Proposed Drilling Site
Llandow Industrial Estate (site 2)

Noise Impact Assessment
3123/ENS1_rev3

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1.0 Introduction

Coastal Oil & Gas Ltd is proposing to drill at a site located on the southern part of the Llandow Industrial Estate, Llandow. Drilling is proposed to take place 24 hours a day for approximately 8 weeks. We understand that conditions on a similar site nearby restricted drilling to between October and March inclusive, possibly because of a local camp site/caravan park.

Hunter Acoustics have been commissioned to propose noise limits at critical noise sensitive premises. These are based on background noise monitoring (carried out in May 2011) and current planning guidance.

Appendix A explains acoustic terminology used in this report.

2.0 Planning Guidance

2.1 Minerals Technical Advice Note (Wales) 1

The Minerals Technical Advice Note (Wales) 1 (MTAN1) document gives the following guidance on noise limits for mineral extraction including gas:

- Daytime (0700-1900hrs) noise limits at noise-sensitive properties should be established at 10dB(A) above background levels* (subject to a maximum of 55dB(A) LAeq,1h).;
- Evening (1900-2200hrs) noise limits at NSPs should be established at 10dB(A) above background levels;
- Night-time noise limits at noise-sensitive dwellings should not exceed 42dB(A) LAeq,1h.

* Where it will be difficult not to exceed the background level by more than 10dB(A) without imposing unreasonable burdens on the mineral operator, the limit should be set as near that level as practicable and should not exceed 55dB(A).

MTAN1 also states the following;

"During temporary and short-term operations higher levels may be reasonable but should not exceed 67dB(A) for periods of up to 8 weeks in a year at specified noise sensitive properties."

The exploratory drilling operation is therefore considered a temporary / short-term operation as it is proposed to last for up to 8 weeks.

2.2 BS8233 'Sound Insulation & Noise reduction for Buildings – Code of Practice, & World Health Organisation Guidance (residential receivers)

BS8233 quotes 30dB(A) as a 'good standard, 35dB(A) as a 'reasonable' standard for noise levels in bedrooms. The 30dB(A) 'good' standard is based on The World Health Organisation (WHO) 'Guidelines for Community Noise – 1999', which quotes 30dB(A) as the threshold for sleep disturbance in bedrooms.

These figures equate to an external level of 45 – 50dB(A) taking a 15dB loss through a partially open window.

2.3 Bat Roost

We have not found any guidance on specific noise criteria for bat roosts however we would make the following observations;

a) High frequency/ultrasound noise emission is not likely to be an issue, bearing in mind the roost is 525m north of the proposed drilling site, and air/ground absorption effects at frequencies above 8kHz would be at least 1dB per meter. Ultrasound levels at the bat roost 525m away are therefore not indicated to be an issue.

b) A report from Dr Feltwell of Wildlife Matters refers to research showing that "the noise produced by tree branches or rustling reed beds produces the same levels of noise in the bat's acoustic environment and that they can differentiate between natural and man-made noises. Researchers found *'that noise does interfere with bat's ability to locate prey and feed, but no more than naturally occurring noises that the bats regularly encounter*.'" (Schaub A, Ostwald J, Siemers BM. 2008. Foraging bats avoid noise. The Journal of Experimental Biology, 211(Pt 19):3174-80)

c) It also appears likely that bats roost around working quarries and industrial sites across the country. This roost is near an existing recycling centre and we would therefore expect lorries to pass relatively close on most days, generating noise levels well in excess of emissions from the proposed drill site.

2.4 Noise Predictions

Noise levels have been predicted under light winds according to *"The Propagation of Noise from Petroleum and Petrochemical Complexes to Neighbouring Communities"* - report No.4/81 published by the Oil companies international group for CONservation of Clean Air and Water - Europe known as the CONCAWE model.

