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FOUL AND SURFACE WATER TECHNICAL NOTE

Development at St. Giles Close,
Shoreham-by-sea, West Sussex

Cheesmur Ltd

Cobbe Barns
Beddingham
Lewes, BN8 6JU

Ref: 2022151-OCE-Z2-XX-RP-C-2101
Issue: 2
Date: 27th Jan 2023

Technical Note

Author : **SFC**

Approved : **CS**

Date : **Jan 2023**

Revision	Date of Issue	Comments	Prepared By	Checked By
P	23.01.2023	Initial Issue	SFC	CS
P2	27.01.2023	Drainage plan revised	SFC	CS

1 Introduction

1.1.1 OCE Ltd have been appointed by Cheesemur to undertake a drainage strategy report for a proposed development at St. Giles Close, Shoreham.

1.1.2 The purpose of this drainage report is to demonstrate how the development area can be satisfactorily drained without increasing flood risk onsite and elsewhere and to satisfy the requirements of planning condition 3, 4 and 8 which relates to surface water drainage.

1.1.3 The existing site consists of concrete hardstanding and garage buildings. The proposed development will consist of 4 residential properties and associated parking and gardens.

1.1.4 The proposed development is located at OS Grid Reference TQ 22600 05728 and has the post code BN43 6GR.

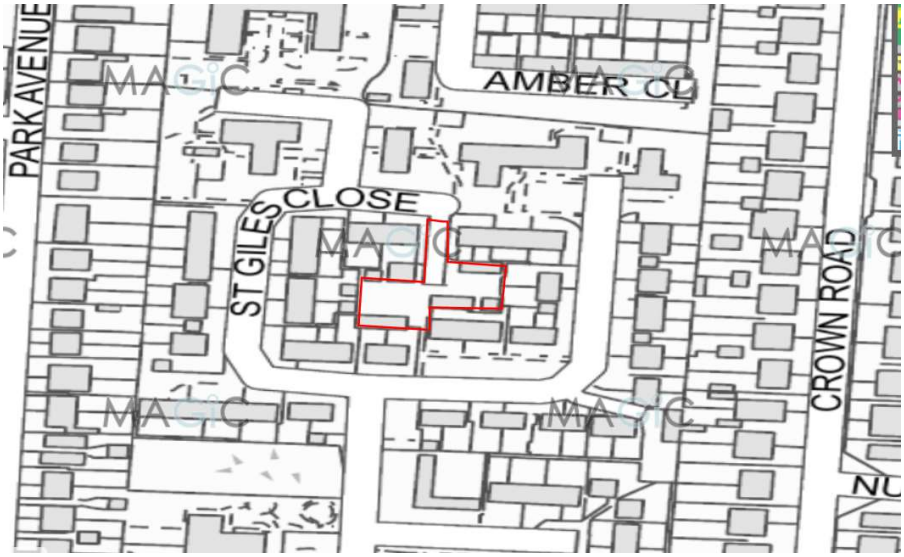
1.1.5 The total red line boundary is approximately 0.135 Ha which is currently 100% impermeable.

1.1.6 The proposed development will result in a total of 0.113 Ha of hardstanding; 0.025 Ha of which being roof areas, 0.017 Ha being permeable-paved parking areas, 0.073 being impermeable driveway/access ways/footpaths with the remaining 0.022ha being garden/landscaping.

1.1.7 The proposed site will make use the existing access off St Giles Close to the north of the development.

1.1.8 The proposed site plan can be found in **Appendix A.**

Fig 1. Site Location



2 Site Geology

2.1 Site Investigation

2.1.1 A series of infiltration tests were carried out by Soils Ltd and published in their letter report of April 2022 (included in **Appendix C** of this report).

2.1.2 Investigations confirmed that the site is underlain by made ground of varying depth over gravelly clay Head deposits down to approximately 1.8m depth. It is known from the BGS that at greater depth lies the Tarrant Chalk formation.

2.1.3 Infiltration tests were carried out within 4 excavations to BRE 365, with the results ranging from 1.75 x 10-4EXP m/sec to 9.6 x 10-5EXP m/sec and is therefore deemed to be of good infiltration potential.

2.1.4 Groundwater Monitoring was not carried out though the letter report notes that no groundwater was encountered at 1.8m depth during the time of the infiltration tests in March 2022, a time of year when groundwater is expected to be at its highest seasonal level.

2.1.5 Previously, boreholes down to 5.0m depth (which were carried out for the main site investigation) had encountered no groundwater ingress.

3 Proposed Drainage Strategy

3.1 SuDS Hierarchy

3.1.1 All options for the destination of run-off generated on site have been assessed in line with the SuDS hierarchy as set out in Building Regulations Part H document and DEFRA's Draft National Standards for SuDS.

Discharge Destination	
Discharge to Ground	Yes
Discharge to Watercourse	No
Discharge to Surface Water Sewer	Yes
Discharge to Other Sewer	No

3.2 Surface Water Drainage

3.2.1 Based upon the results of the Soils Ltd infiltration testing it is proposed that the site discharge as much of the surface water runoff as possible to ground through infiltration, as recommended in the HOP report, with the remainder being discharged to the public surface water sewer at a controlled rate.

3.2.2 The roof areas of plots 1 and 2 are to be collected into a positive drainage network and discharged into a cellular soakaway beneath their garden.

3.2.3 The individual parking areas for each plot will discharge surface water directly to ground through permeable paving with porous sub-base.

3.2.4 The remaining areas of hardstanding, including the roofs of plots 3 and 4, the access way and the turning area to the front of plots 1 and 2, are to be collected and discharged to the surface water sewer through 2 cellular attenuation tanks and flow controls.

3.2.5 The HOP SUDs assessment report of September 2021 proposes a discharge rate of 4.5L/S to be discharged to the surface water sewer. This rate has been split pro-rata to be discharged via attenuation tanks AT1 and AT2. This discharge rate compares to the existing 1 in 2 year runoff rate of 18.3 L/S currently generated by the site (as identified in the HOP Report).

3.2.6 Due to the space restrictions on site, AT2 will discharge at 3.3 L/S using a Hydrbrake. AT1 will discharge at 1.2 L/S through an SEL Protected Orifice Control. These controls are fitted with a device that prevents the kind of blockages that would normally be associated with such low flow rates. It is not possible to combine the two attenuation tanks as their catchment is split by the existing sewers.

3.2.7 The soakaway and porous sub-base volumes have been designed to cater for the critical 1 in 100-year storm +45% without flooding. The worst infiltration test result was used as the basis of the design.

3.2.8 Hydraulic calculations have been carried out and can be found at **Appendix D** of this report.

3.2.9 The suitability of the proposed methods as they relate to water quality were discussed and demonstrated in HOP's Sustainable Drainage Report of September 2021.

