

North Littlehampton

Fitzalan Link Road
Planning Application

Noise Assessment

February 2011

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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 noise proposed noise mitigation barriers, walls and bunds.

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.

The following scenarios have been considered

- Noise from Construction
- Operational Traffic Noise (2008 for verification)
- Operational Traffic Noise 2016

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.

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

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	WYG	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 'Without Development'			2016 Do Something 'With Development'		
	18AAW T	HGV%	Speed (kmph)	18AAW T	HGV%	Speed (kmph)	18AAW T	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 Francisan 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 Clun Road	3826	HGV11	45	3902	HGV09	45	4038	HGV08	45
Link 23 Arundal 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 $L_{Aeq,T}$ 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
R1	246 Lyminster Road	502872.0	105189.6
R2	Old Vicarage	502916.7	104768.7
R3	Baytree House	502761.7	104753.9
R4	203 Lyminster Road	502554.2	104365.3
R5	Woodcote House	502871.9	104269.7
R6	25 Fullers Walk	502889.9	104133.3
R7	9 Granary Way	502969.9	104027.9
R8	1 CrabTree Close	502886.2	104017.5
R10	Directors Cottage	503410.4	103920.4
R11	45 Griffin Crescent	502932.3	103743.8
R12	45 Lyminster Road	502693.2	103683
R13	2 Lyminster Road	502701.2	103438.7
R14	24 Willow Brook	502372.5	103430.2
R15	110 Wick Street	502671.1	103220.9
R16	Braemar, Worth Road	502820.5	103405.1
R17	89 Highdown Drive	503027.1	103187.4
R18	18 Lammar Close	503056.6	103380.2
R19	10 Toddington Park	503126.2	103427.3
R20	23 Toddington Park	503104.1	103588.0



Receptor	Address	Grid reference	
		X	Y
R21	Rosmarinus	503327.3	103699.4
R22	Glenfern	503367.6	103370.6
R23	97 Oakcroft Gardens	503709.1	103260.5
R24	31 Oakcroft Gardens	503712.4	103070.0
R25	144 Timberleys	504045.6	103241.1
R26	Norway Lane	504101.4	103641.0
R27	5 Foxglove Way	504298.4	103197.4
R28	25 Camelia Close	504314.8	103487.6
R29	31 Holly Drive	503203.8	103780.7
R30	2 Mill Lane	502814.2	104045.5
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
R44	16 Hearnfield Road	502767.9	103998.5
R43	27 Fullers Walk	502880.9	104099.1
R45	84 Wick Street	502663.8	103151.5
R46	3 Essex House, Wick St	502645.3	103099.5
R47	59 Wick Street	502643.9	103042.2
R48	29 Wick Street	502638.9	102974.8
R49	125 Arundel Road	502629.2	102778.9
R50	104 Arundel Road	502654.3	102633.3
R51	20 Clun Road	502534.3	102640.5
R52	13 Clun Road	502583.8	102609.7
R53	97 Arundel Road	502638.9	102596.6
R54	90 Arundel Road	502723.8	102604.5
R55	11 Cornwall Road	502790.3	102584.0
R56	40 Cornwall Road	502866.2	102555.3
R57	60 Arundel Road	502733.7	102492.2
R58	42 Arundel Road	502705.7	102357.2
R59	9A Arundel Road	502646.4	102210.0
R60	18 Connaught Road	502788.8	102304.9
R61	Bungalow, Franciscan Wy	502934.9	102278.0
R62	25 East Street	502944.9	102209.7
R63	43 East Street	503043.7	102309.5
R64	40 East Street	503196.7	102307.9
R65	52 East Street	503275.6	102346.6
R66	5 Dorset Close	503417.5	102387.3
R67	5 Horsham Road	503541.2	102394.3
R68	8 Southfields Road	503694.8	102477.2
R69	31 Horsham Road	503597.7	102529.7
R70	13 Elm Grove Road	503502.6	102590.4
R71	51 Horsham Road	503611.4	102617.6
R72	81 Horsham Road	503629.2	102692.5
R73	60 Horsham Road	503727.8	102741.0
R74	114 Horsham Road	503733.0	102905.2



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 representative 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 the 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} (18 hr0))
R1	26.9	27.3	27.0	-0.3
R2	34.2	34.9	39.6	4.7
R3	36.2	36.6	36.7	0.1
R4	69.1	69.4	69.1	-0.3
R5	42.5	42.7	45.7	3.0
R6	47.2	47.5	47.8	0.3
R7	41.6	41.3	46.0	4.7
R8	65.1	65.5	70.2	4.7
R10	53.1	51.5	58.9	7.4
R11	46.9	47.1	54.0	6.9
R12	67.9	68.3	65.2	-3.1
R13	73.4	73.4	72.9	-0.5
R14	65.4	65.0	65.6	0.6
R15	71.4	71.2	69.9	-1.3
R16	72.6	72.6	72.1	-0.5
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
R20	51.8	51.4	69.7	18.3
R21	42.2	42.2	48.0	5.8
R22	72.0	72.4	71.9	-0.5
R23	66.9	67.2	66.9	-0.3
R24	64.6	63.9	61.5	-2.4
R25	70.5	70.3	70.1	-0.2
R26	60.2	48.8	48.7	-0.1
R27	63.8	63.6	63.5	-0.1
R28	56.2	56.4	56.2	-0.2
R29	45.9	44.9	57.2	12.3
R30	65.5	65.9	70.3	4.4
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
R43	54.8	55.1	58.4	3.3
R44	68.8	69.0	66.5	-2.5
R45	71.4	71.3	70.0	-1.3
R46	71.1	71.0	69.6	-1.4
R47	71.5	71.4	70.1	-1.3
R48	71.5	71.4	70.1	-1.3

