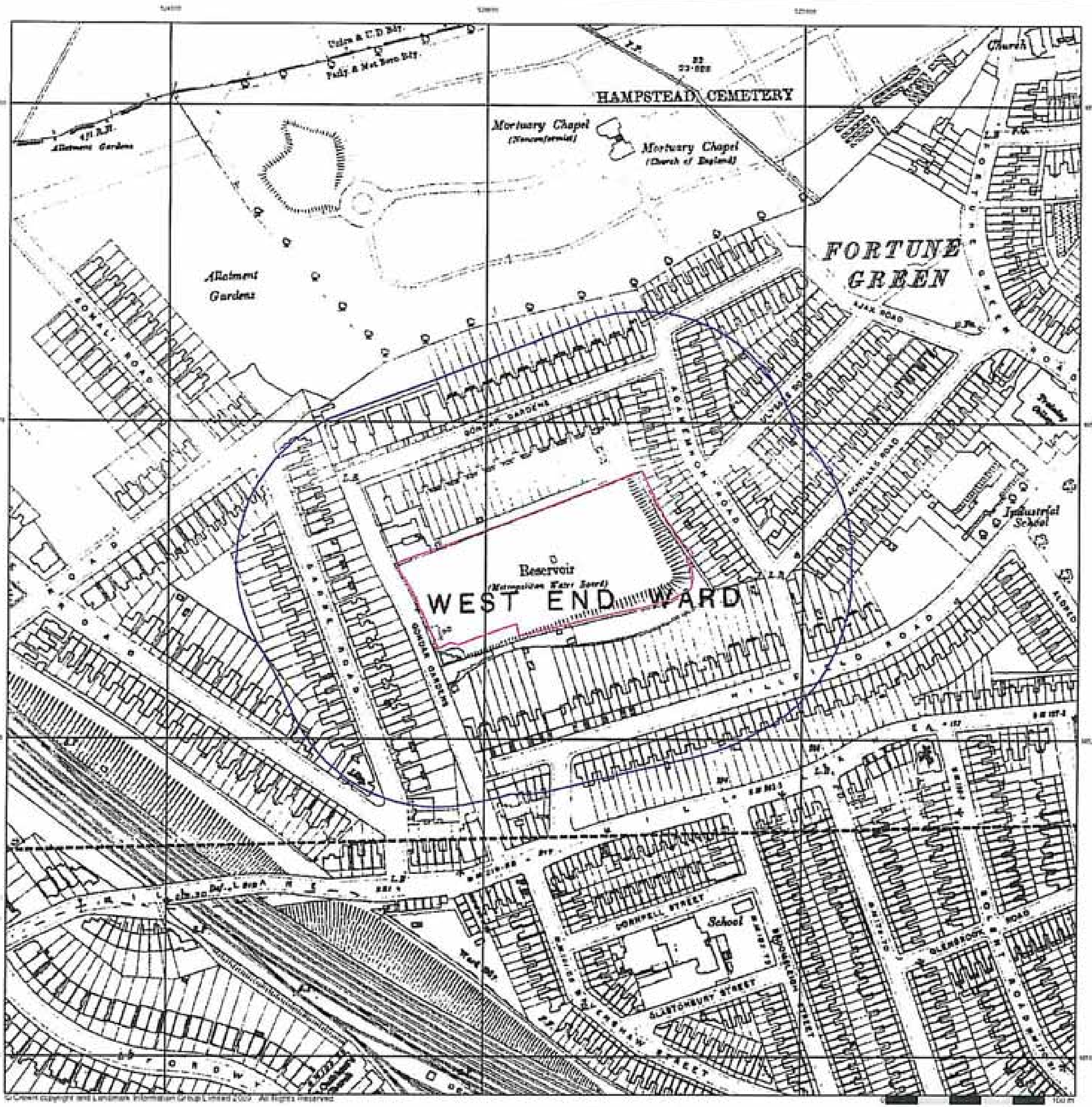

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RSK GROUP PLC

London

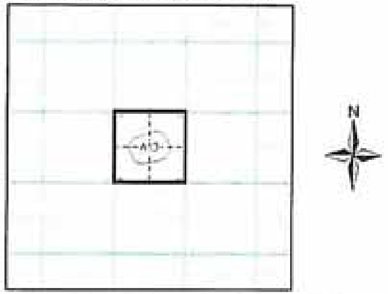
Published 1915

Source map scale - 1:2,500

The historical maps shown were reproduced from maps predominantly held at the scale adopted for England, Wales and Scotland in the 1840's. In 1854 the 1:2,500 scale was adopted for mapping urban areas and by 1896 it covered the whole of what were considered to be the cultivated parts of Great Britain. The published date given below is often some years later than the surveyed date. Before 1938, all OS maps were based on the Cassini Projection, with independent surveys of a single county or group of counties, giving rise to significant inaccuracies in outlying areas.

Map Name(s) and Date(s)

Historical Map - Segment A13



Order Details

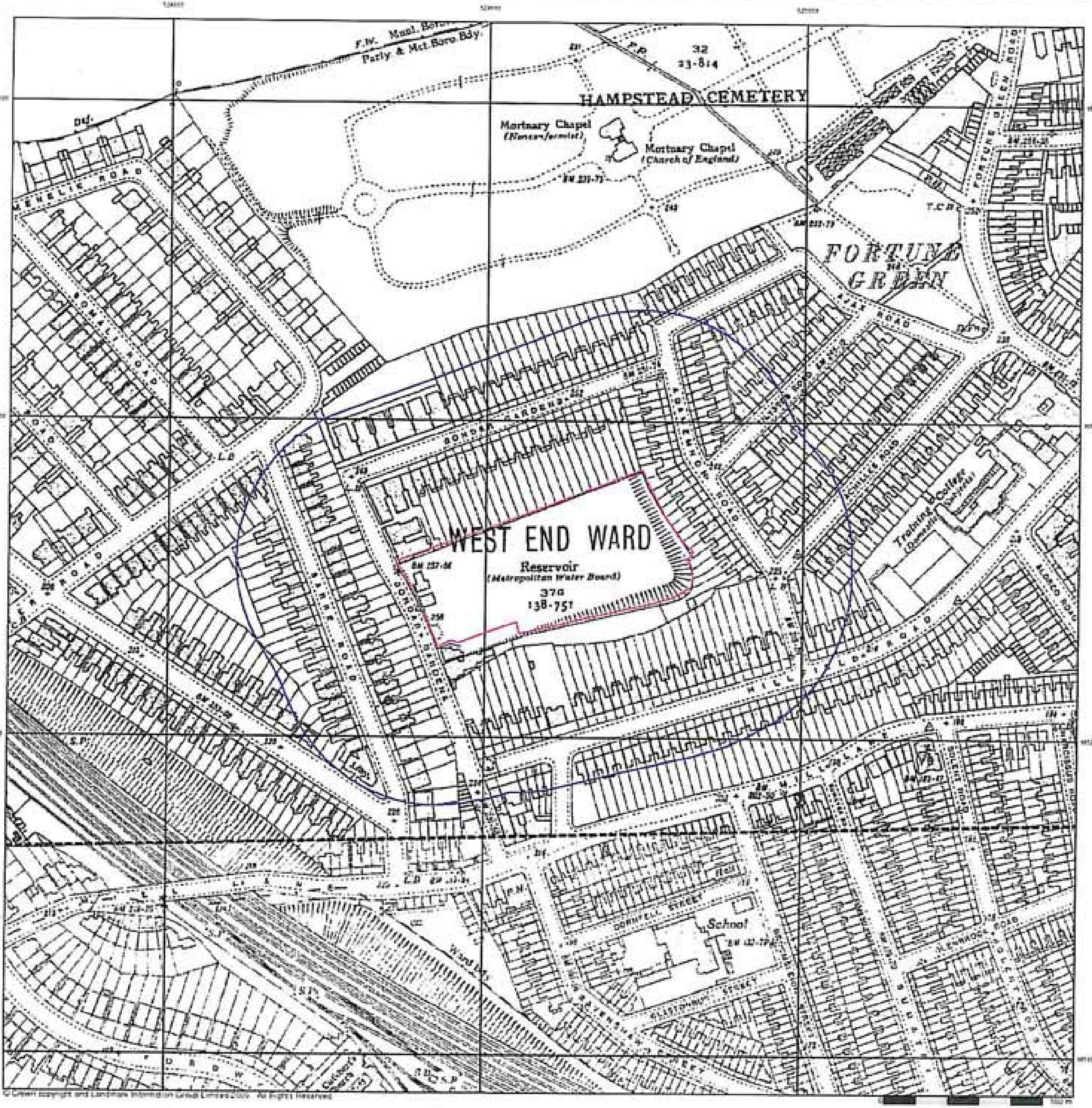
Order Number:	29328636_1_1
Customer Ref:	23283
National Grid Reference:	524840, 185310
Slice:	A
Site Area (Ha):	1.2
Search Buffer (m):	100

Site Details

1 Gondar Gardens, LONDON, NW6 1EW

Landmark

Tel 0844 844 9952
Fax 0844 844 9951
Web www.envirocheck.co.uk



RSK GROUP PLC

London

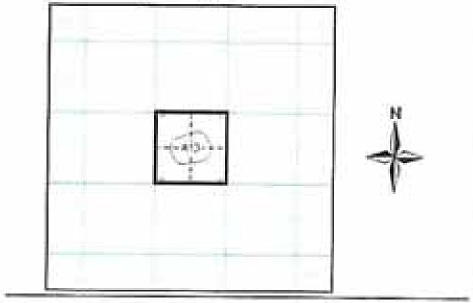
Published 1935 - 1936

Source map scale - 1:2,500

The historical maps shown were reproduced from maps predominantly held at the scale adopted for England, Wales and Scotland in the 1840's. In 1854 the 1:2,500 scale was adopted for mapping urban areas and by 1896 it covered the whole of what were considered to be the cultivated parts of Great Britain. The published date given below is often some years later than the surveyed date. Before 1938, all OS maps were based on the Cassini Projection, with independent surveys of a single county or group of counties, giving rise to significant inaccuracies in outlying areas.

Map Name(s) and Date(s)

Historical Map - Segment A13



Order Details

Order Number:	29328636_1_1
Customer Ref:	23283
National Grid Reference:	524840, 185310
Slice:	A
Site Area (Ha):	1.2
Search Buffer (m):	100

Site Details

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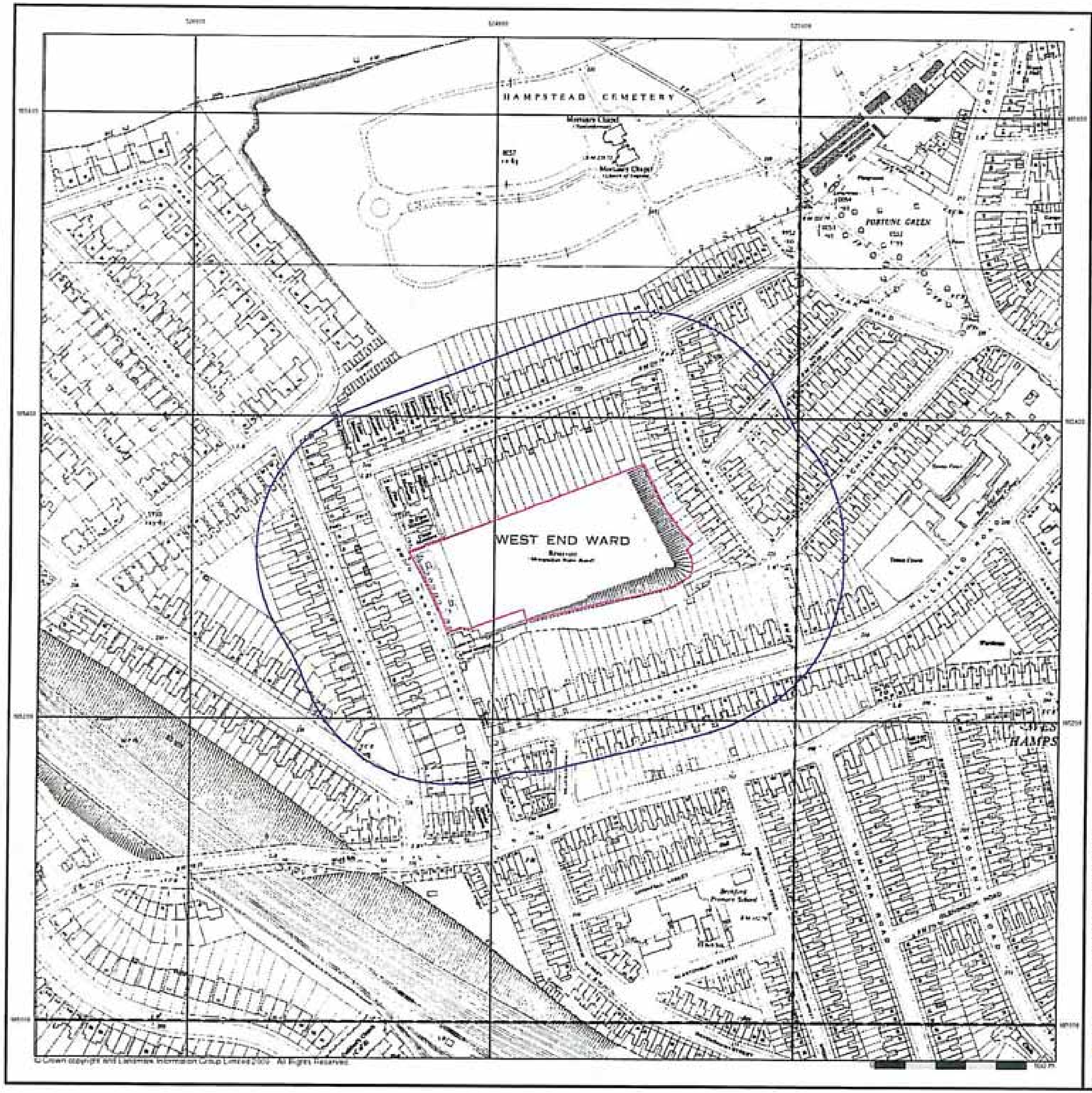

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RSK GROUP PLC

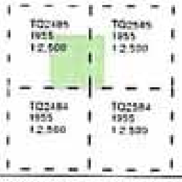
Ordnance Survey Plan

Published 1955

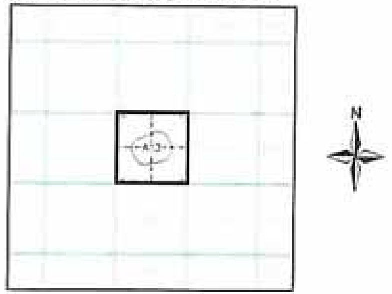
Source map scale - 1:2,500

The historical maps shown were reproduced from maps predominantly held at the scale adopted for England, Wales and Scotland in the 1840's. In 1854 the 1:2,500 scale was adopted for mapping urban areas and by 1896 it covered the whole of what were considered to be the cultivated parts of Great Britain. The published date given below is often some years later than the surveyed date. Before 1938, all OS maps were based on the Cassini Projection, with independent surveys of a single county or group of counties, giving rise to significant inaccuracies in outlying areas.

Map Name(s) and Date(s)



Historical Map - Segment A13



Order Details

Order Number:	29328636_1_1
Customer Ref:	23283
National Grid Reference:	524840, 185310
Slice:	A
Site Area (Ha):	1.2
Search Buffer (m):	100

Site Details

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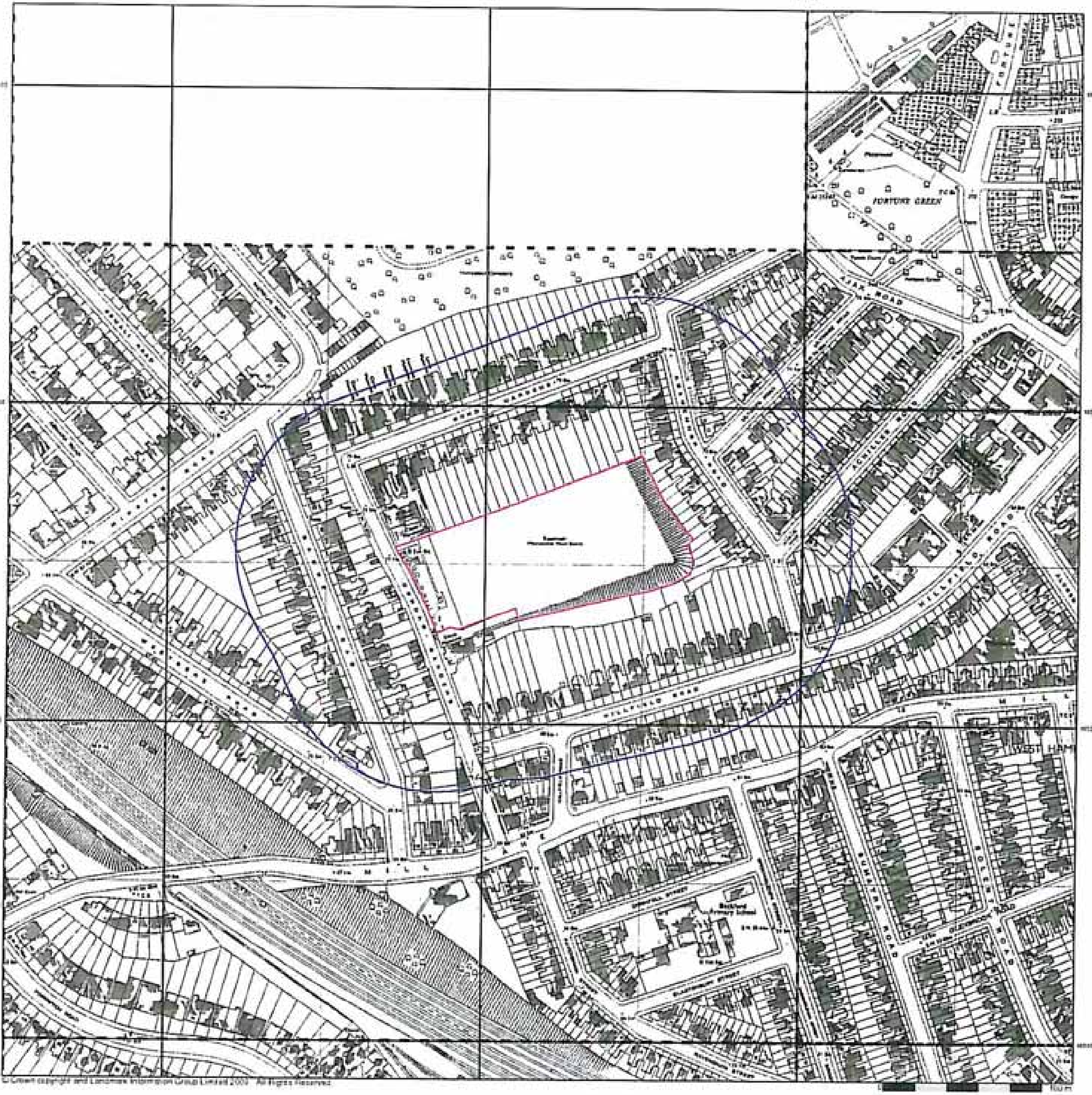
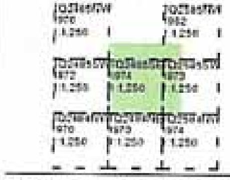


RSK
GROUP PLC

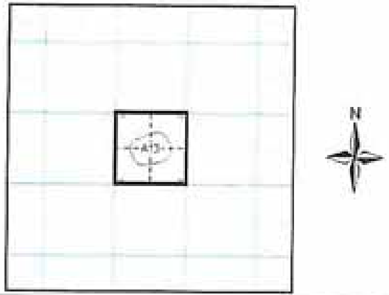
Ordnance Survey Plan
Published 1962 - 1974
Source map scale - 1:1,250

The historical maps shown were reproduced from maps predominantly held at the scale adopted for England, Wales and Scotland in the 1840's. In 1854 the 1:2,500 scale was adopted for mapping urban areas and by 1896 it covered the whole of what were considered to be the cultivated parts of Great Britain. The published date given below is often some years later than the surveyed date. Before 1938, all OS maps were based on the Cassini Projection, with independent surveys of a single county or group of counties, giving rise to significant inaccuracies in outlying areas.

Map Name(s) and Date(s)



Historical Map - Segment A13



Order Details

Order Number:	29328636_1_1
Customer Ref:	23283
National Grid Reference:	524840, 185310
Slice:	A
Site Area (Ha):	1.2
Search Buffer (m):	100

Site Details

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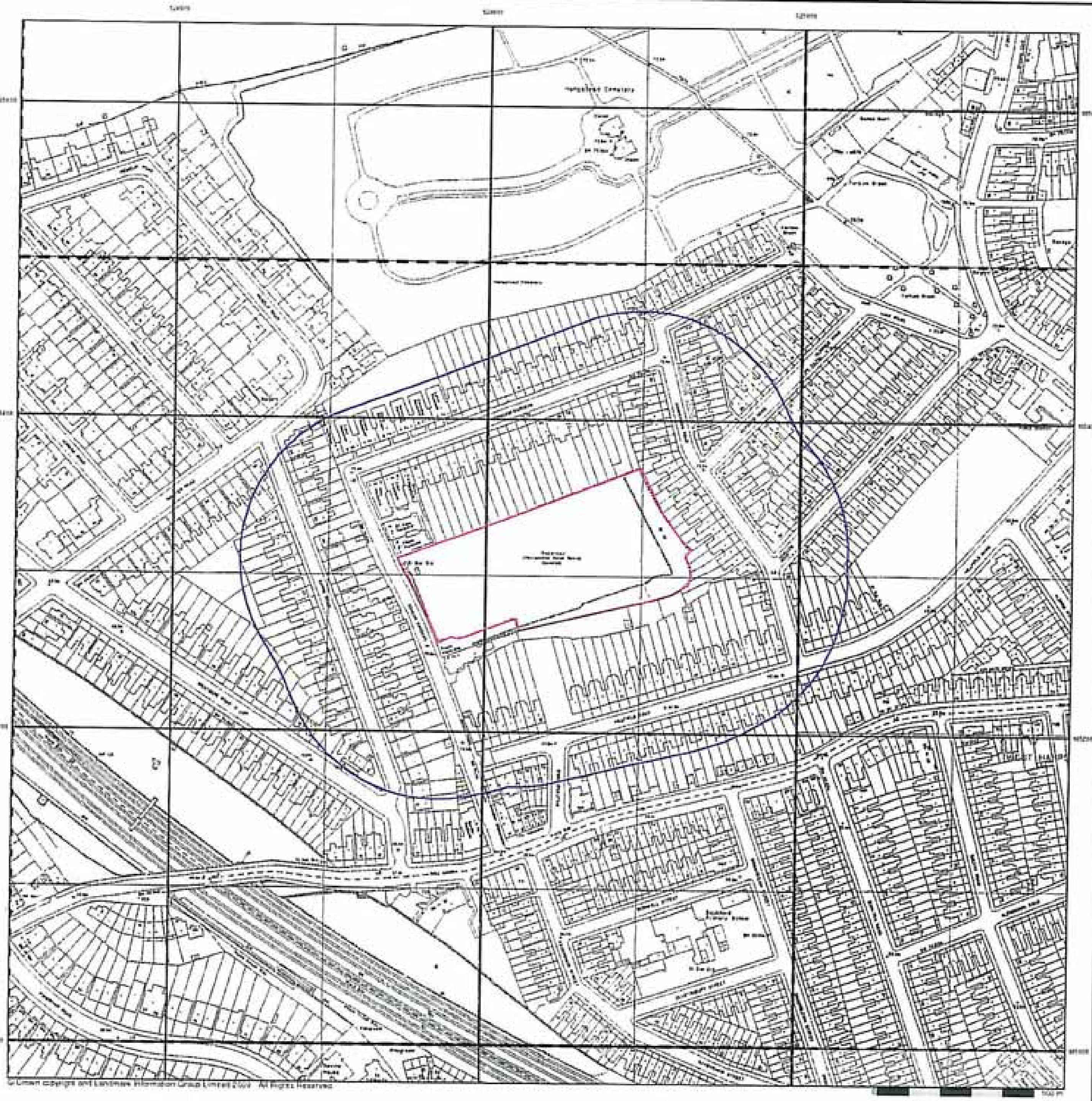

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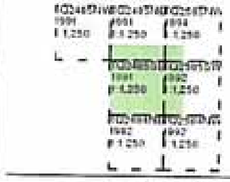
RSK GROUP PLC

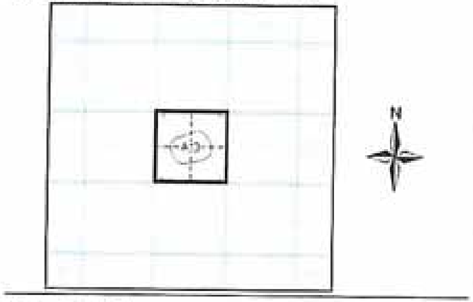
Large-Scale National Grid Data
Published 1991 - 1994
Source map scale - 1:1,250

'Large Scale National Grid Data' superseded SIM cards (Ordnance Survey's 'Survey of Information on Microfilm') in 1992, and continued to be produced until 1999. These maps were the fore-runners of digital mapping and so provide detailed information on houses and roads, but tend to show less topographic features such as vegetation. These maps were produced at both 1:2,500 and 1:1,250 scales.

