Corner	x [m]	y [m]	Base Level [m]	Arc Enabled	Stiffened	Prev. Side: d [m]	Prev. Side: p1 [%]	Prev. Side: p2* [%]	Next Side: d [m]	Next Side: p1 [%]	Next Side: p2* [%]
4	24.000	28.000	-3.6000	Yes	No	-	-	-	-	-	-
5	24.000	20.000	-3.6000	Yes	Yes	0.0	67.000	25.000	0.0	67.000	25.000

Side	x1 [m]	y1 [m]	x2 [m]	y2 [m]	G.M. Curve: Vertical	G.M. Curve: Horizontal
1	18.000	20.000	18.000	41.000	Exc. in front of high stiffness wall in stiff clay (CIRIA C760 Fig. 6.15(b))	Exc. in front of high stiffness wall in stiff clay (CIRIA C760 Fig. 6.15(a))
2	18.000	41.000	24.000	41.000	Exc. in front of high stiffness wall in stiff clay (CIRIA C760 Fig. 6.15(b))	Exc. in front of high stiffness wall in stiff clay (CIRIA C760 Fig. 6.15(a))
3	24.000	41.000	24.000	28.000	No vertical ground movement	No horizontal ground movement
4	24.000	28.000	24.000	20.000	Exc. in front of high stiffness wall in stiff clay (CIRIA C760 Fig. 6.15(b))	Exc. in front of high stiffness wall in stiff clay (CIRIA C760 Fig. 6.15(a))
5	24.000	20.000	18.000	20.000	Exc. in front of high stiffness wall in stiff clay (CIRIA C760 Fig. 6.15(b))	Exc. in front of high stiffness wall in stiff clay (CIRIA C760 Fig. 6.15(a))

Circular Excavations

Vertical Ground Movement Curves

Curve Name: **No vertical ground movement**
Coordinates: [Distance from wall / wall depth or max. excavation depth (x), Depth / wall depth or max. excavation depth (y), Settlement / wall depth or max. excavation depth (z)(%)]

[0.000,0.000,0.000][1.000,0.000,0.000][0.000,1.000,0.000][1.000,1.000,0.000]

Curve Fitting Method: Polynomial
x Order: 1
y Order: 0
Polynomial: z = 0.0x + 0.0
Coeff. of Determination:

Curve Name: **Inst. of contiguous bored pile wall in stiff clay (CIRIA C760 Fig. 6.8(b))**
Coordinates: [Distance from wall / wall depth or max. excavation depth (x), Depth / wall depth or max. excavation depth (y), Settlement / wall depth or max. excavation depth (z)(%)]

[0.000,0.000,0.040][2.000,0.000,0.000]

Curve Fitting Method: Polynomial
x Order: 1
y Order: 0
Polynomial: z = -2.0E-2x + 4.0E-2
Coeff. of Determination: 1.0

Curve Name: **Exc. in front of high stiffness wall in stiff clay (CIRIA C760 Fig. 6.15(b))**
Coordinates: [Distance from wall / wall depth or max. excavation depth (x), Depth / wall depth or max. excavation depth (y), Settlement / wall depth or max. excavation depth (z)(%)]

[0.000,0.000,0.039][0.100,0.000,0.049][0.200,0.000,0.056][0.300,0.000,0.062]
[0.400,0.000,0.067][0.500,0.000,0.070][0.600,0.000,0.072][0.700,0.000,0.073]
[0.800,0.000,0.073][0.900,0.000,0.072][1.000,0.000,0.070][1.100,0.000,0.068]
[1.200,0.000,0.065][1.300,0.000,0.061][1.400,0.000,0.058][1.500,0.000,0.054]
[1.600,0.000,0.050][1.700,0.000,0.046][1.800,0.000,0.042][1.900,0.000,0.038]
[2.000,0.000,0.034][2.100,0.000,0.030][2.200,0.000,0.027][2.300,0.000,0.023]
[2.400,0.000,0.020][2.500,0.000,0.017][2.600,0.000,0.014][2.700,0.000,0.012]
[2.800,0.000,0.010][2.900,0.000,0.008][3.000,0.000,0.007][3.100,0.000,0.005]
[3.200,0.000,0.004][3.300,0.000,0.004][3.400,0.000,0.003][3.500,0.000,0.002]
[3.600,0.000,0.002][3.700,0.000,0.002][3.800,0.000,0.001][3.900,0.000,0.001]
[4.000,0.000,0.000]

Curve Fitting Method: Polynomial
x Order: 4
y Order: 0
Polynomial: z = $-2.6455E-3x^4 + 2.8495E-2x^3 - 1.0051E-1x^2 + 1.0569E-1x + 3.8990E-2$
Coeff. of Determination: 9.9991E-1

Horizontal Ground Movement Curves

Curve Name: **No horizontal ground movement**
Coordinates: [Distance from wall / wall depth or max. excavation depth (x), Depth / wall depth or max. excavation depth (y), Horizontal movement / wall depth or max. excavation depth (z)(%)]
[0.000,0.000,0.000][1.000,0.000,0.000][0.000,1.000,0.000][1.000,1.000,0.000]
Curve Fitting Method: Polynomial
x Order: 0
y Order: 0
Polynomial: z = 0.0
Coeff. of Determination:

Curve Name: **Inst. of contiguous bored pile wall in stiff clay (CIRIA C760 Fig. 6.8(a))**
Coordinates: [Distance from wall / wall depth or max. excavation depth (x), Depth / wall depth or max. excavation depth (y), Horizontal movement / wall depth or max. excavation depth (z)(%)]
[0.000,0.000,0.041][0.050,0.000,0.038][0.100,0.000,0.036][0.150,0.000,0.034]
[0.200,0.000,0.032][0.250,0.000,0.030][0.300,0.000,0.029][0.350,0.000,0.027]
[0.400,0.000,0.025][0.450,0.000,0.023][0.500,0.000,0.022][0.550,0.000,0.020]
[0.600,0.000,0.019][0.650,0.000,0.018][0.700,0.000,0.016][0.750,0.000,0.015]
[0.800,0.000,0.014][0.850,0.000,0.013][0.900,0.000,0.011][0.950,0.000,0.010]
[1.000,0.000,0.009][1.050,0.000,0.008][1.100,0.000,0.007][1.150,0.000,0.006]
[1.200,0.000,0.005][1.250,0.000,0.004][1.300,0.000,0.004][1.350,0.000,0.003]
[1.400,0.000,0.002][1.450,0.000,0.001][1.500,0.000,0.000]
Curve Fitting Method: Polynomial
x Order: 3
y Order: 0
Polynomial: z = $-4.2486E-3x^3 + 1.9096E-2x^2 - 4.6221E-2x + 4.0729E-2$
Coeff. of Determination: 1.0000

Curve Name: **Exc. in front of high stiffness wall in stiff clay (CIRIA C760 Fig. 6.15(a))**
Coordinates: [Distance from wall / wall depth or max. excavation depth (x), Depth / wall depth or max. excavation depth (y), Horizontal movement / wall depth or max. excavation depth (z)(%)]
[0.000,0.000,0.150][4.000,0.000,0.000]
Curve Fitting Method: Polynomial
x Order: 1
y Order: 0
Polynomial: z = -3.75E-2x + 1.50E-1
Coeff. of Determination: 1.00

Damage Category Strains

Ref.	Name	0 (Negligible) to 1 (Very Slight)	1 (Very Slight) to 2 (Slight)	2 (Slight) to 3 (Moderate)	3 (Moderate) to 4 (Severe)
1	Burland Strain Limits	0.0	500.00E-6	750.00E-6	0.0015000

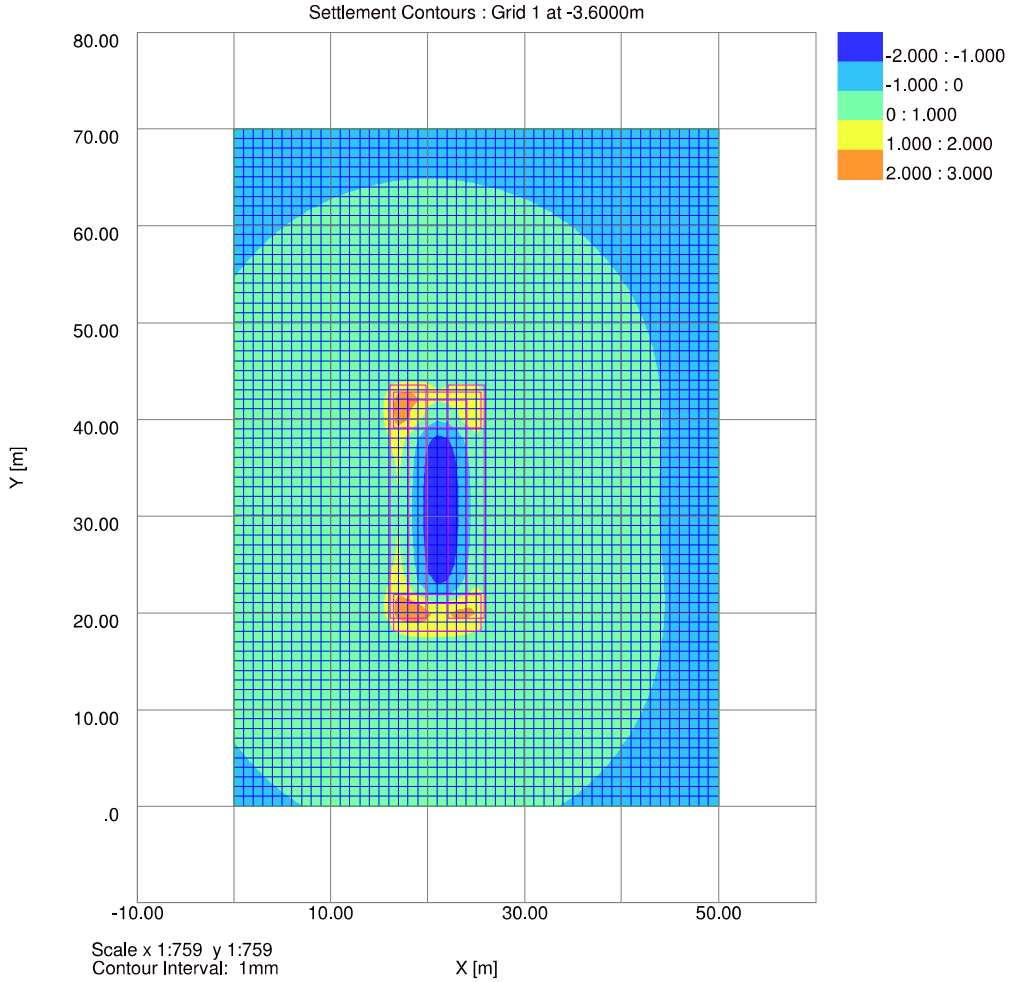
Ref.	Name	0 (Negligible) to 1 (Very Slight)	1 (Very Slight) to 2 (Slight)	2 (Slight) to 3 (Moderate)	3 (Moderate) to 4 (Severe)

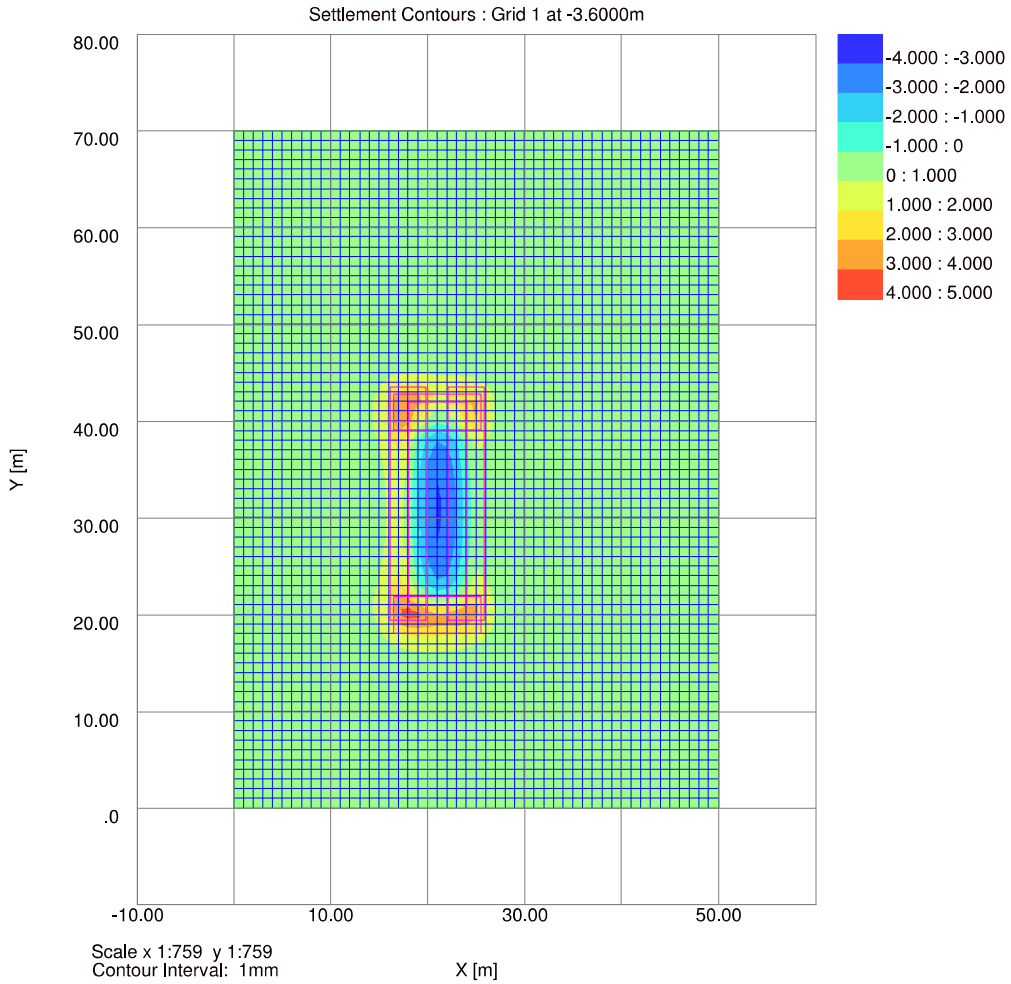
Specific Buildings - Geometry

Ref.	Building Name	Sub-Building Name	Displacement Line	Distance Along Line: Start [m]	Distance Along Line: End [m]	Vertical Offsets from Line for Vertical Movement Calculations [m]	Vertical Displacement Limit Sensitivity [mm]	Damage Category Strains	Poisson's Ratio	E/G
1	24 Crossfield A	Sub 1	24 Crossfield A	0.00000	5.99900	0.0	0.10000	Burland Strain Limits	0.20000	2.6000
2	24 Crossfield B	Sub 2	24 Crossfield B	0.00000	3.79900	0.0	0.10000	Burland Strain Limits	0.20000	2.6000
3	24 Crossfield C	Sub 3	24 Crossfield C	0.00000	4.99900	0.0	0.10000	Burland Strain Limits	0.20000	2.6000
4	24 Crossfield D	Sub 4	24 Crossfield D	0.00000	3.79900	0.0	0.10000	Burland Strain Limits	0.20000	2.6000
5	24 Crossfield E	Sub 5	24 Crossfield E	0.00000	4.99900	0.0	0.10000	Burland Strain Limits	0.20000	2.6000
6	24 Crossfield F	Sub 6	24 Crossfield F	0.00000	5.99900	0.0	0.10000	Burland Strain Limits	0.20000	2.6000
7	24 Crossfield G	Sub 7	24 Crossfield G	0.00000	9.99900	0.0	0.10000	Burland Strain Limits	0.20000	2.6000
8	24 Crossfield H	Sub 8	24 Crossfield H	0.00000	4.99900	0.0	0.10000	Burland Strain Limits	0.20000	2.6000
9	GARAGES A	Sub 9	GARAGES A	0.00000	9.99900	0.0	0.10000	Burland Strain Limits	0.20000	2.6000
10	GARAGES B	Sub 10	GARAGES B	0.00000	21.99900	0.0	0.10000	Burland Strain Limits	0.20000	2.6000
11	GARAGES C	Sub 11	GARAGES C	0.00000	9.99900	0.0	0.10000	Burland Strain Limits	0.20000	2.6000
12	GARAGES D	Sub 12	GARAGES D	0.00000	3.99900	0.0	0.10000	Burland Strain Limits	0.20000	2.6000
13	GARAGES E	Sub 13	GARAGES E	0.00000	9.99900	0.0	0.10000	Burland Strain Limits	0.20000	2.6000
14	GARAGES F	Sub 14	GARAGES F	0.00000	3.99900	0.0	0.10000	Burland Strain Limits	0.20000	2.6000
15	OUTBUILDING A	Sub 15	OUTBUILDING A	0.00000	13.99900	0.0	0.10000	Burland Strain Limits	0.20000	2.6000
16	OUTBUILDING B	Sub 16	OUTBUILDING B	0.00000	5.49900	0.0	0.10000	Burland Strain Limits	0.20000	2.6000
17	OUTBUILDING C	Sub 17	OUTBUILDING C	0.00000	13.99900	0.0	0.10000	Burland Strain Limits	0.20000	2.6000
18	OUTBUILDING D	Sub 18	OUTBUILDING D	0.00000	5.49900	0.0	0.10000	Burland Strain Limits	0.20000	2.6000
19	THE HALL A	Sub 19	THE HALL A	0.00000	14.00000	0.0	0.10000	Burland Strain Limits	0.20000	2.6000
20	THE HALL B	Sub 20	THE HALL B	0.00000	14.00000	0.0	0.10000	Burland Strain Limits	0.20000	2.6000

Specific Buildings - Bending Parameters

Ref.	Building Name	Sub-Building Name	Height [m]	Default	Hogging: 2nd Mom. of Area (per unit width) [m³]	Hogging: Dist. of Bending Strain from N.A. [m]	Hogging: Dist. of N.A. from Edge of Beam in Tension [m]	Sagging: 2nd Mom. of Area (per unit width) [m³]	Sagging: Dist. of Bending Strain from N.A. [m]	Sagging: Dist. of N.A. from Edge of Beam in Tension [m]
1	24 Crossfield A	Sub 1	10.000	Yes	333.33	10.000	10.000	83.333	5.0000	5.0000
2	24 Crossfield B	Sub 2	4.0000	Yes	21.333	4.0000	4.0000	5.3333	2.0000	2.0000
3	24 Crossfield C	Sub 3	4.0000	Yes	21.333	4.0000	4.0000	5.3333	2.0000	2.0000
4	24 Crossfield D	Sub 4	4.0000	Yes	21.333	4.0000	4.0000	5.3333	2.0000	2.0000
5	24 Crossfield E	Sub 5	10.000	Yes	333.33	10.000	10.000	83.333	5.0000	5.0000
6	24 Crossfield F	Sub 6	10.000	Yes	333.33	10.000	10.000	83.333	5.0000	5.0000
7	24 Crossfield G	Sub 7	10.000	Yes	333.33	10.000	10.000	83.333	5.0000	5.0000
8	24 Crossfield H	Sub 8	10.000	Yes	333.33	10.000	10.000	83.333	5.0000	5.0000
9	GARAGES A	Sub 9	4.0000	Yes	21.333	4.0000	4.0000	5.3333	2.0000	2.0000
10	GARAGES B	Sub 10	4.0000	Yes	21.333	4.0000	4.0000	5.3333	2.0000	2.0000
11	GARAGES C	Sub 11	4.0000	Yes	21.333	4.0000	4.0000	5.3333	2.0000	2.0000
12	GARAGES D	Sub 12	4.0000	Yes	21.333	4.0000	4.0000	5.3333	2.0000	2.0000
13	GARAGES E	Sub 13	4.0000	Yes	21.333	4.0000	4.0000	5.3333	2.0000	2.0000
14	GARAGES F	Sub 14	4.0000	Yes	21.333	4.0000	4.0000	5.3333	2.0000	2.0000
15	OUTBUILDING A	Sub 15	4.0000	Yes	21.333	4.0000	4.0000	5.3333	2.0000	2.0000
16	OUTBUILDING B	Sub 16	4.0000	Yes	21.333	4.0000	4.0000	5.3333	2.0000	2.0000
17	OUTBUILDING C	Sub 17	4.0000	Yes	21.333	4.0000	4.0000	5.3333	2.0000	2.0000
18	OUTBUILDING D	Sub 18	4.0000	Yes	21.333	4.0000	4.0000	5.3333	2.0000	2.0000
19	THE HALL A	Sub 19	14.000	Yes	914.67	14.000	14.000	228.67	7.0000	7.0000
20	THE HALL B	Sub 20	14.000	Yes	914.67	14.000	14.000	228.67	7.0000	7.0000


Settlement Contours : Grid 1 at -3.6000m
80.00
70.00
60.00
50.00
40.00
30.00
20.00
10.00
.0
Y [m]
-10.00
10.00
30.00
50.00
X [m]
-2.000 : -1.000
-1.000 : 0
0 : 1.000
1.000 : 2.000
2.000 : 3.000
Scale x 1:759 y 1:759
Contour Interval: 1mm


Settlement Contours : Grid 1 at -3.6000m
80.00
70.00
60.00
50.00
40.00
30.00
20.00
10.00
.0
Y [m]
-10.00
10.00
30.00
50.00
X [m]
-4.000 : -3.000
-3.000 : -2.000
-2.000 : -1.000
-1.000 : 0
0 : 1.000
1.000 : 2.000
2.000 : 3.000
3.000 : 4.000
4.000 : 5.000
Scale x 1:759 y 1:759
Contour Interval: 1mm

Titles

Job No.: J15302
Job Title: The Hall School, Crossfield Street, London NW3 4NU
Sub-title: Total drained movement
Calculation Heading:
Initials: ML
Checker:
Date Saved:
Date Checked:
Notes:
File Name: Total heave.pdd
File Path: C:\Users\Matt Legg\Desktop\PDisp workings\The Hall School