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} (18 hr0)
R49	71.5	71.3	70.0	-1.3
R50	69.1	68.9	67.7	-1.2
R51	66.6	66.2	66.1	-0.1
R52	65.8	65.5	65.3	-0.2
R53	68.2	68.1	67.0	-1.1
R54	67.6	67.5	66.0	-1.5
R55	61.6	61.8	61.1	-0.7
R56	60.4	60.8	60.4	-0.4
R57	70.7	70.7	69.1	-1.6
R58	69.7	69.8	68.2	-1.6
R59	71.1	71.2	69.6	-1.6
R60	70.3	70.2	68.9	-1.3
R61	71.1	71.1	69.8	-1.3
R62	69.7	69.9	70.0	0.1
R63	68.9	68.6	69.4	0.8
R64	66.1	66.4	66.5	0.1
R65	68.9	69.4	69.8	0.4
R66	64.5	65.1	65.4	0.3
R67	68.4	68.8	69.0	0.2
R68	64.8	64.9	64.8	-0.1
R69	71.1	71.2	68.7	-2.5
R70	61.8	62.0	62.0	0.0
R71	70.8	70.9	68.3	-2.6
R72	70.2	70.1	67.6	-2.5
R73	71.7	71.0	68.5	-2.5
R74	69.7	69.0	66.5	-2.5

All values are sound pressure levels in dB re: 2x 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.



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 2m 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	56.7	-0.2
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	63.3	-0.3
R32	150 Highdown Drive	64.5	64.5	0.0
R33	170 Highdown Drive	66.6	66.5	-0.1
R34	138 Highdown Drive	61.5	59.9	-1.6
R35	8 Amberley Close	62.1	60.4	-1.7
R36	10 Amberley Drive	63.6	63.5	-0.1
R37	17 Amberley Close	63.8	63.8	0.0
R38	38 Highdown Drive	60.3	59.8	-0.5
R39	26 Highdown Drive	63.7	62.3	-1.4
R40	85 Cornwall Road	60.0	58.8	-1.2
R41	5 Paterson Willson Road	56.9	56.9	0.0
R42	15 Rosemead	59.8	56.2	-3.6

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 3.6 dB (R42) as shown on SK07.

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.

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 2m 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 3.6 dB.



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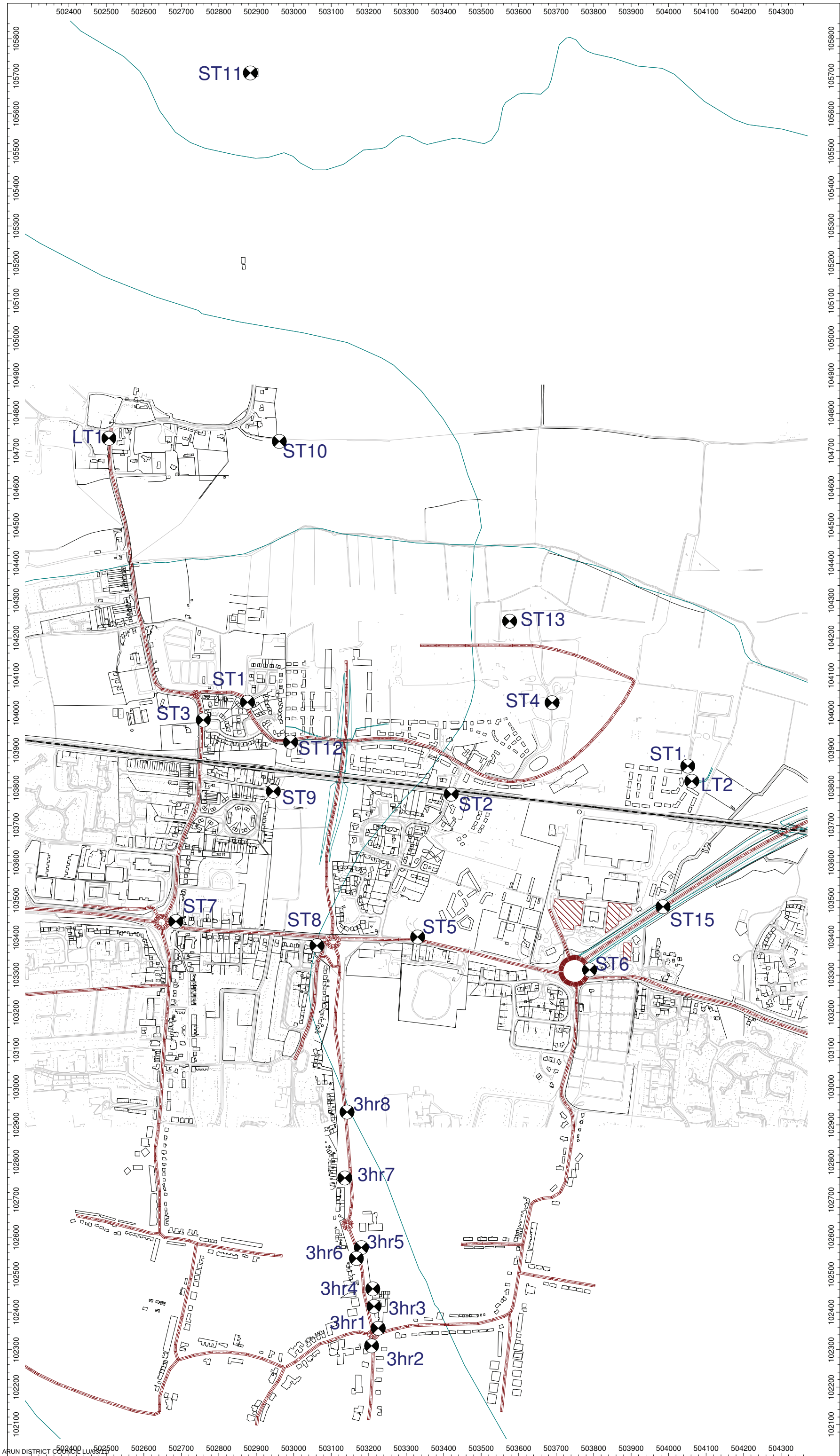
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Appendix

