Section 4

Assessment and Management of Key Environmental Issues

PREAMBLE

This section describes the environmental setting within which the Project Site is located and the specific environmental features of the Project Site and its surrounds that may be affected as the result of the Proposal.

Background information is provided on topography and drainage, climate, land ownership and nearby residences together with any constraints imposed by these features on the Proposal. The environmental features of the Project Site are described and all existing and/or proposed design and operational safeguards and management measures that would be implemented under the Proposal are presented. This is followed by an assessment of any predicted impacts the proposed activities may have after implementation of these measures. Where appropriate, proposed monitoring programs are also described.

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4.1 LOCAL SETTING

4.1.1 Topography and Drainage

The Project Site is located approximately 2.5km from the southern boundary of the Bald Rock National Park, with surrounding land consisting mainly of lightly wooded ridges and predominantly cleared valleys. Regional topography is displayed on **Figure 4.1**. The Project Site is situated on a small ridge to the south of Washpool Creek. The area to the north of the Project Site is relatively flat land that is comprised of patches of remnant vegetation and areas cleared for cropping and light grazing. A small valley is present to the south of the Project Site, created by a further ridge aligned generally parallel to the Project Site.

The topography within the Project Site is displayed on **Figure 4.2** and consists of the existing areas of disturbance and a lightly wooded ridge running generally in an east-west direction with land outside the existing disturbance areas sloping at gradients between 5° and 30°. The existing extraction area has modified the eastern part of the Project Site with several areas levelled during previous operations and for emplacement of overburden and clay fines. The lowest elevation within the existing extraction area is 918m AHD with the operating benches of the existing extraction area at elevations between 930m AHD and 945m AHD on the eastern, southern and western boundaries of this area. A ridge has been retained between the existing quarry benches and the land to the south of the existing extraction area. To the north of the existing extraction area, a level area has been developed for emplacement of overburden and clay fines with the land further north sloping at gradients between 20° and 35° to an elevation of 900m AHD in the vicinity of the Northern Sediment Dam and the northern boundary of the Project Site.

Figure 4.1 also displays the catchment areas in the vicinity of the Project Site. The bulk of the runoff from the Project Site is directed to the north, i.e. towards and beyond the Northern Sediment Dam (see **Figure 4.2**) and Washpool Creek. There are several small, ephemeral watercourses that periodically flow northwards between the Project Site and Washpool Creek. Most of the watercourses disappear before reaching Washpool Creek. Runoff to the south flows into a tributary of Tenterfield Creek that passes through a series of farm dams before joining Tenterfield Creek. Runoff from the southeastern corner of the Project Site would flow into Washbrook Creek that flows around another small ridge to the south of the Project Site before turning west and eventually joining Tenterfield Creek south of Leechs Gully.

The Proposal would modify the topography through removal, in part, of the ridge to the west of the existing extraction area. Potential impacts relating to topography and drainage would include alterations to drainage and sediment control structures as well as altering the visual environment through increased visibility of the modified landform. These issues are discussed further in Section 4.6 and 4.10 respectively.

4.1.2 Land Ownership and Land Use

4.1.2.1 Land Ownership

The land on which the existing quarry is situated is owned by Mr Rod Dowe and has been leased by the Applicant. **Figure 4.3** displays the land ownership within and surrounding the Project Site. Land ownership does not constrain the Proposal.

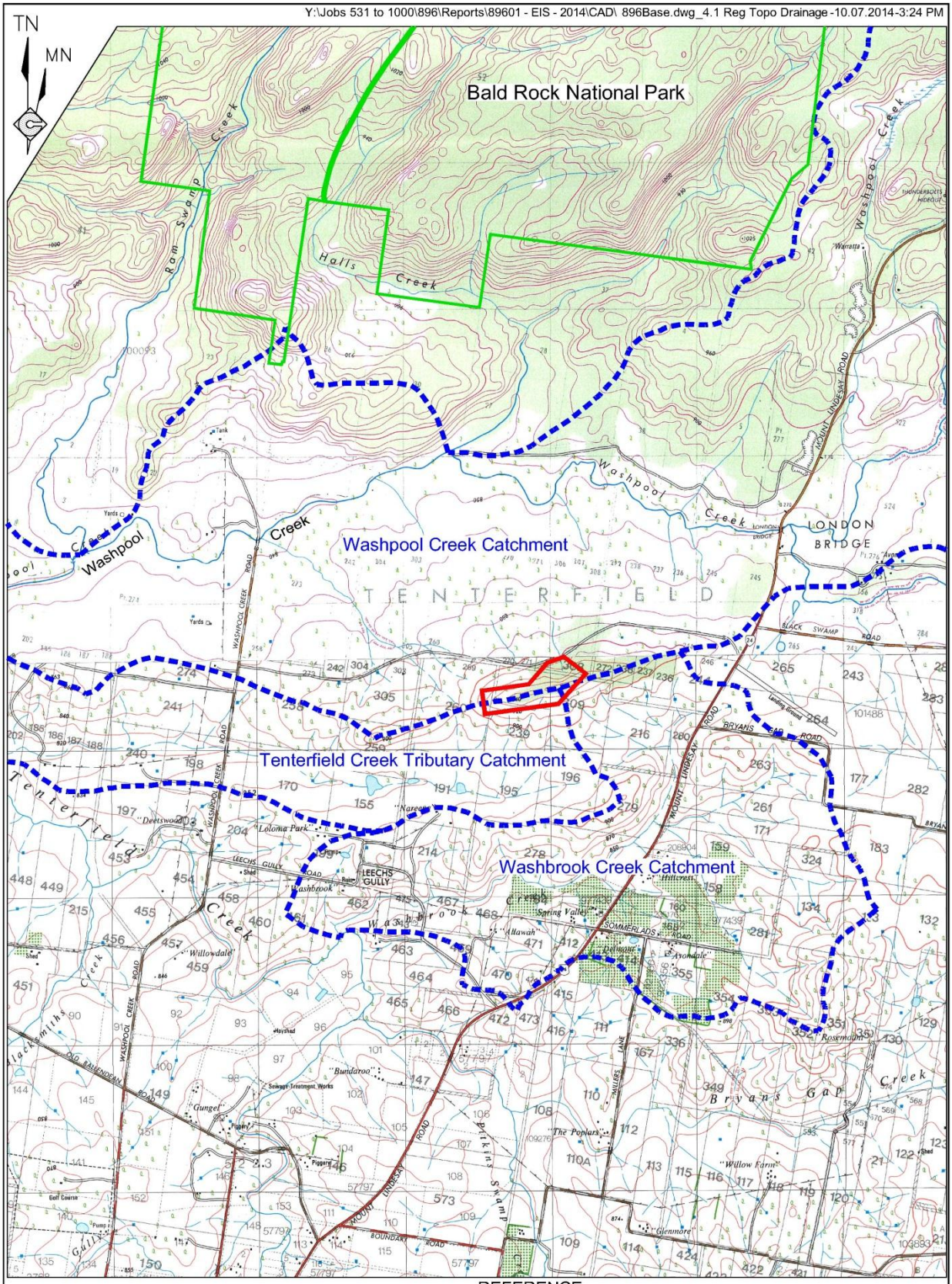


Figure 4.1
REGIONAL TOPOGRAPHY AND DRAINAGE

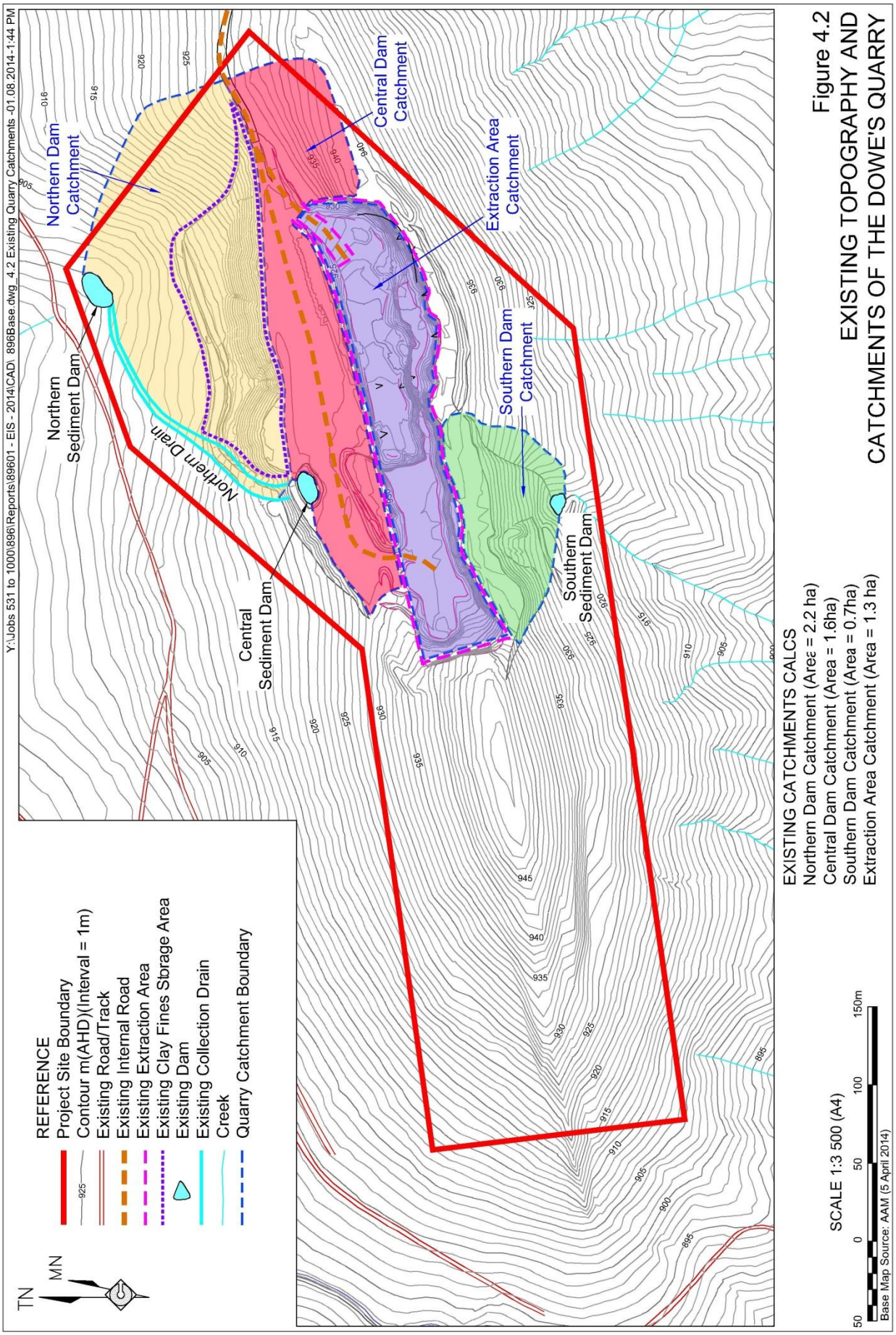
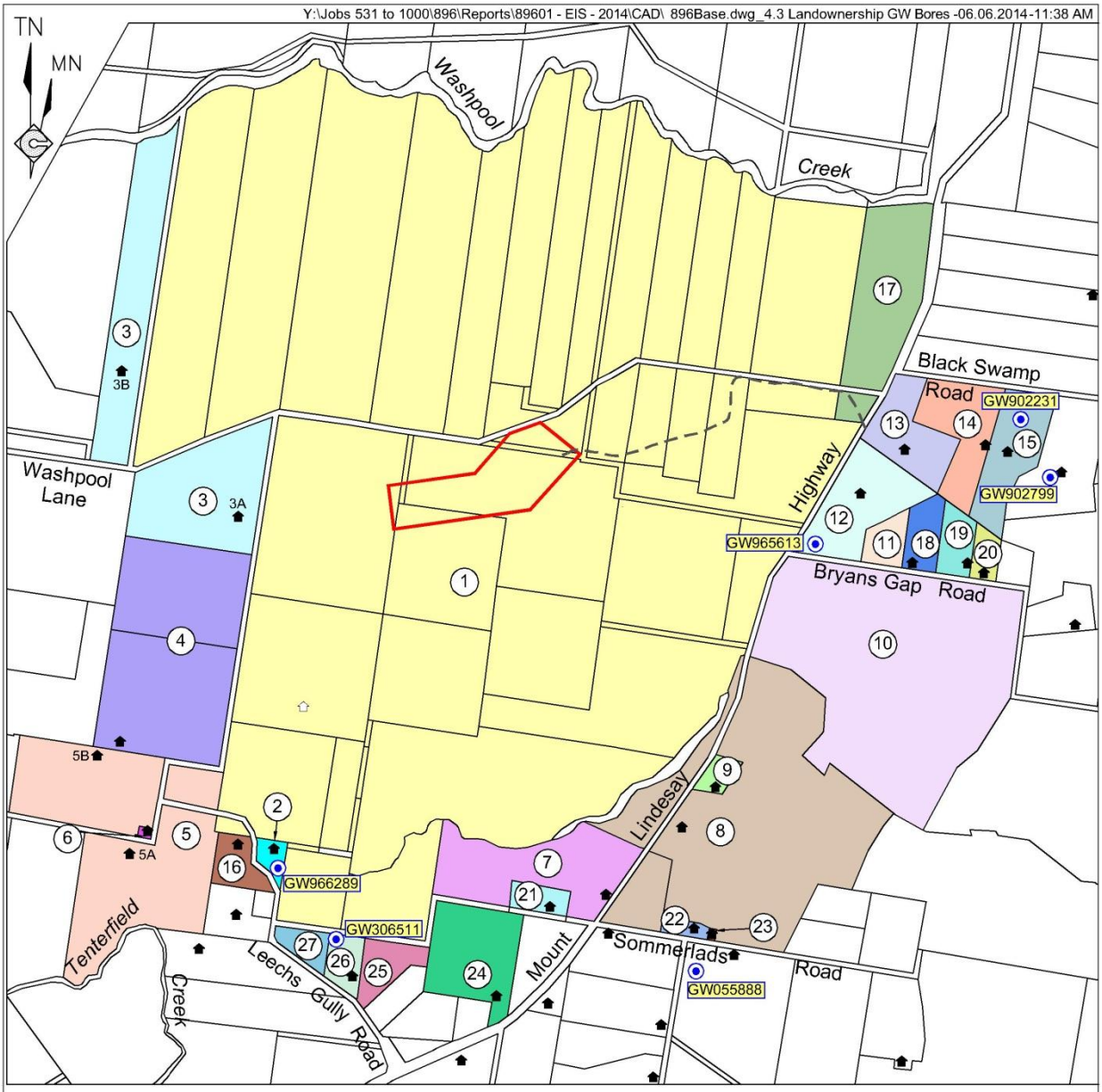


Figure 4.2
EXISTING TOPOGRAPHY AND CATCHMENTS OF THE DOWE'S QUARRY



Ref	Landowner	Ref	Landowner
1	RSH & MO Dowe	14	GM O'Reilly, MP Watt
2	J-P Jacquet, MJ Bielski	15	WH & GM Cooper
3A,3B	Vibrato Investments Pty Limited	16	PA & KM Willis
4	RL Caldwell	17	The State of New South Wales
5A,5B	GL & JM Smith	18	MP & CA Moore
6	DB Weir, GR Smith, WF Marsden	19	GB & DK Phillips
7	SJ & JM Martin	20	CA Jackson, D Bunic
8	RB & CA Sewell	21	DM & AJ Mullins
9	MJ & NJ Lewis, RB & CA Sewell	22	JP & SL Doyle
10	KR & LA Willcocks	23	LD Merchant
11	JK & HJ Ingram	24	Harewood Investments Pty Limited
12	TE Barratt (Jnr), NL Bush	25	D Puglisi
13	IM Ibbett	26	JE Ferguson
		27	D Parsons

REFERENCE
Project Site Boundary
Cadastral Boundary
Quarry Access Road
Residence (Project Related)
Residence (Non-Project Related)
1 Landowner Reference (See Table)
GW965613 Groundwater Bore and Identifier

SCALE 1:25 000 (A4)

250 0 250 500 750 1000 1250 m

Cadastral Source: LPI (2014)
Landowner Source: Department of Lands Online Search - March 2014

Figure 4.3
LAND OWNERSHIP, SURROUNDING RESIDENCES AND GROUNDWATER BORES

4.1.2.2 Land Use

The Project Site is currently used principally for the extraction of quartzose rock. The land owner periodically grazes cattle around the margins of the Quarry to control fuel loads.

The land uses surrounding the Project Site include light grazing and pasture improvement. The existing Quarry is surrounded by remnant vegetation with small patches of vegetation extending approximately 1km to the north to Washpool Creek and further north to Bald Rock National Park.

The Proposal would not result in changes to commercial agricultural land uses surrounding the Project Site. Potential indirect impacts resulting from air quality and noise impacts in the surrounding environment are discussed in Section 4.3 and 4.4 respectively. As described in Section 2.12 it is proposed to rehabilitate the Project Site such that it may be used predominantly for nature conservation and for stock sheltering in some places post-quarry life.

4.1.2.3 Surrounding Residences

Table 4.1 lists the residences displayed on **Figure 4.3** and their respective distances to the closest point of both the existing extraction area and the proposed extraction area.

Table 4.1
Nearby Residences and Distances from Dowe's Quarry

Residence Number[1]	Name	Residence on Property	Direction from Quarry	Distance to Existing Quarry	Distance to Proposed Quarry
1	RSH & MO Dowe	Y	SW	1 100m	730m
2	J-P Jacquet, MJ Bielski	Y	SW	1 590m	1 270m
3A	Vibrato Investments Pty Limited	Y	W	1 050m	540m
3B	Vibrato Investments Pty Limited	Y	NW	1350m	1120m
4	RL Caldwell	Y	SW	1 730m	1 240m
5A	GL & JM Smith	Y	SW	1 940m	1 530m
5B	GL & JM Smith	Y	SW	1700m	1430m
6	DB Weir, GR Smith, WF Marsden	Y	SW	1 840m	1 420m
7	SJ & JM Martin	Y	SSE	1 530m	1 530m
8	RB & CA Sewell	Y	SSE	1 370m	1 400m
9	MJ & NJ Lewis, RB & CA Sewell	Y	SE	1 290m	1 330m
10	KR & LA Willcocks	N	-	-	-
11	JK & HJ Ingram	N	-	-	-
12	TE Barratt (Jnr), NL Bush	Y	E	1 150m	1 300m
13	IM Ibbett	Y	E	1 310m	1 470m
14	GM O'Reilly, MP Watt	Y	E	1 600m	1 770m
15	WH & GM Cooper	Y	E	1 690m	1 850m
16	PA & KM Willis	Y	SW	1 650m	1 300m
17	The State of NSW	N	-	-	-
18	MP & CA Moore	N	-	-	-
19	GB & DK Phillips	Y	E	1 580m	1 710m
20	CA Jackson, D Bunic	N	-	-	-
21	DM & AJ Mullins	Y	S	1 540m	1 520m
22	JP & SL Doyle	Y	SE	1 740m	1 750m
23	LD Merchant	Y	SE	1 770m	1 790m

Note 1 – See reference on **Figure 4.3**

For the purposes of this document surrounding residences are assessed in the following three groups:

- those to the east of the Project Site;
- those to the northwest, west and southwest of the Project Site; and
- those to the south and southeast of the Project Site.

It is noted that there are no residences to the north, between the Project Site and the southern boundary of Bald Rock National Park.

4.1.2.4 Residences Adjacent to the Transport Routes

Figure 4.4 displays the residences located adjacent to the transport routes currently used to transport raw materials to the Sunnyside Crushing and Screening Plant and to back-load clay fines for emplacement at Dowe's Quarry (as previously described in Section 2.8). The setback distances to the residences adjacent to Mount Lindesay Road, New England Highway and Old Ballandean Road, are as follows.

Mount Lindesay Road

- 100kph Section (28m to 46m)
- 70kph Section (18m to 35m)
- 50kph Section (15m to 30m)

New England Highway.

- 100kph Section (18m to 190m)
- 80kph Section (32m to 60m)
- 50kph Section (10m to 30m)

Old Ballandean Road.

- 100kph Section (20m to 140m)

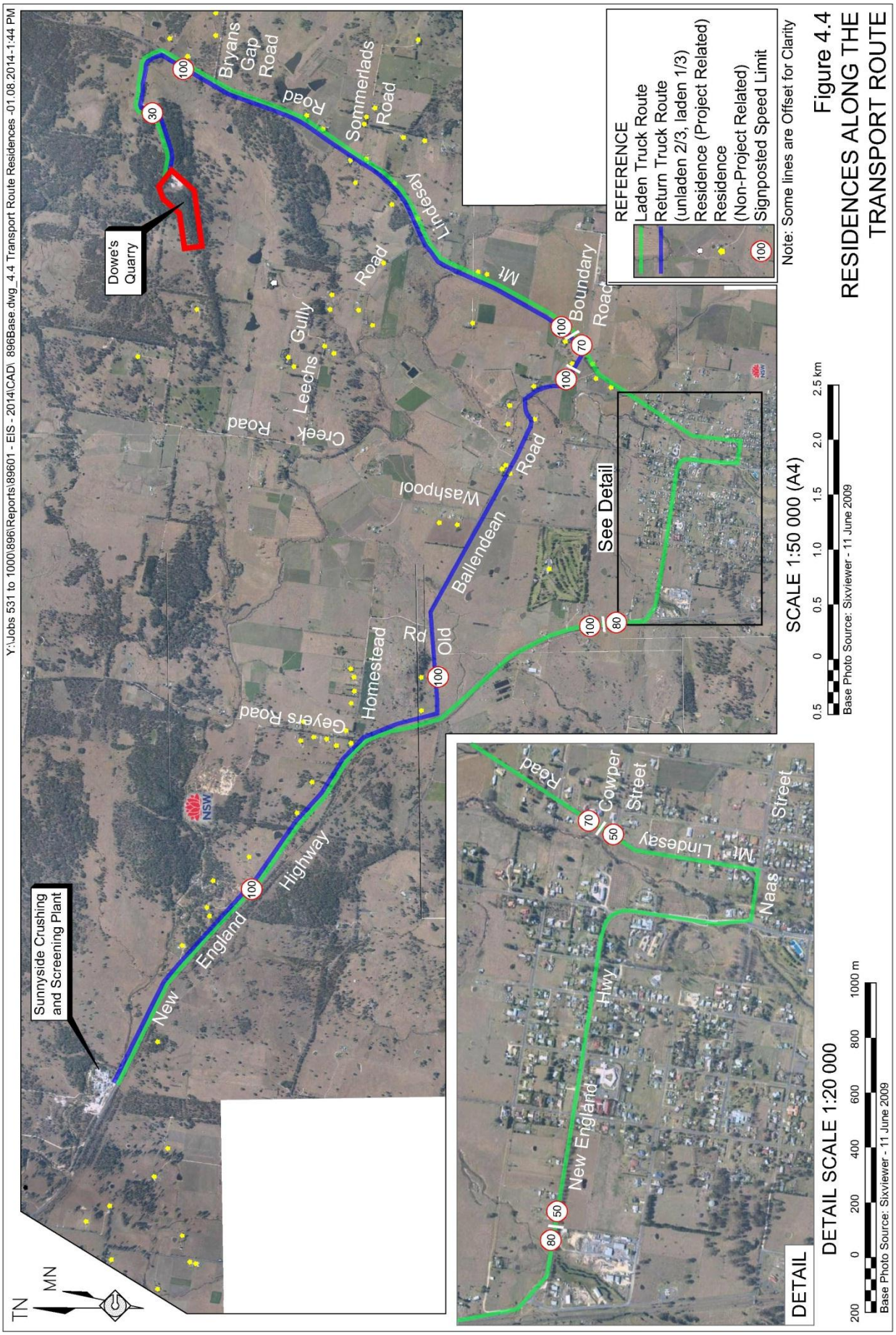
It is noted there are no school zones along the transport route between Dowe's Quarry and the Sunnyside Crushing and Screening plant.

