PROJECT: 15A Parliament Hill	TITLE: Piling	JAMES FRITH LTD
Job No: 0273	Date: Feb '17	Designed: JMF	Checked: JMF

CONSULTING CIVIL AND STRUCTURAL ENGINEERS
www.jamesfrithltd.com | office@jamesfrithltd.com

DESIGN PARAMETERS

JOB DESCRIPTION:

- Design of Contiguous Piling for Temp State as Retaining Wall
- " " " " Perm " as Bearing Piles

STANDARDS USED:

EUROCODES:	BRITISH STANDARDS:		HIGHWAYS AGENCY:		BUILDING REGS:	OTHERS:
BS EN 1990 ☑	BS 5268 ☐	BS 5400 ☐	BD 2/12 ☐	BA 41/98 ☐	PART A ☑	Blue Book
BS EN 1991 ☑	BS 5628 ☐	BS 8118 ☐	BD 21/01 ☐	BA 53/94 ☐	PART B ☐	
BS EN 1992 ☑	BS 5950 ☐	BS 8301 ☐	BD 29/04 ☐	BD 30/87 ☐	PART H ☐	
BS EN 1993 ☑	BS 5975 ☐	BS 7818 ☐	BD 37/01 ☑	BD 74/00 ☐	PART K ☐	
BS EN 1994 ☐	BS 6399 ☐	BS 8081 ☐	BD 44/95 ☐	BD 82/00 ☐	PART M ☐	
BS EN 1995 ☐	BS 8002 ☐		BD 42/00 ☐	BD 31/01 ☐		
BS EN 1996 ☐	BS 8004 ☐		TD 19/06 ☐			
BS EN 1997 ☑	BS 8110 ☐		TD 27/05 ☐			

LOAD REQUIREMENTS:

Highway BD37 - 10kN/m²

MATERIALS USED:

TIMBER	☐	GRP/FRP	☐
STEEL	☑	GLASS	☐
CONCRETE	☑		
MASONRY	☐		
ALUMINIUM	☐		

OTHER: -

GEOTECHNICAL:

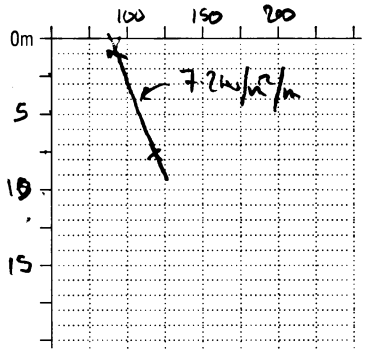
GROUND STRATA LOG: EPS Report

BGS MAP No:

OTHER INFO:

	LEVEL	DESCRIPTION	UNIT WEIGHT	PHI'	c'	Cu	WATER LEVEL
	0.	Made G					
	1m	London Clay	20	23	5	84 -120	-

SHEAR PROFILE:



ASSUMPTIONS:

Vertical Loads Provided by Designer

SIGNATURE:	
DATE:	February 2017
NAME:	JAMES FRITH
TITLE:	DIRECTOR
QUALIFICATIONS:	MEng (Hons) CEng MIStructE FGS
CHECK LEVEL:	I ☑ II III

PROJECT: 15A PARLIAMENT HILL	TITLE: PILING	JAMES FRITH LTD
Job No: 0273	Date: FEB '17	Designed: JMF	Checked: JMF

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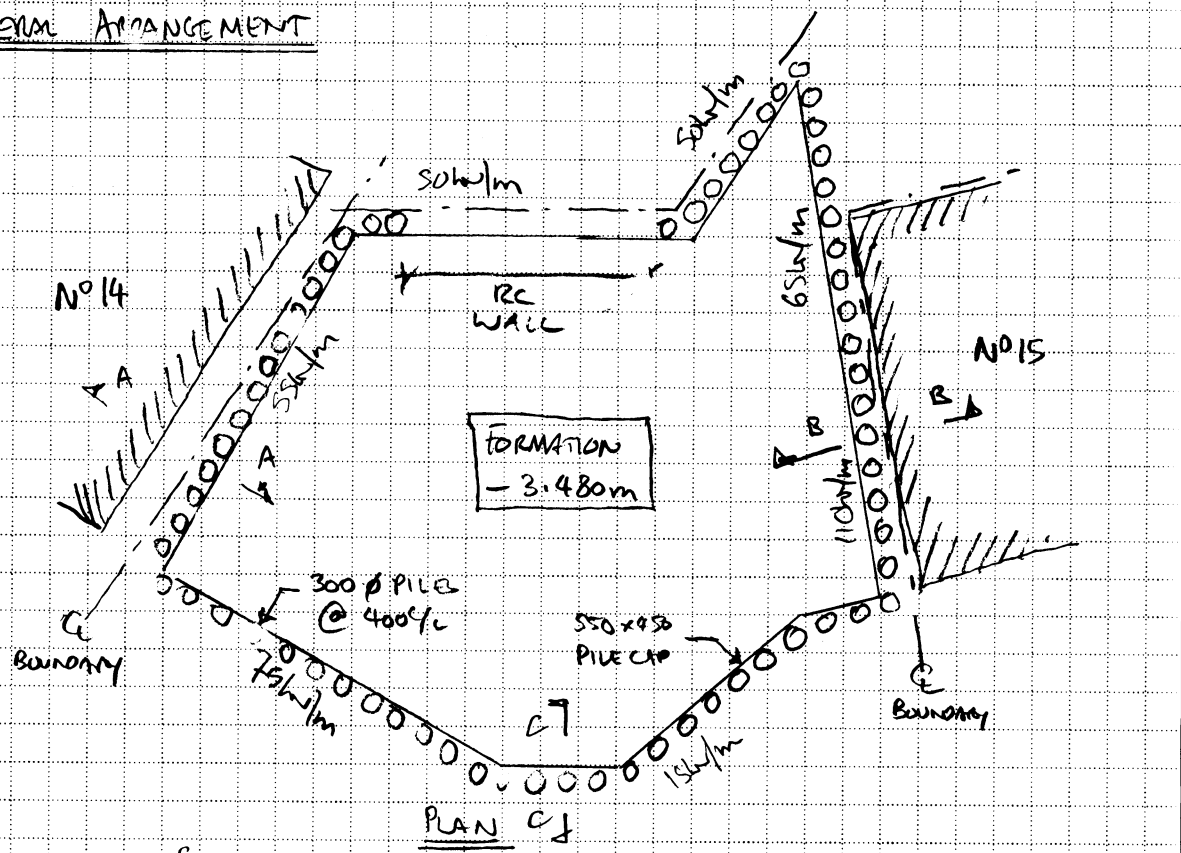
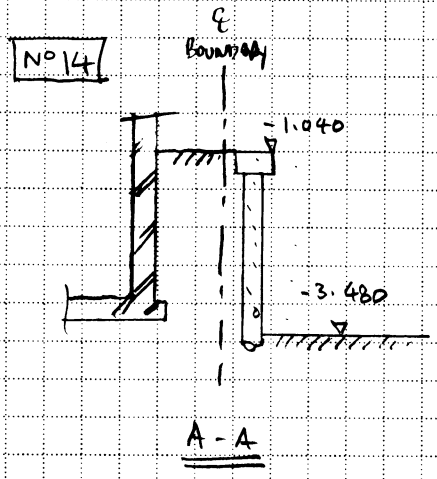
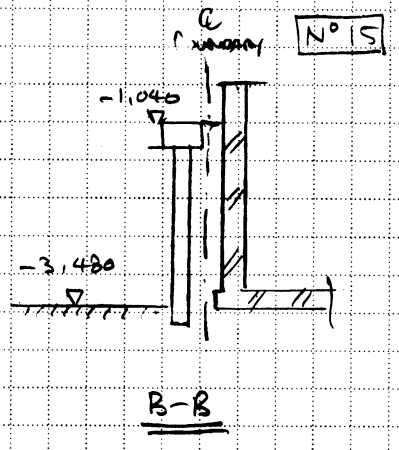
GENERAL ARRANGEMENT

