

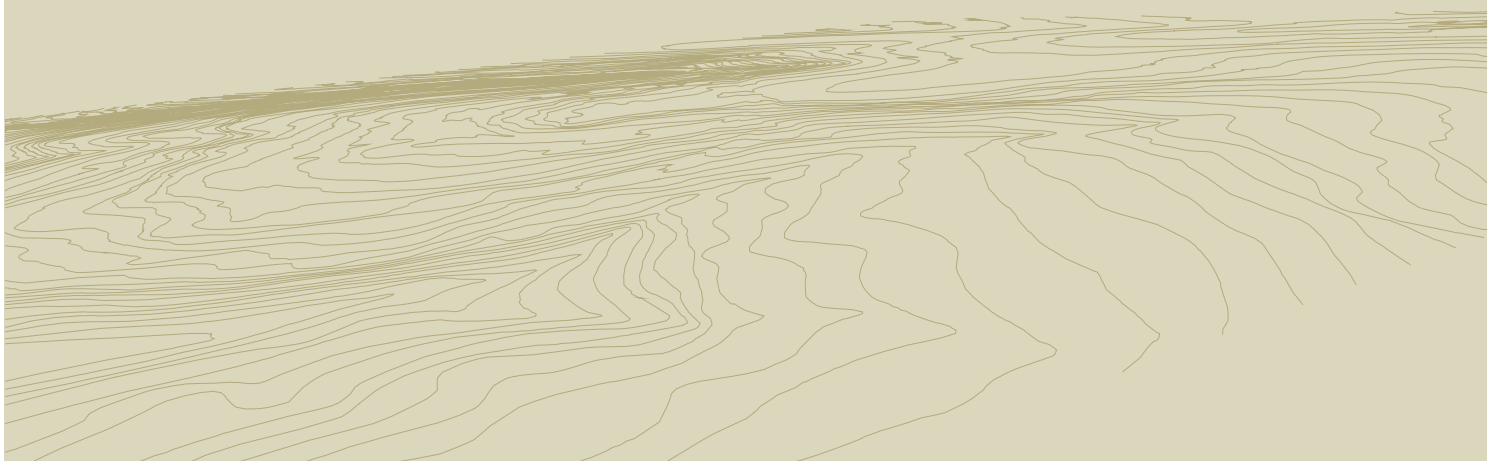


Appendix Q

*AECOM, 2010: Armidale Regional Landfill Noise
Impact Assessment*

ARMIDALE REGIONAL LANDFILL

Environmental Assessment



Armidale Regional Landfill

Noise Impact Assessment



Armidale Regional Landfill

Noise Impact Assessment

Prepared for

Armidale Dumeresq Council

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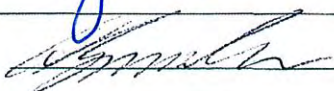
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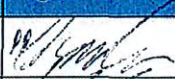
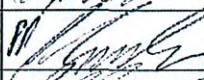
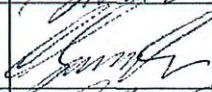
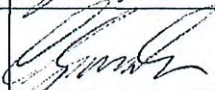
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Contents

Executive Summary.....	vii
1.0 Introduction.....	1
2.0 Description of the Proposed Development.....	2
2.1 Proposed Site	2
2.2 Proposed Operations.....	2
3.0 Environmental Noise Measurements.....	4
3.1 Ambient Noise Level Measurements.....	4
4.0 Noise Criteria	7
4.1 Operational Noise	7
4.1.1 Intrusive Noise Impacts	7
4.1.2 Protecting Noise Amenity	7
4.1.3 Resultant Environmental Noise Criteria.....	7
4.2 Traffic Noise.....	8
4.2.1 Environmental Criteria for Road Traffic Noise.....	8
4.2.2 Sleep Arousal.....	9
4.3 Construction Noise	9
5.0 Site Noise Emission Modelling.....	12
5.1 Modelling Methodology.....	12
5.1.1 Topography and Site Layout.....	12
5.1.2 Meteorological Conditions.....	12
5.1.3 Equipment Noise Levels	13
5.2 Operational Assessment.....	13
5.2.1 Calculated Noise Levels – No Mitigation	14
5.2.2 Recommended Operational Noise Control Measures.....	14
5.2.3 Calculated Sound Power Levels with Plant Noise Attenuation.....	15
5.2.4 Noise Levels at Receivers with Plant Noise Attenuation.....	16
5.3 Construction Scenario	16
5.3.1 Calculated Noise Levels	16
5.3.2 Recommended Construction Noise Control Measures	17
6.0 Off Site Traffic Noise Assessment.....	18
6.1 Increase in Noise Levels.....	18
6.2 Sleep Arousal.....	18
7.0 Conclusion	19

List of Tables

Body Report

Table 1– Existing Background (L_{A90}) and Ambient (L_{Aeq}) Noise Levels – Strathaven	5
Table 2– Existing Background (L_{A90}) and Ambient (L_{Aeq}) Noise Levels – Sherraloy	5
Table 3– Assessed Rating Background Level and Ambient Noise Level	6
Table 4– Recommended L_{Aeq} noise levels from Industrial Noise Sources	7
Table 5– Resultant Environmental Noise Criteria	8
Table 6 – Road Traffic Noise Criteria.....	9
Table 7 – Noise at residences using quantitative assessment	11
Table 8 - Occurrence of source to receiver wind speeds <3m/s at Armidale Airport, 2002	12
Table 9 – Equipment Sound Power Levels	13
Table 10 - Normal Operations During Daytime under Neutral Meteorological Conditions.....	14
Table 11 – Attenuated Equipment Sound Power Levels.....	15
Table 12 – Attenuated Plant Operating During Daytime under Neutral Meteorological Conditions	16
Table 13 - All Construction Plant Operating During Daytime under Neutral Meteorological Conditions.....	17
Table 14 - Increase in Traffic Noise Levels on Waterfall Way – Operation (Worst Case)	33
Table 15 - Increase in Traffic Noise Levels on Waterfall Way – Construction (Worst Case)	33

List of Figures

Body Report

Figure 1 – Site Locality	2
Figure 2 – Noise Logging Locations at (1) Strathaven and (2) Sherraloy.....	4

List of Appendices

Appendix A Graphical Measurement Results
Appendix B Glossary of Acoustic Terminology
Appendix C Traffic Noise Impact – Calculation Results
Appendix D Noise Contour Plots

Executive Summary

Armidale Dumaresq Council is proposing to construct a new landfill facility to replace the existing facility on Long Swamp Rd, which is close to capacity. The proposed site is located approximately 12km east of Armidale, NSW and would be accessed from Waterfall Way. Waste would be processed at the existing landfill and transfer station on Long Swamp Road and would be transported between the transfer station and the site by truck.