4.1.3 Meteorology

4.1.3.1 Introduction

Climatic conditions have the potential to influence a range of Proposal-related impacts at surrounding residences and the local environment. The climate in the vicinity of Tenterfield is referred to as "subtropical highland climate" with cold, frosty winters and warm, wet summers.

This subsection provides a brief overview of the climatic conditions surrounding the Project Site, focusing particularly on those aspects of the climate that are likely to influence the potential Proposal-related environmental impacts, particularly air quality, noise and surface water management.


Y:\Jobs 531 to 1000\896\Reports\89601 - EIS - 2014\CAD\ 896Base.dwg_4.4 Transport Route Residences -01.08.2014-1:44 PM
Figure 4.4
RESIDENCES ALONG THE TRANSPORT ROUTE
REFERENCE
Laden Truck Route
Return Truck Route (unladen 2/3, laden 1/3)
Residence (Project Related)
Residence (Non-Project Related)
Signposted Speed Limit
Note: Some lines are Offset for Clarity
SCALE 1:50 000 (A4)
Base Photo Source: Sixviewer - 11 June 2009
DETAIL SCALE 1:20 000
Base Photo Source: Sixviewer - 11 June 2009
DETAIL
See Detail
Dowe's Quarry
Sunnyside Crushing and Screening Plant
Bryans Gap Road
Sommerlads Road
Lindesay
Mt
Boundary Road
Gully
Leechs Creek Road
Washpool
Ballendean Road
Old Rd
Homestead
Geyers Road
New England Highway
Cowper Street
Naas Street
Mt Lindesay
New England Hwy
TN
MN

Meteorological data for the existing environment was sourced from the local Federation Park Bureau of Meteorology (BOM) station (Station Number – 056032) which provides a data range from 1870 to the present for some parameters. Evaporation data was sourced from the Average Pan Evaporation Map compiled by the Bureau of Meteorology.

Table 4.2 provides a summary of the climate data which is discussed further in the following subsections.

Table 4.2
Climate Data Summary

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
Temperature (°C) 1907 to 2014													
Mean maximum temperature	27.1	26.1	24.6	21.7	18.0	15.0	14.4	16.0	19.5	22.3	24.8	26.6	21.3
Mean minimum temperature	14.4	14.3	12.5	8.5	4.9	2.4	1.0	1.8	4.6	8.0	10.8	13.0	8.0
Highest Daily Temperature	38.3	36.7	35.6	32.9	27.1	24.6	22.7	30.0	31.2	33.5	36.2	36.8	-
Lowest Daily Temperature	4.5	4.0	-3.0	-5.0	-8.8	-9.3	-10.6	-9.5	-7.2	-3.4	-2.0	1.2	-
Rainfall (mm) 1870 to 2014													
Mean monthly rainfall	115.3	94.4	79.9	47.1	48.6	50.6	54.1	43.5	50.7	76.6	85.8	104.7	851.2
Highest daily rainfall	144.0	190.6	139.7	110.6	101.8	109.7	228.6	61.2	83.3	94.0	100.1	124.2	-
Rain Days ≥1mm	8.8	8.1	7.7	5.6	5.7	5.9	5.7	5.3	5.4	6.9	7.5	8.6	-
Evaporation (mm) BOM Pan Evaporation Map 1975 – 2005 (including at least 10 years of data)													
Mean monthly evaporation	200	175	150	125	80	60	60	80	125	150	200	200	≈ 1600
Source: Bureau of Meteorology 2014													

4.1.3.2 Temperature

Temperature patterns follow seasonal expectations with higher mean temperatures during the summer months of December to February and lowest temperatures during winter. The mean maximum temperature varies between 27.1°C and 14.4°C while the mean minimum temperature varies between 1.0°C and 14.4°C. Temperatures in the past have reached 38.3°C in summer and -10.6°C in winter.

4.1.3.3 Rainfall and Evaporation

Mean annual rainfall is 851.2mm, with rainfall distributed unevenly throughout the year. The area displays a distinct drier period for the six months from April to September. Rainfall for January and December is on average higher than 100mm. Rainfall is infrequent with few rain days each month resulting in rainfall greater than 1mm. Rainfall can however be variable, with infrequent, high intensity rainfall events occurring throughout the year with rainfall received generally being twice the average monthly rainfall.

The minimum water settlement and sediment storage zones for the three sediment dams located within the Project Site (see **Figure 4.2**) has been calculated based on a 5-day 90th percentile rainfall event, described in Volume 2E of the Blue Book (DECC 2008) as the design rainfall event for a standard receiving environment. For the Tenterfield locality, the Blue Book

nominates the 5-day 90th percentile event as 47.4mm (Landcom 2004). **Appendix 3** provides further information on the calculation of sediment dam water settlement zones and storage capacity used for the Proposal.

The estimated mean monthly evaporation is higher than mean monthly rainfall for each month resulting in an annual moisture deficit.

4.1.3.4 Wind

The CSIRO prognostic meteorological model TAPM was configured for four complete years between 2010 and 2013 to review prevailing annual wind conditions. **Figure 4.5** displays average wind roses for each season and an annual average predicted by the model for 2013.

Dominant winds were predicted from the west and the east with Environ (2014) noting that this may be a result of the topography of the Project Site (see **Figure 4.1**). Very little wind in other directions was predicted by the model. The dominance of these winds was also verified in discussions with site employees. Westerly winds were predicted for up to 16% of the year and the average wind speed of approximately 4.0m/s was predicted for all seasons. Calms were predicted to occur less than 2% of the time, although Environ (2014) notes that TAPM is generally not reliable for predicting percentage calms, often under-predicting this value.

4.2 TRAFFIC AND TRANSPORTATION

4.2.1 Introduction

The Secretary's EARs identify "*traffic and transport*" as a key issue for assessment in the EIS requiring assessment of potential impacts to the road network and a description of measures that would be implemented to improve or maintain the capacity, efficiency and safety of the road network. In addition, Roads and Maritime Services (RMS) and the Tenterfield Shire Council have requested a detailed consideration of a range of elements including the following.

- Predicted traffic volumes.
- Intersection condition and sight distances.
- Impacts on public transport and alternative transport modes, e.g. cyclists or pedestrians.
- Indirect impacts such as dust and noise generated along the transport routes.
- Details of any proposed road maintenance contributions plan.

The EARs and the requirements of these agencies are included in full as **Appendix 2**.

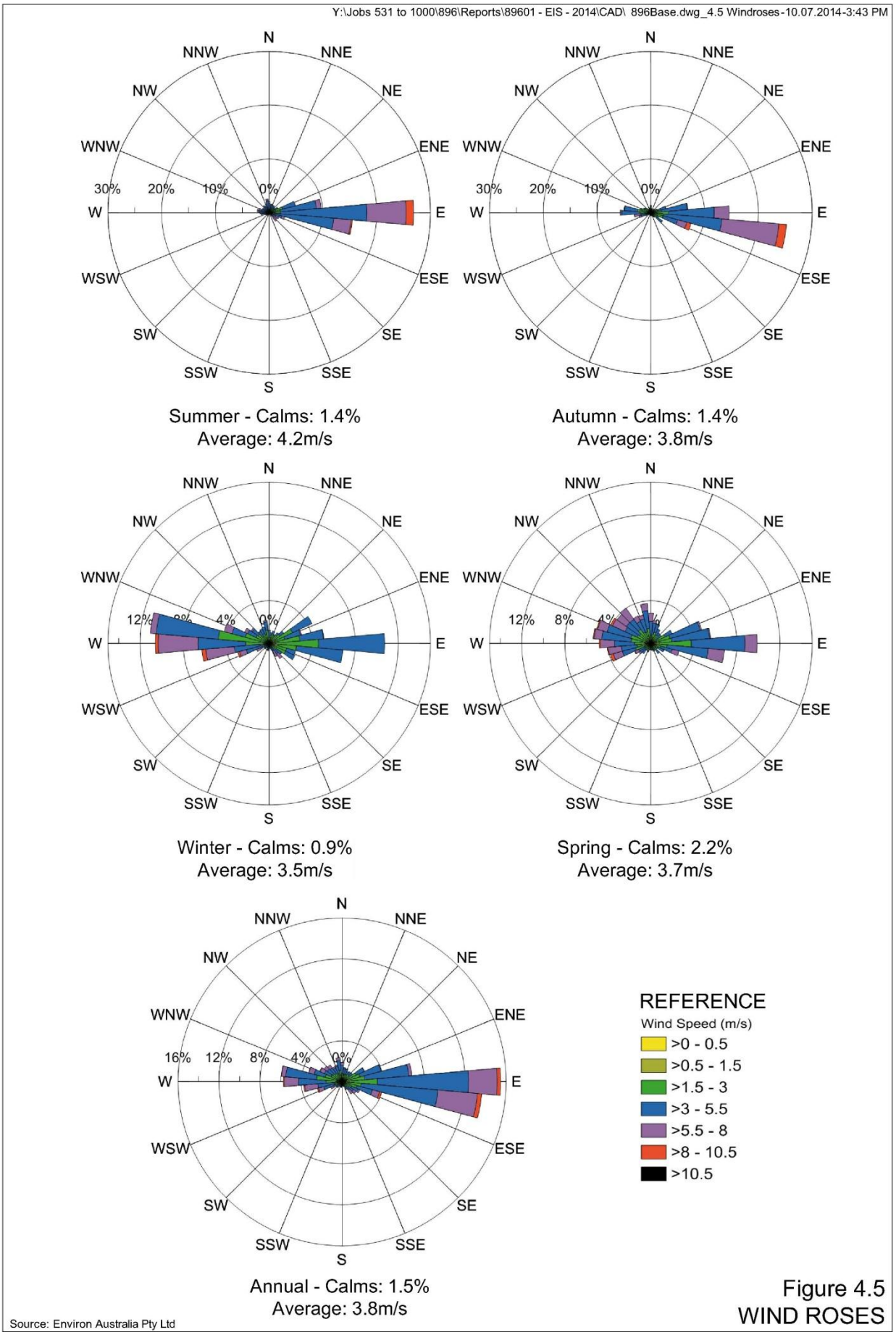


Figure 4.5
WIND ROSES

Based on consideration of the proposed raw materials transportation (Section 2.8) and the local setting (Section 4.1) the specific traffic and transportation related impacts that may result as a consequence of the Proposal (without the implementation of the safeguards, controls and mitigation measures presented in this section) and therefore require assessment include:

- dust nuisance generated by Quarry-related trucks travelling along unsealed roads;
- noise nuisance caused by Quarry-related trucks transporting products along the routes designated in Section 2.8;
- traffic incidents arising from conflict between Quarry-related trucks and other motor vehicles or native fauna; and
- degradation of the surface of public roads and intersections.

It is recognised that the bulk of the materials transported from Dowe's Quarry are destined to the Sunnyside Crushing and Screening Plant. However, for the purposes of this application it is likewise recognised that occasional loads of materials are delivered to other destinations in the Tenterfield area.

The Applicant has commissioned Mr Ben Rossiter of Constructive Solutions Pty Ltd to prepare a Traffic Impact Assessment that reviews the existing traffic levels and assesses the potential impacts of the Proposal on the public local and regional road network. A copy of the assessment report is presented as **Appendix 4** and is referred to hereafter as Constructive Solutions (2014).

It is noted that Dowe's Quarry is fully developed and operational and as such there will be no requirements for any construction or site establishment procedures that would influence traffic levels. The road traffic assessment was prepared with considerable reliance placed upon the experience gained by the Applicant through its operations over the past 30 years.

This subsection provides a summary of the report provided by Constructive Solutions (2014) with respect to the local and regional road network, concentrating on the relevant matters raised in the EARs and includes a review of the existing traffic levels and road conditions, traffic levels expected under the Proposal and proposed management and mitigation measures that may ameliorate potential impacts. This is followed by a review of potential residual impacts after implementation of proposed safeguards and management measures. The text in this subsection relating to the New England Highway beyond its intersection with the local and regional road network has been compiled by R.W. Corkery & Co. Pty Limited in conjunction with the Applicant.

Matters relating to dust generation and road traffic noise are respectively addressed in Sections 4.3 to 4.4 of this document.

4.2.2 Existing and Future Road Transport Environment

4.2.2.1 Introduction

This subsection provides an overview of the existing and predicted future road transport environment used by heavy and light vehicles travelling principally between Dowe's Quarry and the Sunnyside Crushing and Screening Plant. An overview of the existing road conditions and traffic levels is provided as well as an estimate of future traffic levels and traffic generated by the Proposal.

As described in Section 4.2.1, transportation activities are expected to occasionally require delivery of raw material to destinations other than the Sunnyside Crushing and Screening Plant. However, for the purposes of this assessment and given the principal destination for transported materials would remain the Sunnyside Crushing and Screening Plant, only the routes between Dowe's Quarry and the Sunnyside Crushing and Screening Plant has been addressed.

4.2.2.2 Existing Road Network

The road network used by heavy vehicles travelling between Dowe's Quarry and the Sunnyside Crushing and Screening Plant is displayed on **Figure 4.4**. The existing and proposed routes use various roads designated as State, regional and local roads with the route varying depending on the direction of travel.

Mount Lindesay Road (Regional Road MR 622)

Mount Lindesay Road is a regional road that provides a link between Tenterfield and the villages of Legume and Woodenbong as well as an alternative crossing of the Queensland border in the direction of Beaudesert where it has been designated as a highway. The road was decommissioned as a State Highway in 1982 and is recognised locally and regionally for its deteriorated condition (Ingall 2013). The *Tenterfield Shire Council Economic Development Strategy 2013 – 2017* refers to consultation with both State and Federal governments to assist with funding to upgrade the Mount Lindsay Road corridor as one of Council's strategic actions for the 2013 to 2017 period. Within Tenterfield, the Mount Lindesay Road is also referred to as Logan Street.

Between Dowe's Quarry and Tenterfield, the standard and condition of the Mount Lindesay Road varies and traverses generally undulating to steep terrain. The pavement width is generally 6.5m to 7.0m with an unsealed shoulder and narrow verge. The speed limit along this section varies from 100km/hr at the entrance to the quarry access road, further reducing to 70km/hr as vehicles approach Tenterfield and finally to 50km/hr within the town boundary (see **Figure 4.4**). There are no edge lines along the road and centreline marking is worn in sections. Delineation is provided sparsely by guideposts although these are not always duplicated on both sides of the road. The pavement is in a fair to reasonable condition with evidence of some rutting and edge break. There are three intersections and approximately 14 residences adjacent to the 5.1km section of the road to the intersection with Old Ballandean Road and Boundary Road.

Naas Street

Naas Street is a local road within Tenterfield that provides the link between Mount Lindesay Road (Logan Road) and the New England Highway. This 250m section of Naas Street is approximately 7m wide though it narrows at a small culvert before the intersection with the New England Highway. There is evidence of some outer wheel path rutting near the intersection with the New England Highway, however, the pavement condition is reasonable elsewhere. There are no residences adjacent to this section of Naas Street. The speed limit along Naas Street is 50km/hr (see **Figure 4.4**).

Old Ballandean Road

Old Ballandean Road is a local road which links the New England Highway with the Mount Lindesay Road and is used by trucks, either unladen or laden returning to Dowe's Quarry or when back-loading fines for emplacement or stockpiling within the Project Site. Approximately 12 rural holdings with residences are set back from the 3.7km length of the road with various access points.

There is adequate width for a single lane in each direction, however, no line marking and limited guide posts are present. The pavement is in good condition with few defects. There is some evidence of edge break on the northern side of the road. The speed limit is 100km/hr along this road (see **Figure 4.4**). The road also contains two unmarked causeways.

New England Highway (HW9)

The New England Highway is a State Road that links Newcastle in NSW to Yarraman near Toowoomba in Queensland. The highway currently passes through the centre of Tenterfield although the RMS is considering a range of options to construct a highway bypass around Tenterfield (RMS, 2013). Within Tenterfield, the New England Highway is also referred to as Rouse Street.

The 9.1km section of the New England Highway used by trucks travelling to the Sunnyside Crushing and Screening Plant comprises:

- a 1.8 km section within the 50km/hr zone within Tenterfield;
- a 0.7km section within the 80km/hr zone on the northern outskirts of Tenterfield ;
- a 6.6km section within the 100km/hr zone north of Tenterfield.

The New England Highway has been constructed to a high standard with marked centre and fog lines providing 3.5m wide lanes and sealed shoulders between 0.5m and 1.5m wide.

4.2.2.3 Intersections

Intersection sight distances for the majority of intersections with the roads used for quarry-related transportation are provided in **Table 4.3** with the corresponding Safe Intersection Sight Distance (SISD) based on a reaction time of two seconds provided for reference (Austroads, 2010).

The details provided in **Table 4.3** highlight that the following intersections have limited sight distances.

- Leechs Gully Road with Mount Lindesay Road looking north.
- Bryans Gap Road with Mount Lindesay Road looking south.
- Old Ballandean Road with the New England Highway looking north.
- Homestead Road with Old Ballandean Road looking east.
- Washpool Creek Road with Old Ballandean Road looking west.

At each of these intersections trucks using the proposed transport routes would have right of way.

Table 4.3
Estimated Intersection Sight Distance

Intersecting Roads	Sight Distance north (m)	Sight Distance south (m)	Sight Distance east (m)	Sight Distance west (m)	Speed Zone (km/hr)	Safe Intersection Sight Distance (m)#
Mount Lindesay Road						
Old Ballandean Road	260	210	-	-	70	151
Leechs Gully Road	220	240	-	-	100	248
Sommerlads Road	450	265	-	-	100	248
Bryans Gap Road	260	110	-	-	100	248
Quarry Access Road	250	250	-	-	100	248
Naas Street						
New England Highway (Rouse Street)	350	190	-	-	50	97
Mount Lindesay Road (Logan Street)	-	-	360	210	50	97
Old Ballandean Road						
New England Highway	110	>500m	-	-	100	248
Homestead Road	-	-	230	330	100	248
Washpool Creek Road/ Pelham Street	-	-	380	100	100	248
Rouse Street	-	-	N/A	360	100	248

N/A – Not Assessed

– Safe Intersection Sight Distance based on 2 second reaction time (Austroads 2010)

Source: Constructive Solutions (2014) – Modified after Tables 3, 4 and Section 3.2

In its correspondence accompanying to the EARs, RMS requested that the EIS review the following intersections with consideration of the current Austroads guidelines.

- New England Highway and Nass Street intersection.
- New England Highway, Bruxner Way and Old Ballandean Road intersection.
- New England Highway and Sunnyside Crushing Facility Site access point/s.
- Mount Lindesay Road and Old Ballandean Road intersection.
- Mount Lindesay Road and the Dowe's Quarry access road.

New England Highway and Naas Street

Naas Street forms a four way intersection with the New England Highway with the Highway having right of way and a sign-posted speed limit of 50km/hr. Sight distances at this intersection are good with traffic controlled by duplicated stop signs and hold lines at the Naas Street approaches. Both roads have one lane in each direction at the intersection.

The pavement is in good condition and line marking is reasonable. The road shoulder is sealed (approximately 1.5m from edge lines) and a W Beam guardrail provided along the western side of the highway.

New England Highway, Bruxner Way and Old Ballandean Road

The New England Highway has right of way at this intersection with a sign-posted speed limit of 100km/hr on all approaches. As described in **Table 4.3,** the intersection has limited sight distance to the north. The intersection pavement and line marking is in good condition. There is good dimensional capacity for turning manoeuvres with the intersection controlled by duplicated give way signs on the Old Ballandean and Bruxner Way approaches.

New England Highway and Sunnyside Plant Entries

Two entrances are used by vehicles entering and leaving the Sunnyside Crushing and Screening Plant, namely a northern and southern entrance. The highway at both entrances comprises a single lane in both directions. It is noted that these entries/intersections with the New England Highway have been in existence for almost 40 years without any traffic incident.

The northern entrance is used by all trucks entering the plant site from the south and all trucks leaving the site in both a northerly and southerly direction. The southern entrance is used only by vehicles entering the plant site from the north.

The southern entrance is effectively a "T" intersection with a concrete entrance and gutter abutting the sealed highway pavement. The Applicant proposes to extend the concrete entrance further onto the plant site and repair the gutter within the next 2 years. The pavement at the entrance shows a degree of wear arising from the turning movement of trucks entering the plant site. The entrance has excellent visibility of 430m to the north and >500m to the south.

The northern entrance is effectively a "Y" intersection with a gravel entrance from the highway. The entrance also has excellent visibility of 320m to the south and >500m to the north.

Mount Lindesay Road and Old Ballandean Road (and Boundary Road)

The Mount Lindesay Road has right of way at this intersection with a sign-posted speed limit of 70km/hr. There are no controls at the intersection. The pavement is in reasonable condition with evidence of some rutting and edge break. As displayed in **Table 4.3**, sight distances at this intersection are good.

Mount Lindesay Road and Dowe's Quarry Access Road

The intersection of Mount Lindesay Road with the quarry access road heads to the northwest in the direction of the Quarry. The Mount Lindesay Road has right of way at the intersection with a sign-posted speed limit of 100km/hr. The access road is sealed for approximately 120m from the edge of the Mount Lindesay Road. There are no controls at the intersection and no warning signs regarding turning trucks along the Mount Lindesay Road. The pavement is in reasonable condition with evidence of some rutting and edge break. As displayed in **Table 4.3,** sight distances at this intersection are reasonable.

4.2.2.4 Future Road Network

A significant upgrade to the New England Highway is being investigated by RMS to bypass the centre of Tenterfield. A range of route options are under consideration for the bypass. Most of the nominated routes bypass Tenterfield to the west (GHD 2014) and would not impact the proposed transportation route for the Proposal. The single proposed route that bypasses Tenterfield to the east would require an upgrade of Old Ballandean Road and would intersect

with the Mount Lindesay Road. Should this route be selected the Applicant would revisit the transportation route as this would alleviate the need for Proposal-related transportation to pass through the edge of Tenterfield.

Additional changes to the road network may also result from upgrade of the Mount Lindesay Road should the consultation proposed in the *Tenterfield Shire Council Economic Development Strategy 2013 – 2017* be successful.

4.2.2.5 Existing and Projected Traffic Levels

Assessment of traffic levels for the New England Highway bypass of Tenterfield included traffic counts undertaken at several locations within Tenterfield (GHD, 2014). These results are provided in **Table 4.4** and are sourced from traffic counts undertaken from 16 October to 22 October 2012. Additional counts were provided by RMS from surveys undertaken in 2011 on the section of the New England Highway through Tenterfield that is locally known as Rouse Street. Forecast traffic is estimated to 2044 to account for a 30 year Proposal life and has been estimated using an assumed growth rate of 1.5% per annum.

Table 4.4
Current and Forecast Daily Traffic Volumes

Road	Location	Existing Traffic (2012)			Forecast Traffic (to 2044)		
		Light Vehicles	Heavy Vehicles	Total	Light Vehicles	Heavy Vehicles	Total
New England Highway	Rouse Street*	N/A	N/A	6 321	N/A	N/A	10 332
New England Highway	North of Bruxner Way#	2 044	483	2 527	3 292	778	4 069
Mount Lindesay Road	North of Old Ballandean Road#	340	85	425	548	137	684
Old Ballandean Road	West of Mount Lindesay Road#	149	42	191	240	68	308
# 2012 Surveys Undertaken for Tenterfield Heavy Bypass investigation (GHD 2014). * 2011 survey provided by RMS							
Source: Constructive Solutions (2014) – Table 5							

Traffic expected to be generated by the Quarry has been described in Section 2.8. In summary, it is considered that average traffic levels would remain at the existing levels of 20 movements per day (i.e. 10 loads per day) and the maximum traffic level would not exceed 40 movements per day (i.e. 20 loads per day) during periods of high product demand or after long periods of poor weather.

