



Noise Management Plan

October 2021

Essential Services

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1 Introduction

The City of Subiaco requested Lloyd George Acoustics to prepare a Noise Management Plan (NMP) for the City's Infrastructure Maintenance and Waste Services department, to minimise noise impact to sensitive receivers from 'out-of-hours' essential services carried out by the City of Subiaco on major local roads where access is limited due to traffic and high levels of pedestrian use and to reduce impact on café patrons. Refer *Appendix A* for the map showing the location of the works.

Such essential services include:

- Residential and Commercial Waste collections, and
- Road, public places and footpath cleaning.

The Noise Management Plan (NMP) herewith has been prepared to satisfy regulation 14A of the *Environmental Protection (Noise) Regulations 1997* (the Regulations) with guidance taken from the *Department of Environment Regulation Draft Guideline DER2014/001628*.

This NMP will expire 3 years after the day on which it is approved by the CEO; or on such other day, not more than 3 years after the day on which it is approved by the CEO, as the CEO specifies in the approval of the plan.

Appendix C contains a description of some of the terminology used throughout this report.

2 Legislation

Environmental noise in Western Australia is governed by the *Environmental Protection Act 1986*, through the *Environmental Protection (Noise) Regulations 1997* (the Noise Regulations).

Regulation 14A provides requirements for 'essential services' and include the collection of waste, or the cleaning of roads, public places and footpaths. Such activities are defined as class 1 or class 2 works depending on the time of the day they are carried out, as follows:

"class 1 works means specified works carried out between —

- (a) 0700 hours and 1900 hours on any day that is not a Sunday or a public holiday; or
- (b) 0900 hours and 1900 hours on a Sunday or public holiday;

class 2 works means specified works carried out otherwise than between the hours specified in the definition of class 1 works paragraphs (a) and (b);"

Class 1 works are exempt from having to comply with the Noise Regulations provided that, according to regulation 14A (2), the works are carried out in the quietest reasonable and practicable manner, and the equipment used is the quietest reasonably available.

Class 2 works can be exempt from having to comply with regulation 7, as prescribed in regulation 14A(3) as follows:

- (3) *Regulation 7 does not apply to noise emitted in the course of carrying out class 2 works if the works are carried out in accordance with a noise management plan, excluding any ancillary measure, for class 2 works approved in writing by the CEO.*

The requirements for a noise management plan for class 2 works are defined in regulation 14A(6) as follows:

- (6) *A noise management plan for class 2 works is to include, but is not limited to—*
- (a) *details of vehicle or equipment evaluation and purchase policies adopted to select, on a reasonable and practicable basis, the quietest vehicle or equipment available; and*
 - (b) *measures to be adopted to minimise noise emissions resulting from carrying out the works; and*
 - (c) *justification for carrying out the works during the times of day to which the class relates; and*
 - (d) *a description of the specified works to be carried out during the times of day to which the class relates; and*
 - (e) *operator training programs; and*
 - (f) *community information on the manner in which the specified works will be carried out; and*
 - (g) *a complaints response procedure.*

In addition, it is noted that regulation (11) prescribes that a noise management plan expires after a maximum of 3 years from the day on which it is approved by the CEO.

Finally, it must be noted that some type of noise emissions are exempt from compliance, and these are listed in regulation 3. Of particular significance to this NMP are the ***noise emissions from the propulsion and braking systems of motor vehicles operating on a road are exempt*** - refer regulation 3(1)(a).

3 Equipment Details

3.1 Waste Collection

The equipment used for out-of-hours waste collection consists of four, 20 cubic meters waste trucks, three being rear loaded and one side loaded.

Noise levels for one rear loading truck and the one side loading truck were recorded over simulated typical kerb side bin collection which included, hydraulics for lifting the bins, bin lids slamming, waste hitting the inside of the truck and hydraulics during waste compaction cycles. The measurements were carried out at the City of Subiaco's depot in Jolimont. The highest noise levels recorded were:

- 76 dB LAeq,1min and 91 dB LASmax at 5 meters from the back of the rear loader Mercedes Econic 2630 (HV63, registration 1GIP051), and
- 75 dB LAeq,1min and 83 dB LASmax at 5 meters for the side loader Isuzu 320 (HV68, registration 1GRL157).

It is noted the LAeq noise emissions from the waste trucks are dominated by the hydraulic power unit for the lifting mechanism and compactor, since the truck remains at idle during the loading and compaction cycle. However, maximum noise levels will depend on the type of waste in the bins and, to some degree, how the bins are handled during the loading and unloading cycle. The above measurements show that the LAeq noise levels are similar for both type of truck.

Purchasing Plant

When purchasing new plant, The City's Tender documentation specifies maximum acceptable levels of noise emissions. Noise emission data is obtained from suppliers, who provide a Tender submission. Noise emissions data is reviewed as part of the Tender evaluation process, to ensure the plant with the lowest practicable noise levels is selected. When purchasing plant the City also considers the Safe Work Australia - Managing Noise and Preventing Hearing Loss at Work - Code of Practice (July 2020). Based on the measurements a sound power level of 97-98 dB LAeq is estimated for the waste collection trucks. The complete measurement results are also shown in Appendix B.

