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37 HAMILTON ROAD
TWICKENHAM

Preliminary Environmental Assessment

06 / 3890 / FULL

Client
Frendcastle Management Limited

Consulting Engineer
Barnard & Associates

Report No. 2469a
22 July 2004

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**37 HAMILTON ROAD,
TWICKENHAM**

**Preliminary
Environmental Assessment**

Synopsis

An investigation has been carried out at 37 Hamilton Road, Twickenham on the instructions of Friendcastle Management Ltd.

The purpose of the investigation was to determine the ground conditions and to provide preliminary recommendations in respect of environmental matters.

Five continuous open drive (window) sampler boreholes were carried out, supported by a programme of in situ and laboratory testing.

The results indicate that some remediation of the site is expected to be required.

A desk study⁽¹⁾ has previously been carried out by AP GEOTECHNICS and should be read in conjunction with the recommendations given herein.

1

Site description

The site consists of light industrial units, garages and storage with hardstanding in between. The archive study⁽¹⁾ contains a detailed description of the site to which the reader is referred. In addition, the topographical survey drawing is reproduced at Appendix C herein and serves to illustrate the general layout of the site.

2

Field work

The extent of the field work was agreed with the client and comprised five boreholes advanced by continuous open drive sampling techniques to a maximum of 4.5m depth. Their locations are shown on Figure 1 of Appendix C (VSI could not be undertaken due to suspected services in the vicinity).

Representative soil samples were recovered for subsequent laboratory examination and testing. Details of the strata encountered are provided on the Borehole Records at Appendix A; together with particulars of the samples recovered and groundwater observations.

3

Laboratory testing

Chemical analyses was undertaken to detect the presence of contaminants indicated by the desk study, viz:-

Common contaminants listed by the ICRCL ^[2]:-

Total arsenic, cadmium, chromium, lead, mercury, selenium,
copper, nickel, zinc, monohydric phenol, polycyclic aromatic
hydrocarbons and cyanide. Water soluble boron and sulphate.
Sulphide, elemental sulphur and pH value.

Speciated total petroleum hydrocarbons (TPH)

Speciated Polyaromatic hydrocarbons (PAH)

Polychlorinated Biphenyls (PCB)

These analyses were conducted on soil samples and the results are presented at Appendix B.

4

Ground conditions

4.1

Stratigraphy

The stratigraphy of the site as revealed by boreholes is given in detail at Appendix A and is described in general terms hereafter.

4.1.1

Fill material

Underlying the hardstanding was a sand with brick fragments and other man made detritus, sometime black in colour and having a hydrocarbon odour. Underlying this in WS2, 4 & 5 and

replacing it in WS6 was a brown sandy clay with gravel and brick fragments. Fill material was proved to a maximum depth of 1.6m.

4.1.2

Langley Silt

An layer of orange brown or grey brown sandy clay with some gravel was proved beneath the fill in all holes. This material is considered to represent Langley Silt.

A hydrocarbon odour was noted in WS 4.

4.1.3

Kempton Park Gravel

Kempton Park Gravel was proved in all exploratory holes. It was generally found to be a brown and orange brown sandy gravel, sometimes clayey at the top, with occasional clay layers within. The majority of the window sampler holes were terminated in this material although WS4 proved it to 4.2m depth. A hydrocarbon odour was noted in WS4 from 3 to 4.2m depth.

4.1.4

London Clay

London Clay was proved in WS4 only and continued to the full depth of investigation. It comprised a fissured dark grey silty clay, consistent with the unweathered part of the formation.

The clay was visually assessed to be in a generally stiff condition.

4.2

Groundwater

Groundwater was encountered WS4 & 6 at 3 and 3.5m depth rising some 1/2m in the subsequent observation period. Full details are provided on the appropriate borehole record at Appendix A.

5

Discussion

Based on the information given by the desk study, it was concluded that samples should be analysed for contaminants listed by the ICRCCL together with TPH and PAH.