It is noted that the increase in annual production to 100 000tpa from the current level of 60 000tpa would be achieved not by increasing the maximum number of truck movements per day but rather by increasing the number of days in each year when above average or maximum truck movements occur.

Trucks used for quarry-related transport would continue to be parked overnight at the Sunnyside Crushing and Screening Plant and therefore limit light vehicle traffic levels to four movements per day (for the quarry manager and a single machinery operator). It is also expected that occasional visits from contractors and management would require two additional trips (four movements) in a given day.

4.2.2.6 Proposal Contribution to Traffic Levels

The quarry-related traffic during the period when the traffic counts were being assessed for GHD (2014) has been provided from records held by the Applicant. From 16 October to 22 October 2012 the quarry generated an average of 16 loads or 32 movements per day. It has also been conservatively assumed that there were four light vehicle movements per day during that time. These numbers are assumed to have been included in the traffic counts provided in GHD (2014).

In order to estimate the existing contribution to total traffic levels during a period of peak transportation activities from the Quarry, the quarry-related traffic assumed to be included in the traffic counts has been subtracted from the traffic totals provided in **Table 4.4**. The proposed peak quarry-related traffic levels have been added to this number to give a combined traffic level at the peak of quarry-related traffic. The percentage contribution of quarry-related traffic has then been established based on the contribution of quarry-related traffic to the modified combined total. These results have been provided in **Table 4.5**. An annual growth rate of 1.5% has then been applied to the existing traffic minus the quarry-related traffic and a combined total determined for 2044 based on traffic growth and the peak level for quarry-related transport remaining the same. These results are provided in **Table 4.6**.

Table 4.5
Contribution of Proposal-Related Traffic to Traffic Levels

	Existing Traffic (Less Proposal Traffic)		Maximum Quarry Traffic Levels		Combined Traffic		Quarry Contribution to Total Traffic (%)	Quarry Contribution to Heavy Vehicle Traffic (%)
Road	**LV**	**HV**	**LV**	**HV**	**LV**	**HV**		
Mount Lindesay Road[1]	336	53	8	40	344	93	11.0	43.0
Mount Lindesay Road[2,3]	338	69	4	20	342	89	5.6	22.5
Old Ballandean Road	147	26	4	20	151	46	12.2	43.5

LV – Light Vehicle

HV – Heavy Vehicle

Note 1: Mount Lindesay Road north of Old Ballandean Road.

Note 2: Mount Lindesay Road south of Old Ballandean Road

Note 3: For the purposes of this assessment the current traffic volumes on Mount Lindesay Road to the south of Old Ballandean Road are presumed to be the same as those to the north of Old Ballandean Road

Source: Constructive Solutions (2014) – Table 7

Table 4.6
Contribution of Proposal-Related Traffic to Future (2044) Traffic Levels

	Forecast Traffic (Less Proposal Traffic)		Maximum Quarry Traffic Levels		Combined Traffic		Quarry Contribution to Total Traffic (%)	Quarry Contribution to Heavy Vehicle Traffic (%)
Road	**LV**	**HV**	**LV**	**HV**	**LV**	**HV**		
Mount Lindesay Road[1]	542	86	8	40	550	126	7.1	31.7
Mount Lindesay Road[2,3]	545	112	4	20	549	132	3.5	15.2
Old Ballandean Road	237	42	4	20	241	62	7.9	32.3

LV – Light Vehicle

HV – Heavy Vehicle

Note 1: Mount Lindesay Road north of Old Ballandean Road.

Note 2: Mount Lindesay Road south of Old Ballandean Road

Note 3: Current traffic volumes on Mount Lindesay Road to the south of Old Ballandean Road are presumed to be the same as those to the north of Old Ballandean Road

Source: Constructive Solutions (2014) – Table 8

The results from **Table 4.5** and **Table 4.6** indicate that at peak levels the quarry-related traffic would contribute 12.2% of total traffic and 43.5% of heavy vehicle traffic on Old Ballandean Road and 11.0% of traffic and 43.0% of heavy traffic between Old Ballandean Road and the quarry access road. The contribution of traffic to Mount Lindesay Road effectively halves south of the intersection with Old Ballandean Road. This contribution to total traffic would be expected to decrease over time as total traffic levels increased and the peak traffic to and from the Quarry would remain the same.

The contribution of Proposal-related vehicles to traffic on the New England Highway would remain minor. The results of a survey undertaken by RMS in 2011 suggest that at the time of the survey there were 6 321 vehicles using the New England Highway daily at Rouse Street in the centre of Tenterfield (see **Table 4.4**). The Proposal-related contribution to this traffic at the maximum production level would include 4 light vehicle movements and 20 heavy vehicle movements daily. Without incorporating potential changes to the background traffic level over the past three years, this would represent 0.4 percent of the total traffic. The traffic levels, on the New England Highway north of Bruxner Way (**Table 4.4**) provide an indication of the Proposal traffic's contribution to heavy vehicle movements on the New England Highway. Based on maximum production levels, the Proposal would contribute approximately 8.3% of heavy vehicle movements along the New England Highway between Old Ballandean Road and the Sunnyside Crushing and Screening Plant (a distance of approximately 4.8km) while this would be halved to the south of Old Ballandean Road.

4.2.2.7 School Bus Network and Other Road Users

A single school bus operator is known to use sections of the roads proposed to be included in the transportation route. Mr Trevor Austin's school bus service runs from Tenterfield along Naas Street to Logan Street and Mount Lindesay Road as far north as Leechs Gully Road and continues via Washpool Creek Road and Old Ballandean Road before turning right onto Homestead Road.

There are only two drop off and pick up locations on the transportation route located near the transition from the 50km/hr to 70km/hr speed zone on Mount Lindesay Road and at the intersection of Mount Lindesay Road with Old Ballandean Road.

Mr Austin has previously raised concerns about material falling from trucks, which he indicated has been primarily rectified through tarping of all loads. He has also raised concerns regarding the speed of trucks as they approach Tenterfield along Mount Lindesay Road especially as they travel down hill on approach to the bridge over Branch Creek.

There is very limited pedestrian or cyclist activity undertaken on the road network except within the built up town areas.

4.2.2.8 Road Accidents

Road crash data sourced from the NSW Transport Centre for Road Safety for the roads addressed by Constructive Solutions (2014) indicate that over the past five years a single fatality and 11 injuries have resulted from road incidents along the section of roads used by trucks travelling between Dowe's Quarry and the Sunnyside Plant. Constructive Solutions (2014) indicate that the majority of these incidents resulted from vehicles failing to give way and/or stop at intersections. Two of the incidents involved heavy vehicles (including the fatality) however these were not caused by quarry-related vehicles.

4.2.3 Management and Mitigation Measures

The Applicant proposes to continue to transport the raw materials extracted from within Dowe's Quarry in a manner that preserves the safety and amenity of staff, nearby residents and the community of Tenterfield.

In order to ensure this is achieved, the Applicant would continue to implement the recently introduced Driver's Code of Conduct that would be signed by all truck drivers, included in induction and training procedures and retained with drivers at all times during quarry-related transport activities. A copy of the Driver's Code of Conduct is provided as **Appendix 5**. Key information included in the code relates to the following.

- Operating hours for product transportation.
- Self imposed speed limits such that trucks would travel at speeds no greater than 80km/hr on Mount Lindesay Road and Old Ballandean Road and no greater than 30km/hr on the quarry access road and 10km/hr within the Project Site.
- Directions on required driving and other behaviour while undertaking quarry-related transportation activities.
- Personal and public safety instructions while undertaking quarry-related transportation activities.

The Applicant would also modify the Driver's Code of Conduct to include additional details recommended by Constructive Solutions (2014). This would include the following information.

- Directions regarding vehicle checking procedures.
- Details of all known hazards on the haulage route including current bus stop locations.

In addition, the Applicant would commit to seal a further 280m section of the quarry access road from the intersection with the Mount Lindesay Road towards the Project Site increasing the total length of sealed road to 400m. This would limit the possible dust lift off and noise impacts from this section of the road affecting mainly those residences to the east of the intersection of the quarry access road and Mount Lindesay Road. In addition, the Applicant would undertake construction works to improve the intersection with the Mount Lindesay Road in the manner recommended by Constructive Solutions (2014). This would include adding "Give Way" signs and appropriate line marking and widening the mouth of the intersection to improve the angle of entry of the intersection so that trucks can approach Mount Lindesay Road at an angle closer to 90 degrees.

The Applicant has agreed (in consultation with the Tenterfield Shire Council) to pay a contribution to Council for the ongoing maintenance of the local roads along the transport routes (i.e. Mount Lindesay Road and Old Ballandean Road) as described within the *Tenterfield Shire Council Section 94 Development Contributions Plan 2013*. The current contribution level includes a one-off fee of $205 for administrative purposes and an ongoing contribution of $0.04 per tonne per kilometre of materials transported. The contribution payable for material transported from Dowe's Quarry would be 26.4 cents per tonne and 35.2 cents per tonne for the clay fines being back loaded to the Quarry. Based on the transportation of 1.3 million tonnes of quartzose material and return of 0.45 million tonnes of fines, the total contribution over the remaining life of the Quarry is estimated approximately $500 000.

Constructive Solutions (2014) identified various sections of the transport routes used by trucks travelling to and from Dowe's Quarry that exhibit a degree of edge break on the sealed section of the road. The Applicant considers it is appropriate that the Section 94 contributions referred to above are used by Council for the maintenance of these sections of the transport routes.

No intersection upgrades are required along the transport routes (other than minor shoulder widening at the corner of Logan and Naas Streets) given the assessments undertaken by Constructive Solutions (2014) and the absence of any traffic incidents at either of the entrances to the Sunnyside Crushing and Screening Plant from the New England Highway. The southern entrance to the plant is well situated with excellent sight distances which provide motorists sufficient time to safely accommodate for the turning movements of trucks into or from the southern entrance.

Notwithstanding the absence of incidents at the southern entrance to the Sunnyside Crushing and Screening Plant, the Applicant would undertake a range of minor works to upgrade the entrance to the plant by repairing and extending the concrete approaches to the entrance.

The Applicant also recognises that incidents involving a truck travelling to or from Dowe's Quarry may attract a complaint. A complaints management system would continue to be maintained to record each complaint and ensure a thorough investigation is undertaken in accordance with the Driver's Code of Conduct and the results are discussed with the complainant where appropriate to do so.

4.2.4 Assessment of Impacts

The assessment of road traffic impacts relating to the Proposal relies considerably upon the Applicant's experience gained to date through raw material transportation that has occurred since the quarry commenced operations in 1987. The assessment focuses on impacts of vehicles travelling between Dowe's Quarry and the Sunnyside Crushing and Screening Plant and has been extrapolated to 2044 to account for the proposed 30 year life of the Quarry.

4.2.4.1 Road Safety

The traffic impact assessment completed for the Proposal included a Road Safety Risk Assessment, provided as Appendix A to Constructive Solutions (2014) (see **Appendix 4**). The road safety risk assessment was undertaken by Mr Ben Rossiter during a site visit on 29 April 2014. The assessment involved applying a risk rating (based on residual risk) and consideration of the residual risk given the implementation of proposed control and mitigation measures nominated in Constructive Solutions (2014).

It is noted that a range of the mitigation measures proposed in Constructive Solutions (2014) involve general road maintenance issues that are matters for Council as the statutory body responsible for maintenance of these roads, i.e. for the benefit of all motorists. The Applicant considers that, given its commitment to an ongoing contribution to road maintenance through the *Tenterfield Shire Council Section 94 Development Contributions Plan 2013*, responsibility for road maintenance items remains with Council. The Applicant will continue to maintain operational controls and necessary maintenance of internal roads within the Project Site including the quarry access road.

The Applicant's commitment to reseal the intersection of the quarry access road and the Mount Lindesay Road, extend the sealed section to 400m and provide sufficient signage and line marking at this intersection including advisory signs on Mount Lindesay Road, would satisfy the responsibility of the Applicant towards road safety. Operational controls, managed through the Driver's Code of Conduct would maintain the existing high level of safety and amenity of staff, surrounding residents and the Tenterfield community. Elements such as the additional self-imposed limits to vehicle speed would reduce the likelihood of incidents during travel and increase the required reaction time of other drivers entering the road network from residences along the transport routes or turning onto the transport routes from other roads.

Finally, the Applicant would continue to avoid use of Old Ballandean Road for trucks travelling towards the Sunnyside Crushing and Screening Plant due to the poor intersection sight distance to the north at this intersection.

4.2.4.2 School Bus Services and Other Road Users

The Proposal would not result in removal or modification of any existing school bus pick up or drop off points. The issues raised by the school bus operator, Mr Trevor Austin have been addressed within the Driver's Code of Conduct through limits to vehicle speeds and the requirement for drivers to check all running boards are clean and the dust cover fully extended before vehicles can leave Dowe's Quarry. Consultation with Mr Austin and any other operators would continue throughout the quarry life to ensure requirements relating to the safety of school

children are being met. In addition, Mr Austin and other road users are encouraged to utilise the complaints management system in place for operations at the Project Site to nominate any concerns they may have.

It is assessed that continued operations at Dowe's Quarry would not impact the limited number of other road users such as pedestrians and cyclists.

4.2.4.3 Cumulative Traffic Impacts

The Proposal would involve the continued transportation of raw materials from Dowe's Quarry to the Sunnyside Crushing and Screening Plant and occasionally deliveries to other destinations. It is not proposed that the average annual production rate would vary substantially over the life of the Quarry from the existing level of 60 000tpa although increases would occur during occasional periods of high demand for the products produced from the quartzose rock. Consequently, the heavy vehicle movements attributable to the Proposal would not be expected to change from existing levels outside of the occasional peaks in demand.

Overall, the proportion of heavy vehicles travelling to and from Dowe's Quarry is likely to remain comparable to existing levels and therefore maintain a comparable proportion of total heavy vehicle traffic. Council waste management practices involving transfer of general waste to the Boonoo Boonoo Landfill involves an average of eight heavy trucks loads (16 movements) each week along Mount Lindesay Road. The *Tenterfield Shire Council Waste Management Strategy 2013-2021* proposes closure of the Boonoo Boonoo Landfill within the next five years. However, consultation with Council has indicated that this may remain open for a longer period with internal investigations reviewing a period of 20 years at this location. The preferred route for the proposed Tenterfield Heavy Vehicle Bypass is likely to direct heavy vehicle traffic west of Tenterfield (GHD, 2014) and would result in a reduction of heavy vehicle traffic through the centre and northern parts of Tenterfield.

4.2.4.4 Road Condition and Maintenance

The ongoing maintenance of the roads that would be used by trucks travelling to and from Dowe's Quarry would be the responsibility of the Tenterfield Shire Council. The Applicant would contribute an estimated $0.5 million over the life of the quarry to the Tenterfield Shire Council through the *Tenterfield Shire Council Section 94 Development Contributions Plan 2013* which would be used to fund the maintenance of both Mount Lindesay Road and Old Ballandean Road. The commitment to provide this contribution is considered by the Applicant to constitute a fair cost for infrastructure renewal.

4.2.4.5 Conclusion

The assessment of potential impacts resulting from the continued transportation of quartzose material from and the return of fines to Dowe's Quarry has determined that, given the continued implementation of operational safeguards, internal road improvements and financial contributions to Council, the Proposal would result in only minor ongoing impacts to the road network and other road users. The Applicant considers that any degradation of the road surface resulting from ongoing operational transport activities would be suitably offset by the financial contributions agreed with Council.

4.3 AIR QUALITY

4.3.1 Introduction

The EARs identify "a*ir quality*" as a key issue for assessment in the EIS. The EPA also requests that an air quality impact assessment is included in the assessment undertaken for the EIS. The EARs and the requirements of other government agencies are included in full as **Appendix 2**.

Based on consideration of the proposed activities within the Project Site and raw materials transportation (Section 2) and the local setting (Section 4.1) the specific air quality-related impacts that may result as a consequence of the Proposal (without the implementation of the safeguards, controls and mitigation measures presented in this section), and therefore require assessment include:

- dust nuisance arising from operations, including loading of raw materials for transport;
- dust nuisance arising from the movement of trucks over any unsealed areas within the Project Site and along the quarry access road; and
- the potential impact of transport operations associated with the Proposal on regional, State-wide and national greenhouse gas emission levels.

The issue of silicosis caused by the extraction of the quartzose rock was also raised by Mr Bob Tunbridge, a neighbour to Mr Dowe's property.

The Applicant has commissioned Mr Scott Fishwick of ENVIRON Australia Pty Ltd to prepare an air quality impact assessment that includes assessing existing and predicted emissions associated with the Proposal, including greenhouse gases, against relevant air quality criteria. A copy of the assessment report is presented as **Appendix 6** and is referred to hereafter as Environ (2014).

The following subsections provide a summary of Environ (2014) describing the existing air quality environment, potential sources of contamination and the criteria adopted for the air quality impact assessment. This is followed by an overview of the proposed ongoing operational control measures that would be implemented by the Applicant. Finally, the assessment methodology and results are reviewed and the residual air quality impacts of the Proposal considered following the adoption of safeguards and management measures.

Emissions of greenhouse gases (GHG), including carbon dioxide (CO_2), methane (CH_4), nitrous oxide (N_2O), associated with diesel combustion and blasting activities would also be generated under the Proposal. Due to the comparatively low intensity of current quarrying and transportation operations, Environ (2014) consider that GHG emissions from the Quarry would be minor. Furthermore, as the proposed continued operation (and extension) of the Quarry would not change the equipment used at the quarry, operational intensity or material transportation rate, GHG emissions would not change for future operations relative to current operations. For these reasons, and as the assessment of GHG emissions is not a requirement of the EARs for the Proposal, the quantification of GHG emissions was not considered necessary for the assessment.

4.3.2 Existing Air Quality Environment

In order to assess the impacts of the Proposal which involve an understanding of the cumulative air pollution concentrations and compliance with relevant criteria, Environ (2014) reviewed the meteorological conditions at the Project Site to determine the constraints imposed by prevailing conditions, the existing emission sources and likely ambient air quality pollutant concentrations. Although recent air quality data is not available for the environment surrounding the Project Site Environ (2014) has been able to assemble an approximation of background conditions from data collated from a range of sources.

Prevailing meteorological conditions are discussed in Section 4.1.3 and seasonal and annual wind roses presented in **Figure 4.5**. This data provides information on the likely dispersion of air pollutants in the environment surrounding the Project Site. In summary, westerly winds dominate the surrounding environment and may be influenced by the regional topography. Highest wind speeds are also generally experienced from this direction. Rainfall and evaporation data indicate that a moisture deficit occurs throughout the year with the deficit highest during the summer months.

Environ (2014) reviewed the National Pollutant Inventory and the EPA Environment Protection Licence database to establish if any existing sources of atmospheric conditions would contribute to the cumulative assessment of pollutant concentrations. Environ (2014) did not consider that the presence of the nearby Boonoo Boonoo Landfill (approximately 10km to the northeast) or the Tenterfield Sewerage Treatment Plant (approximately 3km to the southwest) would contribute sufficient emissions to be considered in the assessment of cumulative conditions at the Project Site.

The following pollutant emission sources are considered by Environ (2014) to contribute to background particulate matter emission in the vicinity of the Project Site and are consistent with the rural nature of the surrounding landscape.

- Dust stirred up by vehicle movements along unsealed and sealed public roads.
- Diesel emissions from vehicle movements along public roads.
- Wind generated dust from exposed areas within the surrounding landscape.
- Dust and diesel emissions from agricultural activities at neighbouring properties.
- Seasonal emissions from household wood burning fires.
- Episodic emissions from dust storms and vegetation (e.g. bush and grass) fires.

The background concentration of particulate matter (PM_{10}) was gathered from air quality monitoring data sourced from the EPA's New England District air quality monitoring station located at Tamworth. This is considered by Environ (2014) to be the nearest regional location representative of regional trends for ambient pollutant conditions. It is noted that Tamworth has a higher level of residential, commercial and industrial development than Tenterfield and therefore samples from this area would be considered a conservative estimate of conditions at the Project Site. Environ (2014) provides an overview of the data reviewed from air quality monitoring at Tamworth (see Section 5.3 in **Appendix 6**). In summary, the 24-hour average PM_{10} concentrations at Tamworth were less than 30µg/m^3, approximately 95% of the time between 2009 and 2013. The average 24-hour PM_{10} concentration over this period was 16.9µg/m^3.

4.3.3 Assessment Criteria

Pollutants expected to be generated by operations under the Proposal relate mostly to particulate matter including Total Suspended Particulates (TSP), particulate matter less than 10 microns in aerodynamic diameter (PM_{10}) and particulate matter less than 2.5 microns in aerodynamic diameter ($PM_{2.5}$). Environ (2014) considers that impacts from PM_{10} and dust deposition would be the most relevant to operations at the quarry.

The NSW EPA PM_{10} assessment goals, as specified in the "*Approved Methods for the Modelling and Assessment of Air Pollutants in NSW*" (DEC 2005), are:

- a 24 hour maximum PM_{10} level of 50µg/m^3;
- an annual average PM_{10} level of 30µg/m^3; and
- as there is no available background data regarding deposited dust, an incremental annual average dust deposition level of 2g/m^2/month has been assumed.

4.3.4 Sources of Operational Emissions

The following potential sources of operational emissions were considered by Environ (2014).

- Loading, on-site transportation and unloading of topsoil and/or overburden material.
- Drill and blast activities.
- Loading of blasted rock material into road trucks for transportation.
- Wheel-generated matter from unpaved roads (hauling of extracted rock, overburden material and fines).
- Wind erosion of exposed surfaces at the open extraction area and active stockpiling areas.

4.3.5 Operational Controls and Management Measures

It is recognised at the outset that the areas in close proximity to Dowe's Quarry are well vegetated, particularly to the east and west form the extraction area (see **Figure 4.9**). This vegetation has, and would continue to provide, an effective screen to substantially reduce both deposited and suspended dust concentrations at surrounding residences.

It is noted that the operational controls and management measures presented below focus upon the controls required to achieve the environmental assessment criteria nominated in Section 4.3.3. These controls would equally be applicable to achieve criteria relating to the presence of silica in the air. In fact, it is recognised that it is important for silica levels to be controlled within a quarry to ensure that the workforce is not exposed to harmful levels of fine grained silica. The key control measure to achieve this is the use of air conditioned cabins for equipment such as drill rigs and excavators. It remains a fact that silicosis is an issue for occupational health and safety consideration and not an environmental issue affecting the wider community.

Notwithstanding the existence of the surrounding vegetation, the Applicant proposes to implement the following design and operational controls and management measures to further limit the generation of dust from the potential sources identified in Section 4.3.4.