Map Name(s) and Date(s)



Historical Map - Segment A13



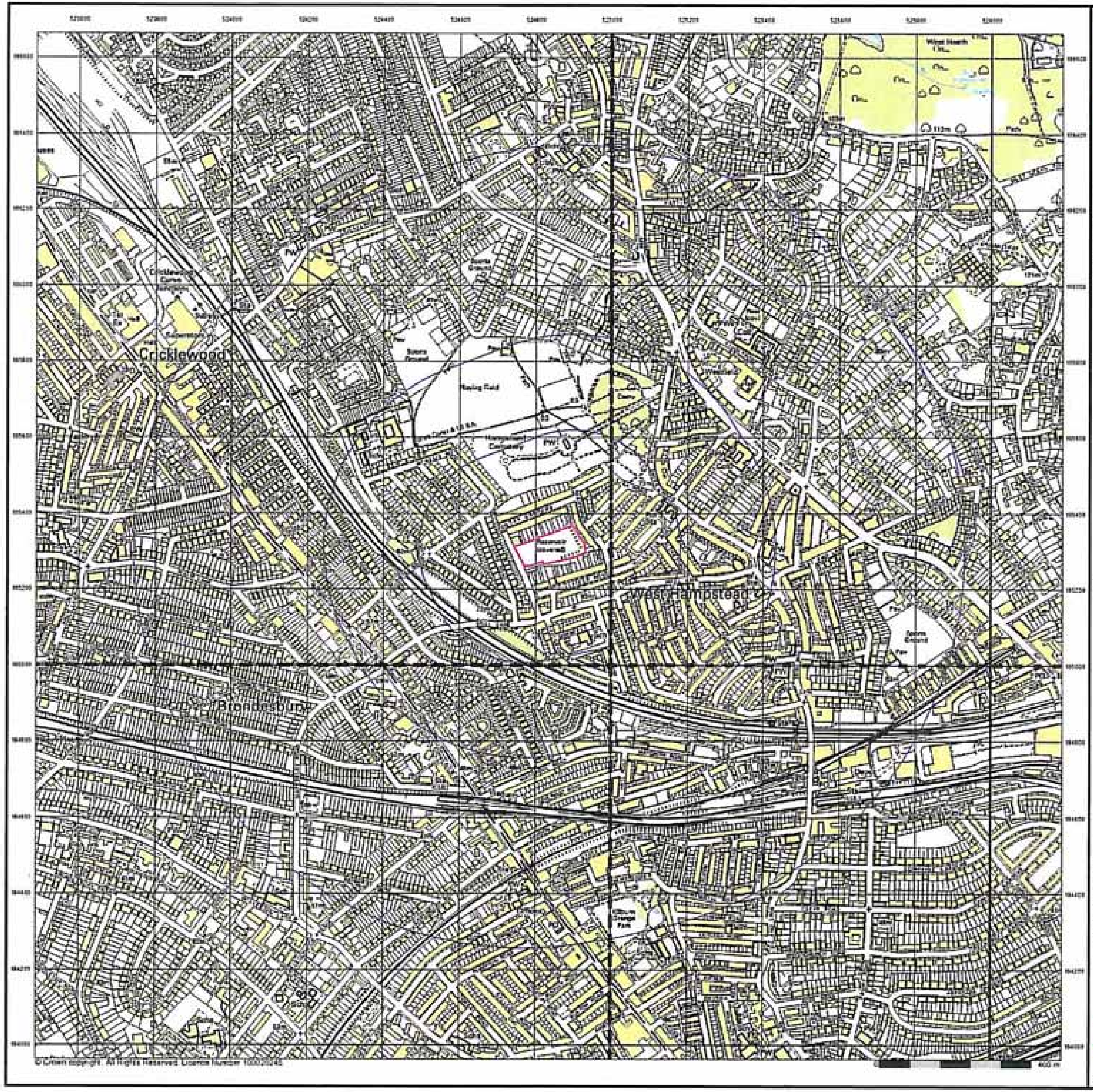
Order Details

Order Number:	29326636_1_1
Customer Ref:	23283
National Grid Reference:	524840, 185310
Slice:	A
Site Area (Ha):	1.2
Search Buffer (m):	100

Site Details

1 Gondar Gardens, LONDON, NW6 1EW

Tel	0844 844 9952
Fax	0844 844 9951
Web	www.envirocheck.co.uk



RSK GROUP PLC

10k Raster Mapping

Published 2006

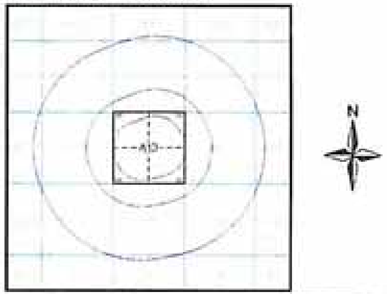
Source map scale - 1:10,000

The historical maps shown were produced from the Ordnance Survey's 1:10,000 colour raster mapping. These maps are derived from Landplan which replaced the old 1:10,000 maps originally published in 1970. The data is highly detailed showing buildings, fences and field boundaries as well as all roads, tracks and paths. Road names are also included together with the relevant road number and classification. Boundary information depiction includes county, unitary authority, district, civil parish and constituency.

Map Name(s) and Date(s)

TQ28NW 2006 1:10,000	TQ28NE 2006 1:10,000
TQ28SW 2006 1:10,000	TQ28SE 2006 1:10,000

Historical Map - Slice A



Order Details

Order Number:	29328636_1_1
Customer Ref:	23283
National Grid Reference:	524840, 185310
Slice:	A
Site Area (Ha):	1.2
Search Buffer (m):	1000

Site Details

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RSK GROUP PLC

10k Raster Mapping
Published 2009
Source map scale - 1:10,000

The historical maps shown were produced from the Ordnance Survey's 1:10,000 colour raster mapping. These maps are derived from Landplan which replaced the old 1:10,000 maps originally published in 1970. The data is highly detailed showing buildings, fences and field boundaries as well as all roads, tracks and paths. Road names are also included together with the relevant road number and classification. Boundary information depiction includes county, unitary authority, district, civil parish and constituency.

Map Name(s) and Date(s)

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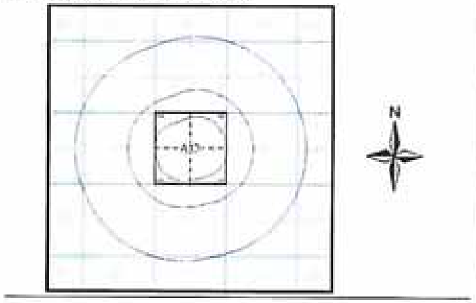
TQ28SW 2009 1:10,000	TQ28SE 2009 1:10,000

Historical Map - Slice A



Order Details

Order Number:	29328636_1_1
Customer Ref:	23283
National Grid Reference:	524840, 185310
Slice:	A
Site Area (Ha):	1.2
Search Buffer (m):	1000

Site Details

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Landmark

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Fax 0844 844 9951
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APPENDIX D

Methodology of Risk Assessment

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) pollutant linkages (source–pathway–receptor) and is used as the basis for 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; and
- 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 (note definition of ecosystem in 'Draft Circular on Contaminated Land', DETR 2000);

- 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; and
- 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 likelihood of an event occurring and its severity have been classified, a risk category can be assigned 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 might 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 and 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 and urgent investigation is required and 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; and
- Very Low: there is a low possibility that harm could occur and if realised the harm is unlikely to be severe.

APPENDIX E

Exploratory Hole Records

BOREHOLE RECORD (Percussive)

Borehole Number: BH1

Site: Gondar Gardens, London

Location:

Client: Linden Homes Ltd

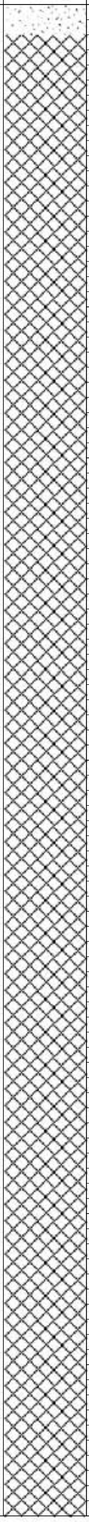
Ground Level: GL not measured

Date: 17 Nov 09

Job No: 23283

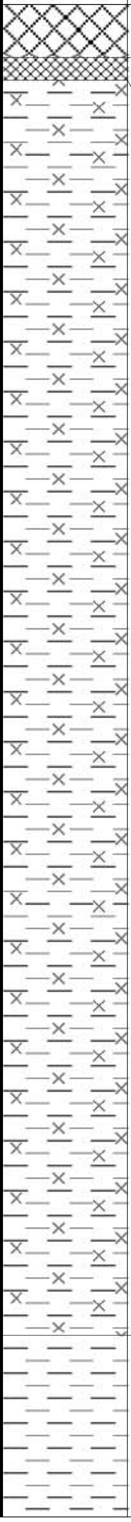
Sheet 1 of 2

GROUND WATER / SAMPLES/TESTS



Strike	Well	Depth (m)	Depth/Type (m)			SPT 'N' or U Blows
			0.10	D	001	
			0.40	D	002	
			0.70	D	003	
			1.30-1.60	U	001	
			1.60	D	004	
			3.00	D	005	S N=11 (1,1,2,2,3,4) [1,1](2,2,3,4)
			4.50-4.80	U	002	
			4.80	D	006	
			6.00	D	007	S N=20 (3,3,4,5,5,6) [3,3](4,5,5,6)
			7.50-7.90	U	003	
			7.90	D	008	
			8.80	D	009	
			9.00	D	010	S N=20 (3,3,4,5,6,5) [3,3](4,5,6,5)

STRATA RECORD



Depth (m)	Level (mAOD)		Key	Description
0.35		0.35		MADE GROUND (Reinforced concrete)
0.50		0.15		MADE GROUND (brown silty sandy clay with fine to coarse gravel, stone and fragments of concrete and brick)
8.80		8.30		Firm becoming stiff brown occasional mottled grey silty CLAY with occasional fine to medium gravel. Occasional pockets of sand.
				Stiff grey silty CLAY with occasional fine gravel. Occasional pockets of sand.

Continued next sheet

Remarks and Water Observations
Groundwater seepage was slightly encountered at 13.0mbgl.

Scale: 1:50

Logged by: MB

Figure:

BOREHOLE RECORD (Percussive)

Borehole Number: **BH1**

Site:
Gondar Gardens, London

Location:

Client:
Linden Homes Ltd

Ground Level:
GL not measured

Date:
17 Nov 09

Job No:
23283

Sheet 2 of 2

GROUND WATER | **SAMPLES/TESTS** | **STRATA RECORD**

Strike	Well	Depth (m)	Depth/Type (m)			SPT 'N' or U Blows	Depth (m)	Level (mAOD)		Key	Description
			10.50-10.80	U	004						
			10.80	D	011						
		11									
		12	12.00	D	012	S N=22 (4,4,4,5,7,6) [4,4](4,5,7,6)					
▽		13									
			13.50-13.90	U	005						
			13.90	D	013						
		14							*11.20*		
		15	15.00	D	014	S N=23 (3,4,5,5,6,7) [3,4](5,5,6,7)					
		16									
			16.50-16.80	U	006						
			16.80	D	015						
		17									
		18	18.00	D	016	S N=32 (4,5,6,9,8,9) [4,5](6,9,8,9)					
		19									
			19.50-19.90	U	007						
			19.90	D	017						

Remarks and Water Observations
Groundwater seepage was slightly encountered at 13.0mbgl.

End of Borehole at 20.00 m

Scale: 1:50

Logged by: MB

Figure:

RSK GROUP PLC STATS	**BOREHOLE RECORD (Window Sampler)**		**Borehole Number:** **PH1**
Site: Gondar Gardens, London	**Location:**		
Client: Linden Homes Ltd	**Ground Level:** GL not measured	**Dates:** 17 Nov 09	**Job No.:** 23283
GROUND WATER / **SAMPLES/TESTS**	**STRATA RECORD**		Sheet 1 of 1

Strike	Well	Depth (m)	Type/Depth (m)	In-situ Tests	Depth (m)	Level (mAOD)		Key	Description
									MADE GROUND (brown grey silty sandy clay with occasional fine to coarse gravel and fragments of stone, brick concrete and roots)
			D001 0.30						
			D002 0.70						
					0.90		0.90		MADE GROUND (remolded stiff to very stiff brown silty clay. Occasional roots and fragments of bricks between 1.5 and 1.7mbgl). Possible desiccation.
		1		C					
			D003 1.20						
				N=18 (2,3,3,4,4,7) [2,3](3,4,4,7)					
					1.90		1.00		Stiff becoming very stiff brown occasional mottled grey silty CLAY with occasional fine to medium gravel. Occasional roots. Occasional pockets of sand. Possible desiccation.
		2		C					
			D004 2.20						
				N=24 (3,3,4,5,7,8) [3,3](4,5,7,8)					
			D005 2.90-3.00						
		3		C					
				N=31 (4,4,6,7,8,10) [4,4](6,7,8,10)					
		4		C	4.00		2.10		***End of Borehole at 4.00 m***
				N=28 (4,4,5,7,7,9) [4,4](5,7,7,9)					

Remarks and Water Observations

Groundwater was not encountered. Hand vane at 1.0m and 2.0m is greater than 240kPa.

Key for Insitu tests
HV-Hand Vane (kN/m2)
PP-Pocket Penotometer (kN/m2)
MP-Mackintosh Probe (N150)

Scale: 1:25

Logged by: NT

Figure:

BOREHOLE RECORD (Window Sampler)

Borehole Number: PH2

Site: Gondar Gardens, London

Location:

Client: Linden Homes Ltd

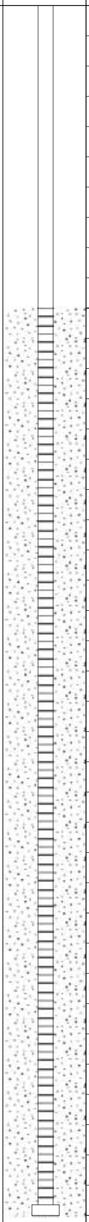
Ground Level: GL not measured

Dates: 17 Nov 09

Job No.: 23283

Sheet 1 of 1

GROUND WATER / SAMPLES/TESTS



Strike	Well	Depth (m)	Type/Depth (m)	In-situ Tests
			D001 0.40	
		1	D002 1.00	C N=15 (2,3,3,4,4,4) [2,3](3,4,4,4)
		2	D003 2.00	C N=14 (2,3,4,2,3,5) [2,3](4,2,3,5)
		3	D004 3.00	C N=20 (2,3,3,4,6,7) [2,3](3,4,6,7)
		4		C N=18 (3,4,4,4,4,6) [3,4](4,4,4,6)

STRATA RECORD

Depth (m)	Level (mAOD)		Key	Description
0.30		0.30		TOPSOIL (grass over grey silty sandy clay with occasional fine to medium gravel, stone and roots)
1.80		1.50		MADE GROUND (remolded stiff to very stiff brown silty clay. Occasional roots and fragments of bricks, concrete, stone and mudstone)
4.00		2.20		Stiff becoming very stiff brown occasional mottled grey silty CLAY with occasional fine to medium gravel. Occasional roots up to 3.0mbgl. Occasional pockets of sand.

End of Borehole at 4.00 m

Remarks and Water Observations

Groundwater was not encountered.

Key for Insitu tests

HV-Hand Vane (kN/m2)

PP-Pocket Penotometer (kN/m2)

MP-Mackintosh Probe (N150)

Scale: 1:25

Logged by: NT

Figure:

BOREHOLE RECORD (Window Sampler)

Borehole Number: PH3

Site:
Gondar Gardens, London

Location:

Client:
Linden Homes Ltd

Ground Level:
GL not measured

Dates:
17 Nov 09

Job No.:
23283

Sheet 1 of 1

GROUND WATER / SAMPLES/TESTS

Strike	Well	Depth (m)	Type/Depth (m)	In-situ Tests
		1	C	N=10 (2,2,2,2,3,3) [2,2](2,2,3,3)
			D001 0.50	
			D002 1.70	
		2	C	N=13 (2,2,3,2,4,4) [2,2](3,2,4,4)
			D003 2.60	
		3	C	N=10 (1,2,2,2,3,3) [1,2](2,2,3,3)
			D004 3.70	
		4	C	N=8 (1,1,1,2,2,3) [1,1](1,2,2,3)

STRATA RECORD

Depth (m)	Level (mAOD)	Description
0.30	0.30	TOPSOIL (grass over grey silty sandy clay with occasional fine to medium gravel and roots)
0.40	0.10	MADE GROUND (Fine coarse gravel and stone)
1.20	0.80	MADE GROUND (remolded stiff brown silty clay with occasional fine to medium gravel. Occasional pockets of sand.
3.10	1.90	Stiff becoming very stiff brown occasional mottled grey silty CLAY with occasional fine to medium gravel. Occasional roots. Occasional pockets of sand (Possible remolded clay)
4.00	0.90	Firm to stiff brown occasional mottled grey silty CLAY with occasional fine to medium gravel. Occasional pockets of sand.

End of Borehole at 4.00 m

Remarks and Water Observations

Groundwards was not encountered. Hand vane at 2.0m is greater than 240kPa.

Key for Insitu tests
HV-Hand Vane (kN/m2)
PP-Pocket Penotometer (kN/m2)
MP-Mackintosh Probe (N150)

Scale: 1:25

Logged by: NT

Figure:

BOREHOLE RECORD (Window Sampler)

Borehole Number: PH4

Site:
Gondar Gardens, London

Location:

Client:
Linden Homes Ltd

Ground Level:
GL not measured

Dates:
17 Nov 09

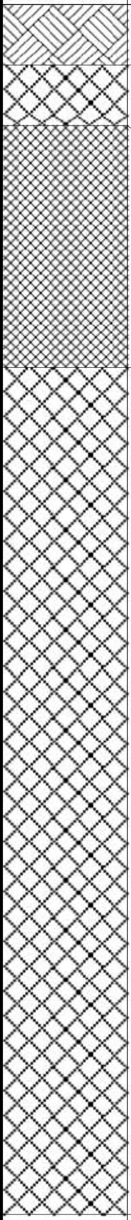
Job No.:
23283

Sheet 1 of 1

GROUND WATER / SAMPLES/TESTS

Strike	Well	Type/Depth (m)		In-situ Tests
		D001	0.50	
				C (1.00) N=6 (1,1,1,1,2,2) [1,1](1,1,2,2)
		D002	1.30	
				C (2.00) N=5 (0,1,1,1,1,2) [0,1](1,1,1,2)
		D003	2.70	
		D004	3.60	
				C (4.00) N=5 (1,1,1,1,1,2) [1,1](1,1,1,2)

STRATA RECORD



Depth (m)	Level (mAOD)		Description
0.20		0.20	TOPSOIL (grass over grey brown silty sandy clay with occasional fine to medium gravel and roots)
0.40		0.20	MADE GROUND (brown grey silty sandy clay with occasional fine to coarse gravel and fragments of stone, tarmac and brick)
1.20		0.80	MADE GROUND (remolded stiff brown silty clay. Occasional pockets of sand)
4.00		2.80	MADE GROUND (remolded Firm to stiff brown silty clay. Occasional pockets of sand. Fragments of brick between 3.5m and 3.7m)

End of Borehole at 4.00 m

Remarks and Water Observations

Groundwarter was not encountered. Hand vane at 2.0m (100kPa) and 3.0m (70kPa).

Key for Insitu tests
HV-Hand Vane (kN/m2)
PP-Pocket Penotometer (kN/m2)
MP-Mackintosh Probe (N150)

Scale: 1:25

Logged by: NT

Figure:

BOREHOLE RECORD (Window Sampler)

Borehole Number:

PH5

Site:
Gondar Gardens, London

Location:

Client:
Linden Homes Ltd

Ground Level:
GL not measured

Dates:
17 Nov 09

Job No.:
23283

Sheet 1 of 1

GROUND WATER / SAMPLES/TESTS

Strike	Well	Depth (m)	Type/Depth (m)	In-situ Tests
	▨		D001 0.30	
	▨	1		C
	▨			N=8 (1,1,2,2,2,2) [1,1](2,2,2,2)
	▨		D002 1.60	
	▨	2		C
	▨			N=6 (1,1,1,2,1,2) [1,1](1,2,1,2)
	▨		D003 2.80	
	▨	3		C
	▨		D004 3.50	N=5 (1,1,1,1,1,2) [1,1](1,1,1,2)
		4		C
				N=7 (1,1,2,1,2,2) [1,1](2,1,2,2)

STRATA RECORD

Depth (m)	Level (mAOD)		Key	Description
0.20		0.20	▨	TOPSOIL (grass over grey brown silty sandy clay with occasional fine to medium gravel and stone)
0.90		0.70	▨	MADE GROUND (grey brown silty sandy clay with occasional fine to coarse gravel, fragments of tramac, brick and stone)
2.10		1.20	▨	MADE GROUND (remolded stiff brown silty clay. Occasional pockets of sand).
4.00		1.90	▨	MADE GROUND (remolded firm to stiff brown silty clay. Occasional fragments of bricks and pockets of sand)
				End of Borehole at 4.00 m

Remarks and Water Observations

Groundwater was not encountered.

Key for Insitu tests
HV-Hand Vane (kN/m2)
PP-Pocket Penotometer (kN/m2)
MP-Mackintosh Probe (N150)

Scale: 1:25

Logged by: NT

Figure:

BOREHOLE RECORD (Window Sampler)

Borehole Number: PH6

Site:
Gondar Gardens, London

Location:

Client:
Linden Homes Ltd

Ground Level:
GL not measured

Dates:
17 Nov 09

Job No.:
23283

Sheet 1 of 1

GROUND WATER

Strike	Well	Depth (m)

SAMPLES/TESTS

Type/Depth (m)		In-situ Tests
D001	0.30	
		C
		N=12 (2,2,3,2,3,4) [2,2](3,2,3,4)
D002	2.00	
		N=12 (3,2,2,3,3,4) [3,2](2,3,3,4)
D003	2.70	
		C
		N=21 (3,3,4,4,6,7) [3,3](4,4,6,7)
D004	3.80	
		C
		N=12 (2,2,2,3,3,4) [2,2](2,3,3,4)

STRATA RECORD

Depth (m)	Level (mAOD)	Description
0.10	*0.10*	TOPSOIL (grass over grey brown silty sandy clay with occasional fine to medium gravel and roots)
0.50	*0.40*	MADE GROUND (remolded brown silty sandy clay with occasional fine to coarse gravel)
1.10	*0.60*	MADE GROUND (brown grey silty sandy clay with occasional fine to coarse gravel and fragments of stone, tarmac and brick and roots)
1.70	*0.60*	MADE GROUND (Remolded stiff brown silty clay with occasional fine to coarse gravel and fragments of stone and roots)
4.00	*2.30*	Stiff brown occasional mottled grey silty CLAY with occasional fine to medium gravel. Occasional pockets of sand.

End of Borehole at 4.00 m

Remarks and Water Observations

Groundwater was not encountered.