3.0 Environmental Noise Survey

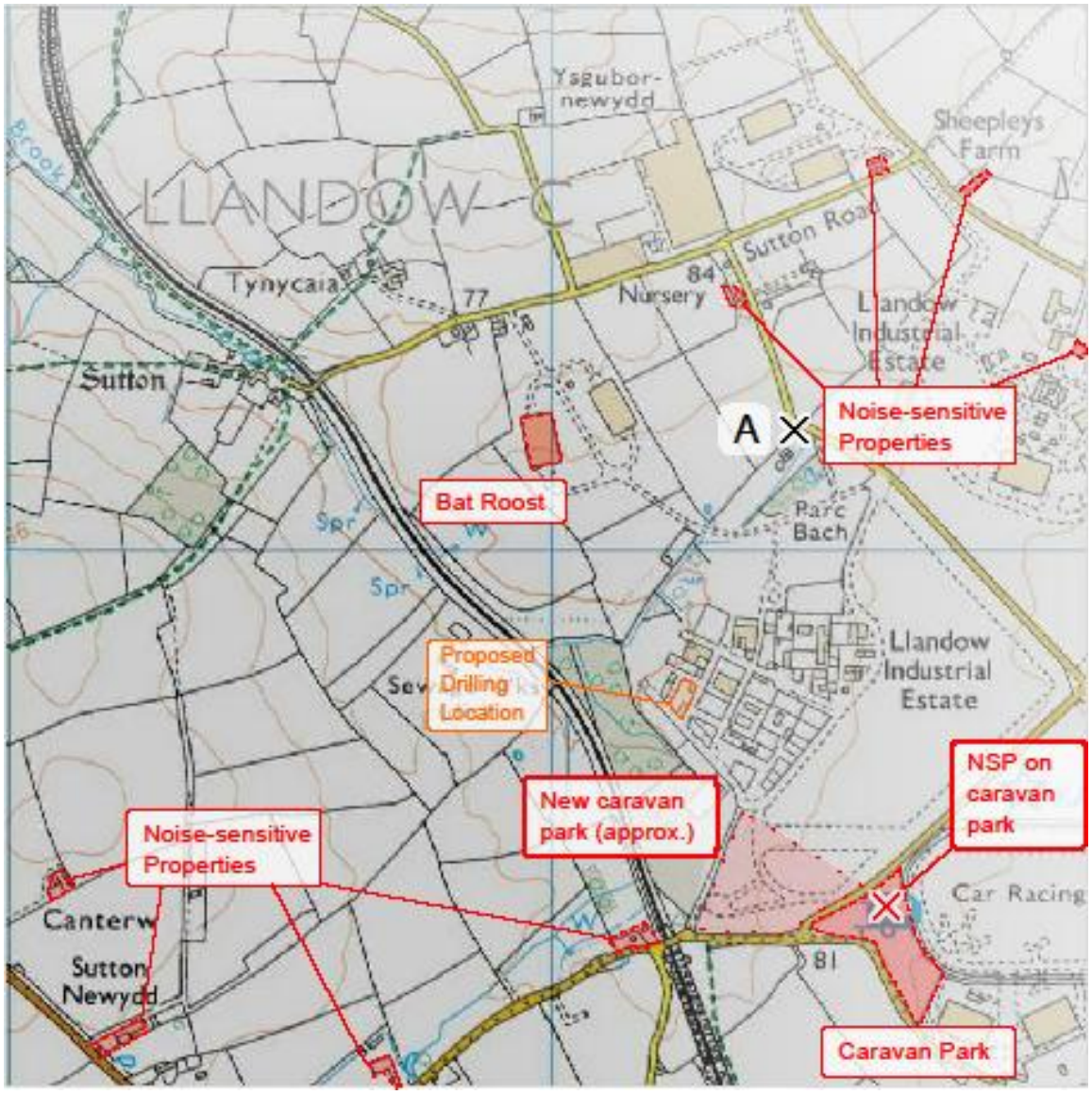
3.1 Procedure

Continuous noise monitoring was carried out between 1600hrs on 19th May and 1035hrs on 20th May 2011 to determine existing background noise levels. Data including L_{max}, L_{eq} & L_{90} was logged at 5-minute intervals over the monitoring period.

Site plan 3123/SP1 shows the development site and the measurement position used;

Position A — Located north of proposed drilling site, approximately 1.2 - 1.5m above local ground level. Background noise levels at this location deemed representative of those at the nearest NSPs.

