Appendix C Extract of Soiltechnics Ground Investigation report (August 2023), including Infiltration Testing and Trial Pit information

1 Executive summary

General

We recommend the following executive summary is not read in isolation to the main report which follows.

Site description, history and development proposals

The site is located within the predominantly residential/commercial area of West Didsbury approximately 6km south of Manchester City Centre. The site lies at the western corner of the Lapwing Lane and Palatine Road crossroads at postal address M20 3ZA.

The site was first developed in 1893 with a large building in the eastern corner matching the current site layout. Since 1893 several smaller buildings have been present in the north and west of the site which were subsequently demolished. The reported use of the site is a public house, residential and school. Offsite historic land uses include a town/corporation yard (adjacent to north west), railway line (adjacent to east), electrical substation (c.10m north) and a garage (c.135m north east).

We understand the site will be redeveloped for residential use comprising apartment blocks of twenty-four 1-bed and thirteen 2-bed retirement living units with shared landscaped space. The blocks are to be 2.5-3-stories in height.

Ground conditions encountered

Table summarising soil types

Strata	Depth to top (m)	Depth to bottom (m)	Thickness (m)	Summary description
Made Ground	0.0	0.6 – >1.2	0.6 – >1.2	Light grey to brown gravels of limestone and brick
Glaciofluvial Sheet Deposits	0.6 – 0.9, locally >1.2	>3.2	>2.5	Light grey to brown gravelly slightly clayey sand.

Foundation solution

In our opinion the naturally deposited Glaciofluvial Sheet Deposits will adequately support the proposed buildings on concrete strip / trench fill type foundations. Further details are provided within Section 7 of the report.

Ground bearing floor slabs can be adopted at this site where Made Ground and Topsoil deposits are fully removed within the footprint of the building. In areas where ground floors are elevated requiring in excess of 600mm of fills, or where it is impracticable to remove Made Ground, then we recommend the use of a suspended ground floor with a sub floor void determined following NHBC Standards, Chapter 4.2.

Based on laboratory test results, a subgrade CBR value of 3% can be deduced at formation level. A concrete class of DS-1 and ACEC-1 can be adopted on site.

Initial infiltration testing was undertaken in 2021. Further on-site infiltration testing with observations made over an extended period of time was undertaken in October 2022, to allow production of more accurate infiltration rates.

In summary infiltration rates of ~1.0 x 10^{-5} m/s were recorded in TP101 and TP102 in the SW of the site. Slower infiltration rates of <1.0 x 10^{-5} m/s were recorded elsewhere, with a site-wide average of 9.55 x 10^{-6} m/s.

Chemical and gaseous contamination

No access could be gained to the north and east of the site during the original 2021 investigation due to the presence of the public house. The western half of the pub was since demolished and further trial pits were undertaken in previously inaccessible areas to the assess the wider extent of potential ground contamination.

Elevated PAH and TPH concentrations were identified on site during the 2021 and 2022 investigations. We are, therefore, of the opinion that the site represents a moderate risk of causing harm to the health of future end users based on current development proposals.

There is little soil onsite which could be utilised as a suitable growing medium for plants. The importation of soils for lawns and soft landscaping would be required. Such material will require verification prior to import, to ensure it is suitable for use with respect to concentrations of chemical contaminants.

No significant sources of gaseous contamination have been identified, therefore, do not consider there to be a gas risk on site.

Barrier pipes are likely to be a requirement on site due to the PAHs identified, however, we recommend Untied Utilities are consulted to determine their requirements.

Landfill classification

The site wide Made Ground (comprising sandy gravels of limestone and brick) are suitable for disposal at a **non-hazardous** landfill but cannot be classified as inert owing to the presence of elevated mineral oil within the soils.

4 Fieldwork

4.1	General
4.2	Site restrictions
4.3	Exploratory trial pits
4.4	Sampling strategies

4.1 General

4.1.1 The original fieldwork was carried out on 16th April 2021 has comprised five trial pits to a maximum depth of 3.2m below ground level (bgl). Additional fieldwork carried out on 6th and 7th October 2022 comprised a further six trial pits (one hand dug) to a maximum depth of 2.0m below ground level.

4.1.2 A plan of the site showing observed/existing site features and position of exploratory points is presented on Drawing 02.

4.1.3 The extent of fieldwork activities and position of exploratory points were determined by Soiltechnics.

4.1.4 Exploratory points were positioned to avoid known locations of underground services, to avoid possible location of proposed foundations but were also positioned to provide a reasonable coverage of the site. Prior to commencement of exploratory excavations an electronic cable locating tool was used to scan the area of the excavation. If we received a response to this equipment then the excavation would be relocated.

4.1.5 All soils exposed in excavations were described in accordance with BS EN ISO 14688 *'Identification and Classification of soil'* and BS EN ISO 14689 *'Identification and classification of rock'.*

4.2 Site restrictions

4.2.1 There were no significant onsite restrictions at the time of investigation with the exception of the presence of the remaining parts of the former public house buildings in both 2021 and 2022.

4.3 Exploratory trial pits

4.3.1 Trial pits TP01 to TP05 (2021) and TP101 to TP105 (2022) were excavated to a maximum depth of 3.2m using a rubber tyred excavator, while TP106 was excavated using hand held digging equipment to a depth of 0.7m. Surface asphalt was initially broken out using hydraulic breaking equipment fixed to the excavator. The excavations were backfilled with excavated material compacted using the back of the excavator bucket. Whilst we attempted to reinstate the excavation to its original condition some short-term settlement of the backfilling materials may occur. Asphalt surfacing was not replaced.

4.3.2 Sampling and logging was carried out as trial pit excavations proceeded but were not entered at depths exceeding 1.2m, or where trial pit sides were deemed unstable. The density of granular soils encountered in excavations was gauged by the ease of excavation.

4.3.3 Soil samples for subsequent laboratory determination of concentration of chemical contaminants were taken from the sides of trial pits using clean stainless-steel equipment and stored in new plastic containers, which were labelled and sealed. The stainless-steel sampling equipment was cleaned with deionised water between sampling points Samples from below access depth into trial pits were taken as a sub sample from soil contained in the excavator bucket, discarding any soil, which may have been in contact with the bucket. If as a consequence of visual or olfactory evidence, a sample was suspected to be contaminated by organic material, the sample was stored in an amber glass jar with a PTFE sealing washer.

4.3.4 Soil samples for subsequent laboratory 'classification' testing were taken from the side of trial pits or from bulk samples taken from the excavator bucket. The sample was immediately placed in a plastic bag and subsequently sealed and labelled. Samples for determination of water content were placed in sealable tubs and appropriately labelled. Soil samples were obtained to meet Category A and quality class 3 to 5 as described in BS EN I997-2:2007 (table 3.1) sufficient for laboratory testing being considered. Sample sizes were also appropriate for the laboratory test being considered (refer BS EN I997-2:2007 annex L).

4.3.5 Copies of trial pit borehole logs are presented within Appendix D.

4.3.6 Infiltration testing carried out in trial pits

4.3.6.1 Soil infiltration tests were carried out in trial pits TP02 and TP04 at depths between 1.12m and 1.82m in 2021 during our original 2021 investigations, and between TP101 to TP104 at depths between 0.90m and 2.0m during our 2022 investigation. Infiltration tests were carried out following the procedures described in the Building Research Establishment (BRE) DG 365 (2016) "*Soakaway Design*". Records of test results and calculations to determine a soil infiltration rate are presented in Appendix C.

4.3.6.2 During 2021 investigations the rate at which water placed in each trial pit dissipated was slow and a maximum of three test cycles could not be carried out in TP02 during one day of fieldwork (the BRE document recommends three full test cycles).

4.3.6.3 In 2022, three test cycles could were carried out in TP102 and TP103 during two days of fieldwork. Two test cycles were carried out in TP101 and TP104 during two days of fieldwork, with one cycle completed in TP04 in one day of fieldwork. Test results have been used to produce a soil infiltration rate for each test cycle, using the method described in the BRE publication.

4.4 Sampling strategies

4.4.1 Geotechnical

4.4.1.1 In general we adopted a judgemental sampling strategy in relation to geotechnical aspects of the investigation. The location and frequency of sampling was carried out in consideration of the following:

i) Topography
ii) Geology (including Made Ground)
iii) Nature of development proposals

4.4.2 Environmental

4.4.2.1 Details of sampling with respect to contamination issues are described in Section 8.

4.4.3 Sample retention

4.4.3.1 Samples are stored for a period of one month following issue of this report, unless otherwise requested.

soiltechnics
environmental ▪ geotechnical ▪ building fabric

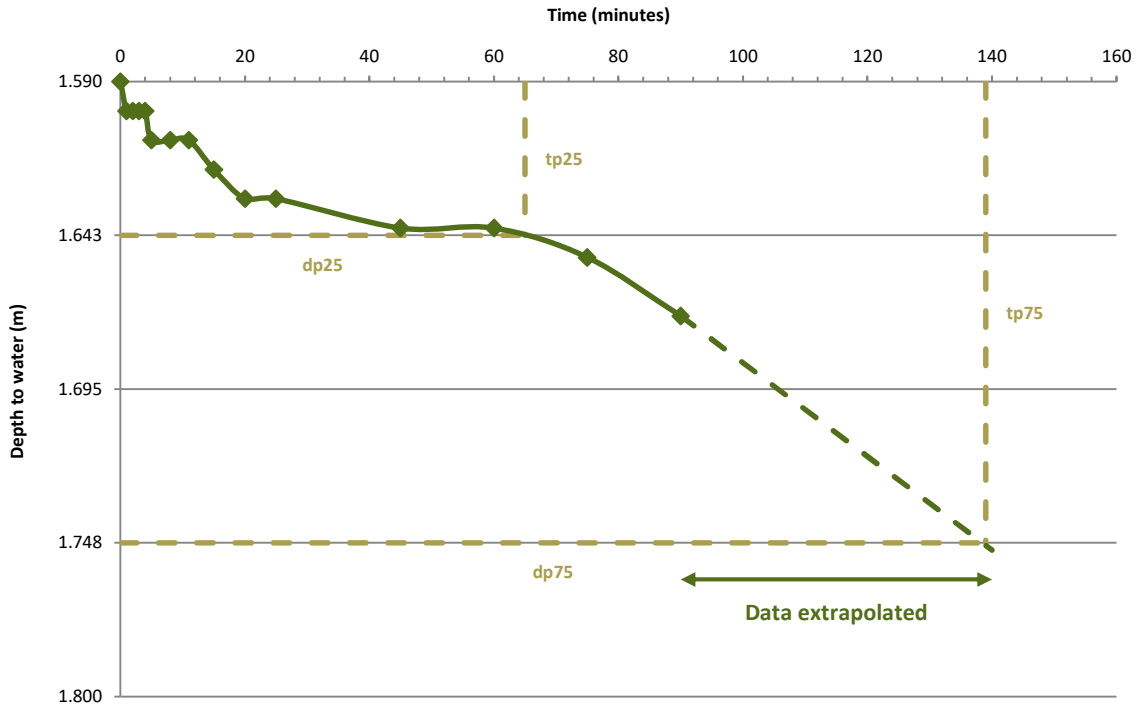
Soil infiltration test (following BRE Digest 365 2016)

Location	Cycle	Test date	Dimensions (m)
TP02	1	16/04/2021	0.70m x 2.00m

Depth at start of test (m)	Groundwater observations (at time of excavation)
1.8	No groundwater encountered.

$$f = \frac{V_{p75-25}}{a_{p50} \times t_{p75-25}}$$

V_{p75-25}	*Effective storage volume of water between 75% (dp75) and 25% (dp25) effective depth*	0.147m³ m^3
a_{p50}	*Internal surface area up to 50% effective depth and including the base*	1.967m² m^2
$t_{p75} - t_{p25}$	*Time for the water level to fall from 75% to 25% effective depth*	4440 s



f	***Soil infiltration rate***	**1.68E-05 m/s**

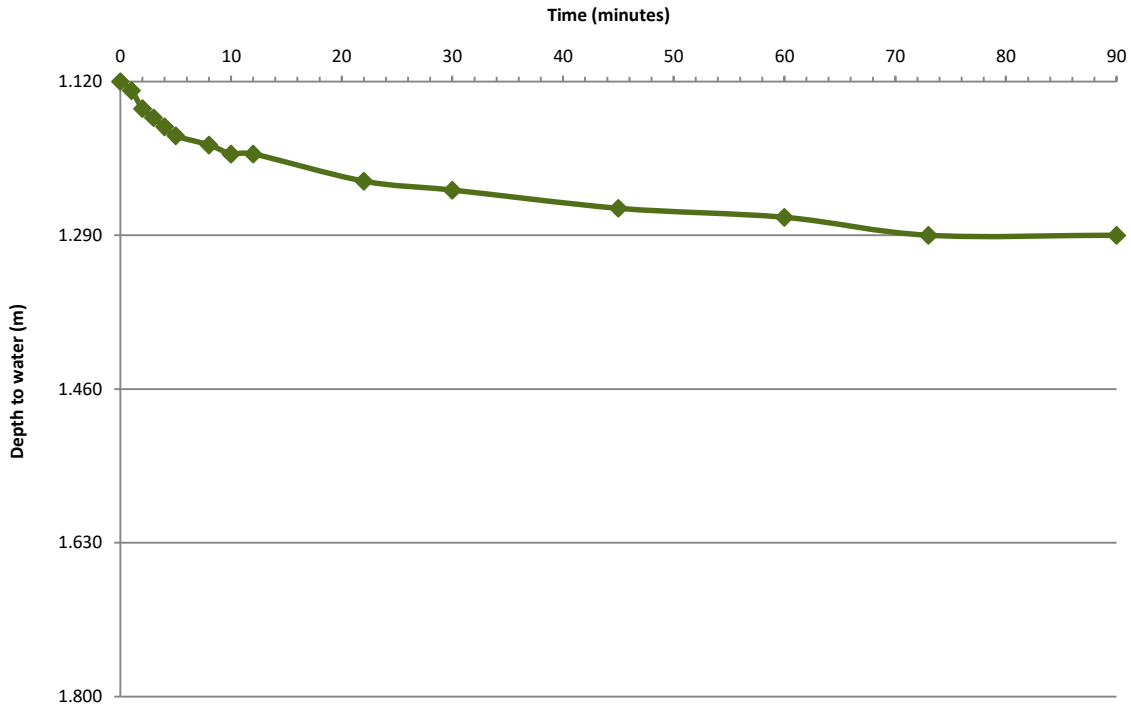
soiltechnics
environmental ▪ geotechnical ▪ building fabric

Soil infiltration test (following BRE Digest 365 2016)

Location	Cycle	Test date	Dimensions (m)
TP02	2	16/04/2021	0.70m x 2.00m

Depth at start of test (m)	Groundwater observations (at time of excavation)
1.8	No groundwater encountered.

