Paul Horsley Acoustics Ltd
Acoustics & Noise Control Consultancy

Acoustic Report

Environmental Noise Survey
Land at the former Dawson Fabrics Ltd
Greenside Mills
Saville Road
Skelmanthorpe
Huddersfield, HD8 9EE

Our Reference – J2507

Survey Dates – Between 9th to 10th August 2016

Survey and Report by – Paul Horsley MIOA

Report compiled by: Paul Horsley MIOA

Date of Report: 12.08.16

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1.0 Agent

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2.0 Subject

Proposed residential development of land at
The former Dawson Fabrics Ltd site
Greenside Mills
Saville Road
Skelmanthorpe
Huddersfield
HD8 9EE

3.0 Aims

The aim of this report is to determine the existing baseline background noise environment levels, over a typical 24-hour weekday period, affecting the proposed residential development location in support of the proposed Planning Application for the site relating to noise.

Provide an assessment of the results in accordance with the recommendations laid down in the National Planning Policy Framework, NPPF, for the proposed development site with respect to noise.

Provide mitigating noise control advice relating to the achievement of an acceptable internal environment for the development as recommended with World Health Organization's "Guidance for Community Noise, 1999".

4.0 Location and Description of Existing Noise Sources

The proposed site is located at the former Dawson Fabrics Ltd premises to the north and east of the Saville Road, Skelmanthorpe and consists of a sloping plot of land, presently occupied by the derelict factory site. The area can be best described as a rural setting away from any major transport hub, approximately 10 Km ESE of Huddersfield Town Centre.

The plot of land under consideration is generally triangular in shape measuring a maximum 310m x 140m. The land slopes down sharply from Saville Road in an easterly and northerly direction, and graduating to the southern border, a total of 16m slope overall. The northern boundary is formed by Kirklees Light Railway line, with existing residential premises beyond the north western boundary. The north eastern site boundary is formed by open farmland, with the south western boundary formed by Marsden Street with a mix of residential and a commercial premises on the opposite side of Marsden Street. The southern and south western site boundary is formed by Saville Road which runs past the site, having established residential premises on the opposite site of the road. Skelmanthorpe Industrial estate is located approximately 75m south of the site and surrounded by residential premises. There is a public footpath which runs through the centre of the site and crosses over the KLR at the mid-north position of the site.

The primary noise sources during daytime periods within the vicinity of the site are predominantly due to traffic noise from vehicles periodically passing along Saville Road, affecting the southern boundaries of the site only.

The Kirklees Light Railway, KLR, is an 18" narrow gauge private recreational single track railway line and operates a regular timetable from March to December between Clayton West and Shelley, primarily coinciding with school holidays. KLR run mini steam trains with carriages hourly past the northern from 10.20 to 16.20 and is the main noise source affecting the site boundary at this location. There are no discernible nighttime noise sources.

It is the noise from these sources that are under consideration within this report.

5.0 Guidance on the Assessment of Noise Levels

The purpose of any criterion or standard for environmental noise should be to safeguard against unacceptable levels of community response, deemed as a feeling of annoyance during daytime or disturbance at night. WHO defines annoyance as "a feeling of displeasure evoked by noise"

The main source of information relating to noise and the community response are field studies including noise measurements and social surveys. These surveys attempt to establish a correlation between the two sets of results.

In the absence of any definitive guidance and in order to establish suitable noise criteria, it is necessary to rely on general guidance and assessment methods used for community noise sources. Discussions on the current methods are given below.

5.1 BS4142:2014 'Method for Rating and Assessing Industrial and Commercial Sound'

This recently revised standard provides a method for rating and assessing sound of an industrial and/or commercial nature. The method uses outdoor sound levels to assess the likely effect of sound on people who might be inside or outside a dwelling or premises used for residential purposes. It is limited to applicable sounds and is not intended for noise amounting to nuisance or rating noise outside the scope of the Standard.

Unlike the previous version of the Standard, rating levels are not prescriptive, but more context based, with the following applicable to rating values:

- Typically, the greater this difference (variance between impact of background and rating level), the greater the magnitude of impact.
- A difference of around +10 dB or more is likely to be an indication of a significant adverse impact, depending upon the context.
- A difference of around +5 dB is an indication of an adverse impact, depending upon the context.
- The lower the rating level is relative to the measured sound level, the less it is that the specific sound source will have an adverse impact or a significant impact. Where the rating does not exceed the background sound level, this is an indication of the specific sound source having a low impact, depending upon context.

