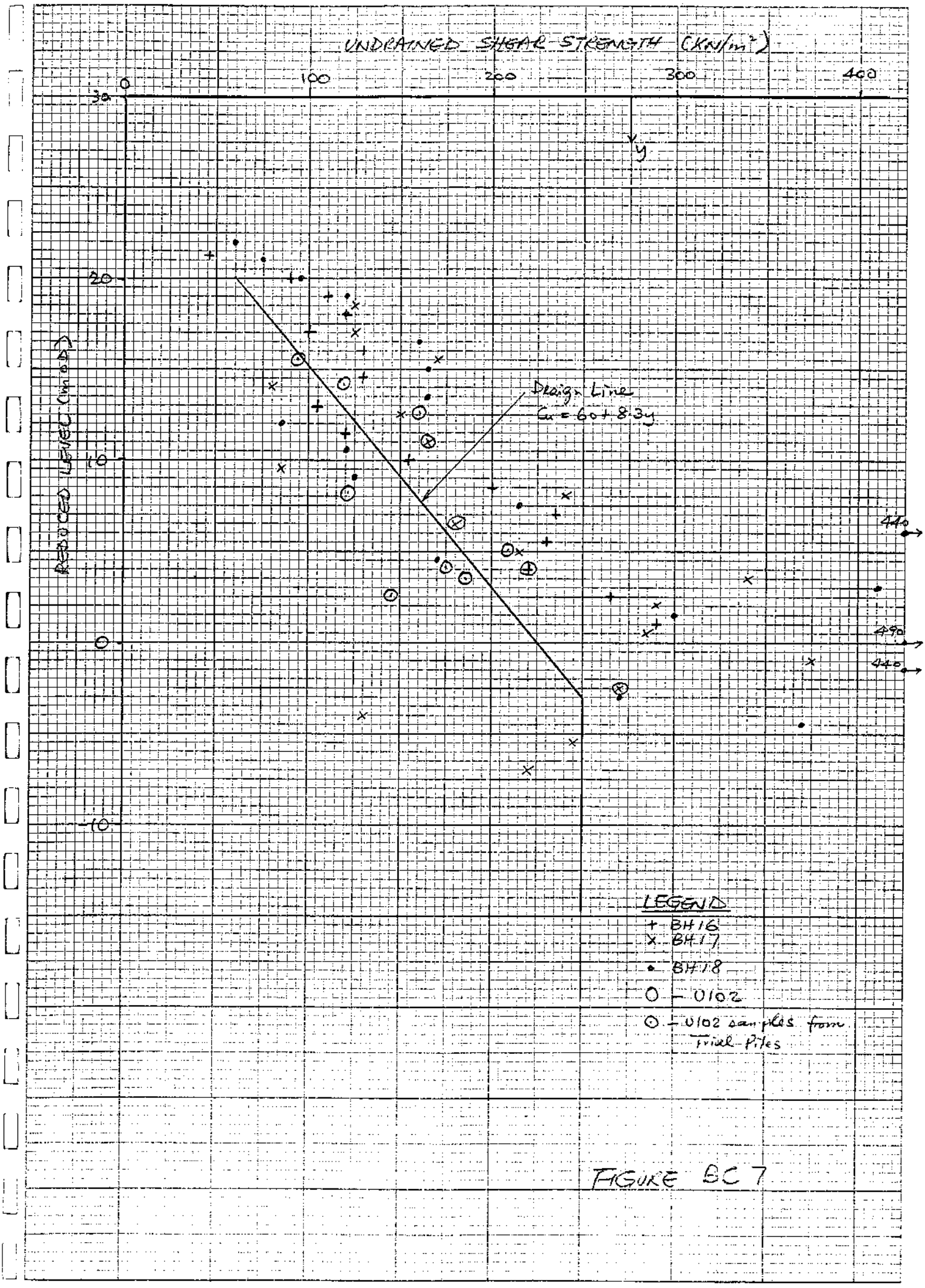

UNDRAINED SHEAR STRENGTH (KN/m²)
0
100
200
300
400
30
20
10
0
REDUCED LEVEL (m O.D.)
y
Design Line
Cu = 60 + 8·3y
440
490
440
LEGEND
+ BH16
× BH17
• BH18
O — U102
⊙ — U102 samples from Trial Piles

FIGURE EC 7

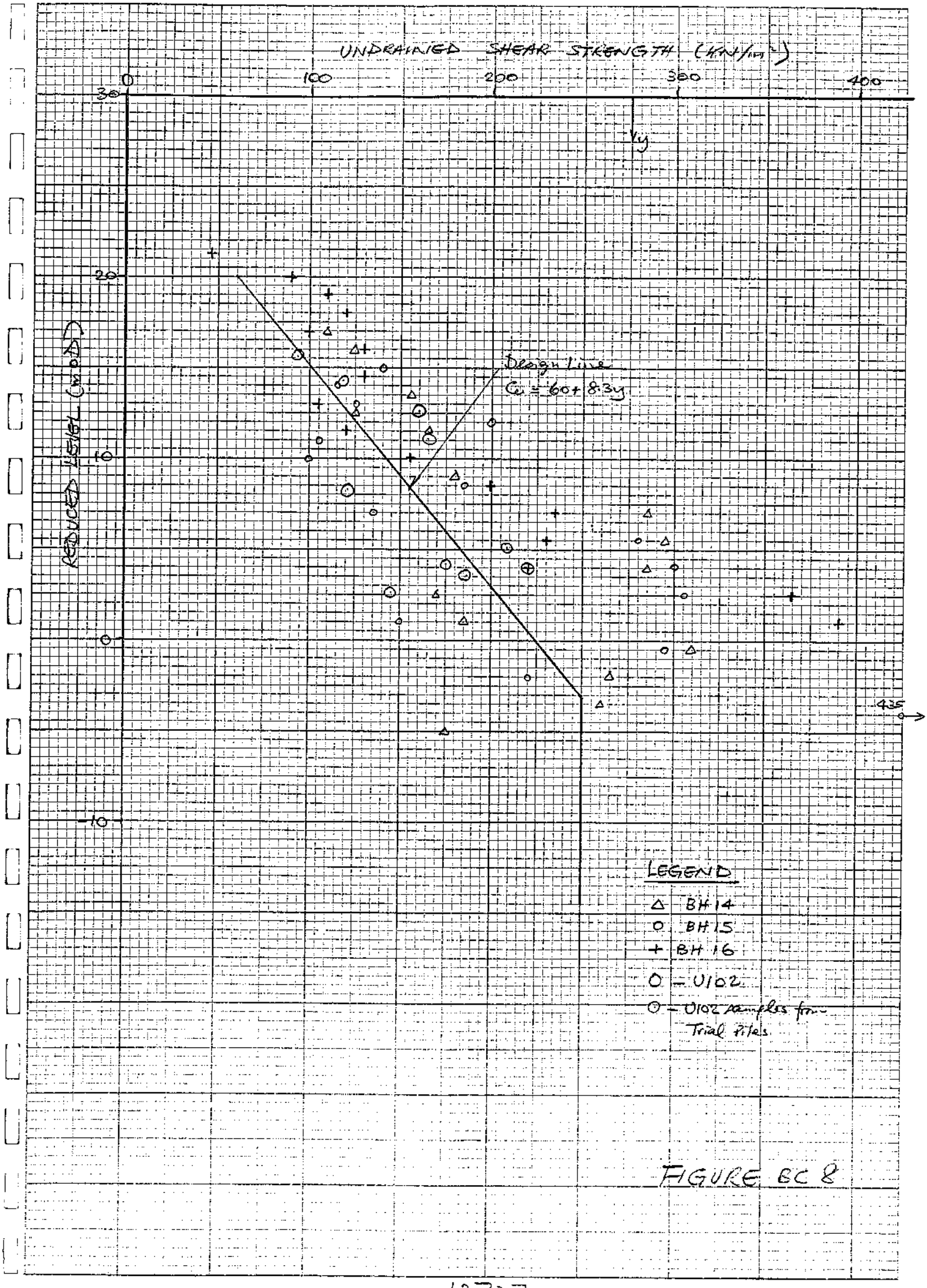

UNDRAINED SHEAR STRENGTH (KN/m²)
0
100
200
300
400
30
20
10
0
-10
REDUCED LEVEL (m.O.D.)
Vy
Design Line
Cu = 60 + 8.3y
435
LEGEND
△ BH 14
○ BH 15
+ BH 16
O – U102
⊙ – U102 samples from Trial Piles

FIGURE BC 8

FILES IN ZONE X : SUBJECT TO FILL HEAVE

PILE NO.	*APPLIED AXIAL LOAD (KN)	LENGTH (m)	DIAMETER (mm)	UNSLEEVED	OVERDRILLED & SLEEVED	SLEEVED ONLY	APPLIED LATERAL LOAD (KN)	CUT-OFF LEVEL (mOD)	TOE LEVEL (mOD)	MAIN REINFORCEMENT	SHEAR REINFORCEMENT
GL (1)											
A7	950		600		✓			20.375	+3.00		
A8	650		600		✓			20.425	+6.50		
A9	1050		600		✓			20.500	+2.00		
A10	1050		600		✓			20.700	+2.00		
A11	950		600		✓			20.425	+3.00		
A12	1100		600		✓			20.325	+1.40		
GL (2)											
A13	1700		600		✓			20.325	-5.00		
A14	1650		600	✓			80	20.300	-3.00		
A15	1650		600	✓			80	20.700	-3.00		
A16	1100		600		✓			20.325	+1.40		
A42	1100		600		✓			20.325	+1.40		
GL (3)											
A17	1500		600		✓				-3.00		
A18	1500		600	✓			80	20.300	-1.50		
A19	1500		600	✓			80	20.700	-1.50		
A20	1700		600		✓			20.325	-5.00		
GL (4)											
A21	1500		600		✓			20.300	-3.00		
A22	1550		600	✓			80	20.300	-2.20		
A23	1550		600	✓			80	20.700	-2.20		
A24	1700		600		✓			20.325	-5.00		
GL (5)											
A25	1400		600		✓			20.325	-2.00		
A26	1450		600	✓			80	20.300	-1.00		
A27	1450		600	✓			80	20.700	-1.00		
A28	1700		600		✓			20.325	-5.00		
GL (6)											
A29	1300		600		✓			20.325	-0.60		
A30	1200		600		✓			19.765	+0.20		
A31	900		600	✓			80	19.765	+5.20		
A32	1500		600		✓			20.325	-3.00		
A33	1300		600		✓			20.325	+0.20		
GL (7)											
A34	1450		600**		✓			18.205	-3.30		
A35	1450		600**		✓			18.405	-3.30		
A36	1450		600**		✓			18.205	-3.30		
A37	1450		600**			✓		18.405	-3.30		
A38	1450		600**			✓		18.205	-3.30		
A39	1400		600**		✓			18.405	-2.70		
A40	1400		600**		✓			18.405	-2.70		
A41	1400		600**		✓			18.825	-2.70		

← TWA sewer →

NOTE

* AXIAL LOAD given in Dwg No. LO(0)1000/J

** Piles adjacent to TWA Sewer

SUMMARY OF TOE LEVELS REQUIRED FOR BEARING CAPACITY

(45° RULE AS SPECIFICATION CL 8.01.6 NOT APPLIED)

PILES IN ZONE X : SUBJECT TO SOIL HEAVE

PILE NO.	*APPLIED AXIAL LOAD (KN)	LENGTH (m)	DIAMETER (mm)	UNSLEEVED	OVERBURDEN & SLEEVED	SLEEVED ONLY	APPLIED LATERAL LOAD (KN)	CUT-OFF LEVEL (mOD)	TOE LEVEL (mOD)	MAIN REINFORCEMENT	SHEAR REINFORCEMENT
GL(R)											
W2	1700		600**		✓			20.075	-6.00		
W3	↕		600		✓			↕	-5.00		
W4			600**		✓				-6.00		
W5			600		✓				-5.00		
W6			600**		✓				-6.00		
W7			600**			✓	40		-6.00		
W8	1700		600	✓			40	20.075	-3.75		
W9	↕		600**			✓	40	↕	-6.00		
W10			600	✓			80		-3.75		
W11			600**						-6.00		
W12			600		✓				-5.00		
W13			600**		✓				-6.00		
W14			600		✓				-5.00		
W15	1700		600**		✓			20.075	-6.00		
GL(?)											
W16	1700		600		✓			19.100	-5.50		
W17	1700		600		✓			19.100	-5.50		
W18	1700		600		✓			19.100	-5.50		
W19	1700		600		✓			19.1[illegible]	-5.50		
W20	1700		600		✓			19.100	-5.50		
W21	1550		600		✓			19.47[illegible]	-4.00		
W22	1550		600		✓			19.47[illegible]	-4.00		
W23	1550		600		✓			19.47[illegible]	-4.00		
W24	1550		600		✓			19.472	-4.00		
W25	1700		600		✓			19.022	-5.50		
W26	1700		600		✓			19.022	-5.50		
W27	1700		600		✓			19.022	-5.50		
W28	1700		600		✓			19.022	-5.50		
W29	1700		600		✓			19.022	-5.50		
W30	1700		600		✓			19.922	-5.50		
W31	1600		600		✓			18.825	-4.70		
W32	1600		600		✓			18.825	-4.70		
W33	1600		600		✓			18.825	-4.70		
W34	1600		600		✓			18.825	-4.70		
W35	1600		600		✓			18.825	-4.70		
GL(0)											
W36	1700		600	✓				18.825	-4.20		
W37	1700		600	✓				18.825	-4.20		
W38	1700		600	✓				18.825	-4.20		
W39	1700		600	✓				18.825	-4.20		
W40	1700		600	✓				18.825	-4.20		
W188	550		500		✓			20.847	+6.20		
W189	550		500		✓			19.100	+5.50		
W190	550		500		✓			19.100	+5.50		
W191	550		500	✓				19.100	+8.50		
W192	550		500	✓				19.100	+8.50		
W194	550		500		✓			20.847	+6.20		
W195	550		500		✓			20.847	+6.20		
W196	550		500		✓			19.100	+5.50		
W197	550		500		✓			19.100	+5.50		
W202	500		500	✓			80	20.747	+7.00		

NOTE
* AXIAL LOAD given in Dwg. NO. L0(0)1000/J
** Piles adjacent to TWA Sewer

SUMMARY OF TOE LEVELS REQUIRED FOR BEARING CAPACITY
(45° RULE AS SPECIFICATION CL. 8.01.6 NOT APPLIED)

PILES IN ZONE Y : SUBJECT TO LATERAL SOIL DISPLACEMENT

PILE NO.	*APPLIED AXIAL LOAD (KN)	LENGTH (m)	DIAMETER (mm)	UNSLEEVED	OVERBORED & SLEEVED	SLEEVED ONLY	APPLIED LATERAL LOAD (KN)	CUT-OFF LEVEL (mOD)	TOE LEVEL (mOD)	MAIN REINFORCEMENT	SHEAR REINFORCEMENT
GL(0)											
W40	1700		600	✓				19.022	-3.00		
W41	↕		600	✓				↕	↕		
W42			600	✓							
W43			600	✓							
W44	1700		600	✓					-3.00		
W45	↕		600	✓				↕	↕		
W46			600	✓							
W47			600	✓							
W48			600	✓							
W49	1700		600	✓				19.022	-3.00		
W50	1600		600		✓			18.825	-3.00		
W51	1600		600		✓			18.825	↕		
W52	1600		600		✓			18.825			
W53	1600		600		✓			18.825			
W208	1600		600		✓			18.825	-3.00		
GL(1)											
W48	1700		600	✓				18.825	-3.00		
W49	1700		600	✓				↕	↕		
W50	1700		600	✓				18.825			
W51	1700		600	✓				18.825			
W204	1700		600	✓				18.825	-3.00		
W193	600		500	✓				14.100	+6.50		
W198	550		500		✓			↕	+6.00		
W199	550		500	✓					+7.30		
W200	550		500	✓					+7.30		
W201	700		500	✓				14.100	+9.70		

NOTE

* AXIAL LOAD given in Drg. No. LO(0)/000/J

SUMMARY OF TOE LEVELS REQUIRED FOR BEARING CAPACITY

(45° RULE AS SPECIFICATION CL. 8.01.6 NOT APPLIED)

7.0 PILES SUBJECT TO TENSION

Sheets T1 to T14
and TF1 to TF5

OVE ARUP AND PARTNERS

12727/BS/KAH
15th July 1983

GRANARY SITE, ST. PANCRAS WAY

Piles subject to tension

1. General

In all cases, piles are installed after the removal of any existing overburden. The following factors have been considered in assessing the reinforcement necessary to resist tension in the piles.

1. Continuing swelling of the clay due to the demolition of the Granary Warehouse, 5 years ago.

2. Swelling, due to removal of existing overburden which will occur in the period of about one year before the piles are under full load.

3. Swelling as in (2) above continuing after the piles have been loaded.

4. The ability of the swelling clay to transmit loads in shear to the piles and hence develop tension.

For reference the site may be divided into three areas, A, B and C, as shown in Figure 1.

2. Area A - No existing overburden

In area A the only effect which could cause tension is the removal of the Granary Warehouse about 5 years ago. A comparison has been made with the measured heave at a site in Horseferry Road, as published by May (1975). The unloading at Horseferry Road was about 175 kPa, roughly double that at the Granary site. There was a water table in gravel over the clay and therefore a ready supply of water to the surface of the clay. Other data are included in Figure 2 where it can be seen that in a year about 5 years after the start of swelling the maximum heave was about 8mm.

It may be concluded that in the equivalent period at the Granary site the heave will be less than half of this, i.e. less than 4mm.

It is considered that this will be insufficient to mobilise significant shaft friction at the piles and hence cause significant tensions. Furthermore, even if tension did result and the piles cracked, the cracks would be small and unimportant. It is therefore concluded that no tension reinforcement is required in the piles in Area A.

3. Area B - existing embankment at north end of site. In the year before the piles are loaded, swelling will occur in Area B due to removal of the existing overburden. The amount of swelling which will occur has been assessed as follows:

Butler (1975) reanalysed May's data and showed that it was reasonably consistent with his correlations of stiffness with undrained shear strength. His work indicates that about 17% of the total long-term swelling occurred within the first year after unloading.

The total long term swelling has therefore been computed using the VDISP program as in our calculations "Analysis of ground movement" dated 5/7/83. Figure 3 shows the heave expected within one year of removal of load, due to 17% of total swelling. This heave due to swelling does not include heave due to undrained deformations which occur before the piles are constructed.

In Area B the heave expected within one year generally exceeds 20mm. It is considered that this would be sufficient to mobilise the full shear strength along much of the pile/soil interface. It is therefore necessary to reinforce the piles in Area B against tension.

The calculations of tensile forces and reinforcement are attached. The calculation is based on the following assumptions:

a) Shaft friction is fully mobilised in the most adverse manner possible.
b) The shaft friction is calculated using $\alpha\ c_u$ with $\alpha = 0.7$. This high value is pessimistic in this case.
c) Cracking and extension of the piles are to be controlled. Design is based on a permissible steel stress of 250 N/mm².

The extent of the area in which piles are to be reinforced has been limited to the area where calculated heave within one year exceeds 10mm and is indicated on Figure 5. This will be referred to as Zone Y.

4. Area C - rubble berm

In Area C an existing rubble berm is to be removed. The pressure to be removed is smaller and less extensive than is the case for Area B.

The computed heave at the ground surface for the year after removal of the load is shown in Figure 3, and does not exceed 10mm in this area. It is considered that this is unlikely to be sufficient to mobilise enough shaft friction and hence tensile force to crack the piles. If cracking does occur, however, it will consist of a small number of cracks up to about 2mm wide and these will close again when the piles are loaded. It is considered that this will not significantly affect the load-carrying characteristics of the piles. In fact, if it has any noticeable effect, it will reduce long term differential movement of the building.

4. Area C - rubble berm (contd)

In the long term the piles in Area C will be under load but, because they have factors of safety of about 2, it is likely that in swelling ground the lower portion of the pile will not be stressed by the load. It is therefore possible that this portion of the pile, which would not be needed to carry load, could be subject to tensile forces.

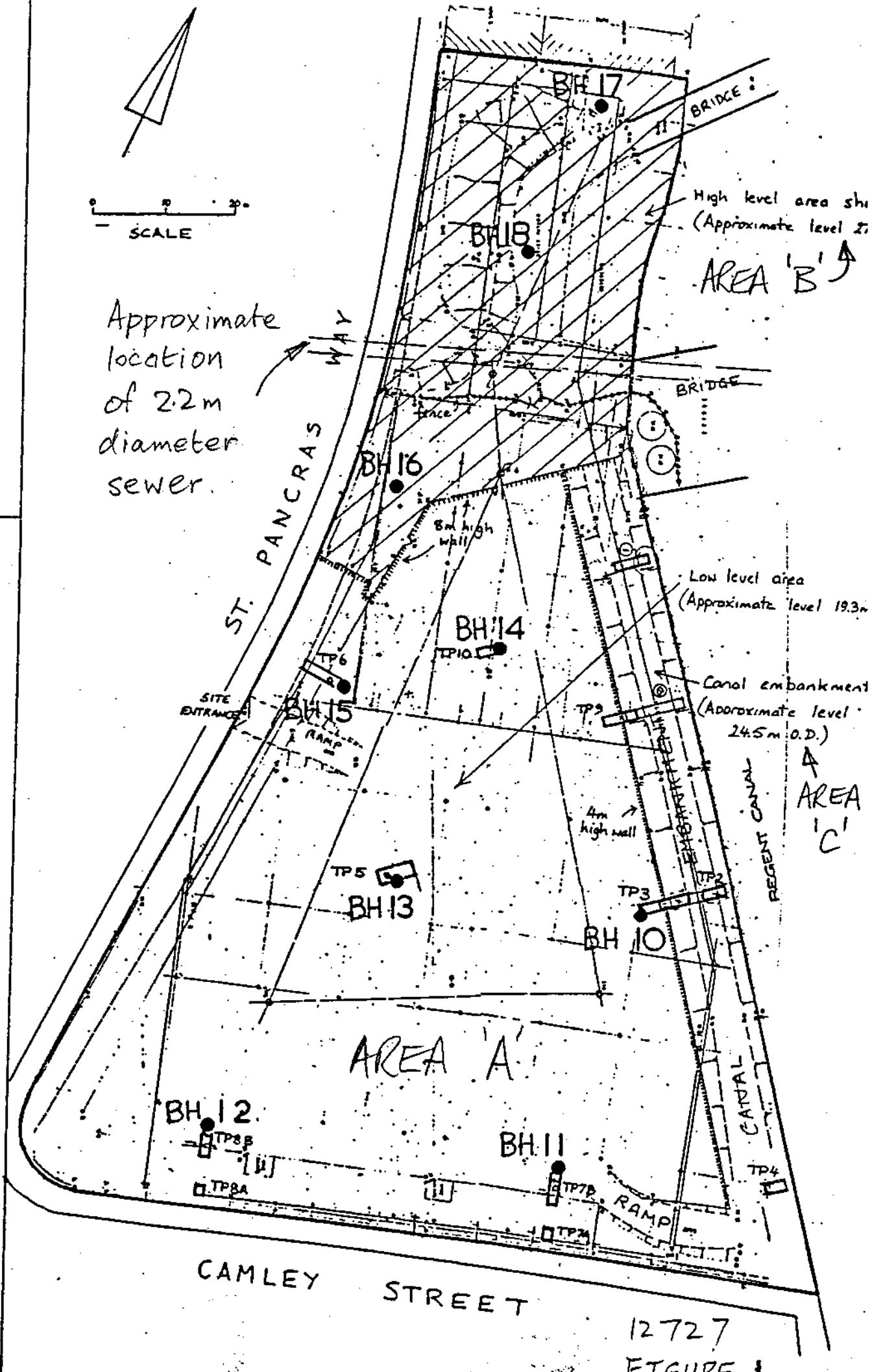
It is debatable whether this would matter, but as a check the long term extension of the ground in the lower 7m of the pile has been assessed. In this computation the working loads of the piles were applied as an equivalent uniform pressure at +7m OD. The computed long term extension of the ground between +7m OD and 0m OD is shown in Figure 4, together with the computed long term heave of the ground surface due to the nett loads.

The computed long term extension of the ground adjacent to the lower 7m of the piles does not exceed 7mm. It is considered that this is not enough to cause significant damage to the piles.

It is therefore considered that reinforcement for tension is not needed in the piles in Area C.

CONTRACT : ST.PANCRAS WAY/CAMLEY STREET, N.W.1
REPORT No.: 1870/JAD

SITE PLAN



12727
FIGURE 1

0.035 MN/m² was used.)

Construction of basement

A diagrammatic section of the basement is shown in *Fig. 4*. The basement is approximately 11 m deep over the whole site and forms a two-level car park. The sides of the excavation were retained by using diaphragm walls of reinforced concrete approximately 0.5 m thick cast in 1.5 m widths and extending into the London Clay to provide a cut-off for the ground water. These walls were incorporated in the final construction. A reinforced concrete raft, generally 1.2 m thick but thickened to 1.8 m under the central columns and

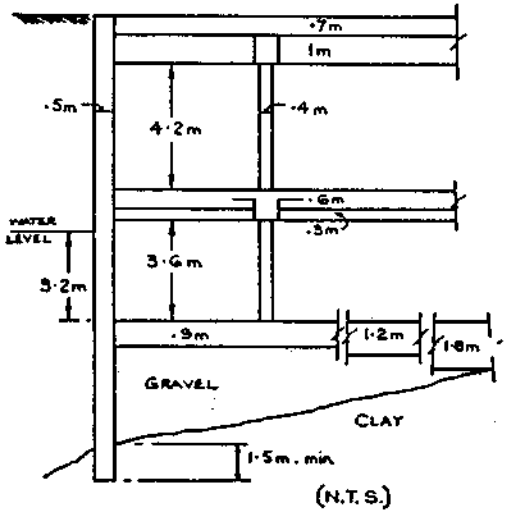


Fig. 4

lift shaft areas and reduced to 0.9 m thick near the perimeter, provides the basement floor. Intermediate and ground floors are of beam and slab construction. The plan size of the basement can be obtained from *Fig. 2* and the dead load of the basement structure is 48 kN/m². (In estimating the heave the raft was approximated to a rectangle 64.2 m × 88.8 m.)

The excavation was begun in June 1966 and finally completed in November 1967. The basement concrete was finished up to ground floor level in May 1968.

Observation of heave

The measured changes in height of the various survey points (*Fig. 2*) are recorded in *Table 1* and have been plotted graphically against the square root of elapsed time in months, in *Fig. 5*. The graphs show a straight line relationship up to the last readings but show a zero error with what seems to be

Table 1

Date of reading (initial reading Sept. 1967)	*Survey marks* 1	2	3	4	5	6	7	8	9	10	11
	(Accumulative change in height in millimetres—upward changes positive)										
March 1968	0.8	0.7	−0.5	−0.4	−0.1	0	0.5	1.1	0.6	−0.6	0.5
July 1968	7.4	7.7	8.5	9.0	9.2	8.1	5.0	8.6	6.7	6.6	7.3
Sept. 1968	8.8	9.6	10.9	11.4	11.7	10.1	6.0	11.0	8.1	8.0	8.4
July 1969	16.8	18.1	21.1	22.5	22.2	18.7	11.4	20.2	15.7	15.4	15.0
Sept. 1969	19.4	20.5	24.0	25.8	25.5	21.2	12.9	23.3	18.0	17.3	17.0
Nov. 1969	19.7	20.6	24.1	26.2	25.7	20.7	12.6	23.5	18.0	16.8	17.0
Feb. 1970	22.2	23.7	27.4	29.6	28.4	23.9	14.7	26.7	20.3	19.7	19.8
May 1970	27.3	29.5	33.9	36.1	35.6	30.2	19.6	32.3	26.0	25.7	24.7
Aug. 1970	31.5	33.4	38.4	40.9	40.2	34.1	22.2	36.6	29.5	28.8	27.5
Dec. 1970	29.3	31.5	36.7	39.6	38.9	31.6	19.2	35.2	27.2	25.9	25.0
Mar. 1971	32.1	34.7	40.1	43.4	42.3	34.8	21.8	38.1	29.9	28.9	27.4
Aug. 1971	35.0	38.0	44.0	47.1	46.1	38.5	24.1	41.4	32.5	31.7	29.6
Oct. 1971	36.7	39.5	45.8	41.2	48.1	39.3	24.7	43.3	33.8	32.6	30.3
Feb. 1972	39.6	42.7	48.8	52.3	51.1	41.8	27.4	46.1	36.2	35.1	32.7
May 1972	41.7	45.3	51.8	55.3	53.9	44.6	29.4	48.6	38.4	37.7	34.7
Oct. 1972	44.9	48.3	55.1	58.9	57.2	47.4	31.3	51.8	40.8	39.6	36.6
Feb. 1973	46.7	50.1	57.4	60.2	59.5	49.0	32.8	53.0	42.3	41.2	38.3

measurements accurate to 0.1 mm

	Points W, X, Y, Z			
	W	X	Y	Z
Initial reading July 1968				
Change to Oct. 1971	12.2	9.1	12.2	15.2

Measurements taken on concrete slab accurate to ±5 mm only

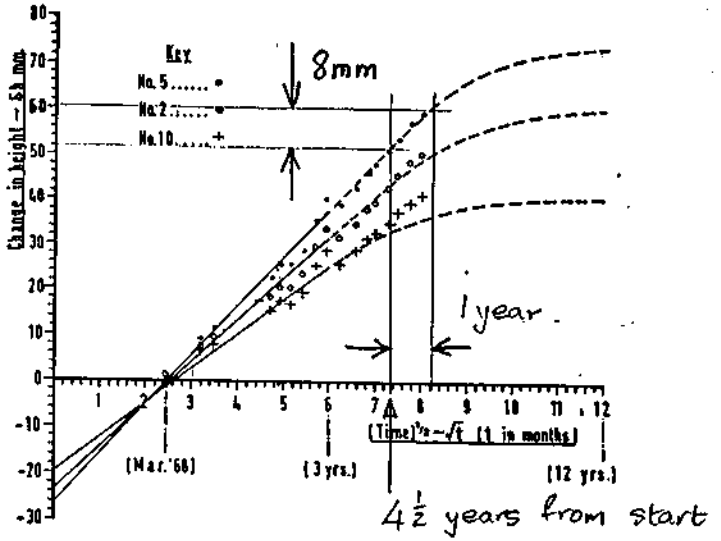


Fig. 5. Recorded heave

FIGURE 2

CONTCUOUS PILE WALL. SEE DOC. Nº 5404/L000/1000.

HIGH LEVEL CANAL WALL

CANAL WALL

STEEL SHEET PILING IN CANAL SEE DOC. Nº 5404/L000/1001.

REGENTS CANAL.

BUBBLE SEEN.

EXISTING BRICK INNER WALL

APPROX 1·2m DIA. SEWER

EXISTING BRICK RETAINING WALL

APPROX 1·1m DIA. SEWER.

OUTLINE OF NEW BUILDING.

PARTY WALL

EXISTING WEST BOUNDARY WALL

FIGURES SHOW MOVEMENT IN mm

+ve values indicate heave

PREDICTED SWELLING CONSTRUCTION

(17% of Total Long Term Swelling)

12727

AT/12/1/83

FIGURE 3.

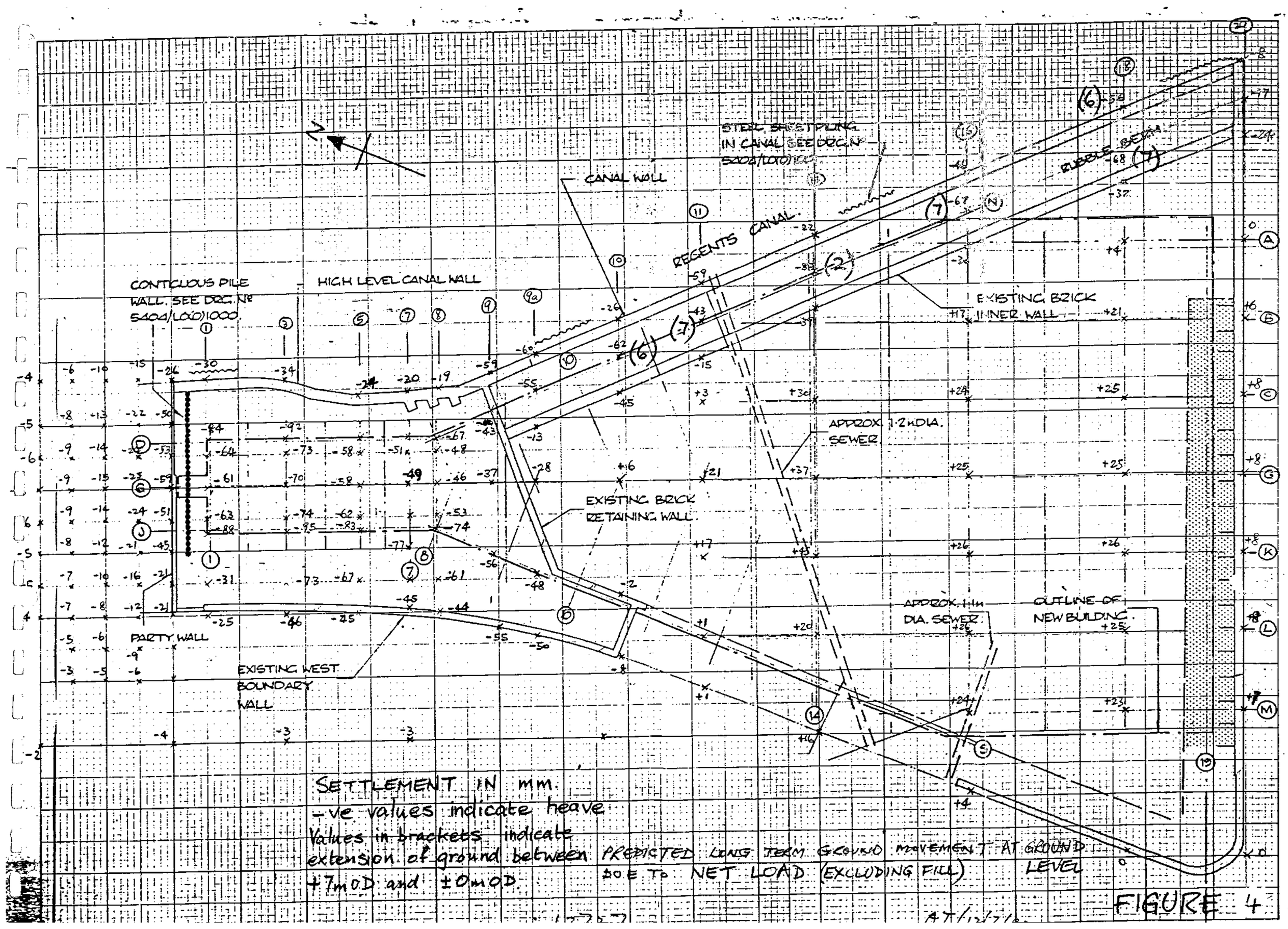

CANAL WALL
STEEL SHEETPILING IN CANAL SEE DRG. Nº 5404/1000/1000
REGENTS CANAL
CONTIGUOUS PILE WALL. SEE DRG. Nº 5404/1000/1000
HIGH LEVEL CANAL WALL
EXISTING BRICK INNER WALL
APPROX. 1·2m DIA. SEWER
EXISTING BRICK RETAINING WALL
APPROX. 1·1m DIA. SEWER
OUTLINE OF NEW BUILDING
PARTY WALL
EXISTING WEST BOUNDARY WALL
SETTLEMENT IN mm.
-ve values indicate heave
Values in brackets indicate extension of ground between +7m OD and ±0m OD.
PREDICTED LONG TERM GROUND MOVEMENT AT GROUND LEVEL DUE TO NET LOAD (EXCLUDING FILL)

FIGURE 4

ZONE X

ZONE IN WHICH PILES ARE DESIGNED FOR TENSION DUE TO SOIL HEAVE

HEAVE

STEEL SHEET PILE WALL FOR DETAILS SEE DRG. No L(X0)1001.

℄ T.H.C.A. SEWER [SEE NOTE 1]

APPROXIMATE LINE OF EXTG. BRICK RETAINING WALL

500 DIA. PRELIM. 3200 TEST PILE.

ZONE IN WHICH PILES ARE DESIGNED FOR LATERAL SOIL DISPLACEMENT

ZONE Y

HEAVE

FIGURE 5.

12727

CALCULATION SHEET

12727 | T4

Member / Location

Drg. Ref.

Job Title

Made by AT Date 26.8.83 Chd.

Reinforcement design for piles within area of Heave (zone X)

The calculations as follows are divided into two parts.

Part one deals with reinforcement requirement at the top section of the piles (pages T5 to T9)

Part two shows design charts for tension reinforcement other than top section of the piles (pages T10 and T11.)

SUMMARY OF REINFORCEMENT REQUIRED AT TOP SECTION OF PILES

Pile Dia. (mm)	Type	Main Reinforcement AT PILE TOP	Shear* Reinforcement
600	Overbored and sleeved	6Y25	R8-300 c/c
600	Sleeved not subject to applied lateral load	6Y25	R8-300 c/c
600	Unsleeved not subject to applied lateral load	6Y25	R12-200 c/c
600	Unsleeved and subject to applied lateral load of 80 KN	6Y25	R8-300 c/c
600	Sleeved and subject to applied lateral load of 40 KN	6Y25	R8-300 c/c
500	Overbored and sleeved	6Y25	R8-300 c/c
500	Unsleeved not subject to applied lateral load	4Y25	R12-200 c/c
500	Unsleeved and subject to applied lateral load	6Y25	R8-300 c/c

* To the full length of piles.

CALCULATION SHEET

12727 T5

Member / Location

Drg. Ref.

Job Title Granary Site

Made by AT Date 26.8.83 Chd.

(i) Overbored and sleeved piles within area of Heave (ZONE X)

Because these piles are required to be sleeved at the upper 4m below the cut-off level, the pile section will act as a column. Hence, the reinforcement design requirement should comply with CP110, Cl. 3.5.1.1 for columns. It requires that the min steel area for the section is to be 1%.

(a) For 600 mm diameter,

Area of pile, $A_c = \frac{\pi}{4} \times 600^2 = 282743 \text{ mm}^2$

$\therefore A_s = 1\% \times 282743 = 2827 \text{ mm}^2$

USE 6Y25 ($A_s = 2945 \text{ mm}^2$)

(b) For 500 mm diameter,

Area of pile, $A_c = \frac{\pi}{4} \times 500^2 = 196350 \text{ mm}^2$

$\therefore A_s = 1\% \times 196350 = 1964 \text{ mm}^2$

require 4Y25 ($A_s = 1964 \text{ mm}^2$)

Recommend 6Y25 ($A_s = 2945 \text{ mm}^2$) (Crack control)

Shear Reinforcement

The design of these piles are the same as the corresponding piles within ~~zone~~ Y. Refer calculation for overbored and sleeved piles in zone Y for detail.

Hence,

Recommend R8 - 300 mm c/c

CALCULATION SHEET

12727 T6

Member / Location

Drg. Ref.

Job Title

Made by AT Date 8/83 Chd.

(ii) Sleeved piles within area of Heave (Zone X) not subjected to applied lateral load

i.e. Piles nos A37 and A38. (660mm diameter)

Use 1% of steel reinforcement as recommended in the reinforcement calculation in zone Y.

i.e. $\frac{100 A_s}{A_c} = 1\%$

or USE 6Y25 ($A_s = 2945 mm^2$)

Shear Reinforcement

Nominal reinforcement required

i.e. R8 - 300 mm c/c

CALCULATION SHEET

12727 | T7

Member / Location

Drg. Ref.

Job Title

Made by AT Date 8/83 Chd.

(iii) Unsleeved Piles with area of Heave (zone X) not subject to applied lateral loads

(a) 600 mm diameter piles

Pile nos. W36, 37, 38, 39 and 205.

The reinforcement design for these piles has been included in the calculation under "Piles subject to additional tensile forces within heave area".

required steel is 4Y25 ($A_s = 1600\ mm^2$)

Recommended steel is 6Y25 ($A_s = 2945\ mm^2$)

(b) 500 mm diameter piles

Pile nos. W191, W192

Use calculated steel reinforcement as in zone Y.

i.e. 4Y25 ($A_s = 1964 mm^2$)

Shear Reinforcement

Same as calculated reinforcement in zone Y.

500 mm diameter R12 – 200 mm c/c

600 mm diameter R12 – 200 mm c/c

CALCULATION SHEET

12727	T 8
Member / Location	
Drg. Ref.	
Job Title	Made by AT Date 8/83 Chd.

(iv.) Unsleeved Piles within area of Heave (Zone X) and also subject to applied Lateral load of 80KN

600 mm diameter

Piles Nos: A14, A15, A18, A19, A22, A23, A26, A27, A31, W8, W10, and W202

Refer calculation on "piles subject to lateral loads."

$\therefore$ use $\frac{100 A_s}{A_c} = 1.0\%$

i.e. USE 6Y25 ($A_s = 2954 mm^2$)

CALCULATION SHEET

12727 T9

Member / Location

Org. Ref.

Job Title

Made by AT Date 8/83 Chd.

(V) Sleeved piles within area of Heave (Zone X) and also subject to applied lateral load of 40 KN

600 mm diameter

Pile nos W7 and W9.

Refer calculation on "piles subject to lateral loads"

Applied lateral load = 40 KN.

Required $\frac{100 A_s}{A_c} = 0.625\%$

USE 6Y25 ($A_s = 2945\ mm^2$)

Shear Reinforcement

USE R8 - 300 mm c/c

CALCULATION SHEET

12727 | T10

Member / Location

Drg. Ref.

Job Title

Made by AT Date 8/83 Chd.

PART TWO

DESIGN CHARTS FOR REINFORCEMENT TO PILES SUBJECT TO TENSION OTHER THAN TOP SECTION OF PILE

PILE DIAMETERS : 500mm and 600mm

CALCULATION SHEET

Maximum tensile force on piles in embankment area

12727 | T11

Member / Location

Orig. Ref.

Job Title: Granary Site | Made by: AT. | Date: 7.7.83 | Chd.

Calculation of Maximum Tensile force on piles in embankment area (600mm pile)

The removal of 6 to 7m of embankment will cause clay to heave, thus causing tension to the piles in the embankment area.

Assuming the clay is fully mobilised on the whole of the pile perimeter,

length of mobilised clay surface = πD

New max. shaft force per pile

$= \alpha \times \pi D \times \int_0^y C_{uy}\,dy$

Take $\alpha = 0.7$ (conservative)

$C_{uy} = 70 + 11y$ kPa

$D = 600$mm

$l = 20.3$m (typical pile with cut-off level at 20.3m, toe level at 0.0m)

$\therefore T = 0.7 \times \pi \times 0.6 \times \int_0^{20.3} (70 + 11y)\,dy$

$= 1.32\,(70y + 5.5y^2)_0^{20.3}$

$= 1.32 \times 3687.5$

$= 4866$ kN

Length of pile in clay (m)	Max. calculated tensile force, T exerted by clay,* (kN)
5	644
10	1650
15	3020
20	4752
25	6848

OAP20

OVE ARUP & PARTNERS
CALCULATION SHEET

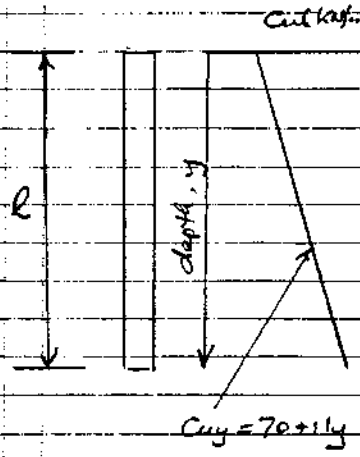
Job No	Sheet No	Rev.
12727	T12	

Member / Location

Drg Ref

Job Title: Granary Site | Made by: AT | Date: 10/8/83 | Chd

Check on reinforcement for 500 mm diameter piles within the heave area



pile diameter, D = 500mm.

Max. shaft force on each pile

$= \alpha \times \pi D \times \int_0^y Cuy\,dy$

The following calculation is similar to those in Section T of Appendix G.

Take $\alpha = 0.7$

$Cuy = (70 + 11y)$ kN/m²

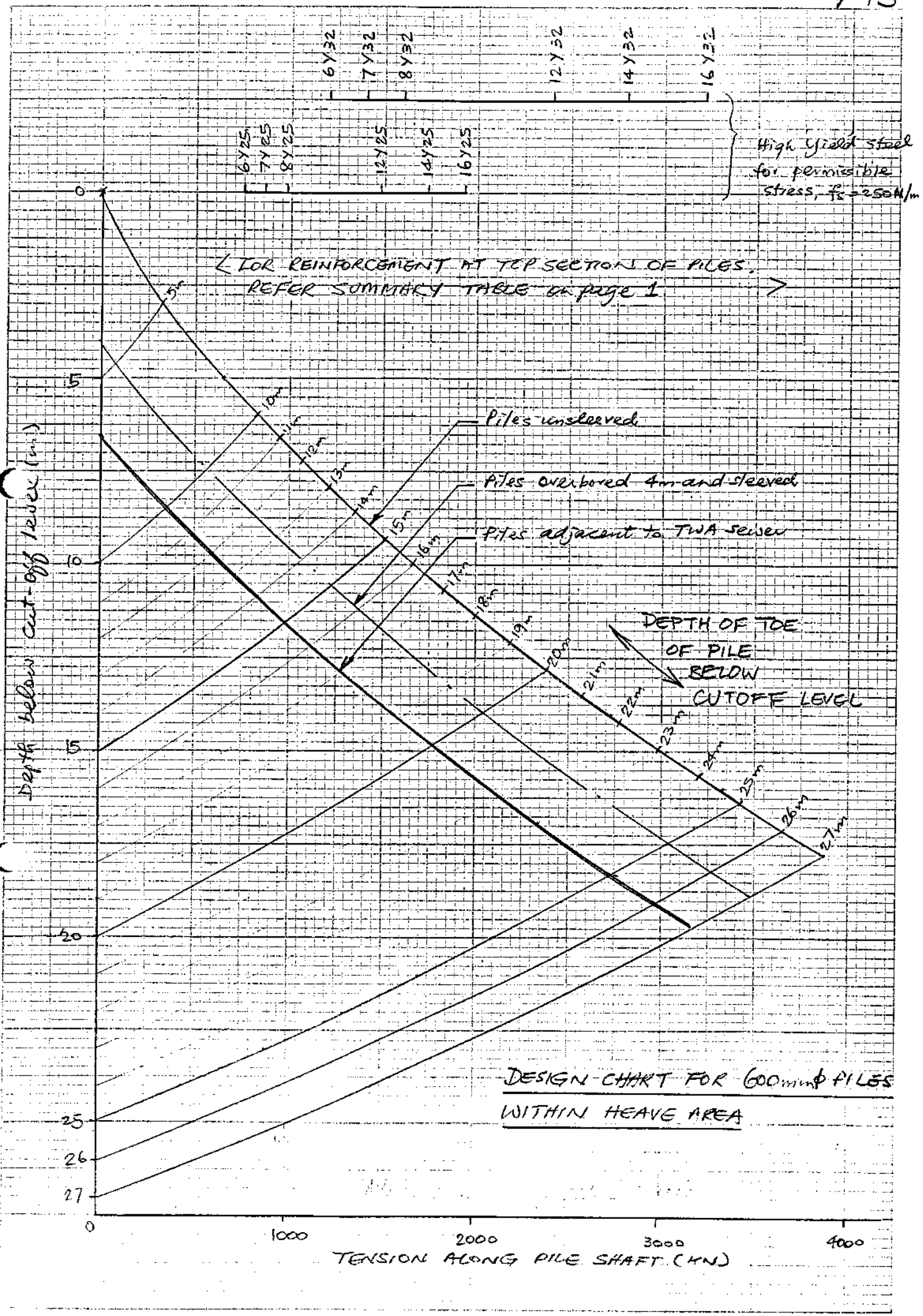
$\therefore$ Max shaft force, $T = 0.7 \times \pi \times 0.5 \int_0^l (70 + 11y)\,dy$

$= 1.1 \times (70l + 5.5l^2)$

$= (77 + 6.05l)\,l$ KN.

Length of pile (m)	Max shaft force, T (KN)	Max tension on pile (KN) (½ × max. shaft force)
0	0	0
5	536	268.0
10	1375	687.5
15	2516	1258.0
20	3960	1980.0
25	5706	2853.0

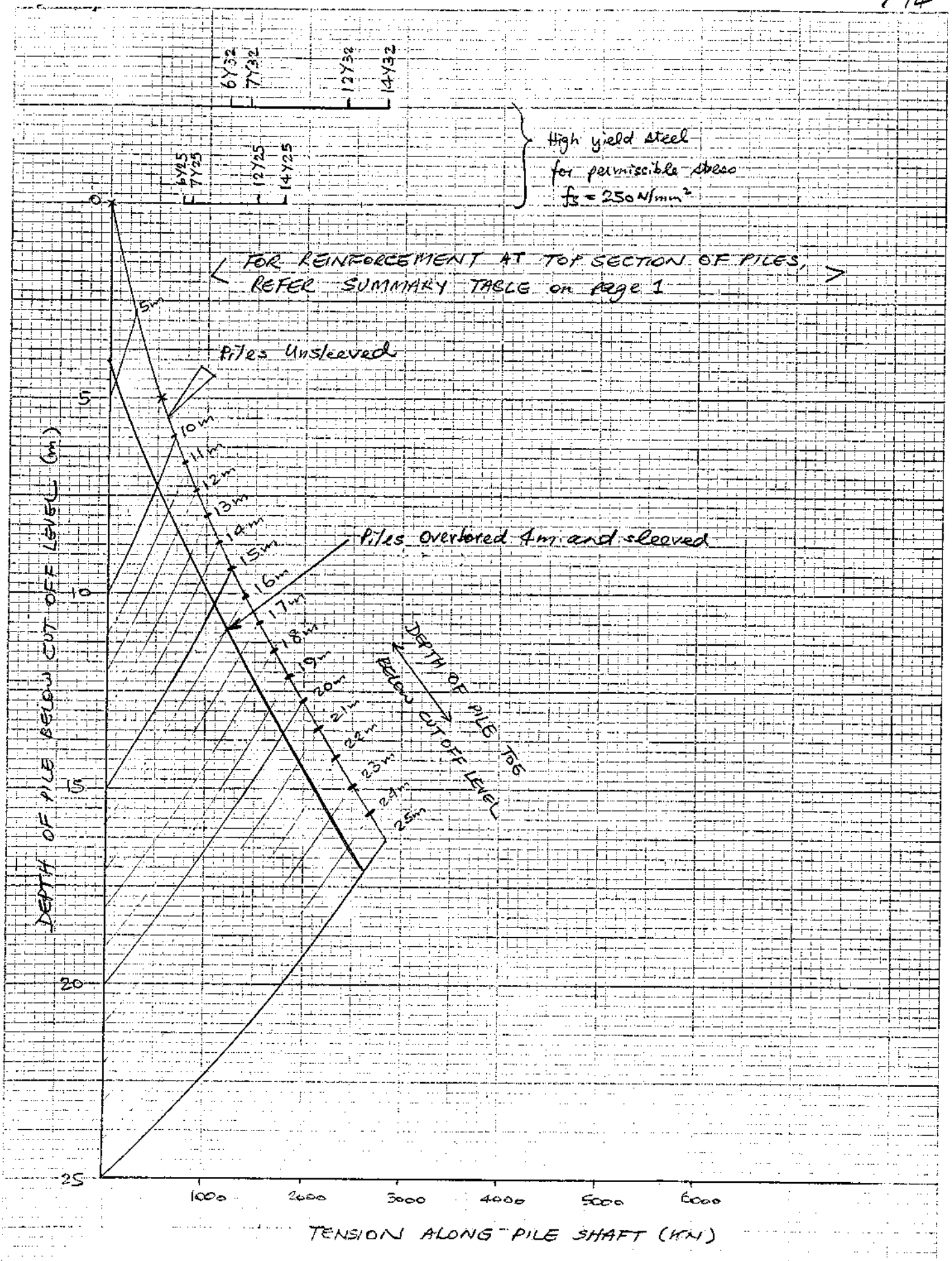
See Design Chart.



DESIGN CHART FOR 600mm ϕ PILES WITHIN HEAVE AREA

12727

AT/11/7/82



DESIGN CHART FOR 500mm Ø PILES WITHIN HEAVE AREA

AT/10/8/83

CALCULATION SHEET

Piles subject to additional tensile forces within heave area

12727 TF1/4

Member / Location

Drg. Ref.

Job Title Granary Site

Made by AT Date 23.8.83 Chd.

PILES SUBJECT TO ADDITIONAL TENSILE FORCE

It was noted in the correspondence on 12 August, 1983 from R Traves's Mayan that there will be uplift pressure exerted to the underside of the beams and pile caps as the clay heave to piles along gridlines D/1-8 and N/8-10. It is anticipated that these tensile forces to piles will be short term and will be relieved by the building weight as the construction progresses.

The piles affected included (see attached letter)

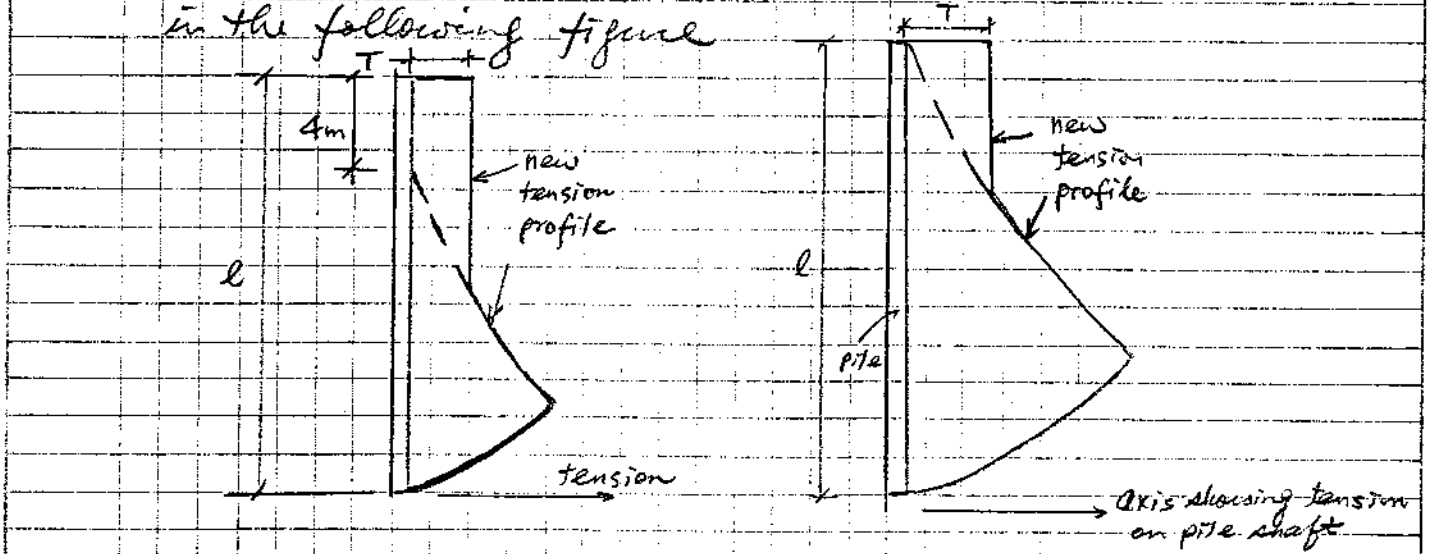
Gridline	Pile Nos.	Short Term max. tensile force (kN)
D/1-8	A7, A13, A21, A25, A29, A30, A31, A35 (8 Nos)	600
N/8-10	W2, W3, W4, W16-W20, W36-W39, W205 (13 Nos)	400

Method of calculating reinforcement

Because of the existence of tensile forces at the top of these piles, additional reinforcement is required to resist these forces and to prevent excessive cracking to the piles. It is noted that the above piles will also experience tensile forces on the pile shaft as they are within area of heave. Except for piles W36-W39 & W205, all of these piles are overbored and sleeved. Design of steel reinforcement for piles overbored and sleeved at the upper 4m (6.5m for piles adjacent to TWA sewer) within the heave area has been made on 27 July, 83, with

the recommended steel reinforcement required to be 0.5%. Subsequently, it is noted that the sleeved section would act as a column. Hence, the minimum amount of area of steel is 1% according to CP110, Cl. 3.5.1.1.

Since the piles have been designed to experience tension on the pile shaft; a design chart has been produced to calculate steel reinforcement of them. The additional tension at the top section can be shown in the following figure



Overbored and Sleeved Piles unsleeved piles

Calculation of steel reinforcement with additional tensile force

(i) Short term tensile force = 600 KN

Piles along Gridline D/1-8.

For steel reinforcement to resist tension,

$T = A_s f_s$

Where T = tensile force,

A_s = area of steel reinforcement

f_s = 250 N/mm² allowable stress to control cracking in concrete.

$$\therefore A_s = \frac{T}{f_s} = \frac{600 \times 10^3}{250} = 2400 \text{mm}^2$$

USE 6Y25 ($A_s = 2945 \text{mm}^2$)

$$\text{Actual } \frac{100 A_s}{A_c} = \frac{2945}{\frac{\pi}{4} \times 600^2} = 1.04\%$$

The amount of steel complies with CP110, Cl 3.5.1.1.