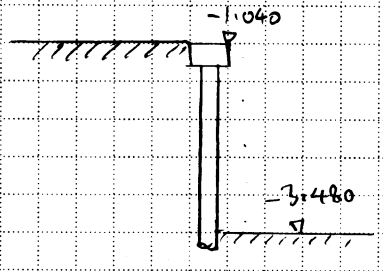




A-A



B-B



C-C

GEOLOGICAL INFORMATION

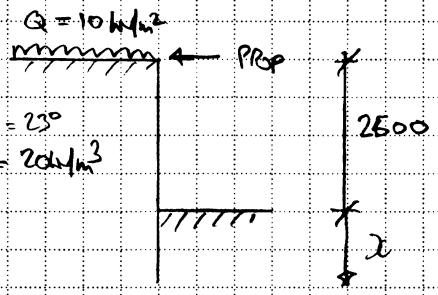
- GEOTECHNICAL DATA DERIVED FROM 'EPS GI REPORT AND BASEMENT IMPACT ASSESSMENT'
- BOREHOLE LOCATED AT THE FRONT OF THE PROPERTY
- BOREHOLE LOG SUMMARY
  - 0 - 1m = MADE GROUND
  - 1m - 6m - LONDON CLAY → FIRM TO STIFF
- C_u PROFILE 84 kN/m² @ 1m $\bar{C_u}$ = 102 kN/m²
  120 kN/m² @ 6m $C' = 0.1\bar{C_u}$ = 10 kN/m² ⇒ LIMIT TO 5kN/m²
- $E_u = 450 C_u$
  $= 45900$ kN/m²
- $\phi' = 23°$
- $\gamma_s = 20$ kN/m³

FOR PILES IN TEMPORARY STATE FoS = 1.50
" " PERMANENT STATE EC7 FACTORS

ANALYSIS OF PILES IN RETAINING SITUATION CARRIED OUT USING CAOS PILED WALL SUITE

TEMPORARY STATE (FoS = 1.5)

IDEALISED DIAGRAM:

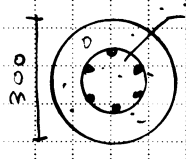


FROM CAOS PILED WALL SUITE
x_{MIN} = 4.5 - 2.5 = 2m

M_{EK} = 15.2 kNm/m × 1.5 = 23 kNm
V_{EK} = 29.6 kN/m × 1.5 = 45 kN
δ_{max} = 2mm (MIDDLE)
PROP FORCE = 12 kN/m

IF WALL IS UN-PROPPED: x_{MIN} = 7 - 2.5 = 4.5m
M_{EK} = 46 kNm/m × 1.5 = 69 kNm @ ULS
V_{EK} = 85 kN/m × 1.5 = 128 kN @ ULS
δ_{max} = 12mm @ TOP

BS EN 1992-1-1



f_{ck} = 32 N/mm² (C32/40)
d = 300 - 75 - 10 - 8 = 207mm
d/h = 207/300 = 0.7

USING M-N INTERACTION CHARTS:

$\frac{M}{h^3 f_{ck}} = \frac{(23 \times 0.4m) \times 10^6}{300^3 \times 32} = 0.011 \Rightarrow \frac{\rho f_{yk}}{f_{ck}} = 0.02$

$= \frac{(69 \times 0.4m) \times 10^6}{300^3 \times 32} = 0.032 \Rightarrow = 0.12$

PROPPED

$A_S = \frac{0.02 \times \pi \times 300^2 \times 32}{500 \times 4} = 91 mm^2$

$A_{S,MIN} = \frac{0.13}{100} \times \frac{\pi \times 300^2}{4} = 92 mm^2$

} 4 B12 BARS

UN-PROPPED

$A_S = \frac{0.12 \times \pi \times 300^2 \times 32}{500 \times 4} = 543 mm^2$

$A_{S,MIN} = 92 mm^2$

} 6 B16 BARS

SHEAR

$\frac{A_{SW}}{S} = \frac{45 \times 10^3}{0.9 \times 207 \times 0.87 \times 500 \times Cot22} = 0.22$

$\frac{A_{SW}}{S} = \frac{128 \times 10^3}{0.9 \times 207 \times 0.87 \times 500 \times Cot22} = 0.64$

$S_{MAX} = 0.75d = 155 mm \Rightarrow$) $12 \times \phi = 120 mm \Rightarrow$ 12cm c/c

$A_{SW,MIN} = 26.4 mm^2$ B10 LINKS @ 120 c/c

$A_{S,MIN} = 76.8 mm^2$ B10 LINKS @ 120 c/c

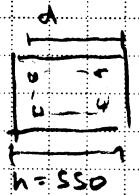
$V_{RD,C} = 0.124 \times 300 \times 207 \times (1 - \frac{32}{250}) - 32 \times 10^{-3} = 215 kN > 45 kN$ ✓

PILE CAP

- MAX SPAN PROPPED = 4.0m
- " " UNPROPPED = 7.7m

$M_{EQ} = (12 \times 1.5) \times 4.8^2 \times 0.125 = 36 kNm$ ULS & 93kN/m

$V_{EQ} = (12 \times 1.5) \times 4.8 \times 0.5 = 43 kN$ ULS & 69kN/m



$f_{cu} = 32 N/mm^2$
Cover = 50m
$d = 550 - 50 - 10 - 8 = 482 mm$

$K = \frac{36 \times 10^6}{450 \times 482^2 \times 32} = 0.011 \Rightarrow 0.95d = 458 mm$

$A_S = \frac{36 \times 10^6}{0.87 \times 500 \times 458} = 181 mm^2$

$A_{S,MIN} = \frac{0.13}{100} \times 550 \times 450 = 322 mm^2$

} PROVIDE 2 Nº H16 $A_S = 402 mm^2$

$\frac{A_{SW}}{S} = \frac{43 \times 10^3}{0.9 \times 482 \times 0.87 \times 500 \times Cot22} = 0.092$