3123/SP1 - Site Plan Showing Monitoring Position



3.2 Equipment Used

The following equipment was used:

Make	Description	Model	Serial Number	Last Calibrated	Certificate No.
Larson Davis	Type 1 - Sound Level Meter	820	1334	26-Apr-11	16512
Larson Davis	Preamplifier	828	1960	26-Apr-11	16512
GRAS	Microphone 1/2" Prepolarized FF	40AE	34343	26-Apr-11	16512
Norsonic AS	Calibrator (114.04 dB @ 999.71 Hz)	1251	31429	08-Jul-10	U7208

The measurement systems were calibrated before and after the survey. No variation occurred.

3.3 Weather Conditions

Weather conditions were mainly dry throughout the monitoring period with no significant winds.

4.0 Results

Time history graph 3123/TH1 shows L_{max}, L_{eq} & L_{90} sound pressure levels measured over consecutive 5-minute periods at position 1.

Period	Minimum Consistent L_{90}	Proposed Noise Limit
Daytime (0700-1900)	37.5dB(A)	47.5dB(A)
Evening (1900-2200)	34.8dB(A)	44.8dB(A)
Night (2200-0700)	20.8dB(A)	42.0dB(A)

Period	Average L_{eq}
Entire survey period	46.2dB(A)

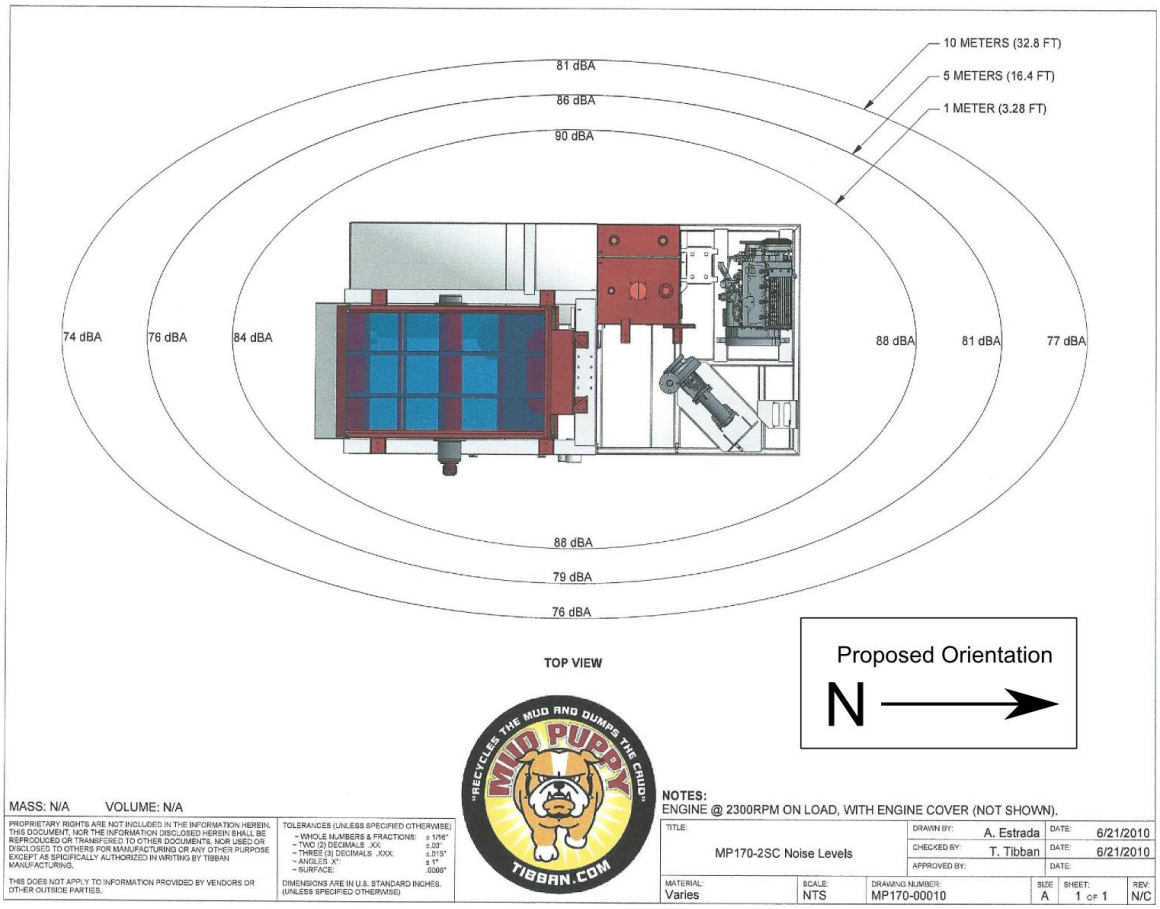
Time history graph 3123/TH1 shows L_{max}, L_{eq} & L_{90} sound pressure levels measured over consecutive 5-minute periods at position A.