The noise emission from the proposed landfill development off Waterfall Way has been assessed against the criteria contained in the DEC *Industrial Noise Policy* to determine the impact at the nearest receivers throughout the life of the landfill.

Due to the low existing background noise levels, the noise emission from the site operations would need to be controlled to ensure compliance with the INP criteria. The required mitigation measures would include the use of silencers and engine enclosures on permanent site equipment to achieve a reduction in noise levels of 5-10 dB(A).

With these and the additional mitigation measures discussed in Section 5.2.2 implemented, it is expected that the noise levels at the nearest receivers would generally comply with the INP criteria for the typical operational scenarios that have been analysed.

The expected increase in traffic noise resulting from traffic generated by the development was calculated and was found to be less than 2 dB(A). Therefore the development would be expected to comply with the criteria outlined in the DEC *Environmental Criteria for Road Traffic Noise*.

As the proposed development would be reliant on engineered noise control treatment, the ongoing maintenance of equipment will be critical to ensure the continuing compliance with the noise criteria. For this reason it is recommended that an annual compliance monitoring program be undertaken to confirm that the site noise emissions remain acceptable over the life of the landfill.

1.0 Introduction

Armidale Dumaresq Council is proposing to construct a new landfill facility to replace the existing facility on Long Swamp Rd, which is close to capacity. The proposed site for the new landfill facility (the site) is located approximately 12km east of Armidale, NSW and would be accessed from Waterfall Way. Waste would be processed at the existing landfill and transfer station on Long Swamp Road and would be transported between the transfer station and the site by truck. No public access to the proposed site would be provided.

The proposed development would involve minor excavation associated with the construction of the landfill cells, the construction of a sealed access road between Waterfall Way and the landfill site and the construction of unsealed maintenance roads around the perimeter of the site. Landfill operations would originate at the south of the site and would generally move north over the 50 year design life of the facility.

AECOM was commissioned to provide a noise impact assessment of the proposed landfill development site during construction and operation of the facility.

This report assesses the noise impact of the proposed landfill facility at the most affected residential receivers located around the proposed landfill site. The environmental noise impact has been assessed against the relevant criteria presented in the Department of Environment and Conservation's (DEC) Industrial Noise Policy (INP) and recommendations have been made to minimise the impact of the proposed development on the existing noise environment of the area throughout the life of the development.

2.0 Description of the Proposed Development

2.1 Proposed Site

The site of the proposed landfill facility is located approximately 12km east of Armidale with access to the site from Waterfall Way as shown in Figure 1 below. The site is located in a rural area, with the proposed site and surrounding area predominantly open grassland and paddocks.



Figure 1 – Site Locality

Typical rural residences are distributed around the site with the most-affected residences located approximately 350m from the Southern boundary of the proposed site, approximately 900m from the Western boundary of the proposed site and approximately 250m north of the proposed Waterfall Way site access.

Additional residences located at greater distances to the East and the North West of the site have also been included in the assessment but would be less affected by the proposed development.

2.2 Proposed Operations

Waste would be processed at the existing landfill and transfer station on Long Swamp Road and would be transported between the transfer station and the site by truck. No direct public access to the proposed site would be provided.

The proposed landfill facility would operate seven days per week with the proposed operating hours from 7:00am to 5:30pm Monday to Friday and 8:00am to 6:30pm on Saturday, Sunday and Public Holidays.

The main activities on the site would be associated with the unloading, distribution and compaction of waste materials in the landfill cells and the loading, distribution and compaction of cover material. For the purpose of this report the operations occurring on the site are as summarised below:

- Three waste vehicles per day arrive from the Long Swamp Rd transfer station via Waterfall Way and the proposed site access road.

- The trucks proceed along the perimeter maintenance road to the landfill cell in use, where they unload the waste.
- The empty trucks exit the site along the perimeter maintenance road and the sealed access road to Waterfall Way.
- The waste material is distributed in the landfill cell using a dozer and compactor throughout the operating hours of the facility.
- Cover material is loaded from an adjacent cell using an excavator and transported using a bogie type truck. One truck per day would bring additional cover material to the site.
- The cover material is spread using the dozer or excavator and is then compacted. Covering operations would generally occur in the afternoon and would be expected to be approximately 4 hours in duration.
- Two passenger vehicles per day would be associated with the transport of employees to and from the site.

3.0 Environmental Noise Measurements

3.1 Ambient Noise Level Measurements

Two ARL EL-215 noise loggers were used to continuously measure ambient noise levels approximately 30m from residences (Strathaven and Sherraloy) in close proximity to the site for a period of 1 week. The locations of the loggers are shown in Figure 2 below.