This preliminary investigation has highlighted contamination predominantly by hydrocarbons in all exploratory positions apart from WS6. It is our experience that a level of 350mg/kg is generally acceptable to the Local Environmental Health Officer and the Environment Agency for TPH. On the above basis significant hydrocarbon contamination has been found at the following locations:-

WS2 @ 0.3m

WS4 @ 1.3m

WS4 @ 3.3m

WS5 @ 0.3m

The sample from WVS2 also showed significant level of PAH contamination.

All PCB results were below detection limits.

In addition, isolated heavy metal contamination, by arsenic in WVS6 and mercury in WVS2, has been revealed.

Based on the laboratory testing carried out so far, significant hydrocarbon contamination has been found in a number of locations (one of which is below the groundwater). Additional investigation and sampling will be required to determine the lateral and vertical extent of the contamination. Also confirmation should be obtained as to whether the groundwater has been impacted. After this has been completed, a site specific risk assessment should be undertaken once the development layout is known to derive acceptable threshold levels. This is expected to confirm that some remediation will be required. In situ bioremediation is a proven technology to achieve this and is expected to be the most appropriate remediation solution for the TPH and PAH.



AP A M Smith
AP GEOTECHNICS LTD.
22 July 2004

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References

- [1] Report No. 2469
Desk Study
37 Hamilton Road, Twickenham
AP Geotechnics Ltd., 30 June 2004
- [2] ICRCI Guidance Note 59/83
Guidance on the assessment and redevelopment of contaminated land
Interdepartmental Committee on the Redevelopment of Contaminated Land
Second Edition, July 1987

PROCEDURAL NOTES for GROUND INVESTIGATIONS

General

This report is based upon data obtained from field descriptions of the strata and examination of the samples by an engineer, together with the results of in situ and laboratory tests as appropriate. Responsibility cannot be accepted for variations in ground conditions between and around any of the exploratory points that is not revealed by the data. Whilst the report may offer an opinion on the ground conditions between exploratory points and below the depth of investigation, this is for guidance only and no liability is accepted for its accuracy.

Drilling procedure

Boring by light cable percussion drilling allows the ground conditions to be reasonably well established. However, a certain amount of disturbance is inevitable and some mixing of soils can occur.

Sampling procedure

"Undisturbed" samples of predominantly cohesive soils are taken with a 100mm diameter open tube sampler, generally in accordance with BS 5930: 1999.

Where appropriate, or where an undisturbed sample is unsuccessful, disturbed samples are recovered and sealed into polythene bags.

Groundwater samples are taken when water is encountered in sufficient quantity.

Standard penetration tests

The test is conducted generally in accordance with BS 1377: Part 9: 1990. The sampler tube is subject to a seating drive of 150mm into the soil at the base of the borehole. Results are given on the Borehole Records as the number of blows required to drive the sampler tube a further 300mm and this is known as the "N" value. Where the driving resistance is such that full penetration is not achieved, the test is generally terminated after 50 blows and the actual distance penetrated is recorded.

Groundwater

Groundwater observations necessarily reflect the conditions encountered at the time of the exploratory work. Long term monitoring of standpipes is usually required to establish an equilibrium water level since the normal rate of boring is too fast to permit steady state conditions to be achieved.

Groundwater levels are subject to variations caused by changes in drainage conditions and seasonal climatic changes.

Water may necessarily be added to advance the bore whilst casing may be required to maintain an open hole. These can both mask subsequent groundwater observations and are therefore noted on the individual Borehole Record.

April 2002

APPENDICES

A Borehole Records

Symbols and Abbreviations
Borehole Records

B Laboratory Test Results

Contaminants in soil

C Figures and Drawing

Figure 1 Borehole location plan

Drawing Drawing No. 2519/01P
Site Survey; Hamilton Road, Twickenham
Ground Surveys, June 2004

APPENDIX A

BOREHOLE RECORDS

SYMBOLS and ABBREVIATIONS

Samples

Undisturbed

- U Standard open drive "undisturbed"
102mm dia. in boreholes
38mm dia. in trial pits, window sampler and
hand auger bores.
- T Thin wall open drive
- P Piston
- C CBR mould