As the drill rig is proposed to operate 24 hrs/day during the 8-week period, night-time is the critical period when setting noise limits at residences.

5.0 Noise Predictions

The following pattern of noise radiation for the proposed shaker/cyclone (Tibban Mud Puppy) is quoted by the manufacturer;

3123/D1 – Diagram Showing Pattern of Noise Radiation for Shaker/Cyclone`



Noise levels range from 74dB(A) to 81dB(A) at 10m.

The proposed drill rig has a typical noise level of 79 dB(A) at 1m – based on data included in an email from Oliver Taylor dated 21/01/2011 with manufacturer's specifications for a similar drill rig and our own measurements of a similar drill rig.

The manufacturer's data sheet for the Aggreko Diesel Generating Set SHP/8035E dated September 2009 lists the sound pressure level below 60dB(A) at 7 metres and is therefore indicated not to contribute significantly to overall sound power levels.

Based on noise data for the Manitou MHT 780 TELEHANDLER and previous measurements of typical mobile plant activity, a figure of 77dB dB SPL at 10m has been used in our assessment of mobile noise, with a maximum of 50% on-time (i.e. 30 minutes operation in an hour).

Noise levels have been predicted using the CONCAWE model with the shaker/cyclone orientated such that the quietest side of the rig faces towards the nearest NSPs (see 'Proposed Orientation' marked on 3123/D1 above).

5.1 Noise Sensitive Properties

Locations of critical residential noise properties are shown in site plan 3123/SP1.

The critical noise sensitive premises assessed are houses and farms located approximately,

1. 390m south,
2. 475m south-east,
3. 750m north,
4. 800m – 1km west/south-west,
5. 900m north-east,

of the proposed drill site.

Further noise-sensitive locations have been identified as follows, located approximately:

6. 320m south (new caravan park*)
7. 475m south (caravan park*)
8. 525m north (Bat roost)

of the proposed drill site.

*We understand that the caravan park is open from February 1st to November 30th.

5.1.1 Residences

At residential NSPs the following noise levels are predicted:

Note: No screening losses have been included in the predictions at this stage.

Position	Predicted noise level at residence (dB L_{Aeq}) from stationary and mobile plant combined
1. 390m south	40.8
2. 475m south-east	38.7
3. 750m north	33.8
4. 800m west	32.3
5. 900m north-east	31.6

Predicted combined noise levels from stationary and mobile plant without screening meet the night-time limits set in MTAN1 at residences (see section 4.0 above).

Allowing for a 15dB loss through a partially open window, noise levels are also predicted to meet the ‘good’ standard quoted in BS8233 and therefore to be below the World Health Organisation (WHO) night-time 30dB(A) threshold for sleep disturbance.

5.1.2 Caravan Park

At caravan park sites the following noise levels are predicted:

Note: No screening losses have been included in the predictions at this stage.

Position	Predicted noise level at residence (dB L_{Aeq}) from stationary and mobile plant combined
6. 320m south	43.1
7. 475m south-east	38.4

We understand that tents are pitched at the caravan park - tents are not indicated to provide any significant protection against external noise.

If drilling is carried out when the caravan park is in use (February 1st – November 30th), in order to meet MTAN1 noise criteria at closest tents/caravans, stationary and mobile plant should be fully screened (this excludes the high level drill section - observations at another drill site indicated that noise levels are generated by the low level generator/exhaust, not from the actual drill section).

The screen should be a minimum 10kg/m^2 mass per unit area, impervious, and high enough to remove line of sight to critical tents/caravans – it should therefore be located as close as practical to the noise sources in order to maximise attenuation. Removing line of sight in this way is indicated to give 8.7dB of attenuation to tents at ground level.

