PJCE	**TECHNICAL NOTE**
	Pringuer-James Consulting Engineers **(Structural & Civil Engineers)** Overseas House, Elm Grove, London SW19 4HE Tel : 020 8940 4159 Email: mail@PJCE.com

Project: 53 Fitzroy Park London N6 6JA	Project No. L2368
By: Vlad Myrsikov	Date:
Title: Drainage design for planning supplementary report	No. L2368-TN-001-A

Planning Application Reference: 2018/2104/P

Introduction

This is a Supplementary Technical Note to previously issued L2368-TN-001_B. This Technical Note provides supplementary information, plans and calculations and to satisfy Planning Condition13:

Prior to commencement of development details of a sustainable urban drainage system shall be submitted to and approved in writing by the local planning authority. Such system shall be based on demonstrating 50% attenuation of all runoff. The system shall be implemented as part of the development and thereafter retained and maintained.

Additional Information

The following additional information has been provided with this technical note:

- Detailed design drawing including details.
- Breakdown of impermeable areas pre and post development.
- Infiltration test results.
- Greenfield Rate calculations.
- Detailed calculations for all SuDS components.

Since the preparation of the previous technical note, it was confirmed that the development does not have a connection to the pond and will not have a connection in the future. Only two remaining options are infiltration or pumping to the sewer.

In line with various statutory requirements and non-statutory guidance, the design has been changed to 100% infiltration and focuses to ensure all rainfall, up to 1-in-100year +40% Climate Change is captured and infiltrated on site.

If infiltration is deemed not acceptable, the design will revert to non-infiltrating SuDS and pumping to sewer at Greenfield Rate of 0.7 l/s, however this is not preferred as it disrupts natural flow of the catchment and adds unnecessary storm water to public sewers.

Impermeable Areas

The existing site is 1,283m^2 in size with approximately 23% occupied by an existing house and hard standing areas. The house is approximately 120m^2 in footprint and remaining hard standing areas approximately 185m^2.

No formalised drainage system or connection to public sewer has been identified during investigations (albeit one gully has been noted) and it is understood that the existing house drains all surface water into the gardens and adjoining areas.

The proposed development consists of a newly built house, car parking areas, and rear garden patio as main impermeable areas. Additionally, the large garden contains water features and a gazebo style structure.

Figure 1 (right) demonstrates areas that were considered for drainage. A full sketch is provided in the Appendix.

The gazebo has not been included in calculations as it has an open slated roof and flow-through timber decking, which overall will mimic the natural behaviour of the open ground.

The overall new impermeable area for the new development has been calculated at 610m^2 which is broken down into three sub-catchments, each with its own SuDS infiltration feature.

Catchment 1 – Car park (sand colour)
Catchment 2 – Main roofs (orange and green)
Catchment 3 – Rear patio (yellow and magenta)

Figure 1- Catchments

Catchment areas are shown in the table below:

Description of Area	Total area drained	Colour
Car Park	152 m^2	Sand
Main Building Roof (Excluding green roofs)	125 m^2	Blue
Main Building Roof (Green roofs only)	142 m^2	Green (Hatched)
First floor Patio and canopy	40 m^2	Yellow
Patio	95 m^2	Magenta
Water feature	56 m^2	Magenta
TOTAL	610 m^2	

Figure 2 - Catchment Areas

Infiltration Testing

The soil conditions generally identified 1.0m to 1.4m of clean made ground over clay bed, which is consistent with expectations for an old river bed. Groundwater generally was found to be 3-4m deep, below clay layer. In some bore holes a perched water table was found, however in all boreholes this was just above underlying clay layer and not significant. Only shallow infiltration SuDS are viable, with infiltration into made ground, which mimic natural environment.

Extensive infiltration testing to BRE365 has been commissioned, to examine existing rates at different parts of the site. A total of 10 tests have been completed, showing a range of values from 2.86x10^{-4} m/s down to 5.49x10^{-6} m/s depending on location. Refer to Appendix for more information.

The SuDS will be designed using lowest obtained f value. Where long SuDs components are used, the average between different f values in the vicinity of the SuDS component will be used.

Greenfield Rate

Greenfield Rate has been calculated using HR Wellingford using FEH data on www.uksuds.com website. The resultant value is shown below, and full calculation provided in appendix.

Site Area	Greenfield Rate
1,283 m^2	1.21 l/s

Figure 3 - Greenfield Rate

Modelling

Catchment 1

Catchment 1 consists of Type B, permeable car park. Although some infiltration capacity exists within the made ground underneath the car park, for the purposes of the modelling this has been assumed to be zero.

To maximise the storage usage and limit flow-down to downstream SuDS infiltration component, the car park is flow-controlled via a 17mm orifice plate.

Blockage risk is very low as the water reaching the orifice plate has been filtered through 4/20mm permeable pavement stone and perforated pipe before reaching the orifice plate.

Catchment 2

Catchment 2 consists of a bioretention basin with attenuation/infiltration tank under, and a detention basin used to contain high intensity events. The catchment receives rainwater water from the roofs and outflow from Catchment 1. All water from the upstream catchment will drain to the bioretention area, filter, and then enter the attenuation/infiltration storage.

Soil infiltration value has been derived using average of worst test result at the actual bioretention location and is equal to 0.02956m/hr (8.21×10^{-6} m/s) as per BRE365 methodology.

Bioretention systems are similar to permeable pavements as filtration of fines occurs outside (above) the structure, and therefore the base infiltration to be used for infiltration calculations. This is confirmed by CIRIA753 Section 18.1 which stipulates that for bioretention systems the silting and clogging will occur at transition medium layer (Geotextile) and not at the drainage layer under the bioretention media. The bioretention design will allow for 2 separate geomembranes; the first membrane would be used to wrap the tank and the second membrane as transition medium between soil layer and drainage.

Due to limitations of the MicroDrainage software, bioretention has been modelled as dry swale structure. The soil medium has been ignored as it does not provide hydraulic benefit to the model. The design detail for bioretention is presented on the design drawing in Appendix

The detention basin peak level of ponding was manually calculated by using MicroDrainage derived "flooded volume" of 7.1m^3 (1-in-100year +40% Climate Change) and detention basin area of 117m^3. The maximum ponding is 60mm, however conservatively, the detention basin edge levels are set at a minimum of 150mm from the detention based, giving additional factor of safety.

Results

Both Catchment 1 and Catchment 2 are calculated using the MicroDrainage Cascade model. This provides the most conservative result. Calculations are completed for 1-in-100 year +40% Climate Change and for 1-in-30year +40% Climate Change. The lower intensity event is used to validate that system has sufficient capacity to store water within cellular storage and pavement without flooding.

	1-in-10+40% CC model	1-in-100+40% CC model
Maximum attenuation volume	19.1 m^3	28.7 m^3
Peak water level in permeable pavement	0.257 mm	0.386 mm
Peak water level in bioretention area	80.151 mOD	80.207mOD (MicroDrainage) 80.260mOD (hand calculation)
Half drain time	316 mins	453 mins

Figure 4 - Catchment 1&2 Cascade results

Catchment 3

Catchment 3 consists of a bioretention basin, accepting sheet flow from the paving and water feature hard standing areas.

The soil infiltration value has been derived using the average of worst test results at the actual bioretention location and is equal to 0.020268m/hr ($5.63x10^{-6}$ m/s) as per BRE365 methodology.

Bioretention design and modelling is identical to Catchment 1 bioretention structure design methodology. Catchment 3 does not have detention basin for excess water storage and instead is designed to hold all water within crates and overflow over.

Results

The catchment is calculated using MicroDrainage Source Control model and the SuDS element is the only component in the drainage system.

	1-in-100 +40% CC model
Maximum attenuation volume	14.9 m^3
Peak water level	80.166 mOD
Half drain time	417 mins

Figure 5 -Catchment 3 Results

Summary

The new development at 53 Fitzroy Park will utilise SuDS principles to dispose of surface water via infiltration to the existing made ground overlaying the site. The proposal mimics natural Greenfield site pattern.

Extensive infiltration rates were proven to be good to average.

APPENDIX A

Design Drawing

- L2368-C-52-700 – Storm Water Drainage Layout and Details.

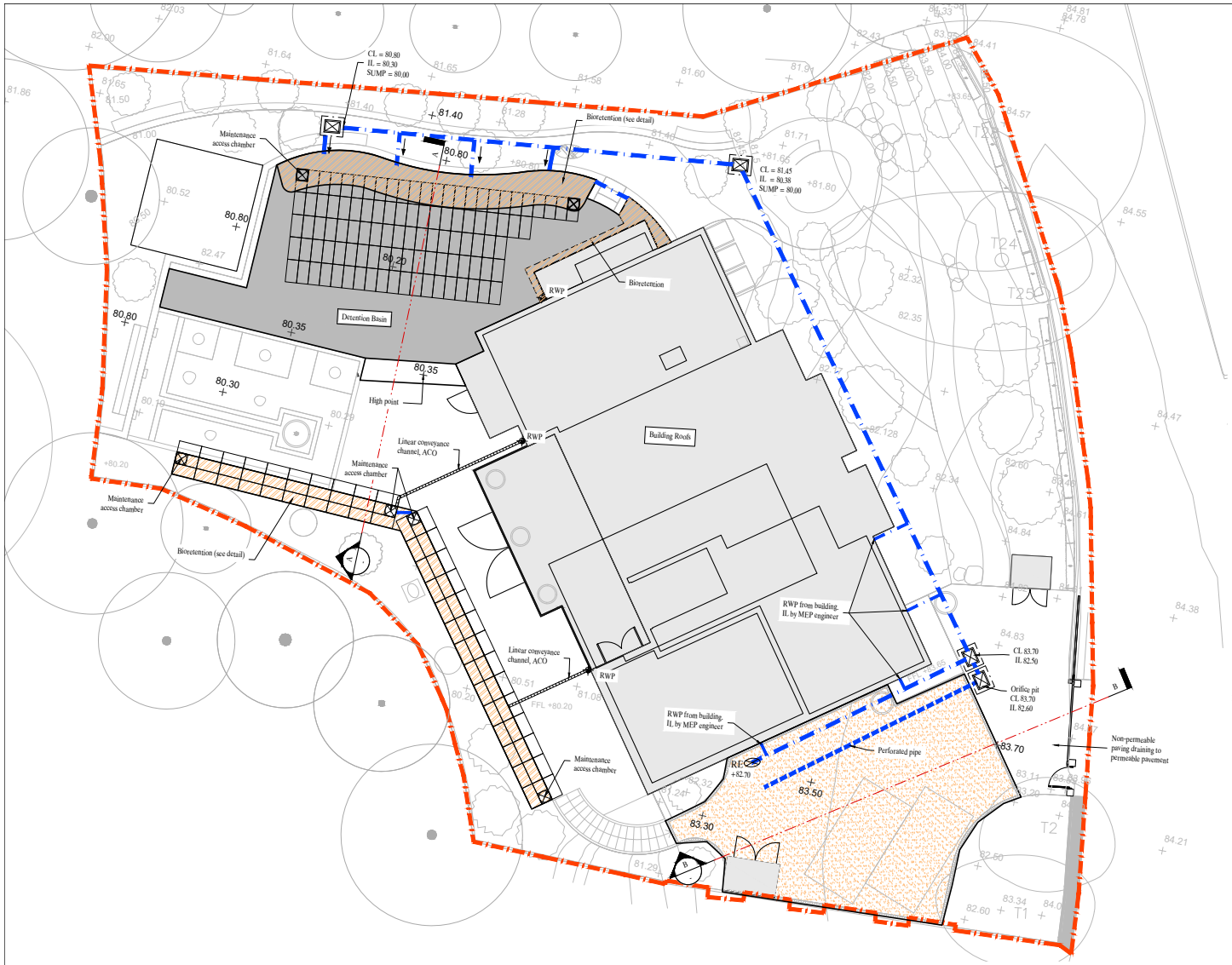
Sketches

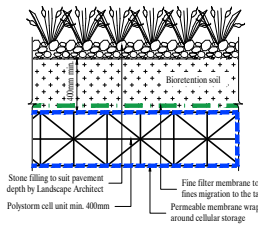
- L2368-SK-C-010 – Catchment Areas

Reference Plans

- Landscape Masterplan

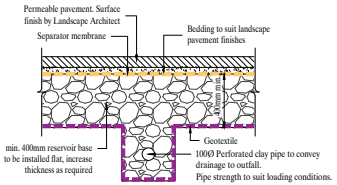
Please note: Landscape Masterplan is provided for general reference only, however it has not been updated to reflect SuDS proposed within this Technical Note. The Landscape Masterplan will be updated once SuDS design is approved by the council.





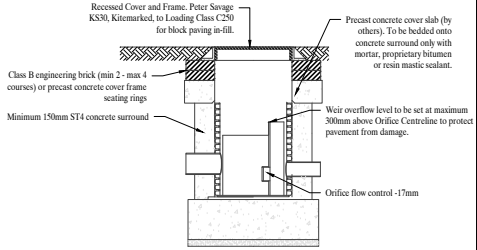
BIORETENTION TYPICAL DETAIL

Scale 1:20



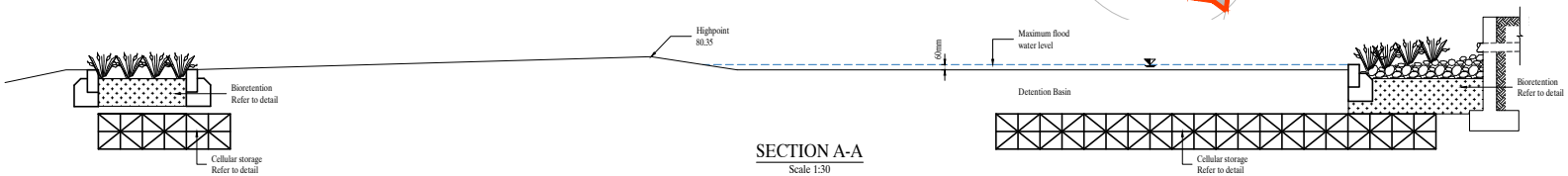
PERMEABLE PAVEMENT TYPICAL DETAIL

Scale 1:20



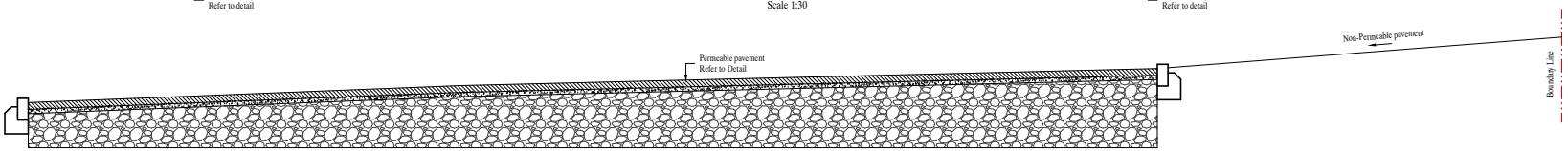
TYPICAL MANHOLE CHAMBER

Scale 1:20



SECTION A-A

Scale 1:30



SECTION B-B

Scale 1:30

Notes:

1. All dimensions are in millimetres unless otherwise stated.
2. All levels are in metres unless otherwise stated.
3. This drawing should be read in conjunction with all relevant architects, structural engineers and m&e engineers drawings and specification.
4. For setting out of rainwater drain points refer to architects and M.E.P. drawings.
5. All pipes are clay to BS EN 295 U.N.O.
6. All stacks/svp/rwp are 100Ø U.N.O.
7. All pipes are 100Ø unless noted otherwise.
8. All drains are to be laid in a constant gradient between manhole chambers.
9. All buried concrete products and mortars are to contain class 2 sulphate resisting cement.

Legend:

- Surface water pipe
- Site boundary
- RE — Rodding eye
- RWP — RWP stack
- IC — Inspection chamber 450x450

Rev.	Date	Drawn	Amendment
-	15.04.19	MA	Issued for Approval

PRINGUER-JAMES
CONSULTING ENGINEERS
Overseas House, Elm Grove, London, SW19 4HE
Phone/Fax : 020 8940 4159
Email : mail@pjce.com Website : www.pjce.com

ARTIN HOMES

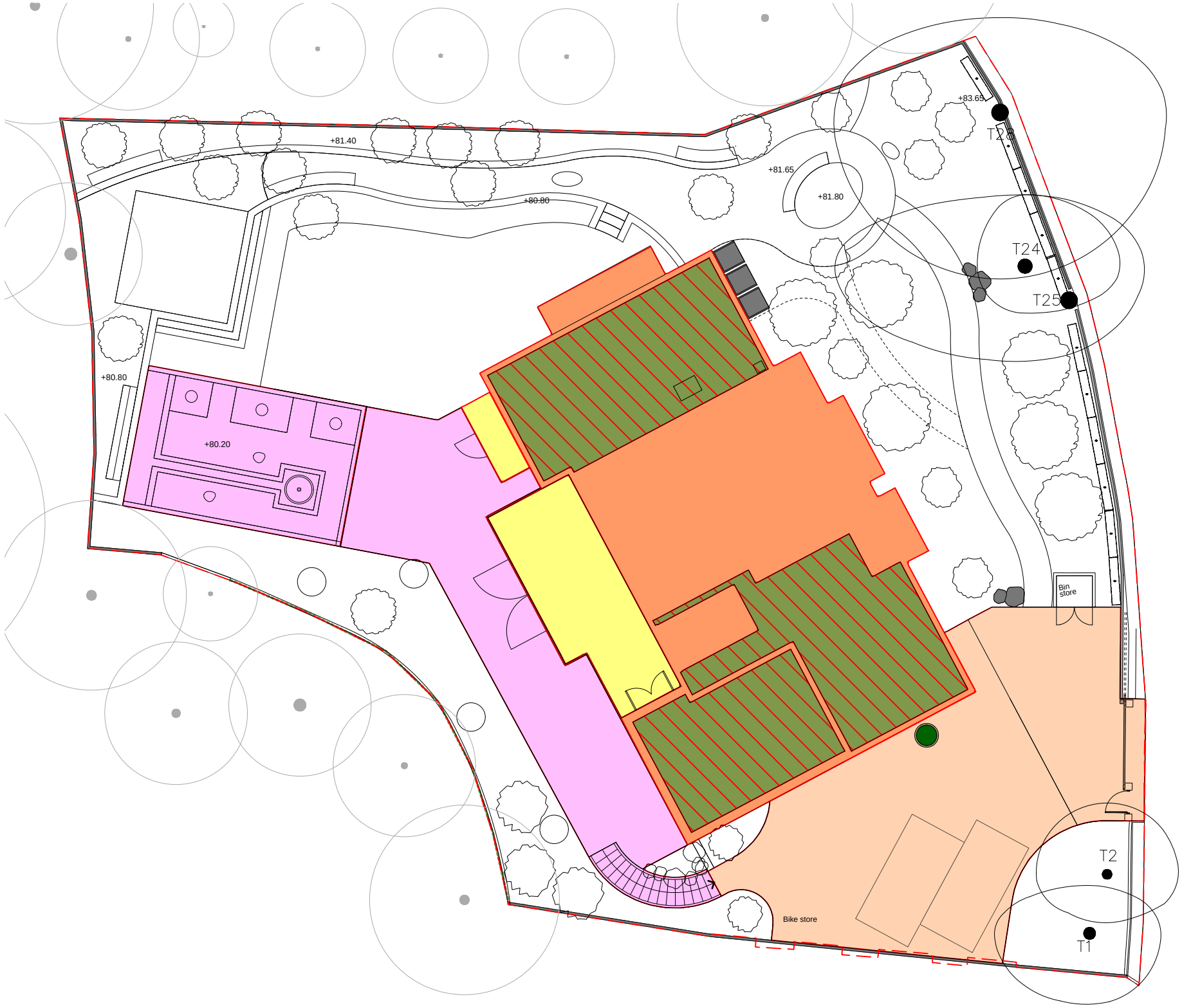
53 FITZROY PARK,
LONDON, N6 6JA

DRAINAGE DESIGN & DETAILS

Status : APPROVAL

Scales : 1:100@A1			Date : APR 2019
Drawn : MA		Engineer : VM	Checked : JL

Drawing No.
L2368-C-52-700 -


+81.40
+80.80
+81.65
+81.80
+83.65
T23
T24
T25
+80.80
+80.20
Bin store
T2
T1
Bike store

KEY LEGEND

- Grey-beige natural stone paving, to be laid in fixed widths with random lengths on a full mortar bed over at least 150mm of compacted MOT Type 1 sub base.
- 600 x 600 x 20mm grey porcelain paving, laid corner to corner on pedestal system.
- Bespoke timber pergola with timber open slatted roof. Maximum height 250cm above floor level, to be constructed from a suitable hardwood such as Western red cedar or Sipele Mahogany. Floor to be formed of a hardwood timber decked area for comfort and water permeability to ground. The steps up to the pergola will be constructed with grey-beige natural stone in order to match the retaining walls running into this area.
- Driveway treatment - minimum 70% to be a fully permeable resin bound finish with a maximum of 30% to be a fully grouted grey mix of Porphyry setts sized 60 and 80mm to be laid in bogen fan pattern to the sloping entrance areas. The whole area to be bounded with an edging course of the same material.
- Sculptural feature to be set on a stone plinth within the planting bed adjacent to the main exit from the house to give a focal point from within the buidling. This sculpture could be subtly lit for additional effect in the evening.
- Water will run down the face of a stone clad feature wall then passing via stainless steel shutes set into the retaining wall below into the canal running across this area of the garden. The ground in this area is dressed with 10mm ornamental aggregate set into a CEDAPATH stabilistation system.
- Water moves from the canal into the rill which flows forwards on a very slight slope to a pool which presents a bubbling fountainjet of water slightly above ground level. The rill is coped / edged in grey-beige natural stone. This area will also feature natural boulders with a sawn top to be honed and presented as a seat.
- Secondary informal path within the woodland area, laid in bark mulch for the purpose of access to plantings for maintenance.
- Primary path through Woodland garden finished in grey 14mm ornamental aggregate. Where path runs through RPA area, gravel to be laid in Celltrack 38 over 75mm ProtectaWeb from Wrekin products resulting in a "no dig" path through the RPA.
- Secret garden destination to be finished in gravel to be laid in Celltrack 38 over 75mm ProtectaWeb from Wrekin products. Landscape boulders to the back of this area help to provide a natural retaining wall. Ferns and campanula will be planted into the crevices to soften this feature.
- Retaining walls to terraces to be constructed from reinforced concrete blockwork. The fascia will be dressed with grey/beige natural stone slips (75-100mm) fixed with mortar from the back but "dry" at the front. All to be capped with a sawn grey-beige natural coping at least 40mm in depth.
- High quality closedboard fence from Jacksons Fencing to a maximum height of 2 metres. To be colour stained to dark grey on the inner side.
- Bespoke feature fence to be constructed from Western Red Cedar or Sipele mahogany with open horizontal slats sized 50, 75 and 100mm wide. Gaps between the slats will range from 30 to 75mm so that plenty of light will pass through this boundary onto planting in the long border but without a compromise to security.
- Rock garden to be created from natural stone boulders. This area will feature a small natural waterfall from rock to water level at the base of this area. The wall at the back of the pool will be dressed with "slips" of rock to create a feature wall.
- Steps to be finished in grey/beige natural stone with glass balustrade work to either side.
- Bin and Bike store as per architect's specification, dressed with horizontal hardwood slats and topped in a sedum roof
- Front entrance step in grey/beige natural stone
- Automated sliding gate with separate pedestrian entrance to be constructed from galvanized steel and powdercoated to black
- Sculptural focal point on lawn terrace, inspired by a natural form such as a seed pod or floral pattern.
- Three compost bins 1x1 m over bark mulch connected to the secondary path

Note: Proposed spot heights are shown in black, existing spot heights are shown in blue and contours are shown in white.

