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Project:

MFG Salendine Huddersfield

Title:

Noise Impact Assessment

quietly moving forward



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1 INTRODUCTION

- 1.01 Environmental Equipment Corporation Limited has been commissioned by MBH Design Studio Ltd to undertake a noise assessment of the operation of a new jet wash bay to be installed at the Salendine service station in Huddersfield.
- 1.02 This noise assessment has been conducted in accordance with current British Standard and World Health Organisation guidance for community noise and the results of a noise survey carried out over an extended period including a weekend. This document has been prepared during the ongoing COVID 19 epidemic in the UK and the survey was carried out during a period when the Government guidance was to restrict public movement. We have also therefore carried out this review to include the *Joint Guidance on the Impact of COVID-19 on the Practicality and Reliability of Baseline Sound Level Surveying and the Provision of Sound & Noise Impact Assessments by the Association of Noise Consultants [ANC] and the Institute of Acoustics [IOA] Version 4* dated 21st April 2020.
- 1.03 This assessment includes:
- The details of an ambient noise survey undertaken by this practice to measure the existing noise climate around the site; and
 - The prediction of noise impacts at the most affected noise sensitive receptors for two distinct scenarios:
 1. A typical operating time between 0700-2200hrs Monday to Saturday
 2. Operating hours of 0800-2100hrs on Sundays
- 1.04 Whilst every effort has been made to ensure that this report is easy to understand, it is necessarily technical in nature. To assist the reader, an explanation of the terminology used in this report is contained in Appendix A.

2 SITE

- 2.01 The MFG Salendine service station is on the A640 New Hey Road on the west side of Huddersfield. Appendix B includes an existing and proposed site plan.
- 2.02 The site consists of a sales store and forecourt including a motorised car wash as well as an existing jet wash sited on the eastern most boundary.
- 2.03 The nearest and most affected residential dwellings are located along Celandine Avenue to the south of the proposed second jet wash bay.
- 2.04 The following aerial view (courtesy of Google 2021) identifies the site, the proposed location of the new jet wash bay along with the immediate vicinity including the noise monitoring location. The existing jet wash bay is also labelled and will be retained. The proposed new jet wash bay will have a 2.6m tall solid screen along its south and east extents, acoustically screening the jet wash activities from the properties along Celandine Avenue.

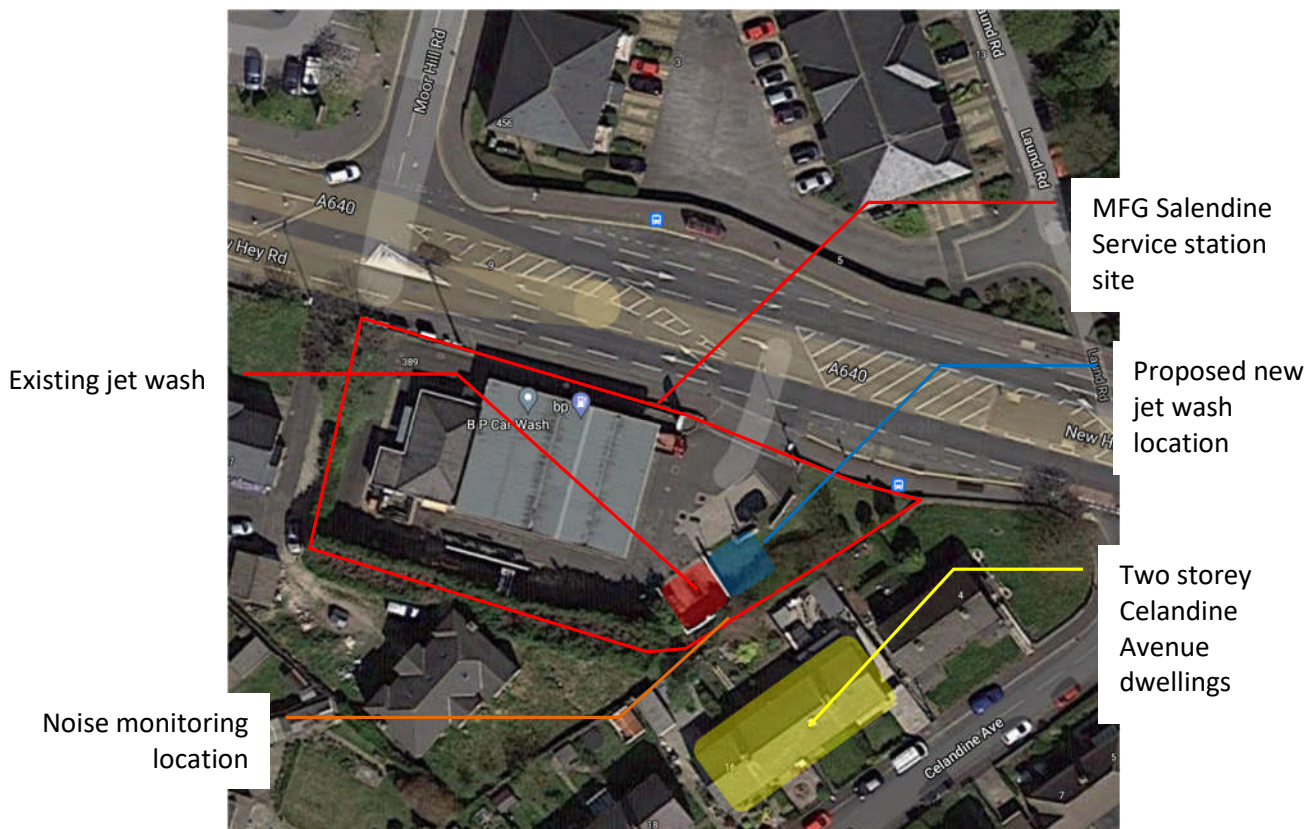


Figure 1: Annotated site plan aerial view.

2.05 It is expected that this new equipment will typically operate between the hours of 0700 – 2200hrs Monday to Saturday and 0800-2100hrs on Sundays. The service station is open 0600-2300hrs every day.

3 GUIDANCE

3.01 A summary of the current National Planning Policy Framework including the Noise Policy Statement for England is presented in Appendix C of this document. We have reviewed the noise impact in line with current National Planning Policy guidance as this document is the basis upon which Local Council Plans are drawn up. The assessment methodology of 'BS4142:2014: 'Methods for rating and assessing industrial and commercial sound'' is the principle standard against which to assess potential impact in this context and that standard in turn requires that the assessment outcomes be judged and considered taking into account context and relevant guidance metrics.

3.02 Additional guidance has been taken from current British Standards and World Health Organisation Guidance. These documents provide useful reference for assessing acceptability against established absolute noise limits.

BS4142:2014 'Methods for rating and assessing industrial and commercial sound'

3.03 To assess the acceptability of the resultant noise levels we have consulted the relevant standards. BS 4142:2014 'Methods for rating and assessing industrial and commercial sound'. The scope of BS4142 includes that assessment of the following sources:

- Sound from industrial and manufacturing processes;
- Sound from fixed installations which comprise mechanical and electrical plant and equipment;
- Sound from the loading and unloading of goods and materials at industrial and/or commercial premises; and
- Sound from mobile plant and vehicles that is an intrinsic part of the overall sound emanating

3.04 BS4142 gives guidance on assessing the likelihood of adverse impacts by calculating a 'rating level' of the new noise source and comparing its magnitude at noise sensitive locations to the existing or underlying background noise level. The background noise level is subtracted from the 'rating level' to assess the likelihood of complaints:

- The greater the difference the greater the likelihood of complaints.
- A difference of around +10dB or more is an indication of a significant adverse impact, depending on the context.
- A difference of +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 noise level, the less likely it is that the specific sound source will have an adverse impact or 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 sound impact, depending on the context.

3.05 This assessment is carried out over a one hour period for the daytime and a fifteen minute period for the night-time. For the purposes of the standard it states that daytime and night-time are typically 07:00 to 23:00 hours and 23:00 to 07:00 hours respectively.

