

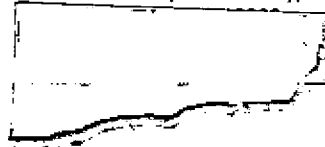


SUBSTITUTION

Noise Assessment for the Proposed Fitzalan Link Road, Littlehampton

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1.0 Introduction

This report presents the findings of a noise assessment undertaken for the proposed Fitzalan Link Road. The proposals include the construction of a new highway connecting Worthing Road to East Street. The noise effects of construction and proposed traffic noise with respect to the existing residents has been assessed using CADNA noise modelling software which incorporates ISO 9613 and CRTN methodologies and calculations. The noise models have been used to evaluate the effectiveness of proposed noise mitigation barriers, walls and bunds which have been updated from the previous version of this report.

This version of the report also considers the effects of the proposed link road on The Littlehampton Academy buildings currently being constructed and considers noise intrusion and garden noise levels at those residential dwellings adjacent to the proposed Fitzalan link.

A description of the existing noise environment in and around the site is provided. Noise surveys have been undertaken and the results used to verify predictions of the short-term and long-term effects of noise.

1.1 Scope of the Assessment

The noise assessment considers the effect of the proposed development on key sensitive human receptors. The geographical scope of the study area is confined to the area of the development as well as the existing developed areas of Littlehampton immediately surrounding the site and on the local road network. The Fitzalan Link Road development is closely linked to the proposed North Littlehampton Strategic Development Area mixed use development and associated Lyminster Road Bypass South. The noise and vibration effects of these developments is the subject of a separate assessment, however, as the traffic effects of the two schemes are linked, the cumulative effect of the traffic from two schemes has been considered as part of this assessment. Predicted noise intrusion levels will be calculated at the façades of the Littlehampton Academy facing towards the proposed Fitzalan Link Road and compared with the BB93 criteria or for the case of naturally ventilated buildings the additional BB101 criteria have also been used.

The following scenarios have been considered

- Noise from Construction
- Operational Traffic Noise (2008 for verification)
- Operational Traffic Noise 2016
- Noise Intrusion to Residential Dwellings
- Noise Intrusion to the Littlehampton Academy



2.0 Assessment Methodology

No formal consultations were undertaken during the preparation of the noise assessment. The assessments undertaken are based on a detailed noise survey of the study area followed by the development of a baseline noise propagation model. The model has been used to predict the effect of the various noise sources at the various key noise receptors.

2.1 Construction Noise Assessment Criteria

Noise from potential construction activity has been assessed in accordance with BS 5228-1: 2009 'Code of Practice for Noise and vibration control on construction and open sites' which provides guidance on the prediction, measurement and assessment of noise generated from construction sites as follows.

Significance based upon fixed noise limits

In order to determine whether construction noise levels are significant or not, reference has been made to the method provided in Annex E.2 of BS 5228-1:2009. On demolition/construction sites, noise limits for works are generally set with reference to the need to avoid speech interference in buildings adjacent to the site. Annex E.2 gives advice on maximum levels of demolition/construction site noise during daytime hours (taken to be 0700 to 1900 hours). The advice is that the noise levels outside the nearest window of the occupied room closest to the site boundary should not exceed:

- 75 dBA in urban areas near main roads or in heavy industrial areas;
- 70 dBA in rural, suburban and urban areas away from main roads and industrial noise.

For the purposes of this assessment it is considered that the existing noise sensitive properties adjacent to the site should be assessed against the 75 dB(A) criteria which is the upper limits level as measured outside of living rooms and offices below which conversation would not be difficult.



2.2 Traffic Noise Assessment Criteria

The assessment compares the 'with development' scenario and the 'without development' scenario for a selection of residential receptors considered to be worst case in terms of their proximity to traffic changes. For the purposes of assessing the significance of any effects, the criteria in Table 2.1 has been used. This table has been produced with reference to Chapter 2 of the Interim Advice Note 81/06 (Highways Agency, June 2006).

Table 2.1 Environmental Effects Significance Criteria

Variation in Road Traffic Noise Levels $L_{A10(18\text{ hr})}$ (dB)	Significance
> +5.0	Substantial Adverse
+3.0 – +4.9	Moderate Adverse
+1.0 – +2.9	Slight Adverse
+0.9 – -0.9	Neutral
-1.0 – -2.9	Slight Beneficial
-3.0 – -4.9	Moderate Beneficial
< -5.0	Substantial Beneficial

In addition to the above, an assessment will be undertaken to assess eligibility under the 1975 Noise Insulation Regulations. The 1975 Noise Insulation Regulations and subsequent amendment Regulations provide criteria for assessing the eligibility for noise mitigation or properties based on variations in traffic noise due to a new or improved road scheme. Noise level criteria are given within the Regulations which, if satisfied, indicate whether properties in the vicinity may be entitled to the installation of additional noise insulation or to a grant to cover the cost of the noise insulation.

The entitlement conditions of the Noise Insulation Regulations are triggered when:

- 'the L_{A10} (18 hour) predicted figure is greater by at least 1 dB than the prevailing noise level'
- 'the L_{A10} (18 hour) predicted figure is not less than the specified level (L_{A10} (18 hour) = 68 dB)'
- 'the noise caused, or expected to be caused, by traffic using or expected to use the new highway makes an effective contribution to the L_{A10} (18 hour) predicted figure of at least 1 dB'



2.3 Noise Intrusion Assessment Criteria

The criteria in BS 8233:1999 '*Sound insulation and noise reduction for buildings – Code of practice*' has been chosen as a suitable method for determining an adequate level of noise control to ensure that noise levels within existing properties, as a result of the proposed redevelopment, meet the following recommended noise level targets.

These targets are:

		Good		Reasonable	
Living rooms	$L_{Aeq} =$	30	–	40 dB	
Bedrooms	$L_{Aeq} =$	30	–	35 dB,	$L_{Amax, \text{night-time}} = 45 \text{ dB}$
Gardens	$L_{Aeq} =$	50	–	55 dB	

BS 8233 suggests that a typical façade, regardless of construction, will offer a maximum of 15 dB sound *insulation* when windows are open. Therefore, the maximum external noise level from the source under consideration will be 50 dB(A) to ensure a maximum L_{Aeq} of 35 dB within the rooms and thus achieve the 'reasonable' internal noise target level.

These levels are also comparable to the World Health Organisation Recommendations in their 'Guidelines for Community Noise' (1999) publication which states that outdoor levels of 45 dB $L_{Aeq,T}$ for open windows at night or internal levels of 30 dB $L_{Aeq,T}$ are guideline values to prevent sleep disturbance. Similarly outdoor levels of 60 dB L_{Amax} for open windows at night or internal levels of 45 dB L_{Amax} are also maximum noise level guideline values to prevent sleep disturbance.



2.3 Building Bulletin 93 (BB 93)

The acoustic performance standards of this report will be based upon guidance provided within Section 1.0 of BB93, which provides the design standard for acoustics in new and refurbished school buildings. The regulatory framework of BB93 is provided by the following Building Regulation.

Approved Document E deals with the requirements of Part E of Schedule 1 to the Building Regulations 2000 and now includes schools within its requirements. The document states that to satisfy Requirement E4 it will be necessary to meet the standards stated in Section 1.0 of BB93.

Additionally, Requirement E4 specifically states "Each room or other space in a school shall be designed and constructed in such a way that they have acoustic conditions and insulation against disturbance by noise appropriate to its intended use." This requirement relates not only to rooms but also to circulation spaces such as staircases and corridors

Therefore, compliance with both regulations will be satisfied by adhering to Section 1.0 of BB93.

2.4 Building Bulletin 101 (BB 101)

Building Bulletin 101 provides the regulatory framework in support of the Building Regulations for the adequate provision of ventilation in schools. Naturally ventilated schools are required to meet the standards defined by BB93.

The guidance is as follows:

- For the Minimum Fresh Air Supply Rate of 3 l/s per person, the design should achieve the performance standards for the indoor ambient noise levels in Table 1.1 of Building Bulletin 93. If the design uses a Minimum Fresh Air Supply Rate that is greater than 3 l/s per person, the indoor ambient noise levels with this ventilation rate should still achieve the BB93 performance standards in Table 1.1 of BB93.
- When the Design Capability Supply Rate of 8 l/s per person is provided by natural ventilation, the design should achieve the BB93 performance standards for the indoor ambient noise levels in Table 1.1 of BB93 when they have been increased by 5 dB $L_{Aeq, 30min}$.



Table 2.2 Education Building Noise Intrusion Level Criteria

Target internal noise levels from external noise sources for spaces on western façades of the Littlehampton Academy are considered with reference with Building Bulletin 93 (BB 93) and Building Bulletin 101 (BB 101). The internal noise level requirements appropriate to the new building, if naturally ventilated, assume that the ventilation rate of 8 l/s will be achieved by open windows. The recommended target internal and resulting external noise levels are given in Table 2.2. It is assumed that an open window can reduce noise levels by up to 15 dB. If the building / space is not naturally ventilated then the more stringent BB 93 criteria would be used, but further attenuation would be achieved through closed windows and for the purpose of this assessment are assumed to reduce external noise levels by up to 32 dB.

