CONTAMINANTS IN SOIL

Project: HOMEBASE, MANOR ROAD, RICHMOND UPON THAMES, TW9 1YB
Client: Taylor Wimpey West London

Project No: 21031
Sheet No: 2/2

Semi-Volatile Organic Compounds by GC-MS										
Location	BH1	WSA	WSD							
Sample										
Depth, m	1.00	0.50	0.80							
Determinand	Concentration, µg/kg									
Anthracene	<0.05	0.52	<0.05							
Carbazole	<0.3	<0.3	<0.3							
Dibutyl phthalate	<0.2	<0.2	<0.2							
Anthraquinone	<0.3	<0.3	<0.3							
Fluoranthene	1.3	5.7	0.53							
Pyrene	1.2	5.1	0.48							
Butyl benzyl phthalate	<0.3	<0.3	<0.3							
Benzo(a)anthracene	0.68	3.5	0.35							
Chrysene	0.72	3.3	0.29							
Benzo(b)fluoranthene	0.57	4.1	0.42							
Benzo(k)fluoranthene	0.41	1.8	0.17							
Benzo(a)pyrene	0.58	3.8	0.38							
Indeno(1,2,3-cd)pyrene	0.26	1.7	0.21							
Dibenz(a,h)anthracene	<0.05	0.56	<0.05							
Benzo(ghi)perylene	0.34	2.1	0.26							

Notes

1. The results are expressed as µg/kg dry weight soil after correction for moisture content

CONTAMINANTS IN SOIL

Project: HOMEBASE, MANOR ROAD, RICHMOND UPON THAMES, TW9 1YB
Client: Taylor Wimpey West London

Project No: 21031
Sheet No: 1/1

Volatile Organic Compounds by GC-MS											
Location	BH1	WSA	WSD								
Sample											
Depth, m	1.00	0.50	0.80								
Determinand	Concentration, µg/kg										
MTBE											
Chloromethane	<1.0	<1.0	<1.0								
Chloroethane	<1.0	<1.0	<1.0								
Bromomethane	<1.0	<1.0	<1.0								
Vinyl Chloride	<1.0	<1.0	<1.0								
Trichlorofluoromethane	<1.0	<1.0	<1.0								
1,1-Dichloroethene	<1.0	<1.0	<1.0								
1,1,2-Trichloro 1,2,2-Trifluoroethane	<1.0	<1.0	<1.0								
Cis-1,2-dichloroethene	<1.0	<1.0	<1.0								
MTBE (Methyl Tertiary Butyl Ether)	<1.0	<1.0	<1.0								
1,1-Dichloroethane	<1.0	<1.0	<1.0								
2,2-Dichloropropane	<1.0	<1.0	<1.0								
Trichloromethane	<1.0	<1.0	<1.0								
1,1,1-Trichloroethane	<1.0	<1.0	<1.0								
1,2-Dichloroethane	<1.0	<1.0	<1.0								
1,1-Dichloropropene	<1.0	<1.0	<1.0								
Trans-1,2-dichloroethene	<1.0	<1.0	<1.0								
Benzene	<1.0	<1.0	<1.0								
Tetrachloromethane	<1.0	<1.0	<1.0								
1,2-Dichloropropane	<1.0	<1.0	<1.0								
Trichloroethene	<1.0	<1.0	<1.0								
Dibromomethane	<1.0	<1.0	<1.0								
Bromodichloromethane	<1.0	<1.0	<1.0								
Cis-1,3-dichloropropene	<1.0	<1.0	<1.0								
Trans-1,3-dichloropropene	<1.0	<1.0	<1.0								
Toluene	<1.0	<1.0	<1.0								
1,1,2-Trichloroethane	<1.0	<1.0	<1.0								
1,3-Dichloropropane	<1.0	<1.0	<1.0								
Dibromochloromethane	<1.0	<1.0	<1.0								
Tetrachloroethene	<1.0	<1.0	<1.0								
1,2-Dibromoethane	<1.0	<1.0	<1.0								
Chlorobenzene	<1.0	<1.0	<1.0								
1,1,1,2-Tetrachloroethane	<1.0	<1.0	<1.0								
Ethylbenzene	<1.0	<1.0	<1.0								
p & m-Xylene	<1.0	<1.0	<1.0								
Styrene	<1.0	<1.0	<1.0								
Tribromomethane	<1.0	<1.0	<1.0								
o-Xylene	<1.0	<1.0	<1.0								
1,1,2,2-Tetrachloroethane	<1.0	<1.0	<1.0								
Isopropylbenzene	<1.0	<1.0	<1.0								
Bromobenzene	<1.0	<1.0	<1.0								
n-Propylbenzene	<1.0	<1.0	<1.0								
2-Chlorotoluene	<1.0	<1.0	<1.0								
4-Chlorotoluene	<1.0	<1.0	<1.0								
1,3,5-Trimethylbenzene	<1.0	<1.0	<1.0								
tert-Butylbenzene	<1.0	<1.0	<1.0								
1,2,4-Trimethylbenzene	<1.0	<1.0	<1.0								
sec-Butylbenzene	<1.0	<1.0	<1.0								
1,3-Dichlorobenzene	<1.0	<1.0	<1.0								
p-Isopropyltoluene	<1.0	<1.0	<1.0								
1,2-Dichlorobenzene	<1.0	<1.0	<1.0								
1,4-Dichlorobenzene	<1.0	<1.0	<1.0								
Butylbenzene	<1.0	<1.0	<1.0								
1,2-Dibromo-3-chloropropane	<1.0	<1.0	<1.0								
1,2,4-Trichlorobenzene	<1.0	<1.0	<1.0								
Hexachlorobutadiene	<1.0	<1.0	<1.0								
1,2,3-Trichlorobenzene	<1.0	<1.0	<1.0								

CONTAMINANTS IN SOIL

Project: HOMEBASE, MANOR ROAD, RICHMOND UPON THAMES, TW9 1 Project No: 21031
Client: Manhire Associates Geoenvironmental Sheet No: 1/1

Location	Sample	Depth	Asbestos identification		
		m	Description of matrix	Overall percentage of asbestos identified (approx.)	Type of asbestos identified
BH1		1.00	Brown clay and sand with gravel		none detected
BH2		0.80	Brown clay and sand with gravel and vegetation		none detected
BH3		0.60	Brown clay and sand with gravel		none detected
WSA		0.50	Brown clay and sand with gravel and rubble		none detected
WSB		0.50	Brown sand and gravel with rubble		None detected
WSB		1.00	Brown loam and sand with gravel		Chrysotile-Loose Fibres
WSC		0.80	Brown loam and sand with gravel		none detected
WSD		0.80	Brown sandy loam with gravel and vegetation		none detected
WSD		1.00	Brown sandy loam with gravel and vegetation		none detected
WSE		0.60	Brown sandy loam with gravel		Chrysotile-Loose Fibres

APPENDIX D

ORIGINAL TESTING CERTIFICATES

i2 Analytical Ltd.
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Croxley Green
Business Park,
Watford,
Herts,
WD18 8YS

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f: 01923 237404
e: reception@i2analytical.com

Analytical Report Number : 22-83803

Project / Site name:	Homebase, RIchmond	**Samples received on:**	08/09/2022
Your job number:	5567	**Samples instructed on/ Analysis started on:**	13/09/2022
Your order number:		**Analysis completed by:**	21/09/2022
Report Issue Number:	1	**Report issued on:**	21/09/2022
Samples Analysed:	4 10:1 WAC Samples		

Signed: Izabela Wójcik

Izabela Wójcik
Reporting Specialist
For & on behalf of i2 Analytical Ltd.

Standard Geotechnical, Asbestos and Chemical Testing Laboratory located at: ul. Pionierów 39, 41 -711 Ruda Śląska, Poland.

Accredited tests are defined within the report, opinions and interpretations expressed herein are outside the scope of accreditation.

Standard sample disposal times, unless otherwise agreed with the laboratory, are :

soils - 4 weeks from reporting
leachates - 2 weeks from reporting
waters - 2 weeks from reporting
asbestos - 6 months from reporting

Excel copies of reports are only valid when accompanied by this PDF certificate.

Any assessments of compliance with specifications are based on actual analytical results with no contribution from uncertainty of measurement.
Application of uncertainty of measurement would provide a range within which the true result lies.
An estimate of measurement uncertainty can be provided on request.

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Waste Acceptance Criteria Analytical Results

Report No:	**22-83803**						
					Client: APGEO		
Location	**Homebase, RIchmond**						
Lab Reference (Sample Number)	2422955 / 2422956				**Landfill Waste Acceptance Criteria Limits**		
Sampling Date	06/09/2022				Inert Waste Landfill	Stable Non-reactive HAZARDOUS waste in non-hazardous Landfill	Hazardous Waste Landfill
Sample ID	BH1						
Depth (m)	3.00						
Solid Waste Analysis							
TOC (%)**	< 0.1				3%	5%	6%
Loss on Ignition (%) **	0.8				--	--	10%
BTEX (µg/kg) **	< 10				6000	--	--
Sum of PCBs (mg/kg) **	< 0.007				1	--	--
Mineral Oil (mg/kg) EH_1D_CU_AL	< 10				500	--	--
Total PAH (WAC-17) (mg/kg)	< 0.85				100	--	--
pH (units)**	8.2				--	>6	--
Acid Neutralisation Capacity (mmol / kg)	3.6				--	To be evaluated	To be evaluated
Eluate Analysis (BS EN 12457 - 2 preparation utilising end over end leaching procedure)	10:1 mg/l			10:1 mg/kg	Limit values for compliance leaching test using BS EN 12457-2 at L/S 10 l/kg (mg/kg)		
Arsenic *	0.0029			0.0259	0.5	2	25
Barium *	0.0056			0.0506	20	100	300
Cadmium *	< 0.0001			< 0.0008	0.04	1	5
Chromium *	0.0006			0.0057	0.5	10	70
Copper *	0.0011			0.0098	2	50	100
Mercury *	< 0.0005			< 0.0050	0.01	0.2	2
Molybdenum *	0.0031			0.0278	0.5	10	30
Nickel *	0.0039			0.036	0.4	10	40
Lead *	0.0021			0.019	0.5	10	50
Antimony *	< 0.0017			< 0.017	0.06	0.7	5
Selenium *	< 0.0040			< 0.040	0.1	0.5	7
Zinc *	0.0034			0.031	4	50	200
Chloride *	4.8			43	800	15000	25000
Fluoride	0.46			4.2	10	150	500
Sulphate *	5.9			53	1000	20000	50000
TDS*	53			480	4000	60000	100000
Phenol Index (Monohydric Phenols) *	< 0.010			< 0.10	1	-	-
DOC	13.4			121	500	800	1000
Leach Test Information							
Stone Content (%)	< 0.1						
Sample Mass (kg)	0.70						
Dry Matter (%)	92						
Moisture (%)	8.2						

Results are expressed on a dry weight basis, after correction for moisture content where applicable.
*= UKAS accredited (liquid eluate analysis only)
Stated limits are for guidance only and i2 cannot be held responsible for any discrepancies with current legislation
** = MCERTS accredited

Landfill WAC analysis (specifically leaching test results) must not be used for hazardous waste classification purposes as defined by the Waste (England and Wales) Regulations 2011 (as amended) and EA Guidance WM3.
This analysis is only applicable for landfill acceptance criteria (The Environmental Permitting (England and Wales) Regulations) and does not give any indication as to whether a waste may be hazardous or non-hazardous.

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Waste Acceptance Criteria Analytical Results

Report No:	**22-83803**						
					Client: APGEO		
Location	**Homebase, RIchmond**						
Lab Reference (Sample Number)	2422957 / 2422958				**Landfill Waste Acceptance Criteria Limits**		
Sampling Date	06/09/2022				Inert Waste Landfill	Stable Non-reactive HAZARDOUS waste in non-hazardous Landfill	Hazardous Waste Landfill
Sample ID	BH2						
Depth (m)	3.00						
Solid Waste Analysis							
TOC (%)**	< 0.1				3%	5%	6%
Loss on Ignition (%) **	0.7				--	--	10%
BTEX (µg/kg) **	< 10				6000	--	--
Sum of PCBs (mg/kg) **	< 0.007				1	--	--
Mineral Oil (mg/kg) EH_1D_CU_AL	< 10				500	--	--
Total PAH (WAC-17) (mg/kg)	< 0.85				100	--	--
pH (units)**	8.1				--	>6	--
Acid Neutralisation Capacity (mmol / kg)	2.7				--	To be evaluated	To be evaluated
Eluate Analysis (BS EN 12457 - 2 preparation utilising end over end leaching procedure)	10:1 mg/l			10:1 mg/kg	Limit values for compliance leaching test using BS EN 12457-2 at L/S 10 l/kg (mg/kg)		
Arsenic *	< 0.0010			< 0.0100	0.5	2	25
Barium *	0.0082			0.0779	20	100	300
Cadmium *	< 0.0001			< 0.0008	0.04	1	5
Chromium *	0.0006			0.0054	0.5	10	70
Copper *	0.0010			0.0098	2	50	100
Mercury *	< 0.0005			< 0.0050	0.01	0.2	2
Molybdenum *	0.0017			0.0163	0.5	10	30
Nickel *	0.0040			0.038	0.4	10	40
Lead *	0.0033			0.031	0.5	10	50
Antimony *	< 0.0017			< 0.017	0.06	0.7	5
Selenium *	< 0.0040			< 0.040	0.1	0.5	7
Zinc *	0.0042			0.039	4	50	200
Chloride *	3.0			28	800	15000	25000
Fluoride	0.26			2.5	10	150	500
Sulphate *	10			95	1000	20000	50000
TDS*	47			440	4000	60000	100000
Phenol Index (Monohydric Phenols) *	< 0.010			< 0.10	1	-	-
DOC	8.17			77.4	500	800	1000
Leach Test Information							
Stone Content (%)	< 0.1						
Sample Mass (kg)	0.90						
Dry Matter (%)	93						
Moisture (%)	6.7						

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Waste Acceptance Criteria Analytical Results

Report No:	**22-83803**						
					Client: APGEO		
Location	**Homebase, RIchmond**						
Lab Reference (Sample Number)	2422959 / 2422960				**Landfill Waste Acceptance Criteria Limits**		
Sampling Date	06/09/2022				Inert Waste Landfill	Stable Non-reactive HAZARDOUS waste in non-hazardous Landfill	Hazardous Waste Landfill
Sample ID	WSA						
Depth (m)	1.50						
Solid Waste Analysis							
TOC (%)**	0.2				3%	5%	6%
Loss on Ignition (%) **	1.1				--	--	10%
BTEX (µg/kg) **	< 10				6000	--	--
Sum of PCBs (mg/kg) **	< 0.007				1	--	--
Mineral Oil (mg/kg) EH_1D_CU_AL	< 10				500	--	--
Total PAH (WAC-17) (mg/kg)	< 0.85				100	--	--
pH (units)**	8.0				--	>6	--
Acid Neutralisation Capacity (mmol / kg)	2.3				--	To be evaluated	To be evaluated
Eluate Analysis (BS EN 12457 - 2 preparation utilising end over end leaching procedure)	10:1 mg/l			10:1 mg/kg	Limit values for compliance leaching test using BS EN 12457-2 at L/S 10 l/kg (mg/kg)		
Arsenic *	0.0035			0.0320	0.5	2	25
Barium *	0.0068			0.0624	20	100	300
Cadmium *	< 0.0001			< 0.0008	0.04	1	5
Chromium *	0.0009			0.0083	0.5	10	70
Copper *	0.0017			0.016	2	50	100
Mercury *	< 0.0005			< 0.0050	0.01	0.2	2
Molybdenum *	0.0213			0.194	0.5	10	30
Nickel *	0.0042			0.039	0.4	10	40
Lead *	0.0029			0.026	0.5	10	50
Antimony *	< 0.0017			< 0.017	0.06	0.7	5
Selenium *	< 0.0040			< 0.040	0.1	0.5	7
Zinc *	0.0026			0.024	4	50	200
Chloride *	5.2			47	800	15000	25000
Fluoride	0.80			7.3	10	150	500
Sulphate *	6.2			57	1000	20000	50000
TDS*	60			540	4000	60000	100000
Phenol Index (Monohydric Phenols) *	< 0.010			< 0.10	1	-	-
DOC	16.8			153	500	800	1000
Leach Test Information							
Stone Content (%)	< 0.1						
Sample Mass (kg)	0.90						
Dry Matter (%)	93						
Moisture (%)	7.1						

Results are expressed on a dry weight basis, after correction for moisture content where applicable.
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Waste Acceptance Criteria Analytical Results

Report No:	**22-83803**						
					Client: APGEO		
Location	**Homebase, RIchmond**						
Lab Reference (Sample Number)	2422961 / 2422962				**Landfill Waste Acceptance Criteria Limits**		
Sampling Date	06/09/2022				Inert Waste Landfill	Stable Non-reactive HAZARDOUS waste in non-hazardous Landfill	Hazardous Waste Landfill
Sample ID	WSC						
Depth (m)	1.50						
Solid Waste Analysis							
TOC (%)**	0.3				3%	5%	6%
Loss on Ignition (%) **	2.0				--	--	10%
BTEX (µg/kg) **	< 10				6000	--	--
Sum of PCBs (mg/kg) **	< 0.007				1	--	--
Mineral Oil (mg/kg) EH_1D_CU_AL	< 10				500	--	--
Total PAH (WAC-17) (mg/kg)	< 0.85				100	--	--
pH (units)**	7.7				--	>6	--
Acid Neutralisation Capacity (mmol / kg)	1.3				--	To be evaluated	To be evaluated
Eluate Analysis (BS EN 12457 - 2 preparation utilising end over end leaching procedure)	10:1 mg/l			10:1 mg/kg	Limit values for compliance leaching test using BS EN 12457-2 at L/S 10 l/kg (mg/kg)		
Arsenic *	0.0013			0.0115	0.5	2	25
Barium *	0.0469			0.401	20	100	300
Cadmium *	< 0.0001			< 0.0008	0.04	1	5
Chromium *	0.0012			0.010	0.5	10	70
Copper *	0.0038			0.033	2	50	100
Mercury *	< 0.0005			< 0.0050	0.01	0.2	2
Molybdenum *	0.0031			0.0265	0.5	10	30
Nickel *	0.0049			0.042	0.4	10	40
Lead *	0.0029			0.025	0.5	10	50
Antimony *	< 0.0017			< 0.017	0.06	0.7	5
Selenium *	< 0.0040			< 0.040	0.1	0.5	7
Zinc *	0.0063			0.054	4	50	200
Chloride *	2.1			18	800	15000	25000
Fluoride	0.67			5.7	10	150	500
Sulphate *	88			760	1000	20000	50000
TDS*	150			1300	4000	60000	100000
Phenol Index (Monohydric Phenols) *	< 0.010			< 0.10	1	-	-
DOC	6.30			54.0	500	800	1000
Leach Test Information							
Stone Content (%)	< 0.1						
Sample Mass (kg)	0.90						
Dry Matter (%)	88						
Moisture (%)	12						

Results are expressed on a dry weight basis, after correction for moisture content where applicable.
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** = MCERTS accredited

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Analytical Report Number : 22-83803
Project / Site name: Homebase, RIchmond

* These descriptions are only intended to act as a cross check if sample identities are questioned. The major constituent of the sample is intended to act with respect to MCERTS validation. The laboratory is accredited for sand, clay and loam (MCERTS) soil types. Data for unaccredited types of solid should be interpreted with care.

Stone content of a sample is calculated as the % weight of the stones not passing a 10 mm sieve. Results are not corrected for stone content.

Lab Sample Number	Sample Reference	Sample Number	Depth (m)	Sample Description *
2422955	BH1	None Supplied	3	Brown sand with gravel.
2422957	BH2	None Supplied	3	Brown sand with gravel.
2422959	WSA	None Supplied	1.5	Brown sand with gravel.
2422961	WSC	None Supplied	1.5	Brown clay and sand with gravel.

