Penrith Lakes Development Corporation

Section 75W Amendment Application – Importation of ENM/VENM

Summary Report

243932-01

Final | 1 December 2015

Job number 243932-01

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Document Verification

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Job title		Section 75W Amendment Application – Importation of ENM/VENM		Job number 243932-01
Document title		Summary Report		File reference
Document ref		243932-01		
Revision	Date	Filename	PLDC s75W Report_Draft#1_16.11.15.docx	
Draft 1	16 Nov 2015	Description	First draft	
			Prepared by	Checked by	Approved by
		Name	Aoibhin Flanagan	Guy Raithby-Veall	Guy Raithby-Veall
		Signature			
Draft 2	18 Nov 2015	Filename	PLDC s75W Report_Draft#2_18.11.15.docx	
		Description	Amendments to Draft 1 following preliminary review by PLDC	
			Prepared by	Checked by	Approved by
		Name	Aoibhin Flanagan	Guy Raithby-Veall	Guy Raithby-Veall
		Signature			
Final	01 Dec 2015	Filename	PLDC s75W Report_Final.docx	
		Description	Amendments to Draft 2 following final review by PLDC	
			Prepared by	Checked by	Approved by
		Name	Aoibhin Flanagan Guy Raithby-Veall	Guy Raithby-Veall	Guy Raithby-Veall
		Signature	Aoibhin Flanagan		
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		Description			
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		Signature			

Issue Document Verification with Document ✓

Contents

1 Introduction

Arup has been commissioned by Penrith Lakes Development Corporation (PLDC) to prepare an environmental assessment to accompany a Section 75W (s75W) modification application for the Penrith Lakes Scheme under Section 75W of the *Environmental Planning and Assessment Act 1979* (EP&A Act).

This modification incorporates changes from previous consents granted for the importation of Excavated Natural Material (ENM) and Virgin Excavated Natural Material (VENM) to the Penrith Lakes Scheme. This summary report assesses the potential environmental impacts associated with the changed hours of operation of the Penrith Lakes Scheme.

Specifically, PLDC propose to modify some of the existing Development Applications (DAs) to allow an extension of the hours of haulage of the ENM and VENM, with the proposed operational hours being 6:00 am to 9:00 pm on weekdays and 6:00 am to 3:00 pm on Saturdays. No change to the total number of truck movements is proposed.

The proposed break-down of truck movements is as follows:

- 6:00 am to 7:00 am Up to 40 truck movements/hour
- 7:00 am to 6:00 pm Up to 60 truck movements/hour
- 6:00 pm to 9:00 pm Up to 30 truck movements/hour.

This summary report contains a detailed assessment of the noise and vibration impacts resulting from the proposed modification of importation of ENM and VENM, in accordance with appropriate assessment criteria set by the NSW Office of Environment and Heritage (OEH). The modification would not result in any further significant environmental impacts as discussed in Section 4.

2 Project

2.1 Establishment of the Penrith Lakes Scheme

The Penrith Lakes Scheme was first identified as part of the *Regional Environmental Study, 1984* (RES), where it was recognised as a major water based parkland based around a four lake system to be constructed during the course of orderly excavation and rehabilitation of the land. The RES included the findings of detailed investigations into the rehabilitation solution for the site, including studies into lake drainage, lake water management and flood protection.

The RES formed the basis for the gazettal of *Sydney Regional Environmental Plan No. 11 – Penrith Lakes Scheme* (SREP 11) in 1986, which identified the development controls and framework for the coordinated development of quarrying activities and future aquatic based recreational land use outcomes within the site.

The Penrith Lakes Scheme is also specifically defined in *State Environmental Planning Policy (Penrith Lakes Scheme) 1989* (Penrith Lakes SEPP), which is now the principal planning instrument for the development site.

PLDC formed in the 1980s to undertake the coordinated extraction and rehabilitation operations of its three shareholder companies (Boral, Hanson and Holcim) in accordance with the expressed wish of the NSW Government and the Penrith City Council. PLDC undertakes agreed earthworks for the organised extraction of the raw materials by its shareholders and the subsequent site rehabilitation as outlined in the RES and agreed with the NSW State Government.

The 1987 Deed of Agreement, established a co-operative joint venture between the State of NSW and PLDC to implement the Penrith Lake Scheme.

2.2 Site and Surrounds

2.2.1 Existing Conditions

The Penrith Lakes Scheme is located within the Penrith City Council Local Government Area across the suburbs of Castlereagh and Penrith approximately 2.5 km to the north of the Penrith town centre. The site is bounded by the Nepean River to the south and west, Cranebrook Village and the Cranebrook Escarpment to the east, and rural land to the north.

The site covers an area of 1,935 ha and is approximately 7 km long and 3.5 km wide (at its widest point). The site is located on the Castlereagh floodplain of the Nepean River, at the base of the Blue Mountains. The site is accessible via the M4 and Castlereagh Road.

The first stage of the Penrith Lakes Scheme, the Sydney International Regatta Centre (SIRC), was completed in 1995. The SIRC is set within 178 ha of native and landscaped parkland and incorporates a range of recreational facilities. The

Eastern Lakes and various smaller areas located immediately east of Old Castlereagh Road were completed in 2007. Both sections are currently managed by the Office of State Lands and NSW Department of Sport and Recreation.

The end of quarrying operations was announced on 21 September 2015 completing more than 130 years of sand and gravel extraction.

Boorooberongal Lake, a 260 hectare area at the very north of the site, is a complete ecological precinct. The area has been designed to focus on providing habitat for wildlife passing through the area, and as an area that may in the future offer significant research and educational value. The Marri Lake and Lake Burralow are the two largest lakes suitable for public recreation such as sailing, kayaking and boating.

The Penrith Lakes Scheme also incorporates the rehabilitation of sections of the Castlereagh floodplain. It required the excavation of overburden, sand and gravel to a typical depth of about 14m. The Penrith area was a major source of supply of sand and crushed river gravel for the Sydney construction industry since the 1880s. There is currently a shortfall of overburden material resulting in the requirement for the importation of eight (8) million tonnes of ENM and VENM.

2.2.2 Proposed Conditions

After rehabilitation, the Penrith Lakes Scheme should comprise approximately 1,150 ha of open parklands (including potential land for urban development on the eastern side between the lakes and Castlereagh Road), 700 ha of interconnected lake and 65 ha of wetlands. The parklands will include approximately nine km of riverbank, which has been privately owned for many years. Almost all of this riverbank should become part of the publicly owned parkland, thereby increasing public access to the Nepean River for recreational use.

Upon completion, the rehabilitated Penrith Lakes Scheme will comprise four main lakes: two recreation lakes (Marri Lake and Lake Burralow), a wildlife lake (the Boorooberongal Lake) and a warm up and competition lake associated with the already completed Sydney International Regatta Centre (SIRC).

Rehabilitation includes approximately 410 ha of land envisaged for possible future urban uses under the Penrith Lakes SEPP.

2.3 Background to the Existing and Approved Operations

The Penrith Lakes Scheme has a broad range of past and current uses that range from historical Aboriginal cultural heritage uses to extensive agricultural practices to the more recent establishment of the SIRC. The most extensive use of the site in recent times relates to the sand and gravel quarries that have operated intensively on site over the past 50 years. The RES and subsequent approval of the Penrith Lakes Scheme were premised on the agreed four lake system to restore the area after the extractive industries had completed their use on the site.

The site of the Penrith Lakes Scheme has been the subject of various DAs for quarrying, extraction and rehabilitation, including:

- Development Application No.1 (DA1) - DA 350/81
- Development Application No.2 (DA2) - DA86-2720 and P92/00744/001
- Development Application No.3 (DA3) - P97/00237 Pt4
- Development Application No.4 (DA4) - P97/00237 Pt4.

The Department of Planning and Environment approved a collective modification to three of the DAs on the 2 February 2014 for the following amendments relating to the Penrith Lakes Scheme:

- to extend the timing of the consent to late 2015
- to alter the source of the VENM used to rehabilitate the Penrith Lakes Site
- minor changes to haulage routes into the Penrith Lakes Site
- removal of one access point into the Penrith Lakes Site
- a change in acoustic legislation in NSW has necessitated updated noise monitoring to assess the works against noise criteria.

The importation of VENM and ENM is currently restricted to set time windows in accordance with previous s75W approvals. The current approved operating hours for the importation of VENM and ENM are given in Table 1.

Table 1 Current approved hours of operation

Monday to Friday	Saturdays	Sundays and Public holidays
7.00 am to 6.00 pm	7:00 am to 1:00 pm	No work

2.4 Proposed Modifications

It has come to PLDC's attention through discussions with the NSW Department of Planning and various contractors that with the current and proposed tunnelling and excavation projects, such as Sydney Metro Northwest, NorthConnex, WestConnex and also future urban metro tunnels, there is an urgent need for suitable approved, disposal sites with large tipping areas and all weather access. The Penrith Lakes Scheme is one of the few locations in Sydney that is suitable for disposal of tunnel spoil arising from such projects.

PLDC is therefore seeking to submit a modification application for the extension of operating hours for VENM and ENM importation under s 75W of the EP&A Act. The proposed modifications to the operating hours are outlined in Table 2.

Table 2 Proposed modifications to hours of operation

	Monday to Friday	**Saturdays**	**Sundays and Public holidays**
Current	7.00 am to 6.00 pm	7:00 am to 1:00 pm	No work
Proposed	**6:00 am to 9.00 pm**	**6:00 am to 3:00 pm**	No work
± change	**+3 hrs. (pm)**	**+2 hrs. (pm)**	No change

3 Statutory Framework

3.1 Commonwealth Legislation

3.1.1 Environment Protection and Biodiversity Conservation Act 1979

Under the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) a referral is required to the Australian Government for proposed 'actions that have the potential to significantly impact on matters of national environmental significance or the environment of Commonwealth land'.

The proposed modification would not have a significant impact on any matters of national environmental significance (MNES) and/or the environment of Commonwealth land. Accordingly, the proposal has not been referred to the Department of Environment.

3.2 New South Wales Legislation

3.2.1 Environmental Planning and Assessment Act 1979 and Regulations 2000

The EP&A Act and associated regulations, and environmental planning instruments provides the framework for the assessment of environmental impacts and approval of development in the State. As such, the proposed modification must be assessed in accordance with the EP&A Act and associated regulations.

The existing works for the extraction, rehabilitation, reconstruction and landscaping of the land at Penrith Lakes at the time were approved by the Minister for Planning under Part 4 of the EP&A Act.

Section 8J(8) of *Environmental Planning and Assessment Regulation 2000* (EP&A Regulation) allows an existing development consent that was determined under Part 4 of the EP&A Act before 1 August 2005 to be modified under Part 3A of the Act and section 75W of the Act applies to any modification of such a consent:

a. a development consent granted by the Minister under section 100A or 101 of the Act,

b. a development consent granted by the Minister under State Environmental Planning Policy No 34—Major Employment-Generating Industrial Development,

c. a development consent granted by the Minister under Part 4 of the Act (relating to State significant development) before 1 August 2005 or under clause 89 of Schedule 6 to the Act,

d. a development consent granted by the Land and Environment Court, if the original consent authority was the Minister and the consent was of a kind referred to in paragraph c.

In 2011, Part 3A of the EP&A Act was repealed. Subsequently transitional arrangements were include as part of the repeal of Part 3A. Under these arrangements, Clause 12 of Schedule 6A of the EP&A Act specifically provides that section 75W continues to apply to modifications of the development consents referred to in clause 8J (8) of the EP&A Regulation. These arrangement stand in respect to modification application.

As the existing development consent was approved by the (then) Minister for Planning and Environment under Section 101 of the EP&A Act, Section 75W of the EP&A Act applies for the modification to the existing development consent.

3.2.2 Protection of the Environment Operations Act 1997

The NSW *Protection of the Environment Operations Act 1997* (POEO Act), administered by the OEH is the key piece of legislation for environmental protection. The POEO Act also clearly outlines pollution offences relating to land, water, air and noise pollution and includes a duty to report pollution incidents.

The existing quarrying and extractives activities undertaken at the Penrith Lakes Scheme are already subject of an Environment Protection Licence (EPL) under Licence 2956.

This EPL will be amended to include the proposed hours of operation to ensure compliance. The proposed modifications would not require any further update to any other sections of the EPL.

3.2.3 Threatened Species Conservation Act 1995

The NSW *Threatened Species Conservation Act 1995* (TSC Act) lists threatened species, populations and ecological communities in NSW and provides their protection.

If a proposal is likely to have an impact on a threatened species, population or ecological community, this is required to be assessed. If the proposal is likely to occur in an area where threatened species, population or ecological communities are present then a Seven Part Test would need to be undertaken to determine if there would be any significant impacts.

The proposed modification would not have a significant impact on any matters protected under the TSC Act.

3.2.4 National Parks and Wildlife Act 1974

The *National Parks and Wildlife Act 1974* (NPW Act) provides for the control and management of national parks, nature reserves, wetlands, reserves, historic sites and other state reserves. The NPW Act also outlines approval requirements for works in the vicinity of Aboriginal heritage and provides for the protection of flora and fauna.

The NPW Act aims to conserve nature, habitat, ecosystems, ecosystem processes and biological diversity at the community, species and genetic levels. All native fauna is protected, threatened or otherwise, under the NPW Act. Schedule 13 lists protected plants which shall not be harmed or picked on any land either on or off National Park estate. The NPW Act provides legislative protection for Aboriginal heritage in the State. Part 6 of the Act refers to Aboriginal objects and places and prevents persons from impacting on an Aboriginal place or relic, without consent or a permit.

The proposed modification would not have a significant impact on any matters protected under the NPW Act.

3.2.5 Heritage Act 1977

The NSW *Heritage Act 1977* (Heritage Act) is a statutory tool to conserve non-Aboriginal heritage in NSW. The Heritage Act provides for protection of items of local, regional and state heritage significance and it is used to regulate development that may impact on the State's heritage assets. Development or activities cannot be carried out which may affect an item listed on the State Heritage Register without approval under Section 60 of the Heritage Act. Administered by the NSW Heritage Office, the Act details the statutory requirements for protecting historic buildings and places and includes any place, building, work, relic, movable object or precinct, which may be of historic, scientific, cultural, social, archaeological, natural or aesthetic value.

Under Section 139 of the Heritage Act, approval is also required prior to the disturbance or excavation of land if it would, or is likely to, result in a relic being discovered, exposed or damaged.

The proposed modification would not have a significant impact on any matters protected under the Heritage Act.

3.2.6 Waste Avoidance and Resource Recovery Act 2001

The NSW *Waste Avoidance and Resource Recovery Act 2001* (WARR Act) promotes waste avoidance and resource recovery to achieve a continual reduction in waste generation through the efficient use of resources and implementation of the waste hierarchy.

The proposed modification would not have a significant impact on waste resources and the existing waste management procedures would continue to remain in place.

3.2.7 Protection of the Environment Operations (Waste) Regulation 2005

The NSW *Protection of the Environment Operations (Waste) Regulation 2005* (POEO Waste Regulations) outlines the regulatory waste framework and outlines specific requirements for some waste streams.

The proposed modification would not have a significant impact on waste resources and would not result in the creation of any new waste streams.

3.2.8 Water Management Act 2000

The *Water Management Act 2000* (WM Act) relates to the management of surface and groundwater in NSW and provides a single statute for the regulation of water use and works that may impact on both marine and fresh surface and groundwater.

The proposed modification would not have a significant impact on water resources protected under the WM Act.

3.2.9 Water Act 1912

The *Water Act 1912* (Water Act) outlines the need for permits and/or licenses for the extraction of surface (Part 2 of the Water Act) and groundwater (Part 5 of the Water Act).

