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Acoustic Note AP03.ph.102819 for project information **27th March 2019**

Re: 17 Branch Hill, London, NW3 7NA
Noise from carport ventilation ducts

Ref Documents

[1] AP01-ph-102819
[1] AP02-ph-102819

We write to report our findings with regard to noise egress from the carport ventilation duct terminations as assessed against the planning consent.

The basis of compliance with draft planning consent condition 7 is that *"the noise levels from that piece of plant/equipment at any sensitive façade shall be at least 10dB(A) below the LA90, expressed in dB(A)".* The lowest measured daytime background noise is 43dBA. The lowest measured night time background noise is 34dBA. In order to comply with the requirements of the planning condition, any noise emanating from the plant room should not exceed a level of 24dBA (10dB below the lowest measured background noise over the operational hours of the plant) at the nearest noise sensitive façade.

The proposed location of the plant room, ventilation ducts and their proximity to adjacent noise sensitive properties is shown in Diagram 1 below.

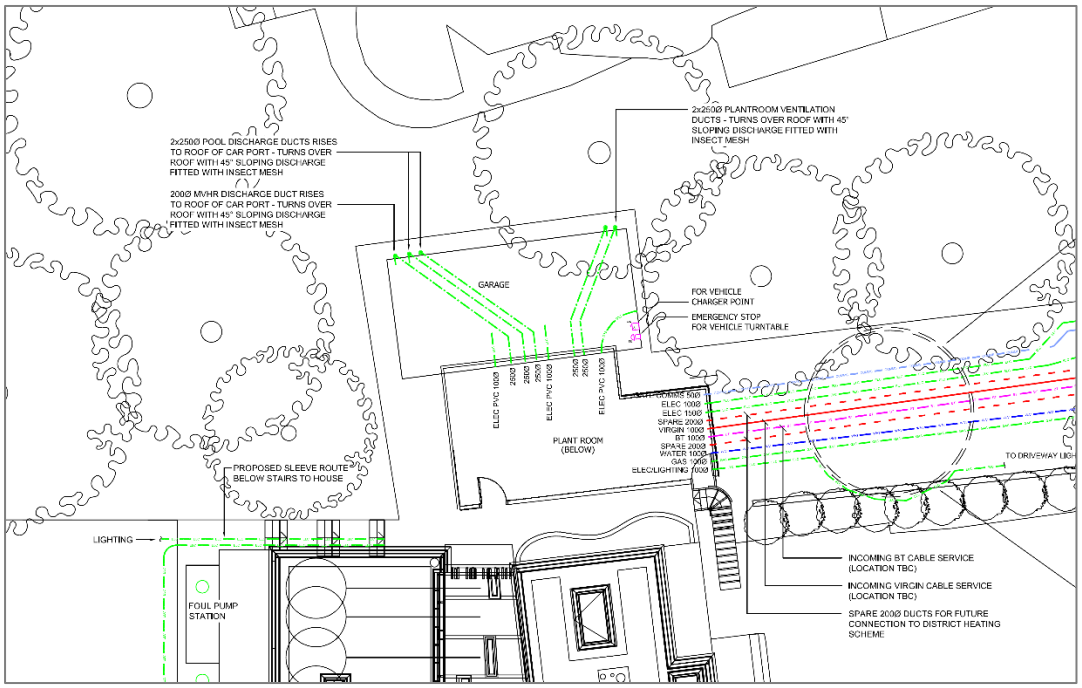

Diagram 1

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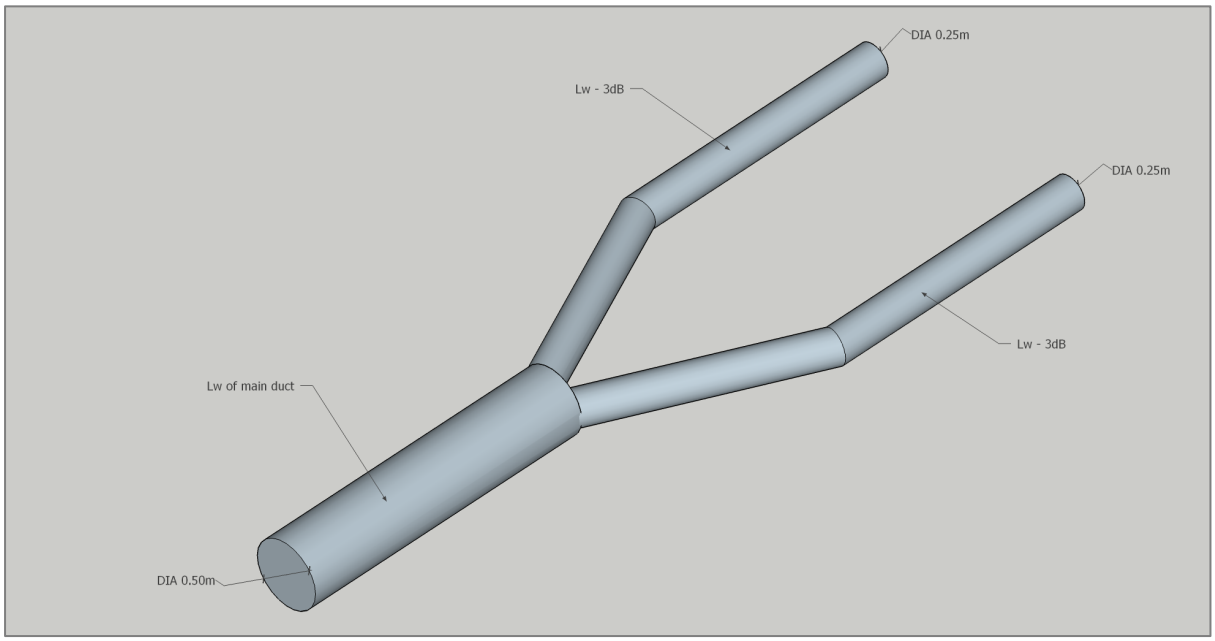
In our original assessments (referenced above), natural ventilation to the plant room was provided by 1no. 500Ø ventilation duct. Further, the swimming pool ventilation discharge was provided by 1no. 500Ø ventilation duct. It is understood that due to space constraints, both of these ducts have been split into 2no. smaller 250Ø ventilation ducts. The discharge duct for the MVHR is unchanged.

