling areas with appropriate bunding and/or absorbent material
  - Refuelling will be via a designated refuelling truck
  - Will be attended at all times
  - Spill kits will be readily available and personnel trained in their use. A spill kit will be kept on the refuelling truck at all times
  - Hand tools will be refuelled within lined trays of site vehicles wherever possible
  - An emergency spill kit (such as oil absorbent material) will be available on site at all times to contain and clean up any accidental hydrocarbon spill
  - Any contaminated material will be disposed at an appropriately licensed facility and used spill kit materials replaced
- Regular checks of vehicles working at the quarry will be conducted to ensure that no oils or fuels are leaking.

6.3.5 Monitoring

- Erosion and sediment controls will be inspected at least weekly (with maintenance and/or modifications made as necessary). Inspections and/or maintenance during wet-weather may be increased where necessary. All sediment basin discharge points will be clearly identified and access made available at all times for inspections or management. A typical monitoring program is provided in Table 6-7.

Table 6-7 Typical monitoring program

Aspect	Frequency	Details	Responsibility
Erosion and sediment controls	Following rain	Erosion and sediment controls are to be monitored following rain events and maintained, as required.	Site Manager
Sediment basin	Following rain	The volume of water in the sediment basin is to be monitored following rain.	Site Manager
Basin capacity	Following rain	The volume of sediment is to be monitored (e.g. via a permanent stake in the dam with a mark showing depth of sediment) and removed to maintain an 80% capacity.	Site Manager
Spill kit	Monthly	The spill kit is to be checked and any missing materials to be replaced.	Site Manager

7. Groundwater

7.1 Existing conditions

The primary aquifers in the vicinity of the site are the Quaternary alluvial / colluvial groundwater source and the porous and fractured rock groundwater source.

7.1.1 Alluvial water groundwater sources

The alluvial / colluvial groundwater source in the site forms a shallow unconfined aquifer with reported thickness up to 17 metres to the east of the site, as shown in Figure 7-1.

Bores located to the east of the site within the alluvial groundwater source indicate that depth to groundwater is in the order of 2 m below ground level (bgl). Based on a review of topographic data, natural surface levels in the vicinity of these bores is approximately 25 m AHD indicating that groundwater elevation in the alluvial aquifer is approximately 23 m AHD. These bores are located down gradient of the site and therefore alluvial / colluvial groundwater would be anticipated to be slightly higher in the vicinity of the site.

7.1.2 Porous and fractured rock groundwater sources

Porous and fractured rock aquifer underlies the alluvial /colluvial aquifer and outcrops across the site.

Based on the results of the search of the NSW Bore Database, water bearing zones of bores within the porous and fractured rock aquifer to the east of the site are typically in the order of 25 mbgl. Based on a review of topographic data, natural surface levels in the vicinity of these bores is approximately 25 m AHD.

Groundwater levels would be expected to be approximately 0 m AHD near the coast. Regional groundwater flows are anticipated to be towards the coast. Therefore, based on the available information regarding groundwater levels and flow direction, groundwater levels in the porous and fractured groundwater source in the vicinity of the site are expected to be slightly greater than 0 m AHD.

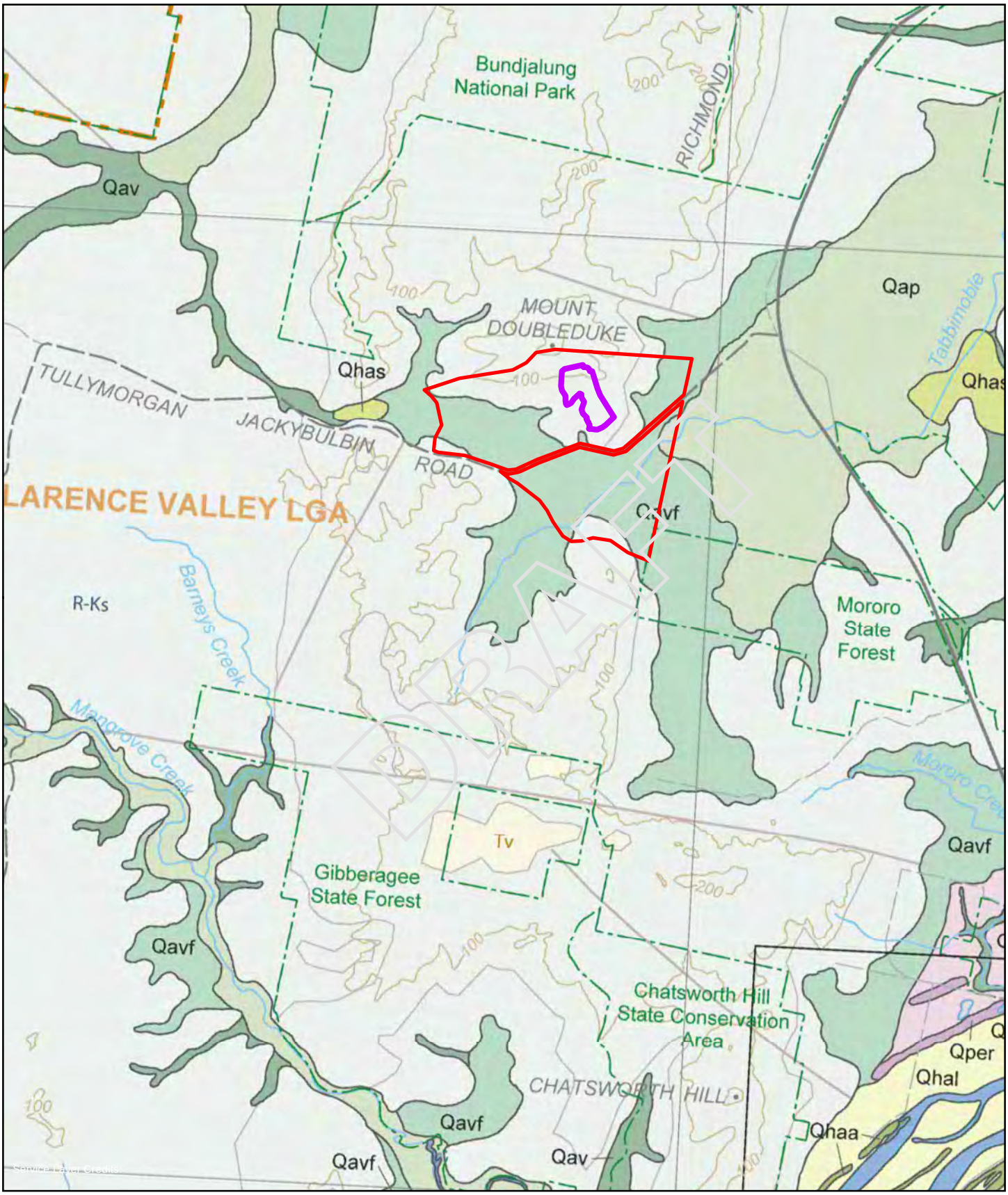
The level of extraction in the existing quarry pit has reached a level of 44 m AHD and the quarry has reportedly remained free from groundwater inflows. This indicates that the water table is below a level of 44 m AHD.

7.1.3 Aquifer connectivity

The Richmond River Area Unregulated, Regulated and Alluvial Water Sources WSP – *Background Document* (NOW, 2010) states that there is a significant connection between surface water and alluvial groundwater and that there is a low to moderate connection between surface flows and porous and fractured groundwater. The estimated travel time between surface water to alluvial groundwater is days to months while the estimated travel time between surface water and groundwater in the fractured and porous aquifer is years to decades (NOW, 2010). This indicates that there is a low connection between alluvial groundwater and the fractured and porous rock aquifer.

7.1.4 Existing groundwater monitoring

Groundwater quality monitoring has been undertaken from two groundwater monitoring bores which are located south west of the existing sediment basin. It is assumed that these bores are screening the alluvial groundwater source associated with the adjacent ephemeral drainage line. The location of these bores is shown in Figure 7-2.



LEGEND

- Subject site
- Study Area

Paper Size A4

0 200 400 800 1,200 1,600

Metres

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

N

Newman Quarrying

Sly's Quarry Environmental Impact Statement
Biodiversity Assessment

Quaternary Geological Mapping

Job Number	22-17528
Revision	A
Date	02 Apr 2015

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

N:\AU\Coffs Harbour\Projects\22\17528\GIS\Maps\Deliverables\22_17528_Z012_Quaternary_Mapping.mxd

Data source: LDP:DTDB, 2012. NSW Geological Survey: Geological Mapping, 2008. ESRI: Aerial Imagery, 2014. Newman: Study Area. Created by: smacdonald

A summary of groundwater monitoring results is shown in Table 7-1. The results suggest the groundwater has a neutral pH and is relatively fresh.

Table 7-1 Groundwater monitoring results

Date	pH	EC (µS/cm)
8/10/2014	7.4	591

7.1.5 NSW Bore Database Search

A search of the NSW Groundwater Bore Database was undertaken to identify registered bores within a 5 km radius of the site. The search identified six bores, with three bores being registered as domestic stock or stock, two bores registered as monitoring bores and one bore registered for oil exploration. Approximate bore locations are shown in Figure 7-3 and bore details are shown in Table 7-2.

Two of the bores registered as domestic stock or stock were located to the south east of the site with the third being located to the west. Of these bores, all extracted groundwater from the porous and fractured rock aquifer and all had yields less than 1 L/s.

The monitoring and exploration bores were located to the east of the site in the vicinity of the Pacific Highway. None of these bores had yields reported.

Overall, the search of the NSW Groundwater Bore Database indicated that there is limited groundwater reliance and usage of the porous and fractured rock aquifer for domestic and stock purposes in the vicinity of the site. Based on the low yields reported, the porous and fractured rock aquifer is considered to be a less productive groundwater source under the NSW AIP.

Table 7-2 Results of NSW Bore Database Search

Name	Licence No.	Use	Depth (m)	WBZ	SWL	Salinity	Yield (L/s)	Aquifer
GW306470	30BL185061	Monitoring Bore	23.3	2.1-16				Clayey Sand, Sand
GW053996		Oil Exploration	358.7	28-31, 44-46, 50-52, 103-106, 137, 150, 174, 334				Sandstone, Light Grey Shale, Silty Sandstone, Light Grey Sandstone, Siltstone, Lithic
GW306469	30BL185061	Monitoring Bore	14.87	1.25-6.50	2			Sand, Silty Sand
GW016816	30BL007221	Stock	26.5	25.3	15.2	Sweet	0.32	Soft Rock
GW306232	30BL184382	Domestic Stock	79	34-38, 72-77	18	1745, 1520	0.25, 0.76	Fractured Sandstone
GW065285	30BL138302	Domestic Stock	47	5-25, 41-44	16		0.1, 0.4	Soft Sandstone

LEGEND

- Lot 2 DP 1055044
- Road
- Lot
- Groundwater Wells
- Stockpiles
- Sediment ponds
- Waterways
- Open Drain

Paper Size A3

0 25 50 100 150 200

Metres

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

N

Newman Quarrying
Sly's Quarry Environmental Impact Statement

Job Number 22-17528
Revision A
Date 18 Feb 2015

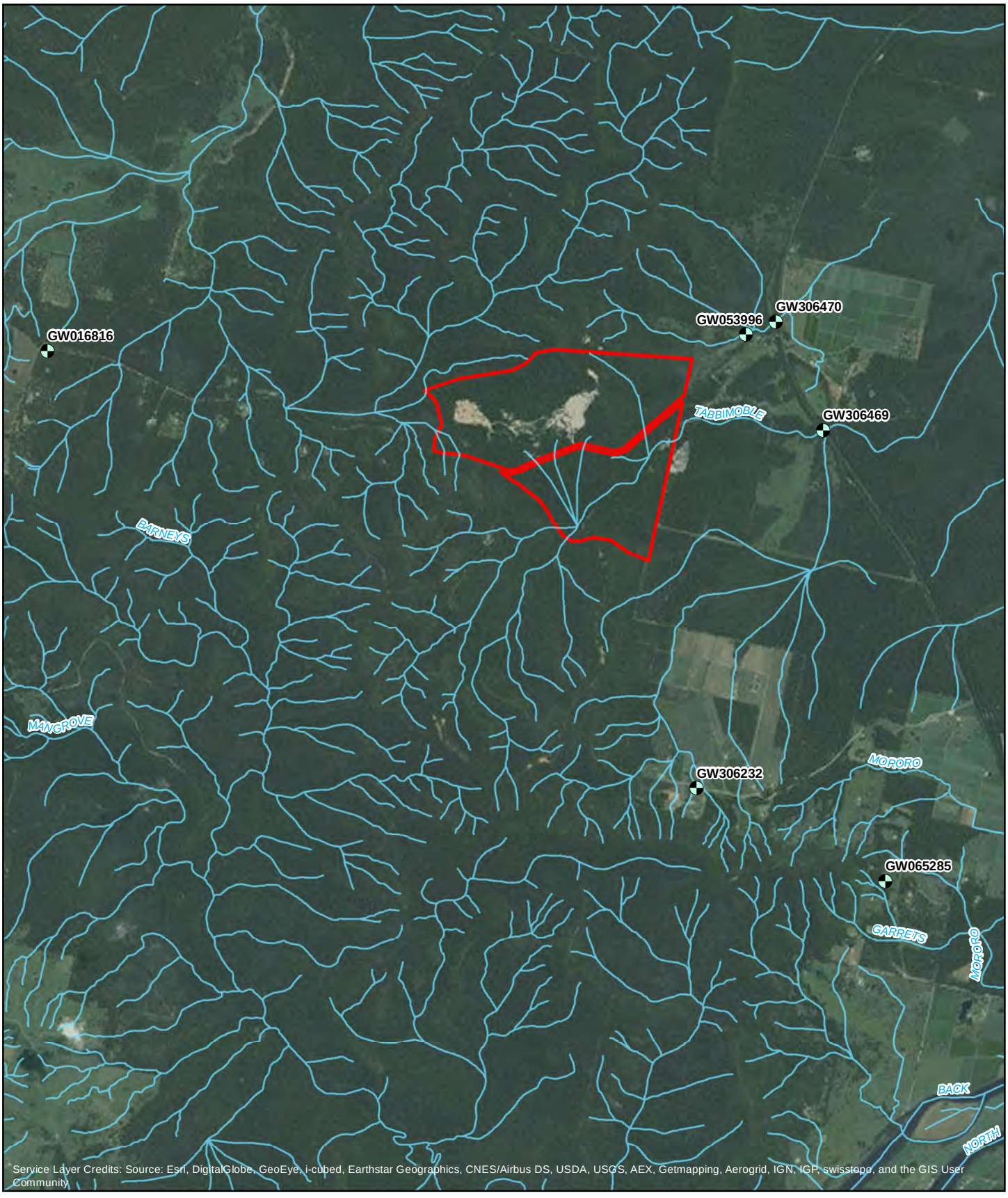
Figure 7-2

Groundwater Monitoring Locations

N:\AU\Coffs Harbour\Projects\22\17528\GIS\Maps\Deliverables\22_17528_Z007_Lot2_Quarry_Area.mxd

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

Data Source: NSW Department of Lands: Cadastre - Jan 2014; Geoscience Australia: 250k Data - Jan 2014; NSW Department od Primary Industry - Jan 2014; ESRI imagery Jan 2014. Created by: qjchung



LEGEND

- Groundwater Bore
- HydroLine_LPI_DTDB_2012
- Study Area

Paper Size A4

0 200 400 800 1,200 1,600

Metres

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

N

Newman Quarrying

Sly's Quarry Environmental Impact Statement
Biodiversity Assessment

Job Number	XX-12345
Revision	A
Date	27 Nov 2014

Groundwater Bore Database Search Figure 7-3

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

N:\AU\Coffs Harbour\Projects\22\17528\GIS\Maps\Deliverables\22_17528_Z003_Groundwater_Bore_Search.mxd

Data source: LDP:DTDB, 2012. NSW Department of Natural Resources: Groundwater Bore, 2014. ESRI: Aerial Imagery, 2014. Newman: Study Area. Created by: smacdonald

7.1.6 Groundwater dependant ecosystems

The potential vegetation GDEs within the vicinity of the site have been mapped in the Groundwater Dependant Ecosystem Atlas (BOM, 2014). Potential GDEs in the vicinity of the site include vegetation communities including:

- Northern Open Grassy Blackbutt
- Coastal Range Bloodwood-Mahagony
- Paperbark
- Narrowleaved White Mahogany - Red Mahogany - Grey Ironbark - Grey Gum
- Needlebark Stringybark
- Foothill Grey Gum-Ironbark-Spotted Gum
- Swamp Oak
- Grey Gum - Grey Ironbark - White Mahogany
- Blackbutt - Spotted Gum
- Blackbutt - Bloodwood / Apple
- Scribbly Gum – Bloodwood
- Lowlands Scribbly Gum
- Stringybark – Bloodwood
- Clarence Lowlands Spotted Gum
- Lowland Red Gum winter flowering

7.2 Potential groundwater impacts

The proposed quarry will extract to a level of 44 m AHD. As outlined in Section 7.1.2 groundwater is expected to remain below this level. The project is not anticipated to intercept groundwater. A cross section of the quarry and the predicted water table is shown in Figure 7-4.

The review of geological mapping indicates that the proposed extraction footprint does not extend to the alluvial sediments. The extraction footprint will come within approximately 60 metres of areas mapped as alluvial sediments to the south and south west. Assuming the proposed extraction does not enter alluvial sediments; it is predicted that the proposed extraction will have no impact on alluvial groundwater.

As alluvial groundwater is embargoed under the Water Act 1912 and the WM Act it is recommended that, in order to ascertain the potential presence of groundwater, a shallow standpipe monitoring bore be drilled to the south west of the proposed extraction footprint. It is recommended that the monitoring bore be drilled down to the sandstone bedrock.

There will be no change to access routes, buildings or facilities as part of the project. Therefore it is assumed that there will be minimal impact on recharge due to any change in impervious area. There may be a slight increase in recharge in the fractured and porous aquifer due to removal of overlying rock strata.

As the project is not anticipated to intercept groundwater, the project will not require any groundwater licences under the *Water Act 1912.*

The project is not anticipated to intercept groundwater and therefore it is expected that the quarry will not intercept contaminated groundwater.

7.3 Management measures

7.3.1 Groundwater monitoring

As outlined in Section 7.2 it is recommended that a monitoring bore be constructed in the mapped alluvial aquifer to the south west of the proposed quarry footprint, in a similar location as the existing monitoring wells.

All new monitoring bores are to be constructed in accordance with the *Minimum Construction Requirements for Water Bores in Australia* (NUDLC, 2011).

New and existing monitoring bores should be monitored quarterly throughout the life of the project for groundwater level, pH and EC. All new and existing monitoring bores require licencing under Part 5 of the *Water Act 1912.* It is recommended that existing monitoring bores are capped to attempt to prevent the ingress of rainfall.

As specified in DIPNR (2003), groundwater monitoring should be undertaken in general accordance with '*A Practical Guide for Groundwater Sampling'* (Jiwan & Gates, 1992). Low flow sampling techniques will be used where practical for purging and sampling of bores (rather than using bailers or submersible pumps) to minimise aquifer disturbance and reduce the volume of groundwater extracted during sampling.

In general, the groundwater monitoring methodology is as follows:

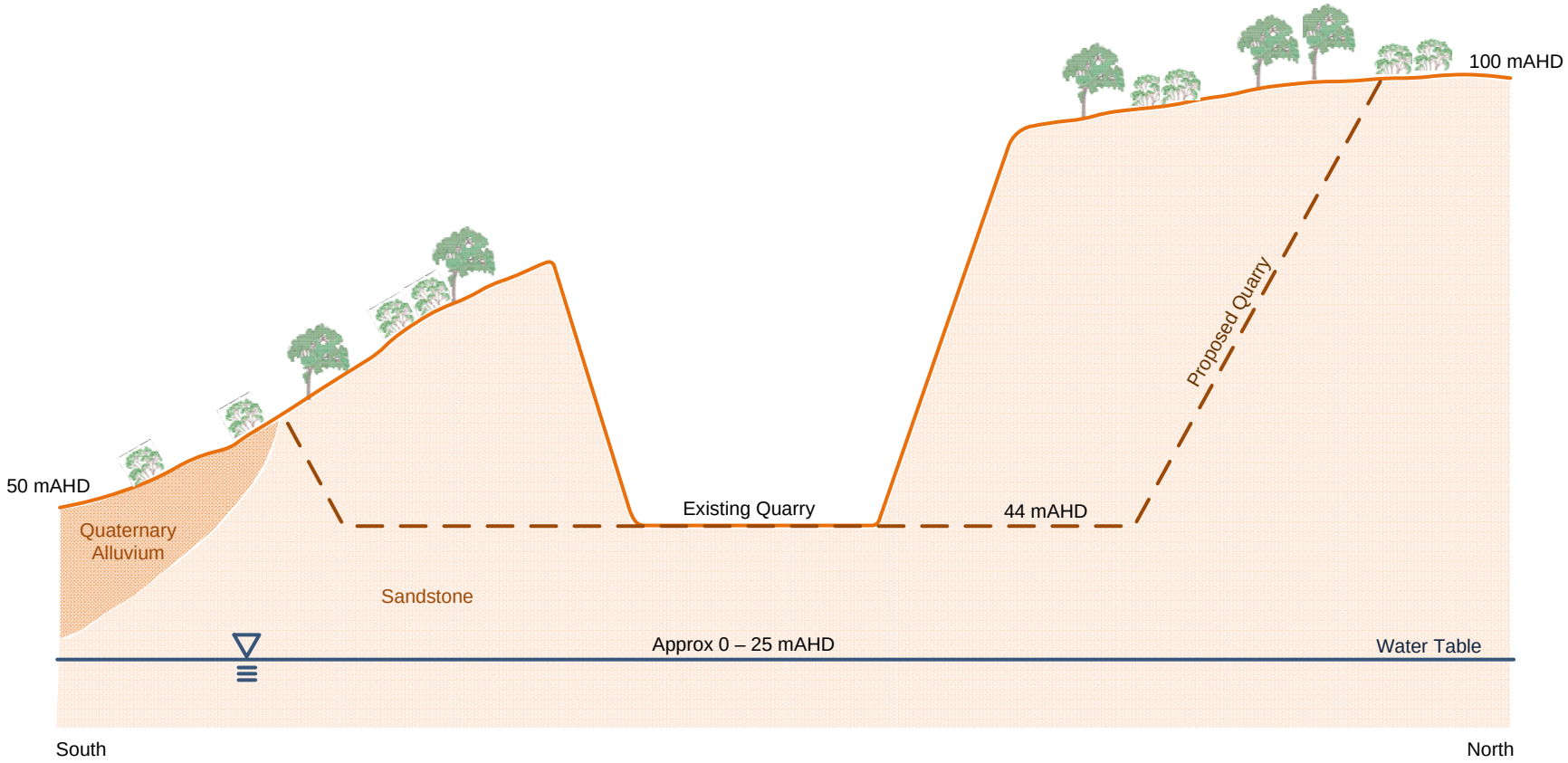
- Gauging of groundwater levels prior to purging.
- Purging of monitoring bores using a low flow peristaltic pump or Micropurge system. To limit the disturbance of possible sediments in the base of each bore, the sample tubing at each bore should be lowered to approximately the middle of the screened interval for purging and sample collection.
- Measurement of groundwater field parameters (pH, EC) using a calibrated water quality meter and a flow cell during purging. pH and EC readings should be recorded in the field once they have stabilised.
- Decontamination of all non-dedicated sampling equipment between monitoring locations.

If a bore is too deep and low flow sampling cannot be undertaken with available pumping equipment, bailing is acceptable for sample collection provided that there is sufficient removal of stagnant water in the bore prior to sampling so that the sample is representative of the aquifer.

If an unexpected change in groundwater level or quality is recorded, that is outside natural variability, then an investigation should be undertaken to determine if the change in level or quality is due to the quarry operations.

7.3.2 Storage of fuels

All fuels stored on site must be appropriately stored. Storage of fuels will require bunding around storage containers and any locations where refuelling occurs.



LOCATION	Sly's Quarry
DRAWN	SM
CHECKED	IG
APPROVED	BL
SCALE	NTS

Quarry Cross Section

NEWMAN QUARRYING PTY LTD

DATE Nov 2014

Figure 7-4

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8. Summary and conclusion

- GHD has been engaged by Newman Quarrying to undertake a surface and groundwater assessment for the proposed sandstone quarry expansion at Tullymorgan-Jackybulbin Road, Mororo, NSW, known as Sly's Quarry. The proposal is to expand the existing sandstone quarry by 18.3 hectares and increase the extraction rate up to 500,000 tonnes per annum.
- The site is located within the Clarence River catchment with unnamed ephemeral drainage lines flowing in a southwest direction to Tabbimoble Creek around the site. Tabbimoble Creek drains via the Bundjalung National Park marshes to the Clarence River near Iluka.
- The ephemeral drainage lines are diverted around the works area and bypass the site water dams, discharging to Tabbimoble creek under Tullymorgan Jackybulbin Road. Within the works area, the pit floor and stockpiled areas discharge to an initial sediment pond, this overflows to the main sediment basin. The main sediment basin is the discharge point from the site. The site office, weighbridges, wash plant and other outbuildings along the site discharge to 3 smaller sediment basins. These basins discharge to the main sediment basin.
- Information from nearby bores and a borehole on site suggest the groundwater level is below the final extraction depth of the quarry and the rock has a relatively low permeability.
- The proposed quarry expansion could potentially have the following key impacts on surface water:
  - Altering the local topography at the site, which could increase the risk of erosion and sedimentation if not adequately managed.
  - Surface water discharging from the works areas could entrain sediment from disturbed areas resulting in decreased water quality entering waterways. The sediment could include dust generated from the operations and sediment tracked by vehicular movements on the site.
  - The proposed operation would potentially expose a larger proportion of rock areas and other impervious areas compared with the existing site leading to increased runoff volumes during rain events and larger runoff peaks during storm events.
  - The unnamed ephemeral drainage line could experience elevated water levels during severe storm events. If these are not managed adequately, flood waters could ingress into the works areas.
  - Day to day operations would require the handling of chemicals or hydrocarbons, and other contaminates. If management practices are not adequately implemented, then risk of accidental spillage with potential contamination of surface water could exist.
- The quarry is not expected to intercept the groundwater aquifer and is unlikely to affect sensitive receptors or water quality.
- A number of management measures will be implemented to avoid potential impacts associated with the proposed quarry expansion. These will include amongst others:
  - Compiling and operating under an Environmental Management Plan with associated Soil and Erosion Management Plan and training all quarry staff. If any works encroach the riparian zone of the unnamed ephemeral drainage line (in accordance with the Water Management Act 2000) a controlled activity approval would be required.

- Doubling the sediment basin volume to manage surface water discharges from the site.
- Using recycled runoff for dust suppression and operational water. The site water balance has shown that there is sufficient runoff to meet demand, with any surplus water disposed offsite, after treatment.
- Quarry activities will be programed to minimise the extent and duration of disturbance, and catchment and construction/operational areas runoff will be separated to avoid contamination. Runoff from construction/operational areas will be collected and treated in the main sediment basin.
- Bunding at a number of locations around the perimeter of the works area, to prevent overflow from the adjacent unnamed ephemeral drainage line.
- Designated impervious bunded facilities will be provided for cleaning and/or maintenance of vehicles, plant or equipment and all chemicals and fuels associated with construction will be stored in roofed and bunded areas.
- Regular monitoring of erosion and sediment controls to ensure that management facilities are operating in accordance with specifications.

- It is recommended that a monitoring bore be constructed in a similar location to the existing monitoring well in accordance with the *Minimum Construction Requirements for Water Bores in Australia* and regularly monitored.

On the basis of implementing the management measures, it is considered that any impacts to surface water and groundwater from the proposed quarry extension, would be adequately mitigated.

9. References

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- RMS (2014). *Woolgoolga to Ballina Pacific Highway Upgrade EIS*. Roads and Maritime Services.

Appendices

Appendix A – Quarry Plans

No	Revision	Note: * indicates signatures on original issue of drawing or last revision of drawing	Drawn	Job Manager	Project Director	Date

GHD
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DO NOT SCALE

Drawn	S. Verhellen	Designer	
Drafting Check		Design Check	
Approved (Project Director)			
Date			
Scale	AS SHOWN	This Drawing must not be used for Construction unless signed as Approved	

Client: Newman Quarrying
Project: Slys Quarry
Title: Proposed Quarry Expansion

Original Size: A1
Drawing No: 22-17528-001
Rev:

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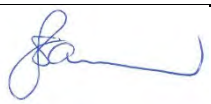
Document Status

Rev No.	Author	Reviewer		Approved for Issue		
		Name	Signature	Name	Signature	Date
0	R Berg – Surface Water I Gilmore - Groundwater	Ben Luffman		S Lawer		March 15
1	S Douglas/R Berg	Ben Luffman		S Lawer		01/05/2015

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Appendix D Noise Impact Assessment

Newman Quarrying Pty Ltd

Noise Impact Assessment

Proposed Quarry Expansion at Lot 2 DP 1055044, Tullymorgan-Jackybulbin Road, Mororo

April 2015

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Glossary

Term	Description
dB	Decibel, which is 10 times the logarithm (base 10) of the ratio of a given sound pressure to a reference pressure; used as a unit of sound.
dB(A)	Unit used to measure 'A-weighted' sound pressure levels.
INP	Industrial Noise Policy
$L_{Aeq\ (period)}$	Equivalent sound pressure level: the steady sound level that, over a specified period of time, would produce the same energy equivalence as the fluctuating sound level actually occurring.
Rating Background Level (RBL)	The overall single-figure background level representing each assessment period (day/evening/night) over the whole monitoring period. This is the level used for assessment purposes. The NSW INP states that where the measured RBL is less than 30 dB(A), the RBL is considered to be 30 dB(A).
$L_{A1\ (period)}$	The sound pressure level that is exceeded for 1% of the measurement period.
$L_{A10\ (period)}$	The sound pressure level that is exceeded for 10% of the measurement period.
$L_{A90\ (period)}$	The sound pressure level that is exceeded for 90% of the measurement period.
L_{Amax}	The maximum sound level recorded during the measurement period.
L_{Amin}	The minimum sound level recorded during the measurement period.
Mitigation	Reduction in severity.
Peak Particle Velocity	Current practice for assessments of the risk of structural damage to buildings use measurements of Peak Particle Velocity (PPV) ground vibration (v_p), which is the maximum vector sum of three orthogonal time-synchronized velocity components. When not directly measured by an instrument, PPV may be determined by: $v_p = \sqrt{(v_x^2 + v_y^2 + v_z^2)}$ Where v_x, v_y, v_z are the instantaneous components of particle velocity of the x, y, z primary axes, respectively.
Rating Background Level (RBL)	The overall single-figure background level representing each assessment period (day/evening/night) over the whole monitoring period. This is the level used for assessment purposes.
Receiver	A noise modelling term used to describe a map reference point where noise is predicted. A sensitive receiver would be a home, work place, church, school or other place where people spend time.
RNP	Road Noise Policy
Sound Pressure Level (SPL)	Sound pressure level 20 times the logarithm to the base 10 of the ratio of the root mean square (RMS) sound pressure level to the reference sound pressure level of 20 micropascals.
Vibration	The variation of the magnitude of a quantity which is descriptive of the motion or position of a mechanical system, when the magnitude is alternately greater and smaller than some average value or reference. Vibration can be measured in terms of its displacement, velocity or acceleration. The common units for velocity are millimetres per second (mm/s).

1. Introduction

1.1 Purpose of this report

GHD Pty Ltd (GHD) was engaged by Newman Quarrying Pty Ltd (Newman Quarrying) to prepare a Noise Impact Assessment (NIA) report to address the potential noise impacts from the proposed expansion of a sandstone quarry at Lot 2 DP 1055044, Tullymorgan-Jackybulbin Road, Mororo, known as Slys Quarry.

The proposal involves the expansion of the existing sandstone quarry by 11.1 hectares and an increase in the extraction rate up to 500,000 tonnes per annum. The primary purpose of the quarry would be to supply substantial quantities of quarry materials required for current and proposed Pacific Highway works, and for supply to Clarence Valley Council (CVC) and local contractors.

It is estimated that the quarry would have an available resource of about 7 million tonnes which would allow extraction for a period of between 30 and 40 years, depending on demand.

1.2 Scope

The scope of work to conduct the Noise Impact Assessment involved:

- A review of the surrounding study area to gain an understanding of local site features and the location and nature of potential sensitive receivers.
- A review of existing environmental studies, as applicable.
- Undertaking noise monitoring at two noise sensitive receiver locations indicative of the local ambient noise environment.
- Establishing project specific noise and vibration goals for the proposal with consideration to the following New South Wales (NSW) Office of Environment and Heritage (OEH) publications:
  - Industrial Noise Policy (OEH, 2000) (INP).
  - Road Noise Policy (OEH, 2011) (RNP).
- A review of site operations to identify principal noise sources during operation and their corresponding sound power levels.
- Undertake two operational noise modelling scenarios using Computer Aided Noise Abatement (CadnaA) software to predict sound pressure levels emanating from the site based on current quarry configuration and after expansion. For each scenario, off-site noise levels resulting from typical extraction rate and peak extraction rate will be investigated.
- Undertaking a desktop assessment of potential road traffic noise impacts from heavy vehicles entering/exiting the site on public roads.
- Providing a summary of the predicted results and outlining recommendations for in-principle noise mitigation measures, where exceedances are predicted.

1.3 Limitations

This report: has been prepared by GHD for Newman Quarrying Pty Ltd and may only be used and relied on by Newman Quarrying Pty Ltd for the purpose agreed between GHD and Newman Quarrying Pty Ltd as set out in Section 1.2 of this report.

GHD otherwise disclaims responsibility to any person other than Newman Quarrying Pty Ltd arising in connection with this report. GHD also excludes implied warranties and conditions, to the extent legally permissible.

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

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

The opinions, conclusions and any recommendations in this report are based on assumptions made by GHD described in this report (refer to Section 1.4 of this report). GHD disclaims liability arising from any of the assumptions being incorrect.

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

1.4 Assumptions

The following assumptions were made in this assessment:

- Quarry operating hours would be:
  - Weekdays - 6:30 am to 6.00 pm.
  - Saturdays - 6:30 am - 4.00 pm.
  - Sundays or public holidays - No work.
- Excavation, crushing or loading would not commence until after 7:00 am. Blasting, on an ad-hoc basis, would only occur on weekdays between the hours of 10:00 am and 4:00 pm.
- The operational equipment used on site would be limited to those assessed in this report.

1.5 Secretary's environmental assessment requirements

1.5.1 Overview

Approval under Part 4.1 of the *Environmental Planning and Assessment Act 1979* (the EP&A Act) is being sought for the project.

The Secretary's environmental assessment requirements (SEARs) for the project were issued on 21 August 2014. The SEARs have informed the preparation of the noise impact assessment. The SEARs include a requirement noise impact assessment to address the following:

- An assessment of the likely operational noise impacts of the development under the NSW Industrial Noise Policy, paying particular attention to the obligations in Chapters 8 and 9 of the policy.
- An assessment of the likely road noise impacts of the development under the NSW Road Noise Policy.
- An assessment of the likely blasting impacts of the development on people, animals, buildings and infrastructure, and significant natural features, having regard to the relevant ANZEC guidelines.

Table 1-1 outlines where the requirements of the SEARs that have been addressed within this report.

Table 1-1 Secretary's environmental assessment requirements

SEAR reference	Report section
Clarence Valley Council recommendations: Noise issues – noise will be a major consideration. Noise from drilling, blasting, trucks, crushing, transport and machinery etc.	Section 5
RMS recommendations: Impacts of road traffic noise and dust generated along the primary haulage route.	Section 5
An assessment of the likely blasting impacts of the development on people, animals, buildings and infrastructure, and significant natural features, having regard to the relevant ANZEC guidelines.	Section 6 Blast impacts to animals are covered in Slys Quarry Environmental Impact Statement, Biodiversity Assessment Report.

2. Existing environment

2.1 Site location

The existing quarry is located off Jackybulbin Road, Mororo, approximately 17 km north of Maclean. The quarry is located 1.5 km west of the Pacific Highway. The site is surrounded by bushland.

2.2 Existing noise sensitive receivers

Eleven potential sensitive receivers in the vicinity of the quarry have been identified from aerial imagery. Aerial imagery available does not clearly identify whether R3 and R6 are in fact residential receivers, but have been included in this assessment as a conservative measure.

The nearest identified sensitive receiver is located approximately 1.5 km from the quarry boundary.

Sensitive receivers identified in the vicinity of the site are detailed in Table 2-1. Figure 1 shows a site aerial image and the location of identified noise sensitive receivers. These receivers have been identified to represent those with the greatest potential for adverse noise impact. Figure 1 identifies the nearest residential receivers to Slys Quarry.

Table 2-1 Identified noise sensitive receivers

Receiver	Receiver type	Approximate distance to nearest boundary[1](m)
R1	Residential	1600
R2	Residential	1700
R3	Residential	1500
R4	Residential	2600
R5	Residential	2700
R6	Residential	2800
R7	Residential	3200
R8	Residential	3600
R9	Residential	3300
R10	Residential	3500
R11	Residential	3000

1. Distance measured to the nearest boundary of operations for stage 1 configuration

2.2.1 Potential future sensitive receivers

This assessment has considered existing sensitive receivers only. GHD is not aware of plans for future development in the area, however, acknowledges that future development may occur. The potential for noise and vibration impacts on future development in the area would need to be assessed on a case-by-case basis.

Section 5.5.1 and Section 6.4.3 provides further discussion around potential impacts on future sensitive receivers.

Figure 1 Site location and noise sensitive receivers

2.3 Existing noise environment

Background noise monitoring was undertaken by GHD at two locations between 13 November 2014 and 21 November 2014. These locations were considered to represent the existing ambient noise environment in the area and were identified by GHD in consultation with the client as being a safe and secure place for equipment, minimising the risk of theft or vandalism. Logger locations are shown in Figure 2.

Figure 2 Unattended logger locations

The noise loggers were programmed to accumulate L_{A90}, L_{A10}, L_{Aeq} and L_{Amax} noise descriptors continuously over sampling periods of 15 minutes for the entire monitoring period. Logger calibration was checked before and after measurements using a Bruel and Kjaer 4231 Sound Level Calibrator (serial number 2542101).

The data collected by the loggers was downloaded and analysed, and any invalid data removed. Invalid data generally refers to periods of time where average wind speeds were greater than 5 m/s[1], or when rainfall occurred. Concurrent 15 minute weather data were sourced from the Bureau of Meteorology's (BoM) Yamba automatic weather station (AWS) (22 km south east of the site).

Details of the noise loggers and monitoring locations are provided in Table 2-2.

All sampling activities were undertaken with consideration of the specifications outlined in the AS 1055 (1997) '*Description and Measurement of Environmental Noise'* and the NSW INP.

[1] Wind speed measurements are taken at 10 m height. Noise logger microphones are located at 1.5 m height. To account for the vertical wind profile from 10 m down to 1.5 m (microphone height), noise data was filtered based on 7 m/s wind speeds.

Table 2-2 Background noise monitoring details

Noise logger	Logger 1	Logger 2
Monitoring location	Lot 100 Jackybulbin Rd (representative of receivers 1 and 2.)	Funnels Rd (representative of receivers 3 to 11)
Logger type	Svan 955	SVAN 955
Logger serial no.	27623	27622
Measurement started	13/11/14 9:45	13/13/14 13:20
Measurement ceased	21/11/14 11:00	21/11/14 10:00
Pre measurement calibration check (94.0 dB at 1 kHz)	94.0 dB	94.0 dB
Post measurement calibration check (94.0 dB at 1 kHz)	93.9 dB	93.9 dB
Frequency weighting	A	A
Time response	Fast	Fast

2.3.1 Summary of noise monitoring results

Unattended noise monitoring results

A summary of calculated background L_{A90} and ambient L_{Aeq} (day, evening and night) noise levels for the monitoring periods are provided in Table 2-3 and Table 2-4 for Logger 1 and Logger 2 respectively. Daily charts of the monitoring results and weather data are presented in Appendix A.

Site observations at the monitoring locations indicated that the primary noise sources in the area were as follows:

- Road traffic on the Pacific Highway at Logger 1.
- Natural noise sources such as insects, birds and wind noise in foliage at Logger 2.

No quarry activities were audible during the deployment of the loggers.

Table 2-3 Summary of noise monitoring results – Logger 1, dB(A)

Date	Background L_{90} dB(A)			Ambient L_{Aeq} dB(A)		
	Day (7 am to 6 pm)	Evening (6 pm to 10 pm)	Night (10 pm to 7 am)	Day (7 am to 6 pm)	Evening (6 pm to 10 pm)	Night (10 pm to 7 am)
Thursday 13/11/14	42	42	38	52	50	50
Friday 14/11/14	40	42	40	49	50	52
Saturday 15/11/14	36	37	37	52	48	51
Sunday 16/11/14	39	40	40	54	50	52
Monday 17/11/14	40	40	39	51	50	51
Tuesday 18/11/14	39	41	38	53	51	51
Wednesday 9/11/14	43	41	39	52	51	51
Thursday 20/11/14	39	43	43	50	53	53
RBL and LAeq Overall	40	41	39	52	51	52

Table 2-4 Summary of noise monitoring results - Logger 2, dB(A)

Date	Background L_{90} dB(A)			Ambient L_{Aeq} dB(A)		
	Day (7 am to 6 pm)	Evening (6 pm to 10 pm)	Night (10 pm to 7 am)	Day (7 am to 6 pm)	Evening (6 pm to 10 pm)	Night (10 pm to 7 am)
Thursday 13/11/14	28	23	19	40	36	40
Friday 14/11/14	31	24	29	43	36	41
Saturday 15/11/14	27	25	20	40	38	40
Sunday 16/11/14	27	25	21	45	37	39
Monday 17/11/14	29	25	22	43	37	43
Tuesday 18/11/14	30	25	22	44	40	40
Wednesday 9/11/14	31	25	21	44	42	46
Thursday 20/11/14	25	32	23	43	43	41
RBL and LAeq Overall	29	25	22	43	39	42

Attended noise monitoring results

A summary of the attended noise monitoring results are provided in Table 2-5.

Table 2-5 Summary of attended noise monitoring results dB(A)

Monitoring location	Date	Measurement time		Measured noise levels dB(A)			Observations (instantaneous dB(A))
		Start	Stop	L_{Aeq}	L_{A90}	L_{A10}	
Logger 1	13/11/2014	12:22	12:37	50	42	51	• Quarry inaudible. • No audible industry noise • Pacific Hwy dominant noise source. • Birds and insects noted. • Three instances of quarry traffic passby noted, LAmax approximately 66 – 69 dB(A). • Slight breeze SE-ESE, 23 degrees, cloudy.
Logger 2	21/11/2014	10:15	10:30	40	36	43	• Quarry inaudible. • No audible industry noise. • Mostly natural noise sources, wind in foliage, birds and insects. • Three instances of aircraft flyover noted. • Still to 2 m/s NE wind speed, 29 – 33 degrees, 3/8 cloud coverage.

3. Project description

3.1 Proposed site operations

The proposal is for the expansion of the existing quarry to extract a maximum of 500,000 tonnes per annum (tpa). The existing quarry is shown in Figure 3.

Figure 3 Typical quarry crushing operations and existing pit area

The site currently has a partially formed quarry wall and pit working area. The current floor of the quarry is approximately 44 m Australian Height Datum (AHD) with a second level to the east at approximately 58 m AHD. The centre of the existing quarry has active faces to the north, east and west, as shown in Figure 3.

Proposed quarry operations would be carried out in three stages and in response to demand. The extraction is proposed to move north and east initially, to the extent of the currently approved quarry. The eastern extent of the excavation would remain 10 m from the road reserve located along the eastern boundary. The excavation would be to the current floor level of 44 m AHD. Proposed expansion plans are shown in Appendix B.

Stage 1 would cover an area of 6.9 hectares and extract approximately 2.3 million tonnes.

Stage 2 would involve expanding the quarry to the north and south and to a depth of 44 m AHD. This would expand the quarry by 5.7 hectares and involve the extraction of approximately 2.8 million tonnes of material.

Stage 3 would be the final stage and would expand the quarry further north and south. Stage 3 would involve an expansion of 5.4 hectares to a depth of 44 m AHD. This would involve extracting approximately 1.8 million tonnes of material.

Material extraction would typically be undertaken using anexcavator. Blasting would be undertaken on a periodic basis depending upon demand for the resource and when manual extraction becomes too difficult or dangerous.

Extracted material would then be crushed, screened and where necessary blended with other materials from the quarry, or material imported to the quarry. The materials would be stockpiled on the quarry floor in numbered stockpiles of approximately 4,000 tonnes each. This material would be loaded onto trucks as required for transportation off-site.

All material processing, size reduction and screening into different grades would occur on-site unless requested otherwise.

The proposed sequence of operations for each stage would generally be:

- Establish the sediment and erosion control measures and other environmental safeguards.
- Clearing vegetation, if necessary. The bulk of cleared vegetative waste would be piled in a suitable location, clear of adjacent vegetated areas and mulched for future revegetation works.
- Topsoil would be stripped, stockpiled and protected against erosion for use in revegetation works.
- Excavation of the weathered rock material, where possible, the deeper layers would be excavated in a similar manner but would also include blasting. Blasting is anticipated to be carried out at a frequency of between two blasts per month to one blast per year, depending on demand and the material encountered. The blasting would be undertaken by a specialist contractor in accordance with regulatory requirements. Drilling would be required as part of blasting operations to allow for down-hole placement of explosives.
- Rock hammering may be required to break large rocks.
- The rock is collected by an excavator and fed into a jaw crusher. The crusher produces an output of various sizes of fill or aggregate which are separated by a screening machine into various piles based on aggregate size. Sand is also produced in this process. The crusher and screener are moved around the quarry floor as necessary to be close to the quarry face and accumulated, excavated stone.
- Loading of the material directly from the stockpile onto trucks for removal from site.
- The excavation continues, as described above, within each stage until it reaches the ultimate depth of 44 m AHD. During the excavation, 10 m high by 10 m wide benches are established at the quarry face.
- Once the extraction is complete, topsoil would be respread on the disturbed areas and revegetated, where possible.

3.2 Extraction rate

To service the demand from the Pacific Highway upgrade works it may be necessary to extract and process up to 500,000 tpa, although this rate of extraction is expected to be uncommon. It is more likely that the annual extraction rate during the upgrade of the Pacific Highway would be around 250,000 to 300,000 tpa. After the Highway upgrade is complete, the annual extraction rate is anticipated to reduce to about 100,000 to 150,000 tpa.

Based on the assessment of the underpinning demand, and allowing for downtime from wet weather etc (about 40%), it is realistic to project a maximum daily extraction and haul rate of about 4,000 tonnes with an average daily win and haul of about 1,500 tonnes. At the other extreme, there will be periods when no materials are extracted or transported from the site. The average daily win and haul rate would reduce significantly following the completion of the highway upgrade.

3.3 Hours of operation

The hours of operation would depend on demand with some periods of high activity and other times when activity is limited to the occasional loading of haulage trucks. The proposed hours of operation are:

- Quarry operating hours would be:
  - Weekdays - 6:30 am to 6.00 pm.
  - Saturdays - 6:30 am - 4.00 pm.
  - Sundays or public holidays - No work.
- Excavation, crushing or loading would not commence until after 7:00am. Blasting, on an ad-hoc basis, would only occur on weekdays between the hours of 10:00am and 4:00pm.

3.4 Quarry equipment

Table 3-1 lists the plant and equipment that would operate on site.

Table 3-1 Quarry equipment

Type	Typical make/model	Approximate number	Typical frequency of use	Description
Excavators	Komatsu PC350 – 8	2	12- 40 hrs/ week	Excavating material and stockpiling. Clearing and grubbing of vegetation and stripping of topsoil.
	Komatsu PC710-5	1		
Front-end Loader	Komatsu WA400-3	1	10 hrs/week	Loading material onto the haul trucks and stockpiling material within the pit floor.
	Komatsu WA470-3	1	30 hrs/week	
	Kawazaki 90ZV	1	45 hrs/week	
Crusher	McCloskey J50	1	20 – 40 hrs/ week	Crushing rock main jaw crusher. Crushing rock spare jaw crusher.
	Komatsu BR380JG-1	1		
Screen	Sandvik GE440	1	20 – 40 hrs/ week	Only for aggregate/gravel production and overburden screening.
	Sandvik GA340	1		
Haul Trucks	Truck and dog Contractors	Up to 125/day	Up to 125/day	Delivery of materials to customers and stockpiling in pit if needed and carting unsuitable material to rehabilitation areas.
Water Cart	Isuzu	1	10 hrs/week	To water haul roads and stockpiles.
Water Pump	Honda	3	10 hrs/week	To dewater excavation/basin and to fill water cart from standpipe. To water stockpiles and put moisture in products.
Generator	Cummins	1	5 hrs/week	Provide electricity to wash plant and dam pump.
	Able	1	9 hrs/day	Provide power to weighbridge and fuel pump.
Hand tools	Various	5	2 hrs/week	General activities maintaining plant.

It is anticipated that not all of the equipment listed above would be operational on-site at any one time.

3.5 Access and traffic generation

The majority of traffic to and from the quarry would access the site from the Pacific Highway and Tullymorgan-Jackybulbin Road via an existing, formed gravel access road that runs to the quarry pit. The layout of the quarry provides a loop that allows trucks and machinery to enter the quarry, load and exit, all while travelling in a forward direction.

Less than 10 deliveries per year would be to the west of the quarry along Tullymorgan-Jackybulbin Road.

Truck and dog trailer combinations have a capacity of about 32 tonnes. At an average daily production, which would generate a win and haul rate of approximately 1,500 tonnes per day, the quarry is expected to generate about 50 truck and dog loads (100 movements) per day. At its peak, the quarry is expected to win and haul about 4,000 tonnes per day which would require about 125 truck and dog loads (250 truck movements) per day. At other times there would be periods when no trucks would be generated by the quarry.

The quarry workforce is expected to generate about 24 light vehicle movements per day.

4. Noise criteria

4.1 Operational noise

Operational industrial noise criteria are derived from the NSW INP.

The INP provides non mandatory industrial noise criteria to aid in the assessment of industrial noise sources scheduled under the *Protection of the Environment Operations Act 1997*. The policy sets two separate noise criteria to meet environmental noise objectives, one to account for intrusiveness and the other to protect the amenity of particular land uses.

Intrusiveness is assessed by determining the background noise level, where the equivalent continuous noise level from quarry operations should not be more than 5 decibels (dB) above the measured background level. The amenity criterion is based on noise criteria specific to the land use and associated activities. The project specific level is the more stringent of the intrusive and amenity criteria.

The intrusive, amenity and project specific levels are shown Table 4-1. The sensitive receivers in the vicinity of the quarry have been identified from aerial imagery. Aerial imagery available does not clearly identify whether R3 and R6 are in fact residential receivers, but have been included in this assessment as a conservative measure.

The nearest identified receiver is located approximately 1.5 km from the quarry boundary. Sensitive receivers identified in the vicinity of the site are detailed in Table 2-1. Figure 1 shows a site aerial image and the location of identified noise sensitive receivers. These receivers have been identified to represent those with the greatest potential for adverse noise impact.

The INP rural residential category has been adopted for all identified receivers to determine the applicable amenity criteria.

Table 4-1 Project specific operational noise criteria – daytime dB(A)

Criterion	Logger 1 (Lot 100 Jackybulbin Rd)	Logger 2 (Funnels Rd)
Rating background level, LA90(Period)	40	29[1]
Intrusiveness criteria, LAeq(15min)	45	35
Amenity criteria (rural), LAeq(period)	50	50
Project specific criterion, LAeq (15min)	**45**	**35**

Note 1: The NSW INP notes that "where the rating background level is found to be less than 30 dB(A), then it is set to 30 dB(A).

The NSW INP requires that the noise level at residences be assessed at the most affected point on or within the residential boundary or, if this is more than 30 m from the residence, at the most-affected point within 30 m of the residence.

In selecting the appropriate noise criteria for each receiver, the following methodology was used:

- The noise criterion of 45 dB(A) $L_{eq(15\ min)}$ derived from Logger 1 was adopted at receivers located close to the Pacific Highway.
- The noise criterion of 35 dB(A) $L_{eq(15\ min)}$ derived from Logger 2 was adopted at all other receivers.

The adopted criterion for individual receivers is shown in Table 5-2.

4.2 Traffic on public roads

GHD understand that rock material would be hauled from the site along Jackybulbin Road. Therefore, the quarry has the potential to create additional traffic noise on Jackybulbin Road.

Given the quarry access road is located on the site and is not a public road, noise from the access road is assessed under the INP.

The NSW *Road Noise Policy* (OEH, 2011) (RNP) provides non-mandatory road traffic noise target levels for land use developments with potential to create additional traffic on public roads.

Jackybulbin Road has been considered a local road. The road traffic noise target levels are presented in Table 4-2.

Table 4-2 RNP traffic noise target levels at residential receivers – dB(A)

Type of development	Day (7 am – 10 pm)	Night (10 pm – 7 am)
Existing residences affected by additional traffic on existing local roads generated by land use developments.	$LAeq_{(1\ hour)}$ 55 (external)	$LAeq_{(1\ hour)}$ 50 (external)

5. Noise impact assessment

5.1 Noise modelling methodology

The noise emissions from the operation have been assessed through noise modelling using Computer Aided Noise Abatement (CadnaA v4.4) to predict sound pressure levels at the nearest identified noise sensitive receivers.

CadnaA is a computer program for the calculation, assessment and prognosis of noise propagation. CadnaA calculates environmental noise propagation according to ISO 9613-2, *Acoustics – Attenuation of sound during propagation outdoors*. Propagation calculations take into account sound intensity losses due to hemispherical spreading, atmospheric absorption and ground absorption.

The ISO 9613-2 algorithm also takes into account the presence of a well-developed moderate ground based temperature inversion, such as commonly occurs on clear, calm nights or downwind conditions which are favourable to sound propagation. As a result, predicted received noise levels are expected to represent a worst case scenario.

5.2 Noise generating equipment

Table 5-1 displays a list of identified noise generating equipment used during site operations and their corresponding sound power levels.

Table 5-1 Noise sources and sound power levels

Noise source	Octave centre frequency (Hz) dB(lin)								Lw dB(A)	Source of data
	63	125	250	500	1k	2k	4k	8k		
Excavator Komatsu pc350-8	79	86	90	95	96	95	89	81	101	A
Excavator Komatsu pc350-8 with rock hammer attachment	89	99	106	106	110	112	110	104	117	A
Excavator Komatsu pc710-5	92	96	99	100	105	101	94	86	108	A
Front End Loader Kowazaki 90ZV	73	93	96	101	100	100	95	87	106	A
Front End Loader Komatsu WA400-3	73	93	96	101	100	100	95	87	106	D
Front End Loader Komatsu WA470-3	73	93	96	101	100	100	95	87	106	D
Crusher McCloskey J50	90	103	106	103	109	107	103	93	114	A
Crusher Komatsu BR380JG-1	90	103	106	103	109	107	103	93	114	D
Screen Sandvik GE440	91	97	103	110	112	110	105	95	116	A
Screen Sandvik GA340	84	90	96	100	103	100	96	89	107	A
Haul trucks	85	95	96	98	100	97	91	83	105	D
Water cart Isuzu	85	85	87	85	87	84	81	74	94	A
Generator Cummins	70	79	88	89	85	75	73	66	93	A
Generator Able	68	77	79	80	79	80	74	69	86	A

1. Excavator pc350-8 with rock hammer attachment was measured while breaking rocks. This sample was considered representative of typical operations, and thus the LAeq was used to calculate the sound power of the operation. A 3 dB(A) penalty has been applied due to the impulsive nature of the noise, as recommended by the NSW INP.

A. On site noise measurement.
B. BS 5228.1 – 2009.
C. Engineering Noise Control, Third Edition, A. Bies and H. Hanson, 1998.
D. Previous noise measurement data undertaken by GHD of similar plant.
E. UK Department for Environment, Food and Rural Affairs.
F. Australian Standard AS 2436-2010.
G. Adopted from Sandvik QJ 341 crusher.

5.3 Modifying factor corrections

Where a noise source contains certain characteristics, such as tonality, impulsiveness, intermittency or dominant low-frequency content, it can cause greater levels of annoyance than other noise sources at the same noise level. The INP provides correction factors which are to be applied to the predicted noise levels for when such sources exist.

A review of site noise sources has been undertaken, based on the observations made on site as well as noise data taken on site. No on-site noise sources were found to contain low frequency or tonal characteristics. Intermittency characteristics need only be assessed where the noise source occurs during the night period. Since Slys Quarry does not operate during the night time period, intermittency was not assessed.

On-site measurement of an excavator breaking rocks with a rock hammer attachment was found to be impulsive in nature. This noise source received a 3 dB(A) adjustment as recommended by the NSW INP.

5.4 Model configuration

As the quarry progresses throughout its lifetime, the shape of the working area would change. For example, the pit walls would become larger and the location of the working area would move throughout various stages. It would be impracticable to attempt to model all stages of the quarry life. Therefore, the following two operational scenarios have been modelled and assessed.

- **Scenario 1**: Proposed operations with current quarry shape (considered to represent a worst-case scenario as equipment would be most exposed to sensitive receivers).
- **Scenario 2**: Proposed operations with final quarry shape.

For both Scenario 1 and Scenario 2, the noise impact of the quarry on surrounding receivers has been assessed at:

- Average daily production, which is expected to generate about 50 truck and dog loads (100 movements) per day.
- Peak daily production, which would require about 125 truck and dog loads (250 truck movements) per day.

The following assumptions were made with regard to the model configuration:

- A general ground absorption coefficient of 1.0 was used throughout the model, representing the surrounding vegetation and land uses.
- Sound propagation is calculated according to the ISO 9613-2 algorithm, with noise enhancing meteorological conditions such as a moderate temperature inversion or light breeze in the direction of the receiver.
- Modelling is based on atmospheric conditions of 10˚C and 70% humidity.

The noise modelling assumptions are as follows:

- All modelled equipment was assumed to be operating simultaneously at full sound power.
- There were assumed to be 24 light vehicle movements per day for staff (12 in / 12 out).
- Noise source heights above ground level were modelled as follows:
  - Excavator: 2.5 m.
  - Screening plant: 3 m.
  - Front End Loader: 2 m.
  - Crusher: 3 m.
  - Haul truck: 3 m.
  - Light vehicles: 0.5 m.
  - Generator and pump: 1 m.
- Blast hole drilling was not assessed in this noise model since this is not a regular activity.
- Single storey receivers were modelled at a height of 1.5 m above ground.

5.5 Operational noise model results

Noise levels were predicted for future operation based on the operating conditions outlined in Section 3. The predicted noise levels for daytime site operations are shown in Table 5-2.

Model results indicate that noise levels generated from quarry operations are predicted to comply with the INP daytime noise criteria at all sensitive receivers. It is noted that off-site noise levels at R3 are close to the criteria, and the use of the rock hammer during peak daily production may cause an exceedance depending on the location of equipment.

Predictions under Scenario 2 indicate that the changing quarry shape will make little difference to the receiver levels.

This assessment is considered conservative as it has not considered the potential screening benefits of equipment operating behind stockpiles.

An assessment of noise mitigation measures has been provided in Section 7.1. It should be noted that the noise modelling is based on worst case operating conditions with conservative assumptions regarding site operations and equipment sound power levels. This conservative approach is likely to result in predicted operational noise levels being slightly higher than actual noise levels.

Figure 4 to Figure 9 shows the predicted operational noise contour plots for Scenario 1 and Scenario 2.

5.5.1 Potential future sensitive receivers

Predicted operational noise impacts indicate that the most stringent day time noise criterion of 35 dB(A) is typically confined to within a few hundred metres of the quarry pit, except for under peak production and when the rock hammer is in use. Under these scenarios, the noise criterion contour extends further, primarily to the south.

To the east, the noise criterion contour is mostly confined within the site boundaries under all operating scenarios.

All land encompasses by the noise criterion contour line is currently heavily vegetated and unlikely to be developed into a sensitive land use.

Predicted results should be used as a guide, indicating the land area surrounding the site which has potential to be adversely affected by noise. Local authorities could use this information for planning purposes in assessing the suitability of land for potential development.

Table 5-2 Predicted operational noise levels

Sensitive Receiver	Noise criterion Leq dB(A)	Predicted noise level Leq dB(A)							
		Scenario 1 – Existing quarry configuration				Scenario 2 – Final quarry configuration			
		Average daily production without rock breaking	Average daily production with rock breaking	Peak daily production without rock breaking	Peak daily production with rock breaking	Average daily production without rock breaking	Average daily production with rock breaking	Peak daily production without rock breaking	Peak daily production with rock breaking
R1	45	26	26	28	28	26	26	28	29
R2	45	25	26	27	28	26	26	28	28
R3	35	32	33	34	35	30	31	32	33
R4	35	23	25	25	26	21	22	23	24
R5	35	23	24	25	25	20	21	22	23
R6	35	22	23	24	25	20	21	22	23
R7	35	21	22	22	23	18	19	21	21
R8	35	19	20	21	22	17	18	19	20
R9	35	20	21	22	23	18	18	20	21
R10	35	20	21	21	22	17	18	19	20
R11	35	21	22	23	24	19	20	21	22

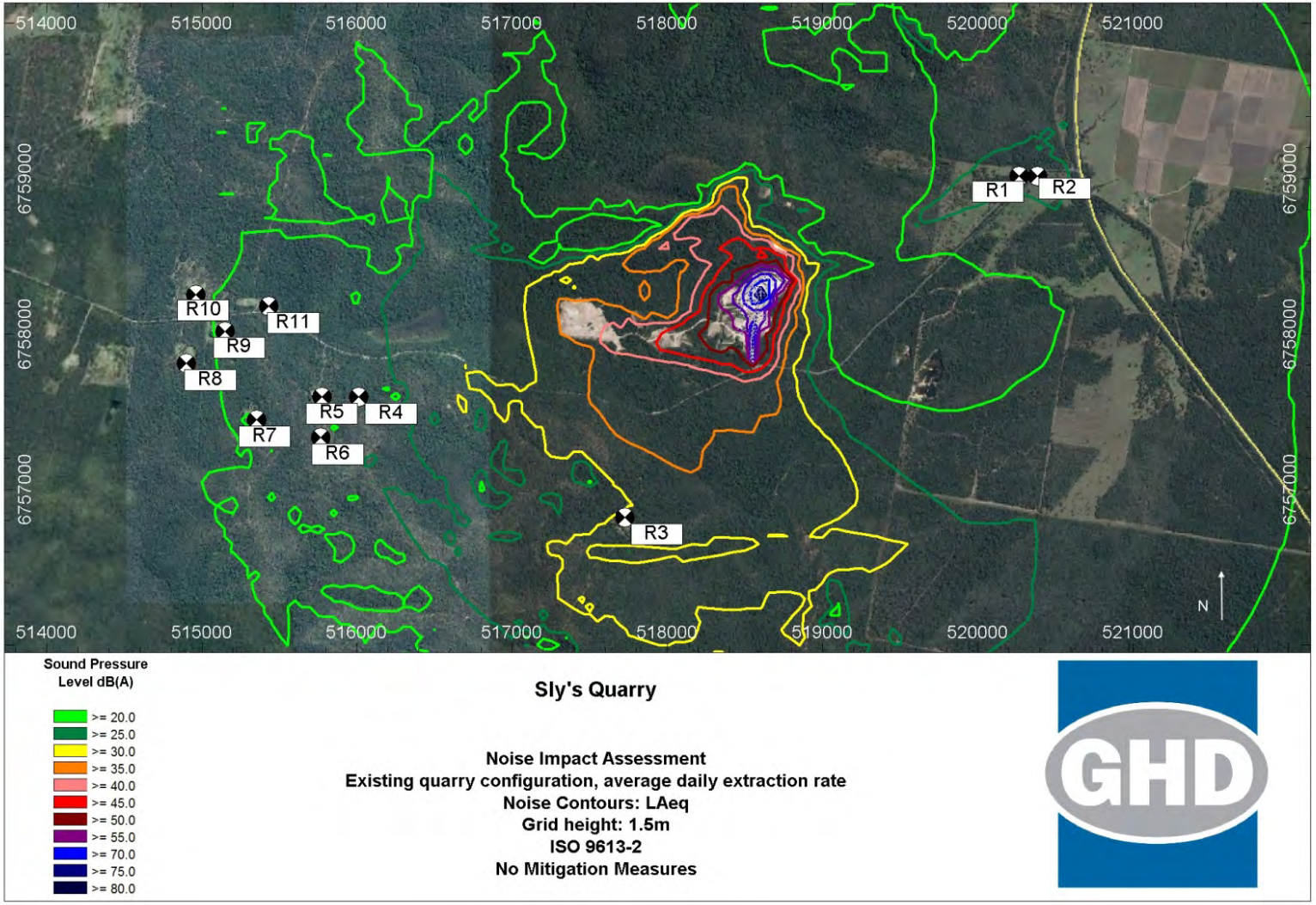


Figure 4 Predicted operational noise levels – Scenario 1 – Average daily production

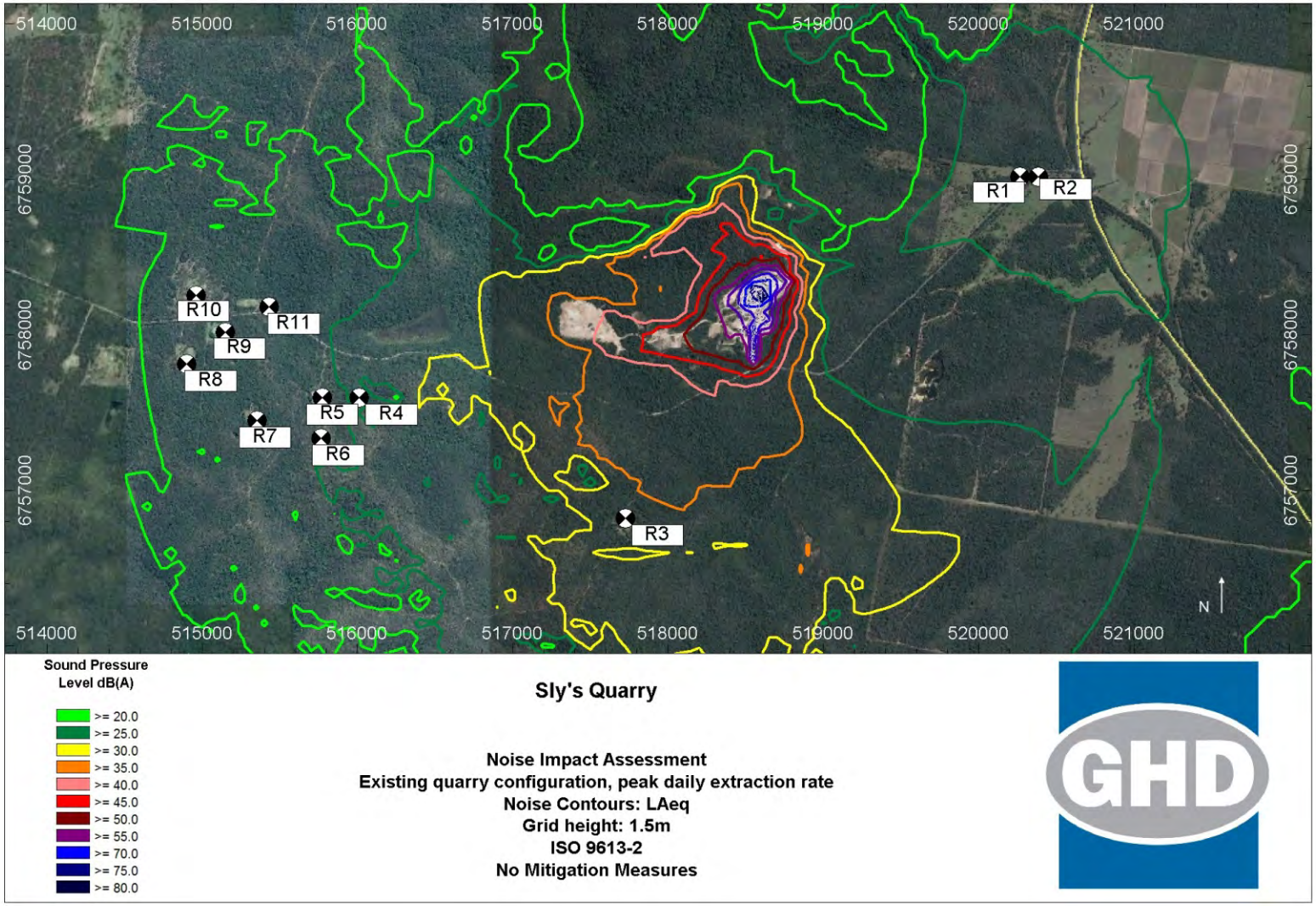


Figure 5 Predicted operational noise levels – Scenario 1 – Peak daily production

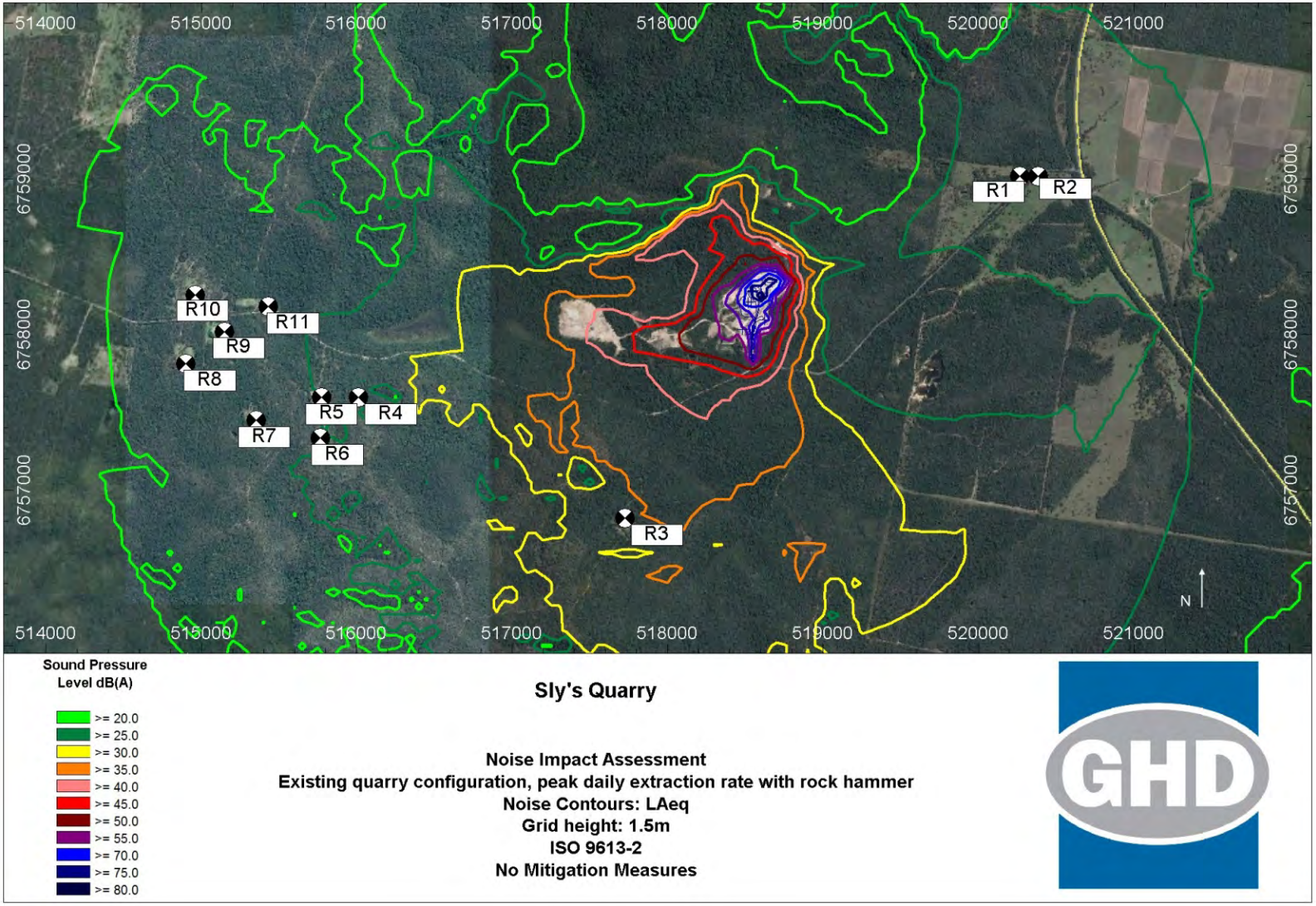


Figure 6 Predicted operational noise levels – Scenario 1 – Peak daily production with rock hammer

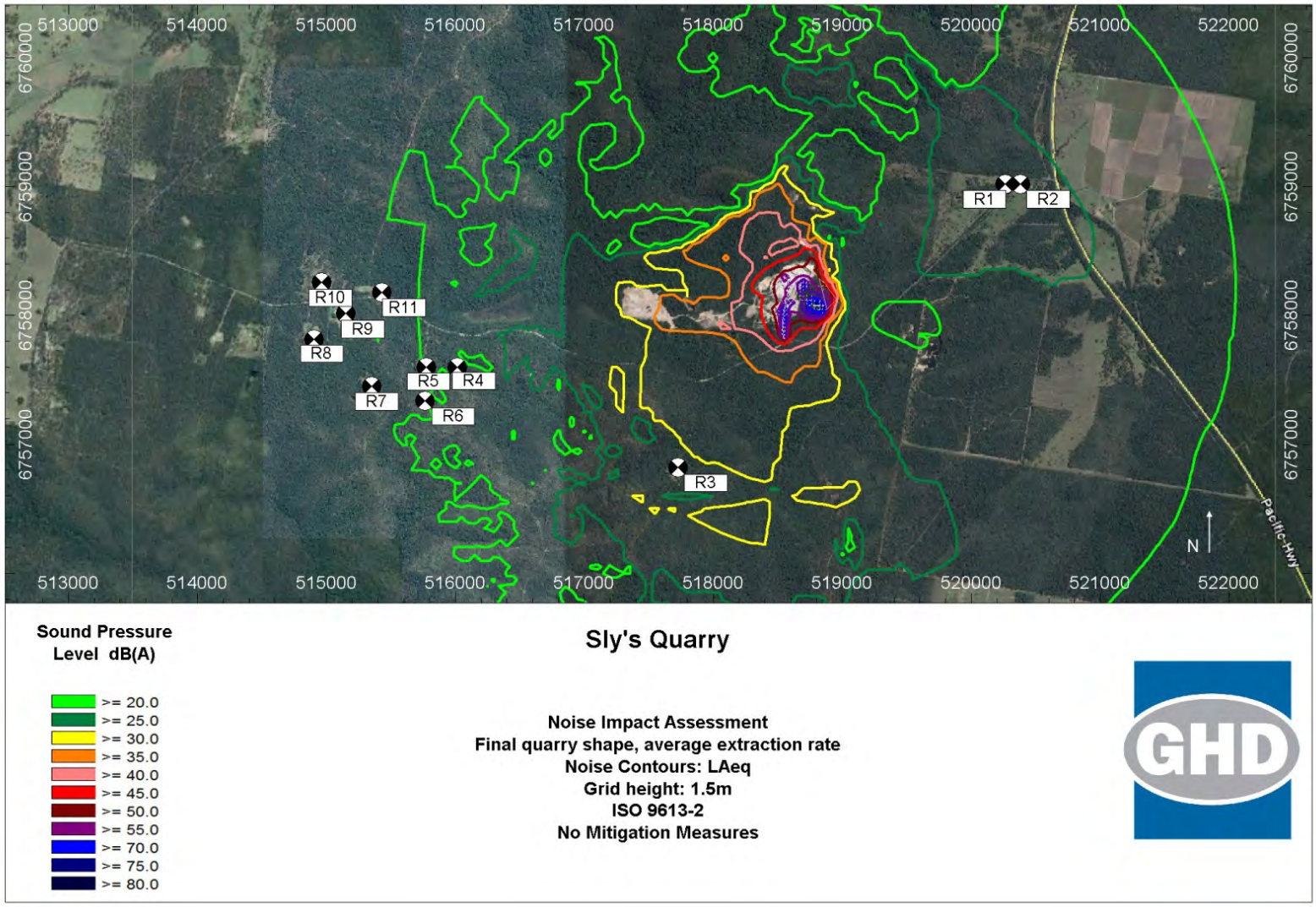


Figure 7 Predicted operational noise levels – Scenario 2 – Average daily production

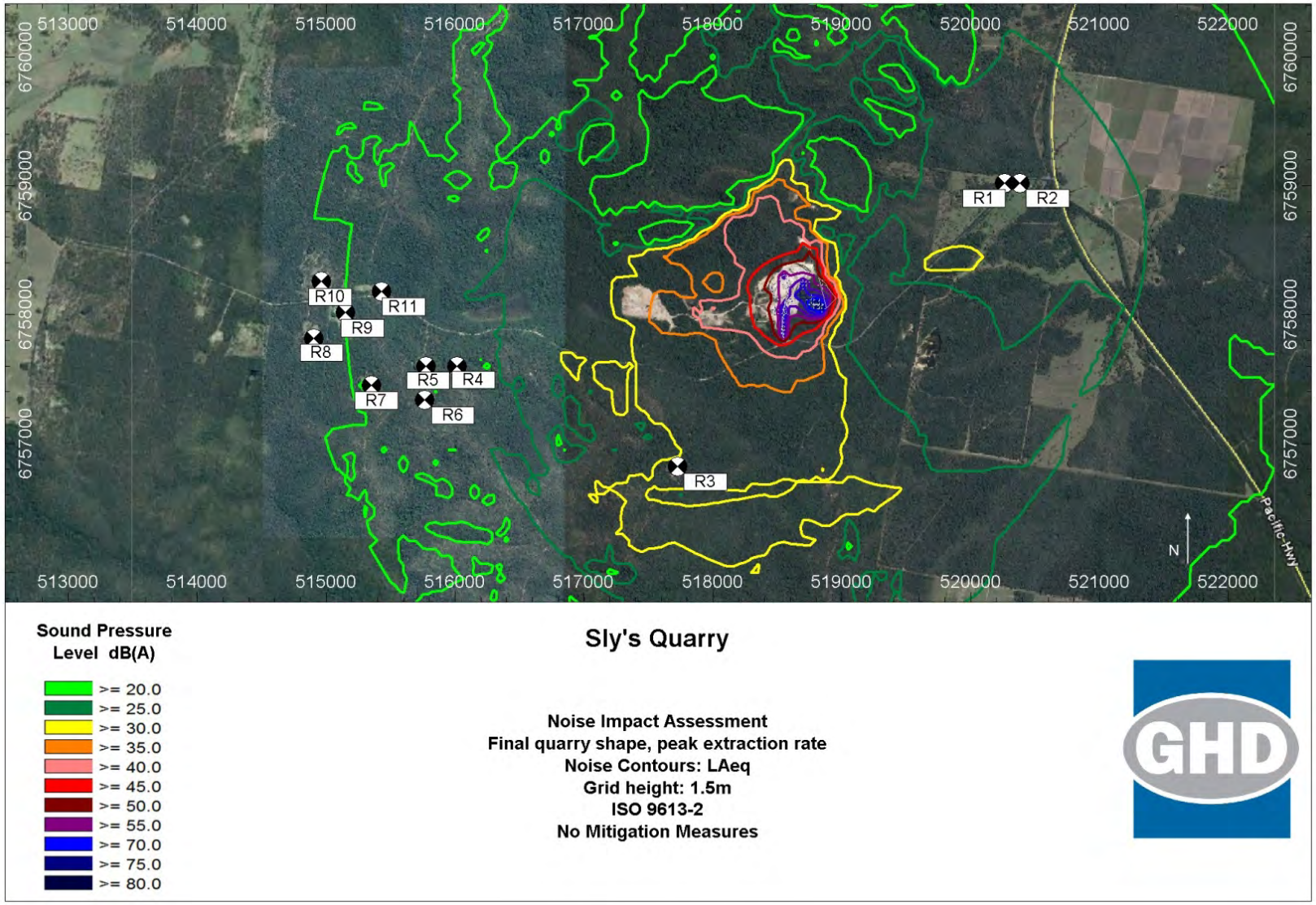


Figure 8 Predicted operational noise levels – Scenario 2 – Peak daily production

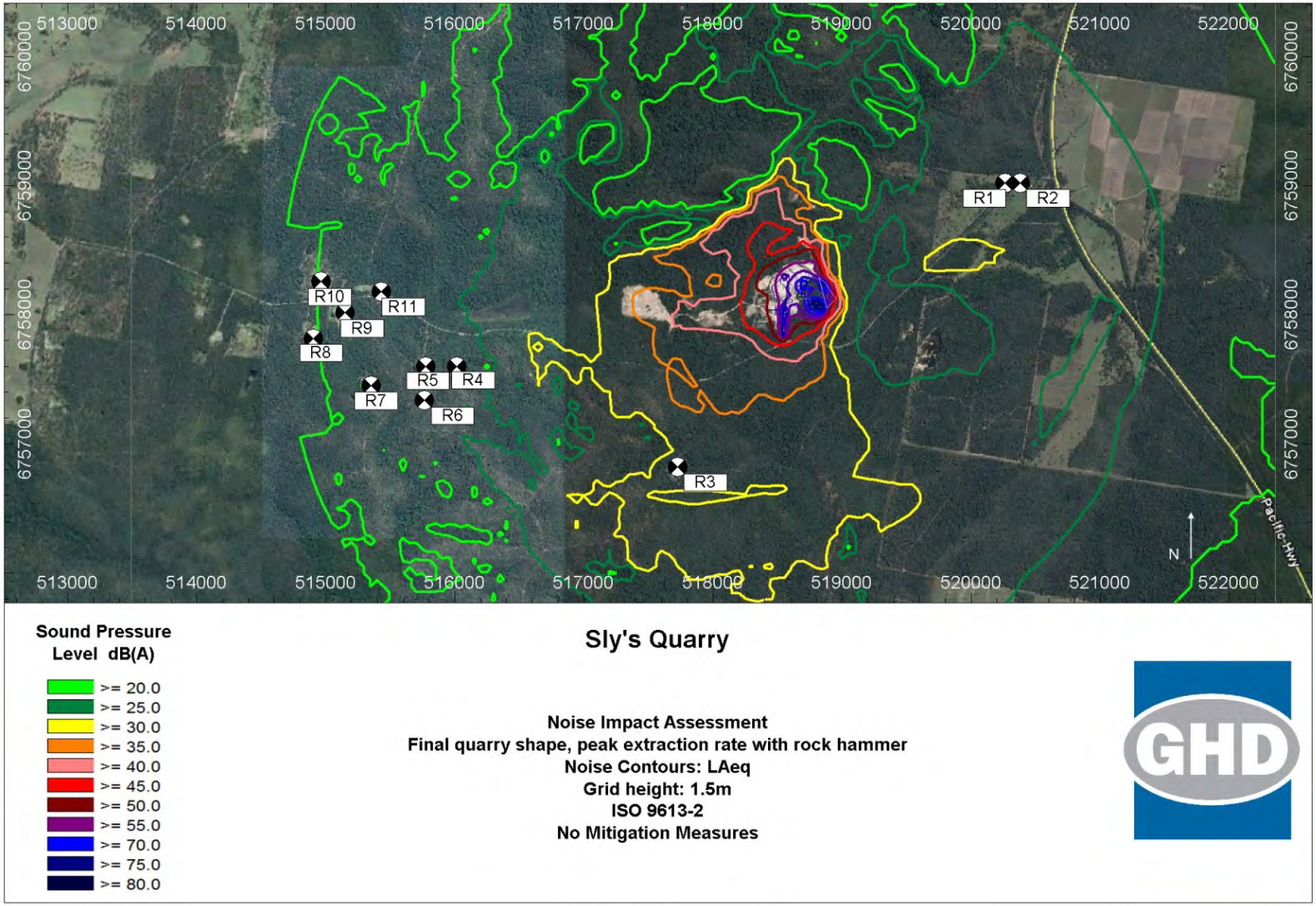


Figure 9 Predicted operational noise levels – Scenario 2 – Peak daily production with rock hammer

5.6 Road traffic noise

Continuous traffic flow related noise is typically calculated using the United Kingdom Calculation of Road Traffic Noise (CoRTN) algorithm, however due to the non-continuous nature of the heavy vehicle movements to and from the site, the United States EPA's Intermittent Traffic Noise guidelines has been utilised to determine potential impacts. The following equation outlines the mathematical formula used in calculating the $L_{eq,T}$ noise level for intermittent traffic noise.

$$L_{eq,T} = L_b + 10\log\left[1 + \frac{ND}{T}\left(\frac{10^{(L_{max} - Lb)/10} - 1}{2.3} - \frac{(L_{max} - L_b)}{10}\right)\right]$$

Where:

L_b is background noise level, dB(A).