Analytical Report Number : 22-83803
Project / Site name: Homebase, RIchmond

Water matrix abbreviations:
Surface Water (SW) Potable Water (PW) Ground Water (GW) Process Waters (PrW) Final Sewage Effluent (FSE) Landfill Leachate (LL)

Analytical Test Name	Analytical Method Description	Analytical Method Reference	Method number	Wet / Dry Analysis	Accreditation Status
BS EN 12457-2 (10:1) Leachate Prep	10:1 (as recieved, moisture adjusted) end over end extraction with water for 24 hours. Eluate filtered prior to analysis.	In-house method based on BSEN12457-2.	L043-PL	W	NONE
Acid neutralisation capacity of soil	Determination of acid neutralisation capacity by addition of acid or alkali followed by electronic probe.	In-house method based on Guidance an Sampling and Testing of Wastes to Meet Landfill Waste Acceptance""	L046-PL	W	NONE
Loss on ignition of soil @ 450oC	Determination of loss on ignition in soil by gravimetrically with the sample being ignited in a muffle furnace.	In house method.	L047-PL	D	MCERTS
Mineral Oil (Soil) C10 - C40	Determination of mineral oil fraction extractable hydrocarbons in soil by GC-MS/GC-FID.	In-house method with silica gel split/clean up.	L076-PL	D	NONE
Moisture Content	Moisture content, determined gravimetrically. (30 oC)	In house method.	L019-UK/PL	W	NONE
Speciated WAC-17 PAHs in soil	Determination of PAH compounds in soil by extraction in dichloromethane and hexane followed by GC-MS with the use of surrogate and internal standards.	In-house method based on USEPA 8270. MCERTS accredited except Coronene.	L064-PL	D	MCERTS
PCB's By GC-MS in soil	Determination of PCB by extraction with acetone and hexane followed by GC-MS.	In-house method based on USEPA 8082	L027-PL	D	MCERTS
pH at 20oC in soil	Determination of pH in soil by addition of water followed by electrometric measurement.	In house method.	L005-PL	W	MCERTS
Stones content of soil	Standard preparation for all samples unless otherwise detailed. Gravimetric determination of stone > 10 mm as % dry weight.	In-house method based on British Standard Methods and MCERTS requirements.	L019-UK/PL	D	NONE
Total organic carbon (Automated) in soil	Determination of organic matter in soil by oxidising with potassium dichromate followed by titration with iron (II) sulphate.	In house method.	L009-PL	D	MCERTS
BTEX in soil (Monoaromatics)	Determination of BTEX in soil by headspace GC-MS.	In-house method based on USEPA8260	L073B-PL	W	MCERTS
Total BTEX in soil (Poland)	Determination of BTEX in soil by headspace GC-MS.	In-house method based on USEPA8260	L073-PL	W	MCERTS
Metals in leachate by ICP-OES	Determination of metals in leachate by acidification followed by ICP-OES.	In-house method based on MEWAM 2006 Methods for the Determination of Metals in Soil""	L039-PL	W	ISO 17025
Chloride 10:1 WAC	Determination of Chloride colorimetrically by discrete analyser.	In house based on MEWAM Method ISBN 0117516260.	L082-PL	W	ISO 17025
Fluoride 10:1 WAC	Determination of fluoride in leachate by 1:1ratio with a buffer solution followed by Ion Selective Electrode.	In-house method based on Use of Total Ionic Strength Adjustment Buffer for Electrode Determination"	L033B-PL	W	ISO 17025
Sulphate 10:1 WAC	Determination of sulphate in leachate by ICP-OES	In-house method based on MEWAM 1986 Methods for the Determination of Metals in Soil""	L039-PL	W	ISO 17025
Total dissolved solids 10:1 WAC	Determination of total dissolved solids in water by EC probe using a factor of 0.6.	In-house method based on Examination of Water and Wastewater 20th Edition: Clesceri, Greenberg & Eaton	L031	W	ISO 17025

Analytical Report Number : 22-83803
Project / Site name: Homebase, RIchmond

Water matrix abbreviations:
Surface Water (SW) Potable Water (PW) Ground Water (GW) Process Waters (PrW) Final Sewage Effluent (FSE) Landfill Leachate (LL)

Analytical Test Name	Analytical Method Description	Analytical Method Reference	Method number	Wet / Dry Analysis	Accreditation Status
Monohydric phenols 10:1 WAC	Determination of phenols in leachate by distillation followed by colorimetry.	In-house method based on Examination of Water and Wastewater 20th Edition: Clesceri, Greenberg & Eaton	L080-PL	W	ISO 17025
Dissolved organic carbon 10:1 WAC	Determination of dissolved inorganic carbon in leachate by TOC/DOC NDIR Analyser.	In-house method based on Examination of Water and Wastewater 20th Edition: Clesceri, Greenberg & Eaton	L037-PL	W	NONE

For method numbers ending in 'UK' analysis have been carried out in our laboratory in the United Kingdom.
For method numbers ending in 'PL' analysis have been carried out in our laboratory in Poland.
Soil analytical results are expressed on a dry weight basis. Where analysis is carried out on as-received the results obtained are multiplied by a moisture correction factor that is determined gravimetrically using the moisture content which is carried out at a maximum of 30oC.

Unless otherwise indicated, site information, order number, project number, sampling date, time, sample reference and depth are provided by the client. The instructed on date indicates the date on which this information was provided to the laboratory.

Information in Support of Analytical Results

List of HWOL Acronyms and Operators

Acronym	Descriptions
HS	Headspace Analysis
MS	Mass spectrometry
FID	Flame Ionisation Detector
GC	Gas Chromatography
EH	Extractable Hydrocarbons (i.e. everything extracted by the solvent(s))
CU	Clean-up - e.g. by Florisil®, silica gel
1D	GC - Single coil/column gas chromatography
2D	GC-GC - Double coil/column gas chromatography
Total	Aliphatics & Aromatics
AL	Aliphatics
AR	Aromatics
#1	EH_2D_Total but with humics mathematically subtracted
#2	EH_2D_Total but with fatty acids mathematically subtracted
_	Operator - understore to separate acronyms (exception for +)
+	Operator to indicate cumulative e.g. EH+HS_Total or EH_CU+HS_Total

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Analytical Report Number : 22-83806

Project / Site name:	Homebase, Richmond	**Samples received on:**	08/09/2022
Your job number:	5567	**Samples instructed on/ Analysis started on:**	13/09/2022
Your order number:		**Analysis completed by:**	21/09/2022
Report Issue Number:	1	**Report issued on:**	21/09/2022
Samples Analysed:	10 soil samples		

Izabela Wójcik

Signed:

Izabela Wójcik
Reporting Specialist
For & on behalf of i2 Analytical Ltd.

Standard Geotechnical, Asbestos and Chemical Testing Laboratory located at: ul. Pionierów 39, 41 -711 Ruda Śląska, Poland.

Accredited tests are defined within the report, opinions and interpretations expressed herein are outside the scope of accreditation.

Standard sample disposal times, unless otherwise agreed with the laboratory, are :

soils - 4 weeks from reporting
leachates - 2 weeks from reporting
waters - 2 weeks from reporting
asbestos - 6 months from reporting

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Any assessments of compliance with specifications are based on actual analytical results with no contribution from uncertainty of measurement.
Application of uncertainty of measurement would provide a range within which the true result lies.
An estimate of measurement uncertainty can be provided on request.

Analytical Report Number: 22-83806
Project / Site name: Homebase, Richmond

Lab Sample Number				2422973	2422974	2422975	2422976	2422977
Sample Reference				BH1	BH2	BH3	WSA	WSB
Sample Number				None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Depth (m)				1.00	0.80	0.60	0.50	0.50
Date Sampled				06/09/2022	06/09/2022	06/09/2022	06/09/2022	06/09/2022
Time Taken				None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Analytical Parameter (Soil Analysis)	**Units**	**Limit of detection**	**Accreditation Status**					
Stone Content	%	0.1	NONE	< 0.1	< 0.1	< 0.1	< 0.1	59
Moisture Content	%	0.01	NONE	17	11	15	9	5.4
Total mass of sample received	kg	0.001	NONE	0.4	0.4	0.4	0.4	0.4
Asbestos in Soil Screen / Identification Name	Type	N/A	ISO 17025	-	-	-	-	-
Asbestos in Soil	Type	N/A	ISO 17025	Not-detected	Not-detected	Not-detected	Not-detected	Not-detected
Asbestos Analyst ID	N/A	N/A	N/A	DSO	DSO	DSO	DSO	DSO
Total Phenols								
Total Phenols (monohydric)	mg/kg	1	MCERTS	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Speciated PAHs								
Naphthalene	mg/kg	0.05	MCERTS	-	< 0.05	0.35	-	0.4
Acenaphthylene	mg/kg	0.05	MCERTS	-	< 0.05	0.38	-	< 0.05
Acenaphthene	mg/kg	0.05	MCERTS	-	< 0.05	0.32	-	0.67
Fluorene	mg/kg	0.05	MCERTS	-	< 0.05	0.3	-	0.69
Phenanthrene	mg/kg	0.05	MCERTS	-	1.6	5	-	4.5
Anthracene	mg/kg	0.05	MCERTS	-	0.44	1.1	-	0.66
Fluoranthene	mg/kg	0.05	MCERTS	-	3	11	-	3.9
Pyrene	mg/kg	0.05	MCERTS	-	3.3	9.8	-	3.1
Benzo(a)anthracene	mg/kg	0.05	MCERTS	-	2.2	6.5	-	1.7
Chrysene	mg/kg	0.05	MCERTS	-	1.9	6.8	-	1.1
Benzo(b)fluoranthene	mg/kg	0.05	MCERTS	-	2.3	7.2	-	1.2
Benzo(k)fluoranthene	mg/kg	0.05	MCERTS	-	1.6	4.4	-	0.87
Benzo(a)pyrene	mg/kg	0.05	MCERTS	-	2.4	7.2	-	1
Indeno(1,2,3-cd)pyrene	mg/kg	0.05	MCERTS	-	1.2	3.8	-	0.61
Dibenz(a,h)anthracene	mg/kg	0.05	MCERTS	-	0.36	0.99	-	< 0.05
Benzo(ghi)perylene	mg/kg	0.05	MCERTS	-	1.6	4.6	-	0.77
Total PAH								
Speciated Total EPA-16 PAHs	mg/kg	0.8	MCERTS	-	21.9	69.7	-	21.4
Heavy Metals / Metalloids								
Arsenic (aqua regia extractable)	mg/kg	1	MCERTS	17	14	22	18	11
Barium (aqua regia extractable)	mg/kg	1	MCERTS	110	110	150	150	110
Beryllium (aqua regia extractable)	mg/kg	0.06	MCERTS	0.79	0.76	1	0.84	0.61
Boron (water soluble)	mg/kg	0.2	MCERTS	0.7	3.1	0.8	1	3.4
Cadmium (aqua regia extractable)	mg/kg	0.2	MCERTS	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2
Chromium (aqua regia extractable)	mg/kg	1	MCERTS	31	22	18	27	22
Copper (aqua regia extractable)	mg/kg	1	MCERTS	21	27	67	39	89
Lead (aqua regia extractable)	mg/kg	1	MCERTS	450	110	420	120	76
Mercury (aqua regia extractable)	mg/kg	0.3	MCERTS	0.6	< 0.3	0.8	0.7	< 0.3
Nickel (aqua regia extractable)	mg/kg	1	MCERTS	21	16	21	21	14
Selenium (aqua regia extractable)	mg/kg	1	MCERTS	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Vanadium (aqua regia extractable)	mg/kg	1	MCERTS	44	37	44	45	27
Zinc (aqua regia extractable)	mg/kg	1	MCERTS	170	64	110	100	88

Analytical Report Number: 22-83806
Project / Site name: Homebase, Richmond

Lab Sample Number				2422973	2422974	2422975	2422976	2422977
Sample Reference				BH1	BH2	BH3	WSA	WSB
Sample Number				None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Depth (m)				1.00	0.80	0.60	0.50	0.50
Date Sampled				06/09/2022	06/09/2022	06/09/2022	06/09/2022	06/09/2022
Time Taken				None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Analytical Parameter (Soil Analysis)	**Units**	**Limit of detection**	**Accreditation Status**					
Monoaromatics & Oxygenates								
Benzene	µg/kg	1	MCERTS	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Toluene	µg/kg	1	MCERTS	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Ethylbenzene	µg/kg	1	MCERTS	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
p & m-xylene	µg/kg	1	MCERTS	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
o-xylene	µg/kg	1	MCERTS	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
MTBE (Methyl Tertiary Butyl Ether)	µg/kg	1	MCERTS	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Petroleum Hydrocarbons								
TPH-CWG - Aliphatic >EC5 - EC6 $_{HS\_1D\_AL}$	mg/kg	0.001	MCERTS	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001
TPH-CWG - Aliphatic >EC6 - EC8 $_{HS\_1D\_AL}$	mg/kg	0.001	MCERTS	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001
TPH-CWG - Aliphatic >EC8 - EC10 $_{HS\_1D\_AL}$	mg/kg	0.001	MCERTS	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001
TPH-CWG - Aliphatic >EC10 - EC12 $_{EH\_CU\_1D\_AL}$	mg/kg	1	MCERTS	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
TPH-CWG - Aliphatic >EC12 - EC16 $_{EH\_CU\_1D\_AL}$	mg/kg	2	MCERTS	< 2.0	13	< 2.0	11	20
TPH-CWG - Aliphatic >EC16 - EC21 $_{EH\_CU\_1D\_AL}$	mg/kg	8	MCERTS	< 8.0	22	< 8.0	24	43
TPH-CWG - Aliphatic >EC21 - EC35 $_{EH\_CU\_1D\_AL}$	mg/kg	8	MCERTS	< 8.0	48	< 8.0	51	110
TPH-CWG - Aliphatic (EC5 - EC35) $_{EH\_CU+HS\_1D\_AL}$	mg/kg	10	MCERTS	< 10	83	< 10	85	170
TPH-CWG - Aromatic >EC5 - EC7 $_{HS\_1D\_AR}$	mg/kg	0.001	MCERTS	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001
TPH-CWG - Aromatic >EC7 - EC8 $_{HS\_1D\_AR}$	mg/kg	0.001	MCERTS	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001
TPH-CWG - Aromatic >EC8 - EC10 $_{HS\_1D\_AR}$	mg/kg	0.001	MCERTS	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001
TPH-CWG - Aromatic >EC10 - EC12 $_{EH\_CU\_1D\_AR}$	mg/kg	1	MCERTS	< 1.0	< 1.0	< 1.0	< 1.0	11
TPH-CWG - Aromatic >EC12 - EC16 $_{EH\_CU\_1D\_AR}$	mg/kg	2	MCERTS	< 2.0	6.5	9.7	7.3	23
TPH-CWG - Aromatic >EC16 - EC21 $_{EH\_CU\_1D\_AR}$	mg/kg	10	MCERTS	< 10	23	37	30	49
TPH-CWG - Aromatic >EC21 - EC35 $_{EH\_CU\_1D\_AR}$	mg/kg	10	MCERTS	< 10	60	82	74	92
TPH-CWG - Aromatic (EC5 - EC35) $_{EH\_CU+HS\_1D\_AR}$	mg/kg	10	MCERTS	< 10	89	130	110	180

Analytical Report Number: 22-83806
Project / Site name: Homebase, Richmond

Lab Sample Number				2422973	2422974	2422975	2422976	2422977
Sample Reference				BH1	BH2	BH3	WSA	WSB
Sample Number				None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Depth (m)				1.00	0.80	0.60	0.50	0.50
Date Sampled				06/09/2022	06/09/2022	06/09/2022	06/09/2022	06/09/2022
Time Taken				None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Analytical Parameter (Soil Analysis)	**Units**	**Limit of detection**	**Accreditation Status**					
VOCs								
Chloromethane	µg/kg	1	ISO 17025	< 1.0	-	-	< 1.0	-
Chloroethane	µg/kg	1	NONE	< 1.0	-	-	< 1.0	-
Bromomethane	µg/kg	1	ISO 17025	< 1.0	-	-	< 1.0	-
Vinyl Chloride	µg/kg	1	NONE	< 1.0	-	-	< 1.0	-
Trichlorofluoromethane	µg/kg	1	NONE	< 1.0	-	-	< 1.0	-
1,1-Dichloroethene	µg/kg	1	NONE	< 1.0	-	-	< 1.0	-
1,1,2-Trichloro 1,2,2-Trifluoroethane	µg/kg	1	ISO 17025	< 1.0	-	-	< 1.0	-
Cis-1,2-dichloroethene	µg/kg	1	MCERTS	< 1.0	-	-	< 1.0	-
MTBE (Methyl Tertiary Butyl Ether)	µg/kg	1	MCERTS	< 1.0	-	-	< 1.0	-
1,1-Dichloroethane	µg/kg	1	MCERTS	< 1.0	-	-	< 1.0	-
2,2-Dichloropropane	µg/kg	1	MCERTS	< 1.0	-	-	< 1.0	-
Trichloromethane	µg/kg	1	MCERTS	< 1.0	-	-	< 1.0	-
1,1,1-Trichloroethane	µg/kg	1	MCERTS	< 1.0	-	-	< 1.0	-
1,2-Dichloroethane	µg/kg	1	MCERTS	< 1.0	-	-	< 1.0	-
1,1-Dichloropropene	µg/kg	1	MCERTS	< 1.0	-	-	< 1.0	-
Trans-1,2-dichloroethene	µg/kg	1	NONE	< 1.0	-	-	< 1.0	-
Benzene	µg/kg	1	MCERTS	< 1.0	-	-	< 1.0	-
Tetrachloromethane	µg/kg	1	MCERTS	< 1.0	-	-	< 1.0	-
1,2-Dichloropropane	µg/kg	1	MCERTS	< 1.0	-	-	< 1.0	-
Trichloroethene	µg/kg	1	MCERTS	< 1.0	-	-	< 1.0	-
Dibromomethane	µg/kg	1	MCERTS	< 1.0	-	-	< 1.0	-
Bromodichloromethane	µg/kg	1	MCERTS	< 1.0	-	-	< 1.0	-
Cis-1,3-dichloropropene	µg/kg	1	ISO 17025	< 1.0	-	-	< 1.0	-
Trans-1,3-dichloropropene	µg/kg	1	ISO 17025	< 1.0	-	-	< 1.0	-
Toluene	µg/kg	1	MCERTS	< 1.0	-	-	< 1.0	-
1,1,2-Trichloroethane	µg/kg	1	MCERTS	< 1.0	-	-	< 1.0	-
1,3-Dichloropropane	µg/kg	1	ISO 17025	< 1.0	-	-	< 1.0	-
Dibromochloromethane	µg/kg	1	ISO 17025	< 1.0	-	-	< 1.0	-
Tetrachloroethene	µg/kg	1	NONE	< 1.0	-	-	< 1.0	-
1,2-Dibromoethane	µg/kg	1	ISO 17025	< 1.0	-	-	< 1.0	-
Chlorobenzene	µg/kg	1	MCERTS	< 1.0	-	-	< 1.0	-
1,1,1,2-Tetrachloroethane	µg/kg	1	MCERTS	< 1.0	-	-	< 1.0	-
Ethylbenzene	µg/kg	1	MCERTS	< 1.0	-	-	< 1.0	-
p & m-Xylene	µg/kg	1	MCERTS	< 1.0	-	-	< 1.0	-
Styrene	µg/kg	1	MCERTS	< 1.0	-	-	< 1.0	-
Tribromomethane	µg/kg	1	NONE	< 1.0	-	-	< 1.0	-
o-Xylene	µg/kg	1	MCERTS	< 1.0	-	-	< 1.0	-
1,1,2,2-Tetrachloroethane	µg/kg	1	MCERTS	< 1.0	-	-	< 1.0	-
Isopropylbenzene	µg/kg	1	MCERTS	< 1.0	-	-	< 1.0	-
Bromobenzene	µg/kg	1	MCERTS	< 1.0	-	-	< 1.0	-
n-Propylbenzene	µg/kg	1	ISO 17025	< 1.0	-	-	< 1.0	-
2-Chlorotoluene	µg/kg	1	MCERTS	< 1.0	-	-	< 1.0	-
4-Chlorotoluene	µg/kg	1	MCERTS	< 1.0	-	-	< 1.0	-
1,3,5-Trimethylbenzene	µg/kg	1	ISO 17025	< 1.0	-	-	< 1.0	-
tert-Butylbenzene	µg/kg	1	MCERTS	< 1.0	-	-	< 1.0	-
1,2,4-Trimethylbenzene	µg/kg	1	ISO 17025	< 1.0	-	-	< 1.0	-
sec-Butylbenzene	µg/kg	1	MCERTS	< 1.0	-	-	< 1.0	-
1,3-Dichlorobenzene	µg/kg	1	ISO 17025	< 1.0	-	-	< 1.0	-
p-Isopropyltoluene	µg/kg	1	ISO 17025	< 1.0	-	-	< 1.0	-
1,2-Dichlorobenzene	µg/kg	1	MCERTS	< 1.0	-	-	< 1.0	-
1,4-Dichlorobenzene	µg/kg	1	MCERTS	< 1.0	-	-	< 1.0	-
Butylbenzene	µg/kg	1	MCERTS	< 1.0	-	-	< 1.0	-

