Section 4

Assessment and Management of Key Environmental Issues

PREAMBLE

This section describes the specific environmental features of the Application Area, focussing on the DZP Site and its surrounds that would or may be affected during the life of the Proposal. The proposed design and/or operational safeguards and management measures are presented, followed by an assessment of the predicted level of impact(s) the proposed activities may have after implementation of these measures. Where appropriate, proposed monitoring programs are also described.

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4.1 BACKGROUND

4.1.1 Introduction

The descriptions of various environmental aspects of the Proposal throughout this section are reliant upon a range of background information common to many of the key environmental issues. In this subsection, the local setting is described and background information is provided on the topography, climate, land ownership and residences, land uses and the community surrounding the DZP Site.

4.1.2 Topography and Drainage

4.1.2.1 Regional Topography and Drainage

Figure 4.1 presents the regional topography and drainage surrounding the DZP Site. The DZP Site is located at the western side of the Great Dividing Range, with steeply sloped and deeply incised valleys and ridges with elevations in excess of 800m AHD located approximately 50km to the east-southeast of the DZP Site.

Approximately 30km to the southeast and southwest of the DZP Site are two north-south orientated ranges, namely the Catombal Ranges and Harveys Range respectively. The Catombal Ranges has a maximum elevation at Mt Arthur of 522m AHD, while maximum elevations in the Harveys Range are between 700m AHD and 775m AHD.

To the south of the DZP Site, an area of undulating topography associated with Dog Trap Hill includes a range of low hills with elevations between 450m AHD and 607m AHD, with gentle slopes.

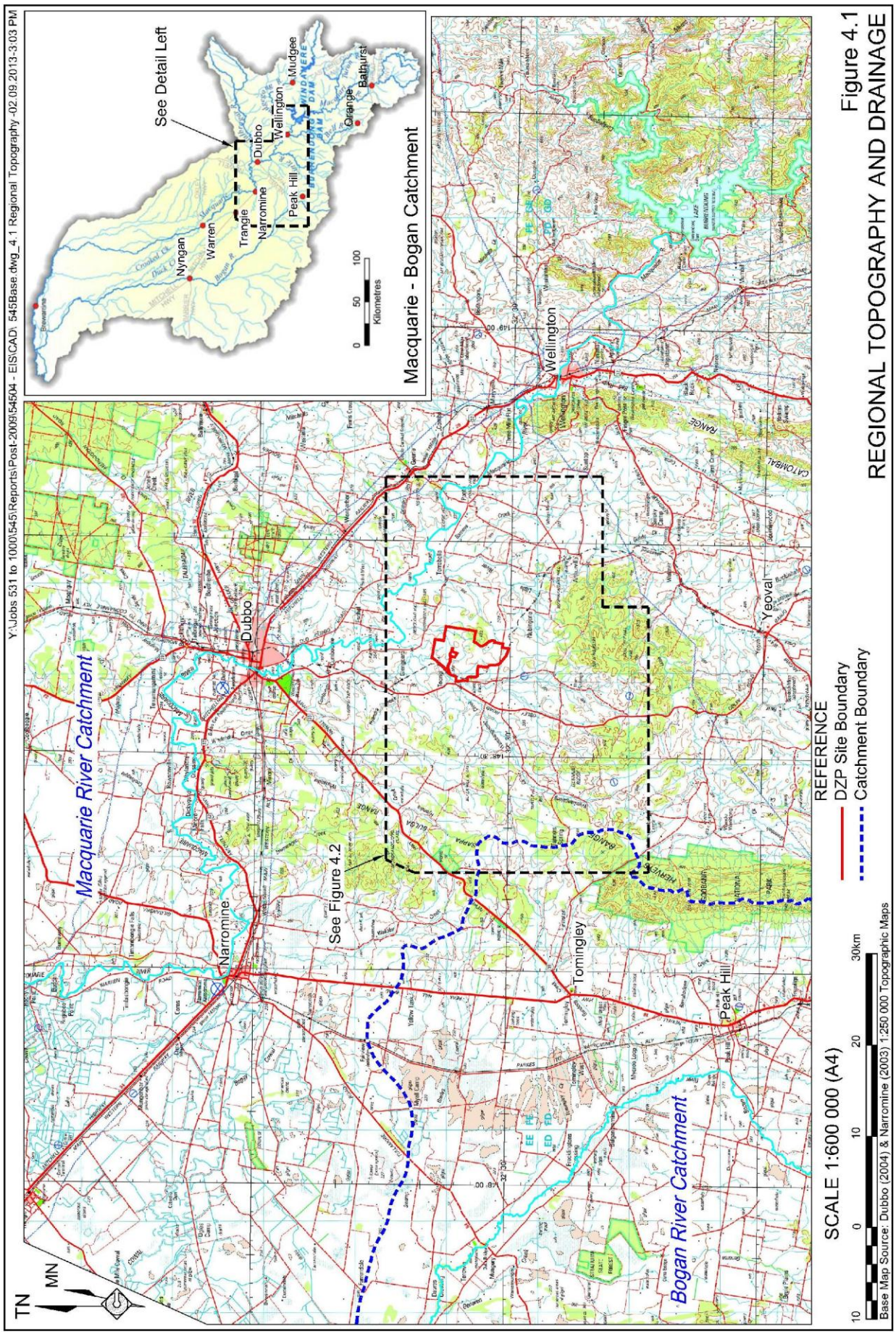
To the northeast and north of the DZP Site, the topography is undulating, with gentle slopes and elevations between 300m AHD and 450m AHD.

To the northwest and west of the DZP Site and west of the Harveys Range, the topography is flat to very gently sloping, with elevation between 250m AHD and 325m AHD.

The DZP Site is located in the upper section of the Macquarie River Catchment which in turn is located within the wider Macquarie-Bogan Catchment. The Macquarie – Bogan Catchment comprises an area of approximately 74 800km^2, and merges with the Darling River near Brewarrina in western NSW. The Macquarie-Bogan Catchment includes two major water storages, namely the Windamere Dam, located near Rylstone, with a capacity of 361GL, and Burrendong Dam, located approximately 50km to the east of the DZP Site, with a capacity of 1 154GL. Key water management issues within the catchment include water sharing and water use, reductions in flow and associated adverse impacts on the Ramsar-listed Macquarie Marches (located in the lower reaches of the catchment) and salinity.

4.1.2.2 Local Topography and Drainage

Figure 4.2 presents the local topography and drainage surrounding the DZP Site. Approximately 10km to the south of the DZP Site, is an area of hills with variably steep to moderate slopes and elevations between 450m AHD and 550m AHD.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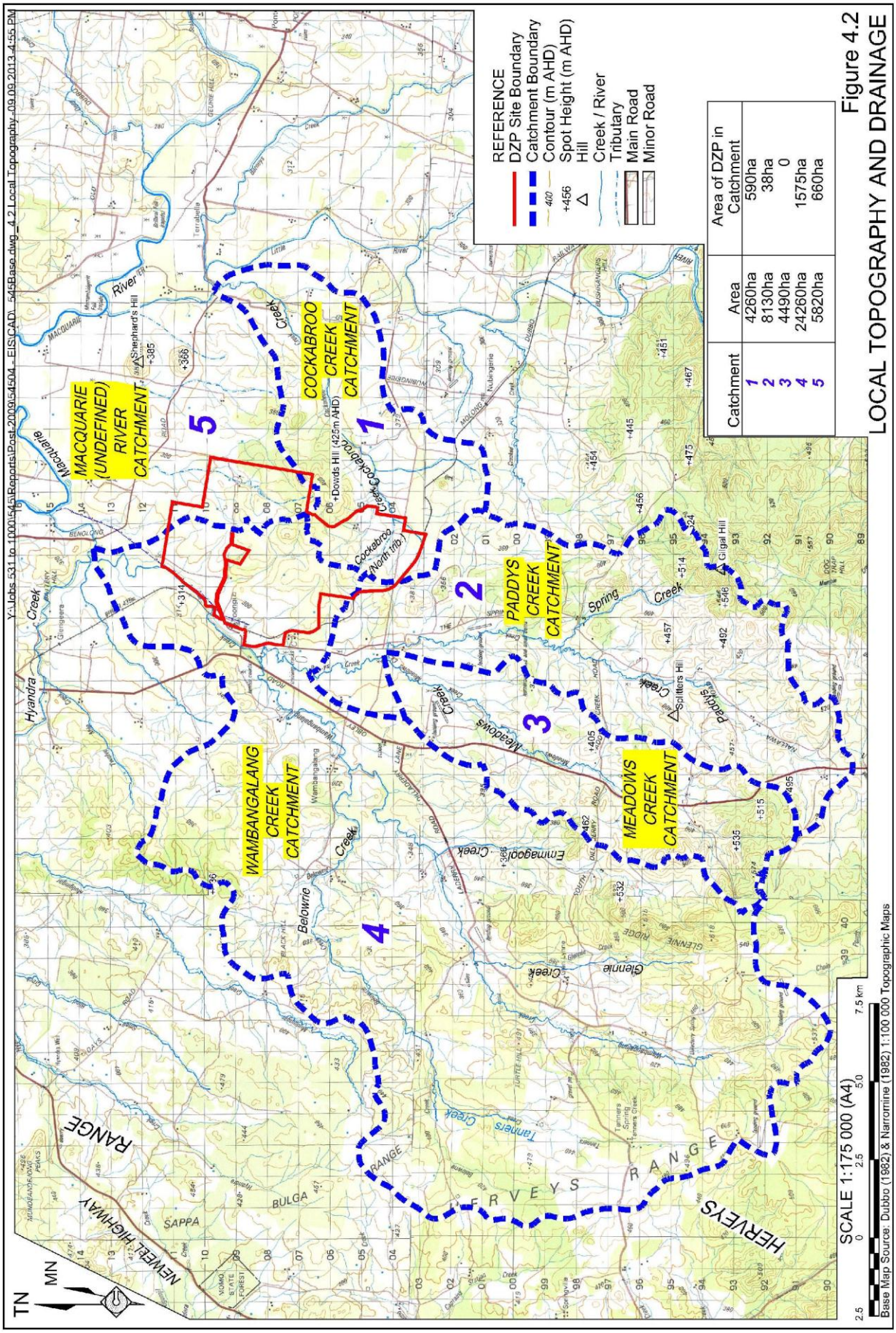
See Detail Left
Macquarie - Bogan Catchment
Mudgee
Bathurst
Orange
Wellington
Dubbo
Peak Hill
Narromine
Trangle
Warren
Nyngan
Kilometres
Macquarie River Catchment
Bogan River Catchment
See Figure 4.2
Yeoval
Tomingley
TN
MN
REFERENCE
DZP Site Boundary
Catchment Boundary
SCALE 1:600 000 (A4)
Base Map Source: Dubbo (2004) & Narromine (2003) 1:250 000 Topographic Maps
Figure 4.1
REGIONAL TOPOGRAPHY AND DRAINAGE


REFERENCE
DZP Site Boundary
Catchment Boundary
Contour (m AHD)
Spot Height (m AHD)
Hill
Creek / River
Tributary
Main Road
Minor Road
Catchment | Area | Area of DZP in Catchment
1 | 4260ha | 590ha
2 | 8130ha | 38ha
3 | 4490ha | 0
4 | 24260ha | 1575ha
5 | 5820ha | 660ha
MACQUARIE (UNDEFINED) RIVER CATCHMENT
COCKABROO CREEK CATCHMENT
PADDYS CREEK CATCHMENT
MEADOWS CREEK CATCHMENT
WAMBANGALANG CREEK CATCHMENT
Cockabroo Creek (North Trib.)
Spring Creek
Meadows Creek
Paddys Creek
Emmagool Creek
Belowrie Creek
Glennie Creek
Tanners Creek
Shepherd's Hill
Gilgal Hill
Splitters Hill
Dowds Hill (425m AHD)
HERVEYS RANGE
NEWELL HIGHWAY
SAPPA BULGA RANGE
TN
MN
SCALE 1:175 000 (A4)
Base Map Source: Dubbo (1982) & Narromine (1982) 1:100 000 Topographic Maps
Figure 4.2
LOCAL TOPOGRAPHY AND DRAINAGE

The area immediately surrounding the DZP Site is characterised by undulating hills with moderate to gentle slopes, surrounded by creek flats and floodplains. Elevations vary between 546m AHD on Gilgal Hill approximately 12km south of the DZP Site and 275m AHD along the banks of the Macquarie River to the north and east of the DZP Site.

Surface water drainage surrounding the DZP Site typically flows to the north and northeast, towards the Macquarie River, located approximately 2.25km from the closest point of the DZP Site. Catchments surrounding the DZP Site may be described as follows.

Wambangalang, Paddys and Meadows Creeks Catchments

The greater Wambangalang Creek catchment (Catchment 4 on **Figure 4.2**), including the catchments of Meadows and Paddys Creeks, drains north-northeast before joining the Macquarie River approximately 7km north of the DZP Site. The catchment drains an area of approximately 345km^2 or approximately 0.5% of the Macquarie River catchment. The DZP Site is located in the lower section of the catchment.

Principal creeks draining into Wambangalang Creek include on the western side of the catchment Belowrie, Glennie, Emmagool and Tanners Creeks. Meadows Creek drains the central section of the catchment and Paddys and Springs Creeks drain the southeastern section of the catchment. All flows are ephemeral but may have some degree of subsurface flow through unconsolidated alluvium.

Topography in the head of the catchment is steep to undulating with granite tors, pavements and rocky outcrops occurring especially near the catchment divide. Igneous intrusions such as Turtle Hill form high hills and knolls in excess of 500m AHD which can have steep slopes and rocky outcrops. These rise significantly above the surrounding land.

In the lower catchment (where the DZP Site is located) slopes are undulating to gentle, although elevations of approximately 400m AHD occur over the western section of the DZP Site along the catchment boundary with Cockabroo Creek. Elevations within the catchment range from 620m AHD to 275m AHD, a fall of 345m.

Cockabroo Creek Catchment

The Cockabroo Creek Catchment (Catchment 1 on **Figure 4.2**) drains to the east before joining the Little River approximately 4km east of the DZP Site. This small catchment of 4 260ha drains surface flows off a local high point, namely Dowds Hill, with an elevation of 425m AHD. Slopes are typically undulating to gentle, with steeper slopes in the vicinity of Dowds Hill.

Macquarie River (Undefined) Catchment

The Macquarie River (Undefined) Catchment (Catchment 5 on **Figure 4.2**), an area of approximately 5 820ha, flows via several ephemeral channels directly into the Macquarie River, approximately 7km to the north of the DZP Site. While the catchment is bound by several isolated hills up to 385m AHD, the elevation is generally below 320m AHD and slopes are flat to undulating.

4.1.2.3 DZP Site Topography and Drainage

Figure 4.3 presents the topography and drainage within the DZP Site. In summary, the DZP Site is dominated by a series of hills with maximum elevations between 325m AHD and 400m AHD. Dowds Hill, located immediately to the southeast of the DZP Site has an elevation of 425m AHD. The lowest sections of the DZP Site are located on the western boundary of the Site, with elevations of approximately 275m AHD, adjacent to the Wambangalang Creek.

Slopes within the DZP Site vary from approximately 1:60 (V:H) in the vicinity of Wambangalang Creek to approximately 1:5 (V:H) on the flanks of the higher hills. The surface of the steeper sections of the DZP Site varies from a common semi-continuous rock pavement to steeper outcrops of boulders.

The DZP Site includes four catchments as follows.

- **Cockabroo Creek Catchment**

  The Cockabroo Creek Catchment occupies the southeastern section of the DZP Site. Within the DZP Site, the catchment drains to an unnamed, ephemeral creek which, for the purposes of this assessment, is referred to as Cockabroo Creek (North Tributary). Approximately 1km of that creek within the DZP Site may be classified as a third order stream (based on the Strahler stream ordering classification).

- **Macquarie River (Undefined) Catchment**

  The Macquarie River (undefined) Catchment occupies the eastern section of the DZP Site. Within the DZP Site, the catchment drains to one of two unnamed ephemeral creeks, which, for the purposes of this assessment, are referred to as Watercourse A and Watercourse D. Watercourse A may be classified as a second order stream within the DZP Site, while Watercourse D becomes a third order stream approximately 600m upstream of the DZP Site boundary.