The Standard introduces additional rating elements, these being subject assessments of tonality, and impulsivity of a sound source, with weighted rating values accordingly applied at the judgment of the assessor.

The introduction of Uncertainty has been applied to the measured values; again, consideration of this is left to the professional executing the survey and assessment. However, steps are provided within the

Standard for the reduction of uncertainty in both measurement and calculations of the sound source and rating value.

Actual meteorological conditions are now required to be recorded and reported upon for the survey and report.

5.2 National Planning Policy Framework, NPPF.

The newly incumbent National Planning Policy Framework, NPPF, provides advice to planning authorities in England on how they must seek to minimise the adverse impact of noisy activities on noise sensitive receptors. This NPPF, replacing PPG 24, and is not prescriptive with respect to specific noise levels, and is mainly concerned with the advising on good practice for environmental noise assessment.

In the absence of definitive noise criterion within the NPPF most Local Authorities in England default to the daytime noise levels inside dwellings not to exceed NR 35; and NR 25, to be achieved inside dwellings at night to avoid sleep disturbance, based upon ingress of external noise sources.

5.3 World Health Organization 1999 "Guidance for Community Noise"

This document provides a review of the effects of noise and a description of the principles of the WHO health criteria and guidelines for Community Noise.

The effects of noise in dwellings are identified as sleep disturbance, annoyance and speech interference. For bedrooms, the critical effect is sleep disturbance. Indoor guideline values for bedrooms are 30 dB LAeq for continuous noise and 45 dB LAmax for sound events. At night time, outside sound levels about 1 metre from facades of living spaces should not exceed 45 dB LAeq, so that people may sleep with bedroom windows open. This value is equivalent to that specifies in the Criteria 12 document; however it is now assumed that the noise reduction from outside to inside with the window open is 15 dB.

To enable casual conversation indoors during the daytime, the sound level of the interfering noise should not exceed 35 dB LAeq.

To protect the majority of people from being **seriously** annoyed during the daytime, the outdoor sound level from steady, continuous noise should not exceed 55dB LAeq on balconies, terraces and in outdoor living areas. To protect the majority of people from being **moderately** annoyed during the daytime, the outdoor sound level should not exceed 50 dB LAeq.

Table 1 of the document summarises the guideline values for community noise in specific environments and includes the noise indices to be adopted. Significantly, the corresponding time base to be used for the assessment is also included.

The relevant extracts of Table 1 are reproduced thus:

Specific Environment	Critical health effect (s)	LAeq dB	Time Base hours	LAMax dB
Outdoor living area	Serious annoyance, daytime and evening	55	16	-
	Moderate Annoyance, Daytime and evening	50	16	-
Dwelling, Indoors	Speech intelligibility & moderate annoyance daytime & evening.	35	16	-
	Sleep Disturbance, night-time	30	8	45
Outside Bedroom	Sleep disturbance, window open (Outdoor Values)	45	8	60

5.4 Subjective Impression of Noise Changes

The following Table provides a semantic scale that may be used to "subjectively" rate changes in sound pressure level.

Table 1: Subjective effect of changes in sound pressure level

Change in sound level dB	Change in Power		Change in apparent loudness
	Decrease	Increase	
3	1/2	2	Just perceptible
5	1/3	3	Clearly noticeable
10	1/10	10	Half / Twice as loud
20	1/100	100	Much quieter / louder

After Bies and Hansen

This table is taken from Professor Colin H Hansen's publication "Fundamentals of Acoustics" page 41, for the Department of Mechanical Engineering, University of Adelaide.

This table also appears in "Engineering Noise Control" by Colin Hansen and David Bies, a comprehensive reference book, amongst others.

6.0 Survey Equipment

Integrating Sound Level Meter, RION NA-27, Type 1, Serial No 431986

RION UC-53A Microphone Serial No 35771

RION NC-74 Calibrator Serial No 530712

Windshield

Tripod

(Current Equipment Calibration Test Certification available upon request)

7.0 Survey Method

An attended pre-development environmental noise assessment survey was carried out encompassing daytime, evening and nighttime periods between 9th and 10st August 2016 by the author.

LA_{eq}, $LA_{90,}$ $LA_{10,}$ and LA_{max} sound measurements were taken using the sound analyser.