Disturbed

- D Small
- c Small (contaminants)
- B Bulk
- W Water

In situ tests

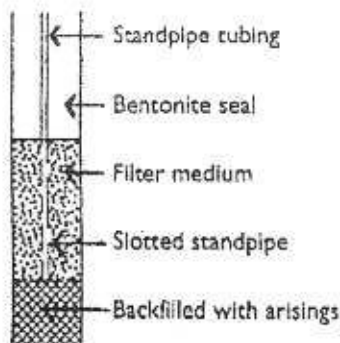
- SPT Standard Penetration Test, open shoe
- CPT solid cone
- Blow count given as seating drive/four increments of 75 mm
- VA Vane test
- P () Hand penetrometer (kg/cm²)
- M () Mexe probe (CBR %)

Water records

- Σ_1 Standing level
- Σ_2 Depth encountered

suffix identifies separate strikes

Standpipes



Excavation Method Drive-in Window Sampler	Dimensions	Ground Level (mOD)	Client Fronccastle	Job Number 2469
	Location See Site Plan	Dates 08/06/04	Engineer	Sheet 1/1

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
0.30 0.30	J1 C1				(0.15) 0.15 (0.35) 0.50	TARVAC FILL: Black sand with brick fragments, concrete fragments, clinker and gravel with a hydrocarbon odour. FILL: Brown clay with occasional brick fragments, occasional black flecking and rare coal fragments.		
0.80 0.80	J2 C2				(0.50) 1.00	Orange brown gravelly sandy CLAY.		
1.30 1.30	J3 C3				(0.50) 1.50	Orange brown clayey sandy GRAVEL.		
1.80 1.80	J4 C4				(0.70) 2.20	Orange grey brown mottled sandy CLAY.		
2.30 2.30	J5 C5				(0.20) 2.40 (0.40)	Brown with occasional black flecking CLAY with occasional gravel and occasional layers of yellow orange sand.		
2.80 2.80	J6 C6				2.80 (0.20) 3.00	Brown sandy GRAVEL.		
						Complete at 2.80m		

Remarks Borehole was dry.	Scale (approx) 1:25	Logged By
	Figure No. 1002.2	

Excavation Method Drive-In Window Sampler	Dimensions	Ground Level (MOD)	Client Frendesalle	Job Number 2469
	Location See Site Plan	Dates 03/05/04	Engineer	Sheet 1/1

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (MOD)	Depth (m) (Thickness)	Description	Legend	Water
0.30 0.30	J1 C1				0.15 (0.65)	TARMAC FILL: Brown sand with brick, ash, clinker and much gravel.		
0.80 0.80	J2 C2				0.75	Grey brown silty CLAY with occasional gravel and occasional black flecking.		
1.30	C3				(1.75)	...abundant gravel.		
1.80	C4				2.50	Orange brown sandy GRAVEL.		
2.30	C5				3.00	Complete at 3.00m		

Remarks Borehole was dry.	Scale (approx)	Logged By
	1:25	
	Figure No. 1002.3	

Excavation Method Drive-in Window Sampler	Dimensions	Ground Level (mOD)	Client Frendcasilla	Job Number 2488A
	Location See Site Plan	Date 08/08/04	Engineer	Sheet 1/1

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
0.30 0.30	J1 C1				0.10 (0.40)	TARMAC FILL: Black sand with tarmac, clinker and brick fragments.		
0.80 0.80	J2 C2				0.50 (1.10)	FILL: Orange brown clay with gravel, brick fragments, ash and clinker.		
1.30 1.30	J3 C3					Hydrocarbon odour		
1.60 1.60	J4 C4				1.60 (0.60)	Orange brown silty sandy CLAY with occasional gravel, black flecking and pockets of orange brown sand. Hydrocarbon odour.		
2.30	C5				2.20 (0.60)	Black grey slightly clayey sandy GRAVEL Hydrocarbon odour		W1
2.80	J6					... abundant gravel.		W1
3.30	J7		Water strike (1) at 3.00m, rose to 2.83m in 20 mins.		3.00 (1.20)	Dark brown grey sandy GRAVEL with a hydrocarbon odour.		
4.50	J8				4.20 (0.30)	Stiff grey CLAY.		
					4.50	Complete at 4.50m		

Remarks
Water sample recovery unsuccessful due to clay and silt repeatedly blocking recovery tube.