3.3 Foul water drainage

3.3.1 The foul drainage for all properties will be collected in pipework and discharged to the public foul sewer that passes through the middle of the site, subject to S106 consent.

3.3.2 Plots 1 and 2 will connect to existing public foul manhole Ref 5711. Plots 3 and 4 will connect to the existing 225mm diameter sewer that passes north to south through the site via a junction connection, subject to S106 consent.

3.3.3 The final location of sewer connections is subject to confirmation of depths on site as well as confirmation of the situation as it relates to the potential for a building-over agreement.

4.1 Maintenance

4.1.1 During construction, the Contractor will be responsible for maintaining the drainage and SuDS (Sustainable Drainage Systems). Upon handover, the developer will appoint a maintenance firm to take on the responsibility of these duties as laid out in this report.

4.1.2 The maintenance schedule for the proposed development will be split down into two separate categories; SuDS features and regular private drainage.

4.2 SuDS at St Giles Close, Shoreham

4.2.1 As listed above, in section 5.1.2, the SuDS features used on site will be a cellular soakaway and permeable surfacing with porous sub-base, along with attenuation tanks and flow controls.

4.2.2 The SuDS features have been designed for easy maintenance and comprise:

- Regular Day-to-Day care – litter collection, regular gardening to control vegetation growth and checking inlets where water enters the SuDS features
- Occasional tasks – checking the SuDS features and removing any silt that builds up in the SuDS feature
- Remedial work – repairing damage where necessary

4.3 SuDS Drainage Maintenance Specification

4.3.1 Soakaway/Attenuation Tanks

In order to maintain the functioning of the soakaway and attenuation tanks, the following maintenance requirements should be adhered to:

Table 21.3 Operation and maintenance requirements for attenuation storage tanks

Maintenance Schedule	Required Action	Typical Frequency
Regular Maintenance	Inspect and identify any areas that are not operating correctly. If required, take remedial action	Monthly for 3 months, then annually
	Remove debris from the catchment surface (where it may cause risks to performance)	Monthly
	For systems where rainfall infiltrates into the tank from above, check surface of filter for blockage by sediment, algae, or other matter; remove and replace surface infiltration medium as necessary.	Annually
	Remove sediment from per-treatment structures and/or internal forebays	Annually, or as required
Remedial Actions	Repair/rehabilitate inlets, outlet, overflows and vents	As required
Monitoring	Inspect/check all inlets, outlets, vents, and overflows to ensure that they are in good condition and operating as designed	Annually
	Survey inside of tank for sediment build-up and remove if necessary	Every 5 years or as required

4.3.2 **Permeable Surfacing**

In order to maintain the functioning of the permeable paving, the following maintenance requirements should be adhered to:

Table 21.3 Operation and maintenance requirements for permeable surfacing

Maintenance Schedule	Required Action	Typical Frequency
Regular Maintenance	Brushing and vacuuming (standard cosmetic sweep over whole surface)	Once a year, after autumn leaf fall, or reduced frequency as required, based on site-specific observations of clogging or manufacturer's recommendations – pay particular attention to areas where water runs onto pervious surface from adjacent impermeable areas as this area is most likely to collect the most sediment
Occasional maintenance	Stabilise and mow contributing and adjacent areas	As required
	Removal of weeds or management using glyphosate applied directly into the weeds by an applicator rather than spraying	As required – once per year on less frequently used pavements
Remedial Actions	Remediate any landscaping which, through vegetation maintenance or soil slip, has been raised to within 50mm of level of the paving	As required
	Remedial work to any depressions, rutting and cracked or broken blocks considered detrimental to the structural performance or a hazard to users, and replace lost jointing material	As required
	Rehabilitation of surface and upper substructure by remedial sweeping	Every 10 to 15 years or as required (if infiltration performance is reduced due to significant clogging)
Monitoring	Initial inspection	Monthly for three months after installation
	Inspect for evidence of poor operation and/or weed growth – if required take remedial action	Three-monthly, 48h after large storms in first six months
	Inspect silt accumulation rate and establish appropriate brushing frequencies	Annually
	Monitor inspection chambers	Annually

4.4 General Drainage Maintenance Specification

4.4.1 Inlet Structures and Inspection Chambers

- Inlet structures such as rainwater downpipes, road gullies and channel drains should be free from obstruction at all times to all free flow through the SuDS
- Inspection Chambers and Rodding Eyes are used on bends or where pipes come together. They allow access and cleaning to the system if necessary.

Inlet Structures and Inspection Chambers	
Regular Maintenance	**Frequency**
Inlet Structures Inspect rainwater downpipes, channel drains and road gullies, removing obstructions and silt as necessary. Check that there is no physical damage. Strim vegetation 1m min surround to structures and keep area free from silt and debris	Monthly
Inspections Chambers and below ground control chambers. Remove cover and inspect, ensuring that the water is flowing freely and that the exit route for water is unobstructed. Remove debris and silt. Undertake inspection after leaf fall in Autumn	Annually
Occasional Maintenance Check topsoil levels are 20mm above edges of chambers to avoid mower damage.	As necessary
Remedial Work Repair physical damage if necessary	As required

4.4.2 Below ground drainage pipes

- Below ground drainage pipes convey water to the SuDS system. They should always be free from obstruction to allow free flow.

Below Ground Drainage Pipes	
Regular Maintenance	**Frequency**
Inspect and identify any areas that are not operating correctly. If required, take remedial action.	Monthly for 3 months then annually
Remove debris from the catchment surface (where it may cause risks to performance)	Monthly
Remove sediment from pre-treatment inlet structures and inspection chambers.	Annually or as required
Maintain vegetation to designed limits within the vicinity of below ground drainage pipes and tanks.	Monthly or as required
Remedial Work Repair physical damage if necessary	 As required
Monitoring Inspect all inlets, outlets and vents to ensure that they are in good conditions and operating as designed.	 Annually
Survey inside of pipe runs for sediment build up and remove if necessary.	Every 5 years or as required

5 Summary and Conclusions

5.1.1 OCE were instructed by Cheesemur Ltd to produce a Drainage Statement to enable the discharge of planning conditions 3, 4 and 8 of the Adur District Council planning consent AWDM/1272/21 for St Giles Close, Shoreham.

5.1.2 A portion of the surface water runoff will discharge to ground through infiltration at rates determined by the Soils Investigation infiltration testing results. A cellular soakaway will deal with roof runoff for plots 1 and 2. All parking areas will utilise porous paving to discharge to ground.

5.1.3 Remaining hard-paved areas will discharge to the public surface water sewer at a total rate of 4.5 L/S during the critical 1 in 100 year storm plus an allowance of 45%. This represents a reduction of 13.8 L/S from the existing 1 in 2 year rate of 18.3 L/S.