The proposed modification would not have a significant impact on water resources protected under the Water Act.

3.3 Relevant Policies and Guidelines

3.3.1 State Environmental Planning Policies

The relevant environmental planning instruments that apply to the site and/or the proposed development are:

- State Environmental Planning Policy (Penrith lakes) 1989 (Penrith Lakes SEPP)

- State Environmental Planning Policy No. 55 – Remediation of Land (SEPP 55)

3.3.1.1 Penrith Lakes SEPP

As noted in Section 2.1, the Penrith Lakes SEPP is the principal planning instrument for the Penrith Lakes Scheme. The aims and objectives of the Penrith Lakes SEPP are to permit the implementation of the Penrith Lakes Scheme and to:

a) to provide a development control process establishing environmental and technical matters which must be taken into account in implementing the Penrith Lakes Scheme in order to protect the environment,

b) to identify and protect items of the environmental heritage,

c) to identify land which may be rezoned for urban purposes, and

d) to permit interim development in order to prevent the sterilization of land to which this Policy applies during implementation of the Penrith Lakes Scheme.

The proposed modification would align with these objectives and assist with the implementation of the Penrith Lakes Scheme without any significant impact on any matters protected under the Penrith Lakes SEPP.

Specifically, Clause 8 of the Penrith Lakes SEPP provides that any development for the purposes of implementing the Penrith Lake Scheme is permissible with development consent.

The proposed modifications would therefore require approval from the Minister of Planning or a delegate of the Minister.

3.3.1.2 SEPP 55

SEPP 55 and associated contaminated land planning guidelines establish the requirements for the investigation and remediation of contaminated land as part of development in NSW. Clause 7 of SEPP 55 effectively states that a consent authority must not consent to the carrying out of any development on land unless it has considered whether the land is contaminated, and it is satisfied that the land is suitable in its present state, or will be made suitable after remediation, for the proposed land use.

The proposed modification would not alter the land use and thus there would be no significant impact on any matters protected under SEPP 55.

4 Environmental assessment

4.1 Introduction

The proposed modification to the operational hours would result in a potential change to anticipated noise and vibration at surrounding sensitive receptors. There are no further potential impacts associated with the modification due to the following:

- There would be no change to the number of truck movements
- The extent of the site and all site boundaries would remain intact
- Emissions, discharge limits, administrative and operating conditions (with the exception of operational hours), monitoring and recording procedures would remain as outlined in the EPL
- Scheduled operational extractive activities would remain at the same scale.

4.2 Noise Assessment

4.2.1 Introduction

To address the potential noise and vibration impacts, a noise and vibration assessment has been undertaken (refer to Appendix A). This assessment is subsequent to the original Statement of Environmental Effects for the Penrith Lakes Scheme undertaken in 2008, the initial modification that was approved in 2009, the revised assessment for haulage of VENM undertaken in 2012, and revised assessment for haulage of ENM and VENM undertaken in 2014.

Given the relatively short timeframe between the previous assessment and this current assessment, no additional noise measurements have been undertaken. The previous assessment and subsequent noise monitoring following the commencement of VENM haulage is considered to adequately capture the existing road traffic noise environment.

4.2.2 Existing Environment

4.2.2.1 Criteria

Internal noise

The operational noise conditions and criteria are outlined in the EPL and in DAs, specifically DA2, DA3 and DA4. The criteria in the EPL and DA2/DA3/DA4 apply at all times of the day.

The following conditions highlight the permitted noise conditions as outlined in the EPL:

L6.1 Noise from the premises must not exceed the following noise emission criterion for the duration specified:

a) L_{AMAX} – 70 dB(A) at any time;

b) $L_{A10, 15minutes}$ – 65 dB(A) for any continuous 4 weeks at any residential premises specified in L6.2;

c) $L_{A10, 15\ minutes}$ – 60 dB(A) for any continuous 3 months at any residential premises specified in L6.2;

d) $L_{A10, 15\ minutes}$ – 55 dB(A) for any continuous 2 years at any residential premises specified in L6.2; and

e) Less than 55 dB(A) for the remainder of the time.

L6.2 Noise from the premises is to be measured at any point within one metre of the boundary of any residential premises, excluding residential premises on Castlereagh Escarpment, to determine compliance with condition L6.1.

The Minister for Planning, also set out the following conditions in DA2, DA3 and DA4 with respect to the noise environment. Further conditions outlined in DA2 are denoted by italics.

32) The Applicant shall not exceed the following maximum noise levels in those areas designated.

a) Cranebrook Village and Other Dwellings outside the Scheme area (but not on the Escarpment)

(i) **Maximum Noise Levels**

These criteria are the same as those given in L6.1 of the DEC conditions above.

(ii) The above absolute maximum may be exceeded as a result of construction of the noise control works, e.g. noise bunds.

(iii) In the area south of Cranebrook village all rehabilitation works shall be setback 20 metres from the residential area.

(iv) In the area north of Cranebrook village all rehabilitation works shall be setback 50 metres from residential areas.

b) Dwellings on the Castlereagh Escarpment

(i) Maximum Noise Levels

Noise levels as measured at any one dwelling on the Escarpment are not to exceed the following criteria.

Maximum Noise Limits (L_{A10})

Absolute maximum – 70 dB(A)

Greater than – 65 dB(A) for 3 months

Greater than – 55 dB(A) for 30 months

Less than – 55 dB(A) for remainder of time

(ii) All extraction and rehabilitation to take place a minimum of 200m from dwellings on the escarpment.

External noise

Traffic noise impacts from public roads in NSW are assessed against the OEH's *Road Noise Policy* (RNP[1]), which provides guidelines for acceptable noise levels from new and existing roadways, and from developments which have the potential to create additional traffic on existing roadways.

The RNP criteria follow a 'non-mandatory performance-based approach', in that the criteria are given as targets for traffic noise from developments, while recognising that in some cases it may not be feasible to comply with the targets and a long-term noise mitigation strategy is more suitable.

The importation of VENM and ENM has been treated as a 'land use with the potential to create additional traffic' for the purposes of setting noise criteria. The RNP criteria are given for two time periods – day (07:00-22:00) and night (22:00-07:00).

Based on the existing traffic noise data (outlined in Section 4.2.2.4) it is considered reasonable to modify the day and night time periods as follows:

- Day 6:00 am to 10:00pm (16hr)
- Night 10:00pm to 6:00am (8hr)

The appropriate noise criteria from the RNP for traffic noise from the importation of VENM are given in Table 5.

Table 3 NSW Road Noise Policy

Road	RNP Category	Time Period	Daytime Criterion
Freeway/arterial/sub-arterial roads	3. Existing residences affected by additional traffic on existing freeways/arterial/sub-arterial roads generated by land use developments	16-hour	60 dB $L_{Aeq,16hr}$

It is however noted that an increase of up to 2 dB represents a minor impact that is considered barely perceptible to the average person.

Vibration

Criteria for vibration are given by the Department of Environment and Climate Change's (DECC) *Assessing Vibration guideline*[2] . As with the RNP, these

1 NSW Office of Environment and Heritage *Road Noise Policy (July, 2011)*

2 NSW Department of Environment and Conservation (2006) – *Assessing Vibration: a technical guideline*

criteria are non-mandatory goals for new developments. Vibration criteria are based on two components:

- Maintaining human comfort of building occupants
- Preventing damage to a building and its contents

The human comfort vibration criterion is significantly below the building damage vibration criterion, and therefore achieving the human comfort condition generally results in the building damage condition being met.

For intermittent vibration sources, such as road and rail traffic, the concept of a 'vibration dose value' (VDV) has been adopted. For residences, the acceptable VDV range is as follows:

- Preferred value: 0.2 $m/s^{1.75}$
- Maximum value: 0.4 $m/s^{1.75}$

The DECC's vibration guidance is generally based on British Standard BS6472[3]. BS6472 and its Australian equivalent, Australian Standard AS2670.2[4], give a series of rating curves to assess human exposure to vibration levels, and provide further guidance on acceptable vibration levels. Table 2 of AS2670.2 recommends that daytime continuous or intermittent vibration levels in residential receivers should not exceed Curve 4 of AS2670.2.

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3 British Standard BS6472.2 (1992) *Guide to evaluation of human exposure to vibration in buildings (1 to 80 Hz)*

4 Australian Standard AS2670.2 (1990) – *Evaluation of human exposure to whole-body vibration. Part 2: Continuous and shock-induced vibration in buildings (1 to 80 Hz)*

4.2.2.2 Truck Haulage Routes

The existing truck haulage routes for VENM and ENM on the road network surrounding the site from both the north and south are outlined in Figure 1 and Figure 2.

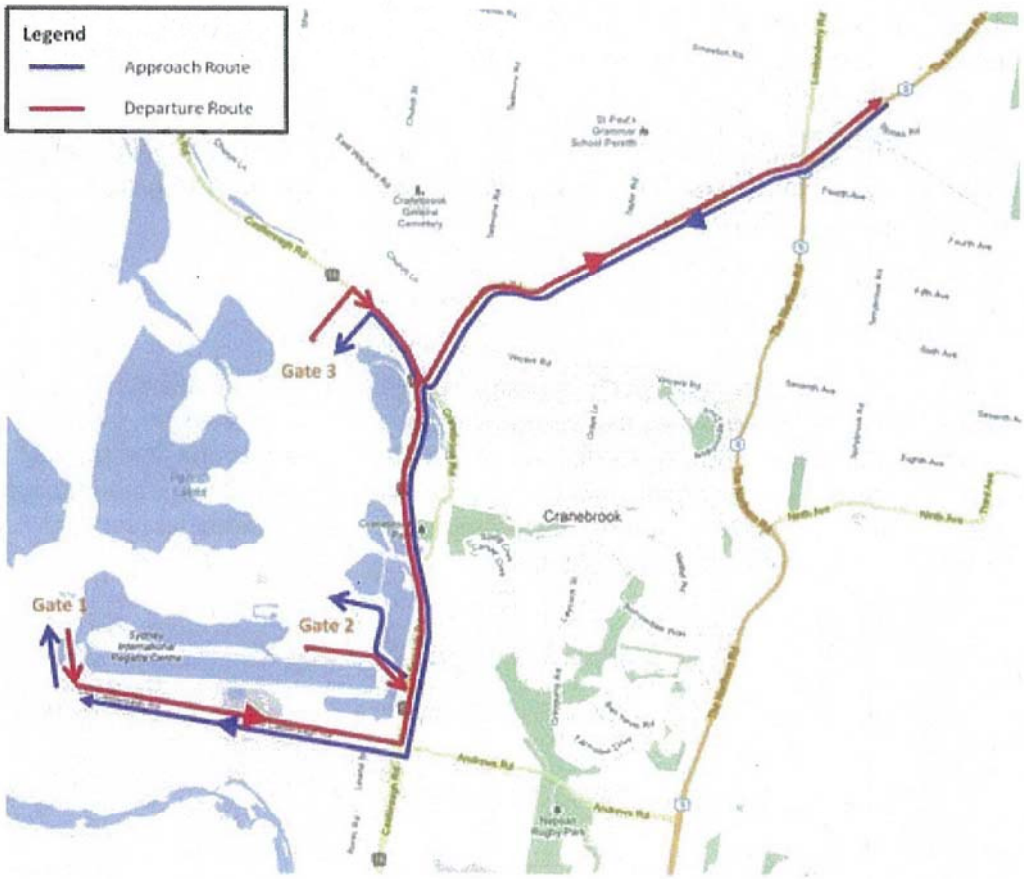

Figure 1 Vehicle Access Routes for Trucks Approaching from the North

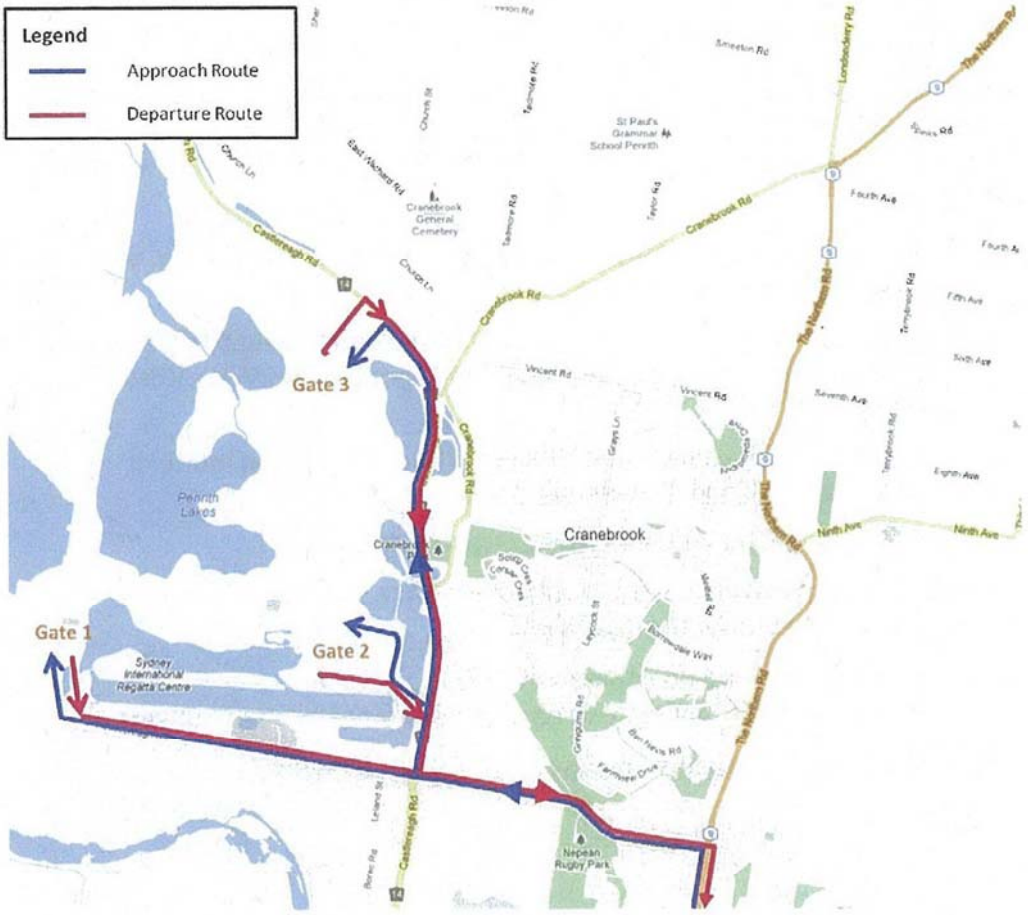

Figure 2 Vehicle Access Routes for Trucks Approaching from the South

4.2.2.3 Noise Sensitive Receivers

Representative noise sensitive receivers have been identified on various sections of the truck haulage routes. The receiver locations have not changed since the most recent noise assessment undertaken in October 2015. The noise sensitive receivers are:

- **Receiver 1:** 1999 Old Castlereagh Road – Old Castlereagh Road, west of Castlereagh Road roundabout
- **Receiver 2:** 538 Cranebrook Road and The Lakes Church, 540 Cranebrook Road (Receiver 2A) – on Castlereagh Road, north of Andrews Road roundabout.
- **Receiver 3:** Lot 5, Cranebrook Village– Castlereagh Road, north of Cranebrook Road; and Cranebrook Road.
- **Receiver 4:** 74 Church Lane (faces Castlereagh Road)
- **Receiver 5:** receivers on The Northern Road (not shown in Figure 3) (typically ~50 m from the road edge)
- **Receiver 6:** receivers on Andrews Road (typically ~ 30 m from the road edge and protected by a noise bund).

The location of these sensitive receivers are shown in Figure 3.

