CONSTRUCTION NOISE & VIBRATION
IMPACT ASSESSMENT
PROPOSED 330kV TRANSMISSION LINE
WOLLAR TO WELLINGTON

35.5830.R1:CFCD1
Rev 02

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REFERENCES

Reference 1: Department of Environment and Conservation,
Environmental Noise Control Manual.

Reference 2: Department of Environment and Conservation,
'Industrial Noise Policy'.

Reference 3: Australian Standard AS2107-1987
Acoustic - Recommended Design Sound Levels and Reverberation Times for Building Interiors.

Reference 4: Australian Standard AS1055-1989
Acoustic - Description and Measurement of Environmental Noise.

Reference 5: German Standard DIN4150 -1986 - Part 3

Reference 6: British Standard BS7385 -1993 - Part 2

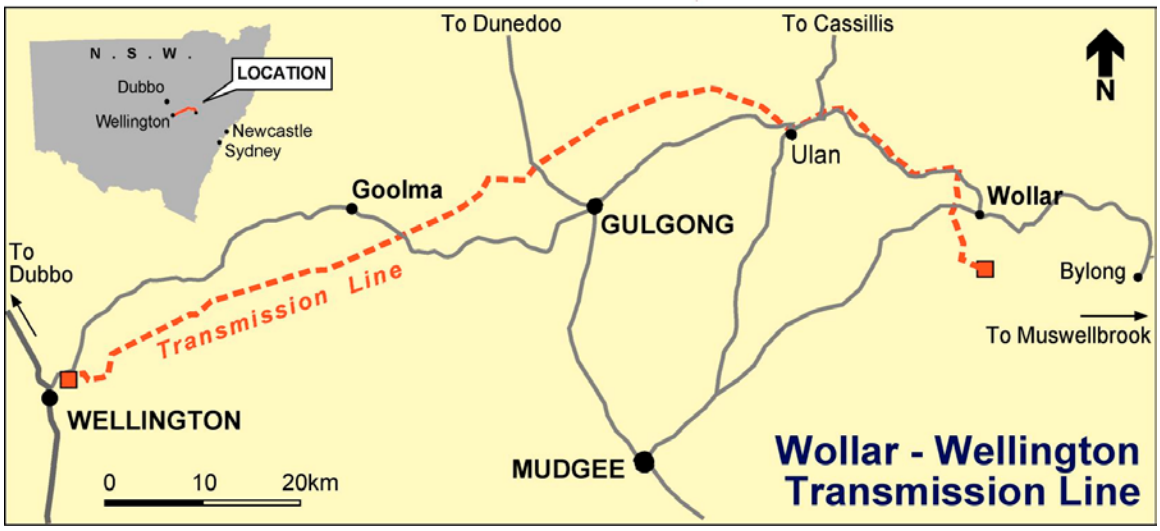
1.0 INTRODUCTION

TransGrid proposes to construct a new 330kV above ground transmission line between Wollar and Wellington. *Figure 1* shows the preferred alignment of the proposal. A new sub station is proposed at Wollar, however does not form part of this assessment and will be subject to a separate application to the Mid-Western Regional Council.

Atkins Acoustics was commissioned by International Environmental Consultants Pty Ltd on behalf of TransGrid to conduct a desktop study to assess construction noise and vibration associated with the construction of the transmission line. The main aims of the noise and vibration assessment were:

- identify sensitive land uses in the area that could be affected by construction noise and vibration impacts;
- estimate background noise levels likely to prevail within the study area;
- predict noise and vibration emission levels from various construction activities at representative reference distances;
- assess potential construction noise and vibration impacts;
- recommend conceptual controls and procedures to minimise potential noise and vibration impacts during construction; and
- report on the results and findings of the assessment.

Figure 1: Location of Transmission Line Route



This study has been undertaken to identify potential construction impacts associated with the proposal. *Transgrid* will prepare noise and vibration management plans, while it will be the responsibility of the contractor to, implement and maintain noise and vibration controls to satisfy the *DEC* requirements or conditions imposed by the consent authority.

The findings and recommendations from this desktop study have been prepared for the particular investigation described and no part should be used in any other context or for any other purpose.

2.0 PROJECT DESCRIPTION

2.1 Overview

The proposed 330kV transmission line between Wollar and Wellington will provide additional capacity and improve the reliability of the electricity supply to the central west of NSW.

The main physical components of the proposal comprise supporting structures (towers) and the conductor cables that transmit electricity. It is envisaged that the single circuit transmission line will carry twin conductors of approximately 30mm diameter, spaced 380mm apart, two overhead ground wires, one of which is an optical fibre ground wire. The cables will generally be supported by rectangular-based steel lattice towers, with typical tower heights ranging from 22-36 metres spaced typically 400 metres apart.

The construction works and erection of the transmission lines will require a number of construction stages including:

- Centreline survey
- Access track construction
- Vegetation clearing
- Structure foundations
- Structure erection
- Conductor and earthwire stringing

2.2 Transmission Line Route

The preferred route for the transmission line is identified in *Figure 1* and is generally located within cleared or partially cleared rural areas. Some wooded areas will require the felling of trees prior to earthworks, construction and erection. The route is generally located away from residential areas and isolated residential buildings.

