```
            Type of structure = Fully Embedded Wall
     Elevation of toe of wall = -3.60
Maximum finite element length =  0.20 m
     Youngs modulus of wall E = 2.1000E+07 kN/m2
  Moment of inertia of wall I = 7.0987E-03 m4/m run
                        E.I = 149073 kN.m2/m run
         Yield Moment of wall = Not defined
```

STRUTS and ANCHORS

Strut/ anchor no.	Elev.	Strut spacing m	X-section area of strut sq.m	Youngs modulus kN/m2	Free length m	Inclin -ation (degs)	Pre- stress /strut kN	Tension allowed
1	-0.20	1.00	0.300000	2.100E+07	5.65	0.00	0	Yes
2	-1.20	1.00	0.030000	2.000E+08	5.65	0.00	0	No
3	-2.30	1.00	0.030000	2.000E+08	5.65	0.00	0	No
4	-3.40	1.00	0.300000	2.100E+07	5.65	0.00	0	Yes

CONSTRUCTION STAGES

Construction stage no.	Stage description
1	Excavate to elevation 0.00 on PASSIVE side Toe of berm at elevation -0.80 Width of top of berm = 0.10 Width of toe of berm = 0.90
2	Install strut or anchor no.1 at elevation -0.20
3	Excavate to elevation -0.80 on PASSIVE side
4	Apply water pressure profile no.1 (Mod. Conserv.)
5	Excavate to elevation -0.80 on PASSIVE side Toe of berm at elevation -1.80 Width of top of berm = 0.10 Width of toe of berm = 1.10
6	Install strut or anchor no.2 at elevation -1.20
7	Excavate to elevation -1.80 on PASSIVE side
8	Apply water pressure profile no.2 (Mod. Conserv.)
9	Excavate to elevation -1.80 on PASSIVE side Toe of berm at elevation -2.80 Width of top of berm = 0.10 Width of toe of berm = 1.10
10	Install strut or anchor no.3 at elevation -2.30
11	Excavate to elevation -2.80 on PASSIVE side
12	Apply water pressure profile no.3 (Mod. Conserv.)
13	Excavate to elevation -2.80 on PASSIVE side Toe of berm at elevation -3.60 Width of top of berm = 0.10 Width of toe of berm = 0.90
14	Install strut or anchor no.4 at elevation -3.40
15	Excavate to elevation -3.60 on PASSIVE side
16	Fill to elevation -3.20 on PASSIVE side with soil type 4
17	Remove strut or anchor no.3 at elevation -2.30
18	Remove strut or anchor no.2 at elevation -1.20
19	Remove strut or anchor no.1 at elevation -0.20

FACTORS OF SAFETY and ANALYSIS OPTIONS

Limit State options: Serviceability Limit State
All loads and soil strengths are unfactored

Stability analysis:
Method of analysis - Strength Factor method
Factor on soil strength for calculating wall depth = 1.00

Parameters for undrained strata:
Minimum equivalent fluid density = 5.00 kN/m3
Maximum depth of water filled tension crack = 0.00 m

Bending moment and displacement calculation:
Method - Subgrade reaction model using Influence Coefficients
Open Tension Crack analysis? - No
Non-linear Modulus Parameter (L) = 0 m

Boundary conditions:

Length of wall (normal to plane of analysis) = 2400.00 m

Width of excavation on active side of wall = 11.30 m
Width of excavation on passive side of wall = 11.30 m

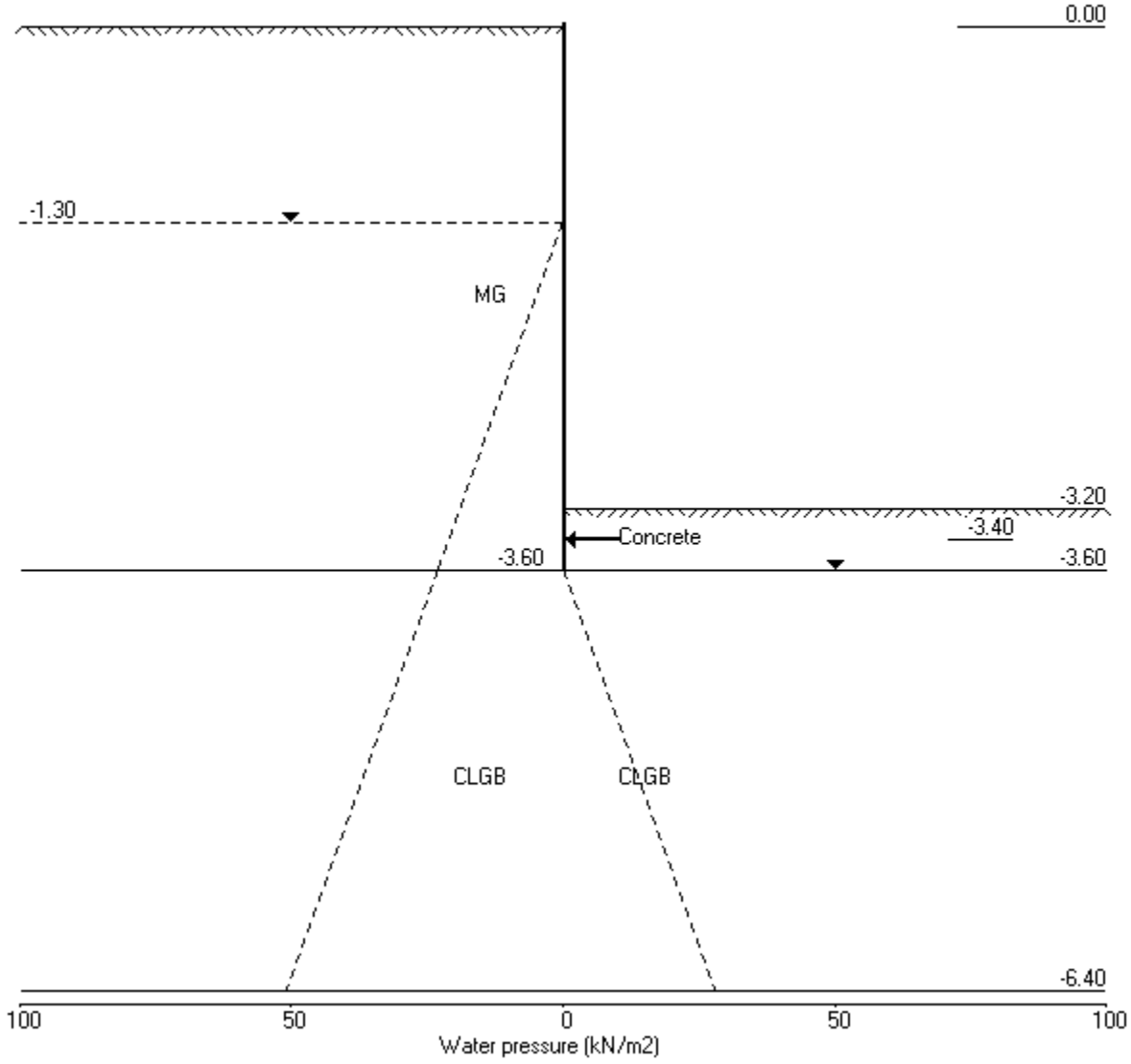
Distance to rigid boundary on active side = 11.30 m
Distance to rigid boundary on passive side = 11.30 m

OUTPUT OPTIONS

Stage no.	Stage description	Output options: Displacement, Bending mom., Shear force	Active, Passive pressures	Graph. output
1	Excav. to elev. 0.00 on PASSIVE side	No	No	No
2	Install strut no.1 at elev. -0.20	No	No	No
3	Excav. to elev. -0.80 on PASSIVE side	No	No	No
4	Apply water pressure profile no.1	No	No	No
5	Excav. to elev. -0.80 on PASSIVE side	No	No	No
6	Install strut no.2 at elev. -1.20	No	No	No
7	Excav. to elev. -1.80 on PASSIVE side	No	No	No
8	Apply water pressure profile no.2	No	No	No
9	Excav. to elev. -1.80 on PASSIVE side	No	No	No
10	Install strut no.3 at elev. -2.30	No	No	No
11	Excav. to elev. -2.80 on PASSIVE side	No	No	No
12	Apply water pressure profile no.3	No	No	No
13	Excav. to elev. -2.80 on PASSIVE side	No	No	No
14	Install strut no.4 at elev. -3.40	No	No	No
15	Excav. to elev. -3.60 on PASSIVE side	No	No	No
16	Fill to elev. -3.20 on PASSIVE side	No	No	No
17	Remove strut no.3 at elev. -2.30	No	No	No
18	Remove strut no.2 at elev. -1.20	No	No	No
19	Remove strut no.1 at elev. -0.20	No	No	No
*	Summary output	Yes	-	Yes

Units: kN,m

Stage No.19 Remove strut no.1 at elev. -0.20



Units: kN,m

Stage No. 19 Remove strut or anchor no.1 at elevation -0.20

STABILITY ANALYSIS of Fully Embedded Wall according to Strength Factor method

Factor of safety on soil strength

Stage No.	--- G.L. --- Act.	Pass.	Strut Elev.	FoS for toe elev. = -3.60 Factor of Safety	Moment equilib. at elev.	Toe elev. for FoS = 1.000 Toe elev.	Wall Penetr -ation
19	0.00	-3.20	-3.40	Conditions not suitable for FoS calc.			

BENDING MOMENT and DISPLACEMENT ANALYSIS of Fully Embedded Wall

Analysis options

Length of wall perpendicular to section = 2400.00m
Subgrade reaction model - Boussinesq Influence coefficients
Soil deformations are elastic until the active or passive limit is reached
Open Tension Crack analysis - No

Rigid boundaries: Active side 11.30 from wall
Passive side 11.30 from wall

Limit State: Serviceability Limit State

Calculated Bending Moments and Strut Forces are to be multiplied by a factor of 1.35 to obtain values for structural design. See summary for factored values.

Node no.	Y coord	Nett pressure kN/m2	Wall disp. m	Wall rotation rad.	Shear force kN/m	Bending moment kN.m/m	Strut forces kN/m
1	0.00	0.00	0.002	-6.66E-04	0.0	-0.0	
2	-0.20	1.00	0.002	-6.66E-04	0.1	0.0	
3	-0.40	2.00	0.002	-6.66E-04	0.4	0.1	
4	-0.60	3.00	0.002	-6.66E-04	0.9	0.2	
5	-0.80	4.00	0.003	-6.66E-04	1.6	0.5	
6	-1.00	5.00	0.003	-6.67E-04	2.5	0.9	
7	-1.20	6.00	0.003	-6.69E-04	3.6	1.5	
8	-1.30	6.50	0.003	-6.70E-04	4.2	1.9	
9	-1.45	7.25	0.003	-6.72E-04	5.3	2.6	
10	-1.60	8.76	0.003	-6.75E-04	6.5	3.5	
11	-1.80	11.48	0.003	-6.81E-04	8.5	5.0	
12	-2.00	14.18	0.003	-6.89E-04	11.0	6.9	
13	-2.15	16.20	0.003	-6.97E-04	13.3	8.8	
14	-2.30	18.21	0.004	-7.07E-04	15.9	11.0	
15	-2.45	20.21	0.004	-7.19E-04	18.8	13.6	
16	-2.60	22.20	0.004	-7.35E-04	22.0	16.6	
17	-2.80	24.84	0.004	-7.60E-04	26.7	21.5	
18	-3.00	27.46	0.004	-7.93E-04	31.9	27.3	
19	-3.20	30.06	0.004	-8.34E-04	37.6	34.3	
		-2057.14	0.004	-8.34E-04	37.6	34.3	
20	-3.40	32.90	0.004	-8.58E-04	-164.8	0.7	-157.9
		32.90	0.004	-8.58E-04	-6.9	0.7	
21	-3.60	35.76	0.005	-8.58E-04	0.0	-0.0	

At elev.-3.40 Strut force = -157.9 kN/strut = -157.9 kN/m run

(continued)

Stage No.19 Remove strut or anchor no.1 at elevation -0.20

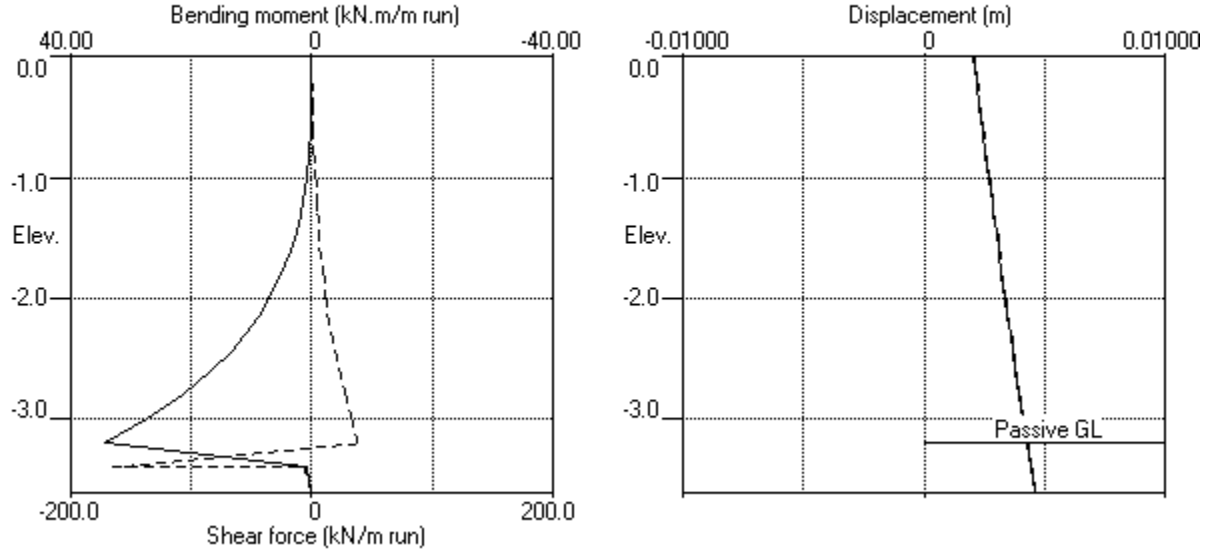
Node no.	Y coord	ACTIVE side						
			Effective stresses			Total	Coeff. of	
		Water press.	Vertic -al	Active limit	Passive limit	Earth pressure	earth pressure	subgrade reaction
		kN/m2	kN/m2	kN/m2	kN/m2	kN/m2	kN/m2	kN/m3
1	0.00	Total>	0.00	0.00	61.89	0.00	0.00a	2582
2	-0.20	Total>	2.73	1.00m	64.62	1.00	1.00a	2582
3	-0.40	Total>	5.45	2.00m	67.34	2.00	2.00a	2582
4	-0.60	Total>	8.18	3.00m	70.07	3.00	3.00a	2582
5	-0.80	Total>	10.90	4.00m	72.79	4.00	4.00a	2582
6	-1.00	Total>	13.63	5.00m	75.52	5.00	5.00a	2582
7	-1.20	Total>	16.36	6.00m	78.25	6.00	6.00a	2582
8	-1.30	Total>	17.72	6.50m	79.61	6.50	6.50a	2582
9	-1.45	Total>	20.41	7.25m	82.30	7.25	7.25a	2582
10	-1.60	Total>	23.10	8.00m	84.99	8.76	8.76	2582
11	-1.80	Total>	26.69	9.00m	88.58	11.48	11.48	2582
12	-2.00	Total>	30.28	10.00m	92.17	14.18	14.18	2582
13	-2.15	Total>	32.98	10.75m	94.87	16.20	16.20	2582
14	-2.30	Total>	35.67	11.50m	97.56	18.21	18.21	2582
15	-2.45	Total>	38.36	12.25m	100.25	20.21	20.21	2582
16	-2.60	Total>	41.05	13.00m	102.94	22.20	22.20	2582
17	-2.80	Total>	44.64	14.00m	106.53	24.84	24.84	2582
18	-3.00	Total>	48.23	15.00m	110.12	27.46	27.46	2582
19	-3.20	Total>	51.82	16.00m	113.71	30.06	30.06	2582
20	-3.40	Total>	55.41	17.00m	117.30	33.90	33.90	11088
21	-3.60	Total>	59.00	18.00m	120.89	37.76	37.76	11088