(ii) Short term tensile force = 400 KN

Tension $T = A_s f_s$

$$\therefore A_s = \frac{T}{f_s} = \frac{400 \times 10^3}{250} = 1600 \text{mm}^2$$

$$\text{or } \frac{100 A_s}{A_c} \text{ (required)} = \frac{1600 \times 100}{\frac{\pi}{4} \times 600^2} = 0.57\% \Rightarrow A_s = 1612 \text{mm}^2$$

(a) Overbored and sleeved Piles

This is less than 1% required by CP110, Cl. 3.5.1.1

∴ USE 6Y25 ($A_s = 2945 \text{mm}^2$)

(b) Unsleeved Piles (W36-W39, W20R) require 6Y20 ($A_s = 1885 \text{mm}^2$)

Recommend 6Y25 ($A_s = 2945 \text{mm}^2$)

It is considered not necessary to design steel reinforcement to the above piles for combined tension and bending moment due to lateral soil displacement for the short term because:

(1) The tension and bending moment will be unlikely to occur at the same time during the construction of the building (Refer paragraph 2 of attached letter)

(2) If they occur at the same time, the crack sections of the pile will reduce the pile stiffness, hence bending moments will be significantly reduced.

SUMMARY OF STEEL REINFORCEMENT SUBJECT TO TENSILE FORCE

Gridline	Pile Nos.	As (mm^2)	Main Reinforcement	Shear Reinforcement
D/1-8	A7, A13, A21, A25, A29-31 A35	2945	6Y25	Nominal Reinforcement Required R8-300c/c.
N/8-10	W2-W4, W16-W20, W36-W39, W205	2945 1600	6Y25 +6Y25	

† Recommended value, see calculation for detail.

1/10

TF5

R TRAVERS MORGAN & PARTNERS

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Messrs. T.P. Bennett & Son,
262, High Holborn,
London, WC1V 7DU.

Our ref: S.5404/WG/

CO/1

12th August, 1983.

Dear Sirs,

NWMLO, Granary Site
Pile Design - Short Term Tensile Forces

Further to our letter of 10th August referring to the design of piles, Mr. Holland of Expanded Piling requested to know the reason for the requirements in paragraph 4(c). These requirements call for a minimum of 6 Y25 bars to resist possible heave forces at the top of the piles.

We explained that we anticipate that along grid lines D/1-8 and N/8-10 small uplift pressures will occur on the underside of the beams and pile caps as the clay heaves. These uplift forces will develop tension forces in the piles in the short term until sufficient building weight is added to the piles. We anticipate that 50% of the tension force will be relieved by building weight within 4 months after completion of the pile caps and 100% within 9 months.

We estimate the maximum tension forces due to this effect will be 600 kN for piles A7, 13, 21, 25, 29, 30, 31 and 35 and 400 kN for piles W2, 3, 4, 16, 17, 18, 19, 20, 36, 37, 38, 39 and 205.

In our letter of 10th August we proposed the provision of a minimum of 6 Y25 bars to resist these forces. As Expanded Piling are responsible for the design of the piles, Mr. Holland wished to know if they should allow for these short term tensile forces in their design or confine themselves to providing a minimum of 6 Y25 bars. We would emphasize Expanded Piling's responsibility and recommend that they should be advised to consider these short term tensile forces and alter their design if they consider it necessary.

OAP

Yours faithfully,
for R. TRAVERS MORGAN & PARTNERS

A. H. D...

Copy to :
Expanded Piling Co. Ltd. ✓
Messrs. Cyril Sweett & Partners
E.R.

THE EXPANDED PILING CO. LTD.

15 AUG 1983

CATERHAM 40418

8.0 PILES SUBJECT TO LATERAL LOADS

Sheets L1 to L16

CALCULATION SHEET

PILES SUBJECT TO APPLIED LATERAL LOAD

12727 | L1 / 16

Member / Location

Org. Ref.

Job Title: GRANARY SITE | Made by: AT | Date: 28.8.83. | Chd.

PILES SUBJECT TO APPLIED LATERAL LOAD

Some piles as shown below have been designed to resist lateral load of 40KN and 80KN due to wind loading to the building.

(Refer Contract Drawing No. Lo(0) 1000/J)

PILE NO.	DESIGN HORIZONTAL LOAD (KN)	
A14	80	PILES WITHIN HEAVE AREA (ZONE X)
A15	80	
A18	80	
A19	80	
A22	80	
A23	80	
A26	80	
A27	80	
A31	80	
W8	80	
W10	80	
W202	80	
W7	40	
W9	40	
W75	80	PILES OUTSIDE HEAVE AREA (EXCL. ZONE Y)
W76	80	
W151	80	
W152	80	
W153	80	
W151	80	
W58	40	
W57	40	
W50	40	
W61	40	
W62	40	
W63	40	
W64	40	
W65	40	
W66	40	
W67	40	
W68	40	
W69	40	

(Continued next page)

CALCULATION SHEET

12727 | L2/16

Member / Location

Drg. Ref.

Job Title

Made by AT Date 28.8.83

Pile No.	Design horizontal load (KN)
W70	40
W71	40
W72	40
W73	40
W74	40
W77	40
W78	40
W79	40
W80	40
W81	40
W82	40
W83	40
W84	40
W85	40
W95	40
W96	40
W97	40
W98	40
W102	40
W103	40
W126	40
W127	40
W128	40
W129	40
W130	40
W131	40
W132	40
W133	40
W137	40
W138	40
W139	40
W142	40
W143	40
W144	40

PILES OUTSIDE HEAVE AREA

CALCULATION SHEET

12727 | L3/16

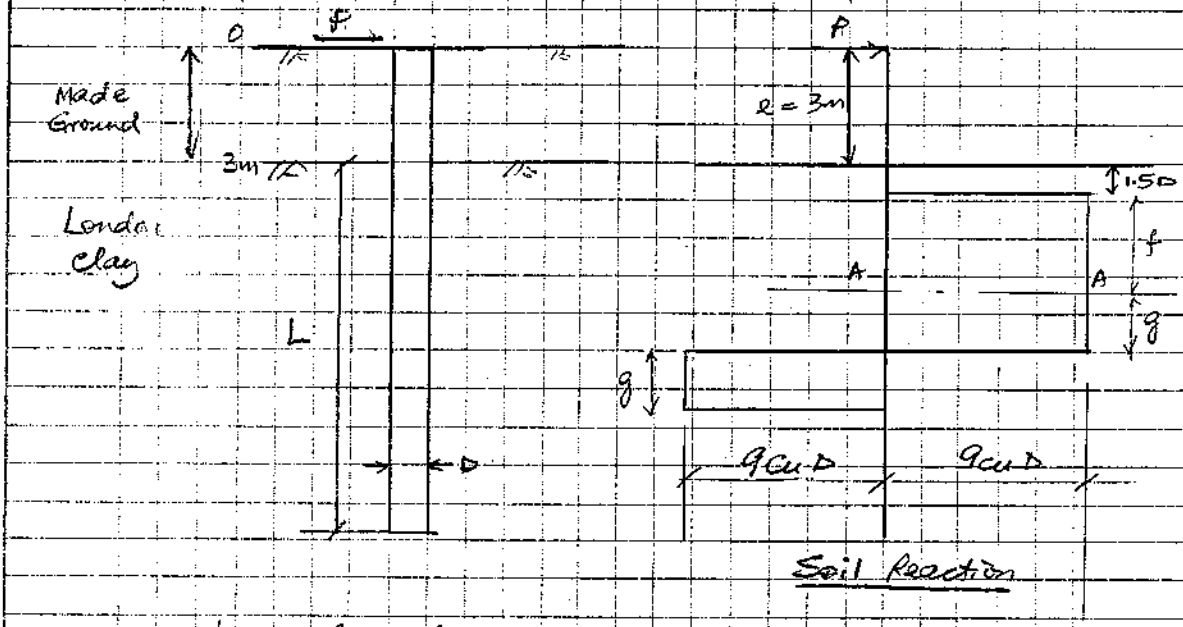
Member / Location

Org. Ref.

Job Title

Made by AT Date 12.7.83. Chd.

Lateral Load



L = length of penetration, m.
D = Diameter of pile, m (0.6m)
Cu = undrained shear strength, KPa
P = applied lateral load.

Assumptions.

1. Thickness of made ground is 3m outside heave area
2. The pile is unrestrained at the top
3. Use Cu = 100 KPa as average soil strength
4. For calculation of ultimate lateral load and bending moment, reduce the soil strength by a factor of 3.

Design Method

Use method by B. Broms (1965) in "Design of Laterally Loaded Piles" Proc ASCE, Vol. 91, SM3, pp. 77-99.

CALCULATION SHEET

12727 L4/16

Member / Location

Drg. Ref.

Job Title

Made by A.T. Date 28.8.83 Chd.

(A) Reinforcement design for piles within area of Heave (ZONE X)

Three categories to be considered:

1. 600 mm diameter piles subject to applied lateral load 80KN
2. 600 mm diameter piles subject to applied lateral load 40KN
3. 500mm diameter piles subject to applied lateral load 80KN.

Assume eccentricity, e = 1m, for analysis of piles within area of heave.

A.1. 600 mm diameter piles subject to applied lateral load 80KN

Applied lateral load, P = 80KN

Undrained shear strength = $100 KN/m^2$

At working condition, apply a factor of 3,

i.e $C_w = \frac{C_u}{3} = 33 KN/m^2$

Diameter of pile = 0.6m

$$\therefore \frac{P}{C_w D^2} = \frac{80}{33 \times 0.6^2} = 6.7$$

Eccentricity, e = 1m

$$\therefore \frac{e}{D} = \frac{1.0}{0.6} = 1.67$$

$$\therefore \text{Figure 4, } \frac{M}{C_w D^3} = 24$$

$$\Rightarrow M = 24 \times C_w D^3$$
$$= 24 \times 33 \times 0.6^3$$
$$= \underline{171.1 KNm}$$

$\therefore$ Maximum bending moment is 171.1 KNm

This value of bending moment will be used as ultimate bending moment for the reinforcement design of piles.

CALCULATION SHEET

12727 | LS/16

Member / Location

Drg. Ref.

Job Title

Made by AT. Date 28.8.83 Chd.

A.1. Reinforcement (Cont'd)

Maximum axial load = 1700 KN

Design axial load = (1700 × 1.4) N = 2380 KN (Safety factor = 1.4 to ultimate limit state)

Design bending moment, M = 171.1 KNm

$\therefore \frac{M}{h^3} = \frac{171.1 \times 10^6}{600^3}$ (h = 600mm, dia of pile)

$= 0.79 \text{ N/mm}^2$

$\frac{N}{h^2} = \frac{2380 \times 10^3}{600^2}$

$= 6.61 \text{ N/mm}^2$

Diameter of cage, h_s = 600 - 2×75 = 450 mm (cover = 75mm)

$\frac{h_s}{h} = \frac{450}{600} \doteq 0.8$

CP110, Part 3, Figure 108, $f_{cu} = 25 \text{ N/mm}^2$, $f_y = 410 \text{ N/mm}^2$

$\therefore \frac{100 A_s}{A_c} = 0.2\%$

$A_s = 0.2\% \times \frac{\pi}{4} \times 600^2$

$= 565 \text{ mm}^2$

Because of the possibility of lateral soil movement within embankment area, it is recommended that all the piles should be reinforced with a minimum 1% steel. (Also refer calculation for piles in zone Y).

$\therefore \frac{100 A_s}{A_c} = 1\% \Rightarrow A_s = 1\% \times \frac{\pi}{4} \times 600^2 = 2827 \text{ mm}^2$

$\therefore$ USE 6Y25 ($A_s = 2945 \text{ mm}^2$)

The above steel reinforcement applies for the following piles: A14, A15, A16, A17, A25, A25Y, A26 & A27 (8 No.)

CALCULATION SHEET

12727 L6/16

Member / Location

Drg. Ref.

Job Title

Made by AT. Date 28.8.83. Chd.

A.1. (Cont'd) Reinforcement for Pile No. A31

Applied axial load = 900KN

Design axial load, $N = 900 \times 1.4 = 1260KN$

Design bending moment, $M = 171.1 KNm$ (previous calc.)

$$\frac{M}{h^3} = \frac{171.1 \times 10^6}{600^3} = 0.79 N/mm^2$$

$$\frac{N}{h^2} = \frac{1260 \times 10^3}{600^2} = 3.5 N/mm^2$$

Cl.10, Part 3, Figure 10B,

$$\therefore \frac{100 A_s}{A_c} = 0\%$$

As calculation above, steel area is required to be 1%.

$$\frac{100 A_s}{A_c} = 1\% \Rightarrow A_s = 2827 mm^2$$

$\therefore$ USE 6Y25 ($A_s = 2945 mm^2$)

CALCULATION SHEET

12727 | L7/16

Member/Location

Drg. Ref.

Job Title | Made by AT. | Date 28.8.83 | Chd.

A.2. 600 mm diameter piles subject to applied lateral load 40KN

Applied lateral load, P = 40KN

Soil Strength, $C_u = \frac{150}{3} = 33\ KN/m^2$

eccentricity, $e = 3\ m$

$D = 0.6\ m$

$\therefore \frac{P}{C_u D^2} = \frac{40}{33 \times 0.6^2} = 3.34$

$\frac{e}{D} = \frac{1.0}{0.6} = 1.67$

Figure 4, $\frac{M}{C_u D^3} = 11$

$\therefore M = 11 \times 33 \times 0.6^3$

$= 78.4\ KNm$

$\therefore$ Maximum bending moment = 78.4KNm

Reinforcement

Applied axial load = 1700 KN

Design axial load, $N = 1700 \times 1.4 = 2380KN$

Design bending moment, $M = 78.4KNm$

$\frac{M}{h^3} = \frac{78.4 \times 10^6}{600^3} = 0.36\ N/mm^2$

$\frac{N}{h^2} = \frac{2380 \times 10^3}{600^2} = 6.61\ N/mm^2$

Cl 10, Part 3, Figure 10B,

$\therefore \frac{100 A_s}{A_c} = 0\%$

Recommend to use 1% of reinforcement to be consistent with reinforcement calculation for piles in Zone Y.

$\therefore A_s = 1.0\% \times \frac{\pi}{4} \times 600^2$

$= 2827\ mm^2$

USE 6Y25 ($A_s = 2945\ mm^2$)

CALCULATION SHEET

12727 | L8/16

Member / Location

Drg. Ref.

Job Title

Made by AT. Date 28.8.83 Chd.

(W202)

A.3 500mm diameter piles, subject to applied lateral load 80KN

Applied lateral load = 80KN

$C_u = \frac{100}{3} = 33 KN/m^2$

$e = 3m$

$D = 0.5m$

$$\frac{P}{C_u D^2} = \frac{80}{33 \times 0.5^2} = 9.7$$

$$\frac{e}{D} = \frac{1.0}{0.5} = 1.67$$

Figure 4, $\frac{M}{C_u D^3} = 3.7$

$\therefore M = 3.7 \times 33 \times 0.5^3$

$= 152.6 KNm$

$\therefore$ Maximum bending moment is 152.6 KNm

Reinforcement

Applied axial load = 500 KN

Design axial load, $N = 500 \times 1.4 = 700 KN$

Design bending moment, $M = 152.6 KNm$

$$\frac{M}{h^3} = \frac{152.6 \times 10^6}{500^3} = 1.22 N/mm^2$$ (h = 500mm dia. of pile)

$$\frac{N}{h^2} = \frac{700 \times 10^3}{500^2} = 2.8 N/mm^2$$

$h_s = (500 - 2 \times 75) = 350 mm$

$$\frac{h_s}{h} = \frac{350}{500} = 0.7$$

CP110, Part 2, Figure 109,

$\therefore 100 \frac{A_s}{A_c} = 0.8\% \Rightarrow A_s = 0.8\% \times \frac{\pi}{4} \times 500^2 = 1571 mm^2$

But require min. $\frac{100 A_s}{A_c} = 1\%$ for possibility of lateral axial movement.

CALCULATION SHEET

12727 L9/16

Number / Location

Orig. Ref

Job Title

Made by AT Date 28.8.83 Chd.

From p. L8/16,

$\therefore \frac{100 A_s}{A_c} = 1\%$

$A_s = 1\% \times \frac{\pi}{4} \times 500^2 = 1963 mm^2$

Require 4Y25 ($A_s = 1964 mm^2$)

To control cracking,

Recommend to use 6Y25 ($A_s = 2945 mm^2$)

CALCULATION SHEET

12727 L10/16

Member / Location

Drg. Ref.

Job Title

Made by AT. Date 28.8.83. Chd.

(B) Reinforcement Design for Piles outside the Heave area

Only two categories are considered:

4. 600mm diameter piles subject to applied lateral load 80KN

5. 600mm diameter piles subject to applied lateral load 40KN.

B.4. 600mm diameter piles subject to applied lateral load 80KN

$\therefore P = 80KN$

$C_u = \frac{100}{3} = 33 KN/m^2$

$D = 0.6m$

$e = 3m$ (Thickness of fill)

$\therefore \frac{P}{C_u D^2} = \frac{80}{33 \times 0.6^2} = 6.7$

$\frac{e}{D} = \frac{3}{0.6} = 5$

Figure 4, $\frac{M}{C_u D^3} = 43$

$\therefore M = 43 \times 33 \times 0.6^3$

$= 306.5 KNm$

Reinforcement

Maximum axial load = 1700KN

Design axial load, $N = 1700 \times 1.4 = 2380KN$

Design bending moment, $M = 306.5 KNm$ (from Calc. section A1)

$\therefore \frac{M}{h^3} = 1.42 N/mm^2$

$\frac{N}{h^2} = 6.61 N/mm^2$

CP110, Part 3, Figure 10c,

$\therefore \frac{100 A_s}{A_c} = 1.3\% \Rightarrow A_s = 1.3\% \times \frac{\pi}{4} \times 600^2 = 3676 mm^2$

Provide 8 Y25 ($A_s = 3927 mm^2$)

OAP20

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CALCULATION SHEET

Job No.	Sheet No.	Rev.
12727	L11/16.	

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CALCULATION SHEET

1207 L12/16

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Job Title

Made by AT Date 28.8.83 Chd.

B.5. 600mm diameter piles subject to applied lateral load 40KN

$\therefore P = 40\,KN$

$C_w = \frac{100}{3} = 33\,KN/m^2$

$D = 0.6\,m$

$e = 3\,m$

$\therefore \frac{P}{C_w D^2} = 3.34$

$\frac{e}{D} = 5.0$

Figure 4, $\frac{M}{C_w D^3} = 22$

$\therefore M = 22 \times 33 \times 0.6^3$

$= \underline{156.8\,KNm}$

Reinforcement

Max. axial load = 1700 KN

Design axial load, $N = 1700 \times 1.4 = 2380\,KN$

Design bending moment, $M = 156.8\,KNm$

$\frac{M}{h^3} = \frac{156.8 \times 10^6}{600^3} = 0.73\,N/mm^2$

$\frac{N}{h^2} = \frac{2380 \times 10^3}{600^2} = 6.61\,N/mm^2$

CP110, Part 3, Figure 108,

$\therefore \frac{100 A_s}{A_c} = 0\%$

Since min. of area of reinforcement required = 0.5%
(Specification, Cl. 16.04)

$\therefore \frac{100 A_s}{A_c} = 0.5\% \Rightarrow A_s = 0.5\% \times \frac{\pi}{4} \times 600^2 = 1414\,mm^2$

USE 6Y20 ($A_s = 1885\,mm^2$)

CALCULATION SHEET

12727 L13/16

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Job Title

Made by AT. Date 28.8.83 Chd.

Find minimum length of steel cage

eccentricity, $e = 3m$

diameter, $D = 0.6m$

$C_u = 33 KN/m^2$

For $L = 3m$ where L = length of penetration into good clay.

i.e. this case, length below cut-off level

that is, total length of cage below cut-off level

$= L + e = 3 + 3 = \underline{6m}$

$\frac{L}{D} = \frac{3}{0.6} = 5$

$\frac{e}{D} = \frac{3}{0.6} = 5$

Figure 3, $\therefore \frac{P_{ult}}{C_u D^2} \doteq 3.3$

$\therefore P_{ult} = 3.3 \times 33 \times 0.6^2$

$= 39.2 KN$ < smallest applied lateral load of 40 KN

$\underline{L = 3m \text{ is inadequate}}$

For $L = 5m$

Total cage length below cut-off level $= 5 + 3 = \underline{8m}$

$\frac{L}{D} = \frac{5}{0.6} = 8.3$, $\frac{e}{D} = \frac{3}{0.6} = 5$

Figure 3, $\therefore \frac{P_{ult}}{C_u D^2} = 11$

$\therefore P_{ult} = 11 \times 33 \times 0.6^2 = \underline{131 KN}$

This value is equivalent to a factor of $(\frac{131}{80} =) 1.6$ to the largest applied load.

$\therefore L = 5m$ is adequate.

$\therefore$ Total cage length required is 8m below cut-off level

CALCULATION SHEET

12727 | L14/16

Member / Location

Drg. Ref.

Job Title

Made by AT. Date 28.8.83. Chd.

Deflection of laterally loaded piles at ground surface

(Pile Diameter 600mm)

Using Broms theory,

$$\beta = \sqrt[4]{\frac{k_h D}{4(EI)_p}}$$

where k_h = coefficient of hori. subgrade reaction

D = diameter of pile = 600mm

$(EI)_p$ = stiffness of pile section.

Take $E_p = 20000\ MN/m^2$

$$I_p = \frac{\pi D^4}{64}$$

$$\therefore (EI)_p = 20,000 \times \frac{\pi}{64} \times 0.6^4 = 127.234\ MNm^2$$

Since $k_h = 67 \frac{C_u}{D}$ (Broms, 1972)

Take $C_u = 70\ KPa$ at top of London clay

$$\therefore k_h = 67 \times \frac{70}{0.6} = 7816\ KN/m^3$$

$$\therefore \beta = \sqrt[4]{\frac{7816 \times 0.6}{4 \times 127.234}} = 0.31$$

For pile length = 21.3m (pile no. A26)

$$\therefore \beta L = 0.31 \times 21.3 = 6.6 > 1.5$$

∴ long pile

For restrained long pile, deflection at ground (eg. pile cap.)

$$y_o = \frac{HF}{K_h D}$$

For $H = 40KN$, $= \frac{40 \times 0.31}{7316 \times 0.6} = \underline{2.6mm}$

For $H = 80KN$, $y_o = 2.6 \times 2 = \underline{5.2mm}$

CALCULATION SHEET

12727 | L15/16

Member / Location

Drg. Ref.

Job Title

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SUMMARY OF PILES SUBJECT TO APPLIED LATERAL LOAD

(A) Piles within area of Heave (Zone X)

Applied Lateral Load (KN)	Pile Diameter (mm)	Pile No.	Required Steel area (mm)	Main Reinforcement
		W8, W10		
80	600	A14, A15, A18, A19, A22, A23, A26 A27	2827	6Y25
	600	A31	2827	6Y25
	500	W202	1963	*6Y25
40	600	W7, W9	2827	6Y25

* See calculation for recommended main reinforcement

(B) Piles outside area of Heave (ie NOT IN ZONES X OR Y)

Applied Lateral Load (KN)	Pile Diameter (mm)	Required Steel area (mm^2)	Main Reinforcement	Cage Length (m)	Calc. hori. deflection (mm)
80	600	3676	8Y25	8.0	5.2
40	600	1414	6Y20	8.0	2.6

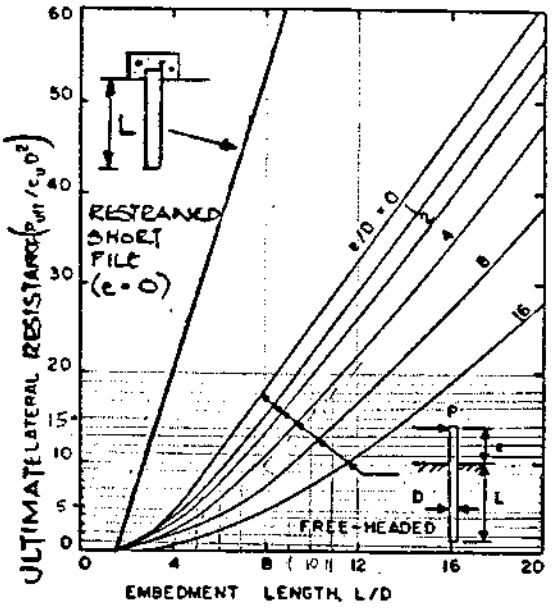

FIG. 3 ULTIMATE LATERAL RESISTANCE FOR COHESIVE SOILS RELATED TO EMBEDMENT LENGTH

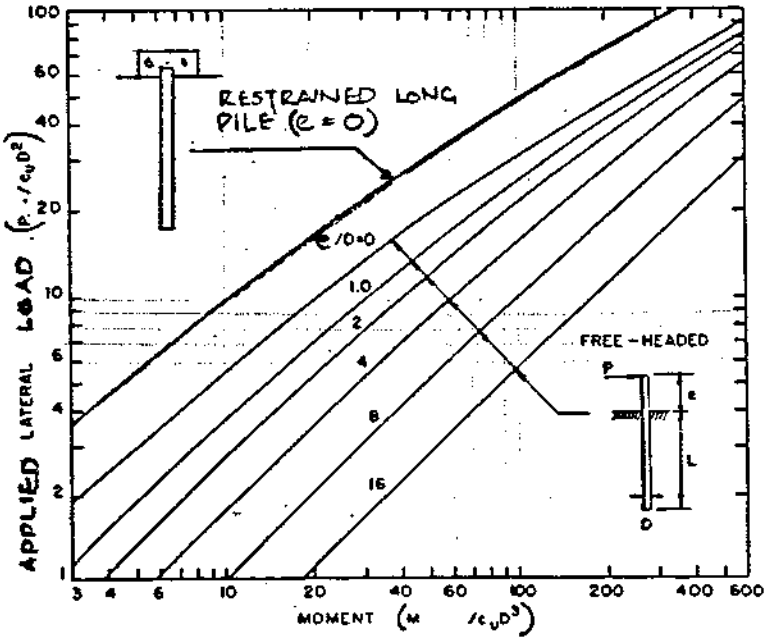

FIG. 4 MAXIMUM BENDING MOMENT IN PILE IN COHESIVE SOIL

9.0 PILES SUBJECT TO LATERAL GROUND MOVEMENT.

Sheets LD1 to LD3
and Y1 to Y16

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CALCULATION SHEET

Job No.	Sheet No.	Rev.
12727	LD 1/3	

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Job Title: Granary Site

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Design of piles for lateral displacement.

Computation of long term lateral movement is difficult because it depends critically on the effective Poisson's ratio and anisotropy of the clay. To obtain an approximate estimate, the following procedure has been followed:

1. Carry out finite element analysis for long term drained condition, using a circular load (90m diameter) as before, but no bored pile wall. ($E' = 130 c_u$, $\nu = 0.2$)
2. Compare the maximum heave (176 mm) with the maximum heave beneath the building obtained using VDISP and the net loads (70mm). The difference is due to
   a) the difference between gross and net loads
   b) the complex geometry modelled more accurately by VDISP.
3. Multiply all displacements from the finite element analysis [(1) above]

by $\frac{70}{176} = 0.4$.

4. Figure LD1 attached is a plot of the lateral movements at ground level obtained in this way. Since these movements would occur as the soil swells and softens, it is unlikely to be able to sustain the high shear stresses required to give a sharp peak to the displacements. It is therefore considered that piles within about 15m of the embankment at the north of the site should be reinforced to accept 10mm of lateral movement of the ground relative to the pile caps. **

In addition to piles subject to heave (Zone X) piles in Zone Y will be designed for this lateral movement (Figure LD2)

5. For an applied displacement, the worst case for both bending moment and shear force occurs when the soil is as stiff as possible. Since softening of the clay is necessary to cause movement, it is considered permissible to assume $c_u = 100$ kPa

** Lateral movements due to removal of the rubble fill will be relatively small and can be neglected.

6. Use a subgrade reaction model with no tension allowed on the pile shaft, the coefficient of subgrade reaction is derived with $k_h = 82 c_u/B$ where B is the pile diameter (Rooms, 1972)

7. The behaviour of the pile when subjected to lateral displacement of 10mm has been modelled using program FREW – Flexible Retaining Wall program. Three cases have been considered as below:

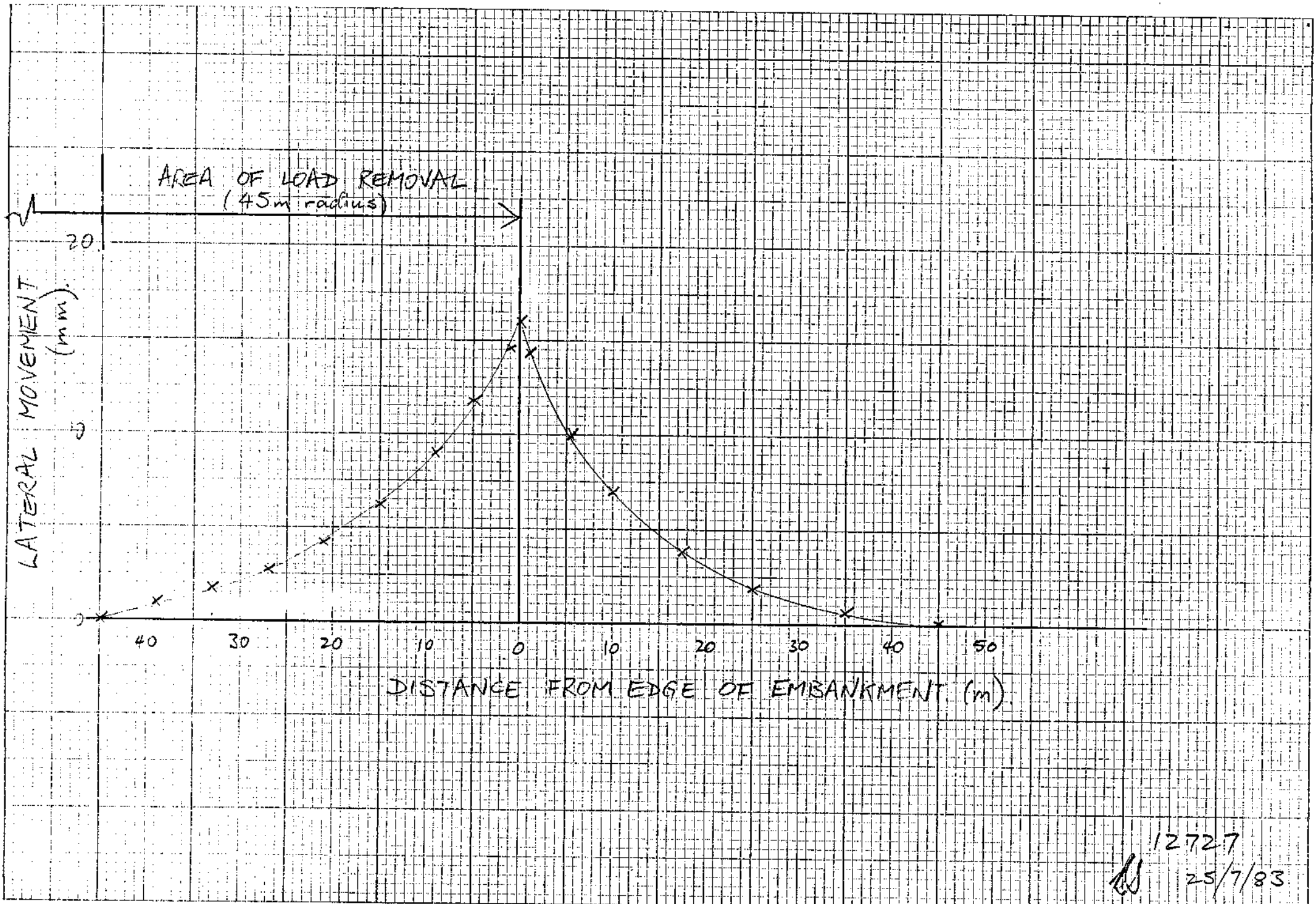
Case 1 : 1.B1L Piles unsleeved, $(EI)_p = 0.13 \times 10^6$ KNm^2

Case 2 : 4.B1L Piles overbored 4m and sleeved $(EI)_p = 0.13 \times 10^3$ KNm^2

Case 3 : 5.B1L Piles overbored 4m and sleeved $(EI)_p = 0.065 \times 10^3$ KNm^2

A conversion factor of 0.6 was introduced as appropriate to correct from the unit length assumed in the program to the pile diameter. The FREW results are presented in Figure LD3.

8. The enclosed calculations consider steel reinforcement design of piles both unsleeved and overbored and sleeved. Design of unsleeved piles in Zone Y is based on bending moments and shear forces from 1.B1L result whereas overbored and sleeved piles are from 4.B1L results, both cases being the worst condition.



12727

25/7/83

FIGURE 4.1

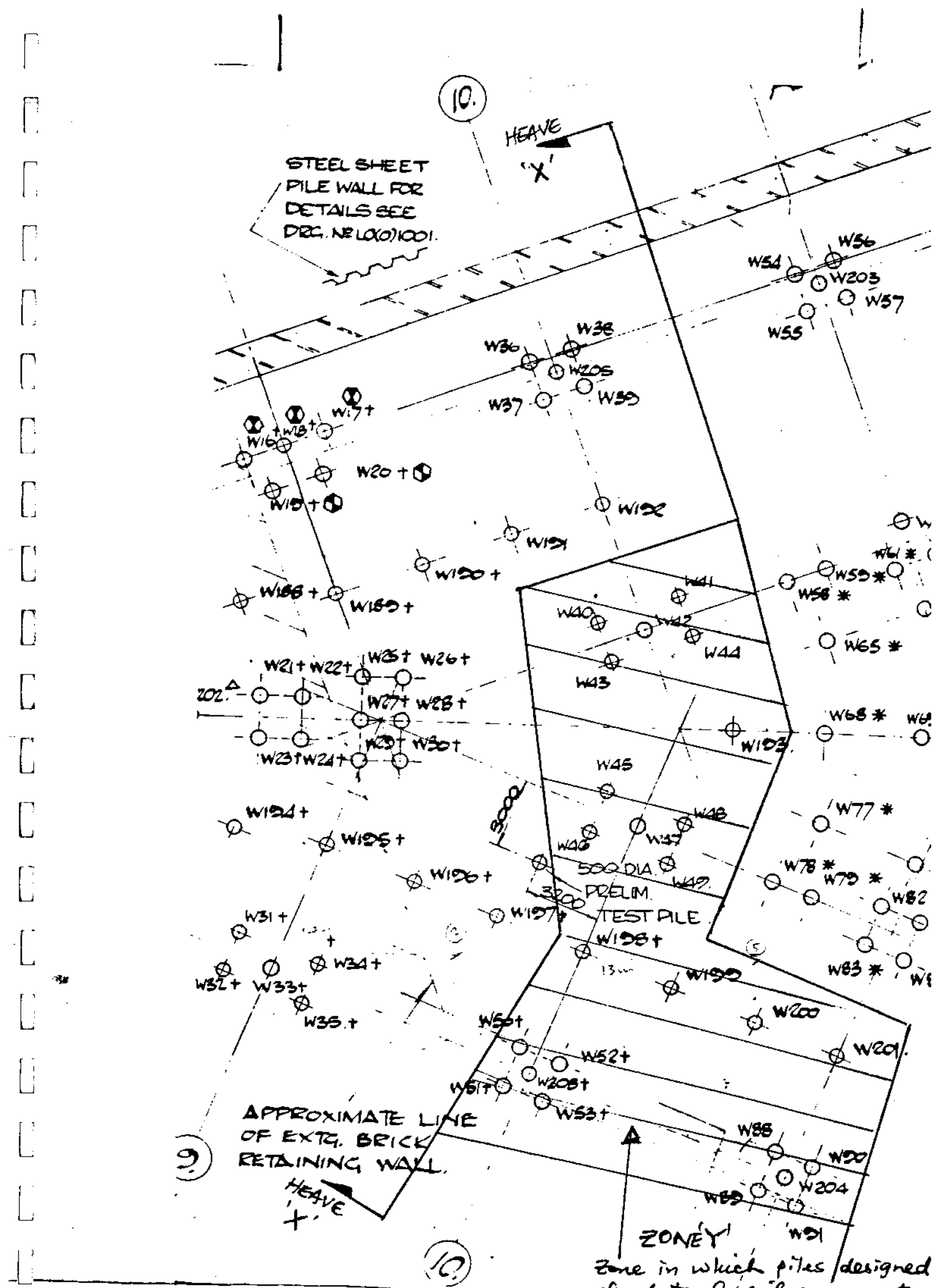


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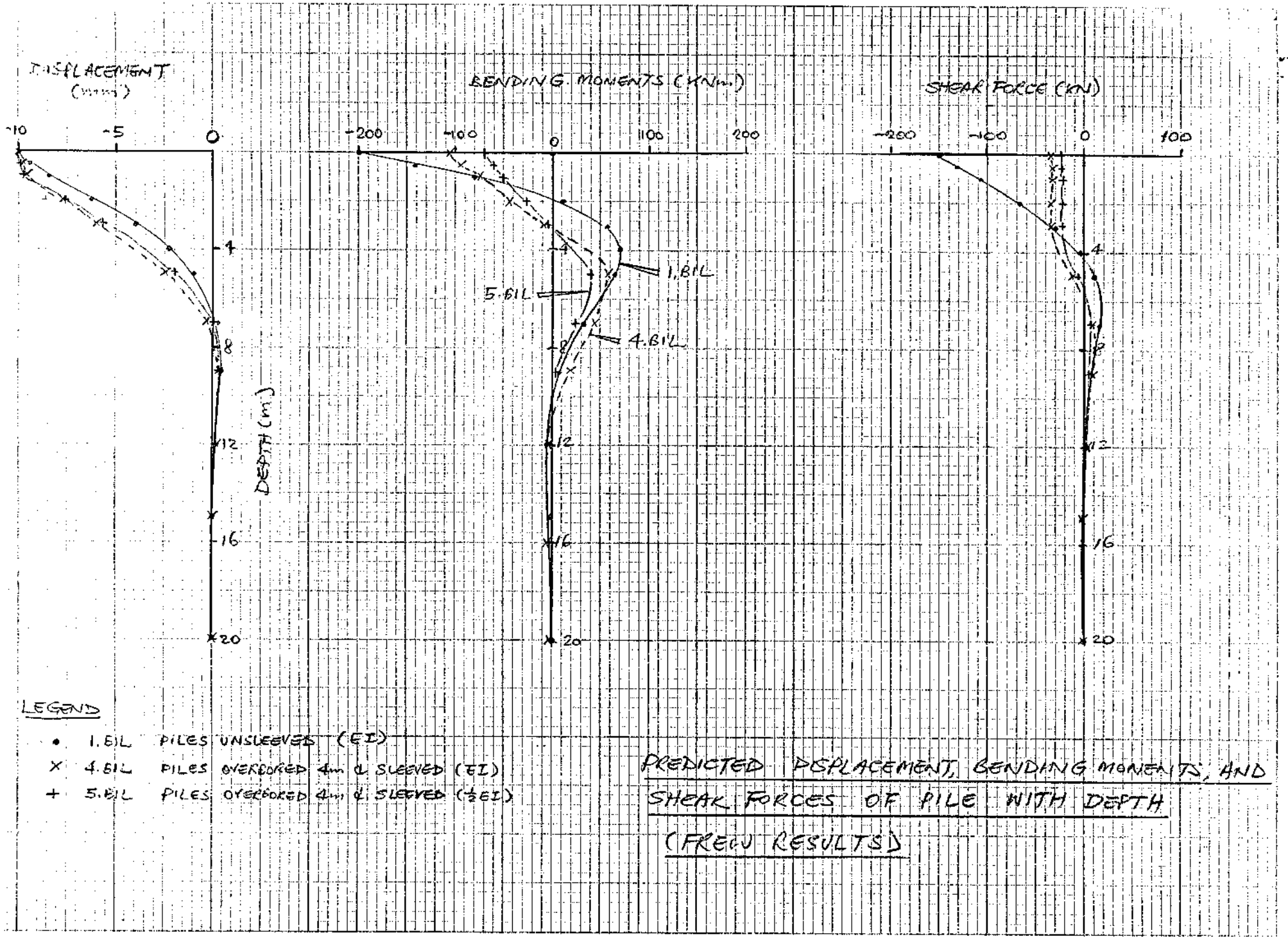
FIGURE LD2



PREDICTED DISPLACEMENT, BENDING MOMENTS, AND SHEAR FORCES OF PILE WITH DEPTH (FREW RESULTS)

FIGURE 1 D.3

CALCULATION SHEET

Piles subject to Lateral Soil Displacement

12727 Y1/16

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Job Title Granary Site

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The following set of calculations presents the reinforcement design of piles subject to lateral soil displacement (zone Y). It is concluded that 1% of steel is required to the piles.

It is considered that piles within area of heave (zone X) should be reinforced for the possibility of lateral soil displacement. Therefore, this requires a minimum amount of 1% steel in those piles.

CALCULATION SHEET
Reinforcement Design of Piles in ZONE Y

12727 | Y2/15
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Reinforcement Design of Piles in ZONE Y (Figure LD2)

Within this zone, the soil is assumed to move horizontally by an amount of 10mm, thus exerting a lateral force on all the 25 piles in this area. The piles are divided into the following types:

(i) 600mm diameter piles

1. unsleeved

W40, 41, 42, 43, 44, 45, 46, 47, 48, 49, W88, 89, 90, 91, 204

2. Overbored & sleeved (sleeved length = 4m below cut-off level)

W50, 51, 52, 53, 208.

(ii) 500mm diameter piles

3. Unsleeved

W 199, 200, 201

4. Overbored & sleeved (sleeved length = 4m below cut-off level)

W198

A computer program FREW was run to calculate the shear forces and bending moments experienced by the piles with soil stiffness $E_s = 4000 KN/m^2$, $\nu = 0.2$.

The following results are used for the reinforcement design:

Run 1 : 1.8IL 600mm unsleeved piles $(EI)_{pile} = 0.15 \times 10^6 KNm^2$

Run 2 : 4.8IL 600mm overbored & sleeved piles $(EI)_{pile} = 0.13 \times 10^6 KNm^2$

Run 3 : 8.8IL 500mm unsleeved piles $(EI)_{pile} = 0.091 \times 10^6 KNm^2$

Run 4 : 9.8IL 500mm overbored & sleeved piles $(EI)_{pile} = 0.081 \times 10^6 KNm^2$

CALCULATION SHEET

12727 Y3/16

Member / Location

Drg. Ref.

Job Title

Made by AT. Date 25.8.83 Chd.

ii) Reinforcement for unsleeved piles – 600 mm

Max. axial load = 1700 KN

FREW 1.BIL result :

Max. bending moment = 198.9 KNm per pile

Max. shear force = 148 KN per pile

For ultimate limit state, use factor 1.4

Main reinforcement

Design $M = 198.9 \times 1.4 = 278.46$ KNm

Design axial load, $N = 1700 \times 1.4 = 2380$ KN

CP110, Part 3, Figure 108,

$f_{cu} = 25$ N/mm^2, $f_y = 410$ N/mm^2

$\frac{hs}{h} = \frac{450}{600} = 0.75$ (say 0.8)

$\therefore \frac{M}{h^3} = \frac{278.46 \times 10^6}{600^3} = 1.29$ N/mm^2

$\frac{N}{h^2} = \frac{1530 \times 10^3}{600^2} = 6.64$ N/mm^2

$\therefore \frac{100 A_s}{A_c} = 0.9\%$

Since $A_s = \frac{\pi}{4} \times 600^2 = 282743$ mm^2

$\therefore A_s = 0.9\% \times 282743 = 2545$ mm^2

USE 6T25 ($A_s = 2945$ mm^2)

$\frac{100 A_s}{A_c} = \frac{2945}{282743} = 1.04\%$

CALCULATION SHEET

12727 Y4 / 16

Member / Location

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Shear Reinforcement

Design the shear reinforcement of the pile section as if in beams according to CP110, cl. 3.3.6 where shear stress

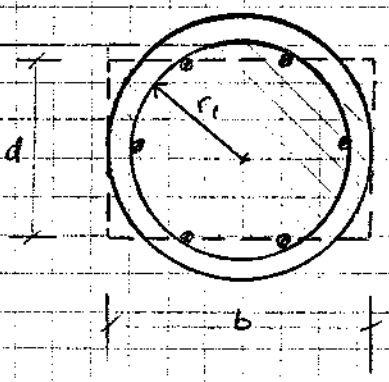
$$v = \frac{V}{bd} \qquad (1)$$

where V is ultimate shear force

b is width of rectangular section

d is effective depth

Find equivalent rectangular pile section.



Idealise the circular pile section to be the same as an equivalent rectangular section with $b \times d$

where b is the diameter of the pile

d is the depth of pile such that the top & bottom surfaces are taken to be at compressive and tensile reinforcement.

with $d = 2r_1 \cos 30°$ (assuming 6 main bars are used)

CALCULATION SHEET

12727 YS 115

Member / Location

Drg. Ref.

Job Title

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Shear Reinforcement (cont'd)

FREM 1.81L result,
max. shear force = 148 KN

Ultimate shear force = $148 \times 1.4 = 207.2$ KN

Pile section: $b = 600$mm

$2r_1 = 600 - 2 \times 75 = 450$mm (cover = 75mm)

$\therefore d = 2r_1 \cos 30°$
$= 450 \cos 30°$
$= 390$mm

From eqn ①,

$$v = \frac{V}{bd} = \frac{207.2 \times 10^3}{600 \times 390} = 0.89 \text{ N/mm}^2$$

CP110, Table 6, $f_{cu} = 25$ N/mm^2

max. shear stress, $v_{max} = 3.75$ N/mm^2 $> v$

$\therefore$ O.K.

CP110, Table 5, $f_{cu} = 25$ N/mm^2

Take $\frac{1}{2}$ x total main reinforcement are in tension;

$\therefore \frac{100 A_s}{A_c} = \frac{1}{2} \times 1\% = 0.5\%$

Table 5, $\therefore v_c = 0.5$ N/mm^2

$\therefore v > v_c$ require shear reinforcement

Shear reinforcement

$$\frac{A_{sv}}{S_v} \geq \frac{b(v - v_c)}{0.87 f_{yv}}$$

where A_{sv}, S_v are area and spacing of shear reinforcement
f_{yv} is yield stress of shear reinforcement

$f_{yv} = 250$ N/mm^2 for mild steel

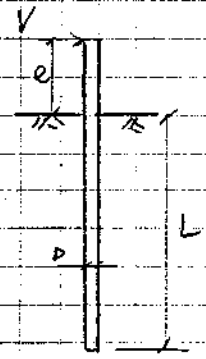
$$\therefore \left(\frac{A_{sv}}{s_v}\right)_r \geq \frac{600(0.89-0.5)}{0.87 \times 250} = 1.08 \text{ mm}$$

USE R12 - 200 mm c/c

$$\frac{A_{sv}}{s_v} \text{ (actual)} = \frac{2 \times \pi \times 6^2}{200} = 1.13 \text{ mm} > \left(\frac{A_{sv}}{s_v}\right)_r$$

R12 - 200 mm c/c O.K.

Length of Cage



Use method suggested by Broms (1965)
"Design of laterally loaded piles"
Proc. ASCE, Vol. 91, SM3 pp. 79-99.

Assume:

① Pile unrestrained at top

② Fill is 3m thick, i.e. $e = 3m$

③ Average undrained shear strength $c_u = 100 kN/m^2$

④ Soil strength in working condition, $c_w = c_u \div 3$

⑤ Total length of cage = $(L + e)$ below cut-off level of pile

Ultimate applied shear force, $V = 207.2 kN$

$$\frac{V}{c_w D^2} = \frac{3 \times 207.2}{100 \times 0.6^2} = 17.3$$

$$\frac{e}{D} = \frac{3}{0.6} = 5$$

Figure 3, $\frac{L}{D} = 10.8$

$$\therefore L = 10.8 \times 0.6 = 6.5m$$

∴ Total length of cage below cut-off level

$= 6.5 + 3 = \underline{9.5m}$ (say $\underline{10m}$)

CALCULATION SHEET

12727 | Y7 / 15

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12) Reinforcement for overbored & sleeved piles – 600mm

Max. axial load = 1600 KN

FREW 4.81L results

Max. bending moment = 105.9 KNm per pile

Max shear force = 33.4 KN per pile

Main reinforcement

Design $M = 105.9 \times 1.4 = 148.26$ KNm

Design axial load, $N = 1600 \times 1.4 = 2240$ KN

Where factor 1.4 for ULS design.

$$\frac{M}{h^3} = \frac{148.26}{600^3} \times 10^6 = 0.69 \text{ N/mm}^2$$

$$\frac{N}{h^2} = \frac{2240}{600^2} \times 10^3 = 6.22 \text{ N/mm}^2$$

CP110, Part 3, Figure 10.8,

$$\therefore \frac{160 A_s}{A_c} = 0$$

∴ nominal reinforcement required

But CP110, Cl 3.5.1.1 states min steel area for column to be 1% (Note: top 4m of pile acted as column)

$$\therefore \frac{160 A_s}{A_c} = 1\%$$

$A_s = 1\% \times 282743 = 2827 \text{ mm}^2$

i.e USE 6 Y 25 ($A_s = 2945 \text{ mm}^2$)

CALCULATION SHEET

12727 Y8/16

Member / Location

Org. Ref.

Job Title

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Shear Reinforcement

FROM 4.B1L results,

max shear force = 33.4 kN

Ultimate shear force = $33.4 \times 1.4 = 46.76$ kN

Pile section $b = 600$ mm, $d = 390$ mm (see page Y4)

$$v = \frac{V}{bd} = \frac{46.76 \times 10^3}{600 \times 390}$$

$= 0.2$ N/mm^2

CP110, Table 5, $f_{cu} = 25$ N/mm^2

for $\frac{100 A_s}{A_c} = \frac{1}{2} \times 1\% = 0.5\%$

$v_c = 0.5$ N/mm^2

i.e $v < v_c$

nominal reinforcement required

CP110, Cl 5.11.4.3,

		Y25mm
Min size of links:	$\frac{1}{4}$ × smallest size of main bars	6.2mm
Min spacing of links:	12 × smallest size of main bars	300 mm

∴ USE R8 - 300mm C/c

Length of Cage

Figure and assumptions as Case (1) on page 5,

ultimate applied shear force, $V = 33.4 \times 1.4 = 46.76$ kN

$C_u = 33$ kN/m^2, $D = 0.6$m, $e = 4$m (sleeved length = 4m)

$$\frac{V}{C_u D^2} = \frac{46.76}{33 \times 0.6^2} = 3.9 \text{ (say 4)}, \quad \frac{e}{D} = \frac{4}{0.6} = 6.7$$

CALCULATION SHEET

12727 Y9/16

Member / Location

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Job Title

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Figure 3, $\frac{L}{b} = 5.5$

$\therefore L = 5.5 \times 0.6 = 3.3m$

$\therefore$ Total length of cage below cut-off level

$= 4 + 3.3 = 7.3m$ (say 8m)

CALCULATION SHEET

12727 | Y10/15

Member / Location

Org. Ref.

Job Title | Made by AT. Date 25.8.83 Chd.

ii 3) Reinforcement for 500mm unsleeved piles

Max. axial load, N = 550 KN

FREW 8.81L results where $(EI)_{pile} = 0.031 \times 10^6$ KNm²

Max. bending moment, M = 117.8 KNm per pile

Design $M = 117.8 \times 1.4 = 164.92$ KNm

Design $N = 550 \times 1.4 = 770$ KN

$$\frac{M}{h^3} = \frac{164.92}{500^3} \times 10^6 = 1.32 \text{ N/mm}^2$$

$$\frac{N}{h^2} = \frac{770 \times 10^3}{500^2} = 3.08 \text{ N/mm}^2$$

$h = 500$ mm, $h_s = 500 - 2 \times 75 = 350$ mm

$$\frac{h_s}{h} = \frac{350}{500} = 0.7$$

$f_{cu} = 25$ N/mm², $f_y = 410$ N/mm²

CP110, Part 3, Figure 109,

$$\therefore \frac{100 A_s}{A_c} = 0.85\%$$

$$A_c = \frac{\pi}{4} \times 500^2 = 196350 \text{ mm}^2$$

$$\therefore A_s = 0.85\% \times 196350 = 1669 \text{ mm}^2$$

USE 4Y25 ($A_s = 1964$ mm²)

$$\text{Actual } \frac{100 A_s}{A_c} = \frac{1964}{196350} \times 100\% = 1.0\%$$

CALCULATION SHEET

12727 Y(1 /16

Member / Location

Org. Ref.

Job Title

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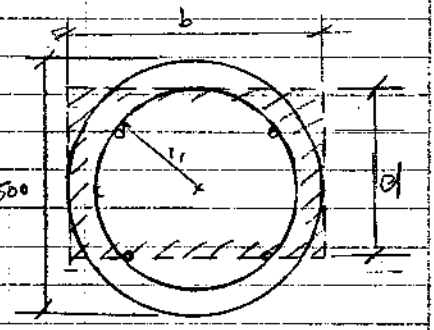
Shear Reinforcement

FROM 8.BIL results:

Max. shear force = 94.9 KN

Ultimate applied shear force, $V = 94.9 \times 1.4 = 132.86$ KN

Pile Section, 500mm diameter



Equivalent rectangular section,

$b = 500$ mm

$d = r_1(\cos 45° + 1)$

$= 175(0.7071 + 1)$

$= 298.5$ mm

Cover 75mm

$2r_1 = 500 - 150 = 350$ mm

Shear stress,

$$v = \frac{V}{bd} = \frac{132.86 \times 10^3}{500 \times 298.5} = 0.89 \text{ N/mm}^2$$

CP110, Table 5, $f_{cu} = 25$ N/mm²

for $\frac{100 A_s}{A_c} = \frac{1}{2} \times 1\% = 0.5\%$

$\therefore v_c = 0.5$ N/mm²

$\Rightarrow v > v_c$ require shear reinforcement

$$\left(\frac{A_{sv}}{S_v}\right)_r = \frac{b(v - v_c)}{0.87 f_{yv}} = \frac{500 \times (0.89 - 0.5)}{0.87 \times 250} = 0.90 \text{ mm}$$

USE R12 - 200 mm c/c

Where Actual $\left(\frac{A_{sv}}{S_v}\right) = \frac{2 \times \pi \times 6^2}{200} = 1.13 \text{ mm} > \left(\frac{A_{sv}}{S_v}\right)_r$

$\therefore$ R12 - 200 mm c/c O.K.

CALCULATION SHEET

12727 Y12/16

Member / Location

Org. Ref.

Job Title

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Length of Cage

Figure and assumptions same as case (i) on page 5,

Ultimate applied shear force, $V = 132.86 KN$.

$C_w = 33 KN/m^2$

$D = 0.5m$

$e = 3m$ (Thickness of fill)

$$\therefore \frac{V}{C_w D^2} = \frac{132.86}{33 \times 0.5^2} = 16.1$$

$$\frac{e}{D} = \frac{3}{0.5} = 6$$

Figure 3, $\therefore \frac{L}{D} = 10.5$

$\therefore L = 10.5 \times 0.5 = 5.25m$

$\therefore$ Total length of cage below cut-off level

$= L + e = 5.25 + 3 = 8.25m$ (say 8.0m)

CALCULATION SHEET

12727 Y13 /16

Member / Location

Drg. Ref.

Job Title

Made by AT Date 25.8.83. Chd.

Case (ii4) : Reinforcement for 500mm overbored & sleeved p.tes

Max. axial load, N = 550 KN

FREW 9.81L results where $(EI)_{pile} = 0.031 \times 10^6$ KNm²

Max bending moment, M = 41.8 KNm per pile

Design M = 41.8 x 1.4 = 58.52 KNm

Design N = 550 x 1.4 = 770 KN

$$\frac{M}{h^3} = \frac{58.52 \times 10^6}{500^3} = 0.47 \text{ N/mm}^2$$

$$\frac{N}{h^2} = \frac{770 \times 10^3}{500^2} = 3.08 \text{ N/mm}^2$$

CP110, Part 3, Figure 109, $f_{cu} = 25$ N/mm², $f_y = 410$ N/mm²

$$\frac{h_s}{h} = 0.7$$

$$\therefore \frac{100 A_s}{A_c} = 0$$

nominal reinforcement required

BUT, because top 4m has been sleeved, it acts as a column, CP110, Cl. 3.5.1.1 states min. steel area for column to be 1%

$$\therefore \frac{100 A_s}{A_c} = 1\%$$

$$A_c = 196350 \text{ mm}^2$$

$$\therefore A_s = 1964 \text{ mm}^2$$

USE 4Y25 ($A_s = 1964$ mm²)

Actual $100 \frac{A_s}{A_c} = 1.0\%$

CALCULATION SHEET

12727 Y14 /16

Member / Location

Drg. Ref.

Job Title

Made by AT Date 25.8.87 Chd.