- **Wambangalang Creek Catchment**

  The Wambangalang Creek Catchment occupies the western section of the DZP Site. Within the DZP Site, the catchment drains to one of three unnamed ephemeral creeks, which, for the purposes of this assessment, are referred to as Watercourse B, Watercourse C and Watercourse E. Watercourse B may be classified as a third order stream within the DZP Site, while Watercourse C and Watercourse E are second and first order streams respectively.

- **Paddys Creek Catchment**

  The Paddys Creek Catchment, which forms part of the larger Wambangalang Creek Catchment, occupies a very small area in southwestern section of the DZP Site.

SEEC (2013) notes that there are approximately 64 existing farm dams (with a total estimated volume of approximately 82ML) within the DZP Site and surrounding properties which are, or would be owned by the Applicant upon receipt of development consent for the Proposal.

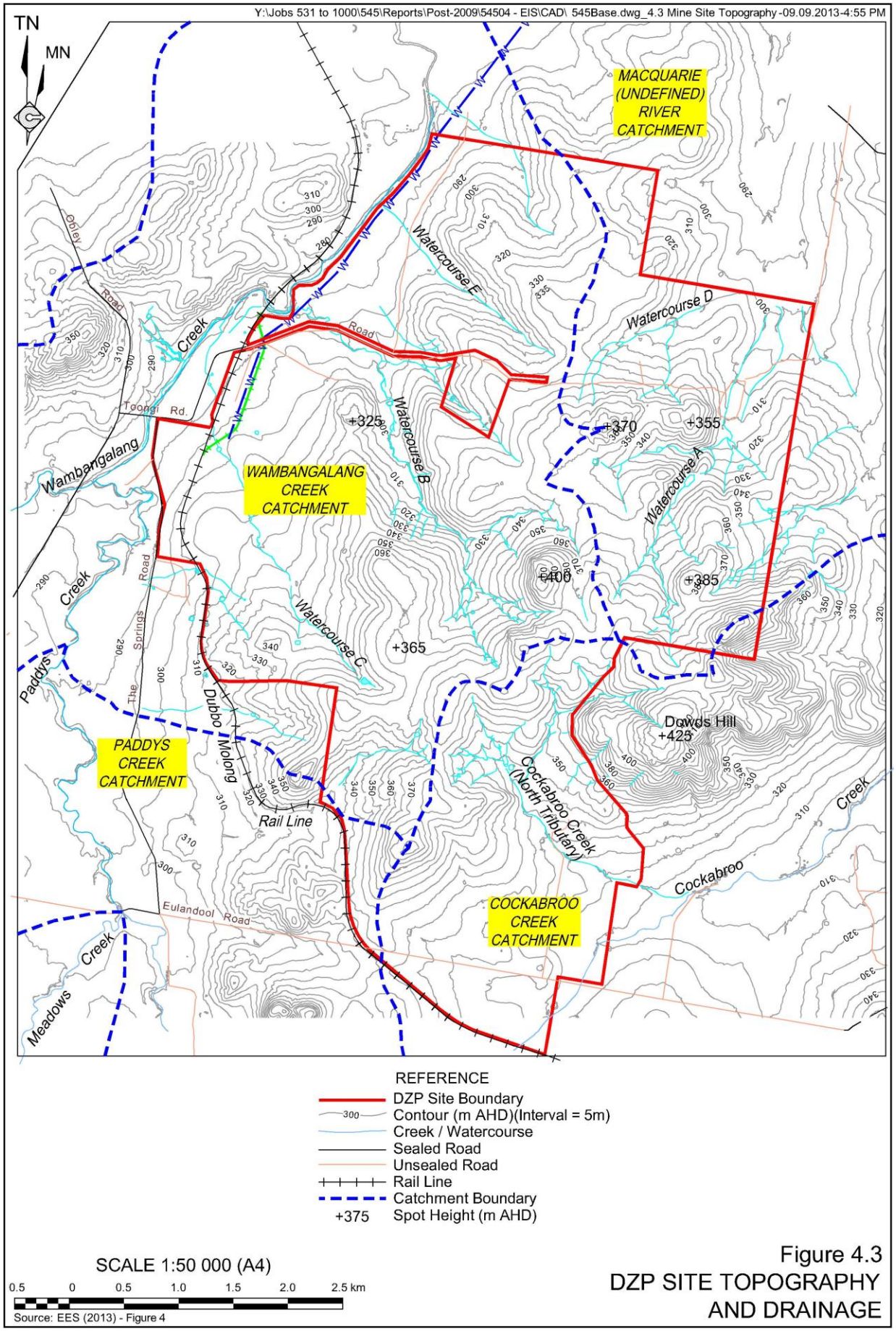


Figure 4.3
DZP SITE TOPOGRAPHY AND DRAINAGE

Environmental Earth Sciences (EES) (2013) confirms that ephemeral springs occur within the DZP Site, generally at the break point of steeper slopes where the surface is intermittently incised by a rising groundwater table following rainfall events. Such springs are known to occur on Cockabroo Creek (North Tributary), Watercourse B and Watercourse A, feeding several of the farm dams. Sub-surface groundwater flows are towards the local creeks, with Paddys Creek to the west listed as having a "high potential for groundwater interaction" by the *Groundwater Dependent Ecosystem Map* published by the Bureau of Meteorology (BOM, 2012). Groundwater interaction refers to a surface water system that is "reliant on surface expression of groundwater". Wambangalang Creek to the north of Obley Road and Cockabroo Creek to the north of Eulandool Road, are both identified by as having a "moderate potential for groundwater interaction" (BOM, 2012).

4.1.3 Climate

4.1.3.1 Introduction and Data Sources

This subsection describes climatic conditions surrounding the DZP Site. The data presented in this section has been sourced from the following Bureau of Meteorology weather stations.

- Temperature and Humidity - Dubbo Airport AWS (Station Number 065070), located approximately 24km to the north-northwest of the DZP Site.
- Rainfall – Dubbo (Mentone) (Station Number 065030), located approximately 11km to the southwest of the DZP Site.
- Evaporation – Wellington Agricultural Research Centre (Station Number 065035), located approximately 36km to the east-southeast of the DZP Site.

Climate data from the above sources is presented in **Table 4.1.**

Table 4.1
Climate Statistics

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
Temperature (°C) (1993 to 2013)													
Mean maximum	33.4	31.8	28.7	24.6	19.9	16.3	15.4	17.4	21.1	24.6	28.3	31.0	
Mean minimum	18.2	17.7	14.3	10.1	6.4	4.3	3.1	3.3	6.1	9.2	13.6	15.7	
Relative Humidity (%) (1993 to 2010)													
Mean 9am	56	62	64	64	76	86	86	76	67	56	56	52	
Mean 3pm	32	36	36	37	47	57	55	47	43	36	35	30	
Monthly Rainfall (mm) (1894 to 2013)													
Mean	66.4	53.5	52.8	47.0	50.7	53.6	54.6	53.8	42.7	55.5	54.7	57.5	647.3
Lowest	1.8	0.0	0.0	0.0	0.0	1.6	1.3	0.0	0.0	0.0	0.0	0.0	274.6
5th %ile	6.7	2.0	0.9	0.9	2.2	8.9	7.3	9.2	7.6	4.7	5.2	4.8	359.1
Median	47.0	37.2	35.6	32.8	42.0	44.4	50.5	49.0	37.8	47.0	40.9	51.3	643.7
95th %ile	170.4	156.3	158.0	153.7	120.6	126.7	120.6	111.8	94.9	142.7	144.3	134.9	971.0
Highest	292.0	292.5	299.2	341.4	179.4	219.1	177.0	134.2	151.6	208.6	224.6	201.0	1 527.1
Evaporation (Pan) (mm) (1965 to 2005)													
Mean Daily	8.8	7.8	6.3	4.2	2.5	1.6	1.7	2.4	3.4	5.1	6.9	8.6	4.9
Mean Monthly	273.0	218.4	195.3	126.0	77.5	48.0	52.7	74.4	102.0	158.0	207.0	266.6	1 798.9
Source: Bureau of Meteorology – Climate Data Online													

4.1.3.2 Temperature and Humidity

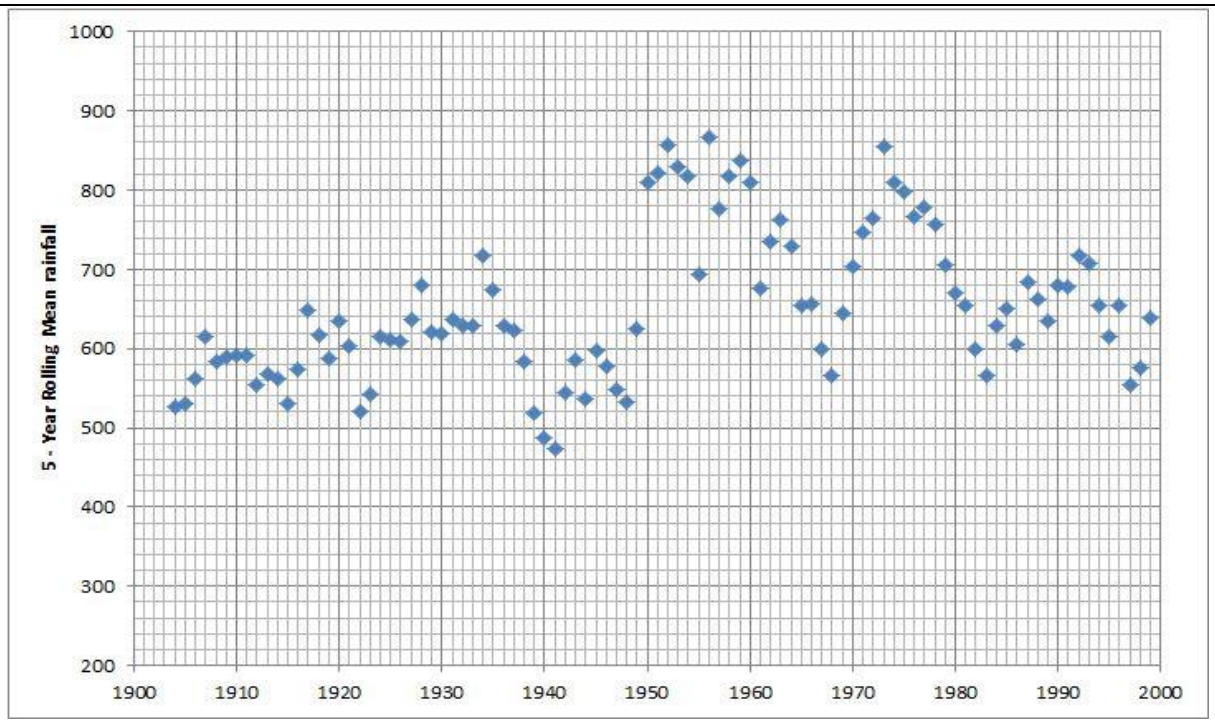
January is typically the warmest month of the year with a mean daily maximum temperature of 33.4°C and mean daily minimum temperature of 18.2°C. The coolest month of the year is typically July with the lowest mean daily maximum temperature of 15.4°C and coldest mean minimum temperature of 3.1°C.

In both the 9:00am and 3:00pm relative humidity data sets, the highest humidity is experienced in June at 86% and 57% respectively. Conversely, the least humid month is December with a 9:00am and 3:00pm relative humidity of 52% and 30% respectively.

4.1.3.3 Rainfall

On average, 647.3mm of rain is recorded each year, with that rainfall spread relatively evenly throughout the year. January is typically the wettest month (66.4mm) and September is the driest month (42.7mm). Rainfall can, however be highly variable from year to year with annual rainfall varying from 274.6mm to 1527.1mm and monthly rainfall varying from nil to 341mm.

SEEC (2013) notes that the rainfall patterns at the Dubbo (Mentone) station reveal a number of long-term trends. In summary, the period from 1894 to around 1950 was relatively consistent, however, from 1950 onwards, an approximately 20-year wet/dry cycle is evident, with the periods 1950 to 1960 and 1970 to 1980 being wetter than the intervening decades (see **Figure 4.4**).



Source: SEEC (2013) – Figure 10

Figure 4.4
ROLLING 5-YEAR RAINFALL TOTALS

4.1.3.4 Evaporation

Mean evaporation at the Wellington Agricultural Station throughout the year is 4.9mm per day or 1 798.9mm per year. Monthly evaporation varies between 48mm in June and 273mm in January. Mean monthly pan evaporation is greater than mean monthly rainfall in all months except June and July.

4.1.3.5 Wind Speed and Direction

Pacific Environment Limited (PEL) (2013) reviewed wind data collected for three different periods, namely 2003, 2005-2008 and 2010-2012, at the Toongi Meteorological Station and Dubbo Airport AWS. That data was used to inform a model of the local wind environment prepared using the CALMET software, an industry standard software package.

Figures 7 to *14* of PEL (2013) present the wind roses for each of the eight years during which data has been collected. The year 2008 was ultimately selected as representative of the prevailing annual conditions of the local setting by PEL (2013) and **Figure 4.5** presents the wind roses for this year.

In summary, wind distribution patterns at the DZP Site are dominated by winds from the south-southwest in autumn, winter and spring, with northeasterly winds dominating in summer.

4.1.3.6 Temperature Inversions

An inversion is an increase temperature with height, or to the layer within which such an increase occurs. Inversions are common during the winter when subsiding air from a high pressure system (also referred to as an anti-cyclone) warms as it descends and produces a layer of warmer air around 1 000m to 2 000m above the surface. This inversion is strengthened at night due to radiational cooling of the lowest levels of the atmosphere.

No data is available with respect to local inversion conditions, however, it is anticipated that inversions would form during the winter time over the DZP Site. Having assessed the meteorological data collected from the Toongi Meteorological Station, in particular sigma theta data which provides an indication of Pasquill Gifford stability categories[1], EMM (2013) have adopted the default inversion parameter for 'F' class stability (as opposed to the more stable 'G' Class) nominated in the Industrial Noise Policy (INP) (EPA, 1999). This considers a normal inversion for non-arid areas (rainfall > 500mm/yr) to have a strength of 3°/100m (EPA, 1999).

4.1.4 Surrounding Land Ownership and Residences

4.1.4.1 Land Ownership

Figure 4.6 displays the land ownership within and surrounding the DZP Site and Macquarie River Water Pipeline. The Applicant currently owns two properties, "Ugothery" and "Grandale" within the DZP Site and holds a 'Call' option to purchase the remaining land.

[1] Atmospheric stability is categorised as Class A (least stable) to Class G (most stable) with inversions generally forming under more stable conditions.