Therefore the revised scheme uses 5no. ventilation ducts in total as follows:

1. The plant room will be naturally ventilated via 2no. 250Ø ventilation duct that will discharge over the garage roof.
2. The swimming pool ventilation system (AHU) will discharge air via 2no. 250Ø ventilation ducts.
3. The atmosphere discharge duct for the MVHR (200Ø ventilation duct) will be routed to a terminal above the garage roof.

In terms of noise egress, the predicted noise levels in our original assessments holds true. In terms of splitting ducts, the sound power energy is equally divided given the ratio of the two ducts is the same (see Diagram 1 below).



For ease of reference, the calculation assessments for the original duct terminations are copied below:

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Acoustic Note AP01.ph.102819 for client information **17th January 2017**

Re: 17 Branch Hill, London, NW3 7NA
Noise from external condensers and swimming pool plant

Ref Docs

[1] 102819.ph.Issue2

We write to report our findings with regard to noise egress from the swimming pool plant and the external condenser units.

The basis of compliance with draft planning consent condition 7 is that *"the noise levels from that piece of plant/equipment at any sensitive façade shall be at least 10dB(A) below the LA90, expressed in dB(A)".* The lowest measured daytime background noise is 43dBA. The lowest measured night time background noise is 34dBA. The planning

The proposed location of the condenser units is shown below in Diagram 1 below.