L_{max} is vehicle maximum noise level, dB(A).

T is the time for each group of vehicles (min).

N is number of vehicle trips.

D is duration of noise of each vehicle (min).

The parameters above were determined as follows:

- Background noise levels are based on the unattended noise monitoring conducted at Location 1.
- The heavy vehicle maximum noise level was measured at Logger 1.
- The duration of each vehicle passby was 10.8 seconds.
- The time for each group of vehicles was 60 minutes.

Table 5-3 summarises the predicted road traffic noise level for when the quarry is operating at peak daily production, and compares this against the RNP criteria.

Table 5-3 Predicted road traffic noise level during peak daily production

Roadway	Generated heavy vehicle movements per day (average daily production)	Generated heavy vehicle movements per day (peak daily production)	RNP criteria Day (7 am – 10 pm)	Predicted road noise level	
				Average daily production $LAeq_{(1\ hour)}$ dB(A)	Peak daily production $LAeq_{(1\ hour)}$ dB(A)
Jackybulbin Rd	100 (50 loads)	250 (125 loads)	$L_{Aeq(1\ hour)}$ 55 (external)	49	52

1. Predicted results have received a 2.5 dB(A) façade correction

Table 5-3 shows that using this algorithm, road traffic noise along Jackybulbin Road due to an increase in heavy vehicles during peak daily production is expected to comply with the RNP criteria.

However, the increase in heavy vehicle traffic is expected to be noticeable to receivers R1 and R2, and have the potential to generate annoyance. In particular, bumps, pot holes or other irregularities in the roadway can cause short-term increased noise during vehicle passbys. Recommendations for noise mitigation measures are provided in Section 7. Note that receivers R3 to R11 are situated west of the quarry access road, and would not be affected by heavy vehicle road noise.

6. Blast impact assessment

6.1 Criteria

6.1.1 Environment Protection Licence (EPL)

The current EPL No 11649 relating to the existing quarry operations indicates the following:

L4 Blasting

L4.1 Blasting at the premises is limited to 1 blast on each day on which the blasting is permitted.

L4.2 The airblast overpressure level from blasting operations in or on the premises must not exceed:

a) 115 dB (Lin Peak) for more than 5% of the total number of blasts during each reporting period; and

b) 120 dB (Lin Peak) at any time.

At the most affected residence or noise sensitive location that is not owned by the licensee or subject to a private agreement between the owner of the residence or noise sensitive location and the licensee as to an alternative overpressure level.

L4.3 The ground vibration peak particle velocity from blasting operations carried out in or on the premises must not exceed:

a) 5mm/s for more than 5% of total number of blasts carried out on the premises during each reporting period; and

b) 10mm/s at any time.

At most affected residence or noise sensitive location that is not owned by the licensee or subject to a private agreement between the owner of the residence or noise sensitive location and the licensee as to an alternative overpressure level.

It should be noted that the last paragraph refers to overpressure, which is believed to be a typographical error and should refer to ground vibration peak particle velocity.

6.1.2 ANZECC

The ANZECC Guidelines to Minimise Annoyance due to Blasting Overpressure and Ground Vibration has been adopted for assessment of blasting noise and vibration impacts in this report. This guideline specifies recommended human comfort criteria for blasting activities.

The ANZECC recommended maximum level for airblast overpressure is 115 dB(L) peak. This level may be exceeded on up to 5% of the total number of blasts over a period of 12 months. However, the airblast overpressure must not exceed 120 dB(L) peak for any blast.

Ground-borne vibration level should not exceed 5 mm/sec Peak Particle Velocity (PPV). The recommended PPV level may be exceeded on up to 5% of the total number of blasts over a period of 12 months. However, the level should not exceed 10 mm/sec at any time.

ANZECC guideline recommends that blasting should only be permitted during the following hours:

- Monday to Saturday, 9am to 5pm.
- No blasting on Sundays or Public Holidays.

The frequency of blasting should not take place more than once per day. This requirement does not apply to minor blasts.

The abovementioned restrictions on times and frequency of blasting do not apply to premises where the effects of the blasting are not perceived at noise sensitive sites.

When a temperature inversion is known to exist, blasting should be avoided if practicable.

Reference to the above criteria indicates the EPL airblast overpressure and ground vibration levels are the same as the ANZECC criteria.

6.2 Blast monitoring

Blast monitoring was conducted during a blast event at Slys Quarry on the 13 November 2014. The aim of the monitoring was to measure ground vibration and overpressure results during a typical blast event and determine site constants for the area which can be used for blast predictions.

Blast monitoring was conducted by GHD at one location in the vicinity of residential sensitive receptor R2 during the blast event and supplemented with monitoring conducted by the blasting contractor. The blasting contractor recorded overpressure and ground vibration levels at two locations as shown on Figure 10 below.

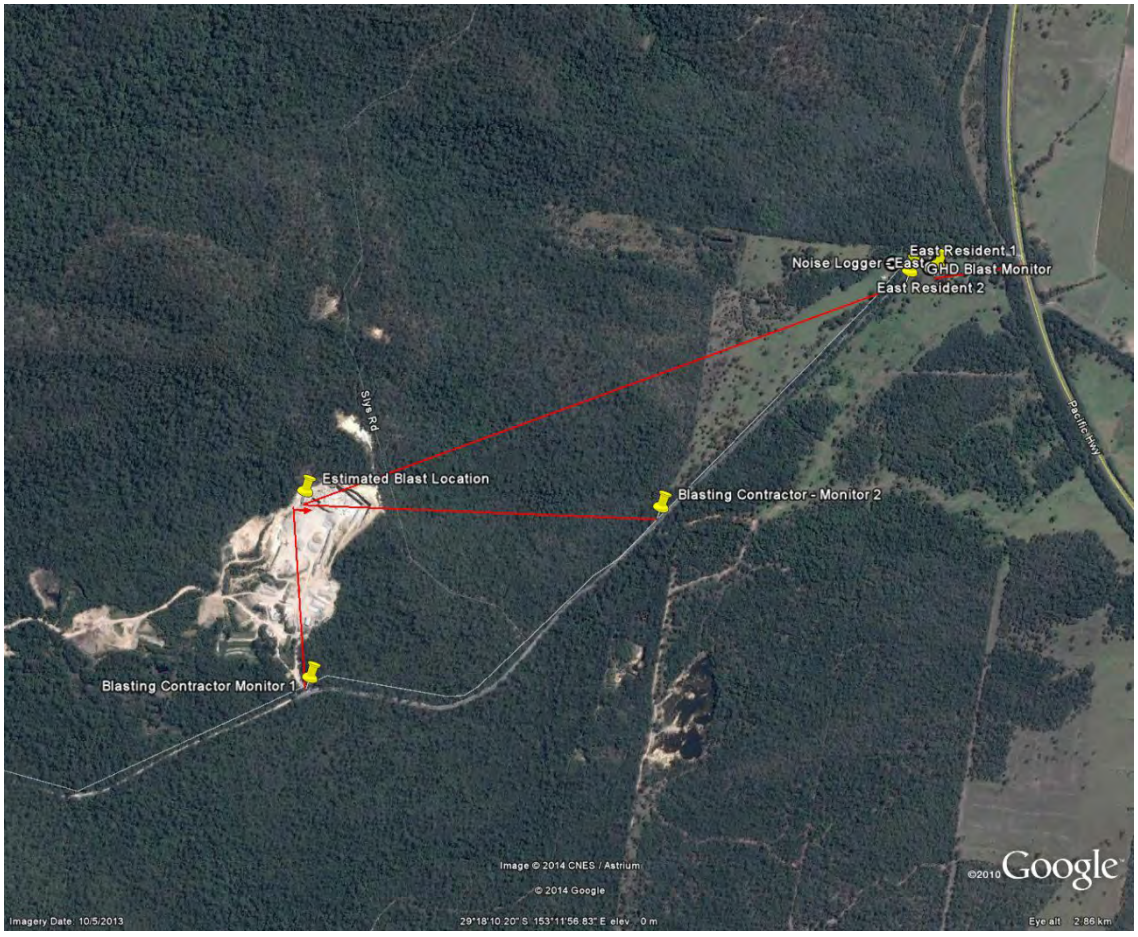


Figure 10 Blast monitoring locations

The monitoring position at R2 was prepared by removing the top layer of grass or loose soil and firmly securing the vibration monitor geophone on the exposed surface using ground-spikes. The microphone was setup facing the blast location at a height of 1.2 metres above ground level.

The vibration monitor was set to record peak vibration levels as a 10-second interval histogram recording. Additionally, a waveform recording trigger was set to 1.5 mm/s to enable identification and further analysis of significant vibration events. The trigger was set at 1.5 mm/s to minimise risk of triggering due to extraneous events such as vehicle passbys on Jackbulbin Road.

6.2.1 Instrumentation details

The vibration monitoring described in this report was completed using an Instantel® Minimate Plus™ vibration monitor, as pictured in Figure 11.

Figure 11 Instantel® Minimate Plus™ vibration monitor and geophone

The Minimate Plus uses a tri-axial geophone to monitor ground vibration peak particle velocity (PPV) in each axial direction and has an inbuilt data logger, downloadable to PC where analysis can be performed using Blastware software. The peak vector sum (PVS) of each measurement is resolved from the acquired data using Blastware.

Equipment setup and specification are presented in Table 6-1.

Table 6-1 Equipment register and setup

Equipment	Serial Number	Calibration Due Date	Recording Mode	Range (mm/s)	Sample Rate (per second)
Instantel Minimate Plus	BE 12721	5 March 2015 (Saros Pty Ltd)	Histogram Combo	31.7mm/s	2048

6.2.2 Blast configuration

The blasting contractor provided the blast monitoring results for their monitors along with the configuration parameters for the blast setup. A summary of the site blast design and site parameters is provided below in Table 6-2.

The blast design and evaluation report can be found in Appendix C

Table 6-2 Blast design parameters and configuration

Parameter	Value
Blast hole diameter	89 mm
Stemming length	1.0 m
Number of holes	28
Average depth of holes	14.16 m
Bench height	7.5 m
Bench area	14.16 m x 7.5 m x 23.33 m
Maximum charge mass per hole	116 kg
Maximum instantaneous charge (MIC)	5487 kg
Blast pattern	2.5 m x 2.5 m
No of holes per delay	1

6.2.3 Blast monitoring results

A summary of the vibration measurement results recorded at the site are presented in Table 6-3.

Table 6-3 Blast monitoring results

Parameter	Approximate distance and direction to blast source	PPV (mm/s) Criteria: 5mm/s	Overpressure dB(L) Criteria: 115 dBL
Location 1 (Blasting Contractor monitor near gate to quarry)	530 metres North	0.78	88[a]
Location 2 (Blasting Contractor monitor near Jackbulbin Road)	1030 metres West	0.17	112
Location 3 (GHD monitor near sensitive receiver R2)	1860 metres West-southwest	0.13	101

[a] This result is not considered valid as it is the noise floor of the instrument, therefore has not been used in this assessment.

The above results indicate the criteria are met at all monitoring locations for both ground vibration and airblast overpressure.

6.3 Blast prediction methodology

GHD have adopted the above blast monitoring results to use in predictions of the ground vibration and airblast overpressure over varying distances on the assumption that the blast parameters would be representative of the conditions at Slys Quarry for future blasting. GHD has adopted this information assuming that the blast procedure and vibration monitoring were undertaken with consideration to the relevant publications and standards, including:

- Australian and New Zealand Environment Conservation Council (ANZECC), "*Technical Basis for Guidelines to Minimise Annoyance due to Blasting Overpressure and Ground Vibration*" (1990).
- Australian Standard AS 2187.2 – 2006, "Explosives – Storage, transport and use. Part 2: Use of explosives".

Estimations for ground vibration and airblast overpressure during blasting have been made with consideration to Australian Standard AS2187.2-2006.

6.3.1 Airblast calculations

Airblast radiates outwards from the blast site and attenuates with distance.

Airblast levels have been estimated using the following cube root scaling formula:

$$P = K_a \left(\frac{R}{Q^{1/3}} \right)^a$$ **Equation (1)**

Table 6-4 summarises the constants in Equation (1) and the values that have been assumed to estimate airblast levels, based on the provided monitoring results.

Table 6-4 Airblast parameters and assumptions

Parameter	Definition	Assumed value
P	Pressure (kPa)	N/A
Q	Explosive charge mass per hole (kg)	116.0 (1)
R	Distance from charge (m)	Range: 530 to 1864
a	Site exponent	-1.70
Ka	Site constant	55.1 (2)

1. Charge mass has been adopted from the blast design and evaluation report provided in Appendix C.
2. Ka site constant has been determined by using the known airblast pressure level, site exponent, charge mass and distance from the blasting contractor and GHD monitoring results provided.

6.3.2 Ground vibration calculations

Ground vibration radiates outwards from the blast site and gradually reduces in magnitude with distance from the blast.

Factors that affect the level of ground vibration arriving at a point from a blast typically include:

- Charge mass fired per hole.
- Distance.
- Ground transmission characteristics.

Ground vibration levels have been estimated using the following formula.

$$V = K_g \left(\frac{R}{Q^{1/2}} \right)^{-B}$$ **Equation (2)**

Table 6-5 summarises the constants in Equation (2) and the values that have been assumed to estimate ground vibration levels, based on the provided monitoring results.

Table 6-5 Ground vibration parameters and assumptions

Parameter	Definition	Assumed value
V	Ground vibration in Vector Peak Particle Velocity (VPPV) (m/s)	N/A
R	Distance from charge (m)	Range: 530 to 1864
Q	Maximum charge mass (kg)	116.0 (1)
Kg, B	Constants related to site and rock properties for estimation purposes	Kg = 1389 (2) B = 1.8

1. Charge mass has been adopted from the blast design and evaluation attached as Appendix C
2. Kg site constant has been determined by using the known ground vibration level, site exponent, charge mass and distance.

6.4 Predicted results

Figure 12 displays a plot of airblast overpressure and ground vibration against distance from the blast. These plots have been based on the assumptions and values outlined above in Table 6-4 and Table 6-5.

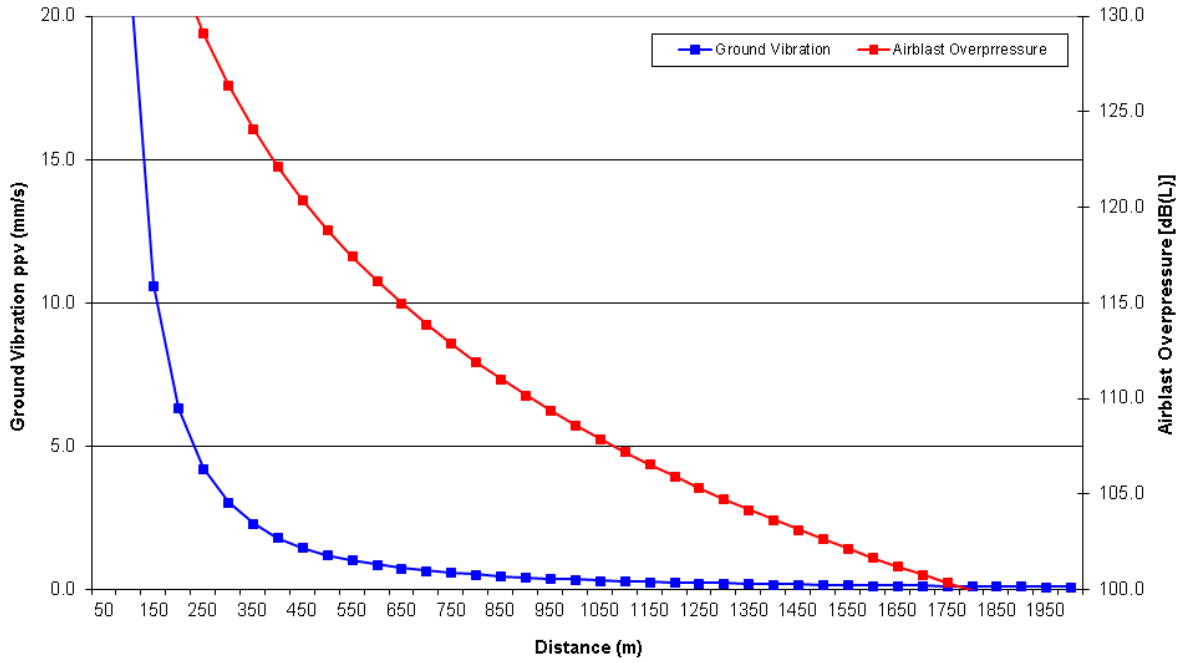


Figure 12 Estimated ground vibration and airblast overpressure levels from blasting

Based on the assumptions outlined above, estimated ground vibration and airblast levels from blasting suggest that, on average, the recommended limits of 5 mm/s and 115 dB(L) would be achieved at a minimum distance of approximately 250 m and 650 m respectively from the blast location. The nearest receivers are located approximately 1500 m from potential blasting locations. Therefore, based on assumptions above, it is expected that the blasting guidelines should be met at all receivers if blasting techniques are similar to those used during the blast in which measurement data was recorded at Slys Quarry on 13 November 2014.

However, due to variability in blasting impacts, it is recommended that the blasting contractor continues to conduct monitoring during blasts at the site to confirm predictions and assess compliance with the ground vibration and airblast overpressure limits.

Adverse meteorological conditions such as temperature inversions and wind direction can significantly increase airblast overpressure levels. Temperature inversions are most common during night and early morning periods, therefore should not affect blasting during the recommended standard operating hours. Prevailing winds can vary throughout the year and on a day-to-day basis. To assist in the reduction of airblast overpressure propagation, blasting should not be conducted when the prevailing winds are blowing towards the nearest residential receivers.

6.4.1 Predicted blasting buffer distances

Air blast overpressure and ground vibration has been predicted for a range of charge masses and are shown in Figure 13 and Figure 14 for varying distances and assuming average blasting parameters. The distance to comply with the *Technical Basis for Guidelines to Minimise Annoyance due to Blasting Overpressure and Ground Vibration* (ANZECC, 1990) are also shown.

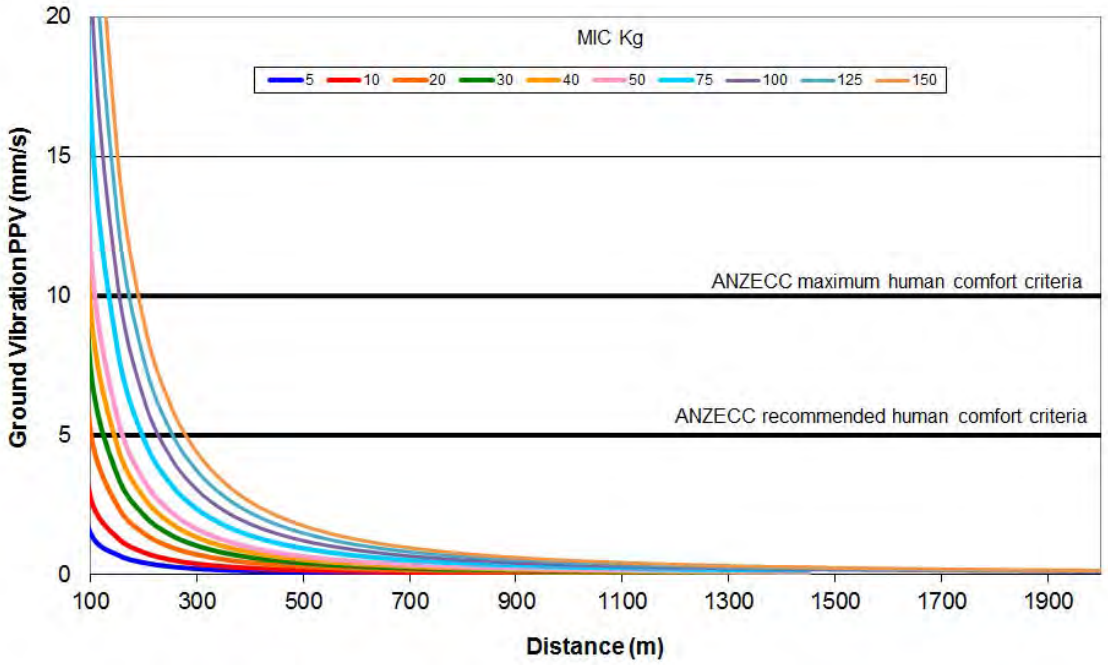


Figure 13 Ground vibration predictions for different charge masses and distances

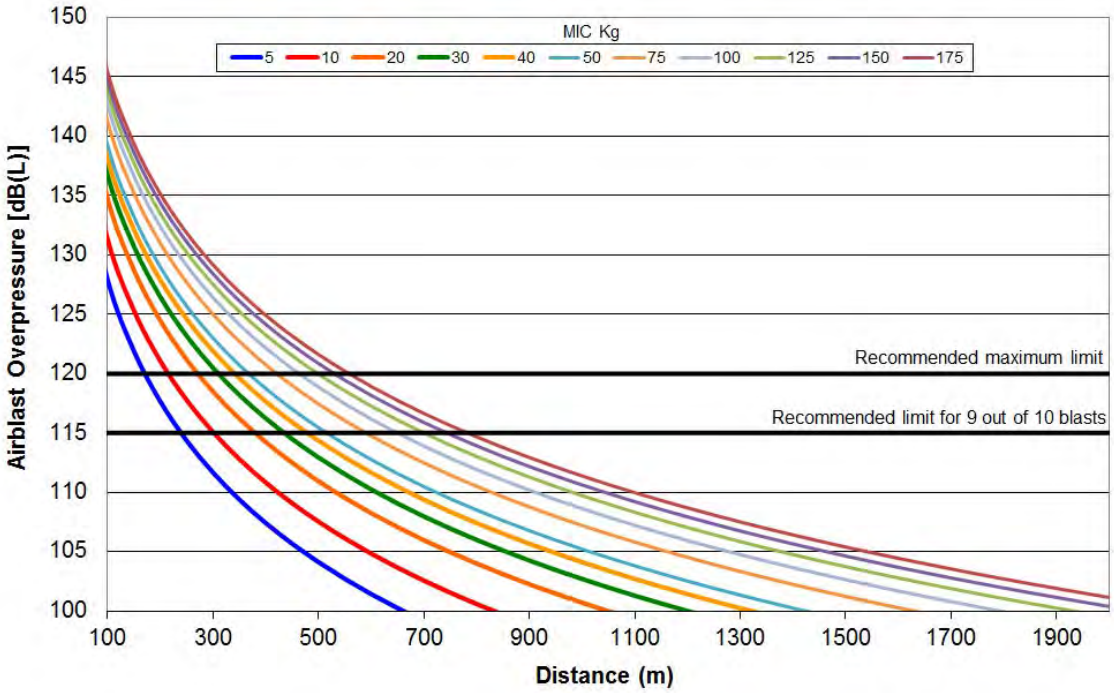


Figure 14 Air blast overpressure predictions for different charge masses and distances

6.4.2 Assessment of blasting impacts

The predicted results shown in Figure 13 and Figure 14 indicate that blasting would be restricted by the air blast overpressure rather than the ground vibration levels.

Although the exact location of blasting is not known at this stage of the project, if it were to occur it would most likely be located in areas moving further away from sensitive receptors than currently experienced. The nearest sensitive receivers are over 1,500 metres away, therefore blasting impacts based on the above parameters are expected to comply with the blasting criteria.

Although blasting impacts are not anticipated, mitigation such as reduced maximum instantaneous charge may be employed to minimised potential airblast overpressure impacts. Further methods to reduce the impact of airblast overpressure are provided in Section 7.2.

It is recognised that the design of blast would be up to the blast contractor and that the above information has been assumed for this assessment only, in the absence of specific information regarding future blasting at the proposed site.

Once the exact location and details of blasting is known, the distance to the receiver should be used for the charge mass estimate. Blast monitoring should then be undertaken to assess compliance, determine the site specific blast parameters and confirm the predictions.

6.4.3 Potential future sensitive receivers

Based on the assessment of current blast activities, the recommended limits of 5 mm/s and 115 dB(L) would be achieved at a minimum distance of approximately 250 m and 650 m respectively from the blast location. The nearest existing receivers are located approximately 1500 m from potential blasting locations. Future sensitive receivers located beyond 650 m from the blast location are unlikely to experience adverse impacts from blast events. If future sensitive receivers are located within 650 m of blast locations, further assessment would be required. Coordination with the blasting contractor may also be required to limit the MIC per blast.

7. Mitigation measures

7.1 Specific noise mitigation measures

Noise modelling predictions indicate marginal compliance of the operational noise criteria at receiver R3 when the rock hammer is used during peak daily production.

Noise predictions have been based on a number of conservative assumptions and model configurations, such as peak production rate and haul truck movements. For these reasons, it is likely that actual site noise on a day-to-day basis would be lower than the predicted values. Therefore, it is recommended that compliance noise monitoring be undertaken to verify the predicted noise levels. Compliance noise monitoring is discussed further in Section 7.5.

The following discussion around potential noise mitigation measures is provided to demonstrate how compliance with the adopted noise goals can be achieved. The requirements for noise mitigation have been based on operating Scenario 1, peak daily production while also operating the rock hammer. Table 7-1 provides a breakdown of the individual contributions to the total noise levels the most affected receivers for peak daily production respectively. Note that individual contributions will depend on the working location of each machine.

The results of Table 7-1 can be used to identify where noise mitigation would be most efficient at reducing total noise levels from site operations. Analysis of operational noise levels indicates that crushers, rock hammering and screens are the primary noise sources.

Due to the availability of material within the quarry, one of the most effective and practical measures of mitigating noise levels from the crushing and screening plants during average and peak daily production is to construct and maintain earth mounds around the processing areas, thus providing shielding effects to noise propagation off site. Earth mounds should be located to intersect the line-of-sight between the noise source and the receivers. An alternative method of shielding the crushing and screening plant would be to use shipping containers. It is recommended to stack two shipping containers on top of each other in the direction of the most exposed sensitive receivers to achieve the required height for effective shielding.

Additionally, an acoustic screen could be erected around the working area of the excavator during rock hammering operations. This acoustic screen would be positioned to intersect the line-of-sight between the noise source and the receivers. This would be particularly beneficial during times where rock hammering activities are being conducted while two crushers are operating.

Table 7-1 Partial noise levels (Scenario 1) – peak daily production with rock hammer operating

Source	Individual noise contribution L_{eq} dB(A)										
	R1	R2	R3	R4	R5	R6	R7	R8	R9	R10	R11
Screen QE440	22	22	29	21	20	20	18	16	17	17	19
Crusher Komatsu	21	21	27	19	18	17	16	14	15	14	15
Rock hammer	16	16	27	18	17	17	15	14	15	14	16
Crusher McCloskeyj50	21	21	27	18	17	17	16	14	15	15	16
Komatsu pc710-5	12	13	23	8	12	12	8	9	9	9	10
Screen QA340	13	13	20	12	11	10	9	7	7	7	7
FEL KOMATSU WA400	9	9	18	10	9	9	7	6	7	6	8
FEL KOMATSU WA470	16	15	18	11	10	9	8	6	7	6	8
FEL 90zv	16	15	18	10	10	9	8	6	7	6	8
Dog and trailers	12	12	18	8	8	7	6	4	5	4	6
Excavator pc350-8	8	8	14	6	5	5	3	1	2	1	2
Excavator pc350-8	6	7	14	6	5	4	3	1	2	1	3
Light vehicles	6	6	8	2	1	0	0	0	0	0	0
Generator Cummins	0	0	4	0	0	0	0	0	0	0	0
Water cart	0	0	2.4	0	0	0	0	0	0	0	0
Generator Able	0	0	0.3	0	0	0	0	0	0	0	0
Total	**28**	**28**	**35**	**26**	**25**	**25**	**23**	**22**	**23**	**22**	**24**

7.2 Blasting mitigation measures

It is recommended that all sensitive receivers be informed when blasting is to be undertaken. Reducing charge mass and increasing distance is the most effective way of reducing blasting impacts. Blasting should only occur from 10 am to 4 pm, Monday to Friday and should not generally take place more than once per day.

Once the exact location and details of blasting is known, the distance to the receiver should be used for the charge mass estimate.

Adverse meteorological conditions such as temperature inversions and wind direction can significantly increase airblast overpressure levels. Temperature inversions are most common during night and early morning periods, particularly during winter periods and therefore should not affect blasting during the recommended standard hours.

Due to variability in blasting impacts, it is recommended that monitoring be undertaken during initial blasts at the site to confirm predictions and assess compliance with the ground vibration and airblast overpressure limits.

7.3 Work ethics

All site workers would be sensitised to the potential for noise impacts on local residents and encouraged to take practical and reasonable measures to minimise the impact during the course of their activities. This would include:

- Where practical, machines would be operated at low speed or power and switched off when not being used rather than left idling for prolonged periods.
- Keep truck drivers informed of designated vehicle routes, parking locations and delivery hours.
- Avoid dropping materials from height and avoid metal to metal contact on material.
- All engine covers would be kept closed while equipment is operating.

7.4 Community relations

Consultation and cooperation with the neighbours to the site would assist in minimising uncertainty, misconceptions and adverse reactions to noise. It is recommended the following community relation measures be implemented:

- The quarry manager would erect a sign at the entrance of the quarry with a phone number and permanent site contact so that noise complaints can be received and addressed in a timely manner.
- Upon receipt of a noise complaint, noise monitoring would be undertaken and reported as soon as possible. If exceedances are detected, the situation would be reviewed in order to identify means to attempt to reduce the impact to acceptable levels (i.e. 45 dB(A) or 35 dB(A), depending on the receiver location).

7.5 Compliance noise monitoring

Noise measurements could not be taken of all quarrying equipment during visits to the site. In addition the shape of the quarry and precise location of noise sources relative to the pit wall would also affect the propagation of noise from the site. This creates a level of uncertainty in noise model predictions, which is common in most predictive assessments. Due to the marginal level of compliance at R3, it is recommended that compliance noise monitoring be undertaken during quarry operations to verify noise model predictions and confirm compliance with the adopted noise criterion. Compliance noise monitoring should also be undertaken following receipt of a complaint relating to noise emissions from the site.

The results of compliance noise monitoring would be used to determine the requirement to implement or increase noise mitigation measures such as earth mounds/shipping containers. Noise monitoring would be undertaken with consideration to the NSW INP.

Noise monitoring should be conducted following any change in operating conditions that are likely to increase noise emissions from the site (such as a sudden increase in production rate or heavy vehicle movements) or move noise sources significantly closer to noise sensitive receivers.

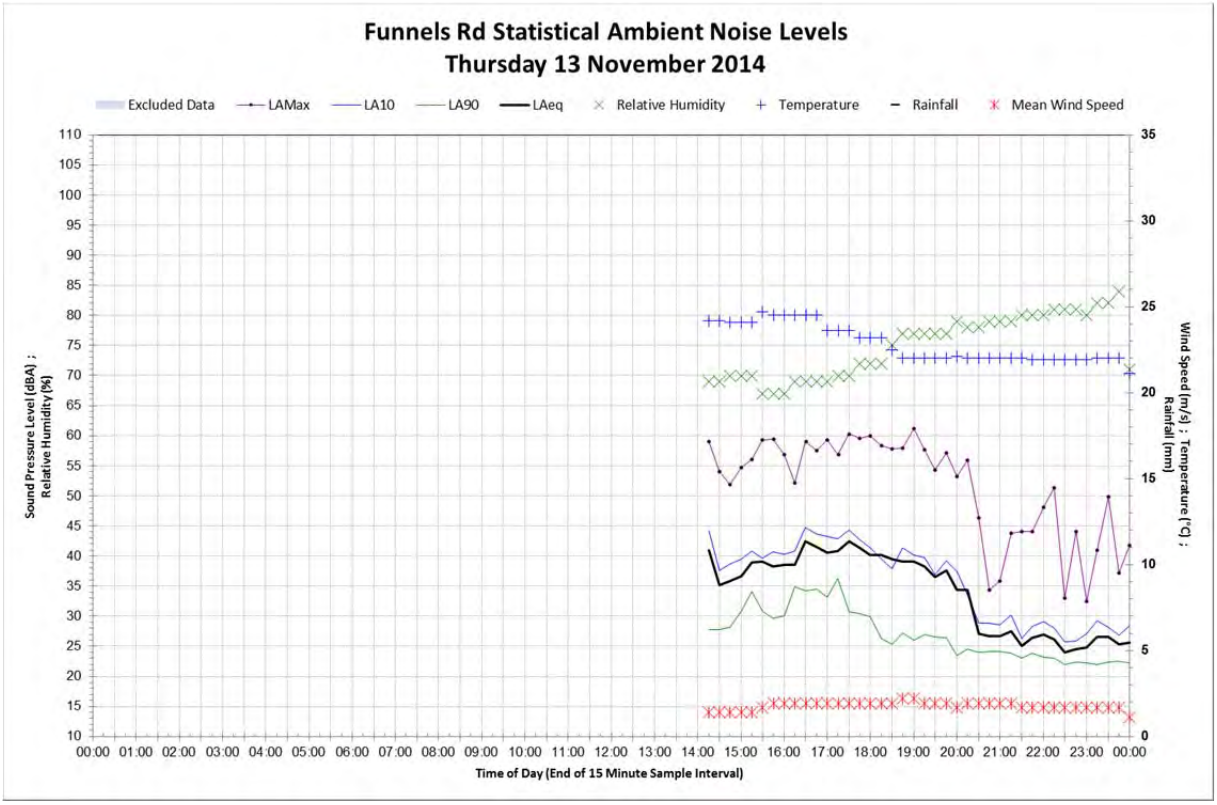
8. Conclusion

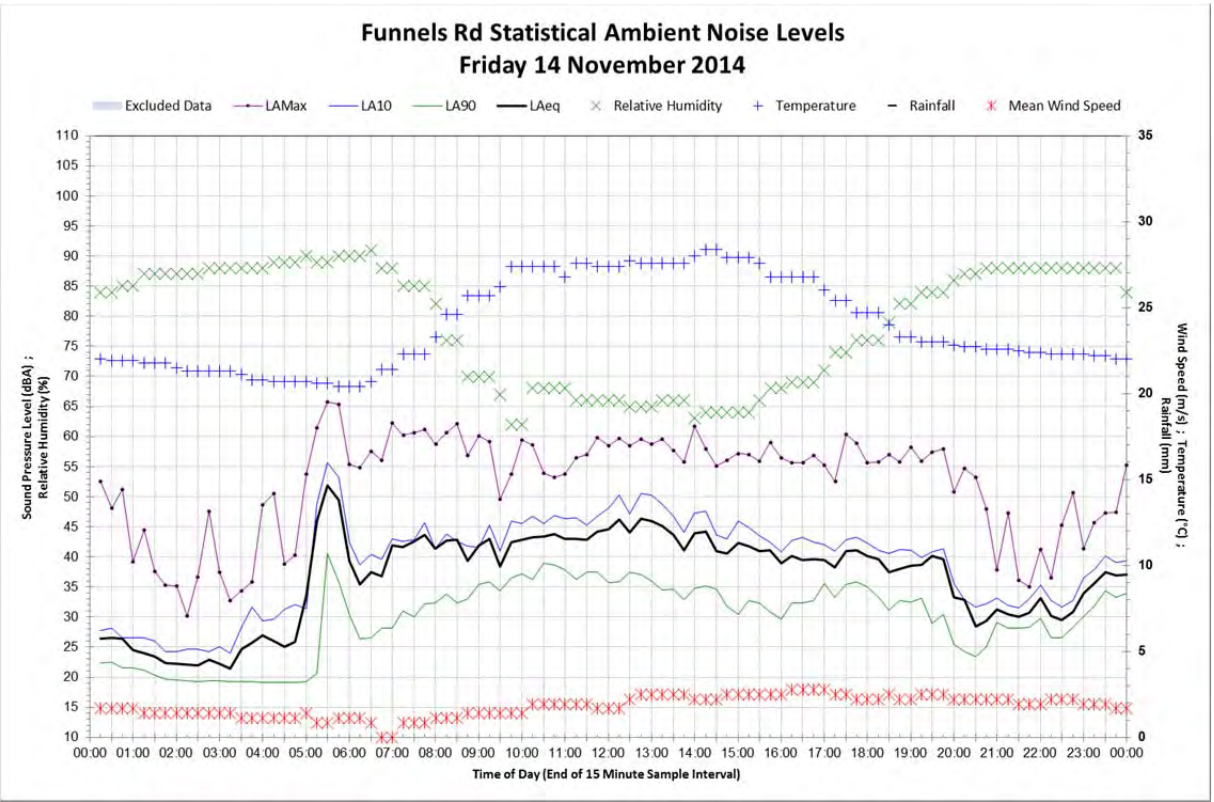
An assessment of the potential noise impacts from current and future operations at Slys Quarry has been undertaken. This assessment has led to the following conclusions, which are subject to the limitations outlined in Section 1.3:

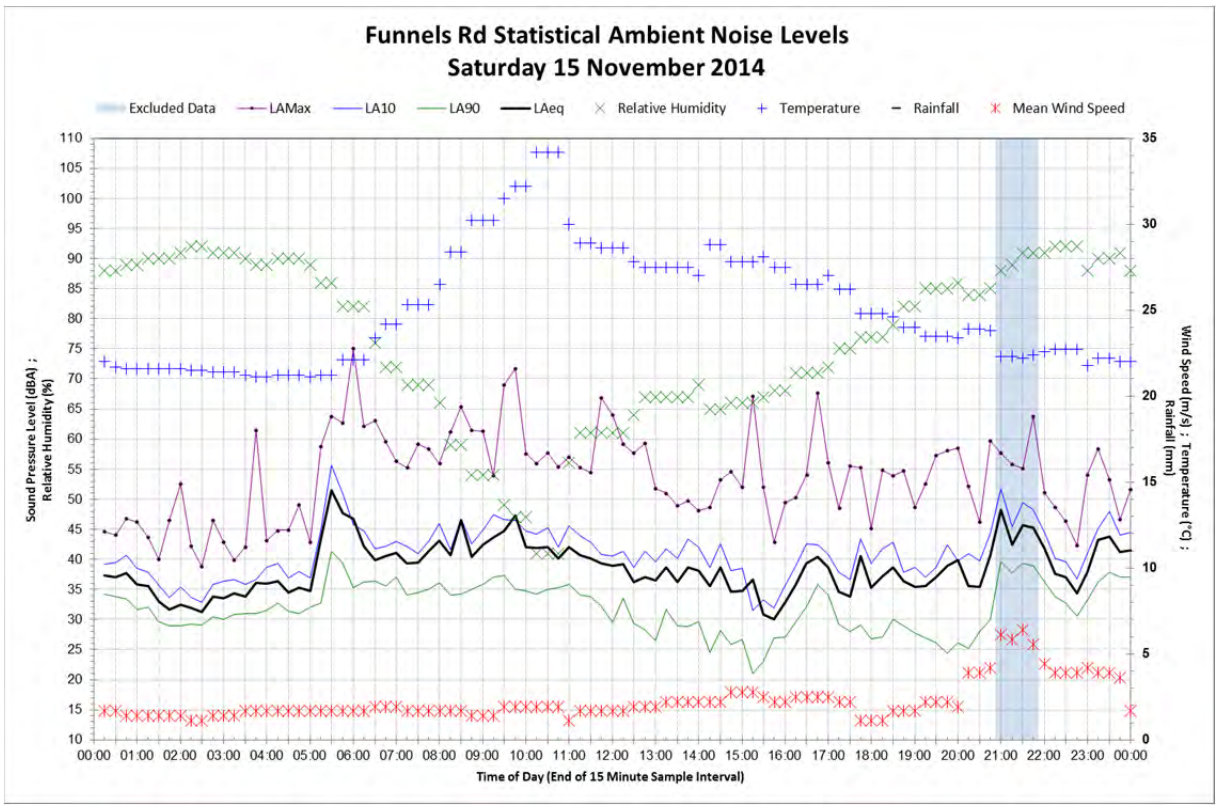
- Existing noise levels in the area surrounding the site are low and typical of a rural environment. Receivers R1 and R2 are much closer to the Pacific Highway than the other receivers, and as such, background levels measured here were dominated by road noise.
- An operational noise criterion of 45 dB(A) $L_{eq(15\ min)}$ derived from Logger 1 was adopted at receivers located close to the Pacific Highway.
- An operational noise criterion of 35 dB(A) $L_{eq(15\ min)}$ derived from Logger 2 was adopted at all other receivers.
- The operational noise assessment has been undertaken based on a worst-case operating scenario, with all equipment operating at maximum sound power levels.
- The noise assessment indicates that the noise levels due to operation of the quarry are expected to meet the adopted noise criteria at all identified sensitive receivers with the rock hammer operating. The noise assessment indicates that undertaking rock hammering during peak daily production will result in marginal compliance at receiver R3. Compliance monitoring is recommended to confirm predictions.
- An analysis of noise mitigation requirements to achieve compliance at all identified receivers has been undertaken. The crushers, screens and rock hammering activities were identified as being the primary noise sources, and thus mitigation measures should target these activities for greatest affect. Using quarry material or other structures to block the line-of-sight between these activities and receivers would be the most effective and practical mitigation measures to implement.
- The predicted growth in quarry traffic along Jackybulbin Rd due to peak production operations was investigated using the United States EPA's Intermittent Traffic Noise guidelines. This model indicated road noise along Jackybulbin Road would comply with the RNP criteria at all assessed sensitive receivers However, the increase in heavy vehicle traffic is expected to be noticeable to receivers R1 and R2, and may cause annoyance.
- Based on the blast data taken at Slys Quarry noise and vibration impacts from blasting are expected to, on average, comply with the adopted criterion at all receivers, providing the distance to the nearest receiver is used to determine charge mass. It is recommended that a blasting contractor be engaged to continue monitoring to confirm compliance.
- Further recommendations have been provided in Section 7 to assist in minimising potential noise impacts.

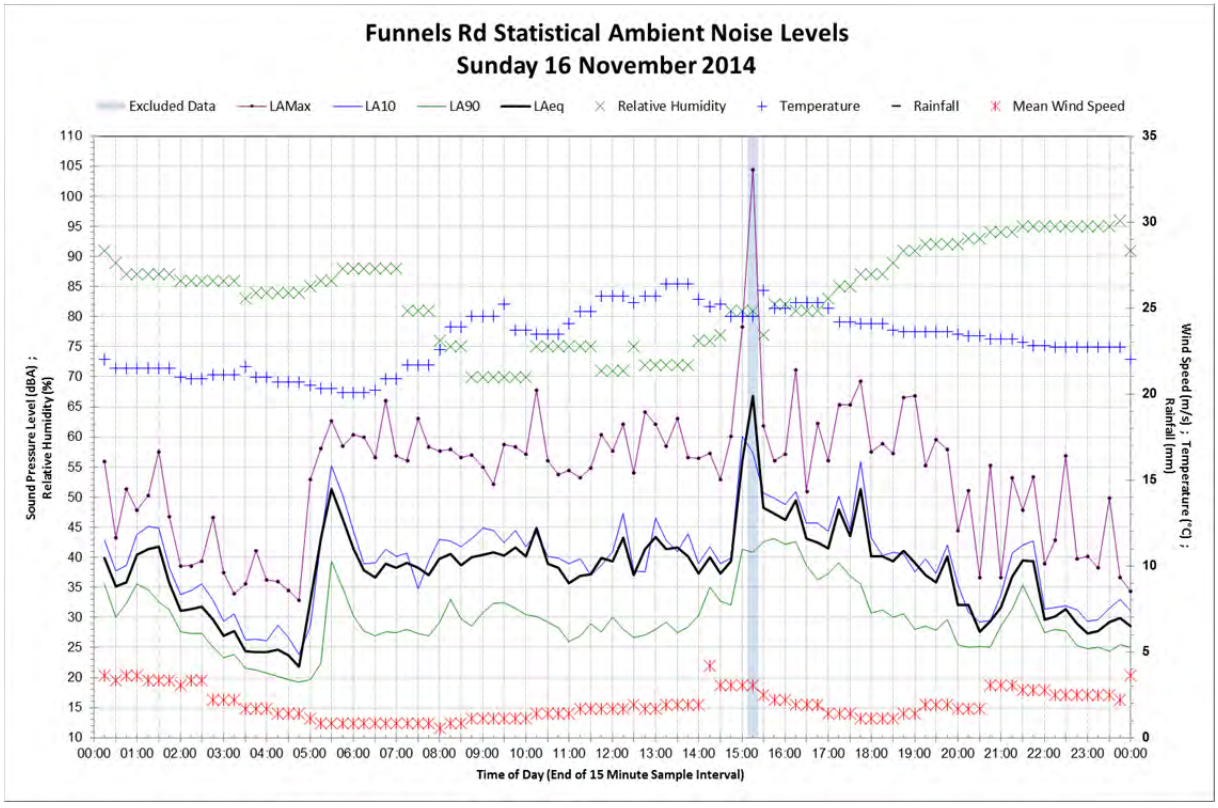
Appendices

Appendix A – Unattended noise monitoring charts






Funnels Rd Statistical Ambient Noise Levels
Saturday 15 November 2014
Excluded Data
LAMax
LA10
LA90
LAeq
Relative Humidity
Temperature
Rainfall
Mean Wind Speed
Sound Pressure Level (dBA) ; Relative Humidity (%)
Wind Speed (m/s) ; Temperature (°C) ; Rainfall (mm)
Time of Day (End of 15 Minute Sample Interval)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Temperature
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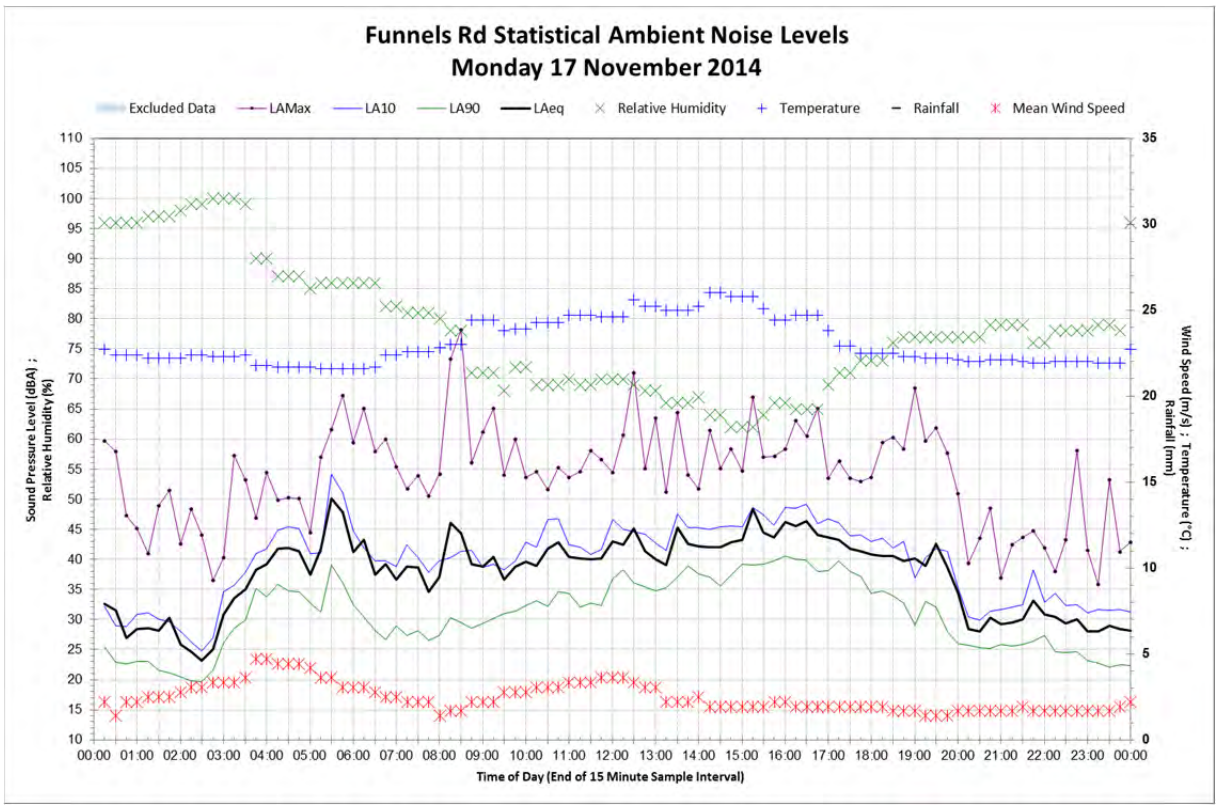
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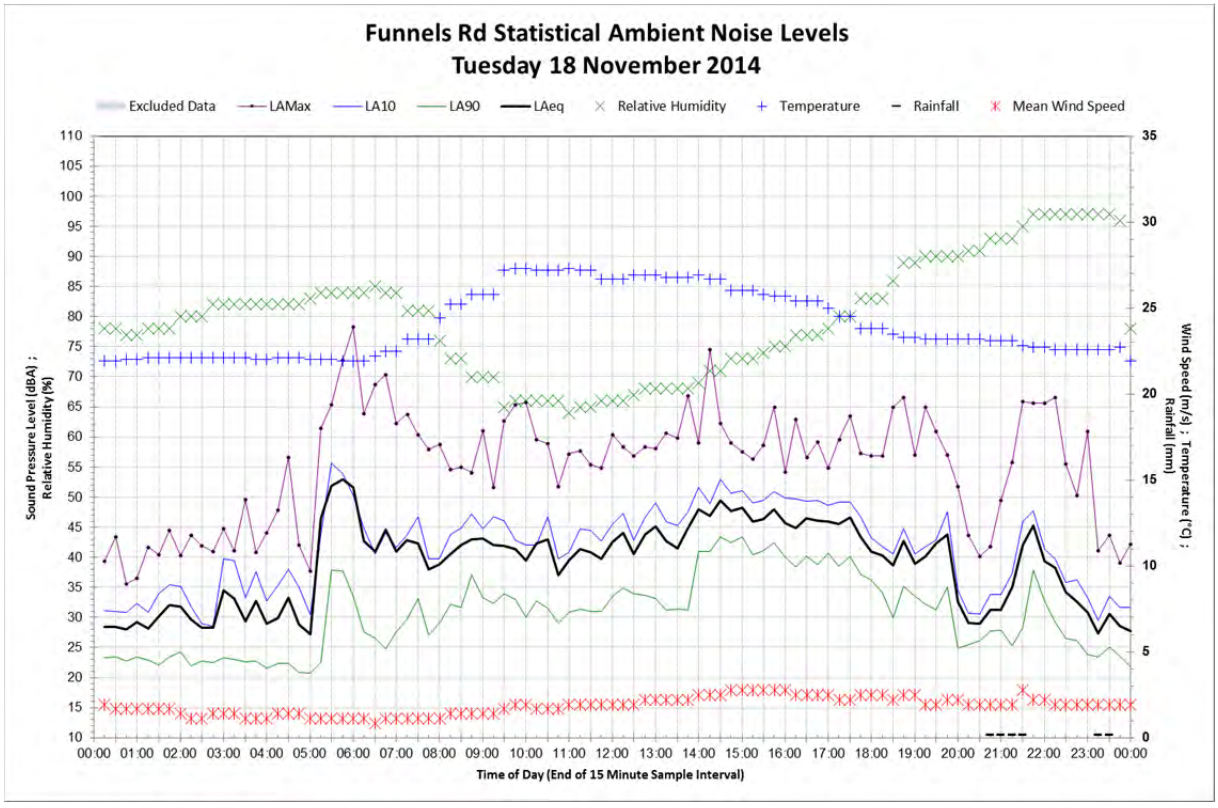
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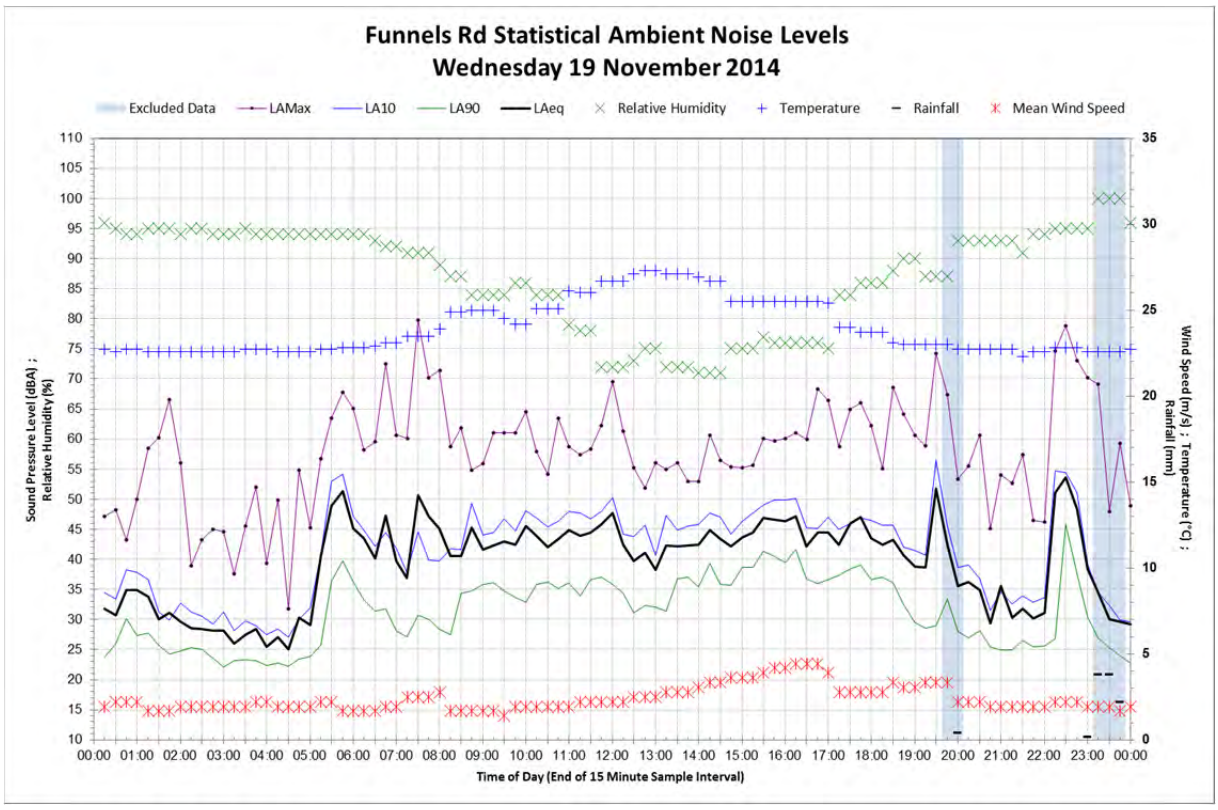
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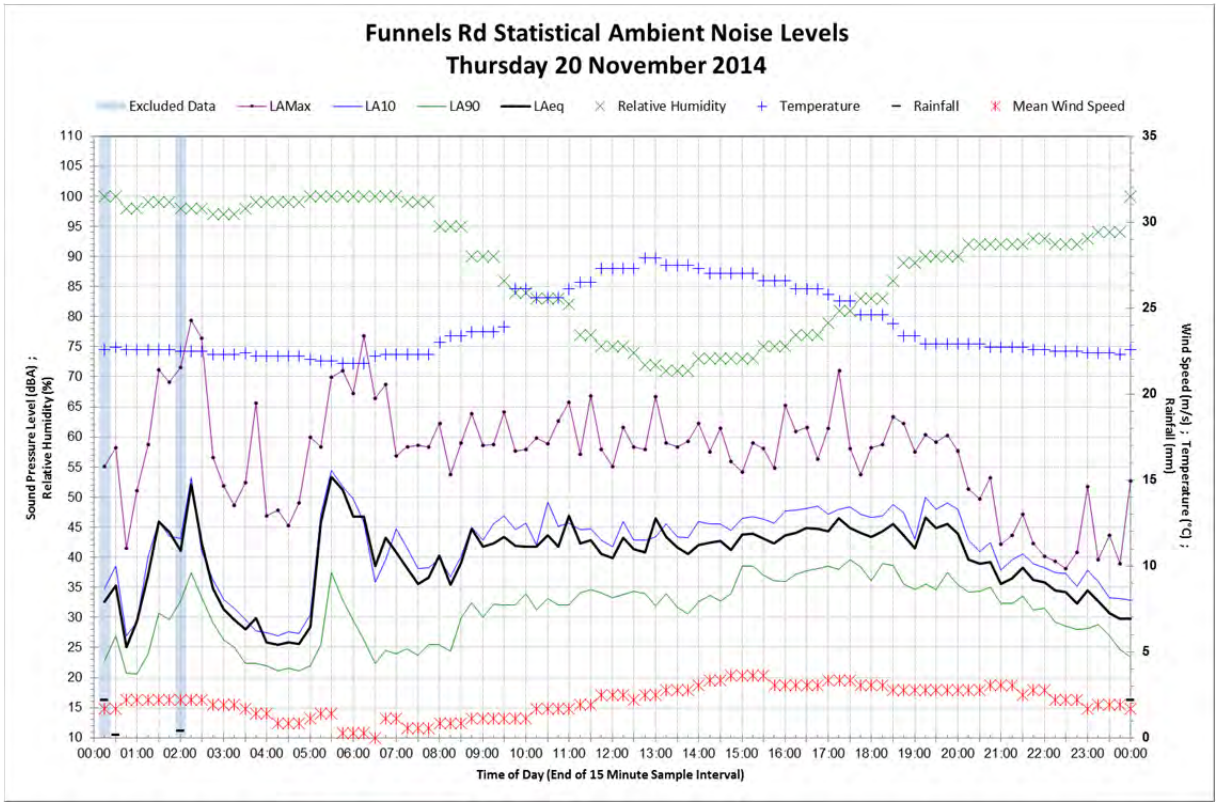
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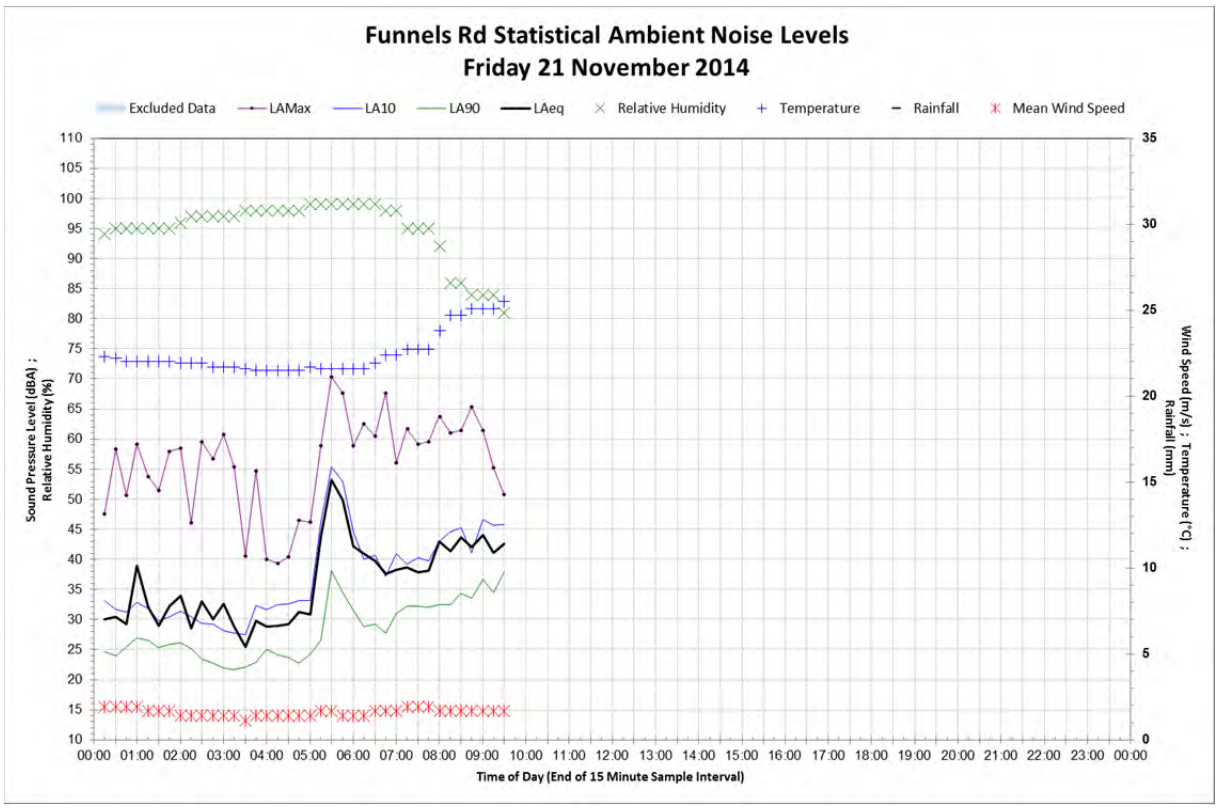
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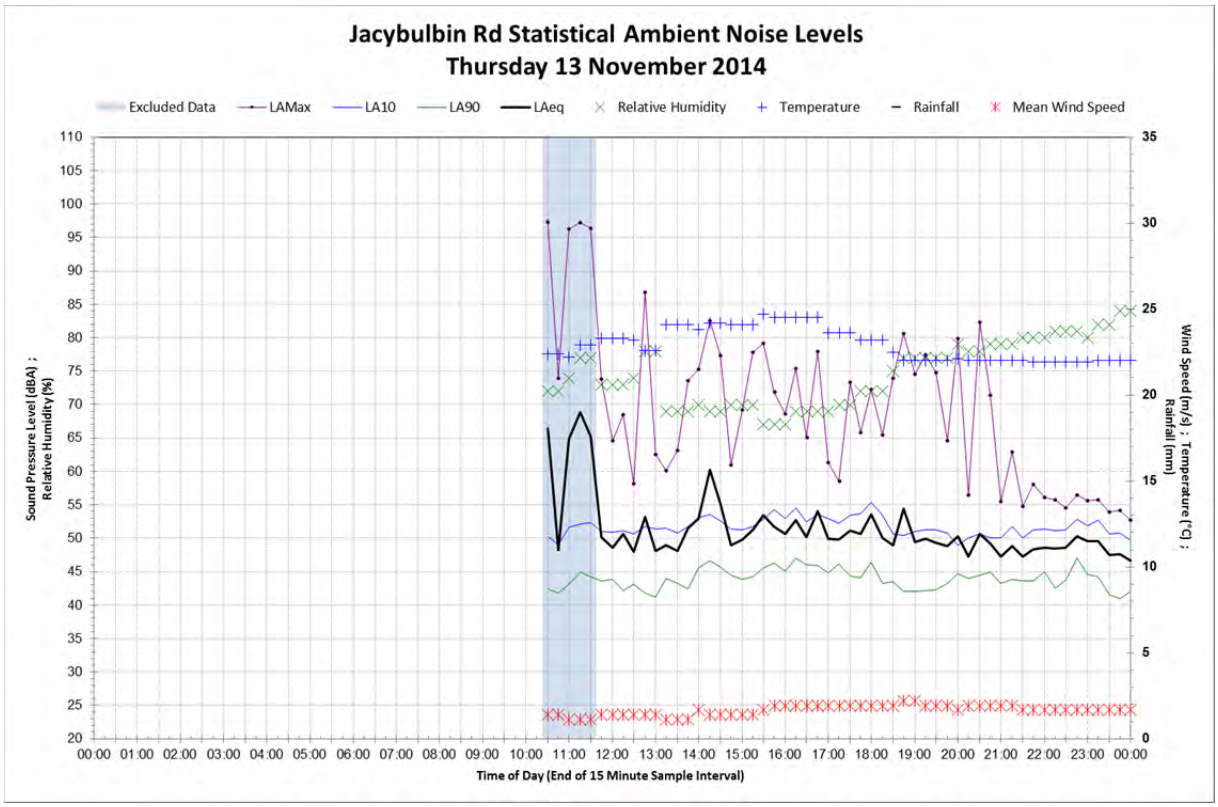
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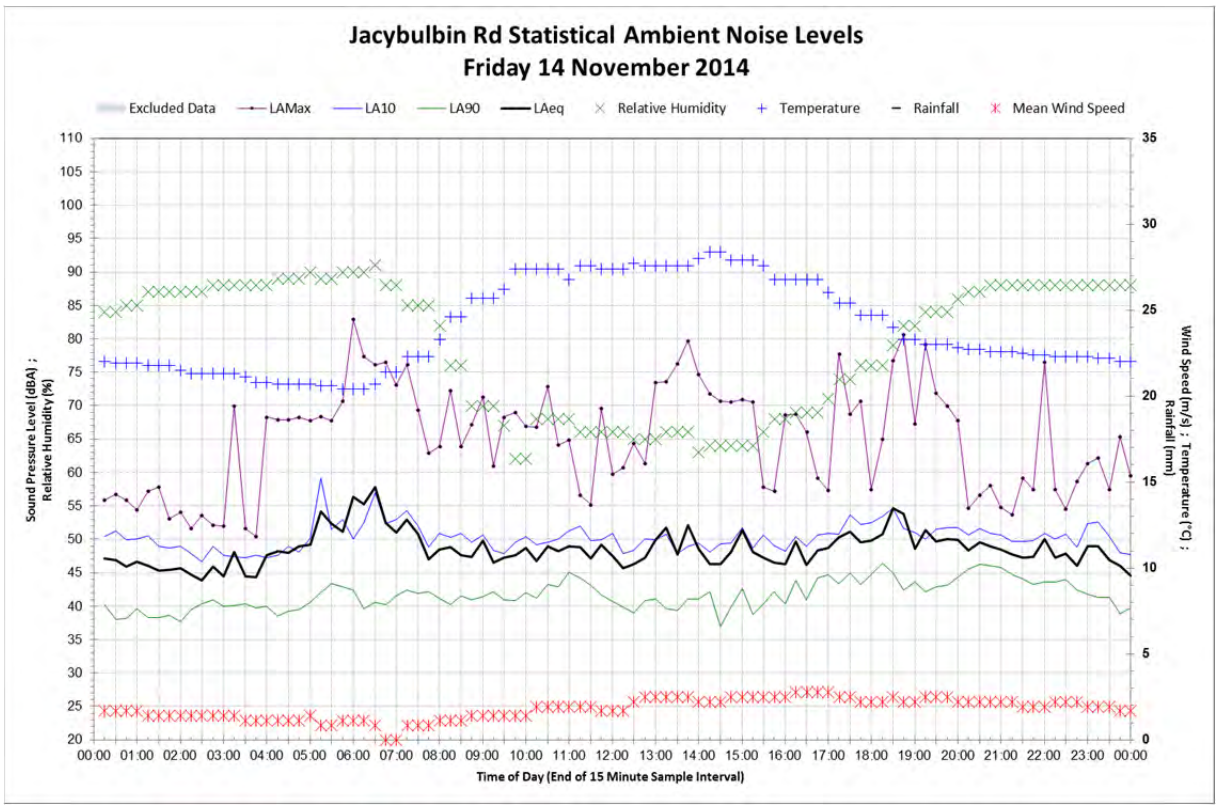
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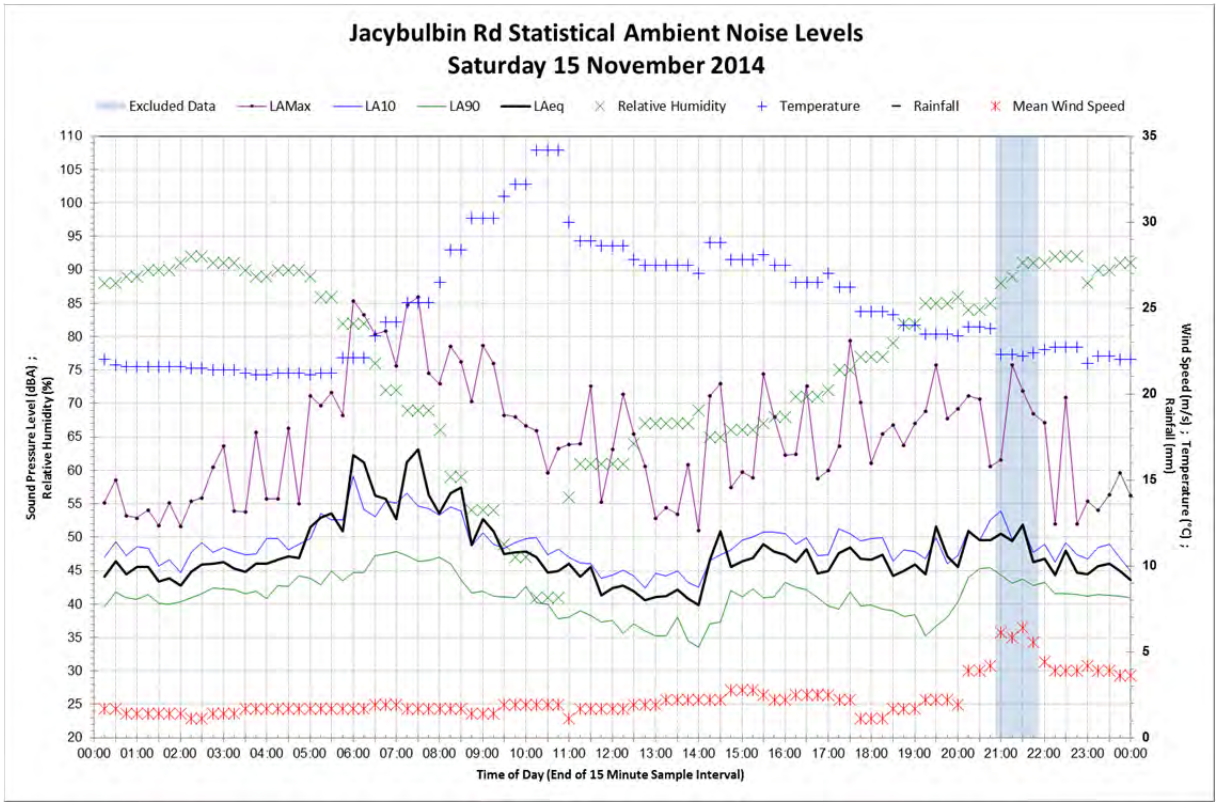
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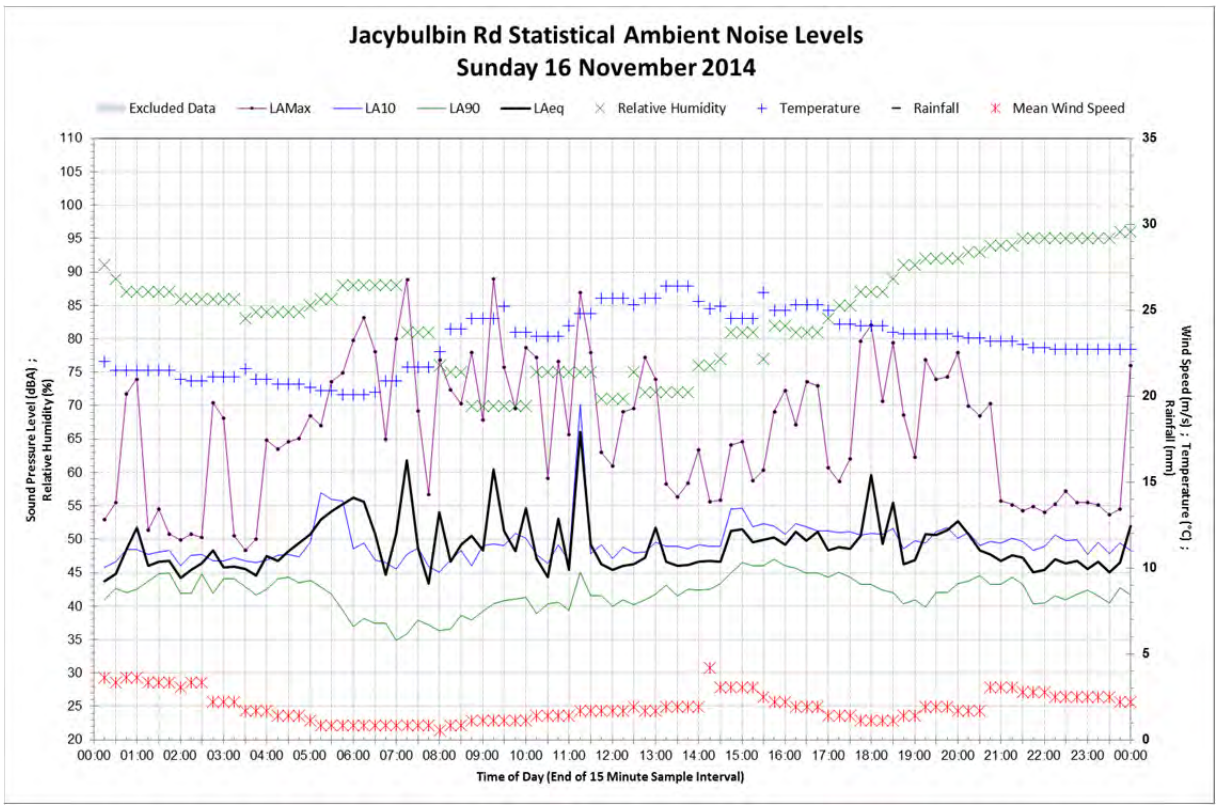
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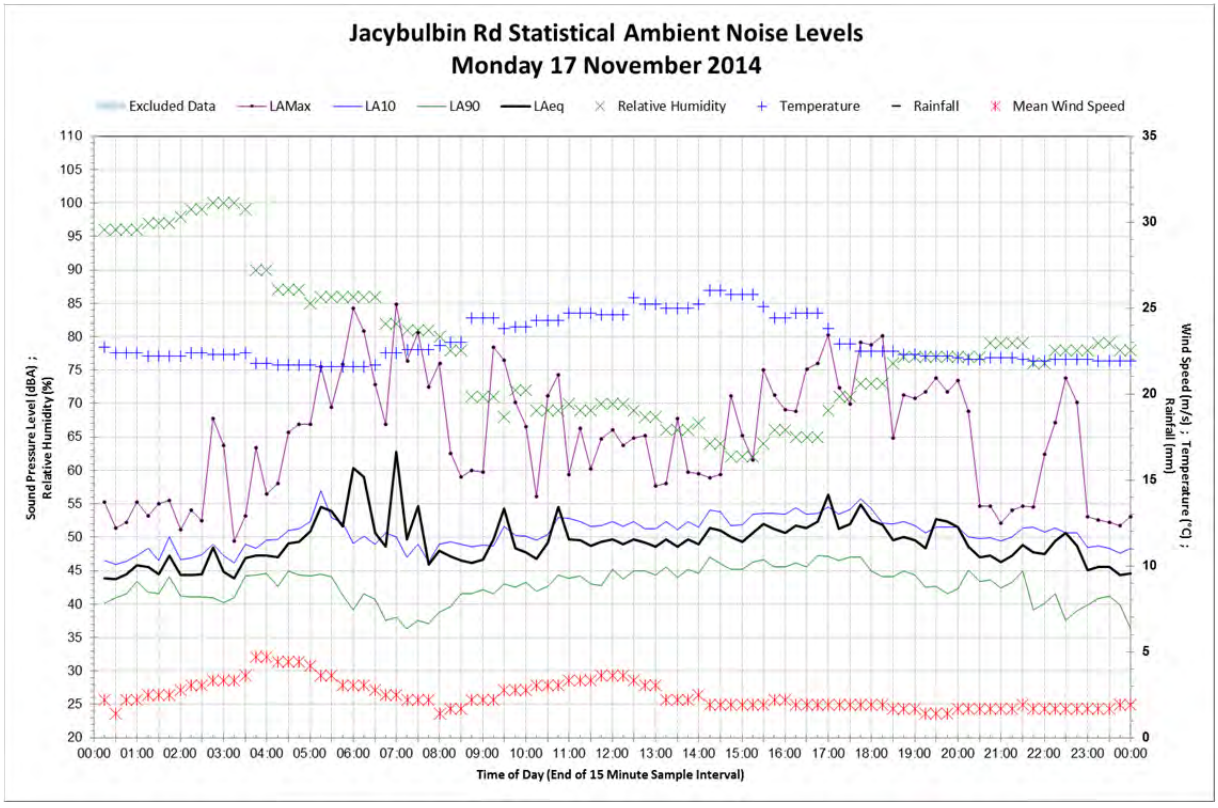
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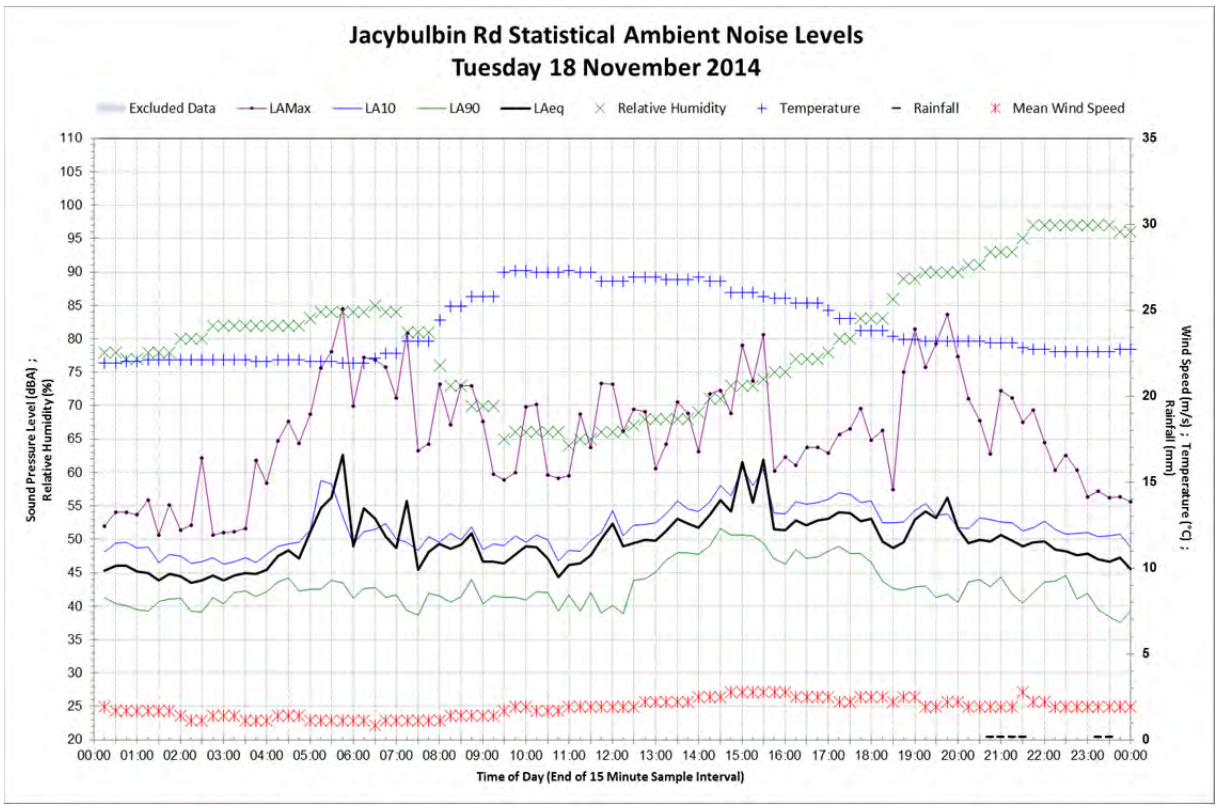
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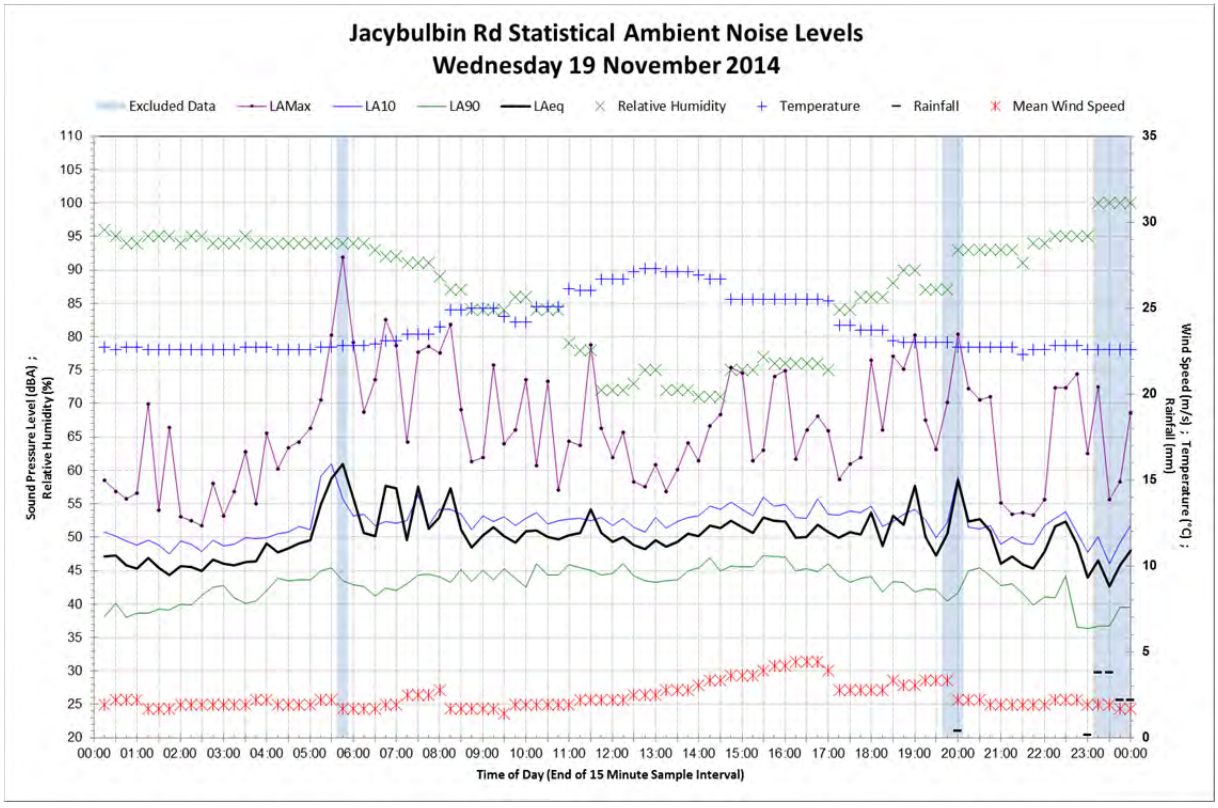
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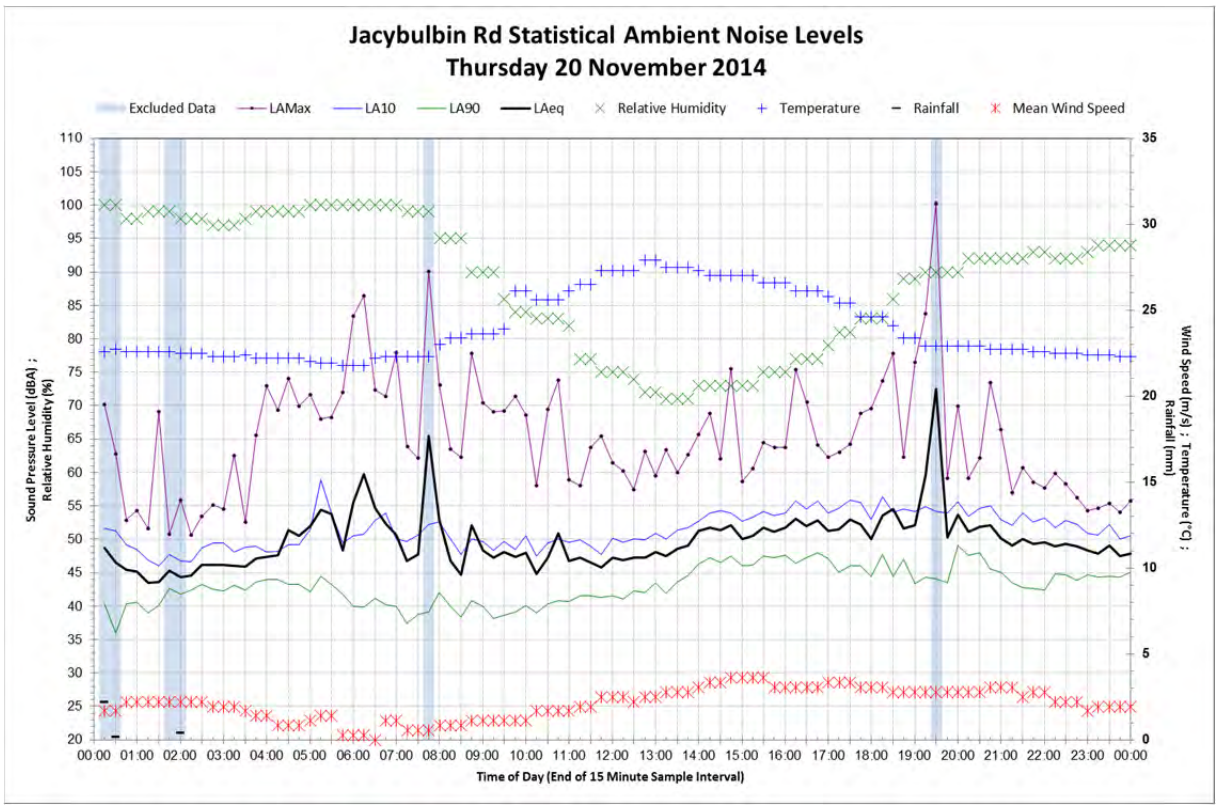
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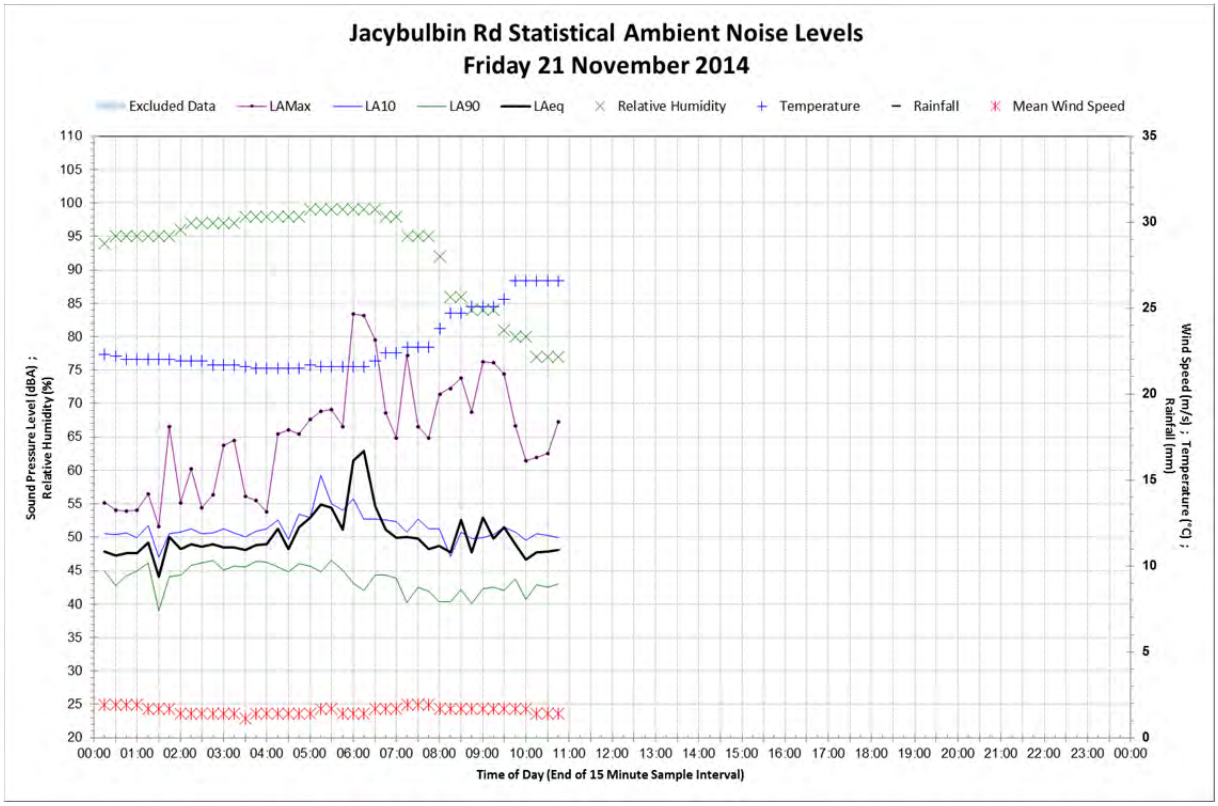
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Wind Speed (m/s) ; Temperature (°C) ; Rainfall (mm)
Time of Day (End of 15 Minute Sample Interval)

Appendix B – Proposed expansion plans

No	Revision	Note: * indicates signatures on original issue of drawing or last revision of drawing	Drawn	Job Manager	Project Director	Date

GHD
Level 8, 180 Lonsdale Street, Melbourne VIC 3000 Australia
T 61 3 8687 8000 F 61 3 8687 8111
E melmail@ghd.com.au W www.ghd.com

DO NOT SCALE

Drawn	S. Verhellen	Designer	
Drafting Check		Design Check	
Approved (Project Director)			
Date			
Scale	AS SHOWN	This Drawing must not be used for Construction unless signed as Approved	

Client	Newman Quarrying
Project	Slys Quarry
Title	Proposed Quarry Expansion
Original Size	A1
Drawing No:	22-17528-001
Rev:	

Appendix C – Contractor blast design and evaluation report

G:\22\1752803\Technical\Noise and vibration\Slys quarry blasting\Blasting sheet_contractor

G:\22\1752803\Technical\Noise and vibration\Slys quarry blasting\Blasting Contractor Monitoring Results

RON SOUTHON PTY LTD
Drilling and Blasting Contractors

PO Box 48
ALSTONVILLE NSW 2477

ABN: 81 067 549 339

Ph: 02 6628 0477
Fax: 02 6628 1756
Mobile: 0407 752 003
Email: shot2@hotkey.net.au

BLAST SUMMARY RECORD

Customer: NEWMANS QUARRY

Date: 13 / 11 / 14 Time: 1.30pm

Quarry: TULLYMORGAN Position in Quarry: MIDDLE BENCH

Weather Condition: FINE

Elect: INITIATION Nonel Delay Nos: 17's & 42's

No of Holes per Delay: 1 Mic: 116kg

Total Exp: 2600 kg P.F: 1.04 p/t

Stemming Height: 1m Stemming Material: 10mm AGGREGATE

Pattern: 2.5m X 2.5m

Hole Size: 89mm

No of Holes: 28 Sub Drill: 0.5m

Avg. Depth of Holes: 14.16m Total Lin.Metres 396.5 l/m

Measurements (m^3): 14.16m X 7.5m X 23.33m

Total CubicMetres 2477.6 m^3

Payment: Lineal ☐ Cubic ☒

Extra Cost: Wet Products: Ez Pump Emulsion

EXPLOSIVES	
Explosive Type	Total Explosives Used (kg)
Dry	Dry
Wet Ez1 Pump Emulsion	Wet 2600 kg
	Total 2600 kg
GROUND AND AIR VIBRATION	
Peak Particla Velocity (mm/s)	0.783 mm/s & 0.17 mm/s
Air Overpressure (dBL)	88 dBL & 112 dBL
Distance to Geophone (m)	

Compiled by: Nick Chilcott

Gate.