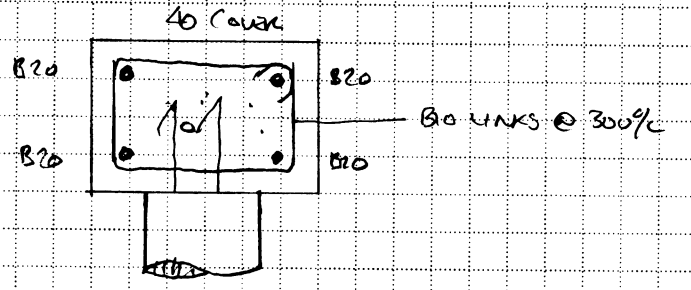
$S_{MAX} = 362 mm \Rightarrow 300 c/c$ $A_{S,MIN} = 28 mm^2 \Rightarrow$ B10 LINKS @ 300 c/c

FOR UNFACTORED

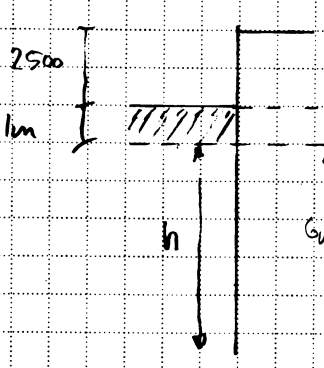
$k = 0.0284 \Rightarrow z = 0.95d = 458mm$

$A_s = 467 mm^2 \Rightarrow$ 2 no B20

$\frac{A_{sv}}{s} = 0.148 \Rightarrow A_{sv} = 44 mm^2 \Rightarrow$ B8 LINKS



BEARING PILE DESIGN



$h_{MIN} = 4.5m$ FOR TEMP STATE

$\Delta C_u = \frac{120 - 84}{5} = 7.2 kN/m^2/m$

$\gamma_b = 2.0$; $\gamma_s = 2.0$

$R_d = \frac{A_b q_{bk}}{\gamma_{red}} + A_s q_{sk}$

$= \frac{\pi \times 0.3^2}{4} \times \frac{9 \times C_{uk}}{2.0 \times 1.4} + \frac{(0.9 \times h \times 2) \times 0.45 \times \overline{C_{uk}}}{2.0 \times 1.4}$

TRY 5m : $C_{ub} = 138 kN/m^2$, $h = 5m$

$C_{us} = 120 kN/m^2$

$R_d = 31.4 kN + 77.6 kN$

$= 109 kN$ / PILE OR $272 kN/m$

MAX PILE LOAD = $110 kN/m$ SLS } LESS THAN R_d o.k.

$\approx 143 kN/m$ GEO-2 }

BS EN 1993-1-1

Pads

WHERE USED MAX LOAD = $4.8 \times (12 \times 1.5) \times 1.75$
= 108kN ULS @ 90° TO PILE CAP
= 153kN ULS @ 45° TO PILE CAP

AXIAL CAPACITY OF 203 UC 46 S275

N_{b,Rd_2} = 422kN @ L_E = 7m > 153kN ok//

IF AT 45° BOLTS WILL HAVE COMPONENT SHEAR OF 153kN

⇒ PROVIDE 6 No M16 gr8.8 BOLTS
$F_{v,Rd}$ = 6 x 60.3 = 361kN ULS

JAMES FRITH LTD Consulting Civil and Structural Engineers	Page No 1 Analysis C01
CADS Piled Wall Suite Version 5.31 Design of embedded retaining walls and cofferdams	Project 0273 File Name c01.pws
15a PARLIAMENT HILL Contig Wall	Engineer JMF Date 03-02-2017

Pile geometry

Pile top Level	10	m
Pile Length	4.5	m
Pile toe level	5.5	m
Active ground slope	0	Degrees (To horizontal)

Soils and ground water initial data (Soils data given for active and passive sides)

Initial Ground Water level -50

Top Level m	Description	Bulk Dens kN/m3	Sat' Dens kN/m3	Young Mod kN/m2	Young Inc. kN/m3	Cu C' kN/m2	C Inc. kN/m3	Phi Deg	Wall Shear Ratio	Ka Kp	Kac Kpc
10.00	Silty CLAY	20.00	20.00	45900	0	5		23		.44	1.32
						5		23		2.28	3.02

Construction sequence

Stage Ref	Stage Type	Level or Angle m/deg.	Load kN(/m)	Offset m	Width m	Length m
1	Active surcharge	10.00	10.0	.0		
2 A	Passive side excavation	8.50				
3	Insert prop	10.00				
4 A	Passive side excavation	7.50				
5 A	Insert prop	7.70				

Code of practice

Code of practice or reference document	Custom parameters (user selection)
Application of pressures for stability	FOS on gross pressures
FOS on moments (stability check)	1.50
ULS factor on Tan(Phi) values	1.00
ULS fFactor on drained cohesion values	1.00
ULS factor on undrained cohesion values	1.00
ULS factor on active soil pressures	1.00
ULS factor on passive soil pressures	1.00
ULS factor on active water pressures	1.00
ULS factor on passive water pressures	1.00
ULS factor on loads applied to the soil	1.00
ULS factor on loads applied to the wall	1.00
FOS on embedment (stability check)	1.00
Correction factor on cantilever embedment	1.20

Wall analysis detail options

Nominal Phi for load distribution	30.0	Degrees
Depth of water filled tension cracks	.0	m
Density of water	10.0	kN/m3
Minimum equivalent fluid density	5.0	kN/m3
Depth of passive softened soil	1.0	m
Continuity model for wall analysis	Pins at second and lower props	