SK01	Monitoring Locations
SK02	Receptor Locations
SK03	Traffic Links
SK04	DS2016 Predicted Traffic Noise $L_{A10(18 \text{ hr})}$
SK05	Scheme Traffic Contribution
SK06	DS2016 Predicted Traffic Noise $L_{A10(18 \text{ hr})}$ with noise mitigation.
SK07	Effects of Barriers
SK08	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

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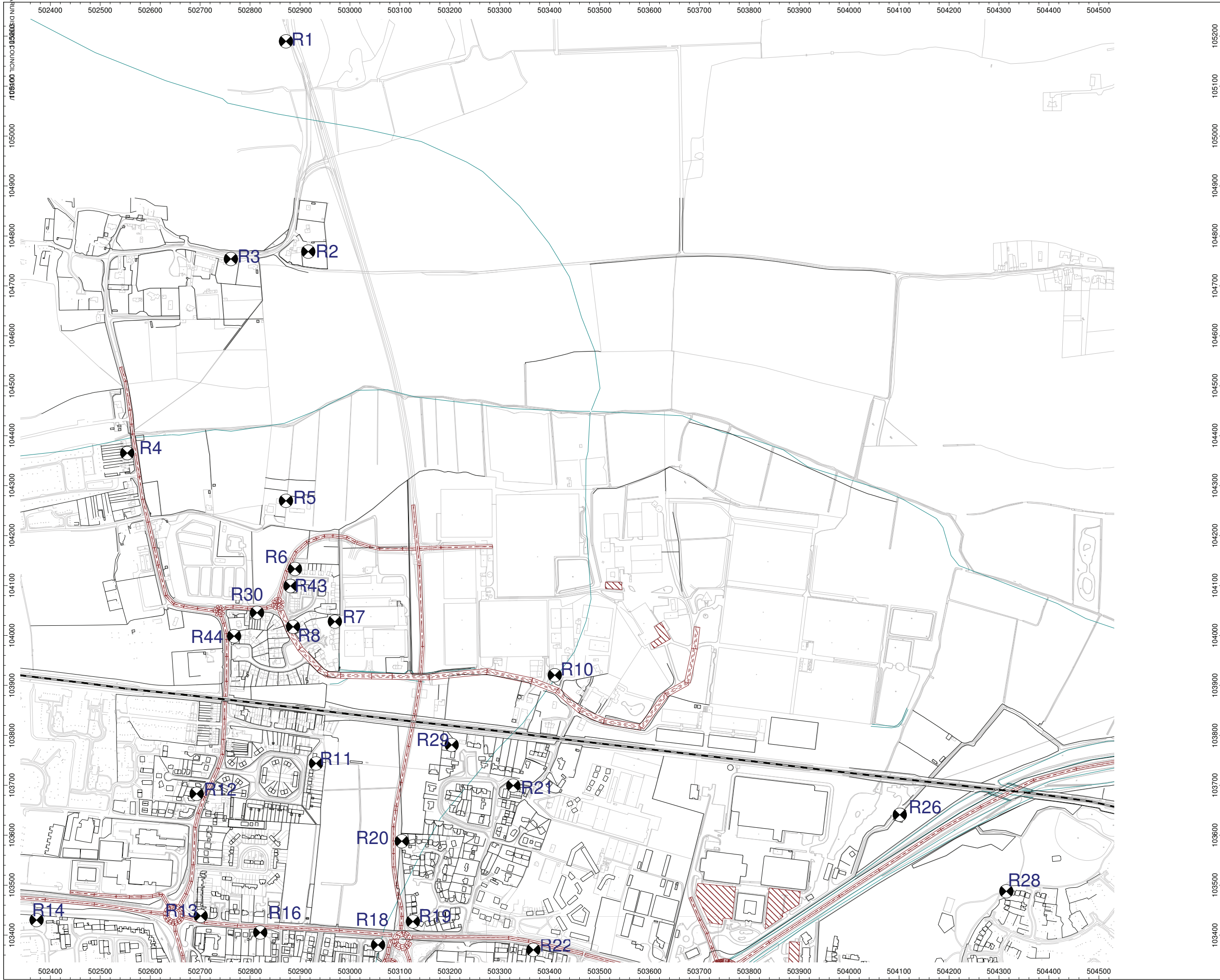
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Project:
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Project Number:
A044029-2