- Ensure the dust collection system on the drill rig remains effective.
- Limit blasting and secondary rock breakage during periods of high winds or extremely dry weather, where it is practical to do so.
- Apply a bitumen seal to a 280m section of the quarry access road to increase the sealed length of the road to 400m from the intersection with the Mount Lindesay Road. This road sealing would remove the need for the Applicant to undertake road watering on the section of the quarry access road that has been most problematic to date. Notwithstanding the road sealing proposed, the Applicant would undertake road watering on the remaining unsealed section of the road, if dust becomes a nuisance during periods of westerly winds.
- Ensure all other internal roads are surfaced with appropriate materials to limit dust lift-off and graded, where necessary.
- Ensure care would be taken to avoid spillage during loading.
- Limit load sizes, as appropriate, to ensure materials do not extend above truck sidewalls.
- Ensure each truck cover is fully extended on laden vehicles before each truck leaves the quarry.
- All vehicles travelling on the quarry access road are limited to a speed no greater than 30km/hr.
- All vehicles travelling on internal unsealed roads within the Project Site are limited to a speed no greater than 10km/hr.
- The complaints management system would continue to be maintained to ensure that all complaints are dealt with through investigation and implementation of corrective treatments.

A number of the above measures are included in the Driver's Code of Conduct (**Appendix 5**).

4.3.6 Assessment Methodology

4.3.6.1 Introduction

In order to establish the potential impacts likely to result from the continued operation (and extension) of Dowe's Quarry, Environ (2014) reviewed three recent air quality impact assessments that involved detailed atmospheric dispersion modelling. The three assessments relied upon were chosen based on having similar or greater annual average emissions as predicted for Dowe's Quarry (provided in Section 4.3.7 above), and similar operational parameters including operation type and maximum annual extraction levels. However, Environ (2014) also notes that the three assessments relied upon also included product processing, had greater traffic levels, and a greater land area from which wind erosion would occur at exposed surfaces, indicating that the likely impacts of the Proposal are likely to be significantly lower than those predicted by a comparative assessment. The assessments are therefore considered by Environ (2014) to provide a very conservative basis for comparison.

Environ (2014) used the Australian National Pollutant Inventory (NPI) and specifically the NPI Emission Estimation Technique Manual for Mining (NPI EETMM, 2012) as well as the United States Environmental Protection Agency (US-EPA) AP-42 emission factors as primary sources of information to predict fugitive particulate emissions associated with the Proposal.

Predicted TSP emissions were estimated and simulated to provide an indication of dust deposition rates while PM_{10} and $PM_{2.5}$ were estimated using ratios for the smaller particle size fractions available within the literature. Details of the emission scenarios and emission reduction factors that were used as inputs to the emission assessment are provided in the following subsections.

4.3.6.2 Operational Emission Scenarios

Environ (2014) reviewed three operational scenarios to assess the change in emissions associated with the operations within the Project Site. These included the following.

- Existing operations.
- Scenario 1 – Future operations 1.
- Scenario 2 – Future operations 2.

The layout of the existing operations scenario is based on the layout provided in **Figure 2.1**, while **Figure 4.6** and **Figure 4.7** display the indicative layout and equipment locations used to establish Scenario 1 and Scenario 2.

4.3.6.3 Emission Reduction Factors

Environ (2014) has taken into account the commitment by the Applicant to fully seal the 400m section of the quarry access road from the intersection with Mount Lindesay Road. The US-EPA AP-42 paved roads emission factor has therefore been applied to this section of the road.

4.3.7 Assessment Results

A detailed summary of total emissions by point source is provided in Table 2 of Environ (2014) (see **Appendix 6**). A summary of total annual emissions for Dowe's Quarry is provided in **Table 4.7**. A review of the point source emission results indicates that the most significant source of particulate emissions is the movement of vehicles along unsealed areas of the Project Site and the quarry access road. The decrease in annual emissions evident in results for Scenario 1 and Scenario 2 results is attributable to the proposed sealing of the first 400m of the quarry access road from the intersection with Mount Lindesay Road.

Table 4.7
Calculated Annual Particulate Matter Emissions

Pollutant	Calculated Total Annual Emissions (t/annum)		
	Existing Operations	Scenario 1 – Future Operations 1	Scenario 2 – Future Operations 2
TSP	54.2	41.6	46.8
PM_{10}	16.6	13.1	14.7
$PM_{2.5}$	1.8	1.5	1.6
Source: Environ (2014) – Table 3 (**Appendix 6**)			

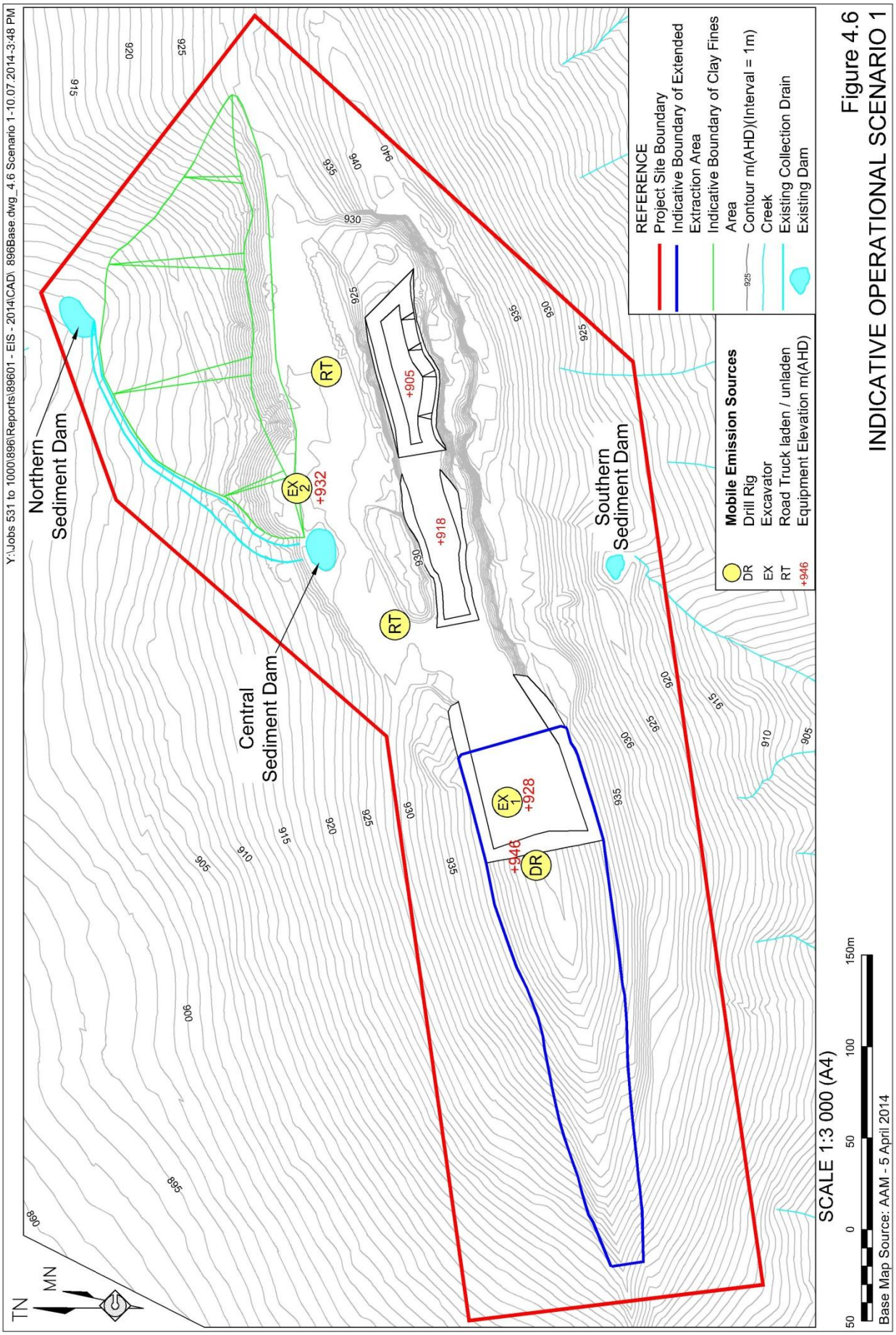


Figure 4.6
INDICATIVE OPERATIONAL SCENARIO 1

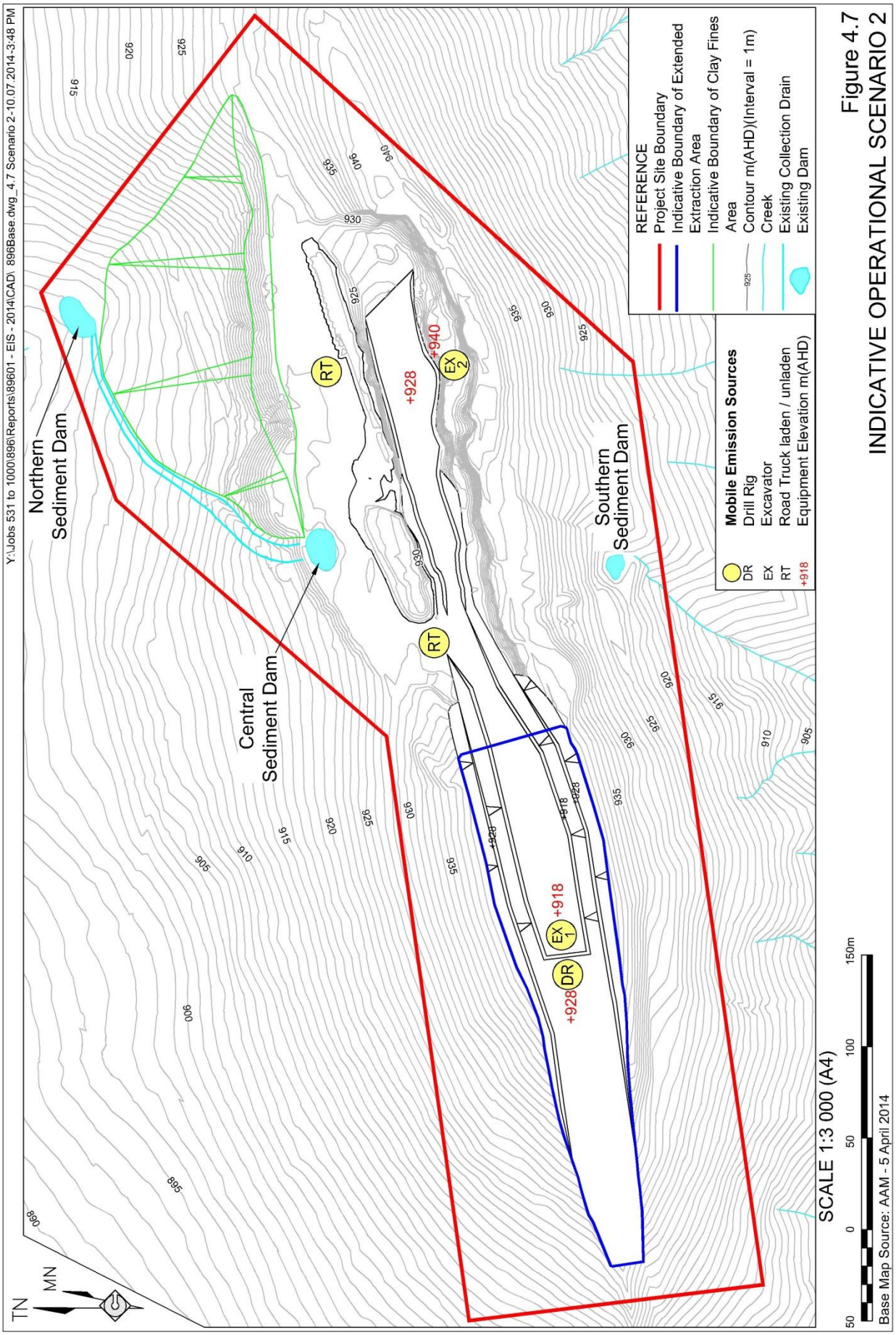


Figure 4.7
INDICATIVE OPERATIONAL SCENARIO 2

4.3.8 Assessment of Impacts

The following three assessments were reviewed by Environ (2014).

- ENVIRON (2013a) Mawsons Quarry Expansion - Air Quality Impact Assessment (Assessment 1).
- ENVIRON (2013b) Allandale Quarry Expansion - Air Quality Impact Assessment (Assessment 2).
- ENVIRON (2012) Talbragar Quarry Modification - Air Quality Impact Assessment (Assessment 3).

Potential residential receptors of particulate emissions are displayed in **Figure 4.3**. The closest receptors to the Project Site and quarry access road are located approximately 600m to the west of the Project Site (Residence 3a) and approximately 200m to the east and south of the quarry access road (Residences 12 and 13). The closest residence to the south is approximately 1.2km from the Project Site (Residence 9). Taking into account the dominant wind direction and large separation distance, Environ (2014) considers the potential for adverse impacts at this location to be minimal and therefore did not include residences to the south in the comparative assessment.

The maximum predicted 24-hour, annual average PM_{10} concentrations and annual average dust deposition levels at 200m and 600m from the site boundary reported within Assessment 1, 2 and 3 were analysed. The model predictions for each of the three assessments at 200m and 600m from the Project Site boundary are provided in **Table 4.8**.

Table 4.8
Summary of Results for Predicted Particulate Matter at Comparative Quarrying Sites

	Maximum Incremental 24-hour Average PM_{10} ($\mu g/m^3$)	Maximum Incremental Annual Average PM_{10} ($\mu g/m^3$)	Incremental Annual Average Dust Deposition Levels (g/m^2/month)
200m from the Project Site Boundary			
Assessment 1	3 - 15	0.1 – 0.9	0.1 – 0.5
Assessment 2	3 - 22	0.1 - 0.2	0.1 – 0.3
Assessment 3	7 - 33	1 – 5.0	0.2 – 1.5
600m from the Project Site Boundary			
Assessment 1	1 - 6	0.1 – 0.2	0.1 – 0.2
Assessment 2	2 – 15	0.1 – 0.6	<0.1 - 0.1
Assessment 3	4 - 12	0.2 – 2.0	0.1 – 0.5

The results provided in **Table 4.8** indicate that maximum incremental 24-hour average PM_{10} concentrations would be the most significant with regards to compliance with relevant criteria (see Section 4.3.2). Of the three assessments reviewed, Assessment 1 is considered by Environ (2014) to be of the greatest relevance to Dowe's Quarry due to the annual extraction rate, transportation involved and calculated annual PM_{10} emissions. The results provided within Assessment 1 were therefore considered to be a conservative upper limit estimate of potential impacts from for the Project Site and most appropriate for comparison with the Proposal.

Based on a comparison with Assessment 1, Environ (2014) consider that peak incremental 24-hour average PM_{10} concentrations of 15µg/m^3 could be experienced 200m from the Project Site and would present a worst case scenario for operations under the Proposal. Given that expected background PM_{10} concentrations are typically less than 30µg/m^3 within rural NSW (see section 4.3.2) it is unlikely that the cumulative impacts of the Proposal would exceed the NSW EPA 24-hour average PM_{10} criteria adopted for the Proposal of 50µg/m^3.

In addition, the residences surrounding the following factors were taken into consideration when reviewing potential impacts at the Project Site.

- Proposed operations under the Proposal would not alter the equipment, daily extraction rates or transportation processes currently being used by the Applicant at Dowe's Quarry.
- The modelling undertaken for each of the assessments reviewed by Environ (2014) incorporated higher traffic levels, were based on larger surface areas from which wind erosion would occur and also included on-site processing of products. It is considered that impacts from the Proposal would be significantly lower than predicted through review of these assessments.
- Environ (2014) notes that for each of the assessments reviewed, the peak predicted concentrations of particulates occurred downwind of operations (relative to the dominant wind direction for the location). It is therefore likely that peak concentrations are likely to occur to the west of the Project Site. The closest residence on the western side of the Project Site is approximately 600m from the Project Site boundary, i.e. Residence 3a.
- The assumed rural NSW background PM_{10} concentrations were based on monitoring undertaken at Tamworth which has a higher level of residential, commercial and industrial development than Tenterfield. It is considered that the background PM_{10} concentrations surrounding the Project Site would be significantly lower than those measured at Tamworth.
- Dowe's Quarry has been in operation since 1987 and has only received a minor number of dust-related complaints from residents to the east of the quarry access road. The sealing of the first 400m of the quarry access road would substantially reduce dust generation for those residents.

Based on the qualitative assessment completed by Environ (2014) and the factors considered above it is expected that there would be negligible dust impacts associated with the Proposal.

4.3.9 Air Quality Monitoring

Given that noticeable impacts to air quality around Dowe's Quarry are not expected to occur, monitoring of air quality is not proposed. However, should any sustained complaints be received by the Applicant, a deposited dust monitoring program would be initiated to establish compliance with the criteria adopted in Section 4.3.3. Other parameters could be monitored in the event elevated levels of deposited dust are consistently recorded.

4.4 NOISE

4.4.1 Introduction

The EARs identify "*noise and vibration*" as key issues for assessment in the EIS. The EPA also requests that a noise impact assessment is included in the assessment undertaken for the EIS. The EARs and the requirements of other government agencies are included in full as **Appendix 2**. Potential impacts associated with blasting activities are addressed in Section 4.5.

Based on consideration of the proposed activities within the Project Site and raw materials transportation (Section 2) and the local setting (Section 4.1) the specific noise-related impacts that may result as a consequence of the Proposal (without the implementation of the safeguards, controls and mitigation measures presented in this section) and therefore require assessment include:

- noise nuisance associated with operational activities; and
- noise nuisance associated with Proposal-related traffic.

The Applicant has commissioned Mr Neil Pennington of Spectrum Acoustics Pty Ltd to prepare a Noise and Vibration Assessment that includes an assessment of predicted noise levels against appropriate noise criteria. A copy of the assessment report is presented as **Appendix 7** and is referred to hereafter as Spectrum (2014). The following subsections summarise Spectrum (2014) describing the existing noise setting, predicted noise levels associated with operations and transport activities and operational controls that would be implemented by the Applicant. Finally, an assessment of any residual noise impacts of the Proposal following the implementation of these safeguards and management measures is provided.

4.4.2 Existing Noise Environment

In order to establish Project-specific criteria at representative receptors for the noise assessment Spectrum (2014) reviewed the existing acoustical environment and meteorological conditions to determine the prevailing atmospheric conditions.

A description of prevailing meteorological conditions at the Project Site is provided in Section 4.1.3 and seasonal and annual wind roses presented in **Figure 4.5**. The *NSW Industrial Noise Policy* (INP) (EPA, 2000) requires consideration of winds when a wind speed of less than 3m/s, measured at 10m height, occurs for 30% or more of the time in any season in any assessment period. The wind roses provided in **Figure 4.5** indicate that winds of up to 3m/s occurred less than 15% of the time during all seasons and from all directions. As a result, Spectrum (2014) did not consider wind factors in their assessment of noise impacts. In addition, as operating hours will only occur between 7:00am and 5:00pm Monday to Saturday, night time inversion conditions have not been considered within the assessment.

The environment surrounding the Project Site is rural in nature with likely background noise sources including the following.

- Agricultural activities.
- Traffic on the Mount Lindesay Road and nearby small access roads.
- Wind blowing through nearby tress and bird calls.

In accordance with Section B1.3.3 of the INP default background noise level of 30dB(A) has been adopted, against which noise sources from the Project Site (combined with the quarry access road) were assessed.

4.4.3 Environmental Noise Criteria

4.4.3.1 Operational Noise Criteria

Intrusiveness Criteria

As described in the INP, this criterion limits Equivalent Continuous Noise Levels (L_{eq}) from an industrial noise source to the Rating Background Level (RBL) for a time period, plus 5dB. The RBL(L_{90}) is defined as a single figure background level representing each assessment period. Based on the assumptions described in Section 4.4.2 above, the Intrusiveness Criteria for the Proposal would be 35dB(A)$_{Leq(15min)}$.

Amenity Criteria

This criterion is also described in the INP and aims to protect against excessive noise in situations where an area is becoming increasingly developed. The criterion is based on the nature of the receiver area and existing levels of industrial noise. As there is very little industrial noise in this predominantly rural environment this criterion has not been applied to the Proposal.

Sleep Disturbance Criteria

As the quarry would operate only between the hours of 7:00am and 5:00pm, Monday to Saturday, the sleep disturbance criterion does not apply.

In summary, the Project-Specific Noise Criteria will be the Intrusiveness Criteria of 35dB(A)$_{Leq(15min)}$.

4.4.3.2 Road Traffic Noise Criteria

The Proposal requires assessment under the provisions of the NSW *Road Noise Policy* (RNP) (DECCW 2011) as vehicles used to transport raw materials associated with Proposal would access both arterial and local roads. The Proposal will therefore be considered against the criteria established in the RNP.

Table 4.9 provides the road traffic noise criteria, described in the RNP that has been adopted for the assessment of road traffic noise for the Proposal.

Table 4.9
Road Traffic Noise Criteria

Situation	Recommended Criteria (Daytime – 7:00am to 10:00pm)
Existing residences affected by additional traffic on existing freeway/arterial/sub-arterial roads generated by land use developments.	$L_{eq\ (15\text{-}hour)}$ 60
Existing residences affected by additional traffic on local roads generated by land use developments.	$L_{eq\ (15\text{-}hour)}$ 55
Source: RNP 2011 – Adapted after Spectrum (2014)	

As the quarry would operate only between the hours of 7:00am and 5:00pm, the night time criteria provided in the RNP does not apply.

4.4.4 Operational Controls and Management Measures

The Applicant is committed to minimising the noise generated by extraction, and transport activities through the implementation of the following operational noise controls and management measures.

- All hours of operation presented in Section 2.12 would be strictly adhered to.
- The maximum number of truck movements per day would be limited to 40 movements per day.
- All drivers would be required to sign a Driver's Code of Conduct requiring a high standard of driver performance, avoidance of using exhaust brakes in built-up areas and travel at the required speeds.
- The internal road network would be graded, as required, to limit body noise from empty trucks.
- All equipment operating within the Project Site would be fitted with standard noise limiting controls such as engine covers and exhaust mufflers.
- All equipment on the Project Site would be regularly serviced to ensure sound power levels of each item remains at or below that nominated for noise modelling purposes.
- Any maintenance work would be undertaken at the Sunnyside Crushing and Screening Plant. Where this is not practical this work would be confined to standard daytime operational hours. Any inaudible maintenance could be undertaken beyond these core hours.

4.4.5 Assessment Methodology

4.4.5.1 Noise Assessment Input and Assumptions

The following inputs were included in the operational noise assessment undertaken by Spectrum (2014).

Residential Receivers

A representative sample of residential properties was considered by Spectrum (2014) and corresponds with those displayed in **Figure 4.3**. As described in Section 4.1.2.3, residences surrounding the Project Site were separated into three groups for ease of reference, i.e.:

- those to the east of the Project Site;
- those to the northwest, west and southwest of the Project Site; and
- those to the south and southeast of the Project Site.

Operational Noise Scenarios

To assess the worst case noise scenarios for operation of Dowe's Quarry, two operational scenarios were considered by Spectrum (2014). These scenarios are described in detail in Section 4.3.6.2 and displayed in **Figure 4.6** and **Figure 4.7**. They provide representative operational activities at two alternative stages of development of the Proposal.

Noise Sources

The sound power levels of the equipment used in the operational scenarios are provided in **Table 4.10**.

Table 4.10
Noise Source Sound Power Levels

Equipment	Indicative Number	Use	Sound Power Level dB(A) $L_{eq(15minute)}$
Excavator (Komatsu PC300)	2	Soil stripping, excavation	104
Drill (Atlas Copco T35)	1	Drilling blast holes	114
Haul truck (15 m^3)	2-3	Transport material from extraction to Sunnyside Plant	108
Source: Spectrum (2014) – Table 4			

Road Transport Conditions

The following inputs/assumptions were included in the assessment of road transport noise levels.

