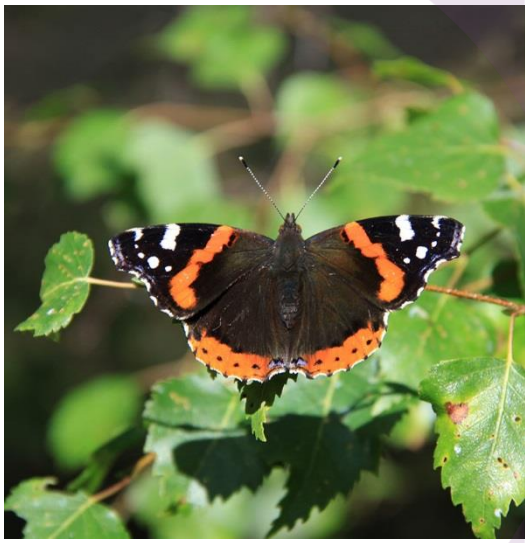
Greater Manchester Combined Authority

Reliance Street – Replacement of Waste Reception Building

Sound Assessment

Final Report







Wood Environment & Infrastructure Solutions UK Limited – October 2018

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1	Draft Report 18410i1	September 2018
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Executive summary

Purpose of this report

The Greater Manchester Combined Authority (GMCA) are looking to replace the waste reception building at their Site on Reliance Street, Newton Heath, Manchester. The sound assessment detailed in this report has been produced in support of the planning application for the proposed new building.

Assessment

Background sound monitoring has been undertaken as part of the assessment process at three locations considered to be representative of the nearest noise sensitive receptors (NSRs) to the Site. The measured sound levels from the survey have been utilised as part of the BS 4142:2014 assessment detailed within this report.

A sound propagation model has been constructed in order to predict sound rating levels at each NSR and comparisons have been made against the background sound levels measured in line with guidance advocated within BS 4142:2014.

Findings

The BS 4142:2014 assessment has demonstrated that the sound levels predicted from the Site are deemed '**low impact depending on the context**' for the NSRs, during the daytime operational hours (07:00 – 18:00hrs).

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1. Introduction

1.1 Background

Wood Environment & Infrastructure Solutions UK Limited (Wood) has been commissioned by Greater Manchester Combined Authority (GMCA) to undertake an assessment of the potential impacts resulting from sound emissions associated with the replacement of the waste reception building at the existing Reliance Street waste management facility in Newton Heath, Manchester ('the Site').

1.2 Site Location

The Site is located on Reliance Street, within the area of Newton Heath approx. 5 km north east of Manchester City Centre (National Grid Reference SD881009). The Site is located in a largely industrial setting close to Junction 22 of the M60 and is accessed from the A62 Oldham Road. The extant site comprises a Household Waste Recycling Centre (HWRC) and a Mechanical Biological Treatment (MBT) with anaerobic digestion (AD) plant, and a waste reception building. The Site is rail linked via a dedicated siding off the Manchester to Oldham line. The Site is bounded by an earth mound and a belt of trees to the north, with residential areas beyond, including Broadhurst Primary School. Various existing industrial units are situated to the east of the Site including a scrap yard. To the south of the Site lies a railway line, with a siding which services the existing waste management facility. Beyond the railway line lie dwellings on Lilmore Avenue and an industrial/commercial trading estate.

The nearest noise sensitive receptors (NSRs) have been identified as Moston Grange Care Home, approximately 20 m west of the Site boundary, dwellings on Calverton Drive/Holly Bank and Lilmore Avenue, approximately 150 m north and 40 m south of the Site boundary respectively. The Site location and NSRs are shown on Figure A.1 of Appendix A.

1.3 Proposed Development

The proposed development is a replacement for the existing waste reception building, including mitigation measures such as appropriate noise attenuation as part of the building construction, roller shutter doors (assumed to be closed at all times apart from when a vehicle is entering/leaving the building), and one-way traffic. The aim of the proposals is to minimise any potential adverse effects by enclosing all activities within a single purpose-built building. The replacement building will comprise of a Mechanical Treatment and Reception (MTR) building. The extant MBT and AD operation at the Site will cease and be mothballed.

1.4 Consultation

The survey and assessment methodology was agreed with Karen Williamson at Manchester City Council on the 18th of June 2018.

1.5 Scope of the Report

In summary, this report outlines the sound assessment of the proposed development at the Site, including survey methodology and assessment. The pertinent aspects of the Scope of Work are as follows:

- Review of background sound data measured in the vicinity of the Site, including the determination of a representative background sound level at the NSRs for use in this assessment;
- Construction of a sound propagation model of the Site and surrounding area in order to predict the sound rating level at each NSR due to operation of the Site; and
- Assessment to determine the likely significance of impact at each NSR in accordance with the methodology outlined in BS 4142:2014 *Methods for rating and assessing industrial and commercial sound*.

2. Terminology

The ratio between the quietest audible sound and the loudest tolerable sound is a million to one in terms of the change in sound pressure. The scale used to represent the dynamic range of sound for humans is the decibel (dB) scale which extends from 0 to 140 dB(A) corresponding to the intensity of the sound pressure level. It is widely accepted that a change of 3 dB(A) is required for a person to perceive the change in a steady sound level and that an increase or decrease of 10 dB(A) is perceived and being twice of half as loud respectively.

The ear has the ability to recognise a particular sound depending on the pitch or frequencies found at the source. Microphones cannot differentiate sound in the same way as the ear and to counter this, the sound measuring instrument applies a correction to correspond more closely to the frequency response of the human ear. The correction factor is called 'A-weighting' and the resulting measurements are written as dB(A). The dB(A) is internationally accepted and has been found to correspond well with people's subjective reaction to sound. Typical dB(A) levels for familiar sounds are given in Table 2.1.

Table 2.1 Typical sound levels

Approximate Sound Level dB(A)	Example
0	Limit of Hearing
20	Rural area at night, no wind or adverse weather conditions
30	Library
40	Quiet office without noisy machinery, such as typewriters
50	Normal conversation
60	In car noise without radio
80	Household vacuum cleaner
100	Pneumatic drill
140	Threshold of pain[1]

The following indices are used when describing sound:

- $\boldsymbol{L_W}$ is the sound power level. It is a measure of the total sound energy radiated by a source of sound, and is used to calculate sound levels at a distant location. The L_{WA} is the A-weighted sound power level;
- $\boldsymbol{L_{eq,T}}$ is the equivalent continuous sound level, and is the sound level of a steady sound with the same energy as a fluctuating sound over the same period. It is possible to consider this level as the ambient sound encompassing all sound at a given time. The $L_{Aeq,T}$ is the A-weighted equivalent continuous sound level;
- $\boldsymbol{L_{max}}$ is the maximum recorded sound level during the measurement period. The L_{Amax} is the A-weighted maximum sound level;

[1] Bies, D. A., Hansen, C. H., 2009. Engineering Noise Control: Theory & Practice. 4th Edition. Abingdon: Spon Press.

- L_{10} index represents the sound level exceeded for 10 percent of the measurement period. It is used to measure road traffic noise levels. The L_{A10} is the A-weighted road traffic noise level;[1]
- L_{90} index represents the sound level exceeded for 90 % of the measurement period and is used to indicate quieter times during the measurement period. It is often used to measure the background sound level. The L_{A90} is the A-weighted background sound level;
- **One-third octave bands** are used to represent the frequency or content of a sound. Bass and Treble on a Hi-Fi system is a very basic representation of the frequency content of sound. One-third octave bands are derived by splitting the audio signal into discrete entities. A single octave band comprises 3 No. one-third octave bands. One-third octave and octave bands are usually presented without a weighting/filter such as A weighting, however such weightings can be applied to frequency spectra to then derive a weighted overall broadband result;
- **Acoustic environment** is defined as the sound with contribution from all sources, as modified by the current environment and associated conditions. This is related to the ambient sound, which is the totally encompassing sound in a given situation at a given time, usually composed of sound from many sources near and far;
- **Residual sound** is the sound remaining at the assessment location when the specific sound source is suppressed to such a degree that it does not contribute to the ambient sound. This is the case when a sound source/proposed development is yet to be installed and/or be operational. The residual sound level is the equivalent continuous A-weighted sound pressure level deemed to represent the residual sound ($L_r = L_{Aeq,T}$) at the assessment location over a given time interval, T;
- **Background sound level** is the A weighted sound pressure level that is exceeded by the residual sound at the assessment location for 90% of a given time interval, T, measured using time weighting F and quoted to the nearest whole number of decibels. This represents the underlying sound level in the absence of contributions from the sound source under assessment relating to the residual sound level but characterised by $L_{A90,T}$;
- **Specific sound level** is the equivalent continuous A-weighted sound pressure level produced by a specific sound source (i.e. the sound source under assessment in accordance with BS 4142:2014) at the assessment location over a given reference time interval, T_r;
- **Rating level** is the specific sound level with the addition and inclusion of any acoustic characteristic feature corrections of the sound. If no acoustic features are present then the rating level is equal to the specific sound level;
- **Tonality** is an acoustic feature, which represents a sound that has a dominant 'pitch' characteristic similar to a sine wave or musical note. Sounds with a perceptible tone are more easily noticeable and should therefore carry a character correction where deemed appropriate under the guidance in BS 4142:2104;
- **Impulsivity** is an acoustic feature where the sound level of a source is highly variable over time. Humans are more sensitive to impulsive sound, when compared to a continuous sound of the same sound pressure level. Therefore, an acoustic character feature correction can be applied when deemed appropriate under the guidance in BS 4142:2014; and
- **Intermittency** is classified as a considered acoustic feature in BS 4142:2014. Humans are more sensitive to sounds that are intermittent in nature when compared to a continuous sound of the same specific sound level. Therefore, a correction can be applied for the presence of such a characteristic.

3. Relevant Guidance and Policy

The suitability of a site for a particular use depends on the existing acoustic environment and the sound impact created by aspects of the development. There are a number of guidance documents which contain advice on the assessment and control of sound, with regards to developments such as the proposed MTR building. These are summarised in the following sections.