Site Address:
Littlehampton

Drawing Title / Scenario:
Receptor Locations

Drawing Number:
SK02 A

Scale : Not to scale

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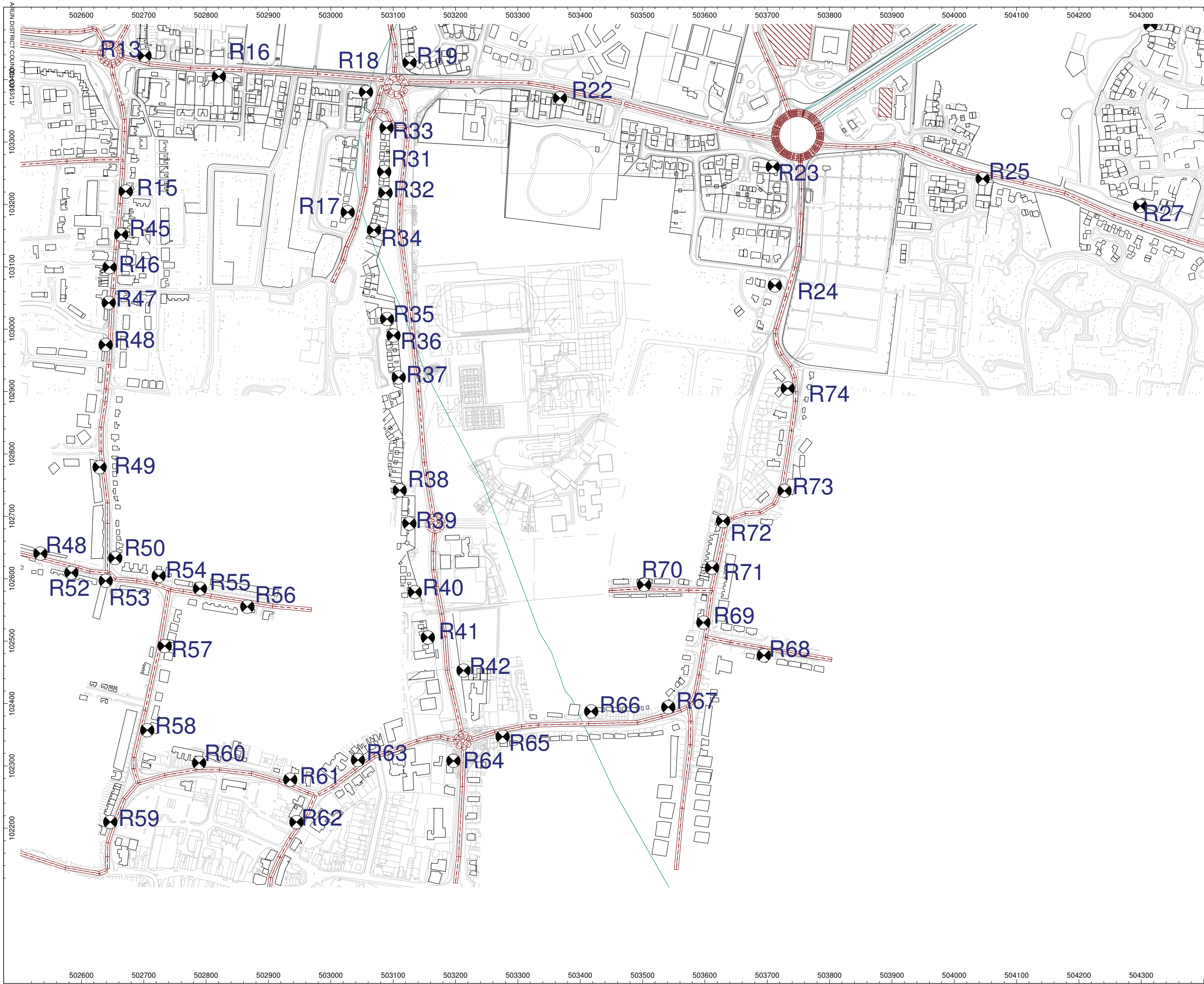
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Site Address:
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Drawing Title / Scenario:
Receptor Locations

Drawing Number:
SK02 B

Scale : Not to scale

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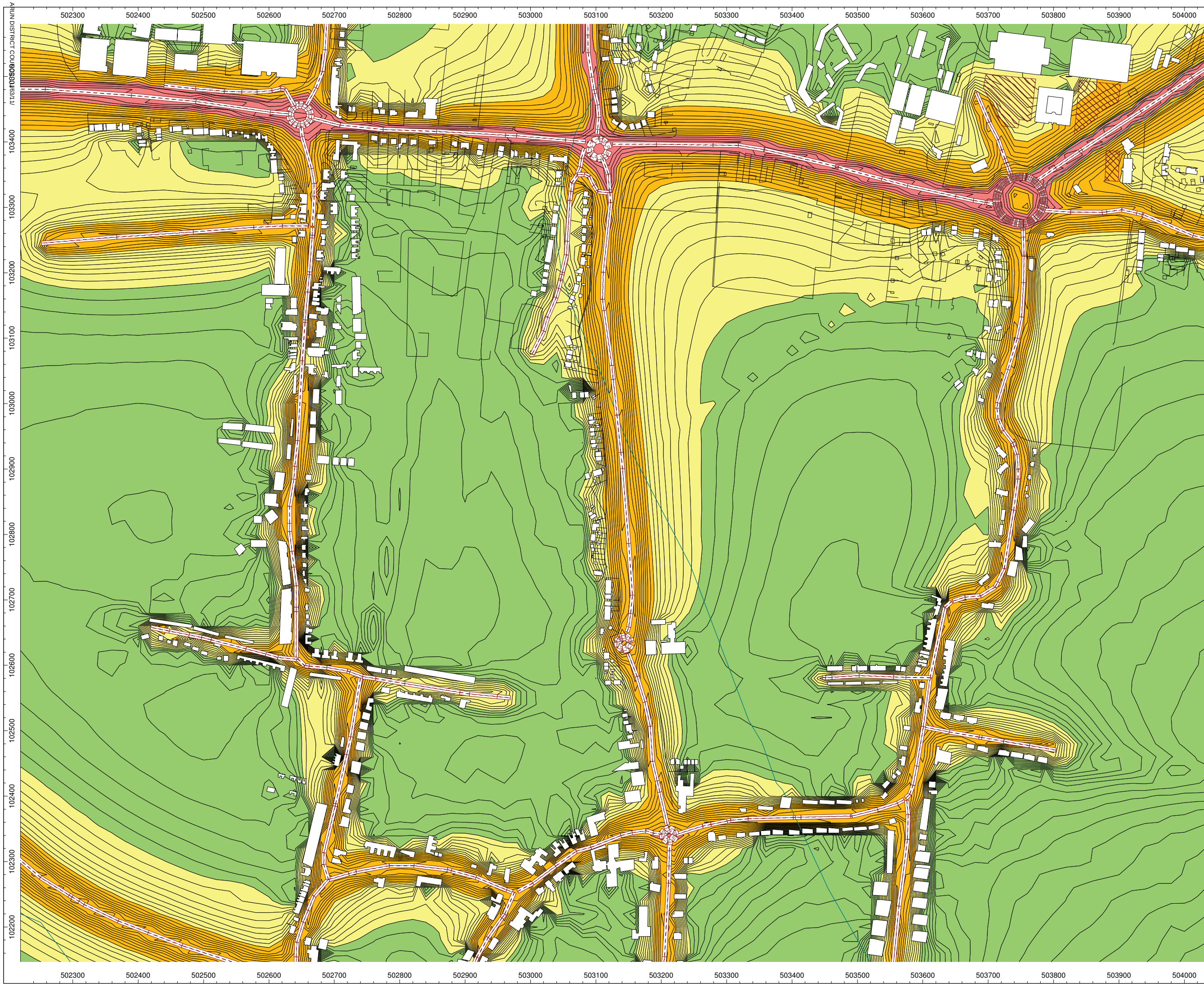
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Project:
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Project Number:
A044029-2

