

Noise Assessment

Hand Car Wash and Valet Centre, Cudworth, Barnsley, S72 8YA

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Comments

Comments

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Noise Assessment

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1. Introduction

1.1 Background

Temporary planning permission was granted on appeal (APP/R4408/A/14/2215170) for the operation of a Hand Car Wash and Valet Centre, Cudworth, Barnsley. The Planning Inspectorate stated in the Appeal Decision Notice that the facility "*is unlikely to give rise to unacceptable noise and disturbance*". Because of the concerns of the Council and neighbouring residents in relation to the potential for water spray drift and noise disturbance, a precautionary approach was taken with planning permissin granted for a temporary period of 18 months.

Planning permission for permanent operation of the facility is sought. In support of this and in agreement with Environmental Health of Barnsley Metropolitan Borough Council (MBC), a noise assessment of the current operation has been undertaken.

A glossary of acoustic terminology used in this report is presented in Appendix A.

1.2 Site History and Description

The site was previously used as a Fuel Filling Station called Star Garage, which in addition to the provision of fuel had a car jet wash facility within the north-east area of the site and vacuum and air facility adjacent to the kiosk building. Star Garage closed in 2004.

The Hand Car Wash and Valet Centre was granted temporary planning permission on appeal on 18th July 2014. The facility comprises of two car wash bays with perspex screens on the outer edge of each bay with another perspex screen separating the bays. Vehicles enter the site from Pontefract Road and drive into one of the two car wash bays where they are hand washed using jet sprays and hand cloths. Following the hand car wash they drive towards the exit where they are dried and polished. Vacuum and valetting service is undertaken within the western area of the site adjacent to Pontefract Road.

The site is bound by Pontefract Road to the west with residential terraced housing beyond at approximately 15 metres from the site boundary. To the north are the gardens of the dwelling houses on Intake Lane which themselves are located to the east of the site at approximately 10 metres from the site boundary. To the south is Intake Lane beyond which are several new residential properties together with land which is to be developed for residential use. The residential properties on Intake Lane referred to as Garden Cottages, are set on lower ground to that of the site.

Figure 1 illustrates the site location and that of the nearest residential receptors.

2. Noise Assessment Criteria

When selecting the appropriate noise criteria for assessment purpose, consideration has been given to relevant planning policy and regulations concerning the operation of the Hand Car Wash and Valet Centre. Consideration has been given to advice contained within the National Planning Policy Framework (NPPF)[1], Noise Policy Statement For England[2] and Noise Planning Practice Guidance[3], although direct noise assessment criteria has not been drawn from these documents.

With regard to acoustic design and noise control, the NPPF provides a set of overarching aims, broadly reflecting those already contained in the Noise Policy Statement for England (NPSE). They are directed towards the avoidance of significant adverse impacts and reduction of other adverse impacts on health and quality of life; set within the context of the Government's policy on sustainable development.

2.1 World Health Organisation Guideline For Community Noise, 1999

The World Health Organisation 1999 document '*Guidelines for Community Noise*'[4] gives guidance on desirable levels of noise for specific environments having regard to the potential health effects. The recommended guideline values of 'community' or environmental noise are set at the level of the lowest health effect below which the effect can assumed to be negligible. Environmental noise encompasses contribution from all sources, road, rail air and industries.

With regard to external daytime noise levels, WHO recommends a daytime noise level of ≤55dB $L_{Aeq,16h}$ to protect the majority of the population from serious annoyance and ≤50dB $L_{Aeq,16h}$ to protect the majority of the population from moderate annoyance. The WHO document does however recognise that in many areas these guideline values are exceeded.

2.2 BS4142 Methods For Rating And Assessing Industrial And Commercial Sound, 2014

The primary source of guidance in determining the significance of sound of an industrial and/or commercial nature on residential receptors, is provided in BS 4142:2014 '*Methods for rating and assessing industrial and commercial sound*'[5].

BS 4142 states that the potential impact from industrial/commercial operations is based on the noise level difference between the source, known as the 'specific noise' level ($L_{Aeq,T}$), compared with the 'background noise' level ($L_{A90,T}$) that exists in the absence of the source in question. Where the sound contains any acoustic characteristics such as tonality, impulsiveness and intermittency then the specific noise level is adjusted in-line with BS 4142 advice to determine the rating noise level ($L_{Ar,Tr}$).

Typically, the greater the difference between the rating noise level and the background noise level the greater the potential of an adverse impact. BS 4142 states: -

- A difference of + 10dB or more is likely to be an indication of a significant adverse impact, depending on the context.
- A difference of +5dB or more is likely to be an indication of an adverse impact, depending on the context.

1 Communities and Local Government. (2012) The Planning Policy Planning Framework. Crown Copyright.
2 Defra. (2010) *Noise Policy Statement for England*.· Crown copyright.
3 http://planningguidance.communities.gov.uk/blog/guidance/noise/noise-guidance/ (October 2016)
4 World Health Organisation (WHO) (1999), 'Guidelines for Community Noise'. WHO.
5 BSI. British Standard 2014, BS 4142:2014 'Methods for rating and assessing industrial and commercial sound''. BSI,

- 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.

Of key importance with the latest British Standard is consideration of the context. For example; the character and level of the residual sound compared to the character and level of the specific sound and design measures used to reduce and attenuate noise.