Instantel®

INSTANTEL BlastMate III

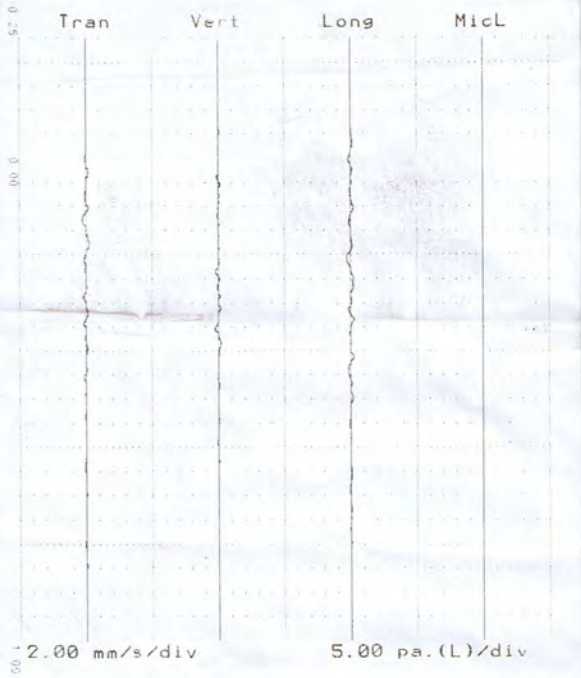
Serial Number	BA10184 V 10.20-8.17
Trigger Source	Geo 0.510 mm/s Mic 105.0 dB(L)
Geo Range	254.0 mm/s
Record Time	1.0 s at 1024 sps
newmans quarry	tullymorgan
front gate	
RON SOUTHON P/L	
General:	
Extended Notes	

Trigger Long at 12:09:07 Nov 13 14

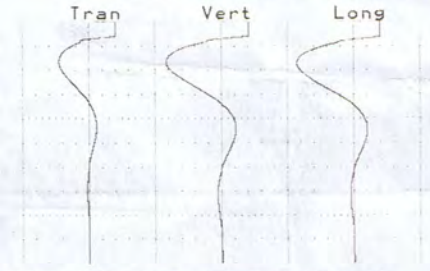
	Tran	Vert	Long	
PPV	0.635	0.635	0.635	mm/s
ZC Freq	19	27	15	Hz
Time	0.125	0.354	0.201	sec
Accel	0.0265	0.0265	0.0265	g
Pk Disp	0.00707	0.00484	0.00831	mm

PVS 0.783 mm/s at 0.211 Sec

PSPL 88.0 dB(L) at 0.352 Sec
>100 Hz



SENSORCHECK CALIBRATION



FI=7.7 OI=3.8 FV=7.5 OV=3.7
FL=7.5 OL=4.0 FM=19.7 PM=528
Tran, Vert, Long, MicL Passed
Battery Level: 6.2 Volts

Calibration Name Standards & Testing
Calibration October 21, 2014

Half Way.

INSTANTEL DS477 BLASTMATE

SERIAL # 3106 U 5.51

CLIENT newmans quarry tully morgan

LOCATION

USER

TRIG SOURCE geo or mic

TRIG LEVEL 1.97 mm/s 110 dB(L)

RECORD TIME 1 s

NOTES:

TRIGGERED mic. at 12:10:25
13 Nov. 2014

	TRAN	VERT	LONG	
PPV	0.00	0.13	0.13	mm/s
FREQ	N/A	N/A	N/A	
TIME	2	-94	-1	ms
ACCEL	0.00	0.01	0.01	g
PK DISP:	0.000	0.000	0.000	mm

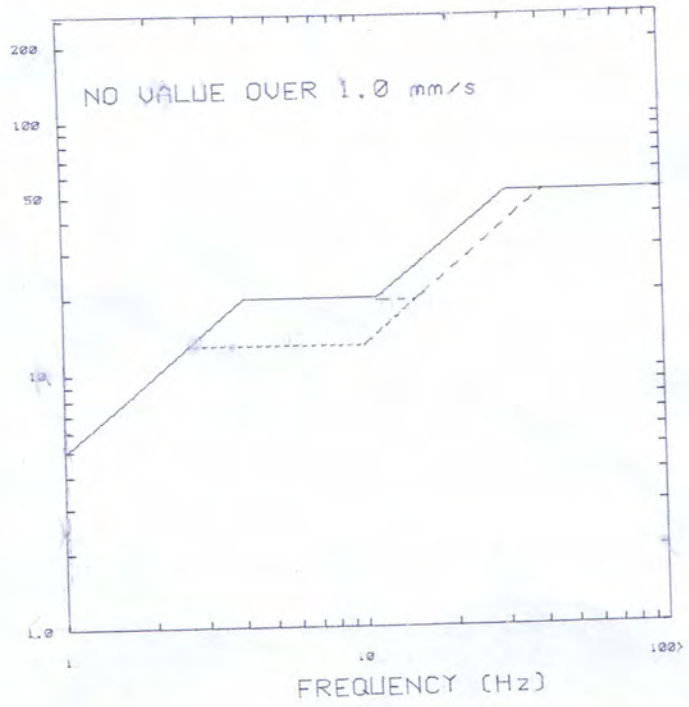
PVS 0.17 mm/s at 154 ms

PK AIR O/P 112 dB(L) at 120 ms

FREQ N/A

USBM RI8507 AND OSMRE ANALYSIS

ALL GROUND CHANNELS(mm/s)



GHD

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Document Status

Rev No.	Author	Reviewer		Approved for Issue		
		Name	Signature	Name	Signature	Date
0	A Rees	C Evenden		S Lawer		18/03/2015
1	A Rees	C Evenden		S Lawer		24/04/2015

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Appendix E Air Quality Impact Assessment

Newman Quarrying Pty Ltd

Air Quality Impact Assessment

Proposed Quarry Expansion at Lot 2 DP 1055044, Tullymorgan-Jackybulbin Road, Mororo

April 2015

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Table index

Figure index

Appendices

Glossary – Air quality

Term	Definition
km	Kilometre
PM_{10}	The fraction of suspended particulate matter with an aerodynamic diameter less than 10 μm are referred to as PM_{10}.
TSP	The term total suspended particulate (TSP) matter refers to airborne particles typically less than 50 microns (μm) in aerodynamic diameter.
US EPA	United States Environment Protection Agency
VKT	Vehicle kilometre travelled

1. Introduction

1.1 Purpose of this report

GHD Pty Ltd (GHD) was engaged by Newman Quarrying Pty Ltd (Newman Quarrying) to prepare an Air Quality Impact Assessment (AQIA) report to address the potential air quality impacts from the proposed expansion of a sandstone quarry at Lot 2 DP 1055044, Tullymorgan-Jackybulbin Road, Mororo, known as Slys Quarry.

The proposal involves the expansion of the existing sandstone quarry by 11.1 hectares and an increase in the extraction rate up to 500,000 tonnes per annum. The primary purpose of the quarry would be to supply substantial quantities of quarry materials required for current and proposed Pacific Highway works, and for supply to Clarence Valley Council (CVC) and local contractors.

It is estimated that the quarry would have an available resource of about 7 million tonnes which would allow extraction for a period of between 30 and 40 years, depending on demand.

1.2 Scope

The focus of this AQIA has been on dust, being the primary emission to air from the quarry.

The following scope of work was undertaken:

- Desktop review of site plans, aerial photographs and topographic maps to gain an understanding of the existing environment in terms of local terrain, existing/proposed operations and sensitive receptors within the study area.
- A review of available ambient air quality monitoring data to gain an understanding of existing air quality in the vicinity of the quarry.
- Determined applicable dust criteria with consideration to the *Approved Methods for the Modelling and Assessment of Air Pollutants in New South Wales (DEC, 2005)*.
- Synthesis of a site-representative meteorological data file with which to gain an understanding of the local wind climate and use as model input for conducting atmospheric dispersion modelling.
- Derived a dust emission inventory for the proposed quarry operations with which to identify significant sources of air pollution, in particular dust emissions, and estimate the emission rates for each item of equipment used on the quarry site. The primary focus of developing an emissions inventory for the site is to identify the primary sources of dust emissions in order to target dust mitigation measures. The next focus is as an input to the dispersion modelling (next dot point).
- Dust modelling using the regulatory atmospheric dispersion model Ausplume to predict the incremental dust impact from quarry operations at surrounding residences.
- Recommended targeted mitigation and management measures to reduce dust impacts from the site and, if warranted, consideration of a dust monitoring programme.

1.3 Limitations

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

GHD otherwise disclaims responsibility to any person other than Newman Quarrying Pty Ltd arising in connection with this report. GHD also excludes implied warranties and conditions, to the extent legally permissible.

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

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

The opinions, conclusions and any recommendations in this report are based on assumptions made by GHD described in this report (refer to Section 1.4). GHD disclaims liability arising from any of the assumptions being incorrect.

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

1.4 Assumptions

The following assumptions were made in this assessment:

- The equipment used on site would be limited to those assessed in this report.

1.5 Secretary's environmental assessment requirements

1.5.1 Overview

Approval under Partn 4.1 of the *Environmental Planning and Assessment Act 1979* (the EP&A Act) is being sought for the project.

The Secretary's environmental assessment requirements (SEARs) for the project were issued on 21 August 2014. The SEARs have informed the preparation of the air quality impact statement for the project. The SEARs include a requirement biodiversity impact assessment to address the following:

- Including an assessment of the likely air quality impacts of the development in accordance with the Approved Methods for the Modelling and Assessment of Air Pollutants in NSW.

Table 1-1 outlines where the requirements of the SEARs that have been addressed within this report.

Table 1-1 Secretary's environmental assessment requirements

SEAR reference (Clarence Council recommendation)	Report section
Air quality – dust emissions	Section 7

2. Existing environment

2.1 Site location

The existing quarry is located off Tullymorgan-Jackybulbin Road, Mororo, approximately 17 km north of Maclean. The quarry is located 1.5 km west of the Pacific Highway. The site is surrounded by bushland.

2.2 Sensitive receivers

There are few sensitive receivers in the vicinity of the quarry. The nearest residences are located approximately 1.5 km from the quarry boundary.

Sensitive receivers identified in the vicinity of the site are detailed in Table 2-1.

Figure 1 shows a site aerial image and the location of identified isolated rural residence sensitive receivers. These receivers have been identified to represent those with the greatest potential for adverse dust impact (viz. any receptors in the same general direction but further away have a lesser impact).

Table 2-1 Identified sensitive receivers

Receiver	Receiver type	Approximate distance to nearest activity (m)
R1	Residential	1600
R2	Residential	1700
R3	Residential	1500
R4	Residential	2600
R5	Residential	2700
R6	Residential	2800
R7	Residential	3200
R8	Residential	3600
R9	Residential	3300
R10	Residential	3500
R11	Residential	3000

2.2.1 Potential future sensitive receptors

This assessment has considered existing sensitive receivers only. GHD is not aware of plans for future development in the area, however, acknowledges that future development may occur. The potential for air quality impacts on future development in the area would need to be assessed on a case-by-case basis.

Section 7.6 provides further discussion around potential impacts on future sensitive receivers.

2.1 Ambient air quality

The NSW OEH operates ambient air quality monitoring stations in selected areas around NSW, however they do not have a station in proximity of the quarry. The closest air quality data to the region is in Tamworth or the Lower Hunter regions. These sites are subjected to additional industrial and urban sources compared to a rural location. In view of this, an ambient level of PM_{10} of 15 $\mu g/m^3$ has been assumed for rural coastal NSW areas away from the drier inland, industrial sources and urbanised environments.

GHD are not aware of any complaints regarding dust emissions from current quarry operations.

Figure 1 Site location and identified sensitive receptors

2.2 Local meteorology

The transport and dispersion of the air emissions from the quarry would be influenced by prevailing synoptic flows and vertical temperature profiles that would alter both diurnally and with wind direction.

The characterisation of local wind patterns requires accurate site-representative hourly recordings of wind direction and speed over a period of at least a year. When considering the most representative dataset to the site location, there is a substantial distance as well as intervening terrain changes from the site to the nearest meteorological observation data station at Yamba Pilot Station (BOM Station ID 058012), at 22 kilometres south west of the site and on the coast. Given that Yamba Pilot Station is heavily influenced by its exposed coastal location and the distance between the two sites, such a dataset could not be used. In order to have a representative dataset of wind conditions at the quarry, a synthetic meteorological data set was considered to be the best way to obtain site representative data. A 12-month dataset was constructed using the 3D prognostic modelling package TAPM and the diagnostic 3D meteorological model CALMET for the year 2012. This dataset was used in this investigation.

Appendix A provides further details on the methodology used to determine the site-representative meteorological data.

2.2.1 Wind patterns

The local meteorology largely determines the pattern of off-site dust impact on receptors (such as residential housing, even in rural settings with isolated dwellings on acreage). The effect of wind on dust dispersion patterns can be examined using the wind and stability class distributions at the site from the dataset that is produced by CALMET. The winds at a site are most readily displayed by means of wind rose and stability rose plots, giving the distribution of winds and the wind speeds from these directions as well as the distribution of the stability classes.

The features of particular interest in this assessment are:

- The dominant wind directions;
- Some isolated instances of persistent moderate to strong winds (creating a dust emission) that are from a wind sector for most hours of any given day; and
- The relative incidence of stable light wind conditions that yield minimal mixing.

The latter defines peak impacts from ground-based sources.

Annual and season variation in wind

The annual average wind rose for the entire data period of August 2012 to July 2013 is shown in Figure 2 along with the seasonal wind roses after the CALMET corrections to the TAPM initial wind field. This indicates that for the specific location of the quarry, the winds on an annual basis are mostly from the west-south-west and east. This is due to distinct seasonal patterns in summer where coastal winds bring in a high proportion of easterlies while in winter cool-air drainage off the slopes to the west and pre- and post-frontal westerly winds funnels the western component of the winds arriving from the north-west and south-west sectors. Due to the location of the site in a valley and surrounded by bushland (the latter exerting a drag on wind flows), both the summer coastal winds and winter drainage flows consist mostly of light winds. The lightest winds, indicated by grey shading in the wind rose, are common from all directions with the favourability of the easterly summer winds and west-southwesterly winter flows.

The transition seasons of autumn and spring have the same general pattern as the annual pattern, with less dominant ocean winds and drainage flows still making up dominant wind directions. Autumn also has a distinctive south to southeasterly component.

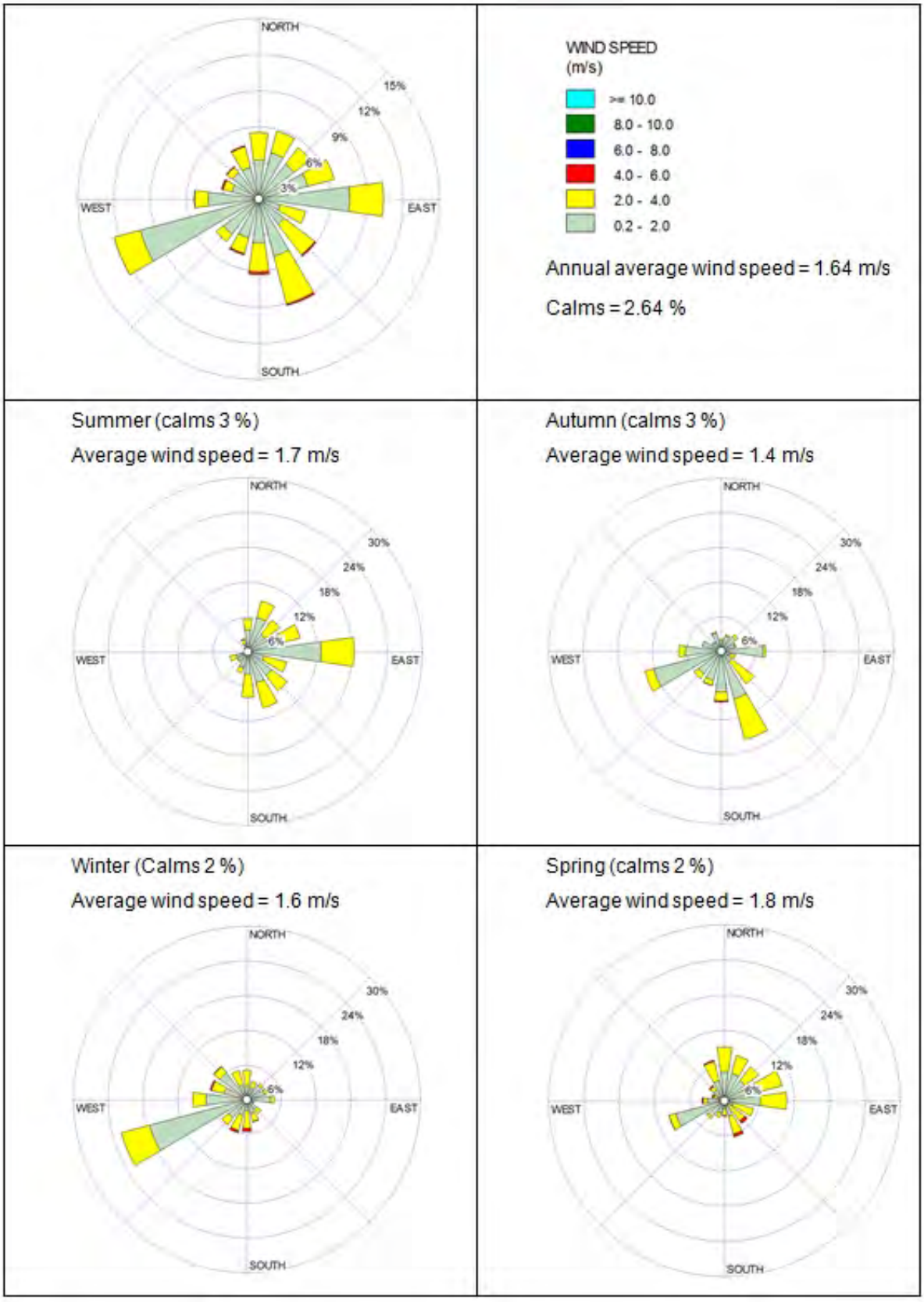

Figure 2 CALMET predicted annual and seasonal variability wind roses, Mororo

2.3 Patterns of atmospheric stability

Atmospheric stability substantially affects the capacity of a pollutant such as particulate matter, to disperse into the surrounding atmosphere upon discharge and is a measure of the turbulent energy in the atmosphere. For a quarry, particulate emissions will have greatest impact downwind during stable conditions, reducing to a minimum impact during unstable conditions.

There are six Pasquill–Gifford classes (A-F) used to describe atmospheric stability and these classes are grouped into three general stability categories; stable (classes E-F), neutral (class D), and unstable (classes A-C). The climate parameters of wind speed, cloud cover and solar insolation are used to define the stability category, and as these parameters vary diurnally, there is a corresponding variation in the occurrence of each stability category. Stability is most readily displayed by means of a stability rose plot, giving the frequency of winds from different directions for various stability classes A to F.

Figure 3 shows the frequency of stability class for all hours of the 12 month dataset from August 2012 to July 2013 from the model generated dataset and Figure 4 shows the stability rose for the entire data period. Noting that a neutral atmosphere (D) is usually the dominant stability state of the atmosphere, due to the high frequency of light winds in this dataset, D stability only occurs about 5% per cent of the time. Stable atmospheres (E and F class stabilities) occur about 48.4 per cent of the time and are predicted to be the most frequent at the site, with stability class F contributing most of these stable flows. Figure 4 shows that stable winds (annually) are dominant from all directions, and due to the highest frequency of winds from the east (in summer) and west-southwest (in winter) most of these stable flows occur from these directions.

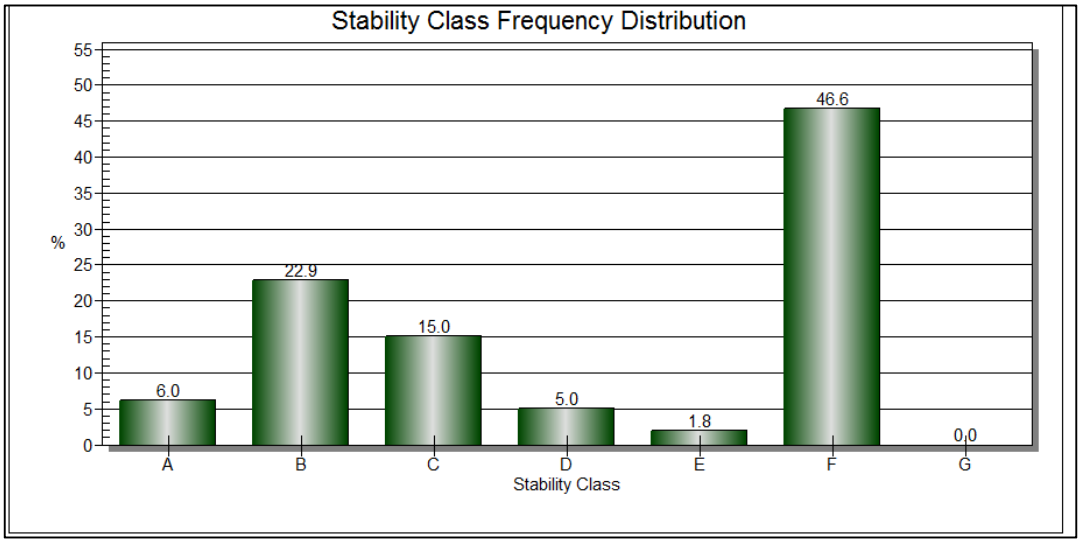

Figure 3 CALMET predicted annual stability frequency

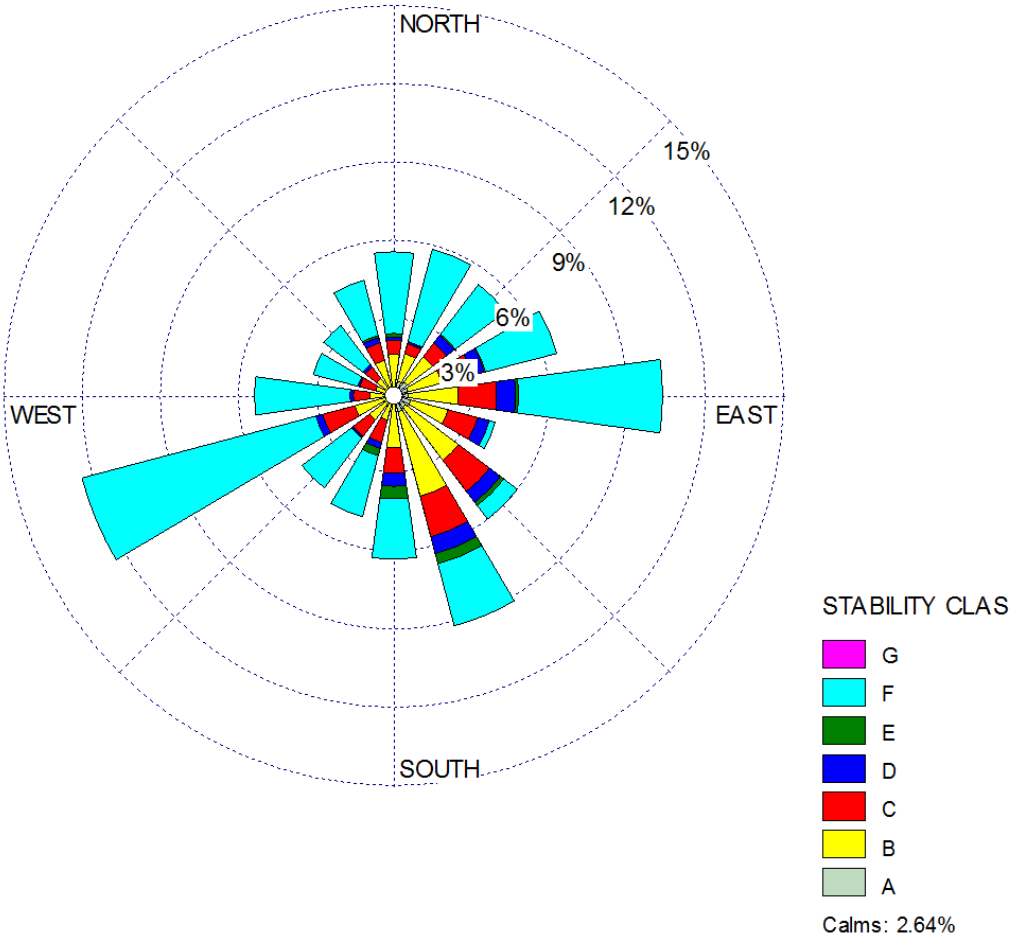

Figure 4 CALMET predicted annual stability rose

3. Dust impact assessment criteria

Air quality impact assessment criteria are prescribed within the NSW OEH *Approved Methods*.

To ensure the environmental outcomes are achieved, dust emissions from a premise must be assessed against the assessment criteria given in Table 3-1.

Table 3-1 Dust assessment criteria

Pollutant	Averaging period	Criterion
PM_{10}	24 hours	50 μg/m^3
	Annual	30 μg/m^3
TSP	Annual	90 μg/m^3
Dust deposition (insoluble fraction)	Annual	2 g/m^2/month*

** Maximum Increment. Maximum allowable cumulative impact of 4 g/m^2/month.*

The above criteria are provided as cumulative (incremental plus background) concentration levels.

4. Project description

4.1 Proposed site operations

The proposal is for the expansion of the existing quarry to extract a maximum of 500,000 tonnes per annum (tpa). The existing quarry is shown in Figure 5.

Figure 5 Typical quarry crushing operations and existing pit area

The site currently has a partially formed quarry wall and pit working area. The current floor of the quarry is approximately 44 m Australian Height Datum (AHD) with a second level to the east at approximately 58 m AHD. The centre of the existing quarry has active faces to the north, east and west, as shown in Figure 5.

Proposed quarry operations would be carried out in three stages and in response to demand. The extraction is proposed to move north and east initially, to the extent of the currently approved quarry. The eastern extent of the excavation would remain 10 m from the road reserve located along the eastern boundary. The excavation would be to the current floor level of 44 m AHD. Proposed expansion plans are shown in Appendix B.

Stage 1 would cover an area of 6.9 hectares and extract approximately 2.3 million tonnes.

Stage 2 would involve expanding the quarry to the north and south and to a depth of 44 m AHD. This would expand the quarry by 5.7 hectares and involve the extraction of approximately 2.8 million tonnes of material.

Stage 3 would be the final stage and would expand the quarry further north and south. Stage 3 would involve an expansion of 5.4 hectares to a depth of 44 m AHD. This would involve extracting approximately 1.8 million tonnes of material.

Material extraction would typically be undertaken using an excavator. Blasting would be undertaken on a periodic basis depending upon demand for the resource and when manual extraction becomes too difficult or dangerous.

Extracted material would then be crushed, screened and where necessary blended with other materials from the quarry, or material imported to the quarry. The materials would be stockpiled on the quarry floor in numbered stockpiles of approximately 4,000 tonnes each. This material would be loaded onto trucks as required for transportation off-site.

All material processing, size reduction and screening into different grades, would occur on-site unless requested otherwise.

The proposed sequence of operations for each stage would generally be:

- Establish the sediment and erosion control measures and other environmental safeguards.
- Clearing vegetation, if necessary. The bulk of cleared vegetative wastes would be piled in a suitable location, clear of adjacent vegetated areas and mulched for future revegetation works.
- Topsoil would be stripped, stockpiled and protected against erosion for use in revegetation works.
- Excavation of the weathered rock material, where possible, the deeper layers would be excavated in a similar manner but would also include blasting. Blasting is anticipated to be carried out at a frequency of between two blasts per month to one blast per year, depending on demand and the material encountered. The blasting would be undertaken by a specialist contractor in accordance with regulatory requirements. Drilling would be required as part of blasting operations to allow for down-hole placement of explosives.
- Rock hammering may be required to break large rocks.
- The rock is collected by an excavator and feed into a jaw crusher. The crusher produces an output of various sizes of fill or aggregate which are separated by a screening machine into various piles based on size. Sand is also produced in this process. The crusher and screener are moved around the quarry floor as necessary to be close to the quarry face and accumulated, excavated stone material.
- Loading of the material directly from the stockpile onto trucks for removal from site.
- The excavation continues, as described above, within each stage until it reaches the ultimate depth of 44 m AHD. During the excavation, 10 m high by 10 m wide benches are established at the quarry face.
- Once the extraction is complete, topsoil would be respread on the disturbed areas and revegetated, where possible.

4.2 Extraction rate

To service the demand from the Pacific Highway upgrade works it may be necessary to extract and process up to 500,000 tpa, although this rate of extraction is expected to be uncommon. It is more likely that the annual extraction rate during the upgrade of the Pacific Highway would be around 250,000 to 300,000 tpa. After the Highway upgrade is complete, the annual extraction rate is anticipated to reduce to about 100,000 to 150,000 tpa.

Based on the assessment of the underpinning demand, and allowing for downtime from wet weather etc (about 40%), it is realistic to project a maximum daily extraction and haul rate of about 4,000 tonnes with an average daily win and haul of about 1,500 tonnes. At the other extreme, there will be periods when no materials are extracted or transported from the site. The average daily win and haul rate would reduce significantly following the completion of the highway upgrade.

4.3 Hours of operation

The hours of operation would depend on demand with some periods of high activity and other times when activity is limited to the occasional loading of haulage trucks. The proposed hours of operation are:

- Weekdays – 6:30 am - 6.00 pm.
- Saturdays – 6:30 am - 4.00 pm.
- Sundays and public holidays - No work.

Excavation, crushing or loading would not commence until after 7:00 am. Blasting, on an ad-hoc basis, would only occur on weekdays between the hours of 10:00 am and 4:00 pm.

4.4 Quarry equipment

Table 4-1 lists the plant and equipment that would operate on site.

Table 4-1 Quarry equipment

Type	Typical make/model	Approximate number	Typical frequency of use	Description
Excavators	Komatsu PC350 – 8	2	12- 40 hrs/ week	Excavating material and stockpiling. Clearing and grubbing of vegetation and stripping of topsoil.
	Komatsu PC710-5	1		
Front-end Loader	Komatsu WA400-3	1	10 hrs/week	Loading material onto the haul trucks and stockpiling material within the pit floor.
	Komatsu WA470-3	1	30 hrs/week	
	Kawazaki 90ZV	1	45 hrs/week	
Crusher	McCloskey J50	1	20 – 40 hrs/ week	Crushing rock main jaw crusher. Crushing rock spare jaw crusher.
	Komatsu BR380JG-1	1		
Screen	Sandvik GE440	1	20 – 40 hrs/ week	Only for aggregate/gravel production and overburden screening.
	Sandvik GA340	1		
Haul Trucks	Truck and dog Contractors	Up to 125/day	Up to 125/day	Delivery of materials to customers and stockpiling in pit if needed and carting unsuitable to rehabilitation areas.
Water Cart	Isuzu	1	10 hrs/week	To water haul roads and stockpiles.
Water Pump	Honda	3	10 hrs/week	To dewater excavation/basin and to fill water cart from standpipe. To water stockpiles and put moisture in products.
Generator	Cummins	1	5 hrs/week	Provide electricity to wash plant and dam pump. Provide power to weighbridge and fuel pump.
	Able	1	9 hrs/day	
Hand tools	Various	5	2 hrs/week	General activities maintaining plant.

It is anticipated that not all of the equipment listed above would be operational on-site at any one time.

4.1 Access and traffic generation

The majority of traffic to and from the quarry would access the site from the Pacific Highway and Tullymorgan-Jackybulbin Road via an existing, formed gravel access road that runs to the quarry pit. The layout of the quarry provides a loop that allows trucks and machinery to enter the quarry, load and exit, all while travelling in a forward direction.

Less than 10 deliveries per year would be to the west of the quarry along Tullymorgan-Jackybulbin Road.

Truck and dog trailer combinations have a capacity of about 32 tonnes. At an average daily production, which would generate a win and haul rate of approximately 1,500 tonnes per day, the quarry is expected to generate about 50 truck and dog loads (100 movements) per day. At its peak, the quarry is expected to win and haul about 4,000 tonnes per day which would require about 125 truck and dog loads (250 truck movements) per day. At other times there would be periods when no trucks would be generated by the quarry.

The quarry workforce is expected to generate about 24 light vehicle movements per day.

5. Emissions inventory

5.1 Dust emissions

This air quality assessment focuses on dust, this being the primary emission to air from the quarry with potential for off-site impact. The particulate matter fractions of interest assessed in this report are airborne concentrations of Total Suspended Particulate (TSP) and fine particulate matter (PM_{10}) as well as total deposited dust.

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

- Rock quarrying e.g. occasional blasting, excavation and bulldozing.
- Material processing and handling e.g. crushing, screening and loading.
- Vehicle induced dust emissions in pit area and haul road.
- Wind erosion of exposed unstable soil surfaces and localised stockpiles.

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[1]. The techniques used to estimate emissions from mining operations are based primarily on activity rate (e.g. tonnes per hour). The United States Environment Protection Agency Emission Factors and AP-42, *Compilation of Air Pollution Emission Factors* (AP-42) were also utilised, particularly for rock crushing, where they were deemed to be more applicable than the NPI emission factors, which are based on more general mining operations (involving coal and topsoil).

The proposed maximum material throughput of up to 4,000 tonnes per day equates, on average, to approximately 364 tonnes per hour (tph) over an 11 hour day. Although it is not expected that the quarry would operate at 364 tph consistently, this production rate has been chosen to represent a worst-case scenario to derive emission rates. A more average production rate has also been modelled based on an annual production of 300,000 tonnes, equating to approximately 1,500 tonnes per day or 136 tph.

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

- Truck and dog trailer combinations have a capacity of 32 tonnes. At the peak production rate of 4,000 tonnes per day, this equates to approximately 125 truckloads per day. As each haul truck would enter and exit the site, this equates to a maximum of 250 haul truck movements per day. Each haul truck was assumed to travel 1200 m each way to enter and leave the quarry from Tullymorgan-Jackybulbin Road. At the average production rate of 1,500 tonnes per day, 50 truckloads would be required per day.
- The use of a water truck has been assumed not to generate dust emissions, as its use would act to suppress emissions. Therefore, the water truck has not been included in the emissions inventory.
- It was assumed that 100% of rock was processed to primary standard (i.e. 364 tph at peak production input to the crusher) and two-thirds of this rock was then processed to secondary standard (i.e. 242 tph at peak production). There would be no tertiary crushing on site.

[1] National Pollutant Inventory (NPI) Emission Estimation Technique Manual for Mining, Version 3.1.

- Conservatively, control factors for pit retention have not been applied (5% for PM_{10} and 50% for TSP).
- GHD has conservatively assumed that the entire quarry pit area consists of unconsolidated areas. Therefore, wind erosion was modelled as acting over the entire pit area of 400 x 400 m.
- Ad-hoc blasting activities would be an infrequent event at the proposed quarries and as a result have not been included in the dispersion modelling assessment. Further discussion on dust impacts from blasting events can be found in Section 7.4.

Table 5-1 and Table 5-2 summarise the emission factors adopted and calculated emission rates for each item of equipment and activity within the quarry. Emission calculations have been supplied for:

- Peak production rate of 364 tph.
- Average production rate of 136 tph.

Table 5-1 Dust emission inventory – peak production 364 tph

Equipment	TSP Emission Factor	PM_{10} Emission Factor	Unit	Application / assumptions	Estimate of TSP Emission Rate (kg/hr)		Estimate of PM_{10} Emission Rate (kg/hr)	
					No controls	With controls	No controls	With controls
Excavator	0.00097	0.00046	kg/t	3 excavators, each handling 364 tph. Loading material into crushing plant. No control. ER per excavator.	0.35	0.35	0.17	0.17
Loader(3)	0.00097	0.00046	kg/t	1 loader, handling 364 tph. Loading material into haul trucks. 50% control applied when water sprays are used on crushers and stockpiles are watered (4).	0.35	0.18	0.17	0.08
Crusher – Primary	0.0167	0.00605	kg/t	364 tph. Controls applied for water sprays: • EF(TSP) = 0.00177 • EF(PM_{10}) = 0.000663	6.07	0.64	2.20	0.24
Crusher – Secondary	0.0167	0.00605	kg/t	2/3 of product crushed to secondary. Therefore, 242 tonne per hour crushed to secondary. Control for watering as per Primary crusher.	4.05	0.43	1.47	0.16
Haul trucks	3.17	0.85	kg/VKT(5)	Maximum 125 trucks per day (250 movements). Haul route 650 metres. Equals 162.5 km per day total travel. • 75% controls for Level 2 watering (>2 Litre/m^2/hr)	43.2	10.81	11.6	2.90
Wind erosion	See Section 6.2.2							

(1) A soil silt content of 6.2% and moisture content of 2% was used to calculate emission rates. GHD considers these values to be more appropriate for hard rock quarries rather than the default NPI values of 10% and 2%, respectively. Reference: MARICOPA COUNTY AIR POLLUTION CONTROL REGULATIONS: REGULATION II – PERMITS AND FEES, RULE 242, EMISSION OFFSETS GENERATED BY THE VOLUNTARY PAVING OF UNPAVED ROADS 2007.

(2) Crushing plant emissions include emissions from the screens, the crushers, the surge bin, the feeder and the conveyor belt that are integral to the crushing process.

(3) Loader processes include wheel generated dust emissions and fugitive emissions from loading of material into trucks.

(4) A 50% control factor applied when wet suppression used on crushers. Moisture carry over would mean that processed material in stockpiles would also have higher moisture content. Stockpiles may also be watered.

(5) VKT: Vehicle Kilometres Travelled.

Table 5-2 Dust emission inventory – average production 136 tph

Equipment	TSP Emission Factor	PM_{10} Emission Factor	Unit	Application / assumptions	Estimate of TSP Emission Rate (kg/hr)		Estimate of PM_{10} Emission Rate (kg/hr)	
					No controls	With controls	No controls	With controls
Excavator	0.00097	0.00046	kg/t	3 excavators, each handling 364 tph. Loading material into crushing plant. No control. ER per excavator.	0.13	0.13	0.06	0.06
Loader(3)	0.00097	0.00046	kg/t	1 loader, handling 364 tph. Loading material into haul trucks. 50% control applied when water sprays are used on crushers and stockpiles are watered (4).	0.13	0.07	0.06	0.03
Crusher – Primary	0.0167	0.00605	kg/t	364 tph. Controls applied for water sprays: • EF(TSP) = 0.00177 • EF(PM_{10}) = 0.000663	2.28	0.24	0.83	0.09
Crusher – Secondary	0.0167	0.00605	kg/t	2/3 of product crushed to secondary. Therefore, 242 tonne per hour crushed to secondary. Control for watering as per Primary crusher.	1.52	0.16	0.55	0.06
Haul trucks	3.17	0.85	kg/VKT(5)	Maximum 125 trucks per day (250 movements). Haul route 650 metres. Equals 162.5 km per day total travel. • 75% controls for Level 2 watering (>2 Litre/m^2/hr)	16.2	4.05	4.35	1.09
Wind erosion	See Section 6.2.2							

(1) A soil silt content of 6.2% and moisture content of 2% was used to calculate emission rates. GHD considers these values to be more appropriate for hard rock quarries rather than the default NPI values of 10% and 2%, respectively. Reference: MARICOPA COUNTY AIR POLLUTION CONTROL REGULATIONS: REGULATION II – PERMITS AND FEES, RULE 242, EMISSION OFFSETS GENERATED BY THE VOLUNTARY PAVING OF UNPAVED ROADS 2007.

(2) Crushing plant emissions include emissions from the screens, the crushers, the surge bin, the feeder and the conveyor belt that are integral to the crushing process.

(3) Loader processes include wheel generated dust emissions and fugitive emissions from loading of material into trucks.

(4) A 50% control factor applied when wet suppression used on crushers. Moisture carry over would mean that processed material in stockpiles would also have higher moisture content. Stockpiles may also be watered.

(5) VKT: Vehicle Kilometres Travelled.

Figure 6 and Figure 7 show the breakdown of emission sources from quarry activities with and without controls such as water sprays. Emissions are based on peak production rate of 364 tph. It can be seen that haul trucks generate the largest portion of dust emissions.

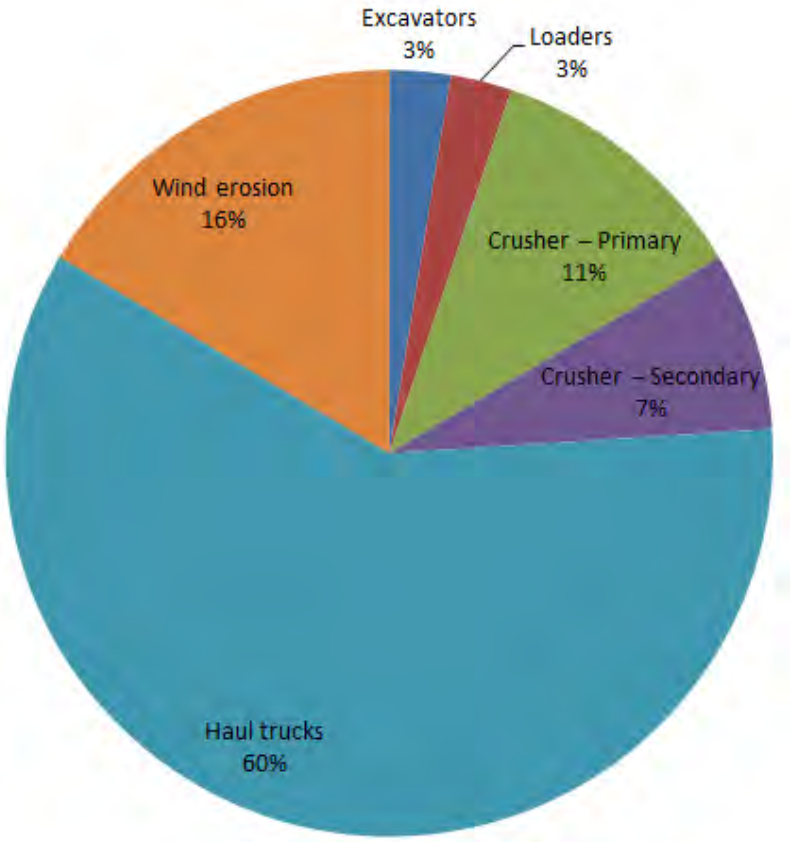

Figure 6 Breakdown of PM_{10} emissions – no controls

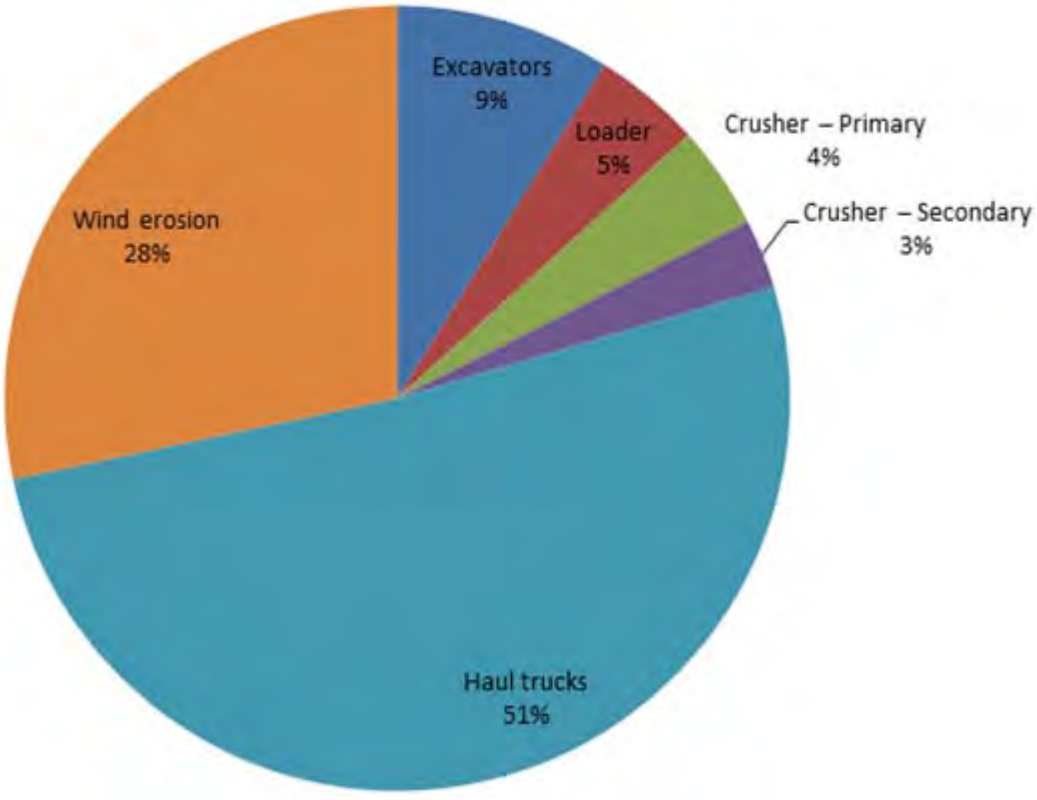

Figure 7 Breakdown of PM_{10} emissions – with controls

Table 5-3 gives a technical summary of the source characteristics used as input to the dispersion model.

Table 5-3 Source characteristics

Source	Horizontal spread (m)	Vertical spread (m)	Source height (m)
Crusher/screen	5	3	0
Loader	5	2	0
Excavator	5	3	0
Haul trucks	10	3	0
Wind erosion	150	1	0

5.2 Emissions other than dust

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

6. Impact assessment methodology

Atmospheric dispersion modelling was conducted to predict the maximum ground level concentrations (GLC) of dust (TSP and PM_{10}) resulting from emissions to air from the quarry. Dust deposition rates were also predicted. The predicted GLC's and dust deposition rates were then assessed against the relevant criteria.

Dispersion modelling of emissions to air requires the selection of an appropriate model and then the selection of three general types of input. These are:

- Hourly site-specific or site-representative meteorological data for a period of not less than one year. The meteorological data file used in this assessment is discussed in Section 2.2.
- Source characterisation (which includes emission rate inventory and source geometry – see section 5.1).
- Model configuration – in which the various model settings are selected to best characterise the physical processes specific to this site and to make best use of the available emissions and meteorological data.

The source characterisation and model configuration are detailed below under relevant section headings.

6.1 The model

Ausplume version 6.0 is a regulatory approved dispersion model and was used in this assessment. Using the *Approved Methods* guidance, the terrain is not considered too complex for the model assumptions as all sources are ground-based volume and area sources, rather than point sources.

6.2 Source characterisation

6.2.1 Mobile and fixed plant

Processing and mobile equipment, such as the crushers (with associated screens and conveyors etc.), loaders and excavators have been modelled as individual 'volume' sources using the corresponding emission rates and characteristics presented in Table 5-1, and Table 5-3.

The movement of haul trucks along the access road has been represented by a series of volume sources (with elongated rectangles as their base), evenly spaced along the access road length. Emission rates have been split evenly between each volume source along the haul road.

6.2.2 Wind erosion

Wind erosion was modelled as an area source over the surface area of the quarry pit area with dust emission rates set in for each wind speed category proportional to the wind speed cubed as shown in Table 6-1. This then provides the NPI default emission factor of 0.4 kg/ha/hour for TSP and 0.2 kg/ha/hour for PM_{10} averaged across the whole year.

Table 6-1 Wind erosion dust emission rates proportional to wind speed

Wind speed category (m/s)	Specific TSP emission rate (kg/hr/m^2)	Specific PM_{10} emission rate (kg/hr/m^2)
> 10.80	0.00024	0.00012
8.24 > 10.80	0.00012	0.00006
5.15 > 8.23	0.000041	0.000021
3.10 > 5.14	0.000010	0.000005
1.55 > 3.09	0.0000021	0.0000011
0 > 1.54	0	0

6.2.3 Dust deposition

Dust deposition parameters, where the model requires a particle size distribution, have been set[2] as provided in Table 6-2. This provides a roughly 50/50 split for PM_{10} as a fraction of TSP.

Table 6-2 Dust deposition parameters

Fraction No.	Mass fraction	Particle size (micron)	Particle density (g/cm^3)
1	0.052	1.8	2.6
2	0.140	4.0	2.6
3	0.223	8.0	2.6
4	0.322	17.0	2.6
5	0.263	31.0	2.6

6.2.4 Model configuration

The dispersion model was run based on the maximum production rate of 364 tph and the more likely production rate of 136 tph. Dust impacts have been predicted with and without controls, as detailed in Table 5-1 and Table 5-2. Annual average impacts for TSP and dust deposition have been conservatively modelled based on the peak production rate of 364 tph.

Key components of the Ausplume model configuration used in this assessment are as follows:

- Ground level concentrations (GLC) were predicted over an 8 km by 5 km receptor grid, with a grid resolution of 50 m.
- As a conservative measure, dry depletion was not selected for PM_{10} model runs. Dry depletion was included in the TSP and dust deposition model runs.
- The 'Rural' options for the Irwin wind profile exponents were used.
- Horizontal dispersion was parameterised according to equations for the Pasquill-Gifford curves.
- A roughness height of 0.8 m ('Forest') was used to represent the bushland that surrounds the site.

Further detail on the Ausplume configuration can be found in the sample Ausplume output file attached in Appendix C.

[2] Based on data provided in the NSW Minerals Council Technical Paper: Particulate Matter and Mining Interim Report, 2000.

7. Impact assessment

An analysis of the predicted results from dispersion modelling is presented below.

Maximum predicted ground level concentrations and deposition rates at each of the identified receptors have been predicted and added to the adopted background levels to determine the cumulative impact, which can then be compared against the NSW assessment criteria.

In addition to the conservative approach taken in the dispersion modelling, it is acknowledged that tall, thick vegetation surrounds the site in all directions. This would assist to dampen wind speeds (the meteorological models used do account substantially to this 'drag' on the wind speeds) and filter airborne dust as it travels from the site. These conditions cannot be fully represented in the dispersion model and therefore adds a level of conservatism to model predictions.

7.1 PM_{10} impacts

The 24-hour average impacts for PM_{10} have been predicted at each of the identified receptors. As discussed in Section 2.2.1, an ambient PM_{10} concentration of 15 $\mu g/m^3$ has been adopted as the background level. Therefore, with the aim of meeting the criterion of 50 $\mu g/m^3$, the incremental impact must be 35 $\mu g/m^3$ or less at receptor locations.

Table 7-1 displays the predicted 24-hour average PM_{10} concentrations at each receptor – highest one-day event in the year. Predicted results indicate compliance with the 24-hour average PM_{10} criterion at all receptors for both average and peak production rates.

Table 7-1 Predicted PM_{10} 24-hour average ground level concentration ($\mu g/m^3$)

Receiver	Cumulative criterion	Adopted background	Adopted incremental impact criterion	Peak production rate		Average production rate	
				No controls	With controls	No controls	With controls
R1	50	15	35	10	2	4	1
R2				10	3	4	1
R3				6	2	2	<1
R4				5	1	2	<1
R5				5	1	2	<1
R6				3	1	1	<1
R7				4	1	1	<1
R8				5	1	2	<1
R9				5	1	2	<1
R10				3	1	1	<1
R11				4	1	2	<1

PM_{10} concentration levels over an annual average are well below the adopted criterion.

Figure 8 and Figure 9 shows the maximum predicted ground level concentration contours for quarry operations at peak production of 364 tph with and without dust control measures.

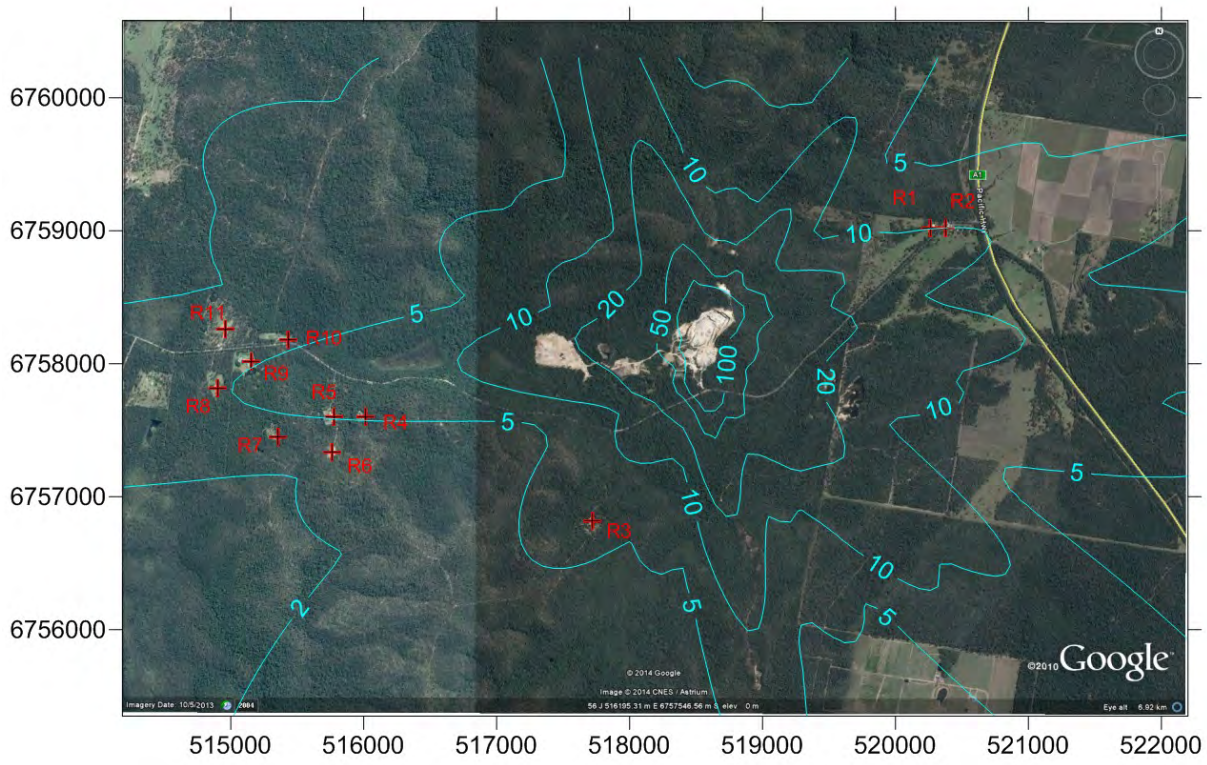

Figure 8 PM_{10} 24-hour average highest concentrations, no controls ($\mu g/m^3$)

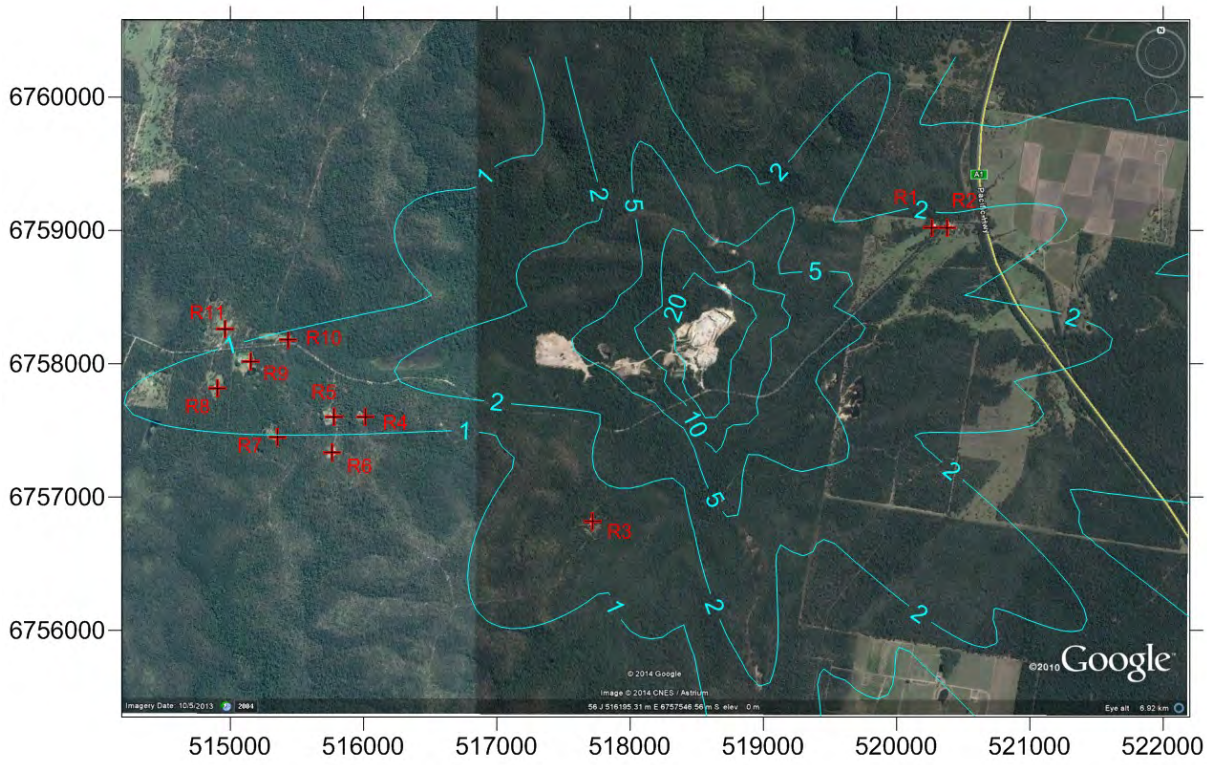

Figure 9 PM_{10} 24-hour average highest concentrations, with controls ($\mu g/m^3$)

7.2 TSP

Predictions of maximum ground level TSP concentrations have been made based on peak production rates without dust control measures.

Table 7-2 shows the maximum predicted ground level TSP concentration levels, which indicate that even without dust control measures, the predicted incremental impact at the most exposed sensitive receptor is well below the TSP annual average criterion of 90 μg/m^3. It is also evident from the results that even with the addition of a typical TSP background concentration of 30 μg/m^3, the total (cumulative) impact would still be well below the assessment criterion.

Table 7-2 Predicted TSP annual average concentrations at peak production rate

Receptor	TSP concentration (μg/m3)
R1	3
R2	3
R3	2
R4	1
R5	<1
R6	<1
R7	<1
R8	<1
R9	<1
R10	<1
R11	<1

7.3 Dust deposition

Predictions of dust deposition rates have been made based on the peak production rate.

In the absence of site-specific dust deposition data, a conservative background dust deposition level of 2 g/m^2/month was adopted. Table 7-3 shows the maximum predicted incremental dust deposition rates at sensitive receptors for emissions with no controls. The incremental dust deposition criterion of 2 g/m^2/month is expected to be comprehensively met at all identified receptors.

Table 7-3 Predicted dust deposition rates at peak production rate

Receptor	Dust deposition (g/m^2/month)
R1	0.02
R2	0.02
R3	0.02
R4	0.01
R5	0.01
R6	0.01
R7	0.01
R8	0.01
R9	0.01
R10	0.01
R11	0.01

7.4 Dust emissions from blasting

As previously discussed, blasting would take place infrequently at the quarry. Dust plumes generated from a blast event can be significant, however, they are generally well dispersed within a short time period (in the order of seconds to minutes). Therefore, the contribution to off-site dust levels on a 24-hour averaging period would be negligible. There is no criterion set in NSW for exposure to short-term PM_{10} or TSP over a duration shorter than one day.

The Ausplume dispersion model has a minimum emission rate input of 1-hour blocks. Therefore, an accurate representation of a blast event over a period of approximately 1 minute cannot be made. A hypothetical example of potential dust impacts off site from a blast event is provided below. This example utilises the PM_{10} emission factors for blasting provided in the NPI EET Manual for Mining. The following parameters were used:

- Blast Area = 20 m x 20 m = 400 m^2.
- Hole depth = 5 m.
- Soil Moisture = 2%.
- PM_{10} mass emission rate based on the above = 319 kg/blast.
- One blast per 24-hour period.
- Concentration in dust plume (assume 50 m high) = 319/(20 x 20 x 50) = 0.016 kg/m^3.

A test model run (screening level) indicated that the maximum impact at the nearest receptor occurred under neutral atmospheric conditions and wind of approximately 3 m/sec. Conservatively assuming this plume does not immediately disperse, it would pass over a receptor on the site boundary for a period of 20/3 = 7 seconds. During this time the receptor would experience high concentration levels of PM_{10}, while for the remainder to the 24-hour period it would receive no impact from the quarry, assuming all other activities cease during blast events. Therefore, the 24-hour average PM_{10} concentration from a blast event becomes 0.016x7/86400 = 1.29E-6 kg/m^3, or 1.29 $\mu g/m^3$. This concentration is approximately 3% of the PM_{10} 24-hour criterion.

Therefore, due to the short-term duration of blasting and the cessation of other quarry activities during the blast it is highly unlikely that blast dust emissions would have a significant effect on day-to-day dust impacts for off-site sensitive receptors.

7.5 Future movement of activities within the quarry

Future quarry operations would be carried out in stages and in response to demand. Extraction is proposed to move north and south (Stage 2 and 3) from current operations.

As the quarry working area progressively moves around the site, the signature of dust emissions from the site will also change. The processing plant is mobile and would be moved to the active working area. Due to the infinite number of potential operating configurations on site, only one configuration has been assessed in this report, with equipment towards the centre of the site in Stage 1, as in Section 6.2.

Given the predicted degree of compliance at receptors and the limited distance in which the processing activities would move closer to these receptors, adverse dust impacts are highly unlikely.

Based on the predicted dust impacts under worst-case operating conditions, the relocation of quarry equipment around the site is not anticipated to greatly affect the potential for adverse dust impacts at identified receptors.

7.6 Potential future sensitive receptors

Predicted dust impacts indicate that short-term PM_{10} has the greatest potential for adverse impacts off site. The results of Section 7.1 show that the incremental impact criterion contour of 35 $\mu g/m^3$ is generally confined to within the site boundary, providing dust control measures are implemented.

Without dust control measures, the impact criterion contour extends up to a few hundred metres from the quarry working area. All land encompasses by the PM_{10} criterion contour line is currently heavily vegetated and unlikely to be developed into a sensitive land use.

Predicted results should be used as a guide, indicating the land area surrounding the site which has potential to be adversely affected by dust. Local authorities could use this information for planning purposes in assessing the suitability of land for potential development.

8. Mitigation measures

8.1 General quarry operations

While dust impacts from quarry operations are not expected to be an issue, the following mitigation measures will be implemented in order to minimise the potential for impacts:

- Water sprays on crushing and screening plant.
- Haul truck routes will be watered as required, particularly during peak periods of high frequency vehicle movements and extended dry spells.

The moisture content of the material processed can have a substantial effect on emissions. Water sprays are generally the most simple and effective form of dust suppression on processing activities. Water sprays work by increasing the moisture content of material. The surface wetness causes fine particles to agglomerate on or to adhere to the faces of larger stones, with a resulting dust suppression effect.

While water sprays would be impractical to use with the excavator, they can be effectively used in crushing and screening plant. Moisture carry over would mean that processed material in stockpiles would also have higher moisture content. In addition, stockpiles may also be intermittently watered during extended dry periods, allowing for a controlled emission factor to be applied to loader and loading operations.

Wind erosion is expected to contribute less than 28% of total site PM_{10} emissions. Therefore, in general, over a 24-hour period, wind erosion is not considered to be a problem. However, the sudden onset of weather systems that involve sharp increases in wind speed can have the effect of quickly stripping the fine surface silt content from exposed non-vegetated or non-rehabilitated soil, particularly if the silt content on that soil is high through recent mechanical activity. If not dealt with pro-actively, this can cause short-term (in the order of minutes) peaks in inhalable dust concentrations. It is therefore recommended that the quarry manager be provided with daily weather updates (e.g. the Bureau of Meteorology have a standard daily service) that will contain warnings of the sudden onset of strong winds. In the event of such warning, the manager could then take steps to ensure that exposed areas that could reasonably be subjected to wind erosion are consolidated by the timely application of water sprays.

If off-site dust impacts are noted as being an issue (e.g. complaints from neighbours or visible and extensive dust plumes), dust monitoring and visual observations of dust plumes should be conducted during quarry operations. Dust monitoring at the nearest sensitive receptors, or at a location in the direction of the prevailing wind on that day could be used to alert the quarry when high levels of particulates are recorded and operations can be adjusted accordingly.

8.2 Blasting mitigation measures

The following recommendations are provided to assist in minimising the off-site dust impacts from blasting at the quarry, though the blast contractor would determine their effectiveness and practicability.

- Identified sensitive receptors should be notified when blasting is planned to occur.
- Where possible, blasting should not occur during times when winds are in the direction of the nearest receptors, and should preferably occur during times when winds are calm or blowing away from the nearest receptors.
- Water sprays should be used as dust suppression just before and during the blast.
- Blast mats such as hessian or rubber matting may be used to suppress impacts from blasting, including flyrock and particulate emissions.

9. Conclusion

An assessment of potential air quality impacts associated with the proposed expansion of Slys Quarry has been undertaken. The proposal is to expand the existing sandstone quarry by 18.3 hectares and increase the extraction rate up to 500,000 tonnes per annum.

The air quality assessment has led to the following conclusions:

- There is at least 1500 m from the quarry to the nearest identified sensitive receptor.
- The emissions inventory identified the haul trucks as the primary source of dust emissions from the site.
- Short-term concentration levels of fine particulates (PM_{10}) pose the greatest potential for off-site dust impacts.
- Predicted PM_{10} 24-hour average concentrations indicate compliance with the adopted criterion at all identified sensitive receptors.
- PM_{10} and TSP concentrations over an annual average were predicted to be well below the applicable criteria.
- Whilst not specifically required, a discussion around dust mitigation measures is provided in Section 8.
- In summary, off-site dust impacts are considered unlikely from the assessed quarry operations so that basic, normal dust suppression activity will be sufficient.

Appendices

Appendix A – Meteorological methodology

Year selection

In order to select the year of modelling, monthly rainfall was compared to long-term averages over the period 2008 to present to analyse and obtain the most representative year and include seasonal variations. The variability of rainfall from the monthly and 12-month averages, along with a month-by-month skew pattern, was considered and it was found that the period from August 2012 to July 2013 has the lowest skew over this period suggesting the least variance from extreme conditions (excessively wet or dry periods).

TAPM modelling

The TAPM prognostic model was run to obtain a coarse meteorological 3D gridded dataset for the site for the selected 12 month period (2012/13). This dataset is based on synoptic and other observations informing a regional meteorological model with a resolution of tens of kilometres as well as local terrain and land use information with a resolution of 1000 m. The TAPM model parameters are summarised in **Table A1**. Sea surface temperatures were decreased to dT = -1.5 to enhance coastal sea breezes (moderate to strong winds not well modelled by TAPM with default settings) and deep soil volumetric moisture content was decreased over selected winter months to account for the slightly drier winter/spring period of the selected dataset.

Table A1 Selected TAPM model settings

Parameter	Value
Modelled Year	August 2012 to July 2013
Domain centre	UTM: 56H 523,468mE; 6757,829 mN Latitude = S 29° 18.5’ Longitude = E 153° 14.5’
Number of vertical levels	25
Number of Easting Grid Points	41
Number of Northing Grid Points	41
Outer Grid Spacing Number of inner Grid (nests)	10,000 m x 10,000 m 3
Grid Horizontal Resolution	Level 1 – 10,000 m Level 2 – 5,000 m Level 3 – 1,500 m

CALMET modelling

The US EPA approved version of CALMET (Version 5.8) was used to resolve the wind field around the quarry to a 500 m spatial resolution. The application of CALMET for this purpose is an approved modelling approach in New South Wales (Approved Methods, DECC, 2005), with further technical model guidance documentation for CALMET settings provided as a guideline (OEH, 2011).

GHD has found from previous studies that TAPM does not predict light wind conditions as well as CALMET. It is these meteorological conditions that are critical for the correct prediction of dust impact from ground based area sources such as found in quarries.

Upon completion of the broad scale TAPM modelling runs, a CALMET simulation was set up to run for the modelled year of 2012-13, combining the three dimensional gridded data output from the TAPM model and using the CALTAPM conversion utility available with CALMET. This approach is consistent with NSW OEH (2011) guidance documentation. Since no diagnostic, observational data is directly used, this model methodology is known as 'No-observation' mode (aka 'NOOBS' - albeit that observations are indirectly used in the TAPM model initialisation phase).

CALMET was run using the NOOBS mode with the TAPM data provided as an initial guess field. All CALMET settings were selected as per the CALPUFF guidance document OEH (2011) for "No-Obs" mode, except for the following.

- Kinematic effects were computed (IKINE = 1)
- O'Brien adjustment for vertical velocity smoothing (IOBR = 1)

A terrain file was generated using the SRTM3 Global database in the Geophysical Processor in Calpuff View. Land use was also generated using this Processor and the GLCC Australia Pacific Database to a 500 metre spacing, whose resolution to 1000 metres was supplemented to 500 metres using manual inputs. The topography of the region is shown below in **Figure A1**.