Figure 3 Location of sensitive noise receptors

4.2.2.4 Noise Monitoring

Truck haul by-pass measurements (2008)

Several measurements of haul truck pass-bys were made by the edge of the carriageway of Old Castlereagh Road during a site visit on 20 February 2008. These measurements are still considered relevant to this updated assessment since the truck types used for haulage are unlikely to change significantly. The measurements were made at a distance of approximately 2.5 m from the carriageway edge, from trucks travelling on both sides of the carriageway.

Table 4 Haul Truck Pass-By Noise Survey Measurements, dB re 20 μPa

Carriageway Side	Number of Trucks	Single event exposure level (SEL)	L_{max}
Near	5	88-93 dB	87-93 dB
Far	5	87-91 dB	86-90 dB
Average of both sides	10	92 dB	90 dB

Traffic noise surveys (2012)

A traffic noise survey was conducted in May 2012. Unattended noise loggers were used to conduct statistical noise measurements over the course of the survey, measuring the L_1, L_{10}, L_{eq}, and L_{90} parameters over 15-minute time periods. The unattended noise measurements were supplemented by attended noise measurements of the traffic noise levels at the logger locations.

The noise loggers were located in the vicinity of each noise sensitive receiver, with the location selected to minimise the influence of other non-traffic noise sources. The logger locations were typically at a different distance from the carriageway than the nearest noise sensitive receiver, and therefore the measured traffic noise levels was corrected according to the distance from the road to the receiver. Additionally, a 2.5 dB(A) façade correction was applied when assessing noise levels at a residence.

An overview of measured traffic noise levels is given below in Table 3. Noise levels at the noise sensitive receivers have been calculated, and are given in Table 4:

Table 5 Traffic Noise Survey Measurements, dB re 20 μPa

Logger Location	Parameter	Approximate Distance from Carriageway Edge	Measured Average Weekday Noise Level
1	$L_{Aeq,15hr}$	9 m	62 dB
2	$L_{Aeq,15hr}$	22 m	60 dB
3	$L_{Aeq,15hr}$	1.5 m	75 dB

Table 6 Measured and Predicted Existing Traffic Noise Survey Measurements at Noise Sensitive Receivers, dB re 20 µPa

Receiver	Parameter	Approximate Distance from Carriageway Edge	Façade-Corrected Average Weekday Noise Level	Criterion	Existing Levels Meet Criterion?
1	$L_{Aeq,15hr}$	31 m	58 dB	60 dB	Yes
2	$L_{Aeq,15hr}$	25 m	64 dB	60 dB	No
2A	$L_{Aeq,15hr}$	16 m	66 dB	60 dB	No
3	$L_{Aeq,15hr}$	19 m	71 dB	60 dB	No
4	$L_{Aeq,15hr}$	80 m	57 dB	60 dB	Yes
5	$L_{Aeq,15hr}$	50 m	59 dB	60 dB	Yes*
6	$L_{Aeq,15hr}$	30 m	59 dB	60 dB	Yes*

* Just under criterion; treated as being exceeding the criterion as discussed below

The measured and predicted levels show that existing road traffic noise levels exceeded noise criteria at all receivers except for those on Old Castlereagh Road (Receiver 1) and Castlereagh Road north of Cranebrook Road (Receiver 4), prior to the commencement of VENM haulage. Receivers 5 and 6 (The Northern Road and Andrews Road) are just under the noise criteria.

In this circumstance, the RNP allows for a 2 dB(A) 'relative increase' criterion to be applied since existing noise levels are almost at the absolute 60 dB(A) criterion. As such, the applicable criteria from the RNP are generally that noise from the VENM/ENM operations should not increase the existing noise levels by more than 2 dB(A).

With respect to Old Castlereagh Road and Castlereagh Road north of Cranebrook Road, VENM/ENM truck movements should not give rise to an exceedance of the 60 dB(A) criterion.

Follow up noise surveys (2013)

A further noise survey was undertaken in August – September 2013 (prior to the commencement of VENM haulage) to monitor background traffic monitoring from the vicinity of the Penrith Lakes Scheme. The logging locations were generally similar to the logger locations from the previous 2008 and 2012 traffic noise surveys, with some changes:

- Logger 2 was located further to the north along Castlereagh Road to minimise the potential impact of pedestrian traffic on measured noise levels
- Logger 3 was located so as to measure noise from Castlereagh Road north of Cranebrook Road. In 2012 this logger was set up in a position where noise on Cranebrook Road was dominant.

The results of this monitoring shows that background traffic flows on the surrounding road network have a morning peak starting at or before 6:00 am.

Example logger graphs from the background noise trial are shown in Figure 4 through to Figure 7.

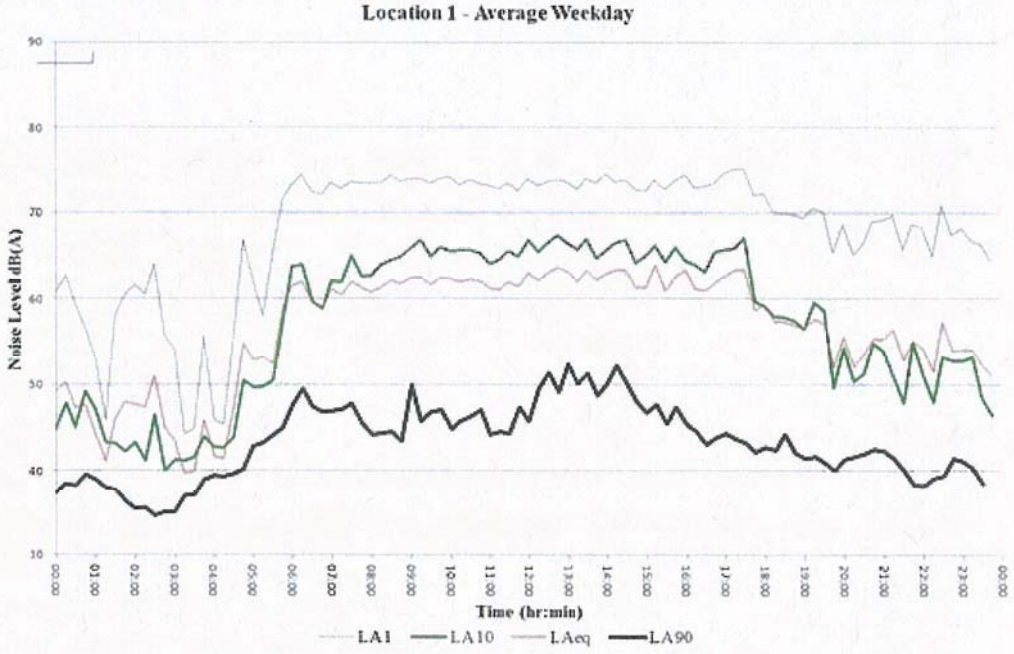

Figure 4 Average Weekday Traffic Noise Levels, Location 1 (Old Castlereagh Road), 9 August to 16 August 2013

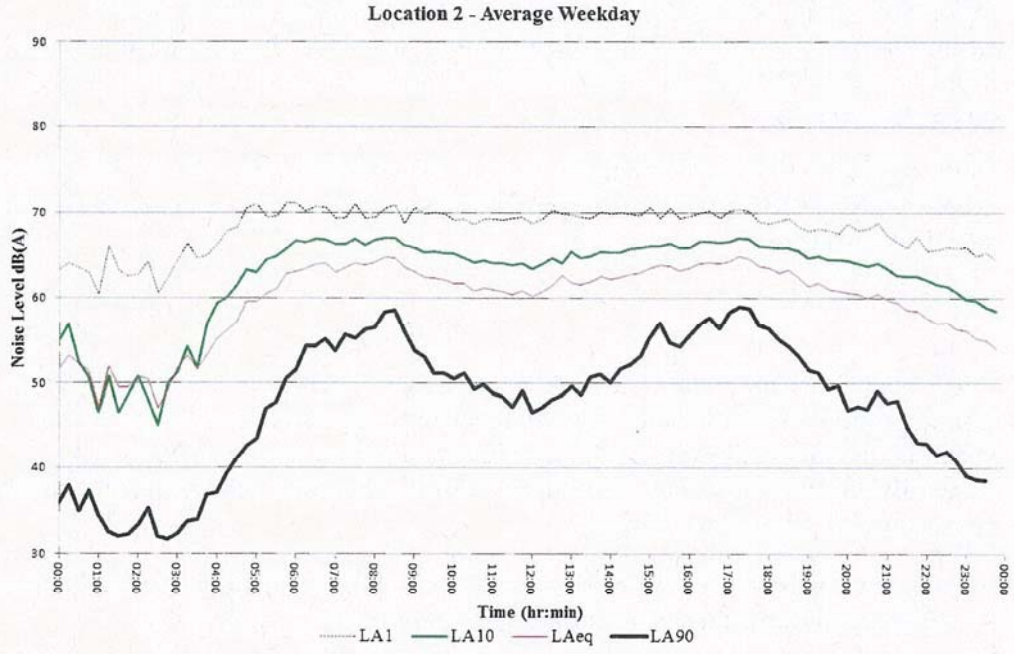

Figure 5 Average Weekday Traffic Noise Levels, Location 2 (Castlereagh Road, south of Cranebrook Road), 9 August to 16 August 2013

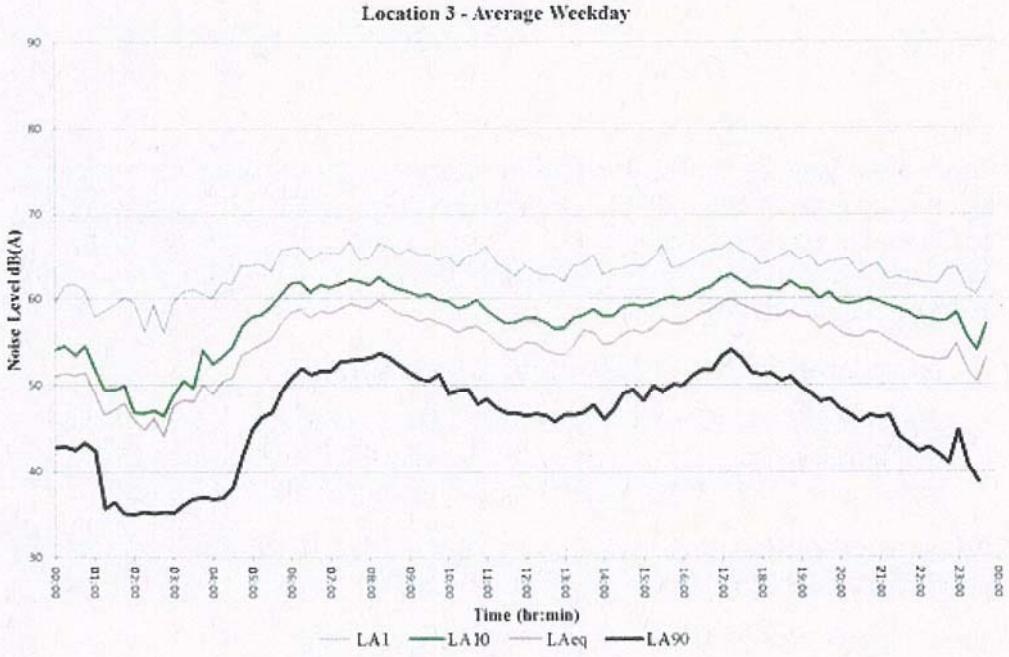

Figure 6 Average Weekday Traffic Noise Levels, Location 3 (Castlereagh Road, near Cranebrook Road intersection), 9 August to 16 August 2013

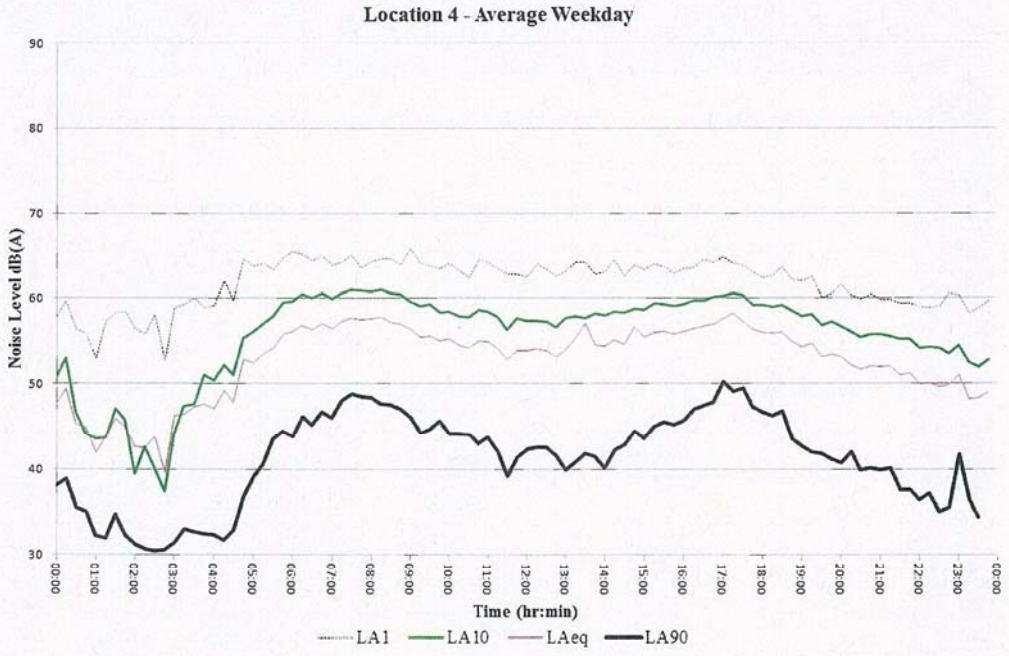

Figure 7 Average Weekday Traffic Noise Levels, Location 4 (Castlereagh Road north of Cranebrook Road), 9 August to 16 August 2013

4.2.3 Impacts

4.2.3.1 Noise Forecasts

Noise modelling for the predicted traffic and associated noise across the proposed years of operation (2014-2018) have been forecasted. The traffic noise levels were forecasted using a combination of the CoRTN[5] traffic noise model, and the measured truck pass-by SELs. Traffic volumes were provided by Arup Transport Planning two scenarios:

- the approved quarry + VENM haulage scenario; and
- the proposed additional VENM/ENM scenario, based on 476 additional VENM/ENM haul trucks movements per day (2015/2016 and 2016/2017), reducing to 238 VENM/ENM haul truck movements in 2017/2018.

The forecasted noise levels, including a 2.5 dB facade reflection, are given for each of the proposed years of operation in Table 8.

Table 7 Traffic Noise Predictions, 2012-2015 - dB re 20 μPa

	Receiver	Level ($dBL_{Aeq, 16hr}$)		Criterion	Acceptable?
		Existing Quarry Operations + Approved VENM Haulage	Proposed Additional VENM/ENM Haulage		
2014/2015	1	63 dB	-	-	-
	2	63 dB	-	-	-
	2A	65 dB	-	-	-
	3	73 dB	-	-	-
	4	58 dB	-	-	-
	5	59 dB	-	-	-
	6	60 dB	-	-	-
2015/2016	1	58 dB	61 dB	60 dB(A)	Yes*
	2	63 dB	63 dB	2 dB increase	Yes
	2A	65 dB	65 dB	2 dB increase	Yes
	3	71 dB	73 dB	2 dB increase	Yes
	4	58 dB	58 dB	60 dB(A)	Yes
	5	59 dB	59 dB	2 dB increase	Yes
	6	59 dB	61 dB	2 dB increase	Yes
2016/2017	1	58 dB	61 dB	60 dB(A)	Yes*
	2	63 dB	63 dB	2 dB increase	Yes
	2A	65 dB	65 dB	2 dB increase	Yes

5 United Kingdom Department of Transport (1988) – *Calculation of Road Traffic Noise*, Her Majesty's Stationery Office

	Receiver	Level ($dBL_{Aeq, 16hr}$)		Criterion	Acceptable?
		Existing Quarry Operations + Approved VENM Haulage	Proposed Additional VENM/ENM Haulage		
	3	71 dB	73 dB	2 dB increase	Yes
	4	58 dB	59 dB	60 dB(A)	Yes
	5	59 dB	59 dB	2 dB increase	Yes
	6	59 dB	61 dB	2 dB increase	Yes
2017/2018	1	55 dB	58 dB	60 dB(A)	Yes
	2	63 dB	63 dB	2 dB increase	Yes
	2A	65 dB	65 dB	2 dB increase	Yes
	3	71 dB	72 dB	2 dB increase	Yes
	4	58 dB	59 dB	60 dB(A)	Yes
	5	59 dB	59 dB	2 dB increase	Yes
	6	59 dB	60 dB	2 dB increase	Yes

*Marginal exceedance of 1 dB(A); additionally this noise level is the same as the 2014/2015 traffic noise level (baseline).