2.3 Barnsley Metropolitan Borough Council Environmental Health

Environmental Health of Barnsley MBC have not specified a threshold noise level or rating noise level in relation to the prevailing background noise level to which the Hand Car Wash and Valet Centre should satisfy. It is understood that assessment of the operation would be determined having regard to WHO, BS4142 and comparison of the current operation with its temporary permission.

3. Environmental Noise Survey

3.1 Noise Sensitive Receptors

The closest residential sensitive receptors to the site are presented as Table 1 and illustrated in Figure 1.

Table 1: Noise Sensitive Receptors

SR (Figure 1)	Description	Distance from Site Boundary
A	Semi-detached residential dwellings, Intake Lane	10m (east)
B	Terrace residential dwellings, Pontefract Road	15m (west)
C	New residential dwellings, Intake Lane	15m (south)

3.2 Historic Noise Survey Data

A baseline noise survey was undertaken in May 2014 prior to the opening of the facility. An environmental grade 1 sound level meter was installed for several days from Thursday 9th May to Tuesday 14th May 2014 within the garden of 17 Garden Cottage, Intake Lane. This was supplemented with attended short-term noise measurements within the vicinity of Pontefract Road representative of noise levels at the Pontefract Road properties.

A summary of the noise survey results are presented as Table 2.

Table 2: Summary of Historic Noise Survey Data (Free-Field)

Monitoring Location (Figure 1)	Monitoring Period	Average Noise Level dB[1]			
		$L_{Aeq,T}$	$L_{AFmax,T}$[2]	$L_{A10,T}$	$L_{A90,T}$
	Weekday				
LT1A	Morning (09:00-10:00)	58	76	59	49
	Quiet Day (10:00-15:00)	58	74	60	51
	Afternoon (15:00-18:00)	58	74	61	52
	Saturday				
LT1A	Quiet Day (10:00-15:00)	57	71	59	50
	Afternoon (15:00-17:00)	57	72	59	51
	Sunday				
LT1A	Morning (09:00-09:30)	53	67	57	42
	Morning (09:30-10:00)	55	75	58	43
	Quiet Day (10:00-15:00)	58	81	60	48
	Afternoon (15:00-18:00)	58	77	61	47
	Weekday				
ST1A	Morning (10:40-11:40)	70	83	74	55

Notes: Note: [1] Rounded to nearest whole decibel. [2] Logarithmic average. [3] 90th Percentile. [4] Arithmetic average

3.3 Environmental Noise Survey

A further noise survey was undertaken on Sunday 9th October 2016 to establish prevailing noise levels at and within the vicinity of the site pre and during operation of the Hand Car Wash and Valet Centre. The survey strategy was agreed in advance with Environmental Health Department of Barnsley MBC a representative of which was present during equipment set up and for the duration of the noise survey excepting the last 30 minutes.

An environmental sound level meter was set-up within the garden area of 15 Garden Cottages located immediately to the east of the site. At this location measurement covered both the non-operational and operational period of the Hand Car Wash and Valet Centre.

Concurrent noise measurements where undertaken during the operational period at the eastern site boundary with 15 Garden Cottages and within the vicinity of the north-eastern site boundary with 17 Garden Cottages. This was supplemented by noise measurements at a central location to the car wash bay approximately 5 m from the perspex screen. Noise monitoring locations are illustrated in Figure 1. Full details of the baseline noise survey are presented within Appendix B.

A summary of the noise survey results are presented as Table 3. It should be noted that all measurements were façade measurements, taken within 1 metre of reflecting surfaces. To take account of this the measured noise level has been reduced by 3dB therefore representative of free-field conditions.

Table 3: Summary of Baseline Noise Survey (Free-Field)

Monitoring Location (Figure 1)	Monitoring Period	Average Noise Level dB[1]			
		$L_{Aeq,T}$[2]	$L_{AFmax,T}$[3]	$L_{A10,T}$[4]	$L_{A90,T}$[3]
	Sunday 9th October 2016				
ST1B	Pre-Operation (09:00-09:30)	49	67	52	37
	Pre-Operation (09:30-10:00	51	68	54	43
	Operation (10:00–13:15)	54	65	57	47
	Operation (11:15-12-10)	53	62	56	47
	Operation (12:20-13:00)	54	64	57	48
ST2B	Operation (11:15-12:10)	70	84	75	54
ST3B	Operation (12:20-13:00)	68	81	71	56
ST4B	Operation (12:25-13:05)	65	77	68	55

Note: [1] Rounded to nearest whole decibel. [2] Logarithmic average. [3] 90th Percentile. [4] Arithmetic average

Pre-operation, the dominant noise source noted within the garden of 15 Garden Cottages was road traffic noise from Pontefract Road. During operational hours noise from jet wash operations was noted to be subjectively discernible.

It should be noted that the Hand Car Wash and Valet Centre was noted to be operating at maximum capacity on the morning of Sunday 9th October with both car wash bays being used simultaneously and constantly. Additional observed operations included polish and drying pre exiting and vacuum and valeting within the western area of the site. On this basis the noise survey data is considered to be worst-case scenario.

The highest noise levels were from jet wash operations, in particularly when wheel arches were being done.