Insufficient infiltration over 90 minutes of monitoring therefore unable to calculate soil infiltration rate.



soiltechnics
environmental ▪ geotechnical ▪ building fabric

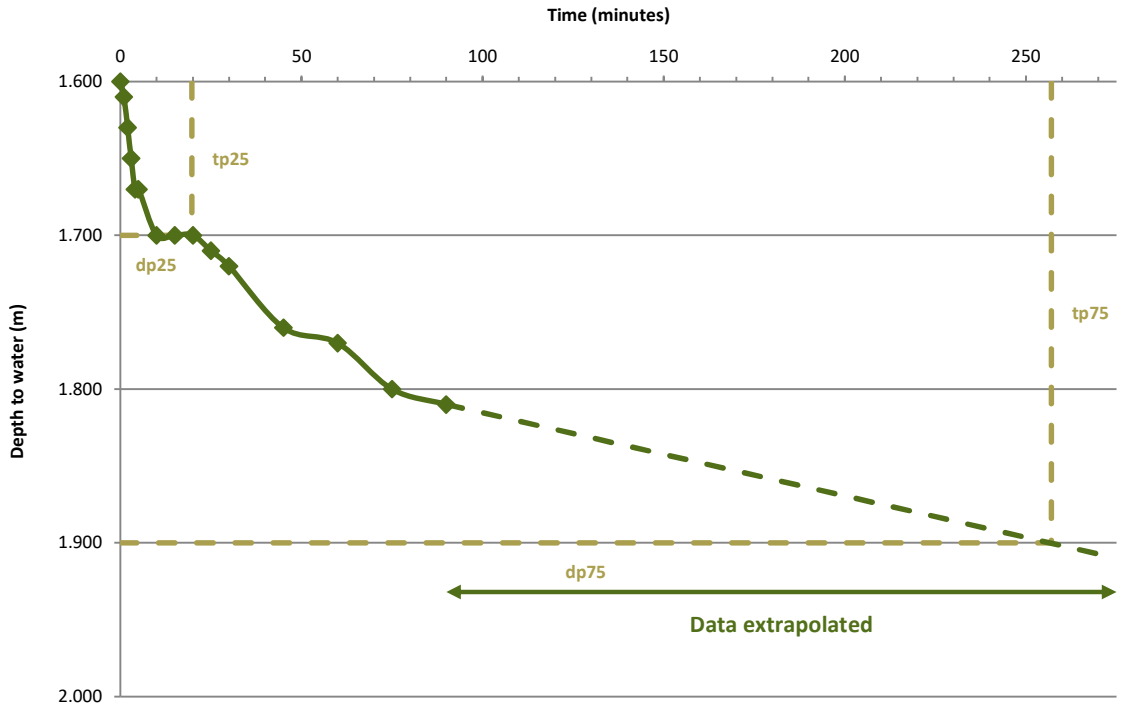
Soil infiltration test (following BRE Digest 365 2016)

Location	Cycle	Test date	Dimensions (m)
TP04	1	16/04/2021	0.70m x 2.50m

Depth at start of test (m)	Groundwater observations (at time of excavation)
2	No groundwater encountered.

$$f = \frac{V_{p75-25}}{a_{p50} \times t_{p75-25}}$$

V_{p75-25}	*Effective storage volume of water between 75% (dp75) and 25% (dp25) effective depth*	0.35m³ m^3
a_{p50}	*Internal surface area up to 50% effective depth and including the base*	3.03m² m^2
$t_{p75} - t_{p25}$	*Time for the water level to fall from 75% to 25% effective depth*	14235 s



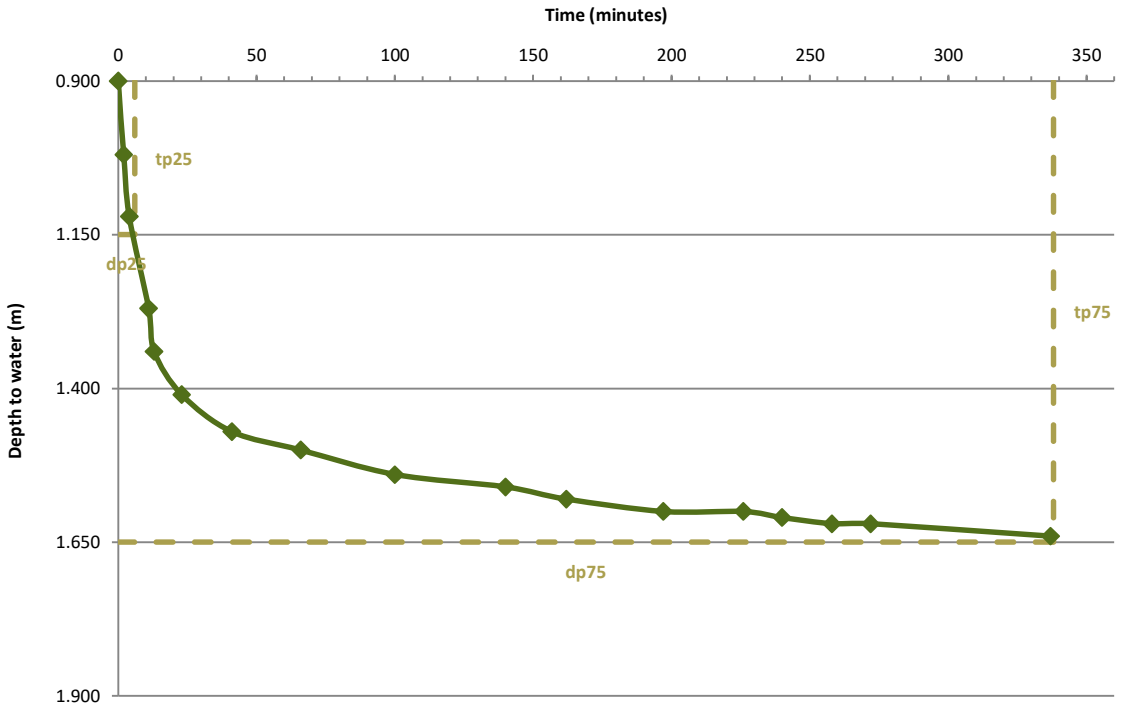
f	***Soil infiltration rate***	**8.11E-06 m/s**

soiltechnics
environmental ▪ geotechnical ▪ building fabric

Soil infiltration test (following BRE Digest 365 2016)

Location	Cycle	Test date	Dimensions (m)
TP101	1	06/10/2022	0.70m x 2.10m

Depth at start of test (m)	Groundwater observations (at time of excavation)
0.9	No groundwater encountered. Pit silted to 1.9m depth



$$f = \frac{V_{p75-25}}{a_{p50} \times t_{p75-25}}$$

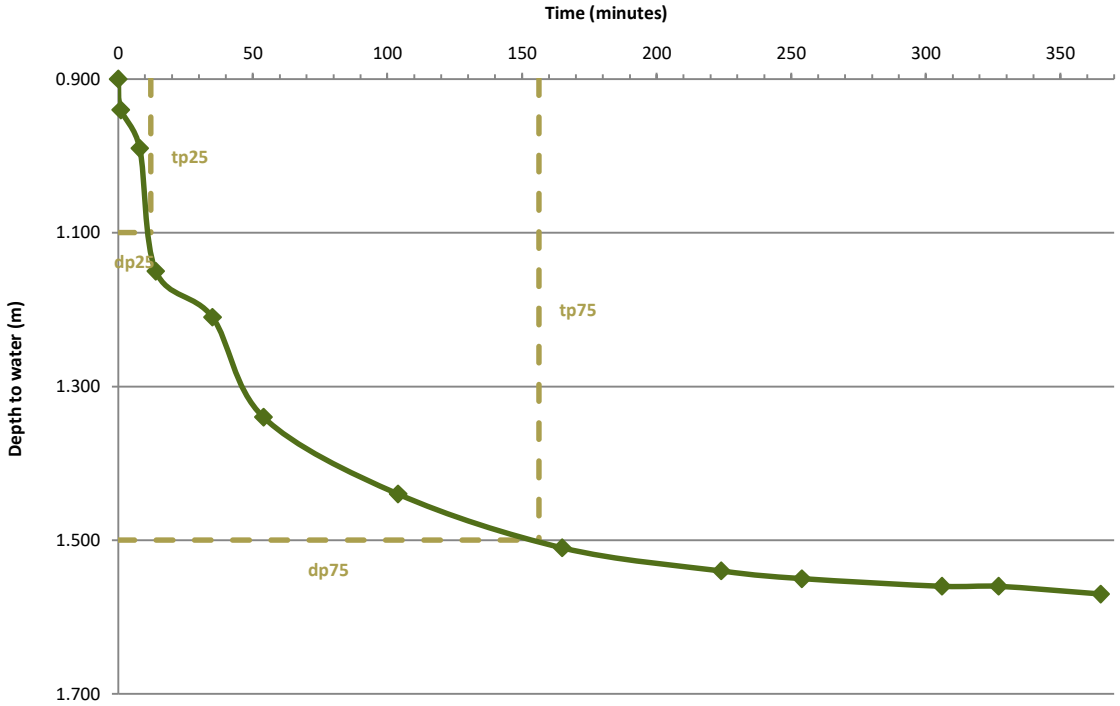
V_{p75-25} Effective storage volume of water between 75% (dp75) and 25% (dp25) effective depth	**0.735**	**m^3**
a_{p50} Internal surface area up to 50% effective depth and including the base	**4**	**m^2**
$t_{p75} - t_{p25}$ Time for the water level to fall from 75% to 25% effective depth	**19920**	**s**
f Soil infiltration rate	**8.64E-06**	**m/s**

soiltechnics
environmental ▪ geotechnical ▪ building fabric

Soil infiltration test (following BRE Digest 365 2016)

Location	Cycle	Test date	Dimensions (m)
TP101	2	06/10/2022	0.70m x 2.10m

Depth at start of test (m)	Groundwater observations (at time of excavation)
0.9	No groundwater encountered. Pit silted/collpased to 1.7m prior to 2nd cycle commencing



$$f = \frac{V_{p75-25}}{a_{p50} \times t_{p75-25}}$$

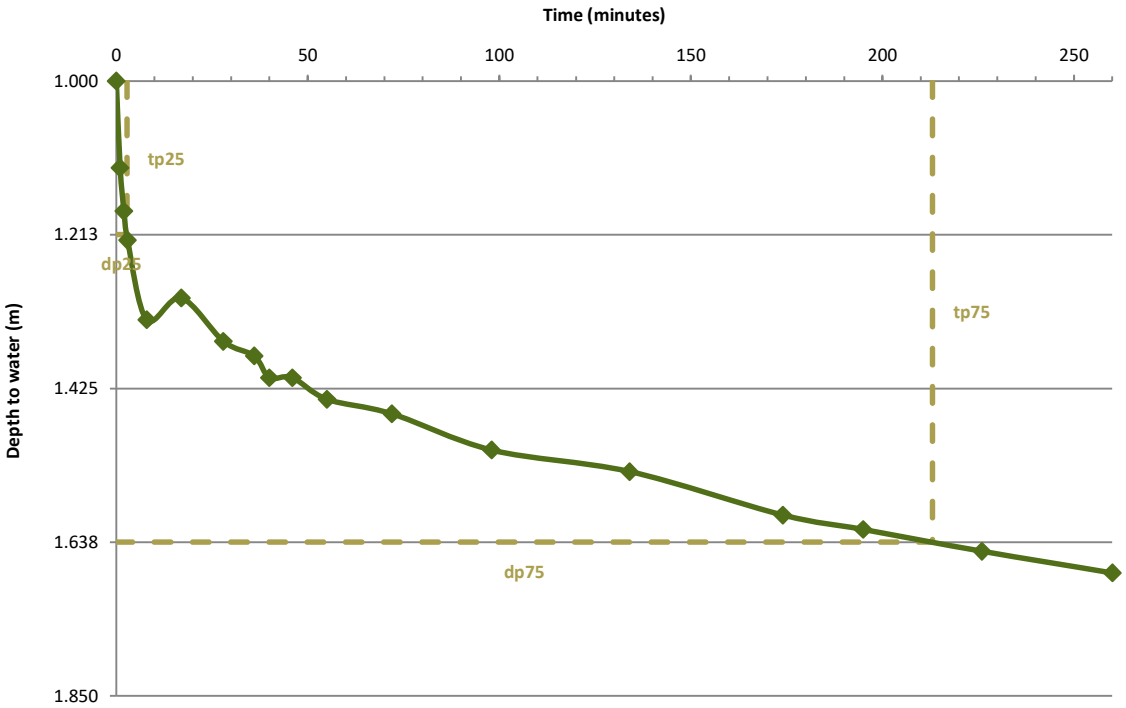
V_{p75-25} Effective storage volume of water between 75% (dp75) and 25% (dp25) effective depth	**0.588**	**m^3**
a_{p50} Internal surface area up to 50% effective depth and including the base	**4**	**m^2**
$t_{p75} - t_{p25}$ Time for the water level to fall from 75% to 25% effective depth	**8650**	**s**
f Soil infiltration rate	**1.83E-05**	**m/s**

soiltechnics
environmental ▪ geotechnical ▪ building fabric

Soil infiltration test (following BRE Digest 365 2016)

