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).

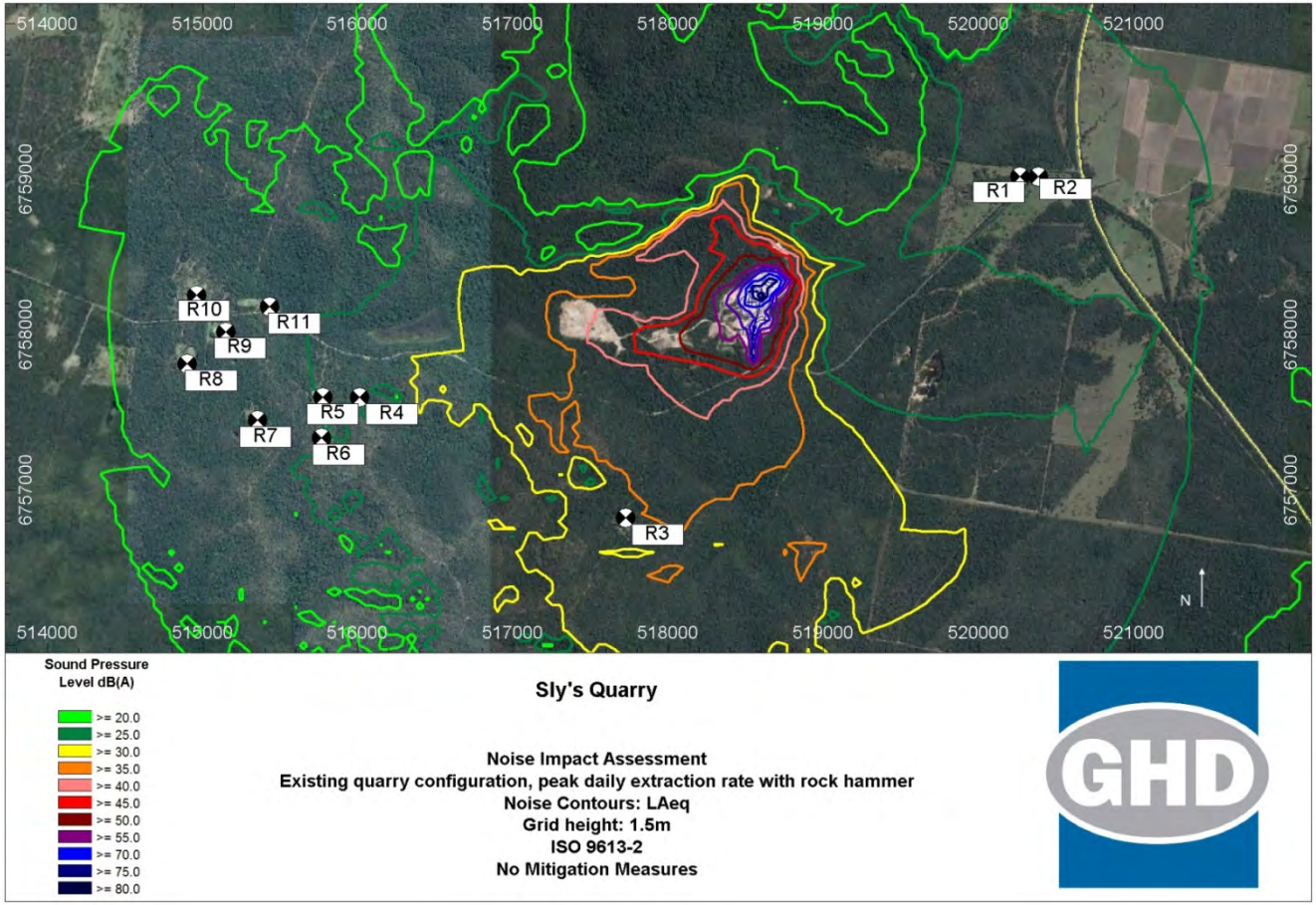


Figure 5-2 Predicted operational noise levels – Scenario 1 (existing quarry configuration) – Peak daily production with rock hammer