Site Address:
Littlehampton

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

Drawing Number:
SK03

- > 0.0 dB
- > 55.0 dB
- > 63.0 dB
- > 72.0 dB
- > 90.0 dB

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Scale : Not to scale

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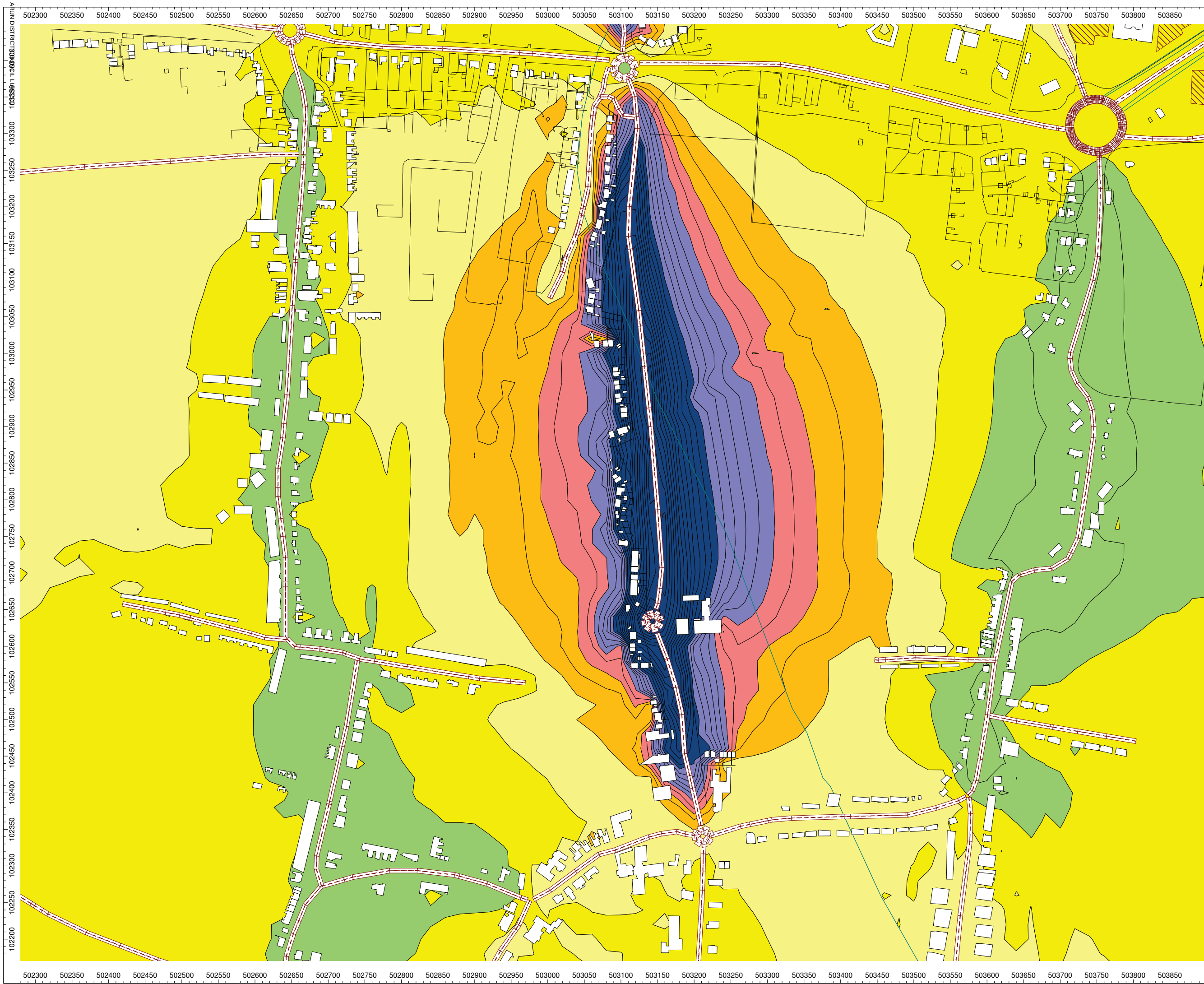
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Client:
Greencore Group Plc

Project:
Proposed Fitzalan Link

Project Number:
A044029-2

Site Address:
Littlehampton

Drawing Title / Scenario:
Contribution from
Development Traffic
LA10 (18 Hour)