The measurement indices noted above are defined as follows:

LA_{eq}, T	the "A" weighted equivalent continuous noise level of sample period T
LA_{10}, T	the "A" weighted level exceeded for 10% of sample period T
LA_{90}, T	the "A" weighted level exceeded for 90% of sample period T
LA_{max}	The "A" weighted maximum level during the sample period T

Various sound measurements were taken using the sound analyser. The meter was calibrated before and after the measurements using the calibrator to ensure accuracy of the results. No fluctuations were noted between calibrations and the results obtained can be deemed to be an accurate representation of the levels recorded.

In order to ascertain the existing typical background noise climate, sound recordings were taken at over several continuous 1-hour sample periods during daytime and continuous 15-minute sample periods at evening and night.

The meter was mounted on the tripod at a height of 1.5m above ground and at least 3m from any reflective plain. Refer to Appendix A for a marked up locational sketch for the survey points.

8.0 Prevailing Weather Conditions

9th August 2016 - Evening – 13°C, 10% cloud cover, wind WNW 0-2m/s, 71% rh, 1024 mb

9-10th August 2016 - Nighttime – 10°C, 50% cloud cover, wind WNW 0-1m/s, 80% rh, 1024 mb

10th August 2016 - Daytime – 16°C, 20% cloud cover, wind W 0-2m/s, 59% rh, 1024 mb

9.0 Pre-Development Noise Survey Results

During the monitoring period separate noise samples were recorded, using a 1/1 Octave Centre Band analysis. These monitoring samples were collected from the northern and southern site boundaries, generally, at the same location for daytime, evening and nighttime periods. This was to establish the general noise levels experienced externally by the site at the most exposed position available and therefore likely to experience the worst case noise climate.

The table of results on the following page indicates the noise levels recorded for the site location selected during the monitoring period, with a brief description of the noise sources contributing to the individually monitored noise levels recorded.

The above monitoring locations should be read in conjunction with the site layout appearing in Appendix A of this report.

Refer to Appendix B for the survey results frequency analysis table.

10.0 Noise Survey Results Table

Location	Description of Location	Period	Data ID	LAmax	LAeq	LA10	LA90	Measurement Duration	Date	Time	Comment
				dB	dB	dB	dB				
1	Northern site boundary	EVENING	1	70.1	45.1	46.2	34.1	00:15:00.00	09-08-2016	19:45:02	Low distant traffic. Kids playing on a motorbike nearby. Birdsong. High altitude aircraft. Cattle.
			2	56.5	44.7	47.7	37.6	00:15:00.00	09-08-2016	20:00:02	
			3	51.1	43.4	47.3	36.1	00:15:00.00	09-08-2016	20:15:02	
		NIGHTTIME	7	41.2	24.2	24.7	22.1	00:15:00.00	09-08-2016	23:31:55	No discernible noise source, other than cattle in fields and dawn chorus from 05.00 onwards
			9	42.8	25.1	25.7	22.1	00:15:00.00	10-08-2016	00:12:59	
			11	31.7	22.7	23.4	21.9	00:15:00.00	10-08-2016	01:14:03	
			13	32.4	22.6	23.3	21.6	00:15:00.00	10-08-2016	02:15:08	
			15	30.8	22.4	23.1	21.6	00:15:00.00	10-08-2016	03:26:13	
			17	34.3	23.1	23.7	22.0	00:15:00.00	10-08-2016	04:22:23	
			19	59.4	36.9	40.3	29.6	00:15:00.00	10-08-2016	05:14:56	
			21	52.5	36.5	39.5	30.3	00:15:00.00	10-08-2016	06:02:40	
		DAYTIME	23	75.1	66.3	71.4	51.8	00:00:41.03	10-08-2016	11:56:22	Passing train at 10m dominant source.
			24	65.7	41.9	45.7	33.7	01:00:00.00	10-08-2016	12:02:11	Birdsong. Passing trains periodically. Aircraft. Cattle in distance. Low distant traffic movements.
			25	68.9	42.4	47.9	33.1	01:00:00.00	10-08-2016	13:02:11	
			26	59.3	36.0	38.9	31.8	01:00:00.00	10-08-2016	14:02:11	
2	Southern site boundary along Saville Road	EVENING	4	60.7	43.0	44.9	32.3	00:15:00.00	09-08-2016	20:48:12	Periodic traffic movements along Saville Road. Birdsong. Aircraft.
			5	46.6	37.5	39.9	33.4	00:15:00.00	09-08-2016	21:03:12	
			6	57.6	37.8	39.4	32.8	00:15:00.00	09-08-2016	21:18:12	
		NIGHTTIME	8	41.9	24.9	25.7	22.9	00:15:00.00	09-08-2016	23:49:06	No discernible noise source, other than cattle in fields and dawn chorus from 05.00 onwards. Vehicles passing along Saville Road from 05.45 onwards
			10	37.2	24.3	25.1	22.4	00:15:00.00	10-08-2016	00:41:09	
			12	40.7	24.7	26.0	22.6	00:15:00.00	10-08-2016	01:38:12	
			14	32.4	24.3	25.6	23.0	00:15:00.00	10-08-2016	02:40:17	
			16	40.3	24.6	25.8	23.6	00:15:00.00	10-08-2016	03:54:22	
			18	34.0	25.7	27.1	23.9	00:15:00.00	10-08-2016	04:45:25	
			20	61.3	41.6	45.2	32.6	00:15:00.00	10-08-2016	05:33:03	
			22	57.5	40.9	44.7	31.4	00:15:00.00	10-08-2016	06:28:27	
		DAYTIME	27	71.7	52.7	53.6	40.0	01:00:00.00	10-08-2016	15:14:29	Traffic along Saville Road dominant but low frequency. Residential activities including lawn mower. Aircraft.
			28	62.9	46.5	49.6	38.7	01:00:00.00	10-08-2016	16:14:29	
			29	73.3	53.9	54.4	38.5	01:00:00.00	10-08-2016	17:14:29	