3.4 Spray Drift

During jet wash operations spray drift was not observed within the garden of 15 Garden Cottages. Wind conditions ranged from calm to gentle breeze of less than 1m/s.

4. Noise Assessment

4.1 WHO Guidelines For Community Noise

The measured noise levels within the garden of 15 Garden Cottages on Sunday 9th October 2016 pre-operation were lower than those measured during the operational period.

- 09:00-09:30 – 49dB $L_{Aeq,30mins}$ (free-field)
- 09:30-10:00 – 51dB $L_{Aeq,30mins}$ (free-field)
- 10:00-13:15 – 54dB $L_{Aeq,T}$ (free-field)

Both the pre-operational and operational noise levels however were below the WHO guideline criteria of ≤55dB $L_{Aeq,16h}$ for protecting the majority of people from serious annoyance within external living areas.

It is should be noted that the noise levels measured during the operational period 10:00-13:15 were lower than the prevailing ambient noise levels measured within the garden of 17 Garden Cottages in May 2014 (refer to Table 2, 10:00-15:00 Sunday 58dB $L_{Aeq,T}$), before the facility was in operation. The historic noise measurements also were also slightly higher for the comparable time periods 09:00-09:30 (53dB $L_{Aeq,30min}$) and 09:30-10:00 (55dB $L_{Aeq,30mins}$). The reason for this difference may be due to the provision of the acoustic grade boundary fence which was installed as part of the development thereby reducing the contribution of road traffic noise from Pontefract Road, or, noise levels within 17 Garden Cottages may be higher than 15 Garden Cottages due to less screening to road traffic noise from Pontefract Road.

Comparison with the historic measured data indicates that after 10:00 on a Sunday morning prevailing noise levels would be expected to increase due to the increase in road traffic noise and human activity and not just due to the operation of the Hand Car Wash and Valet Centre.

Notwithstanding the above, subjectively noise from the jet wash operation, although not excessively loud is discernible within the garden of 15 Garden Cottages.

4.2 BS4142:2014 Assessment

A BS4142 assessment has been undertaken of the Hand Car Wash and Valet Centre to determine the potential significance of the impact. For the purpose of the assessment the measured prevailing background sound level (L_{A90}) between 09:30-10:00 on Sunday 9th of October of 43dB L_{A90} has been used.

Analysis of the 1/3 octave measurements during the operational period indicates that the operational noise is not tonal in accordance with Annex C of BS4142. Full details are presented within Appendix C.

The 'specific noise level' although not tonal or impulsive, subjectively is considered to be readily distinctive against the residual acoustic environmental and therefore a penalty of 3dB has been applied, which is in accordance with BS4142:2014.

Table 4 presents a summary of the results of the BS4142:2014 Assessment.

Without taking account of context the results of the BS4142 assessment indicate noise emissions from the Hand Car Wash and Valet Centre have an adverse impact. As stated in BS4142, "*not all adverse impacts will lead to complaints and not every complaint is proof of an adverse impact*." It is important that consideration of both uncertainty and context is given when determining the overall impact of the facility.

Table 4: BS4142:2014 Assessment Results 15 Garden Cottages

Background Sound Level dB L_{A90}	Residual Sound Level dB $L_{Aeq,T}$	Specific Sound Level adjusted for Residual Sound dB $L_{Aeq,T}$	Rating Noise Level dB $L_{Ar,Tr}$	Difference
43	51	51	54	+11

It should be noted that the BS4142:2014 assessment is worst-case as it is based on a Sunday when prevailing noise levels are likely to be lower compared to the week-day equivalent time period. Also, the background noise level used in the assessment is likely to be lower than the background noise level during the operational period with no operation. For example, Table 2 which presents the May 2014 baseline survey data reports a background noise level of 43dB LA90 between 09:30-10:00 on a Sunday increasing to 48dB LA90 during the quiet daytime period between 10:00-15:00. This would still indicate an adverse impact but with a much lower level difference.

BS4142 specifies that the level of uncertainty in the above calculation should be considered. The level of uncertainty is presented as Table 5.

4.2.1 Uncertainty

BS4142:2014 specifies that the level of uncertainty in the above calculation should be considered. The level of uncertainty is presented as Table 5.

Table 5: BS4142:2014 Level of Uncertainty

Area	Comments	Amount
Equipment	Type 1 integrating sound level meter. Short-term measurement. No drift in calibration.	±1.1dB
Weather	Dry with calm to gentle breeze of less than 1 m/s.	0
Background Sound Level	Pre-operation background sound level (dB LA90) is likely to be lower than background sound level during the operational period of the facility.	-2dB
Specific Sound Level	Pre-operation residual sound level (dB LAeq) is likely to be lower than the residual sound level during the operation period of the facility.	-1dB
Overall		+1.1 / -4.1

Taking account of uncertainty, it is likely that the predicted BS4142 level difference is an overestimation.

4.2.2 Context

When undertaking a BS4142 assessment it is important that the context is also taken into account. In this respect consideration of the overall noise level and inherent mitigation measures has been given.