History

Date	Time	By	Notes
12-Aug-2016	14:24	Matt Legg	
12-Aug-2016	14:42	Matt Legg	
26-Feb-2019	17:54	Matt Legg	
26-Feb-2019	21:14	Matt Legg	
27-Feb-2019	11:03	Matt Legg	Open

Analysis Options

General

Global Poisson's ratio: 0.50
Maximum allowable ratio between values of E: 1.5
Horizontal rigid boundary level: -50.00 [m OD]
Displacements at load centroids: Yes
GSA piled raft data : No

Elastic

Elastic : Yes
Analysis: Boussinesq
Stiffness for horizontal displacement calculations: Weighted average
Using legacy heave correction factor: No

Consolidation

Consolidation : No

Soil ProfilesShort-term

Layer ref.	Name	Level at top	Number of intermediate displacement levels	Youngs Modulus : Top	Youngs Modulus : Btm.	Poissons ratio	Non-linear curve
		[mOD]		[kN/m²]	[kN/m²]		
1	Layer 1	0.0	1	15000.	22500.	0.50000	None
2	Layer 2	-1.5000	6	45000.	75000.	0.50000	None
3	Layer 3	-8.0000	7	75000.	105000.	0.50000	None
4	Layer 4	-15.000	10	105000.	150000.	0.50000	None
5	Layer 5	-25.000	10	150000.	195000.	0.50000	None
6	Layer 6	-35.000	10	195000.	240000.	0.50000	None
7	Layer 7	-45.000	5	240000.	262500.	0.50000	None

Soil ProfilesTotal

Layer ref.	Name	Level at top	Number of intermediate displacement levels	Youngs Modulus : Top	Youngs Modulus : Btm.	Poissons ratio	Non-linear curve
		[mOD]		[kN/m²]	[kN/m²]		
1	Layer 1	0.0	1	11240.	16860.	0.20000	None
2	Layer 2	-1.5000	6	33720.	56200.	0.20000	None
3	Layer 3	-8.0000	7	56200.	78680.	0.20000	None
4	Layer 4	-15.000	10	78680.	112400.	0.20000	None
5	Layer 5	-25.000	10	112400.	146120.	0.20000	None
6	Layer 6	-35.000	10	146120.	179840.	0.20000	None
7	Layer 7	-45.000	5	179840.	196700.	0.20000	None

Soil Zones

Zone	Name	X min [m]	X max [m]	Y min [m]	Y max [m]	Profile
1	Soil Zone 1	0.0	50.000	0.0	70.000	Total

Rectangular Load Data

Load ref.	Name	Orientation of Plane	Centre (Global) : x	Centre (Global) : y	Centre (Global) : z	Position : Angle of local x from	Position : Width x or Radius	Position : Length y	Value : Normal (local z)	Value : Tangential (local x)	Value : Tangential (local y)
			[m]	[m]	[m]	[Degrees]	[m]	[m]	[kN/m²]	[kN/m²]	[kN/m²]
1	Basement Excavation	Horizontal	21.00000	31.50000	-3.60000	0.0	6.0000	21.000	-48.000	0.0	0.0
2	Wall Line Load 1	Horizontal	18.00000	31.50000	-6.00000	0.0	3.7500	24.000	42.000	0.0	0.0
3	Wall Line Load 2	Horizontal	24.00000	31.50000	-6.00000	0.0	3.7500	24.000	27.000	0.0	0.0
4	Wall Line Load 3	Horizontal	21.00000	20.00000	-6.00000	0.0	9.0000	3.7500	42.000	0.0	0.0
5	Wall Line Load 4	Horizontal	21.00000	41.00000	-6.00000	0.0	9.0000	3.7500	42.000	0.0	0.0

Displacement Grids

Name	Extrusion: Direction	X1	Y1	Z1	X2	Y2	Z2	Intervals Along Line	Extrusion: Distance	Extrusion: Intervals Along	Calculate Detailed Results
		[m]	[m]	[m]	[m]	[m]	[m]	[No.]	[m]	[No.]	
Grid 1	Global X	0.00000	0.00000	-3.60000	-	70.00000	-3.60000	70	50.00000	50	Yes No

Warnings

(1)The load at (21.000, 31.500, -3.600)m lies wide of all soil zones. Displacements at its centre have been requested. The first soil profile will be used.

Specific Building Damage Results - Critical Values for All Segments within Each Sub-Building

Stage: Ref.	Stage: Name	Specific Building: Ref.	Specific Building: Name	Sub-building Name	Vertical Offset from Line for Vertical Movement Calculations [m]	Deflection Ratio	Average Horizontal Strain [%]	Max Slope	Max Settlement [mm]	Max Tensile Strain [%]	Max Gradient of Horizontal Displacement Curve	Max Gradient of Vertical Displacement Curve	Min Radius of Curvature (Hogging) [m]	Min Radius of Curvature (Sagging) [m]	Damage Category
0	Base Model	2	24 Crossfield B	Sub 2	0.0	0.0	0.015868	-162.10E-6	0.32136	0.015868	-158.66E-6	-162.10E-6	-	-	0 (Negligible)
		3	24 Crossfield C	Sub 3	0.0	0.0035191	0.0	-158.36E-6	0.47988	0.0035487	0.0	-158.36E-6	-	5051.8	0 (Negligible)
		4	24 Crossfield D	Sub 4	0.0	0.0	0.023684	241.92E-6	0.47988	0.023684	-236.79E-6	241.92E-6	14471.	-	0 (Negligible)
		19	THE HALL A	Sub 19	0.0	0.0041728	0.043481	396.10E-6	3.2337	0.043481	-434.62E-6	396.10E-6	24038.	43080.	0 (Negligible)
		20	THE HALL B	Sub 20	0.0	0.0062266	0.064896	-591.08E-6	4.8264	0.064896	-648.54E-6	-591.08E-6	16112.	-	1 (Very Slight)

Specific Building Damage Results - Critical Segments within Each Building

Stage: Ref.	Stage: Name	Specific Building: Ref.	Specific Building: Name	Parameter	Critical Sub-Building	Critical Segment	Start [m]	End [m]	Curvature	Max Slope	Max Settlement [mm]	Max Tensile Strain [%]	Min Radius of Curvature (Hogging) [m]	Min Radius of Curvature (Sagging) [m]	Damage Category
0	Base Model	0	24 Crossfield A	All vertical displacements are less than the limit sensitivity.											
				All vertical displacements are less than the limit sensitivity.											
				All vertical displacements are less than the limit sensitivity.											
				All vertical displacements are less than the limit sensitivity.											
				All vertical displacements are less than the limit sensitivity.											
		0	24 Crossfield B	Max Slope	Sub 2	1	2.8500	3.7990	Sagging	**162.10E-6**	0.32136	0.015868	-	21592.	0 (Negligible)
				Max Settlement	Sub 2	1	2.8500	3.7990	Sagging	162.10E-6	**0.32136**	0.015868	-	21592.	0 (Negligible)
				Max Tensile Strain	Sub 2	1	2.8500	3.7990	Sagging	162.10E-6	0.32136	**0.015868**	-	21592.	0 (Negligible)
				Min Radius of Curvature (Hogging)		-	-	-	-	-	-	-	-	-	-
				Min Radius of Curvature (Sagging)		-	-	-	-	-	-	-	-	-	-
		0	24 Crossfield C	Max Slope	Sub 3	1	0.0	3.0000	Sagging	**158.36E-6**	0.47988	0.0035487	-	5051.8	0 (Negligible)
				Max Settlement	Sub 3	2	3.0000	4.9990	Sagging	0.0	**0.47988**	35.763E-9	-	-	0 (Negligible)
				Max Tensile Strain	Sub 3	1	0.0	3.0000	Sagging	158.36E-6	0.47988	**0.0035487**	-	5051.8	0 (Negligible)
				Min Radius of Curvature (Hogging)		-	-	-	-	-	-	-	-	-	-
				Min Radius of Curvature (Sagging)	Sub 3	1	0.0	3.0000	Sagging	158.36E-6	0.47988	0.0035487	-	**5051.8**	0 (Negligible)
		0	24 Crossfield D	Max Slope	Sub 4	1	0.0	0.95000	Hogging	**241.92E-6**	0.47988	0.023684	14471.	-	0 (Negligible)
				Max Settlement	Sub 4	1	0.0	0.95000	Hogging	241.92E-6	**0.47988**	0.023684	14471.	-	0 (Negligible)
				Max Tensile Strain	Sub 4	1	0.0	0.95000	Hogging	241.92E-6	0.47988	**0.023684**	14471.	-	0 (Negligible)
				Min Radius of Curvature (Hogging)	Sub 4	1	0.0	0.95000	Hogging	241.92E-6	0.47988	0.023684	**14471.**	-	0 (Negligible)
				Min Radius of Curvature (Sagging)		-	-	-	-	-	-	-	-	-	-
		0	24 Crossfield E	All vertical displacements are less than the limit sensitivity.											
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		0	24 Crossfield F	All vertical displacements are less than the limit sensitivity.											
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		0	24 Crossfield G	All vertical displacements are less than the limit sensitivity.											
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				All vertical displacements are less than the limit sensitivity.											
		0	24 Crossfield H	All vertical displacements are less than the limit sensitivity.											
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		0	GARAGES E	All vertical displacements are less than the limit sensitivity.											
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		0	GARAGES F	All vertical displacements are less than the limit sensitivity.											
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				All vertical displacements are less than the limit sensitivity.											

Stage: Stage: Name Ref.	Specific Building: Ref.	Specific Building: Name	Parameter	Critical Sub-Building	Critical Segment	Start	End	Curvature	Max Slope	Max Settlement	Max Tensile Strain	Min Radius of Curvature (Hogging)	Min Radius of Curvature (Sagging)	Damage Category
			All vertical displacements are less than the limit sensitivity.											
			All vertical displacements are less than the limit sensitivity.											
	0	OUTBUILDING D	All vertical displacements are less than the limit sensitivity.											
			All vertical displacements are less than the limit sensitivity.											
			All vertical displacements are less than the limit sensitivity.											
			All vertical displacements are less than the limit sensitivity.											
			All vertical displacements are less than the limit sensitivity.											
	0	THE HALL A	Max Slope	Sub 19	2	1.8914	10.000	Hogging	**396.10E-6**	2.5256	0.037114	24038.	-	0 (Negligible)
			Max Settlement	Sub 19	1	0.0	1.8914	Sagging	374.21E-6	**3.2337**	0.043481	-	43080.	0 (Negligible)
			Max Tensile Strain	Sub 19	1	0.0	1.8914	Sagging	374.21E-6	3.2337	**0.043481**	-	43080.	0 (Negligible)
			Min Radius of Curvature (Hogging)	Sub 19	2	1.8914	10.000	Hogging	396.10E-6	2.5256	0.037114	**24038.**	-	0 (Negligible)
			Min Radius of Curvature (Sagging)	Sub 19	1	0.0	1.8914	Sagging	374.21E-6	3.2337	0.043481	-	**43080.**	0 (Negligible)
	0	THE HALL B	Max Slope	Sub 20	1	4.0000	12.108	Hogging	**591.08E-6**	3.7694	0.055393	16112.	-	1 (Very Slight)
			Max Settlement	Sub 20	2	12.108	14.000	Sagging	558.41E-6	**4.8264**	0.064896	-	28871.	1 (Very Slight)
			Max Tensile Strain	Sub 20	2	12.108	14.000	Sagging	558.41E-6	4.8264	**0.064896**	-	28871.	1 (Very Slight)
			Min Radius of Curvature (Hogging)	Sub 20	1	4.0000	12.108	Hogging	591.08E-6	3.7694	0.055393	**16112.**	-	1 (Very Slight)
			Min Radius of Curvature (Sagging)	-	-	-	-	-	-	-	-	-	-	-

GEA Geotechnical & Environmental Associates

Widbury Barn
Widbury Hill
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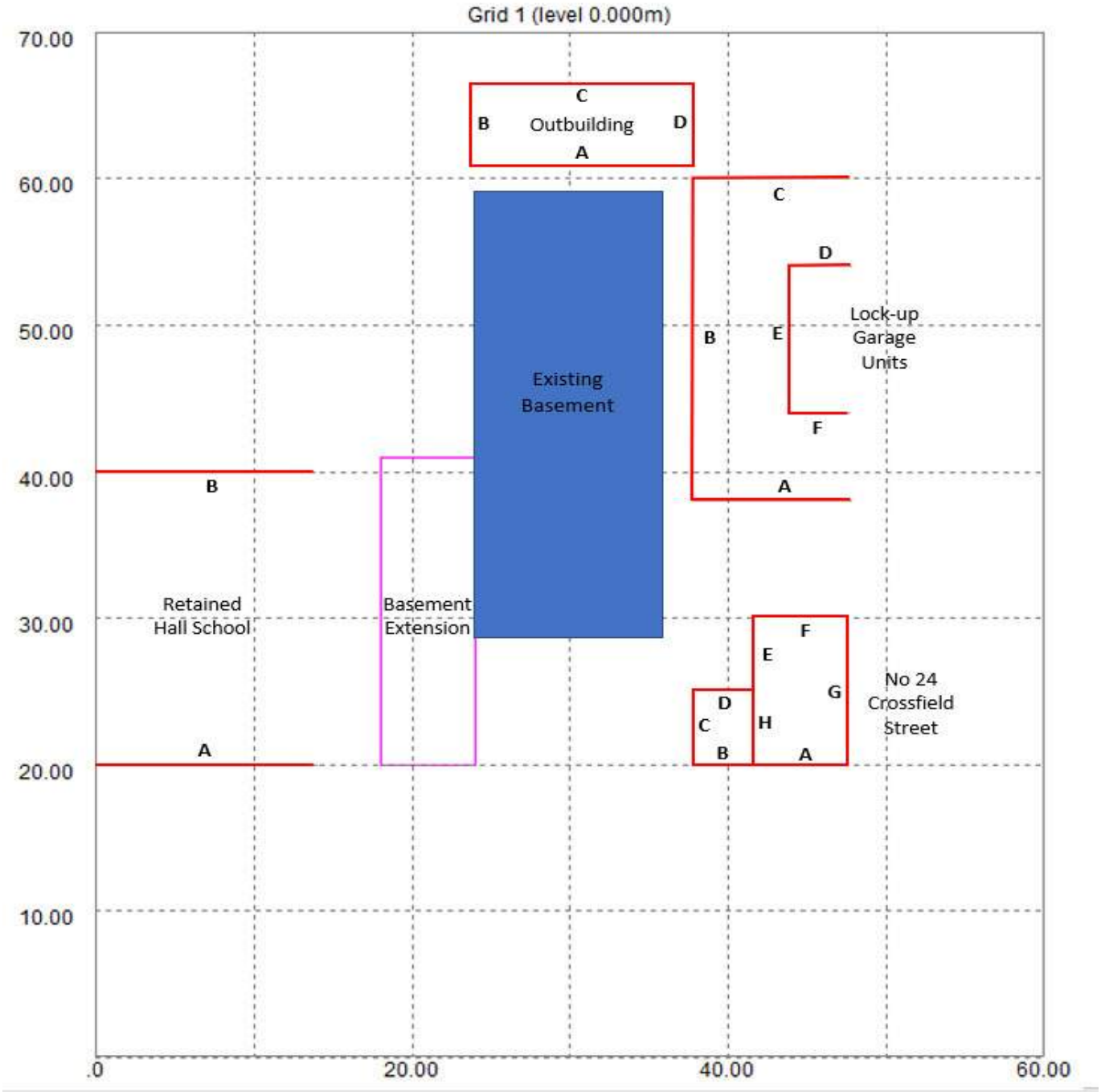
Herts SG12 7QE

Plan of Sensitive Structures

Site	The Hall School, 23 Crossfield Road, London NW3 4NU
Client	The Hall School
Engineer	Elliott Wood

Job Number J15303

Sheet 1 / 1



Geotechnical & Environmental Associates (GEA) is an engineer-led and client-focused independent specialist providing a complete range of geotechnical and contaminated land investigation, analytical and consultancy services to the property and construction industries.

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GEA

C Flood Risk Assessment

elliottwood

The Hall School

Flood Risk Assessment and Below Ground Drainage Statement

engineering a better society

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		Remarks:	**For Planning**				
Revision:	P1	Prepared by:	K Trimmer	Checked by:	K Trimmer	Approved by:	T Kenning
Date:	01/03/2019	Signature:	KTr	Signature:	KTr	Signature:	TKe

Contents

Appendices

One

Introduction

1.1

Elliott Wood Partnership Ltd have been appointed to produce a Below Ground Drainage Strategy and Flood Risk Assessment to support a detailed planning application for the development at The Hall School, 23 Crossfield Rd, London NW3 4NU.

Two

Existing Site

2.1

The Hall School is located in South Hampstead, London, and lies within the London Borough of Camden (LBC). The National Grid reference for the site is 526932E, 184533N. (Refer to Figure 1 for the site location map.)

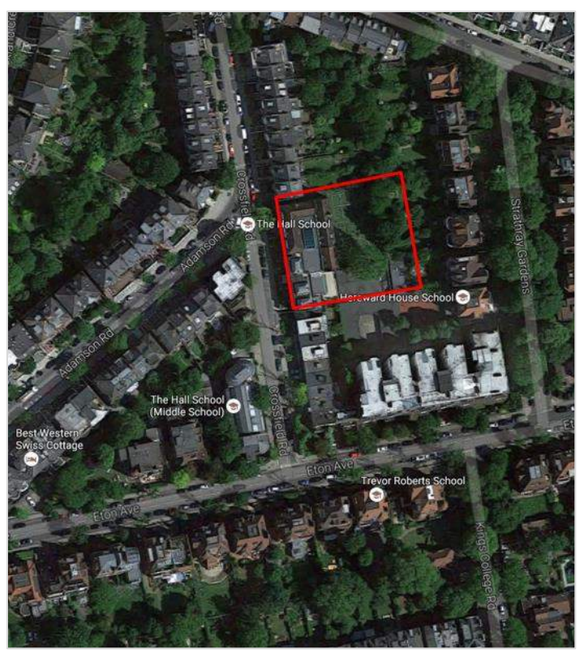


Figure 1 – Site Location Plan (Microsoft product screen shot reprinted with permission from Microsoft Corporation)

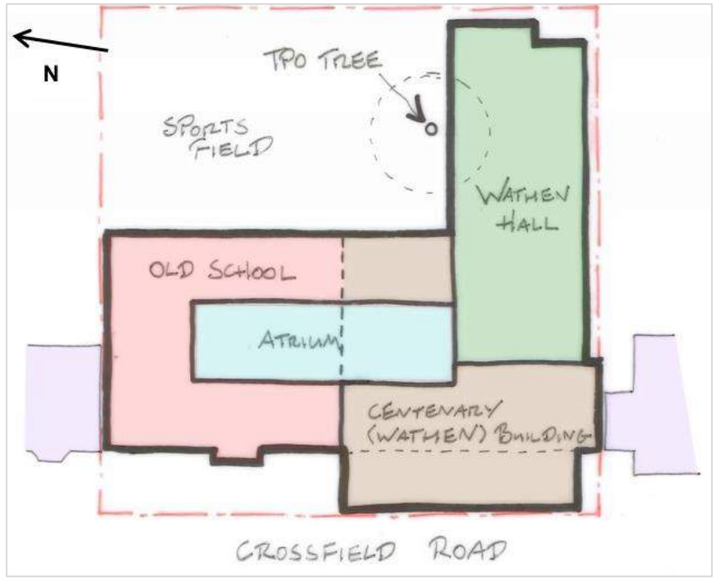


Figure 2 – Existing Buildings

2.2

The existing site comprises of existing school buildings (of varying ages). Namely the 'Old School', 'Wathen Hall', 'Centenary' (Wathen) Building' and the main 'Atrium'. Refer to Figure 2 above which shows the existing arrangement.

2.3

The existing site also comprises of an external play space to the rear of the 'Old School' which is primarily covered by a multi-use games area (MUGA). An existing London plane tree is located adjacent to the Wathen Hall building, which is subject to a Tree Preservation Order (TPO) and is to be retained as part of the proposed scheme.

2.4

Pedestrian access to the site is via Crossfield Road. The entire site is approximately 2,180m^2 and is considered to be 100% impermeable in the existing state.

2.5

A topographic survey has been completed by Metrix Surveys Ltd in October 2015; this can be found in Appendix A. The site broadly consists of a shallow slope from northwest to southeast, with the external playing space being approximately 1.5m below the level of Crossfield Road.

2.6

A ground investigation report was been prepared by GEA Ltd in August 2016, refer to Appendix B for borehole log extracts. Boreholes between 5 & 25m below ground level (bgl) were undertaken as part of the survey works. These found ground conditions to be Made Ground (general depth of made ground was found to be 1-4m bgl) with underlying London Clay, which extended the full extent of the 25m deep boreholes. British Geological Survey (BGS) maps show that the clay may extend to a depth of up to 95m bgl.

Ground water seepage was encountered on site (approximately 1-4m bgl); however, this was thought to be perched water.

Three

Existing Drainage

3.1

Public sewer records have been obtained from Thames Water and are included in Appendix C. Sewer records show that the offsite sewer network is combined (sewers carry both foul and surface water flows). Records show that a 300mm diameter combined water sewer is located in Crossfield Road, which drains towards the 1194x762mm sewer which runs beneath Eton Avenue.

3.2

A CCTV survey of the existing below ground drainage has been conducted on the site which demonstrates the existing property drains via two existing combined water connections at lower ground floor level. One connection is for the existing older retained building and the other connection is for the buildings which are being demolished and replaced. Refer to Appendix D for the CCTV survey report plan.