3.06 The 'rating level' of the noise source is obtained taking the following factors into consideration:

- The new plant noise (the specific noise) is measured or predicted in terms of L_{Aeq} .
- An additional correction shall be included if the noise contains a distinguishable, discrete continuous note, if the noise contains distinct impulses or if the noise is irregular enough to attract attention. The value for any tonal noise can be an addition of up to 6dB and for impulsive noise of up to 9dB.

3.07 The background sound level should be established in terms of the L_{A90} noise index. The standard states that the background sound level should be measured over a period of sufficient length to obtain a representative value. The standard states that *'a representative level ought to account for the range of background sound levels and ought not to automatically to be assumed to be either the minimum or modal value.'*

3.08 BS 4142 goes onto state that:

'The significance of sound of an industrial and/or commercial nature depends upon both the margin by which the rating level of the specific sound source exceeds the background sound level and the context in which the sound occurs. An effective assessment cannot be conducted without an understanding of the reason(s) for the assessment and the context in which the sound occurs/will occur. When making assessments and arriving at decisions, therefore, it is essential to place the sound in context.'

3.09 BS4142 requires uncertainties in the assessment to be considered and, where the uncertainty is likely to affect the outcome of the assessment, steps should be taken to reduce the uncertainty.

BS8233:2014 'Guidance on Sound Insulation and Noise Reduction for Buildings'

3.10 BS8233:2014, 'Guidance on sound insulation and noise reduction for buildings', section 7 gives guidance on acoustic criteria and noise levels appropriate for various internal spaces that have different functions. Section 7.7 relates specifically to buildings having a residential purpose and offers guidance on appropriate internal ambient noise levels for dwellings (when unoccupied) with specific consideration:

- i. for bedrooms, the acoustic effect on sleep; and
- ii. for other rooms, the acoustic effect on resting, listening and communicating.

3.11 The guidance applies to external noise as it affects the internal acoustic environment from sources without a specific character.

3.12 Table 4 of section 7.7.2 recommends the following internal noise limits based on the presence of steady, external noise sources:

Table 4 Indoor ambient noise levels for dwellings

Activity	Location	07:00 to 23:00	23:00 to 07:00
Resting	Living room	35 dB $L_{Aeq,16hour}$	—
Dining	Dining room/area	40 dB $L_{Aeq,16hour}$	—
Sleeping (daytime resting)	Bedroom	35 dB $L_{Aeq,16hour}$	30 dB $L_{Aeq,8hour}$

3.13 The guidance criteria are based upon research and existing guidelines provided by the World Health Organisation.

3.14 It is generally considered that the sound insulation provided by a partially open window will be 15dB, dependent on window type, extent of opening and source frequency content.

3.15 It can be seen that in the worst case, with a partially open window reduction of 15dB, indoor ambient noise targets for bedrooms will be met where the external ambient noise level is below 45dB(A). This is based upon steady noise of an anonymous nature and is consistent with the World Health Organisations LOAEL.

World Health Organisation 'Guidelines for Community Noise 1999'

3.16 In addition to the advice detailed above within BS8233 the WHO Guidelines for community noise, 1999 also provide the following guidance relating to noise during the night time.

'For a good sleep, it is believed that indoor sound pressure levels should not exceed approximately 45 dB L_{AFmax} more than 10 -15 times per night'

- 3.17 The guidelines refer to community noise which is also called environmental noise, residential noise or domestic noise, WHO states that this noise encompasses all sources except noise at the industrial workplace. Main sources of community noise include road, rail and air traffic, industries construction and public work and the neighbourhood. The main indoor sources of noise are ventilation systems, office machines, home appliances and neighbours. Typical neighbourhood noise comes from premises and installations related to the catering trade (restaurant, cafeterias, discotheques, etc.), from live or recorded music, sports events including motor sports, playgrounds, car parks and domestic animals such as barking dogs.

4 MEASUREMENTS

- 4.01 Environmental noise measurements were carried out over an extended period, between 1845 hours on Thursday 10th June, 2021 and concluded 1745 hours on Tuesday 15th June, 2021, to establish the existing noise levels at the site. The survey methodology and results are set out below.
- 4.02 Noise measurements have been carried out at the following position, as shown in Figure 1 and described as:
- Position 1: located at a height of approximately 1.5 metres above ground level. The measurement was not located within 3.5 metres of any reflecting surfaces, other than the mounting surface.
- 4.03 This position is considered to be representative of the rear windows of the dwellings along Celandine Avenue.

5 EQUIPMENT

- 5.01 The equipment used for the survey was as follows:-
- 01dB Cube Integrating Sound Level Meter conforming to Class 1 BS EN 61672, Type 1 BS EN 60804 & BS EN 60651: 1994;
 - 01dB Metravib MCE 212 Condenser Microphone, PRE 21 S Pre-amp and Connecting Leads;
 - 01dB Outdoor Microphone Kit and a
 - Tripod.

5.02 The equipment holds current UKAS or equivalent accreditation and serial numbers as follows:

Sound Level Meter CUBE	Serial No.	11111
	Calibration Date	9 th December, 2019
	Cal Certificate No.	TR-REP-10178
½" GRAS Condenser Mic.	Serial No.	287790
	Calibration Date	9 th December, 2019
	Cal Certificate No.	TR-REP-10178
Calibrator CAL 21	Serial No.	34634297
	Calibration Date	6 th February, 2020
	Cal. Certificate No.	U33985

N.B. Copies of calibration certificates are available upon request.

5.03 The equipment was calibrated both before and after the survey with no difference noted in the levels.

6 RESULTS

- 6.01 The weather during the survey was suitable for noise measurement, it being dry with little wind for the duration of the survey.
- 6.02 Noise sources at the site include local and distant road traffic as well as activity on the garage forecourt and occasional operation of the existing jet wash.
- 6.03 A list of the levels measured is included in Appendix D and represented graphically in Appendix E.
- 6.04 A summary of the time averaged ambient levels and the background levels over the measurement periods are shown in Table 6.1. The representative L_{A90} is based around a review of the 15 minute measurement in the specified period.

Day	Period	Average $L_{Aeq,T}$ – dB	Range L_{A90} – dB	Representative $L_{A90,15min}$ –dB
Thursday 10 th June, 2021	Operating Period (0700-2200hrs)	-	-	-
	Day time (1845-1900 hrs)	56.7	49.2	-
	Evening (1900-2300 hrs)	53.7	38-51	-
	Night-time (2300-0700 hrs)	51.4	33-48	-
Friday 11 th June, 2021	Operating Period (0700-2200hrs)	57.1	41-53	48
	Day time (0700-1900 hrs)	57.0	49-53	-
	Evening (1900-2300 hrs)	56.6	41-51	-
	Night-time (2300-0700 hrs)	53.6	33-45	-
Saturday 12 th June, 2021	Operating Period (0700-2200hrs)	56.5	43-52	45
	Day time (0700-1900 hrs)	56.7	46-52	-
	Evening (1900-2300 hrs)	55.1	43-49	-
	Night-time (2300-0700 hrs)	50.8	33-44	-
Sunday 13 th June, 2021	Operating Period (0800-2100hrs)	55	40-50	45
	Day time (0700-1900 hrs)	55.1	40-50	-
	Evening (1900-2300 hrs)	53.5	35-47	-
	Night-time (2300-0700 hrs)	52.2	32-46	-
Monday 14 th June, 2021	Operating Period (0700-2200hrs)	57.0	41-54	45
	Day time (0700-1900 hrs)	57.4	48-54	-
	Evening (1900-2300 hrs)	54.3	40-49	-
	Night-time (2300-0700 hrs)	51.9	31-48	-
Tuesday 15 th June, 2021	Operating Period (0700-2200hrs)	-	-	-
	Day time (0700-1745 hrs)	58.1	46-53	-

Table 6.1: Free-Field Measured Ambient along with Range and Representative Background Noise Levels

- 6.05 The representative L_{A90} is based upon a review of the 15 minute measurements over the proposed jet wash operating period and has been set as being 45 dB(A). The typical background noise level during the middle of the daytime is some 5-6 dB higher and therefore the representative background noise level, being somewhat lower, can be considered to provide a robust assessment under BS4142.

