Project	Kingston Wharf, Brighton Road, Shoreham-by-Sea – Acoustic Mitigation
To	Richard Abraham – HGP Architects
From	7th Wave Acoustics Ltd
Date	5th December 2022
Ref	1177.001M.Facade.2.0.JP

1 INTRODUCTION

7th Wave Acoustics has been appointed by HGP Architects Ltd, on behalf of PMC Construction Ltd, to prepare a report, setting out the final scheme of acoustic mitigation, to protect occupants from external noise at the Kingston Wharf Development, Brighton Road, Shoreham-by-Sea.

The Local Planning Authority has granted planning consent for the development (Ref: AWDM/051/21), which was subject to a number of planning conditions. Condition 38, set out below, is pertinent to this report:

Condition 38: Noise - Acoustic Mitigation

No residential units shall be occupied until acoustic mitigation measures have been completed in accordance with the recommendations of the submitted Noise Impact Assessment by 7th Wave Acoustics (ref: 1109.001R.4.0.RF), and additional details, including provisions for ventilation which shall have first been submitted to and approved in writing by the Local Planning Authority and these mitigation and ventilation measures shall be permanently maintained thereafter.

Reason: To protect residents from noise, vibration and overheating in accordance with policies 34 of the Adur Local Plan and SH7 of the Shoreham Harbour Joint Action Plan 2019.

This report provides detailed calculations to determine whether the chosen glazing and ventilation system will be appropriate and to recommend further mitigation, should it be required. This note should be read in conjunction with the main noise impact assessment report for the site (1109.001R.4.0.RF), herein referred to as the Report.

The site will comprise a *'mixed-use development comprised of three blocks of residential dwellings (4 to 8 storeys) and mixed use business centre (office, storage and café uses) – incorporating riverside walk, landscaping and ancillary car and cycle parking.'*

The floor plans referred to in this report, and used calculation purposes, are presented in Figures A1 to A4 of Appendix A.

The architectural sections for the development are presented in Figures A5 to A14 of Appendix A.

2 NOISE CALCULATIONS

The calculation method described in Annex G of BS 8233:2014 has been used to predict noise levels inside habitable rooms within a selection of dwellings.

The calculation method enables composite façade sound reductions to be calculated taking into consideration the sound reduction afforded by the external walls, roof and window elements plus any ventilation apertures in the façade.

The acoustic algorithm used to calculate the façade sound reduction and the internal noise levels is reproduced below.

$$L_{eq,2} = L_{eq,ff} + 10log_{10}\left(\frac{A_0}{S}10^{\frac{-D_{n,e}}{10}} + \frac{S_{wi}}{S}10^{\frac{-R_{wi}}{10}} + \frac{S_{ew}}{S}10^{\frac{-R_{ew}}{10}} + \frac{S_{rr}}{S}10^{\frac{-R_{rr}}{10}}\right) + 10log_{10}\left(\frac{S}{A}\right) + 3$$

Where:

$L_{eq,ff}$	is the equivalent, free-field, continuous sound pressure level outside the room elements under consideration;
A_0	is a reference absorption area of 10 m^2 and is independent of frequency;
$D_{n,e}$	is the insulation of the trickle ventilator measured according to BS EN ISO 10140;
S_{wi}	is the area in square metres (m^2) of the windows of the room;
R_{wi}	is the sound reduction index (octave band value) of the window;
S_{ew}	is the area in square metres (m^2) of the external wall of the room;
R_{ew}	is the sound reduction index (octave band value) of the external wall;
S_{rr}	is the area in square metres (m^2) of the ceiling of the room;
R_{rr}	is the sound reduction index (octave band values) of the roof/ceiling;
S_f	is the total façade area in square metres (m^2) of the room in question;
S	is the total area in square metres (m^2) of elements through which sound enters the room, i.e. $S_f + S_{rr}$;
A	is the equivalent absorption area of the receiving room being considered; and
+3	is a correction factor

Construction Assumptions

Architectural plans, received from HGP Architects Ltd, have been used to derive details of the specific construction of the building envelope.

The sound reduction for a typical masonry wall construction has been extracted from the Woods Practical Guide to Noise Control[1].

The assumed SRI of the wall construction is presented overleaf in Table 2.1.

Due to the main noise source impacting the site is from road traffic on Brighton Road (A259), noise through the roof element of the construction has not been considered.

[1] Woods practical guide to noise control. Ian Sharland. 1990

The internal noise calculations have been undertaken on a selection of the worse-case habitable rooms on the most exposed North, East, South and West facing facades of the development i.e. the rooms with the smallest volume and largest glazing area that are not acoustically screened.

It is understood that the proposed development will utilise mechanical ventilation with heat recovery (MVHR). Therefore, the development does not require passive vents, which removes an additional pathway for external to internal noise transfer.

The proposed glazing units selected for the development have been used in the calculations.. The acoustic data for the proposed glazing products are presented in Figures A15, A16 and A17 of Appendix A.

It is understood that on the front façade (north façade), the 46 dB R_w glazing product is proposed for all bedrooms. For living rooms on the front façade (north façade) the 37 dB R_w glazing product is proposed. It is understood that the 35 dB R_w glazing product is installed on all other habitable rooms across the development (east, south and west façades). It is noted that the chosen glazing systems R_w values match those recommended in the Report.

The sound reduction for the selected glazing options is presented in Table 2.1.

Table 2.1: Building Element Sound Reduction Index (SRI)

Building Element	Source	R_w	1/1-Octave Band Frequency, Sound Reduction Index, dB					
			125 Hz	250 Hz	500 Hz	1 kHz	2 kHz	4 kHz
Wall	Woods	-	34	34	40	56	73	76
Glazing [1]	Manufacturer Test Data	35	22	25	35	40	40	39
Glazing [2]	Manufacturer Test Data	37	28	34	37	38	36	47
Glazing [3]	Manufacturer Test Data	46	30	39	43	46	48	49

Notes:
[1] Glazing specified as 4-20-4 configuration
[2] 8.8mm acoustic laminate-18mm spacer and 10mm toughened glass; and
[3] 8.8mm Optiphon-20mm cavity-12.8mm Optiphon.

Free-field Noise Levels

The adopted daytime $L_{Aeq,\ 16hr}$, night-time $L_{Aeq,8hr}$ ambient noise levels and the night-time $L_{Amax,F}$ levels used for the purpose of these calculations have been derived from the baseline ambient noise levels obtained during the unattended monitoring survey, as presented in the Report.

The adopted external free-field noise levels for daytime ($L_{Aeq,\ 16hr}$), night-time ($L_{Aeq,\ 8hr}$) and night-time ($L_{Amax,F}$) are presented in Table 2.2.

The 1/1 octave band sound spectrums summarised below in Table 2.2 are the logarithmic averages of the octave band noise levels measured during the daytime and night-time periods during the site survey at the LT1 monitoring location. Details of this noise survey are presented in the Report. The spectrums have then been adjusted according to the final calculated dB(A) receptor, again, as shown in the Report.

Table 2.2: Adopted Daytime and Night-Time External free-Field Noise Levels

Location	Representative Calculated Receptor Point[1]	Period	Time Base (hr)	$L_{Aeq,T}$ dB (A)	1/1-Octave Band External Free-Field Noise Level, dB $L_{eq,T}$					
					125 Hz	250 Hz	500 Hz	1 kHz	2 kHz	4 kHz
North Facade	R1	Daytime	16	70	63	64	63	67	63	54
		Night-time	8	64	58	58	57	61	57	50
East Facade	R5	Daytime	16	61	54	55	54	58	54	45
		Night-time	8	55	49	49	48	52	48	41
South Facade	R6	Daytime	16	36	29	30	29	33	29	20
		Night-time	8	30	24	24	23	27	23	16
West Facade	R2	Daytime	16	65	58	59	58	62	58	49
		Night-time	8	59	53	53	52	56	52	45

Note: [1] Receptor point as presented in report ref: 1109.001R.4.0.RF

Assessment of Internal Levels

Based on the calculated composite façade sound reductions, predicted ambient noise levels inside a selection of 'worse case' rooms on each exposed façade of the development are summarised below in Table 2.3. An example of the detailed calculations is presented in Figures A18 of Appendix A.

Table 2.3: Calculated Daytime Internal Noise Levels

Period	Façade Direction	Flat Type #	Room	Free-Field External Noise Level, dB $L_{Aeq,16hr}$	Calculated Internal Noise Level, dB $L_{Aeq,16hr}$	Room Activity	BS 8233 Guideline Level Achieved?
Daytime (07:00hrs to 23:00hrs)	North	18	Bedroom 1	70	30	Daytime Resting	Yes
		28	Living Room	70 / 65[1]	34		Yes
		18	Living Room	70 / 36[2]	27		Yes
	East	16	Bedroom 1	61	26		Yes
	South	13	Bedroom 1	35	<10		Yes
	West	16	Bedroom 1	65	31		Yes

Notes:
[1] The selected room has both a north facing and west facing façade. 70 dB $L_{Aeq,16hr}$ has been adopted as the representative free-field noise level for the north facing façade and 65 dB $L_{Aeq,16hr}$ has been adopted as the representative noise level for the west façade. Each façade considers the adopted glazing specification (37 dB R_w for the north façade and 35 dB R_w for the west). The calculated internal levels breaking in through each façade element has then been logarithmically summated to derive an internal ambient dB $L_{Aeq,16hr}$ noise level; and
[2] The selected room has both a north facing and south facing façade. 70 dB $L_{Aeq,16hr}$ has been adopted as the representative free-field noise level for the north facing façade and 35 dB $L_{Aeq,16hr}$ has been adopted as the representative noise level for the south façade. The same calculation process is followed as per note 1.

Table 2.4: Calculated Night-Time Internal Noise Levels

Period	Façade	Flat Type	Room	Free-Field External Noise Level, dB $L_{Aeq,16hr}$	Calculated Internal Noise Level, dB $L_{Aeq,16hr}$	Room Activity	WHO Guideline Level Achieved?
Night-time (23:00hrs to 07:00hrs)	North	18	Bedroom 1	64	24	Sleeping	Yes
	East	16	Bedroom 1	55	20		Yes
	South	13	Bedroom 1	30	<10		Yes
	West	16	Bedroom 1	59	25		Yes

Based on the calculated façade sound reductions, the noise predictions show that internal noise levels fall below the adopted daytime and night-time guideline levels of 35 and 30dB $L_{Aeq,T}$ respectively.

World Health Organisation $L_{Amax,F}$ Noise Levels

Maximum $L_{Amax,F}$ noise levels generated at night have also been considered at the proposed development site.

WHO guideline noise criteria sets an internal sleep disturbance noise limit of 42 dB $L_{Amax,F}$ for the onset of critical health effects, which is a level which should not be exceeded on a regular basis. Based on an interpretation that for a noise to be regular, it needs to occur several (i.e. more than two) times per hour, the $L_{Amax,F}$ noise needs to be based upon an average of at least 10-15 events that are typical in nature.