Overall Noise Level

The overall measured noise level during operation of the Hand Car Wash and Valet Centre of 54dB $L_{Aeq,T(free\text{-}field)}$ within the garden of 15 Garden Cottages satisfies the recommended guideline value of WHO to protect the majority of people from serious annoyance. The prevailing noise level does however increase within the garden of 15 Garden Cottages from 51dB $L_{Aeq,30mins\ (free\text{-}field)}$ to 54dB $L_{Aeq,T\ (free\text{-}field)}$ when the facility is operational. Although the overall operational noise level within the garden area is not particularly high in the context of WHO guidance, it is discernible.

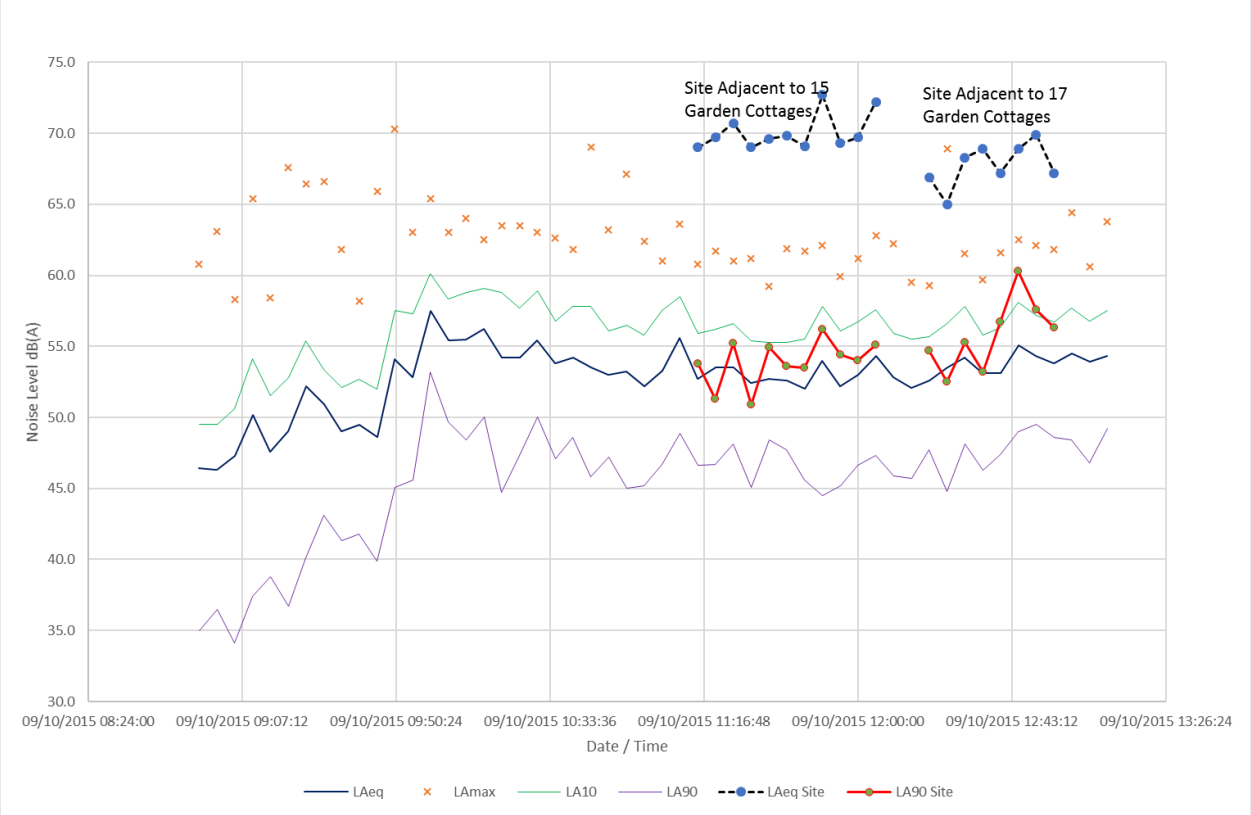
Noise Mitigation Measures

There are a number of mitigation measures that the Hand Car Wash and Valet Centre current use to reduce noise emission from its site.

- Perspex screens (approximately 2m high) at the edge and separating the two car wash bays;
- Acoustic grade timber fence (approximately 1.8m high) on the eastern and northern site boundary;
- Acoustic barrier (approximately 2m high) on the eastern site boundary in front of the acoustic grade boundary fence, extending the length of the car wash bays;
- Vacuum operations conducted adjacent to Pontefract Road where prevailing noise levels are higher;
- Containment of vacuums within lined wooden boxes; and
- Restricted hours of operation.

The effectiveness of the noise mitigation measures, in-particular with regard to the acoustic grade fence and barrier is demonstrated by the large reduction in on-site noise levels compared to those experienced within the garden area. Graph 1 presents the measured garden noise levels together with concurrent on-site noise measurements. It should be noted that both are presented as façade noise levels.

Graph 1: Measured Garden & On-Site Noise Levels (Free-Field)



5. Conclusions

Waterman have undertaken a noise assessment of the Hand Car Wash and Valet Centre, Cudworth, Barnsley. The noise assessment is in support of the continued operation of the facility which currently has temporary permission for an 18-month period.