Shear Reinforcement

FREW 9.81L results:

Max. shear force = 14.0 kN

ultimate applied shear force, $V = 14 \times 1.4 = 19.6$ kN

Pile section

Equivalent rectangular section, (see page 10)

$b = 500$ mm

$d = 298.5$ mm

shear stress $v = \frac{V}{bd} = \frac{19.6 \times 10^3}{500 \times 298.5} = 0.13$ N/mm^2

CP110, Table 5, $f_{cu} = 25$ N/mm^2

for $\frac{100 A_s}{A_c} = \frac{1}{2} \times 1.0\% = 0.5\%$

$v_c = 0.5$ N/mm^2

i.e $v < v_c$

nominal reinforcement required.

CP110, Cl 3.11.4.3,

Since main reinforcement is 4Y25

Shear reinforcement of R8 - 300 mm c/c is adequate

Length of Cage

Figure and assumptions same as case (1) on page 5,

ultimate applied shear force $V = 19.6$ kN

$C_u = 33$ kN/m^2, $D = 0.5$ m, $e = 4$ m (sleeved length = 4 m)

$\therefore \frac{V}{C_u D^2} = \frac{19.6}{33 \times 0.5^2} = 2.38$

$\frac{e}{D} = \frac{4}{0.5} = 8$

CALCULATION SHEET

12727 Y15 /16

Member / Location

Drg. Ref.

Job Title

Made by AT. Date 25.8.83. Chkd.

Figure 3, $\therefore \frac{L}{D} \doteq 6$

$\therefore L = 6 \times 0.5 = 3\,m$

Total length of cage below cut-off level

$= L + e = 3 + 4 = 7m$ (use 8m)

12727 Y16/16

Member / Location

Drg. Ref.

Job Title

Made by AT. Date 25.8.83, Chd.

SUMMARY OF REINFORCEMENT DESIGN FOR CONEY PILES

Pile Dia	Type	Main Reinforcement	Shear Reinforcement	Cage Length below cut-off level
600	unsleeved	6Y25	R12-200mm c/c	10m
600	overbored & sleeved	6Y25	R8-300mm c/c	8m
500	unsleeved	4Y25	R12-200mm c/c	8m
500	overbored & sleeved	4Y25	R8-300mm c/c	8m

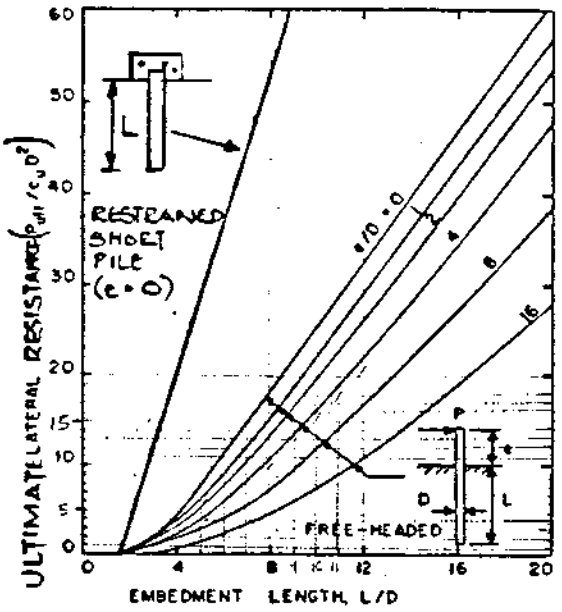


FIG. 3 ULTIMATE LATERAL RESISTANCE FOR COHESIVE SOILS RELATED TO EMBEDMENT LENGTH

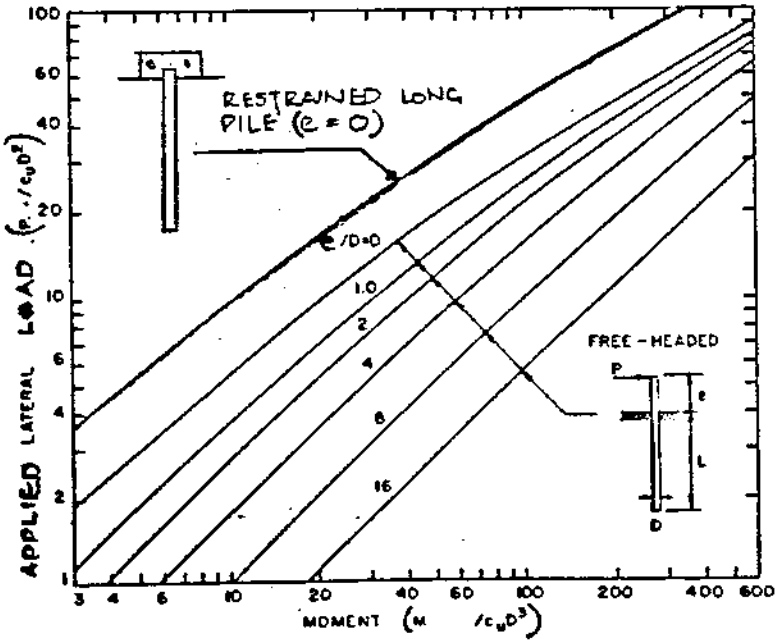


FIG. 4 MAXIMUM BENDING MOMENT IN PILE IN COHESIVE SOIL

Taken from BROMS (1965) "Design of Laterally Loaded Piles" PROC. ASCE, Vol. 91, SM3.

Granary Site. 1727

10.0 RELATIVE MOVEMENTS OF PILES DUE TO HEAVE

Sheets PM1 to PM6.

OAP20

OVE ARUP & PARTNERS
CALCULATION SHEET

Job No.	Sheet No.	Rev.
12727	PM1/6	

Member / Location

Drg. Ref.

Job Title: GRANARY SITE

Made by: BS Date: 26.8.83 Chd.

Relative movement of piles in the area of leave.

The following steps have been taken:

1. Compute ground movements at level +6 m OD which will take place in the long term after installation of piles.

2. Estimate settlement gradient caused by differences of length of adjacent piles, assuming that the "45° rule" of clause 8.01.6 of the specification is applied.

Conclusions.

1. The attached figure PM1 shows the computed movement at +6 m OD. This is considered to be representative of the global movements of the piles. In areas of settlement, no allowance is made for the effect of removal of the granary structure, and settlement may therefore be significantly over-predicted. Nonetheless, the gradient of settlement between plan distances more than exceeds 1/800

OAP20

OVE ARUP & PARTNERS
CALCULATION SHEET

Job No.	Sheet No.	Rev.
12727	PM2/6	

Member / Location

Drg. Ref.

Job Title

Made by BS Date 26.8.83 Chd.

2 The attached calculations indicate that local gradients of settlement caused by variation of pile length will not exceed 1/1000 provided that the 45° rule is applied

3. Thus, the worst computed gradient of settlement between adjacent piles is

$$\frac{1}{800} + \frac{1}{1000} = 1/440.$$

4. The assumed toe levels of the piles are indicated on the attached figure PM3.

OAP20

OVE ARUP & PARTNERS
CALCULATION SHEET

Job No.	Sheet No.	Rev.
12727	PM3/6	
Member / Location		
Drg. Ref.		
Job Title	Made by RL Date 8/83 Chd.	

Relative vertical movement of piles due to varying lengths in the area of Leave.

The following steps have been followed using output from VDISP runs:

HEUNS — undrained Leave (no imposed load)

LODRS — long term (drained) Leave for net loading.

1. For 7 typical points in the area of Leave the relative displacements of levels +6 m OD and +11 m OD were extracted.
2. The difference Δ between the long term Leave (δ_d) and the short term Leave (δ_u) was obtained for each level. This difference Δ (mm) is considered to correspond to the long term movement of piles for which $\frac{2}{3}$ toe depth is at +6 and +11 m OD.
3. The gradient of Δ with depth was found.
4. From this it was shown that even for short piles at these high levels the computed gradient of Leave

with respect to horizontal position would be less than 1/500 provided the gradient between the toes of the piles is less than 1.07 mm (vertical) to 1 mm (horizontal).

Thus calculated differential settlements lie within 1/500 provided the "45° rule" of specification clause 8.01.6 is applied.

This calculation is very conservative since application of the "45° rule" requires that no piles in the area of Leave Lane Toe levels above +2 m OD. Thus highest "2/3 depth" level is +8 m OD

The profile of computed displacement with depth is attached for the VDISP location with the most severe value of $\frac{\Delta s}{\Delta z}$. This indicates that between +8 m OD and 0 m OD the gradient $\frac{\Delta s}{\Delta z}$ is 1.6 mm/m. Thus if the 45° rule is applied the maximum gradient of settlement will be 1.6/1.5 mm/m i.e. 1.07 mm settlement per 1.0 m in ground (1/940) (say 1/1000).

OAP20

OVE ARUP & PARTNERS
CALCULATION SHEET

Job No.	Sheet No.	Rev.
12727	PM5/6	

Member / Location

Drg. Ref.

Job Title

Made by RL Date 8/83. Chd.

VDISP point	Level +6			Level +11			
	δ_u	δ_d	Δ	δ_u	δ_d	Δ	$d\Delta/dy$
150	14·2	24·7	10·5	19·2	43·6	24·4	2·8 } worst $\frac{d\Delta}{dy}$
14	13·6	23·4	9·8	18·6	42·07	23·5	2·8 }
22	10·8	10·2	-0·6	13·8	23·5	9·7	2·1
148	12·2	21·6	9·6	16·4	38·0	21·6	2·4
133	8·6	12·8	4·2	12·2	26·1	13·9	1·9
144	12·4	22·4	10·0	17·0	39·5	22·5	2·5
166	13·2	20·2	7·0	17·8	37·9	20·1	2·6
76	9·3	7·6	-1·7	11·6	18·3	6·7	1·7

Require $\frac{d\Delta}{dx} < \frac{1}{500} = 2$ mm/m. (x – hori. axis, z – vert. axis)

$\frac{dy}{dx} < \frac{2}{2.8} = 0.71$ mm/m.

i.e. gradient between $\frac{2}{3}$ points of adjacent piles $\geq$ 0.71 m (vertical) per m (horizontal)

∴ gradient between bases of adjacent piles $\geq 0.71 \times 1.5$

$= 1.07$ m/m.

This is slightly less critical than the 45° rule in the specification, clause 8.01.6

OAP20

OVE ARUP & PARTNERS
CALCULATION SHEET

Job No.	Sheet No.	Rev.
12727	PM6/6	

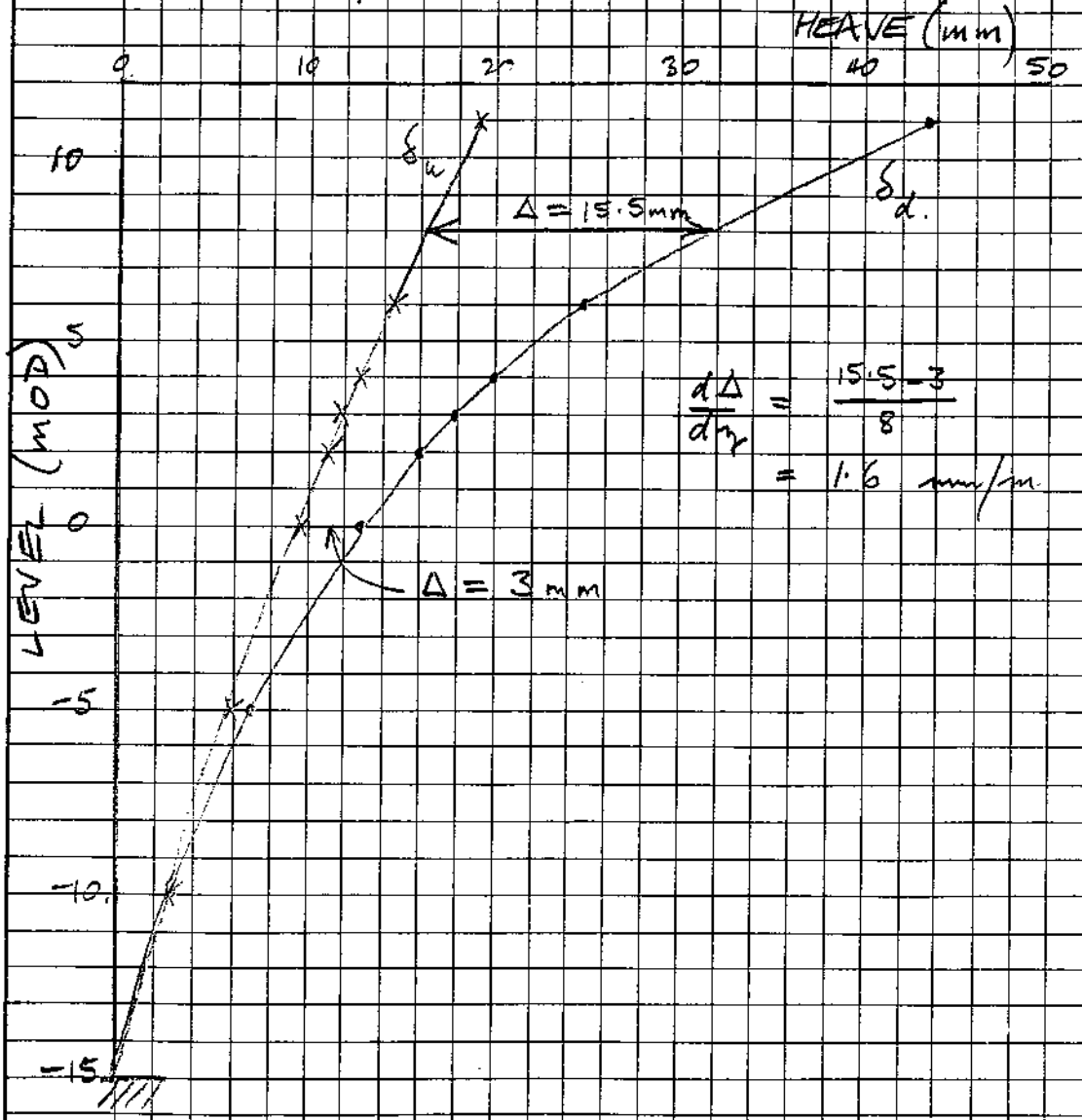
Member / Location

Drg. Ref.

Job Title

Made by [illegible] Date 8/83 Chd.

VDISP point 150



$$\frac{d\Delta}{d\gamma} = \frac{15.5 - 3}{8}$$

$$= 1.6 \text{ mm/m}$$

APPENDIX F
DETAILED UXO RISK ASSESSMENT

Detailed Unexploded Ordnance (UXO) Risk Assessment

Project Name	The Ugly Brown Building (Ted Baker Head Office)
Client	RSK
Site Address	6a St Pancras Way London NW1 0TB
Report Reference	DA7410-00
Date	24th October 2018
Originator	JMa

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Executive Summary

Site Location and Description

The site is located in the London Borough of Camden. It is bordered to the north by residential structures, south by Granary Street, east by the Grand Union Canal, and west by St Pancras Way. St Pancreas International Station is situated approximately 500m southeast of the site.

The site boundary is an irregular shape currently occupied by a large commercial structure. The commercial structure currently acts as the head office for Ted Baker plc.

The site is approximately centred on the OS grid reference: **TQ 2963083749**

Proposed Works

It is understood that the proposed project will involve the demolition of the existing building and construction of six new buildings ranging in height from two to twelve storeys above ground and two basement levels.

The proposed intrusive works at this stage will involve drilling cable boreholes to depths ranging from 25m to 40m, window-sampling boreholes to 5m and hand excavated trial pits to 3m depth.

Geology and Bomb Penetration Depth

Site specific geotechnical information was not available to 1st Line Defence at the time of the production of this report. An assessment of maximum bomb penetration depth can be made once such data becomes available, or by a UXO specialist during on-site support.

It should be noted that the maximum depth that a bomb could reach may vary across a site and will be largely dependent on the specific underlying geological strata and its density.

UXO Risk Assessment

1st Line Defence has assessed that there is a **Low Risk** from items of unexploded German aerial delivered ordnance and anti-aircraft ordnance across the majority of the site, with a small area of **Medium Risk** present in its northern section. This assessment is based on the following factors:

- During WWII, the Metropolitan Borough of St. Pancras sustained a very high density bombing campaign, with an average of 258 items falling per 1,000 acres according to Home Office statistics.
- London Bomb census mapping recorded two bomb strikes on the northern area of the site between 1940-1941 and February 1944. However, due to the lack of written ARP records available for St. Pancras it is not possible to confirm their calibre, the extent of the damage caused or whether these two plotted strikes do in fact represent only one bombing incident. High-resolution aerial photography shows that part of the roof was replaced on the 'L-shaped' structure occupying this section of the site. This indicates that this area did sustain some level of bomb damage.
- High-resolution aerial photography shows that the structures north of the site (adjacent to the 'L-shaped building) were of poor condition and Goad insurance mapping states that they were vacant from 1942. Therefore, this area likely had little access and poor ground cover which will have hindered UXO inspection. This creates an issue when taking into account the 'J curve' effect, in which UXO would end their trajectory at a lateral offset from point of entry often ending up beneath adjacent structures/sites.
- In contrast, LCC records the southern edge of the large 'Ale and Porter' store that occupied the majority of the site as sustaining only 'blast damage, minor in nature'. This is verified by high-resolution aerial photography which shows part of the roofing in this area was repaired. High-resolution aerial and oblique photography show that the structure remained intact throughout the war.
- As this large structure was several stories high, the likelihood of a UXO penetrating at depth is low. As well as this, it is anticipated to have continued in use as a major commercial structure throughout the war. This composition of the structure and its level of access greatly decreases the chance of a UXO remaining undetected where this structure was situated.

UXO Risk Assessment

- Based on this criteria it has been possible to reduce the risk from UXO across the majority of the site area. This has not been the case within the northern section of the site due to its proximity to two bomb incidents and position directly adjacent to a dilapidated area. Furthermore, the open ground occupying the northern area (which was used for lorry repairs) is believed to have been less conductive to the inspection of UXO than the areas occupied by structures.

Recommended Risk Mitigation Measures

The following risk mitigation measures are recommended to support the proposed works at The Ugly Brown Building (Ted Baker Head Office):

All Works

- Site Specific UXO Awareness Briefings to all personnel conducting intrusive works.

Medium Risk Areas

Open Intrusive Works (trial pits, service pits, open excavations, shallow foundations etc.)

- UXO Specialist On-site Support

Boreholes and Piled Foundations

- Intrusive Magnetometer Survey of all borehole and pile locations/clusters down to maximum bomb penetration depth.

Risk Map

For indicative purposes – not to scale.

Low Risk

Medium Risk

Works in All Areas:

- Site Specific Unexploded Ordnance Awareness Briefings to all personnel conducting intrusive works.

Works in Low-Medium Risk Areas:

- Unexploded Ordnance (UXO) Specialist presence on site to support open intrusive works.
- Intrusive Magnetometer Survey of any borehole or pile locations/clusters down to an assessed maximum bomb penetration depth.

Glossary

Abbreviation	Definition
AA	Anti-Aircraft
AFS	Auxiliary Fire Service
AP	Anti-Personnel
ARP	Air Raid Precautions
AWAS	Air Warfare Analysis Section
DA	Delay-action
EOC	Explosive Ordnance Clearance
EOD	Explosive Ordnance Disposal
FP	Fire Pot
GM	G Mine (Parachute mine)
HAA	Heavy Anti-Aircraft
HE	High Explosive
IB	Incendiary Bomb
LAA	Light Anti-Aircraft
LCC	London County Council
LRRB	Long Range Rocket Bomb (V-2)
LSA	Land Service Ammunition
MOL	Molotov (Incendiary Bomb)
OB	Oil Bomb
PAC	Pilotless Aircraft (V-1)
PB	Phosphorous Bomb
PM	Parachute Mine
POW	Prisoner Of War
RAF	Royal Air Force
RCAF	Royal Canadian Air Force
RFC	Royal Flying Corps
RNAS	Royal Naval Air Service
ROF	Royal Ordnance Factory
SA	Small Arms
SAA	Small Arms Ammunition
SD1000	1,000kg high explosive bomb
SD2	Anti-personnel “Butterfly Bomb”
SIP	Self-Igniting Phosphorous
U/C	Unclassified bomb
UP	Unrotated Projectile (rocket)
USAAF	United States Army Air Force
UX	Unexploded
UXAA	Unexploded Anti-Aircraft
UXB	Unexploded Bomb
UXO	Unexploded Ordnance
V-1	Flying Bomb (Doodlebug)
V-2	Long Range Rocket
WAAF	Women’s Auxiliary Air Force
X	Exploded

Contents

Annexes

List of Report Annexes	
Annex A	Site Location Maps
Annex B	Recent Aerial Photography
Annex C	Client Provided Site Plan
Annex D	Pre and Post-WWII Historical Maps
Annex E	Goad Fire Insurance Mapping
Annex F	Examples of German Aerial Delivered Ordnance
Annex G	Example of UXO Entry Holes/ The 'J-curve' Effect Principle
Annex H	Examples of UXO Incidents
Annex I	WWI Map of Air Raids and Naval Bombardments / London WWI Bomb Plot Map
Annex J	London WWII Bomb Density Map
Annex K	Luftwaffe Reconnaissance Imagery
Annex L	London WWII Bomb Density Map
Annex M	London Civil Defence Region V-1 Flying Bomb Map
Annex N	London County Council Bomb Damage Map
Annex O	1945 RAF Aerial Photography of the Site
Annex P	Oblique Photography
Annex Q	Examples of Anti-Aircraft Projectiles
Annex R	Risk-Map of the Site Area

1st Line Defence Limited
Detailed Unexploded Ordnance (UXO) Risk Assessment

Site: The Ugly Brown Building (Ted Baker Head Office)
Client: RSK

1. Introduction

1.1. Background

1st Line Defence has been commissioned by RSK to conduct a Detailed Unexploded Ordnance (UXO) Risk Assessment for the proposed works at the Ugly Brown Building (Ted Baker Head Office).

Buried UXO can present a significant risk to construction works and development projects. The discovery of a suspect device during works can cause considerable disruption to operations as well as cause unwanted delays and expense.

UXO in the UK can originate from three principal sources:

1. Munitions resulting from wartime activities including German bombing in WWI and WWII, long range shelling, and defensive activities.
2. Munitions deposited as a result of military training and exercises.
3. Munitions lost, burnt, buried or otherwise discarded either deliberately, accidentally, or ineffectively.

This report will assess the potential factors that may contribute to the risk of UXO contamination. If an elevated risk is identified at the site, this report will recommend appropriate mitigation measures, in order to reduce the risk to as low as is reasonably practicable. Detailed analysis and evidence will be provided to ensure an understanding of the basis for the assessed risk level and any recommendations.

This report complies with the guidelines outlined in *CIRIA C681*, 'Unexploded Ordnance (UXO) A Guide for the Construction Industry'.

2. Method Statement

2.1. Report Objectives

The aim of this report is to conduct a comprehensive assessment of the potential risk from UXO at the Ugly Brown Building (Ted Baker Head Office). The report will also recommend appropriate site and work-specific risk mitigation measures to reduce the risk from explosive ordnance during the envisaged works to a level that is as low as reasonably practicable.

2.2. Risk Assessment Process

1st Line Defence has undertaken a five-step process for assessing the risk of UXO contamination:

1. The risk that the site was contaminated with UXO.
2. The risk that UXO remains on the site.
3. The risk that UXO may be encountered during the proposed works.
4. The risk that UXO may be initiated.
5. The consequences of initiating or encountering UXO.

In order to address the above, 1st Line Defence has taken into consideration the following factors:

- Evidence of WWI and WWII German aerial delivered bombing as well as the legacy of Allied occupation.
- The nature and conditions of the site during WWII.
- The extent of post-war development and UXO clearance operations on site.
- The scope and nature of the proposed works and the maximum assessed bomb penetration depth.
- The nature of ordnance that may have contaminated the proposed site area.

2.3. Sources of Information

Every reasonable effort has been made to ensure that relevant evidence has been consulted and presented in order to produce a thorough and comprehensible report for the client. To achieve this the following, which includes military records and archive material held in the public domain, have been accessed:

- The National Archives, Kew, and the Camden Local Studies and Archives Centre.
- Historical mapping datasets.
- Historic England National Monuments Record.
- Relevant information supplied by RSK.
- Available material from 33 Engineer Regiment (EOD) Archive.
- 1st Line Defence's extensive historical archives, library and UXO geo-datasets.
- Open sources such as published books and internet resources.

Research involved a visit to Camden Local Studies and Archives Centre and The National Archives.

2.4. General Considerations of Historical Research

This desktop assessment is based largely upon analysis of historical evidence. Every reasonable effort has been made to locate and present significant and pertinent information. 1st Line Defence cannot be held accountable for any changes to the assessed risk level or risk mitigation measures, based on documentation or other data that may come to light at a later date, or which was not available to 1st Line Defence during the production of this report.

It is often problematic and sometimes impossible to verify the completeness and accuracy of WWII-era records. As a consequence, conclusions as to the exact location and nature of a UXO risk can rarely be quantified and are to a degree subjective. To counter this, a range of sources have been consulted and analysed. The same methodology is applied to each report during the risk assessment process. 1st Line Defence cannot be held responsible for any inaccuracies or the incompleteness in available historical information.

3. Background to Bombing Records

During WWII bombing records were gathered by the police, Air Raid Precaution (ARP) wardens and military personnel. Records were maintained in the form of local and regional written records, maps depicting the locations of individual strikes, and maps indicating the levels of damage sustained by structures. Records typically documented when, where and what types of bombs had fallen during an air raid. Records of bomb strikes were made either through direct observation or by post-raid surveys. The immediate priority was focused on assisting casualties and minimising damage. As a result some records were incomplete and contradictory.

The quality, detail and nature of record keeping could vary considerably between boroughs and towns. No two areas identically collated or recorded data. While some local authorities maintained records with a methodical approach, sources in certain areas can be considerably more vague, dispersed, and narrower in scope. Many records were even damaged or destroyed in subsequent bombing raids. Records of raids that took place on sparsely or uninhabited areas were often based upon third party or hearsay information and are therefore not always reliable. Furthermore, records of attacks on military or strategic targets were often maintained separately from the general records and have not always survived.

4. Background to Allied Records

During WWII considerable areas of land were requisitioned by the army for the purpose of defence, training, and the construction of airfields and facilities for munitions production. Records relating to military features vary and some may remain censored. Within urban environments datasets will be consulted detailing the location of munition production as well as air and land defences. In rural locations it may be possible to obtain plans of airfields and military establishments, as well as operational training logs, plans and personal memoirs.

5. UK Regulatory Environment

5.1. General

There is no formal obligation requiring a UXO risk assessment to be undertaken for construction projects in the UK, nor is there any specific legislation stipulating the management or mitigation of UXO risk. However, it is implicit in the legislation outlined below that those responsible for intrusive works (archaeology, site investigation, drilling, piling, excavation etc.) should undertake a comprehensive and robust assessment of the potential risks to employees and that mitigation measures are implemented to address any identified hazards.

5.2. CDM Regulations 2015

The Construction (Design and Management) Regulations 2015 (CDM 2015) define the responsibilities of parties involved in the construction of temporary or permanent structures.

The CDM 2015 establishes a duty of care extending from clients, principle co-ordinators, designers, and contractors to those working on, or affected by, a project. Those responsible for construction projects may therefore be accountable for the personal or proprietary loss of third parties, if correct health and safety procedure has not been applied.

Although the CDM does not specifically reference UXO, the risk presented by such items is both within the scope and purpose of the legislation. It is therefore implied that there is an obligation on parties to:

- Provide an appropriate assessment of potential UXO risks at the site (or ensure such an assessment is completed by others).
- Put in place appropriate risk mitigation measures if necessary.
- Supply all parties with information relevant to the risks presented by the project.
- Ensure the preparation of a suitably robust emergency response plan.

5.3. The 1974 Health and Safety at Work etc. Act

All employers have a responsibility under the Health and Safety at Work etc. Act 1974 and the Management of Health and Safety at Work Regulations 1999, to ensure the health and safety of their employees and third parties, so far as is reasonably practicable and conduct suitable and sufficient risk assessments.

5.4. Additional Legislation

In the event of a casualty resulting from the failure of an employer/client to address the risks relating to UXO, the organisation may be criminally liable under the Corporate Manslaughter and Corporate Homicide Act 2007.

6. Role of Commercial UXO Contractors and The Authorities

6.1. Commercial UXO Contractors

In the event that a risk of UXO contamination is detected at the proposed site, the support of a UXO specialist may be recommended. A UXO specialist may be able to avoid unnecessary call-outs to the authorities through the disposal or removal of low risk items. In addition a specialist will assist in the swift recognition of high risk items, and will thereafter co-ordinate with the local authority with the objective of causing minimal levels of disruption to site operations, whilst putting in place safe and appropriate measures.

For more information on the role of commercial UXO specialists, see *CIRIA C681*.

6.2. The Authorities

The police have a responsibility to co-ordinate the emergency services in the event of an ordnance-related incident at a construction site. Upon inspection they may impose a safety cordon, order an evacuation, and call the military authorities Joint Services Explosive Ordnance Disposal (JSEOD) to arrange for investigation and/or disposal. In the absence of a UXO specialist, police officers will usually employ such precautionary safety measures, thereby causing works to cease, and possibly requiring the evacuation of neighbouring businesses and properties.

The priority given to the police request will depend on JSEOD's judgement of the nature of the UXO risk, the location, people and assets at risk, as well as the availability of resources. The speed of response varies; authorities may respond immediately or in some cases it may take several days for the item of ordnance to be dealt with.

Depending on the on-site risk assessment the item of ordnance may be removed from the site and/or destroyed by a controlled explosion. The latter process is lengthy and may necessitate the establishment of addition cordons and evacuations.

Following the removal of an item of UXO, the military authorities will only undertake further investigations or clearances in high risk situations. If there are regular UXO finds on a site the JSEOD may not treat each occurrence as an emergency and will recommend the construction company puts in place alternative procedures, such as the appointment of a commercial contractor to manage the situation.

7. The Site

7.1. Site Location

The site is located in the London Borough of Camden. It is bordered to the north by residential structures, south by Granary Street, east by the Grand Union Canal, and west by St Pancras Way. St Pancreas International Station is situated approximately 500m southeast of the site.

The site is approximately centred on the OS grid reference: TQ2963083749.

Site location maps are presented in **Annex A**.

7.2. Site Description

The site boundary is an irregular shape currently occupied by a large commercial structure. The commercial structure currently acts as the head office for Ted Baker plc.

A recent aerial photograph and site plan are presented in **Annex B** and **Annex C** respectively.

8. Scope of the Proposed Works

8.1. General

It is understood that the proposed project will involve the demolition of the existing building and construction of six new buildings ranging in height from two to twelve storeys above ground and two basement levels.[1]

The proposed intrusive works at this stage will involve drilling cable boreholes to depths ranging from 25m to 40m, window-sampling boreholes to 5m and hand excavated trial pits to 3m depth.

9. Ground Conditions

9.1. General Geology

The British Geological Survey (BGS) map shows the bedrock geology of the site to be underlain by the London Clay Formation – clay, silt and sand, of the Palaeogene Period. No superficial deposits are recorded in this source.

9.2. Site Specific Geology

Information provided by the client indicates that an intrusive site investigation was undertaken prior to the construction of the existing building on site. It was indicated that the site was underlain by up to 2.5m bgl of made ground, overlying approximately 20m thickness of London Clay. This was underlain by the Woolwich and Reading Beds (clay).

10. Site History

10.1. Introduction

[1] Djajasaputra, Rudy. *'BASEMENT IMPACT ASSESSMENT FOR UGLY BROWN BUILDING CAMDEN'.* GDP Partnership Ltd. (22.09.17).

The purpose of this section is to identify the composition of the site pre and post-WWII. It is important to establish the historical use of the site, as this may indicate the site's relation to potential sources of UXO as well as help with determining factors such as the land use, groundcover, likely frequency of access and signs of bomb damage.

10.2. Ordnance Survey Historical Maps

Relevant historical maps were obtained for this report and are presented in **Annex D.** See below for a summary of the site history shown on acquired mapping.

WWI Period		
Date	**Scale**	**Description**
1916	1:2,500	This map indicates the site was occupied by two structures. One large commercial structure, which encompassed the majority of the site, and a smaller 'L-shaped' structure occupying the north. The site was bordered by residential structures to the north, St. Pancras Workhouse to the south and residential structures, Camden Works and the Royal Vet College to the east.

Pre-WWII		
Date	**Scale**	**Description**
1938	1:10,560	This map shows less detail of individual structures due to its scale. Despite this, it indicates there was no significant change to the site from the previous map edition.

Post-WWII		
Date	**Scale**	**Description**
1955 - 1956	1:1,250	This map indicates no significant changes occurred to the site during WWII. Within the vicinity of the site, three residential structures to the west and eight to the north have been cleared. A structure bordering north is labelled as 'ruin'; and St. Pancras Workhouse has undergone some significant structural change, becoming University College Hospital. The Royal Vet College has also expanded in size.
1962 - 1971	1:1,250	This map shows that the 'L-shaped' structure on the northern section of the site was removed from around 1962.

10.3. Goad Fire Insurance Mapping

Available pre and post-WWII fire insurance plans for the site were obtained by 1st Line Defence. These are comprehensive street plans detailing the structure and uses of individual buildings. The plans were originally designed to assist the fire insurance industry. See **Annex E** for the mapping with the site boundary outlined accordingly.

WWII	
Date	**Description**
1942	This map shows that the large structure on site was used by Bass, Ratcliffe, & Gretton as well as Woolworth & Co Ltd. The smaller structure in the north of the site was used for lorry repairs.

	This confirms that the structures on site were used for commercial purposes. The structure adjoining the site from the north is labelled as vacant from 1942.

Post-WWII	
Date	**Description**
1960	This map indicates that the structures on site continued to be used by the same companies post-WWII. This indicates that their use of these structures was not significantly hindered during WWII.

11. Aerial Bombing Introduction

11.1. General

During WWI and WWII, many towns and cities across the UK were subjected to bombing which often resulted in extensive damage to city centres, docks, rail infrastructure and industrial areas. The poor accuracy of WWII targeting technology and the nature of bombing techniques often resulted in neighbouring areas to targets sustaining collateral damage.

In addition to raids which concentrated on specific targets, indiscriminate bombing of large areas also took place, this occurred most prominently in the London 'Blitz', though affected many other towns and cities. As discussed in the following sections, a proportion of the bombs dropped on the UK did not detonate as designed. Although extensive efforts were made to locate and deal with these UXBs at the time, many still remain buried and can present a potential risk to construction projects.

The main focus of research for this report will concern German aerial delivered weapons dropped during WWII, although WWI bombing will also be considered.

11.2. Generic Types of WWII German Aerial-delivered Ordnance

An understanding of the type and characteristics of the ordnance used by the Luftwaffe during WWII allows an informed assessment of the hazards posed by any unexploded items that may remain in situ on a site. Images and brief summaries of the characteristics of the above listed German aerial delivered ordnance are presented in **Annex F**.

Generic Types of WWII German Aerial Delivered Ordnance		
Type	**Frequency**	**Likelihood of detection**
High Explosive (HE) bombs	In terms of weight of ordnance dropped, HE bombs were the most frequently deployed by the Luftwaffe during WWII.	Although efforts were made to identify the presence of unexploded ordnance following an air raid, often the damage and destruction caused by detonated bombs made observation of UXB entry holes impossible. The entry hole of an unexploded bomb can be as little as 20cm in diameter and was easily overlooked in certain ground conditions (see **Annex G**). Furthermore, ARP documents describe the danger of assuming that damage, actually caused by a large UXB, was due to an exploded 50kg bomb. UXBs therefore present the greatest risk to present–day intrusive works.
Aerial or Parachute mines (PM)	There were deployed less frequently than HE and IBs due to size, cost and the difficulty of deployment.	If functioning correctly, PMs generally would have had a slow rate of descent and were very unlikely to have penetrated the ground. Where the parachute failed, mines would have simply shattered on impact if the main charge failed to explode. There have been extreme cases when these items have been found unexploded. However, in these scenarios, the ground was either extremely soft or the munition fell into water.
1kg Incendiary bombs (IB)	In terms of the number of weapons dropped, small IBs were the most	IBs had very limited penetration capability and in urban areas would often have been located in post-raid surveys. If they failed to initiate and fell in water, on soft vegetated ground, or bombed rubble, they could have gone unnoticed.

	numerous. Millions of these were dropped throughout WWII.	
Large Incendiary bombs (IB)	These were not as common as the 1kg IBs, although they were more frequently deployed than PMs and AP bomblets.	If large IBs did penetrate the ground, complete combustion did not always occur and in such cases they could remain a risk to intrusive works.
Anti-personnel (AP) bomblets	These were not commonly used and are generally considered to pose a low risk to most works in the UK.	SD2 bomblets were packed into containers holding between 6 and 108 submunitions. They had little ground penetration ability and should have been located by the post-raid survey unless they fell into water, dense vegetation or bomb rubble.

11.3. Failure Rate of German Aerial-delivered Ordnance

It has been estimated that 10% of WWII German aerial delivered HE bombs failed to explode as designed. Reasons for why such weapons might have failed to function as designed include:

- Malfunction of the fuze or gain mechanism (manufacturing fault, sabotage by forced labour or faulty installation).
- Many were fitted with a clockwork mechanism that could become immobilised on impact.
- Failure of the bomber aircraft to arm the bombs due to human error or an equipment defect.
- Jettisoning the bomb before it was armed or from a very low altitude. This most likely occurred if the bomber aircraft was under attack or crashing.

From 1940 to 1945 bomb disposal teams dealt with a total of 50,000 explosive items of 50kg, over, 7,000 anti-aircraft projectiles and 300,000 beach mines. Unexploded ordnance is still regularly encountered across the UK, see press articles in **Annex H**.

11.4. V-Weapons

Hitler's 'V-weapon' campaign began from mid-1944. It used newly developed unmanned cruise missiles and rockets. The V-1 known as the *flying bomb* or *pilotless aircraft* and the V-2, a long range rocket, were launched from bases in Germany and occupied Europe. A total of 2,419 V-1s and 517 V-2s were recorded in the London Civil Defence region alone.

Although these weapons caused considerable damage their relatively low numbers allowed accurate records of strikes to be maintained. These records have mostly survived. There is a negligible risk from unexploded V-weapons on land today since even if the 1000kg warhead failed to explode, the weapons are so large that they would have been observed and the risk dealt with at the time. Therefore, V-weapons are referenced in this report not as a viable risk factor, but primarily in order to help account for evidence of damage and clearance reported.

12. UXB Ground Penetration

12.1. General

An important consideration when assessing the risk from a UXB is the likely maximum depth of burial. There are several factors which determine the depth that an unexploded bomb will penetrate:

- Mass and shape of bomb.
- Height of release.
- Velocity and angle of bomb.
- Nature of the ground cover.

- Underlying geology.

Geology is perhaps the most important variable. If the ground is soft, there is a greater potential of deeper penetration. For example, peat and alluvium are easier to penetrate than gravel and sand, whereas layers of hard strata will significantly retard and may stop the trajectory of a UXB.

12.2. The J-Curve Effect

J-curve is the term used to describe the characteristic curve commonly followed by an aerial delivered bomb dropped from height after it penetrates the ground. Typically, as the bomb is slowed by its passage through underlying soils, its trajectory curves towards the surface. Many UXBs are found with their nose cone pointing upwards as a result of this effect. More importantly however is the resulting horizontal offset from the point of entry. This is typically a distance of about one third of the bomb's penetration depth, but can be up to 15m.

12.3. WWII UXB Penetration Studies

During WWII the Ministry of Home Security undertook a major study on actual bomb penetration depths, carrying out statistical analysis on the measured depths of 1,328 bombs as reported by bomb disposal (BD) teams. Conclusions were made as to the likely average and maximum depths of penetration of different sized bombs in different geological strata.

For example, the largest common German bomb (500kg) had a likely concluded penetration depth of 6m in sand or gravel but 11m in clay. The maximum observed depth for a 500kg bomb was 11.4m and for a 1,000kg bomb 12.8m. Theoretical calculations suggested that significantly greater penetration depths were probable.

12.4. Site Specific Bomb Penetration Considerations

When considering an assessment of the bomb penetration at the site of proposed works the following parameters have been used:

- WWII geology – London Clay Formation.
- Impact angle and velocity – 10-15° from vertical and 270 metres per second.
- Bomb mass and configuration – The 500kg SC HE bomb, without retarder units or armour piercing nose (this was the largest of the common bombs used against Britain).
-

It has not been possible to determine maximum bomb penetration capabilities at this stage due to the limitations of site specific borehole geotechnical information available. An assessment can be made once such information becomes available or by an UXO Specialist on-site.

13. Initiation of Unexploded Ordnance

13.1. General

Unexploded ordnance does not spontaneously explode. All high explosive filling requires significant energy to create the conditions for detonation to occur. In the case of unexploded German bombs discovered within the construction site environment, there are a number of potential initiation mechanisms.

13.2. UXB Initiation Mechanisms

UXB Initiation	
Direct Impact	Unless the fuze or fuze pocket is struck, there needs to be a significant impact e.g. from piling or large and violent mechanical excavation, onto the main body of the weapon to initiate a buried iron bomb. Such violent action can cause the bomb to detonate.
Re- starting the Clockwork Fuze	A small proportion of German WWII bombs employed clockwork fuzes. It is probable that significant corrosion would have taken place within the fuze mechanism over the last 70+ years that would prevent clockwork mechanisms from functioning. Nevertheless, it was reported that the clockwork fuze in a UXB dealt with by 33 EOD Regiment in Surrey in 2002 did re-start.
Friction Impact	The most likely scenario resulting in the detonation of a UXB is friction impact initiating the shock-sensitive fuze explosive. The combined effects of seasonal changes in temperature and general degradation over time can cause explosive compounds to crystallise and extrude out from the main body of the bomb. It may only require a limited amount of energy to initiate the extruded explosive which could detonate the main charge.

Annex H2 details incidents where intrusive works have caused items of UXO to detonate, resulting in death or injury and damage to plant.

13.3. Effects of Detonation

When considering the potential consequences of a detonation, it is necessary to identify the significant receptors that may be affected. The receptors that may potentially be at risk from a UXO detonation on a construction site will vary depending on the site specific conditions but can be summarised as follows:

- People – site workers, local residents and general public.
- Plant and equipment – construction plant on site.
- Services – subsurface gas, electricity, telecommunications.
- Structures – not only visible damage to above ground buildings, but potentially damage to foundations and the weakening of support structures.
- Environment – introduction of potentially contaminating materials.

14. The Risk from German Aerial Delivered UXBs

14.1. World War I

During WWI London was targeted and bombed by Zeppelin Airships as well as Gotha and Giant fixed-wing aircraft. An estimated 250 tons of ordnance (high explosive and incendiary bombs) was dropped on Greater London, more than half of which fell on the City of London (see **Annex I** for a WWI bomb plot map of London). This source does not record any WWI bombing incidents to have directly affected the site, although a number of strikes area recorded in the vicinity.

Two significant attacks on the City of London were recorded to have hit the St Pancras area. The first came from a Goth bomber in daylight on 9th July 1917. Three bombs fell within the borough, including two on St Pancras Road. Another attack came on the 17th February 1918, from a single Zeppelin that dropped five bombs in the borough, which apparently fell on and near St. Pancras station.

WWI bombs were generally smaller than those used in WWII and were dropped from a lower altitude. This resulted in limited UXB penetration depths. Aerial bombing was often such a novelty at the time that it attracted public interest and even spectators to watch the raids in progress. For these reasons

there is a limited risk that UXBs passed undiscovered in the urban environment. When combined with the relative infrequency of attacks and an overall low bombing density the risk from WWI UXBs is considered low and will not be further addressed in this report.

14.2. World War II Bombing of St. Pancras

The Luftwaffe's main objective for the attacks on Britain was to inhibit the country's economic and military capability. To achieve this they targeted airfields, depots, docks, warehouses, wharves, railway lines, factories, and power stations. As the war progressed the Luftwaffe bombing campaign expanded to include the indiscriminate bombing of civilian areas in an attempt to subvert public morale.

During WWII the site was located within the Metropolitan Borough of St. Pancras, which sustained a very high density of bombing, as represented by bomb density data figures and maps, see section below. This was mainly due to the borough containing notable targets such as St. Pancras Railway Station and King's Cross Station, as well as its' proximity to major civil targets, such as Buckingham Palace. A Luftwaffe target photograph of the surrounding area is presented in **Annex K**.

Records of bombing incidents in the civilian areas of London were collected by the Air Raid Precautions wardens and collated by the Civil Defence Office. Some other organisations, such as port and railway authorities, maintained separate records. Records would be in the form of typed or hand written incident notes, maps and statistics. Bombing data was carefully analysed, not only due to the requirement to identify those parts of the country most needing assistance, but also in an attempt to find patterns in the Germans' bombing strategy in order to predict where future raids might take place.

Records of bombing incidents for the Metropolitan Borough of St. Pancras are presented in the following sections.

14.3. WWII Home Office Bombing Statistics

The following table summarises the quantity of German aerial delivered bombs (excluding 1kg incendiaries and anti-personnel bombs) dropped on the Metropolitan Borough of St. Pancras between 1940 and 1945.

Record of German Ordnance Dropped on the Metropolitan Borough of St. Pancras		
Area Acreage		**2694**
Weapons	High Explosive bombs (all types)	**641**
	Parachute mines	**8**
	Oil bombs	**14**
	Phosphorus bombs	**11**
	Fire pots	**0**
	Pilotless aircraft (V-1)	**20**
	Long range rocket bombs (V-2)	**2**
Total		**696**
Number of Items per 1,000 acres		**258.4**

Source: Home Office Statistics
This table does not include UXO found during or after WWII.

Detailed records of the quantity and locations of the 1kg incendiary and anti-personnel bombs were not routinely maintained by the authorities as they were frequently too numerous to record. Although the risk relating to IBs is lesser than that relating to larger HE bombs, they were similarly designed to inflict damage and injury. Anti-personnel bombs were used in much smaller quantities and are rarely

found today but are potentially more dangerous. Although Home Office statistics were not recorded, both types of item should not be overlooked when assessing the general risk to personnel and equipment.

14.4. London Civil Defence Region ARP Bomb Census Maps

During WWII, the ARP Department within the Research and Experiments Branch of the Ministry of Home Security produced consolidated, weekly and V-1 pilotless aircraft bomb census maps for the London Civil Defence Region. These maps collectively shows the approximate locations of bombs, mines and rockets. The site area was checked on each available map sheet, those showing bomb incidents on and in the immediate vicinity of the site are discussed below and are presented in **Annex L**.

London Consolidated Bomb Census Maps	
Date Range	**Comments**
Night Bombing up to 7th October 1940	No bomb strikes are recorded on site. The nearest is plotted approximately 100m south in St Pancras Hospital.
7th October 1940 to 6th June 1941	A bomb strike is recorded on the northern section of the site. Its' placement is appears to be on the small structure present on site in this area.

London Weekly Bomb Census Maps	
Date Range	**Comments**
18th/19th February 1944	One HE bomb strike is recorded in the northern section of the site. Similar to the strike recorded in the consolidated mapping, it is placed on or near the small structure present on site in this area.

V-1 Pilotless Aircraft Bomb Census Map	
Date Range	**Comments**
1944-45	One V-1 flying bomb fell approximately 275m away on Crowndale Road.

14.5. London Bomb Census Reports

Bomb census reports compiled by the Research and Experiments Branch of the Ministry of Home Security during WWII were consulted at The National Archives. These reports recorded information such as the date, time, type and damage caused by major bomb incidents in London.

They do not cover the entire period of bombing during the war and are thus not considered to be comprehensive. A transcript of the associated written records of major bomb incidents in the site area is presented in the table below. Only those recorded incidents on or in close proximity to the site have been highlighted.

Ministry of Home Security Bomb Census Reports		
Date	**Size of bomb**	**Comments**

16th to 17th April 1941	Unknown HE	St Pancras Hospital Pancras Way Bomb detonated on sets in roadway at "B" block opposite south stables. Severe structural damage to north end of "B" block section demolished – Laundry building east of crater demolished. "I" block N.E of crater doors, window frames, windows 1st, 2nd, 3rd floors blasted off. Brickwork pitted over 100 yards "B" block south of crater.

14.6. Metropolitan Borough of St. Pancras Local ARP Records

A visit was made to Camden Local Studies and Archives Centre to confirm if any local ARP incident records or bomb census mapping exist for the district. Unfortunately, only miscellaneous ARP correspondence (including discussion on warden posts, gas masks, and equipment) was found to be available, and no references were found within these papers to enemy bombing incidents. It is understood that such records were destroyed in the post-war period, the reason for which is unclear.

14.7. London County Council Bomb Damage Map

A map created by London County Council (LCC) showing the extent of bomb damage in the city was compiled during/after WWII. The section showing the area of the site is described in the table below and presented in **Annex N**.

LCC Bomb Damage Map	
Date Range	**Comments**
1940-1945	This map indicates the presence of minor bomb damage to the large structure occupying the site. The edge of its' southern side is highlighted as 'blast damage, minor in nature'. This may be due to the substantial damage sustained by structures bordering south of the site. One is labelled as 'damage beyond repair' whilst the other is labelled 'seriously damaged, but repairable at cost'. The structures bordering west of the site are labelled as 'blast damage minor in nature' and a structure bordering north was labelled 'general blast damage, not structural.'

14.8. WWII-Era Aerial Photographs

WWII-era ground-level, aerial and oblique photographs displaying the site area were consulted. These photographs provide record of the potential composition of the site during the war, as well as its condition immediately following the war.

WWII-Era Aerial Photographs		
Date	**Sources**	**Description**
19th September 1945	National Monuments Record Office (Historic England)	This high-resolution aerial photography is presented in **Annex O**. There is no visible direct bomb damage to either of the structures occupying the site. However part of the roof of the smaller 'L-shaped' structure and the roofing on the southern side of the large structure look like they have been recently rebuilt and may be evident of repair work following bomb incidents. This also appears to be the case with many of the structures bordering west. South of the site, in St Pancras Hospital, two structures have been cleared and another has sustained severe external damage. Structure adjoining

		north of the site also appear to be externally damaged. Any obvious areas of areas of cleared ground , severe damage or repair are highlighted in **Annex O2**.
1946	Britain From Above	These two oblique photographs are presented in **Annexe P**. They are largely consistent with the above photograph but are shown from an angle which displays the height of both structures occupying the site. Both structures on site are taller than their surroundings, the larger structure is several storeys high. There is no visible damage to the western sides of each structure, providing further clarification of their condition during WWII.

14.9. Abandoned Bombs

A post air-raid survey of buildings, facilities, and installations would have included a search for evidence of bomb entry holes. If evidence of an entry hole was encountered, Bomb Disposal Officer Teams would normally have been requested to attempt to locate, render safe, and dispose of the bomb. Occasionally, evidence of UXBs was discovered but due to a relatively benign position, access problems, or a shortage of resources the UXB could not be exposed and rendered safe. Such an incident may have been recorded and noted as an 'abandoned bomb'.

Given the inaccuracy of WWII records and the fact that these bombs were 'abandoned', their locations cannot be considered definitive or the lists exhaustive. The MoD states that 'action to make the devices safe would be taken only if it was thought they were unstable'. It should be noted that other than the 'officially' abandoned bombs, there will inevitably be UXBs that were never recorded.

1st Line Defence holds no records of officially registered abandoned bombs at or near the site of the proposed works.

14.10. Bomb Disposal Tasks

The information service from the Explosive Ordnance Disposal (EOD) Archive Information Office at 33 Engineer Regiment (EOD) is currently facing considerable delay. It has therefore not been possible to include any updated official information regarding bomb disposal/clearance tasks with regards to this site. A database of known disposal/clearance tasks has been referred to which does not make reference to such instances occurring within the site of proposed works. If any relevant information is received at a later date RSK will be advised.

14.11. Evaluation of German Aerial Delivered UXB Risk

Factors	Conclusion

Density of Bombing *It is important to consider the bombing density when assessing the possibility that UXBs remain in an area. High levels of bombing density could allow for error in record keeping due to extreme damage caused to the area.*	During WWII the site was located within the Metropolitan Borough of St. Pancras, which sustained a very high density of bombing, with an average of 258 bombs recorded per 1,000 acres according to Home Office statistics. London bomb census mapping indicates that at least one HE incidents affected the north of the site whilst the remainder was left untouched. They also show that numerous incidents affected the structures within the wider vicinity of the site. One such incident was recorded in the London Bomb Census reports where St Pancras Hospital, which bordered south of the site, was significantly damaged by bombing.
Damage *If buildings or structures on a site sustained bomb or fire damage any resulting rubble and debris could have obscured the entry holes of unexploded bombs dropped during the same, or later, raids. Similarly, a High Explosive bomb strike in an area of open agricultural land will have caused soil disturbance, increasing the risk that a UXB entry hole would be overlooked.*	LCC damage mapping recorded no significant damage to either of the structures on site. The southern edge of the larger structure was labelled as 'blast damage, minor in damage'. This can be corroborated by the high-resolution aerial photograph which shows new roofing on the southern side of the large structure, indicating it was recently rebuilt. This minor level of damage was likely the result of blast damage from incidents situated opposite Granary Street. Although it was not labelled by LCC, roofing on the smaller structure in the north of the site looks like it was rebuilt, which suggests it may have also sustained some bomb damage. This is correlated by the two bomb incidents recorded in this area between 1940-1941 and 1944, Structure adjoining the site to the north also appear to be externally damaged, though whether this was the direct result of bomb damage or dilapidation is unclear.
Access Frequency *UXO in locations where access was irregular would have a greater chance of passing unnoticed than at those that were regularly occupied. The importance of a site to the war effort is also an important consideration as such sites are likely to have been both frequently visited and subject to post-raid checks for evidence of UXO.*	The site is situated in an urban area and both structures occupying it were used for commercial purposes. Therefore, it is likely that the site had a regular level of access and observation during WWII. The level of monitor present may however have been disrupted by bombing within the northern section of the site. The structure on the north of the site may have been particularly affected due to the fact its' roof was repaired.
Ground Cover *The nature of the ground cover present during WWII would have a substantial influence on any visual indication that may indicate UXO being present.*	The site was predominantly occupied by structures which remained intact throughout the war. Therefore, the presence of bomb entry holes will have been apparent. The large structure currently occupied by The Ugly Brown Building was several storeys high which will have made evidence of UXO more obvious and means they were unlikely to have penetrated at depth. The northern area of the site contained open ground which will have been less conductive to UXO inspection. The structure adjoining north of the site was damaged so evidence of UXO will have been significantly reduced in this area. This creates an issue when taking into account the 'J curve' effect, in which UXO would end their trajectory at a lateral offset from point of entry often ending up beneath adjacent structures/sites.
Bomb Failure Rate	There is no evidence to suggest that the bomb failure rate in the locality of the site would have been dissimilar to the 10% normally used.
Abandoned Bombs	1st Line Defence holds no records of abandoned bombs at or within the site vicinity.

Bombing Decoy sites	1st Line Defence could find no evidence of bombing decoy sites within the site vicinity.
Bomb Disposal Tasks	1st Line Defence could find no evidence of bomb disposal tasks within the site boundary and immediate area.

15. The Risk from Allied Ordnance

15.1. General

The potential risk of encountering Allied ordnance on construction sites is particularly elevated in areas previously associated with military activity. This includes munitions deposited by military training exercises, dumped as a result of poor working practices, or deliberately placed to prevent adversary occupation and from other home defence activities. For example, contamination from items of Land Service (LSA) and Small Arms Ammunition (SAA) may result from historical occupation of an area or its use for military training.

It should be highlighted that there is no evidence that the site formerly had any military occupation or usage that could have led to contamination with such items of Allied ordnance. Despite this, urban areas such as the location of the site, can however be at risk from buried unexploded Anti-Aircraft projectiles fired during WWII – as addressed below.

15.2. Defending the UK From Aerial Attack

During WWII the Ministry of Defence employed a number of defence tactics against the Luftwaffe from bombing major towns, cities, manufacturing areas, ports and airfields. These can be divided into passive and active defences (examples are provided in the table below).

Active Defences	Passive Defences
• Anti-aircraft gun emplacements to engage enemy aircraft. • Fighter aircraft to act as interceptors. • Rockets and missiles were used later during WWII.	• Blackouts and camouflaging to hinder the identification of Luftwaffe targets. • Decoy sites were located away from targets and used dummy buildings and lighting to replicate urban, military, or industrial areas. • Barrage balloons forced enemy aircraft to greater altitudes. • Searchlights were often used to track and divert adversary bomber crews during night raids.

Active defences such as anti-aircraft artillery present a greater risk of UXO contamination than passive defences. Unexploded ordnance resulting from dogfights and fighter interceptors is rarely encountered and difficult to accurately qualify.

15.3. Anti-Aircraft Artillery (AAA)

During WWII three main types of gun sites existed: heavy anti-aircraft (HAA), light anti-aircraft (LAA) and 'Z' batteries (ZAA). If the projectiles and rockets fired from these guns failed to explode or strike an aircraft they would descend back to land. The table below provides further information on the operation and ordnance associated with these type of weapons.