Key for Insitu tests
HV-Hand Vane (kN/m2)
PP-Pocket Penotometer (kN/m2)
MP-Mackintosh Probe (N150)

Scale: 1:25

Logged by: NT

Figure:

BOREHOLE RECORD (Window Sampler)

Borehole Number: PH7

Site: Gondar Gardens, London

Location:

Client: Linden Homes Ltd

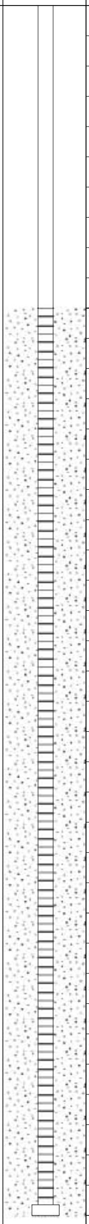
Ground Level: GL not measured

Dates: 17 Nov 09

Job No.: 23283

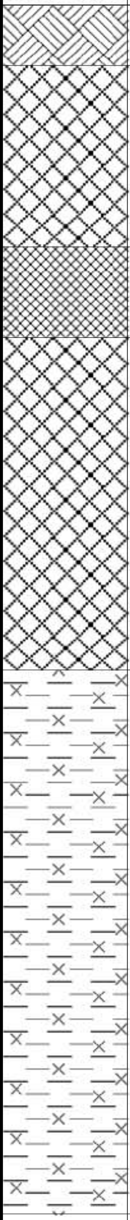
Sheet 1 of 1

GROUND WATER / SAMPLES/TESTS



Depth (m)	Type/Depth (m)	In-situ Tests
0.30	D001 0.30	
1.00		C
1.45		N=8 (2,2,2,2,2,2) [2,2](2,2,2,2)
1.80	D002 1.80	
2.00		C
2.40	D003 2.40	
2.45		N=9 (2,1,2,2,2,3) [2,1](2,2,2,3)
3.00		C
3.50	D004 3.50	N=20 (3,3,4,4,5,7) [3,3](4,4,5,7)
4.00		C
4.45		N=12 (1,2,2,3,3,4) [1,2](2,3,3,4)

STRATA RECORD



Depth (m)	Level (mAOD)	Description
0.20	0.20	TOPSOIL (grass over grey brown silty sandy clay with occasional fine to medium gravel)
0.80	0.60	MADE GROUND (brown grey silty sandy clay with occasional fine to coarse gravel and fragments of stone, brick and roots)
1.10	0.30	MADE GROUND (sand and gravel with stone)
2.20	1.10	MADE GROUND (remolded stiff brown silty clay. Occasional roots, fragments of bricks and pockets of sand)
4.00	1.80	Stiff bown occasional mottled grey silty CLAY with occasional fine to medium gravel. Occasional roots up to 3.0mbgl. Occasional pockets of sand.

End of Borehole at 4.00 m

Remarks and Water Observations

Groundwater was not encountered.

Key for Insitu tests
HV-Hand Vane (kN/m2)
PP-Pocket Penotometer (kN/m2)
MP-Mackintosh Probe (N150)

Scale: 1:25

Logged by: NT

Figure:

APPENDIX F

Chemical Test Certificates

envirolab
Units 7 & 8 Sandpits Business Park
Mottram Road, Hyde, Cheshire, SK14 3AR

FINAL ANALYTICAL TEST REPORT

Envirolab Job Number: 09/01125
Issue Number: 2 **Date:** 27 November, 2009

Client:
RSK STATS Hemel Hempstead
18 Frogmore Road
Hemel Hempstead
UK
HP3 9RT

Project Manager:	Naveneethan Thiruchelvam
Project Name:	Gondar Gardens, London
Project Ref:	23283
Order No:	Not specified
Date Samples Received:	19/11/09
Date Instructions Received:	19/11/09
Date Analysis Completed:	25/11/09

Prepared by:	**Approved by:**
MMarshall	GScott
Melanie Marshall Laboratory Coordinator	Gill Scott Laboratory Manager

Notes - Soil samples
All results are reported as dry weight (<40°C).
Stones >10mm are removed from the sample prior to analysis and results corrected where appropriate.
Subscript A indicates analysis performed on the sample as received.
Subscript D indicates analysis performed on the dried sample.
Superscript M indicates method accredited to MCERTS.
Samples with matrix code 7 are not predominantly sand/loam/clay and are not covered by our MCERTS accreditation.

Notes - General
Superscript * indicates subcontracted analysis.
Superscript # indicates method accredited to ISO 17025.
Analytical results reflect the quality of the sample at the time of analysis only.
Method summaries are available upon request.
Opinions and interpretations expressed are outside the scope of our accreditation.
IS indicates Insufficient sample for analysis.
IS-QC indicates Insufficient sample for reanalysis following QC failure.
NDP indicates No Determination Possible.

MCERTS
THE ENVIRONMENT AGENCY MONITORING CERTIFICATION SCHEME
UKAS TESTING 1247

Envirolab Job Number: 09/01125 **Client Project Name: Gondar Gardens, London**

Client Project Ref: 23283

Lab Sample ID	09/01125/1	09/01125/2	09/01125/3	09/01125/4	09/01125/5	09/01125/6	09/01125/7	09/01125/8	Units	Method ref
Client Sample No										
Client Sample ID	PH1	PH1	PH2	PH3	PH6	PH7	PH1	BH1		
Depth to Top	0.30	0.70	0.40	0.50	0.30	0.30	2.20	3.00		
Depth To Bottom										
Date Sampled	17-Nov-09	17-Nov-09	17-Nov-09	17-Nov-09	17-Nov-09	17-Nov-09	17-Nov-09	17-Nov-09		
Sample Type	Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil		
Sample Matrix Code	6	6	3	6	6	6A	6	3		
Asbestos Screen$_{A}$	No ACM	No ACM	No ACM	No ACM	No ACM	No ACM	-	-		Visual
pH$_{D}^{M\#}$	7.9	8.1	8.8	8.1	7.6	8.3	8.1	8.2		A-T-031s
Sulphate (water sol 2:1)$_{D}^{M\#}$	0.03	0.04	0.03	0.18	0.02	<0.01	-	-	g/l	A-T-026s
Sulphate BRE (water sol 2:1)$_{D}^{M\#}$	-	-	-	-	-	-	0.58	1.92	g/l	A-T-026s
Sulphate (acid soluble)$_{D}^{M\#}$	750	460	310	340	280	560	-	-	mg/kg	A-T-028
Sulphate BRE (acid sol)$_{D}^{M\#}$	-	-	-	-	-	-	0.14	1.32	% w/w	A-T-028
Arsenic$_{D}^{M\#}$	12	10	7	14	11	22	-	-	mg/kg	A-T-024
Cadmium$_{D}^{M\#}$	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	-	-	mg/kg	A-T-024
Copper$_{D}^{M\#}$	32	22	18	55	43	49	-	-	mg/kg	A-T-024
Chromium$_{D}^{M\#}$	75	77	60	44	82	44	-	-	mg/kg	A-T-024
Chromium (hexavalent) Dep$_{D}$	<1	<1	<1	<1	<1	<1	-	-	mg/kg	A-T-040s
Lead$_{D}^{M\#}$	74	24	16	201	215	367	-	-	mg/kg	A-T-024
Mercury$_{D}$	0.47	0.25	0.25	4.20	0.36	0.64	-	-	mg/kg	A-T-024
Nickel$_{D}^{M\#}$	45	47	36	33	50	31	-	-	mg/kg	A-T-024
Selenium$_{D}^{M\#}$	2	2	2	2	2	2	-	-	mg/kg	A-T-024
Sulphur BRE (total)$_{D}$	-	-	-	-	-	-	0.06	0.54	% w/w	A-T-024
Zinc$_{D}^{M\#}$	100	82	65	118	193	194	-	-	mg/kg	A-T-024

Envirolab Job Number: 09/01125 **Client Project Name: Gondar Gardens, London**

Client Project Ref: 23283

Lab Sample ID	09/01125/1	09/01125/2	09/01125/3	09/01125/4	09/01125/5	09/01125/6	09/01125/7	09/01125/8	Units	Method ref
Client Sample No										
Client Sample ID	PH1	PH1	PH2	PH3	PH6	PH7	PH1	BH1		
Depth to Top	0.30	0.70	0.40	0.50	0.30	0.30	2.20	3.00		
Depth To Bottom										
Date Sampled	17-Nov-09	17-Nov-09	17-Nov-09	17-Nov-09	17-Nov-09	17-Nov-09	17-Nov-09	17-Nov-09		
Sample Type	Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil		
Sample Matrix Code	6	6	3	6	6	6A	6	3		
Speciated TPH										
Ali >C5-C6$_{A}^{\#}$	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	-	-	mg/kg	A-T-022s
Ali >C6-C8$_{A}^{\#}$	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	-	-	mg/kg	A-T-022s
Ali >C8-C10$_{A}^{\#}$	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	-	-	mg/kg	A-T-022s
Ali >C10-C12$_{A}^{\#}$	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	-	-	mg/kg	A-T-023s
Ali >C12-C16$_{A}^{\#}$	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	-	-	mg/kg	A-T-023s
Ali >C16-C21$_{A}^{\#}$	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	-	-	mg/kg	A-T-023s
Ali >C21-C35$_{A}^{\#}$	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	-	-	mg/kg	A-T-023s
Total Aliphatics$_{A}^{\#}$	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	-	-	mg/kg	A-T-022+23s
Aro >C5-C7$_{A}^{\#}$	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	-	-	mg/kg	A-T-022s
Aro >C7-C8$_{A}^{\#}$	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	-	-	mg/kg	A-T-022s
Aro >C8-C9$_{A}^{\#}$	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	-	-	mg/kg	A-T-022s
Aro >C9-C10$_{A}^{\#}$	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	-	-	mg/kg	A-T-022s
Aro >C10-C12$_{A}^{\#}$	2.0	2.4	2.4	3.6	1.7	2.0	-	-	mg/kg	A-T-023s
Aro >C12-C16$_{A}^{\#}$	5.7	3.3	4.5	4.2	2.3	2.0	-	-	mg/kg	A-T-023s
Aro >C16-C21$_{A}^{\#}$	13.3	0.9	0.5	1.2	1.2	<0.1	-	-	mg/kg	A-T-023s
Aro >C21-C35$_{A}^{\#}$	8.7	<0.1	<0.1	<0.1	<0.1	<0.1	-	-	mg/kg	A-T-023s
Total Aromatics$_{A}^{\#}$	30	6.6	7.4	9.0	5.2	3.9	-	-	mg/kg	A-T-022+23s
TPH (Ali & Aro)$_{A}^{\#}$	30	6.6	7.4	9.1	5.2	3.9	-	-	mg/kg	A-T-022+23s
BTEX - Benzene$_{A}^{\#}$	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	-	-	mg/kg	A-T-022s
BTEX - Toluene$_{A}^{\#}$	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	-	-	mg/kg	A-T-022s
BTEX - Ethyl Benzene$_{A}^{\#}$	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	-	-	mg/kg	A-T-022s
BTEX - m & p Xylene$_{A}^{\#}$	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	-	-	mg/kg	A-T-022s
BTEX - o Xylene$_{A}^{\#}$	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	-	-	mg/kg	A-T-022s
MTBE$_{A}^{\#}$	<0.01	<0.01	<0.01	0.01	0.01	<0.01	-	-	mg/kg	A-T-022s

Envirolab Job Number: 09/01125 **Client Project Name: Gondar Gardens, London**

Client Project Ref: 23283

Lab Sample ID	09/01125/1	09/01125/2	09/01125/3	09/01125/4	09/01125/5	09/01125/6	09/01125/7	09/01125/8	Units	Method ref
Client Sample No										
Client Sample ID	PH1	PH1	PH2	PH3	PH6	PH7	PH1	BH1		
Depth to Top	0.30	0.70	0.40	0.50	0.30	0.30	2.20	3.00		
Depth To Bottom										
Date Sampled	17-Nov-09	17-Nov-09	17-Nov-09	17-Nov-09	17-Nov-09	17-Nov-09	17-Nov-09	17-Nov-09		
Sample Type	Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil		
Sample Matrix Code	6	6	3	6	6	6A	6	3		
PAH 16										
Acenapthene$_A^{M\#}$	0.13	0.04	0.01	0.11	<0.01	0.08	-	-	mg/kg	A-T-019s
Acenapthylene$_A^{\#}$	0.07	<0.01	<0.01	<0.01	<0.01	0.02	-	-	mg/kg	A-T-019s
Anthracene$_A^{M\#}$	1.67	0.14	<0.01	1.19	<0.01	0.25	-	-	mg/kg	A-T-019s
Benzo(a)anthracene$_A^{M\#}$	0.93	0.01	0.02	0.22	<0.01	0.03	-	-	mg/kg	A-T-019s
Benzo(a)pyrene$_A^{M\#}$	2.13	0.04	0.04	0.92	<0.01	0.34	-	-	mg/kg	A-T-019s
Benzo(b)fluoranthene$_A^{M\#}$	1.04	0.05	0.02	0.26	<0.01	0.09	-	-	mg/kg	A-T-019s
Benzo(ghi)perylene$_A^{M\#}$	1.47	0.05	0.04	0.40	<0.01	0.43	-	-	mg/kg	A-T-019s
Benzo(k)fluoranthene$_A^{M\#}$	1.31	0.07	0.02	0.57	<0.01	0.34	-	-	mg/kg	A-T-019s
Chrysene$_A^{M\#}$	4.16	0.12	0.05	1.80	<0.01	0.73	-	-	mg/kg	A-T-019s
Dibenzo(ah)anthracene$_A^{M\#}$	0.06	0.01	0.06	0.06	<0.01	0.16	-	-	mg/kg	A-T-019s
Fluoranthene$_A^{M\#}$	9.08	0.14	0.02	4.20	0.01	1.57	-	-	mg/kg	A-T-019s
Fluorene$_A^{M\#}$	0.02	<0.01	<0.01	<0.01	<0.01	<0.01	-	-	mg/kg	A-T-019s
Indeno(123-cd)pyrene$_A^{M\#}$	0.53	0.08	0.07	0.06	<0.01	0.12	-	-	mg/kg	A-T-019s
Naphthalene$_A^{M\#}$	0.04	0.02	0.02	0.04	<0.01	0.07	-	-	mg/kg	A-T-019s
Phenanthrene$_A^{M\#}$	2.50	0.05	<0.01	1.80	<0.01	0.34	-	-	mg/kg	A-T-019s
Pyrene$_A^{M\#}$	8.04	0.37	0.02	3.87	<0.01	1.28	-	-	mg/kg	A-T-019s
Total PAH$_A^{\#}$	33.2	1.19	0.41	15.5	0.01	5.85	-	-	mg/kg	A-T-019s

Envirolab Job Number: 09/01125

Client Project Name: Gondar Gardens, London

Client Project Ref: 23283

Lab Sample ID	09/01125/9	09/01125/10	09/01125/11	09/01125/12					Units	Method ref
Client Sample No										
Client Sample ID	BH1	BH1	BH1	BH1						
Depth to Top	6.00	9.00	15.00	19.90						
Depth To Bottom										
Date Sampled	17-Nov-09	17-Nov-09	17-Nov-09	17-Nov-09						
Sample Type	Soil	Soil	Soil	Soil						
Sample Matrix Code	3	3	3	3						
pH$_D^{M\#}$	8.3	8.7	8.9	9.1						A-T-031s
Sulphate BRE (water sol 2:1)$_D^{M\#}$	2.00	2.10	0.97	0.41					g/l	A-T-026s
Sulphate BRE (acid sol)$_D^{M\#}$	0.40	0.69	0.15	0.11					% w/w	A-T-028
Sulphur BRE (total)$_D$	0.12	0.71	0.42	1.41					% w/w	A-T-024

APPENDIX G

Generic Assessment Criteria for Human Health
With gardens

Generic Assessment Criteria for Human Health
Residential Scenario – Private Gardens

The human health generic assessment criteria (GAC) have been developed during a period of regulatory review and updating of the Contaminated Land Exposure Assessment (CLEA) project. Hence, the Environment Agency (EA) is in the process of publishing updated reports relating to the CLEA project and the GAC presented in this document may change to reflect these updates. This issue was prepared following the publication of soil guideline value reports and associated publications(1) for mercury, selenium, benzene, toluene, ethylbenzene and xylene in March 2009 plus arsenic and nickel in May 2009. Where available, the published soil guideline values (SGV)(1) have been used as GAC.

1. Model Selection

Soil assessment criteria (SAC) were calculated for compounds where SGV have not been published using CLEA v1.04. Groundwater assessment criteria (GrAC) protective of human health via the inhalation pathway were derived using the RBCA 1.3b model. RSK has updated the inputs within RBCA to reflect the UK guidance(2-5). The SAC and GrAC collectively are termed GAC.

2. Conceptual Model

In accordance with EA Science Report SC050221/SR3(3), the residential with private garden scenario considers risks to a female child between the ages of 0 and 6 years old. In accordance with Box 3.1, SR3(3), the pathways considered for production of the SAC in the residential with gardens scenario are:

- Direct soil and dust ingestion;
- Consumption of homegrown produce;
- Consumption of soil attached to homegrown produce;
- Dermal contact with soil and indoor dust, and
- Inhalation of indoor and outdoor dust and vapours.

Figure 1 is a conceptual model illustrating these linkages.

The pathway considered in production of the GrAC is the volatilisation of compounds from groundwater and subsequent vapour inhalation by residents whilst indoors. Figure 2 illustrates this linkage. Although the outdoor air inhalation pathway is also valid, this contributes little to the overall risks owing to the dilution in outdoor air.

Within RBCA, the solubility limit of the determinant restricts the extent of volatilisation, which in turn drives the indoor air inhalation pathway. Whilst the same restriction is not built into the CLEA model, the model output cells are flagged red where the soil saturation limit has been exceeded. In accordance with the SGV report for xylene(1), where the soil saturation or solubility limit has been exceeded the GAC has been set at this limit. It should be noted this is a highly conservative assumption. Unless free-phase product is present, concentrations of the chemical are unlikely to be present at sufficient concentration to result in an exceedance of the health criteria value (HCV).

3. Input Selection

Chemical data was obtained from EA Report SC050021/SR7(5) and the health criteria values (HCV) from the UK TOX reports (published 2002 and 2009) where available.

For total petroleum hydrocarbons (TPH), HCV and chemical specific parameters were taken from the TPH Criteria Working Group (TPHCWG). Until further information is available regarding whether the TPH fractions should be considered cumulatively and/or additional data becomes available regarding background exposure, RSK has taken the conservative view that 50% exposure to TPH fractions is derived from background. Thus, the mean daily intake has been set at 50% of the toxicological data. Aromatic hydrocarbons C_5-C_8 were not modelled since benzene and toluene are being modelled separately. The aromatic C_8-C_9 hydrocarbon fraction comprises ethylbenzene, xylene and styrene. Since ethylbenzene and xylene are being modelled separately, the physical, chemical and toxicological data for this band has been taken from styrene. Owing to the lack of UK-specific data, default information in the RBCA model was used to evaluate methyl tertiary butyl ether (MTBE). No published UK data was available for 1,2,4- and 1,3,5-trimethylbenzene, so information was obtained from the US EPA. Toxicity reports were generated by RSK in line with guidance in CLR9(7) for 14 of the 16 USEPA polycyclic aromatic hydrocarbons (PAH). RSK notes that CLR9(7) has been withdrawn and these toxicity reports may need to be updated using additional references included within SR2(2). However, the data in these documents is considered to remain valid since it broadly follows the approach outlined in SR2. Therefore, the HCV from these reports was used with the chemical data obtained from SR7(5), where available.

RBCA uses toxicity data for the inhalation pathway in different units to the CLEA model and cannot consider separately the mean daily intake (MDI), occupancy periods or breathing rates. Therefore, the HCV was amended to take account of:

- Amendments to the MDI using Table 3.4 of SR2(2);
- A child weighing 13.3kg (average of 0-6 year old female in accordance with Table 4.6 of SR3(3)) and breathing 11.85m^3 (average daily inhalation rate for a 0-6yr old female in accordance with Table 4.14 of SR3(3); and
- The 50% rule (for petroleum hydrocarbons, trimethylbenzenes and MTBE)(2) where MDI data is not currently available but background exposure is considered important in the overall exposure.

Physical Parameters

For the residential with private gardens scenario, the CLEA default building is a small two-storey terrace house with concrete ground bearing slab. The house is assumed to have a 100m^2 private garden consisting of lawn, flowerbeds and incorporating a 20m^2 plot for growing fruit and vegetables consumed by the residents. SR3(3) notes this residential building type to be the most conservative in terms of protection from vapour intrusion. The building parameters are outlined in Table 5.

The parameters for a sandy loam soil type were used in line with SR3(3). This includes a value of 6% for the percentage soil organic matter (SOM) within the soil. In RSK's experience, this is rather high for many sites. To avoid undertaking site specific risk assessments for this parameter, RSK has produced an additional set of SAC for an SOM of 1%.

For the GrAC, the depth to groundwater was taken as 2.5m based on RSK's experience of assessing the volatilisation pathway from groundwater.

4. GAC

The SAC were produced using the input parameters in Tables 1 to 5 and the GrAC using input parameters in Table 6. The final selected GAC are presented by pathway in Table 7 and the combined GAC in Table 8.