3.3

The surface water runoff rates for the existing site have been calculated using the Modified Rational Method equation below (based on CIRIA C697):

Q = 2.78.C.i.A

Where Q = Existing peak runoff (l/s), C = non-dimensional runoff coefficient=1, i = Rainfall intensity and A = total catchment area being drained

The existing surface water run-off rate associated with the demolished and reconstructed building has been calculated as follows, based on an area of 830m^2 and a rainfall intensity of 50mm/hr.

Q = 2.78 x 1 x 50mm/hr x 0.083

Q Total = 11.5 l/s

If considering the whole site (which includes the existing old retained building and MUGA), the surface water runoff rate has been calculated as follows, based on an area of 2,180m^2 and a rainfall intensity of 50mm/hr.

Q = 2.78 x 1 x 50mm/hr x 0.218

Q Total = 30.3 l/s

Four

Proposed Development

4.1

The project involves the redevelopment of the school site, retaining the early school buildings but demolishing and replacing subsequent additions. The front elevation to the new extension will be sympathetic in size and treatment to the retained fabric, with additional studio and classroom space provided in place of the existing hall at the rear of the site.

Five

Proposed Drainage Strategy

5.1

The surface water drainage strategy for the site has been considered in line with London Plan Policies 5.12 (Flood Risk Management) and 5.13 (Sustainable Drainage). The following drainage hierarchy has therefore been considered:

1. Store rainwater for later use
2. Use infiltration techniques, such as porous surfaces in non-clay areas
3. Attenuate rainwater in ponds or open water features for gradual release
4. Attenuate rainwater by storing in tanks or sealed water features for gradual release
5. Discharge rainwater direct to a watercourse
6. Discharge rainwater to a surface water sewer/drain
7. Discharge rainwater to the combined sewer.

5.2

Drainage via infiltration has been considered for the development however following a review of the ground conditions (i.e. underlying clay) it is considered that soakaways are not viable for this project.

5.3

External space on site is limited, as such, attenuation within ponds or open water features is not considered to be feasible.

5.4

There are no nearby accessible water courses and the existing Thames Water sewer network in the vicinity is combined use.

5.5

Considering the above, the foul and surface water generated by the development will aim to re-use the existing gravity connections from the development. Ultimately discharging to the Thames Water combined sewer beneath Crossfield Road.

5.6

For this development, 62% of the site consists of the existing old retained building and existing MUGA which drain via a separate combined water outlet. The remaining 38% of the site contains buildings which are to be demolished and reconstructed.

5.7

When considering the existing buildings to be retained, it is not considered feasible to implement a restriction on surface water run-off, due to the extreme complexities associated with separating the existing drainage network on site (in order to install the appropriate flow controls and attenuation devices).

5.8

When considering the new build element of the development, it is again not considered feasible to restrict run-off via below ground attenuation devices. It is not considered viable to install a tank underneath the existing MUGA due to the damage it would cause, the implications with the TPO of the London Plane Tree and it is considered unlikely that drainage would be able to discharge via gravity this way. Surface water would therefore require pumping, which is not deemed feasible, as this would increase the flood risk to the building.

5.9

In light of the above, alternative solutions for restricting run-off from the development areas have been explored. Where possible, a green roof has been introduced (over the Wathen Hall building), covering 173m^2 of roof area, which is indicated in orange on Figure 3 below). A green wall system is also proposed in areas shown in yellow, which equates to approximately 113m^2. Refer to the Architects general arrangement drawings and building elevations for the extents of the green roof and green wall proposed.

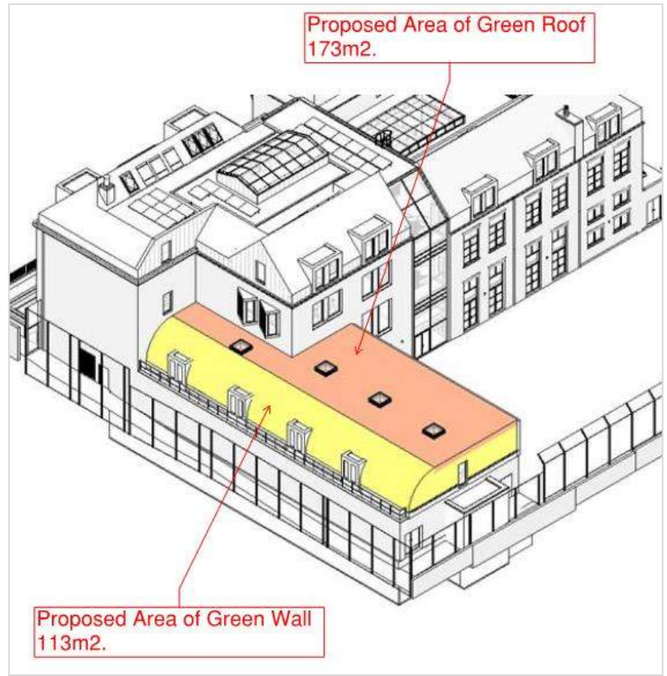


Figure 3 – Proposed green roof and green wall extents

5.10

The above proposals have been discussed previously with both Thames Water and the Lead Local Flood Authority (refer to Appendix E for previous correspondence with Thames Water).

5.11

In summary, Thames Water were previously satisfied with the surface water proposals at the development site and the run-off restrictions achieved by installing the green roof system. It should be noted that since the time of the discussions with Thames Water the green roof area has increased from 163m^2 to 173m^2. Refer to Appendix F for the Microdrainage calculations for the site pre-development and post-development for the area that the green roof covers.

5.12

In conjunction with the above, low flow water efficient appliances will be specified as part of the new development in order to reduce water consumption. These will be specified by the project M&E Engineer.

5.13

The evaluation of SuDS devices is summarised in the table below:

SuDS Technique	Y/N	Comment
Green Roofs	Y	**Green roofs will be incorporated within the scheme. Refer to the Architect's drawings for location and extents. Run-off restrictions achieved from the green roof system have been reviewed with Thames Water who are satisfied with the proposals.**
Basins and ponds	N	External space on site is limited, attenuation within ponds or open water features is not considered to be feasible.
Filter strips and swales	N	Filter strips and swales are not appropriate due to unsuitable ground conditions.
Infiltration devices	N	Infiltration is not deemed feasible for this site as the existing ground conditions are not conducive to infiltration techniques.
Tanked systems	N	When considering the existing buildings to be retained, it is not considered feasible to implement a restriction on surface water run-off – refer to section 5.8 of this report. When considering the new build element of the development, it is again not considered feasible to restrict run-off via below ground attenuation devices. It is not considered viable to install a tank underneath the existing MUGA due to the damage it would cause, the implications with the TPO of the London Plane Tree and it is considered unlikely that drainage would be able to discharge via gravity this way. Surface water would therefore require pumping, which is not deemed feasible, as this would increase the flood risk to the building. The green roof and green wall specified are deemed to be a more appropriate form of SuDS device in this instance.

Six

Maintenance Requirements

6.1

All SuDS devices will be maintained by the property owner for the lifetime of the development in accordance with the SuDS Manual as summarised below:

Green Roofs:

Maintenance Schedule	Required Action	Recommended Frequency
Regular Inspections	Inspect all components including soil substrate, vegetation, drains, irrigation systems (if applicable), membranes and roof structure for proper operation, integrity of waterproofing and structural stability.	Annually and after severe storms
	Inspect soil substrate for evidence of erosion channels and identify any sediment sources	Annually and after severe storms
	Inspect drain inlets to ensure unrestricted runoff from the drainage layer to the conveyance or roof drain system	Annually and after severe storms
	Inspect underside of roof for evidence of leakage	Annually and after severe storms
Regular maintenance	Remove debris and litter to prevent clogging of inlet drains and interference with plant growth	Six monthly and annually or as required
	During establishment (i.e. year one), replace dead plants as required.	Monthly (but usually the responsibility of manufacturer)
	Post establishment, replace dead plants as required (where >5% of coverage)	Annually (in Autumn)
	Remove fallen leaves and debris from deciduous plant foliage	Six monthly or as required
	Remove nuisance and invasive vegetation including weeds	Six monthly or as required
	Mow grasses, prune shrubs and manage other planting (if appropriate) as required – clippings should be removed and allowed to accumulate	Six monthly or as required
Remedial actions	If erosion channels are evident, these should be stabilised with extra soil substrate similar to the original material, and sources of erosion damage should be identified and controlled.	As required
	If drain inlet has settled, cracked or moved, investigate and repair as appropriate	As required

Gullies:

Inspection and removal of debris from silt trap once a year; preferably after leaf fall in the autumn.

Drainage pipes, manholes & silt traps:

Inspect manholes & silt traps for build-up of silt and general debris (once a year, preferably after leaf fall in the autumn). If silt/debris is building up then clean with jetting lorry / gully sucker and inspect pipe – repeat cleaning if required. If the pipes to be jetted are plastic then a high flow, low pressure setting should be used so that the pipes are not damaged.

Unusual / unresolved problems:

If the drainage system is still holding water following cleaning with a jetter, or the jetting of the system removes excessive amounts of debris this may indicate greater issues within the system. A CCTV survey is likely to be required and further advice should be sought from a drainage engineer.

Seven

Flood Risk Policy

7.1

Camden Strategic Flood Risk Assessment - The LBC Strategic Flood Risk Assessment (SFRA) was completed by URS in July 2004. This report aims to provide a reference and policy document to inform the local development framework and any subsequent plans.

7.2

Sequential Test and Exception Test - The Sequential and Exception Tests should be applied when choosing the location of new development and the layout of the development site. The aim of the Sequential Test is to steer new development to areas with the lowest probability of flooding. The Exception Test is utilised if no suitable development areas can be found in low risk areas. As the proposed development is located within Flood Zone 1, both the sequential test and the exception test are not required.

Eight

Flooding from Rivers and Sea

8.1

Flood Zone information published by GOV.uk shows that the proposed school site lies within Flood Risk Zone 1 (low risk). Sites within Flood Zone 1 have a chance of flooding of less than 1 in 1000 years (0.1%) due to coastal or river flooding. The flood risk in the surrounding area can be seen in Figure 4.

8.2

A review of the Flood Maps found within the LBC SFRA confirms that this site is located within Flood Zone 1, and as noted within the LBC SFRA, no historic flooding has occurred within the borough as a result of fluvial or tidal sources.

8.3

After review of the relevant information this development is considered to be at **low risk** of flooding from rivers and seas.

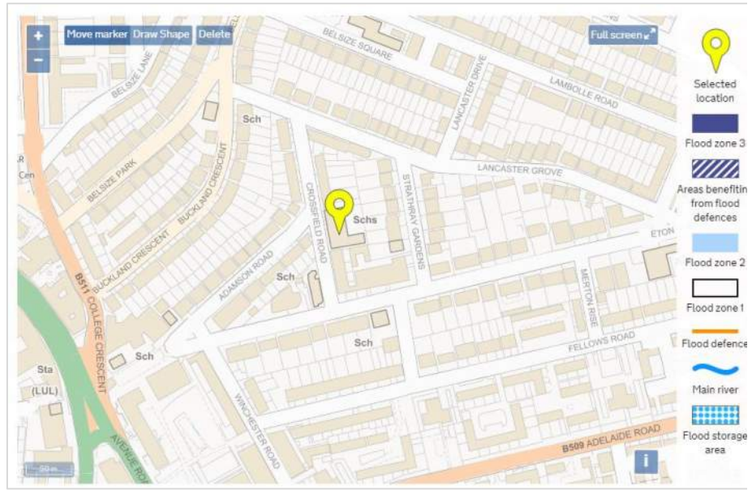


Figure 4 – Flood Zones in Surrounding Area (GOV.uk)

Flooding from Surface Water

8.4

Overland rainwater flows occur when the infiltration capacity of land or the drainage capacity of a local sewer network is exceeded. The extents of overland flooding will depend upon the rainfall event, the degree of saturation of the soil, the permeability of soils and the topography of the site.

8.5

Following review of the GOV.uk surface water map (refer to Figure 5), this site is considered to be at very low risk of flooding from overland flow i.e. less than 1 in 1000 chance of flooding any given year. The site is also shown to be located in a low risk area in the LBC SFRA 'Updated Flood Maps for Surface Water Flooding' map (uFMfSW) as shown in Figure 6.

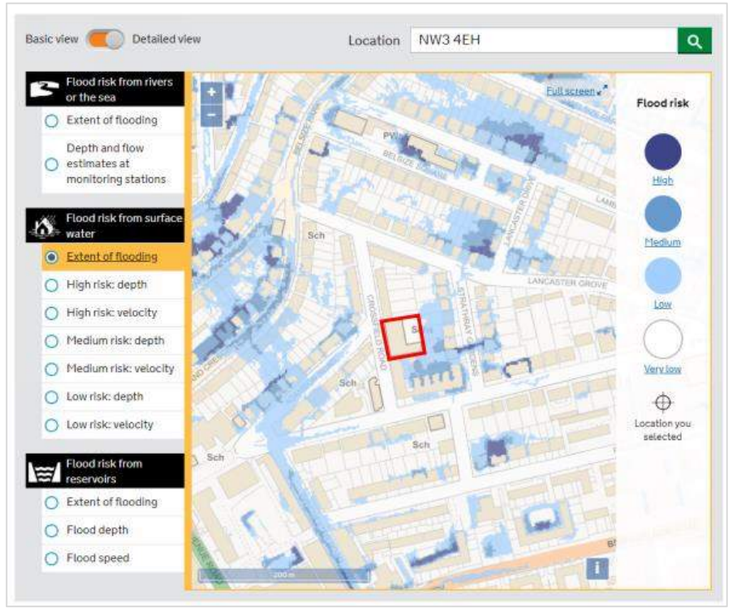


Figure 5 – Risk of surface water flooding (GOV.uk)

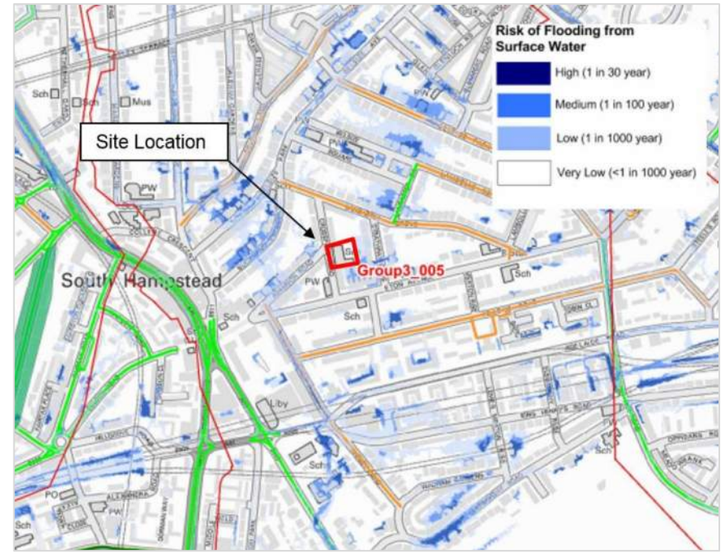


Figure 6 – LBC SFRA Figure 3v uFMfSW)

8.6

In general the levels along the western boundary of the site are above those along the pavement of Crossfield Road. Therefore surface water within the road will ultimately flow away from the site, towards Eton Avenue, discharging into local highway gullies. Refer to Appendix A for the site topographical survey.

8.7

After review of the relevant information this development is considered to be at **low risk** of flooding from surface water.

Flooding from Sewers

8.8

Public sewer records have been obtained from Thames Water and are included in Appendix C. Sewer records show that the offsite sewer network is combined (sewers carry both foul and surface water flows). Records show that a 300mm diameter combined water sewer is located in Crossfield Road.

8.9

Thames Water are responsible for operating and maintaining their sewer infrastructure, therefore the likelihood of sewer surcharging is expected to be low.

8.10

The LBC SFRA shows that the site is located within an area which has had one reported incidence of internal sewer flooding. Refer to Figure 7 for an extract of the SFRA 'DG5 Internal Sewer Flooding' map.

8.11

The LBC SFRA also shows that the site is located outside of areas which have previously had reported issues as a result of external sewer flooding. Refer to Figure 8 for an extract of the SFRA 'DG5 External Sewer Flooding' map.

8.12

All new drainage on site will be designed to protect the local drainage network against public sewer surcharge.

8.13

After review of the relevant information this development is considered to be at **low risk** of flooding from sewers.

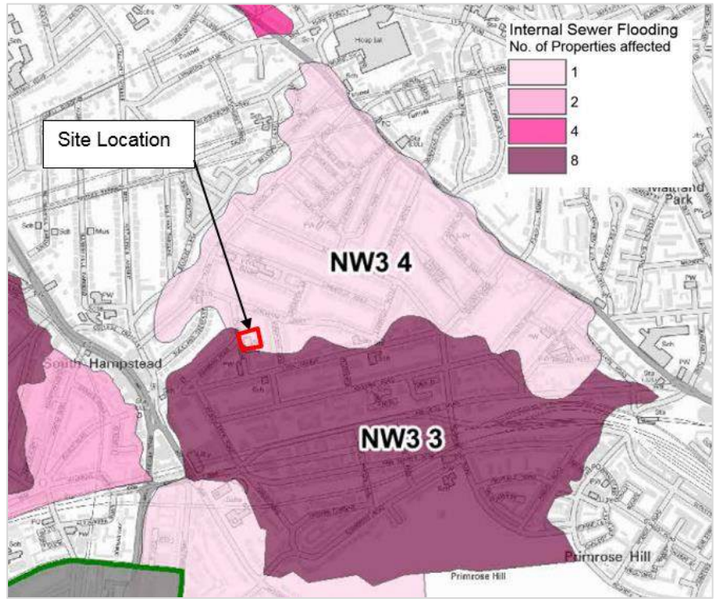


Figure 7 – LBC SFRA DG5 Internal Sewer Flooding Map

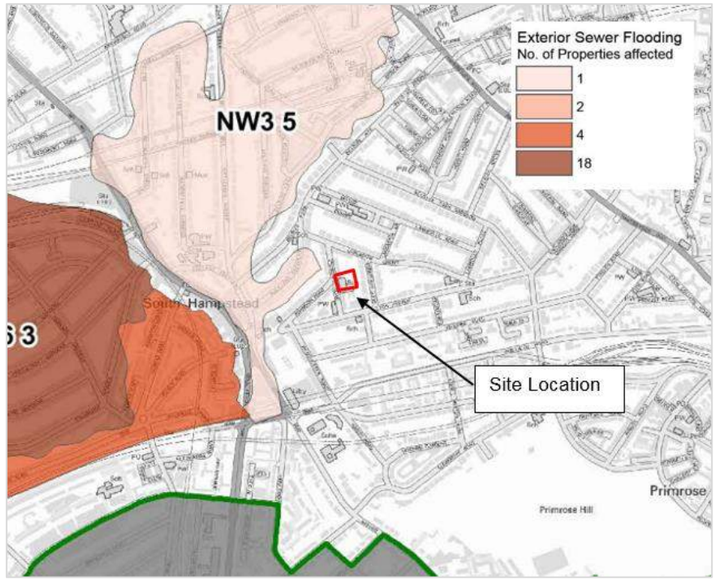


Figure 8 – LBC SFRA DG5 External Sewer Flooding Map

Flooding from Groundwater

8.14

Groundwater flooding can occur following an extended prolonged period of low intensity rainfall. The future risk from this source is more uncertain than surface water as the climate change predictions indicate that although sea levels will rise, thus possibly raising groundwater levels, overall summer rainfall will decrease, therefore having a long-term effect of lowering the groundwater levels. However, long periods of wet weather are predicted to increase, and these are the type of weather patterns that can cause groundwater flooding to occur.

8.15

A Ground investigation report has been prepared by GEA Ltd in August 2016. Boreholes between 5 & 25m below ground level (bgl) were undertaken as part of the survey works. The boreholes found the ground conditions to be Made Ground (general depth of made ground was found to be 1-4m bgl) with underlying London Clay, which extended the full extent of the 25m deep borehole. British Geological Survey (BGS) maps show that the clay may extend to a depth of up to 95m bgl.

8.16

Ground water seepage was encountered on site (approximately 1-4m bgl); however, this was thought to be perched water, refer to Appendix B for the SI Borehole Logs. Data from BGS indicates that the continuous standing groundwater level is approximately 90m below ground level.

8.17

The EA does not have any historic evidence of flooding in the area arising from groundwater.

8.18

The LBC SFRA shows areas within the borough that are susceptible to elevated ground water (refer to Figure 9); the development site is not located within one of these areas.

8.19

The site itself and majority of the surrounding area is paved which reduces the risk of ground water at the surface. Flooding due to ground water elsewhere in the area would follow localised flow paths, similar to those shown on the GOV.uk surface water flood risk map, and would then discharge into the local sewer system.

8.20

After review of the relevant information this development is considered to be at **low risk** of flooding from groundwater.

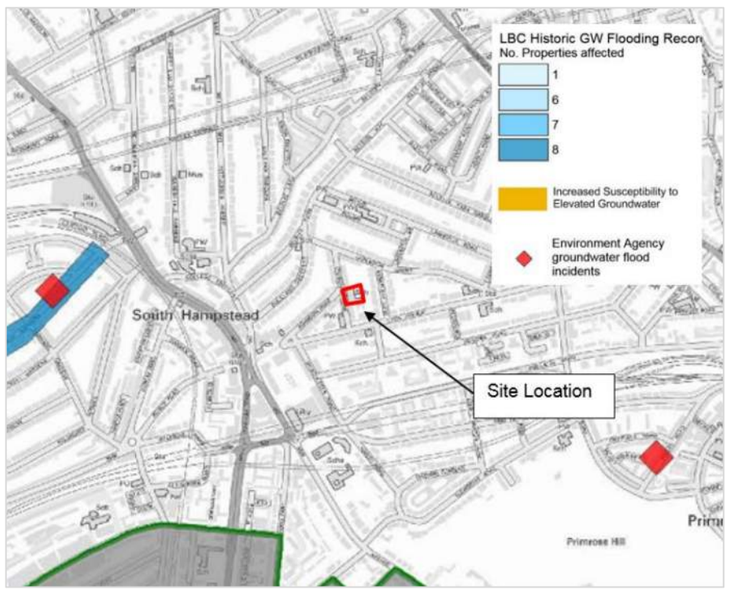


Figure 9 – LBC SFRA Increased Susceptibility to Elevated Groundwater Map

Flooding from Artificial Water Bodies

8.21

The closest watercourses to the site are the Hampstead Ponds (which are located approximately 1,250m north of the site) and the Regents Canal (which is located approximately 1,350m south of the site). Refer to Figure 10 which shows the 'Risk of Flooding from Reservoirs' map found on the EA website.