Anti-Aircraft Artillery				
Item	**Description**			
HAA	These large calibre guns such as the 3.7" QF (Quick Firing) were used to engage high flying enemy bombers., They often fired large HE projectiles, which were usually initiated by integral fuzes triggered by impact, area, time delay or a combination of aforementioned mechanisms. The closest HAA was located approximately 3.2km north-west of the site, however the range of a projectile can be up to 15km.			
LAA	These mobile guns were intended to engage fast, low flying aircraft. They were typically rotated between locations on the perimeters of towns and strategically important industrial works. As they could be moved to new positions with relative ease when required, records of their locations are limited. The most numerous of these were the 40mm Bofors gun which could fire up to 120 x 40mm HE projectiles per minute to over 1,800m.			
Variations in HAA and LSA Ammunition	**Gun type**	**Calibre**	**Shell Weight**	**Shell Dimensions**
	3.0 Inch	76mm	7.3kg	76mm x 356mm
	3.7 Inch	94mm	12.7kg	94mm x 438mm
	4.5 Inch	114mm	24.7kg	114mm x 578mm
	40mm	40mm	0.9kg	40mm x 311mm
Z-AA	The three inch unrotated rocket/projectile known as the UP-3 had initially been developed for the Royal Navy. The UP-3 was also used in ground-based single and 128-round launchers known as ''Z'' batteries. The rocket, containing a high explosive warhead was often propelled by cordite.			

The conditions in which an HAA or LAA projectiles may have fallen unnoticed within a site area are analogous to those regarding aerial delivered ordnance. For detailed analysis on the ground conditions and access frequency within the proposed site, see the evaluation of German Bombing Records in, **Section 14**.

Illustrations of Anti-Aircraft artillery, projectiles and rockets are presented at **Annex Q**.

15.4. Evaluation of Allied Ordnance Risk

1st Line Defence has considered the following potential sources of Allied ordnance contamination:

Sources of Contamination	Conclusion
Military Camps *Military camps present an elevated risk from ordnance simply due to the large military presence and likelihood of associated live ordnance training.*	1st Line Defence could find no evidence of a military camp within the site.
Anti-Aircraft Defences *Anti-Aircraft defences were employed across the country. Proximity to anti-aircraft defences increases the chance of encountering AA projectiles.*	1st Line Defence could find no evidence of Anti-Aircraft defences such as a HAA or LAA gun emplacement occupying or bordering the site. The closest HAA was located approximately 3.2km north-east of the site, however the range of a projectile can be up to 15km. The conditions in which HAA or LAA projectiles may have fallen unnoticed within a site footprint are analogous to those regarding German aerial delivered ordnance.

Home Guard Activity *The Home Guard regularly undertook training and ordnance practice in open areas, as well as burying ordnance as part of anti-invasion defences.*	Evidence of Home Guard training areas and activities is difficult to obtain. 1st Line Defence has no evidence of any Home Guard activities on the site.
Defensive Positions *Defensive positions suggest the presence of military activity, which is often indicative of ordnance storage, usage or disposal.*	There is no evidence of any defensive features formerly located on or bordering the site footprint.
Training or firing ranges *Areas of ordnance training saw historical ordnance usage in large numbers, often with inadequate disposal of expended and live items. The presence of these ranges significantly impact on the risk of encountering items of ordnance in their vicinity.*	There is no evidence of such features affecting the site.
Defensive Minefields *Minefields were placed in strategic areas to defend the country in the event of a German invasion. Minefields were not always cleared with an appropriate level of vigilance.*	There is no evidence of defensive minefields affecting the site.
Ordnance Manufacture *Ordnance manufacture indicates an increased chance that items of ordnance were stored, or disposed of, within a location.*	No information of ordnance being stored, produced, or disposed of within the proposed site could be found.
Military Related Airfields *Military airfields present an elevated risk from ordnance simply due to the large military presence and likelihood of associated live ordnance training or bombing practice.*	The site was not situated within the perimeters or vicinity of a military airfield.

16. Ordnance Clearance and Post-WWII Ground Works

16.1. General

It is important to consider the extent to which any explosive ordnance clearance (EOC) activities or extensive ground works have occurred on site. This may indicate previous ordnance contamination or reduce the risk that ordnance remains undiscovered.

16.2. UXO Clearance

1st Line Defence has no evidence that any official ordnance clearance operations have taken place on site. Note however that we have not received confirmation of this fact from 33 EOD Regiment.

16.3. Post-war Redevelopment

The site has experienced significant development since the end of WWII. The structure occupying the north was removed in 1962. In 1978 the large structure was destroyed by a fire[2] and was replaced by *The Ugly Brown Building* which occupies the place of both the large and small structure which occupied the site during WWII.

17. 1st Line Defence Risk Assessment

17.1. Risk Assessment Stages

Taking into account the quality of the historical evidence, the assessment of the overall risk from unexploded ordnance is based on the following five considerations:

1. That the site was contaminated with unexploded ordnance.
2. That unexploded ordnance remains on site.
3. That such items will be encountered during the proposed works.
4. That ordnance may be initiated by the works operations.
5. The consequences of encountering or initiating ordnance.

[2] *http://www.evtra.org.uk/wp-content/uploads/2017/04/Ted-Baker-Ugly-Brown-Building-Proposal.pdf*

UXO Risk Assessment	
Quality of the Historical Record	The research has evaluated pre- and post-WWII Ordnance Survey maps, Luftwaffe reconnaissance imagery, London Bomb Census mapping, Goad Fire Insurance mapping, Oblique Photography, High-Resolution Aerial Photography, and London Bomb Census Reports. The record set is of generally unsatisfactory quality due to the lack of written records for the area of St. Pancras. It is understood that such records were destroyed in the post-war period. However due to the acquisition of additional records, such as aerial imagery, it has been possible to ascertain the wartime condition of the majority of the site with a good degree of confidence.
The Risk that the Site was Contaminated with UXO	After considering the following facts, 1st Line Defence has assessed that there is a **Low Risk** from items of unexploded German aerial delivered and anti-aircraft ordnance within the majority of site boundary, with a small area of **Medium Risk** in the northern area. • During WWII, the Metropolitan Borough of St. Pancras sustained a very high density bombing campaign, with an average of 258 items falling per 1,000 acres according to Home Office statistics. This is largely attributed to the borough containing notable targets such as St. Pancras Railway Station and King's Cross Station, as well as its position within central London. • London Bomb census mapping recorded two bomb strikes on the northern area of the site between 1940-1941 and February 1944. However, due to the lack of written ARP records available for St. Pancras it is not possible to confirm their calibre, the extent of the damage caused or whether these two plotted strikes do in fact represent only one bombing incident. High-resolution aerial photography shows that part of the roof was replaced on the 'L-shaped' structure occupying this section of the site. This indicates that this area did sustain some level of bomb damage. • High-resolution aerial photography shows that the structures north of the site (adjacent to the 'L-shaped building) were of poor condition and Goad insurance mapping states that they were vacant from 1942. Therefore, this area likely had little access and poor ground cover which will have hindered UXO inspection. This creates an issue when taking into account the 'J curve' effect, in which UXO would end their trajectory at a lateral offset from point of entry often ending up beneath adjacent structures/sites. • In contrast, LCC records the southern edge of the large 'Ale and Porter' store that occupied the majority of the site as sustaining only 'blast damage, minor in nature'. This is verified by high-resolution aerial photography which shows part of the roofing in this area was repaired. High-resolution aerial and oblique photography show that the structure remained intact throughout the war. • As this large structure was several stories high, the likelihood of a UXO penetrating at depth is low. As well as this, it is anticipated to have continued in use as a major commercial structure throughout the war. This composition of the structure and its level of access greatly decreases the chance of a UXO remaining undetected where this structure was situated. • Based on this criteria it has been possible to reduce the risk from UXO across the majority of the site area. This has not been the case within the northern section of the site due to its proximity to two bomb incidents and position directly adjacent to a dilapidated area. Furthermore, the open ground occupying the northern area (which was used for lorry repairs) is believed to have been less conductive to the inspection of UXO than the areas occupied by structures. • There is no evidence that the site formerly had any military occupation or usage that could have led to contamination with items of Allied ordnance, such as LSA and SAA. The conditions in which HAA or LAA projectiles may have fallen unnoticed

	within the site boundary are however analogous to those regarding aerial delivered ordnance.
The Risk that UXO Remains on Site	The site has experienced significant development since the end of WWII. The structure occupying the north was removed in 1962. In 1978 the large structure was destroyed by a fire and was replaced by The Ugly Brown Building which occupies the place of both the large and small structure which occupied the site during WWII. The risk of UXO remaining is only considered to have been mitigated at the location and down to the depth of post-war foundations and excavations. Below these depths and away from these areas, a risk is still considered to remain.
The Risk that UXO may be Encountered during the Works	The most likely scenarios under which items of UXO could be encountered during construction works is during piling, drilling operations or bulk excavations for basement levels. The risk of encountering will depend on the extent of the works, such as the numbers of boreholes/piles (if required) and the volume of the excavations. An aerial delivered bomb may come to rest at any depth between just below ground level and its maximum penetration depth. Consequently there is also a possibility that UXBs could be encountered during shallow excavations (for services or site investigations) into the original WWII ground level. There is not considered to be any significant risk of encountering UXO during works planned within the footprint and down to the depth of any post-war buildings/excavations. Beyond these depths and away from these areas, a risk of encounter could remain.
The Risk that UXO may be Initiated	The risk that UXO could be initiated if encountered will depend on its condition, how it is found, and the energy with which it is struck. Certain construction activities such as piling and percussive drilling pose a greater risk of initiating UXO in comparison to machine excavation, where the force of impact is generally lower and the item is more likely to be observed. If a UXB is struck by piling or percussive drilling equipment, the force of the impact can be sufficient to detonate the main high explosive charge irrespective of the condition of the fuze or other components. Violent vibration might also impart enough energy to a chemical detonator for it to function, and there is a potential risk that clockwork fuzes could restart.
The Consequences of Encountering or Initiating Ordnance	The repercussions of the inadvertent detonation of items of UXO during intrusive ground works are potentially severe, both in terms of human and financial cost. A serious risk to life and limb, damage to plant and total site shutdown during follow-up investigations are potential outcomes. If appropriate risk mitigation measures are undertaken, the chances of initiating an item of UXO during ground works is comparatively low. The primary consequence of encounter of UXO will therefore be economic. This would be particularly notable in the case of sites with a high-profile or where it is necessary to evacuate the public from the surrounding area. A site may be closed from a few hours to a week with potentially significant cost in lost time. It should be noted that even the discovery of suspected or possible items of UXO during intrusive works (if handled solely through the authorities), may also involve loss of production. Generally, the first action of the police in most cases will be to isolate the locale whilst awaiting military assistance, even if this becomes unnecessary.

17.2. Assessed Risk Level

Taking into consideration the findings of this study, 1st Line Defence has assessed that there is a **Low Risk** from German and anti-aircraft unexploded ordnance at the majority of the site. The site's northern section has been assessed as **Medium Risk**.

Low Risk

Ordnance Type	Risk Level			
	Negligible	Low	Medium	High
German Unexploded HE Bombs		✓		
German 1kg Incendiary Bombs		✓		
Anti-Aircraft Artillery Projectiles		✓		
Allied Military Land Service Ammunition (Grenades, Mortars etc.)	✓			

Medium Risk

Ordnance Type	Risk Level			
	Negligible	Low	Medium	High
German Unexploded HE Bombs			✓	
German 1kg Incendiary Bombs			✓	
Anti-Aircraft Artillery Projectiles			✓	
Allied Military Land Service Ammunition (Grenades, Mortars etc.)	✓			

18. Proposed Risk Mitigation Methodology

18.1. General

The following risk mitigation measures are recommended to support the proposed works at The Ugly Brown Building (Ted Baker Head Office):

Type of Work	Recommended Mitigation Measure
All Works	• **Site Specific UXO Awareness Briefings to all personnel conducting intrusive works.** As a minimum precaution, all personnel working on the site should be briefed on the basic identification of UXO and what to do in the event of encountering a suspect item. This should in the first instance be undertaken by a UXO Specialist. Posters and information on the risk of UXO can be held in the site office for reference.

Shallow Intrusive Works/Open Excavations	• **Unexploded Ordnance (UXO) Specialist Presence on Site to support shallow intrusive works** When on site the role of the UXO Specialist would include: • Monitoring works using visual recognition and instrumentation, including immediate response to reports of suspicious objects or suspected items of ordnance that have been recovered by the ground workers on site. • Providing UXO awareness briefings to any uninformed staff and advise staff of the need to modify working practices to take account of the ordnance risk. • To aid incident management which would involve liaison with the local authorities and police should ordnance be identified and present an explosive hazard.
Borehole/Piles	• **Intrusive Magnetometer Survey of all borehole and pile locations down to a maximum bomb penetration depth:** 1st Line Defence can deploy a range of intrusive magnetometer techniques to clear pile locations. The appropriate technique is influenced by a number of factors, but most importantly the site's ground conditions. The appropriate survey methodology would be confirmed once the enabling works have been completed.

In making this assessment and recommending these risk mitigation measures, if known, the works outlined in the 'Scope of the Proposed Works' section were considered. Should the planned works be modified or additional intrusive engineering works be considered, 1st Line Defence should be consulted to see if a re-assessment of the risk or mitigation recommendations is necessary.

1st Line Defence Limited **24th October 2018**

This Report has been produced in compliance with the Construction Industry Research and Information Association (CIRIA) C681 guidelines for the writing of Detailed UXO Risk Assessments.

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This report has been prepared by 1st Line Defence Limited with all reasonable care and skill. The report contains historical data and information from third party sources. 1st Line Defence Limited has sought to verify the accuracy and comprehensiveness of this information where possible but cannot be held accountable for any inherent errors. Furthermore, whilst every reasonable effort has been made to locate and access all relevant historical information, 1st Line Defence cannot be held responsible for any changes to risk level or mitigation recommendations resulting from documentation or other information which may come to light at a later date.

Site Location Maps

Annex: **A**

1ST LINE DEFENCE

Unit 3, Maple Park
Essex Road, Hoddesdon,
Hertfordshire. EN11 0EX
Email: info@1stlinedefence.co.uk
Tel: +44 (0)1992 245 020

Client: **RSK**

Approximate site boundary

N

Project: **The Ugly Brown Building (Ted Baker Head Office)**

Ref: **DA7410-00**

Source: Google Maps

Recent Aerial Photography

Annex: **B**

1ST LINE DEFENCE

Unit 3, Maple Park
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Tel: +44 (0)1992 245 020

Client: **RSK**

Approximate site boundary

N

Project: **The Ugly Brown Building (Ted Baker Head Office)**

Ref: **DA7410-00**

Source: Google Earth ™ Mapping Services

Client Provided Site Plan

Annex: **C**

1ST LINE DEFENCE

Unit 3, Maple Park
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Tel: +44 (0)1992 245 020

Client: **RSK**

Approximate site boundary

N

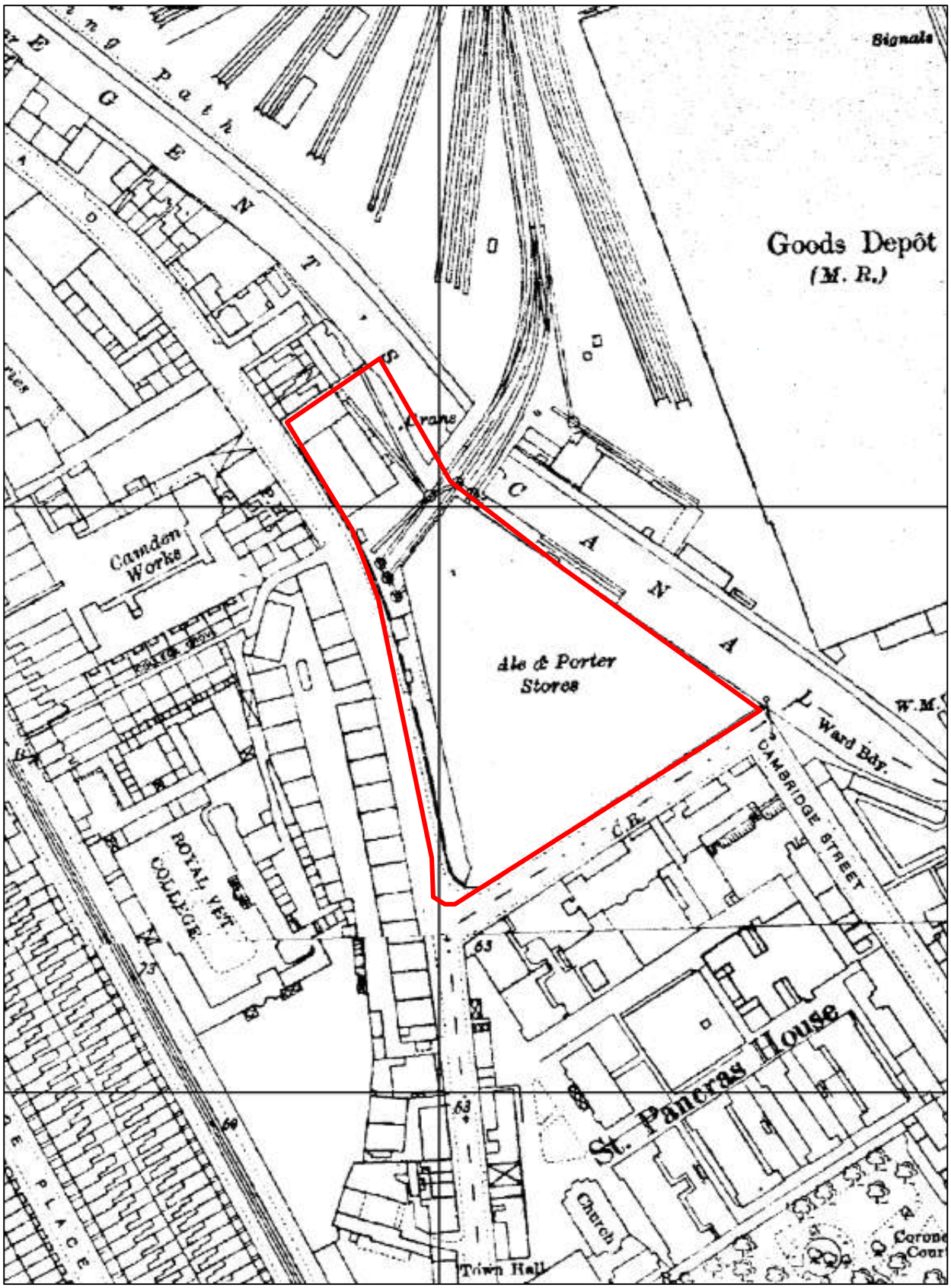
Project: **The Ugly Brown Building (Ted Baker Head Office)**

Ref: **DA7410-00**

Source: The Client

1916 Historical Map

Annex: **D1**



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Client: **RSK**

Approximate site boundary

N

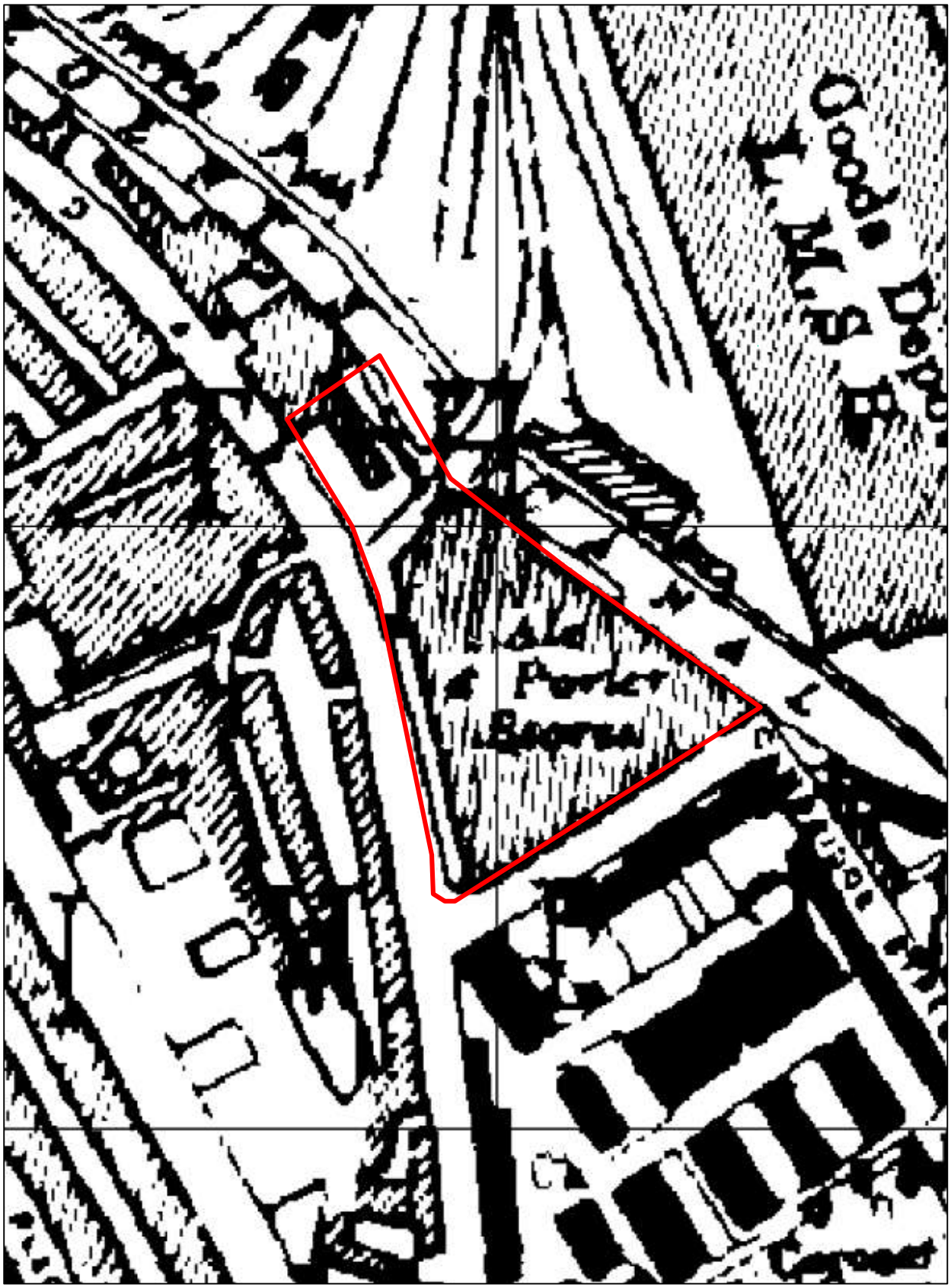
Project: **The Ugly Brown Building (Ted Baker Head Office)**

Ref: **DA7410-00**

Source: Landmark Maps

1938 Historical Map

Annex: **D2**



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Client: **RSK**

Approximate site boundary

Project: **The Ugly Brown Building (Ted Baker Head Office)**

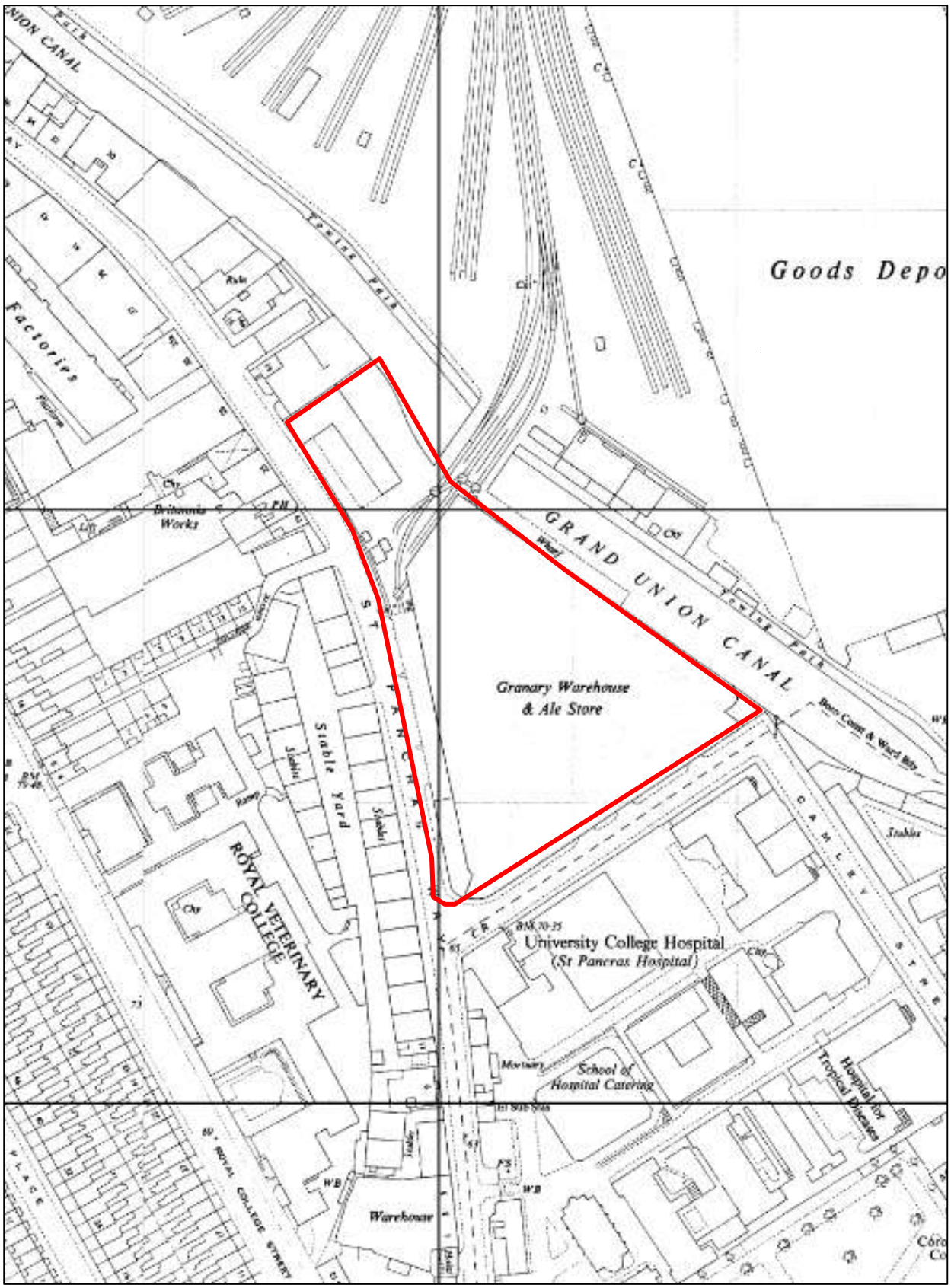
N

Ref: **DA7410-00**

Source: Landmark Maps

1955 - 1956 Historical Map

Annex: **D3**



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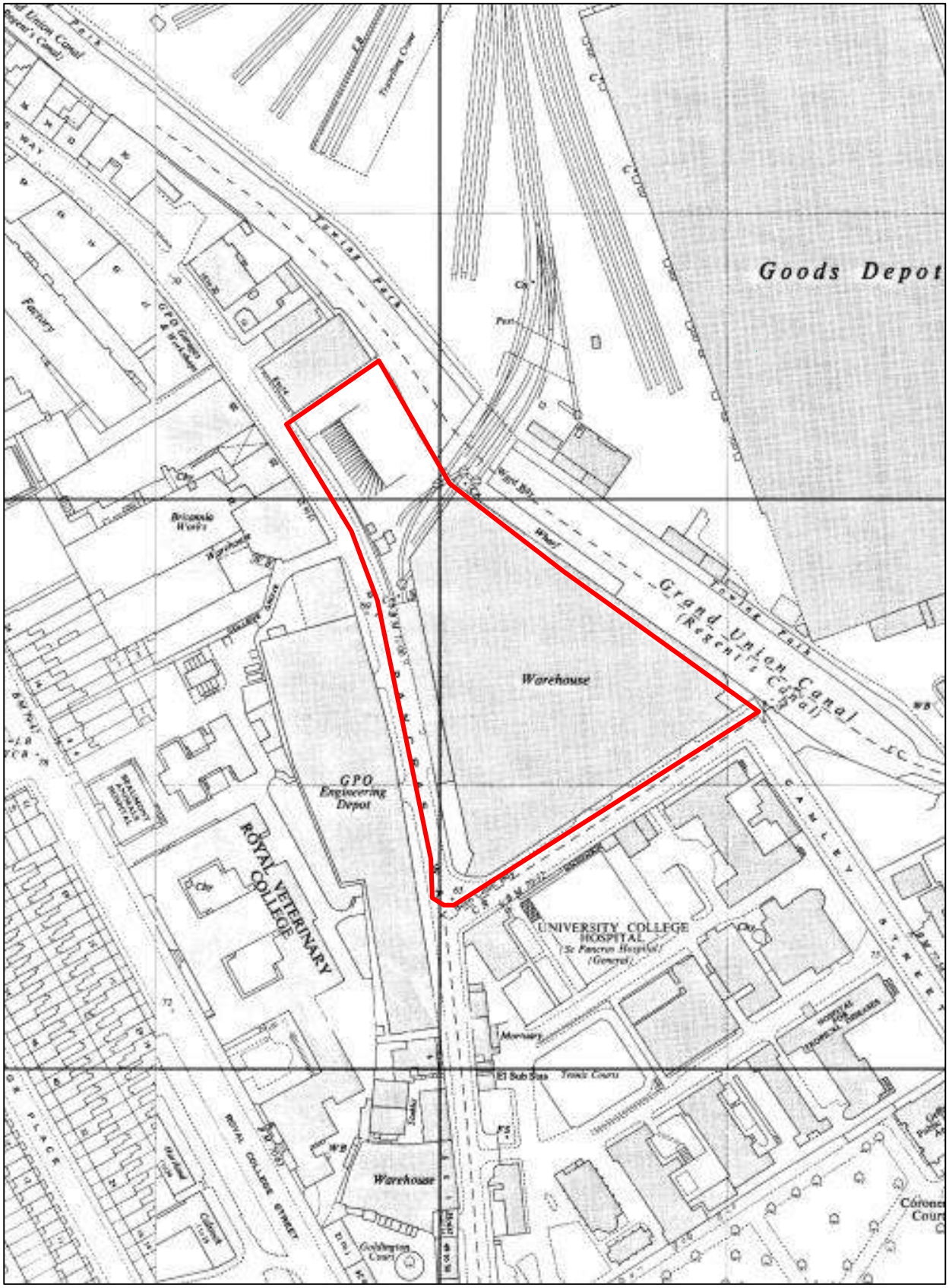
Email: info@1stlinedefence.co.uk
Tel: +44 (0)1992 245 020

Client: **RSK**	**Approximate site boundary**	N
Project: **The Ugly Brown Building (Ted Baker Head Office)**		
Ref: **DA7410-00**	Source: Landmark Maps	

1962 - 1971 Historical Map

Annex: D4



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Client: **RSK**

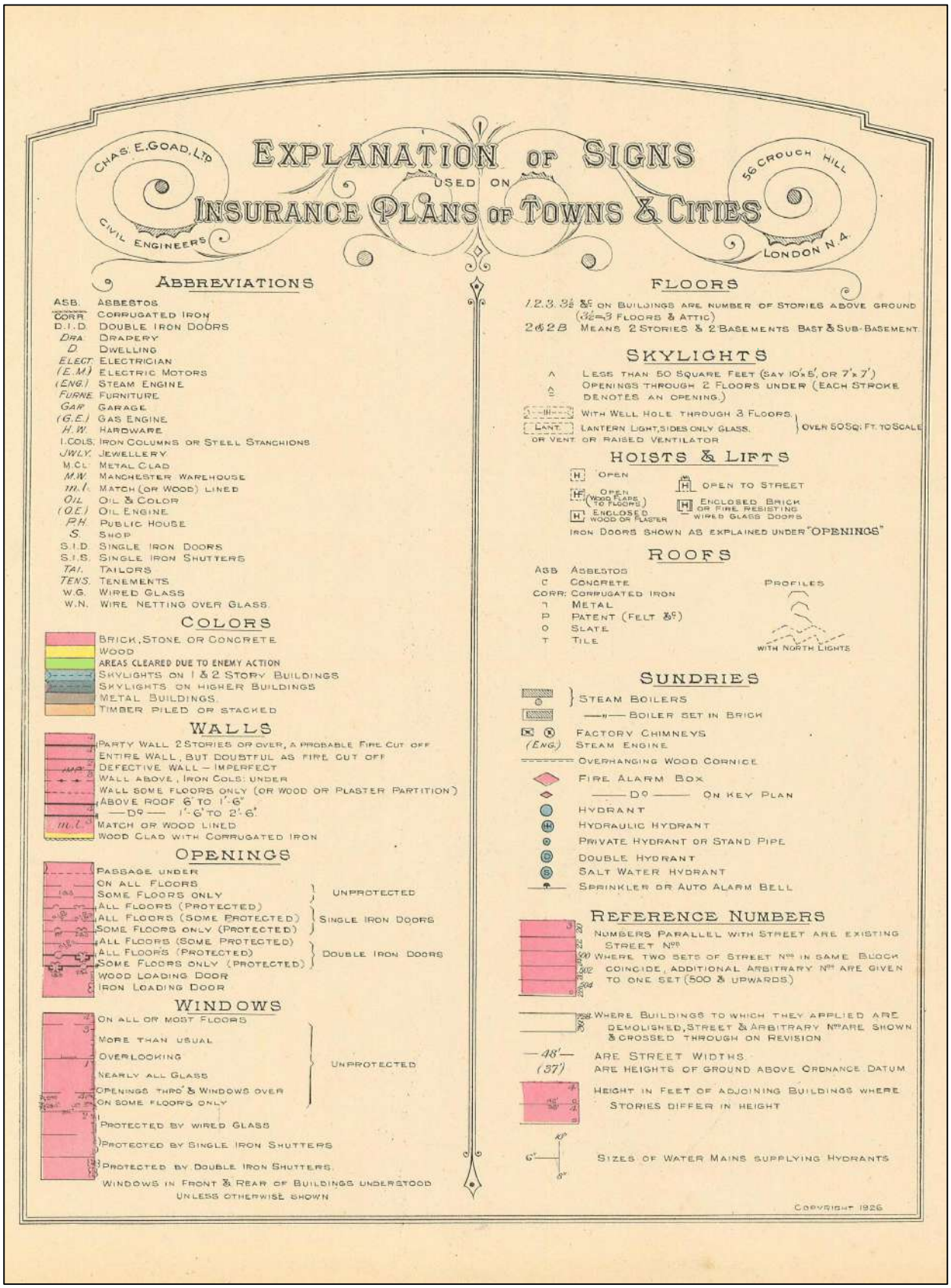
Approximate site boundary

Project: **The Ugly Brown Building (Ted Baker Head Office)**

N

Ref: **DA7410-00**

Source: Landmark Maps



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Client: **RSK**

Approximate site boundary

N

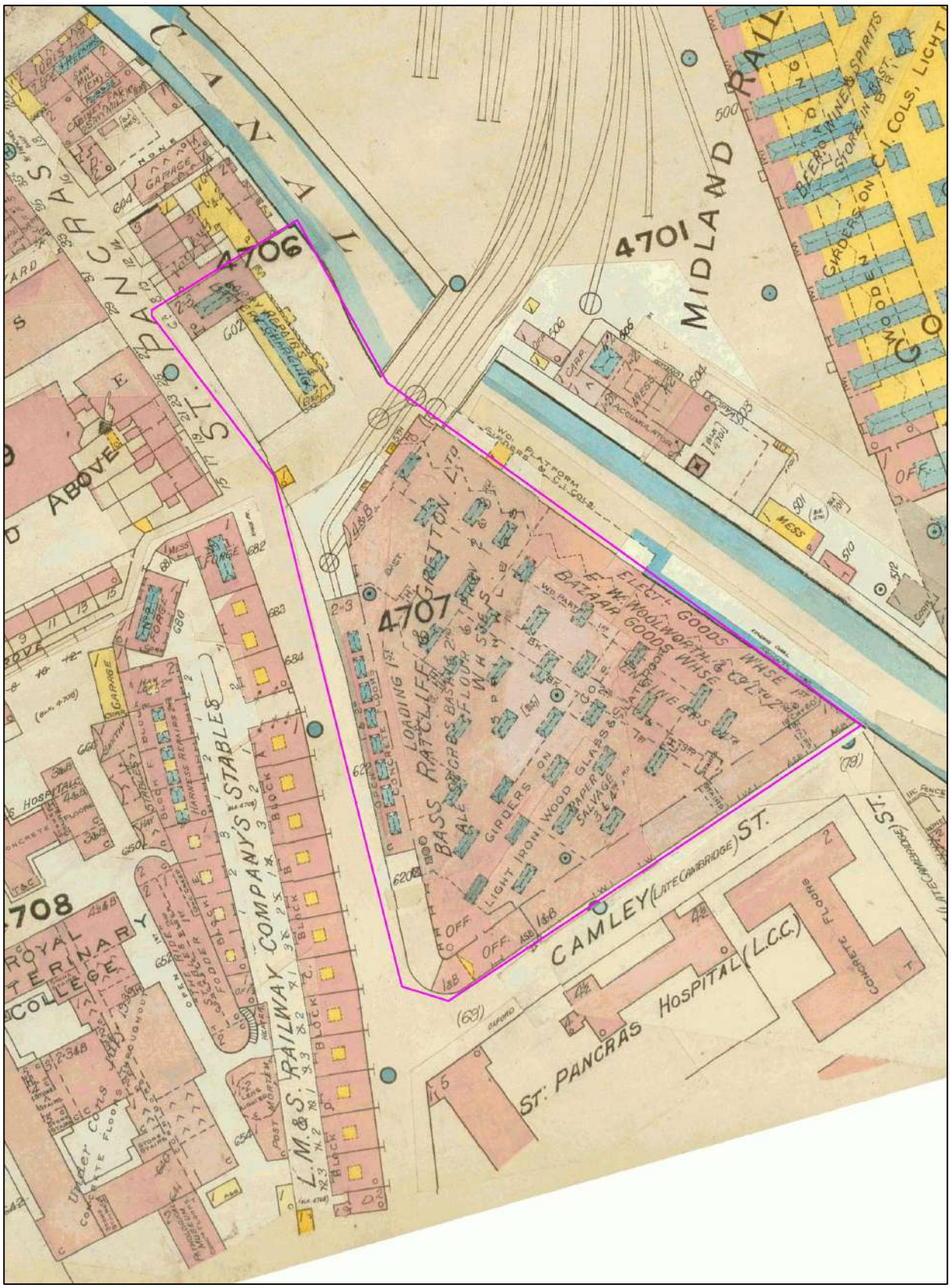
Project: **The Ugly Brown Building (Ted Baker Head Office)**

Ref: **DA7410-00**

Source: Landmark Maps

Goad Fire Insurance Mapping 1942

Annex: **E2**



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Project: **The Ugly Brown Building (Ted Baker Head Office)**

Ref: **DA7410-00**

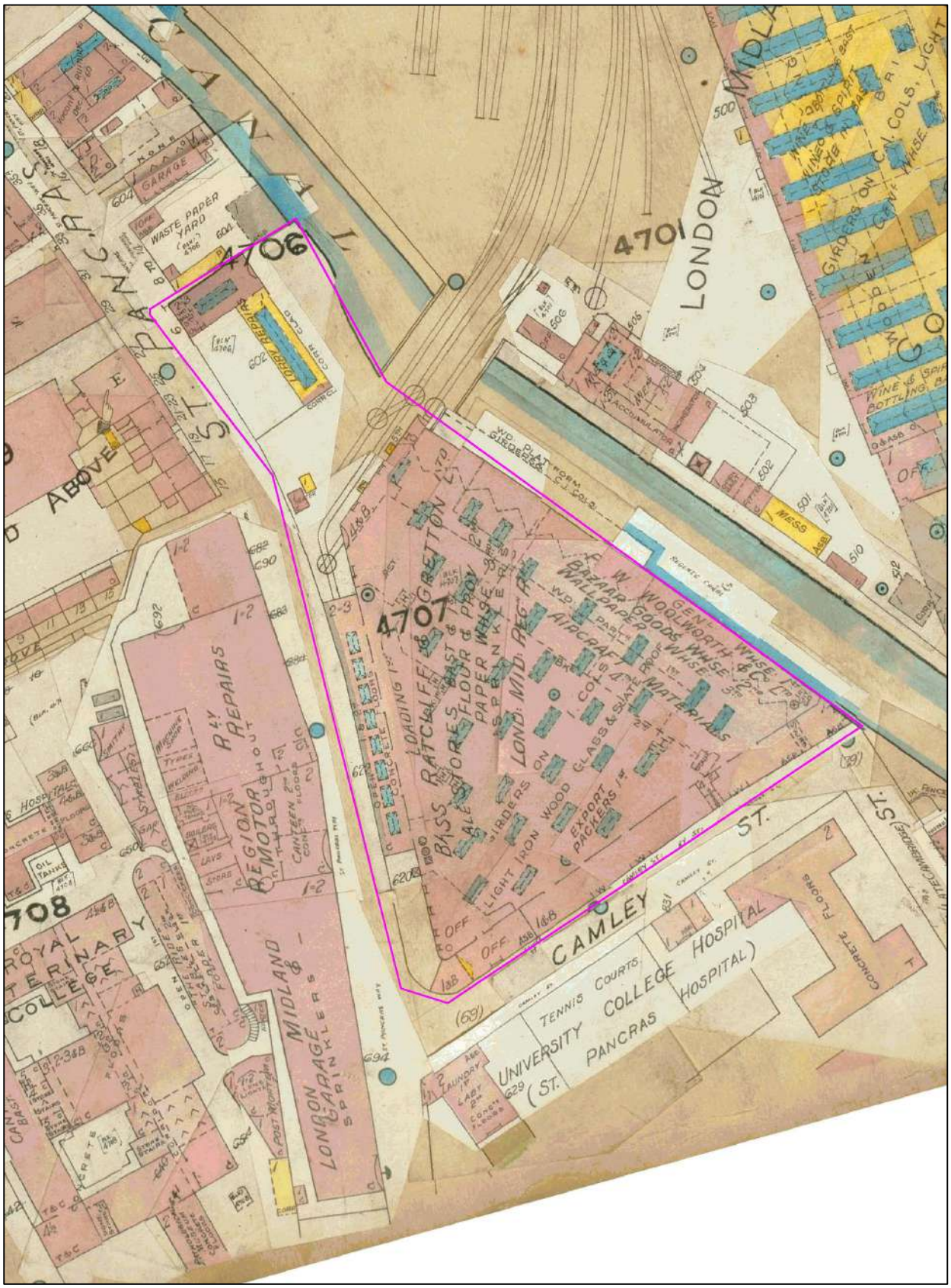
Source: Landmark Maps

Approximate site boundary

N

Goad Fire Insurance Mapping 1960

Annex: **E3**



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Ref: **DA7410-00**

Source: Landmark Maps

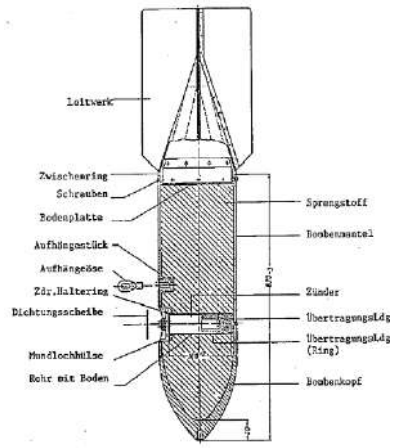
Approximate site boundary

N

Examples of German Air-Delivered Ordnance

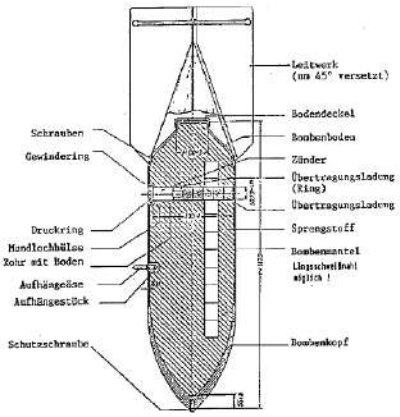
SC 50kg High Explosive Bomb

Bomb Weight	40-54kg (88-119lb)
Explosive Weight	c25kg (55lb)
Fuze Type	Impact fuze/electro-mechanical time delay fuze
Bomb Dimensions	1,090 x 280mm (42.9 x 11.0in)
Body Diameter	200mm (7.87in)
Use	Against lightly damageable materials, hangars, railway rolling stock, ammunition depots, light bridges and buildings up to three stories.
Remarks	The smallest and most common conventional German bomb. Nearly 70% of bombs dropped on the UK were 50kg.



SC 250kg High Explosive Bomb

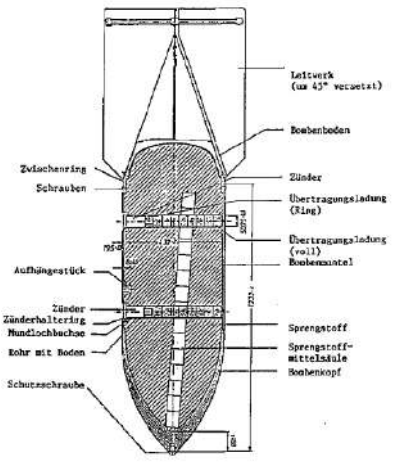
Bomb Weight	245-256kg (540-564lb)
Explosive Weight	125-130kg (276-287lb)
Fuze Type	Electrical impact/mechanical time delay fuze.
Bomb Dimensions	1640 x 512mm (64.57 x 20.16in)
Body Diameter	368mm (14.5in)
Use	Against railway installations, embankments, flyovers, underpasses, large buildings and below-ground installations.
Remarks	It could be carried by almost all German bomber aircraft, and was used to notable effect by the Junkers Ju-87 Stuka (Sturzkampfflugzeug or dive-bomber).

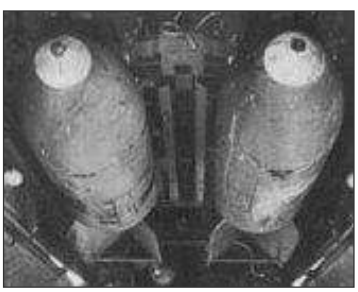


SC250 bomb being loaded onto German bomber

SC 500kg High Explosive Bomb

Bomb Weight	480-520kg (1,058-1,146lb)
Explosive Weight	250-260kg (551-573lb)
Fuze Type	Electrical impact/mechanical time delay fuze.
Bomb Dimensions	1957 x 640mm (77 x 25.2in)
Body Diameter	470mm (18.5in)
Use	Against fixed airfield installations, hangars, assembly halls, flyovers, underpasses, high-rise buildings and below-ground installations.
Remarks	40/60 or 50/50 Amatol TNT, trialene. Bombs recovered with Trialen filling have cylindrical paper wrapped pellets 1-15/16 in. in length and diameter forming





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Project: **The Ugly Brown Building (Ted Baker Head Office)**

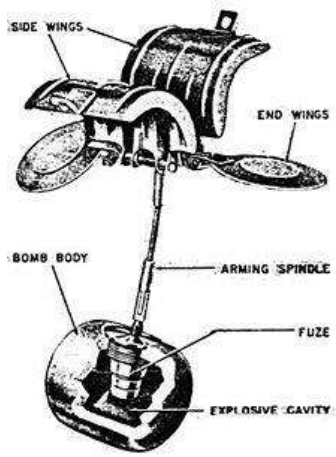
Ref: **DA7410-00**

Source: Various sources

Examples of German Air-Delivered Ordnance

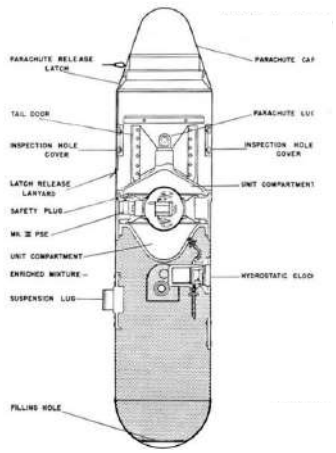
SD2 Anti-Personnel 'Butterfly Bomb'

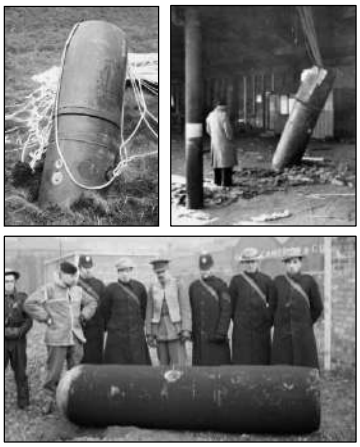
Bomb Weight	2kg (4.41lb)
Explosive Weight	7.5oz (225 grams) of Amatol surrounded by a layer of bituminous composition.
Fuze Type	41 fuze (time) , 67 fuze (clockwork time delay) or 70 fuze (anti-handling device)
Body Diameter	3in (7.62 cm) diameter, 3.1in (7.874) long
Use	Designed as an anti-personnel/ fragmentation weapon. They were delivered by air, being dropped in containers of 23-144 sub-munitions that opened at a predetermined height, thus scattering the bombs.
Remarks	Very rare. First used against Ipswich in 1940, but were also dropped on Kingston upon Hull, Grimsby and Cleethorpes in June 1943, amongst various other targets in UK. As the bombs fell the outer case flicked open by springs which caused four light metal drogues with a protruding 5 inch steel cable to deploy in the form of a parachute & wind vane which armed the device as it span.



Parachute Mine (Luftmine B / LMB)

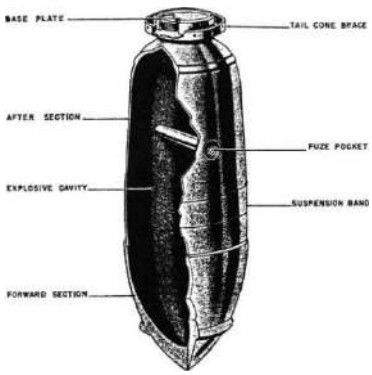
Bomb Weight	Approx. 990kg (2176lb)
Explosive Weight	Approx. 705kg (1,554lb)
Fuze Type	Impact/ Time delay / hydrostatic pressure fuze
Dimensions	2.64m x 0.64m (3.04m with parachute housing)
Use	Against civilian, military and industrial targets. Used as blast bombs and designed to detonate above ground level to maximise damage to a wider area.
Remarks	Deployed a parachute when dropped in order to control its descent. Had the potential to destroy a whole street of housing in a 100m radius.





SC 1000kg

Bomb Weight	993-1027kg (2,189-2,264lb)
Explosive Weight	530-620kg (1168-1367lb)
Fuze Type	Electrical impact/mechanical time delay fuze.
Filling	Mixture of 40% amatol and 60% TNT, but when used as an anti-shipping bomb it was filled with Trialen 105, a mixture of 15% RDX, 70% TNT and 15% aluminium powder.
Bomb Dimensions	2800 x 654mm (110 x 25.8in)
Body Diameter	654mm (18.5in)
Use	SC type bombs are General Purpose Bombs used primarily for general demolition work. Constructed of parallel walls with comparatively heavy noses. They are usually of three piece welded construction



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Client: **RSK**

Project: **The Ugly Brown Building (Ted Baker Head Office)**

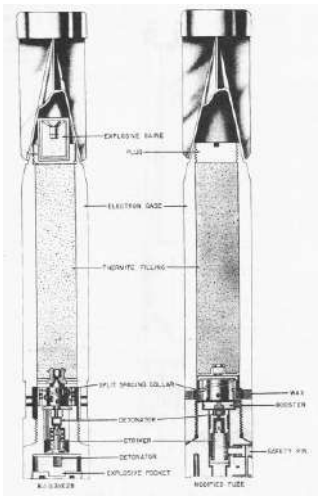
Ref: **DA7410-00**

Source: Various sources

German Incendiary Bombs

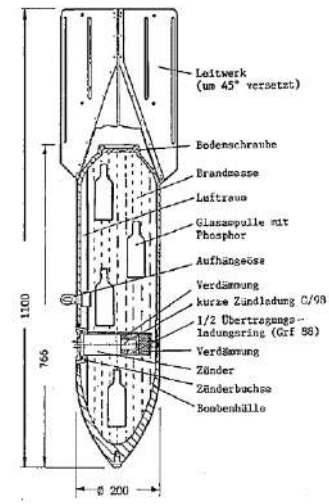
1kg Incendiary Bomb

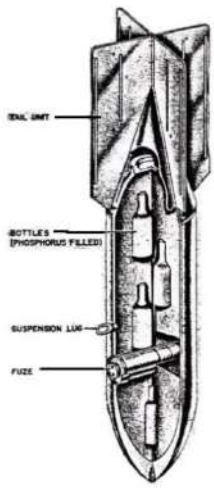
Bomb Weight	1.0 and 1.3kg (2.2 and 2.9lb)
Explosive Weight	680g (1.3lb) Thermite 8-15gm Explosive Nitropenta
Fuze Type	Impact fuze
Bomb Dimensions	350 x 50mm (13.8 x 1.97in)
Body Diameter	50mm (1.97in)
Use	As incendiary – dropped in clusters against towns and industrial complexes
Remarks	Magnesium alloy case. Sometimes fitted with high explosive charge. The body is a cylindrical alloy casting threaded internally at the nose to receive the fuze holder and fuze.



C50 A Incendiary Bomb

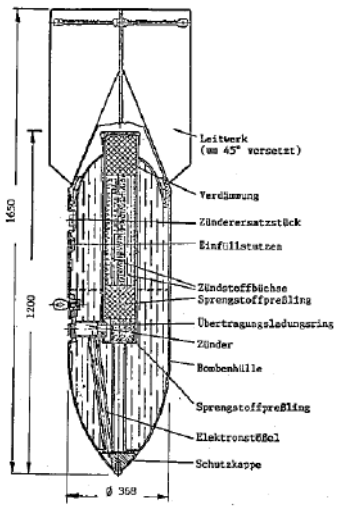
Bomb Weight	c41kg (90.4lb)
Explosive Weight	0.03kg (0.066lb)
Incendiary Filling	12kg (25.5lb) liquid filling with phosphor igniters in glass phials. Benzine 85%; Phosphorus 4%; Pure Rubber 10%
Fuze Type	Electrical impact fuze
Bomb Dimensions	1,100 x 280mm (43.2 x 8in)
Use	Against all targets where an incendiary effect is required
Remarks	Early fill was a phosphorous/carbon disulphide incendiary mixture





Flam C-250 Oil Bomb

Bomb Weight	125kg (276lb)
Explosive Weight	1kg (2.2lb)
Fuze Type	Super-fast electrical impact fuze
Filling	Mixture of 30% petrol and 70% crude oil
Bomb Dimensions	1,650 x 512.2mm (65 x 20.2in)
Body Diameter	368mm (14.5in)
Use	Often used for surprise attacks on ground troops, against troop barracks and industrial installations. Thin casing – not designed for ground penetration



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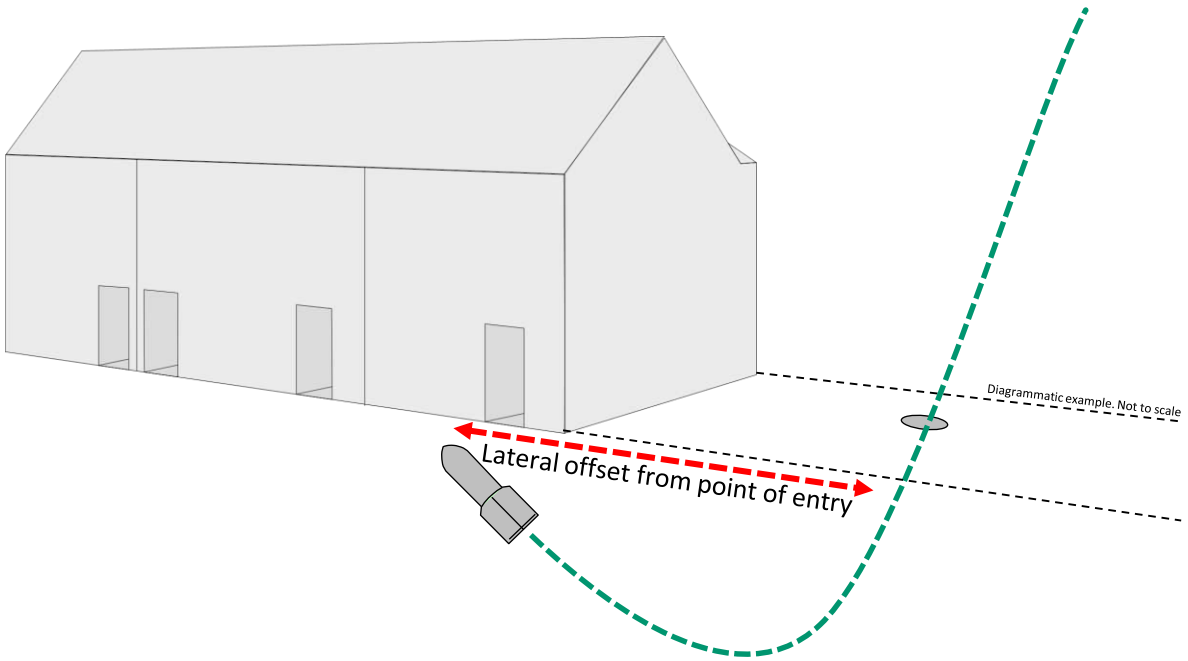
Source: Various sources



Top: J-curve Effect - Due to angle of entry, unexploded bombs would often end their trajectory at a lateral offset from point of entry, often ending up beneath adjacent extant structures/sites.