5.1.4 Flow controls will be a Hydrobrake in AT2 (to reduce footprint of tank) and an SEL Protected orifice control in AT1 which is fitted with a device to protect the orifice from blockages normally associated with such low flow rates.

5.1.5 The Foul drainage will be connected to the public foul sewer at 2 points in the existing sewers that cross the site (subject to S106 approval).

5.1.6 The report has demonstrated that the proposed drainage measures ensure that suitable means of surface water and foul drainage can be achieved for the proposed development.

6 Appendices

6.1 Appendix A – Site Plan

Site Plan 1:100 @ A1

1:100

Schedule of Accommodation

2 x 2b 4p Houses @ 79.20 sqm
2 x 1b 2p Houses @ 50.72 sqm

Total 4 homes
Site Area = 0.14 ha
Density = 28 dwellings per hectare

Parking 10 spaces
Bins and cycles in private gardens



Notes

1. This drawing is the copyright of MH Architects Ltd
2. Do not scale this drawing except for Local Authority planning purposes
3. All dimensions must be checked on site by the contractor prior to commencement of the works.

Client Approval

X	A - Approved
X	B - Approved with comments
X	C - Do not use

Rev.	Revision Note/Purpose of Issue	Drw By	Date	Chk By	Date
P02	Change to boundary	TM	12/03/21	KM	12/03/21
P08	Road material changed to permeable paving as per client request to match HOP design	YM	28/06/21	NKS	28/06/21
P09	Distances amended to show to site boundaries	YM	01/07/21	NKS	01/07/21

Application Site

KEY: Landscape

A: Private planting including shrubs, native species to encourage biodiversity.

B: Private paths, terraces & patios in light patio slabs 450x450mm.

C: Block paving of varying lengths to main pathways and private entrances

D: Brick and timber clad bin store

E: Secure outdoor timber and metal cycle storage.

F: Brick wall 900mm high

G: Timber knee rails 450mm high to protect frontages and planting areas

H: Timber close boarded fence 1800mm high

J: Brick wall 1800mm high

K: Permeable paving, Herringbone to allocated parking spaces

L: Public planting including shrubs, native species to encourage biodiversity.

M: Tarmac to public pathways

N: Tarmac road surface

Garages to be demolished

Rear access to existing neighbouring properties retained

ADUR & WORTHING COUNCILS

Client
Adur District Council

Job title
St Giles Close Residential Development

Drawing title
Proposed Site Plan

Drawn	Date	Checked	Date	Scale at A1
TM	12/03/2021	KM	12/03/2021	1:100

Job No.	Pro.	Org.	Zone	Level	Type	Role	No.	Rev.
19-210	HDH	MHA	ZZ	XX	DR	A	520	P09

Purpose of Issue
PLANNING

Ground Floor | Bicentennial Building
Southern Gate | Chichester
West Sussex | PO19 8EZ

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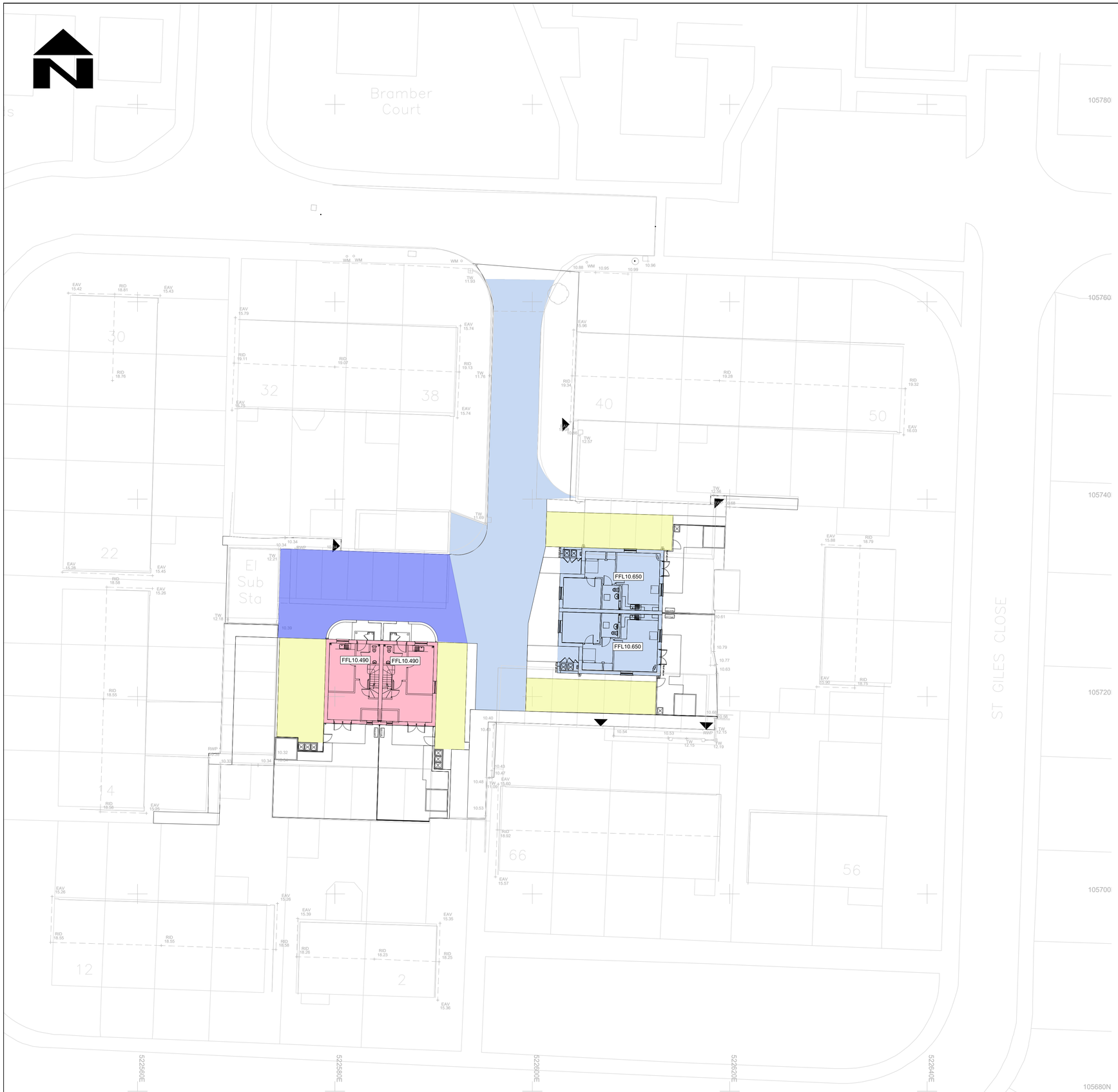
www.mharchitects.co.uk