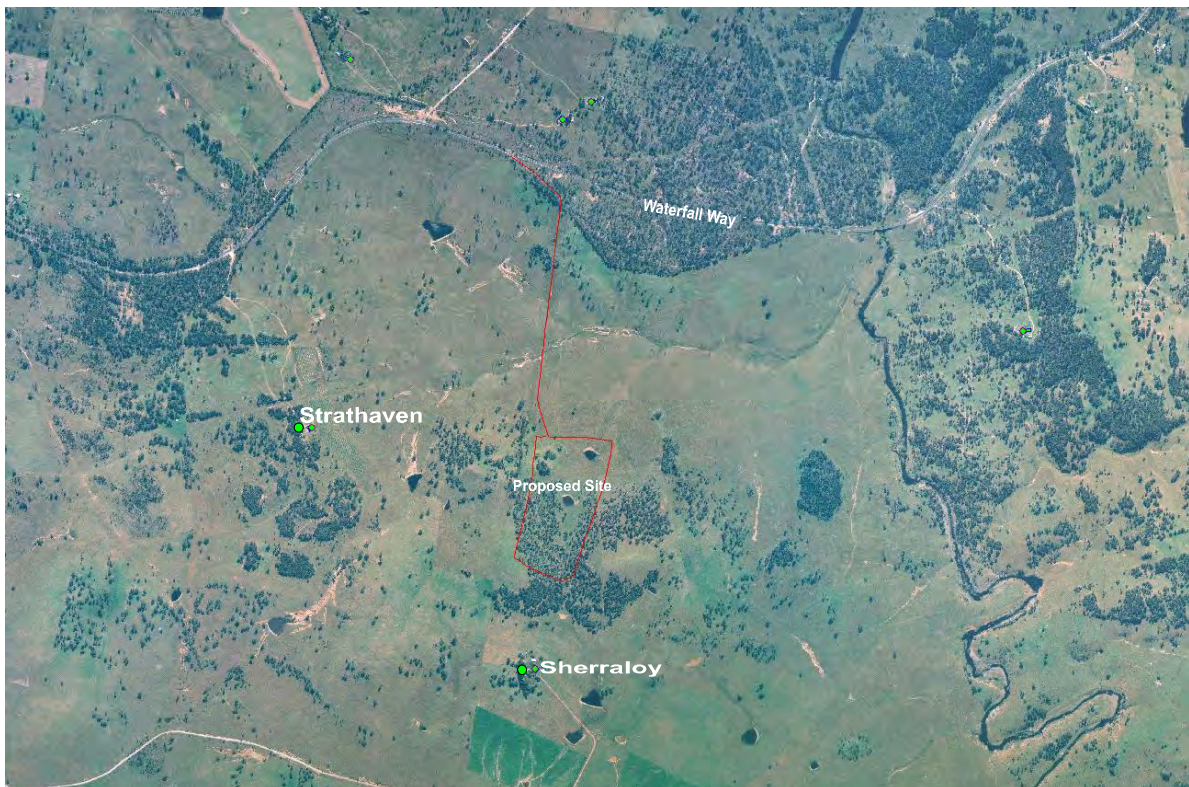


Figure 2 – Noise Logging Locations at (1) Strathaven and (2) Sherraloy

The existing noise environment at the receivers is typical of rural areas, with ambient noise levels during the day dominated by rural human activity, animals and intermittent traffic. Natural sounds such as wind in trees and grass and small contributions of industrial noise from distant water pumps were also audible at times during the assessment. The loggers were set for a sample period of 15 minutes and continuously logged from Friday 2nd June until Friday 9th June 2006.

A noise logger measures the noise level over the sample period and then determines L_{A1} , L_{A10} , L_{A90} , L_{Amax} and L_{Aeq} levels of the noise environment. The L_{A1} , L_{A10} and L_{A90} levels are the levels exceeded for 1%, 10% and 90% of the sample period respectively. The $L_{A,max}$ is indicative of maximum noise levels due to individual noise events such as the pass by of a heavy vehicle. The $L_{A,90}$ is taken as the background noise level. The L_{Aeq} level is the equivalent continuous sound level and has the same sound energy over the sample period as the actual noise environment with fluctuating sound levels.

The background noise level is defined by the DEC as “the underlying level of noise present in ambient noise when all unusual extraneous noise is removed”. It can include sounds that are normal features of a location and may include birds, traffic, insects etc. The background noise level is represented by the $L_{A90,15\text{ min}}$ descriptor. Existing background and ambient noise levels are presented in **Table 1** and **Table 2**.

The measured noise levels were analysed to determine a single assessment background level (ABL) for each day, evening and night period, in accordance with the INP. The ABL is established by determining the lowest ten-percentile level of the L_{A90} noise data acquired over each period of interest. The background noise level or rating background level (RBL) representing the day, evening and night-time assessment periods is based on the median of individual ABLs determined over the entire monitoring period.

Table 3 presents the RBL's determined for each receiver and assessment period and an overall representative L_{Aeq} noise level determined by logarithmically averaging each assessment period for the entire monitoring period. Graphical representations of the logged noise levels are included in **Appendix A**. It is noted that where the noise levels are measured to be 25 dB(A), the measurements are affected by the noise floor of the instrumentation and the actual noise levels may be significantly lower. However, in situations where the RBL is assessed to be less than 30 dB(A), the INP criteria limits the RBL to 30 dB(A).

Table 1– Existing Background (L_{A90}) and Ambient (L_{Aeq}) Noise Levels – Strathaven

Day	L_{A90} Background Noise Levels			L_{Aeq} Ambient Noise Levels		
	Day	Evening	Night	Day	Evening	Night
Friday 02 June, 2006	34	30	30	48	39	41
Saturday 03 June, 2006	31	26	25	41	30	29
Sunday 04 June, 2006	27	25	25	38	30	32
Monday 05 June, 2006	27	27	26	38	62	48
Tuesday 06 June, 2006	27	25	26	40	31	29
Wednesday 07 June, 2006	27	26	26	42	32	32
Thursday 08 June, 2006	28	26	26	40	33	35
Friday 09 June, 2006	28	-	-	36	-	-
RBL / Log Average	27	26	26	42	54	41

Table 2– Existing Background (L_{A90}) and Ambient (L_{Aeq}) Noise Levels – Sherraloy

Day	L_{A90} Background Noise Levels			L_{Aeq} Ambient Noise Levels		
	Day	Evening	Night	Day	Evening	Night
Friday 02 June, 2006	31	29	29	40	35	37
Saturday 03 June, 2006	29	25	25	47	49	38
Sunday 04 June, 2006	26	26	26	53	27	28
Monday 05 June, 2006	26	27	27	34	56	43
Tuesday 06 June, 2006	26	25	26	35	29	29
Wednesday 07 June, 2006	27	27	27	37	30	31
Thursday 08 June, 2006	26	26	27	35	29	30
Friday 09 June, 2006	29	-	-	35	-	-
RBL / Log Average	27	26	27	45	49	37

Table 3– Assessed Rating Background Level and Ambient Noise Level

	RBL and Ambient Noise Levels					
	Day		Evening		Night	
Location	RBL	L _{Aeq}	RBL	L _{Aeq}	RBL	L _{Aeq}
1. Strathaven	30*	42	30*	34	30*	35
2. Sherraloy	30*	45	30*	41	30*	34

Notes:

1. Day is defined as 7:00am to 6:00pm, Monday to Saturday and 8:00am to 6:00pm Sundays & Public Holidays.
 2. Evening is defined as 6:00pm to 10:00pm, Monday to Sunday & Public Holidays.
 3. Night is defined as 10:00pm to 7:00am, Monday to Saturday and 10:00pm to 8:00am Sundays & Public Holidays
- *Where the RBL is found to be less than 30 dB(A), then it is set to 30 dB(A) in accordance with DEC recommendations.