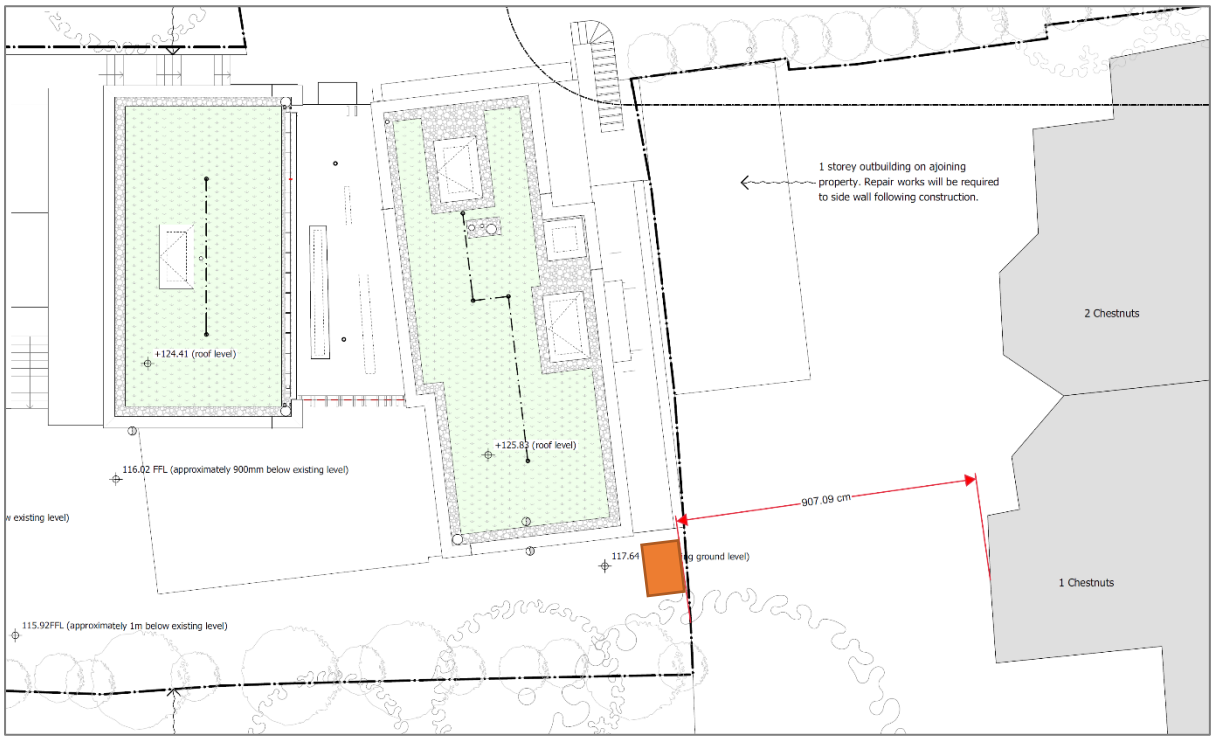

Diagram 1

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The condenser units will be 2No. Mitsubishi PUHY-P250YKB. These units will be fitted with acoustic kits and located in a screened 'compound'. They will be operated in normal mode during the day time period (0700-2300hrs) and low noise mode during the night time period (2300-0700hrs). Based on the site plan the distance from the condenser 'compound' to the adjacent noise sensitive property (1 Chestnuts) is approximately 9m. The calculation exercise follows in Tables 1 and 2.

	Octave Band Centre Frequency (Hz)								dBA
Standard mode	63	125	250	500	1000	2000	4000	8000	
Mitsubishi PUHY-P250YKB	75	65	62	57	50	46	42	38	59
Mitsubishi PUHY-P250YKB	75	65	62	57	50	46	42	38	59
Total	78	68	65	60	53	49	45	41	62
Acoustic kit	-3	-1	-3	-10	-12	-9	-10	-10	
Screening	-5	-5	-5	-5	-5	-5	-5	-5	
Distance attenuation	-19	-19	-19	-19	-19	-19	-19	-19	
Façade level	50	43	38	26	17	16	10	6	33

Table 1

	Octave Band Centre Frequency (Hz)								dBA
Low noise mode	63	125	250	500	1000	2000	4000	8000	
Mitsubishi PUHY-P250YKB	62	60	47	46	39	31	29	26	48
Mitsubishi PUHY-P250YKB	62	60	47	46	39	31	29	26	48
Total	65	63	50	49	42	34	32	29	51
Acoustic kit	-3	-1	-3	-10	-12	-9	-10	-10	
Screening	-5	-5	-5	-5	-5	-5	-5	-5	
Distance attenuation	-19	-19	-19	-19	-19	-19	-19	-19	
Façade level	37	38	23	14	5	0	0	0	23

Table 2

The calculation exercise demonstrates that the proposal meets with the Local Planning Authority (LPA) requirements with respect to noise. The following mitigation measures must be included in the design:

1. Acoustic kit fitted to both condensers
2. Screening around condenser location
3. Standard mode for condensers during period 0700-2300hrs – predicted noise impact 33dBA
4. Low noise mode for condensers during period 2300-0700hrs – predicted noise impact 23dBA

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The swimming pool air handling unit is located in the plant room at lower ground floor level and is ducted to atmosphere as highlighted below:

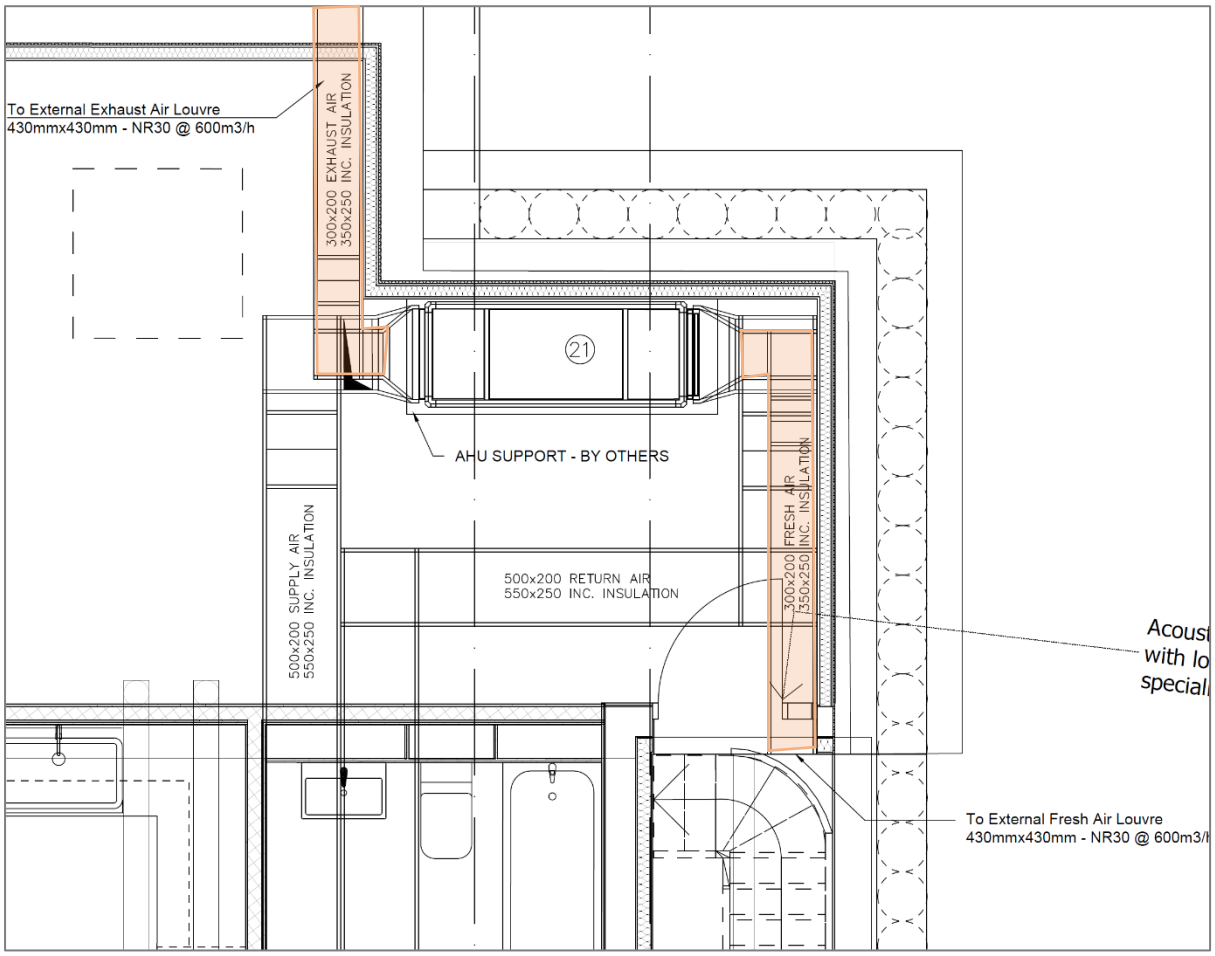

Diagram 2

In order to determine the atmosphere side noise level from the swimming pool air handling unit, consideration was given to attenuation through the duct system components.

Noise emanating from the atmosphere side fresh air and exhaust ducting was calculated as shown overleaf. The calculation exercise assumed that the terminating grilles for each duct run were Caice SS150 acoustic louvres (or equivalent acoustic performance). The fresh air duct run meets the requirements of the LPA. The calculated noise level is 23dBA. The exhaust air duct run fails to meet the requirements of the LPA. The calculated noise level is 31dBA. Additional attenuation will be required on the atmosphere side exhaust air duct run. This attenuator will need to reduce the noise by 7dBA. This can be readily achieved with an in-line silencer.

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CONTRACT TITLE: 17 Branch Hill, London, NW3
SOUND SOURCE: Swimming Pool AHU
MAKE & MODEL: Phoenix EC 1000 Super Plus
From: Exhaust air