NO DIMENSIONS ARE TO BE SCALED FROM THIS DRAWING. USE FIGURED DIMENSIONS ONLY

ALL EXISTING DIMENSIONS, LEVELS, DRAIN RUNS AND SITE CONDITIONS ARE TO BE CHECKED PRIOR TO CONSTRUCTION OR COMMENCEMENT OF SHOP DRAWINGS

ALL DISCREPANCIES OR OMISSIONS ARE TO BE REPORTED TO THE DESIGNER

INFORM THE DESIGNER BEFORE ANY WORK STARTS IF THE DRAWINGS EXCEED THE QUANTITIES IN ANY WAY

Contact details
2b The Hangar, Perseverance Works, 38 Kingsland Road, London E2 8DD
020 7732 9233
07802 754983
john@johndavieslandscape.co.uk

Project name
53 Fitzroy Park

Client
Mr. M Saadati

Drawing name	Drawing number	Scale	Date of issue	Drawn by	Revision	Revision notes
Master plan - Hardscape details	002	1:100 @ A1	03.04.2019	JD/HC	001	Permeable driveway treatment added

FOR INFORMATION

APPENDIX B

Infiltration test results and associated plan showing test locations.

Site & Location	**53 Fitzroy Park, Highgate, London N6 6JA**	Report No: **10368/SCW**

Trial pit soakage test results

TP No: 1 **Depth: 0.30 m** Test No: **1**

Dimensions:

Width = **0.30** m
Length = **0.30** m

Perimeter = 1.20 m
Base area = 0.09 m^2

Ground sequence:

0.00 to 0.30 Made Ground - Dark brown clayey gravelly silt with occasional fragments of glass, brick and ash. Frequent roots

Readings measured from **0.00** m above ground level

No	Mins	Depth m	Depth mbgl	
1	**0**	**0.09**	0.09	
2	**1**	**0.11**	0.11	
3	**2**	**0.12**	0.12	
4	**3**	**0.12**	0.12	
5	**4**	**0.13**	0.13	
6	**5**	**0.13**	0.13	
7	**11**	**0.16**	0.16	< WL1
8	**19**	**0.18**	0.18	
9	**28**	**0.20**	0.20	
10	**37**	**0.23**	0.23	<WL2
11	**48**	**0.25**	0.25	
12	**63**	**0.27**	0.27	
13	**80**	**0.28**	0.28	
14	**90**	**0.29**	0.29	
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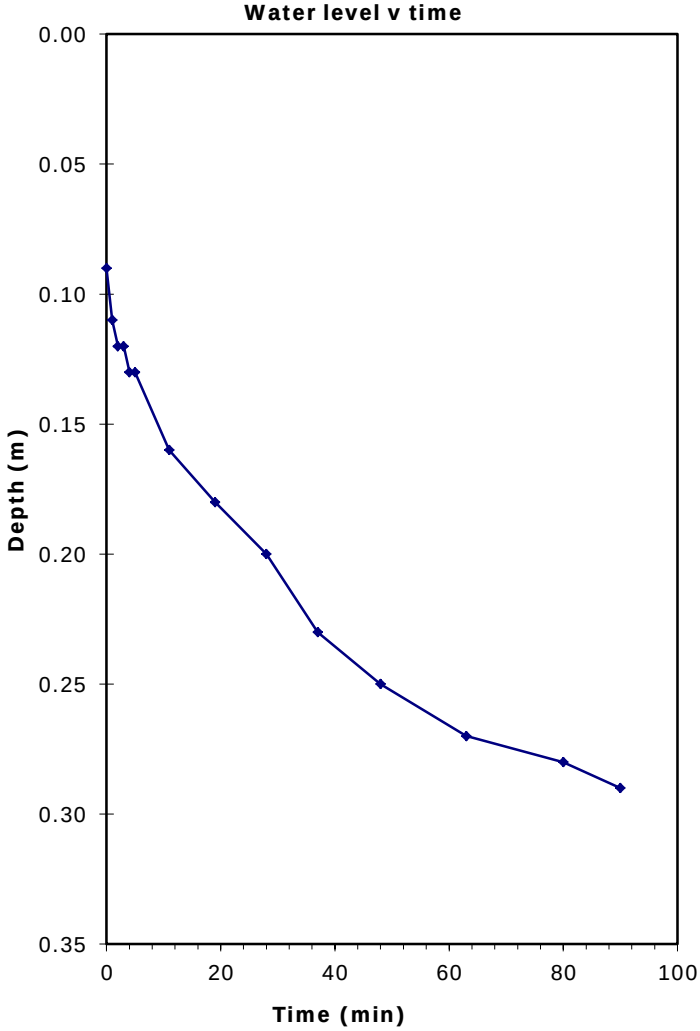
Water level v time



		Water Level (m)	Time (sec)
WL 1 [top]	**7**	0.16	660
WL 2 [bottom]	**10**	0.23	2220

Vol change	=	0.01	m^3	V
Soakage area	=	0.2160	m^2	A
Time	=	1560	sec	T

Soil infiltration rate **1.87E-05 m/sec**

The 'soil infiltration rate' is calculated using two selected water levels (BRE DG 365: 2016 "Soakaway design")

Site & Location	53 Fitzroy Park, Highgate, London N6 6JA	Report No:	10368/SCW

Trial pit soakage test results

TP No: 1 **Depth: 0.30 m** Test No: **2**

Dimensions:

Width = **0.30** m
Length = **0.30** m

Perimeter = 1.20 m
Base area = 0.09 m^2

Ground sequence:

0.00 to 0.30 Made Ground - Dark brown clayey gravelly silt with occasional fragments of glass, brick and ash. Frequent roots

Readings measured from **0.00** m above ground level

No	Mins	Depth m	Depth mbgl	
1	**0**	**0.09**	0.09	
2	**1**	**0.10**	0.10	
3	**2**	**0.10**	0.10	
4	**3**	**0.10**	0.10	
5	**4**	**0.11**	0.11	
6	**5**	**0.11**	0.11	
7	**20**	**0.13**	0.13	< WL1
8	**34**	**0.17**	0.17	
9	**60**	**0.21**	0.21	
10	**85**	**0.23**	0.23	<WL2
11	**100**	**0.25**	0.25	
12	**121**	**0.27**	0.27	
13	**153**	**0.30**	0.30	
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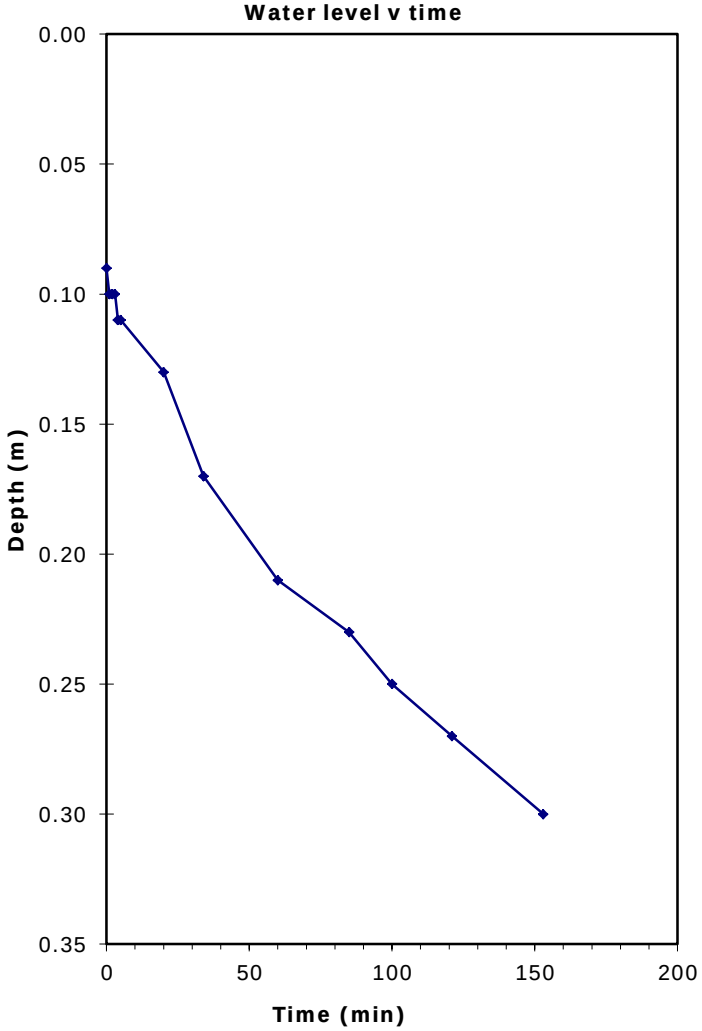
Water level v time



		Water Level (m)	Time (sec)
WL 1 [top]	**7**	0.13	1200
WL 2 [bottom]	**10**	0.23	5100

Vol change	=	0.01	m^3	V
Soakage area	=	0.2340	m^2	A
Time	=	3900	sec	T

Soil infiltration rate **9.86E-06 m/sec**

The 'soil infiltration rate' is calculated using two selected water levels (BRE DG 365: 2016 "Soakaway design")

Site & Location	53 Fitzroy Park, Highgate, London N6 6JA	Report No:	10368/SCW

Trial pit soakage test results

TP No: 1 **Depth: 0.30 m** Test No: **3**

Dimensions:

Width = **0.30** m
Length = **0.30** m

Perimeter = 1.20 m
Base area = 0.09 m^2

Ground sequence:

0.00 to 0.30 Made Ground - Dark brown clayey gravelly silt with occasional fragments of glass, brick and ash. Frequent roots

Readings measured from **0.00** m above ground level

No	Mins	Depth m	Depth mbgl	
1	**0**	**0.07**	0.07	
2	**1**	**0.07**	0.07	
3	**2**	**0.08**	0.08	
4	**3**	**0.08**	0.08	
5	**4**	**0.08**	0.08	
6	**5**	**0.08**	0.08	
7	**15**	**0.10**	0.10	< WL1
8	**29**	**0.13**	0.13	
9	**51**	**0.16**	0.16	
10	**70**	**0.19**	0.19	<WL2
11	**89**	**0.22**	0.22	
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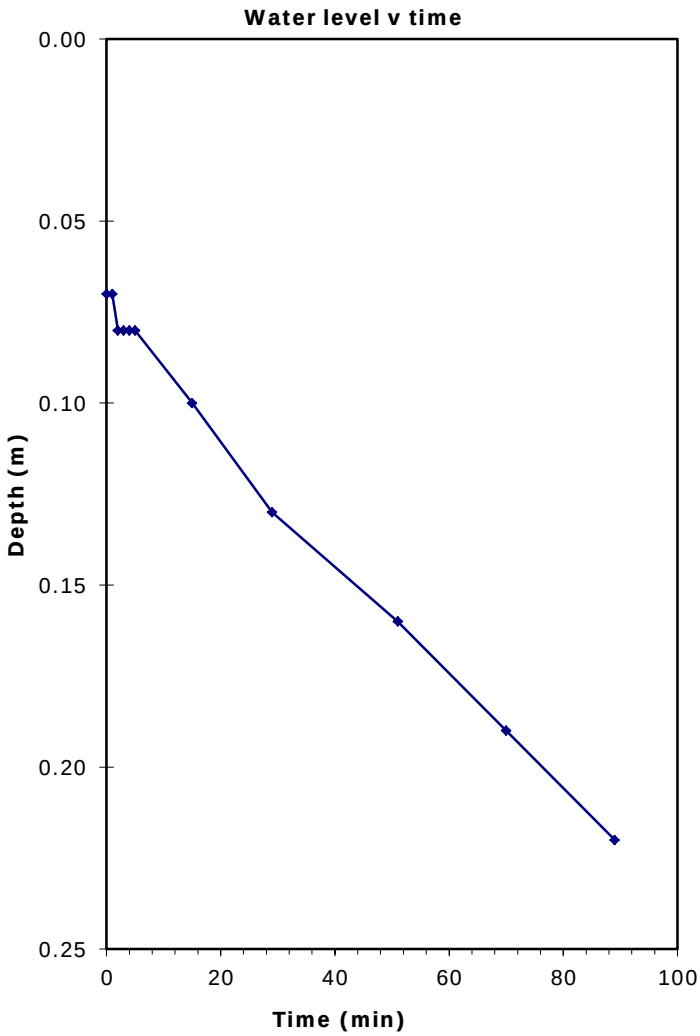

		Water Level (m)	Time (sec)
WL 1 [top]	**7**	0.10	900
WL 2 [bottom]	**10**	0.19	4200

Vol change	=	0.01	m^3	V
Soakage area	=	0.2760	m^2	A
Time	=	3300	sec	T

Soil infiltration rate **8.89E-06 m/sec**

The 'soil infiltration rate' is calculated using two selected water levels (BRE DG 365: 2016 "Soakaway design")

Site & Location	53 Fitzroy Park, Highgate, London N6 6JA	Report No:	10368/SCW

Trial pit soakage test results

TP No: 2 **Depth: 0.32 m** Test No: **1**

Dimensions:

Width = **0.27** m
Length = **0.27** m
Perimeter = 1.08 m
Base area = 0.07 m^2

Ground sequence:

0.00 to 0.10 Made Ground soft dark brown silty gravelly clay with occasional fragments of ash and roots

0.10 to 0.32 Made Ground - firm orange brown silty clay with a little gravel. Occasional roots

Readings measured from **0.00** m above ground level

No	Mins	Depth m	Depth mbgl	
1	**0**	**0.13**	0.13	
2	**1**	**0.14**	0.14	
3	**2**	**0.15**	0.15	
4	**3**	**0.15**	0.15	
5	**4**	**0.15**	0.15	< WL1
6	**5**	**0.16**	0.16	
7	**12**	**0.16**	0.16	
8	**21**	**0.17**	0.17	
9	**31**	**0.18**	0.18	
10	**40**	**0.20**	0.20	<WL2
11	**57**	**0.20**	0.20	
12	**70**	**0.20**	0.20	
13	**85**	**0.20**	0.20	
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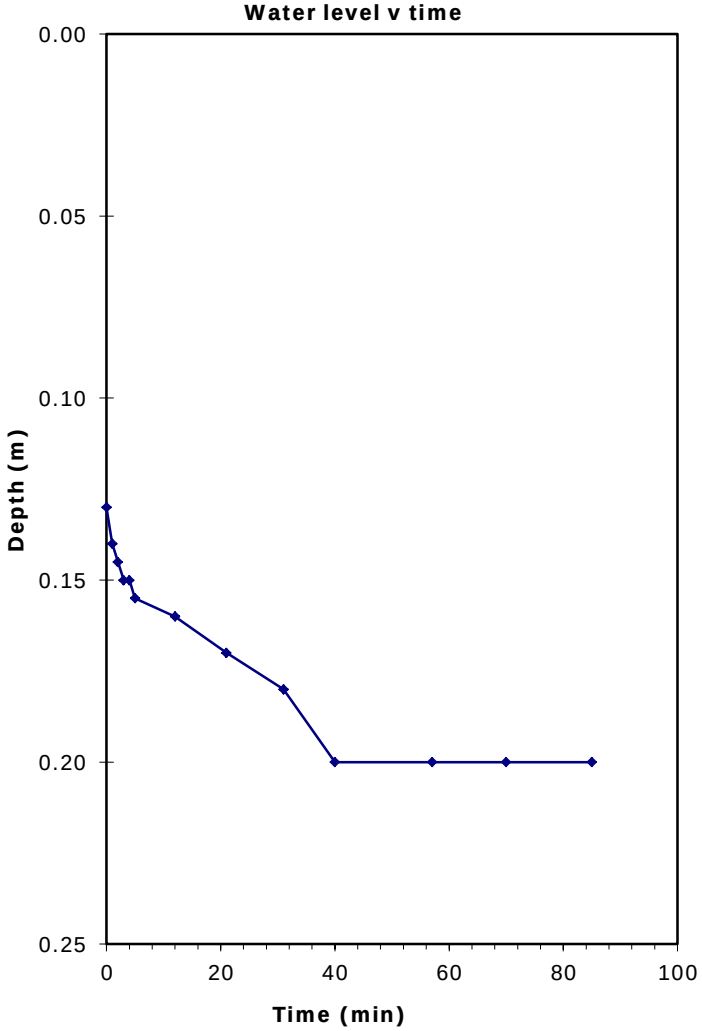
Water level v time



		Water Level (m)	Time (sec)
WL 1 [top]	**5**	0.15	240
WL 2 [bottom]	**10**	0.20	2400

Vol change	=	0.00	m^3	V
Soakage area	=	0.2295	m^2	A
Time	=	2160	sec	T

Soil infiltration rate **7.35E-06 m/sec**

Soil Consultants

The 'soil infiltration rate' is calculated using two selected water levels (BRE DG 365: 2016 "Soakaway design")

Site & Location	53 Fitzroy Park, Highgate, London N6 6JA	Report No:	10368/SCW

Trial pit soakage test results

TP No: 2 **Depth: 0.32 m** Test No: **2**

Dimensions:

Width = **0.27** m
Length = **0.27** m
Perimeter = 1.08 m
Base area = 0.07 m^2

Ground sequence:

0.00 to 0.10 Made Ground soft dark brown silty gravelly clay with occasional fragments of ash and roots

0.10 to 0.32 Made Ground - firm orange brown silty clay with a little gravel. Occasional roots

