

**A14.9 – Bank Station Capacity Upgrade –
Abstraction and Historic Wells Current Status
(London Underground)**



Bank Station Capacity Upgrade

Abstraction and Historic Wells

Current Status

April 2012-04-04

LUSTN-0008798-STR-002051

London Underground

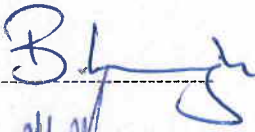
Ground Floor, Albany House, 55 Broadway, London SW1H 0BD

BANK STATION CAPACITY UPGRADE


ABSTRACTION AND HISTORIC WELLS - CURRENT STATUS

Prepared by: Paul Hill Signature:  Date: ---16th April 2012---

(Project Engineer)

Checked by: Billy Kavanagh Signature:  Date: 26/04/12

(Delivery Manager)

Checked by: Jon Colclough Signature:  Date: 26/04/2012

(Environmental Engineer)

Issue and Revision Record

Version	Date	Originator	Checker	Approver	Description
0.1	April 2012	Paul Hill	Jon Colclough	Billy Kavanagh	

BANK STATION CAPACITY UPGRADE

ABSTRACTION AND HISTORIC WELLS - CURRENT STATUS

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BANK STATION CAPACITY UPGRADE

ABSTRACTION AND HISTORIC WELLS - CURRENT STATUS

1.0 Introduction

This paper presents supplementary works undertaken after receipt of the RIBA D designers report and reflects the current status of the live abstraction licences as well as locations of historic lined wells, which may be impacted by the tunnelling on the Bank Capacity Upgrade scheme. The site is located approximately 300m north of the tidal River Thames.

2.0 Current Status

AT RIBA D the Designer has undertaken a study of the Water Resources within the Bank area ([LUSTN-0008798-DOC-001173](#)) identifying potential impacts to the water resources. The study has identified seven abstraction points within 250m of 10 King William Street, one of which is used for human consumption, as well as a further sixty eight historic water supply boreholes. These were identified using the “water well” filter within the BGS GeoIndex. Details of the wells are attached to this paper.

Reference	1	2	3	4	5	6	7
Operator	The London Assurance	J.P.I.T. (Pte) Limited	City Of London Real Property	Asgard Estates Ltd	Lloyds Tsb Bank Plc	National Westminster Bank Plc	Bank Of China
Licence number	28/39/39/0127	28/39/39/0056	28/39/39/0050	28/39/39/0094	28/39/39/0186	28/39/39/0072	28/39/39/0170
Location	1 King William Street, LONDON, Eo4	Three Boreholes At Gracechurch Street, London Ec3	52 Gracechurch Street, LONDON, Ec3	Borehole At 98/106 Cannon Street, London Eo4	71 Lombard Street, London - Borehole	1 Princes Street, LONDON, Ec2	90-96 Cannon Street, LONDON
Abstraction	Office	Commercial/Industrial/Public Services: Drinking; Cooking; Sanitary; Washing; (Small Garden)	Commercial Use (pubs etc)	Commercial/Industrial/Public Services: Drinking; Cooking; Sanitary; Washing; (Small Garden)	Commercial/Industrial/Public Services: Drinking; Cooking; Sanitary; Washing; (Small Garden)	Commercial Use (pubs etc)	Drinking, Cooking, Sanitary, Washing or Swimming Pools
Abstraction type	Not Supplied	Water may be abstracted from a single point	Not Supplied	Water may be abstracted from a single point	Water may be abstracted from a single point	Not Supplied	Not Supplied
Source	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater
Authorised start	Not Supplied	01-Jan-10	Not Supplied	31-Dec-10	01-Jan-10	Not Supplied	Not Supplied
Authorised end	Not Supplied	31-Dec-10	Not Supplied	20th February 1990	31-Dec-10	Not Supplied	Not Supplied
Permit start date	Not Supplied	1st January 1997	Not Supplied	Not Supplied	6th April 2000	Not Supplied	Not Supplied

Source: Envirocheck report [Ref 11]

