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AGL ENERGY LIMITED

WAUKIVORY PILOT PROJECT

CONSTRUCTION NOISE COMPLIANCE SURVEY

REPORT J0215-01-R2

16 SEPTEMBER 2014

Prepared for:
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1. INTRODUCTION

This report presents results from a construction noise compliance survey at various residences in the vicinity of the Waukivory Pilot Project (the project) which is part of the Gloucester Coal Seam Gas Project being developed by AGL Energy Limited. The project includes construction of the following infrastructure:

- Gas collection equipment fitted to four existing gas wells known as WK11, WK12, WK13 and WK14 located approximately 2 km south of Gloucester, NSW;
- Trenching and installation of gas collection pipelines (gathering lines) between the four wells;
- Trenching and installation of a water transfer pipeline between the southern well (WK13) to two surface dams located approximately 1 km and 2.5 km south of the wells;
- Directional drilling to install gathering lines and the water transfer pipeline under the Avon River, Waukivory Creek and Fairbairns Road;
- Gravel hardstand areas around each well, security fences and other ancillary infrastructure; and
- Fracture stimulation of the coal seam around each well to increase gas flow.

The project is subject to Environment Protection Licence (EPL) 20358 issued by the Environment Protection Authority (EPA).

AGL Energy Limited commissioned the *Waukivory Pilot Project Construction Noise Management Plan* (CNMP) (EMGA Mitchell McLennan, 6 August 2014) in response to Condition G2.2 of the EPL. Section 4.2.3 of the CNMP recommends noise monitoring during activities predicted to generate maximum noise impacts during the construction program, while Section 5.1 of the CNMP recommends a number of responses to noise related complaints including noise monitoring at potentially affected receivers to assess construction noise levels against relevant criteria.

This report has been commissioned by AGL Energy Limited in response to Sections 4.2.3 and 5.1 of the CNMP. Noise measurements were taken during a site visit on Thursday 11 September 2014.

1.1. Glossary

The following acoustical terms are used in this report:

Sound Pressure	Small air pressure variations above and below normal atmospheric pressure that are perceived by human ears as sound.
Frequency	The rate of sound pressure fluctuations per second, expressed as cycles per second or hertz (Hz). Human ears in good condition can typically detect sound in the frequency range 20 Hz to 20,000 Hz (20 kHz), depending on sound level.
Decibels, dB	A noise level unit based on a logarithmic scale of pascals of sound pressure above and below atmospheric pressure. Expressing a sound pressure level in decibels implies root-mean-squared (RMS) sound pressure unless explicitly stated otherwise. Human ears in good condition can typically detect sound pressures from the threshold of perception at 0 dB (20 uPa) to the threshold of pain at 140 dB (200 Pa), depending on frequency. An increase of 10 dB is perceived as an approximate doubling of sound level by a human ear.
dBL	Linear decibels, the same as dB but used to explicitly define a decibel scale in the absence of any frequency weighting.
dBA	A-weighted decibels, where the A weighting means frequencies below 500Hz and above 10kHz are artificially reduced to approximate the frequency response of an average human ear. Most sound monitoring instruments include an A-weighting option, enabling direct measurement of noise levels in dBA.

- LA90 The A-weighted noise level exceeded 90% of the time (which can be thought of as the quietest 10% of the time) over a defined measurement period, usually 15 minutes or one hour, and widely accepted as the background noise level.
- LA90,15min Same as LA90 with the measurement period specifically stated.
- LAeq The A-weighted equivalent continuous, or logarithmic average, noise level over a defined time period either measured or predicted at a specific location.
- LAeq,15min Same as LAeq with the measurement period specifically stated.
- Background Level see LA90.

2. RECEIVERS

The CNMP identified 10 residential receivers with the potential to receive significant construction noise. Table 1.2 in the CNMP presents the address and location of each receiver and is reproduced in Table 1.

Table 1: Identified Residential Receivers (from Table 1.2 in the CNMP).