Node no.	Y coord	PASSIVE side						
			Effective stresses			Total	Coeff. of	
		Water press.	Vertic -al	Active limit	Passive limit	Earth pressure	earth pressure	subgrade reaction
		kN/m2	kN/m2	kN/m2	kN/m2	kN/m2	kN/m2	kN/m3
1	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.0
2	-0.20	0.00	0.00	0.00	0.00	0.00	0.00	0.0
3	-0.40	0.00	0.00	0.00	0.00	0.00	0.00	0.0
4	-0.60	0.00	0.00	0.00	0.00	0.00	0.00	0.0
5	-0.80	0.00	0.00	0.00	0.00	0.00	0.00	0.0
6	-1.00	0.00	0.00	0.00	0.00	0.00	0.00	0.0
7	-1.20	0.00	0.00	0.00	0.00	0.00	0.00	0.0
8	-1.30	0.00	0.00	0.00	0.00	0.00	0.00	0.0
9	-1.45	0.00	0.00	0.00	0.00	0.00	0.00	0.0
10	-1.60	0.00	0.00	0.00	0.00	0.00	0.00	0.0
11	-1.80	0.00	0.00	0.00	0.00	0.00	0.00	0.0
12	-2.00	0.00	0.00	0.00	0.00	0.00	0.00	0.0
13	-2.15	0.00	0.00	0.00	0.00	0.00	0.00	0.0
14	-2.30	0.00	0.00	0.00	0.00	0.00	0.00	0.0
15	-2.45	0.00	0.00	0.00	0.00	0.00	0.00	0.0
16	-2.60	0.00	0.00	0.00	0.00	0.00	0.00	0.0
17	-2.80	0.00	0.00	0.00	0.00	0.00	0.00	0.0
18	-3.00	0.00	0.00	0.00	0.00	0.00	0.00	0.0
19	-3.20	0.00	0.00	0.00	0.00	0.00	0.00	0.0
		Total>	0.00	0.00	17000.00	2087.19	2087.19	6.35E+08
20	-3.40	Total>	4.80	1.00m	17004.80	1.00	1.00a	46199904
21	-3.60	Total>	9.60	2.00m	17009.60	2.00	2.00a	46199904

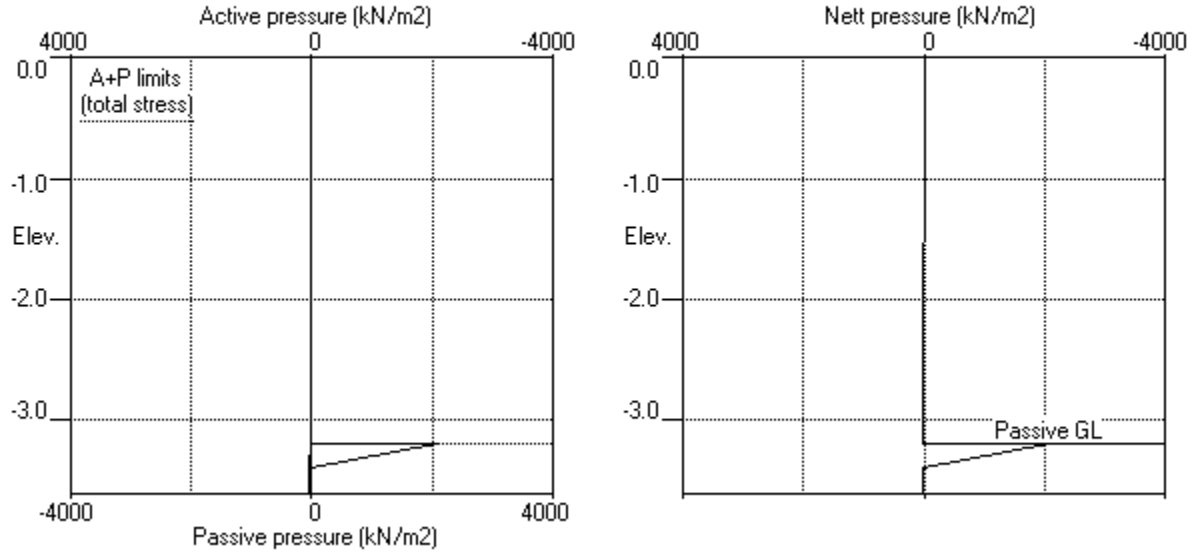
Note: 2.00a Soil pressure at active limit
       123.45p Soil pressure at passive limit

Units: kN,m

Stage No.19 Remove strut no.1 at elev. -0.20



Stage No.19 Remove strut no.1 at elev. -0.20



Units: kN,m

Summary of results

LIMIT STATE PARAMETERS

Limit State: Serviceability Limit State

All loads and soil strengths are unfactored

STABILITY ANALYSIS of Fully Embedded Wall according to Strength Factor method

Factor of safety on soil strength

Stage No.	--- G.L. --- Act.	Pass.	Strut Elev.	FoS for toe elev. = -3.60 Factor of Safety	Moment equilib. at elev.	Toe elev. for FoS = 1.000 Toe elev.	Wall Penetr -ation
1	0.00	0.00	Cant.	Conditions not suitable for FoS calc.			
2	0.00	0.00		No analysis at this stage			
3	0.00	-0.80	-0.20	11.077	n/a	-0.81	0.01
4	0.00	-0.80	-0.20	9.469	n/a	-0.81	0.01
5	0.00	-0.80	-0.20	4.464	n/a	-0.83	0.03
6	0.00	-0.80		No analysis at this stage			
7	0.00	-1.80		More than one strut			
8	0.00	-1.80		More than one strut			
9	0.00	-1.80		More than one strut			
10	0.00	-1.80		No analysis at this stage			
11	0.00	-2.80		More than one strut			
12	0.00	-2.80		More than one strut			
13	0.00	-2.80		More than one strut			
14	0.00	-2.80		No analysis at this stage			
15	0.00	-3.40		More than one strut			
16	0.00	-3.20		More than one strut			
17	0.00	-3.20		More than one strut			
18	0.00	-3.20		More than one strut			
19	0.00	-3.20	-3.40	Conditions not suitable for FoS calc.			

Units: kN,m

Summary of results

BENDING MOMENT and DISPLACEMENT ANALYSIS of Fully Embedded Wall

Analysis options

Length of wall perpendicular to section = 2400.00m
Subgrade reaction model - Boussinesq Influence coefficients
Soil deformations are elastic until the active or passive limit is reached
Open Tension Crack analysis - No

Rigid boundaries: Active side 11.30 from wall
Passive side 11.30 from wall

Limit State: Serviceability Limit State

Calculated Bending Moments and Strut Forces have been multiplied by a factor of 1.35 to obtain values for structural design.

Bending moment, shear force and displacement envelopes

Node no.	Y coord	Displacement		Bending moment Calculated		Bending moment Factored		Shear force Calculated		Shear force Factored	
		max.	min.	max.	min.	max.	min.	max.	min.	max.	min.
		m	m	kN.m/m		kN.m/m		kN/m	kN/m	kN/m	kN/m
1	0.00	0.002	-0.000	0	-0	0	-0	0	0	0	0
2	-0.20	0.002	-0.000	0	0	0	0	37	-10	50	-13
3	-0.40	0.002	-0.000	8	-2	10	-2	37	-9	50	-13
4	-0.60	0.002	0.000	15	-4	20	-5	38	-9	51	-12
5	-0.80	0.003	0.000	23	-5	31	-7	39	-8	53	-10
6	-1.00	0.003	0.000	31	-7	41	-9	40	-7	54	-9
7	-1.20	0.003	0.000	39	-8	52	-11	42	-33	56	-44
8	-1.30	0.003	0.000	36	-8	48	-11	4	-32	6	-43
9	-1.45	0.003	0.000	32	-9	43	-12	5	-31	7	-41
10	-1.60	0.003	0.000	29	-9	39	-12	6	-29	9	-39
11	-1.80	0.003	0.000	26	-9	35	-13	8	-26	11	-36
12	-2.00	0.003	0.000	23	-9	31	-12	11	-23	15	-31
13	-2.15	0.003	0.000	22	-8	29	-11	13	-21	18	-28
14	-2.30	0.004	0.000	21	-7	28	-9	16	-31	21	-42
15	-2.45	0.004	0.000	16	-5	22	-7	19	-28	25	-38
16	-2.60	0.004	0.000	17	-3	22	-4	22	-25	30	-34
17	-2.80	0.004	0.000	21	-1	29	-2	27	-20	36	-27
18	-3.00	0.004	0.000	27	-1	37	-1	32	-15	43	-20
19	-3.20	0.004	0.000	34	-0	46	-1	38	-9	51	-13
20	-3.40	0.005	0.000	1	-0	1	-0	1	-165	1	-222
21	-3.60	0.005	0.000	0	-0	0	-0	0	0	0	0

Summary of results (continued)

Calculated Bending Moments and Strut Forces have been multiplied by a factor of 1.35 to obtain values for structural design.

Maximum and minimum bending moment and shear force at each stage

Stage	Bending moment						Shear force					
	Calculated				Factored		Calculated				Factored	
no.	max.	elev.	min.	elev.	max.	min.	max.	elev.	min.	elev.	max.	min.
	kN.m/m		kN.m/m		kN.m/m		kN/m		kN/m		kN/m	kN/m
1	0	-2.30	-0	-3.60	0	-0	0	-0.40	0	0.00	0	0
2	No calculation at this stage											
3	0	-0.20	-4	-1.45	0	-5	3	-2.45	-6	-0.20	3	-8
4	0	-0.20	-4	-1.45	0	-5	3	-2.60	-5	-0.20	4	-7
5	0	-0.20	-4	-1.45	0	-5	3	-2.60	-5	-0.20	4	-7
6	No calculation at this stage											
7	26	-1.20	-0	-3.60	34	-0	28	-1.20	-24	-1.20	38	-33
8	34	-1.20	-0	-3.60	45	-0	36	-1.20	-29	-1.20	49	-39
9	34	-1.20	-0	-3.60	45	-0	36	-1.20	-29	-1.20	49	-39
10	No calculation at this stage											
11	36	-1.20	-0	-3.60	49	-0	39	-1.20	-29	-2.30	53	-40
12	36	-1.20	-0	-3.60	49	-0	39	-1.20	-31	-2.30	53	-42
13	36	-1.20	-0	-3.60	49	-0	39	-1.20	-31	-2.30	53	-42
14	No calculation at this stage											
15	37	-1.20	-0	-3.60	49	-0	39	-1.20	-31	-2.30	53	-42
16	37	-1.20	-0	-3.60	49	-0	39	-1.20	-31	-2.30	53	-42
17	39	-1.20	-0	-3.60	52	-0	42	-1.20	-33	-1.20	56	-44
18	11	-3.20	-9	-1.80	15	-13	32	-3.20	-48	-3.40	43	-65
19	34	-3.20	-0	0.00	46	-0	38	-3.20	-165	-3.40	51	-222

Maximum and minimum displacement at each stage

Stage	Displacement				Stage description
no.	maximum	elev.	minimum	elev.	
	m		m		
1	0.000	-3.60	-0.000	0.00	Excav. to elev. 0.00 on PASSIVE side
2	No calculation at this stage				Install strut no.1 at elev. -0.20
3	0.003	-3.60	-0.000	0.00	Excav. to elev. -0.80 on PASSIVE side
4	0.004	-3.60	-0.000	0.00	Apply water pressure profile no.1
5	0.004	-3.60	-0.000	0.00	Excav. to elev. -0.80 on PASSIVE side
6	No calculation at this stage				Install strut no.2 at elev. -1.20
7	0.005	-3.60	-0.000	0.00	Excav. to elev. -1.80 on PASSIVE side
8	0.005	-3.60	-0.000	0.00	Apply water pressure profile no.2
9	0.005	-3.60	-0.000	0.00	Excav. to elev. -1.80 on PASSIVE side

10	No calculation at this stage				Install strut no.3 at elev. -2.30
11	0.005	-3.60	-0.000	0.00	Excav. to elev. -2.80 on PASSIVE side
12	0.005	-3.60	-0.000	0.00	Apply water pressure profile no.3
13	0.005	-3.60	-0.000	0.00	Excav. to elev. -2.80 on PASSIVE side
14	No calculation at this stage				Install strut no.4 at elev. -3.40
15	0.005	-3.60	-0.000	0.00	Excav. to elev. -3.60 on PASSIVE side
16	0.005	-3.60	-0.000	0.00	Fill to elev. -3.20 on PASSIVE side
17	0.005	-3.60	-0.000	0.00	Remove strut no.3 at elev. -2.30
18	0.005	-3.60	-0.000	0.00	Remove strut no.2 at elev. -1.20
19	0.005	-3.60	0.000	0.00	Remove strut no.1 at elev. -0.20

Summary of results (continued)

Calculated Bending Moments and Strut Forces have been multiplied by a factor of 1.35 to obtain values for structural design.