3.1 Noise Policy Statement for England

The Noise Policy Statement for England (NPSE) was published by DEFRA in March 2010 and forms the overarching statement of noise policy for England. It sets out the long term vision of the Government, as follows:

"*[to] Promote good health and a good quality of life through the effective management of noise within the context of Government policy on sustainable development.*"

This vision is supported by the following aims, which are reflected in the provisions of the NPPF:

"*Through the effective management and control of environmental, neighbour and neighbourhood noise within the context of Government policy on sustainable development:*

- *Avoid significant adverse impacts on health and quality of life;*
- *Mitigate and minimise adverse impacts on health and quality of life; and*
- *Where possible, contribute to the improvement of health and quality of life.*"

The Explanatory Note to the NPSE (paragraph 2.14) acknowledges that noise contributing to annoyance and/or sleep disturbance in human populations can have long term consequences for health and wellbeing. It introduces three 'Effect Levels' relevant to the assessment of noise. These are:

- NOEL – No Observed Effect Level - This is the level below which no effect can be detected. In simple terms, below this level, there is no detectable effect on health and quality of life due to the noise;
- LOAEL – Lowest Observed Adverse Effect Level - This is the level above which adverse effects on health and quality of life can be detected; and
- SOAEL – Significant Observed Adverse Effect Level - This is the level above which significant adverse effects on health and quality of life occur.

The aim of the NPSE is to avoid noise occurring at the SOAEL level or above, and minimize, as far as possible, all noise occurring between the LOAEL and SOAEL brackets.

The NPSE states that it is not possible to have a single, numerical definition of the SOAEL that is applicable to all noise sources in all situations, since the SOAEL is likely to be different for different noise sources, for different receptors and at different times. Further research is required to increase understanding of what constitutes a significant adverse impact on health and quality of life due to noise, and the NPSE states that not stating specific SOAEL levels provides a suitable degree of policy flexibility until such evidence is available.

3.2 BS 4142:2014 '*Methods for Rating and Assessing Industrial and Commercial sound*'

BS 4142:2014 is used to rate and assess sound of an industrial nature including but not limited to assessing sound from proposed, new, modified or additional sources of industrial sound. It contains guidance on the monitoring and assessment of industrial and commercial sound sources (including fixed installations comprising mechanical and electrical plant and equipment) affecting sensitive receptors.

A methodology is detailed for determining the effects of new or existing sound sources relies on comparing the operational rating level, $L_{Ar,Tr}$, with the background sound level, $L_{A90,T}$ (i.e. the level that would be present without the development) over a representative time period. The representative time period depends on the time period that the sound source operates, i.e. 1 hour during the day time and 15 minutes during the night-time. It provides guidance on the measurement of background sound, the determination of specific sound and calculation of the rating level.

BS 4142:2014 assessment methodology also states that:

- Typically, the higher the rating level is above the background sound level the greater the magnitude of impact;
- A difference of around +10dB or more is likely to be an indication of a significant adverse impact, depending on the context; and
- A difference of around +5dB is likely to be an indication of an adverse impact, depending on the context.

The lower the rating level is relative to the measured background sound level, the less likely it is that the specific sound source will have an adverse impact or a significant adverse impact. Where the rating level does not exceed the background sound level, this is an indication of the specific sound source having a low impact, depending on the context.

3.3 ISO 9613-2:1996 '*Acoustics – Attenuation of Sound during Propagation Outdoors – Part 2: General Method of Calculation*'

ISO 9613-2:1996 '*Acoustics – Attenuation of sound during propagation outdoors – Part 2: General method of calculation*' specifies methods for the description of sound outdoors in community environments. ISO 9613 can be applied to a wide variety of sound sources and includes methods to determine most of the major mechanisms of sound attenuation such as:

- Geometric divergence (A_{div}) – spherical spreading of sound energy;
- Atmospheric absorption (A_{atm}) – attenuation of sound due to interaction with the air (dependant on frequency of sound and negligible at short distances);
- Ground effect (A_{gr}) – sound reflecting by the ground surface interfering with the sound propagating directly from source to receiver;
- Reflection from surfaces (image source method, included in A_{gr} calculation) – sound is reflected from hard surfaces such as building façades due to the acoustic impedance of the surface. This effect increases the sound level when compared to a location free of buildings (i.e. free field); and
- Screening by obstacles (A_{bar}) – Hard obstacles such as close boarded timber fences and varying topography, including hills attenuate the sound from a source due to the insertion loss properties of the obstacle. However, there is an element of the sound which will diffract around

the obstacle especially at lower frequencies. The diffraction effect is determined using the path differences between the direct and diffracted sound. It should be noted that the screening effect provided by trees and foliage is negligible in the majority of cases; the exception is large areas of dense forest or plantations.

3.4 Local Planning Policy

The following local policies have been identified relevant to sound:

3.4.1 Manchester Core Strategy 2012 to 2027

Policy DM 1 'Development Management'

"All development should have regard to the following specific issues:

Effects on amenity including noise. This could also include proposals which would be sensitive to existing environment conditions, such as noise".

3.4.2 Manchester Extant Unitary Development Policies (UDP)

Citywide Development Control Policies – 26. Development and Noise DC26.1 – DC26.6

"The Council considers that the planning process has a role to play in reducing noise levels generally and, through the development control system, to consider carefully the relationship between different land-uses from the point of view of noise generation and impact. Reaching judgements on what is or is not an acceptable amount or type of noise is a complex matter, consideration of which will depend on the particular circumstances on the ground."

3.4.3 Greater Manchester Joint Waste Development Plan Document April 2012

Waste and Amenity

"Whilst waste management facilities are an essential form of development, they are also capable of introducing impacts to areas used for housing and employment, such as noise pollution. The control of these impacts is therefore a key factor in the successful location of future waste management development."

4. Data Gathering

A number of key information requirements were identified in order to facilitate preparation of the sound assessment. The information obtained to assess the potential sound impacts of operations is discussed in this section.

4.1 Site Overview

A review of relevant Ordnance Survey mapping and aerial photography has been undertaken in order to identify the closest NSRs to the Site and land topography between the Site and NSRs.

4.2 Sensitive Receptors and Descriptions

Table 4.1 provides details of the three closest NSRs to the Site (as shown on Figure A.1)

Table 4.1 Noise sensitive receptor and monitoring locations

NSR ID	Monitoring Location ID	Receptor Name	Approximate Distance from Site Boundary (m)	Easting (m)	Northing (m)
NSR1	M1	Moston Grange Care Home	125	388019	401013
NSR2	M2	Dwellings on Claverton Drive	225	388050	401228
NSR3	M3	Dwellings on Lilmore Avenue	60	388269	400885

The assessment has focused on the likely sound impacts at each NSR outlined in Table 4.1 as a result of the proposed development.

4.3 Survey Methodology

4.3.1 Background Sound Survey

Two sound surveys were undertaken, one at locations M2 and M3 between 11:15hrs on Wednesday the 27th of June 2018 until 09:30hrs on Wednesday the 4th of July 2018 and one at M1 between 10:00hrs on Tuesday 10th of July until 09:00hrs on Tuesday the 17th of July 2018.

The purpose of the baseline sound survey was to establish the existing acoustic environment at each identified NSR.

Sound monitoring was conducted in line with methodology outlined in BS 4142:2014 and BS 7445 Part 1:2003 '*Description and measurements of environmental noise*'.

BS 4142:2014 describes a method for determining the Background Sound Level ($L_{A90,T}$) through monitoring, which has been adopted in this survey.

BS 7445-1:2003 details standardised guidance for the measurement of environmental noise. The pertinent details of BS 7445-1:2003 adopted in this assessment are as follows:

- Instrumentation to measure equivalent continuous A-weighted sound pressure level conforming to type 1 as given in BS EN 61672-1:2013;
- All equipment calibrated, and the calibration shall follow manufacturer's instructions. All Wood sound monitoring equipment is calibrated at an accredited laboratory at a minimum interval of 24 months. To maintain confidence in recorded sound levels, sound level meters were field calibrated prior to and after use with the recommended manufacturer's calibrator. No significant drift (i.e. greater than 0.1dB) in calibration was recorded; and
- Minimise the influence of reflections by, whenever possible, undertaking measurements at least 3.5m from any reflective surface other than the ground. Preferred measurement height is 1.2m to 1.5m above the ground.

Sound monitoring was conducted at 3No. locations (M1-M3) which were considered to be representative of the acoustic environment at the chosen NSRs for the Site. The sound level meter was set-up within the garden of the dwellings considered to be representative of the background sound level at each identified NSRs.

Throughout the 7-day measurement period at M1, 1No. 15 minute measurement period and at M3, 6No. 15 minute measurement periods were excluded from the data analysis process due to what have been assumed to be unrepresentative peaks in the sound levels recorded. The reason for these peaks is unconfirmed however based on survey observations they are considered likely to be due to domestic noise e.g children playing in the garden rather than due to Site operations. Table 4.2 summarises the data excluded from the data analysis process due to the above reasons.

Table 4.2 Excluded measurement data

Monitoring Location ID	Date	Time	dB $L_{A90,15min}$
M3	28/06/2018	18:30	54
M3	30/06/2018	17:00	52
M3	30/06/2018	17:15	51
M3	30/06/2018	18:45	54
M3	02/07/2018	11:15	56
M3	03/07/2018	18:30	52
M1	11/07/2018	08:15	53

All staff involved with sound measurements of both the background sound and source measurements were fully competent, either being Members of the Institute of Acoustics or holding the Institute of Acoustics (IoA) Certificate of Competence in Environmental Noise Measurement. Details of the instrumentation used during the survey are given in Appendix B.

Weather conditions on deployment of the equipment were noted to be fine, with 0% cloud coverage. Average wind speeds of less than $5ms^{-1}$, temperature of 24°C, road conditions dry with no precipitation and good visibility.