The façade noise level of 87 dB $L_{Amax,F}$, presented in the Report is considered representative of the worst affected façade (north façade) facing the A259.

A summary of the representative external free-field night-time $L_{Amax,F}$ noise levels is presented below in Table 2.5.

The 1/1 octave band sound spectrums summarised below in Table 2.5 have been derived by logarithmically averaging the 1/1 octave band $L_{Amax,F}$ noise levels measured during the night-time period during the site survey at the LT1 monitoring location, as presented in the Report.

The noise levels on the east, south and west façades are calculated to be 9 dB, 34 dB and 5 dB lower than the noise levels on the north façade respectively. The spectrums have therefore been adjusted accordingly.

Table 2.5: Summary of Representative Free-field External Night-Time Noise $L_{Amax,F}$ Noise Levels

Façade	Period	Time Base (hr)	Free-field $L_{Amax,F}$ dB (A)	1/1-Octave Band External Free-Field Noise Level, dB $L_{max,F}$					
				125 Hz	250 Hz	500 Hz	1 kHz	2 kHz	4 kHz
North	Night-time	8	84	79	76	75	78	76	73
East			75	70	67	66	69	67	64
South			50	45	42	41	44	42	39
West			79	74	71	70	73	71	68

Note: [1] -3dB correction to correct from façade to free-field.

An assessment of the calculated night-time $L_{Amax,F}$ noise levels inside a selection of bedrooms on each of the exposed façades the front façade has been undertaken and is presented in Table 2.6 below.

Table 2.6: Calculated Internal $L_{Amax,F}$ Noise Levels

Period	Façade	Flat Type	Room	Free-Field External Noise Level, dB $L_{Amax,F}$	Calculated Internal Noise Level, dB $L_{Amax,F}$	Room Activity	WHO Guideline Level Achieved
Night-time (23:00 to 07:00 hrs)	North	18	Bedroom 1	84	42	Sleeping	Yes
	East	16	Bedroom 1	75	38		Yes
	South	13	Bedroom 1	50	<20		Yes
	West	16	Bedroom 1	79	42		Yes

Based on this assessment of maximum $L_{Amax,F}$ noise levels, the calculated internal maximum $L_{Amax,F}$ noise levels meet the WHO guideline noise level of 42 dB $L_{Amax,F}$.

3 CONCLUSIONS

7th Wave Acoustics has been appointed by HGP Architects Ltd, on behalf of PMC Construction Ltd, to prepare a report, setting out the final scheme of acoustic mitigation, to protect occupants from external noise at the Kingston Wharf Development, Brighton Road, Shoreham-by-Sea.

Detailed noise calculations have been undertaken to consider the suitability of the proposed glazing product, for the protection against the ingress of external noise into habitable rooms.

It is understood that the proposed development will utilise mechanical ventilation with heat recovery (MVHR). Therefore, the final scheme for the development does not incorporate passive vents, which removes an additional pathway for external to internal noise transfer.

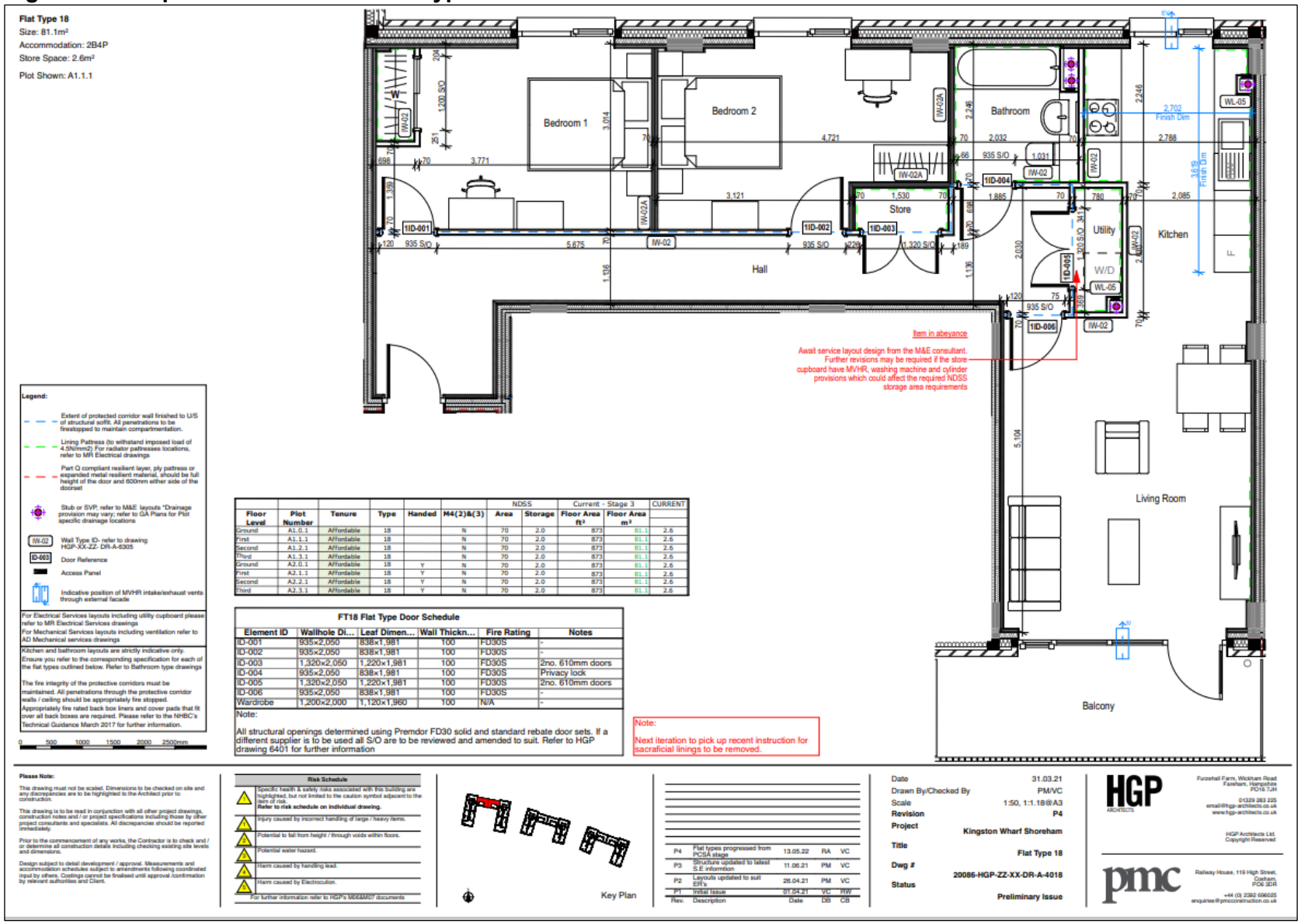
The results of the assessment show that the internal ambient $L_{Aeq,T}$ noise levels calculated during 16-hour day and 8-hour night-time periods are predicted to meet BS 8233:2014's desirable guideline noise levels with windows closed within the habitable rooms of the dwellings.

The night-time $L_{Amax,\ F}$ internal noise levels will not exceed the WHO limit of 42dB $L_{Amax,F}$ for the prevention of sleep disturbance.

The proposed scheme is therefore considered to provide sufficient protection against the ingress of external noise into habitable rooms and satisfies the requirements of Condition 38.

Appendix A – Figures

Figure A1: Proposed Floor Plan – Flat Type 18



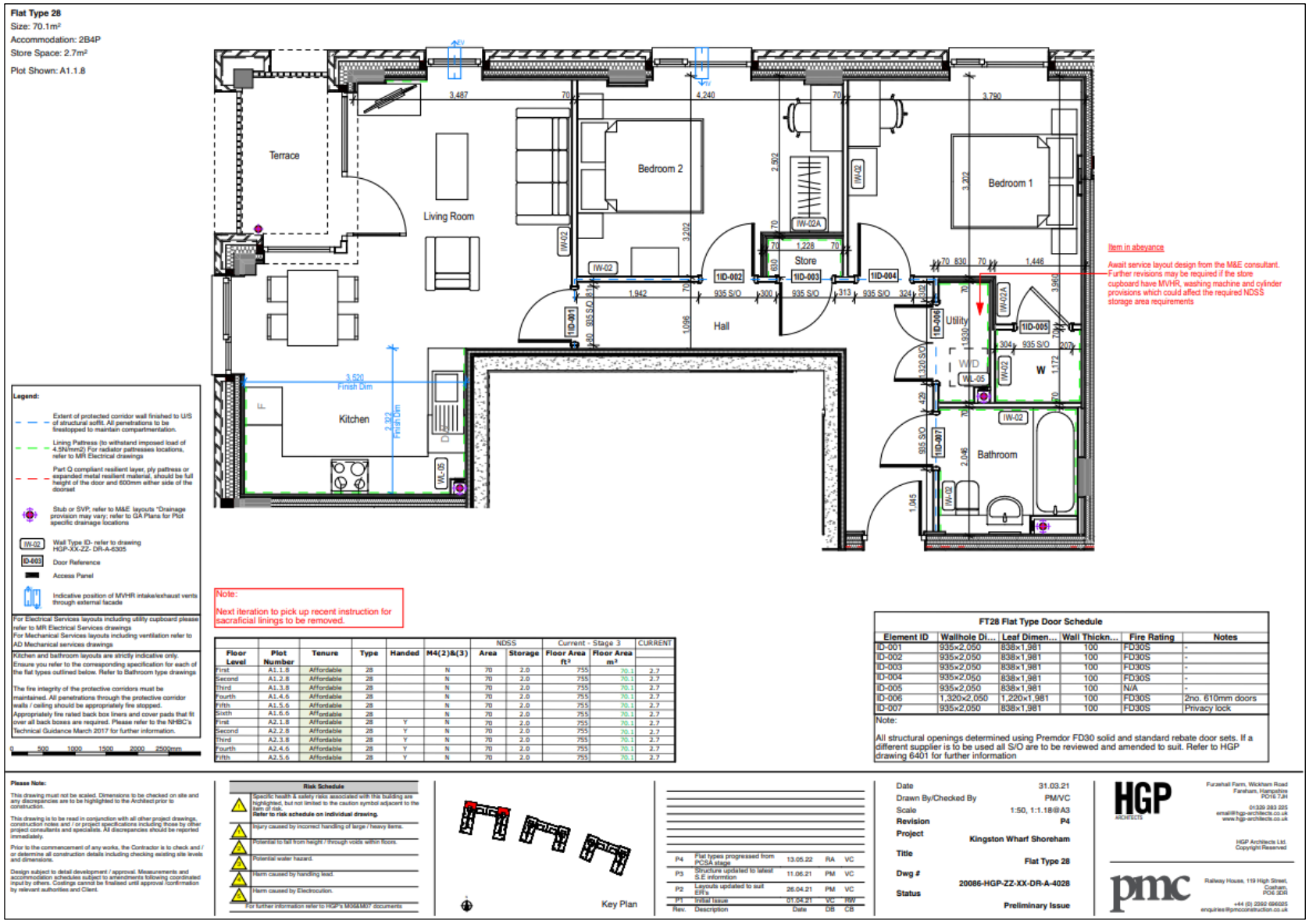
Floor Level	Plot Number	Tenure	Type	Handed	M4(2)&(3)	NDSS Area	NDSS Storage	Current - Stage 3 Floor Area ft²	Current - Stage 3 Floor Area m²	CURRENT
Ground	A1.0.1	Affordable	1B		N	70	2.0	873	81.1	2.6
First	A1.1.1	Affordable	1B		N	70	2.0	873	81.1	2.6
Second	A1.2.1	Affordable	1B		N	70	2.0	873	81.1	2.6
Third	A1.3.1	Affordable	1B		N	70	2.0	873	81.1	2.6
Ground	A2.0.1	Affordable	1B	Y	N	70	2.0	873	81.1	2.6
First	A2.1.1	Affordable	1B	Y	N	70	2.0	873	81.1	2.6
Second	A2.2.1	Affordable	1B	Y	N	70	2.0	873	81.1	2.6
Third	A2.3.1	Affordable	1B	Y	N	70	2.0	873	81.1	2.6