Drawing Number:
SK04

- > -10.0 dB
- > -5.0 dB
- > -3.0 dB
- > -1.0 dB
- > 0.0 dB
- > 1.0 dB
- > 3.0 dB
- > 5.0 dB
- > 10.0 dB
- > 99.0 dB
- > 99.0 dB
- > 99.0 dB

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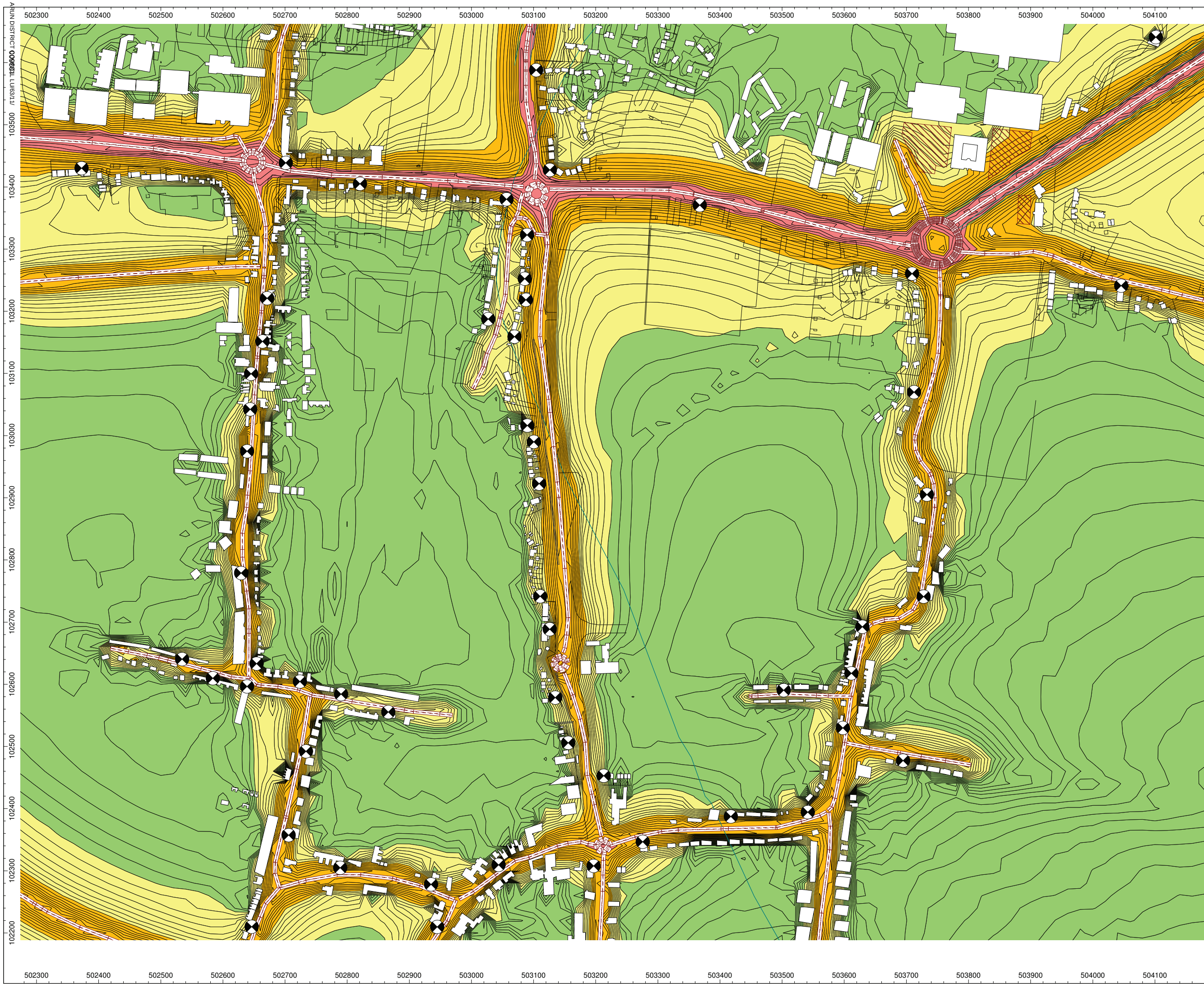
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Project:
Proposed Fitzalan Link