Following clearing of the proposed route alignment, the main construction activities would be centred at the proposed tower locations.

2.3 Potentially Affected Receivers

Built up residential areas are generally located well away from the proposed transmission line route between Wollar and Wellington, however some isolated residences occur near the centre-line. The closest privately owned residence is approximately 250m from a tower site, whilst typically residences are located in excess of 800m from the centre-line. The Ulan Public School is located approximately 500m from a proposed tower site separated by public road and rail-line. Accordingly the noise assessment has considered anticipated construction activities and noise levels at various reference distances to represent potential sensitive receiver locations.

2.4 Construction Hours

Proposed construction hours are 7.00am to 6.00pm Monday to Saturday and to a limited extent on Sundays or public holidays. Where potential noise impacts are identified for nearby residential receivers, construction hours may be restricted on Saturdays, Sunday and public holidays.

Work outside of the proposed hours would only occur when:

- Activities do not cause a noise nuisance at any nearby residential building/s.
- Delivery of materials which are required outside of normal hours for safety reasons as requested by Police or other authorities.
- Emergency work to avoid loss of lives and/or property.

3.0 EXISTING AMBIENT NOISE ENVIRONMENT

Considering the extent of the proposed transmission line route and study area consisting predominantly of rural areas with minimal human activity Atkins Acoustics has not monitored the existing noise environment prevailing in the study area.

In the absence of noise monitoring, the assessment has adopted the minimum background RBL noise level of 30dB(A) in accordance with *Section 3.1.2* of the Department of Environment and Conservation, Industrial Noise Policy (*INP*).
This is a conservative approach, particularly with respect to the Ulan residential area given the anticipated higher background noise levels resulting from road traffic, rail traffic and mining activities.

4.0 NOISE and VIBRATION ASSESSMENT GOALS

The Department of Environment and Conservation (*DEC*) recommends goals for the assessment of construction noise in the Environmental Noise Control Manual (*ENCM*) and *"Technical Basis for Guidelines to Minimise Annoyance due to Blasting Overpressure and Ground Vibration"*.

4.1 Construction Noise

The *ENCM* (Chapter 171) assessment guidelines and goals for short, medium and long-term daytime construction activities are as follows:

(i) Short Term Construction Periods

For construction periods of less than four (4) weeks, the *DEC* recommends that the $L_{A10,15min}$ noise level from construction activities should not exceed the rating background noise level (RBL) by more than 20dB(A).

(ii) Medium Term Construction Periods

For construction periods extending from four (4) to twenty-six (26) weeks, the *DEC* recommends that the $L_{A10,15min}$ noise level from construction activities should not exceed the RBL by more than 10dB(A).

(iii) Long Term Construction Periods

For construction periods longer than twenty-six (26) weeks, the *DEC* recommends that the $L_{A10,15min}$ construction noise should not exceed the RBL by more than 5dB(A).

For evening and night-time activities, the *DEC* normally accepts that the $L_{A10,15min}$ construction noise should not exceed the background noise level by more than 5dB(A) between 6.00pm and 10.00pm, and not exceed the background level between 10.00pm and 7.00am. Albeit under normal work scheduling, evening and night construction operations is not proposed.

In setting these goals the *DEC* recognises that there is limited opportunity to reduce noise from construction plant and activities, and that the goals are not always satisfied.

Considering the adopted RBL of 30dB(A), the assessment goals recommended for evaluating daytime construction activities are summarised in *Table 1* below.

For assessment purpose the construction noise is assessed at a residential boundary or thirty (30) metres from a residential dwelling, if the boundary is more than thirty (30) metres from the dwelling.

Table 1: Construction Noise Goals (Day)
dB(A) ref: 20×10^{-6} Pa

Reference Location	Sound Pressure Level dB(A)			
	Adopted RBL	Noise Assessment Goals ($L_{A10,15min}$)		
	Day	Short Term	Medium Term	Long Term
Any Residential Receiver	30	50	40	35

4.2 Ground Vibration

The effect of vibration on humans and structures is normally considered and evaluated in terms of annoyance and structural damage.

4.2.1 Annoyance

For assessing human exposure to vibration, the *ENCM* (Chapter 174) recommends goals in terms of potential disturbance to the occupants of buildings. In accordance with the *DEC* goals, *Table 2* presents a summary of vibration levels recommended for the project.

For assessment purpose the vibration is measured on the floor or within the building structure.

Table 2: Vibration Limits (Human Annoyance)
Velocity (vertical axis 1 Hz – 80 Hz)

Description	Time	Continuous Vibration mm/sec	Intermittent Vibration mm/sec
Residential	Day	0.2-0.6	8-12

4.2.2 Perception

For comparison and evaluation of vibration in terms of human response, *Table 3* presents a summary of levels referenced to degrees of perception and potential reactions.