3.2 Cleaning Plant

The cleaning plant include a variety of plant, from a large truck mounted road sweeper, to small hand-held leaf blowers.

Typical equipment types and noise levels are presented in *Table 3-1*. The complete measurement results are also shown in *Appendix B*.

Table 3-1 Typical Cleaning Plant Noise Levels

Plant Description	Operational Mode	Fleet Number	LAeq,1min Noise Levels	
			Side	Rear
Rosmech 700 Rosmech Scarab street sweeper	Auxiliary Engine ON	1 EFT 074	72 at 5 m	62 at 5 m
	Auxiliary Engine ON, Brush and Vacuum unit on HIGH		85 at 5 m	85 at 5 m
	Auxiliary Engine ON, Brush and Vacuum unit on Low		80 at 5 m	84 at 5 m
STIHL BGA 85 handheld electric blower vacuum	Full blast, pointing down from standing position	-	77 at 3 m	81 at 3 m
STIHL BGA 100 handheld electric blower	Full blast, pointing down from standing position	-	64 at 3 m	79 at 3 m

From the measurements above it can be noted that all plant has directional properties that is, the noise levels to the back and the side of the equipment differ. In the case of the STIHL BGA 100 electric blower, a difference in noise levels of 15 dB was recorded between the side and rear of the equipment.

Such directional properties can be used to minimise the noise impact to nearby sensitive receivers by orienting the noisiest side of the plant or equipment away from the receiver(s).

With regards to the Scarab street sweeper, it can also be seen that a noise level difference of 5 dB was recorded on the side of the unit between the vacuum 'High' and 'Low' modes (the brushes operate in the same way for either modes). However, a lower noise level difference of 2 dB was recorded at the rear of the vehicle between both modes of vacuum operation. From observations on site, it is assumed to be due to the fan and air exhaust being located near the rear of the plant, therefore exposing the rear of the unit to higher noise levels generally.

4 Justification for 'Out-of-Hours' Work

The areas where waste collection and cleaning services are being carried out experience a significant increase in vehicular traffic volumes from 7.00am onwards. This is shown in *Table 4-1*, which summarises the traffic increase from 6.00am to 7.00am.

Table 4-1 Average Traffic Volumes

Average traffic volumes per hour (*)

Road / Street name	Traffic volumes at 6.00am	Traffic volumes at 7.00am	Traffic volume % increase
Roberts Road	278	793	185%
Subiaco Road	67	181	170%
Onslow Road	98	351	258%
Aberdare Road	551	1,052	91%
Nicholson Road	353	659	87%
Thomas Street	1,935	3,036	57%
Selby Street	393	966	146%

(*) Provided by the City of Subiaco for the purpose of this NMP

In addition, a number of businesses commencing trading before 7.00am, including numerous cafes and restaurants, along Hay Street, Roberts Road, Rokeby Road, Nicholson and a small shopping Centre on Onslow Road. This results in increased pedestrian and vehicular traffic, and reduced parking in the area. The increase in pedestrian and vehicle traffic makes waste collection and pavement cleaning during daytime impracticable and more dangerous, and potentially hampering the flow of traffic causing significant delays, inconvenience and frustration for other road users.

As such, conducting the works 'out-of-hours' from 6.00am Monday to Saturday would:

- Significantly reduce the number of pedestrian and vehicle interactions therefore promoting safety to the public and the City's workforce,
- Improve access to waste collections points resulting in:
 - shorter waste collection cycles and therefore noise exposure,
 - improve manual handling for City's personnel, therefore minimising risk of injury, and
- Improve access on main roads i.e. no obstructing traffic.

5 Works Description and Controls

5.1 Waste Collection

The collection of general waste, recycling and public place litter bin waste occurs 6 days per week utilising rear lift and side lift waste collection vehicles. This is mostly kerb side collection and nearby sensitive receivers may therefore be impacted. Bins are wheeled to the rear or side of the truck and emptied. Compaction of waste generally occurs immediately to ensure the truck is ready for the next waste collection.

It is noted that trucks and other mobile plant are fitted with 'smart' broadband reversing alarms i.e. the noise level of the alarm depends on background noise level and/or proximity to obstacle at rear of vehicle.

To minimise the impact from domestic and commercial rubbish collection at noise-sensitive receivers the following will be implemented:

- Waste collection trucks with lifting/compaction system with sound power level not exceeding 100 dB(A),
- All plant properly fitted with 'smart' broadband reversing alarms i.e. the noise level of the alarm

depends on background noise level and/or proximity to obstacle at rear of vehicle.