8.22

The LBC SFRA confirms that no flooding incidents associated with the Regents Canal have been recorded within the borough, and that the risk of flooding as a result of overtopping or breaching of the canal is considered to be low.

8.23

The LBC SFRA also notes that inspection of the Hampstead Ponds is carried out as required under the Reservoirs Act 1975, routine maintenance is carried out as and when required.

8.24

After review of the relevant information this development is considered to be at **low risk** of flooding from artificial water bodies.

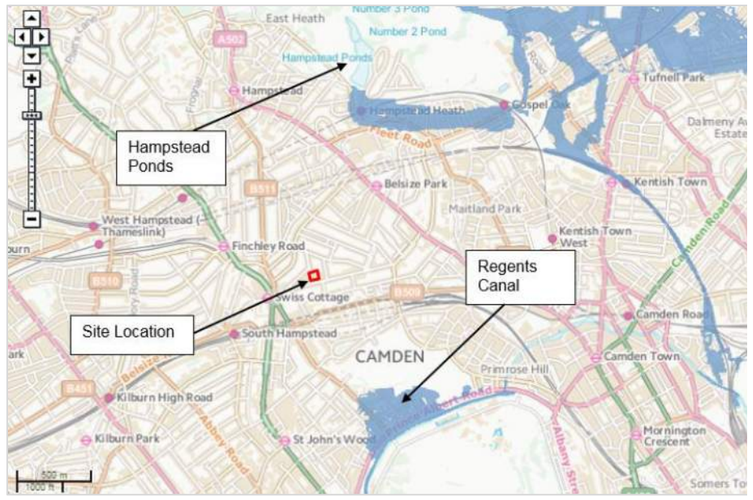


Figure 10 – Risk of Flooding from Reservoirs Map(Contains Environment Agency information © Environment Agency and/or database rights. Based on information © Local Authorities)

Flood Risk Summary

8.25

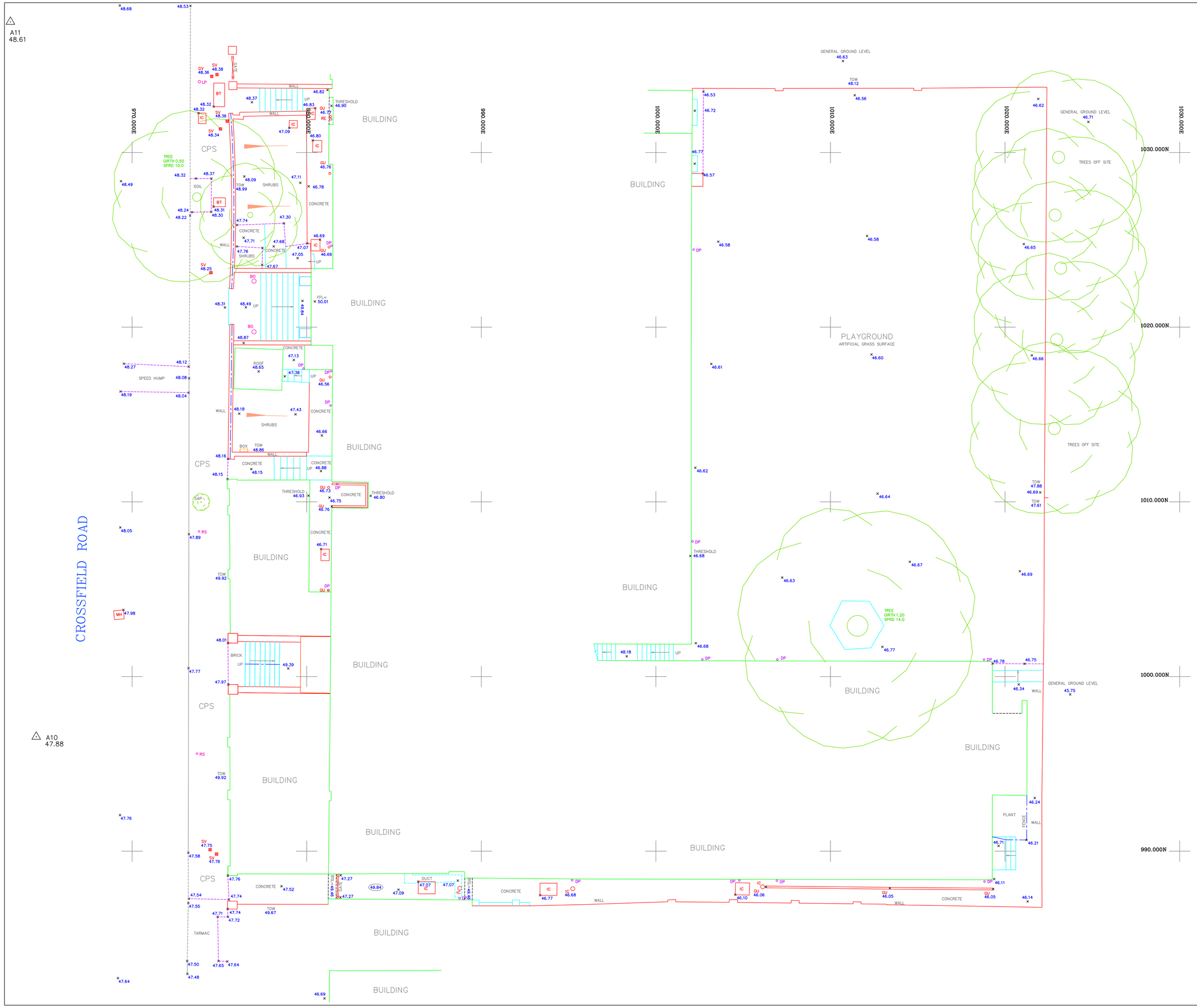
A review of all potential sources of flooding has found the site be at low. The new proposed drainage network should ensure that the building remains safe from flooding in the event of a localised drainage failure. In addition, levels across the site should ensure that surface water is directed away from building entrances.

elliottwood

Appendices

engineering a better society

A Topographic Survey



INDICATIVE ONLY

Topographical Abbreviations

A/R	Assumed Route	MKR	Marker
BH	Borehole	MT	Mercury Telecom Cover
BOL	Bollard	OHC	Overhead Cable
BT	British Telecom Cover	OHP	Overhead Pipe
BW	Barbed Wire Fence	OSBM	Ordnance Survey Bench Mark
BWK	Brickwork	PB	Post Box
CATV	Cable TV Cover	PGM	Permanent Ground Marker
CB	Close Boarded Fence	PR	Post & Rail Fence
CCTV	Closed Circuit TV	PW	Post & Wire Fence
CHLK	Chainlink Fence	PWM	Post & Wire Mesh Fence
CHPL	Chestnut Paling Fence	RE	Rodding Eye
CL	Cover Level	RG	Road Gully
CM	Cable Marker	RN	Road Name
CP	Catch Pit	RS	Road Sign
CPL	Catch Pit Base Level	RW	Retaining Wall
DIA	Diameter	RWP	Rain Water Pipe
DK	Drop Kerb	SAP	Sapling
DP	Down Pipe	SC	Stop Cock
EJB	Electricity Junction Box	SPR	Spread
EC	Electricity Cover	STA	Traverse Station
EP	Electricity Pole	SV	Stop Valve
ER	Earthing Rod	SVP	Soil Vent Pipe
FH	Fire Hydrant	SW	Storm Water
FIG	Feed Into Ground	TB	Telephone Box
FW	Foul Water	TBM	Temporary Bench Mark
GU	Gully	TFR	Taken From Records
GV	Gas Valve	TJB	Telephone Junction Box
H	Height	TPT	Trial Pit
IC	Inspection Cover	TL	Traffic Light
IL	Invert Level	TP	Telephone Pole
IR	Iron Railing Fence	UTL	Unable To Lift
KO	Kerb Outlet	UTT	Unable To Trace
LB	Litter Bin	VP	Vent Pipe
LC	Lamp Column	WKH	Water Key Hole
LP	Lamp Post	WM	Water Meter
MH	Manhole	WV	Water Valve
		- - -	Approximate

THIS SURVEY DATA HAS BEEN PREPARED FOR THE CLIENT DETAILED BELOW TO AN AGREED SPECIFICATION. UNLESS OTHERWISE AGREED IN WRITING THE LIABILITY OF METRIX SURVEYS LTD IS LIMITED TO THE CLIENT OR HIS APPOINTED AGENT AND DOES NOT EXTEND TO USE BEYOND THE LIMITATIONS OF THE SPECIFICATION.

Survey Station Information

STA No.	Easting	Northing	Level	Type
STN A10	964.512	996.550	47.88	Nail
STN A11	963.033	1037.480	48.61	Nail

Notes

The Grid is Arbitrary

All Levels are related to Station A1 given value 50.00m (Previous survey)

Rev	QA Check	Description	Date
5	-	-	-
4	-	-	-
3	-	-	-
2	-	-	-
1	-	-	-
0	GR	First Complete Issue	26-10-2015
Prelim	-	Preliminary - Not Complete	-

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SURVEYED BY
METRIX SURVEYS LTD
7 WEST END
SHERBORNE ST JOHN
BASINGSTOKE
HAMPSHIRE
RG24 9LB

TEL 01256 851672
CELL 07734 233459
E-MAIL postbox@metrixsurveys.com
www.metrixsurveys.com

SURVEYED	SR	CLIENT: Archial NORR
DRAWN	SR	
SCALE	1:100	

TOPOGRAPHICAL SURVEY

ADDRESS:
THE HALL SCHOOL
CROSSFIELD ROAD
LONDON NW3

JOB No	DRAWING NUMBER
14064B / 15085T	15085T/100

A1 Sheet - 841mm X 594mm

B Site Investigation – Borehole Logs

GEA Geotechnical & Environmental Associates	Widbury Barn Widbury Hill Ware SG12 7QE	**Site** The Hall School, 23 Crossfield Street, London NW3 4NU	**Borehole Number** **BH1**

Boring Method	**Casing Diameter**		**Ground Level (mOD)**	**Client**	**Job Number**
	Depth	Diameter			
Dismantlable Cable Percussion Rig	2.00	150		The Hall School	J15302
	Location		**Dates**	**Engineer**	**Sheet**
	526946.00E 184515.00N		28/10/2015	Elliott Wood	Sheet 1 of 3

Depth (m)	Sample / Tests	Casing Depth (m)	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
						(0.10)	Astro Turf surface over foam underlay and asphalt		
0.20	D1					(0.20)	Lean-mix concrete over stone chippings		
0.30	D2					(0.30)	Asphalt		
0.50	B3						Made Ground (brownish grey silty clay with rootlets, gravel, brick, coal and concrete fragments)		
0.75	D4					(1.05)			
1.20 - 1.65	B5								
1.20 - 1.65	SPT (C)N=11	1.00		N=11 (1,2/2,2,3,4)		1.35	Medium to firm fissured brown silty CLAY with pockets of orange-brown silt and fine sand and fine selenite, has blocky fissuring.		
1.75	D6								
2.00 - 2.45	U7					(1.65)			
2.75	D8								
3.00 - 3.45	D9					3.00			
3.00 - 3.45	SPT (S)N=15	2.00		N=15 (1,2/3,3,4,5)			Stiff high strength locally fissured brown silty laminated CLAY with partings and pockets of orange-brown and grey silt and fine to coarse selenite crystals.		
3.75	D10								
4.00 - 4.45	U11								
4.75	D12								
5.00 - 5.45	D13								
5.00 - 5.45	SPT (S)N=16	2.00		N=16 (1,2/3,3,4,6)					
6.00	D14								
6.50 - 6.95	U15					(6.50)			
7.50	D16								
8.00 - 8.45	D17								
8.00 - 8.45	SPT (S)N=19	2.00		N=19 (4,3/4,5,5,5)					
9.00	D18						*abundant partings of orange-brown silty sand.*		
9.50 - 9.95	U19					9.50	Very stiff high strength to very high strength dark grey silty CLAY, locally very laminated with fine selenite, occasional white shells, occasional pale grey veins and white		

Continued on Next Page

Remarks

4 hrs spent moving rig and all equipment to borehole location.
Services inspection pit excavated from GL to 1.2 m for 1 hr.
Chiselling on claystone between 17.0 m to 17.30 m for 30 mins.
5hrs spent removing rig and equipment off of site.
Groundwater monitoring standpipe installed in borehole to 8.00 m.

Scale (approx)	**Logged By**
1:50	ML

GEA Geotechnical & Environmental Associates
Widbury Barn
Widbury Hill
Ware
SG12 7QE

Site	Borehole Number
The Hall School, 23 Crossfield Street, London NW3 4NU	BH1

Boring Method	Casing Diameter		Ground Level (mOD)	Client	Job Number
	Depth	Diameter			
Dismantlable Cable Percussion Rig	2.00	150		The Hall School	J15302
	Location		**Dates**	**Engineer**	**Sheet**
	526946.00E 184515.00N		28/10/2015	Elliott Wood	Sheet 2 of 3

Depth (m)	Sample / Tests	Casing Depth (m)	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
							foraminifera.		
10.50	D20								
11.00 - 11.45	D21								
11.00 - 11.45	SPT (S)N=24	2.00		N=24 (3,4/5,6,6,7)					
12.00	D22								
12.50 - 12.95	U23								
13.50	D24								
14.00 - 14.45	D25								
14.00 - 14.45	SPT (S)N=27	2.00		N=27 (3,5/5,6,7,9)					
15.00	D26					(15.50)			
15.50 - 15.95	U27								
16.50	D28								
17.00 - 17.45	D29						*claystone at 17.00 m*		
17.00 - 17.45	SPT (S)N=33	2.00		N=33 (14,15/11,8,6,8)					
18.00	D30								
18.50 - 18.95	U31								
19.50	D32								
20.00 - 20.45	D33								

Continued on Next Page

Remarks

4 hrs spent moving rig and all equipment to borehole location.
Services inspection pit excavated from GL to 1.2 m for 1 hr.
Chiselling on claystone between 17.0 m to 17.30 m for 30 mins.
5hrs spent removing rig and equipment off of site.
Groundwater monitoring standpipe installed in borehole to 8.00 m.

Scale (approx)	Logged By
1:50	ML

GEA Geotechnical & Environmental Associates
Widbury Barn
Widbury Hill
Ware
SG12 7QE

Site	Borehole Number
The Hall School, 23 Crossfield Street, London NW3 4NU	BH1

Boring Method	Casing Diameter		Ground Level (mOD)	Client	Job Number
	Depth	Diameter			
Dismantlable Cable Percussion Rig	2.00	150		The Hall School	J15302
	Location		**Dates**	**Engineer**	**Sheet**
	526946.00E 184515.00N		28/10/2015	Elliott Wood	Sheet 3 of 3

Depth (m)	Sample / Tests	Casing Depth (m)	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
20.00 - 20.45	SPT (S)N=34	2.00		N=34 (5,6/7,8,8,11)					
21.00	D34								
21.50 - 21.95	U35								
22.50	D36								
23.00 - 23.45	D37								
23.00 - 23.45	SPT (S)N=35	2.00		N=35 (5,6/8,8,9,10)					
							claystone at 23.70 m		
24.00	D38								
24.55 - 25.00	D40								
24.55 - 25.00	SPT (S)N=37	2.00		N=37 (7,6/7,8,9,13)					
24.55 - 25.00	U39					25.00	Complete at 25.000m		

Remarks

4 hrs spent moving rig and all equipment to borehole location.
Services inspection pit excavated from GL to 1.2 m for 1 hr.
Chiselling on claystone between 17.0 m to 17.30 m for 30 mins.
5hrs spent removing rig and equipment off of site.
Groundwater monitoring standpipe installed in borehole to 8.00 m.

Scale (approx)	Logged By
1:50	ML

GEA Geotechnical & Environmental Associates
Widbury Barn
Widbury Hill
Ware
SG12 7QE

Site	Borehole Number
The Hall School, 23 Crossfield Street, London NW3 4NU	BH2

Boring Method	Casing Diameter		Ground Level (mOD)	Client	Job Number
Drive-in Window Sampler	Depth	Diameter		The Hall School	J15302
	Location		Dates	Engineer	Sheet
	526939.00E 184539.00N		30/10/2015	Elliott Wood	Sheet 1 of 1

Depth (m)	Sample / Tests	Casing Depth (m)	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
						(0.20) 0.20	Concrete		
						(0.20) 0.40	Made Ground (dark brown and black silty sandy gravel with ash)		
						(2.00)	Made Ground (brown silty clay with gravel and fine brick fragments)		
2.00	D1			Seepage		2.40			
						(0.40) 2.80	Made Ground (crushed brick and gravel)		
						(1.00) 3.80	Made Ground (greyish brown loosely cemented gravel and brick)		
4.00	D2						Firm fissured locally very thinly laminated silty CLAY with partings of bluish grey silt occasional pockets of dark orange-brown fine sand, coarse selenite and fine white shells		
4.50	D3					(1.50)			
5.00	D4					5.30	Complete at 5.300m		

Remarks

Borehole advanced through the base of TRial Pit 1 at a depth of 1.80 m.
Groundwater monitoring standpipe installed in borehole to 5.00 m.

Scale (approx)	Logged By
1:50	ML

GEA Geotechnical & Environmental Associates Widbury Barn Widbury Hill Ware SG12 7QE			**Site** The Hall School, 23 Crossfield Street, London NW3 4NU	**Borehole Number** **BH3**
Boring Method Drive-in Window Sampler	**Casing Diameter** Depth / Diameter	**Ground Level (mOD)**	**Client** The Hall School	**Job Number** J15302
	Location 526964.00E 184508.00N	**Dates** 30/10/2015	**Engineer** Elliott Wood	**Sheet** Sheet 1 of 1

Depth (m)	Sample / Tests	Casing Depth (m)	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
						(0.15) 0.15	Concrete with 6 mm reinforcement		
							Made Ground (dark brown silty clay with gravel, decayed roots, brick and coal fragments)		
						(1.05)			
0.90	D1			Seepage					
						1.20 (0.20)	Made Ground (brown silty clay with gravel)		
						1.40			
1.60	D2						Soft rapidly becoming firm fissured brown CLAY with bluish grey veins, occasional small pockets of orange-brown fine sand and fine selenite		
2.60	D3								
3.60	D4					(4.60)			
4.60	D5						*coarse selenite and pockets of pale grey silt below 4.50 m*		
5.60	D6								
						6.00	Complete at 6.000m		

Remarks	Scale (approx)	Logged By
Borehole advanced through the base of Trial Pit No 2 at a depth of 0.70 m.	1:50	ML

GEA Geotechnical & Environmental Associates Widbury Barn Widbury Hill Ware SG12 7QE			**Site** The Hall School, 23 Crossfield Street, London NW3 4NU	**Borehole Number** **BH4**
Boring Method Drive-in Window Sampler	**Casing Diameter** Depth / Diameter	**Ground Level (mOD)**	**Client** The Hall School	**Job Number** J15302
	Location 526920.00E 184520.00N	**Dates** 30/10/2015	**Engineer** Elliott Wood	**Sheet** Sheet 1 of 1

Depth (m)	Sample / Tests	Casing Depth (m)	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
						(0.20) 0.20	Concrete		
						(0.80)	Made Ground (brown silty clay with gravel and brick fragments)		
						1.00	Firm fissured locally very thinly laminated silty CLAY with partings of bluish grey silt occasional pockets of dark orange-brown fine sand, coarse selenite and fine white shells		
						(4.00)			
						5.00	Complete at 5.000m		

Remarks

Groundwater monitoring standpipe installed in borehole to a depth of 5.00 m.

Scale (approx)	**Logged By**
1:50	ML

C Thames Water Sewer Records

Asset Location Search

Elliott Wood Partnership LLP
241

LONDON
SW19 1SD

Search address supplied The Hall School Charitable Trust
23
Crossfield Road
London
NW3 4NU

Your reference 2150206 The Hall School Hampstead

Our reference ALS/ALS Standard/2015_3055369

Search date 29 May 2015

You are now able to order your Asset Location Search requests online by visiting
www.thameswater-propertysearches.co.uk

Asset Location Search

Search address supplied: The Hall School Charitable Trust, 23, Crossfield Road, London, NW3 4NU

Dear Sir / Madam

An Asset Location Search is recommended when undertaking a site development. It is essential to obtain information on the size and location of clean water and sewerage assets to safeguard against expensive damage and allow cost-effective service design.

The following records were searched in compiling this report: - the map of public sewers & the map of waterworks. Thames Water Utilities Ltd (TWUL) holds all of these.

This searchprovides maps showing the position, size of Thames Water assets close to the proposed development and also manhole cover and invert levels, where available.

Please note that none of the charges made for this report relate to the provision of Ordnance Survey mapping information. The replies contained in this letter are given following inspection of the public service records available to this company. No responsibility can be accepted for any error or omission in the replies.

You should be aware that the information contained on these plans is current only on the day that the plans are issued. The plans should only be used for the duration of the work that is being carried out at the present time. Under no circumstances should this data be copied or transmitted to parties other than those for whom the current work is being carried out.

Thames Water do update these service plans on a regular basis and failure to observe the above conditions could lead to damage arising to new or diverted services at a later date.