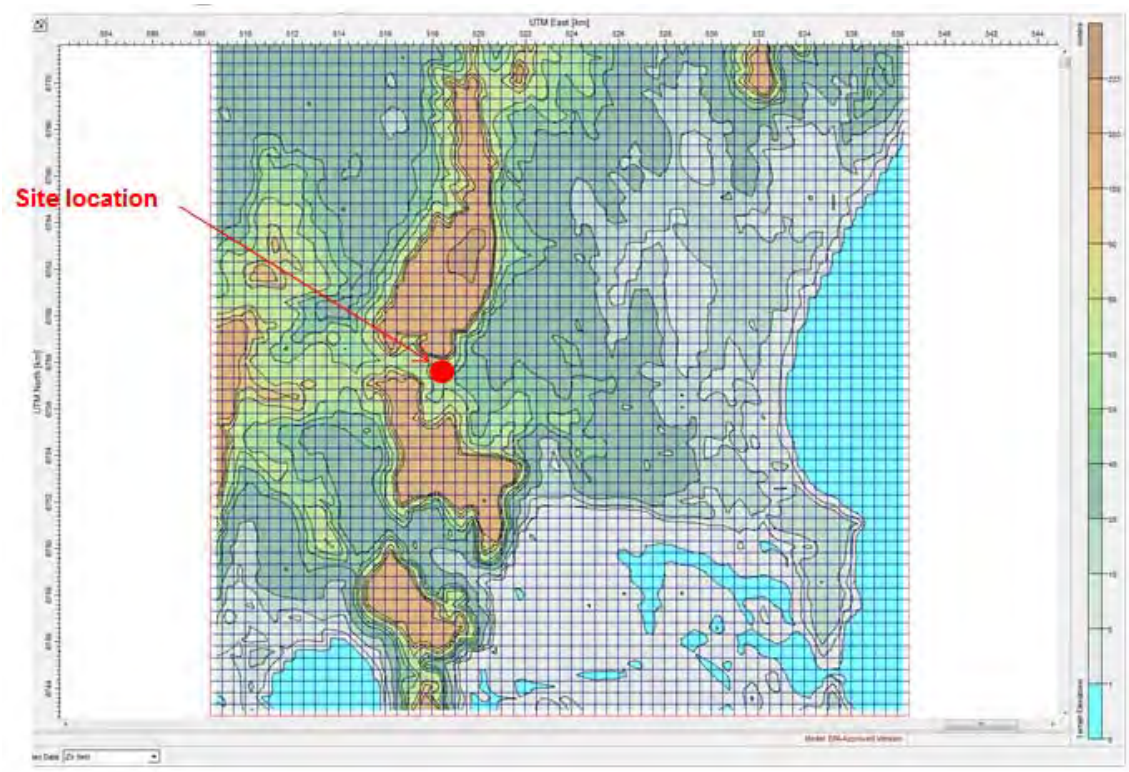

Figure A1 Site topography and location (source: Calpuff View)

As evident from **Figure A1**, the site is located between two significant hills to the north and south of the site that sit greater than 150 metres above the quarry. The shape of these hills results in a funnelling effect directly west of the quarry, which has the effect of a valley permitting westerly winds to reach to site and reducing northerly and southerly winds, which would require greater strength to reach the quarry over the hills. The coast is also evident in **Figure A1** to the east with some inland water bodied to the south-east and south.

The TERRAD variable of CALMET was set to a value of 4.0 km based on an inspection of the terrain elevations in the immediate vicinity of the quarry, based on OEH (2011) guidance.

The CALMET model parameters are summarised in **Table A2**.

Table A2 Selected CALMET model settings

Parameter	Value
Mode	No-Obs
UTM Zone	56
Domain Origin (SW corner)	Easting: 508.468 km Northing: 6742.829 km
Modelled Year	August 2012 to July 2013 (inclusive)
Horizontal Grid Resolution	60 x 60 at 0.5 km resolution (30.0 km x 30.0 km)
Number of Vertical Levels	11
Vertical Levels (m)	20,40,60,90,120,180,250,500,1000,2000,3000
CALMET Settings for No-Obs mode (OEH, 2011)	TERRAD = 4.0 km Kinematic Effects O'Brien Vertical Velocity Adjustments

Regional climate and prevailing meteorology

The local climate at the site is affected by broader regional patterns of synoptic pressure and wind with embedded weather systems. Synoptic features vary in intensity and location according to the season. For instance, during summer a high-pressure belt (the southern hemisphere anticyclonic ridge) is usually found over or just to the south of continental Australia, bringing warm weather while the subtropical easterlies cover most of the continent. These prevailing easterly winds during the warmer months of the year enhance the sea breeze effects at this location. In winter, the subtropical high-pressure belt is most often located further north over the continent, allowing westerly winds and occasional to frequent strong cold fronts to affect southern Australia – this includes a 'southerly buster', at times, at this location.

Appendix B – Quarry plans

No	Revision	Note: * indicates signatures on original issue of drawing or last revision of drawing	Drawn	Job Manager	Project Director	Date

GHD
Level 8, 180 Lonsdale Street, Melbourne VIC 3000 Australia
T 61 3 8687 8000 F 61 3 8687 8111
E melmail@ghd.com.au W www.ghd.com

DO NOT SCALE

Drawn	S. Verhellen	Designer	
Drafting Check		Design Check	
Approved (Project Director)			
Date			
Scale	AS SHOWN	This Drawing must not be used for Construction unless signed as Approved	

Client	Newman Quarrying
Project	Slys Quarry
Title	Proposed Quarry Expansion
Original Size	A1
Drawing No:	22-17528-001
Rev:	

Appendix C – Ausplume output file

```
1                    ____________________________________________

                       Slys Quarry PM10_controlled_364 t/hr

                     ____________________________________________

 Concentration or deposition                              Concentration
 Emission rate units                                      kg/hour
 Concentration units                                      microgram/m3
 Units conversion factor                                  2.78E+05
 Constant background concentration                                0.00E+00
 Terrain effects                                          None
 Smooth stability class changes?                          No
 Other stability class adjustments ("urban modes")        None
 Ignore building wake effects?                            No
 Decay coefficient (unless overridden by met. file)       0.000
 Anemometer height                                        10 m
 Roughness height at the wind vane site                   0.300 m
 Use the convective PDF algorithm?                        No

                     DISPERSION CURVES
 Horizontal dispersion curves for sources <100m high  Pasquill-Gifford
 Vertical  dispersion  curves for sources <100m high  Pasquill-Gifford
 Horizontal dispersion curves for sources >100m high  Briggs Rural
 Vertical  dispersion  curves for sources >100m high  Briggs Rural
 Enhance horizontal plume spreads for buoyancy?       Yes
 Enhance  vertical  plume spreads for buoyancy?       Yes
 Adjust horizontal P-G formulae for roughness height? Yes
 Adjust  vertical  P-G formulae for roughness height? Yes
 Roughness height                                     0.800m
 Adjustment for wind directional shear                None

                      PLUME RISE OPTIONS
 Gradual plume rise?                                  Yes
 Stack-tip downwash included?                         Yes
 Building downwash algorithm:                        PRIME method.
 Entrainment coeff. for neutral & stable lapse rates 0.60,0.60
 Partial penetration of elevated inversions?          No
 Disregard temp. gradients in the hourly met. file?   No

 and in the absence of boundary-layer potential temperature gradients
 given by the hourly met. file, a value from the following table
 (in K/m) is used:

    Wind Speed                Stability Class
     Category       A      B      C      D      E      F
   ____________________________________________________________
        1         0.000  0.000  0.000  0.000  0.020  0.035
        2         0.000  0.000  0.000  0.000  0.020  0.035
        3         0.000  0.000  0.000  0.000  0.020  0.035
        4         0.000  0.000  0.000  0.000  0.020  0.035
        5         0.000  0.000  0.000  0.000  0.020  0.035
        6         0.000  0.000  0.000  0.000  0.020  0.035

 WIND SPEED CATEGORIES
 Boundaries between categories (in m/s) are:  1.54,  3.09,  5.14,  8.23, 10.80

 WIND PROFILE EXPONENTS: "Irwin Rural" values (unless overridden by met. file)

 AVERAGING TIMES
 24 hours
  average over all hours

 ____________________________________________________________________________
```

Slys Quarry PM10_controlled_364 t/hr

SOURCE CHARACTERISTICS

INTEGRATED POLYGON AREA SOURCE: WIND

X0(m)	Y0(m)	Ground El	No. Vertices	Ver. spread	Height
485762	6558782	0m	4	1m	0m

Integrated Polygon Area Source Vertice Locations (in metres)

No.	X	Y	No.	X	Y
1	485762	6558782	2	485946	6558782
3	485961	6558867	4	485834	6558942

Emission rates by stability and wind speed, in kg/hour per square metre:

Wind speeds (m/s):	< 1.5	1.5_ 3.1	3.1_ 5.1	5.1_ 8.2	8.2_10.8	>10.8
Stability A:	0.00E+00	1.10E-06	5.00E-06	2.10E-05	6.00E-05	1.20E-04
Stability B:	0.00E+00	1.10E-06	5.00E-06	2.10E-05	6.00E-05	1.20E-04
Stability C:	0.00E+00	1.10E-06	5.00E-06	2.10E-05	6.00E-05	1.20E-04
Stability D:	0.00E+00	1.10E-06	5.00E-06	2.10E-05	6.00E-05	1.20E-04
Stability E:	0.00E+00	1.10E-06	5.00E-06	2.10E-05	6.00E-05	1.20E-04
Stability F:	0.00E+00	1.10E-06	5.00E-06	2.10E-05	6.00E-05	1.20E-04

No gravitational settling or scavenging.

VOLUME SOURCE: CRUSHP

X(m)	Y(m)	Ground Elevation	Height	Hor. spread	Vert. spread
518627	6758397	0m	0m	5m	3m

Emission rates by hour of day in kg/hour:

1	0.00E+00	2	0.00E+00	3	0.00E+00	4	0.00E+00
5	0.00E+00	6	0.00E+00	7	0.00E+00	8	2.40E-01
9	2.40E-01	10	2.40E-01	11	2.40E-01	12	2.40E-01
13	2.40E-01	14	2.40E-01	15	2.40E-01	16	2.40E-01
17	2.40E-01	18	2.40E-01	19	0.00E+00	20	0.00E+00
21	0.00E+00	22	0.00E+00	23	0.00E+00	24	0.00E+00

No gravitational settling or scavenging.

VOLUME SOURCE: CRUSHS

X(m)	Y(m)	Ground Elevation	Height	Hor. spread	Vert. spread
518586	6758374	0m	0m	5m	3m

Emission rates by hour of day in kg/hour:

1	0.00E+00	2	0.00E+00	3	0.00E+00	4	0.00E+00
5	0.00E+00	6	0.00E+00	7	0.00E+00	8	1.60E-01
9	1.60E-01	10	1.60E-01	11	1.60E-01	12	1.60E-01
13	1.60E-01	14	1.60E-01	15	1.60E-01	16	1.60E-01
17	1.60E-01	18	1.60E-01	19	0.00E+00	20	0.00E+00
21	0.00E+00	22	0.00E+00	23	0.00E+00	24	0.00E+00

No gravitational settling or scavenging.

VOLUME SOURCE: EXC1&2

X(m)	Y(m)	Ground Elevation	Height	Hor. spread	Vert. spread
518608	6758328	0m	0m	5m	3m

Emission rates by hour of day in kg/hour:

1	0.00E+00	2	0.00E+00	3	0.00E+00	4	0.00E+00

5	0.00E+00	6	0.00E+00	7	0.00E+00	8	3.80E-01
9	3.80E-01	10	3.80E-01	11	3.80E-01	12	3.80E-01
13	3.80E-01	14	3.80E-01	15	3.80E-01	16	3.80E-01
17	3.80E-01	18	3.80E-01	19	0.00E+00	20	0.00E+00
21	0.00E+00	22	0.00E+00	23	0.00E+00	24	0.00E+00

No gravitational settling or scavenging.

VOLUME SOURCE: LOAD12

X(m)	Y(m)	Ground Elevation	Height	Hor. spread	Vert. spread
518702	6758337	0m	0m	5m	2m

Emission rates by hour of day in kg/hour:

1	0.00E+00	2	0.00E+00	3	0.00E+00	4	0.00E+00
5	0.00E+00	6	0.00E+00	7	0.00E+00	8	1.60E-01
9	1.60E-01	10	1.60E-01	11	1.60E-01	12	1.60E-01
13	1.60E-01	14	1.60E-01	15	1.60E-01	16	1.60E-01
17	1.60E-01	18	1.60E-01	19	0.00E+00	20	0.00E+00
21	0.00E+00	22	0.00E+00	23	0.00E+00	24	0.00E+00

No gravitational settling or scavenging.

VOLUME SOURCE: EXC3

X(m)	Y(m)	Ground Elevation	Height	Hor. spread	Vert. spread
518669	6758370	0m	0m	5m	3m

Emission rates by hour of day in kg/hour:

1	0.00E+00	2	0.00E+00	3	0.00E+00	4	0.00E+00
5	0.00E+00	6	0.00E+00	7	0.00E+00	8	1.70E-01
9	1.70E-01	10	1.70E-01	11	1.70E-01	12	1.70E-01
13	1.70E-01	14	1.70E-01	15	1.70E-01	16	1.70E-01
17	1.70E-01	18	1.70E-01	19	0.00E+00	20	0.00E+00
21	0.00E+00	22	0.00E+00	23	0.00E+00	24	0.00E+00

No gravitational settling or scavenging.

VOLUME SOURCE: LOAD3

X(m)	Y(m)	Ground Elevation	Height	Hor. spread	Vert. spread
518654	6758287	0m	0m	5m	2m

Emission rates by hour of day in kg/hour:

1	0.00E+00	2	0.00E+00	3	0.00E+00	4	0.00E+00
5	0.00E+00	6	0.00E+00	7	0.00E+00	8	8.00E-02
9	8.00E-02	10	8.00E-02	11	8.00E-02	12	8.00E-02
13	8.00E-02	14	8.00E-02	15	8.00E-02	16	8.00E-02
17	8.00E-02	18	8.00E-02	19	0.00E+00	20	0.00E+00
21	0.00E+00	22	0.00E+00	23	0.00E+00	24	0.00E+00

No gravitational settling or scavenging.

VOLUME SOURCE: TRUK1

X(m)	Y(m)	Ground Elevation	Height	Hor. spread	Vert. spread
518563	6757805	0m	0m	10m	3m

Emission rates by hour of day in kg/hour:

1	0.00E+00	2	0.00E+00	3	0.00E+00	4	0.00E+00
5	0.00E+00	6	0.00E+00	7	0.00E+00	8	1.70E-01
9	1.70E-01	10	1.70E-01	11	1.70E-01	12	1.70E-01
13	1.70E-01	14	1.70E-01	15	1.70E-01	16	1.70E-01
17	1.70E-01	18	1.70E-01	19	0.00E+00	20	0.00E+00
21	0.00E+00	22	0.00E+00	23	0.00E+00	24	0.00E+00

No gravitational settling or scavenging.

VOLUME SOURCE: TRUK2

X(m)	Y(m)	Ground Elevation	Height	Hor. spread	Vert. spread
518540	6757849	0m	0m	10m	3m

Emission rates by hour of day in kg/hour:

1	0.00E+00	2	0.00E+00	3	0.00E+00	4	0.00E+00
5	0.00E+00	6	0.00E+00	7	0.00E+00	8	1.70E-01
9	1.70E-01	10	1.70E-01	11	1.70E-01	12	1.70E-01
13	1.70E-01	14	1.70E-01	15	1.70E-01	16	1.70E-01
17	1.70E-01	18	1.70E-01	19	0.00E+00	20	0.00E+00
21	0.00E+00	22	0.00E+00	23	0.00E+00	24	0.00E+00

No gravitational settling or scavenging.

VOLUME SOURCE: TRUK3

X(m)	Y(m)	Ground Elevation	Height	Hor. spread	Vert. spread
518542	6757912	0m	0m	10m	3m

Emission rates by hour of day in kg/hour:

1	0.00E+00	2	0.00E+00	3	0.00E+00	4	0.00E+00
5	0.00E+00	6	0.00E+00	7	0.00E+00	8	1.70E-01
9	1.70E-01	10	1.70E-01	11	1.70E-01	12	1.70E-01
13	1.70E-01	14	1.70E-01	15	1.70E-01	16	1.70E-01
17	1.70E-01	18	1.70E-01	19	0.00E+00	20	0.00E+00
21	0.00E+00	22	0.00E+00	23	0.00E+00	24	0.00E+00

No gravitational settling or scavenging.

VOLUME SOURCE: TRUK4

X(m)	Y(m)	Ground Elevation	Height	Hor. spread	Vert. spread
518549	6758001	0m	0m	10m	3m

Emission rates by hour of day in kg/hour:

1	0.00E+00	2	0.00E+00	3	0.00E+00	4	0.00E+00
5	0.00E+00	6	0.00E+00	7	0.00E+00	8	1.70E-01
9	1.70E-01	10	1.70E-01	11	1.70E-01	12	1.70E-01
13	1.70E-01	14	1.70E-01	15	1.70E-01	16	1.70E-01
17	1.70E-01	18	1.70E-01	19	0.00E+00	20	0.00E+00
21	0.00E+00	22	0.00E+00	23	0.00E+00	24	0.00E+00

No gravitational settling or scavenging.

VOLUME SOURCE: TRUK5

X(m)	Y(m)	Ground Elevation	Height	Hor. spread	Vert. spread
518564	6758068	0m	0m	10m	3m

Emission rates by hour of day in kg/hour:

1	0.00E+00	2	0.00E+00	3	0.00E+00	4	0.00E+00
5	0.00E+00	6	0.00E+00	7	0.00E+00	8	1.70E-01
9	1.70E-01	10	1.70E-01	11	1.70E-01	12	1.70E-01
13	1.70E-01	14	1.70E-01	15	1.70E-01	16	1.70E-01
17	1.70E-01	18	1.70E-01	19	0.00E+00	20	0.00E+00
21	0.00E+00	22	0.00E+00	23	0.00E+00	24	0.00E+00

No gravitational settling or scavenging.

VOLUME SOURCE: TRUK6

X(m)	Y(m)	Ground Elevation	Height	Hor. spread	Vert. spread
518603	6758120	0m	0m	10m	3m

Emission rates by hour of day in kg/hour:

1	0.00E+00	2	0.00E+00	3	0.00E+00	4	0.00E+00
5	0.00E+00	6	0.00E+00	7	0.00E+00	8	1.70E-01
9	1.70E-01	10	1.70E-01	11	1.70E-01	12	1.70E-01
13	1.70E-01	14	1.70E-01	15	1.70E-01	16	1.70E-01
17	1.70E-01	18	1.70E-01	19	0.00E+00	20	0.00E+00
21	0.00E+00	22	0.00E+00	23	0.00E+00	24	0.00E+00

No gravitational settling or scavenging.

VOLUME SOURCE: TRUK7

X(m)	Y(m)	Ground Elevation	Height	Hor. spread	Vert. spread
518617	6758224	0m	0m	10m	3m

Emission rates by hour of day in kg/hour:

1	0.00E+00	2	0.00E+00	3	0.00E+00	4	0.00E+00
5	0.00E+00	6	0.00E+00	7	0.00E+00	8	1.70E-01
9	1.70E-01	10	1.70E-01	11	1.70E-01	12	1.70E-01
13	1.70E-01	14	1.70E-01	15	1.70E-01	16	1.70E-01
17	1.70E-01	18	1.70E-01	19	0.00E+00	20	0.00E+00
21	0.00E+00	22	0.00E+00	23	0.00E+00	24	0.00E+00

No gravitational settling or scavenging.

VOLUME SOURCE: TRUK8

X(m)	Y(m)	Ground Elevation	Height	Hor. spread	Vert. spread
518619	6758288	0m	0m	10m	3m

Emission rates by hour of day in kg/hour:

1	0.00E+00	2	0.00E+00	3	0.00E+00	4	0.00E+00
5	0.00E+00	6	0.00E+00	7	0.00E+00	8	1.70E-01
9	1.70E-01	10	1.70E-01	11	1.70E-01	12	1.70E-01
13	1.70E-01	14	1.70E-01	15	1.70E-01	16	1.70E-01
17	1.70E-01	18	1.70E-01	19	0.00E+00	20	0.00E+00
21	0.00E+00	22	0.00E+00	23	0.00E+00	24	0.00E+00

No gravitational settling or scavenging.

VOLUME SOURCE: TRUK9

X(m)	Y(m)	Ground Elevation	Height	Hor. spread	Vert. spread
518543	6758313	0m	0m	10m	3m

Emission rates by hour of day in kg/hour:

1	0.00E+00	2	0.00E+00	3	0.00E+00	4	0.00E+00
5	0.00E+00	6	0.00E+00	7	0.00E+00	8	1.70E-01
9	1.70E-01	10	1.70E-01	11	1.70E-01	12	1.70E-01
13	1.70E-01	14	1.70E-01	15	1.70E-01	16	1.70E-01
17	1.70E-01	18	1.70E-01	19	0.00E+00	20	0.00E+00
21	0.00E+00	22	0.00E+00	23	0.00E+00	24	0.00E+00

No gravitational settling or scavenging.

VOLUME SOURCE: TRUK10

X(m)	Y(m)	Ground Elevation	Height	Hor. spread	Vert. spread
518474	6758244	0m	0m	10m	3m

Emission rates by hour of day in kg/hour:

1	0.00E+00	2	0.00E+00	3	0.00E+00	4	0.00E+00
5	0.00E+00	6	0.00E+00	7	0.00E+00	8	1.70E-01
9	1.70E-01	10	1.70E-01	11	1.70E-01	12	1.70E-01
13	1.70E-01	14	1.70E-01	15	1.70E-01	16	1.70E-01
17	1.70E-01	18	1.70E-01	19	0.00E+00	20	0.00E+00
21	0.00E+00	22	0.00E+00	23	0.00E+00	24	0.00E+00

No gravitational settling or scavenging.

VOLUME SOURCE: TRUK11

X(m)	Y(m)	Ground Elevation	Height	Hor. spread	Vert. spread
518475	6758158	0m	0m	10m	3m

Emission rates by hour of day in kg/hour:

1	0.00E+00	2	0.00E+00	3	0.00E+00	4	0.00E+00
5	0.00E+00	6	0.00E+00	7	0.00E+00	8	1.70E-01
9	1.70E-01	10	1.70E-01	11	1.70E-01	12	1.70E-01
13	1.70E-01	14	1.70E-01	15	1.70E-01	16	1.70E-01
17	1.70E-01	18	1.70E-01	19	0.00E+00	20	0.00E+00
21	0.00E+00	22	0.00E+00	23	0.00E+00	24	0.00E+00

No gravitational settling or scavenging.

VOLUME SOURCE: TRUK12

X(m)	Y(m)	Ground Elevation	Height	Hor. spread	Vert. spread
518483	6758125	0m	0m	10m	3m

Emission rates by hour of day in kg/hour:

1	0.00E+00	2	0.00E+00	3	0.00E+00	4	0.00E+00
5	0.00E+00	6	0.00E+00	7	0.00E+00	8	1.70E-01
9	1.70E-01	10	1.70E-01	11	1.70E-01	12	1.70E-01
13	1.70E-01	14	1.70E-01	15	1.70E-01	16	1.70E-01
17	1.70E-01	18	1.70E-01	19	0.00E+00	20	0.00E+00
21	0.00E+00	22	0.00E+00	23	0.00E+00	24	0.00E+00

No gravitational settling or scavenging.

VOLUME SOURCE: TRUK13

X(m)	Y(m)	Ground Elevation	Height	Hor. spread	Vert. spread
518556	6758101	0m	0m	10m	3m

Emission rates by hour of day in kg/hour:

1	0.00E+00	2	0.00E+00	3	0.00E+00	4	0.00E+00
5	0.00E+00	6	0.00E+00	7	0.00E+00	8	1.70E-01
9	1.70E-01	10	1.70E-01	11	1.70E-01	12	1.70E-01
13	1.70E-01	14	1.70E-01	15	1.70E-01	16	1.70E-01
17	1.70E-01	18	1.70E-01	19	0.00E+00	20	0.00E+00
21	0.00E+00	22	0.00E+00	23	0.00E+00	24	0.00E+00

No gravitational settling or scavenging.

VOLUME SOURCE: TRUK14

X(m)	Y(m)	Ground Elevation	Height	Hor. spread	Vert. spread
518554	6758037	0m	0m	10m	3m

Emission rates by hour of day in kg/hour:

1	0.00E+00	2	0.00E+00	3	0.00E+00	4	0.00E+00
5	0.00E+00	6	0.00E+00	7	0.00E+00	8	1.70E-01
9	1.70E-01	10	1.70E-01	11	1.70E-01	12	1.70E-01
13	1.70E-01	14	1.70E-01	15	1.70E-01	16	1.70E-01
17	1.70E-01	18	1.70E-01	19	0.00E+00	20	0.00E+00
21	0.00E+00	22	0.00E+00	23	0.00E+00	24	0.00E+00

No gravitational settling or scavenging.

VOLUME SOURCE: TRUK15

X(m)	Y(m)	Ground Elevation	Height	Hor. spread	Vert. spread

518540	6757913	0m	0m	10m	3m

Emission rates by hour of day in kg/hour:

1	0.00E+00	2	0.00E+00	3	0.00E+00	4	0.00E+00
5	0.00E+00	6	0.00E+00	7	0.00E+00	8	1.70E-01
9	1.70E-01	10	1.70E-01	11	1.70E-01	12	1.70E-01
13	1.70E-01	14	1.70E-01	15	1.70E-01	16	1.70E-01
17	1.70E-01	18	1.70E-01	19	0.00E+00	20	0.00E+00
21	0.00E+00	22	0.00E+00	23	0.00E+00	24	0.00E+00

No gravitational settling or scavenging.

VOLUME SOURCE: TRUK16

X(m)	Y(m)	Ground Elevation	Height	Hor. spread	Vert. spread
518541	6757851	0m	0m	10m	3m

Emission rates by hour of day in kg/hour:

1	0.00E+00	2	0.00E+00	3	0.00E+00	4	0.00E+00
5	0.00E+00	6	0.00E+00	7	0.00E+00	8	1.70E-01
9	1.70E-01	10	1.70E-01	11	1.70E-01	12	1.70E-01
13	1.70E-01	14	1.70E-01	15	1.70E-01	16	1.70E-01
17	1.70E-01	18	1.70E-01	19	0.00E+00	20	0.00E+00
21	0.00E+00	22	0.00E+00	23	0.00E+00	24	0.00E+00

No gravitational settling or scavenging.

VOLUME SOURCE: TRUK17

X(m)	Y(m)	Ground Elevation	Height	Hor. spread	Vert. spread
518564	6757803	0m	0m	10m	3m

Emission rates by hour of day in kg/hour:

1	0.00E+00	2	0.00E+00	3	0.00E+00	4	0.00E+00
5	0.00E+00	6	0.00E+00	7	0.00E+00	8	1.70E-01
9	1.70E-01	10	1.70E-01	11	1.70E-01	12	1.70E-01
13	1.70E-01	14	1.70E-01	15	1.70E-01	16	1.70E-01
17	1.70E-01	18	1.70E-01	19	0.00E+00	20	0.00E+00
21	0.00E+00	22	0.00E+00	23	0.00E+00	24	0.00E+00

No gravitational settling or scavenging.

1

Slys Quarry PM10_controlled_364 t/hr

RECEPTOR LOCATIONS

The Cartesian receptor grid has the following x-values (or eastings):

514200.m 514300.m 514400.m 514500.m 514600.m 514700.m 514800.m
514900.m 515000.m 515100.m 515200.m 515300.m 515400.m 515500.m
515600.m 515700.m 515800.m 515900.m 516000.m 516100.m 516200.m
516300.m 516400.m 516500.m 516600.m 516700.m 516800.m 516900.m
517000.m 517100.m 517200.m 517300.m 517400.m 517500.m 517600.m
517700.m 517800.m 517900.m 518000.m 518100.m 518200.m 518300.m
518400.m 518500.m 518600.m 518700.m 518800.m 518900.m 519000.m
519100.m 519200.m 519300.m 519400.m 519500.m 519600.m 519700.m
519800.m 519900.m 520000.m 520100.m 520200.m 520300.m 520400.m
520500.m 520600.m 520700.m 520800.m 520900.m 521000.m 521100.m
521200.m 521300.m 521400.m 521500.m 521600.m 521700.m 521800.m
521900.m 522000.m 522100.m 522200.m

and these y-values (or northings):

6755350.m 6755400.m 6755450.m 6755500.m 6755550.m 6755600.m 6755650.m
6755700.m 6755750.m 6755800.m 6755850.m 6755900.m 6755950.m 6756000.m

6756050.m 6756100.m 6756150.m 6756200.m 6756250.m 6756300.m 6756350.m
6756400.m 6756450.m 6756500.m 6756550.m 6756600.m 6756650.m 6756700.m
6756750.m 6756800.m 6756850.m 6756900.m 6756950.m 6757000.m 6757050.m
6757100.m 6757150.m 6757200.m 6757250.m 6757300.m 6757350.m 6757400.m
6757450.m 6757500.m 6757550.m 6757600.m 6757650.m 6757700.m 6757750.m
6757800.m 6757850.m 6757900.m 6757950.m 6758000.m 6758050.m 6758100.m
6758150.m 6758200.m 6758250.m 6758300.m 6758350.m 6758400.m 6758450.m
6758500.m 6758550.m 6758600.m 6758650.m 6758700.m 6758750.m 6758800.m
6758850.m 6758900.m 6758950.m 6759000.m 6759050.m 6759100.m 6759150.m
6759200.m 6759250.m 6759300.m 6759350.m 6759400.m 6759450.m 6759500.m
6759550.m 6759600.m 6759650.m 6759700.m 6759750.m 6759800.m 6759850.m
6759900.m 6759950.m 6760000.m 6760050.m 6760100.m 6760150.m 6760200.m
6760250.m 6760300.m

DISCRETE RECEPTOR LOCATIONS (in metres)

No.	X	Y	ELEVN	HEIGHT	No.	X	Y	ELEVN	HEIGHT
1	520262	6759020	0.0	0.0	7	515352	6757452	0.0	0.0
2	520380	6759019	0.0	0.0	8	514901	6757815	0.0	0.0
3	517723	6756821	0.0	0.0	9	515150	6758018	0.0	0.0
4	516012	6757597	0.0	0.0	10	514962	6758257	0.0	0.0
5	515774	6757599	0.0	0.0	11	515431	6758180	0.0	0.0
6	515765	6757335	0.0	0.0					

METEOROLOGICAL DATA : Ausplume Met File from Calmet Run (using Noobs and T
A

GHD

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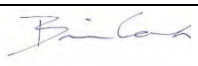
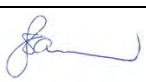
Document Status

Rev No.	Author	Reviewer		Approved for Issue		
		Name	Signature	Name	Signature	Date
0	T Gribble	B Cork		S Lawer		20/03/2015
1	T Gribble	B Cork		S Lawer		24/04/2015

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Appendix F Ecology Assessment

Newman Quarrying Pty Ltd

Sly's Quarry Environmental Impact Statement

Biodiversity Assessment Report

May 2015

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Figure index

Appendices

1. Introduction

1.1 Overview

GHD Pty Ltd (GHD) was engaged by Newman Quarrying Pty Ltd (Newman Quarrying) to prepare a Biodiversity Assessment report to address the potential biodiveristy impacts from the proposed expansion of a sandstone quarry at Lot 2 DP 1055044, Tullymorgan-Jackybulbin Road, Mororo, known as Sly's Quarry.

The proposal involves the expansion of the existing sandstone quarry by 11.1 hectares and an increase in the extraction rate up to 500,000 tonnes per annum. The primary purpose of the quarry would be to supply substantial quantities of quarry materials required for current and proposed Pacific Highway works, and for supply to Clarence Valley Council (CVC) and local contractors.

It is estimated that the quarry would have an available resource of about 7 million tonnes which would allow extraction for a period of between 30 and 40 years, depending on demand.

This biodiversity assessment report forms part of the EIS for the proposal.

1.2 Proposal description

The quarry operation would be carried out in stages and in response to demand. It is therefore difficult to predict exactly how the extraction would progress. In general, the extraction is proposed to move north and east initially, to the extent of the currently approved quarry. The eastern extent of the excavation would remain 10 m from the road reserve located along the eastern boundary. The excavation would be to the current floor level of 44 m AHD.

Stage 1 would cover an area of approximately 7 hectares and extract approximately 2.3 million tonnes.

Stage 1 already has approvals in place under an existing development application. Any references to site areas within this report relate to the proposed expansion of Stages 2 and 3.

Stage 2 would involve expanding the quarry to the north and south and to a depth of 44 m AHD. Stage 2 (south) would be exhausted prior to Stage 2 (north) being developed. This would expand the quarry by approximately 5.7 hectares and involve the extraction of approximately 2.8 million tonnes of material. This would involve the removal of 5.27 hectares of native vegetation.

Stage 3 would be the final stage and would expand the quarry further north and south. Stage 3 (south) would be exhausted prior to Stage 3 (north) being developed. Stage 3 would involve an expansion of approximately 5.4 hectares to a depth of 44 m AHD. This would involve extracting approximately 1.8 million tonnes of material. This would include the removal of approximately 5.2 hectares of native vegetation.

The extraction of all stages would progress in 10 m by 10 m benches to a final depth of 44m AHD. Following extraction, the material would be crushed, screened and where necessary blended with other materials from the quarry, or material imported to the quarry. The materials would be stockpiled on the quarry floor in numbered stockpiles of approximately 4,000 tonnes each. Samples from each stockpile would be analysed for compliance with RMS specifications before being transported offsite. This process takes approximately 20 days.

The proposed sequence of operations for each stage would generally be:

- Establish the sediment and erosion control measures and other environmental safeguards.
- Clearing vegetation, if necessary. The bulk of cleared vegetative wastes would be piled in a suitable location, clear of adjacent vegetated areas and mulched for future revegetation works.
- Topsoil would be stripped, stockpiled and protected against erosion for use in revegetation works.
- Excavation of the weathered rock material, where possible. The deeper layers would be excavated in a similar manner but would also include blasting. Blasting is anticipated to be carried out at a frequency of between two blasts per month to one blast per year, depending on demand and the material encountered. The blasting would be undertaken by a specialist contractor in accordance with regulatory requirements.
- If the rock is too large, a rock hammering, where required to break large rocks into smaller pieces.
- The rock is collected by an excavator and feed into a jaw crusher. The crusher produces an output of various sizes of fill or aggregate which are separated by a screening machine into various piles based on size. Sand is also produced in this process. The crusher and screener are moved around the quarry floor as necessary to be close to the quarry face and accumulated, excavated stone.
- Loading of the material directly from the stockpile onto trucks for removal from site.
- The excavation continues, as described above, within each stage until it reaches the ultimate depth of 44m AHD. During the excavation, 10 m high by 10 m wide benches are established at the quarry face. At the top of each bench, a safety bund/wall is constructed to prevent people or machinery falling over the bench. The benches and quarry floor would be graded to the sediment basin located in the south-western end of the quarry area.
- Once the extraction is complete, topsoil would be respread on the disturbed areas and revegetated, where possible. The established erosion and water control measures would be maintained until the rehabilitated surface is adequately stabilised.

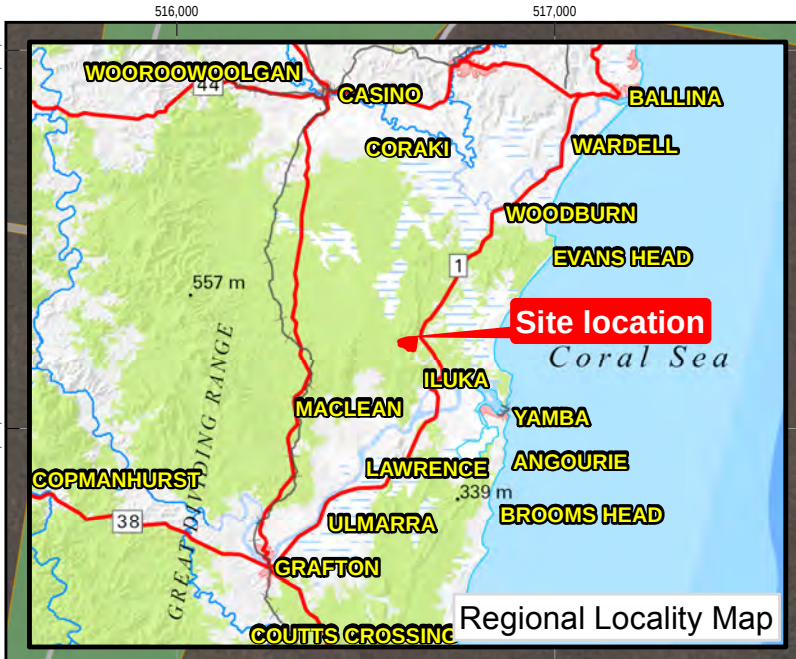
Other details relating to quarry operations include:

- If there is a special order for large boulders, for example for breakwater or river or sea wall repair or construction, these are set aside and transported as such.
- Occasionally, in order to comply with RMS specifications, materials won from the quarry would be blended with other materials won from the quarry, or with imported materials (eg, sand, clay), prior to being stockpiled on the floor of the quarry.
- Some sand is transported to the onsite wash plant for processing.

1.3 Proposal location and study area

The subject site is located at Lot 2 in DP 1055044 on land with frontage to the Tullymorgan-Jackybulbin Road approximately 2 kilometres west of the Pacific Highway, Mororo, NSW. The site is approximately 55 km north north-east of Grafton and 32 km south from the town of Woodburn, within the Clarence Valley Local Government Area (LGA). Slys Road is located along the eastern boundary of the site (see Figure 1).

The study area is 18.1 hectares in size and contains a previous area of disturbance that is currently being used as a quarry, several recently cleared access tracks and areas of regrowth native vegetation.



BUNDJALUNG StateConservationArea

BUNDJALUNG NationalPark

SLYS ROAD

PACIFIC HIGHWAY

TULLYMORGAN-JACKYBULBIN ROAD

TABBIMOBLE CREEK

A

B

C

MCMAHONS TRAIL

MORORO STATE FOREST

GIBBERAGEE STATE FOREST

Source: Esri, DigitalGlobe, GeoEye, i-cubed, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo, and the GIS User Community

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6,761,000 6,760,000 6,759,000 6,758,000 6,757,000 6,756,000 6,755,000

LEGEND

- Current Quarry Areas
- Lot 2 DP 1055044
- Road
- Lot
- Waterways
- Waterbody
- Natural Parks
- State Forest

Paper Size A3

0 100 200 400 600 800

Metres

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

N

Newman Quarrying
Sly's Quarry Environmental Impact Statement

Job Number 22-17528
Revision A
Date 11 Dec 2014

Site location

Figure 1

N:\AU\Coffs Harbour\Projects\22\17528\GIS\Maps\Deliverables\22_17528_Z006_Lot2_Site_location.mxd

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

Data Source: NSW Department of Lands: Cadastre - Jan 2014; Geoscience Australia: 250k Data - Jan 2014; NSW Department od Primary Industry - Jan 2014; ESRI imagery Jan 2014. Created by: qjchung

1.4 Secretary's environmental assessment requirements

1.4.1 Overview

Approval under Part 4.1 of the *Environmental Planning and Assessment Act 1979* (the EP&A Act) is being sought for the proposal.

The Secretary's environmental assessment requirements (SEARs) for the proposal were issued on 21 August 2014. The SEARs have informed the preparation of the environmental impact statement for the proposal. The SEARs include a requirement for a biodiversity impact assessment to address the following:

- The likely biodiversity impacts of the development, having regard to OEH's requirements.
- A biodiversity offset strategy to ensure the development would maintain or improve the biodiversity values of the region in the medium to long term.

This assessment specifically considers matters relevant to biodiversity. The applicant has chosen to use the BioBanking Methodology (BBAM) in accordance with the NSW Biodiversity Offsets Policy for Major Projects (2014) and associated Framework for Biodiversity Assessment (FBA) to quantify the proposal's impacts and determine suitable offsets within the policies guidelines.

Table 1 outlines where the requirements of the SEARs have been addressed within this report. The methodology for this assessment is provided in Chapter 2 of this report.

Table 1 Secretary's environmental assessment requirements

SEAR reference (OEH recommendations)	Report section
A field survey should be conducted and documented in accordance with relevant guidelines, including: • The Threatened Species Survey and Assessment Guidelines: Field Survey Methods for Fauna – Amphibians (DECCW 2009) • Threatened Biodiversity Survey and Assessment: Guidelines for Developments and Activities – Working Draft (DEC 2004)	Section 4 Following consultation with OEH the biodiversity survey was conducted in accordance with the Framework for Biodiversity Assessment (FBA) (OEH 2014b) and the NSW Biodiversity Offsets Policy for Major Projects (OEH 2014) Initial surveys identified the presence of the threatened plant species, *Hibbertia marginata*. Additional targeted surveys were undertaken to identify plant locations and numbers within the proposed quarry footprint.
The EA should contain as a minimum	
a) The requirements set out in the Guidelines for Threatened Species Assessment (DoP 2005)	Section 4 Following consultation with OEH the biodiversity survey was conducted in accordance with the Framework for Biodiversity Assessment (FBA (OEH 2014b) Initial surveys identified the presence of the threatened plant species, *Hibbertia marginata*. Additional targeted surveys were undertaken to identify plant locations and numbers within the proposed quarry footprint.

SEAR reference (OEH recommendations)	Report section
b) A description and geo-referenced mapping of the study area, key habitat features, survey locations, vegetation communities and reported locations of threatened species, populations and ecological communities present in the subject site and study area.	Section 5
c) Description of survey methodologies use, including timing, location and weather conditions.	Section 4
d) Details, including qualifications and experience of all staff undertaking the surveys, mapping and assessment of the impacts.	Section 4.5
e) Identification of national and state listed threatened biota known or likely to occur in the study area and their conservation status.	Section 5.1 and Appendix A
f) Description of the likely impacts of the proposal on biodiversity and wildlife corridors, including direct and indirect and construction and operation impacts.	Section 6
g) Identification of the avoidance, mitigation and management measures that will be put in place as part of the proposal to avoid or minimise impacts including details about alternative options considered and how long term management arrangements will be guaranteed.	Section 7
h) Description of the residual impacts of the proposal. If the proposal cannot adequately avoid or mitigate impacts on biodiversity, then a biodiversity offset package is expected.	Section 8.4
i) Provision of specific Statement of Commitments relating to biodiversity.	Section 7
4. An assessment of the significance of direct and indirect impacts of the proposal for threatened biodiversity known or considered likely to occur in the study area based on the presence of suitable habitat.	This assessment has been carried out in accordance with the NSW Biodiversity Offsets Policy for Major Projects (OEH 2014e). Assessments of significance for threatened biota are therefore not required.
5. Use the Biobanking Assessment Methodology (BBAM) to assess biodiversity impacts arising from the proposal.	Section 8

SEAR reference (OEH recommendations)	Report section
6. Where appropriate, likely impacts (both direct and indirect) on any adjoining and/or nearby OEH estate reserved under the National Parks and Wildlife Act 1974 or any marine and estuarine protected areas under the Fisheries Management Act 1994 or the Marine Parks Act 1997 should be considered.	Not applicable
7. With regard to the Commonwealth Environment Protection and Biodiversity Conservation Act 1999, the assessment should identify any relevant Matters of National Environmental Significance and whether the proposal has been referred to the Commonwealth or already determined to be a controlled action.	Section 6.5

1.5 Purpose of this report

This biodiversity assessment report has been prepared to assess the potential ecological impacts of the proposal and determine suitable offsets. Specifically, the objectives of this assessment are to:

- Address the SEARs for the proposal.
- Outline the methods used in the biodiversity assessment.
- Describe the existing environment of the study area in terms of its ecological values, including type and condition of vegetation communities and terrestrial and aquatic habitats.
- Identify flora and fauna species and ecological communities within the study area that have the potential to be impacted by the proposal.
- Provide a description of the proposal, including potential impacts on biodiversity values and measures to avoid or mitigate impacts.
- Present the data used to perform the FBA assessment and credit calculations for the proposal.
- Calculate the number and type of biodiversity credits using BBAM 2014 that would be required to offset impacts of the proposal and outline a Biodiversity Offset Strategy.
- Provide concluding statements to demonstrate that the proposal would 'improve or maintain' biodiversity values.

This biodiversity assessment and credit calculations were conducted by Dan Williams (accredited assessor number 0073) and Arien Quin (accredited assessor number 0120) in accordance with the FBA. The report was peer reviewed by Dan Williams.

1.5.1 Framework for biodiversity assessment

The NSW Government has developed a NSW Biodiversity Offsets Policy for Major Projects (the policy). Major Projects include State Significant Development (SSD) and State Significant Infrastructure (SSI). Under the policy, the FBA must be used by a proponent to assess all biodiversity values on the development site for the Major Project. Under the FBA, a Biodiversity

Assessment Report must be prepared to describe the biodiversity values present at the site, assess impacts of the proposal and determine the number of biodiversity credits required to offset impacts of the proposal.Where a proponent is proposing to establish an offset for the Major Project, the Biobanking Assessment Methodology (BBAM) must be used to assess the biodiversity values of the offset site and to identify the number and type of biodiversity credits that may be created on the offset site.

The Biodiversity Offset Strategy will outline how the proponent intends to offset the impacts of the Major Project. These reports form part of the EIS. These assessments must be made by a person accredited in accordance with section 142B(1)(c) of the NSW *Threatened Species Conservation Act 1995* (TSC Act).

This Biodiversity Assessment Report has been prepared by accredited assessors (see Section 4.5) and includes desktop assessments, site surveys and offset calculations in accordance with the FBA.

1.5.2 Biobanking assessment methodology

BioBanking was established by the New South Wales Department of Environment, Climate Change and Water (DECCW) (now the Office of Environment and Heritage (OEH)) as a method to address the loss of biodiversity and threatened species. The scheme attempts to create a market framework for the conservation of biodiversity values and the offsetting of development impacts.

BioBanking is established under Part 7A of the *NSW Threatened Species Conservation Act 1995* (TSC Act), which was enabled by the *Threatened Species Conservation Amendment (Biodiversity Banking) Bill 2006*. The *Threatened Species Conservation (Biodiversity Banking) Regulation 2008* provides additional rules for specific aspects of the scheme that are important for its operation.

The Biobanking Assessment Methodology (BBAM) sets out how biodiversity values will be assessed, establishes rules for calculating the number and class of biodiversity credits, and determines the trading rules that will apply. The BBAM includes a software package known as the BioBanking Credit Calculator (the credit calculator) which processes site survey and assessment data. The credit calculator is used to determine:

- The type and extent of surveys required for a biodiversity assessment.
- The number and type of biodiversity credits that are required for a development site to offset impacts on biodiversity either as part of a Major Project biodiversity assessment or an application for a BioBanking statement.
- The number and type of biodiversity credits generated through the conservation and management of a biobank site.

The credit calculator has been used in this Biodiversity Assessment Report to determine the number and type of biodiversity credits required to offset the impacts of the proposal. The credit calculator will also be used to determine the biodiversity credits generated at an appropriate offset site in order to finalise the Biodiversity Offset Strategy for the proposal, either through the survey and assessment of a suitable offset site or through the purchase of biodiversity credits from an established biobank.

1.6 Definitions

For the purpose of this document, the following definitions have been used:

- The ‘proposal’ refers to the proposed quarry expansion works which are discussed in Section 1.2.

- The ‘subject site’ refers to the area that would be directly impacted by the proposal (Stage 2 and 3).
- The ‘study area’ refers to the area that was subject to field survey and assessed for direct or indirect impacts that may arise from the proposal in this this Biodiversity Assessment Report.
- The ‘locality’ refers to the area within a 10km radius of the proposal.

1.7 Glossary of terms

Term	Definition
Biobank site	Land that is designated by a biobanking agreement to be a biobank site.
Biobanking agreement	An agreement entered into between the landowner and the Minister under Part 7A of the TSC Act for establishing a biobank site.
BioBanking Assessment Methodology (BBAM)	The rules of BioBanking established under the TSC Act that determine credits created, credits required and the circumstances that improve or maintain biodiversity values.
BioBanking	The biodiversity banking and offsets scheme established under Part 7A of the TSC Act.
Biodiversity credit report	Specifies the number and type of biodiversity credits: required to offset the impacts of a development to obtain a Biobanking statement; or required to offset the impacts of a Major Project in accordance with the FBA; or that would be generated through conservation and management of a biobank site under a BioBanking agreement.
BioBanking Trust Fund	The Trust Fund established under Part 7A of the TSC Act to hold funds from the sale of credits.
Biodiversity credit	A unit of biodiversity value to measure specific development impacts or conservation gains in accordance with the FBA or the BBAM. Includes ecosystem credits or species credits.
Biodiversity offsets	Specific measures that are put in place to compensate for impacts on biodiversity values.
Biodiversity values	The composition, structure and function of ecosystems including threatened species, populations and ecological communities, and their habitats.
Ecosystem credit	A credit that relates to a vegetation type and the threatened species that are reliably predicted by that vegetation type (as a habitat surrogate).
Locality	The area within a 10 km radius of the subject site.
Subject site	The area that would be directly impacted by construction and operation of the proposal.
Species Credit	A credit that relates to an individual threatened species that cannot be reliably predicted based on habitat surrogates. Threatened species that require species credits are identified in the Threatened Species Profile Database.
Study area	The area that was subject to a site survey and assessed for direct or indirect impacts arising from construction and operation of the proposal.
The policy	The NSW Biodiversity Offsets Policy for Major Projects
Threatened biota	Threatened species, populations or ecological communities listed under the TSC Act and/or the EPBC Act.
Major project	Major projects include State Significant Development (SSD) and State Significant Infrastructure (SSI)
FBA	The Framework for Biodiversity Assessment. The methodology to assess impacts on biodiversity that must be used by a proponent to assess all biodiversity values on the development site for a Major Project in accordance with The NSW Biodiversity Offsets Policy for Major Projects.

1.8 Scope and limitations

This report: has been prepared by GHD for Newman Quarrying Pty Ltd and *may only be used and relied on by Newman Quarrying Pty Ltd for the purpose agreed between GHD and the Newman Quarrying Pty Ltd as set out in section 1.5 of this report.*

GHD otherwise disclaims responsibility to any person other than Newman Quarrying Pty Ltd arising in connection with this report. GHD also excludes implied warranties and conditions, to the extent legally permissible.

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

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

The opinions, conclusions and any recommendations in this report are based on assumptions made by GHD described in this report (refer section(s) 1.9 of this report). GHD disclaims liability arising from any of the assumptions being incorrect.

1.9 Assumptions and limitations

Given the short duration of the field survey it is likely that some species that utilise the study area (permanently, seasonally or transiently) were not detected during the survey. These species may include flora species such as annual, ephemeral or cryptic species. Some fauna species are also mobile and transient in their use of resources, and some are seasonal migrants, and it is likely that not all species that potentially occur in the study area were recorded during the survey period.

The habitat assessment conducted for the site allows for identification of habitat resources for species. As such, the survey was not designed to detect all species, rather to provide an overall assessment of the ecological values on site in order to predict potential impacts of the proposal, with particular emphasis on endangered ecological communities, threatened species and their habitats.

It was beyond the scope of this assessment to undertake all detailed threatened species surveys. The BBAM predicts the type of threatened species requiring additional surveys and these results are only known after completion of the plot/transect surveys and results entered into the credit calculator. Targeted surveys were completed for *Hibbertia marginata* as this species was the only threatened flora species found within the study area that required further assessment.. All other threatened species were either included in the ecosystem credit calculations or deemed unlikely to occur at the site.

Site conditions (including the presence of threatened species of flora and/or fauna) may change after the date of this report. GHD does not accept responsibility arising from, or in connection with, any change to the site conditions. GHD is also not responsible for updating this report if the site conditions change.

2. Legislative context

2.1 State legislation

2.1.1 Environmental Planning and Assessment Act 1979

The *Environmental Planning and Assessment Act 1979* (EPA Act) forms the legal and policy platform for project assessment and approval in NSW and aims to, inter alia, 'encourage the proper management, project and conservation of natural and artificial resources'

The proposal will be assessed under Part 4.1 of the EPA Act as 'State significant development'. Approval from the Minister for Planning is required and an Environmental Impact Statement (EIS) is required to be prepared.

Under Clause 111(1) of the EPA Act, determining authorities must 'examine and take into account to the fullest extent possible all matters affecting or likely to affect the environment by reason of that activity'. This report addresses the biodiversity components of the 'environment' to assist the proponent with addressing the relevant sections considerations of section 111 of the EPA Act.

In addition, section 111(4) of the EPA Act provides that the determining authority must consider the effect of an activity on:

- Critical habitat (as defined under the TSC Act and FM Act).
- Species, populations or ecological communities, or their habitats (as listed under the TSC Act and FM Act) and whether there is likely to be a significant effect on those species, populations or ecological communities.
- Other protected fauna or protected native plants listed under the *National Parks and Wildlife Act 1974*.

Under the policy, the SEARs for an EIS will require a proponent to apply the FBA to assess impacts on biodiversity values. The FBA will also be applied to identify reasonable measures and strategies that can be taken to avoid and minimise impacts on biodiversity. A Biodiversity Assessment Report will describe the biodiversity values present on the development site and the impact of the Major Project on these values. A Biodiversity Offset Strategy will outline how the proponent intends to offset the impacts of the Major Project.

2.1.2 Threatened Species Conservation Act 1995

The *Threatened Species Conservation Act 1995* (TSC Act) provides the statutory framework for biota of conservation significance in NSW. The Act aims to, inter alia, 'conserve biological diversity and promote ecologically sustainable project'. 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, 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.

The TSC Act has been addressed in the current assessment through:

- Desktop review to determine the threatened species, populations or ecological communities (threatened biota) listed under the Act that have been previously recorded within the locality of the site and consequently could occur subject to the habitats present.

- Completion of plot/transect surveys in accordance with the BBAM.
- Targeted field surveys for threatened biota (to be completed).
- Identification of suitable impact mitigation and environmental management measures for threatened biota, where required.

2.1.3 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.

The FM Act has been addressed in the current assessment through undertaking:

- A desktop review to determine the threatened species, populations or ecological communities that have been previously recorded within the locality of the site and consequently could occur subject to the habitats present.
- Assessment of potential impacts on aquatic habitats.

2.1.4 Native Vegetation Act 2003

The *Native Vegetation Act 2003* (NV Act) and *Native Vegetation Regulation 2005* guide the way native vegetation is managed in NSW by preventing broadscale clearing, unless it improves or maintains environmental outcomes.

Due to the proposal being considered designated development and State Significant development, by virtue of clause 25(f) of the NV Act and 89(j) of the EP&A Act, approval for clearing under the NV Act is not required.

2.1.5 Noxious Weeds Act 1993

The *Noxious Weeds Act 1993* (NW Act), provides for the declaration of noxious weeds by the Minister for Primary Industries. Noxious weeds may be considered noxious on a National, State, Regional or Local scale. All private landowners, occupiers, public authorities and Councils are required to control noxious weeds on their land under Part 3 Division 1 of the NW Act. As such, if present, noxious weeds on the site should be assessed and controlled.

2.2 Commonwealth legislation

The purpose of the Commonwealth EPBC Act is to ensure that actions likely to cause a significant impact on matters of national environmental significance undergo an assessment and approval process. Under the EPBC Act, an action includes a project, undertaking, project or activity. An action that 'has, will have or is likely to have a significant impact on a matter of national environmental significance' is deemed to be a 'controlled action' and may not be

undertaken without prior approval from the Australian Government Minister for Sustainability, Environment, Water, Population and Communities (the Minister).

The EPBC Act identifies matters of national environmental significance (MNES) as:

- world heritage properties
- national heritage places
- wetlands of international importance (Ramsar wetlands)
- threatened species and ecological communities
- migratory species
- Commonwealth marine areas
- nuclear actions (including uranium mining)
- a water resource, in relation to coal seam gas development and large coal mining development

The EPBC Act has been addressed in this assessment through:

- desktop review to determine the ecological MNES that have been previously recorded within the locality of the site and hence could occur, subject to the habitats present
- targeted field surveys for species and ecological communities listed under the Act
- identification of suitable impact mitigation and environmental management measures for threatened species, where required
- assessment of potential impacts on MNES.

2.3 Local environmental planning instruments

2.3.1 Clarence Valley Local Environment Plan

Local Environmental Plans (LEPs) are prepared by Councils to guide planning decisions in their Local Government Areas and establish the requirements for the use and development of land.

Under the *Clarence Valley Local Environmental Plan 2011*,(CVLEP) the study area is zoned as RU2 Rural. Extractive industries, as defined in the Dictionary of the CVLEP, are not listed in the Land Use Table for the RU2 zone. However, the permissibility of the proposed development is determined by the *State Environmental Planning Policy (SEPP) (Mining, Petroleum Production and Extractive Industries) 2007* (MPEI SEPP) which prevails over the LEP.

For further discussion of the land use zoning of the study area refer to the EIS document (GHD 2014a).

2.3.2 Clarence Valley Comprehensive Koala Plan of Management (CKPoM)

State Environmental Planning Policy No. 44 – Koala Habitat Protection (SEPP 44) aims to encourage the proper conservation and management of areas of natural vegetation that provide habitat for Koalas. SEPP 44 also aims to ensure a permanent free-living population of Koalas over their present range, and reverse the current trend of Koala population decline by:

Schedule 1 of SEPP No. 44 lists LGAs to which the Policy applies. The site falls within the Maclean LGA (now part of the Clarence Valley Council) which is listed under this schedule. Where an approved Comprehensive Koala Plan of Management (CKPoM) exists for an LGA, this takes precedence over SEPP 44. Although a CKPoM has been prepared by the Clarence Valley Council, the site does not fall within any of the three management areas covered by the plan and therefore the CKPoM does not apply to this proposal.

Under SEPP 44, 'potential' Koala habitat is defined as areas of native vegetation where the trees of the types listed in Schedule 2 of the Policy constitute at least 15% of the total number of trees in the upper or lower strata of the tree component. If potential habitat is identified at the site then further assessment is required to determine whether core habitat is present.

'Core' Koala habitat is defined as an area of land with a resident population of Koalas, evidenced by attributes such as breeding females (that is, females with young) and recent sightings of and historical records of a population. If core Koala habitat is to be impacted by a proposal, an approved Koala Plan of Management is required prior to approval of the proposed development.

In accordance with the requirements of SEPP 44, assessment of the site to determine whether it provides 'potential' or 'core' Koala habitat as defined by the Policy was undertaken and the potential impacts of the proposal on the Koala have been considered in this report (see Section 5.4.3).

3. Existing environment

3.1 Location and land uses

The subject site is located approximately 55 km north north-east of the city of Grafton and 32 km south from the town of Woodburn, The subject site consists of a cleared area in the centre which is currently used for quarry activities and there is another small patch of cleared land near the north east corner of the proposal site.

The lower slopes of Lot 2 north of Tullymorgan-Jackybulbin Road have been extensively cleared of vegetation although there is a substantial treed buffer of dry sclerophyll forest along most of the road frontage. The clearing may have resulted from the previous history of selective logging on the site and in the area. It is also associated with the sand extraction and quarrying activities approved for Lot 2 in the past (Newman, 2014).

To the south, west and north of the cleared portion are heavily forested areas. To the west the site is bound by Slys road. Mount. Doubleduke is a small mountain reaching 230 m above sea level in the north of the subject site. Several forested reserves are located in the surrounding locality. These include Bundjalung Crown Reserve, Devils Pulpit State Forest, Gibberagee State Forest and Mororo State Forest.

3.2 Geology, soils and geomorphology

The site area generally has poor soils of sandy composition mostly derived from the underlying sandstone. In lower-lying areas, soils may be derived from stream deposition. It is located in the southern end of the Clarence-Moreton Basin in northern NSW and includes extensive deposits of quartzose sandstone. The sandstone exists in the Kangaroo Creek Formation and related geological structures. In the locality of the quarry, these sandstone deposits are generally well-exposed and quite accessible. They are easily worked to produce a principal product of medium- to coarse-grained siliceous sandstone that is used in a number of engineering applications, particularly road works.

The Kangaroo Creek sandstone is estimated to range in thickness from 150 m to 500 m. At the existing quarry face, the sandstone exists in a series of beds ranging in thickness from less than 1 m to up to 3 m (Newman, 2014).

Reference to the Woodburn 1:100,000 scale soil landscapes sheet (Morand, 2001) shows the site is comprised of three landscape units. These include the Kooyong (ky), Cliff Road (cx) and Coraki (ck) landscape units which are all underlain by Kangaroo Creek Sandstone (quartz sandstone).

The most northern section of the site is comprised of Kooyong (ky) landscape unit. This is characterised by rolling low hills and hills. Relief is typically 100 – 200 m, elevation of 20 – 180 m and slopes of 20 - 35%. This unit has shallow to deep soils (50 – 150 cm) consisting of yellow and brown Kurosols and Tenosols throughout hill slopes and crests with moderately deep to deep (>60cm) Red Kurosols on highly ferruginised sandstone, usually on crests and upper slopes when present.

The southern section of the site is comprised of Cliff Road (cx) landscape unit. This is characterised by rolling low hills and hills on Kangaroo Creek Sandstone (quartz sandstone). Relief is typically 180-150 m, an elevation of 20-180 m, with slopes of 10 - 20% and occasionally 30 – 25%. Rock outcrop is common. These two landscape units have soil that generally overlies a combination of colluvium, friable, porous sandstone saprolite and fresh rock, often shattered and fragmented at the weathering front. Iron – indurated sandstone occur on ridge crests.

The Coraki (ck) landscape unit is found in a small section along the eastern boundary of the site. Landscapes of the Coraki unit consist of undulating rises, with a relief of 10 – 30 m and slopes of 2 – 10%, with elevation generally greater than 35 m. Well drained, deep soils (greater than 100 m depth) occur and consist of Otheric Tenosols or Aeric Podosols throughout hills slopes and crests. On the lower slopes, deep (greater than 150 m) Grey Kurosols soils occur.

A small section of the site near the centre of the site is considered disturbed terrain which has been disturbed by human activity to a depth of at least 100 cm and has removed, greatly disturbed or buried the original soil.

3.3 Topography

The natural topography of the site falls in a south westerly direction, and has been altered by the existing quarry activities. This site catchment is located within the southern foothills of Mount Doubleduke.

A ridgeline runs along the northern and eastern boundary of the site. The ridgeline starts at the northern end of the site at an elevation of about 100 m Australian Height Datum (AHD) and falls towards the southern extent of the site to about 42 m AHD. The existing quarry floor is relatively level at 44 m AHD.

A number of unnamed ephemeral tributaries drain around the site, being diverted around the works area, and discharge to Tabbimoble Creek. Tabbimoble Creek drains via the Bundjalung National Park marshes to the Clarence River near Iluka.

In the centre of the site the existing quarry has altered the natural topography by excavating the rock from the southern slopes of Mount Doubleduke.

3.4 Surface Water

The site is located within the Clarence River catchment with unnamed ephemeral drainage lines flowing in a southwest direction to Tabbimoble Creek. The ephemeral drainage lines are diverted around the works area and bypass the site water dams, discharging to Tabbimoble creek under Tullymorgan Jackybulbin Road.

Within the works area, the pit floor and stockpiled areas discharge to an initial sediment pond (approx. 2.4 ML), this overflows to the main sediment basin (7m deep, appox.12.6 ML). The main sediment basin is the discharge point from the site. The site office, weighbridges, wash plant and other outbuildings along the site discharge to three smaller sediment basins (total approx. 0.55 ML). These basins discharge to the main sediment basin.

Some water quality information was collected from the main sediment basin before it exits the site (GHD 2014b). The results indicate the water quality is fresh, with neutral pH and low to moderate suspended solids.

3.5 Climate

The North Coast region is considered to be sub-tropical with warm, wet summers and dry, mild winter.

The Bureau of Meteorology website provides climatic information for the proposal area, taken from the Yamba weather station (site number 058012, closest station to the study area with detailed long-term climate statistics). The mean annual rainfall for this area is 1460.1 mm. Rainfall is typically highest in summer and early autumn and lowest in late winter and early spring. Mean daily maximum temperatures range from 26.7^{o}C in summer to 20.1^{o}C in winter with mean minimum temperatures ranging from 19.1^{o}C in summer down to 9.7^{o}C in winter (BOM 2014). The weather conditions during the field survey are outlined in Section 4.3. Weather during the survey was taken from recordings at Yamba Pilot Station.

4. Methodology

4.1 Approach

This Biodiversity Assessment Report has been prepared to describe the impacts of the project on biodiversity values using the FBA (OEH, 2014a).

The main components of the methodology for the biodiversity assessment were:

- Desktop assessment to describe the existing environment and landscape features of the study area and to identify the suite of threatened biota potentially affected by the proposal.
- Field survey to describe the biodiversity values of the proposal site and surrounding study area and determine the likelihood of threatened biota and their habitats occurring in the proposal site or being affected by the proposal.
- FBA calculations using the credit calculator v.4.1 to quantify the biodiversity impacts of the proposal and to determine the biodiversity credits that would be required to offset these impacts.

The biodiversity assessment and biodiversity credit calculations were performed by Arien Quin and Dan Williams in accordance with the FBA.

4.2 Desktop assessment

4.2.1 Literature and database review

A desktop database review was undertaken to identify threatened flora and fauna species, populations and ecological communities (biota) listed under the TSC Act and FM Act, and MNES listed under the EPBC Act, that could be expected to occur in the locality, based on previous records, known distribution ranges, and habitats present. These were also used to obtain the necessary site data to perform FBA calculations. Biodiversity resources pertaining to the proposal site and locality (i.e. within a 10 km radius of the site) that were reviewed prior to conducting field investigations included:

- The Commonwealth Department of the Environment (DoE) Protected Matters Search Tool (PMST), for Matters of National Environmental Significance (MNES) known or predicted to occur in the locality (DoE, 2014a).
- DotE online species profiles and threats database (DoE, 2014b).
- Office of Environment and Heritage (OEH) Wildlife Atlas database (licensed) for records of threatened species, populations and endangered ecological communities listed under the TSC Act that have been recorded within the locality of the proposal (OEH, 2014a).
- OEH threatened biota profiles for descriptions of the distribution and habitat requirements of threatened biota (OEH, 2014b). This resource was used to identify the suite of threatened ecological communities (TECs) that could potentially be affected by the proposal and to inform habitat assessments.
- The NSW vegetation types database (OEH, 2014c) to identify matching Plant Community Types (PCTs) known or likely to occur in the study area as required by the FBA.
- Department of Primary Industries (DPI) online protected species viewer for records of threatened aquatic species in the locality (DPI, 2014a).
- The list of species credit-type species identified by the FBA Credit Calculator based on the initial credit calculations.

- Aerial photographs and satellite imagery of the study area.
- Previous specialist studies undertaken at the site.

The threatened and migratory species identified in the desktop assessment are presented in Appendix A. Following collation of database records and threatened species and community profiles, a 'likelihood of occurrence' assessment was prepared for threatened and migratory species and ecological communities with reference to the broad vegetation types and habitats contained within the study area. This was further refined following field surveys and verification of vegetation types and identification and assessment of habitat present within the study area. A likelihood of occurrence ranking was attributed to these biota based on this information.

4.3 Site survey

4.3.1 Survey effort

Staged surveys of the development site were conducted with reference to the FBA and appropriate targeted survey guidelines. Site surveys included:

- Initial site stratification and vegetation mapping
- BioBanking plot/transect surveys
- Incidental threatened flora surveys
- Opportunistic fauna surveys
- Targeted flora surveys
- Preliminary investigation of potential biobank site

Survey effort that has directly contributed to this biodiversity assessment is summarised in Table 2 and described below.

Table 2 Survey effort

Stage	Date	Survey Technique
Initial FBA assessment survey	29 and 30 October 2014	Vegetation mapping; targeted threatened flora surveys; opportunistic fauna observations; fauna habitat assessment.
FBA assessment survey	25 and 26 November 2014	20 m x 50 m plot / transects; opportunistic fauna observations; fauna habitat assessment.
Additional FBA assessment survey	2-4 February 2015	Targeted *Hibbertia marginata* surveys; preliminary vegetation mapping of potential biobank site.

4.3.2 Site stratification

Pre-existing vegetation mapping was ground-truthed in the field via systematic walked transects across the entire proposal site and by walking the boundary of vegetation units. Necessary adjustments were made by hand on aerial photographs of the study area. The site was divided into relatively homogenous or discrete zones for assessment based on observed vegetation structure, species composition, soil type, landscape position and condition. Native vegetation was divided into vegetation zones which represented a distinct plant community type (PCT) and broad condition state. Three native PCTs were identified in the proposal site as shown on Figure 2. The remainder of the proposal site contains cleared areas used for quarrying activities.

4.3.3 Plot/transect surveys

Plot and transect surveys were conducted on site in accordance with the FBA to confirm vegetation types, assess site condition and where required to calculate biodiversity credits. The site value was determined by assessing ten site condition attributes against benchmark values. Benchmarks are quantitative measures of the range of variability in condition in vegetation with relatively little evidence of alteration, disturbance or modification by humans since European settlement. Cover abundance data was also collected for each species within the 20 metre x 20 metre portion of each plot/transect.

Plots were used to sample potential vegetation zones (i.e. PCTs and broad condition classes) based on the initial site stratification. Seven plot/transects were sampled within the proposal site as shown on Figure 2.

4.3.4 Targeted threatened flora surveys

Initial threatened plant surveys were limited to incidental sightings only and confirmed the presence of *Hibbertia marginata.* Further targeted surveys were undertaken in accordance with the BBAM to quantify the number of individuals being impacted by the proposal and to calculate the number of species credits that will be required to be secured to offset these impacts. This data was collected by walking along transects spaced approximately 5-10 m apart within Stages 2 and 3 of the proposed quarry footprint and recording the location and number of *Hibbertia marginata* plants as they were encountered. For accurate identification of the species, a sample was taken and sent to the NSW Botanical Gardens for confirmation in accordance with advice from OEH.

4.3.5 Fauna surveys

The site survey methodology included relatively limited targeted fauna survey techniques (e.g. no trapping) because the FBA assesses the majority of threatened fauna species that could occur based on habitat surrogates.

An assessment was made of the type and quality of habitats present in the study area for native fauna. Habitat quality was based on the level of breeding, nesting, feeding and roosting resources available. The study area was searched for habitat features, such as hollow-bearing trees, feed trees for the Grey-headed Flying-fox and Koala and water bodies. Opportunistic and incidental observations of fauna species were recorded at all times during field surveys. Casual fauna observations were made in suitable areas of habitat throughout the course of the survey and while incidentally traversing the development site. This included visual inspection of trees and woody debris, active searches for small fauna and opportunistic observation of scats, tracks, burrows or other traces.

4.4 FBA calculations

The proposal was assessed according to the methodology presented in the FBA (OEH, 2014a), the DECC (2009) *BioBanking Assessment Methodology and Credit Calculator Operational Manual* and the *Draft Operational Manual for using the BioBanking Credit Calculator v4.1* (OEH, 2011). The credit calculator is a software application that is used to apply the FBA as well as BioBanking assessments. Data is entered into the credit calculator based on information collected in the desktop assessment, site surveys and from using GIS mapping software.

The FBA credit calculations were performed by Arien Quin and Dan Williams using credit calculator Version 4.1. The credit calculations will be submitted to OEH. The biodiversity credit report is included as Appendix D.

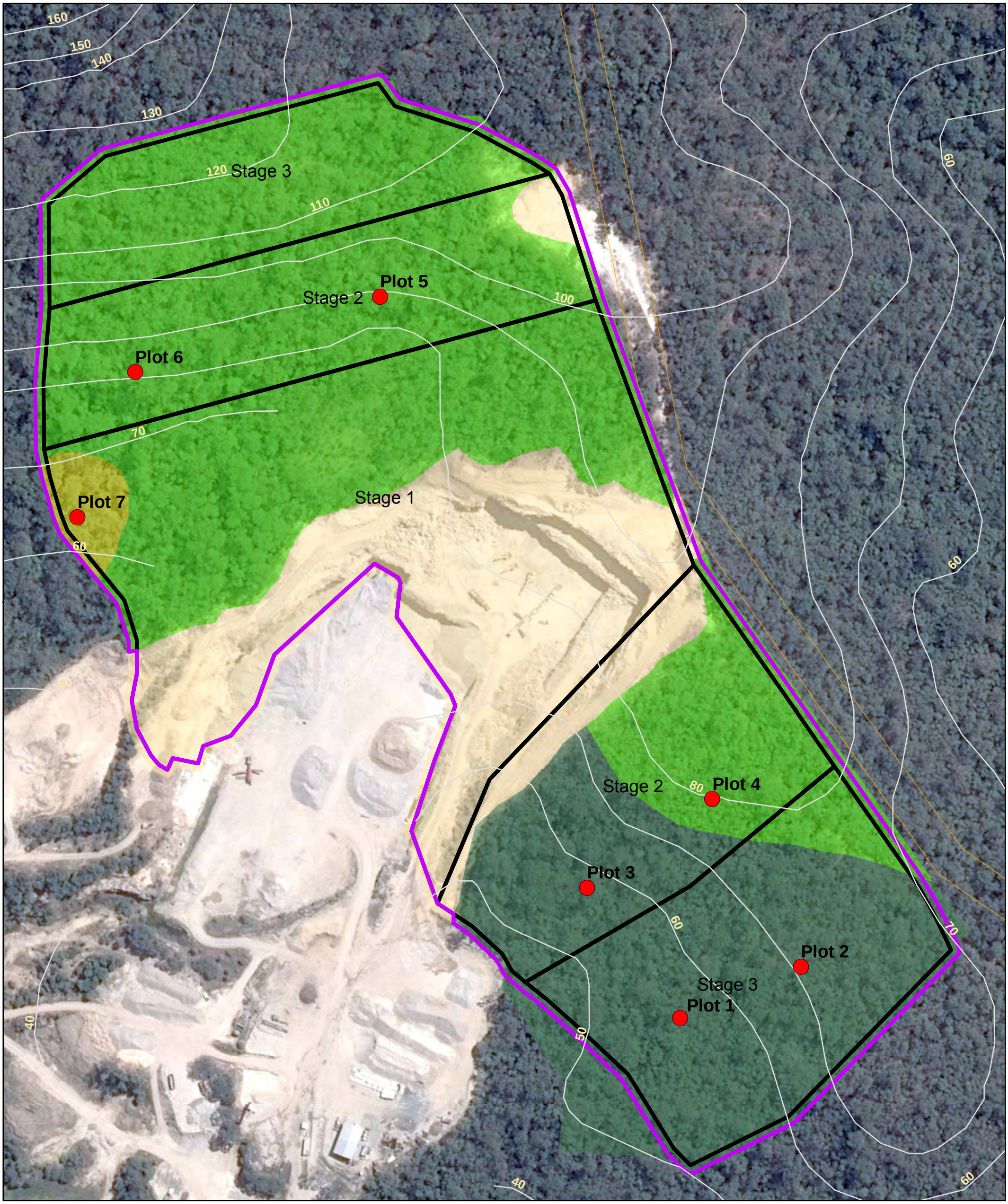
The data and assumptions used to perform the FBA credit calculations are summarised in Chapter 8.

4.5 Staff qualifications

Field surveys were conducted by Ben Harrington, Arien Quin, Kaycee Simuong and Amanda Ayres. Credit calculations and reporting was performed by Daniel Williams and Arien Quin. The assessment was peer reviewed by Dan Williams Staff qualifications are presented in Table 3.

Table 3 Staff qualifications

Name	Position / Project Role	Qualifications	Relevant Experience
Dan Williams	Principal ecologist /, credit calculations and report review	B. App. Sc. Cons Tech BioBanking Assessor Accreditation	15+ years
Arien Quin	Ecologist / site surveys / credit calculations / reporting	BA, BSc BioBanking Assessor Accreditation	8+ years
Ben Harrington	Senior Ecologist / site surveys	BSc, MSc (Physical Geography) BioBanking Assessor Accreditation	10+ years
Amanda Ayres	Ecologist / targeted *Hibbertia marginata* surveys / reporting	BEnvSc	10+ years
Quan Chang	GIS/ mapping	M App.Sc	8+ years
Kaycee Simuong	Ecologist / targeted *Hibbertia marginata* surveys / site surveys / reporting	BEnvSc (Hons)	1 year



LEGEND

- biobanking plot/transects
- Subject site
- Stages
- 10m contour
- cadastre
- Blackbutt - Turpentine dry heathy open forest on sandstones
- Blackbutt - bloodwood dry heathy open forest on Quaternary sands
- Swamp Mahogany swamp forest of the coastal lowlands
- Cleared

Paper Size A3

0 10 20 40 60 80

Metres

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

N

GHD

Newman Quarrying
Sly's Quarry Environmental Impact Statement
Biodiversity Assessment

Job Number 22-17528
Revision A
Date 20 Mar 2015

Vegetation types and survey locations

Figure 2

N:\AU\Coffs Harbour\Projects\22\17528\GIS\Maps\Deliverables\22_17528_Z002_Vegetation_zones_RevB.mxd

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

Data Source: NSW Department of Lands: Cadastre - Jan 2014; Geoscience Australia: 250k Data - Jan 2014; NSW Department od Primary Industry - Jan 2014; Google image Jan 2014. Created by: qjchung

5. Results

5.1 Desktop assessment

5.1.1 Threatened ecological communities

Seven threatened ecological communities (TECs) listed under the TSC Act have been recorded in the Northern Rivers –Clarence Sandstones IBRA subregion (OEH 2014b). In addition one TEC listed under the EPBC Act is predicted to occur in the locality (DotE 2014a) (Appendix A).

5.1.2 Threatened populations and species

The Atlas of NSW Wildlife database (OEH 2014a) identifies 10 threatened flora species listed under the TSC Act previously recorded in the locality. The protected matters search (DoTE 2014a) identifies 16 threatened flora species listed under the EPBC Act as potentially occurring in the locality (see Appendix A).

The Atlas of NSW Wildlife database (OEH 2014a) identifies 44 threatened fauna species listed under the TSC Act as having been previously recorded in the locality. The protected matters search (DotE 2014a) identifies 20 threatened fauna species listed under the EPBC Act as potentially occurring in the locality (note that exclusively marine species have been excluded from this list). A copy of the EPBC protected matters search is provided in Appendix C.

Three threatened species listed under the FM Act have been previously recorded in the locality (see Appendix A).

5.1.3 Migratory species

The protected matters search (DotE 2014a) identifies 14 migratory species listed under the EPBC Act as potentially occurring in the locality (not including marine and pelagic species).

5.1.4 Other matters of national environmental significance

No other ecological MNES were identified by the protected matters search as occurring or likely to occur in the locality.

5.2 Flora survey results

5.2.1 Flora species

A total of 101 flora species were recorded within the study area. All of these species are native other than one exotic species (*Lantana camara*). The full list of flora species recorded is presented in Appendix B. The diversity of species present in the study area is likely to be greater than this list, as the cryptic nature of some species means detection is only possible at certain times of year and following specific weather events such as rainfall.

Flora species recorded are discussed below in relation to the vegetation communities occurring within the study area.

5.2.2 Plant community types

Two PCTs occur within the study area, these communities are described below.

Blackbutt - Bloodwood dry heathy open forest on sandstones of the northern North Coast (NR114)

Blackbutt-bloodwood dry heathy open forest is a tall open forest that occurs on deep sands of old dune systems along the NSW North Coast.

This community is dominated by Pink Bloodwood (*Corymbia intermedia*), Tallowwood (*Eucalyptus microcorys*), Blackbutt (*Eucalyptus pilularis*) and *Angophora paludosa* to 25 metres tall. Over a tall shrub layer to 10 metres dominated by *Acacia leiocalyx*, Red Ash (*Alphitonia excelsa*), Logon Apple (*Acronychia imperforata*) and Salwood (*Acacia disparrima*). A lower layer of shrubs includes Coffee Bush (*Breynia oblongata*), Cheese Tree (*Glochidion ferdinandi*) and Tree Heath (*Trochocarpa laurina*). The ground storey consists of a dense layer of leaf litter with a sparse cover (< 3%) of herbs and grasses. Common species within the ground layer include Many-flowered Mat-rush (*Lomandra multiflora*), Blue Flax Lily (*Dianella cerulea var. producta*), Rough Saw Sedge (*Gahnia aspera*), Spear Grass (*Austrostipa pubescens*) and Creeping Beard Grass (*Oplismenus imbecillis*) (refer to plate 2).

This vegetation type covers approximately 4.23 hectares of the study area.

Plate 1 Blackbutt - bloodwood dry heathy open forest in the south west of the study area

Blackbutt - Turpentine dry heathy open forest on sandstones of the lower Clarence of the North Coast (NR123)

Blackbutt-Turpentine dry heathy forest is a tall open forest that occurs on sandstone geologies of the Clarence-Moreton Basin from the southern Richmond Range east to the Coast Range.

Within the study are this plant community is dominated by Blackbutt (*Eucalyptus pilularis*), Turpentine (*Syncarpia glomerata*), Red Mahogany (*Eucalyptus resinifera*) and *Angophora woodsiana* to 25 metres tall with a cover of approximately 40%. The midstorey consists of a tall shrub layer to 8 metres dominated by *Acacia leiocalyx*, Red Ash (*Alphitonia excelsa*), Tree Heath (*Trochocarpa laurina*), Flaky-barked Tea-tree (*Leptospermum trinervium*) *Persoonia conjuncta*, Cheese tree (*Glochidion ferdinandiana*) and Blackthorn (*Bursaria spinosa*) over a dense low shrublayer to 2 metres dominated by Handsome Flat Pea (*Platylobium formosum*),

Hibbertia marginata, *Leucopogon lanceolatus* and Coffee Bush (*Breynia oblongata*). The groundlayer is dominated by Wire Grass (*Entolasia stricta*), Grass Trees (*Xanthorrhoea* sp), Spiny-headed Mat-rush (*Lomandra longifolia*), Rough Saw-sedge (*Gahnia aspera*), Common Bracken (*Pteridium esculentum*), Crinkle Bush (*Lomatia silaifolia*), Blue Flax-lily (*Dianella cerulea*) and *Lepidosperma laterale*. This community also contains a variety of vines and climbers including Wonga Wonga Vine (*Pandorea pandorana*), Lawyer vine (*Smilax australis*), Sweet Sarsaparilla (*Smilax glyciphylla*), Molucca Bramble (Rubus moluccanus var. trilobus) and Stiff Jasmine (*Jasminum volubile*).

This vegetation type covers approximately 6.27 hectares of the study area.

Plate 2 Blackbutt - Turpentine dry heathy open forest in the north of the study area

5.2.3 Noxious and environmental weeds

One flora species declared as noxious under the NW Act occurs within the study area. This species (Lantana (*Lantana camara*)) is a class 4 noxious weed which in accordance with the NW Act must be managed in a manner that continuously inhibits the ability of the plant to spread.

Within the study area Lantana occurs as small isolated patches scattered through the site.

5.3 Fauna and habitat survey results

5.3.1 Fauna species

A total of 20 fauna species were recorded within the study area including 19 birds and one reptile. These species were recorded incidentally during the site visit and no targeted surveys for fauna were undertaken. It is likely that the site would be utilised by a range of other fauna species not recorded during this survey. A full list of fauna species recorded in the study area is presented in Appendix B.

5.3.2 Fauna habitat

The main fauna habitats that occur within the subject site are associated with the dry open forest communities. These habitat types are described in detail below.