Table 3: Human Perception of Vibration
Ref: German Standard DIN 4150 (1986)

Vibration Levels mm/sec	Likely Perception
0.15	Perception Threshold
0.35	Barely Noticeable
1.0	Noticeable
2.2	Easily Noticeable
6.0	Strongly Noticeable
14.0	Very Strongly Noticeable

4.2.3 Structural Damage

The response of a building structure to ground-borne vibration is affected by the type of foundation, ground condition, building construction and state of repair of the building. The British Standard BS7385 (1993) provides limits above which the risk of vibration-induced damage to structures is minimal. *Table 4* presents a summary of the structural damage vibration limits specified in the British Standard BS7385.

For assessment purposes the vibration is measured on any component of the building structure.

Table 4: Structural Damage Goals
Ref: British Standard BS7385 (1993)

Type of Building	Peak Component Particle Velocity at Foundation (mm/sec)	
	4Hz to 15Hz	**≥ 15Hz**
1. Reinforced or framed structures, industrial and heavy commercial buildings	50mm/s	50mm/s
2. Un-reinforced or light-framed structures, residential or light commercial type buildings	15mm/s at 4Hz increasing to 20mm/s at 15Hz	20mm/s at 15Hz increasing to 50mm/s at 15Hz and above
	A maximum displacement of 0.6mm (zero to peak) not to be exceeded at frequencies below 4Hz for Building Type 2.	

Notes
1. *The vibration levels recommended in Table 4 provide minimal risk of vibration-induced damage to structures. The risk of damage tends towards zero at 12.5mm/s peak component particle velocity.*
2. *Minor and major damage to structures are possible at vibration magnitudes greater than twice and four times the values in Table 4 respectively.*
3. *Values in Table 4 relate predominantly to transient vibration which does not give rise to resonant responses to structures and low-rise buildings. Where dynamic loading caused by continuous vibration which gives rise to dynamic magnification due to resonance, then the values in Table 4 may need to be reduced by up to 50%.*
4. *Important structures such historical buildings which are difficult to repair may require special consideration on a case-by-case basis and should not necessarily be assumed to be more sensitive unless structurally unsound.*
5. *Damage to buildings may arise indirectly from vibration in certain ground conditions where vibration is sufficient to cause soil compaction*

4.3 Blast Assessment Goals

Guidelines documented in the *DEC "Technical Basis for Guidelines to Minimise Annoyance due to Blasting Overpressure and Ground Vibration*" have been used to establish goals for assessing blast air-blast overpressure and ground vibration.

As site specific blast laws have not been established, the following conservative blast assessment parameters have been adopted for predicting and assessing blast impacts.

4.3.1 Air-blast Overpressure

The *DEC* recommends a level 115dBLin for the assessment of air-blast overpressure at residential dwellings and commercial premises. The *DEC* normally allows this level to be exceeded by up to 5% of the total blasts over a period of 12 months, with a maximum limit of 120dBLin.

4.3.2 Ground Vibration

The *DEC* ground vibration goal for residential and commercial premises is 5mm/sec (peak particle velocity). The *DEC* normally allow this level to be exceeded by up to 5% of the total number of blasts over a period of 12 months with a maximum limit of 10mm/s.

4.3.3 Blast Project Assessment Goals

From the *DEC* recommendations, *Table 5* provides a summary of the recommended blast assessment goals.

Table 5: Assessment Goals for Blasting

Assessment Location	Air-blast Overpressure dBLin		Ground Vibration PPV mm/s	
	Recommended	Maximum Allowable	Recommended	Maximum Allowable
Residential/Commercial Buildings	115	120	5	10

For assessment purpose blast overpressure the *DEC* recommends measurement at any sensitive receiver at least three point five (3.5) metres of a building or structure, and ground vibration measured at any point which is located at least the longest dimension of the foundations of a building or structure away from such building or structure.

5.0 CONSTRUCTION PLANT and NOISE EMISSIONS

The main construction activities envisaged include: access track construction, vegetation clearing, structure foundations, structure erection, and conductor and earth-wire stringing. The sequence would generally be conducted as follows, however subject to the work program some activities may be conducted concurrently at multiple locations.

5.1 Overview of Construction Activities

5.1.1 Centre-line Survey

A centre-line survey check and structure cross section measurement would be required. It is anticipated that minimal noise impact would be involved with this activity and that the only plant and equipment envisaged would include 4wd vehicles and sledge hammers for installing identifying pegs. There may be the occasional use of chainsaws to clear vegetation to allow access and sight-lines.

5.1.2 Access Track Construction

Access to each proposed support structure would be required for cranes, trucks transporting material, concrete trucks and other vehicles providing construction materials. Temporary sites for storage of conductor drums, winding and breaking equipment would be required along the route and will also require access roads.

Where possible, existing access tracks would be utilised and upgraded to accommodate the construction activities. Continuous access is not required along the entire route, however where terrain allows continuous access, it may be the simplest and least extensive method for access.

Where new access is provided or existing access upgraded, it is anticipated that the use of dozers, front-end loaders, graders and water carts would be required.