Contact Us

If you have any further queries regarding this enquiry please feel free to contact a member of the team on 0845 070 9148, or use the address below:

Thames Water Utilities Ltd
Property Searches
PO Box 3189
Slough
SL1 4WW

Email: searches@thameswater.co.uk
Web: www.thameswater-propertysearches.co.uk

Asset Location Search

Waste Water Services

Please provide a copy extract from the public sewer map.

Enclosed is a map showing the approximate lines of our sewers. Our plans do not show sewer connections from individual properties or any sewers not owned by Thames Water unless specifically annotated otherwise. Records such as "private" pipework are in some cases available from the Building Control Department of the relevant Local Authority.

Where the Local Authority does not hold such plans it might be advisable to consult the property deeds for the site or contact neighbouring landowners.

This report relates only to sewerage apparatus of Thames Water Utilities Ltd, it does not disclose details of cables and or communications equipment that may be running through or around such apparatus.

The sewer level information contained in this response represents all of the level data available in our existing records. Should you require any further Information, please refer to the relevant section within the 'Further Contacts' page found later in this document.

For your guidance:

- The Company is not generally responsible for rivers, watercourses, ponds, culverts or highway drains. If any of these are shown on the copy extract they are shown for information only.
- Any private sewers or lateral drains which are indicated on the extract of the public sewer map as being subject to an agreement under Section 104 of the Water Industry Act 1991 are not an ‘as constructed’ record. It is recommended these details be checked with the developer.

Clean Water Services

Please provide a copy extract from the public water main map.

Enclosed is a map showing the approximate positions of our water mains and associated apparatus. Please note that records are not kept of the positions of individual domestic supplies.

For your information, there will be a pressure of at least 10m head at the outside stop valve. If you would like to know the static pressure, please contact our Customer

Asset Location Search

Centre on 0800 316 9800. The Customer Centre can also arrange for a full flow and pressure test to be carried out for a fee.

For your guidance:

- Assets other than vested water mains may be shown on the plan, for information only.
- If an extract of the public water main record is enclosed, this will show known public water mains in the vicinity of the property. It should be possible to estimate the likely length and route of any private water supply pipe connecting the property to the public water network.

Payment for this Search

A charge will be added to your suppliers account.

Asset Location Search

Further contacts:

Waste Water queries

Should you require verification of the invert levels of public sewers, by site measurement, you will need to approach the relevant Thames Water Area Network Office for permission to lift the appropriate covers. This permission will usually involve you completing a TWOSA form. For further information please contact our Customer Centre on Tel: 0845 920 0800. Alternatively, a survey can be arranged, for a fee, through our Customer Centre on the above number.

If you have any questions regarding sewer connections, budget estimates, diversions, building over issues or any other questions regarding operational issues please direct them to our service desk. Which can be contacted by writing to:

Developer Services (Waste Water)
Thames Water
Clearwater Court
Vastern Road
Reading
RG1 8DB

Tel: 0845 850 2777
Email: developer.services@thameswater.co.uk

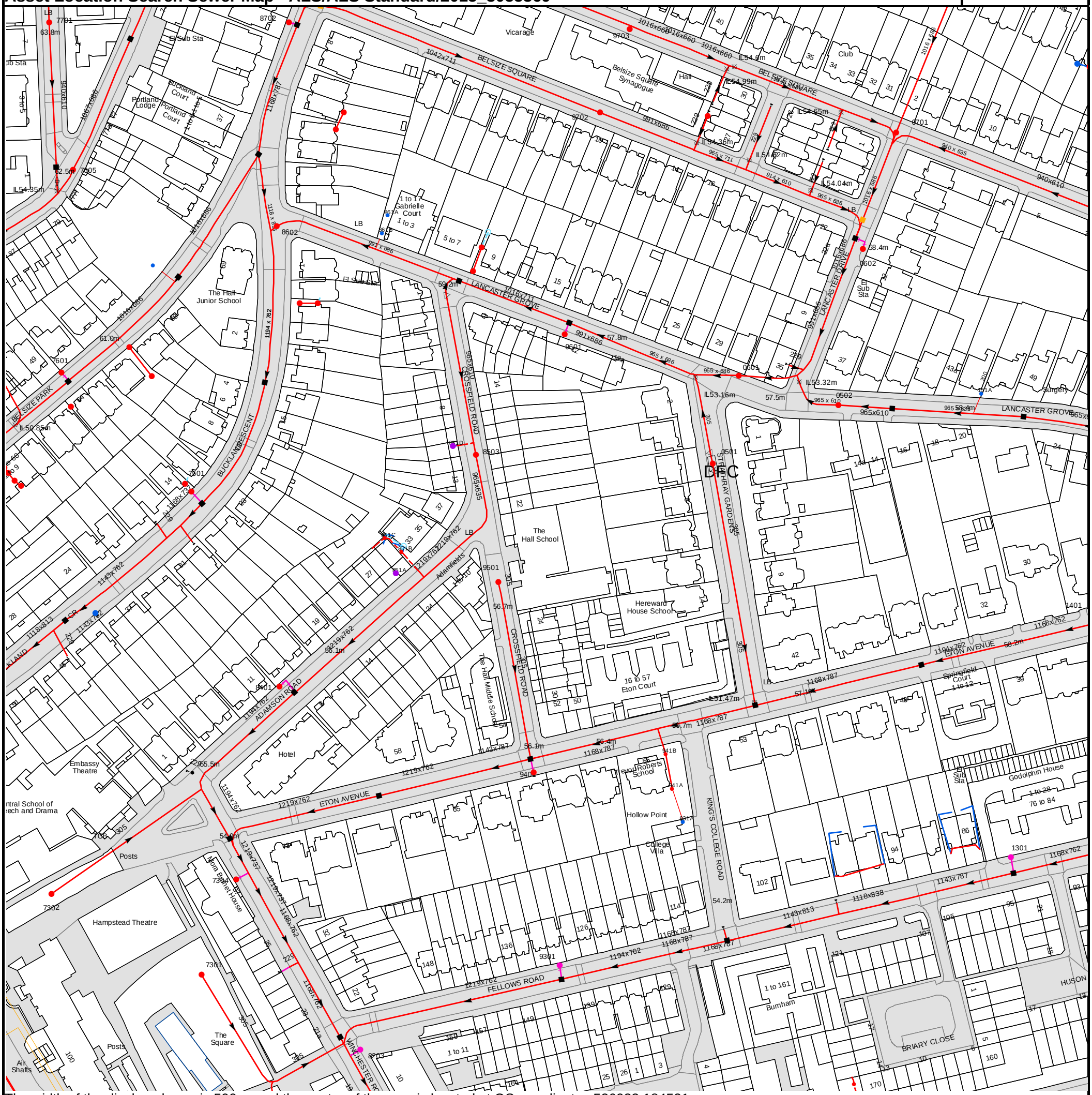
Clean Water queries

Should you require any advice concerning clean water operational issues or clean water connections, please contact:

Developer Services (Clean Water)
Thames Water
Clearwater Court
Vastern Road
Reading
RG1 8DB

Tel: 0845 850 2777
Email: developer.services@thameswater.co.uk

Asset Location Search Sewer Map - ALS/ALS Standard/2015_3055369



The width of the displayed area is 500 m and the centre of the map is located at OS coordinates 526933,184521

The position of the apparatus shown on this plan is given without obligation and warranty, and the accuracy cannot be guaranteed. Service pipes are not shown but their presence should be anticipated. No liability of any kind whatsoever is accepted by Thames Water for any error or omission. The actual position of mains and services must be verified and established on site before any works are undertaken.

Based on the Ordnance Survey Map with the Sanction of the controller of H.M. Stationery Office, License no. 100019345 Crown Copyright Reserved.

NB. Levels quoted in metres Ordnance Newlyn Datum. The value -9999.00 indicates that no survey information is available

Manhole Reference	Manhole Cover Level	Manhole Invert Level
17CC	n/a	n/a
17CB	n/a	n/a
7701	64.11	59.55
7601	n/a	n/a
75AI	n/a	n/a
7605	62.39	54.49
76CB	n/a	n/a
75BC	n/a	n/a
761A	n/a	n/a
8602	60.58	52.1
8702	n/a	n/a
86BD	n/a	n/a
86BC	n/a	n/a
87BB	n/a	n/a
87AJ	n/a	n/a
861B	n/a	n/a
861A	n/a	n/a
851D	n/a	n/a
86AB	n/a	n/a
8503	58.09	52.29
96AF	n/a	n/a
96AE	n/a	n/a
9601	n/a	n/a
9702	60.11	54.16
9703	60.69	54.89
07BJ	n/a	n/a
0601	n/a	n/a
0502	n/a	n/a
0602	n/a	n/a
0701	59.18	54.13
151A	n/a	n/a
941A	n/a	n/a
9401	n/a	n/a
941B	n/a	n/a
8401	n/a	n/a
74BA	0	0
9501	57.16	52.81
851A	n/a	n/a
851B	n/a	n/a
85BA	n/a	n/a
851C	n/a	n/a
7501	n/a	n/a
65CG	n/a	n/a
75BI	n/a	n/a
65CH	n/a	n/a
65CI	n/a	n/a
0501	57.19	n/a
8203	n/a	n/a
7301	54.25	52.42
7302	57.15	54.52
7304	n/a	n/a
9301	n/a	n/a
931A	n/a	n/a
021A	50.62	49.35
1301	n/a	n/a

The position of the apparatus shown on this plan is given without obligation and warranty, and the accuracy cannot be guaranteed. Service pipes are not shown but their presence should be anticipated. No liability of any kind whatsoever is accepted by Thames Water for any error or omission. The actual position of mains and services must be verified and established on site before any works are undertaken.

ALS Sewer Map Key

Public Sewer Types (Operated & Maintained by Thames Water)

Foul: A sewer designed to convey waste water from domestic and industrial sources to a treatment works.

Surface Water: A sewer designed to convey surface water (e.g. rain water from roofs, yards and car parks) to rivers or watercourses.

Combined: A sewer designed to convey both waste water and surface water from domestic and industrial sources to a treatment works.

Trunk Surface Water

Trunk Foul

Storm Relief

Trunk Combined

Vent Pipe

Bio-solids (Sludge)

Proposed Thames Surface Water Sewer

Proposed Thames Water Foul Sewer

Gallery

Foul Rising Main

Surface Water Rising Main

Combined Rising Main

Sludge Rising Main

Proposed Thames Water Rising Main

Vacuum

Sewer Fittings

A feature in a sewer that does not affect the flow in the pipe. Example: a vent is a fitting as the function of a vent is to release excess gas.

Air Valve

Dam Chase

Fitting

Meter

Vent Column

Operational Controls

A feature in a sewer that changes or diverts the flow in the sewer. Example: A hydrobrake limits the flow passing downstream.

Control Valve

Drop Pipe

Ancillary

Weir

End Items

End symbols appear at the start or end of a sewer pipe. Examples: an Undefined End at the start of a sewer indicates that Thames Water has no knowledge of the position of the sewer upstream of that symbol, Outfall on a surface water sewer indicates that the pipe discharges into a stream or river.

Outfall

Undefined End

Inlet

Other Symbols

Symbols used on maps which do not fall under other general categories

Public/Private Pumping Station

Change of characteristic indicator (C.O.C.I.)

Invert Level

Summit

Areas

Lines denoting areas of underground surveys, etc.

Agreement

Operational Site

Chamber

Tunnel

Conduit Bridge

Other Sewer Types (Not Operated or Maintained by Thames Water)

Foul Sewer

Surface Water Sewer

Combined Sewer

Gulley

Culverted Watercourse

Proposed

Abandoned Sewer

Notes:

1) All levels associated with the plans are to Ordnance Datum Newlyn.

2) All measurements on the plans are metric.

3) Arrows (on gravity fed sewers) or flecks (on rising mains) indicate direction of flow.

4) Most private pipes are not shown on our plans, as in the past, this information has not been recorded.

5) 'na' or '0' on a manhole level indicates that data is unavailable.

6) The text appearing alongside a sewer line indicates the internal diameter of the pipe in milimetres. Text next to a manhole indicates the manhole reference number and should not be taken as a measurement. If you are unsure about any text or symbology present on the plan, please contact a member of Property Insight on 0845 070 9148.

Asset Location Search Water Map - ALS/ALS Standard/2015_3055369

The width of the displayed area is 500 m and the centre of the map is located at OS coordinates 526933, 184521.

The position of the apparatus shown on this plan is given without obligation and warranty, and the accuracy cannot be guaranteed. Service pipes are not shown but their presence should be anticipated. No liability of any kind whatsoever is accepted by Thames Water for any error or omission. The actual position of mains and services must be verified and established on site before any works are undertaken.

Based on the Ordnance Survey Map with the Sanction of the controller of H.M. Stationery Office, License no. 100019345 Crown Copyright Reserved.

ALS Water Map Key

Water Pipes (Operated & Maintained by Thames Water)

4"

Distribution Main: The most common pipe shown on water maps. With few exceptions, domestic connections are only made to distribution mains.

16"

Trunk Main: A main carrying water from a source of supply to a treatment plant or reservoir, or from one treatment plant or reservoir to another. Also a main transferring water in bulk to smaller water mains used for supplying individual customers.

3" SUPPLY

Supply Main: A supply main indicates that the water main is used as a supply for a single property or group of properties.

3" FIRE

Fire Main: Where a pipe is used as a fire supply, the word FIRE will be displayed along the pipe.

3" METERED

Metered Pipe: A metered main indicates that the pipe in question supplies water for a single property or group of properties and that quantity of water passing through the pipe is metered even though there may be no meter symbol shown.

Transmission Tunnel: A very large diameter water pipe. Most tunnels are buried very deep underground. These pipes are not expected to affect the structural integrity of buildings shown on the map provided.

Proposed Main: A main that is still in the planning stages or in the process of being laid. More details of the proposed main and its reference number are generally included near the main.

Valves

- General Purpose Valve
- Air Valve
- Pressure Control Valve
- Customer Valve

Hydrants

- Single Hydrant

Meters

- Meter

End Items

Symbol indicating what happens at the end of a water main.

- Blank Flange
- Capped End
- Emptying Pit
- Undefined End
- Manifold
- Customer Supply
- Fire Supply

Operational Sites

- Booster Station
- Other
- Other (Proposed)
- Pumping Station
- Service Reservoir
- Shaft Inspection
- Treatment Works
- Unknown
- Water Tower

Other Symbols

- Data Logger

PIPE DIAMETER	DEPTH BELOW GROUND
Up to 300mm (12")	900mm (3')
300mm - 600mm (12" - 24")	1100mm (3' 8")
600mm and bigger (24" plus)	1200mm (4')

Other Water Pipes (Not Operated or Maintained by Thames Water)

Other Water Company Main: Occasionally other water company water pipes may overlap the border of our clean water coverage area. These mains are denoted in purple and in most cases have the owner of the pipe displayed along them.

Private Main: Indiates that the water main in question is not owned by Thames Water. These mains normally have text associated with them indicating the diameter and owner of the pipe.

Terms and Conditions

All sales are made in accordance with Thames Water Utilities Limited (TWUL) standard terms and conditions unless previously agreed in writing.

1. All goods remain in the property of Thames Water Utilities Ltd until full payment is received.
2. Provision of service will be in accordance with all legal requirements and published TWUL policies.
3. All invoices are strictly due for payment 14 days from due date of the invoice. Any other terms must be accepted/agreed in writing prior to provision of goods or service, or will be held to be invalid.
4. Thames Water does not accept post-dated cheques-any cheques received will be processed for payment on date of receipt.
5. In case of dispute TWUL`s terms and conditions shall apply.
6. Penalty interest may be invoked by TWUL in the event of unjustifiable payment delay. Interest charges will be in line with UK Statute Law 'The Late Payment of Commercial Debts (Interest) Act 1998'.
7. Interest will be charged in line with current Court Interest Charges, if legal action is taken.
8. A charge may be made at the discretion of the company for increased administration costs.

A copy of Thames Water's standard terms and conditions are available from the Commercial Billing Team (cashoperations@thameswater.co.uk).

We publish several Codes of Practice including a guaranteed standards scheme. You can obtain copies of these leaflets by calling us on 0800 316 9800

If you are unhappy with our service you can speak to your original goods or customer service provider. If you are not satisfied with the response, your complaint will be reviewed by the Customer Services Director. You can write to him at: Thames Water Utilities Ltd. PO Box 492, Swindon, SN38 8TU.

If the Goods or Services covered by this invoice falls under the regulation of the 1991 Water Industry Act, and you remain dissatisfied you can refer your complaint to Consumer Council for Water on 0121 345 1000 or write to them at Consumer Council for Water, 1st Floor, Victoria Square House, Victoria Square, Birmingham, B2 4AJ.

Ways to pay your bill

Credit Card	**BACS Payment**	**Telephone Banking**	**Cheque**
Call **0845 070 9148** quoting your invoice number starting CBA or ADS.	Account number **90478703** Sort code **60-00-01** A remittance advice must be sent to: **Thames Water Utilities Ltd., PO Box 3189, Slough SL1 4WW.** or email **ps.billing@thameswater.co.uk**	By calling your bank and quoting: Account number **90478703** Sort code **60-00-01** and your invoice number	Made payable to '**Thames Water Utilities Ltd**' Write your Thames Water account number on the back. Send to: **Thames Water Utilities Ltd., PO Box 3189, Slough SL1 4WW** or by DX to **151280 Slough 13**

Thames Water Utilities Ltd Registered in England & Wales No. 2366661 Registered Office Clearwater Court, Vastern Rd, Reading, Berks, RG1 8DB.

Search Code

IMPORTANT CONSUMER PROTECTION INFORMATION

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The Search Code:

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- sets out minimum standards which firms compiling and selling search reports have to meet
- promotes the best practise and quality standards within the industry for the benefit of consumers and property professionals
- enables consumers and property professionals to have confidence in firms which subscribe to the code, their products and services.

By giving you this information, the search firm is confirming that they keep to the principles of the Code. This provides important protection for you.

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Firms which subscribe to the Search Code will:

- display the Search Code logo prominently on their search reports
- act with integrity and carry out work with due skill, care and diligence
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- conduct business in an honest, fair and professional manner
- handle complaints speedily and fairly
- ensure that products and services comply with industry registration rules and standards and relevant laws
- monitor their compliance with the Code

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If you have a query or complaint about your search, you should raise it directly with the search firm, and if appropriate ask for any complaint to be considered under their formal internal complaints procedure. If you remain dissatisfied with the firm's final response, after your complaint has been formally considered, or if the firm has exceeded the response timescales, you may refer your complaint for consideration under The Property Ombudsman scheme (TPOs). The Ombudsman can award compensation of up to £5,000 to you if he finds that you have suffered actual loss as a result of your search provider failing to keep to the Code.

Please note that all queries or complaints regarding your search should be directed to your search provider in the first instance, not to TPOs or to the PCCB.

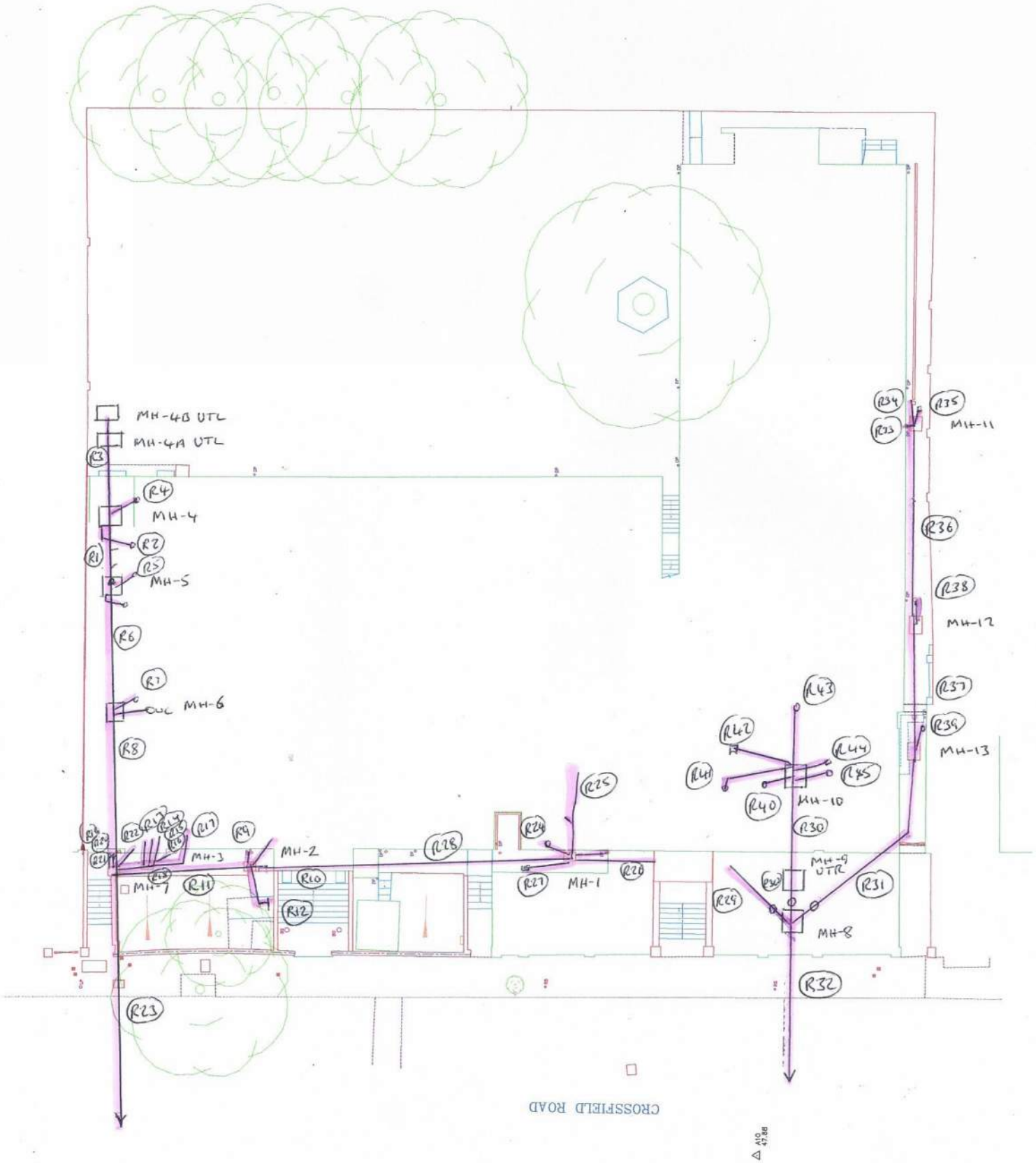
TPOs Contact Details

The Property Ombudsman scheme
Milford House
43-55 Milford Street
Salisbury
Wiltshire SP1 2BP
Tel: 01722 333306
Fax: 01722 332296
Email: admin@tpos.co.uk

You can get more information about the PCCB from www.propertycodes.org.uk

PLEASE ASK YOUR SEARCH PROVIDER IF YOU WOULD LIKE A COPY OF THE SEARCH CODE

D CCTV Drainage Survey Plan


MH-4B UTL
MH-4A UTL
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MH-11
MH-12
MH-13
MH-9 UTR
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R42
R43
R44
R45
CROSSFIELD ROAD

E Previous Correspondence with Thames Water

From: John Georgoulias <john.georgoulias@thameswater.co.uk>
Sent: 08 February 2019 10:01
To: Keri Trimmer <k.trimmer@elliottwood.co.uk>
Subject: THE HALL SCHOOL [Filed 08 Feb 2019 10:06]

Hi Keri,

Please find below our formal response sent to the Local Authority on 27th March 2018.