Figure 1
Conceptual Model for CLEA Residential Scenario – Private Gardens

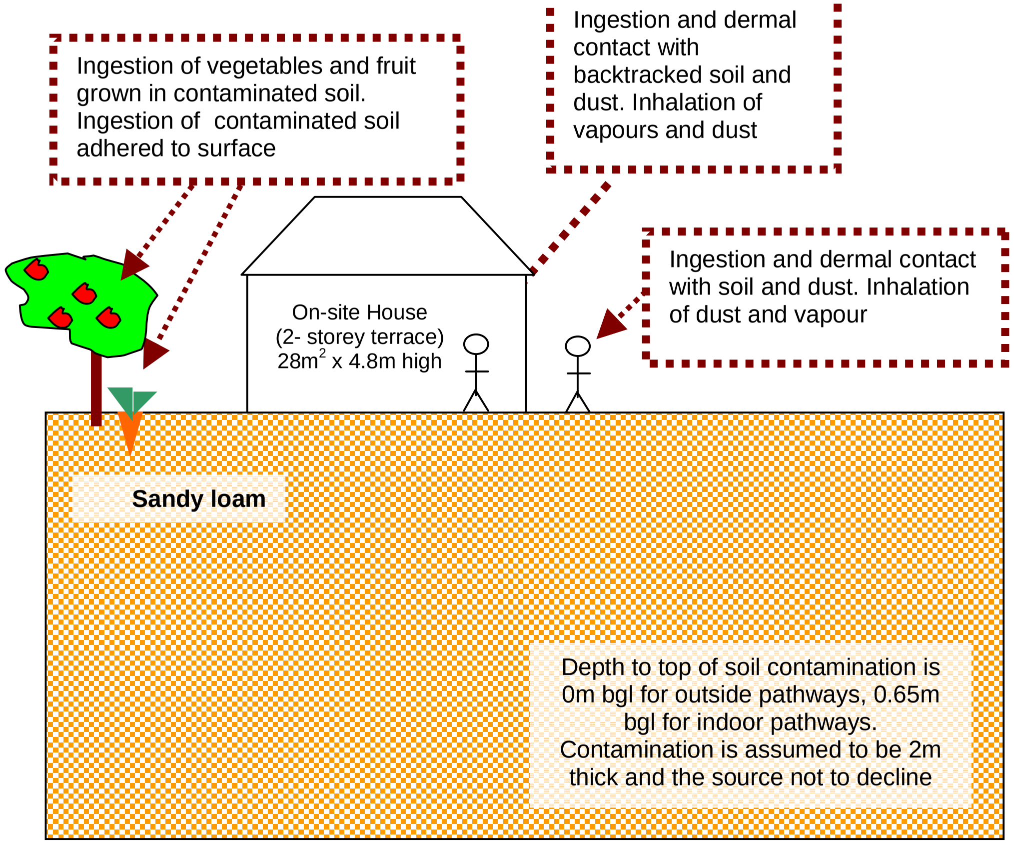


Table 1
Exposure Assessment Parameters for Residential Scenario - Private Gardens – Inputs for RBCA Model

Parameter	Value	Justification
Land use	Residential with homegrown produce	Chosen land use
Receptor	Female child age 1 to 6	Key generic assumption given in Box 3.1, SR3
Building	Small terraced house	Key generic assumption given in Box 3.1, report SC050021/SR3. Two storey small terraced house chosen as it is the most conservative residential building type in terms of protection from vapor intrusion (Section 3.4.6, SR3)
Soil type	Sandy Loam	Most common UK soil type (Section 4.3.1, From Table 3.1, SR3)
Start AC (age class)	1	Range of age classes corresponding to key generic assumption that the critical receptor is a young female child aged zero to six. From Box 3.1, report SC050021/SR3.
End AC (age class)	6	
SOM (%)	(i) 6	Representative of sandy loamy soil according to EA Guidance note dated January 2009 entitled 'Changes We Have Made to the CLEA Framework Documents'
	(ii) 1	To provide SAC for sites where SOM <6% as often observed by RSK
pH	7	Model default

Table 2
Residential with Private Gardens –Homegrown Produce Data for CLEA Model

	Consumption Rate (g FW kg^{-1} BW day^{-1}) by Age Class						Dry Weight Conversion Factor	Homegrown Fraction (average)	Homegrown Fraction (high end)	Soil loading factor	Preparation correction factor
Name	1	2	3	4	5	6	g DW g^{-1} FW	-	-	g g^{-1} DW	-
Green vegetables	7.12	6.85	6.85	6.85	3.74	3.74	0.096	0.05	0.33	1.00E-03	2.00E-01
Root vegetables	10.69	3.30	3.30	3.30	1.77	1.77	0.103	0.06	0.4	1.00E-03	1.00E+00
Tuber vegetables	16.03	5.46	5.46	5.46	3.38	3.38	0.21	0.02	0.13	1.00E-03	1.00E+00
Herbaceous fruit	1.83	3.96	3.96	3.96	1.85	1.85	0.058	0.06	0.4	1.00E-03	6.00E-01
Shrub fruit	2.23	0.54	0.54	0.54	0.16	0.16	0.166	0.09	0.6	1.00E-03	6.00E-01
Tree fruit	3.82	11.96	11.96	11.96	4.26	4.26	0.157	0.04	0.27	1.00E-03	6.00E-01
Justification	Table 4.17, SR3						Table 6.3, SR3	Table 4.19, SR3		Table 6.3, SR3	

Table 3
Residential with Private Gardens – Land Use Data for CLEA Model

Parameter	Unit	Age Class					
		1	2	3	4	5	6
EF (soil and dust ingestion)	day yr^{-1}	180	365	365	365	365	365
EF (consumption of homegrown produce)	day yr^{-1}	180	365	365	365	365	365
EF (skin contact, indoor)	day yr^{-1}	180	365	365	365	365	365
EF (skin contact, outdoor)	day yr^{-1}	180	365	365	365	365	365
EF (inhalation of dust and vapour, indoor)	day yr^{-1}	365	365	365	365	365	365
EF (inhalation of dust and vapour, outdoor)	day yr^{-1}	365	365	365	365	365	365
Justification		Table 3.1, SR3					
Occupancy period (indoor)	hr day^{-1}	23	23	23	23	19	19
Occupancy period (outdoor)	hr day^{-1}	1	1	1	1	1	1
Justification		Table 3.2, SR3					
Soil to skin adherence factor (indoor)	mg cm^{-2} day^{-1}	6.00E-02	6.00E-02	6.00E-02	6.00E-02	6.00E-02	6.00E-02
Soil to skin adherence factor (outdoor)	mg cm^{-2} day^{-1}	1.00E+00	1.00E+00	1.00E+00	1.00E+00	1.00E+00	1.00E+00
Justification		Table 8.1, SR3					
Soil and dust ingestion rate	g day^{-1}	1.00E-01	1.00E-01	1.00E-01	1.00E-01	1.00E-01	1.00E-01
Justification		Table 6.2, SR3					

Table 4
Residential with Private Gardens – Receptor Data for CLEA Model

Parameter	Unit	Age Class						Justification
		1	2	3	4	5	6	
Body weight	kg	5.6	9.8	12.7	15.1	16.9	19.7	Table 4.6, SR3
Body height	m	0.7	0.8	0.9	0.9	1	1.1	
Inhalation rate	m^{3} day^{-1}	8.5	13.3	12.7	12.2	12.2	12.2	Table 4.14, SR3
Max exposed skin fraction (indoor)	m^{2} m^{-2}	0.32	0.33	0.32	0.35	0.35	0.33	Table 4.8, SR3
Max exposed skin fraction (outdoor)	m^{2} m^{-2}	0.26	0.26	0.25	0.28	0.28	0.26	

Table 5
Residential with Private Gardens – Soil and Building Inputs for CLEA Model

Parameter	Unit	Value	Justification
SOIL PROPERTIES for sandy loam			
Porosity, total	cm^3 cm^{-3}	0.53	Default soil type is sandy loam, section 4.3.1, SR3. Parameters for sandy loam from Table 4.4, SR3
Porosity, air filled	cm^3 cm^{-3}	0.20	
Porosity, water filled	cm^3 cm^{-3}	0.33	
Residual soil water content	cm^3 cm^{-3}	0.12	
Saturated hydraulic conductivity	cm s^{-1}	3.56E-03	
van Genuchten shape parameter (*m*)	-	3.20E-01	
Bulk density	g cm^{-3}	1.21	
Threshold value of wind speed at 10m	m s^{-1}	7.20	Default value taken from Section 9.2.2, SR3
Empirical function (F_x) for dust model	-	1.22	Value taken from Section 9.2.2, SR3
Ambient soil temperature	K	283	Annual average soil temperature representative of UK surface soils. Section 4.3.1, SR3
AIR DISPERSION MODEL			
Mean annual wind speed (10 m)	m s^{-1}	5.00	Default value taken from Section 9.2.2, SR3
Air dispersion factor at height of 0.8 m	g m^{-2} s^{-1} per kg m^{-3}	2400	Values for a 0.01 ha site, appropriate to a residential land use in Newcastle (most representative city for UK). (from Table 9.1, SR3) Assumed child of 6 is not tall enough to reach 1.6m
Air dispersion factor at height of 1.6 m	g m^{-2} s^{-1} per kg m^{-3}	0	
Fraction of site with hard or vegetative cover	m^2 m^{-2}	0.75	Section 3.2.6, SR3 based on residential land use
BUILDING PROPERTIES for small terrace house with ground-bearing floor slab			
Building footprint	m^2	28	From Table 3.3 and 4.21, SR3
Living space air exchange rate	hr^{-1}	0.50	
Living space height (above ground)	m	4.8	
Living space height (below ground)	m	0.0	Assumed no basement
Pressure difference (soil to enclosed space)	Pa	3.1	From Table 3.3, SR3
Foundation thickness	m	0.15	
Floor crack area	cm^2	423	
Dust loading factor	µg m^{-3}	50	Default value for a residential site taken from Section 9.3, SR3
VAPOUR MODEL			
Default soil gas ingress rate	cm^3 s^{-1}	25	Generic flow rate, Section 10.3, SR3
Depth to top of source (beneath building)	cm	50	Section 3.2.6, SR3 states source is 50cm below building or 65cm below ground surface
Depth to top of source (no building)	cm	0	Section 10.2, SR3 assumes impact from 0-1m for outdoor inhalation pathway
Thickness of contaminant layer	cm	200	Model default for indoor air, Section 4.9, SR4
Time average period for surface emissions	years	6	Time period of a 0 to 6 year old, Box 3.5, SR3
User-defined effective air permeability	cm^2	3.05E-08	Calculated for sandy loam using equations in Appendix 1, SR3

Figure 2
GrAC Conceptual Model for RBCA Residential with Gardens Scenario

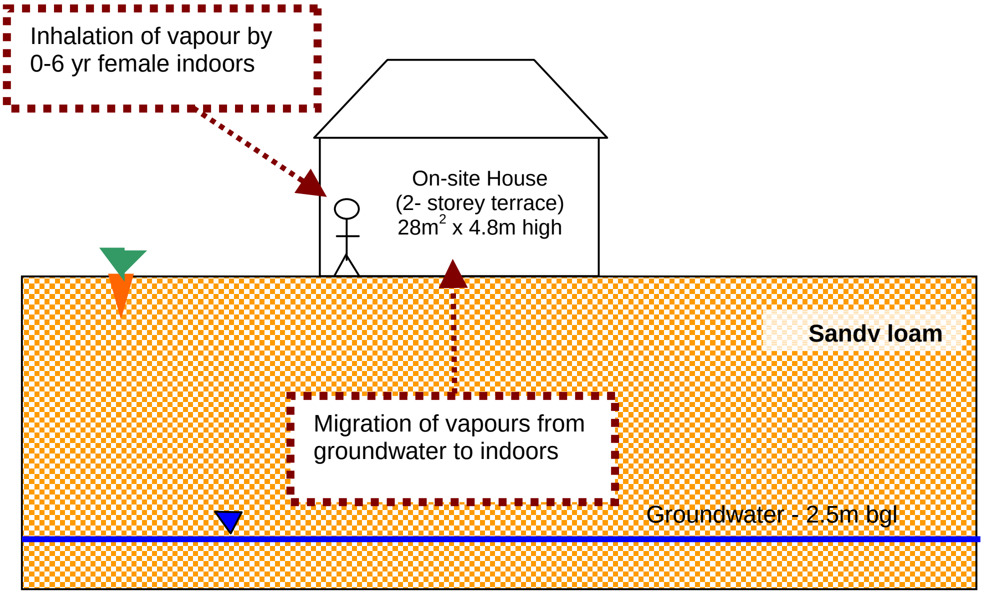


Table 6
Residential with Private Gardens RBCA Inputs

Parameter	Unit	Value	Justification
RECEPTOR			
Averaging time	Years	6	From Box 3.1, SR3
Receptor weight	kg	13.3	Average of CLEA 0-6 year old female data, Table 4.6, SR3
Exposure duration	Years	6	From Box 3.1, report , SR3
Exposure frequency	Days/yr	350	Weighted using occupancy period of 23 hours per day for 365 days of the year
SOIL TYPE – SANDY LOAM			
Total porosity	-	0.53	CLEA value for sandy loam. Parameters for sandy loam from Table 4.4, SR3
Volumetric water content	-	0.33	
Volumetric air content	-	0.20	
Dry bulk density	g cm^{-3}	1.21	
Vertical hydraulic conductivity	cm s^{-1}	3.56E-3	CLEA value for saturated conductivity of sandy loam, Table 4.4, SR3
Vapour permeability	m^2	3.05E-12	Calculated for sandy loam using equations in Appendix 1, SR3
Capillary zone thickness	m	0.1	Professional judgement
Fraction organic carbon	%	(i) 0.0348	Representative of sandy loam according to EA Guidance note dated January 2009 entitled Changes We Have Made to the CLEA Framework Documents
		(ii) 0.0058	To provide SAC for site's where SOM < 6% as often observed by RSK
BUILDING			
Building volume/area ratio	m	4.8	Table 3.3, SR3
Foundation area	m^2	28	
Foundation perimeter	m	22	Calculated assuming building measures 7m x 4m to give 28m^2 foundation area
Building air exchange rate	d^{-1}	12	Table 3.3, SR3
Depth to bottom of foundation slab	m	0.15	
Foundation thickness	m	0.15	
Foundation crack fraction	-	0.0151	Calculated from floor crack area of 423 cm^2 and building footprint of 28m^2 in Table 4.21, SR3
Volumetric water content of cracks	-	0.33	Assumed equal to underlying soil type in assumption that cracks become filled with soil over time. Parameters for sandy loam from Table 4.4, SR3
Volumetric air content of cracks	-	0.2	
Indoor/outdoor differential pressure	Pa	3.1	From Table 3.3, SR3

REFERENCES

1) Environment Agency, 31 March 2009 and May 2009. Science Report SC050021 / benzene SGV, toluene SGV, ethylbenzene SGV, xylene SGV, mercury SGV, selenium SGV, nickel SGV and arsenic SGV. Supplementary information for the derivation of SGV for: benzene, toluene, ethylbenzene, xylene, mercury, selenium, nickel and arsenic. Contaminants in soil: updated collation of toxicological data and intake values for humans: benzene, toluene, ethylbenzene, xylene, mercury, selenium, nickel and arsenic.

2) Environment Agency, January 2009. Science Report SC050021/SR2 Human Health Toxicological Assessment of Contaminants in Soil.

3) Environment Agency, January 2009. Science Report SC050021/SR3 Updated Technical Background to the CLEA Model.

4) Environment Agency, January 2009. Science Report SC050021/SR4 CLEA Software (Version 1.04) Handbook.

5) Environment Agency. 2008. Science Report SC050021/SR7. Compilation of Data for Priority Organic Pollutants for Derivation of Soil Guideline Values.

6) Environment Agency and DEFRA. Contaminants in Soil: Collation of Toxicological Data and Intake Values for Humans. Numbers 1–12, 14, 16–25.

7) Environment Agency. March 2002. CLR 9. Contaminants in soil: Collation of Toxicological Data and Intake Values for Humans.

GENERIC ASSESSMENT CRITERIA FOR HUMAN HEALTH - RESIDENTIAL WITH PRIVATE GARDENS

Table 7
Human Health Generic Assessment Criteria by Pathway for Residential Scenario - Private Gardens

		GrAC	SAC Appropriate to Pathway SOM 1% (mg/kg)			Soil Saturation	SAC Appropriate to Pathway SOM 6% (mg/kg)			Soil Saturation
Compound		(mg/l)	Oral	Inhalation	Combined	Limit (mg/kg)	Oral	Inhalation	Combined	Limit (mg/kg)
Metals										
Arsenic	(b,c)	-	3.24E+01	8.50E+01	2.35E+01	NR	3.24E+01	8.50E+01	2.35E+01	NR
Cadmium		-	6.21E+01	4.25E+01	2.93E+01	NR	6.21E+01	4.25E+01	2.93E+01	NR
Chromium (hexavalent)		-	2.78E+02	4.25E+01	3.76E+01	NR	2.78E+02	4.25E+01	3.76E+01	NR
Copper		-	8.96E+03	6.08E+03	4.74E+03	NR	8.96E+03	6.08E+03	4.74E+03	NR
Lead	(a)	-	4.50E+02	-	-	NR	4.50E+02	-	-	NR
Elemental Mercury (Hg^0)	(b,d)	9.40E-03	-	1.70E-01	-	4.31E+00	-	1.02E+00	-	2.58E+01
Inorganic Mercury (Hg^{2+})	(b)	-	1.81E+02	2.55E+03	1.69E+02	NR	1.81E+02	2.55E+03	1.69E+02	NR
Methyl Mercury (Hg^{4+})	(b)	2.00E+01	1.39E+01	1.59E+01	7.40E+00	7.33E+01	1.39E+01	6.53E+01	1.14E+01	3.04E+02
Nickel	(b,d)	-	5.31E+02	1.27E+02	1.19E+02	NR	5.31E+02	1.27E+02	1.19E+02	NR
Selenium	(b,c)	-	3.51E+02	-	-	NR	3.51E+02	-	-	NR
Zinc	(c)	-	2.53E+04	-	-	NR	2.53E+04	-	-	NR
Cyanide		-	2.66E+01	3.97E+00	3.68E+00	NR	2.66E+01	3.97E+00	3.68E+00	NR
Volatile Organic Compounds										
Benzene	(b)	2.60E+01	1.12E-01	2.69E-01	7.92E-02	1.22E+03	4.89E-01	1.04E+00	3.32E-01	4.71E+03
Toluene	(b)	1.90E+03	1.47E+02	6.26E+02	1.19E+02	8.69E+02	7.59E+02	3.14E+03	6.11E+02	4.36E+03
Ethylbenzene	(b)	2.60E+02	1.06E+02	1.70E+02	6.52E+01	5.18E+02	5.70E+02	9.32E+02	3.54E+02	2.84E+03
Xylene - m	(b)	8.40E+01	2.02E+02	5.56E+01	4.36E+01	6.25E+02	1.09E+03	3.07E+02	2.40E+02	3.46E+03
Xylene - o		1.00E+02	1.85E+02	5.98E+01	4.52E+01	4.78E+02	9.96E+02	3.27E+02	2.46E+02	2.62E+03
Xylene - p		8.70E+01	1.91E+02	5.34E+01	4.17E+01	5.76E+02	1.02E+03	2.94E+02	2.28E+02	3.17E+03
Total xylene		8.40E+01	2.02E+02	5.56E+01	4.36E+01	6.25E+02	1.09E+03	3.07E+02	2.40E+02	3.46E+03
Methyl t-Butyl ether		2.20E+03	1.75E+00	1.84E+02	1.75E+00	1.66E+04	7.41E+00	3.70E+02	7.37E+00	3.34E+04
Trichloroethene		1.80E+00	2.83E+00	1.10E-01	1.06E-01	1.54E+03	1.40E+01	5.11E-01	4.93E-01	7.14E+03
Tetrachloroethene		3.60E+00	1.06E+01	1.60E+00	1.39E+00	4.24E+02	5.55E+01	8.21E+00	7.15E+00	2.18E+03
1,1,1-Trichloroethane		2.60E+01	3.20E+02	6.33E+00	6.21E+00	1.43E+03	1.55E+03	2.84E+01	2.79E+01	6.39E+03
1,1,1,2Tetrachloroethane		1.40E+01	5.19E+00	1.08E+00	8.93E-01	2.60E+03	2.78E+01	5.83E+00	4.82E+00	1.40E+04
1,1,2,2-Tetrachloroethane		1.40E+01	2.70E+00	2.76E+00	1.37E+00	2.67E+03	1.30E+01	1.24E+01	6.34E+00	1.20E+04
Carbon Tetrachloride		5.50E-02	1.05E+00	1.81E-02	1.79E-02	1.52E+03	5.44E+00	8.99E-02	8.92E-02	7.54E+03
1,2-Dichloroethane		3.00E-01	3.06E-02	6.46E-03	5.34E-03	3.41E+03	1.05E-01	1.60E-02	1.39E-02	8.43E+03
Vinyl Chloride		1.90E-02	3.69E-03	5.43E-04	4.73E-04	1.36E+03	1.21E-02	1.07E-03	9.86E-04	2.69E+03
1,2,4-Trimethylbenzene		7.50E-02	3.39E+01	7.42E-01	7.38E-01	1.03E+02	1.87E+02	4.19E+00	4.17E+00	5.85E+02
1,3,5-Trimethylbenzene		4.70E-02	1.45E+01	4.60E-01	4.56E-01	9.47E+01	7.94E+01	2.59E+00	2.56E+00	5.33E+02
Semi-Volatile Organic Compounds										
Acenaphthene		3.20E+00	2.05E+02	7.34E+00	7.08E+00	1.32E+02	7.49E+02	4.32E+01	4.09E+01	7.89E+02
Acenaphthylene		4.20E+00	1.23E+01	5.45E-01	5.22E-01	3.89E+02	5.32E+01	3.21E+00	3.03E+00	2.31E+03
Anthracene		2.10E-02	4.26E+04	1.39E+03	1.34E+03	3.60E+00	5.15E+04	7.40E+03	6.47E+03	2.16E+01
Benzo(a)anthracene		3.80E-03	1.42E+01	8.09E+00	5.16E+00	1.71E+00	1.57E+01	2.05E+01	8.90E+00	1.03E+01
Benzo(b)fluoranthene		2.00E-03	1.47E+01	2.50E+01	9.25E+00	1.22E+00	1.58E+01	2.87E+01	1.02E+01	7.29E+00
Benzo(g,h,i)perylene		2.60E-04	2.35E+03	5.38E+04	2.25E+03	1.87E-02	2.40E+03	5.63E+04	2.30E+03	1.12E-01
Benzo(k)fluoranthene		8.00E-04	1.50E+01	2.66E+01	9.60E+00	6.87E-01	1.59E+01	2.91E+01	1.03E+01	4.12E+00
Chrysene		2.00E-03	1.37E+02	1.95E+02	8.03E+01	4.40E-01	1.55E+02	2.72E+02	9.90E+01	2.64E+00
Dibenzo(a,h)anthracene		6.00E-04	1.53E+00	2.37E+00	9.28E-01	3.93E-03	1.59E+00	2.85E+00	1.02E+00	2.36E-02
Fluoranthene		2.30E-01	1.12E+02	1.51E+01	1.33E+01	1.89E+01	1.50E+02	7.18E+01	4.85E+01	1.13E+02
Fluorene		1.90E+00	2.35E+03	8.85E+01	8.53E+01	1.53E+02	6.86E+03	5.23E+02	4.86E+02	9.13E+02
Indeno(1,2,3-cd)pyrene		2.00E-04	1.45E+01	2.43E+01	9.08E+00	6.14E-02	1.58E+01	2.86E+01	1.02E+01	3.68E-01
Phenanthrene		5.30E-01	2.39E+03	1.17E+03	7.85E+02	7.06E+01	3.03E+03	6.33E+03	2.05E+03	4.23E+02
Pyrene		1.30E-01	1.08E+03	1.44E+02	1.27E+02	2.20E+00	1.49E+03	6.93E+02	4.73E+02	1.32E+01
Benzo(a)pyrene		3.80E-03	1.49E+00	2.62E+00	9.49E-01	9.11E-01	1.58E+00	2.90E+00	1.02E+00	5.46E+00
Naphthalene		1.90E+01	2.68E+01	1.64E+00	1.54E+00	7.64E+01	1.43E+02	9.27E+00	8.71E+00	4.32E+02
Phenol	(c)	-	4.40E+02	-	-	4.16E+04	1.98E+03	-	-	1.74E+05

GENERIC ASSESSMENT CRITERIA FOR HUMAN HEALTH - RESIDENTIAL WITH PRIVATE GARDENS

Table 7
Human Health Generic Assessment Criteria by Pathway for Residential Scenario - Private Gardens

Compound		GrAC (mg/l)	SAC Appropriate to Pathway SOM 1% (mg/kg)			Soil Saturation Limit (mg/kg)	SAC Appropriate to Pathway SOM 6% (mg/kg)			Soil Saturation Limit (mg/kg)
			Oral	Inhalation	Combined		Oral	Inhalation	Combined	
Total Petroleum Hydrocarbons										
Aliphatic hydrocarbons EC_5-EC_6		1.00E+01	8.97E+03	2.47E+01	2.47E+01	3.69E+02	4.31E+04	8.04E+01	8.03E+01	1.20E+03
Aliphatic hydrocarbons >EC_6-EC_8		5.40E+00	1.52E+04	5.11E+01	5.10E+01	1.69E+02	6.62E+04	2.39E+02	2.39E+02	7.93E+02
Aliphatic hydrocarbons >EC_8-EC_{10}		2.30E-01	3.14E+03	1.11E+01	1.11E+01	8.46E+01	4.12E+03	6.29E+01	6.27E+01	4.79E+02
Aliphatic hydrocarbons >EC_{10}-EC_{12}		3.40E-02	3.99E+03	5.36E+01	5.35E+01	5.02E+01	4.34E+03	3.18E+02	3.12E+02	2.98E+02
Aliphatic hydrocarbons >EC_{12}-EC_{16}		7.60E-04	4.39E+03	2.48E+02	2.45E+02	2.22E+01	4.41E+03	1.49E+03	1.34E+03	1.33E+02
Aliphatic hydrocarbons >EC_{16}-EC_{21}	(c)	-	8.84E+04	-	-	9.15E+00	8.84E+04	-	-	5.49E+01
Aliphatic hydrocarbons >EC_{21}-EC_{35}	(c)	-	8.84E+04	-	-	6.45E+00	8.84E+04	-	-	3.87E+01
Aromatic hydrocarbons >EC_8-EC_9		6.50E+01	1.66E+02	2.65E+02	1.33E+02	6.20E+02	8.50E+02	1.54E+03	7.02E+02	3.61E+03
Aromatic hydrocarbons >EC_9-EC_{10}		7.40E+00	5.53E+01	1.77E+01	1.60E+01	6.20E+02	2.83E+02	1.03E+02	9.17E+01	3.61E+03
Aromatic hydrocarbons >EC_{10}-EC_{12}		2.50E+01	8.04E+01	9.74E+01	5.84E+01	3.72E+02	3.90E+02	5.74E+02	3.04E+02	2.19E+03
Aromatic hydrocarbons >EC_{12}-EC_{16}		5.80E+00	1.40E+02	5.05E+02	1.29E+02	1.70E+02	6.01E+02	3.00E+03	5.67E+02	1.01E+03
Aromatic hydrocarbons >EC_{16}-EC_{21}	(c)	-	8.84E+04	-	-	5.99E+01	8.84E+04	-	-	3.59E+02
Aromatic hydrocarbons >EC_{21}-EC_{35}	(c)	-	1.11E+03	-	-	4.82E+00	1.29E+03	-	-	2.89E+01

Notes:

-' Generic assessment criteria not calculated owing to low volatility of substance and therefore no pathway, or an absence of toxicological data.

