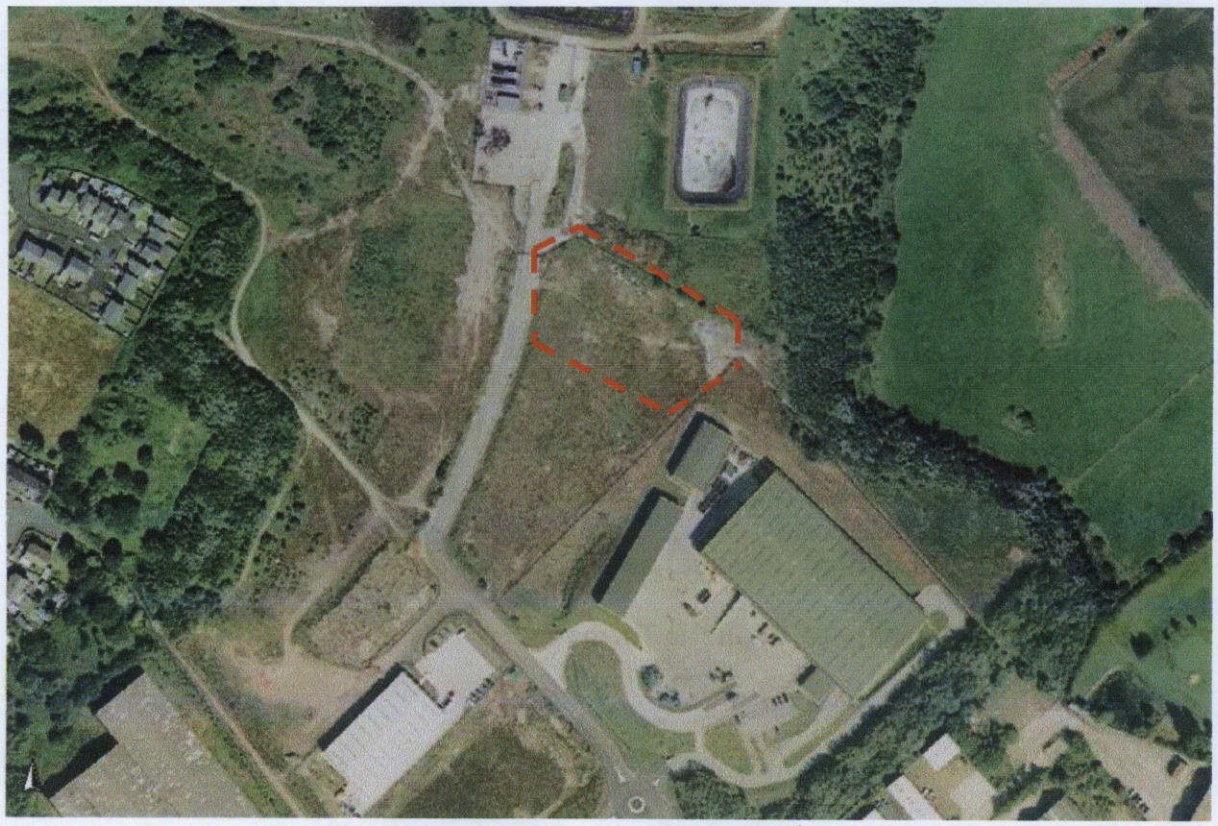
Wigan Council

PLACES DIRECTORATE

ECONOMY, TRADING AND INFRASTRUCTURE DIVISIONS

NEW ORGANICS WASTE TRANSFER STATION

APPENDIX C – NOISE IMPACT ASSESSMENT



Date of Submission: - 15th November 2013

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Revision 0

Wigan Council

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1.0 Introduction & Scope

1.21.1 The proposed waste transfer station is to be located adjacent to the existing waste recycling centre and Kirkless Landfill compound. The location and site layout of the proposal is detailed in Appendix 1.

1.31.2 The site chosen is located within an existing industrial estate with commercial premises in the immediate vicinity. The nearest residential receptor is located approximately 215m to the west on Hemfield Close.

1.41.3 The proposed waste transfer station is to be situated wholly within an industrial building except for the staff car parking, weighbridge and vehicle reception point, vehicle wash off, overnight vehicle storage and plant area.

1.51.4 The applicant has indicated that the facility will employ an air management system to control the odours within the building. For this purpose an air handling unit (AHU) is proposed and is to be situated to the rear of the proposed building on a concrete apron. This system has yet to be designed and no details exist relating to this system.

1.61.5 The facility is for the sole use of the Local Authority and will not take any third party co-mingled waste. The facility is therefore likely to operate normal working hours which are likely to be Monday – Friday 07:00 – 17:30 and Saturday (07:00 – 17:30) to take in missed collections through the week. This includes bank holidays. It is unknown if the AHU is to be operated through-out the night-time. For the purpose of the assessment the assumption is that the air handling unit will be in operation through the night.

1.71.6 The process has been described as the receipt of waste from Council refuse collection wagons from approximately 09:00 onwards, tipping off of refuse into a dedicated bay, handling of material by a front end wheeled loader and then loading of bulk loaders for dispatch to other suitable facilities from around 15:00 onwards.

1.81.7 Refuse wagons will be cleaned and disinfected in a dedicated area that is depicted external to the building before returning to the Makerfield Way depot for overnight storage. No vehicles are expected to be stored on the site except for in an emergency.

1.91.8 It is envisaged the facility will handle approximately 30,000 tonnes per annum, which would equate to approximately 120 tonnes on average per day. Peak levels in June/July and October would expect to reach approximately 250-300tonnes per day.

1.101.9 It is anticipated that to remove the waste would need between 2-5 bulk lorries per day, these are vehicle movements which are already on the wider public highway network but are being diverted from the existing Kirkless WTS to the proposed site. There is no intention to store waste in the building over-night but a contingency of a maximum of 48hours storage has been agreed as a suitable timeframe and is in line with good practice for handling of such a waster stream.

~~1.11~~1.10 After discussing the project with the applicant the scope of works required included assessment of noise from vehicle movements arriving and departing the premises on Makerfield Way on existing sensitive premises (residential and commercial) during the daytime, noise from proposed plant and equipment (inc vehicle wash-off) during the daytime & night-time (AHU unit only) and noise from the use of front end wheeled loader within the building during the daytime.

2.0 Relevant Local & National Policies and Guidance

2.1 Details of noise guidance used to assess noise from proposed waste management facilities was previously outlined in PPG24[1]. PPG24[1] has been withdrawn and replaced by the National Planning Policy Framework[2] (NPPF). In the absence of specific planning policy guidance on noise, it is considered for the purposes of this assessment that the principles established in the former PPG24[1] remain a useful aide to assess noise acceptability.

2.2 PPG24[1] outlined the considerations to be taken into account in determining planning applications both for noise-sensitive developments and those which generate noise.

2.3 PPG24[1] described how the planning system could be used to minimise the adverse impact of noise without placing unreasonable restrictions on development and business.

2.4 For industrial noise PPG24[1] stated that *"the likelihood of noise complaints from industrial development can be assessed, where the standard is appropriate, using guidance in BS4142:1990"*. It also directs the assessor to BS8233:1999[3] but this standard advises BS4142:1997[4] should be used for assessing industrial noise.

2.5 BS4142:1997[4] relates to the assessment of noise where it occurs in an area of mixed residential and commercial properties. Given the character of the area of the proposed development, the standard is directly applicable.

2.6 In summary BS4142:1997[4] compares source noise averaged over an hour during the day and 5 minutes at night, to the background noise level in the area (obtained in the absence of the source). Night time activity is not proposed and thus in this case, the hourly average sound energy needs to be compared with existing daytime background noise levels.