4.2.3.2 Summary of Impacts

The impact of the proposed modifications to the DA2, DA3 and DA4 consents to allow an extension of importation hours of VENM and ENM to the Penrith Lakes Scheme has been assessed against the relevant licence conditions and OEH guidance for noise and vibration.

Noise levels for a typical VENM/ENM haul truck scenario (approximately 476 truck movements per day divided between the three site entries) were assessed. In addition, a further 'worst case' scenario was considered for all haul trucks using the worst-affected road segment (Old Castlereagh Road), which has infrastructure that is better suited to handle larger volumes of trucks than the other entrances.

Under the extreme 'worst-case' scenario where all 476 truck movements use Old Castlereagh Road, the external noise level at the receivers on this road segment would be 64 dB $L_{Aeq,16hr}$. With the existing façade upgrades (provided as part of previous Penrith Lakes Scheme projects) providing ~15 dB(A) noise reduction, this would result in an internal noise level of ~49 dB $L_{Aeq,16hr}$. NSW road noise criteria are typically based on lightweight dwelling constructions which provide ~10 dB(A) traffic noise reduction – i.e. the criterion of 60 dB $L_{Aeq,15hr}$ (external) is equivalent to ~50 dB $L_{Aeq,15hr}$ (internal).

These existing mitigation measures mean that internal noise levels under the 'worst case' haulage scenario (where all haul trucks use Old Castlereagh Road) will comply with the equivalent RNP noise criteria. Under a typical operation scenario where truck numbers are divided between the various haulage routes and

entry points, external and internal noise levels on Old Castlereagh Road would comply with the RNP criteria.

The proposed extension of operational hours has been assessed using the 'shoulder period' provisions of the RNP (outlined in Table 5), because existing noise levels in the vicinity of site show a morning peak from 6:00 am. Therefore extending the day time period to include the proposed haulage hours is considered reasonable.

Additional noise and vibration impacts from internal traffic movements are expected to be minimal, with external traffic being the only significant source of noise.

Predicted vibration levels at surrounding receivers are below the recommended criterion of Curve 4 of AS2670.2, and the estimated VDV is predicted to be below 0.2 $m/s^{1.75}$ and therefore the vibration impact of the extended VENM/ENM haul traffic is expected to be minimal and meet the relevant vibration criterion.

4.2.4 Mitigation Measures

To control the traffic noise impacts, administrative measures are recommended, such as dividing the overall daily haul traffic between several access locations to reduce the traffic noise impact on any one road segment. A Noise Management Plan will be implemented to document the traffic noise management procedures.

The overall noise impact of the s75W modification is expected to be low, and administrative measures are expected to be effective in controlling this noise impact to acceptable levels and meet the relevant noise criteria.

5 Summary and Conclusion

PLDC currently has approval via modification of approvals DA2, DA3 and DA4 for the site to import up to eight (8) million tonnes of VENM and ENM at a maximum rate of three (3) million tonnes per year via road haulage.

PLDC is seeking to submit a modification application for the existing development consent for the site. The proposed working hours are not considered to be consistent with the existing development consent for the site, therefore a modification to the consent is required. The modification can be assessed under s75Wof the EP&A Act by virtue of section 8J(8)(a) of the EP&A Regulation, because the original consent was granted by the Minister under section 100A or 101 of the EP&A Act.

The modification is for the extension of operating hours for the importation of VENM and ENM to the site. An environmental assessment of noise and vibration impacts has been undertaken and concluded that it is unlikely that the modification will have any significant environmental impact. The additional noise and vibration impacts from the proposed extension of operating hours have concluded that extending the day time period to include the proposed haulage hours is considered reasonable. The additional noise and vibration impacts from internal traffic movements are also expected to be minimal.

The noise and vibration assessment recommends that PLDC continues to implement effective administrative mitigation measures to control the traffic noise impacts, including the division of overall daily haul traffic between several access locations to reduce the traffic noise impact on any one road segment. The report also recommends that the Noise Management Plan should be updated to document the traffic noise management procedures.

With the implementation of effective administrative measures to control the noise impact to acceptable levels and meet the relevant noise criteria, the overall noise impact of the s75W modification is expected to be negligible.

Predicted vibration levels at surrounding receivers are below the recommended criterion of Curve 4 of AS2670.2, and the estimated VDV is predicted to be below 0.2 $m/s^{1.75}$ and therefore the vibration impact of the VENM/ENM haul traffic is expected to be minimal and meet the relevant vibration criterion.

Appendix A

Penrith Lakes Development Corporation

Importation of VENM and ENM

Section 75W Application: Assessment of Noise and Vibration Impacts - Extended Hours of Operation

AAc/223104/03/R01

Rev A | 30 October 2015

Job number 223104

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Document Verification

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Job title		Importation of VENM and ENM		Job number 223104
Document title		Section 75W Application: Assessment of Noise and Vibration Impacts - Extended Hours of Operation		File reference
Document ref		AAc/223104/03/R01		
Revision	Date	Filename	0001Report_Section75W_VENM+ENM_Haulage.docx	
Draft 1	12 Aug 2014	Description	First draft	
			Prepared by	Checked by	Approved by
		Name	Cameron Hough	Chris Field	Chris Field
		Signature			
Rev A	30 Oct 2015	Filename	Report_Noise_S75W_AdditionalHours.docx	
		Description	Update of previous (2014) S75W assessment to include extended proposed hours of VENM haulage.	
			Prepared by	Checked by	Approved by
		Name	Cameron Hough	Simon Ham	Cameron Hough
		Signature			
		Filename		
		Description		
			Prepared by	Checked by	Approved by
		Name			
		Signature			
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		Name			
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Issue Document Verification with Document ✓

Contents

Tables

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1 Introduction

Penrith Lakes Development Corporation (PLDC) currently has approval via modification of approvals DA2, DA3 and DA 4 for the site to import up to 5 million tonnes of Excavated Natural Material (ENM) and Virgin Excavated Natural Material (VENM) via road haulage.

PLDC propose to modify DA2, DA3 and DA4 to allow an extension of the hours of haulage of the ENM and VENM, with the proposed operational hours being from 6:00 am to 9:00 pm. No change to the total number of truck movements is proposed.

The proposed break-down of truck movements is as follows:

- 6:00 am to 7:00 am Up to 40 truck movements/hour
- 7:00 am to 6:00 pm Up to 60 truck movements/hour
- 6:00 pm to 9:00 pm Up to 30 truck movements/hour

Arup has been commissioned by Penrith Lakes Development Corporation (PLDC) to prepare an Environmental Assessment (EA) in order to assess the potential environmental effects associated with the changed hours of operation of the previous consent granted for the importation of ENM and VENM to the Penrith Lakes Scheme.

This EA is to accompany an application to modify the existing consents to Development Application 2 (DA2), Development Application 3 (DA3), and Development Application 4 (DA4). The EA and modified Development Applications are to be lodged by PLDC to the Minister for determination under Section 75W of the *Environmental Planning and Assessment Act* 1979.

This report contains an assessment of the noise and vibration impacts resulting from the proposed modification of importation of ENM and VENM, in accordance with appropriate assessment criteria set by the NSW Office of Environment and Heritage (OEH). This assessment is subsequent to an original Statement of Environmental Effects for the project undertaken in 2008 for the original modification that was approved in 2009, a revised EA for haulage of VENM undertaken in 2012, and a revised EA for haulage of ENM and VENM in 2014.

Given the relatively short timeframe between the previous assessment and this current assessment, no additional noise measurements have been conducted as the previous noise survey and subsequent noise monitoring following the commencement of VENM haulage is considered to adequately capture the existing road traffic noise environment on the road network adjacent to the Penrith Lakes scheme.

2 Criteria

2.1 Operational Noise Criteria

There are two sets of conditions in respect of noise emitted from within the PLDC site:

- one from the EPL issued by the Department of Environment and Conservation (DEC), now Office of Environment and Heritage (OEH), and
- from the Minister for Planning for the DA2, DA3 and DA4 Consents.

Numerically, these consent conditions impose the same noise criteria for noise from internal movements within the PLDC site. Details of the consent conditions are given below. Acoustic terminology is presented in Appendix D.

2.1.1 DEC Conditions

The DEC, in issuing Licence No. 002956, set the following conditions in respect of noise emitted from the development:

L6.1 Noise from the premises must not exceed the following noise emission criterion for the duration specified:

a) L_{AMAX} – 70 dB(A) at any time;

b) $L_{A10,\ 15minutes}$ – 65 dB(A) for any continuous 4 weeks at any residential premises specified in L6.2;

c) $L_{A10,\ 15\ minutes}$ – 60 dB(A) for any continuous 3 months at any residential premises specified in L6.2;

d) $L_{A10,\ 15\ minutes}$ – 55 dB(A) for any continuous 2 years at any residential premises specified in L6.2; and

e) Less than 55 dB(A) for the remainder of the time.

L6.2 Noise from the premises is to be measured at any point within one metre of the boundary of any residential premises, excluding residential premises on Castlereagh Escarpment, to determine compliance with condition L6.1.

2.1.2 Minister for Planning and Environment Conditions – DA2, DA3 and DA4 consent

The Minister for Planning and Environment, as the consent authority, set the following conditions in the consent to DA2, DA3 and DA4, in respect of noise emitted from the development. Extra conditions within the DA2 consent are denoted by italics.

32) The Applicant shall not exceed the following maximum noise levels in those areas designated.

a) Cranebrook Village and Other Dwellings outside the Scheme area (but not on the Escarpment)

(i) **Maximum Noise Levels**

These criteria are the same as those given in L6.1 of the DEC conditions above.

(ii) The above absolute maximum may be exceeded as a result of construction of the noise control works, e.g. noise bunds.

(iii) In the area south of Cranebrook village all rehabilitation works shall be setback 20 metres from the residential area.

(iv) In the area north of Cranebrook village all rehabilitation works shall be setback 50 metres from residential areas.

b) Dwellings on the Castlereagh Escarpment

(i) Maximum Noise Levels

Noise levels as measured at any one dwelling on the Escarpment are not to exceed the following criteria.

Maximum Noise Limits (L_{A10})

Absolute maximum – 70 dB(A)

Greater than – 65 dB(A) for 3 months

Greater than – 55 dB(A) for 30 months

Less than – 55 dB(A) for remainder of time

(ii) All extraction and rehabilitation to take place a minimum of 200m from dwellings on the escarpment.

2.2 Internal Traffic Noise

Truck movements on internal haul roads within the PLDC scheme are covered by the existing DEC and DA2/DA3/DA4 consents criteria, including transportation of fill within the site. Under the proposed modification to these consents, these internal traffic movements are expected to continue in order to transport the VENM and ENM around the PLDC site, and therefore the overall number of internal truck movements is expected to be similar with the changed operating hours.

Note also that the DEC and DA2/DA3/DA4 criteria apply at all times of the day and therefore remain applicable for changed hours of site operation.

Therefore, the additional noise and vibration impacts from internal traffic sources resulting from the changed hours of operation of the importation of ENM and VENM are considered to be negligible, and only impacts from external traffic sources will be considered as part of this assessment.

2.3 External Traffic Noise

2.3.1 Road Noise Policy

Traffic noise impacts from public roads in NSW are assessed against the OEH's *Road Noise Policy* (RNP[1]), which provides guidelines for acceptable noise levels from new and existing roadways, and from developments which have the potential to create additional traffic on existing roadways.

The RNP criteria follow a 'non-mandatory performance-based approach', in that the criteria are given as targets for traffic noise from developments, while recognising that in some cases it may not be feasible to comply with the targets and a long-term noise mitigation strategy is more suitable.

The importation of VENM and ENM has been treated as a "land use with the potential to create additional traffic" for the purposes of setting noise criteria. The RNP criteria are given for two time periods – day (0700-2200) and night (2200-0700).

The proposed operation hours of the modified ENM and VENM importation are 6:00 am to 9:00 pm, which would include one hour (6:00 am to 7:00 am) during the 'night' time period.

Because of the limited number of traffic movements occurring during the Night time period (up to 40), the change to the $L_{Aeq,9hr}$ noise level resulting from the addition of 40 vehicle movements will be negligible.

Accordingly it is proposed to assess noise impacts from haulage between 6:00 am and 7:00 am using the concept of "shoulder periods" from the RNP, which notes that:

"at times, it may be reasonable to vary the standard time periods applied to the day and night. For example, the noise levels in an area may begin to rise sharply earlier than 7:00 am... due to early morning activity from the community. In these situations, it is reasonable to consider varying the standard day-time and night-time periods".

Logger data from the vicinity of PLDC (e.g. the background traffic monitoring data from August/September 2013 prior to the commencement of VENM haulage, see Arup report *PLDC VENM Importation – Background and Trial Noise Monitoring Report* dated 26 September 2013), shows that background traffic flows on the surrounding road network have a morning peak starting at or before 6:00 am. Example logger graphs from the background noise trial are shown in Figure 1 through Figure 4below.