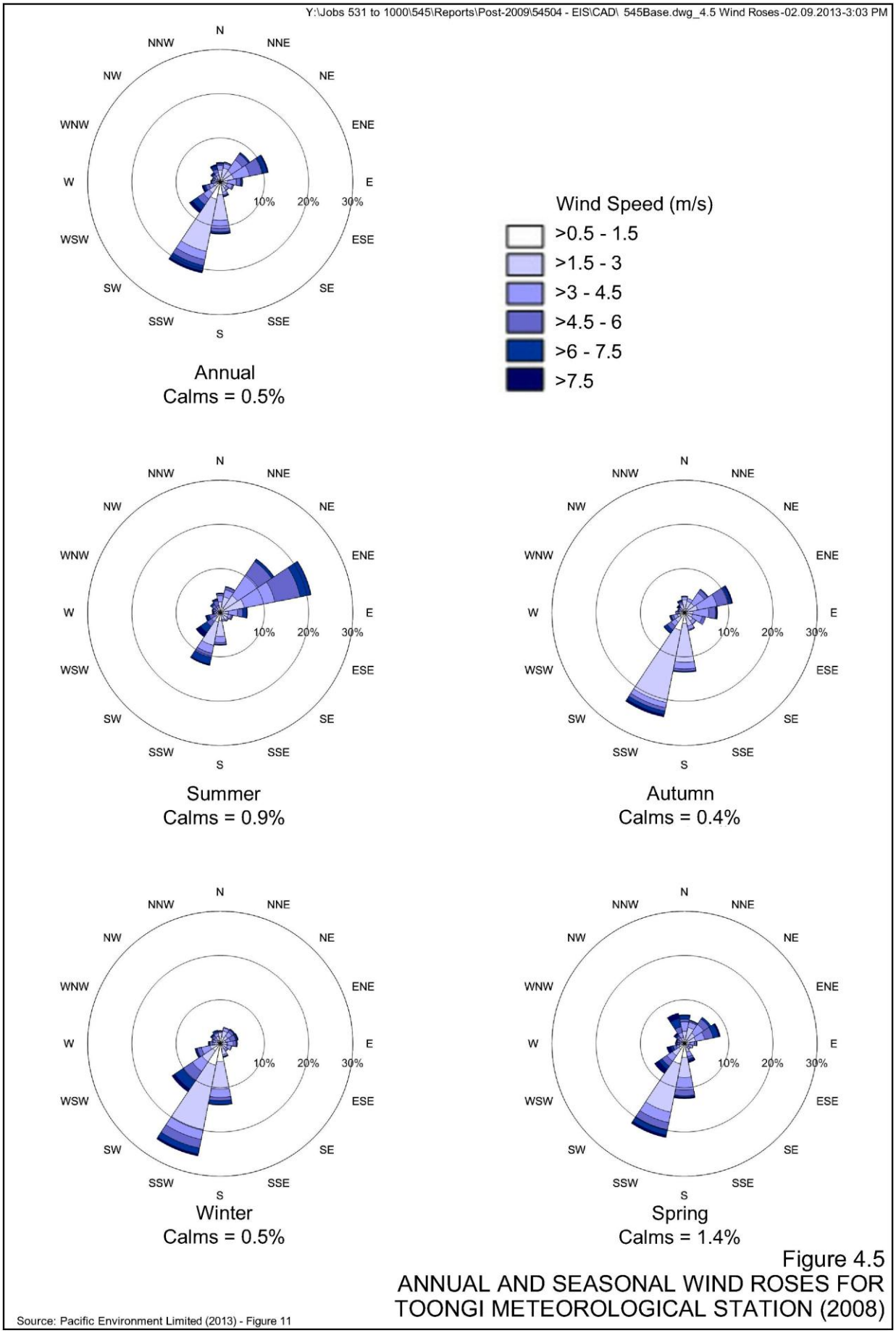
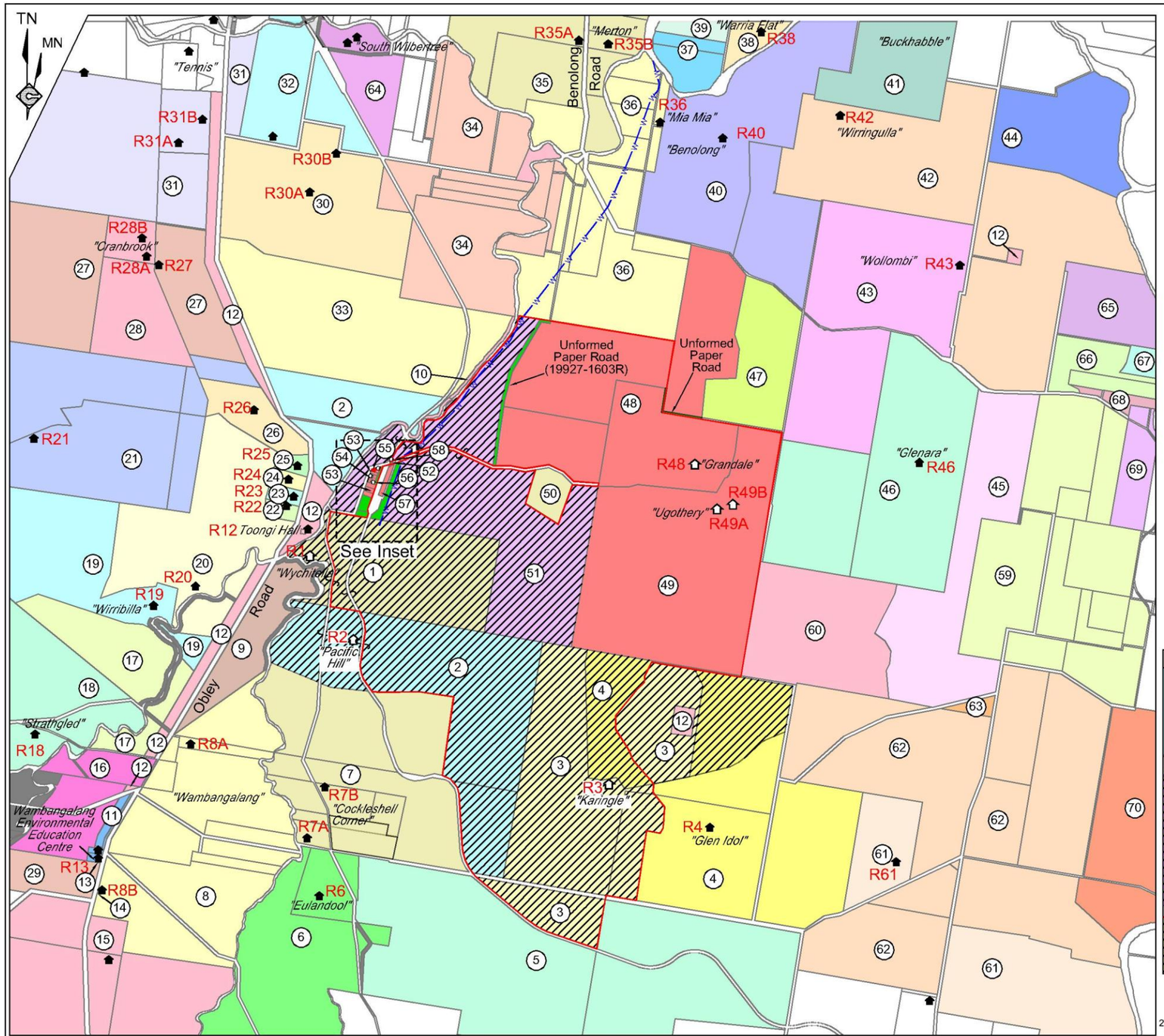


Figure 4.5
ANNUAL AND SEASONAL WIND ROSES FOR TOONGI METEOROLOGICAL STATION (2008)

Source: Pacific Environment Limited (2013) - Figure 11



Y:\Jobs 531 to 1000\545\Reports\Post-2009\54504 - EIS\CAD\ 545Base.dwg_4.6 Land Ownership-09.09.2013-4:55 PM

Ref	Landowner	Ref	Landowner
1	M & M Brennan	36	M & N Clatworthy
2	WB & MJ Harper	37	LJ & PG Picton
3	WT Hyland	38	IL Shields
4	KA Hyland	39	TB Noonan
5	RD Farrelly	40	P & A Schuster
6	C & A Bagshaw	41	P & K Squires
7	Waroona P/L (R & H Whitely)	42	B & M Wooster
8	Befe Holding P/L (G Lane)	43	G Evans
9	S Ellis	44	W & D Schneider
10	The State of New South Wales	45	RM Evans
11	Minister for Education and Training	46	CJ Amey
12	The State of New South Wales	47	CA & RJ Weber
13	Anglican Property Trust Diocese of Bathurst	48	Australian Zirconia Ltd
		49	Australian Zirconia Ltd
14	Telstra	50	R Usher
15	M & M Brennan	51	T & N Rothery
16	M & C Coddington	52	Public Transport Commission
17	MJ Ellis	53	Australian Zirconia Ltd
18	AV Ellis	54	Australian Zirconia Ltd
19	T Daly	55	BJ & LT Morgan
20	RD Mcaneney	56	Australian Zirconia Ltd
21	Trealmont (RC Bob Miller)	57	Australian Zirconia Ltd
22	K & F Riley	58	JR McLennan
23	D &S Read	59	CA & RJ Weber
24	S & H Pigram	60	R Hudson
25	L Beer	61	J Robinson
26	S & A McIntyre	62	KG Robinson
27	CF Pascoe	63	GI Robinson
28	JL Pascoe	64	E & S Portelli
29	PN Blackett	65	MA Chaseling
30	S Creswell	66	JM Hunter
31	PS Donnelly	67	KN Wildman
32	ML Giffin	68	FG Owens
33	M & N Clatworthy	69	P & J Madden, M Tink
34	D Osborn	70	JK Tucker
35	Ian Taylor		

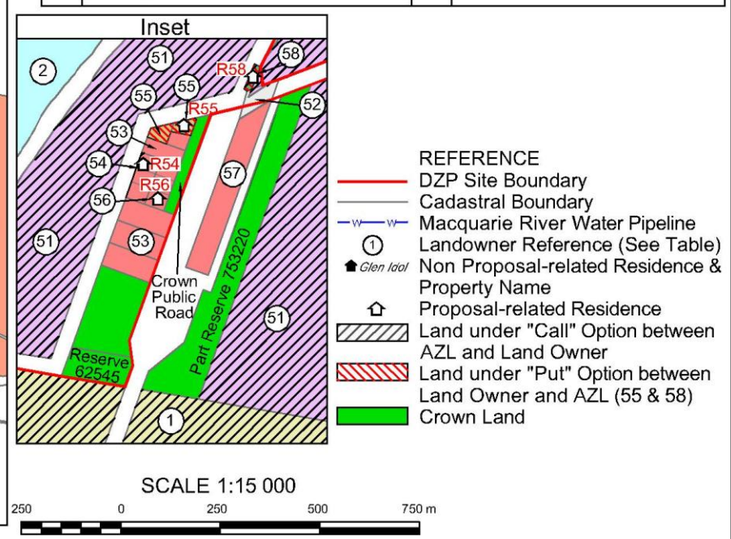


Figure 4.6
SURROUNDING LAND OWNERSHIP AND RESIDENCES

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Notable blocks of land not currently owned by or under purchase agreement are the following.

- Property 50. The Applicant is continuing to negotiate with the owners of Lot 312, DP595631 in relation to an option to purchase this land. It is understood that this property has entitlement to construct a dwelling, although no dwelling is constructed at the time of finalisation of this document.
- Crown Reserve 753220 (Lot 7300, DP1149010) (for future public recreation) is located to the east of the Dubbo-Molong Rail Line and adjoins the western boundary of the DZP Site. This land is currently licensed for grazing to the landowner of the adjoining land (T & N Rothery – Property 51). The Applicant has expressed an interest in acquiring this reserve and discussions with the Crown Lands division of the Department of Primary Industries – Catchment & Lands (DPI-C&L) have commenced and are ongoing.
- Unformed roads. The Applicant has commenced negotiations with DPI-C&L to acquire the land associated with the two unformed paper roads identified on **Figure 4.6**, one of which is within the DZP Site.

The village of Toongi is located on Toongi Road between Wambangalang Creek and the Dubbo-Molong Rail Line and contains a mixture of small and large residential lots, land previously owned by GrainCorp for siloing of grain and Crown Land reserves. The Applicant has purchased two of the residential properties and the former GrainCorp land. A 'Put' option is held by two of the remaining property owners which may be actioned by these landowners requiring the Applicant to purchase the properties at an agreed price. The remaining freehold land is owned by a single landowner with whom the Applicant intends to negotiate the acquisition of the land.

There are three parcels of Crown Land within the village of Toongi as follows.

- An unformed paper road runs to the east of the residential lots of Toongi parallel with the Dubbo-Molong Rail Line. This land is the subject of the previously identified negotiations to purchase the land from DPI-C&L.
- Crown Reserve 62545 (Lots 41 & 61, DP753220) (for public recreation) is located at the southern end of Toongi and adjoins the western boundary of the DZP Site. This land is currently licensed for grazing to the landowner of the adjoining land (M & M Brennan – Property 1). A Land Claim under the *Aboriginal Land Rights Act 1983* has been made over this reserve and a decision on this claim is pending. The Applicant has expressed an interest in acquiring this reserve and would formalise negotiations following determination over the Land Claim which would confirm who the Applicant is to negotiate with.

The Macquarie River Water Pipeline traverses Lots 1, 2, 3, 4, 27, 30, 62, 63 and 311 of DP753220, and traverses three agricultural properties: "Whychitella" (Property 1), "Toongi Valley" (Property 51) and "Mia Mia" (Property 36), as well as several road reserves. The Applicant is finalising negotiations with the landowner of the "Mia Mia" property for the creation of an easement across this property extending between the northern edge of the DZP Site and the Macquarie River. It would be possible to align the pipeline between the DZP Site and the Macquarie River on road reserves, however, by traversing the lots noted previously, the

length of the pipeline would be reduced and the requirement for severe direction changes avoided. The only notable road to be crossed would be Benolong Road, approximately 2km from the Macquarie River.

4.1.4.2 Residences and Sensitive Receptors

Residences and other sensitive receptors on and surrounding the DZP Site are identified on **Figure 4.6**. This includes the following Proposal-related residences[2].

- Five residences located on the DZP Site, three of which are owned by the Applicant (R48, R49A and R49B), with the remaining two the subject of "Call" options (R3 and R51).
- A further two residences are located on properties held under 'Call' option by the Applicant outside the DZP Site (R1 and R2).
- Four residences within Toongi (in which currently five people reside), are either owned by the Applicant or there is a 'Put' option for purchase in place. The Toongi Quilt Shop is a business run from a home in the village.

Figure 4.6 also identifies 32 non-Proposal-related residences and other sensitive receptors as follows.

- 30 residences within 5km of component disturbance areas of the DZP Site.
- The Toongi Hall (R12), located approximately 280m west of the DZP Site
- Wambangalang Environmental Education Centre (R13) located on Obley Road approximately 4.2km southwest of the DZP Site.

Both the Proposal- and non-Proposal related residential and other receptors are identified on **Figure 4.6** with the preface (R) followed by the property reference number, e.g. R26.

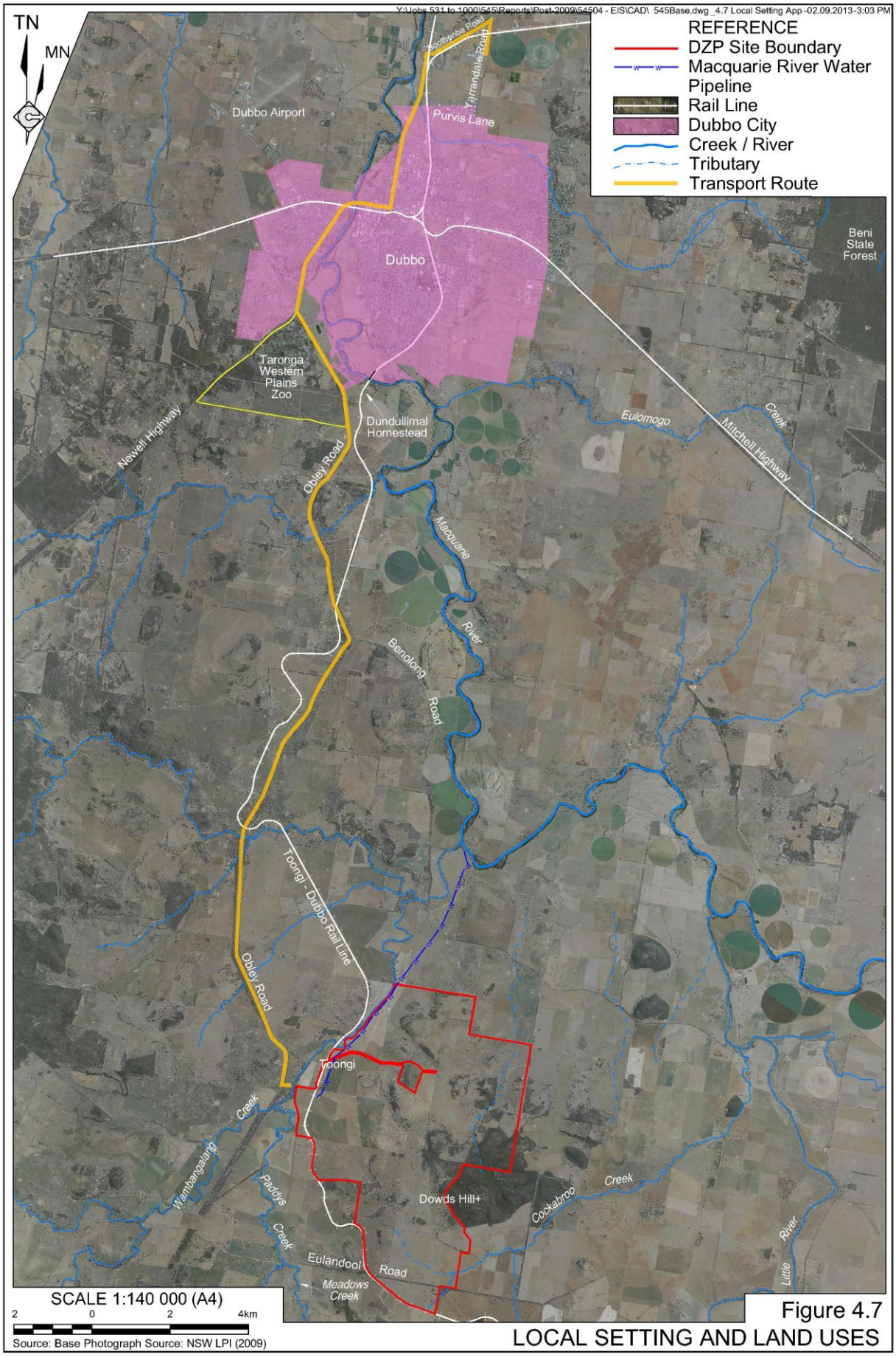
4.1.5 Land Use and Local Setting

Land use in the Macquarie-Bogan Catchment is dominated by extensive agriculture with over 80% of the catchment being used for grazing. Dryland cropping accounts for approximately 9% of land use and occurs predominantly in the middle and lower parts of the catchment. Forestry, conservation and other native landscapes together account for approximately 5% of the catchment area (NOW, 2011).

