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Dear Sirs,

NOISE IMPACT ASSESSMENT FOR PROPOSED RESIDENTIAL DEVELOPMENT, FORMER KINGSTONE SCHOOL, BROADWAY, BARNSLEY, SOUTH YORKSHIRE

1.00 INTRODUCTION

1.01 Environmental Noise Solutions Limited (ENS) has been commissioned by Taylor Wimpey to carry out a noise assessment for a proposed residential development on a large parcel of land at the former Kingstone School site situated on Broadway, Barnsley (hereafter referred to as the application site).

1.02 The objectives of the assessment were to:

- Measure the ambient noise climate at the application site during representative periods of the daytime and at night;
- Determine the ambient noise climate at the application site over the entire 16-hour daytime and 8-hour night time periods with reference to pertinent calculation methods;
- Assess the potential impact of noise on the proposed development (with reference to the National Planning Policy Framework and other pertinent guidance);
- Provide recommendations for a scheme of noise attenuation works, as necessary, to ensure that the future occupants of the proposed development do not experience any unacceptable loss of amenity due to noise.

1.03 This report details the methodology and results of the assessment and provides recommendations for the layout (location and orientation of residential dwellings), in addition to building envelope design (fenestration and ventilation) and boundary screening. It has been prepared to accompany a planning application to be submitted to Barnsley Council (BC) for the proposed mixed use development of the application site.

1.04 This report has been prepared for Taylor Wimpey for the sole purpose described above and no extended duty of care to any third party is implied or offered. Third parties making reference to the report should consult Taylor Wimpey and ENS as to the extent to which the findings may be appropriate for their use.

1.05 A glossary of acoustic terms used in the main body of the text is contained in Appendix 1.

Continued from page 1

2.00 SITE SETTING AND PROPOSED DEVELOPMENT

2.01 For reference, the application site is located approximately 1.5 kilometres to the west of Barnsley town centre and is set in a mixed use area containing residential dwellings, a nursery and a Co-Op warehouse. The application site is bound by:

- Broadway to the north east, with a Co-Op warehouse and a fire station beyond:
- An existing residential estate to the north west;
- Open fields to the south west, with the M1 beyond; and
- A nursery school to the south east.

2.02 Broadway is a relatively busy single carriageway 'A-road' with 40 mph speed limit. The M1 motorway is situated approximately 520 metres to the west of the application site.

2.03 Current proposals are for residential dwellings (houses) to be constructed throughout the application site, with gardens to properties along Broadway situated to the rear of the associated dwellings .

3.00 BASELINE NOISE MONITORING

3.01 In order to determine the ambient noise levels at the application site, baseline noise surveys were undertaken on Wednesday 13th and Monday 18th November 2013.

3.02 For the purpose of the noise impact assessment, the following noise monitoring positions were adopted (approximate location of the noise monitoring positions is contained in Appendix 2):

- MP1 was located near to the north eastern boundary of the application site, at a distance of approximately 16 metres to the nearside kerb of Broadway;

- MP2 was located in the southern corner of the application site, at a distance of approximately 150 metres from the nearside kerb of Broadway;

- MP3 was located near to the south western boundary of the application site at a distance of circa 150 metres from the nearside kerb of Broadway; and

- MP4 was located near to the north eastern boundary of the application site, directly opposite the entrance to the Co-Op warehouse.

3.03 During the course of the daytime and night time noise surveys the dominant noise source was noted to be local road traffic along Broadway and distant road traffic along the M1.

3.04 Noise measurements were undertaken using two Bruel & Kjaer 2260 Type 1 integrating sound level meters. Measurements were made in a free field environment at 1.5 metres above local ground level. A windshield was fitted for all measurements. The measurement systems calibration was verified immediately before the commencement of the measurement sessions and again at the end, using a Bruel & Kjaer Type 4231 calibrator. No drift in calibration level was noted. Weather conditions throughout the survey were appropriate for monitoring.

3.05 Measurements consisted of A–weighted broadband parameters, together with linear one-third octave band L_{eq} levels. The following table contains a summary of the measurement data for each measurement session, at each measurement position, rounded to the nearest decibel.