A Davis Vantage Vue weather station was set-up at M2 throughout the duration of the survey. Based on the readings (see Appendix C) no data has been excluded from the analysis due to rainfall or unsuitable wind speeds. Therefore, 665No. 15 minute logging periods were considered suitable for the use in the data analysis process to represent M2 and M3.

For monitoring location M1, a technical error occurred with the weather station therefore weather data from www.wunderground.com has been used to determine any periods of unsuitable weather conditions for noise monitoring outlined in the BS 4141:2014. From analysis of the data provided by www.wundergorund.com, no 15 minute logging periods have been excluded from the data analysis due to rainfall or high wind speeds. Therefore, 665 no. 15 minute logging periods were considered suitable for the use in the data analysis process.

Survey Uncertainty

BS 4142:2014 requires consideration of the uncertainty associated with measured values. Measurement uncertainty was minimised for the background sound measurement using the following steps:

- The measurement location was representative of the external amenity area of the dwelling;
- The measurement position was located away from reflecting surfaces and leafy vegetation;
- The measurements were undertaken using the minimum logging period suggested in BS 4142:2014;
- The measurements included daytime and night-time periods for a typical day;
- The measurements were undertaken under suitable weather conditions as described in Section 6.4 of BS 4142:2014, as indicated by the results of the weather monitoring;
- The measurements were rounded to the nearest whole number before calculation of averages, totals etc.; and
- The instrumentation is suitable according to Section 5 of BS 4142:2014.

4.3.2 Source Sound Surveys

Sound source surveys were undertaken at different Viridor waste sites to determine sound levels of equipment understood to be similar of the typical operations of the proposed building on the Reliance Street Site. The purpose of the survey was to improve the accuracy of the model inputs, discussed in Section 5. The results from the sound source survey can be seen in Table 4.5.

Viridor – Nash Road

A sound survey was undertaken at Viridor Waste Management, Nash Road, Trafford Park on Thursday 8th March 2018.

The measured sound levels from various activities at the Nash Road site are believed to be similar to the proposed replacement waste treatment building at Reliance Street. The various activities included RCV vehicle movements, vehicle movements from artic lorries and front end wheeled loader operations.

Viridor – Langley Lane

A sound survey was undertaken at Viridor Waste Management, Langley Lane, Manchester on Thursday the 12th of July 2018.

Sound levels were measured of a variety of waste treatment equipment on the Langley Lane site which are understood to be the same equipment planned for the proposed replacement waste treatment building at Reliance Street. The waste treatment equipment included a pre-shredder, conveyers and a rail compactor.

4.4 Survey Results

4.4.1 Background Sound Survey

A summary of the measured sound levels is shown in Table 4.3 (rounded to the nearest decibel).

Table 4.3 Measured sound levels

Monitoring Location	Time Period	dB $L_{Aeq, 15min}$	dB Mean $L_{A90, 15min}$	dB Mode $L_{A90, 15min}$	dB L_{Amax}
M1	Daytime (07:00-23:00)	50	41	43	84
	Night-time (23:00-07:00)	44	38	38	75
	Site operational hours (07:00 – 18:00)	51	43	43	84
M2	Daytime (07:00-23:00)	45	38	37	86
	Night-time (23:00-07:00)	42	35	36	78
	Site operational hours (07:00 – 18:00)	45	38	38	83
M3	Daytime (07:00-23:00)	52	44	43	91
	Night-time (23:00-07:00)	49	42	42	76
	Site operational hours (07:00 – 18:00)	51	45	45	86

Time history charts of the measured sound levels for the duration of the survey can be seen in Appendix D.

In order to determine the levels to use for the assessment process, comparisons between the mean and mode have been undertaken. Histograms of the measured $L_{A90, 15min}$ for each monitoring location during the Site's operational hours have been created and can be seen in Appendix E. It was deemed appropriate to assign the modal levels for monitoring locations M1, M2 and M3 due to the frequency of occurrence being sufficiently dominant for the modal value.

The adopted background sound levels based on the sound survey are given in Table 4.4.

Table 4.4 Summary of the background sound Levels used within the assessment

Monitoring Location	Period	dB $L_{A90,15\ min}$	Reason
M1	Site operational hours (07:00 – 18:00)	43	Most commonly occurring value
	Night-time (23:00-07:00)	38	Most commonly occurring value
M2	Site operational hours (07:00 – 18:00)	38	Most commonly occurring value
	Night-time (23:00-07:00)	36	Most commonly occurring value
M3	Site operational hours (07:00 – 18:00)	45	Most commonly occurring value
	Night-time (23:00-07:00)	42	Most commonly occurring value

Survey Observations

Observations were made at each monitoring location throughout the deployment and collection of the kit, as well as night-time observations on the 3rd July 2018 between 00:00 and 01:00hrs. A summary of each location can be seen below.

M1 – Moston Grange Care Home

Moston Grange Care Home was dominated by road traffic noise from the Reliance Street and St Marys Road, however, railway noise dominated when a pass by occurred. Sound from typical activities in the care home sometimes audible along with birdsong and distant operational sound from an unidentified source.

The acoustic environment during night-time was dominated by distant road traffic noise from Oldham Road and St Marys Road. Wind rustling leaves and birdsong were audible throughout the observations.

M2 - Dwellings on Calvander Close

The acoustic environment was dominated by railway movements, located to the west of the dwellings. Other audible noise sources included, Broadhurst Primary School, birdsong and occasional sound from an unidentified industrial source.

The acoustic environment at night included a mixture of sound sources including noise from the railway line, distant road traffic noise from St Marys Road, wind rustling trees and domestic pet activities.

M3 - Dwellings on Lilmore Avenue

The railway line situated to the north of the dwellings was considered dominant when a train pass by occurred. Road traffic noise from Oldham Road was continuous and audible but not dominant. Industrial noise from the scrap yard, located to the northeast of Lilmore Avenue was also audible on occasions.

Night-time observations concluded that road traffic noise from Oldham Road was the dominant sound source. Other audible sound sources included wind rustling from trees, domestic pets and a distant aircraft.

4.4.2 Source Sound Survey

A summary of both sound source surveys can be in found in Table 4.5 and Table 4.6, detailing the type of plant, the resulting sound power levels, and the projected percentage the plant is considered to be operational for within an hourly period.

Table 4.5 Summary of sound levels from source measurements

Type of Plant	Description	% on Time (Per hour)	SWL (dB)
26 Tonne Front End Loader	Front end loader, engine idling	33%	105
RCV Lorry	RCV lorry vehicle movements	25%	113
Bulking Artic Vehicle	Artic vehicle collecting waste container	15%	111
Pre-Shredder	Operational pre-Shredder	75%	100
Conveyors	Operational conveyors	75%	94
Rail Compactor	Operational rail compactor	75%	98
26 Tonne Front End Wheeled Loader	Front end wheeled loader organising waste after delivery	100%	116
RCV Lorry	RCV lorry tipping glass waste	60%	121

Table 4.6 Sound sources considered in determining the overall SWL dB in the proposed buildings for each octave band

			Sound Power Level, dB per Octave Band Centre Frequency (Hz)							
Sound Source	Reference	Building containing sound source	63	125	250	500	1000	2000	4000	8000
26 Tonne Front End Loader (Idling)	Measured Data	Main building	102	99	97	96	93	89	83	73
RCV Lorry Movements	Measured Data	Main building	107	107	106	105	101	99	100	85
Bulking Artic	Measured Data	Main building	110	103	94	91	91	89	82	72

			Sound Power Level, dB per Octave Band Centre Frequency (Hz)							
Vehicle (Idling)										
Pre-Shredder	Measured Data	Main building	91	90	95	93	92	89	81	71
Conveyors	Measured Data	Main building	88	88	89	84	82	78	75	68
Rail Compactor	Measured Data	Rail compactor building	86	88	94	92	86	83	83	78
26 Tonne Front End Wheeled Loader (Moving waste)	Measured Data	Main building	111	111	107	106	105	104	103	97
RCV Lorry (Tipping waste)	Measured Data	Main building	101	100	102	107	108	116	117	109

The overall SWL dB inside the proposed main building and the proposed rail compactor building was calculated by logarithmically summing the data provided in Table 4.6, the final values can be seen in Table 4.7 and

Table 4.8.

Table 4.7 Overall sound power level calculated inside the main proposed building

	Total SWL (dB)	63	125	250	500	1000	2000	4000	8000
Overall SWL in the building	115	110	109	106	105	104	104	103	96

Table 4.8 Overall sound power level calculated inside the rail compactor proposed building

	Total SWL (dB)	63	125	250	500	1000	2000	4000	8000
Overall SWL in the building	100	88	90	96	94	88	85	85	80

5. Modelling and Assessment

5.1 Plant Sound Emissions

The Site will comprise of a variety of equipment/processes operating both inside and outside the new proposed waste treatment building. Usual operations will include RCV lorries driving onto the Site and entering the building, unloading waste and exiting the Site. Front end wheeled loaders will then begin organising waste inside of the building before the waste treatment process begins. The procedure utilises numerous items of equipment, including, rail conveyors, shredders and waste containers. Once the waste treatment procedure is complete, bulking artic vehicles and freight trains collect it. Details of the operational equipment, associated sound levels and % on-times as included in this assessment can be found in Appendix G.

The associated rail loading/unloading activities from the Site have not been considered in the sound propagation model as these operations are existing and continued to operate during the background monitoring survey. The data analysis process has determined that background sound levels at the NSRs were not elevated during periods when the rail activities were taking place. It has therefore been concluded that the measured background sound levels at each of the three receptors are representative. Appendix F provides charts detailing the measured background sound data at each monitoring location, and highlights the time periods when the rail activities were present at the Site. The usual timetable for the rail activities is every working day between 16:40 and 18:40.

5.2 Sound Propagation Modelling

In order to determine the impact of sound due to the proposed plant on the NSRs, a comprehensive sound propagation model was developed using the Stapelfeldt LimA computational sound modelling suite (v. 11.1).