4.0 Noise Criteria

4.1 Operational Noise

The NSW Department of Environment and Conservation (DEC) provides guidelines for external noise emissions from developments provided in the New South Wales Industrial Noise Policy (INP). In accordance with the Director General's requirements the noise emission from the site has been assessed against the INP criteria which will apply to the mobile plant and equipment operated on the site.

The assessment procedure for industrial noise sources has two components:

1. Controlling intrusive noise impacts in the short term for residences.
2. Maintaining noise level amenity for particular land uses for residences and other land uses.

4.1.1 Intrusive Noise Impacts

The INP states that the noise from any single source should not intrude greatly above the prevailing background noise level. Industrial noises are generally considered acceptable if the equivalent continuous (energy-average) A-weighted level of noise from the source (L_{Aeq}), measured over a 15 minute period, does not exceed the background noise level measured in the absence of the source by more than 5 dB. This is often termed the Intrusiveness Criterion.

The 'Rating Background Level' (RBL) is the background noise level to be used for assessment purposes and is determined by the methods given in Section 3.1 of the INP. Using the rating background noise level approach results in the intrusiveness criterion being met for 90% of the time. Adjustments are to be applied to the level of noise produced by the source that is received at the assessment point where the noise source contains annoying characteristics such as tonality or impulsiveness.

As operation of the proposed facility is only intended for the day time period, and no fixed equipment will be left operating overnight, the daytime RBL will be the controlling period. Since the RBL in the area has been assessed to be 30 dB(A) for all periods, the applicable intrusiveness criterion is 35dB(A).

4.1.2 Protecting Noise Amenity

To limit continuing increases in noise levels, the maximum ambient noise level within an area from industrial noise sources should not normally exceed the acceptable noise levels specified in Table 2.1 of the INP. That is, the background noise level should not exceed the level appropriate for the particular locality and land use. This is often termed the "Background Creep" or Amenity criterion.

For a residential receiver in a rural area, the recommended amenity criteria are shown in Table 4.

Table 4– Recommended L_{Aeq} noise levels from Industrial Noise Sources

Type of receiver	Indicative Noise Amenity Area	Time of Day	Recommended L_{Aeq} Noise Level dB(A)	
			Acceptable Noise Level (ANL)	Recommended Maximum
Residence	Rural	Day	50	55
		Evening	45	50
		Night	40	45

4.1.3 Resultant Environmental Noise Criteria

A summary of the intrusive and amenity criteria is given in Table 5. The final criteria are formulated to satisfy the lowest of the amenity or intrusiveness criteria for each time period. Note that the night and evening period criteria have been shown for completeness only, and are not applicable to this assessment since no operations will take place outside of the daytime period.

Table 5– Resultant Environmental Noise Criteria

Period	RBL (L_{A90})	Intrusive Criterion = RBL + 5	Ambient L_{Aeq}	Amenity Criteria	Final Criteria
Receiver 1 – Strathaven					
Day	30	35	42	50	35
Evening *	30	35	34	45	35
Night *	30	35	35	40	35
Receiver 2 – Sherraloy					
Day	30	35	45	50	35
Evening *	30	35	41	45	35
Night *	30	35	34	40	35

* Night and evening criteria not applicable to this assessment as no operations will take place outside of the daytime period

As the criteria are identical at both receivers and equal to the minimum criteria to be used for all assessment periods, the existing noise levels and criteria at the northern and western receivers are also expected to be similar. This was confirmed by attended measurements of the background noise level at the Northern boundary of the site.

These criteria apply to environmental noise emissions from mechanical equipment and vehicle noise emissions from the site.

It is noted that the situation where the RBL is identical for the day and night assessment periods is acknowledged in section 2.1 of the INP where it is stated:

"In some rural situations, the rating background level may be the same for the day and night. In these cases it is recognised that excursions of noise above the intrusiveness criterion during the day would not usually have the same impact as they would at night. This is due to the more sensitive nature of activities likely to be disturbed at night (for example, sleep and relaxation)"

Therefore, AECOM considers that small exceedances of the environmental criteria of less than 5 dB(A) for parts of the day would not be expected to cause an adverse impact on the receivers.

4.2 Traffic Noise

4.2.1 Environmental Criteria for Road Traffic Noise

In accordance with the Director General's requirements, the DEC's *Environmental Criteria for Road Traffic Noise* (ECRTN) has been used for the assessment of noise from traffic visiting the subject development.

Waste vehicles bound for the proposed landfill facility from the Long Swamp Road transfer station would use Long Swamp Road and Canambe Street and would then turn right onto Grafton Road and proceed along Waterfall Way to the proposed site. Grafton Road and Waterfall Way would be classified as collector roads according to the DEC guidelines and Long Swamp Road and Canambe Street would be classified as local roads.

Table 6 presents the road traffic noise criteria from the ECRTN for land use developments with potential to create additional traffic on existing collector and local roads. The external noise criteria are applied at 1 metre from the affected external building façade.

Table 6 – Road Traffic Noise Criteria

Period	Parameter	Criterion
Collector Roads		
Day (7.00 am – 10.00pm)	$L_{Aeq, 1hr}$	60
Night (10.00 pm – 7.00am)	$L_{Aeq, 1hr}$	55
Local Roads		
Day (7.00 am – 10.00pm)	$L_{Aeq, 1hr}$	55
Night (10.00 pm – 7.00am)	$L_{Aeq, 1hr}$	50

In cases where noise from an existing road already exceeds the above criteria, the DEC recommends that, where feasible, existing noise levels should be mitigated to meet the noise criteria. Examples of applicable strategies include appropriate location of private access roads; regulating times of use; using clustering; using 'quiet' vehicles; and using barriers and acoustic treatments.