London Borough of Camden Camden Town Hall Argyle Street Euston Road London WC1H 8EQ
27 March 2018

Our DTS Ref: 53960 Your Ref: 2016/6319/P - Disc of surface water

Dear Sir/Madam

Re: THE HALL SCHOOL, 23 CROSSFIELD ROAD, LONDON, NW3 4NT

Waste Comments
Thank you for consulting Thames Water for the discharge of matters relating to surface water. Thames Water confirm they are happy for the surface water condition referenced to be discharged based on the information submitted

Water Comments

Supplementary Comments
Further to discussions with Keri Trimmer from the Elliot Wood Partnership, Thames Water confirms that we are happy with the surface water proposals and as such agree to the discharge of the related condition.

Yours faithfully

Development Planning Department

Development Planning, Thames Water, Maple Lodge STW,
Denham Way, Rickmansworth, WD3 9SQ Tel:020 3577 9998
Email: devcon.team@thameswater.co.uk

Kind regards

John Georgoulias
Developer Services – Thames Valley Regional Development Planning Lead
Mobile 07747 645428 Landline 020 3577 9959
john.georgoulias@thameswater.co.uk

Maple Lodge Sewage Treatment Works, Denham Way, Rickamsworth, WD3 9SQ
Find us online at developers.thameswater.co.uk

F MicroDrainage Calculations

170m2 without green roof

Elliott Wood Partnership LTD		Page 1
241 The Broadway London SW19 1SD		
Date 01/03/2019 12:41 File SITE WITHOUT GREEN	Designed by jdelishaj Checked by	
Innovyze	Network 2018.1	

STORM SEWER DESIGN by the Modified Rational Method

Design Criteria for Storm

Pipe Sizes STANDARD Manhole Sizes STANDARD

FSR Rainfall Model - England and Wales

Return Period (years)	100	PIMP (%)	100
M5-60 (mm)	21.000	Add Flow / Climate Change (%)	0
Ratio R	0.430	Minimum Backdrop Height (m)	0.200
Maximum Rainfall (mm/hr)	100	Maximum Backdrop Height (m)	1.500
Maximum Time of Concentration (mins)	30	Min Design Depth for Optimisation (m)	1.200
Foul Sewage (l/s/ha)	0.000	Min Vel for Auto Design only (m/s)	1.00
Volumetric Runoff Coeff.	0.750	Min Slope for Optimisation (1:X)	500

Designed with Level Soffits

Time Area Diagram for Storm

Time (mins)	Area (ha)	Time (mins)	Area (ha)
0-4	0.011	4-8	0.006

Total Area Contributing (ha) = 0.017

Total Pipe Volume (m³) = 0.079

Network Design Table for Storm

PN	Length (m)	Fall (m)	Slope (1:X)	I.Area (ha)	T.E. (mins)	Base Flow (l/s)	k (mm)	HYD SECT	DIA (mm)	Section Type	Auto Design
S1.000	5.000	0.050	100.0	0.017	6.00	0.0	0.600	o	100	Pipe/Conduit	
S1.001	5.000	0.050	100.0	0.000	0.00	0.0	0.600	o	100	Pipe/Conduit	

Network Results Table

PN	Rain (mm/hr)	T.C. (mins)	US/IL (m)	Σ I.Area (ha)	Σ Base Flow (l/s)	Foul (l/s)	Add Flow (l/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
S1.000	100.00	6.11	9.000	0.017	0.0	0.0	0.0	0.77	6.0	4.6
S1.001	100.00	6.22	8.950	0.017	0.0	0.0	0.0	0.77	6.0	4.6

	Run-off without Green Roof	Run-off with Green Roof
1 year	**2.4 l/s**	**0.7l/s**
30 year	**5.7 l/s**	**1.9l/s**
100 year	**7.2 l/s**	**3.5l/s**

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Manhole Schedules for Storm

MH Name	MH CL (m)	MH Depth (m)	MH Connection	MH Diam.,L*W (mm)	Pipe Out PN	Pipe Out Invert Level (m)	Pipe Out Diameter (mm)	Pipes In PN	Pipes In Invert Level (m)	Pipes In Diameter (mm)	Backdrop (mm)
S1	10.000	1.000	Open Manhole	1050	S1.000	9.000	100				
S2	10.000	1.050	Open Manhole	1050	S1.001	8.950	100	S1.000	8.950	100	
S3	10.000	1.100	Open Manhole	1050		OUTFALL		S1.001	8.900	100	

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PIPELINE SCHEDULES for Storm

Upstream Manhole

PN	Hyd Sect	Diam (mm)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH Connection	MH DIAM., L*W (mm)
S1.000	o	100	S1	10.000	9.000	0.900	Open Manhole	1050
S1.001	o	100	S2	10.000	8.950	0.950	Open Manhole	1050

Downstream Manhole

PN	Length (m)	Slope (1:X)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH Connection	MH DIAM., L*W (mm)
S1.000	5.000	100.0	S2	10.000	8.950	0.950	Open Manhole	1050
S1.001	5.000	100.0	S3	10.000	8.900	1.000	Open Manhole	1050

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Area Summary for Storm

Pipe Number	PIMP Type	PIMP Name	PIMP (%)	Gross Area (ha)	Imp. Area (ha)	Pipe Total (ha)
1.000	-	-	100	0.017	0.017	0.017
1.001	-	-	100	0.000	0.000	0.000
				Total	Total	Total
				0.017	0.017	0.017

Free Flowing Outfall Details for Storm

Outfall Pipe Number	Outfall Name	C. Level (m)	I. Level (m)	Min I. Level (m)	D,L (mm)	W (mm)
S1.001	S3	10.000	8.900	0.000	1050	0

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1 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Storm

Simulation Criteria

Areal Reduction Factor	1.000	Additional Flow - % of Total Flow	0.000
Hot Start (mins)	0	MADD Factor * 10m³/ha Storage	2.000
Hot Start Level (mm)	0	Inlet Coeffiecient	0.800
Manhole Headloss Coeff (Global)	0.500	Flow per Person per Day (l/per/day)	0.000
Foul Sewage per hectare (l/s)	0.000		

Number of Input Hydrographs	0	Number of Storage Structures	0
Number of Online Controls	0	Number of Time/Area Diagrams	0
Number of Offline Controls	0	Number of Real Time Controls	0

Synthetic Rainfall Details

Rainfall Model	FSR	Ratio R	0.432
Region	England and Wales	Cv (Summer)	0.750
M5-60 (mm)	21.000	Cv (Winter)	0.840

Margin for Flood Risk Warning (mm)	300.0	DVD Status	OFF
Analysis Timestep	Fine	Inertia Status	OFF
DTS Status	ON		

Profile(s)	Summer and Winter
Duration(s) (mins)	15, 30, 60, 120, 240, 360, 480, 960, 1440
Return Period(s) (years)	1, 30, 100
Climate Change (%)	0, 0, 0

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level (m)
S1.000	S1	15 Winter	1	+0%	30/15 Winter				9.047
S1.001	S2	15 Winter	1	+0%	30/15 Winter				8.997

PN	US/MH Name	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Pipe Flow (l/s)	Status	Level Exceeded
S1.000	S1	-0.053	0.000	0.45		2.4	OK	
S1.001	S2	-0.053	0.000	0.44		2.3	OK	

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30 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Storm

Simulation Criteria

Areal Reduction Factor	1.000	Additional Flow - % of Total Flow	0.000
Hot Start (mins)	0	MADD Factor * 10m³/ha Storage	2.000
Hot Start Level (mm)	0	Inlet Coeffiecient	0.800
Manhole Headloss Coeff (Global)	0.500	Flow per Person per Day (l/per/day)	0.000
Foul Sewage per hectare (l/s)	0.000		

Number of Input Hydrographs	0	Number of Storage Structures	0
Number of Online Controls	0	Number of Time/Area Diagrams	0
Number of Offline Controls	0	Number of Real Time Controls	0

Synthetic Rainfall Details

Rainfall Model	FSR	Ratio R	0.432
Region	England and Wales	Cv (Summer)	0.750
M5-60 (mm)	21.000	Cv (Winter)	0.840

Margin for Flood Risk Warning (mm)	300.0	DVD Status	OFF
Analysis Timestep	Fine	Inertia Status	OFF
DTS Status	ON		

Profile(s)	Summer and Winter
Duration(s) (mins)	15, 30, 60, 120, 240, 360, 480, 960, 1440
Return Period(s) (years)	1, 30, 100
Climate Change (%)	0, 0, 0

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level (m)
S1.000	S1	15 Winter	30	+0%	30/15 Winter				9.108
S1.001	S2	15 Winter	30	+0%	30/15 Winter				9.052

PN	US/MH Name	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Pipe Flow (l/s)	Status	Level Exceeded
S1.000	S1	0.008	0.000	1.08		5.7	SURCHARGED	
S1.001	S2	0.002	0.000	1.05		5.5	SURCHARGED	

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100 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Storm

Simulation Criteria

Areal Reduction Factor	1.000	Additional Flow - % of Total Flow	0.000
Hot Start (mins)	0	MADD Factor * 10m³/ha Storage	2.000
Hot Start Level (mm)	0	Inlet Coeffiecient	0.800
Manhole Headloss Coeff (Global)	0.500	Flow per Person per Day (l/per/day)	0.000
Foul Sewage per hectare (l/s)	0.000		

Number of Input Hydrographs	0	Number of Storage Structures	0
Number of Online Controls	0	Number of Time/Area Diagrams	0
Number of Offline Controls	0	Number of Real Time Controls	0

Synthetic Rainfall Details

Rainfall Model	FSR	Ratio R	0.432
Region	England and Wales	Cv (Summer)	0.750
M5-60 (mm)	21.000	Cv (Winter)	0.840

Margin for Flood Risk Warning (mm)	300.0	DVD Status	OFF
Analysis Timestep	Fine	Inertia Status	OFF
DTS Status	ON		

Profile(s)	Summer and Winter
Duration(s) (mins)	15, 30, 60, 120, 240, 360, 480, 960, 1440
Return Period(s) (years)	1, 30, 100
Climate Change (%)	0, 0, 0

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level (m)
S1.000	S1	15 Winter	100	+0%	30/15 Winter				9.185
S1.001	S2	15 Winter	100	+0%	30/15 Winter				9.089

PN	US/MH Name	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Pipe Flow (l/s)	Status	Level Exceeded
S1.000	S1	0.085	0.000	1.36		7.2	SURCHARGED	
S1.001	S2	0.039	0.000	1.37		7.2	SURCHARGED	

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170m2 with green roof

Elliott Wood Partnership LTD		Page 1
241 The Broadway London SW19 1SD		
Date 01/03/2019 13:21 File SITE WITH GREEN ROOF.MDX	Designed by jdelishaj Checked by	
Innovyze	Network 2018.1	

STORM SEWER DESIGN by the Modified Rational Method

Design Criteria for Storm

Pipe Sizes STANDARD Manhole Sizes STANDARD

FSR Rainfall Model - England and Wales

Return Period (years)	100	PIMP (%)	100
M5-60 (mm)	21.000	Add Flow / Climate Change (%)	0
Ratio R	0.430	Minimum Backdrop Height (m)	0.200
Maximum Rainfall (mm/hr)	100	Maximum Backdrop Height (m)	1.500
Maximum Time of Concentration (mins)	30	Min Design Depth for Optimisation (m)	1.200
Foul Sewage (l/s/ha)	0.000	Min Vel for Auto Design only (m/s)	1.00
Volumetric Runoff Coeff.	0.750	Min Slope for Optimisation (1:X)	500

Designed with Level Soffits

Time Area Diagram for Storm

Time (mins)	Area (ha)
0-4	0.000

Total Area Contributing (ha) = 0.000

Total Pipe Volume (m³) = 0.079

Network Design Table for Storm

PN	Length (m)	Fall (m)	Slope (1:X)	I.Area (ha)	T.E. (mins)	Base Flow (l/s)	k (mm)	HYD SECT	DIA (mm)	Section Type	Auto Design
S1.000	5.000	0.050	100.0	0.000	6.00	0.0	0.600	o	100	Pipe/Conduit	
S1.001	5.000	0.050	100.0	0.000	0.00	0.0	0.600	o	100	Pipe/Conduit	

Network Results Table

PN	Rain (mm/hr)	T.C. (mins)	US/IL (m)	Σ I.Area (ha)	Σ Base Flow (l/s)	Foul (l/s)	Add Flow (l/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
S1.000	100.00	6.11	9.000	0.000	0.0	0.0	0.0	0.77	6.0	0.0
S1.001	100.00	6.22	8.950	0.000	0.0	0.0	0.0	0.77	6.0	0.0

	Run-off without Green Roof	Run-off with Green Roof
1 year	**2.4 l/s**	**0.7l/s**
30 year	**5.7 l/s**	**1.9l/s**
100 year	**7.2 l/s**	**3.5l/s**

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Manhole Schedules for Storm

MH Name	MH CL (m)	MH Depth (m)	MH Connection	MH Diam.,L*W (mm)	Pipe Out PN	Pipe Out Invert Level (m)	Pipe Out Diameter (mm)	Pipes In PN	Pipes In Invert Level (m)	Pipes In Diameter (mm)	Backdrop (mm)
S1	10.000	1.000	Open Manhole	1050	S1.000	9.000	100				
S2	10.000	1.050	Open Manhole	1050	S1.001	8.950	100	S1.000	8.950	100	
S3	10.000	1.100	Open Manhole	1050		OUTFALL		S1.001	8.900	100	

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PIPELINE SCHEDULES for Storm

Upstream Manhole

PN	Hyd Sect	Diam (mm)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH Connection	MH DIAM., L*W (mm)
S1.000	o	100	S1	10.000	9.000	0.900	Open Manhole	1050
S1.001	o	100	S2	10.000	8.950	0.950	Open Manhole	1050

Downstream Manhole

PN	Length (m)	Slope (1:X)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH Connection	MH DIAM., L*W (mm)
S1.000	5.000	100.0	S2	10.000	8.950	0.950	Open Manhole	1050
S1.001	5.000	100.0	S3	10.000	8.900	1.000	Open Manhole	1050

Free Flowing Outfall Details for Storm

Outfall Pipe Number	Outfall Name	C. Level (m)	I. Level (m)	Min I. Level (m)	D,L (mm)	W (mm)
S1.001	S3	10.000	8.900	0.000	1050	0

Time Area Diagram for Green Roof at Pipe Number S1.000 (Storm)

Area (m^3) 170 Evaporation (mm/day) 3
Depression Storage (mm) 5 Decay Coefficient 0.050

Time From:	(mins) To:	Area (ha)	Time From:	(mins) To:	Area (ha)	Time From:	(mins) To:	Area (ha)	Time From:	(mins) To:	Area (ha)
0	4	0.003089	32	36	0.000624	64	68	0.000126	96	100	0.000025
4	8	0.002529	36	40	0.000511	68	72	0.000103	100	104	0.000021
8	12	0.002071	40	44	0.000418	72	76	0.000084	104	108	0.000017
12	16	0.001695	44	48	0.000342	76	80	0.000069	108	112	0.000014
16	20	0.001388	48	52	0.000280	80	84	0.000057	112	116	0.000011
20	24	0.001136	52	56	0.000229	84	88	0.000046	116	120	0.000009
24	28	0.000930	56	60	0.000188	88	92	0.000038			
28	32	0.000762	60	64	0.000154	92	96	0.000031			

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1 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Storm

Simulation Criteria

Areal Reduction Factor	1.000	Additional Flow - % of Total Flow	0.000
Hot Start (mins)	0	MADD Factor * 10m³/ha Storage	2.000
Hot Start Level (mm)	0	Inlet Coeffiecient	0.800
Manhole Headloss Coeff (Global)	0.500	Flow per Person per Day (l/per/day)	0.000
Foul Sewage per hectare (l/s)	0.000		

Number of Input Hydrographs	0	Number of Storage Structures	0
Number of Online Controls	0	Number of Time/Area Diagrams	1
Number of Offline Controls	0	Number of Real Time Controls	0

Synthetic Rainfall Details

Rainfall Model	FSR	Ratio R	0.432
Region	England and Wales	Cv (Summer)	0.750
M5-60 (mm)	21.000	Cv (Winter)	0.840

Margin for Flood Risk Warning (mm)	300.0	DVD Status	OFF
Analysis Timestep	Fine	Inertia Status	OFF
DTS Status	ON		

Profile(s)	Summer and Winter
Duration(s) (mins)	15, 30, 60, 120, 240, 360, 480, 960, 1440
Return Period(s) (years)	1, 30, 100
Climate Change (%)	0, 0, 40

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level (m)
S1.000	S1	60 Winter	1	+0%					9.023
S1.001	S2	60 Winter	1	+0%					8.973

PN	US/MH Name	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Pipe Flow (l/s)	Status	Level Exceeded
S1.000	S1	-0.077	0.000	0.13		0.7	OK	
S1.001	S2	-0.077	0.000	0.12		0.6	OK	

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30 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Storm

Simulation Criteria

Areal Reduction Factor	1.000	Additional Flow - % of Total Flow	0.000
Hot Start (mins)	0	MADD Factor * 10m³/ha Storage	2.000
Hot Start Level (mm)	0	Inlet Coeffiecient	0.800
Manhole Headloss Coeff (Global)	0.500	Flow per Person per Day (l/per/day)	0.000
Foul Sewage per hectare (l/s)	0.000		

Number of Input Hydrographs	0	Number of Storage Structures	0
Number of Online Controls	0	Number of Time/Area Diagrams	1
Number of Offline Controls	0	Number of Real Time Controls	0

Synthetic Rainfall Details

Rainfall Model	FSR	Ratio R	0.432
Region	England and Wales	Cv (Summer)	0.750
M5-60 (mm)	21.000	Cv (Winter)	0.840

Margin for Flood Risk Warning (mm)	300.0	DVD Status	OFF
Analysis Timestep	Fine	Inertia Status	OFF
DTS Status	ON		

Profile(s)	Summer and Winter
Duration(s) (mins)	15, 30, 60, 120, 240, 360, 480, 960, 1440
Return Period(s) (years)	1, 30, 100
Climate Change (%)	0, 0, 40

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level (m)
S1.000	S1	30 Winter	30	+0%					9.042
S1.001	S2	30 Winter	30	+0%					8.993

PN	US/MH Name	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Pipe Flow (l/s)	Status	Level Exceeded
S1.000	S1	-0.058	0.000	0.36		1.9	OK	
S1.001	S2	-0.057	0.000	0.37		1.9	OK	

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100 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Storm

Simulation Criteria

Areal Reduction Factor	1.000	Additional Flow - % of Total Flow	0.000
Hot Start (mins)	0	MADD Factor * 10m³/ha Storage	2.000
Hot Start Level (mm)	0	Inlet Coeffiecient	0.800
Manhole Headloss Coeff (Global)	0.500	Flow per Person per Day (l/per/day)	0.000
Foul Sewage per hectare (l/s)	0.000		

Number of Input Hydrographs	0	Number of Storage Structures	0
Number of Online Controls	0	Number of Time/Area Diagrams	1
Number of Offline Controls	0	Number of Real Time Controls	0

Synthetic Rainfall Details

Rainfall Model	FSR	Ratio R	0.432
Region	England and Wales	Cv (Summer)	0.750
M5-60 (mm)	21.000	Cv (Winter)	0.840

Margin for Flood Risk Warning (mm)	300.0	DVD Status	OFF
Analysis Timestep	Fine	Inertia Status	OFF
DTS Status	ON		

Profile(s)	Summer and Winter
Duration(s) (mins)	15, 30, 60, 120, 240, 360, 480, 960, 1440
Return Period(s) (years)	1, 30, 100
Climate Change (%)	0, 0, 40

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level (m)
S1.000	S1	30 Winter	100	+40%					9.059
S1.001	S2	15 Winter	100	+40%					9.010

PN	US/MH Name	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Pipe Flow (l/s)	Status	Level Exceeded
S1.000	S1	-0.041	0.000	0.66		3.5	OK	
S1.001	S2	-0.040	0.000	0.63		3.4	OK	

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D Outline Structural Calculations – Basement

elliottwood

The Hall School

23 Crossfield Road, London
NW3 4NU

Structural Calculations
Basement

Job number:	2190008
Revision:	P1
Status:	For Planning
Date:	08/03/19

Document Control

		remarks:	For Planning				
revision:	P1	prepared by:	Suzanna Cooper	checked by:	David Dempster	approved by:	James Souter
date:	March 2019	signature:		signature:		signature:	

Contents

1.0 Introduction

Elliott Wood Partnership Ltd (EW) have been appointed by The Hall School to provide Structural Engineering input for the design of the proposed redevelopment of The Hall School Senior School site. The works include retaining the early school buildings but demolishing and replacing subsequent additions. The existing basement under the new development will be retained and the extent increased with the addition of a new single-story basement between the Old School and Walthen Hall.