Continued from page 2

Table 3.1 – Summary of Noise Measurement Data

Position	Date	Time	L_{Aeq} (dB)	L_{A90} (dB)	L_{A10} (dB)	L_{A1} (dB)	Comment
MP1	13/11/2013	11:42-12:08	67	55	71	75	Road traffic along Broadway, maximum noise levels of 80 dB L_{AFmax} at night
MP1	13/11/2013	13:46-14:26	68	58	72	76	
MP1	18/11/2013	05:15-05:31	63	46	46	75	
MP1	18/11/2013	07:56-08:12	68	56	72	76	
MP2	13/11/2013	12:53-13:17	56	53	57	62	Distant road traffic, occasional noise from adjacent car park
MP2	18/11/2013	08:23-09:14	53	50	53	58	
MP3	18/11/2013	06:55-07:11	55	54	57	58	Distant road traffic
MP3	13/11/2013	13:28-13:43	58	56	60	61	
MP3	13/11/2013	14:53-15:23	59	58	61	64	
MP3	18/11/2013	05:36-05:51	55	53	56	58	
MP4	13/11/2013	15:44-15:54	67	60	70	73	Road traffic along Broadway, occasional movements at Co-Op Warehouse
MP4	18/11/2013	05:59-06:50	62	53	66	71	
MP4	18/11/2013	07:27-07:47	66	55	70	73	

Daytime ambient noise level ≈ 69 dB $L_{Aeq\ (07:00–23:00)}$ at MP1 based on CRTN methodology
Daytime ambient noise level ≈ 56 dB $L_{Aeq,T}$ at MP2, up to 59 dB $L_{Aeq,T}$ at MP3 and up to 67 dB $L_{Aeq,T}$ at MP4

Night time ambient noise level of ≈ 60 dB $L_{Aeq,(23:00–07:00)}$ at MP1 based on TRL methodology

3.06 For the prediction of daytime road traffic noise, the Department of Transport's Memorandum on the Calculation of Road Traffic Noise (CRTN) explains that the following shortened measurement procedure may be used. Measurements of L_{A10} are made over any three consecutive hours between 10:00 and 17:00 hours. Using $L_{A10\ (3\ hour)}$ as the arithmetic mean of the three consecutive values of hourly L_{A10}, the $L_{A10\ (18\ hour)}$ can be calculated from the equation:

(i) $L_{A10\ (18\ hour)} = L_{A10\ (3\ hour)} - 1$ dB

3.07 PPG24 further states that for road traffic noise:

(ii) $L_{Aeq\ (0700–2300)} \approx L_{A10\ (0600–0000))} - 2$ dB

3.08 Substituting (ii) into (i) gives the following approximation:

(iii) $L_{Aeq\ (0700–2300)} \approx L_{A10,\ 3\ hour} - 3$ dB

3.09 Although the above measurement procedure has not been strictly followed, it is evident that road traffic noise levels (L_{A10}) were consistent throughout the survey period. Therefore, the measurements taken are considered appropriate for establishing the daytime ambient noise level.

3.10 The daytime ambient noise level near to the north eastern boundary of the application site (16 metres to nearside kerb of Broadway) is calculated at 69 dB $L_{Aeq(0700-2300)}$. Noise levels along the south western boundary of the application site were measured at up to 59 dB $L_{Aeq,T}$.

3.11 A study prepared by TRL Limited on behalf of the Department for Environment, Food and Rural Affairs (DEFRA) entitled 'Converting the UK Traffic Noise Index $L_{A10\ (18\ hour)}$ to EU Noise

Indices for Noise Mapping' presents a methodology for calculating night time road traffic noise levels based on daytime road traffic noise level based on the following formulae:

(iv) $L_{Aeq\ (23:00–07:00)} \approx 0.90 * L_{A10,\ 18\ hour} – 3.77$ (for non-motorways)

and

(v) $L_{Aeq\ (23:00–07:00)} \approx 0.87 * L_{A10,\ 18\ hour} + 4.24$ (for motorways)

3.12 Based on the formula above, a predicted noise level of 60 dB $L_{Aeq\ (2300-0700)}$ is calculated at position MP1.

3.13 Night time ambient noise levels along the south western boundary of the application site were significantly lower, measured at approximately 55 dB $L_{Aeq,T}$ immediately prior to the daytime period.