Table 2.2 Noise Level Criteria

Sensitive Space	L _{Aeq} 30 mins (dB)			
	Internal Requirement (BB 93) Not Naturally Ventilated	Internal Requirement (BB 101) Naturally Ventilated	External Requirement (BB93) Windows Open	External Requirement (BB101) windows Open
Music Ensemble, Practice or Performance rooms SEN Classrooms, Speech Therapy Rooms Drama Studios, Large Lecture Rooms	30	35	45	50
Primary School Classrooms, & General Teaching Areas Nursery School Playrooms and Quiet Rooms Music Classrooms, Libraries Small Lecture Rooms, Conference Rooms Medical rooms, Multi-Purpose Halls	35	40	50	55
Science Labs, Design and Technology areas Sports Halls, Dance Studios, Offices	40	45	55	60
Atria / Circulation Spaces Dining Rooms, Corridors, Changing Areas	45	50	60	65
Kitchens Toilets	50	55	65	70



2.4 Noise Modelling Methodology

Three dimensional noise modelling has been undertaken, based on the monitoring data, to predict L_{A90} and source noise levels at a large number of locations both horizontally and vertically. CADNA noise modelling software has been used. This model is based on the Department of Transport Calculation of Road Traffic Noise (CRTN) and ISO 9613 noise propagation methodology and allows for detailed prediction of noise levels to be undertaken for large numbers of receptor points and different noise emission scenarios both horizontally and vertically.

The modelling software calculates noise levels based on the emission parameters and spatial settings that are entered. Input data, assumptions and model settings as given in Table 2.2 below have been used.

Table 2.2 Modelling Parameters Sources & Assumptions

Parameter	Source	Details
Horizontal distances – around site	Ordnance Survey	Ordnance Survey
Ground levels – around site	Ordnance Survey	Ordnance Survey
Ground levels – other areas	Site Observations and Ordnance Survey	OS 1:25,000 contours and OS 1:10,000 spot heights.
Traffic data – local roads	WYGE	Traffic flows for local roads based on WYGE observations and experience.
Building heights – around site	WYGE Observations	8 m height for two storey residential properties.
Barrier heights	WYGE Observations	All barriers at 1.0 m with the exception of hedges and trees which are assumed to offer no noise protection. Barriers on site from site visit data.
Receptor positions	WYGE	1 m from façade, height of 1.5 m for ground floor, 4 m for first floor properties with ground floor or bungalow dormer windows. 7 m for dormer windows on two storey properties. 1.5 m height for model grid and monitoring locations for validation.
Reflections	WYGE	First order reflections have been applied based on mirror image sources
Absorbent Ground	CADNA	Frequency dependant ground absorption has been applied based on values specified in VDI 2714/16 clause 6.3.
Façade Correction	CADNA	Façade corrections have been incorporated into the modelling
Gradient	CADNA	Gradient for each road has been calculated from the height information using the 'calc slope of roads' tool

The CRTN methodology uses predicted road traffic volumes to model noise levels at receptor locations. These have been positioned 1 m in front of external windows or doors of an eligible room (i.e. a living room or bedroom of a residential property). It is acknowledged that a number of these assumptions will affect the overall noise levels presented in this report. However, it should be noted that certain assumptions made, as identified above, are worst case.



2.5 Model Input Data

2.5.1 Construction Noise

Information regarding noise emissions from equipment used on construction and open sites has been obtained from Annex C of BS 5228-1:2009 *Code of practice for noise and vibration control on construction and open sites – Part 1: Noise*. This annex presents a range of current sound level data on typical site equipment and common site activities.

This data was obtained by field measurements for items of plant in actual use on construction and open sites in the UK. Levels quoted in the database are based on an average (logarithmic) of measured sound levels, and where appropriate have been derived from more than one model of similarly sized plant. The results are presented as un-weighted octave band activity L_{eq} levels, and overall A-weighted activity L_{eq} levels in dB. All sound pressure levels are standardized to 10 metres from the plant.

The activities, items of plant and associated noise levels shown in Table 2.3 have been used for the purposes of this assessment based upon WYGE experience of similar projects.

Table 2.3 Assumed Construction Equipment

Activity	Plant / Equipment	L_{Aeq} dB @ 10 m
Ground Excavation / Earthworks	Tracked Excavator	85
	Articulated Dump Truck	93
	Pneumatic Breaker x2	87
Construction	Tracked Excavator	85
	Piling x2	97
	Air Hammer x2	90
	Roller Compaction x2	70
	Articulated Dump Truck	93

2.5.2 Road Traffic Data

All roads expected to make a significant contribution have been included within this assessment. Co-ordinates for each of the road links have been taken from available Ordnance Survey data. Traffic data for roads affected by the proposed road has been predicted by WYG as shown in Table 2.4 and shown in SK04.



Table 2.4 Traffic Data used in Models

Road	2008 Baseline			2016 Do Minimum			2016 Do Something		
	18AAWT	HGV%	Speed (kmph)	18AAWT	HGV%	Speed (kmph)	18AAWT	HGV%	Speed (kmph)
Link 1 Bridge Road	28665	HGV10	52	30252	HGV10	52	31127	HGV09	57
Link 2 Bridge/Terminus Road	13534	HGV06	46	16244	HGV05	46	16694	HGV04	45
Link 3 Franciscan Way	16081	HGV08	26	17340	HGV07	26	16647	HGV04	33
Link 4 East Street (B2140)	8033	HGV11	30	8882	HGV10	30	9072	HGV10	30
Link 5 East Street (B2187)	10188	HGV05	53	10711	HGV04	51	13517	HGV05	44
Link 6 Fitzalan Road	5261	HGV09	43	5399	HGV09	47	5680	HGV08	39
Link 7 (East Street)	10529	HGV04	50	11943	HGV04	50	13228	HGV04	49
Rbt 5 (Link 7)	10529	HGV04	50	11943	HGV04	50	13228	HGV04	49
Link 8 St Floras Road	4325	HGV09	46	4489	HGV08	45	4688	HGV08	45
Link 10 Southfields Road	4211	HGV09	35	4267	HGV09	35	4551	HGV08	35
Link 9 Horsham Road	12206	HGV08	26	13728	HGV07	27	11083	HGV03	28
Link 11 Horsham Road	12206	HGV08	26	13728	HGV07	27	11083	HGV03	28
Link 12 Horsham Road	12206	HGV08	26	13728	HGV07	27	11083	HGV03	28
Link 13 Horsham Road	13727	HGV09	44	13381	HGV08	36	10520	HGV04	33
Link 14 Worthing Road	11044	HGV10	36	10941	HGV09	38	11562	HGV08	35
Link 15 A259	23196	HGV08	53	25197	HGV08	51	25859	HGV08	47
Link 16 Body Shop	3257	HGV05	44	3316	HGV10	43	3493	HGV09	45
Link 17 Worthing Road	27062	HGV11	51	28861	HGV11	49	31867	HGV09	46
rbt 4 (link 17)	27062	HGV11	51	28861	HGV11	49	31867	HGV09	46
Link 18 Worthing Road	24004	HGV12	49	25675	HGV12	48	30048	HGV09	25
Rbt 2 (Link 18)	24004	HGV12	49	25675	HGV12	48	30048	HGV09	25
Link 19 Worthing Road	23171	HGV13	33	24346	HGV12	31	23534	HGV10	36
Rbt 1 (Link 19)	23171	HGV13	33	24346	HGV12	31	23534	HGV10	36
Link 20 Wick Street	12171	HGV14	28	12307	HGV13	24	12070	HGV10	28
Link 21 Arundel Road	8872	HGV15	45	8231	HGV16	45	7576	HGV11	45
Link 22 Oun Road	3826	HGV11	45	3902	HGV09	45	4038	HGV08	45
Link 23 Arundel Road	9898	HGV11	30	10979	HGV09	30	9543	HGV06	27
Link 24 Cornwall Road	1177	HGV05	39	1683	HGV02	39	1377	HGV03	41
Link 25 A284 Arundel Road South	10544	HGV10	46	11911	HGV08	46	9995	HGV05	46
Link 26 A259 Bypass	21163	HGV12	57	22258	HGV11	51	23676	HGV11	57
Link 27 Hawthorn Road	1198	HGV09	25	1230	HGV08	23	1273	HGV07	25
Link 28 Courtwick Road	5336	HGV10	30	6352	HGV08	29	6608	HGV08	30
Link 29 Lyminster Road	11951	HGV13	25	13074	HGV12	23	9559	HGV07	27
Link 30 Lyminster Road	11981	HGV13	28	13120	HGV12	25	9571	HGV07	23
Link 31 Lyminster Road	13565	HGV11	59	14550	HGV11	60	14871	HGV11	55
Rbt 3 (link 31)	13565	HGV11	59	14550	HGV11	60	14871	HGV11	55
Link 32 Mill Lane	3634	HGV11	27	3934	HGV11	27	8716	HGV12	19
Link 33 Mill Lane W of Hearnefield Road	3163	HGV01	45	2983	HGV00	46	9166	HGV10	47
Link 36 New Road North Section	0	HGV01	0	0	HGV01	0	17026	HGV05	64
Link 37 Proposed Road South of New Roundabout	0	HGV01	0	0	HGV01	0	10131	HGV15	18
Link 38 Highdown Drive	843	HGV05	41	1314	HGV04	41	0	HGV04	0
Link 38 Proposed Highdown Drive	0	HGV01	0	0	HGV01	0	1118	HGV05	41
Link 39 Fitzalan North	0	HGV01	0	0	HGV00	0	8285	HGV16	49
Fitz rbt 1(link 39)	0	HGV02	0	0	HGV00	0	8285	HGV16	49
Link 40 Fitzalan South	0	HGV01	0	1867	HGV06	0	2370	HGV07	15
Link 41 Elmgrove Road	1789	HGV07	27	1837	HGV07	26	1906	HGV07	27



2.5.3 Model Verification

The model was verified by modelling the monitoring locations for the day and night-time scenarios. The comparison between the monitoring and modelling results are shown in Tables 10.8 and 10.9 below.