Location	Cycle	Test date	Dimensions (m)
TP102	1	06/10/2022	0.70m x 2.10m

Depth at start of test (m)	Groundwater observations (at time of excavation)
1	No groundwater encountered. Pit collpased slightly at start of test to 1.85m depth



$$f = \frac{V_{p75-25}}{a_{p50} \times t_{p75-25}}$$

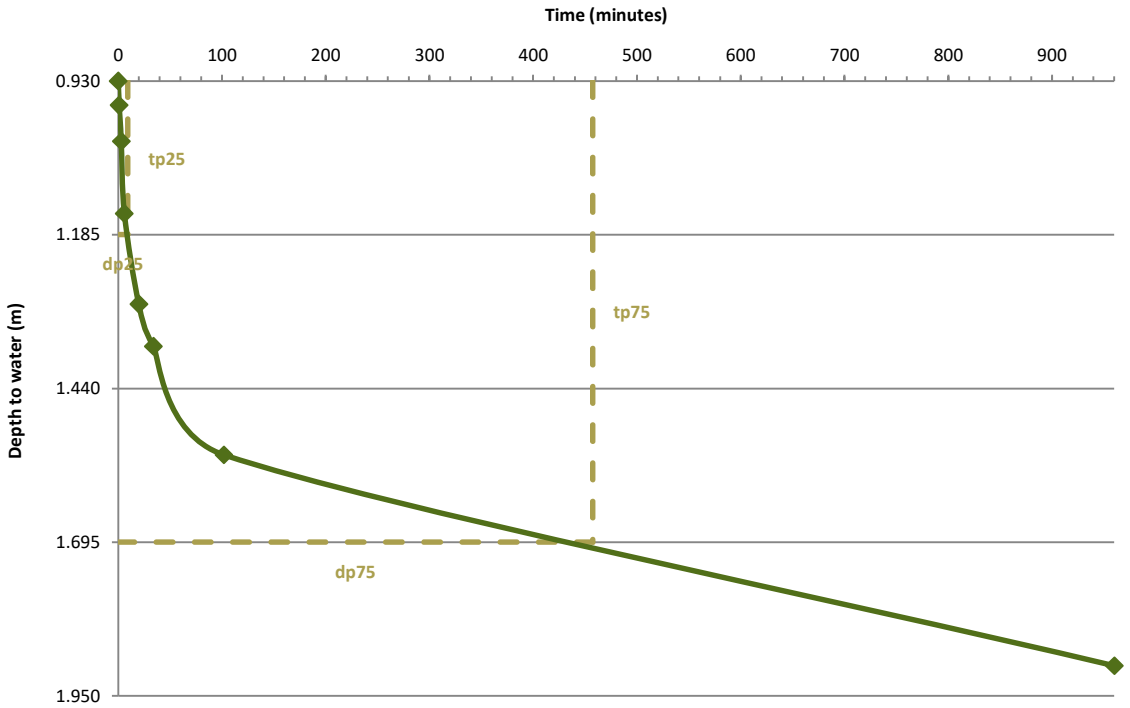
V_{p75-25} Effective storage volume of water between 75% (dp75) and 25% (dp25) effective depth	**0.62475**	**m^3**
a_{p50} Internal surface area up to 50% effective depth and including the base	**4**	**m^2**
$t_{p75} - t_{p25}$ Time for the water level to fall from 75% to 25% effective depth	**12616**	**s**
f Soil infiltration rate	**1.29E-05**	**m/s**

soiltechnics
environmental ▪ geotechnical ▪ building fabric

Soil infiltration test (following BRE Digest 365 2016)

Location	Cycle	Test date	Dimensions (m)
TP102	2	06/10/2022	0.70m x 2.10m

Depth at start of test (m)	Groundwater observations (at time of excavation)
0.93	No groundwater encountered. Pit re-excavated to 1.95m depth for 2nd cycle



$$f = \frac{V_{p75-25}}{a_{p50} \times t_{p75-25}}$$

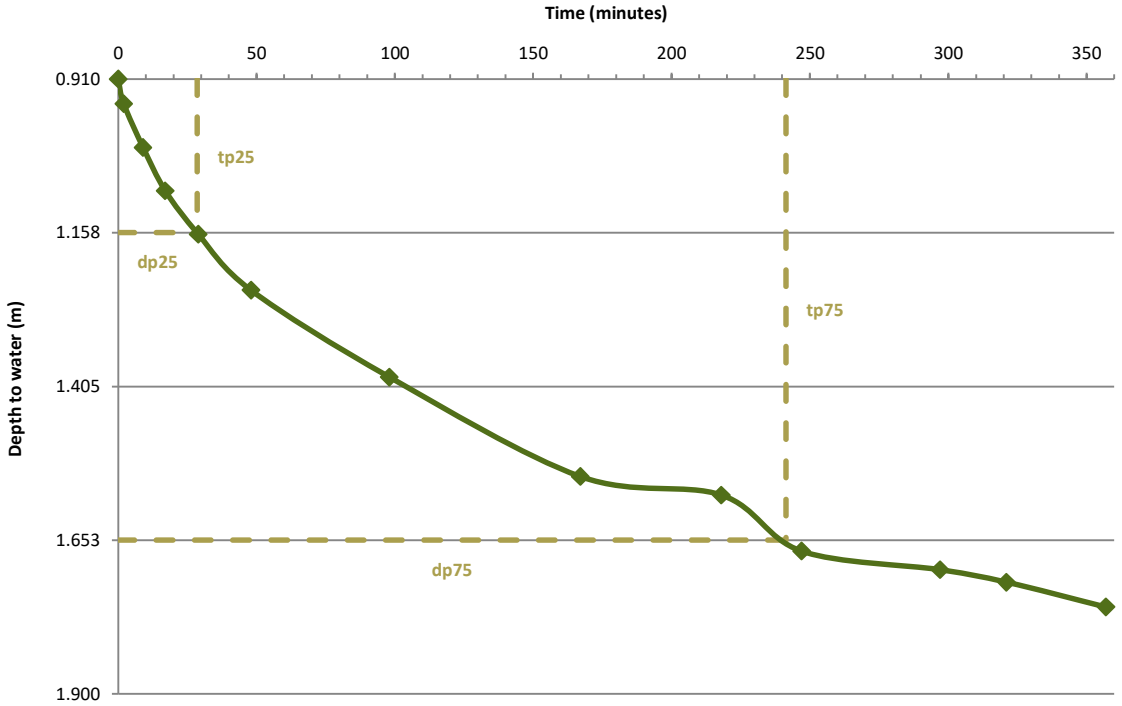
V_{p75-25} Effective storage volume of water between 75% (dp75) and 25% (dp25) effective depth	**0.7497**	**m^3**
a_{p50} Internal surface area up to 50% effective depth and including the base	**4**	**m^2**
$t_{p75} - t_{p25}$ Time for the water level to fall from 75% to 25% effective depth	**26891**	**s**
f Soil infiltration rate	**6.44E-06**	**m/s**

soiltechnics
environmental ▪ geotechnical ▪ building fabric

Soil infiltration test (following BRE Digest 365 2016)

Location	Cycle	Test date	Dimensions (m)
TP102	3	07/10/2022	0.70m x 2.10m

Depth at start of test (m)	Groundwater observations (at time of excavation)
0.91	No groundwater encountered. Pit silted to 1.9m at start of 3rd cycle on day 2



$$f = \frac{V_{p75-25}}{a_{p50} \times t_{p75-25}}$$

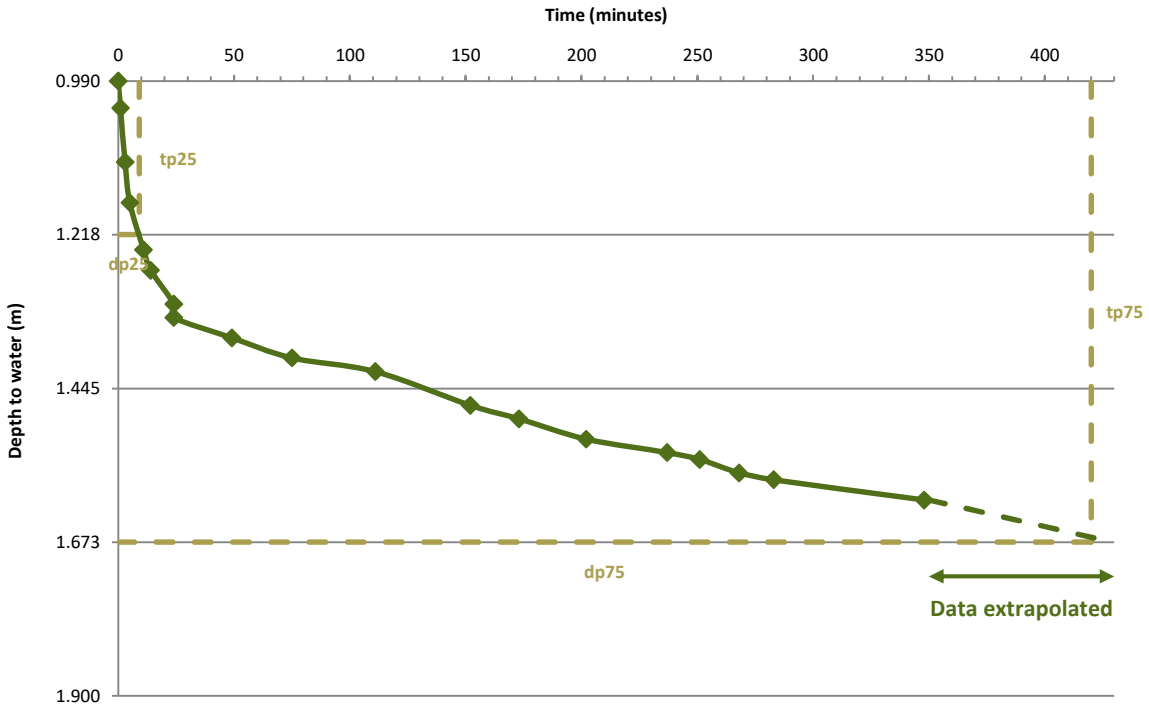
V_{p75-25} Effective storage volume of water between 75% (dp75) and 25% (dp25) effective depth	**0.72765**	**m^3**
a_{p50} Internal surface area up to 50% effective depth and including the base	**4**	**m^2**
$t_{p75} - t_{p25}$ Time for the water level to fall from 75% to 25% effective depth	**12767**	**s**
f Soil infiltration rate	**1.34E-05**	**m/s**

soiltechnics
environmental ▪ geotechnical ▪ building fabric

Soil infiltration test (following BRE Digest 365 2016)

Location	Cycle	Test date	Dimensions (m)
TP103	1	06/10/2022	0.70m x 2.10m

Depth at start of test (m)	Groundwater observations (at time of excavation)
0.99	No groundwater encountered. Pit partially collpased to 1.9m during test



$$f = \frac{V_{p75-25}}{a_{p50} \times t_{p75-25}}$$

V_{p75-25} Effective storage volume of water between 75% (dp75) and 25% (dp25) effective depth	**0.66885**	**m^3**
a_{p50} Internal surface area up to 50% effective depth and including the base	**4**	**m^2**
$t_{p75} - t_{p25}$ Time for the water level to fall from 75% to 25% effective depth	**24656**	**s**
f Soil infiltration rate	**6.75E-06**	**m/s**

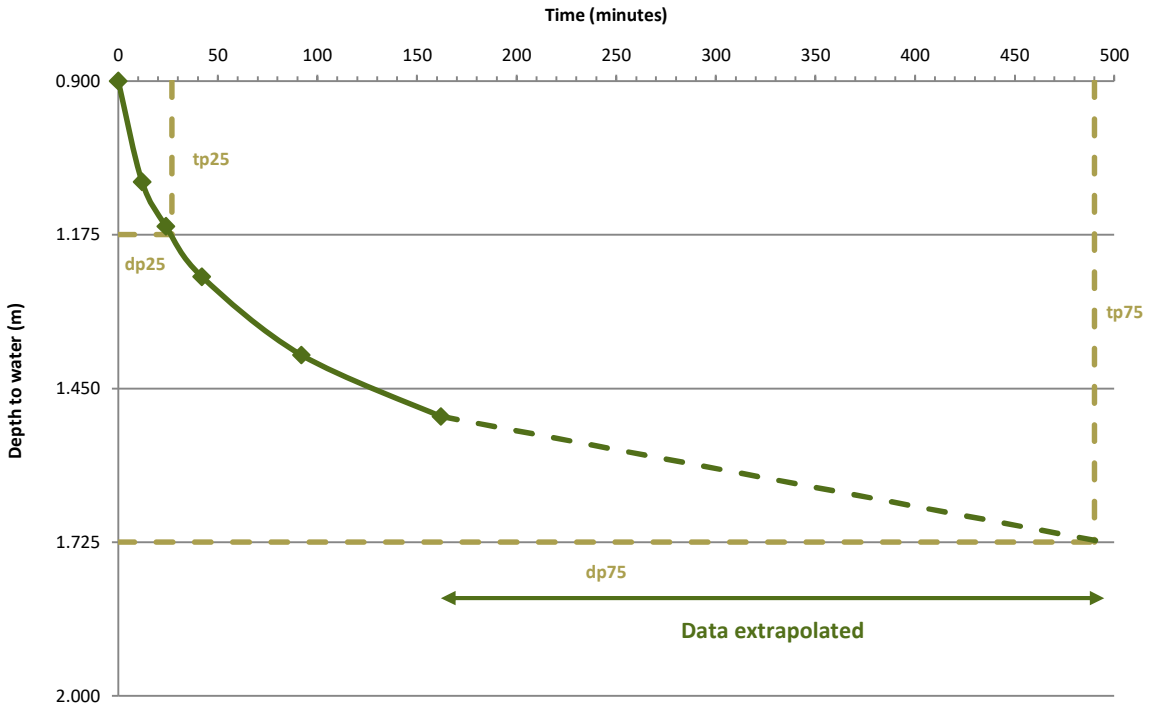
soiltechnics
environmental ▪ geotechnical ▪ building fabric