11.0 Results Analysis

The above noise survey, carried out between 9th and 10th August 2016, was chosen as a representative weekday period to reflect the typical noise climate for the area surrounding the proposed development site.

The noise survey results obtained for the site can, therefore, be deemed to be representative of normal activities for the area and will be used as the base for analysis and assessment purposes below.

Assessments of the individual results indicate that the monitoring positions selected are affected primarily by traffic noise sources from the movements along Saville Road. Kirklees Light Railway was the dominant source when trains passed the northern site boundary, with whistle soundings the primary source due to there being a pedestrian crossing at mid site location, however, this is only periodic and limited to daytime only. Nighttime periods were dominated at early morning by the dawn chorus, otherwise there was no discernible noise sources audible around the site.

From the data acquired during the various assessment periods the following exposure noise levels have been established for the site.

Table of Calculated Total Exposure Levels for Site

Northern Boundary

Period	**Noise Level**
Daytime (0700 – 2300 Hrs)	LAeq, 16 Hours – 43 dB
Night-time (2300 – 0700 Hrs)	LAeq, 8 Hours – 31 dB LAmax - 59 dB * LAmax Average – 35 dB

Southern Boundary

Period	**Noise Level**
Daytime (0700 – 2300 Hrs)	LAeq, 16 Hours – 52 dB
Night-time (2300 – 0700 Hrs)	LAeq, 8 Hours – 35 dB LAmax - 61 dB * LAmax Average – 40 dB

* Due to dawn chorus only

12.0 Mitigating Circumstances

The proposal for the development site is for the demolition of the existing factory buildings on site and erection of variuos residential premises consisting of detached, semi-detached and terraced plots. These premises will be accessed from Saville Road to the south via a purpose built access road. Since this is an outline planning application, there are no finalized details of the residential premises proposed for the site.

There are 3 main areas to consider within the development to ensure that the building provides adequate attenuation against the ingress of external noise sources that are likely to affect the comfort and amenity of the residents.

- Building Fabric Construction
- Glazing Units
- External Recreational Areas

12.1 Building Fabric Construction

The Building Regulation, relating to the minimum acoustic requirements for the various areas of the development, must be met.

Actual verification of the acoustic properties of the buildings fabric will need to be executed by pre-completion sound testing prior to occupation, or through certified test data with a Robust Details construction method.

Based upon the external baseline noise levels recorded, primarily due to traffic noise, the minimum weighted sound reduction, Rw, of the external façades will need to be Rw 40 dB to ensure that an internal specification of 30 $L_{Aeq,\ 8hours}$ dB maximum, (equivalent to NR 25), is met within the noise sensitive dwelling areas during nighttime periods, as determined within the WHO recommendations. The LAMax of 61 dB, due to the dawn chorus, will be attenuated such that the internal level will be 46 LAMax dB, generally in line with the specific requirements of WHO.