Scale (approx)
1:25
Logged By
Figure No.
1002.4

Excavation Method Drive-In Window Sampler	Dimensions	Ground Level (mOD)	Client Frenccastle	Job Number 2460
	Location See Site Plan	Dates 08/06/04	Engineer	Sheet 1/1

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
0.30 0.30	J1 C1				0.10 (0.40)	TARMAC FILL: Black sand with gravel, ash, clinker and tarmac fragments.		
0.80 0.80	J2 C2				0.50 (0.50)	FILL: Orange brown silty sandy clay with black flecking, gravel and occasional brick fragments.		
1.30 1.30	J3 C3				1.00 (0.50)	Dark orange slightly gravelly very sandy CLAY with occasional black flecking.		
1.80	C4				1.50	Orange brown gravelly SAND.		
2.30	C5				(1.50)			
2.80 2.80	J7 C6				3.00	Complete at 3.00m		

Remarks Borehole was dry.	Scale (approx) 1:25	Logged By
	Figure No. 1002.5	

Excavation Method Drive-in Window Sampler	Dimensions	Ground Level (mOD)	Client Freencastle	Job Number 2459
	Location See Site Plan	Dates 08/06/04	Engineer	Sheet 1/1

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
0.30	C1				0.10 (0.60)	TARMAC FILL: Brown gravelly clay with frequent tarmac fragments.		
0.80 0.85	J1 C2				0.70 (0.80)	Soft dark brown gravelly silty CLAY.		
1.20	C3				1.50	...very gravelly.		
1.80 1.80	J2 C4				(0.50) 2.00	Dark brown very clayey GRAVEL.		
2.30	C5					Dark brown gravelly SAND.		
2.80 2.80	J3 C6				(2.00)			▼
3.20	J4		Water strike(1) at 3.50m, rose to 2.91m in 20 mins.		4.00	Complete at 4.00m		▼

Remarks
Water sample recovery unsuccessful due to silt and clay content repeatedly blocking recovery tube, 3.5m-4.0m. Recovery insufficient for sampling.

Scale (approx)

1:25

Logged By

Figure No.
1002.6

APPENDIX B

LABORATORY TEST RESULTS

CONTAMINANTS IN SOIL

Project: 37 HAMILTON ROAD, TWICKENHAM
 Client: Frenncastle Management Ltd
 Agent: Barnard & Associates

Project No: 2469a
 Sheet No: 1/2

Location	Sample	Depth m	Arsenic	Boron water soluble	Cadmium	Chromium		Copper	Lead	Mercury	Nickel	Selenium	Zinc	Cyanide			PCB as Aroclor	Phenols	Sulphide (SO ₄)		Sulphide	pH	TPH by GC-FTD unspeciated	Sulphur elemental	Pb/Hg unspeciated
						hexavalent	total							total	free	complex			total %	sol. g/l					
WS 2	C1	0.30	14	0.64	<0.50	22	43	130	27	26	0.29	130	<0.50			0.52	0.12	<5.0	8.3	430	<100	240			
	J3	1.30																		120					
	J5	2.30																		<50					
WS 3	J1	0.30	11	1.5	<0.50	21	28	87	0.59	14	0.34	69	<0.50			<0.50	<0.06	<5.0	8.2	320	<100	13			
	C2	0.90																		<50					
	J6	2.80																		<50					
WS 4	C2	0.80	15	0.77	<0.50	0.25	26	38	84	0.58	21	0.27	250	<0.50		0.65	0.09	<5.0	7.9	140	120	10			
	J7	3.30																		<50					
	J8	4.50																		<50					
WS 5	J1	0.30	8	0.45	<0.50	18	12	28	0.18	12	0.18	35	<0.50			<0.50	<0.06	<5.0	7.9	4800	<100	<2			
	C2	0.80																		<50					
	J3	1.30																		<50					
	J6	2.80																		<50					
CLEA trigger			20		1 - 8*	130		450	8	50	35														

CLEA trigger applicable to residential land use with plant uptake.