This report includes structural calculations for the design of the new basement and checks on the existing basement, including:

- Design of the new contig pile wall acting as the retaining wall of the new basement
- Design of the new basement slab
- Checks on the existing basement retaining wall in the proposed case.

2.0 Description of Site

2.1 The Hall School site is located approximately 400m northeast of Swiss Cottage London Underground Station, and fronts onto Crossfield Road to the west. The site is bounded on the remaining sides by residential properties.

2.2 The overall Senior School site is broadly square in shape and measures approximately 50m by 50m on plan. External playing space occupies around a third of the site in the northeast corner.

2.3 A line of trees extends along the east site boundary and there is a large London plane tree in the centre of the site. The London plane is subject to a Tree Preservation Order (TPO), and is to be retained as part of the proposed scheme.

2.4 Records for the historic lost rivers known in London indicate that the site is approximately 100m away from the routes shown for two tributaries to the River Tyburn.

2.5 Record information suggests that there are no known underground tunnels or structures near to the site. The routes of the Jubilee and Metropolitan lines, which pass through nearby Swiss Cottage London Underground Station do not pass near to the site.

2.6 The existing basement, known as Wathen Hall, lies along the Southern boundary of the site.

2.7 On the South boundary, the external face of the basement wall is approximately 1.2m from the neighbouring buildings, which are single storey garages.

2.8 The basement wall on the north is approximately 1.2m from the adjacent main school building which is currently founded on shallow pad foundations. The existing building is to be demolished and the proposed building to be founded on piles, therefore mitigating any effects on the basement wall.

Figure 1: Site Location

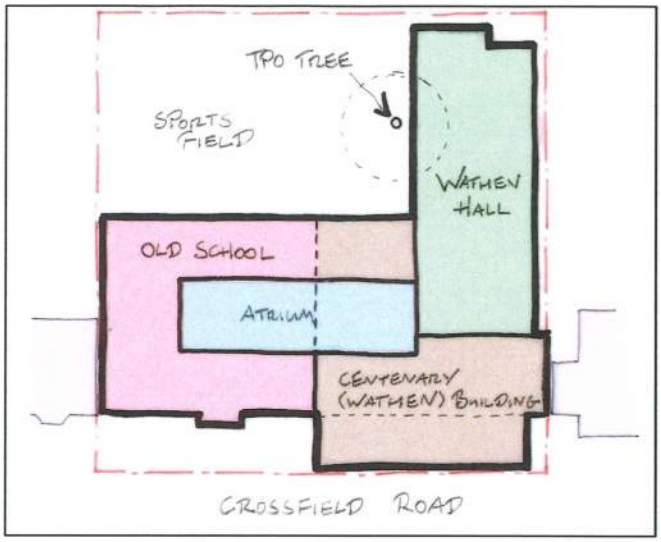


Figure 2: Existing buildings

3.0 Scope of Works

The proposed development of the site can be broadly divided into three elements:

- Demolition of the Wathen Hall superstructure to be replaced with new studio and classroom space over the existing single-storey substructure
- Demolition of the Centenary (Wathen) Building, to be replaced with a new four-storey school building supported partially over the existing Wathen Hall basement, partially on a new single-storey basement next to the Old School, and partially on new piled foundations from ground level
- Refurbishment of the Old School building, including the reconstruction of the roof to the rear elevation at a higher level, and low-key alterations to the internal structure to accommodate the interface with the new school building.

Substructure Proposal:

3.1 It is proposed to retain the existing single-storey basement under the Wathen Hall and to create a new single-storey basement under the part of the footprint of the new building between the Old School building and the Wathen Hall.

3.2 The basement under the new school building is proposed using a contiguous piled retaining wall. The piles are anticipated to be 450mm diameter bored piles, designed to be propped in the permanent case by the slabs at the lower ground floor level. The internal face of the piled retaining wall will be lined with an in-situ waterproof concrete lining wall.

3.3 To mitigate the impact of the new basement on the foundations to the retained Old School building, the piled retaining wall will be set approximately 3m from the face of the existing masonry wall. This offset means that excavations required to form the capping beam to the piled wall will be at an adequate distance to avoid undermining the existing foundation.

3.4 The retained basement box is to be re-supported on new piled foundations in order to mitigate the potential effects of differential settlement and avoid movement joints within the basement structure

3.5 Cantilever ground beams are proposed to support the new vertical structure set tight against the existing masonry wall of the Old School building. Each ground beam will run continuously over a group of piles centred around 1.2m from the face of the wall; this offset is driven by the constraints of the piling equipment. The depth of the ground beams will be sized to avoid undermining the existing foundations.

3.6 The ground beams will also support the existing retaining wall, which will span horizontally as a deep beam between ground beams to transfer vertical loads.

3.7 The lower ground and basement slabs under the school building will be typically formed from a suspended flat slab construction. The internal columns will be founded on piled foundations.

3.8 It is proposed to retain the existing basement walls of the Wathen Hall as part of the new permanent structure. In the temporary case, horizontal propping across the basement volume will resist the lateral earth pressure. The retaining walls will act as cantilevers in the permanent case, and the reinforcement content will be confirmed on site to ensure any change in moment can be accommodated.

3.9 To avoid internal columns, the ground floor structure will span the clear width of the hall. This long span structure will be sensitive to vibration, particularly as the floor will be used for group activities. The structure is therefore proposed using deep, fabricated steelwork sections acting compositely with the reinforced concrete floor slab. Similar but heavier steelwork sections will act as transfer beams where the hall extends under the new school building.

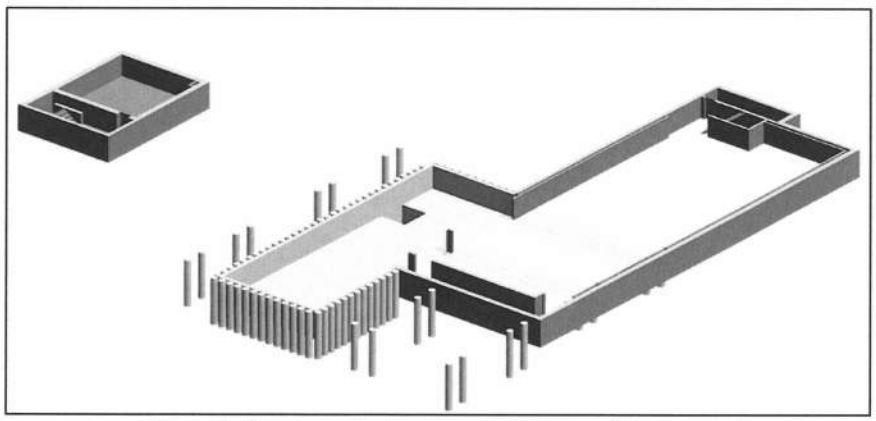


Figure 3: Basement structure: existing and proposed

4.0 Design Aids

4.1 Design Codes

The design of the structural elements have generally been carried out to satisfy the requirements of the British Standards and Eurocodes (and all relevant National Annexes) listed below. This is not an exhaustive list:

BS EN 1990:2002 Eurocode 0:	Basis of structural design
BS EN 1991-1-1:2002 Eurocode 1:	Actions on structures
BS EN 1993-1-1:2005 Eurocode 2:	Design of concrete structures – Part 1-1: General rules and rules for buildings
BS EN 1997-1:2004 Eurocode 7:	Geotechnical design – Part 1: General rules

All to include revisions and amendments to date with appropriate National Annexes and approved NCCIs.

5.0 Design Criteria

5.1 Load Combinations

The following combinations have been used throughout the calculations:

Partial safety Factors to Eurocodes	Permanent		Leading variable		Accompanying variable	
	Unfavourable	Favourable	Unfavourable	Favourable	Unfavourable	Favourable
ULS (Strength)	1.35	1.00	1.50	0	$Y_{0,i}$ 1.50	0
ULS (Equilibrium)	1.10	0.90	1.50	0	$Y_{0,i}$ 1.50	0
SLS (Characteristic)	1.00	1.00	1.00	0	$Y_{0,i}$ 1.00	0

Where $Y_{0,i}$= 0.7

5.2 Material Data

Concrete	Grade C32/40 U.N.O
Reinforcement Bars	Grade f_y=500 N/mm^2 to BS 4449 U.N.O

5.3 Acceptance Criteria

Vertical Deflections

The following vertical deflection limits will be used in the design of all new structural members:

Element	Deflection Type	Limit
Reinforced Concrete Beams and Slab	Long term deflection due to dead and imposed loads (including long term creep effects of sustained loading)	L/250
	Incremental deflection due to dead and imposed loads occurring after construction of finishes and partitions (including long term creep effects of sustained loading)	L/500

Note: L=distance between supports for span considered. For cantilevers, L is equivalent to twice cantilever length.

Lateral deflections

Analysis and design of the lateral load resisting system is based on the following allowable drift criteria:

Maximum Total Drift: H/500 (under service load conditions)

Maximum Interstorey Drift: h/500 (under service load conditions)

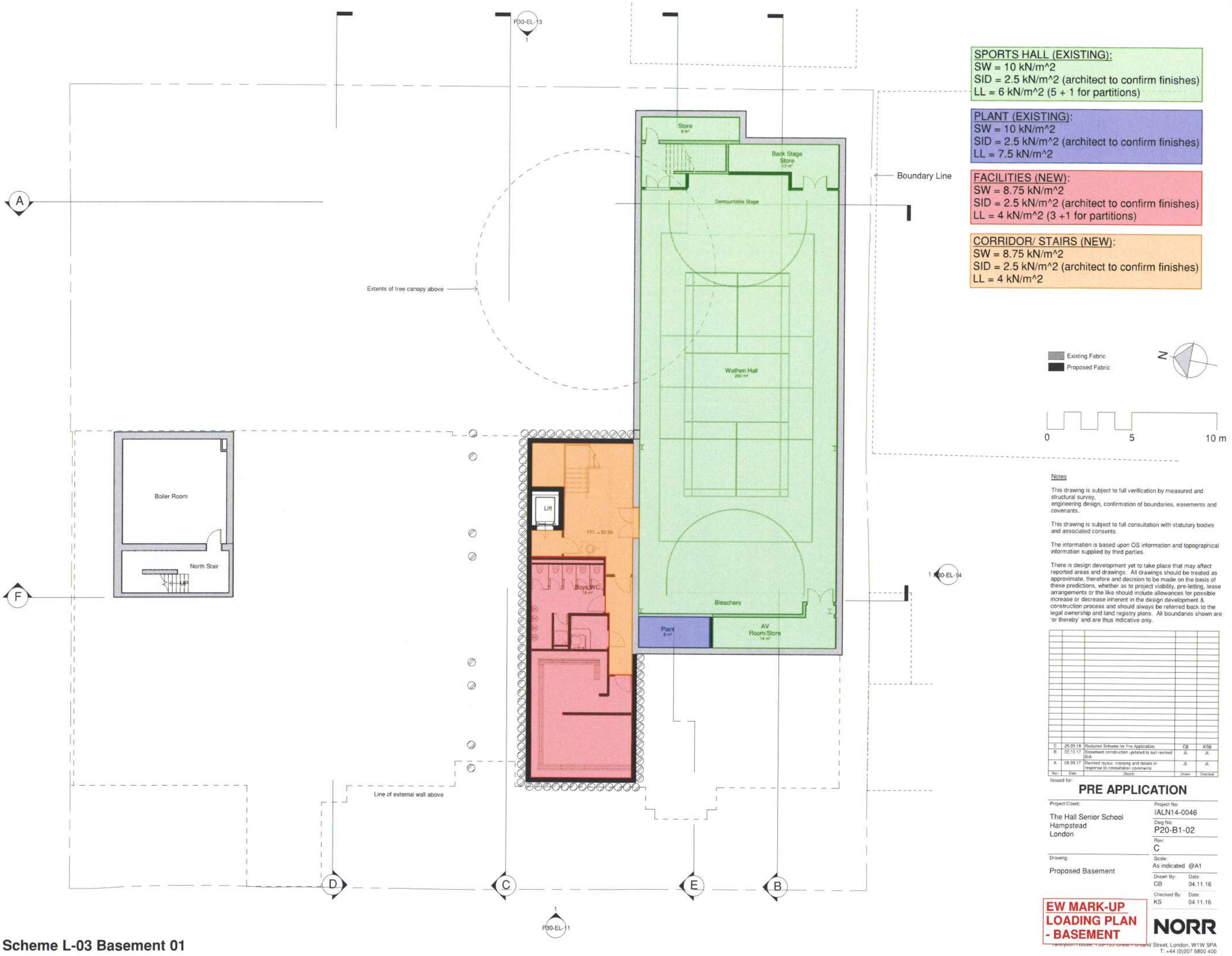
Where H = Total building height, h = Storey height under consideration

6.0 Loads

The following tables give values for the proposed design load allowances for the basement areas.

	Finishes (kN/m2)	Live (kN/m2)	Partitions (kN/m2)
Studio/Gymnasia	2.5	5.0	1.0
Facilities	2.5	3.0	1.0
Corridors, stairways	2.5	4.0	-
Plantroom	2.5	7.5	-

See over for Basement loading plan.



Planning Scheme L-03 Basement 01
1 : 100

SPORTS HALL (EXISTING):
SW = 10 kN/m^2
SID = 2.5 kN/m^2 (architect to confirm finishes)
LL = 6 kN/m^2 (5 + 1 for partitions)

PLANT (EXISTING):
SW = 10 kN/m^2
SID = 2.5 kN/m^2 (architect to confirm finishes)
LL = 7.5 kN/m^2

FACILITIES (NEW):
SW = 8.75 kN/m^2
SID = 2.5 kN/m^2 (architect to confirm finishes)
LL = 4 kN/m^2 (3 +1 for partitions)

CORRIDOR/ STAIRS (NEW):
SW = 8.75 kN/m^2
SID = 2.5 kN/m^2 (architect to confirm finishes)
LL = 4 kN/m^2

Existing Fabric
Proposed Fabric

N

0 5 10 m

Notes

This drawing is subject to full verification by measured and structural survey,
engineering design, confirmation of boundaries, easements and covenants.

This drawing is subject to full consultation with statutory bodies and associated consents.

The information is based upon OS information and topographical information supplied by third parties.

There is design development yet to take place that may affect reported areas and drawings. All drawings should be treated as approximate, therefore and decision to be made on the basis of these predictions, whether as to project viability, pre-letting, lease arrangements or the like should include allowances for possible increase or decrease inherent in the design development & construction process and should always be referred back to the legal ownership and land registry plans. All boundaries shown are 'or thereby' and are thus indicative only.

Rev	Date	Details	Drawn	Checked
C	25.09.18	Reduced Scheme for Pre Application	CB	KSB
B	02.10.17	Basement construction updated to suit revised BIA	JL	JL
A	08.05.17	Revised layout, massing and details in response to consultation comments	JL	JL

Issued for:

PRE APPLICATION

Project/Client:
The Hall Senior School
Hampstead
London

Project No:
!ALN14-0046

Dwg No:
P20-B1-02

Rev:
C

Drawing:
Proposed Basement

Scale:
As indicated @A1

Drawn By: CB Date: 04.11.16

Checked By: KS Date: 04.11.16

EW MARK-UP
LOADING PLAN
- BASEMENT

NORR
Tennyson House, 159-165 Great Portland Street, London, W1W 5PA
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www.norr.com

Contractors must work only to figured dimensions which are to be checked on site.
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7.0 Ground Conditions

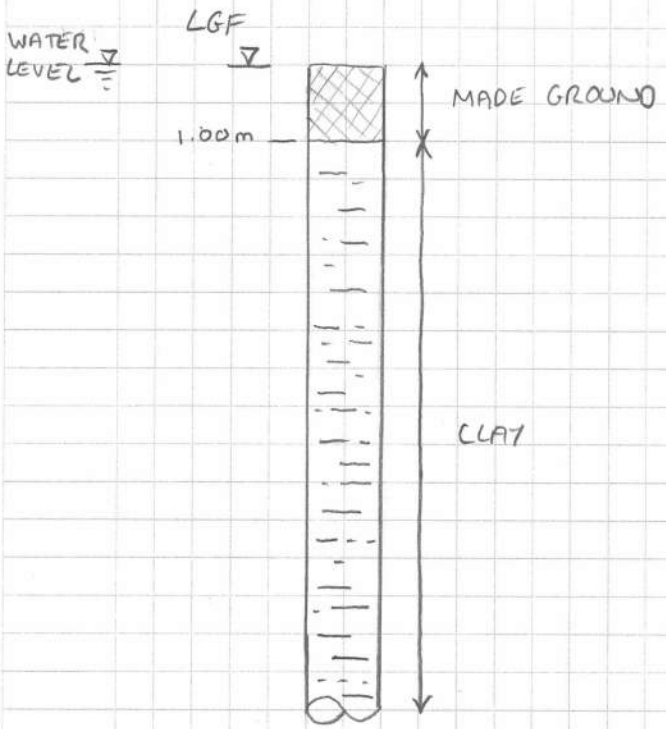
GROUND CONDITIONS

SITE INVESTIGATIONS HAVE BEEN CONDUCTED WHICH HAVE ANALYSED THE SOIL CONDITIONS. THE FOLLOW SOIL PARAMETERS HAVE BEEN TAKEN FROM THE SITE INVESTIGATION REPORT.

FROM LGF LEVEL (55.87):

MADE GROUND	1m DEEP	17 kN/m³	$\phi = 27$
LONDON CLAY	1m - DEPTH	20 kN/m³	$\phi = 24$

WATER LEVER IS TO BE TAKEN CONSERVATIVELY @ LOWER GROUND FLOOR LEVEL (55.87)



$$ka = \frac{(1-\sin\phi)}{(1+\sin\phi)}$$

$$= \frac{1-\sin(24)}{1+\sin(24)} = 0.42$$

BEARING PRESSURE = 150 kN/m²

FOR MORE INFORMATION REFER TO GEA SITE INVESTIGATION IN APPENDIX B OF EW'S PLANNING REPORT

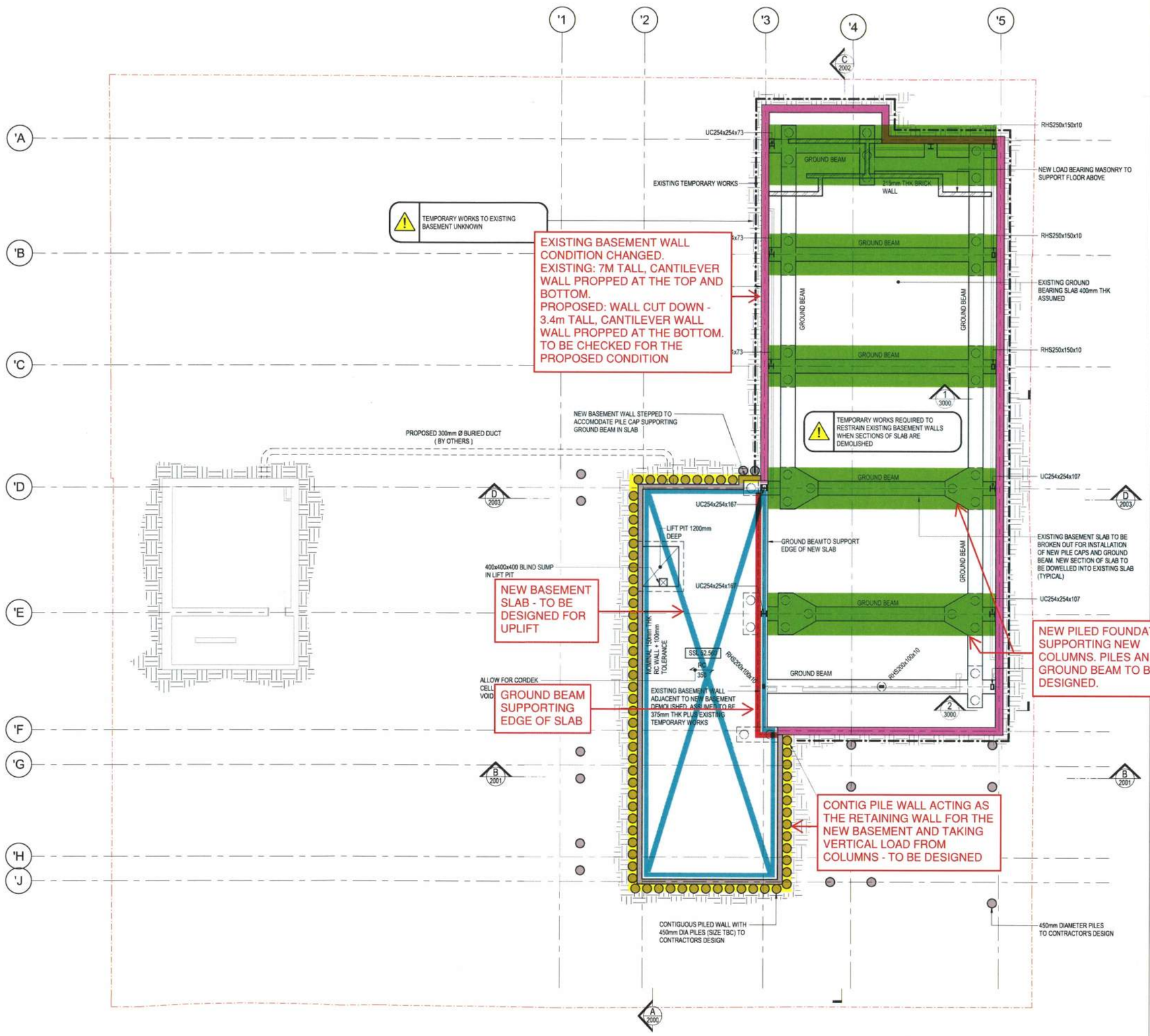
8.0 Calculations

The page over highlights the locations of the different basement elements included in the calculations.