LimA is used widely in sound propagation modelling and mapping projects throughout the UK and Europe. Developed by Stapelfeldt Ingenieuresellschaft mbH, it can implement a number of methodologies for the calculation of sound levels, including the calculation of industrial sound.

The LimA modelling suite allows a 3D environmental model to be constructed, using digital mapping and topographic data. As such, it takes into account the following factors potentially affecting levels of sound propagation in the area surrounding a particular noise source:

- Sound source location (as shown by digital mapping data);
- Relative distances between sound sources/ receptors;
- Locations and dimensions of barriers (man-made or topographic) between sound source and receptor;
- Ground contours, determining the relative heights of sources/ receptors and barriers; and
- Ground cover effects such as soft ground attenuation etc.

LimA allows the calculation of sound levels at specific, single points, or over a calculation-grid of specified size.

Modelling Assumptions

The calculation methods given in ISO 9613 Parts 1 and 2 have been used to predict the sound propagation in the model. The calculation results are considered to be worst case as they assume downwind propagation,

which in reality would not occur at all times due to changes in wind direction. Predictions assume mixed ground attenuation (G=0.5). No existing barriers e.g. acoustic fencing have been included between the Site and the NSRs as a worst case assessment.

Sound Emission Calibrations

Each proposed sound source has been included in the sound propagation model using the sound source data as detailed in Appendix G. Vehicle movements entering and leaving the Site have been represented by a line source. Each façade of the proposed new building has been represented by an area source. Measured sound levels of each internal item of plant/operation (Table 4.6) have been used to calculate the noise break-out for each façade of the building. It is understood that the building will be a single insulated panel construction. An example panel[2] has been used for the purposes of this assessment. The Sound Reduction Index (SRI) assumed for the building wall and roof panels is shown in Table 5.1.

Table 5.1 Sound reduction index values

Frequency (Hz)	63	125	250	500	1K	2K	4K	8K
SRI (dB)	20	18	20	24	20	29	39	47

The KS1000 RW insulated wall panel has a single figure sound reduction Rw = 25dB.

The calculated reverberant sound pressure level within the building and the SRI of the building shell have been used to calculate a source term for the break-out sound. This has then been used in LimA, with the appropriate area for each building element to enable calculation of the sound radiated from the building.

5.3 BS 4142:2014

BS 4142:2014 provides a guidance on appropriate methodology and criteria for assessing the impacts of a new or existing sound source by comparing the operational sound level (rating level) with the sound level that is present without development (background sound level) i.e. the existing acoustic environment.

A penalty should be applied to the specific sound level if a tone, impulsive or other characteristic occurs or is expected to be present for new or modified sound sources.

5.3.1 Tonality

For sound sources ranging from not tonal to prominently tonal, the Joint Nordic Method gives a penalty of between +1 dB and +6 dB for tonality. Based on a subjective assessment this can be interpreted as per Table 5.2.

Table 5.2 Subjective method - tonality penalties

Penalty	Source Condition
+2 dB	Tone which is just perceptible at the noise receptor
+4 dB	Tone is clearly perceptible at the noise receptor

[2] Kingspan, Trapezoidal Insulated Wall Panel KS1000 RW (05/2015)

Penalty	Source Condition
+6 dB	Tone is highly perceptible at the noise receptor

A penalty for tonality has not been applied in the assessment as it has been assumed that the attenuation provided by the proposed building will be sufficient to prevent any tonal characteristics being audible at the NSRs. All plant should be designed appropriately to prevent any tonal characteristics occurring at source, and therefore reducing the chance of any audible tones at the NSRs.

5.3.2 Impulsivity

A penalty of +9 dB can be applied for sound that is highly impulsive, considering both the rapidity of the change in sound level and the overall change in sound level. Based on a subjective assessment this can be interpreted as per Table 5.3.

Table 5.3 Subjective method - impulsivity penalties

Penalty	Source Condition
+3dB	Impulsivity which is just perceptible at the noise receptor
+6 dB	Impulsivity is clearly perceptible at the noise receptor
+9 dB	Impulsivity is highly perceptible at the noise receptor

A penalty for impulsivity is not considered to be applicable as sound of an impulsive nature would not be expected to be audible at the NSRs from the proposed plant. All key operations will take place within the building with roller shutter doors closed.

5.3.3 Intermittency and Other Sound Characteristics

Where the specific sound is intermittent and/or readily distinctive against the residual acoustic environment, a penalty of 3 dB can be applied. As all key operations will take place within the building with roller shutter doors closed, no penalty is considered appropriate. This has been further verified by subjective observations undertaken by the surveyor during sound measurements at an existing site performing comparable operations.

5.3.4 Reference Time Periods

The appropriate reference time interval for assessing a sound source is dependent upon when it operates i.e. during the daytime or night-time. BS 4142:2014 determines the reference time interval as 1 hour during the day and 15 minutes during the night. The shorter time interval at night means that short duration sound with an on-time of less than 1 hour will lead to a greater specific sound level when determined over the reference time interval during the night than during the day. This is due to the heightened sensitivity of humans to sound when preparing to sleep.

The assumed on time for each piece of equipment considered in the noise model can be found in Appendix G.

It is generally accepted that the night period should cover times when the general adult population are preparing for sleep or are actually sleeping. The daytime period is determined as 07:00 hrs to 23:00 hrs and the night-time period is 23:00 hrs to 07:00 hrs.

5.3.5 Assessment of Impacts

As shown in Table 5.4 the greater the rating level is above the background sound level, $L_{A90,T}$ the greater the significance of noise impact.

Table 5.4 BS 4142:2014 assessment guidance

Guidelines	Comment
Rating level from site operations of around +10 dB or more above the existing $L_{A90,T}$ background sound level	An indication of significant adverse impact, depending on the context
Rating level from site operations of around +5 dB above the existing $L_{A90,T}$ background sound level	An indication of an adverse impact, depending on the context
Rating level from site operations does not exceed the existing $L_{A90,T}$ background sound level	An indication of a specific sound source having a low impact, depending on the context

The sound propagation model has been used to determine the specific sound levels for daytime operational periods at the NSRs as shown in Table 5.5.

The background sound levels that were measured at M1-M3 have been used for the assessment as the measured sounds levels are considered to be representative of each location. Table 5.5 details the BS 4142:2014 assessment for the daytime operational hours (07:00-18:00hrs) at the closest NSRs.

Table 5.5 BS 4142:2014 assessment - daytime operational hours

Description	NSR1	NSR2	NSR3
Specific Sound Level	43	37	42
Rating sound Level, dB $L_{Ar,Tr}$	43	37	42
Background Sound Level, dB $L_{A90,T}$	43	37	43
BS 4142 Rating Sound Level and Background Sound Level Margin, dB	0	0	-1
BS 4142 Comment/Outcome	An indication of a specific sound source having a low impact, depending on the context	An indication of a specific sound source having a low impact, depending on the context	An indication of a specific sound source having a low impact, depending on the context

It can be seen that the rating levels due to the proposed Site has been deemed '**low impact depending on the context**' at all NSRs.

It should be noted that this area contains a large percentage of existing commercial/industrial facilities, some of which are of a similar nature and are likely to include similar operations, therefore the proposed Site is not considered to be out of character with the existing acoustic environment. In addition to this, the project is to provide a replacement building on a similar area of the Site and therefore similar operations have previously been undertaken here.

6. Conclusion

Wood Environment & Infrastructure Solutions UK Limited has been commissioned by Greater Manchester Combined Authority (GMCA) to undertake an assessment of the potential impacts resulting from sound emissions associated with the proposed MBT building and associated operations at the waste management facility in Newton Heath, Manchester.

Baseline sound monitoring was undertaken at the closest NSRs to the Site, over a full weekday and weekend period. Monitoring was conducted in line with guidance and methodology advocated within BS 4142:2014.

A sound propagation model of the proposed plant operating inside of the new MTR building and external plant has been constructed to enable the rating sound level to be predicted at each NSR. These rating levels have been compared to the existing background sound level for each NSR.

A BS 4142:2014 assessment has been carried out in order to determine the impact at each NSR. The outcome of the assessment demonstrated that '**low impact depending on the context**' is predicted during daytime operational hours (07:00-18:00hrs).