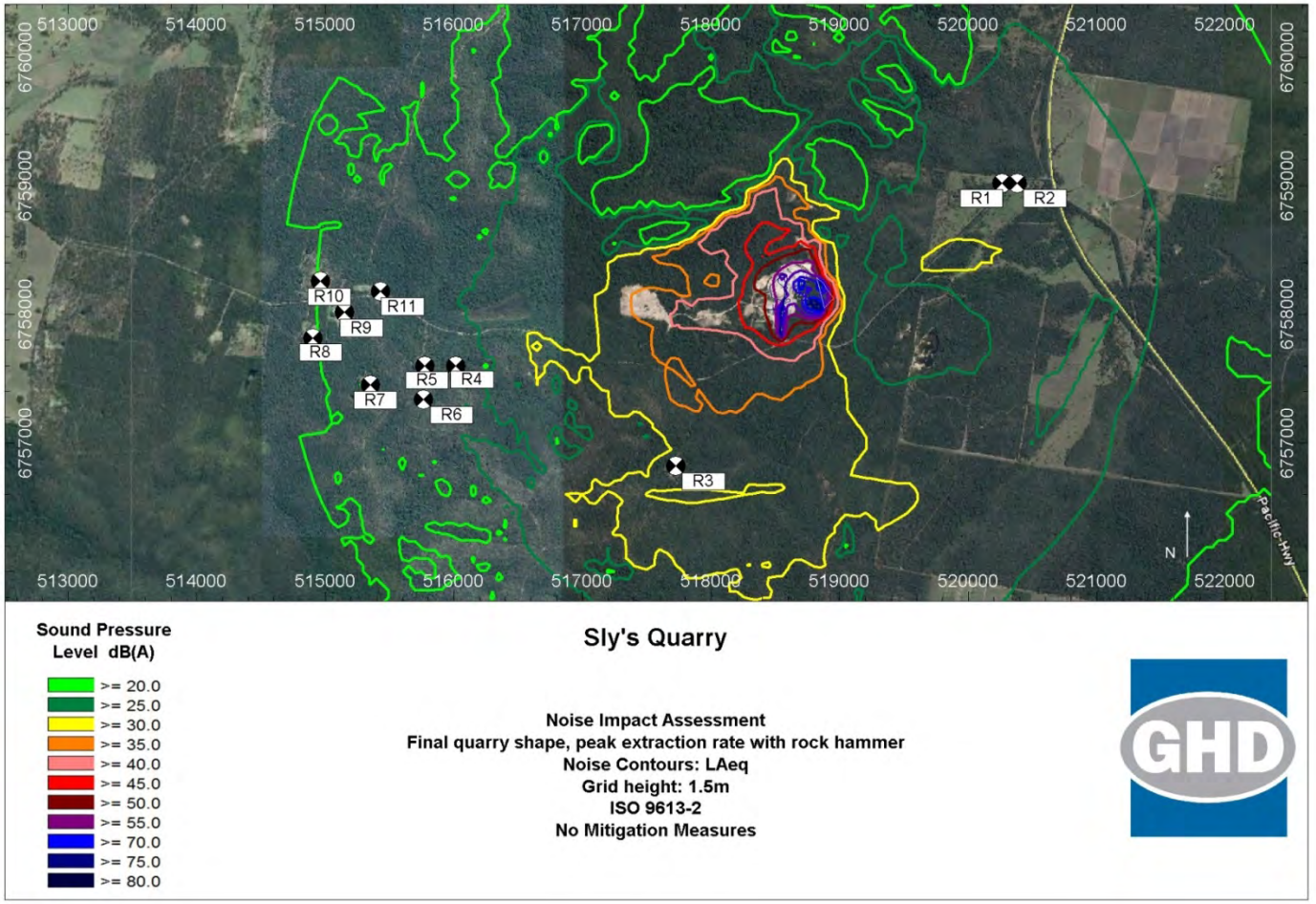


Figure 5-3 Predicted operational noise levels – Scenario 2 – Peak daily production with rock hammer

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.

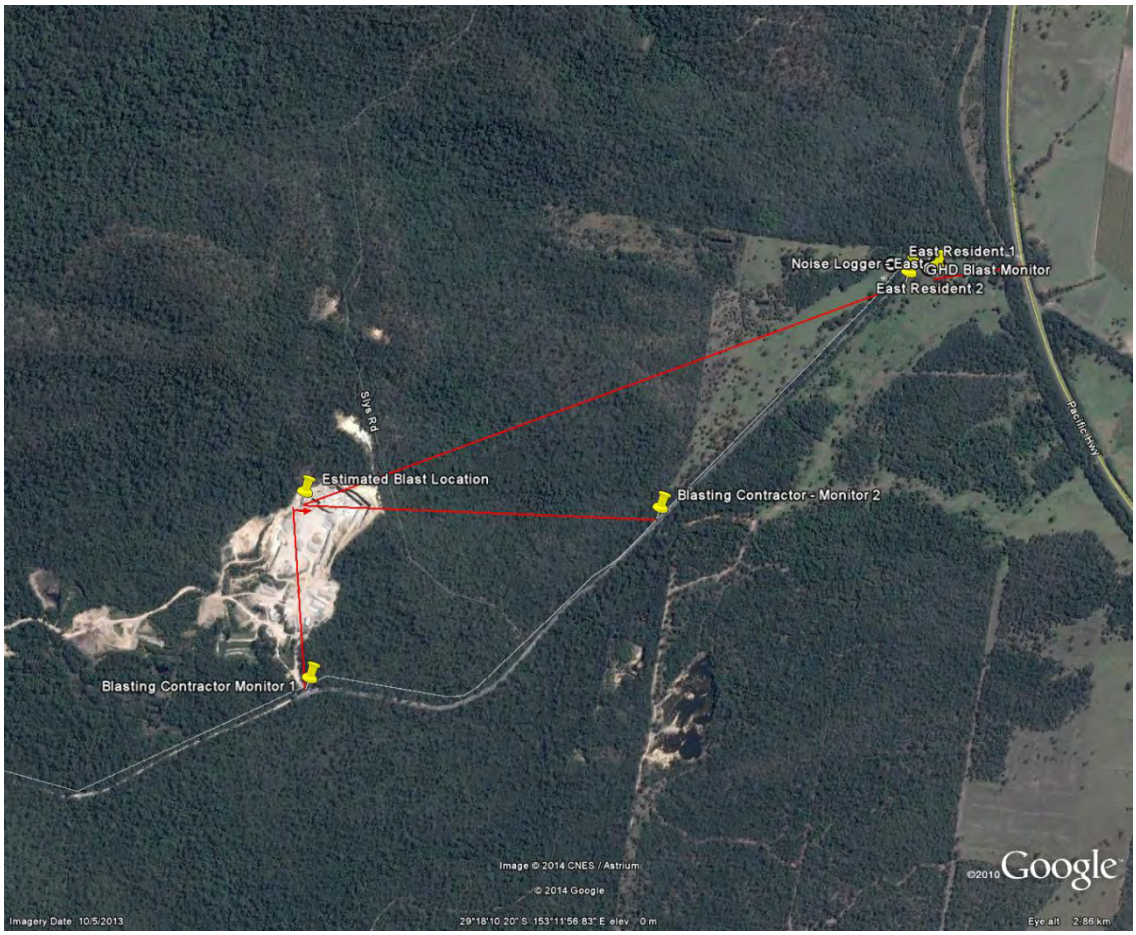


Figure 5-4 Blast monitoring locations

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.