Readings measured from **0.00** m above ground level

No	Mins	Depth m	Depth mbgl	
1	**0**	**0.03**	0.03	
2	**1**	**0.03**	0.03	
3	**2**	**0.03**	0.03	
4	**3**	**0.03**	0.03	
5	**4**	**0.04**	0.04	
6	**5**	**0.04**	0.04	
7	**10**	**0.06**	0.06	< WL1
8	**22**	**0.08**	0.08	
9	**48**	**0.14**	0.14	
10	**69**	**0.16**	0.16	<WL2
11	**86**	**0.17**	0.17	
12	**110**	**0.18**	0.18	
13	**140**	**0.18**	0.18	
14	**155**	**0.18**	0.18	
15	**170**	**0.18**	0.18	
16	**184**	**0.18**	0.18	
17	**200**	**0.18**	0.18	
18	**221**	**0.18**	0.18	
19	**235**	**0.18**	0.18	
20				
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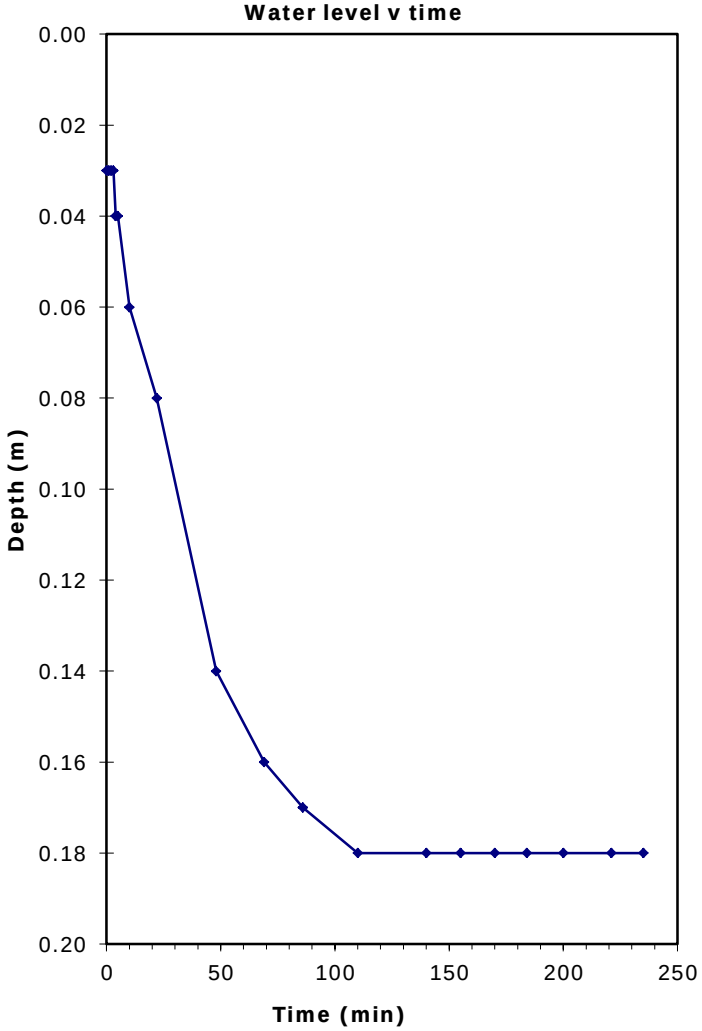
Water level v time



		Water Level (m)	Time (sec)
WL 1 [top]	**7**	0.06	600
WL 2 [bottom]	**10**	0.16	4140

Vol change	=	0.01	m^3	V
Soakage area	=	0.2997	m^2	A
Time	=	3540	sec	T

Soil infiltration rate **6.87E-06 m/sec**

The 'soil infiltration rate' is calculated using two selected water levels (BRE DG 365: 2016 "Soakaway design")

Site & Location	**53 Fitzroy Park, Highgate, London N6 6JA**	Report No: **10368/SCW**

Trial pit soakage test results

TP No: 3 **Depth: 0.34 m** Test No: **1**

Dimensions:

Width = **0.30** m
Length = **0.25** m
Perimeter = 1.10 m
Base area = 0.08 m^2

Ground sequence:

0.00 to 0.10 Made Ground soft dark brown silty gravelly clay with occasional fragments of ash and roots

0.10 to 0.34 Made Ground - firm orange brown silty clay with a little gravel. Occasional roots

Readings measured from **0.00** m above ground level

No	Mins	Depth m	Depth mbgl	
1	**0**	**0.09**	0.09	
2	**1**	**0.10**	0.10	
3	**2**	**0.11**	0.11	
4	**3**	**0.12**	0.12	
5	**4**	**0.14**	0.14	< WL1
6	**5**	**0.15**	0.15	
7	**13**	**0.21**	0.21	<WL2
8	**23**	**0.28**	0.28	
9	**32**	**0.34**	0.34	
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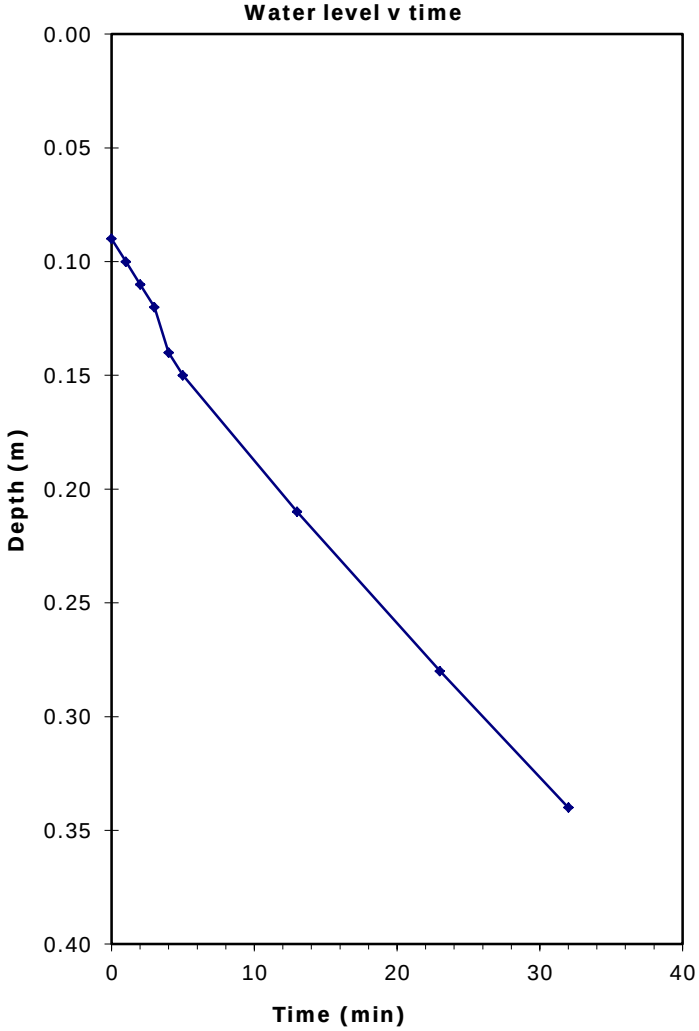
Water level v time



		Water Level (m)	Time (sec)
WL 1 [top]	**5**	0.14	240
WL 2 [bottom]	**7**	0.21	780

Vol change	=	0.01	m^3	V
Soakage area	=	0.2565	m^2	A
Time	=	540	sec	T

Soil infiltration rate **3.79E-05 m/sec**

The 'soil infiltration rate' is calculated using two selected water levels (BRE DG 365: 2016 "Soakaway design")

Site & Location	53 Fitzroy Park, Highgate, London N6 6JA	Report No:	10368/SCW

Trial pit soakage test results

TP No: 3 **Depth: 0.34 m** Test No: **2**

Dimensions:

Width = **0.30** m
Length = **0.25** m
Perimeter = 1.10 m
Base area = 0.08 m^2

Ground sequence:

0.00 to 0.10 Made Ground soft dark brown silty gravelly clay with occasional fragments of ash and roots

0.10 to 0.34 Made Ground - firm orange brown silty clay with a little gravel. Occasional roots

Readings measured from **0.00** m above ground level

No	Mins	Depth m	Depth mbgl	
1	**0**	**0.07**	0.07	
2	**1**	**0.08**	0.08	
3	**2**	**0.08**	0.08	
4	**3**	**0.08**	0.08	
5	**4**	**0.08**	0.08	
6	**5**	**0.09**	0.09	
7	**17**	**0.15**	0.15	< WL1
8	**36**	**0.21**	0.21	
9	**55**	**0.27**	0.27	<WL2
10	**74**	**0.31**	0.31	
11	**95**	**0.33**	0.33	
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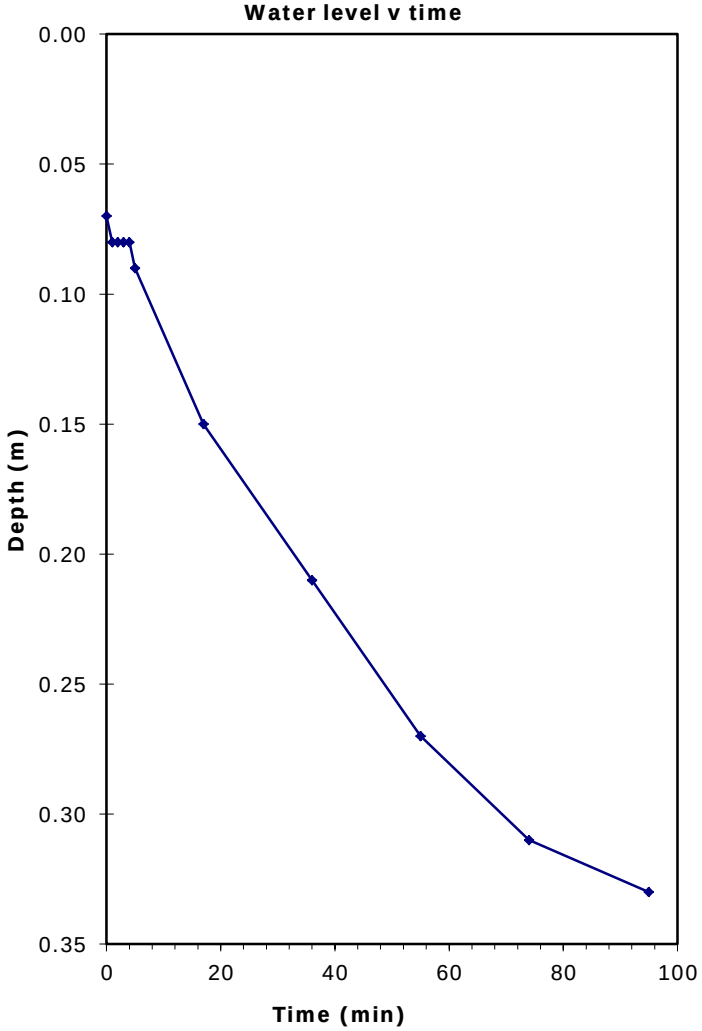
Water level v time



		Water Level (m)	Time (sec)
WL 1 [top]	**7**	0.15	1020
WL 2 [bottom]	**9**	0.27	3300

Vol change	=	0.01	m^3	V
Soakage area	=	0.2180	m^2	A
Time	=	2280	sec	T

Soil infiltration rate **1.81E-05 m/sec**

The 'soil infiltration rate' is calculated using two selected water levels (BRE DG 365: 2016 "Soakaway design")

Site & Location	53 Fitzroy Park, Highgate, London N6 6JA	Report No:	10368/SCW

Trial pit soakage test results

TP No: 3 **Depth: 0.34 m** Test No: **3**

Dimensions:

Width = **0.30** m
Length = **0.25** m
Perimeter = 1.10 m
Base area = 0.08 m^2

Ground sequence:

0.00 to 0.10 Made Ground soft dark brown silty gravelly clay with occasional fragments of ash and roots

0.10 to 0.34 Made Ground - firm orange brown silty clay with a little gravel. Occasional roots

Readings measured from **0.00** m above ground level

No	Mins	Depth m	Depth mbgl	
1	**0**	**0.08**	0.08	
2	**1**	**0.08**	0.08	
3	**2**	**0.08**	0.08	
4	**3**	**0.09**	0.09	
5	**4**	**0.09**	0.09	
6	**5**	**0.14**	0.14	< WL1
7	**23**	**0.16**	0.16	
8	**37**	**0.19**	0.19	
9	**53**	**0.23**	0.23	<WL2
10	**76**	**0.26**	0.26	
11	**90**	**0.33**	0.33	
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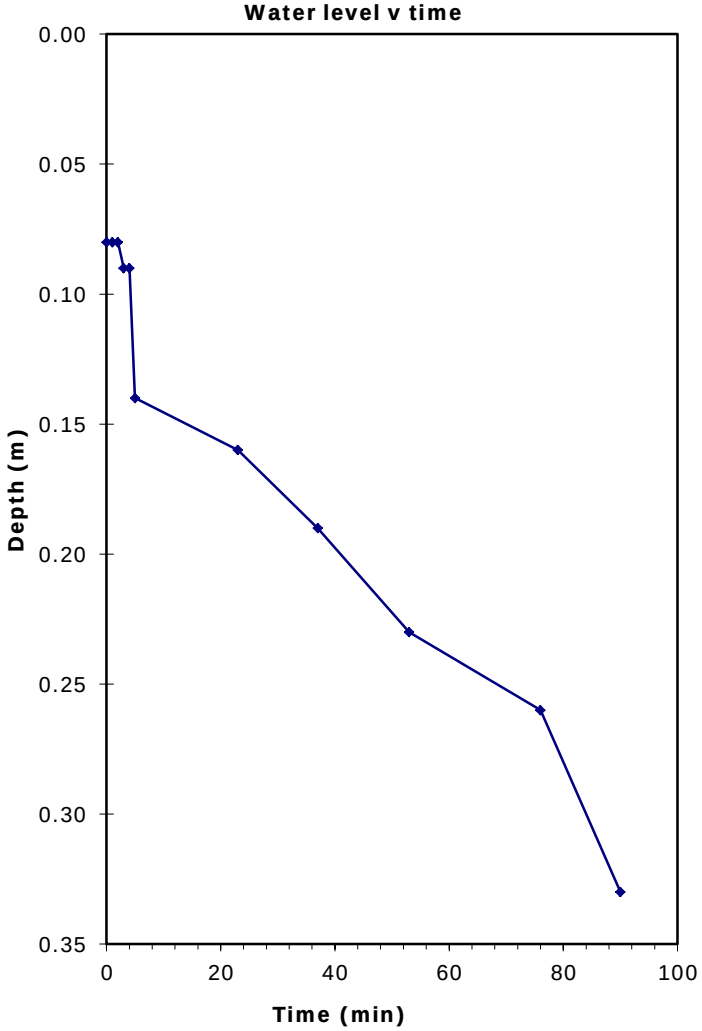
Water level v time



		Water Level (m)	Time (sec)
WL 1 [top]	**6**	0.14	300
WL 2 [bottom]	**9**	0.23	3180

Vol change	=	0.01	m^3	V
Soakage area	=	0.2455	m^2	A
Time	=	2880	sec	T

Soil infiltration rate **9.55E-06 m/sec**

The 'soil infiltration rate' is calculated using two selected water levels (BRE DG 365: 2016 "Soakaway design")

Site & Location	53 Fitzroy Park, Highgate, London N6 6JA	Report No: 10368/SCW

Trial pit soakage test results

TP No: 4 **Depth: 0.35 m** Test No: **1**

Dimensions:

Width = **0.25** m
Length = **0.25** m
Perimeter = 1.00 m
Base area = 0.06 m^2

Ground sequence:

0.00 to 0.10 Made Ground soft dark brown silty gravelly clay with occasional roots

0.10 to 0.35 Made Ground - firm orange brown mottled grey silty clay with a little gravel. Occasional roots

Readings measured from **0.00** m above ground level

No	Mins	Depth m	Depth mbgl	
1	**0**	**0.17**	0.17	
2	**1**	**0.25**	0.25	< WL1
3	**2**	**0.29**	0.29	
4	**3**	**0.32**	0.32	<WL2
5	**4**	**0.34**	0.34	
6	**5**	**0.35**	0.35	
7				
8				
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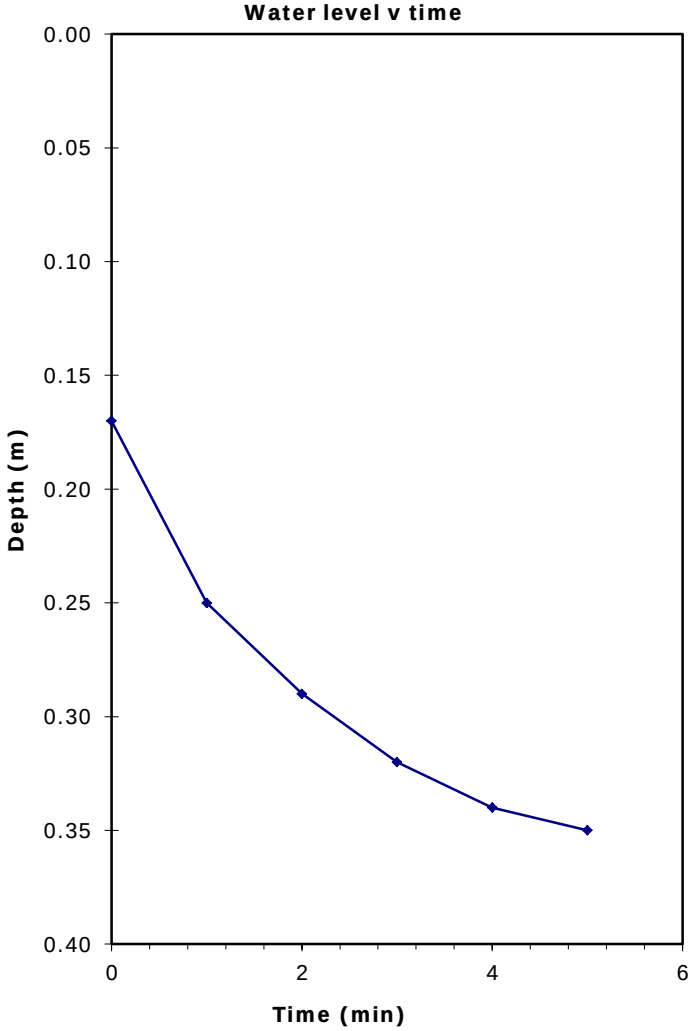
Water level v time



		Water Level (m)	Time (sec)
WL 1 [top]	**2**	0.25	60
WL 2 [bottom]	**4**	0.32	180

Vol change	=	0.00	m^3	V
Soakage area	=	0.1275	m^2	A
Time	=	120	sec	T

Soil infiltration rate **2.86E-04 m/sec**

The 'soil infiltration rate' is calculated using two selected water levels (BRE DG 365: 2016 "Soakaway design")

Site & Location	53 Fitzroy Park, Highgate, London N6 6JA	Report No:	10368/SCW

Trial pit soakage test results

TP No: 4 **Depth: 0.35 m** Test No: **2**

Dimensions:

Width = **0.25** m
Length = **0.25** m
Perimeter = 1.00 m
Base area = 0.06 m^2

Ground sequence:

0.00 to 0.10 Made Ground soft dark brown silty gravelly clay with occasional roots

0.10 to 0.35 Made Ground - firm orange brown mottled grey silty clay with a little gravel. Occasional roots

Readings measured from **0.00** m above ground level

No	Mins	Depth m	Depth mbgl	
1	**0**	**0.08**	0.08	
2	**1**	**0.13**	0.13	< WL1
3	**2**	**0.19**	0.19	
4	**3**	**0.24**	0.24	
5	**4**	**0.29**	0.29	<WL2
6	**5**	**0.30**	0.30	
7	**8**	**0.35**	0.35	
8				
9				
10				
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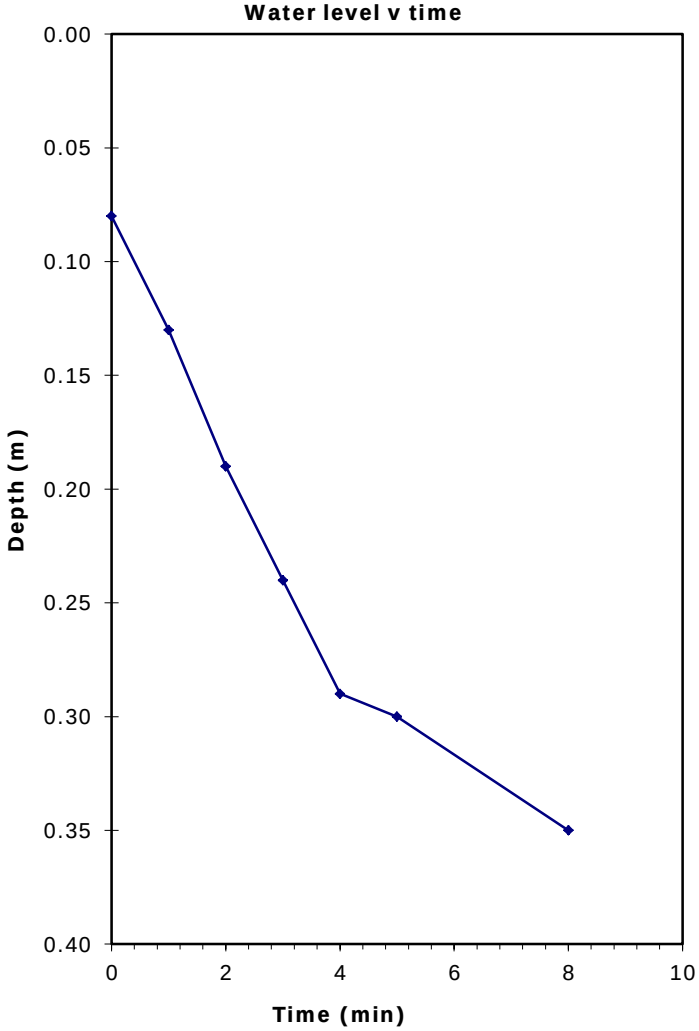
Water level v time