Analytical Report Number: 22-83806
Project / Site name: Homebase, Richmond

Lab Sample Number				2422973	2422974	2422975	2422976	2422977
Sample Reference				BH1	BH2	BH3	WSA	WSB
Sample Number				None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Depth (m)				1.00	0.80	0.60	0.50	0.50
Date Sampled				06/09/2022	06/09/2022	06/09/2022	06/09/2022	06/09/2022
Time Taken				None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Analytical Parameter (Soil Analysis)	**Units**	**Limit of detection**	**Accreditation Status**					
1,2-Dibromo-3-chloropropane	µg/kg	1	ISO 17025	< 1.0	-	-	< 1.0	-
1,2,4-Trichlorobenzene	µg/kg	1	MCERTS	< 1.0	-	-	< 1.0	-
Hexachlorobutadiene	µg/kg	1	MCERTS	< 1.0	-	-	< 1.0	-
1,2,3-Trichlorobenzene	µg/kg	1	ISO 17025	< 1.0	-	-	< 1.0	-

Analytical Report Number: 22-83806
Project / Site name: Homebase, Richmond

Lab Sample Number				2422973	2422974	2422975	2422976	2422977
Sample Reference				BH1	BH2	BH3	WSA	WSB
Sample Number				None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Depth (m)				1.00	0.80	0.60	0.50	0.50
Date Sampled				06/09/2022	06/09/2022	06/09/2022	06/09/2022	06/09/2022
Time Taken				None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Analytical Parameter (Soil Analysis)	**Units**	**Limit of detection**	**Accreditation Status**					
SVOCs								
Aniline	mg/kg	0.1	NONE	< 0.1	-	-	< 0.1	-
Phenol	mg/kg	0.2	ISO 17025	< 0.2	-	-	< 0.2	-
2-Chlorophenol	mg/kg	0.1	MCERTS	< 0.1	-	-	< 0.1	-
Bis(2-chloroethyl)ether	mg/kg	0.2	MCERTS	< 0.2	-	-	< 0.2	-
1,3-Dichlorobenzene	mg/kg	0.2	MCERTS	< 0.2	-	-	< 0.2	-
1,2-Dichlorobenzene	mg/kg	0.1	MCERTS	< 0.1	-	-	< 0.1	-
1,4-Dichlorobenzene	mg/kg	0.2	MCERTS	< 0.2	-	-	< 0.2	-
Bis(2-chloroisopropyl)ether	mg/kg	0.1	MCERTS	< 0.1	-	-	< 0.1	-
2-Methylphenol	mg/kg	0.3	MCERTS	< 0.3	-	-	< 0.3	-
Hexachloroethane	mg/kg	0.05	MCERTS	< 0.05	-	-	< 0.05	-
Nitrobenzene	mg/kg	0.3	MCERTS	< 0.3	-	-	< 0.3	-
4-Methylphenol	mg/kg	0.2	NONE	< 0.2	-	-	< 0.2	-
Isophorone	mg/kg	0.2	MCERTS	< 0.2	-	-	< 0.2	-
2-Nitrophenol	mg/kg	0.3	MCERTS	< 0.3	-	-	< 0.3	-
2,4-Dimethylphenol	mg/kg	0.3	MCERTS	< 0.3	-	-	< 0.3	-
Bis(2-chloroethoxy)methane	mg/kg	0.3	MCERTS	< 0.3	-	-	< 0.3	-
1,2,4-Trichlorobenzene	mg/kg	0.3	MCERTS	< 0.3	-	-	< 0.3	-
Naphthalene	mg/kg	0.05	MCERTS	< 0.05	-	-	0.25	-
2,4-Dichlorophenol	mg/kg	0.3	MCERTS	< 0.3	-	-	< 0.3	-
4-Chloroaniline	mg/kg	0.1	NONE	< 0.1	-	-	< 0.1	-
Hexachlorobutadiene	mg/kg	0.1	MCERTS	< 0.1	-	-	< 0.1	-
4-Chloro-3-methylphenol	mg/kg	0.1	NONE	< 0.1	-	-	< 0.1	-
2,4,6-Trichlorophenol	mg/kg	0.1	MCERTS	< 0.1	-	-	< 0.1	-
2,4,5-Trichlorophenol	mg/kg	0.2	MCERTS	< 0.2	-	-	< 0.2	-
2-Methylnaphthalene	mg/kg	0.1	NONE	< 0.1	-	-	< 0.1	-
2-Chloronaphthalene	mg/kg	0.1	MCERTS	< 0.1	-	-	< 0.1	-
Dimethylphthalate	mg/kg	0.1	MCERTS	< 0.1	-	-	< 0.1	-
2,6-Dinitrotoluene	mg/kg	0.1	MCERTS	< 0.1	-	-	< 0.1	-
Acenaphthylene	mg/kg	0.05	MCERTS	< 0.05	-	-	0.21	-
Acenaphthene	mg/kg	0.05	MCERTS	< 0.05	-	-	0.3	-
2,4-Dinitrotoluene	mg/kg	0.2	MCERTS	< 0.2	-	-	< 0.2	-
Dibenzofuran	mg/kg	0.2	MCERTS	< 0.2	-	-	< 0.2	-
4-Chlorophenyl phenyl ether	mg/kg	0.3	ISO 17025	< 0.3	-	-	< 0.3	-
Diethyl phthalate	mg/kg	0.2	MCERTS	< 0.2	-	-	< 0.2	-
4-Nitroaniline	mg/kg	0.2	MCERTS	< 0.2	-	-	< 0.2	-
Fluorene	mg/kg	0.05	MCERTS	< 0.05	-	-	0.23	-
Azobenzene	mg/kg	0.3	MCERTS	< 0.3	-	-	< 0.3	-
Bromophenyl phenyl ether	mg/kg	0.2	MCERTS	< 0.2	-	-	< 0.2	-
Hexachlorobenzene	mg/kg	0.3	MCERTS	< 0.3	-	-	< 0.3	-
Phenanthrene	mg/kg	0.05	MCERTS	0.8	-	-	2.7	-
Anthracene	mg/kg	0.05	MCERTS	< 0.05	-	-	0.52	-
Carbazole	mg/kg	0.3	MCERTS	< 0.3	-	-	< 0.3	-
Dibutyl phthalate	mg/kg	0.2	MCERTS	< 0.2	-	-	< 0.2	-
Anthraquinone	mg/kg	0.3	MCERTS	< 0.3	-	-	< 0.3	-
Fluoranthene	mg/kg	0.05	MCERTS	1.3	-	-	5.7	-
Pyrene	mg/kg	0.05	MCERTS	1.2	-	-	5.1	-
Butyl benzyl phthalate	mg/kg	0.3	ISO 17025	< 0.3	-	-	< 0.3	-
Benzo(a)anthracene	mg/kg	0.05	MCERTS	0.68	-	-	3.5	-
Chrysene	mg/kg	0.05	MCERTS	0.72	-	-	3.3	-
Benzo(b)fluoranthene	mg/kg	0.05	MCERTS	0.57	-	-	4.1	-
Benzo(k)fluoranthene	mg/kg	0.05	MCERTS	0.41	-	-	1.8	-
Benzo(a)pyrene	mg/kg	0.05	MCERTS	0.58	-	-	3.8	-

Analytical Report Number: 22-83806
Project / Site name: Homebase, Richmond

Lab Sample Number				2422973	2422974	2422975	2422976	2422977
Sample Reference				BH1	BH2	BH3	WSA	WSB
Sample Number				None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Depth (m)				1.00	0.80	0.60	0.50	0.50
Date Sampled				06/09/2022	06/09/2022	06/09/2022	06/09/2022	06/09/2022
Time Taken				None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Analytical Parameter (Soil Analysis)	**Units**	**Limit of detection**	**Accreditation Status**					
Indeno(1,2,3-cd)pyrene	mg/kg	0.05	MCERTS	0.26	-	-	1.7	-
Dibenz(a,h)anthracene	mg/kg	0.05	MCERTS	< 0.05	-	-	0.56	-
Benzo(ghi)perylene	mg/kg	0.05	MCERTS	0.34	-	-	2.1	-

U/S = Unsuitable Sample I/S = Insufficient Sample

Analytical Report Number: 22-83806
Project / Site name: Homebase, Richmond

Lab Sample Number				2422978	2422979	2422980	2422981	2422982
Sample Reference				WSB	WSC	WSD	WSD	WSE
Sample Number				None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Depth (m)				1.00	0.80	0.80	1.00	0.60
Date Sampled				06/09/2022	06/09/2022	06/09/2022	06/09/2022	06/09/2022
Time Taken				None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Analytical Parameter (Soil Analysis)	**Units**	**Limit of detection**	**Accreditation Status**					
Stone Content	%	0.1	NONE	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Moisture Content	%	0.01	NONE	5.8	6.2	5	4.3	5.1
Total mass of sample received	kg	0.001	NONE	0.4	0.4	0.4	0.4	0.4
Asbestos in Soil Screen / Identification Name	Type	N/A	ISO 17025	Chrysotile- Loose Fibres	-	-	-	Chrysotile- Loose Fibres
Asbestos in Soil	Type	N/A	ISO 17025	Detected	Not-detected	Not-detected	Not-detected	Detected
Asbestos Analyst ID	N/A	N/A	N/A	DSO	DSO	DSO	DSO	DSO
Total Phenols								
Total Phenols (monohydric)	mg/kg	1	MCERTS	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Speciated PAHs								
Naphthalene	mg/kg	0.05	MCERTS	0.43	0.37	-	0.6	< 0.05
Acenaphthylene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	-	< 0.05	< 0.05
Acenaphthene	mg/kg	0.05	MCERTS	0.98	0.41	-	< 0.05	< 0.05
Fluorene	mg/kg	0.05	MCERTS	0.95	0.44	-	< 0.05	< 0.05
Phenanthrene	mg/kg	0.05	MCERTS	5.6	3	-	1.5	0.22
Anthracene	mg/kg	0.05	MCERTS	0.87	0.51	-	0.21	< 0.05
Fluoranthene	mg/kg	0.05	MCERTS	4.9	3.1	-	2.2	0.66
Pyrene	mg/kg	0.05	MCERTS	3.9	2.6	-	1.9	0.9
Benzo(a)anthracene	mg/kg	0.05	MCERTS	2.1	1.6	-	1.4	0.5
Chrysene	mg/kg	0.05	MCERTS	1.4	1.4	-	1.1	0.6
Benzo(b)fluoranthene	mg/kg	0.05	MCERTS	1.9	1.7	-	1.5	0.58
Benzo(k)fluoranthene	mg/kg	0.05	MCERTS	0.67	0.58	-	0.55	0.39
Benzo(a)pyrene	mg/kg	0.05	MCERTS	1.6	1.5	-	1.2	0.48
Indeno(1,2,3-cd)pyrene	mg/kg	0.05	MCERTS	0.73	0.62	-	0.59	0.28
Dibenz(a,h)anthracene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	-	< 0.05	< 0.05
Benzo(ghi)perylene	mg/kg	0.05	MCERTS	0.92	0.88	-	0.74	0.37
Total PAH								
Speciated Total EPA-16 PAHs	mg/kg	0.8	MCERTS	26.9	18.7	-	13.3	4.98
Heavy Metals / Metalloids								
Arsenic (aqua regia extractable)	mg/kg	1	MCERTS	12	17	19	24	13
Barium (aqua regia extractable)	mg/kg	1	MCERTS	150	330	51	99	63
Beryllium (aqua regia extractable)	mg/kg	0.06	MCERTS	0.64	0.83	0.66	0.73	0.47
Boron (water soluble)	mg/kg	0.2	MCERTS	2.1	2.1	0.5	1.6	2
Cadmium (aqua regia extractable)	mg/kg	0.2	MCERTS	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2
Chromium (aqua regia extractable)	mg/kg	1	MCERTS	20	23	27	18	19
Copper (aqua regia extractable)	mg/kg	1	MCERTS	49	82	27	56	26
Lead (aqua regia extractable)	mg/kg	1	MCERTS	100	200	74	720	170
Mercury (aqua regia extractable)	mg/kg	0.3	MCERTS	< 0.3	< 0.3	0.6	1.1	< 0.3
Nickel (aqua regia extractable)	mg/kg	1	MCERTS	13	19	21	23	13
Selenium (aqua regia extractable)	mg/kg	1	MCERTS	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Vanadium (aqua regia extractable)	mg/kg	1	MCERTS	29	32	45	34	26
Zinc (aqua regia extractable)	mg/kg	1	MCERTS	130	140	81	130	54

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Project / Site name: Homebase, Richmond

Lab Sample Number				2422978	2422979	2422980	2422981	2422982
Sample Reference				WSB	WSC	WSD	WSD	WSE
Sample Number				None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Depth (m)				1.00	0.80	0.80	1.00	0.60
Date Sampled				06/09/2022	06/09/2022	06/09/2022	06/09/2022	06/09/2022
Time Taken				None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Analytical Parameter (Soil Analysis)	**Units**	**Limit of detection**	**Accreditation Status**					
Monoaromatics & Oxygenates								
Benzene	µg/kg	1	MCERTS	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Toluene	µg/kg	1	MCERTS	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Ethylbenzene	µg/kg	1	MCERTS	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
p & m-xylene	µg/kg	1	MCERTS	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
o-xylene	µg/kg	1	MCERTS	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
MTBE (Methyl Tertiary Butyl Ether)	µg/kg	1	MCERTS	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Petroleum Hydrocarbons								
TPH-CWG - Aliphatic >EC5 - EC6 $_{HS\_1D\_AL}$	mg/kg	0.001	MCERTS	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001
TPH-CWG - Aliphatic >EC6 - EC8 $_{HS\_1D\_AL}$	mg/kg	0.001	MCERTS	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001
TPH-CWG - Aliphatic >EC8 - EC10 $_{HS\_1D\_AL}$	mg/kg	0.001	MCERTS	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001
TPH-CWG - Aliphatic >EC10 - EC12 $_{EH\_CU\_1D\_AL}$	mg/kg	1	MCERTS	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
TPH-CWG - Aliphatic >EC12 - EC16 $_{EH\_CU\_1D\_AL}$	mg/kg	2	MCERTS	10	7	< 2.0	< 2.0	26
TPH-CWG - Aliphatic >EC16 - EC21 $_{EH\_CU\_1D\_AL}$	mg/kg	8	MCERTS	31	22	< 8.0	< 8.0	83
TPH-CWG - Aliphatic >EC21 - EC35 $_{EH\_CU\_1D\_AL}$	mg/kg	8	MCERTS	91	53	< 8.0	< 8.0	190
TPH-CWG - Aliphatic (EC5 - EC35) $_{EH\_CU+HS\_1D\_AL}$	mg/kg	10	MCERTS	130	83	< 10	< 10	300
TPH-CWG - Aromatic >EC5 - EC7 $_{HS\_1D\_AR}$	mg/kg	0.001	MCERTS	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001
TPH-CWG - Aromatic >EC7 - EC8 $_{HS\_1D\_AR}$	mg/kg	0.001	MCERTS	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001
TPH-CWG - Aromatic >EC8 - EC10 $_{HS\_1D\_AR}$	mg/kg	0.001	MCERTS	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001
TPH-CWG - Aromatic >EC10 - EC12 $_{EH\_CU\_1D\_AR}$	mg/kg	1	MCERTS	8.8	< 1.0	< 1.0	< 1.0	< 1.0
TPH-CWG - Aromatic >EC12 - EC16 $_{EH\_CU\_1D\_AR}$	mg/kg	2	MCERTS	19	8.3	< 2.0	< 2.0	< 2.0
TPH-CWG - Aromatic >EC16 - EC21 $_{EH\_CU\_1D\_AR}$	mg/kg	10	MCERTS	37	23	< 10	< 10	< 10
TPH-CWG - Aromatic >EC21 - EC35 $_{EH\_CU\_1D\_AR}$	mg/kg	10	MCERTS	70	54	< 10	15	< 10
TPH-CWG - Aromatic (EC5 - EC35) $_{EH\_CU+HS\_1D\_AR}$	mg/kg	10	MCERTS	140	85	< 10	23	< 10

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Project / Site name: Homebase, Richmond

Lab Sample Number				2422978	2422979	2422980	2422981	2422982
Sample Reference				WSB	WSC	WSD	WSD	WSE
Sample Number				None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Depth (m)				1.00	0.80	0.80	1.00	0.60
Date Sampled				06/09/2022	06/09/2022	06/09/2022	06/09/2022	06/09/2022
Time Taken				None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Analytical Parameter (Soil Analysis)	**Units**	**Limit of detection**	**Accreditation Status**					
VOCs								
Chloromethane	µg/kg	1	ISO 17025	-	-	< 1.0	-	-
Chloroethane	µg/kg	1	NONE	-	-	< 1.0	-	-
Bromomethane	µg/kg	1	ISO 17025	-	-	< 1.0	-	-
Vinyl Chloride	µg/kg	1	NONE	-	-	< 1.0	-	-
Trichlorofluoromethane	µg/kg	1	NONE	-	-	< 1.0	-	-
1,1-Dichloroethene	µg/kg	1	NONE	-	-	< 1.0	-	-
1,1,2-Trichloro 1,2,2-Trifluoroethane	µg/kg	1	ISO 17025	-	-	< 1.0	-	-
Cis-1,2-dichloroethene	µg/kg	1	MCERTS	-	-	< 1.0	-	-
MTBE (Methyl Tertiary Butyl Ether)	µg/kg	1	MCERTS	-	-	< 1.0	-	-
1,1-Dichloroethane	µg/kg	1	MCERTS	-	-	< 1.0	-	-
2,2-Dichloropropane	µg/kg	1	MCERTS	-	-	< 1.0	-	-
Trichloromethane	µg/kg	1	MCERTS	-	-	< 1.0	-	-
1,1,1-Trichloroethane	µg/kg	1	MCERTS	-	-	< 1.0	-	-
1,2-Dichloroethane	µg/kg	1	MCERTS	-	-	< 1.0	-	-
1,1-Dichloropropene	µg/kg	1	MCERTS	-	-	< 1.0	-	-
Trans-1,2-dichloroethene	µg/kg	1	NONE	-	-	< 1.0	-	-
Benzene	µg/kg	1	MCERTS	-	-	< 1.0	-	-
Tetrachloromethane	µg/kg	1	MCERTS	-	-	< 1.0	-	-
1,2-Dichloropropane	µg/kg	1	MCERTS	-	-	< 1.0	-	-
Trichloroethene	µg/kg	1	MCERTS	-	-	< 1.0	-	-
Dibromomethane	µg/kg	1	MCERTS	-	-	< 1.0	-	-
Bromodichloromethane	µg/kg	1	MCERTS	-	-	< 1.0	-	-
Cis-1,3-dichloropropene	µg/kg	1	ISO 17025	-	-	< 1.0	-	-
Trans-1,3-dichloropropene	µg/kg	1	ISO 17025	-	-	< 1.0	-	-
Toluene	µg/kg	1	MCERTS	-	-	< 1.0	-	-
1,1,2-Trichloroethane	µg/kg	1	MCERTS	-	-	< 1.0	-	-
1,3-Dichloropropane	µg/kg	1	ISO 17025	-	-	< 1.0	-	-
Dibromochloromethane	µg/kg	1	ISO 17025	-	-	< 1.0	-	-
Tetrachloroethene	µg/kg	1	NONE	-	-	< 1.0	-	-
1,2-Dibromoethane	µg/kg	1	ISO 17025	-	-	< 1.0	-	-
Chlorobenzene	µg/kg	1	MCERTS	-	-	< 1.0	-	-
1,1,1,2-Tetrachloroethane	µg/kg	1	MCERTS	-	-	< 1.0	-	-
Ethylbenzene	µg/kg	1	MCERTS	-	-	< 1.0	-	-
p & m-Xylene	µg/kg	1	MCERTS	-	-	< 1.0	-	-
Styrene	µg/kg	1	MCERTS	-	-	< 1.0	-	-
Tribromomethane	µg/kg	1	NONE	-	-	< 1.0	-	-
o-Xylene	µg/kg	1	MCERTS	-	-	< 1.0	-	-
1,1,2,2-Tetrachloroethane	µg/kg	1	MCERTS	-	-	< 1.0	-	-
Isopropylbenzene	µg/kg	1	MCERTS	-	-	< 1.0	-	-
Bromobenzene	µg/kg	1	MCERTS	-	-	< 1.0	-	-
n-Propylbenzene	µg/kg	1	ISO 17025	-	-	< 1.0	-	-
2-Chlorotoluene	µg/kg	1	MCERTS	-	-	< 1.0	-	-
4-Chlorotoluene	µg/kg	1	MCERTS	-	-	< 1.0	-	-
1,3,5-Trimethylbenzene	µg/kg	1	ISO 17025	-	-	< 1.0	-	-
tert-Butylbenzene	µg/kg	1	MCERTS	-	-	< 1.0	-	-
1,2,4-Trimethylbenzene	µg/kg	1	ISO 17025	-	-	< 1.0	-	-
sec-Butylbenzene	µg/kg	1	MCERTS	-	-	< 1.0	-	-
1,3-Dichlorobenzene	µg/kg	1	ISO 17025	-	-	< 1.0	-	-
p-Isopropyltoluene	µg/kg	1	ISO 17025	-	-	< 1.0	-	-
1,2-Dichlorobenzene	µg/kg	1	MCERTS	-	-	< 1.0	-	-
1,4-Dichlorobenzene	µg/kg	1	MCERTS	-	-	< 1.0	-	-
Butylbenzene	µg/kg	1	MCERTS	-	-	< 1.0	-	-