3.14 The proposed layout indicates that the closest residential dwellings to Broadway are situated at a distance of approximately 18 metres from the nearside kerb. Therefore assuming line source propagation, 1 dB of distance attenuation may be applied to the measured maximum.

3.15 The design noise levels at the closest residential dwellings to Broadway are therefore calculated to be 68 dB $L_{Aeq,(0700-2300)}$, 60 dB $L_{Aeq(2300-0700)}$ and 79 dB L_{AFmax}.

3.16 Very little noise associated with the Co-Op warehouse was observed during either the daytime or night time noise surveys. The orientation of the warehouse is such that all potentially noisy activities take place to the north west of the site, fully screened from view of the proposed dwellings.

3.17 Vehicles enter the warehouse site via an entrance on Broadway, before driving clockwise around to the far side of the warehouse. Vehicles leave the site by completing a loop and emerging at a gated exit, adjacent to the entrance. The process is relatively quick and the mechanised gate did not create any significant maximum noise levels.

3.18 Although activity was observed during the night time hours (consisting of occasional HGVs entering and exiting the warehouse site), maximum and ambient noise levels remained unaffected. Furthermore, the character of the noise was considered to be similar to that in the absence of any activity (vehicle movements). The noise impact of the existing warehouse on the proposed development is therefore considered to be negligible.

4.00 NOISE IMPACT ASSESSMENT CRITERIA

4.01 The National Planning Policy Framework (NPPF), came into force on 27 March 2012 and is a material consideration in planning decisions. At the heart of the NPPF is a presumption in favour of sustainable development, and the policies in Paragraphs 18 to 219 of the NPPF, taken as a whole, constitute the Government's view on what sustainable development in England means in practice for the planning system.

4.02 The NPPF states that there are three dimensions to sustainable development, which include an economic role (contributing to building a strong, responsive and competitive economy), a social role (providing the supply of housing required to meet the needs of present and future generations) and an environmental role (which includes minimising waste and pollution).

4.03 The NPPF supersedes Planning Policy Guidance Note 24 (PPG 24). The main policy statement in relation to noise is Paragraph 123 of the NPPF, which states

Planning policies and decisions should aim to:

- *Avoid noise from giving rise to significant adverse impacts on health and quality of life as a result of new development;*

- *Mitigate and reduce to a minimum other adverse impacts on health and quality of life arising from noise from new development, including through the use of conditions;*

- *Recognise that development will often create some noise and existing businesses wanting to develop in continuance of their business should not have unreasonable restrictions put on them because of changes in nearby land uses since they were established (note: subject to the provisions of the Environmental Protection Act 1990 and other relevant law); and*

- *Identify and protect areas of tranquillity which have remained relatively undisturbed by noise and are prized for their recreational and amenity value for this reason.*

4.04 In relation to 'adverse impacts', the NPPF refers to the Explanatory Note to the Noise Policy Statement for England (NPSE) for guidance.

4.05 The Noise Policy Statement for England (NPSE) and associated Explanatory Note were published by DEFRA in 2010 and set out the Government's noise management strategy to enable noise management decisions to be made within the wider context (i.e. guiding principles of sustainable development), in a cost-effective manner and in a timely fashion.

4.06 Fundamental to this approach is '*there is a need to integrate consideration of the economic and social benefit of the activity or policy under examination with proper consideration of the adverse environmental effects, including the impact of noise on health and quality of life. This should avoid noise being treated in isolation in any particular situation, i.e. not focussing solely on the noise impact without taking into account other related factors'*.

4.07 The noise policy aims of NPSE are to (i) avoid significant adverse impact on health and quality of life, (ii) mitigate and minimise adverse impacts on health and quality of life, and (iii) where possible, contribute to the improvement of health and quality of life. The policy aims are always to be considered within the context of the Government's policy on sustainable development.