		Water Level (m)	Time (sec)
WL 1 [top]	**2**	0.13	60
WL 2 [bottom]	**5**	0.29	240

Vol change	=	0.01	m^3	V
Soakage area	=	0.2025	m^2	A
Time	=	180	sec	T

Soil infiltration rate **2.74E-04 m/sec**

SoilConsultants

The 'soil infiltration rate' is calculated using two selected water levels (BRE DG 365: 2016 "Soakaway design")

Site & Location	53 Fitzroy Park, Highgate, London N6 6JA	Report No:	10368/SCW

Trial pit soakage test results

TP No: 4 **Depth: 0.35 m** Test No: **3**

Dimensions:

Width = **0.25** m
Length = **0.25** m
Perimeter = 1.00 m
Base area = 0.06 m^2

Ground sequence:

0.00 to 0.10 Made Ground soft dark brown silty gravelly clay with occasional roots

0.10 to 0.35 Made Ground - firm orange brown mottled grey silty clay with a little gravel. Occasional roots

Readings measured from **0.00** m above ground level

No	Mins	Depth m	Depth mbgl	
1	**0**	**0.08**	0.08	
2	**1**	**0.12**	0.12	
3	**2**	**0.17**	0.17	< WL1
4	**3**	**0.20**	0.20	
5	**4**	**0.25**	0.25	
6	**5**	**0.29**	0.29	
7	**7**	**0.31**	0.31	<WL2
8	**8**	**0.33**	0.33	
9	**10**	**0.34**	0.34	
10	**12**	**0.35**	0.35	
11				
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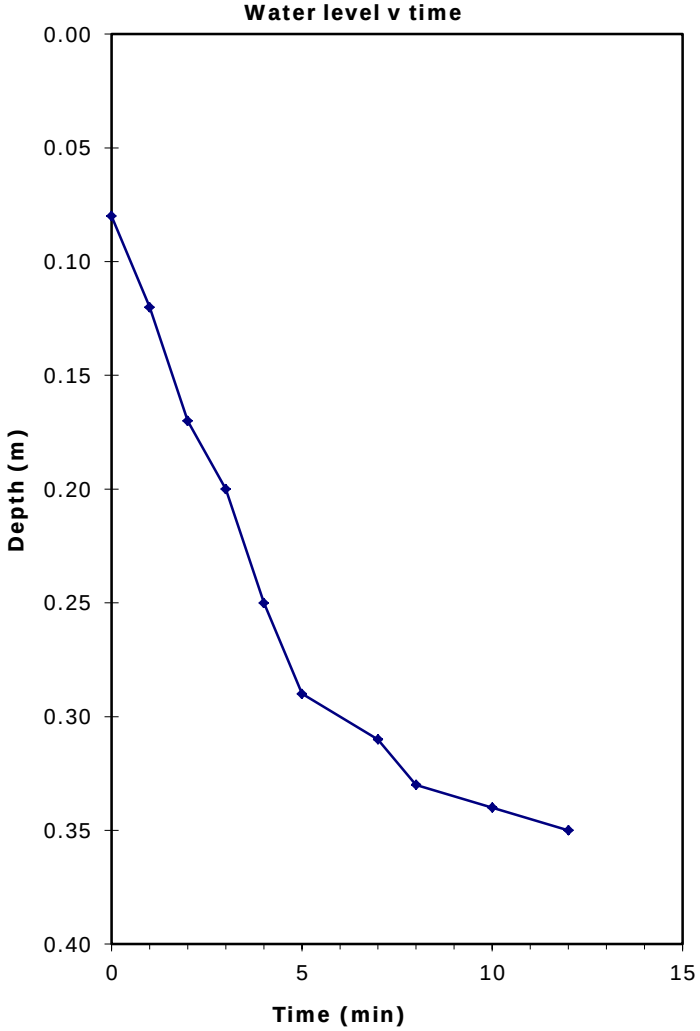
Water level v time



		Water Level (m)	Time (sec)
WL 1 [top]	**3**	0.17	120
WL 2 [bottom]	**7**	0.31	420

Vol change	=	0.01	m^3	V
Soakage area	=	0.1725	m^2	A
Time	=	300	sec	T

Soil infiltration rate **1.69E-04 m/sec**

The 'soil infiltration rate' is calculated using two selected water levels (BRE DG 365: 2016 "Soakaway design")

Site & Location	**53 Fitzroy Park, Highgate, London N6 6JA**	Report No: **10368/SCW**

Trial pit soakage test results

TP No: 5 **Depth: 0.39 m** Test No: **1**

Dimensions:

Width = **0.30** m
Length = **0.27** m
Perimeter = 1.14 m
Base area = 0.08 m^2

Ground sequence:

0.00 to 0.15 Made Ground soft dark brown silty gravelly clay with occasional ash and roots

0.15 to 0.39 Made Ground - dark brown slightly clayey sandy silt with a little gravel. Occasional fragemnts of china, ask, wood and roots

Readings measured from **0.00** m above ground level

No	Mins	Depth m	Depth mbgl	
1	**0**	**0.16**	0.16	
2	**1**	**0.17**	0.17	
3	**2**	**0.18**	0.18	
4	**3**	**0.19**	0.19	
5	**4**	**0.20**	0.20	
6	**5**	**0.20**	0.20	
7	**10**	**0.22**	0.22	< WL1
8	**15**	**0.24**	0.24	
9	**20**	**0.25**	0.25	
10	**30**	**0.27**	0.27	
11	**45**	**0.29**	0.29	<WL2
12	**60**	**0.31**	0.31	
13	**66**	**0.31**	0.31	
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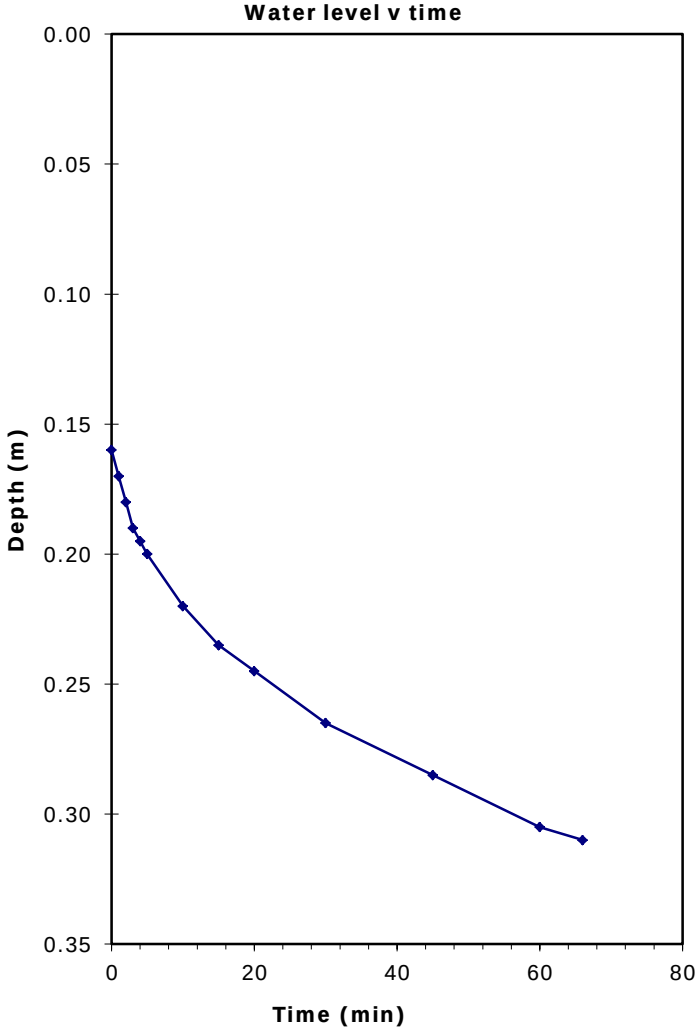
Water level v time



	Water Level (m)	Time (sec)
WL 1 [top]	**7**	0.22	600
WL 2 [bottom]	**11**	0.29	2700

Vol change	=	0.01	m^3	V
Soakage area	=	0.2378	m^2	A
Time	=	2100	sec	T

Soil infiltration rate **1.05E-05 m/sec**

The 'soil infiltration rate' is calculated using two selected water levels (BRE DG 365: 2016 "Soakaway design")

Site & Location	53 Fitzroy Park, Highgate, London N6 6JA	Report No:	10368/SCW

Trial pit soakage test results

TP No: 5 **Depth: 0.39 m** Test No: **2**

Dimensions:

Width = **0.30** m
Length = **0.27** m
Perimeter = 1.14 m
Base area = 0.08 m^2

Ground sequence:

0.00 to 0.15 Made Ground soft dark brown silty gravelly clay with occasional ash and roots

0.15 to 0.39 Made Ground - dark brown slightly clayey sandy silt with a little gravel. Occasional fragemnts of china, ask, wood and roots

Readings measured from **0.00** m above ground level

No	Mins	Depth m	Depth mbgl	
1	**0**	**0.16**	0.16	
2	**1**	**0.16**	0.16	
3	**2**	**0.16**	0.16	
4	**3**	**0.17**	0.17	
5	**5**	**0.17**	0.17	< WL1
6	**10**	**0.19**	0.19	
7	**20**	**0.20**	0.20	
8	**30**	**0.21**	0.21	
9	**40**	**0.23**	0.23	<WL2
10	**50**	**0.24**	0.24	
11	**63**	**0.25**	0.25	
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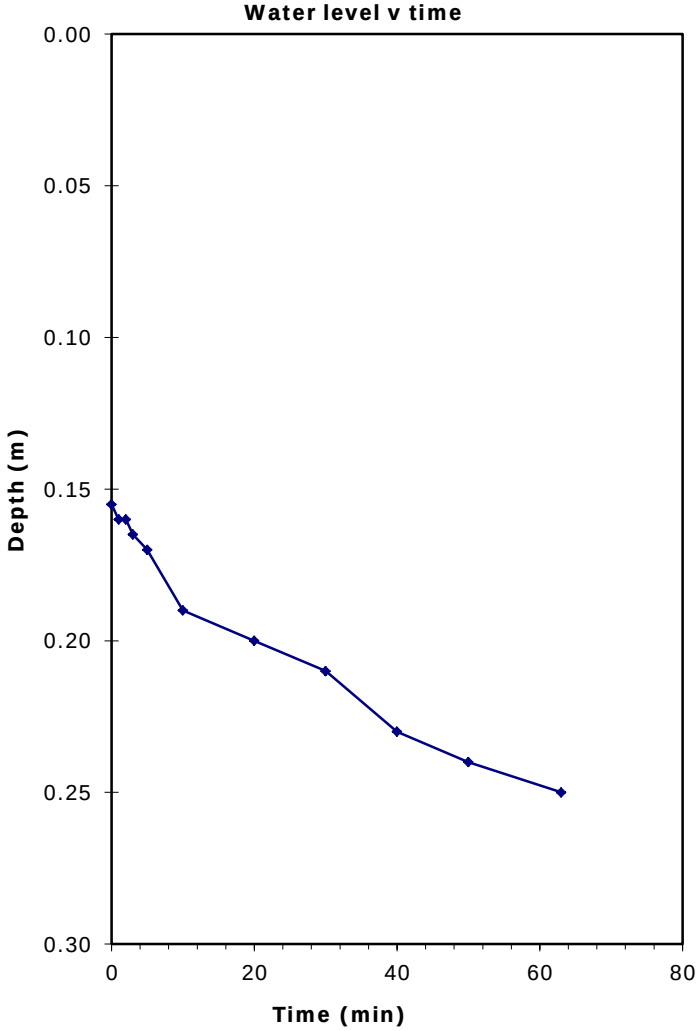
Water level v time



		Water Level (m)	Time (sec)
WL 1 [top]	**5**	0.17	300
WL 2 [bottom]	**9**	0.23	2400

Vol change	=	0.00	m^3	V
Soakage area	=	0.2976	m^2	A
Time	=	2100	sec	T

Soil infiltration rate **7.78E-06 m/sec**

The 'soil infiltration rate' is calculated using two selected water levels (BRE DG 365: 2016 "Soakaway design")

Site & Location	**53 Fitzroy Park, Highgate, London N6 6JA**	Report No: **10368/SCW**

Trial pit soakage test results

TP No: **5** **Depth: 0.39 m** Test No: **3**

Dimensions:

Width = **0.30** m
Length = **0.27** m
Perimeter = 1.14 m
Base area = 0.08 m^2

Ground sequence:

0.00 to 0.15 Made Ground soft dark brown silty gravelly clay with occasional ash and roots

0.15 to 0.39 Made Ground - dark brown slightly clayey sandy silt with a little gravel. Occasional fragemnts of china, ask, wood and roots

Readings measured from **0.00** m above ground level

No	Mins	Depth m	Depth mbgl	
1	**0**	**0.16**	0.16	
2	**1**	**0.16**	0.16	
3	**2**	**0.16**	0.16	
4	**3**	**0.16**	0.16	
5	**4**	**0.16**	0.16	
6	**5**	**0.16**	0.16	
7	**20**	**0.18**	0.18	
8	**30**	**0.18**	0.18	< WL1
9	**50**	**0.20**	0.20	
10	**86**	**0.23**	0.23	
11	**105**	**0.25**	0.25	
12	**121**	**0.25**	0.25	
13	**143**	**0.27**	0.27	<WL2
14	**165**	**0.27**	0.27	
15	**179**	**0.28**	0.28	
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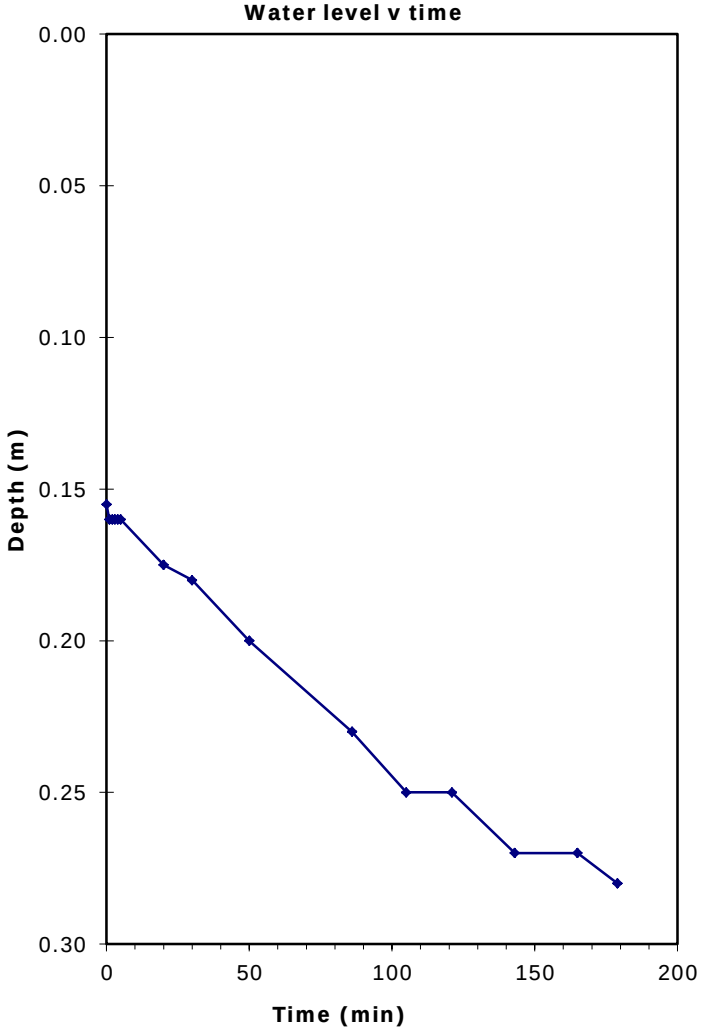
Water level v time



		Water Level (m)	Time (sec)
WL 1 [top]	**8**	0.18	1800
WL 2 [bottom]	**13**	0.27	8580

Vol change	=	0.01	m^3	V
Soakage area	=	0.2691	m^2	A
Time	=	6780	sec	T

Soil infiltration rate **4.00E-06 m/sec**

The 'soil infiltration rate' is calculated using two selected water levels (BRE DG 365: 2016 "Soakaway design")

Site & Location	53 Fitzroy Park, Highgate, London N6 6JA	Report No:	10368/SCW

Trial pit soakage test results

TP No: 6 **Depth: 0.36 m** Test No: **1**

Dimensions:

Width = **0.26** m
Length = **0.25** m

Perimeter = 1.02 m
Base area = 0.07 m^2

Ground sequence:

0.00 to 0.36 Made Ground - Dark brown clayey gravelly silt with occasional fragments of glass, brick, slate and ash. Frequent roots

Readings measured from **0.00** m above ground level

No	Mins	Depth m	Depth mbgl	
1	**0**	**0.16**	0.16	
2	**1**	**0.21**	0.21	
3	**2**	**0.23**	0.23	< WL1
4	**3**	**0.25**	0.25	
5	**4**	**0.27**	0.27	
6	**5**	**0.29**	0.29	
7	**10**	**0.35**	0.35	<WL2
8	**12**	**0.36**	0.36	
9				
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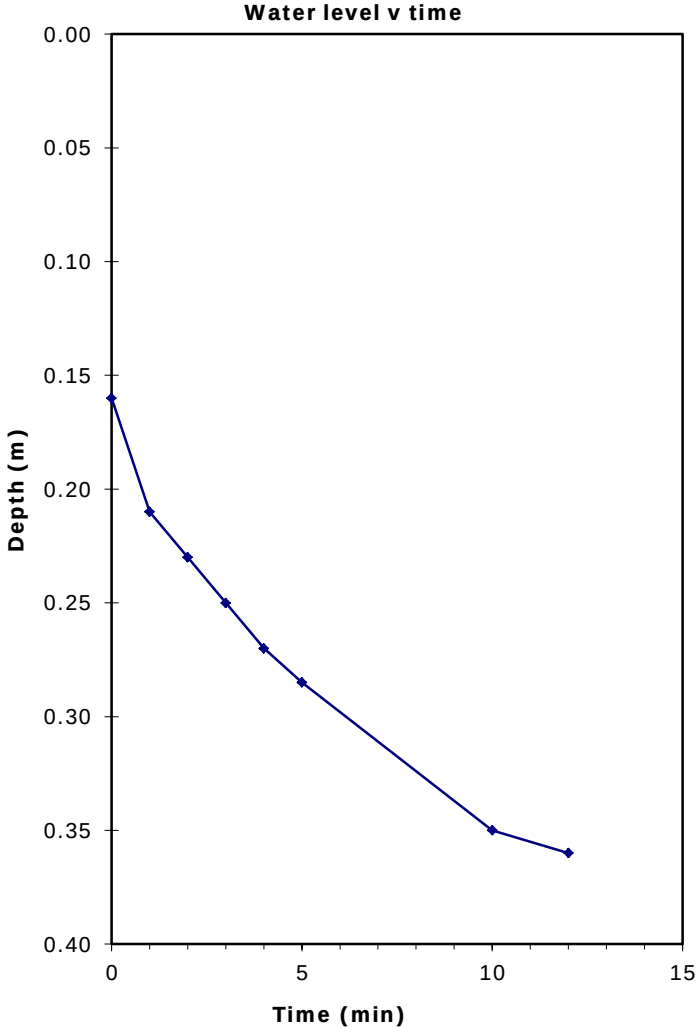
Water level v time



		Water Level (m)	Time (sec)
WL 1 [top]	**3**	0.23	120
WL 2 [bottom]	**7**	0.35	600

Vol change	=	0.01	m^3	V
Soakage area	=	0.1364	m^2	A
Time	=	480	sec	T

Soil infiltration rate **1.19E-04 m/sec**

The 'soil infiltration rate' is calculated using two selected water levels (BRE DG 365: 2016 "Soakaway design")

Site & Location	53 Fitzroy Park, Highgate, London N6 6JA	Report No:	10368/SCW

Trial pit soakage test results

TP No: 6 **Depth: 0.36 m** Test No: **2**

Dimensions:

Width = **0.26** m
Length = **0.25** m

Perimeter = 1.02 m
Base area = 0.07 m^2

Ground sequence:

0.00 to 0.36 Made Ground - Dark brown clayey gravelly silt with occasional fragments of glass, brick, slate and ash. Frequent roots