Soil infiltration test (following BRE Digest 365 2016)

Location	Cycle	Test date	Dimensions (m)
TP103	2	06/10/2022	0.70m x 2.10m

Depth at start of test (m)
0.9

Groundwater observations (at time of excavation)
No groundwater encountered. After 200mins the pit sides collpased, significantly affecting the test. Data extrapolated from last measurement prior to collapse



$$f = \frac{V_{p75-25}}{a_{p50} \times t_{p75-25}}$$

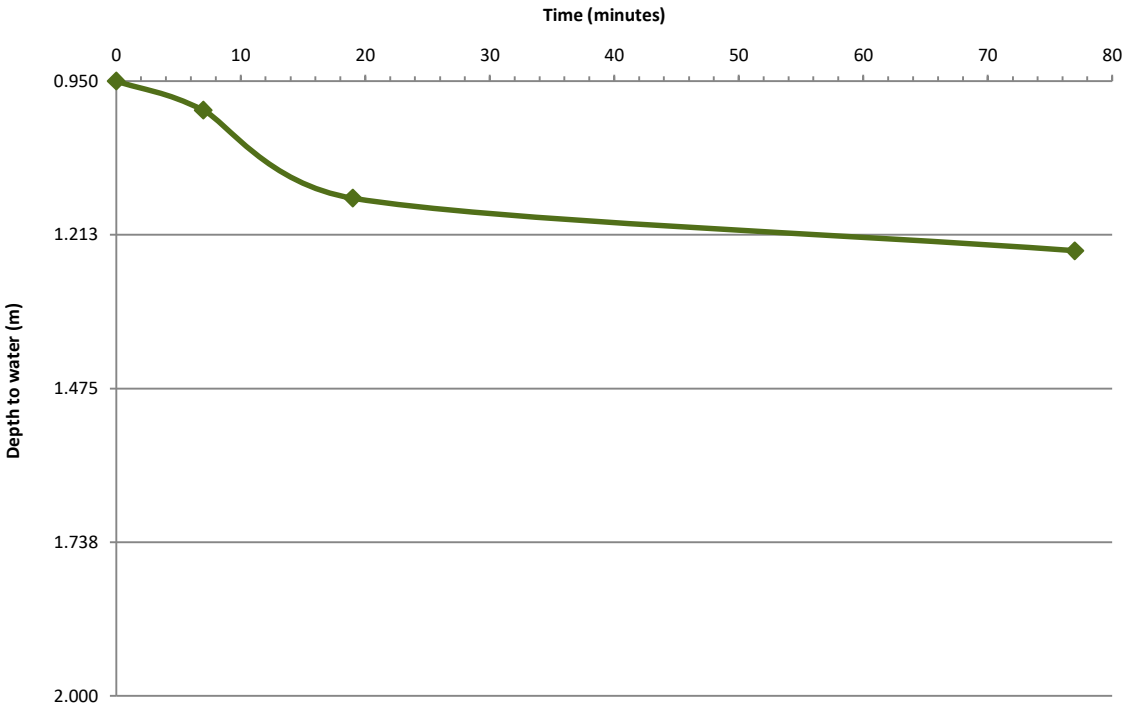
V_{p75-25} Effective storage volume of water between 75% (dp75) and 25% (dp25) effective depth	**0.8085**	**m^3**
a_{p50} Internal surface area up to 50% effective depth and including the base	**5**	**m^2**
$t_{p75} - t_{p25}$ Time for the water level to fall from 75% to 25% effective depth	**27780**	**s**
f Soil infiltration rate	**6.40E-06**	**m/s**

soiltechnics
environmental ▪ geotechnical ▪ building fabric

Soil infiltration test (following BRE Digest 365 2016)

Location	Cycle	Test date	Dimensions (m)
TP103	3	06/10/2022	0.70m x 2.10m

Depth at start of test (m)	Groundwater observations (at time of excavation)
0.95	No groundwater encountered.



Insufficient infiltration over 77 minutes of monitoring therefore unable to calculate soil infiltration rate.

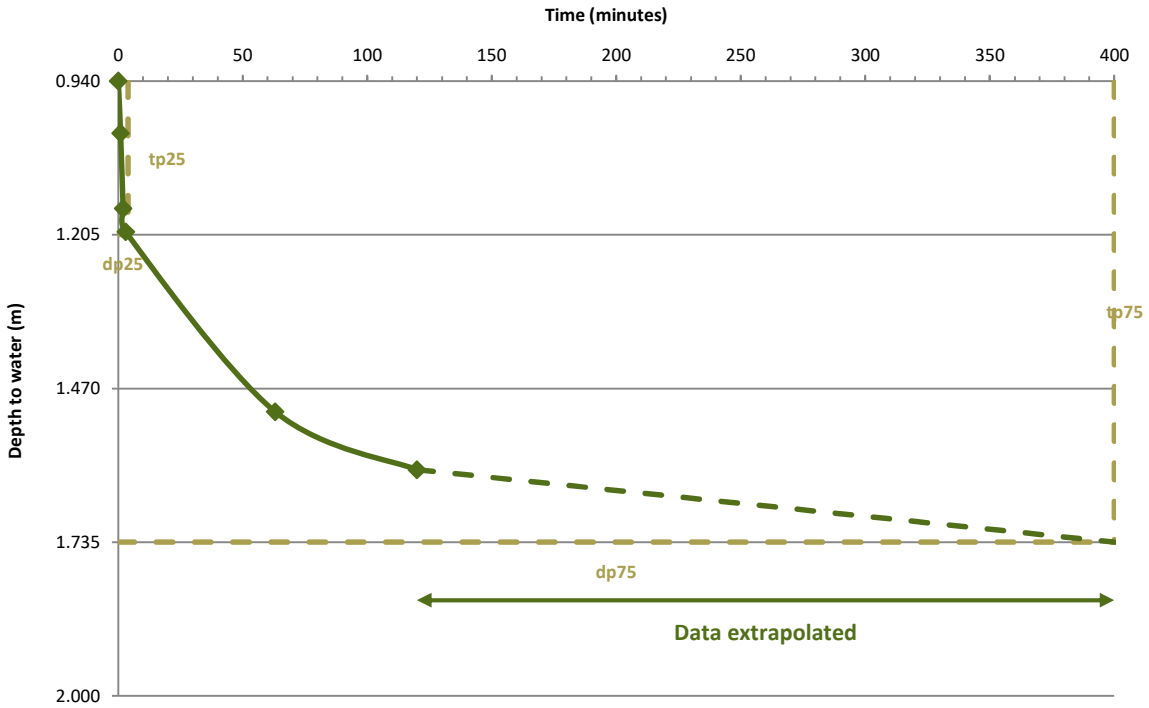
soiltechnics
environmental ▪ geotechnical ▪ building fabric

Soil infiltration test (following BRE Digest 365 2016)

Location	Cycle	Test date	Dimensions (m)
TP104	1	07/10/2022	0.70m x 2.10m

Depth at start of test (m)
0.91

Groundwater observations (at time of excavation)
No groundwater encountered. Significant period of inclement weather after 120mins. Test terminated and data extrapolated from last measurement prior to event



$$f = \frac{V_{p75-25}}{a_{p50} \times t_{p75-25}}$$

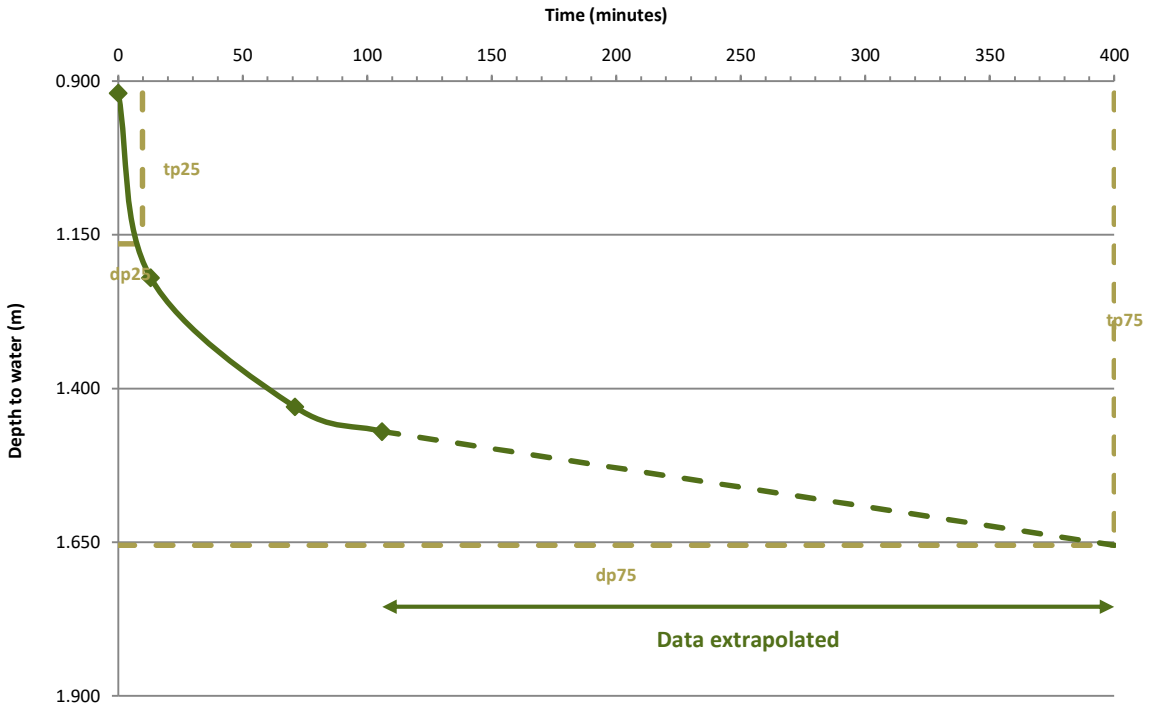
V_{p75-25} Effective storage volume of water between 75% (dp75) and 25% (dp25) effective depth	**0.7791**	**m^3**
a_{p50} Internal surface area up to 50% effective depth and including the base	**4**	**m^2**
$t_{p75} - t_{p25}$ Time for the water level to fall from 75% to 25% effective depth	**23762**	**s**
f Soil infiltration rate	**7.39E-06**	**m/s**

soiltechnics
environmental ▪ geotechnical ▪ building fabric

Soil infiltration test (following BRE Digest 365 2016)

Location	Cycle	Test date	Dimensions (m)
TP104	2	07/10/2022	0.70m x 2.10m

Depth at start of test (m)	Groundwater observations (at time of excavation)
0.92	No groundwater encountered.



$$f = \frac{V_{p75-25}}{a_{p50} \times t_{p75-25}}$$

V_{p75-25} Effective storage volume of water between 75% (dp75) and 25% (dp25) effective depth	**0.7203**	**m^3**
a_{p50} Internal surface area up to 50% effective depth and including the base	**4**	**m^2**
$t_{p75} - t_{p25}$ Time for the water level to fall from 75% to 25% effective depth	**23412**	**s**
f Soil infiltration rate	**7.30E-06**	**m/s**

soiltechnics
environmental ▪ geotechnical ▪ building fabric

Key to legends

Composite materials, soils and lithology							
	Topsoil		Made Ground		Boulders		Chalk
	Clay		Coal		Cobbles		Concrete
	Gravel		Limestone		Mudstone		Peat
	Sand		Sandstone		Silt		Siltstone

Note: Composite soil types are signified by combined symbols.

Key to 'test results' and 'sampling' columns

Test result	
Depth	Records depth that the test was carried out (i.e.: at 2.10m or between 2.10m and 2.55m)
Result	PP – Pocket penetrometer result reported as an equivalent undrained shear strength (kN/m²) by applying a factor of 50. SV – Hand held shear vane result reported as an undrained shear strength (kN/m²). Where multiple readings are taken at the same level the average value is shown on the log. * Signifies that instrument limit reached.

Sampling		
From (m) To (m)	Records depth of sampling	
Type	D	Disturbed sample
	B	Bulk disturbed sample
	ES	Environmental sample
	W	Water sample
	U	Undisturbed thick-walled sample 100mm diameter sampler
	UT	Undisturbed thin walled sample 100mm diameter sampler
	UTF	Failed undisturbed sample

Water observations

Described at foot of log and shown in the 'water strike' column.

▼ Water level observed after specified delay in drilling

▽ Water strike

Density

Density recorded in brackets determined by qualitative field assessment or inferred from density testing and soil descriptions from across the site (i.e.: [Medium dense]).