					OCTAVE BAND CENTRE FREQUENCY (Hz)								
	OVERALL Lw				63	125	250	500	1k	2k	4k	8k	dBA
1			L_w of fan		68	70	68	69	66	68	65	56	73
2				1.000									
3			Lw at grille		68	70	68	69	66	68	65	56	73
4													
5	LENGTH (m)	C or R	x (mm)	x (mm)									
6	5.00	R	200-400	200-400	4.90	6.60	4.90	3.30	2.30	2.30	2.30	2.30	
7													
8													
9													
10													
11													
12													
13													
14													
15													
16	Bends (Unlined)												
17	NUMBER	TYPE	SIZE (mm)										
18	2	90	0250-0300		0.00	0.00	2.00	14.00	14.00	8.00	6.00	6.00	
19													
20													
21													
22													
23													
24													
25	BRANCHES												
26					0	0	0	0	0	0	0	0	
27													
28													
29	DUCT X-SECTIONAL AREAS												
30													
31													
32	OTHER ATTENUATION												
33	Caice SS150 acoustic louvre				4	4	6	8	11	11	11	10	
34	Building edge diffraction				5	5	5	5	5	5	5	5	
35													
36													
37	END REFLECTION SIZE (m)												
38	0.151 – 0.200				9	5	2	0	0	0	0	0	
39													
40				**Lw LEAVING SYSTEM**	45	49	48	39	34	42	41	33	47
41	Room Volume (m^3)			10000	-26	-26	-26	-26	-26	-26	-26	-26	
42	Mid-Frequency RT (s)			0.1	-10	-10	-10	-10	-10	-10	-10	-10	
43				**REVERBERANT SPL**	9	13	12	3	-2	6	5	-3	11
44	Distance to Listener			5	-25	-25	-25	-25	-25	-25	-25	-25	
45	Q=1 in free space			n/a	0	0	0	0	0	0	0	0	
46	Q=2 flush with surface			0.621 – 1.900	5	6	7	8	9	9	9	9	
47	Q=4 junction with 2 surfaces			n/a	0	0	0	0	0	0	0	0	
48				**DIRECT SPL**	25	30	30	22	18	26	25	17	31
49				**RESULTANT TOTAL SPL**	25	30	30	22	18	26	25	17	31
50	NR ACHIEVED/REQUIRED		30	20	51	39	31	24	20	17	14	13	30
51	Additional Attenuation Required				0	0	0	0	0	9	11	4	

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CONTRACT TITLE: 17 Branch Hill, London, NW3
SOUND SOURCE: Swimming Pool AHU
MAKE & MODEL: Phoenix EC 1000 Super Plus
From: Fresh air

					OCTAVE BAND CENTRE FREQUENCY (Hz)								
	OVERALL Lw				63	125	250	500	1k	2k	4k	8k	dBA
1			L_w of fan		66	66	64	64	62	63	61	52	69
2				1.000									
3			Lw at grille		66	66	64	64	62	63	61	52	69
4													
5	LENGTH (m)	C or R	x (mm)	x (mm)									
6	3.00	R	200-400	200-400	2.94	3.96	2.94	1.98	1.38	1.38	1.38	1.38	
7													
8													
9													
10													
11													
12													
13													
14													
15													
16	Bends (Unlined)												
17	NUMBER	TYPE	SIZE (mm)										
18	1	90	0250-0300		0.00	0.00	1.00	7.00	7.00	4.00	3.00	3.00	
19													
20													
21													
22													
23													
24													
25	BRANCHES												
26					0	0	0	0	0	0	0	0	
27													
28													
29	DUCT X-SECTIONAL AREAS												
30													
31													
32	OTHER ATTENUATION												
33	Caice SS150 acoustic louvre				4	4	6	8	11	11	11	10	
34	Building edge diffraction				5	5	5	5	5	5	5	5	
35													
36													
37	END REFLECTION SIZE (m)												
38	0.151 – 0.200				9	5	2	0	0	0	0	0	
39													
40				**Lw LEAVING SYSTEM**	45	48	47	42	37	42	41	33	48
41	Room Volume (m^3)			10000	-26	-26	-26	-26	-26	-26	-26	-26	
42	Mid-Frequency RT (s)			0.1	-10	-10	-10	-10	-10	-10	-10	-10	
43				**REVERBERANT SPL**	9	12	11	6	1	6	5	-3	12
44	Distance to Listener			13	-33	-33	-33	-33	-33	-33	-33	-33	
45	Q=1 in free space			n/a	0	0	0	0	0	0	0	0	
46	Q=2 flush with surface			0.621 – 1.900	5	6	7	8	9	9	9	9	
47	Q=4 junction with 2 surfaces			n/a	0	0	0	0	0	0	0	0	
48				**DIRECT SPL**	16	21	21	17	13	18	16	9	23
49				**RESULTANT TOTAL SPL**	17	22	21	18	13	18	17	9	23
50	NR ACHIEVED/REQUIRED		22	20	51	39	31	24	20	17	14	13	30
51	Additional Attenuation Required				0	0	0	0	0	1	2	0	

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ACOUSTICS PLUS

Acoustic Note AP02.ph.102819 for project information **19th July 2017**

Re: 17 Branch Hill, London, NW3 7NA
Noise from plant room

Ref Docs

[1] 102819.ph.Issue2

We write to report our findings with regard to noise egress from the proposed lower ground floor plant room.

The basis of compliance with draft planning consent condition 7 is that *"the noise levels from that piece of plant/equipment at any sensitive façade shall be at least 10dB(A) below the LA90, expressed in dB(A)".* The lowest measured daytime background noise is 43dBA. The lowest measured night time background noise is 34dBA. In order to comply with the requirements of the planning condition, any noise emanating from the plant room should not exceed a level of 24dBA (10dB below the lowest measured background noise over the operational hours of the plant) at the nearest noise sensitive façade.