5.1.3 Vegetation Clearing

Vegetation clearing would be kept to a minimum and confined to areas in the immediate vicinity of the support structures. In addition vegetation may require removal where there are potential infringements on electrical clearances.

It is proposed that clearing would generally be conducted in small teams utilising hand tools such as chain saws and the like. Where large trees are identified, tree "pushers" may be utilised to remove entire trees including stumps. Where possible, all vegetation would be mulched and distributed locally or heaped and burnt.

5.1.4 Structure Foundations

The construction of foundations for the self supporting tower structures would generally involve boring of a hole for each leg, installation of steel reinforcing and stub leg followed by pouring of concrete.

Where ground conditions are poor or for heavier tension towers, more substantial foundations may be required and involve open excavation, installation of formwork and reinforcing, pouring of concrete followed by backfilling. In steeper terrain the preparation of a level platform may be required for working area.

Where footings are required in rock, a compressor, drill and blasting of rock may be required. Accordingly this study has included a blast and overpressure assessment.

Temporary concrete batching plants would be established at various points along the route to provide concrete for the project.

5.1.5 Structure Erection

It is generally proposed to fabricate (cut, drill and galvanise) the steel framework for the tower structures off-site and transported to site via semi-trailer or the like. Towers would then be erected in sections with the assistance of cranes.

It is envisaged that the erection crew would consist of four to six (4-6) workers for assembly, followed by a team of six to nine (6-9) workers for structure erection. Anticipated time for erection of a structure is up to six (6) days. The construction crews would probably move along the transmission line route at about ten to twenty (10-20) structures a week.

5.1.6 Conductor and Earthwire Stringing

It is proposed to utilise a process known as “tension stringing” for the stringing of conductors and earthwires. Stringing would generally be conducted in five to ten (5-10) kilometre sections subject to terrain, access and structure type.

Stringing operations would involve approximately twenty (20) people, over the section being strung. The enviaged equipment required for the stringing of the towers includes winches, tensioners and a generator. It is anticipated that each section would take approximately one to two (1-2) weeks.

5.2 Construction Equipment Noise Emission Levels

For the assessment of noise emanating from the envisaged construction activities, the following plant noise levels (*Table 6*) have been considered in the noise modelling for typical construction scenarios.

Table 6: Typical Plant and Equipment
dB(A) re: 20×10^{-6} Pa

Item	Plant Description	Number of Items	Sound Pressure Level L_{A10} @ 7m
Access Track Construction			
Dozer	Tracked	1	90
Water Cart		1	80
		Total	**90**
Vegetation Clearing			
Timber Shredder	Truck mounted	1	90
Excavator	Kato 750	1	82
Chainsaw		1	85
		Total	**92**
Structure Foundations			
Excavator	Kato 750	1	82
Drill Rig	truck mounted	1	87
		Total	**88**
Concrete Vibrators		1	80
Drill Rig	truck mounted	1	87
		Total	**88**

Table 6: Typical Plant and Equipment (cont.)
dB(A) re: 20 × 10^{-6} Pa

Item	Plant Description	Number of Items	Sound Pressure Level L_{A10} @ 7m
Structure Erection			
Crane	Truck mounted	1	80
Compressor	1000 CFM	1	77
Welders		2	75
		Total	**83**
Conductor and Earthwire Erection			
Crane	Truck mounted	1	80
Winch		2	66
Generator	Diesel	1	76
Braking Device		2	66
		Total	**82**
Batching Plant			
Batching Plant		1	85

5.3 Construction Equipment Vibration Emission Levels

During the excavation and construction activities associated with access tracks and preparation of some platforms, it will be necessary to use plant and equipment that will generate ground vibration. To evaluate the likely effects of the construction activities, the following vibration levels (*Table 7*) have been considered.

Table 7: Typical Plant Vibration Levels
mm/s

Plant Description	Vibration Levels mm/sec		
	@ 5m	@ 20m	@ 40m
Rock-breaker (large)	5	0.5	0.3
Truck	1	0.05	0.02

6.0 CONSTRUCTION NOISE and VIBRATION IMPACT ASSESSMENT

6.1 Construction Noise

A summary of the predicted construction noise levels for various stages of construction at reference distances are presented in *Table 8*. The calculation assume all plant referenced in *Table 6* operating simultaneously and takes no account of potential shielding from topography or ground absorption, accordingly the expected levels at distances greater than one hundred (100) metres are expected to be lower.

Table 8: Predicted Noise Levels from Construction Activities
L_{A10} dB(A) re: 20×10^{-6} Pa

Construction Activity	Distance from Construction Activity (m)						
	25m	50m	100m	200m	400m	800m	1600m
Access Track Construction	79	73	67	61	55	49	43
Vegetation Clearing	81	75	69	63	57	51	46
Structure Foundations							
- excavation	77	71	65	59	53	47	41
- concrete pouring	77	71	65	59	53	47	41
Structure Erection	72	66	60	54	42	36	30
Conductor and Earthwire Erection	71	65	59	53	47	41	35
Batching Plant	74	67	61	56	50	44	38

The predicted noise levels for the access track construction and vegetation clearing activities exceed the *DEC* short-term assessment goal (50dB(A)) at residential properties within 800 metres of the construction activities. It is envisaged that such activities would be short term (1-3 days) and hours of activities modified to minimise disturbance. With respect to structure foundations, noise exceedances are predicted for residential properties within approximately 600m of the activities. For other construction activities, the predicted noise levels show compliance for residential properties at distances of 300m or greater.