For traffic generating developments the criteria stipulates that traffic arising from the development should not lead to an increase in existing noise levels of more than 2 dB(A) for all road types.

4.2.2 Sleep Arousal

The DEC ECRTN recommends that an assessment of sleep arousal due to the pass-bys of heavy vehicles during the night period be conducted.

A detailed discussion of the issues involved in sleep arousal can be found in the ECTRN. The following summary of sleep arousal issues gives recommendations for noise criteria to control maximum internal noise levels. The intent of a sleep arousal criterion is to ensure that the amenity of sleeping areas is protected and sleep arousal, beyond reasonable limits is avoided.

The following characteristics of a noise signal are identified as being strongly related to sleep disturbance.

- The peak level of the noise events, described by L_{Amax}
- The emergence of noise events above the general ambient noise level, described by measures such as $(L_{Amax} - L_{Aeq})$ or $(L_{Amax} - L_{A90})$
- The number of such noise events occurring during the sleeping period

A comparison of the existing research on sleep arousal results in the following conclusions:

- Maximum internal noise levels below 55 dB(A) are unlikely to cause awakening reactions
- One or two noise events per night, with maximum internal noise levels of 70 dB(A), are not likely to affect health and well being significantly.

As no night time operations have been proposed, the development would not be expected to generate heavy vehicle traffic during the night time assessment period.

4.3 Construction Noise

In July 2009 the NSW Department of Environment, Climate Change and Water (DECCW) published their *Interim Construction Noise Guidelines (ICNG)* for use in construction noise assessment. This document supersedes their previous publication the *Environmental Noise Control Manual (ENCM)* and is used as the basis for establishing construction noise criteria.

Under the existing DECCW policy, a construction noise management plan is required to be compiled by the Contractor, prior to construction commencing. Noise level objectives must be set for the daytime and evening periods, and must be complied with where reasonably practicable. Work that is proposed outside of standard working hours, as defined in the *ICNG*, generally requires strong justification.

The noise management plan should detail the "best practice" construction methods to be used, presenting a reasonable and feasible approach. The plan should identify the extent of the residential area affected and assess the impact on residents. The plan should detail any community relation programs that are planned e.g. prior notification for particularly noisy activities, letter box drop regarding out of hours construction work to be undertaken and a 24 hour contact phone number for residents to call should they have any complaints or questions.

The ICNG defines what is considered to be feasible and reasonable as follows:

Feasible

A work practice or abatement measure is feasible if it is capable of being put into practice or of being engineered and is practical to build given project constraints such as safety and maintenance requirements.

Reasonable

Selecting reasonable measures from those that are feasible involves making a judgment to determine whether the overall noise benefits outweigh the overall adverse social, economic and environmental effects, including the cost of the measure.

The ICNG recommends that a quantitative assessment is carried out for all 'major construction projects that are typically subject to the EIA process'. A quantitative assessment, based on a likely 'worst case' construction scenario, has been carried out for the proposed development.

Predicted noise levels at nearby noise sensitive receivers (residential, commercial and industrial premises) are compared to the levels provided in Section 4 of the ICNG. Where an exceedance of the criteria is predicted the ICNG advises that the proponent should apply all feasible and reasonable work practises to minimise the noise impact.

Criteria for residential receivers are set using the information in **Table 7**.

The initial construction works for the landfill facility are understood to involve partial clearing of the site, the construction of the site access and maintenance roads, drainage works, landscaping works and some excavation of the landfill area. Based on the assessed RBL outlined in Section 4.1, the construction noise criteria would be 40 dB(A) during the day-time at the nearest residential receiver.

Ongoing construction and capping of landfill cells after the initial works were complete would be required to comply with the operational noise criteria for the site.

Table 7 – Noise at residences using quantitative assessment

Time of Day	Management Level L_{Aeq} (15min)*	How to Apply
Recommended standard hours: <ul style="list-style-type: none"> Monday to Friday 7 am to 6 pm Saturday 8 am to 1 pm No work on Sundays or public holidays 	Noise affected RBL + 10 dB	<ul style="list-style-type: none"> The noise affected level represents the point above which there may be some community reaction to noise. Where the predicted or measured L_{Aeq} (15 min) is greater than the noise affected level, the proponent should apply all feasible and reasonable work practices to meet the noise affected level. The proponent should also inform all potentially impacted residents of the nature of works to be carried out, the expected noise levels and duration, as well as contact details.
	Highly noise affected 75 dB(A)	<ul style="list-style-type: none"> The highly noise affected level represents the point above which there may be strong community reaction to noise. Where noise is above this level, the relevant authority (consent, determining or regulatory) may require respite periods by restricting the hours that the very noisy activities can occur, taking into account: <ol style="list-style-type: none"> times identified by the community when they are less sensitive to noise (such as before and after school for works near schools, or mid-morning or mid-afternoon for works near residences) if the community is prepared to accept a longer period of construction in exchange for restrictions on construction times.
Outside recommended standard hours	Noise affected RBL + 5 dB	<ul style="list-style-type: none"> A strong justification would typically be required for works outside the recommended standard hours. The proponent should apply all feasible and reasonable work practices to meet the noise affected level. Where all feasible and reasonable practices have been applied and noise is more than 5 dB(A) above the noise affected level, the proponent should negotiate with the community. For guidance on negotiating agreements see section 7.2.2 (ICNG).

* Noise levels apply at the property boundary that is most exposed to construction noise, and at a height of 1.5 m above ground level. If the property boundary is more than 30 m from the residence, the location for measuring or predicting noise levels is at the most noise-affected point within 30 m of the residence. Noise levels may be higher at upper floors of the noise affected residence.

5.0 Site Noise Emission Modelling

5.1 Modelling Methodology

A three dimensional noise model of the site and surrounds was constructed using SoundPLAN version 6.3. The noise levels at the receiver were calculated according to the CONCAWE algorithms for industrial noise sources.

5.1.1 Topography and Site Layout

The topography within the proposed site and surrounding area was based on 0.5m contour survey drawings and 10m contours, both provided by AECOM's designers.

The site boundary and layout of the landfill was based on AECOM's preliminary site layout drawings.