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Project / Site name: Homebase, Richmond

Lab Sample Number				2422978	2422979	2422980	2422981	2422982
Sample Reference				WSB	WSC	WSD	WSD	WSE
Sample Number				None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Depth (m)				1.00	0.80	0.80	1.00	0.60
Date Sampled				06/09/2022	06/09/2022	06/09/2022	06/09/2022	06/09/2022
Time Taken				None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Analytical Parameter (Soil Analysis)	Units	Limit of detection	Accreditation Status					
1,2-Dibromo-3-chloropropane	µg/kg	1	ISO 17025	-	-	< 1.0	-	-
1,2,4-Trichlorobenzene	µg/kg	1	MCERTS	-	-	< 1.0	-	-
Hexachlorobutadiene	µg/kg	1	MCERTS	-	-	< 1.0	-	-
1,2,3-Trichlorobenzene	µg/kg	1	ISO 17025	-	-	< 1.0	-	-

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Project / Site name: Homebase, Richmond

Lab Sample Number				2422978	2422979	2422980	2422981	2422982
Sample Reference				WSB	WSC	WSD	WSD	WSE
Sample Number				None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Depth (m)				1.00	0.80	0.80	1.00	0.60
Date Sampled				06/09/2022	06/09/2022	06/09/2022	06/09/2022	06/09/2022
Time Taken				None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Analytical Parameter (Soil Analysis)	**Units**	**Limit of detection**	**Accreditation Status**					
SVOCs								
Aniline	mg/kg	0.1	NONE	-	-	< 0.1	-	-
Phenol	mg/kg	0.2	ISO 17025	-	-	< 0.2	-	-
2-Chlorophenol	mg/kg	0.1	MCERTS	-	-	< 0.1	-	-
Bis(2-chloroethyl)ether	mg/kg	0.2	MCERTS	-	-	< 0.2	-	-
1,3-Dichlorobenzene	mg/kg	0.2	MCERTS	-	-	< 0.2	-	-
1,2-Dichlorobenzene	mg/kg	0.1	MCERTS	-	-	< 0.1	-	-
1,4-Dichlorobenzene	mg/kg	0.2	MCERTS	-	-	< 0.2	-	-
Bis(2-chloroisopropyl)ether	mg/kg	0.1	MCERTS	-	-	< 0.1	-	-
2-Methylphenol	mg/kg	0.3	MCERTS	-	-	< 0.3	-	-
Hexachloroethane	mg/kg	0.05	MCERTS	-	-	< 0.05	-	-
Nitrobenzene	mg/kg	0.3	MCERTS	-	-	< 0.3	-	-
4-Methylphenol	mg/kg	0.2	NONE	-	-	< 0.2	-	-
Isophorone	mg/kg	0.2	MCERTS	-	-	< 0.2	-	-
2-Nitrophenol	mg/kg	0.3	MCERTS	-	-	< 0.3	-	-
2,4-Dimethylphenol	mg/kg	0.3	MCERTS	-	-	< 0.3	-	-
Bis(2-chloroethoxy)methane	mg/kg	0.3	MCERTS	-	-	< 0.3	-	-
1,2,4-Trichlorobenzene	mg/kg	0.3	MCERTS	-	-	< 0.3	-	-
Naphthalene	mg/kg	0.05	MCERTS	-	-	< 0.05	-	-
2,4-Dichlorophenol	mg/kg	0.3	MCERTS	-	-	< 0.3	-	-
4-Chloroaniline	mg/kg	0.1	NONE	-	-	< 0.1	-	-
Hexachlorobutadiene	mg/kg	0.1	MCERTS	-	-	< 0.1	-	-
4-Chloro-3-methylphenol	mg/kg	0.1	NONE	-	-	< 0.1	-	-
2,4,6-Trichlorophenol	mg/kg	0.1	MCERTS	-	-	< 0.1	-	-
2,4,5-Trichlorophenol	mg/kg	0.2	MCERTS	-	-	< 0.2	-	-
2-Methylnaphthalene	mg/kg	0.1	NONE	-	-	< 0.1	-	-
2-Chloronaphthalene	mg/kg	0.1	MCERTS	-	-	< 0.1	-	-
Dimethylphthalate	mg/kg	0.1	MCERTS	-	-	< 0.1	-	-
2,6-Dinitrotoluene	mg/kg	0.1	MCERTS	-	-	< 0.1	-	-
Acenaphthylene	mg/kg	0.05	MCERTS	-	-	< 0.05	-	-
Acenaphthene	mg/kg	0.05	MCERTS	-	-	< 0.05	-	-
2,4-Dinitrotoluene	mg/kg	0.2	MCERTS	-	-	< 0.2	-	-
Dibenzofuran	mg/kg	0.2	MCERTS	-	-	< 0.2	-	-
4-Chlorophenyl phenyl ether	mg/kg	0.3	ISO 17025	-	-	< 0.3	-	-
Diethyl phthalate	mg/kg	0.2	MCERTS	-	-	< 0.2	-	-
4-Nitroaniline	mg/kg	0.2	MCERTS	-	-	< 0.2	-	-
Fluorene	mg/kg	0.05	MCERTS	-	-	< 0.05	-	-
Azobenzene	mg/kg	0.3	MCERTS	-	-	< 0.3	-	-
Bromophenyl phenyl ether	mg/kg	0.2	MCERTS	-	-	< 0.2	-	-
Hexachlorobenzene	mg/kg	0.3	MCERTS	-	-	< 0.3	-	-
Phenanthrene	mg/kg	0.05	MCERTS	-	-	0.23	-	-
Anthracene	mg/kg	0.05	MCERTS	-	-	< 0.05	-	-
Carbazole	mg/kg	0.3	MCERTS	-	-	< 0.3	-	-
Dibutyl phthalate	mg/kg	0.2	MCERTS	-	-	< 0.2	-	-
Anthraquinone	mg/kg	0.3	MCERTS	-	-	< 0.3	-	-
Fluoranthene	mg/kg	0.05	MCERTS	-	-	0.53	-	-
Pyrene	mg/kg	0.05	MCERTS	-	-	0.48	-	-
Butyl benzyl phthalate	mg/kg	0.3	ISO 17025	-	-	< 0.3	-	-
Benzo(a)anthracene	mg/kg	0.05	MCERTS	-	-	0.35	-	-
Chrysene	mg/kg	0.05	MCERTS	-	-	0.29	-	-
Benzo(b)fluoranthene	mg/kg	0.05	MCERTS	-	-	0.42	-	-
Benzo(k)fluoranthene	mg/kg	0.05	MCERTS	-	-	0.17	-	-
Benzo(a)pyrene	mg/kg	0.05	MCERTS	-	-	0.38	-	-

Analytical Report Number: 22-83806
Project / Site name: Homebase, Richmond

Lab Sample Number				2422978	2422979	2422980	2422981	2422982
Sample Reference				WSB	WSC	WSD	WSD	WSE
Sample Number				None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Depth (m)				1.00	0.80	0.80	1.00	0.60
Date Sampled				06/09/2022	06/09/2022	06/09/2022	06/09/2022	06/09/2022
Time Taken				None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Analytical Parameter (Soil Analysis)	Units	Limit of detection	Accreditation Status					
Indeno(1,2,3-cd)pyrene	mg/kg	0.05	MCERTS	-	-	0.21	-	-
Dibenz(a,h)anthracene	mg/kg	0.05	MCERTS	-	-	< 0.05	-	-
Benzo(ghi)perylene	mg/kg	0.05	MCERTS	-	-	0.26	-	-

U/S = Unsuitable Sample I/S = Insufficient Sample

Analytical Report Number : 22-83806
Project / Site name: Homebase, Richmond

* These descriptions are only intended to act as a cross check if sample identities are questioned. The major constituent of the sample is intended to act with respect to MCERTS validation. The laboratory is accredited for sand, clay and loam (MCERTS) soil types. Data for unaccredited types of solid should be interpreted with care.

Stone content of a sample is calculated as the % weight of the stones not passing a 10 mm sieve. Results are not corrected for stone content.

Lab Sample Number	Sample Reference	Sample Number	Depth (m)	Sample Description *
2422973	BH1	None Supplied	1	Brown clay and sand with gravel.
2422974	BH2	None Supplied	0.8	Brown clay and sand with gravel and vegetation.
2422975	BH3	None Supplied	0.6	Brown clay and sand with gravel.
2422976	WSA	None Supplied	0.5	Brown clay and sand with gravel and rubble.
2422977	WSB	None Supplied	0.5	Brown sand with gravel and rubble.
2422978	WSB	None Supplied	1	Brown loam and sand with gravel.
2422979	WSC	None Supplied	0.8	Brown loam and sand with gravel.
2422980	WSD	None Supplied	0.8	Brown loam and sand with gravel and vegetation.
2422981	WSD	None Supplied	1	Brown sandy loam with gravel and vegetation.
2422982	WSE	None Supplied	0.6	Brown sandy loam with gravel.

Analytical Report Number : 22-83806
Project / Site name: Homebase, Richmond

Water matrix abbreviations:
Surface Water (SW) Potable Water (PW) Ground Water (GW) Process Waters (PrW) Final Sewage Effluent (FSE) Landfill Leachate (LL)

Analytical Test Name	Analytical Method Description	Analytical Method Reference	Method number	Wet / Dry Analysis	Accreditation Status
Metals in soil by ICP-OES	Determination of metals in soil by aqua-regia digestion followed by ICP-OES.	In-house method based on MEWAM 2006 Methods for the Determination of Metals in Soil.	L038-PL	D	MCERTS
Asbestos identification in soil	Asbestos Identification with the use of polarised light microscopy in conjunction with dispersion staining techniques.	In house method based on HSG 248	A001-PL	D	ISO 17025
Boron, water soluble, in soil	Determination of water soluble boron in soil by hot water extract followed by ICP-OES.	In-house method based on Second Site Properties version 3	L038-PL	D	MCERTS
Moisture Content	Moisture content, determined gravimetrically. (30 oC)	In house method.	L019-UK/PL	W	NONE
Monohydric phenols in soil	Determination of phenols in soil by extraction with sodium hydroxide followed by distillation followed by colorimetry.	In-house method based on Examination of Water and Wastewater 20th Edition: Clesceri, Greenberg & Eaton (skalar)	L080-PL	W	MCERTS
Speciated EPA-16 PAHs in soil	Determination of PAH compounds in soil by extraction in dichloromethane and hexane followed by GC-MS with the use of surrogate and internal standards.	In-house method based on USEPA 8270	L064-PL	D	MCERTS
Stones content of soil	Standard preparation for all samples unless otherwise detailed. Gravimetric determination of stone > 10 mm as % dry weight.	In-house method based on British Standard Methods and MCERTS requirements.	L019-UK/PL	D	NONE
Semi-volatile organic compounds in soil	Determination of semi-volatile organic compounds in soil by extraction in dichloromethane and hexane followed by GC-MS.	In-house method based on USEPA 8270	L064-PL	D	MCERTS
Volatile organic compounds in soil	Determination of volatile organic compounds in soil by headspace GC-MS.	In-house method based on USEPA8260	L073B-PL	W	MCERTS
BTEX and MTBE in soil (Monoaromatics)	Determination of BTEX in soil by headspace GC-MS.	In-house method based on USEPA8260	L073B-PL	W	MCERTS
TPHCWG (Soil)	Determination of hexane extractable hydrocarbons in soil by GC-MS/GC-FID.	In-house method with silica gel split/clean up.	L088/76-PL	W	MCERTS

For method numbers ending in 'UK' analysis have been carried out in our laboratory in the United Kingdom.
For method numbers ending in 'PL' analysis have been carried out in our laboratory in Poland.
Unless otherwise indicated, site information, order number, project number, sampling date, time, sample reference and depth are provided by the client. The instructed on date indicates the date on which this information was provided to the laboratory.

Analytical Report Number : 22-83806
Project / Site name: Homebase, Richmond

Water matrix abbreviations:
Surface Water (SW) Potable Water (PW) Ground Water (GW) Process Waters (PrW) Final Sewage Effluent (FSE) Landfill Leachate (LL)

Analytical Test Name	Analytical Method Description	Analytical Method Reference	Method number	Wet / Dry Analysis	Accreditation Status

Information in Support of Analytical Results

List of HWOL Acronyms and Operators

Acronym	Descriptions
HS	Headspace Analysis
MS	Mass spectrometry
FID	Flame Ionisation Detector
GC	Gas Chromatography
EH	Extractable Hydrocarbons (i.e. everything extracted by the solvent(s))
CU	Clean-up - e.g. by Florisil®, silica gel
1D	GC - Single coil/column gas chromatography
2D	GC-GC - Double coil/column gas chromatography
Total	Aliphatics & Aromatics
AL	Aliphatics
AR	Aromatics
#1	EH_2D_Total but with humics mathematically subtracted
#2	EH_2D_Total but with fatty acids mathematically subtracted
_	Operator - understore to separate acronyms (exception for +)
+	Operator to indicate cumulative e.g. EH+HS_Total or EH_CU+HS_Total

APPENDIX E

FIGURES

Homebase, 84 Manor Road,
Richmond Upon Thames,
TW9 1YB

Site Plan

Scale: unknown

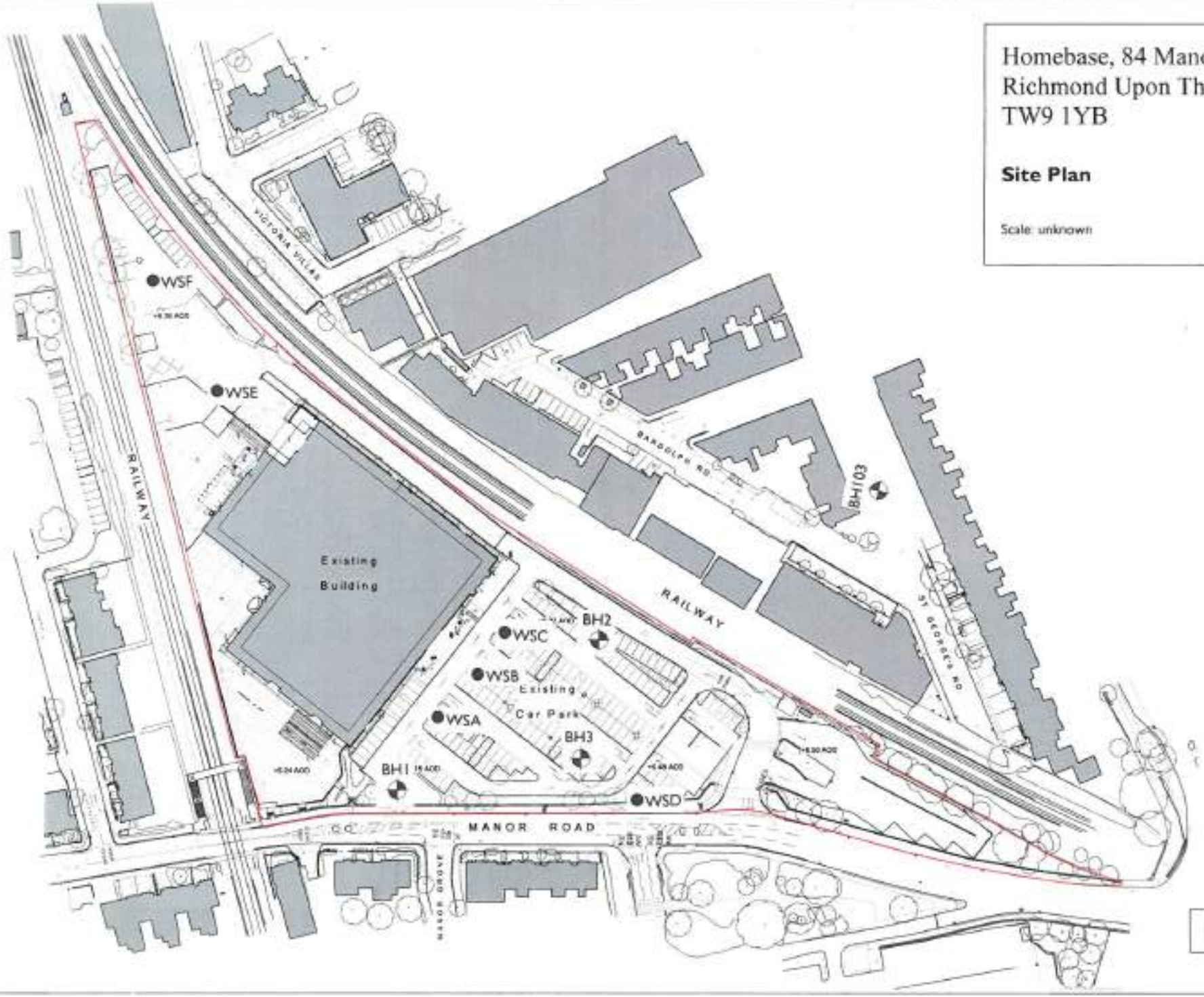
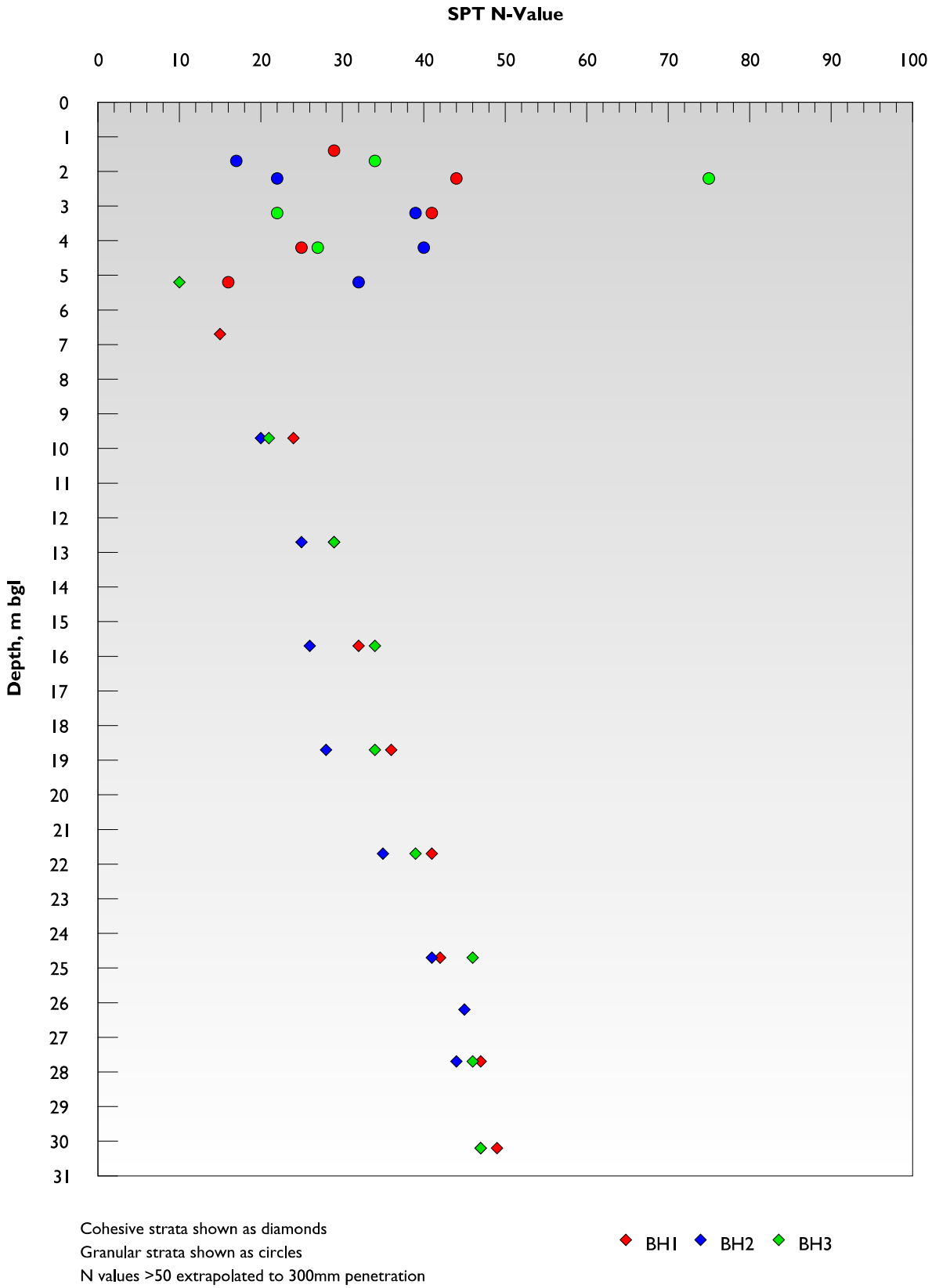