1 NSW Office of Environment and Heritage *Road Noise Policy (July, 2011)*

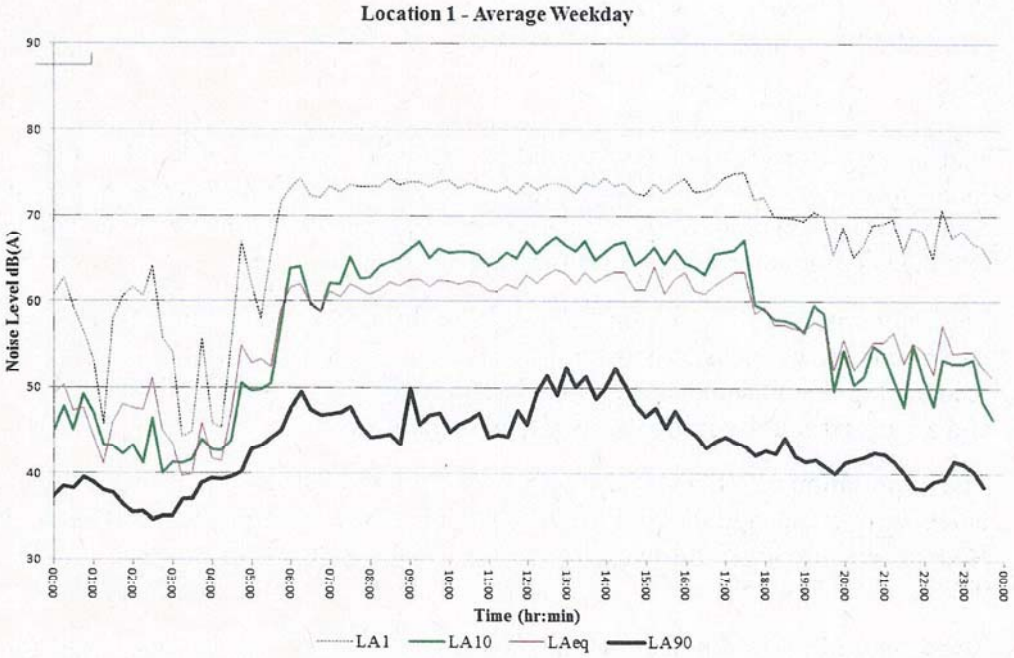

Figure 1 Average Weekday Traffic Noise Levels, Location 1 (Old Castlereagh Road), 9 August to 16 August 2013

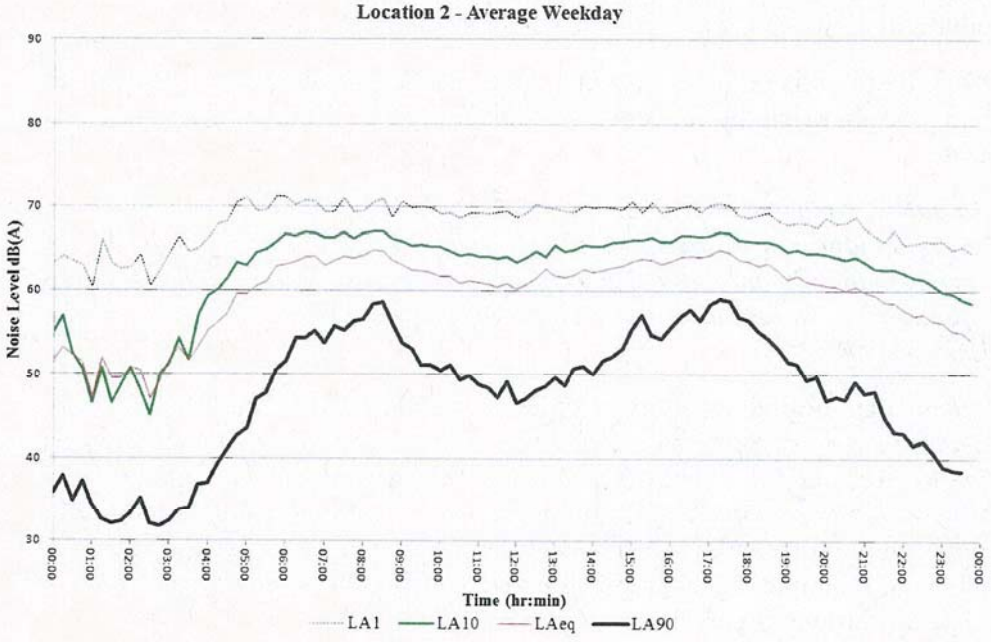

Figure 2 Average Weekday Traffic Noise Levels, Location 2 (Castlereagh Road, south of Cranebrook Road), 9 August to 16 August 2013

Figure 3 Average Weekday Traffic Noise Levels, Location 3 (Castlereagh Road, near Cranebrook Road intersection), 9 August to 16 August 2013

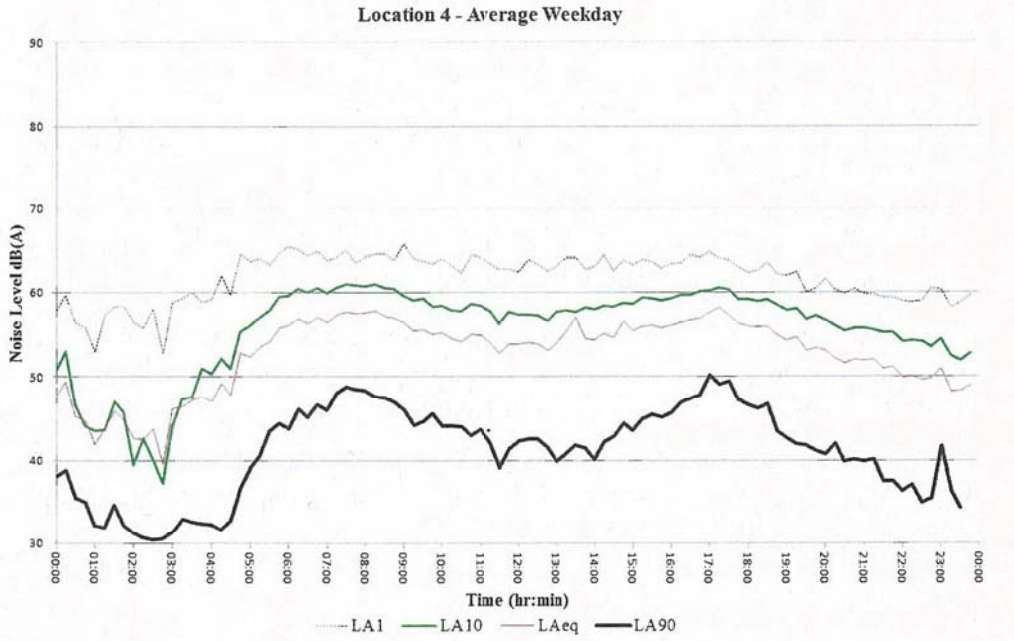

Figure 4 Average Weekday Traffic Noise Levels, Location 4 (Castlereagh Road north of Cranebrook Road), 9 August to 16 August 2013

Based on the existing traffic noise data, it is considered reasonable to modify the day and night time periods as follows:

- Day 6:00 am to 10:00pm (16hr)

- Night 10:00pm to 6:00am (8hr)

The appropriate noise criteria from the RNP for traffic noise from the importation of VENM are given below in Table 1.

Road	RNP Category	Time Period	Daytime Criterion
Freeway/arterial/sub-arterial roads	3. Existing residences affected by additional traffic on existing freeways/arterial/sub-arterial roads generated by land use developments	16-hour	60 dB $L_{Aeq,16hr}$

Table 1 NSW Road Noise Policy

Where existing traffic noise levels are above the noise assessment criteria, the primary objective is to reduce these through feasible and reasonable measures to meet the assessment criteria. A secondary objective is to protect against excessive decreases in amenity as the result of a project by applying the relative increase criteria.

In assessing feasible and reasonable mitigation measures, an increase of up to 2 dB represents a minor impact that is considered barely perceptible to the average person.

See Appendix D for a glossary of relevant acoustic terminology.

2.4 Vibration

Criteria for vibration are given by the DECC "Assessing Vibration" guideline[2] . As with the RNP, these criteria are non-mandatory goals for new developments. Vibration criteria are based on two components:

- Maintaining human comfort of building occupants
- Preventing damage to a building and its contents

The human comfort vibration criterion is significantly below the building damage vibration criterion, and therefore achieving the human comfort condition generally results in the building damage condition being met.

For intermittent vibration sources, such as road and rail traffic, the concept of a 'vibration dose value' (VDV) has been adopted. For residences, the acceptable VDV range is as follows:

- Preferred value: 0.2 $m/s^{1.75}$
- Maximum value: 0.4 $m/s^{1.75}$

2 NSW Department of Environment and Conservation (2006) – *Assessing Vibration: a technical guideline*

The DECC's vibration guidance is generally based on British Standard BS6472[3]. BS6472 and its Australian equivalent, Australian Standard AS2670.2[4], give a series of rating curves to assess human exposure to vibration levels, and provide further guidance on acceptable vibration levels. Table 2 of AS2670.2 recommends that daytime continuous or intermittent vibration levels in residential receivers should not exceed Curve 4 of AS2670.2.

3 British Standard BS6472.2 (1992) *Guide to evaluation of human exposure to vibration in buildings (1 to 80 Hz)*

4 Australian Standard AS2670.2 (1990) – *Evaluation of human exposure to whole-body vibration. Part 2: Continuous and shock-induced vibration in buildings (1 to 80 Hz)*

3 Noise-Sensitive Receivers

Noise Sensitive Receiver locations were identified as being representative of the residences along a section of road, and were selected to be on a section of road where VENM haulage trucks are proposed to be used. The receiver locations have not changed since the previous 2014 noise assessment.

The project noise-sensitive receivers (NSRs) are:

- **Receiver 1:** 1999 Old Castlereagh Road – Old Castlereagh Road, west of Castlereagh Road roundabout
- **Receiver 2:** 538 Cranebrook Road and The Lakes Church, 540 Cranebrook Road (Receiver 2A) – on Castlereagh Road, north of Andrews Road roundabout.
- **Receiver 3:** Lot 5, Cranebrook Village– Castlereagh Road, north of Cranebrook Road; and Cranebrook Road.
- **Receiver 4:** 74 Church Lane (faces Castlereagh Road)
- **Receiver 5:** receivers on The Northern Road (not shown in Figure 5) (typically ~50 m from the road edge)
- **Receiver 6:** receivers on Andrews Road (typically ~ 30 m from the road edge and protected by a noise bund)

The locations of these receivers are shown in Figure 5 below:

Figure 5 Overview of Receiver Locations

Receiver 1 is located on Old Castlereagh Road, and is set back approximately 30 m from the edge of the carriageway, and is considered to be characteristic of the residential properties located on the northern side of Old Castlereagh Road, and will be exposed to traffic noise from any VENM haul trucks using the former Cemex/Fine Sand Plant access point.

Receivers 2 and 2A are located adjacent to the new alignment of Castlereagh Road, adjacent to the intersection with Nepean Street. It is unclear whether these receivers are now considered to be on the new Castlereagh Road alignment, as historically they were located on Cranebrook Road prior to the realignment.

These receivers are located approximately at the point where the posted speed limit on Castlereagh Road changes from 60 km/h to 80 km/h, and are located north of one of the proposed access point for VENM haul trucks, the former Pioneer Plant access. These receivers therefore will not be exposed to noise from any VENM haul trucks using this access point. However, the traffic flow at these receivers is considered to be representative for Castlereagh Road north of Andrews Road.

In future there are likely to be additional noise-sensitive receivers on Castlereagh Road north of Andrews Road. These receivers are located south of the Pioneer Plant access site and will be exposed to any noise from trucks using this access site. To account for these future receivers, noise levels at Receivers 2/2A have been predicted, including traffic movements to the Pioneer Plant access site, in order to model the noise exposure for all receivers along this road segment.

Receiver 3 is located on Cranebrook Road, near the intersection of Castlereagh Road and Cranebrook Road, and is set back approximately 20 m from Cranebrook Road. Noise levels at this receiver are dominated by traffic flows along Cranebrook Road. This location is therefore considered representative of other receiver locations aligning Cranebrook Road.

An additional receiver (Receiver 4, 74 Church Lane Castlereagh), which is set-back approximately 80 m from Castlereagh Road, has been introduced to assess noise from Castlereagh Road north of Cranebrook Road alone. This receiver is considered to be characteristic of the receivers along this road segment.

Additional receivers (Receiver 5 and Receiver 6) have been used to assess noise impacts from VENM/ENM movements on The Northern Road and Andrews Road, respectively; however due to the greater traffic volumes on these road segments the relative impact of PLDC traffic movements is expected to be reduced compared to the other receivers.

3.1 Truck Routes

Additional VENM and ENM traffic is likely to have the greatest acoustic impact on the roads immediately adjacent to the Penrith Lakes Scheme. At locations further from the PLDC site, the presence of traffic from other sources means that the additional traffic noise impact from the VENM/ENM haul trucks is likely to be negligible.

Figure 6 and Figure 7 present an overview of the proposed VENM/ENM haul truck movements on the road segments surrounding the PLDC site for Trucks approaching from both the north and south respectively.

The proposed change in hours does not entail a change in the proposed haulage routes for haulage traffic.

Figure 6 Vehicle Access Routes for Trucks Approaching from the North

Figure 7 Vehicle Access Routes for Trucks Approaching from the South

The most affected roads are likely to be Old Castlereagh Road and Castlereagh Road, both of which form part of the PLDC site boundaries, and Cranebrook Road.

Old Castlereagh Road forms the access route for heavy vehicle traffic to and from the former Cemex plant and the Fine Sand plant, while Castlereagh Road and Cranebrook Road carry through traffic between Penrith and Windsor.

4 Traffic Noise Survey

4.1 Survey Methodology

A traffic noise survey was conducted between the 9th and 17th May 2012 at three measurement locations, corresponding closely to Receivers 1, 2 and 3. Unattended noise loggers were used to conduct statistical noise measurements over the course of the survey, measuring the L_1, L_{10}, L_{eq}, and L_{90} parameters over 15-minute time periods.

The unattended noise measurements were supplemented by attended noise measurements of the traffic noise levels at the measurement locations. Roadside measurements were also conducted to measure source noise levels from the existing haul trucks using Old Castlereagh Road, with several truck pass-bys being recorded and the single-event noise exposure level (SEL) for a haul truck being measured for use in noise predictions.

The noise loggers were located in the vicinity of each noise-sensitive receiver, with the location selected to minimise the influence of other non-traffic noise sources at the receiver.

Logger and receiver locations are shown in the following figures below.

Figure 8 2012 Survey: Receiver 1 and Logger 1 Location Plan (Old Castlereagh Road)

Figure 9 2012 Survey: Receivers 2/2A and Logger 2 Location Plan (Castlereagh Road)

Figure 10 2012 Survey: Receiver 3 and Logger 3 Location Plan (Cranebrook Road)

Figure 11 2012 Survey: Receiver 4 Location Plan, 74 Church Lane (closer to Castlereagh Road)

4.2 Measured Data

Average weekday noise measurements for each logger location are presented in the figures below. Daily noise data is available on request.

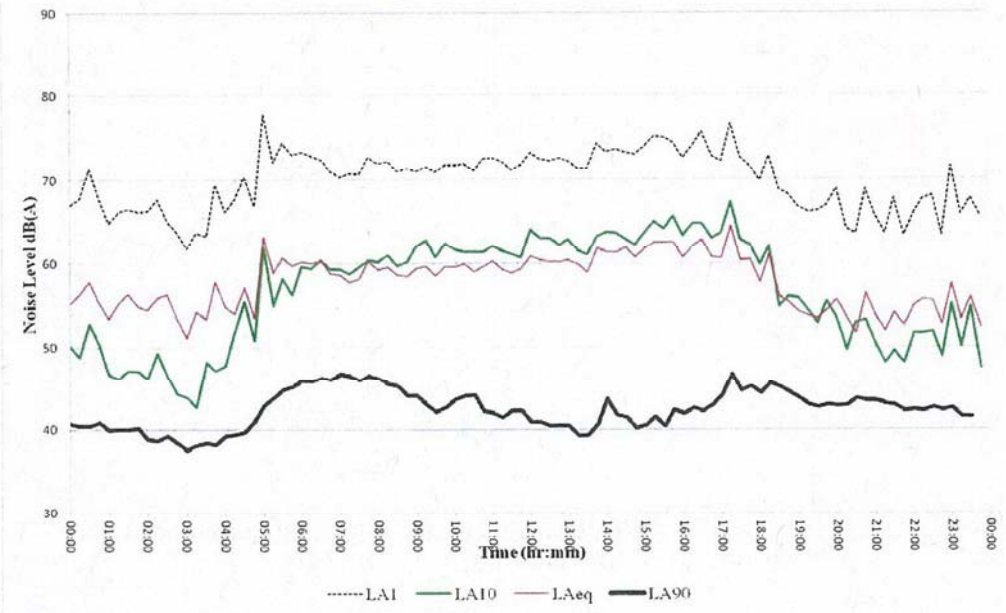

Figure 12 Average Weekday Noise Measurements, Logger 1 (Old Castlereagh Road),9 May 2012 - 17 May 2012.