5.1.2 Meteorological Conditions

The INP requires temperature inversions to be considered for developments where night time operations are proposed and temperature inversions typically occur for more than 30% of the total night time during winter (June, July, August). As the proposed development will only operate during the daytime period, assessment of noise from the site with a temperature inversion is not required.

The INP also requires wind effects to be considered where a source to receiver wind speed of less than 3 m/s occurs for more than 30% of any assessment period in any season. At wind speeds above 3 m/s, noise produced by the wind itself generally obscures noise produced by industrial sources.

Meteorological data for a typical year (2002) has been assessed to determine the occurrence of wind conditions on the site that are likely to cause increased noise levels at the receiver. Table 8 presents the results of an analysis of the occurrence of wind speeds less than 3m/s in the area, based on meteorological data for 2002 from the Bureau of Meteorology weather station at Armidale Airport.

Table 8 - Occurrence of source to receiver wind speeds <3m/s at Armidale Airport, 2002

Direction (Site to Receiver)	Day				Evening				Night			
	Summer	Autumn	Winter	Spring	Summer	Autumn	Winter	Spring	Summer	Autumn	Winter	Spring
N	11%	12%	9%	10%	8%	12%	15%	11%	26%	26%	28%	24%
NE	13%	15%	9%	9%	8%	17%	17%	9%	29%	29%	23%	17%
E	14%	15%	9%	8%	7%	18%	17%	11%	29%	29%	21%	15%
SE	13%	16%	9%	8%	10%	21%	20%	15%	24%	24%	17%	11%
S	12%	13%	8%	7%	10%	16%	22%	17%	9%	9%	11%	8%
SW	12%	12%	10%	10%	11%	15%	25%	21%	10%	10%	20%	20%
W	11%	11%	10%	10%	12%	13%	23%	18%	9%	9%	21%	22%
NW	13%	11%	9%	11%	9%	12%	22%	15%	14%	14%	26%	26%

As shown in Table 8, source to receiver wind speed of less than 3 m/s were found to occur for less than 30% of the time for the Day time and Evening assessment periods throughout the year. Whilst the incidence of wind up to 3 m/s approaches 30% in some directions during the night time period, night time operations are not proposed. Therefore, in accordance with the INP guidelines, wind effects are not required to be included in the analysis.

Based on the above discussion, the noise emissions have been assessed under neutral meteorological conditions as this is would be the predominate condition in terms of sound propagation.

5.1.3 Equipment Noise Levels

Site measurements of the landfill compactor were undertaken at the existing Long Swamp Rd landfill facility. However, it is understood that much of the existing landfill equipment would be replaced and newer, higher capacity machinery would typically be used at the proposed landfill facility.

Therefore, sound power levels of typical landfill machinery have been used for the purpose of this assessment. These sound power levels were based on site measurements, AECOM's experience with similar equipment and the typical midpoint levels recommended in Australian Standard AS2436 – *Guide to Noise Control on Construction, Maintenance and Demolition Sites*.

The equipment sound power levels used in the model are summarised in Table 9.

Table 9 – Equipment Sound Power Levels

Equipment Description	Sound Power Level dB(A)
Excavator	110
Dozer (D5)	113
Water Cart	105
Compactor (Landfill)	107
Grader	114
Tipper Truck	105
Truck	97
Scraper	114

Sources were modelled as operating on the finished landfill contours to present a conservative estimation of noise levels at the receivers. In this instance minimal shielding is provided by the landfill waste itself and would be typical of the situation where the landfill cells are reaching their finished level. In practice, some additional shielding would be provided by the landfill cells and/or the natural contours for the majority of the operating life of the landfill.

5.2 Operational Assessment

The operational assessment was based on the equipment outlined below operating on the proposed site. The equipment was generally distributed along the south and the western areas of the landfill to represent the least favourable distribution of noise sources due to the proximity to Receivers 1 and 2. Two scenarios were addressed as follows:

- One scenario would be typical of the normal filling and compacting operations on the site with the following equipment operating within the working landfill cell.
 - 1 x compactor
 - 1 x dozer
 - 1 x tipper truck
- The other scenario would be typical of the covering operations on the site that would occur in the afternoon with the following equipment operating within the working landfill cell.
 - 1 x compactor
 - 1 x scraper
 - 1 x cover truck
 - 1 x excavator

The following traffic movements have been incorporated along the site roads for both operational scenarios and would be typical of the worst case operation of the site:

- 2 truck movements per hour along the site access road (it is understood that the site operations would be managed such that the three daily waste vehicles would arrive at the site at times spread throughout the day, and more than one vehicle would not arrive in any one hour period. The two truck movements per hour on the site access road equates to one truck arriving and departing the site);
- 1 truck movement per hour along the perimeter maintenance road;
- 1 movement per hour along the perimeter maintenance road for the water cart;
- The compactor, dozer and stationary truck distributed across the active landfill cell.

The dozer and compactor would generally be confined to the landfill cells and therefore it is unlikely that these machines would be regularly used on the perimeter haul road.

Both operational scenarios were repeated in cell 1, 3 and 5 to determine the worst repeating case noise levels for the southern, western and northern receivers over the 50 year life of the proposed landfill.

5.2.1 Calculated Noise Levels – No Mitigation

Noise levels were calculated at the identified receivers under neutral meteorological conditions. The calculated noise levels resulting from the proposed development for the operational scenario are summarised in Table 10, below.

Table 10 - Normal Operations During Daytime under Neutral Meteorological Conditions

Receiver	Location Of Equipment					
	Cell 1		Cell 3		Cell 5	
	Fill	Cover	Fill	Cover	Fill	Cover
Strathaven	33	34	33	35	34	35
Sherraloy	40*	43*	28	35	27	31
Riverton	23	25	25	27	25	27
4 North 1	27	29	30	31	30	32
5 North 2	27	28	29	30	30	31
6 North West	23	24	24	26	25	26

* Denotes exceedance of environmental criterion.