One of the most common scenarios for the above occurring was where a UXB fell into a ‘bomb site’ (such as the area shown **Top Left**), the entry hole of the bomb obscured by debris and rubble present. Note that the entry hole of a 50kg UXB could be as little as 20cm in diameter (**Left**).

Photograph **above** shows 250kg bomb found in Bermondsey pointing upwards, demonstrating ‘J-curve’

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Source: Various sources

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England Regions London

Bermondsey bomb: World War Two device safely removed

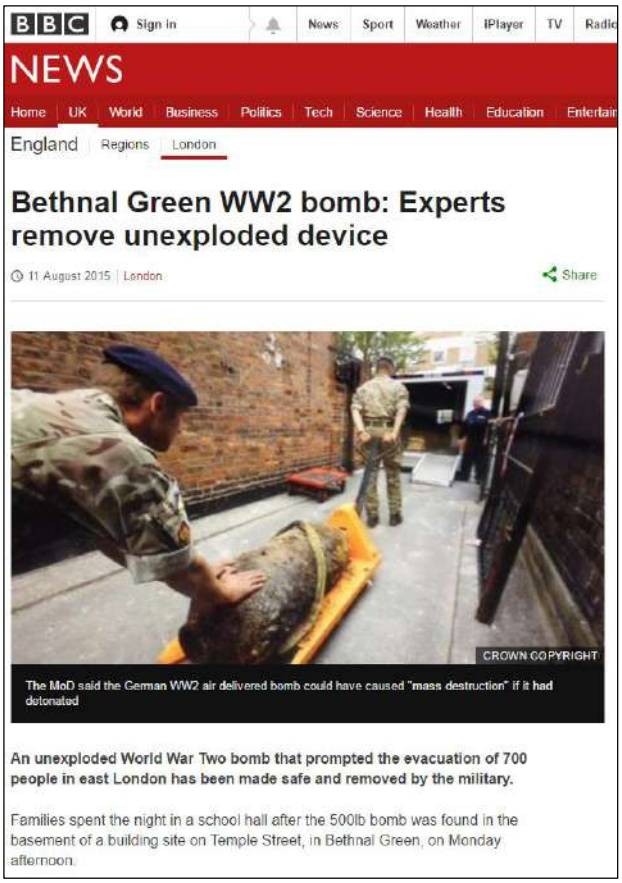
24 March 2015 London Share

The bomb measured about 5ft (1.5m) in length

An unexploded World War Two bomb found in south London has been driven away safely under police and Army escort.

The 500lb (250kg) device was found on a building site in Grange Walk, Bermondsey on Monday

250kg HE bomb found in Bermondsey March 2015



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Bethnal Green WW2 bomb: Experts remove unexploded device

11 August 2015 London Share

The MoD said the German WW2 air delivered bomb could have caused "mass destruction" if it had detonated

An unexploded World War Two bomb that prompted the evacuation of 700 people in east London has been made safe and removed by the military.

Families spent the night in a school hall after the 500lb bomb was found in the basement of a building site on Temple Street, in Bethnal Green, on Monday afternoon.

250kg HE bomb found in Bethnal Green, Aug 2016

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England Regions Somerset

Bath WW2 bomb scare: Device defused, police say

13 May 2016 Somerset Share

The bomb was found on the site of a former school on Thursday

A 500lb World War Two bomb found on the site of a former school in Bath has been defused and made safe.

250kg HE bomb found in Bath, May 2016

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England Regions London

Wembley WW2 live bomb posed 'risk to life'

22 May 2015 London Share

A blast wall was put up around the bomb to minimise damage if it exploded

An unexploded World War Two bomb uncovered by builders near Wembley Stadium posed "a genuine risk to life", the Army has said.

50kg HE bomb found in Wembley, May 2015

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Project: **The Ugly Brown Building (Ted Baker Head Office)**

Ref: **DA7410-00** Source: BBC News

BASF has confirmed that an explosive device, most likely a World War II-era bomb, caused the blast that left one person injured Tuesday at a plant construction site in Germany.

The explosion was reported at BASF's Ludwigshafen toluene diisocyanate (TDI) plant, which recently broke ground for a 300,000 metric tons per year TDI production plant and other construction to expand its facilities.

1st March 2013

BASF is expanding their its Ludwigshafen location by expanding several plants and building a TDI plant, which was the site of an explosion on Tuesday (Feb. 26). One person was injured in the blast, which BASF believes was caused when excavation work detonated a bomb.

Early reports had speculated that excavation work had detonated a bomb from World War II. While the age of the bomb has not been confirmed, BASF has said that an explosive device was detonated.

BASF Provides Some Details

Responding to a request from *PaintSquare News* for more information on Wednesday (Feb. 27), BASF's manager of media relations and corporate communications Europe, Ursula von Stetten, wrote in an email, "So here [are] the facts: The detonation took place at 10:00 a.m. One person was injured; the injury is not serious. He will be kept in the hospital for some days.

"Cause of the detonation was an explosive device, presumably a bomb deriving from the Second World War. The device detonated when grounding work was done. No details on [a] delay [are] available. At the moment, the exact circumstances of the incident are [being] evaluated."

19th September 2013

WWII bomb injures 17 at Hattingen construction site

Published: 19 Sep 08 16:53 CET

Share +1 0 Tweet 0

Seventeen people were injured on Friday when a construction crew unwittingly detonated a buried World War II-era bomb in Hattingen.

- Liberals grit teeth ahead of May state election (17 Mar 12)
- Nazi death camp guard Demjanjuk dies (17 Mar 12)
- Stupid stunt causes bomb scare chaos (16 Mar 12)

An excavator apparently drove over a 250-kilogramme (550 pound) American bomb, damaging surrounding buildings. Most of the injured suffered auditory trauma from the blast, and the excavator operator suffered injuries to his hands, police in the German state of North Rhine-Westphalia said.

"The hole was astoundingly small for such a large bomb full of so many explosives," Armin Gebhard, head of the Arnsberg department for military ordnance removal, told The Local. "But of course it damaged all the surrounding buildings too. We are really happy it wasn't worse."

World War II Bomb Explodes on German Motorway

A highway construction worker in Germany accidentally struck an unexploded World War II bomb, causing an explosion which killed him and wrecked several passing cars.

Tweet 0 Recommend 1

23rd October 2006

AP

A cutting machine lies wrecked by the side of the A3 motorway next to a small crater left by the explosion.

A World War II bomb has exploded during construction work on a German highway, killing one worker and injuring several motorists who were driving past, police said.

The worker had been cutting through the road surface near the south-western town of Aschaffenburg when his machine struck the bomb and triggered it. Police said they weren't sure yet what type of bomb it was. "The explosion seems to have been too small for it to have been an aircraft bomb," a police spokesman said.

The A3 Autobahn linking the cities of Frankfurt and Würzburg has been blocked in both directions.

More than 60 years since the end of World War II, construction workers still frequently unearth unexploded bombs and it is not uncommon for whole city districts to be cordoned off and even evacuated while bomb disposal experts defuse them.

Indeed, just last week, some 22,000 people were evacuated from their homes in Hanover when three World War II bombs were discovered.

Allied pilots rained nearly 2 million tons of explosives on Germany during the war. Landmines, hand grenades, mortar bombs and anti-tank devices from the fighting on German soil at the end of the war are also found, and authorities say it will take decades before the country is cleared of duds.

Between 400 and 600 bombs are discovered a year in the state of North Rhine-Westphalia alone, where the heavily industrialized Ruhr region was a major target for Allied bombers.

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2 June 2010 Last updated at 15:37

Share

World War II bomb kills three in Germany

Three people have been killed and six injured trying to defuse a World War II bomb in central Germany.

2nd June 2010

All the victims were involved in an operation to defuse the bomb

Workers building a sports stadium had earlier unearthed the bomb in the town of Goettingen.

It was not immediately clear why the bomb, reportedly weighing 500kg (1,100lb), had detonated.

Unexploded WWII bombs dropped by Allied planes are frequently found in Germany, though it is unusual for them to explode unexpectedly.

A special commission is investigating the causes of the explosion, while prosecutors are considering whether the team leader should face charges of manslaughter through culpable negligence, the BBC's Oana Lungescu reports from Berlin.

The blast happened an hour before the defusing operation was due to start.

Officials said the three men who died were experienced sappers, or combat engineers, who over 20 years had defused up to 700 bombs.

More than 7,000 people were immediately evacuated when the 500kg bomb was found. Several schools, a kindergarten and local companies remain closed.

June 2006

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Project: **The Ugly Brown Building (Ted Baker Head Office)**

Ref: **DA7410-00**

Source: Various news sources

Mile End volunteers find live grenade in Regent's Canal

6 November 2014 | London

The grenade was found while volunteers helped clear a stretch of Regent's Canal

Volunteers clearing up a stretch of canal in east London unearthed an unexploded grenade from World War Two.

The live grenade was found at about 15:00 GMT along a stretch of Regent's Canal near Salmon Lock in Mile End.

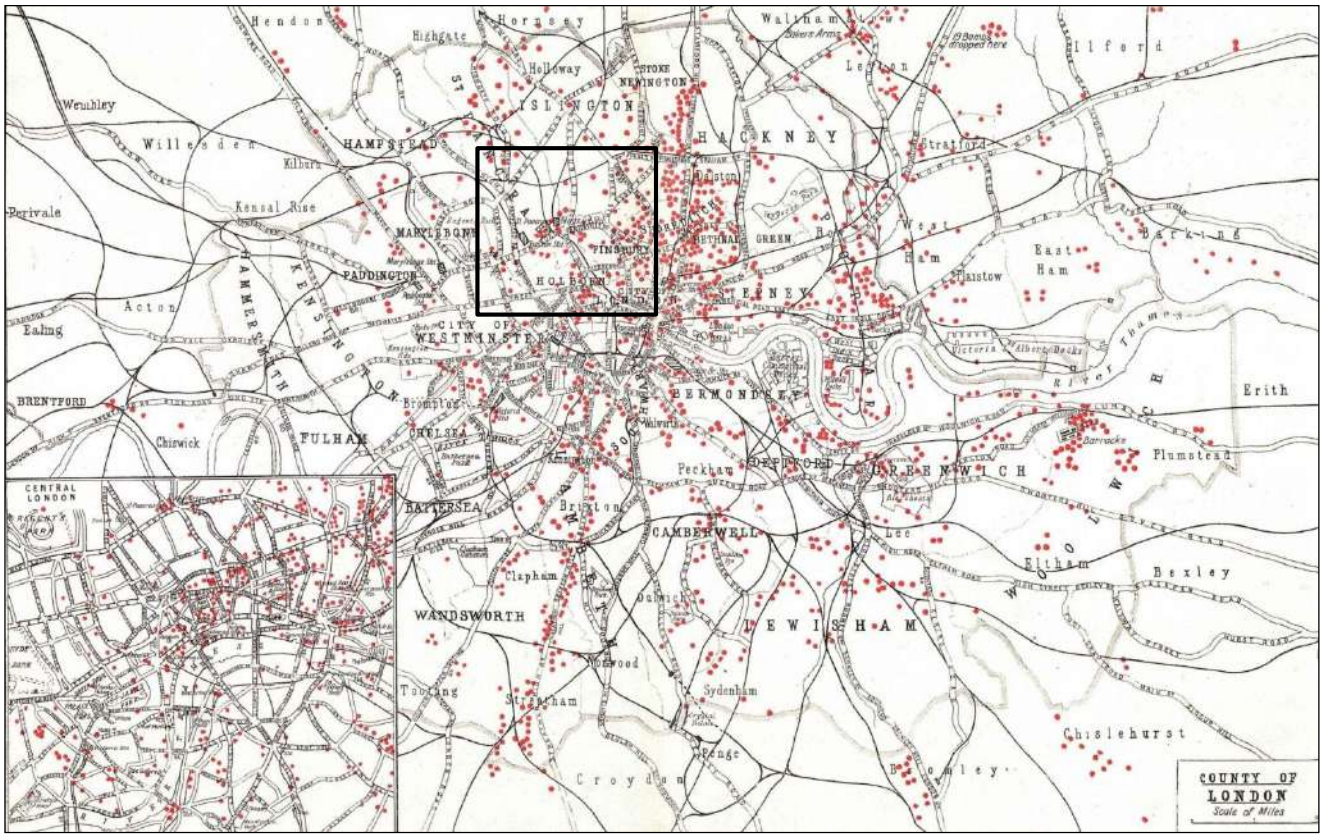
Scotland Yard said it was alerted by the Canal and River Trust, which organised the event, and it took the grenade away to dispose of it.

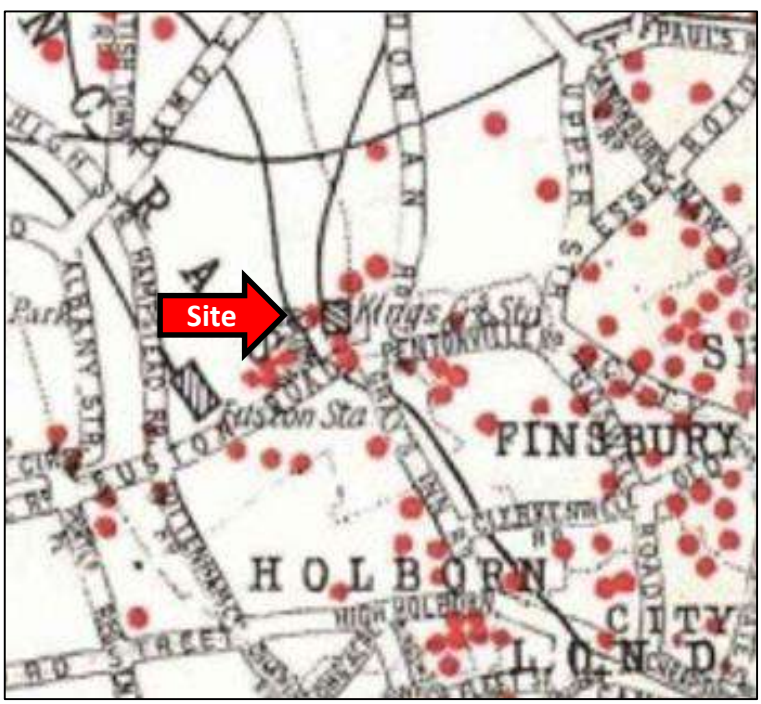
Debbie Vidler, from the trust, said: "We often find weird and wonderful things in the bottom of canals."

She added: "Today we discovered numerous shopping trolleys, bicycles, mobile phones... but we were not expecting to find a 70-year-old unexploded bomb."

WWI Bomb Plot Map, London

Annex: I





Examples of 50 and 100kg German WWI bombs

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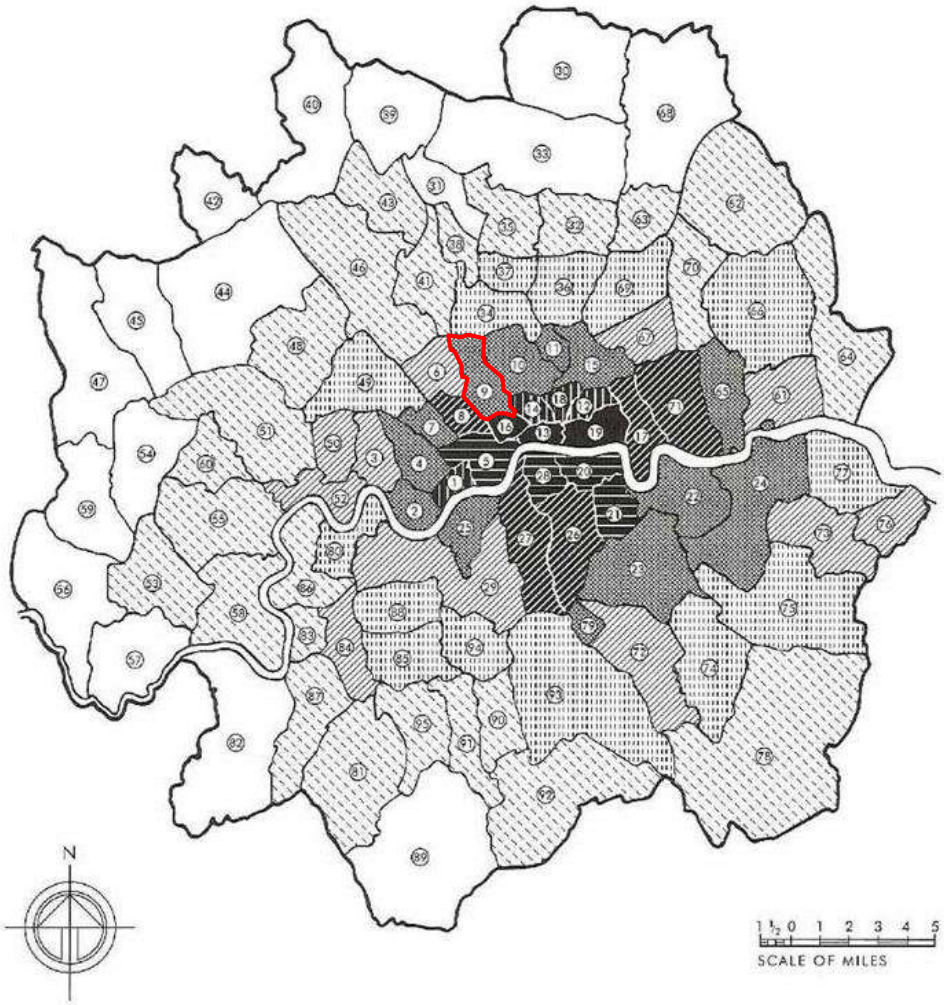
Ref: **DA7410-00**

Source: The National Archives, Kew

N

London WWII Bomb Density Map

Annex: J



No. OF BOMBS PER 1,000 ACRES

OVER 600	300 – 399	100 – 149
500 – 599	200 – 299	50 – 99
400 – 499	150 – 199	UNDER 50

1 Chelsea	25 Battersea	49 Willesden	72 Beckenham
2 Fulham	26 Camberwell	50 Acton	73 Bexley
3 Hammersmith	27 Lambeth	51 Ealing	74 Bromley
4 Kensington	28 Southwark	52 Brentford and Chiswick	75 Chislehurst and Sidcup
5 Westminster	29 Wandsworth	53 Feltham	76 Crayford
6 Hampstead	30 Cheshunt	54 Hayes and Harlington	77 Erith
7 Paddington	31 East Barnet	55 Heston and Isleworth	78 Orpington
8 St. Marylebone	32 Edmonton	56 Staines	79 Penge
9 St. Pancras	33 Enfield	57 Sunbury	80 Barnes
10 Islington	34 Hornsey	58 Twickenham	81 Epsom and Ewell
11 Stoke Newington	35 Southgate	59 Yiewsley and West Drayton	82 Esher
12 Bethnal Green	36 Tottenham	60 Southall and Norwood	83 Kingston on Thames
13 City of London	37 Wood Green	61 Barking	84 Malden and Coombe
14 Finsbury	38 Friern Barnet	62 Chigwell	85 Merton and Morden
15 Hackney	39 Potters Bar	63 Chingford	86 Richmond
16 Holborn	40 Elstree	64 Dagenham	87 Surbiton
17 Poplar	41 Finchley	65 East Ham	88 Wimbledon
18 Shoreditch	42 Bushey	66 Ilford	89 Banstead
19 Stepney	43 Barnet U.D.	67 Leyton	90 Beddington and Wallington
20 Bermondsey	44 Harrow	68 Waltham Holy Cross	91 Carshalton
21 Deptford	45 Ruislip and Northwood	69 Walthamstow	92 Coulsdon and Purley
22 Greenwich	46 Hendon	70 Wanstead and Woodford	93 Croydon
23 Lewisham	47 Uxbridge	71 West Ham	94 Mitcham
24 Woolwich	48 Wembley		95 Sutton and Cheam

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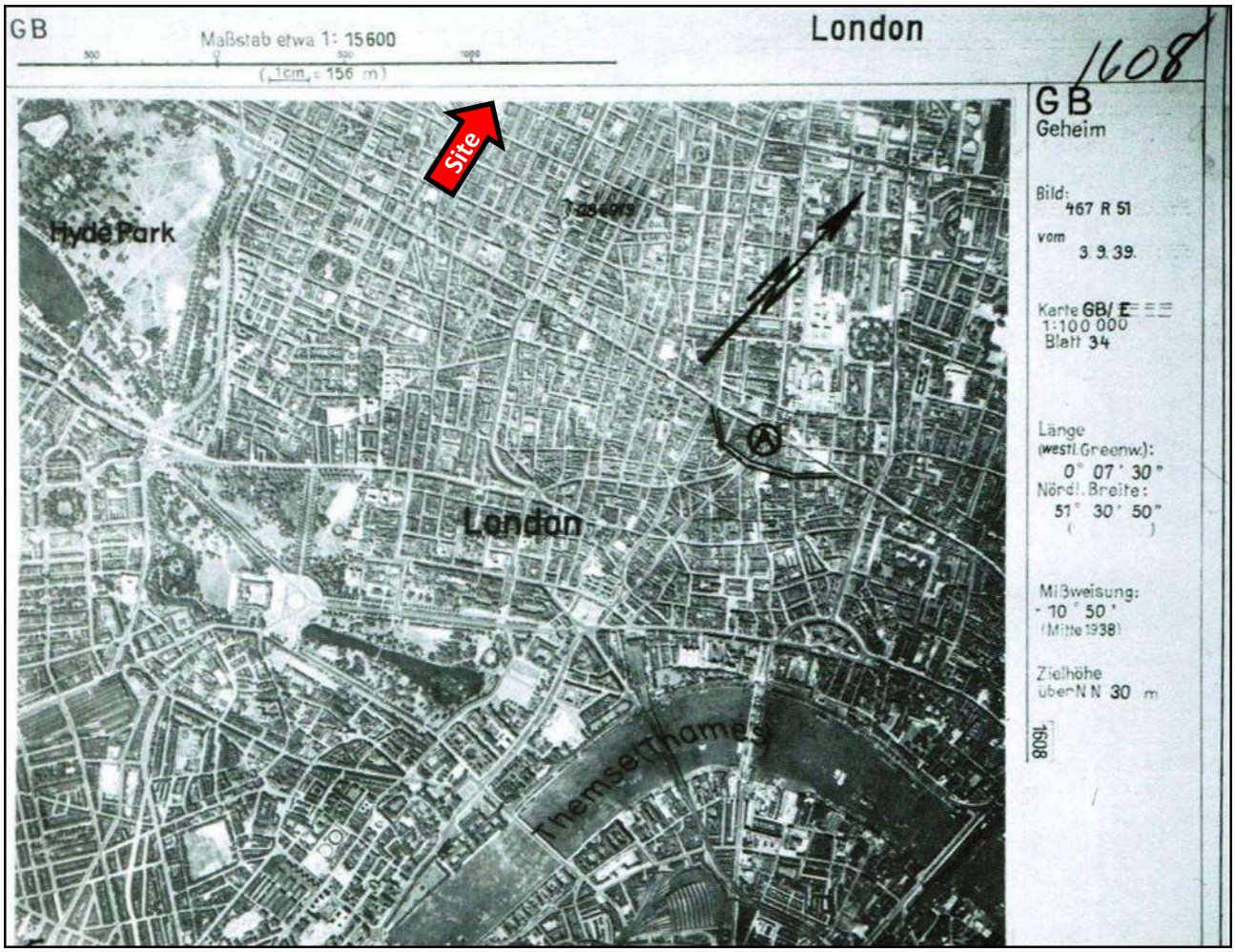
Source: The London Metropolitan Archives

N



London – Barnes

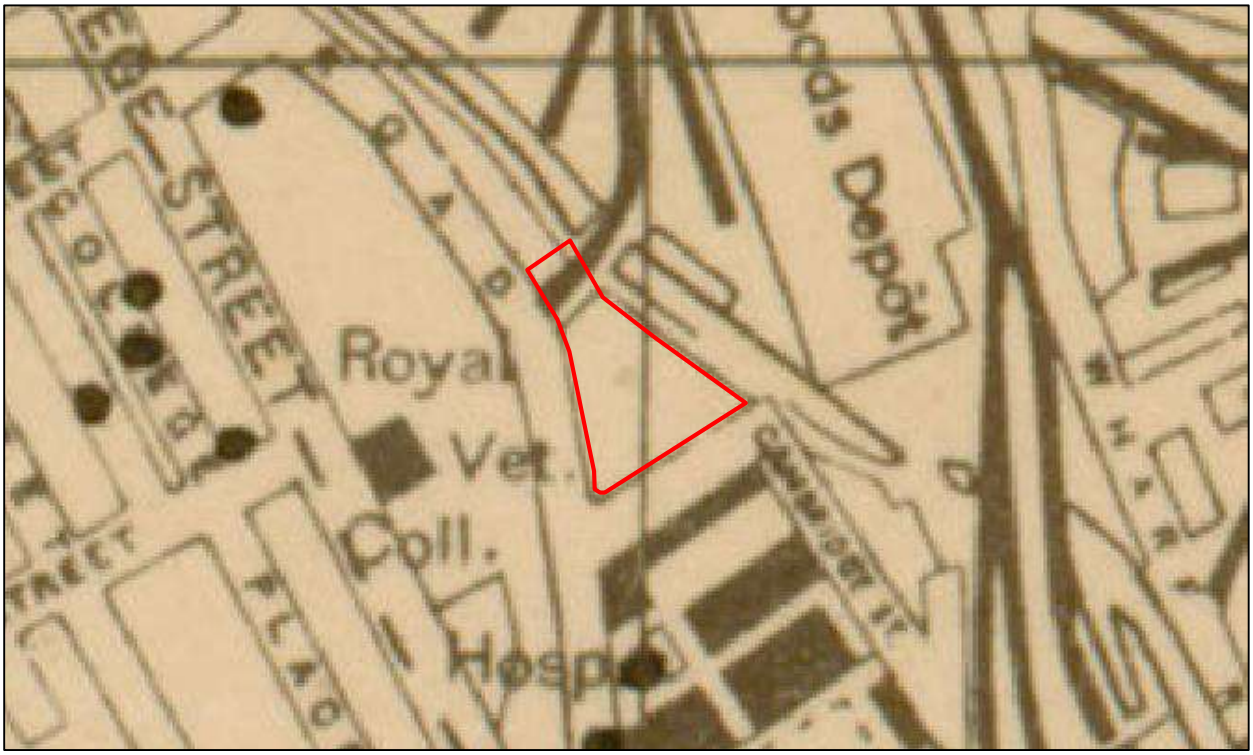
A. It is not clear what this strategic target was.

The site located approximately 4km north-east of Buckingham Palace.

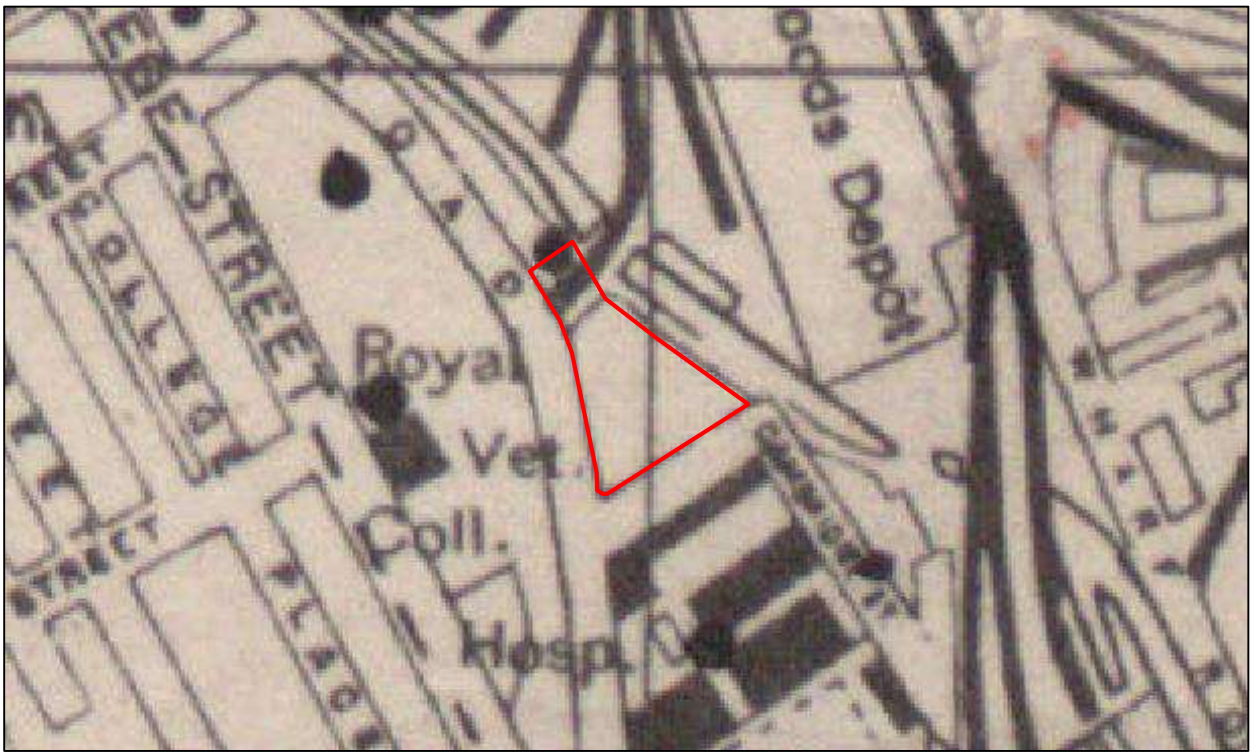
Consolidated London Bomb Census Mapping

Annex: **L1**

Night Bombing up to 7th October 1940



Night Bombing 7th October 1940 to 6th June 1941



Recorded bomb strike

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Client: **RSK**

Approximate site boundary

N

Project: **The Ugly Brown Building (Ted Baker Head Office)**

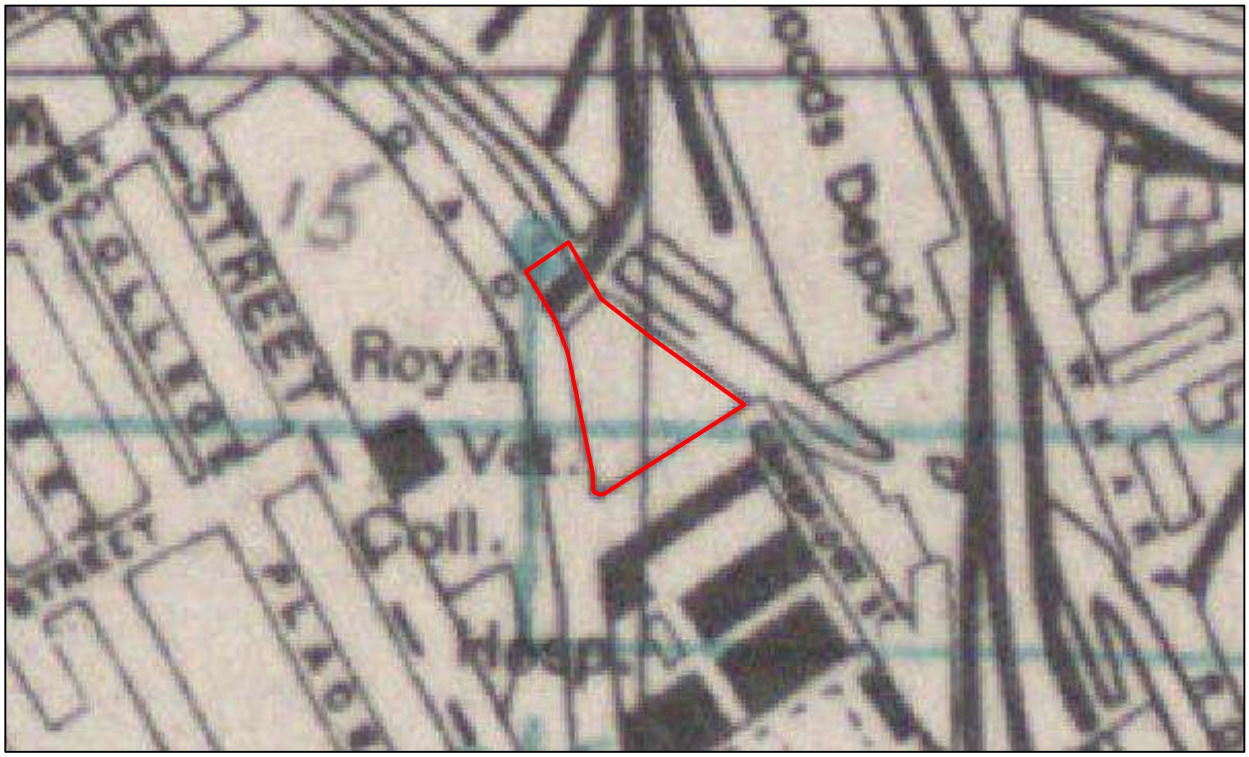
Ref: **DA7410-00**

Source: The National Archives, Kew

Weekly London Bomb Census Mapping

Annex: **L2**

18/19th February 1944



Recorded HE bomb strike

Recorded UXB strike

Recorded incendiary bomb shower

Recorded oil bomb strike

Colour refers to day of the week.

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Client: **RSK**

Approximate site boundary

N

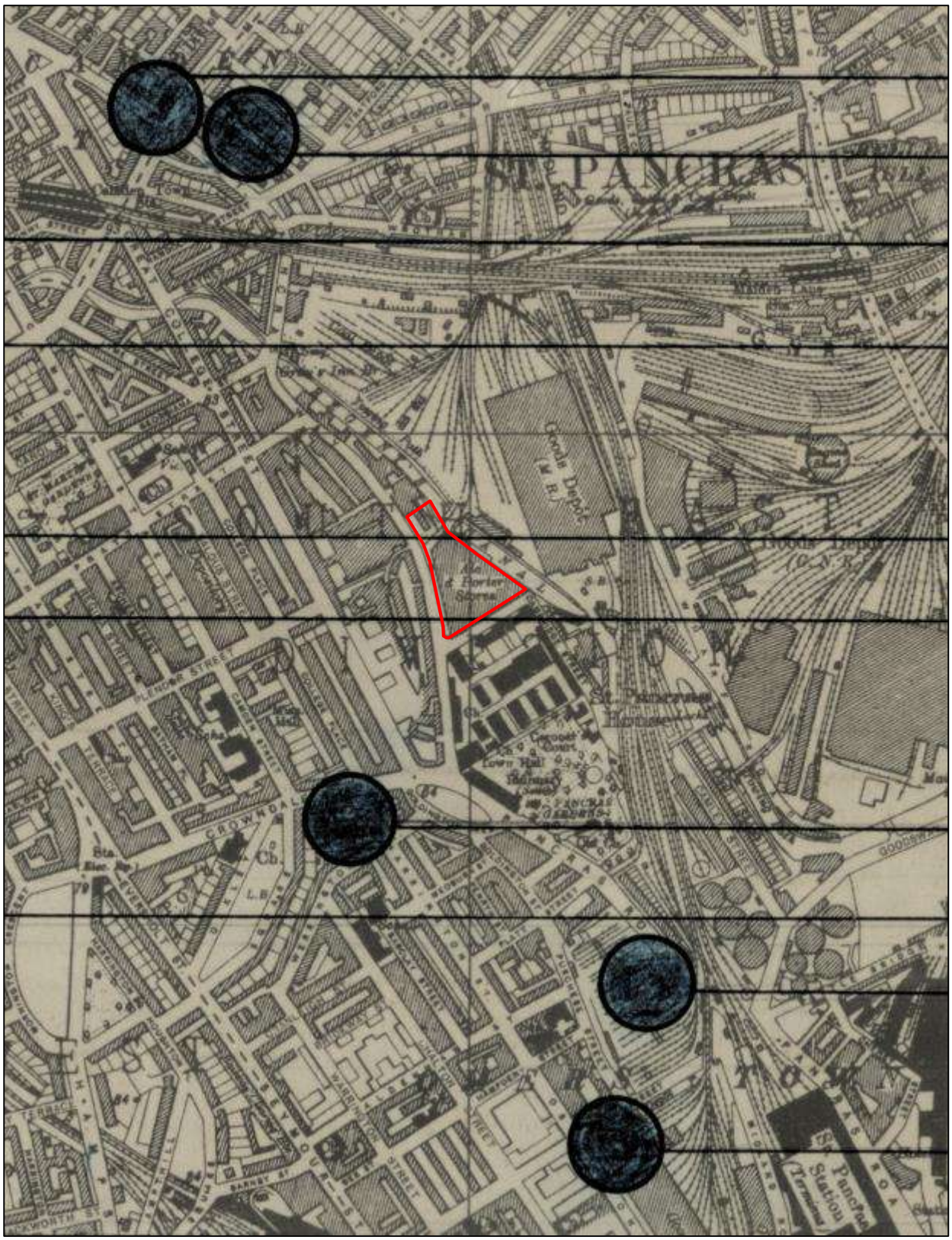
Project: **The Ugly Brown Building (Ted Baker Head Office)**

Ref: **DA7410-00**

Source: The National Archives, Kew

London V-1 Flying Bomb Map

Annex: **M**



V-1 flying bomb

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Client: **RSK**

Approximate site boundary

N

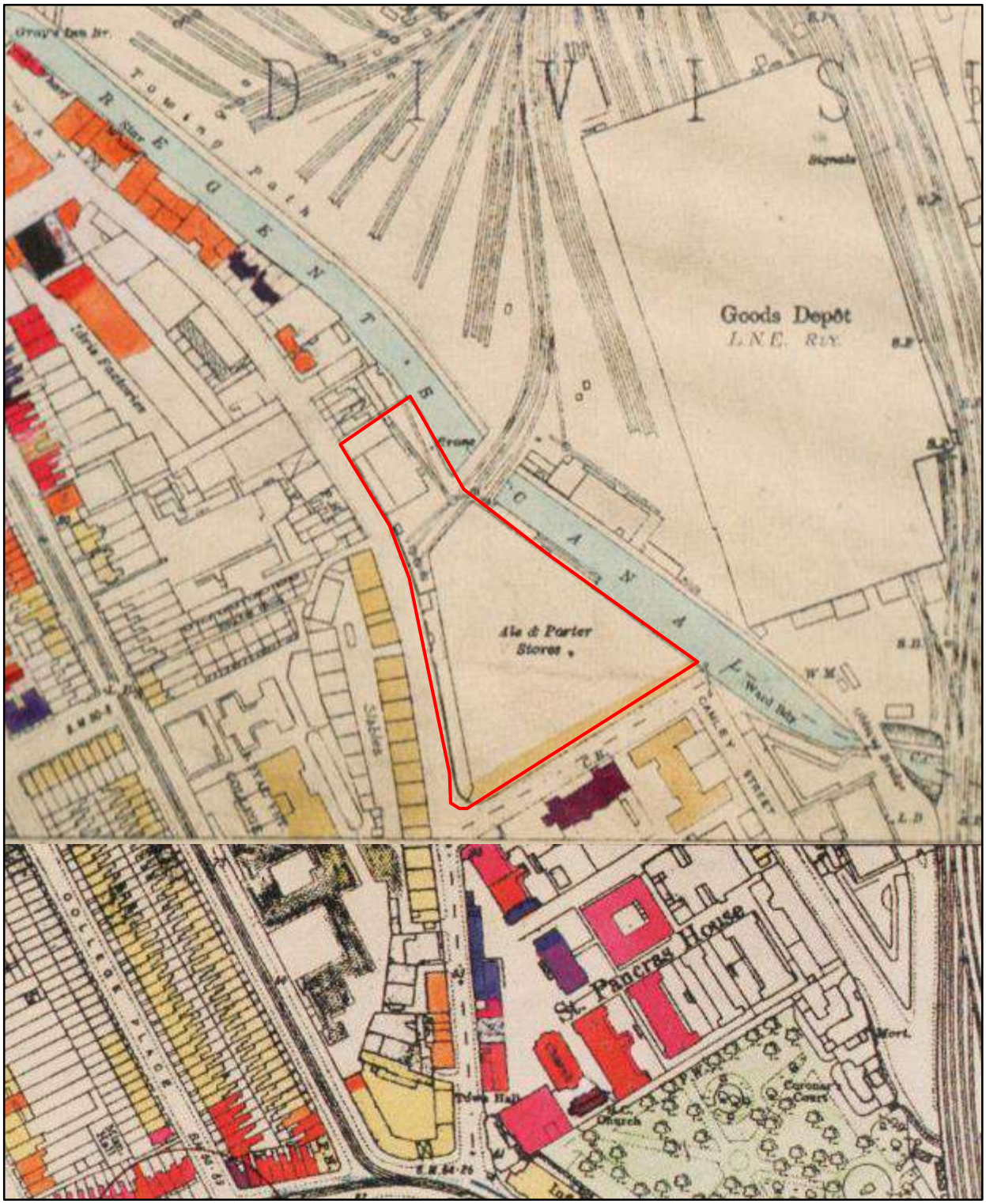
Project: **The Ugly Brown Building (Ted Baker Head Office)**

Ref: **DA7410-00**

Source: The National Archives, Kew

London County Council Bomb Damage Map

Annex: N



Black	Total destruction	Orange	General blast damage; not structural
Purple	Damage beyond repair	Yellow	Blast damage, minor in nature
Dark Red	Seriously damaged; doubtful if repairable	Light Green	Clearance areas
Light Red	Seriously damaged, but repairable at cost		

V-1 Flying Bomb

V-2 Long Range Rocket

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Approximate site boundary

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Source: London Metropolitan Archives

RAF Aerial Photography 19th September 1945

Annex: **O1**

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Approximate site boundary

N

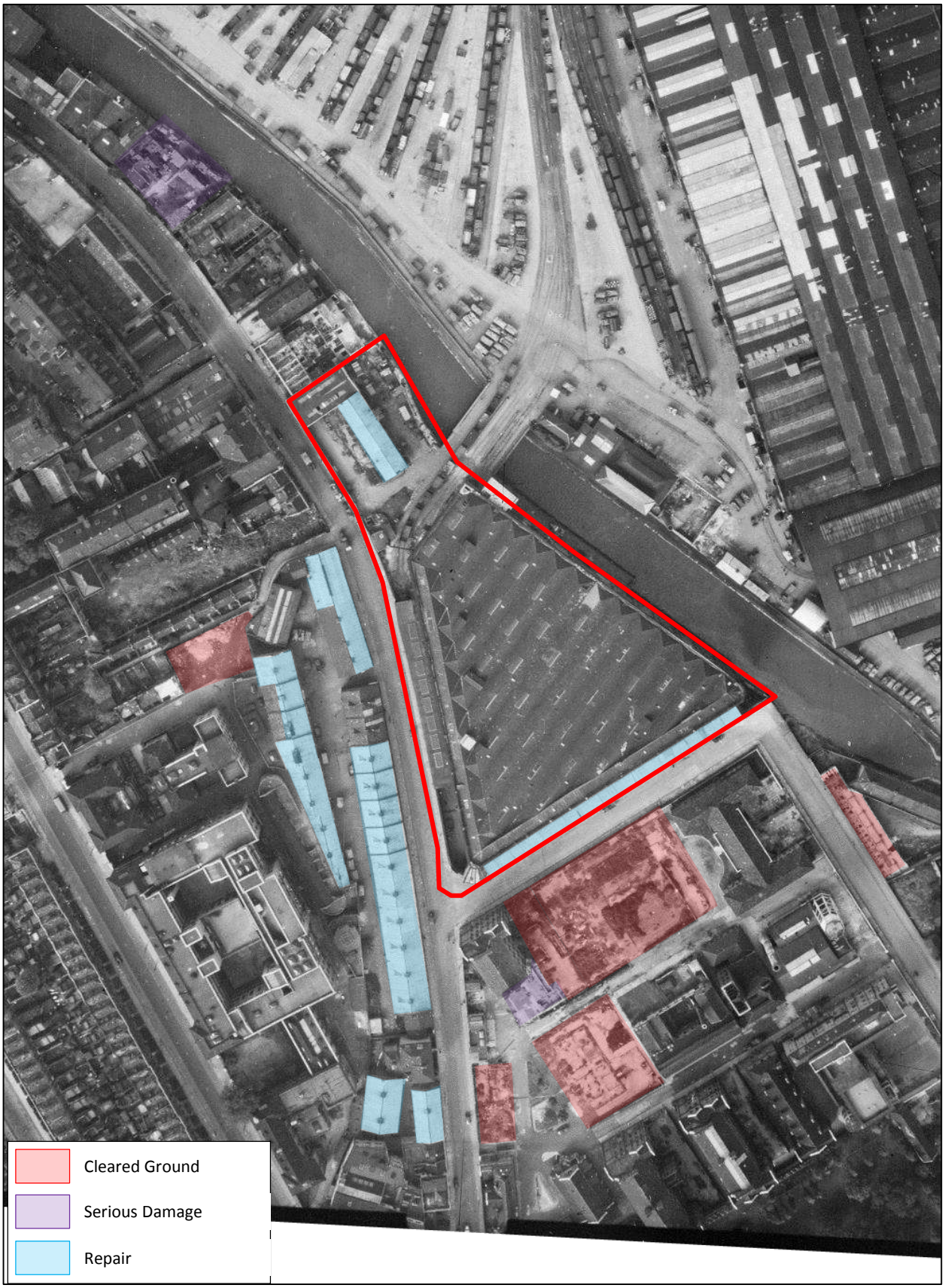
Project: **The Ugly Brown Building (Ted Baker Head Office)**

Ref: **DA7410-00**

Source: National Monuments Record Office (Historic England)

RAF Aerial Photography 19th September 1945

Annex: O2



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Approximate site boundary

N

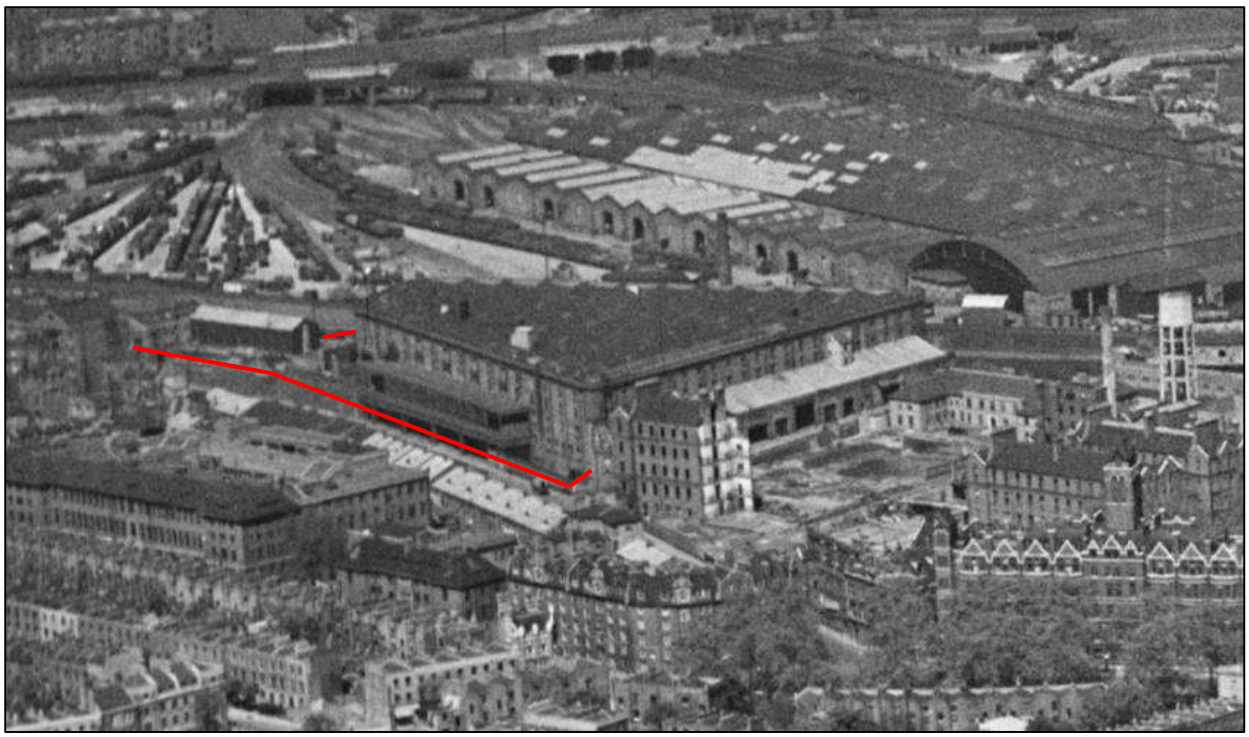
Project: **The Ugly Brown Building (Ted Baker Head Office)**

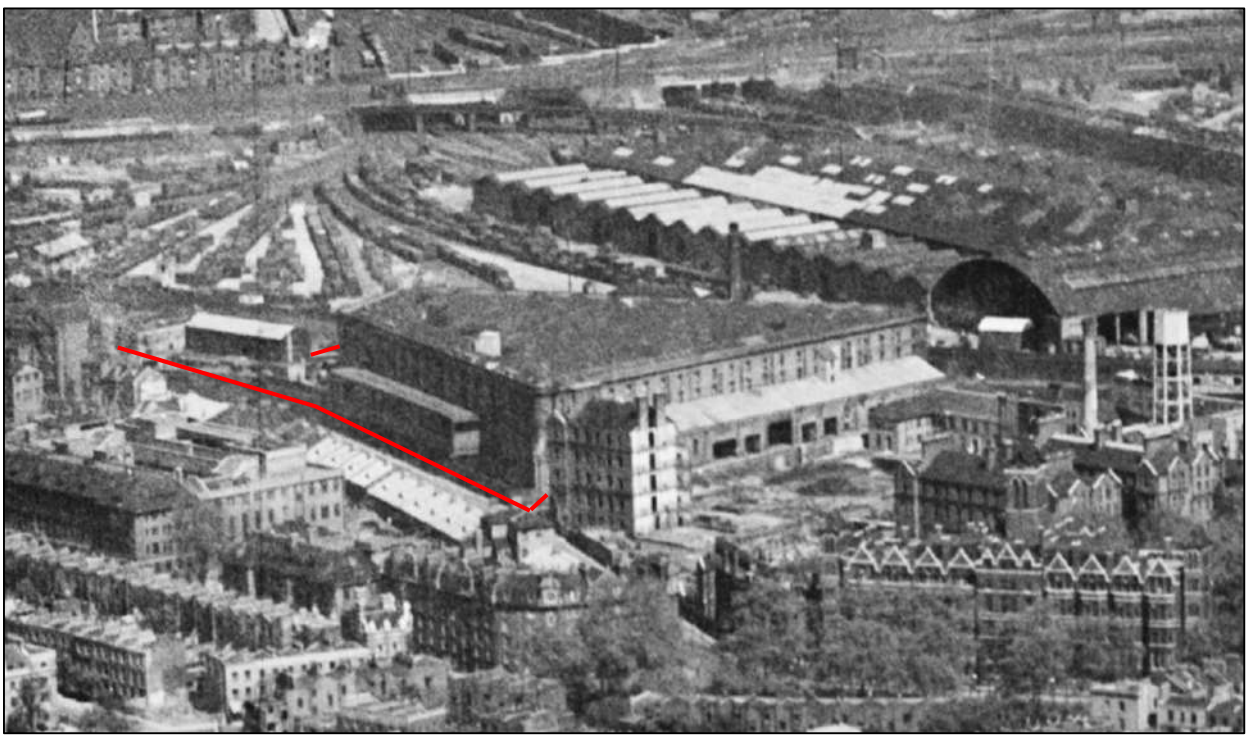
Ref: **DA7410-00**

Source: National Monuments Record Office (Historic England)

Oblique Aerial Photography 1946

Annex: P





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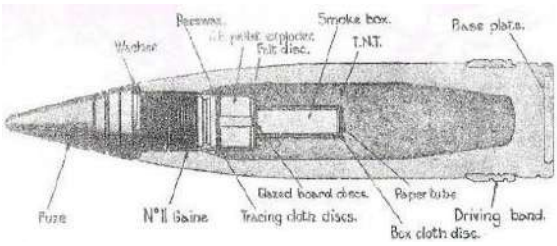
Ref: **DA7410-00**

Source: National Monuments Record Office (Historic England)

Examples of Anti-Aircraft Projectiles

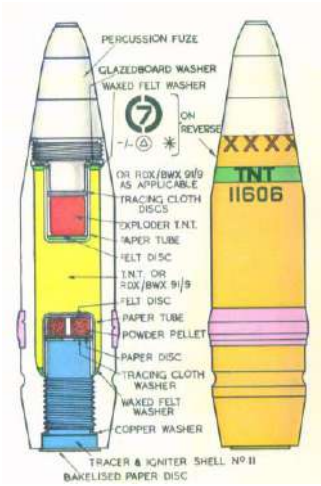
3.7 Inch QF Anti-Aircraft Projectile

Projectile Weight	28lb (12.6 kg)
Explosive Weight	2.52lbs
Fuze Type	Mechanical Time Fuze
Dimensions	3.7in x 14.7in (94mm x 360mm)
Rate of Fire	10 to 20 rounds per minute
Use	The 3.7in AA Mks 1-3 were the standard Heavy Anti-Aircraft guns of the British Army.
Ceiling	30,000ft to 59,000ft



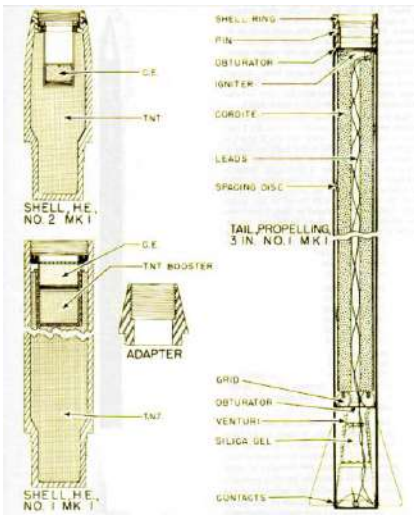
40mm Bofors Projectile

Projectile Weight	1.96lb (0.86kg)
Explosive Weight	300g (0.6lb)
Fuze Type	Impact Fuze
Rate of Fire	120 rounds per minute
Projectile Dimensions	40 x 180mm
Ceiling	23,000ft (7000m)
Remarks	Light quick fire high explosive anti-aircraft projectile. Each projectile fitted with small tracer element. If no target hit, shell would explode when tracer burnt out. Designed to engage aircraft flying below 2,000ft



3in Unrotated Projectile (UP) Anti-Aircraft Rocket ("Z" Battery)

HE Projectile Weight	3.4kg (7.6lb)
Explosive Weight	0.96kg (2.13lb)
Filling	High Explosive – TNT. Fitted with aerial burst fuzing
Dimensions of projectile	236 x 83mm (9.29 x 3.25in)
Remarks	As a short range rocket-firing anti-aircraft weapon developed for the Royal Navy. It was used extensively by British ships during the early days of World War II. The UP was also used in ground-based single and 128-round launchers known as Z Batteries. Shell consists of a steel cylinder reduced in diameter at the base and threaded externally to screw into the shell ring of the rocket motor



1ST LINE DEFENCE
Unit 3, Maple Park
Essex Road, Hoddesdon,
Hertfordshire. EN11 0EX
Email: info@1stlinedefence.co.uk
Tel: +44 (0)1992 245 020

Client: **RSK**

Project: **The Ugly Brown Building (Ted Baker Head Office)**

Ref: **DA7410-00**

Source: Various sources

Risk Map – Site Plan Overlay

Annex: **R1**

Low Risk

Medium Risk

All Risk Areas:

- Site Specific Unexploded Ordnance Awareness Briefings to all personnel conducting intrusive works

Medium Risk Area:

- Unexploded Ordnance (UXO) Specialist Presence on Site to support shallow intrusive works
- Intrusive Magnetometer Survey of all Borehole and pile locations down to a maximum bomb penetration depth

For indicative purposes – not to scale

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Client: **RSK**

Project: **The Ugly Brown Building (Ted Baker Head Office)**

Ref: **DA7410-00**

Source: Various sources

Risk Map – 1945 Aerial Imagery

Annex: **R2**

Low Risk

Medium Risk

All Risk Areas:

- Site Specific Unexploded Ordnance Awareness Briefings to all personnel conducting intrusive works

Medium Risk Area:

- Unexploded Ordnance (UXO) Specialist Presence on Site to support shallow intrusive works
- Intrusive Magnetometer Survey of all Borehole and pile locations down to a maximum bomb penetration depth

For indicative purposes – not to scale

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Ref: **DA7410-00**

Source: Various sources

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1ST LINE DEFENCE

APPENDIX G
SITE RECONNAISSANCE PHOTOGRAPHS

PHOTOGRAPHIC LOG	
Photo no. **1**	
Description: BH02 along northern boundary. Contiguous pile wall beneath plant bed on left	

Photo No. **2**	
Description: Frontage outside Block A.	

Photo No. **3**	
Description: Thames Water sewer running beneath manhole (approximately) into the building at depth.	

Photo No. **4**	
Description: Site frontage on St Pancras Way outside Block B.	