Limited Company
Registered in England No.1994233

mh ARCHITECTS

6.2 **Appendix B – Proposed Drainage Layout**



STANDARD EXTERNAL WORKS NOTES

1. DO NOT SCALE FROM THIS DRAWING, REFER TO FIGURED DIMENSIONS ONLY. THE CONTRACTOR SHOULD CHECK ALL DIMENSIONS ON SITE.
2. ALL DIMENSIONS IN MILLIMETRES AND ALL LEVELS ARE IN METERS UNLESS NOTED OTHERWISE.
3. THIS DRAWING SHOULD BE READ IN CONJUNCTION WITH ALL OTHER RELEVANT ARCHITECT AND ENGINEERING DETAILS, DRAWINGS AND SPECIFICATIONS.
4. ANY DISCREPANCIES SHOULD BE REPORTED TO THE ARCHITECT AND/OR ENGINEER IMMEDIATELY, SO THAT CLARIFICATION CAN BE SOUGHT PRIOR TO THE COMMENCEMENT OF WORK.
5. SOFT SPOTS TO BE REMOVED AND FILLED TO A MINIMUM DEPTH OF 600mm WITH 6F1/6F2 MATERIAL AND PROOF ROLLED PRIOR TO CONSTRUCTION
6. TYPE 1 SUB BASE MATERIAL SHALL BE IN ACCORDANCE WITH CLAUSE 803 OF THE SPECIFICATION FOR HIGHWAY WORKS (SHW) WITH A MINIMUM LAB CBR OF 30%
7. TYPE 6F1/6F2 CAPPING MATERIAL SHALL BE IN ACCORDANCE WITH CLAUSE 613 OF THE SHW WITH A MINIMUM LAB CBR OF 15%
8. ALL ACCESSES TO COMPLY WITH PART M OF THE BUILDING REGULATIONS AS DESIGNED. IF IN DOUBT ASK ENGINEER.
18. IT IS THE RESPONSIBILITY OF THE CONTRACTOR TO CONFIRM THE LOCATION AND DEPTH OF ALL EXISTING SERVICES AND UTILITIES THAT MAY BE PRESENT

CONTRIBUTING AREA PLAN LEGEND (1:100)

Area Served by AT1 - 140m² Tarmacadam

Area Served by AT2 - 270m² Tarmacadam
130m² Roof

Area served by SA1 - 96m² Roof

Areas of self-draining porous paved parking - 454m² Total

REV	DATE	DESCRIPTION	BY	CHK	APP
P1	23.1.23	STAGE 3 ISSUE – FOR COMMENT	SFC	CS	CS

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CLIENT
CHEESEMUR LTD

ARCHITECT
CITYZEN

JOB TITLE
ST. GILES CLOSE
SHOREHAM

DRAWING TITLE
CONTRIBUTING AREAS

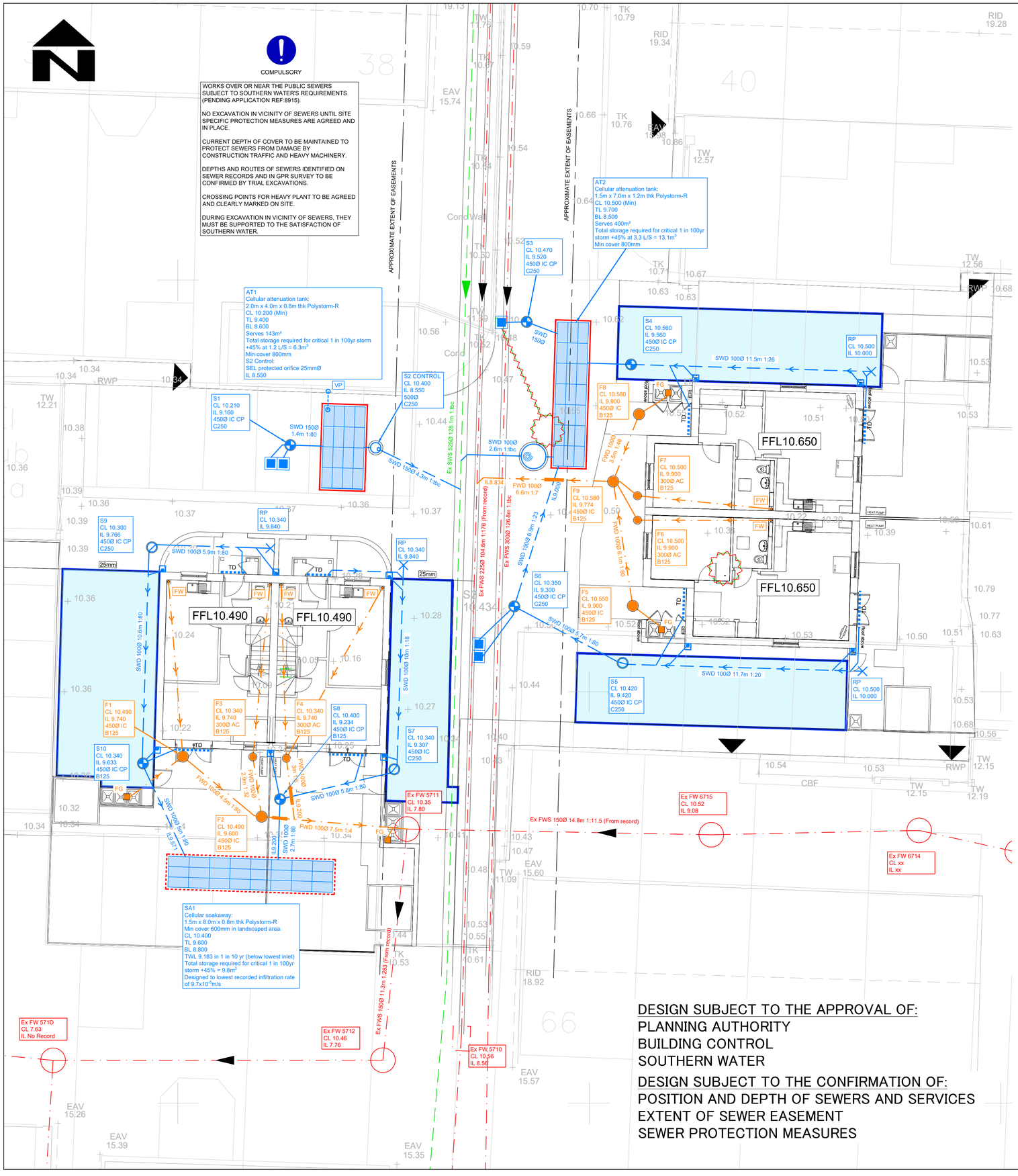
JOB No.	SCALE @ A1	DATE
	1:200	JAN '23

DRAWN	ENGINEER	CHECKED	APP
SFC	SFC		

STATUS S0 WORK IN PROGRESS

REVISION P1 RIBA STATUS STAGE 3 – DEVELOPED DESIGN

DRAWING No.
2022-151-2-150



SAFETY HEALTH AND ENVIRONMENTAL ISSUES

THE FOLLOWING ITEMS ARE CONSIDERED BY THE DESIGNER TO BE A SIGNIFICANT RISK DURING CONSTRUCTION.
THE LIST IS NOT EXHAUSTIVE BUT HAS BEEN PREPARED TO COMMUNICATE RISKS WHICH HAVE BEEN IDENTIFIED DURING THE DESIGN PROCESS. FOR FURTHER INFORMATION REFER TO THE DESIGN HAZARD INVENTORY.