2.7 The standard is the recognised method for evaluating intrusive noise generally and not just industrial noise. The standard applied a penalty of 5dB to noise which has specific characteristics. This supports the importance of noise character.

2.8 The standard also identifies methods for measuring sources of noise and calculating their level. It also identifies methods for measuring the background noise level.

2.9 The standard states a positive indication that complaints are unlikely when average levels are 10 – 15dB below the background noise level and that where noise exhibits specified characteristics such as tonality and intermittency, complaints are clearly indicated when measured source noise levels exceed the background noise level by just 5dB.

2.10 A positive indication of complaint arises with a complaint prediction level of +10dB.

2.11 The change in planning guidance is important and considered below. The new NPPF[2] is relevant to the proposed activities at the proposed site

2.12 Until recently, the key guidance for noise was contained within PPG24[1]. A significant overhaul in planning guidance has been made with the release of the NPPF[2] which formally withdraws PPG24[1] and many other key planning technical guidance notes.

2.13 The NPPF[2] describes that the purpose of planning is to contribute to the achievement of sustainable development and indicates a presumption in favour of sustainable development through plan making and decision taking. The NPPF[2] states it is a material consideration in planning decisions.

2.14 The NPPF[2] advises that the planning system should contribute to and enhance the natural and local environment by preventing new development from being put at unacceptable risk from, or being adversely affected by unacceptable levels of noise pollution.

2.15 The NPPF[2] further advises that to prevent unacceptable risks from pollution and land instability, planning decisions should ensure that new development is appropriate for its location. The effects (including cumulative effects) of pollution on health, the natural environment or general amenity, and the potential sensitivity of the proposed development to adverse effects from pollution, should be taken into account.

2.16 No explanation of what constitutes unacceptable risks or adverse affects from pollution is given. However, pollution is defined in the framework to include noise.

2.17 The NPPF[2] confirms that planning decisions should aim to avoid noise from giving rise to significant adverse impacts on health and quality of life as a result of new development; mitigate and reduce to a minimum other adverse impacts on health and quality of life arising from noise from new development, including through the use of conditions; recognise that development will often create some noise and existing businesses wanting to develop in continuance of their business should not have unreasonable restrictions put on them because of changes in nearby land uses since they were established; and identify and protect areas of tranquillity which have remained relatively undisturbed by noise and are prized for their recreational and amenity value for this reason.

2.18 The first and second sentences in paragraph 123 of the NPPF[2] and considered above also refer to the Explanatory note to the Noise Policy Statement for England[5] by DEFRA. The NPSE[5] sets out the long term vision of government noise policy.

2.19 The NPSE[5] applies to all noise apart from workplace (occupational) noise. The vision contains the following aims: avoid significant adverse impacts on health and quality of life from noise, mitigate and minimise adverse impacts on health and quality of life from noise and where possible contribute to the improvement of health and quality of life.

2.20 The NPPF[2] appears to consider the NPSE[5] consistent with the framework principles. However, to 'promote good health and good quality of life the vision expresses this to be a long term desired policy outcome but uses language such as "promote" and "good" as it recognises that it is not possible to have a single

objective noise-based measure that is mandatory and applicable to all sources of noise in all situations.

2.21 Critically the NPSE[5] does not clarify the conflict between the acceptability of one activity to have a negative noise impact on some individuals although this may be acceptable for the wider benefit to society. Industry should reduce noise where this is practicable and achievable but not restrict economic or sustainable growth and prosperity. This is a fine balance. The planning system should minimise adverse impact from noise without placing unreasonable restrictions on development.

2.22 For industrial noise, PPG24[1] referred the user to Annex 3 paragraph 19 and the use of BS4142:1997[4] to assess the likelihood of complaints from industrial noise. As such it is assumed that BS4142:1997[4] remains relevant to the assessment of noise from the proposed development site.

2.23 The NPPF[2] technical guidance on noise is presented as an annex to the NPPF[2] in Section 28 onwards it considers noise from minerals sites. There are clear similarities between planning for minerals extraction and waster management facilities operationally.

2.24 Technical guidance within the NPPF[2] recognises mineral operations will have some particularly noisy short-term activities that will not meet the limits. In considering activities to be undertaken at this site this will be true for some elements but significant controls may be applied including screening and the implementation of a noise management plan (NMP). A NMP may be required where the Environment Agency (EA) regulate the permit to operate and check compliance. It should be noted the NPPF[2] makes the point that Local Authorities should focus on the acceptable use of the land and the impact of that use rather than the control processes themselves where the use is regulated under pollution control regimes.

2.25 To help assess the noise impact both source data for relevant activities and a propagation model are needed in order to estimate the impact from a specific type of activity.

2.26 As the proposed use have many similarities with noise from open sites BS5228:2009-1[6] is considered to be a relevant guidance on the subject. Appendix F in the standard gives details on how to estimate noise from sites and Appendix C provides sound level data for relevant pieces of equipment.

2.27 For the purpose of this assessment the methodologies in Appendix F (Haul Road, Mobile plant in a defined area and modified version of the Sound Power Calculation) have been used for arrival and departure of vehicles, the wheeled loader within the building and fixed plant (air handling unit & vehicle wash facilities).

2.28 The design targets for the noise levels are outlined in Table 2.1

Table 2.1 – Design Targets

Standard	Design Target
BS412:1997[4]	**Residential** L90 +5dB(A) daytime Equal to L90 – night-time **Commercial** L90+10dB daytime
BS8233:1999[3]	**Residential** Internal living room ≤40dB Internal bedroom ≤35dB **Commercial** Office space ≤50dB $L_{Aeq,t}$
WHO 1999[7]	External amenity areas <55dB $L_{Aeq,t}$

3.0 Methodology

3.1 This section outlines the methodology used to assess the impact of noise from the proposed development to existing noise sensitive properties. Table 3.1 outlines the steps involved and the outcome of that step.

Table 3.1 –

Step	Description	Outcome
1	Identification of noise generating activities likely to impact upon the surrounding existing sensitive receptors based on the information provided by the applicant	The following noise generating activities were identified: - • Arrival and departure of Refuse Wagons & Bulk Loaders. • Manoeuvring of Wheeled Loader within the building. • Use of air handling equipment. • Use of vehicle wash-off area.
2	Identification of existing noise sensitive properties	The following properties were identified as being noise sensitive: - **Residential** • Properties on Hemfield Close & Hemfield Road (215m and 280m to the West respectively) • Properties on Elmlea Gardens and Battersby Street (400m to the South) • Bank House Farm, Hindley Farm and 'The Bungalow' (425m and 500m to the North respectively). **Commercial** • Cinnamon Brow Business Park (150m to the South West). • Hemfield Court (240m to the East) • Hindley Golf Club (310m to the North East).
3	Undertake background noise monitoring at receptor locations or utilise existing relevant monitoring data to quantify baseline noise level conditions at identified receptors.	Existing data available for Elmlea Gardens and Hemfield Close to be used that was collected in to inform recent planning applications. Spot check measurements (30mins) at Elmlea Gardens and Hemfield Close and at Cinnamon Brow. Section 4.0 details the baseline data collected.
4	Selection of plant noise level data from Appendix C of BS5228:2009-1[6]	For the wheeled loader and refuse wagons entry 33 in Table C.6 and the log average entry 18 and 19 in Table C.8 have been used.