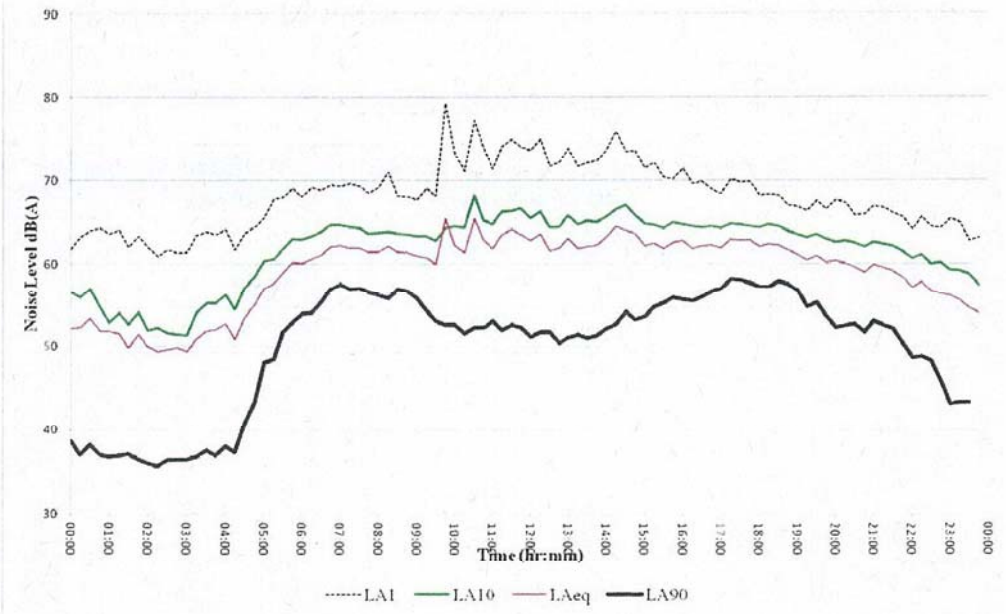

Figure 13 Average Weekday Noise Measurements, Logger 2 (Castlereagh Road), 9 May 2012 - 17 May 2012.

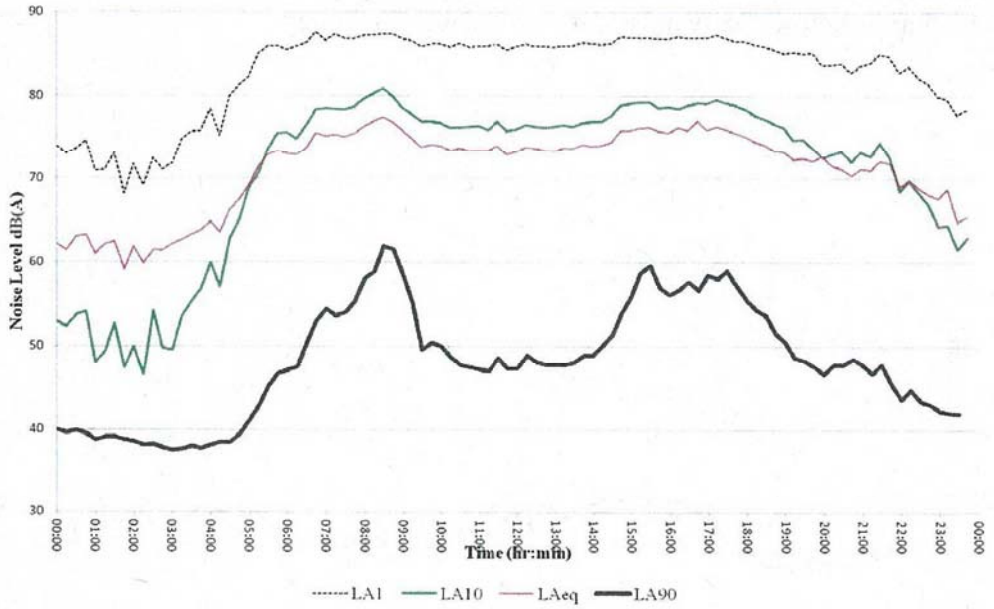

Figure 14 Average Weekday Noise Measurements, Logger 3 (Cranebrook Road), 9 May 2012 - 17 May 2012.

The logger locations were typically at a different distance from the carriageway than the nearest noise-sensitive receiver, and therefore the measured traffic noise levels was corrected to the distance from the road to the receiver. Additionally, a 2.5 dB(A) façade correction must be applied when assessing noise levels at a residence.

An overview of measured traffic noise levels is given below in Table 2. Noise levels at the noise sensitive receivers have been calculated, and are given in Table 3:

Table 2 Traffic Noise Survey Measurements, dB re 20 µPa

Logger Location	Parameter	Approximate Distance from Carriageway Edge	Measured Average Weekday Noise Level
1	$L_{Aeq,15hr}$	9 m	62 dB
2	$L_{Aeq,15hr}$	22 m	60 dB
3	$L_{Aeq,15hr}$	1.5 m	75 dB

Table 3 Measured and Predicted Existing Traffic Noise Survey Measurements at Noise Sensitive Receivers, dB re 20 μPa

Receiver	Parameter	Approximate Distance from Carriageway Edge	Façade-Corrected Average Weekday Noise Level	Criterion	Existing Levels Meet Criterion?
1	$L_{Aeq,15hr}$	31 m	58 dB	60 dB	Yes
2	$L_{Aeq,15hr}$	25 m	64 dB	60 dB	No
2A	$L_{Aeq,15hr}$	16 m	66 dB	60 dB	No
3	$L_{Aeq,15hr}$	19 m	71 dB	60 dB	No
4	$L_{Aeq,15hr}$	80 m	57 dB	60 dB	Yes
5	$L_{Aeq,15hr}$	50 m	59 dB	60 dB	Yes*
6	$L_{Aeq,15hr}$	30 m	59 dB	60 dB	Yes*

* Just under criterion; treated as being exceeding the criterion as discussed below

Measured and predicted levels show that measured existing road traffic noise levels currently exceed noise criteria at all receivers except for those on Old Castlereagh Road (Receiver 1) and Castlereagh Road north of Cranebrook Road (Receiver 4). Receivers 5 and 6 (The Northern Road and Andrews Road) are just under the noise criteria. In this circumstance, the RNP and its predecessor the ECRTN allows for a 2 dB(A) 'relative increase' criterion to be applied since existing noise levels are almost at the absolute 60 dB(A) criterion.

As such, the applicable criteria from the RNP are generally that noise from the VENM/ENM operations should not increase the existing noise levels by more than 2 dB(A).

With respect to Old Castlereagh Road and Castlereagh Road north of Cranebrook Road, VENM/ENM truck movements should not give rise to an exceedance of the 60 dB(A) criterion.

4.3 Haul Truck Pass-By Measurements

Several measurements of haul truck pass-bys were made by the edge of the carriageway of Old Castlereagh Road during the site visit on 20 February 2008. These measurements are still considered relevant to this updated assessment since the truck types used for haulage to/from PLDC are unlikely to change significantly. They were made at a distance of approximately 2.5 m from the carriageway edge, from trucks travelling on both sides of the carriageway.

Table 4 Haul Truck Pass-By Noise Survey Measurements, dB re 20 μPa

Carriageway Side	Number of Trucks	SEL	L_{max}
Near	5	88-93 dB	87-93 dB
Far	5	87-91 dB	86-90 dB
Average of both sides	10	92 dB	90 dB

4.4 Additional Pre-VENM Logging

A follow-up noise survey was undertaken in August 2013 in order to check baseline traffic noise levels on the PLDC road network immediately prior to the commencement of VENM haulage. This data can be used to check the calibration of the traffic noise models.

Four consecutive weeks of background monitoring with no VENM importation were measured from 9 August 2013 to 6 September 2013. The logging locations were generally similar to the logger locations from the previous 2008 and 2012 traffic noise surveys, with some changes:

- Logger 2 was located further to the north along Castlereagh Road to minimise the potential impact of pedestrian traffic on measured noise levels
- Logger 3 was located so as to measure noise from Castlereagh Road north of Cranebrook Road. In 2012 this logger was set up in a position where noise on Cranebrook Road was dominant.

Figure 15 – 2013 Survey: Receiver 1 and Logger 1 Location Plan (Old Castlereagh Road)

Figure 16 – 2013 Survey: Receivers 2/2A and Logger 2 Location Plan (Castlereagh Road)

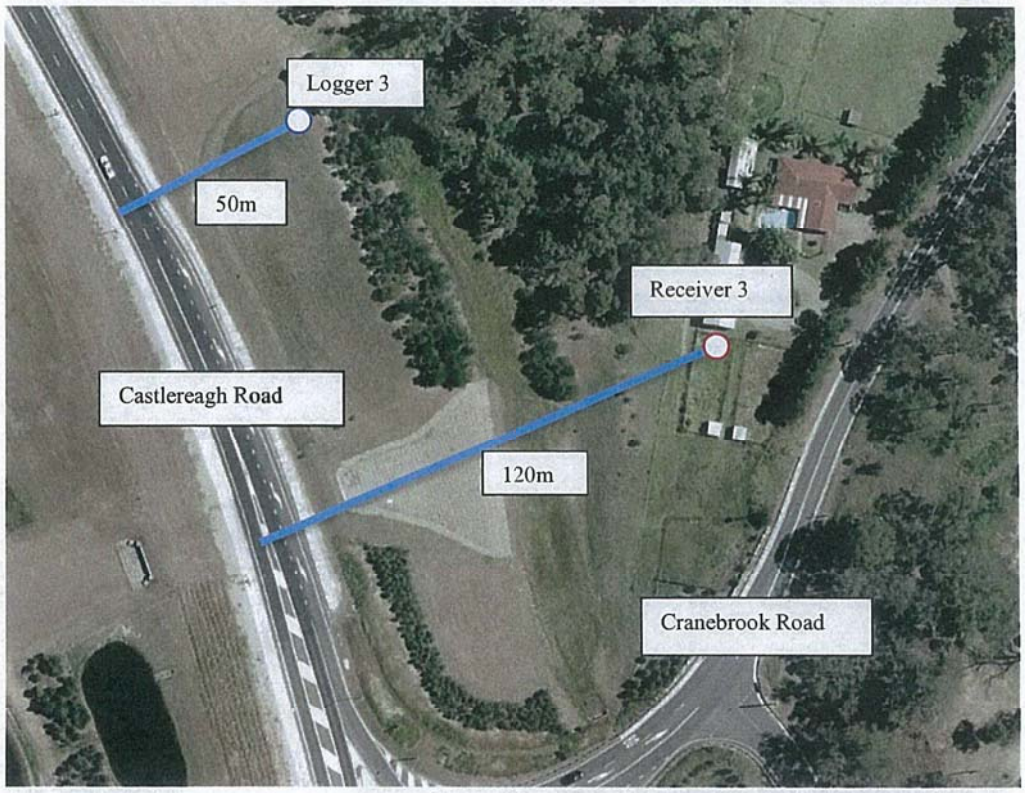

Figure 17 – 2013 Survey: Receiver 3 and Logger 3 Location Plan (Cranebrook and Castlereagh Roads)

Figure 18 – 2013 Survey: Receiver 4 and Logger 4 Location Plan (Castlereagh Road)

5 Noise Predictions

This assessment is subsequent to an original Statement of Environmental Effects for the project undertaken in 2008 and the revised Environmental Assessments conducted in 2012 and 2014 and has been amended based on updated noise and traffic monitoring data.

5.1 Methodology

Noise levels were predicted for traffic on across the proposed years of operation (2014-2018) for the scenario with and without the additional VENM/ENM haulage trucks.

Traffic noise levels were predicted using a combination of the CoRTN[5] traffic noise model, and the measured truck pass-by SEL levels (see Section 3.3). CoRTN is a widely-used prediction method for traffic noise from light vehicles, and is based on measured traffic noise levels in the UK. CoRTN has also been validated for Australian conditions, with studies showing that a correction factor of -1.7 dB(A) should be applied to the predicted CoRTN noise level for Australian road conditions[6].

A calibration study was conducted, comparing the predicted noise levels from CoRTN to the measured traffic noise levels from the logger survey.

Predicted CoRTN noise levels for Castlereagh Road were found to generally correlate well with the measured noise levels, although the difference between measured and CoRTN-predicted noise levels was greater for Cranebrook Road and Old Castlereagh Road (Receiver 3).

This is believed to be due to the greater proportion of heavy vehicles on Old Castlereagh Road and Cranebrook Road. CoRTN is based on measurements of traffic noise in the UK, with small "lorry"-type trucks, and is therefore likely to under-predict noise levels from the articulated semi-trailer heavy vehicles used for existing and future truck movements from the PLDC site.

For Old Castlereagh Road and Cranebrook Road only, CoRTN was used to predict traffic noise levels from light vehicles, with heavy vehicle noise levels being predicted using the measured truck pass-by SEL noise levels. This approach was found to correlate well with the measured noise levels from the unattended noise survey.

Because the 2012 and 2013 surveys use slightly-different logger locations, noise levels have been distance-corrected to receiver locations in order to demonstrate the calibration of the model.

5 United Kingdom Department of Transport (1988) – *Calculation of Road Traffic Noise*, Her Majesty's Stationery Office

6 NSW Roads and Traffic Authority (1992) – *RTA Environment Manual, Volume 2*

Receiver	Parameter	2012 (Measured)	2012 (Predicted)	2013 (Measured)	2013 (Predicted)
1	$L_{Aeq,15hr}$	58 dB	59 dB	59 dB	59 dB
2	$L_{Aeq,15hr}$	64 dB	63 dB	64 dB	63 dB
2A	$L_{Aeq,15hr}$	66 dB	64 dB	65 dB	65 dB
3	$L_{Aeq,15hr}$	71 dB	71 dB	56 dB*	71 dB
4	$L_{Aeq,15hr}$	-	57 dB	57 dB	57 dB

Table 5 Acoustic CoRTN model calibration (free-field levels at logger)

*Note measured level is due to Castlereagh Road alone. Cranebrook Road is the dominant noise source at this receiver.

Predicted noise levels for the 2012 and 2013 Scenarios can be seen to be within 2 dB of measured levels. This validates the selection of the CoRTN model and the modelling methodology.

For Receiver 4 (74 Church Lane) and Receiver 6 (Andrews Road residential receivers), there is a significant height difference between the road segment and the receiver, and therefore where there is the potential for screening of the noise source. For this receiver, noise levels from the road segment were modelled using a "split-height" approach, accounting for the different source height of heavy vehicles compared to cars, and therefore resulting in different screening and ground effect values for each noise source.

Source heights of 1.5 m above the road surface for engine noise and 3.6 m above the road surface for exhaust noise were used for the split height modelling. The exhaust noise source was assumed to be 8 dB(A) lower than the engine noise source, following the guidance of the Transportation Noise Reference Book (TNRB)[7].

Traffic volumes were provided by Arup Transport Planning for the approved quarry + VENM haulage scenario and for the proposed additional VENM/ENM scenario, based on 476 additional VENM/ENM haul trucks movements per day (2015/2016 and 2016/2017), reducing to 238 VENM/ENM haul truck movements in 2017/2018.

Each traffic "movement" for noise predictions is a single truck pass-by of a receiver. If trucks are operating "two-way" on a road segment then each truck will count as two "movements".