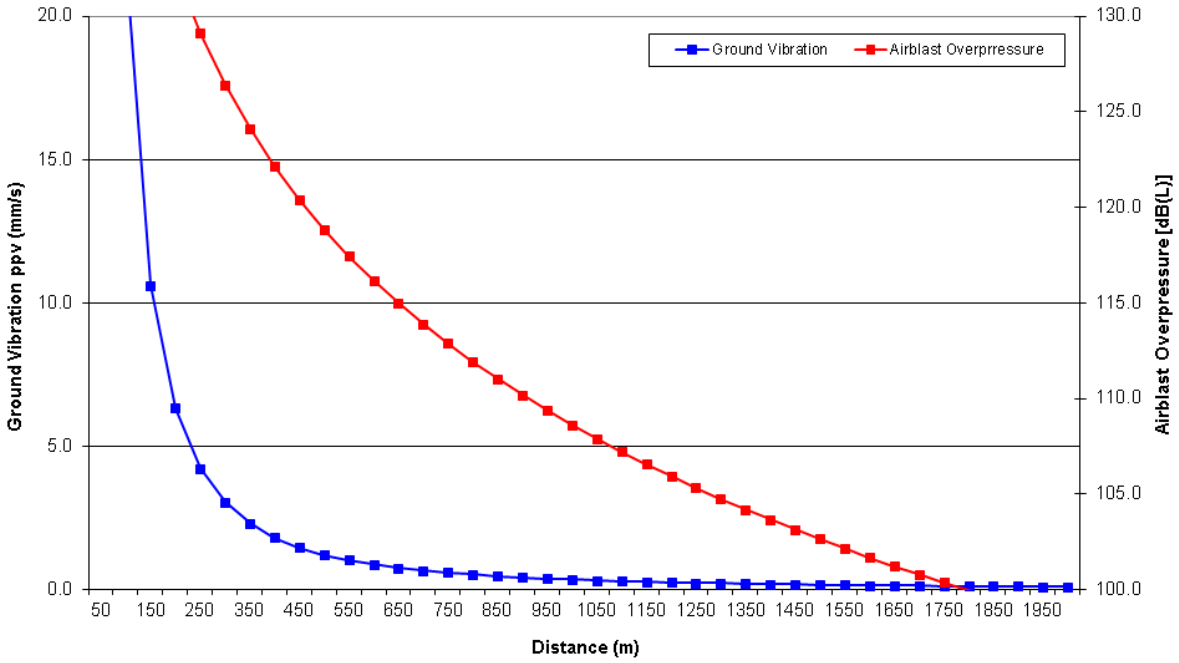


Figure 5-5 Estimated ground vibration and airblast overpressure levels from blasting

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.

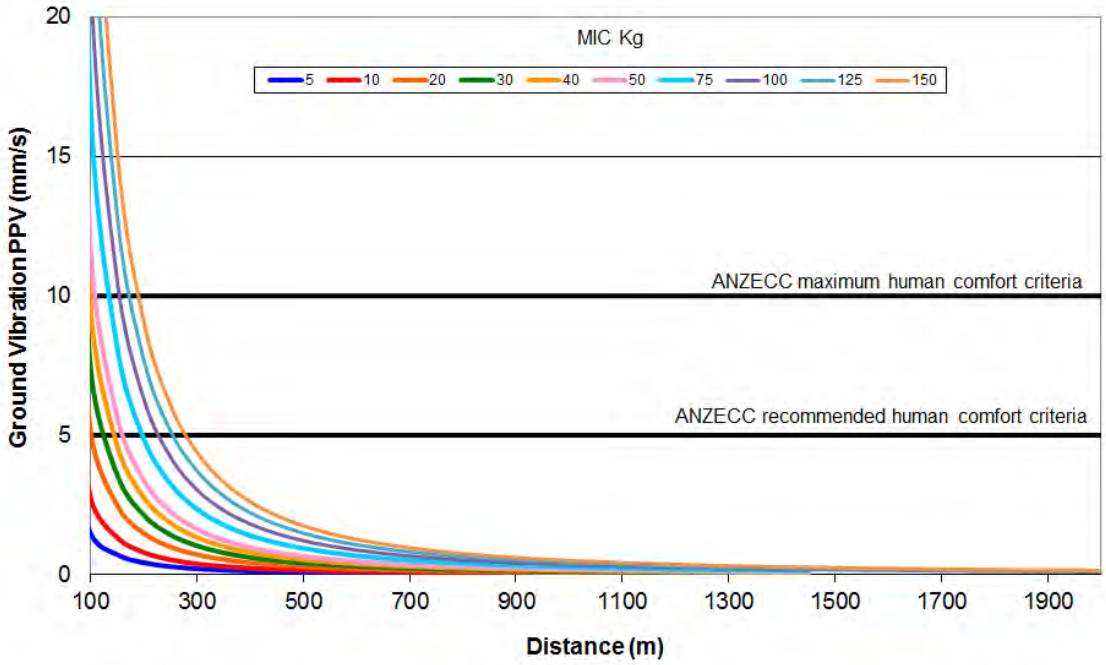


Figure 5-6 Ground vibration predictions for different charge masses and distances

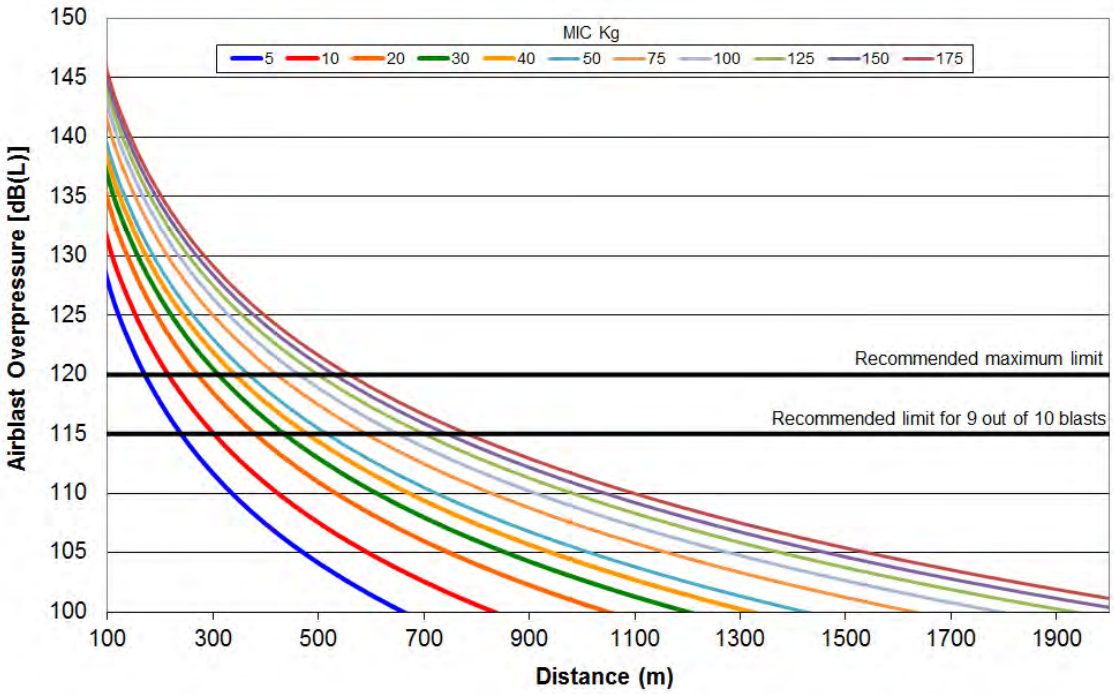


Figure 5-7 Air blast overpressure predictions for different charge masses and distances

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.