The proposed location of the plant room and its proximity to adjacent noise sensitive properties is shown in Diagram 1 below.

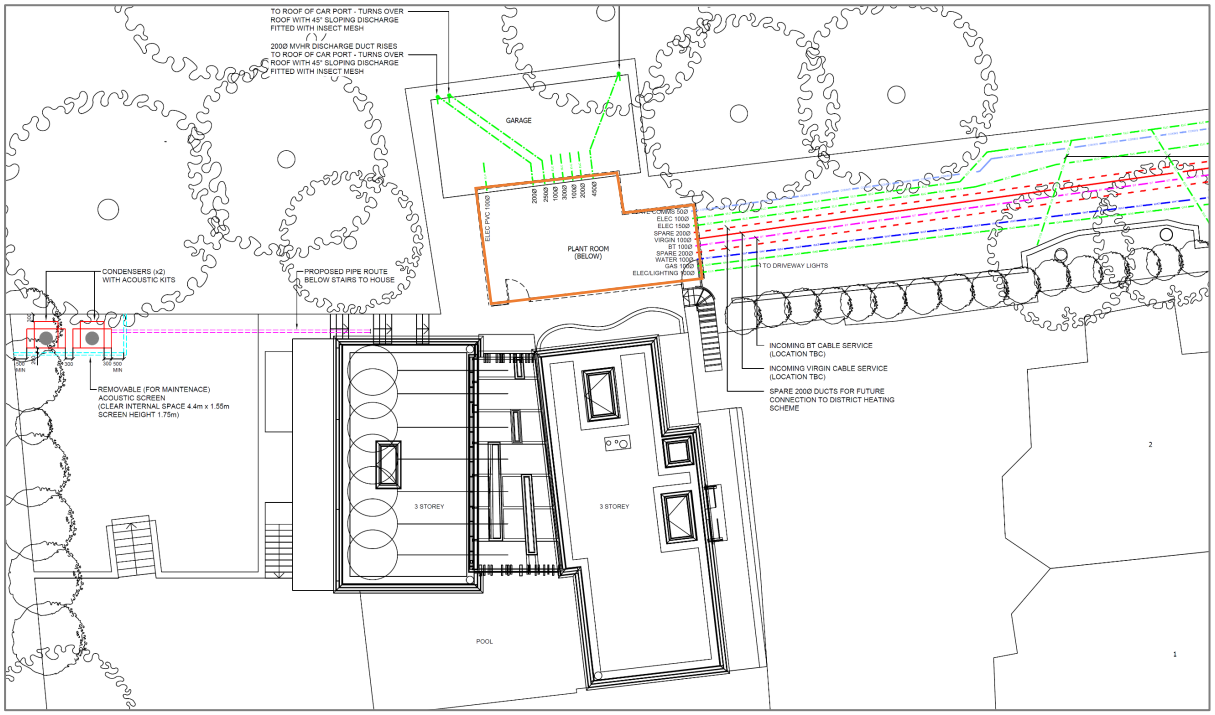

Diagram 1

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A detailed list of proposed plant that will be located in the plant room was provided by Inspire Consulting UK Ltd. The list of equipment is shown in Table 1 below.

Potential Internal noise source	Manufacturer	Model
1. CHP Power Unit	SAV	Loadtracker XRGi-9
2. Boilers	Hoval	Topgas60
3. Domestic water booster	Aquatech Pressmain	AMV-FB Series 6-5
4. Heating pump	Groundfos	Magna3 D 32-40
5. Heating pump	Groundfos	Alpha2 25-40 180
6. Heating pump	Groundfos	Alpha2 25-80 130
7. Heating pump	Groundfos	Alpha2 25-60 130
8. Heating pump	Groundfos	UPS 25-40 130

Table 1

The plant room will be naturally ventilated via a louvred door opening into a lightwell in the south east corner. Further natural ventilation will be provided via a 450Ø ventilation duct that will discharge over the garage roof. The swimming pool ventilation system will also be located in the plant room but the specification of this is yet to be determined. A MVHR fan will also be located in the plant room. The atmosphere discharge duct will be routed to a terminal above the garage roof.