Figure 1


Homebase, 84 Manor Road,
Richmond Upon Thames,
TW9 1YB
Proposed Layout
Scale: unknown
Figure 2

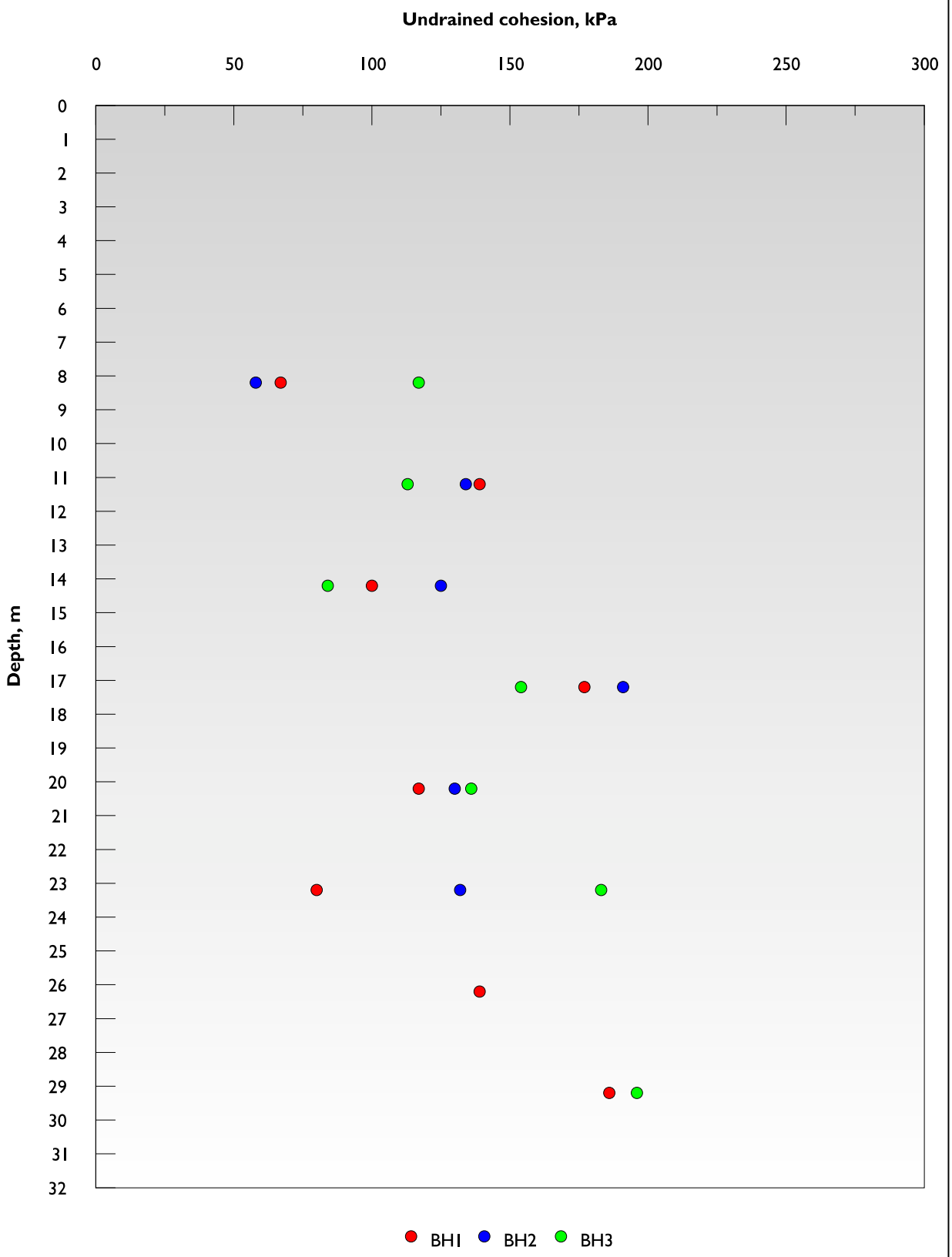
SPT PROFILE
HOMEBASE, 84 MANOR ROAD, RICHMOND



MANHIRE ASSOCIATES
GEO-ENVIRONMENTAL LIMITED

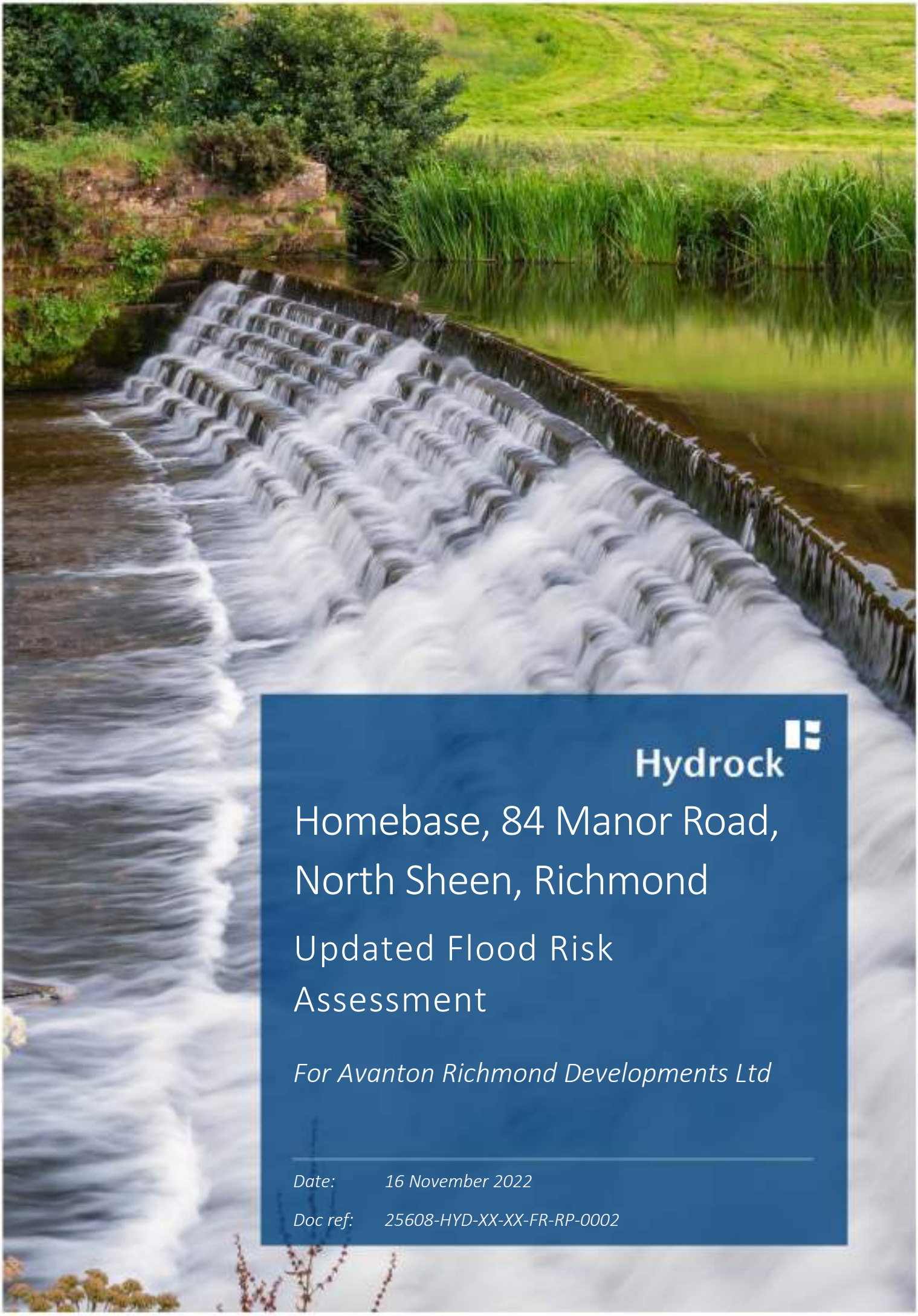
Figure 3

SHEAR STRENGTH PROFILE
HOMEBASE, 84 MANOR ROAD, RICHMOND



APPENDIX D

FLOOD RISK ASSESSMENT



Hydrock

Homebase, 84 Manor Road, North Sheen, Richmond

Updated Flood Risk Assessment

For Avanton Richmond Developments Ltd

Date: *16 November 2022*

Doc ref: *25608-HYD-XX-XX-FR-RP-0002*

DOCUMENT CONTROL SHEET

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P01	S2	16/11/2022	First Issue - For Comment

CONTENTS

Tables

Figures

1. INTRODUCTION

This report has been prepared by Hydrock Consultants Limited (Hydrock) on behalf of our client Avanton Richmond Developments Ltd in support of a Planning Application for a residential development on the former Homebase Site, at 84 Manor Road, North Sheen, Richmond. This report is to act as an updated report to that submitted as part of the previous application and undertaken by Fairhurst (Ref: 126782-RP-X-0001, Date: 15/07/2020)

Local Planning Authorities are advised by the Government's National Planning Policy Framework (NPPF) to consult the Environment Agency (EA) and Lead Local Flood Authority (LLFA) on development proposals in areas at risk of flooding. For a development of this nature the EA and LLFA normally require a Flood Risk Assessment to be submitted in support of such an application. The report has been prepared to consider the requirements of NPPF through:

- Assessing whether the proposed development is likely to be affected by flooding;
- Assessing whether the proposed development is appropriate in the suggested location, and,
- Detailing measures necessary to mitigate any flood risk identified, to ensure that the proposed development and occupants would be safe, and that flood risk would not be increased elsewhere.

The report considers the requirements for undertaking a Flood Risk Assessment as stipulated in NPPF Technical Guidance. Only those requirements that are appropriate to a development of this nature have been considered in the compilation of this report.

This report has been prepared in accordance with current EA Policy.

2. SITE INFORMATION

2.1 Site Location

The site is located at the former Homebase site at 84 Manor Road, North Sheen, Richmond. It is triangular in shape and bound by the railway line to the south and north west boundaries and by Manor Road to the East. The site is surrounded by a combination of residential and commercial developments.

The approximate site address and Ordnance Survey grid reference is shown in Table 1 with the site location shown in Figure 1.

Table 1: Site Referencing Information

Site Referencing Information	
Site Address	Former Homebase 84 Manor Road North Sheen Richmond TW9 1YB
Grid Reference	518901, 175426

Figure 1: Site Location

2.2 Topography

The Topographical Survey indicates the site to be approximately 7mAOD at the east of the site, sloping to approximately 6mAOD at the south west of the site. The south west of the site is contained by a retaining wall with the railway alongside the site at approximately 7.3mAOD.

2.3 Existing Development

The total site area is 1.65ha which is almost entirely impermeable either (i) under buildings or (ii) paved parking, roads and other hardstanding areas.

2.4 Proposed Development

The submitted planning application is for *"Demolition of existing buildings and structures and comprehensive phased residential-led redevelopment to provide residential units (Class C3), flexible commercial, business and service uses (Class E), provision of car and cycle parking, landscaping, public and private open spaces and all other necessary enabling works."*

2.5 Planning History

The site has been submitted for planning in 2019 to the London Borough of Richmond - upon - Thames (application no. 19/0510/FUL). Richmond Council has resolved to refuse permission for this application, however, the Mayor of London considered that the development is of a nature or scale that it would have a significant impact on the implementation of the London Plan policies on housing and affordable housing. Therefore, a direction has been made under Article 7 of the 2008 Order that Richmond Council be advised that the Mayor will act as the local planning authority for the purposes of determining this application.

This report is to serve as an update to those submitted as part of the previous, and refused, planning submission. All elements within this report have been discussed with the GLA.

3. SOURCES OF FLOOD RISK

3.1 Fluvial / Tidal Flooding

The site is located south of a bend in the River Thames located 1.5 km north west and 1.5km east at its closest points respectively, flowing in a generally easterly direction.

The current Environment Agency (EA) Flood Zone Maps (Figure 2) shows the site to be entirely within Flood Zone 1 (Low Risk) with the closest area of Flood Zone associated with the River Thames approximately 400m to the east.

Figure 2: Flood Map for Planning

For reference, the Environment Agency Flood Zones are defined as follows:

- Flood Zone 1 (Low Risk) comprises land assessed as having a ≤0.1% AEP of fluvial or tidal flooding in any given year, equivalent to the ≥1,000yr return period flood event.
- Flood Zone 2 (Medium Risk) comprises land assessed as having a 0.1-1% AEP of fluvial flooding or 0.1-0.5% AEP of tidal flooding in any given year, equivalent to the 1,000-100yr return period flood event.
- Flood Zone 3 (High Risk) comprises land assessed as having a ≥1% AEP of fluvial flooding or ≥0.5% AEP tidal flooding in any given year, equivalent to the ≤100yr return period flood event.

Neither the London Borough of Richmond upon Thames Strategic Flood Risk Assessment nor the EA Recorded Flood Outlines indicate the site to have been impacted by previous incidents of fluvial flooding.

Whilst the potential effects of climate change could increase frequency, depth and extent of fluvial flooding, given the lack of main watercourses in the immediate vicinity of the site, any increase in flood risk is considered unlikely to be of a magnitude so as to result in on-site fluvial flooding. The site can therefore be concluded to be at 'low' risk of fluvial flooding.

3.2 Tidal Flooding

The River Thames is considered to be tidal within the borough of Richmond upon Thames. However, as the site lies within Flood Zone 1 it is considered to be at Low risk of Tidal Flooding.

3.3 Surface Water Flooding

Surface water flooding occurs as the result of an inability of intense rainfall to infiltrate the ground. This often happens when the maximum soil infiltration rate or storage capacity is reached. Flows generated by such events either enter existing land drainage features or follow the general topography which can concentrate flows and lead to localised ponding/flooding.

The EA Surface Water Flood Risk Map (Figure 3) shows the site predominantly at 'Low risk' of surface water flooding, with some isolated patches of medium risk within the south of the site and along the north west boundary associated with the railway line. There are some 'high risk' areas (>10%) around the edge of the building.

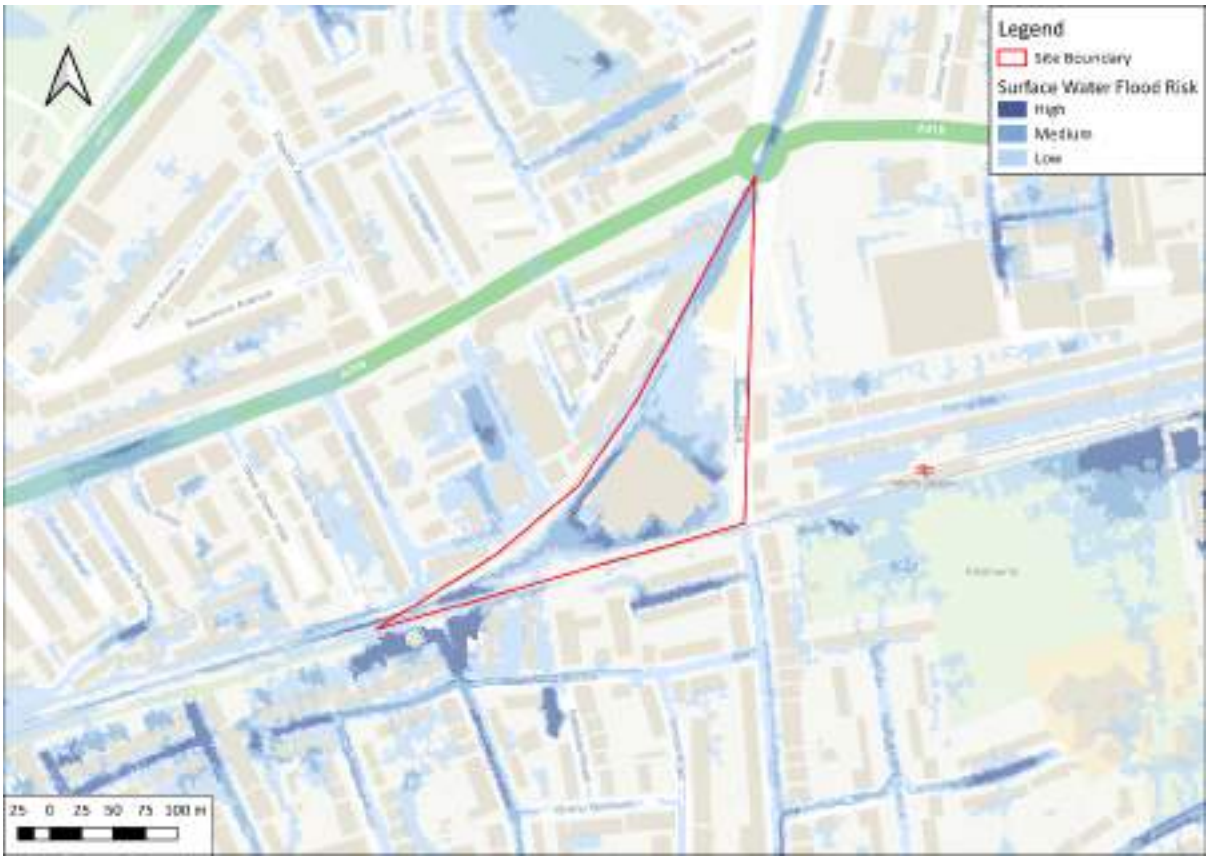


Figure 3: Surface Water Flooding

In the low-risk scenario depths range from below 300mm to 900mm, whilst in the high-risk scenario the site is predominantly free from surface water flooding except for a few isolated pockets around the boundary of the existing building more likely to be associated with topographical depressions than a surface water flow route.

Figure 4: High Risk Scenario - Surface Water Flooding

The Strategic Flood Risk Assessment shows depths of flooding across the site. Figure 5 shows during the 1 in 100-year event depths are between 0.15 to 0.3m in the southern part of the site whilst the northern part of the site is free from surface water flooding.

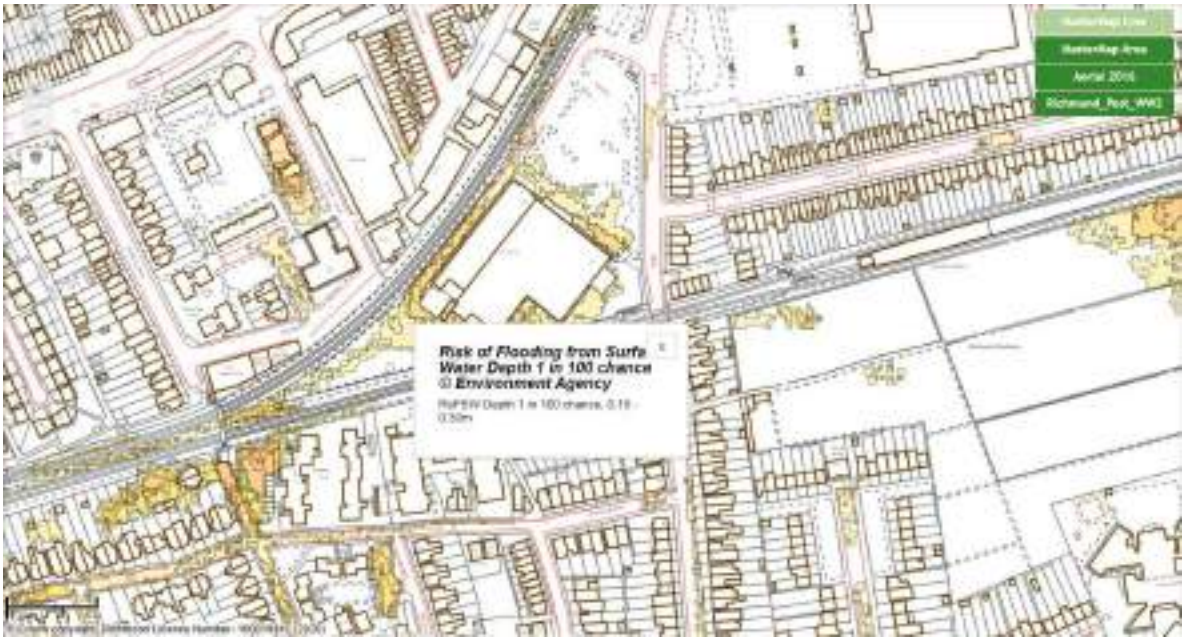


Figure 5: SFRA Surface Water Flood Depths

It should be noted that the EA mapping does not take into account of existing positive drainage systems in the vicinity and given the sites location in a highly developed area are likely to be extensive. Such a system would likely mitigate the risk of any overland flows entering the site.