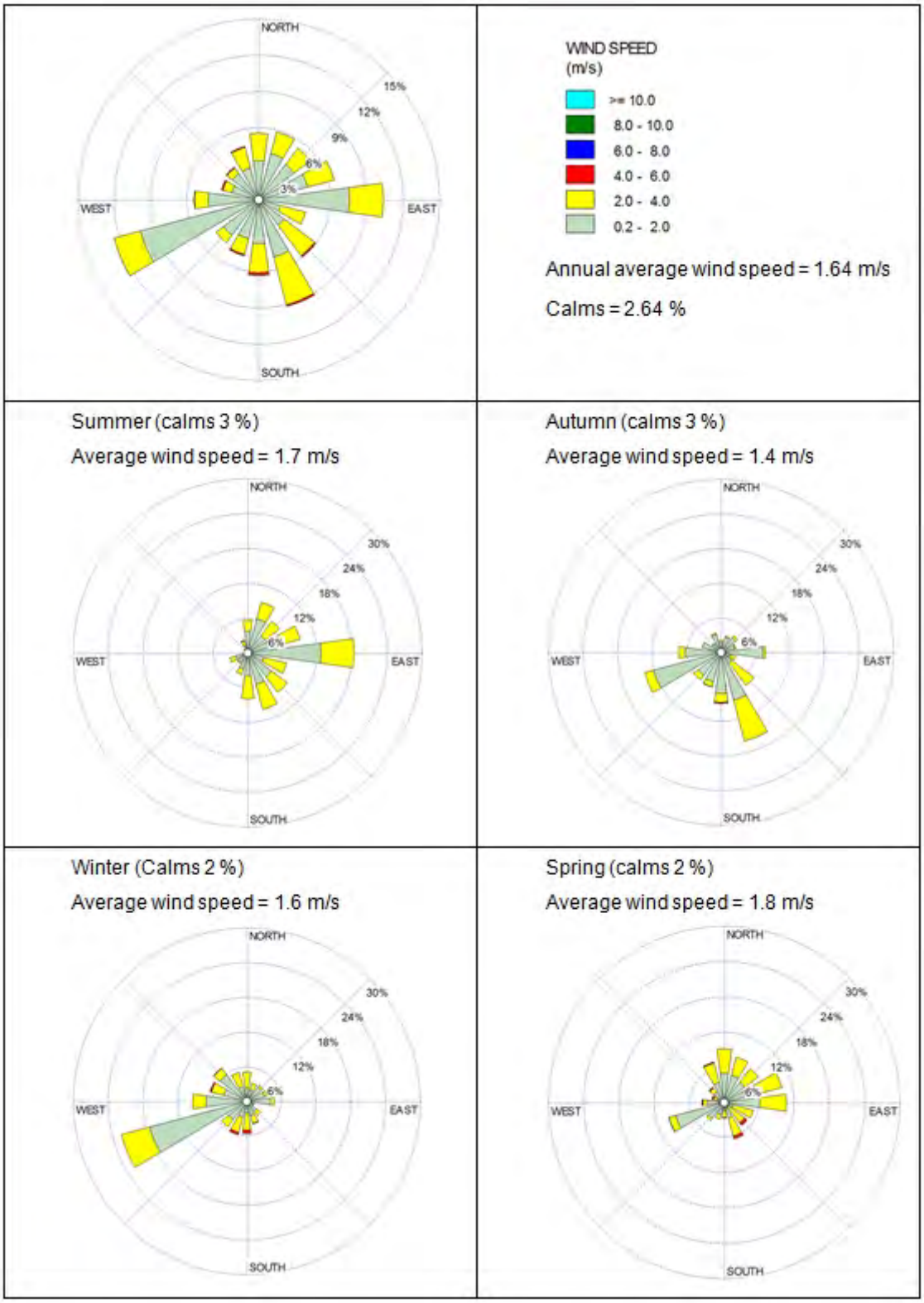


Figure 5-9 CALMET predicted annual and seasonal variability wind roses, Mororo

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.