The study area would be expected to support a moderately high diversity of native fauna species. Habitat values within the study area are somewhat lower than might be given the previous selective logging that has occurs at the site. There are, however, scattered mature-age trees which were likely retained throughout the logging process: these occur across the study area. There are also other ongoing habitat disturbances such as noise from quarry operations.

The study area contains a range of habitat features which would provide shelter and foraging resources for a variety of native fauna, including:

- Myrtaceous trees and shrubs, including preferred feed tree species for threatened birds and arboreal mammals and a tall midstorey of *Allocasuarina* spp., which would provide foraging resources for granivorous birds including the threatened Glossy Black-cockatoo.
- Small patches of dense, low shrubs, mainly the exotic Lantana, which provide shelter and foraging habitat for a range of small woodland birds and terrestrial mammals.
- Moderate density of woody debris and fallen logs which would provide shelter and foraging habitat for a range of native reptiles, and foraging substrate for native insectivorous birds and mammals.
- A moderate density of hollow-bearing trees with a range of hollow sizes and positions, including trees with hollows at ground level, limb hollows, trunk fissures and dead trees (stags). These would provide potential roost sites for several native birds, arboreal and terrestrial mammals and microbats.
- Small ephemeral drainage lines which would provide foraging and breeding habitat for a range of native frogs, reptiles and birds.
- The quarry face itself, which is uneven and may provide basking, shelter and foraging resources for native reptiles, and potential shelter habitat for small terrestrial mammals or birds as well as diurnal roosts for microbats.

Dry Heathy Open Forest

Blackbutt – Bloodwood dry heathy open forest and Blackbutt –Tallowwood dry heathy open forest are the dominant vegetation types within the study area. These vegetation types are characterised by Blackbutt (*Eucalyptus pilularis*), Pink Bloodwood (*Corymbia intermedia*) and Tallowwood (*Eucalyptus microcorys*) with Red Mahogany (*Eucalyptus resinifera*), *Angophora woodsiana* and *Angophora paludosa* occurring in lesser abundance.

These eucalypts would provide foraging habitat for a wide variety of bird species including cuckoos, honeyeaters, thornbills, gerygones, whistlers, fantails, bowerbirds and figbirds as well as a range of arboreal mammals. A range of threatened birds could forage on occasion in this community, including the Varied Sittella (*Daphoenositta chrysoptera*). Forest owls including the Powerful Owl (*Ninox strenua*) may prey on arboreal mammals at the site on occasion.

The presence of *Allocasuarina littoralis* within the small tree stratum is likely to provide foraging resources for local populations of the Glossy Black-cockatoo (*Calyptorhynchus lathami*), which have been previously recorded near the site (OEH 2014). This species is known to frequent preferred feed trees which are mature, healthy, in dense stands and bear good quantities of fruit (DECCW, 2010b). This species may forage on occasion at the site.

A number of hollow bearing trees were recorded within these vegetation types. Hollows ranged in size from small large and are likely to provide habitat for a number of hollow-dependent fauna, such as possums, gliders, bats and a variety of birds. These hollows may also provide habitat for threatened species such as the Yellow Bellied Glider (*Petaurus australis*), Squirrel Glider (*Petaurus norfolkensis*) and Brush-tailed Phascogale (*Phascogale tapoatafa*) all of which have been recorded within the locality.

Dense leaf litter is present in most areas, and some small logs scattered throughout which is likely to provide habitat for a range of reptile species.

Feed trees

The study area supported a range of trees which would provide foraging resources for native birds, bats and arboreal mammals. This includes a variety of flowering eucalypts, including profusely flowering species identified as keystone nectar feed trees (DECC 2007), which would be used by a range of native nectarivorous birds, including the Noisy Friarbird (*Philemon corniculatus*), Scarlet Honeyeater (*Myzomela sanguinolenta*) and Lewin's Honeyeater (*Meliphaga lewinii*), by arboreal mammals such as the Sugar Glider (*Petaurus breviceps*) and Common Brushtail Possum (*Trichosurus vulpecula*) and by the threatened Grey-headed Flying-fox, all of which were recorded during surveys. Eucalypts and other canopy species also provide foraging substrates for insectivorous birds such as the Willy Wagtail (*Rhipidura leucophrys*), Thornbill species (*Acanthiza* spp.) and Cicadabirds (*Coracina tenuirostris*).

Eucalypts recorded include both summer and winter flowering species meaning the study area would be able to support nectarivorous species at most times of year, although flowering times and productivity may vary from year to year. Winter flowering species are particularly important for threatened species such as the Grey-headed Flying-fox, which suffers food bottlenecks in winter and spring (Eby and Law 2008).

Eucalypt species present at the site would provide potential foraging resources, including sap, foliage or nectar for a range of threatened species, including: birds such as the Little Lorikeet (*Glossopsitta pusilla*); threatened arboreal mammals, including the Yellow-bellied Glider (*Petaurus australis*), Squirrel Glider (*Petaurus norfolcensis*) and the Koala (*Phascolarctos cinereus*); and bats such as the Grey-headed Flying-fox. Other threatened species may also forage within or above the canopy or on the trunks of these trees, including the Varied Sittella (*Daphoenositta chrysoptera)* and a range of threatened microbats.

5.3.3 Habitat connectivity

Vegetation and habitats within the study area are contiguous with extensive areas of native vegetation that extends in all directions. This vegetation includes vegetated fauna movement corridors that connect the site to the Mororo State Forset to the south east, Devils Pulpit State Forest to the north east, Bundjalung Crown Reserve and Tabbimobile State Forest to the north.

This connectivity would allow a broad range of mobile fauna species to use habitats within the study area, either as part of their home territory or as an adjunct to their core areas of habitat in response to seasonal resource availability. Connectivity of the site to large tracts of surrounding native vegetation is likely to increases the overall diversity of fauna species which may use habitats within the study area but also increases the likelihood that only a subset of these species will be present during any one season or survey period.

5.4 Conservation significance

5.4.1 Threatened ecological communities

No EECs were recorded within the study area.

5.4.2 Threatened flora species

One threatened flora species (Bordered Guinea Flower (*Hibbertia marginata*) listed as vulnerable under both the TSC and EPBC Acts was recorded within the subject site during the current assessment. This species was found growing within areas of Blackbutt –Turpentine dry heathy open forest and Blackbutt-Bloodwood dry heath open forest.

Locations of where this species was recorded are shown on Figure 3.

This plant was recorded opportunistically during initial vegetation surveys and mapping. Additional systematic targeted surveys were undertaken at a later date to determine the extent and size of this population within the subject site.

In addition to Bordered Guinea Flower there is potential habitat within the study area for four other threatened flora species to occur. These species are listed in Table 4 below.

Table 4 Threatened flora with potential habitat in the study area

Species Name	Common Name	TSC Act status	EPBC Act status
Cryptostylis hunteriana	Leafless Tongue Orchid	V	V
Lindsaea incisa	Slender Screw-Fern	E	-
Paspalidium grandispiculatum	A Grass	V	V
Polygala linariifolia	Native Milkwort	E	-

The codes used in this table are; E – endangered; V – vulnerable;

None of these species were identified during field surveys.

No threatened flora species listed under the FM Act are likely to occur in the study area, or immediately downstream of the study area.

5.4.3 Threatened fauna species

No threatened fauna species were identified within the study area during the current field surveys. A total of 23 threatened fauna species are considered to have the potential to occur at the site based on the presence of suitable habitat. These species are listed in Table 5, and can be divided into the following seven guilds on the basis of habitat requirements and life-history characteristics.

No threatened fauna species listed under the FM Act are likely to occur in the study area, or downstream of the study area.

The current survey did not include any targeted threatened species surveys. It is therefore assumed that threatened fauna species which have been recorded in the locality and for which there is suitable habitat within the study area have potential to occur.

Forest owls and raptors

Four species, comprising the Powerful, Barking and Masked Owls and the Square-tailed Kite, may potentially occur within the study area. None of these species was recorded during current or previous surveys.

The three owls all require large tree hollows in large, mature trees for nesting, while the Square-tailed Kite nests in forks or large horizontal braches of large, mature trees, generally along or near watercourses. Larger mature trees are scattered throughout the study area. A subset of these trees contains hollows which may be of a sufficient size for the three threatened owls,

which require large tree hollows for nesting. Some trees may also be of a suitable size for use by the Square-tailed Kite. No evidence of nesting (such as regurgitated pellets, extensive whitewash) was observed.

All four species listed above may forage above and within habitats present within the study area. Woody debris and small tree hollows present within the study area would provide shelter and foraging habitats for small mammals, birds, reptiles and frogs which would provide potential prey for these birds. All four species all have very large home ranges (in the order of hundreds to thousands of hectares), and individuals of these species may use roosting, nesting and foraging habitats within the study area as part of a much larger territory.

Woodland birds

None of the five species of threatened woodland birds considered to have the potential to occur were observed within the study area.

Preferred feed trees of the Glossy Black-cockatoo occur within the study area and although no evidence of chewed *Allocasuarina* cones was observed the species has been previously recorded immediately east of the study area (OEH 2014a). This species requires large hollows for nesting and may nest within a subset of the hollows available within the study area. The Glossy Black-cockatoo feeds almost exclusively on the seeds of *Casuarina* and *Allocasuarina* species (OEH 2013b). The study area had *Allocasuarina* species scattered in low abundance throughout the site and it is likely that the Glossy Black-cockatoo would forage within the site on occasion.

The Little Lorikeet occurs from the coast to the inland slopes; however the box gum-ironbark woodlands of the western slopes are regarded as being the core habitats of this species (Courtney and Debus 2006). They have highly specialised nest-hollow requirements, typically using hollows with small entrances in living wood, which serves to exclude many competitors. They appear to reuse the same hollows for several decades, suggesting suitable hollows are limiting (Courtney and Debus 2006, OEH 2014a). They may also breed in coastal areas and may nest within a subset of the hollows present within the study area. This species is regarded as being semi-nomadic and would be likely to occur and forage within the study area in response to seasonal eucalypt flowering events.

The Varied Sittella may forage and breed within the study area. This species is insectivorous and would forage on rough barked eucalypts (such as *Eucalyptus resinifera, C. intermedia* and *E. carnea*). The species nests in tree forks high in the canopy and may reuse nests over successive years: no nests were observed but the species is relatively common within the locality. The habitat value of the study area for this species may be somewhat reduced by the effects of historic logging and recent burning: the Varied Sittella is sedentary and sensitive to habitat simplification, including reductions in shrub and ground cover, logs, fallen branches and litter (Watson et al. 2001; Seddon et al. 2003).

Arboreal mammals

The study area contains potential habitat for four species of threatened arboreal mammal, the Yellow-bellied Glider, Squirrel Glider, Brush-tailed Phascogale and Koala. The Yellow-bellied glider had been previously recorded directly adjacent to the study area (OEH 2014).

The study area supports potential foraging habitat for the Yellow-bellied and Squirrel Gliders, including identified feed trees for the Yellow-bellied Gliders and highly productive nectar-producing eucalypts which may be used by the Squirrel Glider. There are 55 records of the Yellow-bellied Glider within the locality, with the closest occurring less than 200 metres to the east of the study area. There are ten records of the Squirrel Glider within the locality. The most recent record of the Squirrel Glider from 2002 is approximately 2 km to the south. The presence

of records of these species within contiguous areas of vegetation surrounding the site indicates that both species could occur and forage within the study area.

Both of these gliders require tree hollows for nesting and roosting. Yellow-bellied Gliders live in small family groups, with actual numbers varying between locations (NPWS, 2003). Family groups occupy large home ranges of approximately 20-85 hectares (Goldingay, 1992) which are exclusive to a single family group (Goldingay, 1994). Yellow-bellied Gliders typically occupy tall, large diameter trees with large hollows, with family groups using up to 13 den trees within their home range (Goldingay and Kavanagh, 1990). Squirrel Gliders also require abundant tree hollows for refuge and nest sites, with family groups utilising a number of hollows within their home range (OEH, 2011). Hollows used by Squirrel Gliders are small (approximately 5 centimetres diameter). They live in family groups of 2-10 individuals (Quin, 1995) and maintain home ranges of 0.65 and 10.5 hectares, varying according to habitat quality and food resource availability (Quin, 1995; Goldingay and Jackson 2004).

A subset of the hollows present within the study area may therefore provide potential roosting and breeding habitat for these Gliders.

The Brush-tailed Phascogale also typically roosts and nests in hollows or rotted stumps, using up to 40 nests per year (Soderquist and Rhind 2008). Individuals have relatively large, overlapping (though females exclude unrelated females) home ranges, spanning 20-40 hectares for females and over 100 hectares for males (Soderquist and Rhind 2008). The study area contains potential roosting, breeding and foraging habitat for this species, and may contribute to the home range of several individuals.

SEPP 44 – Koala habitat assessment

The development footprint contains several preferred feed tree species of the Koala, including Tallowwood (*Eucalyptus microcorys*), Red Mahogany (*E. resinifera*) and Pink Bloodwood (*Corymbia intermedia*).

Tallowwood is the only feed tree species listed under Schedule 2 of SEPP 44. This species is considered to constitute at least 15% of the total number of trees at the site. Consequently in accordance with the definitions outlined under the Policy (see Section 2.3.2), the site constitutes 'potential' Koala habitat.

The Koala has been recorded relatively frequently, with 58 sightings recorded within the locality within the NSW Wildlife Atlas since 1980. This includes two records from 2006 and 2010 within 200 metres of the development footprint and another record from approximately 2km to the west (OEH 2014a). Targeted surveys for the Koala were not undertaken during field surveys and opportunistic sightings were not recorded. Large scratches were observed opportunistically on a number of trees, however due to the nature of these scratches, it is believed to be evidence of the Lace Monitor (*Varanus varius*) which was observed during the survey, as opposed to the Koala which tends to leave small, 'poc' marks on trees.

Despite the presence of 'potential' Koala habitat as defined by SEPP 44, the limited number of recent records within close proximity to the site suggests that the site does not provide 'core' Koala habitat as defined by the Policy (see Section 2.3.2). Although the Clarence Valley CKPoM does not cover the site, using the definitions outlined in the plan, the site is classified as 'preferred Koala habitat: secondary (class A)' due to presence of listed primary (Tallowwood) and secondary food tree species (Red Mahogany and Pink Bloodwood).

Based on this information, the presence of the Koala was considered likely on a transient basis and consequently this species has been included in the credit calculations accordingly (see Chapter 8).

Terrestrial mammals

The study area would represent suitable habitat for threatened terrestrial mammals such as the Common Planigale and Spotted-tailed Quoll (note that the Quoll may also use arboreal habitats, including tree hollows).

Spotted-tailed Quolls use hollow-bearing trees, fallen logs, small caves, rock crevices, boulder fields and rocky-cliff faces as den sites (OEH 2014b). According to a study conducted in Limeburners Creek, quolls used hollows in trees and logs with medium to large circumferences (typically greater than 50 cm dbh for logs and greater than 70 cm dbh for trees), and entrances between 16-41 cm diameter (average 26.13) in logs and between 7-27 cm (average 15.85cm) in tree hollows (Andrews 2005). In a study in south-eastern Australia, two Spotted-tailed Quolls were recorded using 15 den sites, and females used a number of dens while rearing young (Belcher and Darrant 2006). Spotted-tailed Quolls are solitary, with the female being territorial (although they do tolerate their own female offspring). Female home ranges are between 180-1000 ha. Male home ranges are between 2000-5000 hectares and overlap with other males and a number of females (Belcher et al. 2008). Quolls have been observed to selectively use gullies, creeklines and escarpments when moving, avoiding mid slope areas (Belcher 2000, in Andrews 2005).

Habitat value for the Spotted-tailed Quoll would be somewhat reduced within the study area by the effects of historic logging. Shelter habitats for this species are still present with hollow-bearing trees (including trees with ground-level hollows), logs and other woody debris. The species may forage throughout the study area, although woody debris and other shelters for prey species such as small mammals, frogs and reptiles are also concentrated in lower slopes and gully areas.

There is limited information available on the ecology of the Common Planigale, however it is known to shelter under rocks, fallen timber and bark, human debris (e.g. sheet iron) and in termite mounds. It is also known to forage amongst leaf litter, dense grass and low vegetation (Burnett 2008). They are able to tolerate some degree of disturbance and occur close to human habitation (Burnett 2008).

As for the Spotted-tailed Quoll, the habitat value of the study area for the Common Planigale may be somewhat reduced within the study area by the effects of historic logging. Shelter habitats for this species are still present under logs and other woody debris.

Bats

A total of eight species of bats are considered to have the potential to occur within the study area given the presence of local records and the habitats present. Seven of these species are microbats, Microbat species with the potential to occur within the study area may be divided into cave-roosting species which would use the study area as foraging habitat only, and hollow-roosting species which may roost and/or breed within the study area.

The eighth species is the Grey-headed Flying-fox which roosts and breeds in large social camps with up to several thousand individuals. The study area does not contain a roost camp for this species, but there is large camp near Iluka which is situated approximately 18 km to the south east of the study area (Roberts 2006). The Grey-headed Flying-fox may travel up to 50 km in a night to forage (Eby and Law 2008) and individuals using these camps would therefore be likely to forage within the study area, which contains several identified feed trees for the species. These trees include species which flower in winter and spring, during identified food bottlenecks for this species.

Reptiles

Stephen's Banded Snake is an arboreal snake that occurs in moist eucalypt forest and rainforest, foraging on the ground but sheltering in tree hollows. Individuals may use between 5 and 30 hollows and have large home ranges, averaging approximately 5 hectares for females and 20 hectares for males. Within these home ranges, snakes have been shown to select refuges (mostly tree hollows but also including tree crevices, termitaria or vines) within trees which were significantly taller, thicker, with more hollows and later growth stages than other trees in the area (Fitzgerald et al 2002a). The closest record of Stephen's Banded Snake is approximately 4 km to the south (OEH 2014a); however this species is relatively cryptic and may be more widespread than suggested by recorded sightings.

Moister vegetation along the drainage lines would be potentially suitable for this threatened species, and contains a moderate density of potential shelter sites. Individuals may also forage within drier, less suitable habitat upslope from the drainage lines but this would be regarded as marginal foraging habitat only.

Table 5 Threatened fauna with the potential to occur within the study area

Species name	Common Name	TSC Act Status	EPBC Act status
Calyptorhynchus lathami	Glossy Black-Cockatoo	V	-
Coracina lineata	Barred Cuckoo-shrike	V	-
Daphoenositta chrysoptera	Varied Sittella	V	-
Glossopsitta pusilla	Little Lorikeet	V	-
Lophoictinia isura	Square-tailed Kite	V	-
Ninox connivens	Barking Owl	V	-
Ninox strenua	Powerful Owl	V	-
Tyto novaehollandiae	Masked Owl	V	-
Chalinolobus nigrogriseus	Hoary Wattled Bat	V	-
Dasyurus maculatus	Spotted-tailed Quoll	V	E
Miniopterus australis	Little Bentwing-bat	V	-
Miniopterus schreibersii oceanensis	Eastern Bentwing-bat	V	-
Mormopterus norfolkensis	Eastern Freetail-bat	V	-
Nyctophilus bifax	Eastern Long-eared Bat	V	-
Petaurus australis	Yellow-bellied Glider	V	-
Petaurus norfolcensis	Squirrel Glider	V	-
Phascogale tapoatafa	Brush-tailed Phascogale	V	-
Phascolarctos cinereus	Koala	V	V
Planigale maculata	Common Planigale	V	-

Species name	Common Name	TSC Act Status	EPBC Act status
Pteropus poliocephalus	Grey-headed Flying-fox	V	V
Saccolaimus flaviventris	Yellow-bellied Sheathtail-bat	V	-
Scoteanax rueppellii	Greater Broad-nosed Bat	V	-
Hoplocephalus stephensii	Stephens' Banded Snake	V	-

The codes used in this table are: CE – critically endangered; E – endangered; V – vulnerable;, M- migratory

5.4.4 Migratory species

One migratory species (Rainbow Bee-eater), listed under the EPBC Act was recorded within the study area and a further 13 migratory bird species listed under the EPBC Act are known or predicted from the locality of the study area. Some of these species can be reliably excluded from occurring, based on their broad habitat requirements, however a total of four species (including the Rainbow Bee-eater) have the potential to occur on an occasional or transient basis in response to favourable conditions within the subject site (see Table 12 and discussion below).

The Fork-tailed Swift (*Apus pacificus*) and White-throated Needletail (*Hirundapus caudacutus*) both breed in the northern hemisphere and are almost exclusively aerial while in Australia during the non-breeding season. These birds may forage and fly over the study area but would be unlikely to land and/or be dependent on the habitats present within the study area.

Two migratory woodland species may occur within the study area, Satin Flycatcher tends to prefer moist, densely vegetated habitats, though they may occur in more open habitats while migrating. The Rainbow Bee-eater (*Merops ornatus*) is generally found in open forests and woodlands and roosts in banks and sand dunes. Both of these species are likely to forage and/or breed within the study area.

Table 6 Migratory fauna listed under EPBC Act with the potential to occur within the study area

Species Name	Common Name	Likelihood of occurrence
Apus pacificus	Fork-tailed Swift	**Possible** Non-breeding visitor. Potential aerial foraging habitat present.
Hirundapus caudacutus	White-throated Needletail	**Possible-** Non-breeding visitor. Potential aerial foraging habitat present.
Merops ornatus	Rainbow Bee-eater	**Known-**Potential breeding and foraging habitat present.
Myiagra cyanoleuca	Satin Flycatcher	**Possible-**Potential breeding and foraging habitat present.

518,500

6,758,500

Stage 3
2.1ha

Stage 2
2.7ha

Stage 1
6.9ha

Stage 2
3ha

Stage 3
3.1ha

6,758,000

518,500

LEGEND

Subject site

Hibbertia Marginata

Stages

cadastre

10m contour

Paper Size A3

0 10 20 40 60 80

Metres

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

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Newman Quarrying
Sly's Quarry Environmental Impact Statement
Biodiversity Assessment

Job Number 22-17528
Revision A
Date 18 Feb 2015

Threatened species recorded within study area

Figure 3

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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

Data Source: NSW Department of Lands: Cadastre - Jan 2014; Geoscience Australia: 250k Data - Jan 2014; NSW Department od Primary Industry - Jan 2014; Google image Jan 2014. Created by: qjchung

6. Impact assessment

6.1 Direct impacts

6.1.1 Clearing of vegetation

The proposal would require the clearing of 10.5 hectares of native vegetation, comprising 4.23 hectares of Blackbutt - Bloodwood dry heathy open forest and 6.27 hectares of Blackbutt - Turpentine dry heathy open forest. Vegetation clearing in these communities would involve removal of a moderately diverse range of non-threatened native plants, including mature trees, as well as potential habitat for threatened biota. The extent of proposed clearing of each vegetation community is summarised in Table 7.

Table 7 Proposed removal of native vegetation within the proposal site

Plant Community	TSC Act Status	EPBC Act Status	Condition	Area Impacted (ha)
Blackbutt - Bloodwood dry heathy open forest	-	-	Moderate/ good	4.23
Blackbutt - Turpentine dry heathy open forest	-	-	Moderate/ good	6.27
TOTAL				**10.5**

Clearing of native vegetation is listed as a Key Threatening Process under both the NSW TSC Act and the Commonwealth EPBC Act. Under the TSC Act, native vegetation is made up of plant communities, comprising primarily indigenous species. Clearing is defined as the destruction of a sufficient proportion of one or more strata layers within a stand or stands of native vegetation so as to result in the loss, or long-term modification, of the structure, composition and ecological function of a stand or stands (NSW Scientific Committee 2001). There would be a total of 10.5 hectares of clearing of native vegetation for construction of the proposal (see Table 7).

6.1.2 Removal of habitat resources

The development would require the clearing of habitat for native fauna, including native vegetation within the site footprint and important habitat resources (hollow-bearing trees) for native biota. The proposed clearing of this habitat has potential to have impacts on local fauna populations within the site, including displacement or mortality of individuals and removal of habitat resources within sites. The magnitude of these 'likely' impacts is assessed below. The development would require the clearing of 10.5 hectares of native vegetation as a result of direct surface disturbance during construction.

A range of native bird species that could potentially occupy the site would be affected by the removal of native vegetation and other habitat resources. The majority of these species are mobile, widespread and common, the exception being Powerful Owl (*Ninox strenua*), Masked Owl and Barking Owl which may forage in the area occasionally as part of a wider area of occupation. Further, there are large quantities of equivalent habitat and resources in the locality. Overall, it is likely that the impact on local populations of native birds would be minor.

Potential foraging habitat for Grey-headed Flying-fox (*Pteropus poliocephalus*), Squirrel Glider (*Petaurus norfolcensis)*, Yellow-Bellied Glider (*Petaurus australis)*, Brush Tailed Phascogale (*Phascogale tapoatafa)* and Koala (*Phascolarctos cinereus*) occurs within the study area Construction would clear an area of potential foraging habitat for these species, however given

the potential alternative foraging resources in the local area, the loss of this potential habitat is considered to be minor.

Large mobile mammals that may occur within the site (ie. Swamp Wallabies (*Wallabia bicolor*)) could readily evade injury as there is ample opportunity to escape into alternative habitats to the north, east or south of the site. There is the potential for adverse effects on smaller or less mobile terrestrial mammals, reptiles or frogs sheltering within the native vegetation at the time of removal, as a result of direct surface disturbance during the construction. Smaller species may be sheltering in dense vegetation or beneath woody debris during construction.

Potential foraging and denning habitat occurs onsite for arboreal mammals. A number of common and potentially threatened microbats may occur at the site and may forage across the entire site and potentially roost within the hollow-bearing trees onsite. The proposed works would remove foraging habitat for these species as well as a large number of potential roost sites. It is likely that individuals would be adversely affected during clearing, particularly individuals sheltering in tree hollows. Mitigation measures outlined in Section 7 would partially ameliorate impacts on these species. The removal of hollow-bearing trees is important because of the time it takes for these resources to develop in regenerating vegetation. However given the extensive areas of alternative habitat surrounding the site, this development would affect a minor proportion of available habitat resources for hollow-dependant fauna in the locality.

A range of native reptiles have the potential to occupy the site. These species are likely to be widespread and common. No threatened reptiles are likely to occur within the site. It is possible that individuals would be adversely affected during clearing, particularly those which burrow or shelter beneath woody debris. Mitigation measures outlined in Section 7 would partially ameliorate these impacts.

There are likely to be ongoing impacts on fauna utilising adjacent areas of habitat associated with noise and other disturbances as quarrying is already conducted at the site although resident fauna are likely to be adapted to these disturbances.

6.1.3 Fragmentation and barrier effects

The proposal will not result in the isolation or fragmentation of any areas of native vegetation. The proposal would, however, slightly reduce connectivity of vegetation within the study area by removing vegetation from around the area once used as a quarry. Given the extensive area of native vegetation surrounding the site connectivity would not be significantly impacted.

Vegetation outside the boundary of the study area (to the north, south and east) will allow fauna movement around the boundary of the study area, despite removing vegetation from the central portion of the site. The proposal would not affect local or migratory movements of any native fauna species outside of the study area.

The site is located to the south and east of a number of state forests that are included within a key regional habitat corridor and is also immediately adjacent to land mapped as key fauna habitat (DECC 2001) (see Figure 4). Any existing movements of mobile fauna species and ecosystem processes through this area would be largely unaffected by the proposal.

6.1.4 Fauna injury and mortality

The proposed works present an inherent risk of injury and mortality to native fauna. Specific risks include:

- During construction when vegetation and habitats are being cleared
- Through machinery and plant
- Operational traffic

Remnant native vegetation would have greater habitat value for native fauna and there is an increased risk of injury or mortality of native fauna which may be sheltering in this habitat during the construction period. There is considerable scope for native fauna to evade injury and/or seek alternative habitat in an extensive area of native vegetation surrounding the site.

Recommendations have been made in Section 7 to minimise the risk of vegetation clearing activities resulting in the injury or mortality of resident fauna.

6.1.5 Degradation of aquatic habitats

There are no aquatic habitats within the subject site, but small drainage lines do occur which would provide water to creeks in the surrounding locality during periods of high rainfall. Aquatic habitats could provide breeding and shelter resources for common frog and reptile species.

Potential sources of impacts to surface water within the site include:

- Runoff from areas stripped of vegetation
- Runoff from hardstand areas, including roads, processing areas and site facilities
- Leakage or spillage of hydrocarbon products from vehicles, wash down areas and workshops
- Refuelling bays and fuel, oil and grease storages

The nearest sensitive aquatic habitats within the immediate vicinity of the site is Tabbimoble Creek, located about 600 metres to the south of the site.

Potential water quality impacts may be associated with runoff from disturbed areas, including vegetation clearing, construction lay down areas and access roads if risks are not effectively managed and appropriate mitigation measures implemented.

Soil protection measures and techniques would be implemented during construction and operation of the quarry. Any localised increases in erosion hazard would be limited to the immediate construction footprint and there would be appropriate control devices and buffers in place. The proposal is unlikely to impact sensitive aquatic habitats at the site or the locality.

The site currently contains both hardstand areas and vegetated areas. The proposal would result in a slight increase in hardstand areas but not to the extent that significant changes to surface water flows or quality are likely to occur. Existing flows to and through existing culverts would be maintained. The proposal is unlikely to result in changes to the existing hydrological regimes at the site.

518,500

519,000

6,758,500

6,758,000

Mororo

LEGEND

Subject site

cadastre

Fauna Key Habitats

Key Habitat

regional

Paper Size A3

0 10 20 40 60 80 100

Metres

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

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Newman Quarrying
Sly's Quarry Environmental Impact Statement
Biodiversity Assessment

Job Number 22-17528
Revision A
Date 18 Feb 2015

Key habitat corridors

Figure 4

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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

Data Source: NSW Department of Lands: Cadastre - Jan 2014; Geoscience Australia: 250k Data - Jan 2014; NSW Department od Primary Industry - Jan 2014; Google image Jan 2014. Created by: qjchung

6.2 Indirect impacts

6.2.1 Edge effects

'Edge effects are inherent or natural in nature (i.e. wherever changes in vegetation or landscape cause sudden changes in vegetation structure) but can have negative impacts if their creation alters ecological processes. They also change habitat conditions created at or near the boundary between areas. In general, edge effects increase in relation to the dissimilarity between adjoining habitats.

Removal of vegetation causes a number of new environmental conditions to develop along the edges of the cleared environments, in particular in environments that originally contain the upper strata levels (canopy and/ or shrub layer) of vegetation. The removal of vegetation generally promotes the invasion of exotic species and/or disturbance tolerant native plants. With the invasion of these new species it often becomes difficult for the original plant species to recolonise once disturbed.

The proposed quarry area and immediate surroundings are already somewhat disturbed, with evidence of minor weed infestations around the perimeter of the existing cleared area. The proposal would increase the size of the quarry and result in areas that are currently not exposed to edge effects being exposed to possible detrimental impacts as a result of quarry expansion. Impacts are likely to include the introduction or spread of weed species, light and dust to new areas of vegetation, which are currently less affected by these impacts, reducing flora and fauna habitat values in the newly exposed edge areas.

6.2.2 Introduction or spread of weeds

The proposal may cause the dispersal of weed propagules (seeds, stems and flowers) into adjacent areas of native vegetation via plant and machinery, erosion (wind and water) and via workers shoes and clothing. Some sections of the study area already support infestations of Lantana, however there is a possibility that additional, more invasive or otherwise damaging environmental weeds may be introduced to the retained vegetation, or that existing Lantana infestations may be further spread into areas that are currently free from infestations. Depending upon the weeds introduced to the site, this could result in a decline in the condition of retained native vegetation and associated native fauna habitats.

6.2.3 Pests and pathogens

The proposal has the potential to introduce or spread pathogens such as *Phytophthora cinnamomi* (Phytophthora) and *Uredo rangelii* (Myrtle Rust) within the study area through vegetation disturbance and increased visitation unless appropriate mitigation measures are put in place. Spread of *Batrachochytrium dendrobatidis* (Chytrid fungus) is also possible, given the presence of drainage lines in the study area but is unlikely as these drainage lines are relatively small and would not hold water for long periods. Where present, 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 wipe out entire populations once introduced into an area. Mitigation measures are included in Section 7 to minimise the potential for any impacts such as pathogen introduction as a result of the proposal.

One cane toad was also identified during surveys. Should this species be identified in the potential biobank site additional management actions would be included to ensure its control?

6.2.4 Erosion, dust generation and sedimentation

Clearing of vegetation may increase erosion and sedimentation in the study area. Uncontrolled erosion of topsoil from excavated areas and exposed soils and corresponding deposition into native vegetation or freshwater creeks can cause weed problems and stifle plant growth. Sedimentation runoff to waterways from exposed soils due to riparian vegetation clearing and/or earthworks can adversely affect aquatic life in ephemeral creeks downslope by altering water quality and filling aquatic habitat with fine sediment. This reduces the habitat value of these areas for fauna such as frogs.

The topography of the site and the nature of the proposal mean that there is potential for impacts resulting from erosion and sedimentation if adequate controls are not in place during the expansion of the quarry and vegetation clearing activities. Mitigation measures are described in Section 7 to minimise potential impacts of sedimentation and erosion.

6.2.5 Soil and water pollution

The proposal has the potential to result in pollution and contaminated runoff within the proposal footprint and adjoining areas through soil disturbance and quarry expansion activities. Potential sources of soil and water pollution include:

- Soil disturbance during quarry expansion and vegetation clearing activities
- Inappropriate management of soil and material stockpiles
- Hydrocarbon leaks or spills from vehicles or equipment used in quarrying or vegetation clearance activities, as well as during works on the access road
- Increased runoff from hardstand areas
- Increased sediment transfer and erosion potential in areas cleared of vegetation

The topography of the study area and nature of the proposal means that there is potential for soil and water pollution as a result of the proposal if appropriate controls are not adopted during quarry expansion and vegetation clearing and soil disturbance activities.

It is anticipated that any water released into the environment as a result of the proposal would be of a similar quality to present conditions. There is potential for a slight increase in turbidity, however mitigation measures to reduce the potential for such matters are described in Section 7, and include minimising the disturbance area, the use of erosion and sediment control devices and pollution control methods.

6.2.6 Noise and vibration

There would be noise and vibration impacts during the various stages of quarry operation as a result of vegetation clearing, vehicle movement, operation of plant and blasting for expansion of the quarry itself. Due to the topography of the site and staging of the proposed works, noise and vibration impacts would likely be limited to the areas immediately around the study area.

Raised levels of noise and vibration may deter native fauna from using the area surrounding the source of any noise or vibration. This may potentially interrupt dispersal within the locality if an individual is unwilling to travel through an area where increased levels of noise or vibration is detectable, or may cause some species to abandon an area in search of areas where it is not detectable. It is likely that fauna species that occur in the vicinity of the study area are somewhat habituated to noises and vibration resulting from the existing quarry, and that species which are sensitive to any increased levels have moved away given the existing quarry has been operational for some time.

The expansion of the quarry will expose new areas to increased noise and vibration levels, due to quarry expansion activities, resulting in regular blasting activities and the presence of heavy vehicle traffic in and around the quarry. Given the current noise and vibration levels in the vicinity of the proposal, the proposal has the potential to result in additional short-term impacts on native biota.

Mitigation measures to reduce noise and vibration generated by the proposal are outlined in Section 7.

6.2.7 Artificial lighting

Night time security and/or operational lighting can potentially discourage native species from using habitat where diffuse light penetrates into adjoining areas of vegetation. The foraging and nesting regimes of some nocturnal native mammals and birds can therefore be disrupted by lighting. In addition the eyesight of nocturnal species (such as owls and possums) is hindered by bright lights, and where they are affected by this, they can become more susceptible to predation.

The proposal would involve works during daylight hours only, meaning there would be no need for any new additional lighting associated with the proposal. As such, impacts associated with increased light are unlikely and would not result in any negative effects on native biota within the study area.

6.2.8 Aquatic impacts

The proposal has the potential to indirectly impact on aquatic habitats through alterations to hydrology in the study area, including changes to surface and groundwater flows and increased sedimentation or contamination in runoff. Potential impacts have been assessed as part of the Surface and Groundwater Assessment (GHD 2014). Impacts that could modify aquatic habitat value include:

Alterations to groundwater flows

The Surface and Groundwater Assessment indicates that changes to groundwater flows would be minor as the proposal is not anticipated to intercept groundwater (GHD 2014b). There will be no change to access routes, buildings or facilities as part of the proposal. Therefore it is assumed that there will be minimal impact on recharge due to any change in impervious area. There may be a slight increase in recharge in the fractured and porous aquifer due to removal of overlying rock strata.

Impacts on groundwater would be monitored quarterly. Should the monitoring indicate that impacts are likely to be outside the identified and approved impact range then appropriate mitigation measures would be developed and implemented in consultation with the relevant agencies.

Alterations to surface water flows

The proposed works would alter the local topography at the site, which would affect the drainage of surface water. It is likely that surface water from beyond the works area would be diverted around the works, which could lead to a concentration and discharge of flows rather than distributed discharges. The impact of this could be increased risk of erosion and sedimentation if not adequately managed.

Surface water discharging from the work areas could entrain sediment from disturbed areas. If these are not adequately managed, decreased water quality could enter waterways. The sediment could include dust generated from the operations and sediment tracked by vehicular movements on the site.

The proposed operation would potentially expose a larger proportion of rock areas and other impervious areas compared with the existing site. This could lead to increased runoff volumes during rain events and larger runoff peaks during storm events.

Day to day operations would require the handling of chemicals or hydrocarbons, and other contaminates. If management practices are not adequately implemented, then risk of accidental spillage with potential contamination of surface water could exist

These potential impacts would be managed as described in the Surface and Groundwater Assessment. Mitigation measures would include the collection of runoff from construction/operational areas. This water would be treated in a similar manner as per the current operation. For the future works area the main sediment and other basins provide sufficient storage. Runoff collected in the basin will be used for onsite purposes (dust suppression and operational water) in the first instance. Any additional water will be pumped and discharged to the unnamed ephemeral drainage line after appropriate treatment.

In addition catch drains, contour and diversion drains across exposed areas will be installed, immediately following clearing, and maintained until the site is stabilised. Key areas of flow concentration will be provided with rock protection to prevent erosion.

As discussed above the hydrology of the study area has already been substantially modified by works for the existing quarry. Given the extent of existing modifications to the local catchment the proposal would result in only a minor change to hydrology and would be highly unlikely to adversely affect any aquatic habitats.

Water quality impacts

Surface water quality in the proposal area may be modified by increased sediment loads from disturbed area and the potential for chemical or hydrocarbon residues, leaks and spills from machinery and operational practices.

The potential for adverse impacts on water quality would be avoided or minimised through the implementation of appropriate mitigation measures as outlined in Section 7 and the Surface and Groundwater Assessment (GHD 2014b). These would include the use of existing settlement basins to collect and treat surface flows from the quarry as described above. Water discharged into nearby areas would be required to meet water quality standards imposed by the relevant licensing conditions.

6.2.9 Aquatic disturbance and impacts on fish habitat

The introduction of pollutants from the proposal into the surrounding environment and increased sedimentation if uncontrolled, could potentially impact on water quality.

The potential for water quality impacts on Tabbimoble Creek are considered to be low given the distance of the creek from the subject site. Notwithstanding potential water quality impacts would be managed through the implementation of mitigation measures, including the use of sedimentation basins.

No endangered aquatic communities, aquatic fauna or marine vegetation listed under the FM Act or EPBC Act occur in the study area and no significant impacts on riparian vegetation or habitats downstream of the proposal site are anticipated as a result of the proposal. There would be no impact on Key Fish Habitat as a result of the proposal.

6.3 Key threatening processes

A key threatening process (KTP) is defined in the TSC Act (DEC 2005) 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.

There are currently 38 KTPs listed under the TSC Act and eight listed under the FM Act. A number of KTPs are listed under more than one Act. Those potentially relevant to this proposal are listed in Table 8 below. Mitigation measures to limit the impacts of these KTPs are discussed in Chapter 7.

Table 8 Key Threatening Processes of relevance to the proposal

KTP	Status	Comment
Clearing of native vegetation	TSC Act EPBC Act	Clearing of native vegetation has occurred historically within and around the site though selective logging and associated with the existing quarry. This has resulted in a variety of impacts on the remaining native vegetation including increased weed invasion due to soil disturbance and edge effects. This KTP would be exacerbated by the removal of 10.5 hectares of native vegetation within the site.
Clearing of hollow-bearing trees	TSC Act	Past clearing at the site is likely to have resulted in a loss of hollow-bearing trees. At present there is a mixture of mature and immature vegetation within the site. This KTP would be exacerbated by the removal of numerous hollow-bearing trees within the site.
Removal of dead wood and dead trees	TSC Act	The vegetation to be removed has a lower density of dead wood and dead trees than other areas of vegetation which would be retained within the study area, however still contains a low-moderate density of dead wood and dead trees. Mitigation measures are provided in Section 7 to limit the potential for impacts to native biota as a result of removal of dead wood and dead trees.
Invasion and establishment of exotic vines and scramblers	TSC Act	Vegetation within the study area has the potential to be invaded by exotic vines and scramblers, particularly within areas of TEC vegetation. Vehicles and plant have the potential to introduce propagules of exotic vines and scramblers, as could soil disturbance during quarry expansion activities. The implementation of a Weed Management Plan is recommended to limit the spread of weeds.
Invasion establishment and spread of *Lantana camara*	TSC Act	The site has been subject to historical disturbance and consequently Lantana has invaded areas of the site. This KTP is likely to be exacerbated onsite without the implementation of weed management.
Invasion of plant communities by perennial exotic grasses	TSC Act	Parts of the study area have been subject to historical forestry activities, and as a result, there are exotic weed species in some areas of the study area. Weeds have also been introduced in edge areas associated with the existing cleared area. Vehicles and plant could further spread exotic grass species, as could soil disturbance during quarry activities and vegetation clearing. There is the potential for perennial exotic grasses to invade retained and adjacent native vegetation through disturbance during quarry expansion activities. The implementation of a Weed Management Plan is recommended to limit the spread of weeds.

KTP	Status	Comment
Introduction and establishment of Exotic Rust Fungi of the order Pucciniales pathogenic on plants of the family Myrtaceae	TSC Act	Quarry operation activities have the potential to introduce Myrtle Rust to the study area. Mitigation measures to reduce the potential for the introduction myrtle rust are recommended to reduce the potential for impacts on native vegetation.
Infection of frogs by amphibian chytrid causing the disease chytridiomycosis	TSC Act; EPBC Act	Quarry operation activities have the potential to introduce amphibian chytrid to the study area, which could lead to death of local frogs. This is unlikely, however, given no works would be undertaken within the drainage line or major dams. The implementation of a Flora and Fauna Management Plan with specific measures to reduce the potential for the introduction chytrid fungus is recommended to limit impacts on fauna and their habitats.
Predation by the European Red Fox	TSC Act; EPBC Act	Evidence of foxes were observed in the study area. The proposal is unlikely to increase the incidence of this species.

6.4 Impacts on threatened biota listed under NSW legislation

The proposal may result in direct and indirect impacts on threatened biota listed under the TSC Act including the removal of occurrences of the threatened plant, *Hibbertia marginata* and the removal of habitat for up to 23 threatened fauna species that may occur in the study area (see Table 5). Impacts on threatened biota listed under the TSC Act have been assessed through the FBA calculations included in Chapter 8.

No aquatic threatened biota listed under the FM Act or their habitats are likely to occur in the study area or to be affected by the proposal.

6.5 Impacts on Matters of National Environmental Significance

6.5.1 Threatened ecological communities

There are no threatened ecological communities listed under the EPBC Act within the subject site.

6.5.2 Threatened flora species

One threatened flora species (Bordered Guinea Flower (*Hibbertia marginata*)) listed under the EPBC Act occurs within the study area. Based on the presence of suitable habitat there is also a possibility that a further two flora species listed under this Act may occur. These include:

- Leafless Tongue Orchid (*Cryptostylis hunteriana*) and
- A Grass (*Paspalidium grandispiculatum*)

Bordered Guinea Flower (Hibbertia marginata)

Bordered Guinea Flower is restricted to the southern Richmond Range between Casino and Grafton and grows in grassy or shrubby dry open eucalypt forest at low altitudes on sandstone. A total of 1,190 individuals of Bordered Guinea Flower were identified within the subject site during targeted searches for the species. The locations where this species was identified are shown on Figure 3.

Leafless Tongue Orchid (Cryptostylis hunteriana)

Cryptostylis hunteriana is a small perennial terrestrial orchid that lacks leaves. In NSW, the species occurs between Batemans Bay and Nowra with additional records in Nelson Bay, Wyee, Washpool National Park, Nowendoc State Forest, Ku-Ring-Gai Chase National Park, Ben Boyd National Park, the Catherine Hill Bay area, Dolphin Point and Bulahdelah. There are no records of the species in the locality of the proposal; however it is predicted to occur within the locality.

The flowering period for this species in NSW is generally from December to February (OEH 2014a).

The species was not recorded during the field survey; however potential habitat exists for this species in the 10.5 hectares of native vegetation that may be impacted by the proposal

A Grass (Paspalidium grandispiculatum)

In NSW, is known from the north of Grafton in the Mount Neville, Gibberagee and Doubleduke vicinities. It is likely to be restricted to poor sandy soils on sandstone. It has been found in open forest of Turpentine (*Syncarpia glomulifera*) on undulating topography as well as in drier forest types on ridges.

Within the study area there is suitable habitat for this species within the 4.23 hectares of Blackbutt - bloodwood dry heathy open forest

There are two records for this species in the locality, both occur approximately 8 km north of the subject site.

Under the provisions of the EPBC Act, the proposed development is being referred to the Department of the Environment in relation to the impacts on the identified Hibbertia marginata population. Other potential MNES have been addressed through the FBA and its associated BioBanking assessment.

6.5.3 Threatened fauna species

No threatened fauna species as listed under the EPBC Act have been recorded within the study area; however potential habitat for three threatened fauna species listed under the Act exists within the study area. These include:

- Grey-headed Flying Fox (*Pteropus poliocephalus)*
- Koala (*Phascolarctos cinereus*)
- Spotted Tailed-quoll (*Dasyurus maculatus*)

Grey-headed Flying Fox

The Grey-headed Flying-fox is predicted to occur within 10 km of the subject site (DoE 2014). The Grey-headed Flying-fox may forage on occasion in the proposal site when eucalypts are in flower. The proposal would not directly or indirectly affect any roost camps. Construction for the proposal would remove 10.5 hectares of foraging habitat including all remnant and regrowth species in the proposal site. Large expanses of foraging habitat are available in the locality. Habitat to be removed comprises a negligible proportion of the available habitat present in the locality.

Koala

Feed trees of Koalas are present at the site as Tallowwood (*Eucalyptus microcorys),* Red Mahogany (*E. resinifera)* and Pink Bloodwood. The presence of these species indicates that the majority of vegetation at the site would qualify as 'potential' Koala habitat. As discussed in Section 5.4.3, the presence of the Koala was considered likely on a transient basis and consequently this species has been included in the credit calculations accordingly (see Chapter 8).

Spotted-tailed Quoll

Spotted-tailed Quolls use hollow-bearing trees, fallen logs, small caves, rock crevices, boulder fields and rocky-cliff faces as den sites (OEH 2014b). According to a study conducted in Limeburners Creek, quolls used hollows in trees and logs with medium to large circumferences (typically greater than 50 cm dbh for logs and greater than 70 cm dbh for trees), and entrances between 16-41 cm diameter (average 26.13) in logs and between 7-27 cm (average 15.85cm) in tree hollows (Andrews 2005).

Habitat value for the Spotted-tailed Quoll would be somewhat reduced within the study area by the effects of historic logging. Shelter habitats for this species are still present with hollow-bearing trees (including trees with ground-level hollows), logs and other woody debris. The species may forage throughout the study area, although woody debris and other shelters for prey species such as small mammals, frogs and reptiles are also concentrated in lower slopes and gully areas.

Potential MNES have been addressed through the FBA and its associated BioBanking assessment.

6.5.4 Migratory species

One migratory bird species (Rainbow Bee-eater) listed under the EPBC Act was recorded during surveys. There is also potential habitat for the Fork-tailed Swift, White-throated Needletail and Satin Flycatcher.

The Fork-tailed Swift and White-throated Needletail are both predominantly aerial species that may fly over the site or use the study area for foraging on occasion. It is unlikely that the proposal area would provide any significant habitat for these birds and any individuals that may occur would occur on a transient basis only.

The proposal would remove up to 10.5 hectares of known and potential foraging habitat for the remaining three woodland bird species. Individuals of these species may also breed within the study area or locality. The vegetation that would be removed makes up a very small proportion of similar habitats present within the locality, which includes over 6000 hectares in conservation reserves. The Significant Impact Guidelines (DotE 2013c) for migratory species listed under the EPBC Act define important habitat as follows:

'An area of 'important habitat' for a migratory species is:

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

The study area is not considered important habitat for any of these species, according to the significant impact criteria for migratory species (DotE 2013c). This is due to the fact that potential habitat in the study area would not support an ecologically significant proportion of the population of these species, is not of critical importance to these species at particular life-cycle stages, is not at the limit of these species ranges, and is not within an area where these species are declining. No assessments of significance have been prepared for these species. Based on the above considerations the proposal is unlikely to impose “a significant effect” on any of the listed migratory fauna species predicted to occur within the locality.

7. Mitigation and management measures

7.1 Introduction

The mitigation of adverse effects arising from the proposal has been presented according to the hierarchy of avoidance, mitigation and offsetting of impacts.

The proposal would result in direct impacts on native biota and their habitats within the proposed quarry area. There is also the potential for impacts on habitats outside the disturbance area through indirect impacts such as noise, sedimentation, runoff or edge effects. Specific mitigation measures are recommended to minimise such impacts on the natural environment.

The proposal would result in some unavoidable impacts imposed upon some elements of the natural environment, including removal of regrowth native vegetation and imposition of edge effects on adjoining areas of retained native vegetation. These residual impacts are not expected to impose a significant negative effect on any local populations of native biota, including threatened species, TECs and their habitats, which occur in the study area or in adjoining habitats.

The following sections detail recommended measures to avoid and mitigate impacts required offset contributions that have been calculated in accordance with the FBA to offset residual impacts of the proposal.

7.2 Avoidance of impacts

The proposal is for the expansion of an existing quarry. The majority of the proposed quarry expansion area falls within land that has been modified by historical land uses, including logging and past quarry activities. As a result, impacts on native flora and fauna are somewhat less than would be associated with a less disturbed site.

Results of the field survey were used to identify ecological constraints within the study area. This information informed the detailed design phase of the proposal, which entailed modification of the original plans so as to avoid areas of high ecological constraint, namely identified areas of TEC vegetation and some occurrences of the threatened species Bordered Guinea Flower (*Hibbertia marginata*). This alteration to the original plans has reduced the overall area of planned quarry in order to avoid direct impacts on these areas.

Siting of construction compounds and other construction infrastructure in already cleared areas would also avoid impacts on native biodiversity values.

7.3 Mitigation of impacts

The proposal will impact native vegetation communities and habitat for threatened flora and fauna. In order to minimise the potential impacts of the proposal on biodiversity, the mitigation measures detailed below are recommended.

7.3.1 Detailed design phase

During the detailed design process, the impact of the proposal on areas with high biodiversity values should be minimised wherever possible by:

- Undertaking targeted threatened species surveys to determine the occurrence and extent of threatened species within the subject site and mapping of significant habitat features such as hollow bearing trees.
- Minimising the area of native vegetation to be cleared wherever possible.

- Avoidance of identified hollow-bearing trees wherever possible.
- Minimising disturbance to adjacent retained vegetation, aquatic and riparian areas.

These measures aim to guide the vegetation clearing process by encouraging the contractor to avoid unnecessary clearing of vegetation, and limiting vegetation clearing to that which is required for the proposal only. Any establishment of laydown areas, site compounds or similar should be located within existing cleared areas or within the proposal footprint, so as to avoid any additional impacts outside the proposal footprint.

7.3.2 Environment management plan

An Environment Management Plan (EMP) would be prepared for the proposal. The EMP would include, as a minimum, industry-standard measures for the management of soil, surface water, weeds and pollutants, as well as site-specific measures including the environmental impact mitigation measures outlined below. While some of these mitigation measures are relevant to other assessments completed as part of this EMP (e.g. Surface and Groundwater Assessment), they are included here as they are relevant to maintaining existing levels of habitat and biodiversity values associated with the study area and adjacent habitats.

Worker induction

Ensure all workers are provided with an environmental induction prior to starting work on site. This would include information on the ecological values of the subject site and study area and measures to be implemented to protect biodiversity.

Water quality management

A Water Management Plan would be incorporated into the EMP and designed to minimise the impact of altered groundwater and surface water flows at the site. This would include measures to ensure the impact of water releases from the settlement ponds would have minimal impact on adjacent areas of native vegetation and aquatic habitats. Mitigation measures would include, but not be limited to:

- Monitoring of all water to be pumped into the environment prior to pumping, targeting turbidity levels.
- Use of results of monitoring to determine the need to treat water to be discharged (e.g. flocculation).
- Appropriate management of surface flows from the quarry area, including sufficient settlement time within overflow ponds to allow sediment load to be deposited.
- Treatment (if necessary) of excess surface water in accordance with relevant licensing standards to ensure water quality in adjacent aquatic habitats is not impacted.
- Staged release of excess water where necessary to reduce erosion potential of additional surface flows into adjacent vegetation and aquatic areas.
- Ongoing contamination, sediment and erosion control measures as per the EMP.
- Use of an oil sock to remove any hydrocarbons in water to be pumped into the environment.
- Ongoing monitoring of surface and groundwater quality and development of contingency measures to address any decrease in quality due to quarrying activities.

Erosion control

A Sediment and Erosion Control Plan will be incorporated in the EMP and should contain detailed mitigation measures to reduce soil erosion and pollutant run-off during all quarry operations as well as during all works on the access road. These would include:

- Installation of erosion and sediment control measures prior to any works.
- Regular inspection of erosion and sediment control measures, particularly following rainfall events, to ensure their ongoing functionality.
- Stockpile management measures which minimise the potential for erosion and surface water runoff.
- Construction and maintenance of silt fences to capture and isolate any surface water runoff.
- Immediate removal offsite of excavated materials.

Dust

Specific measures will be incorporated into the EMP to minimise the generation of dust and associated impacts on adjacent natural environments. These would include:

- Setting maximum speed limits for all traffic within the proposal area to limit dust generation.
- Use of a water tanker or similar to spray unpaved roads during quarry operation where required.
- Application of dust suppressants or covers on soil stockpiles.
- Stockpile management to limit the potential for dust generation.

Chemical spills

Specific measures will be incorporated into the EMP to minimise the potential for chemical spills and associated impacts on adjacent natural environments. These would include:

- All chemicals must be kept in clearly marked bunded areas.
- Regularly inspect vehicles and mechanical plant for leakage of fuel or oil.
- No re-fuelling of vehicles, washing of vehicles or maintenance of vehicles and plant to be undertaken within 20 m of waterways.

Management of bushfire risk

A Bushfire Management Plan would be incorporated into the EMP to minimise the risk of bushfire and associated impacts on the natural environment, and would include the following measures:

- Hot works permits will be obtained for all activities likely to generate sparks. Restrictions contained within these permits would be based on the forecast fire danger.
- Pre-planned fire response action plans will be prepared in accordance with the nationally endorsed ‘Prepare, Act, Survive’ format. The action plans will be issued as part of the site induction for all site personnel.
- Limitations on relevant quarrying procedures will be developed which would be applied during the fire season based on specific fire danger ratings. An example of such restrictions may include the halting of all works during extreme or catastrophic fire danger days.

7.3.3 Flora and fauna management plan

A Flora and Fauna Management Plan (FFMP) should be prepared as a sub-plan to the EMP for the proposal. The FFMP would identify environmental management measures to protect the natural environment (e.g. weed and pathogen controls) and detailed site-specific and species-specific mitigation measures and management protocols to be implemented before, during and after all quarry activities to further avoid or reduce impacts on threatened biodiversity.

The FFMP would include but not be restricted to key protocols for the protection of threatened flora, fauna and their habitats as outlined below. More detailed species-specific management and mitigation protocols for threatened species or groups of species with similar habitat requirements of relevance to the proposal would be developed and documented in detail in the FFMP. As noted above, these specific protocols will be important to address remaining uncertainties with respect to potential impacts.

Pre-quarry expansion

Minimising vegetation clearance and habitat loss

Disturbance and removal of some areas of regrowth native vegetation and habitat will be unavoidable during the expansion of the quarry. To reduce the potential for adverse impacts on ecologically sensitive areas the following measures would be implemented:

- Locating stockpiles in already cleared and disturbed areas to avoid further removal of native vegetation and/or hollow-bearing trees.
- Delineation and protection of exclusion zones around native vegetation to be retained.

Pre-clearance surveys

Pre-clearing surveys of fauna and flora habitat would be carried out by a qualified ecologist. Pre-clearing surveys would largely focus on:

- Mapping and marking of hollow-bearing trees that would require removal.
- Mapping and marking any significant habitat features (large woody debris or hollow logs) for relocation into adjacent habitat areas.
- Inspections of habitat trees for resident fauna, including inspections of hollows, nests and under exfoliating bark.
- Pre-clearing surveys for threatened plants in areas of potentially suitable habitat. Target species would include:
  - Boarded Guinea Flower (*Hibbertia marginata*)
  - Leafless Tongue Orchid (*Cryptostylis hunteriana*)
  - Slender Screw-Fern (*Lindsaea incisa)*
  - A Grass (*Paspalidium grandispiculatum)*
  - Native Milkwort (*Polygala linariifolia)*
- Protocols to protect any identified threatened plants from quarry expansion works whilst appropriate mitigation options are assessed.
- Consideration of feasibility of site/species specific mitigation techniques, including seed collection/cuttings.

Phytophthora management

Phytophthora may occur in the proposed development area given annual rainfall for the area is greater than 600 mm (McDougall and Summerell, 2003).

Hygiene measures in accordance with national best practice guidelines for Phytophthora (DEH 2006) to prevent the introduction or spread of the pathogen during the vegetation clearing phases of the proposal should be incorporated into the FFMP and include decontamination of personnel and plant equipment prior to entering the subject site and when traversing between areas of vegetation within the subject site.

These measures relate to the vegetation clearing and access road construction/upgrade stages of the proposal only, and should accompany measures that ensure plant and machinery does not enter any areas of retained vegetation within the study area. It is envisaged that once the expansion has been completed and during day to day quarry operations when machinery movement is restricted to established roads and tracks, that these measures would not be required.

Chytrid fungus management

Vegetation clearing and quarrying activities have the potential to introduce amphibian chytrid fungus to the study area, which could lead to death of local frogs. This potential is limited, however, as there would be no works in aquatic areas. Hygiene measures to prevent the introduction or spread of the pathogen during the vegetation clearing should be incorporated into the FFMP and include decontamination of plant equipment prior to entering the subject site. These measures would be developed with reference to OEH Hygiene protocol for the control of disease in frogs (DECCW, 2008).

These measures relate to the vegetation clearing and access road construction stages of the proposal only, and should accompany measures that ensure plant and machinery does not enter any areas of retained vegetation within the study area. It is envisaged that once the expansion has been completed and during day to day quarry operations when machinery movement is restricted to established roads and tracks, that these measures would not be required.

Myrtle rust management

Vegetation clearing activities have the potential to introduce myrtle rust to the study area, which could lead to death of native myrtaceous vegetation. Hygiene measures to prevent the introduction or spread of the pathogen during the vegetation clearing phases of the proposal should be incorporated into the FFMP. These would include exclusion zones around retained areas of native vegetation and/or provision of machine and footwear washdown stations for all equipment and personnel working in areas of native vegetation.

These measures relate to the vegetation clearing stages of the proposal only, and should accompany measures that ensure plant and machinery does not enter any areas of retained vegetation within the study area. It is envisaged that once the expansion has been completed and during day to day quarry operations when machinery movement is restricted to established roads and tracks, that these measures would not be required during quarry expansion.

Management of weeds and edge effects

A weed management plan would be included within the FFMP, and would include a description of the following:

- Type and location of weeds of concern (including noxious weeds) within the proposal disturbance footprint.
- Sensitive receivers (such as native vegetation and waterways) within or adjacent to the proposal disturbance footprint.
- Measures to prevent the spread of weeds, including hygiene procedures for equipment, footwear and clothing.
- Proposed weed control methods and targeted areas.
- Weed disposal protocols.

The weed management plan would include measures designed to mitigate edge effects that reduce impacts outside the footprint of the proposal (namely within surrounding retained vegetation). The aim of these measures would be to control the possible impacts at their source within existing weed infested areas and soften the edge between the earthworks and the retained native vegetation. Measures that would be adopted include:

- Avoid stockpiling of materials adjacent to native vegetation wherever possible.
- Avoid stockpiling of fill in areas of remnant vegetation but instead in adjacent already cleared areas.
- Implementing soil erosion and sediment control measures.
- During quarry expansion areas of vegetation to be retained should be demarcated to restrict access by site staff and machinery to remnant vegetation.
- During quarry expansion undertake maintenance of silt fences and other mitigation measures to isolate runoff; and immediately rehabilitate disturbed vegetation to limit the potential for colonisation by weeds.
- Implementing a weed management strategy.
- Undertake water quality monitoring program during quarry expansion to assess extent of impact on waterways.

Managing vehicle movements

The proposal would increase the risk of injury or mortality of native fauna due to vehicle strike by increasing the rate of vehicle visitation to the site. This risk would be reduced by:

- Restricting vehicle movements to operational (daylight) hours.
- Implementing and enforcing appropriate speed limits for vehicles traversing the site.

Groundcover clearance protocol

Groundcover substrate, in particular fallen logs, provides important habitat for native fauna, including threatened species. A groundcover clearance protocol would be incorporated into the FFMP, including the following measures:

- Remove large woody debris and rock fragments using excavator grabs or manual handling if practicable.
- Place intact large woody debris within adjacent areas of intact vegetation.
- Scrape and stockpile leaf litter and topsoil separately from deeper fill material.

Tree-dwelling fauna management protocol

A plan for the management of impacts on tree-dwelling species, in particular those that utilise tree-hollows would be developed. A hollow-bearing/habitat tree clearance protocol would be incorporated into the FFMP, including the following measures:

- Pre-clearing surveys undertaken by a suitably qualified ecologist or wildlife handler.
- Installation of suitable nest boxes in adjacent vegetation will be considered prior to clearing to provide a safe location for hollow-dwelling fauna to be transferred to during clearing operations. The number of hollow-bearing trees and types of hollows identified during pre-clearance surveys should be used to determine the number and types of nest boxes installed.
- Protocols for the safe inspection of trees and tree-hollows for fauna and methods to encourage fauna to vacate trees with minimal potential for distress or harm, including clearing surrounding vegetation prior to felling hollow-bearing trees.
- Protocols for the management and release of captured animals, including consideration of the appropriate management of injured or deceased individuals.
- Wildlife should not be handled wherever possible. Quarry staff should only handle wildlife in an emergency situation. Uninjured wildlife should be gently encouraged to leave the site by the ecologist/ wildlife specialist. Injured wildlife would be taken to a local WIRES carer or veterinarian for treatment and care if necessary.
- Capture and relocation or captive rearing of less mobile fauna (such as Koalas or nestling birds) by a trained fauna handler and with assistance from Wildlife Information Rescue and Education Service (WIRES) as required.
- Targeted pre-clearing surveys for hollow-dwelling fauna species including but not limited to microbats, arboreal mammals and birds.

8. Impact summary and thresholds

8.1 Introduction

The FBA credit calculations were performed by Arien Quin and Dan Williams using credit calculator Version 4.1. The credit calculations will be submitted to OEH and the biodiversity credit report is included as Appendix D.

The data and assumptions used to perform the FBA credit calculations are summarised below according to the structure and information requirements outlined in Appendix 7 of the FBA (OEH, 2014a).

8.2 Impact summary

8.2.1 Areas not requiring assessment

An assessor is not required to assess areas in a proposal site without native vegetation unless the SEARs for the proposal specifically require it.

Existing quarry disturbance comprise 'cleared land' according to the FBA and the BioBanking methodology (DECC, 2009) because it contains no native over storey or mid storey vegetation and greater than 50% exotic ground cover or >90% bare earth. Further, the majority of the vegetation that is present is located on cuttings or fill material associated with unnatural landforms such as embankments.

These areas do not comprise native vegetation or threatened species habitat according to the FBA and so were not sampled with plot/transects.

8.2.2 Areas requiring offsets

All vegetation within the study area is in moderate/good condition and has a score of greater than 17. Therefore all areas mapped as containing native vegetation communities that will be impacted by the proposal would require offsetting. This is the trigger for completing the credit impact calculations in accordance with section 9.3.1.1(c) of the FBA.

8.2.3 Impacts requiring further consideration

Certain impacts on biodiversity values of a Major Project require further consideration by the consent authority. These are impacts that are particularly complicated or severe. A decision will be made by the consent authority on whether it is appropriate for these impacts to occur or whether modifications to the Major Project are required to avoid or minimise the impact.

In accordance with section 9.2.1.3 of the FBA, impacts that require further consideration include:

- Significant impacts on landscape features.
- Impacts on CEECs or impacts on EECs that are likely to significantly affect the persistence or viability of an EEC.
- Impacts on critical habitat or on threatened species that are likely to significantly affect the persistence or viability of a population of a threatened species that has not previously been recorded in the IBRA subregion (see Section 9.2.5.1 of the FBA).

The proposal does not include any impacts that require further consideration in accordance with these criteria.

8.2.4 Summary of impact avoidance

The proposal is an expansion of a quarry in an area that has been used historically as a quarry, so its location is fundamentally limited by the location of the previous quarry. The majority of the proposed quarry extension area falls within land that has been modified by historical land uses, including logging and past quarry activities. As a result, impacts on native flora and fauna are somewhat less than would be associated with a less disturbed site.

Results of the field survey were used to identify ecological constraints within the study area. This information was used during the detailed design phase of the proposal, which entailed modification of the original plans so as to avoid areas of high ecological constraint, namely the identified areas of TEC vegetation and some of the identified occurrences of the threatened species Bordered Guinea Flower (*Hibbertia marginata*). Amendments to the quarry footprint included removing both the north east and south west corners of the extraction area where a large population of *Hibbertia marginata* occurs. This alteration to the original plans has reduced the overall area of planned quarry expansion, reduced the impact to *Hibbertia marginata* and has seen the proposed quarry expansion area be repositioned in order to minimise direct impacts on these areas.

Unfortunately, the *Hebertia marginata* is located on the bulk of the resource due to previous minor disturbance (access tracks and the like) as this species prefers habitats subject to disturbance. It is considered unfeasible to modify the layout of the quarry further as it would limit the amount of resource that could be accessed to meet demand. ,It would also impact on the functionality and efficiency of the quarry. To the west and south the volume and quality of the resource is not suitable and expansion to the east is restricted by the Crown Land road reserve.

To limit the impact on the *Hebertia marginata*, the quarry is proposed to be developed in stages, with Stage 1 containing few individuals. Stage 2 (south) would be excavated next which has less *Hebertia marginata* than Stage 2 (north). Stage 1 and Stage 2 (south) contain over half the total resource, so depending on the demand, the quarry may never proceed past these stages. If Stage 3 is extracted, Stage 3 (south) would be extracted first which would avoid impacting the *Hebertia marginata*, within Stage 3 (north), until absolutely necessary.

Siting of construction compounds and other construction infrastructure in already cleared areas would also avoid impacts on native biodiversity values.

8.2.5 Summary of impact mitigation

Measures to mitigate impacts on biodiversity include:

- Refinement of impacts during the detailed design phase
- Development of an EMP which would include detailed measures to minimise impacts associated with the proposal. The EMP would include the following subplans.
  - Water Management Plan
  - Erosion and Sediment Control Plan
  - Bushfire Management Plan
  - Flora and Fauna Management Plan

Further details regarding mitigation measures for the proposal are described in detail in Section 7.

8.2.6 Direct impacts

The proposal would result in direct impacts within the subject site comprising:

- Disturbance of an overall construction footprint of 11.07 hectares of which 0.57 hectares is cleared land associated with the existing quarry or other infrastructure.
- Removal or modification of 10.5 hectares of native vegetation and associated habitat resources for threatened species and other native biota.
- Removal of approximately 1,190 counts of the threatened flora species, *Hibbertia marginata*.

A more detailed description of direct impacts and the likely effect on the biodiversity values of the study area is provided in Chapter 6.

8.2.7 Indirect impacts

Indirect impacts associated with the proposal have been described in detail in Chapter 6 and include potential edge effects, introduction and/or spread of weeds, introduction and/or spread of pests and pathogens, effects of erosion and sedimentation, generation of dust, noise and vibration.

Provided mitigation measures outlined in Section 7 are implemented there are unlikely to be any substantial indirect impacts associated with construction or operation activities. Therefore no additional, indirect impacts have been included in the credit calculations.

9. Framework for biodiversity assessment calculations

Imapcts associated with the proposal have been assessed in accordance with the BBAM for Major Projects with the results outlined below.

9.1 Landscape features

The FBA requires the assessment of landscape features to help describe the biodiversity values of the study area and assess the impacts of the proposal. Landscape features relevant to the FBA calculations are shown on Figure 5 and summarised in Table 9.

Table 9 Landscape features

Landscape feature	Proposal site
Interim Biogeographic regionalisation of Australia (IBRA) bioregion and IBRA subregions	The proposal site is located entirely within the 'NSW North Coast IBRA bioregion and Clarence Sandstone IBRA subregion.
Mitchell landscapes	The proposal site contains the Clarence-Manning Basin Margin Mitchell landscapes (DECC 2008a).
Rivers, streams and estuaries	The proposal site does not contain any rivers, streams or estuaries.
Wetlands	The proposal site does not contain any important or local wetlands as defined in the FBA (OEH, 2014a).

9.2 Landscape value

The landscape assessment for the site is shown on Figure 5 and summarised in Table 8. The approach to the landscape assessment is described below.

One hundred (100) hectare and 1,000 hectare assessment circles were used to estimate the extent and connectivity of native vegetation and habitat surrounding the site. Vegetation cover and connectivity was estimated based on the current situation and after the development of the site using GIS measurement of foliage projective cover within the assessment circles. The assessment circles were placed so as to capture the greatest change in vegetation cover as a result of the development. The percentage change in vegetation cover was estimated by subtracting the area of vegetation that would be impacted as a result of the proposal from the existing area of native vegetation within the assessment circles. There is currently approximately 82 hectares of vegetation within the 100 hectare circle. This would be reduced to around 71.5 hectares. Within the 1,000 hectare assessment circle vegetation cover would be reduced from approximately 925 hectares to 914.5 hectares (See Figure 5).

Patch size and connectivity were assessed using GIS and air photo interpretation of native vegetation cover within the assessment circles and adjoining areas of native vegetation. Impacts on connectivity are calculated by entering the 'primary link' for the development site. The primary link before the proposed development is > 500 m, the maximum value for a FBA assessment. This would remain unchanged after the development.

Based on site surveys the over-storey vegetation, as well as mid storey and groundcover vegetation, within the primary link are in good condition and is at benchmark values.

Table 8 Landscape assessment values summary

Landscape Attribute	Before development	After development
% Native vegetation cover in 1000 ha assessment circle	91-95% (925 ha)	91-95% % (914.5 ha)
% Native vegetation cover in 100 ha assessment circle	81-85% (82 ha)	71-75% (71.5 ha)
Connectivity value width	> 500 m	> 500 m
Connectivity value over-storey condition	PFC at BM	PFC at BM
Connectivity value mid-storey or groundcover condition	PFC BM	PFC BM

*PFC = percentage foliage cover; BM = benchmark values for the attribute (OEH, 2014d)

517,000 517,500 518,000 518,500 519,000 519,500 520,000 520,500

6,760,500 6,760,000 6,759,500 6,759,000 6,758,500 6,758,000 6,757,500 6,757,000 6,756,500 6,756,000

SLYS ROAD

PACIFIC HIGHWAY

SLYS ROAD

TULLYMORGAN-JACKYBULBIN ROAD

MCMAHONS TRAIL

TABBIMOBLE CREEK

Source: Esri, DigitalGlobe, GeoEye, i-cubed, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo, and the GIS User Community

LEGEND

- Subject site
- 100ha circle
- 1000ha circle
- Cleared
- Vegetation
- roads
- Waterways
- cadastre

Paper Size A3

0 65 130 260 390 520

Metres

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

N

GHD

Newman Quarrying
Sly's Quarry Environmental Impact Statement
Biodiversity Assessment

Job Number 22-17528
Revision A
Date 11 Dec 2014

Landscape Assessment

Figure 5

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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

Data Source: NSW Department of Lands: Cadastre - Jan 2014; Geoscience Australia: 250k Data - Jan 2014; NSW Department od Primary Industry - Jan 2014; ESRI Jan 2014. Created by: qjchung

9.3 Native vegetation

One vegetation zone and threatened species sub zone was created for each PCT and broad condition state in the proposal site. The area of each zone was calculated using GIS. Vegetation zones within the proposal site are summarised below in Table 10.

All vegetation zones within the study area are in Moderate/good condition and are connected to an extensive area of native vegetation extending to the north, south east and west of the site. The area of contiguous treed vegetation connected to the study area was calculated with GIS and is greater than the maximum value for adjacent remnant area in the FBA of 500 hectares, so for all Moderate/good condition vegetation zones the adjacent remnant area was entered as 501 hectares. Patch size, including low condition vegetation is also equal to the maximum area within the FBA of 501 hectares.

Site value data was collected using the BioBanking plot/transect methodology and was entered for each plot/transect field in each vegetation zone. This data is provided in Appendix B.

Table 10 Vegetation zones

Veg Zone ID	Plant Community Type	Veg Type Code	Adjacent remnant area (ha)	Patch size (ha)	Extent cleared in the CMA sub region (percent)	Area (ha)	Plot / transects required	Plot / transects completed
1	Blackbutt - Turpentine dry heathy open forest on sandstones of the lower Clarence of the NSW North Coast Bioregion	NR123	501	501	10	6.27	3	3
2	Blackbutt - bloodwood dry heathy open forest on Quaternary sands of the northern NSW North Coast Bioregion	NR114	501	501	40	4.23	3	3
					TOTAL	**10.5**	**7**	**7**

9.4 Threatened species

9.4.1 Predicted threatened species

The credit calculator reports the suite of threatened fauna species that are predicted to be associated with ecosystem credits generated for the proposal. That is, the threatened fauna species that are predicted to use habitat within the vegetation types at the proposal site. Each of these species has a 'Threatened species multiplier' that feeds into the ecosystem credit calculations. If that fauna species or specific habitat resources for that species are not present at the development site, then the Threatened species multiplier may be adjusted.

The suite of threatened species associated with ecosystem credits for the development is shown in Table 11 along with an assessment of whether habitat components for these threatened species are present in the vegetation zones within the proposal site (refer to Appendix A).

Table 11 Predicted threatened species (ecosystem credit species)

Common Name	Scientific Name	Threatened species multiplier	Habitat components present in vegetation zones ?
Barking Owl	*Ninox connivens*	3	Yes
Barred Cuckoo-shrike	*Coracina lineata*	1.5	Yes
Beccari's Freetail-bat	*Mormopterus beccarii*	2.2	Yes
Brown Treecreeper (eastern subspecies)	*Climacteris picumnus* subsp. *victoriae*	2	Yes
Bush Stone-curlew	*Burhinus grallarius*	2.6	No
Common Blossom-bat	*Syconycteris australis*	1.2	No
Eastern Freetail-bat	*Mormopterus norfolkensis*	2.2	Yes
Glossy Black-Cockatoo	*Calyptorhynchus lathami*	1.8	Yes
Golden-tipped Bat	*Kerivoula papuensis*	1.3	No
Greater Broad-nosed Bat	*Scoteanax rueppellii*	2.2	Yes
Grey-crowned Babbler (eastern subspecies)	*Pomatostomus temporalis subsp. temporalis*	1.3	No
Hoary Wattled Bat	*Chalinolobus nigrogriseus*	2.1	Yes
Little Eagle	*Hieraaetus morphnoides*	1.4	Yes
Little Lorikeet	*Glossopsitta pusilla*	1.8	Yes
Masked Owl	*Tyto novaehollandiae*	3	Yes
New Holland Mouse	*Pseudomys novaehollandiae*	2.6	No
Powerful Owl	*Ninox strenua*	3	Yes
Speckled Warbler	*Chthonicola sagittata*	2.6	No
Spotted-tailed Quoll	*Dasyurus maculatus*	2.6	Yes
Square-tailed Kite	*Lophoictinia isura*	1.4	Yes
Swift Parrot	*Lathamus discolor*	1.3	Yes
Varied Sittella	*Daphoenositta chrysoptera*	1.3	Yes
Yellow-bellied Glider	*Petaurus australis*	2.3	Yes
Yellow-bellied Sheathtail-bat	*Saccolaimus flaviventris*	2.2	Yes

9.4.2 Species credits

The credit calculator references geographic, vegetation and habitat data for the proposal site to generate a list of the species credit-type threatened species predicted to occur and requiring targeted survey.

One threatened flora species (*Hibbertia marginata*) was recorded within the study area. Targeted surveys were undertaken in order to accurately assess the extent of impacts on this species and the final number of species credits required. In addition, three threatened fauna species were considered likely to occur at the site and have been included in the credit calculations accordingly.

9.4.3 Biodiversity credits

The data from the fieldwork and mapping was entered into Version 4.1 of the BioBanking credit calculator as a 'Major Project' assessment to determine the number and type of biodiversity credits that would be required to offset impacts at the proposal site. The Biodiversity credit report is included in Appendix D and summarised below.

Ecosystem Credits

A total of 768 ecosystem credits would be required to offset the impacts of the proposal as shown in Table 12.

Table 12 Ecosystem credits required to offset impacts of the proposal

Vegetation Zone	Area (ha)	Current site value score	Future site value score	Change in landscape value score	Ecosystem credits required
NR 123	6.27	100	0	100	283
NR 114	4.23	85.94	0	85.94	485
TOTAL					**768**

Species Credits

A total of 17,437 species credits would be required to offset the impacts of the proposal as shown in Table 13.

Table 13 Species credits required to offset impacts of the proposal

Common name	Scientific name	Extent of impact (individuals)	Species credits required
Bordered guinea flower	*Hibbertia marginata*	1,190	16,660
Koala	*Phascolarctos cinereus*	10.5 ha	273
Common planigale	*Planigale maculata*	10.5 ha	273
Squirrel glider	*Petaurus norfolcensis*	10.5 ha	231
Total			**17,437**

10. Biodiversity offset strategy

10.1 Overview

This section presents the draft Biodiversity Offset Strategy, which outlines how the proponent intends to offset the impacts of the proposal.

The credit calculator has been used in this Biodiversity Assessment Report to determine the number and type of biodiversity credits required to offset impacts of the proposal. The Biodiversity credit report is included in Appendix D.

The Biodiversity Offset Strategy for the proposal would include the purchase and retirement of the following biodiversity credits as calculated in accordance with the FBA:

- 485 ecosystem credits for Blackbutt-Turpentine dry heathy open forest (NR 123)
- 283 ecosystem credits for Blackbutt-Bloodwood dry heathy open forest (NR 114)
- 16,660 species credits for *Hibbertia marginata*
- 273 species credits for the Koala
- 231 species credits for the Squirell glider
- 273 species credits for the Common planigale

A Biodiversity Offset Strategy developed in accordance with the FBA is likely to satisfy the biodiversity offsetting requirements of the EPBC Act and associated policy.

A Biodiversity Offset Strategy for the proposal is to conserve an appropriate portion of land onsite in a biobanking agreement.

It is anticipated that the survey and assessment of a preferred biobank site in accordance with the BBAM, and the application for a BioBanking agreement would occur within 12 months of the issuing of Conditions of Consent. The necessary credits would then be retired. Further consultation is expected with OEH during the assessment of the biobank site to agree on the exact number and type of species credits required to adequately offset the proposal. Preliminary surveys have confirmed the preferred biobank site contains 'matching' vegetation for the ecosystem credits required and contains populations of the threatened flora species *Hibbertia marginata* as well as suitable habitat for the three threatened fauna species requiring offsetting. In regard to these species, it is expected that due to the approach taken in this assessment to assume these species are present based on known records and habitat conditions, the same outcome would apply to the proposed biobank as it is located immediately adjacent to the development site in a contiguous patch of the same vegetation type and in the same or better condition.

Details of the preferred biobank site are included below.

10.1.1 Potential BioBank site

A preliminary investigation of a potential biobank site located to the south of Jackybulbin Road (refer Figure 6), was undertaken to identify and map vegetation communities.

Preliminary investigations confirmed the presence of the following five vegetation types:

- Blackbutt-Bloodwood dry heathy open forest on Quaternary sands (NR 114)
- Blackbutt-Turpentine dry heathy open forest on sandstones (NR 123)
- Swamp Mahogany swamp forest of the coastal lowlands (NR 254)

- Paperbark swamp forest of the coastal lowlands (NR 217)
- Spotted Gum-Grey Ironbark-Pink Bloodwood open forest of the Clarence Valley lowlands (NR 246)

Broad-scale mapping of these vegetation types is provided at Figure 6. The approximate area of each vegetation type within the biobank site is provided in Table 14.

Table 14 Areas of vegetation types within the BioBank site

Vegetation Type	Vegetation Type ID	Area (ha)
Blackbutt-Bloodwood dry heathy open forest on Quaternary sands	NR 114	74.4
Blackbutt-Turpentine dry heathy open forest on sandstones	NR 123	13.5
Swamp Mahogany swamp forest of the coastal lowlands	NR 254	30
Paperbark swamp forest of the coastal lowlands	NR 217	15.1
Spotted Gum-Grey Ironbark-Pink Bloodwood open forest of the Clarence Valley lowlands	NR 246	1.9
Total		134.9

It is anticipated that results from the detailed biobanking assessment associated with establishing a biobank site would inform consultation with OEH to agree on the minimum size and final shape of the biobank site. Initial calculations indicate that less than 134.9 hectares will be required to adequately offset the ecosystem credits however, as mentioned, consultation with OEH will be required to agree on the final credits to adequately offset all of the proposals impacts in accordance with the trading guidelines associated with the FBA.