Deflection parameters

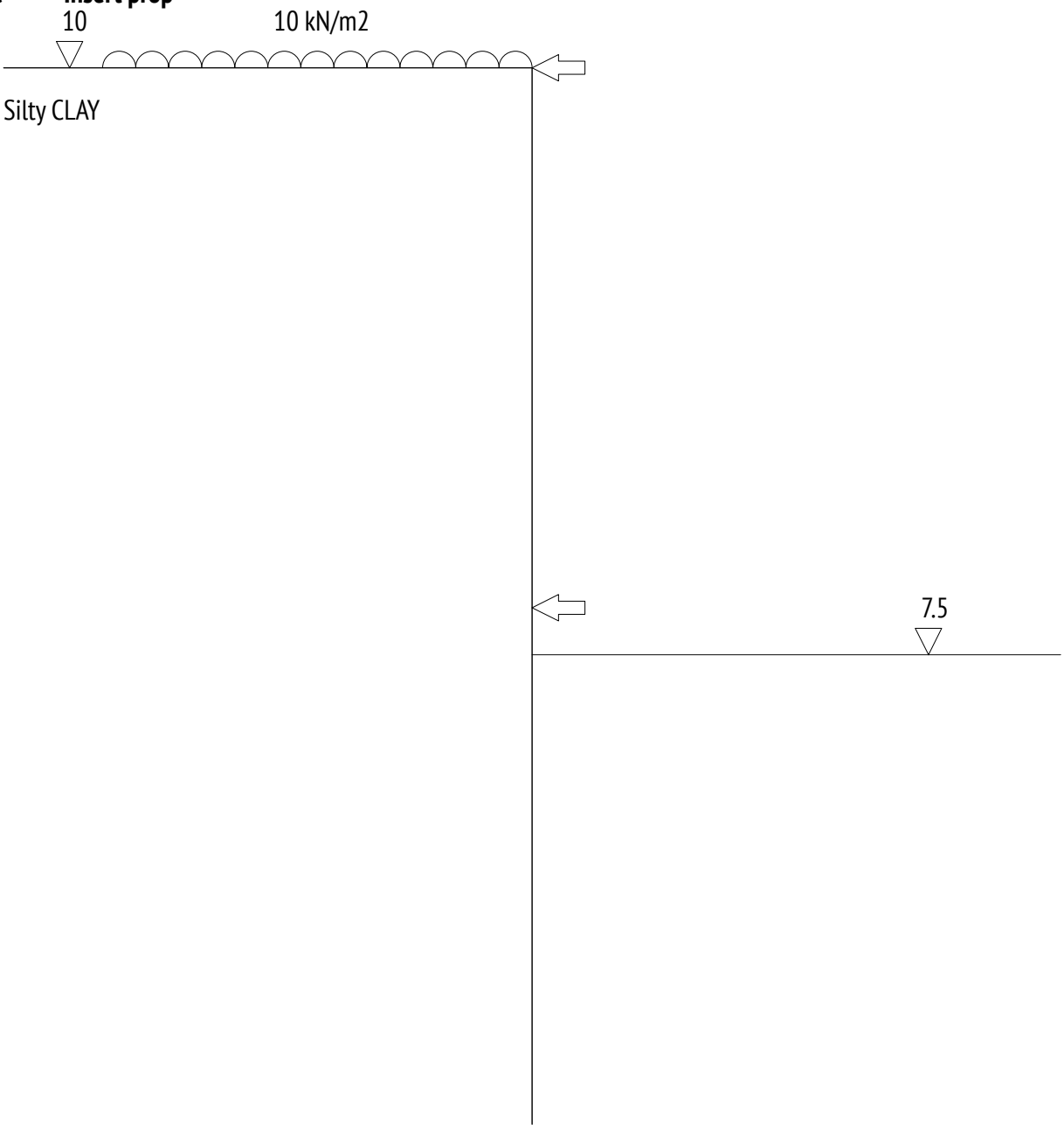
Wall moment of inertia	99402	cm4/m
Wall Youngs modulus	27000000	kN/m2
Properties for prop at 10.0		
Prop/Tie cross sectional area	200	cm2 each
Prop/Tie Youngs modulus	210000000	kN/m2
Prop/Tie length	10.0	m
Prop/Tie spacing	6.0	m
Waling moment of inertia	Waling deflection not included	
Waling Youngs modulus	Waling deflection not included	
Prop/Tie preload	0	kN
Initial lack of fit	0.0	mm

Deflection parameters - continued

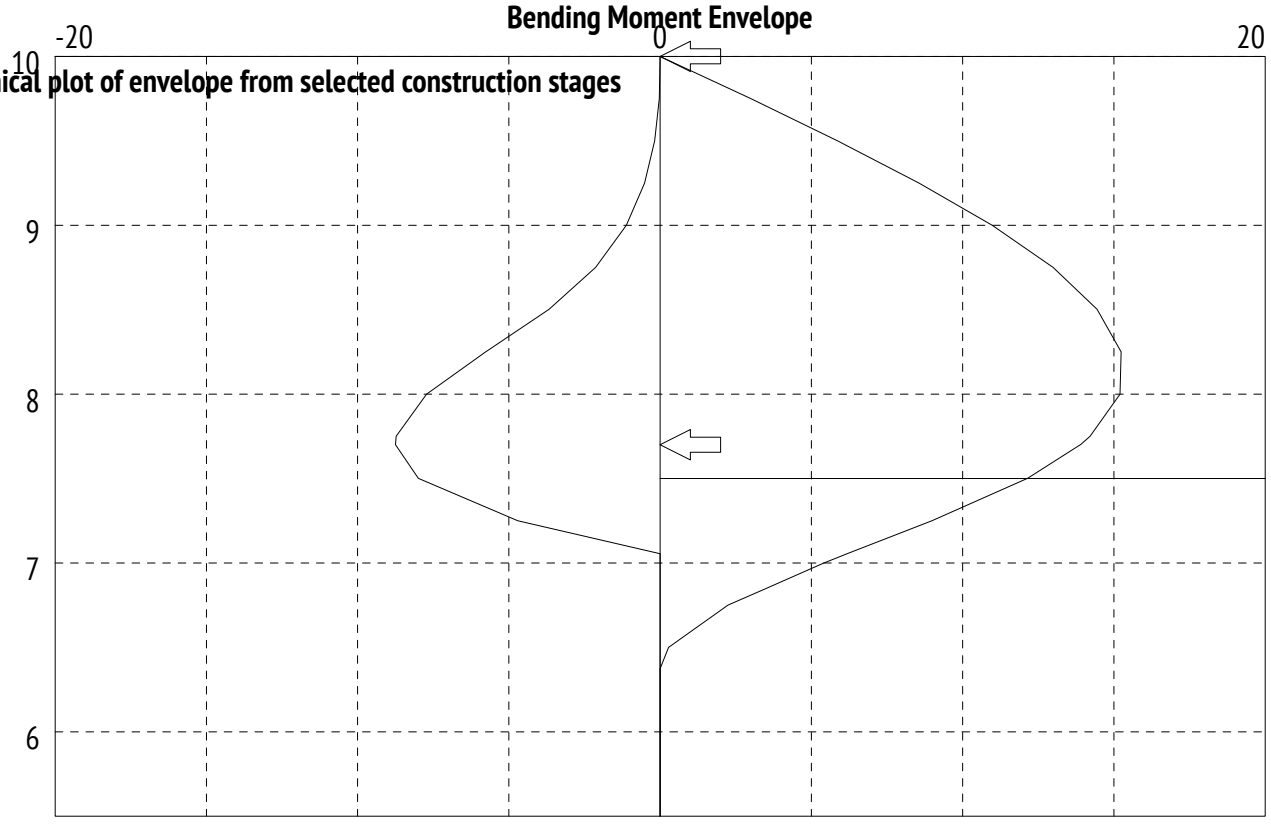
Properties for prop at 7.7

Prop/Tie cross sectional area	200	cm2 each
Prop/Tie Youngs modulus	210000000	kN/m2
Prop/Tie length	10.0	m
Prop/Tie spacing	6.0	m
Waling moment of inertia	Waling deflection not included	
Waling Youngs modulus	Waling deflection not included	
Prop/Tie preload	0	kN
Initial lack of fit	0.0	mm