As the envisaged construction activities are transient and would last no more than four (4) weeks at any one location, any noise impact would be short-term. Where practical and feasible, engineering noise controls and work practices would be considered to minimise noise impacts. In terms of noise impacts from activities associated with structure foundations, we would recommend localised acoustic *controls* be considered where residences are located within 400m of the site, this would typically involve orientation of equipment, staging of activities, shielding and minimisation of simultaneous operations. To ensure noise impacts are minimised it is recommended that a Construction Environmental Management Plan (CEMP) be prepared and implemented by the contractor engaged to construct the transmission line.

To minimise potential noise impacts, the construction activities would normally be restricted to the daytime hours 7:00am to 6:00pm Monday to Saturday. For noisy work outside these hours, appropriate times would be negotiated with affected residences (if any).

6.2 Vibration Levels from Construction Equipment

The main source of ground vibration that has been identified in this assessment is associated with rock breakers.

Ground vibration from breakers could range up to 0.5mm/sec at a distance of twenty (20) metres, and would be below 0.3mm/sec at forty (40) metres. The predicted ground vibration levels at these distances satisfy the recommended assessment goals, and expected to be acceptable from both human disturbance and structural damage points of view.

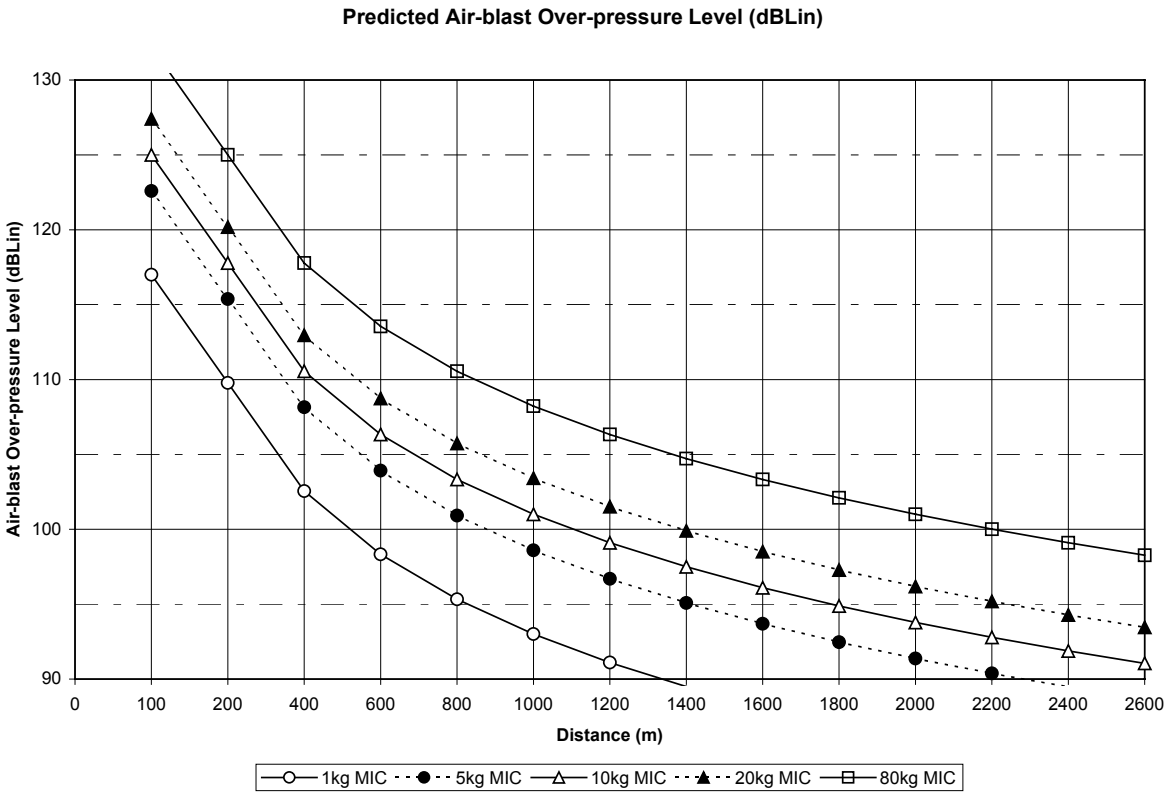
6.3 Blast Assessment

Confined blasting may be required along the proposed route to remove potential rock outcrops and excavate footings. Blast holes would be drilled and filled with an explosive charge and detonated with the aid of primers and detonators. Impacts associated with blasting normally relate to air blast overpressure and ground vibration.