FT18 Flat Type Door Schedule

Element ID	Wallhole Di...	Leaf Dimen...	Wall Thickn...	Fire Rating	Notes
ID-001	935×2,050	838×1,981	100	FD30S	-
ID-002	935×2,050	838×1,981	100	FD30S	-
ID-003	1,320×2,050	1,220×1,981	100	FD30S	2no. 610mm doors
ID-004	935×2,050	838×1,981	100	FD30S	Privacy lock
ID-005	1,320×2,050	1,220×1,981	100	FD30S	2no. 610mm doors
ID-006	935×2,050	838×1,981	100	FD30S	-
Wardrobe	1,200×2,000	1,120×1,960	100	N/A	-

Note:
All structural openings determined using Premdor FD30 solid and standard rebate door sets. If a different supplier is to be used all S/O are to be reviewed and amended to suit. Refer to HGP drawing 6401 for further information

Figure A2: Proposed Floor Plan – Flat Type 28



Floor Level	Plot Number	Tenure	Type	Handed	M4(2)&(3)	NDSS Area	NDSS Storage	Current - Stage 3 Floor Area ft²	Current - Stage 3 Floor Area m²	CURRENT
First	A1.1.8	Affordable	2B		N	70	2.0	755	70.1	2.7
Second	A1.2.8	Affordable	2B		N	70	2.0	755	70.1	2.7
Third	A1.3.8	Affordable	2B		N	70	2.0	755	70.1	2.7
Fourth	A1.4.6	Affordable	2B		N	70	2.0	755	70.1	2.7
Fifth	A1.5.6	Affordable	2B		N	70	2.0	755	70.1	2.7
Sixth	A1.6.6	Affordable	2B		N	70	2.0	755	70.1	2.7
First	A2.1.8	Affordable	2B	Y	N	70	2.0	755	70.1	2.7
Second	A2.2.8	Affordable	2B	Y	N	70	2.0	755	70.1	2.7
Third	A2.3.8	Affordable	2B	Y	N	70	2.0	755	70.1	2.7
Fourth	A2.4.6	Affordable	2B	Y	N	70	2.0	755	70.1	2.7
Fifth	A2.5.6	Affordable	2B	Y	N	70	2.0	755	70.1	2.7

FT28 Flat Type Door Schedule

Element ID	Wallhole Di...	Leaf Dimen...	Wall Thickn...	Fire Rating	Notes
ID-001	935x2,050	838x1,981	100	FD30S	-
ID-002	935x2,050	838x1,981	100	FD30S	-
ID-003	935x2,050	838x1,981	100	FD30S	-
ID-004	935x2,050	838x1,981	100	FD30S	-
ID-005	935x2,050	838x1,981	100	N/A	-
ID-006	1,320x2,050	1,220x1,981	100	FD30S	2no. 610mm doors
ID-007	935x2,050	838x1,981	100	FD30S	Privacy lock

Note:
All structural openings determined using Premdor FD30 solid and standard rebate door sets. If a different supplier is to be used all S/O are to be reviewed and amended to suit. Refer to HGP drawing 6401 for further information