Readings measured from **0.00** m above ground level

No	Mins	Depth m	Depth mbgl	
1	**0**	**0.15**	0.15	
2	**1**	**0.16**	0.16	
3	**2**	**0.17**	0.17	
4	**3**	**0.18**	0.18	
5	**4**	**0.18**	0.18	
6	**5**	**0.19**	0.19	
7	**11**	**0.22**	0.22	< WL1
8	**18**	**0.24**	0.24	
9	**28**	**0.27**	0.27	
10	**38**	**0.31**	0.31	
11	**50**	**0.33**	0.33	<WL2
12	**60**	**0.35**	0.35	
13	**69**	**0.36**	0.36	
14				
15				
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20				
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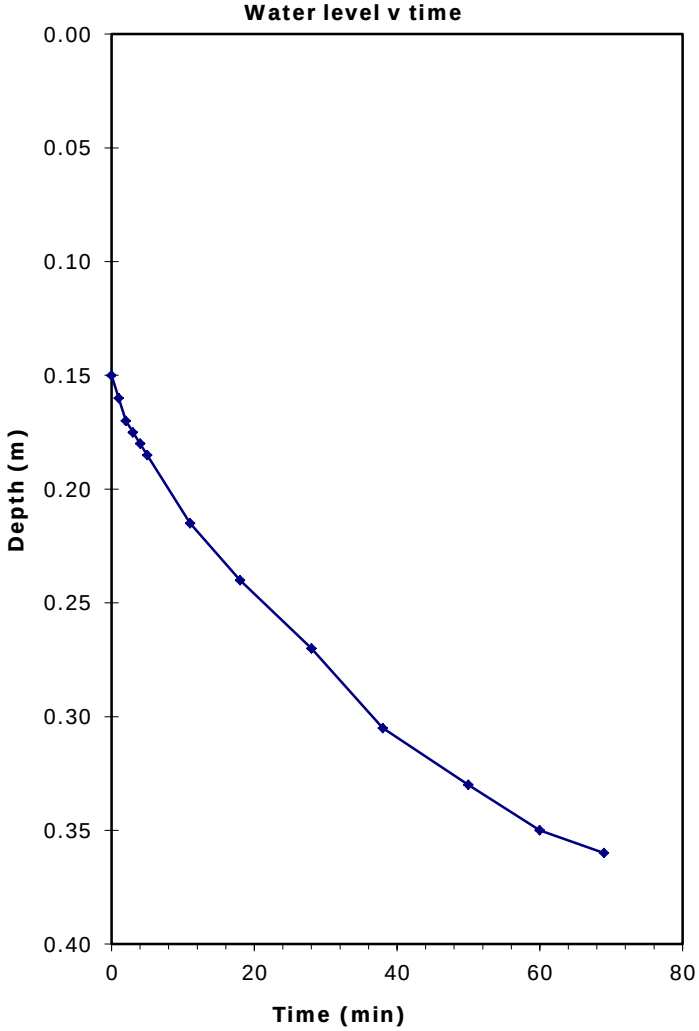
22				
23				
24				
25				

Water level v time



	Water Level (m)	Time (sec)
WL 1 [top]	**7**	0.22	660
WL 2 [bottom]	**11**	0.33	3000

Vol change	=	0.01	m^3	V
Soakage area	=	0.1543	m^2	A
Time	=	2340	sec	T

Soil infiltration rate **2.07E-05 m/sec**

The 'soil infiltration rate' is calculated using two selected water levels (BRE DG 365: 2016 "Soakaway design")

Site & Location	53 Fitzroy Park, Highgate, London N6 6JA	Report No:	10368/SCW

Trial pit soakage test results

TP No: 6 **Depth: 0.36 m** Test No: **3**

Dimensions:

Width = **0.26** m
Length = **0.25** m

Perimeter = 1.02 m
Base area = 0.07 m^2

Ground sequence:

0.00 to 0.36 Made Ground - Dark brown clayey gravelly silt with occasional fragments of glass, brick, slate and ash. Frequent roots

Readings measured from **0.00** m above ground level

No	Mins	Depth m	Depth mbgl	
1	**0**	**0.13**	0.13	
2	**1**	**0.14**	0.14	
3	**2**	**0.14**	0.14	
4	**3**	**0.15**	0.15	
5	**4**	**0.15**	0.15	
6	**5**	**0.16**	0.16	
7	**14**	**0.18**	0.18	
8	**24**	**0.19**	0.19	< WL1
9	**40**	**0.22**	0.22	
10	**50**	**0.22**	0.22	
11	**70**	**0.25**	0.25	
12	**106**	**0.27**	0.27	
13	**125**	**0.29**	0.29	
14	**143**	**0.30**	0.30	<WL2
15	**165**	**0.31**	0.31	
16	**186**	**0.32**	0.32	
17	**200**	**0.33**	0.33	
18				
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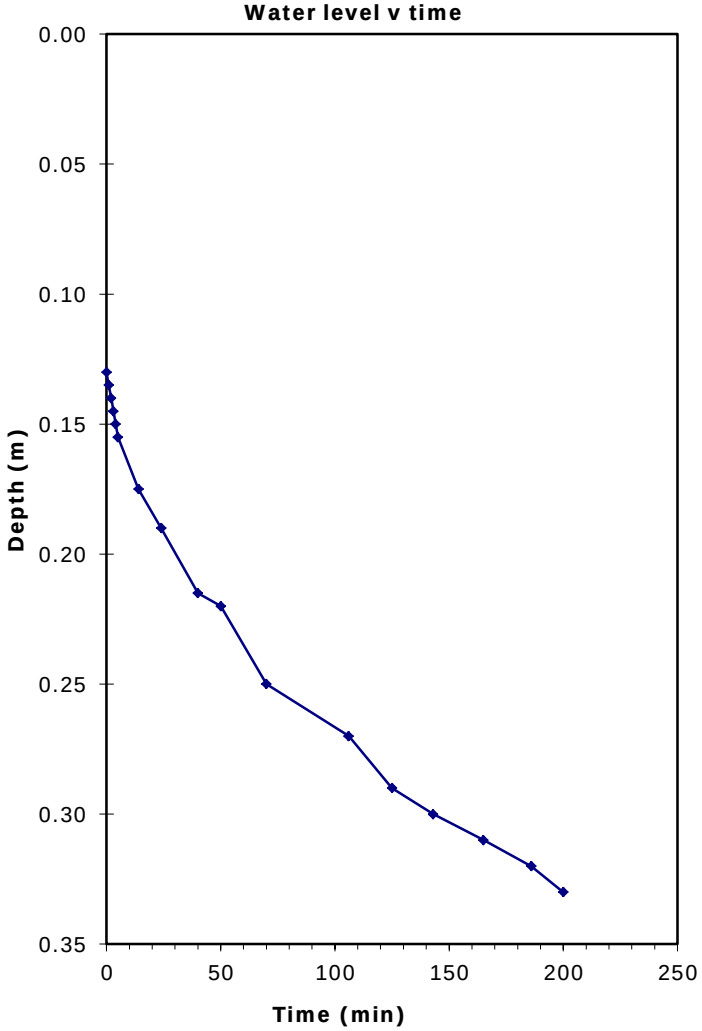
Water level v time



		Water Level (m)	Time (sec)
WL 1 [top]	**8**	0.19	1440
WL 2 [bottom]	**14**	0.30	8580

Vol change	=	0.01	m^3	V
Soakage area	=	0.1823	m^2	A
Time	=	7140	sec	T

Soil infiltration rate **5.49E-06 m/sec**

The 'soil infiltration rate' is calculated using two selected water levels (BRE DG 365: 2016 "Soakaway design")

Site & Location	53 Fitzroy Park, Highgate, London N6 6JA	Report No: 10368/SCW

Trial pit soakage test results

TP No: 7 **Depth: 0.40 m** Test No: **1**

Dimensions:

Width = **0.25** m
Length = **0.25** m
Perimeter = 1.00 m
Base area = 0.06 m^2

Ground sequence:

0.00 to 0.15 Made Ground soft dark brown silty gravelly clay with occasional ash and roots

0.15 to 0.40 Made Ground - dark brown slightly clayey sandy silt with a little gravel. Occasional fragemnts of china, ask, wood and roots

Readings measured from **0.00** m above ground level

No	Mins	Depth m	Depth mbgl	
1	**0**	**0.18**	0.18	
2	**1**	**0.22**	0.22	
3	**2**	**0.23**	0.23	< WL1
4	**3**	**0.24**	0.24	
5	**4**	**0.25**	0.25	
6	**5**	**0.26**	0.26	
7	**10**	**0.29**	0.29	
8	**19**	**0.32**	0.32	<WL2
9	**33**	**0.39**	0.39	
10				
11				
12				
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23				
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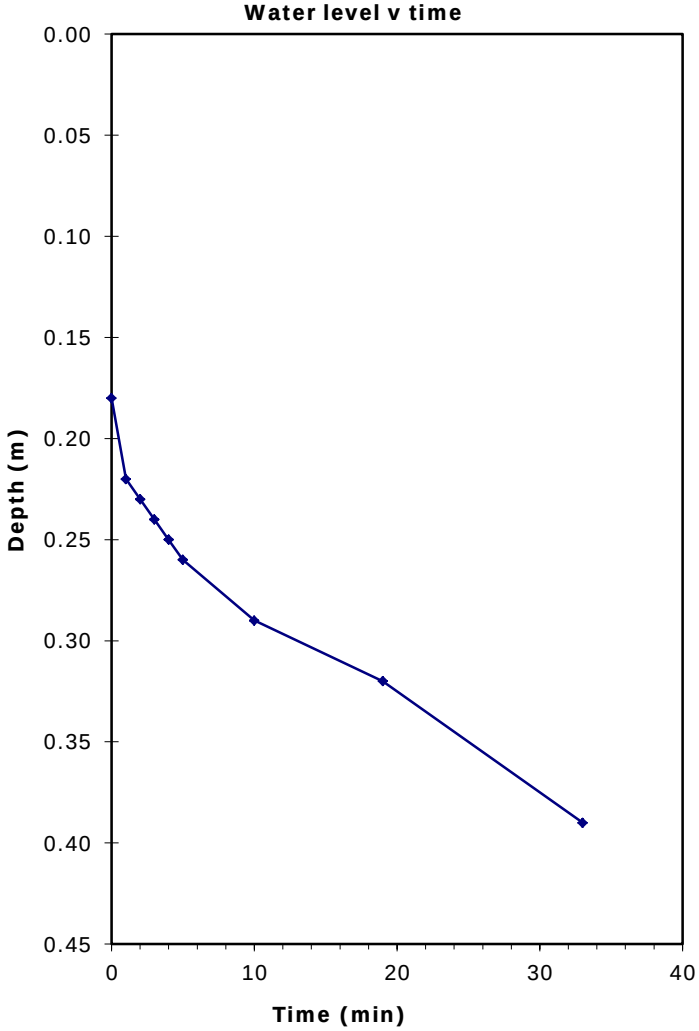
25				

Water level v time



		Water Level (m)	Time (sec)
WL 1 [top]	**3**	0.23	120
WL 2 [bottom]	**8**	0.32	1140

Vol change	=	0.01	m^3	V
Soakage area	=	0.1875	m^2	A
Time	=	1020	sec	T

Soil infiltration rate **2.94E-05 m/sec**

Soil Consultants

The 'soil infiltration rate' is calculated using two selected water levels (BRE DG 365: 2016 "Soakaway design")

Site & Location	53 Fitzroy Park, Highgate, London N6 6JA	Report No:	10368/SCW

Trial pit soakage test results

TP No: 7 **Depth: 0.40 m** Test No: **2**

Dimensions:

Width = **0.25** m
Length = **0.25** m
Perimeter = 1.00 m
Base area = 0.06 m^2

Ground sequence:

0.00 to 0.15 Made Ground soft dark brown silty gravelly clay with occasional ash and roots

0.15 to 0.40 Made Ground - dark brown slightly clayey sandy silt with a little gravel. Occasional fragemnts of china, ask, wood and roots

Readings measured from **0.00** m above ground level

No	Mins	Depth m	Depth mbgl	
1	**0**	**0.08**	0.08	
2	**1**	**0.13**	0.13	
3	**2**	**0.17**	0.17	< WL1
4	**3**	**0.19**	0.19	
5	**4**	**0.20**	0.20	
6	**5**	**0.22**	0.22	
7	**16**	**0.31**	0.31	<WL2
8	**40**	**0.40**	0.40	
9				
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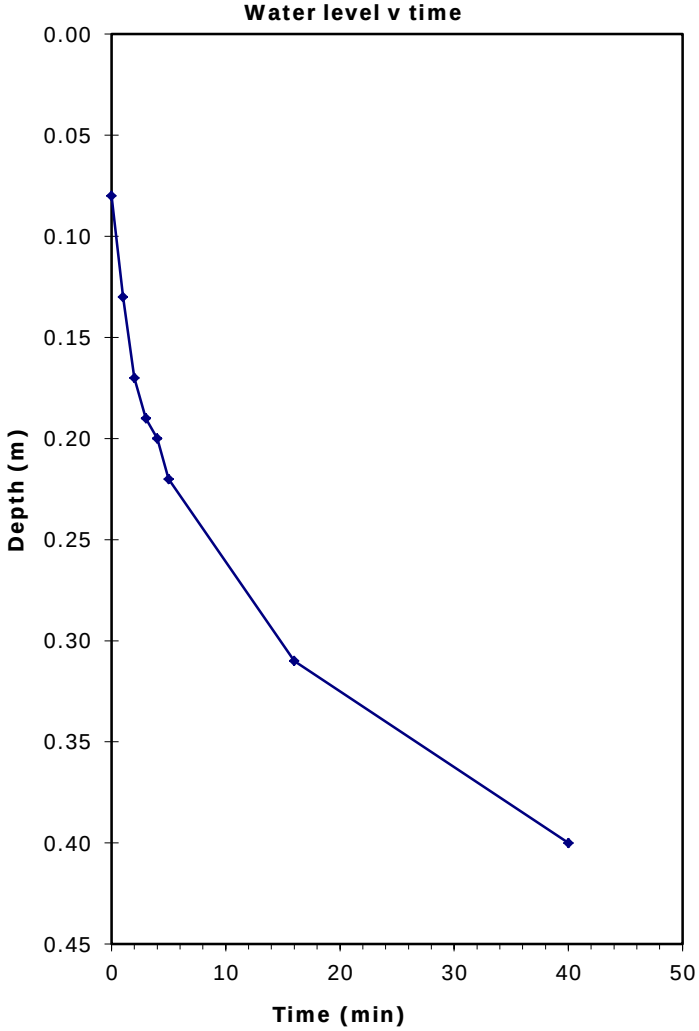
Water level v time



		Water Level (m)	Time (sec)
WL 1 [top]	**3**	0.17	120
WL 2 [bottom]	**7**	0.31	960

Vol change	=	0.01	m^3	V
Soakage area	=	0.2225	m^2	A
Time	=	840	sec	T

Soil infiltration rate **4.68E-05 m/sec**

The 'soil infiltration rate' is calculated using two selected water levels (BRE DG 365: 2016 "Soakaway design")

Site & Location	**53 Fitzroy Park, Highgate, London N6 6JA**	Report No: **10368/SCW**

Trial pit soakage test results

TP No: 7 **Depth: 0.40 m** Test No: **3**

Dimensions:

Width = **0.25** m
Length = **0.25** m
Perimeter = 1.00 m
Base area = 0.06 m^2

Ground sequence:

0.00 to 0.15 Made Ground soft dark brown silty gravelly clay with occasional ash and roots

0.15 to 0.40 Made Ground - dark brown slightly clayey sandy silt with a little gravel. Occasional fragemnts of china, ask, wood and roots

Readings measured from **0.00** m above ground level

No	Mins	Depth m	Depth mbgl	
1	**0**	**0.10**	0.10	
2	**1**	**0.11**	0.11	
3	**2**	**0.12**	0.12	
4	**3**	**0.13**	0.13	
5	**4**	**0.13**	0.13	
6	**5**	**0.14**	0.14	< WL1
7	**30**	**0.22**	0.22	
8	**57**	**0.27**	0.27	
9	**85**	**0.30**	0.30	
10	**105**	**0.31**	0.31	
11	**122**	**0.33**	0.33	<WL2
12	**145**	**0.37**	0.37	
13	**158**	**0.38**	0.38	
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22				
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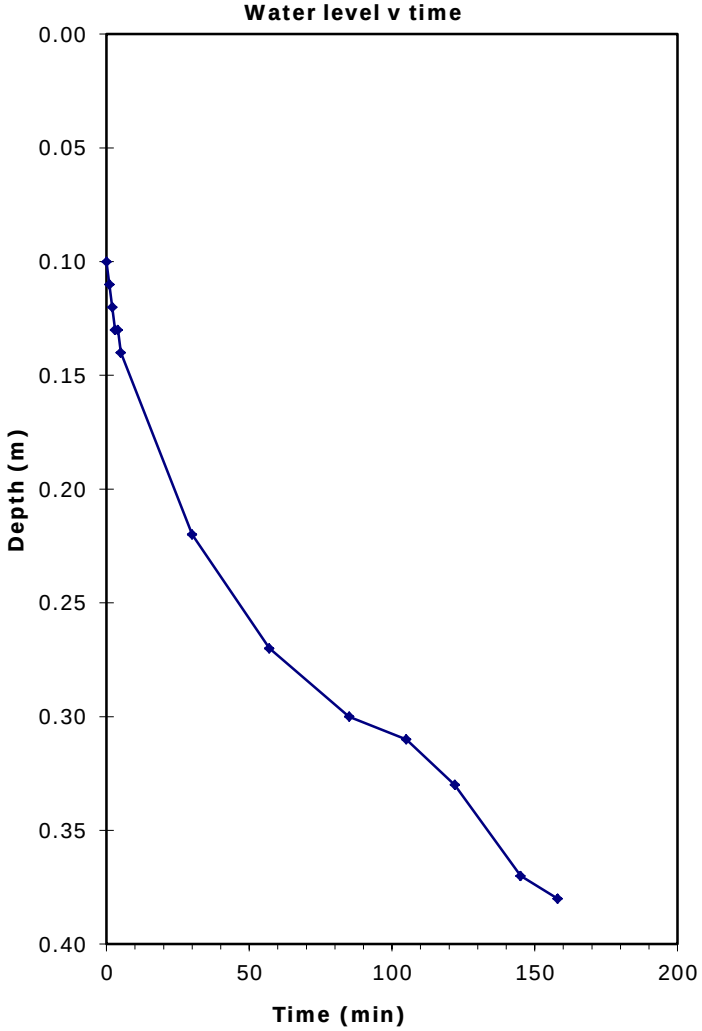
24				
25				

Water level v time



		Water Level (m)	Time (sec)
WL 1 [top]	**6**	0.14	300
WL 2 [bottom]	**11**	0.33	7320

Vol change	=	0.01	m^3	V
Soakage area	=	0.2275	m^2	A
Time	=	7020	sec	T

Soil infiltration rate **7.44E-06 m/sec**

The 'soil infiltration rate' is calculated using two selected water levels (BRE DG 365: 2016 "Soakaway design")

Site & Location	53 Fitzroy Park, Highgate, London N6 6JA	Report No:	10368/SCW

Trial pit soakage test results

TP No: 8 **Depth: 0.40 m** Test No: **1**

Dimensions:

Width = **0.30** m
Length = **0.28** m
Perimeter = 1.16 m
Base area = 0.08 m^2

Ground sequence:

0.00 to 0.25 Made Ground soft dark brown silty gravelly clay with occasional fragments of ash and roots

0.25 to 0.40 Made Ground - firm orange brown silty clay with a little gravel. Occasional roots

Readings measured from **0.00** m above ground level

No	Mins	Depth m	Depth mbgl	
1	**0**	**0.12**	0.12	
2	**1**	**0.14**	0.14	
3	**2**	**0.16**	0.16	
4	**3**	**0.18**	0.18	
5	**4**	**0.20**	0.20	< WL1
6	**5**	**0.21**	0.21	
7	**20**	**0.28**	0.28	
8	**32**	**0.31**	0.31	
9	**46**	**0.33**	0.33	<WL2
10	**60**	**0.36**	0.36	
11	**74**	**0.40**	0.40	
12				
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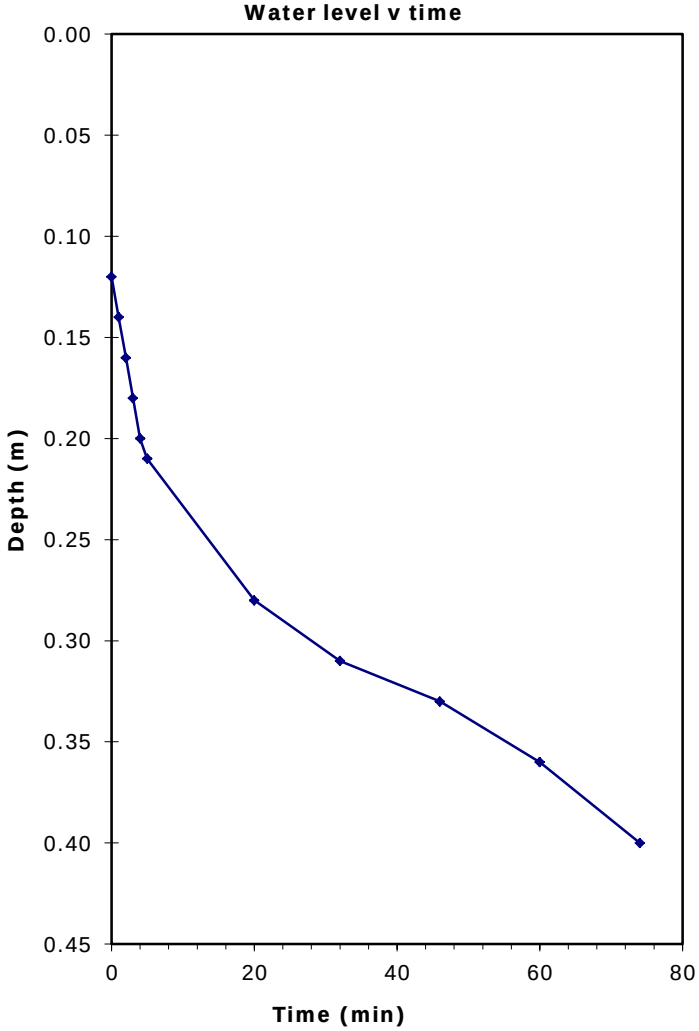
Water level v time