The analysis indicates that the environmental criteria would be met for all receivers when equipment is operating in Cell 3 and Cell 5. Where equipment is operating in Cell 1, at the south of the site, the noise level at Receiver 2 would be expected to exceed the criteria by up to 8 dB(A) and the mitigation measures discussed in Section 5.2.2 should be implemented to reduce the impact of the development on the existing acoustical environment. Noise contour plots for operations in Cell 1 have been included in **Error! Reference source not found.**

5.2.2 Recommended Operational Noise Control Measures

5.2.2.1 Silencers on Heavy Equipment

Permanent heavy equipment used on site should have noise attenuation measures installed which would typically make the equipment suitable for use in urban areas and which comply with regulatory requirements. The noise attenuation measures should include:

1. The encapsulation of engine chambers, with careful regard to ventilation requirements of the engines; and,
2. Fitting 'Department of Environment and Conservation (DEC)' approved silencers to all powered operated plant.

These mitigation measures would be expected to provide attenuation of between 5-10 dB(A) and should be applied to the Dozer, Excavator, Compactor and Scraper as required to achieve the sound power levels indicated in Table 11.

Table 11 – Attenuated Equipment Sound Power Levels

Equipment Description	Sound Power Level dB(A)
Excavator	105*
Dozer (D5)	108*
Water Cart	105
Compactor (Landfill)	102*
Grader	109*
Tipper Truck	105
Truck	97
Scraper	109*

*5 dB(A) reduction applied for silencing

5.2.2.2 Reversing Alarms

Reversing alarms are a common source of annoyance complaints from facilities that involve the use of heavy vehicles in their operation. Due to the low existing background noise levels in the vicinity of the proposed site it is recommended that consideration be given to noise emissions in the selection of reversing alarms that are fitted to vehicles using the facility.

Where equipment is required to have a reversing alarm, it is recommended that reversing alarms which automatically adjust output sound levels according to the prevailing ambient noise level be used. Preferably, broadband reversing alarms should be fitted in place of tonal alarms.

5.2.2.3 Staging Plan

It is noted that the equipment would generally operate below the level of the perimeter maintenance road during the early life of each cell and some additional natural shielding would be provided which has not been included in the modelling. Similarly, as the level of material in the landfill increases, additional shielding would be provided to the south and the east by the compacted waste itself.

It has been proposed that the landfill is filled from the east to the west and from the south to the north. However, it is noted that filling each cell from the west to the east would maximise the amount of shielding provided to Receiver 1 over the life of the landfill.

5.2.2.4 Location of Stockpiles

As far as practical, cover material should generally be stockpiled along the west or south of the active landfill cell in order to provide additional shielding to the most-affected receivers.

5.2.2.5 Minimise Dozer and Scraper Operations

Noise levels at all receivers are typically dominated by Dozer and Scraper operations. Therefore, the use of these items of plant should be minimised as far as practical, particularly when working at the extremities of the site.

Dozer and scraper operations would not be undertaken prior to 7am on weekdays and prior to 8am on weekends and public holidays, therefore there will be no noise impact during the night time assessment period.

5.2.3 Calculated Sound Power Levels with Plant Noise Attenuation

With the plant noise control measures outlined in Section 5.2.2.1 and 5.2.2.2 implemented, the sound power levels for the equipment would be approximately as shown in Table 11.

5.2.4 Noise Levels at Receivers with Plant Noise Attenuation

The noise modelling was repeated to determine the expected noise impact in the situation where attenuated equipment is used. Noise levels were calculated at the identified receivers under neutral meteorological conditions with the recommended plant noise attenuation measures implemented. The calculated noise levels resulting from the operation of the proposed development with the recommended plant noise attenuation measures implemented are summarised in **Table 12**.

Table 12 – Attenuated Plant Operating During Daytime under Neutral Meteorological Conditions

Receiver	Location Of Equipment					
	Cell 1		Cell 3		Cell 5	
	Fill	Cover	Fill	Cover	Fill	Cover
Strathaven	29	30	30	31	30	31
Sherraloy	35	38*	24	31	23	27
Riverton	20	21	22	23	22	23
4 North 1	25	25	27	28	28	29
5 North 2	24	24	26	27	27	28
6 North West	19	20	21	22	22	23

*Denotes exceedance of environmental criterion.

The results indicate a minor exceedance of the criteria at the Sherraloy receiver of approximately 3 dB(A) during covering operations of Cell 1. However, it should be noted that the modelling assumes that the plant is operating on the finished contours of the landfill, which will only occur as the cell (or sub-cell) reaches capacity. This represents a “worst case” since, for the majority of the operating life of Cell 1, additional shielding to the Sherraloy receiver would be provided by the natural contours of the site.

Therefore, it is considered that with only the plant noise mitigation measures implemented, the proposed development would generally comply with the environmental criteria for the site, under the neutral meteorological conditions that have been shown to be typical of the site. Minor exceedances of the criterion of up to 3 dB(A) may occur at certain times near the end of the operating life of Cell 1.

However, since the day time criterion is equal to the night time criterion and the INP minimum assessment level, clause 2.1 of the INP would apply, meaning minor exceedances of 3 dB(A) would generally be acceptable for the daytime operations.

5.3 Construction Scenario

The assessment of the construction scenario was based on the following equipment operating on the proposed site.

- 20 truck movements per day along the site access road, with a peak of 5 movements per hour;
- 10 truck movements per hour along the perimeter maintenance road;
- 1 movement per hour along the perimeter road and site access road for the water cart;
- 1 Compactor and 1 Grader located along the western portion of the perimeter road; and,
- 1 Excavator and 1 Dozer working in the area of Cell 1.

Equipment would generally be distributed across the site, however, a worst case scenario where the equipment is predominantly working at the extremities of the construction area nearest Receivers 1 and 2 has been used for the purpose of the noise assessment.

5.3.1 Calculated Noise Levels

The analysis indicates that the proposed construction noise objective of 40 dB(A) would be expected to be met for the all receivers when equipment is operating in the typical configuration described above. Small variations in noise levels would be expected at the receivers based on variation in the location of the equipment and wind

conditions. Under the maximum impact wind conditions outlined in the INP the noise levels would be expected to be 5-6 dB(A) higher than the levels in Table 13. However, these conditions have been shown to occur for less than 30% of any assessment period in any season and, in accordance with the guidance given in the INP are not considered to be significant.