5	Selection of prediction methodology from source to receiver	The following methodologies have been chosen to predict noise levels from relevant activities at the facility Refuse vehicles and bulk loaders arriving & departing - Haul road calculation described in Appendix F of BS5228:2009[6] Wheeled loader working within the building - Mobile plant in a defined area calculation described in Appendix F of BS5228:2009-1[6] Fixed air handling plant - Method for plant sound power. This method has been adapted to advise on maximum sound power level of the plant to be given to the design engineer as to not exceed recommended rating levels.
6	Prediction of sound levels from source to receiver using the selected method.	Section 5.0 details the results of the prediction.
7	Assessment of predicted results against BS4142:1997[4] methodology and BS8233:1999[3] noise level design targets	Section 5.0 details the assessment of the predicted results.
8	Recommend suitable mitigation	Section 6.0 details the recommended mitigation measures
9	Assessment of residual noise levels after mitigation	Section 7.0 details the assessment of residual noise levels after mitigation.
10	Draw down conclusions	Section 8.0 provides the conclusions.

4.0 Baseline Monitoring

4.1 This section details the results of baseline monitoring undertaken, the data already held on file for the locations spot checked.

4.2 Appendix 2, 3 and 4 provide details of equipment used and weather observations during the monitoring visit spot checks and raw tabulated data.

4.3 Table 4.1 details the aggregated 15minute daytime measurement results for each identified location. The locations of the monitoring positions are provided on the plan in Appendix 1.

4.4 Location 1 is adjacent to Elmlea Gardens in the bottom corner of the new car park serving the Council Depot. At this location the noise climate was dominated by plant noise at Morrison's. There were also several vehicle movements from Council vehicles at the depot. Bird song and pedestrians talking along the public footpath were also noted.

4.5 Location 2 was situated on derelict land to the rear of properties on Hemfield Close. The location was heavily vegetated and there was a bund screening the houses with only the tops of the houses visible through the vegetation. The noise climate at this location consisted of distant road traffic, aircraft flyovers, the landfill gas flare and intermittent bangs from the wider estate. Birdsong was also noted.

4.6 Location 3 was adjacent to entrance to Cinnamon Brow Business Park. The noise climate at this location consisted of road traffic to the Business Park and Council Recycling Centre. A pressure washer was also observed being used at a business for the majority of this measurement.

4.7 Table 4.2 details other daytime background measurements measured by various third parties as part of other planning application in the area. These have been included to provide extra data to ensure a robust background monitoring assessment. The data is presented as in the original report and the source is credited.

4.8 No night-time monitoring has been undertaken at the identified receptors. Third party data for the nearest residential properties on Hemfield Close is available and this has been used. The night-time data is for use in the assessment of the maximum plant noise levels for the air handling unit required. Table 4.3 details this third party measurement data. The data is presented as in the original report and the source is credited.

Table 4.1 – Daytime Measurement Results

Position	Date	Start Time	$L_{Aeq(00:15:00)}$	$L_{AF(max)}$	$L_{AF(min)}$	L_{A90}	L_{A10}
Land adjacent to Elmlea Gardens - L1	21/9/2012#	12:13:11	44.4	58.0	39.8	41.9	46.2
		12:28:11	46.9	66.8	39.7	42.3	48.8
		12:43:11	46.2	65.2	39.9	42.3	54.0
		12:58:11	50.2	72.7	40.8	43.9	53.0
	7/10/2013	11:45:33*	48.7	57.2	43.9	46.1	51.1
		11:58:19	48.7	58.8	43.7	45.5	50.8
		12:13:18	49.6	63.2	43.2	45.0	52.4
Logarithmic Average			**48.2**	**66.4**	**41.9**	**44.1**	**51.5**
Land adjacent to Hemfield Close– L2	1/5/2013##	07:03:07	49.2	62.1	42.7	44.5	53.6
		07:18:07	47.3	61.5	41.7	43.4	50.6
		07:33:07	47.4	60.3	40.6	43.1	50.8
		07:48:07	47.2	63.2	40.7	42.9	50.6
		14:41:43	45.5	63.9	37.5	47.7	40.3
		14:56:43	42.8	61.2	35.3	46.3	38.1
		15:11:43	42.3	62.7	36.2	38.3	44.1
		15:26:43	45.5	68	35.8	38.5	45.8
	7/10/2013	13:00:06	53.1	72.4	39.7	46.2	40.7
		13:15:06	44.3	58.0	40.0	46.1	41.1
Logarithmic Average			**47.7**	**65.6**	**39.7**	**44.6**	**48.4**
Adjacent to Cinnamon Brow Business Park – L3	7/10/2013	13:36:54	52.6	66.2	41.1	44.6	56.4
		13:51:54	54.7	65.6	43.6	48.5	58.3
Logarithmic Average			**53.8**	**65.9**	**42.5**	**47.0**	**57.5**

These measurements were taken in the assessment of A/12/77282

These measurements were taken in the assessment of A/13/77931

* Measurement duration was 00:08:12 due to battery failure

Table 4.2 – Daytime Third Party Measurement Results

Data Source	Report Title	Noise impact assessment for proposed European Metal Recycling (EMR) Ltd facility at Hemfield Road, Wigan					
	Report Date	13 February 2013					
	Prepared By	MAS Environmental					
	Report Reference	MAS/EMR/DTB/130213					
Position	**Date**	**Start Time**	$L_{Aeq,t}$	$L_{AF(max)}$	$L_{AF(min)}$	L_{A90}	L_{A10}
Monitoring Point 2 – Equivalent to L2	12/6/12	10:50:18#	49.0	-	-	40.0	53.0
		11:00:02#^2	45.0	-	-	39.0	48.0
Monitoring Point 3 – Equivalent to		11:12:53#^3	43.0	-	-	38.0	47.0
		11:20:03#^4	44.0	-	-	39.0	47.0

L2							
Logarithmic Average			**45.9**			**39.1**	**49.6**
Monitoring Point 8 – Equivalent to Hindley Golf Club (No spot check undertaken)	12/6/12	13:01:00#^5	47	-	-	41	49
Logarithmic Average			**47**			**41**	**49**

Measurement duration # 00:10:00; #^2 00:07:00; #^3 00:15:00; #^4 00:15:00; #^5 00:10:00

Table 4.3 – Night-time Third Party Measurement Data

Data Source	**Report Title**		Kirkless Materials Recycling and Transfer Facility Makerfield Way, Higher Ince, Wigan - Night-time Noise Assessment				
	Report Date		February 2013				
	Prepared By		SLR				
	Report Reference		403.00197.00870				
Position	**Date**	**Start Time**	$L_{Aeq(00:05:00)}$	$L_{AF(max)}$	$L_{AF(min)}$	L_{A90}	L_{A10}
Belle Green Lane – Equivalent to L2		01:20	33.3	50.7	-	31.2	34.4
		01:25	33.0	38.0	-	31.9	33.8
		01:30	32.3	37.6	-	31.2	33.1
		01:35	32.2	35.3	-	31.1	32.9
		01:40	32.8	43.9	-	31.6	33.4
		01:45	33.4	35.9	-	32.2	34.3
Logarithmic Average			**32.9**	**44.3**	-	**31.6**	**33.7**
Bank House Farm – Equivalent to L2		01:00	37.0	42.6	-	31.1	39.8
		01:05	37.4	42.9	-	31.0	39.9
		01:15	36.0	41.7	-	31.0	39.8
		01:20	38.3	44.1	-	31.6	40.1
		01:25	34.8	41.5	-	31.7	39.5
		01:30	39.0	42.0	-	32.3	40.1
		01:35	32.3	41.4	-	31.0	32.8
		01:40	38.9	50.3	-	32.0	40.0
		01:45	35.8	58.5	-	31.1	39.2
		01:50	38.2	42.1	-	31.3	39.8
		01:55	35.5	43.6	-	30.7	39.4
Logarithmic Average			**37.0**	**49.5**	-	**31.4**	**39.4**
Hemfield Road – Equivalent L2		00:45	36.3	50.9	-	35.1	37.1
		00:50	36.3	38.9	-	35.4	37.0
		00:55	35.9	39.7	-	34.7	36.8
		01:00	35.0	37.5	-	34.2	35.7
		01:05	34.8	44.2	-	33.8	35.6
		01:10	36.0	53.2	-	33.9	37.0
Logarithmic Average			35.8	48.0	-	34.6	36.6

5.0 Prediction Results & Assessment

5.1 This section presents the results of the noise predictions based on BS5228:2009-1[6] methodologies identified in Section 3.0. Appendix 5 contains the calculation sheets for the predictions.