Table 2.5 Modelled vs. Monitored Results L_{Aeq}

Loc	L_{Aeq} Daytime			L_{Aeq} Night-time		
	Monitored	Modeled	Difference	Monitored	Modeled	Difference
LT1	64.9	63.6	-1.3	56.8	58.0	1.2
LT2	56.1	56.1	0.0	49.6	49.7	0.1
ST1	64.2	63.6	-0.6	-	-	-
ST2	63.7	64.5	0.8	54.4	55.0	0.6
ST3	66.2	67.2	1.0	-	-	-
ST4	54.5	51.7	-2.8	-	-	-
ST5	66.1	66.3	0.2	61.8	62.5	0.7
ST6	69.4	70.5	1.1	63.0	64.4	1.4
ST7	71.4	71.1	-0.3	-	-	-
ST8	63.2	62.1	-1.1	-	-	-
ST9	43.6	46.0	2.4	-	-	-
ST10	42.5	44.9	2.4	-	-	-
ST11	73.9	72.0	-1.9	-	-	-
ST12	64.8	63.8	-1.0	-	-	-
ST13	40.9	43.9	3.0	-	-	-
ST14	51.9	54.7	2.8	-	-	-
ST15	83.6	80.8	-2.8	-	-	-

All values are sound pressure levels in dB re: 2×10^{-5} Pa

Table 2.6 Modelled vs. Monitored Results L_{A10}

Loc	L_{A10} , 18 hours		
	Monitored	Modeled	Difference
LT1	64.5	71.3	6.8
LT2	56.0	51.7	-4.3
ST1	67.4	66.9	-0.5
ST2	65.1	46.4	-18.7
ST3	69.3	72.0	2.7
ST4	52.1	44.1	-8.0
ST5	68.3	73.5	5.2
ST6	70.6	74.9	4.3
ST7	73.2	72.2	-1.0
ST8	64.8	67.0	2.2
ST9	43.5	47.4	3.9
ST10	43.4	41.5	-1.9
ST11	76.9		
ST12	67.4	62.6	-4.8
ST13	41.0	41.5	0.5
ST14	52.4	50.3	-2.1
ST15	86.9	75.3	-11.6
3hr1	63.5	67.6	4.1
3hr2	71.0	68.9	-2.1
3hr3	50.5	55.1	4.6
3hr4	49.2	50.9	1.7



3hr5	65.1	47.3	-17.8
3hr6	53.2	47.0	-6.2
3hr7	48.3	45.6	-2.7
3hr8	50.1	45.2	-4.9

All values are sound pressure levels in dB re: 2×10^{-5} Pa

The L_{Aeq} verification points show a divergence between monitored and modelled results of no more than 3 dB, the model is assumed to be suitably verified.

With regard to the L_{A10} models these are based directly on the traffic data provided to enable a direct comparison of the with and without scenarios generated by the traffic models. As these noise levels are based on the traffic model flows (which in turn are based on the traffic counts) there is a less strong correlation between the modelled and monitored results. The most significant differences are seen in locations ST2 which is influenced by existing train passing events, which are not taken account of in the traffic models, location 3hr5 which was affected by noise from the adjacent school playground during the survey and ST15 which was affected by peak traffic noise during the 15 minute survey.

2.6 Sensitive Receptors

Table 2.7 summarises receptor locations that have been selected to represent worst-case representative existing residential receptors. Worst case facades of properties have been represented. The locations of the receptors are shown on SK02.

Table 2.7 Existing Receptor Locations for Delivery and Traffic Noise Assessment

Receptor	Address	Grid reference	
		X	Y
R17	89 Highdown Drive	503027.1	103187.4
R18	18 Lammar Close	503056.6	103380.2
R19	10 Toddington Park	503126.2	103427.3
R31	158 Highdown Drive	503085.8	103252.4
R32	150 Highdown Drive	503087.7	103218.4
R33	170 Highdown Drive	503089.4	103322.8
R34	138 Highdown Drive	503069.3	103159.1
R35	8 Amberley Close	503090.1	103016.2
R36	10 Amberley Drive	503100.5	102990.0
R37	17 Amberley Close	503108.9	102922.8
R38	38 Highdown Drive	503110.6	102741.6
R39	26 Highdown Drive	503125.9	102688.6
R40	85 Cornwall Road	503134.9	102578.6
R41	5 Paterson Willson Road	503155.7	102505.8
R42	15 Rosemead	503213.0	102452.8



3.0 Baseline Conditions

3.1 Noise Survey

A monitoring survey was undertaken to characterise baseline ambient noise levels currently experienced on the site and to establish the relative local background and traffic noise levels.

Equipment used during the survey included:

B&K 2260	Environmental Noise Analyser	s/n	2361273
B&K 4231	Calibrator	s/n	2326568
Norsonic 131	Environmental Noise Analyser	s/n	1312722
Norsonic 1251	Sound Calibrator	s/n	31043

The measurement equipment was checked against the appropriate calibrator at the beginning and end of the measurements, in accordance with recommended practice and no drift was observed. The accuracy of the calibrators can be traced to National Physical Laboratory Standards, calibration certificates for which are available on request.

A baseline monitoring survey was undertaken at locations (as specified in Table 3.1 and shown in SK02) from 16:50 Monday 19th May 2008 to 13:30 Wednesday 21st May 2008. The noise survey consisted of one unattended noise meter left to measure noise levels throughout this period and six short-term measurements for a minimum of 10 minutes. Measurements were taken at an approximate height of 1.5 metres in free field conditions. Weather conditions during the survey were observed as being dry and still.

During the noise survey it was noted that highway works were affecting traffic flows. It was therefore deemed that noise measurements on the road near to these works would potentially not be representable of normal conditions. In view of this, additional noise measurements were undertaken at roadside locations. Further noise measurements were also undertaken at locations on site to take into account seasonal changes. In total, eleven additional measurements were taken as shown on SK02 and described in Table 3.1. Nine short-term measurements were undertaken between 12:30 – 16:45 Friday 29th August 2008 with one additional measurement taken at original location ST6. A noise analyser was left unattended to measure levels over a week from Friday 29th August to 15:30 3rd September 2008 at LT2.

In addition, in 2009 further monitoring was undertaken at 8 locations using the 3hr shortened form of monitoring in accordance with eth CRTN methodology for the purpose of identifying existing noise levels close to the proposed road.

Table 3.1 Noise Monitoring Locations

Ref	Description	Co-ordinates	
		X	Y
LT1	Public open space in the junction of Lyminster Road and Church Lane.	502506.8	104733.6
LT2	Adjacent to fishing pond to the east of Greencore Glasshouses.	504062.2	103817.5
ST1	Mill Lane/ Fullers Walk junction.	502876.6	104028.5
ST2	Toddington Lane, on bend before rail crossing.	503419.9	103783.2
ST3	Layby on Lyminster Road /Hernfield Road junction.	502758.7	103981.1
ST4	Ind estate road, entrance to triangular building.	503689.2	104027.5
ST5	Toddington Road/ Worthing Road junction.	503330.8	103401.7
ST6	Worthing Road roundabout.	503789.4	103314.0
ST7	2 m from roadside on pavement adjacent to 2 Lyminster Road.	502685.5	103443.3
ST8	3 m from fenceline bordering 18 Lammas Close.	503061.7	103378.7
ST9	Wire fenceline at top of drive to 41 Griffen Crescent.	502945.3	103790.9
ST10	Footpath to the rear of the Old Vicarage, Lyminster Road.	502967.8	104729.9
ST11	2 m from roadside on pavement adjacent to 245 Lyminster Road.	502884.2	105708.8
ST12	Toddington Lane adjacent to Yoder Toddington Nurseries.	502991.3	103925.7
ST13	Loading area adjacent to Zuider Zee Nurseries.	503576.0	104245.0
ST14	Adjacent to fishing pond 3 m from Greencore Glasshouses.	504051.0	103858.3
ST15	North side of A259 adjacent to railway bridge, east of development site.	503981.7	103487.7
3hr1	Off East street Near roundabout	503225.2	102357.1
3hr2	Off Fitzalan Road	503207.6	102310.2
3hr3	South of Summerlea House Nursing Home	503214.0	102415.4
3hr4	North of 15 Rosemead Road	503210.8	102462.3
3hr5	South of Elm Grove Infant School	503180.3	102572.4
3hr6	Opposite 1 Paterson Wilson Road	503167.2	102543.6
3hr7	Opposite 16 Amberly Close	503142.1	102934.3
3hr8	Opposite 46 Highdown Drive	503136.2	102758.5

3.2 Noise Survey Results

Ambient and background noise levels are usually described using the L_{Aeq} index (a form of energy average) and the L_{A90} index (i.e. the level exceeded for 90% of the measurement period) respectively. Road traffic noise is generally described using the L_{A10} index (i.e. the level exceeded for 10% of the measurement period). The results of the statistical measurements and frequency measurements conducted during the 2008 survey are summarised in Table 3.2 below. All values are sound pressure levels in dB (re: 2×10^{-5} Pa). The results of the 2009 survey are shown in Table 3.3.