6.3.1 Air-blast Overpressure Prediction Model

Air-blast overpressure is a function of maximum instantaneous explosive charge and the distance between the receiver and blast location. *Figure 2* presents as summary of MIC blast design data used to predict air-blast overpressure.

Figure 2: Air-blast Overpressure v Distance



The predicted MIC's in *Table 9* are based on the *DEC* 115dBLin goal.

Table 9: Predicted Air-blast Overpressure MIC's

Receiver	Distance metres	Lower MIC range kg.
Residential/Commercial	200	<5
	400	<40
	600	<60
	800	<140
	1000	140
	1200	>140

6.3.1(a) Assessment

The results in *Table 9* show that the *DEC* air-blast overpressure goal (115dBLin) can be satisfied with the employment of controlled MIC's. As a precautionary measure, it is recommended that initial blasts be undertaken at not less than 200 metres from sensitive receiver locations and MIC's limited to no more than <5kg. The initial blasts should be monitored and blast site laws developed from the recorded data. The data should be compiled to confirm maximum charge weights and compliance with the *DEC* air-blast overpressure limits. The site data would be used to establish site blast laws and optimise further blasts.

6.3.2 Ground Vibration Prediction Model

Ground vibration is a function of maximum instantaneous charge, the distance between receiver and blast location, rock type and ground condition. The predictive formula adopted for peak particle velocity (PPV) assessment has been based on the site law data provided in Australian Standard AS2187: Part 2 (1993). *Figure 3* provide the predicted PPV v distance vibration levels for average rock conditions.

Figure 3: Ground Vibration v Distance

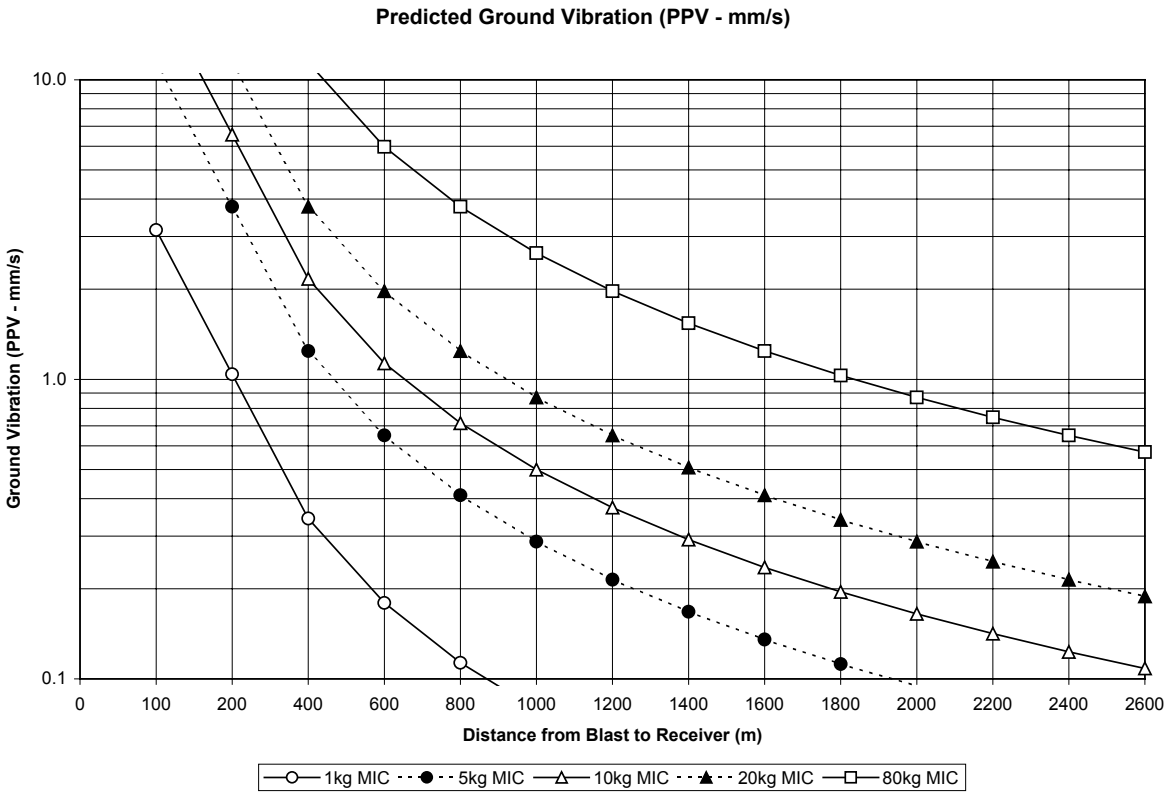


Table 10 presents the range of calculated MIC's required to satisfy the 5mm/sec vibration limits.