Location	Address	Coordinates (MGA Zone 56)
R1	20 Grantham Road, Forbesdale	402023, 6453041
R2	Intersection of Fairbairns Lane and North Coast Railway	401824, 6452610
R3	176 Fairbairns Road, Forbesdale	402095, 6452080
R4 ¹	237 Fairbairns Road, Forbesdale	402510, 6451653
R5 ¹	197 Fairbairns Road, Forbesdale	403184, 6452184
R6	114 Maslens Lane, Gloucester	402747, 6453425
R7	304 Fairbairns Road, Forbesdale	402282, 6451332
R8	305 Fairbairns Road, Forbesdale	402822, 6450969
R9	Lot 881 Fairbairns Road, Forbesdale	402942, 6450475
R10	384 Fairbairns Road, Forbesdale	403012, 6450236

¹ Receivers R4 and R5 are owned by a neighbouring mining company.

A plan of the area showing the location of each receiver is attached as Appendix A.

3. NOISE CRITERIA

Construction activity associated with the project is subject to noise criteria recommended in the *Interim Construction Noise Guideline* (ICNG) (Department of Environment and Climate Change NSW, July 2009). The ICNG recommends two noise assessment levels during standard construction hours, which are 7 am to 6 pm Monday to Friday and 8 am to 1 pm Monday to Saturday excluding public holidays:

- A ‘noise affected’ level set 10 dBA above the background noise level represents the point above which there may be some community reaction to noise and all feasible and reasonable mitigation measures should be implemented; and
- A ‘highly noise affected’ level of 75 dBA above the background noise level represents the point above which there may be a strong community reaction to noise and additional mitigation measures such as respite periods may be appropriate.

Section 2.2 of the CNMP reports a measured background noise level at or below 30 LA90,15min at all receivers which leads to a ‘noise affected’ level of 40 LAeq,15min during normal construction hours at all receivers.

4. METHOD OF ASSESSMENT

Noise measurements were taken on Thursday 11 September 2014 in the vicinity of each potentially affected receiver using a Svan 957 Type 1 sound level analyser which was programmed to measure and store 1-second Leq noise levels in 1/3 octave bands from 20 Hz to 20 kHz for each measurement period. The analyser was fitted with a 12.7mm condenser microphone and a windshield and mounted on a tripod with the microphone located approximately 1.2m above the ground. Noise measurements were taken at each location for a representative period of nominally 15 minutes, however a shorter measurement duration of 5 minutes was used where construction noise was not audible or was well within the noise affected level of 40 LAeq,15min.

Instrument calibration was checked at the beginning and end of the noise survey using an 01dB Cal-01 acoustic calibrator which produces 94 dB at 1kHz. Copies of current calibration certificates for these instruments, from a NATA-accredited laboratory, have not been attached to this report but are available upon request.

The measured 1-second data were subsequently processed to exclude noise produced by extraneous sources to enable the separate noise contribution from construction activity alone to be determined, based on detailed notes taken during each measurement period. Charts showing the total measured noise level and the separate noise contribution from construction activity are attached to this report in Appendix B.

The noise survey complies with the recommendations in Section 5.1 of the CNMP, particularly Section 5.1.1 which discusses noise monitoring equipment and Section 5.1.2 which discusses an appropriate noise survey methodology.

5. RESULTS

Total measured noise levels at each location, and noise levels produced by construction activity alone, are presented for each assessed receiver in the order in which the noise measurements were taken.

Weather conditions were acceptable for noise monitoring with generally calm conditions and light winds up to 1 m/s from the south west towards the end of the survey. An air temperature of approximately 25 °C was accompanied by clear skies.

5.1. Receiver R5

Noise measurements were taken at Receiver R5, at a location approximately 30 m south of the residence, from 10:15 am on Thursday 11 September 2014. Construction activities at the time of the noise measurement included unloading and installation of concrete sections forming part of the boundary walls at WK12 using a Franna crane and gravel spreading, grading and rolling at WK13 using a backhoe loader and a vibrating roller.

Other sources of noise that were audible during the survey at R5 included horses adjacent to R5, intermittent bird calls, with distant traffic intermittently audible.

The only noticeable source of construction noise was the crane operating at WK12, which was generally inaudible or barely audible during the measurement period. Noise from the crane was measurable for a period of only 4 seconds and audible for a period of approximately 8 seconds in the measurement period of approximately 5 minutes.

A total noise level of 36.6 LAeq,15min was measured at R5. A construction noise level of approximately 21 LAeq,15min would have been measured in the absence of extraneous noise, however as this estimate is based on only 4 seconds of measurable construction noise it is subject to significant uncertainty.