Preliminary assessment of the potential biobank site revealed that the vegetation types and condition are comparable with those identified within the proposed quarry footprint. Occurences of the threatened plant, *Hibbertia marginata*, were also identified (refer Figure 6) suggesting that the proposed biobank site provides suitable habitat for this species.

Based on these initial findings it is proposed that a BioBanking assessment be undertaken for the potential biobank site, subject to approval of the proposed expansion. A summary of the proposed approach is provided as follows.

517,000 517,500 518,000 518,500 519,000 519,500

6,759,000 6,758,500 6,758,000 6,757,500 6,757,000 6,756,500

LEGEND

- Hibbertia Marginata
- Subject site
- Study area
- 10m contour
- cadastre
- Spotted Gum - Grey ironbark - Pink Bloodwood Open Forest
- Paperbark swamp forest of the coastal lowlands
- Blackbutt - Turpentine dry heathy open forest on sandstones
- Blackbutt - Bloodwood dry heathy open forest on Quaternary sands
- Swamp Mahogany swamp forest of the coastal lowlands

Paper Size A3

0 50 100 200 300 400

Metres

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

N

Newman Quarrying
Sly's Quarry Environmental Impact Statement
Biodiversity Assessment

Job Number 22-17528
Revision A
Date 18 Feb 2015

Proposed Biobank Site: Vegetation Types

Figure 6

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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

Data Source: NSW Department of Lands: Cadastre - Jan 2014; Geoscience Australia: 250k Data - Jan 2014; NSW Department od Primary Industry - Jan 2014; Google image Jan 2014. Created by: qjchung

10.2 Summary of the BioBanking process

The offsets strategy for the proposal will include the proposed offset site being formally titled and conserved under a BioBanking agreement. To deliver the biodiversity outcomes required by a BioBanking agreement, the following biodiversity management framework would be implemented at the proposed offset site:

- ***Conservation*** – A 'conservation covenant' would be placed over the proposed offset site in perpetuity. This covenant extinguishes all potential future land uses other than exploration/mining rights.
- ***Vegetation Rehabilitation*** – Existing vegetation would have a 'targeted' weed control program applied to improve 'condition' throughout the proposed offset site. Revegetation activities would increase the extent of native vegetation, through time, of the proposed offset site.
- ***Maintenance and monitoring*** – An annual maintenance and monitoring regime would be applied to the proposed offset site in perpetuity to ensure improvements in ecological values are maintained.

10.3 Conservation covenant (BioBanking agreement)

Entering into a BioBanking agreement places a conservation covenant over the land, regardless of zoning. This covenant is the strongest available on private lands and extinguishes all land uses other than conservation. The estimated timeline for completing the BioBanking agreements for the biobank site is shown in Table 15.

Table 15 Program for obtaining a BioBanking Agreement for the Proposed Offset Site

Task description	Timing
Complete site surveys and BioBanking assessment	Witthin 6 months from approval of the Offsets Proposal
Complete draft Managements Actions Plan and costing template	Within 6 months from approval of the Offsets Proposal
BioBanking agreement signed	Within 12 months from approval of the Offset Proposal
Implementation of Management Actions Plan	Commence immediately after BioBanking agreement signed, the Total Fund Deposit has been paid and the agreed minimum number of credits are retired.

There are circumstances where additional approval from the NSW Minister for the Environment may overturn the covenant for mining rights and, potentially, significant infrastructure but the BioBanking methodology includes mechanisms to ensure any impacts from these activities are, again, suitable offset as an addition to any offsetting activities required by a given project in its own right. Details of this policy can be provided by the BioBanking Unit.

BioBanking agreements include detailed contractual and financial obligations on the landowner and purchaser and, in the absence of draft BioBanking agreements (including the draft detailed management actions plan and contractual obligations on both parties), it is unreasonable to expect a land owner to commit at this stage as these are the documents to be prepared/ negotiated and agreed in the next 12 months. The offset proposal can commit to entering the

next stage of negotiations and, as contingency, can commit to retiring the minimum number of credits required to offset its impact. This is the most important point when using BioBanking as this achieves the 'improve or maintain' outcome for ecology required for approval.

10.4 Management actions

10.4.1 Approach

The following describes the actions that would likely be required for ongoing management of the proposed offset site. A Management Actions Plan (prepared in accordance with the BioBanking Methodology), detailing rehabilitation activities and an associated management program, would be prepared and included in the final BioBanking agreement. The Management Actions Plan forms the basis of the funds required to be placed in the BioBanking Trust when purchasing the credits. The BioBanking Trust then funds the BioBank site owner to implement the management actions plan.

BioBank sites may have two types of management actions applied:

- Standard Management Actions
- Site Specific Management Actions

Standard management actions are those actions required on the proposed offset site to improve vegetation condition when entering into a BioBanking agreement. The standard management actions for all BioBank (Table 16) are:

- Management of grazing for conservation
- Weed control
- Management of fire for conservation
- Management of human disturbance
- Retention of regrowth and remnant native vegetation
- Replanting or supplementary planting where natural regeneration would not be sufficient (note: it is anticipated that natural regeneration would be sufficient for the proposed biobank site and hence supplementary planting works would not be undertaken)
- Retention of dead timber
- Erosion control
- Retention of rocks

Based on the habitat resources within the site and the suite of threatened species which are predicted to occur, the credit calculator nominates management actions that would be required to alleviate site-specific threates. Undertaking these actions is over and above the minimal requirements for a BioBank site. Additional management actions that are likely to be required at the proposed offset site are summarised below:

- Cat and/or fox control
- Exclude miscellaneous feral species
- Control of feral and/or overabundant native herbivores (e.g. rabbit, goats, deer etc)
- Maintain or reintroduce flow regimes (aquatic flora)

The Management Actions Plan will identify site specific vegetation rehabilitation and management actions appropriate for the proposed offset site which would be completed during the preparation of the BioBanking agreement. A summary of the likely actions, including an estimate of timeframe, are included below.

Table 16 Summary of rehabilitation and management for proposed offset site

Management measure	Activities required	Timing
Management of grazing	Install stock fencing in accordance with the MAP	Within the first year of establishing the BioBank site
	Maintenance and repair	Annually
Weed control	Control of noxious and large woody weeds (target 80% control)	Within first 3 years of establishing BioBank site
	Completion of primary and secondary bush regeneration programs targeting other weeds	Within first 10 years of establishing BioBank site
Management of human disturbance	Install controlled access point/s and fencing in accordance with the MAP	Within the first 6 months of establishing the BioBank site
Retention of vegetation and retention of dead timber	Installation of protective fencing in accordance with MAP	Within the first 6 months of establishing the BioBank site
Erosion control	Installation of erosion control measures in accordance with the MAP	Within first 3 months of establishing the BioBank site.
Feral animal control	Trapping and targeted removal of pest species	Immediately upon establishment of BioBank site and monitored regularly
Maintain or reintroduce flow regimes (aquatic flora)	Removal of any 'barriers' to flow regimes	Within first year of establishing BioBank site
Monitoring and reporting	Reports will be prepared and issued in accordance with MAP by OEH	Annually in perpetuity

10.5 Monitoring of the offset site

The purchase of credits includes two components: Part A being the cost of rehabilitation and management and, Part B being the 'profit' to the relevant landowner. The Part A funds are the equivalent of all costs associated with the rehabilitation, management and monitoring of the BioBank site/s in perpetuity.

The BioBanking methodology includes preparation of a Management Actions Plan for each BioBank site. The methodology also includes a credit pricing tool which places a commercial value for completing each of the actions listed in the Management Actions Plan. These funds are held by the BioBanking Trust and managed by OEH. The funds are provided to the land owner on an annual basis for the amount equivalent to works required in that year. The BioBank owner is then required to submit standards reports, outlining the works completed, their success and monitoring results. OEH then review the reports and, if works have been completed satisfactorily, provide the next payment for the following years work. The OEH also include site visits as part of their auditing process.

10.6 Compliance assurance

BioBanking includes a range of provisions to ensure delivery of the conservation outcomes. The OEH have the ability to:

- Enforce the provisions of the conservation covenant placed over the land.
- Adjust rehabilitation and management actions program depending on how the site responds.
- Includes contingency for things such as natural disasters which may impact on the success or otherwise of the program.
- Have the authority to take legal actions against Biobank site owners for non-compliance including, as a last resort, acquisition of the land.

11. Conclusions

The proposal involves the expansion of Sly's Quarry and would require the removal of approximately 10.5 hectares of native vegetation. This includes 6.27 hectares of Blackbutt-Turpentine dry heathy forest and 4.23 hectares of Blackbutt-Bloodwood dry heathy forest.

Vegetation at the site has been previously disturbed due to past logging practices, however it remains relatively weed free with only small patches of the noxious weed Lantana (*Lantana camara)* scattered through the site.

The habitats within the study area are contiguous with large tracts of native vegetation that surround the site. To the south and east of the site is an identified key regional fauna habitat corridor which connects coastal habitats with those of the ranges to the west. This corridor also includes Mororo State Forest, Gibberagee State Forest, Bungalung Crown Reserve and Devils Pulpit State Forest. This habitat connectivity would allow a broad range of mobile fauna species to use habitats within the study area, either as part of their home territory or as an adjunct to their core areas of habitat in response to seasonal resource availability.

11.1 Impacts on state-listed biota

One threatened flora species (Bordered Guinea Flower (*Hibbertia marginata*)) listed as vulnerable under the TSC Act was identified within the study area. There is also potential habitat for up to three additional threatened flora species listed under the TSC Act to occur and be impacted by the proposal. A total of 10.5 hectares of native regrowth vegetation which constitutes potential habitat for these threatened flora species would be impacted by the proposal.

No threatened ecological communities listed under the TSC Act were identified within the study area.

No threatened fauna species were identified within or directly adjacent to the study area as a result of the current field surveys, however the site provides potential habitat for up to 23 threatened fauna species listed under the TSC Act, including:

- Forest owls and raptors
- Woodland birds
- Wetland birds
- Hollow-dependent arboreal mammals
- Terrestrial mammals
- Hollow-roosting microbats, cave-roosting microbats and the Grey-headed Flying-fox
- One reptile

No threatened biota listed under the FM Act are likely to occur in the study area, or downstream of the study area.

11.2 EPBC Act MNES

One threatened flora species, Bordered Guinea Flower (*Hibbertia marginata*), listed as vulnerable under the EPBC Act was identified within the subject site. Further detailed survey was undertaken to determine the size and extent of this species within the subject site.

The subject site also contains potential habitat for an additional two threatened flora species, three threatened fauna species and four migratory bird species listed under the EPBC Act. There are no other MNES within the locality which would be affected by the proposal.

Under the provisions of the EPBC Act, the proposed development is being referred to the Department of the Environment in relation to the impacts on the identified *Hibbertia marginata* population. Other potential MNES have been addressed through the FBA and its associated BioBanking assessment.

11.3 Avoidance and mitigation of impacts

The proposal has been resized and repositioned during the detailed design phase in order to avoid sensitive ecological receptors such as threatened ecological communities and known threatened species.

Recommended mitigation measures are included in this report in order to minimise the impact of the proposal on native flora, fauna and ecological processes within the study area and adjacent land. These measures would be incorporated into an Environmental Management Plan for the proposal, and would include:

- Pre-clearing surveys and clearing protocols to minimise risk of damage to resident fauna, minimise clearing of native vegetation and prevent encroachment into retained adjoining habitats.
- Installation of nest-boxes will be considered prior to clearing to provide alternative roosting sites for hollow-dependant fauna. The number and types of nest-boxes used should be determined based on the results of the pre-clearance surveys.
- Standard environmental management measures to minimise the risk of indirect impacts on adjoining habitats through contaminated runoff, sedimentation, erosion, noise and vibration.

11.4 Requirement to offset impacts under the FBA

The Biobanking credit calculator V 4.1 has been used in this Biodiversity Assessment Report to determine the number and type of biodiversity credits required to offset impacts of the proposal. The Biodiversity credit report is included in Appendix D.

The Biodiversity Offset Strategy for the proposal would include the purchase and retirement of the following ecosystem credits as calculated in accordance with the FBA:

- 485 ecosystem credits for Blackbutt-Turpentine dry heathy open forest (NR 123)
- 283 ecosystem credits for Blackbutt-Bloodwood dry heathy open forest (NR 114)
- 16,660 species credits for *Hibbertia marginata*
- 273 Koala species credits
- 231 Squirell glider credits
- 273 Common planigale credits

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Appendix A – Likelihood of occurrence table

Threatened Biota Habitat Table

Databases Searched

Office of Environment and Heritage (OEH) (2014a) Threatened species profiles- threatened ecological communities known or predicted to occur within the Northern Rivers CMA subregion.

Department of the Environment (DoE) (2014) EPBC PMST Online Search 3 December 2014 - 10 km buffer.

Department of Primary Industries (DPI) (2014) Records viewer search for threatened and protected aquatic species - Northern Rivers CMA.

Office of Environment and Heritage (OEH) (2014b) NSW Wildlife Atlas Search - threatened species results within a 10 km buffer

Likelihood of Occurrence

Matters considered in determining the likelihood of occurrence include:

- Known natural distributions including prior records (database searches) and site survey results.
- Geological/ soil preferences.
- Specific habitat requirements (e.g. aquatic environs, seasonal nectar resources, tree hollows etc).
- Climatic considerations (e.g. wet summers; snow fall).
- Home range size and habitat dependence.
- Topographical preferences (e.g. coastal headlands, ridgetops, midslopes, gilgai, wetlands).

The likelihood of occurrence scale is defined as follows:

Likelihood of Occurrence Scale

Scale	Description
Known	Species known to occur within the site (e.g. breeding and foraging habitat; foraging habitat; movement corridors). Detected on or immediately adjacent to the site.
Likely	Presence of high value suitable habitat (e.g. breeding and foraging habitat; important movement corridors). Not detected.
Possible	Presence of medium value suitable habitat (e.g. disturbed breeding conditions; constrained foraging habitat; movement corridors). Not detected.

Scale	Description
Unlikely	Presence of low value suitable habitat (e.g. disturbed conditions; isolated small habitat area; fragmented movement corridors). Not detected.
Nil	No suitable habitat or corridors linking suitable habitat present. Not detected.

Note: Marine species which are restricted to marine environments only (such as whales, dolphins, sharks and seabirds) are excluded from the Likelihood of Occurrence Table as there is no marine habitat in the subject site.

Scientific Name	Common Name	TSC/FM Act	EPBC Act	Habitat Association	Nature of record	Presence on site
EECs						
Coastal Cypress Pine Forest in the New South Wales North Coast Bioregion		EEC		Coastal Cypress Pine Forest is apparently restricted to the NSW North Coast bioregion. The dominant species, *C. columellaris*, extends into south-east Queensland as far north as Hervey Bay. Any occurrence of the community in south-east Queensland is likely to be highly restricted. In NSW, Coastal Cypress Pine Forest is currently known from the local government areas of Tweed, Byron, Ballina, Richmond Valley and Clarence Valley, but may occur elsewhere within the bioregion.	Recorded within 10km (OEH 2014)	Does not occur.
Coastal Saltmarsh in the New South Wales North Coast, Sydney Basin and South East Corner Bioregions		EEC	V	This community occurs in the intertidal zone along the NSW coast. Species composition varies with elevation and latitude, with Saltmarsh in southern NSW being generally more species-rich than further north.	Recorded within 10km (OEH 2014)	Does not occur.
Freshwater Wetlands on Coastal Floodplains of the New South Wales North Coast, Sydney Basin and South East Corner Bioregions		EEC	-	Occurs in coastal areas subject to periodic flooding with standing fresh water for at least part of the year. Typically on silts, muds or humic loams below 20 m elevation in low-lying parts of floodplains, alluvial flats, depressions, drainage lines, backswamps, lagoons and lakes. Structure and composition varies spatially and temporally depending on the water regime, though is usually dominated by herbaceous plants and has few woody species.	Recorded within 10km (OEH 2014)	Does not occur.
Littoral Rainforest in the New South Wales North Coast, Sydney Basin and South East Corner Bioregions		EEC	CEEC	Occurs along the NSW coast, usually within 2km of the ocean on a variety of substrates. Variable structure and composition, typically with closed canopy. Generally rainforest species with vines a major component.	Recorded within 10km (OEH 2014) Predicted to occur within 10km (DotE 2014)	Does not occur.
Lowland Rainforest of Subtropical Australia		EEC	CE	This ecological community occurs on basalt and alluvial soils, including sand and old or elevated alluvial soils as well as floodplain alluvia. The community mostly occurs in areas < 300m asl. It differs from Littoral rainforest in that it typically occurs more than 2 km from the coast.	Recorded within 10km (OEH 2014) Predicted to occur within 10km (DotE 2014)	Does not occur.

Scientific Name	Common Name	TSC/FM Act	EPBC Act	Habitat Association	Nature of record	Presence on site
Low land Rainforest on Floodplain in the New South Wales North Coast Bioregion		EEC	CE	Low land Rainforest on Floodplain generally occupies riverine corridors and alluvial flats w ith rich, moist silts often in subcatchments dominated by basic volcanic substrates. Major examples once occurred, and remnants remain, on the floodplains of the Tw eed, Richmond, Clarence, Bellinger, Macleay, Hastings, Manning, and Hunter Rivers. Other minor river systems also support the community.	Recorded w ithin 10km (OEH 2014)	Does not occur.
Subtropical Coastal Floodplain Forest of the New South Wales North Coast Bioregion		EEC	-	Subtropical Coastal Floodplain Forest is know n from parts of the Local Government Areas of Tw eed, Byron, Lismore, Ballina, Richmond Valley, Clarence Valley, Coffs Harbour, Bellingen, Nambucca, Kempsey, Hastings, Greater Taree, Great Lakes and Port Stephens, but may occur elsew here in this bioregion. Major examples once occurred on the floodplains of the Tw eed, Richmond, Clarence, Macleay, Hastings and Manning Rivers, although smaller floodplains w ould have also supported considerable areas of this community.	Recorded w ithin 10km (OEH 2014)	Does not occur.
Sw amp Sclerophyll forest on Coastal floodplains of the NSW North Coast, Sydney Basin and South East Corner bioregions		EEC	-	Usually occurs below 20m asl (sometimes up to 50m). Associated w ith humic clay loams and sandy loams, on w aterlogged or periodically inundated alluvial flats and drainage lines associated w ith coastal floodplains. Characterised by open to dense tree layer of eucalypts and paperbarks, w ith trees up to or higher than 25 m. Includes areas of fern land and tall reed or sedge land, w here trees are sparse or absent.	Recorded w ithin 10km (OEH 2014)	Does not occur w ithin the subject site.
Themeda grassland on seacliffs and coastal headlands in the NSW North Coast, Sydney Basin and South East Corner Bioregion		EEC		Occurs on a range of substrates in the NSW North Coast, Sydney Basin and South East Corner bioregionsThe community is found on a range of substrates, although stands on sandstone are infrequent and small.	Recorded w ithin 10km (OEH 2014)	Does not occur.

Threatened flora known or predicted from the locality, habitat associated and likelihood of occurrence.

Scientific Name	Common Name	TSC/FM Act	EPBC Act	Habitat Association	Nature of record	Suitable habitat present?
FLORA						
Acronychia littoralis	Scented Acronychia	E	E	Scented Acronychia is found on sand in humid, high rainfall zones (greater than 1600 mm), within 2 km of the ocean. The species occurs in transition zones between littoral rainforest and swamp sclerophyll forest; between littoral and coastal cypress pine communities; and margins of littoral forest and cleared land.	**Predicted** to occur within 10km (DotE 2014)	**Unlikely**. No suitable habitat present at site.
Anthraxon hispidus	Hairy-joint Grass	V	V	Moisture and shade-loving grass, found in or on the edges of rainforest and in wet eucalypt forest, often near creeks or swamps.	**Predicted** to occur within 10km (DotE 2014)	**Unlikely**. No suitable habitat present at site.
Cyperus aquatilis	Water Nutgrass	E	-	In NSW, known only from a few sites north from Grafton. Also occurs in Queensland, Northern Territory, Western Australia and New Guinea. Grows in ephemerally wet sites, such as roadside ditches and seepage areas from small cliffs, in sandstone areas.	**1 record** within 10km (OEH 2014)	**Unlikely**. No suitable habitat present at site.
Cryptocarya foetida	Stinking Cryptocarya	V	V	Grows in dry rainforest on steep basalt boulder slopes on soil that is scarce but relatively high in nutrients and very well-drained.	**Predicted** to occur within 10km (DotE 2014)	**Unlikely**. No suitable habitat present at site.
Cryptostylis hunteriana	Leafless Tongue Orchid	V	V	Occurs in coastal areas from East Gippsland to southern Queensland. Habitat preferences not well defined. Grows mostly in coastal heathlands, margins of coastal swamps and sedgelands, coastal forest, dry woodland, and lowland forest. Prefers open areas in the understorey and is often found in association with Cryptostylis subulata and Cryptostylis erecta. Soils include moist sands, moist to dry clay loam and occasionally in accumulated eucalypt leaves. Flowers November-February.	**Predicted** to occur within 10km (DotE 2014)	**Possible**. Potential habitat present at site.

Scientific Name	Common Name	TSC/FM Act	EPBC Act	Habitat Association	Nature of record	Suitable habitat present?
Eucalyptus glaucina	Slaty Red Gum	V	V	Found on the north coast of NSW and in separate districts: near Casino where it can be locally common, and farther south, from Taree to Broke, west of Maitland. Grows in grassy woodland and dry eucalypt forest on deep, moderately fertile and well-watered soils.	**Predicted** to occur within 10km (DotE 2014) **7 records** within 10km (OEH 2014)	**Unlikely**. No suitable habitat present at site.
Gossia fragrantissima	Sweet Myrtle		E	Occurs in south-east Queensland and in north-east NSW south to the Richmond River. Mostly found on basalt-derived soils. Found in dry subtropical and riverine rainforest.	**Predicted** to occur within 10km (DotE 2014)	**Unlikely**. No suitable habitat present at site.
Grammitis stenophylla	Narrow-leaf Finger Fern	E	-	Occurs in eastern Queensland and eastern NSW. In NSW it has been found on the south, central and north coasts and as far west as Mount Kaputar National Park near Narrabri. Likes moist places, usually near streams, on rocks or in trees, in rainforest and moist eucalypt forest	**3 records** within 10km (OEH 2014)	**Unlikely**. No suitable habitat present at site.
Hibbertia marginata	Bordered Guinea Flower	V	V	Occurs only in north-east NSW, where it is restricted to the southern Richmond Range between Casino and Grafton. Grows in grassy or shrubby dry open eucalypt forest at low altitudes on sandstone.	**Predicted** to occur within 10km (DotE 2014) **17 records** within 10km (OEH 2014)	**Known.** Found throughout site during field surveys.
Lindsaea incisa	Slender Screw Fern	E	-	In NSW it is known only from a few locations between Woombah and just south of Coffs Harbour. Also occurs in north and south-east Queensland. Found in dry eucalypt forest on sandstone and moist shrubby eucalypt forest on metasediments. It is usually found in waterlogged or poorly drained sites along creeks, where ferns, sedges and shrubs grow thickly.	**6 records** within 10km (OEH 2014)	**Unlikely**. Some suitable conditions present, however no waterlogged areas or creeklines which are preferred habitat.
Marsdenia longiloba	Slender Marsdenia	E	V	Scattered sites on the north coast of NSW north from Barrington Tops. Occurs in subtropical and warm temperate rainforest, lowland moist or open eucalypt forest adjoining rainforest and, sometimes, in areas with rock outcrops.	**Predicted** to occur within 10km (DotE 2014)	**Unlikely**. No suitable habitat present at site.

Scientific Name	Common Name	TSC/FM Act	EPBC Act	Habitat Association	Nature of record	Suitable habitat present?
Maundia triglochinoides		V	-	Restricted to coastal NSW and extending into southern Queensland. The current southern limit is Wyong; former sites around Sydney are now extinct. Grows in swamps, lagoons, dams, channels, creeks or shallow freshwater 30 - 60 cm deep on heavy clay, low nutrients.	**3 records** within 10km (OEH 2014)	**Unlikely**. No suitable habitat present at site.
Melichrus sp. Gibberagee	Narrow-leaf Melichrus		E	Restricted to north-east NSW. Known only from a single population in Gibberagee State Forest and adjacent private property, about 40 km south of Casino. Low-altitude dry eucalypt forest on gentle slopes. Found mainly in grassy forests under tall spotted gum and ironbarks.	**Predicted** to occur within 10km (DotE 2014) **1 record** within 10km (OEH 2014)	**Unlikely**. No suitable habitat present at site.
Parsonsia dorrigoensis	Milky silkpod		E	Milky Silkpod is found only within NSW, with scattered populations in the north coast region between Kendall and Woolgoolga. Found in subtropical and warm-temperature rainforest, on rainforest margins, and in moist eucalypt forest up to 800 m, on brown clay soils.	**Predicted** to occur within 10km (DotE 2014)	**Unlikely**. No suitable habitat present at site.
Paspalidium grandispiculatum	A grass	V	V	In NSW, it is known from the north of Grafton in the Mount Neville, Gibberagee and Doubleduke vicinities. It is likely to be restricted to poor sandy soils on sandstone. It has been found in open forest of Turpentine (*Syncarpia glomulifera*) on undulating topography as well as in drier forest types on ridges.	**Predicted** to occur within 10km (DotE 2014) **2 records** within 10km (OEH 2014)	**Possible.** Suitable habitat and associated species present at site.
Persicaria elatior	Tall Knotweed	V	V	Tall Knotweed has been recorded in south-eastern NSW (Mt Dromedary, Moruya State Forest near Turlinjah, the Upper Avon River catchment north of Robertson, Bermagui, and Picton Lakes. In northern NSW it is known from Raymond Terrace (near Newcastle) and the Grafton area (Cherry Tree and Gibberagee State Forests). Normally grows in damp places, especially beside streams and lakes. Occasionally in swamp forest or associated with disturbance.	**Predicted** to occur within 10km (DotE 2014)	**Unlikely.** Minimal preferred habitat on site, but small potential to be present in swamp areas.

Scientific Name	Common Name	TSC/FM Act	EPBC Act	Habitat Association	Nature of record	Suitable habitat present?
Phaius australis	Lesser Swamp-orchid		E	Occurs in Queensland and north-east NSW as far south as Coffs Harbour. Occurs in swampy grassland or swampy forest including rainforest, eucalypt or paperbark forest, mostly in coastal areas.	**Predicted** to occur within 10km (DotE 2014)	**Unlikely.** Targeted searches were conducted across the site and it was determined that the species was unlikely to be present.
Polygala linariifolia	Native Milkwort	V	-	North from Copeton Dam and the Warialda area to southern Queensland; also found on the NSW north coast near Casino and Kyogle, and there is an isolated population in far western NSW near Weebah Gate, west of Hungerford. Found on sandy soils in dry eucalypt forest and woodland with a sparse understorey.	**1 record** within 10km (OEH 2014)	**Possible** Suitable habitat present within open dry eucalypt forest at site.
Prostanthera palustris	Swamp Mint-bush	-	V	Only known from the Jerusalem Creek area in the north of Bundjalung National Park, near Evans Head. Grows in in wet shrubland to heathland subject to extended waterlogging in poorly drained white siliceous sandy soil with a high organic content.	**Predicted** to occur within 10km (DotE 2014) **1 record** within 10km (OEH 2014)	**Unlikely.** Targeted searches undertaken in areas of suitable habitat and this species was not recorded.
Streblus pendulinus	Siah's Backbone, Sia's Backbone, Isaac Wood	-	E	Siah's Backbone occurs from Cape York Peninsula to Milton, south-east New South Wales (NSW), as well as Norfolk Island (ATRP 2010; Jessup 2003; The Royal Botanic Gardens and Domain Trust 2011). Siah's Backbone is found in warmer rainforests, chiefly along watercourses. The species grows in well developed rainforest, gallery forest and drier, more seasonal rainforest (ATRP 2010).	**Predicted** to occur within 10km (DotE 2014)	**Unlikely.** No suitable habitat present at site.
Thesium australe	Austral Toadflax	V	V	Austral Toad-flax is found in very small populations scattered across eastern NSW, along the coast, and from the Northern to Southern Tablelands. Although originally described from material collected in the SW Sydney area, populations have not been seen in a long time. It may persist in some areas in the broader region. Occurs in grassland on coastal headlands or grassland and grassy woodland away from the coast.	**Predicted** to occur within 10km (DotE 2014)	**Unlikely**. No suitable habitat present at site.

Threatened fauna known or predicted from the locality, habitat association and likelihood of occurrence in the subject site

Scientific Name	Common Name	TSC/FM Act	EPBC Act	Habitat association	Nature of record	Presence on site
FAUNA						
Birds						
Anthochaera phrygia	Regent Honeyeater	CE	E	In NSW confined to two known breeding areas: the Capertee Valley and Bundarra-Barraba region. Non-breeding flocks occasionally seen in coastal areas foraging in flowering Spotted Gum and Swamp Mahogany forests, presumably in response to drought. Inhabits dry open forest and woodlands, particularly Box-Ironbark woodland and riparian forests of River Sheoak, with an abundance of mature trees, high canopy cover and abundance of mistletoes.	**Predicted** to occur within 10km (DotE 2014) **2 records** within 10km (OEH 2014)	**Unlikely**. Suitable habitat not present at the site. Some potential habitat present in the wider study area.
Botaurus poiciloptilus	Australasian Bittern	E	E	Widespread but uncommon over most NSW except the northwest. Favours permanent freshwater wetlands with tall dense reedbeds particularly *Typha* spp. and *Eleocharis* spp., with adjacent shallow, open water for foraging. Roosts during the day amongst dense reeds or rushes and feeds mainly at night on frogs, fish, yabbies, spiders, insects and snails.	**Predicted** to occur within 10km (DotE 2014)	**Unlikely.** No permanent wetlands with emergent vegetation present at site.
Burhinus grallarius	Bush Stone-curlew	E	-	The Bush Stone-curlew is found throughout Australia except for the central southern coast and inland, the far south-east corner, and Tasmania. Only in northern Australia is it still common however and in the south-east it is either rare or extinct throughout its former range. Inhabits open forests and woodlands with a sparse grassy groundlayer and fallen timber.	**3 records** within 10km (OEH 2014)	**Unlikely -** . Suitable habitat not present.

Scientific Name	Common Name	TSC/FM Act	EPBC Act	Habitat association	Nature of record	Presence on site
Calyptorhynchus lathami	Glossy Black-Cockatoo	V	-	Widespread but uncommon from coast to southern tablelands and central western plains. Feeds almost exclusively on the seeds of *Allocasuarina* species. Prefers woodland and open forests, rarely away from Allocasuarina. Roost in leafy canopy trees, preferably eucalypts, usually <1 km from feeding site. Nests in large (approx. 20cm) hollows in trees, stumps or limbs, usually in Eucalypts (Higgins 1999).	**45 records** within 10km (OEH 2014)	**Possible.** Could potentially use *Allocasuarina littoralis* on site for foraging. Trees suitable for nesting found throughout site.
Climacteris picumnus victoriae	Brown Treecreeper (eastern subspecies)	V	-	The Brown Treecreeper is endemic to eastern Australia and occurs in eucalypt forests and woodlands of inland plains and slopes of the Great Dividing Range. It is less commonly found on coastal plains and ranges. Mainly inhabits woodlands dominated by stringybarks or other rough-barked eucalypts, usually with an open grassy understorey, sometimes with one or more shrub species; also found in mallee and River Red Gum (*Eucalyptus camaldulensis*) Forest bordering wetlands with an open understorey of acacias, saltbush, lignum, cumbungi and grasses.	**20 records** within 10km (OEH 2014)	**Unlikely**. Suitable habitat not present.
Coracina lineata	Barred Cuckoo-shrike	V	-	Coastal eastern Australia from Cape York to the Manning River in NSW. Barred Cuckoo-shrikes are generally uncommon in their range, and are rare in NSW. Found in rainforest, eucalypt forests and woodlands, clearings in secondary growth, swamp woodlands and timber along watercourses.	**1 record** within 10km (OEH 2014)	**Possible**. Suitable habitat present however no watercourses on site.

Scientific Name	Common Name	TSC/FM Act	EPBC Act	Habitat association	Nature of record	Presence on site
Cyclopsitta diophthalma coxeni	Coxen's Fig-Parrot	CE	E/M	Coxen's Fig-Parrot occurs in rainforest habitats including subtropical rainforest, dry rainforest, littoral and developing littoral rainforest, and vine forest.	**Predicted** to occur within 10km (DotE 2014)	**Unlikely.** No suitable habitat present.
Daphoenositta chrysoptera	Varied Sittella	V	-	Sedentary, occurs across NSW from the coast to the far west. Inhabits eucalypt forests and woodlands, especially rough-barked species and mature smooth-barked gums with dead branches, mallee and Acacia woodland. Sensitive to habitat isolation and loss of structural complexity, and adversely affected by dominance of Noisy Miners. Cleared agricultural land is potentially a barrier to movement. Builds a cup-shaped nest of plant fibres and cobwebs in an upright tree fork high in the living tree canopy, and often re-uses the same fork or tree in successive years.	**8 records** within 10km (OEH 2014)	**Possible**. Suitable habitat present at site. No Noisy Minors observed at site and site is surrounded by forest.
Dasyornis brachypterus	Eastern Bristlebird	E	E	Occurs in three disjunct areas of south-eastern Australia: southern Queensland/northern NSW, the Illawarra Region and in the vicinity of the NSW/Victorian border. Habitat characterised by dense, low vegetation including heath and open woodland with a heathy understorey. The fire history of habitat is important, and the Illawarra and southern populations reach maximum densities in habitat that have not been burnt for over 15 years.	**Predicted** to occur within 10km (DotE 2014)	**Unlikely**. No suitable habitat present and study area is outside of known distribution
Dromaius novaehollandiae	Emu	EP	-	The species is now restricted to coastal and near-coastal areas between Evans Head and Red Rock and a small isolated population further west in the Bungawalbin area. It now appears to be absent from Broadwater National Park,	**5 records** within 10km (OEH 2014)	**Unlikely** Suitable habitat not present at site.

Scientific Name	Common Name	TSC/FM Act	EPBC Act	Habitat association	Nature of record	Presence on site
				there are few recent sightings from its former stronghold in Bundjalung National Park and it is not known whether a natural population continues to persist in the Port Stephens area. On the NSW north coast, Emus occur in a range of predominantly open lowland habitats, including grasslands, heathland, shrubland, open and shrubby woodlands, forest, and swamp and sedgeland communities, as well as the ecotones between these habitats. They also occur in plantations of tea-tree and open farmland, and occasionally in littoral rainforest.		
Ephippiorhynchus asiaticus	Black-necked Stork	E	-	Primarily inhabits permanent freshwater wetlands and surrounding vegetation including swamps, floodplains, watercourses and billabongs, freshwater meadows, wet heathland, farm dams and shallow floodwaters. Will also forage in inter-tidal shorelines, mangrove margins and estuaries. Feeds in shallow, still water. This species breeds during summer, nesting in or near a freshwater swamp	**9 records** within 10km (OEH 2014)	**Unlikely.** No permanent wetlands or watercourses on site.
Erythrotriorchis radiatus	Red Goshawk	V	CE	Red Goshawks inhabit open woodland and forest, preferring a mosaic of vegetation types with a large source of birds as food and permanent water nearby. In NSW, preferred habitats include mixed subtropical rainforest, *Melaleuca* swamp forest and riparian *Eucalyptus* forest of coastal rivers.	**Predicted** to occur within 10km (DotE 2014)	**Unlikely**. Preferred habitat types not on site and no permanent water sources on site.

Scientific Name	Common Name	TSC/FM Act	EPBC Act	Habitat association	Nature of record	Presence on site
Glossopsitta pusilla	Little Lorikeet	V	-	Occurs from coast to western slopes of the Great Dividing Range. Inhabits dry, open eucalypt forests and woodlands. Occurrence is positively associated with patch size, and with components of habitat complexity including canopy cover, shrub cover, ground cover, logs, fallen branches and litter. Feed primarily on profusely-flowering eucalypts and a variety of other species including melaleucas and mistletoes. On the western slopes and tablelands *Eucalyptus albens* and *E. melliodora* are particularly important food sources for pollen and nectar respectively. Mostly nests in small (opening approx. 3cm) hollows in living, smooth-barked eucalypts, especially *Eucalyptus viminalis, E. blakelyi and E. dealbata*. Most breeding records are from the western slopes.	**20 records** within 10km (OEH 2014)	**Possible.** May occasionally forage within the study area.
Grus rubicunda	Brolga	V	-	The Brolga was formerly found across Australia, except for the south-east corner, Tasmania and the south-western third of the country. It is still abundant in the northern tropics, but very sparse across the southern part of its range. Though Brolgas often feed in dry grassland or ploughed paddocks or even desert claypans, they are dependent on wetlands too, especially shallow swamps, where they will forage with their head entirely submerged.	**5 records** within 10km (OEH 2014)	**Unlikely.** No wetlands or swamp present on site.
Irediparra gallinacea	Comb-crested Jacana	V	-	Occurs on freshwater wetlands in northern and eastern Australia, mainly in coastal and subcoastal regions, from the north-eastern Kimberley Division of Western Australia to Cape York Peninsula then south along the east coast to the Hunter region of NSW, with stragglers recorded in	**1 record** within 10km (OEH 2014)	**Unlikely.** No wetlands or swamp present on site

Scientific Name	Common Name	TSC/FM Act	EPBC Act	Habitat association	Nature of record	Presence on site
				south-eastern NSW (possibly in response to unfavourable conditions further north). Inhabit permanent freshwater wetlands, either still or slow-flowing, with a good surface cover of floating vegetation, especially water-lilies, or fringing and aquatic vegetation.		
Lathamus discolor	Swift Parrot	E	E,M	Migratory, travelling to the mainland from March to October. Breeds in Tasmania from September to January. On the mainland, it mostly occurs in the southeast foraging on winter flowering eucalypts and lerps, with records of the species between Adelaide and Brisbane. Principal over-winter habitat is box-ironbark communities on the inland slopes and plains. *Eucalyptus robusta, Corymbia maculata* and *C. gummifera* dominated coastal forests are also important habitat.	**Predicted** to occur within 10km (DotE 2014)	**Unlikely.** Suitable habitat not present at the site. Some potential habitat present in the wider study area.
Lophoictinia isura	Square-tailed Kite	V	-	In NSW, scattered records of the species throughout the state indicate that the species is a regular resident in the north, north-east and along the major west-flowing river systems. It is a summer breeding migrant to the south-east, including the NSW south coast, arriving in September and leaving by March. Found in a variety of timbered habitats including dry woodlands and open forests. Shows a particular preference for timbered watercourses.	**1 record** within 10km (OEH 2014)	**Possible** Suitable habitat present at site.
Melanodryas cucullata cucullata	Hooded Robin (south-eastern form)	V	-	The south-eastern form (subspecies *cucullata*) is found from Brisbane to Adelaide and throughout much of inland NSW, with the exception of the extreme north-west, where it is replaced by subspecies *picata*. Two other subspecies occur outside NSW. Prefers lightly wooded country,	**1 record** within 10km (OEH 2014)	**Unlikely**. Suitable habitat not present.

Scientific Name	Common Name	TSC/FM Act	EPBC Act	Habitat association	Nature of record	Presence on site
				usually open eucalypt woodland, acacia scrub and mallee, often in or near clearings or open areas.		
Melithreptus gularis gularis	Black-chinned Honeyeater (eastern subspecies)	V	-	In NSW it is widespread, with records from the tablelands and western slopes of the Great Dividing Range to the north-west and central-west plains and the Riverina. It is rarely recorded east of the Great Dividing Range, although regularly observed from the Richmond and Clarence River areas. It has also been recorded at a few scattered sites in the Hunter, Central Coast and Illawarra regions, though it is very rare in the latter. Occupies mostly upper levels of drier open forests or woodlands dominated by box and ironbark eucalypts, especially Mugga Ironbark (*Eucalyptus sideroxylon*), White Box (*E. albens*), Inland Grey Box (*E. microcarpa*), Yellow Box (*E. melliodora*), Blakely's Red Gum (*E. blakelyi*) and Forest Red Gum (*E. tereticornis*).	**4 records** within 10km (OEH 2014)	**Unlikely** Suitable habitat not present
Ninox connivens	Barking Owl	V	-	Occurs from coast to inland slopes and plains, though is rare in dense, wet forests east of the Great Dividing Range and sparse in higher parts of the tablelands and in the arid zone. Inhabits eucalypt woodlands, open forest, swamp woodlands, and, especially in inland areas, timber along watercourses. Roosts along creek lines in dense, tall understorey foliage (e.g. in Acacia and Casuarina), or dense eucalypt canopy. Nests in hollows of large, old eucalypts including *Eucalyptus camaldulensis*, *Eucalyptus albens, Eucalyptus polyanthemos* and *Eucalyptus blakelyi*. Birds and mammals important prey during breeding. Territories range from 30 to 200 hectares.	**11 records** within 10km (OEH 2014)	**Possible.** May utilise site for foraging at times, however no roost rites or preferred nesting trees available.

Scientific Name	Common Name	TSC/FM Act	EPBC Act	Habitat association	Nature of record	Presence on site
Ninox strenua	Powerful Owl	V	-	Occurs from the coast to the western slopes. Solitary and sedentary species. Inhabits a range of habitats from woodland and open sclerophyll forest to tall open wet forest and rainforest. Prefers large tracts of vegetation. Nests in large tree hollows (> 0.5 m deep), in large eucalypts (dbh 80-240 cm) that are at least 150 years old. Pairs have high fidelity to a small number of hollow-bearing nest trees and defend a large home range of 400 - 1,450 ha. Forages within open and closed woodlands as well as open areas.	**1 records** within 10km (OEH 2014)	**Possible.** Suitable habitat and hollows present on site.
Pandion cristatus	Eastern Osprey	V	M	Favours coastal areas, especially the mouths of large rivers, lagoons and lakes. They feed on fish over clear, open water. Breeding takes place from July to September in NSW, with nests being built high up in dead trees or in dead crowns of live trees, usually within one kilometre of the sea.	**8 records** within 10km (OEH 2014)	**Unlikely**. No suitable habitat or prey present at site.
Pezoporus wallicus wallicus	Eastern Ground Parrot	V	-	In NSW populations have declined and contracted to islands of coastal or subcoastal heathland and sedgeland habitats. The species is found in small numbers on the north coast (Broadwater, Bundjalung, Yuraygir NPs) and Myall Lakes on the central coast. The largest populations occur on the NSW south coast, particularly Barren Grounds NR, Budderoo NP, the Jervis Bay area and Nadgee NR. Small numbers are recorded at Morton and Ben Boyd NP and other areas on the south coast. Occurs in high rainfall coastal and near coastal low heathlands and sedgelands, generally below one metre in height and	**2 records** within 10km (OEH 2014)	**Unlikely**. No suitable habitat present at site.

Scientific Name	Common Name	TSC/FM Act	EPBC Act	Habitat association	Nature of record	Presence on site
				very dense (up to 90% projected foliage cover).		
Pomatostomus temporalis temporalis	Grey-crowned Babbler (eastern subspecies)	V	-	In NSW, the eastern sub-species occurs on the western slopes of the Great Dividing Range, and on the western plains reaching as far as Louth and Balranald. It also occurs in woodlands in the Hunter Valley and in several locations on the north coast of NSW. It may be extinct in the southern, central and New England tablelands. Inhabits open Box-Gum Woodlands on the slopes, and Box-Cypress-pine and open Box Woodlands on alluvial plains.	**21 records** within 10km (OEH 2014)	**Unlikely.** Suitable habitat not present.
Tyto novaehollandiae	Masked Owl	V	-	Occurs across NSW except NW corner. Most common on the coast. Inhabits dry eucalypt woodlands from sea level to 1100 m. Roosts and breeds in large (>40cm) hollows and sometime caves in moist eucalypt forested gullies. Hunts along the edges of forests and roadsides. Home range between 500 ha and 1000 ha. Prey mostly terrestrial mammals but arboreal species may also be taken.	**13 records** within 10km (OEH 2014)	**Possible** Preferred habitat at site and hollows for nesting and breeding
Turnix melanogaster	Black-breasted Button-quail	CE	V	The Black-breasted Button-quail prefers drier low closed forests including dry rainforests, vine forest and vine thickets. Understorey may be dense or sparse but has a deep moist leaf-litter layer.	**Predicted** to occur within 10km (DotE 2014)	**Unlikely**. No suitable habitat present at site.

Scientific Name	Common Name	TSC/FM Act	EPBC Act	Habitat association	Nature of record	Presence on site
Mammals						
Aepyprymnus rufescens	Rufous Bettong	V	-	The original range from Coen in north Queensland to central Victoria has been reduced to a patchy distribution from Cooktown, Queensland, to north-eastern NSW as far south as Mt Royal National Park. In NSW it has largely vanished from inland areas but there are sporadic, unconfirmed records from the Pilliga and Torrington districts. Inhabit a variety of forests from tall, moist eucalypt forest to open woodland, with a tussock grass understorey. A dense cover of tall native grasses is the preferred shelter.	**3 records** within 10km (OEH 2014)	**Unlikely**. Only marginal habitat present at the site.

Scientific Name	Common Name	TSC/FM Act	EPBC Act	Habitat association	Nature of record	Presence on site
Chalinolobus dwyeri	Large-eared Pied Bat	V	V	Occurs from the coast to the western slopes of the divide. Largest numbers of records from sandstone escarpment country in the Sydney Basin and Hunter Valley (Hoye and Schulz 2008). Roosts in caves and mines and most commonly recorded from dry sclerophyll forests and woodlands. An insectivorous species that flies over the canopy or along creek beds (Churchill 2008). In southern Sydney appears to be largely restricted to the interface between sandstone escarpments and fertile valleys.	**Predicted** to occur within 10km (DotE 2014)	**Unlikely**. No suitable roosting habitat present at site.
Chalinolobus nigrogriseus	Hoary Wattled Bat	V	-	In north east NSW it extends from Port Macquarie in the south, north to the Queensland border. The species has been recorded as far west as Armidale and Ashford. Occurs in dry open eucalypt forests, favouring forests dominated by Spotted Gum, boxes and ironbarks, and heathy coastal forests where Red Bloodwood and Scribbly Gum are common. Because it flies fast below the canopy level, forests with naturally sparse understorey layers may provide the best habitat.	**4 records** within 10km (OEH 2014)	**Possible.** Suitable habitat present.
Dasyurus maculatus	Spotted-tailed Quoll	V	E	Inhabits a range of environments including rainforest, open forest, woodland, coastal heath and inland riparian forest, from the sub-alpine zone to the coastline. Den subject sites are in hollow-bearing trees, fallen logs, small caves, rock crevices, boulder fields and rocky-cliff faces. Females occupy home ranges of up to 750 ha and males up to 3,500 ha, which are usually traversed along densely vegetated creek lines.	**Predicted** to occur within 10km (DotE 2014) **3 records** within 10km (OEH 2014)	**Possible.** Some suitable habitat but densely vegetated creeklines absent. May occasionally utilise site.

Scientific Name	Common Name	TSC/FM Act	EPBC Act	Habitat association	Nature of record	Presence on site
Falsistrellus tasmaniensis	Eastern False Pipistrelle	V	-	Occurs on southeast coast and ranges. Prefers tall (>20m) and wet forest with dense understorey. Absent from small remnants, preferring continuous forest but can move through cleared landscapes and may forage in open areas. Roosts in hollow trunks of Eucalypts, underneath bark or in buildings. Forages in gaps and spaces within forest, with large foraging range (12km foraging movements recorded) (Churchill 2008, Law et al 2008).	**3 records** within 10km (OEH 2014)	**Unlikely.** Preferred habitat not present at site.
Miniopterus australis	Little Bentwing-bat	V	-	Occurs from Cape York to Sydney. Inhabits rainforests, wet and dry sclerophyll forests, paperbark swamps and vine thickets. Only one maternity cave known in NSW, shared with Eastern Bentwing-bats at Willi Willi, near Kempsey. Outside breeding season roosts in caves, tunnels and mines and has been recorded in a tree hollow on one occasion. Forages for insects beneath the canopy of well-timbered habitats (Churchill 2008, Hoye and Hall 2008).	**19 records** within 10km (OEH 2014)	**Possible.** Many records within locality and suitable habitat present
Miniopterus schreibersii oceanensis	Eastern Bentwing-bat	V	-	Generally occurs east of the Great Dividing Range along NSW coast (Churchill 2008). Inhabits various habitats from open grasslands to woodlands, wet and dry sclerophyll forests and rainforest. Essentially a cave bat but may also roost in road culverts, stormwater tunnels and other man-made structures. Only 4 known maternity caves in NSW, near Wee Jasper, Bungonia, Kempsey and Texas. Females may travel hundreds of kilometres to the nearest maternal colony (Churchill 2008).	**2 records** within 10km (OEH 2014)	**Possible.** Some habitat present on site.

Scientific Name	Common Name	TSC/FM Act	EPBC Act	Habitat association	Nature of record	Presence on site
Mormopterus norfolkensis	Eastern Freetail-bat	V	-	Occurs in dry sclerophyll forest and woodland east of the Great Dividing Range. Forages in natural and artificial openings in vegetation, typically within a few kilometres of its roost. Roosts primarily in tree hollows but also recorded from man-made structures or under bark (Churchill 2008).	**1 record** within 10km (OEH 2014)	**Possible.** Roosting and foraging habitat present on site.
Myotis macropus	Southern Myotis	V	-	Mainly coastal but may occur inland along large river systems. Usually associated with permanent waterways at low elevations in flat/undulating country, usually in vegetated areas. Forages over streams and watercourses feeding on fish and insects from the water surface. Roosts in a variety of habitats including caves, mine shafts, hollow-bearing trees, stormwater channels, buildings, under bridges and in dense foliage, typically in close proximity to water (Campbell 2011). Breeds November or December (Churchill 2008).	**2 records** within 10km (OEH 2014)	**Unlikely.** No foraging habitat on site and no permanent waterways.
Nyctophilus bifax	Eastern Long-eared Bat	V	-	In NSW they appear to be confined to the coastal plain and nearby coastal ranges, extending south to the Clarence River area, with a few records further south around Coffs Harbour. The species can be locally common within its restricted range. Lowland subtropical rainforest and wet and swamp eucalypt forest, extending into adjacent moist eucalypt forest.	**2 records** within 10km (OEH 2014)	**Possible.** Some preferred habitat present on site.
Petaurus australis	Yellow-bellied Glider	V	-	The Yellow-bellied Glider is found along the eastern coast to the western slopes of the Great Dividing Range, from southern Queensland to Victoria. Occur in tall mature eucalypt forest generally in areas with high rainfall and nutrient rich soils. Forest type preferences vary with	**55 records** within 10km (OEH 2014)	**Likely.** Many records in locality. Some preferred habitat present on site.

Scientific Name	Common Name	TSC/FM Act	EPBC Act	Habitat association	Nature of record	Presence on site
				latitude and elevation; mixed coastal forests to dry escarpment forests in the north; moist coastal gullies and creek flats to tall montane forests in the south.		
Petaurus norfolcensis	Squirrel Glider	V	-	Occurs along the drier inland slopes as well as coastal habitats. Inhabits woodland and open forest with a Eucalyptus, Corymbia or Angophora overstorey and a shrubby understorey of Acacia or Banksia. Key habitat components include reliable winter and early-spring flowering Eucalypts, Banksia or other nectar sources, and hollow-bearing trees for roost and nest sites (van der Ree and Suckling 2008, Quin et al 2004), with social groups moving between multiple hollows. Social groups include one or two adult males and females with offspring, and have home ranges of 5-10ha within NSW (van der Ree and Suckling 2008, Kavanagh 2004).	**10 records** within 10km (OEH 2014)	**Likely.** Many records in locality. Some preferred habitat present on site.
Phascogale tapoatafa	Brush-tailed Phascogale	V	-	The Brush-tailed Phascogale has a patchy distribution around the coast of Australia. In NSW it is mainly found east of the Great Dividing Range although there are occasional records west to the divide. Prefer dry sclerophyll open forest with sparse groundcover of herbs, grasses, shrubs or leaf litter. Also inhabit heath, swamps, rainforest and wet sclerophyll forest.	**3 records** within 10km (OEH)	**Possible.** Some records in locality. Some preferred habitat present on site.
Phascolarctos cinereus	Koala	V	V	Occurs from coast to inland slopes and plains. Restricted to areas of preferred feed trees in eucalypt woodlands and forests. Home range varies depending on habitat quality, from < 2 to several hundred hectares.	**Predicted** to occur within 10km (DotE 2014) **58 records** within 10km (OEH 2014)	**Likely.** Previously observed very close to site. Some preferred feed trees present on site.

Scientific Name	Common Name	TSC/FM Act	EPBC Act	Habitat association	Nature of record	Presence on site
Planigale maculata	Common Planigale	V	-	Coastal north-eastern NSW, coastal east Queensland and Arnhem Land. The species reaches its confirmed southern distribution limit on the NSW lower north coast however there are reports of its occurrence as far south as the central NSW coast west of Sydney. Inhabit rainforest, eucalypt forest, heathland, marshland, grassland and rocky areas where there is surface cover, and usually close to water.	**1 record** within 10km (OEH)	**Possible.** Some preferred habitat present on site.
Potorous tridactylus	Long-Nosed Potoroo	V	V	Restricted to east of the Great Dividing Range, with annual rainfall >760 mm. Inhabits coastal heath and dry and wet sclerophyll forests. Requires relatively thick ground cover and appears restricted to areas of light and sandy soil (Johnston 2008). Feeds on fungi, roots, tubers, insects and their larvae, and other soft-bodied animals in the soil.	**Predicted** to occur within 10km (DotE 2014)	**Unlikely.** Minimal suitable habitat present on site.
Pseudomys gracilicaudatus	Eastern Chestnut Mouse	V	-	In NSW the Eastern Chestnut Mouse mainly occurs north from the Hawkesbury River area as scattered records along to coast and eastern fall of the Great Dividing Range extending north into Queensland. There are however isolated records in the Jervis bay area. Mostly found, in low numbers, in heathland and is most common in dense, wet heath and swamps. In the tropics it is more an animal of grassy woodlands.	**1 record** within 10km (OEH)	**Unlikely.** Minimal suitable habitat present on site.
Pseudomys novaehollandiae	New Holland Mouse	-	V	Occurs in disjunct, coastal populations from Tasmania to Queensland. In NSW inhabits a variety of coastal habitats including heathland, woodland, dry sclerophyll forest with a dense shrub layer and vegetated sand dunes (Wilson and Bradtke 1999). Populations may recolonise/ increase in	**Predicted** to occur within 10km (DotE 2014)	**Unlikely.** Minimal suitable habitat present on site.

Scientific Name	Common Name	TSC/FM Act	EPBC Act	Habitat association	Nature of record	Presence on site
				size in regenerating native vegetation after wildfire, clearing and sandmining. Presence strongly correlated with understorey vegetation density, and high floristic diversity in regenerating heath (Lock and Wilson 1999).		

Scientific Name	Common Name	TSC/FM Act	EPBC Act	Habitat association	Nature of record	Presence on site
Pteropus poliocephalus	Grey-headed Flying-fox	V	V	Roosts in camps within 20 km of a regular food source, typically in gullies, close to water and in vegetation with a dense canopy. Forages in subtropical and temperate rainforests, tall sclerophyll forests and woodlands, heaths, swamps and street trees, particularly in eucalypts, melaleucas and banksias. Highly mobile with movements largely determined by food availability (Eby and Law 2008). Will also forage in urban gardens and cultivated fruit crops.	**Predicted** to occur within 10km (DotE 2014) **10 records** within 10km (OEH 2014)	**Likely.** Potentially uses site for foraging habitat. Many records nearby.
Saccolaimus flaviventris	Yellow-bellied Sheathtail-bat	V	-	Migrates from tropics to SE Aus in summer. Forages across a range of habitats including those with and without trees, from wet and dry sclerophyll forest, open woodland, Acacia shrubland, mallee, grasslands and desert. Roosts communally in large tree hollows and buildings (Churchill 2008).	**2 records** within 10km (OEH 2014)	**Possible**. Foraging habitat present and some large hollows available for roosting.
Scoteanax rueppellii	Greater Broad-nosed Bat	V	-	Occurs on the east coast and Great Dividing Range. Inhabits a variety of habitats from woodland to wet and dry sclerophyll forests and rainforest, also remnant paddock trees and timber-lined creeks, typically below 500m asl. Forages in relatively uncluttered areas, using natural or man-made openings in denser habitats. Usually roosts in tree hollows or fissures but also under exfoliating bark or in the roofs of old buildings. Females congregate in maternal roosts in suitable hollow trees (Hoye and Richards 2008, Churchill 2008).	**4 records** within 10km (OEH 2014)	**Possible**. Foraging habitat present and some large hollows available for roosting.

Scientific Name	Common Name	TSC/FM Act	EPBC Act	Habitat association	Nature of record	Presence on site
Thylogale stigmatica	Red-legged Pademelon	V	-	Patchily distributed along coastal and subcoastal eastern Australia from Cape York to the Hunter Valley in NSW. Southern range records are from the Watagan Mountains and the Wyong district. There are unconfirmed records from the western New England Tablelands (e.g. west of Emmaville). This species is also found in New Guinea. Inhabits forest with a dense understorey and ground cover, including rainforest, moist eucalypt forest and vine scrub.	**3 records** within 10km (OEH 2014)	**Unlikely.** Minimal suitable habitat present at the site.
Vespadelus troughtoni	Eastern Cave Bat	V	-	The Eastern Cave Bat is found in a broad band on both sides of the Great Dividing Range from Cape York to Kempsey, with records from the New England Tablelands and the upper north coast of NSW. The western limit appears to be the Warrumbungle Range, and there is a single record from southern NSW, east of the ACT. A cave-roosting species that is usually found in dry open forest and woodland, near cliffs or rocky overhangs; has been recorded roosting in disused mine workings, occasionally in colonies of up to 500 individuals.	**1 record** within 10km (OEH 2014)	**Unlikely.** Suitable habitat not present at the site.
Xeromys myoides	Water Mouse	-	V	Although the Water Mouse had been documented in three distinct locations (Northern Territory, Central south Queensland, south-east Queensland) they require similar habitat including mangroves and the associated saltmarsh, sedgelands, clay pans, heathlands and freshwater wetlands. The main habitat difference at each location is the littoral, supralittoral and terrestrial vegetation which differs in structure and composition. These differences dictate the species' nesting behaviour.	**Predicted** to occur within 10km (DotE 2014)	**Unlikely.** No watercourses on site.

Scientific Name	Common Name	TSC/FM Act	EPBC Act	Habitat association	Nature of record	Presence on site
Frogs						
Crinia tinnula	Wallum Froglet	V	-	Wallum Froglets are found only in acid paperbark swamps and sedge swamps of the coastal 'wallum' country. In NSW the species extends from north of the Queensland border south to Kurnell (OEH 2012).	**5 records** within 10km (OEH 2014)	**Unlikely.** Minimal suitable habitat present at the site.
Litoria brevipalmata	Green-thighed Frog	V	-	Isolated localities along the coast and ranges from just north of Wollongong to south-east Queensland. Green-thighed Frogs occur in a range of habitats from rainforest and moist eucalypt forest to dry eucalypt forest and heath, typically in areas where surface water gathers after rain. It prefers wetter forests in the south of its range, but extends into drier forests in northern NSW and southern Queensland.	**1 record** within 10km (OEH 2014)	**Unlikely.** Minimal suitable habitat present at the site.
Litoria olongburensis	Olongburra Frog, Wallum Sedge Frog	V	V	This frog has been recorded in south-east Queensland and north-east NSW, from Lake Wongeel, Fraser Island south to Woolgoolga. It is found in ephemeral, semi-permanent and permanent wetlands with emergent reeds, ferns and/or sedges, in undisturbed coastal wallum. May also be found around creeks and freshwater lakes in coastal wallum.	**Predicted** to occur within 10km (DotE 2014) **2 records** within 10km (OEH 2014)	**Unlikely.** Minimal suitable habitat present at the site.
Mixophyes iteratus	Giant Barred Frog	E	E	Occurs on the coast and ranges from south-eastern QLD to the Hawkesbury River in NSW, particularly in Coffs Harbour - Dorrigo area. Forage and live amongst deep, damp leaf litter in rainforest, moist eucalypt forest and nearby dry eucalypt forest. Breed in shallow, flowing rocky streams. Within Sydney Basin, confined to small populations in tall, wet forest in the Watagan Mountains north of the Hawkesbury and the lower Blue Mountains (White 2008b).	**Predicted** to occur within 10km (DotE 2014)	**Unlikely**. No suitable breeding or foraging habitat on site.

Scientific Name	Common Name	TSC/FM Act	EPBC Act	Habitat association	Nature of record	Presence on site
Reptiles						
Hoplocephalus stephensii	Stephens' Banded Snake	V	-	Coast and ranges from Southern Queensland to Gosford in NSW. Inhabits rainforest and eucalypt forests and rocky areas up to 950 m in altitude.	**1 record** within 10km (OEH 2014)	**Possible.** Some suitable habitat present.
Coeranoscincus reticulatus	Three-toed Snake-tooth Skink	V	V	The Three-toed Snake-tooth Skink occurs on the coast and ranges from the Macleay valley in NSW to south-eastern Queensland. It is very uncommon south of Grafton. Inhabits rainforest and occasionally moist eucalypt forest, on loamy or sandy soils.	**Predicted** to occur within 10km (DotE 2014)	**Unlikely**. No suitable habitat on site.
Insects						
Phyllodes imperialis smithersi	Pink Underwing month	-	E	The Pink Underwing Moth is distributed from Nambour, south-east Queensland, to Dorrigo in northern. It is currently known from five locations, of which Mary Cairncross Scenic Reserve, near Maleny (Queensland), contains the only confirmed breeding habitat. This subspecies occurs within the Burnett Mary and South East (Queensland) and Northern Rivers (NSW) Natural Resource Management Regions. It is found below the altitude of 600 m in undisturbed, subtropical rainforest. It occurs in association with the vine *Carronia multisepalea*, a collapsed shrub that provides the food and habitat the moth requires in order to breed.	**Predicted** to occur within 10km (DotE 2014)	**Unlikely**. No suitable habitat on site.

Scientific Name	Common Name	TSC/FM Act	EPBC Act	Habitat association	Nature of record	Presence on site
Fish						
Epinephelus daemelii	Black Cod	V	V	Adult Black Cod are usually found in caves, gutters and beneath bommies on rocky reefs. Smaller fish are found in coastal rock pools and around rocky estuaries.	**Predicted** to occur within 10km (DotE 2014)	**Nil.** No waterways on site.
Nannoperca oxleyana	Oxleyan Pygmy Perch		E		**Predicted** to occur within 10km (DotE 2014)	**Nil.** No waterways on site.

All information in this table is taken from NSW OEH and Commonwealth DoE Threatened Species profiles (OEH 2014, DoE 2014) unless otherwise stated. The codes used in this table are: CE – critically endangered; E – endangered; V – vulnerable; EP – endangered population; CEEC – critically endangered ecological community; EEC – endangered ecological community, M- migratory, Ma – marine.

EPBC Act-listed migratory fauna known or predicted from the locality, habitat association and suitable habitat present at the subject site

Scientific Name	Common Name	TSC/FM Act	EPBC Act	Habitat Association	Nature of record	Presence on site
Migratory Birds						
Wetland or Marine species						
Apus pacificus	Fork-tailed Swift	-	M	Recorded in all regions of NSW. Non- breeding, and almost exclusively aerial while in Australia. Occurs over urban and rural areas as well as areas of native vegetation.	**Predicted** to occur within 10km (DotE 2014)	**Possible.** Aerial species that may forage or fly over the study area.
Ardea alba	Great Egret	-	M	Occurs across NSW. Within NSW there are breeding colonies within the Darling Riverine Plains and Riverina regions, and minor colonies across its range including the north and north-east of the state. Reported from a wide range of wetland habitats (for example inland and coastal, freshwater and saline, permanent and ephemeral, open and vegetated, large and small, natural and artificial).	**Predicted** to occur within 10km (DotE 2014)	**Unlikely.** No permanent or temporary water source at site.
Ardea ibis	Cattle Egret	-	M	Occurs across NSW. Principal breeding sites are the central east coast from Newcastle to Bundaberg. Also breeds in major inland wetlands in north NSW (notably the Macquarie Marshes). Occurs in tropical and temperate grasslands, wooded lands and terrestrial wetlands. Uses predominately shallow, open and fresh wetlands with low emergent vegetation and abundant aquatic flora. Sometimes observed in swamps with tall emergent vegetation and commonly use areas of tall pasture in moist, low-lying areas.	**Predicted** to occur within 10km (DotE 2014)	**Unlikely.** No permanent or temporary water source at site.

Scientific Name	Common Name	TSC/FM Act	EPBC Act	Habitat Association	Nature of record	Presence on site
Charadrius mongolus	Lesser Sand Plover, Mongolian Plover	V	M	In Australia the species is found around the entire coast but is most common in the Gulf of Carpentaria, and along the east coast of Queensland and northern NSW. Individuals are rarely recorded south of the Shoalhaven estuary, and there are few inland records. It is almost entirely coastal in NSW, favouring the beaches of sheltered bays, harbours and estuaries with large intertidal sandflats or mudflats; occasionally occurs on sandy beaches, coral reefs and rock platforms	**Predicted** to occur within 10km (DotE 2014)	**Unlikely.** Site is not coastal.
Gallinago hardwickii	Latham's Snipe		M	Occurs along the coast and west of the great dividing range. Non breeding visitor to Australia. Inhabit permanent and ephemeral wetlands up to 2000 m asl. Typically in open, freshwater wetlands with low, dense vegetation (incl. swamps, flooded grasslands and heathlands). Can also occur in saline/brackish habitats and in modified or artificial habitats close to human activity.	**Predicted** to occur within 10km (DotE 2014)	**Unlikely.** No permanent or temporary water source at site.
Numenius phaeopus	Whimbrel		M	Migrant to Australia and New Zealand, with a primarily coastal distribution. There are also scattered inland records of Whimbrels in all regions. It is found in all states but is more common in the north. Often found on the intertidal mudflats of sheltered coasts. It is also found in harbours, lagoons, estuaries and river deltas, often those with mangroves, but also open, unvegetated mudflats. It is occasionally found on sandy or rocky beaches, on coral or rocky islets, or on intertidal reefs and platforms. It has been infrequently recorded using saline or brackish lakes near coastal areas.	**Predicted** to occur within 10km (DotE 2014)	**Unlikely.** No permanent or temporary water source at site.
Pluvialis fulva	Pacific		M	Occurs along the east coast, especially along Queensland and New South Wales. Usually inhabits coastal habitats, though it	**Predicted** to occur within 10km	**Unlikely.** No permanent or temporary water

Scientific Name	Common Name	TSC/FM Act	EPBC Act	Habitat Association	Nature of record	Presence on site
	Golden Plover			occasionally occurs around inland wetlands. They are less often recorded in terrestrial habitats, usually wetlands such as fresh, brackish or saline lakes, billabongs, pools, swamps and wet claypans, especially those with muddy margins and often with submerged vegetation or short emergent grass.	(DotE 2014)	source at site.
Terrestrial species						
Haliaeetus leucogaster	White-bellied Sea-eagle		M	Primarily coastal but may extend inland over major river systems. Breeds close to water, mainly in tall open forest/woodland but also in dense forest, rainforest, closed scrub or remnant trees. Usually forages over large expanses of open water, but also over open terrestrial habitats (e.g. grasslands).	**Predicted** to occur within 10km (DotE 2014)	**Unlikely.** No permanent or temporary water source at site.
Hirundapus caudacutus	White-throated Needletail		M	Recorded along NSW coast to the western slopes and occasionally from the inland plains. Breeds in northern hemisphere. Almost exclusively aerial while in Australia. Occur above most habitat types, but are more frequently recorded above more densely vegetated habitats (rainforest, open forest and heathland) than over woodland or treeless areas.	**Predicted** to occur within 10km (DotE 2014)	**Possible** Suitable habitat present at site.
Merops ornatus	Rainbow Bee-eater		M	Widespread across mainland Australia. Mainly inhabits open forests and woodlands and shrublands, often in proximity to permanent water. Also occurs in cleared/semi-cleared habitats including farmland and residential areas. Excavates a nest burrow in flat/sloping ground in banks of waterways, dams, roadside cuttings, gravel pits or cliff faces. Southern populations migrate north for winter after breeding.	**Predicted** to occur within 10km (DotE 2014)	**Possible.** May use site for foraging but limited nesting sites available.

Scientific Name	Common Name	TSC/FM Act	EPBC Act	Habitat Association	Nature of record	Presence on site
Monarcha melanopsis	Black-faced Monarch		M	Summer breeding migrant to south-east. Occurs along the coast of NSW. Inhabits rainforests, eucalypt woodlands, coastal scrub and damp gullies. It may be found in more open woodland when migrating (Birds Australia 2005).	**Predicted** to occur within 10km (DotE 2014)	**Unlikely.** Minimal suitable habitat present at site and 15 km from coast.
Monarcha trivirgatus	Spectacled Monarch		M	The Spectacled Monarch is found in coastal north-eastern and eastern Australia, including coastal islands, from Cape York, Queensland to Port Stephens, New South Wales. It is much less common in the south. It prefers thick understorey in rainforests, wet gullies and waterside vegetation, as well as mangroves.	**Predicted** to occur within 10km (DotE 2014)	**Unlikely.** Minimal suitable habitat present at site and 15 km from coast.
Myiagra cyanoleuca	Satin Flycatcher		M	In NSW widespread on and east of the Great Divide, sparsely scattered on the western slopes, very occasional records on the western plains. Inhabit heavily vegetated gullies in eucalypt-dominated forests and taller woodlands, often near wetlands and watercourses. On migration, occur in coastal forests, woodlands, mangroves and drier woodlands and open forests. Generally not in rainforests.	**Predicted** to occur within 10km (DotE 2014)	**Possible.** May use site at times, however not near water source.
Rhipidura rufifrons	Rufous Fantail		M	Found along NSW coast and ranges. Inhabits rainforest, dense wet forests, swamp woodlands and mangroves. During migration, it may be found in more open habitats or urban areas (Birds Australia 2008).	**Predicted** to occur within 10km (DotE 2014)	**Unlikely.** Minimal suitable habitat present at site and 15 km from coast.

All information in this table is taken from NSW OEH and Commonwealth Department of the Environment Threatened Species profiles (OEH 2014a, DoE 2014a) unless otherwise stated. The codes used in this table are: CE – critically endangered; E – endangered; V – vulnerable; EP – endangered population; CEEC – critically endangered ecological community; EEC – endangered ecological community; VEC- vulnerable ecological community, M - migratory.

Appendix B – Field survey results

Table 17 Flora species recorded within study area

Family	Exotic	Scientific Name	Common Name	TSC Status	EPBC Status
Adiantaceae		*Adiantum formosum*	Giant Maidenhair	P	
		Cheilanthes sieberi	Rock Fern		
Anthericaceae		*Laxmannia gracilis*	Slender Wire Lily		
		Thysanotus tuberosus	Common Fringe-lily		
Apocynaceae		*Parsonsia straminea*	Common Silkpod		
Arecaceae		*Archontophoenix cunninghamiana*	Bangalow Palm	P	
		Livistona australis	Cabbage Palm	P	
Aspleniaceae		*Asplenium australasicum*	Bird's Nest Fern	P	
Asteraceae		*Chrysocephalum apiculatum*	Common Everlasting		
		Euchiton sphaericus	Star Cudweed		
		Lagenophora gracilis	Slender Lagenophora		
		Senecio sp.	Groundsel, Fireweed		
Bignoniaceae		*Pandorea pandorana*	Wonga Wonga Vine		
Casuarinaceae		*Allocasuarina littoralis*	Black She-Oak		
Commelinaceae		*Murdannia graminea*			
Convolvulaceae		*Dichondra repens*	Kidney Weed		
Cunoniaceae		*Ceratopetalum gummiferum*	Christmas Bush	P	
Cyperaceae		*Gahnia aspera*	Rough Saw-sedge		
		Gahnia clarkei	Tall Saw-sedge		
		Lepidosperma laterale	Variable Sword-sedge		
Dennstaedtiaceae		*Hypolepis muelleri*	Harsh Ground Fern		
		Pteridium esculentum	Bracken		
Dicksoniaceae		*Calochlaena dubia*	Rainbow Fern		
Dilleniaceae		*Hibbertia marginata*	Bordered Guinea Flower	V,P	V
		Hibbertia scandens	Climbing Guinea Flower		
Elaeocarpaceae		*Tetratheca* sp.			
Ericaceae		*Leucopogon lanceolatus*			
		Melichrus procumbens	Jam Tarts		
		Monotoca scoparia			
		Trochocarpa laurina	Tree Heath		
Euphorbiaceae		*Homalanthus populifolius*			
		Mallotus philippensis	Red Kamala		
Fabaceae (Faboideae)		*Daviesia ulicifolia*	Gorse Bitter Pea		
		Desmodium varians	Slender Tick-trefoil		
		Glycine clandestina	Twining glycine		
		Platylobium formosum			
Fabaceae (Mimosoideae)		*Acacia complanata*	Flat-stemmed Wattle		
		Acacia disparrima subsp. *disparrima*	Brush Ironbark Wattle		

Family	Exotic	Scientific Name	Common Name	TSC Status	EPBC Status
		Acacia falcata			
		Acacia leiocalyx subsp. *leiocalyx*	Curracabah		
		Acacia sp.	Wattle		
Lamiaceae		*Plectranthus graveolens*			
Lobeliaceae		*Lobelia dentata*			
		Pratia purpurascens	Whiteroot		
Lomandraceae		*Lomandra filiformis*	Wattle Matt-rush		
		Lomandra longifolia	Spiny-headed Mat-rush		
		Lomandra multiflora subsp. *multiflora*	Many-flowered Mat-rush		
Luzuriagaceae		*Eustrephus latifolius*	Wombat Berry		
Menispermaceae		*Stephania japonica*	Snake vine		
Myrtaceae		*Acmena smithii*	Lilly Pilly		
		Angophora paludosa			
		Angophora woodsiana			
		Corymbia gummifera	Red Bloodwood		
		Corymbia henryi	Large-leaved Spotted Gum		
		Corymbia intermedia	Pink Bloodwood		
		Eucalyptus acmenoides	White Mahogany		
		Eucalyptus carnea	Thick-leaved Mahogany		
		Eucalyptus microcorys	Tallowwood		
		Eucalyptus pilularis	Blackbutt		
		Eucalyptus resinifera	Red Mahogany		
		Eucalyptus robusta	Swamp Mahogany		
		Leptospermum polygalifolium	Tantoon		
		Leptospermum trinervium	Slender Tea-tree		
		Lophostemon suaveolens	Swamp Mahogany		
		Melaleuca quinquenervia	Broad-leaved Paperbark		
		Syncarpia glomulifera	Turpentine		
Oleaceae		*Jasminum volubile*			
Orchidaceae		*Dendrobium* sp.		P	
Oxalidaceae		*Oxalis perennans*			
Phormiaceae		*Dianella caerulea*	Blue Flax-lily		
		Dianella caerulea var. *producta*			
Phyllanthaceae		*Breynia oblongifolia*	Coffee Bush		
		Glochidion ferdinandi	Cheese Tree		
		Poranthera microphylla	Small Poranthera		
Pittosporaceae		*Bursaria spinosa*	Native Blackthorn		
		Pittosporum multiflorum	Orange Thorn		
Plantaginaceae		*Veronica cinerea*	Hairy Speedwell		
Poaceae		*Austrostipa pubescens*			
		Echinopogon ovatus	Forest Hedgehog Grass		

Family	Exotic	Scientific Name	Common Name	TSC Status	EPBC Status
		Entolasia marginata	Bordered Panic		
		Entolasia stricta	Wiry Panic		
		Imperata cylindrica	Blady Grass		
		Microlaena stipoides	Weeping Grass		
		Oplismenus aemulus			
		Oplismenus imbecillis			
		Panicum simile	Two-colour Panic		
		Themeda australis	Kangaroo Grass		
Proteaceae		*Lomatia silaifolia*	Crinkle Bush	P	
		Persoonia conjuncta		P	
		Persoonia levis	Broad-leaved Geebung	P	
Rhamnaceae		*Alphitonia excelsa*	Red Ash		
Rosaceae		*Rubus moluccanus* var. *trilobus*	Molucca Bramble		
Rubiaceae		*Pomax umbellata*	Pomax		
Rutaceae		*Acronychia imperforata*	Logan Apple		
		Zieria minutiflora subsp. *minutiflora*			
Sapindaceae		*Dodonaea viscosa* subsp. *cuneata*	Wedge-leaf Hop-bush		
Smilacaceae		*Smilax australis*	Lawyer Vine		
		Smilax glyciphylla	Sweet Sarsaparilla		
Verbenaceae	*	*Lantana camara*	Lantana		
Violaceae		*Viola hederacea*	Ivy-leaved Violet		
Xanthorrhoeaceae		*Xanthorrhoea* sp.		P	

Key – P = protected species, V= vulnerable species

NB – The field survey results above relate to a previous reiteration of the development footprint (a larger area was originally proposed) and includes species not present in the current area of impact.

Table 18 Fauna species recorded within the study area

Class	Scientific Name	Common Name	NSW Status	EPBC Status
Aves	*Pardalotus striatus*	Striated Pardalote	P	
Aves	*Dacelo novaeguineae*	Laughing Kookaburra	P	
Aves	*Philemon corniculatus*	Noisy Friarbird	P	
Aves	*Entomyzon cyanotis*	Blue-faced Honeyeater	P	
Aves	*Rhipidura leucophrys*	Willie Wagtail	P	
Aves	*Pachycephala rufiventris*	Rufous Whistler	P	
Aves	*Oriolus sagittatus*	Olive-backed Oriole	P	
Aves	*Meliphaga lewinii*	Lewin's Honeyeater	P	
Aves	*Merops ornatus*	Rainbow Bee-eater	P	M
Aves	*Trichoglossus chlorolepidotus*	Scaly-breasted Lorikeet	P	
Reptilia	*Varanus varius*	Lace Monitor	P	
Aves	*Alectura lathami*	Australian Brush-turkey	P	
Aves	*Rhipidura albiscapa*	Grey Fantail	P	
Aves	*Neochmia temporalis*	Red-browed Finch	P	
Aves	*Eopsaltria australis*	Eastern Yellow Robin	P	
Aves	*Myzomela sanguinolenta*	Scarlet Honeyeater	P	
Aves	*Coracina tenuirostris*	Cicadabird	P	
Aves	*Sericornis frontalis*	White-browed Scrubwren	P	
Aves	*Myiagra rubecula*	Leaden flycatcher	P	
Aves	*Colluricincla harmonica*	Grey Shrike-thrush	P	

Key- P= protected M= migratory

NB – The field survey results above relate to a previous reiteration of the development footprint (a larger area was originally proposed) and may include species not present in the current area of impact.

Development site plot/transect data

Vegetation Zone	Veg Type ID	Plot ID	Native plant species richness	Native over-storey cover	Native mid-storey cover	Native ground cover (grasses)	Native ground cover (shrubs)	Native ground cover (other)	Exotic plant cover	Number of trees with hollows	Over storey regeneration	Total length of fallen logs	Easting	Northing	Zone
1	NR114	1	34	31	55	32	4	28	0	3	0.71	85	518775	6758077	56
		2	31	16	55.5	22	4	10	0	4	0.71	61	518849	6758109	56
		3	37	19	62.5	38	10	38	0	8	0.71	55	518718	6758157	56
2	NR123	4	32	27	45.5	52	4	14	0	6	1	28	518795	6758212	56
		5	40	31	51.5	58	30	60	0	5	1	30	518590	6758521	56
		6	39	35	56.5	54	18	18	0	7	1	23	518440	6758474	56
3	NR254	7	35	27	71	22	12	56	8	2	1	79	518405	6758385	56

Appendix C – EPBC Act Protected Matters Search

Australian Government

Department of the Environment

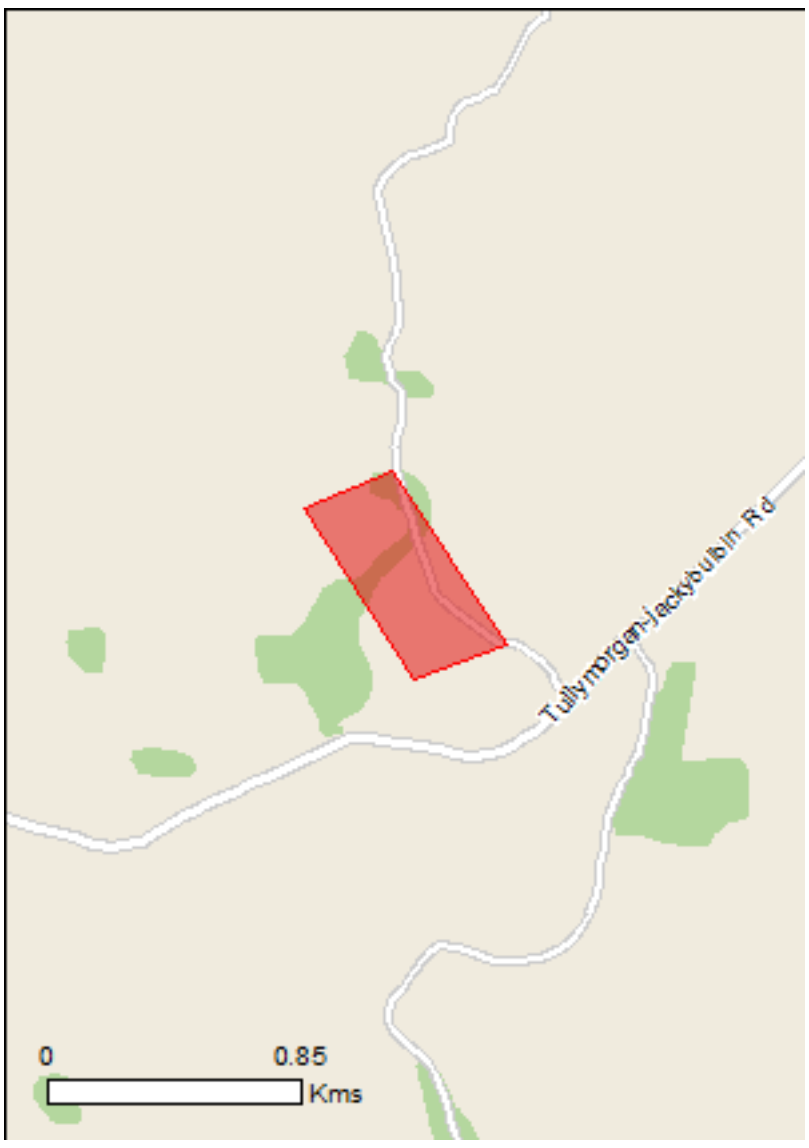
EPBC Act Protected Matters Report

This report provides general guidance on matters of national environmental significance and other matters protected by the EPBC Act in the area you have selected.