7 NOISE MODELLING

- 7.01 The propagation of noise across and beyond the site due to the activities associated with the new jet wash bay has been modelled using CadnaA software produce by Datakustik. Calculations are undertaken using the General Method of Calculation from ISO9613-2:1996. Within the noise model, buildings and the immediate topography have been accounted for along with the screening attenuation of the proposed solid barriers to the sides of the jet wash bay (2.6m tall in all directions excluding north-east).
- 7.02 Source noise data used in the model has been based upon manufacturers published levels as listed below. In addition, EEC Ltd have previously undertaken in-situ measurements of the jet wash plant and operation, which has been used in these calculations. Copies of the manufacturer's datasheets are included in Appendix E.

Jet washes	Istobal model 4CA2000	<70dBA at 1m (Published)
		67 dBA* at 1.5m (measured average for a typical 11-minute wash cycle).

**67 dB was the recorded L_{Aeq} over the typical 11-minute wash cycle. Maximum L_{AF} emission values of up to 78 dB were recorded during the ultra-rinse with lance periods (approximately 1.5-2 minutes of the full cycle). Details of this are included in Appendix F.*

7.03 The following illustrations show a graphical representation of the noise model and calculated noise levels due to the operation of each element outlined above:

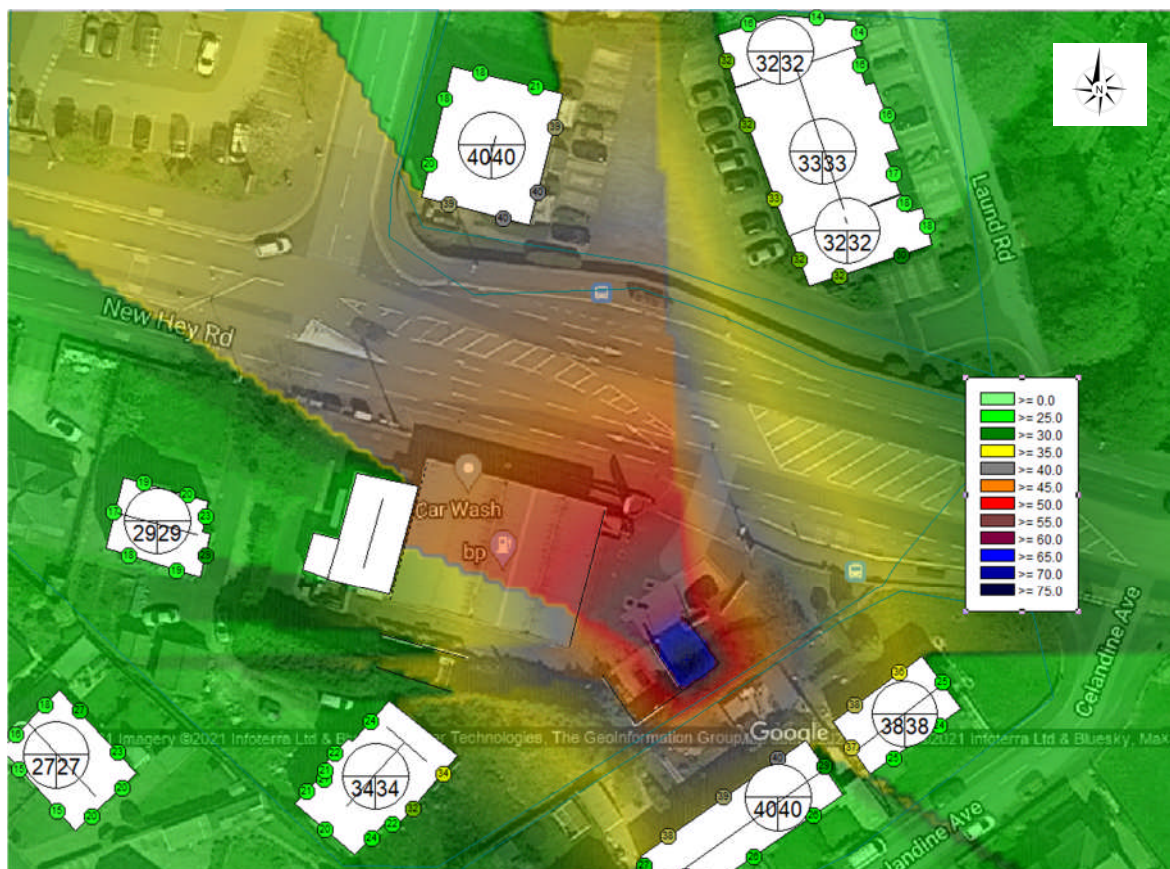


Figure 2: Noise model – site-wide sound pressure levels due to the operation of the proposed jet wash plant.

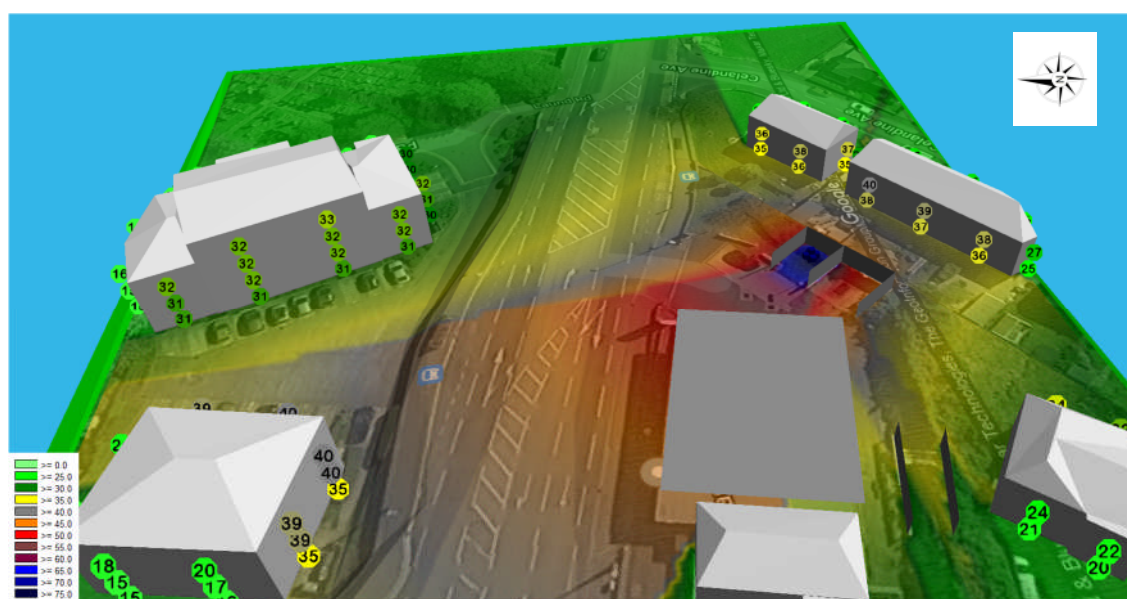


Figure 3: Noise model looking north– site-wide sound pressure levels due to the operation of the proposed jet wash plant.

- 7.04 The model shows that the operational sound pressure will be up to 40 dB(A) at the nearest most affected receptors along Celadine Avenue.

8 BS4142 ASSESSMENT

- 8.01 The impact due to noise arising from the operation of the proposed jet wash has been assessed in accordance with BS4142 for distinct worst-case scenarios:

- **Monday to Saturday operation (0700-2200hrs)**

The New Jet Wash bay assumed to be operational continuously for the course of the BS4142 1-hour reference period.

- **Sunday operation (0800-2100hrs)**

The New Jet Wash bay assumed to be operational continuously for the course of the BS4142 1-hour reference period.