* cadmium trigger is pH dependent (1, 2 or 8 mg/kg at pH = 6, 7 or 8 respectively)

All units are mg/kg dry weight of soil unless otherwise stated, except for pH which is dimensionless

Exceptions denoted thus:

XX

CONTAMINANTS IN SOIL

Project: 37 HAMILTON ROAD, TWICKENHAM
 Client: Frenncastle Management Ltd
 Agent: Barnard & Associates

Project No: 2469a
 Sheet No: 2/2

Location	Sample	Depth m	Arsenic	Barium	Cadmium	Chromium		Copper	Lead	Mercury	Nickel	Selenium	Zinc	Cyanide			PCB	Phenols	Sulphate (SO ₄)		Sulphide	pH	TTH by GC-FTD		Sulphur elemental	PAH
						hexavalent	total							total	free	complex			total %	sol. ppt			unprecipitated	elemental		
WS 6	C1	0.30	22	0.75	<0.50	0.73	28	44	96	1	24	0.66	100	<0.50			<0.10	0.62	0.07	<5.0	8.5	<50	<100	150		
	J2	0.80																								
	C4	1.80	16	0.28	<0.50		20	7	0.2	0.21	20	0.16	36	<0.50			<0.50		<0.06	<5.0	8.2	<50	<100	4		
	J4	3.30																								
CLEA trigger			20		1.8†		130		450	8		50	35													

CLEA trigger applicable to residential land use with plant uptake

† cadmium trigger is pH dependent (1, 2 or 8 mg/kg at pH = 6, 7 or 8 respectively)

All units are mg/kg dry weight of soil unless otherwise stated, except for pH which is dimensionless

Exceptions denoted thus:

XX

CONTAMINANTS IN SOIL

Project: 37 HAMILTON ROAD, TWICKENHAM
 Client: Frenncastle Management Ltd
 Agent: Barnard & Associates

Project No: 2469a
 Sheet No: 1/1

Speciated Total Petroleum Hydrocarbons by GC - FID												
	Location	WS4	WS4	WS6								
	Sample	J3	J6	J3								
	Depth, m	1.30	2.80	2.80								
Concentration, mg/kg												
Determinand												
>C6 - C10		<50	<50	<50								
>C10 - C20		130	<50	<50								
>C20 - C40		550	<50	<50								
Total >C6 - C40		680	<50	<50								

CONTAMINANTS IN SOIL

Project: 37 HAMILTON ROAD, TWICKENHAM
 Client: Frenncastle Management Ltd
 Agent: Barnard & Associates

Project No: 2469a
 Sheet No: 1/1

Speciated Polycyclic Aromatic Hydrocarbons			
	Location	WS2	WS6
	Sample	C1	C1
	Depth, m	0.30	0.30
Determinand	Concentration, mg/kg		
PAH			
napthalene		5.5	2.7
acenaphthylene		<0.50	<0.50
acenaphthene		7.3	4.7
fluorene		4.6	<0.50
phenanthrene		22	25
anthracene		10	9
fluoranthene		56	33
pyrene		43	24
benzo(a)anthracene		17	9.9
chrysene		19	11
benzo(b)fluoranthene		17	4.7
benzo(k)fluoranthene		6.5	3.8
benzo(a)pyrene		17	9.8
indeno(1,2,3-cd)pyrene		0.77	<0.50
dibenzo(ah)anthracene		7.2	4
benzo(ghi)perylene		7.1	4.7
Total PAH		240	146

Notes

1. Total PAH = Sum of 16 identified components
2. ND = Not Detected
3. The results are expressed as mg/kg dry weight soil after correction for moisture content