Stage ref. **5**
Stage type **Insert prop**



Graphical plot of envelope from selected construction stages



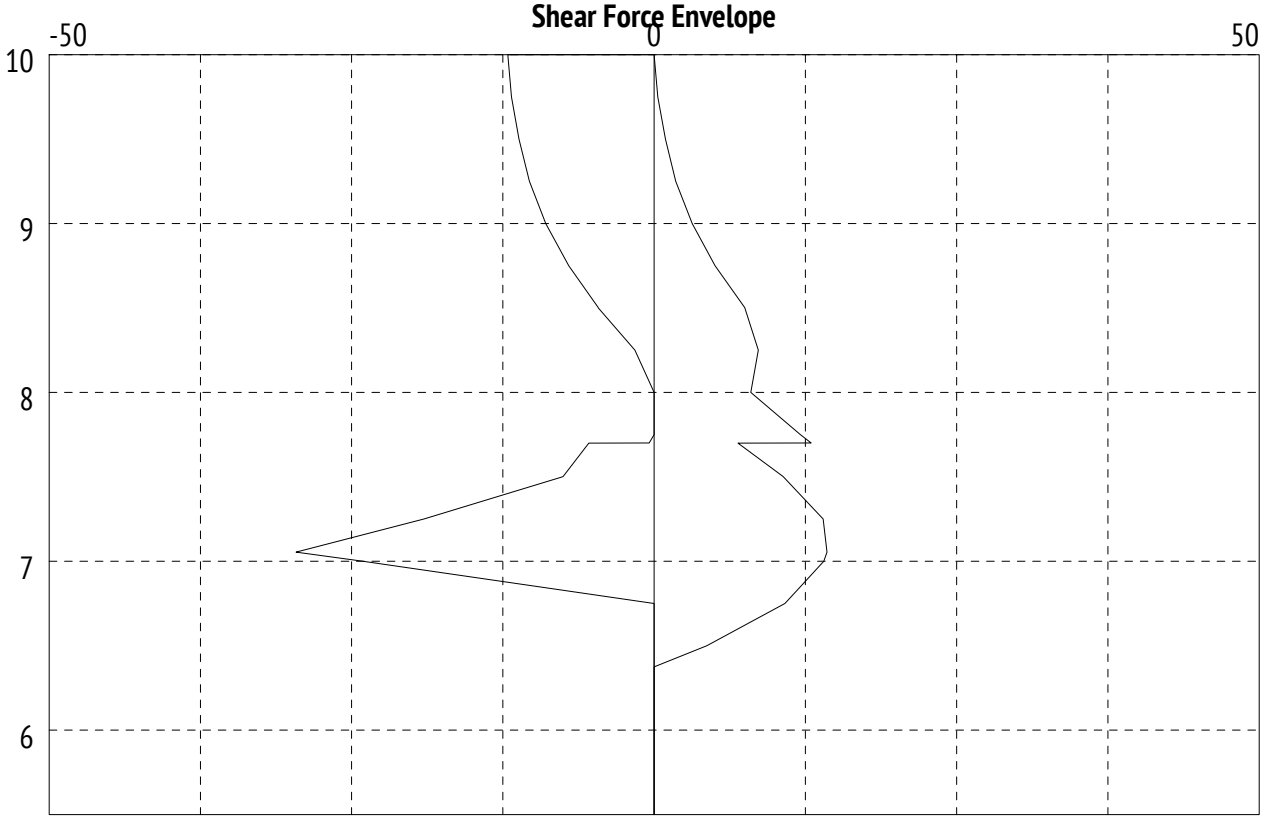


Table of envelope for wall forces

Calc Level m	Bending Minimum kNm/m	Bending Maximum kNm/m	Shear Minimum kN/m	Shear Maximum kN/m	Prop Force kN/m
10.00	.0	.0	.0	.0	12.1
10.00	.0	.0	.0	12.1	
9.00	-11.0	1.1	-3.1	9.0	
8.50	-14.4	3.7	-7.5	4.6	
8.50	-14.5	3.7	-7.5	4.6	
8.00	-15.2	7.7	-8.0	.0	
7.70	-13.9	8.7	-13.0	.4	18.4
7.70	-13.9	8.7	-6.9	5.4	
7.50	-12.2	8.0	-10.7	7.5	
7.50	-12.1	8.0	-10.7	7.6	
7.05	-6.2	.0	-14.3	29.6	
7.00	-5.4	.0	-14.0	24.1	
6.84	-3.4	.0	-11.9	8.5	
6.37	.0	.0	.0	.0	
6.00	.0	.0	.0	.0	
5.50	.0	.0	.0	.0	

JAMES FRITH LTD Consulting Civil and Structural Engineers	Page No 1 Analysis C02
CADS Piled Wall Suite Version 5.31 Design of embedded retaining walls and cofferdams	Project 0273 File Name c02.pws
15a PARLIAMENT HILL Contig Wall	Engineer JMF Date 03-02-2017

Pile geometry

Pile top Level	10	m
Pile Length	7	m
Pile toe level	3	m
Active ground slope	0	Degrees (To horizontal)

Soils and ground water initial data (Soils data given for active and passive sides)

Initial Ground Water level -50

Top Level m	Description	Bulk Dens kN/m3	Sat' Dens kN/m3	Young Mod kN/m2	Young Inc. kN/m3	Cu C' kN/m2	C Inc. kN/m3	Phi Deg	Wall Shear Ratio	Ka Kp	Kac Kpc
10.00	Silty CLAY	20.00	20.00	45900	0	5		23		.44	1.32
						5		23		2.28	3.02

Construction sequence

Stage Ref	Stage Type	Level or Angle m/deg.	Load kN(/m)	Offset m	Width m	Length m
1	Active surcharge	10.00	10.0	.0		
2 A	Passive side excavation	7.50				
3 A	Insert prop	7.70				

Code of practice

Code of practice or reference document	Custom parameters (user selection)
Application of pressures for stability	FOS on gross pressures
FOS on moments (stability check)	1.50
ULS factor on Tan(Phi) values	1.00
ULS fFactor on drained cohesion values	1.00
ULS factor on undrained cohesion values	1.00
ULS factor on active soil pressures	1.00
ULS factor on passive soil pressures	1.00
ULS factor on active water pressures	1.00
ULS factor on passive water pressures	1.00
ULS factor on loads applied to the soil	1.00
ULS factor on loads applied to the wall	1.00
FOS on embedment (stability check)	1.00
Correction factor on cantilever embedment	1.20