5.2 Table 5.1 contains the maximum plant noise level for the AHU for consideration by the air handling design engineer to aid plant selection. Levels are provided for each location but the lowest overall maximum is recommended so as to ensure compliance with recommended Rating Levels.

5.3 Table 5.2 and 5.3 contains the daytime and night-time predicted noise levels at the identified locations (L1 – L3) for the use of the wheeled loader with no building attenuation, vehicle movements along Hemfield Road, vehicle wash-off area (using suggested minimum L_{wA} level at the three locations) and air handling unit (using the minimum L_{wA} level at the three locations). The night-time predicted level includes only the air handling unit.

Table 5.1 – Recommended Air Handling Unit & Vehicle Wash-off Plant Sound Power Level (L_{wA})

Source	Maximum L_{wA}
Vehicle Wash-Off (07:00 – 17:00)	85dB
AHU Daytime (07:00 – 23:00)	90dB
AHU Night-time (23:00 – 07:00)	90dB

Table 5.2 – Daytime Predicted Noise Level

Source	Predicted $L_{Aeq(01:00:00)}$		
	L1 - Properties to South of Council Depot (i.e. Battersby St, Elmlea Gardens etc...)	L2 – Properties to the West (i.e. Hemfield Close, Hemfield Road, DeTrafford Drive)	L3 - Cinnamon Brow Business Park
Wheeled Loader	45.8dB	50.8dB	53.3dB
Vehicle Movements	42.8dB	43.9dB	56.2dB
AHU	25.0dB	30.0dB	33.0dB
Vehicle Wash-Off	21.0dB	30.0dB	28.0dB
Cumulative	47.6dB	51.7dB	58.0dB

Table 5.3 – Night-time Predicted Noise Level

Source	Predicted $L_{Aeq(01:00:00)}$		
	L1 - Properties to South of Council Depot (i.e. Battersby St,	L2 – Properties to the West (i.e. Hemfield Close, Hemfield Road,	L3 - Cinnamon Brow Business Park

	Elmlea Gardens etc...)	DeTrafford Drive)	
AHU	25dB	30dB	N/A
Cumulative	25dB	30dB	N/A

5.4 The assessment of the predicted noise levels is undertaken by using the methodology set out in BS4142:1997[4]. Table 5.4 details the recommend Rating Levels based on the lowest backgrounds measured from measurements by us and third parties.

Table 5.4 – Suggested Rating Levels

Location	Recommended Daytime Rating Level	Recommended Night-time Rating Level
L1 – Properties to the South#	43dB	35dB
L2 – Properties to the West#	50dB	35dB
L3 – Cinnamon Brow#	55dB	N/A

The recommended rating level is based on the lowest measured background LA90 +5dB as this is residential property.

The recommended rating level is based on the lowest measured background LA90 +10dB as this is commercial property.

5.5 The daytime rating levels are then compared to the cumulative predicted levels. Table 5.5 details this comparison.

Table 5.5 – Comparison of Predicted Level and Recommended Rating Level in the Daytime

Location	Predicted Cumulative Level	Recommended Daytime Rating Level	Difference
L1 – Properties to the South	48dB	47dB	+1dB
L2 – Properties to the West	52dB	43dB	+9dB
L3 – Cinnamon Brow	58dB	55dB	+3dB

5.6 In all cases during the daytime the recommended rating level is not met. Therefore mitigation measures are needed to reduce the levels to the recommended levels.

5.7 The predictions can be considered worst case as the assumption in the cumulative prediction is that the maximum number of vehicles arrive and depart in the hour, the vehicle wash-off is operational, the wheeled loader is operation (without the benefit of a building) and the air handling units are operational (without the benefit of screening from the proposed building).

5.8 However, to ensure Rating Levels are met mitigation will be recommended for the largest contributing elements.

5.9 Table 5.6 details the comparison of the night-time rating level with the predicted noise level from the air handling unit.

Table 5.6 - Comparison of Predicted Level and Recommended Rating Level in the Night-time

Location	Predicted Cumulative Level	Recommended Daytime Rating Level	Difference
L1 – Properties to the South	30dB	35dB	-5dB
L2 – Properties to the West	25dB	35dB	-10dB
L3 – Cinnamon Brow	N/A	N/A	N/A

5.10 The based on a L_{wA} of 90dB for the air handling unit the predicted noise level is calculated to be less than the recommended Rating Level. In reality, due to screening at properties to the South from existing industrial buildings the level is likely to much lower than predicted; therefore the prediction can be assumed to be worst case.

5.11 The level predicted to properties in the West already benefit from a nominal screening correction due to the existing earth bund to the rear of properties on Hemfield Close and existing industrial buildings on Cinnamon Brow Business Park. It is again felt the screening correction is an under-estimation of the likely reductions and the prediction can be considered worst case.

5.12 Properties to the North and East are at a greater distance than the properties to the West so therefore the natural attenuation due to distance will ensure that Rating Levels are met. Monitoring data is available for Bank House Farm (to the North) and the recommended night-time Rating Level (35dB) will be achieved.

5.13 For the relevant receptors basic break-in calculations and comparison of the predicted levels with the external amenity calculations have been undertaken. For external break-in calculations nominal attenuation of the building envelope with a window or door open for partial ventilation is assumed to be 10dB.

5.14 Table 5.7 details the break-in calculation results.

Table 5.7 – BS8233:1999[3] Calculation

Location	Worst Case Predicted Cumulative Level $L_{Aeq,t}$	Building Envelope Attenuation	Predicted Internal Level $L_{Aeq,t}$
L1 – Properties to the South	48dB	-10dB	38dB
	25dB		15dB
L2 – Properties to the West	52dB		42dB
	30dB		20dB
L3 – Cinnamon Brow	58dB		48dB

5.15 Table 5.8 details the comparison of the predicted internal levels with the relevant design targets in BS8233:1999[3]. The reasonable level specified in the standard is the preferred design target.

Table 5.8 – Comparison of Predicted Internal Level with BS8233:1999[3] Design Target

Location	Predicted Internal Level $L_{Aeq,t}$	Design Target Level $L_{Aeq,t}$	Difference
L1 – Properties to the South	38dB	40dB	-2dB
	15dB	35dB	-20dB
L2 – Properties to the West	42dB	40dB	+2dB
	20dB	35dB	-15dB
L3 – Cinnamon Brow	48dB	50dB	-2dB

5.16 The comparison with the internal level standard shows that for L1 and L3 the design targets should be achieved without the need for mitigation during the daytime. L2 however does not meet the standard. It should be noted that the predicted levels are worst case and the levels experienced are likely to be less. However, mitigation measures will still be recommended for the appropriate sources of noise.

5.17 For L1 and L2 the night-time predicted internal level complies with the recommended design target.

5.18 BS8233:1999[3] does not provide a standard for external amenity spaces. WHO 1999[7] provides guidance on external amenity areas and states that external levels in amenity areas should be around 50dB $L_{Aeq,t}$ with a upper maximum of 55dB $L_{Aeq,t}$.

5.19 Comparison of the predicted levels in Table 5.5 with this level shows that the external amenity area level will be achieved for locations L1 and L2. L3 has not been considered due to its commercial nature.