EC - equivalent carbon. GrAC - groundwater assessment criteria. SAC - soil assessment criteria.

The CLEA model output is colour coded depending upon whether the soil saturation limit has been exceeded.

▨	Calculated SAC exceeds soil saturation limit and may significantly effect the interpretation of any exceedances since the contribution of the indoor and outdoor vapour pathway to total exposure is >10%. This shading has also been used for the RBCA output where the theoretical solubility limit has been exceeded. SAC/GrAC is set at soil saturation/solubility limit.
🟨	Calculated SAC exceeds soil saturation limit but will not effect the SSV significantly since the contribution of the indoor and outdoor vapour pathway to total exposure is <10%.
🟩	Calculated SAC does not exceed the soil saturation limit.

For consistency where the theoretical solubility limit within RBCA has been exceeded in production of the GrAC, these cellls have also been hatched red.

The SAC for organic compounds are dependant upon soil organic matter (SOM) (%) content. To obtain SOM from total organic carbon (TOC) (%) divide by 0.58. 1% SOM is 0.58% TOC. DL Rowell Soil Science: Methods and Applications, Longmans, 1994.

SAC for TPH fractions, polycyclic aromatic hydrocarbons, MTBE, BTEX and trimethylbenzene compounds were produced using an attenuation factor for the indoor air inhalation pathway of 10 to reduce conservatism associated with the vapour inhalation pathway, section 10.1.1, SR3

(a) GAC taken as former Soil Guideline Value owing to uncertainty regarding toxicological approach to be adopted by the Environment Agency.

(b) GAC taken from the Environment Agency SGV reports published March and May 2009.

(c) SAC for selenium, zinc, phenol, aliphatic and aromatic hydrocarbons >EC16 does not include inhalation pathway owing to absence of toxicity data. SAC for arsenic is only based on oral contribution (rather than combined) owing to the relative small contribution from inhalation in accordance with the SGV report.

(d) SAC for elemental mercury and nickel is based on the inhalation pathway only owing to an absence of toxicity for elemental mercury andr in accordance with the SGV report for nickel.

GENERIC ASSESSMENT CRITERIA FOR HUMAN HEALTH - RESIDENTIAL WITH PRIVATE GARDENS

Table 8
Human Health Generic Assessment Criteria for Residential Scenario - Private Gardens

Compound	GrAC for Groundwater (mg/l)	SAC for Soil SOM 1% (mg/kg)	SAC for Soil SOM 6% (mg/kg)
Metals			
Arsenic	-	32	32
Cadmium	-	29	29
Chromium (hexavalent)	-	38	38
Copper	-	4,700	4,700
Lead	-	450	450
Elemental Mercury (Hg^0)	0.009	0.17	1.0
Inorganic Mercury (Hg^{2+})	-	170	170
Methyl Mercury (Hg^{4+})	20	7.4	11
Nickel	-	130	130
Selenium	-	350	350
Zinc	-	25,000	25,000
Cyanide	-	3.7	3.7
Volatile Organic Compounds			
Benzene	26	0.08	0.33
Toluene	1,900	120	610
Ethylbenzene	260	65	350
Xylene - m	84	44	240
Xylene - o	100	45	250
Xylene - p	87	42	230
Total xylene	84	44	240
Methyl t-Butyl ether	2,200	1.8	7.4
Trichloroethene	1.8	0.11	0.49
Tetrachloroethene	3.6	1.4	7.2
1,1,1-Trichloroethane	26	6.2	28
1,1,1,2Tetrachloroethane	14	0.89	4.8
1,1,2,2-Tetrachloroethane	14	1.4	6.3
Carbon Tetrachloride	0.06	0.02	0.09
1,2-Dichloroethane	0.3	0.005	0.01
Vinyl Chloride	0.02	0.0005	0.001
1,2,4-Trimethylbenzene	0.08	0.74	4.2
1,3,5-Trimethylbenzene	0.05	0.46	2.6
Semi-Volatile Organic Compounds			
Acenaphthene	3.2	7.1	41
Acenaphthylene	4.2	0.52	3.0
Anthracene	0.02	1,300	6,500
Benzo(a)anthracene	0.004	5.2	8.9
Benzo(b)fluoranthene	0.002	9.3	10
Benzo(g,h,i)perylene	0.0003	2,300	2,300
Benzo(k)fluoranthene	0.0008	9.6	10
Chrysene	0.002	80	99
Dibenzo(a,h)anthracene	0.0006	0.93	1.0
Fluoranthene	0.23	13	49
Fluorene	1.9	85	490
Indeno(1,2,3-cd)pyrene	0.0002	9.1	10
Phenanthrene	0.53	790	2,100
Pyrene	0.13	130	470
Benzo(a)pyrene	0.004	0.95	1.0
Naphthalene	19	1.5	8.7
Phenol	-	440	2,000
Total Petroleum Hydrocarbons			
Aliphatic hydrocarbons EC_5-EC_6	10	25	80
Aliphatic hydrocarbons >EC_6-EC_8	5.4	51	240
Aliphatic hydrocarbons >EC_8-EC_{10}	0.23	11	63
Aliphatic hydrocarbons >EC_{10}-EC_{12}	0.03	50	300
Aliphatic hydrocarbons >EC_{12}-EC_{16}	0.0008	22	130
Aliphatic hydrocarbons >EC_{16}-EC_{21}	-	88,000	88,000
Aliphatic hydrocarbons >EC_{21}-EC_{35}	-	88,000	88,000
Aromatic hydrocarbons >EC_8-EC_9	65	130	700
Aromatic hydrocarbons >EC_9-EC_{10}	7.4	16	92
Aromatic hydrocarbons >EC_{10}-EC_{12}	25	58	300
Aromatic hydrocarbons >EC_{12}-EC_{16}	5.8	130	570
Aromatic hydrocarbons >EC_{16}-EC_{21}	-	88,000	88,000
Aromatic hydrocarbons >EC_{21}-EC_{35}	-	1,100	1,300

Notes:

-' Generic assessment criteria not calculated owing to low volatility of substance and therefore no pathway, or an absence of toxicological data.

EC - equivalent carbon. GrAC - groundwater assessment criteria. SAC - soil assessment criteria.

The SAC for organic compounds are dependent on Soil Organic Matter (SOM) (%) content. To obtain SOM from total organic carbon (TOC) (%) divide by 0.58. 1% SOM is 0.58% TOC. DL Rowell Soil Science: Methods and Applications, Longmans, 1994.

SAC for TPH fractions, polycyclic aromatic hydrocarbons, MTBE, BTEX and trimethylbenzene compounds were produced using an attenuation factor for the indoor air inhalation pathway of 10 to reduce conservatism associated with the vapour inhalation pathway, section 10.1.1, SR3.

SAC for aliphatic C10-C12 and C12-C16 is taken as soil saturation limit in acordance with CLEA. For consistency with CLEA, the GrAC for aliphatic and aromatic C12-C16 hydrocarbons and all PAH (acenaphthylene) has been set as the theoretical solubility limit.

▨	Calculated SAC exceeds soil saturation limit (SSL), thus SSL taken as SAC in line with recently published SGV. For consistency where the GrAC exceeds the solubility limit, GrAC has been set at the solubility limit. These are highly conservative since concentrations of the chemical are very unlikely to be at sufficient concentration to result in an exceedance of the health criteria value at the point of exposure (i.e. indoor air) provided free-phase product is absent.

APPENDIX H

Generic Assessment Criteria for Phytotoxic Effects, Pipelines and Controlled Waters

GENERIC ASSESSMENT CRITERIA FOR PHYTOTOXIC EFFECTS, PIPELINES AND CONTROLLED WATERS

This appendix presents the generic assessment criteria (GAC) that RSK considers are suitable for assessing risks to:

- Vegetation via the uptake of phytotoxic determinants through plant roots;
- Water supply pipes constructed using conventional pipe materials, i.e. polyethylene; and
- Controlled waters.

The GAC for each of these receptors is discussed in turn.

PHYTOTOXIC DETERMINANTS TO FACILITATE HEALTHY PLANT GROWTH

Copper and zinc can inhibit plant growth but are not normally hazardous to human health. The GAC for this pollutant linkage have been taken from Department of the Environment Publication, Code of Practice for Agricultural Use of Sewage Sludge, 1996. The GAC for the phytotoxic determinants are presented in Table A1. The table also includes nickel since this is also phytotoxic determinant and the Soil Guideline Value (SGV which is protective of human health) for a commercial (5000mg/kg) or residential without plant uptake (75mg/kg) is greater than the GAC to protect plant growth in acidic soil. Therefore, the SGV may not be suitably protective of the phytotoxic effects pathway.

Table A1: Generic Assessment Criteria for Phytotoxic Determinants

Determinant	Generic Assessment Criteria (mg/kg)			
	pH 5.0 < 5.5	pH 5.5 < 6.0	pH 6.0 < 7.0	pH >7.0
Zinc	200	200	200	300
Copper	80	100	135	200
Nickel	50	60	75	110

WATER SUPPLY PIPES

Risks to water supply pipes have been assessed in accordance with the Water Regulations Advisory Scheme Information and Guidance Note 9-04-03, dated October 2002 and the flow chart included as Figure A1 in this appendix.

The regulations include a requirement to use only suitable materials when laying water pipes and laying water pipes without protection is not permitted at contaminated sites. The water supplier has a statutory duty to enforce the regulations. Therefore, this assessment is a guide, the results of which should be checked with the water supplier.

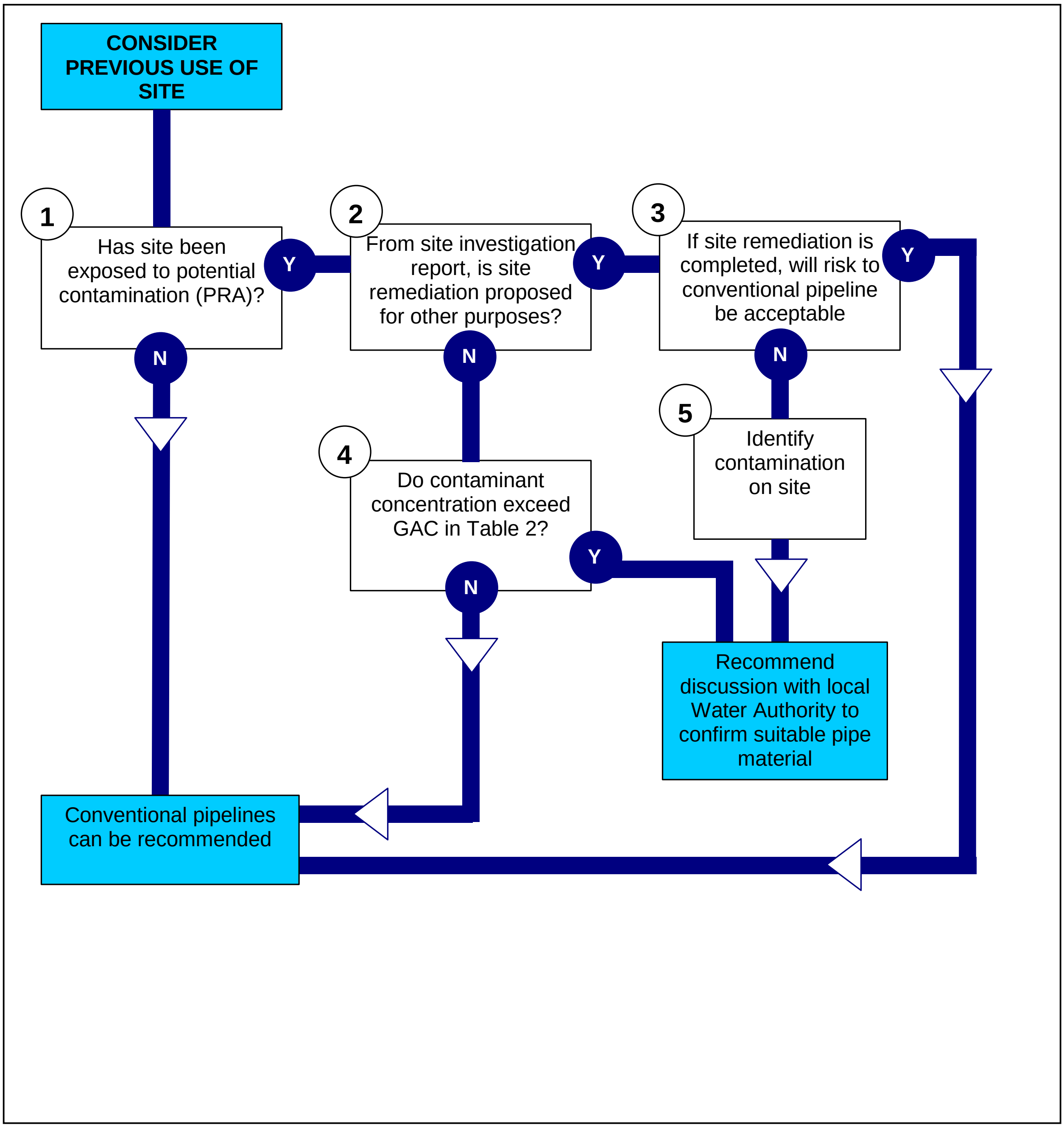
Since water supply pipes are typically laid at a minimum depth of 750mm below finished ground levels, sample results from depths between 0.5m and 1.5m below finished level are generally considered suitable for assessing risks to water supply. Samples outside these depths can be used providing the strata is the same as that in which water supply pipes are likely to be located. The GAC for this linkage are recorded in Table A2 and are based on recommendations of the 'Foundation for Water Research Guidance Note, FR0448: Laying Potable Water Pipelines in Contaminated Ground, 1994'. Owing to the number of caveats and lack of research into contaminants that could affect water supply, the water industry has undertaken research on a project entitled 'Pipe Materials Selection and Specification for use in Contaminated Land'. This document will be used to update the GAC for this pathway once available.

Table A2: Generic Assessment Criteria for Water Supply Pipes

CONTAMINANT	**GAC (mg/kg dried soil)**
Corrosion	
Sulphate (SO_4)	2000
Sulphur (S)	5000
Sulphide	250
pH	Less than pH5 Greater than pH8
Toxic Substances	
Antimony(Sb)	10
Arsenic (As)	10*
Cadmium(Cd)	3
Chromium (hexavalent) (Cr)	25
Chromium (total) (Cr)	600
Cyanide (free) (CN)	25*
Cyanide (complexed) (CN)	250*
Lead (Pb)	500
Mercury (Hg)	1
Selenium(Se)	3
Thiocyanate (SCN)	50
Organic Contaminants	
Coal Tar	50
Cyclohexane extractable	50
Phenol	5
Polycyclic Aromatic Hydrocarbons	50
Toluene extractable	50
Petroleum Hydrocarbons	50
Notes: * denotes 'it is not recommended that water pipes should be laid in sites where these substances are identified or suspected'.	

FIGURE A1

FLOW CHART FOR WATER SUPPLY PIPELINE ASSESSMENT ADOPTED FROM GUIDANCE NOTE 9-04-03



CONTROLLED WATERS

The GAC for controlled waters are presented in Table A3. In line with the Environment Agency's Remedial Targets Methodology dated December 2006, the GAC for controlled waters are termed 'target concentrations'.

The target concentration can be derived by several means with consideration to:

- Whether the substance is classified as List I or List II substance by the EU under the Groundwater Directive 80/68/EEC;
- Background concentrations in the aquifer; and
- Published guidance such as Environmental Quality Standards that are protective of ecology or The Water Supply (Water Quality) Regulations 2001 that are protective of drinking water.

A list of target concentrations considered suitable to assess risks to major aquifers and minor aquifers are presented in Table A3. Those for a major aquifer are taken from the UK Water Supply (Water Quality) Standards where possible owing to the possibility of a drinking water supply being within an influencing distance from the site or the possibility of one being installed. The target concentrations for a minor aquifer are generally taken as the freshwater Environmental Quality Standards where available owing to groundwater in minor aquifers commonly providing baseflow to surface watercourses.

Table A3: Target Concentrations for Controlled Waters

Determinant	Target Concentrations (mg/l)	
	Major Aquifer/Source Protection Zone	Minor Aquifer/Surface Watercourse
Metals		
Arsenic	0.01$^{(1)}$	0.05$^{(7)}$
Cadmium	0.005$^{(1)}$	0.005$^{(7)}$
Chromium (total)	0.05$^{(1)}$	0.005, 0.01, 0.02, 0.02, 0.05, 0.05$^{(8)}$
Copper	2.0$^{(1)}$	0.001, 0.006, 0.01, 0.01, 0.01 0.028$^{(8)}$
Lead	0.025$^{(1)}$	0.004, 0.01, 0.01, 0.02, 0.02, 0.02$^{(8)}$
Mercury	0.001$^{(1)}$	0.001$^{(7)}$
Selenium	0.01$^{(1)}$	0.01$^{(1,12)}$
Nickel	0.02$^{(1)}$	0.05, 0.1, 0.15, 0.15, 0.2, 0.2$^{(8)}$
Zinc	5$^{(2)}$	0.008, 0.05, 0.075, 0.075, 0.075, 0.125$^{(8)}$

Chlorinated Solvents		
Trichloroethene	0.01(1)	0.01(7)
Tetrachloroethene		0.01(7)
1,1,1-Trichloroethane	0.0001(3)	0.1(7)
1,1,2-Trichloroethane	0.0001(3)	0.4(7)
Carbon Tetrachloride	0.003(1)	0.012(7)
1,2-Dichloroethane	0.003(1)	0.01(7)
Vinyl Chloride	0.0005(1)	0.0005(1,12)
Trihalomethanes	0.1(4)	0.1(4,12)
Chloroform (one of the trihalomethanes included above)	-	0.012(7)
Polycyclic Aromatic Hydrocarbons		
Acenaphthene	0.0058(9,13)	0.0058(9)
Acenaphthylene	0.0058(9,13)	0.0058(9)
Anthracene	0.000012(9,13)	0.000012(9)
Benzo(a)anthracene	0.000018(9,13)	0.000018(9)
Benzo(b)fluoranthene	0.0001(1)	0.000014(9)
Benzo(k)fluoranthene		0.000014(9)
Benzo(g,h,i)perylene		0.00002(9)
Indeno(1,2,3-cd)pyrene		No data(9)
Chrysene	0.00001(9,13)	0.00001(9)
Dibenzo(a,h)anthracene	0.00001(9,13)	0.00001(9)
Fluoranthene	0.00001(9,13)	0.00001(9)
Fluorene	0.0021(9,13)	0.0021(9)
Phenanthrene	0.003(9,13)	0.003(9)
Pyrene	0.00004(9,13)	0.00004(9)
Benzo(a)pyrene	0.00001(1)	0.000015(9)
Naphthalene	0.01(9,13)	0.01(7)
Petroleum Hydrocarbons		
Total Petroleum Hydrocarbons	0.01(2)	0.01(2,10)
Benzene	0.001(1)	0.03(7)
Toluene	0.004(3)	0.05(7)
Ethylbenzene	0.02(8,13)	0.02(8)
Xylene	0.003(3)	0.03(7)
Methyl t-Butyl ether	0.015(6)	0.015(6,12)
Pesticides and Herbicides		
Aldrin	0.00003(1)	0.00001(7)
Dieldrin	0.00003(1)	0.00003(1,12)
Heptachlor	0.00003(1)	0.00003(1,12)
Heptachlor epoxide	0.00003(1)	0.00003(1,12)
Other pesticides	0.0001(1)	0.0001(1,12)
Total pesticides	0.0005(1)	0.0005(1,12)

Endrin	0.000005(7,13)	0.000005(7)
Total DDT	0.000025(7,13)	0.000025(7)
Azinphos - methyl	0.00001(7,13)	0.00001(7)
Cyfluthrin	0.000001(7,13)	0.000001(7)
Demeton	0.0005(7,13)	0.0005(7)
Dichlorvos	0.000001(7,13)	0.000001(7)
Dimethoate	0.001(7,13)	0.001(7)
Endosulphan	0.000003(7,13)	0.000003(7)
Fenitrothion	0.000001(7,13)	0.000001(7)
Flucofuron	0.001(7,13)	0.001(7)
Malathion	0.00001(7,13)	0.00001(7)
Mevinphos	0.00002(7,13)	0.00002(7)
Omethoate	0.00001(7,13)	0.00001(7)
PCSDs	0.00005(7,13)	0.00005(7)
Permethrin	0.00001(7,13)	0.00001(7)
Sulcofuron	0.025(7,13)	0.025(7)
Triazaphos	0.000005(7,13)	0.000005(7)
Atrazine & Simazine	0.002(7,13)	0.002(7)
Bentazone	0.5(7,13)	0.5(7)
Linuron	0.002(7,13)	0.002(7)
Mecoprop	0.02(7,13)	0.02(7)
Trifluralin	0.0001(7,13)	0.0001(7)
Miscellaneous		
Cyanide	0.05(1)	0.05(1,12)
Phenol	0.0005(2)	0.03(7)
Sodium	200(1)	170(7)
Chloride	250(1)	250(7)
Ammonium (as NH_{4+})	0.5(1)	0.5(1,12)
Ammonia (NH_3 as N)	0.015(7,13)	0.015(7)
Sulphate	250(1)	400(7)
Iron	0.20(1)	1(7)
Manganese	0.05(1)	0.05(1,12)
Aluminium	0.2(1)	0.2(1,12)
Nitrate (as NO_3)	50(1)	50(1,12)
Nitrite (as NO_2)	0.5(1)	0.5(1,12)

Notes

1. Statutory Instrument 2000 No 3184. The Water Supply (Water Quality) Regulations.
2. Statutory Instrument 1989 No 1147. The Water Supply (Water Quality) Regulations, 1989.
3. Environment Agency. Minimum Reporting Values listed in Appendix 7 of Hydrogeological Risk Assessments for Landfills and the Derivation of Groundwater Control and Trigger Levels. LFTGN01. Note target concentration for xylenes is 0.003mg/l each for o-xylene and m/p xylene.
4. Statutory Instrument 1989 No 3184. The Water Supply (Water Quality) Regulations, 2000 – sum of chloroform, bromoform, dibromochloromethane and bromodichloromethane.
5. Target concentration for Major Aquifer receptor taken as equal to target concentration for Minor Aquifer owing to absence of published guidance for PAH compounds other than those which are carcinogenic.
6. Environment Agency MTBE Guidance.
7. Freshwater Environmental Quality Standards.
8. Freshwater Environmental Quality Standards for all fish life (including game) and dependent upon hardness range. Hardness ranges are: 0-50mg/l $CaCO_3$, 50-100 mg/l $CaCO_3$, 100-150 mg/l $CaCO_3$, 150-200 mg/l $CaCO_3$, 200-250 mg/l $CaCO_3$ and >250 mg/l $CaCO_3$. The target concentrations included in Table 3 are listed in order of increasing calcium carbonate concentrations.
9. Polycyclic Aromatic Hydrocarbons (PAH): Priorities for Environmental Quality Standard Development, WRc Plc, R&D Technical Report P45. 2002. Where Predicted No-Effect Concentration is below the laboratory method detection limit (LMDL) for chrysene, dibenzo(ah)anthracene and fluoranthene, the target concentration has been set at the LMDL of 0.00001mg/l.
10. Owing to hydrocarbons being List I substances, 0.01mg/l (DWS) should be used in the first instance against the total of the hydrocarbon bands. However, if the hydrocarbon concentrations measured in groundwater exceed this value, an alternative value of 0.05mg/l could be used providing it is justified based on the type of aquifer and distance to secondary receptors such as a stream. The value is taken as the lowest concentration in Statutory Instrument 1996 No. 3001 titled The Surface Waters (Abstraction for Drinking Water) (Classification) Regulations, 1996.
11. Value for ethylbenzene taken from R&D Technical Report P2-115/TR4 – Proposed Environmental Quality Standards for Ethylbenzene in Water.
12. Where a published target concentration considered suitable for use with a minor aquifer could not be found for certain substances such as selenium, the target concentration used for the major aquifer has been adopted.
13. Where a published target concentration considered suitable for use with a major aquifer could not be found for certain substances such as ethylbenzene, the target concentration used for the minor aquifer has been adopted.

‘-’ A target concentration for chloroform for a major aquifer is absent since it is one of the trihalomethane compounds. See note 4 above.