Greenfinch, Didsbury
STV6154

soiltechnics
environmental ▪ geotechnical ▪ building fabric

STRATA				WATER STRIKES	IN SITU TESTING		SAMPLING		
DESCRIPTION	DEPTH (m)	REDUCED LVL (m OD)	LEGEND		TYPE / DEPTH (m)	RESULT	FROM (m)	TO (m)	TYPE
ASHPALT. (MADE GROUND)	0.12								
[Medium dense] light grey to brown slightly sandy GRAVEL of medium to coarse angular to subrounded limestone. (MADE GROUND)							0.30		ES
							0.60		ES
[Loose] light grey to brown gravelly slightly clayey SAND. Gravel is medium rounded to subrounded sandstone. (GLACIOFLUVIAL SHEET DEPOSITS)	0.70								
...at 1m depth, clay pipe.							1.00		B
							1.70		B
							2.50		B
TRIAL PIT TERMINATED AT 3.20m	3.20								

Notes Collapse of trial pit sides at 3.2m due to water ingress, trial pit terminated.	**Title** Trial pit record	**Dimensions (w x l)** 0.70m x 2.60m	**Date(s)** 16/04/2021
	Method Machine excavator	**Logged by** TO	**Sheet number** Sheet 1 of 1
Groundwater observations Groundwater encountered at 3.1m depth, filling trial pit to 3.07m in 10 minutes.	**Level (m OD)** -	**Compiled by** KD	**Revision**
	Co-ordinates -	**Checked by** SCD	**TP01**

Greenfinch, Didsbury
STV6154

soiltechnics
environmental ▪ geotechnical ▪ building fabric

STRATA				WATER STRIKES	IN SITU TESTING		SAMPLING		
DESCRIPTION	DEPTH (m)	REDUCED LVL (m OD)	LEGEND		TYPE / DEPTH (m)	RESULT	FROM (m)	TO (m)	TYPE
ASHPALT.	0.11								
(MADE GROUND)							0.20		ES
[Medium dense] light grey slightly sandy GRAVEL of fine to coarse angular limestone.							0.40		ES
(MADE GROUND)	0.60								
[Loose] light grey to brown gravelly slightly clayey SAND. Gravel is medium rounded to subrounded sandstone.							0.80		B
(GLACIOFLUVIAL SHEET DEPOSITS)									
...at 1m depth, clay pipe.							1.20		B
							1.60		B
TRIAL PIT TERMINATED AT 1.80m	1.80								

Notes Trial pit sides remained upright and stable upon completion. Trail pit terminated to perform Infiltration testing.	**Title** Trial pit record	**Dimensions (w x l)** 0.70m x 2.00m	**Date(s)** 16/04/2021
	Method Machine excavator	**Logged by** TO	**Sheet number** Sheet 1 of 1
Groundwater observations No groundwater encountered.	**Level (m OD)** -	**Compiled by** KD	**Revision**
	Co-ordinates -	**Checked by** SCD	**TP02**

Greenfinch, Didsbury
STV6154

soiltechnics
environmental ▪ geotechnical ▪ building fabric

STRATA				WATER STRIKES	IN SITU TESTING		SAMPLING		
DESCRIPTION	DEPTH (m)	REDUCED LVL (m OD)	LEGEND		TYPE / DEPTH (m)	RESULT	FROM (m)	TO (m)	TYPE
ASHPALT.	0.12								
(MADE GROUND)									
[Medium dense] light grey slightly sandy GRAVEL of fine to coarse angular limestone.	0.40								
(MADE GROUND)									
[Medium dense] dark grey slightly clayey gravelly SAND. Gravel is fine to medium angular brick and concrete.	0.60								
(MADE GROUND)									
[Loose] brown gravelly slightly clayey SAND. Gravel is medium rounded to subrounded sandstone.							0.90		B
(GLACIOFLUVIAL SHEET DEPOSITS)							1.60		B
							2.10		B
TRIAL PIT TERMINATED AT 2.50m	2.50								

Notes Collapse of trial pit sides between 1.8-2.5m depth on completion, widening trial pit by 1.1m each side. Trail pit terminated due to extensive collapsing.	**Title** Trial pit record	**Dimensions (w x l)** 0.70m x 2.30m	**Date(s)** 16/04/2021
	Method Machine excavator	**Logged by** TO	**Sheet number** Sheet 1 of 1
Groundwater observations No groundwater encountered.	**Level (m OD)** -	**Compiled by** KD	**Revision**
	Co-ordinates -	**Checked by** SCD	**TP03**

Greenfinch, Didsbury
STV6154

soiltechnics
environmental ▪ geotechnical ▪ building fabric

STRATA				WATER STRIKES	IN SITU TESTING		SAMPLING		
DESCRIPTION	DEPTH (m)	REDUCED LVL (m OD)	LEGEND		TYPE / DEPTH (m)	RESULT	FROM (m)	TO (m)	TYPE
ASHPALT.	0.12								
(MADE GROUND)							0.20		ES
[Medium dense] dark brown to light grey slightly sandy GRAVEL of medium to coarse angular to subrounded limestone.									
(MADE GROUND)							0.50		ES
[Loose] light grey to brown gravelly slightly clayey SAND. Gravel is medium rounded to subrounded sandstone.	0.60								
(GLACIOFLUVIAL SHEET DEPOSITS)							0.80		B
							1.30		B
							1.80		B
TRIAL PIT TERMINATED AT 2.00m	2.00								

Notes Collapse of trial pit sides at 2m depth after filling with water widening trial pit by 0.5m on the east side and 0.4m on the west side. Infiltration testing performed.	**Title** Trial pit record	**Dimensions (w x l)** 0.70m x 2.50m	**Date(s)** 16/04/2021
	Method Machine excavator	**Logged by** TO	**Sheet number** Sheet 1 of 1
Groundwater observations No groundwater encountered.	**Level (m OD)** -	**Compiled by** KD	**Revision**
	Co-ordinates -	**Checked by** SCD	**TP04**

Greenfinch, Didsbury
STV6154

soiltechnics
environmental ▪ geotechnical ▪ building fabric

STRATA				WATER STRIKES	IN SITU TESTING		SAMPLING		
DESCRIPTION	DEPTH (m)	REDUCED LVL (m OD)	LEGEND		TYPE / DEPTH (m)	RESULT	FROM (m)	TO (m)	TYPE
ASHPALT. (MADE GROUND)	0.12						0.20		ES
[Medium dense] brown very sandy GRAVEL of fine to coarse angular brick and limestone with occasional half brick. (MADE GROUND)							0.30		ES
							0.50		D
[Loose] light brown gravelly slightly clayey SAND. Gravel is medium rounded to subrounded sandstone. (GLACIOFLUVIAL SHEET DEPOSITS)	0.60						1.00		B
							1.80		B
TRIAL PIT TERMINATED AT 2.00m	2.00								

Notes Collapse of trial pit sides at 2m depth widening trial pit by 1m on the east side and 0.6m on the west side filling pit to 1.2m depth. Trail pit terminated due to extensive collapsing.	**Title** Trial pit record	**Dimensions (w x l)** 0.70m x 2.20m	**Date(s)** 16/04/2021
	Method Machine excavator	**Logged by** TO	**Sheet number** Sheet 1 of 1
Groundwater observations No groundwater encountered.	**Level (m OD)** -	**Compiled by** KD	**Revision**
	Co-ordinates -	**Checked by** SCD	**TP05**

Greenfinch, Didsbury
STV6154

soiltechnics
environmental ▪ geotechnical ▪ building fabric

STRATA				WATER STRIKES	IN SITU TESTING		SAMPLING		
DESCRIPTION	DEPTH (m)	REDUCED LVL (m OD)	LEGEND		TYPE / DEPTH (m)	RESULT	FROM (m)	TO (m)	TYPE
ASPHALT. (ASPHALT)	0.12								
Light grey to brown sandy medium to coarse angular to subrounded GRAVEL of limestone and brick. (MADE GROUND)									
Light grey to brown gravelly SAND. Gravel is medium rounded to subrounded sandstone. (GLACIOFLUVIAL SHEET DEPOSITS)	0.80						1.00	2.00	B
TRIAL PIT TERMINATED AT 2.00m	2.00								

Notes Trial pit sides remained upright and stable upon completion.	**Title** Trial pit record	**Dimensions (w x l)** 0.70m x 2.10m	**Date(s)** 06/10/2022
	Method Machine excavator	**Logged by** TO	**Sheet number** Sheet 1 of 1
Groundwater observations No groundwater encountered.	**Level (m OD)** -	**Compiled by** KD	**Revision**
	Co-ordinates -	**Checked by** SCD	**TP101**

Greenfinch, Didsbury
STV6154

soiltechnics
environmental ▪ geotechnical ▪ building fabric

STRATA				WATER STRIKES	IN SITU TESTING		SAMPLING		
DESCRIPTION	DEPTH (m)	REDUCED LVL (m OD)	LEGEND		TYPE / DEPTH (m)	RESULT	FROM (m)	TO (m)	TYPE
ASPHALT. (ASPHALT)	0.12								
Light grey to brown sandy medium to coarse angular to subrounded GRAVEL of limestone and brick. (MADE GROUND)									
Light grey to brown gravelly SAND. Gravel is medium rounded to subrounded sandstone. (GLACIOFLUVIAL SHEET DEPOSITS)	0.70						1.00	2.00	B
TRIAL PIT TERMINATED AT 2.00m	2.00								

Notes Trial pit sides remained upright and stable upon completion.	**Title** Trial pit record	**Dimensions (w x l)** 0.70m x 2.10m	**Date(s)** 06/10/2022
	Method Machine excavator	**Logged by** TO	**Sheet number** Sheet 1 of 1
Groundwater observations No groundwater encountered.	**Level (m OD)** -	**Compiled by** KD	**Revision**
	Co-ordinates -	**Checked by** SCD	**TP102**

Greenfinch, Didsbury
STV6154

soiltechnics
environmental ▪ geotechnical ▪ building fabric

STRATA				WATER STRIKES	IN SITU TESTING		SAMPLING		
DESCRIPTION	DEPTH (m)	REDUCED LVL (m OD)	LEGEND		TYPE / DEPTH (m)	RESULT	FROM (m)	TO (m)	TYPE
ASPHALT. (ASPHALT)	0.12								
Light grey to brown sandy medium to coarse angular to subrounded GRAVEL of limestone and brick with cobbles of brick. (MADE GROUND)									
Light grey to brown gravelly SAND. Gravel is medium rounded to subrounded sandstone. (GLACIOFLUVIAL SHEET DEPOSITS)	0.90						1.00	2.00	B
TRIAL PIT TERMINATED AT 2.00m	2.00								

Notes Trial pit sides remained upright and stable upon completion.	**Title** Trial pit record	**Dimensions (w x l)** 0.70m x 2.10m	**Date(s)** 06/10/2022
	Method Machine excavator	**Logged by** TO	**Sheet number** Sheet 1 of 1
Groundwater observations No groundwater encountered.	**Level (m OD)** -	**Compiled by** KD	**Revision**
	Co-ordinates -	**Checked by** SCD	**TP103**

Greenfinch, Didsbury
STV6154

soiltechnics
environmental ▪ geotechnical ▪ building fabric

STRATA				WATER STRIKES	IN SITU TESTING		SAMPLING		
DESCRIPTION	DEPTH (m)	REDUCED LVL (m OD)	LEGEND		TYPE / DEPTH (m)	RESULT	FROM (m)	TO (m)	TYPE
ASPHALT. (ASPHALT)	0.12								
Light grey to brown sandy medium to coarse angular to subrounded GRAVEL of limestone and brick. (MADE GROUND)									
Light grey to brown gravelly SAND. Gravel is medium rounded to subrounded sandstone. (GLACIOFLUVIAL SHEET DEPOSITS)	0.60						1.00	2.00	B
TRIAL PIT TERMINATED AT 2.00m	2.00								

Notes Trial pit sides remained upright and stable upon completion.	**Title** Trial pit record	**Dimensions (w x l)** 0.70m x 2.10m	**Date(s)** 07/10/2022
	Method Machine excavator	**Logged by** TO	**Sheet number** Sheet 1 of 1
Groundwater observations No groundwater encountered.	**Level (m OD)** -	**Compiled by** KD	**Revision**
	Co-ordinates -	**Checked by** SCD	**TP104**

Greenfinch, Didsbury
STV6154

soiltechnics
environmental ▪ geotechnical ▪ building fabric

STRATA				WATER STRIKES	IN SITU TESTING		SAMPLING		
DESCRIPTION	DEPTH (m)	REDUCED LVL (m OD)	LEGEND		TYPE / DEPTH (m)	RESULT	FROM (m)	TO (m)	TYPE
Dark brown to brown very gravelly SAND. Gravel is fine to coarse angular brick, concrete, timber, glass and metal. (MADE GROUND)							0.30		ES
							0.70		ES
							1.10		ES
TRIAL PIT TERMINATED AT 1.20m	1.20								

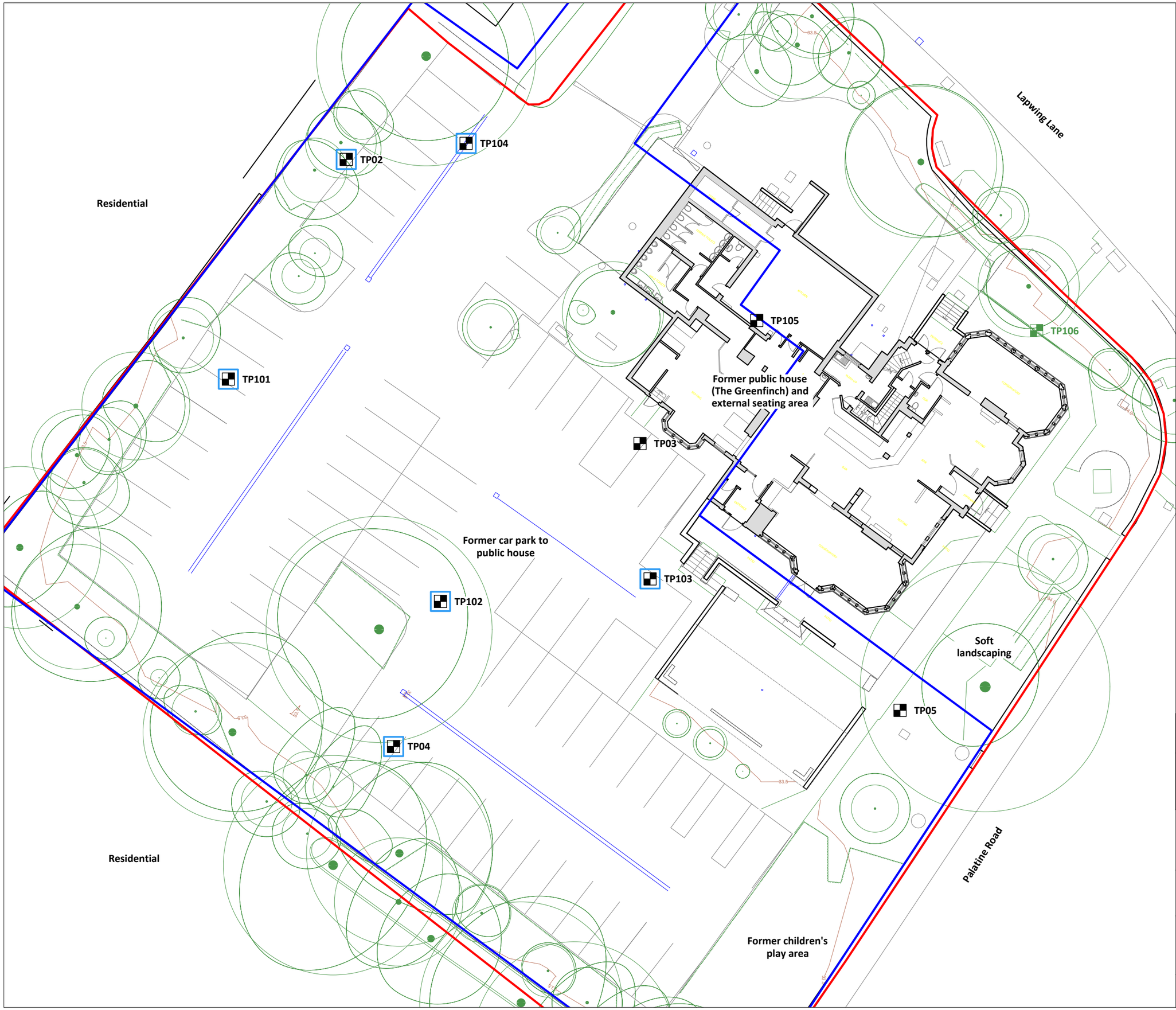
Notes Trial pit sides remained upright and stable upon completion.	**Title** Trial pit record	**Dimensions (w x l)** 0.70m x 2.10m	**Date(s)** 07/10/2022
	Method Machine excavator	**Logged by** TO	**Sheet number** Sheet 1 of 1
Groundwater observations No groundwater encountered.	**Level (m OD)** -	**Compiled by** KD	**Revision**
	Co-ordinates -	**Checked by** SCD	**TP105**