5.20 A comparison of the log average measured $L_{Aeq,t}$ with the predicted levels from the worst case situation at the site shows that the for L1 the predicted LAeq,t is equal to the existing $L_{Aeq,t}$. L2 and L4 show an increase of +3dB and +4dB on the log average measured LAeq's. This difference is likely to be just perceptible to the occupiers of such spaces.

5.21 In summary the three assessment methods used to quantify the impact (BS4142:1997[4], Comparison with BS8233:1999[3] & WHO 1999[7] design standards and comparison with existing $L_{Aeq,t}$) shows that impact could be characterised as being minor. However, BS4142:1997[4] is the preferred assessment method and the result of that assessment indicates mitigation is required to reduce the predicted cumulative noise level.

5.22 Section 6.0 discusses suitable mitigation measures.

6.0 Recommended Mitigation Measures

6.1 Mitigation is recommended to reduce the predicted noise levels to the design target specified in Table 5.4.

6.2 Mitigation is not required for the air handling system as long as the L_{wA} of the proposed air handling system does not exceed 90dB. It is recommended once the planning permission is secured and the air handling system is being specified Business Compliance and Improvement are consulted to ensure the recommended L_{wA} is achieved.

6.3 It is my view that the level of 90dB L_{wA} will not be an insurmountable constraint on the final system. Furthermore, additional sound reduction techniques can be employed to help to reduce the noise level to the L_{wA} specified.

6.4 Mitigation is not required for the vehicle wash-off plant as long as the L_{wA} of the system does not exceed 85dB. I would however recommend that the wash off area is located within the building thus reducing this impact even further.

6.5 A review of the prediction calculations in Appendix 5 shows that the two major contributing elements are the vehicle movements to and from the site and the wheeled loader movements.

6.6 It is unlikely that changes can be made to vehicles that are servicing the site and as previously sytated thesed vehciels are already entering the area at the site next adjacent. Therefore, the only option is to mitigate the wheeled loader activity with the use of a building. A building is required for the facility to ensure odours are controlled and is therefore not an insurmountable constraint.

6.7 Based on the cumulative noise level it is recommended the minimum weighted composite sound reduction index (Composite SRI) for the building is 20dB $R_{w(Comp)}$. It is recommended Business Compliance and Improvement is consulted to ensure that the recommended $R_{w(Comp)}$ specified is achieved with the final building design. It is my opinion that 20dB $R_{w(Comp)}$ is achievable for an industrial type building.

6.8 Table 6.1 gives a summary of the recommended mitigation measures for ease of reference for each indentified noise source.

Table 6.1 – Summary of Mitigation Measures

Activity	Recommend Mitigation Specification
Wheeled Loader	Minimum building composite $R_{w(Comp)}$ 20dB
Service vehicles	No mitigation recommended
Air handling system	Maximum L_{wA} 90dB
Vehicle wash-off	Maximum L_{wA} 85dB# It is recommended the vehicle wash-off facility is located internal to the building if other constraints allow it.

assuming the facility is located external to the building.

6.9 Section 7.0 now discusses the residual noise levels if the above recommended mitigation is implemented.

7.0 Residual Noise Levels

7.1 Table 7.1 documents the residual noise levels after the mitigation recommended in Table 6.1 has been implemented.

Table 7.1 – Residual Noise Levels

Location	Residual Level after Mitigation	Recommended Daytime Rating Level	Difference
L1 – Properties to the South	43dB	47dB	-4dB
L2 – Properties to the West	44dB	43dB	+1dB
L3 – Cinnamon Brow	56dB	55dB	+1dB

7.2 Table 7.1 shows that for L2 the recommended Rating Levels is met. For L1 & L3 the recommended Rating Level is exceeded by 1dB.

7.3 As previously mentioned the assessment has assumed that all the vehicles servicing, the bulk loaders that take away the waste arrive, the wheeled loader is in operation, the vehicle wash-off is in operation and the air handling unit is in operation, all at once.

7.4 It is unlikely the above scenarios will ever occur as the physical footprint of the site can only accommodate 3 vehicles tipping at once and several of the bulk loaders won't arrive until after the final load has arrived and been bulked up.

7.5 The contributing factor to this exceedance is the vehicle movements. The closest office already experiences HGV vehicle movements along this road as these arrive and depart Cinnamon Brow Business Park currently.

7.6 Therefore an exceedance of 1dB on the rating level for L1 and L3 is considered well within the margins of error.

7.7 A suitably worded planning condition can be recommended to require maximum L_{wA} for specific plant and composite insulation values of the building to protect the surrounding receptors from excess noise.

8.0 Conclusion

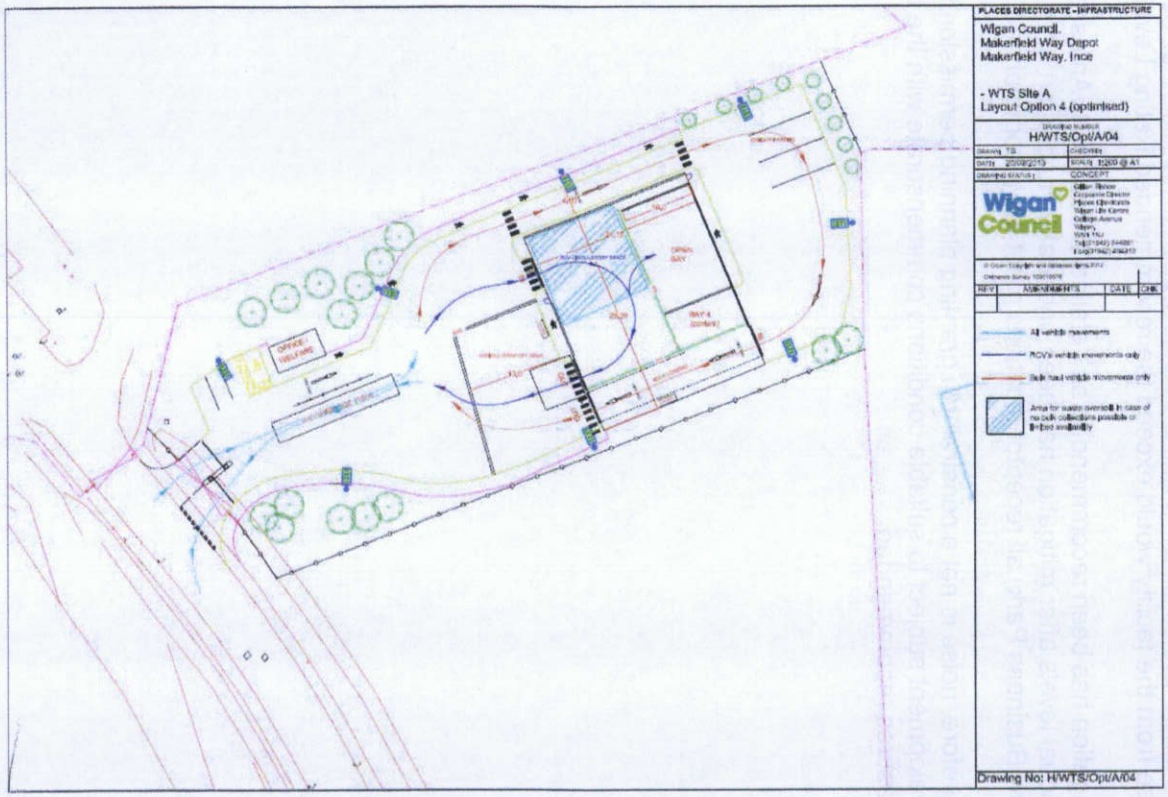
8.1 An assessment to predicted and quantify the impact of the likely noise levels from the waste transfer station has been undertaken.