- 8.02 The two operational scenarios have been assessed against the background noise measurements made onsite, as outlined in Sections 4 – 6. Both scenarios are modelled against a representative background noise level of 45 dB(A) L_{90} .

- 8.03 The following table presents the BS4142 assessment procedure for the activities and periods described above based on the noise immissions modelled in CadnaA (above). The assessments include commentary on context and reference to absolute noise standards found in BS8233:2014 'Guidance on sound insulation and noise reduction for buildings' and WHO guidelines, summary details of which can be found in Appendix C.

Results		Relevant Clause	Commentary
Assessment made during the daytime, so reference time interval is 1 hour		7.2	
Calculated Specific Noise Cumulative from all equipment.	40 dB $L_{Aeq,1 \text{ hour}}$	7.3.6	Noise modelled using CadnaA, assumes continuous operation of all items during peak periods
Acoustic Character Correction	+ 3 dB	9.2	Switching on and off of the wash pump is expected to be just perceptible
Rating Sound Level	(40+3) dB = 43 dB	9.2	Overall 1 hour level
Background Noise Level	45 dB $L_{A90,1 \text{ hour}}$	8	Representative Daytime Background
Difference	(43-45) dB= -2 dB	11	
Assessment indicates the noise will be of low impact, depending on context		11	
Uncertainty of assessment	Not Significant	10	The noise model uses certified published source data and representative background noise levels are based on a extended period including a weekend.

Table 8.1: BS4142 Assessment for continuous jet wash activity

- 8.04 As indicated in the above BS4142 assessment, the operational noise from the car washing is expected to be of low impact, depending on context, during the typical period of operation at the assessed receiver position.
- 8.05 The proposed new jet wash will be installed adjacent to the existing jet wash. There is also a motorised car wash on the site and therefore noise from the new jet wash will not be out of character for the area. Based on the rating noise level from the operation the new jet wash being below the representative background noise level, the noise impact is considered to be low.
- 8.06 The following review looks at the noise levels within the most affected dwelling along Celadine Avenue based on them having both their windows open and closed.

- 8.07 A minimum loss for a double glazed window with trickle ventilation will be 20dB with typical losses over 25 dB. A typical loss of 15dB could be expected for noise passing through a partially open window. Table 8.2 presents the noise levels that could be expected within the dwellings against the relevant BS 8233 design criteria.

Condition	Calculated $L_{Aeq,15min}$ external	Minimum sound reduction loss	Resultant internal ambient noise level	BS8233 Design Criterion
Windows Closed	40 dB	20 dB	<20dB(A) $L_{eq,1 \text{ hour}}$	35dB(A) $L_{eq,16 \text{ hour}}$
Windows Open	40dB	15dB	25dB(A) $L_{eq,1 \text{ hour}}$	35dB(A) $L_{eq,16 \text{ hour}}$

**Table 8.2: Calculated Worst Case Internal Ambient Noise levels
within Celadine Avenue dwellings**

- 8.08 The assessment has shown that the noise from the operation of the new jet wash bay will be of low impact based on the typical background noise level. The resultant noise levels within the dwellings will also satisfy current World Health Organisation and British Standard Guidance for daytime sleeping and resting conditions.
- 8.09 Certain events during the typical operation of the jet wash, most notably the ultra-rinse with lance function of the jet wash stations, will result in instantaneous noise levels approximately 10 dB higher than presented in the tables above, up to 50 dB L_{Aeq} . These short instances of higher-level noise are however still expected to have limited impact considering existing ambient noise levels from varying activities are consistently in excess of 50 dB $L_{Aeq,15 \text{ min}}$ even during the quieter times of the day.

9 CONCLUSIONS

- 9.01 MBH Design Studio Ltd has appointed Environmental Equipment Corporation Limited to undertake a noise assessment of the operation of the proposed jet wash facilities at the MFG Salendine service station.
- 9.02 The assessment has been carried out in accordance with BS4142, BS8233 and national planning guidance and is based on an environmental noise survey conducted at the site, as well as both published and site-measured noise emissions for the specified equipment.
- 9.03 The potential noise impact of the operation of the jet wash at the closest and most affected noise sensitive receptors has been assessed using calculated sound pressure levels using a noise model produced in CadnaA software, accounting for the noise reduction offered by the proposed jet wash bay screens.
- 9.04 Calculations have shown that the operation of the bay over the proposed operating periods will have no significant impact on the nearest and most affected receivers given the relative magnitude of the noise and the context of the site which is set on a relatively busy road.

APPENDIX A

GLOSSARY OF TECHNICAL TERMS

ACOUSTIC TERMINOLOGY

Absorption Classes	The sound absorption of a material is rated from Class A to Class E, where Class A materials provide the highest level of sound absorption.
Ambient Noise Levels	Noise levels measured in the absence of noise requiring control, frequently measured to determine the situation prior to the additional of a new noise source.
dB	Decibel. The logarithmic unit of sound level.
dBA	A-weighted decibel. The A-weighting approximates the response of the human ear.
$D_{nT,w}$	Weighted standardized level difference. A single number quantity of the sound level difference between two rooms. $D_{nT,w}$ is typically used to measure the on-site sound insulation performance of a building element such as a wall, floor or ceiling. Measured in accordance with BS EN ISO 16283-1 and weighted in accordance with BS EN ISO 717-1.
$D_{n,e,w}$	The weighted element-normalized level difference. A single number rating of the sound reduction provided by a sound passing through an individual element. $D_{n,e,w}$ is typically used to define the sound insulation provided by ventilators. Measured in accordance with BS EN ISO 10140-2:2010 and rated in accordance with BS EN ISO 717-1.
Flanking	Transmission of sound energy through paths adjacent to the building element being considered. For example, sound may be transmitted around a wall by travelling up into the ceiling space and then down into the adjacent room.
Frequency	Sound can occur over a range of frequencies extending from the very low, such as the rumble of thunder, up to the very high such as the crash of cymbals. Sound is generally described over the frequency range from 63Hz to 4kHz, roughly equal to the range of frequencies on a piano.
Impact Sound	Sound produced by an object impacting directly on a building structure, such as footfall noise or chairs scrapping on a floor.
$L_{Aeq,t}$	The equivalent continuous sound level measured in dBA. This is commonly referred to as the average noise level. "t" is the interval time for the measurement which is most often 30 minutes when demonstrating compliance with BB93.
$L_{A90,t}$	The noise level exceeded for 90% of the measurement period, measured in dBA. This is commonly referred to as the background noise level.
$L'_{nT,w}$	Weighted, standardized impact sound pressure level. A single number rating of the impact sound insulation of a floor/ceiling when impacted on by a standard "tapper" machine. The lower the $L'_{nT,w}$, the better the acoustic performance. Measured in accordance with BBS EN ISO 140-7 and rated in accordance with BS EN ISO 717-2.
NR	Noise Rating. A single number rating which is based on the sound level in the octave bands 31.5Hz – 8kHz inclusive, generally used to assess noise from mechanical services in buildings.
Octave Band	Frequencies are often grouped together into octaves for analysis. Octave bands are labelled by their centre frequency which are: 63Hz, 125Hz, 250Hz, 500Hz, 1kHz, 2kHz and 4kHz.
Reverberation Time (T_{mf})	Reverberation time is used for assessing the acoustic qualities of a space. It is defined as the time it takes for an impulse to decay by 60dB. T_{mf} is the arithmetic average of the reverberation time in the mid frequency bands (500Hz, 1kHz and 2kHz).
R_w	Weighted sound reduction index. A single number rating of the sound insulation performance of a specific building element. R_w is measured in a laboratory. R_w is commonly used by manufacturers to describe the sound insulation performance of building elements such as plasterboard and concrete. Measured in accordance with BS EN ISO 10140-2:2010 and rated in accordance with BS EN ISO 717-1.
Sound Absorption	When sound hits a surface, some of the sound energy is absorbed by the surface material. Sound absorption refers to the ability of a material to absorb sound, rated from 0, complete reflection, to 1, complete absorption.
Sound Insulation	When sound hits a surface, some of the sound energy travels through the material. 'Sound insulation' refers to the ability of a material to prevent the travel of sound.
Structure-borne transmission	Transmission of sound energy as vibrations via the structure of a building.