APPENDIX C

FIGURE
and
DRAWING



37 Hamilton Road, Twickenham

Borehole location plan

Not to scale

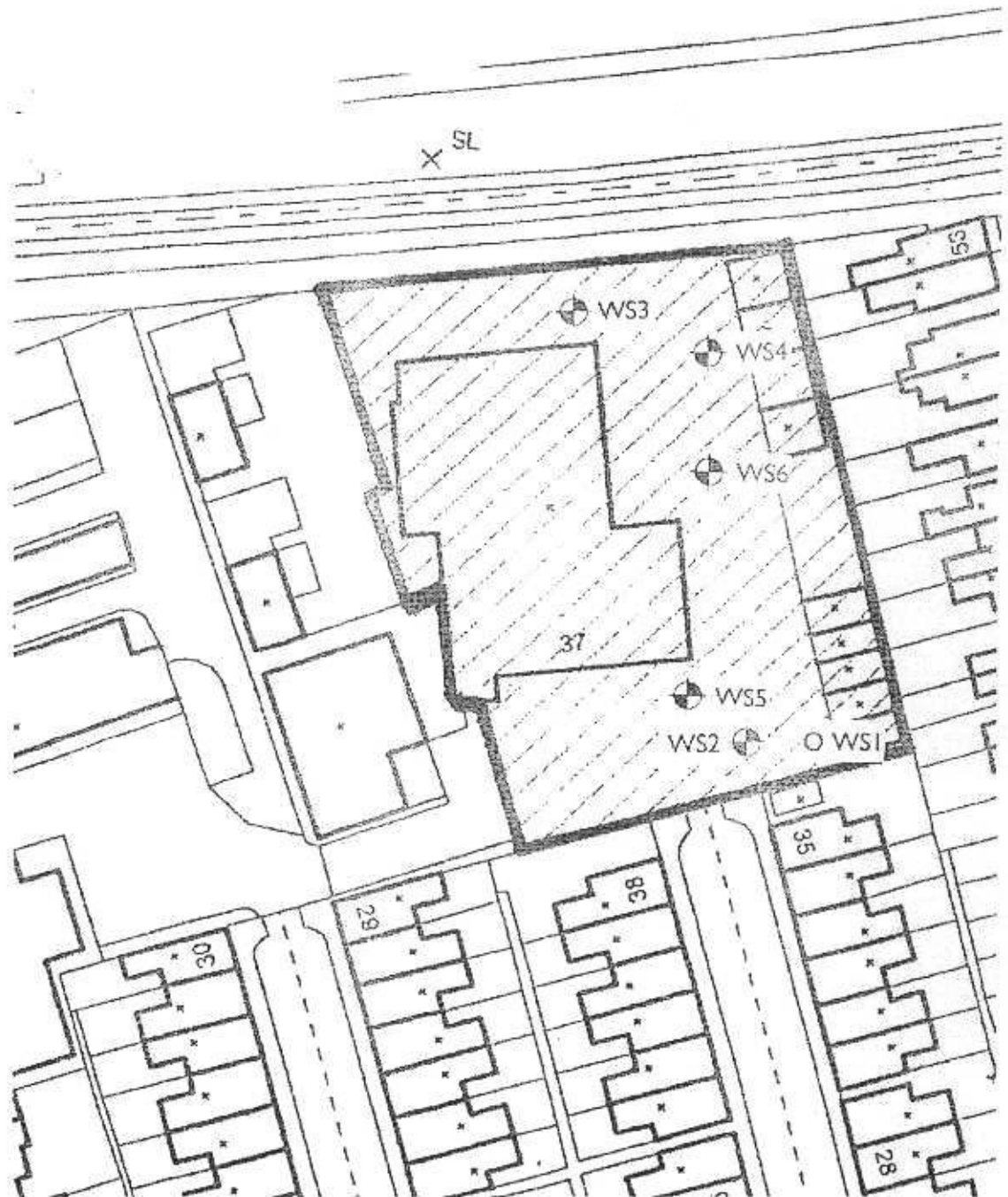


Figure 1