Seven Abstraction points identified within 250m of the site

BANK STATION CAPACITY UPGRADE

ABSTRACTION AND HISTORIC WELLS - CURRENT STATUS

Since the receipt of the RIBA D report ([LUSTN-0008798-DOC-001173](#)) from the Designers London Underground have carried out further consultation with the Environment Agency, March 2012, and have updated the status of the current Abstraction licensed Wells. London Underground has also identified historic wells that may impact tunnelling, with the well liners intersecting the tunnel horizon and passing into the chalk aquifer. The EA has verbally confirmed that wells with abstraction rates below 20 cubic metres per day do not require Abstraction Licence applications. It is possible that other wells in the area may be in use but cannot be identified.

Only one of the identified wells in the table above has a current abstraction license; **28/39/39/0166 - Lloyds TSB Bank PLC 71 Lombard Street EC2, which is reference 5 in the above table.**

The EA confirmed an additional abstraction licence located within the Bank of England; **28/39/39/0024 at NGR TQ 327 812 – purpose, office use.**

Further investigative works will be required, a Multi Discipline Contractor (MDC) is being procured and it is anticipated that they will carry out this works.

1. Investigate with the local authority wells that are abstracting less than 20 cubic metres/day and do not require abstraction licenses, which may impact the BSC works.
2. Review and report on the legal ramifications of wells impacted requiring removal/ replacement.

Details of historic Well boring records are attached in appendices and were obtained from the BGS web site; <http://www.bgs.ac.uk/data/boreholescans/home.html>



Figure 1 - Borehole Location Impacted by Tunnel Alignment

Appendices

Appendix A - Record of Well Boring: Boreholes 48-49



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[Report an issue with this borehole](#)

48, 49?

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**NGRC
BOREHOLE RECORDS
ADJUSTMENT FORM**

QUARTER SHEET TO 38 SW

BH REGISTRATION NUMBER 3070 - 3467

RECORDS ENTERED AND HELD BY WALLINGFORD

BH REGISTRATION NUMBER(S)



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① Depth 137.16m.

Report an issue with this borehole

TQ 38 SW 1698. KWS
532 790 186940

<< < Prev Page 2 of 4 Next >> ② Depth 52.3m.

Telephone BUCKHURST 2437

ARTESIAN WORKS
BROMLEY, E.

J. J. ELAM, A.M. INST. B.E.
J. J. ELAM, JNR.

Our Ref.

Your Ref.



James J. Elam & Company Son Ltd.
HYDRAULIC & GENERAL ENGINEERS

Water Supplies • Artesian Wells • Bore Hole Air Lift & Windmill
Pumps • Chlorination Plants • Fire Protection Installations
Electrical Repairs • Geological Opinion and Schemes Prepared
MAINTENANCE, REPAIRS AND OVERHAULS

NR. TQ 3278093

ARTESIAN WELL.
COMPTOIR NATIONAL d'ESCOMPTE de PARIS.
KING WILLIAM STREET. E.C.

(1) ~~Approximately 1915~~ November 1916.
Below Street Level 18 feet.

A

Diff. 12	Gravel.....	12	feet
L.C. 137.	Yellow & Blue Clay..	7	.
	Blue Clay.....	130	.
W.R. 50	Mottled Clay.....	28	.
	Clay & Shell	9	.
	Green Sand & Pebbles.	13	.
T.S. 41	Green Sand	11	.
	Hard Grey Sand	30	.
Ch 20	Chalk & Flints	210	450 feet

7x1 2.12.44 Boring 6" - by Williams 1916.
Water Level 187 feet
Yield about 700 gallons per hour. 650g.p.h.

(2) A second Well bored in 1925 Strata approximately the same.
Diameter 6"
Water Level 214 feet (1925) October 1930. 262 feet
Yield approximately as No 1. Williams 1925.

B

Site visited 28th Sept 1946

253/790

TQ 38/4 125

②

Section of B.