- CARE TO BE TAKEN TO PROTECT ALL UNDERGROUND SERVICES, BOTH NEW AND EXISTING.
- TEMPORARY STABILITY OF EXISTING WALLS DURING FOUNDATION EXCAVATION WORKS. CONTRACTOR TO PROVIDE TEMPORARY PROPPING, BRACING AND EXCAVATION PROPPING AS REQUIRED.
- DEEP EXCAVATIONS - RISK OF COLLAPSE AND FALLS INTO EXCAVATIONS. CONTRACTOR TO ONLY EXCAVATE DEEP EXCAVATIONS BY MACHINE AND NOT BY HAND. NO PERSONNEL TO ENTER EXCAVATIONS. OPEN EXCAVATIONS TO BE BOARDED OVER AND/OR PROTECTED BY TEMPORARY FENCING.
- LIFTING OF HEAVY STEEL AND CONCRETE SECTIONS (P.C. FLOORING, STEEL BEAMS AND COLUMNS). THE CONTRACTOR MUST USE MECHANICAL LIFTING AIDS TO INSTALL THE ITEMS LISTED ABOVE.
- ASBESTOS AND GROUND CONTAMINATION - THE CONTRACTOR MUST UNDERTAKE AN HSG264 COMPLIANT DEMOLITION AND REFURBISHMENT SURVEY AND OBTAIN A GROUND CONTAMINATION SURVEY BEFORE COMMENCING WORKS AND ENSURE ALL RECOMMENDATIONS AND PRECAUTIONS ARE UNDERTAKEN.

DRAINAGE LEGEND (1:100)

EXISTING FEATURES

- Ex FWD — Existing foul water sewer/drain and manhole
- Ex SWD — Existing surface water sewer/drain and manhole
- Existing foul/surface water sewer/drain and manhole to be abandoned

PROPOSED FEATURES

- SWD — Storm water sewer/drain
- Pipe crossing (thickening denotes pipe above)
- CD — Channel drain
- TD — Threshold drain
- Rainwater pipe connecting via Back-inlet gully
- Storm water access chamber (300Ø)
- Storm water inspection chamber (450Ø)
- Storm water catchpit chamber (450Ø)
- Storm water rodding eye
- 'Raintaina' by SEL (RWP discharge directly to porous paving)
- Permavoid distribution tank
- Road gully
- Storm water orifice flow control chamber (500Ø)
- Storm water vortex flow control chamber
- FWD — Foul water sewer/drain
- FW — Soil stack (type TBC by architect/m&e engineer)
- Foul water access chamber (300Ø)
- Foul water inspection chamber (450Ø)
- FG — Trapped foul gully
- 00.000 — Finished floor level
- 100Ø 4.5m 1:100 Z BED — Pipe info - diameter, length, gradient, bedding type

ABBREVIATIONS

MH	- MANHOLE
IC	- INSPECTION CHAMBER
AC	- ACCESS CHAMBER
CP	- CATCHPIT
BC	- BRAKE CHAMBER
RE	- RODDING EYE
IL	- INVERT LEVEL
SL	- SUMP LEVEL
CL	- COVER LEVEL
TL	- TOP OF CELLULAR SA
BL	- BASE OF CELLULAR SA
FL	- FORMATION LEVEL

POROUS PARKING AREAS FOR PLOTS 1-4

Porous Paved Parking with porous sub-base Paving:

- 60mm Porous Blocks
- 50mm 2/6mm Laying Course
- Geotextile
- 250mm 5/20mm Sub Base
- Geotextile

Minimum porous sub-base thickness required for critical 1 in 100yr storm = 78mm
Designed to recorded infiltration rate of $9.7x10^{-5}$m/s

Site Specific Notes

1. Capacities of soakaway and porous sub-base based on worst infiltration test result of $9.7x10^{-5}$m/s
2. Roof runoff from plots 1 & 2 piped directly into cellular soakaway SA1.
3. Runoff from each parking area to discharges directly to ground through porous sub-bases.
4. Due to space restrictions, remaining areas are to discharge to surface water sewer including roofs of plots 3 & 4, access road and driveway in front of plots 1 & 2.
5. Total discharge rate to SW sewer 4.5 L/S as proposed in HOP drainage strategy.
6. Total terminal discharge split between 2 attenuation tanks and 2 connections to the SW sewer: AT1 discharges 1.2 L/S, AT2 discharges at 3.3 L/S
7. AT1 uses SEL protected orifice to ensure no blockages despite low flow rate. AT2 uses hydrobrake to reduce plan area of storage due to lack of space.
8. No groundwater encountered in trial holes during infiltration testing in March 2022
9. Sewer records incomplete and GPR inprecise therefore all existing sewer levels to be measured on site and their levels reported to engineer for confrmation of design prior to ANY construction works.

DESIGN SUBJECT TO THE APPROVAL OF:
PLANNING AUTHORITY
BUILDING CONTROL
SOUTHERN WATER

DESIGN SUBJECT TO THE CONFIRMATION OF:
POSITION AND DEPTH OF SEWERS AND SERVICES
EXTENT OF SEWER EASEMENT
SEWER PROTECTION MEASURES