According to the INP, a low frequency penalty of +5 dBA should be added to the estimated construction noise level to account for the low frequency nature of the construction noise, as identified by the dBC level being more than 15 decibels above the dBA level. The 5 dBA correction factor added to the estimated construction noise level of 21 LAeq,15min remains below the recommended 40 LAeq,15min construction noise goal, therefore construction noise at Receiver R5 is considered acceptable.

5.2. Receiver R6

Receiver R6 includes two residences adjacent to a number of farm related buildings such as storage sheds and workshops. The main residence is located north of the workshop and is effectively shielded from project noise by the large workshop building, while a second residence is located west of the workshop and would have an unobstructed view of the project.

Noise measurements were taken at a location approximately 50 m south of the workshop which is approximately 140 m south of the main residence and approximately 110 m south east of the second residence, in order to avoid disturbance to residents and avoid extraneous noise from workshop activities. This location is not within 30 m of the residence as recommended by relevant policy documents, however is closer to the project and more remote and shielded from workshop noise and is therefore acceptable. The noise measurement was taken from 10:35 am on Thursday 11 September 2014.

Construction noise was intermittently audible along with extraneous sources such as cows, birds and a motorbike. Construction noise sources included a crane operating at WK12 and a backhoe operating at WK13, although the backhoe was not visible from the monitoring location and noise from this source was inferred from the sound that was audible during the survey.

The 1-second 1/3 octave noise level traces, combined with notes taken during the noise survey, allowed the noise survey data to be separated into construction-related and extraneous categories although some uncertainty in the results is unavoidable. There were periods of a few seconds where audible construction noise coincided with a bird call, at which times the significant lower frequency components were assigned to the construction noise category while the higher frequencies were considered extraneous noise.

A total noise level of 39.2 LAeq,15min was measured at this location, with a construction noise contribution estimated at 31 LAeq,15min. A 5 dBA low frequency correction factor added to the estimated construction noise level of 31 LAeq,15min remains below the recommended 40 LAeq,15min construction noise goal, therefore construction noise at Receiver R6 is considered acceptable.

5.3. Receiver R4

Noise measurements were taken at Receiver R4, at a location approximately 10 m north west of the residence on the side of Fairbairns Road, from 10:55 am on Thursday 11 September 2014. During the noise measurement period a backhoe operating at WK13 completed its task, travelled along Fairbairns Road to a previous horizontal directional drilling site approximately 160 m south of R4 and worked there for the remainder of this noise monitoring period. Other audible sources included a remote controlled plane flying approximately 1 km to the north east, local and distant traffic, various domestic sounds near R7 approximately 200 m south west and birds.

A total noise level of 56.7 LAeq,15min, due primarily to passing traffic, was measured at this location over a 15 minute period. An estimated construction noise level of 26 LAeq,15min occurred during this period, entirely due to the backhoe operating at WK13 and at the previous drilling site to the south, although this result is subject to significant uncertainty as construction noise could only be measured for a total period of just under one minute.

A 5 dBA low frequency correction factor added to the estimated construction noise level of 26 LAeq,15min remains below the recommended 40 LAeq,15min construction noise goal, therefore construction noise at Receiver R4 is considered acceptable.

5.4. Receiver R3

Noise measurements were taken at Receiver R3, at a location approximately 45 m east of the residence on the side of Fairbairns Road, from 11:25 am on Thursday 11 September 2014. While the noise measurement location was not within 30 m of the residence, the location was selected as it is readily accessible and is considered appropriate as it is slightly closer to the project and is therefore conservative.

Construction activity included a backhoe (or similar machine) and a vibrating roller operating at WK13, although these machines were not visible as a solid noise and security barrier has been constructed around the WK13 compound. The backhoe was most likely spreading and grading gravel, while the roller was compacting the gravel.

Extraneous noise sources that were audible during the measurement period included passing traffic, a radio controlled plane operating approximately 1 km north east for a short period, a train, birds and wind.

A total noise level of 51.4 LAeq,15min was measured at R3, primarily due to passing traffic and fairly consistent bird activity. A construction noise level of approximately 29 LAeq,15min has been determined in the absence of extraneous sources, although some uncertainty remains due to the difficulty of separating construction noise from extraneous sources when both are audible simultaneously. A significant peak was noted in the 31.5 Hz band due to the vibrating roller, as shown in the relevant chart appended to this report.