8.2 The assessment indicated that without mitigation (i.e. a building) the cumulative noise from the facility would exceed the recommended Rating Levels.

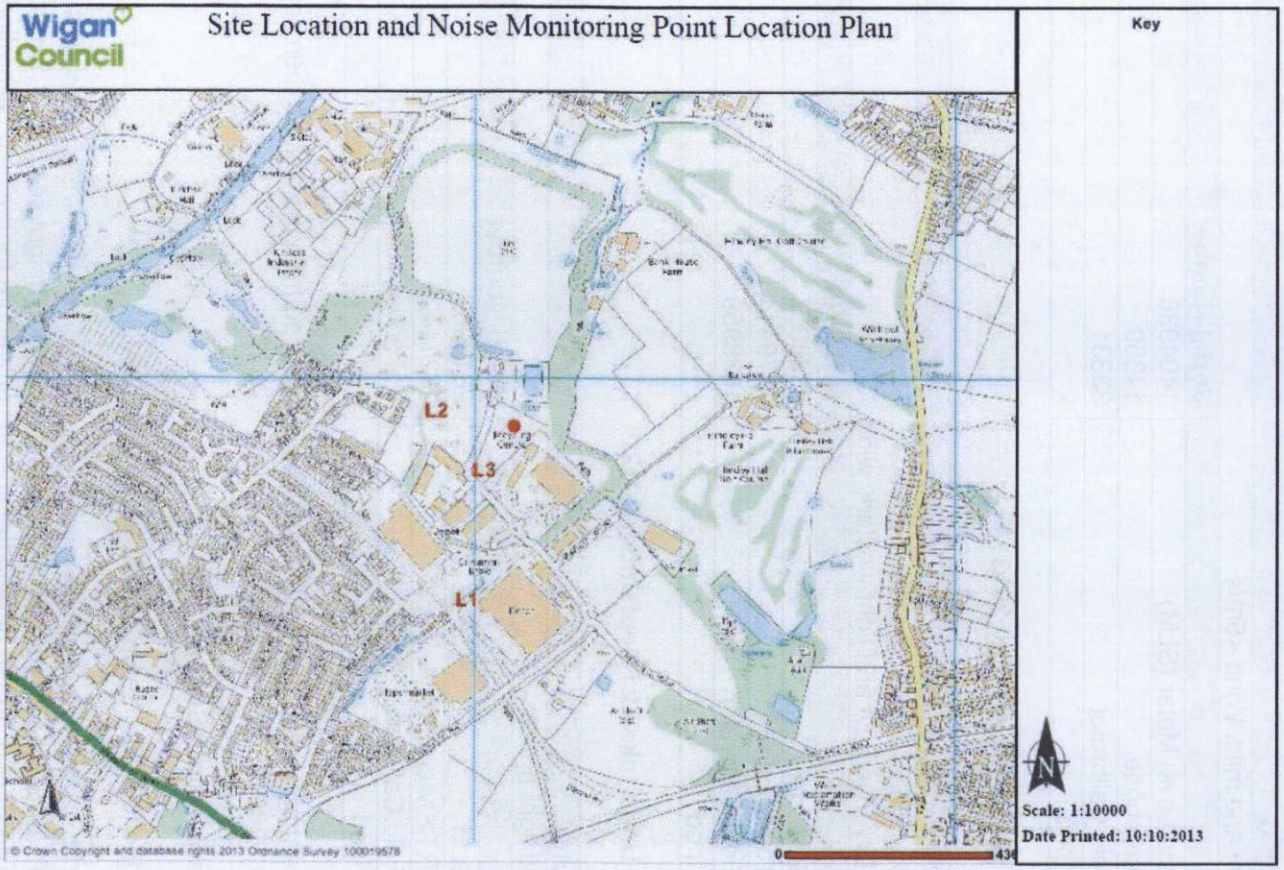
8.3 Mitigation has been recommended as detailed in Table 6.1. An assessment of the residual levels after mitigation has been undertaken and apart from L3 (Cinnamon Brow Business Park) all receptor locations meet the recommended standard.

8.4 Therefore, noise is not a constraint in granting planning permission for this development subject to suitable conditions commensurate with the mitigation measures recommended.

Appendix A – Site Layout Plan



Appendix B – Location Plan



Appendix C – Noise Monitoring Equipment Used & Weather Observations

Monitoring Undertake 7 October 2013

Weather Noted	
Dry, overcast and mild. Wind <5m/s	
Equipment	**Serial Number**
Nor140 Sound Level Meter (SLM)	1404936
Nor1209 Microphone	14369
Nor1251 Field Calibrator	33331
Mounting Tripod	-

Monitoring Undertaken 1 May 2013

Weather Noted	
Morning – Dry, clear, wind from west 1-2m/s Afternoon - Dry, overcast and light westerly wind <5/ms	
Equipment	**Serial Number**
B&K 2238 SLM	2368857
B&K4188 Microphone	2379414
B&K 4231 Field Calibrator	1838959
Mounting Tripod	-

Monitoring Undertaken 21 September 2012

Weather Noted	
Dry, cold and light breeze	
Equipment	**Serial Number**
B&K 2250 SLM	2619965
B&K <INSERT> Microphone	2621142
B&K 4231 Field Calibrator	Not noted
Mounting Tripod	-

The equipment and weather conditions can be referenced from the reports themselves and are not replicated here.

Method of equipment Set-up

In all cases the following setup procedure was followed

1. The SLM and microphone are connected (combination referred to as SLM)
2. The SLM mounted onto tripod and microphone height set 1.2 – 1.5m from the ground.
3. The SLM is turned on and the specific procedure for the field calibration is followed. For the B&K equipment the reference tones was 94.0dB ± tolerance, for the Nor140 the reference tone was 114dB ± tolerance. In all cases the SLM displayed a level within the tolerance allowed.
4. A windshield was fitted in all cases.
5. The SLM was set to run using either 1 second or 1 minute logs.
6. The SLM was checked for drift at the end of each measurement using the field calibrator. The measurement was only saved if the drift was within ±0.2dB.

Appendix D – Calculation Spreadsheets

Wheeled Loader Calculation Sheet

Location 1

Stage No.	Frequency / Description	63	125	250	500	1000	2000	4000	8000	Broadband
1	Sound pressure level selection	92	84	83	77	76	74	71	62	93.354239
2a	Calculation from Sound Pressure to Sound Power	120	112	111	105	104	102	99	90	121.35424
2b	Source - Receiver distance	355	355	355	355	355	355	355	355	
2c	Traverse Length	20	20	20	20	20	20	20	20	
3	Distance correction	59.00457	59.00457	59.00457	59.00457	59.00457	59.00457	59.00457	59.00457	
4	Reflection correction	0	0	0	0	0	0	0	0	
5	Screening correction	5	5	5	5	5	5	5	5	
6	Resultant SPL	55.99543	47.99543	46.99543	40.99543	39.99543	37.99543	34.99543	25.99543	57.349672
	A-weighting correction	26.2	16.1	8.6	3.2	0	-1.2	-1	-1.1	
	Resultant LAeq	29.79543	31.89543	38.39543	37.79543	39.99543	39.19543	35.99543	27.09543	
7	Distance Ratio Correction	0.056338	0.056338	0.056338	0.056338	0.056338	0.056338	0.056338	0.056338	
	Correction Factor (F)	1	1	1	1	1	1	1	1	
8	Duration of activity	1	1	1	1	1	1	1	1	
8	Equivalent on Time	1	1	1	1	1	1	1	1	
9	Correct percentage on-time %	100	100	100	100	100	100	100	100	
10	Resultant LAeq Correction	0	0	0	0	0	0	0	0	
11	Resultant LAeq	29.79543	31.89543	38.39543	37.79543	39.99543	39.19543	35.99543	27.09543	45.822801