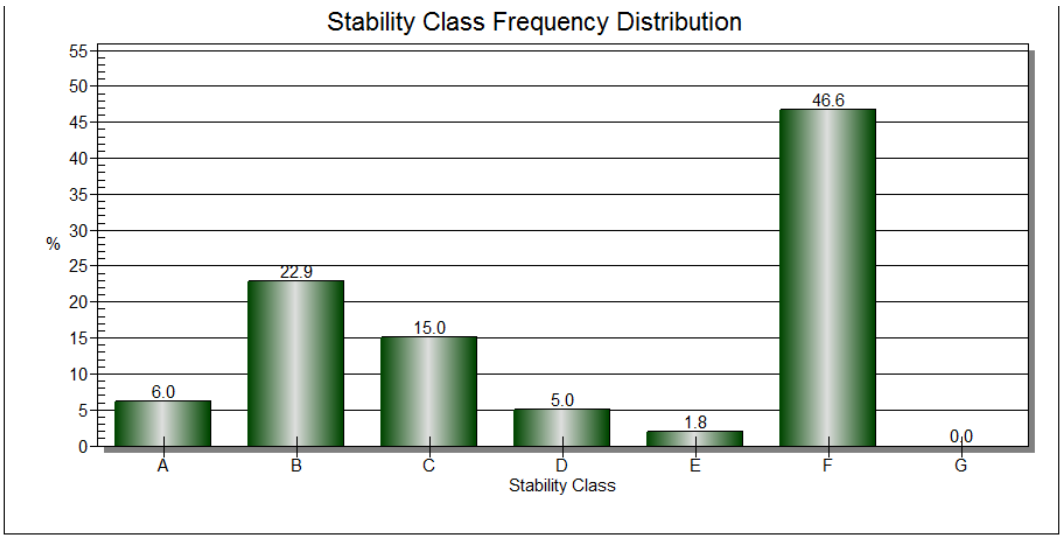


Figure 5-10 CALMET predicted annual stability frequency

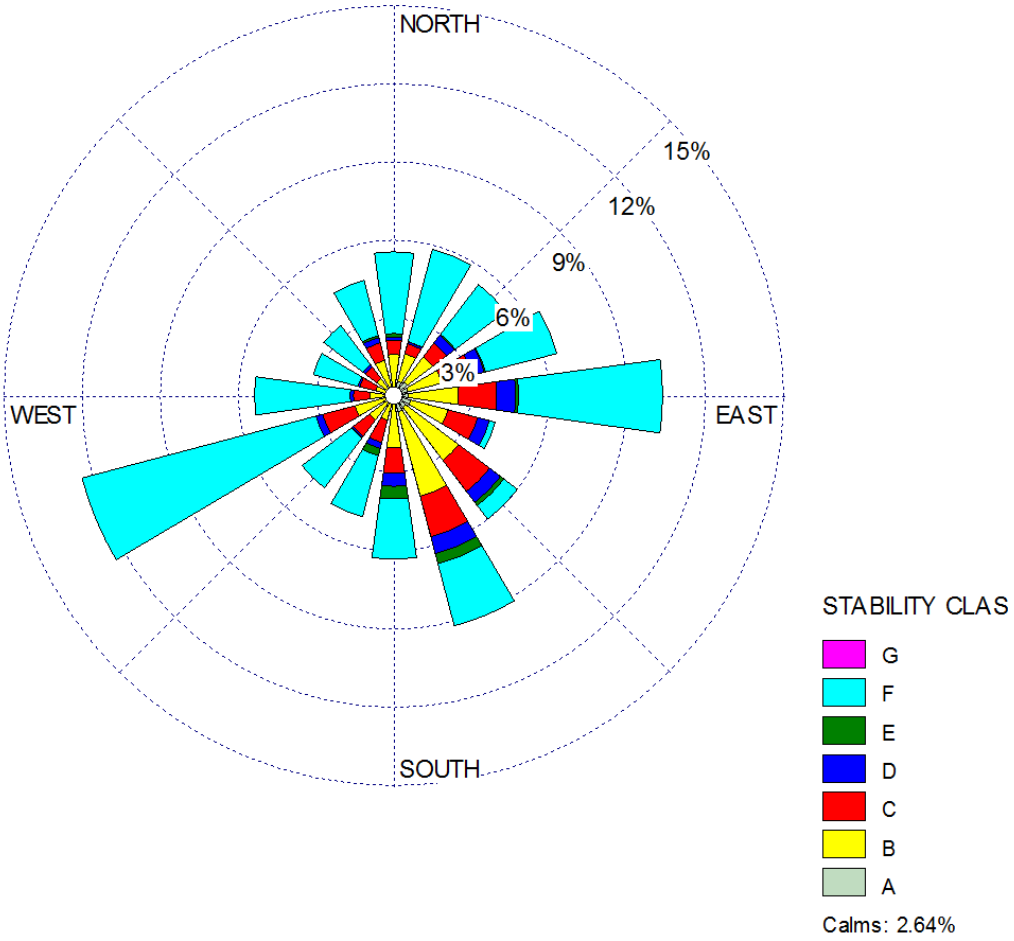


Figure 5-11 CALMET predicted annual stability rose

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.