An environmental noise survey was undertaken on Sunday 9th October 2016 to establish the prevailing noise levels within the vicinity of the residential receptors located to the east of the site; namely Garden Cottages. Continuous noise measurements were taken before the facility opened between 09:00 and 10:00 and during the operational hours of 10:00-13:15 within the garden of 15 Garden Cottages. Concurrent noise measurements were also taken on-site at the eastern site boundary during operational hours. Throughout the operational survey period the facility was continuously busy with both car wash bays in use together with vacuuming and valeting operations being undertaken within the western area of the site. The noise assessment is therefore considered to be worst-case.

Both the survey strategy and assessment methodology were agreed in advance with Environmental Health of Barnsley MBC. Furthermore, a representative from Barnsley MBC was present during the noise survey excepting the last 30 minutes.

During operation of the Hand Car Wash and Valet Centre the prevailing noise levels at 15 Garden Cottages increased by approximately 3dB. The overal free-field operational noise levels at Garden Cottages were below the recommended WHO guideline value of ≤55dB $L_{Aeq,16h}$ to protect the majority of people from serious annoyance. Notwithstanding this, the noise from jet was operations was discernable in the garden of 15 Garden Cottages.

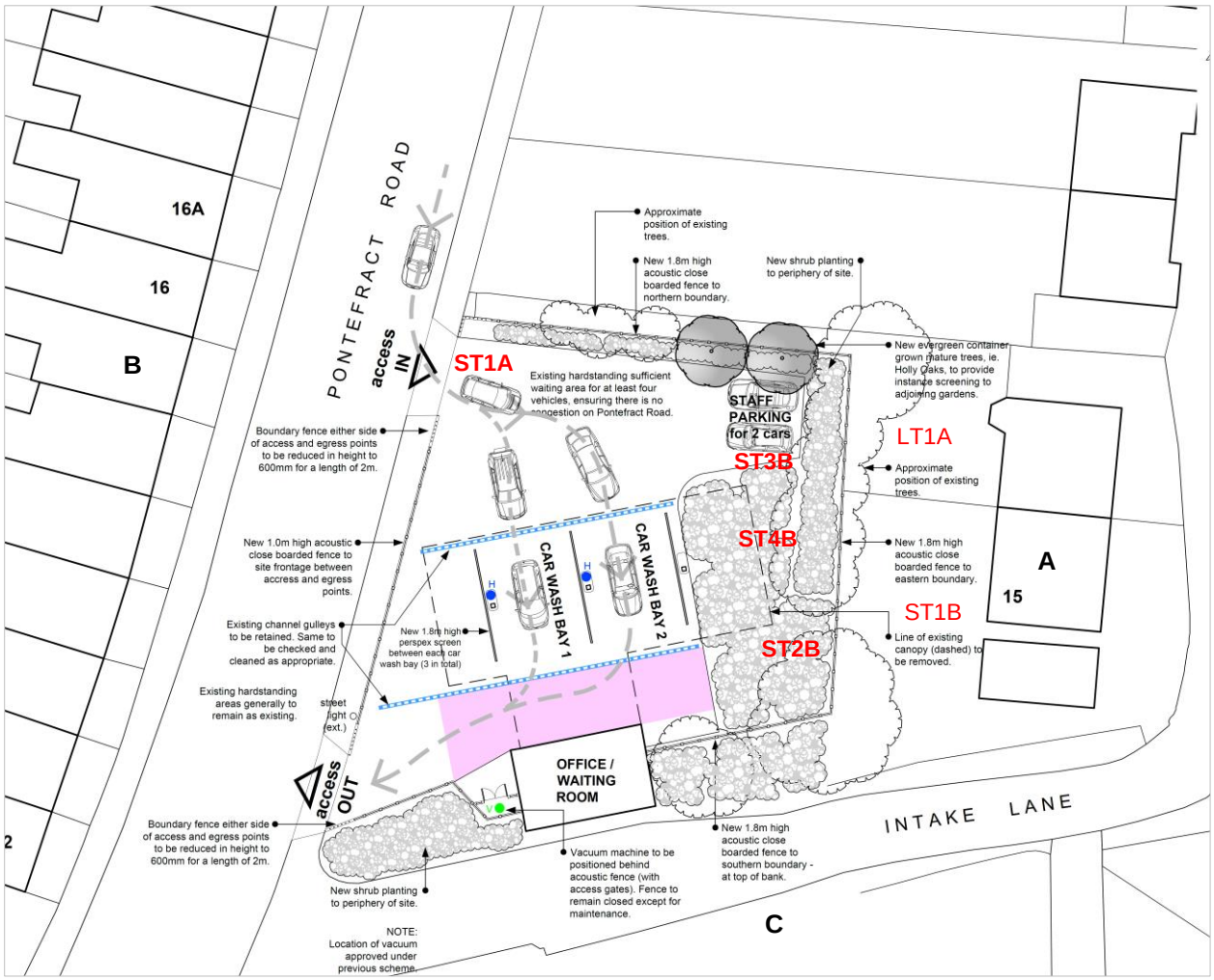
A BS4142:2014 noise assessment indicates that the potental impact of the Hand Car Wash and Valet Centre is adverse. In accordance with BS4142:2014, "*not all adverse impacts will lead to complaints and not every complaint is proof of an adverse impact"*. When context is taken into account, the overall noise level in the context of WHO guidance is not considered unreasonable. Further to this there are a number of noise mitigation measures currently employed at the site which signficantly reduce the on-site levels:

- Perspex screens (approximately 2m high) at the edge and separating the two car wash bays;
- Acoustic grade timber fence (approximately 1.8m high) on the eastern and northern boundary;
- Acoustic screen (approximately 2m high) on the eastern site boundary in front of the acoustic grade boundary fence, extending the length of the car wash bays;
- Vacuum operations conducted adjacent to Pontefract Road where prevailing noise levels are higher;
- Containment of vacuums within lined wooden boxes; and
- Restricted hours of operation.