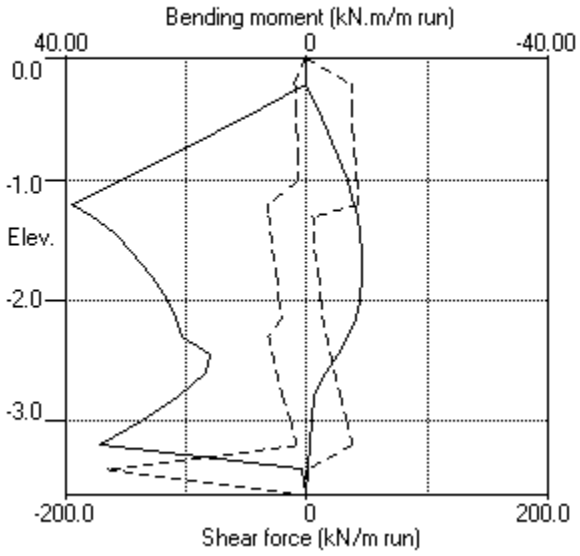
Strut forces at each stage (horizontal components)

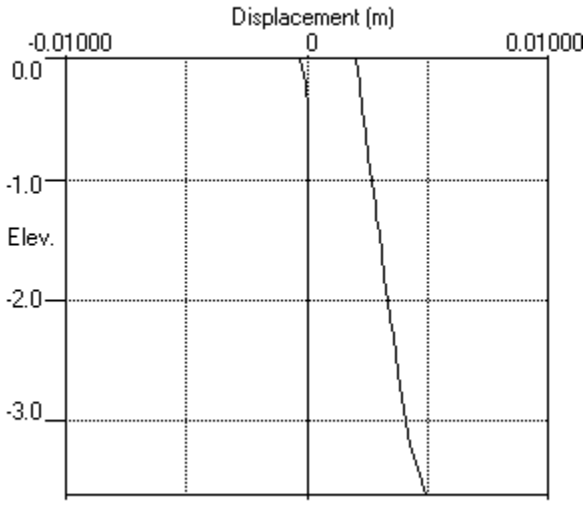
Stage no.	Strut no. 1 at elev.-0.20			Strut no. 2 at elev.-1.20			Strut no. 3 at elev.-2.30		
	--Calculated-- kN per m run	kN per strut	Factored kN per strut	--Calculated-- kN per m run	kN per strut	Factored kN per strut	--Calculated-- kN per m run	kN per strut	Factored kN per strut
3	6	6	8	---	---	---	---	---	---
4	6	6	8	---	---	---	---	---	---
5	6	6	8	---	---	---	---	---	---
7	-23	-23	-31	53	53	71	---	---	---
8	-31	-31	-42	65	65	88	---	---	---
9	-31	-31	-42	65	65	88	---	---	---
11	-33	-33	-45	61	61	83	22	22	30
12	-34	-34	-45	60	60	82	25	25	33
13	-34	-34	-45	60	60	82	25	25	33
15	-34	-34	-46	60	60	81	26	26	35
16	-34	-34	-46	60	60	81	26	26	35
17	-36	-36	-49	74	74	100	---	---	---
18	11	11	14	---	---	---	---	---	---

Stage no.	Strut no. 4 at elev.-3.40		
	--Calculated-- kN per m run	kN per strut	Factored kN per strut
15	4	4	5
16	4	4	5
17	-4	-4	-5
18	-42	-42	-57
19	-158	-158	-213

Units: kN,m

Bending moment, shear force, displacement envelopes





Units: kN,m

INPUT DATA

SOIL PROFILE

Stratum no.	Elevation of top of stratum	Soil types Active side	Passive side
1	0.00	1 MG	1 MG
2	-3.60	2 CLGB	2 CLGB
3	-6.40	3 CLGB	3 CLGB

SOIL PROPERTIES

No.	Soil type -- Description (Datum elev.)	Bulk density kN/m3	Young's Modulus Eh,kN/m2 (dEh/dy)	At rest coeff. Ko (dKo/dy)	Consol state. NC/OC (Nu)	Active limit Ka (Kac)	Passive limit Kp (Kpc)	Cohesion kN/m2 (dc/dy)
1	MG	13.63a	5040	0.658	OC	1.000	1.000	25.00u
		17.95b			(0.490)	(2.389)	(2.476)	
2	CLGB	17.85a	12490	0.658	OC	1.000	1.000	50.00u
		18.53b			(0.490)	(2.389)	(2.476)	
3	CLGB	19.91a	16960	0.658	OC	1.000	1.000	65.00u
		21.87b			(0.490)	(2.389)	(2.476)	
4	Concrete	24.00	2.10E+7	0.000	OC	1.000	1.000	8500u
					(0.490)	(2.000)	(2.000)	

Note: (a) and (b) are Bulk Densities above and below the water table

Additional soil parameters associated with Ka and Kp

No.	Soil type ------- Description	--- parameters for Ka --- Soil friction angle	Wall adhesion coeff.	Back-fill angle	--- parameters for Kp --- Soil friction angle	Wall adhesion coeff.	Back-fill angle
1	MG	0.00	0.500	0.00	0.00	0.667	0.00
2	CLGB	0.00	0.500	0.00	0.00	0.667	0.00
3	CLGB	0.00	0.500	0.00	0.00	0.667	0.00
4	Concrete	0.00	0.000	0.00	0.00	0.000	0.00

GROUND WATER CONDITIONS

Density of water = 10.00 kN/m3

	Active side	Passive side
Initial water table elevation	-2.00	-2.00

Automatic water pressure balancing at toe of wall : No

Water press. profile no.	Active side Point no.	Elev. m	Piezo elev. m	Water press. kN/m2	Passive side Point no.	Elev. m	Piezo elev. m	Water press. kN/m2	
1	1	-2.00	-2.00	0.0	1	-2.00	-2.00	0.0	MC
2	Not defined								
3	1	-2.00	-2.00	0.0	1	-3.60	-3.60	0.0	MC
4	Not defined								
5	1	-1.30	-1.30	0.0	1	-3.60	-3.60	0.0	WC

6	1	-1.30	-1.30	0.0	1	-2.00	-2.00	0.0	WC

WALL PROPERTIES

Type of structure = Fully Embedded Wall
Elevation of toe of wall = -3.60
Maximum finite element length = 0.20 m
Youngs modulus of wall E = 2.1000E+07 kN/m2
Moment of inertia of wall I = 7.0987E-03 m4/m run
E.I = 149073 kN.m2/m run
Yield Moment of wall = Not defined

STRUTS and ANCHORS

Strut/anchor no.	Elev.	Strut spacing m	X-section area of strut sq.m	Youngs modulus kN/m2	Free length m	Inclin -ation (degs)	Pre-stress /strut kN	Tension allowed
1	-0.20	1.00	0.300000	2.100E+07	5.65	0.00	0	Yes
2	-1.20	1.00	0.030000	2.000E+08	5.65	0.00	0	No
3	-2.30	1.00	0.030000	2.000E+08	5.65	0.00	0	No
4	-3.40	1.00	0.300000	2.100E+07	5.65	0.00	0	Yes

CONSTRUCTION STAGES

Construction stage no.	Stage description
1	Excavate to elevation 0.00 on PASSIVE side Toe of berm at elevation -1.30 Width of top of berm = 0.10 Width of toe of berm = 1.40
2	Install strut or anchor no.1 at elevation -0.20
3	Install strut or anchor no.2 at elevation -1.20
4	Excavate to elevation -1.30 on PASSIVE side
5	Apply water pressure profile no.1 (Mod. Conserv.)
6	Excavate to elevation -1.30 on PASSIVE side Toe of berm at elevation -1.80 Width of top of berm = 0.10 Width of toe of berm = 0.60
7	Excavate to elevation -1.80 on PASSIVE side
8	Apply water pressure profile no.3 (Mod. Conserv.)
9	Excavate to elevation -1.80 on PASSIVE side Toe of berm at elevation -2.80 Width of top of berm = 0.10 Width of toe of berm = 1.10
10	Install strut or anchor no.3 at elevation -2.30
11	Excavate to elevation -2.80 on PASSIVE side
12	Excavate to elevation -2.80 on PASSIVE side Toe of berm at elevation -3.60 Width of top of berm = 0.10 Width of toe of berm = 0.90
13	Install strut or anchor no.4 at elevation -3.40
14	Excavate to elevation -3.60 on PASSIVE side
15	Fill to elevation -3.20 on PASSIVE side with soil type 4
16	Remove strut or anchor no.3 at elevation -2.30
17	Remove strut or anchor no.2 at elevation -1.20
18	Remove strut or anchor no.1 at elevation -0.20

FACTORS OF SAFETY and ANALYSIS OPTIONS

Limit State options: Serviceability Limit State
All loads and soil strengths are unfactored

Stability analysis:
Method of analysis - Strength Factor method
Factor on soil strength for calculating wall depth = 1.00

Parameters for undrained strata:
Minimum equivalent fluid density = 5.00 kN/m3

Maximum depth of water filled tension crack = 0.00 m

Bending moment and displacement calculation:
Method - Subgrade reaction model using Influence Coefficients
Open Tension Crack analysis? - No
Non-linear Modulus Parameter (L) = 0 m

Boundary conditions:
Length of wall (normal to plane of analysis) = 2400.00 m

Width of excavation on active side of wall = 11.30 m
Width of excavation on passive side of wall = 11.30 m

Distance to rigid boundary on active side = 11.30 m
Distance to rigid boundary on passive side = 11.30 m

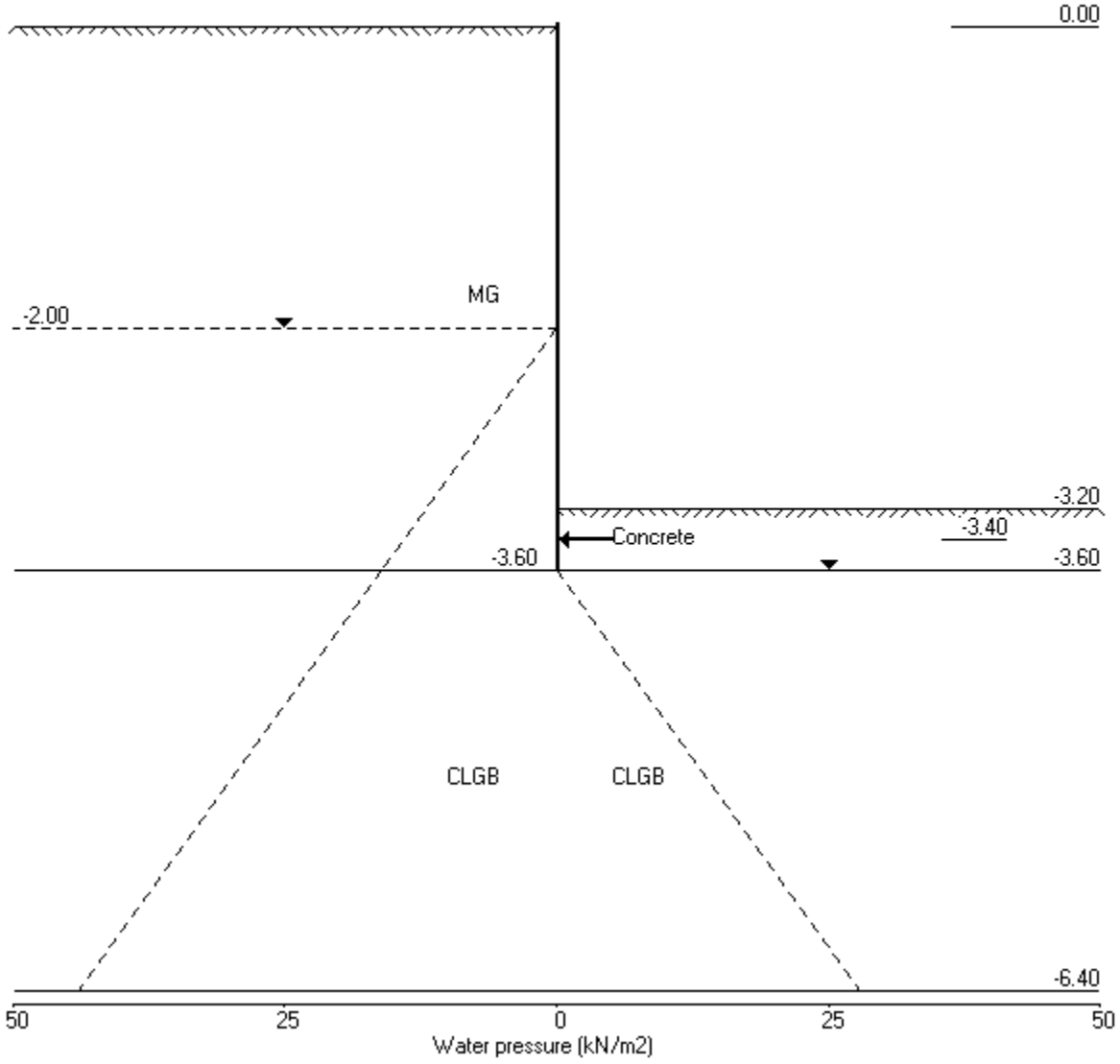
OUTPUT OPTIONS

Stage no.	Stage description	Output options: Displacement, Bending mom., Shear force	Active, Passive pressures	Graph. output
1	Excav. to elev. 0.00 on PASSIVE side	Yes	Yes	Yes
2	Install strut no.1 at elev. -0.20	Yes	Yes	Yes
3	Install strut no.2 at elev. -1.20	Yes	Yes	Yes
4	Excav. to elev. -1.30 on PASSIVE side	Yes	Yes	Yes
5	Apply water pressure profile no.1	Yes	Yes	Yes
6	Excav. to elev. -1.30 on PASSIVE side	Yes	Yes	Yes
7	Excav. to elev. -1.80 on PASSIVE side	Yes	Yes	Yes
8	Apply water pressure profile no.3	Yes	Yes	Yes
9	Excav. to elev. -1.80 on PASSIVE side	Yes	Yes	Yes
10	Install strut no.3 at elev. -2.30	Yes	Yes	Yes
11	Excav. to elev. -2.80 on PASSIVE side	No	No	No
12	Excav. to elev. -2.80 on PASSIVE side	No	No	No
13	Install strut no.4 at elev. -3.40	Yes	Yes	Yes
14	Excav. to elev. -3.60 on PASSIVE side	Yes	Yes	Yes
15	Fill to elev. -3.20 on PASSIVE side	Yes	Yes	Yes
16	Remove strut no.3 at elev. -2.30	Yes	Yes	Yes
17	Remove strut no.2 at elev. -1.20	Yes	Yes	Yes
18	Remove strut no.1 at elev. -0.20	Yes	Yes	Yes
*	Summary output	Yes	-	Yes

SOILS LIMITED | Sheet No.
Program: WALLAP Version 6.05 Revision A46.B59.R49 | Job No. 15655
Licensed from GEOSOLVE | Made by : DVT
Data filename/Run ID: 15655_Rev1.05_GW_remedial2_SLS |
12 Platt's Lane, London NW3 7NR | Date: 2-12-2016
Please modify / add | Checked :

Units: kN,m

Stage No.18 Remove strut no.1 at elev. -0.20



Units: kN,m

Stage No. 18 Remove strut or anchor no.1 at elevation -0.20

STABILITY ANALYSIS of Fully Embedded Wall according to Strength Factor method

Factor of safety on soil strength

Stage No.	--- G.L. --- Act.	Pass.	Strut Elev.	FoS for toe elev. = -3.60 Factor of Safety	Moment equilib. at elev.	Toe elev. for FoS = 1.000 Toe elev.	Wall Penetr -ation
18	0.00	-3.20	-3.40	Conditions not suitable for FoS calc.			

BENDING MOMENT and DISPLACEMENT ANALYSIS of Fully Embedded Wall

Analysis options

Length of wall perpendicular to section = 2400.00m

Subgrade reaction model - Boussinesq Influence coefficients

Soil deformations are elastic until the active or passive limit is reached

Open Tension Crack analysis - No

Rigid boundaries: Active side 11.30 from wall
Passive side 11.30 from wall

Limit State: Serviceability Limit State

Calculated Bending Moments and Strut Forces are to be multiplied by a factor of 1.35 to obtain values for structural design. See summary for factored values.