- Where practicable, waste bins suspected of containing glass will be emptied into trucks as far as practicable from noise-sensitive premises in order to maximise the source-receiver distance as follows:
 - o Garbage truck to park as far as practicable from noise-sensitive premises, ahead of, or past, the garbage collection point. The recyclable rubbish bin(s) is (are) then manually wheeled away from the collection point to be loaded onto the truck, so as to maximise the source-receiver distance, or use other buildings as noise barriers.

5.2 Cleaning of Roads, Footpaths and Public Places

Roads, footpaths and public places are cleaned following a specific schedule which can be found on the City's website and use a variety of equipment including road sweeper and manual blowers for the removal of leaf matter, debris and litter.

Road sweepers generally travel un-interrupted along their designated route to the next scheduled section. Footpath and road cleaning occurs every fortnight, noting that some areas require extra cleaning due to deciduous trees or shrubs and those areas require an additional sweep at certain times of the year.

For public places e.g. Subiaco Square, Rokeby Road, Hay Street and public car parks, cleaning may involve several plant at once in the area to maximise cleaning efficiency and minimise cleaning time.

To minimise the impact from the cleaning of roads, footpaths and public places at noise-sensitive receivers, the following will be implemented:

- All plant fitted with smart broadband reversing alarms,
- At night-time (prior to 7am), road sweepers will be operated in 'low' vacuum mode,
- All cleaning activities scheduled so that occurrence of works is minimised at night-time however, due to unforeseen circumstances or scheduled public events in specific areas, access restriction due to public infrastructure works or clean up after major storms, works may be required to occur at night-time,
- Where practicable, only the STIHL BGA100 hand-held electric blower will be used near sensitive receivers at night-time as it is the blower with the lowest noise levels,
- Where practicable, any work requiring the use of either hand-held blower will be carried out so as to point the back of either blower away from the receivers,
- Where practicable, areas where regular cleaning activities are required will be alternated so as to avoid activities occurring at a similar time on every occasion, and
- Where practicable, cleaning activities scheduled on a Sunday will be alternated so as to provide at least one 'respite' Sunday in every 4 weeks.

6 Operators Training

6.1 Waste Collection

Operator training with regard to this plan is required for all operators of waste collection vehicles before commencing specified works under this plan. The relevant training is a verification of competency and includes:

- Adequate licence for type of vehicle,
- Vehicle Induction,
- Vehicle Inspections and Weekly Checks, and
- Safe Operating Procedures.

In relation to noise minimisation, further training will be provided by the City with a focus on noise mitigation and include as a minimum:

- Waste collection routes to minimise noise impacts,
- Identification of areas suitable to be 'compaction zones',
- Reducing accelerating and braking noise, and
- Engaging with residents and responding to complaints.
- Logging of noise issues and follow-up.

6.2 Cleaning of Roads, Footpaths and Public Places

Operator training with regard to this plan is required for all operators of street cleaning vehicles before commencing specified works under this plan. The relevant training is a verification of competency 'Heavy Rigid Sanitation Vehicle' with vehicle specific OEM (Original Equipment Manufacturer) training/certification.

In relation to noise minimisation, the City will implement additional training which will focus on noise mitigation and include as a minimum:

- Street cleaning routes to minimise noise impacts,
- Various modes of plant operation and impact on noise emissions,
- Awareness of other operations emitting noise.
- Engaging with residents and responding to complaints,
- Logging of noise issues and follow-up
- Inspecting equipment for excessive noise, and
- All operators are required to undergo annual refresher training.

7 Community Information

Community information regarding the works carried out under this plan will be accessible on the City's website, with its link communicated to all permanent occupiers potentially affected by noise from the works via their rates notices or other City publication. The information provided will include:

- a brief description of the works,
- where the Noise Management Plan (NMP) can be accessed,
- a schedule of the works, which can be found on the City's web site.
- how to lodge comments or complaints about the works, and
- the duration of the current NMP approval, the date of the next review and how to make a submission.

8 Complaints Response

All noise complaints regarding 'out-of-hours' essential services (i.e. class 2 works) within the City of Subiaco boundaries carried out under this plan will be recorded and investigated by the Coordinator Infrastructure Maintenance and Waste Service or delegate.

The investigation will include discussion of the issue with the person(s) concerned and an on-site assessment where warranted during the works if it is considered appropriate in the circumstances. The complainant will be advised in writing the outcome of the investigation and any alteration that have been or will be made to the operation(s); or alternatively the reason why no alterations are considered reasonable, practicable or necessary.