Information on the coverage of this report and qualifications on data supporting this report are contained in the caveat at the end of the report.

Information is available about Environment Assessments and the EPBC Act including significance guidelines, forms and application process details.

Report created: 16/03/15 12:51:57



Coordinates

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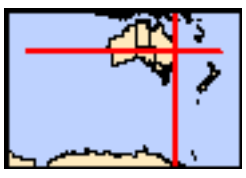

Summary

Matters of National Environmental Significance

This part of the report summarises the matters of national environmental significance that may occur in, or may relate to, the area you nominated. Further information is available in the detail part of the report, which can be accessed by scrolling or following the links below. If you are proposing to undertake an activity that may have a significant impact on one or more matters of national environmental significance then you should consider the Administrative Guidelines on Significance.

World Heritage Properties:	None
National Heritage Places:	None
Wetlands of International Importance:	None
Great Barrier Reef Marine Park:	None
Commonwealth Marine Areas:	None
Listed Threatened Ecological Communities:	1
Listed Threatened Species:	56
Listed Migratory Species:	38

Other Matters Protected by the EPBC Act

This part of the report summarises other matters protected under the Act that may relate to the area you nominated. Approval may be required for a proposed activity that significantly affects the environment on Commonwealth land, when the action is outside the Commonwealth land, or the environment anywhere when the action is taken on Commonwealth land. Approval may also be required for the Commonwealth or Commonwealth agencies proposing to take an action that is likely to have a significant impact on the environment anywhere.

The EPBC Act protects the environment on Commonwealth land, the environment from the actions taken on Commonwealth land, and the environment from actions taken by Commonwealth agencies. As heritage values of a place are part of the 'environment', these aspects of the EPBC Act protect the Commonwealth Heritage values of a Commonwealth Heritage place and the heritage values of a place on the Register of the National Estate.

This part of the report summarises other matters protected under the Act that may relate to the area you nominated. Approval may be required for a proposed activity that significantly affects the environment on Commonwealth land, when the action is outside the Commonwealth land, or the environment anywhere when the action is taken on Commonwealth land. Approval may also be required for the Commonwealth or Commonwealth agencies proposing to take an action that is likely to have a significant impact on the environment anywhere.

A permit may be required for activities in or on a Commonwealth area that may affect a member of a listed threatened species or ecological community, a member of a listed migratory species, whales and other cetaceans, or a member of a listed marine species.

Commonwealth Land:	None
Commonwealth Heritage Places:	None
Listed Marine Species:	38
Whales and Other Cetaceans:	1
Critical Habitats:	None
Commonwealth Reserves Terrestrial:	None
Commonwealth Reserves Marine	None

Extra Information

This part of the report provides information that may also be relevant to the area you have nominated.

Place on the RNE:	2
State and Territory Reserves:	6
Regional Forest Agreements:	1
Invasive Species:	39
Nationally Important Wetlands:	1
Key Ecological Features (Marine)	None

Details

Matters of National Environmental Significance

Listed Threatened Ecological Communities [Resource Information]

For threatened ecological communities where the distribution is well known, maps are derived from recovery plans, State vegetation maps, remote sensing imagery and other sources. Where threatened ecological community distributions are less well known, existing vegetation maps and point location data are used to produce indicative distribution maps.

Name	Status	Type of Presence
Lowland Rainforest of Subtropical Australia	Critically Endangered	Community likely to occur within area

Listed Threatened Species [Resource Information]

Name	Status	Type of Presence
Birds		
Anthochaera phrygia Regent Honeyeater [82338]	Endangered	Species or species habitat known to occur within area
Botaurus poiciloptilus Australasian Bittern [1001]	Endangered	Species or species habitat known to occur within area
Cyclopsitta diophthalma_coxeni Coxen's Fig-Parrot [59714]	Endangered	Species or species habitat may occur within area
Dasyornis brachypterus Eastern Bristlebird [533]	Endangered	Species or species habitat likely to occur within area
Diomedea epomophora_epomophora Southern Royal Albatross [25996]	Vulnerable	Species or species habitat may occur within area
Diomedea epomophora_sanfordi Northern Royal Albatross [82331]	Endangered	Species or species habitat may occur within area
Diomedea exulans_antipodensis Antipodean Albatross [82269]	Vulnerable	Species or species habitat may occur within area
Diomedea exulans_exulans Tristan Albatross [82337]	Endangered	Species or species

Name	Status	Type of Presence
		habitat may occur within area
Diomedea exulans gibsoni Gibson's Albatross [82271]	Vulnerable	Species or species habitat may occur within area
Diomedea exulans (sensu lato) Wandering Albatross [1073]	Vulnerable	Species or species habitat may occur within area
Erythrotriorchis radiatus Red Goshawk [942]	Vulnerable	Species or species habitat known to occur within area
Lathamus discolor Swift Parrot [744]	Endangered	Species or species habitat likely to occur within area
Macronectes giganteus Southern Giant-Petrel [1060]	Endangered	Species or species habitat may occur within area
Macronectes halli Northern Giant-Petrel [1061]	Vulnerable	Species or species habitat may occur within area
Rostratula australis Australian Painted Snipe [77037]	Endangered	Species or species habitat likely to occur within area
Thalassarche cauta cauta Shy Albatross, Tasmanian Shy Albatross [82345]	Vulnerable	Species or species habitat may occur within area
Thalassarche cauta salvini Salvin's Albatross [82343]	Vulnerable	Species or species habitat likely to occur within area
Thalassarche cauta steadi White-capped Albatross [82344]	Vulnerable	Species or species habitat likely to occur within area
Thalassarche eremita Chatham Albatross [64457]	Endangered	Species or species habitat may occur within area
Thalassarche melanophris Black-browed Albatross [66472]	Vulnerable	Species or species habitat may occur within area
Thalassarche melanophris impavida Campbell Albatross [82449]	Vulnerable	Species or species habitat may occur within area
Turnix melanogaster Black-breasted Button-quail [923]	Vulnerable	Species or species habitat may occur within area
Fish		
Epinephelus daemelii Black Rockcod, Black Cod, Saddled Rockcod [68449]	Vulnerable	Species or species habitat likely to occur within area
Nannoperca oxleyana Oxleyan Pygmy Perch [64468]	Endangered	Species or species habitat likely to occur within area
Frogs		
Litoria olongburensis Wallum Sedge Frog [1821]	Vulnerable	Species or species habitat known to occur within area

Name	Status	Type of Presence
Mixophyes iteratus		
Giant Barred Frog, Southern Barred Frog [1944]	Endangered	Species or species habitat likely to occur within area
Insects		
Phyllodes imperialis smithersi		
Pink Underwing Moth [86084]	Endangered	Species or species habitat may occur within area
Mammals		
Chalinolobus dwyeri		
Large-eared Pied Bat, Large Pied Bat [183]	Vulnerable	Species or species habitat likely to occur within area
Dasyurus maculatus maculatus (SE mainland population)		
Spot-tailed Quoll, Spotted-tail Quoll, Tiger Quoll (southeastern mainland population) [75184]	Endangered	Species or species habitat likely to occur within area
Phascolarctos cinereus (combined populations of Qld, NSW and the ACT)		
Koala (combined populations of Queensland, New South Wales and the Australian Capital Territory) [85104]	Vulnerable	Species or species habitat known to occur within area
Potorous tridactylus tridactylus		
Long-nosed Potoroo (SE mainland) [66645]	Vulnerable	Species or species habitat known to occur within area
Pseudomys novaehollandiae		
New Holland Mouse, Pookila [96]	Vulnerable	Species or species habitat likely to occur within area
Pteropus poliocephalus		
Grey-headed Flying-fox [186]	Vulnerable	Foraging, feeding or related behaviour known to occur within area
Xeromys myoides		
Water Mouse, False Water Rat, Yirrkoo [66]	Vulnerable	Species or species habitat likely to occur within area
Plants		
Allocasuarina defungens		
Dwarf Heath Casuarina [21924]	Endangered	Species or species habitat likely to occur within area
Arthraxon hispidus		
Hairy-joint Grass [9338]	Vulnerable	Species or species habitat may occur within area
Cryptocarya foetida		
Stinking Cryptocarya, Stinking Laurel [11976]	Vulnerable	Species or species habitat likely to occur within area
Cryptostylis hunteriana		
Leafless Tongue-orchid [19533]	Vulnerable	Species or species habitat may occur within area
Eucalyptus glaucina		
Slaty Red Gum [5670]	Vulnerable	Species or species habitat likely to occur within area
Gossia fragrantissima		
Sweet Myrtle, Small-leaved Myrtle [78867]	Endangered	Species or species habitat likely to occur within area
Hibbertia marginata		
[21970]	Vulnerable	Species or species habitat likely to occur within area
Marsdenia longiloba		
Clear Milkvine [2794]	Vulnerable	Species or species habitat likely to occur within area
Melichrus sp. Gibberagee (Benwell 97239)		
Narrow-leaf Melichrus [86881]	Endangered	Species or species

Name	Status	Type of Presence
		habitat likely to occur within area
Parsonsia dorrigoensis Milky Silkpod [64684]	Endangered	Species or species habitat may occur within area
Paspalidium grandispiculatum a grass [10838]	Vulnerable	Species or species habitat likely to occur within area
Persicaria elatior Knotweed [5831]	Vulnerable	Species or species habitat likely to occur within area
Phaius australis Lesser Swamp-orchid [5872]	Endangered	Species or species habitat likely to occur within area
Prostanthera palustris Swamp Mint-bush [66703]	Vulnerable	Species or species habitat likely to occur within area
Streblus pendulinus Siah's Backbone, Sia's Backbone, Isaac Wood [21618]	Endangered	Species or species habitat likely to occur within area
Thesium australe Austral Toadflax, Toadflax [15202]	Vulnerable	Species or species habitat likely to occur within area
Reptiles		
Caretta caretta Loggerhead Turtle [1763]	Endangered	Species or species habitat known to occur within area
Chelonia mydas Green Turtle [1765]	Vulnerable	Species or species habitat known to occur within area
Coeranoscincus reticulatus Three-toed Snake-tooth Skink [59628]	Vulnerable	Species or species habitat may occur within area
Dermochelys coriacea Leatherback Turtle, Leathery Turtle, Luth [1768]	Endangered	Species or species habitat may occur within area
Eretmochelys imbricata Hawksbill Turtle [1766]	Vulnerable	Species or species habitat known to occur within area
Natator depressus Flatback Turtle [59257]	Vulnerable	Species or species habitat may occur within area

Listed Migratory Species [Resource Information]

* Species is listed under a different scientific name on the EPBC Act - Threatened Species list.

Name	Threatened	Type of Presence
Migratory Marine Birds		
Apus pacificus Fork-tailed Swift [678]		Species or species habitat likely to occur within area
Diomedea antipodensis Antipodean Albatross [64458]	Vulnerable*	Species or species habitat may occur within area
Diomedea dabbenena Tristan Albatross [66471]	Endangered*	Species or species habitat may occur within area

Name	Threatened	Type of Presence
Diomedea epomophora (sensu stricto)		
Southern Royal Albatross [1072]	Vulnerable*	Species or species habitat may occur within area
Diomedea exulans (sensu lato)		
Wandering Albatross [1073]	Vulnerable	Species or species habitat may occur within area
Diomedea gibsoni		
Gibson's Albatross [64466]	Vulnerable*	Species or species habitat may occur within area
Diomedea sanfordi		
Northern Royal Albatross [64456]	Endangered*	Species or species habitat may occur within area
Macronectes giganteus		
Southern Giant-Petrel [1060]	Endangered	Species or species habitat may occur within area
Macronectes halli		
Northern Giant-Petrel [1061]	Vulnerable	Species or species habitat may occur within area
Thalassarche cauta (sensu stricto)		
Shy Albatross, Tasmanian Shy Albatross [64697]	Vulnerable*	Species or species habitat may occur within area
Thalassarche eremita		
Chatham Albatross [64457]	Endangered	Species or species habitat may occur within area
Thalassarche impavida		
Campbell Albatross [64459]	Vulnerable*	Species or species habitat may occur within area
Thalassarche melanophris		
Black-browed Albatross [66472]	Vulnerable	Species or species habitat may occur within area
Thalassarche salvini		
Salvin's Albatross [64463]	Vulnerable*	Species or species habitat likely to occur within area
Thalassarche steadi		
White-capped Albatross [64462]	Vulnerable*	Species or species habitat likely to occur within area
Migratory Marine Species		
Caretta caretta		
Loggerhead Turtle [1763]	Endangered	Species or species habitat known to occur within area
Chelonia mydas		
Green Turtle [1765]	Vulnerable	Species or species habitat known to occur within area
Dermochelys coriacea		
Leatherback Turtle, Leathery Turtle, Luth [1768]	Endangered	Species or species habitat may occur within area
Dugong dugon		
Dugong [28]		Species or species habitat may occur within area
Eretmochelys imbricata		
Hawksbill Turtle [1766]	Vulnerable	Species or species habitat known to occur within area
Lamna nasus		
Porbeagle, Mackerel Shark [83288]		Species or species habitat may occur within area

Name	Threatened	Type of Presence
Manta birostris		
Giant Manta Ray, Chevron Manta Ray, Pacific Manta Ray, Pelagic Manta Ray, Oceanic Manta Ray [84995]		Species or species habitat may occur within area
Natator depressus		
Flatback Turtle [59257]	Vulnerable	Species or species habitat may occur within area
Sousa chinensis		
Indo-Pacific Humpback Dolphin [50]		Species or species habitat likely to occur within area
Migratory Terrestrial Species		
Haliaeetus leucogaster		
White-bellied Sea-Eagle [943]		Species or species habitat known to occur within area
Hirundapus caudacutus		
White-throated Needletail [682]		Species or species habitat known to occur within area
Merops ornatus		
Rainbow Bee-eater [670]		Species or species habitat may occur within area
Monarcha melanopsis		
Black-faced Monarch [609]		Species or species habitat known to occur within area
Monarcha trivirgatus		
Spectacled Monarch [610]		Species or species habitat known to occur within area
Myiagra cyanoleuca		
Satin Flycatcher [612]		Species or species habitat known to occur within area
Rhipidura rufifrons		
Rufous Fantail [592]		Species or species habitat known to occur within area
Migratory Wetlands Species		
Ardea alba		
Great Egret, White Egret [59541]		Species or species habitat known to occur within area
Ardea ibis		
Cattle Egret [59542]		Species or species habitat likely to occur within area
Charadrius mongolus		
Lesser Sand Plover, Mongolian Plover [879]		Species or species habitat likely to occur within area
Gallinago hardwickii		
Latham's Snipe, Japanese Snipe [863]		Species or species habitat may occur within area
Numenius phaeopus		
Whimbrel [849]		Species or species habitat likely to occur within area
Pluvialis fulva		
Pacific Golden Plover [25545]		Species or species habitat likely to occur within area
Rostratula benghalensis (sensu lato)		
Painted Snipe [889]	Endangered*	Species or species habitat likely to occur within area

Other Matters Protected by the EPBC Act

Listed Marine Species [Resource Information]		
* Species is listed under a different scientific name on the EPBC Act - Threatened Species list.		
Name	Threatened	Type of Presence
Birds		
Anseranas semipalmata Magpie Goose [978]		Species or species habitat may occur within area
Apus pacificus Fork-tailed Swift [678]		Species or species habitat likely to occur within area
Ardea alba Great Egret, White Egret [59541]		Species or species habitat known to occur within area
Ardea ibis Cattle Egret [59542]		Species or species habitat likely to occur within area
Charadrius mongolus Lesser Sand Plover, Mongolian Plover [879]		Species or species habitat likely to occur within area
Diomedea antipodensis Antipodean Albatross [64458]	Vulnerable*	Species or species habitat may occur within area
Diomedea dabbenena Tristan Albatross [66471]	Endangered*	Species or species habitat may occur within area
Diomedea epomophora (sensu stricto) Southern Royal Albatross [1072]	Vulnerable*	Species or species habitat may occur within area
Diomedea exulans (sensu lato) Wandering Albatross [1073]	Vulnerable	Species or species habitat may occur within area
Diomedea gibsoni Gibson's Albatross [64466]	Vulnerable*	Species or species habitat may occur within area
Diomedea sanfordi Northern Royal Albatross [64456]	Endangered*	Species or species habitat may occur within area
Gallinago hardwickii Latham's Snipe, Japanese Snipe [863]		Species or species habitat may occur within area
Haliaeetus leucogaster White-bellied Sea-Eagle [943]		Species or species habitat known to occur within area
Hirundapus caudacutus White-throated Needletail [682]		Species or species habitat known to occur within area
Lathamus discolor Swift Parrot [744]	Endangered	Species or species habitat likely to occur within area
Macronectes giganteus Southern Giant-Petrel [1060]	Endangered	Species or species habitat may occur within

Name	Threatened	Type of Presence
		area
Macronectes halli Northern Giant-Petrel [1061]	Vulnerable	Species or species habitat may occur within area
Merops ornatus Rainbow Bee-eater [670]		Species or species habitat may occur within area
Monarcha melanopsis Black-faced Monarch [609]		Species or species habitat known to occur within area
Monarcha trivirgatus Spectacled Monarch [610]		Species or species habitat known to occur within area
Myiagra cyanoleuca Satin Flycatcher [612]		Species or species habitat known to occur within area
Numenius phaeopus Whimbrel [849]		Species or species habitat likely to occur within area
Pandion haliaetus Osprey [952]		Breeding known to occur within area
Pluvialis fulva Pacific Golden Plover [25545]		Species or species habitat likely to occur within area
Rhipidura rufifrons Rufous Fantail [592]		Species or species habitat known to occur within area
Rostratula benghalensis (sensu lato) Painted Snipe [889]	Endangered*	Species or species habitat likely to occur within area
Thalassarche cauta (sensu stricto) Shy Albatross, Tasmanian Shy Albatross [64697]	Vulnerable*	Species or species habitat may occur within area
Thalassarche eremita Chatham Albatross [64457]	Endangered	Species or species habitat may occur within area
Thalassarche impavida Campbell Albatross [64459]	Vulnerable*	Species or species habitat may occur within area
Thalassarche melanophris Black-browed Albatross [66472]	Vulnerable	Species or species habitat may occur within area
Thalassarche salvini Salvin's Albatross [64463]	Vulnerable*	Species or species habitat likely to occur within area
Thalassarche steadi White-capped Albatross [64462]	Vulnerable*	Species or species habitat likely to occur within area
Mammals		
Dugong dugon Dugong [28]		Species or species habitat may occur within area
Reptiles		
Caretta caretta Loggerhead Turtle [1763]	Endangered	Species or species habitat known to occur

Name	Threatened	Type of Presence
		within area
Chelonia mydas		
Green Turtle [1765]	Vulnerable	Species or species habitat known to occur within area
Dermochelys coriacea		
Leatherback Turtle, Leathery Turtle, Luth [1768]	Endangered	Species or species habitat may occur within area
Eretmochelys imbricata		
Hawksbill Turtle [1766]	Vulnerable	Species or species habitat known to occur within area
Natator depressus		
Flatback Turtle [59257]	Vulnerable	Species or species habitat may occur within area

Whales and other Cetaceans		[Resource Information]
Name	Status	Type of Presence
Mammals		
Sousa chinensis		
Indo-Pacific Humpback Dolphin [50]		Species or species habitat likely to occur within area

Extra Information

Places on the RNE		[Resource Information]

Note that not all Indigenous sites may be listed.

Name	State	Status
Natural		
Lower Clarence River Area	NSW	Indicative Place
Jerusalem Creek Area	NSW	Registered

State and Territory Reserves	[Resource Information]
Name	State
Bundjalung	NSW
Bundjalung	NSW
Chatsworth Hill	NSW
FMAs in CASINO	NSW
Mororo Creek	NSW
UNE Special Management Zone No1	NSW

Regional Forest Agreements	[Resource Information]

Note that all areas with completed RFAs have been included.

Name	State
North East NSW RFA	New South Wales

Invasive Species	[Resource Information]

Weeds reported here are the 20 species of national significance (WoNS), along with other introduced plants that are considered by the States and Territories to pose a particularly significant threat to biodiversity. The following feral animals are reported: Goat, Red Fox, Cat, Rabbit, Pig, Water Buffalo and Cane Toad. Maps from Landscape Health Project, National Land and Water Resouces Audit, 2001.

Name	Status	Type of Presence
Birds		
Acridotheres tristis		
Common Myna, Indian Myna [387]		Species or species habitat likely to occur within area

Name	Status	Type of Presence
Anas platyrhynchos Mallard [974]		Species or species habitat likely to occur within area
Carduelis carduelis European Goldfinch [403]		Species or species habitat likely to occur within area
Columba livia Rock Pigeon, Rock Dove, Domestic Pigeon [803]		Species or species habitat likely to occur within area
Lonchura punctulata Nutmeg Mannikin [399]		Species or species habitat likely to occur within area
Passer domesticus House Sparrow [405]		Species or species habitat likely to occur within area
Pycnonotus jocosus Red-whiskered Bulbul [631]		Species or species habitat likely to occur within area
Streptopelia chinensis Spotted Turtle-Dove [780]		Species or species habitat likely to occur within area
Sturnus vulgaris Common Starling [389]		Species or species habitat likely to occur within area
Frogs		
Rhinella marina Cane Toad [83218]		Species or species habitat likely to occur within area
Mammals		
Bos taurus Domestic Cattle [16]		Species or species habitat likely to occur within area
Canis lupus familiaris Domestic Dog [82654]		Species or species habitat likely to occur within area
Felis catus Cat, House Cat, Domestic Cat [19]		Species or species habitat likely to occur within area
Feral deer Feral deer species in Australia [85733]		Species or species habitat likely to occur within area
Lepus capensis Brown Hare [127]		Species or species habitat likely to occur within area
Mus musculus House Mouse [120]		Species or species habitat likely to occur within area
Rattus norvegicus Brown Rat, Norway Rat [83]		Species or species habitat likely to occur within area
Rattus rattus Black Rat, Ship Rat [84]		Species or species habitat likely to occur within area
Sus scrofa Pig [6]		Species or species habitat likely to occur

Name	Status	Type of Presence
		within area
Vulpes vulpes Red Fox, Fox [18]		Species or species habitat likely to occur within area
Plants		
Alternanthera philoxeroides Alligator Weed [11620]		Species or species habitat likely to occur within area
Anredera cordifolia Madeira Vine, Jalap, Lamb's-tail, Mignonette Vine, Anredera, Gulf Madeiravine, Heartleaf Madeiravine, Potato Vine [2643]		Species or species habitat likely to occur within area
Asparagus aethiopicus Asparagus Fern, Ground Asparagus, Basket Fern, Sprengi's Fern, Bushy Asparagus, Emerald Asparagus [62425]		Species or species habitat likely to occur within area
Asparagus plumosus Climbing Asparagus-fern [48993]		Species or species habitat likely to occur within area
Cabomba caroliniana Cabomba, Fanwort, Carolina Watershield, Fish Grass, Washington Grass, Watershield, Carolina Fanwort, Common Cabomba [5171]		Species or species habitat likely to occur within area
Chrysanthemoides monilifera Bitou Bush, Boneseed [18983]		Species or species habitat likely to occur within area
Chrysanthemoides monilifera subsp. rotundata Bitou Bush [16332]		Species or species habitat likely to occur within area
Dolichandra unguis-cati Cat's Claw Vine, Yellow Trumpet Vine, Cat's Claw Creeper, Funnel Creeper [85119]		Species or species habitat likely to occur within area
Eichhornia crassipes Water Hyacinth, Water Orchid, Nile Lily [13466]		Species or species habitat likely to occur within area
Genista sp. X Genista monspessulana Broom [67538]		Species or species habitat may occur within area
Lantana camara Lantana, Common Lantana, Kamara Lantana, Large-leaf Lantana, Pink Flowered Lantana, Red Flowered Lantana, Red-Flowered Sage, White Sage, Wild Sage [10892]		Species or species habitat likely to occur within area
Opuntia spp. Prickly Pears [82753]		Species or species habitat likely to occur within area
Pinus radiata Radiata Pine Monterey Pine, Insignis Pine, Wilding Pine [20780]		Species or species habitat may occur within area
Protasparagus densiflorus Asparagus Fern, Plume Asparagus [5015]		Species or species habitat likely to occur within area
Protasparagus plumosus Climbing Asparagus-fern, Ferny Asparagus [11747]		Species or species habitat likely to occur within area
Rubus fruticosus aggregate Blackberry, European Blackberry [68406]		Species or species habitat likely to occur within area
Salvinia molesta Salvinia, Giant Salvinia, Aquarium Watermoss,		Species or species

Name	Status	Type of Presence
Kariba Weed [13665]		habitat likely to occur within area
[Senecio madagascariensis](#) Fireweed, Madagascar Ragwort, Madagascar Groundsel [2624]		Species or species habitat likely to occur within area
Reptiles		
[Hemidactylus frenatus](#) Asian House Gecko [1708]		Species or species habitat likely to occur within area

Nationally Important Wetlands [Resource Information]

Name	State
[Bundjalung National Park](#)	NSW

Coordinates

-29.30168 153.19264,-29.3062 153.19604,-29.30707 153.19321,-29.3026 153.18997,
-29.30168 153.1926,-29.30168 153.19264

Caveat

The information presented in this report has been provided by a range of data sources as acknowledged at the end of the report.

This report is designed to assist in identifying the locations of places which may be relevant in determining obligations under the Environment Protection and Biodiversity Conservation Act 1999. It holds mapped locations of World Heritage and Register of National Estate properties, Wetlands of International Importance, Commonwealth and State/Territory reserves, listed threatened, migratory and marine species and listed threatened ecological communities. Mapping of Commonwealth land is not complete at this stage. Maps have been collated from a range of sources at various resolutions.

Not all species listed under the EPBC Act have been mapped (see below) and therefore a report is a general guide only. Where available data supports mapping, the type of presence that can be determined from the data is indicated in general terms. People using this information in making a referral may need to consider the qualifications below and may need to seek and consider other information sources.

For threatened ecological communities where the distribution is well known, maps are derived from recovery plans, State vegetation maps, remote sensing imagery and other sources. Where threatened ecological community distributions are less well known, existing vegetation maps and point location data are used to produce indicative distribution maps.

For species where the distributions are well known, maps are digitised from sources such as recovery plans and detailed habitat studies. Where appropriate, core breeding, foraging and roosting areas are indicated under 'type of presence'. For species whose distributions are less well known, point locations are collated from government wildlife authorities, museums, and non-government organisations; bioclimatic distribution models are generated and these validated by experts. In some cases, the distribution maps are based solely on expert knowledge.

Only selected species covered by the following provisions of the EPBC Act have been mapped:

- migratory and
- marine

The following species and ecological communities have not been mapped and do not appear in reports produced from this database:

- threatened species listed as extinct or considered as vagrants
- some species and ecological communities that have only recently been listed
- some terrestrial species that overfly the Commonwealth marine area
- migratory species that are very widespread, vagrant, or only occur in small numbers

The following groups have been mapped, but may not cover the complete distribution of the species:

- non-threatened seabirds which have only been mapped for recorded breeding sites
- seals which have only been mapped for breeding sites near the Australian continent

Such breeding sites may be important for the protection of the Commonwealth Marine environment.

Acknowledgements

This database has been compiled from a range of data sources. The department acknowledges the following custodians who have contributed valuable data and advice:

-Department of Environment, Climate Change and Water, New South Wales
-Department of Sustainability and Environment, Victoria
-Department of Primary Industries, Parks, Water and Environment, Tasmania
-Department of Environment and Natural Resources, South Australia
-Parks and Wildlife Service NT, NT Dept of Natural Resources, Environment and the Arts
-Environmental and Resource Management, Queensland
-Department of Environment and Conservation, Western Australia
-Department of the Environment, Climate Change, Energy and Water
-Birds Australia
-Australian Bird and Bat Banding Scheme
-Australian National Wildlife Collection
-Natural history museums of Australia
-Museum Victoria
-Australian Museum
-SA Museum
-Queensland Museum
-Online Zoological Collections of Australian Museums
-Queensland Herbarium
-National Herbarium of NSW
-Royal Botanic Gardens and National Herbarium of Victoria
-Tasmanian Herbarium
-State Herbarium of South Australia
-Northern Territory Herbarium
-Western Australian Herbarium
-Australian National Herbarium, Atherton and Canberra
-University of New England
-Ocean Biogeographic Information System
-Australian Government, Department of Defence
-State Forests of NSW
-Geoscience Australia
-CSIRO
-Other groups and individuals

The Department is extremely grateful to the many organisations and individuals who provided expert advice and information on numerous draft distributions.

Please feel free to provide feedback via the Contact Us page.

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Appendix D – Biodiversity credit report

Biodiversity credit report

This report identifies the number and type of biodiversity credits required for a major project.

Date of report: 23/02/2015 Time: 11:21:26AM Calculator version: v4.0

Major Project details

Proposal ID:	0082/2014/1471MP
Proposal name:	Sly's Quarry
Proposal address:	Tullymorgan-Jackybulbin Road Mororo NSW
Proponent name:	Newman Quarry
Proponent address:	
Proponent phone:	0265868714
Assessor name:	Daniel Williams
Assessor address:	Level 1, 62 Clarence Street Port Macquarie NSW 2444
Assessor phone:	6586 8714
Assessor accreditation:	0082

Summary of ecosystem credits required

Plant Community type	Area (ha)	Credits created
Blackbutt - bloodwood dry heathy open forest on Quaternary sands of the northern NSW North Coast Bioregion	4.23	283.00
Blackbutt - Turpentine dry heathy open forest on sandstones of the lower Clarence of the NSW North Coast Bioregion	6.27	485.00
Total	10.50	768

Credit profiles

1. Blackbutt - bloodwood dry heathy open forest on Quaternary sands of the northern NSW North Coast Bioregion, (NR114)

Number of ecosystem credits created	283
IBRA sub-region	Clarence Sandstones

Offset options - Plant Community types	Offset options - IBRA sub-regions
Blackbutt - bloodwood dry heathy open forest on Quaternary sands of the northern NSW North Coast Bioregion, (NR114) Blackbutt - bloodwood dry heathy open forest on sandstones of the northern NSW North Coast Bioregion, (NR115) Blackbutt - Spotted Gum shrubby open forest on sandstones of the lower Clarence Valley of the NSW North Coast Bioregion, (NR118) Pink Bloodwood - Red Mahogany - Smudgy Apple shrubby open forest on sandstone of northern NSW North Coast Bioregion, (NR218)	Clarence Sandstones and any IBRA subregion that adjoins the IBRA subregion in which the development occurs

2. Blackbutt - Turpentine dry heathy open forest on sandstones of the lower Clarence of the NSW North Coast Bioregion, (NR123)

Number of ecosystem credits created	485
IBRA sub-region	Clarence Sandstones

Offset options - Plant Community types	Offset options - IBRA sub-regions
Angophora paludosa shrubby forest and woodland on sandstone or sands of the NSW North Coast Bioregion, (NR101) Angophora robur shrubby forest and woodland on sandstones of the NSW North Coast Bioregion, (NR102) Bailey's Stringybark - Needlebark Stringybark heathy woodland on sandstones of the lower Clarence Valley of the NSW North Coast Bioregion, (NR104) Blackbutt - bloodwood dry heathy open forest on Quaternary sands of the northern NSW North Coast Bioregion, (NR114) Blackbutt - bloodwood dry heathy open forest on sandstones of the northern NSW North Coast Bioregion, (NR115) Blackbutt - Spotted Gum shrubby open forest on sandstones of the lower Clarence Valley of the NSW North Coast Bioregion, (NR118) Blackbutt - Turpentine dry heathy open forest on sandstones of the lower Clarence of the NSW North Coast Bioregion, (NR123) Needlebark Stringybark - Large-fruited Blackbutt heathy open forest on sandstones of the northern NSW North Coast Bioregion, (NR199) Needlebark Stringybark - Red Bloodwood heathy woodland on sandstones of the lower Clarence of the NSW North Coast Bioregion, (NR200) Needlebark Stringybark - Turpentine heathy open forest of the Clarence lowlands of the NSW North Coast Bioregion, (NR201) Pink Bloodwood - Red Mahogany - Smudgy Apple shrubby open forest on sandstone of northern NSW North Coast Bioregion, (NR218) Scribbly Gum - Red Bloodwood heathy open forest of the coastal lowlands of the NSW North Coast Bioregion, (NR228)	Clarence Sandstones and any IBRA subregion that adjoins the IBRA subregion in which the development occurs

Summary of species credits required

Common name	Scientific name	Extent of impact Ha or individuals	Number of species credits created
Bordered Guinea Flower	Hibbertia marginata	1,190.00	16,660
Koala	Phascolarctos cinereus	10.50	273
Squirrel Glider	Petaurus norfolcensis	10.50	231
Common Planigale	Planigale maculata	10.50	273

GHD

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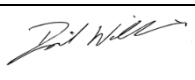
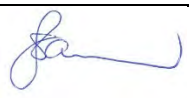
Document Status

Rev No.	Author	Reviewer		Approved for Issue		
		Name	Signature	Name	Signature	Date
0	A Ayres	Dan Williams	*Dan Williams*	S Lawer	*S Lawer*	20/03/2015
1	A Ayres	Dan Williams		S Lawer		01/05/2015

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Appendix G Traffic Impact Assessment

Newman Quarries Pty Ltd

Sly's Quarry Expansion

Traffic Impact Assessment

March 2015

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Appendices

1. Introduction

1.1 Project overview

GHD Pty Ltd (GHD) was engaged by Newman Quarrying Pty Ltd (Newman Quarrying) to prepare a Traffic Impact Assessment (TIA) report to address the potential traffic impacts from the proposed expansion of a sandstone quarry at Lot 2 DP 1055044, Tullymorgan-Jackybulbin Road, Mororo, known as Sly's Quarry.

The proposal involves the expansion of the existing sandstone quarry by 11.1 hectares and an increase in the extraction rate up to 500,000 tonnes per annum. The primary purpose of the quarry would be to supply substantial quantities of quarry materials required for current and proposed Pacific Highway works, and for supply to Clarence Valley Council (CVC) and local contractors.

It is estimated that the quarry would have an available resource of about 7 million tonnes which would allow extraction for a period of between 30 and 40 years, depending on demand.

1.2 Purpose of this report

This traffic impact assessment has been prepared by GHD Pty Ltd (GHD) on behalf of Newman Quarries Pty Ltd for the expansion of the existing Sly's Quarry (referred to in this report as 'the proposal'). This assessment has been prepared to form a part of an Environmental Impact Statement (EIS) for the proposal.

1.3 Scope

The study area for this traffic and access assessment encompasses the local road network around Sly's Quarry, Mororo NSW.

This assessment has been prepared to address specific requirements, including the Secretaries Environmental Assessment Requirements (SEARs) for the Department of Planning and Environment (DPE), and key issues raised by statutory agencies through formal correspondence.

The requirements relevant to this assessment, along with a reference to the relevant sections of this report, are provided below in Table 1.

Table 1 Assessment requirements

Source	Requirement	Section of this report
Director General's Requirements (Traffic and Transport)	An assessment of the likely traffic impacts of the development on the capacity, condition, safety and efficiency of the local and State road network, having regard to any requirements of the RMS and Council's requirements	4
	Consideration of access arrangements for the proposed development, as well as the proposed explosives depot	3.6, 4.0, 4.3, 4.4
Roads and Maritime Services	A detailed traffic study should include:	
	Impact of existing and proposed development on the road network with consideration for a 10 year horizon	4.0
	The volume and distribution of traffic generated	3.6
	Intersection sight distances at key intersections along the primary haulage route	4.3, 4.4
	Existing and proposed access conditions	2, 3.6
	Details of improvements for road intersections with consideration for the current Austroads Guidelines, particularly the Intersection of Tullymorgan-Jackybulbin Road with the Pacific Highway	4.3,4.4
	Detail of servicing and parking arrangements	4.8
	Traffic Management for construction and operational phases of the proposed development	3, 4
	Impact on public transport (public and school bus routes) and consideration for alternative transport modes (eg cyclists and pedestrians	4.6
	Impact of road traffic noise and dust generated along the primary haulage route	4.7
	Clause 16(1)of the SEPP (Mining, Petroleum Production and Extractive Industries)	4.9
Clarence Valley Council	A Traffic Impact Assessment and Road Safety Audit should be provided that lists a number of relevant issues. This would consider the intersection servicing the quarry site off Tullymorgan-Jackybulbin Road, Tullymorgan-Jackybulbin Road and the intersection with the Pacific Highway.	4
	The report should include an assessment of: – Conflict/potential for conflict between the quarry operation and the proposed Explosives Depot – The suitability of internal access roads including widths, drainage and pavement to safely accommodate both activites.	4

2. Existing conditions

A plan of the study area is shown in Figure 2. Key roads in the surrounding area include Tullymorgan-Jackybulbin Road and the Pacific Highway.

2.1 Tullymorgan-Jackybulbin Road

Tullymorgan-Jackybulbin Road is a two-way single carriageway road and provides access from the Pacific Highway to Sly's Quarry and other rural/residential properties. There is no sign posted speed-limit, and as such the default speed limit for non-built up areas of 100km/h applies. It is however not expected that vehicles would travel at this speed in the vicinity of the quarry access point, with lower operating speeds likely due to the nearby corner to the east, and the beginning of an unsealed section immediately to the west. The road is sealed from the highway to the existing quarry access road and is unsealed further west of this point. The roadway is approximately 6.5-7.5m wide, generally with grassed verges and no road shoulders.

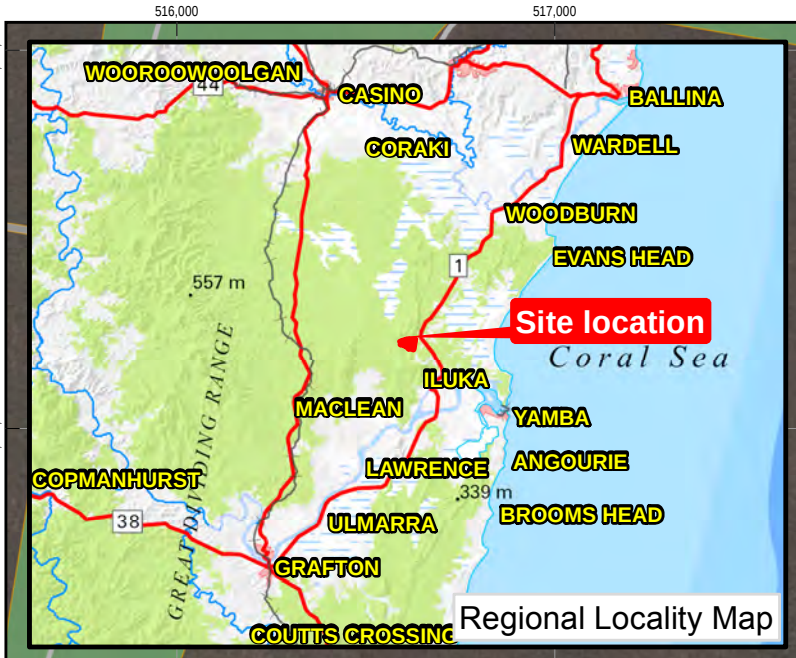
2.2 Pacific Highway

The Pacific Highway in the vicinity of Tullymorgan – Jackybulbin Road is a two-way single carriageway road. The sign posted speed limit is 100 km/h. The Pacific Highway is a major transport corridor between Sydney and Brisbane. This section of the highway will be upgraded to be dual-carriageway with two lanes in each lane as part of the Pacific Highway upgrade program. Currently, Tullymorgan-Jackybulbin Road meets the Pacific Highway in a T intersection for a single carriageway. The refined concept design for the Pacific Highway upgrade project shows a Seagull T intersection for a dual carriageway will be implemented at the intersection with Tullmorgan - Jackybulbin Road.

2.3 Sly's Quarry access

The access to the existing Sly's Quarry is located on Tullymorgran-Jackybulbin Road, approximately 2.6 kilometres west of the Pacific Highway. The access road is approximately four metres wide and 400 m long from the intersection to the site office. There is an onsite speed limit of 20 km/h. The site access is gated. Figure 1 below shows the site access point.

Figure 1 Site Access Road and Gate



BUNDJALUNG StateConservationArea

BUNDJALUNG NationalPark

SLYS ROAD

PACIFIC HIGHWAY

TULLYMORGAN-JACKYBULBIN ROAD

TABBIMOBLE CREEK

A

B

C

MCMAHONS TRAIL

MORORO STATE FOREST

GIBBERAGEE STATE FOREST

Source: Esri, DigitalGlobe, GeoEye, i-cubed, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo, and the GIS User Community

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LEGEND

- Current Quarry Areas
- Lot 2 DP 1055044
- Road
- Lot
- Waterways
- Waterbody
- Natural Parks
- State Forest

Paper Size A3

0 100 200 400 600 800

Metres

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

N

Newman Quarrying
Sly's Quarry Environmental Impact Statement

Job Number 22-17528
Revision A
Date 11 Dec 2014

Site location

Figure 2

N:\AU\Coffs Harbour\Projects\22\17528\GIS\Maps\Deliverables\22_17528_Z006_Lot2_Site_location.mxd

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

Data Source: NSW Department of Lands: Cadastre - Jan 2014; Geoscience Australia: 250k Data - Jan 2014; NSW Department od Primary Industry - Jan 2014; ESRI imagery Jan 2014. Created by: qjchung

2.4 Daily traffic volumes

2.4.1 Tullymorgan-Jackybulbin Road

There are no traffic counts that exist for Tullymorgan-Jackybulbin Road. For this reason, the existing traffic flow (not including existing quarry traffic) was calculated based on the RTA (Roads and Maritime Services) Guide to Traffic Generating Developments (2002) using the following assumptions:

- Tullymorgan-Jackybulbin Road continues west, and then south towards the town of Ashby. It was assumed that the residents of dwellings more than 10km along the road away from the quarry would continue via Ashby to access the Pacific Highway. Dwellings within this 10 km zone would access the highway by passing the quarry.
- There are 12 lots with residential dwellings with this 10km zone of Tullymorgan-Jackybulbin Road.
- The RTA Guide to Traffic Generating Developments (2002) recommends that there are 9.0 daily vehicle trips per dwelling.
- It was assumed that 10% of traffic is heavy vehicles on this section.

The existing traffic generated by Sly's quarry is known to fluctuate substantially depending on demand for the quarry products. During busy periods where the extraction rate is 100,000 tonnes/annum, there are approximately 80 truck movements per day. The existing workforce at the quarry consists of seven employees, generating 14 light vehicle movements per day.

This calculated traffic was added to the traffic known to be generated by Sly's Quarry and is summarised in table 2 below.

Traffic Generation source	Light Vehicles (v/d)	Heavy Vehicles(v/d)	Total
Residential dwellings	97	11	108
Sly's Quarry	14	80	94
Total	111	91	202

2.4.2 Pacific Highway

Roads and Maritime has provided traffic data for the Pacific Highway in two locations on the Pacific Highway. These are:

- Station HWDSTC, 200 m south of Yamba Road. This site is approximately 20 km south of Tullymorgan-Jackybulbin Road.
- Station 04233 at New Italy. This site is approximately 18 km north of Tullymorgan-Jackybulbin Road.

The average daily traffic for each of these sites is shown in Table 2.

Additional information provided by RMS showed that at the Yamba Road counting station, heavy vehicles represented 18% of all traffic.

Table 2 Pacific Highway traffic volume data

Year	Location	ADT
2012	200 m south of Yamba Road, 20 km south of Tullymorgan-Jackybulbin Road - Northbound	5750
2012	200 m south of Yamba Road, 20 km south of Tullymorgan-Jackybulbin Road - Southbound	5750
2012	200 m south of Yamba Road, 20 km south of Tullymorgan-Jackybulbin Road – Total	11,500
2011	New Italy, 18 km north of Tullymorgan-Jackybulbin Road – Northbound	6000
2011	New Italy, 18 km north of Tullymorgan-Jackybulbin Road – Southbound	6000
2011	New Italy, 18 km north of Tullymorgan-Jackybulbin Road – Total	12,000

Source: RMS

To apply this traffic data to the current year, a 2% p.a. traffic growth on the Pacific Highway was assumed to 2014. It was also assumed that the volume at Tullymorgan-Jackybulbin Road is an average of the two locations. Using these assumptions the traffic volumes shown in Table 3 were calculated.

Table 3 Pacific Highway calculated traffic volumes 2014

Direction	Light Vehicles (v/d)	Heavy Vehicles(v/d)	Total
Northbound	5060	1110	6170
Southbound	5059	1111	6170
Total	10,119	2221	12,340

2.5 Crash history

Crash history has been provided by Roads and Maritime Services for Tullymorgan-Jackybulbin Road from the Pacific Highway to the west of the quarry access and for the Pacific Highway itself, 1 km either side of the Tullymorgan-Jackybulbin Road intersection. This data is inclusive of January 2009 to December 2014 and is included in Appendix A.

In the data period, there were a total of 6 crashes with three resulting in injury and none resulting in fatalities. None of the crashed occurred at the intersection of the Pacific Highway and Tullymorgan-Jackybulbin Road, with the closest being approximately 300m to the south. There were no crashes in the vicinity of the quarry access or on Tullymorgan-Jackybulbin Road.

This crash history does not indicate any existing road safety issues that would be exacerbated by the proposal.

2.6 Other transport modes

2.6.1 Buses

Northern Rivers Bus Lines operates a public bus service (route 695) between Grafton and Lismore which runs on the Pacific Highway past the Tullymorgan-Jackbulbin Road intersection.

Each weekday there is one weekday service to Lismore in the morning and one weekday service to Grafton in the afternoon. The closest stop to the proposed development is approximately 7 km south of Tullymorgan-Jackybulbin Road in Woombah Woods.

School bus services currently use Tullymorgan-Jackybulbin road as a u-turn facility after picking up / dropping off school children. This occurs during the morning and afternoon. Figure 3 below shows the signage for the area where the buses complete this manoeuvre.

Figure 3 School bus u-turn facility signage

2.6.2 Cyclists

There is no provision for cyclists on Tullymorgan-Jackybulbin Road.

2.6.3 Pedestrians

There is no provision for pedestrians on Tullymorgan-Jackybulbin Road.

3. Proposal

3.1 General

Newman Quarrying proposes to expand a sandstone quarry at Lot 2 DP 1055044, Tullymorgan-Jackybulbin Road, Mororo, known as Sly's Quarry. The proposal is to expand the existing sandstone quarry by 18 hectares and increase the extraction rate up to 500,000 tonnes per annum.

The primary purpose of the quarry would be to supply substantial quantities of quarry materials required for current and proposed Pacific Highway works, and for supply to Clarence Valley Council (CVC) and local contractors.

Maintaining the current Pacific Highway and the proposed Pacific Highway upgrade will require a considerable volume of imported quarry materials. Depending on a range of factors, including funding, these works could extend over a period of approximately five years. After completion of the Highway works, the quarry would continue to supply material for maintenance of the Pacific Highway as well as to CVC and private contractors.

To assist with the rehabilitation of Site B, Site C and the proposed quarry expansion, it is also intended to import unsuitable virgin excavated natural material (VENM) and mulch from the highway upgrade works.

3.2 Objectives of the Proposal

The objectives of the proposal are to:

- Establish a quarry operation to extract sandstone materials for delivery to highway works projects, local Councils and local industry.
- Operate the quarry so as to minimise any potential environmental impacts and comply with all relevant legislation and guidelines.
- Rehabilitate the extraction area upon exhaustion of the resource to minimise any long term impacts.

3.3 Site layout

The site is accessed from Tullymorgan-Jackybulbin Road via a gravel access road that travels in a northerly direction. A site office and weighbridge are located approximately 200m along the access road with a car parking area and maintenance shed located to the east. A generator and fuel storage/fuel bowser are also in this location.

The centre of the existing and proposed quarry is located approximately 150m north of the site office. This area is also the main stockpiling area, with an additional stockpile area located to the east. The proposed quarry will extend in a northerly and southerly direction from the centre of the current quarry.

The current floor of the quarry is approximately 44 m Australian Height Datum (AHD) with a second level to the east at approximately 58m AHD. The centre of the existing quarry has active faces to the north, east and west, as shown in the photograph below.

Figure 4 Existing quarry

Another stockpile area is located to the south west of the quarry which also includes a bunded oil storage shed, generator and wash plant.

3.4 Hours of Operation

The hours of operation would depend on demand with some periods of high activity and other times when activity is limited to the occasional loading of haulage trucks. The proposed hours of operation are:

- Weekdays – 6:30am - 6.00pm
- Saturdays – 6:30am - 4.00pm
- Sundays or public holidays - No work

Excavation, crushing or loading would not commence until after 7am. Blasting would only occur on weekdays between the hours of 10am and 4pm.

3.5 Type of Machinery

The following items of plant and equipment are necessary for the operation of the quarry:

Type	Typical Make/Model	Approximate Number	Typical Frequency of use	Description
Excavators	Komatsu pc350 – 8 Komatsu pc710-5	2 1	12- 40hrs/ week	Excavating material and stockpiling Clearing and grubbing of vegetation and stripping of topsoil
Screen	Sandvik qe440 Sandvik qa340	1 1	20 - 40hrs/ week	Only for aggregate/gravel production and overburden screening
Front-end Loader	Komatsu wa400-3 Komatsu wa470-3	1 1	10hrs/week 30hrs/week	Loading material onto the haul trucks and stockpiling material within the pit floor

Type	Typical Make/Model	Approximate Number	Typical Frequency of use	Description
	Kawazaki 90zv	1	45hrs/week	
Crusher	McCloskey j50 Komatsu br380jg-1	1 1	20 - 40hrs/ week	Crushing rock main jaw crusher Crushing rock spare jaw crusher
Haul Trucks	Truck and dog Contractors	1 Up to 125/day	45hrs/week Up to 125/day	Delivery of materials to customers and stockpiling in pit if needed and carting unsuitable to rehabilitation areas.
Water Cart	Isuzu	1	10hrs/week	To water haul roads and stockpiles
Water Pump	Honda	3	10hrs/week	To dewater excavation/basin and to fill watercart from standpipe To water stockpiles and put moisture in products
Generator	Cummins Able	1 1	5hrs/week 9hrs/day	Provide electricity to washplant and dam pump Provide power to weighbridge and fuel pump
Hand tools	Various	5	2hrs/week	General activities maintaining plant

It is anticipated that not all of the equipment listed above would be operational on-site at any one time.

3.6 Access and Traffic Volumes

The majority of traffic to and from the quarry would access the site from the Pacific Highway and Tullymorgan-Jackybulbin Road via an existing, formed gravel access road that runs to the quarry pit. The layout of the quarry provides a loop that allows, trucks and machinery to enter the quarry, load and exit, all while travelling in a forward direction.

Less than 10 deliveries per year would be to the west of the quarry along Tullymorgan-Jackybulbin Road.

3.6.1 Traffic Generation

Workforce Traffic

During operation it is likely that there would be a maximum of twelve construction workers or plant operators on the site at any one time. This would yield a daily workforce traffic generation in the order of 24 vehicle trips per day (vtpd). It is assumed the majority of the workforce would arrive between 6:30 am and 7:30 am and depart generally between 3:00 pm and 6:30 pm.

Heavy Vehicle Traffic

Truck and dog trailer combinations have a capacity of about 32 tonnes. At an average daily production, which would generate a win and haul rate of approximately 1,500 tonnes, the quarry is expected to generate about 50 truck and dog loads or 100 truck movements per day. At its peak, the quarry is expected to win and haul about 4,000 tonnes per day which would involve about 125 truck and dog loads or 250 truck movements per day. At other times there would be periods when no trucks would be generated by the quarry.

Once the Pacific Highway upgrade is complete, the demand is expected to decrease, as would the number of truck movements. It is anticipated that no more than 150,000 tonnes annually would be won and hauled from the quarry, which would generate, on average, about 750 tonnes per day, over a 200 day working year. This would result in about 25 truck and dog loads or 50 truck movements per day. However, as with all quarries, there is no average requirement for materials hence truck numbers may exceed this number for short periods and at other times, no trucks would be operating.

4. Impact assessment

4.1 Cumulative traffic impacts

At its peak, the quarry would be expected to generate 250 truck movements per day, and 24 staff movements. Current levels of activity are around 80 truck movements per day.

As a result of the proposal, daily traffic volumes on Tullymorgan-Jackybulbin Road would be expected to increase from the existing average of 202 vehicles per day to 382 vehicles per day. This level of activity would represent an increase of some 89% on the current traffic volumes on Tullymorgan-Jackybulbin Road. The proportion of heavy vehicles would increase from 45% currently to approximately 68%, as shown in Table 4.

It is unclear at this stage whether the explosives depot proposal that utilises the same access point as Sly's quarry will go ahead and for this reason the traffic generated by this proposal has not been considered as part of this assessment. However, if it does proceed it is expected that the traffic volumes generated will be significantly less than those generated by the quarry with 8 heavy vehicle and six light vehicle movements each day. These volumes are unlikely to cause any significant problems. However if the explosives depot is to go ahead in the future, another traffic assessment should be commissioned to determine the specific impacts bought about by the development.

Table 4 Impacts on traffic volumes on Tullymorgan-Jackybulbin Road

Scenario	Total Vehicles	Light Vehicles	Heavy Vehicles	% HV
Existing	202	111	91	45%
Less current quarry activities	94	14	80	
Plus Proposal	274	24	250	
Future	382	121	261	68%

The increase in traffic volume on Tullymorgan-Jackybulbin Road will also result in an increase in traffic on the Pacific Highway. Table Table 5 outlines the expected increase in traffic volumes due to the proposed development.

Table 5 Impacts on traffic volumes on the Pacific Highway

Scenario	Total Vehicles	Light Vehicles	Heavy Vehicles	% HV
Existing	12,340	10,119	2221	18%
Less current quarry activities	94	14	80	
Plus Proposal	274	24	250	
Future	12,520	10,129	2391	19%

The daily traffic volumes on the Pacific Highway are expected to increase by 1.5% as a result of the proposal. This small increase in traffic (which is less than the assumed annual growth rate) is not expected to have any significant impact on the Pacific Highway in the vicinity of the proposed development. The percentage of heavy vehicles on this section of the Pacific highway is also expected to increase from 18% to 19% as a result of this proposed development.

The plan to reintroduce fill material and mulch to site during the construction of the Pacific Highway Upgrade Project to aid the rehabilitation of sites B and C (as discussed in section 3.1) should be designed to backfill haulage vehicles wherever practical to minimise the total traffic volume as much as possible.

4.2 Access Road

The existing access road is relatively narrow, however it does allow for inbound and outbound vehicles to pass each other without leaving the formed roadway in certain places. Due to the potential increase in heavy vehicles and the unsealed road surface, the road condition may deteriorate at a faster rate than it does currently. Maintenance of the existing road should be reviewed and potentially a more frequent maintenance regime be put in place.

4.3 Site Access intersection

4.3.1 Intersection configuration

Haulage trucks would enter and exit the site using the existing access onto Tullymorgan-Jackybulbin Road. It is expected that almost all truck movements will be to and from the east (Pacific Highway), with right turns into the site and left turns out onto Tullymorgan-Jackybulbin Road.

The likely traffic volumes at this intersection can be compared with design warrants in the Austroads Guide to Road Design Part 4A.

It is expected that the peak design hour would contain approximately 10% of truck movements into and out of the quarry (13 trucks turning in, 13 trucks turning out). It can also be estimated that the design peak hour would contain 10% of the total average daily traffic which would indicate a peak hourly volume of 38 vehicles on Tullymorgan-Jackybulbin Road. Figure 5 shows the warrants for turn treatments based on traffic volumes.

The right turn into the quarry access, with approximately 13 trucks per hour turning in, and an affected volume of 38 vehicles per hour on Tullymorgan-Jackybulbin Road requires a basic right turn (BAR) treatment. The left turn into the quarry access would have only a rare occurrence of turning trucks, and would also require only a basic right turn (BAL) treatment. These treatments are illustrated in Figure 6. Although at a skew angle, these BAL and BAR treatments already exist at the site access point.

Even with background growth in traffic volumes on the Tullymorgan-Jackybulbin Road., or with an increase in the volume of truck activity at the quarry, this type of intersection is likely to be suitable for many years to come.

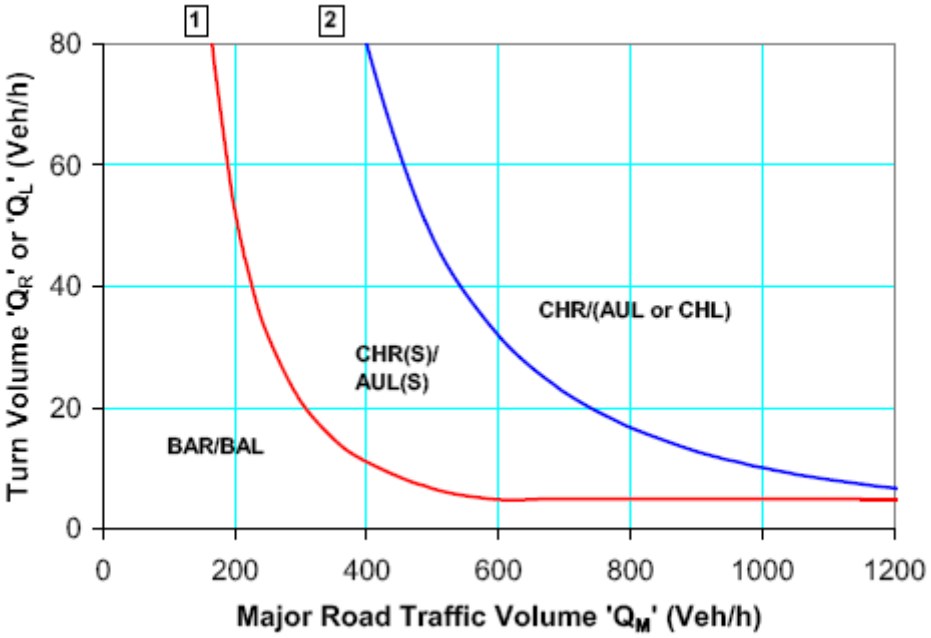


Figure 5 Austroads warrants for turn treatments on the major road at unsignalised intersections – operating speeds less than 100 km/h

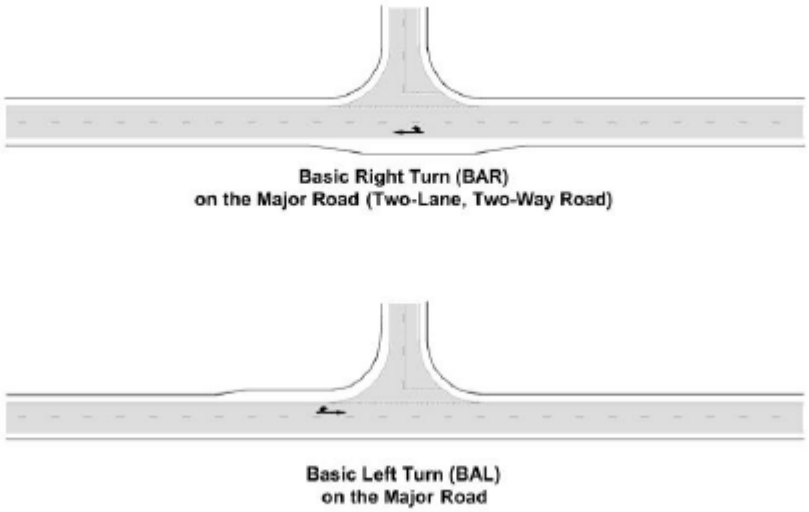


Figure 6 Austroads Rural Basic BA turn treatments

4.3.2 Sight distance assessment

The requirements for sight distance are specified in the Austroads Guide to Road Design Part 4A. For a 100 km/hr speed environment, the sight distance requirement is 248 m. The sight distance in both directions is less than the required 248 m with 220 m to the east and 200 m to the west. However as noted in Section 2.1, existing speeds on Tullymorgran-Jackybulbin Road in the vicinity of this intersection are generally lower than 100 km/h and this would lower the requirement for sight distance. The available sight distance is adequate in both directions for an 80 km/h speed environment, which is commensurate with the expected speed of traffic past the site access.

As there are already warning signs in place along the roadway advising motorists of the potential for truck movements from the site access point and as the quarry has already been operating without incident for some time, the sight distance at this intersection is considered adequate.

This sight distance in both directions is illustrated in Figure 7 and Figure 8.

Figure 7 Looking east from site access

Figure 8 Looking west from site access

4.4 Pacific Highway / Tullymorgan-Jackybulbin Road intersection

4.4.1 Intersection configuration

Haulage trucks would enter and exit Tullymorgan-Jackybulbin Road from both directions on the Pacific Highway.

The likely traffic volumes at this intersection can be compared with design warrants in the Austroads Guide to Road Design Part 4A to determine the suitability of the existing intersection layout.

It is expected that the peak design hour would contain approximately 10% of truck movements into and out of the quarry (13 trucks turning in, 13 trucks turning out). Traffic count data provided by Roads and Maritime shows that the peak hour volume on the Pacific Highway in the vicinity of Tullymorgan-Jackybulbin Road can be estimated as 1234 veh/h (10% of the ADT).

The left turn into Tullymorgan-Jackybulbin Road, with approximately 13 trucks per hour turning in, and an affected volume of 617 vehicles per hour on the Pacific Highway (assumed peak direction one-way flow), requires an auxiliary or channelized left-turn treatment (AUL or CHL). This intersection currently has an AUL treatment.

The right turn into Tullymorgan-Jackybulbin Road, with approximately 13 trucks per hour turning in, and an affected volume of 1234 vehicles per hour on the Pacific Highway (assumed peak direction one-way flow), requires a channelised right turn bay. At present, this intersection treatment is already in place.

There is not expected to be a large growth in traffic on Tullymorgan-Jackybulbin Road in the foreseeable future and as such this intersection is likely to be suitable for at least a 10 year horizon. The proposed intersection arrangements for the upgrade of this intersection as part of the Pacific Highway upgrade program should be sufficient for the volumes described above.

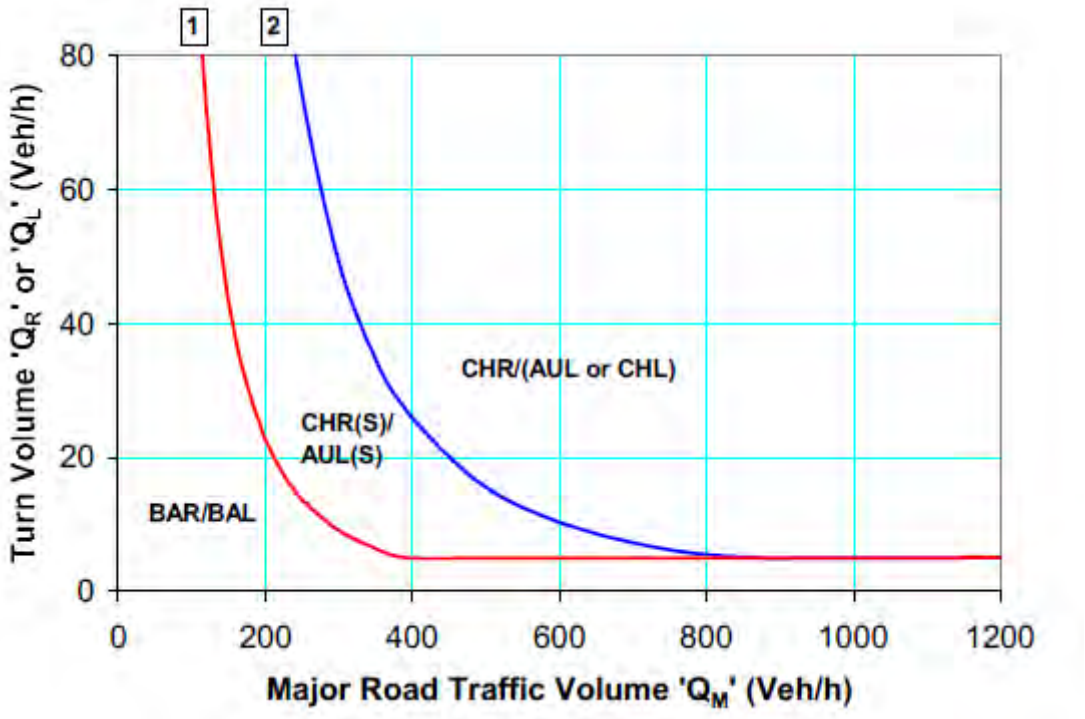


Figure 9 Austroads warrants for turn treatments on the major road at unsignalised intersections – operating speeds more than 100 km/h

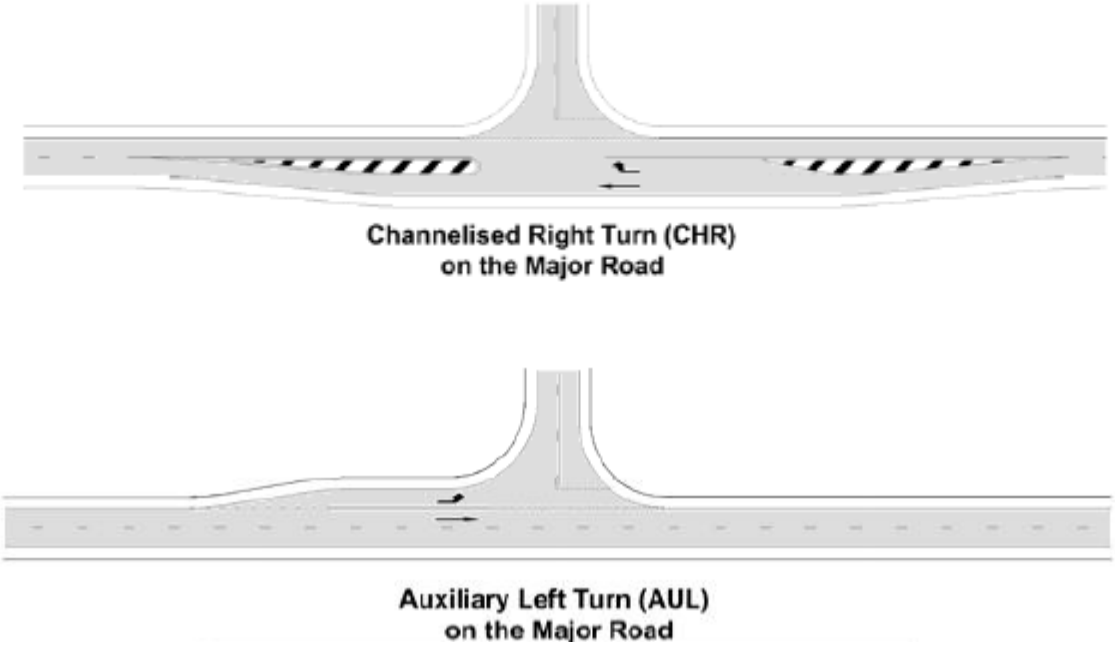


Figure 10 Austroads rural channelised right turn and auxiliary left turn treatments.

4.4.2 Sight distance assessment

The requirements for sight distance are specified in the Austroads Guide to Road Design Part 4A. For a 100 km/hr speed environment, the sight distance requirement is 248 m. The site distance at this intersection exceeds the required 248 m in both directions with 370 m to the north and 500 m to the south. This is illustrated in Figure 11 and Figure 12.

Figure 11 Looking north on the Pacific Highway from Tullymorgan-Jackybulbin Road

Figure 12 Looking south on the Pacific Highway from Tullymorgan-Jackybulbin Road

4.5 Haulage route

Haulage of quarry materials would primarily be between the site and the Pacific Highway via Tullymorgan-Jackybulbin Road, for distribution onto the wider network. Precise routes will depend on the location of works utilising quarry outputs. For the purpose of this assessment, the following comments can be made about the safety performance of the Tullymorgan-Jackybulbin Road route:

- In general, Tullymorgan-Jackybulbin Road is considered to provide a safe road environment for the haulage activities.
- The alignment of Tullymorgan-Jackybulbin Road, being predominantly straight between the quarry and the Pacific Highway, provides drivers with good forward sight distance to be aware of any potential obstructions or other issues.
- The low volume of traffic estimated on Tullymorgan-Jackybulbin Road, with a 2-way peak volume of 382 vehicles per day, also results in a reduced risk level associated with 2-vehicle collisions.
- The crash history is not indicative of any particular safety deficiencies at specific locations and the nature and frequency of crashes is likely to be typical of similar road types elsewhere.

On this basis, it is unlikely that a formal road safety audit process will identify any major issues with this section of road. However, if required by Council, a Road Safety Audit of the proposed haulage route should be completed prior to commencement of haulage activities.

4.6 Impact on Vulnerable Road Users

The quarry site is remote from any source of vulnerable road user (pedestrians and cyclists) activity. As noted in Section 2.6, there are no specific facilities for pedestrians or cyclists on Tullymorgan-Jackybulbin Road. However given the relatively low traffic volumes on the road, the scale of traffic increase expected, and the physical characteristics of the road that provide for good forward sight distance, there is not expected to be any deterioration in safety for pedestrians or cyclists. Similarly, it is not expected that there will be any direct impact on existing bus stops or bus services, including school bus services as a result of the proposed development.

4.7 Road Traffic Noise and Dust

A separate Air and Noise assessment has been completed as a part of the environmental impact statement.

4.8 On-Site Traffic Management

The quarry area will be accessed via the access road. A site office and amenities block is located approximately 400 m north of Tullymorgan-Jackybulbin Road. At this location, there is expected to be sufficient space for the manoeuvring and parking of staff vehicles, and other site vehicles as required.

Traffic movement within the quarry will depend on the area being excavated at the time. Vehicle access paths will be established to suit the specific activities being undertaken.

4.9 State Environment Planning Policy (Mining, Petroleum Production and Extractive Industries) 2007

Clause 16 (1) of the SEPP for Mining, Petroleum Production and Extractive Industries requires that, amongst other things, before granting consent for development for the purposes of mining or extractive industry that involves the transport of materials, the consent authority must consider whether or not the consent should be issued subject to conditions that do any one or more of the following:

(a) require that some or all of the transport of materials in connection with the development is not to be by public road,

- The haulage route for this development is completely on public roads. The use of non-public roads is not practical or feasible for this proposed development.

(b) limit or preclude truck movements, in connection with the development, that occur on roads in residential areas or on roads near to schools,

- There are no schools in the nearby vicinity of the quarry or on Tullymorgan-Jackbulbin Road. Most residential properties exist to the west of the quarry; however there are two residential properties to the east near the Pacific Highway. Nearly all vehicle movements associated with the development will be to the east of the quarry.

(c) require the preparation and implementation, in relation to the development, of a code of conduct relating to the transport of materials on public roads.

- Newman Quarrying currently has a code of conduct relating to the transport of materials on public roads. This takes the form of a Truck Safety System and a Heavy vehicle Drivers Manual. Both documents outline the drivers' responsibilities in ensuring the safe operation of their vehicles at all times and also ensures they conform to environmental standards such as the covering of loads.

5. Recommendations

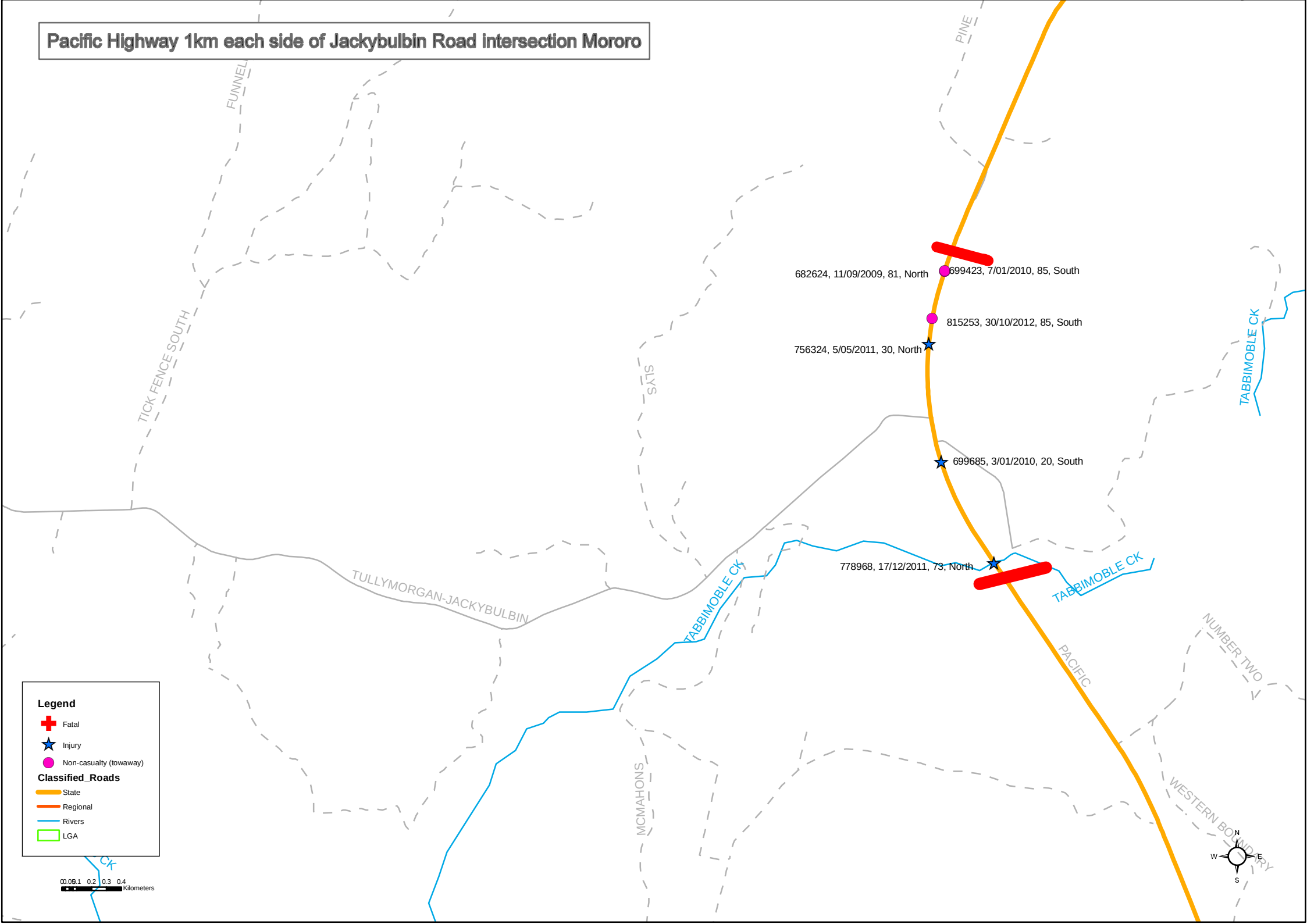
To minimise potential impacts to traffic and access due to the proposal, the following measures are recommended:

- The maintenance of the site access road should be reviewed and if necessary, frequency of maintenance should be increased to cope with the increased heavy vehicle movements generated by the proposed development.
- Vehicles should conform to a code of conduct for the transport of materials on public roads.
- Where practicable, haulage vehicles should be backloaded to carry loads on both inward and outward journeys, to minimise total vehicle movements.

Subject to these recommendations, the proposed development is supported on traffic grounds.

Appendices

Appendix A – Crash Data


Pacific Highway 1km each side of Jackybulbin Road intersection Mororo
682624, 11/09/2009, 81, North
699423, 7/01/2010, 85, South
815253, 30/10/2012, 85, South
756324, 5/05/2011, 30, North
699685, 3/01/2010, 20, South
778968, 17/12/2011, 73, North
PINE
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TABBIMOBLE CK
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TABBIMOBLE CK
PACIFIC
NUMBER TWO
MCMAHONS
WESTERN BOUNDARY
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Injury
Non-casualty (towaway)
Classified_Roads
State
Regional
Rivers
LGA
0 0.05 0.1 0.2 0.3 0.4
Kilometers
N
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Summary Crash Report

# Crash Type		
Car Crash	5	83.3%
Light Truck Crash	1	16.7%
Rigid Truck Crash	0	0.0%
Articulated Truck Crash	2	33.3%
'Heavy Truck Crash	(2)	(33.3%)
Bus Crash	0	0.0%
"Heavy Vehicle Crash	(2)	(33.3%)
Emergency Vehicle Crash	0	0.0%
Motorcycle Crash	0	0.0%
Pedal Cycle Crash	0	0.0%
Pedestrian Crash	0	0.0%

' Rigid or Artic. Truck " Heavy Truck or Heavy Bus
These categories are NOT mutually exclusive

Location Type		
*Intersection	0	0.0%
Non intersection	6	100.0%

* Up to 10 metres from an intersection
~ 07:30-09:30 or 14:30-17:00 on school days

Collision Type		
Single Vehicle	4	66.7%
Multi Vehicle	2	33.3%

Road Classification		
Freeway/Motorway	0	0.0%
State Highway	6	100.0%
Other Classified Road	0	0.0%
Unclassified Road	0	0.0%

Contributing Factors		
Speeding	2	33.3%
Fatigue	3	50.0%

Weather		
Fine	4	66.7%
Rain	0	0.0%
Overcast	1	16.7%
Fog or mist	0	0.0%
Other	0	0.0%

Road Surface Condition		
Wet	0	0.0%
Dry	5	100.0%
Snow or ice	0	0.0%

Natural Lighting		
Dawn	2	33.3%
Daylight	3	50.0%
Dusk	0	0.0%
Darkness	1	16.7%

Crash Movement		
Intersection, adjacent approaches	0	0.0%
Head-on (not overtaking)	1	16.7%
Opposing vehicles; turning	0	0.0%
U-turn	0	0.0%
Rear-end	1	16.7%
Lane change	0	0.0%
Parallel lanes; turning	0	0.0%
Vehicle leaving driveway	0	0.0%
Overtaking; same direction	0	0.0%
Hit parked vehicle	0	0.0%
Hit railway train	0	0.0%
Hit pedestrian	0	0.0%
Permanent obstruction on road	0	0.0%
Hit animal	0	0.0%
Off road, on straight	0	0.0%
Off road on straight, hit object	1	16.7%
Out of control on straight	0	0.0%
Off road, on curve	0	0.0%
Off road on curve, hit object	3	50.0%
Out of control on curve	0	0.0%
Other crash type	0	0.0%

Speed Limit				
			~ 40km/h or less	0 0.0%
40 km/h or less	0	0.0%	80 km/h zone	0 0.0%
50 km/h zone	0	0.0%	90 km/h zone	0 0.0%
60 km/h zone	0	0.0%	100 km/h zone	6 100.0%
70 km/h zone	0	0.0%	110 km/h zone	0 0.0%

CRASHES	6	
Fatal crash	0	0.0%
Injury crash	3	50.0%
Non-casualty crash	3	50.0%

Time Group		% of Day	
00:01 - 02:59	1	16.7%	12.5%
03:00 - 04:59	0	0.0%	8.3%
05:00 - 05:59	1	16.7%	4.2%
06:00 - 06:59	1	16.7%	4.2%
07:00 - 07:59	0	0.0%	4.2%
08:00 - 08:59	0	0.0%	4.2%
09:00 - 09:59	0	0.0%	4.2%
10:00 - 10:59	1	16.7%	4.2%
11:00 - 11:59	0	0.0%	4.2%
12:00 - 12:59	1	16.7%	4.2%
13:00 - 13:59	0	0.0%	4.2%
14:00 - 14:59	0	0.0%	4.2%
15:00 - 15:59	0	0.0%	4.2%
16:00 - 16:59	1	16.7%	4.2%
17:00 - 17:59	0	0.0%	4.2%
18:00 - 18:59	0	0.0%	4.2%
19:00 - 19:59	0	0.0%	4.2%
20:00 - 21:59	0	0.0%	8.3%
22:00 - 24:00	0	0.0%	8.3%

Street Lighting	Off/Nil		% of Dark
0	of	1 in Dark	0.0%

CASUALTIES	3	
Killed	0	0.0%
Injured	3	100.0%
^ Unrestrained	0	0.0%

^ Belt fitted but not worn, No restraint fitted to position OR No helmet worn

Crashes		Casualties
1	2012	0
2	2011	2
2	2010	1
1	2009	0

~ School Travel Time		
Involvement	0	0.0%

McLean Periods			% Week
A	1	16.7%	17.9%
B	1	16.7%	7.1%
C	2	33.3%	17.9%
D	0	0.0%	3.5%
E	0	0.0%	3.6%
F	0	0.0%	10.7%
G	0	0.0%	7.1%
H	1	16.7%	7.1%
I	1	16.7%	12.5%
J	0	0.0%	10.7%

Day of the Week						# Holiday Periods		
Monday	0	0.0%	Thursday	2	33.3%	Sunday	1	16.7%
Tuesday	1	16.7%	Friday	1	16.7%	WEEKDAY	4	66.7%
Wednesday	0	0.0%	Saturday	1	16.7%	WEEKEND	2	33.3%

New Year	1	16.7%	Queen's BD	0	0.0%	Easter SH	0	0.0%
Aust. Day	0	0.0%	Labour Day	0	0.0%	June/July SH	0	0.0%
Easter	0	0.0%	Christmas	0	0.0%	Sept./Oct. SH	0	0.0%
Anzac Day	0	0.0%	January SH	2	33.3%	December SH	0	0.0%

Crashid dataset Pacific Highway 1km either side of Jackybulbin Road Intersection

Percentages are percentages of all crashes. Unknown values for each category are not shown on this report.