12	Resultant LAeq(16hr) correction	2.0412	2.0412	2.0412	2.0412	2.0412	2.0412	2.0412	2.0412	
13	Resultant LAeq(16hr)	27.75423	29.85423	36.35423	35.75423	37.95423	37.15423	33.95423	25.05423	43.781602
14	Required Rating Level									45
15	Building Attenuation Requirement (Rw)									-1.2183983
16	Recommended Building (Rw) Required + 20%									-1.462078
17	Average Rw of Industrial Building									20
18	Level with Specified Composite Rw									23.8

Location 2

Stage No.	Frequency / Description	63	125	250	500	1000	2000	4000	8000	Broadband
1	Sound pressure level selection	92	84	83	77	76	74	71	62	93.354239
2a	Calculation from Sound Pressure to Sound Power	120	112	111	105	104	102	99	90	121.35424
2b	Source - Receiver distance	200	200	200	200	200	200	200	200	
2c	Traverse Length	20	20	20	20	20	20	20	20	
3	Distance correction	54.0206	54.0206	54.0206	54.0206	54.0206	54.0206	54.0206	54.0206	
4	Reflection correction	0	0	0	0	0	0	0	0	
5	Screening correction	5	5	5	5	5	5	5	5	
6	Resultant SPL	60.9794	52.9794	51.9794	45.9794	44.9794	42.9794	39.9794	30.9794	62.333639
	A-weighting correction	26.2	16.1	8.6	3.2	0	-1.2	-1	-1.1	
	Resultant LAeq	34.7794	36.8794	43.3794	42.7794	44.9794	44.1794	40.9794	32.0794	
7	Distance Ratio	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	

	Correction									
	Correction Factor (F)	1	1	1	1	1	1	1	1	
8	Duration of activity	1	1	1	1	1	1	1	1	
8	Equivalent on Time	1	1	1	1	1	1	1	1	
9	Correct percentage on-time %	100	100	100	100	100	100	100	100	
10	Resultant LAeq(1hr) Correction	0	0	0	0	0	0	0	0	
11	Resultant LAeq(1hr)	34.7794	36.8794	43.3794	42.7794	44.9794	44.1794	40.9794	32.0794	50.806769
12	Resultant LAeq(16hr) correction	2.0412	12.0412	12.0412	12.0412	12.0412	12.0412	12.0412	12.0412	
13	Resultant LAeq(16hr)	32.7382	24.8382	31.3382	30.7382	32.9382	32.1382	28.9382	20.0382	39.645687
14	Required Rating Level									45
15	Building Attenuation Requirement (Rw)									5.8067686
16	Recommended Building (Rw) Required + 20%									6.9681224
17	Average Rw of Industrial Building									20
18	Level with Specified Composite Rw									30.8

Location 3

Stage No.	Frequency / Description	63	125	250	500	1000	2000	4000	8000	Broadband
1	Sound pressure level selection	92	84	83	77	76	74	71	62	93.354239
2a	Calculation from Sound Pressure to Sound Power	120	112	111	105	104	102	99	90	121.35424

2b	Source - Receiver distance	150	150	150	150	150	150	150	150	
2c	Traverse Length	20	20	20	20	20	20	20	20	
3	Distance correction	51.52183	51.52183	51.52183	51.52183	51.52183	51.52183	51.52183	51.52183	
4	Reflection correction	0	0	0	0	0	0	0	0	
5	Screening correction	5	5	5	5	5	5	5	5	
6	Resultant SPL	63.47817	55.47817	54.47817	48.47817	47.47817	45.47817	42.47817	33.47817	64.832414
	A-weighting correction	26.2	16.1	8.6	3.2	0	-1.2	-1	-1.1	
	Resultant LAeq	37.27817	39.37817	45.87817	45.27817	47.47817	46.67817	43.47817	34.57817	
7	Distance Ratio Correction	0.133333	0.133333	0.133333	0.133333	0.133333	0.133333	0.133333	0.133333	
	Correction Factor (F)	1	1	1	1	1	1	1	1	
8	Duration of activity	10	10	10	10	10	10	10	10	
8	Equivalent on Time	10	10	10	10	10	10	10	10	
9	Correct percentage on-time %	100	100	100	100	100	100	100	100	
10	Resultant LAeq(10hr) Correction	0	0	0	0	0	0	0	0	
11	Resultant LAeq(10hr)	37.27817	39.37817	45.87817	45.27817	47.47817	46.67817	43.47817	34.57817	53.305543
12	Resultant LAeq(16hr) correction	2.0412	2.0412	2.0412	2.0412	2.0412	2.0412	2.0412	2.0412	
13	Resultant LAeq(16hr)	35.23697	37.33697	43.83697	43.23697	45.43697	44.63697	41.43697	32.53697	51.264344
14	Required Rating Level									45
15	Building Attenuation Requirement (Rw)									6.2643436
16	Recommended Building (Rw) Required + 20%									7.5172123
17	Average Rw of Industrial Building									20
18	Level with Specified Composite Rw									31.3

Haul Road Calculation

Location 1

Stage No.	Frequency / Description	63	125	250	500	1000	2000	4000	8000	Broadband
1	Sound Pressure Level	82	79	78	75	71	72	66	62	85.64246
2	Sound Pressure Level to Sound Power conversion	110	107	106	103	99	100	94	90	113.6425
3	Number of vehicles per hour	30	30	30	30	30	30	30	30	
4	Velocity (kph)	48	48	48	48	48	48	48	48	
5a	Distance from Receiver to Haul Road Centre	220	220	220	220	220	220	220	220	
5b	Distance Correction	23.42423	23.42423	23.42423	23.42423	23.42423	23.42423	23.42423	23.42423	
6	Reflection Correction	0	0	0	0	0	0	0	0	
7	Screening Correction	5	5	5	5	5	5	5	5	
8a	Angle of view	180	180	180	180	180	180	180	180	
8b	Angle of view Correction	0	0	0	0	0	0	0	0	
9a	Resultant Leq	46.53457	43.53457	42.53457	39.53457	35.53457	36.53457	30.53457	26.53457	50.17703
9b	A-weighting correction	26.2	16.1	8.6	3.2	0	-1.2	-1	-1.1	
9c	Resultant LAeq	20.33457	27.43457	33.93457	36.33457	35.53457	37.73457	31.53457	27.63457	42.77655

Location 2

Stage No.	Frequency / Description	63	125	250	500	1000	2000	4000	8000	Broadband

1	Sound Pressure Level	82	79	78	75	71	72	66	62	85.64246
2	Sound Pressure Level to Sound Power conversion	110	107	106	103	99	100	94	90	113.6425
3	Number of vehicles per hour	30	30	30	30	30	30	30	30	
4	Velocity (kph)	48	48	48	48	48	48	48	48	
5a	Distance from Receiver to Haul Road Centre	170	170	170	170	170	170	170	170	
5b	Distance correction	22.30449	22.30449	22.30449	22.30449	22.30449	22.30449	22.30449	22.30449	
6	Reflection Correction	0	0	0	0	0	0	0	0	
7	Screening Correction	5	5	5	5	5	5	5	5	
8a	Angle of view	180	180	180	180	180	180	180	180	
8b	Angle of view Correction	0	0	0	0	0	0	0	0	
9a	Resultant Leq	47.65431	44.65431	43.65431	40.65431	36.65431	37.65431	31.65431	27.65431	51.29677
9b	A-weighting correction	26.2	16.1	8.6	3.2	0	-1.2	-1	-1.1	
9c	Resultant LAeq	21.45431	28.55431	35.05431	37.45431	36.65431	38.85431	32.65431	28.75431	43.89629