Node no.	Y coord	Nett pressure kN/m2	Wall disp. m	Wall rotation rad.	Shear force kN/m	Bending moment kN.m/m	Strut forces kN/m
1	0.00	0.00	0.002	3.04E-04	0.0	0.0	
2	-0.20	1.00	0.002	3.04E-04	0.1	0.0	
3	-0.40	2.00	0.002	3.04E-04	0.4	0.1	
4	-0.60	3.00	0.002	3.04E-04	0.9	0.2	
5	-0.80	4.00	0.002	3.03E-04	1.6	0.4	
6	-1.00	5.00	0.002	3.02E-04	2.5	0.8	
7	-1.20	6.54	0.002	3.01E-04	3.7	1.5	
8	-1.30	7.50	0.002	3.00E-04	4.4	1.9	
9	-1.45	8.94	0.002	2.97E-04	5.6	2.6	
10	-1.60	10.38	0.002	2.94E-04	7.0	3.6	
11	-1.80	12.27	0.002	2.88E-04	9.3	5.2	
12	-2.00	14.15	0.001	2.80E-04	11.9	7.3	
13	-2.15	16.48	0.001	2.72E-04	14.2	9.3	
14	-2.30	18.81	0.001	2.61E-04	16.9	11.6	
15	-2.45	21.13	0.001	2.48E-04	19.9	14.4	
16	-2.60	23.44	0.001	2.32E-04	23.2	17.6	
17	-2.80	26.50	0.001	2.05E-04	28.2	22.7	
18	-3.00	29.54	0.001	1.70E-04	33.8	28.9	
19	-3.20	32.57	0.001	1.27E-04	40.0	36.3	
		-2177.84	0.001	1.27E-04	40.0	36.3	
20	-3.40	35.89	0.001	1.02E-04	-174.2	0.8	-166.6
		35.89	0.001	1.02E-04	-7.5	0.8	
21	-3.60	39.23	0.001	1.01E-04	0.0	-0.0	

At elev.-3.40 Strut force = -166.6 kN/strut = -166.6 kN/m run

(continued)

Stage No.18 Remove strut or anchor no.1 at elevation -0.20

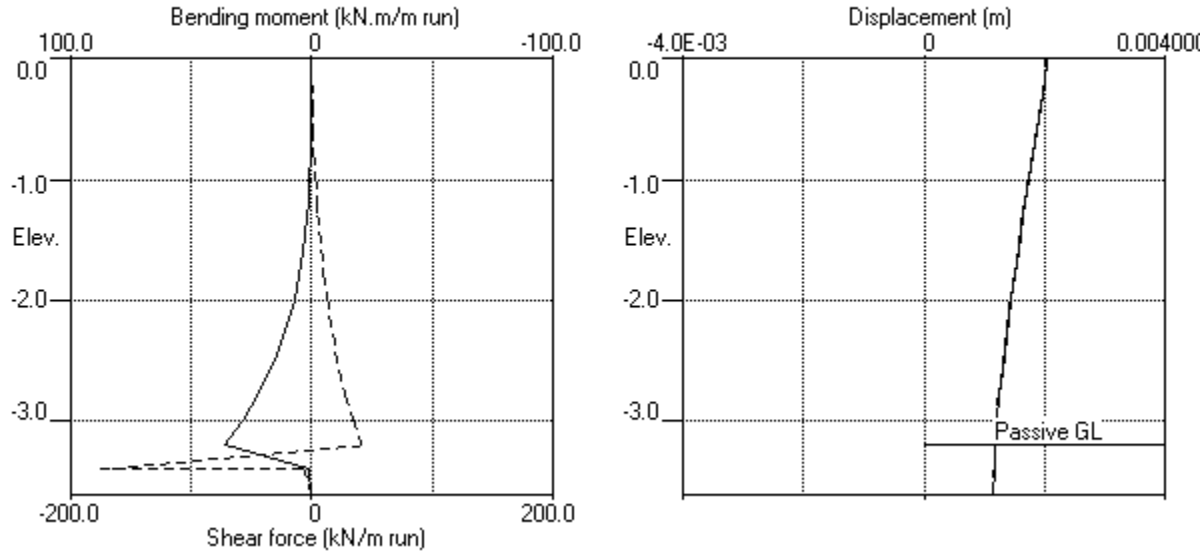
Node no.	Y coord	ACTIVE side						
			Effective stresses				Total	Coeff. of
		Water press.	Vertic -al	Active limit	Passive limit	Earth pressure	earth pressure	subgrade reaction
		kN/m2	kN/m2	kN/m2	kN/m2	kN/m2	kN/m2	kN/m3
1	0.00	Total>	0.00	0.00	61.89	0.00	0.00a	2589
2	-0.20	Total>	2.73	1.00m	64.62	1.00	1.00a	2589
3	-0.40	Total>	5.45	2.00m	67.34	2.00	2.00a	2589
4	-0.60	Total>	8.18	3.00m	70.07	3.00	3.00a	2589
5	-0.80	Total>	10.90	4.00m	72.79	4.00	4.00a	2589
6	-1.00	Total>	13.63	5.00m	75.52	5.00	5.00a	2589
7	-1.20	Total>	16.36	6.00m	78.25	6.54	6.54	2589
8	-1.30	Total>	17.72	6.50m	79.61	7.50	7.50	2589
9	-1.45	Total>	19.76	7.25m	81.65	8.94	8.94	2589
10	-1.60	Total>	21.81	8.00m	83.70	10.38	10.38	2589
11	-1.80	Total>	24.53	9.00m	86.42	12.27	12.27	2589
12	-2.00	Total>	27.26	10.00m	89.15	14.15	14.15	2589
13	-2.15	Total>	29.95	10.75m	91.84	16.48	16.48	2589
14	-2.30	Total>	32.65	11.50m	94.53	18.81	18.81	2589
15	-2.45	Total>	35.34	12.25m	97.23	21.13	21.13	2589
16	-2.60	Total>	38.03	13.00m	99.92	23.44	23.44	2589
17	-2.80	Total>	41.62	14.00m	103.51	26.50	26.50	2589
18	-3.00	Total>	45.21	15.00m	107.10	29.54	29.54	2589
19	-3.20	Total>	48.80	16.00m	110.69	32.57	32.57	2589
20	-3.40	Total>	52.39	17.00m	114.28	36.89	36.89	11087
21	-3.60	Total>	55.98	18.00m	117.87	41.23	41.23	11087

Node no.	Y coord	PASSIVE side						
			Effective stresses				Total	Coeff. of
		Water press.	Vertic -al	Active limit	Passive limit	Earth pressure	earth pressure	subgrade reaction
		kN/m2	kN/m2	kN/m2	kN/m2	kN/m2	kN/m2	kN/m3
1	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.0
2	-0.20	0.00	0.00	0.00	0.00	0.00	0.00	0.0
3	-0.40	0.00	0.00	0.00	0.00	0.00	0.00	0.0
4	-0.60	0.00	0.00	0.00	0.00	0.00	0.00	0.0
5	-0.80	0.00	0.00	0.00	0.00	0.00	0.00	0.0
6	-1.00	0.00	0.00	0.00	0.00	0.00	0.00	0.0
7	-1.20	0.00	0.00	0.00	0.00	0.00	0.00	0.0
8	-1.30	0.00	0.00	0.00	0.00	0.00	0.00	0.0
9	-1.45	0.00	0.00	0.00	0.00	0.00	0.00	0.0
10	-1.60	0.00	0.00	0.00	0.00	0.00	0.00	0.0
11	-1.80	0.00	0.00	0.00	0.00	0.00	0.00	0.0
12	-2.00	0.00	0.00	0.00	0.00	0.00	0.00	0.0
13	-2.15	0.00	0.00	0.00	0.00	0.00	0.00	0.0
14	-2.30	0.00	0.00	0.00	0.00	0.00	0.00	0.0
15	-2.45	0.00	0.00	0.00	0.00	0.00	0.00	0.0
16	-2.60	0.00	0.00	0.00	0.00	0.00	0.00	0.0
17	-2.80	0.00	0.00	0.00	0.00	0.00	0.00	0.0
18	-3.00	0.00	0.00	0.00	0.00	0.00	0.00	0.0
19	-3.20	0.00	0.00	0.00	0.00	0.00	0.00	0.0
		Total>	0.00	0.00	17000.00	2210.41	2210.41	6.35E+08
20	-3.40	Total>	4.80	1.00m	17004.80	1.00	1.00a	46197362
21	-3.60	Total>	9.60	2.00m	17009.60	2.00	2.00a	46197362

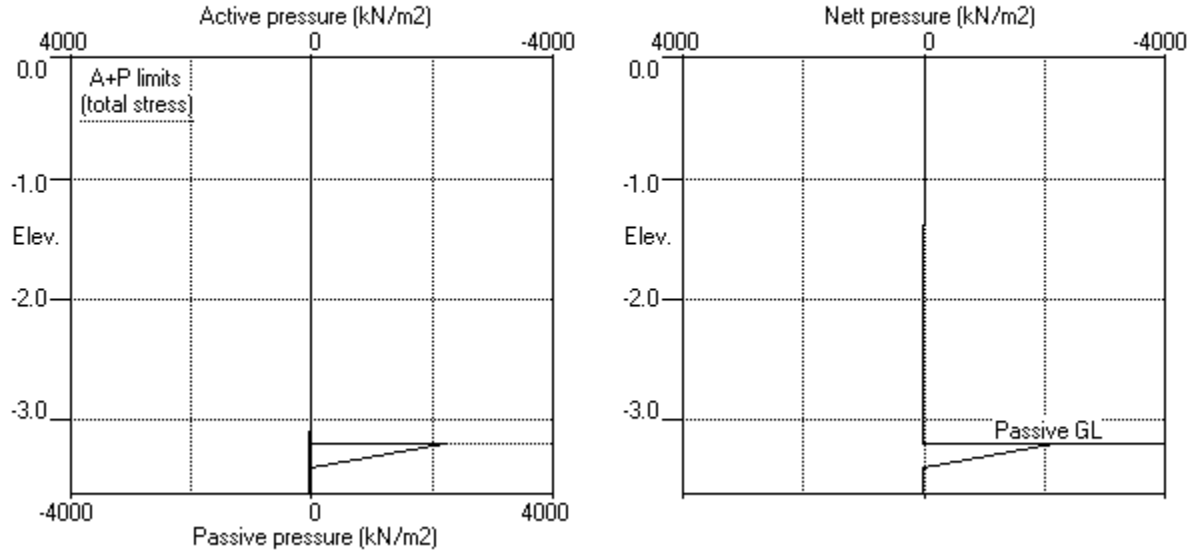
Note: 2.00a Soil pressure at active limit
       123.45p Soil pressure at passive limit

Units: kN,m

Stage No.18 Remove strut no.1 at elev. -0.20



Stage No.18 Remove strut no.1 at elev. -0.20



Units: kN,m

Summary of results

LIMIT STATE PARAMETERS

Limit State: Serviceability Limit State

All loads and soil strengths are unfactored

STABILITY ANALYSIS of Fully Embedded Wall according to Strength Factor method

Factor of safety on soil strength

Stage No.	--- G.L. --- Act.	Pass.	Strut Elev.	FoS for toe elev. = -3.60 Factor of Safety	Moment equilib. at elev.	Toe elev. for FoS = 1.000 Toe elev.	Wall Penetr -ation
1	0.00	0.00	Cant.	Conditions not suitable for FoS calc.			
2	0.00	0.00		No analysis at this stage			
3	0.00	0.00		No analysis at this stage			
4	0.00	-1.30		More than one strut			
5	0.00	-1.30		More than one strut			
6	0.00	-1.30		More than one strut			
7	0.00	-1.80		More than one strut			
8	0.00	-1.80		More than one strut			
9	0.00	-1.80		More than one strut			
10	0.00	-1.80		No analysis at this stage			
11	0.00	-2.80		More than one strut			
12	0.00	-2.80		More than one strut			
13	0.00	-2.80		No analysis at this stage			
14	0.00	-3.40		More than one strut			
15	0.00	-3.20		More than one strut			
16	0.00	-3.20		More than one strut			
17	0.00	-3.20		More than one strut			
18	0.00	-3.20	-3.40	Conditions not suitable for FoS calc.			

Units: kN,m

Summary of results

BENDING MOMENT and DISPLACEMENT ANALYSIS of Fully Embedded Wall

Analysis options

Length of wall perpendicular to section = 2400.00m
Subgrade reaction model - Boussinesq Influence coefficients
Soil deformations are elastic until the active or passive limit is reached
Open Tension Crack analysis - No

Rigid boundaries: Active side 11.30 from wall
Passive side 11.30 from wall

Limit State: Serviceability Limit State

Calculated Bending Moments and Strut Forces have been multiplied by a factor of 1.35 to obtain values for structural design.

Bending moment, shear force and displacement envelopes

Node no.	Y coord	Displacement		Bending moment Calculated		Bending moment Factored		Shear force Calculated		Shear force Factored	
		max.	min.	max.	min.	max.	min.	max.	min.	max.	min.
		m	m	kN.m/m		kN.m/m		kN/m	kN/m	kN/m	kN/m
1	0.00	0.002	-0.000	0	-0	0	-0	0	0	0	0
2	-0.20	0.002	-0.000	0	0	0	0	59	-10	80	-14
3	-0.40	0.002	-0.000	12	-2	16	-3	60	-10	81	-13
4	-0.60	0.002	-0.000	24	-4	32	-5	61	-9	82	-12
5	-0.80	0.002	0.000	36	-5	49	-7	62	-8	84	-10
6	-1.00	0.002	0.000	49	-7	66	-9	63	-6	86	-8
7	-1.20	0.002	0.000	62	-8	83	-11	65	-46	88	-61
8	-1.30	0.002	0.000	57	-8	77	-11	4	-44	6	-60
9	-1.45	0.002	0.000	51	-9	69	-12	6	-43	8	-58
10	-1.60	0.002	0.000	46	-9	62	-12	7	-41	10	-55
11	-1.80	0.002	0.000	39	-9	53	-12	9	-38	13	-51
12	-2.00	0.001	0.000	33	-8	45	-10	12	-35	16	-47
13	-2.15	0.001	0.000	29	-7	39	-9	14	-32	19	-43
14	-2.30	0.001	0.000	26	-5	35	-7	17	-37	23	-49
15	-2.45	0.001	0.000	20	-3	27	-4	20	-33	27	-45
16	-2.60	0.001	0.000	18	-1	24	-1	23	-30	31	-40
17	-2.80	0.001	0.000	23	0	31	0	28	-25	38	-33
18	-3.00	0.001	0.000	29	0	39	0	34	-19	46	-26
19	-3.20	0.001	0.000	36	0	49	0	40	-13	54	-17
20	-3.40	0.001	0.000	1	0	1	0	0	-174	0	-235
21	-3.60	0.001	0.000	0	-0	0	-0	0	0	0	0

Summary of results (continued)

Calculated Bending Moments and Strut Forces have been multiplied by a factor of 1.35 to obtain values for structural design.