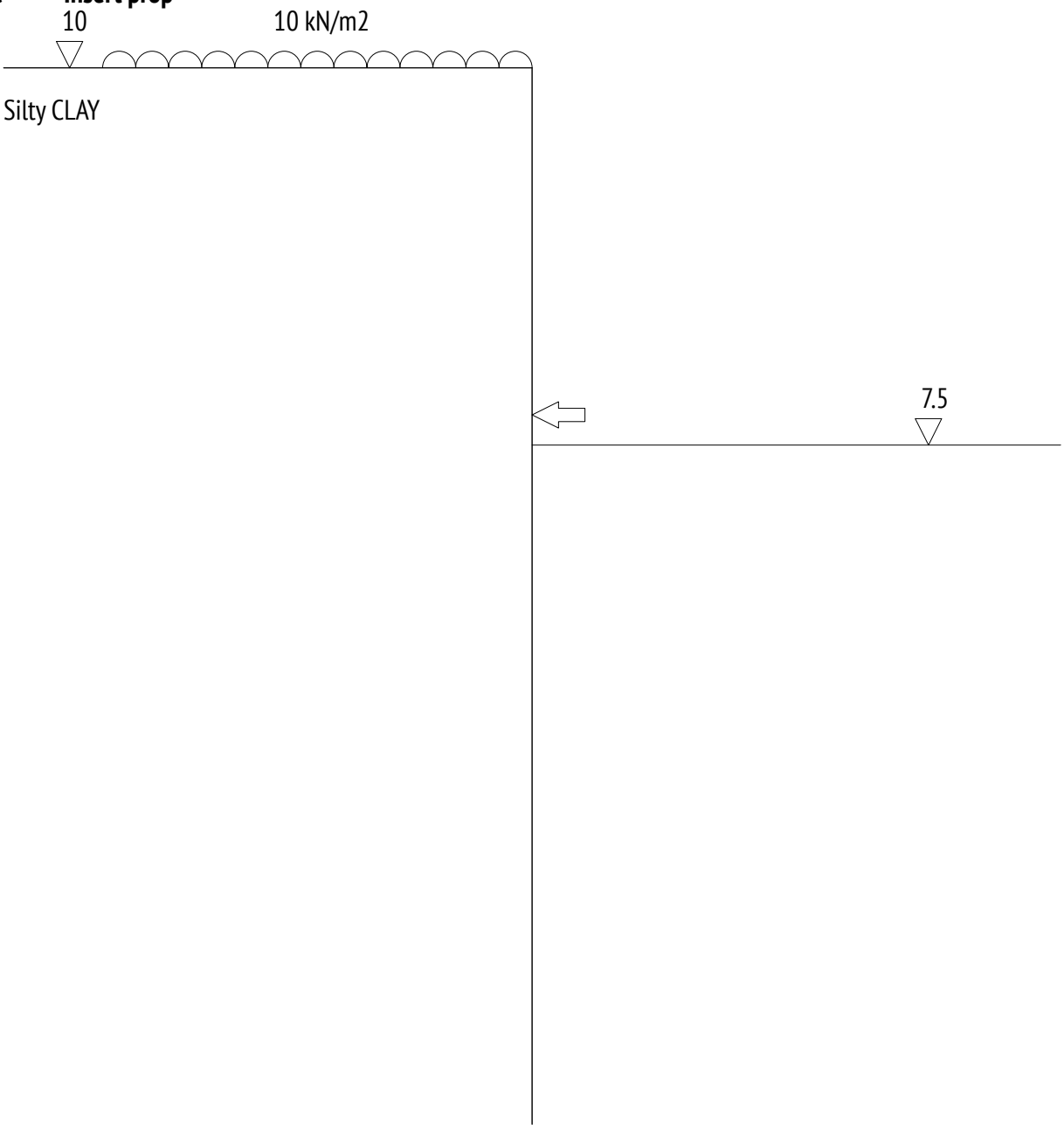
Wall analysis detail options

Nominal Phi for load distribution	30.0	Degrees
Depth of water filled tension cracks	.0	m
Density of water	10.0	kN/m3
Minimum equivalent fluid density	5.0	kN/m3
Depth of passive softened soil	1.0	m
Continuity model for wall analysis	Pins at second and lower props	