APPENDIX B

PROPOSED AND EXISTING

SITE PLAN

APPENDIX C
PLANNING POLICY
AND GUIDANCE

PLANNING POLICY AND GUIDANCE

British Standard 4142

To assess the acceptability of the resultant noise levels we have consulted the relevant standards. BS 4142:2014 'Methods for rating and assessing industrial and commercial sound' has been used to assess the likelihood any adverse impacts based on the resultant noise level from the new plant item, including any corrections for the character of the noise against the existing background noise level.

BS4142 gives guidance on assessing the likelihood of adverse impacts by calculating a 'rating level' of the new noise source and comparing its magnitude at noise sensitive locations to the existing or underlying background noise level. The background noise level is subtracted from the 'rating level' to assess the likelihood of complaints:

- The greater the difference the greater the likelihood of complaints.
- A difference of around +10dB or more is an indication of a significant adverse impact, depending on the context.
- A difference of +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 noise level, the less likely it is that the specific sound source will have an adverse impact or 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 sound impact, depending on the context.

This assessment is carried out over a one hour period for the daytime and a fifteen minute period for the night-time. For the purposes of the standard it states that daytime and night-time are typically 07:00 to 23:00 hours and 23:00 to 07:00 hours respectively.

The 'rating level' of the noise source is obtained taking the following factors into consideration:

- The new plant noise (the specific noise) is measured or predicted in terms of L_{Aeq} .
- An additional correction shall be included if the noise contains a distinguishable, discrete continuous note, if the noise contains distinct impulses or if the noise is irregular enough to attract attention. The value for any tonal noise can be an addition of up to 6dB and for impulsive noise of up to 9dB.

BS 4142 goes onto state that:

‘The significance of sound of an industrial and/or commercial nature depends upon both the margin by which the rating level of the specific sound source exceeds the background sound level and the context in which the sound occurs. An effective assessment cannot be conducted without an understanding of the reason(s) for the assessment and the context in which the sound occurs/will occur. When making assessments and arriving at decisions, therefore, it is essential to place the sound in context.’

BS4142 has been referenced in setting noise limits for any fixed plant proposed as part of the proposed development.

British Standard 8233

BS8233:2014, ‘Guidance on sound insulation and noise reduction for buildings’, section 7 gives guidance on acoustic criteria and noise levels appropriate for various internal spaces that have different functions. Section 7.7 relates specifically to buildings having a residential purpose and offers guidance on appropriate internal ambient noise levels for dwellings (when unoccupied) with specific consideration:

- i. for bedrooms, the acoustic effect on sleep; and
- ii. for other rooms, the acoustic effect on resting, listening and communicating.

The guidance applies to external noise as it affects the internal acoustic environment from sources without a specific character.

Table 4 of section 7.7.2 recommends the following internal noise limits based on the presence of steady, external noise sources:

Table 4 Indoor ambient noise levels for dwellings

Activity	Location	07:00 to 23:00	23:00 to 07:00
Resting	Living room	35 dB $L_{Aeq,16hour}$	—
Dining	Dining room/area	40 dB $L_{Aeq,16hour}$	—
Sleeping (daytime resting)	Bedroom	35 dB $L_{Aeq,16hour}$	30 dB $L_{Aeq,8hour}$

WHO Night Noise Guidelines for Europe

The World Health Organisation’s ‘Night Noise Guidelines for Europe – 2009’ includes guidance on the effects of external night time noise on the population’s health. Table 5.4 of that document outlines the health effects associated with different external average, yearly night time (2300 – 0700hrs) noise levels based on levels outside of bedroom windows ($L_{night, outside}$). For external noise levels up to 30dBA, although individual sensitivities and circumstances may differ, no substantial biological effects are observed. Thus 30 dBA is equivalent to the NOEL for night noise. Furthermore, there is no sufficient evidence that the biological effects observed at the level below 40 dB $L_{night,outside}$ are harmful to health. However, adverse health effects are observed at the level above 40 dB $L_{night,outside}$ and is thus equivalent to the LOAEL.

Average night noise level over a year $L_{\text{night, outside}}$	Health effects observed in the population	Table 3 Effects of different levels of night noise on the population's health
Up to 30 dB	Although individual sensitivities and circumstances may differ, it appears that up to this level no substantial biological effects are observed. $L_{\text{night, outside}}$ of 30 dB is equivalent to the no observed effect level (NOEL) for night noise.	
30 to 40 dB	A number of effects on sleep are observed from this range: body movements, awakening, self-reported sleep disturbance, arousals. The intensity of the effect depends on the nature of the source and the number of events. Vulnerable groups (for example children, the chronically ill and the elderly) are more susceptible. However, even in the worst cases the effects seem modest. $L_{\text{night, outside}}$ of 40 dB is equivalent to the lowest observed adverse effect level (LOAEL) for night noise.	
40 to 55 dB	Adverse health effects are observed among the exposed population. Many people have to adapt their lives to cope with the noise at night. Vulnerable groups are more severely affected.	
Above 55 dB	The situation is considered increasingly dangerous for public health. Adverse health effects occur frequently, a sizeable proportion of the population is highly annoyed and sleep-disturbed. There is evidence that the risk of cardiovascular disease increases.	

APPENDIX D

SURVEY RESULTS
(TABULAR)

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MBH Design Studio

Tabulated Noise data

Sheet 1 of 5

Time	L _{Aeq}	L _{AMax}	L _{A90}
18:45	56.7	74.2	49.2
19:00	56.1	67.5	50.7
19:15	55.2	70.9	47.0
19:30	54.7	81.4	45.9
19:45	54.7	65.0	48.2
20:00	54.7	73.1	46.8
20:15	54.9	69.3	43.7
20:30	53.8	66.0	43.3
20:45	53.6	66.6	43.0
21:00	55.8	71.4	43.6
21:15	53.1	73.6	43.7
21:30	51.5	66.1	41.2
21:45	51.8	62.5	41.5
22:00	51.5	70.1	40.2
22:15	50.0	64.7	38.9
22:30	51.8	68.4	39.8
22:45	49.2	63.0	37.8
23:00	50.7	66.4	38.7
23:15	48.9	65.0	38.5
23:30	48.0	64.1	37.7
23:45	46.6	64.9	36.1
00:00	45.5	63.3	35.6
00:15	46.1	59.1	35.3
00:30	44.8	61.2	35.1
00:45	46.8	64.8	34.7
01:00	45.3	62.9	34.1
01:15	45.5	63.0	35.0
01:30	46.3	65.9	35.4
01:45	42.2	57.8	35.4
02:00	42.3	60.4	34.1
02:15	45.4	66.6	35.3
02:30	46.7	64.5	35.6
02:45	45.4	61.0	34.6
03:00	44.6	66.7	32.8
03:15	48.2	66.2	33.9
03:30	51.2	66.8	34.1
03:45	56.2	84.2	35.4
04:00	46.7	63.1	36.4
04:15	49.2	69.3	37.1
04:30	56.3	72.1	38.3
04:45	52.9	69.6	42.2
05:00	55.9	70.6	42.2
05:15	53.9	68.0	40.7
05:30	52.4	71.6	42.2
05:45	54.1	77.5	43.0
06:00	53.9	68.2	43.3
06:15	55.1	67.6	46.0
06:30	55.6	68.1	46.1