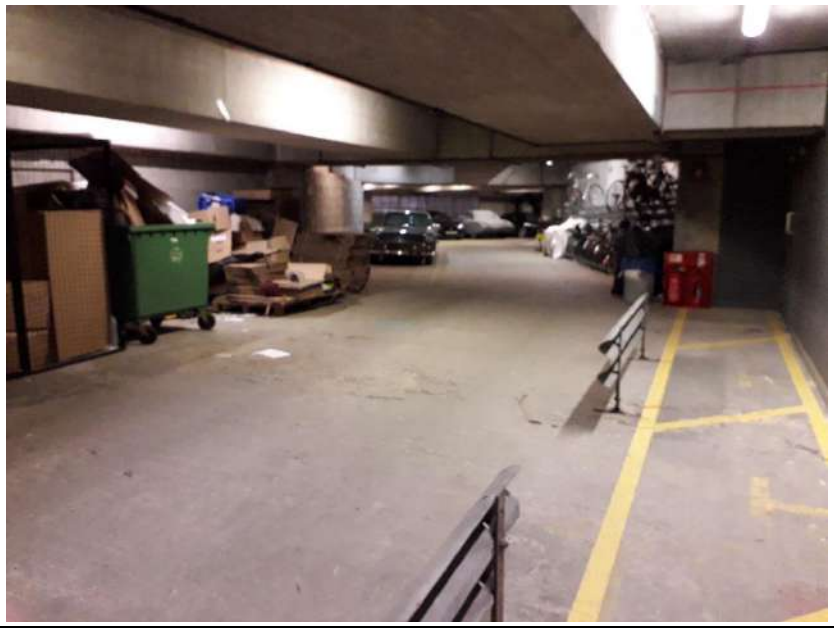
Photo No. **5**	
Description: Entrance into car park beneath Block B.	

Photo No. **6**	
Description: Car park beneath Block B.	

Photo No. **7**	
Description: Eastern site boundary showing UBB to the right and looking south.	

Photo No. **8**	
Description: Northern end of site on eastern boundary looking north to party wall with Canal Side Studios.	

APPENDIX H
TECHNICAL BACKGROUND

H1 Desk Study

Aquifer designation and Source protection zones

Principal aquifer: layers of rock or drift deposit that have high intergranular and/or fracture permeability (usually providing a high level of water storage). They may support water supply and/or river base flow on a strategic scale.

Secondary A aquifer: permeable layers capable of supporting water supplies at a local rather than strategic scale, and in some cases forming an important source of base flow to rivers.

Secondary B aquifer: predominantly lower permeability layers that may store and yield limited amounts of groundwater due to localised features such as fissures, thin permeable horizons and weathering.

Secondary undifferentiated aquifer: it has not been possible to attribute either a category A or B to a rock type. In most cases this means that it was previously designated as both a minor and non-aquifer in different locations owing to the variable characteristics.

Unproductive' strata: low permeability with negligible significance for water supply or river base flow.

The EA generally adopts a three-fold classification of source protection zones (SPZ) surround abstractions for public water supply. The Site is situated in an area defined as follows:

- Zone 1 or the 'inner protection zone' is located immediately adjacent to the groundwater source and is based on a 50-day travel time from any point below the water table to the source. It is designed to protect against the effects of human activity and biological/chemical contaminants that may have an immediate effect on the source
- Zone 2 or the 'outer protection zone' is defined by a 400-day travel time from a point below the water table to the source. The travel time is designed to provide delay and attenuation of slowly degrading pollutants
- Zone 3 or the 'total catchment' is the area around the source within which all groundwater recharge is presumed to be discharged at the source.

Preliminary risk assessment methodology

CLR11 outlines the framework to be followed for risk assessment in the UK. The framework is designed to be consistent with UK legislation and policies including planning. Under CLR11, three stages of risk assessment exist: preliminary, generic quantitative and detailed quantitative. An outline conceptual model should be formed at the preliminary risk assessment stage that collates all the existing information pertaining to a site in text, tabular or diagrammatic form. The outline conceptual model identifies potentially complete (termed possible) contaminant linkages (contaminant–pathway–receptor) and is used as the basis for the design of the site investigation. The outline conceptual model is updated as further information becomes available, for example as a result of the site investigation.

Production of a conceptual model requires an assessment of risk to be made. Risk is a combination of the likelihood of an event occurring and the magnitude of its consequences. Therefore, both the likelihood and the consequences of an event must be taken into account when assessing risk. RSK has adopted guidance provided in CIRIA C552 for use in the production of conceptual models.

The likelihood of an event can be classified on a four-point system using the following terms and definitions based on CIRIA C552:

- highly likely: the event appears very likely in the short term and almost inevitable over the long term or there is evidence at the receptor of harm or pollution
- likely: it is probable that an event will occur or circumstances are such that the event is not inevitable, but possible in the short term and likely over the long term
- low likelihood: circumstances are possible under which an event could occur, but it is not certain even in the long term that an event would occur and it is less likely in the short term
- unlikely: circumstances are such that it is improbable the event would occur even in the long term.

The severity can be classified using a similar system also based on CIRIA C552. The terms and definitions relating to severity are:

- severe: short term (acute) risk to human health likely to result in 'significant harm' as defined by the Environment Protection Act 1990, Part IIA. Short-term risk of pollution of sensitive water resources. Catastrophic damage to buildings or property. Short-term risk to an ecosystem or organism forming part of that ecosystem (note definition of ecosystem in 'Draft Circular on Contaminated Land', DETR 2000)
- medium: chronic damage to human health ('significant harm' as defined in 'Draft Circular on Contaminated Land', DETR 2000), pollution of sensitive water resources, significant change in an ecosystem or organism forming part of that ecosystem
- mild: pollution of non-sensitive water resources. Significant damage to crops, buildings, structures and services ('significant harm' as defined in 'Draft Circular on Contaminated Land', DETR 2000). Damage to sensitive buildings, structures or the environment
- minor: harm, not necessarily significant, but that could result in financial loss or expenditure to resolve. Non-permanent human health effects easily prevented by use of personal protective clothing. Easily repairable damage to buildings, structures and services.

Once the probability of an event occurring and its consequences have been classified, a risk category can be assigned according to the table below.

		Consequences			
		Severe	**Medium**	**Mild**	**Minor**
Probability	**Highly likely**	Very high	High	Moderate	Moderate/low
	Likely	High	Moderate	Moderate/low	Low
	Low likelihood	Moderate	Moderate/low	Low	Very low
	Unlikely	Moderate/low	Low	Very low	Very low

Definitions of these risk categories are as follows together with an assessment of the further work that may be required:

- very high: there is a high probability that severe harm could occur or there is evidence that severe harm is currently happening. This risk, if realised, could result in substantial liability; urgent investigation and remediation are likely to be required
- high: harm is likely to occur. Realisation of the risk is likely to present a substantial liability. Urgent investigation is required. Remedial works may be necessary in the short term and are likely over the long term
- moderate: it is possible that harm could arise, but it is unlikely that the harm would be severe and it is more likely that the harm would be relatively mild. Investigation is normally required to clarify the risk and determine the liability. Some remedial works may be required in the longer term
- low: it is possible that harm could occur, but it is likely that if realised this harm would at worst normally be mild
- very low: there is a low possibility that harm could occur and if realised the harm is unlikely to be severe.

H2 Site Investigation Methodology

Ground gas monitoring

An infrared gas meter was used to measure gas flow, concentrations of carbon dioxide (CO_2), methane (CH_4) and oxygen (O_2) in percentage by volume, while hydrogen sulphide (H_2S) and carbon monoxide (CO) were recorded in parts per million. Initial and steady state concentrations were recorded. In addition, during the first monitoring round, all wells were screened with a PID to establish if there are any interferences and cross-sensitivity of other hydrocarbons with the infrared gas meter.

Low flow groundwater sampling

Groundwater samples were retrieved using a United States Environment Protection Agency (USEPA) approved low-flow purging and sampling methodology.

The low-flow method relies on moving groundwater through the well screen at approximately the same rate as it flows through the geological formation. This results in a significant reduction in the volume of water extracted before sampling and significantly reduces the amount of disturbance of the water in the monitoring well during purging and sampling. Drawdown levels in the monitoring well and water quality indicator parameters (pH, temperature, electrical conductivity, redox potential and dissolved oxygen) are monitored during low-flow purging and sampling, with stabilisation indicating that purging is complete and sampling can begin. As the flow rate used for purging, in most cases, is the same or only slightly higher than the flow rate used for sampling, and because purging and sampling are conducted as one continuous operation in the field, the process is referred to as low-flow purging and sampling.

H3 Site Investigation Methodology

Statistical assessment

Statistical analysis of the results has been conducted in accordance with *Guidance on Comparing Soil Contamination Data with a Critical Concentration* (CIEH and CL:AIRE, 2008) as detailed in Appendix D.

Statistical analysis is utilised to establish whether the land is suitable for the proposed use under the land use planning system by attempting to answer a key question. For a site being developed the key question is: '*can we confidently say that the level of contamination on this land is low relative to some appropriate measure of risk?*' More specifically, this is expressed as '*Is there sufficient evidence that the true mean concentration of the contaminant (μ) is less than the critical concentration (C_c)?*', where the critical concentration could be the GAC or a site-specific assessment criterion (SSAC). The true mean (μ) is unknown and therefore a conservative estimate, termed the upper confidence limit (UCL), of this value is derived from the data. The UCL is then compared against the GAC.

In statistical terms the question above is handled through the use of a formal hypothesis – the null hypothesis and the alternate hypothesis. The statistical tests are structured to show (with a defined level of confidence, in this case 95%) which of the two hypotheses is most likely to be true, by determining whether the null hypothesis can be rejected.

For consideration under the planning regime, the null (H_0) and alternative (H_1) hypotheses are presented in **Error! Reference source not found.**.

Null and alternative hypotheses

Hypothesis	Equation	Description
Null (H_0)	$\mu \geq C_c$	The true mean concentration is equal to, or greater than, the critical concentration
Alternative (H_1)	$\mu < C_c$	The true mean concentration is less than the critical concentration

Therefore, if the null hypothesis is accepted for a certain contaminant it can be concluded that its concentration is high relative to the critical concentration, which in the case of this assessment is taken to be the GAC/SSAC and as such the whole site may be classed as being contaminated by a particular substance.

In addition, the statistical guidance provides an outlier test (Grubbs' test) that has been used within this assessment for the identification of 'outliers' or 'hotspots'. The 'outlier' test is conducted before undertaking statistical analysis (and 'outliers' may be removed from the dataset) but **only** where the conceptual model supports this.

The statistical tests applied to the dataset are selected based on whether the data is normally or non-normally distributed. The distribution of the dataset has been assessed using the Shapiro-Wilks normality test. Where the dataset has been found to be normally distributed the one sample t-test is undertaken. Where data has been found to be non-normally distributed Chebyshev's theorem is utilised.

Reuse of suitable materials

The Definition of Waste: Development Industry Code of Practice (CL:AIRE, 2011) (CoP) was developed in cons**u**ltation with the Environment Agency and development industry to enable the re-use of materials under certain scenarios and subject to demonstrating that specific criteria are met. The current reuse scenarios covered by the CoP comprise

- reuse on the site of origin (with or without treatment)
- direct transfer of clean and natural soils between sites
- use in the development of land other than the site of origin following treatment at an authorised Hub site (including a fixed soil treatment facility).

The importation of made ground soils (irrespective of contamination status) or crushed demolition materials is not permitted currently under the CoP and requires either a standard rules environmental permit or a U1 waste exemption (see below).

In the context of excavated materials used on-sites undergoing development, four factors are considered to be of particular relevance in determining if the material is a waste or when it ceases to be waste:

- the aim of the Waste Framework Directive is not undermined, i.e. if the use of the material will create an unacceptable risk of pollution of the environment or harm to human health it is likely to be waste
- the material is certain to be used
- the material is suitable for use both chemically and geotechnically
- only the required quantity of material will be used.

The CoP requires the preparation of a materials management plan (MMP) that confirms the above factors will be met. This plan needs to be reviewed by a 'Qualified Person' (QP) who will then issue a declaration form to the EA. As the project progresses, data must be collated and on completion a verification report produced that shows the MMP was followed and describes any changes.

The MMP establishes whether specific materials are classified as waste and how excavated materials will be treated and/or reused in line with the CoP. The MMP is likely to form part of the site waste management plan.

APPENDIX I
EXPLORATORY HOLE RECORDS

FINAL

BOREHOLE LOG

Contract:	Client:	Borehole:
Ugly Brown Building	**The Trustees of the St Pancras Way Block A Unit Trust & Big Lobster Ltd**	**BH01**

Contract Ref:	Start:	Ground Level (m AOD):	National Grid Co-ordinate:	Sheet:
371654	**11.01.19** End: **14.01.19**	**23.75**	**E:529575.7 N:183844.8**	**1** of **4**

Samples and In-situ Tests				Water	Backfill & Instru-mentation	Description of Strata	Reduced Level	Depth (Thick ness)	Material Graphic Legend
Depth	No	Type	Results						
1.00	1	ES				MADE GROUND: Dark brown gravelly sandy CLAY. Gravel is subangular to rounded fine and medium brown and cream flint, brick and concrete.			
1.00		PID	0.1ppm					(2.20)	
1.50-1.95	1	SPT(c)	N=23						
1.50	2	DSPT							
2.00	2	ES							
2.00		PID	0.1ppm			. . . Below 2.00m, gravel is fine to coarse.	21.55	2.20	
2.50-2.95	2	SPT(c)	N=21			MADE GROUND: Yellowish brown gravelly very clayey fine to coarse SAND. Gravel is angular to rounded fine to coarse brown and cream flint, brick and concrete.			
2.50	4	DSPT						(1.35)	
3.00	3	ES							
3.00		PID	0.0ppm				20.20	3.55	
3.50-3.95	3	SPT(c)	N=12			Firm thinly laminated light brown CLAY. With slightly sandy pockets 20-40mm. Sand is light yellowish brown fine. Rare fine sand sized selenite. Rare bluish grey gleying. [Possible Made Ground]	19.75	4.00	
3.50	6	DSPT							
4.00	4	ES				Firm thinly laminated light brown CLAY. With slightly sandy pockets 20-40mm. Sand is light yellowish brown, fine. Occasional fine to coarse sand sized selenite. (LONDON CLAY FORMATION)			
4.00-4.45	8	UT	14 blows						
4.00		PID	0.3ppm						
5.00-5.45	10	UT	20 blows						
6.00-6.45	12	UT	25 blows					(4.60)	
				≈		. . . At 6.50m, claystone.			
7.00-7.45	14	UT	27 blows						
						. . . Below 7.50, becoming stiff.			
8.00-8.45	16	UT	30 blows				15.15	8.60	
						Description on next sheet			

Boring Progress and Water Observations					
Date	Time	Borehole Depth	Casing Depth	Borehole Diameter (mm)	Water Depth
11/01/19	08:00		-		
11/01/19	17:00	4.50	4.50	150	-
14/01/19	08:00	4.50	4.50	150	-
14/01/19		6.60	4.50	150	6.60
14/01/19	17:00	18.00	6.80	150	-
15/01/19	08:00	18.00	6.80	150	Dry
15/01/19		22.20	6.80	150	22.20
15/01/19	17:00	31.00	6.80	150	Dry

Chiselling / Slow Progress		
From	To	Duration (hh:mm)

General Remarks

1. Inspection pit dug to 1.20m to check for services.
2. Downhole UXO magnetometer survey carried out by specialist.
3. Groundwater seepages encountered at 6.00m and 22.20m depth.
4. On completion, an 80mm diameter standpipe

All dimensions in metres | Scale: **1:50**

Method Used:	Plant Used:	Drilled By:	Logged By:	Checked By:
Inspection pit + Cable percussion	**Bespoke Rig**	**Mark Taylor**	**RMiller**	

FINAL

BOREHOLE LOG

Contract:	Client:	Borehole:
Ugly Brown Building	**The Trustees of the St Pancras Way Block A Unit Trust & Big Lobster Ltd**	**BH01**

Contract Ref:	Start:	Ground Level (m AOD):	National Grid Co-ordinate:	Sheet:
371654	**11.01.19** End: **14.01.19**	**23.75**	**E:529575.7 N:183844.8**	**2** of **4**

Samples and In-situ Tests				Water	Backfill & Instru-mentation	Description of Strata	Reduced Level	Depth (Thick ness)	Material Graphic Legend
Depth	No	Type	Results						
9.50-9.95 9.50	4 18	SPT DSPT	N=19			Stiff fissured thinly laminated greyish brown CLAY. Rare mica speckling. (LONDON CLAY FORMATION) *(stratum copied from 8.60m from previous sheet)*			
10.25	19	D							
11.00-11.45	20	UT	32 blows					(5.40)	
11.50 11.50	21	D V	c_u=>125						
12.50-12.95 12.50	5 22	SPT DSPT	N=23						
13.25	23	D				. . . At 13.25m, pyritised nodule 20mm.	9.75	14.00	
14.00-14.45	24	UT	36 blows			Stiff to very stiff thinly laminated dark greyish brown CLAY. With frequent mica speckling. (LONDON CLAY FORMATION)			
14.50	25	D					8.75	(1.00) 15.00	
15.50-15.95 15.50	6 26	SPT DSPT	N=30			Very stiff thinly laminated dark greyish brown slightly sandy silty CLAY. Sand is fine. With frequent mica speckling. (LONDON CLAY FORMATION)			
16.25	27	D						(2.00)	
17.00-17.45	28	UT	41 blows				6.75	17.00	
17.50 17.50	29	D V	c_u=>125			Very stiff thinly laminated dark greyish brown CLAY. With 2mm grey burrows. (LONDON CLAY FORMATION)		(1.00)	
							5.75	18.00	

Boring Progress and Water Observations					
Date	Time	Borehole Depth	Casing Depth	Borehole Diameter (mm)	Water Depth
16/01/19	08:00	31.00	6.80	150	24.10
16/01/19	17:00	35.00	6.80	150	Dry

Chiselling / Slow Progress		
From	To	Duration (hh:mm)

General Remarks

was installed to 35m to facilitate downhole geophysical survey.
5. SPT hammer GEH3-2019 (E_r = 47.00%) used.

All dimensions in metres | Scale: **1:50**

Method Used:	Plant Used:	Drilled By:	Logged By:	Checked By:
Inspection pit + Cable percussion	**Bespoke Rig**	**Mark Taylor**	**RMiller**	

FINAL

BOREHOLE LOG

Contract:	Client:	Borehole:
Ugly Brown Building	**The Trustees of the St Pancras Way Block A Unit Trust & Big Lobster Ltd**	**BH01**

Contract Ref:	Start:	Ground Level (m AOD):	National Grid Co-ordinate:	Sheet:
371654	**11.01.19** End: **14.01.19**	**23.75**	**E:529575.7 N:183844.8**	**3** of **4**

Samples and In-situ Tests				Water	Backfill & Instru-mentation	Description of Strata	Reduced Level	Depth (Thick ness)	Material Graphic Legend
Depth	No	Type	Results						
18.50-18.95 18.50	7 30	SPT DSPT	N=32			Very stiff thinly laminated dark greyish brown slightly sandy silty CLAY. Sand is fine. With 2mm grey burrows. (LONDON CLAY FORMATION)			
19.25	31	D							
20.00-20.45	32	UT	43 blows						
20.50	33	D						(5.50)	
21.50-21.95 21.50	8 34	SPT DSPT	N=38						
22.25	35	D				. . . At 22.20m, driller notes sand band.			
23.00-23.45	36	UT	48 blows						
23.50	37	D					0.25	23.50	
24.50-24.95 24.50	9 38	SPT DSPT	N=44			Very stiff thinly laminated dark greyish brown CLAY. Locally slightly fine sandy. (LONDON CLAY FORMATION) . . . At 23.50m, slightly fine sandy, silty.			
25.25	39	D				. . . Between 25.25m and 26.50m, clayey SILT with rare bioturbations.		(3.30)	
26.00-26.45	40	UT	55 blows						
26.50	41	D					-3.05	26.80	
26.80	41A	D				*Description on next sheet*			

Boring Progress and Water Observations					
Date	Time	Borehole Depth	Casing Depth	Borehole Diameter (mm)	Water Depth

Chiselling / Slow Progress		
From	To	Duration (hh:mm)

General Remarks

All dimensions in metres | Scale: **1:50**

Method Used:	Plant Used:	Drilled By:	Logged By:	Checked By:
Inspection pit + Cable percussion	**Bespoke Rig**	**Mark Taylor**	**RMiller**	AGS

FINAL

BOREHOLE LOG

Contract:	Client:	Borehole:
Ugly Brown Building	**The Trustees of the St Pancras Way Block A Unit Trust & Big Lobster Ltd**	**BH01**

Contract Ref:	Start:	Ground Level (m AOD):	National Grid Co-ordinate:	Sheet:
371654	**11.01.19** End: **14.01.19**	**23.75**	**E:529575.7 N:183844.8**	**4** of **4**

Samples and In-situ Tests				Water	Backfill & Instru-mentation	Description of Strata	Reduced Level	Depth (Thick ness)	Material Graphic Legend
Depth	No	Type	Results						
26.80		V	c_u=>125			Stiff brownish grey mottled greyish blue silty CLAY. (LAMBETH GROUP - LOWER MOTTLED BEDS) *(stratum copied from 26.80m from previous sheet)*	-3.75	(0.70) 27.50	
27.50-27.95 27.50	10 42	SPT DSPT	N=50			Very stiff light brown mottled greyish blue mottled reddish brown silty CLAY. (LAMBETH GROUP - LOWER MOTTLED BEDS)			
28.25	43	D							
29.00-29.45	44	UT	68 blows						
29.50	45	D				. . . Below 29.50m, greyish blue mottled brownish red.			
30.50-30.94 30.50	11 46	SPT DSPT	N=53*			. . . Below 30.50m, light brown mottled greyish blue and brownish red.			
31.25	47	D						(7.50)	
32.00-32.45	48	UT	73 blows						
32.50	49	D				. . . Below 32.50m, grey mottled greenish yellow.			
33.50-33.88 33.50	12 50	SPT DSPT	N=67*						
34.25	51	D				. . . Below 34.25m, light brown, greyish purple, dark brownish red, greenish yellow and bluish grey mottled.			
34.50-34.95	52	UT	81 blows				-11.25	35.00	
35.00 35.00	53	D V	c_u=>125			Cable percussion borehole terminated at a depth of 35m.			

Boring Progress and Water Observations					
Date	Time	Borehole Depth	Casing Depth	Borehole Diameter (mm)	Water Depth

Chiselling / Slow Progress		
From	To	Duration (hh:mm)

General Remarks

All dimensions in metres | Scale: **1:50**

Method Used:	Plant Used:	Drilled By:	Logged By:	Checked By:
Inspection pit + Cable percussion	**Bespoke Rig**	**Mark Taylor**	**RMiller**	

FINAL

BOREHOLE LOG

Contract:	Client:	Borehole:
Ugly Brown Building	**The Trustees of the St Pancras Way Block A Unit Trust & Big Lobster Ltd**	**BH02**

Contract Ref:	Start:	Ground Level (m AOD):	National Grid Co-ordinate:	Sheet:
371654	**07.01.19** End: **09.01.19**	**22.02**	**E:529562.2 N:183835.8**	**1** of **4**

Samples and In-situ Tests				Water	Backfill & Instru-mentation	Description of Strata	Reduced Level	Depth (Thick ness)	Material Graphic Legend
Depth	No	Type	Results						
						MADE GROUND: Dark brown slightly sandy slightly gravelly CLAY. Sand is fine and medium. Gravel is subangular and subrounded fine to coarse yellowish orange, brown and black flint and brick. Occasional roots and rootlets to 0.40m.	21.46	(0.56) 0.56	
0.30	1	ES							
0.30	1	D							
0.30		PID	0.0ppm						
0.60	2	ES				Firm to stiff fissured light yellowish brown mottled bluish grey and brownish red CLAY. Rare rootlets with gleying surround. [Possible Reworked Ground]			
0.60	2	D							
0.60		PID	0.0ppm						
0.70-1.20	1	B						(1.44)	
0.75		V	c_u=>125						
1.20-1.65	1	$SPT_{(NR)}$	N=10						
1.30	3	ES							
1.60	3	D					20.02	2.00	
2.00-2.45	2	SPT	N=11			Firm yellowish brown CLAY. With occasional pockets <30mm of oxidised orange-brown silt. Occasional fine sand sized selenite crystals and rare blue-grey gleying. (LONDON CLAY FORMATION)			
2.00	4	D							
3.00-3.45	1	UT	40 blows 100% recovery						
3.45	5	D				. . . At 3.45m, frequent laminations and pockets of orange-brown silt and blue-grey gleying.		(3.65)	
4.00-4.45	2	UT	45 blows 100% recovery						
4.45	6	D				. . . At 4.40m, claystone. . . . At 4.45m, becoming silty with frequent fine to coarse sand sized selenite crystals.			
5.20-5.65	3	UT	40 blows 100% recovery				16.37	5.65	
5.65	7	D				Stiff thinly laminated light yellow brown mottled orange brown CLAY. Occasional fine to coarse sand sized selenite crystals. (LONDON CLAY FORMATION)			
6.00	8	D							
6.50-6.95	4	UT	50 blows 100% recovery					(1.55)	
6.95	9	D					14.82	7.20	
7.50	10	D				Stiff thinly laminated dark brown grey CLAY. (LONDON CLAY FORMATION) . . . Between 7.20m and 8.45m: with occasional oxidised reddish orange between laminations. Rare mica speckling.			
8.00-8.45	5	UT	55 blows 100% recovery						
8.45	11	D							

Boring Progress and Water Observations					
Date	Time	Borehole Depth	Casing Depth	Borehole Diameter (mm)	Water Depth
07/01/19	08:00		-		
07/01/19	17:00	4.50	1.50	150	Dry
08/01/19	08:00	4.50	1.50	150	3.20
08/01/19	17:00	19.00	5.00	150	Dry
09/01/19	08:00	19.00	5.00	150	17.00
09/01/19	17:00	30.00	5.00	150	Dry

Chiselling / Slow Progress		
From	To	Duration (hh:mm)

General Remarks

1. Inspection pit dug to 1.20m to check for services.
2. Downhole UXO magnetometer survey carried out by specialist.
3. Borehole was dry during drilling however groundwater seepages entered borehole overnight.

All dimensions in metres | Scale: **1:50**

Method Used:	Plant Used:	Drilled By:	Logged By:	Checked By:
Inspection pit + Cable percussion	**Dando 100 (cut down)**	**Dave Rosenwold**	**RMiller**	

FINAL

BOREHOLE LOG

Contract:	Client:	Borehole:
Ugly Brown Building	**The Trustees of the St Pancras Way Block A Unit Trust & Big Lobster Ltd**	**BH02**

Contract Ref:	Start:	Ground Level (m AOD):	National Grid Co-ordinate:	Sheet:
371654	**07.01.19** End: **09.01.19**	**22.02**	**E:529562.2 N:183835.8**	**2** of **4**

Samples and In-situ Tests				Water	Backfill & Instru-mentation	Description of Strata	Reduced Level	Depth (Thick ness)	Material Graphic Legend
Depth	No	Type	Results						
9.00	12	D				Stiff thinly laminated dark brown grey CLAY. (LONDON CLAY FORMATION) . . . Between 7.20m and 8.45m: with occasional oxidised reddish orange between laminations. Rare mica speckling.*(stratum copied from 7.20m from previous sheet)*			
9.50-9.95	3	SPT	N=24						
9.50	13	D							
9.95	39	D							
10.50	14	D							
10.50		V	c_u=93						
11.00-11.45	6	UT	60 blows 100% recovery			. . . Below 11.00m, very stiff.		(7.80)	
11.45	15	D							
11.45		V	c_u=112						
12.00	16	D							
12.00		V	c_u=>125						
12.50-12.95	4	SPT	N=31						
12.50	17	D							
13.50	18	D							
14.00-14.45	7	UT	70 blows 89% recovery						
14.45	19	D					7.02	15.00	
15.00	20	D				Very stiff fissured dark brown slightly sandy silty CLAY. Sand is fine. With occasional light brown slightly fine sandy pockets <50mm and occasional selenite crystals. (LONDON CLAY FORMATION)			
15.50-15.95	5	SPT	N=34						
15.50	21	D							
16.50	22	D						(3.00)	
17.00-17.45	8	UT	75 blows 89% recovery						
17.45	23	D					4.02	18.00	

Boring Progress and Water Observations					
Date	Time	Borehole Depth	Casing Depth	Borehole Diameter (mm)	Water Depth

Chiselling / Slow Progress		
From	To	Duration (hh:mm)

General Remarks

4. On completion, an 80mm diameter standpipe was installed to 30m to facilitate downhole geophysical survey.
5. SPT hammer EQU2136-2018 (E_r = 87.47%) used.

All dimensions in metres | Scale: **1:50**

Method Used:	Plant Used:	Drilled By:	Logged By:	Checked By:
Inspection pit + Cable percussion	**Dando 100 (cut down)**	**Dave Rosenwold**	**RMiller**	

FINAL

BOREHOLE LOG

Contract:	Client:	Borehole:
Ugly Brown Building	**The Trustees of the St Pancras Way Block A Unit Trust & Big Lobster Ltd**	**BH02**

Contract Ref:	Start:	Ground Level (m AOD):	National Grid Co-ordinate:	Sheet:
371654	**07.01.19** End: **09.01.19**	**22.02**	**E:529562.2 N:183835.8**	**3** of **4**

Samples and In-situ Tests				Water	Backfill & Instru-mentation	Description of Strata	Reduced Level	Depth (Thick ness)	Material Graphic Legend
Depth	No	Type	Results						
18.00	24	D				Stiff dark brown slightly sandy CLAY. Sand is light brown, fine. With occasional forams and grey infilled burrows. (LONDON CLAY FORMATION)			
18.50-18.95	6	SPT	N=40						
18.50	25	D							
19.50	26	D							
20.00-20.45	9	UT	80 blows 89% recovery						
20.45	27	D				. . . At 20.45m, fissured dark brown CLAY. Rare light brown fine sand lenses <1mm. Fissures are closely spaced.			
21.00	28	D							
21.50-21.95	7	SPT	N=38						
21.50	29	D						(7.50)	
22.50	30	D							
23.00-23.45	10	UT	80 blows 78% recovery						
23.45	31	D				. . . Below 23.45m, rare carbonaceous matter and rare light brown fine sand lenses.			
24.00	32	D							
24.50-24.95	8	SPT	N=47						
24.50	33	D					-3.48	25.50	
25.50	34	D				Very stiff fissured brown and blue-grey mottled CLAY. Fissures are extremely closely spaced, randomly orientated, polished. (LAMBETH GROUP - LOWER MOTTLED BEDS)		(0.95)	
26.00-26.45	11	UT	95 blows 89% recovery				-4.43	26.45	
26.45	35	D				*Description on next sheet*			

Boring Progress and Water Observations					
Date	Time	Borehole Depth	Casing Depth	Borehole Diameter (mm)	Water Depth

Chiselling / Slow Progress		
From	To	Duration (hh:mm)

General Remarks

All dimensions in metres | Scale: **1:50**

Method Used:	Plant Used:	Drilled By:	Logged By:	Checked By:
Inspection pit + Cable percussion	**Dando 100 (cut down)**	**Dave Rosenwold**	**RMiller**	

FINAL

BOREHOLE LOG

Contract:	Client:	Borehole:
Ugly Brown Building	**The Trustees of the St Pancras Way Block A Unit Trust & Big Lobster Ltd**	**BH02**

Contract Ref:	Start:	Ground Level (m AOD):	National Grid Co-ordinate:	Sheet:
371654	**07.01.19** End: **09.01.19**	**22.02**	**E:529562.2 N:183835.8**	**4** of **4**

Samples and In-situ Tests				Water	Backfill & Instru-mentation	Description of Strata	Reduced Level	Depth (Thick ness)	Material Graphic Legend
Depth	No	Type	Results						
27.00	36	D				Very stiff fissured reddish brown mottled blue-grey CLAY. Fissures are extremely closely spaced, randomly orientated, polished. Becoming mottled brown with depth. (LAMBETH GROUP - LOWER MOTTLED BEDS) *(stratum copied from 26.45m from previous sheet)*			
27.80-28.25	9	SPT	N=50			. . . Below 27.80m, blue-grey mottled reddish brown and brown.			
27.80	37	D						(3.55)	
28.80	38	D				. . . Below 28.80m, blue-grey mottled yellowish brown, rarely mottled reddish brown and brown.			
29.50-29.95	12	UT	110 blows 89% recovery						
						. . . At 29.95m, hard, mottled purple and yellowish brown.	-7.98	30.00	
						Cable percussion borehole terminated at a depth of 30m.			

Boring Progress and Water Observations					
Date	Time	Borehole Depth	Casing Depth	Borehole Diameter (mm)	Water Depth

Chiselling / Slow Progress		
From	To	Duration (hh:mm)

General Remarks

All dimensions in metres | Scale: **1:50**

Method Used:	Plant Used:	Drilled By:	Logged By:	Checked By:
Inspection pit + Cable percussion	**Dando 100 (cut down)**	**Dave Rosenwold**	**RMiller**	

FINAL

BOREHOLE LOG

Contract:	Client:	Borehole:
Ugly Brown Building	**The Trustees of the St Pancras Way Block A Unit Trust & Big Lobster Ltd**	**BH03**

Contract Ref:	Start:	Ground Level (m AOD):	National Grid Co-ordinate:	Sheet:
371654	**16.01.19** End: **17.01.19**	**21.76**	**E:529562.9 N:183816.2**	**1** of **5**

Samples and In-situ Tests				Water	Backfill & Instrumentation	Description of Strata	Reduced Level	Depth (Thickness)	Material Graphic Legend
Depth	No	Type	Results						
0.00-0.50	1	B				MADE GROUND: Paving slab over brick and concrete fill (drillers description).		(0.50)	
0.40	1	ES					21.26	0.50	
0.50-1.00	2	B				Soft to firm light brown mottled bluish grey silty CLAY. Frequent decaying rootlets. With pockets of crushed selenite crystals. [Possible reworked natural soil]. (LONDON CLAY FORMATION)		(0.60)	
1.10	1	D					20.66	1.10	
1.10		V	c_u=94			Firm thinly laminated light brown silty CLAY. With occasional pockets <5mm of brownish orange silt and occasional medium sand sized selenite crystals. (LONDON CLAY FORMATION)			
1.20-1.65	1	UT	40 blows						
1.70	2	D							
2.00-2.45	2	UT	50 blows 0% recovery						
2.00-2.50	3	B		≈					
2.70	3	D							
2.70		V	c_u=117						
3.00-3.45	3	UT	50 blows						
3.50	4	D				. . . Below 3.50m, fissured. Fissures are predominantly sub-horizontal with light orange silt dusting on surfaces.		(5.40)	
3.87	5	D				. . . Below 3.80m, rare becoming occasional relict rootlets with gleying.			
4.00-4.45	4	UT	50 blows						
4.50	6	D							
4.80	7	D							
4.80		V	c_u=>125						
5.00-5.45	5	UT	50 blows						
5.50	8	D							
6.00	9	D		≈			15.26	6.50	
6.50-6.95	1	SPT	N=22			Stiff fissured dark brownish grey CLAY. Locally with rare bioturbations. (LONDON CLAY FORMATION) . . . Between 6.50m and 8.50m, with mica speckling.			
7.50	10	D							
8.00-8.45	6	UT	55 blows						
8.50	11	D							
8.50		V	c_u=120						

Boring Progress and Water Observations					
Date	Time	Borehole Depth	Casing Depth	Borehole Diameter (mm)	Water Depth
16/01/19	08:00		-		
16/01/19		2.50	1.00	150	2.50
16/01/19		6.50	3.00	150	6.50
16/01/19		12.00	7.50	150	12.00
16/01/19	17:00	25.00	7.50	150	Dry
17/01/19	08:00	25.00	7.50	150	21.50
17/01/19	17:00	40.00	7.50	150	Dry

Chiselling / Slow Progress		
From	To	Duration (hh:mm)

General Remarks

1. Inspection pit dug to 1.20m to check for services.
2. Downhole UXO magnetometer survey carried out by specialist.
3. Groundwater seepages encountered at 2.50m, 6.50m and 12.00m depth.
4. On completion, a 34mm diameter standpipe

All dimensions in metres | Scale: **1:50**

Method Used:	Plant Used:	Drilled By:	Logged By:	Checked By:
Inspection pit + Cable percussion	**Dando 2000 Mark 2**	**Dave Hutson**	**RMiller**	

FINAL

BOREHOLE LOG

Contract:	Client:	Borehole:
Ugly Brown Building	**The Trustees of the St Pancras Way Block A Unit Trust & Big Lobster Ltd**	**BH03**

Contract Ref:	Start:	Ground Level (m AOD):	National Grid Co-ordinate:	Sheet:
371654	**16.01.19** End: **17.01.19**	**21.76**	**E:529562.9 N:183816.2**	**2** of **5**

Samples and In-situ Tests				Water	Backfill & Instrumentation	Description of Strata	Reduced Level	Depth (Thickness)	Material Graphic Legend
Depth	No	Type	Results						
9.00	12	D				Stiff fissured dark brownish grey CLAY. Locally with rare bioturbations. (LONDON CLAY FORMATION)			
9.00		V	c_u=>125						
9.50-9.95	2	SPT	N=22						
								(7.00)	
10.50	13	D							
11.00-11.45	7	UT	60 blows						
11.50	14	D							
12.00	15	D							
12.00		V	c_u=>125						
12.50-12.95	3	SPT	N=27						
							8.26	13.50	
13.50	16	D				Stiff becoming very stiff fissured dark brownish grey slightly sandy silty CLAY. Sand is fine. Occasional mica speckling. Rare 4mm pyrite. (LONDON CLAY FORMATION)			
14.00-14.45	8	UT	65 blows						
14.50	17	D							
15.00	18	D							
15.50-15.95	4	SPT	N=32					(4.50)	
16.50	19	D							
16.50		V	c_u=96						
17.00-17.45	9	UT	60 blows						
17.50	20	D					3.76	18.00	

. . . Between 6.50m and 8.50m, with mica speckling.*(stratum* copied from 6.50m from previous sheet)

Boring Progress and Water Observations					
Date	Time	Borehole Depth	Casing Depth	Borehole Diameter (mm)	Water Depth

Chiselling / Slow Progress		
From	To	Duration (hh:mm)

General Remarks

was installed with a response zone between 1.00m and 7.00m.
5. SPT hammer HD02-2018 (E_r = 72.00%) used.

All dimensions in metres | Scale: **1:50**

Method Used:	Plant Used:	Drilled By:	Logged By:	Checked By:
Inspection pit + Cable percussion	**Dando 2000 Mark 2**	**Dave Hutson**	**RMiller**	

FINAL

BOREHOLE LOG

Contract:	Client:	Borehole:
Ugly Brown Building	**The Trustees of the St Pancras Way Block A Unit Trust & Big Lobster Ltd**	**BH03**

Contract Ref:	Start:	Ground Level (m AOD):	National Grid Co-ordinate:	Sheet:
371654	**16.01.19** End: **17.01.19**	**21.76**	**E:529562.9 N:183816.2**	**3** of **5**

Samples and In-situ Tests				Water	Backfill & Instrumentation	Description of Strata	Reduced Level	Depth (Thickness)	Material Graphic Legend
Depth	No	Type	Results						
18.00	21	D				Very stiff thinly laminated dark grey silty CLAY. With occasional pockets of silt and bioturbation. With rare fine sand selenite. (LONDON CLAY FORMATION)			
18.50-18.95	5	SPT	N=39						
19.50	22	D							
19.50		V	c_u=>125						
20.00-20.45	10	UT	75 blows						
20.50	23	D							
21.00	24	D						(6.50)	
21.50-21.95	6	SPT	N=39						
22.50	25	D							
23.00-23.45	11	UT	75 blows						
23.50	26	D							
24.00	27	D				. . . At 24.00m, rare pyrite <4mm.			
24.00		V	c_u=>125				-2.74	24.50	
24.50-24.95	7	SPT	N=42			Very stiff grey mottled greyish blue CLAY. (LAMBETH GROUP - LOWER MOTTLED BEDS)			
25.50	28	D							
25.50		V	c_u=>125			. . . Below 25.50m, light brown mottled greyish blue and brownish red.			
26.00-26.45	12	UT	85 blows						
26.50	29	D							

Boring Progress and Water Observations					
Date	Time	Borehole Depth	Casing Depth	Borehole Diameter (mm)	Water Depth

Chiselling / Slow Progress		
From	To	Duration (hh:mm)

General Remarks

All dimensions in metres | Scale: **1:50**

Method Used:	Plant Used:	Drilled By:	Logged By:	Checked By:
Inspection pit + Cable percussion	**Dando 2000 Mark 2**	**Dave Hutson**	**RMiller**	

FINAL

BOREHOLE LOG

Contract:	Client:	Borehole:
Ugly Brown Building	**The Trustees of the St Pancras Way Block A Unit Trust & Big Lobster Ltd**	**BH03**

Contract Ref:	Start:	Ground Level (m AOD):	National Grid Co-ordinate:	Sheet:
371654	**16.01.19** End: **17.01.19**	**21.76**	**E:529562.9 N:183816.2**	**4** of **5**

Samples and In-situ Tests				Water	Backfill & Instru-mentation	Description of Strata	Reduced Level	Depth (Thick ness)	Material Graphic Legend
Depth	No	Type	Results						
27.00	30	D				Very stiff grey mottled greyish blue CLAY. (LAMBETH GROUP - LOWER MOTTLED BEDS) *(stratum copied from 24.50m from previous sheet)*			
27.50-27.95	8	SPT	N=59			. . . Below 27.00m, variably mottled grey, greyish blue, yellowish green and brownish red.			
28.50	31	D							
29.00-29.45	13	UT	90 blows						
29.50	32	D				. . . Below 29.50m, mottled purple.			
30.00	33	D							
30.50-30.95	9	SPT	N=58						
31.50	34	D							
32.00-32.45	14	UT	100 blows					(15.50)	
32.50	35	D							
33.00	36	D							
33.00		V	c_u=>125						
33.50-33.95	10	SPT	N=65						
34.50	37	D							
34.50		V	c_u=>125						
35.00-35.45	15	UT	110 blows						
35.50	38	D							

Boring Progress and Water Observations					
Date	Time	Borehole Depth	Casing Depth	Borehole Diameter (mm)	Water Depth

Chiselling / Slow Progress		
From	To	Duration (hh:mm)

General Remarks

All dimensions in metres | Scale: **1:50**

Method Used:	Plant Used:	Drilled By:	Logged By:	Checked By:
Inspection pit + Cable percussion	**Dando 2000 Mark 2**	**Dave Hutson**	**RMiller**	

FINAL

BOREHOLE LOG

Contract:	Client:	Borehole:
Ugly Brown Building	**The Trustees of the St Pancras Way Block A Unit Trust & Big Lobster Ltd**	**BH03**

Contract Ref:	Start:	Ground Level (m AOD):	National Grid Co-ordinate:	Sheet:
371654	**16.01.19** End: **17.01.19**	**21.76**	**E:529562.9 N:183816.2**	**5** of **5**

Samples and In-situ Tests				Water	Backfill & Instrumentation	Description of Strata	Reduced Level	Depth (Thickness)	Material Graphic Legend
Depth	No	Type	Results						
36.00	39	D				Very stiff grey mottled greyish blue CLAY. (LAMBETH GROUP - LOWER MOTTLED BEDS) *(stratum copied from 24.50m from previous sheet)*			
36.50-36.65	11	SPT	N=150*						
37.50	40	D							
38.00-38.50	4	B							
38.00-38.45	16	UT	120 blows 0% recovery						
39.00	41	D							
39.50-39.63	12	SPT	N=200*						
							-18.24	40.00	
40.00	42	D				Cable percussion borehole terminated at a depth of 40m.			

Boring Progress and Water Observations					
Date	Time	Borehole Depth	Casing Depth	Borehole Diameter (mm)	Water Depth

Chiselling / Slow Progress		
From	To	Duration (hh:mm)

General Remarks

All dimensions in metres | Scale: **1:50**

Method Used:	Plant Used:	Drilled By:	Logged By:	Checked By:
Inspection pit + Cable percussion	**Dando 2000 Mark 2**	**Dave Hutson**	**RMiller**	

FINAL

BOREHOLE LOG

Contract:	Client:	Borehole:
Ugly Brown Building	**The Trustees of the St Pancras Way Block A Unit Trust & Big Lobster Ltd**	**BH04**

Contract Ref:	Start:	Ground Level (m AOD):	National Grid Co-ordinate:	Sheet:
371654	**17.01.19** End: **21.01.19**	**23.73**	**E:529584.4 N:183840.8**	**1** of **3**

Samples and In-situ Tests				Water	Backfill & Instrumentation	Description of Strata	Reduced Level	Depth (Thickness)	Material Graphic Legend
Depth	No	Type	Results						
						MADE GROUND: Reinforced CONCRETE with 5mm diameter rebar.	23.53	0.20	
						MADE GROUND: Pale yellow red sandy slightly clayey subangular to subrounded flint, brick, concrete and charcoal GRAVEL. Sand is medium to coarse, orangish yellow.	23.36	0.37	
						MADE GROUND: Brown black cemented clayey angular to subrounded brick and concrete GRAVEL. Cement is bituminous.	23.23	0.50	
							22.37	(0.86) 1.36	
1.50-1.95	1	SPT(c)	N=15			MADE GROUND: Yellowish red very sandy angular to subrounded fine to coarse brick, charcoal and flint GRAVEL. Locally well cemented. Sand is medium and coarse. Occasional cobbles of subrounded brick.			
1.50	1	ES				. . . At 0.80m, frequent roots.			
1.50	1	D							
1.50		PID	0.0ppm						
						MADE GROUND: Brown slightly gravelly CLAY. With occasional cobbles of concrete and fine gravel sized brick and concrete.		(1.94)	
2.50-2.55	2	SPT(c)	NP			. . . At 2.40m, driller notes brick and concrete obstruction - possible old canal wall footing.			
2.50	2	ES							
2.50	2	D							
2.50		PID	0.0ppm				20.43	3.30	
3.30	3	ES				MADE GROUND: Orange-brown and brown slightly sandy gravelly CLAY. Gravel is fine and medium brick and concrete.			
3.30	3	D							
3.30		PID	0.0ppm					(1.20)	
4.00	4	D				. . . Below 4.00m, rare fine gravel of brick.			
							19.23	4.50	
4.50-4.95	5	UT				Firm thinly laminated brown silty CLAY. With orange-brown silt partings becoming frequent with depth. (LONDON CLAY FORMATION)			
5.00	6	D							
5.50-5.95	7	UT	21 blows						
6.00	8	D		≈				(3.40)	
6.50-6.95	9	UT	39 blows 0% recovery			. . . At 6.50m, claystone. . . . Below 6.60m, fissured with orange-brown silt on surfaces. With occasional fine selenite crystals.			
7.00-7.45	10	UT	24 blows						
7.50	11	D							
							15.83	7.90	
8.00-8.45	12	UT	29 blows			Stiff dark brownish grey silty CLAY. With occasional partings of light brown silt. (LONDON CLAY FORMATION)			
8.50	13	D							

Boring Progress and Water Observations

Date	Time	Borehole Depth	Casing Depth	Borehole Diameter (mm)	Water Depth
17/01/19	12:00	1.36	-		Dry
17/01/19	17:00	2.50	2.50	200	Dry
18/01/19	08:00	2.50	2.50	200	Dry
18/01/19		4.00	4.00	150	Dry
18/01/19		6.40	4.00	150	6.40
18/01/19	17:00	10.00	6.60	150	Dry
21/01/19	08:00	10.00	6.60	150	5.90
21/01/19		21.70	6.60	150	21.70

Chiselling / Slow Progress

From	To	Duration (hh:mm)
2.50	3.30	01:30

General Remarks

1. Inspection pit dug to 1.36m using a machine excavator to facilitate structural survey of sheet pile canal wall.
2. Inspection pit backfilled prior to drilling to allow the rig to set up safely.
3. Borehole drilled between buried canal wall and existing sheet piled canal wall.

All dimensions in metres | Scale: **1:50**

Method Used:	Plant Used:	Drilled By:	Logged By:	Checked By:
Inspection pit + Cable percussion	**Bespoke Rig**	**Mark Taylor**	**MMcCann**	

FINAL

BOREHOLE LOG

Contract:	Client:	Borehole:
Ugly Brown Building	**The Trustees of the St Pancras Way Block A Unit Trust & Big Lobster Ltd**	**BH04**

Contract Ref:	Start:	Ground Level (m AOD):	National Grid Co-ordinate:	Sheet:
371654	**17.01.19** End: **21.01.19**	**23.73**	**E:529584.4 N:183840.8**	**2** of **3**

Samples and In-situ Tests				Water	Backfill & Instru-mentation	Description of Strata	Reduced Level	Depth (Thick ness)	Material Graphic Legend
Depth	No	Type	Results						
9.00-9.45	14	UT	31 blows			Stiff dark brownish grey silty CLAY. With occasional partings of light brown silt. (LONDON CLAY FORMATION) *(stratum copied from 7.90m from previous sheet)* . . . Below 9.50m, thinly laminated.		(3.35)	
9.50	15	D							
10.50-10.95	3	SPT	N=21						
10.50	16	DSPT							
							12.48	11.25	
11.25	17	D				Stiff dark brownish grey CLAY. With occasional mica speckling. (LONDON CLAY FORMATION)			
12.00-12.45	18	UT	33 blows						
12.50	19	D				. . . Below 12.50m, becoming very stiff with occasional bioturbations infilled with light grey silt 2mm x 20mm. . . . At 12.60m, claystone.		(4.25)	
12.50		V	c_u=>150						
13.50-13.95	4	SPT	N=29						
13.50	20	DSPT				. . . At 13.95m, claystone.			
14.25	21	D							
15.00-15.45	22	UT	38 blows				8.23	15.50	
15.50	23	D				Very stiff dark brownish grey slightly sandy silty CLAY. Sand is fine. With occasional mica speckling and bioturbations. (LONDON CLAY FORMATION)			
15.50		V	c_u=>150						
16.50-16.95	5	SPT	N=33						
16.50	24	DSPT							
17.25	25	D							

Boring Progress and Water Observations					
Date	Time	Borehole Depth	Casing Depth	Borehole Diameter (mm)	Water Depth
21/01/19	17:00	25.00	6.60	150	Dry

Chiselling / Slow Progress		
From	To	Duration (hh:mm)

General Remarks

4. Downhole UXO magnetometer survey carried out by specialist.
5. Groundwater seepages encountered at 6.40m and 21.70m depth.
6. On completion, an 80mm diameter standpipe was installed to 25m to facilitate downhole geophysical survey.

All dimensions in metres | Scale: **1:50**

Method Used:	Plant Used:	Drilled By:	Logged By:	Checked By:
Inspection pit + Cable percussion	**Bespoke Rig**	**Mark Taylor**	**MMcCann**	

FINAL

BOREHOLE LOG

Contract:	Client:	Borehole:
Ugly Brown Building	**The Trustees of the St Pancras Way Block A Unit Trust & Big Lobster Ltd**	**BH04**

Contract Ref:	Start:	Ground Level (m AOD):	National Grid Co-ordinate:	Sheet:
371654	**17.01.19** End: **21.01.19**	**23.73**	**E:529584.4 N:183840.8**	**3** of **3**

Samples and In-situ Tests				Water	Backfill & Instru-mentation	Description of Strata	Reduced Level	Depth (Thick ness)	Material Graphic Legend
Depth	No	Type	Results						
18.00-18.45	26	UT	41 blows			Very stiff dark brownish grey slightly sandy silty CLAY. Sand is fine. With occasional mica speckling and bioturbations. (LONDON CLAY FORMATION) *(stratum copied from 15.50m from previous sheet)*			
18.50	27	D						(7.00)	
19.50-19.95	6	SPT	N=34						
19.50	28	DSPT							
20.25	29	D							
21.00-21.45	30	UT	48 blows						
21.50	31	D		≈					
21.50		V	c_u=>150				1.23	22.50	
22.50-22.95	7	SPT	N=44			Very stiff dark brownish grey CLAY. With occasional mica speckling. (LONDON CLAY FORMATION)			
22.50	32	DSPT							
23.25	33	D						(2.00)	
24.00-24.45	34	UT	55 blows				-0.77	24.50	
24.50	35	D				Dark brown grey very sandy CLAY. Sand is fine. With rare bioturbations. (LONDON CLAY FORMATION)		(0.50)	
25.00	36	D				. . . At 25.00m, slightly sandy silty CLAY. Sand is fine.	-1.27	25.00	
						Cable percussion borehole terminated at a depth of 25m.			

Boring Progress and Water Observations					
Date	Time	Borehole Depth	Casing Depth	Borehole Diameter (mm)	Water Depth

Chiselling / Slow Progress		
From	To	Duration (hh:mm)

General Remarks

7. SPT hammer GEH3-2019 (E_r = 47.00%) used.

All dimensions in metres | Scale: **1:50**

Method Used:	Plant Used:	Drilled By:	Logged By:	Checked By:
Inspection pit + Cable percussion	**Bespoke Rig**	**Mark Taylor**	**MMcCann**	

FINAL

BOREHOLE LOG

Contract:	Client:	Borehole:
Ugly Brown Building	**The Trustees of the St Pancras Way Block A Unit Trust & Big Lobster Ltd**	**BH05**

Contract Ref:	Start:	Ground Level (m AOD):	National Grid Co-ordinate:	Sheet:
371654	**11.01.19** End: **15.01.19**	**21.82**	**E:529570.8 N:183828.5**	**1** of **4**

Samples and In-situ Tests				Water	Backfill & Instru-mentation	Description of Strata	Reduced Level	Depth (Thick ness)	Material Graphic Legend
Depth	No	Type	Results						
						Concrete Screed	21.78	0.05	
						Reinforced CONCRETE. 10mm diameter rebar at 85mm bgl, 215mm bgl and 225mm bgl, 15mm diameter rebar at 130mm bgl	21.49	0.33	
0.40	1	D				. . . At 0.33m, plastic membrane	21.32	0.50	VOID
0.70	1	ES				VOID with fragments of clayboard under concrete.		(0.80)	
0.70		PID	0.0ppm						
0.90-1.20	1	B				MADE GROUND: Brown slightly sandy slightly gravelly silty CLAY. Gravel is angular and subangular fine to coarse brick, flint, concrete and rare slag. With pockets of fine and medium sand and pockets <20mm of orange clay.	20.52	1.30	
0.90	2	D							
1.30-1.75	1	SPT	N=10						
1.30	1	ES							
1.30	3	D							
1.30		PID	0.0ppm			Firm brown silty CLAY. With localised partings of orange-brown silt. (LONDON CLAY FORMATION)			
2.50-2.95	1	UT	40 blows 100% recovery						
2.95	4	D				. . . At 2.95m, thinly laminated.			
2.95		V	c_u=55						
3.50-3.95	2	UT	40 blows 100% recovery					(4.65)	
3.95	5	D		≈		. . . At 3.95m, indistinctly fissured with pockets of orange-brown silt.			
3.95		V	c_u=68						
4.50-4.95	3	UT	40 blows 100% recovery						
4.95	6	D				. . . Below 4.95m, becoming stiff.			
4.95		V	c_u=120						
5.50-5.95	4	UT	45 blows 100% recovery				15.87	5.95	
5.95	7	D				Stiff fissured brown and orange brown silty CLAY. With partings of orange-brown silt and rare selenite crystals. (LONDON CLAY FORMATION)			
6.50	8	D						(1.55)	
7.00-7.45	5	UT	45 blows 100% recovery				14.32	7.50	
7.45	9	D				Stiff fissured thinly laminated greyish brown silty CLAY. With rare bioturbations. (LONDON CLAY FORMATION)			
8.00	10	D				. . . At top, with pockets of orange-brown silt.			
8.50-8.95	2	SPT	N=24						
8.50	11	D							

Boring Progress and Water Observations					
Date	Time	Borehole Depth	Casing Depth	Borehole Diameter (mm)	Water Depth
11/01/19	08:00	0.33	-	300	Dry
11/01/19		4.00	1.50	150	4.00
11/01/19	17:00	10.50	1.50	150	Dry
14/01/19	08:00	10.50	1.50	150	1.80
14/01/19		12.50	7.75	150	12.50
14/01/19	17:00	21.00	7.75	150	Dry
15/01/19	08:00	21.00	7.75	150	17.50
15/01/19		23.00	7.75	150	23.00

Chiselling / Slow Progress		
From	To	Duration (hh:mm)

General Remarks

1. Inspection pit dug to 1.20m through 300mm diameter cored slab to check for services.
2. Downhole UXO magnetometer survey carried out by specialist.
3. Groundwater seepages encountered at 4.00m, 12.50m and 23.00m depth.
4. On completion, a 50mm diameter standpipe

All dimensions in metres | Scale: **1:50**

Method Used:	Plant Used:	Drilled By:	Logged By:	Checked By:
Concrete coring (300mm) + Cable	**Dando 100 (cut down)**	**Dave Rosenwold**	**MMcCann**	

FINAL

BOREHOLE LOG

Contract:	Client:	Borehole:
Ugly Brown Building	**The Trustees of the St Pancras Way Block A Unit Trust & Big Lobster Ltd**	**BH05**

Contract Ref:	Start:	Ground Level (m AOD):	National Grid Co-ordinate:	Sheet:
371654	**11.01.19** End: **15.01.19**	**21.82**	**E:529570.8 N:183828.5**	**2** of **4**

Samples and In-situ Tests				Water	Backfill & Instrumentation	Description of Strata	Reduced Level	Depth (Thickness)	Material Graphic Legend
Depth	No	Type	Results						
9.50	12	D				Stiff fissured thinly laminated greyish brown silty CLAY. With rare bioturbations. (LONDON CLAY FORMATION) *(stratum copied from 7.50m from previous sheet)*			
9.50		V	c_u=>130						
10.00-10.45	6	UT	45 blows 100% recovery						
10.45	13	D						(5.95)	
10.45		V	c_u=>130						
11.00	14	D							
11.00		V	c_u=>130						
11.50-11.95	3	SPT	N=21						
11.50	15	D							
12.50	16	D		≈		. . . At 12.50m, silty with abundant bioturbations <1mm.			
13.00-13.45	7	UT	55 blows 100% recovery				8.37	13.45	
13.45	17	D				Very stiff locally thinly laminated slightly sandy silty CLAY. Sand is fine. With occasional fine gravel sized pockets of grey brown silt / fine sand. (LONDON CLAY FORMATION)			
13.45		V	c_u=>130						
14.00	18	D				. . . At 14.00m, occasional fine gravel sized pyrite and bioturbations.			
14.00		V	c_u=>130						
14.50-14.95	4	SPT	N=31						
14.50	19	D							
15.50	20	D							
16.00-16.45	8	UT	65 blows 100% recovery						
16.45	21	D							
17.00	22	D							
17.50-17.95	5	SPT	N=39			. . . At 17.50m, occasional fine gravel sized pyrite.			
17.50	23	D							

Boring Progress and Water Observations					
Date	Time	Borehole Depth	Casing Depth	Borehole Diameter (mm)	Water Depth
15/01/19	17:00	35.00	7.75	150	Dry

Chiselling / Slow Progress		
From	To	Duration (hh:mm)

General Remarks

was installed with a response zone between 1.50m and 10.00m.
5. SPT hammer EQU2136-2018 (E_r = 87.47%) used.