On this basis, although noise emissions from the Hand Car Wash and Valet Centre contribute to the prevailing noise level when operational, reasonable steps have been undertaken by the operator to signifcantly reduce noise emissions from the site to within those considered acceptable by WHO guidance.

It should also be noted that during the survey no spray drift was observed within the garden of 15 Garden Cottages.

Figure 1: Site Plan & Noise Monitoring Location



APPENDICES

A. Glossary of Acoustic Terminology

Acoustic barrier — Solid walls or partitions, solid fences, earth mounds, buildings, etc used to reduce noise, without eliminating it.

Ambient sound — The totally encompassing sound in a given situation at a given time, usually composed of sound from all sources near and far.

Assessment period — The period in a day over which assessments are made.

Background Sound Level — A-weighted sound pressure level that is exceeded by the residual sound at the assessment location for 90% of the given time interval.

Barrier — See "Acoustic barrier", a solid object used to attenuate sound.

Broadband — Containing the full range of frequencies.

Decibel [dB] — The level of noise is measured objectively using a Sound Level Meter. This instrument has been specifically developed to mimic the operation of the human ear. The human ear responds to minute pressure variations in the air. These pressure variations can be likened to the ripples on the surface of water but of course cannot be seen. The pressure variations in the air cause the eardrum to vibrate and this is heard as sound in the brain. The stronger the pressure variations, the louder the sound is heard.

The range of pressure variations associated with everyday living may span over a range of a million to one. On the top range may be the sound of a jet engine and on the bottom of the range may be the sound of a pin dropping.

Instead of expressing pressure in units ranging from a million to one, it is found convenient to condense this range to a scale 0 to 120 and give it the units of decibels. The following are examples of the decibel readings of every day sounds;

• Four engine jet aircraft at 100m	120 dB
• Riveting of steel plate at 10m	105 dB
• Pneumatic drill at 10m	90 dB
• Circular wood saw at 10m	80 dB
• Heavy road traffic at 10m	75 dB
• Telephone bell at 10m	65 dB
• Male speech, average at 10m	50 dB
• Whisper at 10m	25 dB
• Threshold of hearing, 1000 Hz	0 dB

dB(A): A-weighted decibels — The ear is not as effective in hearing low frequency sounds as it is hearing high frequency sounds. That is, low frequency sounds of the same dB level are not heard as loud as high frequency sounds. The sound level meter replicates the human response of the ear by using an electronic filter which is called the "A" filter. A sound level measured with this filter switched on is denoted dB(A) or as L_A dB. Practically all noise is measured using the A filter. The sound pressure level in dB(A) gives a close indication of the subjective loudness of the noise.

Facade — Façade levels refer to levels taken at a distance of between 1 and 3.5 m of the façade of a building. The difference between the façade and free-field level will depend on the distance from the reflecting surface, but is generally accepted to be approximately 3 dB(A) and 1m from the reflecting surface.

Free-Field — A situation in which the radiation from a sound source is completely unaffected by the presence of any reflecting surfaces.

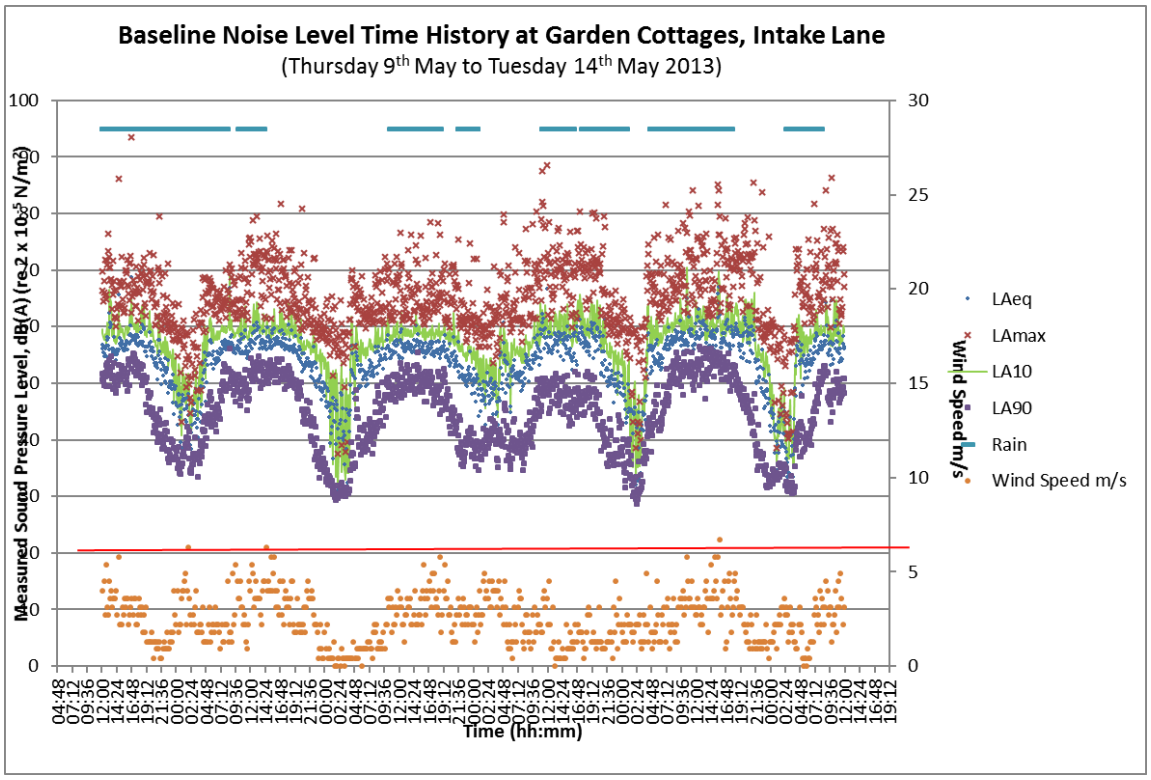
L_{10} — The sound pressure level that is exceeded for 10% of the time for which the given sound is