- The closest residence to the transportation route is 15m from the road along the Mount Lindesay Road, 10m from the New England Highway route and 20m from the route along Old Ballandean Road (as described in Section 4.1.2.4).
- A truck speed of 80km/hr has been assumed given that this is maximum speed limit directed in the Driver's Code of Conduct.
- An maximum annual production rate of 100 000t, requiring 40 truck movements per day (as described in Section 2.8.3).

4.4.5.2 Operational Noise Assessment

Predictive noise modelling was undertaken by Spectrum (2014) using the Renzo Tonin and Associate's *Environmental Noise Model v3.06* (ENM) software for each of the atmospheric scenarios described earlier (see also Section 4.3.6.2 and **Figure 4.6** and **Figure 4.7**). Point calculations were performed at a representative sample of residential receivers selected for each of the three residence groups described in Section 4.4.5.1.

4.4.5.3 Road Traffic Noise Assessment

Spectrum (2014) developed an assessment methodology for road traffic noise that utilises equations provided in the US Environmental Protection Agency document No. 550/9-74-004 *Information on Levels of Noise Requisite to Protect Public Health and Welfare with an Adequate Margin of Safety, March 1974.*

Values adopted for maximum vehicle noise at the assessment point were based on a sample of measurements of quarry truck pass-by noise, considered to be representative of the conditions and setting at the Project Site. These measurements were recorded by Spectrum Acoustics at other hard rock quarries in recent years from receivers at a variety of distances and truck speeds and were considered by Spectrum (2014) as representative of the Proposal.

Further information on the adopted methodology and the equations used for assessment of road traffic noise is provided in Section 4.4 of Spectrum (2014) (**Appendix 7**).

4.4.6 Assessment Results

4.4.6.1 Predicted Operational Noise Levels

Predicted noise levels under neutral atmospheric conditions for the two modelled scenarios are provided in **Table 4.11**. All modelled results predict noise levels below the Proposal-specific noise criteria of 35dB(A)$_{Leq(15min)}$.

Table 4.11
Predicted Operational Noise Levels (dB(A),$L_{eq(15min)}$)

Receiver	Neutral Meteorological Conditions		Criterion
	Scenario 1	Scenario 2	
East of Project Site			
R10	31	30	35
R11	31	30	35
R12	32	30	35
R13	31	30	35
R14	30	<30	35
R15	<30	<30	35
R18	30	<30	35
R19	<30	<30	35
R20	<30	<30	35
South and Southeast of the Project Site			
R7	<30	<30	35
R8	<30	<30	35
R9	<30	<30	35
R21	<30	<30	35
R22	<30	<30	35
R23	<30	<30	35
West and Southwest of the Project Site			
R2	<30	<30	35
R3A	31	33	35
R3B	<30	30	35
R4	<30	<30	35
R5A	<30	<30	35
R5B	<30	<30	35
R6	<30	<30	35
R16	<30	<30	35
Source: Spectrum (2014) – Modified after Tables 5 and 6			

4.4.6.2 Predicted Road Traffic Noise Levels

Predicted traffic noise levels at the various speeds and set back distances for residential receptors (as described in Section 4.1.2.4) were derived using the equations described in Spectrum (2014) and representative maximum pass-by noise levels for laden and unladen trucks sourced from the Spectrum library of noise measurements. The results are provided in **Table 4.12**.

Table 4.12
Predicted Traffic Noise Levels

Road	Speed (km/hr)	Distance (m)	Traffic Noise dB(A) $_{Leq(15hour)}$	Criterion dB(A) $_{Leq(15hour)}$
Mount Lindesay Road	100*	28	46.9	55
	70	18	47.9	55
	50	15	47.4	55
New England Highway	100	18	48.9	55
	80	32	45.1	55
	50	10	49.2	55
Old Ballandean Road	80*	20	49.3	50
* Sign posted speed is 100km/hr, however the self-imposed speed limit of 80km/hr has been applied. Source: Spectrum (2014) – Table 8				

Each of the results is predicted to be below the daytime criterion of 55dB(A) for receivers along the New England Highway and Mount Lindesay Road, and is also below the daytime criterion of 50dB(A) for receivers along Old Ballandean Rd.

4.4.7 Assessment of Impacts

Based on the predictive assessments undertaken by Spectrum (2014), the continued operation of Dowe's Quarry is not expected to exceed the adopted criteria and therefore would result in negligible impact to residential properties surrounding the Project Site and residences along the transport routes used by quarry-related trucks.

In addition, the following factors should be taken into consideration when reviewing potential impacts at the Project Site.

- The proposed ongoing operations would not alter the equipment, extraction rates or the transportation route and methods currently being used by the Applicant at Dowe's Quarry.
- As described in Section 4.2.2.5 quarry-related transport on the New England Highway contributes a small percentage to the total trucks that use this State road for transportation of products.
- The selection of comparative assessment road noise levels used as inputs for the calculations provided in Spectrum (2014) were selected to provide a conservative prediction of conditions created by quarry-related transport activities.

- Dowe's Quarry has been in operation since 1987 and has received no complaints concerning noise impacts from surrounding residences or along the transport routes during that time.

4.4.8 Noise Monitoring

Given there have been no complaints over the past 27 years of operation regarding the noise generated by equipment operating within the Quarry, monitoring of noise is not proposed. However, should any sustained complaints relating to noise be received, the Applicant would commission an independent noise assessment to establish the actual levels and compliance with the criteria set out in Section 4.4.3.

4.5 BLASTING

4.5.1 Introduction

The EARs identify "*noise and vibration*" as key issues for assessment in the EIS. The EPA also requests that the noise impact assessment includes consideration of potential impacts from blasting and associated vibration. The EARs and the requirements of other government agencies are included in full as **Appendix 2**. Potential impacts associated with noise from operations and raw material transport is addressed in Section 4.4.

Based on consideration of the proposed activities (Section 2) and the local setting (Section 4.1) the specific blasting-related impacts that may result as a consequence of the Proposal (without the implementation of the safeguards, controls and mitigation measures presented in this section) and therefore require assessment include:

- noise associated with blasting activities; and
- vibration resulting from blasting activities.

The Applicant has commissioned Dr Neil Pennington of Spectrum Acoustics Pty Ltd to prepare a Noise and Vibration Assessment that includes as assessment of predicted airblast overpressure or noise levels generated through blasting activities and associated vibration impacts against appropriate criteria. A copy of the assessment report is presented as **Appendix 7** and is referred to hereafter as Spectrum (2014). The following subsections summarise the blasting-related content of Spectrum (2014) describing the proposed blasting schedule, potential impacts to the noise environment and any operational controls that would be put in place to manage or mitigate these impacts. Finally, an assessment of any residual impacts resulting from blasting activities following the implementation of these safeguards and management measures is provided.

4.5.2 Existing Blasting Operations

Blasting operations at Dowe's Quarry have been carried out since extraction operations commenced in 1987. Since this time, the Applicant has developed a blasting method suited to the conditions at the Project Site. At no time during the intervening period have complaints been received regarding blast noise, vibration or flyrock impacts at local residences.

The existing blast schedule, that is proposed to be continued under the Proposal, includes blasting at approximately monthly intervals, however these may be more frequent should client demand for products require higher levels of extraction (for instance where maximum annual extraction volume of 100 000t is expected). A summary of the blast design used at the quarry is as follows.

- Drill holes are 89mm in diameter with a maximum depth of 15m.
- Drill holes typically have a 3.3m x 3.3m spacing, 3m stemming and use 5.6kg/m of ANFO.
- Typical blasts use 3 rows with 8 drill holes per row and a combination of 17ms and 45ms delays on the detonators.

Using the above blast design as a guide, it is assumed that each drilled hole would contain 67.2kg of ANFO, fired at one hole per delay. Maximum instantaneous charge (MIC) would be 67.2kg for each blast.

4.5.2.1 Blasting Criteria

The EPA has adopted recommended airblast and ground vibration levels published in the Australian and New Zealand Environment and Conservation Council (ANZECC) guideline *Technical Basis for Guidelines to Minimise Annoyance due to Blasting Overpressure and Ground Vibration – September 1990.* These recommended levels are based on prevention of human discomfort and have been adopted as the assessment criteria for the blasting assessment for residential receptors.

- The maximum airblast overpressure level should not exceed 115dB linear peak on more than 5% of the total number of blasts over 12 months. The maximum level should not exceed 120dB linear peak at any time.
- The maximum ground vibration velocity should be less than 5mm/s peak vector sum (PVS) for more than 5% of the total number of blasts over 12 months. The maximum level should not exceed 10mm/s at any time.
- Blasting should generally take place no more than once per day, unless a misfire occurs.

4.5.3 Operational Controls and Safeguards

The following operational controls would be implemented to ensure that any potential impacts from blasting are limited and that blasting processes are undertaken efficiently and safely.

- Blasting would be restricted to the hours of 10:00am to 3:00pm, Monday to Saturday as specified Section 2.12.
- Blasting would take place no more than once per day as specified in the ANZECC guidelines and described in Section 4.5.2.

- Blast design and impact would continue to be monitored during each blast to ensure that blast characteristics are not resulting in overpressure or vibration levels that are not consistent with the existing blasting methods.

4.5.4 Assessment of Impacts

To predict air blast overpressure and ground vibration levels, a series of standard equations were applied and the proposed blast conditions provided in Section 4.5.2 used as inputs. The use of these equations and their sources are discussed in detail in Section 4.3 of Spectrum (2014) (see **Appendix 7**).

The results for air blast overpressure and ground vibration levels were predicted for receivers nearest to the Project Site from the three residence groups described in Section 4.4.5.1 and are provided in **Table 4.13**.

Table 4.13
Predicted Blast Overpressure and Ground Vibration for the Project Site

Location	Distance (m)	Overpressure (dB)	Criterion	Vibration (mm/s)	Criterion
R12 (east)	1 160	108.5	115	0.7	5.0
R9 (southeast)	1 295	107.4	115	0.6	5.0
R3A (west)	740	113.2	115	1.4	5.0
Source: Spectrum (2014) – Table 7					

The results from **Table 4.13** indicate that while blasts are likely to be heard within several kilometres of the Project Site the blast overpressure and ground vibration levels are likely to be below the adopted criteria at each of the reviewed receivers. This indicates that potential impacts from blasting will be minimal and within guideline levels established to prevent structural damage to surrounding residences.

4.5.5 Monitoring

The explosives supplier is required to monitor each blast at a distance of approximately 300m from the active extraction area along the quarry access road.

4.6 WATER RESOURCES

4.6.1 Introduction

The EARs identify "water resources" as a key issue for assessment in the EIS. In addition, the NOW and EPA request that an adequate and secure water source and any licensing requirements be identified for the Proposal, that impacts to surface water and groundwater (including groundwater dependent ecosystems) are considered, that the requirements of the NSW Farm Dams Policy are addressed and sediment and erosion control measures are considered for the management of stormwater within the Project Site. The EARs and the requirements of other government agencies are included in full as **Appendix 2**.

Based on consideration of the proposed activities (Section 2) and the local setting (Section 4.1), the specific impacts to surface water and groundwater quality and availability that may result as a consequence of the Proposal (without the implementation of the safeguards, controls and mitigation measures presented in this assessment section) and therefore require assessment include:

- inadequate supply of water for operational activities such as watering of unsealed internal roads;
- insufficient storage capacity within sediment dams;
- reduced availability of water to local native fauna and flora resulting in stress or reduction in viability of native vegetation;
- sediment discharge and contamination of the surrounding environment resulting from overflow of sediment dams or inadequate drainage from disturbed surfaces;
- discharge of dirty or contaminated water to Washpool Creek or Washbrook Creek resulting in pollution of downstream waters; and
- erosion causing decreased availability of soil for rehabilitation.

Due to the elevation of the Project Site (extraction is proposed to a depth of approximately 890m AHD as described in Section 2.5.2), it is not considered that groundwater would be intercepted through extraction activities. In addition, groundwater is not proposed to be used as a water source. Registered groundwater bores within the vicinity of the Project Site are displayed on **Figure 4.3**, indicating that the closest registered bore is approximately 950m from the Project Site boundary (Bore 965613 within Property Reference 12). As a result, it is not considered that the Proposal would constrain groundwater used by surrounding residents/land users nor result in contamination of these groundwater resources. Groundwater and groundwater dependent ecosystems are therefore not considered further in this assessment.

The required capacity of sediment dams including the sediment storage and water settlement areas for each dam was calculated by Mr Alex Irwin, Senior Consultant with R.W. Corkery & Co. Pty Limited and is provided as **Appendix 3**. The report is referred to hereafter as RWC (2014).

The following subsections provide an overview of the existing water storage structures within the Project Site and the changes that are proposed to manage the changing landscape throughout the life of the Proposal, including any operational controls or management measures that would be implemented. An assessment of residual impacts assuming the adoption of the nominated management measures is provided.

4.6.2 Existing Water Storage Structures

The drainage characteristics of the Project Site are described in Section 4.1.1. The predominant watercourses are Washpool Creek to the north, a small tributary of Tenterfield Creek to the south and Washbrook Creek to the southeast of the Project Site. It is noted, however, that only small, ephemeral watercourses connect the Project Site to these creeks. **Figure 4.2** displays the existing local catchments draining the Project Site and includes the existing sediment dams and the Northern Drain.

Existing Extraction Area Catchment

The Existing Extraction Area Catchment drains an area of 1.3ha with all rainfall retained within the pit where it infiltrates towards the groundwater table.

Southern Dam Catchment

This catchment drains an area of approximately 0.7ha to the Southern Sediment Dam. The catchment has been modified to divert any runoff from the areas disturbed on the southern side of the existing extraction area to the Southern Sediment Dam and all vegetation cleared through previous activities.

Central Dam Catchment

This catchment drains an area of approximately 1.6ha with runoff directed towards the Central Sediment Dam. This catchment has been highly modified by the existing extraction area and overburden emplacement and the majority of the area has been graded to be relatively flat at an elevation of approximately 927m AHD. The area is predominantly used by trucks to access the active operational area to transport raw materials and overburden. The Applicant proposes to progressively enlarge the area of the Central Dam Catchment as the upper surface of the fines emplacement is progressively constructed in a northerly direction. The Central Dam Catchment includes a small area of undisturbed vegetation on the eastern section to the south of the quarry access road where this road enters the existing extraction area. Any overflow from the Central Sediment Dam would flow to the Northern Sediment Dam via the Northern Drain (see **Figure 4.2**).

Northern Dam Catchment

This catchment drains the fines emplacement area and encompasses an area of approximately 2.2ha. The catchment has been modified through clearing in preparation for and through fines emplacement activities. The existing catchment area has been filled along the southern boundary to an elevation of 927m AHD so that it is level with the Central Dam Catchment and drops off steeply to the north for approximately 50m where the clay fines are unloaded. A contour bank has been constructed 10m from the base of the existing stockpiles to collect all sediment-laden runoff and redirect this towards vegetated areas and the Northern Sediment Dam.

4.6.3 Potential Impacts

The Proposal has the potential to impact upon both the quality and quantity of surface water flowing from the Project Site.

4.6.3.1 Water Pollution

Potential sources of water pollution include runoff from the active extraction area, the overburden or fines stockpiles and the quarry access road as well as uncontrolled discharge from the three sediment dams. Suspended solids, i.e. sand, silt, or clay particles in water and hydrocarbons are likely to be the major sources of pollution.

4.6.3.2 Surface Water Flows

With the development of the Proposal, the catchment areas would change to reflect the nature of extraction activities, overburden emplacement and stockpiling of fines. Indicative future catchment areas are displayed in **Figure 4.8**.

The area of the Extraction Area Catchment would progressively increase to reflect the proposed extended extraction area (see **Figure 4.8**). It is estimated that the total catchment area would be 2.7ha towards the end of quarry life. This would increase the volume of stormwater runoff contained within this catchment area much of which would be likely to be absorbed by the back-filled fines or soak through the pit floor as it currently does.

A new road is proposed to be constructed to provide access to the extended extraction area as extraction progresses to the west (see **Figure 4.8**). This road would be constructed to ensure all runoff from the road surface is directed back to the Central Dam. This would increase the soil erodibility (K) factor for this section of the catchment. It is estimated that the total catchment area for the Central Dam would encompass 1.8ha.

As the fines emplacement is progressively developed from the east (Stages 1 to 5), the runoff from the upper surface of the emplacement would continue to be captured within the Central Dam Catchment and drain westward to the Central Dam.

A 'Catchment Overlap' has been included within the Northern Dam Catchment to account for development of the fines emplacement and likelihood that stormwater runoff within the overlapping area would eventually flow towards the Central Dam.

4.6.3.3 Water Use

Water use within the Project Site has been limited to that required by a water truck for periodic dust suppression on the quarry access road. Water for this purpose has previously been sourced from the Sunnyside Crushing and Screening Plant. Whilst it is recognised the sealing of 400m of the quarry access road will reduce the need for water for road dust suppression, the Applicant proposes that water for dust suppression would be sourced from the settlement zone within the Northern and Central Sediment Dams reducing reliance on the Sunnyside Crushing and Screening Plant as a water source for the Proposal.

The three dams within the Project Site have been constructed for the purpose of sediment retention and settlement and are therefore not considered within any Maximum Harvestable Rights Dam Capacity calculations for the Project Site. There are no dams within the Project Site that would require licensing for water use.

4.6.4 Erosion and Sedimentation

Uncontrolled runoff from active extraction areas, stockpiles or areas cleared in preparation for future activities may lead to sheet, rill and/or gully erosion over areas of the Project Site.

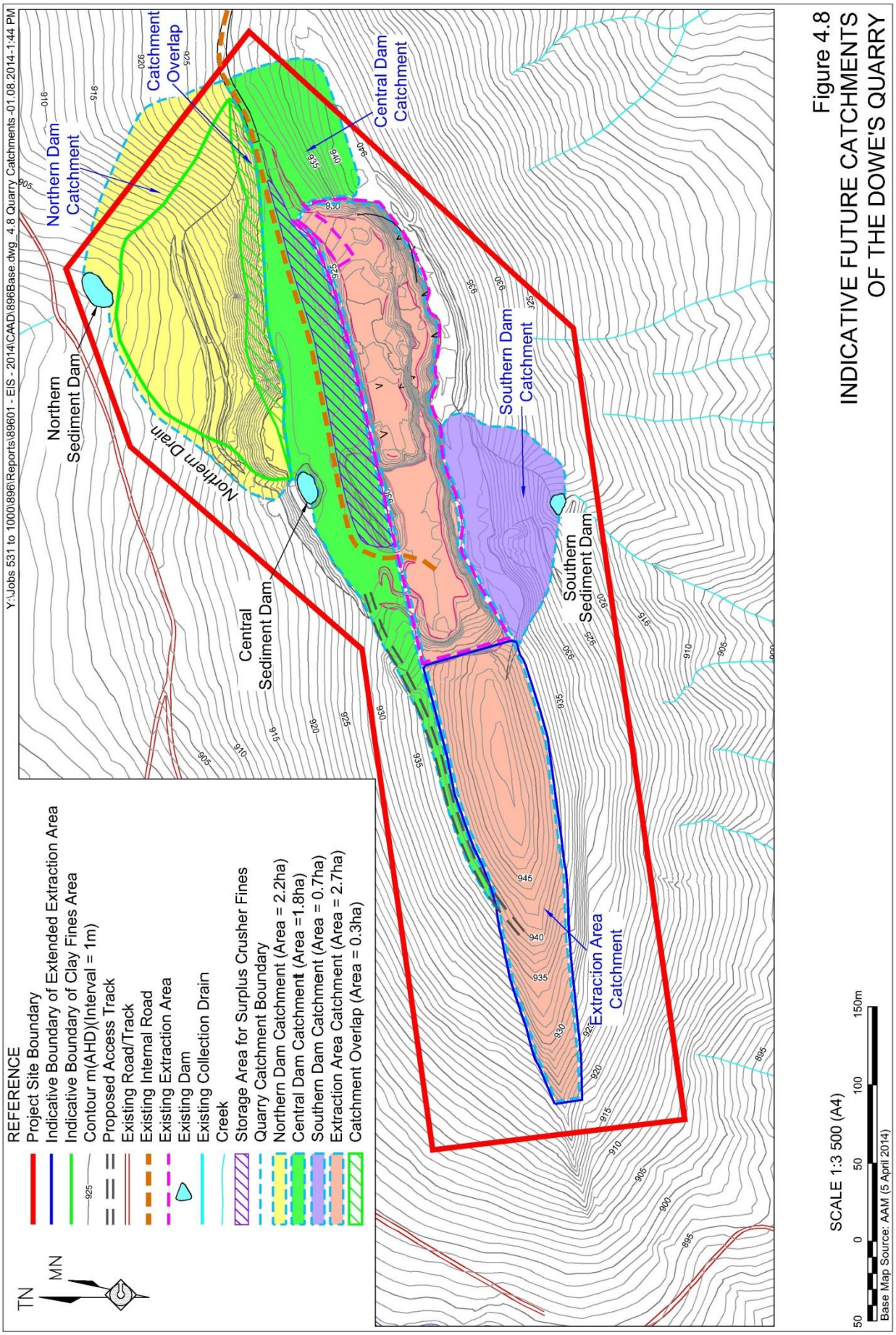


Figure 4.8
INDICATIVE FUTURE CATCHMENTS
OF THE DOWE'S QUARRY

4.6.5 Design and Operational Safeguards

4.6.5.1 Surface Water Flows and Storage

RWC (2014) applied estimates of rainfall and erosion data, the soil hydrologic group and the catchment areas displayed on **Figure 4.8**, to determine the required capacity of the three sediment basins within the Project Site. The capacity comprised the minimum settlement and storage requirements for a 90th percentile 5-day rainfall event (the design rainfall event specified in Volume 2E of the Blue Book for standard receiving environments (Landcom 2004)). As all runoff captured within the Extraction Area Catchment would be retained within the pit, this catchment has not been included in the calculation of sediment dam volumes. The assumptions and final calculations used for each catchment are included in **Appendix 3** and a summary of the results provided in **Table 4.14**.

Table 4.14
Settlement and Storage Volume Requirements

Dam	Water Settlement Zone (m^3)	Sediment Storage Zone (m^3)	Total (m^3)
Northern Sediment Dam	605	412	1 017
Central Sediment Dam	589	153	742
Southern Sediment Dam	192	104	296
Source: RWC (2014) – see **Appendix 3**			

On the basis of the above, the following modifications to the water management system would be undertaken.

- The Central Sediment Dam would be enlarged to allow for the settlement and storage volume requirements. In addition, a small sediment trap would be constructed directly on the eastern side of the dam along the boundary of the Northern Dam Catchment and where the 'Catchment Overlap' is proposed. The sediment trap would be constructed to be approximately 2m wide by 6m long and approximately 1m deep. This sediment trap would be regularly cleaned out with an excavator to remove retained sediment, as required.
- The Northern Sediment Dam would be enlarged to account for the storage requirements of the minimum settlement and storage requirements for a 90th percentile 5-day rainfall event and to also allow for overflow of the Central Sediment Dam, diverted to the Northern Sediment Dam via the Northern Drain. A sediment trap would also be constructed, to similar dimensions as that proposed for the Central Catchment Dam, within the Northern Drain directly prior to the drain entering the Northern Sediment Dam. This sediment trap would also be regularly cleaned out to remove retained sediment, as required.

As the volume of the Southern Sediment Dam is sufficient to meet the capacity requirements in **Table 4.14** this dam would be stabilised and developed such that it may be accessed for use by stock sheltering in the area.