Figure A3: Proposed Floor Plan – Flat Type 16

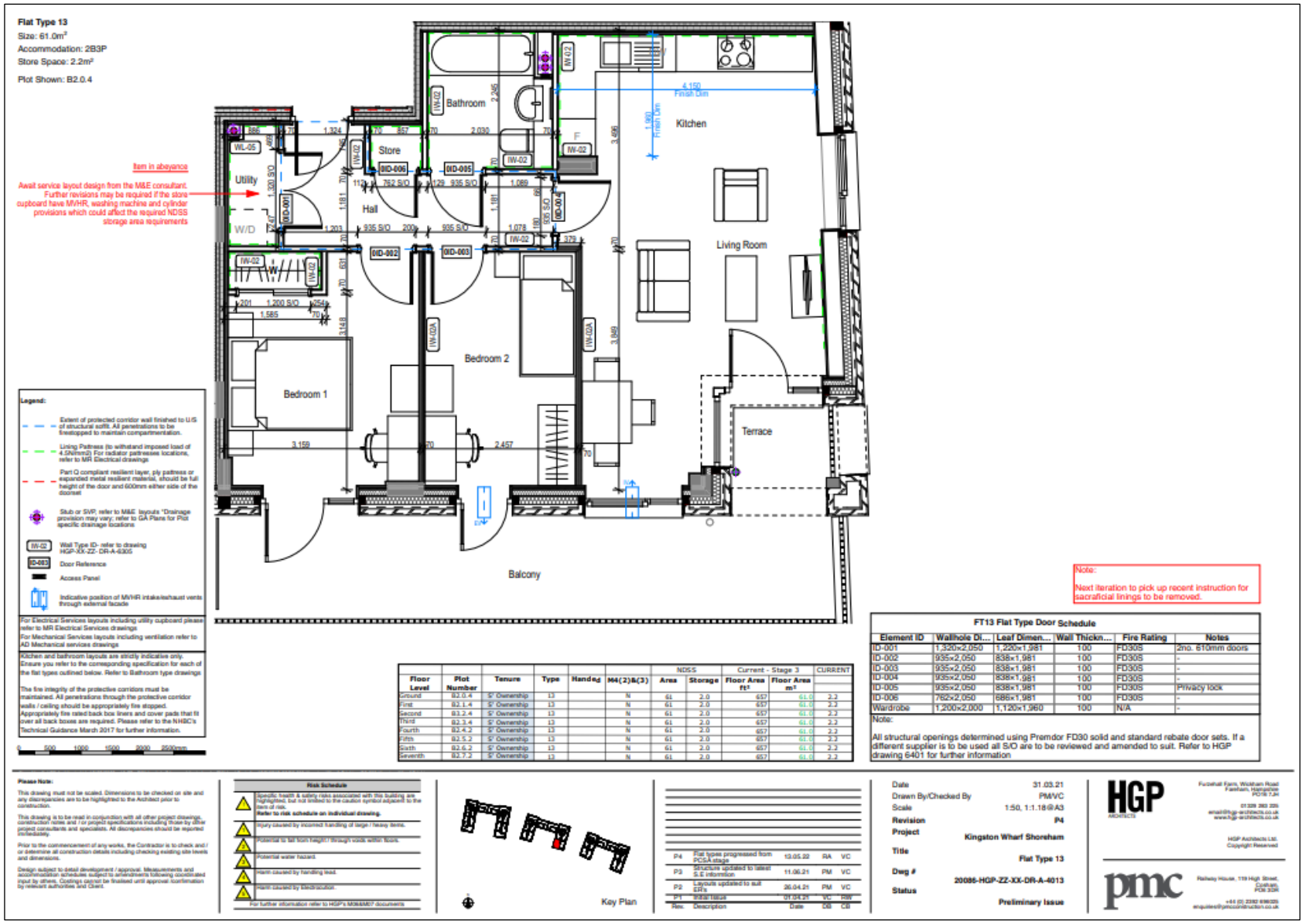


Figure A4: Proposed Floor Plan – Flat Type 13

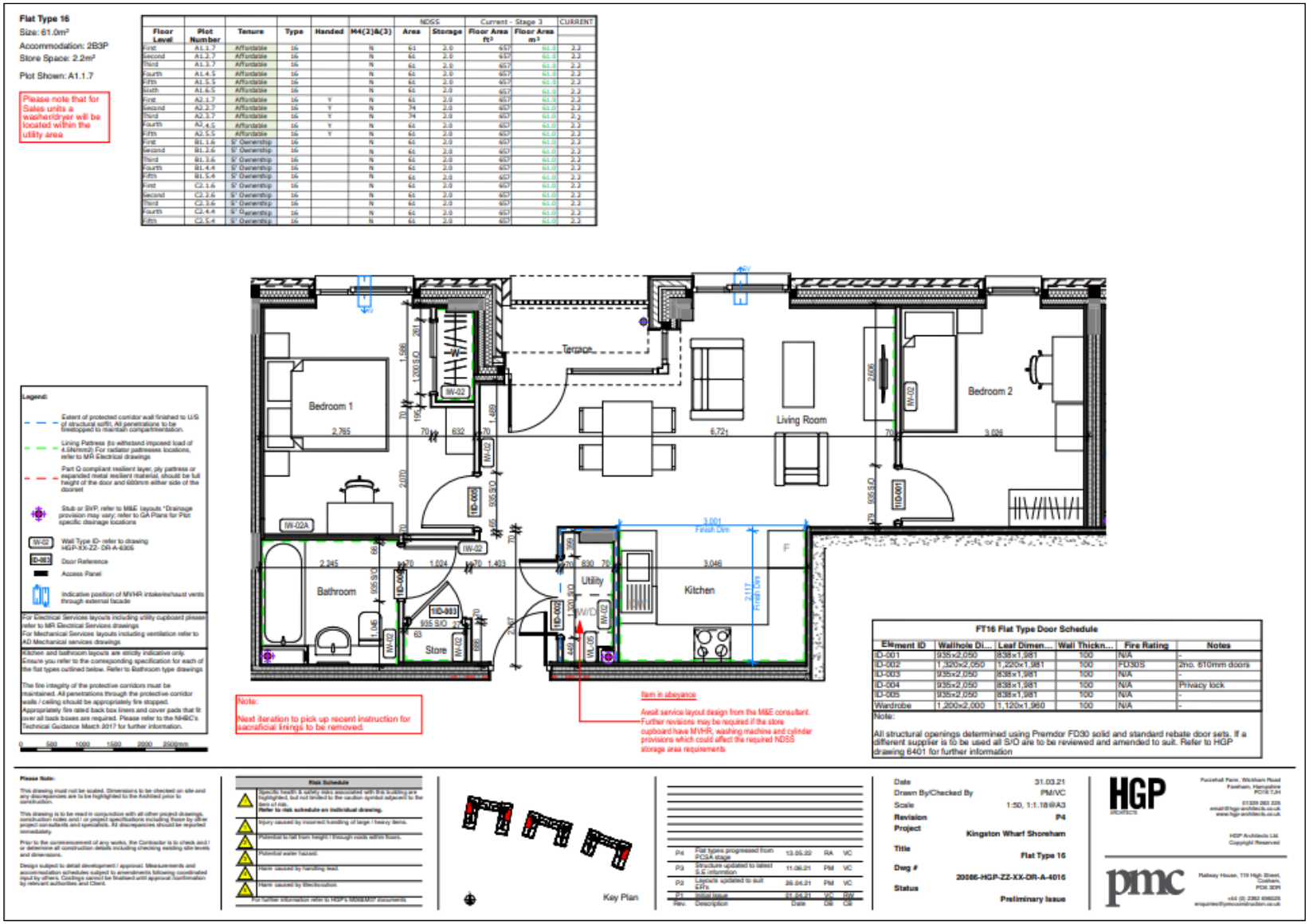


Figure A5: Block A – Section A

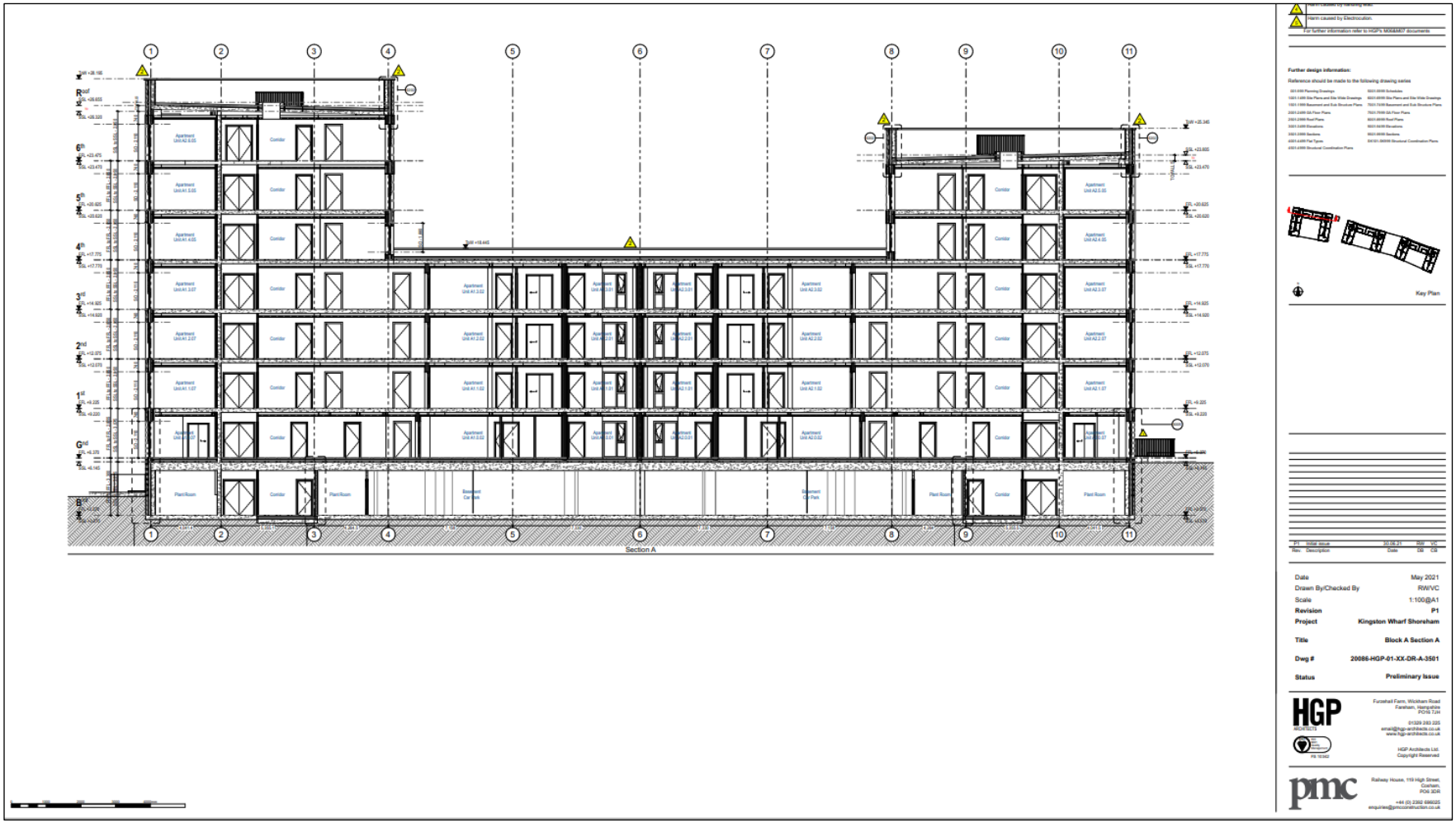


Figure A6: Block A – Section B

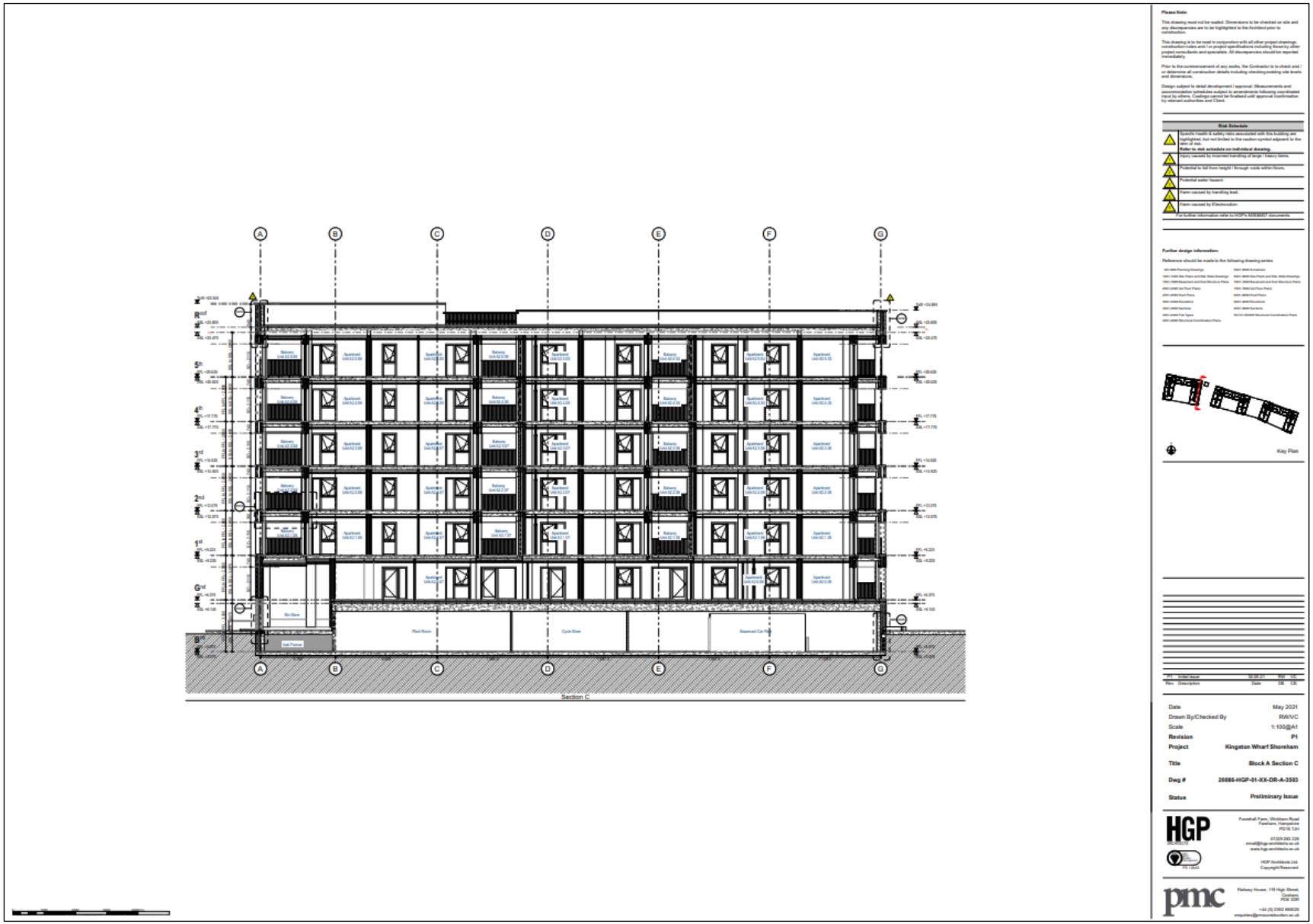


Figure A7: Block A – Section C

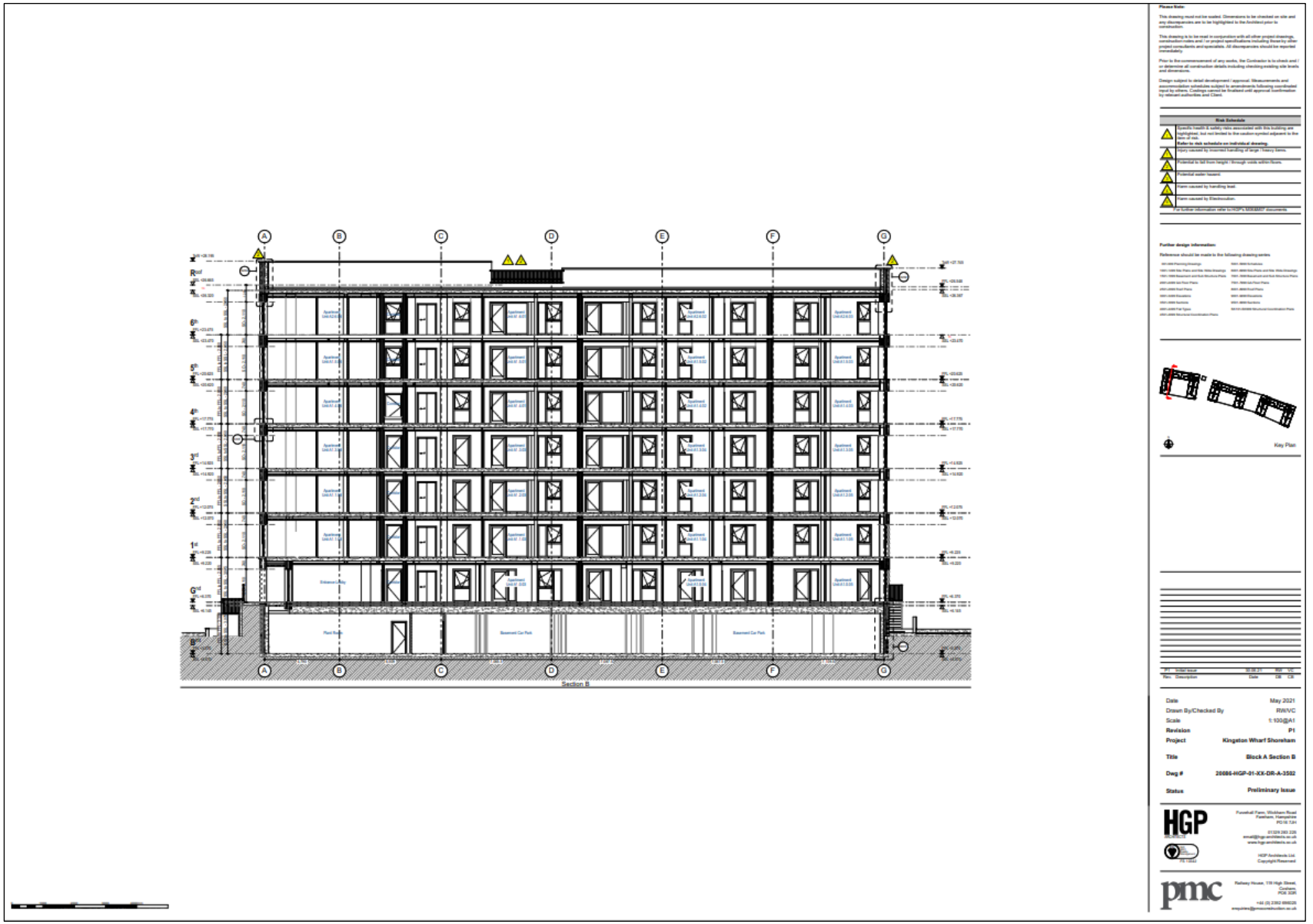


Figure A8: Block A – Section D

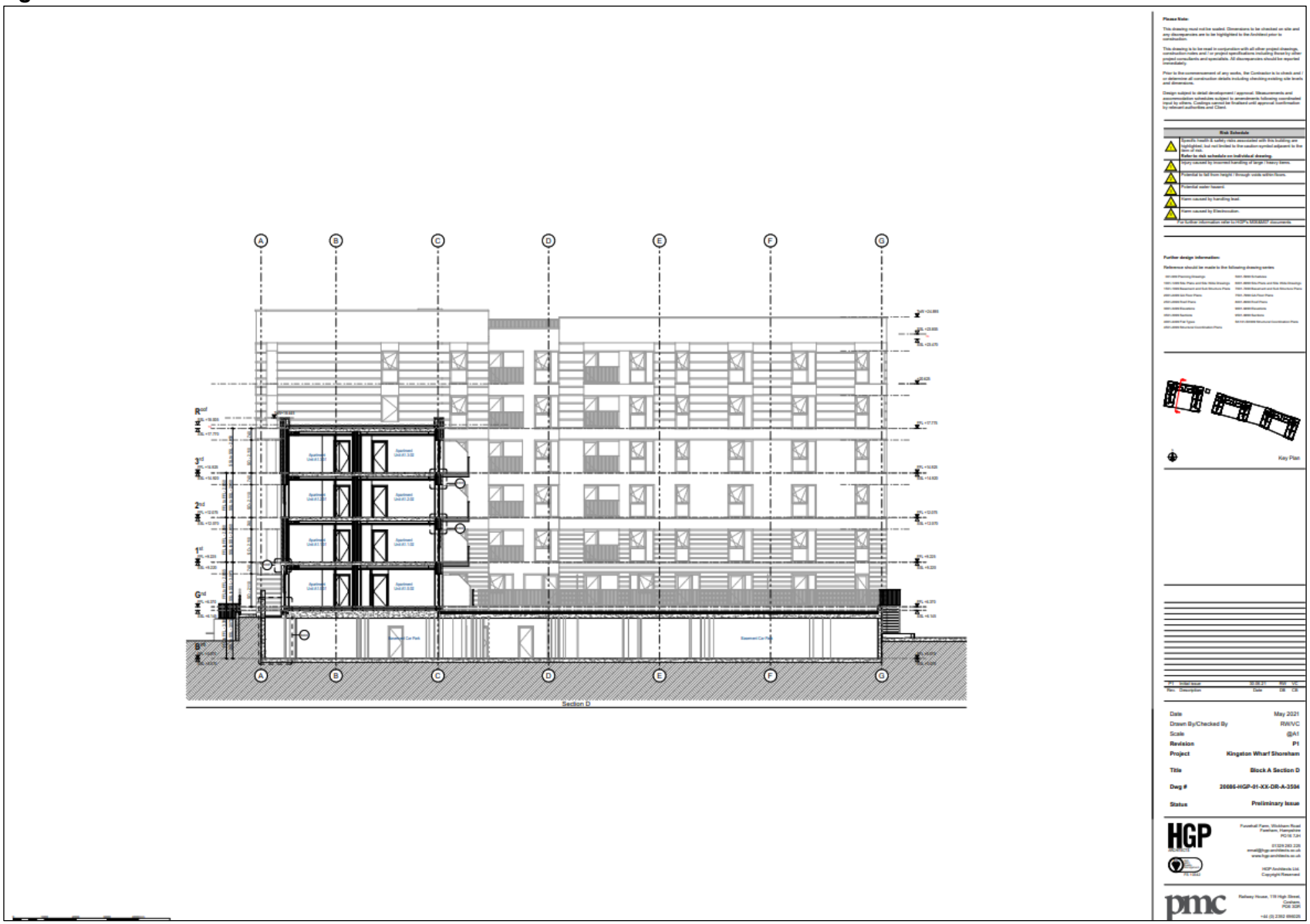


Figure A9: Block B – Section A

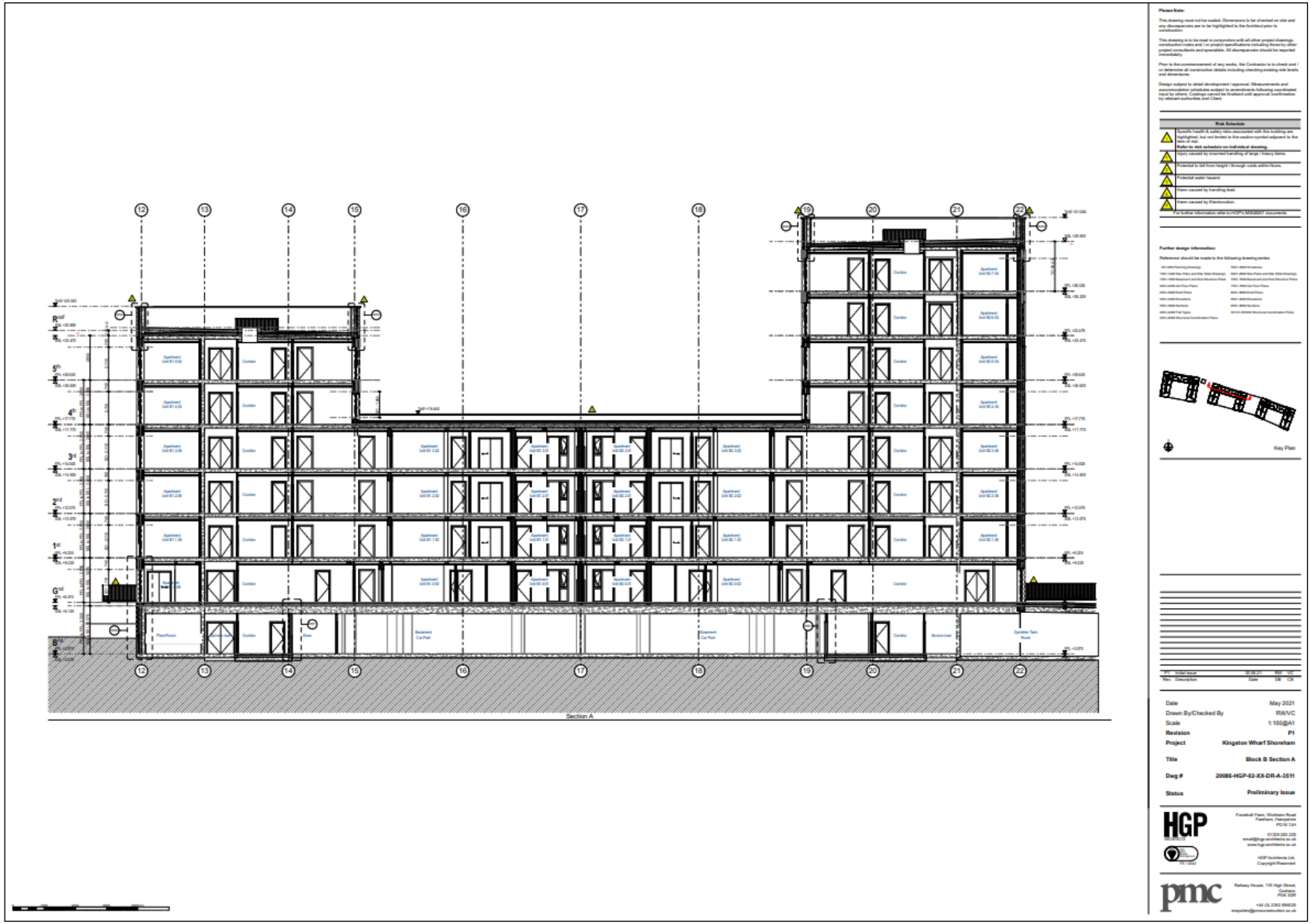


Figure A10: Block B – Section B