Table 3.2 Results of 2008 Baseline Noise Monitoring Survey (Average Levels)

Period	Duration	Monitoring times	Location	L_{Aeq} (dB)	L_{Amax} (dB)	L_{Amin} (dB)	L_{A10} (dB)	L_{A90} (dB)
Day	28.5 hours	19/05/2008 16:49 - 23:00 20/05/2008 07:00 - 23:00 21/05/2008 07:00-13:20	LT1	64.9	86.2	48.7	65.5	54.6
Night	16 hours	19-20/05/08 23:00 - 7:00 20-21/05/08 23:00 -07:00		56.8	71.5	40.0	60.7	46.0
Day	Hours	29/09/2008 15:30 - 23:00 30-31/09/08 07:00- 23:00 01-02/10/08 07:00 -23:00 03/10/2008 07:00 -15:30	LT2	56.1	81.5	45.8	57.0	49.7
Night	hours	29-31/09/08 23:00-07:00 01-02/10/08 23:00 -07:00 03/10/2008 00:00 -07:00		49.6	68.1	38.6	52.4	42.4
Day	10 mins	20/05/2008 17:32	ST1	64.2	80.5	38.3	68.4	45.0
	10 mins	20/05/2008 18:05	ST2	63.7	84.5	42.3	66.1	46.0
	10 mins	20/05/2008 17:45	ST3	66.2	79.7	43.2	70.3	53.3
	10 mins	20/05/2008 18:24	ST4	54.5	77.5	45.0	53.1	46.9
	10 mins	20/05/2008 18:50	ST5	66.1	78.1	51.8	69.3	55.4
	10 mins	20/05/2008 19:05	ST6	67.9	80.0	51.2	71.3	58.0
	5 mins	29/08/2008 16:24	ST6	69.4	80.0	59.7	71.6	65.4
	10 mins	29/08/2008 16:36	ST7	69.4	80.0	59.7	71.6	65.4
	10 mins	29/08/2008 12:36	ST8	71.4	83.6	61.7	74.2	64.9
	10 mins	29/08/2008 12:56	ST9	63.2	76.2	49.1	65.8	56.7
	10 mins	29/08/2008 13:27	ST10	43.6	71.2	37.2	44.5	39.2
	10 mins	29/08/2008 13:41	ST11	42.5	58.8	38.0	44.4	39.4
	10 mins	29/08/2008 13:57	ST12	64.8	80.6	38.5	68.4	40.5
	10 mins	29/08/2008 14:49	ST13	40.9	60.1	35.7	42.0	37.7
	10 mins	29/08/2008 15:22	ST14	51.9	64.3	44.6	53.4	48.6
	10 mins	29/08/2008 16:06	ST15	83.6	96.8	63.2	87.9	72.5
Night	10 mins	20/05/2008 21:31	ST1	60.7	79.0	35.7	61.4	38.3
	10 mins	20/05/2008 22:20	ST2	54.4	70.2	37.6	58.4	39.6
	10 mins	20/05/2008 21:47	ST3	63.6	83.0	39.9	67.2	43.5
	10 mins	20/05/2008 22:06	ST4	48.4	68.5	37.9	48.8	41.3
	10 mins	20/05/2008 22:37	ST5	61.8	82.2	51.1	65.0	52.9
	10 mins	20/05/2008 23:02	ST6	63.0	84.6	42.9	67.3	49.6

All values are sound pressure levels in dB re: 2×10^{-5} Pa.



Table 3.3 Results of 2009 Baseline Noise Survey

Name	Start	Duration	L _{Aeq}	L _{Amax}	L _{Amin}	L _{A10}	L _{A90}
3hr1	13/10/2009 10:26	3 hours	62.5	90.8	43.9	63.5	61.2
3hr2	13/10/2009 10:30	3 hours	66.3	91.9	37.2	71	50.5
3hr3	13/10/2009 13:39	3 hours	49.2	75.3	36.6	50.5	47.2
3hr4	13/10/2009 14:00	3 hours	46.8	63.8	38.7	49.2	41.2
3hr5	14/10/2009 10:55	3 hours	67.2	98.0	38.9	65.1	43.1
3hr6	14/10/2009 11:19	3 hours	49.6	81.7	36.4	53.2	42.5
3hr7	14/10/2009 14:45	3 hours	47.3	65.7	41.7	48.3	46.7
3hr8	14/10/2009 14:51	3 hours	48.2	70.0	39.1	50.1	42.0

3.3 Existing Noise Environment

Existing ambient noise levels around the site are dominated by traffic using Worthing Road, Lyminster Road and East Street.



4.0 Identification and Evaluation of Impacts

4.1 Construction Noise Assessment

Table 4.1 shows predicted levels of construction noise at existing residential receptors for comparison with the recommended noise limit within BS 5228-1 fixed limit of 75 dB. This assessment has been undertaken without hoarding mitigation. The highest noise level at each receptor throughout the construction process has been used.

Table 4.1 Construction Noise Assessment Results

Ref	Location	Worst Case Predicted Noise Levels from Construction L_{Aeq}
R17	89 Highdown Drive	51.0
R18	18 Lammar Close	56.7
R19	10 Toddington Park	56.5
R31	158 Highdown Drive	56.1
R32	150 Highdown Drive	57.1
R33	170 Highdown Drive	60.5
R34	138 Highdown Drive	56.8
R35	8 Amberley Close	54.1
R36	10 Amberley Drive	53.6
R37	17 Amberley Close	58.8
R38	38 Highdown Drive	62.1
R39	26 Highdown Drive	66.6
R40	85 Cornwall Road	57.4
R41	5 Paterson Willson Road	49.8
R42	15 Rosemead	49.0

All values are sound pressure levels in dBA re: 2×10^{-5} Pa.

Results above in table 4.1 indicate that the noise levels would be below the noise limit of 75 dB at all of the existing residential receptors throughout the construction process. However, as a detailed construction plan of works including types and number of machinery is not available, there is potential for marginal exceedances at receptor dwellings for a limited duration, as those road works closest to the residential dwellings are undertaken. Proposed construction noise mitigation measures are therefore recommended (see section 5.0).



4.2 Operational Phase (Traffic Noise) Assessments

Table 4.2 below show the results of the traffic assessment comparing the L_{A10} noise levels from the 'with' and 'without' development traffic flows. SK04 illustrates the figures in 2016 'with' scheme and SK05 illustrates the change in noise levels as a result of the scheme.

Table 4.2 Traffic Noise Assessment

Ref	L_{A10} 2008 Without Development	2016 DM L_{A10} Without Development	2016 DS L_{A10} With Development	Effect of Scheme 2016 (change in noise levels $L_{A10(18hr)}$)
R17	54.8	56.2	56.9	0.7
R18	69.2	69.5	69.4	-0.1
R19	65.6	66.3	68.7	2.4
R31	53.1	54.9	63.6	8.7
R32	48.3	51.2	64.5	13.3
R33	61.9	62.9	66.6	3.7
R34	48.1	50.4	61.5	11.1
R35	47.0	48.7	62.1	13.4
R36	46.9	48.5	63.6	15.1
R37	45.2	46.7	63.8	17.1
R38	44.1	44.9	60.3	15.4
R39	44.6	45.2	63.7	18.5
R40	43.8	44.5	60.0	15.5
R41	43.4	44.0	56.9	12.9
R42	52.7	53.0	59.8	6.8

All values are sound pressure levels in dB re: 2×10^{-5} Pa.

The results show that the magnitude of the noise effect of the proposed scheme ranges from a 'slight beneficial' to 'substantial adverse' effect. Receptors that experience a reduction in noise levels are those affected by the reduction in traffic flows on Lymister Road, Wick Street and Worthing Road. Receptors that see a substantial adverse effect (NB of cumulative effects of both of the schemes) are located close to the new roads around Toddington Park and close to the Fitzalan Link Road.

There are no receptors that qualify for noise insulation under the Noise Insulation Regulations, as no properties that have an existing noise level of 68 dB or above and increase in noise levels by more than 1 dB, as a result of a new or altered highway.

4.2 Residential Noise Intrusion Assessment

Predicted internal L_{Aeq} noise levels, at nearby sensitive receptors of the proposed Fitzalan Link Road without any mitigation have been assessed both with windows open, where a reduction from a partially open window of 15 dB has been used, and with windows closed where an assumption of single glazing with a sound reduction of 30 dB has been used.

Table 4.3 Noise Intrusion Levels L_{Aeq}

Location	External L_{Aeq}	Internal L_{Aeq} with Windows Open	Internal L_{Aeq} with Windows Closed	Criteria Internal L_{Aeq}
R17	54.9	39.9	24.9	40
R18	67.4	52.4	37.4	40
R19	66.7	51.7	36.7	40
R31	61.6	46.6	31.6	40
R32	62.5	47.5	32.5	40
R33	64.6	49.6	34.6	40
R34	59.5	44.5	29.5	40
R35	60.1	45.1	30.1	40
R36	61.6	46.6	31.6	40
R37	61.8	46.8	31.8	40
R38	58.3	43.3	28.3	40
R39	61.7	46.7	31.7	40
R40	58.0	43.0	28.0	40
R41	54.9	39.9	24.9	40
R42	58.0	43.0	28.0	40

All values are sound pressure levels in dB re: 2×10^{-5} Pa.

The assessment presented in the table above shows that the internal L_{Aeq} noise levels from the proposed Fitzalan Link Road generated from the 2016 'Do Something' (with development) traffic model. The assessment shows that the predicted noise levels from the 2016 'Do Something' (which incorporates traffic using the Fitzalan link road) will meet the relevant noise intrusion criteria at all receptors with windows closed without any mitigation.