		Water Level (m)	Time (sec)
WL 1 [top]	**5**	0.20	240
WL 2 [bottom]	**9**	0.33	2760

Vol change	=	0.01	m^3	V
Soakage area	=	0.2406	m^2	A
Time	=	2520	sec	T

Soil infiltration rate **1.80E-05 m/sec**

The 'soil infiltration rate' is calculated using two selected water levels (BRE DG 365: 2016 "Soakaway design")

Site & Location	**53 Fitzroy Park, Highgate, London N6 6JA**	Report No: **10368/SCW**

Trial pit soakage test results

TP No: **8** **Depth: 0.40 m** Test No: **2**

Dimensions:

Width = **0.30** m
Length = **0.28** m
Perimeter = 1.16 m
Base area = 0.08 m^2

Ground sequence:

0.00 to 0.25 Made Ground soft dark brown silty gravelly clay with occasional fragments of ash and roots

0.25 to 0.40 Made Ground - firm orange brown silty clay with a little gravel. Occasional roots

Readings measured from **0.00** m above ground level

No	Mins	Depth m	Depth mbgl	
1	**0**	**0.10**	0.10	
2	**1**	**0.12**	0.12	
3	**2**	**0.13**	0.13	
4	**3**	**0.14**	0.14	
5	**4**	**0.15**	0.15	
6	**5**	**0.15**	0.15	< WL1
7	**30**	**0.22**	0.22	
8	**43**	**0.23**	0.23	
9	**70**	**0.27**	0.27	
10	**90**	**0.31**	0.31	
11	**122**	**0.33**	0.33	<WL2
12	**142**	**0.34**	0.34	
13	**160**	**0.35**	0.35	
14	**184**	**0.36**	0.36	
15	**197**	**0.38**	0.38	
16				
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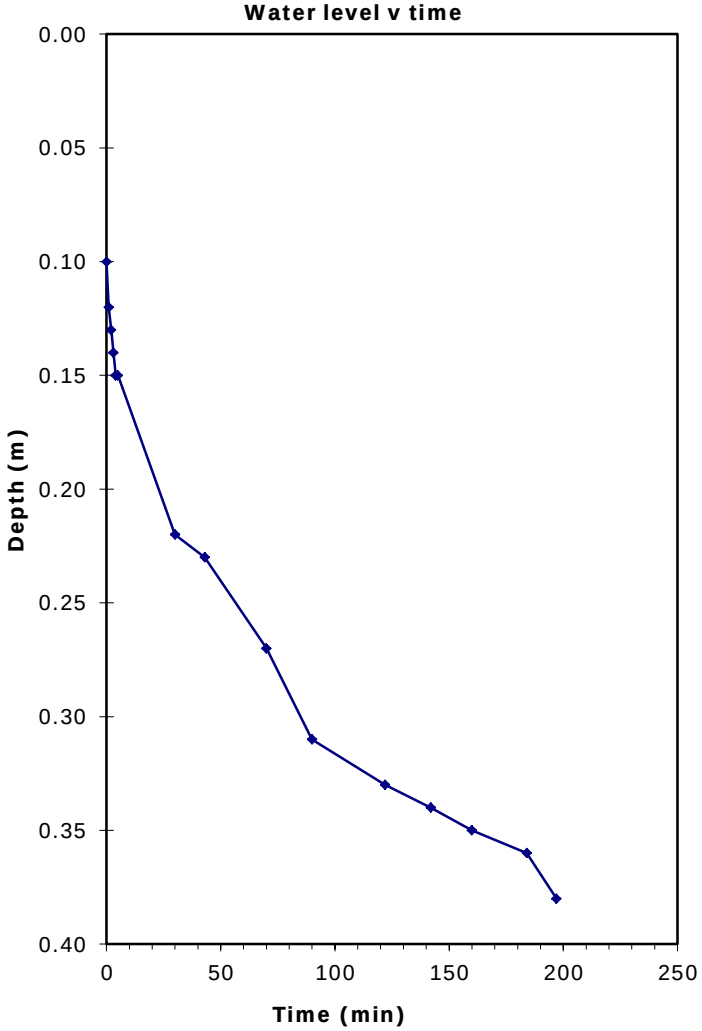
25				

Water level v time



		Water Level (m)	Time (sec)
WL 1 [top]	**6**	0.15	300
WL 2 [bottom]	**11**	0.33	7320

Vol change	=	0.02	m^3	V
Soakage area	=	0.2696	m^2	A
Time	=	7020	sec	T

Soil infiltration rate **7.99E-06 m/sec**

The 'soil infiltration rate' is calculated using two selected water levels (BRE DG 365: 2016 "Soakaway design")

Site & Location	**53 Fitzroy Park, Highgate, London N6 6JA**	Report No: **10368/SCW**

Trial pit soakage test results

TP No: **9** **Depth: 0.38 m** Test No: **1**

Dimensions:

Width = **0.25** m
Length = **0.28** m

Perimeter = 1.06 m
Base area = 0.07 m^2

Ground sequence:

0.00 to 0.38 Made Ground - Dark brown clayey gravelly silt with occasional fragments of glass, brick and ash. Frequent roots

Readings measured from **0.00** m above ground level

No	Mins	Depth m	Depth mbgl	
1	**0**	**0.06**	0.06	
2	**1**	**0.07**	0.07	
3	**2**	**0.08**	0.08	
4	**3**	**0.09**	0.09	
5	**4**	**0.10**	0.10	
6	**5**	**0.10**	0.10	
7	**21**	**0.14**	0.14	< WL1
8	**33**	**0.16**	0.16	
9	**78**	**0.20**	0.20	
10	**98**	**0.21**	0.21	
11	**115**	**0.22**	0.22	
12	**136**	**0.25**	0.25	
13	**193**	**0.27**	0.27	<WL2
14	**204**	**0.27**	0.27	
15	**222**	**0.27**	0.27	
16	**250**	**0.27**	0.27	
17	**268**	**0.27**	0.27	
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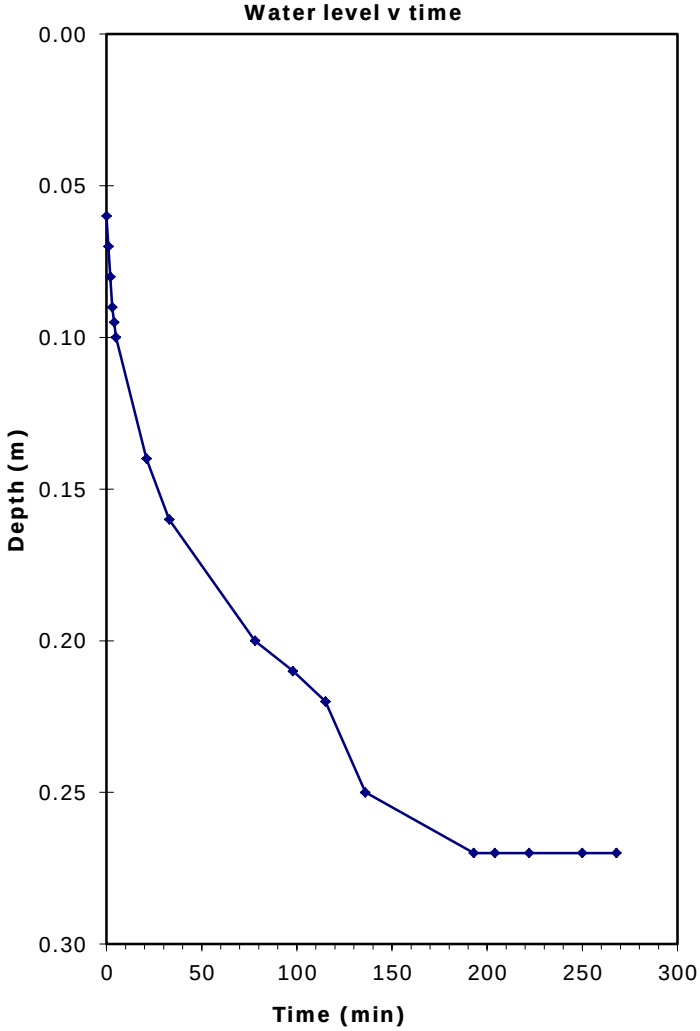
Water level v time



		Water Level (m)	Time (sec)
WL 1 [top]	**7**	0.14	1260
WL 2 [bottom]	**13**	0.27	11580

Vol change	=	0.01	m^3	V
Soakage area	=	0.2555	m^2	A
Time	=	10320	sec	T

Soil infiltration rate **3.45E-06 m/sec**

The 'soil infiltration rate' is calculated using two selected water levels (BRE DG 365: 2016 "Soakaway design")

Site & Location	53 Fitzroy Park, Highgate, London N6 6JA	Report No:	10368/SCW

Trial pit soakage test results

TP No: 10 **Depth: 0.40 m** Test No: **1**

Dimensions:

Width = **0.25** m
Length = **0.25** m

Perimeter = 1.00 m
Base area = 0.06 m^2

Ground sequence:

0.00 to 0.40 Made Ground - Dark brown clayey gravelly silt with occasional fragments of glass, brick and ash. Frequent roots

Readings measured from **0.00** m above ground level

No	Mins	Depth m	Depth mbgl	
1	**0**	**0.16**	0.16	
2	**1**	**0.21**	0.21	
3	**2**	**0.24**	0.24	< WL1
4	**3**	**0.26**	0.26	
5	**4**	**0.27**	0.27	
6	**5**	**0.29**	0.29	
7	**10**	**0.33**	0.33	<WL2
8	**20**	**0.40**	0.40	
9				
10				
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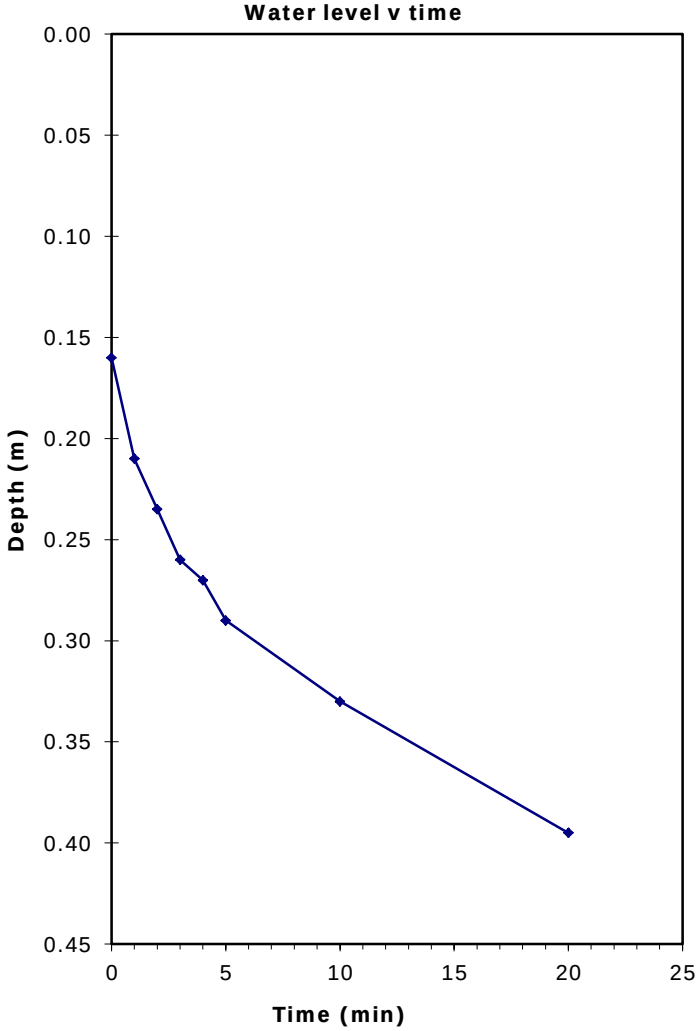
Water level v time



		Water Level (m)	Time (sec)
WL 1 [top]	**3**	0.24	120
WL 2 [bottom]	**7**	0.33	600

Vol change	=	0.01	m^3	V
Soakage area	=	0.1800	m^2	A
Time	=	480	sec	T

Soil infiltration rate **6.87E-05 m/sec**

Soil Consultants

The 'soil infiltration rate' is calculated using two selected water levels (BRE DG 365: 2016 "Soakaway design")

Site & Location	53 Fitzroy Park, Highgate, London N6 6JA	Report No:	10368/SCW

Trial pit soakage test results

TP No: 10 **Depth: 0.40 m** Test No: **2**

Dimensions:

Width = **0.25** m
Length = **0.25** m

Perimeter = 1.00 m
Base area = 0.06 m^2

Ground sequence:

0.00 to 0.40 Made Ground - Dark brown clayey gravelly silt with occasional fragments of glass, brick and ash. Frequent roots

Readings measured from **0.00** m above ground level

No	Mins	Depth m	Depth mbgl	
1	**0**	**0.16**	0.16	
2	**1**	**0.18**	0.18	
3	**2**	**0.19**	0.19	
4	**3**	**0.20**	0.20	
5	**4**	**0.21**	0.21	
6	**5**	**0.22**	0.22	< WL1
7	**15**	**0.29**	0.29	
8	**25**	**0.33**	0.33	
9	**35**	**0.38**	0.38	<WL2
10	**45**	**0.40**	0.40	
11				
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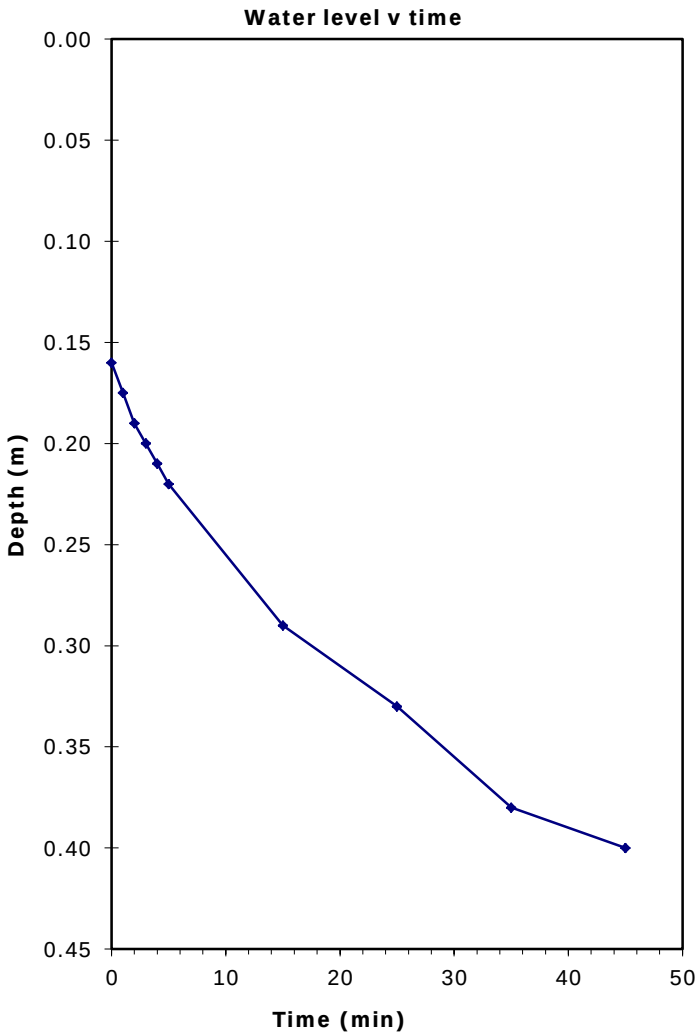

		Water Level (m)	Time (sec)
WL 1 [top]	**6**	0.22	300
WL 2 [bottom]	**9**	0.38	2100

Vol change	=	0.01	m^3	V
Soakage area	=	0.1625	m^2	A
Time	=	1800	sec	T

Soil infiltration rate **3.42E-05 m/sec**

The 'soil infiltration rate' is calculated using two selected water levels (BRE DG 365: 2016 "Soakaway design")

Site & Location	53 Fitzroy Park, Highgate, London N6 6JA	Report No:	10368/SCW

Trial pit soakage test results

TP No: 10 **Depth: 0.40 m** Test No: **3**

Dimensions:

Width = **0.25** m
Length = **0.25** m

Perimeter = 1.00 m
Base area = 0.06 m^2

Ground sequence:

0.00 to 0.40 Made Ground - Dark brown clayey gravelly silt with occasional fragments of glass, brick and ash. Frequent roots

Readings measured from **0.00** m above ground level

No	Mins	Depth m	Depth mbgl	
1	**0**	**0.16**	0.16	
2	**1**	**0.17**	0.17	
3	**2**	**0.18**	0.18	
4	**3**	**0.19**	0.19	
5	**4**	**0.20**	0.20	< WL1
6	**5**	**0.20**	0.20	
7	**15**	**0.25**	0.25	
8	**25**	**0.29**	0.29	
9	**35**	**0.32**	0.32	<WL2
10	**60**	**0.39**	0.39	
11				
12				
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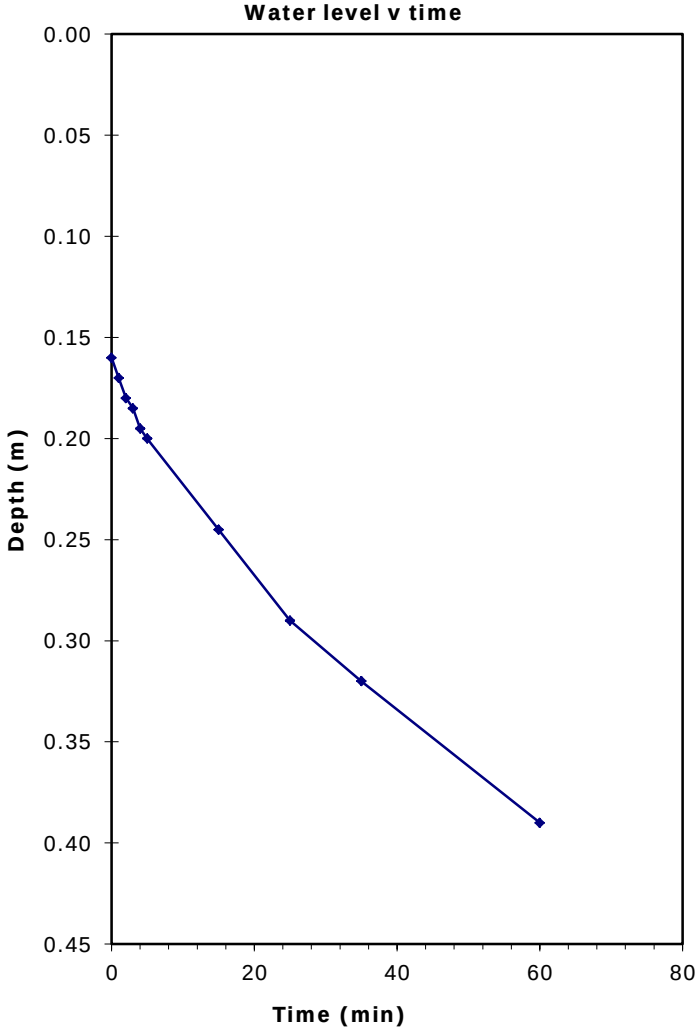
25				

Water level v time



		Water Level (m)	Time (sec)
WL 1 [top]	**5**	0.20	240
WL 2 [bottom]	**9**	0.32	2100

Vol change	=	0.01	m^3	V
Soakage area	=	0.2050	m^2	A
Time	=	1860	sec	T

Soil infiltration rate **2.05E-05 m/sec**

The 'soil infiltration rate' is calculated using two selected water levels (BRE DG 365: 2016 "Soakaway design")