Figure 4.7 presents the DZP Site, Macquarie River Pipeline, Dubbo-Molong Rail Line and surrounding roads that would be used to access the DZP Site. In summary, the features of the local setting and land uses may be described as follows.

- Residential areas – associated with Dubbo City. Dubbo is a major regional centre with a population of over 41 000 (Section 4.15 provides an overview of the socio-economic setting, infrastructure and services of Dubbo).

[2] Proposal-related residences are considered those owned by the Applicant or for which a negotiated agreement is held between the landowner and the Applicant. Proposal-related residences are generally exempt from assessment against environmental criteria with the exception of criteria relating to 24hr PM_{10} concentrations.


Y:\Jobs 531 to 1000\545\Reports\Post-2009\54504 - EIS\CAD\ 545Base.dwg_4.7 Local Setting App -02.09.2013-3:03 PM
TN
MN
REFERENCE
DZP Site Boundary
Macquarie River Water Pipeline
Rail Line
Dubbo City
Creek / River
Tributary
Transport Route
Dubbo Airport
Purvis Lane
Yarrandale Road
Boothamba Road
Dubbo
Beni State Forest
Taronga Western Plains Zoo
Dundullimal Homestead
Newell Highway
Obley Road
Eulomogo Creek
Mitchell Highway
Macquarie River
Benolong Road
Toongi - Dubbo Rail Line
Toongi
Wambangalang Creek
Paddys Creek
Dowds Hill+
Cockabroo Creek
Eulandool Road
Meadows Creek
Little River
SCALE 1:140 000 (A4)
2 0 2 4km
Source: Base Photograph Source: NSW LPI (2009)
Figure 4.7
LOCAL SETTING AND LAND USES

- Taronga Western Plains Zoo. The zoo is a major tourist attraction and conservation initiative.
- Transportation infrastructure – including Dubbo airport, Mitchell and Newell Highways and other regional and local roads and the Main Western Railway and associated branch lines, including the Dubbo-Molong Rail line.
- The Macquarie River – which flows in a generally northerly direction (through Dubbo). Major tributaries of the Macquarie River identifiable and include, Little River and Wambangalang Creek (see Section 4.1.2).
- Agricultural activities – identified by the extensive clearing of woodland vegetation, identifiable paddocks and irrigation features. Irrigation agriculture, dryland cropping and grazing of cattle and sheep are all established features of the local setting.

Figure 4.8 presents the setting and surrounding land uses surrounding the DZP Site. In summary, the features of the local setting and land uses surrounding the DZP Site may be described as follows.

- Agricultural activities – dry land cropping is the predominant land use surrounding the DZP Site, with some irrigation cropping also undertaken predominantly on land adjoining the Macquarie River.
- Community facilities – including a community hall community hall, waste transfer, recreational facilities such as sports field, tennis courts and camping ground, all of which are located at Toongi and the Wambangalang Environmental Education Centre located approximately 4.2km to the southwest of the DZP Site.
- Transportation facilities – including local roads and the disused Dubbo-Molong Rail Line and associated sidings.
- Residential – including the four residences of Toongi and four smaller rural residential blocks located to the west of Obley Road approximately opposite its intersection with Toongi Road.

The Agricultural Impact Statement (AIS), presented as **Appendix 9** of the EIS, provides a more detailed review of the local agricultural land use on and surrounding the DZP Site.

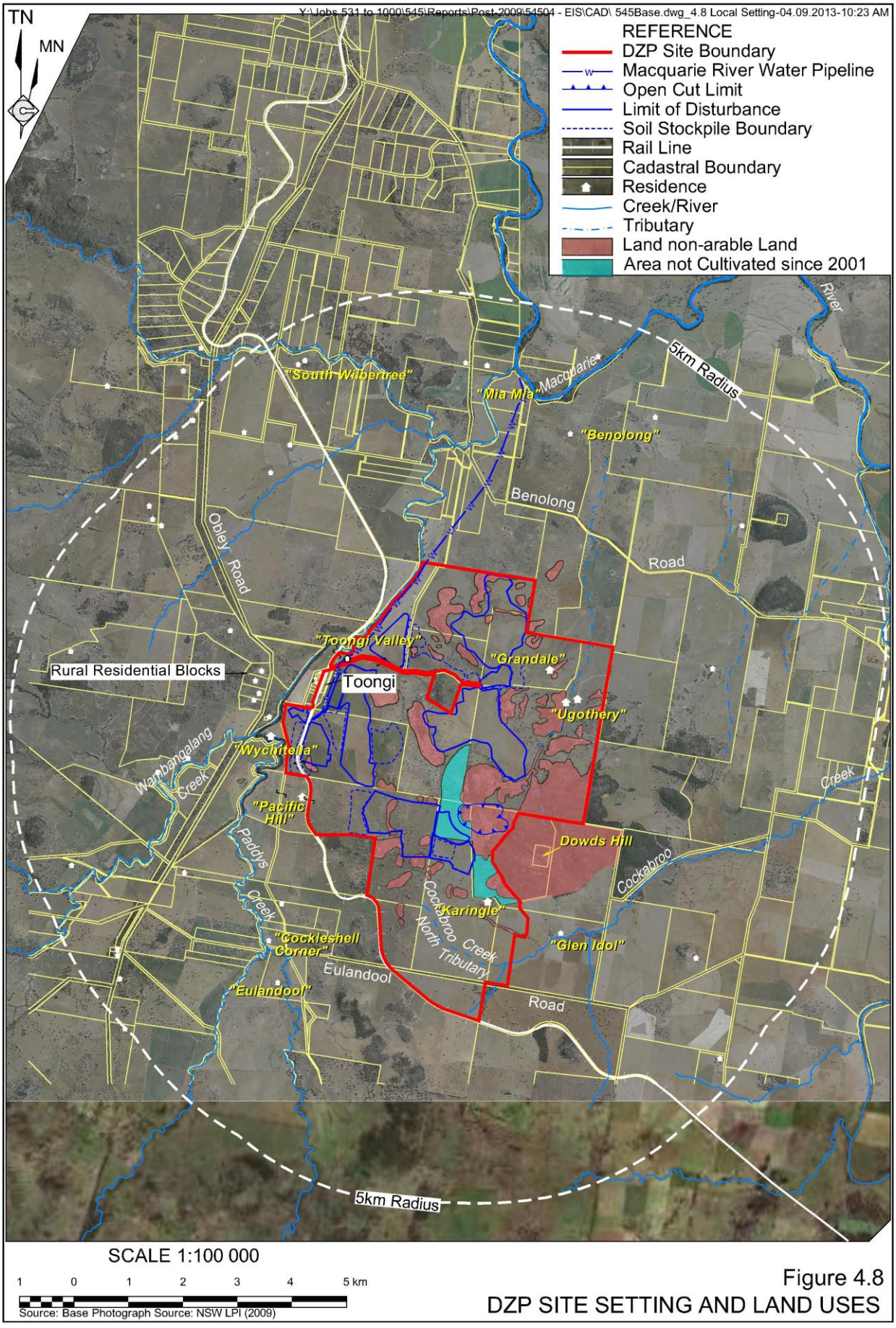


Figure 4.8
DZP SITE SETTING AND LAND USES

4.2 NOISE AND VIBRATION

4.2.1 Introduction

The Director-General's Requirements (DGRs) issued by DP&I identified "***Noise****"* as a key issue for assessment including "*a quantitative assessment of potential:*

- *construction, operational and off-site transport noise impacts;*
- *reasonable and feasible mitigation measures, including evidence that there are no such measures available other than those proposed; and*
- *monitoring and management measures, in particular real-time, attended noise monitoring and predictive meteorological forecasting."*

Additional matters for consideration in preparing the EIS were also provided in the correspondence attached to the DGRs from the NSW Environment Protection Authority (EPA) which requested that "*Potential impacts on the noise amenity of the surrounding area should be assessed in accordance with the NSW Government's Industrial Noise Policy (INP) (and other relevant guidelines mentioned below) accounting for all noise sources associated with the project*". Dubbo City Council requested that the EIS include a "*detailed analysis of any impact of rail noise on future residential development in this area (Southeast Residential Development) of the City*."

Based on the risk analysis undertaken for the Proposal (Section 3.5), the potential impacts relating to noise and their risk rankings without the adoption of any mitigation measures are as follows.

- Noise levels associated with the construction of the Site and rail line, general operations and processing, product loading and rail or road traffic noise causing annoyance and/or distractions and impacts to amenity (high).
- Noise levels associated with the construction activities, general operations and processing and rail loading of product causing adverse effects on physical or mental health (medium to high).
- Adverse effects on the local fauna assemblage (low).
- Sleep disturbance as a result of maximum noise levels caused through rail loading of product, rail and road traffic (medium to high).
- Vibration from blasting causing structural damage to buildings and structures (low).
- Vibration from blasting and rail traffic causing reduced local amenity (low to medium).
- Vibration from blasting causing reduced biodiversity value of the site (low).
- Vibration from blasting causing reduced livestock productivity (medium).

The noise and vibration impact assessment for the Proposal was undertaken by Messrs Oliver Muller and Teanuanua Villierme of EMGA Mitchell McLennan (EMM). The resulting report is presented as Part 1 of the *Specialist Consultants Studies Compendium* and is referred to

hereafter as "EMM (2013)". This subsection of the EIS provides a summary of the noise and vibration impact assessment, concentrating on those matters raised in the DGRs and submissions to the DGRs provided by various government agencies. A consolidated list of the identified requirements and where each is addressed in the EIS is presented in **Appendix 3**.

4.2.2 Existing Environment

4.2.2.1 Introduction

Existing noise levels in the vicinity of the DZP Site are influenced by a range of sources including traffic on the Obley Road and local roads, agricultural equipment, stock, wind in trees, insects and birds. In order to characterise the local variation in noise levels, EMM (2013) undertook a review of a previous unattended and attended noise monitoring program which was undertaken by Richard Heggie & Associates Pty Ltd in 2001 (RHA, 2001) at five locations surrounding the DZP Site. To further extrapolate the data, EMM (2013) conducted further background attended noise surveys at three representative receptors in March 2012. This subsection provides an overview of the results of that monitoring.

4.2.2.2 Unattended Noise Monitoring

Unattended noise logging was conducted in 2001 (RHA, 2001) to quantify the ambient noise environment at surrounding receptors identified in **Figure 4.6**. **Table 4.2** reproduces the rating background levels (RBLs) from unattended noise logging undertaken over a ten day period at five locations on and surrounding the DZP Site.

Table 4.2
Historic Unattended Ambient Noise Environment

Receptor (Reference[1])	Rating Background Level (RBL), dB(A)		
	Day	Evening	Night
Bye (R54)	30	30	27
Grandale (R48)	28	29	28
Pacific Hill (R2)	28	30	30
Wambangalang (R8A)	33	31	28
Wirribilla (R19)	30	33	30

Note 1: Refer to **Figure 4.6**
Source: EMM (2013) - Table 1

4.2.2.3 Attended Noise Monitoring

In order to supplement the unattended noise logger measurements and to assist in identifying the character and duration of the ambient noise sources, operator-attended 15 minute background noise surveys were conducted at three locations on 14 March 2012. **Table 4.3** presents the results of the attended noise monitoring program.

Table 4.3
Operator-attended Ambient Noise Survey Results

Receptor (Reference[1])	Time (hrs)	Noise Descriptor (dB(A) ref 20Pμa)		Observations and typical maximum Sound Pressure Levels (SPL))dB(A))
		$L_{Aeq(15\text{-}min)}$	$L_{90(15\ min)}$	
Bye (R54)	10:35	42	30	Rural background 30 to 32, wind 34 to 42
Karingle (R3)	11:18	44	31	Birds 32 to 46, rural background 30 to 32, wind 35
Cnr Toongi and Obley Road	13:03	48	28	Rural background 28 to 30, traffic 40 to 67, insects/wind 42
Note 1: Refer to **Figure 4.6**				
Source: EMM (2013) - Table 2				

4.2.2.4 Rating Noise Background Level

Based on the results of the attended and unattended noise monitoring programs, collected and processed in accordance with the requirements of the NSW *Industrial Noise Policy* (INP) (see Section 4.2.4.2), **Table 4.4** presents the Rating Background Noise Levels to be adopted.

Table 4.4
Adopted Rating Background Levels

Receptor	Time period	RBL (dB(A))
All Receptors	Day	30
	Evening	30
	Night	30
Source: EMM (2013) - Table 3		

4.2.3 Potential Noise and Vibration Impacts

There is potential for the various operations associated with the Proposal to generate noise and vibration which may be noticed at receptors within the Toongi and Dubbo localities. The following operations associated with the Proposal have been identified as sources of potential noise and vibration related impacts.

- Construction activities during the site establishment phase, both associated with the establishment of infrastructure on the DZP Site and various off-site components such as the Macquarie River Water Pipeline and Toongi-Dubbo Rail Line (daytime only).
- Mining and general earthworks processing operations on the DZP Site (daytime).
- Processing operations on the DZP Site (daytime, evening and night-time)
- Conveying, loading and despatch of product by road and rail (24 hours per day).
- Blasting-related air overpressure and ground vibration (daytime only).
- Rail operations from the Toongi-Dubbo Rail Line (from up to six rail movements per week).

Each of these sources of noise and potential impacts is considered in the following sections.

4.2.4 Assessment Criteria

4.2.4.1 Introduction

The following subsections summarise the noise criteria that were used by EMM (2013) to assess the noise impacts of the Proposal at privately-owned receptors and land within the local environment and at sensitive receptors within the Toongi and Dubbo localities. For the purposes of defining relevant criteria, the following periods define daytime, evening and night-time.

- Daytime.
  - 7:00am to 6:00pm (Monday to Saturday).
  - 8:00am to 6:00pm (Sunday and public holidays).
- Evening – 6:00pm to 10:00pm.
- Night-time.
  - 10:00pm to 7:00am (Monday to Saturday).
  - 10:00pm to 8:00am (Sunday and public holidays).

4.2.4.2 Operational Noise Assessment Criteria

The Environment Protection Authority released the NSW *Industrial Noise Policy* (INP) in January 2000 (EPA, 2000). The INP provides a framework and process for deriving operational noise criteria for project approvals and development consents under the EP&A Act and setting operational noise limits in environment protection licences under the POEO Act. The Proposal is a scheduled activity under Schedule 1 of this latter Act. The INP specifies two noise criteria, namely:

- an intrusiveness criterion which requires that the equivalent continuous noise level ($L_{Aeq,15min}$) from a specific industrial source at a privately-owned receptor should not exceed the background noise level by more than 5 decibels; and
- an amenity criterion which aims to maintain noise amenity throughout a community over the whole daytime, evening or night-time periods and considers cumulative noise from all industrial sources.