STANDARD DRAINAGE NOTES

1. DO NOT SCALE FROM THIS DRAWING, REFER TO FIGURED DIMENSIONS ONLY. THE CONTRACTOR SHOULD CHECK ALL DIMENSIONS ON SITE.
2. ALL DIMENSIONS IN MILLIMETRES AND ALL LEVELS ARE IN METERS UNLESS NOTED OTHERWISE.
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4. ANY DISCREPANCIES SHOULD BE REPORTED TO THE ARCHITECT AND/OR ENGINEER IMMEDIATELY, SO THAT CLARIFICATION CAN BE SOUGHT PRIOR TO THE COMMENCEMENT OF WORK.
5. BEFORE COMMENCING CONSTRUCTION THE CONTRACTOR MUST CHECK THE INVERT LEVELS OF EXISTING SEWERS TO WHICH CONNECTIONS ARE MADE. IN ADDITION THE CONTRACTOR MUST LOCATE AND DETERMINE INVERT LEVELS OF THE EXISTING SPURS TO WHICH CONNECTIONS ARE PROPOSED. ANY DISCREPANCIES ARE TO BE NOTIFIED TO THE ENGINEER IMMEDIATELY, PRIOR TO CONSTRUCTION.
6. ALL DRAINAGE WORKS SHOULD COMMENCE AT THE PROPOSED DOWNSTREAM CONNECTION POINT, THE WORKS CONTINUING UPSTREAM FOLLOWING CONFIRMATION OF THE TIE-IN INVERT LEVELS TO THE ENGINEER. CONNECTIONS TO MANHOLES OR LARGER SIZED PIPES ETC. SHOULD BE SOFFIT TO SOFFIT UNLESS OTHERWISE INSTRUCTED BY THE ENGINEER, IF THIS IS NOT POSSIBLE INFORM THE ENGINEER IMMEDIATELY.
7. COVER LEVELS SHOWN ARE APPROXIMATE. COVERS AND FRAMES SHALL BE SET TO FINISHED GROUND LEVELS AND FALLS.
8. ALL UN-REFERENCED PIPES ARE TO BE 100mm DIA
9. ALL PIPES TO BE ADOPTED, OR CONNECTING TO ADOPTED SEWERS, TO BE VITRIFIED CLAY TO BS EN 295 AND BS65 (SWS ONLY), OR CONCRETE PIPES TO BE EN 1916 AND BS5911:PART 1.
10. ROAD GULLY OUTLET PIPES ARE TO BE 150mm DIA. WITH CONCRETE SURROUND AND FLEXIBLE JOINTS. ALL GULLIES SHALL BE FITTED WITH GRADE D400 GRATINGS AND FRAMES TO BS EN124, UNLESS OTHERWISE STATED.
11. ALL ADOPTABLE SEWERS SHALL BE CONSTRUCTED TO THE STANDARDS AND SPECIFICATION LAID DOWN DOWN IN 'SEWERS FOR ADOPTION' 6th EDITION, WITH A VIEW TO ADOPTION UPON COMPLETION OF WORKS.
12. ALL PRIVATE DRAINAGE TO BE IN ACCORDANCE WITH THE BUILDING REGULATIONS APPROVED DOCUMENT PART-H, AND TO THE SATISFACTION OF THE BUILDING CONTROL INSPECTOR.
13. THE CONTRACTOR IS TO KEEP A RECORD OF ANY VARIATIONS MADE ON SITE, INCLUDING THE RELOCATION OF SEWERS OR DRAINS, SO THAT AN AS CONSTRUCTED DRAWING CAN BE PREPARED UPON COMPLETION OF THE PROJECT.
14. STUB CONNECTIONS TO ADOPTABLE MANHOLES SHALL BE MADE FROM VITRIFIED CLAY AND CONSIST OF TWO ROCKER PIPES LAID AT THE SAME GRADIENT AS THE UP OR DOWNSTREAM PIPE.
15. IF ANY SUB SOIL DRAINAGE SYSTEMS ARE UNCOVERED DURING THE WORKS CONTACT THE ENGINEER FOR INSTRUCTIONS. SUB SOIL DRAINS ARE TO BE DIVERTED AROUND NEW WORKS AND CONNECTED INTO THE SURFACE WATER.
16. NO PRIVATE AREAS ARE TO DRAIN ONTO ADOPTABLE AREAS AND VICE VERSA.
17. ALL EXISTING MANHOLE COVER'S, GULLIES, ETC, ARE TO BE RAISED/LOWERED TO SUIT NEW LEVELS.
18. IT IS THE RESPONSIBILITY OF THE CONTRACTOR TO CONFIRM THE LOCATION AND DEPTH OF ALL EXISTING SERVICES AND UTILITIES THAT MAY BE PRESENT
19. UPON COMPLETION BUT PRIOR TO HANDOVER, CONTRACTOR TO CARRY OUT FULL CCTV SURVEY OF DRAINAGE SYSTEM WHICH IS TO BE REVIEWED BY ENGINEER TO ENSURE SATISFACTORY INSTALLATION
20. MANHOLE AND CHAMBER COVER GRADES:

- 'A15' IN ALL LANDSCAPED AREAS AND ON FOOTPATHS
- 'B125' IN ALL DRIVEWAYS
- 'C250' IN PRIVATE PARKING AREAS
- 'D400' IN CARRIAGEWAY/ACCESS ROAD

REV	DATE	DESCRIPTION	BY	CHK	APP
P2	27.1.23	Revised to architect's comments	SFC	CS	CS
P1	23.1.23	STAGE 3 ISSUE – FOR COMMENT	SFC	CS	CS

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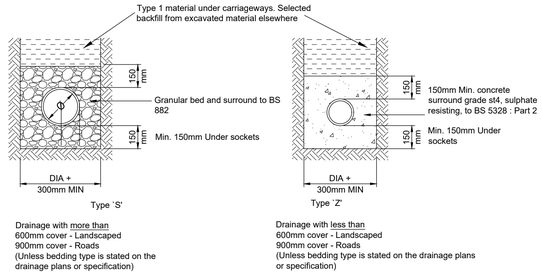
CLIENT: CHEESEMUR LTD
ARCHITECT: CITYZEN
JOB TITLE: ST. GILES CLOSE SHOREHAM
DRAWING TITLE: PROPOSED DRAINAGE LAYOUT

JOB No.	SCALE @ A1	DATE
	1:100	JAN '23

DRAWN	ENGINEER	CHECKED	APP
SFC	SFC		

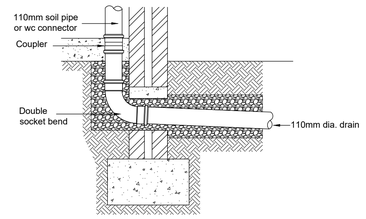
STATUS: S0 WORK IN PROGRESS
REVISION: P2 RIBA STATUS: STAGE 3 – DEVELOPED DESIGN
DRAWING No.: 2022-151-2-200



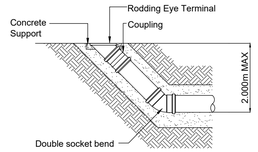
Drainage with more than
600mm cover - Landscaped
900mm cover - Roads
(Unless bedding type is stated on the drainage plans or specification)

Drainage with less than
600mm cover - Landscaped
900mm cover - Roads
(Unless bedding type is stated on the drainage plans or specification)

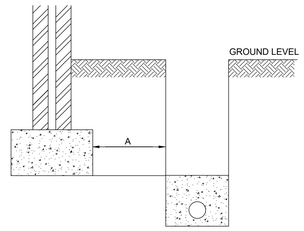
Pipe bedding details in private Areas



Soil pipe / wc connection

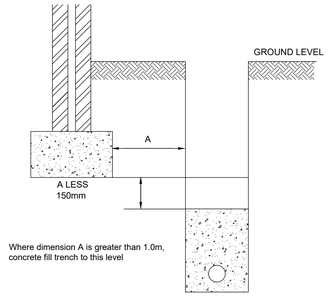


Rodding eye detail



Where dimension A is less than 1.0m, concrete fill trench to level of underside of foundations.