Project Number:
A044029-2

Site Address:
Littlehampton

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

Drawing Number:
SK05

- > 0.0 dB
- > 55.0 dB
- > 63.0 dB
- > 72.0 dB
- > 90.0 dB

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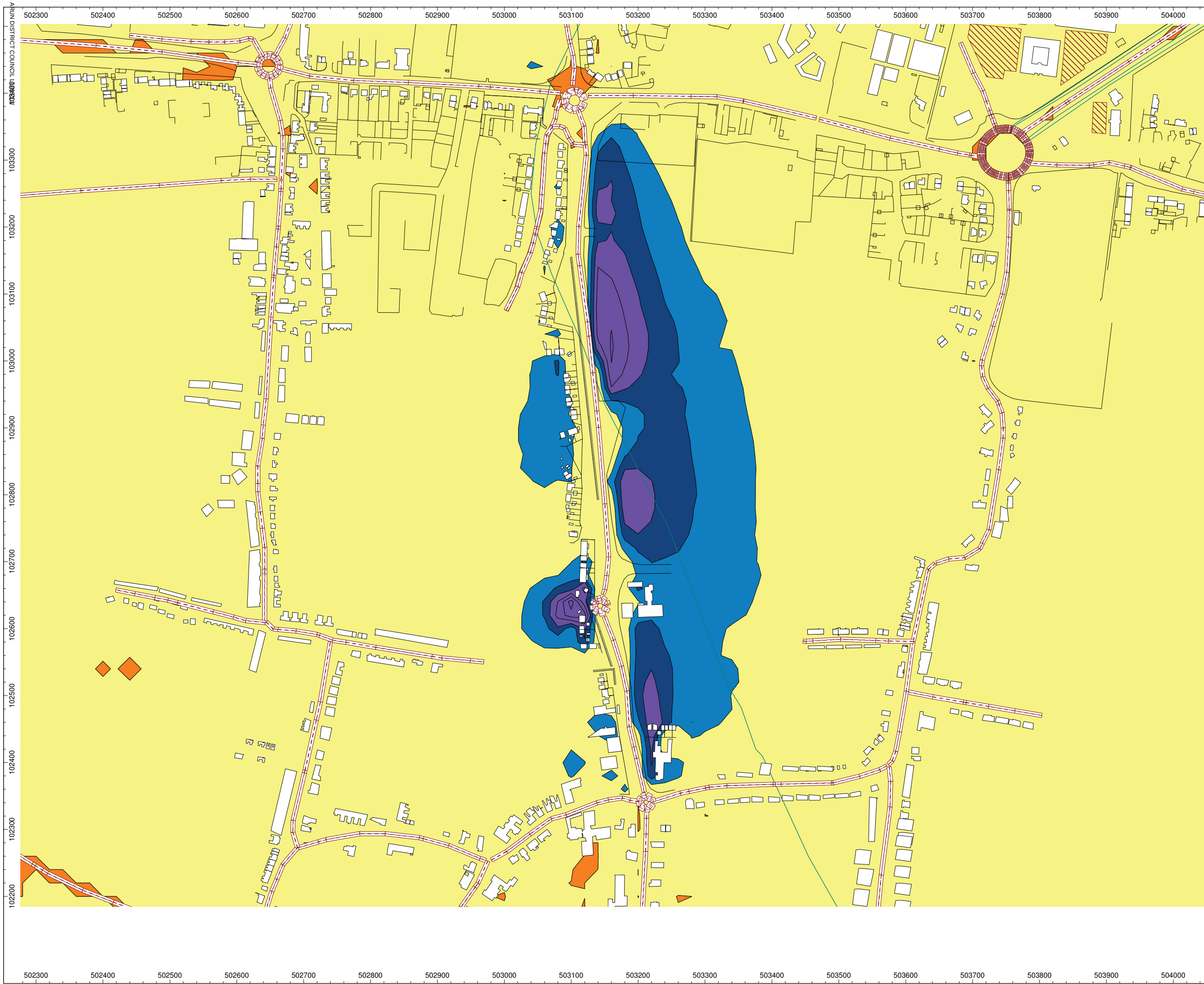
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Client:
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Project:
Proposed Fitzalan Link

Project Number:
A044029-2

Site Address:
Littlehampton

Drawing Title / Scenario:
**Effects of Barriers
& Other Mitigation**

Drawing Number:
SK06

- > -3.0 dB
- > -2.5 dB
- > -2.0 dB
- > -1.5 dB
- > -1.0 dB
- > -0.5 dB
- > 0.0 dB
- > 0.3 dB
- > 0.5 dB
- > 1.0 dB
- > 2.0 dB
- > 3.0 dB

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Scale : Not to scale

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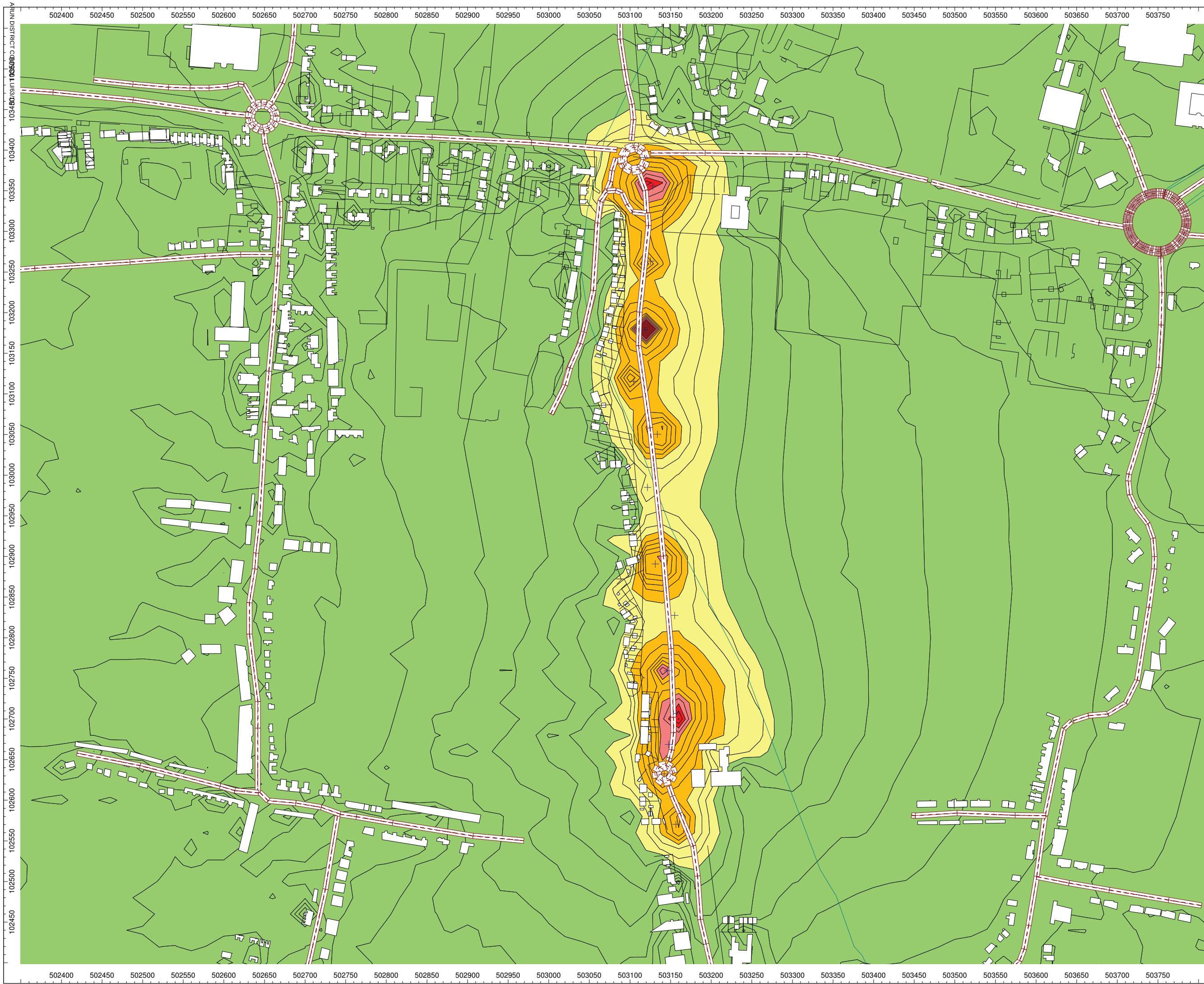
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Client:
Greencore Group Plc