4.08 In relation to the mitigation and minimisation of adverse impacts, NPSE considers that '*in reality, although not always stated, the aim has tended to be to minimise noise 'as far as is reasonably practical'*. This is reinforced in Paragraph 2.24 of the Explanatory Note, which requires that '*all reasonable steps should be taken to mitigate and minimise adverse effects on health and quality of life while also taking into account the guiding principles of sustainable development. This does not mean that such adverse effects cannot occur'*.

4.09 In relation to explaining the 'significant adverse' and 'adverse' effects quoted in the NPPF, NPSE uses the two established concepts from toxicology that are currently being applied to noise impacts, for example by the World Health Organisation (WHO), these are:

- NOEL – No Observed Effect Level. This is the level below which no effect can be detected. In simple terms, below this level, there is no detectable effect on health and quality of life due to noise.

- LOAEL – Lowest Observed Adverse Effect Level. This is the level above which adverse effects on health and quality of life can be detected.

4.10 The NPSE then extends these concepts to lead to a SOAEL – Significant Observed Adverse Effect Level. This is the level above which significant adverse effects on health and quality of life occur.

4.11 No specific criteria are presented in the NPSE, to provide the necessary policy flexibility until further evidence and suitable guidance is available. In lieu of specific criteria, for residential development, ENS makes reference to existing guideline documents, which are summarised in the following paragraph(s).

4.12 BS 8233:1999 'Sound Insulation and Noise Reduction for Buildings – Code of Practice' (BS 8233) defines a range of ambient noise levels for design criteria, in order that good or reasonable conditions are achieved in certain internal and external environments. The following table shows a summary of the levels recommended in BS 8233 for habitable rooms in the proposed development. Additionally, the World Health Organisation (WHO) Guidelines on Community Noise (1999) considers that for speech intelligibility during the daytime and

evening periods, internal living room levels should not exceed 35 dB $L_{Aeq\ (0700\text{-}2300)}$

Table 4.1 – Indoor Ambient Noise Levels as Recommended in BS 8233 (Residential)

Criterion	Typical Situation	Design Range dB $L_{Aeq,\ T}$	
		GOOD	REASONABLE
Reasonable resting / sleeping conditions	Living rooms	30	40
	Bedrooms*	30	35

* For a reasonable standard in bedrooms at night, individual noise events should not normally exceed 45 dB $L_{AF\ max}$.

4.13 With reference to the BS 8233 guideline levels, by definition, the 'reasonable' design criteria cannot represent a significant adverse impact (the prevention of which is the 1st aim of NPSE). With cognisance to the 2nd aim of NPSE (to minimise noise impact), the WHO criterion of 35 dB $L_{Aeq,T}$ during the daytime and BS 8233 'good' design criterion of 30 dB $L_{Aeq,T}$ during the night time are considered appropriate.

4.14 As well as the protection afforded by the new building for occupiers of the internal area, BS 8233 states that barriers or bunds should be considered to protect the gardens. In gardens and balconies etc. it is considered desirable that the steady noise level does not exceed 50 dB $L_{Aeq\ (0700–2300)}$ and 55 dB $L_{Aeq\ (2300–0700)}$ should be regarded as the upper limit (i.e. the upper limit of acceptability).

4.15 Furthermore, WHO Guidelines for Community Noise considers that few people are seriously annoyed (a significant effect) by activity with levels below 55 dB L_{Aeq} in the daytime. On this basis, the SOAEL is an unknown value in excess of 55 dB L_{Aeq}. Therefore, utilising 55 dB L_{Aeq} as the target garden criterion achieves the 1st aim of NPSE (avoiding significant impact).

5.00 SOUND ATTENUATION SCHEME

5.01 In order to calculate the sound insulation requirements of the building envelope for habitable rooms fronting onto Broadway, the Building Research Establishment (BRE) building envelope insulation calculation spreadsheet was used. This spreadsheet is based on the calculation methodology advocated in BS 8233. The spreadsheet allows input of external noise levels, room dimensions and reverberation time together with parameters for the various elements of the building envelope and calculates the internal noise level in terms of the external noise level metric (L_{Aeq} & L_{AFmax} in this case).