A fundamental difference between the intrusiveness and the amenity criteria is the time period over which the noise is measured and this is further discussed below.

Intrusiveness

The intrusiveness criteria require that $L_{Aeq(15min)}$ noise levels from a newly introduced source during the day, evening and night do not exceed the existing rating background level (RBL) by more than 5dB. This is expressed as $L_{Aeq(15min)} \leq RBL + 5 - K$, where $L_{Aeq(15min)}$ is the L_{eq} noise level from the source measured over a 15 minute period and K is a series of adjustments for various noise characteristics.

As a common RBL has been established for all residential receptors surrounding the DZP Site, a single intrusive criteria of 35dB(A) has been established for the Proposal.

Amenity

The amenity assessment is based on noise criteria specific to the land use. As there are no existing industries within the Toongi Village, the base amenity industrial criterion does not apply. For sensitive receptors located in and around the DZP, the rural residential category is suitable. For the Toongi Hall and tennis courts, the amenity criteria for passive and active recreation areas have been adopted respectively. For the Wambangalang Environmental Education Centre (WEEC) the school classroom criterion has been adopted. **Table 4.5** presents the base amenity criteria for the DZP Site.

Table 4.5
Amenity Criteria

Receptor	Indicative Area	Time Period	Recommended Noise Level Leq period (dB(A))	
			Acceptable	Maximum
Residential	Rural	Day	50	55
		Evening	45	50
		Night	40	45
Active Recreation Area	All	When in use	55	60
Passive Recreation Area	All	When in use	50	55
School Classroom	All	Noisiest 1-hour period	35 (internal)	40 (internal)
Source: EMM (2013) - Table 5				

Proposal-Specific Noise Level

The project-specific noise level (PSNL) for the various receptors surrounding the DZP Site is the lower of the calculated intrusive or amenity criteria presented in **Table 4.6**. The intrusive criteria are therefore adopted as the PSNL for the Proposal.

Table 4.6
Proposal specific Noise Levels (PSNL)

Receptor	Time period	RBL dB(A)	Criteria dB(A)
Intrusiveness			
All receptors	Day	30	35
	Evening	30	35
	Night	30	35
Amenity			
Toongi Tennis Courts (R11)	When in use	N/A	55
Toongi Hall (R11)	When in use	N/A	50
WEEC (R13)	Noisiest 1-hour period	N/A	35
Source: Modified after EMM (2013) - Table 6			

Assessment Zones of Impact

The INP states that an increase of 5dB(A) or less above the background noise levels would protect 90% of residents living in the vicinity of an industrial noise source from adverse effects of noise 90% of the time. In subjective terms, any exceedances of the PSNL can be generally described as follows.

- <1dB(A) Negligible noise level increase (Not noticeable by anyone).

- 1dB(A) to 2dB(A) Marginal noise level increase (Not noticeable by most people).
- 3dB(A) to 5dB(A) Moderate noise level increase (Not noticeable by some people but may be noticeable by others).
- >5dB(A) Appreciable noise level increase (Noticeable by most people).

While the INP does not specifically deal with acquisition, an acquisition criteria of greater than 5dB over the PSNL (40dB(A)$L_{Aeq(15\text{-}min)}$) for daytime, evening and night-time periods has been adopted in this assessment for privately owned dwellings. The acquisition zone for vacant lands has been considered for land parcels where more than 25% of the property is affected by an $L_{Aeq(15\text{-}min)}$ of greater than 40dB(A) for daytime, evening and night-time periods.

Exceedances less than 5dB over the PSNL, subject to demonstration that all reasonable and feasible mitigation measures have been implemented, may be considered acceptable under the INP.

4.2.4.3 Low Frequency Noise Criteria

Low frequency noise is typically defined as noise with frequencies below 100Hz, and includes infrasound, i.e. frequencies <20Hz. The INP states that where there is a difference of 15 decibels or more between C and A weighted noise levels[3], than a correction factor of 5 dB is applicable.

4.2.4.4 Sleep Disturbance Criteria

In order to protect against sleep disturbance, the EPA recommends that the $L_{A(1min)}$ noise level (which is approximately the maximum noise level) from any activity should not exceed the RBL by more than 15dB(A) when measured or computed at one metre from a bedroom façade. The "sleep disturbance" criterion is only applicable to night-time operations.

Where the existing rating background level (RBL) is less than 30dB(A), the INP states that a minimum RBL of 30dB(A) should be adopted. Given this, the sleep disturbance criterion when assessed external to any residence is defined as 45dB(A) $L_{A(1min)}$. This level, on the outside of a residence, is equivalent to an internal noise level of <35dB(A).

The likely noise source from the DZP Site that has the potential to generate significant $L_{A(1min)}$ noise levels is associated with unloading/loading trains.

[3] The A-Weighted noise level effectively cuts off the lower and higher frequencies that the average person cannot hear, i.e. it provides for the noise actually heard by the human ear. The C-Weighted noise level includes the higher and particularly lower frequency noise and is used to assess potential damage that may be caused by the imperceptible component of loud noise.

4.2.4.5 Construction Noise Criteria

The assessment and management of on-site construction works is governed by the requirements of the INP. Off-site construction works, namely the construction of the Macquarie River Water Pipeline, Toongi-Dubbo Rail Line, and upgrades to the public road network and various creek crossings is governed by the OEH's "*Interim Construction Noise Guideline*" (ICNG) (DECCW, 2009a). The ICNG recognises that higher levels of noise are likely to be tolerated by people in view of the relatively short duration of the works and recommends the following approaches to mitigating adverse noise impacts from construction sites.

The ICNG recommends that the $L_{Aeq(15min)}$ noise levels arising from construction activities, when measured at boundary or within 30m of the residence (whichever is the lesser), should not exceed the following levels.

- Standard hours (Monday to Friday – 7:00am to 6:00pm & Saturday – 8:00am to 1:00pm).
  - Noise affected[4]: RBL + 10dB(A).
  - Highly noise affected[5]: 75dB(A)
- Non-standard hours (Monday to Friday – 6:00pm to 7:00am, Saturday – 1:00pm to 8:00am, Sundays and public holidays).
  - Noise affected: RBL + 5dB(A)

These noise management levels are generally consistent with community reaction to construction noise.

Criteria for vibration generated by construction activities is discussed in Section 4.2.4.9.

4.2.4.6 Road Traffic Noise Assessment Criteria

Criteria for assessment of noise from traffic on public roads are set out in the NSW Road Noise Policy (RNP) (DECCW, 2011). Under this policy, the Newell Highway and Obley Road would be considered as the freeway / arterial / sub-arterial road types and therefore assessed against the criteria for the "arterial or sub-arterial road" category (see **Table 4.7**).

Table 4.7
Criteria for Traffic Noise – at Roadside Residences

Road Category	Type of development	Noise Level Criterion*	
		Day[1]	Night[2]
Arterial or sub-arterial roads	Existing residences affected by additional traffic on existing freeway/arterial/sub-arterial roads generated by land use development	$L_{Aeq,15hr}$ 60dB(A)	$L_{Aeq,9hr}$ 55dB(A)
Note 1: 07.00am to 10.00pm Note 2: 10.00pm to 07.00am Source: Modified after EMM (2013) - Table 3.5			

[4] The noise affected level represents the point above which there may be some community reaction to noise.
[5] The highly noise affected level represents the point above which there may be strong community reaction to noise.

The RNP also states that, where existing road traffic noise criteria are already exceeded, any additional increase in total traffic noise level should be limited to 2dB, which has been accepted as the threshold of perceptibility to a change in noise level.

4.2.4.7 Rail Noise Assessment Criteria

The *Rail Infrastructure Noise Guideline* (RING) has been issued by the EPA (2013) sets out the rail noise assessment criteria trigger values for airborne and ground-borne noise. The RING supersedes the *Interim Guideline for Assessment of Noise from Rail Infrastructure Projects* (IGANRIP) (EPA & DP&I, 2007) as well as the existing EPA policy on rail traffic generating developments.

Table 4.8 presents the RING airborne noise trigger levels[6] relevant to the Proposal.

Table 4.8
Rail Noise Assessment Criteria

Type of development	Noise Trigger Level dB(A) (External)[3]		Comment
	Day[1]	Night[2]	
Redevelopment of existing rail line	65 $L_{Aeq\ (15\text{-}hr)}$ 85 L_{max}	60 $L_{Aeq\ (9\text{-}hr)}$ 85 L_{max}	These numbers represent external levels of noise that trigger the need for an assessment of the potential noise impacts from a rail infrastructure project. An 'increase' in existing rail noise levels is taken to be an increase of 2dB(A) or more in L_{eq} in any hour or an increase of 3dB(A) or more in L_{max}[3].
Note 1: 07.00am to 10.00pm Note 2: 10.00pm to 07.00am Note 3: The trigger levels presented in this table should be read with the technical notes of Tables 1 and 3 of the RING. Source: Modified after EMM (2013) - Table 3.7			

Furthermore, the Australian Rail Track Corporation (ARTC) Environment Protection Licence (EPL) 3142 provides rail noise emission criteria that are relevant to the Proposal, Condition L6.1 is reproduced below and was considered for the noise and vibration impact assessment:

> *"L6.1.1 General Noise Limits: It is an objective of this Licence to progressively reduce noise levels to the goals of 65dB(A)L_{eq}, (day time from 7am – 10pm), 60dB(A)L_{eq}, (night time from 10pm – 7am) and 85dB(A) (24 hr) max pass-by noise, at one metre from the façade of affected residential properties through the implementation of the Pollution Reduction Programs."*

[6] As the Proposal involves only the use of an above-ground rail network which would not generate ground-borne noise in a receiving building that is higher than airborne noise, ground-borne trigger levels are not considered.

4.2.4.8 Blasting Criteria

The EPA has adopted recommended airblast and ground vibration levels published by the Australian and New Zealand Environment and Conservation Council (ANZECC). 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 recommended maximum vibration level for airblast is 115dB linear peak. The vibration level of 115dB may be exceeded on up to 5% of the total number of blasts over 12 months, however, should not exceed 120 dB linear peak at any time.
- Peak particle velocity (PPV) from ground vibration should not exceed 5mm/s for more than 5% of the total number of blasts over 12 months, however, the maximum level should not exceed 10mm/s at any time.

4.2.4.9 Vibration Criteria

In the absence of an Australian standard for structural vibration damage threshold, the *German Standard DIN 4150: Part 3-1999 "Structural Vibration Part 3: Effects of Vibration on Structures"* has been adopted. The limits presented in this standard are recognised to be conservative with recommendations on residential type structure safe limits as low as 5mm/s, with limits increasing for frequency values above 10Hz.

4.2.5 Assessment Methodology

4.2.5.1 Introduction

This subsection presents the methods and base parameters used to model noise emissions from the Proposal, including the effect of prevailing meteorological conditions. The assessment was conducted in accordance with the following policies and guidelines.

- The NSW Industrial Noise Policy (EPA, 2000).
- The NSW Road Noise Policy (DECCW, 2011).
- The Rail Infrastructure Noise Guideline (RING) (EPA, 2013).
- German Standard DIN4150 - Part 3: 1999.
- Technical basis for guidelines to minimise annoyance due to blasting overpressure and ground vibration (ANZECC, 1990).
- The Interim Construction Noise Guideline (DECC, 2009a).

4.2.5.2 Operational Noise Modelling

Noise predictions were carried out by EMM (2013) using *Brüel and Kjær Predictor Version 8.11* noise prediction software. 'Predictor' calculates total noise levels at receptors from the concurrent operation of multiple noise sources.

Three scenarios were modelled, Year 1, Year 5 and Year 15 operations, considered to be representative of likely noise generation on the DZP Site throughout the life of the Proposal. **Figures 4.9** to **4.11** illustrate the locations of operating equipment included in each scenario. It is noted that the modelled scenario presented in **Figure 4.9** (Year 1) includes what could be considered construction activities associated with the Macquarie River Water Pipeline and Wambangalang Creek crossing upgrade.

Each scenario was modelled under prevailing meteorological conditions (as defined in the INP), determined following analysis of continuous weather data collected at a meteorological station operated by the Applicant on the "Wychitella" property (R1) over a two year period (2007 and 2008). **Table 4.9** presents the meteorological parameters used during the operational noise assessment which represent calm and prevailing conditions for the local area.

Table 4.9
Prevailing Meteorological Conditions

Period	Meteorological Condition	Wind Conditions		
		Wind speed (m/s)	Direction (degrees)	Inversion Class
Daytime	Calm	0	-	-
	Prevailing	1.8	270	-
Evening	Calm	0	-	-
Night-time	Calm	0	-	-
	Prevailing	2.6	All	-
	Inversion[1]	0	-	F

Note 1: Temperature inversion data was not available and the INP default inversion parameters have been adopted.
Source: Modified after EMM (2013) –Table 4.2

The following assumptions and inputs were used during the noise assessment.

- All items of equipment identified in *Tables 4.3* and *4.4* of EMM (2013) were assumed to be operating in the locations and at the times identified in **Figures 4.9** to **4.11**.
- Noise attenuation of the crushing plant and ore handling circuit provided by semi-enclosed barriers and screens located on the western side of the plant. The height of the barrier was modelled at 1m higher than the acoustic centre of the crushing plant and 3m higher than the acoustic centre of the ore handling circuit. *Figures 8* and *9* of EMM (2013) (Part 1 of the Specialist Consultant Studies Compendium) provide a detailed concept of the semi-enclosed barriers/screens that would be constructed.
- The rock breaker required occasionally to reduce the size or ROM ore to the crushing plant would be located within the open cut as opposed to the ROM Pad.
- All equipment to be used was assumed to be reasonably new, well maintained and fitted with manufacturer standard noise mitigation equipment.
- All equipment was assumed to be operating concurrently in order to simulate the overall maximum energy equivalent (i.e. $L_{Aeq(15min)}$) intrusive noise level.