Pipes near buildings

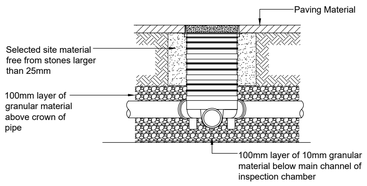


Where dimension A is greater than 1.0m, concrete fill trench to this level

Pipes near buildings

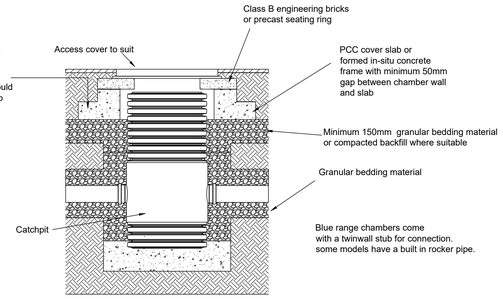
STANDARD EXTERNAL WORKS NOTES

1. DO NOT SCALE FROM THIS DRAWING. REFER TO FIGURED DIMENSIONS ONLY. THE CONTRACTOR SHOULD CHECK ALL DIMENSIONS ON SITE.
2. ALL DIMENSIONS IN MILLIMETRES AND ALL LEVELS ARE IN METERS UNLESS NOTED OTHERWISE.
3. THIS DRAWING SHOULD BE READ IN CONJUNCTION WITH ALL OTHER RELEVANT ARCHITECT AND ENGINEERING DETAILS, DRAWINGS AND SPECIFICATIONS.
4. ANY DISCREPANCIES SHOULD BE REPORTED TO THE ARCHITECT AND/OR ENGINEER IMMEDIATELY, SO THAT CLARIFICATION CAN BE SOUGHT PRIOR TO THE COMMENCEMENT OF WORK.
5. SOFT SPOTS TO BE REMOVED AND FILLED TO A MINIMUM DEPTH OF 600mm WITH 6F1/6F2 MATERIAL AND PROOF ROLLED PRIOR TO CONSTRUCTION
6. TYPE 1 SUB BASE MATERIAL SHALL BE IN ACCORDANCE WITH CLAUSE 803 OF THE SPECIFICATION FOR HIGHWAY WORKS (SHW) WITH A MINIMUM LAB CBR OF 30%
7. TYPE 6F1/6F2 CAPPING MATERIAL SHALL BE IN ACCORDANCE WITH CLAUSE 613 OF THE SHW WITH A MINIMUM LAB CBR OF 15%
8. ALL ACCESSES TO COMPLY WITH PART M OF THE BUILDING REGULATIONS AS DESIGNED. IF IN DOUBT ASK ENGINEER.
18. IT IS THE RESPONSIBILITY OF THE CONTRACTOR TO CONFIRM THE LOCATION AND DEPTH OF ALL EXISTING SERVICES AND UTILITIES THAT MAY BE PRESENT

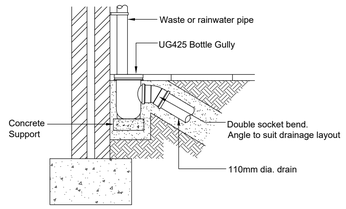


300mmØ SHALLOW INSPECTION CHAMBER DETAIL

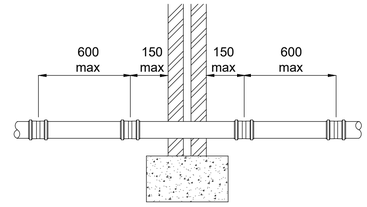
150mm x 150mm concrete surround required for support of cover and frame. Where the inspection chamber is being installed on a driveway subject to light vehicular traffic, or where B125 covers are being used, the concrete support should be 300mm wide x 225mm deep



450mmØ/600mmØ Turtle Enviro Silt Trap Detail

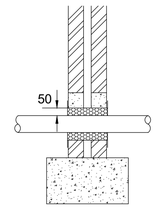


Bottle gully detail



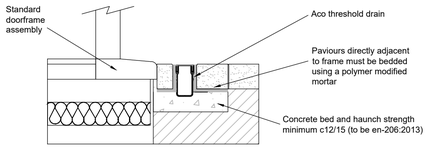
A. Short length of pipe bedded in wall with joints formed within 150mm of each wall face. Adjacent rocker pipes of 600mm max. length with flexible joints.

Pipes through wall detail

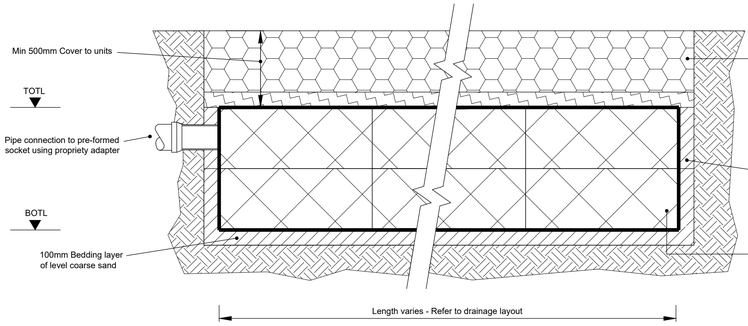


B. Arch or lintelled opening to give min 50mm space all round the pipe. Mask opeing on both sides of the wall with rigid sheet material to prevent entry of fill or vermin. Important Fill void with compressible material to prevent entry of gas.