	measured.
$L_{10,1\text{-hour}}$	The L_{10} level measured over a 1 hour period.
L_{90}	The level of noise exceeded for 90% of the time. The bottom 10% of the sample is the L_{90} noise level. The A-weighted L_{90} is expressed as the L_{A90}.
L_{eq}	Equivalent sound pressure level - the steady sound level that, over a specified period of time, would produce the same energy equivalence as the fluctuating sound level actually occurring.
$L_{Aeq,1\text{-hour}}$	The A-weighted L_{eq} noise level for a specific one-hour period.
L_{Amax}	The maximum RMS A-weighted sound pressure level occurring within a specified time period.
Loudness	A rise of 10 dB in sound level corresponds approximately to a doubling of subjective loudness. That is, a sound of 85 dB is twice as loud as a sound of 75 dB which is twice as loud as a sound of 65 dB and so on. That is, the sound of 85 dB is 400% times the loudness of a sound of 65 dB.
Microphone	An electro acoustic transducer which receives an acoustic signal and delivers a corresponding electric signal.
Noise	Sound which a listener does not wish to hear.
Residual Sound Level	Ambient sound remaining at the assessment location when the specific sound source is source is suppressed to such a degree that it does not contribute to the ambient sound.
Sound level meter	An instrument consisting of a microphone, amplifier and indicating device, having a declared performance and designed to measure sound pressure levels.
Sound pressure level	The level of noise, usually expressed in decibels, as measured by a standard sound level meter with a microphone.
Specific Sound Level	Equivalent continuous A-weighted sound pressure level produced by the specific sound source at the assessment location over a given reference time interval,T.

B. Baseline Noise Survey

Historic Data

Graph B1 presents the time history plot of the noise survey undertaken within the Garden of 17 Garden Cottages in May 2014.



Environmental Noise Survey

An environmental noise survey was undertaken on Sunday 9th October 2016. One noise logger was set up within the Garden of 15 Garden Cottages pre-opening of the Hand Car Wash and Valet Centre. Noise measurements were taken continuously pre and during the operational period of the facility. This was supplemented by concurrent on-site noise measurements taken at the eastern site boundary with Garden Cottages and at a distance at 5m east of the Perspex screen during car wash operations.

During the operational measurement period, both car wash bays were in continued use. Other operations included polish and drying before exiting and vacuum and valeting within the western area of the site adjacent to Pontefract Road.

The garden noise measurements and on-site boundary measurements were taken using an environmental sound level meter with the microphone mounted on an integral metal pole approximately 1.3 metres above ground level. The microphones where covered with a wind-shield. The noise measurement take 5m east of the perspex screen was done using a tripod mounted sound level metre. The microphone was approximately 1.5m above ground level.

All sound level metres were field calibrated pre and post survey with no drift detected.

The weather conditions were dry and sunny. Wind conditions ranged from calm to gentle breeze of less than 1 m/s and therefore suitable for noise monitoring.

Graph B1 presents the measured results within the garden and on-site boundary measurements. The noise levels have been adjusted to free-field values due to the façade noise monitoring location.