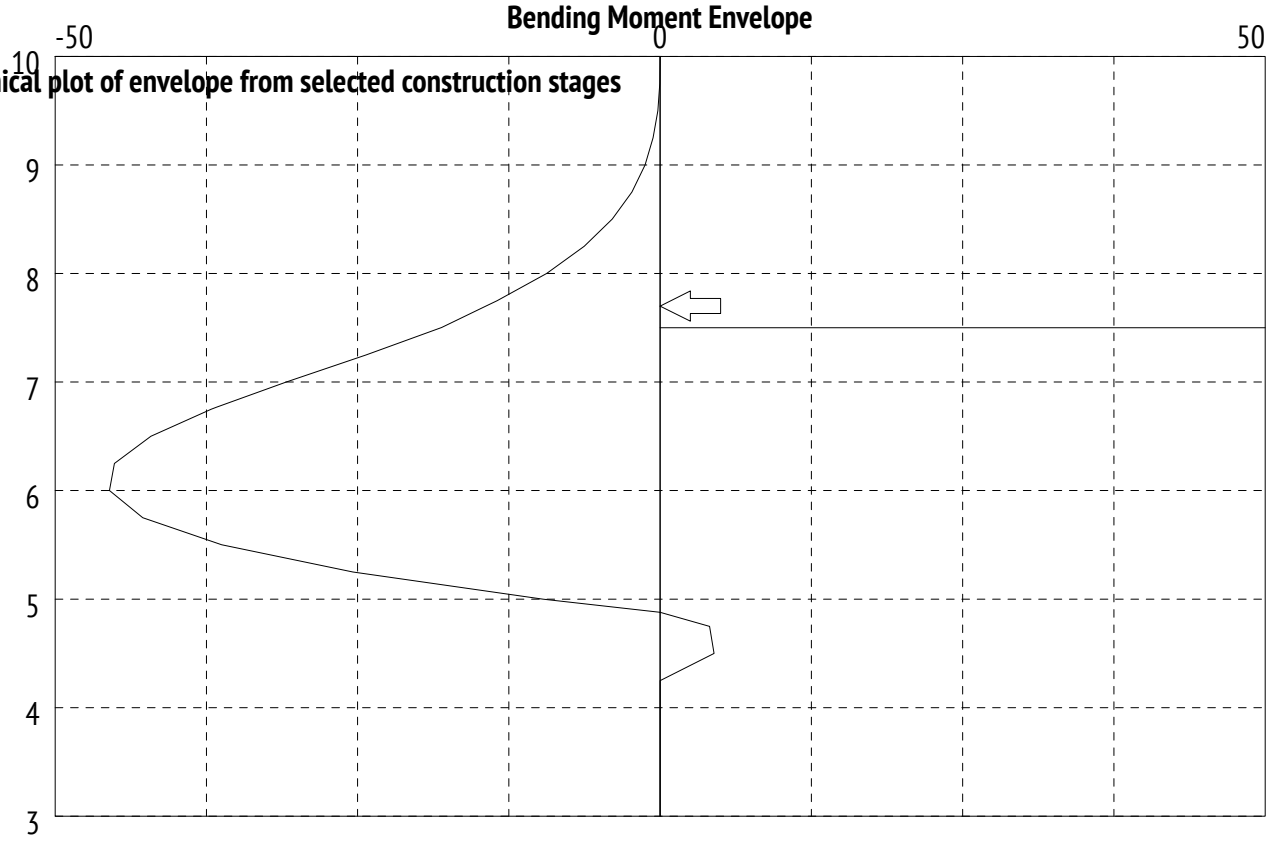
Deflection parameters

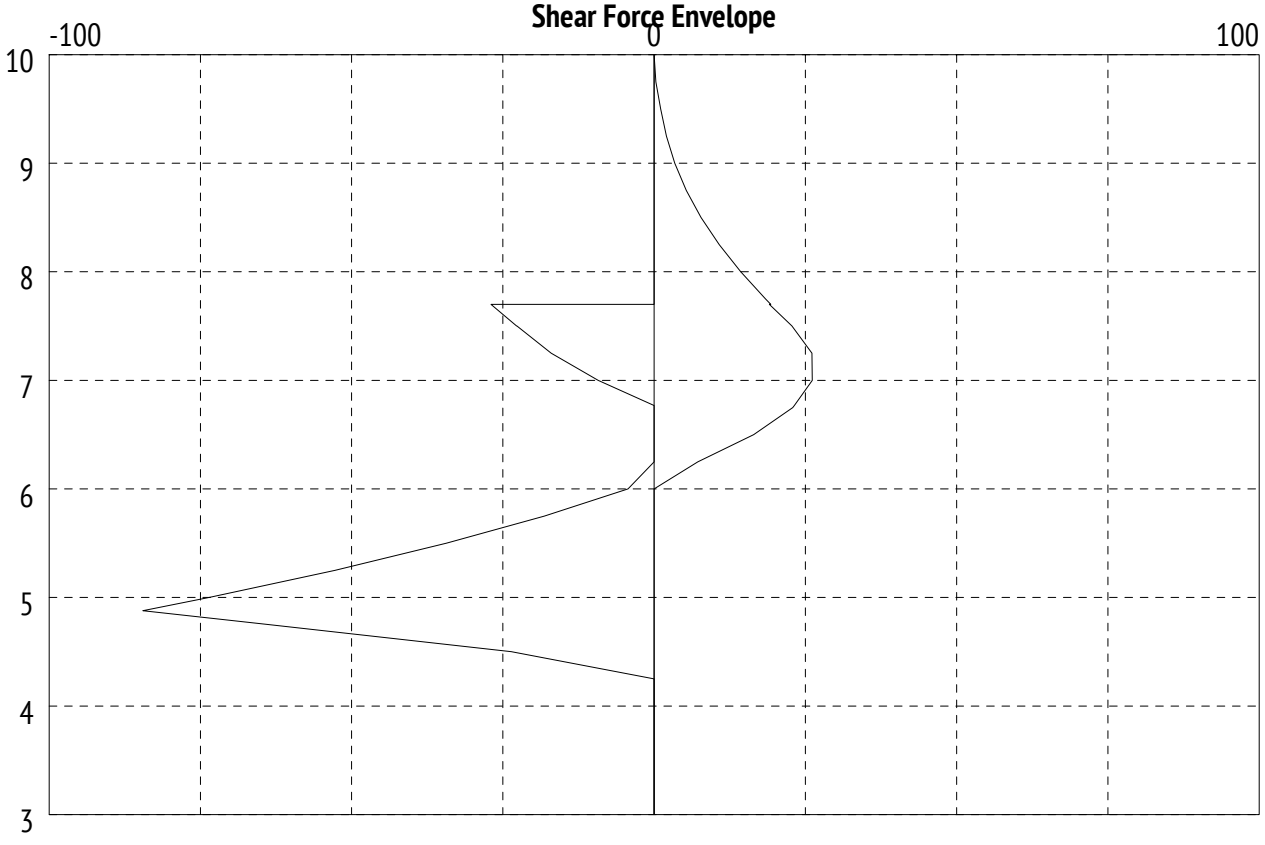
Wall moment of inertia	99402	cm4/m
Wall Youngs modulus	27000000	kN/m2
Properties for prop at 7.7		
Prop/Tie cross sectional area	200	cm2 each
Prop/Tie Youngs modulus	210000000	kN/m2
Prop/Tie length	10.0	m
Prop/Tie spacing	6.0	m
Waling moment of inertia	Waling deflection not included	
Waling Youngs modulus	Waling deflection not included	
Prop/Tie preload	0	kN
Initial lack of fit	0.0	mm

Stage ref. **3**
Stage type **Insert prop**



Graphical plot of envelope from selected construction stages





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10.00	.0	.0	.0	.0	
9.00	.0	1.3	-3.4	.0	
8.00	.0	9.4	-14.3	.0	
7.70	.0	14.4	-19.3	.0	46.3
7.70	.0	14.4	-19.0	27.0	
7.50	.0	18.1	-22.8	22.7	
7.50	.0	18.1	-22.8	22.7	
7.00	.0	30.9	-26.1	9.2	
6.77	.0	36.6	-23.2	.0	
6.00	.0	45.5	.0	4.3	
5.00	.0	9.7	.0	73.5	
4.88	.0	.0	.0	84.5	
4.00	.0	.0	.0	.0	
3.00	.0	.0	.0	.0	

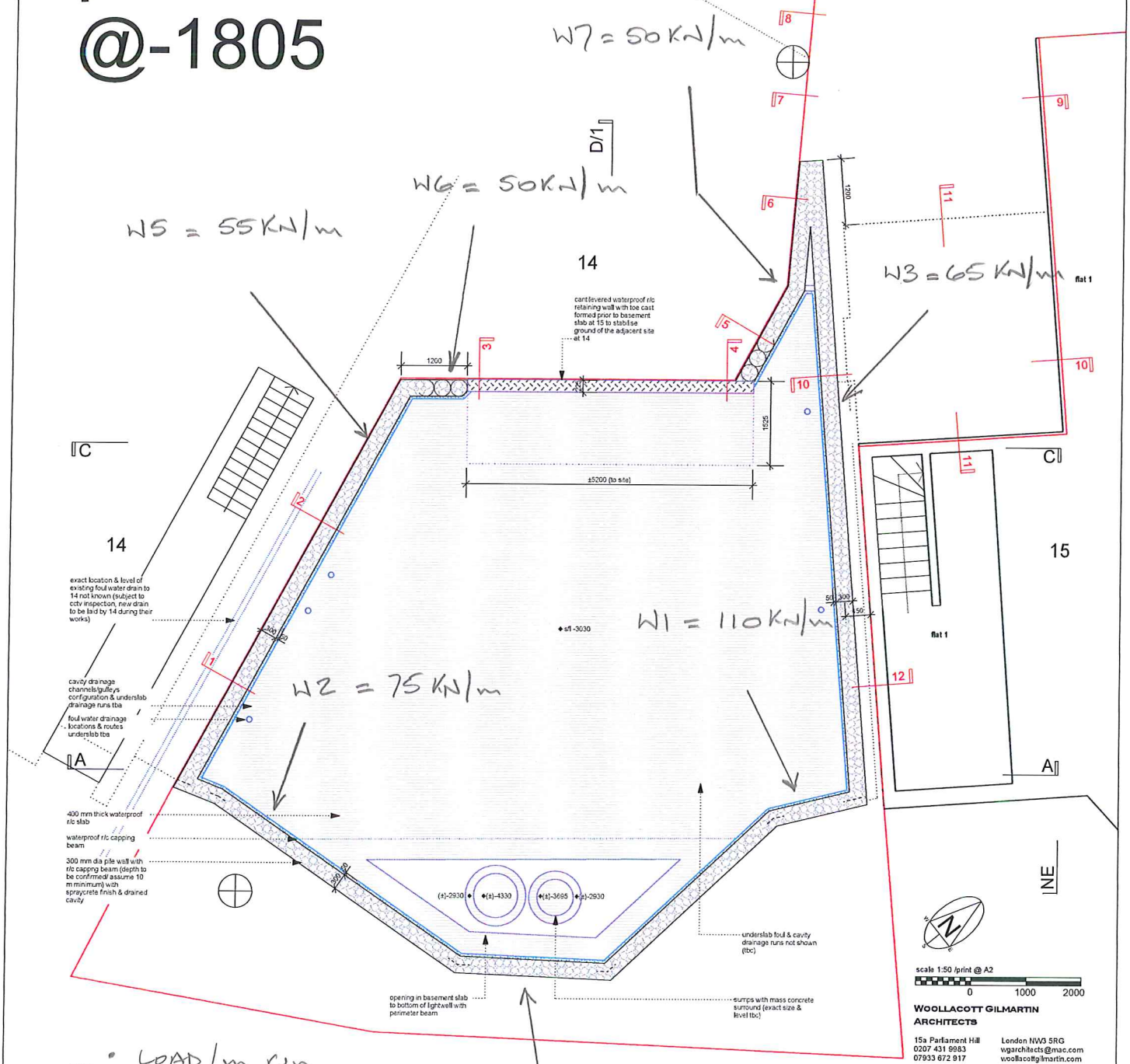
Gyoury Self
CONSULTING ENGINEERS
STRUCTURAL·CIVIL·ENVIRONMENTAL