Table 10: Predicted Ground Vibration (Average Rock Conditions) MIC's

Receiver	Distance metres	Lower MIC range kg.
Residential/Commercial	200	<2
	400	<20
	600	<60
	800	<80
	1000	<120
	1200	<140

6.3.2(a) Assessment

The results summarised in *Table 10* show that the *DEC* ground vibration goal (5mm/sec) can be satisfied with the employment of controlled MIC's. It is recommended that the MIC's for the initial blasts be undertaken at not less than 200 metres from sensitive receiver locations and limited to no more than 2kg. The initial blasts should be monitored to confirm maximum charge weights to ensure compliance with the *DEC* ground vibration limits and optimise future blasts.

7.0 RECOMMENDATION FOR CONTROL MEASURES

It is recommended that a "Construction Environmental Management Plan" (CEMP) be prepared to address the issues of noise and vibration and methods to minimise their impacts. The CEMP would be prepared in consultation with the approving authority and construction contractors. As part of the CEMP, the following should be addressed:

- the selection of plant and equipment where practical on acoustic performance;
- the noise certification of all site plant and equipment prior to commencing site work and regular monitoring to ensure equipment noise emission levels do not deteriorate due to poor maintenance;
- work practices to minimise potential noise and vibration impacts;
- a monitoring program to ensure that construction noise and vibration emissions are controlled and that the best possible practices are being implemented;
- noise and vibration monitoring shall be conducted in response to community complaints and at the request of the *DEC*. Reports of investigations shall be provided to the *DEC* upon request;
- a site noise and vibration training and awareness program for all staff and contractors engaged during construction; and,
- the establishment of procedures to address any noise and vibration complaints received from the public during the construction period.

8.0 CONCLUSION

This desktop study was commissioned as part of an Environmental Impact Statement (EIS) to address noise and vibration impacts associated with the construction of a new 330kV transmission line between Wollar and Wellington.

As part of this study envisaged construction activities have been identified and assessed in accordance with the guidelines and goals recommended in the Department of Environment and Conservation, Environmental Noise Control Manual (*ENCM*).

The main sources of construction noise and vibration identified and addressed in this report are associated with the development of access tracks, vegetation clearing, structure foundations, structure erection and conductor/earthwire stringing.

It is proposed that the construction activities would generally be restricted to daytime hours (7:00am to 6:00pm) Monday to Saturday.

The report has identified the likely level of noise and vibration that could be experienced during various phases of the project. The assessment has shown that noise emissions from vegetation clearing and structure foundations could exceed the recommended assessment goals at residences closer than 600-800m from the construction site without suitable controls. Noise controls could typically involve orientation of equipment, staging of activities, shielding and minimisation of simultaneous operations.

To control environmental noise and vibration impacts during construction, it is recommended that a 'Construction Environmental Management Plan' (CEMP) be prepared. As part of the CEMP, it is recommended that a public relations program be developed and implemented to inform residents and the community of the progress of the construction activities, and potential noise and vibration impacts during each phase of the construction.

Terms and Definitions

Ambient noise:	*The all-encompassing noise associated within a given environment. It is the composite of sounds from many sources, both near and far.*
Assessment period:	*The period in a day over which assessments are made: day (0700 to 1800 h), evening (1800 to 2200 h) or night (2200 to 0700 h).*
Assessment background level (ABL):	*The single-figure background level representing each assessment period – day, evening and night (that is, three assessment background levels are determined for each 24-h period of the monitoring period). Its determination is by the tenth percentile method.*
Background noise:	*The underlying level of noise present in the ambient noise, excluding the noise source under investigation, when extraneous noise is removed. This is described using the L_{A90} descriptor.*
Cumulative noise level:	*The total level of noise from all sources.*
Day:	*The period from 0700 and 1800h (Monday to Saturday) and 0800 to 1800 h (Sundays and Public Holidays).*
dB:	*Abbreviation for decibel – a unit of sound measurement. It is equivalent to 10 times the logarithm (to base 10) of the ratio of a given sound pressure to a reference pressure.*
dB(A):	*Unit used to measure 'A-weighted' sound pressure levels. A-weighting is an adjustment made to sound-level measurement to approximate the response of the human ear.*
Equivalent continuous noise level:	*The level of noise equivalent to the energy average of noise levels occurring over a measurement period.*
Evening:	*The period from 1800 to 2200 h.*

Terms and Definitions (Cont.)

Extraneous Noise: *Noise resulting from activities that are not typical of the area. Atypical activities may include construction, and traffic generated by holiday periods and by special events such as concerts or sporting events. Normal daily traffic is not considered to be extraneous.*

Feasible and reasonable measures: *Feasibility relates to engineering considerations and what is practical to build; reasonableness relates to the application of judgment in arriving at a decision, taking into account the following factors:*

- *noise mitigation benefits (amount of noise reduction provided, number of people protected)*
- *cost of mitigation (cost of mitigation versus benefit provided)*
- *community views (aesthetic impacts and community wishes)*
- *noise levels for affected land uses (existing and future levels, and changes in noise levels.)*

Greenfield site: *Undeveloped land.*

Impulsive noise: *Noise with a high peak of short duration, or a sequence of such peaks.*

Industrial noise sources: *Sources that do not generally move from place to place, for example, stationary sources. Except where other more specific guidelines apply (for example, construction activities, road or rail traffic, emergency diesel generator etc), all industrial noise sources that are scheduled under Protection of the Environment Operations Act 1997 are considered to be industrial sources. In general, these include:*

(Cont.)