4.3 Residential Garden Noise Assessment

Predicted external L_{Aeq} noise levels, at nearby sensitive garden receptor locations, adjacent to the proposed Fitzalan Link Road without any mitigation has been assessed.

Table 4.3 Noise Intrusion Levels L_{Aeq}

Location	External L_{Aeq}	Criteria External L_{Aeq}
R31 Garden Receptor	54.9	50 - 55
R32 Garden Receptor	67.4	50 - 55
R33 Garden Receptor	66.7	50 - 55
R34 Garden Receptor	61.6	50 - 55
R35 Garden Receptor	62.5	50 - 55
R36 Garden Receptor	64.6	50 - 55
R37 Garden Receptor	59.5	50 - 55
R38 Garden Receptor	60.1	50 - 55
R39 Garden Receptor	61.6	50 - 55
R40 Garden Receptor	61.8	50 - 55
R41 Garden Receptor	58.3	50 - 55

All values are sound pressure levels in dB re: 2×10^{-5} Pa.

The assessment presented in the table above shows that the external L_{Aeq} noise levels within gardens from the proposed Fitzalan Link Road generated from the 2016 'Do Something' (with development) traffic model. The assessment shows that the predicted noise levels from the 2016 'Do Something' (which incorporates traffic using the Fitzalan link road) will be above the relevant criteria for gardens and external spaces (55 dB) at all receptors with the exception receptor R31 which would be within the criteria.



4.3 Littlehampton Academy Noise Intrusion Assessment

Noise modelling has been used to establish the predicted external noise levels from the 2016 Do something 'with development' scenario. The worst case external noise levels L_{Aeq} for each façade and height are presented in Table 4.3 below.

Table 4.3 Predicted External Noise Levels at School Building Façade (L_{Aeq})

Receptor	Façade Location	Height (m)	Predicted Levels L_{Aeq}
R75a	Academy West Façade	1.5	54.1
R75b	Academy West Façade	4.0	56.3
R75c	Academy West Façade	6.5	57.4
R76a	Academy South W Façade	1.5	49.1
R76b	Academy South W Façade	4.0	51.1
R76c	Academy South W Façade	6.5	52.2

Based on these predicted noise levels, the spaces where natural ventilation would be appropriate, or where alternative ventilation is required, is presented in Table 4.4 below. The recommendations in the following table are based upon the predicted noise levels from the 2016 Do Something (with development) traffic model.



Table 4.4 Predicted Noise Levels and Corresponding Ventilation Strategies

Sensitive Space (Required BB93 Internal noise level)													
Façade	Predicted External Noise Level L_{Aeq} dB	Music Ensemble, Practice or Performance rooms		SEN Classroom (30 L_{Aeq} dB)		Secondary School Classrooms & General Teaching Areas		Science Labs Design and Technology areas Sports Halls Dance Studios Offices (40 L_{Aeq} dB)		Atria / Circulation Spaces Dining Rooms Corridors, Changing Areas (45 L_{Aeq} dB)		Kitchens, toilets (50 L_{Aeq} dB)	
		Speech Therapy Rooms Drama Studios Large Lecture Rooms (30 L_{Aeq} dB)		Openable windows permissible per BB93 Alternative ventilation Required		Music Classrooms Libraries Small Lecture Rooms Conference Rooms Medical rooms (35 L_{Aeq} dB)		Openable windows permissible per BB101 Alternative ventilation Required		Openable windows permissible per BB101 Alternative ventilation Required		Openable windows permissible per BB101 Alternative ventilation Required	
		Openable windows permissible per BB101	Alternative ventilation Required	Openable windows permissible per BB93	Alternative ventilation Required	Openable windows permissible per BB101	Alternative ventilation Required	Openable windows permissible per BB101	Alternative ventilation Required	Openable windows permissible per BB101	Alternative ventilation Required	Openable windows permissible per BB101	Alternative ventilation Required
Academy West Façade at 1.5m	54.1	No	Likely	No	Likely	N	Likely	Yes	-	Yes	-	Yes	-
Academy West Façade at 4.0m	56.3	No	Likely	No	Likely	N	Likely	No	Likely	Yes	-	Yes	-
Academy West Façade at 6.5m	57.4	No	Likely	No	Likely	N	Likely	No	Likely	Yes	-	Yes	-
Academy South W Façade at 1.5m	49.1	No	Likely	No	Likely	Yes	-	Yes	-	Yes	-	Yes	-
Academy South W Façade at 4.0m	51.1	No	Likely	No	Likely	N	Likely	Yes	-	Yes	-	Yes	-
Academy South W Façade at 6.5	52.2	No	Likely	No	Likely	N	Likely	Yes	-	Yes	-	Yes	-



5.0 Proposed Mitigation Measures

5.1 Construction Noise

During the construction period the nature of the works will change as the project develops and hence, the noise from these activities will also vary. Therefore, particularly noisy activities such as piling or excavating will not continue for the full construction period, but rather for shortened periods, although they may be spread across the whole project duration.

Mitigation measures will need to be detailed within a Construction Environmental Management Plan (CEMP) and in addition could include, but are not limited to, the following:

- Prohibition of night-time working given the urban environment and the proximity of existing local residents to the development site;
- Hoarding protecting the nearest residential receptors from construction noise;
- Where reasonably practicable, noisy plant or processes will be replaced by less noisy alternatives, fitted with silencers and/or other noise suppression systems or enclosed by a suitable enclosure;
- All equipment used upon the proposed development site will be regularly and effectively maintained by trained personnel to minimise noise from machinery;
- Whenever reasonably practicable, machinery will be turned off or throttled down to a minimum when not in use;
- Whenever reasonably practicable, loading and unloading shall be carried out away from existing residential receptors and materials lowered whenever practicable and not dropped;
- Wherever possible, those activities likely to cause the highest levels of noise and vibration will be scheduled to occur at the times when they will cause the least disturbance to local residents. The noisiest construction activities will only be undertaken during daytime hours;
- Careful consideration of the selection of sites for contractors' compounds to ensure that local residents are not unreasonably disturbed;
- All nearby neighbours will be informed of commencement of construction works together with proposed timings of any significantly noisy elements of the works by letter. This letter will also contain the names and 24 hr contact details of site managers or representatives who will be able to respond to any complaints.

The most effective and appropriate mitigation measures for controlling construction and demolition noise can only be fully established once a contractor has determined, with some degree of accuracy, the complete construction programme. However, it is considered that appropriate mitigation measures can be implemented to ensure that local residents will not be unreasonably disturbed by construction noise.



5.2 Operational (Traffic) Noise

The existing boundary fences along the rear gardens of Rosemead, Paterson Wilson Road, Highdown Drive and Amberley Close, some of which are low, open or in a poor state of repair, will not be very effective as noise barriers, will be upgraded to 3.0m close boarded, double lapped timber fences as part of the scheme. A low (1m) graded landscape noise bund has been incorporated into the landscape design where possible as shown on SK06. In addition the proposed flint and brick walls will also offer some noise protection. The traffic noise effects of the development have therefore been re-assessed with these mitigation measures in place accordingly as follows.

Table 5.1 below shows the results of the traffic assessment comparing the L_{A10} noise levels from the 'with' and 'without' barrier scenarios.

Table 5.1 Traffic Assessment with Barriers

Receptor	Receptor Location	$L_{A10(18\text{ hr})}$ 2016 DS Without Barriers	$L_{A10(18\text{ hr})}$ 2016 DS With Barriers	Effects of Noise Barrier $L_{A10(18\text{ hr})}$
R17	89 Highdown D	56.9	56.6	-0.3
R18	18 Lammar Cl	69.4	69.4	0.0
R19	10 Toddington P	68.7	68.4	-0.3
R31	158 Highdown Drive	63.6	61.3	-2.3
R32	150 Highdown Drive	64.5	62.9	-1.6
R33	170 Highdown Drive	66.6	65.8	-0.8
R34	138 Highdown Drive	61.5	58.5	-3.0
R35	8 Amberley Close	62.1	59.1	-3.0
R36	10 Amberley Drive	63.6	61.6	-2.0
R37	17 Amberley Close	63.8	63.4	-0.4
R38	38 Highdown Drive	60.3	59.0	-1.3
R39	26 Highdown Drive	63.7	60.6	-3.1
R40	85 Cornwall Road	60.0	57.5	-2.5
R41	5 Paterson Willson Road	56.9	55.1	-1.8
R42	15 Rosemead	60.0	56.2	-3.8

All values are sound pressure levels in dB re: 2×10^{-5} Pa.

The results show that the barrier reduces noise levels by up to 3.8 dB (R42) as shown on SK07.



5.3 Residential Noise Intrusion Assessment with Mitigation

Predicted internal L_{Aeq} noise levels, at nearby sensitive receptors of the proposed Fitzalan Link Road with the proposed mitigation have been assessed both with windows open, where a reduction from a partially open window of 15 dB has been used, and with windows closed where an assumption of single glazing with a sound reduction of 30 dB has been used.