Location 3

Stage No.	**Frequency / Description**	**63**	**125**	**250**	**500**	**1000**	**2000**	**4000**	**8000**	**Broadband**
1	Sound Pressure Level	82	79	78	75	71	72	66	62	85.64246
2	Sound Pressure Level to Sound Power conversion	110	107	106	103	99	100	94	90	113.6425
3	Number of vehicles per hour	30	30	30	30	30	30	30	30	

4	Velocity (kph)	48	48	48	48	48	48	48	48	
5a	Distance from Receiver to Haul Road Centre	10	10	10	10	10	10	10	10	
5b	Distance correction	10	10	10	10	10	10	10	10	
6	Reflection Correction	0	0	0	0	0	0	0	0	
7	Screening Correction	5	5	5	5	5	5	5	5	
8a	Angle of view	180	180	180	180	180	180	180	180	
8b	Angle of view Correction	0	0	0	0	0	0	0	0	
9a	Resultant Leq	59.9588	56.9588	55.9588	52.9588	48.9588	49.9588	43.9588	39.9588	63.60126
9b	A-weighting correction	26.2	16.1	8.6	3.2	0	-1.2	-1	-1.1	
9c	Resultant LAeq	33.7588	40.8588	47.3588	49.7588	48.9588	51.1588	44.9588	41.0588	56.20078

Air Handling Unit Maximum L_{wA} Calculation

Location 1

Stage No.	Description / Frequency	63	125	250	500	1000	2000	4000	8000	Broadband
1	Required SPL @ Receptor									25
2a	Distance Source - Receiver	355	355	355	355	355	355	355	355	355
2b	Distance correction	51.00457	51.00457	51.00457	51.00457	51.00457	51.00457	51.00457	51.00457	51.0045671
3	Reflection correction									
4	Screening correction	5	5	5	5	5	5	5	5	5
5	Calculated Maximum SWL									89.0

Location 2

Stage No.	Frequency / Description	63	125	250	500	1000	2000	4000	8000	Broadband
1	Required SPL @ Receptor									30
2a	Distance Source - Receiver	215	215	215	215	215	215	215	215	215
2b	Distance correction	46.64877	46.64877	46.64877	46.64877	46.64877	46.64877	46.64877	46.64877	46.6487692
3	Reflection correction									
4	Screening correction	5	5	5	5	5	5	5	5	5
5	Calculated Maximum SWL									89.6

Location 3

Stage No.	Frequency / Description	63	125	250	500	1000	2000	4000	8000	Broadband
1	Required SPL @ Receptor									33
2a	Distance Source - Receiver	150	150	150	150	150	150	150	150	150
2b	Distance correction	43.52183	43.52183	43.52183	43.52183	43.52183	43.52183	43.52183	43.52183	43.5218252
3	Reflection correction									
4	Screening correction	5	5	5	5	5	5	5	5	5
5	Calculated Maximum SWL									89.5

Vehicle Wash-Off Maximum L_{wA} Calculation

Location 1

Stage No.	Frequency / Description	63	125	250	500	1000	2000	4000	8000	Broadband
1	Required SPL @ Receptor									21
2a	Distance Source - Receiver	355	355	355	355	355	355	355	355	355
2b	Distance correction	51.00457	51.00457	51.00457	51.00457	51.00457	51.00457	51.00457	51.00457	51.0045671
3	Reflection correction									
4	Screening correction	5	5	5	5	5	5	5	5	5
5	Calculated Maximum SWL									85.0

Location 2

Stage No.	Frequency / Description	63	125	250	500	1000	2000	4000	8000	Broadband
1	Required SPL @ Receptor									30
2a	Distance Source - Receiver	215	215	215	215	215	215	215	215	215
2b	Distance correction	46.64877	46.64877	46.64877	46.64877	46.64877	46.64877	46.64877	46.64877	46.6487692
3	Reflection correction									
4	Screening correction									
5	Calculated Maximum SWL									84.6

Location 3

Stage No.	Description / Frequency	63	125	250	500	1000	2000	4000	8000	Broadband
1	Required SPL @ Receptor									28
2a	Distance Source - Receiver	150	150	150	150	150	150	150	150	150
2b	Distance correction	43.52183	43.52183	43.52183	43.52183	43.52183	43.52183	43.52183	43.52183	43.5218252
3	Reflection correction									
4	Screening correction	5	5	5	5	5	5	5	5	5
5	Calculated Maximum SWL									84.5

Cumulative Noise – No Mitigation

Location 1

Stage No.	Description / Frequency	63	125	250	500	1000	2000	4000	8000	Broadband
1	Mobile Plant in building									45.8
2	Haul Road									42.8
3	Minimum AHU									25.0
4	Vehicle Wash									21.0
										47.6

Location 2

Stage No.	Description / Frequency	63	125	250	500	1000	2000	4000	8000	Broadband
1	Mobile Plant in building									50.8

2	Haul Road	43.9
3	Night-time AHU	30.0
4	Vehicle Wash	30.0
		51.7

Location 3

Stage No.	Description	Frequency	63	125	250	500	1000	2000	4000	8000	Broadband
1	Mobile Plant in building										53.3
2	Haul Road										56.2
3	Minimum AHU										33.0
4	Vehicle Wash										28.0
											58.0

Residual Noise with Mitigation

Location 1

Stage No.	Description	Frequency	63	125	250	500	1000	2000	4000	8000	Broadband
1	Mobile Plant in building										23.8
2	Haul Road										42.8
3	Minimum AHU										25.0
4	Vehicle Wash										21.0
											42.9

Location 2

Stage No.	Description	Frequency	63	125	250	500	1000	2000	4000	8000	Broadband

1	Mobile Plant in building	30.8
2	Haul Road	43.9
3	Night-time AHU	30.0
4	Vehicle Wash	30.0
		44.4

Location 3

Stage No.	Frequency / Description	63	125	250	500	1000	2000	4000	8000	Broadband
1	Mobile Plant in building									31.3
2	Haul Road									56.2
3	Minimum AHU									33.0
4	Vehicle Wash									28.0
										56.2

Appendix E – Glossary of Acoustic Terms

A-weighting – The adjustment undertaken to a linear sound level to account for the sensitivity of human hearing at different frequencies.

dB – Un-weighted linear measure of sound energy. It is the logarithmic ratio of two fractions (powers of quantity related to powers).

dB(A) – A-weighted measure of sound energy.

$L_{Aeq,t}$ – The steady level of sound energy that contains the same amount of energy as the fluctuating time varying level under the same period of time.

$L_{AF(max)}$ – The maximum RMS A-weighted sound pressure level occurring within a specified time period on a fast response time averaging.

$L_{AF(min)}$ - The minimum RMS A-weighted sound pressure level occurring within a specified time period on a fast response time averaging.

L_{90} – The sound level that is exceeded in the reference time period for 90% of the time. This is recognised background level used.

L_{A90} - The A-weighted sound level that is exceeded in the reference time period for 90% of the time. This is recognised background level used.

L_{10} - The sound level that is exceeded in the reference time period for 10% of the time. This is recognised background level used.

L_{A10} - The A-weighted sound level that is exceeded in the reference time period for 10% of the time. This is recognised background level used.

L_{wA} – The A-weighted sound power level on the decibel scale: $L_{wA} = 10xLog_{10}(w/w_0)$ where w0 is the reference power level of 10^{-12} in Watts

RMS – Root mean square is the square root of the average square of the waveform over specified time period.

Watt – A unit of power. The energy contained in one joule when this is consumed over 1 second.

Appendix F – Reference List

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