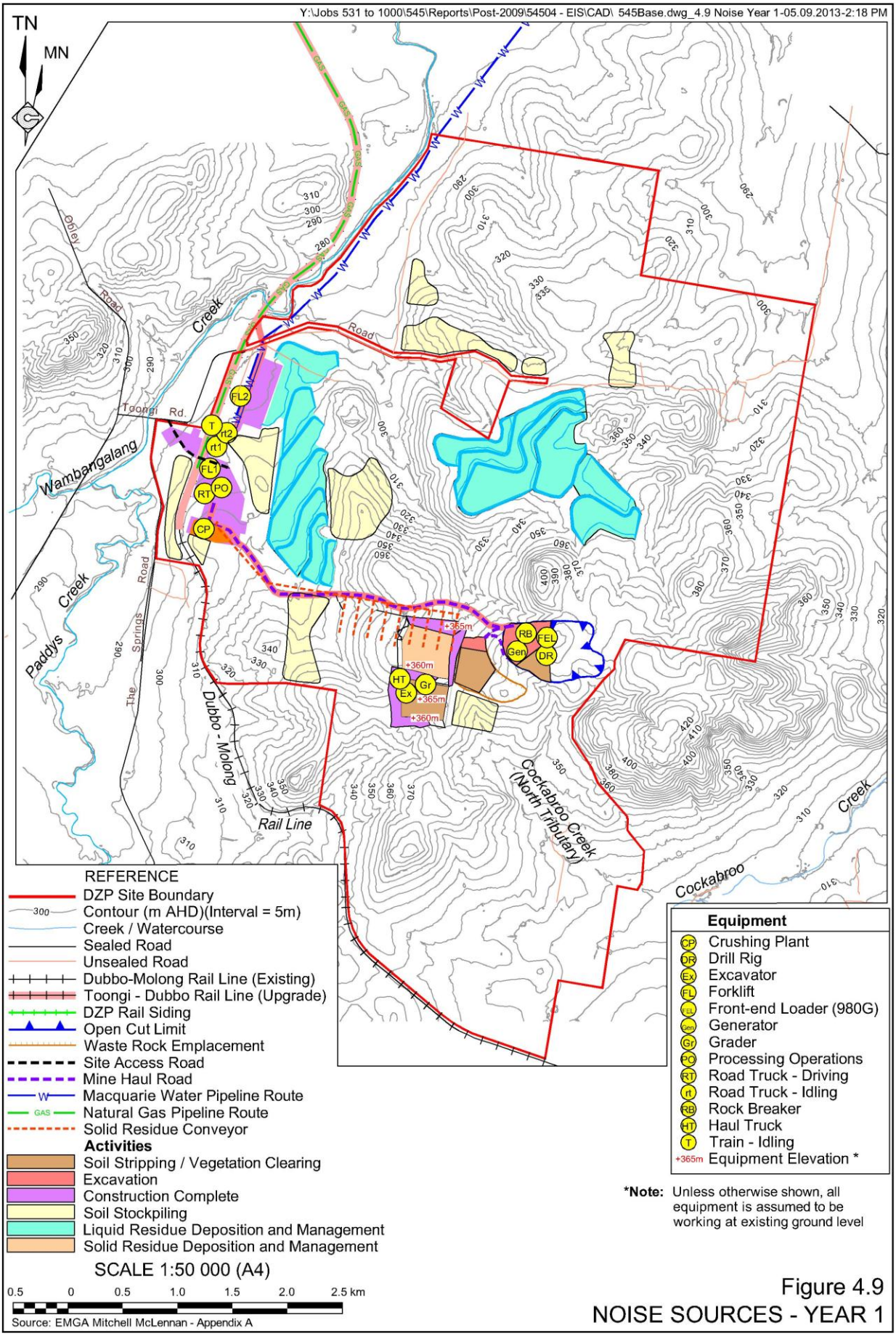


Figure 4.9
NOISE SOURCES - YEAR 1

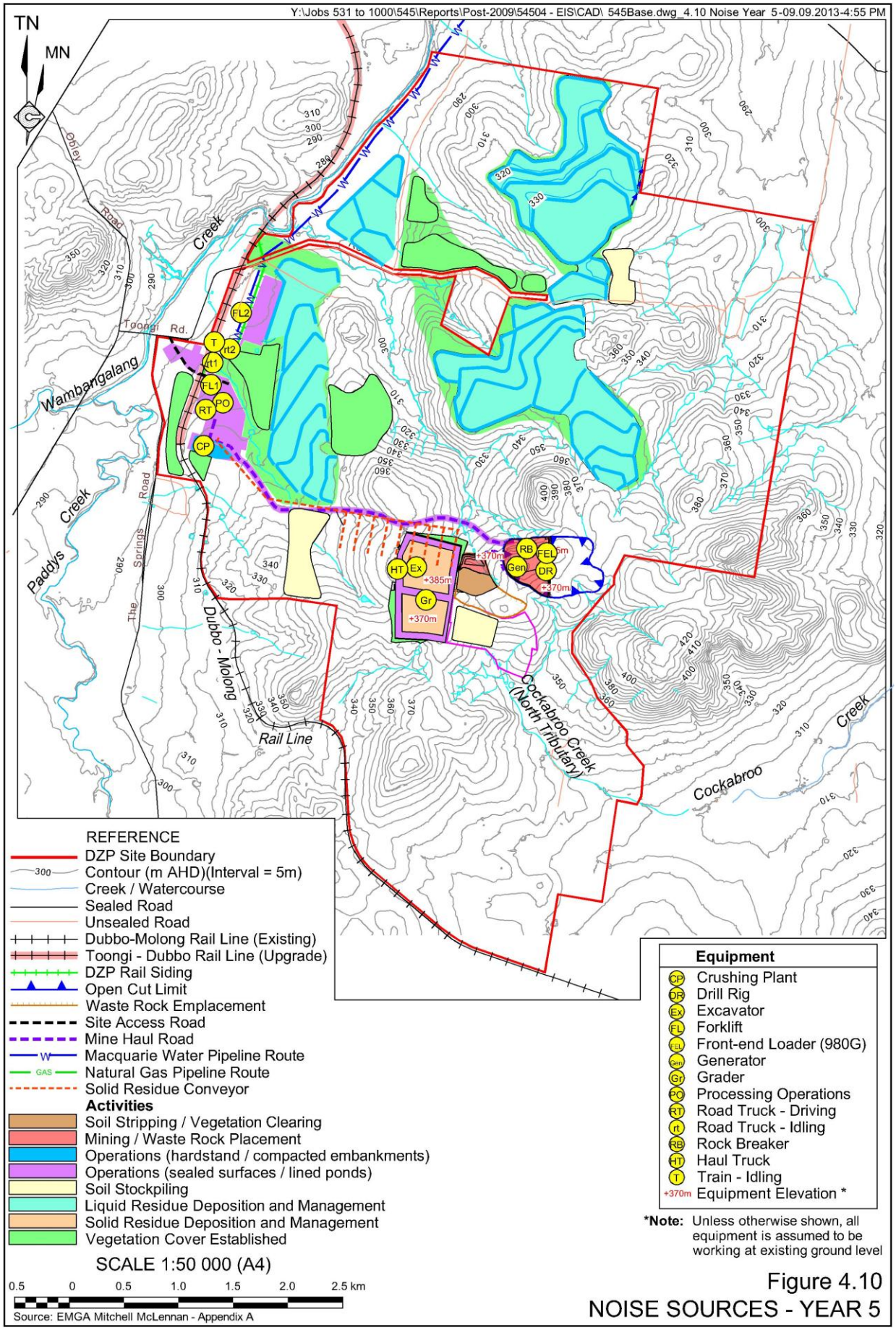


Figure 4.10
NOISE SOURCES - YEAR 5

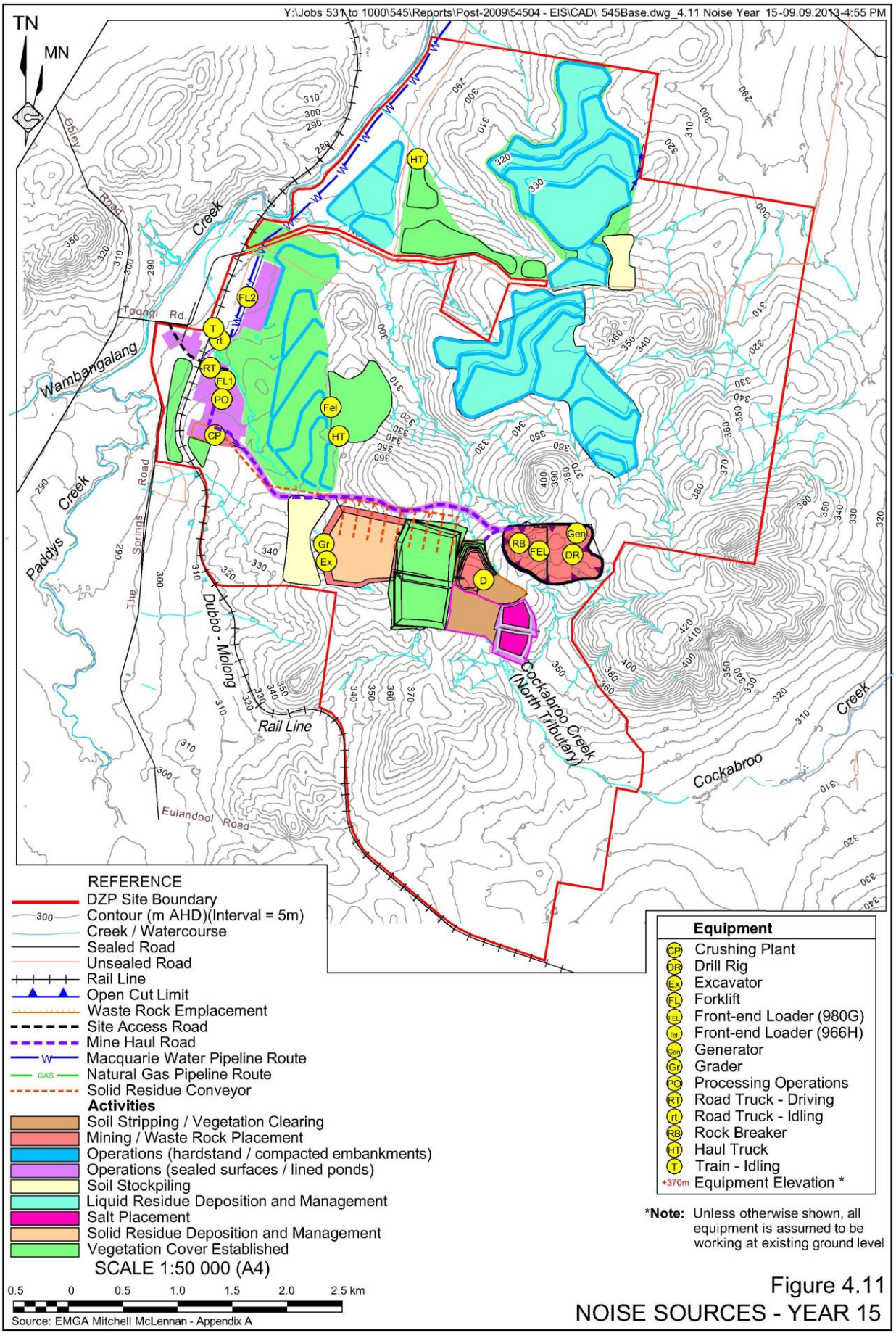


Figure 4.11
NOISE SOURCES - YEAR 15

4.2.5.3 Construction Noise Emissions

The ICNG provides methodology for calculating noise levels based upon source sound power levels and distance attenuation. This methodology was adopted by EMM (2013) to predict a range of noise levels which could be received at the most proximal residential receptor to specific individual construction activities during the 18 month to 2 year construction phase. A range of noise levels was predicted given the transitory and intermittent nature of equipment operation during construction, and to reflect the varying meteorological conditions that could be encountered.

The individual construction activities, nature and duration of the disturbance, typical equipment and distance to the nearest receptor for each are provided in **Table 4.10**. The sound power levels assumed for typical plant to be used in the construction phase of the Proposal are as presented in *Table 4.5* of EMM (2013).

Table 4.10
Project-related Noise Levels for Scenario 1 (Year 1)

Activity	Type / Duration	Typical Plant	Distance to Closest Receptor (m)
Gas Pipeline Corridor	Transient / 50 weeks	Backhoe/small excavator, dozer, grader, trencher, road truck and light vehicle	25
Rail Line upgrade	Transient / 50 weeks	Excavator, crane, FEL, tamping machine, welding truck, road truck and light vehicle	25
Water Pipeline	Transient / 40 weeks	Backhoe/small excavator, dozer, grader, trencher, road truck and light vehicle	70 (R36)
Obley Road upgrade	Transient / 40 weeks	Excavator, dozer, grader, vibrating roller, road truck and light vehicle	65
Wambangalang Creek Bridge	Static / 25 weeks	Excavator, crane, FEL, haul truck and light vehicle	780
Hyandra Creek Bridge	Static / 25 weeks	Excavator, crane, FEL, road truck and light vehicle	200
Twelve Mile Creek Bridge	Static / 25 weeks	Excavator, crane, FEL, road truck and light vehicle	235
Processing area	Static / 20 weeks	Compactor, trencher, jackhammer, pneumatic wrench, rock breaker, scrapers, dozer, grader, generators, road trucks	2 000
Haul road	Static / 20 weeks	Compactor, grader, water truck, FEL, haul truck, scraper and light vehicle	2 000
LRSF Embankments	Static / 20 weeks	Scrapers, dozers, water truck, excavator, grader and light vehicle	Area 2 – 2 000 Area 3 – 2 200 Area 4 – 3 800 Area 5 – 3 100
Open Cut Development	Static / 20 weeks	Drilling rig, dozer, FEL and haul trucks	1 900
WRE Development	Static / 20 weeks	Dozer and haul trucks	1 900
SRSF Embankments	Static / 20 weeks	Grader, scrapers, compactor, water truck, haul trucks and light vehicle	1 900

Source: Modified after EMM (2013) – Tables 5.4 and 5.5

Activities such as open cut and WRE development are included in the construction noise modelling to account for these operations during the 18 month to 2 year construction phase, i.e. prior to the commencement of processing. Notably, these activities are assessed against the INP intrusiveness criteria, as opposed to the construction noise criteria. It is also important to note that should construction activities such as LRSF embankment development coincide with DZP operations, the total fleet operated on the DZP Site would not be increased from that presented in the operational scenarios of **Figures 4.9** to **4.11**. Rather, equipment from areas such as the SRSF, open cut or WRE would be redeployed.

4.2.5.4 Road Traffic Noise Emissions

The road network that would be used, in both directions, includes the Newell Highway, Obley Road and Toongi Road. The nearest privately-owned receptor to these roads is at a distance of 65m.

The Calculation of Road Traffic Noise (CORTN) (UK Department of Transport) method was used to predict the L_{eq} noise levels at the closest receptor for additional traffic travelling along Obley Road. CORTN considers traffic flow volume, average speed, percentage of heavy vehicles and road gradient to establish noise source strength, and includes attenuation due to distance, ground, atmospheric absorption and screening from buildings or barriers. Traffic volumes determined by traffic counts on Obley Road in 2012 were used to calculate existing Obley Road noise levels.

4.2.5.5 Rail Noise and Vibration Emissions

Two transport options are available for rail usage (Preferred Option A and Contingency B in accordance with Section 2.12.1). Both options have the potential to generate off-site rail noise and have been assessed in accordance with the IGANRIP. It is noted that there would be a maximum of one train per 24hr period travelling along either the Toongi-Dubbo Rail Line or from Dubbo to other regional centres. The calculations adopted a typical sound exposure level (SEL) of 90dB(A) at 30m for mixed freight train pass-bys, while the L_{max} calculation was based on a typical train noise emission of 82dB(A) at 30m from the train line.

4.2.5.6 Blasting Emissions

Anticipated ground vibrations and air blast overpressure levels were determined using the blasting formulae presented in Australian Standard 2187.2-1993 *Explosives—Storage, transport and use - Part 2: Use of explosives* and the Orica (ex ICI) Explosives Blasting Guide. This method of determining blast emissions is considered conservative.

The relevant formulae are as follows:

$$PVS = 500 (R/Q^{0.5})^{-1.6}$$

$$dB = 164.2 - 24(\log_{10} R - 0.33 \log_{10} Q)$$

where,

PVS = peak vector sum ground vibration level (mm/s)
dB = peak airblast level (dB Linear)
R = distance between charge and receptor (m)
Q = charge mass per delay (kg) or maximum instantaneous charge (MIC)

4.2.6 Management and Mitigation Measures

4.2.6.1 Introduction

This subsection outlines the suite of measures that would be adopted both from a management perspective and through the use of specific mitigation measures to achieve the required noise levels at the surrounding privately-owned receptors. Emphasis has been placed upon designing the DZP Site to minimise noise levels for as much time as possible.

4.2.6.2 Construction Noise Mitigation

It is noted that construction noise predictions are provided as a range within which it is expected noise levels would be received at the most proximal receptor to the construction activities. In order to minimise this noise level, the Applicant would enforce a comprehensive range of noise mitigation measures as follows.

- Strict adherence to the INP nominated standard hours of operation.
- The equipment operated would have sound power levels equivalent to those nominated in *Table 4.5* of EMM (2013).
- If construction activities are to be undertaken coincident with operations, i.e. following the 18 month to 2 year construction phase, no additional equipment would be used to that presented on **Figures 4.9** to **4.11**, i.e. existing equipment would be re-deployed.
- Occupants of residences adjoining construction activities would be provided with details ahead of time regarding the type of activities, their duration and the specific measures to minimise noise during the period. Occupants would also be provided with contact details for personnel managing the construction activities.
- All mechanical plant and equipment would be silenced with appropriate mufflers and enclosures.
- Where possible, equipment would not be left idling unnecessarily.
- All contractors and personnel would be educated regarding the noise sensitivities by:
  - minimising the use of air brakes;
  - no queuing of vehicles adjacent to any residential receptor, or if unavoidable engines to be switched off;
  - parking of vehicles where appropriate to shield locations prior to being used for maintenance work undertaken outside standard hours of operation;
  - no warming of vehicles permitted before the nominated working hours;
  - accessing sites via entry point most remote to receptors;
  - conservative driving methods;
  - minimising the use of radios and loud voices;

  - locating machinery to orientate direct noise away from closest sensitive receptors;
  - placement of mobile barriers/screens or extraction faces adjacent to static rock breaking sources to shield neighbouring receptors;
  - undertaking of regular maintenance of machinery to minimise noise emissions;
  - use of quietest suitable machinery reasonably available for selected work activities;
  - ensuring the coincidence of noise/plant machinery working simultaneously in close proximity to sensitive receptors is avoided, where practicable; and
  - awareness of the expectation of landowners and surrounding residents.
- Any legitimate complaints from surrounding landowners and occupiers would be responded to in a timely manner.
- The areas for loading and unloading materials and equipment would be positioned as far away as possible from surrounding residences during the site establishment and construction phase.
- Broadband (frequency modulated) reversing alarms would be used instead of tonal reversing alarms on all earthmoving equipment.