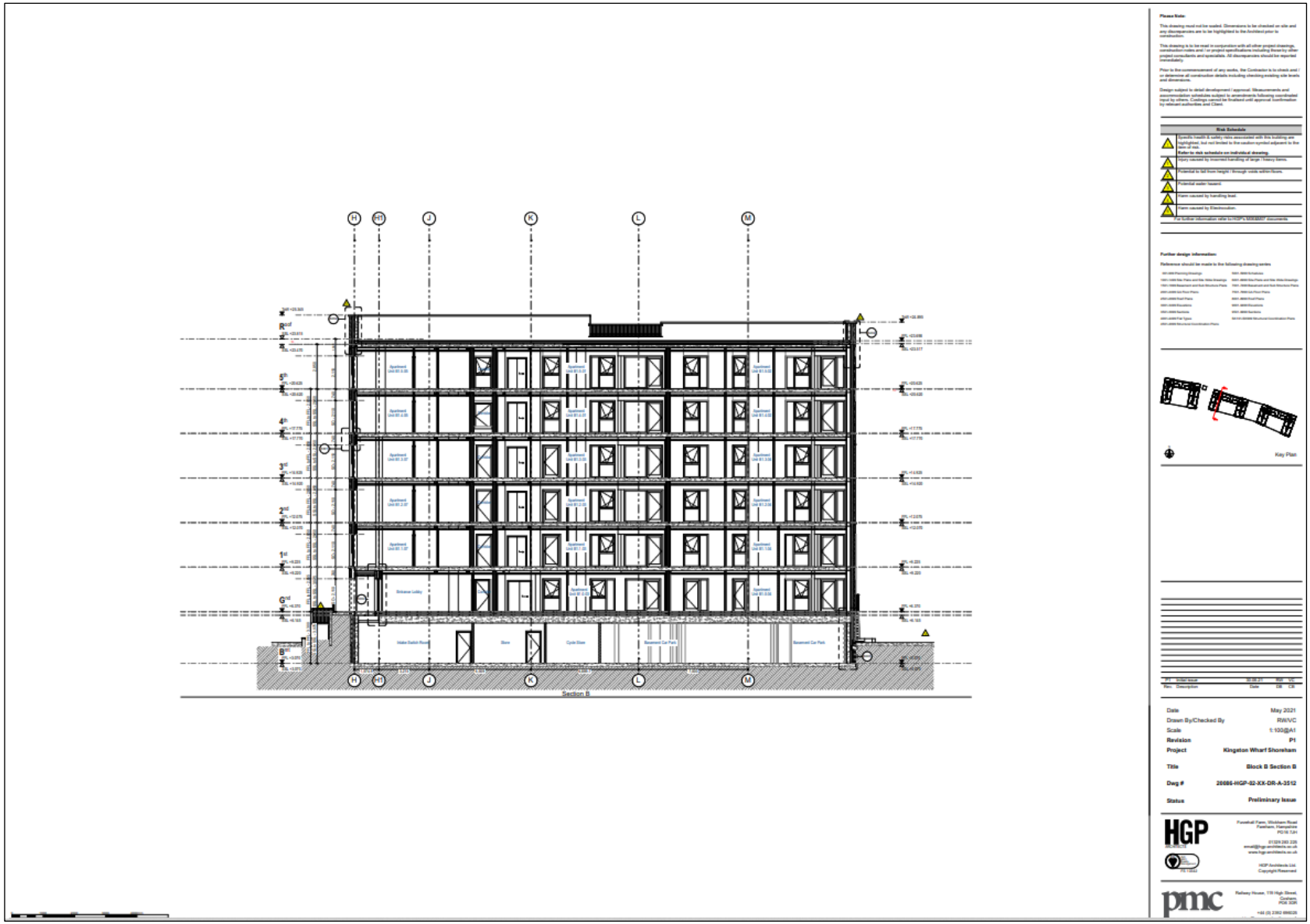


Figure A11: Block B – Section C

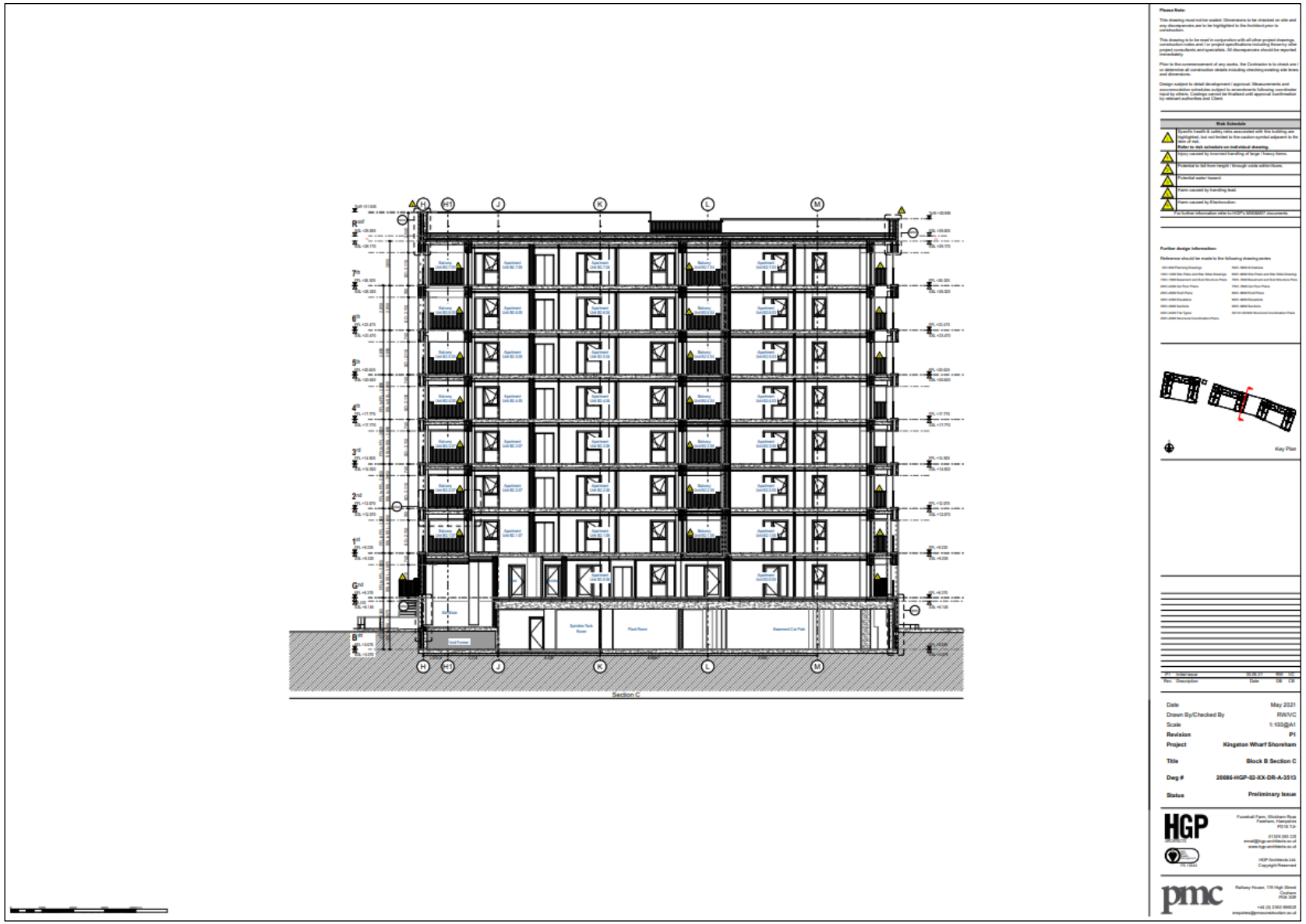


Figure A12: Block C – Section A

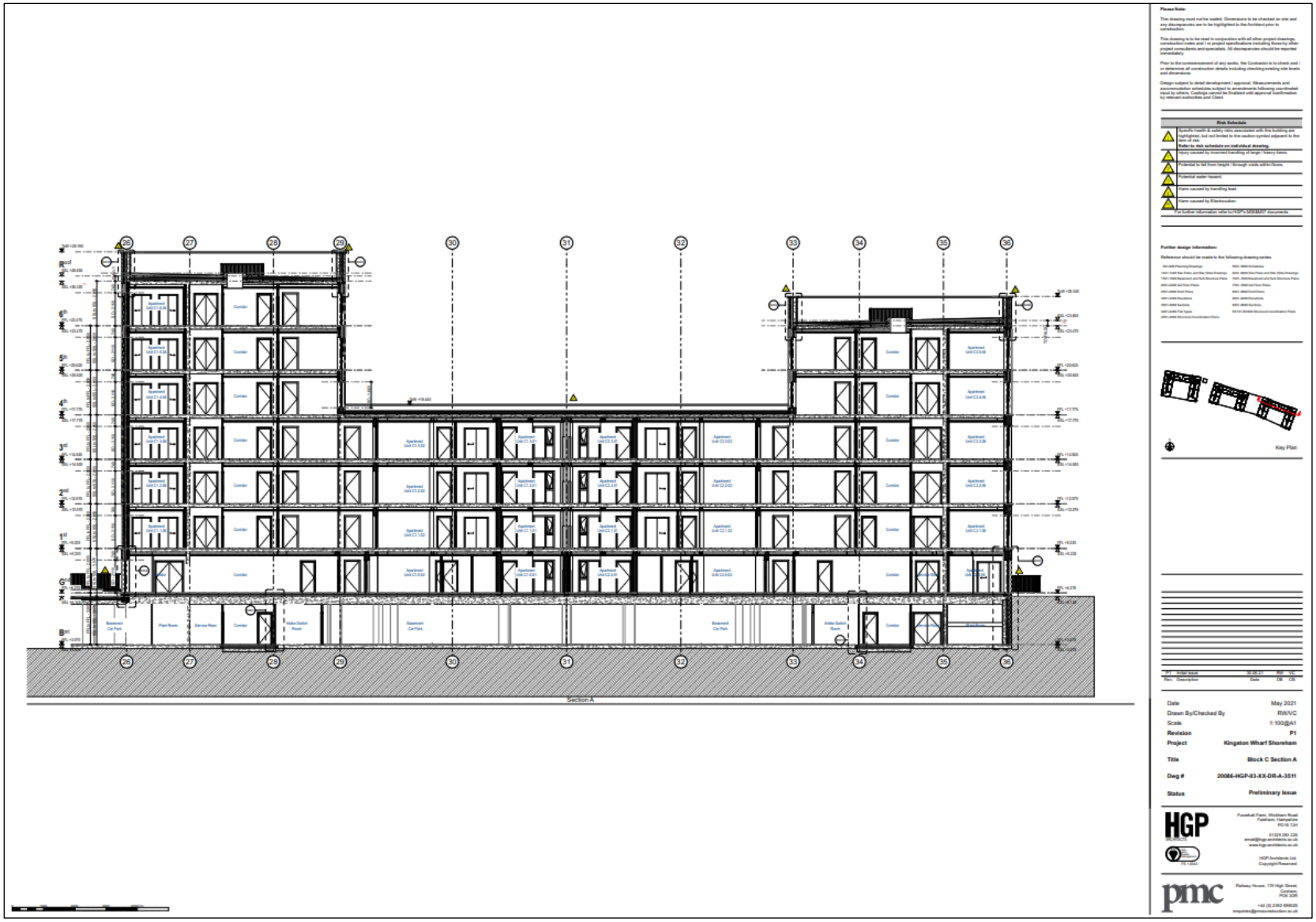


Figure A13: Block C – Section B

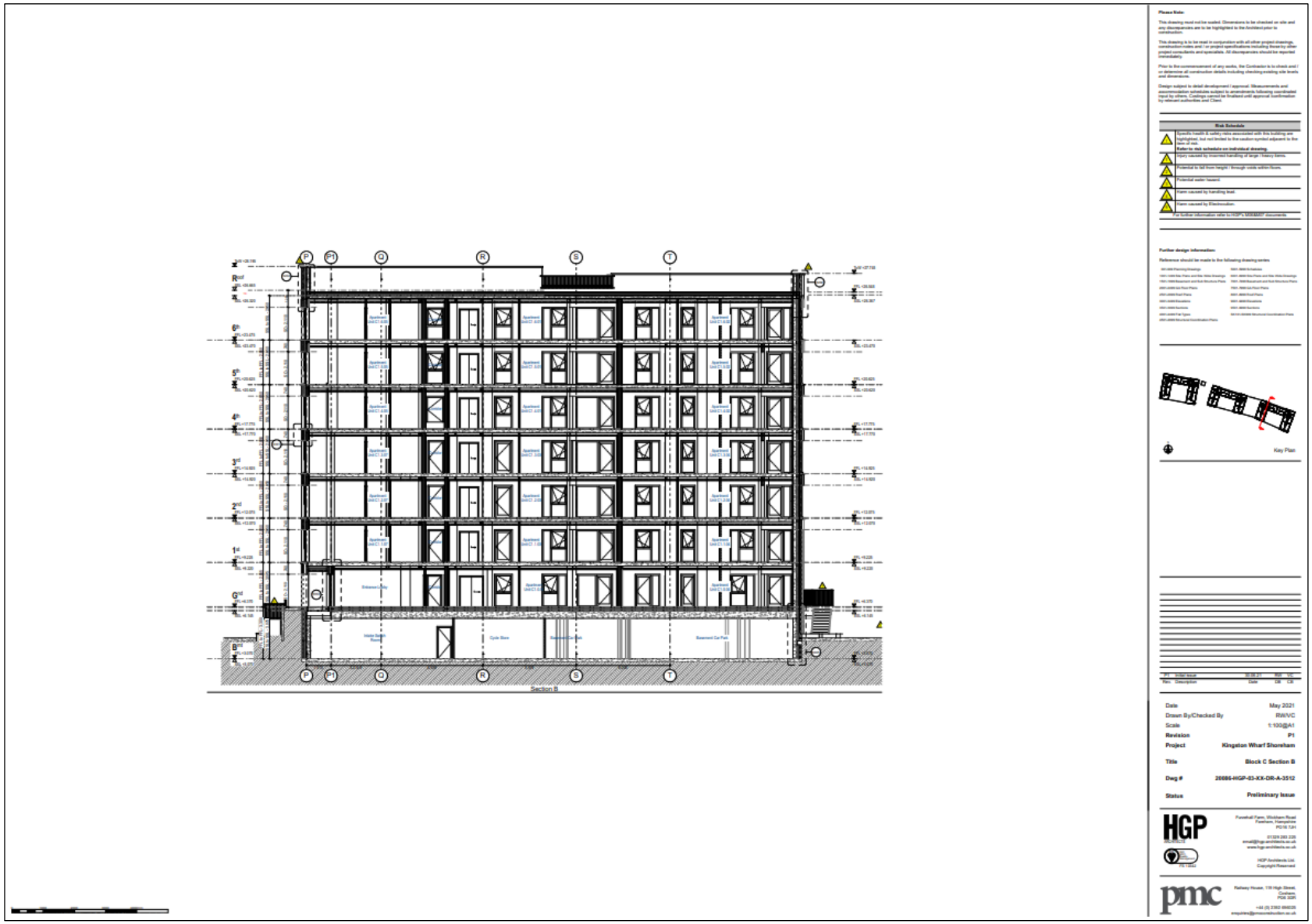


Figure A14: Block C – Section C

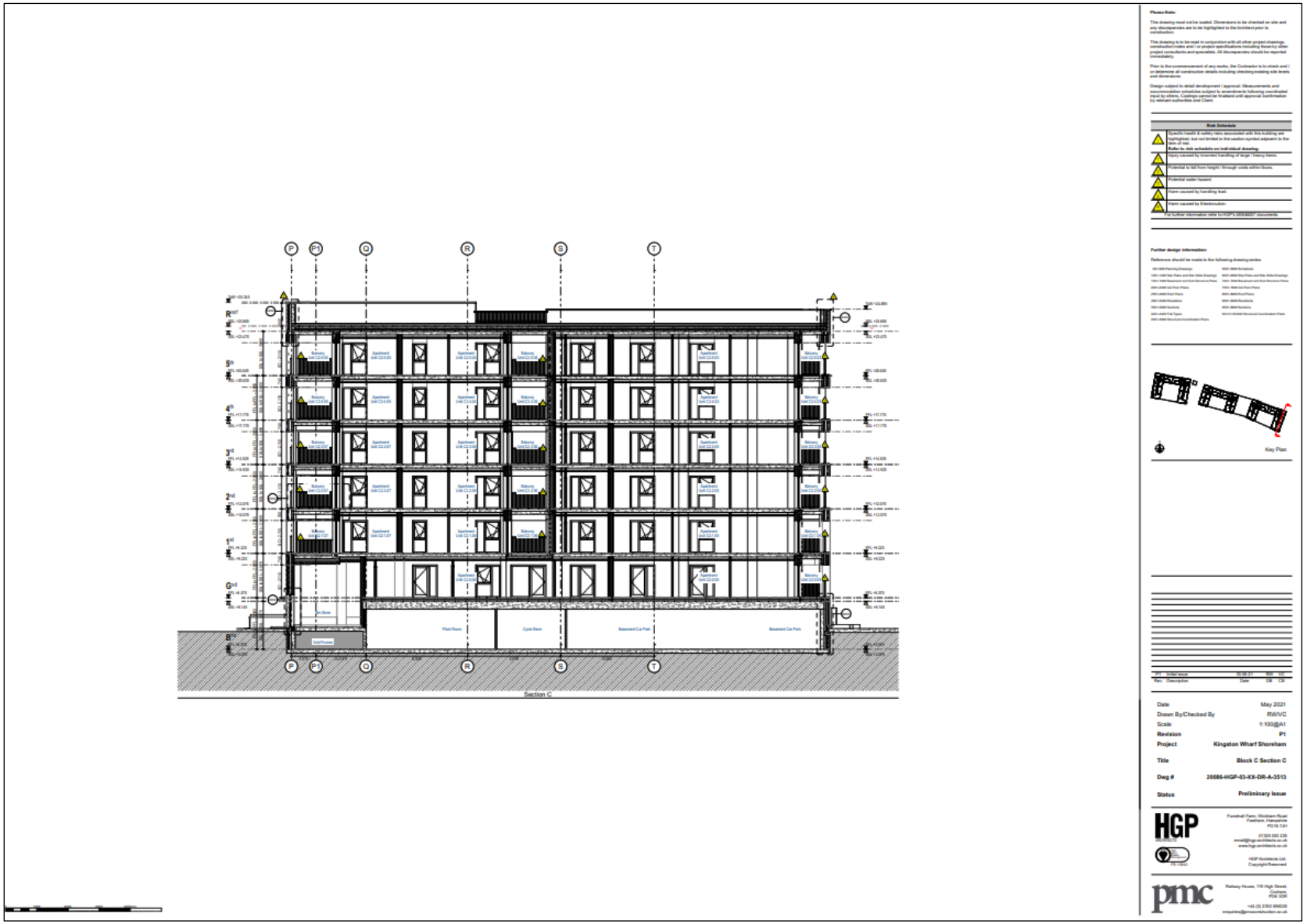


Figure A15: Glazing Specification R_w 46 dB

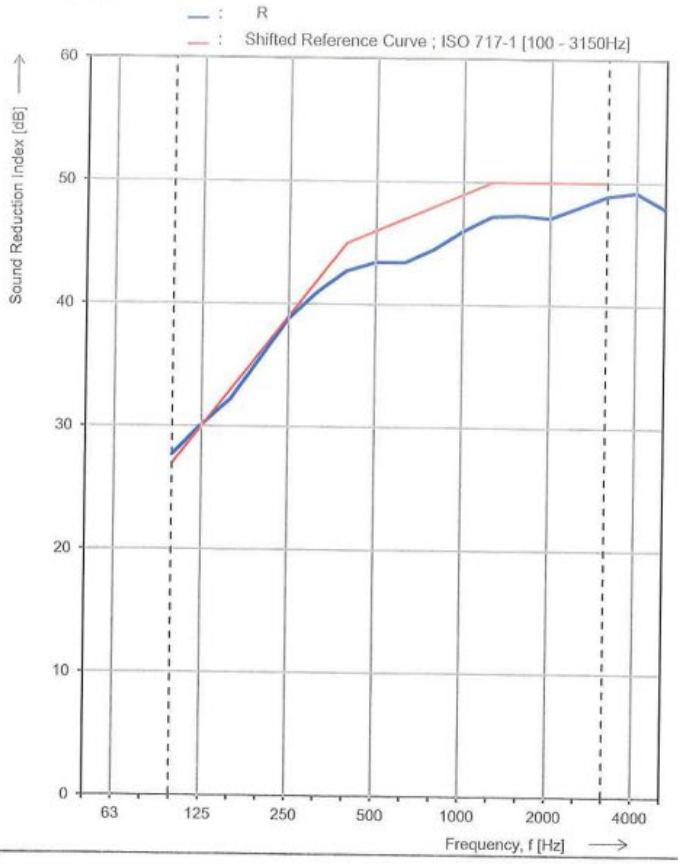
BS EN ISO 10140-2 : 2010, Sound Reduction Index

Laboratory measurement of sound insulation of building elements