Graph B1: Time History of Measured Noise Levels

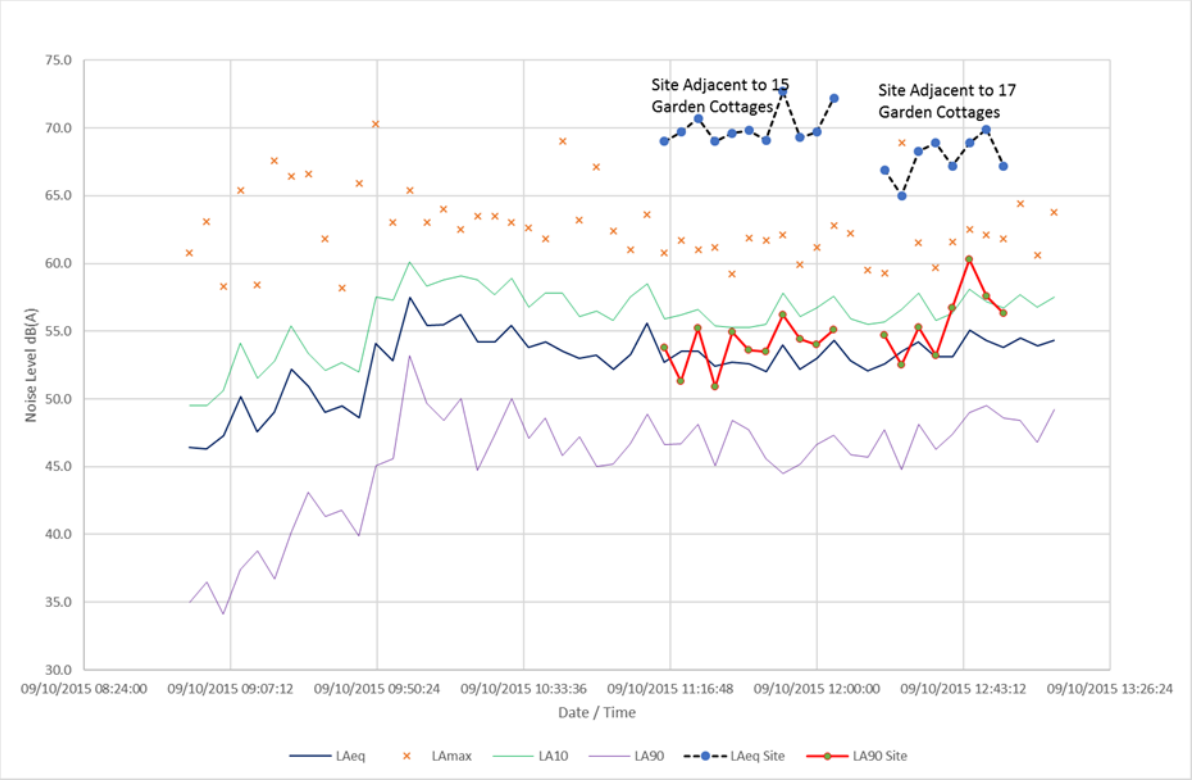


Table B1 presents the measured noise level 5m from the Perspex screen at the easterly car wash bay.

Table B1 Attended Noise Measurement 5m From Perspex Screen of East Car Wash Bay

Start Time	LAeq	LAmax	LA10	LA90
09/10/2016 12:25	66.3	77.8	70.5	54.2
09/10/2016 12:30	67.7	77.2	71.6	57.3
09/10/2016 12:35	67.1	77.7	70.2	54.9
09/10/2016 12:40	66.4	75.4	69.9	57.9
09/10/2016 12:45	68.7	78.7	71.8	61.7
09/10/2016 12:50	69.2	80.1	72.6	59.7
09/10/2016 12:55	67.7	80.6	70.1	58.3
09/10/2016 13:00	68.3	78.1	71.9	57.1
Summary	**68**	**80**	**71**	**58**

Individual Measurement of Whole Car Wash Process				
	LAeq	LAmax	LA10	LA90
Car	67	75	70	58
Truck	64	73	67	54
BMW Car	66	77	69	57
Truck	67	78	70	57
Van Transit	67	79	71	56

Table B2 presents the equipment detail. All equipment used holds a valid calibration certificate.

Table B2: Equipment Detail

Description	Serial Number
Rion NL-52 Sound Level Meter	410085
Rion NL-52 Sound Level Meter	620872
Rion NA-28 Sound Level Meter	1170649
Rion NC-74 Acoustic Calibrator	3422040

C. Appendix C: BS4142 Appendix C – Objective Assessment of Tonality

Table C1 presents the 1/3 octave noise measurements within the garden of 15 Cottage Gardens. This uses the BS4142 1/3 octave objective method for assessing audibility of tones in sound. A discrete tone is considered to be present when the following level differences are identified in the adjacent 1/3 ocatave bands.

- 15dB in the low-frequency 1/3 octave bands (25Hz to 125Hz);
- 8dB in the middle-frequency 1/3 octave bands (160Hz to 400Hz); and
- 5dB in the high-frequency 1/3 octave bands (500Hz to 10 000Hz).

Table C1 1/3 Octave Level Difference

20 Hz	25 Hz	31.5 Hz	40 Hz	50 Hz	63 Hz	80 Hz	100 Hz	125 Hz	160 Hz	200 Hz	250 Hz	315 Hz	400 Hz	500 Hz	630 Hz	800 Hz	1 kHz	1.25 kHz	1.6 kHz	2 kHz	2.5 kHz	3.15 kHz	4 kHz	5 kHz	6.3 kHz	8 kHz	10 kHz
57.2	66.3	62.7	61.7	62.7	61.0	55.7	50.5	46.2	46.8	45.7	44.5	44.0	44.4	43.3	44.6	45.5	46.2	44.5	43.9	43.7	44.1	45.5	46.7	46.4	46.0	44.8	42.1
9.1	-3.6	-1.0	1.0	-1.7	-5.3	-5.2	-4.2		-1.1	-1.2	-0.5	0.4	-1.1	1.3	0.9	0.7	-1.7	-0.6	-0.2	0.4	1.4	1.2	-0.3	-0.5	-1.1	-2.7	

Waterman

UK and Ireland Office Locations