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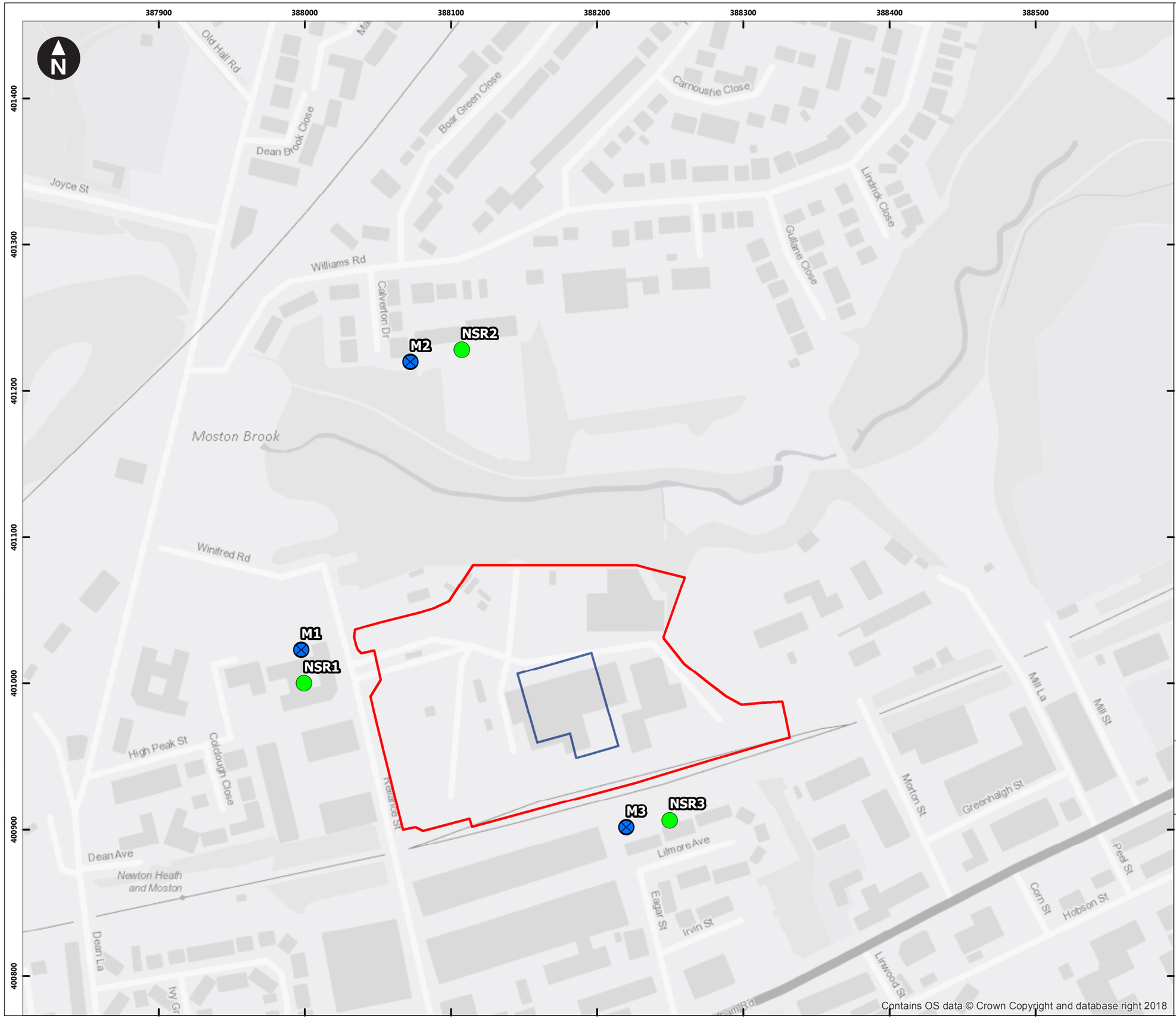
Appendix A
Location Plan



Key

- Site boundary
- Replacement Waste Treatment Building Outline
- Noise Sensitive Receptors (NSR) Locations
- Monitoring Locations (M)

0 20 40 60 80 100 120 140 m

Scale at A3: 1:2,500

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Client

GMCA GREATER MANCHESTER COMBINED AUTHORITY

Reliance Street Sound Assessment

Figure A.1
Noise Sensitive Receptors and Monitoring Locations

September 2018

wood.

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Appendix B
Equipment Calibration Details

Table B.1 Equipment calibration details

Manufacturer	Instrument	Type	Serial Number	Calibration Date
Rion	Sound Level Meter	NL-31	00672900	21/12/2017
Rion	Pre Amplifier	NH-21	23077	21/12/2017
Rion	Microphone	UC-53A	312092	21/12/2017
Rion	Sound Level Meter	NL-31	00541623	02/02/2018
Rion	Pre Amplifier	NH-21	11609	02/02/2018
Rion	Microphone	UC-53A	318928	02/02/2018
Rion	Sound Level Meter	NL-31	00541627	12/05/2017
Rion	Pre Amplifier	NH-21	11613	12/05/2017
Rion	Microphone	UC-53A	306431	12/05/2017
Rion	Calibrator	NC-74	34494241	02/02/2018

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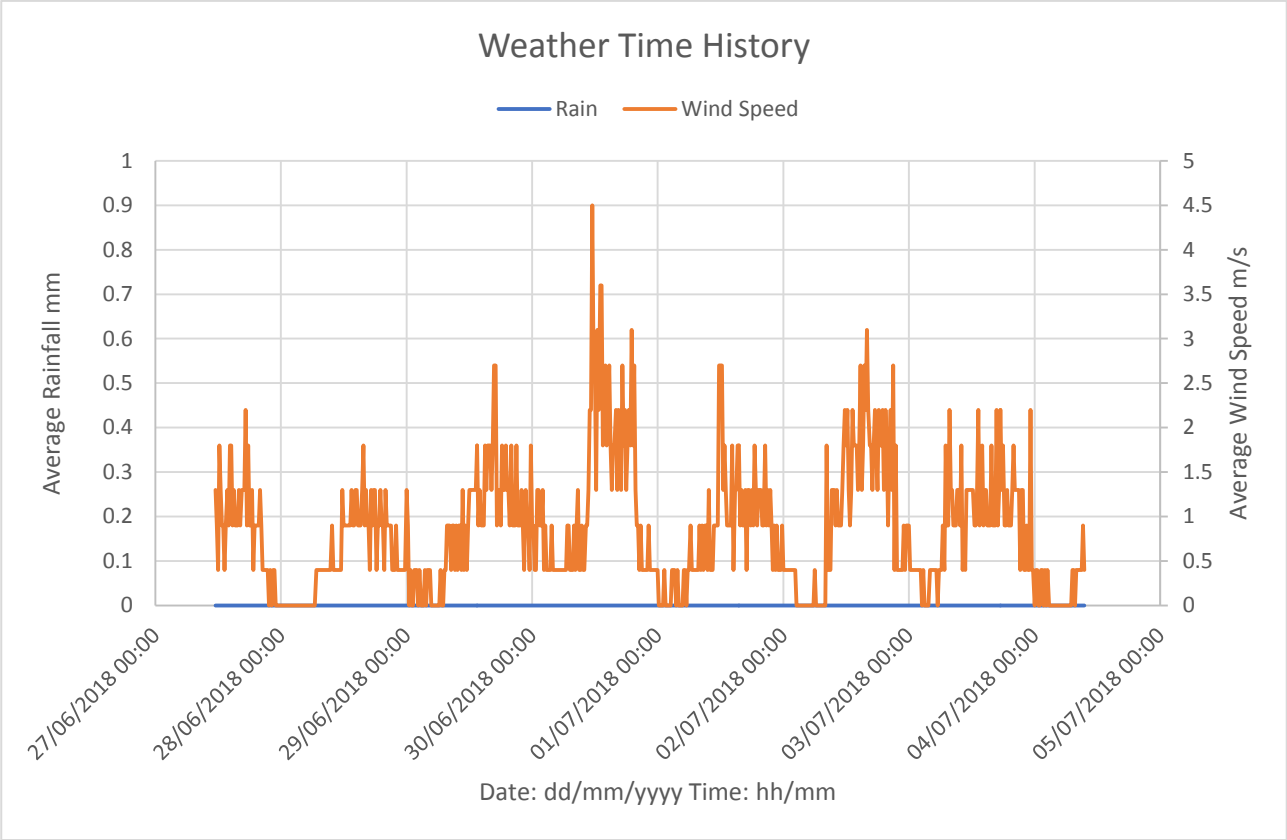
Appendix C
Meteorological Readings



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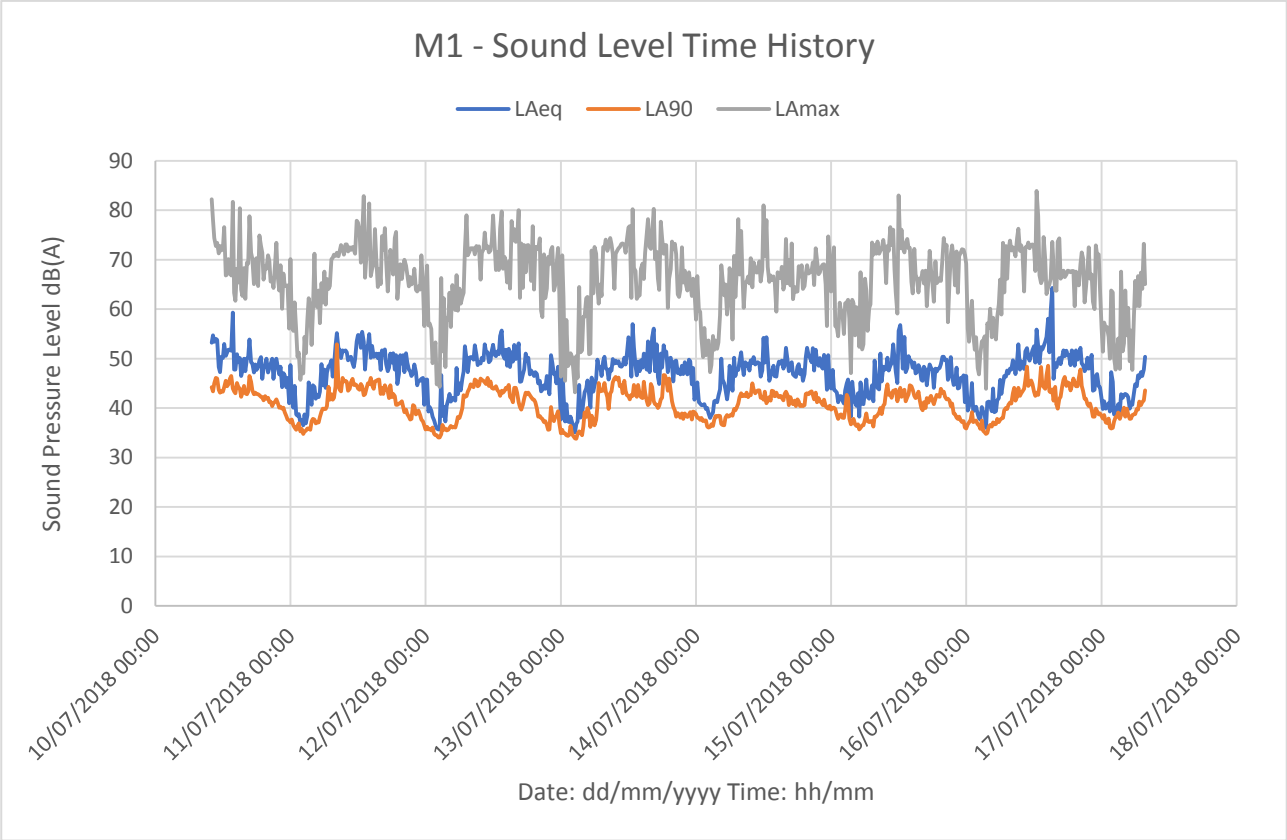
Appendix D
Sound Level Time History Charts