5.02 For the calculations, room parameters were based on a standard living room of 50 m^3 and a standard glazing size of 2 m^2. Calculations were based on a standard masonry construction. Based on a worst case noise level of 68 dB $L_{Aeq,(0700\text{-}2300)}$, a double glazed window rated at 30 dB $R_w + C_{tr}$, (such as a single pane of 10 mm glass and a single pane of 4 mm glass separated by a nominal cavity) along with acoustic trickle vents rated at 42 dB $D_{n,e,w}$ will be required to all dwellings situated along Broadway i.e. within approximately 25 metres of the nearside kerb.

5.03 Based on a standard bedroom of 25 m^3 and a standard glazing size of 1 m^2, ambient noise levels of 60 dB $L_{Aeq,(2300\text{-}0700)}$ and maximum noise levels of up to 79 dB L_{AFmax} at night a double glazed window rated at 32 dB $R_w + C_{tr}$, (such as a single pane of 10 mm glass and a single pane of 6 mm glass separated by a nominal cavity) along with acoustic trickle vents rated at 42 dB $D_{n,e,w}$ will be required to all dwellings situated along Broadway i.e. within 25 metres of the nearside kerb. Due to the relatively high noise levels predicted in these locations, it is recommended that a System 3 mechanical ventilation system (MEV) is provided to these dwellings to prevent the requirement for opening of windows to provide rapid ventilation.

5.04 Dwellings situated at a distance of between 25-40 metres of Broadway will benefit from increased distance attenuation and a maximum 90° angle of view, therefore predicted noise levels at these dwellings will be 63 dB $L_{Aeq,(0700\text{-}2300)}$, 54 dB $L_{Aeq,(2300\text{-}0700)}$ and 74 dB L_{AFmax}. It is

Continued from page 6

recommended that habitable rooms are provided with glazing rated at $\geq$29 dB R_w+C_{tr} (such as a single pane of 8 mm glass and a single pane of 4 mm glass separated by a nominal cavity). Ventilation should be provided by acoustic trickle vents rated at $\geq$ 37 dB $D_{n,e,w}$.

5.05 In reference to the proposed layout, all other dwellings (i.e. those at a distance of > 40 metres from the nearside kerb of Broadway or rooms fully screened from Broadway) will benefit from increased distance attenuation (3 dB assuming line source propagation) and screening/reduced angle of view provided by dwellings closer to Broadway (at least 8 dB based on a reduction to approximately 30^0). Predicted noise levels are therefore calculated to be 57 dB $L_{Aeq,(0700-2300)}$ and 48 dB $L_{Aeq,(2300-0700)}$ (although noise levels are not expected to fall this far at night due to the impact of continuous road traffic noise associated with the M1 motorway, a level of 52-53 dB $L_{Aeq,T}$ is therefore more likely) with maximum noise levels of <72 dB L_{AFmax}.

5.06 Based on measurements taken at numerous sites, it is considered that a typical standard double glazed window with trickle vents in a building façade will provide of the order of 27 to 30 dB (A) sound insulation (from external to internal) to road traffic noise. Standard 'hit and miss' trickle vents along with standard double glazing should therefore be suitable in all other locations within the application site.

Gardens

5.07 The majority of the gardens to the residential dwellings situated adjacent to Broadway are to be located to the rear of the dwellings, fully screened from road traffic noise by the dwellings themselves. Furthermore, the closest gardens to this highway are generally situated at a distance of approximately 32 metres to the nearside kerb of this highway.

5.08 Notwithstanding the above, the current layout places a single garden located adjacent to Broadway at a distance of 24 metres to the nearside kerb. The predicted noise level at this location is therefore calculated to be 67 dB $L_{Aeq,(0700-2300)}$ (based on line source propagation). It is calculated that providing a 2.5 metre high barrier in this location will provide approximately 12 dB of attenuation to road traffic noise, therefore reducing noise levels to circa 55 dB $L_{Aeq,(0700-2300)}$ within this garden.

5.09 A circa 2 metre high barrier is also recommended to the garden of the dwelling in the northern corner of the application site due to this garden of this property having a partial line of sight to the highway.

5.10 Increased distance attenuation in addition to a significant level of screening provided by the dwellings themselves should reduce noise levels to < 55 dB $L_{Aeq,(0700-2300)}$ within gardens throughout the remainder of the application site.