The VENM/ENM truck movements were assumed to be distributed evenly between the three site entrances. This results in the following distribution of the additional haul trucks on each road segment:

- Andrews Road 100%
- Castlereagh Road (north of Cranebrook Road) 33%
- Castlereagh Road (north of Andrews Road) 67%
- Cranebrook Road 100%

7 Nelson, P (ed)(1987), *Transportation Noise Reference Book*, Butterworths

- The Northern Road 100%

The traffic volumes used for prediction are given for each year of proposed operation in Table 6 to Table 9 below. For reference, the following explanations are provided for each column heading:

- ADV – Average Daily Vehicles – Corresponds to the total number of vehicles calculated across the 15 hour period from 7:00 am to 10:00 pm.
- %HGV – Percentage of Heavy Goods Vehicles – the percentage of total number of vehicles that constitutes heavy vehicles (i.e. trucks).
- LV/Day – Light Vehicles per day – the component of total traffic that constitutes light vehicles (i.e. number of cars).
- HGV/Day – Heavy Goods Vehicles per day – the component of total traffic that constitutes heavy goods vehicles (i.e. number of trucks)

Segment	2014/15 (Existing Quarry + Approved VENM)[8]			
	Approved VENM Haulage			
	ADV (6am to 10pm)	%HGV	LV / day	HGV / day
Old Castlereagh Rd	1812	22%	1413	399
Andrews Road	8660	19%	7049	1610
Castlereagh Rd near Nepean St	20853	11%	18623	2231
Castlereagh Rd north of Cranebrook Rd	11406	10%	10237	1168
Cranebrook Road	9448	11%	8385	1062
The Northern Road	21488	9%	19501	1987

Table 6 15 Hour Traffic Volumes used for Prediction, from Arup Transport Planning traffic assessment 2014/15

Segment	2015/16							
	Approved VENM Haulage				Proposed VENM/ENM Haulage (476 total truck movements)			
	ADV (6am to 10pm)	%HGV	LV / day	HGV / day	ADV (6am to 10pm)	%HGV	LV / day	HGV / day
Old Castlereagh Rd	1525	5%	1452	73	1670	13%	1452	218
Andrews Road	8387	14%	7243	1144	8607	16%	7243	1364
Castlereagh Rd near Nepean St	20574	7%	19135	1439	20942	9%	19135	1807
Castlereagh Rd north of Cranebrook Rd	11209	6%	10519	690	11429	8%	10519	910
Cranebrook Road	9365	8%	8616	749	9513	9%	8616	897
The Northern Road	21569	7%	20038	1531	21789	8%	20038	1751

Table 7 15 Hour Traffic Volumes used for Prediction, from Arup Transport Planning traffic assessment 2015/16

[8] 2014/2015 is the last year of operation of the quarry at PLDC and therefore baseline heavy vehicle numbers for subsequent years will be significantly reduced

Segment	2016/17							
	Approved VENM Haulage				Proposed VENM/ENM Haulage (476 total truck movements)			
	ADV (7am to 10pm)	%HGV	LV / day	HGV / day	ADV (7am to 10pm)	%HGV	LV / day	HGV / day
Old Castlereagh Rd	1563	5%	1491	73	1709	13%	1491	218
Andrews Road	8609	14%	7437	1172	8829	16%	7437	1392
Castlereagh Rd near Nepean St	21121	7%	19648	1473	21488	9%	19648	1840
Castlereagh Rd north of Cranebrook Rd	11506	6%	10801	705	11726	8%	10801	925
Cranebrook Road	9614	8%	8847	768	9762	9%	8847	915
The Northern Road	22144	7%	20575	1569	22364	8%	20575	1789

Table 8 15 Hour Traffic Volumes used for Prediction, from Arup Transport Planning traffic assessment 2016/17

Segment	2017/18							
	Approved VENM Haulage				Proposed VENM/ENM Haulage (238 total truck movements)			
	ADV (7am to 10pm)	%HGV	LV / day	HGV / day	ADV (7am to 10pm)	%HGV	LV / day	HGV / day
Old Castlereagh Rd	1530	0%	1530	0	1602	5%	1530	73
Andrews Road	8721	12%	7631	1090	8831	14%	7631	1200
Castlereagh Rd near Nepean St	21483	6%	20160	1323	21667	7%	20160	1506
Castlereagh Rd north of Cranebrook Rd	11694	5%	11083	611	11804	6%	11083	721
Cranebrook Road	9789	7%	9078	712	9863	8%	9078	786
The Northern Road	22608	7%	21111	1497	22718	7%	21111	1607

Table 9 15 Hour Traffic Volumes used for Prediction, from Arup Transport Planning traffic assessment 2017/18

The traffic data shows that the total number of heavy vehicle movements on surrounding roads peaks in 2014/2015 due to the existing quarry operations at PLDC. In subsequent years heavy vehicle numbers would reduce significantly. The proposed VENM/ENM haulage would effectively delay this significant reduction until after 2018.

Figure 19 presents the yearly changes in heavy vehicle movements associated with PLDC operation, which illustrates that traffic volumes (and therefore noise levels) associated with the VENM/ENM haulage project would actually in general be reduced compared to the 2014/2015 scenario, and would be reduced compared to the baseline (pre-VENM haulage) figure of ~870 vehicles per day for 2013/2014.

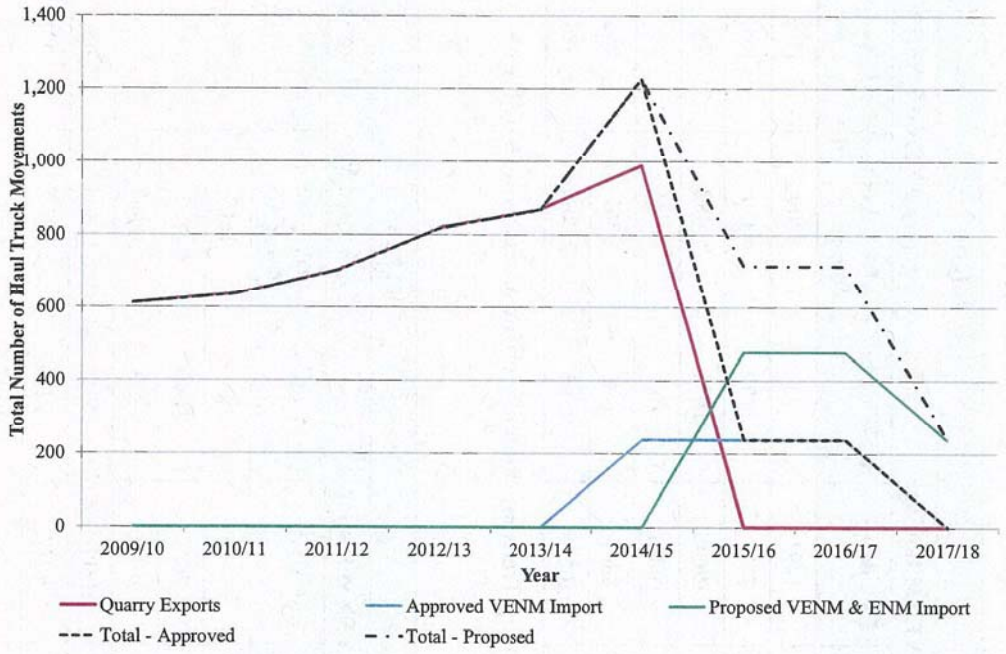

Figure 19 Existing and Proposed Heavy Vehicle Traffic Movements, PLDC

5.2 Predicted Noise Levels

Predicted noise levels, including a 2.5 dB facade reflection, are given for each of the proposed years of operation in

Table 10 below:

Table 10 Traffic Noise Predictions, 2012-2015 - dB re 20 μPa

	Receiver	Level ($dBL_{Aeq, 16hr}$)		Criterion	Acceptable?
		Existing Quarry Operations + Approved VENM Haulage	Proposed Additional VENM/ENM Haulage		
2014/2015	1	63 dB	-	-	-
	2	63 dB	-	-	-
	2A	65 dB	-	-	-
	3	73 dB	-	-	-
	4	58 dB	-	-	-
	5	59 dB	-	-	-
	6	60 dB	-	-	-
2015/2016	1	58 dB	61 dB	60 dB(A)	Yes*
	2	63 dB	63 dB	2 dB increase	Yes
	2A	65 dB	65 dB	2 dB increase	Yes
	3	71 dB	73 dB	2 dB increase	Yes
	4	58 dB	58 dB	60 dB(A)	Yes
	5	59 dB	59 dB	2 dB increase	Yes
	6	59 dB	61 dB	2 dB increase	Yes
2016/2017	1	58 dB	61 dB	60 dB(A)	Yes*
	2	63 dB	63 dB	2 dB increase	Yes
	2A	65 dB	65 dB	2 dB increase	Yes
	3	71 dB	73 dB	2 dB increase	Yes
	4	58 dB	59 dB	60 dB(A)	Yes
	5	59 dB	59 dB	2 dB increase	Yes
	6	59 dB	61 dB	2 dB increase	Yes
2017/2018	1	55 dB	58 dB	60 dB(A)	Yes
	2	63 dB	63 dB	2 dB increase	Yes
	2A	65 dB	65 dB	2 dB increase	Yes
	3	71 dB	72 dB	2 dB increase	Yes
	4	58 dB	59 dB	60 dB(A)	Yes
	5	59 dB	59 dB	2 dB increase	Yes
	6	59 dB	60 dB	2 dB increase	Yes

*Marginal exceedance of 1 dB(A); additionally this noise level is the same as the 2014/2015 traffic noise level (baseline).

The maximum expected traffic flow from VENM/ENM haulage of 476 truck movements is predicted to meet the road noise criteria for all road segments.

Noise levels for 2015/2016 are expected to be approximately the same as 2014/2015 for all road segments. This is because the additional VENM/ENM traffic is offset by the cessation of export truck movements from PLDC.

For 2018, noise levels on some road segments are predicted to decrease, due to the cessation of the approved VENM haulage traffic in 2018.

To illustrate the change in predicted noise levels with changing traffic flows, the following figures graph the predicted traffic noise levels for each year from 2012 to 2018 under the two scenarios ("existing approved operation", including VENM haulage, and "proposed VENM/ENM haulage").

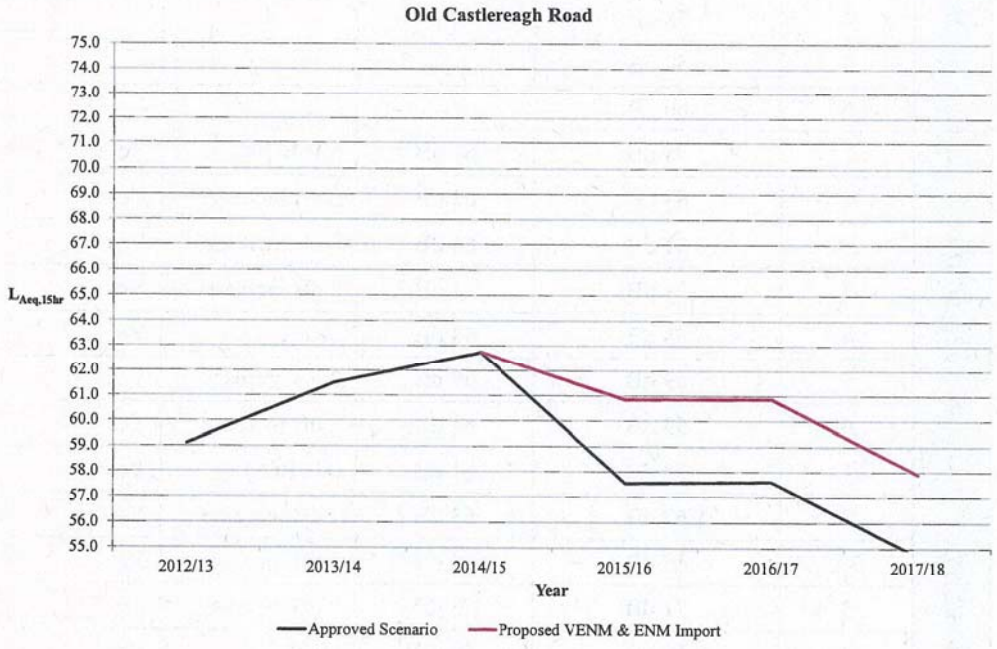

Figure 20 Predicted Traffic Noise Levels, 2012-2018, Old Castlereagh Road

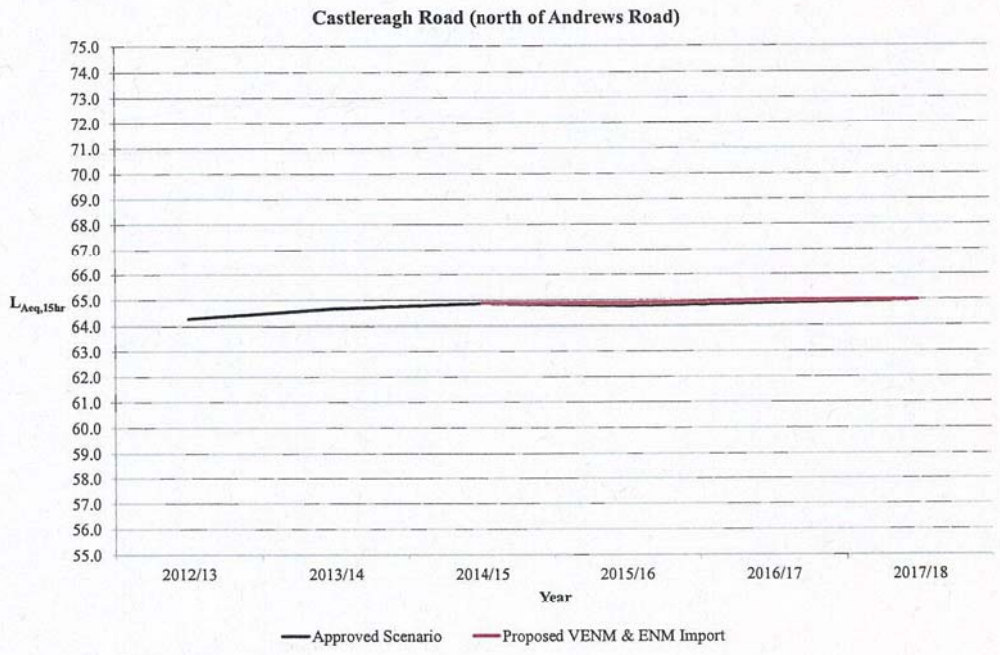

Figure 21 Predicted Traffic Noise Levels, 2012-2018, Castlereagh Road (north of Andrews Road) (Receiver 2A)

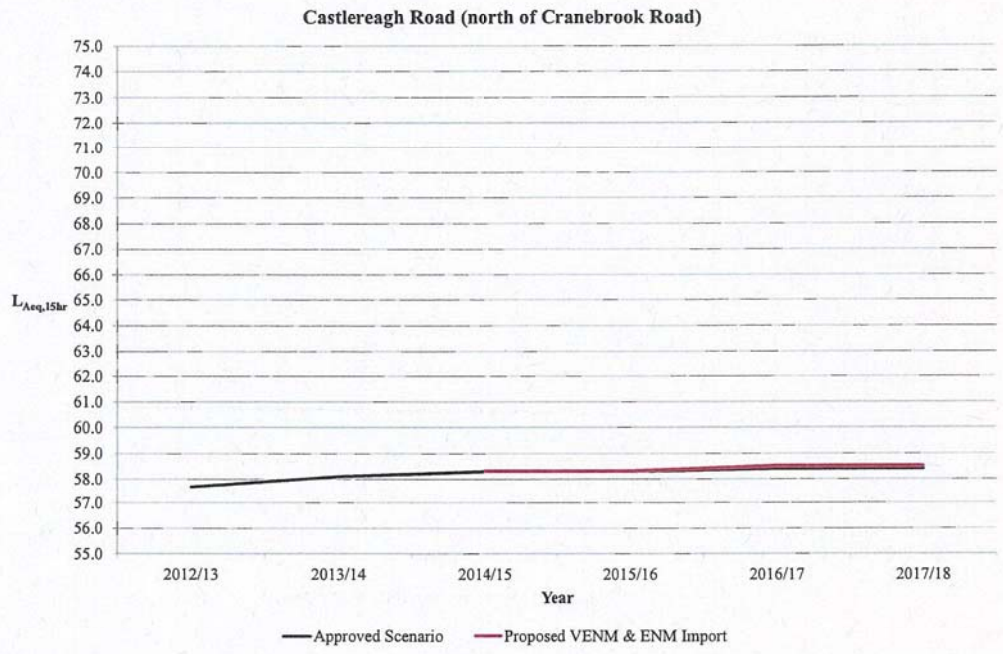

Figure 22 Predicted Traffic Noise Levels, 2012-2018, Castlereagh Road (north of Cranebrook Road)