All dams would be maintained such that they would continue to meet the capacity requirements specified in **Table 4.14** or for the Northern Sediment Dam to allow for overflow from the Central Sediment Dam. This would involve excavation of sediment where this exceeds the sediment storage zone for each dam and stabilisation of drainage and dam walls. The sediment

traps that would be installed adjacent to the Central Sediment Dam and the Northern Sediment Dam would also be excavated to maintain the sediment retention of these devices where required. Extracted sediment would be placed on existing overburden emplacement stockpiles to be used within rehabilitation processes.

4.6.5.2 Water Pollution, Erosion and Sedimentation

Recognising the potential for water pollution through sediment-laden water, erosion across the Project Site and sedimentation of nearby watercourses, surface water management controls including drains and sediment traps would be designed to provide controlled flow paths and minimise the number and velocity of water flows on the Project Site.

Where it is practical to do so, all equipment would be refuelled and any maintenance undertaken at the Sunnyside Crushing and Screening Plant. Where this is not practical, all activities would be undertaken at a suitable distance from water management structures or sumps and all possible care taken to avoid spillage and contamination of surface water.

4.6.6 Assessment of Impacts

Assuming the adoption of the design controls detailed in Section 4.6.4, it is anticipated that there would be a low likelihood that sediment-laden water would be discharged to surrounding water courses or directed to areas of remnant vegetation. The proposed enlargement of the existing sediment dams would provide sufficient capacity to manage predicted runoff resulting from a 90^{th} percentile 5-day rainfall event and storage volume to provide water for use by the water cart for dust suppression on unsealed areas of the Project Site, if required. Additional water management controls would reduce the likelihood of erosion and manage sediment within any runoff.

4.6.7 Water Monitoring and Corrective Actions

The existing water management structures have been sufficient to manage the flow of dirty water within the Project Site since operations began in 1987. The Applicant reports that the sediment dams have remained predominantly dry as the dams have effectively leaked.

As a result, regular surface water monitoring is not proposed, however the Applicant would undertake inspections of all structures to ensure stability and sediment storage capacity is maintained after any significant rainfall event. Where it is required, the Applicant would implement measures to remove any excess sediment and/or debris and repair dams and control structures.

4.7 BIODIVERSITY

4.7.1 Introduction

The EARs identify "*biodiversity*" as a key issue for assessment in the EIS and require the EIS to provide an assessment of the potential impacts to threatened species or populations and their habitats, a description of measures to be implemented to maintain or improve biodiversity

values of the Project Site, and consideration of strategies to offset any impacts to fauna or flora. The OEH also require that a biodiversity assessment is undertaken including consideration of the potential impacts on native vegetation located within the Project Site and the requirements of State Environmental Planning Policy No. 44 – Koala Habitat Protection. The EARs and the requirements of these agencies are included in full as **Appendix 2**.

Based on consideration of the proposed activities (Section 2) and the local setting (Section 4.1), the specific biodiversity related impacts that may result as a consequence of the Proposal (without the implementation of the safeguards, controls and mitigation measures presented in this assessment section) and therefore require assessment include:

- impacts to local and regional distribution of native flora and fauna from the removal of habitat located within the Project Site;
- impacts to local and regional distribution of threatened species, populations and endangered ecological communities as a direct or indirect result of the Proposal; and
- impacts to native flora and fauna from Proposal-related traffic.

An ecological impact assessment of the Proposal was undertaken by Mr Bruce Mullins and Mr Brad Dreis of Eco Logical Australia Pty Ltd (ELA). A copy of the assessment report is presented as **Appendix 8** and referred to hereafter as ELA (2014).

This subsection provides a summary of ELA (2014), concentrating on those matters raised in the EARs and correspondence accompanying the EARs provided by various government agencies. A description of the existing biodiversity setting, operational controls to be implemented by the Applicant and an assessment of the residual impacts of the Proposal following the implementation of these safeguards and management measures are provided.

4.7.2 Assessment Methodology

4.7.2.1 Desktop Assessment

In order to obtain information on flora and fauna to be targeted for survey, and identify species likely to be present and affected by the Proposal, ELA (2014) completed a desktop assessment that involved a search of relevant databases and assessment of likelihood of occurrence of threatened or migratory species. The following databases were searched for records of, or potential habitat for threatened species within a 10km radius of the Project Site, to produce a list of potentially occurring threatened and migratory species.

- NSW Office of Environment and Heritage (OEH) Atlas of NSW Wildlife.
- Commonwealth Department of the Environment (DoE) online Protected Matters Search Tool (PMST).
- OEH Vegetation mapping and Forest Ecosystem Classifications for the Upper and Lower North East NSW.
- Atlas of Living Australia.
- Australian Virtual Herbarium.

There are no known ecological assessments previously undertaken for the Project Site that could be referred to for information.

4.7.2.2 Field Survey

ELA completed field surveys within the Project Site on 26 and 27 March 2014 to validate predictions made based on the desktop assessment completed above and to describe and map potential habitats within the Project Site and prepare a comprehensive species list. The survey method comprised:

- four Biometric plots consistent with the Biobanking Assessment Methodology;
- random meanders;
- 20 minute bird surveys;
- targeted Koala (*Phascolarctos cinereus*) searches across the Project Site including Koala Spot Assessment Technique (SAT) survey of 30 Eucalypt trees for scratches (Phillips and Callaghan, 2011);
- incidental observations of other fauna; and
- identification of significant habitat features, such as hollow-bearing trees and rocky outcrops.

4.7.3 Flora Species and Vegetation Communities of the Project Site

A review of the Wildlife Atlas returned 31 species listed under the *Threatened Species Act 1995* (TSC Act) and the PMST returned 38 species and two ecological communities listed under the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) that occur within 10km of the Project Site. A desktop review completed by ELA (2014) identified that the expected vegetation within the Project Site would comprise Regional Vegetation Community 48 and a Biometric Vegetation Type: New England Blackbutt – Stringybark healthy open forests on granite, eastern New England Tablelands and NSW North Coast. This is not an Endangered Ecological Community (EEC).

The field survey confirmed a single vegetation community which was consistent with the Dry Open New England Blackbutt (Ecosystem 41) as the dominant community with the common species including the following species (see **Figure 4.9**).

- *Eucalyptus biturbinata* (Grey Gum).
- *Eucalyptus campanulata* (New England Blackbutt).
- *Eucalyptus caliginosa* (Broad-leaved Stringybark).
- *Eucalyptus moluccana* (Grey Box).

This vegetation community does not correlate with any EEC listed under State or Federal legislation. A complete list of species identified or likely to occur within the Project Site is provided in Appendix B of ELA (2014) (see **Appendix 8**). In summary, there were a total of 58 flora species identified.

ELA (2014) describes the vegetation within the Project Site as generally in good condition with several large habitat trees over 30m in height, high native species richness and over-storey regeneration. A total of eleven hollow-bearing trees were identified within the Project Site with four of these located within the area of the proposed Extended Extraction Area.

Other minor disturbances within the Project Site included minor weed species invasion, areas that have been historically logged, low impact grazing and some fragmentation resulting from clearing for surrounding pastures.

4.7.4 Existing Fauna Species

The desktop review identified 14 threatened bird and mammal species that occur or have potential to occur within the Project Site. In addition, four migratory bird species have the potential to fly over the Project Site due to the presence of potential habitat nearby.

A complete list of fauna species identified or potentially occurring within the Project Site is provided in Appendix B of ELA (2014) (see **Appendix 8**). In summary, a total of 28 bird species, three mammal species and two exotic species were recorded by ELA (2014). Three species listed as threatened in the TSC Act and/or the EPBC Act were either identified during the surveys or evidence of recent habitation was identified within the Project Site**.** These included:

- the Koala (*Phascolarctos cinereus*) listed as vulnerable under the TSC Act and EPBC Act;
- the Scarlet Robin (*Petroica boodang*) listed as vulnerable under the TSC Act; and
- the Flame Robin (*Petroica phoenicea*) listed as vulnerable under the TSC Act.

Figure 4.9 displays the locations of threatened species identified during field survey. ELA (2014) identify that Koala activity appeared to be infrequent and of low intensity with four out of 30 trees observed to have scats or scratches in the Koala SAT survey area. The SAT results equated to 13% activity which is considered to be low use based on the activity categories for western areas provided within the SAT methodology (ELA, 2014). The location of the Koala SAT survey is displayed on **Figure 4.9**.

The Scarlet Robin and Flame Robin are both listed as vulnerable under the TSC Act. The Scarlet Robin was commonly recorded throughout the Project Site while the Flame Robin was identified on a single occasion. The locations of the sightings of these species are also displayed on **Figure 4.9**.

ELA (2014) notes that the presence of large, hollow-bearing trees within the Project Site may provide a habitat for hollow-dependant birds and mammals, including threatened micro-bats or owls.

The European Red Fox (*Vulpes vulpes*) was identified within the Project Site and evidence of rabbits or hares suggested the presence of this exotic species (ELA,2014).

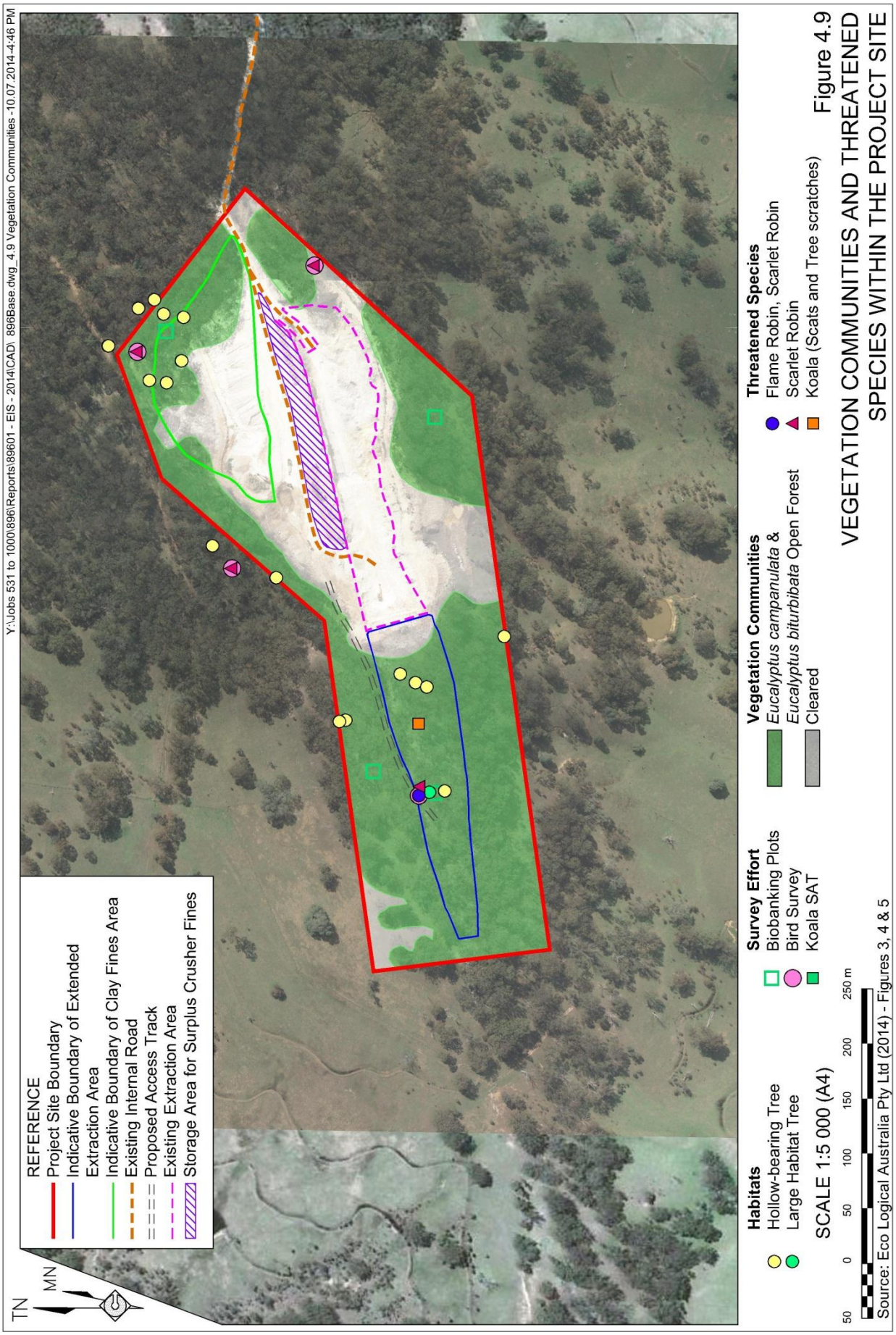


Figure 4.9
VEGETATION COMMUNITIES AND THREATENED SPECIES WITHIN THE PROJECT SITE

4.7.5 Conservation Significance

Following consideration of the results of desktop and field survey within the Project Site and surrounds, ELA (2014) identified 18 subject fauna species (no flora species or vegetation communities) with:

- 3 native species known to occur;
- 1 native species likely to occur;
- 11 native species with a potential to occur; and
- 4 migratory species with a potential to occur.

Table 4.15 provides more detail on these threatened species including their status within the EPBC Act and/or TSC Act.

Table 4.15
Threatened Species Known, Likely or Potentially Occurring Within the Project Site

Threatened Species Known, Likely or Potentially Occurring	Common Name	EPBC Act	TSC Act
KNOWN TO OCCUR			
Phascolarctos cinereus	Koala	Vulnerable (NSW)	Vulnerable
Petroica boodang	Scarlet Robin	Not Listed	Vulnerable
Petroica phoenicea	Flame Robin	Not Listed	Vulnerable
LIKELY TO OCCUR			
Glossopsitta pusilla	Little Lorikeet	Not Listed	Vulnerable
POTENTIAL TO OCCUR			
Calyptorhynchus lathami	Glossy Black Cockatoo	Not Listed	Vulnerable
Climacteris picumnus victoriae	Brown Treecreeper (eastern subspecies)	Not Listed	Vulnerable
Daphoenositta chrysoptera	Varied Sittella	Not Listed	Vulnerable
Melanodryas cucullata cucullata	Hooded Robin (south-eastern form)	Not Listed	Vulnerable
Ninox strenua	Powerful Owl	Not Listed	Vulnerable
Stagonopleura guttata	Diamond Firetail	Not Listed	Vulnerable
Tyto novaehollandiae	Masked Owl	Not Listed	Vulnerable
Falsistrellus tasmaniensis	Eastern False Pipistrelle	Not Listed	Vulnerable
Dasyurus maculatus maculatus	Spotted-tailed Quoll	Endangered	Vulnerable
Petaurus australis	Yellow-bellied Glider	Not Listed	Vulnerable
Petaurus norfolcensis	Squirrel Glider	Not Listed	Vulnerable
POTENTIAL TO OCCUR			
Apus pacificus	Fork-tailed Swift	Migratory	Not Listed
Hirundapus caudactus	White-throated Needletail	Migratory	Not Listed
Merops ornatus	Rainbow Bee-eater	Migratory	Not Listed
Manarcha melanopsis	Black-faced Monarch	Migratory	Not Listed
Modified after ELA (2014) – Table 3			

4.7.6 Management and Mitigation Measures

In accordance with Step 4 of the *Draft Guidelines for Threatened Species Assessment* (DEC/DPI, 2005), the Applicant has designed the Proposal to manage impacts on threatened species by avoiding impacts where possible and then mitigating any anticipated remaining impacts. Due to the small area to be cleared and the relatively minor impact at a landscape scale, ELA (2014) does not consider a biodiversity offset is required for any protected matters known to occur within the Project Site. Biodiversity offsets are discussed in greater detail in Section 7.3.5 of ELA (2014)(see **Appendix 8**). The Applicant would implement the following control measures to avoid or mitigate the risk of adverse impacts on threatened species within the Project Site.

Vegetation Clearing

- Ensure that all areas of proposed disturbance are clearly marked prior to the commencement of clearing campaigns to minimise the potential for over clearing of vegetation.
- Adopt the following procedures to guide all clearing of mature trees.
  - Where necessary engage a qualified or suitably experienced spotter-catcher to undertake an initial assessment of the area to be cleared for threatened species and to guide and inspect the felling of any hollow-bearing trees.
  - Check all trees for the presence of nesting or roosting fauna before felling or pushing, then start tree removal immediately after visual inspection.
  - When a tree with hollows requires removal, the tree is to be gradually nudged at intermittent intervals so that any animal occupying a habitat tree has the chance of vacating the area after the initial disturbance period.
  - Avoid leaving trees on ground unmanaged for more than two weeks as these would quickly become habitat for hollow-dependent species.
- Progressively clear vegetation, as required, throughout the life of the Proposal
- Salvage tree trunks, major limbs and, if practicable, minor branches for use in rehabilitation of disturbed areas within the Project Site.

Fauna Management

- Allow fauna that has become displaced from vegetation clearing to find its way to remnant vegetation and give suitable assistance to any injured fauna including capture and transfer to a local veterinarian or WIRES representative where necessary.

Weed Management

- Weed control would continue to be undertaken to remove/reduce weeds in soils prior to soil stripping activities and on stockpiles and following re-vegetation to ensure native plants are not overgrown during their early periods of growth.

Topsoil Management

- Directly transfer stripped soil materials onto rehabilitation areas where practicable to maximise the opportunity for retention of the natural seed stock, and thereby maximise the revegetation of the final landform with endemic species.
- Confine, where practicable, vehicular access to formed and marked roads and tracks and limit vehicle speeds on the quarry access road to 30km/hr within the Project Site to limit the potential for vehicle trauma to wildlife.

Rehabilitation

- Revegetate disturbed areas within the Project Site as described in Section 2.13.
- Ensure species used during rehabilitation operations are consistent with vegetation community types located within the vicinity of the area to be rehabilitated and are suitable for the proposed final landform and land use.
- Monitor all areas of progressive and final rehabilitation and undertake remedial action in the event that rehabilitation does not comply with the relevant completion criteria.

4.7.7 Assessment of Impacts

4.7.7.1 Threatened Species of National Environmental Significance

All listed threatened species and migratory species protected under international agreements were considered by ELA (2014) in relation to the significant impact criteria provided in the Commonwealth Department of the Environment document *Matters of National Environmental Significance: Significant impact guidelines 1.1* (DoE, 2013). The following species were considered by ELA (2014).

Koala

The significant impact guidelines indicate that significant impacts include those that adversely impact habitat critical to the survival of a species (DoE, 2013a). The *Draft EPBC Act referral guidelines for the vulnerable Koala (*the Draft EPBC Act Guidelines*) (DoE, 2013b*) suggest that habitat loss is the primary adverse effect on habitat critical to the Koala's survival. The Draft EPBC Act Guidelines provide a tool to guide assessment of whether a location contains critical habitat for the Koala by considering the sensitivity, value and quality of the potential habitat within a location (included as Table 3 within DoE (2013b)). The Draft EPBC Act Guidelines require further assessment of an action's adverse impacts to critical habitat to determine if the action requires referral as a controlled action.

An assessment of potential habitat within the Project Site using the tool was undertaken by ELA (2014). Potential habitat within the proposed extraction area had a critical habitat score of five indicating it is critical habitat based on the following observations.

- Evidence of Koala within the Project Site within the last two years.
- The presence of Grey Box, Mountain Gum and Broad-leaved Stringybark which are potential food trees for the species.

- Existing threats from vehicle strike to any Koala population.
- The activities would result in clearing of more than 2ha of habitat containing known Koala food trees.
- The area to be removed is less than 20ha for a habitat score of eight or less. .

However, ELA (2014) conclude that referral as a controlled action would not be required after further assessment of whether the action would adversely affect habitat critical to the survival of the Koala (guided by Figure 2 within DoE (2013b)), and based on the following additional observations.

- A smaller area of Koala habitat is being cleared.
- A habitat score of five just meets the threshold for habitat critical to the survival of the species (maximum score is 10).
- No primary food trees occur on the Project Site.
- The density of Koalas is low i.e. ≤ 0.01/ha.
- The clearing is occurring on the edge of patch and causing minimal fragmentation.
- The method of clearing retains Koala food trees on the Project Site.
- Koala food trees will be included in site rehabilitation.

This supports the field observations provided by ELA (2014) which suggest the habitat is of low quality and that Koalas inhabit the Project Site infrequently.

Spotted-tailed Quoll

The Spotted-tailed Quoll is listed as endangered under the EPBC Act and is considered by ELA (2014) as potentially likely to occur within the Project Site given the proximity of several conservation areas, including Girraween National Park where the species is known to occur. The Significant Impact Guidelines for the Spotted-tailed Quoll relate to potential impacts from the baiting programs. In order to assess the significance of potential impacts relating to the Proposal, ELA (2014) assessed the significance based on criteria provided in *Matters of National Environmental Significance: Significant impact guidelines 1.1* (DoE, 2013).

ELA (2014) concluded that the Proposal was unlikely to have a significant impact on the Spotted-tailed Quoll based on the following observations.

- The Project Site is within a fragmented habitat from previous quarry-related activities and surrounding grazing practices.
- No suitable habitat features such as denning sites were located on the Project Site and therefore breeding patterns are not likely to be disrupted or occupancy reduced.
- The Proposal is unlikely to fragment existing populations.
- The species prefers mature wet forest areas and low levels of disturbance from timber harvesting.

- It is unlikely that the identified European Red Fox would result in the spread of disease, interfere with the recovery of the species or affect critical habitat given the absence of habitat and the likelihood that individuals would be transient in nature.

Migratory Bird Species

As described in Section 4.7.5, ELA (2014) considered four migratory species as potentially likely to occur within the Project Site, namely:

- *Apus pacificus* (Fork-tailed Swift);
- *Hirundapus caudactus* (White-throated Needletail);
- *Merops ornatus* (Rainbow Bee-eater); and
- *Manarcha melanopsis* (Black-faced Monarch).

However, further assessment confirmed that the Project Site would be unlikely to contain important habitat or an ecologically significant proportion of a population of these species (for further detail on this assessment see Section 6.1.3 of ELA (2014)).

4.7.7.2 Threatened Species of State Significance

EP&A Act – 7 Part Test

ELA (2014) assessed the significance of the proposed actions to species listed as threatened in the TSC Act and known or likely to occur within the Project Site (see **Table 4.15**) in accordance with Section 5A of the EP&A Act (also known as a 7 Part Test). The assessment is provided in full in Appendix E of ELA (2014) provided as **Appendix 8** to this document.

ELA (2014) conclude that it would be unlikely that the Proposal would significantly impact any of the subject species based on the following observations.

- The proposed activities would constitute a moderate disturbance in the context of the habitat available within the Project Site and a minor disturbance in the context of the surrounding landscape.
- The Proposal would require the removal of eight hollow-bearing trees. However, five hollow-bearing trees would remain within areas of remnant vegetation within the Project Site and numerous other breeding and foraging habitat is available immediately adjacent and surrounding the Project Site.
- The Proposal would not isolate or fragment any existing connecting areas or corridors of vegetation.
- The Project Site does not provide any suitable denning habitat for species such as the Spotted-tailed Quoll.
- The Project Site does not contain primary food trees for any of the listed species.

SEPP 44 – Koala Habitat Protection

ELA (2014) also reviewed the provisions of *State Environmental Planning Policy No. 44 – Koala Habitat Protection (SEPP 44).*

As outlined in Section 3.3, the Tenterfield Local Government Area (LGA) is listed in Schedule 1 of SEPP 44 as an area that may provide habitat for Koalas. A resident population of Koalas was not evident during the survey and no species identified within the Project Site are listed in Schedule 2 of SEPP 44 as Koala food trees. As such, the Project Site is not considered core or potential Koala habitat and no further provisions of the Policy apply.