Maximum and minimum bending moment and shear force at each stage

Stage	Bending moment						Shear force					
no.	Calculated				Factored		Calculated				Factored	
	max.	elev.	min.	elev.	max.	min.	max.	elev.	min.	elev.	max.	min.
	kN.m/m		kN.m/m		kN.m/m		kN/m		kN/m		kN/m	kN/m
1	0	-3.00	-0	-2.15	0	-0	0	-0.20	0	0.00	0	0
2	No calculation at this stage											
3	No calculation at this stage											
4	38	-1.20	-0	-3.60	51	-0	42	-1.20	-31	-1.20	56	-42
5	38	-1.20	-0	-3.60	51	-0	42	-1.20	-31	-1.20	56	-42
6	38	-1.20	-0	-3.60	51	-0	42	-1.20	-31	-1.20	56	-42
7	51	-1.20	-0	-3.60	68	-0	54	-1.20	-40	-1.20	74	-54
8	59	-1.20	-0	-3.60	79	-0	62	-1.20	-44	-1.20	84	-59
9	59	-1.20	-0	-3.60	79	-0	62	-1.20	-44	-1.20	84	-59
10	No calculation at this stage											
11	60	-1.20	-0	-3.60	81	-0	64	-1.20	-39	-1.20	87	-53
12	60	-1.20	-0	-3.60	81	-0	64	-1.20	-39	-1.20	87	-53
13	No calculation at this stage											
14	60	-1.20	-0	-3.60	81	-0	64	-1.20	-39	-1.20	87	-53
15	60	-1.20	-0	-3.60	81	-0	64	-1.20	-39	-1.20	87	-53
16	62	-1.20	-0	-3.60	83	-0	65	-1.20	-46	-1.20	88	-61
17	15	-3.20	-9	-1.60	20	-12	35	-3.20	-67	-3.40	47	-90
18	36	-3.20	-0	-3.60	49	-0	40	-3.20	-174	-3.40	54	-235

Maximum and minimum displacement at each stage

Stage no.	Displacement				Stage description
	maximum	elev.	minimum	elev.	
	m		m		
1	0.000	-3.60	-0.000	0.00	Excav. to elev. 0.00 on PASSIVE side
2	No calculation at this stage				Install strut no.1 at elev. -0.20
3	No calculation at this stage				Install strut no.2 at elev. -1.20
4	0.001	-3.60	-0.000	0.00	Excav. to elev. -1.30 on PASSIVE side
5	0.001	-3.60	-0.000	0.00	Apply water pressure profile no.1
6	0.001	-3.60	-0.000	0.00	Excav. to elev. -1.30 on PASSIVE side
7	0.001	-3.60	-0.000	0.00	Excav. to elev. -1.80 on PASSIVE side
8	0.001	-3.60	-0.000	0.00	Apply water pressure profile no.3
9	0.001	-3.60	-0.000	0.00	Excav. to elev. -1.80 on PASSIVE side
10	No calculation at this stage				Install strut no.3 at elev. -2.30
11	0.001	-3.60	-0.000	0.00	Excav. to elev. -2.80 on PASSIVE side

12	0.001	-3.60	-0.000	0.00	Excav. to elev. -2.80 on PASSIVE side
13	No calculation at this stage				Install strut no.4 at elev. -3.40
14	0.001	-3.60	-0.000	0.00	Excav. to elev. -3.60 on PASSIVE side
15	0.001	-3.60	-0.000	0.00	Fill to elev. -3.20 on PASSIVE side
16	0.001	-3.60	-0.000	0.00	Remove strut no.3 at elev. -2.30
17	0.001	-3.60	-0.000	0.00	Remove strut no.2 at elev. -1.20
18	0.002	0.00	0.000	0.00	Remove strut no.1 at elev. -0.20

Summary of results (continued)

Calculated Bending Moments and Strut Forces have been multiplied by a factor of 1.35 to obtain values for structural design.

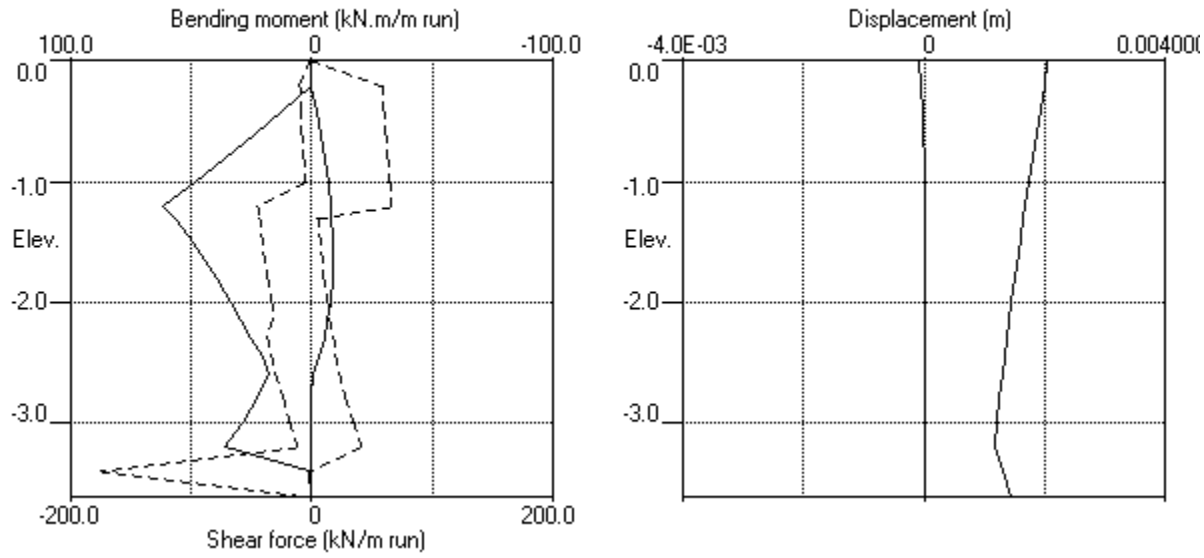
Strut forces at each stage (horizontal components)

Stage no.	Strut no. 1 at elev.-0.20			Strut no. 2 at elev.-1.20			Strut no. 3 at elev.-2.30		
	--Calculated-- kN per m run	Factored kN per strut	Factored kN per strut	--Calculated-- kN per m run	Factored kN per strut	Factored kN per strut	--Calculated-- kN per m run	Factored kN per strut	Factored kN per strut
4	-35	-35	-48	73	73	99	---	---	---
5	-35	-35	-48	73	73	99	---	---	---
6	-35	-35	-48	73	73	99	---	---	---
7	-48	-48	-65	94	94	127	---	---	---
8	-56	-56	-75	106	106	143	---	---	---
9	-56	-56	-75	106	106	143	---	---	---
11	-58	-58	-78	103	103	139	14	14	19
12	-58	-58	-78	103	103	139	14	14	19
14	-58	-58	-78	103	103	139	14	14	19
15	-58	-58	-78	103	103	139	14	14	19
16	-59	-59	-79	111	111	150	---	---	---
17	11	11	14	---	---	---	---	---	---

Stage no.	Strut no. 4 at elev.-3.40		
	--Calculated-- kN per m run	Factored kN per strut	Factored kN per strut
14	1	1	2
15	1	1	1
16	-3	-3	-4
17	-60	-60	-81
18	-167	-167	-225

Units: kN,m

Bending moment, shear force, displacement envelopes



Appendix J Tree Survey Report

Pre-development Arboricultural Survey and Report

Land at 12 Platts Lane, Hampstead London NW3 7NR

A report to: Orly Weinberger, 12 Platts lane NW3 7NR

Date: 9th June 2016

Report No: WAS42/2016 REV1

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Report Verification

This study has been undertaken in accordance with British Standard 5837:2012 “Trees in relation to design, demolition and construction - Recommendations”.

Disclaimer

The contents of this report are the responsibility of Wassells Arboricultural Services Ltd. It should be noted that, whilst every effort is made to meet the client’s brief, no site investigation can ensure complete assessment or prediction of the natural environment.

Wassells Arboricultural Services Ltd accepts no responsibility or liability for any use that is made of this document other than by the client for the purposes for which it was originally commissioned and prepared.

Validity of Data

The findings of this study are valid for a period of 12 months from the date of survey. If works have not commenced by this date, an updated site visit should be carried out by a suitably qualified and experienced arboriculturist to assess any changes to the trees and groups on site and to inform a review of the conclusions and recommendations made.

It should be noted that trees are dynamic living organisms that are subject to natural changes as they age or are influenced by changes in their environment. As such following any significant meteorological event or changes in the growing environment of the trees they should be re-assessed by a suitably qualified and experienced arboriculturist.

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Introduction and Scope of Report

This document has been produced to provide a detailed survey of trees that could be affected by the proposed development and that are within, surrounding and nearby to this reports site demise.

The scope of this report follows the recommendations and guidance described within ***BS 5837: 2012 Trees in Relation to Design, Demolition and Construction – Recommendations*** which sets out the principles and procedures to be applied to achieve a harmonious and sustainable relationship between trees and structures.

The report will assess the quality, amenity and landscape value of all surveyed trees as described by the tree category system within BS 5837 (see section below).

The protection of all trees to be retained and where they are likely to be affected by the proposed development construction activities are described as provisional tree protection measures for information purposes only and shall require a site specific AMS once final plan are agreed.

The report will also indicate, where necessary, the likely impact the proposals may have on those trees in the future.

The report will also recommend any required tree works to enable access and also to mitigate potential damage from construction activity and for the future well being of the trees concerned.

This is intended to support the planning application for development of this site.

The tree survey for the site can be found in Addendum 3 below

Abbreviations:

RPA = root protection area

CEZ = construction exclusion zone

CWA = construction working area (including materials storage)

AMS = arboricultural method statement

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Arboricultural Impact Assessment

Proximity of Proposed Development to existing Trees

Ref: Addendum 1 -Table 1, Addendum 3

All trees in or near the above site have been surveyed and that information is shown in addendum 3 below.

The proposed development of this site involves the construction of a new basement that extends into a sunken patio at the rear of the property.

There is a good massing of trees along the rear boundary of the site, which act as a good local amenity and screening for the school and playground to the rear of the garden. There is a large and good specimen Ash tree in the eastern rear corner of the site that is a dominant tree within the local area.

None of these trees comprising of T1 to T7 shall be affected by the proposed development.

Tree protection barrier should be erected across the rear garden at 2 metres behind the proposed rear of the sunken patio to protect the trees from construction activity and storage of waste/ materials.

At the front of the property there is a reasonable quality False Acacia T8 growing right in the northern corner within a raised bed. This tree has pushed out the front boundary wall due to proximity and is close to the adjoining property number 14. Some builder's rubble has been stacked around the base of this tree and should be removed ASAP to prevent damage to the stem of the tree.

It is proposed to retain this tree but shall require future pruning for encroachment to the next door property. The proposed basement light well to the front of the property is unlikely to impact the RPA of this tree.

Tree protection barrier for this tree shall be required to prevent any construction activity damage.

Tree Protection Measures (Provisional)

Ref: Addendum 1 & 2

**** These measures shall be seen as provisional for planning purposes and subject to a detailed follow up AMS submission as part of a construction plan once proposals are agreed and to conform to any specific planning conditions made ****

Excavation within RPA of Retained Trees

Ref: Addendum 1

* **Please see addendum 1 section on Excavation within RPA of retained trees.**

None for T1 to T7

Potential for T8 but unlikely to be significant – AS required when excavating the front basement lightwell

Tree Protection Barriers & Construction Exclusion Zone

***Please see specification for tree protection barriers shown below**

Trees T1 to T7 shall be protected as shown in tree survey plan below and using barrier as per figure 3 in addendum 4 below.

Tree T8 shall be protected using barrier as per figure 3 in addendum 4 below and constructed as 3 metre square around the tree on house side.

Ground Protection of Existing Surfaces within Root Protection Area (RPA) of Retained Trees

Ref: Addendum 1

* **Please see addendum 1 section on Ground Protection System**

Tree T8 to be protected using existing hard paving during construction phase

Access Facilitation Pruning & Tree Works

Ref: Addendum 2

Recommended tree works are shown in the end column of addendum 3 below

Site Access and Construction Working Area (CWA)

CWA to be outside of tree barriers and CEZ

Site Storage and Accommodation

Not within the RPA of retained trees.

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Installation of Services

Arrangements for this element of the development of the site are unknown as at time of writing this report but are likely to remain as existing.

Changes to the service routes will be carefully considered using the AS below to advise on protection of nearby trees prior to commencement on site.

Arboricultural Supervision (AS)

AS shall be required during work within and adjacent to the RPA of retained trees. It must be undertaken at regular intervals with a written record of the meetings maintained with suitable photographic record in support.

The AS must include a pre-construction commencement site visit, to be arranged by the Site Manager under instruction from Architects, and thereafter at specific events that affect the retained trees on site to enable sign-off by the AS. These are typically as follows:

1. Erection of tree protection fencing
2. Installation of ground protection to retained trees whose RPA are effected by the CWA
3. Start of Excavation/piling of foundations within the RPA of retained trees
4. Tree pruning requirements to prevent crown damage from construction activity
5. Start of Excavation/installation of paths, roads and car parking within RPA of retained trees
6. Installation of underground services within the RPA of retained trees
7. Tree condition survey on completion of construction work

Conclusion

Provided the recommendations shown above and the methodology for protection of any retained trees are followed, there will not be an effect on the current or future condition of those trees that are retained as part of the proposed scheme.

Tree Grading Categories

Ref: Grading Category as per BS 5837:2012 Section 4.5 Table 1 & Table 2 – Tree quality assessment chart. Tree Survey Schedule in Addendum3 below for description of trees categorized

The grading categories are based on the following criteria:

A= those trees of high quality and value suitable for retention for longer than 10years and worthy of being a material constraint to development

B= those trees of moderate quality and value suitable for retention for longer than 10years and worthy of being a material constraint to development

C= those trees of low quality and not worthy of being a material constraint to development

U=trees of such a condition that they cannot realistically be retained as living trees in the context of the current land use

NG = not graded. Those trees not considered to be in any of the above categories

Categories A, B and C have further sub-categories (not qualified in BS) with regards to the reasons for tree retention as follows:

1: Mainly arboricultural qualities.
2: Mainly landscape qualities.
3: Mainly cultural values, including conservation.

Trees categorized within this report:

1 Category A trees = T1

2 Category B trees = T8

3 Category C trees = T3, T4 and T6

4 Category U trees = T2, T5 and T7

5 NG = none

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Age Categories and Distribution

Those trees assessed as being young (Y) in age can generally be considered to have significant growth potential. Whilst these specimens are not likely to make a substantial contribution to the landscape character of the site at present they will, if retained, provide succession for the eventual removal of mature or over- mature trees as a result of declining physiological or structural condition.

Semi mature trees (SM) will generally make a significant contribution to the landscape character and appearance of the site and their retention will provide more immediate succession. These trees will also have significant growth potential.

Mature trees (M) are not considered to have significant future growth potential and have generally reached their maximum expected size for the location. These trees will generally make the highest contribution to the landscape contribution of the site however a tree stock over dominated by mature trees will require careful management to ensure that continuation of canopy cover can be achieved.

Over-mature trees (OM) do not have the potential to increase in size and may in fact reduce in size as their crowns begin to break up. These trees will often make a significant contribution to the landscape character of the site and are likely to have ecological value. However the retention of these trees within new development must be carefully planned as they are approaching the end of their useful life expectancy and they will often have structural defects. Where over-mature trees are to be retained in new development it is essential that access is available for their eventual removal.

Veteran trees (V) are those that show features of biological, cultural or aesthetic value that are characteristic of an individual surviving beyond the typical age range for the species. These trees have negligible potential to increase in size. Veteran trees are usually of a high ecological value and they will require sensitive management where they are to be retained in new development. As such it is again essential that they are located in areas where access is available to undertake management operations and where there is a reduced risk of harm occurring from failure of the trees.