Given a typical modern wall construction comprising an internal leaf of concrete block, lined externally with either stone or brick and a cavity between of at least 75mm, the following performance would be expected from the external façade construction:

Frequency in Hz	125	250	500	1000	2000
R_W of Facade	41	45	45	54	58

Any internal wall construction will need to provide the minimum acoustic requirements necessary to meet with the Building Regulations of $D_{nT,w}$ + C_{tr} 45 dB for airborne and L'_{nTw} 62 dB for impact noise transmission, when considered between all attached residential dwellings including semi-detatched residences and flats.

The roof of the building should provide the necessary sound insulation to meet the Building Regulations with respect to the passage of sound.

12.2 Glazing Units

The primary weakness in any building envelope is usually due to windows, ventilation louvres and other apertures.

The development will not have air conditioning installed within the noise sensitive residential areas of this development, other than extraction from bathrooms which are not within the noise sensitive bedroom areas and therefore the only area of concern are the proposed window systems.

In order to provide adequate attenuation against the sound levels in the area and achieve the Building Regulations and WHO criteria, it is recommended that the formed apertures are fitted with suitable acoustic glazing units.

Using the sound exposure levels assessed for the site, based upon the worst case southern assessment, the minimum recommended Rw dB rating for the glazing systems for the site should be as follows.

Period	**Noise Exposure Level**	**Maximum Internal Bedroom Target Level**	**Minimum RW Values Required**
Daytime (0700 – 2300 Hrs)	LAeq, 16 Hours – 52 dB	LAeq, 16 Hours – 35 dB	**17 dB**
Night-time (2300 – 0700 Hrs)	LAeq, 8 Hours – 35 dB LAmax - 61 dB	LAeq, 8 Hours – 30 dB LAmax - 45 dB	**5 dB** **16 dB**

Based upon generic data for glazing systems, it is possible to provide the necessary sound insulation using a glazing system consisting of a **4mm Glass – 20mm wide Argon Filled Airspace – 4mm Glass**. This system has certified acoustic values of Rw 30 dB, with an R_A 30 dB and $R_{A,tr}$ 27 dB.

The acoustic properties of this type of glazing are provided below for reference.

Glazing type	Frequency in Hz	125	250	500	1000	2000
4/20/4	R_W of Facade	24	20	25	34	37

This is the recommended minimum combination and acoustic properties necessary to achieve the requirements for this elevation of the development.

If we consider an opening a window within a bedroom to provide additional room ventilation, the accepted attenuation value of the open window is -15 dB, this would allow for an internal noise level within a bedroom of up to 31 LAeq dB. This level of ingress is not deemed as likely to result in sleep disturbance due to external sources, set at 30 LAeq dB within WHO, based upon a dawn chorus noise source. If this were traffic related or industrial, and not natural noise, then additional mitigation considerations would need to be provided.

However, should the natural noise source be considered detrimental to sleep, exceeding the recommended WHO limit by only +1dB, and in order to ensure disturbance due to these external noise sources is not experienced whilst still provide adequate ventilation within bedroom areas, an alternative to opening a window would be to consider installation of an acoustic trickle ventilation system.

The trickle ventilation system that provides both adequate background ventilation in accordance with Approved Document F1 and the minimum acoustic properties to maintain the internal noise characteristics of a closed window using a through ventilator. The Rw values quoted above do not include for the trickle vent combination within their values and as such inclusion of a standard trickle vent will diminish the Rw values quoted.

The combined acoustic properties of the acoustic trickle vent system proposed for use on this site, Greenwood 2500EA achieve a specified sound reduction of **46 Dn,e,w dB** through the ventilator in the open position, assuming it is fitted though a 300mm thick wall. This level of attenuation is achieving the minimum requirements necessary to ensure that the internal noise levels inside the bedrooms are maintained for all elevations of this project. Other manufacturers could be considered provided that the Dn,e,w dB value is maintatined.

An alternative to a trickle vent system would be the use of a forced ventilation system, either attending to the dwelling spaces only or a "Whole House" system that would remove the need for opening windows during nighttime periods. This type of system is ususally located within the roof space of the dwelling and as such not likley to give rise to noise issues from its own operation, when considered either for the internal residents or the external amenity of the the nearby noise sensitive residential premises. An acceptable system would be the Seigenia-Aubi EUROPAC which is a forced vent specifically designed for this purpose.

12.3 External Recreational Areas

If the development is to include external recreational areas, these areas would be subject to the recorded noise climate for the site. The recorded external levels ranged between 43 LAeq dB along the northern site boundary and 52 LAeq dB along the southern site boundary during daytime periods.

A noise level of this magnitude is above the recommended noise criteria for outdoor spaces and as such mitigation would be required to achieve the limits of 50 LAeq dB for external spaces as indicated within WHO in section 5 above.