Detailed Crash Report

Crash No.	Date	Day of Week	Time	Distance		ID Feature	Loc Type	Alignment	Weather	Surface Condition	Speed Limit	No. of Tus	Tu Type/Obj	Age/Sex	Street Travelling	Speed Travelling	Manoeuvre	Degree of Crash	Killed	Injured	Factors
																					S F
Northern Region																					
Clarence Valley LGA																					
Mororo																					
Pacific Hwy																					
699423	07/01/2010	Thu	02:20	1 km	N	JACKYBULBIN RD	2WY	CRV	Unk	Unk	100	1	CAR	M55	S in PACIFIC HWY	100	Proceeding in lane	N	0	0	F
E76582901							RUM:	85	Off rt/lft bnd=>obj				Fence (prior to 2014)								
699685	03/01/2010	Sun	16:00	300 m	S	JACKYBULBIN RD	2WY	CRV	Overcast	Dry	100	2	CAR	F18	S in PACIFIC HWY	100	Incorrect side	I	0	1	F
E41517289							RUM:	20	Head on				SEM	M23	N in PACIFIC HWY	100	Proceeding in lane				
815253	30/10/2012	Tue	05:45	5 km	N	MORORO RD	2WY	CRV	Fine	Dry	100	1	TRK	M44	S in PACIFIC HWY	100	Proceeding in lane	N	0	0	S
E49903228							RUM:	85	Off rt/lft bnd=>obj				Tree/bush								
778968	17/12/2011	Sat	06:35		at	TABBIMOBLE CRE BDGE	2WY	STR	Fine	Dry	100	1	CAR	M25	N in PACIFIC HWY	100	Proceeding in lane	I	0	1	F
E46535704							RUM:	73	Off rd rght => obj				Bridge								
Tabbimoble																					
Pacific Hwy																					
682624	11/09/2009	Fri	10:30	1 km	N	JACKBULBIN RD	2WY	CRV	Fine	Dry	100	1	UTE	M56	N in PACIFIC HWY	90	Proceeding in lane	N	0	0	S
E39300865							RUM:	81	Off left/rt bnd=>obj				Tree/bush								
756324	05/05/2011	Thu	12:10	500 m	N	JACKYBULBUIN RD	2WY	CRV	Fine	Dry	100	2	SEM	M53	N in PACIFIC HWY	100	Proceeding in lane	I	0	1	
E44199336							RUM:	30	Rear end				CAR	M80	N in PACIFIC HWY	5	Proceeding in lane				

Report Totals: Total Crashes: 6 Fatal Crashes: 0 Injury Crashes: 3 Killed: 0 Injured: 3

Crashid dataset Pacific Highway 1km either side of Jackybulbin Road Intersection

GHD

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Rev No.	Author	Reviewer		Approved for Issue		
		Name	Signature	Name	Signature	Date
0	N. Hincks	T Bickerstaff		S Lawer		18/03/2015

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Appendix H Aboriginal Cultural Heritage Due Diligence Assessment

EVERICK
Heritage Consultants Pty Ltd

ABN 78102206682

November 2014

ABORIGINAL CULTURAL HERITAGE DUE DILIGENCE ASSESSMENT

SLY'S QUARRY
LOT 2 DP 1055044
MORORO, CLARENCE VALLEY NSW

PREPARED FOR NEWMAN QUARRYING PTY LTD

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Innovative Heritage Solutions

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EXECUTIVE SUMMARY

This assessment provides supporting information to an Application to the Director General for expansion of the existing Sly's Quarry at Lot 2 in DP 1055044 at Mororo in the Clarence Valley LGA, NSW (the 'Project Area').

Everick Heritage Consultants ('The Consultant') was commissioned by GHD Pty Ltd ('GHD') on behalf of its client Newman Quarrying Pty Ltd ('The Proponent') to undertake this assessment. The intent of the assessment is to identify any cultural heritage constraints to the expansion of the quarry. Risks to Aboriginal cultural heritage were assessed through archaeological survey and application of the Office of Environment and Heritage ('OEH') *Due Diligence Code for the Protection of Aboriginal Objects in NSW* (2010).

The brief for this Project was to undertake a Cultural Heritage Due Diligence Assessment of suitable standard to be submitted as a stand-alone report in support of a Development Application. In accordance with the relevant administrative and legislative standards for New South Wales (see Section 2 below), the methods employed in this assessment included:

(a) searches of applicable Indigenous heritage registers;

(b) a review of current and historic satellite imagery;

(c) archaeological survey of the Project Area;

(d) desktop assessment;

(e) assessment of the Project Area in accordance with the Due Diligence Code; and

(f) a report of findings and recommended management strategies.

The Project Area is in Northern New South Wales approximately 15 km north-west of the town of Iluka and approximately 25 km north of the township of Maclean. Lot 2 is approximately 374 ha. The application would involve increasing the existing quarry by 19.6.

A search was conducted on 6 October 2014 of the OEH Aboriginal Heritage Information Management System ('AHIMS'), service number 118615, centring on the Project Area with a 1000 m buffer. The search of the AHIMS Register returned no Aboriginal Sites within the search area.

As a result of the desktop study and field inspection of the proposed expansion to the Sly's Quarry extraction areas and consultation with Yaegl Local Aboriginal Land Council ('LALC') Sites Officer Dale Mercy, the following were agreed to:

(a) Parts of the Project Area have seen minimal past 'disturbance' within the meaning of the Due Diligence Code. Detailed archaeological research and modelling has therefore been undertaken (see Sections 5 and 6 below).

(b) No Indigenous cultural heritage sites or relics were identified within the proposed expansion areas of Sly's Quarry.

(c) No areas have been identified that are considered to potentially contain subsurface deposits of significant Aboriginal heritage.

(d) The Yaegl LALC representative agreed in discussion that no further Aboriginal cultural heritage investigation was required.

Recommendations: Indigenous Cultural Heritage

The following recommendations are cautionary in nature. Whilst it is considered unlikely that they will be required, they should be noted and adhered to, as they relate to managing the legal obligations of the Proponent, which will continue to apply in relation to cultural heritage.

Recommendation 1: Aboriginal Cultural Material Finds Procedure

It is recommended that if it is suspected that Aboriginal material has been uncovered as a result of earth working activities within the Project Area:

(a) work in the surrounding area is to stop immediately;

(b) a temporary fence is to be erected around the site, with a buffer zone of at least 10 metres around the known edge of the site;

(c) an appropriately qualified archaeological consultant is to be engaged to identify the material; and

(d) if the material is found to be of Aboriginal origin, the Aboriginal community is to be consulted in a manner as outlined in the OEH guidelines: Aboriginal Cultural Heritage Consultation Requirements for Proponents (2010).

Recommendation 2: Notifying the OEH

It is recommended that if Aboriginal cultural materials are uncovered as a result of development activities within the Project Area, they are to be registered as Sites in the Aboriginal Heritage Information Management System ('AHIMS') database managed by the OEH. Any management outcomes for the site will be included in the information provided to the OEH.

Recommendation 3: Aboriginal Human Remains

It is recommended that if human remains are located at any stage during earthworks within the Project Area, all works must halt in the immediate area to prevent any further impacts to the remains. The location where they were found should be cordoned off and the remains themselves should be left untouched. The nearest police station, the Yaegl LALC, and the OEH Regional Office (Coffs Harbour) are to be notified as soon as possible. If the remains are found to be of Aboriginal origin and the police release the scene, the Aboriginal community and the OEH should be consulted as to how the remains should be dealt with. Work may only resume after agreement is reached between all notified parties, provided it is in accordance with all parties' statutory obligations.

It is also recommended that in all dealings with Aboriginal human remains, the Proponent should use respectful language, bearing in mind that they are the remains of Aboriginal people rather than scientific specimens.

Recommendation 4: Conservation Principles

In the unlikely event that Aboriginal cultural heritage is identified during Project works, it is recommended that all effort must be taken to avoid any impacts on Aboriginal Cultural Heritage values. Should a situation arise where impacts to Aboriginal cultural heritage is unavoidable, mitigation measures should be negotiated between the Proponent, OEH and the Aboriginal Community.

Recommendations: Non-Indigenous (Historic) Heritage:

There are no recommendations with regard to historic heritage. The Project does not impact on places of historic heritage significance

CONTENTS

FIGURES

TABLES

DEFINITIONS

Aboriginal Object means any deposit, object or material evidence (not being a handicraft made for sale) relating to the Aboriginal habitation of the area that comprises New South Wales, being habitation before or concurrent with (or both) the occupation of that area by persons of non-Aboriginal extraction, and includes Aboriginal remains.

Aboriginal Place means any place declared to be an Aboriginal place (under s. 84 of the NPW Act) by the Minister administering the NPW Act, by order published in the NSW Government Gazette, because the Minister is of the opinion that the place is or was of special significance with respect to Aboriginal culture. It may or may not contain Aboriginal Objects.

ACHCR Guidelines means the OEH *Aboriginal Cultural Heritage Consultation Requirements for Proponents (2010).*

AHIMS means the Aboriginal Heritage Information Management System.

Archaeological Code of Practice means the OEH *Code of Practice for Archaeological Conduct in New South Wales (2010).*

Due Diligence Code means the OEH *Due Diligence Code of Practice for the Protection of Aboriginal Objects in New South Wales (2010).*

EPA Act means the *Environmental Planning and Assessment Act 1979 (NSW).*

EPBC Act means the *Environment Protection and Biodiversity Conservation Act 1999 (NSW).*

GHD means GHD Pty Ltd.

GSV means Ground Surface Visibility, and is a percentage of how much ground surface (bare earth) can be seen at the time an archaeological survey is conducted.

Heritage Act means the *Heritage Act 1977 (NSW).*

In-situ an archaeological technical term for features remaining undisturbed in their original context.

LEP means the Local Environmental Plan.

NCREP 1988 means the *North Coast Regional Environmental Plan 1988*.

NPW Act means the *National Parks and Wildlife Act 1974 (NSW).*

OEH means the New South Wales Office of Environment and Heritage.

PAD means Potential Archaeological Deposit.

PHU means Pacific Highway Upgrade.

Project Area means the land subject to Aboriginal cultural heritage assessment, and being part of Lot 2 DP 1055044 as shown in Figure 2.

Proponent means Newman Quarrying Pty Ltd, and all employees and contractors of the Proponent.

The Project means the proposed quarrying and extraction expansion area from 12.5ha to a proposed 42.55 extraction area also as identified in Figure 2.

The Consultant means qualified archaeological staff and/or contractors of Everick Heritage Consultants Pty Ltd.

TSC 1997 means the N.S.W *Threatened Species Conservation Act* 1997.

1. INTRODUCTION

1.1 Purpose of the Cultural Heritage Assessment

This assessment provides supporting information to an Application to the Director General for expansion of the existing Sly's Quarry at Lot 2 in DP 1055044 at Mororo in the Clarence Valley LGA, NSW ('the Project').

1.2 Proponent & Project Brief

Everick Heritage Consultants ('the Consultant') was commissioned by GHD Pty Ltd ('GHD') on behalf of its client Newman Quarrying Pty Ltd ('the Proponent') to undertake this assessment. The intent of the assessment is to identify any cultural heritage constraints to the expansion of the quarry. Risks to Aboriginal cultural heritage were assessed through archaeological survey and application of the Office of Environment and Heritage ('OEH') *Due Diligence Code for the Protection of Aboriginal Objects in NSW* (2010) ('Due Diligence Code').

1.3 Methodology used during this assessment

The brief for this project was to undertake a Due Diligence Assessment of suitable standard to be submitted as a stand-alone report. In accordance with the relevant administrative and legislative standards for New South Wales (see Section 2 below), the methods employed in this assessment included:

(a) searches of applicable Indigenous heritage registers;

(b) a review of current and historic satellite imagery;

(c) archaeological survey of the Project Area;

(d) desktop assessment;

(e) assessment of the Project Area in accordance with the Due Diligence Code; and

(f) a report of findings and recommended management strategies.

1.4 Defining the Project Area

The Project Area is in Northern New South Wales approximately 15 km north-west of the town of Iluka and approximately 25 km north of the township of Maclean (**Figure 1**). Lot 2 is approximately 374 ha. The application

would involve increasing the existing quarry by 12.5 ha to a total of 42.55 ha. Detailed plans of the lands under cultural heritage assessment ('Project Area') are provided in Figure 3.

1.5 Report Authorship

The site survey was undertaken by Everick Heritage qualified Senior Archaeologist Adrian Piper and Dale Mercy of Yaegl Local Aboriginal Land Council ('LALC') on 17 October 2014. The desktop study was undertaken by Adrian Piper and Tim Robins. This report was written by Adrian Piper assisted by Tim Robins and Tim Hill.

Figure 1: Regional location of the Project Area

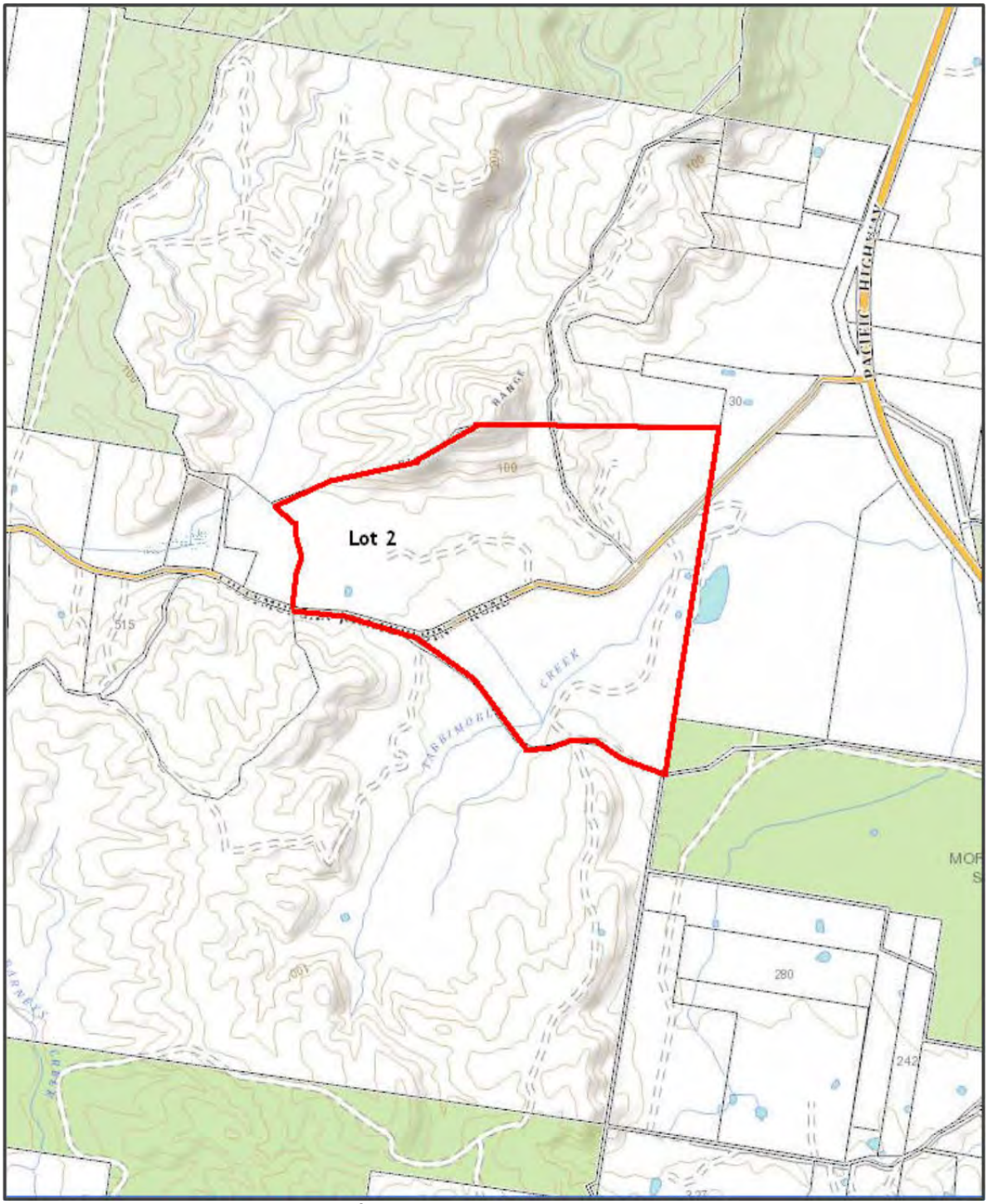

Figure 2: Location of the Project Area over 1:25000 topographic map.

2. LEGISLATIVE AND PLANNING CONTEXT

The following legislation provides the context for cultural heritage in NSW: the *National Parks and Wildlife Act 1974* (NSW) ('NPW Act'), the *Environmental Planning and Assessment Act 1979* (NSW) ('EPA Act') and Local Council Environmental Plans ('LEP') and Development Control Plans. The Commonwealth also has a role in the protection of nationally significant cultural heritage through the *Environmental Protection and Biodiversity Conservation Act 1999* (Cth) ('EPBC Act').

State legislative due diligence standards, as governed by the OEH, have also been referred to in this assessment. Whilst not strictly required, it is proposed that they offer assistance in objectively determining potential impacts and impact mitigation standards for the present scope of works.

In relation to cultural heritage, the proposed works primarily fall within the ambit of the *National Parks and Wildlife Act 1974* (NSW) ('NPW Act') and the *Heritage Act 1977* (NSW). The consent authorities will be the NSW Department of Planning and Environment and where a referral agency is required to be reported to, the OEH. The OEH will also be involved where the Project will impact on identified cultural heritage. The information below lists the legislative and policy framework within which this assessment is set.

The Commonwealth also has a role in the protection of nationally significant cultural heritage through the EPBCA Act *1999* (Cth) and *the Protection of Movable Cultural Heritage Act 1986* (Cth).

2.1 The National Parks and Wildlife Act 1974 (NSW)

The NPW Act is the primary legislation concerning the identification and protection of Aboriginal cultural heritage. It provides for the management of both Aboriginal Objects and Aboriginal Places. Under the NPW Act, an Aboriginal Object is any deposit, object or material evidence (not being a handicraft made for sale) relating to the Aboriginal habitation of the area, regardless of whether the evidence of habitation occurred before or after non-Aboriginal settlement of the land. This means that every Aboriginal Object, regardless of its size or seeming isolation from other Objects, is protected under the Act.

An Aboriginal Place is an area of particular significance to Aboriginal people which has been *declared* an Aboriginal Place by the Minister. The drafting of this legislation reflects the traditional focus on Objects, rather than on areas of significance such as story places and ceremonial grounds. However, a gradual shift in cultural heritage management practices, towards recognising the value of identifying the significance of areas to Indigenous peoples beyond their physical attributes, can be seen in local and State government policies (such as

the Aboriginal Cultural Heritage Consultation Requirements for Proponents ('ACHCR') Guidelines discussed below).

Under Section 86 of the NPW Act, it is an offence to disturb, move, remove or destroy an Aboriginal Object without the consent of the Chief Executive of the OEH. This consent can be either to Investigate (Section 87) or Destroy (Section 90). If a land user is seeking Consent to Destroy, best practice is to generally seek a Section 87 permit first, and then demonstrate to the OEH the minimal significance of the site before applying for a Section 90 Consent. Before applying for Consent under Section 87 or 90, the applicant must undertake broad-based Aboriginal community consultation in accordance with the ACHCR Guidelines discussed below.

2.2 Due Diligence Code of Practice for the Protection of Aboriginal Objects

The Due Diligence Code has been applied to this assessment, and is addressed in Section 9 of this assessment. It operates by posing a series of questions for land users before they commence development. These questions are based around assessing previous ground disturbance. An activity will generally be unlikely to harm Aboriginal Objects where it:

- will cause no additional ground disturbance; or
- is in a developed area; or
- is in a significantly disturbed area.

Where these criteria are not fulfilled, further assessment for Aboriginal cultural heritage will typically be required prior to commencing the activity.

2.3 The ACHCRP (2010)

The ACHCRP (2010) Guidelines provide an acceptable framework for conducting Aboriginal community consultation in preparation for impacts to Aboriginal cultural heritage. Proponents are required to follow them where a Project is likely to impact on cultural heritage and where required by Council. It is recommended by the OEH that all cultural heritage assessments involve this level of consultation, although it is not strictly a requirement unless it meets the above criteria.

The ACHCR Guidelines typically take a minimum of 90 days to complete. However, in complicated Projects this period may need to be extended by several months. The Guidelines require public notice of the assessment, preparation of a proposed methodology, undertaking site meetings and excavations where required, the

production of a draft report, which is distributed to the registered Aboriginal groups and the production of a final report. Although not strictly required, a thorough consultation process will treat the ACHCR Guidelines as a minimum standard of community consultation. Generally, consultants must go to further effort to identify the significance of a given site to the Aboriginal community. This will likely include undertaking additional site inspections if requested by Aboriginal stakeholders, fully resourcing the community by providing copies of past archaeological and environmental assessments in the region and meeting with community members to ascertain their opinions of the site.

2.4 The Heritage Act 1977 (NSW)

The *Heritage Act 1977* (NSW) ('Heritage Act') is aimed at identifying and protecting significant items of historic (as opposed to Aboriginal) cultural heritage. The focus of the legislation is on identifying places of either local or state heritage significance, and protecting them by registration on heritage registers. Significant historic heritage items are afforded little protection (other than at the discretion of councils) where they are not on a heritage register.

Of note are the provisions allowing for interim heritage orders (Part 3), which grants the Minister or the Minister's delegates, (which importantly may include a local government agent) the power to enter a property and provide emergency protection for places that have not yet been put on a heritage register but that may be of local or State significance.

The Heritage Act also makes allowances for the protection of archaeological deposits and relics (Part 6). An archaeological 'relic' means any deposit, object or material evidence which relates to the settlement of the area, not being Aboriginal settlement. Importantly, a former requirement for an archaeological relic to be 50 years or older has recently been repealed. The focus is now on the item's potential heritage significance, not its age. As will be discussed below, it is highly unlikely that archaeological relics of significant historic sites are located within the Project Area.

2.5 Clarence Valley Local Environmental Plan 2012

The Clarence Valley LEP 2012 provides statutory protection for items already listed as being of heritage significance (Schedule 5), items that fall under the ambit of the Heritage Act and Aboriginal Objects under the NPW Act. It ensures that essential best practice components of the heritage decision making process are followed.

Under the Clarence Valley LEP Development consent is required for any of the following:

(a) demolishing or moving any of the following or altering the exterior of any of the following (including, in the case of a building, making changes to its detail, fabric, finish or appearance):

(i) a heritage item; or

(ii) an Aboriginal Object; or

(iii) a building, work, relic or tree within a heritage conservation area;

(b) altering a heritage item that is a building by making structural changes to its interior or by making changes to anything inside the item that is specified in Schedule 5 in relation to the item;

(c) disturbing or excavating an archaeological site while knowing, or having reasonable cause to suspect, that the disturbance or excavation will or is likely to result in a relic being discovered, exposed, moved, damaged or destroyed;

(d) disturbing or excavating an Aboriginal place of heritage;

(e) erecting a building on land:

(i) on which a heritage item is located or that is within a heritage conservation area; or

(ii) on which an Aboriginal object is located or that is within an Aboriginal place of heritage significance;

(f) subdividing land:

(i) on which a heritage item is located or that is within a heritage conservation area; or

(ii) on which an Aboriginal object is located or that is within an Aboriginal place of heritage significance.

2.6 The North Coast Regional Environmental Plan (NCREP 1988)

The *North Coast Regional Environmental Plan 1988* ('NCREP 1988') recognises the importance of regionally significant heritage items and places to the State of NSW. It provides statutory protection for a select number of state and regionally significant heritage items and places in northern NSW. A 'heritage item' means a building, work, relic, tree or place of heritage significance to the North Coast Region specified as described in Schedule 2 or 3 of the NCREP 1988.

For these items, the Richmond Council remains the consent authority. Under the NCREP 1988, Council must consider:

a) the views of the Heritage Council;

b) the heritage significance of the item to the State or region;

c) the extent to which the carrying out of the development would affect the heritage significance of the item and its site;

d) whether the setting of the item, and in particular, whether any stylistic, horticultural or archaeological features of the setting should be retained;

e) measures taken to conserve and preserve the heritage item, including where appropriate, any conservation plan; and

f) if the item constitutes a danger to the users or occupiers.

3. DESCRIPTION OF PROPOSED WORKS

Newman Quarrying Pty Ltd operates Sly's Quarry to produce excavated sandstone rock products. Newman Quarrying intends to seek development consent for an expansion of the existing sandstone quarry so as to increase the area of land where sandstone extraction is approved by 19.6 ha (Figure 3), and increase the maximum annual rate of extraction of sandstone materials to 500,000 tonnes per annum.

The existing sandstone quarry operation takes place in the eastern section of Lot 2 on the northern side of Jackybulbin Road. The current development consent for quarrying on Lot 2 also covers the extraction of sand from the western section (on the northern side), and on the southern side of Jackybulbin Road. The sand extraction involves excavation of *insitu* sand to a depth of 1-4 m. The two sand extraction pits would be closed and rehabilitated, if the current proposal is approved.

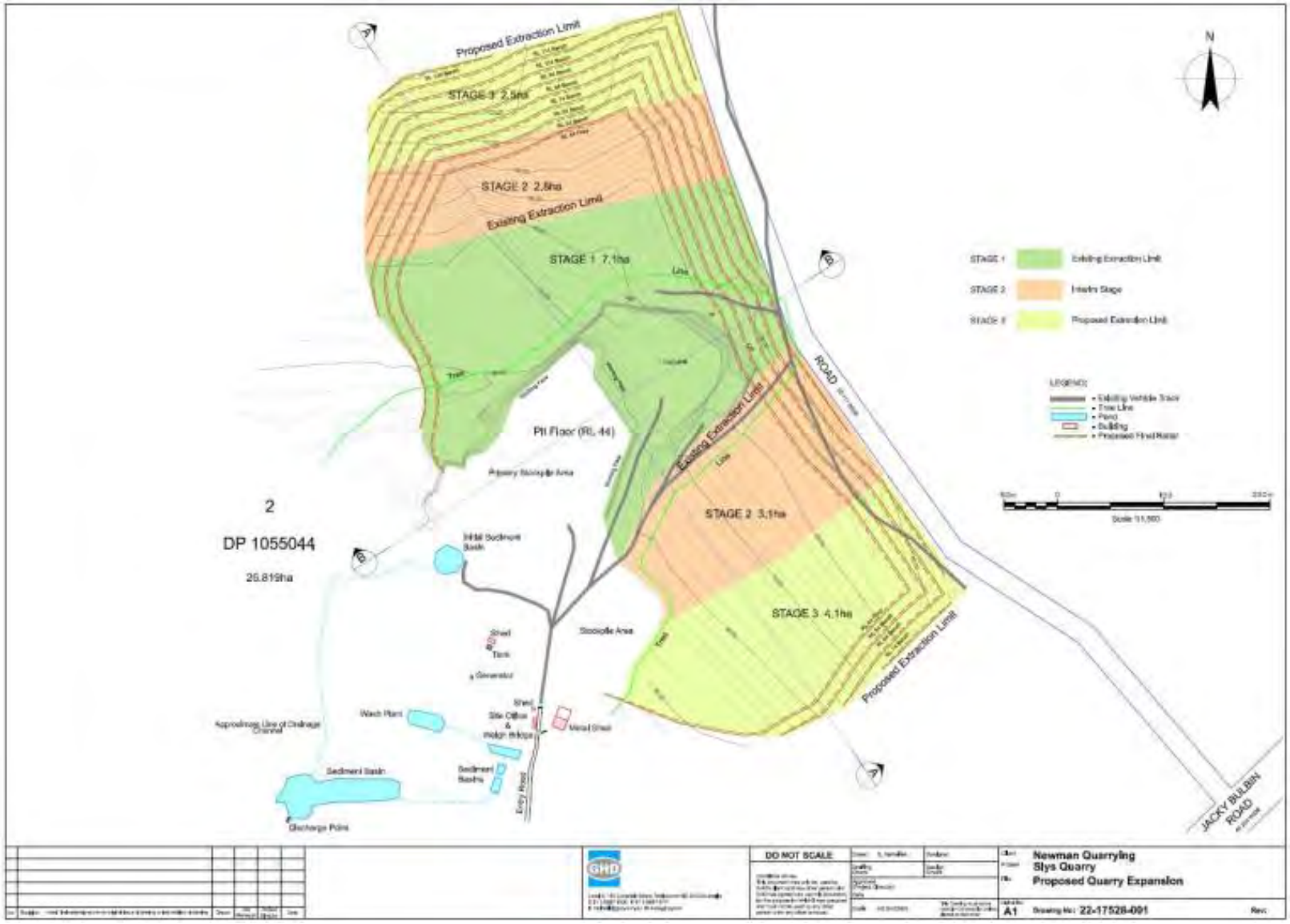

Figure 3: Map of proposed quarry expansion areas

4. ENVIRONMENTAL CONTEXT

4.1 Geology and Soils

The Project Area geology is 'Kangaroo Creek' sandstone formations, which are believed to date from the mid-to-late Jurassic or possibly mid-to-late Cretaceous periods. In the locality of the quarry, these sandstone deposits are generally well-exposed and quite accessible. The Kangaroo Creek sandstone is estimated to range in thickness from 150 m to 500 m within the Project Area. At the existing quarry face, the sandstone exists in a series of beds ranging in thickness from less than 1 m to up to 3 m. The beds are separated by thin layers of fine sandstone, siltstone and carbonaceous material (Novoplan 2014:9).

The area generally has poor soils of sandy composition mostly derived from the underlying sandstone. In lower-lying areas soils may be derived from stream deposition.

4.2 Vegetation

The lower slopes of Lot 2 north of Jackybulbin Road have been extensively cleared although there is a substantial treed buffer of dry sclerophyll forest along most of the road frontage. The clearing may have resulted from a long history of selective logging on the site and in the area. It is also associated with the sand extraction and quarrying activities approved for Lot 2 as mentioned above. The higher slopes of the quarry site retain extensive vegetation cover of open dry sclerophyll forest that includes dense under storey and many large native trees dominated by Blackbutt, Angophora and Syncarpia species. Vegetation arising from a wetter microclimate lies along the lines of watercourses (Novo Plan 2014: 10).

Historically, Lot 2 and the quarry site have had little or no agricultural activity, due to the poor soils and forest coverage. However there has been extensive long term logging and burning that has impacted on the forest cover. While there are some old growth trees, most other trees are in the region of 40-60 years old (NovoPlan 2014: 10).

4.3 Water sources

The quarry site drains from north to south via a number of intermittent watercourses that flow under Jackybulbin Road into Tabbimoble Creek. The creek in turn flows north-east into low coastal swamp land in the Bundjalung National Park and ultimately into the Esk River, a minor tributary to the Clarence that enters the river

near Iluka. The quarry site is not liable to riverine flooding although its intermittent watercourses can flow briskly during periods of heavy rain. (Novoplan 2014: 10).

4.4 Review of Historic Aerial Photography

Historic images from 1966, 1980 and 1993 show the level of prior land disturbance within the Project Area.

The 1966 image shows that no clearing had been undertaken within the project area. At this time the Project Area consisted mainly of open woodland. Jackybulbin Road is visible at this time.

By 1980 two small quarries are visible in the northern portion of the Project Area. The southern of these two quarries appears to be the initial stage of Sly's Quarry.

By 1993 the quarry footprint is developed and indicates full operation. No additional clearing appears to have taken place immediately adjacent to the quarry.

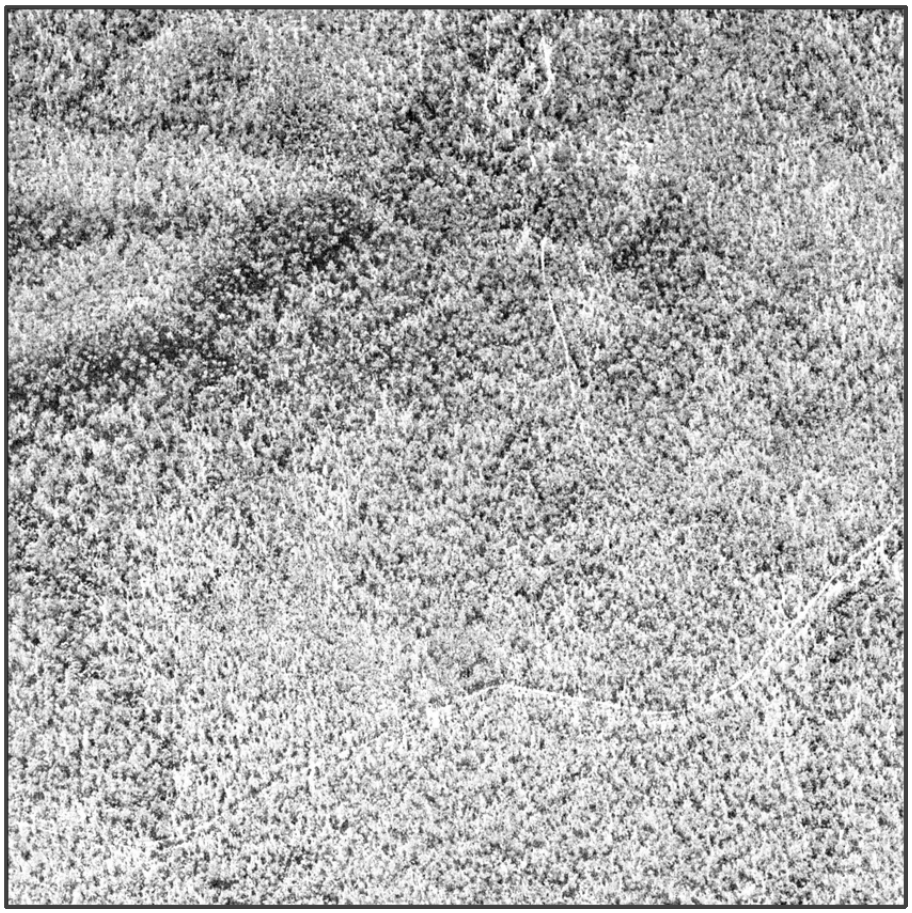

Figure 4: Sly's Quarry Project Area 1966

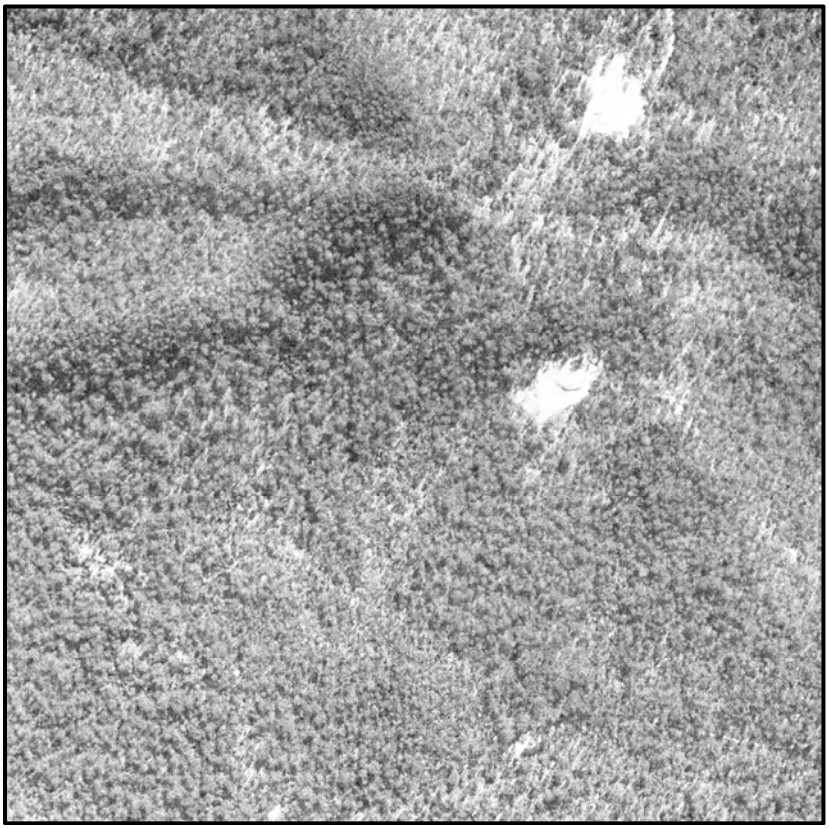

Figure 5: Sly's Quary Project Area 1980

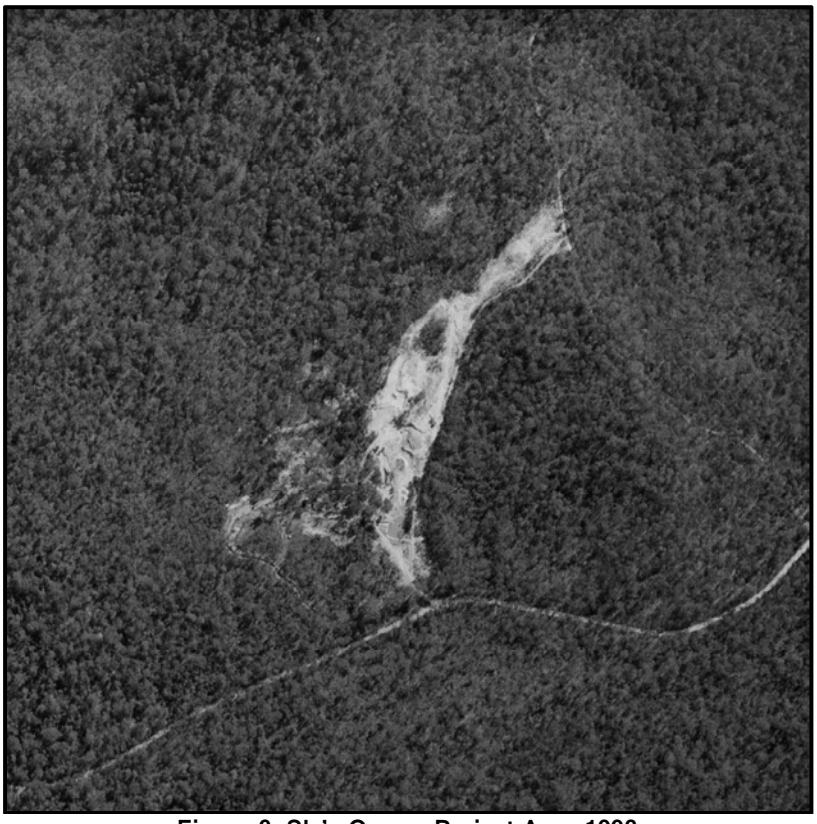

Figure 6: Sly's Quarry Project Area 1993

5. DESKTOP REVIEW: ABORIGINAL CULTURAL HERITAGE

5.1 Traditional Owner Knowledge

The Aboriginal Stakeholders are the primary determinants of the significance of their cultural heritage. Members of the Aboriginal community have been consulted in this instance, with regard to known archaeological sites in the region, and cultural values such as areas of historic and spiritual significance and values relating to flora and fauna. Everick recognise that there is Traditional Owner knowledge associated with the region that may have to be treated in a confidential manner.

5.2 Previous Indigenous Archaeological Assessments

The purpose of a review of previous archaeological and broader Aboriginal cultural heritage assessments is to provide insights into the potential types and locations of sites to be found in the wider locality. However the information must be used bearing in mind topography, access to food and material resources and the past and potential impacts of European land uses. It is seldom that the assessment purpose, environmental, historical and social contexts between one area of assessment and another allows the simple extrapolation of previous results to a current project assessment.

A broad outline of the known chronology of occupation of the immediate coastal zone between the Tweed and the Clarence Rivers is outlined below. The Aboriginal occupation of the Clarence region fits within the known chronology for the far North Coast. Coastal sites in northern N.S.W. date to within the Holocene period. The earliest of these is a shell midden at the base of Sexton Hill on the lower Tweed River where an occupation phase was dated between 4,700 BP and 4,200 BP (Appleton 1993:34). At Ballina a shell midden on Chickiba Creek was found to have accumulated between 1,750 BP and c.100 BP (Bailey 1975:52). Shell samples from the Angels Beach area are dated between 800 BP and 530 BP, with one sample at 900-1,000 BP (Rich 1994: 195). Stone artefacts were assessed on technological grounds to date to within the past 2,000 years (Rich 1994: 161). Bailey's basal date of 1,750 BP (1974) suggests that the modern resource-rich environment may not have been productive enough at an earlier time to support any more than small groups. In contrast, the Tweed River estuarine site was in use some 3,000 years earlier than this (Appleton 1993).

Beach foreshore sites investigated to date have been associated with more recent phases of occupation. Fore dune sites typically take the form of narrow bands of pipi shell, or surface scatters of pipi and stone artefacts. Pipi horizons at South Ballina and Broadwater have dated to 260 years BP and 200 years BP respectively (McBryde 1982: 77). A more substantial pipi midden (AHIMS: #04-06-0061) investigated on the beach foreshore

at Byron Bay had been used between approximately 1,000 and 400 years BP. The 80 cm deep midden deposit was overwhelmingly dominated by pipi shell, with minor inclusions of periwinkle, limpet, sand snail, oyster and cartrut. Bream was the most abundant vertebrate species. Although in lower quantities relative to bream, a broad range of fauna was represented in the midden, including other types of fish, tortoise, macropods, bandicoot, possums, rodents, birds and reptiles. The midden's stone assemblage was characterized by primary flaking debitage which reflected the poor knapping quality of the raw materials used. All of these materials are believed to have been collected from intertidal pebble beds adjacent to the site (Collins 1994).

The earliest dated coastal site in the Clarence area is the estuarine midden at Woomba, now located 10 km inland and 10.5 km south east of the Project Area. The deposit indicated an occupation phase between c. 3260 BP and the contact period (McBryde 1974). The Woomba site had been the earliest known coastal occupation site in northern New South Wales until a shell midden excavation on the Tweed River indicated an occupation phase between 4,700 BP and 4,200 BP (Appleton 1993). At the Woombah site the bulk of shell remains were oyster (90%). Animal and fish bone were rare, suggesting that the economy was based almost entirely around the gathering of shellfish (McBryde 1974: 290). Few stone artefacts were represented. The stone kit consisted of unifaced pebble tools, perhaps used for preparing plant foods, ground edge axes, utilised flakes, some small retouched tools and a few bone points (McBryde 1974: 290). The presence of glass artefacts indicated use of the site into the contact period. Despite the high volume of shell, McBryde concluded the site represented a great number of short sporadic occupations of the site, seasonal visits lasting only a few months (McBryde 1974: 288). Bailey (1975) drew similar conclusions from his calorific research of the North Creek Ballina oyster middens. The oysters provided little more than a minor supplement to the diet and the middens could only have been amassed by large groups over a matter of days (Bailey 1975: 57-59).

Archaeological assessment by Piper of the northern approaches to the Mororo Bridge identified three sites of isolated artefacts on low spurs adjoining the floodplain. The materials were a scraper/core, a retouched flake and flakes all on siliceous materials (Piper 1991). An earlier archaeological assessment sampled the low foothills, floodplain and the dune fields adjacent to Iluka Road and the Clarence River. No Aboriginal sites were identified in the hills and sloped landform units (Piper 1982). Byrne's Heritage Study of the Maclean Shire identified the suite of sites, principally middens, between Woomba and Woody Head as worthy of Class 1 status, Complete Conservation that if adopted required that all designated developments be preceded by archaeological surveys and all sites be retained (Byrne 1986).

Aboriginal cultural heritage assessments in relation to the Pacific Highway Upgrade ('PHU') Woolgoolga to Ballina, have been the most numerous comprehensive studies in this region, be it by necessity, in a narrow corridor of search and subsequent archaeological investigations. The Iluka Road to Woodburn assessment section resulted in seven Aboriginal heritage sites and two Potential Archaeological Deposits ('PAD') (both

associated with existing sites) being located within or near the PHU project boundary i.e. the highway upgrade corridor. These included one scarred tree near New Italy (13-1-0111) and a burial area at Sawpit Creek south of New Italy (13-1-0059). In the vicinity of the Woodburn Interchange an artefact scatter and PAD (13-1-0112), an isolated artefact and a PAD (13-1-0115) as well as an isolated artefact (13-1-0113) were found. The PADs returned 11 mainly silcrete artefacts and three artefacts respectively from test pits on the spurs from the Richmond Ranges called the Tabbimobile rises (EIS 2012:50-54). The sites were assessed as being of moderate to high overall Aboriginal significance with exception of isolated artefacts 13-1-113 and 13-1-0114 which were deemed low (NSW RMS EIS 2013:56).

5.3 The OEH Aboriginal Heritage Information Management System (AHIMS)

Care should be taken when using the AHIMS database to reach conclusions about site prevalence or distribution. For example, a lack of sites in a given area should not be seen as evidence that the area was not occupied by Aboriginal people. It may simply be an indication that it has not been surveyed for Aboriginal sites, or that the survey was undertaken in areas of poor surface visibility. Further, care needs to be taken when looking at the classification of sites. For example, the decision to classify a site an artefact scatter containing shell, rather than a midden, can be a highly subjective exercise, the threshold for which may vary between archaeologists. There are also errors with the data.

A search was conducted on 6 October 2014 of the OEH AHIMS (AHIMS service number 118615), centring on the Project Area with a 1000 m buffer. The search of the AHIMS Register returned no Aboriginal Sites within the search area (Appendix A).

5.4 Other Heritage Register Searches

The following heritage registers were accessed for Indigenous places located in the Clarence Valley area:

- **The World Heritage List**: Contains no Aboriginal heritage listings places within close proximity to the Project Area.
- **Register of the National Estate**: Contains no Aboriginal heritage listings places within close proximity to the Project Area.
- **Commonwealth Heritage List (Australian Heritage Council)**: Contains no Aboriginal heritage listings places within close proximity to the Project Area.
- **The National Heritage List (Australian Heritage Council)**: Contains no Aboriginal heritage listings places within close proximity to the Project Area.

- **The State Heritage Register (NSW Heritage Office)**: Contains no Aboriginal heritage listings places within close proximity to the Project Area.
- **The Clarence Valley LEP 2012**: Contains no Aboriginal heritage listings places within close proximity to the Project Area.

5.5 Cultural Context

5.5.1 Settlement

The Aboriginal people of the lower Clarence River were part of linguistically and culturally associated groups called the Bundjalung, the coastal extent of which occupied the Clarence to Logan Rivers and west to the Dividing Range (Crowley 1978). Tindale (1974) recorded a Jiegera tribe occupying the Clarence River upstream to Grafton. Modern usage refers to the 'Yargir' (Yaegl) as the traditional Aboriginal occupants. Heron (1991) records that the 'Yargir' is more closely related to the southern Gumbaybggir than the Bundjaung, their territory extended south to Corindi Beach, west to Ulmara and north to the Clarence River including 98 of the 100 islands of the Clarence River (Heron 1991: 10). While 'Yargir' country is smaller than neighbouring territories, it is one of the richest in the region in terms of natural resources (Heron 1991: 16).

A review of sightings of Aboriginal coastal groups in Coleman's review of ethno historical sources led her to the conclusion that in the initial stages of European contact, observers of coastal groups described; '…consistently high, semi sedentary local populations on the coast with a highly sophisticated organic material culture which vanished almost overnight with European contact' (Coleman 1982: 7). Population densities for the lower Clarence are considered high, no doubt reflecting the wide variety of ecologies and hunting/gathering opportunities contained. Fry, Commissioner for Lands in the Clarence District, estimated the population for the Clarence as between 525 and 1050 persons (Fry 1894 in Belshaw 1978), a density of one person per three to six square miles.

Later researchers consider that populations for the coastal plains and estuaries were much higher, at possibly one person per three square miles between the Clarence and Evans Rivers (Belshaw 1978: 730). In areas where marine and terrestrial foods were particularly abundant, which would apply to the lower Clarence, estimates may be placed even higher (Pierce 1978; Heron 1991). Population estimates by eye witnesses of Aboriginal numbers for the coastal regions, immediately after European settlement, are highly likely to be underestimates of pre contact numbers due to the impacts of diseases, particularly small pox that spread throughout coastal groups prior to official settlement.

Land belonged to clan groups whose boundaries had been established in Yargir mythology (Creamer and Godwin 1984). Contact between local clans and more distant groups took place for the purposes of exchange, inter marriage, initiations, armed conflict and at times of seasonally abundant food supply. There are two current demographic models to describe possible settlement/movement patterns. One suggests that clan groups would range between the sea coast and the foothills of the coastal ranges on a seasonal basis (McBryde 1974). On ethno-historical evidence McBryde suggests that some seasonal movement was common and that the basic subsistence economy of hunting, fishing and gathering was neither static, nor completely migratory, but characterised by movement between the coast and the foothills (McBryde 1974: 337). A number of early references refer to seasonal movement on a limited scale including Ainsworth (1922) on the Richmond River, Dawson (1935: 25) and McFarlane (1934) on the Clarence River. Bray (1923) states that the Lismore 'tribe' used to go to Ballina at the mouth of the river. Sullivan (1976: 20) notes that inland groups were allowed to come to the Tweed coast for a time. The archaeological evidence for movement in the coastal river valleys is less conclusive (McBryde 1974: 338).

From the few eye witness sources available for the North Coast we can suggest that contact between members of the coastal clans was frequent and may have involved relatively large numbers. Bray records that the coastal Coodjinburra '…used to mix very much with the Ballina Richmond River Blacks' (Bray 1901:9). However it may have been a way of life that rapidly disappeared under the impacts of disease and restrictions on Aboriginal groups by 'authorities' on the movement of Aboriginal people. A review of sightings of Aboriginal coastal groups in Coleman's review of ethno historical sources led her to a conclusion that in the initial stages of European contact, observers of coastal groups describe, '…consistently high, semi sedentary local populations on the coast with a highly sophisticated organic material culture which vanished almost overnight with European contact' (Coleman 1982:7).

McBryde (1974 and 1976) argues for a seasonal movement of people between the coast in summer exploiting marine foods and hunting inland in winter. On the ethno-historical evidence McBryde suggested that some seasonal movement was usual and that the basic subsistence economy of hunting, fishing and gathering was neither static, nor completely migratory, but characterised by movement between the coast and the foothills (McBryde 1974: 337). A number of early references refer to seasonal movement on a limited scale including Ainsworth (1922) on the Richmond River and Dawson (1935) and McFarlane on the Clarence River. Bray (1923) states that the Lismore 'tribe' used to go to Ballina at the mouth of the river. Sullivan (1964: 20) recorded that inland groups were allowed to come to the Tweed coast for a time. The archaeological evidence for movement in the coastal river valleys is less conclusive (McBryde 1974: 338).

5.5.2 Economy

Early recorders of the Yargir economy emphasise the major role of marine foods in their diet. Small, an early resident, observed that while on the coast Yargir people lived on fish and shellfish of all kinds, especially oysters (Small 1898: 46-47). Gray described the Yargir fishing near Micalo Island to the south east of the Project Area. '*Each man had a net made of stinging bark tree attached to a bough about six feet long. Holding a net in each hand they would encircle a school of sea mullet and catch dray loads of the best fish I ever saw*' (Gray 1972). Fishing was conducted by spear (single point) and net on the Clarence, Tweed and Richmond Rivers. Neither the shell fishhook, nor pronged or barbed spear is evident in the archaeological record or in the ethnohistorical record (McBryde 1974). Fish traps were 'made by mangrove bushes arranged in such a way, fish found their way to the centre and weren't able to find their way out' (McCarthy 1917). The use of a natural fish trap on a rock platform at Angourie is recorded by Heron (1993: 24).

Ethnohistorical records are largely directed towards descriptions of hunting techniques employing large groups of people and obvious types of technology requiring demonstrable physical skills; the use of spears, clubs, boomerangs, the 'tow-row' (net) etc. The role of plant foods in the local economy is often understated or overlooked entirely. Certainly, vegetable foods are given no particular prominence in Ainsworth's recollections at Ballina. He refers to yams obtainable in the scrubs, and to bread made from nuts which grew on the coastal headland (Ainsworth 1922: 43). McFarlane (1934), writing of the Clarence River, placed greater emphasis on the role of vegetable foods *'..the woods supply much variety in the shape of fruit or berries but every description of vegetable contributed to the digestive requirements of the collector of food necessities*'.

Aboriginal use of plant foods in the Yamba area has been documented in Heron's (1991) study of the Yargir people. Heron's informants describe the use of Cheeky face yam (Dioscorea bulbifera), Rock fig (Ficus platypoda), Lillypilly (Syzygium paniculatum), Pigface (Carpobrotus glaucesens), Mistletoe (Amyema sp.) and Cunjevoi (Aloasia macrorrhizos) both as a food and medicine. The use of the scrub lily and cunjevoi, a poisonous plant rendered edible after being soaked, ground and kneaded into a cake, is recorded by Small (1898).

The most detailed analysis of material culture of the North Coast has been that undertaken by McBryde (1978). McBryde's sources refer to shields (McFarlane 1934; Dawson 1935), single point fire hardened spears, three types of boomerangs (Dawson 1935), clubs, nulla nulla and pademelon sticks (McFarlane 1934), wooden battle axes, stone axes, digging sticks, bark and palm leaf bags, wooden water vessels, possum rugs, cane and shell necklaces and stone knives (Bundock 1898).

The region of the Tweed, Richmond and Clarence Rivers appears to form a distinct unit. This is particularly so in the case of fishing technology. The multi-pronged fishing spear and the shellfish hook are both absent from this

region. Fish were caught in nets or speared in the shallows (McBryde 1978: 187). Spears were single pointed fire hardened weapons (Dawson 1935: 22), of both lighter and heavier varieties (Byrne 1986: 3). Neither the woomera nor the spear throwing stick was used in this region (Dawson 1935: 22). The range of materials is considered wider than observed in central Australian tribes with fewer all-purpose items, few composite tools and a number of specialised ones. This may reflect a more sedentary life style in a rich environment that required fewer, but more specialised, tools (McBryde 1978: 187). The stone tool element in the material culture was small and unspecialised. The archaeological evidence suggests changes to a simpler stone technology took place only centuries before European settlement. The stone tools in use immediately prior to European settlement, 'show little typological sophistication and did not demand highly skilled craftsmanship' (McBryde 1978: 198).

6. PREDICTIVE MODEL

Previous archaeological and cultural heritage assessments have been limited in terms of the range of landscapes that they have assessed. In addition, there is insubstantial data about the propensity of different landform types to contain a greater or lesser 'body' of archaeological evidence. Previous archaeological assessments in this region have been invariably hindered by the lack of accessible land, and the limited range and area of landforms available to archaeologists. For this reason, researchers are not able to make confident comparisons as to the likelihood or otherwise of Aboriginal sites.

6.1 Predictive Models - Environmental & Landscape Context

From previous assessments we can say that to date, Aboriginal campsites in this coastal zone locality have been identified on dune fields, low hills and spurs that adjoin the Clarence River. They are also identified on some ridgelines, and within rock shelters at higher elevations. These sites statistically tend to be artefact scatters and isolated artefacts. Scarred trees, which would have been in far greater numbers in the region, mainly around regularly used campsites, have almost entirely disappeared due to clearing, cropping, urbanisation and natural processes.

One prevailing model in North Coast Aboriginal archaeology is the use of ridge lines as transit corridors between river valleys and major tributaries within those systems, advanced by many including Byrne (1984), and more recently Fox (2003). In the ridge line landform context, archaeological evidence has been found to consist similarly of artefact scatters, scarred trees and isolated artefacts in 'open' situations as opposed to rock shelters and caves. Associations between ridge line sites, in terms of their contemporaneousness and contents, have not been adequately tested by archaeological investigation. While ridge lines may have served as transit corridors

for Aboriginal groups on a sporadic basis their use as campsites is dependent upon other factors apart from slope, such as shelter from wind, ground covers, dryness, access to water ,material and food resources. In this case the lower eastern and southern margins of Mt Doubleduke adjoining the Clarence River floodplain would appear to have a higher potential than the mid to upper slopes that comprise the Project Area. Few if any sites would be found on the sloping sides of these ridges (Hughes 1991: 5-1). A lack of permanent water would also mitigate against Aboriginal sites of a permanent nature.

6.2 Aboriginal Sites and Features

The Project Area is located in what is considered inland open forest, however it is likely that during the mid to late Holocene period (that is less than 5000 BP) the coastline would have been significantly closer than its present position. There are no specific features of the Project Area or areas that could be demonstrated to have been particularly lucrative in terms of food or material resources that would warrant a moderate to high rating of potential for Aboriginal archaeological sites. The Project Area is not a natural corridor that would link creek headwaters or an area that would have provided distinct natural transit corridors between the coastal main range and the coastal plain and coast.

While there may be no surviving physical evidence of former Aboriginal sites within the landscape, the Aboriginal community may retain anecdotal traditions of ceremonial use and spiritual or mythological connections to a given location. Consultation, found no specific Aboriginal cultural associations with the current Project Area.

The following types of archaeological sites have a low to moderate potential to occur in the Project Area.

6.2.1 Isolated artefacts

These consist of single stone artefacts, which may have been randomly discarded or lost. They may occur in almost any environmental context exploited by Aboriginal people. They are commonly stone axes, single cores, hammer stones, bevelled pounders, pebbles and flakes. Their presence may indicate that more extensive scatters of stone artefacts exist or existed nearby, perhaps obscured by vegetation or dispersed by mechanical means.

It is predicted that this site type is the most likely type of site to occur within the Project Area, but would be more likely found in potential transit/camp areas on the ridge crest (Sly's Road) to the east of the Project Area. Given the steep and moderate slopes it is expected that isolated artefacts have a low potential to occur within the Project Area.

6.2.2 Artefact Scatters

The greatest number of recorded sites on the coastal plains and hills in this region are middens and artefact scatters. Artefact scatters may be found in almost any elevated position usually adjacent to wetlands or creeks. They may also be found on low grades or the level sections of ridge crests and spur lines, particularly where higher ground tapers toward the coastal plain. Materials at these sites are generally stone artefact material only.

As for isolated artefacts it is accepted that this this type of site has a low potential to occur within the Project landscape however ground disturbances through selective logging over a long period and a number of bushfire episodes suggests that the potential for this site type to remain *in situ* and intact is low.

6.2.3 Burial Sites

Burial sites cannot be excluded as there are records of numbers of burial locations in the coastal northern New South Wales region. The majority of these have been found in coastal sand substrate situations particularly in association with middens. Numbers of Aboriginal burials are registered with the OEH AHIMS in the dune fields between the Richmond River and Evans Head. There is a particular concentration of burials in the South Ballina Empire Vale dune fields. There is anecdotal and field evidence of burials on hilltops, rock shelters and rock faces within the Richmond and Tweed Valley regions, much of this information is confidential. The potential for this site type to occur within Area A of the Project Area is considered to be low/moderate due to the sand stone escarpment between the 100-120 m contour that contains small crevices and overhangs suitable for secondary interments (See Section 7: Figure 7 below). Area B is an open woodland side slope vegetated with regrowth with no potential for burials (Figure 7).

6.2.4 Scarred Trees

The majority of scarred trees on the North Coast of NSW result from the removal of bark for use as covering, shields, containers or canoes. There may also be carved trees where the bark has been removed and geometric patterns incised on the tap wood. Generally scarred tree sites are rare due to the extent of forest clearing and the natural aging and collapse of such trees that may have survived. There are few if any old growth trees within the Project Area, therefore scarred trees are of a low potential.

6.2.5 Quarries

The Project Area is comprised of sandstone, which is not typically used for the production of stone tools. Production of grindstones and grinding tools is a possibility however.

7. FIELD SURVEY: INDIGENOUS CULTURAL HERITAGE

7.1 Aboriginal Participation

The Project Area is within the area administered for Aboriginal cultural heritage purposes by Yaegl LALC. A survey for Aboriginal cultural heritage at the Sly's Quarry was undertaken by Mr. Dale Mercy, Sites Officer of the Yaegl LALC and Adrian Piper of Everick Heritage Consultants, on 17 October 2014.

7.2 Field Methods – Sampling Strategy and Recording

The archaeological or scientific aim of the survey was to locate physical evidence of Aboriginal occupation within the Project Area; the evidence of which is most commonly stone artefact scatters, middens and individual (isolated) artefacts. Woodland areas with 'old growth' trees would be inspected for evidence of Aboriginal scarring due to bark removal or holes/notches cut into bark and tap wood. The survey methods aimed to inspect exposed ground surfaces as conditions would allow, to record any archaeological material found and assess its significance, and assess the potential for concealed Aboriginal archaeological sites. For the purposes of describing the archaeological characteristics of the Project Area, the lands assessed have been divided into Area A and Area B. Each has distinct environmental and and use characteristics relevant to the assessment of archaeological potential.

Area A is so steep, densely vegetated and with a closed ground cover almost throughout, that it was not possible to undertake a field inspection in a systematic grid pattern of search (Figure 7). The areas of greatest surface visibility were the surveyed, mechanically cleared, northern and southern boundary lines of approximately 10-15 m width. The sandstone escarpment through the centre of Area A (Area A1) was of particular interest for its potential to contain rock shelters or overhangs that could provide Aboriginal habitation. GPS points were taken to approximately delineate the extent of the sandstone escarpment and lines of travel.

Area B is a moderate slope, similarly densely vegetated with post fire regrowth with a closed ground cover. There are no sandstone outcrops (Figure 7). Transects of approximately 30 m were undertaken across the slope. Search was confined to any surviving old growth trees for Aboriginal tree scars. GPS points were taken to approximately delineate lines of travel.

Photographs were taken as a record of general features and conditions, and to document the degree of surface visibility. Notes were made of the degree of surface visibility, the area of visibility, ground cover, land uses and any other relevant features.

Figure 7: Sly's Quarry expansion archaeological search areas

7.3 Constraints to Site Detection

An assessment of the constraints to site detection is made to assist in formulating a view as to the effectiveness of the field inspection to find Aboriginal sites and cultural materials. It also assists in the forming of a view of the likelihood of concealed sites, keeping in mind a site specific knowledge of the impacts that European land uses and natural processes may have had on the 'survivability' of Aboriginal sites in a Project Area.

The constraints to site detection are influenced by previous European land uses, the area of surface exposure, the degree of surface visibility, current land uses and natural and accelerated (man-made) erosion, aggradation and inundation by sediments (McDonald et. al. 1990: 92-96). The constraints to site detection in regions such as northern NSW are almost always most influenced by post European settlement land uses and seldom by natural erosion processes. These conditions are particularly the case in the proposed quarry expansion areas where it is unlikely that any of the steep to moderate slopes under field assessment have not been heavily disturbed due to the impacts of selective logging and recent and past bush fire episodes.

7.4 Survey Units

The proposed Sly's quarry expansion areas are side slopes off a ridge traversed by Sly's Road on the southern slopes of Mount Doubleduke. For the purposes of the study the following survey units provided the basis for the survey strategy and reporting. Area A is considered as two units: the sandstone escarpment between the 100 m and 120 m (AHD) contour and a second unit comprising the remaining slopes. The area of escarpment in relation to the total area of Area A (5.3 ha) is approximate. Area B is so uniform in its topography that it is considered as a single unit.

Area A. (Remaining slope) 4.6 ha. Steep to moderate slope. Dry sclerophyll regrowth forest. *Surface exposure*: 10%. *Types of exposure*: cleared surveyed boundary lines, animal corridors, quarried slope. *Surface visibility*: 80-100% (mean 90%).

Area A1. (Escarpment) 0.67 ha. Outcrops of sandstone containing faces, small overhangs, crevices and outlying boulders east to west across the slope. Dry sclerophyll regrowth forest. *Surface exposure*: 80%. *Types of exposure*: natural weathering. *Surface visibility*: 80-100% (mean 90%).

Area B. 7.2 ha. Broad moderate/gentle slope of dry sclerophyll forest. *Surface exposure*: 10%. *Types of exposure*: cleared surveyed boundary line. *Surface visibility*: 80-100% (mean 90%).

7.5 Ground Surface Visibility

Ground Surface Visibility (GSV) is a measure of how much ground surface (or bare earth) can be seen at the time of an archaeological survey. It is usually worked out as a percentage (%) of the overall Project Area, although it can also be worked out as a range when GSV changes dramatically within the Project Area. For this assessment, GSV was worked out by assessing a 1 m x 1 m area and inferring how much ground surface was seen within that. This gave a percentage of GSV within the square, which was extrapolated to the entire Project Area, so long as the ground conditions did not fundamentally change.

Table 1 presents information on the extent to which survey data provides sufficient evidence for an evaluation of the distribution of archaeological materials across the study area. The evaluation of survey coverage provides a measure of the potential for landform elements to reveal archaeological evidence. The calculations in Table 1 do not provide an exact percentage of coverage. The total average of surface available for site detection is achieved by totalling the areas for site detection in each unit and dividing by total area.

Table 1: Sly's Quarry Expansion Areas

Survey Unit	*Area A Escarpment*	*Area A1 Slopes*	*Area B*
Landform	Mid slopes	Mid slopes	Mid slopes
Landform Element	Side slope	Side slope	Side slope
Area (ha)	0.67	4.6	7.2
Exposure %	80	10	10
Area of Exposure (ha)	0.5	0.46	0.72
Visibility %	80	90	90
Area for Site Detection (ha)	0.48	0.41	0.6
% of LF for Site Detection	72	9	9
Total Average for Ground Detection: 12 %			

Closed ground covers of dead fall, grasses and shrubs were the main impediment to ground visibility (Figure 8, Figure 9, Figure 10 and Figure 11). However, in this type of environment, the percentages per landform unit available for site detection are in the 10 - 20% range and 'are the norm' for archaeological cultural heritage assessments. An average of 12% of ground surface available, over the Project Area as a whole, is probably an inflated figure due to the higher visibility over sandstone surfaces in the escarpment of Area A1. However given the poor terrain for Aboriginal campsites, small area of assessment and disturbance history, the low average for ground detection is still an adequate proportion on which to base statements as to a lack of cultural heritage archaeological sites with a high degree of certainty.

Figure 8: Sly's Quarry expansion Area A showing survey visibility along existing tracks

Figure 9: Slys Quarry Area A showing nature of sandstone outcrops on upper slopes

Figure 10: Slys Quarry expansion area showing regrowth forest and deep leaf litter

Figure 11: Slys Quarry expansion area showing dense regrowth forest

8. RESULTS OF ABORIGINAL CULTURAL HERITAGE ASSESSMENT

As a result of the desktop study and field inspection of the proposed expansion to the Sly's Quarry extraction areas and consultation with Yaegl LALC Sites Officer Dale Mercy, the following were agreed to.

- No Indigenous cultural heritage sites or relics were identified within the proposed expansion areas of Sly's Quarry.
- No areas have been identified that are considered to potentially contain subsurface deposits of significant Aboriginal heritage.
- All of the Project Area has been disturbed in a manner which constitutes 'disturbance' within the meaning of the Due Diligence Code and is consistent with the Due Diligence Code.
- The Yaegl LALC representative agreed in discussion that no further Aboriginal cultural heritage investigation was required.

9. CULTURAL HERITAGE DUE DILIGENCE ASSESSMENT

The Due Diligence Code recommends a staged analysis of land use, cultural and archaeological factors. This section discusses the analysis of the Project Area when compared against these guidelines.

9.1 Step 1: Will the activity disturb the ground surface?

Yes. See the proposed extraction activities described in the Project Description (Section 3).

9.2 Step 2a: Search of AHIMS Database

A search was conducted on 6 October 2014 of the OEH AHIMS (AHIMS service number 118615), centring on the Project Area with a 1000 m buffer. The search of the AHIMS Register returned no Aboriginal Sites within the search area.

9.3 Step 2b: Does the activity occur in an area where landscape features indicate the presence of Aboriginal cultural heritage?

Having regard to:

a) the nature of Aboriginal occupation in the region;

b) the Project Area's proximity to resources; and

c) the Project Area's original vegetation, soils and topography;

The Due Diligence Code identifies particular landforms as having a higher potential to contain archaeological sites. Ridgelines, elevated areas adjoining alluvial plains, dune fields and river/creek foreshores for example, are known to have a higher association with Aboriginal archaeological sites than slopes and seasonally or permanently inundated wetlands. Aboriginal occupation of the North Coast in the historical period appears to have centred on the major rivers, tributaries, back swamps and wetlands. In the Clarence Valley the majority of registered Aboriginal sites are in the floodplain and estuary. The Aboriginal archaeological evidence for sites in the low hills and moderate slopes of the 'inland' coastal hills of the lower Clarence is sparse. The imbalance may be a result of other factors, for example fewer archaeological surveys in the hills unit, the lower visibility of artefact scatters in woodland situations, the high visibility and extent of midden sites in riverine landscapes. However all historic observers and subsequent ethno historic researchers emphasise the important role of both fresh water and marine food resources although their dominance and dietary contribution in an annual cycle of resource gathering is a subject of debate.

Models to describe possible patterns of settlement and movement in the North Coast region vary considerably. One suggests that clan groups ranged between the seacoast and foothills of the coastal ranges on a seasonal basis (McBryde 1974). Early sources support this view to some extent as there are records describing the movement of inland groups of the Clarence River to the coast during winter (McFarlane 1934; Dawson 1935: 25).

A second model suggests that movement of coastal people was not frequent and that semi-sedentary groups moved north and south within the coastal plain rather than to the upper rivers (Coleman 1982). The model is based upon reports of numbers of small villages composed of dome-shaped weatherproof huts between the mid NSW coast and Moreton Bay. Flinders described a small group of huts in the vicinity of Yamba in 1799, and Perry described two villages on the banks of the lower Clarence in 1839. Similar sightings were reported by Rous on the Richmond (McBryde 1974: 9), Oxley on the Tweed (Piper 1976) and in Moreton Bay (Hall 1982). The construction methods described for these huts seem to suggest occupation for a period of months at a base camp rather than a constant wide-ranging pattern of low-level land use. Godwin (1999: 211-217) argues that

neither of the above 'models' is supported by the archaeological record, and that local conditions dictated exploitation strategies on the North Coast of NSW.

The predictive model advanced in this assessment is based upon the review of the results of previous assessments, archaeological and ethno historical research, an assessment of relationships between landscapes and their Aboriginal land use potential, Aboriginal community information and the review of the current AHIMS site listings. As most of the above sources of information are derived from assessments of Aboriginal cultural heritage in Clarence River floodplain and coastal landform situations it does not readily apply to the topography and other environmental contexts of the Project Area.

The Project Area is part of a low back hills complex emanating from Mt Doubleduke, therefore it may have served as part of the broader hunting and gathering range for groups occupying the Clarence River floodplains. There are no particular parts of the Project Area, which because of access to permanent water, food or material resources, would make the area ‘attractive’ as a campsite or ‘lucrative’ as a source of a particular food or material resource. A close search of the sandstone escarpment in Area A found no sandstone shelters or overhangs that may serve the purpose of occupation, art sites or burials. An Aboriginal transit corridor is unlikely as there is no distinct ridge line that would lead to the coastal uplands to the west or to the headwaters of river systems. There can be a low potential that a background scatter of stone artefacts lost or broken may be randomly scattered throughout the area. However devising a strategy to recover such items prior to the proposed extension to extraction is impractical and would be purely speculative.

9.4 Step 2c: Is there evidence of past ground disturbance?

Yes. The Project Area ranges between areas of disturbance and areas where an absence of old growth (greater than 150 years) trees, suggests that the former original closed forest is now mainly regrowth woodland. It is reasonable to form the conclusion that outside of those areas of demonstrably high or ‘total’ ground disturbance through quarrying and associated activities, the remainder is moderately disturbed. The main disturbances have been selective logging for mill production in the last fifty years and presumably logging in the early historic period of the nineteenth century. It would seem unlikely but not impossible that Aboriginal archaeological sites would ‘survive’ in-situ given the extent and apparent depths of disturbance to at least the upper metre. Under the definitions of the Due Diligence Code, whilst it is possible that all of the Project Area has been ‘disturbed’, a cautionary approach would conclude that some of it may not have been. Regardless, the issue of past ground disturbance is not seen as critical to this assessment, owing to the archaeological models described above.

9.5 Additional Steps

Whilst the Project Area cannot be regarded as having entirely in situ soils, whether all parts have undergone 'disturbance' under the meaning of the Due Diligence Code has not been conclusively determined. However, additional archaeological research has failed to identify any area of particular potential to contain Aboriginal Objects (commonly referred to as Potential Archaeological Deposits). This analysis is consistent with the cultural knowledge provided by the LALC Site Officers, who are of the opinion that the Project has a low potential for harming significant Aboriginal cultural heritage.

10. DISCUSSION & RECOMMENDATIONS: ABORIGINAL CULTURAL HERITAGE

Having evaluated the cultural values of the Project Area, there would appear to be minimal cultural heritage constraints for the Project.

To aid in the interpretation of the site, the Project Area has been divided into a number of risk areas based on archaeological and disturbance characteristics. Table 2 presents a summary of the Aboriginal cultural heritage risks for the Project.

Aboriginal cultural heritage constraints to Projects typically come in three forms of cultural site (Table 2):

1. ***High Significance:*** Aboriginal sites of high significance that must be retained in-situ (where they lie). Sites of this nature typically included large Aboriginal middens, scarred trees or burials. The area affected typically ranges from 200 m^2 to 400 m^2, as even small sites will have to be retained in an appropriate setting.
2. ***Low – Moderate Significance:*** Aboriginal sites of low to moderate significance that need to be salvaged before development can commence. Sites of this nature typically include artefact scatters, isolated artefacts and cultural shell scatters. The area affected typically ranges from 100 m^2 to 2000 m^2.
3. ***Sacred Sites:*** Aboriginal sacred sites that hold special spiritual significance, and must be preserved. Sites of this nature typically include bora rings, ceremonial sites and story places. The area of these sites is generally confined to within 200 m^2 to 600 m^2. However, the site will be situated within a 'cultural landscape', the significance areas of which may extend well beyond the physical boundaries of the site.

Table 2: Aboriginal cultural heritage Risk Summary for the Project Area

Unit	Risk Type	Likelihood	Depth of Deposit (m)
A	High Significance	Nil	N/A
	Low – Moderate Significance	Extremely Low	0.5 – 1.0
	Sacred Sites	Nil	N/A
A1	High Significance	Nil	N/A
	Low – Moderate Significance	Extremely Low	0.5 – 1.0
	Sacred Sites	Nil	N/A
B	High Significance	Nil	N/A
	Low – Moderate Significance	Extremely Low	0.5 – 1.0
	Sacred Sites	Nil	N/A

Having regard to the above, any physical Aboriginal cultural heritage constraints for the Project would most likely be limited to randomly scattered isolated artefacts. However, the risk is extremely low.

If the Project was to proceed, Everick recommends that no further assessment or investigative works are required. This assumption is made on the basis that prior to European settlement the Project Area was quite unsuited to Aboriginal campsites and therefore unlikely to contain significant Aboriginal cultural heritage. We could not argue conclusively that there are no artefacts.

A number of cautionary recommendations would be included in a report to Council that would focus on developing an Aboriginal cultural heritage find procedure and inductions of contractors.

11. RECOMMENDATIONS

The following recommendations are cautionary in nature. Whilst it is considered unlikely that they will be required, they should be noted and adhered to, as they relate to managing the legal obligations of the Proponent in relation to cultural heritage.

Recommendation 1: Aboriginal Cultural Material Finds Procedure

It is recommended that if it is suspected that Aboriginal material has been uncovered as a result of earth working activities within the Project Area:

a) work in the surrounding area is to stop immediately;

b) a temporary fence is to be erected around the site, with a buffer zone of at least 10 metres around the known edge of the site;

c) an appropriately qualified archaeological consultant is to be engaged to identify the material; and

d) if the material is found to be of Aboriginal origin, the Aboriginal community is to be consulted in a manner as outlined in the OEH guidelines: ACHRP (2010).

Recommendation 2: Notifying the OEH

It is recommended that if Aboriginal cultural materials are uncovered as a result of development activities within the Project Area, they are to be registered as Sites in the AHIMS database managed by the OEH. Any management outcomes for the site will be included in the information provided to the OEH.

Recommendation 3: Aboriginal Human Remains

It is recommended that if human remains are located at any stage during earthworks within the Project Area, all works must halt in the immediate area to prevent any further impacts to the remains. The location where they were found should be cordoned off and the remains themselves should be left untouched. The nearest police station, the Yaegl LALC, and the OEH Regional Office (Coffs Harbour), are to be notified as soon as possible. If the remains are found to be of Aboriginal origin and the police release the scene, the Aboriginal community and the OEH should be consulted as to how the remains should be dealt with. Work may only resume after agreement is reached between all notified parties, provided it is in accordance with all parties' statutory obligations.

It is also recommended that in all dealings with Aboriginal human remains, the Proponent should use respectful language, bearing in mind that they are the remains of Aboriginal people rather than scientific specimens.

Recommendation 4: Conservation Principles

In the unlikely event that Aboriginal cultural heritage is identified during Project works, it is recommended that all effort must be taken to avoid any impacts on Aboriginal Cultural Heritage values. Should a situation arise where impacts to Aboriginal cultural heritage is unavoidable, mitigation measures should be negotiated between the Proponent, OEH and the Aboriginal Community.

12. DESKTOP REVIEW: HISTORIC CULTURAL HERITAGE

12.1 Heritage Register Searches

The desktop review concluded that no historically significant cultural heritage sites would be impacted by the Project. The following heritage databases were reviewed on 05 October 2014 to assess the potential for non-Indigenous heritage attributes within the Clarence Valley LGA and specifically for the Mororo area;

- **The World Heritage List**: Contains no historic heritage listings within or within close proximity to the Project Area.
- **Register of the National Estate**: returned four (4) historic heritage listings all of which were located in Woodburn, with the closest being the Broadwater National Park, situated northeast of the Project Area.
- **Commonwealth Heritage List (Australian Heritage Council)**: Contains no historic heritage listings within or within close proximity to the Project Area.
- **The National Heritage List (Australian Heritage Council)**: Contains no historic heritage listings within or within close proximity to the Project Area.
- **The National Trust Register:** Contains no historic heritage listings within or within close proximity to the Project Area.
- **The State Heritage Register (NSW Heritage Office)**: Contains no historic heritage listings for Mororo. One (1) historic heritage item is listed for Evans Head under Section 1 (Heritage Council) and will not be impacted by the Project. Section 2 (Local Councils, Shires and State Agencies) lists one (1) item for Evans Head and seven (7) listings for Woodburn, none of which will be impacted by the Project.
- **Clarence Valley Local Environment Plan 2012:** Contains no historic heritage listings for the Mororo area. 17 items are listed for Evans Head and 12 items are listed for Woodburn, none of which will be impacted by the Project.

13. RESULTS OF HISTORIC HERITAGE FIELD SURVEY

There are no places of historic heritage listed in heritage lists or have there been places of historic heritage found within the Project Area as a result of the field survey.

14. RECOMMENDATIONS: HISTORIC HERITAGE

There are no recommendations with regard to historic heritage. The Project does not impact on places of historic heritage significance

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APPENDIX A: AHIMS SEARCH RESULTS

Office of Environment & Heritage
NSW GOVERNMENT

AHIMS Web Services (AWS)
Search Result

Your Ref Number : EV.319
Client Service ID : 148613

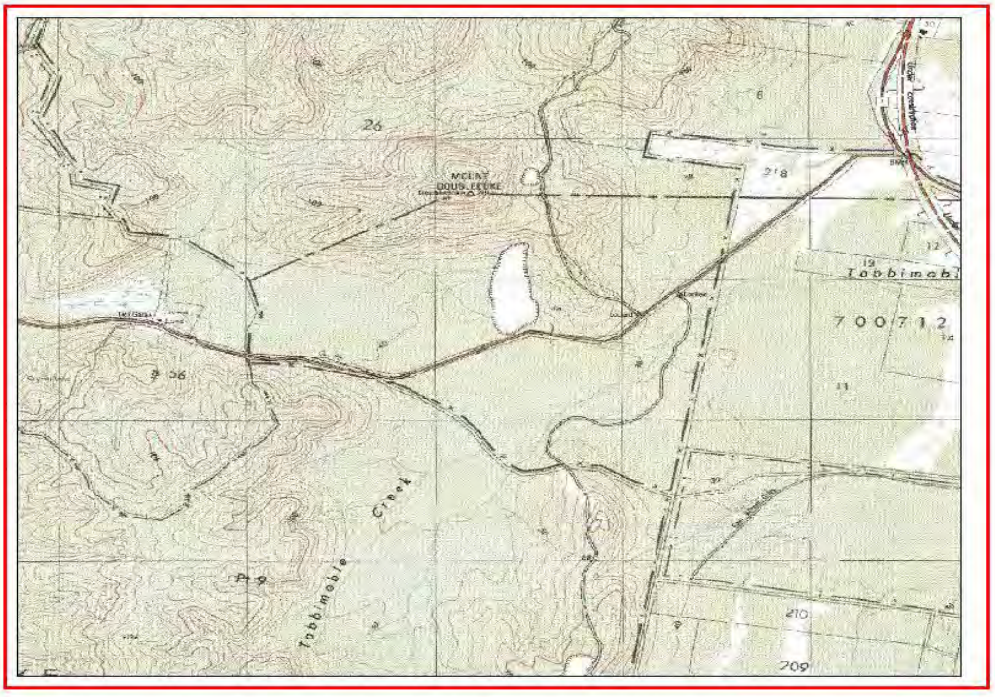
Everick Heritage Consultants Pty Ltd
47 Arthur Tce
Red Hill Queensland 4059
Attention: Jordan Towers
Email: j.towers@everick.com.au

Date: 22 September 2014

Dear Sir or Madam:

AHIMS Web Service search for the following area at Lot : 2, DP:DP1055044 with a Buffer of 1000 meters, conducted by Jordan Towers on 22 September 2014.

The context area of your search is shown in the map below. Please note that the map does not accurately display the exact boundaries of the search as defined in the paragraph above. The map is to be used for general reference purposes only.



A search of the Office of the Environment and Heritage AHIMS Web Services (Aboriginal Heritage Information Management System) has shown that:

0	Aboriginal sites are recorded in or near the above location.
0	Aboriginal places have been declared in or near the above location. *

GHD

230 Harbour Drive
Coffs Harbour NSW 2450
T: (02) 6650 5600 F: (02) 6650 5601 E: cfsmail@ghd.com

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Rev No.	Author	Reviewer		Approved for Issue		
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