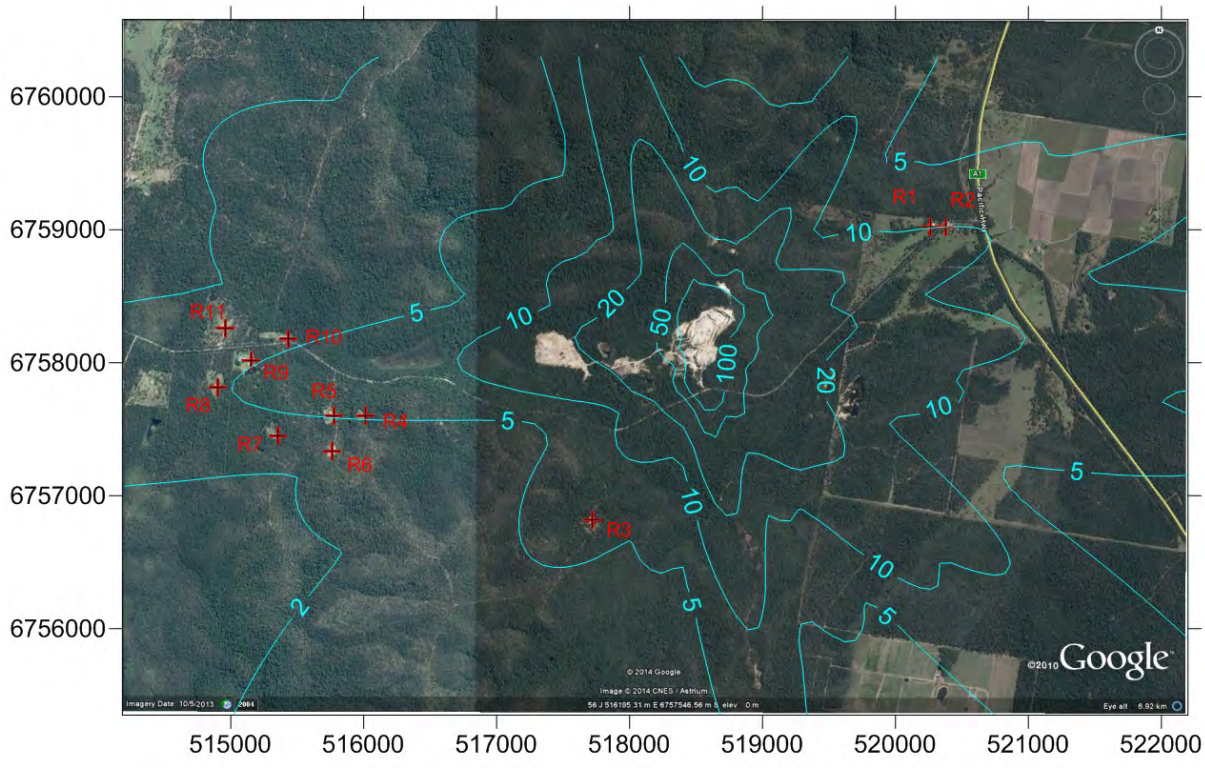


Figure 5-12 PM_{10} 24-hour average highest concentrations, no controls (µg/m^3)

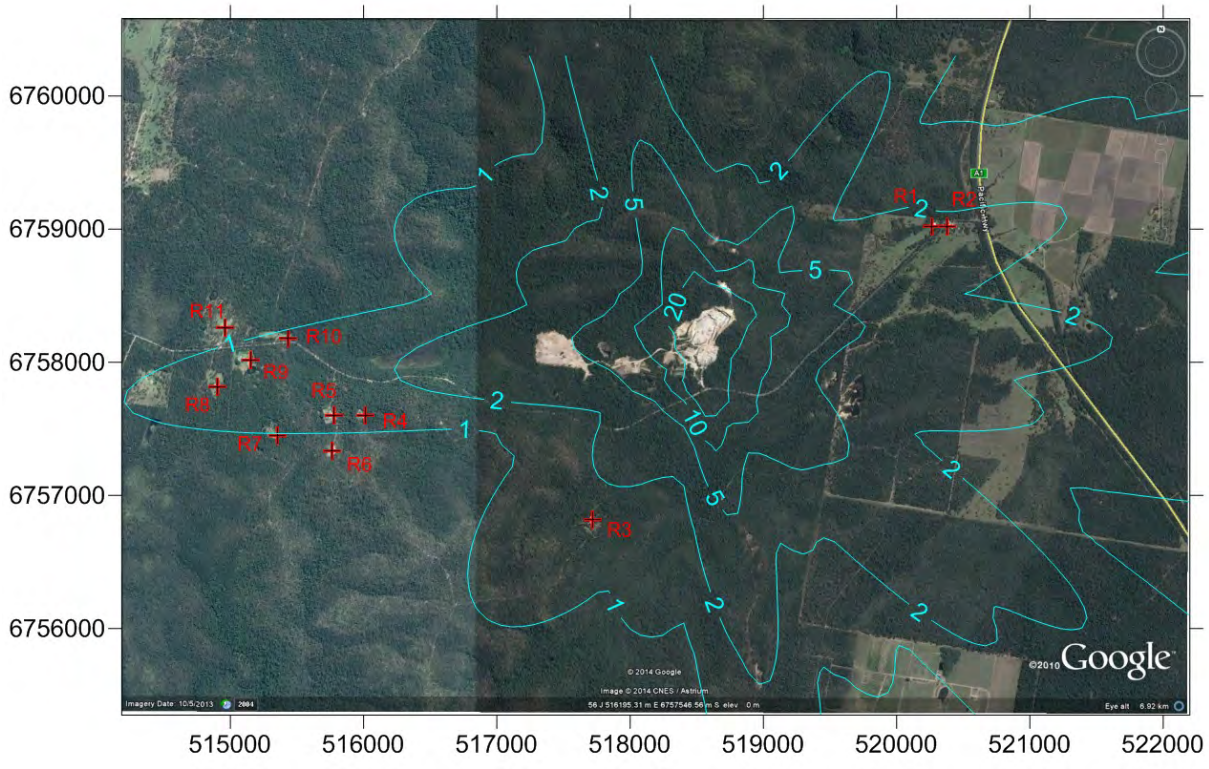


Figure 5-13 PM_{10} 24-hour average highest concentrations, with controls (µg/m^3)

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.