Gyoury Self Partnership (St Albans)
4b Parkway, Porters Wood
St Albans, Hertfordshire AL3 6PA

PRELIMINARY
PILE LOADS/
m RUN.
23.12.2016.

00/-1/a

plan @-1805



- LOAD/m RUN UNFACTORED DL+IL
- LATERAL LOAD TBC

15 KN/m

for discussion

scale 1:50 /print @ A2
0 1000 2000

WOOLLACOTT GILMARTIN ARCHITECTS
15a Parliament Hill
0207 431 9983
07933 672 917
London NW3 5RG
wgarchitects@mac.com
woollacottgilmartin.com

15a Parliament Hill
New House
16.12.16
Proposed
Plan: Basement@-1805

str/1:50/00/-1/a

Environmental Protection Strategies
Tel: 01954 710666
email: info@epstrategies.co.uk
www.epstrategies.co.uk

Borehole No **WS1**
Sheet 1 of 2

Project Name	Project No.	Co-ords: -	Hole Type
15A Parliament Hill	UK14.1639		WLS
Location: 15A Parliament Hill, Hampstead Heath, London, NW3 2SY		Level: -	Scale 1:20
Client: Gyoury Self Partnership		Dates: 20/08/2014	Logged By BV

Well	Water Strikes	Samples & In Situ Testing Depth (m)	Type	Results	Depth (m)	Level (m AOD)	Legend	Stratum Description
					0.02			TOPSOIL (IMPORTED): Light brown slightly sandy silt.
		0.10-0.30	D					MADE GROUND: Light grey and brown crushed concrete with rare fine brick fragments. Rare organic material such as recently active and decayed fine rootlets noted
					0.45			MADE GROUND: Stiff orangey brown silty gravelly clay with occasional fine to coarse brick and clinker noted.
		0.40-0.80	D					
					1.00			Firm to stiff fissured dark yellowish brown silty clay with occasional silt partings (LC).
		1.20	IVN 1	164				
		1.00-1.50	D					
		1.50	IVN 2	148				
		1.80	IVN 3	200				
		1.80-2.00	D					
		2.20	IVN 4	128				
		2.50	IVN 5	122				
		2.80	IVN 6	102				
		2.80-3.00	D					
		3.20	IVN 7	84				
		3.50	IVN 8	108				
		3.80	IVN 9	115				
			Type	Results				Continued next sheet

Remarks: LC = London Clay

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Borehole No **WS1**
Sheet 2 of 2

Project Name	Project No.	Co-ords: -	Hole Type
15A Parliament Hill	UK14.1639		WLS
Location: 15A Parliament Hill, Hampstead Heath, London, NW3 2SY		Level: -	Scale 1:20
Client: Gyoury Self Partnership		Dates: 20/08/2014	Logged By BV

Well	Water Strikes	Samples & In Situ Testing Depth (m)	Type	Results	Depth (m)	Level (m AOD)	Legend	Stratum Description
								Firm to stiff fissured dark yellowish brown silty clay with occasional silt partings (LC).
		4.20	IVN 10	147				
		4.50	IVN 11	141				
		4.80	IVN 12	131				
		4.80-5.00	D					
		5.20	IVN 13	111				
		5.50	IVN 14	114				
		5.80	IVN 15	124				
					6.00			End of Borehole at 6.00 m
			Type	Results				

Remarks: LC = London Clay

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Borehole No **WS2**
Sheet 1 of 2

Project Name	Project No.	Co-ords: -	Hole Type
15A Parliament Hill	UK14.1639		WLS
Location: 15A Parliament Hill, Hampstead Heath, London, NW3 2SY		Level: -	Scale 1:20
Client: Gyoury Self Partnership		Dates: 20/08/2014	Logged By BV

Well	Water Strikes	Samples & In Situ Testing Depth (m)	Type	Results	Depth (m)	Level (m AOD)	Legend	Stratum Description
					0.05			PAVING SLAB.
					0.10			MADE GROUND: Yellowish brown gravelly sand sub-base.
					0.20			MADE GROUND: Brick course.
					0.35			MADE GROUND: Dark brown gravelly sand with rare fine brick and concrete fragments.
								Firm to stiff fissured dark yellowish brown silty clay with occasional silt partings (LC).
		0.80	IVN 1	84				
		1.00-1.20	D					
		1.20	IVN 2	99				
		1.50	IVN 3	99				
		1.80	IVN 4	131				
		2.00-2.20	D					
		2.20	IVN 5	130				
		2.50	IVN 6	131				
		2.80	IVN 7	95				
		3.20	IVN 8	62				
		3.50	IVN 9	88				
		3.80	IVN 10	130				
			Type	Results				

Continued next sheet

Remarks: LC = London Clay

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Borehole No **WS2** Sheet 2 of 2

Project Name	Project No.	Co-ords: -	Hole Type
15A Parliament Hill	UK14.1639		WLS
Location: 15A Parliament Hill, Hampstead Heath, London, NW3 2SY		Level: -	Scale 1:20
Client: Gyoury Self Partnership		Dates: 20/08/2014	Logged By BV

Well	Water Strikes	Samples & In Situ Testing Depth (m)	Type	Results	Depth (m)	Level (m AOD)	Legend	Stratum Description
		4.20	IVN 11	104				Firm to stiff fissured dark yellowish brown silty clay with occasional silt partings (LC).
		4.50	IVN 12	95				
		4.80	IVN 13	99				
	▽	5.00-5.10	D					Very sandy lense noted
		5.80-6.00	D					
					6.00			End of Borehole at 6.00 m
			Type	Results				

Remarks: LC = London Clay

AGS