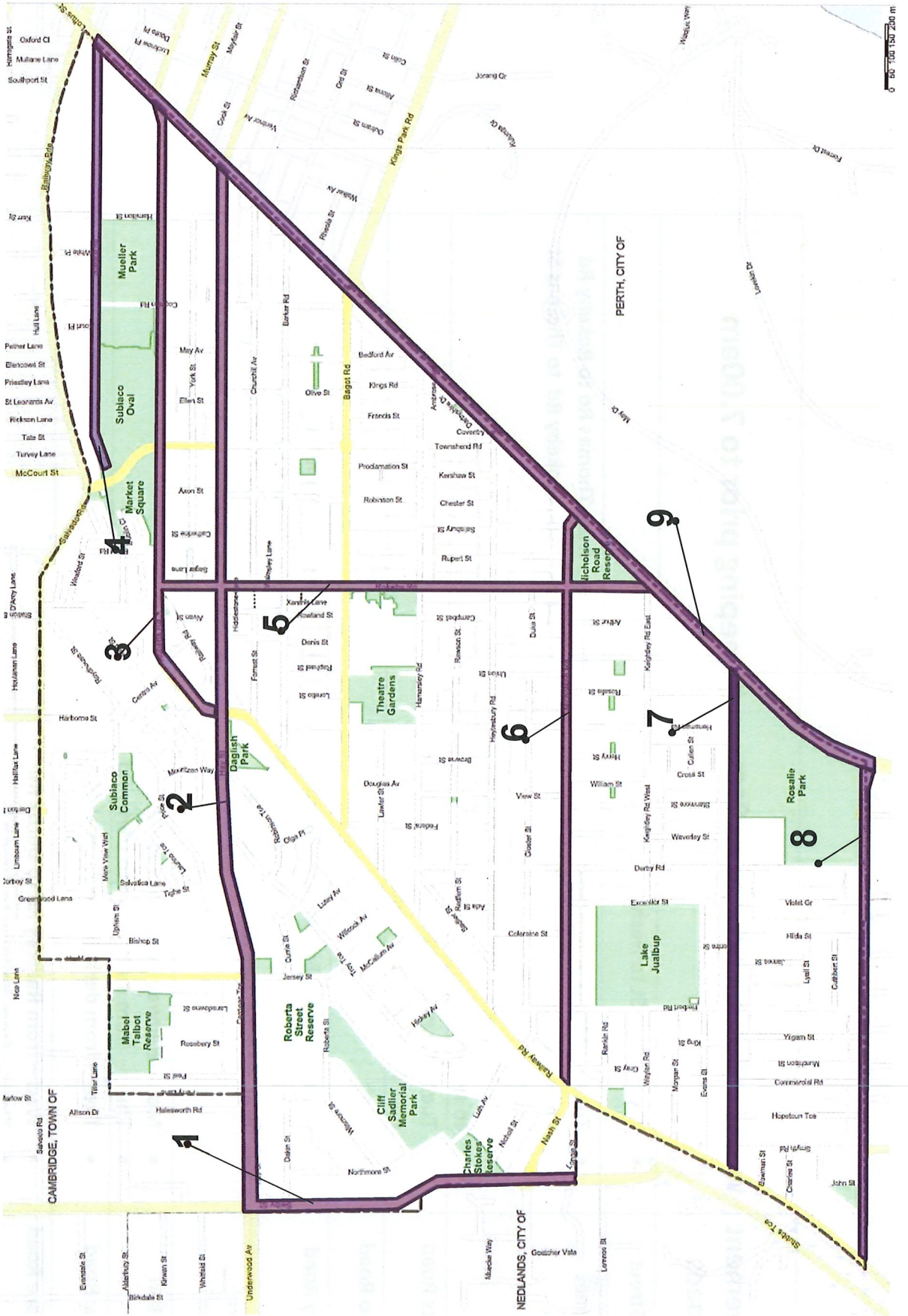
Complaints are lodged with the City of Subiaco following current procedure, that is, via telephone, email or website (online noise complaint form).

Appendix A

City of Subiaco Work Areas

Noise Management plan Roads	Waste collection prior to 7.00am	Sweeping prior to 7.00am
1. Selby Street	<ul style="list-style-type: none"> • Thurs – Hay St to Nash 	
2. Hay Street	<ul style="list-style-type: none"> • Tues – Thomas St to Rokeby Rd • Thurs – Coghlan to Axon & Roberts Rd to Selby St • Fri – Thomas St to Rokeby & Roberts Rd to Jersey St 	<ul style="list-style-type: none"> • Tues – from Thomas Rd to Rokeby Rd • Thurs – from Rokeby Rd to Thomas St
3. Roberts Road	<ul style="list-style-type: none"> • Tues – From Hamilton St to Rokeby Rd • Fri – from Hay St to Rokeby Rd 	
4. Subiaco Road	<ul style="list-style-type: none"> • Mon 	
5. Rokeby Road	<ul style="list-style-type: none"> • Monday - from Barker Rd to Bagot Rd • Tues – from Thomas St to Heytesbury Rd • Wed – Hammersley Rd to Roberts Rd 	<ul style="list-style-type: none"> • Mon – Thomas Rd to Roberts Rd • Tues – Roberts Rd to Hammersley Rd • Wed – Thomas Rd to Roberts Rd • Thurs – Roberts Rd to Hammersley Rd • Fri – Thomas St to Roberts Rd
6. Nicholson Road	<ul style="list-style-type: none"> • Mon – Railway Rd to Rokeby Rd • Thurs – from Railway Rd to Derby Rd 	
7. Onslow Road	<ul style="list-style-type: none"> • Tues – from derby Rd to Thomas St 	
8. Aberdare Road	<ul style="list-style-type: none"> • Wed – from Railway Rd to Derby Rd • Thurs – from Railway to Smyth 	
9. Thomas Street	<ul style="list-style-type: none"> • Tues – Onslow Rd to Rokeby Rd 	