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

Please Note:
Noise Contour Plots are for
illustrative purposes only

Scale : Not to scale

WYGE Leicester 08.02.11

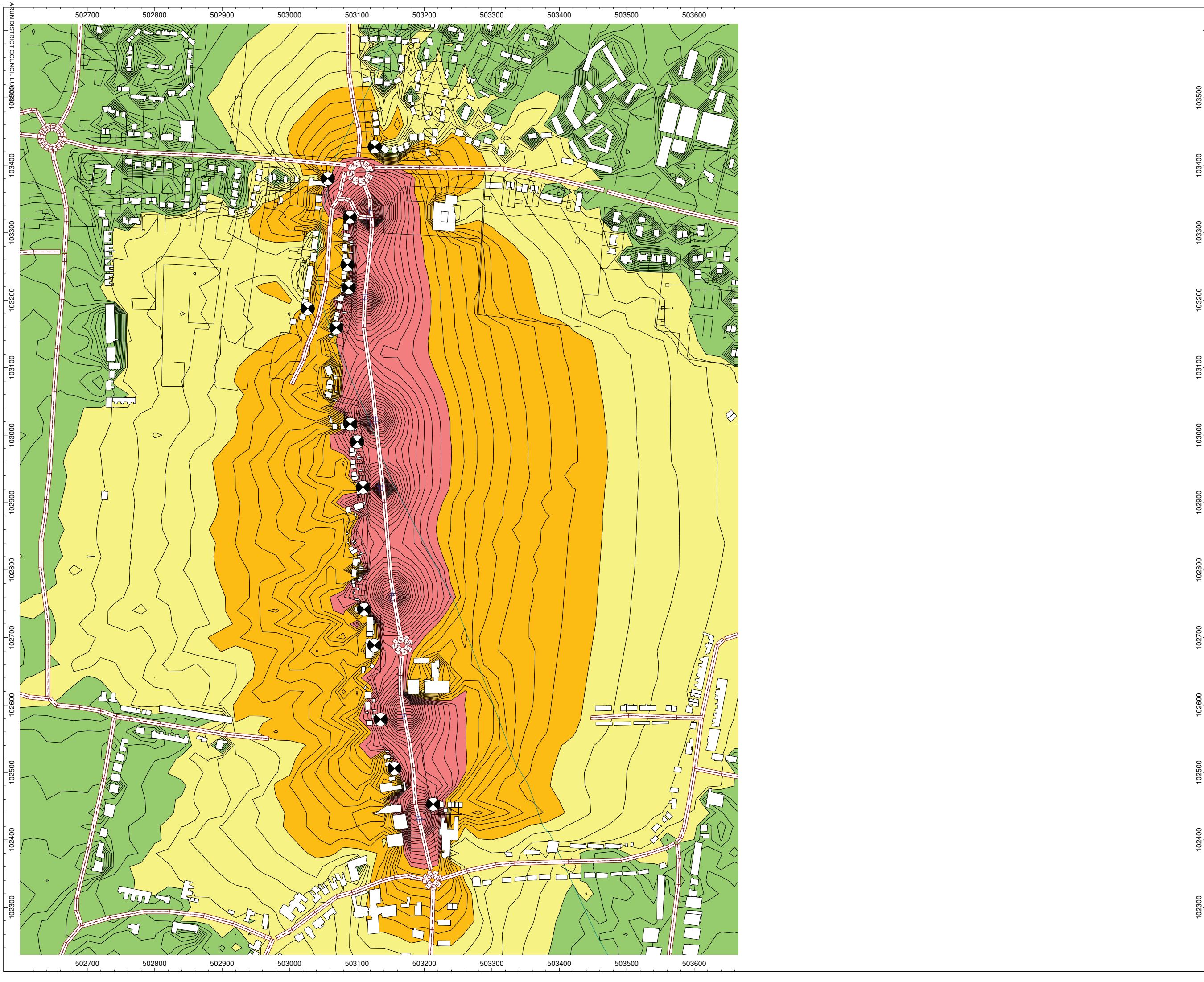
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Leicestershire
LE7 7GR
Tel 0116 234 8000

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Client:
Greencore Group Plc

Project:
Fitzalan Link

Project Number:
A044029-2

Site Address:
Littlehampton

Drawing Title / Scenario:
Predicted Worst Case
Construction Noise LAeq

Drawing Number:
SK08

- > 0.0 dB
- > 55.0 dB
- > 60.0 dB
- > 68.0 dB
- > 90.0 dB

Scale : Not to scale

WYGE Leicester 21.12.09

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