Greenfinch, Didsbury
STV6154

soiltechnics
environmental ▪ geotechnical ▪ building fabric

STRATA				WATER STRIKES	IN SITU TESTING		SAMPLING		
DESCRIPTION	DEPTH (m)	REDUCED LVL (m OD)	LEGEND		TYPE / DEPTH (m)	RESULT	FROM (m)	TO (m)	TYPE
Grass over dark brown slightly clayey SAND with rootlets. (MADE GROUND - TOPSOIL)	0.30						0.40		ES
Dark brown to brown very gravelly SAND. Gravel is fine to coarse angular brick, concrete, timber, glass and timber. (MADE GROUND)	0.70								
TRIAL PIT TERMINATED AT 0.70m									

Notes Trial pit sides remained upright and stable upon completion.	**Title** Trial pit record	**Dimensions (w x l)** 0.40m x 0.40m	**Date(s)** 07/10/2022
	Method Hand excavated	**Logged by** TO	**Sheet number** Sheet 1 of 1
Groundwater observations No groundwater encountered.	**Level (m OD)** -	**Compiled by** KD	**Revision**
	Co-ordinates -	**Checked by** SCD	**TP106**



Key

- TP — Hand excavated trial pit
- TP — Machine excavated trial pit
- Infiltration testing performed
- Search area boundary
- Boundary under consideration

Notes

1. Base drawing provided by Client
2. Exploratory locations are approximate

REV	DESCRIPTION	PRODUCED BY	CHECKED BY	REVIEWED BY	DATE
B	Second issue - additional trial pit and soakaway tests	KD	TO	SCD	18.10.2022
A	First issue	KD	SCD	SCD	02.06.2021

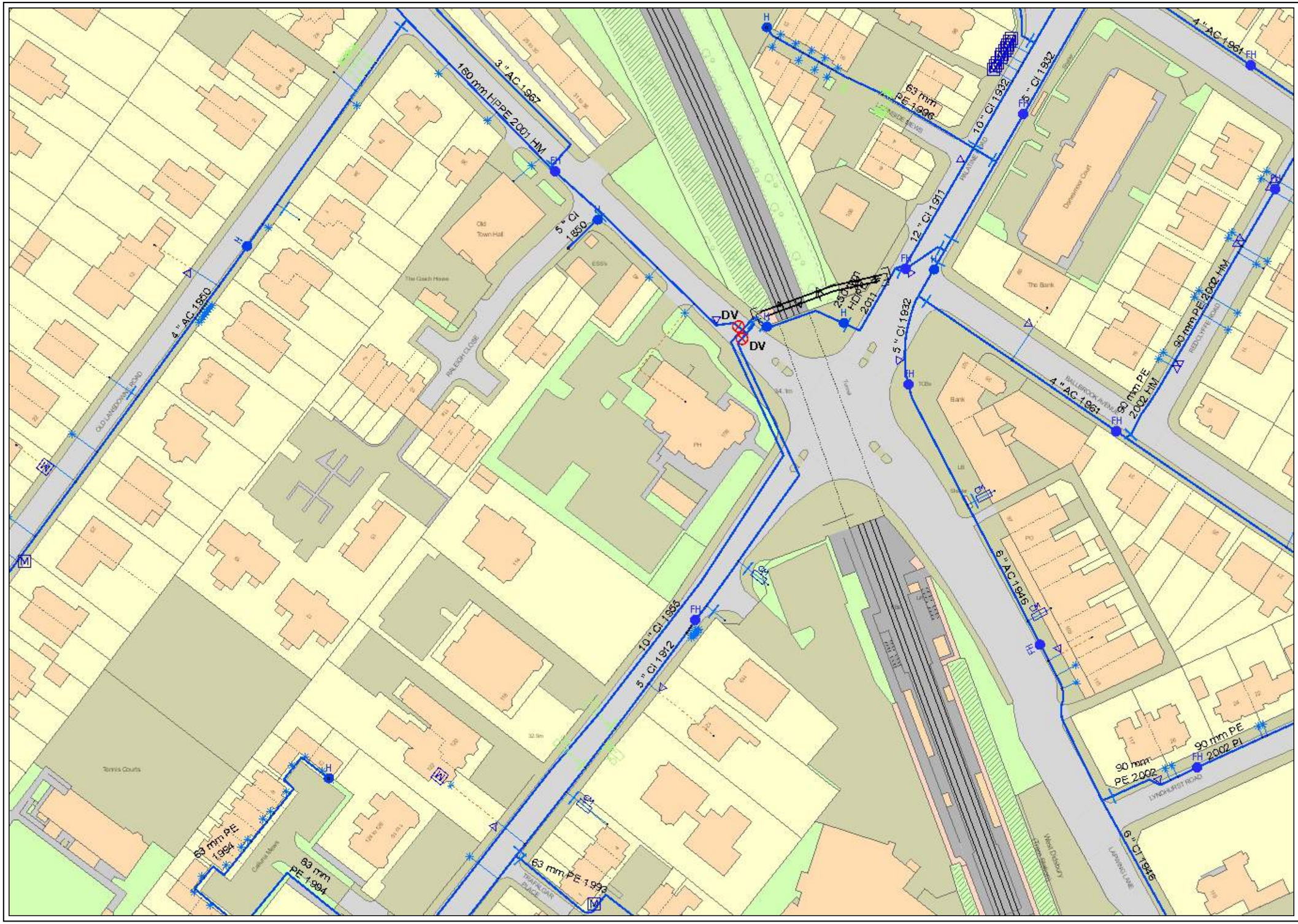
soiltechnics
environmental ▪ geotechnical ▪ building fabric

PROJECT
Greenfinch, Didsbury

TITLE
Exploratory hole plan (current layout)

PROJECT NO.	SCALE AT A3	DRAWING NO.
STV6154	1:250	02

Appendix D United Utilities Asset Records and Correspondence



United Utilities Maps for SafeDig

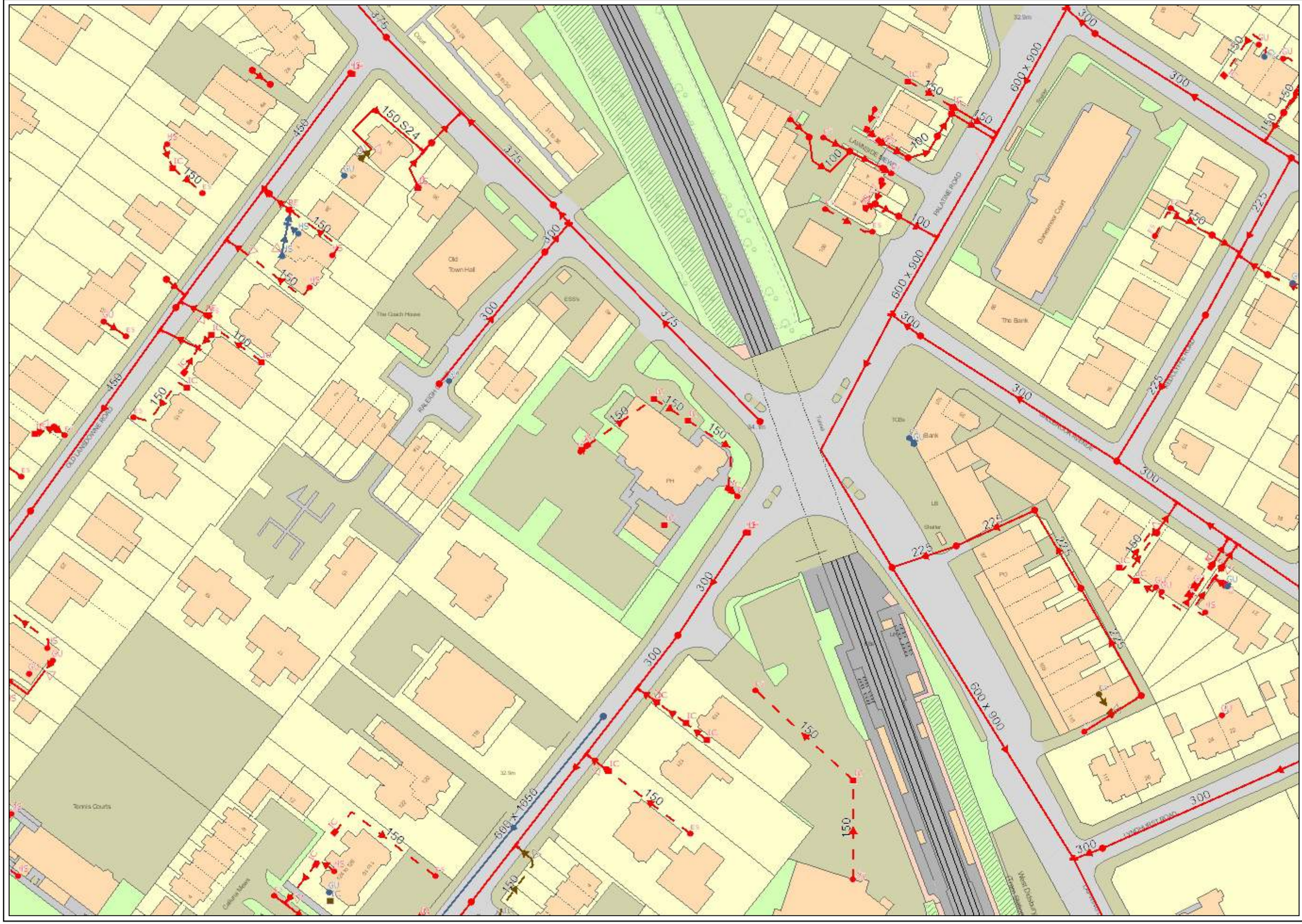
Date :	13/07/2023 14:17:12
Centre X:	384326
Centre Y:	392070
Scale :	1000
UserName:	NRSWA

Extract from maps of United Utilities' Underground Assets

The position of the underground apparatus shown on this plan is approximate only and is given in accordance with the best information currently available. The actual positions may be different from those shown on the plan and private service pipes may be shown by a blue broken line. United Utilities Water will not accept liability for any damage caused by the actual position being different from those shown.

Crown copyright and database rights 2023.Ordnance Survey 100022432 This plan is based on the Ordnance Survey Map with the sanction of the Controller of H.M. Stationary Office. Crown and United Utilities Water copyrights are reserved. Unauthorised reproduction will infringe these copyrights.

United Utilities
Water for the North West



United Utilities Maps for SafeDig

Date :	13/07/2023 14:19:48
Centre X:	384335
Centre Y:	392081
Scale :	1000
UserName:	NRSWA

Extract from maps of United Utilities' Underground Assets

The position of the underground apparatus shown on this plan is approximate only and is given in accordance with the best information currently available. The actual positions may be different from those shown on the plan and private service pipes may be shown by a blue broken line. United Utilities Water will not accept liability for any damage caused by the actual position being different from those shown.

Crown copyright and database rights 2023.Ordnance Survey 100022432 This plan is based on the Ordnance Survey Map with the sanction of the Controller of H.M. Stationary Office. Crown and United Utilities Water copyrights are reserved. Unauthorised reproduction will infringe these copyrights.

United Utilities
Water for the North West

Ben Fenton

From: seweradoptions@uuplc.co.uk
Sent: 19 October 2023 10:44
To: Ben Fenton
Subject: UU REF – 04799999 – Ww PDE - Lapwing Lane, Didsbury

Good Morning Ben,

Thank you for your Pre Development Enquiry, please see our response below:

UU REF – 04799999 – Ww PDE - Lapwing Lane, Didsbury

I can confirm United Utilities has no objections in principal to your proposals of 2.7 l/s to the combined sewer network.

Regards

Anthony

United Utilities
Water for the North West

Anthony Laithwaite
Ww Lead
Ww Engineer
Developer Services & Metering
Customer Services

M: 07880 298897
unitedutilities.com

The information contained in this e-mail is intended only for the individual to whom it is addressed. It may contain legally privileged or confidential information or otherwise be exempt from disclosure. If you have received this Message in error or there are any problems, please notify the sender immediately and delete the message from your computer. You must not use, disclose, copy or alter this message for any unauthorised purpose. Neither United Utilities Group PLC nor any of its subsidiaries will be liable for any direct, special, indirect or consequential damages as a result of any virus being passed on, or arising from the alteration of the contents of this message by a third party.