Noise Management Plan Roads - Map



Appendix B

Equipment Noise Levels

Plant	One-third Octave Band Centre Frequency (Hz)															Overall dB(A)				
	50	63	80	100	125	160	200	250	315	400	500	630	800	1k	1.25k		1.6k	2k	2.5k	3.15k

Rear Loading Mercedes Econic 2630 (HV63, registration 1GIP051) at 5 meters – at idle

Side, $L_{Aeq,1min}$	30.0	39.7	35.0	38.8	41.0	42.0	44.4	46.6	48.3	53.1	51.5	55.5	57.9	57.9	57.4	57.8	58.9	58.7	56.0	54.1	50.4	68
Back, $L_{Aeq,1min}$	26.3	35.8	33.5	37.9	39.8	39.1	35.0	36.7	38.0	43.0	40.3	42.6	43.4	44.6	42.2	43.0	45.1	43.6	41.9	40.0	35.2	54

Rear Loading Mercedes Econic 2630 (HV63, registration 1GIP051) at 5 meters – PTO ON only

Side, $L_{Aeq,1min}$	28.7	39.7	35.5	38.8	41.9	42.5	46.0	44.9	49.3	53.4	54.3	55.0	57.0	56.3	55.3	56.1	57.2	56.5	55.1	53.0	47.8	66
Back, $L_{Aeq,1min}$	27.2	37.6	34.8	39.1	40.1	39.3	36.7	37.0	41.3	43.4	44.4	42.6	43.0	44.2	42.4	42.7	44.8	43.2	42.1	40.1	36.1	55

Rear Loading Mercedes Econic 2630 (HV63, registration 1GIP051) at 5 meters – PTO + Emptying bins (e.g. swing arm + compaction)

Side, $L_{Aeq,1min}$	34.7	39.0	45.6	49.3	54.1	57.1	55.2	54.4	56.7	62.1	62.3	62.6	64.5	67.1	66.8	69.0	70.9	64.4	60.9	58.2	54.3	79
Side, L_{Amax}	35.7	39.9	49.9	54.2	60.0	65.2	64.6	63.7	67.4	72.4	75.6	76.1	76.9	81.5	81.8	84.5	86.4	78.9	74.3	70.2	67.0	91
Back, $L_{Aeq,1min}$	39.4	42.2	47.0	52.1	58.6	58.3	56.5	53.8	60.0	64.3	61.0	62.3	62.7	63.8	62.5	62.3	64.5	63.7	63.0	58.8	57.1	69
Back, L_{Amax}	46.2	46.4	51.0	58.4	63.0	64.0	63.3	61.6	69.7	72.9	68.7	71.2	72.0	74.6	73.3	72.9	75.1	75.3	74.1	69.6	65.3	84

Side loading Isuzu 320 (HV68, registration 1GRL157) at 5 meters – at idle

Side, $L_{Aeq,1min}$	21.1	36.0	34.3	33.8	42.0	42.9	45.9	45.7	50.0	54.7	56.6	56.3	58.0	58.1	58.6	59.4	60.9	59.6	58.1	56.4	54.2	69
Back, $L_{Aeq,1min}$	19.8	24.2	25.6	30.9	36.6	38.5	35.5	38.8	40.9	45.8	47.8	48.1	47.9	48.8	46.4	46.0	48.0	47.0	44.8	41.9	39.2	58

Plant	One-third Octave Band Centre Frequency (Hz)														Overall dB(A)					
	50	63	80	100	125	160	200	250	315	400	500	630	800	1k		1.25k	1.6k	2k	2.5k	3.15k

Side loading Isuzu 320 (HV68, registration 1GRL157) at 5 meters – PTO ON and Paddle

Side, $L_{Aeq,1min}$	25.6	34.6	37.7	40.7	42.8	44.1	43.0	43.9	51.3	54.3	63.7	64.6	57.9	59.0	57.2	57.1	60.2	58.2	55.1	51.7	48.4	70
Back, $L_{Aeq,1min}$	23.8	31.4	33.7	41.2	42.0	40.0	39.7	39.1	43.0	45.9	54.9	51.9	48.0	49.0	45.9	44.7	47.7	46.2	43.6	40.8	38.2	60

Side loading Isuzu 320 (HV68, registration 1GRL157) at 5 meters – PTO ON, Paddle and emptying bins (e.g. swing arm + compaction)