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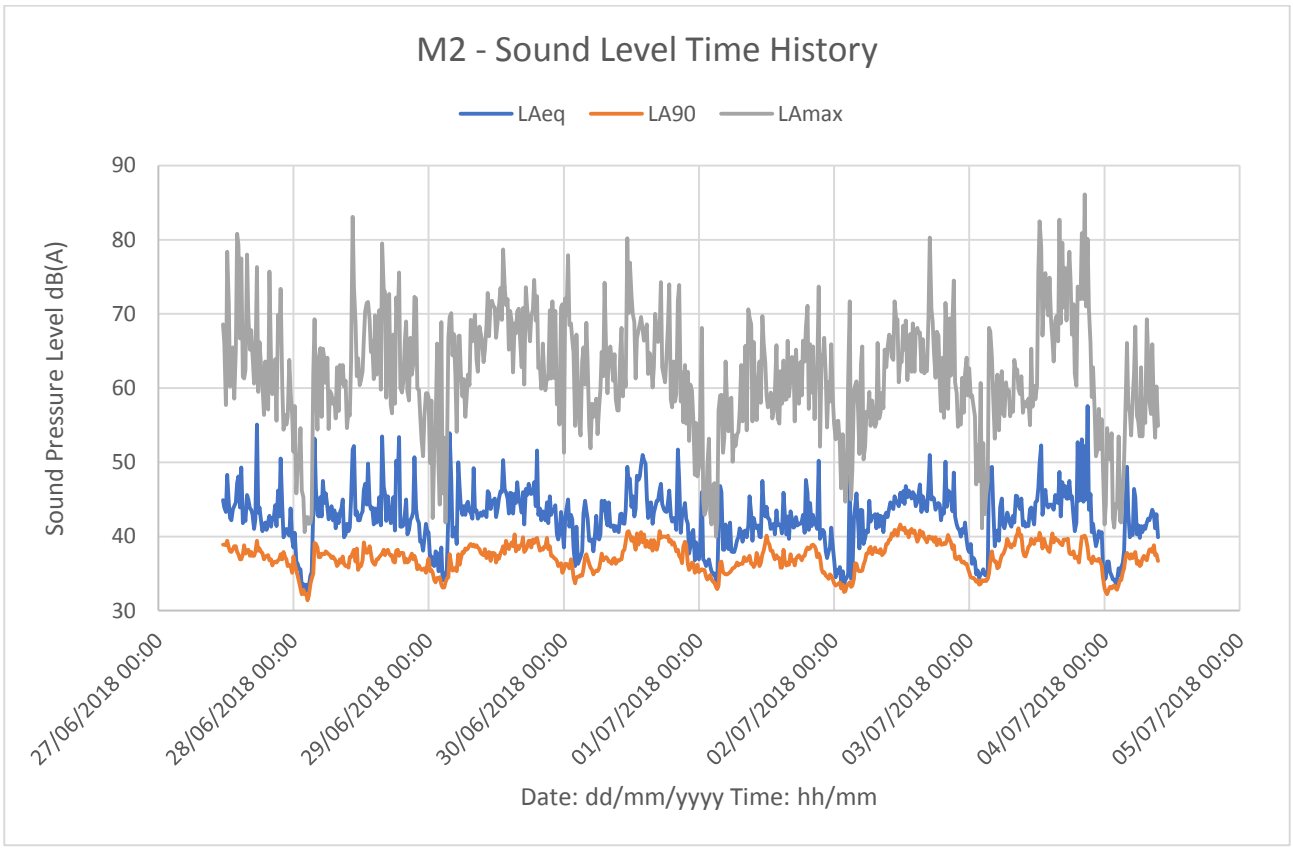