All dimensions in metres | Scale: **1:50**

Method Used:	Plant Used:	Drilled By:	Logged By:	Checked By:
Concrete coring (300mm) + Cable	**Dando 100 (cut down)**	**Dave Rosenwold**	**MMcCann**	

FINAL

BOREHOLE LOG

Contract:	Client:	Borehole:
Ugly Brown Building	**The Trustees of the St Pancras Way Block A Unit Trust & Big Lobster Ltd**	**BH05**

Contract Ref:	Start:	Ground Level (m AOD):	National Grid Co-ordinate:	Sheet:
371654	**11.01.19** End: **15.01.19**	**21.82**	**E:529570.8 N:183828.5**	**3** of **4**

Samples and In-situ Tests				Water	Backfill & Instrumentation	Description of Strata	Reduced Level	Depth (Thickness)	Material Graphic Legend
Depth	No	Type	Results						
18.50	24	D				Very stiff locally thinly laminated slightly sandy silty CLAY. Sand is fine. With occasional fine gravel sized pockets of grey brown silt / fine sand. (LONDON CLAY FORMATION) *(stratum copied from 13.45m from previous sheet)* . . . Below 18.50m, frequent becoming occasional bioturbations.		(11.05)	
19.00-19.45	9	UT	75 blows 100% recovery						
19.45	25	D							
19.45		V	c_u=>130						
20.00	26	D							
20.50-20.95	6	SPT	N=43						
20.50	27	D							
21.50	28	D				. . . At 21.50m, rare medium sand sized pyrite.			
22.00-22.45	10	UT	85 blows 100% recovery						
22.45	29	D							
23.00	30	D							
23.50-23.95	7	SPT	N=42						
23.50	31	D					-2.68	24.50	
24.50	32	D				Very stiff fissured greenish grey mottled greenish blue CLAY. (LAMBETH GROUP - LOWER MOTTLED BEDS) . . . At 24.80m, fissures are sub-horizontal and 45 degs.			
24.80	33	D							
25.00-25.45	11	UT	80 blows 89% recovery						
25.45	34	D				. . . At 25.45m, mottled, brownish-red, with relict rootlets in blue-grey mottling.		(2.00)	
26.00	35	D				. . . Below 26.00m, becoming light breenish brown mottled greenish blue and brownish red.	-4.68	26.50	
26.50-26.95	8	SPT	N=51			*Description on next sheet*			
26.50	36	D							

Boring Progress and Water Observations					
Date	Time	Borehole Depth	Casing Depth	Borehole Diameter (mm)	Water Depth

Chiselling / Slow Progress		
From	To	Duration (hh:mm)

General Remarks

All dimensions in metres | Scale: **1:50**

Method Used:	Plant Used:	Drilled By:	Logged By:	Checked By:
Concrete coring (300mm) + Cable	**Dando 100 (cut down)**	**Dave Rosenwold**	**MMcCann**	

FINAL

BOREHOLE LOG

Contract:	Client:	Borehole:
Ugly Brown Building	**The Trustees of the St Pancras Way Block A Unit Trust & Big Lobster Ltd**	**BH05**

Contract Ref:	Start:	Ground Level (m AOD):	National Grid Co-ordinate:	Sheet:
371654	**11.01.19** End: **15.01.19**	**21.82**	**E:529570.8 N:183828.5**	**4** of **4**

Samples and In-situ Tests				Water	Backfill & Instru-mentation	Description of Strata	Reduced Level	Depth (Thick ness)	Material Graphic Legend
Depth	No	Type	Results						
27.50	37	D				Very stiff light reddish brown intensely mottled greenish blue and red CLAY. (LAMBETH GROUP - LOWER MOTTLED BEDS) *(stratum copied from 26.50m from previous sheet)*		(1.95)	
28.00-28.45	12	UT	90 blows 89% recovery				-6.63	28.45	
28.45	38	D				Very stiff fissured grey mottled yellowish green silty CLAY. With occasional pockets <10mm of yellowish green silt. (LAMBETH GROUP - LOWER MOTTLED BEDS) . . . Below 29.00m, becoming variably bluish grey, yellow, dark brownish red and purple mottled.			
29.00	39	D							
29.50-29.94	9	SPT	N=53*						
29.50	40	D							
30.50	41	D							
31.00-31.45	13	UT	100 blows 67% recovery						
31.45	42	D						(6.55)	
32.00	43	D							
32.50-32.91	10	SPT	N=59*						
32.80	44	D							
33.80	45	D							
34.00-34.45	14	UT	100 blows 67% recovery				-13.18	35.00	
						Cable percussion borehole terminated at a depth of 35m.			

Boring Progress and Water Observations					
Date	Time	Borehole Depth	Casing Depth	Borehole Diameter (mm)	Water Depth

Chiselling / Slow Progress		
From	To	Duration (hh:mm)

General Remarks

All dimensions in metres | Scale: **1:50**

Method Used:	Plant Used:	Drilled By:	Logged By:	Checked By:
Concrete coring (300mm) + Cable	**Dando 100 (cut down)**	**Dave Rosenwold**	**MMcCann**	

FINAL

BOREHOLE LOG

Contract:	Client:	Borehole:
Ugly Brown Building	**The Trustees of the St Pancras Way Block A Unit Trust & Big Lobster Ltd**	**BH06**

Contract Ref:	Start:	Ground Level (m AOD):	National Grid Co-ordinate:	Sheet:
371654	**17.01.19** End: **21.01.19**	**21.81**	**E:529578.1 N:183803.3**	**1** of **4**

Samples and In-situ Tests				Water	Backfill & Instru-mentation	Description of Strata	Reduced Level	Depth (Thick ness)	Material Graphic Legend
Depth	No	Type	Results						
						Paving slab.	21.71	0.10	
						MADE GROUND: Compact Type I fill.	21.61	0.20	
0.30	1	ES				MADE GROUND: Dark brown very sandy subangular to well rounded fine to coarse concrete, flint, brick and coal GRAVEL. Sand is medium and coarse.			
0.30		PID	0.0ppm						
0.70	2	ES							
0.70		PID	0.0ppm					(1.60)	
1.50-1.95	1	SPT(c)	N=2			. . . At 1.50m, low cobble content of subangular concrete.			
1.50	1	DSPT					20.01	1.80	
						MADE GROUND: Dark brownish grey slightly gravelly very clayey fine to coarse SAND. Gravel is possibly of charcoal and brick.			
						. . . Sample B3 at 2.30m very wet.		(1.30)	
2.50-2.95	2	SPT(c)	N=0	≈					
2.50	2	DSPT							
2.60	3	ES							
2.60		PID	0.0ppm				18.71	3.10	
						(Soft) light orangish brown slightly gravelly CLAY. With occasional pockets of orange fine sand. Gravel is angular to subrounded flint. With fine sand sized selenite. [POSSIBLE REWORKED GROUND]. (LONDON CLAY FORMATION)		(1.15)	
3.80-4.25	1	UT	35 blows 100% recovery				17.56	4.25	
						Firm fissured light orangish brown CLAY. With occasional fine to coarse sand sized selenite. Orange staining on fissure surfaces. (LONDON CLAY FORMATION)			
4.80-5.25	2	UT	35 blows 100% recovery						
6.00-6.45	3	UT	40 blows 100% recovery					(3.70)	
6.45	6	D							
7.00	7	D				. . . Below 7.00m, stiff.			
7.00		V	c_u=139						
7.50-7.95	4	UT	60 blows 100% recovery				13.86	7.95	
7.95	8	D				Stiff thinly laminated dark brownish grey CLAY. With rare mica speckling. (LONDON CLAY FORMATION)			
8.50	9	D				. . . Below 8.50m, fissured.			

Boring Progress and Water Observations					
Date	Time	Borehole Depth	Casing Depth	Borehole Diameter (mm)	Water Depth
17/01/19	08:00		-		
17/01/19		2.80	1.50	150	2.80
17/01/19	17:00	6.50	3.50	150	Dry
18/01/19	08:00	6.50	3.50	150	3.20
18/01/19	17:00	18.50	7.50	150	Dry
21/01/19	08:00	18.50	7.50	150	13.20
21/01/19		18.50	7.50	150	18.50
21/01/19		24.50	7.50	150	24.50

Chiselling / Slow Progress		
From	To	Duration (hh:mm)

General Remarks

1. Inspection pit dug to 1.20m to check for services.
2. Downhole UXO magnetometer survey carried out by specialist.
3. Groundwater seepages encountered at 2.80m, 18.50m and 24.50m depth.
4. On completion, an 80mm diameter standpipe

All dimensions in metres | Scale: **1:50**

Method Used:	Plant Used:	Drilled By:	Logged By:	Checked By:
Inspection pit + Cable percussion	**Dando 100 (cut down)**	**Dave Rosenwold**	**RMiller**	

FINAL

BOREHOLE LOG

Contract:	Client:	Borehole:
Ugly Brown Building	**The Trustees of the St Pancras Way Block A Unit Trust & Big Lobster Ltd**	**BH06**

Contract Ref:	Start:	Ground Level (m AOD):	National Grid Co-ordinate:	Sheet:
371654	**17.01.19** End: **21.01.19**	**21.81**	**E:529578.1 N:183803.3**	**2** of **4**

Samples and In-situ Tests				Water	Backfill & Instru-mentation	Description of Strata	Reduced Level	Depth (Thick ness)	Material Graphic Legend
Depth	No	Type	Results						
9.00-9.45	3	SPT	N=21			Stiff thinly laminated dark brownish grey CLAY. With rare mica speckling. (LONDON CLAY FORMATION) *(stratum copied from 7.95m from previous sheet)*			
9.00	10	D							
9.00	3	DSPT							
10.00	11	D				. . . Below 10.00m, very stiff.			
10.50-10.95	5	UT	60 blows 100% recovery					(5.05)	
10.95	12	D				. . . At 10.95m, rare coarse sand to medium gravel sized pyrite nodules.			
10.95		V	c_u=>150			. . . Below 10.95m, with rare silt partings and grey silt infilled burrows.			
11.50	13	D							
12.00-12.45	4	SPT	N=29						
12.00	14	D							
12.00	4	DSPT					8.81	13.00	
13.00	15	D				Very stiff dark brown slightly sandy CLAY. Sand is fine and medium. With occasional grey clay infilled burrows, occasional mica and rare forams. (LONDON CLAY FORMATION)			
13.50-13.95	6	UT	60 blows 100% recovery			. . . At top; occasional dark green slightly fine sandy pockets.			
13.95	16	D				. . . At 13.95m, rare thick laminations of clay. Rare pyrite nodules <30mm long.			
14.50	17	D							
15.00-15.45	5	SPT	N=35						
15.00	18	D							
15.00	5	DSPT							
16.00	19	D							
16.50-16.95	7	UT	65 blows 100% recovery					(6.95)	
16.95	20	D				. . . Below 16.95m, occasional light brown fine sand lenses <1mm.			
17.50	21	D							

Boring Progress and Water Observations					
Date	Time	Borehole Depth	Casing Depth	Borehole Diameter (mm)	Water Depth
21/01/19	17:00	30.00	7.50	150	Dry

Chiselling / Slow Progress		
From	To	Duration (hh:mm)

General Remarks

was installed to 30m to facilitate downhole geophysical survey.
5. SPT hammer EQU2136-2018 (E_r = 87.47%) used.

All dimensions in metres | Scale: **1:50**

Method Used:	Plant Used:	Drilled By:	Logged By:	Checked By:
Inspection pit + Cable percussion	**Dando 100 (cut down)**	**Dave Rosenwold**	**RMiller**	

FINAL

BOREHOLE LOG

Contract:	Client:	Borehole:
Ugly Brown Building	**The Trustees of the St Pancras Way Block A Unit Trust & Big Lobster Ltd**	**BH06**

Contract Ref:	Start:	Ground Level (m AOD):	National Grid Co-ordinate:	Sheet:
371654	**17.01.19** End: **21.01.19**	**21.81**	**E:529578.1 N:183803.3**	**3** of **4**

Samples and In-situ Tests				Water	Backfill & Instru-mentation	Description of Strata	Reduced Level	Depth (Thick ness)	Material Graphic Legend
Depth	No	Type	Results						
18.00-18.45	6	SPT	N=40			Very stiff dark brown slightly sandy CLAY. Sand is fine and medium. With occasional grey clay infilled burrows, occasional mica and rare forams. (LONDON CLAY FORMATION) *(stratum copied from 13.00m from previous sheet)*			
18.00	22	D							
18.00	6	DSPT		≈					
19.00	23	D							
19.50-19.95	8	UT	55 blows 89% recovery						
							1.86	19.95	
19.95	24	D				Recovered as soft and disintegrated. Possible sand band mixed with dark brown slightly sandy silty CLAY with light brown fine sand partings. (LONDON CLAY FORMATION)		(0.55)	
							1.31	20.50	
20.50	25	D				Very stiff dark brown slightly sandy CLAY. Sand is fine and medium. With occasional grey clay infilled burrows, occasional mica and rare forams. (LONDON CLAY FORMATION)		(0.50)	
							0.81	21.00	
21.00-21.45	7	SPT	N=35			Very stiff fissured dark greyish brown CLAY. Rare pyrite nodules <20mm. (LONDON CLAY FORMATION)		(1.00)	
21.00	26	D							
21.00	7	DSPT							
							-0.19	22.00	
22.00	27	D				Very stiff slightly sandy silty CLAY. Sand is fine and medium. Occasional forams and light brown fine sand pockets <2mm. Occasional dark green fine sandy pockets <2mm. (LONDON CLAY FORMATION)			
22.50-22.95	9	UT	60 blows 89% recovery						
22.95	28	D						(2.80)	
23.50	29	D							
24.00-24.45	8	SPT	N=45						
24.00	30	D							
24.00	8	DSPT		≈					
							-2.99	24.80	
25.00	31	D				Very stiff fissured brown, reddish brown and blue-grey mottled CLAY. Fissures are blocky. (LAMBETH GROUP - LOWER MOTTLED BEDS)			
25.50-25.95	10	UT	90 blows 67% recovery						
25.95	32	D				. . . Below 25.95m, hard, reddish brown mottled blue-grey.			
26.50	33	D						(4.15)	

Boring Progress and Water Observations					
Date	Time	Borehole Depth	Casing Depth	Borehole Diameter (mm)	Water Depth

Chiselling / Slow Progress		
From	To	Duration (hh:mm)

General Remarks

All dimensions in metres | Scale: **1:50**

Method Used:	Plant Used:	Drilled By:	Logged By:	Checked By:
Inspection pit + Cable percussion	**Dando 100 (cut down)**	**Dave Rosenwold**	**RMiller**	

FINAL

BOREHOLE LOG

Contract:	Client:	Borehole:
Ugly Brown Building	**The Trustees of the St Pancras Way Block A Unit Trust & Big Lobster Ltd**	**BH06**

Contract Ref:	Start:	Ground Level (m AOD):	National Grid Co-ordinate:	Sheet:
371654	**17.01.19** End: **21.01.19**	**21.81**	**E:529578.1 N:183803.3**	**4** of **4**

Samples and In-situ Tests				Water	Backfill & Instru-mentation	Description of Strata	Reduced Level	Depth (Thick ness)	Material Graphic Legend
Depth	No	Type	Results						
27.00-27.44	9	SPT	N=52*			Very stiff fissured brown, reddish brown and blue-grey mottled CLAY. Fissures are blocky. (LAMBETH GROUP - LOWER MOTTLED BEDS) *(stratum copied from 24.80m from previous sheet)*			
27.00	34	D							
27.00	9	DSPT							
28.00	35	D				. . . At 28.00m, mottled brown. With 1No. 45 degree fissure undulating, smooth, polished.			
28.50-28.95	11	UT	90 blows 89% recovery				-7.14	28.95	
28.95	36	D				Very stiff fissured blue-grey mottled reddish brown and yellowish brown CLAY. Fissures are blocky. (LAMBETH GROUP - LOWER MOTTLED BEDS)		(1.05)	
29.00-29.41	10	SPT	N=58*						
29.30	37	D							
29.50	10	DSPT							
29.50	38	D					-8.19	30.00	
						Cable percussion borehole terminated at a depth of 30m.			

Boring Progress and Water Observations					
Date	Time	Borehole Depth	Casing Depth	Borehole Diameter (mm)	Water Depth

Chiselling / Slow Progress		
From	To	Duration (hh:mm)

General Remarks

All dimensions in metres | Scale: **1:50**

Method Used:	Plant Used:	Drilled By:	Logged By:	Checked By:
Inspection pit + Cable percussion	**Dando 100 (cut down)**	**Dave Rosenwold**	**RMiller**	

FINAL

BOREHOLE LOG

Contract:	Client:	Borehole:
Ugly Brown Building	**The Trustees of the St Pancras Way Block A Unit Trust & Big Lobster Ltd**	**BH07**

Contract Ref:	Start:	Ground Level (m AOD):	National Grid Co-ordinate:	Sheet:
371654	**23.02.19** End: **25.02.19**	**23.65**	**E:529593.0 N:183823.2**	**1** of **3**

Samples and In-situ Tests				Water	Backfill & Instru-mentation	Description of Strata	Reduced Level	Depth (Thick ness)	Material Graphic Legend
Depth	No	Type	Results						
						REINFORCED CONCRETE . . . 6mm smooth steel rebar at 0.03 m depth . . . 12 mm ribbed steel rebar at 0.12 m depth	23.45	0.20	
						MADE GROUND: Brown very sandy fine to coarse concrete and brick GRAVEL with a high cobble content. Cobbles are of concrete and brick with occasional pieces of timber and rare pieces of metal.			
1.50	1	DSPT						(2.90)	
1.50-1.95	2	SPT(c)	N=18						
1.75	24	D							
2.50	3	DSPT							
2.50-2.95	4	SPT(c)	N=17						
3.00	5	ES					20.55	3.10	
3.00	6	D				Firm brown and orange brown CLAY. With partings of orange brown silt. (LONDON CLAY FORMATION)			
3.00		PID	0.0ppm						
3.10	7	ES							
3.10	8	D							
3.10		PID	0.0ppm						
3.50-3.95	9	UT	11 blows 100% recovery						
4.00	10	D							
4.00		V	c_u=70						
4.50-4.95	11	UT	14 blows 100% recovery						
5.00	12	D							
5.50-5.95	13	UT	19 blows 100% recovery					(5.60)	
6.00	14	D				. . . At 6.00m, indistinctly fissured with abundant partings of orange brown silt.			
6.50-6.95	15	UT	23 blows 100% recovery						
7.00	16	D				. . . Below 7.00m, becoming thinly laminated.			
7.00		V	c_u=74						
8.00	17	DSPT				. . . At 8.00m, fine gravel sized selenite crystals.			
8.00-8.45	18	SPT	N=21				14.95	8.70	
8.75	19	D				*Description on next sheet*			

Boring Progress and Water Observations					
Date	Time	Borehole Depth	Casing Depth	Borehole Diameter (mm)	Water Depth
23/01/19	08:00	1.30	-		
23/01/19	10:00	3.20	3.20	200	
23/01/19	17:00	10.00	7.00	150	Dry
24/01/19	08:00	10.00	7.00	150	Dry
24/01/19	14:00	21.30	7.00	150	21.30
24/01/19	17:00	25.00	7.00	150	

Chiselling / Slow Progress		
From	To	Duration (hh:mm)

General Remarks

1. Inspection pit dug to 1.30m using a machine excavator to faciliate structural survey of sheet piled canal wall.
2. Inspection pit backfilled prior to drilling to allow the rig to set up safely.
3. Borehole drilled between buried canal wall and existing sheet piled canal wall.

All dimensions in metres | Scale: **1:50**

Method Used:	Plant Used:	Drilled By:	Logged By:	Checked By:
Inspection pit + Cable percussion	**Bespoke Rig**	**Mark Taylor**	**MMcCann**	

FINAL

BOREHOLE LOG

Contract:	Client:	Borehole:
Ugly Brown Building	**The Trustees of the St Pancras Way Block A Unit Trust & Big Lobster Ltd**	**BH07**

Contract Ref:	Start:	Ground Level (m AOD):	National Grid Co-ordinate:	Sheet:
371654	**23.02.19** End: **25.02.19**	**23.65**	**E:529593.0 N:183823.2**	**2** of **3**

Samples and In-situ Tests				Water	Backfill & Instru-mentation	Description of Strata	Reduced Level	Depth (Thick ness)	Material Graphic Legend
Depth	No	Type	Results						
						Stiff becoming very stiff dark grey brown silty CLAY. (LONDON CLAY FORMATION) *(stratum copied from 8.70m from previous sheet)*			
9.50-9.95	20	UT	29 blows 100% recovery						
10.00	21	D							
11.00	22	DSPT				. . . Below 11.00m, becoming thinly laminated.			
11.00-11.45	23	SPT	N=26						
						. . . At 11.75m, occasional pockets of grey brown silt / fine sand.			
12.50-12.95	25	UT	32 blows 100% recovery						
13.00	26	D							
14.00	27	DSPT							
14.00-14.45	28	SPT	N=31						
14.75	29	D				. . . Below 14.75m, laminations becoming more prominent.			
15.50-15.95	30	UT	40 blows 100% recovery						
16.00	31	D				. . . At 16.00m, bioturbations <1mm diameter.			
16.00		V	c_u=>130					(16.30)	
17.00	32	DSPT							
17.00-17.45	33	SPT	N=35						
17.75	34	D				*Description on next sheet*			

Boring Progress and Water Observations					
Date	Time	Borehole Depth	Casing Depth	Borehole Diameter (mm)	Water Depth

Chiselling / Slow Progress		
From	To	Duration (hh:mm)

General Remarks

4. Downhole UXO magnetometer survey carried out by specialist.
5. Groundwater seepage encountered at 21.30 m depth.
6. On completion, an 80mm diameter standpipe was installed to 25m to facilitate downhole geophysical survey.

All dimensions in metres | Scale: **1:50**

Method Used:	Plant Used:	Drilled By:	Logged By:	Checked By:
Inspection pit + Cable percussion	**Bespoke Rig**	**Mark Taylor**	**MMcCann**	

FINAL

BOREHOLE LOG

Contract:	Client:	Borehole:
Ugly Brown Building	**The Trustees of the St Pancras Way Block A Unit Trust & Big Lobster Ltd**	**BH07**

Contract Ref:	Start:	Ground Level (m AOD):	National Grid Co-ordinate:	Sheet:
371654	**23.02.19** End: **25.02.19**	**23.65**	**E:529593.0 N:183823.2**	**3** of **3**

Samples and In-situ Tests				Water	Backfill & Instru-mentation	Description of Strata	Reduced Level	Depth (Thick ness)	Material Graphic Legend
Depth	No	Type	Results						
						. . . At 17.75, occasional fine gravel sized pockets of grey brown silt / fine sand. Stiff becoming very stiff dark grey brown silty CLAY. (LONDON CLAY FORMATION) *(stratum copied from 8.70m from previous sheet)*			
18.50-18.95	35	UT	45 blows 100% recovery						
19.00	36	D							
20.00	37	DSPT				. . . At 20.00m, frequent bioturbations <1mm diameter.			
20.00-20.45	38	SPT	N=38						
20.75	39	D				. . . At 20.75m, abundant pockets of grey brown silt / fine sand.			
21.50-21.95	40	UT	52 blows 100% recovery						
22.00	41	D							
22.00		V	c_u=>130						
23.00	42	DSPT							
23.00-23.45	43	SPT	N=43						
23.75	44	D				. . . At 23.75, fine gravel sized pyrite nodule.			
24.50-24.95	45	UT	57 blows 100% recovery						
							-1.35	25.00	
25.00	46	D				Cable percussion borehole terminated at a depth of 25m.			

Boring Progress and Water Observations					
Date	Time	Borehole Depth	Casing Depth	Borehole Diameter (mm)	Water Depth

Chiselling / Slow Progress		
From	To	Duration (hh:mm)

General Remarks

7. SPT hammer GEH3-2019 (E_r = 47.00%) used.

All dimensions in metres | Scale: **1:50**

Method Used:	Plant Used:	Drilled By:	Logged By:	Checked By:
Inspection pit + Cable percussion	**Bespoke Rig**	**Mark Taylor**	**MMcCann**	

FINAL

BOREHOLE LOG

Contract:	Client:	Borehole:
Ugly Brown Building	**The Trustees of the St Pancras Way Block A Unit Trust & Big Lobster Ltd**	**BH10**

Contract Ref:	Start:	Ground Level (m AOD):	National Grid Co-ordinate:	Sheet:
371654	**06.02.19** End: **11.02.19**	**23.69**	**E:529612.2 N:183801.3**	**1** of **3**

Samples and In-situ Tests				Water	Backfill & Instru-mentation	Description of Strata	Reduced Level	Depth (Thick ness)	Material Graphic Legend
Depth	No	Type	Results						
						REINFORCED CONCRETE	23.49	0.20	
						. . . 10mm ribbed steel rebar at 0.10 m depth			
						WEAK CONCRETE	23.19	0.50	
						MADE GROUND: (Loose) red brown COBBLES of whole and fragmented bricks. With localised pockets of orange brown sandy fine to coarse concrete and brick gravel.		(1.45)	
							21.74	1.95	
2.00	1	DSPT				MADE GROUND: Dark brown slightly sandy gravelly CLAY. Gravel is subangular fine to coarse concrete and brick.			
2.00	2	ES							
2.00-2.06	3	SPT(c)	NP					(1.15)	
2.00		PID	0.0ppm						
							20.59	3.10	
3.00	4	DSPT				MADE GROUND: Recovered as light brown slightly gravelly very sandy CLAY.			
3.00	5	ES							
3.00-3.06	6	SPT(c)	NP					(1.10)	
3.00		PID	0.1ppm						
							19.49	4.20	
4.00	7	DSPT				MADE GROUND: Light brown sandy GRAVEL of fine to coarse angular flint.	19.29	4.40	
4.00	8	ES							
4.00-4.07	9	SPT(c)	NP						
4.00		PID	0.0ppm			CONCRETE - probably canal wall footing.	18.99	4.70	
4.40	10	D				MADE GROUND: Light brown sandy subangular to subrounded fine to coarse flint GRAVEL.		(0.60)	
5.00	11	DSPT							
5.00-5.45	12	SPT	N=21				18.39	5.30	
5.50	13	DSPT				Firm to stiff thinly laminated brown and orange brown CLAY. With partings of orange brown silt. (LONDON CLAY FORMATION)			
5.50-5.95	14	SPT	N=19						
6.00	14	D				. . . At 6.00m, fine sand size selenite crystals.			
6.50-6.95	15	UT	23 blows 100% recovery					(3.10)	
7.00	16	D							
7.00		V	c_u=55						
7.50	17	DSPT							
7.50-7.95	18	SPT	N=22						
8.00	19	D				. . . At 8.00m, fine gravel sized selenite crystals.			
							15.29	8.40	
8.40	20	D				Stiff thinly laminated dark grey brown CLAY. (LONDON CLAY FORMATION)			
8.50-8.95	21	UT	27 blows 100% recovery						

Boring Progress and Water Observations					
Date	Time	Borehole Depth	Casing Depth	Borehole Diameter (mm)	Water Depth
06/02/19	08:00	1.60	-		
06/02/19		3.10	3.10	200	
06/02/19	17:00	3.10	3.10	200	
07/02/19	08:00	3.10	3.10	200	
07/02/19	17:00	8.00	5.60	150	
08/02/19	08:00	8.00	5.60	150	
08/02/19		14.50	5.60	150	14.50
08/02/19	17:00	20.50	5.60	150	

Chiselling / Slow Progress		
From	To	Duration (hh:mm)
1.70	3.10	04:00
3.10	4.20	03:00
4.40	4.70	00:50

General Remarks

1. Inspection pit dug to 1.60m using machine excavator to faciliate structural survey of sheet piled canal wall.
2. Inspection pit backfilled prior to drilling to allow the rig to set up safely.
3. Borehole drilled between buried canal wall and existing sheet piled canal wall.

All dimensions in metres | Scale: **1:50**

Method Used:	Plant Used:	Drilled By:	Logged By:	Checked By:
Inspection pit + Cable percussion	**Bespoke Rig**	**Mark Taylor**	**MMcCann**	

FINAL

BOREHOLE LOG

Contract:	Client:	Borehole:
Ugly Brown Building	**The Trustees of the St Pancras Way Block A Unit Trust & Big Lobster Ltd**	**BH10**

Contract Ref:	Start:	Ground Level (m AOD):	National Grid Co-ordinate:	Sheet:
371654	**06.02.19** End: **11.02.19**	**23.69**	**E:529612.2 N:183801.3**	**2** of **3**

Samples and In-situ Tests				Water	Backfill & Instru-mentation	Description of Strata	Reduced Level	Depth (Thick ness)	Material Graphic Legend
Depth	No	Type	Results						
9.00	22	D				Stiff thinly laminated dark grey brown CLAY. (LONDON CLAY FORMATION) *(stratum copied from 8.40m from previous sheet)*			
9.00		V	c_u=>130						
9.50	23	DSPT							
9.50-9.95	24	SPT	N=25						
10.25	25	D				. . . At 10.25m, rare fine gravel sized selenite crystals.			
11.00-11.45	26	UT	36 blows 100% recovery						
11.50	27	D				. . . At 11.50m, light grey brown claystone band ~100 mm thick.			
12.50	28	DSPT							
12.50-12.95	29	SPT	N=28					(9.10)	
13.25	30	D							
14.00-14.45	31	UT	46 blows 100% recovery	≈					
14.50	32	D				. . . At 14.50m, light grey brown claytone band ~100 mm thick.			
15.50	33	DSPT							
15.50-15.95	34	SPT	N=31						
16.25	35	D				. . . At 16.25m, bioturbations <1mm diameter.			
17.00-17.45	36	UT	45 blows 100% recovery				6.19	17.50	
17.50	37	D				*Description on next sheet*			
17.50		V	c_u=>130						

Boring Progress and Water Observations					
Date	Time	Borehole Depth	Casing Depth	Borehole Diameter (mm)	Water Depth
11/02/19	08:00	20.50	5.60	150	
11/02/19	17:00	25.00	5.60	150	

Chiselling / Slow Progress		
From	To	Duration (hh:mm)

General Remarks

4. Groundwater seepage encountered at 14.50 m depth.
5. On completion, an 80mm diameter standpipe was installed to 25m to facilitate downhole geophysical survey.
6. SPT hammer GEH3-2019 (E_r = 47.00%) used.

All dimensions in metres | Scale: **1:50**

Method Used:	Plant Used:	Drilled By:	Logged By:	Checked By:
Inspection pit + Cable percussion	**Bespoke Rig**	**Mark Taylor**	**MMcCann**	

FINAL

BOREHOLE LOG

Contract:	Client:	Borehole:
Ugly Brown Building	**The Trustees of the St Pancras Way Block A Unit Trust & Big Lobster Ltd**	**BH10**

Contract Ref:	Start:	Ground Level (m AOD):	National Grid Co-ordinate:	Sheet:
371654	**06.02.19** End: **11.02.19**	**23.69**	**E:529612.2 N:183801.3**	**3** of **3**

Samples and In-situ Tests				Water	Backfill & Instru-mentation	Description of Strata	Reduced Level	Depth (Thick ness)	Material Graphic Legend
Depth	No	Type	Results						
18.50	38	DSPT				Very stiff dark greyish brown slightly sandy silty CLAY. Sand is fine. (LONDON CLAY FORMATION) *(stratum copied from 17.50m from previous sheet)*			
18.50-18.95	39	SPT	N=34			. . . At 18.50m, occasional pockets of grey brown silt / fine sand.			
19.25	40	D							
20.00-20.45	41	UT	51 blows 100% recovery						
20.50	42	D				. . . Below 20.50m, becoming thinly laminated.		(7.50)	
21.50	43	DSPT				. . . At 21.50m, bioturbations <1mm diameter.			
21.50-21.95	44	SPT	N=40						
22.25	45	D				. . . At 22.50m, abundant pockets of grey brown silt / fine sand.			
23.00	46	D							
23.50-23.95	47	UT	57 blows 100% recovery						
24.50	48	DSPT				. . . At 24.50m, bioturbations <1mm diameter.			
24.50-24.95	49	SPT	N=45						
25.00	50	D				. . . At 25.00m, occasional pockets of grey brown silt / fine sand. Cable percussion borehole terminated at a depth of 25m.	-1.31	25.00	

Boring Progress and Water Observations					
Date	Time	Borehole Depth	Casing Depth	Borehole Diameter (mm)	Water Depth

Chiselling / Slow Progress		
From	To	Duration (hh:mm)

General Remarks

All dimensions in metres | Scale: **1:50**

Method Used:	Plant Used:	Drilled By:	Logged By:	Checked By:
Inspection pit + Cable percussion	**Bespoke Rig**	**Mark Taylor**	**MMcCann**	

FINAL

BOREHOLE LOG

Contract:	Client:	Borehole:
Ugly Brown Building	**The Trustees of the St Pancras Way Block A Unit Trust & Big Lobster Ltd**	**BH11**

Contract Ref:	Start:	Ground Level (m AOD):	National Grid Co-ordinate:	Sheet:
371654	**23.01.19** End: **25.01.19**	**21.70**	**E:529585.7 N:183781.8**	**1** of **5**

Samples and In-situ Tests				Water	Backfill & Instru-mentation	Description of Strata	Reduced Level	Depth (Thickness)	Material Graphic Legend
Depth	No	Type	Results						
						MADE GROUND: Paving slab.	21.66	0.04	
						MADE GROUND: Weak CONCRETE.	21.64	0.06	
0.30	1	ES				MADE GROUND: Dark brown sandy silty CLAY with rootlets throughout.		(0.74)	
0.30		PID	0.0ppm				20.90	0.80	
0.70	2	ES				MADE GROUND: Dark brown and orange brown slightly gravelly silty CLAY. With occasional fragments of brick, concrete and clinker. Occasional decomposing roots and rootlets and occasional carbonaceous pockets <5mm and occasional blue-grey gleying.		(0.70)	
0.70		PID	0.0ppm						
1.20	3	ES							
1.20		PID	0.0ppm				20.20	1.50	
1.30-1.75	1	SPT(c)	N=6			. . . At 1.20m, fragment of timber.			
1.30	1	DSPT							
2.10-2.55	1	UT	18 blows 100% recovery			Firm fissured brown silty CLAY. With occasional orange-brown fine sand pockets and lenses <1mm and blue-grey gleying around rootlets. With occasional coarse sand sized selenite crystals. Fissures are extremely closely spaced, randomly orientated. (LONDON CLAY FORMATION)			
3.00-3.45	2	UT	32 blows 100% recovery			. . . At 3.45m, 1No vertical fissure. Fissure is stained orange-brown.			
4.00-4.45	3	UT	38 blows 100% recovery			. . . At 4.45m, orange-brown fine sand lenses and pockets are frequent, with frequent fine sand partings. Rare rootlets.		(5.70)	
5.00-5.45	4	UT	50 blows 100% recovery	≈		. . . Below 5.45m, stiff, brown mottled orange-brown.			
						. . . Below 6.00m, rare selenite.			
6.50-6.95	5	UT	50 blows 100% recovery				14.50	7.20	
						Stiff fissured dark brownish grey CLAY. With occasional mica. Fissures are extremely closely spaced, randomly orientated. With occasional blue-grey clay infilled burrows. (LONDON CLAY FORMATION)			
8.00-8.45	2	SPT	N=23			. . . At top, rare lenses of orange-brown clay.			
8.00	2	DSPT							

Boring Progress and Water Observations					
Date	Time	Borehole Depth	Casing Depth	Borehole Diameter (mm)	Water Depth
23/01/19	08:00		-		
23/01/19		6.00	1.50	150	6.00
23/01/19	17:00	14.50	8.00	150	Dry
24/01/19	08:00	14.50	8.00	150	11.20
24/01/19		19.00	8.00	150	19.00
24/01/19		24.00	8.00	150	24.00
24/01/19		26.00	26.00	125	Dry
24/01/19	17:00	28.50	27.00	125	Dry

Chiselling / Slow Progress		
From	To	Duration (hh:mm)

General Remarks

1. Inspection pit dug to 1.20m to check for services.
2. Groundwater seepages encountered at 6.00m, 19.00m and 24.00m depth.
3. On completion, a 50mm diameter standpipe was installed with a response zone between 1.50m and 7.00m.

All dimensions in metres | Scale: **1:50**

Method Used:	Plant Used:	Drilled By:	Logged By:	Checked By:
Inspection pit + Cable percussion	**Dando 100 (cut down)**	**Dave Rosenwold**	**RMiller**	

FINAL

BOREHOLE LOG

Contract:	Client:	Borehole:
Ugly Brown Building	**The Trustees of the St Pancras Way Block A Unit Trust & Big Lobster Ltd**	**BH11**

Contract Ref:	Start:	Ground Level (m AOD):	National Grid Co-ordinate:	Sheet:
371654	**23.01.19** End: **25.01.19**	**21.70**	**E:529585.7 N:183781.8**	**2** of **5**

Samples and In-situ Tests				Water	Backfill & Instru-mentation	Description of Strata	Reduced Level	Depth (Thick ness)	Material Graphic Legend
Depth	No	Type	Results						
9.00	12	D				Stiff fissured dark brownish grey CLAY. With occasional mica. Fissures are extremely closely spaced, randomly orientated. With occasional blue-grey clay infilled burrows. (LONDON CLAY FORMATION) *(stratum copied from 7.20m from previous sheet)*			
9.50-9.95	6	UT	50 blows 100% recovery						
9.95	13	D				. . . At 9.95m, with thick laminations of very stiff / hard light brown silt / claystone.		(6.30)	
10.50	14	D				. . . Below 9.95m, fissures are closely spaced.			
11.00-11.45	3	SPT	N=25			. . . Below 11.00m, rare forams.			
11.00	15	D							
11.00	3	DSPT							
12.00	16	D							
12.50-12.95	7	UT	60 blows 100% recovery						
12.95	17	D					8.20	13.50	
13.50	18	D				Very stiff dark greyish brown slightly sandy CLAY. Sand is fine. Occasional mica and grey clay infilled burrows. Occasional light brown fine sand lenses and pockets <1mm. (LONDON CLAY FORMATION)			
14.00-14.45	4	SPT	N=35						
14.00	19	D							
14.00	4	DSPT							
15.00	20	D				. . . Below 15.00m, indistinctly fissured. Occasional forams.			
15.50-15.95	8	UT	70 blows 100% recovery			. . . Between 15.00m and 15.45m, rare pyrite <10mm and 1No. partially pyritised wood fragment 30mm long.			
15.95	21	D						(5.45)	
16.50	22	D							
17.00-17.45	5	SPT	N=37						
17.00	23	D							
17.00	5	DSPT							

Boring Progress and Water Observations					
Date	Time	Borehole Depth	Casing Depth	Borehole Diameter (mm)	Water Depth
25/01/19	08:00	28.50	27.00	125	24.20
25/01/19	17:00	40.00	27.00	125	Dry

Chiselling / Slow Progress		
From	To	Duration (hh:mm)

General Remarks

4. SPT hammer EQU2136-2018 (E_r = 87.47%) used.

All dimensions in metres | Scale: **1:50**

Method Used:	Plant Used:	Drilled By:	Logged By:	Checked By:
Inspection pit + Cable percussion	**Dando 100 (cut down)**	**Dave Rosenwold**	**RMiller**	

FINAL

BOREHOLE LOG

Contract:	Client:	Borehole:
Ugly Brown Building	**The Trustees of the St Pancras Way Block A Unit Trust & Big Lobster Ltd**	**BH11**

Contract Ref:	Start:	Ground Level (m AOD):	National Grid Co-ordinate:	Sheet:
371654	**23.01.19** End: **25.01.19**	**21.70**	**E:529585.7 N:183781.8**	**3** of **5**

Samples and In-situ Tests				Water	Backfill & Instrumentation	Description of Strata	Reduced Level	Depth (Thickness)	Material Graphic Legend
Depth	No	Type	Results						
18.00	24	D				Very stiff dark greyish brown slightly sandy CLAY. Sand is fine. Occasional mica and grey clay infilled burrows. Occasional light brown fine sand lenses and pockets <1mm. (LONDON CLAY FORMATION) *(stratum copied from 13.50m from previous sheet)*			
18.50-18.95	9	UT	75 blows 89% recovery				2.75	18.95	
18.95	25	D				Very stiff dark brown silty CLAY. With occasional light brown fine sand lenses <1mm. Occasional forams and grey clay infilled burrows. Rare partially pyritised wood fragments <15mm. (LONDON CLAY FORMATION)		(0.55)	
19.50	26	D				Very stiff dark greyish brown slightly sandy CLAY. Sand is fine and medium. With occasional mica and grey clay infilled burrows and light brown fine sand lenses and pockets <1mm. With frequent becoming occasional forams. (LONDON CLAY FORMATION)	2.20	19.50	
20.00-20.45	6	SPT	N=41						
20.00	27	D							
20.00	6	DSPT							
21.00	28	D				. . . At 21.00m, occasional pyrite nodules <25mm.			
21.50-21.95	10	UT	75 blows 89% recovery						
21.95	29	D						(5.30)	
22.50	30	D							
23.00-23.45	7	SPT	N=45			. . . At 23.00m, horizon of soft very sandy clay. Possible drilling disturbance.			
23.00	31	D							
23.00	7	DSPT							
24.00	32	D							
24.50-24.95	11	UT	90 blows 78% recovery				-3.10	24.80	
24.95	33	D				Very stiff fissured light greyish brown and blue-grey mottled CLAY. Fissures are blocky. (LAMBETH GROUP - LOWER MOTTLED BEDS)			
25.50	34	D				. . . At 25.50m, rare decomposed rootlets.			
26.00	8	DSPT				. . . Below 26.00m, mottled reddish brown.			
26.00-26.45	9	SPT	N=50					(3.15)	
26.00	35	D							

Boring Progress and Water Observations					
Date	Time	Borehole Depth	Casing Depth	Borehole Diameter (mm)	Water Depth

Chiselling / Slow Progress		
From	To	Duration (hh:mm)

General Remarks

All dimensions in metres | Scale: **1:50**

Method Used:	Plant Used:	Drilled By:	Logged By:	Checked By:
Inspection pit + Cable percussion	**Dando 100 (cut down)**	**Dave Rosenwold**	**RMiller**	

FINAL

BOREHOLE LOG

Contract:	Client:	Borehole:
Ugly Brown Building	**The Trustees of the St Pancras Way Block A Unit Trust & Big Lobster Ltd**	**BH11**

Contract Ref:	Start:	Ground Level (m AOD):	National Grid Co-ordinate:	Sheet:
371654	**23.01.19** End: **25.01.19**	**21.70**	**E:529585.7 N:183781.8**	**4** of **5**

Samples and In-situ Tests				Water	Backfill & Instru-mentation	Description of Strata	Reduced Level	Depth (Thick ness)	Material Graphic Legend
Depth	No	Type	Results						
27.00	36	D				Very stiff fissured light greyish brown and blue-grey mottled CLAY. Fissures are blocky. (LAMBETH GROUP - LOWER MOTTLED BEDS) *(stratum copied from 24.80m from previous sheet)*			
27.50-27.95	12	UT	100 blows 67% recovery				-6.25	27.95	
27.95	37	D				Very stiff fissured blue-grey mottled brown CLAY. Fissures are blocky. (LAMBETH GROUP - LOWER MOTTLED BEDS) . . . At 28.00m, 2No. 45 degree fissures, smooth, polished.			
28.50	38	D							
29.00	9	DSPT				. . . Below 29.00m, becoming variably mottled blue-grey, yellow brown, purplish red and greyish purple.			
29.00-29.38	10	SPT	N=63*						
29.00	39	D							
30.00	40	D							
30.50-30.95	13	UT	110 blows 67% recovery						
30.95	41	D							
31.50	42	D							
32.00	10	DSPT							
32.00-32.36	11	SPT	N=71*						
32.00	43	D						(10.05)	
33.00	44	D							
33.50-33.95	14	UT	110 blows 56% recovery						
33.95	45	D							
34.50	46	D							
35.50	11	DSPT							
35.50-35.85	12	SPT	N=75*						
35.50	47	D							

Boring Progress and Water Observations					
Date	Time	Borehole Depth	Casing Depth	Borehole Diameter (mm)	Water Depth

Chiselling / Slow Progress		
From	To	Duration (hh:mm)

General Remarks

All dimensions in metres | Scale: **1:50**

Method Used:	Plant Used:	Drilled By:	Logged By:	Checked By:
Inspection pit + Cable percussion	**Dando 100 (cut down)**	**Dave Rosenwold**	**RMiller**	

FINAL

BOREHOLE LOG

Contract:	Client:	Borehole:
Ugly Brown Building	**The Trustees of the St Pancras Way Block A Unit Trust & Big Lobster Ltd**	**BH11**

Contract Ref:	Start:	Ground Level (m AOD):	National Grid Co-ordinate:	Sheet:
371654	**23.01.19** End: **25.01.19**	**21.70**	**E:529585.7 N:183781.8**	**5** of **5**

Samples and In-situ Tests				Water	Backfill & Instru-mentation	Description of Strata	Reduced Level	Depth (Thick ness)	Material Graphic Legend
Depth	No	Type	Results						
36.50	48	D				Very stiff fissured blue-grey mottled brown CLAY. Fissures are blocky. (LAMBETH GROUP - LOWER MOTTLED BEDS) *(stratum copied from 27.95m from previous sheet)* . . . At 36.50m, 1No 45 degree fissure, planar, smooth, polished.			
37.50	12	DSPT							
37.50-37.83	13	SPT	N=83*						
37.50	49	D					-16.30	38.00	
38.50	50	D				Very stiff dark brown very sandy CLAY. Sand is fine. With pockets <70mm of (soft) brown, red and blue-grey mottled clay. Occasional pockets <10mm of grey fine and medoum sand. Possibly a sand band mixed with clay. (LAMBETH GROUP - LOWER MOTTLED BEDS)			
39.00	51	D						(2.00)	
39.50	13	DSPT							
39.50-39.71	14	SPT	N=150*			. . . Between 39.50m and 40.00m, greyish brown slightly silty fine SAND. With occasional pockets <5mm of (soft) blue-grey clay.			
39.50	52	D					-18.30	40.00	
						Cable percussion borehole terminated at a depth of 40m.			

Boring Progress and Water Observations					
Date	Time	Borehole Depth	Casing Depth	Borehole Diameter (mm)	Water Depth

Chiselling / Slow Progress		
From	To	Duration (hh:mm)

General Remarks

All dimensions in metres | Scale: **1:50**

Method Used:	Plant Used:	Drilled By:	Logged By:	Checked By:
Inspection pit + Cable percussion	**Dando 100 (cut down)**	**Dave Rosenwold**	**RMiller**	

FINAL

BOREHOLE LOG

Contract:	Client:	Borehole:
Ugly Brown Building	**The Trustees of the St Pancras Way Block A Unit Trust & Big Lobster Ltd**	**BH12**

Contract Ref:	Start:	Ground Level (m AOD):	National Grid Co-ordinate:	Sheet:
371654	**18.01.19** End: **18.01.19**	**21.24**	**E:529586.0 N:183759.7**	**1** of **1**

Samples and In-situ Tests				Water	Backfill	Description of Strata	Reduced Level	Depth (Thickness)	Material Graphic Legend
Depth	No	Type	Results						
0.00-0.50	1	B				MADE GROUND: Paving slab.	21.19	0.05	
						MADE GROUND: Coarse yellow brown SAND.	21.04	0.20	
0.50-1.00	2	B				MADE GROUND: Brown silty very sandy angular to subangular fine to coarse red brick and concrete GRAVEL.		(1.00)	
							20.04	1.20	

Boring Progress and Water Observations					
Date	Time	Borehole Depth	Casing Depth	Borehole Diameter (mm)	Water Depth

Chiselling / Slow Progress		
From	To	Duration (hh:mm)

General Remarks

1. Inspection pit dug to 1.20m to check for services. Pit terminated on concrete obstruction at 1.20m and borehole relocated to BH12A.

All dimensions in metres | Scale: **1:50**

Method Used:	Plant Used:	Drilled By:	Logged By:	Checked By:
Inspection pit + Cable percussion	**Dando 2000 Mark 2**	**Dave Hutson**	**RMiller**	

FINAL

BOREHOLE LOG

Contract:	Client:	Borehole:
Ugly Brown Building	**The Trustees of the St Pancras Way Block A Unit Trust & Big Lobster Ltd**	**BH12A**

Contract Ref:	Start:	Ground Level (m AOD):	National Grid Co-ordinate:	Sheet:
371654	**18.01.19** End: **21.01.19**	**21.27**	**E:529585.3 N:183761.0**	**1** of **4**

Samples and In-situ Tests				Water	Backfill & Instru-mentation	Description of Strata	Reduced Level	Depth (Thick ness)	Material Graphic Legend
Depth	No	Type	Results						
0.00-0.50	1	B				MADE GROUND: Paving slab.	21.22	0.05	
						MADE GROUND: Yellowish brown coarse SAND.	21.17	0.10	
						MADE GROUND: CONCRETE.	21.07	0.20	
0.50	1	ES				MADE GROUND: Brown slightly clayey very gravelly medium and coarse SAND. Gravel is angular to subrounded brick, concrete and clinker.		(1.20)	
0.50-1.00	2	B							
0.50		PID	0.0ppm						
1.10	1	D							
1.20-1.65	1	SPT(c)	N=4				19.87	1.40	
1.20	1	DSPT				MADE GROUND: Light brown slightly gravelly sandy CLAY. Sand is cream-white fine and medium. Gravel is angular to rounded fine to coarse flint and brick.		(0.50)	
1.20	1	D					19.37	1.90	
1.20-1.70	3	B							
1.50	2	ES				MADE GROUND: Light brown slightly clayey gravelly fine to coarse SAND. Gravel is subangular and subrounded flint, concrete and brick.		(0.80)	
1.50		PID	0.0ppm						
1.90	2	D					18.57	2.70	
2.00-2.45	2	SPT(c)	N=15						
2.00	2	DSPT							
2.00-2.50	4	B							
2.50	3	ES				MADE GROUND: Light reddish brown gravelly fine to coarse SAND. Gravel is subangular and subrounded flint and brick. With pockets of clay.		(0.50)	
2.50		PID	0.0ppm				18.07	3.20	
2.70	3	D							
3.00-3.45	3	SPT(c)	N=6			Firm becoming stiff thinly laminated light brown CLAY. With rare becoming occasional medium sand sized selenite crystals. (LONDON CLAY FORMATION)			
3.00	3	DSPT							
3.00-3.50	5	B							
3.30	4	ES							
3.30		PID	0.0ppm						
3.70	4	D							
3.70		V	c_u=>125						
4.00-4.45	1	UT	50 blows						
4.50	5	D				. . . Below 4.50m, fissured, with occasional light orangish brown staining on fissure surfaces.			
4.70	6	D				. . . At 4.70m, 1 No fragment of claystone with selenite/calcite veins.			
5.00-5.45	2	UT	45 blows					(4.00)	
5.50	7	D							
6.00	8	D							
6.50-6.95	3	UT	50 blows						
7.00	9	D				. . . At 7.00m, 15mm selenite crystal.	14.07	7.20	
7.50	10	D				Stiff fissured thinly laminated dark brownish grey CLAY. With rare bioturbations and locally micaceous. (LONDON CLAY FORMATION)			
7.50		V	c_u=>125						
8.00-8.45	4	UT	55 blows						
8.50	11	D							

Boring Progress and Water Observations					
Date	Time	Borehole Depth	Casing Depth	Borehole Diameter (mm)	Water Depth
18/01/19	12:00		-		
18/01/19	17:00	1.40	-		Dry
21/01/19	08:00	1.40	-		Dry
21/01/19		11.00	3.00	150	11.00
21/01/10	17:00	30.00	3.00	150	Dry
22/01/19	08:00	30.00	3.00	150	12.10
22/01/19	09:00	30.00	3.00	150	12.10

Chiselling / Slow Progress		
From	To	Duration (hh:mm)

General Remarks

1. Inspection pit dug to 1.20m to check for services.
2. Groundwater seepage encountered at 11.00m depth.
3. On completion, a 34mm diameter standpipe was installed with a response zone between 23.50m and 24.00m, and a 50mm diameter

All dimensions in metres | Scale: **1:50**

Method Used:	Plant Used:	Drilled By:	Logged By:	Checked By:
Inspection pit + Cable percussion	**Dando 2000 Mark 2**	**Dave Hutson**	**RMiller**	

FINAL

BOREHOLE LOG

Contract:	Client:	Borehole:
Ugly Brown Building	**The Trustees of the St Pancras Way Block A Unit Trust & Big Lobster Ltd**	**BH12A**

Contract Ref:	Start:	Ground Level (m AOD):	National Grid Co-ordinate:	Sheet:
371654	**18.01.19** End: **21.01.19**	**21.27**	**E:529585.3 N:183761.0**	**2** of **4**

Samples and In-situ Tests				Water	Backfill & Instrumentation	Description of Strata	Reduced Level	Depth (Thickness)	Material Graphic Legend
Depth	No	Type	Results						
9.00	12	D				Stiff fissured thinly laminated dark brownish grey CLAY. With rare bioturbations and locally micaceous. (LONDON CLAY FORMATION)			
9.50-9.95	5	UT	55 blows			*(stratum copied from 7.20m from previous sheet)*			
10.00	13	D							
10.50	14	D							
10.50		V	c_u=107						
11.00-11.45	4	SPT	N=29			. . . Below approximately 11.00m, very stiff.			
11.00	4	DSPT							
12.00	15	D							
12.50-12.95	6	UT	60 blows						
13.00	16	D							
13.50	17	D							
14.00-14.45	5	SPT	N=36						
14.00	5	DSPT							
15.00	18	D				. . . Below 15.00m, locally slightly sandy silty. Sand is fine.			
15.00		V	c_u=>125						
15.50-15.95	7	UT	65 blows					(16.80)	
16.00	19	D							
16.50	20	D							
17.00-17.45	6	SPT	N=44						
17.00	6	DSPT							

Boring Progress and Water Observations					
Date	Time	Borehole Depth	Casing Depth	Borehole Diameter (mm)	Water Depth

Chiselling / Slow Progress		
From	To	Duration (hh:mm)

General Remarks

combined gas and groundwater monitoring standpipe was installed with a response zone between 1.00m and 5.00m.