Time	L _{Aeq}	L _{AMax}	L _{A90}
06:45	55.0	73.1	47.5
07:00	56.6	70.9	50.0
07:15	57.5	76.4	49.4
07:30	57.0	68.9	51.6
07:45	56.5	65.3	52.0
08:00	57.4	69.4	52.4
08:15	56.5	71.5	51.1
08:30	58.4	70.9	52.0
08:45	58.0	74.5	52.6
09:00	57.1	76.9	50.7
09:15	56.0	65.3	49.9
09:30	55.3	68.7	48.8
09:45	56.7	70.3	49.9
10:00	56.2	67.8	49.7
10:15	58.3	79.7	53.0
10:30	56.5	76.3	51.4
10:45	56.1	80.3	49.5
11:00	56.4	73.3	49.9
11:15	56.9	72.5	50.3
11:30	56.2	65.3	51.3
11:45	55.7	69.8	49.4
12:00	57.7	78.4	51.3
12:15	58.5	77.5	50.2
12:30	60.7	79.7	52.0
12:45	57.8	72.0	51.8
13:00	55.2	68.0	50.0
13:15	57.4	70.1	51.1
13:30	56.1	66.2	49.4
13:45	56.2	68.5	50.5
14:00	55.8	66.1	51.2
14:15	56.3	67.2	51.4
14:30	56.4	67.9	51.3
14:45	56.3	71.9	51.8
15:00	56.1	69.0	51.4
15:15	56.8	72.4	50.3
15:30	56.0	65.7	51.0
15:45	56.1	70.2	50.9
16:00	56.7	70.2	51.7
16:15	57.8	77.1	52.1
16:30	59.4	84.4	52.4
16:45	57.0	71.0	52.3
17:00	55.8	68.7	50.4
17:15	58.2	78.6	51.8
17:30	56.7	69.1	51.9
17:45	57.9	76.5	51.5
18:00	55.3	66.4	50.5
18:15	55.9	68.4	50.9
18:30	56.5	66.2	50.7

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Tabulated Noise data

Sheet 2 of 5

Time	L _{Aeq}	L _{AMax}	L _{A90}
18:45	56.6	67.6	50.2
19:00	56.6	72.2	50.7
19:15	61.6	74.2	50.8
19:30	58.5	68.9	51.4
19:45	57.5	77.6	50.1
20:00	55.2	65.2	47.3
20:15	59.6	75.4	47.8
20:30	58.4	70.8	46.8
20:45	57.9	70.3	46.6
21:00	59.2	73.0	45.1
21:15	52.1	65.0	43.2
21:30	53.0	68.7	43.8
21:45	51.5	63.2	41.4
22:00	52.8	64.4	42.2
22:15	52.3	64.7	42.0
22:30	52.7	66.9	42.3
22:45	52.1	70.1	42.2
23:00	51.4	68.6	41.7
23:15	51.4	62.9	42.3
23:30	53.0	74.1	40.4
23:45	50.6	75.3	40.4
00:00	50.0	71.9	40.7
00:15	49.4	64.8	38.8
00:30	47.7	64.2	37.6
00:45	53.1	74.9	37.1
01:00	48.7	63.9	37.2
01:15	47.3	60.5	36.5
01:30	47.9	63.3	36.1
01:45	44.3	60.4	35.8
02:00	46.6	62.3	36.6
02:15	44.4	59.8	34.2
02:30	43.8	62.8	33.8
02:45	46.2	62.6	32.3
03:00	44.9	63.8	33.5
03:15	47.0	64.9	32.9
03:30	51.8	69.4	34.0
03:45	51.1	65.2	38.0
04:00	47.7	71.0	36.3
04:15	53.4	73.2	35.3
04:30	57.5	75.5	39.9
04:45	64.6	77.1	41.5
05:00	56.4	73.2	41.7
05:15	52.9	70.1	41.9
05:30	51.6	62.5	42.9
05:45	53.5	69.8	43.4
06:00	52.1	75.3	43.2
06:15	53.7	67.5	43.4
06:30	52.6	68.8	44.4

Time	L _{Aeq}	L _{AMax}	L _{A90}
06:45	54.0	67.2	44.8
07:00	53.6	64.8	45.7
07:15	55.0	76.0	46.2
07:30	55.6	74.7	45.6
07:45	55.6	70.1	48.1
08:00	55.8	71.7	47.2
08:15	55.4	65.4	48.1
08:30	56.5	68.1	49.3
08:45	58.0	77.2	49.9
09:00	58.4	75.8	51.5
09:15	55.9	66.5	49.3
09:30	57.0	70.1	50.1
09:45	57.7	75.0	51.7
10:00	56.4	75.0	51.5
10:15	57.1	70.1	51.5
10:30	56.6	70.4	51.2
10:45	57.2	72.2	51.6
11:00	55.3	75.9	50.6
11:15	56.0	72.1	50.7
11:30	59.3	78.8	50.9
11:45	57.2	72.9	51.9
12:00	57.7	70.0	50.1
12:15	57.5	70.1	51.3
12:30	56.7	70.8	50.3
12:45	57.7	78.0	50.5
13:00	55.0	69.6	49.1
13:15	57.9	72.6	49.5
13:30	57.2	71.1	49.9
13:45	55.2	65.0	50.1
14:00	56.4	69.1	50.4
14:15	56.4	70.2	49.4
14:30	59.0	76.7	50.1
14:45	55.9	75.0	49.0
15:00	57.2	70.7	49.4
15:15	57.1	77.3	50.0
15:30	56.6	73.2	48.3
15:45	57.8	71.2	51.3
16:00	57.2	72.1	49.9
16:15	56.0	68.9	48.8
16:30	55.1	67.4	48.4
16:45	55.7	69.9	49.2
17:00	55.5	70.5	48.9
17:15	56.5	72.6	49.8
17:30	56.8	74.4	48.3
17:45	56.1	72.4	47.5
18:00	57.3	75.5	48.1
18:15	55.9	74.8	47.4
18:30	55.5	72.5	47.1

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Tabulated Noise data

Sheet 3 of 5

Time	L _{Aeq}	L _{AMax}	L _{A90}
18:45	55.4	64.3	47.7
19:00	56.5	73.6	49.0
19:15	57.0	67.3	48.5
19:30	60.1	84.5	48.2
19:45	55.4	69.1	47.8
20:00	55.0	67.8	45.5
20:15	53.8	62.1	46.2
20:30	54.1	65.2	46.2
20:45	55.8	69.7	45.0
21:00	55.4	73.7	45.1
21:15	53.2	65.9	44.6
21:30	52.1	61.7	43.5
21:45	53.5	64.3	43.0
22:00	51.9	62.1	42.5
22:15	54.1	75.8	43.1
22:30	51.3	61.4	43.2
22:45	53.2	65.2	43.8
23:00	51.7	64.8	43.6
23:15	51.8	66.8	41.7
23:30	50.5	63.2	40.9
23:45	51.1	66.8	39.1
00:00	50.2	64.7	41.0
00:15	48.2	62.6	39.1
00:30	50.6	65.3	40.1
00:45	49.6	63.6	39.5
01:00	46.6	61.4	38.7
01:15	47.6	61.6	38.7
01:30	49.8	67.8	38.8
01:45	47.5	60.6	34.8
02:00	46.8	60.5	35.3
02:15	44.8	63.0	33.1
02:30	44.7	63.2	33.0
02:45	43.1	60.9	33.0
03:00	43.8	62.1	32.7
03:15	41.5	60.2	32.6
03:30	48.2	66.6	37.0
03:45	46.3	62.4	34.7
04:00	46.6	61.7	36.5
04:15	55.8	67.7	39.1
04:30	56.2	68.3	42.0
04:45	50.7	64.1	37.8
05:00	54.1	71.7	38.1
05:15	53.1	69.7	37.5
05:30	52.0	65.1	38.3
05:45	51.6	69.3	38.0
06:00	54.8	77.9	38.4
06:15	50.4	68.7	37.9
06:30	51.3	61.8	39.9