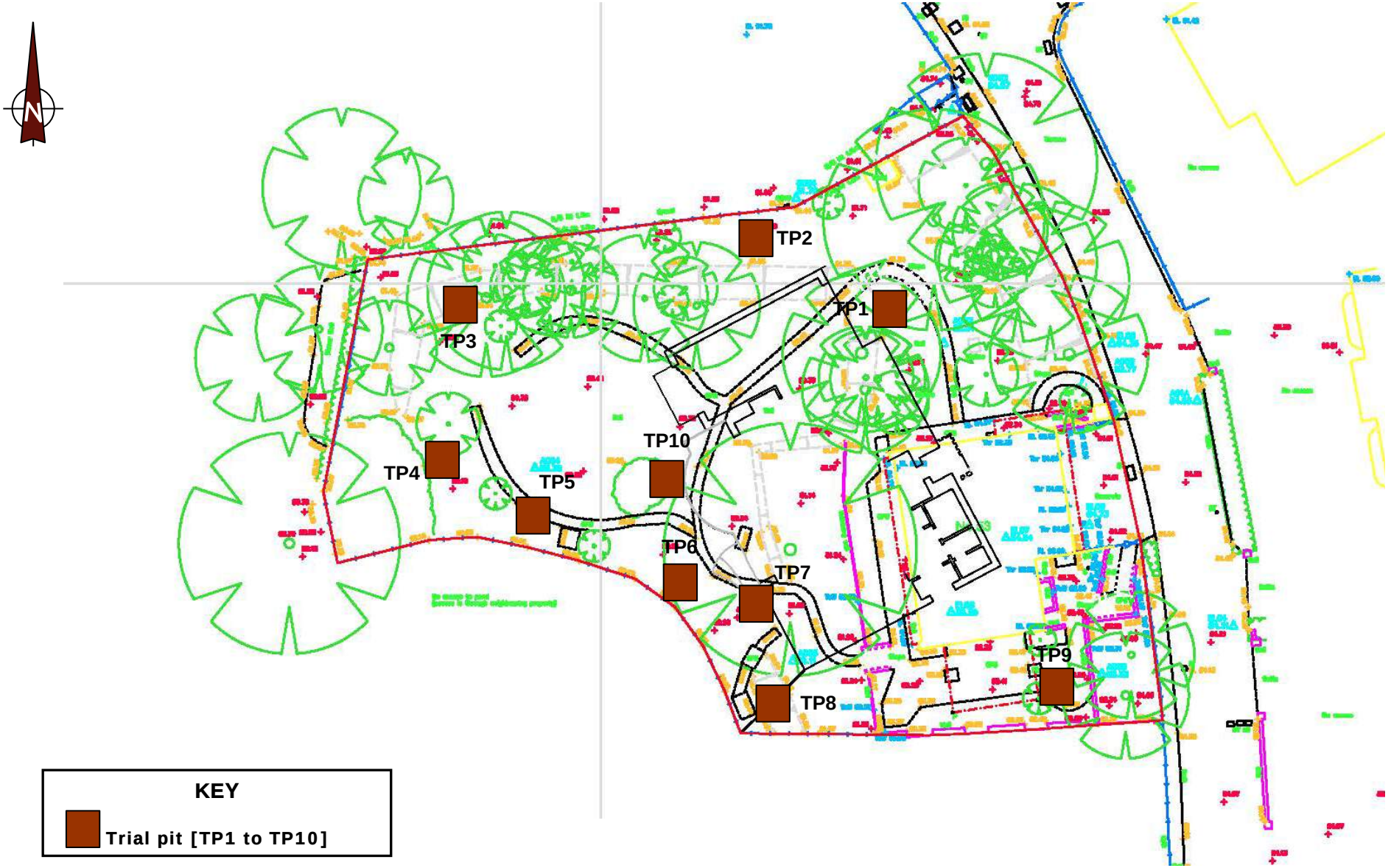
Site Location

53 Fitzroy Park, Highgate, London N6 6JA

Report No:

10368/SCW

Site Plan



Soil Consultants

APPENDIX C

Greenfield Runoff Rate Calculations.

HR Wallingford
Working with water

Greenfield runoff estimation for sites

www.uksuds.com | Greenfield runoff tool

Calculated by:	Vlad M
Site name:	53 Fitzroy
Site location:	53 Fitzroy

This is an estimation of the greenfield runoff rate limits that are needed to meet normal best practice criteria in line with Environment Agency guidance "Preliminary rainfall runoff management for developments", W5-074/A/TR1/1 rev. E (2012) and the SuDS Manual, C753 (Ciria, 2015). This information on greenfield runoff rates may be the basis for setting consents for the drainage of surface water runoff from sites.

Site coordinates

Latitude:	51.56725° N
Longitude:	0.15759° W

Reference:	6426999
Date:	2019-04-10T16:17:56

Methodology	FEH Statistical

Site characteristics

Total site area (ha)	0.1283

Methodology

Qmed estimation method	Calculate from BFI and SAAR
BFI and SPR estimation method	Specify BFI manually
HOST class	N/A
BFI / BFIHOST	0.508
Qmed (l/s)	NaN
Qbar / Qmed Conversion Factor	1.14

Hydrological characteristics

	Default	Edited
SAAR (mm)	659	676
Hydrological region	6	6
Growth curve factor: 1 year	0.85	0.85
Growth curve factor: 30 year	2.3	2.3
Growth curve factor: 100 year	3.19	3.19

Notes:

(1) Is Q_{BAR} < 2.0 l/s/ha?

(2) Are flow rates < 5.0 l/s?

Where flow rates are less than 5.0 l/s consents are usually set at 5.0l/s if blockage from vegetation and other materials is possible. Lower consent flow rates may be set in which case blockage work must be addressed by using appropriate drainage elements

(3) Is SPR/SPRHOST ≤ 0.3?

Greenfield runoff rates

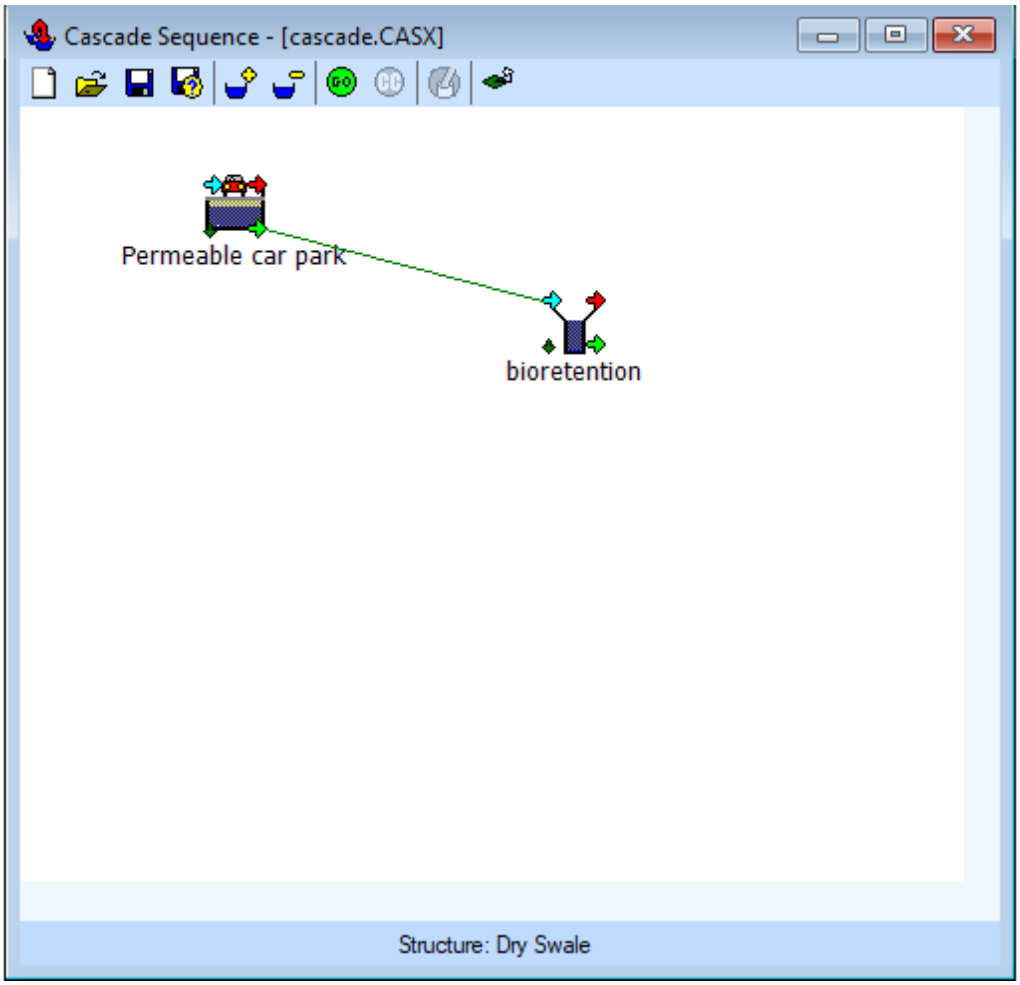
	Default	Edited
Qbar (l/s)	NaN	0.38
1 in 1 year (l/s)	NaN	0.32
1 in 30 years (l/s)	NaN	0.87
1 in 100 years (l/s)	NaN	1.21

APPENDIX D

MicroDrainage Calculations.

Catchment 1 and Catchment 2 cascade model

Catchment 1 – Permeable car park (modelled as flow-controlled porous paving).
Catchment 2 – Bioretention (modelled as Dry Swale).



1-in-30 year (+40% Climate Change) results are presented first, followed by 1-in-100year (+40% Climate Change) results.

Cascade Summary of Results for Permeable car park.SRCX

Upstream Structures	Outflow To	Overflow To
(None)	bioretention.SRCX	(None)

Half Drain Time : 177 minutes.

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Control (l/s)	Max Σ Outflow (l/s)	Max Volume (m³)	Status
15 min Summer	83.042	0.142	0.0	0.3	0.3	4.3	O K
30 min Summer	83.081	0.181	0.0	0.4	0.4	5.4	O K
60 min Summer	83.110	0.210	0.0	0.4	0.4	6.3	O K
120 min Summer	83.148	0.248	0.0	0.4	0.4	7.4	O K
180 min Summer	83.155	0.255	0.0	0.4	0.4	7.6	O K
240 min Summer	83.154	0.254	0.0	0.4	0.4	7.6	O K
360 min Summer	83.140	0.240	0.0	0.4	0.4	7.2	O K
480 min Summer	83.124	0.224	0.0	0.4	0.4	6.7	O K
600 min Summer	83.109	0.209	0.0	0.4	0.4	6.3	O K
720 min Summer	83.095	0.195	0.0	0.4	0.4	5.8	O K
960 min Summer	83.068	0.168	0.0	0.4	0.4	5.0	O K
1440 min Summer	83.023	0.123	0.0	0.3	0.3	3.7	O K
2160 min Summer	82.974	0.074	0.0	0.3	0.3	2.2	O K
2880 min Summer	82.941	0.041	0.0	0.3	0.3	1.2	O K
4320 min Summer	82.906	0.006	0.0	0.3	0.3	0.2	O K
5760 min Summer	82.900	0.000	0.0	0.2	0.2	0.0	O K
7200 min Summer	82.900	0.000	0.0	0.0	0.0	0.0	O K
8640 min Summer	82.900	0.000	0.0	0.0	0.0	0.0	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
15 min Summer	136.640	0.0	4.6	25
30 min Summer	86.744	0.0	6.0	38
60 min Summer	52.822	0.0	7.4	66
120 min Summer	33.733	0.0	9.6	122
180 min Summer	25.405	0.0	10.9	164
240 min Summer	20.549	0.0	11.7	196
360 min Summer	14.971	0.0	12.9	260
480 min Summer	11.839	0.0	13.6	328
600 min Summer	9.827	0.0	14.1	396
720 min Summer	8.420	0.0	14.5	464
960 min Summer	6.577	0.0	15.1	598
1440 min Summer	4.629	0.0	15.8	856
2160 min Summer	3.267	0.0	16.7	1220
2880 min Summer	2.563	0.0	17.4	1568
4320 min Summer	1.842	0.0	18.5	2248
5760 min Summer	1.470	0.0	19.5	0
7200 min Summer	-0.012	0.0	0.0	0
8640 min Summer	-0.010	0.0	0.0	0

Cascade Summary of Results for Permeable car park.SRCX

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Control (l/s)	Max Σ Outflow (l/s)	Max Volume (m³)	Status
15 min Winter	83.042	0.142	0.0	0.3	0.3	4.3	O K
30 min Winter	83.080	0.180	0.0	0.4	0.4	5.4	O K
60 min Winter	83.111	0.211	0.0	0.4	0.4	6.3	O K
120 min Winter	83.149	0.249	0.0	0.4	0.4	7.5	O K
180 min Winter	83.157	0.257	0.0	0.4	0.4	7.7	O K
240 min Winter	83.154	0.254	0.0	0.4	0.4	7.6	O K
360 min Winter	83.138	0.238	0.0	0.4	0.4	7.1	O K
480 min Winter	83.118	0.218	0.0	0.4	0.4	6.5	O K
600 min Winter	83.098	0.198	0.0	0.4	0.4	5.9	O K
720 min Winter	83.078	0.178	0.0	0.4	0.4	5.3	O K
960 min Winter	83.042	0.142	0.0	0.3	0.3	4.3	O K
1440 min Winter	82.984	0.084	0.0	0.3	0.3	2.5	O K
2160 min Winter	82.928	0.028	0.0	0.3	0.3	0.8	O K
2880 min Winter	82.900	0.000	0.0	0.3	0.3	0.0	O K
4320 min Winter	82.900	0.000	0.0	0.2	0.2	0.0	O K
5760 min Winter	82.900	0.000	0.0	0.2	0.2	0.0	O K
7200 min Winter	82.900	0.000	0.0	0.0	0.0	0.0	O K
8640 min Winter	82.900	0.000	0.0	0.0	0.0	0.0	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
15 min Winter	136.640	0.0	4.6	25
30 min Winter	86.744	0.0	6.0	38
60 min Winter	52.822	0.0	7.4	66
120 min Winter	33.733	0.0	9.6	120
180 min Winter	25.405	0.0	10.9	174
240 min Winter	20.549	0.0	11.8	200
360 min Winter	14.971	0.0	12.9	276
480 min Winter	11.839	0.0	13.6	352
600 min Winter	9.827	0.0	14.1	426
720 min Winter	8.420	0.0	14.5	498
960 min Winter	6.577	0.0	15.1	636
1440 min Winter	4.629	0.0	15.8	896
2160 min Winter	3.267	0.0	16.7	1240
2880 min Winter	2.563	0.0	17.4	1476
4320 min Winter	1.842	0.0	18.5	0
5760 min Winter	1.470	0.0	19.5	0
7200 min Winter	-0.012	0.0	0.0	0
8640 min Winter	-0.010	0.0	0.0	0

Cascade Rainfall Details for Permeable car park.SRCX

Rainfall Model	FEH
Return Period (years)	30
FEH Rainfall Version	2013
Site Location	GB 527791 186978 TQ 27791 86978
Data Type	Point
Summer Storms	Yes
Winter Storms	Yes
Cv (Summer)	1.000
Cv (Winter)	1.000
Shortest Storm (mins)	15
Longest Storm (mins)	8640
Climate Change %	+40

Time Area Diagram

Total Area (ha) 0.015

Time (mins) From:	To:	Area (ha)	Time (mins) From:	To:	Area (ha)	Time (mins) From:	To:	Area (ha)
0	4	0.005	4	8	0.005	8	12	0.005

Cascade Model Details for Permeable car park.SRCX

Storage is Online Cover Level (m) 83.300

Porous Car Park Structure

Infiltration Coefficient Base (m/hr)	0.00000
Membrane Percolation (mm/hr)	1000
Max Percolation (l/s)	27.8
Safety Factor	2.0
Porosity	0.30
Invert Level (m)	82.900
Width (m)	10.0
Length (m)	10.0
Slope (1:X)	0.0
Depression Storage (mm)	5
Evaporation (mm/day)	3
Membrane Depth (m)	0

Orifice Outflow Control

Diameter (m) 0.017 Discharge Coefficient 0.600 Invert Level (m) 82.700

Cascade Summary of Results for bioretention.SRCX

Upstream Structures	Outflow To	Overflow To
Permeable car park.SRCX	(None)	(None)

Half Drain Time : 316 minutes.

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Volume (m³)	Status
15 min Summer	79.903	0.143	0.5	7.0	O K
30 min Summer	79.949	0.189	0.5	9.2	O K
60 min Summer	79.996	0.236	0.5	11.5	O K
120 min Summer	80.066	0.306	0.5	14.9	O K
180 min Summer	80.104	0.344	0.5	16.8	O K
240 min Summer	80.126	0.366	0.5	17.9	O K
360 min Summer	80.147	0.387	0.5	18.9	O K
480 min Summer	80.149	0.389	0.5	19.0	O K
600 min Summer	80.143	0.383	0.5	18.8	O K
720 min Summer	80.133	0.373	0.5	18.2	O K
960 min Summer	80.112	0.352	0.5	17.2	O K
1440 min Summer	80.075	0.315	0.5	15.4	O K
2160 min Summer	80.030	0.270	0.5	13.2	O K
2880 min Summer	79.991	0.231	0.5	11.3	O K
4320 min Summer	79.916	0.156	0.5	7.6	O K
5760 min Summer	79.862	0.102	0.5	5.0	O K
7200 min Summer	79.760	0.000	0.0	0.0	O K
8640 min Summer	79.760	0.000	0.0	0.0	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Time-Peak (mins)
15 min Summer	136.640	0.0	75
30 min Summer	86.744	0.0	89
60 min Summer	52.822	0.0	110
120 min Summer	33.733	0.0	156
180 min Summer	25.405	0.0	204
240 min Summer	20.549	0.0	258
360 min Summer	14.971	0.0	372
480 min Summer	11.839	0.0	488
600 min Summer	9.827	0.0	602
720 min Summer	8.420	0.0	684
960 min Summer	6.577	0.0	786
1440 min Summer	4.629	0.0	1024
2160 min Summer	3.267	0.0	1408
2880 min Summer	2.563	0.0	1796
4320 min Summer	1.842	0.0	2428
5760 min Summer	1.470	0.0	3120
7200 min Summer	-0.012	0.0	0
8640 min Summer	-0.010	0.0	0

Cascade Summary of Results for bioretention.SRCX

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Volume (m³)	Status
15 min Winter	79.903	0.143	0.5	7.0	O K
30 min Winter	79.949	0.189	0.5	9.2	O K
60 min Winter	79.995	0.235	0.5	11.5	O K
120 min Winter	80.065	0.305	0.5	14.9	O K
180 min Winter	80.103	0.343	0.5	16.8	O K
240 min Winter	80.126	0.366	0.5	17.9	O K
360 min Winter	80.147	0.387	0.5	18.9	O K
480 min Winter	80.151	0.391	0.5	19.1	O K
600 min Winter	80.146	0.386	0.5	18.9	O K
720 min Winter	80.135	0.375	0.5	18.4	O K
960 min Winter	80.110	0.350	0.5	17.1	O K
1440 min Winter	80.064	0.304	0.5	14.9	O K
2160 min Winter	79.998	0.238	0.5	11.6	O K
2880 min Winter	79.925	0.165	0.5	8.1	O K
4320 min Winter	79.829	0.069	0.4	3.4	O K
5760 min Winter	79.805	0.045	0.4	2.2	O K
7200 min Winter	79.760	0.000	0.0	0.0	O K
8640 min Winter	79.760	0.000	0.0	0.0	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Time-Peak (mins)
15 min Winter	136.640	0.0	75
30 min Winter	86.744	0.0	89
60 min Winter	52.822	0.0	112
120 min Winter	33.733	0.0	156
180 min Winter	25.405	0.0	204
240 min Winter	20.549	0.0	256
360 min Winter	14.971	0.0	366
480 min Winter	11.839	0.0	478
600 min Winter	9.827	0.0	590
720 min Winter	8.420	0.0	692
960 min Winter	6.577	0.0	798
1440 min Winter	4.629	0.0	1072
2160 min Winter	3.267	0.0	1460
2880 min Winter	2.563	0.0	1768
4320 min Winter	1.842	0.0	2400
5760 min Winter	1.470	0.0	2968
7200 min Winter	-0.012	0.0	0
8640 min Winter	-0.010	0.0	0

Cascade Rainfall Details for bioretention.SRCX

Rainfall Model	FEH
Return Period (years)	30
FEH Rainfall Version	2013
Site Location	GB 527791 186978 TQ 27791 86978
Data Type	Point
Summer Storms	Yes
Winter Storms	Yes
Cv (Summer)	1.000
Cv (Winter)	1.000
Shortest Storm (mins)	15
Longest Storm (mins)	8640
Climate Change %	+40

Time Area Diagram

Total Area (ha) 0.010

Time (mins) From:	To:	Area (ha)	Time (mins) From:	To:	Area (ha)	Time (mins) From:	To:	Area (ha)
0	4	0.002	8	12	0.002	16	20	0.002
4	8	0.002	12	16	0.002			

Green Roof

Area (m³) 142 Evaporation (mm/day) 3
Depression Storage (mm) 5 Decay Coefficient 0.050

Time (mins) From:	To:	Area (ha)	Time (mins) From:	To:	Area (ha)	Time (mins) From:	To:	Area (ha)
0	4	0.002580	40	44	0.000349	80	84	0.000047
4	8	0.002113	44	48	0.000286	84	88	0.000039
8	12	0.001730	48	52	0.000234	88	92	0.000032
12	16	0.001416	52	56	0.000192	92	96	0.000026
16	20	0.001159	56	60	0.000157	96	100	0.000021
20	24	0.000949	60	64	0.000128	100	104	0.000017
24	28	0.000777	64	68	0.000105	104	108	0.000014
28	32	0.000636	68	72	0.000086	108	112	0.000012
32	36	0.000521	72	76	0.000071	112	116	0.000010
36	40	0.000427	76	80	0.000058	116	120	0.000008

Cascade Model Details for bioretention.SRCX

Storage is Online Cover Level (m) 80.200

Dry Swale Structure

Infiltration Coefficient Base (m/hr)	0.02956
Infiltration Coefficient Side (m/hr)	0.02956
Safety Factor	1.0
Porosity	1.00
Invert Level (m)	79.760
Trench Height (m)	0.400
Trench Width (m)	3.6
Trench Length (m)	14.3
Trench Infiltration Side (m/hr)	0.02956
Trench Porosity	0.95
Side Slope (1:X)	1.0
Slope (1:X)	0.0
Cap Volume Depth (m)	0.000
Cap Infiltration Depth (m)	0.000

1-in-100 year + 40% Climate Change Cascade Model Results

- Permeable Car Park
- Bioretention

Cascade Summary of Results for Permeable car park.SRCX

Upstream Structures	Outflow To	Overflow To
(None)	bioretention.SRCX	(None)

Half Drain Time : 242 minutes.