Table 5.2 Noise Intrusion Levels L_{Aeq}

Location	External L_{Aeq}	Internal L_{Aeq} with Windows Open	Internal L_{Aeq} with Windows Closed	Criteria Internal L_{Aeq}
R17	54.6	39.6	24.6	40
R18	67.4	52.4	37.4	40
R19	66.4	51.4	36.4	40
R31	59.3	44.3	29.3	40
R32	60.9	45.9	30.9	40
R33	63.8	48.8	33.8	40
R34	56.5	41.5	26.5	40
R35	57.1	42.1	27.1	40
R36	59.6	44.6	29.6	40
R37	61.4	46.4	31.4	40
R38	57.0	42.0	27.0	40
R39	58.6	43.6	28.6	40
R40	55.5	40.5	25.5	40
R41	53.1	38.1	23.1	40
R42	54.2	39.2	24.2	40

All values are sound pressure levels in dB re: 2×10^{-5} Pa.

The assessment presented in the table above shows that the internal L_{Aeq} noise levels from the proposed Fitzalan Link Road generated from the 2016 'Do Something' (with development) traffic model. The assessment shows that the predicted noise levels including the proposed mitigation from the 2016 'Do Something' (which incorporates traffic using the Fitzalan link road) will meet the relevant noise intrusion criteria at all receptors with windows closed. However with windows open, internal noise levels L_{Aeq} would be above the recommended target levels, at the majority of receptors. It should be noted that these predicted noise levels are daytime levels and night-time noise levels are expected to be significantly lower.



5.3 Residential Garden Noise Assessment including Mitigation

Predicted external L_{Aeq} noise levels, at nearby sensitive garden receptor locations, adjacent to the proposed Fitzalan Link Road with the following mitigation measures in place have been assessed. The existing boundary fences along the rear gardens of Rosemead, Paterson Wilson Road, Highdown Drive and Amberley Close, some of which are low, open or in a poor state of repair, will not be very effective as noise barriers, will be upgraded to 3.0m close boarded, double lapped timber fences as part of the scheme. A low (1m) graded landscape noise bund has been incorporated into the landscape design where possible. In addition the proposed flint and brick walls will also offer some noise protection.

Table 5.3 Noise Intrusion Levels L_{Aeq}

Location	External L_{Aeq}	Criteria External L_{Aeq}
R31 Garden Receptor	51.9	50 - 55
R32 Garden Receptor	50.1	50 - 55
R33 Garden Receptor	52.9	50 - 55
R34 Garden Receptor	52.1	50 - 55
R35 Garden Receptor	51.9	50 - 55
R36 Garden Receptor	50.8	50 - 55
R37 Garden Receptor	49.9	50 - 55
R38 Garden Receptor	48.4	50 - 55
R39 Garden Receptor	51.9	50 - 55
R40 Garden Receptor	47.9	50 - 55
R41 Garden Receptor	45.9	50 - 55

All values are sound pressure levels in dB re: 2×10^{-5} Pa.

The assessment presented in the table above shows that the external L_{Aeq} noise levels within gardens from the proposed Fitzalan Link Road generated from the 2016 'Do Something' (with development) traffic model. The assessment shows that the predicted noise levels from the 2016 'Do Something' (which incorporates traffic using the Fitzalan link road) also incorporating the proposed mitigation measures will be above within relevant criteria for gardens and external spaces (55 dB) at all receptors.



6.0 Conclusion

A noise survey has been undertaken for the proposed scheme. The noise monitoring results have been used to verify modelling in order to assess the effects of increased traffic noise and construction noise as a result of the scheme.

Construction noise levels would be below the target noise level of 75 dB at all existing residential receptors throughout the construction process. Residential receptors closest to the proposed road works, at worst may experience noise from road construction marginally in excess of 75 dB. This will be for a limited duration as those road works closest to the house are undertaken. However appropriate mitigation measures have been recommended to be incorporated in the Construction Environmental Management Plan which should ensure that local residents will not be unreasonably disturbed by construction noise.

The magnitude of the noise effect of traffic from the proposed scheme ranges from a 'slight beneficial' to 'substantial adverse' effect. Receptors that experience a reduction in noise levels are those affected by the reduction in traffic flows on Lymister Road, Wick Street and Worthing Road. Receptors that see a substantial adverse effect are located close to the new roads around Toddington Park and close to the Fitzalan Link Road.

There are no receptors that qualify for noise insulation under the Noise Insulation Regulations, as no properties that have an existing noise level of 68 dB or above and increase in noise levels by more than 1 dB, as a result of a new or altered highway.

A residential noise intrusion assessment has shown that internal L_{Aeq} noise levels from the proposed Fitzalan Link Road will meet the relevant noise intrusion criteria at all receptors adjacent to the proposed new Fitzalan Link Road with windows closed without any mitigation.

External noise levels within gardens of those residential dwellings which back onto the proposed Fitzalan Link Road. An assessment showed that without any mitigation, external noise levels L_{Aeq} would be above the relevant criteria (55 dB) for gardens and external spaces at the majority of receptor locations.

A noise intrusion assessment to the Littlehampton Academy has been considered and compared with glazing and ventilation requirements for different room/space uses of school buildings. Recommendations have been made based upon the predicted external noise levels from the 'Do Something' 2016 scenario.

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- ✓ The existing boundary fences along the rear gardens of Rosemead, Paterson Wilson Road, Highdown Drive and Amberley Close, some of which are low, open or in a poor state of repair, and will not be very effective noise barriers, will be upgraded to 3.0 m close boarded, double lapped timber fences as part of the scheme. A low (1m) graded landscape noise bund has been incorporated into the landscape design where possible. The effects of these mitigation measures is a noise reduction of up to 3.8 dB.

An additional assessment has considered noise levels within gardens of those residential dwellings which back onto the proposed Fitzalan Link Road incorporating the mitigation measures as detailed above. An assessment showed that incorporating the proposed mitigation measures, external noise levels L_{Aeq} within gardens would be within the relevant criteria (55 dB) for gardens and external spaces at all receptor locations.



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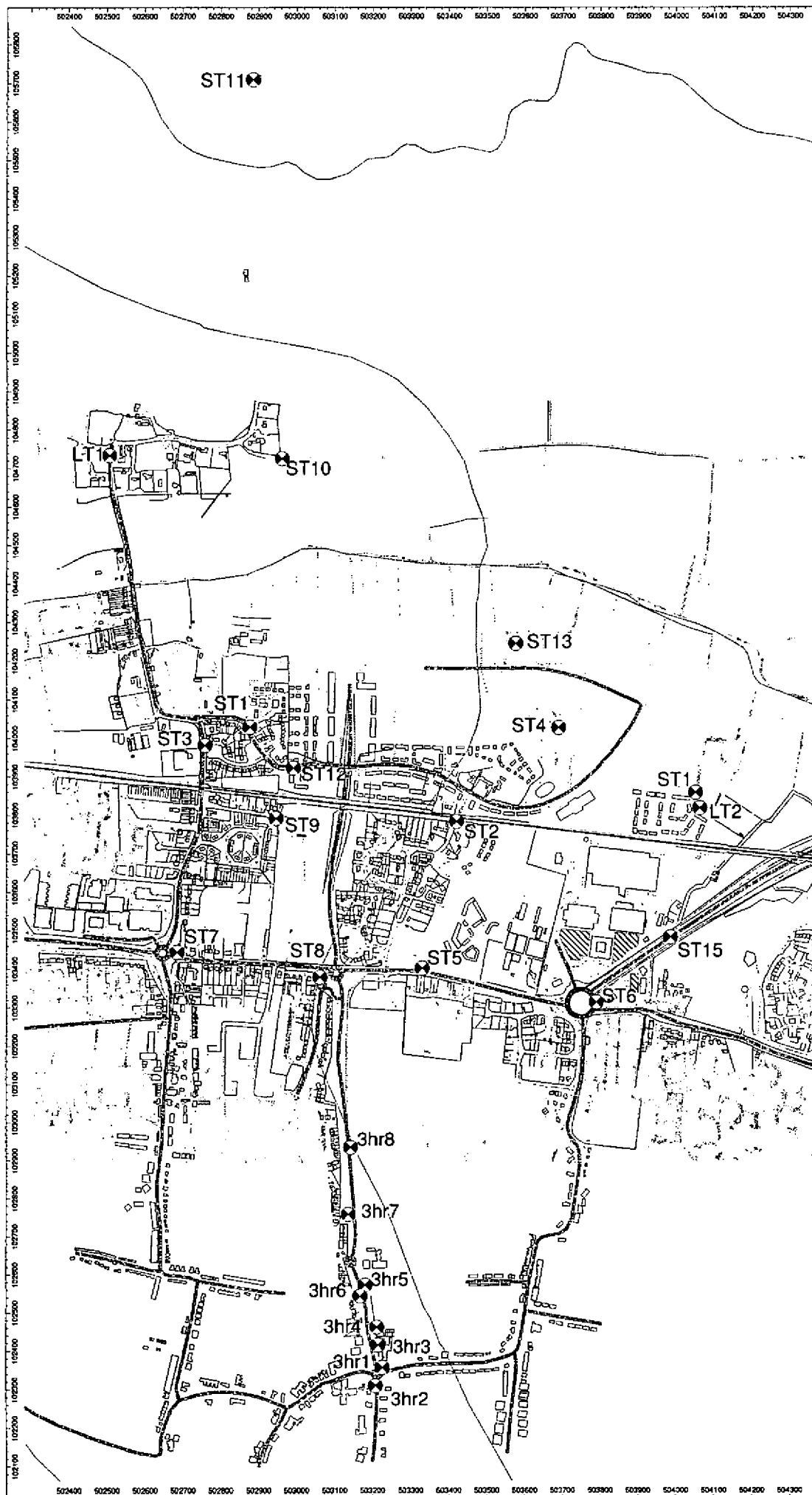
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Appendix