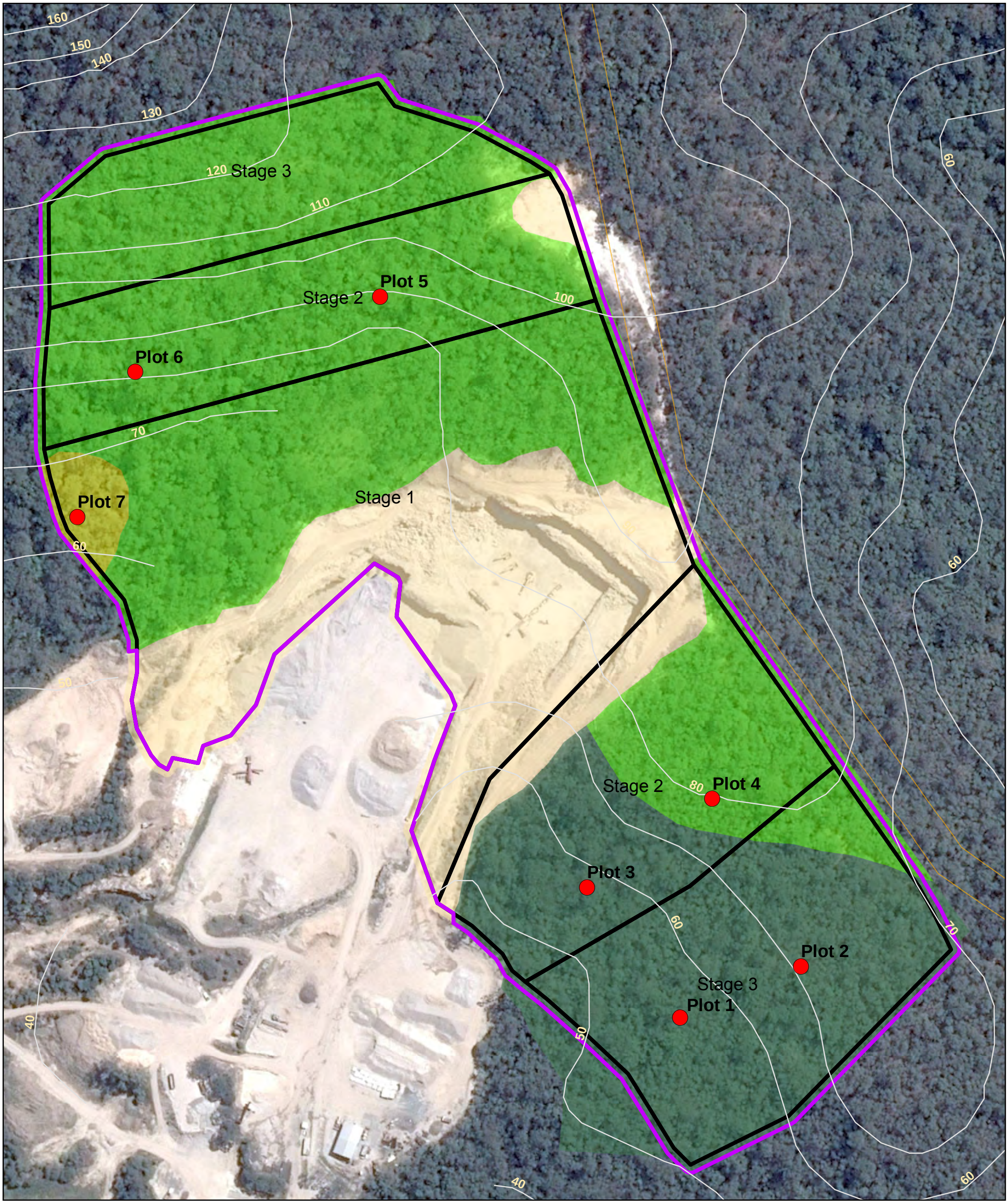
Plant community types

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

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

6,758,000

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

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

N

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.

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 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.

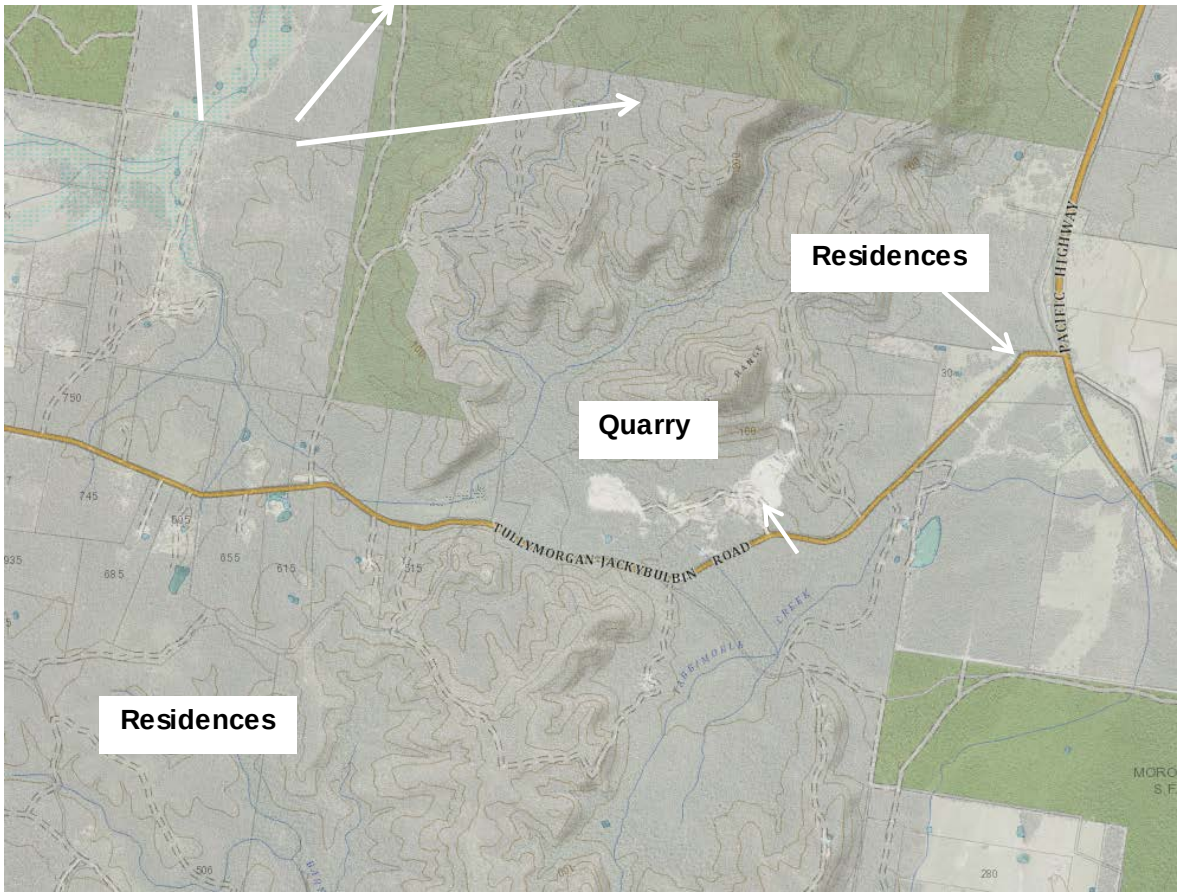


Figure 5-20 Project site and surrounding residents

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.