Side, $L_{Aeq,1min}$	32.7	36.8	45.1	49.5	53.6	54.2	51.2	59.9	64.7	63.5	62.0	67.1	66.4	62.1	62.9	61.1	62.4	63.8	60.4	57.7	54.8	75
Side, L_{Amax}	36.3	37.7	49.0	52.0	55.2	55.2	49.3	61.2	65.5	67.2	66.8	69.7	68.7	67.2	65.6	63.1	63.1	64.4	62.0	58.4	55.4	77
Back, $L_{Aeq,1min}$	30.3	35.0	39.0	43.5	48.0	50.2	45.0	57.8	59.1	52.9	52.1	57.8	55.4	53.0	52.0	50.0	50.2	51.7	48.3	45.6	43.0	66
Back, L_{Amax}	30.3	34.1	36.9	42.8	47.8	50.6	48.2	59.9	63.4	58.5	57.2	60.9	56.7	58.4	56.6	52.7	52.1	55.3	54.2	47.7	45.3	69

Scarab street sweeper Isuzu FSR 700 (registration 1EFT074) at 5 meters – at idle

Side, $L_{Aeq,1min}$	27.6	23.9	31.5	32.0	36.5	38.1	38.0	36.5	39.5	45.1	44.5	45.6	49.9	48.3	50.2	47.8	49.7	49.6	48.0	45.3	42.3	59
Back, $L_{Aeq,1min}$	25.6	26.1	33.7	28.7	33.6	36.7	35.6	32.4	35.2	38.4	39.1	39.0	40.2	38.9	39.8	37.4	37.7	37.0	35.6	32.3	29.3	50

Scarab street sweeper Isuzu FSR 700 (registration 1EFT074) at 5 meters – with Auxiliary ON

Side, $L_{Aeq,1min}$	31.1	36.2	52.6	40.0	44.6	48.1	47.9	48.2	52.6	62.0	59.6	62.2	63.1	60.1	61.6	62.5	60.8	61.2	59.3	55.9	51.9	72
Back, $L_{Aeq,1min}$	29.0	32.2	46.2	38.2	43.3	43.6	45.1	46.9	49.8	50.7	49.7	53.2	53.0	51.5	52.3	52.1	50.3	49.6	47.1	44.7	40.9	62

Plant	One-third Octave Band Centre Frequency (Hz)															Overall dB(A)							
	50	63	80	100	125	160	200	250	315	400	500	630	800	1k	1.25k		1.6k	2k	2.5k	3.15k	4k	5k	
Scarab street sweeper Isuzu FSR 700 (registration 1EFT074) at 5 meters – with Auxiliary ON, brushes and vacuum unit on 'high'																							
Side, L _{Aeq,1min}	49.9	47.3	49.7	58.2	51.7	58.3	58.8	80.9	76.7	69.8	73.6	70.7	73.6	69.5	70.1	71.0	70.6	71.7	69.7	68.6	67.4	67.4	85
Back, L _{Aeq,1min}	53.7	47.9	50.4	51.4	48.6	53.7	62.6	71.5	69.6	69.0	79.9	77.2	76.4	71.3	70.1	71.8	70.7	70.2	68.4	66.4	62.7	62.7	85
Scarab street sweeper Isuzu FSR 700 (registration 1EFT074) at 5 meters – with Auxiliary ON, brushes and vacuum unit on 'low'																							
Side, L _{Aeq,1min}	36.1	42.0	57.6	45.3	51.9	55.9	57.4	65.7	64.7	70.2	69.0	66.6	68.4	67.1	68.0	68.0	67.9	69.7	68.0	67.1	65.8	65.8	80
Back, L _{Aeq,1min}	36.0	40.5	47.0	43.3	44.4	53.5	69.2	79.5	60.9	69.4	79.0	71.2	70.7	67.3	65.9	66.6	66.9	66.0	64.4	62.9	59.5	59.5	84
STIHL BGA 85 at 3 meters - Full power and pointing down from standing position																							
Side, L _{Aeq,1min}	16.9	19.0	21.7	30.3	43.0	46.2	45.6	49.0	49.0	53.8	58.1	67.4	67.0	64.2	69.2	67.3	64.6	67.5	66.0	64.8	59.6	59.6	77
Back, L _{Aeq,1min}	15.9	17.9	24.1	31.7	47.9	46.3	47.5	45.7	51.7	54.5	58.7	69.0	69.4	65.2	69.1	73.1	73.5	73.9	71.5	71.4	67.4	67.4	81
STIHL BGA 100 at 3 meters - Full power and pointing down from standing position																							
Side, L _{Aeq,1min}	11.7	14.6	17.8	21.6	27.2	35.3	38.1	32.7	41.6	46.5	46.2	50.6	52.2	51.6	52.3	54.7	53.6	54.1	53.0	58.7	52.5	52.5	64
Back, L _{Aeq,1min}	13.1	18.1	24.3	23.3	26.2	32.0	33.9	31.4	46.8	51.1	48.1	57.3	58.2	57.3	59.7	64.9	65.6	66.1	65.5	75.3	70.0	70.0	79

Appendix C

Terminology

The following is an explanation of the terminology used throughout this report:

Decibel (dB)

The decibel is the unit that describes the sound pressure and sound power levels of a noise source. It is a logarithmic scale referenced to the threshold of hearing.