References

1. BS 5837:2012 Trees in Relation to Design, Demolition and Construction - Recommendations
2. BS3998:2010 Tree Work – Recommendations
3. NJUG Volume 4 Issue2 2007 – Guidelines for the planning, installation and maintenance of utility apparatus in proximity to trees.
4. NHBC Standards – Section 4.2 Building Near Trees
5. British Geological Survey – London & the Thames Valley
6. Principles of Tree Hazard Assessment – Lonsdale 2001
7. Diagnosis of Ill Health in Trees – Stouts & Winter 2004
8. Tree Survey Plan – at end of report
9. Existing and proposed plans – XUL Architecture drawings 1610 suite

Declaration

This Tree Survey, Impact Assessment and provisional tree protection measures have been written and checked by Richard Wassell of Wassells Arboricultural Services Ltd. and are provided without prejudice as an objective and professional assessment of the trees described.

Signed: R.J.Wassell Date: 09.06.MMXVI

Richard Wassell. Director

MCIHort MArborA NDArb (RFS) Kew Diploma NEBOSHlevel3

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Addendum 1 – Tree Protection

Ref: BS 5837:2012 in Tables C.1 & D.1of annex C & D

Table 1 -Tree protection measurements

Tree Number As per tree survey plan & schedule	Stem Diameter @ 1.5 metres agl. Millimetres	Root Protection Area (RPA) - Radius *measured from centre of stem* Metres	Tree/Root Protection Area (RPA) Sq. Metres	Comment and potential affect of building proposal on the total RPA
T1	900	10.8	366	Not affected
T2	200	2.4	18	Proposed for removal
T3	275	3.3	34	Not affected
T4	450	5.4	92	Not affected
T5				Dead
T6	300	3.6	41	Not affected
T7	250	3	28	Proposed for removal
T8	400	4.8	72	Not affected. AS required when excavating front light well

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Protecting Root Zone of Trees (BS 5837:2012 section 6.2 Figs. 2 & 3):

The Root Protection Area (RPA)

This is the area surrounding a tree that is deemed to contain sufficient roots and rooting volume to maintain the trees viability in the future. The root system is typically concentrated in the uppermost 600 – 1200mm of the soil and is not necessarily symmetrical around the tree, being dependant on a number of factors such as water, nutrients, oxygen, soil penetrability and physical obstructions such as existing foundations or changes in level (terracing).

The RPA is a design layout tool that is deemed to be a minimum area around a tree where the protection of roots and soil structure are treated as a priority. This area is envisaged as and portrayed with a circle around each tree but where there appears to be restrictions to root growth the circle is reshaped to reflect more accurately the likely distribution of the rooting area of the tree concerned.

Key Points

1. AVOID building works within the RPA if at all possible but if not then carefully consider the following: where the RPA is likely to be severely affected because of site design constraints then felling and planting replacement(s) trees in a more suitable location on the site will need to be considered.
2. Where possible do not use strip foundations within the RPA, if absolutely necessary consider using a trenching saw or excavate by hand to avoid 'shatter damage' to the root system.
3. Consider using piling techniques for foundations @ maximum 350 mm diameter with ground beams on or above the surface of the root zone.
4. Unless unavoidable, do not exceed entering the root zone by more than one fifth of RPA radius.
5. Do not trench tangentially across the root zone for footings and services unless it cannot be avoided.
6. Consider 'no dig' techniques for services installation, with radial service lines being preferable to tangential across the root zone. Where this is undertaken then boring must be carried out below 600mm deep.
7. Any hard surfacing, paths and roads need to have the same considerations for the RPA and as in the above points. Where possible paths and hard surfacing (patios etc) need to be surface constructed (cellular) and semi-porous to allow water penetration and gaseous exchange into the root system of trees.

Excavation within Root Protection Area of trees

Where trees are to be retained then any proposed foundation, underground services work and hard surfacing such as roads/paths falling within the RPA of trees that are to be retained shall be kept as far away from tree stems as possible(SEE NOTE 1 ABOVE). Where any such works are necessary within the RPA there will be a requirement to dig carefully by hand and ensure any roots encountered of maximum 25mm in diameter shall be exposed and correctly pruned back by a competent Arborist. Where larger roots are encountered of above 25mm in diameter then advice from the Arboricultural Supervisor (AS) for the site must be sought prior to any work being undertaken.

Any roots exposed/ pruned back as part of the above operation shall NOT be left exposed to drying out. All roots exposed/pruned shall be either covered with damp Hessian sacking prior to backfill or backfilled/covered immediately with a suitable open and free draining compost/loam.

Site Hoarding

Site hoarding shall be no closer than 1.5 metres away from the stem of retained trees and consist of 20mm plywood sheets supported by minimum 100mm square posts and 100 x 50mm rails with posts at 2.5 metre centres.

Post holes for site hoarding that are required within the RPA of nearby trees shall be dug by hand and are to be a maximum of 300 x 300mm and 450mm deep

Ground Protection System Specification:

- Level area of RPA concerned by blinding with sharp sand at maximum depth of 50mm
- Lay geo-textile membrane such as 'Terram' to cover area concerned
- Cover geo-textile with maximum of 100mm MOT Type 1 sub-base
- Retain MOT type 1 with edge restraint such as 30 x 100mm edging board pegged every 2 metres to prevent migration of the sub-base

Addendum 2 – Tree Works

Ref: Addendum 3

Schedule of Tree Works

1. All proposed tree removal and tree pruning works are described in the management recommendations of the tree survey in addendum 3

2. Tree work to be carried out to the following standards and guidelines:

   - BS 3998:2010 Recommendations for Tree Work

   - Tree pruning cuts will be carried out using the 'Natural Target Pruning' technique as defined by: *BS 3998:2010 section 7.2.5 and Fig. 2 The Pruning of Trees, Shrubs and Conifers: George E. Brown & Tony Kirkham – 2nd edition revised & enlarged 2004 and Section 3.1.27 of The Arboricultural Association Specification for Tree Works June 2008.*

   - Crown clean involves removal of dead, diseased & dying wood from tree crown, thinning of overcrowded crown, and removal of Ivy and all epicormic growth within crown including stem & basal epicormic growth.

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Addendum 3 - Schedule of Tree Survey Information – BS5837:2012 section 4.4

SITE: 12 Platts Lane NW3 7NR DATE: 26th May 2016

Tree Number	Species	Diameter Class mm	RPA radius metres	Height metres	Crown Spread metres	Crown height	Age Class	Grading Category	Estimated Life Expectancy	Structure	Physiology, Condition & other factors	Management recommendation
1	Common Ash	900	10.8	25	N= S= E= W=	L/M	M	A2	>30	G	A Good specimen with wide spreading canopy. Some deadwood	RETAIN CC
2	Elderberry	200	2.4	5		L	M	U		P	Leaning towards the house and suppressed by T1	REMOVE
3	Norway Maple	275	3.3	12	N= S= E= W=	M	SM	C2	>10	M	A Twin stem from 2 metres	RETAIN CC and remove Ivy
4	False Acacia	450	5.4	12	N= S= E= W=	M	M	C2	>10	M	A Ivy clad stem and leaning out over school playground to the rear	RETAIN CC and remove Ivy
5	Cherry							U		P	Dead	REMOVE
6	Silver Birch	300	3.6	12	N= S= E= W=	M	M	C2	>10	M	A Ivy clad stem and lower crown	RETAIN CC and remove Ivy
7	Elderberry	250	3	6		L	M	U		P	Twin stem from 1 metre	REMOVE
8	False Acacia	400	4.8	11	N= S= E= W=	M	M	B2	>20	M	A Growing in raised bed right in the corner of front boundary wall with next door. Wall has been pushed out over pavement and damaged. Crown v. close to No. 14 next door. Deadwood	RETAIN CC RC on No. 14 side by 2M and balance

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TREE SURVEY KEY:

Tree Number and Species = number of tree on plan and Common Name as per reference book: A Field Guide to the Trees of Britain and Northern Europe by Alan Mitchell 1974 ISBN: 0 00 219213 6

Height = estimated height of tree from surrounding ground level +/- 3 metres

Diameter Class = diameter of main stem @ 1.5 metres above ground level

Crown Spread = maximum extent of branches measured radially from the base of the tree, trees with asymmetrical crowns are shown with distances in relation to compass points. N = north etc.

Crown Height = height of canopy and/or first major branch above ground level. Low (L) = below 3 metres | Medium (M) = 3 to 6 metres | High (H) = above 6 metres

Age Class = Young(Y): age less than 1/3rd life expectancy | Semi-mature(SM): 1/3rd to 2/3rd life expectancy | Mature (M): Over 2/3rd life expectancy | Over mature (OM): mature and in state of decline | Veteran (V): Surviving beyond typical age range for species

Grading Category: As per BS 5837:2012 Table 1 – Tree quality assessment, which refers to tree quality and landscape/amenity value; A=high, B=moderate, C=low, U = not suitable for retention, NG= not graded

Estimated Life Expectancy = estimated useful and remaining contribution to the site in years

Structure = structural condition of the tree based on roots, trunk, and major stems/branches along with the presence of any structural defects and decay organisms. Categories are: Very Good (VG); Good (G); Moderate (M); Poor (P); Hazardous (H)

Physiology/Condition = Overall health, condition and function of the tree in comparison to a 'normal' specimen of its species and age. Categories are: Above average (AA); Average (A); Declining (D)

Other factors = any other physical/environmental factors that could influence the tree now/in the future

Management Recommendations: N = no work required**. CC** = removal of dead, diseased & dying wood from tree crown, thinning of overcrowded crown, removal of Ivy from crown & stem and removal of all epicormic growth within crown including stem & basal epicormic growth on Lime trees.**LC** = lift crown. **TC** = thin crown. **RC** = reduce crown. **P** = pollard. **SP** = scaffold pollard. **RE** = remove epicormic and basal growth. **FP** = Formative prune **F** = fell to ground level. **FG** = fell and grind out stump. **R** = carry out replacement planting. **AI** = 3 yearly Arboricultural inspection

RPA radius = radius of typical root protection area, described as a circle and measured around centre of the tree

N/K = not known

 # = estimated data

NDG = Next door garden

g.l. = ground level

Alan Mitchell System = Estimate of tree age based on open grown tree with full crown. Age in years = Girth (circumference) in centimetres measured at 1.5 metres above ground level and divided by 2.5 i.e. Tree of girth 250 cm = 100years old

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Email: office@wassells.co.uk
www.wassells.co.uk

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Addendum 4 – Tree Protection Barriers and Tree Care Flow Chart

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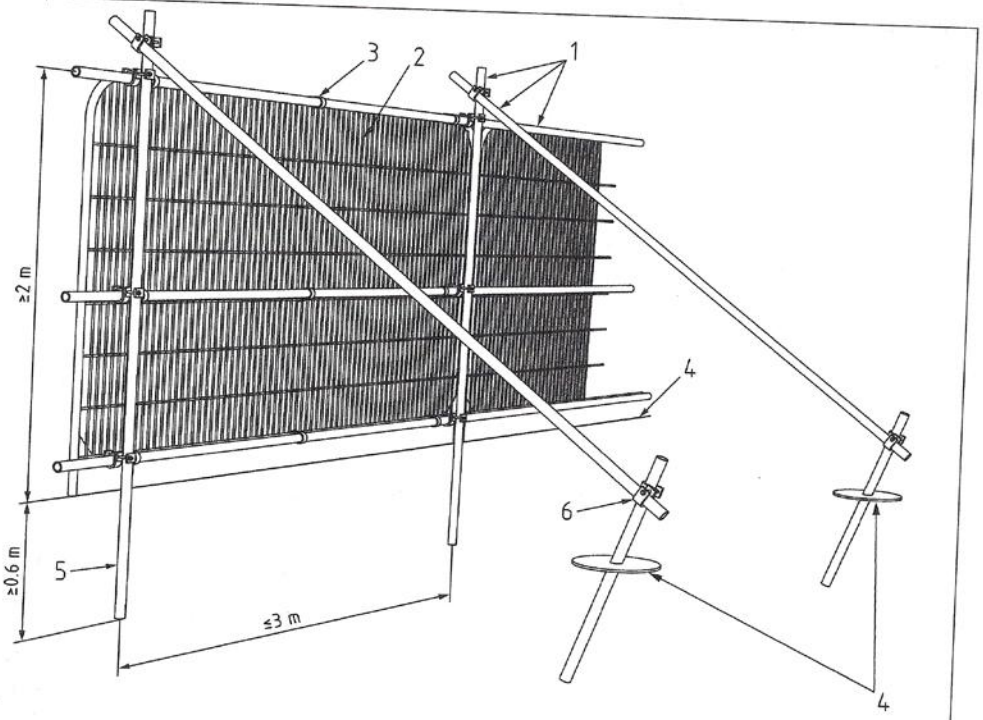
6.2.2.4 All-weather notices should be attached to the barrier with words such as: "CONSTRUCTION EXCLUSION ZONE – NO ACCESS".

Figure 2 **Default specification for protective barrier**



Key

1 Standard scaffold poles
2 Heavy gauge 2 m tall galvanized tube and welded mesh infill panels
3 Panels secured to uprights and cross-members with wire ties
4 Ground level
5 Uprights driven into the ground until secure (minimum depth 0.6 m)
6 Standard scaffold clamps