Time	L _{Aeq}	L _{AMax}	L _{A90}
06:45	51.0	64.3	39.2
07:00	49.0	60.6	39.5
07:15	52.2	65.4	40.4
07:30	51.1	63.9	40.9
07:45	52.3	63.7	41.6
08:00	52.8	62.6	43.1
08:15	53.4	66.9	40.9
08:30	58.2	76.9	45.4
08:45	55.0	69.9	45.6
09:00	53.7	62.5	46.2
09:15	55.1	63.8	46.1
09:30	54.5	67.2	45.1
09:45	53.2	64.3	45.1
10:00	55.2	66.0	46.6
10:15	56.0	68.1	49.3
10:30	54.0	64.3	46.5
10:45	55.7	79.7	48.8
11:00	55.5	66.8	49.4
11:15	55.3	65.4	49.4
11:30	54.8	70.1	48.6
11:45	55.6	82.1	48.5
12:00	55.9	67.9	49.8
12:15	54.9	70.4	48.5
12:30	55.0	69.1	48.1
12:45	55.7	70.1	49.4
13:00	56.3	71.0	50.0
13:15	57.7	70.7	49.0
13:30	54.3	67.4	46.9
13:45	56.6	67.0	49.4
14:00	56.7	73.9	48.3
14:15	56.2	67.3	47.2
14:30	55.9	78.8	46.7
14:45	55.9	76.3	44.5
15:00	55.0	71.9	46.5
15:15	54.2	65.6	46.7
15:30	53.7	70.2	44.1
15:45	53.7	71.7	44.7
16:00	55.6	66.4	47.2
16:15	55.6	74.4	48.0
16:30	56.5	69.3	48.8
16:45	53.8	64.0	46.2
17:00	56.4	73.0	47.5
17:15	54.2	72.7	45.3
17:30	56.3	66.5	47.6
17:45	55.2	67.6	46.3
18:00	54.9	66.9	46.5
18:15	53.8	64.8	46.5
18:30	54.4	65.5	45.6

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Tabulated Noise data

Sheet 4 of 5

Time	L _{Aeq}	L _{AMax}	L _{A90}
18:45	56.1	66.1	47.3
19:00	56.0	66.9	46.8
19:15	54.5	67.4	43.3
19:30	55.2	66.5	42.5
19:45	55.2	67.4	44.8
20:00	55.6	68.1	43.5
20:15	53.9	67.6	44.1
20:30	53.9	70.9	42.9
20:45	52.4	65.5	39.5
21:00	52.4	70.5	37.6
21:15	53.3	69.6	39.0
21:30	51.6	64.7	36.9
21:45	49.9	60.4	36.8
22:00	52.9	70.0	38.3
22:15	50.1	62.8	35.0
22:30	51.0	63.4	35.9
22:45	50.9	73.0	35.2
23:00	48.0	61.0	33.1
23:15	48.1	63.6	34.7
23:30	48.1	61.3	33.3
23:45	47.4	63.8	32.4
00:00	47.8	61.0	32.6
00:15	51.0	67.9	32.4
00:30	47.8	73.0	31.5
00:45	48.2	70.2	35.6
01:00	52.1	78.5	35.2
01:15	46.6	65.4	33.2
01:30	43.0	63.4	31.6
01:45	44.3	60.1	33.0
02:00	41.6	61.3	31.5
02:15	42.2	58.0	33.1
02:30	41.6	60.1	32.0
02:45	44.8	67.2	33.4
03:00	38.3	53.2	32.7
03:15	43.4	65.6	34.5
03:30	48.8	66.9	37.5
03:45	43.9	61.0	35.5
04:00	49.3	69.2	35.6
04:15	57.0	70.2	39.5
04:30	58.2	69.8	42.4
04:45	56.5	68.4	41.1
05:00	53.8	67.6	41.4
05:15	54.8	68.0	40.5
05:30	54.0	67.6	41.2
05:45	55.0	72.8	42.9
06:00	56.6	79.4	43.3
06:15	55.0	66.2	44.2
06:30	56.1	71.2	46.1

Time	L _{Aeq}	L _{AMax}	L _{A90}
06:45	54.9	65.5	44.7
07:00	55.6	66.7	47.5
07:15	56.6	76.0	48.8
07:30	57.0	76.3	51.8
07:45	56.9	68.3	51.7
08:00	57.2	67.3	52.6
08:15	56.5	69.5	51.3
08:30	58.7	77.5	52.0
08:45	57.1	67.2	52.2
09:00	57.5	67.9	51.4
09:15	57.9	73.7	51.3
09:30	56.8	68.6	50.2
09:45	57.1	68.0	50.7
10:00	56.6	67.4	50.0
10:15	56.8	75.9	49.8
10:30	55.9	72.7	50.0
10:45	55.4	66.2	48.6
11:00	58.7	85.0	49.7
11:15	60.1	78.9	50.5
11:30	55.9	65.7	50.2
11:45	56.5	73.0	49.9
12:00	55.9	71.1	51.3
12:15	56.6	72.8	50.4
12:30	56.5	70.9	49.7
12:45	56.6	69.2	49.4
13:00	57.5	76.8	49.6
13:15	56.5	72.5	49.7
13:30	57.3	71.6	50.6
13:45	56.8	70.7	50.5
14:00	55.2	67.5	49.3
14:15	57.2	78.9	50.1
14:30	57.2	74.5	50.4
14:45	58.7	75.7	51.6
15:00	57.2	78.4	51.8
15:15	57.1	70.8	52.6
15:30	58.0	71.3	53.7
15:45	57.3	76.0	51.4
16:00	57.8	69.4	52.2
16:15	61.6	87.3	52.9
16:30	56.9	69.8	51.8
16:45	58.1	68.3	52.9
17:00	59.5	84.3	53.0
17:15	57.8	76.8	52.5
17:30	56.6	69.1	51.9
17:45	58.0	75.1	53.1
18:00	55.8	66.7	49.8
18:15	57.5	79.5	50.6
18:30	58.7	77.4	49.4