5.11 Further to the above, it is recommended that 2 metre high barriers are provided to gardens along the south western boundary of the application site to provide screening to noise associated with road traffic along the M1.

5.12 Please refer to Appendix 2 for the recommended locations of the barrier, with reference to the current layout.

6.00 CONCLUSIONS

6.01 A noise impact assessment has been undertaken for a proposed residential development at land off Broadway (A6133), Barnsley.

6.02 Recommendations for a scheme of sound insulation works have been developed to protect the proposed residential development from the ambient noise climate in accordance with the requirements of the National Planning Policy Framework. On this basis, the ambient noise climate is not considered to represent a constraint to the proposed residential development of the application site.

6.03 A summary of the glazing and ventilation recommendations are provided in Table 6.1 below:

Continued from page 7

Table 6.1 - Glazing & Ventilation Summary

Location	Living Rooms		Bedrooms	
	Glazing	**Ventilation**	**Glazing**	**Ventilation**
Facades facing (and at 90^0 to) Broadway, within 25 metres of the nearside kerb	30 dB R_w (i.e. 10/12/4)	42 dB $D_{n,e,w}$ trickle vents & mechanical extract	32 dB R_w (i.e. 10/12/6)	42 dB $D_{n,e,w}$ trickle vents & mechanical extract
Between 25-40 metres from the nearside kerb of Broadway	29 dB R_w (i.e. 8/12/4)	37 dB $D_{n,e,w}$ trickle vents	29 dB R_w (i.e. 8/12/4)	37 dB $D_{n,e,w}$ trickle vents
Remainder of site and rear facades of more exposed plots	25 dB R_w (i.e. 4/16/4)	Hit-and-miss trickle vents	25 dB R_w (i.e. 4/16/4)	Hit-and-miss trickle vents

I trust that the above meets with your requirements. Should you have any queries please do not hesitate to contact me.

Yours sincerely

Anthony Harper (BSc, MIOA)
Environmental Noise Solutions Limited

cc File

Appendix 1
Glossary of Acoustic Terms

Sound Pressure Level (L_p)

The basic unit of sound measurement is the sound pressure level. As the pressures to which the human ear responds can range from 20 µPa to 200 Pa, a linear measurement of sound levels would involve many orders of magnitude. Consequently, the pressures are converted to a logarithmic scale and expressed in decibels (dB) as follows:

$L_p = 20 \log_{10}(p/p_0)$

Where L_p = sound pressure level in dB; p = rms sound pressure in Pa; and p_0 = reference sound pressure (20 µPa).

A-weighting Network

A frequency filtering system in a sound level meter, which approximates under defined conditions the frequency response of the human ear. The A-weighted sound pressure level, expressed in dB(A), has been shown to correlate well with subjective response to noise.

Equivalent continuous A-weighted sound pressure level, $L_{Aeq, T}$

The value of the A-weighted sound pressure level in decibels of continuous steady sound that within a specified time interval, T, has the same mean-square sound pressure as a sound that varies with time. $L_{Aeq, 16h}$ (07:00 to 23:00 hours) and $L_{Aeq, 8h}$ (23:00 to 07:00 hours) are used to qualify daytime and night time noise levels.

$L_{A10, T}$

The A-weighted sound pressure level in decibels exceeded for 10% of the measurement period, T. $L_{A10, 18h}$ is the arithmetic mean of the 18 hourly values from 06:00 to 24:00 hours.

$L_{A90, T}$

The A-weighted sound pressure level of the residual noise in decibels exceeded 90% of a given time interval, T. L_{A90} is typically taken as representative of background noise.

$L_{AF\ max}$

The maximum A-weighted noise level recorded during the measurement period. The subscript 'F' denotes fast time weighting, slow time weighting 'S' is also used.

Sound Exposure Level (SEL or L_{AE})

The energy produced by a discrete noise event averaged over one second, no matter how long the event actually took. This allows for comparison between different noise events which occur over different lengths of time.