Two species listed as secondary food trees within the *Recovery Plan for the Koala: Phascolarctos cinereus* (DECC, 2008) occur in the area, namely Mountain Gum *(Eucalyptus dalrympleana*) and Grey Box *(Eucalyptus moluccana).* Secondary food trees exhibit a lower level of use than primary trees and their use is generally more density and/or size class dependent. In addition, the presence of markings and scats suggest the Project Site has previously been used as Koala habitat, however, ELA (2014) conclude that the relative age and low intensity of the markings and scats and the low proportion of feed trees suggest Koala usage of the Project Site is infrequent.

4.7.7.3 Key Threatening Processes

The Proposal is likely to exacerbate the following key threatening processes (KTPs) listed under the TSC Act and EPBC Acts:

- Clearing of native vegetation.
- Loss of hollow-bearing trees.
- Removal of dead wood and dead trees.

Consideration of these KTPs is provided as part of the Assessments of Significance undertaken by ELA (2014) for the subject species and summarised in Section 4.7.7.1 and 4.7.7.2. The Applicant considers that through the commitment to carefully manage the clearing of native vegetation through the measures described in Section 4.7.6 and the retention of 6.5ha of remnant vegetation within the Project Site, the potential impacts from these threatening processes would be avoided or mitigated as much as practically possible. The proposed rehabilitation of the Project Site to a primary use for nature conservation at the end of Quarry life would establish endemic native species within the disturbed areas where practical.

4.7.7.4 Conclusion

The principal ecological impacts of the Proposal are concerned with the removal of native vegetation and the subsequent potential impacts to fauna habitat. ELA (2014) has considered the significance of the Proposal in accordance with the EPBC Act, EP&A Act and the TSC Act concluding that it would be unlikely that significant impacts would occur through any key threatening processes or to any species listed in this legislation. No threatened flora species or endangered ecological communities were identified within the Project Site. As a result, the Applicant considers that potential impacts resulting from vegetation clearing associated with the Proposal would be suitably mitigated through management measures and the proposed rehabilitation and would not constrain the Proposal.

4.8 CULTURAL HERITAGE

4.8.1 Introduction

The EARs identify "*Heritage*" as a key issue for assessment in the EIS. In addition, the OEH requests that an appropriate cultural heritage investigation is undertaken of the quartzose outcrop given the potential for use as a raw material source and the location and geology of the Project Site. The EARs and the requirements of relevant government agencies are included in full as **Appendix 2**.

Based on consideration of the proposed activities (Section 2) and the local setting (Section 4.1) the specific cultural heritage-related impacts that may result as a consequence of the Proposal (without the implementation of the safeguards, controls and mitigation measures presented in this section) and therefore require assessment include:

- damage or destruction of known or unidentified Aboriginal artefacts or sites of cultural heritage significance as a direct or indirect result of the Proposal;
- damage or destruction of known or unidentified non-Indigenous heritage artefacts or sites of cultural heritage significance as a direct or indirect result of the Proposal; and
- cumulative reduction of the in-situ archaeological record.

An Aboriginal cultural heritage impact assessment of the Proposal was prepared by Mr John Appleton of Archaeological Surveys and Reports Pty Ltd (ASR). A copy of the assessment report is presented as **Appendix 9** and referred to hereafter as ASR (2014). A review of known non-Indigenous heritage within the locality was undertaken by Mr Rob Corkery and Mr Nicholas Warren of R.W. Corkery & Co. The following subsections provide a summary of ASR (2014) and an assessment of potential impacts to known non-Indigenous heritage, concentrating on those matters raised in the EARs and correspondence accompanying the EARs provided by various government agencies.

4.8.2 Aboriginal Heritage

4.8.2.1 Method of Investigation

Desktop Review

A search of the *Aboriginal Heritage Information Management System* (AHIMS) database for registered Aboriginal heritage sites within a 24km^2 search area surrounding the Project Site resulted in identification of a single item. The site is described as a scar tree and the location marked as approximately 800m south of the intersection of Mount Lindesay Road and the quarry access road or approximately 1.3km southeast of the Project Site. This site would not be impacted by the Proposal.

The identified site was recorded on the AHIMS register as being in Leechs Gully, however the coordinates for the location do not correspond with area known locally as Leechs Gully (see **Figure 4.10**). Section 4.2 of ASR (2014) provides a brief discussion on the reliability and representativeness of sites on the AHIMS register.

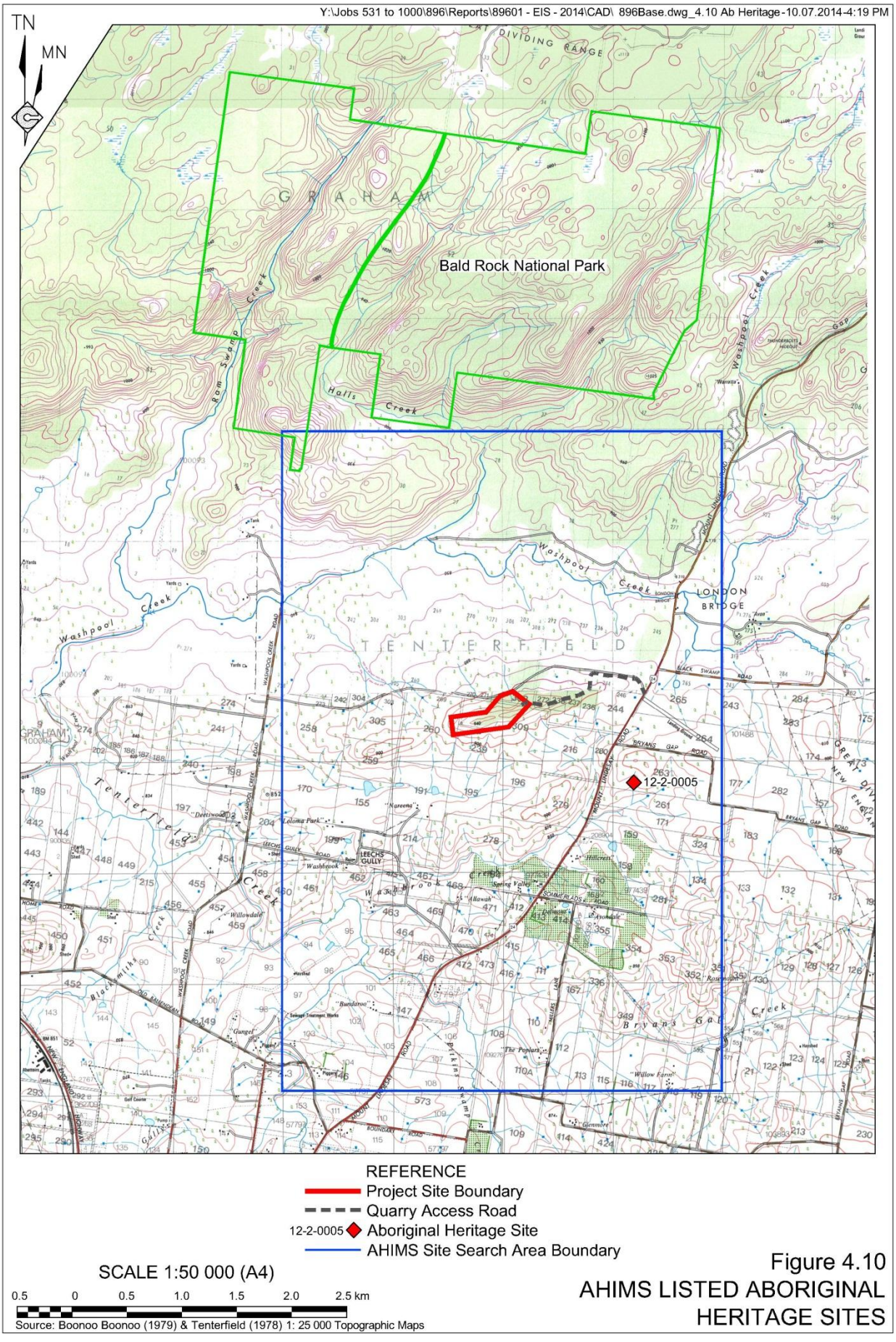


Figure 4.10
AHIMS LISTED ABORIGINAL HERITAGE SITES

Consultation

Consultation undertaken for the Proposal was undertaken in accordance with the following documents.

- *Aboriginal cultural heritage consultation requirements for proponents 2010* (DECCW 2010a) and
- the *Due Diligence Code of Practice for the Protection of Aboriginal Objects in NSW 2010* (DECCW 2010b).

In order to determine the appropriate Aboriginal stakeholders for the Proposal, ASR (2014) sent letters dated 21 March 2014 to the following government agencies and statutory bodies.

- OE&H Planning and Aboriginal Heritage Section - Northeast;
- The NSW and ACT Registry of the National Native Title Tribunal (NNTT);
- Moombahlene Local Aboriginal Land Council (LALC);
- Tenterfield Shire Council;
- NTSCORP Limited;
- Northern Rivers Catchment Management Authority; and
- the Office of the Registrar, Aboriginal Land Rights Act (ALRA).

In addition, an advertisement was placed in the *Tenterfield Star* on 9 April 2014 describing the Proposal and inviting all Aboriginal stakeholders with an interest in the Proposal to register their interest.

Interested parties were given a suitable period of time to respond before the following Registered Aboriginal Parties (RAPs) were collated for the Proposal.

- Kwiembal Elders Indigenous Group.
- Ms Natalene Mercy.
- Ngoorabul Elders.
- Moombahlene LALC.

Responses from the government bodies and statutory bodies advised that there were no listed Registered Aboriginal Owners, no stakeholders registered in the National Native Title Register, no Native Title Claims, no Unregistered Claimant Applications, or any entries in the Register of Indigenous Land Use Agreements with regard to the Project Site.

An Aboriginal Land Claim exists over the Crown Land within Lot 245 DP751540 through which the quarry access road passes in the southern section of the land. As discussed in Section 1.5, advice has been received from NSW Trade & Investment, Crown Lands that based on the provisions of Section 75 of the *Local Land Services Act 2013*, and given that the road in question was in use prior to the land claim being lodged, it is likely that it will not be claimable Crown Land.

In its response to initial consultation, the Tenterfield Shire Council provided a copy of the *Tenterfield LGA Aboriginal Heritage Study* which lists an area named Leechs Gully Reserve or the Tenterfield Aboriginal Reserve as an area of Aboriginal heritage sensitivity. Leechs Gully is

located over 1km to the southwest of the Project Site and would not be impacted by the Proposal. A description of the reserve and its importance to the Aboriginal community is provided in Section 3 of ASR (2014).

Given the nature and scale of the Project Site, ASR (2014) did not consider it necessary to involve RAPs in field investigations. However, ASR (2014) provided each RAP with a copy of the draft Aboriginal cultural heritage assessment (provided as **Appendix 9**). The only response to the report (after the standard 28 day period) was from Ms Natalene Mercy (provided as Appendix v in ASR (2014)). Ms Mercy expressed her satisfaction with the draft report and did not add to cultural information in relation to the Proposal.

Field Survey

The approach to the survey and site types searched for were based on a predictive model developed by Mr Appleton through assessment of the environmental context including the general geology and topography, likely nearby resources such as food (vegetation and animals), water, stone and shelter (see Section 5 of ASR (2014). The predictive model suggested it is possible that the following sites could be present within the Project Site.

- Isolated artefacts
- Artefact scatters
- Scarred trees
- Carved trees.
- Potential Aboriginal Deposits (PADs).

Although the Project Site occurs on a quartzose intrusion this rock was not considered by ASR (2014) to be suitable to be knapped into tools or weapons, and there was no stone anywhere within the Project Site that would have been suitable knapping material.

The survey of the Project Site was undertaken by Mr John Appleton on 2 April 2014 in fine weather with some cloud cover. This was considered by ASR (2014) to be ideal conditions for observing artefacts and modified trees. Details of the field survey including recording of topography, vegetation cover, conditions, the area covered and the effective coverage of the survey are described in Section 7 and Section 8 of ASR (2014). In summary, the survey involved taking a pictorial record of the areas surveyed with these areas divided into three categories, namely, the ridges and upper slopes, the mid-slopes and the drainage lines. A zig-zag approach to sampling was adopted to ensure the sampling included areas that may be subject to peripheral changes at a later date, such as clearing for fire reduction. Table 3 and Table 4 within ASR (2014) provide a statistical review of effective survey coverage and a landform summary respectively.

4.8.2.2 Survey Results

No Aboriginal artefacts or sites were identified during the field survey.

Significance Assessment

As no Aboriginal artefacts or sites were found to be located within the areas to be disturbed and no cultural information was provided by any of the RAPs or attributed to the Project Site, no significance is attributable to these areas in relation to Aboriginal heritage values.

4.8.3 Non-Indigenous Heritage

A desktop review of listed non-Indigenous heritage sites was undertaken on 7 May 2014 and included the following databases.

- Australian Heritage Database
- National Trust Heritage Register
- NSW State Heritage Register
- NSW State Heritage Inventory
- Tenterfield LEP 2013

The search did not identify any sites of non-Indigenous heritage significance within or surrounding the Project Site with the closest sites listed below and displayed on **Figure 4.11**.

- Bald Rock National Park - located 2.5km north of the Project Site
- Tenterfield Station Homestead and outbuildings – located approximately 3.8km south-southwest of the Project Site.
- Tenterfield Station Barn – located approximately 3.7km south-southwest of the Project Site.
- Unnamed House – located approximately 4.0km west-southwest of the Project Site.

No items of heritage significance were identified during a field survey undertaken by Mr John Appleton of Archaeological Surveys and Reports Pty Ltd on 2 April 2014.

Figure 2.4 identifies the transport routes taken by trucks to transport raw materials to the Sunnyside Crushing and Screening Plant and the return route to Dowe's Quarry (as described in Section 2.8). Both routes require that trucks pass by a variety of sites listed in Schedule 5 of the *Tenterfield Local Environmental Plan 2013* as having either local or state heritage significance. These sites are displayed on **Figure 4.11.** A total of eight sites have been identified along the transport routes. It is noted that five of these sites are located adjacent to a State road, namely, the New England Highway (Rouse Street) through the centre of Tenterfield. Quarry-related traffic would form a small proportion of total traffic along this route and the relative impact would not be significant (as described in Section 4.2.5).

4.8.4 Management and Mitigation Measures

As a result of the desktop and field investigations and consultation with Registered Aboriginal Parties established for the Proposal, ASR (2014) confirms that there are no Aboriginal Heritage constraints on either cultural or archaeological grounds to the Proposal. The review of known non-Indigenous heritage databases has concluded that the closest listed heritage item is within 3.7km from the Project Site and that the transportation of raw material and back-loaded fines would not result in significant impacts to the known items of non-Indigenous heritage. There were no items of non-Indigenous heritage significance identified during field surveys.

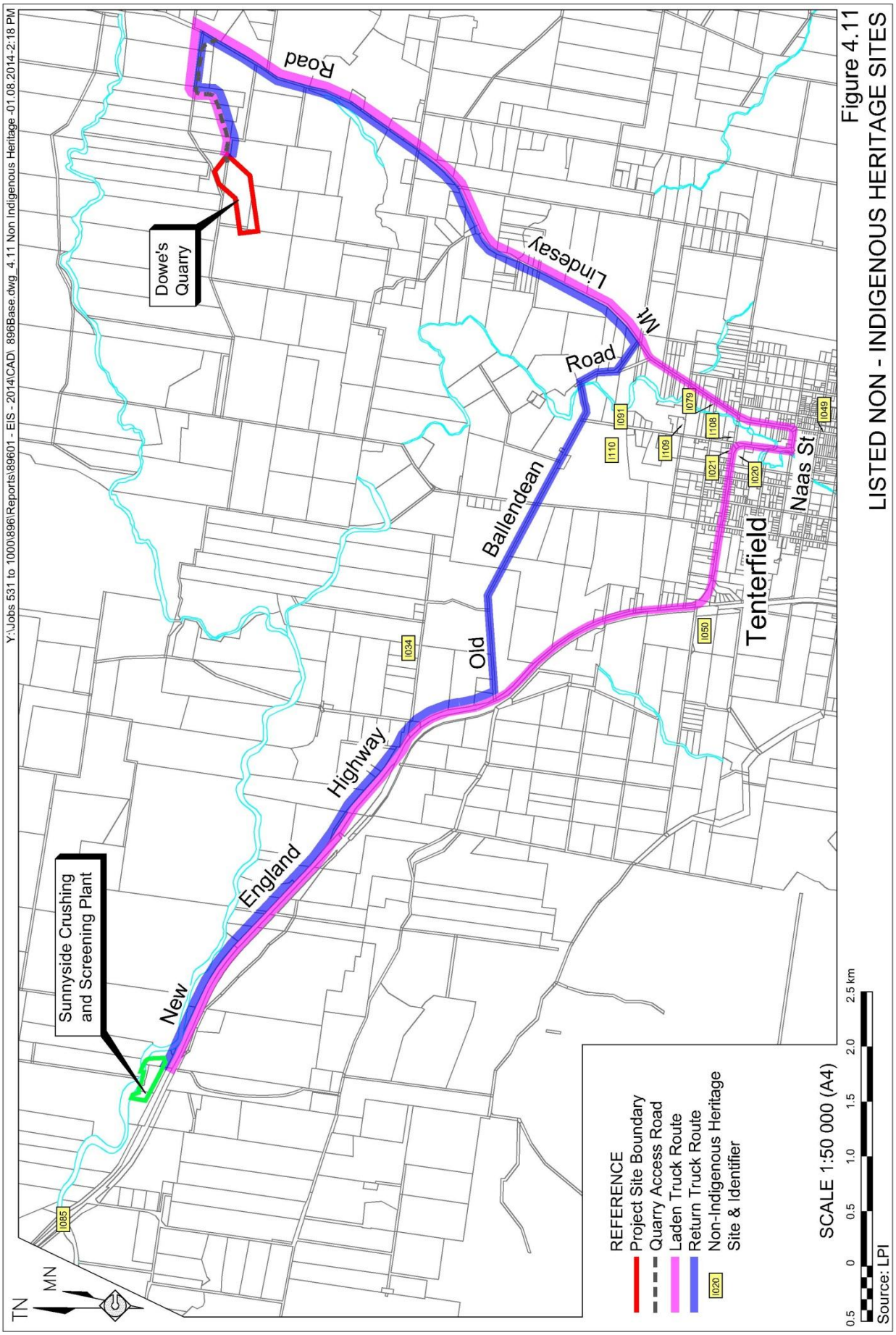


Figure 4.11
LISTED NON - INDIGENOUS HERITAGE SITES

However, the Applicant is aware of the possibility of these items occurring unexpectedly, especially given the historical and landscape context of the Project Site. The Applicant is also aware of reporting obligations under the *National Parks and Wildlife Act 1974* and the *Heritage Act 1977* for items of potential heritage significance. As a result of these factors the Applicant is committed to implementing the following management measures.

- Inclusion of cultural heritage protocols and obligations within induction processes required to be completed by all staff and sub-contractors prior to commencing work within the Project Site.
- A requirement to halt all works in the immediate area if Aboriginal or non-Indigenous cultural objects are uncovered. In this instance a suitably qualified archaeologist and/or Aboriginal community representative would be contacted to determine the significance of the object(s). The site would be appropriately registered with in the AHIMS, Tenterfield Shire Council or with the NSW Heritage Council along with the proposed management outcome for the site. No further work would be undertaken until a management strategy for the newly identified site is prepared in consultation with Aboriginal community representative(s), and relevant permits are obtained.
- A requirement to halt all works in the immediate area if human remains are located during the project to prevent any further impacts to the remains. The NSW Police, the Aboriginal community and OEH would then be notified. If the remains are found to be of Aboriginal origin and the Police consider the site not an investigation site for criminal activities, OEH would be further notified of the situation and works would not resume in the designated area until approval in writing is provided by OEH. In the event that a criminal investigation ensues, works would not to resume in the designated area until approval in writing (has been received) from NSW Police and OEH.
- Should items of cultural heritage significance be discovered within the Project Site all reasonable efforts would be made to avoid impact to cultural heritage values. If impacts are unavoidable, mitigation measures would be negotiated with the appropriate parties.

4.8.5 Assessment of Impacts

The Project Site is assessed to have no significance for cultural heritage values as:

- no items or areas of cultural heritage significance were located within the Project Site in a search of heritage databases and in the field investigation; and
- no values were attributed through consultation with registered stakeholders.

Given that the Project Site is assessed as having no significance for cultural heritage values and assuming the inclusion of management measures to account for unexpected finds within Project Site, and the proposed inductions and operational protocols, it is considered that the potential impact of the Proposal to items or areas of cultural heritage will be negligible.

4.9 SOIL AND LAND RESOURCES

4.9.1 Introduction

The EARs identify "*land resources*" as a key issue for assessment in the EIS requiring consideration of soil and land capability, landforms and topography and surrounding land use. The EPA also requested that potential impacts from erosion and sediment transport, mass movements (landslides) and salinity are assessed. This subsection assesses potential impacts to soil and land resources associated with the Proposal. The EARs and the requirements of relevant government agencies are included in full as **Appendix 2**.

Based on consideration of the proposed activities (Section 2) and the local setting (Section 4.1) including surrounding land use (Section 4.1.2.2) the specific land resource-related impacts that may result as a consequence of the Proposal (without the implementation of the safeguards, controls and mitigation measures presented in this section) and therefore require assessment include:

- a reduction in soil quality as a result of poor management practices (associated with stripping, stockpiling and other handing procedures);
- degradation of soils as a result of reduced aerobic function, modification to soil structure and erosion caused by poor stockpile establishment and management; and
- a reduction in soil quality upon re-use caused by inappropriate handling and placement of the soils or the use of inappropriate fertilisers.

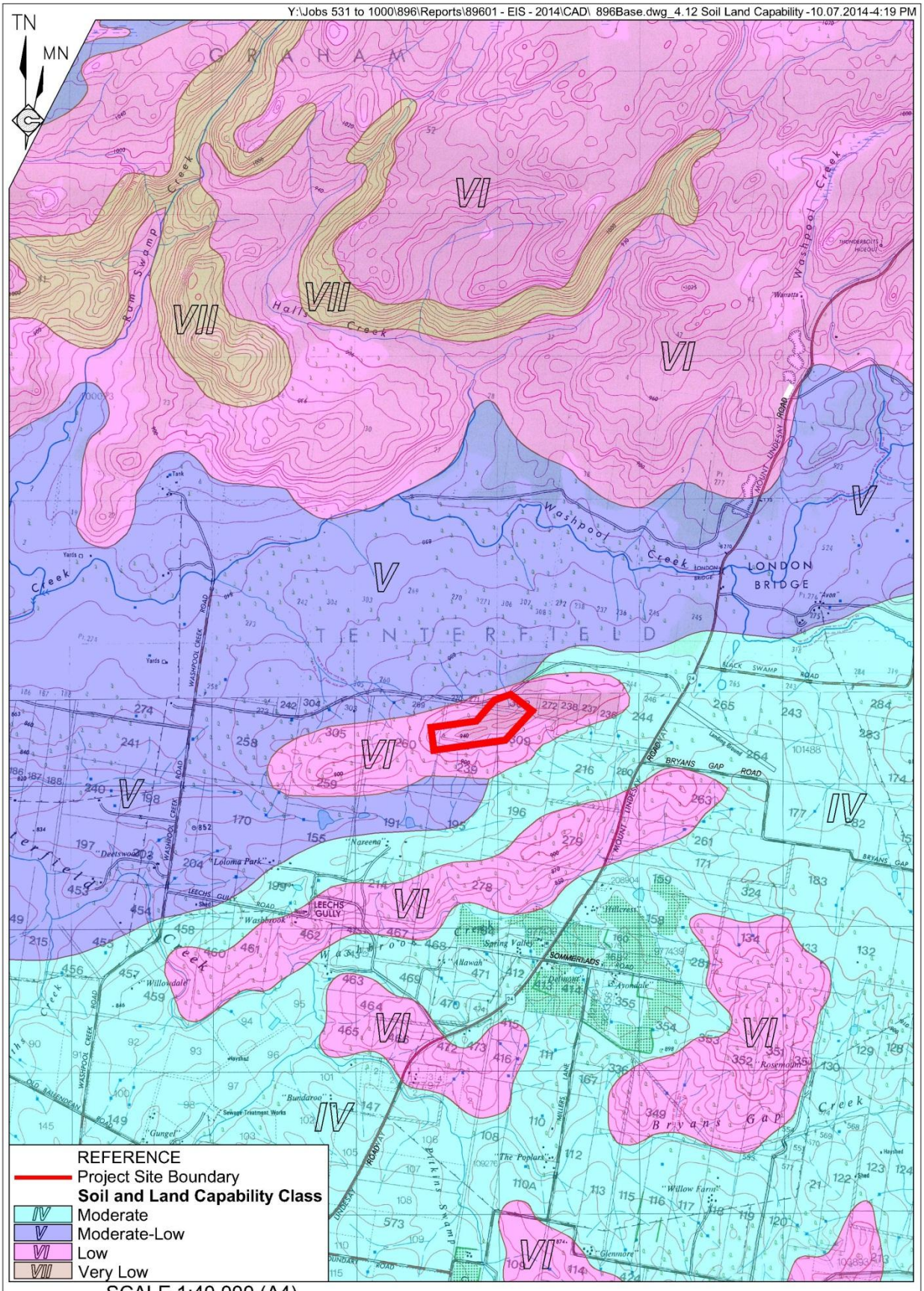
This subsection provides a review of the existing soils within the Project Site and proposed management and mitigation measures that would be implemented under the Proposal. This is followed by a review of any residual impacts after implementation of the proposed safeguards and management measures.