4.2.6.3 Operational Noise Mitigation

The INP states the following with respect to feasible and reasonable noise mitigation.

- Feasibility relates to engineering considerations and what is practical to build.
- Reasonableness relates to the application of judgment in arriving at a decision, taking into account the:
  - noise mitigation benefits (amount of noise reduction provided, number of people protected);
  - cost of mitigation (cost of mitigation versus benefit provided);
  - community views (aesthetic impacts and community wishes); and
  - noise levels for affected land uses (existing and future levels, and changes in noise levels).

Following the completion of initial noise modelling, the Applicant has committed to the following noise mitigation measures.

- Restriction of all but processing, transport and low noise maintenance activities to daytime only.
- Broadband (frequency modulated) reversing alarms would be fitted on all mobile equipment.
- The mining fleet would be operated with sound power levels equivalent to those nominated in *Table 4.3* of EMM (2013).

- Attenuation of noise generated by the crushing plant and ore handling circuit by construction of semi-enclosed barriers and screens (refer to Section 4.2.5.2).
- Placement of the rock breaker within the open cut as opposed to the ROM Pad
- Completion of a detailed review of potential enclosures, noise barriers and other attenuating measures would be completed prior to construction, taking into consideration the frequency and amplitude generated by the processing plant, to ensure (and demonstrate) that it provides sufficient acoustic attenuation.
- A *Noise Management Plan* would be prepared (refer to Section 4.2.6.6.1).

EMM (2013) notes that following mitigation of the processing plant, the noise levels generated from the DZP Site would be a function of the mobile equipment operated, including on-site road trucks, drills, conveyors, front-end loaders and haul trucks. Applying further noise suppression/mitigation to reduce the overall noise levels could be undertaken, however, the overall reduction would be limited to less than 3dB(A), which is generally imperceptible to most people. Given the high cost of noise suppression on the identified plant and equipment and the minor decrease in overall noise levels it would achieve, it is not considered reasonable or feasible to apply such a mitigation measure.

4.2.6.4 Maximum Noise Level (Sleep Disturbance) Mitigation Measures

On-site noise from loading and unloading trains could, if unmitigated or managed, generate L_{max} noise events above the sleep disturbance criteria at several privately owned receptors.

To reduce the potential occurrence of such sleep disturbing noise events, the Applicant would restrict train loading and unloading to after 6:00am and before 10:00pm unless the allocated rail path requires an overnight turn-around of the train.

To mitigate against these potentially sleep disturbing noise events during night-time loading and unloading, AZL would implement and enforce a noise management plan which requires operators to avoid high impact events, e.g. between container and wagon. Forklifts equipped with modern hydraulics are capable of all but eliminating impact noise of such activities. Operators unable to adhere to noise management requirements would be excluded from operating that equipment. This mitigation measure would eliminate the sleep disturbing noise source.

Other mitigation measures were considered by the Applicant and these are reviewed as follows.

- Construction of a 300m long barrier along the western boundary of the DZP Rail Siding.

  This mitigation measure would be costly (>$200 000), the effectiveness of this measure would be limited to 2dB(A) or less due to the slightly elevated location of the receptors that would be effected on the western side of Obley Road (R20 to R23). A reduction in L_{max} noise levels of this magnitude would not influence the sleep disturbing nature of the noise.

- Installation of duratray (or equivalent) lining on rail wagons.

  This mitigation measure is considered impractical due to the limited number of rail movements required by the Proposal which would inevitably result in different trains and wagons being used to travel to and from the DZP Site. As a consequence, there would be no certainty that the treated wagons would travel to and from the DZP Site.

4.2.6.5 Blasting and Vibration Mitigation Measures

Section 2.4.3.3 provides a description of the proposed blasting operations. In summary, each blast would be designed to:

- achieve the required degree of fragmentation;
- satisfy all environmental criteria; and
- contain all fly rock within the nominated blast envelope.

The Applicant would implement the following blasting and vibration mitigation measures throughout the life of the DZP.

- Design and implementation of each blast by a suitably qualified blasting engineer or experienced shot-firer.
- Design each blast to ensure the assessment criteria described in Section 4.2.4.8 are complied with at all residential receptors in the vicinity of the DZP Site
- Identify the blast envelope during design of each blast.
- Modify blast designs, mitigation measures and operating procedures, if required, on the basis of monitoring results.
- Initiate blasts between the hours of 9:00am and 5:00pm Monday to Saturday only. No blasts would be initiated outside these hours, except for safety or emergency reasons.
- Establish and maintain an environmental complaints line and register of complaints in accordance with the requirements of the Environment Protection Licence, once issued.
- Respond promptly to any issue of concern or complaint raised by the community or a government agency.

4.2.6.6 Management Plans

4.2.6.6.1 Noise

Prior to the commencement of construction or mining related activity, a *Noise Management Plan* (NMP) would be prepared detailing activities to manage construction and operational noise emissions from project-related activities. The NMP would:

- provide training and awareness to contractors and employees regarding the statutory, construction and operational requirements for the Proposal;

- identify noise affected properties consistent with the environmental assessment and any subsequent assessments;
- outline mitigation measures to use to achieve the noise limits established;
- outline measures to reduce the impact of intermittent, low frequency and tonal noise (including truck reversing alarms);
- outline the procedure to notify property owners and occupiers that could be affected by noise from the mine;
- establish a protocol to handle noise complaints that includes recording, reporting and acting on complaints;
- specify procedures for undertaking independent noise investigations; and
- describe proactive and predictive modelling and real-time reactive management protocols for managing noise during adverse meteorological conditions.

4.2.6.7 Blasting and Vibration

A *Blast Management Plan* (BMP) would also be prepared detailing activities to manage blasting and vibration emissions from project-related activities. The BMP would:

- provide training and awareness to contractors and employees regarding the statutory, construction and operational requirements for the Proposal;
- identify potential blast and vibration affected properties consistent with the environmental assessment and any subsequent assessments;
- outline mitigation measures to use to achieve the blast limits established;
- outline the procedure to notify property owners and occupiers that could be affected by blasting and vibration from the mine;
- establish a protocol to handle blast and vibration complaints that includes recording, reporting and acting on complaints;
- specify procedures for undertaking independent blast investigations; and
- describe proactive and predictive modelling and real-time reactive management protocols for managing blasting during adverse meteorological conditions.

4.2.7 Assessment of Impacts

4.2.7.1 Construction Noise

The anticipated range of noise levels from construction works are presented in **Table 4.11**. The maximum noise level has been calculated (at the most proximal residence) with all plant operating simultaneously at 100% capacity for the entire 15 minute period. The minimum level represents the noise levels during reduced construction activities over a 15 minute period.

Results of the construction noise assessment identifies that the noise affected criteria, and in some instances the highly noise affected noise criteria (in **bold** on **Table 4.11**), may be exceeded when activities pass by receptors. While the noise associated with the proposed

construction would be highly transient and move away from the receptor within days, noise management and mitigation measures as described in Section 4.2.6.2 and 4.2.6.6.1 are considered critical in reducing noise emissions from these activities. EMM (2013) provides a summary of those receptors where all reasonable and feasible mitigation measures should be implemented and the Applicant has committed to doing so.

Table 4.11
Construction Noise Modelling Results

Construction Activity	Distance to Nearest Receptor (m)	Noise affected criteria dB(A)	Highly noise affected criteria, dB(A)	Modelled noise level range, dB(A)[1]
Gas Pipeline Corridor	25	40	75	35-**79**
Toongi – Dubbo Rail Line Upgrade	25	40	75	34-72
Macquarie Pipeline	70 (R36)	40	75	35-**77**
Obley Road Upgrade	65	40	75	35-77
Wambangalang Creek Bridge	780	40	75	35-45
Hyandra Creek Bridge	200	40	75	35-52
Twelve Mile Creek Bridge	235	40	75	35-53
Processing Area	2 000	35	75	<30-52
Haul Road	2 000	35	75	<30-52
LRSF – Area 1	2 000	35	75	<30-52
LRSF – Area 2	2 200	35	75	<30-41
LRSF – Area 3	3 800	35	75	<30-49
LRSF – Area 4	3 100	35	75	<30-39
Open Cut Development	1 900	35	75	<30-43
WRE Development	1 900	35	75	<30-43
SRSF Embankments	1 900	35	75	<30-43

Note 1: Modelled level is to the nearest receptor from construction activities
Source: Modified after EMM (2013) –Table 5.6

On the basis of the short duration and commitment of the Applicant to implement the mitigation and management measures, the exceedances are considered acceptable.

4.2.7.2 Operational Noise

The predicted noise levels for each scenario under the prevailing meteorological conditions for Scenarios 1 to 3 are provided in **Tables 4.12** to **4.14** for privately owned residential and recreational receptors, including receptors with a contractual agreement in place with the Applicant.

Figure 4.12 to **4.14** provide contour plots of the predicted noise levels for the three operational scenarios.