Terms and Definitions (Cont.)

Industrial noise sources:

- *individual industrial sources such as:*
  - *heating, ventilating and air conditioning (HVAC) equipment*
  - *rotating machinery*
  - *impacting mechanical sources*
  - *other mechanical equipment and machinery such as conveyors*
  - *mobile sources confined to a particular location, such as draglines and haul trucks.*
- *facilities, usually comprising many sources of sound including:*
  - *industrial premises*
  - *extractive industries*
  - *commercial premises*
  - *warehousing facilities*
  - *maintenance and repair facilities.*

Intrusive noise: *Refers to noise that intrudes above the background level by more than 5 decibels.*

L_1 *The sound pressure level that is exceeded for 1% of the time for which the given sound is measured.*

L_{10} *The sound pressure level that is exceeded for 10% of the time for which the given sound is measured.*

L_{A90} *The A-weighted sound pressure level that is exceeded for 90% of the time over which a given sound is measured. This is considered to represent the background noise.*

L_{Aeq} *Equivalent sound pressure level - the steady sound level that, over a specified period of time, would produce the same energy equivalence as the fluctuating sound level actually occurring.*

$L_{Aeq(15hr)}$ *The L_{Aeq} noise level for the period 7 am to 10 pm.*

Terms and Definitions (Cont.)

$L_{Aeq(9hr)}$	*The L_{Aeq} noise level for the period 10 pm to 7 am*
$L_{Aeq(1hr)}$	*The L_{Aeq} noise level for a one-hour period. In the context of this policy it represents the highest tenth percentile hourly A-weighted L_{eq} during the period 7am to 10 pm, or 10 pm to 7 am (whichever is relevant). If this cannot be defined accurately, use the highest A-weighted L_{eq} noise level.*
$L_{10(1hr)}$	*The L_{10} level measured over a 1-hour period.*
$L_{10(18hr)}$	*The arithmetic average of the $L_{10(1hr)}$ levels for the 18-hour period between 0600 and 2400 hours on a normal working day. It is a common traffic noise descriptor.*
Low frequency:	*Noise containing major components in the low-frequency range (20 Hz to 250 Hz) of the frequency spectrum.*
Median:	*The middle value in a number of values sorted in ascending or descending order. Hence, for an odd number of values, the value of the median is simply the middle value. If there is an even number of values the median is the arithmetic average of the tow middle values.*
Most affected location(s):	*Locations that experienced (or will experience) the greatest noise impact from the noise source under consideration. In determining these locations, one needs to consider existing background levels, exact noise source location(s), distance from source (or proposed source) to receiver, and any shielding between source and receiver.*

Terms and Definitions (Cont.)

Noise criteria:	*The general set of non-mandatory noise level targets for protecting against intrusive noise (for example, background noise plus 5dB) and loss of amenity (for example, noise levels for various land uses).*
Night:	*The period from 2200 to 0700 h (Monday to Saturday) and 2200 to 0800 h (Sundays to Public Holidays).*
Noise-sensitive land uses:	*Land uses that are sensitive to noise, such as residential areas, churches, schools and recreation areas.*
Non-mandatory:	*With reference to the proposed policy, means not required by legislation. The proposed policy specifies criteria to be strived for, but the legislation does not make these criteria compulsory. However, the policy will be used as a guide to setting statutory (legally enforceable) limits for licenses and consents.*
Operator:	*Noise-source manager*
Performance-based goals:	*Goals specified in terms of the outcomes/performance be achieved, but not in terms of the means of achieving them.*
Project-specified noise levels:	*Project-specific noise levels are target noise levels for a particular noise generating facility. They are based on the most stringent of the intrusive criteria or amenity criteria. Which of the two criteria is the most stringent is determined by measuring the level and nature of existing noise in the area surrounding the actual or proposed noise generating facility.*
Proponent:	*The developer of the industrial noise source.*

Terms and Definitions (Cont.)

Protection of the Environment Operations Act 1997:	*An Act that consolidates air, water, noise and waste requirements into a single piece of legislation. This Act repeals and replaces (among other Acts) the Noise Control Act 1975.*
Rating background level (RBL):	*The overall single-figure background level representing each assessment period (day / evening / night) over the whole monitoring period (as opposed to over each 24-h period used for the assessment background level). This is the level used for assessment purposes. It is defined as the median value of:* - *all the day assessment background levels over the monitoring period for the day* - *all the evening assessment background levels over the monitoring period for the evening; or* - *all the night assessment background levels over the monitoring period for the night.*
Receiver:	*The noise-sensitive land use at which noise from a development can be heard.*
Sleep disturbance:	*Awakenings and disturbance to sleep stages.*
Spectral characteristics:	*The frequency content of noise.*
Tonality:	*Noise containing a prominent frequency and characterised by a definite pitch.*
Transportation:	*Includes road, rail and air traffic.*