A-Weighting

An A-weighted noise level has been filtered in such a way as to represent the way in which the human ear perceives sound. This weighting reflects the fact that the human ear is not as sensitive to lower frequencies as it is to higher frequencies. An A-weighted sound level is described as LA dB.

Sound Power Level (L_w)

Under normal conditions, a given sound source will radiate the same amount of energy, irrespective of its surroundings, being the sound power level. This is similar to a 1kW electric heater always radiating 1kW of heat. The sound power level of a noise source cannot be directly measured using a sound level meter but is calculated based on measured sound pressure levels at known distances. Noise modelling incorporates source sound power levels as part of the input data.

Sound Pressure Level (L_p)

The sound pressure level of a noise source is dependent upon its surroundings, being influenced by distance, ground absorption, topography, meteorological conditions etc and is what the human ear actually hears. Using the electric heater analogy above, the heat will vary depending upon where the heater is located, just as the sound pressure level will vary depending on the surroundings. Noise modelling predicts the sound pressure level from the sound power levels taking into account ground absorption, barrier effects, distance etc.

L_{ASlow}

This is the noise level in decibels, obtained using the A frequency weighting and the S (Slow) time weighting as specified in IEC 61672-1:2002. Unless assessing modulation, all measurements use the slow time weighting characteristic.

L_{AFast}

This is the noise level in decibels, obtained using the A frequency weighting and the F (Fast) time weighting as specified in IEC 61672-1:2002. This is used when assessing the presence of modulation only.

L_{APeak}

This is the greatest absolute instantaneous sound pressure in decibels using the A frequency weighting as specified in IEC 61672-1:2002.

L_{Amax}

An L_{Amax} level is the maximum A-weighted noise level during a particular measurement.

L_{A1}

An L_{A1} level is the A-weighted noise level which is exceeded for one percent of the measurement period and is considered to represent the average of the maximum noise levels measured.

L_{A10}

An L_{A10} level is the A-weighted noise level which is exceeded for 10 percent of the measurement period and is considered to represent the "intrusive" noise level.

LAeq

The equivalent steady state A-weighted sound level ("equal energy") in decibels which, in a specified time period, contains the same acoustic energy as the time-varying level during the same period. It is considered to represent the "average" noise level.

LA90

An LA90 level is the A-weighted noise level which is exceeded for 90 percent of the measurement period and is considered to represent the "background" noise level.

One-Third-Octave Band

Means a band of frequencies spanning one-third of an octave and having a Centre frequency between 25 Hz and 20 000 Hz inclusive.

LAm_{ax} assigned level

Means an assigned level which, measured as a LA Slow value, is not to be exceeded at any time.

LA1 assigned level

Means an assigned level which, measured as a LA Slow value, is not to be exceeded for more than 1% of the representative assessment period.

LA10 assigned level

Means an assigned level which, measured as a LA Slow value, is not to be exceeded for more than 10% of the representative assessment period.

Tonal Noise

A tonal noise source can be described as a source that has a distinctive noise emission in one or more frequencies. An example would be whining or droning. The quantitative definition of tonality is:

The presence in the noise emission of tonal characteristics where the difference between -

- (a) the A-weighted sound pressure level in any one-third octave band; and
- (b) the arithmetic average of the A-weighted sound pressure levels in the 2 adjacent one-third octave bands,

is greater than 3 dB when the sound pressure levels are determined as LAeq,T levels where the time period T is greater than 10% of the representative assessment period, or greater than 8 dB at any time when the sound pressure levels are determined as LA Slow levels.

This is relatively common in most noise sources.

Modulating Noise

A modulating source is regular, cyclic and audible and is present for at least 10% of the measurement period. The quantitative definition of modulation is:

a variation in the emission of noise that —

- (a) is more than 3 dB LA Fast or is more than 3 dB LA Fast in any one-third octave band;
- (b) is present for at least 10% of the representative.

Impulsive Noise

An impulsive noise source has a short-term banging, clunking or explosive sound. The quantitative definition of impulsiveness is:

a variation in the emission of a noise where the difference between LA peak and LA Max slow is more than 15 dB when determined for a single representative event;

Major Road

Is a road with an estimated average daily traffic count of more than 15,000 vehicles.

Secondary / Minor Road

Is a road with an estimated average daily traffic count of between 6,000 and 15,000 vehicles.

Influencing Factor (IF)

$$= \frac{1}{10} (\% \text{ Type A}_{100} + \% \text{ Type A}_{450}) + \frac{1}{20} (\% \text{ Type B}_{100} + \% \text{ Type B}_{450})$$

where :

% Type A₁₀₀ = the percentage of industrial land within
a 100m radius of the premises receiving the noise

%TypeA₄₅₀ = the percentage of industrial land within
a 450m radius of the premises receiving the noise

% Type B₁₀₀ = the percentage of commercial land within
a 100m radius of the premises receiving the noise

%TypeB₄₅₀ = the percentage of commercial land within
a 450m radius of the premises receiving the noise

+ Traffic Factor (maximum of 6 dB)

= 2 for each secondary road within 100m

= 2 for each major road within 450m

= 6 for each major road within 100m

Representative Assessment Period

Means a period of time not less than 15 minutes, and not exceeding four hours, determined by an inspector or authorised person to be appropriate for the assessment of a noise emission, having regard to the type and nature of the noise emission.