In order to reduce the external noise to below 50 LAeq dB, it is recommended that the southern and western site boundary is afforded a 2.0m high barrier. This barrier could be in the form of an earth bund, solid wall or acoustic screening. The screen method, if selected, would require a minimum 18 Kg/m^2 superficial mass which is possible with a close boarded wooden fence. The screening should be located along the length of the site boundary with Saville Road.

Inclusion of the barrier would reduce the noise levels within any external space to a calculated 39 LAeq dB which is below the level at which annoyance would be experienced by the incumbent residents. Refer to Appendix C for details of the calculation.

13.0 Report Summary

An attended pre-development acoustic assessment of the existing noise levels around the proposed development at land Dawson Fabrics Ltd site north of Saville Road, Skelmanthorpe has been undertaken in support of the proposed planning application for the site.

The noise survey established the pre-existing noise climate and sources for the area; which are primarily due to traffic movements along Saville Road to the south and the Kirklees Light Railway, periodically passing along the northern site boundary.

In order to achieve an acceptable and comfortable internal noise climate for the potential residents the WHO guidance community noise has been utilized for the acoustic target levels for the internal criteria of the dwelling areas of the development. The National Planning Policy Framework has been considered, with NR 35 daytime and NR 25 nighttime internal limits being utilized since the NPPF is not prescriptive in its noise limits.

Mandatory mitigating recommendations are not necessary to provide adequate protection against intrusion from external noise sources and achieve the WHO guidelines for the internal noise climate of the residences.

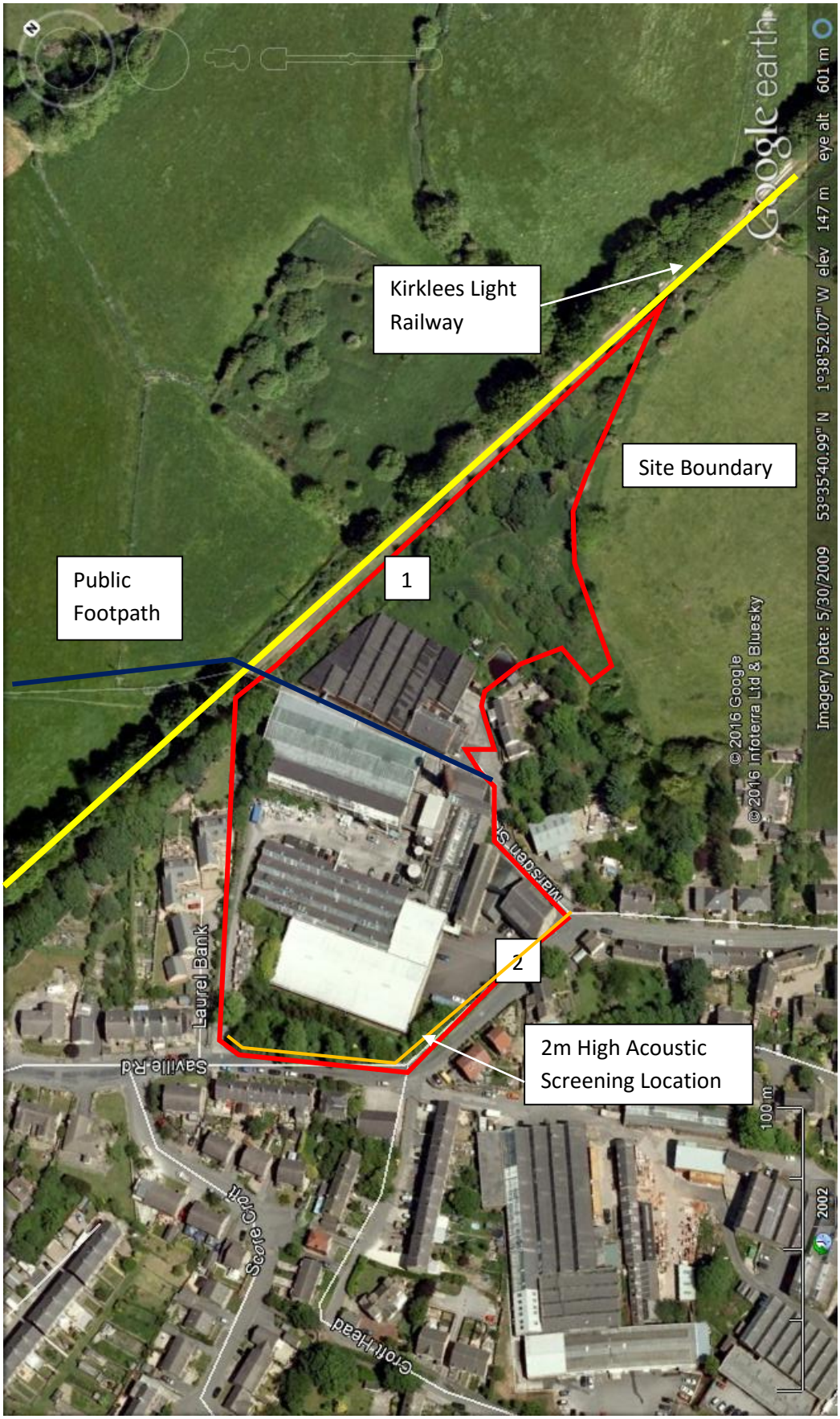
However, recommendations have been proposed for the glazing systems to be employed on this development, in order to achieve the internal dwelling room design target exposure levels as determined within WHO recommendations.