Noise levels at the nearest tents (6. 320m south) are then indicated to fall to around 34.4dB L_{Aeq}. Noise levels at the original caravan park (7. 475m south-east) are indicated to fall to around 29.7dB L_{Aeq}.

This is well below the most critical 42dB(A) night-time limit set in MTAN1, and meets the 35dB 'reasonable' standard quoted in BS8233 for bedrooms.

Levels at the newer part of the caravan park are marginally higher than the WHO 30dB(A) threshold guideline for sleep disturbance, however well below the overall existing ambient night-time (2200-0700hrs) $L_{Aeq,9hr}$ noise level measured during our survey (46.5dB). Hourly ambient L_{Aeq} levels throughout the night-time period ranged from 26.4dB to 53.6dB.

The inclusion of screening also further reduces noise levels at the nearest residential receivers. Removing line of sight to first floor windows is indicated to give 7.4dB of attenuation. Noise levels at the nearest NSP (1. 390m south) are then indicated to fall to around 33.4dB L_{Aeq} (external).

5.1.3 Bat Roost

With screening included, combined noise levels from the drill rig and telehandler at the bat roost are predicted to be 30.8dB L_{Aeq}.

Comparing 30.8dB(A) with the time varying noise climate at position 1 shown in time history graph 3123/TH1, noise levels from drilling operations are not indicated to be significant.

6.0 Good Practice Guide

The following advice is given with the aim of minimising noise emissions from drilling operations.

- Avoid unnecessary revving of engines and switch off equipment when not required.
- Ensure plant and vehicles are properly maintained, check silencers and bearings.
- If the noise is directional, point the source away from noise-sensitive locations – e.g. exhausts.
- Limit the use of particularly noisy plant or vehicles.
- Start up plant sequentially rather than together.
- Ensure plant is operated with noise control hoods closed.
- Where possible, avoid particularly noisy activities during the night-time hours (2200-0700)

7.0 Conclusion

Coastal Oil & Gas Ltd is proposing to drill at a site located on the southern part of the Llandow Industrial Estate, Llandow. Drilling is proposed to take place 24 hours a day for approximately 8 weeks – we understand there will also be some occasional telehandler activity.

Critical noise sensitive premises have been identified as shown on Site Plan 3123/SP1. Background noise levels have been measured at a location assessed representative of the critical noise sensitive premises.

Noise limits have been proposed based on measured background noise levels and current planning guidance.

Predicted noise levels from the drilling operations at nearest residential noise sensitive premises (including the caravan parks) are indicated to fall below MTAN1 night-time limits. Our analysis includes for screening between the drilling site and critical receivers.

Comparing drill noise levels with guidance in BS8233 for bedrooms;

Noise levels at the houses are indicated to meet the 30dB(A) 'good' standard, while levels at the Campsite meet the 35dB(A) 'reasonable' standard.

Levels are also indicated to be well below the existing typical ambient night-time L_{Aeq} noise climate (birdsong, occasional road/air traffic and wind in trees).

Predicted noise levels at the bat roost are only 30.8dB L_{Aeq}, and are therefore not assessed significant compared with existing noise sources around the roost; including those associated with the neighbouring waste recycling centre and wind/rain in trees.

Noise limits and criteria should be confirmed acceptable with the local planning authority/EHO.