SK01	Monitoring Locations
SK02	Receptor Locations
SK03	DS2016 Predicted Traffic Noise $L_{A10(18\text{ hr})}$
SK04	Scheme Traffic Contribution
SK05	DS2016 Predicted Traffic Noise $L_{A10(18\text{ hr})}$ with noise mitigation.
SK06	Effects of Barriers
SK07	Predicted Worst Case Construction Noise L_{Aeq}



Client:
Greencore Group Plc

Project:
Proposed Fitzalan Link

Project Number:
A044029-2

Site Address:
Littlehampton

Drawing Title / Scenario:
Monitoring Locations

Drawing Number:
SK01

Scale : Not to scale

WYGE Leicester 07.02.11

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Client:
Greencore Group Plc

Project:
Proposed Fitzalan Link

Project Number:
A044029-2

Site Address:
Littlehampton

Drawing Title / Scenario:
Receptor Locations

Drawing Number:
SK02 B

Scale: Not to scale

WYGE Leicester 07.02.11

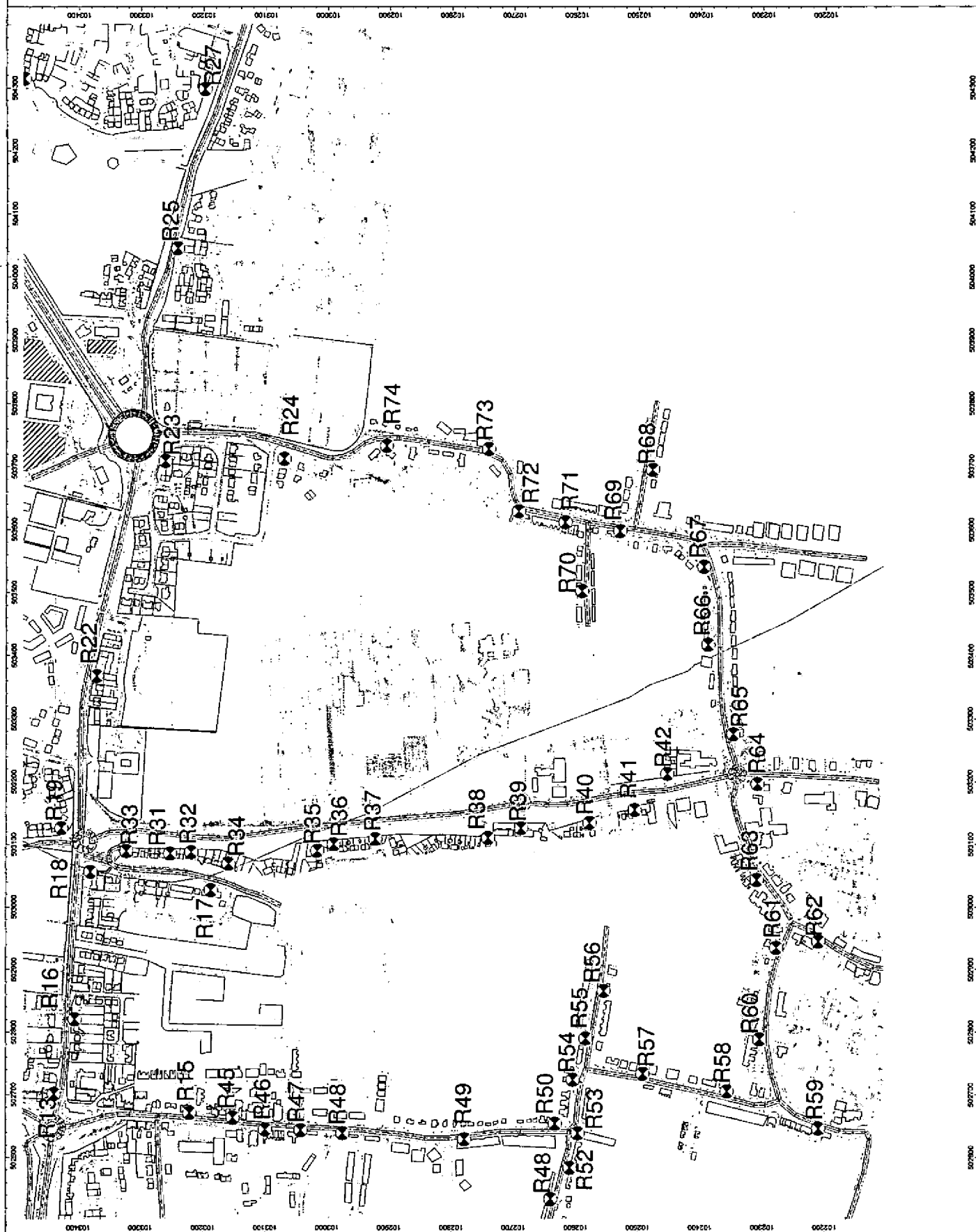
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Executive Plan
Project: WYGE
Location: Littlehampton
Date: 07.02.11
Scale: 1:10,000

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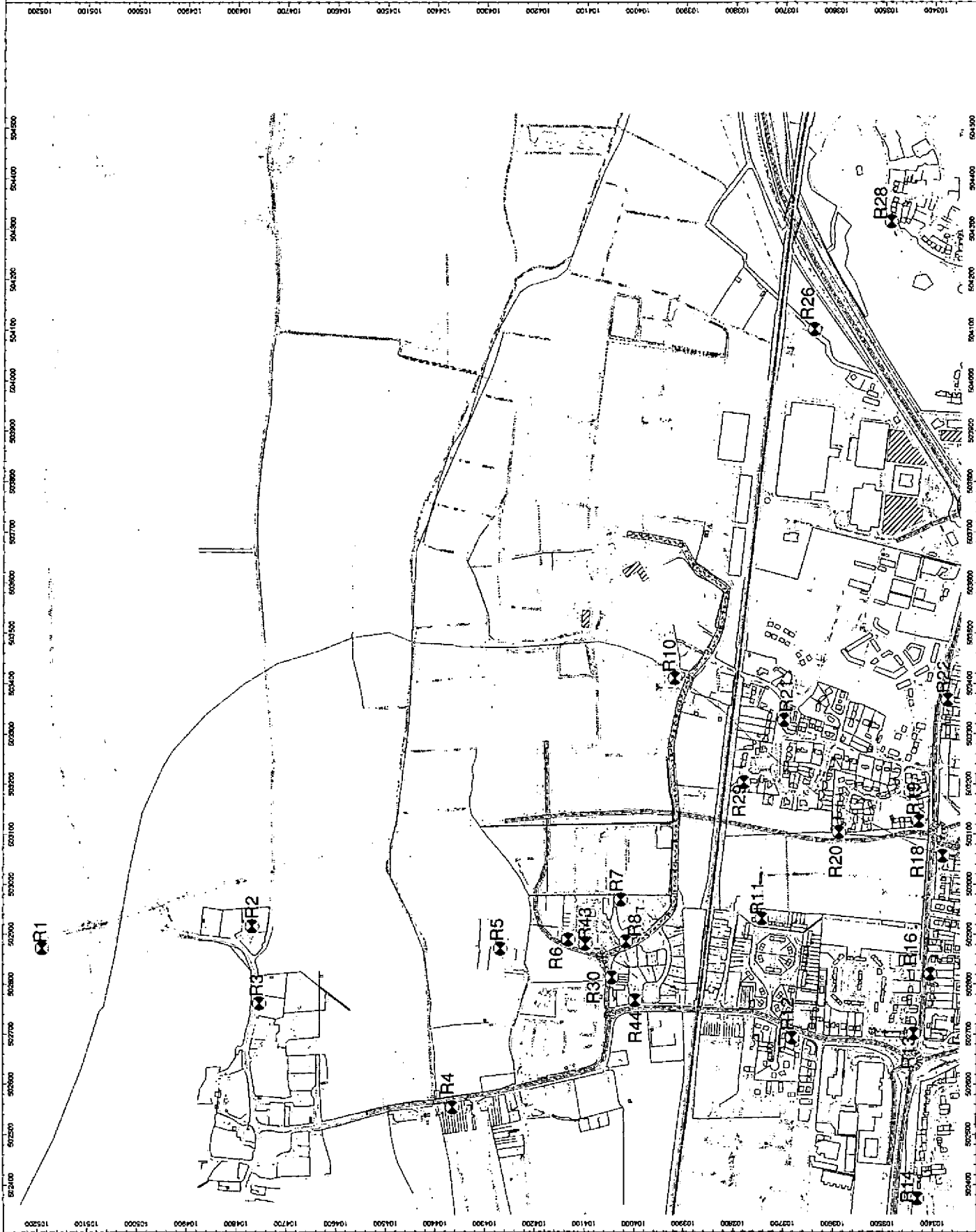


Client: Greencore Group Plc
 Project: Proposed Fitzalan Link
 Project Number: A044029-2
 Site Address: Littlehampton
 Drawing Title / Scenario: Receptor Locations
 Drawing Number: SK02 A
 Scale: Not to scale

WYGE Leicester 07.02.11
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 147-151 Old Road
 Littlehampton, Sussex BN15 2JQ



Client:
Greencore Group Plc

Project:
Proposed Fitzalan Link

Project Number:
A044029-2

Site Address:
Littlehampton

Drawing Title / Scenario:
DS 2016
(With Development Traffic)

Drawing Number:
SK03



Please Note:
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Scale: Not to scale