Table 13 - All Construction Plant Operating During Daytime under Neutral Meteorological Conditions

Receiver	L _{Aeq} dB(A)
Strathaven	36
Sherraloy	38
Riverton	28
4 North 1	32
5 North 2	34
6 North West	28

5.3.2 Recommended Construction Noise Control Measures

A Construction Noise Management Plan (CNMP) should be prepared by the construction contractor prior to the start of site works. The noise management plan should detail the best practice construction methods to be used, presenting a reasonable and feasible approach. The CNMP would also include a noise monitoring program, reasonable and feasible noise mitigation measures, a complaint management strategy and contingency plans if noise exceedances or justified complaints were to occur.

Due to the extremely low existing background noise levels at the receiver locations, all reasonable opportunities to minimise noise emission from the site should be undertaken. The following general measures are typical of the best practice noise management and should be applied to minimise noise emission from the site during the construction period.

- Maximising the offset distance between noisy plant items and nearby noise sensitive receivers;
- Avoiding the co-incidence of noisy plant working simultaneously close together and adjacent to sensitive receivers;
- Orienting equipment away from sensitive areas;
- Carrying out loading and unloading away from noise sensitive areas;
- Selecting site access points and roads as far as possible away from sensitive receivers;
- Ensuring that vehicles required on site do not 'queue' outside the worksite prior to the morning start time;
- Ensuring all construction vehicles enter and leave the site in accordance with site entry controls;
- Ensuring no truck associated with the work is left standing with its engine operating;
- All equipment, including bulldozers, graders, excavators and trucks should have all reasonable and feasible noise controls fitted to reduce noise emission as much as is feasibly possible. The noise attenuation measures should include:
 - The encapsulation of engine chambers;
 - Fitting 'Department of Environment and Conservation (DEC)' approved silencers to all powered operated plant; and,
 - The use of reversing alarms which automatically adjust output sound levels according to the prevailing ambient noise level. Preferably, broadband noise alarms should be fitted in place of tonal alarms.
- Notifying the surrounding community via letter drops and/or local media announcements of any forthcoming unusual construction activities; and,
- Engaging community consultation prior to and throughout the construction phase.

6.0 Off Site Traffic Noise Assessment

6.1 Increase in Noise Levels

The proposed development would be expected to generate twelve traffic movements per day as outlined below:

- 3 x waste vehicles to and from the site (total 6 movements);
- 1 x cover truck to and from the site (total 2 movements); and,
- 2 x staff vehicles to and from the site (total 4 movements).

The increase in traffic noise levels was assessed to determine compliance with the ECRTN criteria.

6.1.1.1 Waste Vehicles from Long Swamp Road Facility

Waste vehicles bound for the proposed landfill facility from the Long Swamp Road transfer station would use Long Swamp Road and Canambe Street and would then turn right onto Grafton Road and proceed along Waterfall Way to the proposed site.

Long Swamp Road and Canambe Street currently experience heavy vehicle traffic associated with the operation of the existing landfill. The number of additional truck movements generated by the proposed landfill would be small. Assuming that the trucks that currently leave empty from the existing Long Swamp Rd Landfill would be used to meet the majority of the transport requirements between the transfer station and the proposed landfill site, a maximum increase in traffic noise levels due to trucks associated with the facility of 1.2 dB(A) would be expected. No significant change to light vehicle traffic noise would be expected.

It is noted that this is an inherently conservative assessment as only the waste vehicles serving the new landfill facility have been considered. In practice, additional traffic on the streets would reduce the impact further. As the number of additional traffic movements is expected to be small, at 3 trucks per day, a detailed assessment of the existing level of traffic noise was not undertaken.

6.1.1.2 Traffic along Waterfall Way

The cover trucks and the staff vehicles would be expected to travel between Armidale and the proposed landfill facility via Waterfall Way but would not originate from the existing transfer station. Upon arrival in Armidale, vehicles leaving the landfill would generally be identified as normal traffic.

The existing vehicle traffic along Waterfall Way has been based on the hourly traffic survey data supplied by Armidale Dumeresq Council.

Due to the small number of traffic movements generated by the facility, a maximum impact assessment has been undertaken, whereby the total number of waste vehicle movements per day has been assumed to occur in each operating hour of the landfill.

The assessment indicates that the volume of traffic movements associated with the development would not be expected to significantly increase traffic noise along Waterfall Way, with a maximum calculated increase in noise levels of 0.7 dB(A) between 7am and 8am on weekday mornings for the operational scenario. The maximum calculated increase in noise levels during the construction period is 0.9 dB(A) between 7am and 8 am on weekday mornings.

Based on the above discussion and the assessment detailed in Appendix **Error! Reference source not found.** the traffic generated by the proposed landfill facility would not be expected to increase traffic noise levels on Waterfall Way, Long Swamp Road or Canambe Street by more than 2 dB(A) and would therefore comply with the ECRTN criteria.

6.2 Sleep Arousal

The operating hours of the landfill and limited number of truck movements would be expected to limit the time of impact for heavy vehicle traffic through the residential areas along Long Swamp Road and Canambe Street to the daytime period. Therefore the development would not be expected to generate additional night time maximum noise events due to heavy vehicle pass bys.

7.0 Conclusion

The noise emission from the proposed landfill facility off Waterfall Way has been assessed against the criteria contained in the DEC *Industrial Noise Policy* to determine the impact at the nearest receivers throughout the life of the landfill site.

Due to the low existing background noise levels, the noise emission from site operations would need to be controlled to ensure compliance with the INP criteria. However, as discussed in Section 4.1.3 and in accordance with Section 2.1 of the INP, a 3 dB(A) exceedance of the day time environmental noise criteria is considered to be negligible and unlikely to have the same impact as an equivalent exceedance at night time. With the mitigation measures discussed in Section 5.2.2 implemented, it is expected that the noise levels at the nearest receivers would comply with the criteria for the typical operational scenarios that have been analysed.

The expected increase in traffic noise resulting from traffic generated by the proposed landfill facility was calculated and found to be less than 2 dB(A). Therefore the proposed landfill facility would be expected to comply with the criteria outlined in the DEC *Environmental Criteria for Road Traffic Noise*.

As the proposed landfill facility would be reliant on engineered noise control treatment, the ongoing maintenance of equipment will be critical to ensure the continuing compliance with the noise criteria. For this reason it is recommended that an annual compliance monitoring program be undertaken to confirm that the site noise emissions remain acceptable over the life of the landfill.