For the purposes of this note, the following noise impacts have been considered:

(a) The egress of noise from items of mechanical plant within the plant room via the louvred door;
(b) The egress of noise from items of mechanical plant within the plant room via the natural ventilation duct;
(c) The egress of noise from the MVHR atmosphere discharge duct;

In order to determine the noise impacts, it was necessary to obtain noise data from the various manufacturers. In some instances, this information was difficult to obtain. A number of manufacturers could only provide noise data as a broadband value. In these instances a spectral distribution has been assumed based on experience. The following information was obtained:

Noise source	Octave Band Centre Frequency (Hz)								dBA
	63	125	250	500	1000	2000	4000	8000	
1. CHP Power Unit	68	61	63	55	51	50	53	48	60
2. Boilers	69	62	64	56	52	51	54	49	61
3. Domestic water booster	63	56	58	50	46	45	48	43	55
4. Heating pump	62	55	57	49	45	44	47	42	54
5. Heating pump	62	55	57	49	45	44	47	42	54
6. Heating pump	62	55	57	49	45	44	47	42	54
7. Heating pump	62	55	57	49	45	44	47	42	54
8. Heating pump	62	55	57	49	45	44	47	42	54

Table 2

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Noise impact (a)

In order to calculate the noise egress, consideration was given to the following formula:

$$L_p = L_w + 10log_{10}T - 10log_{10}V + 14$$

Where L_p *is the reverberant sound pressure level in the plantroom*
L_w *is the sound power level of the plant*
T is the plantroom reverberation time, s
V is the plantroom volume, m^3

$$L_{p_2} = L_{p_1} - R - 6$$

Where L_{p_2} *is the sound pressure level close to the louvre on the outside*
L_{p_1} *is the reverberant sound pressure level in the plantroom*
R is the sound reduction index of the louvre

The following assumptions have been made:

1. The nearest noise sensitive façade belongs to the rear of No.2 The Chestnuts. This property does not have line of sight with the louvred door.
2. The insertion loss of the louvred door is as specified. The attenuation is based on an acoustic louvre supplied by Caice (SHH 150mm). This could be either fabricated as an acoustic door or installed as a demountable louvre behind a weather louvred door.
3. The Aquatech Pressmain AMV-FB Series 6-5 is located within the manufacturers acoustic enclosure as specied by Aquatech.

Calculation Step	Octave Band Centre Frequency (Hz)								dBA
	63	125	250	500	1000	2000	4000	8000	
Reverberant Lp in plantroom	72	65	67	58	55	54	57	51	64
150mm Caice SHH louvre	5	5	7	9	13	13	13	12	19
Level outside plantroom	61	54	54	43	36	35	38	33	49
Building edge diffraction	-10	-10	-10	-10	-10	-10	-10	-10	
Reverberant level in lightwell	6	6	6	6	6	6	6	6	
Distance attenuation	-23	-23	-23	-23	-23	-23	-23	-23	
Level at façade	34	27	27	16	9	8	11	6	22

Table 3

The calculation exercise demonstrates that the proposal meets with the Local Planning Authority (LPA) requirements with respect to noise.

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Noise impact (b)

In order to determine the atmosphere side noise level from the natural ventilation duct, consideration was given to attenuation through the duct system components. In this instance the nearest noise sensitive façade was considered to be Savoy Court.

Noise emanating from the atmosphere side ducting was calculated as shown below. The calculation exercise assumed that there was in line attenuation with a minimum insertion loss as specified in line 33. The calculation exercise demonstrates that the proposal meets with the Local Planning Authority (LPA) requirements with respect to noise.

CONTRACT TITLE: Branch Hill
SOUND SOURCE: Plant room noise
MAKE & MODEL: Various
From: Natural ventilation duct

					OCTAVE BAND CENTRE FREQUENCY (Hz)								
	OVERALL Lw				63	125	250	500	1k	2k	4k	8k	dBA
1			L_w of fan		74	67	69	60	57	56	59	53	66
2				0.250									
3			Lw at grille		68	61	63	54	51	50	53	47	60
4													
5	LENGTH (m)	C or R	x (mm)	x (mm)									
6	4.00	C	400-800		0.28	0.28	0.28	0.40	0.64	0.64	0.64	0.64	
7													
8													
9													
10													
11													
12													
13													
14													
15													
16	Bends (Unlined)												
17	NUMBER	TYPE	SIZE (mm)										
18	2	90	0400-0500		0.00	0.00	10.00	16.00	8.00	6.00	6.00	6.00	
19													
20													
21													
22													
23													
24													
25	BRANCHES												
26					0	0	0	0	0	0	0	0	
27													
28													
29	DUCT X-SECTIONAL AREAS												
30													
31													
32	OTHER ATTENUATION												
33	Minimum in line attenuation required				6	8	10	11	15	15	15	14	
34													
35													
36													
37	END REFLECTION SIZE (m)												
38	0.501 – 0.800				5	2	0	0	0	0	0	0	
39													
40	**Lw LEAVING SYSTEM**				56	51	43	27	27	29	31	27	40
41	Room Volume (m^3)			10000	-26	-26	-26	-26	-26	-26	-26	-26	
42	Mid-Frequency RT (s)			0.1	-10	-10	-10	-10	-10	-10	-10	-10	
43	**REVERBERANT SPL**				20	15	7	-9	-9	-7	-5	-9	4
44	Distance to Listener			6	-27	-27	-27	-27	-27	-27	-27	-27	
45	Q=1 in free space			n/a	0	0	0	0	0	0	0	0	
46	Q=2 flush with surface			0.051 – 0.085	3	4	6	7	8	8	9	9	
47	Q=4 junction with 2 surfaces			n/a	0	0	0	0	0	0	0	0	
48	**DIRECT SPL**				33	28	22	7	9	10	14	9	20
49	**RESULTANT TOTAL SPL**				33	28	22	8	9	10	14	9	20