4. SPT hammer HD02-2018 (E_r = 72.00%) used.

All dimensions in metres | Scale: **1:50**

Method Used:	Plant Used:	Drilled By:	Logged By:	Checked By:
Inspection pit + Cable percussion	**Dando 2000 Mark 2**	**Dave Hutson**	**RMiller**	

FINAL

BOREHOLE LOG

Contract:	Client:	Borehole:
Ugly Brown Building	**The Trustees of the St Pancras Way Block A Unit Trust & Big Lobster Ltd**	**BH12A**

Contract Ref:	Start:	Ground Level (m AOD):	National Grid Co-ordinate:	Sheet:
371654	**18.01.19** End: **21.01.19**	**21.27**	**E:529585.3 N:183761.0**	**3** of **4**

Samples and In-situ Tests				Water	Backfill & Instru-mentation	Description of Strata	Reduced Level	Depth (Thick ness)	Material Graphic Legend
Depth	No	Type	Results						
18.00	21	D				Stiff fissured thinly laminated dark brownish grey CLAY. With rare bioturbations and locally micaceous. (LONDON CLAY FORMATION)			
18.50-18.95	8	UT	65 blows			*(stratum copied from 7.20m from previous sheet)*			
19.00	22	D							
19.50	23	D							
19.50		V	c_u=>125						
20.00-20.45	7	SPT	N=48						
20.00	7	DSPT							
21.00	24	D							
21.50-21.95	9	UT	70 blows						
22.00	25	D				. . . At 22.00m, rare coarse sand sized pyrite.			
22.50	26	D							
22.50		V	c_u=>125						
23.00-23.45	8	SPT	N=52						
23.00	8	DSPT							
							-2.73	24.00	
24.00	27	D				Very stiff grey mottled greyish blue CLAY. (LAMBETH GROUP - LOWER MOTTLED BEDS)			
24.00		V	c_u=>125					(1.00)	
24.50-24.95	10	UT	75 blows						
							-3.73	25.00	
25.00	28	D				Very stiff light brown mottled greyish blue CLAY. (LAMBETH GROUP - LOWER MOTTLED BEDS)			
25.50	29	D							
26.00-26.45	9	SPT	N=57						
26.00	9	DSPT							

Boring Progress and Water Observations					
Date	Time	Borehole Depth	Casing Depth	Borehole Diameter (mm)	Water Depth

Chiselling / Slow Progress		
From	To	Duration (hh:mm)

General Remarks

All dimensions in metres | Scale: **1:50**

Method Used:	Plant Used:	Drilled By:	Logged By:	Checked By:
Inspection pit + Cable percussion	**Dando 2000 Mark 2**	**Dave Hutson**	**RMiller**	

FINAL

BOREHOLE LOG

Contract:	Client:	Borehole:
Ugly Brown Building	**The Trustees of the St Pancras Way Block A Unit Trust & Big Lobster Ltd**	**BH12A**

Contract Ref:	Start:	Ground Level (m AOD):	National Grid Co-ordinate:	Sheet:
371654	**18.01.19** End: **21.01.19**	**21.27**	**E:529585.3 N:183761.0**	**4** of **4**

Samples and In-situ Tests				Water	Backfill & Instru-mentation	Description of Strata	Reduced Level	Depth (Thick ness)	Material Graphic Legend
Depth	No	Type	Results						
27.00	30	D				Very stiff light brown mottled greyish blue CLAY. (LAMBETH GROUP - LOWER MOTTLED BEDS) *(stratum copied from 25.00m from previous sheet)*			
27.50-27.95	11	UT	95 blows			. . . Below 27.00m, variably mottled light brown, greyish blue, reddish brown and dark yellowish green.		(5.00)	
28.00	31	D							
28.50	32	D							
28.50		V	c_u=>125						
29.00-29.45	10	SPT	N=68						
29.00	10	DSPT					-8.73	30.00	
30.00	33	D				Cable percussion borehole terminated at a depth of 30.00m due to borehole instability caused by water seepage.			

Boring Progress and Water Observations					
Date	Time	Borehole Depth	Casing Depth	Borehole Diameter (mm)	Water Depth

Chiselling / Slow Progress		
From	To	Duration (hh:mm)

General Remarks

All dimensions in metres | Scale: **1:50**

Method Used:	Plant Used:	Drilled By:	Logged By:	Checked By:
Inspection pit + Cable percussion	**Dando 2000 Mark 2**	**Dave Hutson**	**RMiller**	

FINAL

BOREHOLE LOG

Contract:	Client:	Borehole:
Ugly Brown Building	**The Trustees of the St Pancras Way Block A Unit Trust & Big Lobster Ltd**	**BH13**

Contract Ref:	Start:	Ground Level (m AOD):	National Grid Co-ordinate:	Sheet:
371654	**30.01.19** End: **05.02.19**	**21.83**	**E:529606.6 N:183786.4**	**1** of **4**

Samples and In-situ Tests				Water	Backfill & Instru-mentation	Description of Strata	Reduced Level	Depth (Thick ness)	Material Graphic Legend
Depth	No	Type	Results						
						Concrete screed.	21.76	0.07	
						Reinforced CONCRETE. 10mm rebar at 60mm, 70mm, 160 and 170mmbgl.	21.55	0.28	
0.40	1	ES				MADE GROUND: Brown slightly sandy gravelly CLAY. Gravel is subangular fine and medium of red brick, concrete and clinker.			
0.40		PID	0.0ppm						
0.70	2	ES							
0.70		PID	0.0ppm						
1.20-1.65	1	SPT(c)	N=7			. . . Below 1.20m, frequent fine to coarse flint gravel.			
1.20	1	DSPT						(2.42)	
1.20	3	ES							
1.20		PID	0.0ppm						
2.00-2.45	2	SPT(c)	N=6						
2.00	2	DSPT					19.13	2.70	
						MADE GROUND: Red brick.		(0.50)	
							18.63	3.20	
						MADE GROUND: Driller notes clay fill and brick rubble.		(0.60)	
							18.03	3.80	
						MADE GROUND: Strong grey SANDSTONE.	17.63	4.20	
						MADE GROUND: Light brown sandy clayey subangular medium and coarse concrete and flint GRAVEL.		(0.60)	
							17.03	4.80	
				≈		MADE GROUND: Brown slightly clayey subangular to rounded fine to coarse flint GRAVEL.		(0.70)	
5.00-5.45	3	SPT(c)	N=10						
5.00	3	DSPT					16.33	5.50	
5.50	4	D				Firm to stiff brown and orange-brown CLAY. With partings of orange-brown silt. (LONDON CLAY FORMATION)			
6.00-6.45	1	UT	50 blows 100% recovery						
6.45	5	D				. . . Below 6.45m, with fine gravel sized selenite crystals and burrows <1mm infilled with brown silt.		(2.50)	
7.00-7.45	4	SPT	N=18			. . . At 7.00m, thinly laminated.			
7.00	4	DSPT							
7.00	6	D					13.83	8.00	
8.00	7	D				Stiff thinly laminated dark greyish brown silty CLAY. With rare selenite crystals and bioturbations. (LONDON CLAY FORMATION)			
8.00		V	c_u=110			. . . At 8.45m, with partings of light brown silt.			
8.50-8.95	2	UT	50 blows 100% recovery			. . . At 8.80m, claystone.			

Boring Progress and Water Observations					
Date	Time	Borehole Depth	Casing Depth	Borehole Diameter (mm)	Water Depth
30/01/19	08:00	0.28	-	300	Dry
30/01/19	17:00	2.70	2.70	150	Dry
31/01/19	08:00	2.70	2.70	150	Dry
31/01/19		2.70	2.70	200	Dry
31/01/19		5.00	5.00	200	5.00
31/01/19		5.00	5.00	150	5.00
31/01/19	17:00	5.30	5.30	150	Dry
01/02/19	08:00	5.30	5.30	150	Dry

Chiselling / Slow Progress		
From	To	Duration (hh:mm)
2.70	3.20	01:03
3.80	4.20	01:45

General Remarks

1. Inspection pit dug to 1.20m through 300mm diameter cored slab to check for services.
2. Borehole drilled in 6" casing to 2.70m and encountered obstruction. Hole redrilled with 8" casing to 5.00m before reducing to 6" casing. Reduced to 5" casing at 21.00m.
3. Water added between 4.80m and 5.30m to

All dimensions in metres | Scale: **1:50**

Method Used:	Plant Used:	Drilled By:	Logged By:	Checked By:
Concrete coring (300mm) + Cable	**Dando 100 (cut down)**	**Dave Rosenwold**	**MMcCann**	

FINAL

BOREHOLE LOG

Contract:	Client:	Borehole:
Ugly Brown Building	**The Trustees of the St Pancras Way Block A Unit Trust & Big Lobster Ltd**	**BH13**

Contract Ref:	Start:	Ground Level (m AOD):	National Grid Co-ordinate:	Sheet:
371654	**30.01.19** End: **05.02.19**	**21.83**	**E:529606.6 N:183786.4**	**2** of **4**

Samples and In-situ Tests				Water	Backfill & Instrumentation	Description of Strata	Reduced Level	Depth (Thickness)	Material Graphic Legend
Depth	No	Type	Results						
8.95	8	D				Stiff thinly laminated dark greyish brown silty CLAY. With rare selenite crystals and bioturbations. (LONDON CLAY FORMATION)			
9.50	9	D				*(stratum copied from 8.00m from previous sheet)*			
9.50		V	c_u=>130			. . . Below 9.50m, very stiff.			
10.00-10.45	5	SPT	N=28						
10.00	10	D							
10.00	5	DSPT							
						. . . At 10.70m, claystone.		(6.00)	
11.00	11	D							
						. . . At 11.35m, claystone.			
11.50-11.95	3	UT	80 blows 100% recovery						
11.95	12	D							
12.50	13	D							
13.00-13.45	6	SPT	N=31						
13.00	14	D							
13.00	6	DSPT					7.83	14.00	
14.00	15	D				Very stiff dark greyish brown slightly sandy silty CLAY. Sand is fine. With pockets of greyish brown silt / fine sand. With frequent bioturbations <1mm. (LONDON CLAY FORMATION)			
14.50-14.95	4	UT	70 blows 100% recovery						
14.95	16	D							
15.50	17	D							
15.50		V	c_u=>130						
16.00-16.45	7	SPT	N=35						
16.00	18	D							
16.00	7	DSPT							
17.00	19	D							
17.50-17.95	5	UT	75 blows 100% recovery						

Boring Progress and Water Observations

Date	Time	Borehole Depth	Casing Depth	Borehole Diameter (mm)	Water Depth
01/02/19		19.50	7.00	150	19.50
01/02/19		21.00	21.00	125	Dry
01/02/19	17:00	21.00	21.00	125	Dry
04/02/19	08:00	21.00	21.00	125	17.20
04/02/19	17:00	31.50	21.00	125	Dry
05/02/19	08:00	31.50	21.00	125	27.00
05/02/19	17:00	35.00	21.00	125	Dry

Chiselling / Slow Progress

From	To	Duration (hh:mm)

General Remarks

facilitate drilling may have obscured water strikes/seepages.

4. Groundwater seepages encountered at 5.00m and 19.50m depth.
5. On completion, a 50mm diameter combined gas and groundwater monitoring standpipe was installed with a response zone between

All dimensions in metres | Scale: **1:50**

Method Used:	Plant Used:	Drilled By:	Logged By:	Checked By:
Concrete coring (300mm) + Cable	**Dando 100 (cut down)**	**Dave Rosenwold**	**MMcCann**	

BOREHOLE LOG

Contract:	Client:	Borehole:
Ugly Brown Building	**The Trustees of the St Pancras Way Block A Unit Trust & Big Lobster Ltd**	**BH13**

Contract Ref:	Start:	Ground Level (m AOD):	National Grid Co-ordinate:	Sheet:
371654	**30.01.19** End: **05.02.19**	**21.83**	**E:529606.6 N:183786.4**	**3** of **4**

Samples and In-situ Tests				Water	Backfill & Instrumentation	Description of Strata	Reduced Level	Depth (Thickness)	Material Graphic Legend
Depth	No	Type	Results						
17.95	20	D				. . . Below 17.95m, locally with frequent partings of greyish brown silt / fine sand. Very stiff dark greyish brown slightly sandy silty CLAY. Sand is fine. With pockets of greyish brown silt / fine sand. With frequent bioturbations <1mm. (LONDON CLAY FORMATION) *(stratum copied from 14.00m from previous sheet)*			
17.95		V	c_u=>130						
18.50	21	D							
19.00-19.45	8	SPT	N=39						
19.00	22	D							
19.00	8	DSPT		≈				(11.00)	
20.00	23	D				. . . Below 20.00m, locally with fine gravel sized pockets of greyish brown silt / fine sand.			
20.50-20.95	6	UT	85 blows 89% recovery						
20.95	24	D							
21.50	25	D				. . . At 21.50m, pyrite nodule 10mm.			
22.00-22.45	9	SPT	N=44						
22.00	26	D							
22.00	9	DSPT							
23.00	27	D							
23.50-23.95	7	UT	85 blows 89% recovery						
23.95	28	D							
24.50	29	D				. . . At 24.50m, rare fine pyrite nodules.			
							-3.17	25.00	
25.00-25.45	10	SPT	N=44			Very stiff fissured light brown, orange-brown and blue-grey silty CLAY. (LAMBETH GROUP - LOWER MOTTLED BEDS)			
25.00	10	DSPT							
25.00	30	D							
26.00	31	D				. . . Below 26.95m, mottled reddish brown.			
26.50-26.95	8	UT	100 blows 89% recovery						

Boring Progress and Water Observations					
Date	Time	Borehole Depth	Casing Depth	Borehole Diameter (mm)	Water Depth

Chiselling / Slow Progress		
From	To	Duration (hh:mm)

General Remarks

1.00m and 5.00m.
6. SPT hammer EQU2136-2018 (E_r = 87.47%) used.

All dimensions in metres | Scale: **1:50**

Method Used:	Plant Used:	Drilled By:	Logged By:	Checked By:
Concrete coring (300mm) + Cable	**Dando 100 (cut down)**	**Dave Rosenwold**	**MMcCann**	

FINAL

BOREHOLE LOG

Contract:	Client:	Borehole:
Ugly Brown Building	**The Trustees of the St Pancras Way Block A Unit Trust & Big Lobster Ltd**	**BH13**

Contract Ref:	Start:	Ground Level (m AOD):	National Grid Co-ordinate:	Sheet:
371654	**30.01.19** End: **05.02.19**	**21.83**	**E:529606.6 N:183786.4**	**4** of **4**

Samples and In-situ Tests				Water	Backfill & Instru-mentation	Description of Strata	Reduced Level	Depth (Thick ness)	Material Graphic Legend
Depth	No	Type	Results						
26.95	32	D				Very stiff fissured light brown, orange-brown and blue-grey silty CLAY. (LAMBETH GROUP - LOWER MOTTLED BEDS) *(stratum copied from 25.00m from previous sheet)*		(4.95)	
27.50	33	D							
28.00-28.44	11	SPT	N=53*						
28.00	11	DSPT							
28.00	34	D							
29.00	35	D							
29.50-29.95	9	UT	100 blows 67% recovery				-8.12	29.95	
29.95	36	D				Very stiff dark grey and brown silty CLAY. (LAMBETH GROUP - LOWER MOTTLED BEDS)			
30.50	37	D				. . . Below 30.50m, fissured and variably mottled dark grey, light grey, brown, pale purple and yellowish brown.			
31.00-31.38	12	SPT	N=64*						
31.00	12	DSPT							
31.00	38	D							
32.00	39	D						(5.05)	
32.50-32.85	13	SPT	N=77*						
32.50	40	D							
33.50	41	D							
34.50-34.83	14	SPT	N=83*						
34.50	42	D					-13.17	35.00	
						Cable percussion borehole terminated at a depth of 35m.			

Boring Progress and Water Observations					
Date	Time	Borehole Depth	Casing Depth	Borehole Diameter (mm)	Water Depth

Chiselling / Slow Progress		
From	To	Duration (hh:mm)

General Remarks

All dimensions in metres | Scale: **1:50**

Method Used:	Plant Used:	Drilled By:	Logged By:	Checked By:
Concrete coring (300mm) + Cable	**Dando 100 (cut down)**	**Dave Rosenwold**	**MMcCann**	

FINAL

BOREHOLE LOG

Contract:	Client:	Borehole:
Ugly Brown Building	**The Trustees of the St Pancras Way Block A Unit Trust & Big Lobster Ltd**	**BH14A**

Contract Ref:	Start:	Ground Level (m AOD):	National Grid Co-ordinate:	Sheet:
371654	**06.02.19** End: **06.02.19**	**21.82**	**E:529626.5 N:183770.7**	**1** of **2**

Samples and In-situ Tests				Water	Backfill	Description of Strata	Reduced Level	Depth (Thickness)	Material Graphic Legend
Depth	No	Type	Results						
						REINFORCED CONCRETE. . . . At 0.10 m, 10mm steel rebar	21.52	0.30	
0.40 0.40	1	ES PID	 0.0ppm			MADE GROUND: (Very dense) brown slightly silty very sandy fine to coarse subangular concrete and brick GRAVEL.		(0.70)	
0.80 0.80	2	ES PID	 0.0ppm				20.82	1.00	
						MADE GROUND: Light brown medium subangluar flint GRAVEL <10mm.	20.62	1.20	
						Cable percussion borehole terminated at a depth of 1.20m due to service obstruction.			

Boring Progress and Water Observations					
Date	Time	Borehole Depth	Casing Depth	Borehole Diameter (mm)	Water Depth

Chiselling / Slow Progress		
From	To	Duration (hh:mm)

General Remarks

1. Inspection pit excavated to 1.20m depth through a 300mm cored slab to check for services.
2. An unknown metal pipe was encountered at the base of the pit prompting the boreholes relocation to BH14B.
3. Borehole BH14B was drilled to 2.20m and

All dimensions in metres | Scale: **1:50**

Method Used:	Plant Used:	Drilled By:	Logged By:	Checked By:
Concrete coring (300mm) + Cable	**Dando 100 (cut down)**	**Dave Rosenwold**	**MMcCann**	

FINAL

BOREHOLE LOG

Contract:	Client:	Borehole:
Ugly Brown Building	**The Trustees of the St Pancras Way Block A Unit Trust & Big Lobster Ltd**	**BH14A**

Contract Ref:	Start:	Ground Level (m AOD):	National Grid Co-ordinate:	Sheet:
371654	**06.02.19** End: **06.02.19**	**21.82**	**E:529626.5 N:183770.7**	**2** of **2**

Samples and In-situ Tests				Water	Backfill	Description of Strata	Reduced Level	Depth (Thickness)	Material Graphic Legend
Depth	No	Type	Results						

Boring Progress and Water Observations					
Date	Time	Borehole Depth	Casing Depth	Borehole Diameter (mm)	Water Depth

Chiselling / Slow Progress		
From	To	Duration (hh:mm)

General Remarks

encountered concrete obstruction. The borehole was relocated to BH14C which was drilled to 2.20m and encountered concrete obstruction.

4. On terminations boreholes BH14A, BH14B and BH14C were backfilled with arisings and reinstated with concrete.

All dimensions in metres | Scale: **1:50**

Method Used:	Plant Used:	Drilled By:	Logged By:	Checked By:
Concrete coring (300mm) + Cable percussion	**Dando 100 (cut down)**	**Dave Rosenwold**	**MMcCann**	

FINAL

BOREHOLE LOG

Contract:	Client:	Borehole:
Ugly Brown Building	**The Trustees of the St Pancras Way Block A Unit Trust & Big Lobster Ltd**	**BH15**

Contract Ref:	Start:	Ground Level (m AOD):	National Grid Co-ordinate:	Sheet:
371654	**28.01.19** End: **30.01.19**	**23.74**	**E:529626.3 N:183791.3**	**1** of **4**

Samples and In-situ Tests				Water	Backfill & Instru-mentation	Description of Strata	Reduced Level	Depth (Thick ness)	Material Graphic Legend
Depth	No	Type	Results						
						REINFORCED CONCRETE	23.54	0.20	
						MADE GROUND: Light grey brown very sandy GRAVEL of fine to coarse concrete with occasional cobbles of concrete.	23.34	0.40	
						CONCRETE	23.24	0.50	
						MADE GROUND: Brown and grey brown slightly clayey very sandy very angular to subangular fine to coarse concrete and brick GRAVEL with high cobble content. Cobbles are of whole and fragmented brick.		(2.00)	
1.50	1	DSPT							
1.50-1.95	2	SPT(c)	N=16						
1.50	3	ES							
							21.24	2.50	
2.50	4	DSPT				MADE GROUND: Brown, black and grey mottled slightly sandy gravelly CLAY. Sand is fine. Gravel is angular and subangular fine to coarse brick.		(0.50)	
2.50-2.95	5	SPT(c)	N=5						
2.50	6	ES					20.74	3.00	
						MADE GROUND: Probable brick and concrete footing of canal wall.			
3.50	7	DSPT				. . . Below 3.50m, slightly gravelly very sandy. Gravel also of flint.		(1.60)	
3.50-3.55	8	SPT(c)	NP						
3.50	9	ES							
							19.14	4.60	
4.50	10	DSPT				Firm brown and orange brown CLAY. (LONDON CLAY FORMATION)			
4.50-4.58	11	SPT(c)	NP						
4.50	12	D				. . . At 4.60m, claystone.	18.74	5.00	
4.60	13	D							
4.60	14	D				Firm becoming stiff brown CLAY. With thin laminae and lenses of orange brown clay, occasional selenite crystals and rare gravel of hard light brown silt / claystone. (LONDON CLAY FORMATION)			
5.00	15	DSPT							
5.00-5.45	16	SPT(c)	N=17						
6.00-6.45	17	UT	22 blows 100% recovery					(2.90)	
6.50	18	D							
7.00	19	DSPT							
7.00-7.45	20	SPT	N=21						
							15.84	7.90	
8.00-8.45	21	UT	28 blows 100% recovery			Stiff fissured dark greyish brown CLAY. Fissures are closely spaced and randomly orientated. With grey clay infilled burrows. Rare pyritised sand pockets <5mm and rare light brown fine sand partings. (LONDON CLAY FORMATION)			
8.50	22	D				. . . At 8.50m, claystone.			

Boring Progress and Water Observations					
Date	Time	Borehole Depth	Casing Depth	Borehole Diameter (mm)	Water Depth
28/01/19	08:00		-		
28/01/19	13:00	4.70	4.70	200	
28/01/19	17:00	8.50	7.00	150	
29/01/19	08:00	8.50	7.00	150	Dry
29/01/19	13:00	15.00	7.00	150	15.00
29/01/19	17:00	20.00	7.00	150	
30/01/19	08:00	20.00	7.00	150	15.90
30/01/19	13:00	24.90	7.00	150	24.90

Chiselling / Slow Progress		
From	To	Duration (hh:mm)
3.00	4.60	04:00
15.00	16.30	00:50

General Remarks

1. Inspection pit dug to 1.50m using a machine excavator to faciliate structural survey of sheet piled canal wall.
2. Inspection pit backfilled prior to drilling to allow the righ to set up safely.
3. Borehole drilled between buried canal wall and existing sheet piled canal wall.

All dimensions in metres | Scale: **1:50**

Method Used:	Plant Used:	Drilled By:	Logged By:	Checked By:
Inspection pit + Cable percussion	**Bespoke Rig**	**Mark Taylor**	**CSiberry**	

FINAL

BOREHOLE LOG

Contract:	Client:	Borehole:
Ugly Brown Building	**The Trustees of the St Pancras Way Block A Unit Trust & Big Lobster Ltd**	**BH15**

Contract Ref:	Start:	Ground Level (m AOD):	National Grid Co-ordinate:	Sheet:
371654	**28.01.19** End: **30.01.19**	**23.74**	**E:529626.3 N:183791.3**	**2** of **4**

Samples and In-situ Tests				Water	Backfill & Instru-mentation	Description of Strata	Reduced Level	Depth (Thick ness)	Material Graphic Legend
Depth	No	Type	Results						
9.00	23	DSPT				Stiff fissured dark greyish brown CLAY. Fissures are closely spaced and randomly orientated. With grey clay infilled burrows. Rare pyritised sand pockets <5mm and rare light brown fine sand partings. (LONDON CLAY FORMATION) *(stratum copied from 7.90m from previous sheet)*			
9.00-9.45	24	SPT	N=36						
9.75	25	D							
10.50-10.95	26	UT	33 blows 100% recovery						
11.00	27	D				. . . At 11.00m depth, sand partings absent. . . . Below 11.00m, pyrite / pyritised sand absent.			
12.00	28	DSPT							
12.00-12.45	29	SPT	N=27					(9.10)	
12.75	30	D							
13.50-13.95	31	UT	46 blows 100% recovery						
14.00	32	D		≈		. . . At 14:00m, claystone.			
15.00	33	DSPT				. . . At 15.00m, claystone.			
15.00-15.07	34	SPT	NP						
15.75	35	D				. . . At 15.75m, rare shell fragments.			
16.50-16.95	36	UT	44 blows 100% recovery						
							6.74	17.00	
17.00	37	D				Very stiff dark brown slightly sandy CLAY. Sand is fine to medium. Occasional grey clay infilled burrows. Rare forams and occasional mica. (LONDON CLAY FORMATION)			

Boring Progress and Water Observations					
Date	Time	Borehole Depth	Casing Depth	Borehole Diameter (mm)	Water Depth
30/01/19	17:00	32.00	7.00	150	

Chiselling / Slow Progress		
From	To	Duration (hh:mm)

General Remarks

4. Groundwater seepages encountered at 15.00m and 24.90m depth.
5. On completion, an 80mm diameter standpipe was installed to 32m to facilitate downhole geophysical survey.
6. SPT hammer GEH3-2019 (E_r = 47.00%) used.

All dimensions in metres | Scale: **1:50**

Method Used:	Plant Used:	Drilled By:	Logged By:	Checked By:
Inspection pit + Cable percussion	**Bespoke Rig**	**Mark Taylor**	**CSiberry**	

FINAL

BOREHOLE LOG

Contract:	Client:	Borehole:
Ugly Brown Building	**The Trustees of the St Pancras Way Block A Unit Trust & Big Lobster Ltd**	**BH15**

Contract Ref:	Start:	Ground Level (m AOD):	National Grid Co-ordinate:	Sheet:
371654	**28.01.19** End: **30.01.19**	**23.74**	**E:529626.3 N:183791.3**	**3** of **4**

Samples and In-situ Tests				Water	Backfill & Instru-mentation	Description of Strata	Reduced Level	Depth (Thick ness)	Material Graphic Legend
Depth	No	Type	Results						
18.00	38	DSPT				Very stiff dark brown slightly sandy CLAY. Sand is fine to medium. Occasional grey clay infilled burrows. Rare forams and occasional mica. (LONDON CLAY FORMATION) *(stratum copied from 17.00m from previous sheet)*			
18.00-18.45	39	SPT	N=34						
18.75	40	D				. . . At 18.75m, silty clay and rare shell fragments.			
19.50-19.95	41	UT	48 blows 100% recovery						
20.00	42	D				. . . At 20.00m, occasional light brown fine sand lenses.			
21.00	43	DSPT				. . . At 21.00m, silty clay.			
21.00-21.45	44	SPT	N=42						
21.75	44	D				. . . Below 21.75m, occasional light brown fine sand lenses with pyritised sand pockets <10mm and pyrite nodules <15mm.			
22.50-22.95	45	UT	53 blows 100% recovery					(11.20)	
23.00	46	D							
24.00	47	DSPT							
24.00-24.45	48	SPT	N=43						
24.75	49	D		≈		. . . At 24.75m, silty clay.			
25.50-25.95	50	UT	56 blows 100% recovery						
26.00	51	D							

Boring Progress and Water Observations					
Date	Time	Borehole Depth	Casing Depth	Borehole Diameter (mm)	Water Depth

Chiselling / Slow Progress		
From	To	Duration (hh:mm)

General Remarks

All dimensions in metres | Scale: **1:50**

Method Used:	Plant Used:	Drilled By:	Logged By:	Checked By:
Inspection pit + Cable percussion	**Bespoke Rig**	**Mark Taylor**	**CSiberry**	

FINAL

BOREHOLE LOG

Contract:	Client:	Borehole:
Ugly Brown Building	**The Trustees of the St Pancras Way Block A Unit Trust & Big Lobster Ltd**	**BH15**

Contract Ref:	Start:	Ground Level (m AOD):	National Grid Co-ordinate:	Sheet:
371654	**28.01.19** End: **30.01.19**	**23.74**	**E:529626.3 N:183791.3**	**4** of **4**

Samples and In-situ Tests				Water	Backfill & Instru-mentation	Description of Strata	Reduced Level	Depth (Thick ness)	Material Graphic Legend
Depth	No	Type	Results						
27.00	52	DSPT				Very stiff dark brown slightly sandy CLAY. Sand is fine to medium. Occasional grey clay infilled burrows. Rare forams and occasional mica. (LONDON CLAY FORMATION) *(stratum copied from 17.00m from previous sheet)*			
27.00-27.45	53	SPT	N=47						
27.75	54	D					-4.46	28.20	
28.20	55	D				Very stiff fissured brown and blue grey mottled CLAY. Fissures are blocky. (LAMBETH GROUP - LOWER MOTTLED BEDS)			
28.50-28.95	56	UT	68 blows 100% recovery						
29.00	57	D				. . . Below 29.00m, mottled reddish brown.			
30.00	58	DSPT						(3.80)	
30.00-30.38	59	SPT	N=67*						
30.75	60	D							
31.50-31.95	61	UT	72 blows 100% recovery						
32.00	62	D				Cable percussion borehole terminated at a depth of 32m.	-8.26	32.00	

Boring Progress and Water Observations					
Date	Time	Borehole Depth	Casing Depth	Borehole Diameter (mm)	Water Depth

Chiselling / Slow Progress		
From	To	Duration (hh:mm)

General Remarks

All dimensions in metres | Scale: **1:50**

Method Used:	Plant Used:	Drilled By:	Logged By:	Checked By:
Inspection pit + Cable percussion	**Bespoke Rig**	**Mark Taylor**	**CSiberry**	

FINAL

WINDOW SAMPLE LOG

Contract:	Client:	Window Sample:
Ugly Brown Building	**The Trustees of the St Pancras Way Block A Unit Trust & Big Lobster Ltd**	**WS01**

Contract Ref:	Start:	Ground Level (m AOD):	National Grid Co-ordinate:	Sheet:
371654	**29.01.19** End: **29.01.19**	**21.86**	**E:529571.6 N:183834.7**	**1** of **2**

Progress	Samples / Tests				Water	Backfill	Description of Strata	Reduced Level	Depth (Thickness)	Material Graphic Legend
Window Run	Depth	No	Type	Results						
							REINFORCED CONCRETE. . . . Two sets of 10mm steel rebar at 0.10 and 0.23 m depth	21.51	(0.35) 0.35	
	0.40 0.40	1	ES PID	0.0ppm			MADE GROUND: Orangish brown slightly clayey gravelly fine to coarse SAND. Gravel is angular to rounded fine to coarse of clinker, brick and flint.	21.26	0.60	
							MADE GROUND: Orangish brown slightly gravelly CLAY. Gravel is subangular medium brick. Occasional relict rootlets.	21.06	0.80	
	0.80 0.80	2	ES PID	0.0ppm			Firm becoming stiff orangish brown CLAY. With occasional gleying and occasional medium to coarse sand selenite. (LONDON CLAY FORMATION)			
1.20 - 2.00 (98mm dia) 100% rec	1.20-1.65	1	SPT	N=8						
	1.80	1	D							
2.00 - 3.00 (85mm dia) 100% rec	2.00-2.45 2.00	2	SPT V	N=21 c_u=112			. . . At 2.00m, gleying and occasional pockets of light brownish orange silty clay.		(2.60)	
	2.50	2	D							
3.00 - 4.00 (75mm dia) 100% rec	3.00-3.45 3.00	3	SPT V	N=19 c_u=>125				18.46	3.40	
	3.50	3	D				Stiff indistinctly fissured orangish brown CLAY. With light orangish brown staining on fissure surfaces. (LONDON CLAY FORMATION)			
4.00 - 5.00 (65mm dia) 100% rec	4.00-4.45 4.00	4	SPT V	N=19 c_u=>125					(1.60)	

Drilling Progress and Water Observations					
Date	Time	Borehole Depth (m)	Casing Depth (m)	Borehole Diameter (mm)	Water Depth (m)

General Remarks

1. Inspection pit excavated to 1.20m depth through a 300mm diameter cored slab to check for services.
2. Clegg hammer test carried out at base of inspection pit.
3. Downhole UXO magnetometer survey carried out by specialist.
4. Stainless steel casing installed throughout depth to facitliate UXO clearance.
5. Final SPT at 5.00m not carried out due to positive reading on UXO magnetometer equipment.

All dimensions in metres | Scale: **1:25**

Method Used:	Plant Used:	Drilled By:	Logged By:	Checked By:
Concrete coring (300mm) +	**Modular Dynamic Sampling Rig**	**Liam Tyler**	**RMiller**	

FINAL

WINDOW SAMPLE LOG

Contract:	Client:	Window Sample:
Ugly Brown Building	**The Trustees of the St Pancras Way Block A Unit Trust & Big Lobster Ltd**	**WS01**

Contract Ref:	Start:	Ground Level (m AOD):	National Grid Co-ordinate:	Sheet:
371654	**29.01.19** End: **29.01.19**	**21.86**	**E:529571.6 N:183834.7**	**2** of **2**

Progress	Samples / Tests				Water	Backfill	Description of Strata	Reduced Level	Depth (Thickness)	Material Graphic Legend
Window Run	Depth	No	Type	Results						
4.00 - 5.00 (65mm dia) 100% rec	4.50	4	D				Stiff indistinctly fissured orangish brown CLAY. With light orangish brown staining on fissure surfaces. (LONDON CLAY FORMATION) *(stratum copied from 3.40m from previous sheet)*	16.86	5.00	
	5.00		V	c_u=>125			Window sample borehole terminated at a depth of 5.00m.			

Drilling Progress and Water Observations					
Date	Time	Borehole Depth (m)	Casing Depth (m)	Borehole Diameter (mm)	Water Depth (m)

General Remarks

6. The borehole remained dry during drilling.
7. On completion the borehole was backfilled with arisings and reinstated with concrete.

All dimensions in metres | Scale: **1:25**

Method Used:	Plant Used:	Drilled By:	Logged By:	Checked By:
Concrete coring (300mm) +	**Modular Dynamic Sampling Rig**	**Liam Tyler**	**RMiller**	

FINAL

WINDOW SAMPLE LOG

Contract:	Client:	Window Sample:
Ugly Brown Building	**The Trustees of the St Pancras Way Block A Unit Trust & Big Lobster Ltd**	**WS02**

Contract Ref:	Start:	Ground Level (m AOD):	National Grid Co-ordinate:	Sheet:
371654	**29.01.19** End: **29.01.19**	**21.83**	**E:529581.7 N:183820.5**	**1** of **2**

Progress	Samples / Tests				Water	Backfill	Description of Strata	Reduced Level	Depth (Thickness)	Material Graphic Legend
Window Run	Depth	No	Type	Results						
							REINFORCED CONCRETE.		(0.29)	
							. . . Two sets of 10 mm steel rebar at 0.07 and 0.20 m depth	21.54	0.29	
	0.40 0.40	1	ES PID	0.0ppm			Firm becoming stiff brown and orange brown CLAY. With pockets of orange brown silt. (LONDON CLAY FORMATION)			
	1.20-1.65	1	SPT	N=9						
1.20 - 2.00 (98mm dia) 100% rec	1.50	2	D				. . . At 1.60m, blue grey gleying and relic rootlets.			
							. . . At 1.80m, orange brown silt horizon.			
	2.00	1	D				. . . Below 2.00m, becoming thinly laminated.			
	2.00-2.45	2	SPT	N=19			. . . At 2.10m, fine gravel sized selenite crystals.			
	2.30	3	D							
2.00 - 3.00 (85mm dia) 100% rec									(4.71)	
							. . . At 2.90m, fine gravel sized selenite crystals.			
	3.00-3.45 3.00	3	SPT V	N=17 c_u=92						
							. . . At 3.30m, thin claystone band <50mm.			
3.00 - 4.00 (75mm dia) 100% rec	3.40	4	D		≈					
	4.00-4.45	4	SPT	N=17						
4.00 - 5.00 (65mm dia) 100% rec										

Drilling Progress and Water Observations					
Date	Time	Borehole Depth (m)	Casing Depth (m)	Borehole Diameter (mm)	Water Depth (m)
		3.50	-		3.50

General Remarks

1. Inspection pit excavated to 1.20m depth through a 300mm diameter cored slab to check for services.
2. Clegg hammer test carried out within base of inspection pit.
3. Downhole UXO magnetometer survey carried out by specialist.
4. Stainless steel casing installed throughout depth to facilitate UXO clearance.
5. Slight groundwater seepage at 3.50m depth.
6. On completion the borehole was backfilled with arisings and reinstated with

All dimensions in metres | Scale: **1:25**

Method Used:	Plant Used:	Drilled By:	Logged By:	Checked By:
Concrete coring (300mm) +	**Modular Dynamic Sampling Rig**	**Liam Tyler**	**MMcCann**	AGS

FINAL

WINDOW SAMPLE LOG

Contract:	Client:	Window Sample:
Ugly Brown Building	**The Trustees of the St Pancras Way Block A Unit Trust & Big Lobster Ltd**	**WS02**

Contract Ref:	Start:	Ground Level (m AOD):	National Grid Co-ordinate:	Sheet:
371654	**29.01.19** End: **29.01.19**	**21.83**	**E:529581.7 N:183820.5**	**2** of **2**

Progress	Samples / Tests				Water	Backfill	Description of Strata	Reduced Level	Depth (Thickness)	Material Graphic Legend
Window Run	Depth	No	Type	Results						
4.00 - 5.00 (65mm dia) 100% rec	4.60	5	D				Firm becoming stiff brown and orange brown CLAY. With pockets of orange brown silt. (LONDON CLAY FORMATION) *(stratum copied from 0.29m from previous sheet)*			
	5.00		V	c_u=>125			. . . At 4.80m, fine to medium gravel sized selenite.	16.83	5.00	
							Window sample borehole terminated at a depth of 5.00m.			

Drilling Progress and Water Observations					
Date	Time	Borehole Depth (m)	Casing Depth (m)	Borehole Diameter (mm)	Water Depth (m)

General Remarks

concrete.

All dimensions in metres | Scale: **1:25**

Method Used:	Plant Used:	Drilled By:	Logged By:	Checked By:
Concrete coring (300mm) +	**Modular Dynamic Sampling Rig**	**Liam Tyler**	**MMcCann**	

FINAL

WINDOW SAMPLE LOG

Contract:	Client:	Window Sample:
Ugly Brown Building	**The Trustees of the St Pancras Way Block A Unit Trust & Big Lobster Ltd**	**WS03**

Contract Ref:	Start:	Ground Level (m AOD):	National Grid Co-ordinate:	Sheet:
371654	**29.01.19** End: **29.01.19**	**22.04**	**E:529576.0 N:183815.5**	**1** of **2**

Progress	Samples / Tests				Water	Backfill & Instru-mentation	Description of Strata	Reduced Level	Depth (Thick ness)	Material Graphic Legend
Window Run	Depth	No	Type	Results						
							REINFORCED CONCRETE. . . . Two sets of 10 mm steel rebar at 0.06 and 0.20 m depth	21.75	(0.29) 0.29	
	0.40	1	ES				MADE GROUND: Brown slightly gravelly CLAY with rare cobbles of red brick. Gravel is fine to coarse subangular red brick.	21.55	0.49	
	0.40	1	D							
	0.40		PID	0.1ppm			Firm becoming stiff brown and orange brown CLAY. With pockets of orange brown silt. (LONDON CLAY FORMATION)			
	0.70	2	ES							
	0.70	2	D							
	0.70		PID	0.0ppm						
	1.20-1.65	1	SPT	N=5						
1.20 - 2.00 (98mm dia)	1.50	3	D				. . . At 1.80m, brown silt horizon.			
	2.00-2.45	2	SPT	N=18						
	2.00		V	c_u=108			. . . Below 2.00m, becoming thinly laminated.			
2.00 - 3.00 (85mm dia)	2.60	4	D				. . . At 2.60m, occasional fine gravel sized selenite crystals.		(4.96)	
	3.00-3.45	3	SPT	N=16						
	3.00		V	c_u=122						
3.00 - 4.00 (75mm dia)	3.40	5	D				. . . At 3.80m, fine gravel sized selenite crystals.			
	4.00-4.45	4	SPT	N=22						
	4.00		V	c_u=>125						
4.00 - 5.00 (65mm dia)										

Drilling Progress and Water Observations

Date	Time	Borehole Depth (m)	Casing Depth (m)	Borehole Diameter (mm)	Water Depth (m)
		2.50	-		2.50
		4.50	-		4.50

General Remarks

1. Inspection pit excavated to 1.20m depth through a 300mm diameter cored slab to check for services.
2. Downhole UXO magnetometer survey carried out by specialist.
3. Stainless steel casing installed throughout depth to facilitate UXO clearance.
4. Groundwater seepages encountered at 2.50m and 4.50m depth.
5. On completion, a 50mm combined gas and groundwater monitoring standpipe installed with a response zone between 1.00m and 2.00m depth.

All dimensions in metres | Scale: **1:25**

Method Used:	Plant Used:	Drilled By:	Logged By:	Checked By:
Concrete coring (300mm) +	**Modular Dynamic Sampling Rig**	**Liam Tyler**	**MMcCann**	

FINAL

WINDOW SAMPLE LOG

Contract:	Client:	Window Sample:
Ugly Brown Building	**The Trustees of the St Pancras Way Block A Unit Trust & Big Lobster Ltd**	**WS03**

Contract Ref:	Start:	Ground Level (m AOD):	National Grid Co-ordinate:	Sheet:
371654	**29.01.19** End: **29.01.19**	**22.04**	**E:529576.0 N:183815.5**	**2** of **2**

Progress	Samples / Tests				Water	Backfill & Instrumentation	Description of Strata	Reduced Level	Depth (Thickness)	Material Graphic Legend
Window Run	Depth	No	Type	Results						
4.00 - 5.00 (65mm dia)	4.80	6	D				Firm becoming stiff brown and orange brown CLAY. With pockets of orange brown silt. (LONDON CLAY FORMATION) *(stratum copied from 0.49m from previous sheet)*			
	5.00-5.45 5.00	5	SPT V	N=17 c_u=>125				16.59	5.45	
							Window sample borehole terminated at a depth of 5.45m.			

Drilling Progress and Water Observations					
Date	Time	Borehole Depth (m)	Casing Depth (m)	Borehole Diameter (mm)	Water Depth (m)

General Remarks

All dimensions in metres | Scale: **1:25**

Method Used:	Plant Used:	Drilled By:	Logged By:	Checked By:
Concrete coring (300mm) +	**Modular Dynamic Sampling Rig**	**Liam Tyler**	**MMcCann**	

FINAL

WINDOW SAMPLE LOG

Contract:	Client:	Window Sample:
Ugly Brown Building	**The Trustees of the St Pancras Way Block A Unit Trust & Big Lobster Ltd**	**WS04**

Contract Ref:	Start:	Ground Level (m AOD):	National Grid Co-ordinate:	Sheet:
371654	**30.01.19** End: **30.01.19**	**21.76**	**E:529596.4 N:183800.5**	**1** of **2**

Progress	Samples / Tests				Water	Backfill	Description of Strata	Reduced Level	Depth (Thickness)	Material Graphic Legend
Window Run	Depth	No	Type	Results						
							REINFORCED CONCRETE. . . . Two sets of 10 mm steel rebar at 0.08 and 0.16 m depth	21.48	(0.28) 0.28	
	0.70 0.70	1	ES PID	0.0ppm			MADE GROUND: Dark brown slightly clayey very sandy subangular to subrounded fine to coarse brick, concrete, flint and clinker GRAVEL. With occasional pieces of plastic. Occasional cobbles of concrete and brick with rare pockets of brown clay.		(1.22)	
	0.90	2	D							
	1.20-1.65	3	SPT(c)	N=9				20.26	1.50	
1.20 - 2.00 (98mm dia) 50% rec							MADE GROUND: Orange brown and brown slightly sandy gravelly CLAY. Gravel is angular to subrounded fine to coarse clinker, brick and concrete.		(0.70)	
	2.00 2.00-2.45 2.00	4 5	ES SPT PID	N=21 0.0ppm	≈			19.56	2.20	
2.00 - 3.00 (85mm dia) 50% rec	2.50	6	D				Stiff thinly laminated light brown CLAY. With occassional gleying and medium to coarse sand sized selenite crystals. Locally with orange brown staining. (LONDON CLAY FORMATION)			
	3.00-3.45 3.00	7	SPT V	N=29 c_u=92						
3.00 - 4.00 (75mm dia) 100% rec	3.50	8	D				. . . At 3.80m, coarse claystone gravel.		(3.25)	
	4.00-4.45 4.00	9	SPT V	N=37 c_u=113						
4.00 - 5.00 (65mm dia) 100% rec										

Drilling Progress and Water Observations

Date	Time	Borehole Depth (m)	Casing Depth (m)	Borehole Diameter (mm)	Water Depth (m)
30/01/19		2.10	-		2.10

General Remarks

1. Inspection pit excavated to 1.20m depth through a 300mm diameter cored slab to check for services.
2. The sides of the inspection pit were unstable.
3. Clegg hammer test carried out within the base of the inspection pit.
4. Groundwater seepage encountered at 2.10m depth.
5. Stratum depths approximate where recovery <100%.
6. On completion the borehole was backfilled with arisings and reinstated with

All dimensions in metres | Scale: **1:25**

Method Used:	Plant Used:	Drilled By:	Logged By:	Checked By:
Concrete coring (300mm) +	**Modular Dynamic Sampling Rig**	**Liam Tyler**	**RMiller**	AGS

FINAL

WINDOW SAMPLE LOG

Contract:	Client:	Window Sample:
Ugly Brown Building	**The Trustees of the St Pancras Way Block A Unit Trust & Big Lobster Ltd**	**WS04**

Contract Ref:	Start:	Ground Level (m AOD):	National Grid Co-ordinate:	Sheet:
371654	**30.01.19** End: **30.01.19**	**21.76**	**E:529596.4 N:183800.5**	**2** of **2**

Progress	Samples / Tests				Water	Backfill	Description of Strata	Reduced Level	Depth (Thickness)	Material Graphic Legend
Window Run	Depth	No	Type	Results						
4.00 - 5.00 (65mm dia) 100% rec	4.50	10	D				Stiff thinly laminated light brown CLAY. With occassional gleying and medium to coarse sand sized selenite crystals. Locally with orange brown staining. (LONDON CLAY FORMATION) *(stratum copied from 2.20m from previous* sheet)			
	5.00-5.45 5.00	11	SPT V	N=41 c_u=119				16.31	5.45	
							Window sample borehole terminated at a depth of 5.45m.			

Drilling Progress and Water Observations					
Date	Time	Borehole Depth (m)	Casing Depth (m)	Borehole Diameter (mm)	Water Depth (m)

General Remarks

concrete.

All dimensions in metres | Scale: **1:25**

Method Used:	Plant Used:	Drilled By:	Logged By:	Checked By:
Concrete coring (300mm) +	**Modular Dynamic Sampling Rig**	**Liam Tyler**	**RMiller**	

FINAL

WINDOW SAMPLE LOG

Contract:	Client:	Window Sample:
Ugly Brown Building	**The Trustees of the St Pancras Way Block A Unit Trust & Big Lobster Ltd**	**WS05**

Contract Ref:	Start:	Ground Level (m AOD):	National Grid Co-ordinate:	Sheet:
371654	**30.01.19** End: **30.01.19**	**21.77**	**E:529593.8 N:183785.4**	**1** of **2**

Progress	Samples / Tests				Water	Backfill & Instru-mentation	Description of Strata	Reduced Level	Depth (Thick ness)	Material Graphic Legend
Window Run	Depth	No	Type	Results						
							REINFORCED CONCRETE. . . . Two sets of 20 mm steel rebar at 0.04 and 0.16 m depth	21.51	0.26	
	0.60 0.60	1	ES PID	0.0ppm			MADE GROUND: Dark brown very sandy angular to subrounded brick, concrete, flint and clinker GRAVEL. Sand is fine to coarse. Locally with pockets of light brown clay.			
	0.90	2	D							
1.20 - 2.00 (98mm dia) 40% rec	1.20-1.65	3	SPT(c)	N=20					(1.89)	
2.00 - 2.15 (85mm dia) 20% rec	2.00-2.07	4	SPT(c)	NP				19.62	2.15	
							The window sample borehole was terminated at a depth of 2.15m on a brick obstruction.			

Drilling Progress and Water Observations

Date	Time	Borehole Depth (m)	Casing Depth (m)	Borehole Diameter (mm)	Water Depth (m)

General Remarks

1. Inspection pit excavated to 1.20m depth through a 300mm diameter cored slab to check for services.
2. The sides of the inspection pit were unstable.
3. Clegg hammer test carried out within the base of the inspection pit.
4. Stratum depths approximate where recovery <100%.
5. Borehole terminated due to formed brick obstruction at 2.15m depth.
6. On completion a 50mm combined gas and groundwater monitoring standpipe

All dimensions in metres | Scale: **1:25**

Method Used:	Plant Used:	Drilled By:	Logged By:	Checked By:
Concrete coring (300mm) +	**Modular Dynamic Sampling Rig**	**Liam Tyler**	**RMiller**	AGS

FINAL

WINDOW SAMPLE LOG

Contract:	Client:	Window Sample:
Ugly Brown Building	**The Trustees of the St Pancras Way Block A Unit Trust & Big Lobster Ltd**	**WS05**

Contract Ref:	Start:	Ground Level (m AOD):	National Grid Co-ordinate:	Sheet:
371654	**30.01.19** End: **30.01.19**	**21.77**	**E:529593.8 N:183785.4**	**2** of **2**

Progress	Samples / Tests				Water	Backfill & Instru-mentation	Description of Strata	Reduced Level	Depth (Thick ness)	Material Graphic Legend
Window Run	Depth	No	Type	Results						

Drilling Progress and Water Observations					
Date	Time	Borehole Depth (m)	Casing Depth (m)	Borehole Diameter (mm)	Water Depth (m)

General Remarks

was installed with a response zone between 1.00m and 2.00m.

All dimensions in metres | Scale: **1:25**

Method Used:	Plant Used:	Drilled By:	Logged By:	Checked By:
Concrete coring (300mm) + Modular Dynamic Sampling	**Modular Dynamic Sampling Rig**	**Liam Tyler**	**RMiller**	AGS

FINAL

WINDOW SAMPLE LOG

Contract:	Client:	Window Sample:
Ugly Brown Building	**The Trustees of the St Pancras Way Block A Unit Trust & Big Lobster Ltd**	**WS06**

Contract Ref:	Start:	Ground Level (m AOD):	National Grid Co-ordinate:	Sheet:
371654	**30.01.19** End: **30.01.19**	**21.79**	**E:529598.8 N:183773.8**	**1** of **1**

Progress	Samples / Tests				Water	Backfill	Description of Strata	Reduced Level	Depth (Thickness)	Material Graphic Legend
Window Run	Depth	No	Type	Results						
							REINFORCED CONCRETE (300 mm core)		(0.28)	
								21.51	0.28	
	0.60 0.60	1	ES PID	0.0ppm			MADE GROUND: Dark brown very sandy angular to sub rounded fine to coarse GRAVEL of brick, concrete and clinker. Sand is fine to coarse. Occasional cobbles of concrete and brick with rare pockets of light brown clay.		(1.22)	
	1.20-1.58	2	SPT(c)	N=74*						
	1.40-1.50	3	SPT(c)	N=195*				20.29	1.50	
							The window sample borehole was terminated at a depth of 1.50m due to very dense ground conditions.			

Drilling Progress and Water Observations					
Date	Time	Borehole Depth (m)	Casing Depth (m)	Borehole Diameter (mm)	Water Depth (m)

General Remarks

1. Inspection pit excavated to 1.20m depth through a 300mm diameter cored slab to check for services.
2. The borehole was terminated at 1.58m depth due to very dense ground conditions.
3. On completion the borehole was backfilled with arisings and reinstated with concrete.

All dimensions in metres | Scale: **1:25**

Method Used:	Plant Used:	Drilled By:	Logged By:	Checked By:
Concrete coring (300mm) +	**Modular Dynamic Sampling Rig**	**Liam Tyler**	**RMiller**	AGS

FINAL

WINDOW SAMPLE LOG

Contract:	Client:	Window Sample:
Ugly Brown Building	**The Trustees of the St Pancras Way Block A Unit Trust & Big Lobster Ltd**	**WS07**

Contract Ref:	Start:	Ground Level (m AOD):	National Grid Co-ordinate:	Sheet:
371654	**11.01.19** End: **11.01.19**	**21.74**	**E:529614.5 N:183786.7**	**1** of **1**

Progress	Samples / Tests				Water	Backfill	Description of Strata	Reduced Level	Depth (Thickness)	Material Graphic Legend
Window Run	Depth	No	Type	Results						
							REINFORCED CONCRETE.			
							. . . One set of 15 mm steel rebar at 0.065m depth, and three sets of 10 mm steel rebar at 0.08, 0.17 and 0.19m depth.	21.52	0.22	
							Concrete core complete at 0.22m depth.			

Drilling Progress and Water Observations					
Date	Time	Borehole Depth (m)	Casing Depth (m)	Borehole Diameter (mm)	Water Depth (m)

General Remarks

All dimensions in metres | Scale: **1:25**

Method Used:	Plant Used:	Drilled By:	Logged By:	Checked By:
Concrete coring (300mm) + Modular Dynamic Sampling	**Modular Dynamic Sampling Rig**	**???**	**MMcCann**	AGS

Southern Testing
Environmental & Geotechnical

SPT Hammer Energy Test Report

in accordance with BSEN ISO 22476-3:2005

Neil Burrows
Southern Testing Laboratories
Unit 11
Charlwoods Road
East Grinstead
RH19 2HU

SPT Hammer Ref:	GEH3
Test Date:	02/02/2018
Report Date:	02/02/2018
File Name:	GEH3.spt
Test Operator:	NPB

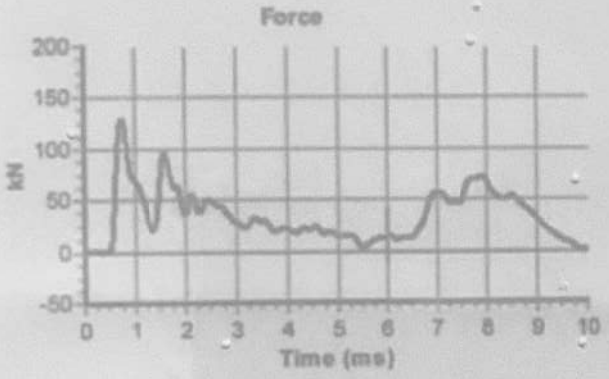
Instrumented Rod Data

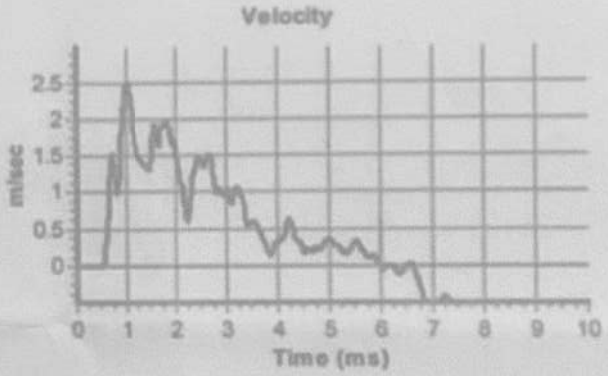
Diameter d_r (mm):	54
Wall Thickness t_r (mm):	6.0
Assumed Modulus E_a (GPa):	200
Accelerometer No.1:	
Accelerometer No.2:	

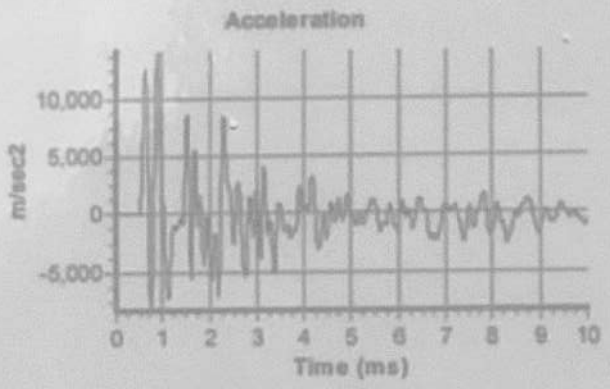
SPT Hammer Information

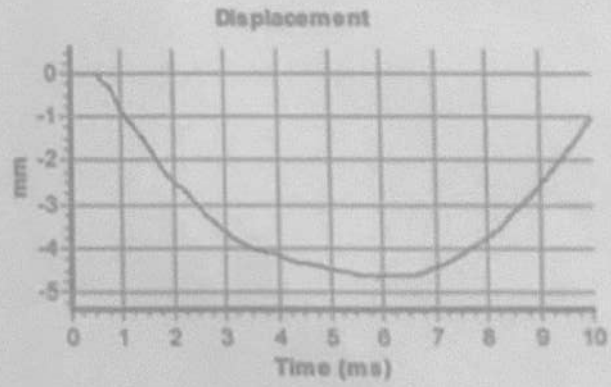
Hammer Mass m (kg):	64.5
Falling Height h (mm):	750
SPT String Length L (m):	14.5

Comments / Location









Calculations

Area of Rod A (mm2):	905
Theoretical Energy E_{theor} (J):	473
Measured Energy E_{meas} (J):	223

Energy Ratio E_r (%): 47

N P Burrows

Signed: N P Burrows
Title: Field Operations Manager

The recommended calibration interval is 12 months