A 5 dBA low frequency correction factor added to the estimated construction noise level of 29 LAeq,15min remains below the recommended 40 LAeq,15min construction noise goal, therefore construction noise at Receiver R3 is considered acceptable.

5.5. Receiver R2

Noise measurements were taken at Receiver R2, at a location approximately 20 m south of the residence on the side of Fairbairns Road, from 11:40 am on Thursday 11 September 2014. Construction activity included backhoe and roller movements within the WK13 compound which were more audible than expected at R2 due to the developing light southerly breeze. Other audible sources included passing traffic, a horse and birds.

A total noise level of 35.0 LAeq,15min, due to a combination of construction and extraneous sources, was measured at this location. Construction noise was audible for much of the time but was not generally dominant compared to other sources. Analysis of the results to remove noise from birds and traffic provides an estimated construction noise level of 27 LAeq. A 5 dBA low frequency correction factor added to the estimated construction noise level of 27 LAeq,15min remains below the recommended 40 LAeq,15min construction noise goal, therefore construction noise at Receiver R2 is considered acceptable.

5.6. Receiver R1

Noise measurements were taken at Receiver R1, at a location approximately 45 m west of the residence to avoid shielding from other buildings adjacent to the residence, from 11:50 am on Thursday 11 September 2014. Construction activity included backhoe and roller activity at WK13 while extraneous sources included birds, insects, wind, a horse and distant traffic.

A total noise level of 30.0 LAeq,15min, due almost entirely to extraneous sources, was measured at this location. Construction noise was occasionally audible but was not clearly measurable over other sources and, as distant traffic and distant construction noise have a similar frequency content, cannot be reliably separated. Construction noise was estimated to be less than 20 LAeq,15min at this receiver.

5.7. Results Summary

Table 2 presents a summary of measured noise levels and estimated or calculated construction noise levels at each monitoring location, including a low frequency penalty of 5 dBA where noted.

Table 2: Measured Total Noise Levels and Construction Noise Levels, 11 September 2014, dBA.

Noise Survey Location	Total Measured Noise Level					Calculated or Estimated Construction Noise Level	
	Lmax	LA1	LA10	LAeq	LA90	LAmix	LAeq
R1	38.2	37.6	31.6	30.0	25.6	-	< 20
R2	48.5	42.9	37.0	35.0	30.0	39 ¹	32 ¹
R3	75.1	59.2	52.2	51.4	31.6	44 ¹	34 ¹
R4	79.8	69.8	45.1	56.7	30.6	46 ¹	31 ¹
R5	50.6	47.7	37.6	36.6	27.8	37 ¹	26 ¹
R6	54.3	47.3	41.3	39.2	32.2	44 ¹	36 ¹