Client:	Deceuninck Ltd	Product Identification:	Deceuninck 5000 Slim - 2 Repeat 3
Mounted by:	Client	Test Room Identification:	Acoustic Transmission Suite
Sample Size:	1.88 m²	Date of Test:	31 January 2018
Manufacturer:	Client		
Description:	Window and Glazing		

Source Room Volume:	136 m^3	Ambient Pressure:	99.7 kPa
Source Room Temperature:	22.1 °C	Measured Mass per unit area:	51.9 kg/m^2
Source Room Relative Humidity:	30.5 %	Curing Time:	Not Applicable
Receiving Room Volume:	221 m^3		
Receiving Room Temperature:	21.1 °C		
Receiving Room Relative Humidity:	34.7 %		

Frequency f [Hz]	R ⅓ octave [dB]
50	-.-
63	-.-
80	-.-
100	27.7
125	30.1
160	32.2
200	35.5
250	38.8
315	41.0
400	42.7
500	43.4
630	43.4
800	44.5
1000	46.0
1250	47.2
1600	47.3
2000	47.1
2500	48.0
3150	48.9
4000	49.2
5000	47.9



Rating according to BS EN ISO 717-1

R_w (C;Ctr) = 46 (-2 ; -5) dB

$C_{50\text{-}3150}$ = -.- dB ; $C_{50\text{-}5000}$ = -.- dB ; $C_{100\text{-}5000}$ = -1 dB

$C_{tr,50\text{-}3150}$ = -.- dB ; $C_{tr,50\text{-}5000}$ = -.- dB ; $C_{tr,100\text{-}5000}$ = -5 dB

Evaluation based on laboratory measurement results obtained in one-third-octave bands by an engineering method.