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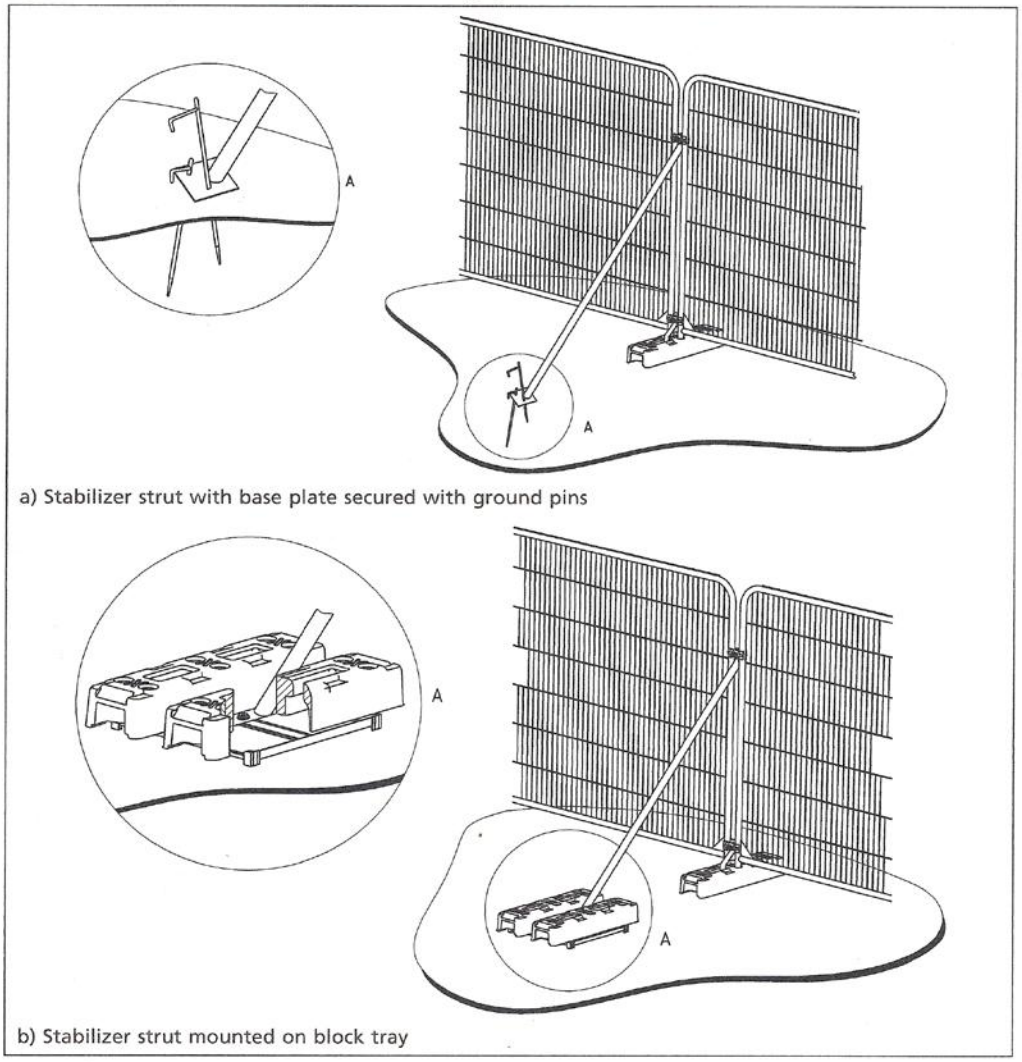
Figure 3 **Examples of above-ground stabilizing systems**



a) Stabilizer strut with base plate secured with ground pins

b) Stabilizer strut mounted on block tray

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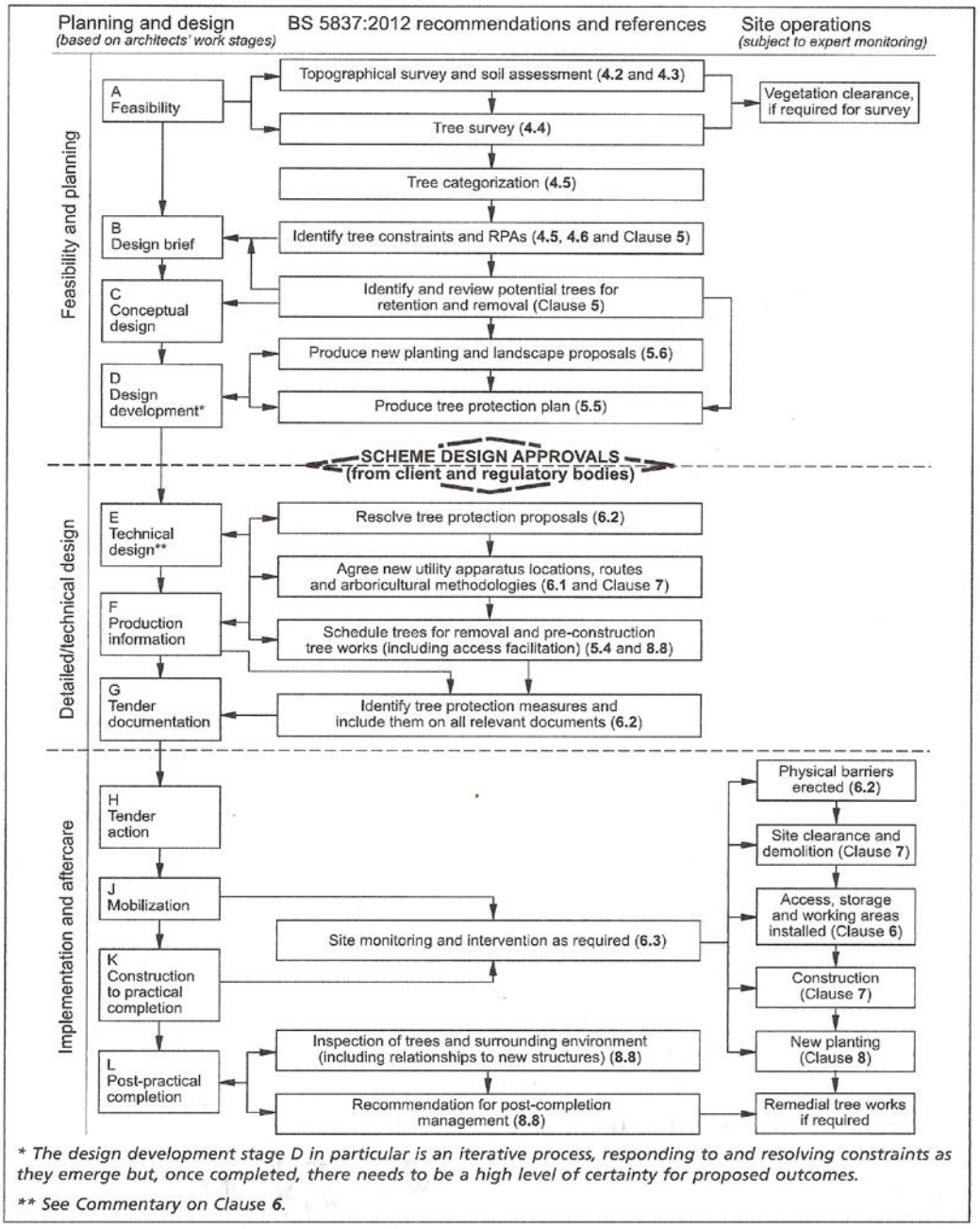
Figure 1 **The design and construction process and tree care**



** The design development stage D in particular is an iterative process, responding to and resolving constraints as they emerge but, once completed, there needs to be a high level of certainty for proposed outcomes.*

*** See Commentary on Clause 6.*

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Addendum 5 – Plans and Picture Gallery

*Proposed and existing site plans
*Tree survey details
*Tree protection measures

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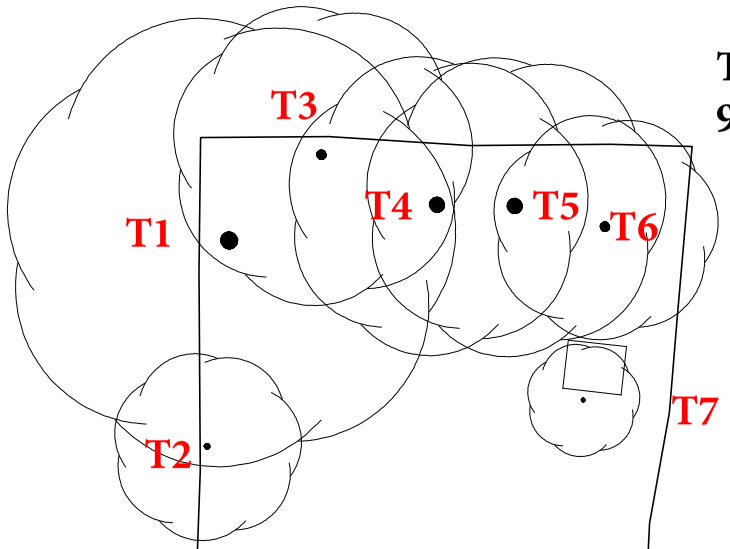
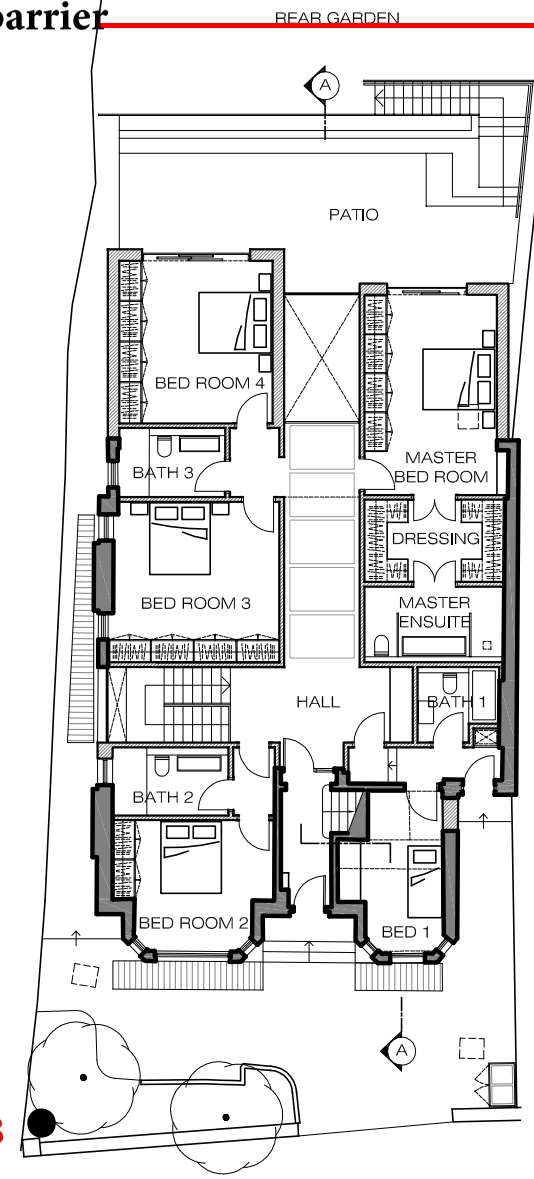
Tree Survey Plan Overlay
9th June 2016

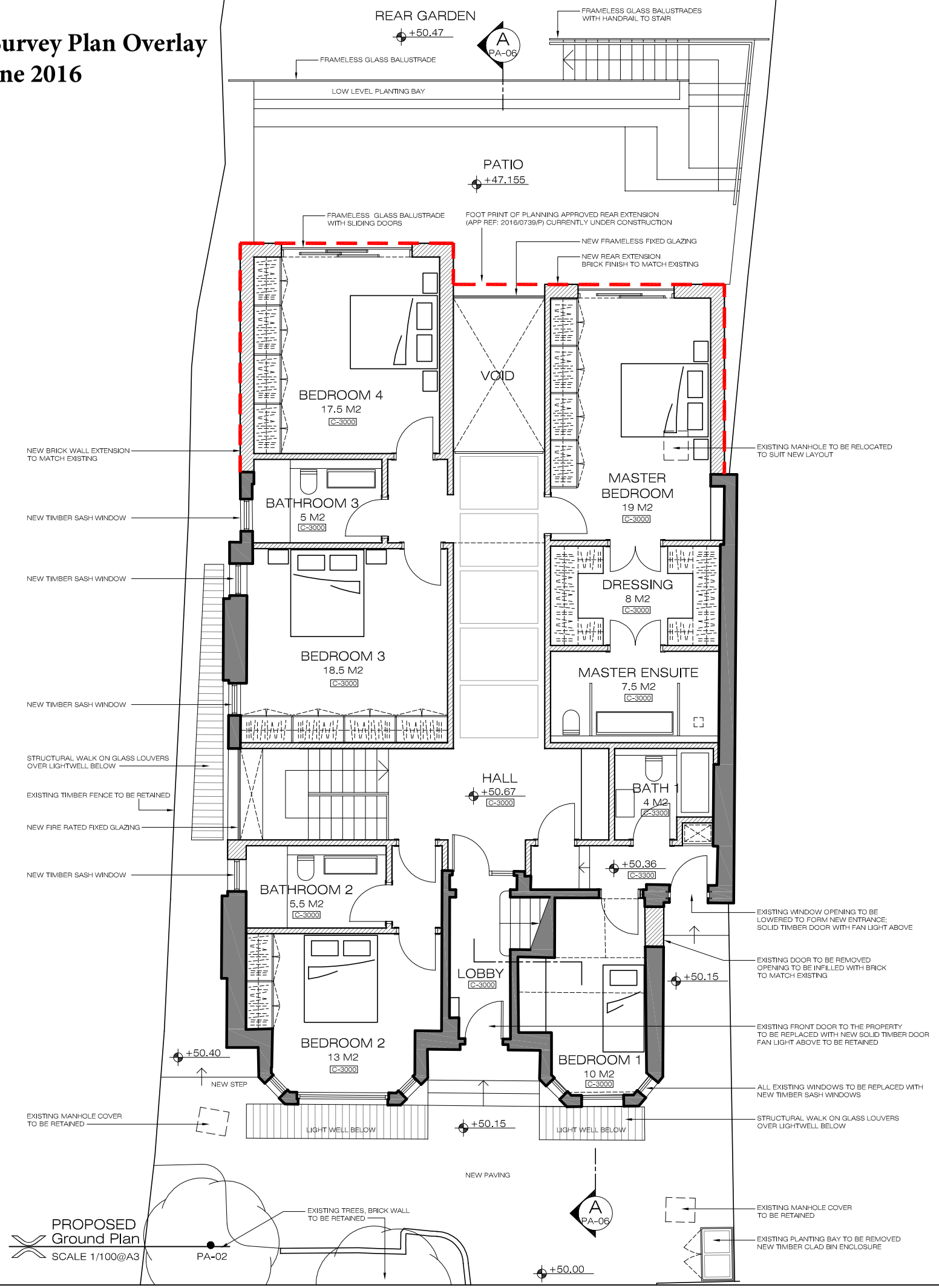


Tree protection barrier



PROPOSED
Ground Plan
SCALE 1/200@A3 PA-02

0 2 4 6 8 10m



PROPOSED
Ground Plan
SCALE 1/100@A3 PA-02

XUL ARCHITECTURE

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33 Belsize Lane
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PLEASE NOTE:

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ADDITIONAL NOTES:

REVISIONS

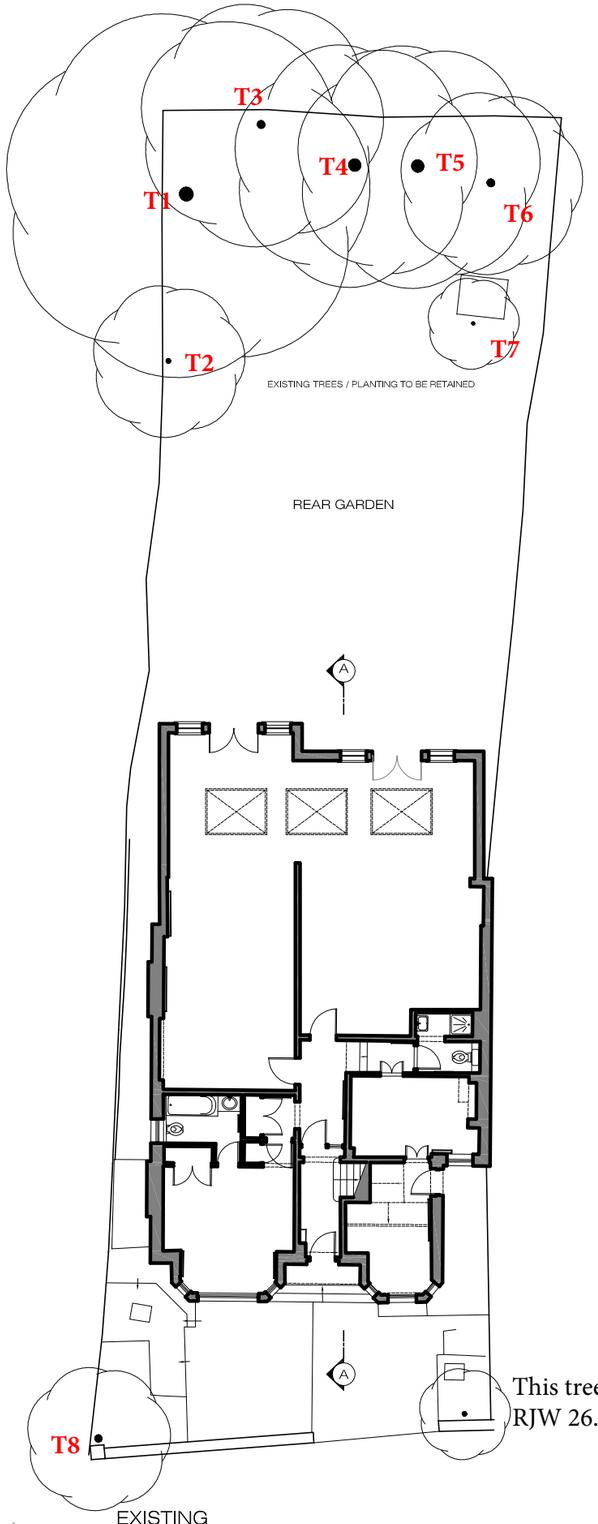
No	Date	Description Issue For	Issue By
00	25/05/16	INFORMATION	JH
01	26/05/16	INFORMATION	JH
02	27/05/16	INFORMATION	JH
03	01/06/16	INFORMATION	JH