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Control (l/s)	Max Σ Outflow (l/s)	Max Volume (m³)	Status
15 min Summer	83.097	0.197	0.0	0.4	0.4	5.9	O K
30 min Summer	83.151	0.251	0.0	0.4	0.4	7.5	O K
60 min Summer	83.196	0.296	0.0	0.4	0.4	8.9	O K
120 min Summer	83.255	0.355	0.0	0.4	0.4	10.7	O K
180 min Summer	83.277	0.377	0.0	0.5	0.5	11.3	O K
240 min Summer	83.283	0.383	0.0	0.5	0.5	11.5	O K
360 min Summer	83.276	0.376	0.0	0.5	0.5	11.3	O K
480 min Summer	83.260	0.360	0.0	0.4	0.4	10.8	O K
600 min Summer	83.241	0.341	0.0	0.4	0.4	10.2	O K
720 min Summer	83.224	0.324	0.0	0.4	0.4	9.7	O K
960 min Summer	83.190	0.290	0.0	0.4	0.4	8.7	O K
1440 min Summer	83.131	0.231	0.0	0.4	0.4	6.9	O K
2160 min Summer	83.062	0.162	0.0	0.4	0.4	4.8	O K
2880 min Summer	83.010	0.110	0.0	0.3	0.3	3.3	O K
4320 min Summer	82.945	0.045	0.0	0.3	0.3	1.3	O K
5760 min Summer	82.911	0.011	0.0	0.3	0.3	0.3	O K
7200 min Summer	82.900	0.000	0.0	0.0	0.0	0.0	O K
8640 min Summer	82.900	0.000	0.0	0.0	0.0	0.0	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
15 min Summer	181.216	0.0	6.3	25
30 min Summer	116.116	0.0	8.2	39
60 min Summer	70.742	0.0	10.1	66
120 min Summer	45.409	0.0	13.1	124
180 min Summer	34.547	0.0	15.0	180
240 min Summer	28.189	0.0	16.3	214
360 min Summer	20.799	0.0	18.1	276
480 min Summer	16.553	0.0	19.2	342
600 min Summer	13.782	0.0	20.0	412
720 min Summer	11.825	0.0	20.6	480
960 min Summer	9.233	0.0	21.4	616
1440 min Summer	6.460	0.0	22.5	882
2160 min Summer	4.492	0.0	23.3	1260
2880 min Summer	3.471	0.0	23.9	1624
4320 min Summer	2.424	0.0	24.7	2336
5760 min Summer	1.887	0.0	25.5	3000
7200 min Summer	-0.012	0.0	0.0	0
8640 min Summer	-0.010	0.0	0.0	0

Cascade Summary of Results for Permeable car park.SRCX

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Control (l/s)	Max Σ Outflow (l/s)	Max Volume (m³)	Status
15 min Winter	83.097	0.197	0.0	0.4	0.4	5.9	O K
30 min Winter	83.152	0.252	0.0	0.4	0.4	7.6	O K
60 min Winter	83.196	0.296	0.0	0.4	0.4	8.9	O K
120 min Winter	83.257	0.357	0.0	0.4	0.4	10.7	O K
180 min Winter	83.281	0.381	0.0	0.5	0.5	11.4	O K
240 min Winter	83.286	0.386	0.0	0.5	0.5	11.6	O K
360 min Winter	83.277	0.377	0.0	0.5	0.5	11.3	O K
480 min Winter	83.258	0.358	0.0	0.4	0.4	10.7	O K
600 min Winter	83.233	0.333	0.0	0.4	0.4	10.0	O K
720 min Winter	83.211	0.311	0.0	0.4	0.4	9.3	O K
960 min Winter	83.167	0.267	0.0	0.4	0.4	8.0	O K
1440 min Winter	83.091	0.191	0.0	0.4	0.4	5.7	O K
2160 min Winter	83.006	0.106	0.0	0.3	0.3	3.2	O K
2880 min Winter	82.949	0.049	0.0	0.3	0.3	1.5	O K
4320 min Winter	82.900	0.000	0.0	0.3	0.3	0.0	O K
5760 min Winter	82.900	0.000	0.0	0.2	0.2	0.0	O K
7200 min Winter	82.900	0.000	0.0	0.0	0.0	0.0	O K
8640 min Winter	82.900	0.000	0.0	0.0	0.0	0.0	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
15 min Winter	181.216	0.0	6.3	25
30 min Winter	116.116	0.0	8.2	39
60 min Winter	70.742	0.0	10.1	66
120 min Winter	45.409	0.0	13.1	122
180 min Winter	34.547	0.0	15.0	178
240 min Winter	28.189	0.0	16.3	230
360 min Winter	20.799	0.0	18.1	286
480 min Winter	16.553	0.0	19.2	364
600 min Winter	13.782	0.0	20.0	440
720 min Winter	11.825	0.0	20.6	514
960 min Winter	9.233	0.0	21.4	660
1440 min Winter	6.460	0.0	22.4	932
2160 min Winter	4.492	0.0	23.3	1316
2880 min Winter	3.471	0.0	23.9	1668
4320 min Winter	2.424	0.0	24.8	0
5760 min Winter	1.887	0.0	25.5	0
7200 min Winter	-0.012	0.0	0.0	0
8640 min Winter	-0.010	0.0	0.0	0

Cascade Rainfall Details for Permeable car park.SRCX

Rainfall Model	FEH
Return Period (years)	100
FEH Rainfall Version	2013
Site Location	GB 527791 186978 TQ 27791 86978
Data Type	Point
Summer Storms	Yes
Winter Storms	Yes
Cv (Summer)	1.000
Cv (Winter)	1.000
Shortest Storm (mins)	15
Longest Storm (mins)	8640
Climate Change %	+40

Time Area Diagram

Total Area (ha) 0.015

Time (mins) From:	To:	Area (ha)	Time (mins) From:	To:	Area (ha)	Time (mins) From:	To:	Area (ha)
0	4	0.005	4	8	0.005	8	12	0.005

Cascade Model Details for Permeable car park.SRCX

Storage is Online Cover Level (m) 83.300

Porous Car Park Structure

Infiltration Coefficient Base (m/hr)	0.00000
Membrane Percolation (mm/hr)	1000
Max Percolation (l/s)	27.8
Safety Factor	2.0
Porosity	0.30
Invert Level (m)	82.900
Width (m)	10.0
Length (m)	10.0
Slope (1:X)	0.0
Depression Storage (mm)	5
Evaporation (mm/day)	3
Membrane Depth (m)	0

Orifice Outflow Control

Diameter (m) 0.017 Discharge Coefficient 0.600 Invert Level (m) 82.700

Cascade Summary of Results for bioretention.SRCX

Upstream Structures	Outflow To	Overflow To
Permeable car park.SRCX	(None)	(None)

Half Drain Time : 453 minutes.

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Volume (m³)	Status
15 min Summer	79.958	0.198	0.5	9.7	O K
30 min Summer	80.022	0.262	0.5	12.8	O K
60 min Summer	80.085	0.325	0.5	15.9	O K
120 min Summer	80.180	0.420	0.5	20.6	O K
180 min Summer	80.202	0.442	0.6	23.4	FLOOD
240 min Summer	80.204	0.444	0.6	25.3	FLOOD
360 min Summer	80.206	0.446	0.6	27.5	FLOOD
480 min Summer	80.207	0.447	0.6	28.4	FLOOD
600 min Summer	80.207	0.447	0.6	28.6	FLOOD
720 min Summer	80.207	0.447	0.6	28.4	FLOOD
960 min Summer	80.205	0.445	0.6	27.1	FLOOD
1440 min Summer	80.203	0.443	0.6	24.2	FLOOD
2160 min Summer	80.187	0.427	0.6	20.9	O K
2880 min Summer	80.135	0.375	0.5	18.4	O K
4320 min Summer	80.046	0.286	0.5	14.0	O K
5760 min Summer	79.963	0.203	0.5	9.9	O K
7200 min Summer	79.760	0.000	0.0	0.0	O K
8640 min Summer	79.760	0.000	0.0	0.0	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Time-Peak (mins)
15 min Summer	181.216	0.0	82
30 min Summer	116.116	0.0	96
60 min Summer	70.742	0.0	118
120 min Summer	45.409	0.0	164
180 min Summer	34.547	1.8	212
240 min Summer	28.189	3.7	266
360 min Summer	20.799	5.8	380
480 min Summer	16.553	6.8	496
600 min Summer	13.782	7.0	612
720 min Summer	11.825	6.7	728
960 min Summer	9.233	5.4	954
1440 min Summer	6.460	2.5	1138
2160 min Summer	4.492	0.0	1484
2880 min Summer	3.471	0.0	1872
4320 min Summer	2.424	0.0	2636
5760 min Summer	1.887	0.0	3232
7200 min Summer	-0.012	0.0	0
8640 min Summer	-0.010	0.0	0

Cascade Summary of Results for bioretention.SRCX

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Volume (m³)	Status
15 min Winter	79.958	0.198	0.5	9.7	O K
30 min Winter	80.022	0.262	0.5	12.8	O K
60 min Winter	80.084	0.324	0.5	15.9	O K
120 min Winter	80.179	0.419	0.5	20.6	O K
180 min Winter	80.202	0.442	0.6	23.4	FLOOD
240 min Winter	80.204	0.444	0.6	25.3	FLOOD
360 min Winter	80.206	0.446	0.6	27.5	FLOOD
480 min Winter	80.207	0.447	0.6	28.5	FLOOD
600 min Winter	80.207	0.447	0.6	28.7	FLOOD
720 min Winter	80.207	0.447	0.6	28.5	FLOOD
960 min Winter	80.206	0.446	0.6	27.3	FLOOD
1440 min Winter	80.202	0.442	0.6	24.0	FLOOD
2160 min Winter	80.166	0.406	0.5	19.9	O K
2880 min Winter	80.090	0.330	0.5	16.1	O K
4320 min Winter	79.943	0.183	0.5	8.9	O K
5760 min Winter	79.845	0.085	0.4	4.1	O K
7200 min Winter	79.760	0.000	0.0	0.0	O K
8640 min Winter	79.760	0.000	0.0	0.0	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Time-Peak (mins)
15 min Winter	181.216	0.0	82
30 min Winter	116.116	0.0	96
60 min Winter	70.742	0.0	118
120 min Winter	45.409	0.0	164
180 min Winter	34.547	1.8	212
240 min Winter	28.189	3.7	264
360 min Winter	20.799	5.9	374
480 min Winter	16.553	6.8	488
600 min Winter	13.782	7.1	602
720 min Winter	11.825	6.9	714
960 min Winter	9.233	5.7	930
1440 min Winter	6.460	2.3	1152
2160 min Winter	4.492	0.0	1560
2880 min Winter	3.471	0.0	1968
4320 min Winter	2.424	0.0	2600
5760 min Winter	1.887	0.0	3232
7200 min Winter	-0.012	0.0	0
8640 min Winter	-0.010	0.0	0

Flooding occurs within detention basin which is 117m³ in size, and equates to 60mm of ponding.

Cascade Rainfall Details for bioretention.SRCX

Rainfall Model	FEH
Return Period (years)	100
FEH Rainfall Version	2013
Site Location	GB 527791 186978 TQ 27791 86978
Data Type	Point
Summer Storms	Yes
Winter Storms	Yes
Cv (Summer)	1.000
Cv (Winter)	1.000
Shortest Storm (mins)	15
Longest Storm (mins)	8640
Climate Change %	+40

Time Area Diagram

Total Area (ha) 0.010

Time (mins) From:	To:	Area (ha)	Time (mins) From:	To:	Area (ha)	Time (mins) From:	To:	Area (ha)
0	4	0.002	8	12	0.002	16	20	0.002
4	8	0.002	12	16	0.002			

Green Roof

Area (m³) 142 Evaporation (mm/day) 3
Depression Storage (mm) 5 Decay Coefficient 0.050

Time (mins) From:	To:	Area (ha)	Time (mins) From:	To:	Area (ha)	Time (mins) From:	To:	Area (ha)
0	4	0.002580	40	44	0.000349	80	84	0.000047
4	8	0.002113	44	48	0.000286	84	88	0.000039
8	12	0.001730	48	52	0.000234	88	92	0.000032
12	16	0.001416	52	56	0.000192	92	96	0.000026
16	20	0.001159	56	60	0.000157	96	100	0.000021
20	24	0.000949	60	64	0.000128	100	104	0.000017
24	28	0.000777	64	68	0.000105	104	108	0.000014
28	32	0.000636	68	72	0.000086	108	112	0.000012
32	36	0.000521	72	76	0.000071	112	116	0.000010
36	40	0.000427	76	80	0.000058	116	120	0.000008

Cascade Model Details for bioretention.SRCX

Storage is Online Cover Level (m) 80.200

Dry Swale Structure

Infiltration Coefficient Base (m/hr)	0.02956
Infiltration Coefficient Side (m/hr)	0.02956
Safety Factor	1.0
Porosity	1.00
Invert Level (m)	79.760
Trench Height (m)	0.400
Trench Width (m)	3.6
Trench Length (m)	14.3
Trench Infiltration Side (m/hr)	0.02956
Trench Porosity	0.95
Side Slope (1:X)	1.0
Slope (1:X)	0.0
Cap Volume Depth (m)	0.000
Cap Infiltration Depth (m)	0.000

Catchment 3: 1-in-100 year + 40% Climate Change Model Results

Summary of Results for 100 year Return Period (+40%)

Half Drain Time : 417 minutes.

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Volume (m^3)	Status
15 min Summer	79.914	0.181	0.3	6.2	O K
30 min Summer	79.962	0.229	0.3	7.8	O K
60 min Summer	80.004	0.271	0.3	9.3	O K
120 min Summer	80.064	0.331	0.3	11.3	O K
180 min Summer	80.094	0.361	0.3	12.3	O K
240 min Summer	80.107	0.374	0.3	12.8	O K
360 min Summer	80.110	0.377	0.3	12.9	O K
480 min Summer	80.104	0.371	0.3	12.7	O K
600 min Summer	80.094	0.361	0.3	12.3	O K
720 min Summer	80.082	0.349	0.3	11.9	O K
960 min Summer	80.058	0.325	0.3	11.1	O K
1440 min Summer	80.013	0.280	0.3	9.6	O K
2160 min Summer	79.956	0.223	0.3	7.6	O K
2880 min Summer	79.911	0.178	0.3	6.1	O K
4320 min Summer	79.848	0.115	0.2	3.9	O K
5760 min Summer	79.808	0.075	0.2	2.6	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m^3)	Time-Peak (mins)
15 min Summer	181.216	0.0	26
30 min Summer	116.116	0.0	40
60 min Summer	70.742	0.0	68
120 min Summer	45.409	0.0	126
180 min Summer	34.547	0.0	184
240 min Summer	28.189	0.0	242
360 min Summer	20.799	0.0	324
480 min Summer	16.553	0.0	384
600 min Summer	13.782	0.0	446
720 min Summer	11.825	0.0	512
960 min Summer	9.233	0.0	650
1440 min Summer	6.460	0.0	920
2160 min Summer	4.492	0.0	1320
2880 min Summer	3.471	0.0	1700
4320 min Summer	2.424	0.0	2420
5760 min Summer	1.887	0.0	3072

Summary of Results for 100 year Return Period (+40%)

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Volume (m³)	Status
7200 min Summer	79.733	0.000	0.0	0.0	O K
8640 min Summer	79.733	0.000	0.0	0.0	O K
10080 min Summer	79.733	0.000	0.0	0.0	O K
15 min Winter	79.936	0.203	0.3	7.0	O K
30 min Winter	79.991	0.258	0.3	8.8	O K
60 min Winter	80.039	0.306	0.3	10.5	O K
120 min Winter	80.109	0.376	0.3	12.9	O K
180 min Winter	80.143	0.410	0.3	14.1	O K
240 min Winter	80.159	0.426	0.3	14.6	O K
360 min Winter	80.166	0.433	0.3	14.9	O K
480 min Winter	80.157	0.424	0.3	14.5	O K
600 min Winter	80.146	0.413	0.3	14.1	O K
720 min Winter	80.132	0.399	0.3	13.7	O K
960 min Winter	80.100	0.367	0.3	12.6	O K
1440 min Winter	80.038	0.305	0.3	10.4	O K
2160 min Winter	79.959	0.226	0.3	7.7	O K
2880 min Winter	79.898	0.165	0.3	5.6	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Time-Peak (mins)
7200 min Summer	-0.012	0.0	0
8640 min Summer	-0.010	0.0	0
10080 min Summer	-0.008	0.0	0
15 min Winter	181.216	0.0	26
30 min Winter	116.116	0.0	40
60 min Winter	70.742	0.0	68
120 min Winter	45.409	0.0	124
180 min Winter	34.547	0.0	182
240 min Winter	28.189	0.0	238
360 min Winter	20.799	0.0	346
480 min Winter	16.553	0.0	412
600 min Winter	13.782	0.0	472
720 min Winter	11.825	0.0	550
960 min Winter	9.233	0.0	702
1440 min Winter	6.460	0.0	996
2160 min Winter	4.492	0.0	1408
2880 min Winter	3.471	0.0	1792

Summary of Results for 100 year Return Period (+40%)

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Volume (m³)	Status
4320 min Winter	79.815	0.082	0.2	2.8	O K
5760 min Winter	79.781	0.048	0.2	1.6	O K
7200 min Winter	79.733	0.000	0.0	0.0	O K
8640 min Winter	79.733	0.000	0.0	0.0	O K
10080 min Winter	79.733	0.000	0.0	0.0	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Time-Peak (mins)
4320 min Winter	2.424	0.0	2468
5760 min Winter	1.887	0.0	3000
7200 min Winter	-0.012	0.0	0
8640 min Winter	-0.010	0.0	0
10080 min Winter	-0.008	0.0	0

Rainfall Details

Rainfall Model	FEH
Return Period (years)	100
FEH Rainfall Version	2013
Site Location	GB 527791 186978 TQ 27791 86978
Data Type	Point
Summer Storms	Yes
Winter Storms	Yes
Cv (Summer)	0.750
Cv (Winter)	0.840
Shortest Storm (mins)	15
Longest Storm (mins)	10080
Climate Change %	+40

Time Area Diagram

Total Area (ha) 0.019

Time (mins) From:	To:	Area (ha)	Time (mins) From:	To:	Area (ha)	Time (mins) From:	To:	Area (ha)
0	4	0.006	4	8	0.006	8	12	0.007

Time Area Diagram

Total Area (ha) 0.000

Time (mins) From:	To:	Area (ha)
0	4	0.000

Model Details

Storage is Online Cover Level (m) 80.200

Dry Swale Structure

Infiltration Coefficient Base (m/hr)	0.02027
Infiltration Coefficient Side (m/hr)	0.02027
Safety Factor	1.0
Porosity	1.00
Invert Level (m)	79.733
Trench Height (m)	0.400
Trench Width (m)	1.5
Trench Length (m)	24.0
Trench Infiltration Side (m/hr)	0.02027
Trench Porosity	0.95
Side Slope (1:X)	1.0
Slope (1:X)	0.0
Cap Volume Depth (m)	0.000
Cap Infiltration Depth (m)	0.000