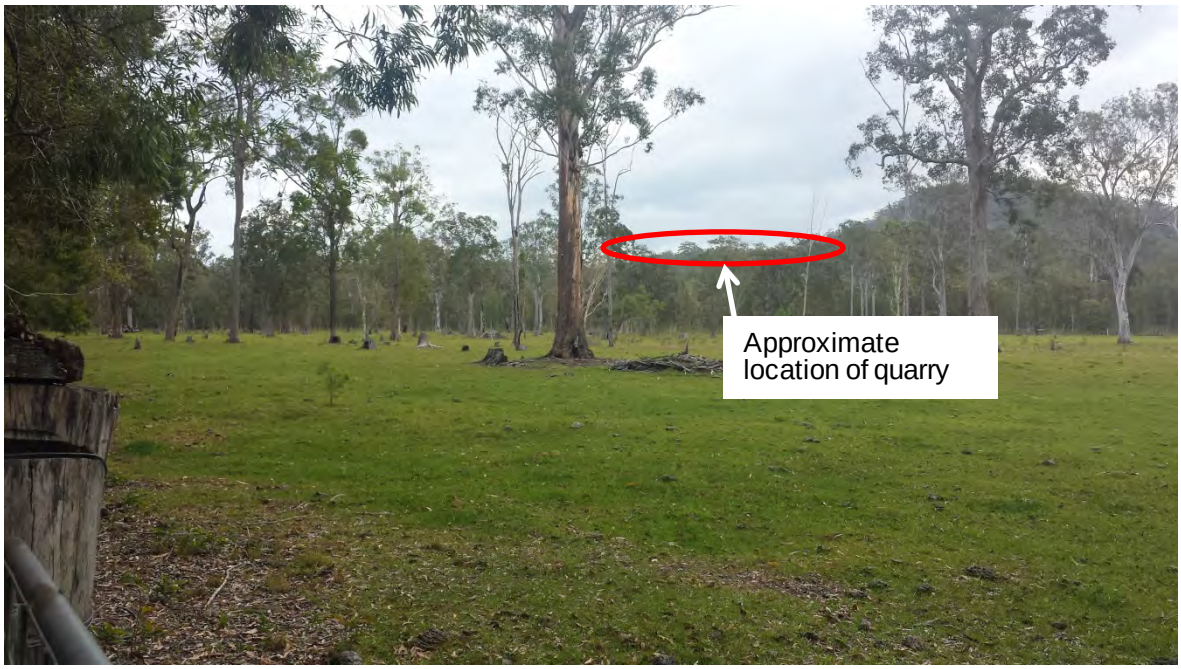


Figure 5-21 View from east towards quarry

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.

Avoiding *Hebertia 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 *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.

7.3.3 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

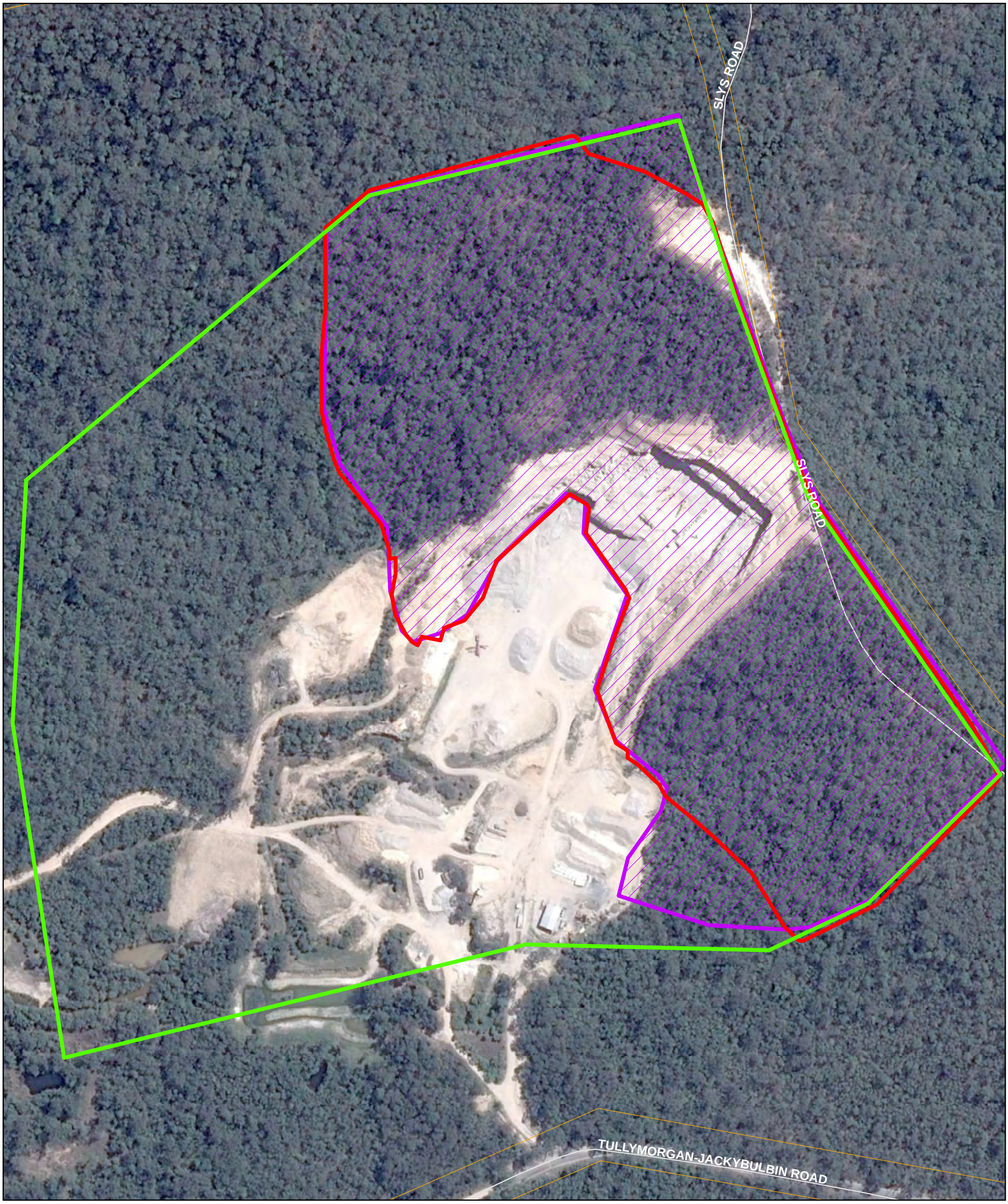
According to the *PoEO Act*, 1991, the precautionary principle means that if there are threats of serious or irreversible damage, lack of full scientific certainty should not be used as a reason for postponing measures to prevent environmental degradation.

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

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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

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.

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