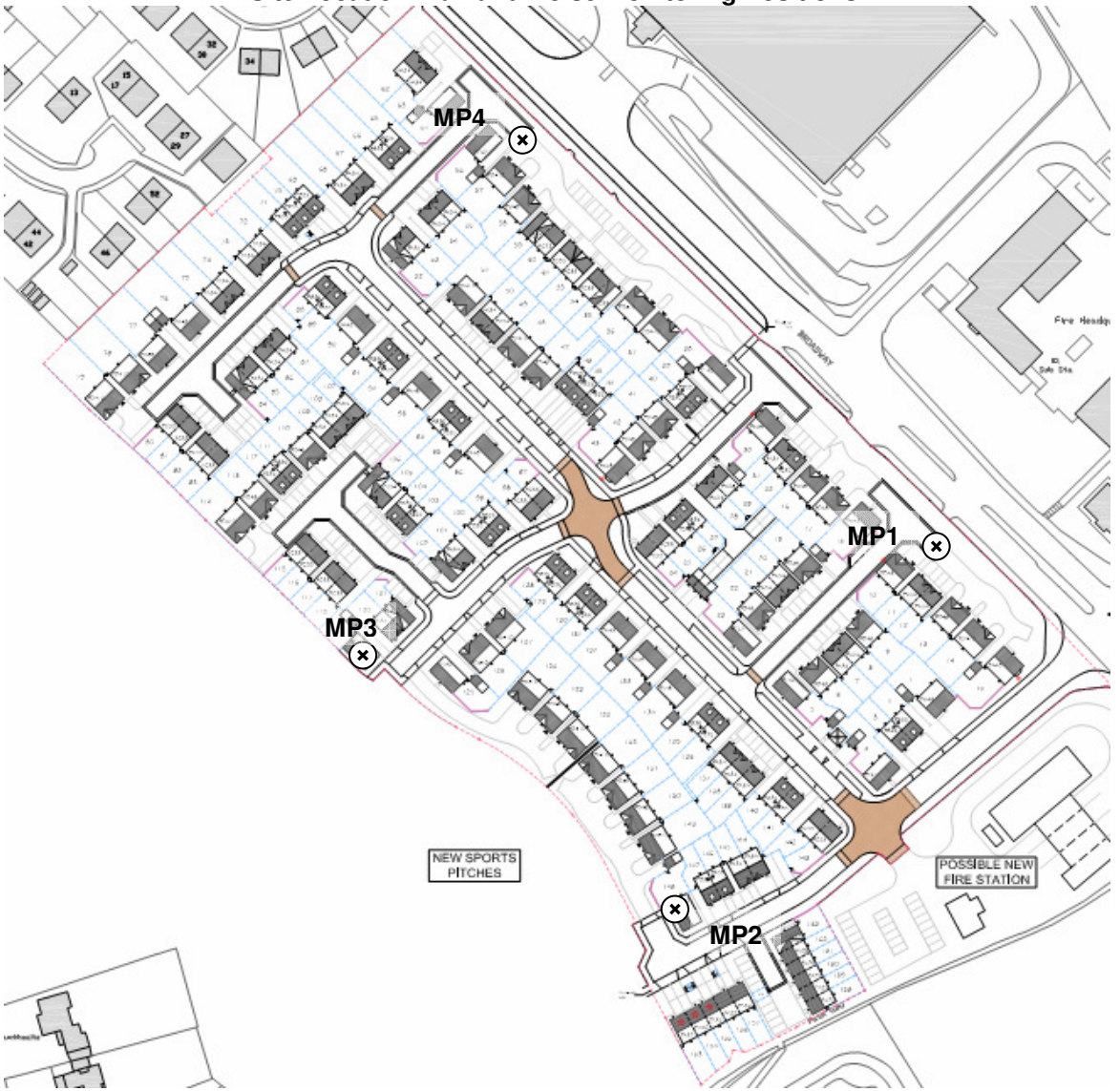
Weighted Sound Reduction Index (R_W)

Single number quantity which characterises the airborne sound insulation properties of a material or building element over a defined range of frequencies (R_W is used to characterise the insulation of a material or product that has been measured in a laboratory).

Weighted Airborne Sound Insulation ($D_{nT,w}$)

Single number quantity which characterises the airborne sound insulation between rooms.

Appendix 2
Site Location Plan and Noise Monitoring Positions



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Appendix 2
Recommended Location of Acoustic Barrier