3.3.1 Surface Water Modelling

Given the indicated risk of surface water flooding on the site, additional hydraulic modelling has been undertaken by Hydrock to confirm existing risk and ensure any risk post-development can be safely managed and / or mitigated. Full details and methodology of the hydraulic modelling are included within the Hydraulic Modelling report (Ref: 25608-HYD-XX-XX-RP-FR-0003). In line with standard modelling practice and guidance, no accommodation has been made for onsite drainage and as such the results are considered conservative and likely an over-estimation of the flood risk on site.

Results of the hydraulic modelling confirm in existing conditions, the site is predicted to lie within a key surface water flow route as shown by the current EA Mapping. This surface water flow route is indicated to occur in all modelled scenarios except the smallest 1 in 5-year and -30-year. Surface water flows are indicated to enter the site via the south western and southern boundaries and flow around the existing Homebase developments on site eventually discharging to the adjacent railway along the north western boundary. The results also confirm that flooding is predicted to also pond around the existing building with depths reaching up to 0.5m in places in the 1 in 100-year plus climate change design event (Figure 6).

The results of the modelling also indicate significant flooding to be present on the adjacent railway line along the north western boundary. Predominantly flows enter the railway line after they flow through the site and due to ground levels, these flows are shown to be attenuated on this land in all scenarios with maximum depths approximately 1.5m in the climate change design event.

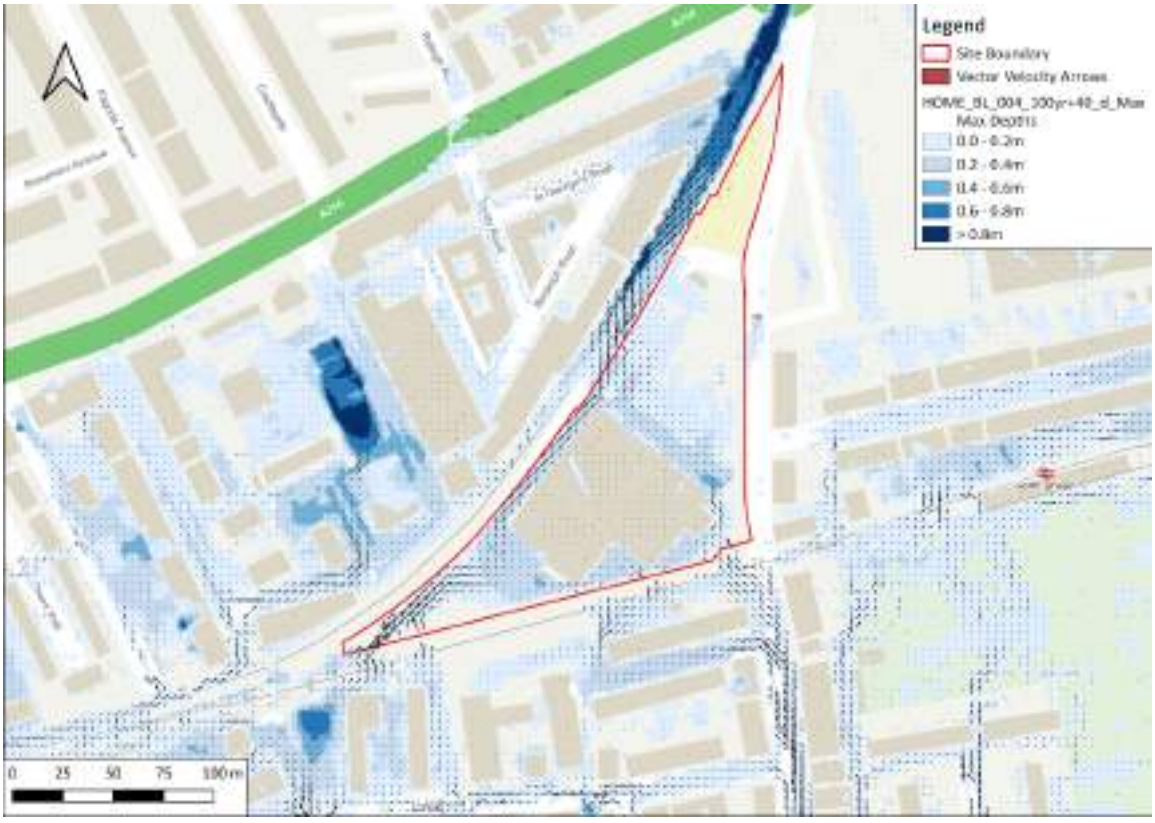


Figure 6. Baseline Modelling - 1 in 100-year plus 40% Climate Change Maximum Depths and Velocity

Following confirmation of the existing risk to site, an exercise was undertaken to confirm risk following the development of the proposed residential and commercial units. Proposed building footprints, FFLs and landscaping levels were included with localised lowering of public realm areas to maintain the existing flow route through the site and where possible attenuate flows as it occurs within the baseline scenario (i.e. deviate from the existing mechanisms as little as possible).

Results of the post development modelling indicate flows would not be restricted and the key flow route from the south west corner would be maintained, with the surface water flow route following topography through the site around the proposed developments. Flooding is predicted to be at its deepest in the south west corner and in the central courtyard area (which has been designed as such) with maximum onsite depths in this scenario indicated to be approximately 500mm, but the majority of onsite flooding is predicted to be below 200mm and considered "shallow".

On site levels have been graded to ensure the existing flow route onto the railway is maintained but managed through the site. Results show an increase of approximately 25mm (and within model tolerance for surface water modelling) onto the railway however the modelling does not include any impacts of on-site surface water drainage features or infiltration which is expected to cause a significant reduction in all flood events. Given this, the modelling is considered to be extremely conservative and as such the increase to the railway considered to be a negligible increase (within acceptable model tolerance) given the existing large depths (>1000mm) already predicted.

The proposed development scenario indicates potential "internal" flooding to Blocks C, D and the entrance of Block A with a maximum depth of 80mm predicted (shown in Block C). Predicted flood maximum flood levels around the proposed blocks are shown below:

Table 2. Post-Development Predicted Maximum Flood Levels - 1 in 100 year plus 40% Climate Change Event

	Maximum Flood Level (mAOD)
Block A	6.48
Block B	6.38
Block C	6.51
Block D	6.79

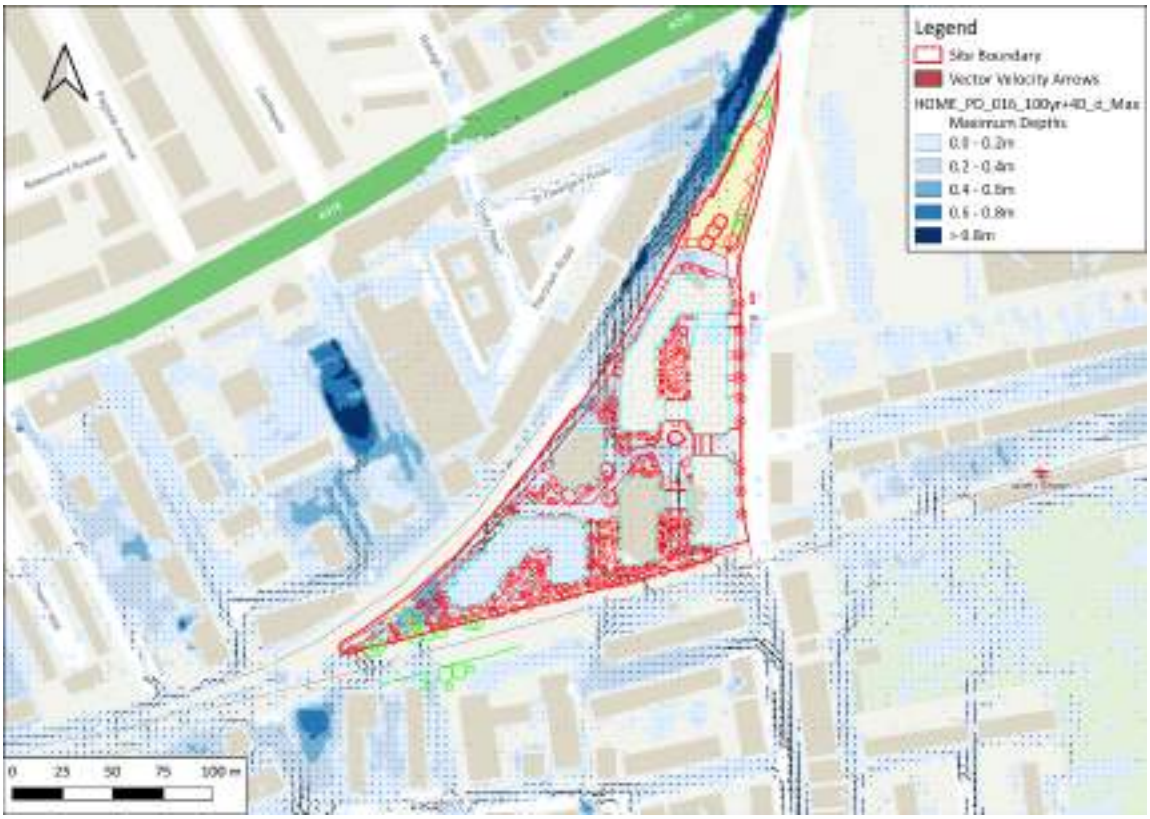


Figure 7. Proposed Development Modelling - 1 in 100-year plus 40% Climate Change Maximum Depths and Velocity

The modelling therefore confirms the site to be at risk of surface water flooding in both the present day and future scenarios and as such, following discussions with the GLA, recommended mitigation has been provided in Section 4.2.

3.4 Groundwater Flooding

According to the BGS Geology viewer the site is underlain by bedrock of the London Clay Formation comprising clay and silt, with superficial deposits of the Kempton Park Gravel Member comprising sand and gravel, suggesting variable permeability.

A borehole undertaken in 1999 in close proximity to the site shows that groundwater was encountered at a depth of 3m bgl.

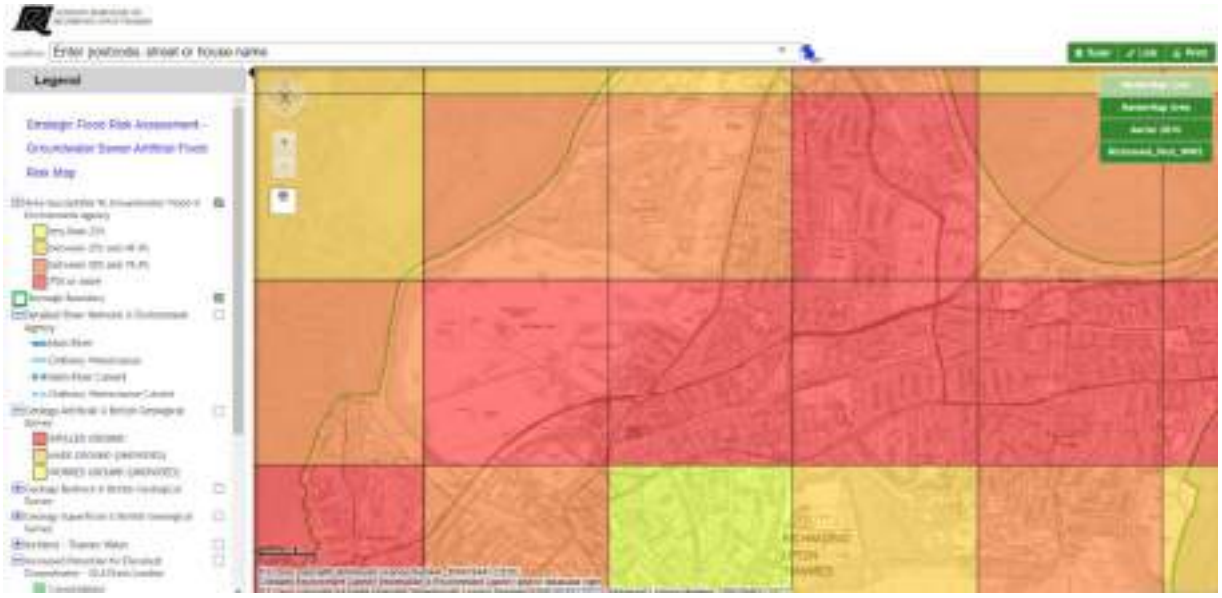


Figure 8: SFRA Groundwater Flooding

The SFRA shows the site, like large parts of Richmond, to lie in an area which is 75% or more susceptible to groundwater flooding. This is most likely due to the permeable superficial deposits.

Further groundwater investigations were undertaken as part of the SFRA in March 2021 which determined that the site lies on the edge of a throughflow catchment area. These are catchments which met all the requirements in the methodology, and therefore possessing properties which may be at risk of throughflow flooding.

The investigation identified that if subsurface developments take place in upstream areas of the other catchments identified as 'throughflow catchment areas', then properties in the downstream regions of the catchment may be at risk of flooding due to throughflow.

In recognition that new basement developments may have an influence on subsurface level flows, a set of recommended policies and guidance recommendations were developed for these catchment areas.

Recommended guidance in relation to Flood Risk and Drainage suggest the following needs to be considered as part of the screening assessment:

- Will the proposed subsurface development result in a change in impermeable area coverage on the site?
- Will the proposed subsurface development impact the flow profile of throughflow, surface water or groundwater to downstream regions?
- Will the proposed subsurface development increase throughflow or groundwater flood risk to neighbouring properties?

This will need to be addressed via a Basement Impact Assessment.

3.5 Sewer and Infrastructure Failure

The site is within a highly developed area with mixed use residential, commercial and industrial use developments bordering the site in all directions and as such it is highly likely that there is an extensive engineered drainage system serving the surrounding areas. The slight gradient shown on site suggests that in the event the surrounding sewer system were to fail or surcharge within the vicinity of the site,

any surcharged sewer overland flows generated are likely to follow the prevailing topography as 'sheet flow' and be shallow in nature.

Thames Water has identified 7 indoor incidents and 2 outdoor incidents associated with the site.

The EA Reservoir Failure Extent mapping (EA, 2022)[1], whilst it does not show the site to lie within the extent of sole potential reservoir flooding, when there is also flooding from rivers the site is expected to be within the maximum flood extent in the event of a failure of multiple reservoirs upstream. Given the monitoring and maintenance requirements for such reservoirs under the Reservoir Act (1975), the risk of such an occurrence is considered very low, and as such there is only a 'residual' risk of flooding due to reservoir failure.

There is no known risk of flooding from canals or any other artificial sources at the site and as such the site is concluded to be at 'negligible risk' from infrastructure failure flooding

[1] EA Long Term Flood Risk Service - https://check-long-term-flood-risk.service.gov.uk/map

4. NATIONAL PLANNING POLICY FRAMEWORK

4.1 Sequential and Exception Test

This assessment has demonstrated that the site is on land designated as Flood Zone 1 by the EA's Flood Zone Mapping.

Paragraph 162 states the aim of the sequential test is to steer new development to areas with the lowest risk of flooding from any source.

As the Environment agency surface water flood maps show the site to be at risk of surface water flooding a sequential test has been requested by the GLA and is submitted with this application (25608-HYD-XX-XX-RP-FR-0001).

The NPPG Flood Risk Vulnerability and Flood Zone Compatibility matrix (Table 3 of the NPPG) also indicates that all forms of development are "appropriate" in Flood Zone 1 without application of the Exception Test.

Accordingly, the application of the Exception Test is addressed within the Sequential Test report (26508-HYD-XX-XX-RP-FR-0001).

4.2 Mitigation Measures

Whilst an Exception Test is not explicitly required under the NPPG, the following section details any measures recommended to mitigate any 'residual' flood risks and to ensure that the proposed development will be safe for its lifetime taking account of the vulnerability of its users, without increasing flood risk elsewhere, akin to the requirements of section 'b' of the Exception Test as outlined in the NPPF.

4.2.1 Finished Floor Level

Whilst the site is within Flood Zone 1, given the currently identified risk of surface water flooding, finished floor levels have been set to best mitigate the predicted surface water flood risk whilst also ensuring a coherent design with multiple other disciplines. Whilst the modelling indicates potential internal flooding as a result of surface water flows, following discussions with the GLA (02/11/2022) mitigation measures have been agreed in principle to ensure the risk is adequately managed / mitigated.

Whilst finished floor levels have been raised as high as practically possible whilst ensuring level access and also minimising any offsite increase in flood risk, the modelling indicated the potential for internal flooding to three of the proposed blocks (Block C and D and the eastern entrance of Block A) therefore it is recommended a number of flood resistance and resilience measures into the design and construction of the ground floor level. The purpose of such measures is to reduce the risk of flood water entry wherever possible, and limit the impact should internal building flooding occur.

The following potential measures for the ground floor level are in accordance with the Government's Improving the Flood Performance of New Buildings document, and include:

- The setting of ground FFLs at a high a level as feasible
  - » Block A (Northern Portion) - 6.45mAOD.
  - » Block A (Southern Portion) - 6.6mAOD

  - Block B - 6.45mAOD
  - Block C - 6.45mAOD
  - Block D - 6.75mAOD
- Ground supported floor construction.
- Water resistant floor finishes, i.e. tiles as opposed to carpet.
- External and internal ground floor level walls constructed of materials with low water penetration, good drying ability, and good retention of pre-flood integrity.
- Sensitive services (i.e. electrics) brought in and continued at a high a level as possible, and ideally at a minimum level of 300mm above finished floor levels.
- Lifts within ground floor entrance lobbies to be designed and installed so as to be flood resilient, i.e. water-sensitive apparatus/controls to be set at a minimum level of 300mm above finished floor levels.
- The installation of 'active' flood measures i.e., permanent 'flood proof' doors to be installed on ground floor entrances of buildings with predicted internal flooding (indicated on a plan with the Flood Warning and Evacuation Plan) with crest level of 600mm freeboard above the 1 in 100-year + climate change design event.
- Electric vehicle charging should either be removable (so it can be removed on receipt of an EA warning) or of a construction that will be unaffected by flood waters.

4.2.2 Safe Access and Egress

Whilst the site is indicated to be within Flood Zone 1 and therefore at low risk of fluvial and tidal sources, EA mapping and further detailed hydraulic modelling has been undertaken by Hydrock which confirms the site to be at risk of flooding from surface water sources as a result of an offsite flow route from the south west and southern boundaries. To manage safe access and egress to site occupants Hydrock have prepared a Flood Warning and Evacuation Plan (FWEP) (Ref: 25608-HYD-XX-XX-RP-FR-0004). This will highlight the flood risk to visitors and detail the procedures to follow in the event of a Flood Warning from the EA being issued for the area.

4.2.3 Floodplain Storage

On the basis that the site has been demonstrated to be at low risk of fluvial and tidal flooding, and therefore outside a functioning floodplain, the proposed development is not considered to increase flood risk within the catchment through a loss of floodplain storage, and accordingly no further mitigation measures are required in this respect.

With regards to surface water flooding hydraulic modelling has shown that any offsite increase as a result of the development is kept to a minimum, within model tolerance and predicted worst-case owing to no drainage included, through lowering of onsite levels to maintain the existing flow route and attenuate on site where possible.

5. SUMMARY

This Flood Risk Assessment (FRA) report has been prepared by Hydrock on behalf of Avanton Richmond Developments Ltd in support of a planning application for a proposed residential development at the Former Homebase Site, 84 Manor Road, North Sheen, Richmond.

A detailed assessment of flood risk has identified that the site is located within Flood Zone 1 (Low Risk) in respect of fluvial flood risk. Hydraulic modelling has been undertaken due to the identified risk of surface water flooding on the site through the current EA Mapping. Results of the modelling confirm the site to be at risk of surface water flooding with the site being located in a key surface water flow route, entering in the south western and southern boundaries, and discharging onto adjacent railway land in the north west.

Post development modelling has been carried out to ensure the flow route is safely managed through preferential lowering on site to minimise any offsite risk. Where risk is still identified on site, a number of flood resistant measures have been recommended to incorporate within the design and construction of the development with a key feature being flood proof doors where there is a potential for internal flooding.

The site is indicated to be at low or negligible risk from all other assessed sources.

The sequential test has been requested due to surface water flooding on site and is included within the planning application.

In accordance with the NPPF and NPPG, the application of the Exception Tests is concluded to not be required in this instance.

Due to the indicated surface water risk on site safe access and egress has been addressed through a Flood Warning and Evacuation Plan which highlights the flood risk to visitors and details the procedures to follow in the event of a Flood Warning from the EA being issued for the area and that the proposed development is also not considered to increase flood risk within the catchment through a loss of floodplain storage.