To provide background ventilation opening windows is a possibility due to the low background noise climate, however, due to the natural noise source of the dawn chorus, which places the internal noise climate above the WHO nighttime limits by +1dB, as an alternative, recommendations have been provided for the acoustic passive or forced ventilation which could be considered for use on the development.

The development may have external recreational areas and as such it is recommended that a 2.0m high acoustic barrier in the form of an earth bund, solid wall or acoustic screen is formed along the southern site boundary adjacent to Saville Road.

Provided that above recommendations are implemented within the development there is no reason to preclude the site for residential purposes on the grounds of noise alone.

APPENDIX A **Locational Outline and Monitoring Position**



APPENDIX B Noise Survey Frequency Analysis Results Table

Location	Description of Location	Period	Data ID	LAmax	LAeq	Leq dB in Freqency Bands Hz								LA10	LA90
						63	125	250	500	1	2	4	8		
				dB	dB	Hz	Hz	Hz	Hz	kHz	kHz	kHz	kHz	dB	dB
1	Northern site boundary	EVENING	1	70.1	45.1	49.8	49.6	44.3	42.9	40.5	35.8	29.2	24.3	46.2	34.1
			2	56.5	44.7	49.9	52.2	44.3	39.3	38.9	38.1	29.9	25.0	47.7	37.6
			3	51.1	43.4	46.4	46.9	41.3	36.5	37.4	39.1	28.1	22.3	47.3	36.1
		NIGHTTIME	7	41.2	24.2	42.0	32.6	23.2	19.0	17.4	14.2	12.7	12.1	24.7	22.1
			9	42.8	25.1	40.2	31.7	25.2	21.2	17.8	15.9	14.1	12.8	25.7	22.1
			11	31.7	22.7	40.0	30.3	21.5	18.3	15.1	12.1	12.2	12.7	23.4	21.9
			13	32.4	22.6	39.6	30.5	21.9	18.3	14.6	12.6	12.2	13.1	23.3	21.6
			15	30.8	22.4	40.2	30.6	22.0	17.7	13.6	12.2	11.9	13.3	23.1	21.6
			17	34.3	23.1	40.0	31.7	23.6	17.9	13.9	12.7	12.9	13.8	23.7	22.0
			19	59.4	36.9	43.2	35.1	30.8	39.0	28.2	22.8	19.6	14.8	40.3	29.6
			21	52.5	36.5	45.3	36.0	30.5	36.6	30.3	27.6	19.5	15.1	39.5	30.3
		DAYTIME	23	75.1	66.3	66.0	63.2	60.0	63.6	62.3	58.7	53.2	46.0	71.4	51.8
			24	65.7	41.9	47.4	40.9	40.3	43.4	34.0	28.3	23.7	19.5	45.7	33.7
			25	68.9	42.4	46.6	41.1	36.1	44.7	31.9	27.7	23.3	19.9	47.9	33.1
			26	59.3	36.0	49.3	39.9	33.8	32.7	31.4	27.1	22.6	20.1	38.9	31.8
2	Southern site boundary along Saville Road	EVENING	4	60.7	43.0	50.0	42.3	40.4	38.5	39.3	35.2	29.6	24.7	44.9	32.3
			5	46.6	37.5	45.5	38.0	33.3	32.5	31.5	30.5	29.3	25.7	39.9	33.4
			6	57.6	37.8	43.7	41.9	35.7	33.2	32.6	30.1	28.5	23.5	39.4	32.8
		NIGHTTIME	8	41.9	24.9	36.1	32.7	25.4	20.2	16.5	16.9	14.8	13.5	25.7	22.9
			10	37.2	24.3	35.9	31.4	23.4	17.6	15.8	16.5	16.0	14.7	25.1	22.4
			12	40.7	24.7	36.1	32.3	24.4	17.9	18.0	16.6	15.7	14.0	26.0	22.6
			14	32.4	24.3	39.1	31.2	23.4	18.7	17.7	15.6	14.9	13.5	25.6	23.0
			16	40.3	24.6	38.6	32.4	24.4	18.2	18.4	16.2	14.5	13.4	25.8	23.6
			18	34.0	25.7	37.8	32.3	25.4	20.7	20.9	16.4	13.3	13.1	27.1	23.9
			20	61.3	41.6	42.5	35.1	34.8	41.8	33.1	27.5	33.8	25.8	45.2	32.6
			22	57.5	40.9	40.6	32.8	28.9	40.7	30.4	30.6	34.3	22.0	44.7	31.4
		DAYTIME	27	71.7	52.7	58.4	52.2	46.9	47.9	49.1	45.8	39.4	31.7	53.6	40.0
			28	62.9	46.5	52.9	51.1	48.5	43.4	40.8	36.9	35.2	28.2	49.6	38.7
			29	73.3	53.9	62.5	53.3	51.7	49.6	49.6	46.8	41.3	34.3	54.4	38.5