4.9.2 Existing Environment

The soils within the proposed extraction area are either non-existent due to the abundance of rock outcrop or skeletal in nature. Soil thickness increases downslope from the central ridge.

An indicative map of soil and land capability within and surrounding the Project Site is provided in **Figure 4.12**. The Project Site is located in an area with an estimated land capability of Class VI, which is considered to have severe limitations for high impact land uses, with land generally more suitable for grazing with limitations, forestry and nature conservation and not suitable for cultivation (OEH, 2012a). The Project Site also has low levels of estimated inherent soil fertility (OEH, 2012b) which supports the classification of land capability as having severe limitations for cultivation uses.

A description of the drainage characteristics of the Project Site is provided in Section 4.1.1 and the proposed management of water resources including erosion and sediment controls have been described in Section 4.6.



Soil and Land Capability Source: Modified after Office of Environment and Heritage (NSW) - April 2014
Source: Boonoo Boonoo (1979) & Tenterfield (1978) 1: 25 000 Topographic Maps

Figure 4.12
SOIL AND LAND CAPABILITY

4.9.3 Management and Mitigation Measures

The Applicant's approach to vegetation clearing, soil stripping and stockpiling procedures have been discussed in Section 2.5.3. A summary of these and other soil management procedures and safeguards which would be implemented are provided as follows.

- All soils would be handled as little as possible to minimise structural damage. This would be achieved by ensuring the areas for stripping and stockpiling are clearly identified prior to activities commencing.
- Mechanical blending of soils would be limited as it is considered that the removal process would sufficiently blend the topsoil and subsoil layers where these exist.
- Unless unavoidable, soil stripping would not be undertaken between December and February each year, i.e. the period of greatest intensity rainfall.
- Soils would not be stripped or replaced during extremely wet or dry conditions.
- Machinery used for stripping operations would place their loads neatly and uniformly so the stockpile does not require further forming prior to establishment of vegetation cover.
- Driving of machinery on the soil stockpiles would be prohibited once the stockpiles are created to minimise compaction and further degradation of soil structure.
- Soil stockpiles would not exceed 2m in height.
- Stockpiles would be seeded and fertilised as soon as possible after emplacement, using a mix of sterile annual groundcover or native grasses.
- Upslope water diversion would direct overland surface water flow away from the soil stockpiles, where practical.

4.9.4 Assessment of Impacts

The management procedures set out in Section 4.9.3 would ensure that soil resources are removed and handled in a manner that retains their structure and prevents further degradation as much as practicably possible. Soil stockpiles would be designed to prevent degradation through storage, and maintain the soil in the best possible condition for successful use in rehabilitation. Assuming the implementation of these soil management measures, the residual impacts associated with soil removal, handling, storage and re-use would be negligible.

As described in Section 4.1.2, the land surrounding the Project Site is owned by Mr Rod Dowe and used primarily for light grazing and pasture improvement. The closest neighbour is approximately 500m to the west of the Project Site (see **Figure 4.3**). It is considered that the Proposal would not alter the productive use of surrounding land.

Under the Proposal, the quartzose extrusion would be progressively extracted, removing much of the existing ridge (as described in Section 2.5 and displayed on **Figure 2.1**). The progressive removal of this landscape feature would alter the surrounding topography and drainage. However, the Proposal would not substantially change the stability of the ridge remaining after extraction. The fines (and overburden) emplacement would be constructed with a sufficiently low outer slope and surface drainage to ensure the long-term stability of the landform created

by the emplacement. Furthermore, and as described in Section 2.13, the Applicant intends to develop a final landform that provides a final land use of predominantly nature conservation and that would blend with the surrounding remnant vegetation (the final landform is displayed on **Figure 2.5**).

Section 4.6 describes the erosion and sedimentation measures that would be implemented under the Proposal including a series of diversion channels that would manage sediment-laden water within the Project Site (see **Figure 4.8**). Development of the final landform would also ensure that the retained drainage and sediment basins are sufficient to allow any sediment to settle out of the water and reduce any potential impacts to local waterways. These measures have been included in the design controls committed to in Section 4.6.5.

Due to the elevation of the Project Site and surrounding area it is not considered that the Proposal would contribute to any salinity in the area, nor impact access and quality of groundwater from existing bores (**Figure 4.3**).

4.10 VISIBILITY

4.10.1 Introduction

The EARs identify "*visual amenity*" as a key issue for assessment in the EIS. The EARs and the requirements of relevant government agencies are included in full as **Appendix 2**.

Based on consideration of the proposed activities (Section 2) and the local setting (Section 4.1) the specific visibility-related impacts that may result as a consequence of the Proposal (without the implementation of the safeguards, controls and mitigation measures presented in this section) and therefore require assessment include:

- increased visibility of the quarry from local residences resulting in decreased visual amenity of the local setting; and
- increased visibility of the quarry from local roads resulting in decreased visual amenity of the LGA as a whole.

This subsection describes the visual environment and considers the visibility of the proposed activities throughout the life of the Proposal.

4.10.2 Existing Environment

The Project Site is located along a ridge oriented generally in an east-west direction and is surrounded by remnant native vegetation. The upper section of the southern part of the existing extraction area is visible from a section of the Mount Lindesay Road and from Tenterfield, i.e. a distance of approximately 7km. **Plates 4.1** to **4.3** display representative views towards the Project Site from various vantage points including from along Mount Lindesay Road to the south of the quarry access road, from Leechs Gully Road and from the closest residence (Residence 3a on **Figure 4.3**). The visibility of the sections of the Project Site from the distant locations is largely confined to observations of the gap in the tree-line along the top of the ridge. The active extraction faces are not visible from any surrounding roads or residences. The locations and directions of the plates are displayed on **Figure 4.3**.

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Plate 4.1: View to the west from Mt Lindesay Road towards the Project Site approximately in line with the residence on Property Reference 12
(Ref: E896D_144)

Plate 4.2: View to the north from Leechs Gully Road towards the Project Site and the area cleared of vegetation within the existing extraction area
(Ref: E896D_133)

Plate 4.3: View to the east from Residence 3A towards the Project Site and the existing extraction area
(Ref: E896D_117)

Remnant vegetation adjacent to Mount Lindesay Road and the existing quarry access road screen the Project Site from view along the road and residences to the east of the Project Site. Remnant vegetation on the edge of the ridge effectively screens activities within the Project Site from residences to the northwest, west and southwest of the Project Site. Residences to the south and southeast of the Project Site are not exposed to the Quarry due to intervening topography and vegetation. Any exposed areas would be rehabilitated in the shortest time possible to avoid prolonged impacts to visual amenity.

4.10.3 Management and Mitigation Measures

The Applicant would continue to operate Dowe's Quarry in a similar manner to past practices by:

i) confining the access to the active operational areas (for equipment and trucks) to the northern side of the ridge, thereby using the ridge to shield these activities from views from Tenterfield and Leechs Gully Road;

ii) orienting the upper exposed bench in a generally north-northeasterly direction to limit the direct exposure of the upper bench to be viewed from Tenterfield and Leechs Gully Road; and

iii) undertaking revegetation on the southern slopes of the ridge to provide for the progressive re-instatement of vegetation near the upper surface of the ridge.

4.10.4 Assessment of Impacts

The closest non-Project-related residence (Residence 3a on **Figure 4.3**), is located approximately 500m to the west of the Project Site. **Plate 4.3** displays the view towards the Project Site from this residence in which the vegetation along the property border and the remnant vegetation within the Project Site would continue to screen extraction activities and Quarry faces from this location. The Applicant has committed to progressing extraction from the existing extraction area in a westerly direction to limit any changes to this vantage point. As described in Section 2.13, rehabilitation of the Project Site would occur progressively throughout the life of the Proposal to limit the duration of any visual impacts.

The visibility of the Project Site from Mount Lindesay Road and from residences adjoining this road is limited by patches of remnant vegetation which act as a screen along the roadside in sections of the Mount Lindesay Road. Vegetation along both the northern and southern boundaries of the Project Site also screens the quarry benches from view along Mount Lindesay Road (see **Plate 4.1**).

It is considered that remnant vegetation and intervening topography together with the proposed mitigation measures will continue to effectively screen the Project Site from local vantage points for the life of the Proposal resulting in minimal impacts to visual amenity.

4.11 SOCIO-ECONOMIC

4.11.1 Introduction

The EARs identify "*Social and Economic Impacts*" as a key issue for assessment in the EIS. The Tenterfield Shire Council and RMS also request information on proposed contributions to management of the surrounding road network. The EARs and the requirements of relevant government agencies are included in full as **Appendix 2**.

Based on consideration of the proposed activities (Section 2) and the local setting (Section 4.1) the specific socio-economic impacts that may result as a consequence of the Proposal (without the implementation of the safeguards, controls and mitigation measures presented in this section) and therefore require assessment include:

- the perceived loss of amenity at local and neighbouring properties resulting in a change in social activities and impact on feelings of wellbeing derived from the associated location; and
- the degradation of local infrastructure and services through continued use for quarry-related activity, this principally applies to the local and regional road network.

This subsection describes the social and economic setting within the local area surrounding Dowe's Quarry together with the Tenterfield Local Government Area (LGA) and reviews the potential socio-economic impacts including benefits, which would continue to occur under the Proposal. Management and mitigation measures that would be implemented should development consent be granted and a final review of the socio-economic impacts and benefits after implementation of these measures is provided. The socio-economic impact assessment for the Proposal was undertaken by Mr Rob Corkery and Mr Nicholas Warren of R.W. Corkery & Co. Pty Limited with assistance from the Applicant.

4.11.2 The Existing Socio-Economic Setting

The Project Site is located in northeastern NSW approximately 8km north of the town of Tenterfield and approximately 14km southeast of the NSW border at the village of Jennings. It is situated within the Tenterfield Local Government Area (LGA).

The Project Site is situated within land owned by Mr Rod Dowe which shares a northern border with the Bald Rock National Park (see **Figure 4.1**). Communities surrounding the Project Site include the following.

- Adjoining Landowners – includes the owners of properties that adjoin the land owned by Mr Rod Dowe.
- The Local Community – includes nearby landowners who are considered to have an interest in the Proposal due to the proximity of Dowe's Quarry to their residences.
- The Tenterfield Community – both residents and businesses in the Tenterfield LGA with an interest in the amenity and ongoing economic development of the LGA.

The adjoining and nearby landowners focus their social interests principally within Tenterfield given its close proximity.

The following subsections provide a brief overview of the socio-economic setting in the Tenterfield LGA based on information provided within the website of the Tenterfield Shire Council and the Australian Bureau of Statistics (ABS) Census data collected in 2011.

The 2011 Census data available from the ABS website provides statistical information on the Tenterfield community including the communities surrounding the Project Site. Due to the low population within the town of Tenterfield, the Project Site and the areas surrounding the Project Site are included in the ABS information within the Tenterfield State Suburb. As a result, analysis at the level of state suburb did not provide significant information on the adjoining neighbours or local community, therefore an overview of the Tenterfield LGA only has been relied upon for this assessment.

4.11.2.1 Population

Table 4.16 provides the population statistics for the Tenterfield LGA and NSW taken from the 2011 Census data available from the ABS (2014). Four categories have been used to separate age groups and give a general overview of the population. These categories separate the population into children and youths, young adults, adults and people of retirement age. The total population is evenly split between males and females. The Tenterfield LGA exhibits a trend common in many regional towns, which is a lower proportion of the total population of young adult age and a higher proportion within the adult and retirement age groups. This is commonly considered to be the result of young adults leaving regional areas in search of further education or employment opportunities.

Table 4.16
Population Statistics (Tenterfield LGA and NSW)

	Tenterfield LGA		NSW	
	Persons	**% of Total**	**Persons**	**% of Total**
Total	6 811	-	6 917 658	-
Males	3 390	49.8%	3 408 878	49.3%
Females	3 421	50.2%	3 508 780	50.7%
Children and Youths (aged 0 – 15)	1 295	19.0%	1 332 515	19.3%
Young adults (aged 16 – 34)	1 098	16.1%	1 834 597	26.5%
Adults (aged 35 – 64)	2 992	43.9%	2 341 690	33.9%
Retirement age (aged 65+)	1 424	20.9%	1 018 180	14.7%
Source: ABS (2011)				

4.11.2.2 Employment

Table 4.17 presents employment statistics from the ABS 2011 Census for the Tenterfield LGA and NSW. The data indicates that in 2011 the Tenterfield LGA has a lower labour force participation rate and a higher unemployment rate compared to the state average for NSW. The LGA also has a higher proportion of its labour force employed in a part time capacity.

Table 4.17
Employment Statistics (Tenterfield LGA and NSW)

	Tenterfield LGA		NSW	
	No.	**%[1]**	**No.**	**%[1]**
Employed				
Full-time[2]	1 507	54.3	2 007 925	60.2
Part-time	909	32.8	939 464	28.2
Employed, away from work[3]	93	3.4	120 121	3.6
Employed, hours not stated	75	2.7	70 821	2.1
Total		**2 584**		**3 138 331**
Unemployed, looking for work				
Full-time work	116	4.2	116 697	3.5
Part-time work	73	2.6	79 829	2.4
Total		**189**		**196 526**
Labour Force Participation				
Total labour force		2 773		3 334 857
Not in labour force		2 376		1 933 275
Labour force status not stated		363		317 017
Total Persons		**5 512**		**5 585 149**
Labour force participation		**50.3%**		**59.7%**

Note 1: Indicates percentage of total labour force

Note 2: Employed, worked full-time' is defined as having worked 35 hours or more in all jobs during the week prior to Census Night.

Note 3: Comprises employed persons who did not work any hours in the week prior to Census Night.

Source: ABS 2011

4.11.2.3 Industry of Employment

Table 4.18 displays the contribution of various industries to employment within the Tenterfield LGA. The Tenterfield LGA has a long history of involvement in agriculture, mining and forestry and **Table 4.18** demonstrates the continued importance of this industry as it employs approximately 20% of the population. It is noteworthy that the Applicant, who employs approximately 20 persons, is the largest private employer in Tenterfield.

Industries such as health services and the retail industry have become important sources of local employment creating important diversity in economic activity in the LGA. The importance of the retail and health care industries is consistent with the relative significance of these industries state-wide. The area has relatively low levels of professional and financial service industry participation in the LGA though this is typical of the ABS category for 'NSW Other Urban' areas within which the Tenterfield LGA falls (ABS 2011).

Table 4.18
Industry of Employment (Tenterfield LGA and NSW)

Industry	Tenterfield LGA		NSW	
	No.	%	No.	%
Agriculture, forestry & fishing	520	20.1	69 576	2.2
Mining	49	1.9	31 186	1.0
Manufacturing	158	6.1	264 865	8.4
Electricity, gas, water & waste services	21	0.8	34 203	1.1
Construction	194	7.5	230 057	7.3
Wholesale trade	59	2.3	138 890	4.4
Retail trade	284	11.0	324 727	10.3
Accommodation & food services	173	6.7	210 380	6.7
Transport, postal & warehousing	113	4.4	155 027	4.9
Information media & telecommunications	6	0.2	72 488	2.3
Financial & insurance services	26	1.0	158 422	5.0
Rental, hiring & real estate services	25	1.0	51 554	1.6
Professional, scientific & technical services	88	3.4	247 295	7.9
Administrative & support services	52	2.0	102 354	3.3
Public administration & safety	148	5.7	192 634	6.1
Education & training	198	7.7	248 951	7.9
Health care & social assistance	284	11.0	364 321	11.6
Arts & recreation services	20	0.8	46 330	1.5
Other services	95	3.7	117 615	3.7
Inadequately described/Not stated	72	2.8	77 455	2.5
Total	**2 584**		**3 138 330**	

Source: ABS 2011

4.11.2.4 Local Amenity, Regional History and Tourism

The Project Site is located approximately 2.5km from the southern border of the Bald Rock National Park. The Tenterfield LGA is recognised for its natural beauty and rural landscapes with ten national park reserves and various agricultural attractions such as wineries and farm gate enterprises present within the LGA.

The Tenterfield LGA is also popularly recognised as the 'Birthplace of our Nation' after Sir Henry Parkes gave a famous speech on Australian federation in the town on 24 October 1889. This and other notable historical milestones have contributed a growing historical tourism industry in the region. The Tenterfield Shire Council has recognised the importance of the tourism industry in its *Economic Development Strategy 2013 – 2017* including several strategic actions involving the development of the tourism industry within Tenterfield and surrounding villages.

4.11.3 Potential Impacts of the Proposal on the Socio-Economic Setting

The following subsections provide an overview of potential impacts to the socio-economic setting of the local area and region that may result from the Proposal.

Employment and Economic Stimulus

Continued operation of Dowe's Quarry would provide for ongoing long-term employment of four employees who either work directly at the quarry or transporting the raw materials to either the Sunnyside Crushing and Screening Plant or destinations beyond. Ongoing employment would be provided indirectly for approximately 20 permanent and casual employees who either work at or are based at the Sunnyside Crushing and Screening Plant which relies on the continued delivery of the raw materials from Dowe's Quarry. Overall, the Applicant spends an estimated $5 million to $6 million each year on wages, machinery servicing, consumables and all other purchases, the bulk of which is spent within the Tenterfield Shire. This annual contribution would continue should development consent be granted.

Finally, the flow-on effect of secure employment for employees who reside in the Tenterfield LGA would provide an additional stimulus to retail and other service industries within Tenterfield Shire.

Reduced Local Amenity and Impacts to Tourism

The proposed extension to the extraction area would result in minor change to the local topography within the Project Site. Given these changes would not be readily discernible from surrounding residences, locations and roads, adverse impacts to the local tourism industry are unlikely.

Environmental Emissions Impacting on Lifestyle

Increased emissions of dust and noise, or impacts on local water resources and vegetation, could potentially impact on the lifestyle of local residents, i.e. without the adoption of the range of proposed design and operational safeguards.

The Social Impact of Road Transport through the Outskirts of Tenterfield

The raw material transportation route is described in Section 2.8 and includes several roads that connect the Mount Lindesay Road with the New England Highway through the northern outskirts of Tenterfield. As described in Section 2.8, this route has been selected based on preserving driver and general road safety. Continued transportation of these raw materials through the outskirts of Tenterfield has the potential to result in impacts from noise and dust emissions as well as the potential for accidents in more populated or built-up areas.

4.11.4 Safeguards and Mitigation Measures

In addition to the mitigation measures and management procedures relating to amenity aspects such as transportation, visibility, noise and air quality described previously in Section 4.2, Section 4.3, Section 4.4 and Section 4.10 respectively, the Applicant would implement the following management and mitigation measures to ensure that the ongoing benefits for the

Tenterfield community that arise from the Proposal are maximised and adverse impacts are minimised. Where possible, these measures have been categorised to reflect the particular aspect that would be addressed by each.

Social and Community

- Engage with surrounding landowners and local community members, as required to inform them about the activities within the quarry.
- Respond to community complaints in an expeditious and courteous manner.

Responsible Road Use

- Continue to implement the Driver's Code of Conduct to ensure that truck drivers remain aware of their responsibilities while driving.

Economic Contribution and Development

- Continue to give preference, where practicable, to suppliers of equipment, services or consumables located within the Tenterfield LGA.

4.11.5 Assessment of Impacts

Darryl McCarthy Constructions Pty Ltd has been an active member of the Tenterfield community since the early 1970s, contributing to the local and regional economy through the provision of jobs for local people, capital expenditure, machinery servicing and other consumables. Contributions through employment provide direct benefits through wages, but also a secondary benefit to local employment and wages through stimulus of the retail and other service industries within the Tenterfield Shire. The sale of the products of Dowe's Quarry provides revenue sourced from outside the LGA which is dispersed through the above activities and wages. These contributions would continue under the Proposal.

The Applicant has committed to payment of a monthly contribution to the Tenterfield Shire Council to assist with road maintenance as specified in the *Section 94 Development Contributions Plan 2013.*

As well as the commitments made in Section 4.11.4, the Applicant's approach to avoiding, mitigating or managing potential impacts to local amenity from the continued operation of Dowe's Quarry has been provided earlier for elements such as product transport (Section 4.2.3), dust emissions (Section 4.3.5), operational noise (Section 4.4.4), blasting impacts (Section 4.5.3), visibility of the Project Site from surrounding residences and roads (Section 4.10.3) and waste management (Section 2.9). Assessment of the residual impacts associated with these elements has indicated that the Proposal would result in only minor impacts to the surrounding environment that would be managed in the short term through the various measures that would be implemented and finally through the rehabilitation process.

The *Economic Development Strategy 2013 – 2017* prepared by the Tenterfield Shire Council highlights the importance of balancing the historic importance of agriculture in the LGA with other industries, such as the retail, health care and tourism industries, to provide diverse sources of employment. Council's vision for economic growth in the Tenterfield Shire is stated as follows.

> *"..... to establish a prosperous shire through balanced, sustainable economic growth managed in a way to create quality lifestyles and satisfy the employment, environmental and social aims of the community."*

The employment and other economic benefits of the continued operation of Dowe's Quarry, including the indirect impact through operations at the Sunnyside Crushing and Screening Plant, would continue to contribute to the continued economic growth of the Tenterfield Shire through wages, stimulus to local services and other indirect impacts. It is considered that the continued operation of Dowe's Quarry would have minor impacts on the surrounding environment through the removal of vegetation and operational impacts such as minor dust and noise emissions. However, these would be managed throughout the life of the quarry and through the rehabilitation within the Project Site. Finally, the Proposal would have minimal impacts on the lifestyle and amenity of surrounding residents, the greater Tenterfield community and tourism in the LGA.

Given the implementation of measures to reduce any residual impacts of operations and the continued economic benefits provided by Dowe's Quarry, it is assessed that the continued operation of the quarry provides benefits that outweigh any residual impacts.