This report therefore demonstrates that, in respect of flood risk, the proposed development of the site:

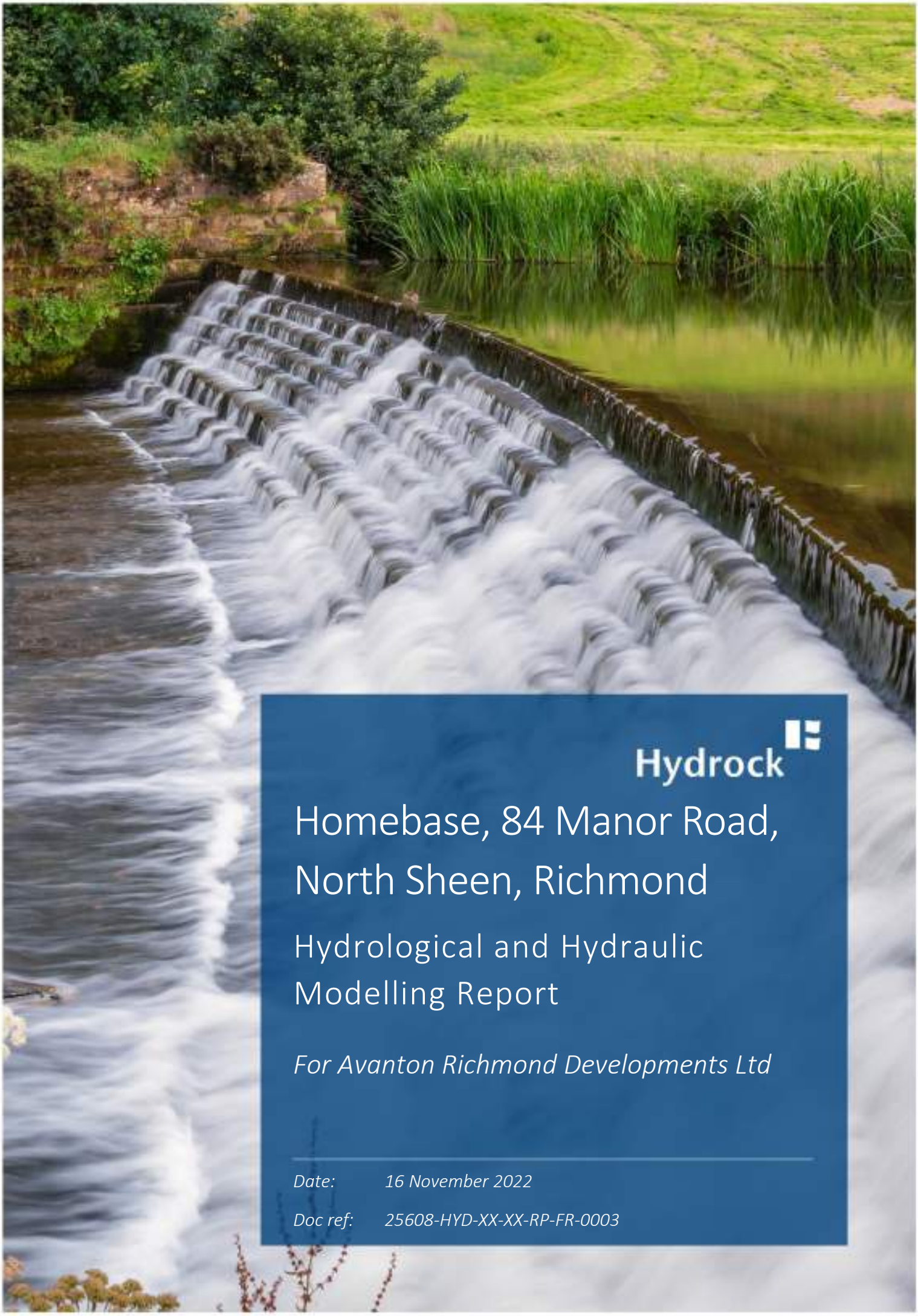
- Is suitable in the location proposed.
- Will be adequately flood resistant and resilient.
- Will not place additional persons at risk of flooding, and will offer a safe means of access and egress.
- Will not increase flood risk elsewhere as a result of the proposed development through the loss of floodplain storage or impedance of flood flows.
- Will put in place measures to ensure surface water is appropriately managed.

As such, the application is concluded to meet the flood risk requirements of the NPPF.

Hydrock Consultants Ltd

6. REFERENCES

Author	Date	Description
Metis Consultants	2021	Strategic Flood Risk Assessment Level 1 - London Borough of Richmond upon Thames https://www.richmond.gov.uk/media/20529/sfra_level_1_report.pdf
Metis Consultants	2021	Further Groundwater Investigations - London Borough of Richmond upon Thames https://www.richmond.gov.uk/media/20819/ldf_further_groundwater_investigations.pdf



Hydrock

Homebase, 84 Manor Road, North Sheen, Richmond

Hydrological and Hydraulic Modelling Report

For Avanton Richmond Developments Ltd

Date: *16 November 2022*

Doc ref: *25608-HYD-XX-XX-RP-FR-0003*

DOCUMENT CONTROL SHEET

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1. INTRODUCTION

This report has been prepared by Hydrock on behalf of Avanton Richmond Developments Ltd to assess the current surface water flood risk to Homebase, 84 Manor Road, North Sheen, Richmond. An initial review of current Environment Agency (EA) mapping has identified the site is in an area of up to 'High' risk from surface water flooding with a potential overland flow path through the site and around the exiting developments

Given the identified level of risk, Hydrock have undertaken a hydrological and hydraulic modelling study to identify and address existing overland surface water flows through a direct rainfall runoff model and provide recommended mitigation where needed to ensure the proposed development would be safe across its design life.

This report should be read in conjunction with the prepared Flood Risk Assessment also undertaken by Hydrock (25608-HYD-XX-XX-RP-FR-0002).

2. SITE INFORMATION

2.1 Location and Setting

Table 1 provides a summary of site referencing information with the site location and approximate red line plan shown in Figure 1.

Table 1. Site Referencing Information

Site Referencing Information	
Nearest Site Address	84 Manor Road, Richmond, London, TW9 1YB
OS Grid Reference	TQ 18914 75421
Easting, Northing	518914,175421

Figure 1. Site Location

The site is located at the former Homebase site in Richmond. It is triangular in shape and bound by the railway line to the south and north west boundaries and by Manor Road to the East. The site is surrounded by a combination of residential and commercial developments.

2.2 Topography

The Topographical Survey indicates the site to be approximately 7mAOD at the east of the site, sloping to approximately 6mAOD at the south west of the site. The south west of the site is contained by a retaining wall with the railway alongside the site at approximately 7.3mAOD.

3. HYDROLOGICAL & HYDRUALIC ASSESSMENT

3.1 Background

The site is indicated to lie within a potential surface water flow path as shown by the Environment Agency (EA) Surface Water Flood Risk Mapping. The existing mapping indicates a potential flow route entering the site via the south-west corner, overtopping the railway, and proceeding through the site eventually exiting onto the railway again along the north west boundary. Flooding is also predicted to pond around the existing Homebase building with deeper and higher risk areas indicated around the building footprint. Figure 2 shows the drainage catchment for which the site sits within and is approximately 1.99km^2, as calculated by the Flood Estimation Handbook (FEH) Web Service.

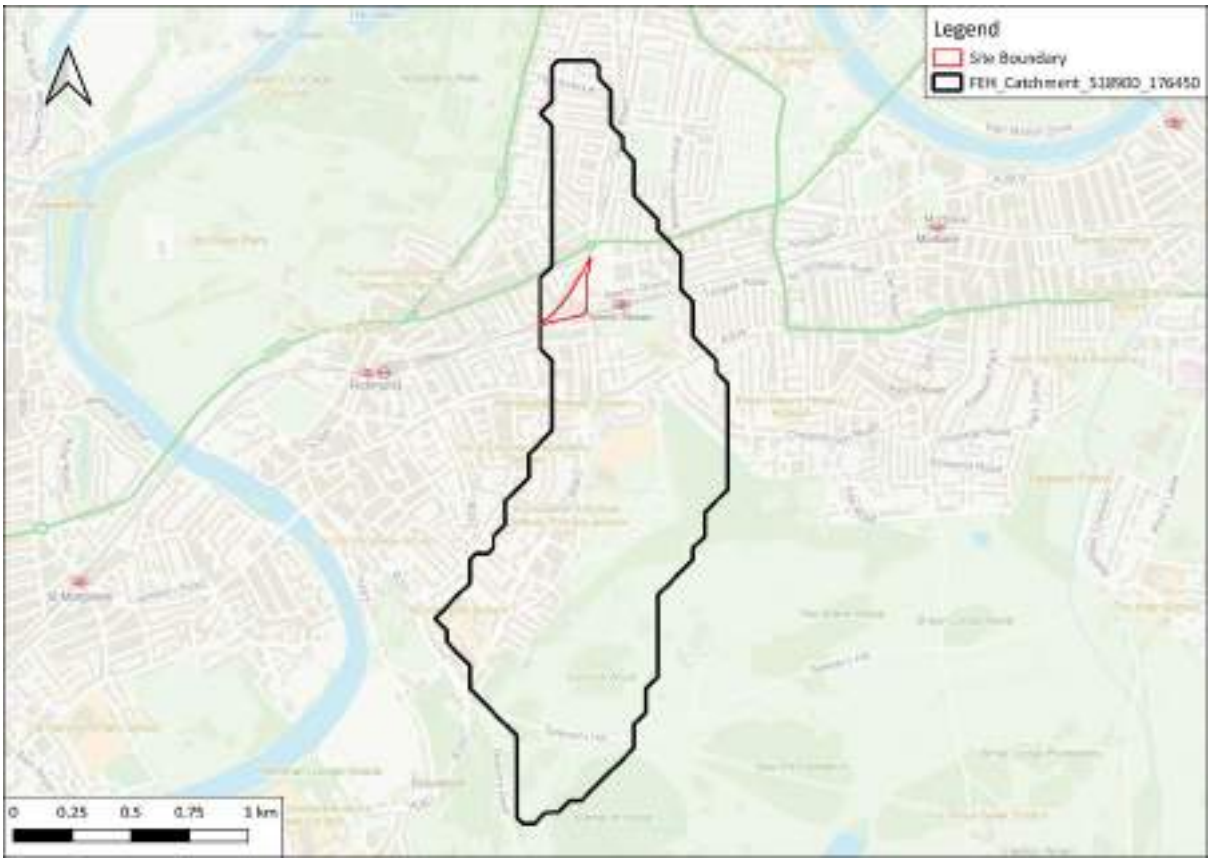


Figure 2. FEH Catchment

A Flood Risk Assessment undertaken by Fairhurst classified the site was to be at low risk of surface water flooding however comments from the Greater London Authority (GLA) have requested further assessment of the surface water risk to the site given its location within a significant flow path in accordance with EA mapping. The EA Mapping indicates the majority of flooding onsite to be between 300-900mm however this data is considered to be coarse whilst also not using accurate site levels (i.e., from a topographical survey).

As such, Hydrock have undertaken a detailed rainfall run-off modelling exercise due to the coarse nature of the EA model data and to quantitatively assess the level of risk to the existing developments and to ensure appropriate mitigation and resilience measures for the proposed development to manage any onsite risk.

3.2 Rainfall Modelling

3.2.1 Rainfall

Rainfall depths are derived from the FEH DDF (Depth Duration Frequency) model with catchment parameters taken from the FEH Web Service from an outlet point at grid reference 420900, 187700.

The following storm events were modelled: 1 in 5-year, -30-year, -30-year + 35% allowance for climate change, -100-year, -100-year + 40% allowances for climate change and -1,000-year rainfall events. Each were run for a duration of 6 hours which is the required storm length for calculating runoff volume as specified in guidance documents[1]. For a catchment of this size, this is considered an appropriate duration, with the minimum recommended duration being a 3-hour event. Further sensitivity testing has also been undertaken to assess the 3-hour, 9-hour and 12-hour storms.

The events considered critical for the surface water drainage design are the 1 in 30-year and 1 in 100-year plus 40% climate change. The 1 in 30-year is the typical design standard under Sewers for Adoption Eighth Edition where no flooding of the system should occur. The 1 in 100-year plus 40% climate change event is the extreme storm which new developments should be designed to withstand, whereby flooding of the network may occur but it must be safely contained away from buildings or key access / egress routes. The 1 in 5-year event has also been run to represent the expected conditions in a more commonly occurring storm event.

3.2.2 Run-off Calculation

Factors which can affect runoff calculations are as follows:

- Permeability of soils, with runoff less accurately predicted in highly permeable soils. The soils in the wider catchment for the site were assessed to be of an average permeability (SPRHOST of 30.21%).
- Small drainage catchments can result in small rainfall depths. Runoff calculated by models with an initial storage component (such as the PDM model used in ReFH) may therefore be very sensitive to storage parameters and initial conditions. Total runoff estimates may therefore be uncertain.
- Urbanisation resulting in different surface characteristics and runoff coefficients to the natural catchment.

Given the complex nature of the issues outlined above, the following method has been used to address the limitations identified above and provide a robust runoff parameterisation for modelling:

- Runoff calculated from 'rural' areas calculated by taking the SPRHOST value from the FEH Catchment Descriptors as a representative percentage run-off value for the site of interest.
- Runoff calculated from 'urban' areas using a hybrid approach which takes the weighted average of the rural runoff (as described above) and a 90% run-off from impermeable areas. The weighting factor is the Percentage Impermeable (PIMP) value as used in the Wallingford procedure. The majority of the study area however was considered to be 'rural' with no significant urban developments within the study area.
- It has been assumed for the purpose of the direct rainfall modelling that no water enters the sewer system. This is considered to be a conservative approach as this system will help to alleviate

[1] Defra / Environment Agency (2013) Rainfall runoff management for developments, pg. 7.

ponding in low-lying areas. This approach is not considered to impact the predicted flow routes as all flows will be routed via the topography and ultimately into the watercourse.

The results of applying these methods are summarised in Table 2.

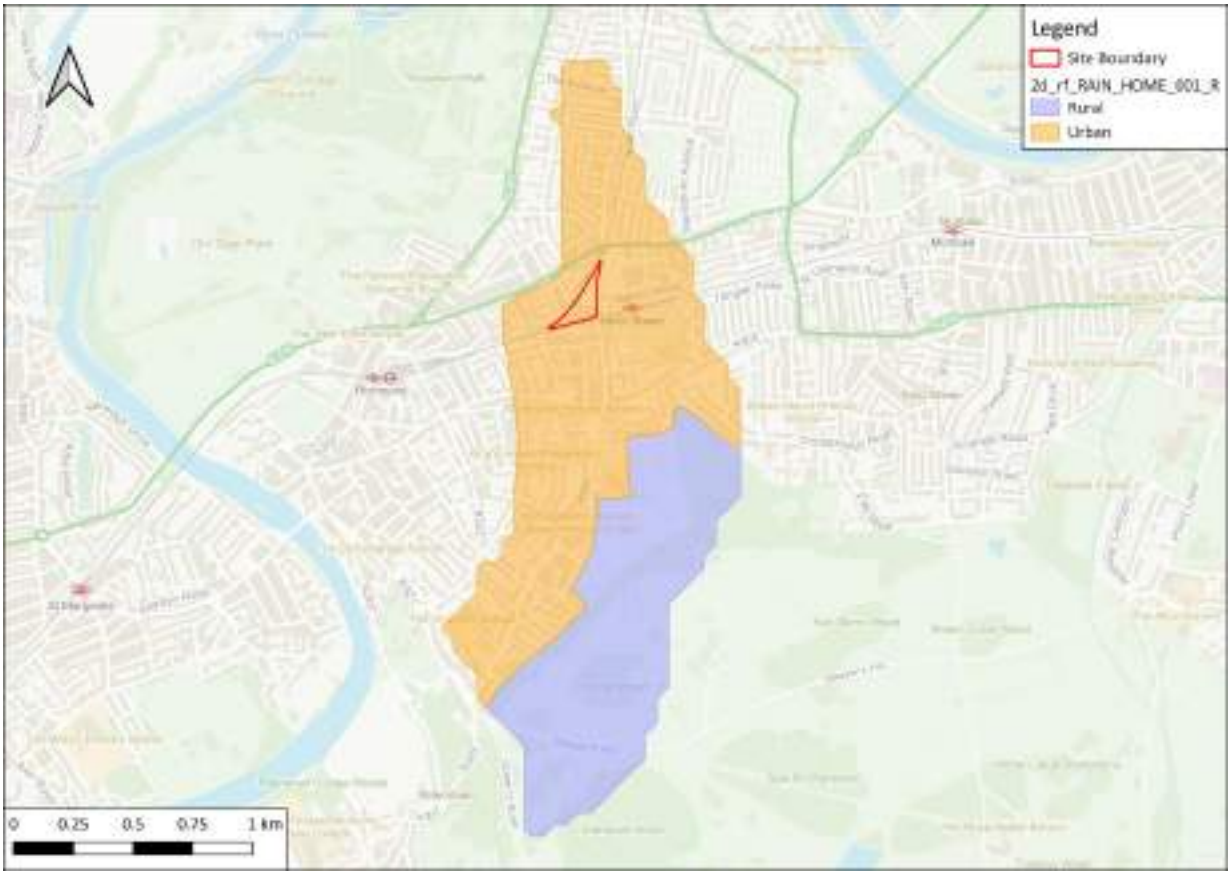


Figure 3. Urban / Rural Catchment De-lineation

Method	Percentage Run-off Values
SPRHOST	0.302
PIMP Weighted Rural/Urban	0.529

Table 2. Runoff Parameterisation, Rural and Urban

3.3 Baseline Hydraulic Assessment

3.3.1 Model Type

Based on the identified need to consider overland flow routes, a linked 2D model has been developed using TUFLOW HPC v2020-10-AB and uses TUFLOW's Sub-Grid Sampling.

3.3.2 Model Grid

The majority of the 2D model is based on LiDAR data flown in 2020 which is at 1m resolution. This was converted within TUFLOW to a 2m grid. This is the latest available information and comparison of this with the OS / satellite mapping suggests that no significant ground level changes have taken place within the area affecting the site since this data was obtained.

Within the site boundary a site-specific topographical survey has been undertaken (LS2024/T/01RevA) in 2018 and the ground levels are not expected to have changed since. As such, to convey accurate levels across the site, the survey was converted to an ASC grid to be used within the model as well as the LiDAR.

Buildings were also included within the ground model as these are an important factor in determining surface water pathways. The building footprints were determined from OS Open Map Local vector files and were raised above immediately surrounding ground levels by 300mm to represent typical flood levels but also to deflect flows.

3.3.3 2D Shapefiles

Figure 4 shows the model schematic and GIS layers which constitute the 2D model. The watershed area (i.e., the model domain '2d_code_HOME_001_R') was determined from the FEH catchment boundary which was checked against LiDAR contours. On review of LiDAR, and also when viewing EA Surface Water Mapping, that an area to the west of the site that was not included within the FEH boundary was indicated to drain east into the existing FEH catchment boundary. As such, the extent of the domain was increased marginally to include this area to allow any resulting off-site flows to follow the existing topography. The extent of the domain was greater than the area of interest for this assessment to ensure that all areas draining to the site would be accounted for. The file '2d_rf_R_HOME_001' follows the domain boundary and references the percentage runoff values for the rural areas as shown in Table 2, the majority of the site area is heavily urbanised with a clear and obvious rural area located in the southern portions of the site.

No further hydraulic structures have been included within the area of interest.