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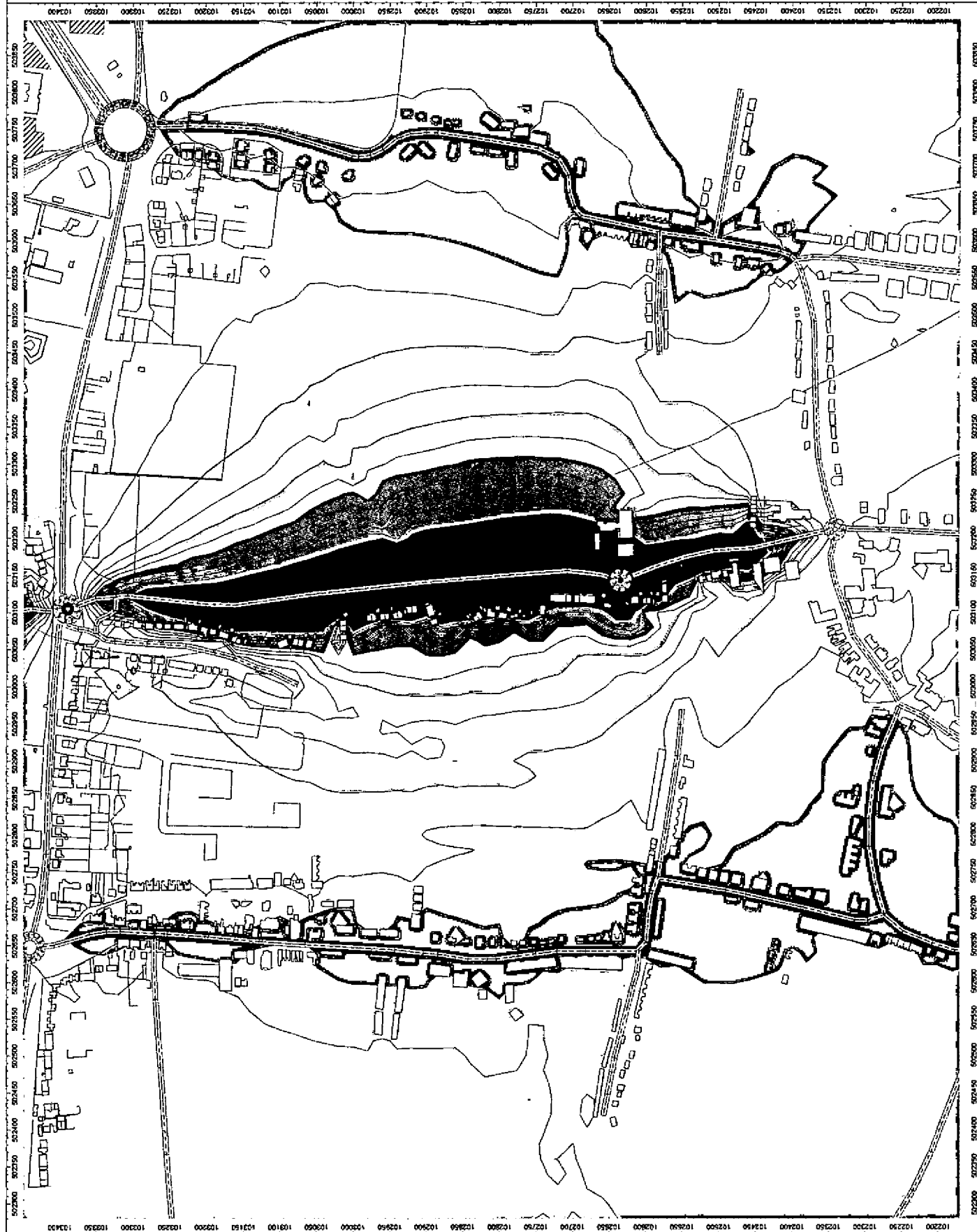


Greencore Plc
Attn: WYGE
Leicester
LE1 7 7 7 7
14.01.11 15.00

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Greencore Group Plc

Project:
Proposed Fitzalan Link

Project Number:
A044029-2

Site Address:
Littlehampton

Drawing Title / Scenario:
DS 2016 Predicted Traffic
Noise LA10 with
Noise Mitigation

Drawing Number:
SK05

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WYGE Leicester 07.02.11

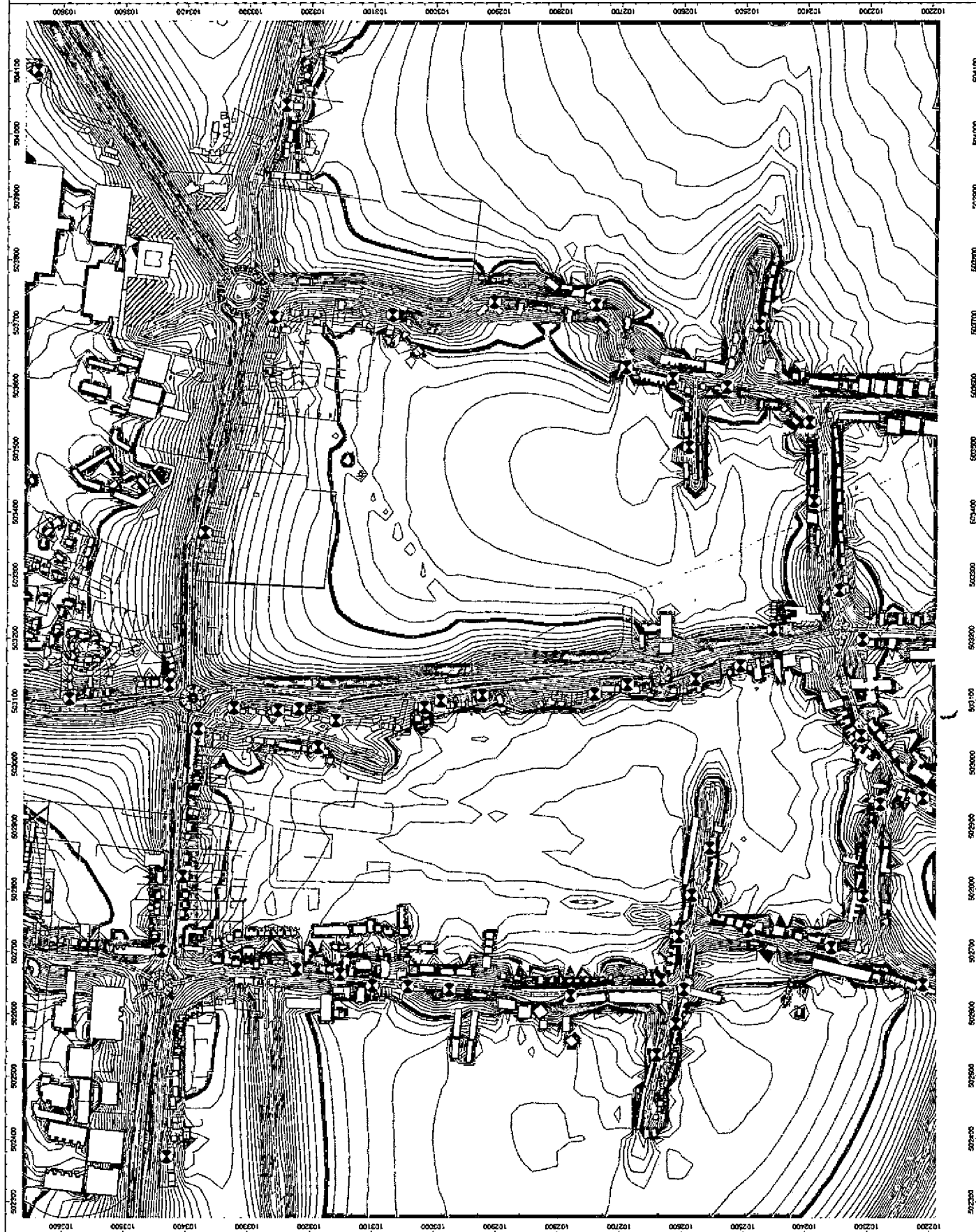
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Endeavour Park
 Ashton Way
 Ashtree
 Leicestershire
 LE17 7QJ

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Client:
Greencore Group Plc

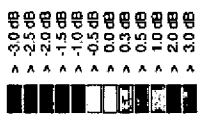
Project:
Proposed Fitzalan Link

Project Number:
A044029-2

Site Address:
Littlehampton

Drawing Title / Scenario:
Effects of Barriers
& Other Mitigation

Drawing Number:
SK06



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Scale : Not to scale

WYGE Leicester 22.05.11
The work has been carried out in accordance with the requirements of the Noise and Vibration Act 2004 and the Noise and Vibration Regulations 2008.
The work has been carried out in accordance with the requirements of the Noise and Vibration Act 2004 and the Noise and Vibration Regulations 2008.
The work has been carried out in accordance with the requirements of the Noise and Vibration Act 2004 and the Noise and Vibration Regulations 2008.



Greencore Plc
Anglo Way
Littlehampton
BN16 2TA
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Client:
Greencore Group Plc

Project:
Proposed Fitzalan Link

Project Number:
A044029-2

Site Address:
Littlehampton

Drawing Title / Scenario:
Construction Noise
Only

Drawing Number:
SK07

> 0.0 dB
> 55.0 dB
> 60.0 dB
> 70.0 dB
> 75.0 dB

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Scale : Not to scale

WYGE Leicester 08.02.11

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Executive Plot
Annotated Map
Leisure Services
100-102, The Quadrant
Leicester, LE1 1JH

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