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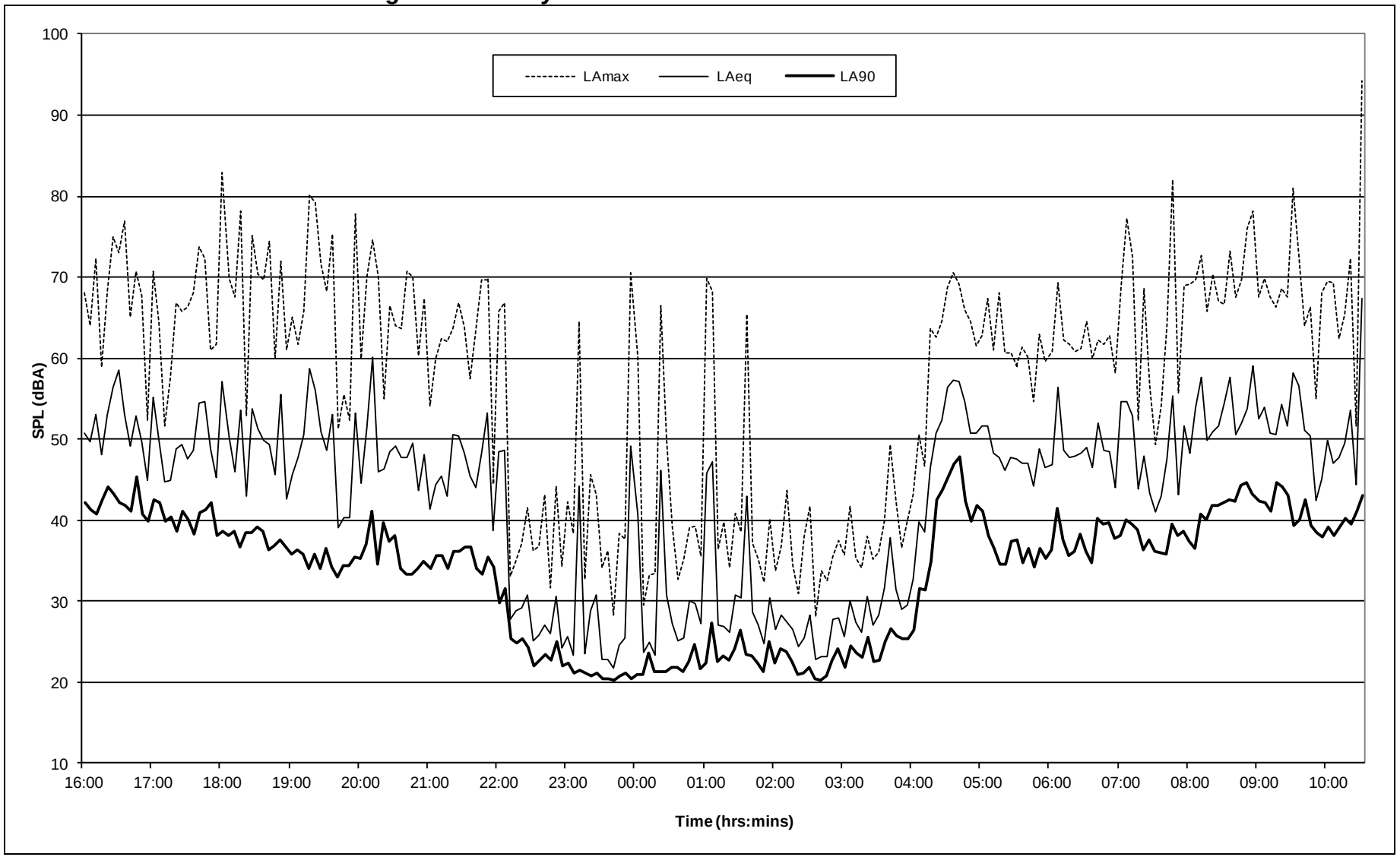
3123/TH1 - Continuous Monitoring Time History at Position A



Appendix A

Acoustic Terminology

Human response to noise depends on a number of factors including; Loudness, Frequency content, and variations in level with time. Various frequency weightings and statistical indices have been developed in order to objectively quantify 'annoyance'. The following units have been used in this report:

dB(A): The sound pressure level weighted to correspond with the frequency response of the human ear, and therefore a persons subjective response to frequency content.

L_{eq}: The Equivalent continuous sound level is a notional steady state level which over a quoted time period would have the same acoustic energy content as the actual fluctuating noise measured over that period.

L_{90}: The sound level which is exceeded for 90% of the measurement period. i.e. The level exceeded for 54 minutes of a 1-hour measurement. It is often used to define the background noise level.

L_{10}: The sound level which is exceeded for 10% of the measurement period. i.e. The level exceeded for 6 minutes of a 1-hour measurement

SEL: 'Sound Exposure Level', The dB(A) level which, if it lasted 1 second, would produce the same sound energy as the event in question (e.g. a train pass-by).