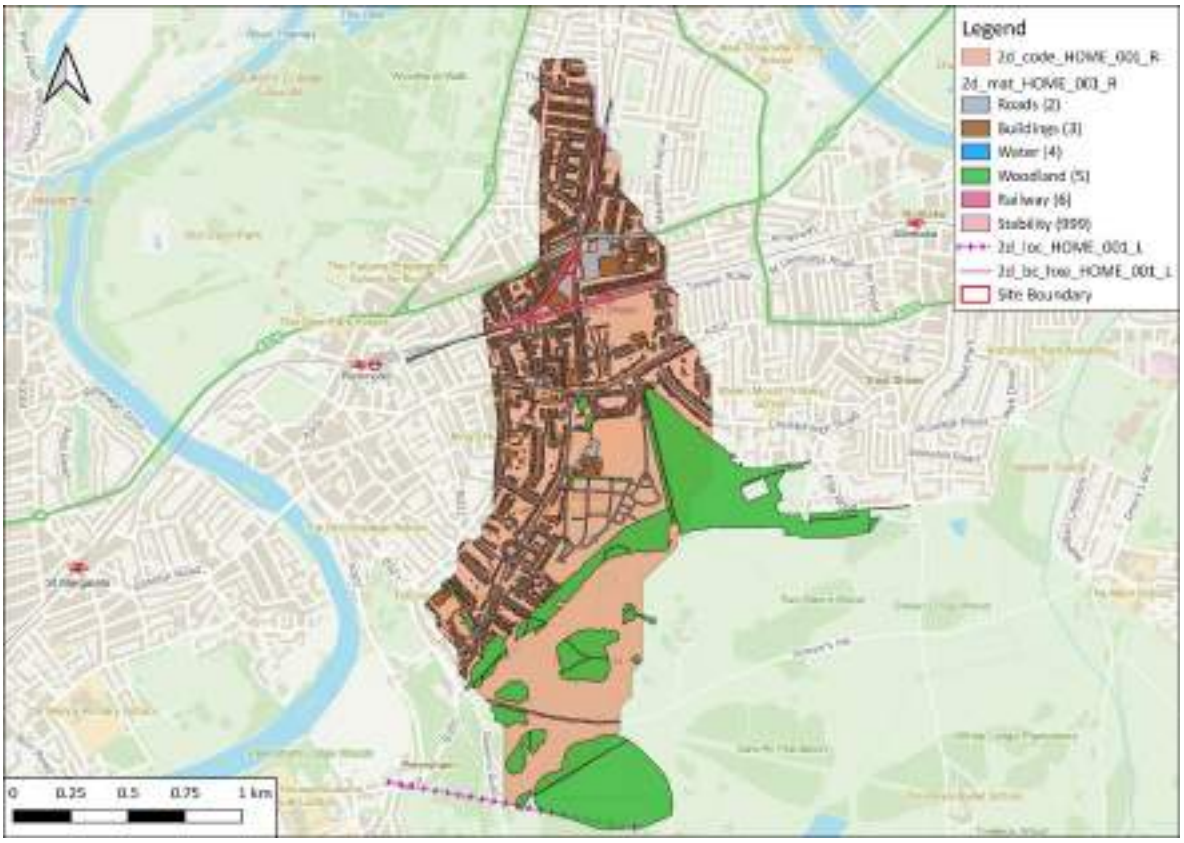


Figure 4. 2D Model Schematic

3.3.4 Boundary Conditions

The model domain was extended some distance downstream of the site (approximately 600m) to limit the potential for any backwater effects from the downstream boundary impacting on the modelled flooding regime in the vicinity of the site. '2d_bc_hxe_HOME_001_L' represents the downstream boundary which was an assumed 'normal depth' with a gradient of 1:1000, to allow water to drain freely at this location.

3.3.5 Roughness Coefficients

The 2D roughness values are represented within the 'Materials.csv' file referenced in the 2D read file (.TRD) which links to the model shapefile '2d_mat_HOME_001_R'. This is based on manning's 'n' roughness values specified by Chow (1959) which is the industry standard approach. Within the 2D code, observed land uses included woodlands, railway, roads, tarmac and buildings and ponds / other water. All other space was assumed as 'pasture' with a Manning's 'n' value of 0.06, which follows the standard modelling approach, (see Table 3).

The materials file is largely based on OS Open Map Local vector files which provides a good basis for existing land uses.

The roads /railway have been modelled as a single centre line with a buffer applied to them to represent their width. A buffer distance of 4m was applied to minor roads and 6m for dual carriageways and railways, which was checked against aerial photography and found to be suitable.

Feature	Manning's 'n'
Roads	0.022
Pasture	0.060
Buildings	0.300
Woodland	0.070
Railway	0.040
Ponds and other water	0.030
Stability	1.000

Figure 5. Manning's 'n' Roughness Values

3.3.6 Model Run Parameters

The model was run at a 2m grid resolution with a 1 second timestep which was considered to provide an appropriate balance between model run times and resolution of results. A 10-hour run time was specified for the 6-hour rainfall events which was sufficient time to observe the runoff affecting the site.

3.3.7 Results

Depth and velocity surface water flood maps for the key return periods are included in Appendix A. This includes the following:

- 1 in 5-year, 6-hour Depths - drawing 25608-HYD-XX-XX-DR-FR-0001.
- 1 in 30-year, 6-hour Depths - drawing 25608-HYD-XX-XX-DR-FR-0002.
- 1 in 100-year plus Climate Change, 6-hour Depths - drawing 25608-HYD-XX-XX-DR-FR-0003.

- 1 in 1000-year, 6-hour Depths - drawing 25608-HYD-XX-XX-DR-FR-0004.

The results of the mapping show that in the baseline scenario, flooding from surface water is expected to impact the site and confirm, in all scenarios except the 5-year and 30-year event, the site lies within a key surface water flow route and matches that of the existing EA Mapping.

In line with the EA Mapping, flooding is shown to enter the site via the south west corner and via the southern boundary of the site from the railway line in all events modelled except the smallest 1 in 5-year event. The flow path from the south-west of the site is indicated to be the primary flow route into the site and is shown to be more prevalent in the larger events (1 in 100yr, -100yr + 40%cc, -1000yr). In all events, whilst there is a flow route indicated through the site, there is also flooding predicted to pond around the existing building with maximum depths up to approximately 0.5m in the critical design event. The results confirm that in all events, excluding the 1 in 5yr and 1 in 30yr, the surface water flow path is indicated to continue off site following local topography to the north and exit the site via the north western boundary and onto the existing railway. Flows are predicted to continue along the railway with maximum depths indicated to be approximately 0.2-1.11m.

The results of the modelling also confirm the risk of surface water ponding along Manor Road, however as expected, this is as a result of a locally lower lying area on Manor Road causing water to pond with maximum depths of 0.14m.

Whilst majority of the flooding onsite is indicated to be slow flowing (i.e., <=0.2m/s) along the northern boundary the existing flow route is predicted to be slightly faster flowing with velocities ranging between 0.2-0.6m/s.

3.3.7.1 Model Stability

On review of the model log file, a number of Warning 2550 were output during the simulation with two HPC NCN Repeated Timesteps occurring during the simulation. Through further inspection, these timesteps occurred within the first hour of the model simulation and no further repeated timesteps occurred during the simulation or across the peak of the hydrographs. No negative depths occurred throughout the simulation and the results seem sensible with no extreme spikes in levels across the area of interest.

A review of the model 2D Mass Balance output indicates the models mass balance to lie well within the ±1% and therefore the model is concluded to be stable.

3.4 Post-Development Modelling

3.4.1 Model Build

Given the identified risk of surface water flooding currently indicated on the site with EA Mapping and confirmed through the hydraulic modelling, there is a need to confirm the proposed development to be appropriate and the surface water risk within the site to be adequately managed.

Every aspect within the model, except those discussed below, has been maintained between the baseline and post-development scenarios to ensure a direct comparison between results.

Initial levels for the post-development scenario have been taken from a technical layout provided by Manhire Associates (ref: MNR-MA-XX-00-DR-C-1060 P6) with the cover levels from this drawing used to create a basic surface for the flood model and read into the modelling through use of region and point GIS Z Shapes.

In order to manage the existing flow path through the site, levels have been lowered throughout the development to create a preferential flow route for any overland flows which may occur and direct them back towards the railway in the north of the site as is what occurs the existing scenario. Where possible, levels have been lowered to allow for more onsite storage, particularly in the main courtyard area in the centre of the proposed development and in the south west corner of the site, and limit any increase in flood depths offsite whilst also ensuring a gradient so that flows are not predicted to be "pond" onsite to a significantly worse extent than is indicated in the baseline scenario.

Proposed building finished floor levels (FFLs) have been included as a separate 2D Z Shape to enforce the levels within the model. Levels have been set as below:

- Block A (Northern Portion) - 6.45mAOD.
- Block A (Southern Portion) - 6.6mAOD
- Block B - 6.45mAOD
- Block C - 6.45mAOD

Due to limitations as a result of tight boundaries, building FFLs and ensuring level access, various gradients and ground lowering has been kept to a minimum to ensure a feasible design with regards to landscaping among other disciplines (fire etc).

It should be noted that the hydraulic modelling undertaken by Hydrock does not account for any existing drainage features that may be serving the area, in line with standard modelling practice, and if anything is an overestimation to current levels of risk on site.

3.4.2 Results

Depth and velocity surface water flood maps for the key return periods are included in Appendix A. This includes the following:

- 1 in 100-year plus Climate Change, 6-hour Depths - drawing 25608-HYD-XX-XX-DR-FR-0005.

The results of the post development modelling confirm that with the proposed levels, the key flow route entering the site from the south west corner is maintained in the post-development scenario ensuring no flows are held back in the developments to the south.

As flows enter the site via the south western and southern boundaries, flows are indicated to follow the preferential flow routes through the lowering of local topography towards the central courtyard or along the north western boundary. The deepest areas of flooding are predicted in the south western corner with maximum depths indicated to be approximately 0.53m in the 1 in 100-year plus climate change design event. Throughout the site, deeper areas of flooding 0.25-0.4m are predicted in the central courtyard, to the north of Block B and along the eastern boundary of Block A however these deeper areas are no worse than the existing "deeper" areas shown in the baseline modelling.

The maintained flow route continues through the site as it does in the existing scenario and proceeds to discharge to the railway in the north western boundary of the site. The modelling indicates a slight increase (25mm) on the land to the north however given the extremely conservative nature of the modelling (i.e., no onsite drainage features or infiltration) and the current experienced depths on this area of flooding (i.e., over 1m) this increase is considered to be negligible and fall within model tolerances. Following discussions with the GLA (02/11/2022) it is concluded that this increase is considered negligible and would ultimately be mitigated through the surface water drainage strategy.

As mentioned, building FFLs have been included within modelling to ensure a coherent design with multiple disciplines. The modelled extents indicate potential "internal" flooding within Blocks C and D and the eastern entrance way of Block A, with a predicted maximum depth of 80mm in Block C, 40mm in Block C and 60mm in Block A entranceway.

3.4.2.1 Model Stability

Similarly, to the baseline model a review of model results and log file indicated a number of Warning 2550 were output during the simulation with two HPC NCN Repeated Timesteps occurring the simulation. Again, these repeated timesteps occurred within the first hour of the model with no further occurrences throughout the simulation. The model results seem sensible and no negative depths were indicated.

A review of the model 2D Mass Balance output indicates the models mass balance to lie well within the ±1% and therefore the model is concluded to be stable.

4. SUMMARY

A 2D Rainfall-Runoff model has been undertaken by Hydrock on behalf of Avanton Richmond Developments Ltd due to the predicted risk of surface water flooding the existing Homebase Site, Manor Road, Richmond as indicated by the current EA Surface Water Flood Risk Mapping.

The direct runoff model confirmed the site to lie directly in the path of a major surface water flow route in the existing scenario with predicted flooding shown to enter the site via the south west and southern boundaries and proceed to flow around existing developments and discharging offsite to the adjacent railway. The modelling indicated some flooding is also stored on the site around the existing developments with maximum depths up to 0.5m in places.

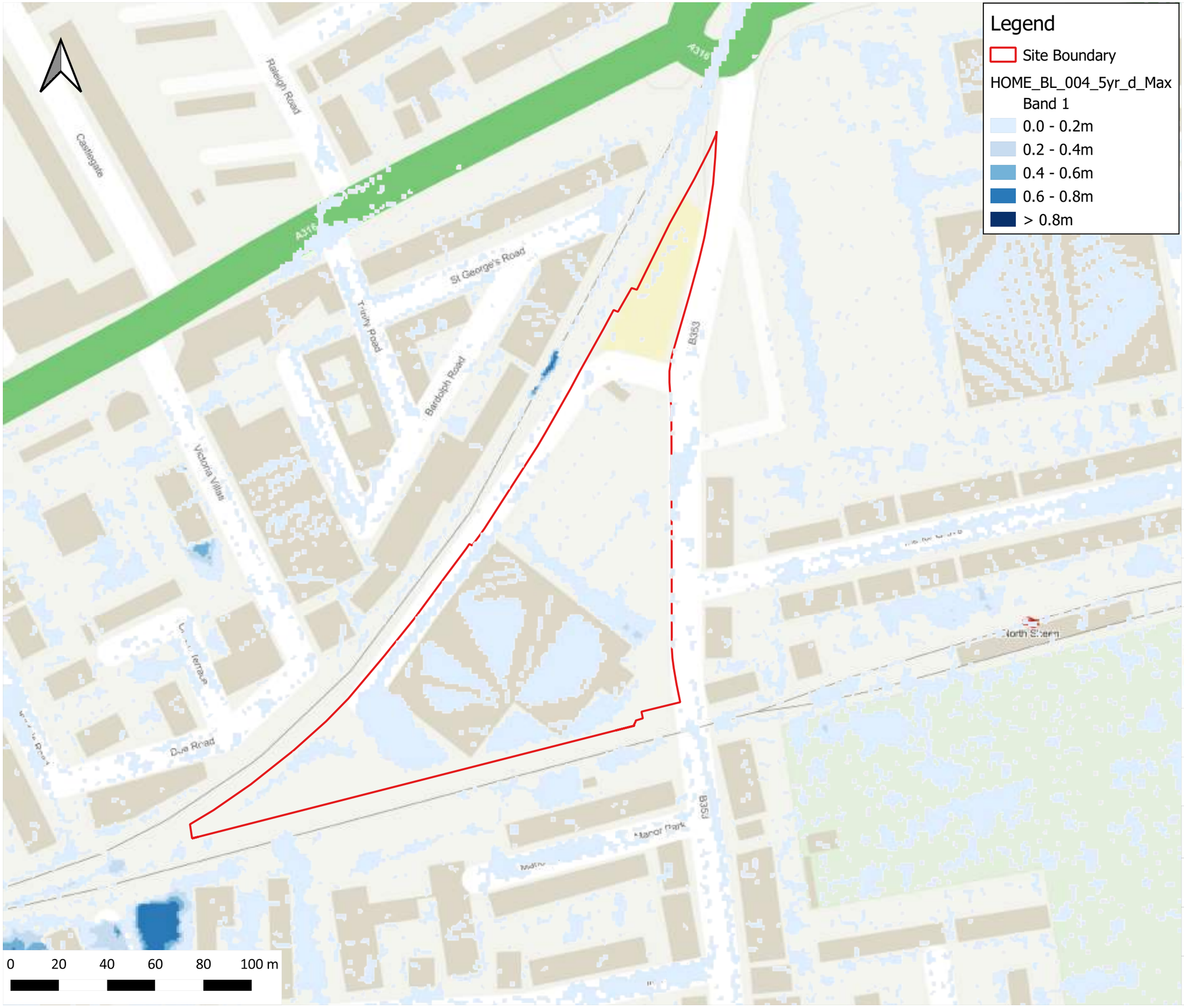
A post-development scenario was also undertaken by Hydrock to confirm the potential risk to the site following the proposed residential and commercial development on site. Proposed building and landscaping finished levels were included within the modelling to align with various other disciplines. Through lowering of site levels, the existing flow route was maintained on site and where possible flows were "stored" in the public realm areas as is what occurs in the existing scenario. Modelling also indicated that there is a potential for internal flooding within Blocks C and D however potential mitigation has been discussed and agreed in principle with the GLA and described as such in the separate Flood Risk Assessment (25608-HYD-XX-XX-RP-FR-0002).

The results of the modelling, as is predicted within EA Mapping, that the site is at risk of surface water flooding lying directly in the path of a surface water flow route. A post -development scenario has confirmed this surface water risk will be maintained and managed through lowering of ground levels with further mitigation measures provided.

Hydrock Consultants Limited

Appendix A

Reference	Title	Type	Originator
25608-HYD-XX-XX-DR-FR-0001	Homebase, Manor Road, Richmond Flood Depths - 1 in 5yr Event, Baseline	Drawing	Hydrock
25608-HYD-XX-XX-DR-FR-0002	Homebase, Manor Road, Richmond Flood Depths - 1 in 30yr Event, Baseline		
25608-HYD-XX-XX-DR-FR-0003	Homebase, Manor Road, Richmond Flood Depths - 1 in 100yr + 40% CC Event, Baseline		
25608-HYD-XX-XX-DR-FR-0004	Homebase, Manor Road, Richmond Flood Depths - 1 in 1000yr Event, Baseline		
25608-HYD-XX-XX-DR-FR-0005	Homebase, Manor Road, Richmond Flood Depths - 1 in 100yr + 40% CC Event, Post Development		



Notes

Manor Road, Richmond Baseline (Existing) Model - 5 year Maximum Depths (m)

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CLIENT

Avanton Richmond Developments Ltd

PROJECT

Homebase, 84 Manor Road, North Sheen, Richmond

TITLE

Baseline Scenario, 1 in 5 year Maximum Flood Depths

HYDROCK PROJECT NO.	SCALE @ A3
25608-IOCB	1:1,500

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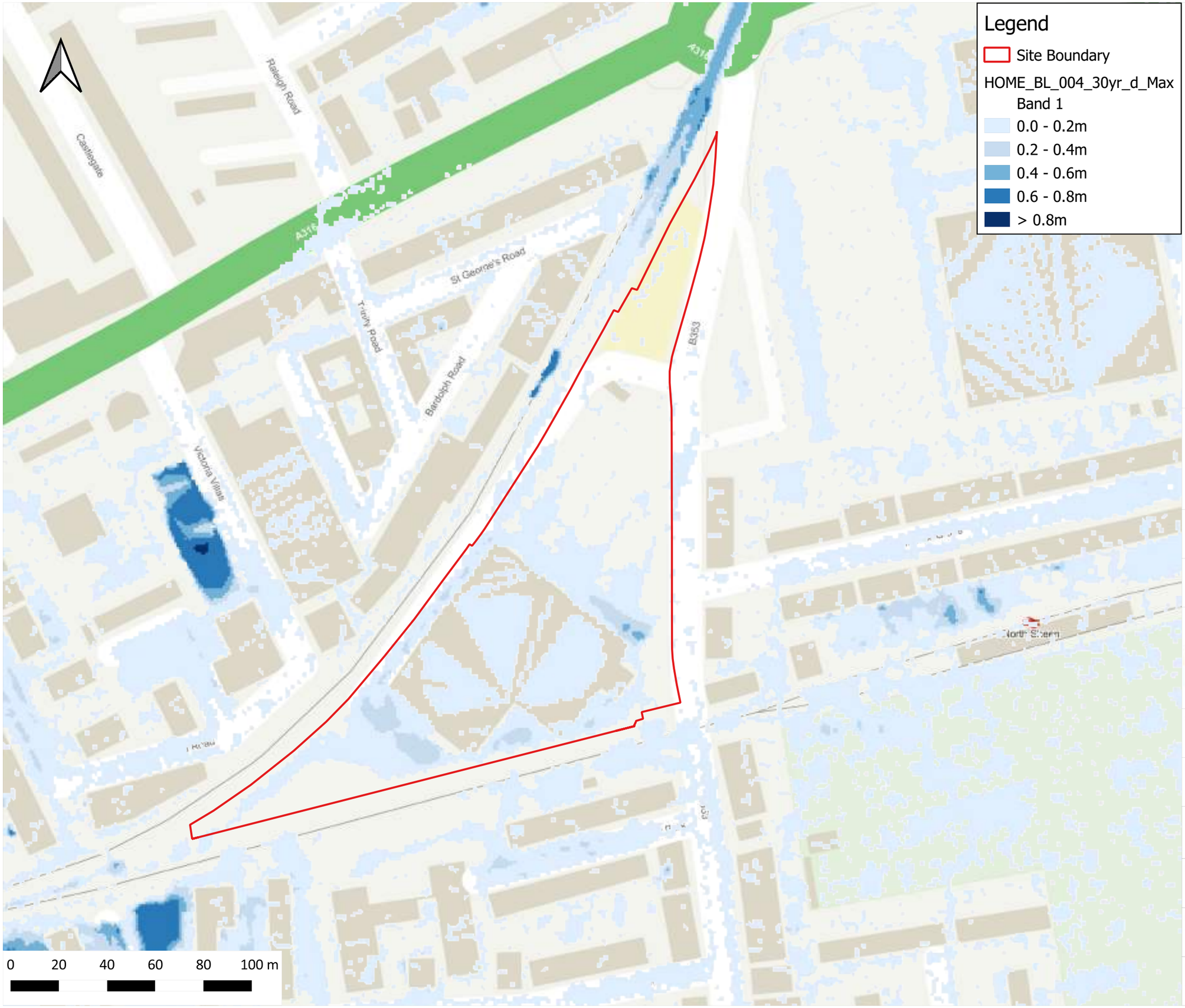

Notes

Manor Road, Richmond Baseline (Existing) Model - 30 year Maximum Depths (m)

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Avanton Richmond Developments Ltd

PROJECT

Homebase, 84 Manor Road, North Sheen, Richmond

TITLE

Baseline Scenario, 1 in 30 year Maximum Flood Depths

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