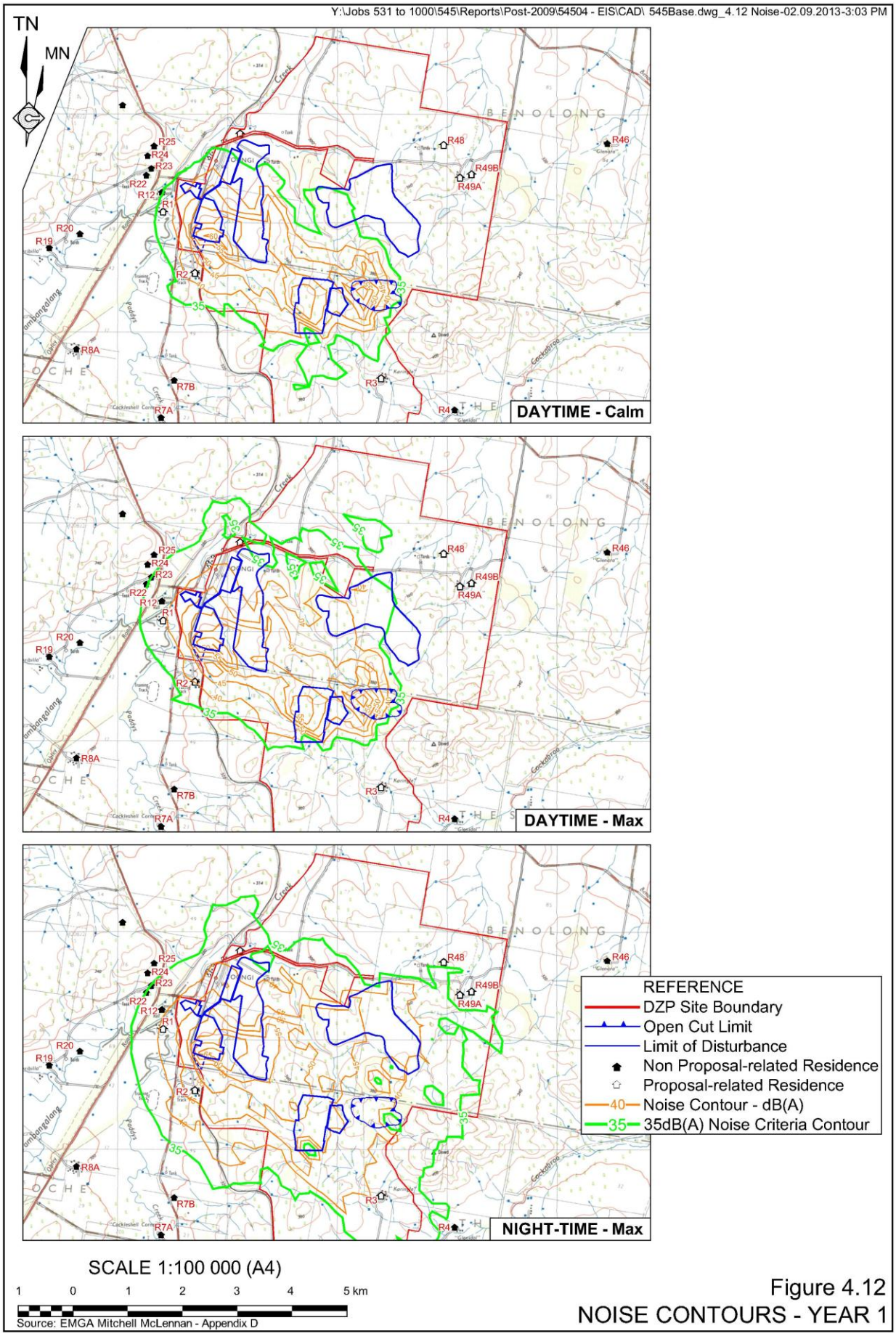


Figure 4.12
NOISE CONTOURS - YEAR 1

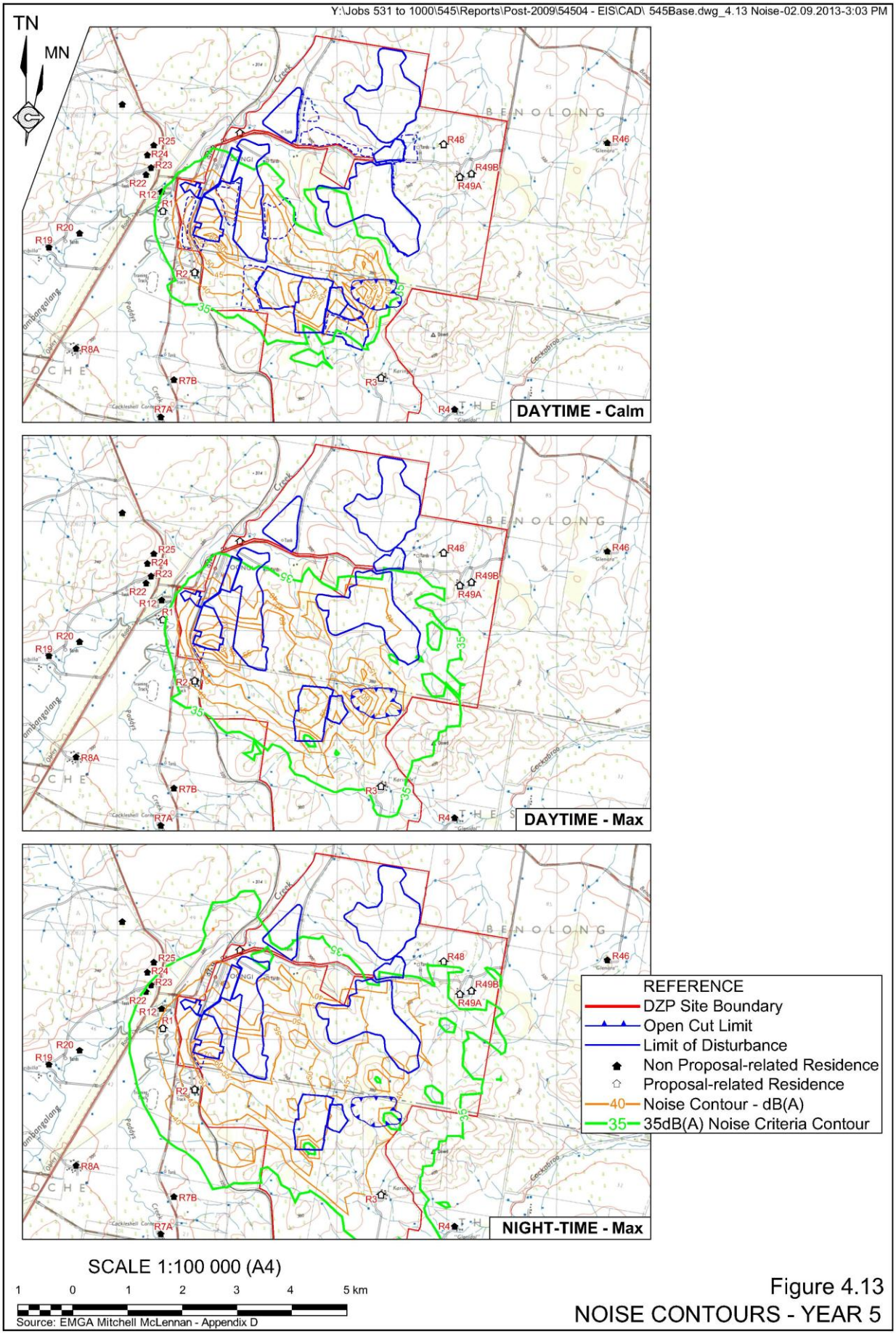


Figure 4.13
NOISE CONTOURS - YEAR 5

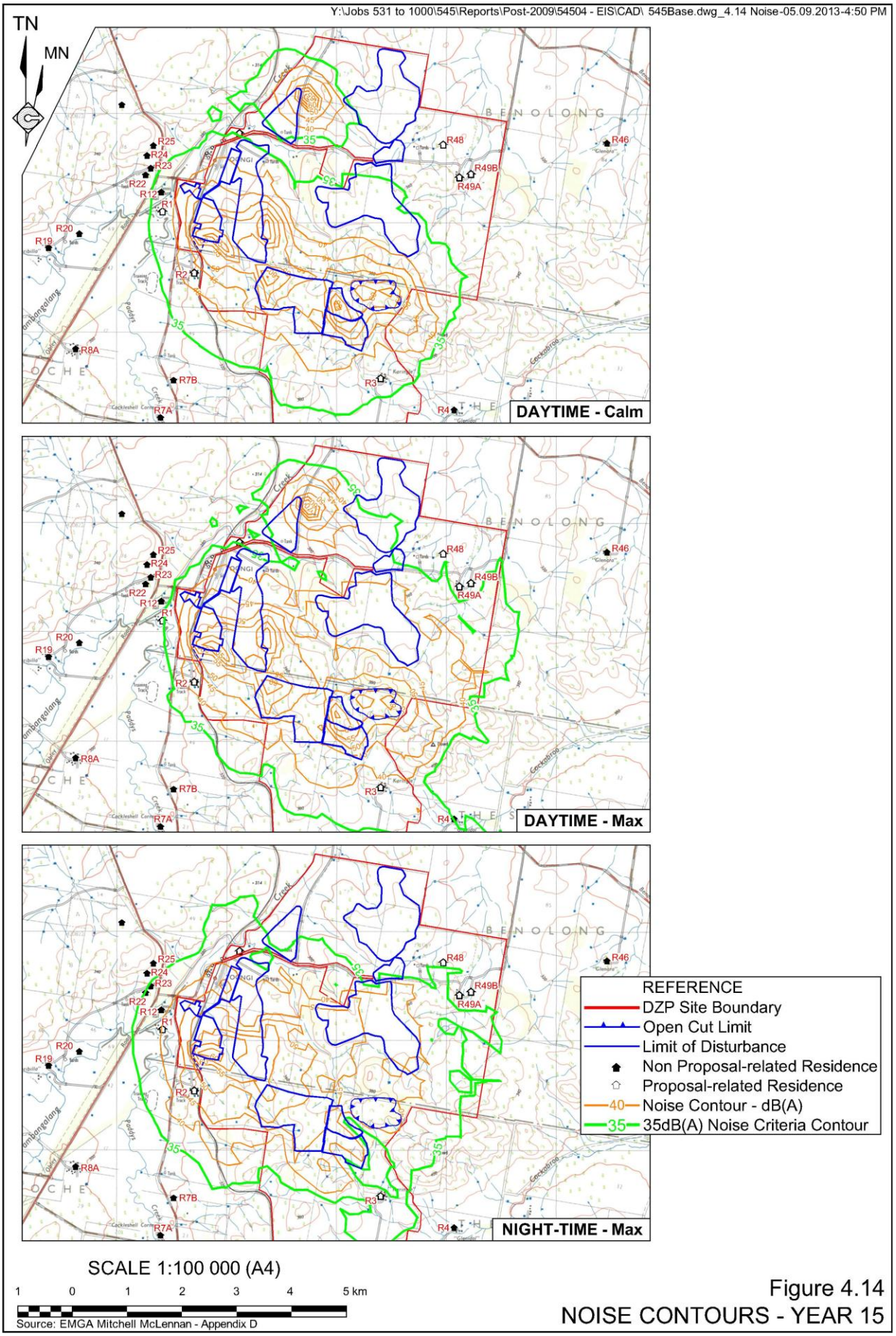


Figure 4.14
NOISE CONTOURS - YEAR 15

Table 4.12
Project-related Noise Levels for Scenario 1 (Year 1)

Receptor ID[1]	PSNL	Day		Night		
		Calm	Winds	Calm	Winds	Inversion
Privately owned receptors						
R12 (Hall)	50	35	38	≤35	39	37
R12 (Tennis court)	55	35	38	≤35	39	37
R13 (WEEC)[2]	35[3]	≤35	≤35	≤35	≤35	≤35
All remaining private receptors	35	≤35	≤35	≤35	≤35	≤35
Receptors with a contractual agreement in place with the Applicant						
R1	35	**36**	**38**	**36**	**40**	**38**
R2	35	**41**	**39**	**41**	**46**	**43**
R3	35	≤35	≤35	≤35	**39**	**39**
R51	35	≤35	≤35	≤35	35	≤35
R55	35	≤35	**37**	≤35	**38**	**36**
R58	35	≤35	**36**	≤35	**36**	≤35

Note 1: refer to **Figure 4.6**
Note 2: Noise predictions are external to the WEEC
Note 3: Internal criteria apply when WEEC is in use
Bold value refers to exceedance ≤5dB(A) (Noise Management Zone)
Shaded value refers to exceedance >5dB(A) (Acquisition Zone)
Source: Modified after EMM (2013) – Table 5.1

Table 4.13
Project-related Noise Levels for Scenario 2 (Year 5)

Receptor ID[1]	PSNL	Day		Night		
		Calm	Winds	Calm	Winds	Inversion
Privately owned receptors						
R12 (Hall)	50	≤35	≤35	≤35	39	40
R12 (Tennis court)	55	≤35	≤35	≤35	39	40
R13 (WEEC)[2]	35[3]	≤35	≤35	≤35	≤35	≤35
All remaining private receptors	35	≤35	≤35	≤35	≤35	≤35
Receptors with a contractual agreement in place with the Applicant						
R1	35	**36**	≤35	≤35	**41**	**42**
R2	35	**41**	**40**	≤35	**46**	**46**
R3	35	≤35	**37**	≤35	**39**	≤35
R51	35	≤35	≤35	≤35	**36**	**40**
R55	35	≤35	≤35	≤35	**39**	**41**
R58	35	≤35	≤35	≤35	**36**	**40**

Note 1: refer to **Figure 4.6**
Note 2: Noise predictions are external to the WEEC
Note 3: Internal criteria apply when WEEC is in use
Bold value refers to exceedance ≤5dB(A) (Noise Management Zone)
Shaded value refers to exceedance >5dB(A) (Acquisition Zone)
Source: Modified after EMM (2013) – Table 5.1

Table 4.14
Project-related Noise Levels for Scenario 3 (Year 15)

Receptor ID[1]	PSNL	Year 15 – Day		Year 15 – Night		
		Calm	Winds	Calm	Winds	Inversion
Privately owned receptors						
R12 (Hall)	50	≤35	≤35	≤35	39	37
R12 (Tennis court)	55	≤35	≤35	≤35	39	37
R13 (WEEC)[2]	35[3]	≤35	≤35	≤35	≤35	≤35
All remaining private receptors	35	≤35	≤35	≤35	≤35	≤35
Receptors with a contractual agreement in place with the Applicant						
R1	35	**36**	≤35	**36**	**40**	**38**
R2	35	**41**	**41**	**41**	**45**	**43**
R3	35	**37**	**39**	≤35	**37**	≤35
R51	35	≤35	≤35	≤35	**36**	≤35
R55	35	**36**	35	≤35	**39**	**36**
R58	35	≤35	≤35	≤35	**36**	≤35

Note 1: refer to **Figure 4.6**
Note 2: Noise predictions are external to the WEEC
Note 3: Internal criteria apply when WEEC is in use
Bold value refers to exceedance ≤5dB(A) (Noise Management Zone)
Shaded value refers to exceedance >5dB(A) (Acquisition Zone)
Source: Modified after EMM (2013) – Table 5.1

During night time and prevailing wind conditions, it is predicted that all private receptors (which do not hold an agreement with the Applicant for purchase) would experience noise levels below the operational criteria for all assessment periods and all stages of the DZP.

Three of the receptors with a contractual agreement in place with the Applicant would experience noise levels above the operational criteria, i.e. >35dB(A) (R3, R51 and R58). Three of the receptors are predicted to experience noise levels above the likely acquisition criteria, i.e. >40dB(A) (R1, R2 and R55).

Noise predictions completed for three currently vacant lots were also completed by EMM (2013).

- Crown Reserve 753220 has been identified as likely to experience operational noise levels greater than 40dB(A) over 25% the land area. It is noted the Applicant is negotiating acquisition of this property with the Department of Primary Industries - Catchments and Lands.
- Properties (Receptors) 50 and 53 (Crown Reserve 62545) would not experience operational noise levels greater than 40 dB(A) over more than 25% of their land area. The Applicant holds an agreement with the owner of Property 53 to purchase this property. The Applicant has discussed the possible purchase of Property 50 with the landowner, however, the landowner has indicated they do not wish to sell.

4.2.7.3 Low Frequency Noise

The noise predictions of EMM (2013) include a 5dB modifying factor to the crushing plant for low frequency noise.

4.2.7.4 Sleep Disturbance Noise

The likely source of significant $L_{A(1min)}$ events is associated with unloading/loading trains. The maximum (at source) sound power level of a train being loaded/unloaded (on site) or a train shunting, have previously been measured to be typically 120dB(A).

Maximum noise levels at each residence within the Toongi locality were calculated for prevailing meteorological conditions. Exceedances of sleep disturbance criteria were predicted at four residences (see **Table 4.15**).

Table 4.15
Increased L_{max} Noise Levels at Privately-owned Residences

Privately-owned Residences	L_{max} criterion, dB(A)	Modelled $L_{A(1min)}$ noise level, dB(A)
R22	45	**54**
R23	45	**55**
R24	45	**53**
R25	45	**53**
Source: Modified after EMM (2013) –Table 5.3		

The proposed mitigation measures discussed in Section 4.2.6.4, would eliminate all but occasional high impact noise. It is also noted that while this occasional L_{max} noise would exceed the sleep disturbance criteria of 45dB(A), it would remain below levels that are likely to wake sleeping occupants indoors based on international research as published in the EPA's RNP.

4.2.7.5 Road Traffic Noise

Considering both construction and operational traffic (all three transport options) EMM (2013) determined that in combination with current and predicted future traffic on Obley Road, the relevant road traffic noise criteria would be met. Combined road traffic noise would not exceed:

- 50.7dB(A) during construction phase;
- 51.5dB(A) during the day time and 49.6dB(A) during the night time based on 2012 traffic levels; and
- 53.9dB(A) during the day time and 51.4dB(A) during the night time based on 2032 traffic levels.

4.2.7.6 Rail Noise and Vibration

Noise

Table 4.16 provides the calculated $L_{Aeq(15\text{-hour})}$, $L_{Aeq(9\text{-hour})}$ and L_{max} noise levels from proposed DZP rail movements between Newcastle and Dubbo.

Table 4.16
Existing and Potential Noise Increases Relating to DZP Rail Movements – Newcastle to Dubbo

Distance[1] (m)	Existing Train Noise, dB(A)[2]			DZP Train Noise, dB(A)[3]			Total Train Noise, dB(A)[4]		
	Day, $L_{Aeq(15\text{-hour})}$	Night, $L_{Aeq(9\text{-hour})}$	L_{max}	Day, $L_{Aeq(15\text{-hour})}$	Night, $L_{Aeq(9\text{-hour})}$	L_{max}	Day, $L_{Aeq(15\text{-hour})}$	Night, $L_{Aeq(9\text{-hour})}$	L_{max}
25	52	55	84	48	50	84	53	56	84
30	50	53	80	46	48	80	51	54	80
60	47	50	78	43	45	78	48	51	78
80	46	49	74	42	44	74	47	50	74
100	45	48	72	41	43	72	46	49	72
140	45	47	69	40	42	69	46	48	69
RING Criteria	**65**	**60**	**85**	**65**	**60**	**85**	**65**	**60**	**85**

Note 1: assumed distance to nearest privately owned receptor.
Note 2: based on six existing non-DZP train movements assumed for all periods.
Note 3: based on two DZP movements during any period.
Note 4: based on eight total movements during a 24hr period (i.e. existing trains + DZP trains).
Source: Modified after EMM (2013) - Table 5.15

The predicted noise level results of the maximum train movement are as follows.

- Day and night L_{eq} criteria would be met for all noise receptors at distances 15m (and greater) from the track.
- L_{max} criteria would be met for noise receptors situated 25m (and greater) from the railway.
- Rail noise as a result of the Proposal would only increase existing L_{eq} levels by 1dB(A), and no change to L_{max} levels would be expected, satisfying the IGANRIP recommended increase goals.

Table 4.17 provides the calculated $L_{Aeq(15\text{-hour})}$, $L_{Aeq(9\text{-hour})}$ and L_{max} noise levels from proposed DZP rail movements between Toongi to Dubbo.

Vibration

A review of potential structural vibration was completed by EMM (2013) for the Dundullimal Homestead located opposite Taronga Western Plains Zoo, within the vicinity of Obley Road and situated approximately 65m from the Toongi-Dubbo Rail Line.

EMM (2013) measured data from train pass-bys identified that vibration levels generated at this distance of 65m would be less than 0.5mm/s and would satisfy the sensitive structural criteria of 3mm/s in *German Standard DIN 4150*.

Table 4.17
Potential Noise Levels Relating to DZP Rail Movements – Toongi to Dubbo

Distance[1](m)	DZP train noise, dB(A)[2]		
	Day, $L_{Aeq(15\text{-}hour)}$	Night, $L_{Aeq(9\text{-}hour)}$	L_{max}
25	48	50	84
40	46	48	80
50	43	45	78
80	42	44	74
100	41	43	72
140	40	42	69
RING Criteria	**65**	**60**	**85**

Note 1: Assumed distance to nearest privately owned receptor.
Note 2: Based on two DZP movements during any period.
Source: Modified after EMM (2013) - Table 5.14

4.2.7.7 Blasting Emissions

The proposed blast parameters for the DZP identify a maximum instantaneous charge (MIC) of up to 68 kg (generally 30kg). **Table 4.18** presents the derived overpressure and vibration levels based on 68kg MIC for the closest privately-owned receptors.

The predicted blast overpressure and vibration levels identify that a maximum MIC of 68kg would comply with ANZECC criteria at distances of greater than 450m.

Table 4.18
Predicted Air Blast Overpressure and Vibration Levels at Privately-Owned Receptors

Approximate minimum distance from blast to privately-owned receptors (m)	Derived airblast overpressure (dB(L)peak)	Derived vibration PPV (mm/s)	Max MIC (kg)
2 200	98.5	0.1	68
Criteria	115	5	

Source: EMM (2013) - Table 5.16

4.2.7.8 Taronga Western Plains Zoo

The breeding pens for several species held at Taronga Western Plains Zoo, including White Rhinoceros and African Wild Dogs, are located towards the northeastern property boundary along Obley Road. The potential for the proposed increase in heavy vehicle traffic, and specifically the associated noise, to impact on the behaviour of the animals has been raised as a possible issue.

It is noted that the movement of heavy vehicles is already a feature of Obley Road, with the frequency of movement varying throughout the year (most frequent in late spring and early summer during grain harvest, or other periods of elevated agricultural activity, and less frequent at other times).