Background Noise

Background noise or residual noise is the noise level from sources other than the source of concern. When measuring environmental noise, residual sound is often a problem. One reason is that regulations often require that the noise from different types of sources be dealt with separately. This separation, e.g. of traffic noise from industrial noise, is often difficult to accomplish in practice. Another reason is that the measurements are normally carried out outdoors. Wind-induced noise, directly on the microphone and indirectly on trees, buildings, etc., may also affect the result. The character of these noise sources can make it difficult or even impossible to carry out any corrections.

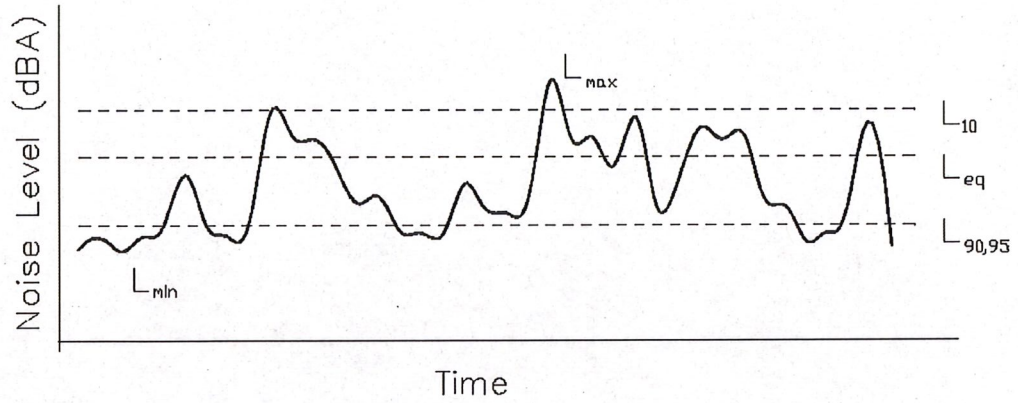
Ambient Noise

Means the level of noise from all sources, including background noise from near and far and the source of interest.

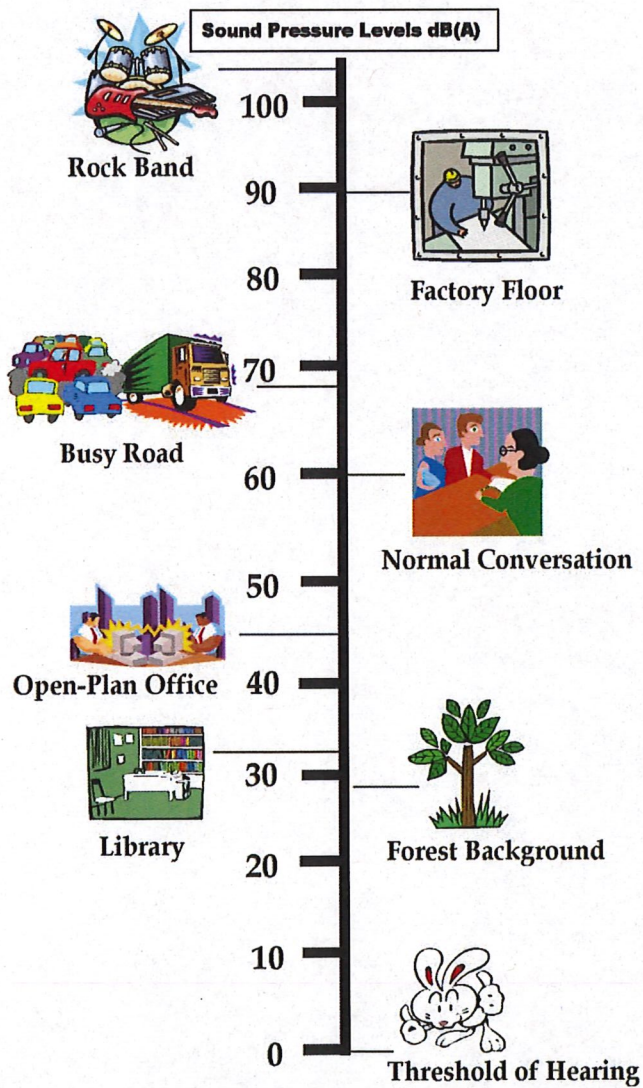
Specific Noise

Relates to the component of the ambient noise that is of interest. This can be referred to as the noise of concern or the noise of interest.

Chart of Noise Level Descriptors



Typical Noise Levels





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