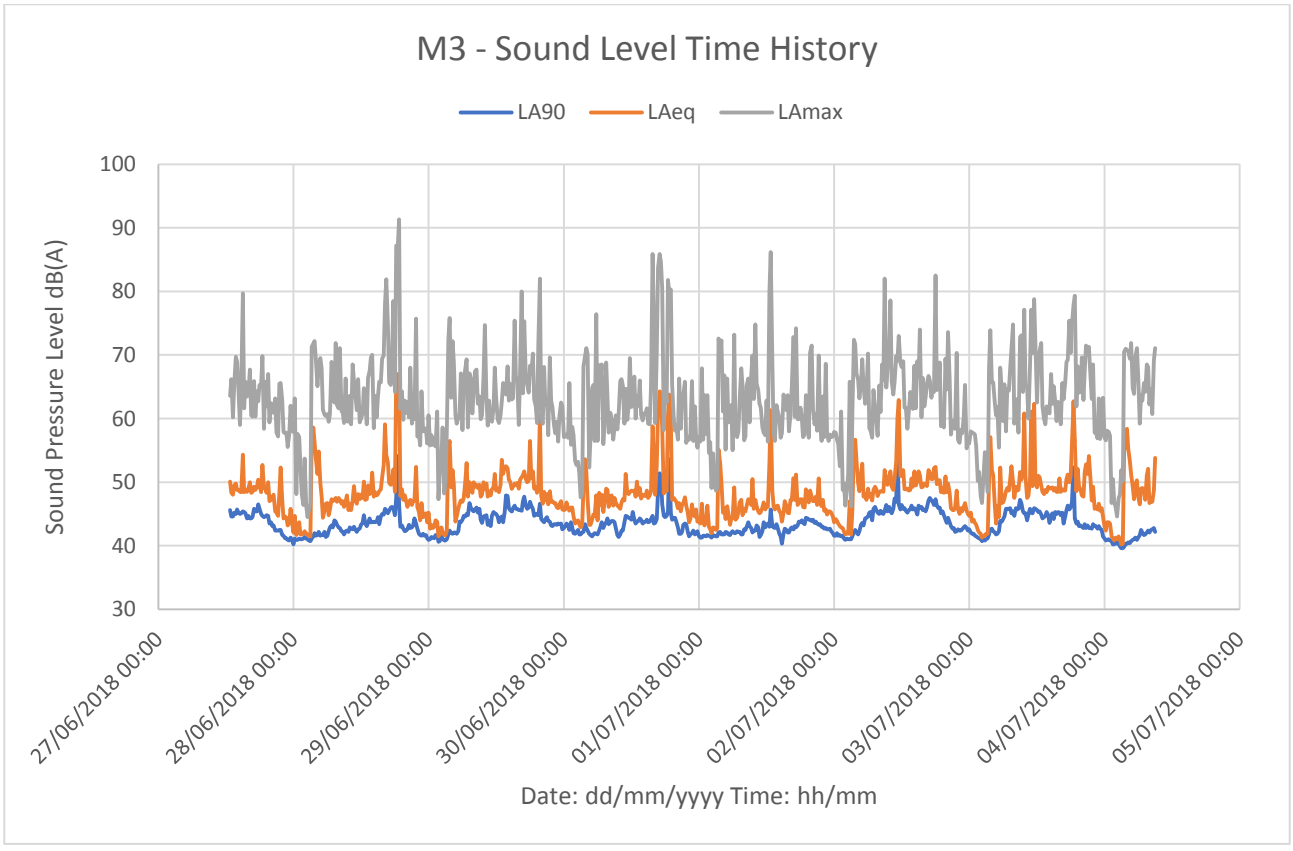

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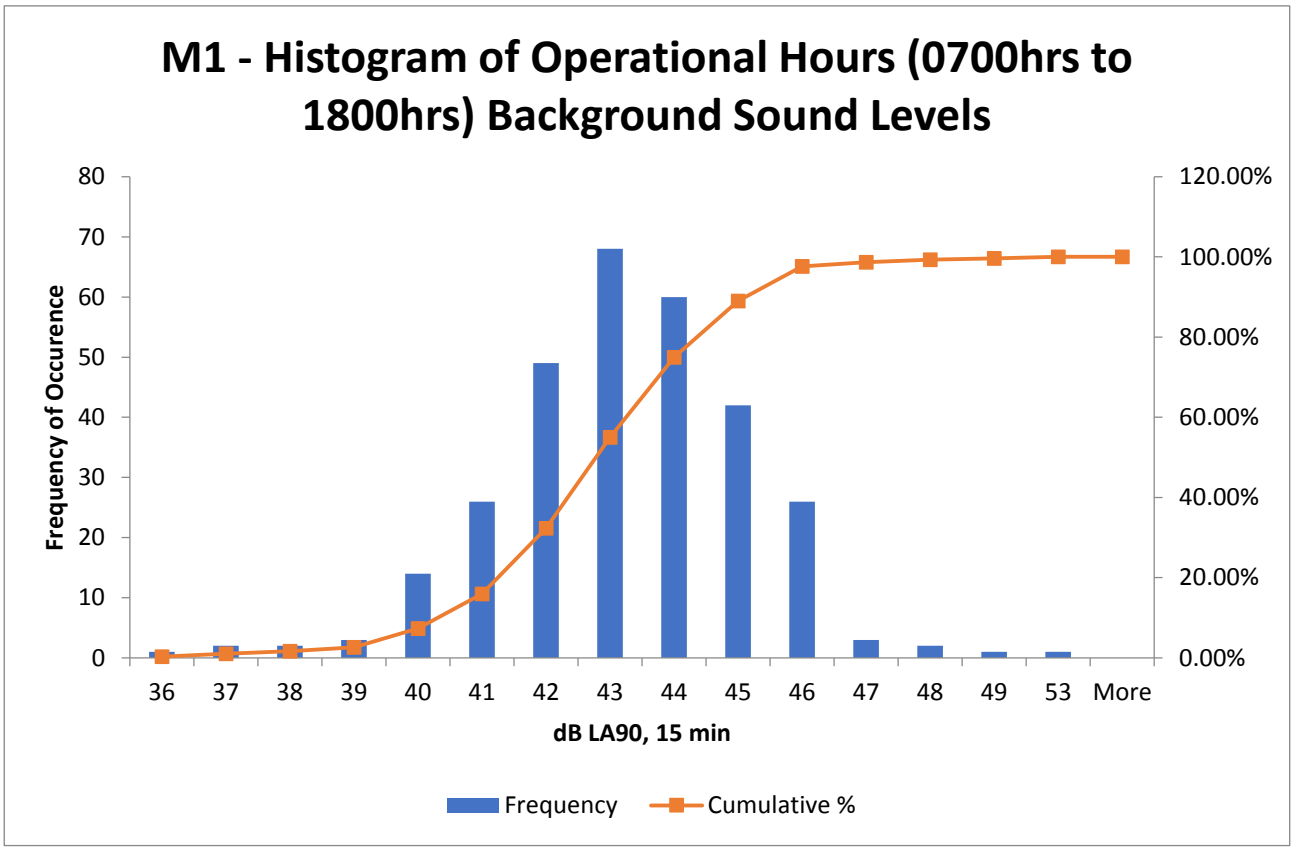
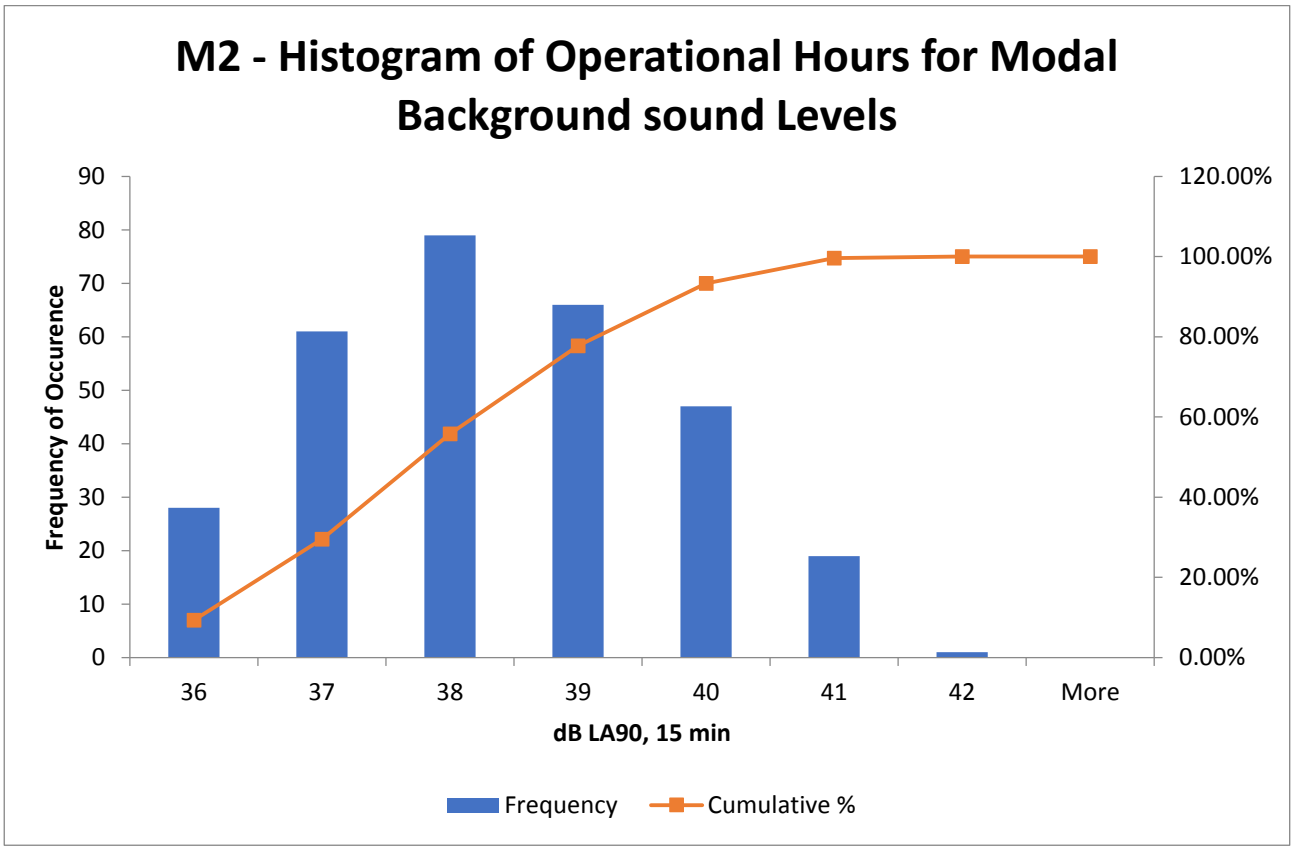
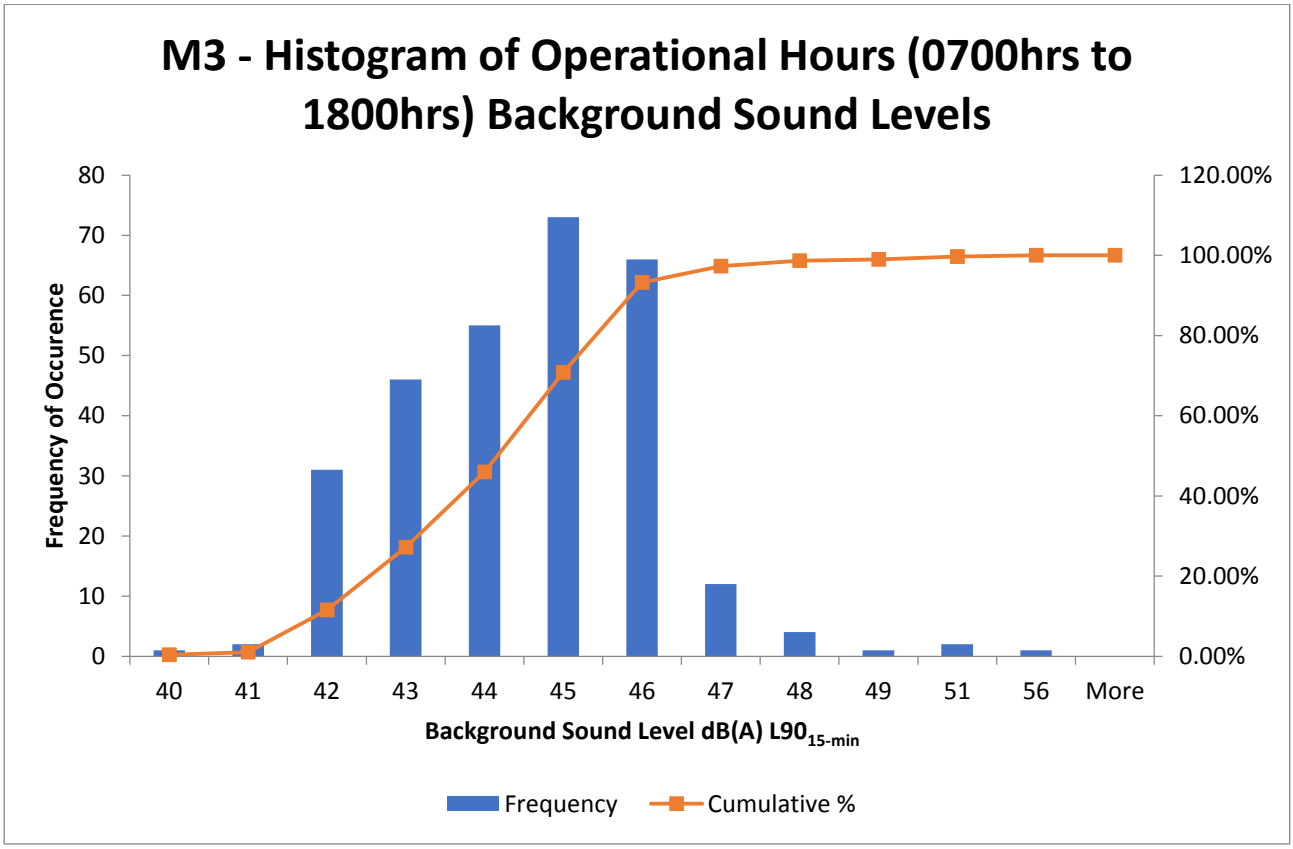
Appendix E
Sound Level Operational Histograms




M2 - Histogram of Operational Hours for Modal Background sound Levels
Frequency of Occurence
90
80
70
60
50
40
30
20
10
0
120.00%
100.00%
80.00%
60.00%
40.00%
20.00%
0.00%
36
37
38
39
40
41
42
More
dB LA90, 15 min
Frequency
Cumulative %


M3 - Histogram of Operational Hours (0700hrs to 1800hrs) Background Sound Levels
Frequency of Occurence
80
70
60
50
40
30
20
10
0
120.00%
100.00%
80.00%
60.00%
40.00%
20.00%
0.00%
40
41
42
43
44
45
46
47
48
49
51
56
More
Background Sound Level dB(A) L90 15-min
Frequency
Cumulative %