United Utilities Group PLC, Haweswater House, Lingley Mere Business Park, Lingley Green Avenue, Great Sankey, Warrington, WA5 3LP
Registered in England and Wales. Registered No 6559020

www.unitedutilities.com
www.unitedutilities.com/subsidiaries

Appendix E Utility Surveys LTD CCTV Drainage Report

Indicative

N

CABLES

S3

S2

GULLY

NO MH

PI1

C1

C2

G

C1

DEBRIS/ COLLAPSE

G1

S1

SVP

RWP

S4

RWP

G3

RWP

C3

ASSUMED ROUTE UNABLE TO CLEAR

G2

G

FULL OF MUD

S5

JOINS MAIN

SL\TITLE\PROVISIONAL.jpg

Overview

Section: 1 **From: G1** **To: S1**	Grade B	**DRB Grade: B** **Pipe Size: 150** **Material: Vitrified Clay (i.e. all clayware)** **Use: Surface Water**
Section: 2 **From: S1** **To: PI1**	Grade B	**DRB Grade: B** **Pipe Size: 150** **Material: Vitrified Clay (i.e. all clayware)** **Use: Surface Water**
Section: 3 **From: G2** **To: S1**	Grade B	**DRB Grade: B** **Pipe Size: 150** **Material: Vitrified Clay (i.e. all clayware)** **Use: Surface Water**
Section: 4 **From: S2** **To: PI1**	Grade A	**DRB Grade: A** **Pipe Size: 150** **Material: Vitrified Clay (i.e. all clayware)** **Use: Surface Water**
Section: 5 **From: S3** **To: S2**	Grade B	**DRB Grade: B** **Pipe Size: 100** **Material: Polyvinyl Chloride** **Use: Surface Water**
Section: 6 **From: S2** **To: C1**	Grade B	**DRB Grade: B** **Pipe Size: 150** **Material: Vitrified Clay (i.e. all clayware)** **Use: Surface Water**
Section: 7 **From: C1** **To: C2**	Grade B	**DRB Grade: B** **Pipe Size: 150** **Material: Vitrified Clay (i.e. all clayware)** **Use: Combined**
Section: 8 **From: C2** **To: C3**	Grade A	**DRB Grade: A** **Pipe Size: 150** **Material: Vitrified Clay (i.e. all clayware)** **Use: Combined**

Total Defects for Project

1 0 33 0 0

Total DRB Grades for Project

2 10 0

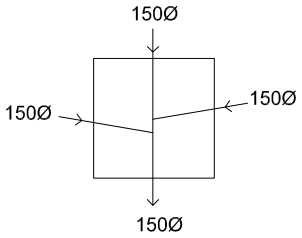
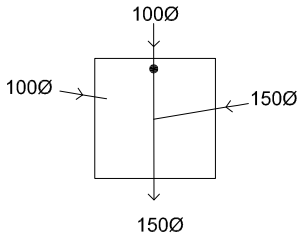
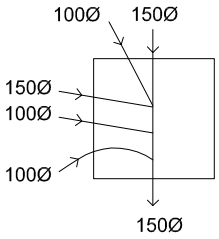
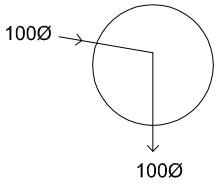
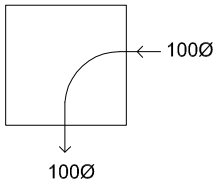
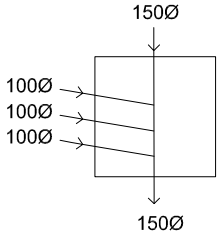
Section: 9 **From: S4** **To: C2**	Grade B	**DRB Grade: B** **Pipe Size: 100** **Material: Vitrified Clay (i.e. all clayware)** **Use: Surface Water**
Section: 10 **From: S4** **To: S5**	Grade B	**DRB Grade: B** **Pipe Size: 100** **Material: Vitrified Clay (i.e. all clayware)** **Use: Surface Water**
Section: 11 **From: C3** **To: SPUR B**	Grade B	**DRB Grade: B** **Pipe Size: 150** **Material: Vitrified Clay (i.e. all clayware)** **Use: Combined**
Section: 12 **From: C3** **To: MAIN**	Grade B	**DRB Grade: B** **Pipe Size: 150** **Material: Vitrified Clay (i.e. all clayware)** **Use: Combined**

UTILITY SURVEYS LTD

5 SUFFOLK ROAD MALDON ESSEX CM9 6AX

LOCATION: THE FORMER GREENFINCH PUB DIDSBURY JOB REF: 071533

CLIENT: CHURCHILL RETIREMENT LIVING DATE: 02/10/2023

MH No. S1 DEPTH. 0.98 COVER. RH CONSTRUCTION. Br REMARKS.		MH No. C3 DEPTH. 2.94 COVER. RH CONSTRUCTION. Br REMARKS.	
MH No. S2 DEPTH. 1.36 COVER. RH CONSTRUCTION. Br REMARKS.			
MH No. S3 DEPTH. 0.86 COVER. CL CONSTRUCTION. Plastic REMARKS.			
MH No. S4 DEPTH. 1.50 COVER. RM CONSTRUCTION. Br REMARKS.			
MH No. C1 DEPTH. 1.76 COVER. RH CONSTRUCTION. Br REMARKS.			
MH No. C2 DEPTH. COVER. CONSTRUCTION. REMARKS.	NOT LIFTED SET IN NEW RESIN BOUND PATH		

KEY:			
	C - Circular	L - Light Duty	Co - Concrete
	S - Square	M - Medium Duty	Br - Brick
	T - Triangular	H - Heavy Duty	R - Rectangular

INTERCEPTOR 1 UNDER PLATES

INTERCEPTOR 1

MANHOLE C3

MANHOLE S2

MANHOLE S5

Appendix F Greenfield Runoff Rates

Simulation Settings

Rainfall Methodology	FEH-22	Analysis Speed	Normal	Additional Storage (m³/ha)	20.0	30 year (l/s)	7.2
Summer CV	0.750	Skip Steady State	x	Check Discharge Rate(s)	✓	100 year (l/s)	8.8
Winter CV	0.840	Drain Down Time (mins)	240	2 year (l/s)	3.2	Check Discharge Volume	x

Storm Durations

15	60	180	360	600	960	2160	4320	7200	10080
30	120	240	480	720	1440	2880	5760	8640	

Return Period (years)	Climate Change (CC %)	Additional Area (A %)	Additional Flow (Q %)	Return Period (years)	Climate Change (CC %)	Additional Area (A %)	Additional Flow (Q %)
2	45	0	0	100	45	0	0
30	45	0	0				

Pre-development Discharge Rate

Site Makeup	Greenfield	BFIHost	0.455	Growth Factor 100 year	2.42	Q 30 year (l/s)	7.2
Greenfield Method	FEH	Region	8	Betterment (%)	0	Q 100 year (l/s)	8.8
Positively Drained Area (ha)	1.000	QBar/QMed conversion factor	1.075	QMed	3.4		
SAAR (mm)	704	Growth Factor 2 year	0.88	QBar	3.7		
Host	1	Growth Factor 30 year	1.98	Q 2 year (l/s)	3.2		

Flow+ v10.7 Copyright © 1988-2023 Causeway Technologies Ltd

Appendix G Brownfield Runoff Rates

Colebrook-White Pipe Capacity Analysis

Project No.	1582
Project Title	The Greenfinch, Didsbury, Manchester
Client	Planning Issues Ltd
Sheet Ref	P:\1582 The Greenfinch, Didsbury, Manchester\D Design and Analysis\SPREADSHEETS\01 Drainage\03 Sewer Design\[Colebrook White Equation (pipe velocity & capacity).xlsx]Colebrook-White

Calcs by	BF
Checked by	CY
Approved by	CY
Date	12.10.2023
Revision	A

Pipe capacity calculation based on the Colebrook White Equation (HR Wallingford, 1990);

$$V = -2\sqrt{(2gDS)}\log_{10}\left(\frac{k_s}{3.7D} + \frac{2.51\nu}{D\sqrt{(2gDS)}}\right)$$

Fluid type: **Foul**

Where:

D	*Pipe diameter*		150	mm
S	*Hydraulic gradient*	1 in	80	m/m
k_s	Effective pipe roughness		1.5	mm
g	*Gravitiational acceleration*		9.81	m/s^2
ν	*kinematic viscosity*		1.01E-06	m^2/s
A	*Cross-sectional flow area*		0.018	m^2
Q	*Discharge*		17.315	l/s
V	Velocity		0.98	m/s

Catchment area analysis based on Modified Rational Method equation (HR Wallingford, 1990);

$$Q_{BAR} = 2.78 \cdot i \cdot A$$

Hydrological Region: 10 *see map

Where:

Q_{BAR}	*Average discharge (l/s)*			
i	*Rainfall intensity (mm/hr)*	i	50.0	mm/hr *see map
A	*Catchment area (m^2)*			

Return Period	2yr	30yr	100yr	
Growth Factor (Q/QBAR)	0.93	1.7	2.08	
Critical Area (ha)	0.1339	0.0733	0.0599	(area that can freely drain)

Brownfield flow rate analysis based on Modified Rational Method (HR Wallingford, 1990);

			2yr	30yr	100yr	QBAR
Area (ha):	0.216	BF flow (l/s):	27.92	51.04	62.45	30.02

Foul capacity analysis for dwellings based on Sewers for Adoption (6th Edition);

l/dwelling/day	0.046
No. dwellings served	374
No. dwellings served +10% infiltration	340

Appendix H Proposed Site Layout

REVISIONS

Rev.	Date	By

PRIVATE & CONFIDENTIAL

0m 1 2 3 4 5 6 7 8 9 10

Scale 1:100

NORTH

LAPWING LANE, DIDSBURY, MANCHESTER M20 3ZA

© 2023 PLANNING ISSUES

planningissues
TOWN PLANNING AND ARCHITECTURE
Nick Wood
Design Manager
Churchill House * Unit 5A Olympic Park
Woolston Grange Avenue
Birchwood * Warrington * WA2 0YL
Tel: 01425 462100
E-mail design@planningissues.co.uk

Client

Churchill
Retirement Living

Project Title

Proposed Retirement Living Apartments
Lapwing Lane
DIDSBURY
M20 3ZA

Drawing Title

Site Plan
RED FILE

Scale	1:100 @ A1	Date	Nov 2023
Drawn	NW	Checked	-
Drawing No.			Rev.

50013DB/RF02

Appendix I Causeway FLOW Soakway Model (Failed)

Design Settings

Rainfall Methodology	FEH-13	Maximum Time of Concentration (mins)	30.00	Preferred Cover Depth (m)	1.200
Return Period (years)	2	Maximum Rainfall (mm/hr)	50.0	Include Intermediate Ground	✓
Additional Flow (%)	45	Minimum Velocity (m/s)	1.00	Enforce best practice design rules	✓
CV	0.750	Connection Type	Level Soffits		
Time of Entry (mins)	4.00	Minimum Backdrop Height (m)	0.200		

Nodes

Name	Area (ha)	T of E (mins)	Cover Level (m)	Diameter (mm)	Depth (m)
1	0.202	4.00	100.000	1350	1.600
OUT	0.000	4.00	100.000	1350	

Simulation Settings

Rainfall Methodology	FEH-13	Analysis Speed	Normal	Additional Storage (m³/ha)	20.0	30 year (l/s)	7.2
Summer CV	0.750	Skip Steady State	x	Check Discharge Rate(s)	✓	100 year (l/s)	8.8
Winter CV	0.840	Drain Down Time (mins)	240	2 year (l/s)	3.2	Check Discharge Volume	x

Storm Durations

15	60	180	360	600	960	2160	4320	7200	10080
30	120	240	480	720	1440	2880	5760	8640	

Return Period (years)	Climate Change (CC %)	Additional Area (A %)	Additional Flow (Q %)	Return Period (years)	Climate Change (CC %)	Additional Area (A %)	Additional Flow (Q %)
2	45	0	0	100	45	0	0
30	45	0	0				

Pre-development Discharge Rate

Site Makeup	Greenfield	BFIHost	0.455	Growth Factor 100 year	2.42	Q 30 year (l/s)	7.2
Greenfield Method	FEH	Region	8	Betterment (%)	0	Q 100 year (l/s)	8.8
Positively Drained Area (ha)	1.000	QBar/QMed conversion factor	1.075	QMed	3.4		
SAAR (mm)	704	Growth Factor 2 year	0.88	QBar	3.7		
Host	1	Growth Factor 30 year	1.98	Q 2 year (l/s)	3.2		

Node 1 Soakaway Storage Structure

Base Inf Coefficient (m/hr)	0.02304	Porosity	0.95	Pit Width (m)	12.000	Inf Depth (m)	
Side Inf Coefficient (m/hr)	0.02304	Invert Level (m)	98.400	Pit Length (m)	12.000	Number Required	1
Safety Factor	5.0	Time to half empty (mins)	6609	Depth (m)	1.600		

Flow+ v10.7 Copyright © 1988-2023 Causeway Technologies Ltd

Results for 2 year +45% CC Critical Storm Duration. Lowest mass balance: 100.00%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
7200 minute winter	1 OUT	5340	98.995	0.595	0.9	83.7424	0.0000	OK

Link Event (Outflow)	US Node	Link	Outflow (l/s)
7200 minute winter	1	Infiltration	0.2

Flow+ v10.7 Copyright © 1988-2023 Causeway Technologies Ltd

Results for 30 year +45% CC Critical Storm Duration. Lowest mass balance: 100.00%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
7200 minute winter	1 OUT	6600	99.624	1.224	1.5	172.2626	0.0000	OK

Link Event (Outflow)	US Node	Link	Outflow (l/s)
7200 minute winter	1	Infiltration	0.3

Flow+ v10.7 Copyright © 1988-2023 Causeway Technologies Ltd

Results for 100 year +45% CC Critical Storm Duration. Lowest mass balance: 100.00%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
5760 minute winter	1 OUT	5520	99.976	1.576	2.2	221.8134	0.0000	OK