APPENDIX I

HAZWASTE Assessment Results

As cmpds (AsS), Cd (CdO), CrVI cmpds ($FeCrO_4$), Cu (Cu_2O), Inorg Hg cmpds (HgO), Pb cmpds ($PbSO_4$), Ni ($NiCO_3$), Se cmpds (SeS) and Zn as ZnO. Also Ba ($BaCO_3$), Be cmpds ($BeSO_4$), Co (CoO), Mn (MnO_2) and Mo (MoO_3)

HASWASTE. Envirolab's Contaminated Land Soil Hazardous Waste Assessment Tool.

Envirolab, Units 7&8 Sandpits Business Park, Mottram Road, Hyde, Cheshire SK14 3AR.
Dr Iain Haslock. BSc, PhD, CChem, MRSC.

Site Code and Name

P/WS/BH epth (m) nvirolab reference		PH1 0.30	PH1 0.70	PH2 0.40	PH3 0.50	PH6 0.30	PH7 0.30								
		mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
Arsenic		12	10	7	14	11	22								
hromium		0.1	0.1	0.1	0.1	0.1	0.1								
opper		32	22	18	55	43	49								
ead		74	24	16	201	215	367								
Nickel		45	47	36	33	50	31								
Zinc		100	82	65	118	193	194								
admium		0.5	0.5	0.5	0.5	0.5	0.5								
ercury		0.47	0.25	0.25	4.20	0.36	0.64								
elenium		2	2	2	2	2	2								
arium															
Beryllium															
Cobalt															
anganese															
olybdenum															
otal USEPA 16 PAHs															
Naphthalene		0.04	0.02	0.02	0.04	<0.01	0.07								
Acenaphthylene		0.07	0.01	0.01	0.01	0.01	0.02								
Acenaphthene		0.13	0.04	0.01	0.11	0.01	0.08								
luorene		0.02	0.01	0.01	0.01	0.01	0.01								
henanthrene		2.50	0.05	0.01	1.80	0.01	0.34								
nthracene		1.67	0.14	0.01	1.19	0.01	0.25								
Fluoranthene		9.08	0.14	0.02	4.20	0.01	1.57								
Pyrene		8.04	0.37	0.02	3.87	0.01	1.28								
enzo(a)anthracene		0.93	0.01	0.02	0.22	0.01	0.03								
hrysene		4.16	0.12	0.05	1.80	0.01	0.73								
enzo(b)fluoranthene		1.04	0.05	0.02	0.26	0.01	0.09								
enzo(k)fluoranthene		1.31	0.07	0.02	0.57	0.01	0.34								
Benzo(a)pyrene		2.13	0.04	0.04	0.92	0.01	0.34								
Indeno(123cd)pyrene		0.53	0.08	0.07	0.06	0.01	0.12								
ibenzo(ah)anthracene		0.06	0.01	0.06	0.06	0.01	0.16								
enzo(ghi)perylene		1.47	0.05	0.04	0.40	0.01	0.43								
enzo(j)fluoranthene															
Benzene		0.01	0.01	0.01	0.01	0.01	0.01								
Toluene		0.01	0.01	0.01	0.01	0.01	0.01								
Ethylbenzene		0.01	0.01	0.01	0.01	0.01	0.01								
ylenes		0.01	0.01	0.01	0.01	0.01	0.01								
rimethylbenzenes		0.01	0.01	0.01	0.01	0.01	0.01								
hlorobenzene															
1,2-Dichlorobenzene															
1,3-Dichlorobenzene															
1,4-Dichlorobenzene															
,2,4-Trichlorobenzene															
-Chlorotoluene															
-Chlorotoluene															
Oil in Waste Carcinogenic H7															
Total TPH	≥1,000mg/kg														
etrol or (C6-C10)	≥1,000mg/kg														
iesel or (C10-C25)	≥10,000mg/kg														
ube Oil or (C25+)	≥1,000mg/kg														
8 IARC H7 Carcinogenic PAHs marker test (applicable to LRD only)	≥1%	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!
Kerosene															
erosene															
reosote															
reosote															
pH Corrosive H8 (Irritant H4)															
pH (soil)	≤2 H8 ≥11.5	7.9	8.1	8.8	8.1	7.6	8.3								
H (leachate)	≤2 H8 ≥11.5														
lkali Reserve (gNaOH/100g)															
H4 Alkali Reserve test	≥13	7.9	8.1	8.8	8.1	7.6	8.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
H8 Alkali Reserve test	≥14.5	7.9	8.1	8.8	8.1	7.6	8.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Produces Toxic Gases H12															
Total Sulphide	≥1,400mg/kg														
ree Cyanide	≥1,200mg/kg														
CBs Total															
henols Total															
Phenol															
Cresols															
ylenols															
-Naphthol															
esourcinol															
Asbestos Screen (enter Y or N)	H7≥0.1%; H5≥3%; H6≥25%														
azard Codes	Thresholds	%	%	%	%	%	%	%	%	%	%	%	%	%	%
rritant H4	≥10%	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Irritant H4	≥20%	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Harmful H5	≥25%	0.024	0.015	0.012	0.042	#VALUE!	0.065	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
oxic H6 (Harmful H5)	≥0.1%H5<7%; H6≥7%	0.000	0.000	0.000	0.001	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
oxic H6 (Harmful H5)	≥3%H5<25%; H6≥25%	0.002	0.002	0.001	0.002	0.002	0.003	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Carcinogenic H7	≥0.1%	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Carcinogenic H7	≥1%	0.009	0.009	0.007	0.007	0.010	0.006	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
orrosive H8 (Irritant H4)	≥5%H4<10%; H8≥10%	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
oxic for Reproduction H10	≥0.5%	0.011	0.004	0.002	0.029	0.031	0.054	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
oxic for Reproduction H10	≥5%	0.011	0.004	0.002	0.029	0.031	0.054	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Mutagenic H11	≥0.1%	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Mutagenic H11	≥1%	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Ecotoxic H14	≥1.0	0.141	0.104	0.081	0.202	#VALUE!	0.302	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000

Consider other individual contaminants on a case by case basis.

Table 3.2 of Annex VI of the CLP Regulation.

APPENDIX J

Geotechnical Testing Results Certificates

UKAS
TESTING
No 2652

STRUCTURAL
SOILS LTD

SITE INVESTIGATION

SOIL, ROCK &
MATERIAL TESTING

GEOTECHNICAL
CONSULTANCY

CONTAMINATED
LAND ASSESSMENT

Nava
RSK STATS Geoconsult Limited
18 Frogmore Road
Hemel Hempstead
Hertfordshire
HP3 9RT

25th November 2009

TESTING REPORT

YOUR REF: 23283

SITE: GONDAR GARDENS, LONDON

CERTIFICATE NUMBER: 580876

DATE SAMPLES RECEIVED: 18th November 2009
DATE TESTING COMMENCED: 18th November 2009

DATE OF SAMPLE DISPOSAL: 25th December 2009

<u>INSTRUCTIONS: Please carry out Moisture Content, Atterberg Limit, Quick Un-drained Triaxial and Oedometer tests on the samples provided.</u>

Dear Nava,

I have pleasure in enclosing the test report for the above project that you submitted to us for testing.

Yours sincerely

Paul Kent
Laboratory Manager

Enc.

18 FROGMORE ROAD
HEMEL HEMPSTEAD
HERTS
HP3 9RT
TEL: 01442 416660
FAX: 01442 437550
hemel@soils.co.uk
www.soils.co.uk

HEAD OFFICE:
Bristol

BRANCH OFFICE:
Castleford
West Yorkshire

art of the **RSK** Group plc

Registered No: 828694 England
Registered Office: 21/22 Park Way, Newbury, Berkshire, RG14 1EE

2652

Date: 25/11/2009
Drawn by: SC
Template issue: 4
Filename: 580876 / 01_SD.XLS

Borehole	Depth (m)	Moisture Content (%)	Sample Description
BH1 / 1	1.30-1.60	29	Bright brown mottled brown sandy CLAY becoming less sandy with depth.
BH1 / 2	4.50-4.80	32	Brown CLAY with occasional gypsum.
BH1 / 3	7.50-7.90	31	Brown CLAY with occasional gypsum.
BH1 / 4	10.50-10.80	25	Very dark brown CLAY with occasional pockets of black silt and gypsum.
BH1 / 5	13.50-13.90	28	Very dark brown CLAY.
BH1 / 6	16.50-16.80	27	Very dark grey CLAY.
BH1 / 7	19.50-19.90	27	Very dark grey CLAY.
BH1 / 4	1.60	33	Brown CLAY with pockets of yellowish brown silty fine sand and some gypsum.
PH1 / 5	2.90-3.00	20	Brown mottled grey CLAY with occasional pockets of silty fine sand.
PH2 / 3	2.00	24	Brown CLAY with some small pockets of silty fine sand and traces of gypsum.

Moisture contents tested in accordance with BS 1377: Part 2: 1990: Clause 3

Key to Gravel Sizes:			
	fine	-	2 to 6mm
	medium	-	6 to 20mm
	coarse	-	20 to 60mm

SUMMARY OF SAMPLE DESCRIPTIONS AND MOISTURE CONTENT

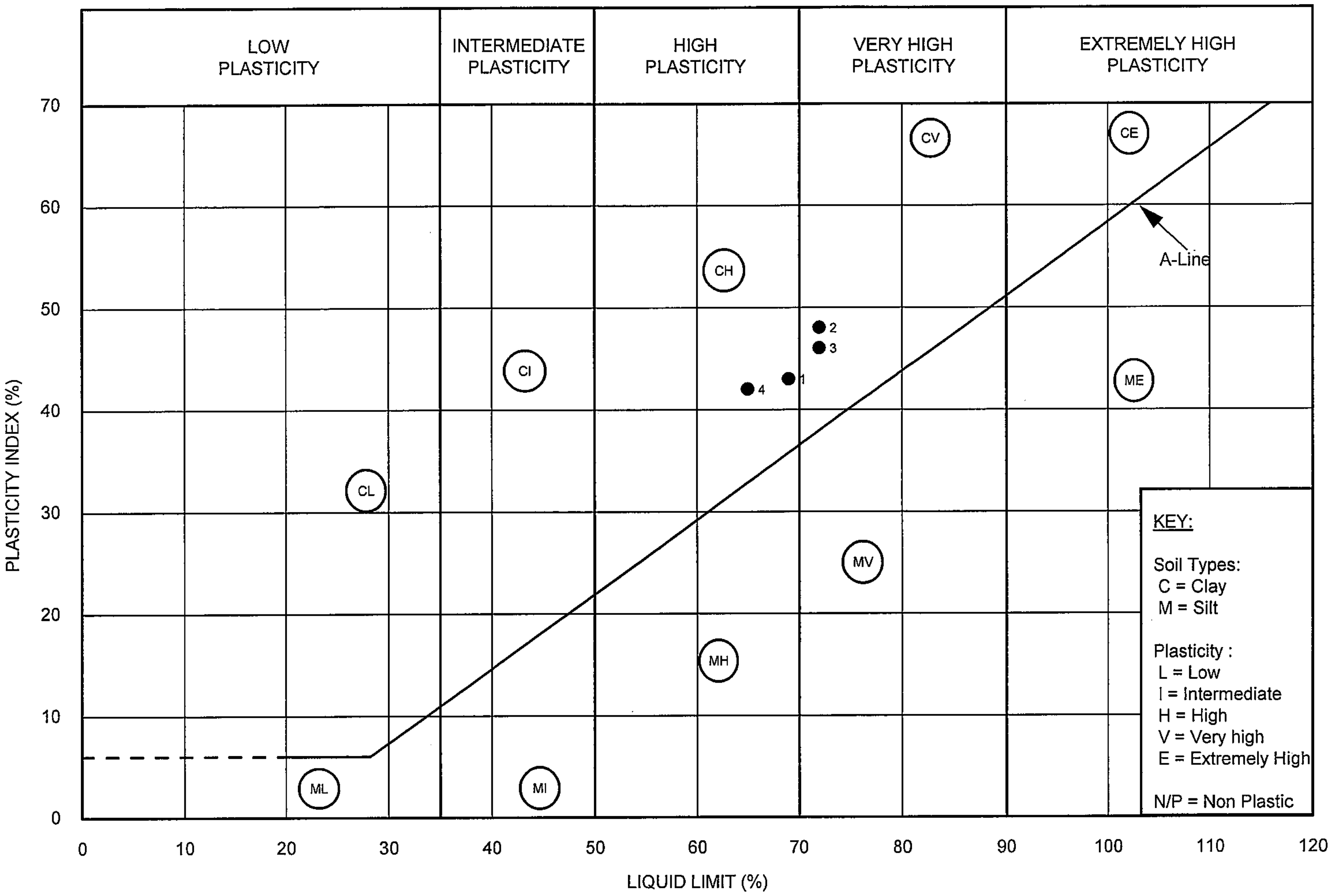
Borehole	Depth (m)	Moisture Content (%)	Sample Description
PH7 / 3	2.40	25	Brown mottled grey CLAY with occasional pockets of silty fine sand.

Moisture contents tested in accordance with BS 1377: Part 2: 1990: Clause 3

Key to Gravel Sizes:	fine	-	2 to 6mm
	medium	-	6 to 20mm
	coarse	-	20 to 60mm

SUMMARY OF SAMPLE DESCRIPTIONS AND MOISTURE CONTENT

UKAS
TESTING
2652



Plot Number	Borehole	Sample	Depth (m)	BS Test Method*	Preparation Method †	% Passing 425 micron Sieve	Liquid Limit (%)	Plastic Limit (%)	Plasticity Index (%)
1	BH1	4	1.60	4.4/5.3/5.4	4.2.3	100	69	26	43
2	PH1	5	2.90-3.00	4.4/5.3/5.4	4.2.3	100	72	24	48
3	PH2	3	2.00	4.4/5.3/5.4	4.2.3	100	72	26	46
4	PH7	3	2.40	4.4/5.3/5.4	4.2.3	100	65	23	42

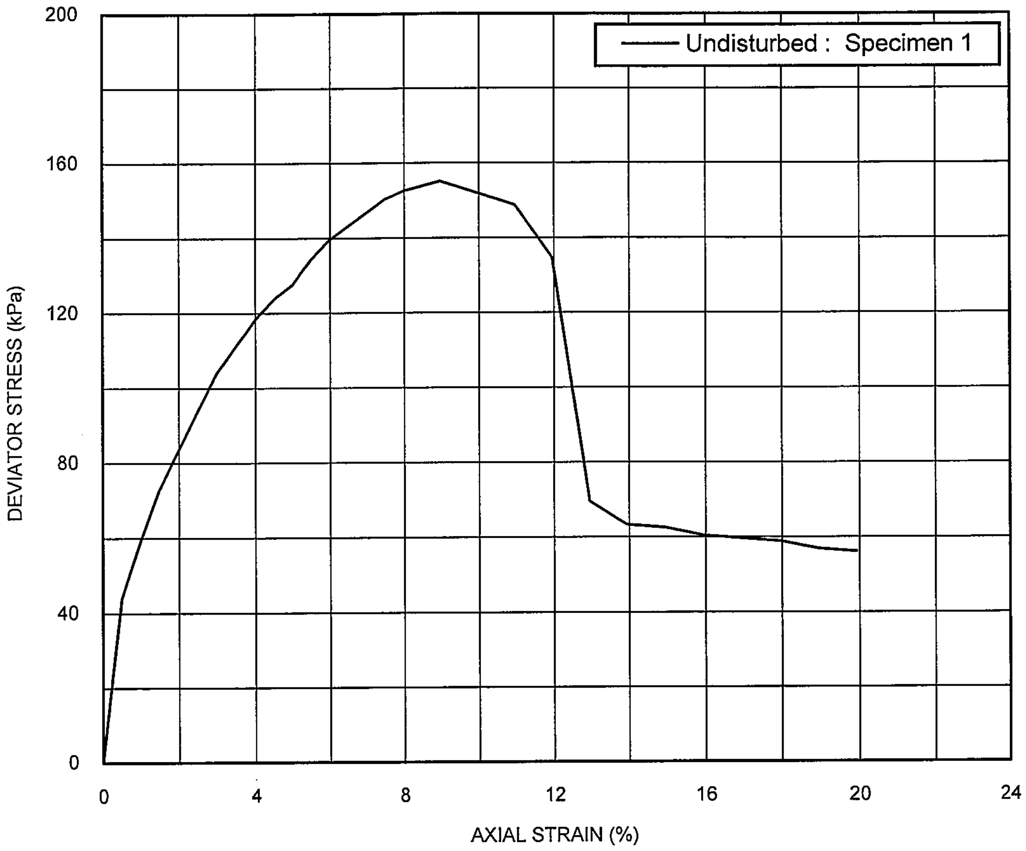
*Tested in accordance with the following clauses of BS 1377:Part 2:1990:
4.3 - Cone Penetrometer Method
4.4 - One point Cone Penetrometer Method
4.5 - Casagrande Method
4.6 - One point Casagrande Method
5.3 - Plastic Limit Method
5.4 - Plasticity Index

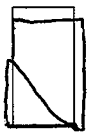
†Tested in accordance with the following clauses of BS 1377:Part 2:1990:
4.2.3 - Natural Soil
4.2.4 - Sieved Specimen

ATTERBERG LIMITS TEST RESULTS

RSK STATS GEOCONSULT LIMITED
GONDAR GARDENS, LONDON 23283

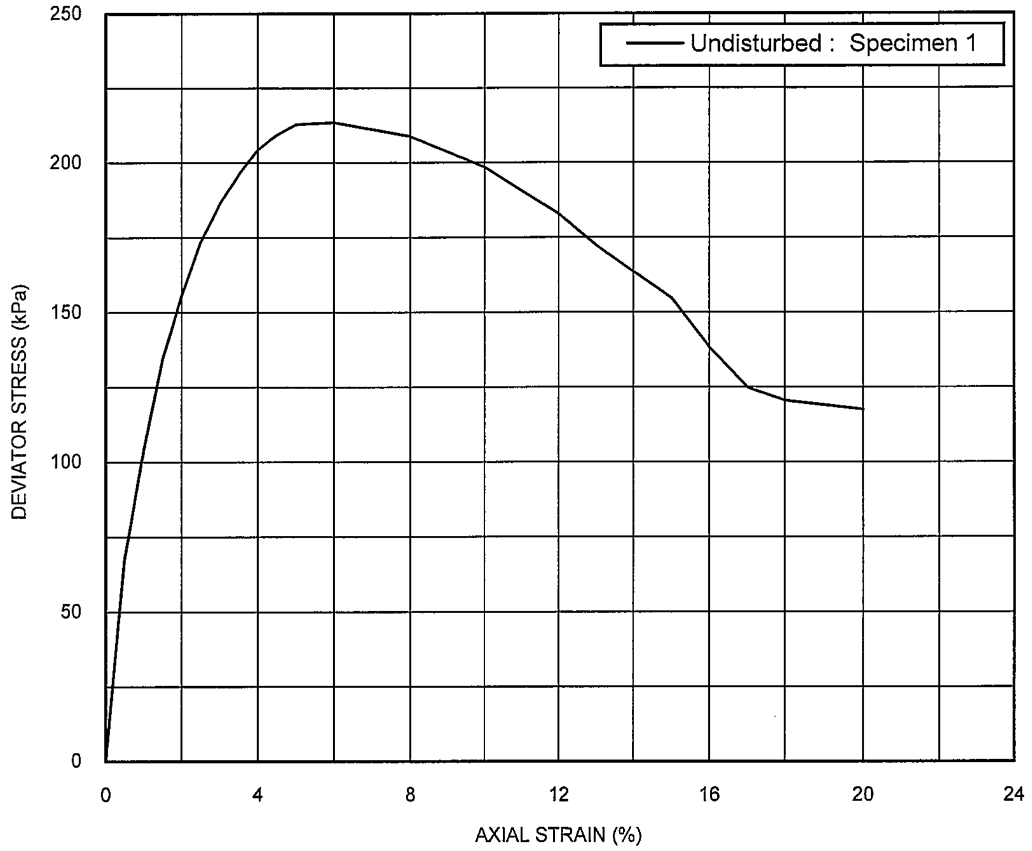
UKAS TESTING
2652

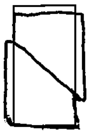


Initial Conditions	Units	Specimen 1
Sample length	mm	202.8
Sample diameter	mm	102.7
Membrane thickness	mm	0.24
Rate of strain	%/min	2.0
Bulk density	Mg/m^3	1.98
Dry density	Mg/m^3	1.56
Moisture content	%	27
Failure Conditions		
Cell pressure	kPa	26
Membrane correction	kPa	0.5
Corrected deviator stress	kPa	155
Strain at failure	%	9.0
Undrained shear strength	kPa	78
Sample Details		Failure shape
Borehole	: BH1	
Sample	: 1	
Depth (m)	: 1.30	

Tested in accordance with BS 1377: Part 7: 1990: Clause 8

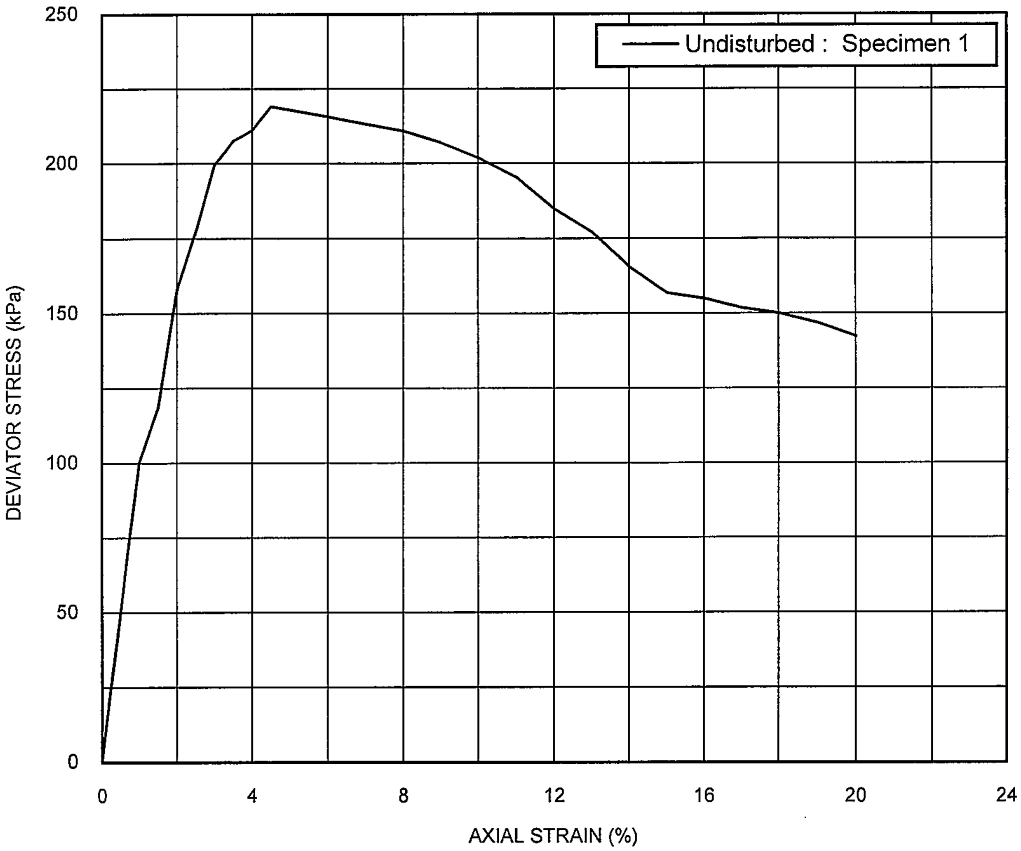
UNCONSOLIDATED UNDRAINED TRIAXIAL COMPRESSION TEST

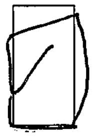


Initial Conditions	Units	Specimen 1
Sample length	mm	210.0
Sample diameter	mm	102.4
Membrane thickness	mm	0.24
Rate of strain	%/min	2.0
Bulk density	Mg/m^3	1.96
Dry density	Mg/m^3	1.49
Moisture content	%	31
Failure Conditions		
Cell pressure	kPa	90
Membrane correction	kPa	0.4
Corrected deviator stress	kPa	214
Strain at failure	%	6.0
Undrained shear strength	kPa	107
Sample Details Borehole Sample Depth (m)	: BH1 : 2 : 4.50	Failure shape 