Made up ground	13
Gravel	12
Yellow clay	1
Blue "	147
Mottled clay	51
Greensand + pebbles	23
" "	10
Grey sand	13
Chalk + flints	20
	<u>450</u>

150

Done by Williams.



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256/790
TQ 38/425 A & B.

256/790 A	Drift	ft.	ins
	London Clay	12	0
	Woolwich + Reading Beds (Intermediate Type)	137	0
	Thanet Sand	50	0
	Upper Chalk	41	0
		210	0

256/790 B	Made ground	13	0
	Drift	12	0
	London Clay	148	0
	Woolwich + Reading Beds (? Intermediate Type)	54	0
	Thanet Sand	23	0
	Upper Chalk	200	0

Invitation 1976

BANK STATION CAPACITY UPGRADE

ABSTRACTION AND HISTORIC WELLS - CURRENT STATUS

Appendix B - Record of Well Boring: Borehole 50



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50

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PHOENIX ASSURANCE CO. KWS.
DATE
DEPTH 189.58m.

TQ 38 SW 2799
3275 8097

TQ 38

TELEPHONE ADVANCE 1417. H/96 255761
ALFRED WILLIAMS & CO. LTD
HYDRAULIC & GENERAL ENGINEERS
AND CONTRACTORS TO H.M. GOVERNMENT.
CLOSE TO BOND ROAD UNDERGROUND RLY. STATION BOW BRIDGE.
DIRECTORS A. P. WILLIAMS & J. ELAN.

Artesian Works.
311, Old Ford Road, Bow, E.3.
London.

PHOENIX ASSURANCE CO
King William Street.
two wells a few yards apart

10	3.11.1915	Blue clay	181
2		Reddish clay	43
2		Mixture clay, stone, pebbles	2
3		Pebbles	3
12		Green sand & pebbles	12
2		Hard grey sand & pebbles	2
5		Green sand	5
20		Grey sand	20
210		Chalk & flints	210

450			feet

Diameter 8 1/2"
Water level 180 feet
Yield 1500 gallons
Completed May 1915

Inf. And log see next page

33064



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~~NOT TO BE USED FOR RECORDS~~
 = PHOENIX ASSURANCE CO.
 ABchurch LINE.

SHOWING AS KWS.

DATE 1932.
 DEPTH 137.16 m.

TQ 38 SW / 2798 - 2799

100 38/296 B

WELL BORING at **the Phoenix Assurance Co. Ltd** County **London S.E.W.**
 1 in map New Series **256** Date **1932**
 Made by **Alfred Williams & Co., Ltd** Bored **622** feet.
 Communicated by **Alfred Williams & Co., Ltd**
 Rest level of water **258 ft. from street level**
 Approximately **1,800** gallons per hour.
 H/190
 (with copy of analysis on separate sheet)

GEOLOGICAL FORMATION.	NATURE OF STRATA.	THICKNESS.		DEPTH.	
		Feet.	Inches.	Feet.	Inches.
Drift	Street level to basement	22	-	22	-
London clay	Ballast	11	-	33	-
	Blue clay	139	-	172	-
	Moulded clay	32	-	204	-
W. and Reading Sands	Mixed sand, shell and clay	7	-	211	-
	Green sand and pebbles	12	-	223	-
Thames sand	Grey sand	45	-	268	-
Upper Chalk	Chalk and flints	351	-	622	-

Diameter - 8 inches

"A.K.B."
 16.9.32.
 Site visited 27th August 1946.
 Three wells
 A & B side by side & originally identical
 One of these wells was deepened to
 to 600' & the other one is 450'.

Am. of. 80.
 16/1/32.
 (a) 450' - output 650 g.p.h.
 (b) 600' " " 1000 g.p.h.
 (c) 600' " " 800 g.p.h.

All three wells used alternatively.
 Pumping 9 hrs day 5 days week & 6 hrs
 on Saturday.
 Average 800 g.p.h. for 9 hrs/day.
 Well top 30' below st. level.