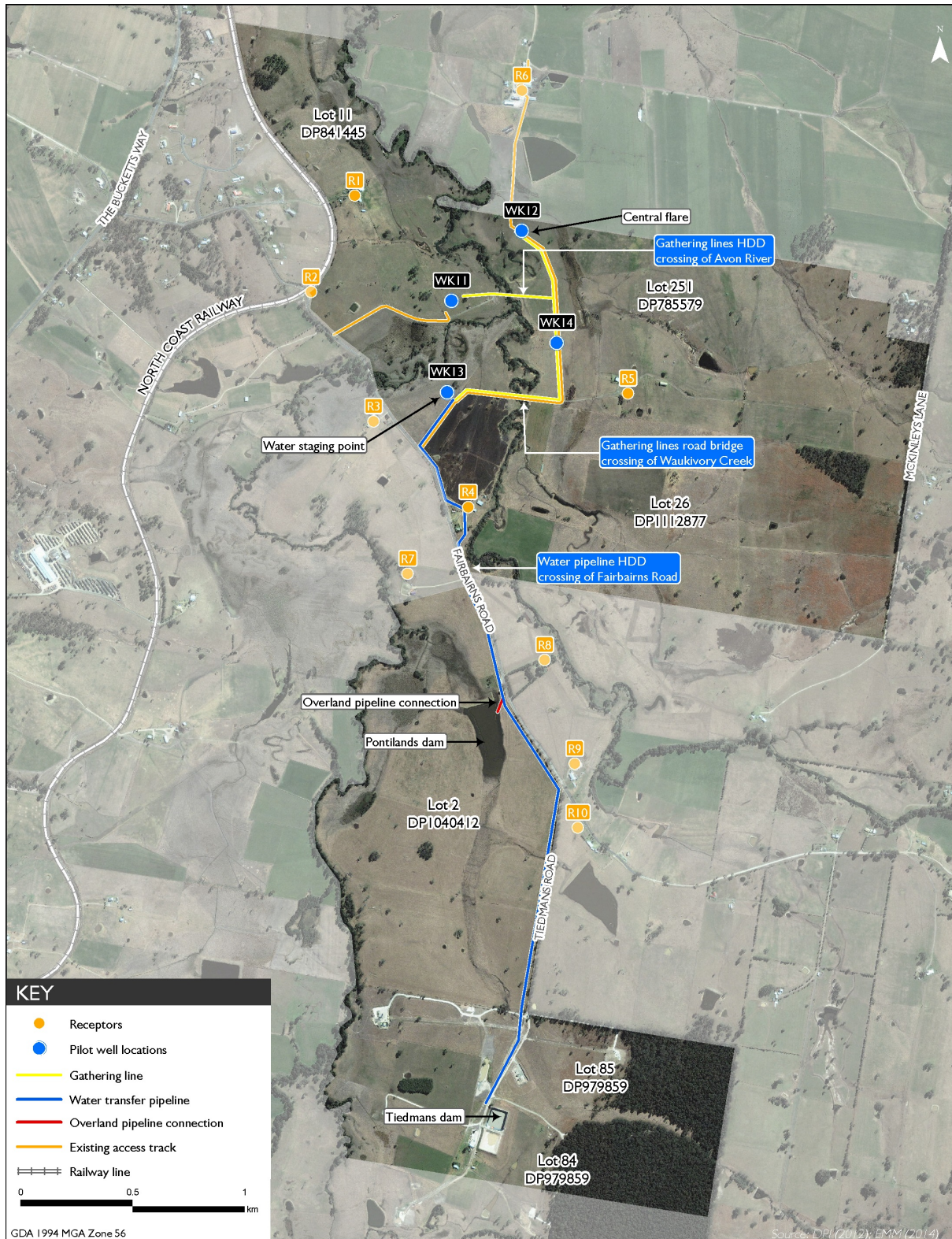
1 The reported construction noise level includes a 5 dBA low frequency correction factor as recommended in the INP.

6. CONCLUSION

This assessment of noise levels produced by construction work associated with the Waukivory Pilot Project at closest residential receivers indicates construction noise levels were below the recommended guideline value of 40 LAeq,15min in the CNMP and relevant EPA policy at all noise monitoring locations.

Based on the results of this assessment, no additional construction noise mitigation measures are recommended and no significant noise impacts are occurring at any receiver in relation to construction work for the project.

APPENDIX A – SITE AND AREA PLAN



Proposed work areas
 Construction Noise and Vibration Management Plan
 Waukivory Pilot Project

Figure 1.1

This plan has been reproduced from the plan on page 3 of the CNMP prepared by EMGA Mitchell McLennan.

APPENDIX B – MEASURED NOISE LEVELS

Charts on the following pages show measured noise levels and construction noise levels where construction noise was audible.

Two charts are shown for each receiver location. The first chart shows a ‘noise level trace’ for the duration of the noise measurement in one second intervals in dBA. The red trace shows measured noise levels, while the blue trace shows periods of noise attributed to construction activities where construction noise was audible. If construction noise was not audible then the blue trace representing construction noise is not included in the chart and the noise measurement was typically shortened to five minutes.

Gaps in the blue trace indicate periods of extraneous noise with no significant construction noise at those times, while a difference between the red and blue traces indicates construction noise sources contributed only part of the total noise levels measured at those times.

The second chart for each receiver location shows the measured average (L_{eq}) noise level in 1/3 octave bands from 20 Hz to 20 kHz and total L_{Aeq} , L_{Ceq} and L_{eq} noise levels. The red bars indicate total measured noise levels while the blue bars indicate the noise level attributed to construction sources.