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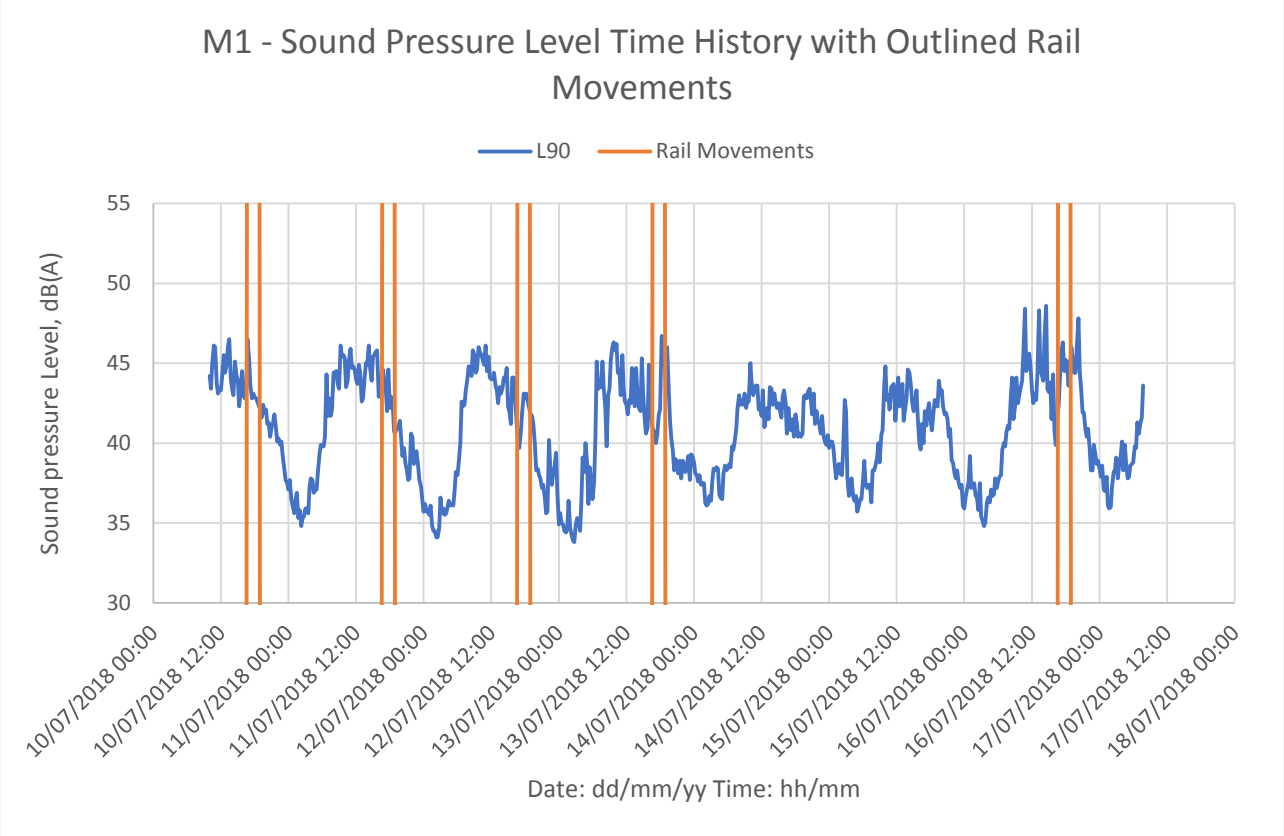
Appendix F
Sound Pressure Level Time History Charts with Outlined Rail Movements



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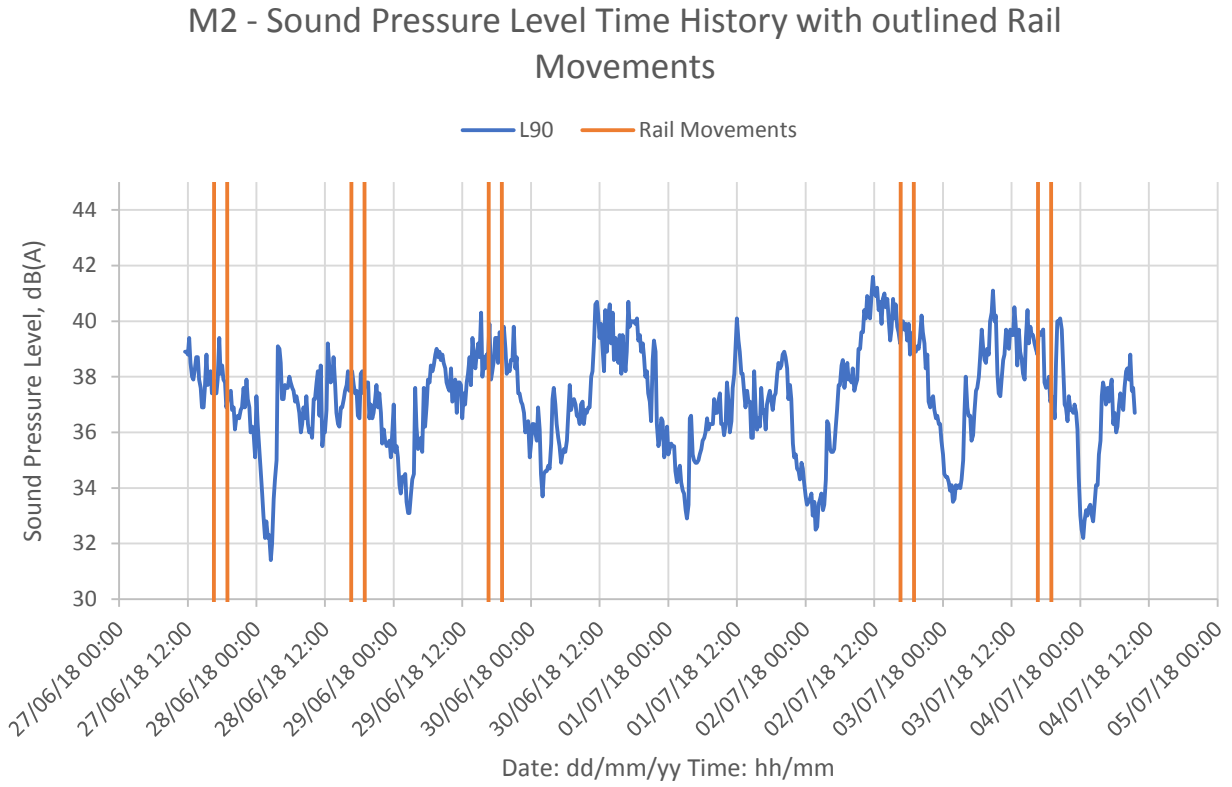

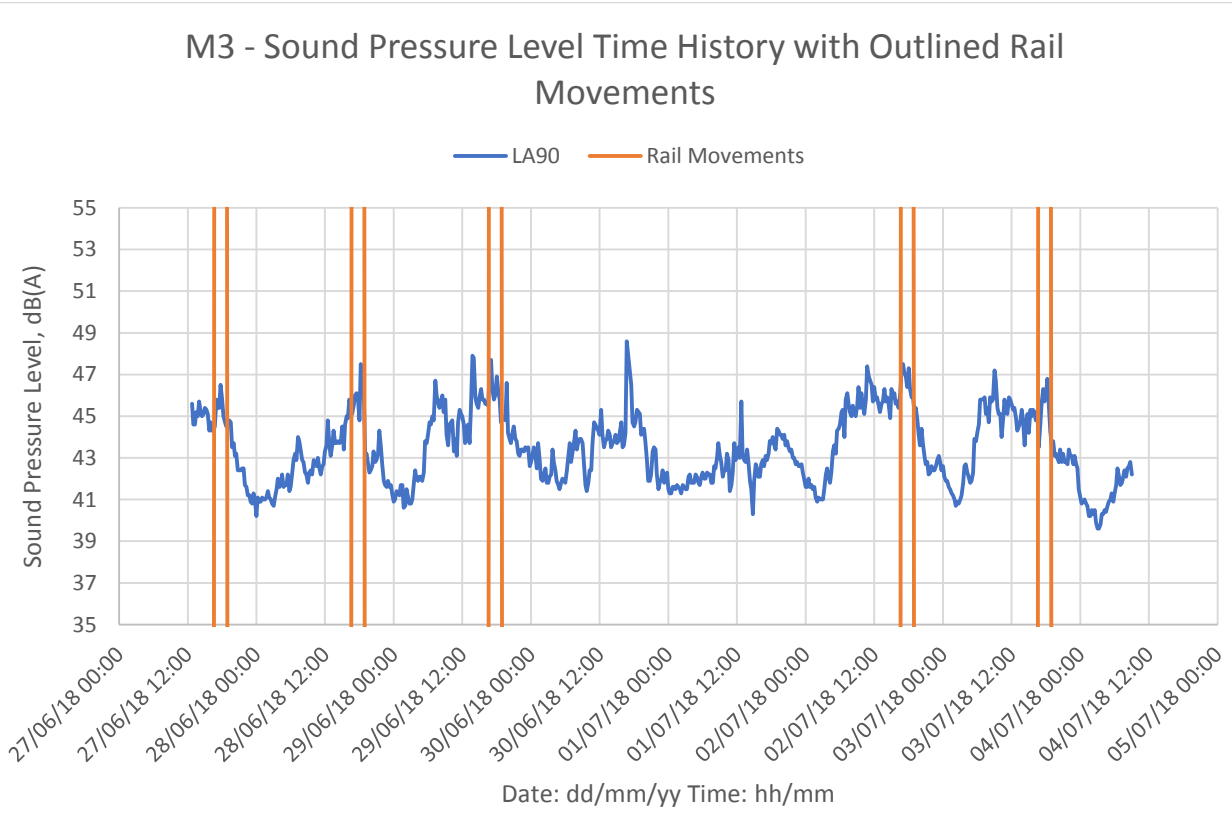

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Appendix G
Assumed Plant List

Table G.1 Assumed plant list

Plant Type	Sound Power Level (dB)	Source Type in Model	No.plant	Assumed % on-time (Per hour)
Internal Plant				
RCV (Movements)	113	Area	3/hr	60
RCV (Glass Tipping)	121	Area	3/hr	60
Bulking Artic Vehicle (Collection)	111	Area	6/day	20
Front End Wheeled Loader	116	Area	1	100
Front End Wheeled Loader (Engine Idling)	105	Area	1	33
Shredder	100	Area	2	75
Conveyors	94	Area	3	75
Rail Compactors	98	Area	2	75
External plant				
RCV Deliveries (Table C.8 ref 20)*	118	Line	3/hr	50
Bulking Artic Vehicle (Table C.6 ref 21)*	124	Line	1 every 2/hr	10
Odour Control Fan	65	Point	1	100

* BS 5228:2009+A1: 2014