R.W.L. 1945 April
 240'
 246'
 254'
 298'
 274' + 263'
 250'

28 August 1946.

GEOLOGICAL SURVEY AND MUSEUM,
 JERVIS STREET, LONDON S.W. 1.
 (B10419). VOL. 10024-5122. 2600. 11 25. Op. 160. O.A.

BANK STATION CAPACITY UPGRADE

ABSTRACTION AND HISTORIC WELLS - CURRENT STATUS

Appendix C - Record of Well Boring: Boreholes 3-4

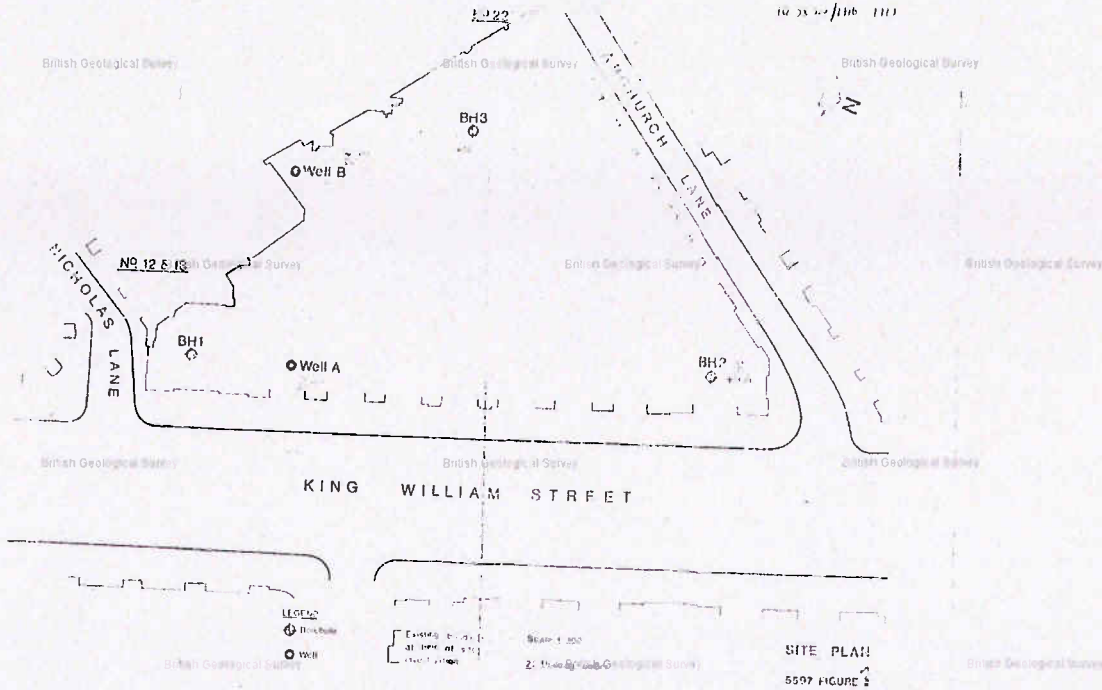


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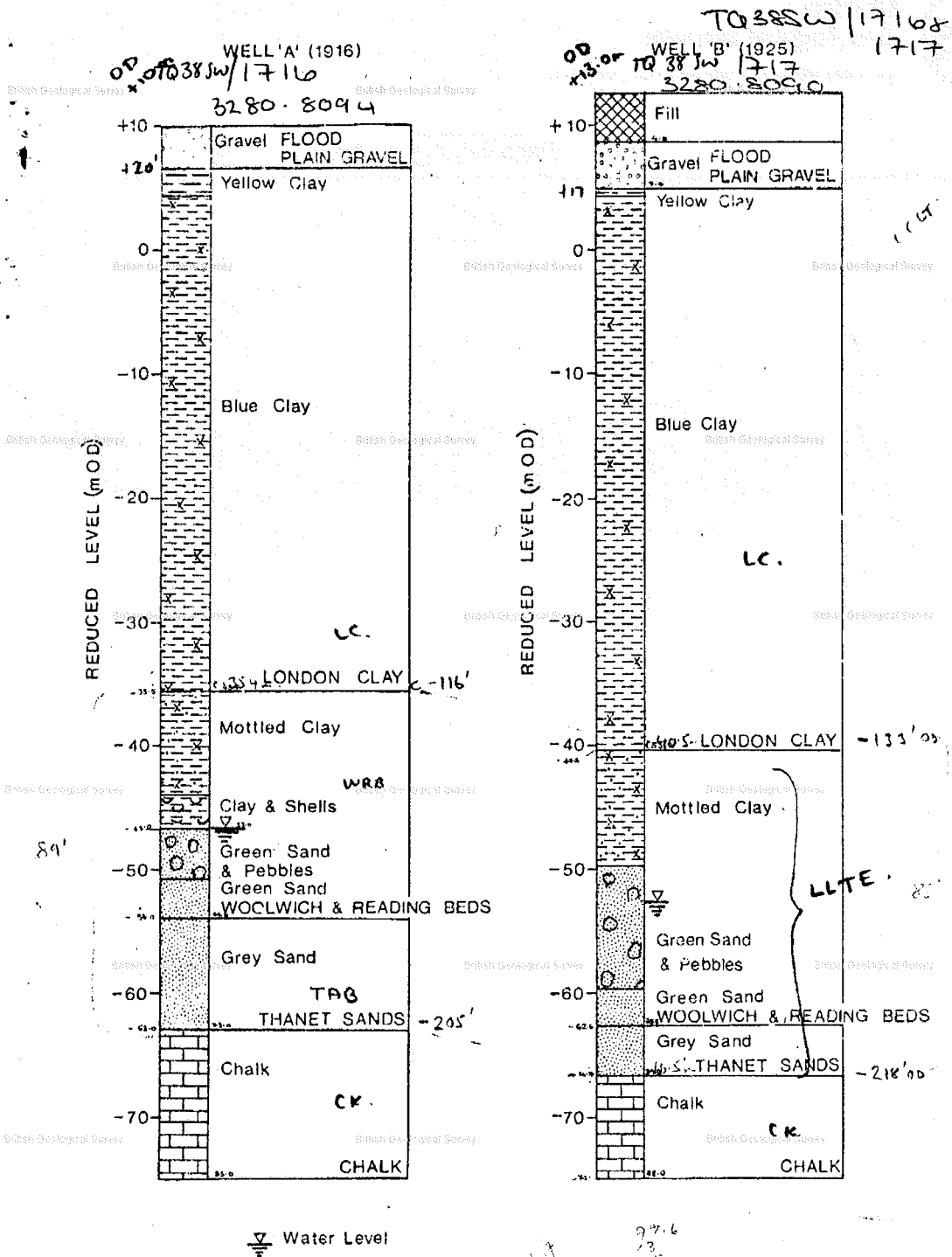
[Report an issue with this borehole](#)

③ ④

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2ND WELLS
DEPTH INDICATED BY GRS AS 88m.
 - A - 1916
 - B - 1925.



WELL PROFILES

5597 FIGURE 4

BANK STATION CAPACITY UPGRADE

ABSTRACTION AND HISTORIC WELLS - CURRENT STATUS

Appendix D - Record of Well Boring: Borehole 59



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59.

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TELEPHONE EAST 694. **768**
ALFRED WILLIAMS & CO.
HYDRAULIC & GENERAL ENGINEERS
AND CONTRACTORS TO H.M. GOVERNMENT
CLOSE TO BOX ROAD UNDERGROUND RLY STATION
KING WILLIAM STREET. STAFFORD HOUSE.
Made and communicated by Alfred Williams & Co. 1921.
Water level 194 feet. Supply about 2000 gallons per hour.
Diameter of bore 8". 20 feet below street level.
Ballast..... 15 = 15
Blue clay..... 134 = 149
Mottled clay..... 7 = 156
Sand and shell..... 29 = 185
Green Sand and Pebbles... 9 = 194
Grey Sand, hard..... 12 = 206
Live Sand..... 34 = 240
Chalk and Flints..... 180 = 420.
Site visited
Deepened again 1939 to 600' - R.W.L. 210. n-266
Average yield 1050 g.p.h.
No. Pumping 2 hrs 1 day - 6 days/week.
Well top 25' below ground.
R.W.L. 268' - 1946.
(? 100' 6" tube 300' - 5" tube)
Sept. 1946
Information from plan 201146.
33071
1944.