APPENDIX C Site Boundary Screen Calculation

Project: GREENSIDE MILLS, SAVILLE ROAD, SKELMANTHORPE

SWL	63	125	250	500	1k	2k	4k	8k
Existing Sound Pressure Level at Receiver (A)	63	53	52	49	49	46	41	34

POSITIVE SCREEN

Source to Barrier	5	
Barrier to Receiver	5	(estimated distance to receiver)
Barrier Height	2	
Source Height	0.5	
Receiver Height	1.2	(direct line of sight assumed between source & receiver)
Path Difference	0.25	

Attenuation due to Screens

Path Difference	63	125	250	500	1k	2k	4k	8k
-0.30	1	0	0	0	0	0	0	0
-0.20	2	1	0	0	0	0	0	0
-0.10	3	2	1	0	0	0	0	0
-0.05	3	3	2	1	0	0	0	0
-0.01	4	4	4	3	3	2	1	1
0.00	5	5	5	5	5	5	5	5
0.01	5	6	6	6	7	8	8	8
0.05	7	7	8	9	10	12	13	13
0.10	7	8	9	10	11	14	16	16
0.20	8	9	10	11	14	16	19	19
0.30	8	9	10	13	16	18	20	20
0.40	9	10	12	14	17	20	22	22
0.50	9	10	12	15	18	20	23	23
1.00	11	12	14	18	20	23	25	25
2.00	14	15	18	20	24	27	29	29
3.00	15	17	20	22	25	28	30	30
4.00	16	18	20	24	26	30	31	31
5.00	16	18	21	25	27	30	32	32

Screening Effect from above table (B):	8	9	10	13	16	18	20	20
SRI of Screen Panels (C):	18	20	22	24	26	30	36	40
Level at Receiver due to Screening Effect (A - B)=D:	55	44	42	36	33	28	21	14
Level at Receiver due to Direct Transmission (A - C)=E:	45	33	30	25	23	16	5	-6
Resultant Level at Receiver (log add'n of D & E:	55	44	42	36	33	28	21	14
NR Level Required: nr40	67	57	49	44	40	37	35	33
Additional Attenuation Required:	-12	-13	-7	-8	-7	-9	-14	-19

dBA Correction:	-26	-16	-9	-3	0	1	1	-1
A-Weighted Equivalent	29	28	33	33	33	29	22	13
dBA Level at Receiver (with no additional attenuation):	39	dBA						

NR65	87	78	72	68	65	62	61	59
NR60	83	74	68	63	60	57	55	54
NR55	79	70	63	58	55	52	50	49
NR50	75	65	59	53	50	47	45	43
NR45	71	61	54	48	45	42	40	38
NR40	67	57	49	44	40	37	35	33
NR35	63	52	45	39	35	32	30	28
NR30	59	48	40	34	30	27	25	23
NR25	55	44	35	29	25	22	20	17

Completed By: Paul Horsley **Date:** 12.08.16