Link Event (Outflow)	US Node	Link	Outflow (l/s)
5760 minute winter	1	Infiltration	0.3

Flow+ v10.7 Copyright © 1988-2023 Causeway Technologies Ltd

Appendix J Causeway FLOW Calculations

Design Settings

Rainfall Methodology	FEH-13	Maximum Time of Concentration (mins)	30.00	Preferred Cover Depth (m)	1.200
Return Period (years)	2	Maximum Rainfall (mm/hr)	50.0	Include Intermediate Ground	✓
Additional Flow (%)	45	Minimum Velocity (m/s)	1.00	Enforce best practice design rules	✓
CV	0.750	Connection Type	Level Soffits		
Time of Entry (mins)	4.00	Minimum Backdrop Height (m)	9.900		

Nodes

Name	Area (ha)	T of E (mins)	Cover Level (m)	Diameter (mm)	Easting (m)	Northing (m)	Depth (m)
1	0.065	4.00	30.000	1200	384296.889	392107.815	1.425
TANK			30.000	1200	384325.903	392086.503	2.000
2	0.051	4.00	30.000	1200	384267.466	392091.433	1.425
CONTROL	0.066	4.00	30.000	1200	384331.690	392043.734	2.500
OUT			30.000	1200	384336.531	392040.139	2.575

Links

Name	US Node	DS Node	Length (m)	ks (mm) / n	US IL (m)	DS IL (m)	Fall (m)	Slope (1:X)	Dia (mm)	T of C (mins)	Rain (mm/hr)
1.001	1	TANK	36.000	0.600	28.575	28.000	0.575	62.6	225	4.36	50.0
1.002	TANK	CONTROL	50.000	0.600	28.000	27.500	0.500	100.0	225	5.00	50.0
2.001	2	CONTROL	80.000	0.600	28.575	27.500	1.075	74.4	225	4.88	50.0
1.003	CONTROL	OUT	6.030	0.600	27.500	27.425	0.075	80.0	225	5.07	50.0

Name	Vel (m/s)	Cap (l/s)	Flow (l/s)	US Depth (m)	DS Depth (m)	Σ Area (ha)	Σ Add Inflow (l/s)	Pro Depth (mm)	Pro Velocity (m/s)
1.001	1.655	65.8	12.8	1.200	1.775	0.065	0.0	67	1.291
1.002	1.307	52.0	12.8	1.775	2.275	0.065	0.0	76	1.088
2.001	1.517	60.3	10.0	1.200	2.275	0.051	0.0	62	1.132
1.003	1.463	58.2	35.8	2.275	2.350	0.182	0.0	128	1.537

Simulation Settings

Rainfall Methodology	FEH-22	Analysis Speed	Normal	Additional Storage (m³/ha)	20.0	30 year (l/s)	7.2
Summer CV	0.750	Skip Steady State	x	Check Discharge Rate(s)	✓	100 year (l/s)	8.8
Winter CV	0.840	Drain Down Time (mins)	240	2 year (l/s)	3.2	Check Discharge Volume	x

Storm Durations

15	60	180	360	600	960	2160	4320	7200	10080
30	120	240	480	720	1440	2880	5760	8640	

Return Period (years)	Climate Change (CC %)	Additional Area (A %)	Additional Flow (Q %)	Return Period (years)	Climate Change (CC %)	Additional Area (A %)	Additional Flow (Q %)
2	45	0	0	100	45	0	0
30	45	0	0				

Pre-development Discharge Rate

Site Makeup	Greenfield	BFIHost	0.455	Growth Factor 100 year	2.42	Q 30 year (l/s)	7.2
Greenfield Method	FEH	Region	8	Betterment (%)	0	Q 100 year (l/s)	8.8
Positively Drained Area (ha)	1.000	QBar/QMed conversion factor	1.075	QMed	3.4		
SAAR (mm)	704	Growth Factor 2 year	0.88	QBar	3.7		
Host	1	Growth Factor 30 year	1.98	Q 2 year (l/s)	3.2		

Node CONTROL Online Hydro-Brake® Control

Flap Valve	x	Objective	(HE) Minimise upstream storage
Replaces Downstream Link	x	Sump Available	✓
Invert Level (m)	27.500	Product Number	CTL-SHE-0066-2600-1900-2600
Design Depth (m)	1.900	Min Outlet Diameter (m)	0.100
Design Flow (l/s)	2.6	Min Node Diameter (mm)	1200

Node TANK Depth/Area Storage Structure

Base Inf Coefficient (m/hr)	0.00000	Safety Factor	2.0	Invert Level (m)	28.000
Side Inf Coefficient (m/hr)	0.00000	Porosity	0.95	Time to half empty (mins)	

Depth (m)	Area (m²)	Inf Area (m²)	Depth (m)	Area (m²)	Inf Area (m²)	Depth (m)	Area (m²)	Inf Area (m²)
0.000	117.0	0.0	0.800	117.0	0.0	0.801	0.0	0.0

Flow+ v10.7 Copyright © 1988-2023 Causeway Technologies Ltd

Results for 2 year +45% CC Critical Storm Duration. Lowest mass balance: 90.99%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
15 minute summer	1	9	28.661	0.086	13.7	0.1765	0.0000	OK
180 minute winter	TANK	168	28.164	0.164	7.4	18.4582	0.0000	OK
15 minute winter	2	10	28.639	0.064	10.8	0.1178	0.0000	OK
180 minute winter	CONTROL	168	28.164	0.664	6.8	1.1021	0.0000	SURCHARGED
120 minute summer	OUT	288	27.453	0.028	1.9	0.0000	0.0000	OK

Link Event (Outflow)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
15 minute summer	1	1.001	TANK	14.0	1.967	0.213	0.2819	
15 minute winter	TANK	1.002	CONTROL	-14.3	-0.514	-0.274	1.2932	
15 minute winter	2	2.001	CONTROL	10.7	0.410	0.177	1.9603	
120 minute summer	CONTROL	1.003	OUT	1.9	0.656	0.032	0.0173	30.7

Flow+ v10.7 Copyright © 1988-2023 Causeway Technologies Ltd

Results for 30 year +45% CC Critical Storm Duration. Lowest mass balance: 90.99%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
15 minute summer	1	9	28.714	0.139	35.2	0.2837	0.0000	OK
240 minute winter	TANK	232	28.574	0.574	14.9	64.4341	0.0000	SURCHARGED
15 minute winter	2	11	28.736	0.161	27.7	0.2970	0.0000	OK
15 minute winter	CONTROL	11	28.629	1.129	61.6	1.8736	0.0000	SURCHARGED
15 minute winter	OUT	11	27.454	0.029	2.0	0.0000	0.0000	OK

Link Event (Outflow)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
15 minute summer	1	1.001	TANK	36.2	2.242	0.550	0.8254	
15 minute winter	TANK	1.002	CONTROL	-50.3	-1.387	-0.968	1.9886	
15 minute winter	2	2.001	CONTROL	25.8	0.776	0.428	2.8053	
15 minute winter	CONTROL	1.003	OUT	2.0	0.671	0.035	0.0183	24.5

Flow+ v10.7 Copyright © 1988-2023 Causeway Technologies Ltd

Results for 100 year +45% CC Critical Storm Duration. Lowest mass balance: 90.99%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
240 minute winter	1	232	29.625	1.050	8.6	2.1448	0.0000	SURCHARGED
240 minute winter	TANK	232	29.625	1.625	21.2	90.8131	0.0000	SURCHARGED
240 minute winter	2	232	29.625	1.050	6.8	1.9386	0.0000	SURCHARGED
240 minute winter	CONTROL	232	29.624	2.124	15.6	3.5244	0.0000	SURCHARGED
240 minute winter	OUT	232	27.458	0.033	2.7	0.0000	0.0000	OK

Link Event (Outflow)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
15 minute summer	1	1.001	TANK	50.2	2.289	0.763	1.0510	
15 minute summer	TANK	1.002	CONTROL	-68.4	-1.746	-1.315	1.9886	
15 minute winter	2	2.001	CONTROL	31.3	0.811	0.519	3.1817	
240 minute winter	CONTROL	1.003	OUT	2.7	0.729	0.047	0.0225	57.9

Flow+ v10.7 Copyright © 1988-2023 Causeway Technologies Ltd

Appendix K Preliminary Drainage Layout

Surface Water Strategy:

Existing Drainage

Existing ACO drain present at site entrance appears to receive small catchment within site boundary. New linear drain to be installed across site access with connection to attenuation tank.

Exceedance Flows

Beyond the capacity of the proposed surface water network and attenuation, exceedance flows would be directed away from the proposed building and towards areas of landscaping, and/or car parking, wherever possible. Beyond the capacity of the site, flows would continue offsite as per existing conditions.

Cellular Attenuation

Cellular tank to receive flows from external hard paving and roof catchments. Chambers immediately upstream of tank to include silt traps

Maintenance

Geocellular Attenuation to be fitted with access turrets for maintenance of feature. Any vented covers to be in accordance with manufacturer recommendations.

Surface Water Strategy:

Catchment

Parking area of adjacent building assumed to drain independently to existing gullies within adjacent development parking area.

Surface Water Strategy:

Flow Control

Proposed surface water control chamber to restrict flows up to 100yr return period. Controlled flows are to discharge into United Utilities' adopted combined network within Palatine Road.

Surface Water Discharge

Attenuated surface water flows to discharge to existing combined sewer beneath Palatine Road as agreed with United Utilities.

Foul Water Strategy:

Foul flows generated by the proposed site to connect to the existing adopted combined sewer network in Palatine Road.

Area Summary Schedule

Total Site Area	0.306 ha
Impermeable Catchment	0.182 ha
Exsting Impermeable Catchment	0.216 ha

Pre-Development Runoff

The site is predominantly brownfield however the equivalent greenfield runoff rates have been assessed for the 'net developable area' using the FEH Method. The whole site brownfield rate has been calculated using the Modified Rational Method (MRM).

Existing Runoff Rates

Return Period	Equivalent Greenfield Rate (l/s) (0.306 ha)	Brownfield Rate (l/s) (0.216 ha)
2yr	1.0	27.9
30yr	2.2	51.0
100yr	2.7	62.5

Attenuation Summary

Cellular Storage Tank

Ownership	Private
Catchment	0.182 ha
Hydraulic Control	Hydrobrake @ IL CTL-SHE-0066-2600-1900-2600
Porosity	95%
Tank Dimensions:	26.0m x 4.5m x 0.8m
Total 100yr+45% Volume required:	**90.8 m³**
Total 100yr+45% Peak Discharge	**2.7 l/s**

Notes

1. The development proposes the construction of a new retirement living complex comprising 24 one-bedroom and 13 two-bedroom apartments.The proposed development has been assessed in line with the National Planning Policy Framework, to allow the planning application to be progressed and to show that the development can be undertaken in an acceptable manner from a flood risk perspective.
2. The proposed development is located within Flood Zone 1 and is not known to be susceptible to flooding from groundwater, infrastructure or artificial sources. Shallow pluvial flooding is shown in the 0.1% annual exceedance event, but this can be mitigated through the surface water management plan.
3. To ensure the development is safe throughout its lifetime, the surface water strategy accounts for runoff in up to the 1 in 100 year return period.
4. The strategy also safeguards against climate change (45%), providing betterment over existing conditions, where the rate and volume of runoff would continue to increase due to climate change.
5. Owing to poor rates of infiltration, existing site constraints (RPA's), and lack of available space, it is not possible to implement soakaway drainage, due to the 24-hour half-drain time requirement. Instead, it is proposed that stormwater runoff utilises an attenuated discharge to the adopted combined sewers within Palatine Road, with peak flows limited to 2.7 l/s peak, as agreed with United Utilities. This provides up to 96% betterment compared to the existing site discharge.
6. During exceedance events, runoff will overflow from the drainage systems and away from the building into the car parking area. From here, the external works design of the site will ensure that any exceedance flows are stored aboveground within the car parking area and amenity space, before continuing off-site.
7. Foul flows generated by the proposed development will be served by a new private network, with discharge to the same combined manhole as surface water flows, within Palatine Road as agreed with United Utilities.
8. All on-site proposed drainage will remain private and will be designed in accordance with Building Regulations Part H and CIRIA C753 and will become the responsibility of the building operator.
9. As the development will be safe from flooding throughout its lifetime and will actively reduce flood risk to properties within the downstream catchment, it is recommended that the Local Planning Authority confirm they have no objections to the proposed development.

Key

- Site Boundary
- RPA — Root Protection Area
- RPA — Root Protection Area to be Removed

Private Existing Drainage

- Surface Water Sewer
- Surface Water Inspection Chamber
- Surface Water Sewer to be Abandoned
- Combined Sewer
- Combined Inspection Chamber
- G — Gully and Connection
- G — Gully and Connection to be Abandoned

Adopted Existing Drainage

- Surface Water Sewer
- Surface Water Manhole
- Combined Sewer
- Combined Manhole

Proposed Private Drainage

- Impermeable Building Catchment
- Impermeable Highway Catchment
- Surface Water Sewer
- Surface Water Flow Control Chamber
- Surface Water Inspection Chamber
- Cellular Attenuation Tank
- Foul Water Sewer
- Foul Water Inspection Chamber
- Overland Flood Flow Route

REV	DATE	DESCRIPTION	BY	CHK	APD
A	24.11.2023	INITIAL ISSUE	BF/BG	LB	CY

CLIENT: CHURCHILL RETIREMENT LIVING

DRAWING STATUS: PLANNING APPLICATION

PROJECT: THE GREENFINCH, DIDSBURY, MANCHESTER

TITLE: PRELIMINARY DRAINAGE LAYOUT

PROJECT No:	DRAWING No:	REV:
1582	01-PDL-1001	A

SCALE @ A1: 0 1:200 10 metres

DESIGN BY:

awcockward partnership
Awcock Ward Partnership, Ada House, Pynes Hill, Exeter, EX2 5TU
Tel: 01392 409007 Web: www.awpexeter.com