TQ 38 SW 2808
3282 8089

Stafford House, King William Street, London E.C.4. Page 203
WELL BORING at Street, E.C. 4. County Middlesex
Geol. map 1 in. map No. Series 256
Made by Legend S.S. 1928.
Sunk _____ feet. Bored 100. feet.
Communicated by Legend S.S.
Height above Ordnance Datum _____ Rest level of water 215'
Yield 2250 g.p.h.
Quality (with copy of analysis on separate sheet)

LITHOLOGICAL FORMATION	NATURE OF STRATA	THICKNESS		DEPTH	
		Feet	Inches	Feet	Inches
H/103 ②	Existing well.	450			
	Chalk flints (water bearing)	52		452	
	Hard grey chalk	37		489	
	Grey chalk.	11		500.	

BANK STATION CAPACITY UPGRADE

ABSTRACTION AND HISTORIC WELLS - CURRENT STATUS

Appendix E - Record of Well Boring: Borehole 6



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N^o6.

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TQ 38 SW 2822 IMRIE HOUSE
532840 180760
DEPTH 152.4 m.
ARTHURST WEST / KWS.

TQ 38 SW / 2822 10 38 14.2

31-36

RECORD of WELL or BORING

Survey No. **1928/42**

at (Name or farm) *Imrie House, Arthur Street West, King William Street*

Town, Village, etc. *Arthurs West* County *West Lothian* Section map *1927*

Exact site (unless a tracing from a map is supplied, give distance and direction from parish church, cross-roads, or other object shown on map) *25 1/2* Popular Edition *1927*
of *1* one-inch map, *1* square

Surface level of ground _____ ft. above Ordnance Datum. Well or Bore commenced at _____ ft. below surface level of ground.

Sunk _____ ft., diameter _____ ft. Bored _____ ft.; diameter of boring: at top _____ in., at bottom _____ in.

Details of lining tubes (nominal diameters preferred) *18' of 10" tubes, 120' of 7 1/2" tubes, 190' of 6"*

Water struck at depths of (feet) _____

Rest-level of water *low* top of well or bore *172* ft. Pumping level *250* ft. Time of recovery _____ hours.

Suction at _____ ft. depth. Yield: (i) on test *1200* galls. per hour, (ii) normal _____ galls. per _____

Quality (attach copy of analysis if available) _____

Made by *J.S.G.* for Mr. *J.S.G.* Date of boring *1945*

Information from *J.S.G. (1945)* *TQ 3284 8076*

GEOLOGICAL CLASSIFICATION	NATURE OF STRATA (and any additional remarks)	THICKNESS		DEPTH	
		Feet.	Inches.	Feet.	Inches.
<i>Made</i>	Made Ground	4	-	4	-
<i>Drift</i>	Large Ballast	18	-	22	-
	Brown Clay	8	-	30	-
<i>18'</i>	Blue	120	-	150	-
	Mottled	21	-	171	-
<i>Dark</i>	Dark Sand	7	-	178	-
<i>65'</i>	Loamy Sand + s.s. etc.	8	-	186	-
	Mottled Clay	5	-	191	-
	Brown loamy sand and pebbles	8	-	199	-
	Green loamy sand	9	-	208	-
	Green sand	7	-	215	-
<i>75'</i>	Dark loamy sand	35	-	250	-
<i>192'</i>	Chalk and flint	142	-	392	-
<i>500'</i>	disputed (date & under unknown)			500	

18' x 10" from 5' down (120 x 7 1/2" withdrawn) 250 x 6" from 2' 6" down.