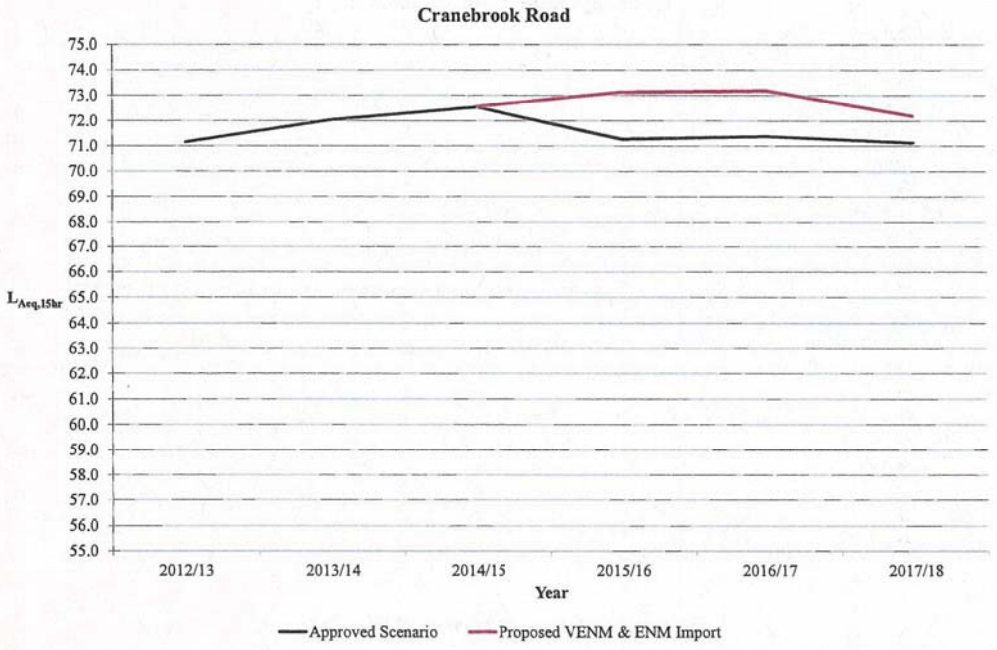

Figure 23 Predicted Traffic Noise Levels, 2012-2018, Cranebrook Road

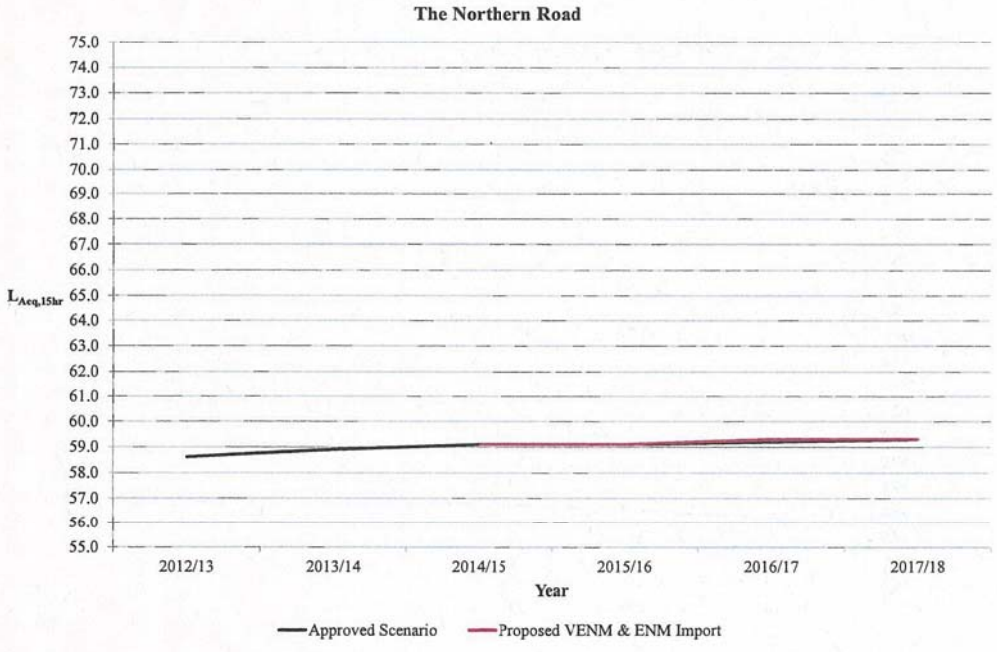

Figure 24 Predicted Traffic Noise Levels, 2012-2018, The Northern Road

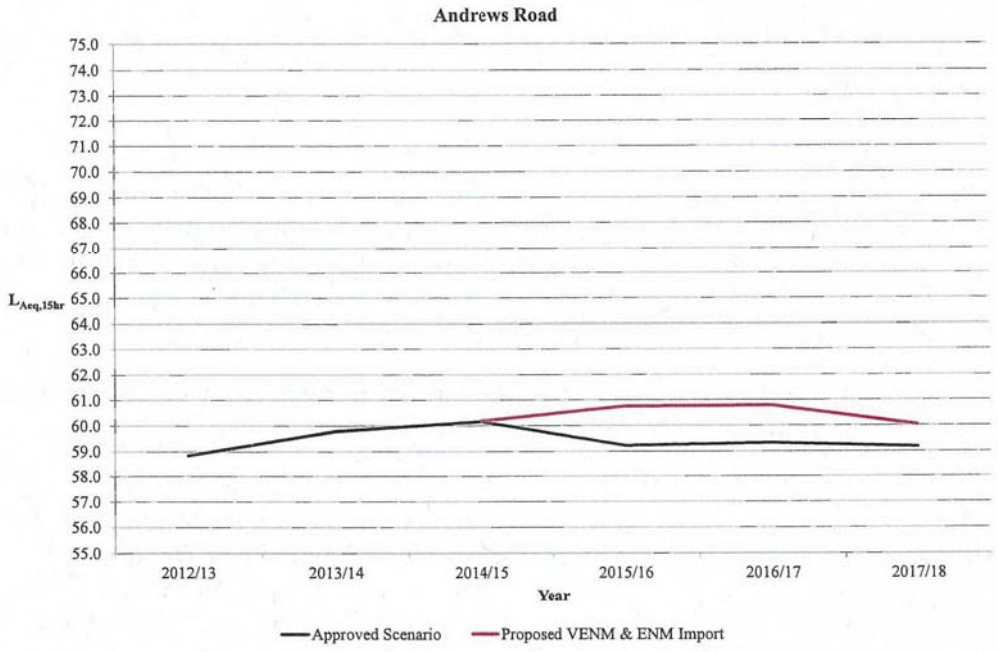

Figure 25 Predicted Traffic Noise Levels, 2012-2018, Andrews Road

6 Assessment of Effects

6.1 Traffic Noise

Depending on PLDC's operational requirements, the VENM/ENM traffic will likely use multiple access points to the PLDC site. The noise predictions above have been based on this based on 'typical' noise predictions where VENM/ENM haul trucks are assumed to be divided evenly between the three site entrances. (See Section 2.1 for the haulage route maps.)

For the typical scenario, VENM/ENM haul traffic is predicted to comply with the RNP criteria for receiver locations on all road segments.

The only road segment where the segment receiving the full number of VENM/ENM trucks would significantly affect overall noise levels is Old Castlereagh Road. Receivers along this road are of double-brick façade construction with window shutters as a result of noise mitigation from previous PLDC haulage projects[9]. This construction will likely result in a façade traffic noise reduction of 15 dB(A) or higher.

Under the extreme 'worst-case' scenario where all 476 truck movements use Old Castlereagh Road, the external noise level at the receivers on this road segment would be 64 dB $L_{Aeq,16hr}$. With the façade construction providing ~15 dB(A) noise reduction, this would result in an internal noise level of ~49 dB $L_{Aeq,16hr}$. NSW road noise criteria are typically based on lightweight dwelling constructions which provide ~10 dB(A) traffic noise reduction – i.e. the criterion of 60 dB $L_{Aeq,15hr}$ (external) is equivalent to ~50 dB $L_{Aeq,15hr}$ (internal).

Hence the façade upgrades to these dwellings provided by previous PLDC projects would result in internal noise levels under the 'worst case' VENM/ENM haulage scenario equivalent to the RNP criteria.

Historically, truck numbers along Old Castlereagh Road were significantly higher than the proposed VENM/ENM haulage.

Hence, even under the (unlikely) 'worst case' traffic scenario, internal noise levels for receivers on Old Castlereagh Road would comply with the equivalent RNP noise criteria. Under a typical operation scenario where truck numbers are divided between the various PLDC site entries, external and internal noise levels on Old Castlereagh Road would comply with the RNP criteria.

Hence noise impacts on receivers on Old Castlereagh Road are assessed as being negligible from the proposed VENM/ENM haulage.

6.1.1 Traffic Noise Management Plan

It is understood that PLDC proposes to control traffic noise impacts from the VENM/ENM haulage by managing the number of haul truck movements on each road segment.

9 Advised by PLDC

A draft Traffic Noise Management Plan for the VENM/ENM haulage operation has been prepared, and traffic noise levels on Castlereagh Road, Cranebrook Road and Old Castlereagh Road will be measured before and after commencement of VENM/ENM haulage to quantify the increase in traffic noise due to the haulage operation.

6.2 Vibration from Haul Trucks

Groundborne vibration levels from road traffic are typically minimal, because the pneumatic tyres of vehicles act to isolate the mass of the vehicle from the road surface. Therefore, the vibration impact from the VENM/ENM haul traffic is expected to be minimal.

Further, no significant increase in the maximum vibration levels at surrounding receivers is expected – these receivers are already exposed to vibration from existing heavy vehicle traffic, and the additional VENM/ENM traffic will increase the number of vibration events but is not expected to increase the magnitude.

As a conservative estimate, indicative predictions have been made using maximum vibration pass-by levels from internal haul traffic, measured on the PLDC site by Arup Acoustics as part of a previous project. The haul trucks measured were significantly larger than the haul trucks (e.g. semi-trailers) likely to be used for the VENM/ENM haulage, and therefore the measured vibration levels are expected to be conservative.

Measured vibration levels at approximately 50 m distance from the haul trucks were in the range 0.05-0.08 mm/s PPV (approximately 0.04-0.06 mm/s RMS), as an overall vibration level. The nearest receiver (2A) is approximately 16 m distance from the carriageway edge, and is therefore approximately 19.5 m from the haul trucks (the traffic source line is typically taken as being 3.5 m from the carriageway edge).

The vibration levels at this distance have been estimated by applying a distance correction, although changes in the ground composition (such as a change from one soil type to another) can affect the vibration propagation.

VDV levels from the VENM/ENM traffic have been estimated using the procedure of the Assessing Vibration guideline, based on these maximum levels from internal haul truck pass-bys. The predicted VDV levels are expected to be conservative, as they are based on maximum vibration levels from the pass-by rather than the energy-average vibration levels.

Predicted vibration levels at the nearest receiver are approximately 0.328-0.526 mm/s PPV (0.232-0.372 mm/s RMS). As these are overall vibration levels, it is not known which frequency band contains the peak value. However, Curve 4 of AS2670.2, which forms the vibration criterion, has as its minimum value (for frequencies above 8 Hz) of 0.398 mm/s RMS, and therefore the VENM/ENM traffic is predicted to meet Curve 4 in all frequency bands.

With 120 VENM/ENM trucks/day, these vibration levels are predicted to produce a maximum VDV of 0.16 $m/s^{1.75}$. This is below the recommended level for residential receivers of 0.2 $m/s^{1.75}$, and therefore it is considered likely that the

overall VDV (i.e. from existing and VENM/ENM traffic) is within the acceptable range of 0.2-0.4 $m/s^{1.75}$ given by the DECC.

Therefore, the predicted vibration levels from haul traffic, using a conservative prediction method, meet the DECC guidance for human comfort, and therefore the VENM/ENM haul traffic is expected to have a minimal vibration impact on the receivers on Old Castlereagh and Castlereagh Roads.

7 Conclusions

The noise and vibration impact of the proposed modifications to the DA2, DA3 and DA4 consents to allow a change in the importation hours of Virgin Excavated Natural Material (VENM) and Excavated Natural Material (ENM) to the Penrith Lakes Scheme over 2015-2018 has been assessed against the relevant licence conditions and OEH guidance for noise and vibration.

The proposed extension of hours has been assessed using the 'shoulder period' provisions of the RNP, because existing noise levels in the vicinity of PLDC show a morning peak from 6:00 am, and therefore extending the day time period to include the proposed haulage hours is considered reasonable.

Additional noise and vibration impacts from internal traffic movements are expected to be minimal, with external traffic (i.e. not on the PLDC site) being the only significant source of noise resulting from the importation of VENM/ENM.

Traffic noise levels were predicted using the Calculation of Road Traffic Noise (CoRTN) methodology, calibrated against results from an unattended traffic noise survey and attended measurements of existing haul truck pass-by noise on Old Castlereagh Road.

Noise levels for a typical VENM/ENM haul truck scenario (approximately 476 truck movements per day divided between the three site entries) were assessed. In addition, a further 'worst case' scenario was considered for all haul trucks using the worst-affected road segment (Old Castlereagh Road), which has infrastructure that is better suited to handle larger volumes of trucks than the other entrances.

Receivers on Old Castlereagh Road have been upgraded with architectural facade treatments and upgraded ventilation in order to allow glazing to remain closed as part of previous PLDC projects. These existing mitigation measures mean that internal noise levels under the 'worst case' haulage scenario (where all haul trucks use Old Castlereagh Road) will be equivalent to the external RNP noise criteria.

Based on current trends, the 'background' traffic on Castlereagh Road and Cranebrook Road will increase with time, and the relative impact of the VENM/ENM haul traffic is predicted to decrease on these roads.

For Old Castlereagh Road, the VENM/ENM haul traffic is essentially 'prolonging' historically-high heavy vehicle numbers on this road, and vehicle numbers (and noise levels) will reduce once the VENM/ENM haulage ceases.

Vibration levels at nearby receivers were assessed using a conservative methodology based on previous Arup measurements of vibration levels from large internal haul trucks on the PLDC site.

To control the traffic noise impact of the VENM/ENM traffic, administrative measures are recommended, such as dividing the overall daily haul traffic between several access locations to reduce the traffic noise impact on any one road segment. A NMP will be implemented for the VENM/ENM haulage to document the traffic noise management procedures.

The overall noise impact of the VENM/ENM haul traffic is expected to be negligible, and administrative measures are expected to be effective in controlling this noise impact to acceptable levels and meet the relevant noise criteria.

Predicted vibration levels at surrounding receivers are below the recommended criterion of Curve 4 of AS2670.2, and the estimated VDV is predicted to be below 0.2 $m/s^{1.75}$ and therefore the vibration impact of the VENM/ENM haul traffic is expected to be minimal and meet the relevant vibration criterion.