Tested in accordance with BS 1377: Part 7: 1990: Clause 8

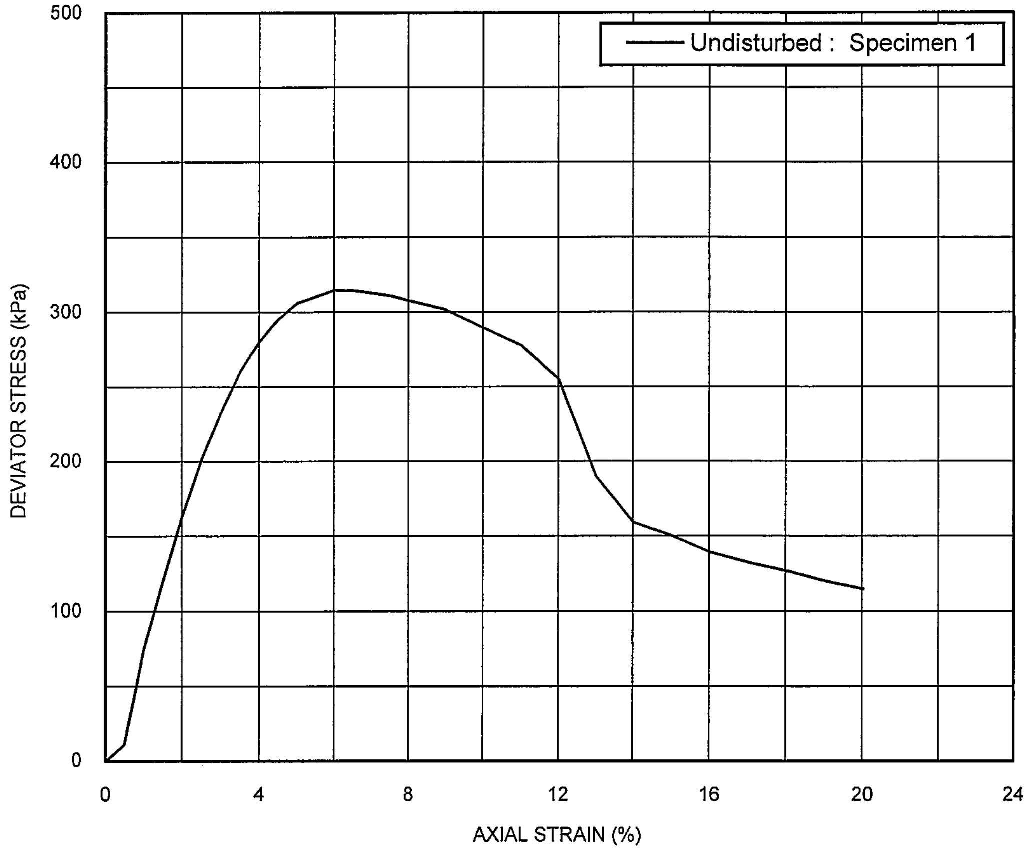
UNCONSOLIDATED UNDRAINED
TRIAXIAL COMPRESSION TEST

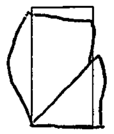


<u>Initial Conditions</u>	<u>Units</u>	<u>Specimen 1</u>
Sample length	mm	209.8
Sample diameter	mm	102.7
Membrane thickness	mm	0.24
Rate of strain	%/min	2.0
Bulk density	Mg/m^3	1.95
Dry density	Mg/m^3	1.48
Moisture content	%	32
<u>Failure Conditions</u>		
Cell pressure	kPa	150
Membrane correction	kPa	0.3
Corrected deviator stress	kPa	219
Strain at failure	%	4.5
Undrained shear strength	kPa	110
<u>Sample Details</u>		<u>Failure shape</u> 
Borehole	: BH1	
Sample	: 3	
Depth (m)	: 7.50	

Tested in accordance with BS 1377: Part 7: 1990: Clause 8

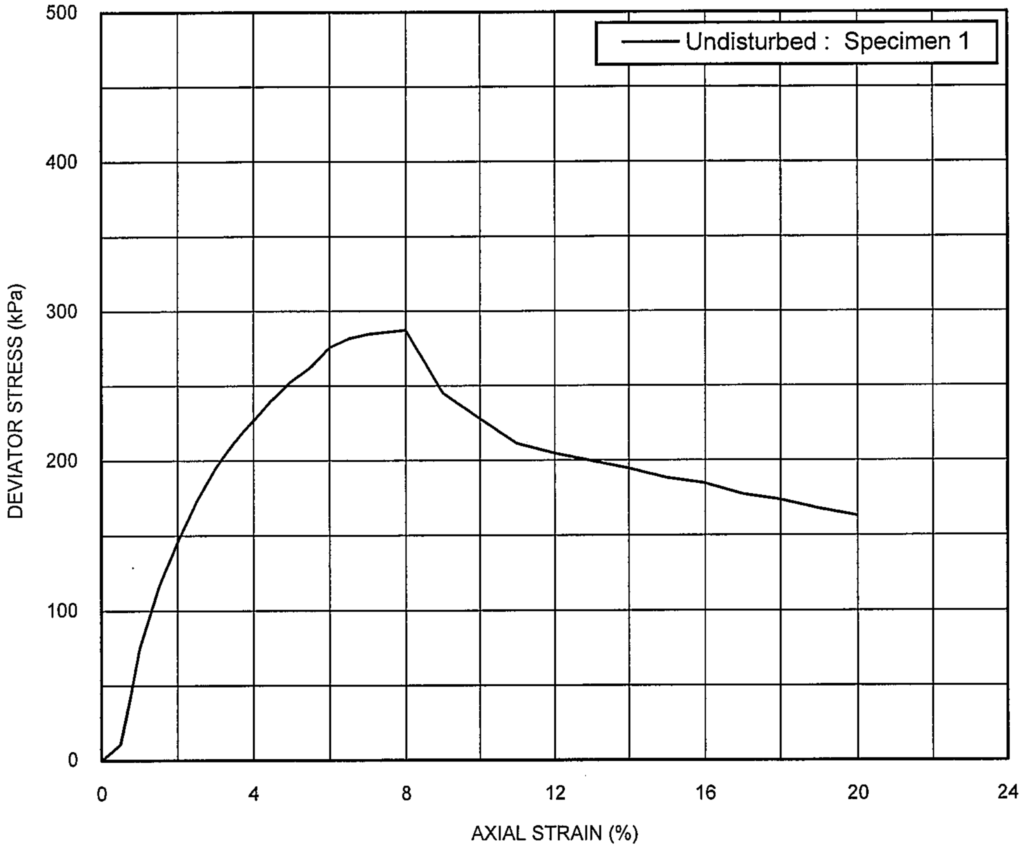
UNCONSOLIDATED UNDRAINED TRIAXIAL COMPRESSION TEST

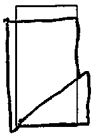


Initial Conditions	Units	Specimen 1
Sample length	mm	209.6
Sample diameter	mm	102.5
Membrane thickness	mm	0.24
Rate of strain	%/min	2.0
Bulk density	Mg/m^3	2.01
Dry density	Mg/m^3	1.59
Moisture content	%	26
Failure Conditions		
Cell pressure	kPa	210
Membrane correction	kPa	0.4
Corrected deviator stress	kPa	314
Strain at failure	%	6.0
Undrained shear strength	kPa	157
Sample Details Borehole Sample Depth (m)	 : BH1 : 4 : 10.50	Failure shape 

Tested in accordance with BS 1377: Part 7: 1990: Clause 8

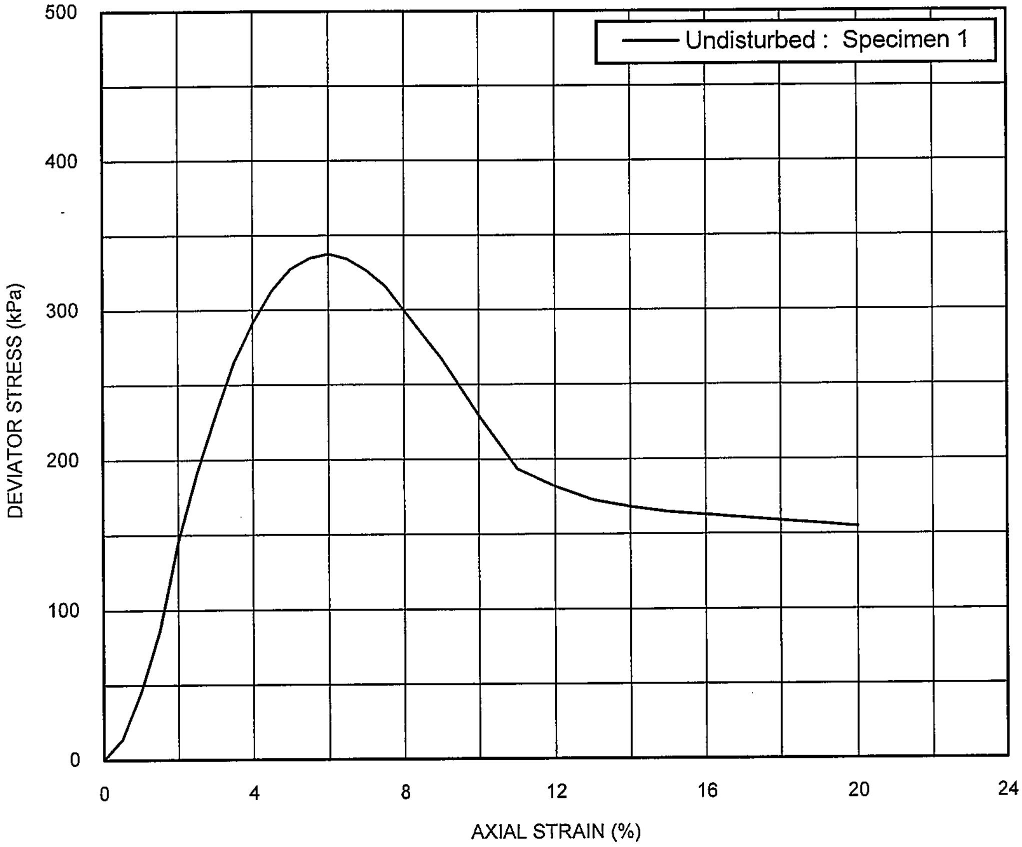
UNCONSOLIDATED UNDRAINED TRIAXIAL COMPRESSION TEST

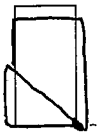


Initial Conditions	Units	Specimen 1
Sample length	mm	210.2
Sample diameter	mm	102.6
Membrane thickness	mm	0.24
Rate of strain	%/min	2.0
Bulk density	Mg/m^3	1.98
Dry density	Mg/m^3	1.55
Moisture content	%	28
Failure Conditions		
Cell pressure	kPa	270
Membrane correction	kPa	0.5
Corrected deviator stress	kPa	287
Strain at failure	%	8.0
Undrained shear strength	kPa	144
Sample Details		Failure shape 
Borehole	: BH1	
Sample	: 5	
Depth (m)	: 13.50	

Tested in accordance with BS 1377: Part 7: 1990: Clause 8

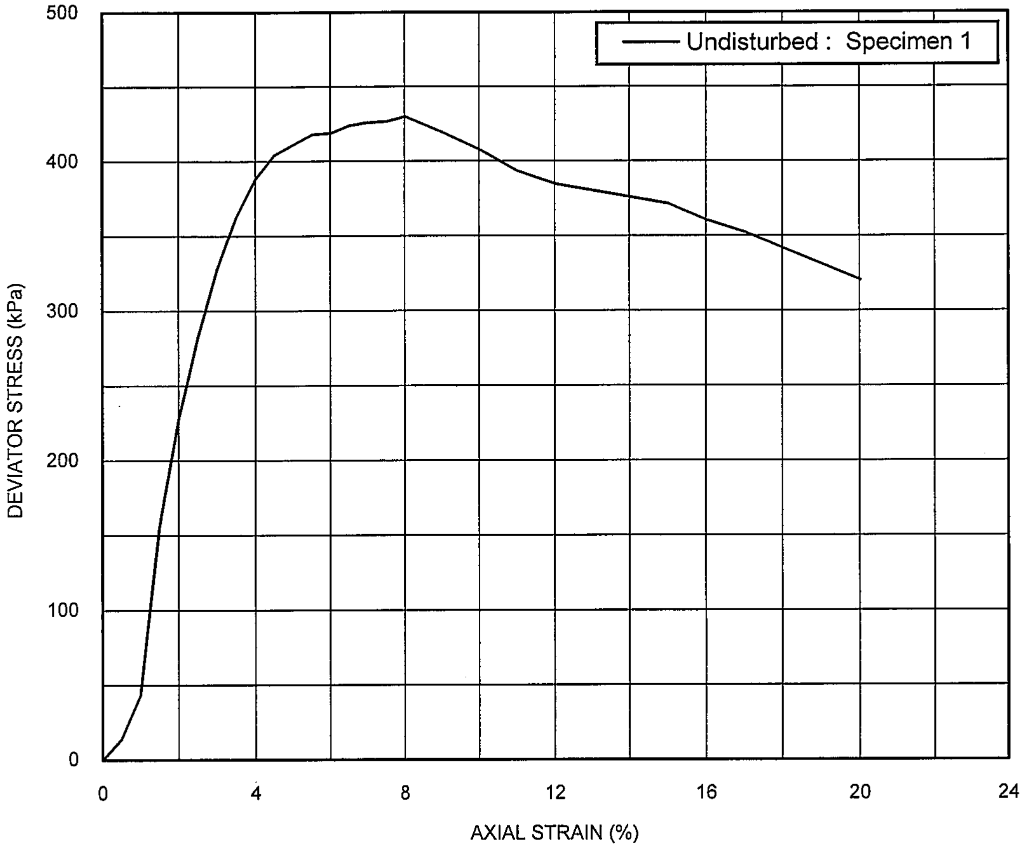
UNCONSOLIDATED UNDRAINED TRIAXIAL COMPRESSION TEST

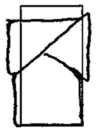


Initial Conditions	Units	Specimen 1
Sample length	mm	209.9
Sample diameter	mm	102.7
Membrane thickness	mm	0.24
Rate of strain	%/min	2.0
Bulk density	Mg/m^3	1.98
Dry density	Mg/m^3	1.56
Moisture content	%	27
Failure Conditions		
Cell pressure	kPa	330
Membrane correction	kPa	0.4
Corrected deviator stress	kPa	337
Strain at failure	%	6.0
Undrained shear strength	kPa	169
Sample Details		**Failure shape**
Borehole	: BH1	
Sample	: 6	
Depth (m)	: 16.50	

Tested in accordance with BS 1377: Part 7: 1990: Clause 8

UNCONSOLIDATED UNDRAINED TRIAXIAL COMPRESSION TEST



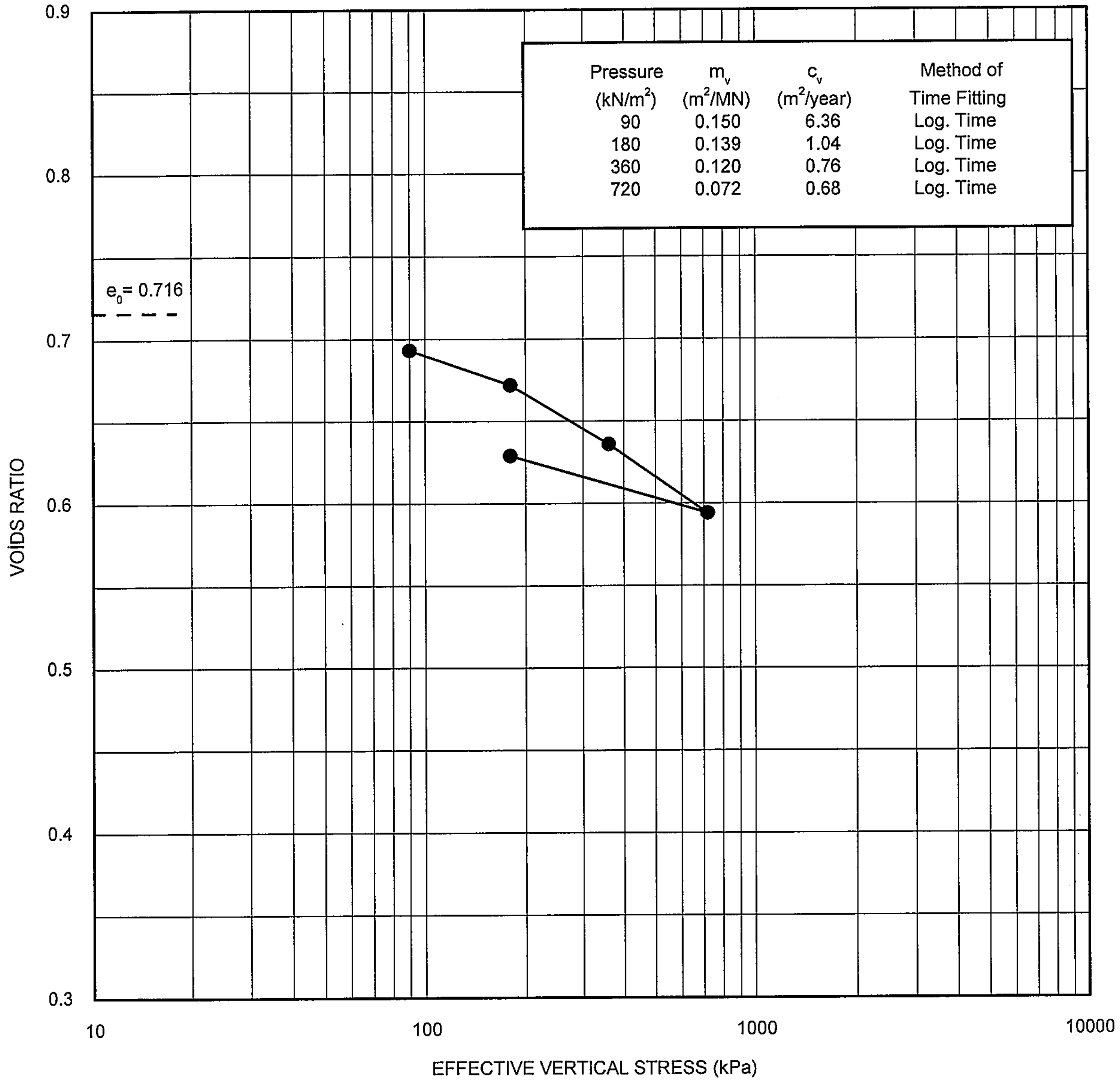
Initial Conditions	Units	Specimen 1
Sample length	mm	209.7
Sample diameter	mm	102.9
Membrane thickness	mm	0.24
Rate of strain	%/min	2.0
Bulk density	Mg/m^3	2.01
Dry density	Mg/m^3	1.58
Moisture content	%	27
Failure Conditions		
Cell pressure	kPa	390
Membrane correction	kPa	0.5
Corrected deviator stress	kPa	430
Strain at failure	%	8.0
Undrained shear strength	kPa	215
Sample Details		Failure shape
Borehole	: BH1	
Sample	: 7	
Depth (m)	: 19.50	

Tested in accordance with BS 1377: Part 7: 1990: Clause 8

UNCONSOLIDATED UNDRAINED
TRIAXIAL COMPRESSION TEST

Te___ Issue___ wn by___ Date: ___2009

Filename: 580876 \ COMPRESS \ BH1_U2_OD.OPJ



Pressure (kN/m^2)	m_v (m^2/MN)	c_v (m^2/year)	Method of Time Fitting
90	0.150	6.36	Log. Time
180	0.139	1.04	Log. Time
360	0.120	0.76	Log. Time
720	0.072	0.68	Log. Time

Initial Conditions

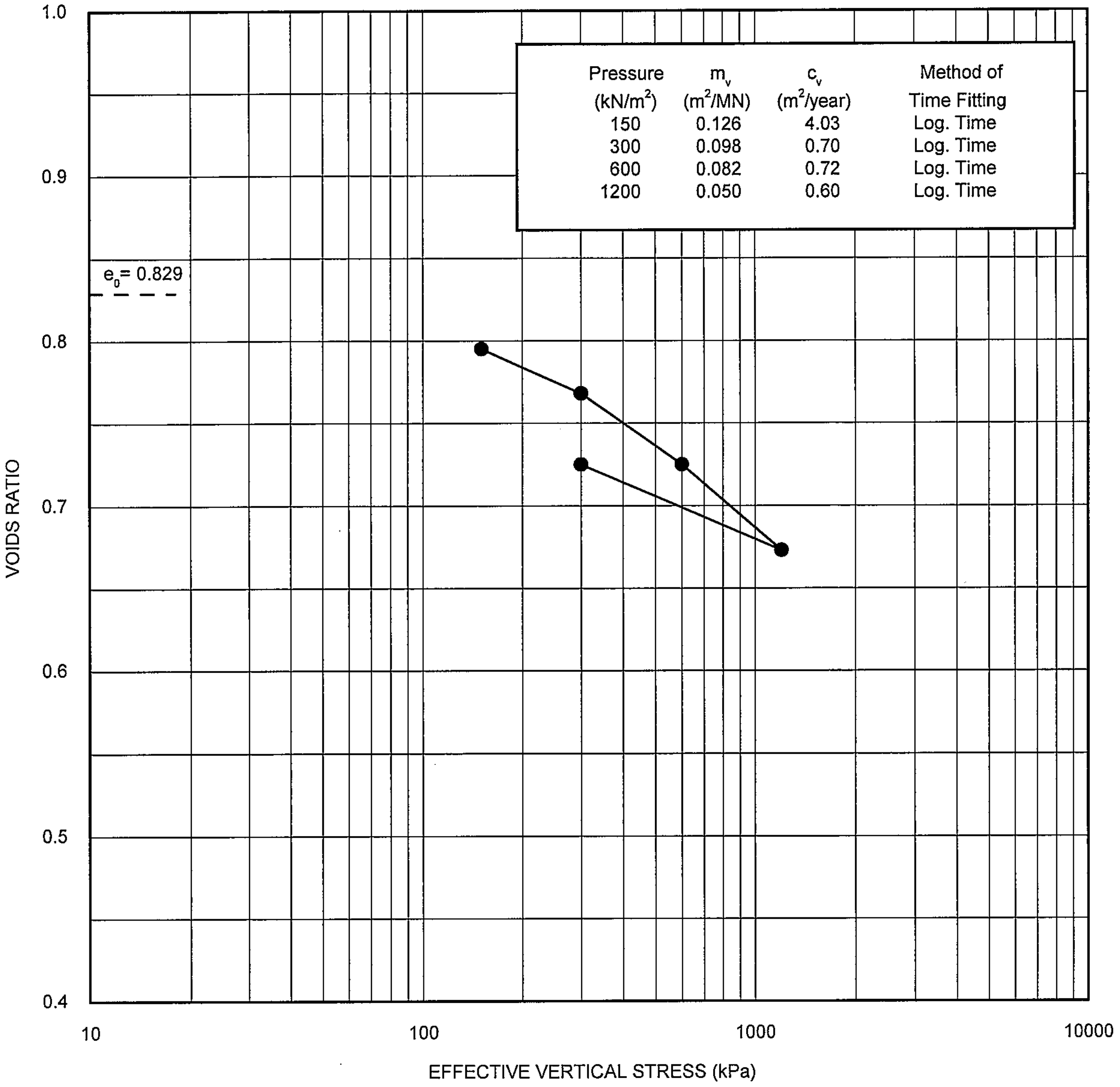
Specimen height : 20.0 mm
Specimen diameter : 75.0 mm
Degree of saturation : 100 %
Particle density : 2.70 Mg/m^3 (Assumed)
Specimen condition : Undisturbed

Bulk density : 2.00 Mg/m^3
Dry density : 1.57 Mg/m^3
Moisture content : 27 %
Lab. temperature : 21 °C
Swelling pressure : NA kPa

Borehole : BH1
Sample : U2
Depth (m): 4.50-4.80
Specimen Depth (m): 4.70

Tested in accordance with BS1377: Part 5: 1990: Clause 3

ONE - DIMENSIONAL
CONSOLIDATION TEST (OEDOMETER)



Pressure (kN/m^2)	m_v (m^2/MN)	c_v (m^2/year)	Method of Time Fitting
150	0.126	4.03	Log. Time
300	0.098	0.70	Log. Time
600	0.082	0.72	Log. Time
1200	0.050	0.60	Log. Time