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Tabulated Noise data

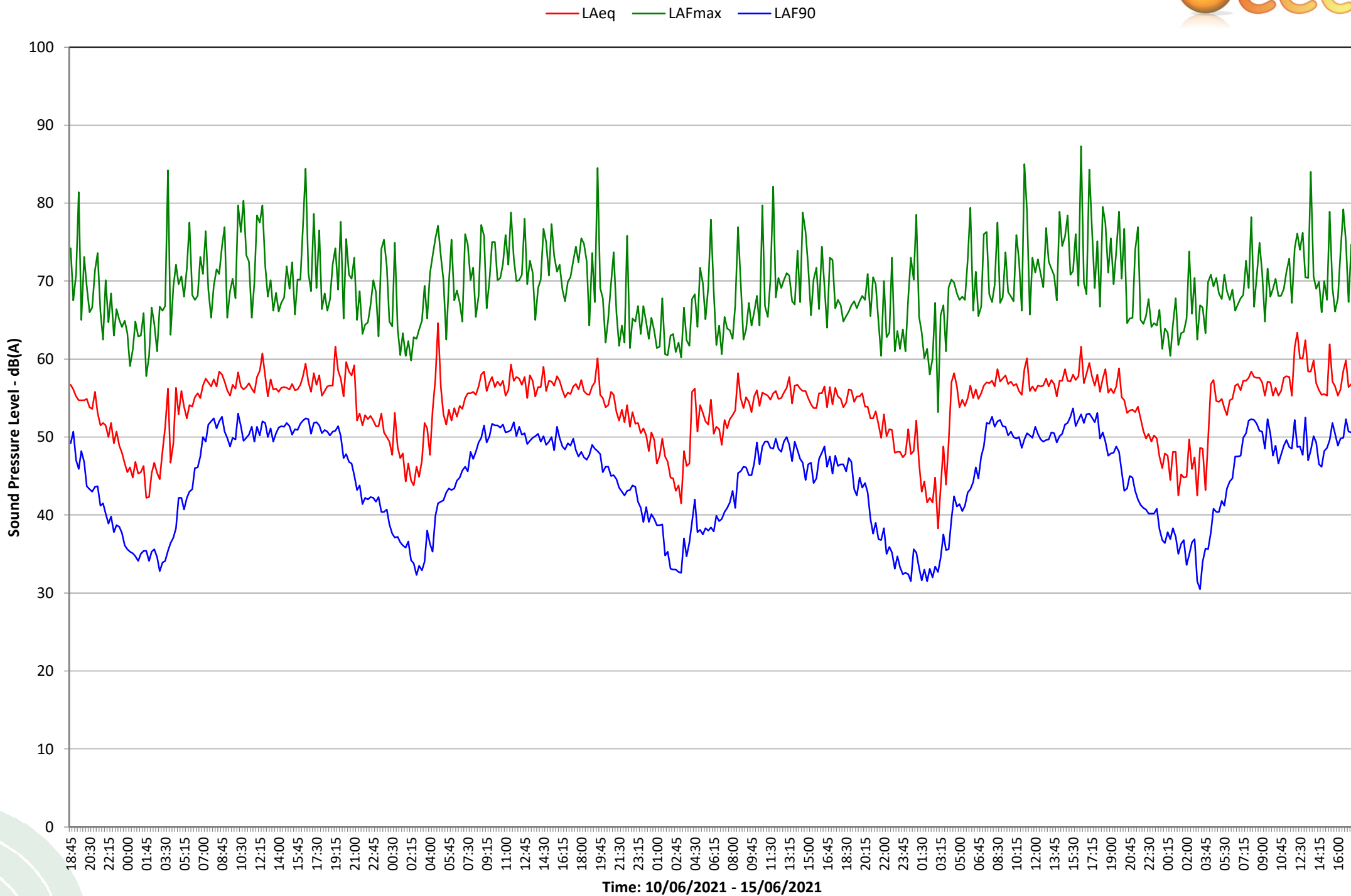
Sheet 5 of 5

Time	L _{Aeq}	L _{AMax}	L _{A90}
18:45	55.7	71.1	47.6
19:00	56.2	75.5	47.9
19:15	55.6	69.6	48.0
19:30	56.5	73.8	48.8
19:45	58.8	78.9	48.1
20:00	55.1	70.3	45.6
20:15	54.7	76.7	43.1
20:30	53.1	64.6	43.4
20:45	53.4	65.2	45.0
21:00	53.5	65.3	44.8
21:15	53.2	73.9	43.1
21:30	53.9	76.9	42.0
21:45	52.4	65.0	41.3
22:00	50.8	64.5	40.9
22:15	49.8	65.5	40.7
22:30	50.4	67.7	40.2
22:45	49.4	64.1	40.2
23:00	50.2	64.6	40.2
23:15	49.8	64.3	40.8
23:30	47.5	66.3	38.2
23:45	46.0	61.3	36.8
00:00	47.9	63.9	36.4
00:15	47.6	63.4	37.8
00:30	44.5	60.4	36.9
00:45	48.1	64.4	38.3
01:00	48.1	67.8	37.2
01:15	42.5	61.8	35.0
01:30	45.2	63.3	36.3
01:45	44.8	63.5	36.8
02:00	44.9	65.2	33.6
02:15	49.7	73.8	34.9
02:30	45.9	65.8	36.5
02:45	47.4	70.4	36.9
03:00	42.5	62.5	31.5
03:15	48.6	66.9	30.5
03:30	48.5	66.6	34.0
03:45	43.2	63.3	35.7
04:00	49.6	69.9	35.6
04:15	56.8	70.8	37.8
04:30	57.3	69.3	40.8
04:45	54.6	70.4	40.4
05:00	54.5	68.4	40.4
05:15	54.9	67.7	41.8
05:30	53.7	70.8	41.2
05:45	52.8	68.7	43.4
06:00	54.7	67.6	44.3
06:15	54.9	68.9	44.7
06:30	56.6	66.2	47.5

Time	L _{Aeq}	L _{AMax}	L _{A90}
06:45	56.8	67.0	47.5
07:00	56.0	67.8	47.6
07:15	57.2	68.2	49.9
07:30	57.2	72.6	50.5
07:45	57.6	69.1	52.1
08:00	58.4	78.2	52.3
08:15	57.7	66.7	52.2
08:30	57.6	70.6	51.7
08:45	57.6	74.9	50.8
09:00	57.0	71.1	50.7
09:15	55.3	64.8	48.5
09:30	57.1	71.6	52.3
09:45	57.0	68.0	50.4
10:00	55.3	69.0	47.6
10:15	56.3	70.3	48.9
10:30	55.3	68.1	46.6
10:45	55.9	68.1	47.7
11:00	57.6	69.0	48.9
11:15	57.8	71.2	49.6
11:30	57.7	72.9	48.7
11:45	55.3	67.2	48.5
12:00	61.5	74.2	52.2
12:15	63.4	76.1	48.7
12:30	60.1	74.0	48.8
12:45	60.1	76.2	47.7
13:00	62.4	70.5	52.5
13:15	58.4	70.4	47.0
13:30	58.4	84.0	48.3
13:45	59.8	70.6	50.1
14:00	56.9	69.0	49.3
14:15	56.0	69.9	46.5
14:30	55.4	66.0	46.2
14:45	55.5	70.0	48.2
15:00	55.3	67.6	48.6
15:15	61.9	78.9	49.6
15:30	57.1	69.1	51.8
15:45	56.5	66.1	50.4
16:00	55.3	67.8	48.9
16:15	56.1	73.7	49.8
16:30	58.5	79.2	49.9
16:45	59.8	75.0	52.3
17:00	56.4	67.3	50.7
17:15	56.8	74.7	50.6
17:30	55.7	67.7	49.9

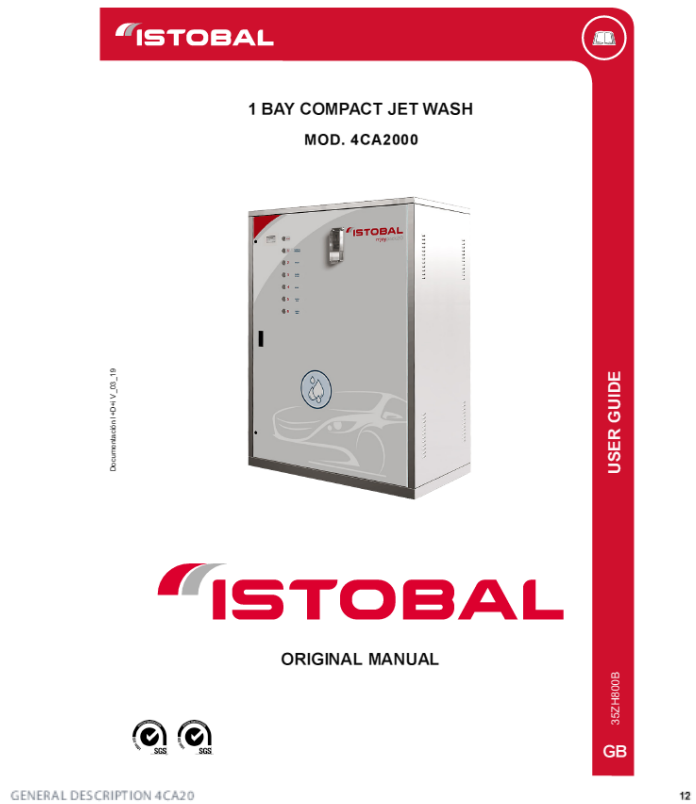
APPENDIX E
SURVEY RESULTS
(GRAPHICAL)

Noise Level Time History at MFG Salendine



APPENDIX F

PUBLISHED AND MEASURED PLANT NOISE DATA



TECHNICAL SPECIFICATIONS

NOISE CONTROL

The level of sound pressure with equivalent weighing is less than 70 dB.

EEC Ltd in-situ measurements of typical jet wash cycle, at a distance of approximately 1.5m.

Noise Level Time History at Jet Wash Noise