BASEMENT

CALCULATIONS FOR THE NEW & EXTG BASEMENTS INCLUDE:

- NEW CONTIG PILE WALL AS TEMPORARY & PERMENANT RETAINING WALL
- BASEMENT SLAB DESIGN FOR UPLIFT
- DESIGN OF NEW GROUND BEAM & PILE CAPS SUPPORTING COLUMNS WITHIN EXTG BASEMENT
- CHECK ON EXTG RETAINING WALL IN PROPOSED CASE ACTING AS AN UNPROPPED CANTILEVER.



This drawing is to be read in conjunction with all relevant architects, engineers and specialists drawings and specifications.

Do not scale from this drawing.

LEGEND

- EXISTING STRUCTURE
- NEW REINFORCED CONCRETE
- NEW PRECAST CONCRETE
- NEW REINFORCED WATER RESISTANT CONCRETE
- PADSTONES
- LOAD BEARING STRUCTURE BELOW
- EXISTING STRUCTURE TO BE REMOVED
- NEW STEEL BEAMS
- NEW LINTELS OVER OPENINGS
- MOMENT CONNECTION
- CRANK IN BEAM
- (NC) NON-COMPOSITE USED BEAM
- ASSUMED SITE BOUNDARY

NOTES

1. METAL DECK SLABS TO BE 140mm THK KINGSPAN MULTIDECK 80 V2 WITH 1.0mm GAUGE AND A142 MESH TO TOP + H10 BARS IN EACH TROUGH
2. ALL SETTING OUT TBC BY ARCHITECT
3. ALL BEAMS ACTING COMPOSITLY WITH SLAB UNLESS NOTED OTHERWISE. ALLOW FOR 19mm, 95mm LONG SEAR STUDS IN EVERY RIB OR MIN 350mm CRS.

BRACING SCHEDULE

REF.	DESIGNATION
VB1	100x15mm FLAT PLATE VERT CROSS BRACING
VB2	INVERTED V - BRACING FLAT PLATE 100x15mm
VB3	V - BRACING FLAT PLATE 100x15mm

FOR CONSTRUCTION

rev	date	by	chk	description
P1	04.03.19	DIv	SCo	Issued For Planning
	19	DPr	SCo	Issued For Planning

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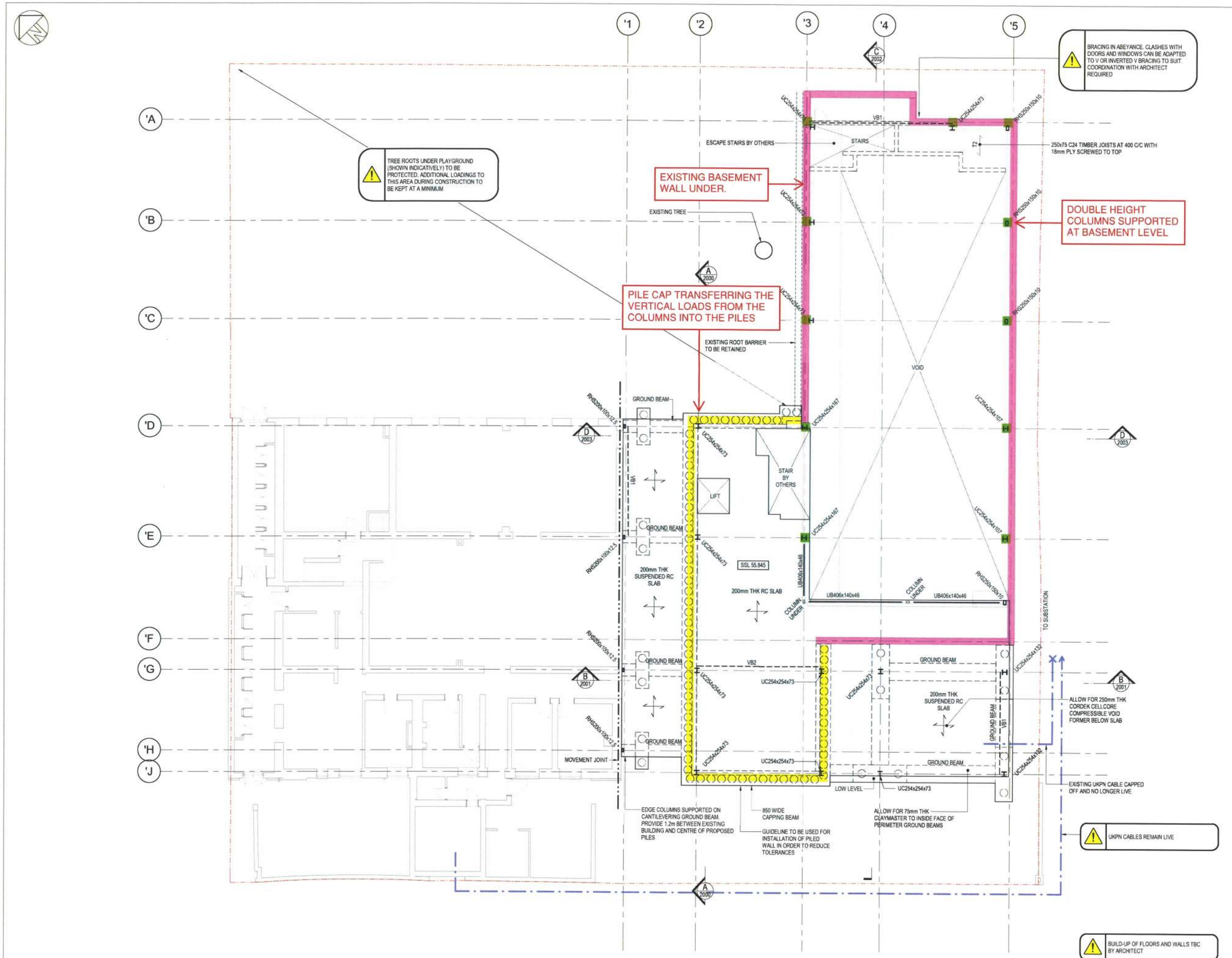
Project
The Hall School
NW3

Drawing title
Proposed Basement Plan

Scale (s)	Date	Drawn
1:50@A1; 1:100@A3	March 2019	DIv

Drawing status: Preliminary
Status S2 Revision P2

Project no. Originator Zone Level Type Role drg no.
2190008-EWP-ZZ-B1-DR-S-0800



This drawing is to be read in conjunction with all relevant architects, engineers and specialists drawings and specifications.

Do not scale from this drawing.

LEGEND

- EXISTING STRUCTURE
- NEW REINFORCED CONCRETE
- NEW PRECAST CONCRETE
- NEW REINFORCED WATER RESISTANT CONCRETE
- PADSTONES
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BRACING SCHEDULE

REF.	DESIGNATION
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VB2	INVERTED V - BRACING FLAT PLATE 100x15mm
VB3	V - BRACING FLAT PLATE 100x15mm

NOT FOR CONSTRUCTION

rev	date	by	chk	description
P2	11.03.19	DPr	SCo	Issued For Planning
P1	04.03.19	Div	SCo	Issued For Planning

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Project
The Hall School
NW3

Drawing title
Proposed Lower Ground Floor Plan

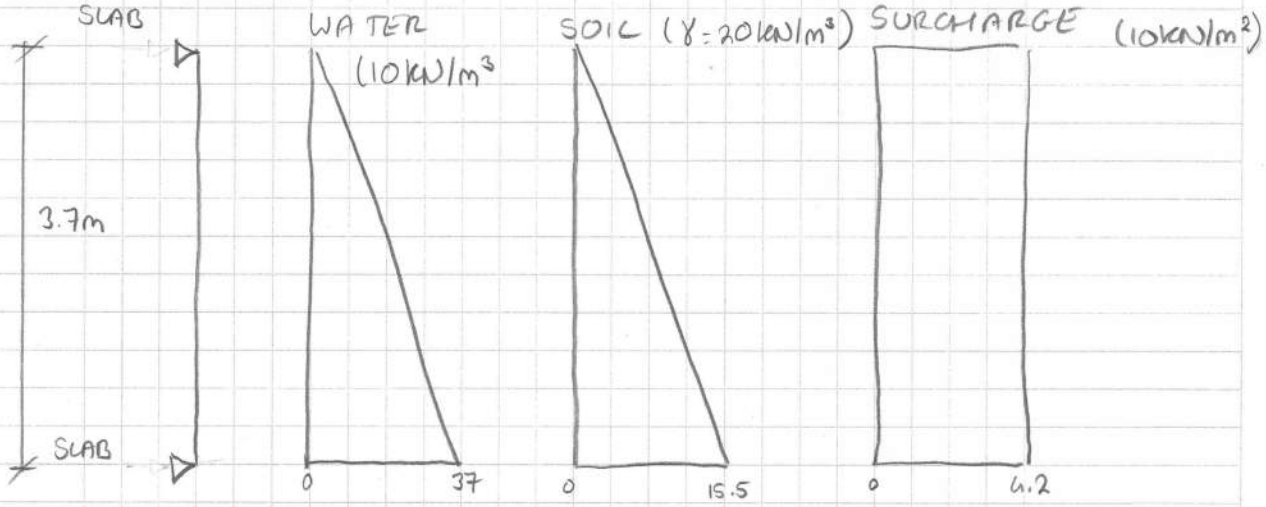
Scale (s)	Date	Drawn
1:50@ A1; 1:100@A3	March : 2019	Div

Drawing status: Preliminary
Status: S2 Revision: P2

Project no.	Originator	Zone	Level	Type	Role	drg no.
2190008	EWP	ZZ	B1	DR	S	0900

8.1 New contig pile wall deign

CHECK CONTIG PILE WALL



SOIL PROPERTIES AS PER RETAINING WALL DESIGN

	(γ)
WATER = 10 × 3.7 = 37 kN/m² /m	(1.2)
SOIL = 0.42 × (20-10) × 3.7 = 15.5 kN/m² /m	(1.35)
SURCHARGE = 10 × 0.42 = 4.2 kN/m² /m	(1.5)

SEE ANALYSIS OVER FOR 1m WIDTH

M = 67.9 kNm
V = 92.2 kN

ASSUME PILES @ 600 c/c ∴ ANALYSIS M × 0.6

67.9 × 0.6 = 40.7 kNm PER PILE

SEE 450 Ø COLUMN DESIGN IN TEDDS

FOR APPLIED MOMENT, ALLOWABLE AXIAL FORCE 8 NO. H20s
= 3875 kN ... OK

ANALYSIS

Tedds calculation version 1.0.17

Loading

Soil - Loading

Surcharge - Loading

Water - Loading

Load combination factors

Load combination	Soil	Surcharge	Water
LoadCombination1 (Strength)	1.35	1.50	1.20
LoadCombination2 (Service)	1.00	1.00	1.00

Element UDL loads

Element	Load case	Position			Load	Orientation
		Type	Start	End	(kN/m)	
1	Surcharge	Ratio	0	1	4.2	GlobalZ

Element VDL loads

Element	Load case	Position			Load		Orientation
		Type	Start	End	Start (kN/m)	End (kN/m)	
1	Soil	Ratio	0	1	15.5	0	GlobalZ
1	Water	Ratio	0	1	37	0	GlobalZ

Results

Forces

Element results

Envelope - Strength combinations

Element	Shear force		Moment			
	Pos (m)	Max abs (kN)	Pos (m)	Max (kNm)	Pos (m)	Min (kNm)
1	0	92.2	1.605	67.9	3.7	0

LoadCombination1 (Strength) - Moment (kNm)

LoadCombination1 (Strength) - Shear (kN)

Element results

Load combination: LoadCombination1 (Strength)

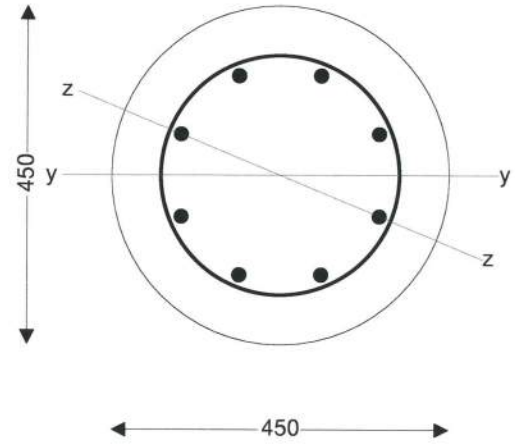
Element	Shear force		Moment			
	Pos (m)	Max abs (kN)	Pos (m)	Max (kNm)	Pos (m)	Min (kNm)
1	0	92.2	1.605	67.9	3.7	0

Tekla Tedds	Project: Hall School				Job no.: 2190008	
	Calcs for: Pile as Retaining Wall - Pile Design as Column				Start page no./Revision: 1	
	Calcs by: SCO	Calcs date: 06/03/2019	Checked by:	Checked date:	Approved by:	Approved date:

RC COLUMN DESIGN

In accordance with EN1992-1-1:2004 incorporating Corrigendum January 2008 and the UK national annex

Tedds calculation version 1.2.14



8 no. 20 mm diameter longitudinal bars
12 mm diameter links
Max link spacing 400 mm generally, 240 mm for 450 mm above and below slab/beam and at laps

Column geometry

Overall diameter h= **450** mm

Concrete details

Cylinder strength of concrete	f_{ck} = **40** MPa	Safety factor for concrete	γ_C = **1.50**
Coefficient α_{cc}	α_{cc} = **0.85**		
Maximum aggregate size	d_g = **20** mm		

Reinforcement details

Nominal cover to links	c_{nom} = **60** mm	Longitudinal bar diameter	ϕ = **20** mm
Link diameter	ϕ_v = **12** mm	Total no. of longitudinal bars	N = **8**
Area of longitudinal reinft	A_s = **2513** mm^2	Safety factor for reinforcement	γ_S = **1.15**
Modulus of elasticity of reinft	E_s = **200000** MPa		

Fire resistance details

Fire resistance period	R = **60** min	Exposure to fire	**More than one side**
Ratio of fire design axial load to design resistance		μ_{fi} = **0.70**	

Check nominal cover for fire and bond requirements

Min cover to links for bond	$c_{min,b}$ = **12** mm	Min axis distance for fire	a_{fi} = **40** mm
Allowance for deviations	Δc_{dev} = **10** mm	Min allowable nominal cover	c_{nom_min} = **22.0** mm

PASS - the nominal cover is greater than the minimum required

Key points on interaction diagram for bending about y axis

Axial load capacity no mt	N_{Rd0} = **4073** kN		
Axial no strain in tension reinft	N_{Rdy1} = **2733** kN	Mt no strain in tension reinft	M_{Rdy1} = **180.1** kNm
Axial conc/tension steel at yield		N_{Rdy2} = **1115** kN	Mt conc/tension steel at yield
	M_{Rdy2} = **223.4** kNm		
		Mt capacity no axial load	M_{Rdy3} = **151.2** kNm
Axial at additional location	N_{Rdy4} = **3507** kN	Mt at additional location	M_{Rdy4} = **112.5** kNm

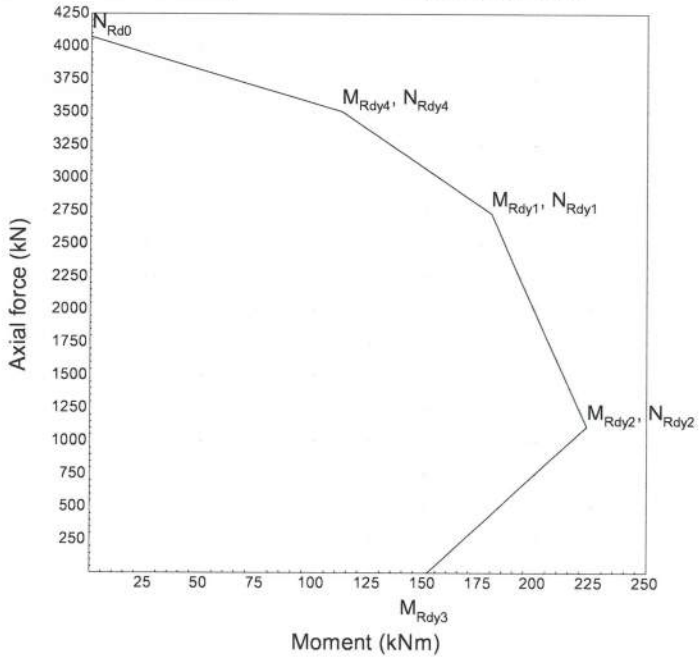
Key points on interaction diagram for bending about z axis

Axial load capacity no mt	N_{Rd0} = **4073** kN		
Axial no strain in tension reinft	N_{Rdz1} = **2848** kN	Mt no strain in tension reinft	M_{Rdz1} = **173.2** kNm

Axial conc/tension steel at yield		N_{Rdz2} = **1219** kN	Mt conc/tension steel at
yield	M_{Rdz2} = **222.8** kNm		
		Mt capacity no axial load	M_{Rdz3} = **154.7** kNm
Axial at additional location	N_{Rdz4} = **3587** kN	Mt at additional location	M_{Rdz4} = **99.6** kNm

Interaction diagram for bending about y axis

450 mm diameter column, 8 no. 20 mm longitudinal bars

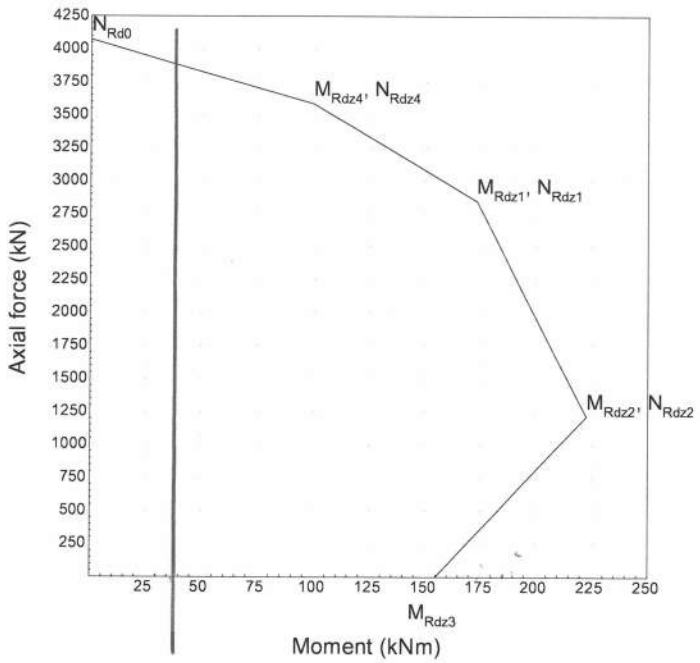


M_{Rdy1} = 180 kNm
M_{Rdy2} = 223 kNm
M_{Rdy3} = 151 kNm
M_{Rdy4} = 113 kNm

N_{Rd0} = 4073 kN
N_{Rdy1} = 2733 kN
N_{Rdy2} = 1115 kN
N_{Rdy3} = 0kN
N_{Rdy4} = 3507 kN

Interaction diagram for bending about z axis

450 mm diameter column, 8 no. 20 mm longitudinal bars



M_{Rdz1} = 173 kNm
M_{Rdz2} = 223 kNm
M_{Rdz3} = 155 kNm
M_{Rdz4} = 100 kNm

N_{Rd0} = 4073 kN
N_{Rdz1} = 2848 kN
N_{Rdz2} = 1219 kN
N_{Rdz3} = 0kN
N_{Rdz4} = 3587 kN

M = 40.7 kNm

8.2 Basement slab design

8.2 Basement slab design

BASEMENT SLAB - UPLIFT

BUOYANCY:

WATER LEVEL TO BE TAKEN CONSERVATIVELY @ LOWER FLOOR LEVEL (55.870)

PARTIAL FACTOR OF 1.1 TO BE TAKEN FOR UPLIFT FORCE (WATER)

PARTIAL FACTOR OF 0.9 TO BE TAKEN FOR SELF-WEIGHT OF SLAB

WATER = 10 kN/m3

HEAVE:

LONG-TERM TO BE TAKEN AS 60% OF WEIGHT OF SOIL REMOVED

0.5m OF MADE GROUND @ 17 kN/m3

UNDERLYING CLAY TO DEPTH @ 19.5 kN/m3

UNDERSIDE OF NEW SLAB = 52.11

DEPTH BELOW LOWER GROUND = 3.76m

FAIL LOAD OF CELLCORE HX S HEAVE PROTECTION = 18 kN/m² (SEE OVER)
∴ HEAVE PRESSURE ON SLAB REDUCED TO = 18 kN/m2

HEAVE PRESSORE = (0.5 x 17 + 3.26 x 19.5) x 0.6
= 43.2 kN/m² [WITHOUT VOID FORMER]

BUOYANCY PRESSORE = 10 x 3.76 = 37.6 kN/m²

UPL = (1.1 x 18.0) + (1.1 x 37.6) = 61.2 kN/m²

LINE LOAD ON BASEMENT WALLS = 61.2 x 3.7
= 226.4 kN/m

TOTAL UPLIFT PRESSURE = 61.2 x 20.1 x 7.4
= 9102.9 kN