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Noise impact (c)

In order to determine the atmosphere side extract noise level from the MVHR ducting, consideration was given to attenuation through the duct system components. In this instance the nearest noise sensitive façade was considered to be Savoy Court.

Noise emanating from the atmosphere side ducting was calculated as shown below. The calculation exercise assumed that there was in line attenuation with a minimum insertion loss as specified in line 33. The calculation exercise demonstrates that the proposal meets with the Local Planning Authority (LPA) requirements with respect to noise.

CONTRACT TITLE: Branch Hill
SOUND SOURCE: MVHR
MAKE & MODEL: Duplexvent DV80L
From: Extract

					OCTAVE BAND CENTRE FREQUENCY (Hz)								
	OVERALL Lw				63	125	250	500	1k	2k	4k	8k	dBA
1			L_w of fan		55	58	64	65	62	63	61	52	69
2				1.000									
3			Lw at grille		55	58	64	65	62	63	61	52	69
4													
5	LENGTH (m)	C or R	x (mm)	x (mm)									
6	4.00	C	200-400		0.28	0.40	0.40	0.64	0.92	0.92	0.92	0.92	
7													
8													
9													
10													
11													
12													
13													
14													
15													
16	Bends (Unlined)												
17	NUMBER	TYPE	SIZE (mm)										
18	2	90	0200-0250		0.00	0.00	0.00	10.00	16.00	8.00	6.00	6.00	
19													
20													
21													
22													
23													
24													
25	BRANCHES												
26					0	0	0	0	0	0	0	0	
27													
28													
29	DUCT X-SECTIONAL AREAS												
30													
31													
32	OTHER ATTENUATION												
33	Minimum in line attenuation required				5	9	18	24	23	25	30	30	
34													
35													
36													
37	END REFLECTION SIZE (m)												
38	0.051 – 0.075				13	8	4	1	0	0	0	0	
39													
40				**Lw LEAVING SYSTEM**	37	41	41	29	22	29	24	15	36
41	Room Volume (m^3)			10000	-26	-26	-26	-26	-26	-26	-26	-26	
42	Mid-Frequency RT (s)			0.1	-10	-10	-10	-10	-10	-10	-10	-10	
43				**REVERBERANT SPL**	1	5	5	-7	-14	-7	-12	-21	0
44	Distance to Listener			4	-23	-23	-23	-23	-23	-23	-23	-23	
45	Q=1 in free space			n/a	0	0	0	0	0	0	0	0	
46	Q=2 flush with surface			0.051 – 0.085	3	4	6	7	8	8	9	9	
47	Q=4 junction with 2 surfaces			n/a	0	0	0	0	0	0	0	0	
48				**DIRECT SPL**	17	22	24	13	7	14	10	1	20
49				**RESULTANT TOTAL SPL**	17	22	24	13	7	14	10	1	20

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ACOUSTICS PLUS

Lest there be any misunderstanding, in order for noise emanating from the plant room to meet with the Local Planning Authority noise criteria, the following attenuation measures should be implemented:

1. The louvred door that provides access from the lightwell into the plantroom should meet the following insertion loss values. If it is not possible to fabricate a door with this performance, it is suggested that a demountable acoustic louvre is installed behind a weather louvred door.

Attenuation	Octave Band Centre Frequency (Hz)							
	63	125	250	500	1000	2000	4000	8000
Acoustic louvre (Caice SHH 150mm)	5	5	7	9	13	13	13	12

2. An in-line attenuator should be installed within the natural ventilation ducting. This attenuator should meet the following insertion loss values.

Attenuation	Octave Band Centre Frequency (Hz)							
	63	125	250	500	1000	2000	4000	8000
In-line attenuation	6	8	10	11	15	15	15	14

3. An in-line attenuator should be installed within the MVHR extract ducting. This attenuator should meet the following insertion loss values.

Attenuation	Octave Band Centre Frequency (Hz)							
	63	125	250	500	1000	2000	4000	8000
In-line attenuation	5	9	18	24	23	25	30	30

4. The Aquatech Pressmain AMV-FB Series 6-5 water booster set should be housed in an acoustic enclosure as provided and specified by Aquatech.