Initial Conditions

Specimen height	: 19.0 mm	Bulk density	: 1.93 Mg/m^3
Specimen diameter	: 75.0 mm	Dry density	: 1.48 Mg/m^3
Degree of saturation	: 100 %	Moisture content	: 31 %
Particle density	: 2.70 Mg/m^3 (Assumed)	Lab. temperature	: 21 °C
Specimen condition	: Undisturbed	Swelling pressure	: NA kPa

Borehole : BH1

Sample : U3

Depth (m): 7.50-7.90

Specimen Depth (m): 7.80

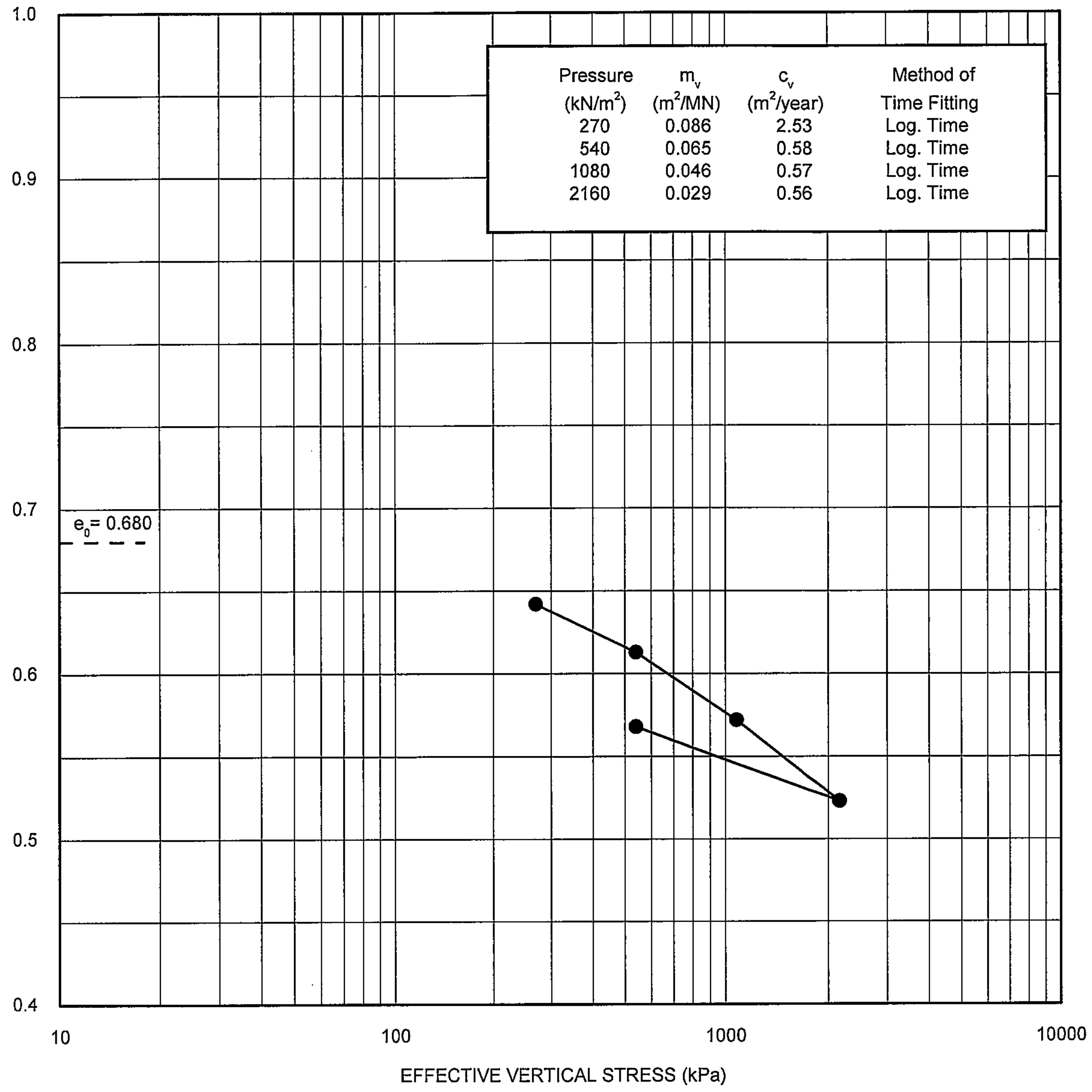
Tested in accordance with BS1377: Part 5: 1990: Clause 3

ONE - DIMENSIONAL
CONSOLIDATION TEST (OEDOMETER)

Filename: 580876\COMPRESS\BH1_U3_OD.OPJ

Te Issue wn by Date: 2009

Filename: 580876 \ COMPRESS \ BH1_U5_OD.OPJ



Pressure (kN/m^2)	m_v (m^2/MN)	c_v ($m^2/year$)	Method of Time Fitting
270	0.086	2.53	Log. Time
540	0.065	0.58	Log. Time
1080	0.046	0.57	Log. Time
2160	0.029	0.56	Log. Time

Initial Conditions

Specimen height	: 20.0 mm	Bulk density	: 2.02 Mg/m^3
Specimen diameter	: 75.0 mm	Dry density	: 1.61 Mg/m^3
Degree of saturation	: 100 %	Moisture content	: 26 %
Particle density	: 2.70 Mg/m^3 (Assumed)	Lab. temperature	: 21 °C
Specimen condition	: Undisturbed	Swelling pressure	: NA kPa

Borehole : BH1

Sample : U5

Depth (m): 13.50-13.90

Specimen Depth (m): 13.80

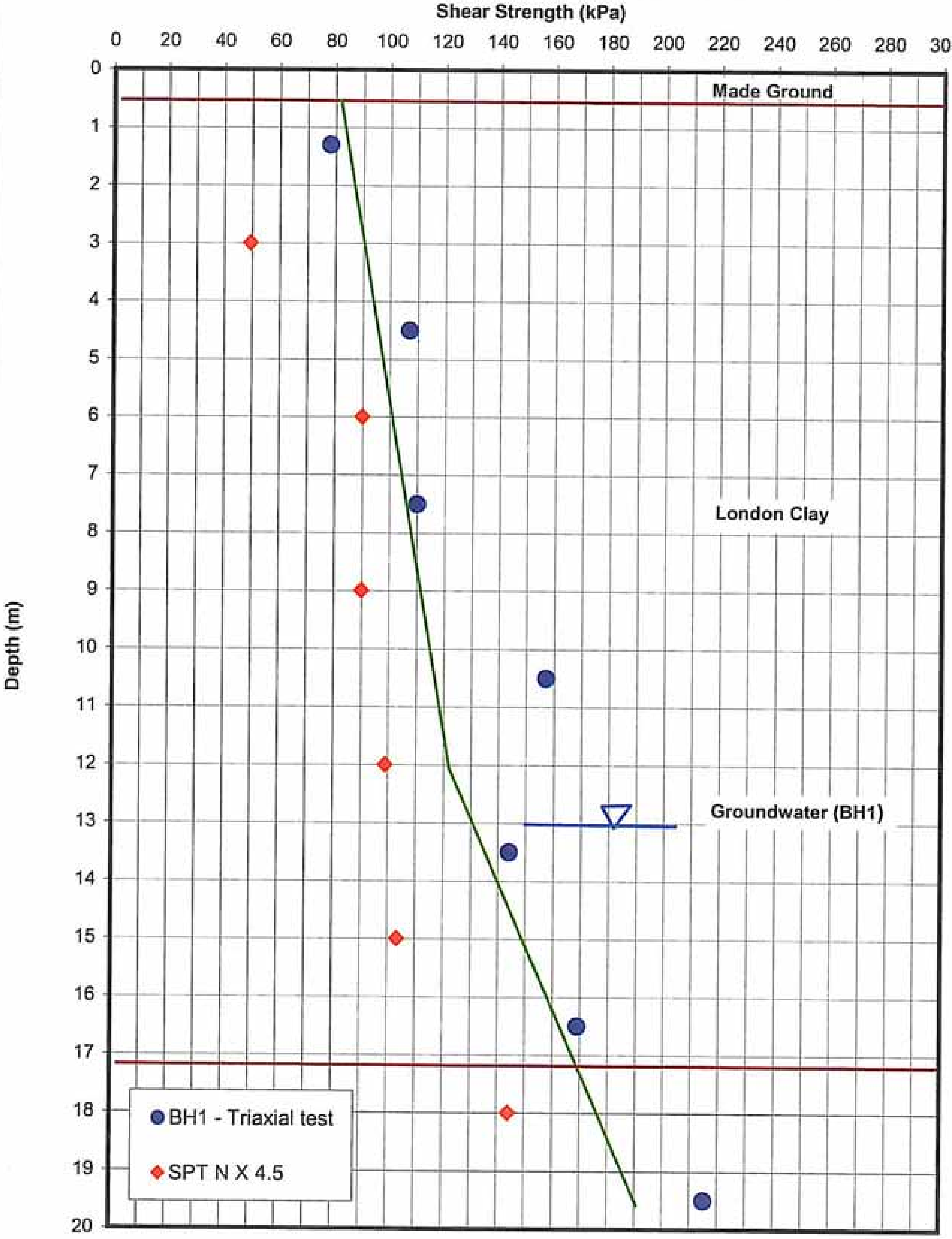
Tested in accordance with BS1377: Part 5: 1990: Clause 3

ONE - DIMENSIONAL
CONSOLIDATION TEST (OEDOMETER)

APPENDIX K

Shear Strength/Depth Profile

RSK GROUP PLC	Site Gondar Gardens, London	**Shear Strength - Depth Profile**	
		Client: Linden Homes Ltd	**Job Number** 23283



18 Frogmore Road
Hemel Hempstead
Hertfordshire
HP3 9RT
UK

Telephone: +44 (0)1442 437500
Fax: +44 (0)1442 437550
www.rsk.co.uk

Our ref: 25113-01L (01)

7th April 2015

Linden Wates (West Hampstead) Limited
Linden House
Linden Square
Harefield
Middlesex
UB9 6TQ

For the attention of Lisa Probyn

Dear Lisa

Gondar Gardens – Summary of Hydrogeology

RSK Environment Limited was instructed by Linden Wates (West Hampstead) Limited to provide a summary of the hydrogeology beneath the above site in order to inform the preparation of basement impact assessment.

The published geological map of the area identifies the geology of the site as London Clay Formation, with no overlying superficial Drift deposits. The lithology of the London Clay Formation in the site vicinity comprises stiff grey silty clay, and the stratum extends to a depth of approximately 40m below ground level. The London Clay Formation is underlain by the Lambeth Group, Thanet Sand Formation and White Chalk Sub-group, the latter at a depth of approximately 100m below ground level.

The London Clay Formation is classified by the Environment Agency as a Non-aquifer (non-productive strata), reflecting its inability to store and transmit significant quantities of groundwater. Values for the coefficient of permeability for the London Clay Formation typically range from 3 x 10^{-9} m/s for clay with sand partings and silty clay to 3 x 10^{-11} m/s for intact clay, indicating the very low permeability of these materials.

At depth, the Thanet Sand Formation and White Chalk Sub-group are designated as Secondary ‘A’ and Principal Aquifers, respectively, and form a regional resource for public supply. However, given the significant thickness of the overlying London Clay Formation, the proposals will have no impact on the deeper groundwater resources.

The results of the ground investigation indicate that the site is underlain by a variable thickness of made ground ranging from 0.5m to in excess of 4m and comprises predominantly cohesive silty sandy clay. The variable thickness of made ground reflects the fill materials placed during the construction of the former covered reservoir. The made ground is directly underlain by the London Clay Formation comprising firm, brown mottled grey silty clay, becoming stiff grey clay with depth.

No groundwater was observed during the exploratory investigation, with the exception of a minor seepage within the London Clay at a depth of approximately 13m below ground level. The investigation results therefore confirmed the anticipated absence of any continuous body of shallow groundwater.

In terms of surface watercourses, there are no known ponds, streams or drainage ditches on or adjacent to the site.

The hydrogeological site conditions outlined above have been considered for the purpose of screening in accordance with CPG4, Figure 1 - Subterranean (ground water) flow screening chart:

1. Is the site located directly above an aquifer?

No.

The site is directly underlain by a non-aquifer (non-productive strata) consisting of the London Clay Formation.

1a. Will the proposed basement extend beneath the water table surface?

No.

The proposed basement level will extend to a maximum depth of approximately 8.0m below existing ground level and does not extend below any continuous body of shallow groundwater.

2. Is the site within 100m of a watercourse, well (used/disused) or potential spring line?

No.

The site is not located within 100m of a known watercourse, well or potential spring line, such as typically present at the Claygate Member/London Clay boundary.

3. Is the site within the catchment of the pond chains on Hampstead Heath?

No.

The site lies approximately 1.7km northeast of the nearest Hampstead Heath drainage catchment and will therefore not impact any catchments.

4. Will the proposed basement development result in a change in the proportion of hard surfaced / paved areas?

Yes.

Whilst the proposed development is envisaged to result in a small net change in the proportion of hard cover across the site, the vast majority of the proposed development (~94%) lies within the footprint of the former covered reservoir. The site is also not underlain by an aquifer, so the proposals will not affect any changes to groundwater levels of flows. Further, the proposed basement lies within the former reservoir so there will be no potential changes in the degree of moisture content of the underlying ground, which in turn could affect stability.

5. As part of the site drainage, will more surface water (e.g. rainfall and run-off) than at present be discharged to the ground (e.g. via soakaways and/or SUDS)?

No.

There are no SUDS/soakaway schemes proposed for the site that would increase discharge to the ground.

6. Is the lowest point of the proposed excavation (allowing for any drainage and foundation space under the basement floor) close to, or lower than, the mean water level in any local pond (not just the pond chains on Hampstead Heath) or spring line?

No.

There are no known surface water courses in the immediate vicinity of the site that could plausibly be impacted by the proposals.

On the basis of the information presented above, it is considered that the impact of the proposed development upon the local hydrogeological regime will be minimal.

We trust the information provided is sufficient for your current requirements, should however, you have any queries or require anything further, please do not hesitate to contact the undersigned.

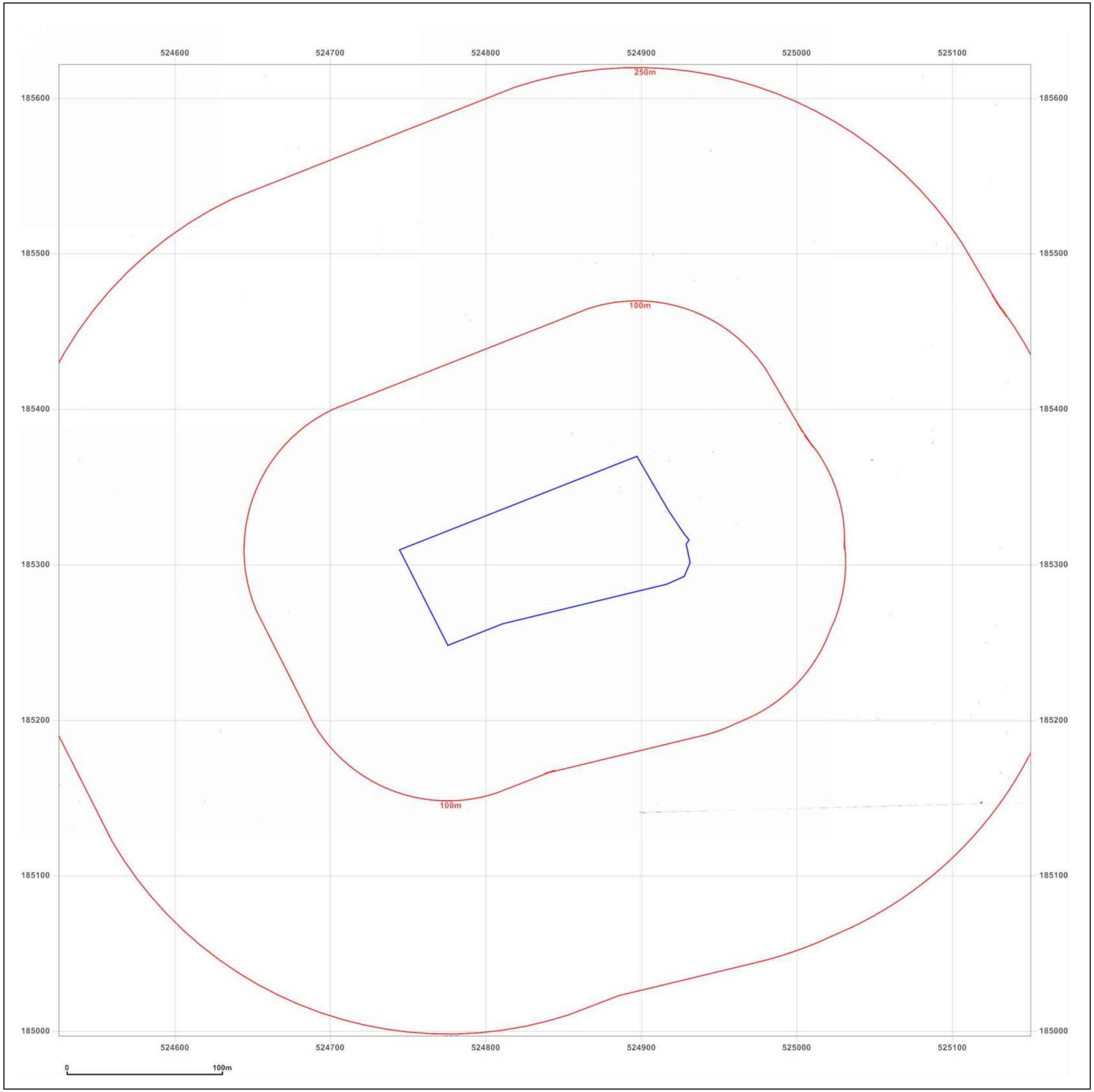
Yours sincerely
For RSK Environment Ltd

Vivie Dent.

Jon Bailey FGS MICE
Associate Director, Geosciences

Vivien Dent BSc MSc CGeol FGS
Principal Hydrogeologist

APPENDIX E
GROUNDSURE REPORT



Site Details:

Gondor Gardens,Gondor
Gardens,West Hampstead,NW6
1QF

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Report Ref:	EMS-418652_559409
Grid Ref:	524838, 185309
Map Name:	County Series
Map date:	**1865**
Scale:	1:2,500
Printed at:	1:2,500

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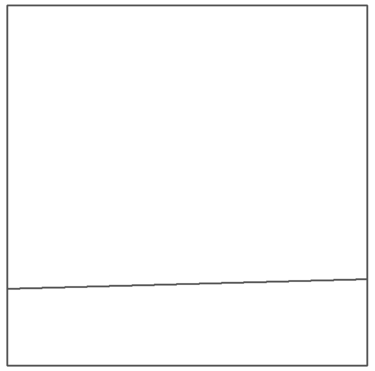
Surveyed 1865
Revised 1865
Edition N/A
Copyright N/A
Levelled N/A



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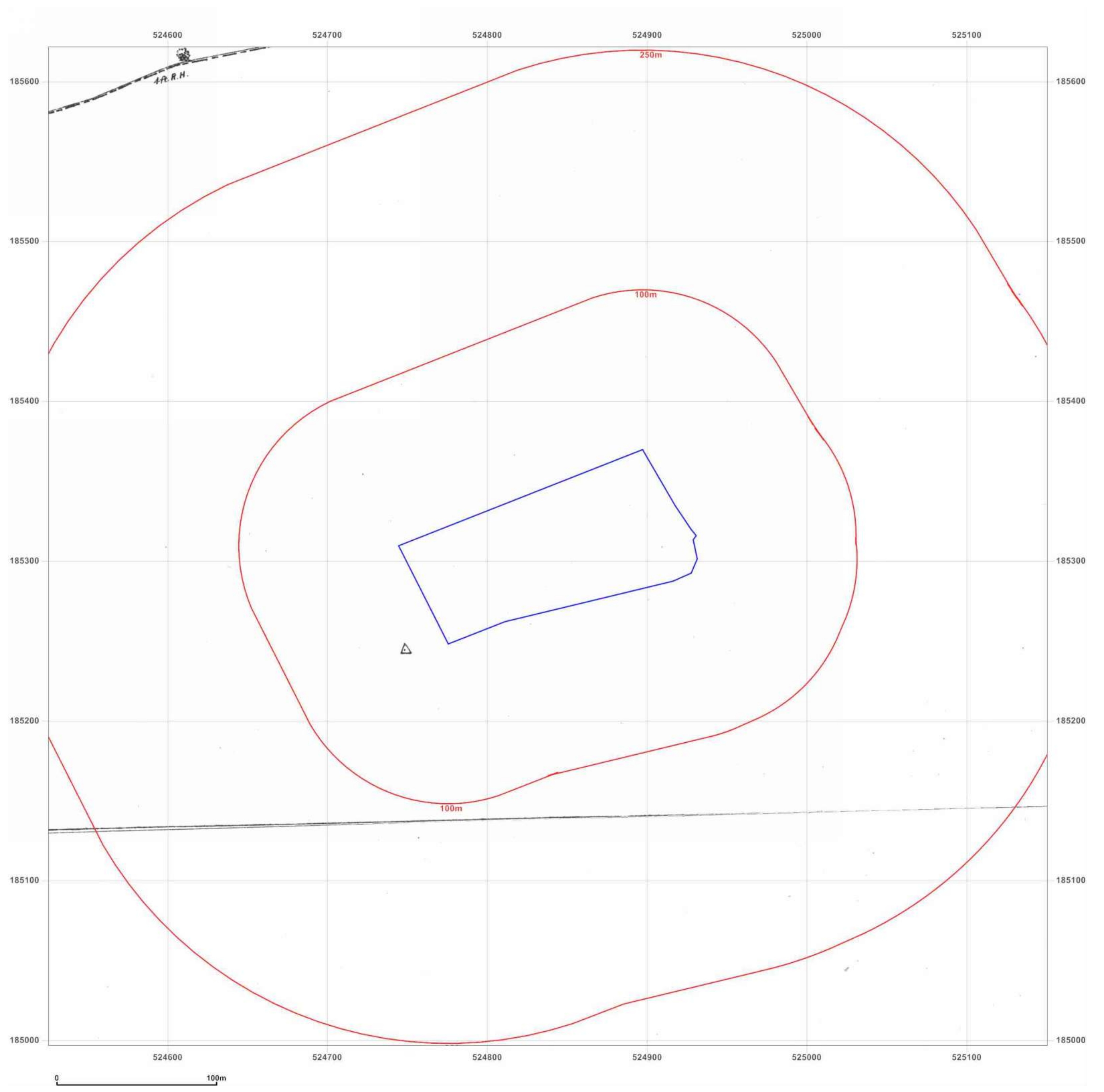
To view map legend click here *Legend*



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Site Details:

Gondor Gardens,Gondor Gardens,West Hampstead,NW6 1QF

Client Ref: EMS_418652_559409
Report Ref: EMS-418652_559409
Grid Ref: 524838, 185309

Map Name: County Series

Map date: **1865-1866**

Scale: 1:2,500

Printed at: 1:2,500

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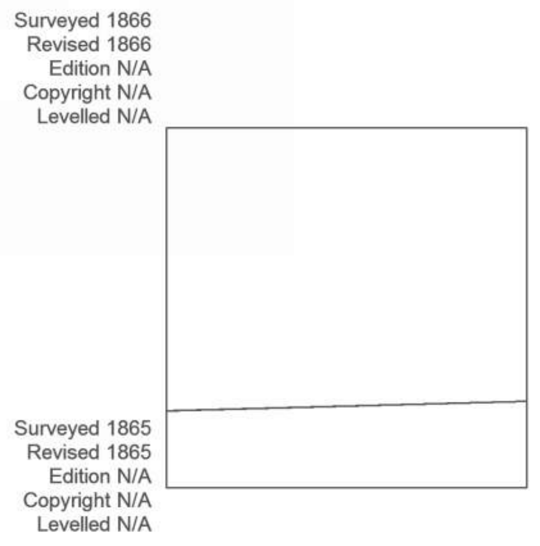

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Site Details:

Gondor Gardens,Gondor
Gardens,West Hampstead,NW6
1QF

Client Ref:	EMS_418652_559409
Report Ref:	EMS-418652_559409
Grid Ref:	524838, 185309
Map Name:	1056 Scale Town Plan
Map date:	**1896**
Scale:	1:1,056
Printed at:	1:1,056

N
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Surveyed 1893
Revised N/A
Edition 1896
Copyright N/A
Levelled N/A

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