Additional information from Siles Co. 26. 5. 46 Glasgow

33056

R.W.L. 216 down in 1931... R.W.L. 221 down in July 1945 P.W.L. 223 Yield 1727 July 1945 Depth when flooded in July 1945 468' 6" This well was desisted for a time owing to many water, it has been put into commission again. J.S.G. 10.3.49.

For Survey use only.

GEOLOGICAL SURVEY AND MUSEUM, SOUTH KENSINGTON, LONDON, S.W.7.

Date received.	G.S.N.	N. of H. notified.	Site marked on 1" map.
----------------	--------	--------------------	------------------------

124728C) W 9920/201

23-14
RECORD of WELL or BORING.

Source House, Arthur Street West, King William Street
 at (house or farm) ~~Mass St, ...~~ Survey No. **11/127**

Town, Village, &c. _____ County _____ State _____
 Exact site (unless a tracing from a map is supplied, give distance and direction from parish church, cross-roads, or other object shown on maps) **256/102** Popular Edition _____
 of _____ one-inch map. _____
 Surface level of ground _____ ft. above Ordnance Datum. Well or Bore commenced at _____ ft. below surface level of ground.
 Sunk _____ ft., diameter _____ ft. Bored _____ ft.; diameter of boring at top _____ in., at bottom _____ in.
 Details of lining tubes (internal diameters preferred) **12' of 10" tubes; 120' of 7 1/2" tubes;**
190' 6" "NGR TQ 328 807."

Water struck at depths of (feet) _____
 Rest-level of water ^{below} top of well or bore **170** ft. Pumping level **250** ft. Time of recovery _____ hours.
 Suction at _____ ft. depth. Yield: (i) on test **1200** galls. per hour; (ii) normal _____ galls. per _____
 Quality (attach copy of analysis if available) _____
 Made by **J.S.C.** for Mr. _____ Date of boring **Sept. 1914**
 Information from **J.S.C. (7/15)**

(For Survey use only). GEOLOGICAL CLASSIFICATION.	NATURE OF STRATA. (and any additional remarks)	THICKNESS.		DEPTH.	
		Feet.	Inches.	Feet.	Inches.
Made	Made Ground	4	-	4	-
Briff	Large Ballast	18	-	22	-
L.S.	Brown Clay	8	-	30	-
128	Blue	120	-	150	-
	Mottled	21	-	171	-
W.B.	Dark Sand	7	-	178	-
65	Loamy Sand + shells	8	-	186	-
	Mottled Clay	5	-	191	-
	Brown loamy sand and pebbles	8	-	199	-
	Green loamy sand	9	-	208	-
	Green sand	7	-	215	-
T.S.	Dark loamy sand	35	-	250	-
35	Chalk and flints	142	-	392	-
OK.					
142					
S.P.	deepened (date & sinker unknown)			500	-
26.8.10					
	18' x 10" from 5' down (120 x 7 1/2" withdrawn) 250 x 6" from 2' 6" down.				
	Additional information from Siler & Co. 26. 8. 16 London				
	R.W.L. 216 down in 1931 R.W.L. 221 1/2 down in July 1948 P.W.L. 223 Depth when plumbed in July 1948 463' 6" This well was discussed for a time owing to enemy action. It has been put into commission again. S.P. 10.3.49.			Yield 1727 July 1948	



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256/792
TQ 38/427

256/792	Made ground
	Griff
British Geological Survey	London Clay
	Woolwich + Reading Beds (Intermediate Type)
	Thanet Sand
	Upper Chalk

ft.	m.
4	0
18	0
128	0
65	0
35	0
250	0

British Geological Survey

British Geological Survey

British Geological Survey

British Geological Survey

Swatheaden 1976

British Geological Survey

British Geological Survey

British Geological Survey

British Geological Survey

British Geological Survey

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BANK STATION CAPACITY UPGRADE

ABSTRACTION AND HISTORIC WELLS - CURRENT STATUS

Appendix F - Well locations