Name of test institute:	The University of Salford, Acoustic Test Laboratory		
No. of test report:	3464-3106	Signature:	
Date: 31 January 2018		Operator:	D. Wong-McSweeney

Report No 3464 22 February 2018

Figure A16: Glazing Specification R_w 37 dB

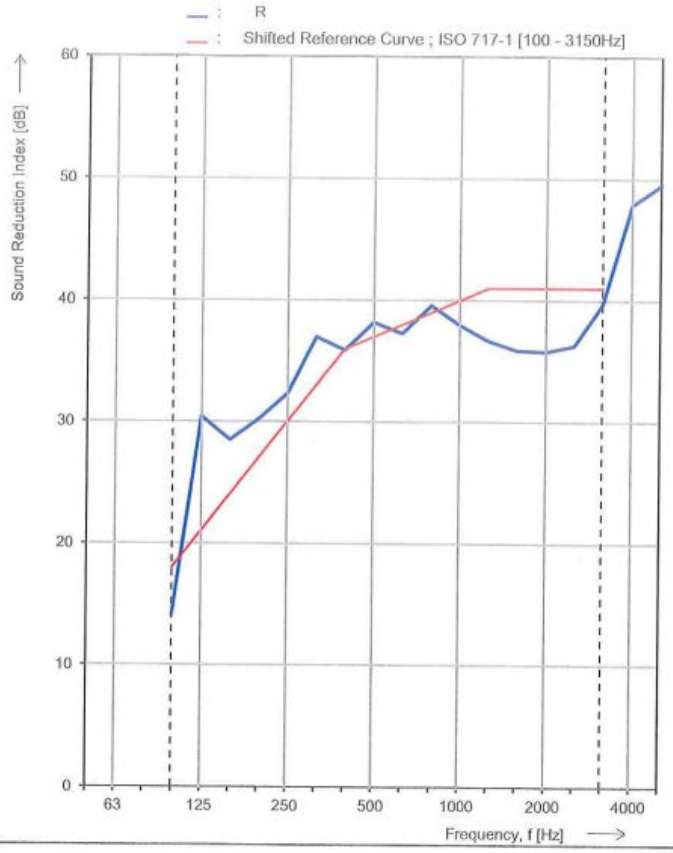
BS EN ISO 10140-2 : 2010, Sound Reduction Index

Laboratory measurement of sound insulation of building elements

Client:	Deceuninck Ltd	Product Identification:	Deceuninck 2500 - 1
Mounted by:	Client	Test Room Identification:	Acoustic Transmission Suite
Sample Size:	1.81 m²	Date of Test:	01 March 2018
Manufacturer:	Client		
Description:	Window and Glazing		

Source Room Volume:	136 m³	Ambient Pressure:	100.0 kPa
Source Room Temperature:	22.3 °C	Measured Mass per unit area:	45.5 kg/m²
Source Room Relative Humidity:	16.3 %	Curing Time:	Not Applicable
Receiving Room Volume:	221 m³		
Receiving Room Temperature:	20.7 °C		
Receiving Room Relative Humidity:	20.6 %		

Frequency f [Hz]	R ⅓ octave [dB]
50	-.-
63	-.-
80	-.-
100	14.1
125	30.4
160	28.5
200	30.2
250	32.3
315	37.0
400	35.9
500	38.2
630	37.3
800	39.6
1000	38.0
1250	36.7
1600	35.9
2000	35.8
2500	36.3
3150	39.7
4000	47.9
5000	49.5



Rating according to BS EN ISO 717-1

R_w (C;Ctr) = 37 (-1 ; -5) dB

$C_{50\text{-}3150}$ = -.- dB ; $C_{50\text{-}5000}$ = -.- dB ; $C_{100\text{-}5000}$ = 0 dB

$C_{tr,50\text{-}3150}$ = -.- dB ; $C_{tr,50\text{-}5000}$ = -.- dB ; $C_{tr,100\text{-}5000}$ = -5 dB

Evaluation based on laboratory measurement results obtained in one-third-octave bands by an engineering method.

Name of test institute:	The University of Salford, Acoustic Test Laboratory		
No. of test report:	3649-3158	Signature:	
Date: 01 March 2018		Operator:	D. Wong-McSweeney

Report No 3649 R1 15 March 2018

Figure A17: Glazing Specification R_w 35 dB

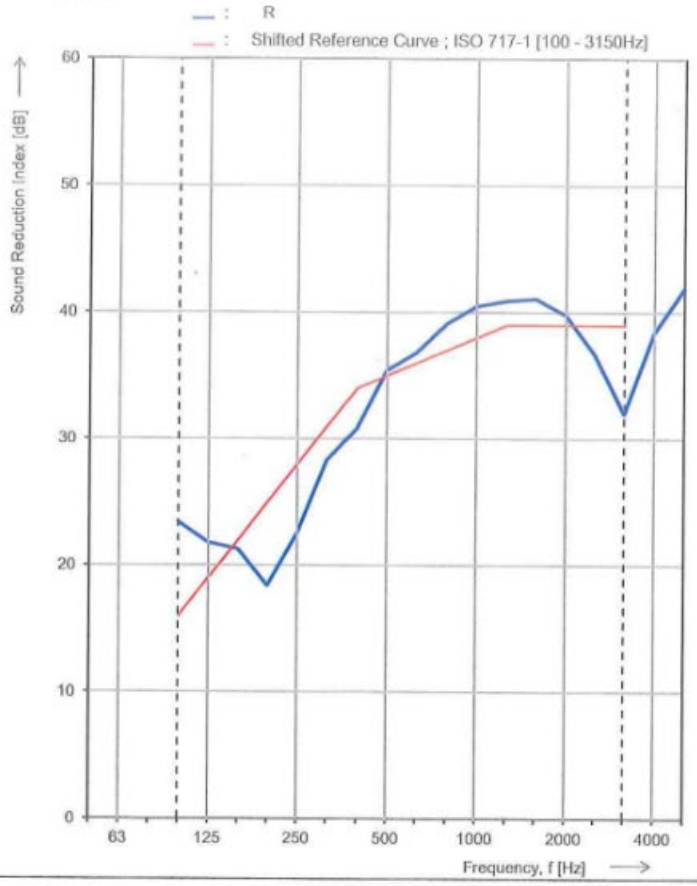
BS EN ISO 10140-2 : 2010, Sound Reduction Index

Laboratory measurement of sound insulation of building elements

Client:	Deceuninck Ltd	Product Identification:	Deceuninck 2500 - 1
Mounted by:	Client	Test Room Identification:	Acoustic Transmission Suite
Sample Size:	1.88 m²	Date of Test:	30 January 2018
Manufacturer:	Client		
Description:	Window and Glazing		

Source Room Volume:	136 m³	Ambient Pressure:	102.2 kPa
Source Room Temperature:	22.3 °C	Measured Mass per unit area:	27.5 kg/m²
Source Room Relative Humidity:	30.0 %	Curing Time:	Not Applicable
Receiving Room Volume:	221 m³		
Receiving Room Temperature:	21.0 °C		
Receiving Room Relative Humidity:	36.4 %		

Frequency f [Hz]	R ⅓ octave [dB]
50	-,-
63	-,-
80	-,-
100	23.4
125	21.8
160	21.3
200	18.4
250	22.5
315	28.3
400	30.8
500	35.4
630	36.8
800	39.1
1000	40.5
1250	40.9
1600	41.1
2000	39.8
2500	36.7
3150	32.0
4000	38.4
5000	41.9



Rating according to BS EN ISO 717-1

R_w (C;Ctr) = 35 (-2 ; -5) dB

$C_{50\text{-}3150}$ = -,- dB ; $C_{50\text{-}5000}$ = -,- dB ; $C_{100\text{-}5000}$ = -1 dB

$C_{tr,50\text{-}3150}$ = -,- dB ; $C_{tr,50\text{-}5000}$ = -,- dB ; $C_{tr,100\text{-}5000}$ = -5 dB

Evaluation based on laboratory measurement results obtained in one-third-octave bands by an engineering method.

Name of test institute:	The University of Salford, Acoustic Test Laboratory		
No. of test report:	3464-3097	Signature:	
Date: 30 January 2018		Operator:	D. Wong-McSweeney

Report No 3464 22 February 2018

Figure A18: Example of Detailed Façade Calculations

Façade	North	Type	Room:	Daytime Measurements (LAeq,T)						
		18	Bedroom 1							
Term	Description		Single value m^2	Octave Band Centre Frequency, Hz						dB (Lin)
				125	250	500	1000	2000	4000	
$L_{eq,ff}$	Free-field level		-	63	64	63	67	63	54	71
R_{wi}	SRI of the window		-	30	39	43	46	48	49	
R_{ew}	SRI of the external wall		-	34	34	40	56	73	76	
	Room Volume		20							
A			-	6	6	6	6	6	6	1
S_f	Façade area (including window)		12	-	-	-	-	-	-	
S_{wi}	Window area		3	-	-	-	-	-	-	
S_{ew}	$S_f - S_{wi}$		9	-	-	-	-	-	-	
S_{rr}	Area of ceiling		0	-	-	-	-	-	-	
S	$S_f + S_{rr}$		12	-	-	-	-	-	-	
A_0	Reference absorption area given in BS EN ISO 10140-2		10	-	-	-	-	-	-	
		Term	Reference letter of result	Octave Band Centre Frequency, Hz						
				125	250	500	1000	2000	4000	
		$L_{eq,ff}$	A	63	64	63	67	63	54	
Ventilation		$D_{n,e}$	B							
Window		R_{wi}	C	30	39	43	46	48	49	
Front Façade		R_{ew}	D	34	34	40	56	73	76	
Roof		R_{rr}								
			E							
Total		$10\log_{10}(B+C+D+E)$	F	-33	-35	-41	-51	-53	-54	
		A (furnished)		6	6	6	6	6	6	
			G	3	3	3	3	3	3	
		$L_{eq,2}$	A + F + G + 3	**36**	**35**	**28**	**22**	**16**	**5**	
		A-weighting dB		-16	-9	-3	0	1	1	
		$L_{eq,2}$ + A-weighting dB		20	26	25	22	17	6	**30**
				98.977876	*424.32847*	*309.28961*	*162.31407*	*47.790234*	*4.3473131*	