Client
PRIVATE CLIENT

Project
12 Platt's Lane
NW3 7NR

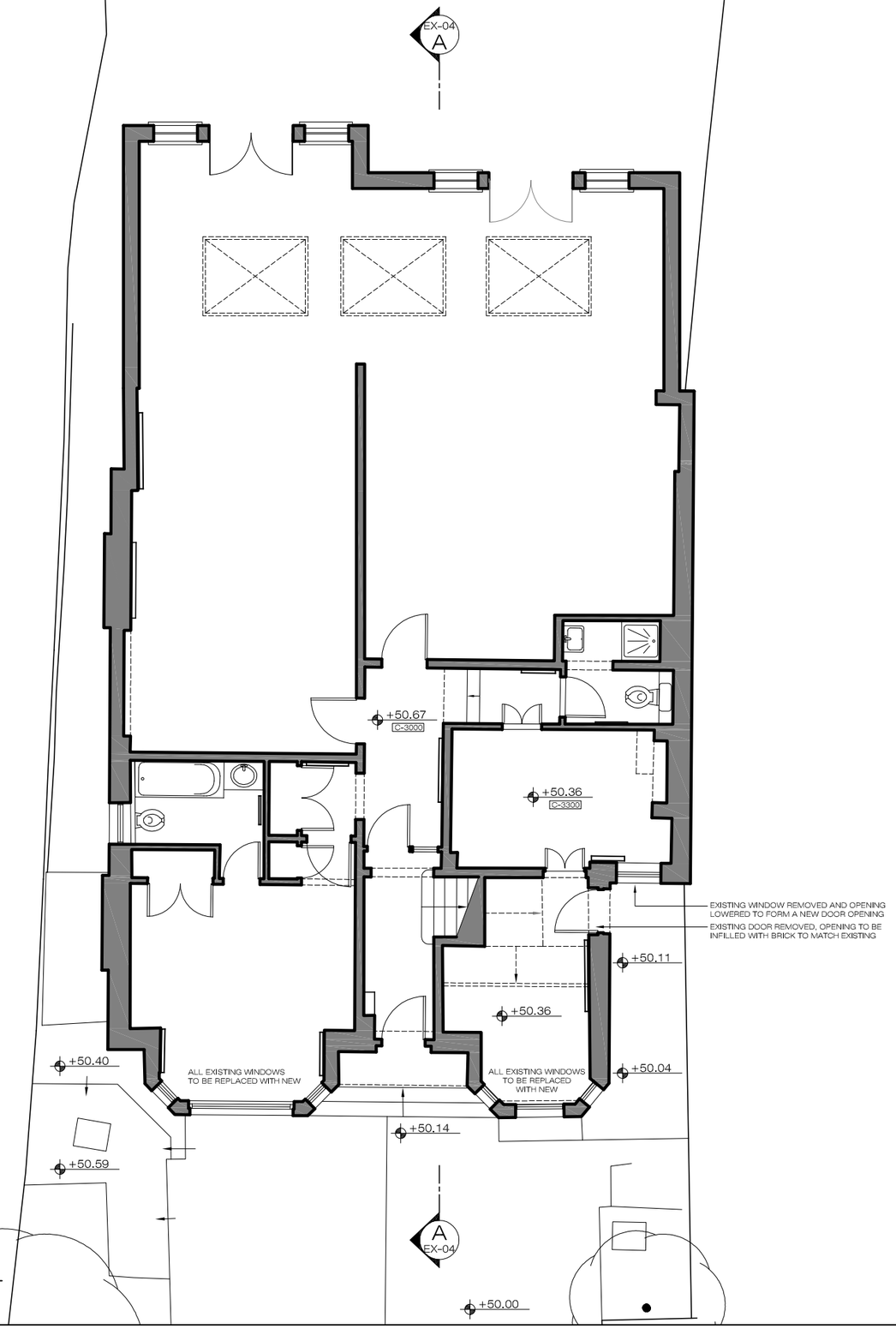
Title
PROPOSED
Ground Floor Plan

Scale 1/100@A3	Dwg. No. PA-02	Rev. 03
Date 24/05/16		
Drawn JH	Project Number 1610	
Checked CC		



EXISTING
Ground Floor Plan
SCALE 1/200@A3 EX-01

0 2 4 6 8 10m



EXISTING
Ground Floor Plan
SCALE 1/100@A3 EX-01

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ADDITIONAL NOTES:

REVISIONS

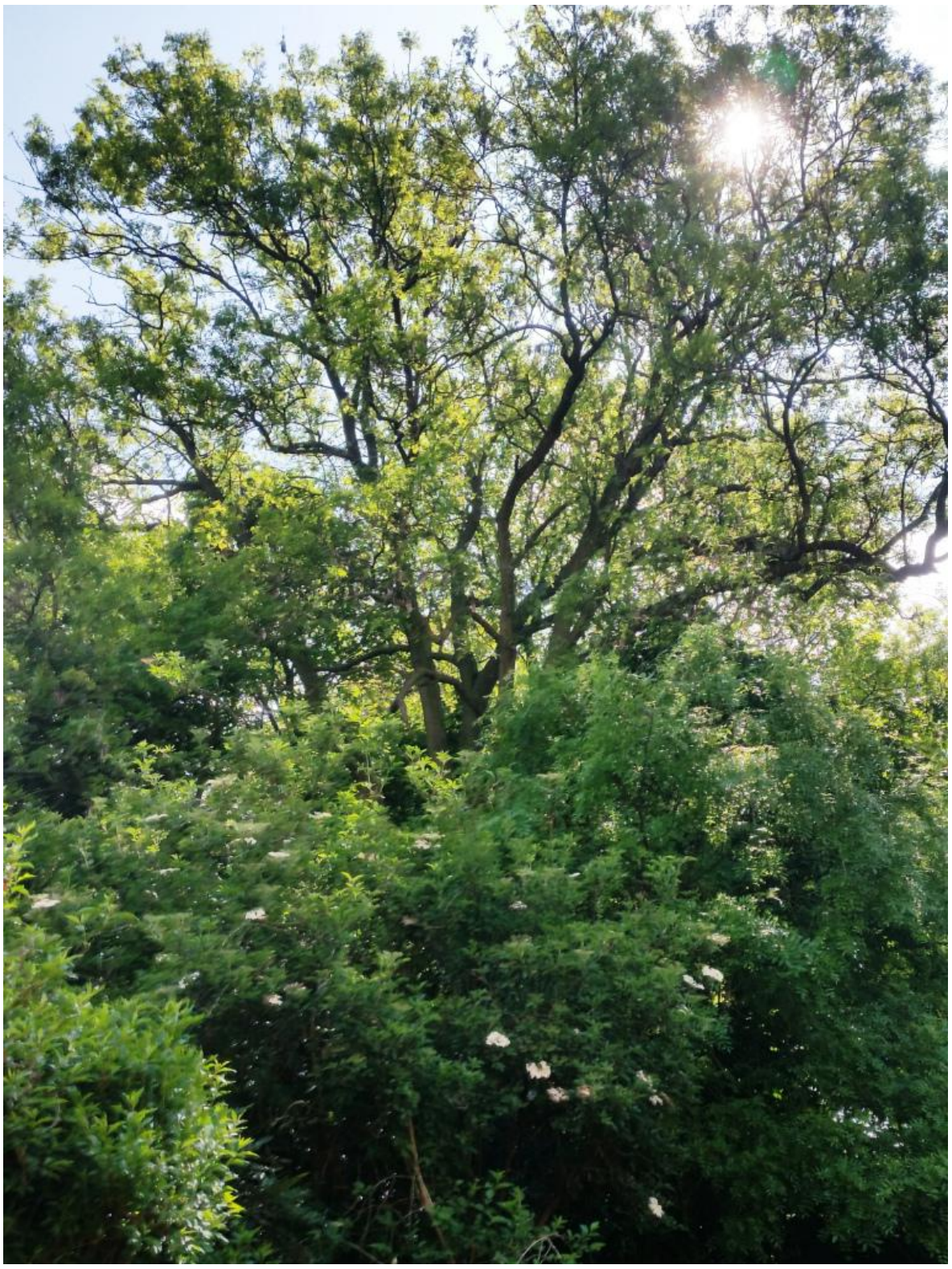
No	Date	Description Issue For	issue By
00	25/05/16	INFORMATION	JH
01	27/05/16	INFORMATION	JH
02	03/06/16	INFORMATION	JH
03	07/06/16	INFORMATION	AM

Client
PRIVATE CLIENT

Project
12 Platt's Lane
NW3 7NR

Title
EXISTING
Ground Floor Plan

Scale	Dwg. No.	Rev.
1/100@A3	EX-01	03
Date 07/06/16		
Drawn JH	Project Number 1610	
Checked CC		



Ash tree T1 from rear of house

View of rear of garden trees from house

False Acacia T8 with front of number 12 on RHS

Appendix K Programme of Works

Aleck Associates Ltd, 707 High Road London N12 0BT	Job no. 2956	
Site: 12 Platts Lane London NW3 7NR	By: SIA	Date: 1 July 2016.
PROVISIONAL PROJECT PROGRAMME	Version: 0.1	

		weeks	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50
1	Set up site																																																		
2	Gantry		erect																			strike																														
3	Strip out ground floor																																																	
4	First floor beams																																																	
5	Excavation phase 1	*400m3*																																																
6	Sequential walls 1	*50 lin m*																																																
7	Excavation phase 2	*900 m3*																																																
8	Sequential walls 2	*50 lin m + slab*																																																
9	Complete slab																																																	
10	Piled walls lining	*20 lin m*																																																
11	Ground floor																																																	
12	Waterproofing																																																	
13	Superstructure works	*structural*																																																
14	Finishing and decoration	*basement*																																																
15	do.	*ground*																																																
16	do.	*first*																																																
17	do.	*second*																																																
18	do.	*exterior*																																																
19	do.	*external works*																																																
20	Snag, c and h/o																																																	
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Appendix L Non-Technical Summary of the BIA

The construction of basements in Central London becomes more frequent and the London Borough of Camden developed a procedure for the authorisation of the construction based upon a series of stages for the estimation of the impact of the basement construction on the built environment.

A Basement Impact Assessment (BIA) must comprise five main stages:

1. Screening;
2. Scoping;
3. Site Investigation and study;
4. Impact Assessment;
5. Review and decision making.

The screening stage was based on a series of queries regarding issues as groundwater flow, land stability and surface flow and flooding and related flowcharts allowing to clarify if the development of a full BIA was needed.

The scoping stage was intended to evaluate the potential impact of the proposed scheme on the built environment in the sites surroundings.

The site investigation and study was intended to determine an understanding of the site and of its immediate surroundings. The understanding should also be based on the results of the screening and scoping stages, but in general comprises a desk study, site walkover, field investigation (including intrusive investigation), monitoring, reporting and interpretation. The site investigation must be able to determine the ground model to be used for further stages of the development of the site.

The basement impact assessment (BIA) was carried out as the proposed development introduced a considerable increase in the differential depth with regards to the foundations of the neighbouring buildings.

The excavation and construction of the basement could potentially induce the development of damages on the neighbouring building due to the development of ground movements remote from the development site.

The geotechnical parameters of the soils involved in the development were evaluated on the basis of the results of the site investigation and on published data.

The geometry and the loads of the proposed development were provided by the Client. The reduction in load at the formation level due to the removal of soils was calculated by applying the soil densities derived from the site investigation to the removed volume of soil derived from the geometry of the development.

The excavation and erection of the basement refer to the Construction Method Statement prepared by the Structural Engineer and provided by the Client. The process introduces the development of both vertical and horizontal movements on site and in the immediate surroundings.

The excavation of the basement will unload the soils at the formation level. The presence of overconsolidated clays implies the development of a certain degree of heave, which will happen in the short term (undrained conditions) and will undergo a further development in the long period.

As the construction proceeds, however, the application of the construction loads will interact with the heave developing in the long term. They will therefore take place on the same time scale and the development of long term heave remains theoretical because of the sequential procedures adopted for the excavation and erection of the underpinning in small bays.

The excavation to the formation level must not be carried out in a single operation, but must be staged to allow the retention of adequate passive resistance of the soils acting on the face of the excavation before the application of temporary propping and the proper construction of the walls.

The excavation of two adjacent bays or in close proximity on the same side of the footprint or on the opposite side of the excavation must not be permitted, as this could destabilise the system and increase the risk for damage to the building, adjacent buildings and of the safety of workers.

The evaluation of heave and/or settlements in the long and in the short term was carried out using the commercial software PDISP. In order to evaluate the vertical deflection induced by excavation and erection on the neighbouring buildings, the vertical movements were calculated along lines linking the outer face of the underpinning with the neighbouring buildings within the zone of influence of the development.

The maximum vertical deflection under the foundations of the neighbouring building must be evaluated in accordance with CIRIA C580. For buildings with adjoining foundations, in general the deflection will be calculated on the movements profile identified from the outer face of the underpinning to the next closest bearing structure. In the case of detached buildings within the zone of influence, the deflection will be evaluated considering the movements profile under the neighbouring buildings themselves.

The software Wallap was used to evaluate the horizontal movements induced on the underpinning and, provoking the formation of further vertical movements due to soil relaxation. The process for the evaluation of the horizontal deflection on adjoining buildings considers the stages needed for the construction sequence. The horizontal deflection on buildings at a distance from the proposed development was undertaken using the correlations from CIRIA C580.

The horizontal strain and the vertical deflection ratio were then calculated according to the procedures reported in CIRIA C580 and combined with reference to the method proposed by Burland (2001) to allow for the evaluation of the expected damage induced by the development on the neighbouring buildings.

The construction of basements is generally acceptable when a maximum category damage 2 (slight) was achieved. However, when the expected damage exceeds a category damage 1 (very slight), mitigation measures must be applied in order to reduce this to a potential category damage 0 (negligible) to preserve the existing buildings, generally identified as brittle and extremely sensitive to ground movements.

When suitable mitigation measures are applied, a further assessment must be carried out to confirm the improvement.

It must be pointed out that the procedure is generally conservative and the real movements and damages induced by the development are typically lower than the calculated values.

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Geotechnical & Environmental Consultants

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