Pipes through wall with lintel detail

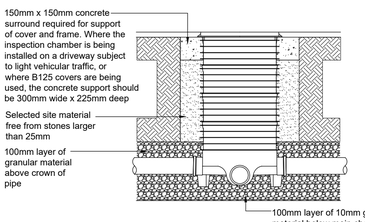


Aco Threshold Drain
(1:20)



Trench soakaway using Polystorm Lite Geomodular units Landscaped areas only
0.8m thick

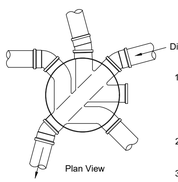
150mmx150mm concrete surround required for support of cover and frame. Where the inspection chamber is being installed on a driveway subject to light vehicular traffic, or where B125 covers are being used, the concrete support should be 300mm wide x 225mm deep



SEL Environmental LTD
Phone: 01254 589987
Email: sales@selenvironmental.com

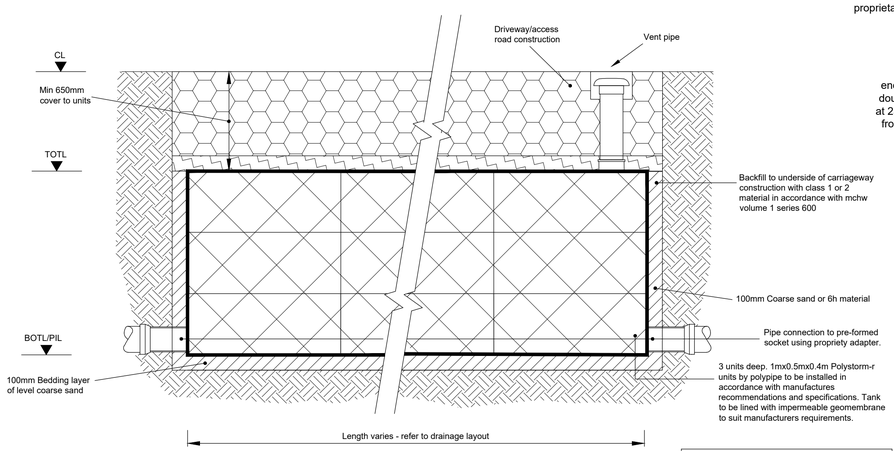
SEL CONTROFLOW 500 ORIFICE CHAMBER

150mm x 150mm concrete surround required for support of cover and frame. Where the inspection chamber is being installed on a driveway subject to light vehicular traffic, or where B125 covers are being used, the concrete support should be 300mm wide x 225mm deep



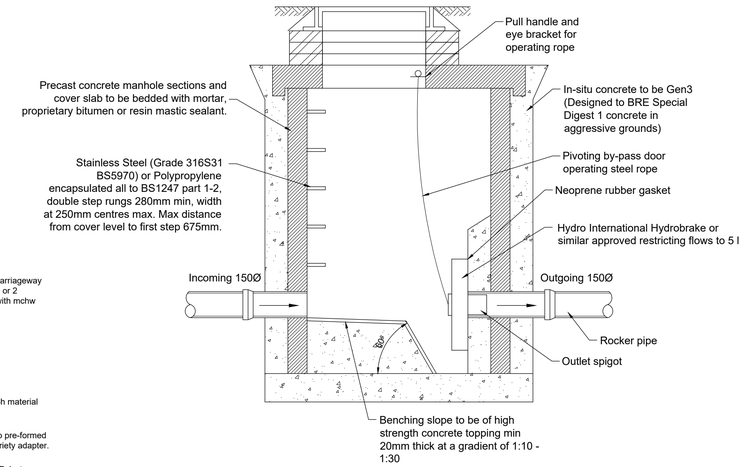
1. In all installations, the main channel of the inspection chamber should always be used. Where the chamber is being used as a change of direction for the drainage system, short radius bends of 11¼°, 15°, 30° and 45° can be used in the inlet and outlet to achieve the required angle.
2. Side inlet branch connections enter the inspection chamber approx. 55mm above the invert of the main channel
3. 320mm dia. chambers are supplied with 2no. blanking plugs for the side inlets and 460mm dia. chambers are supplied with 3no. blanking plugs.

460mmØ INSPECTION CHAMBER DETAIL



All storage tank drainage works shall be carried out in accordance with the specifications, method statements and recommendations of polypipe

Attenuation tank using polystorm-r geomodular units trafficked areas
1.2m deep



Typical Hydrobrake Manhole detail
Chamber is to be constructed to flow control manufacturers specific requirements

REV	DATE	DESCRIPTION	BY	CHK	APP
P1	23.1.23	STAGE 3 ISSUE – FOR COMMENT	SFC	CS	CS

OWENS CONSULTING ENGINEERS LTD
26 BRAMPLEY WAY
ANGMERING, LITTLEHAMPTON
BN16 4GA
TEL 01903 774644
ENQUIRIES@OWENS-CONSULTING.CO.UK

CLIENT: CHEESEMUR LTD

ARCHITECT: CITYZEN

JOB TITLE: ST. GILES CLOSE SHOREHAM

DRAWING TITLE: DRAINAGE CONSTRUCTION DETAILS

JOB No.	SCALE @ A1	DATE
	1:20	JAN '23

DRAWN	ENGINEER	CHECKED	APP
SFC	SFC		

STATUS: S0 WORK IN PROGRESS

REVISION: P1 RIBA STATUS: STAGE 3 – DEVELOPED DESIGN

DRAWING No.: 2022–151–2–500

6.3 **Appendix C – Infiltration Testing**

soils LIMITED
Thomas Telford House, Sun Valley Business Park
Winnall Close
Winchester
S023 OLB

01962 673 330
soilslimited.co.uk

Adur Council

Via email only: Jackie.strube@adur-worthing.gov.uk
1st April 2022

Our Ref.: 19922/LR

Dear Jackie,

Re: St Giles Close, Shoreham by Sea, West Sussex BN42 6GU

We are writing regarding the intrusive investigation undertaken at the above-named site.

Brief
The Soils Limited quotation (reference Q25662 dated 15th December 2021) set the scope of the investigation. The investigation was to comprise 2No. day of infiltration testing in accordance with the principles of BRE DG365:2016. This was to be undertaken to inform the design of a surface water drainage system. The location of the trial pits were decided by the client prior to the site visit.

General
The site was located at St Giles Close, Shoreham by Sea, West Sussex BN42 6GU, a site location plan has been included as Figure 1. The site was located upon superficial Head Deposits overlying the Tarrant Chalk Formation.

Site Works
Site works were undertaken on the 28th and 29th March 2022 and comprised the machine excavation of four trial pits, identified as TPSA1, TPSA2, TPSA3 and TPSA4 to depths ranging between 0.55m (TPSA2) and 1.80m (TPSA1) below ground level (bgl).

Four infiltration tests in accordance with the principles of BRE DG 365:2016 were undertaken in TPSA1, TPSA2, TPSA3 and TPSA4.

A trial hole location plan is included as Figure 2.

Ground Conditions
The ground conditions encountered during the site investigation have been summarised in Table 1

Soils Limited is a limited company registered in England and Wales number 1612073. VAT number 318273558

Registered Office: Newton House, Cross Road, Tadworth, Surrey KT20 5SR

Made Ground (MG)
Head Deposits (HD)
Tarrant Chalk Formation (TACH)

Table 1 – Summary of Ground Conditions

Strata	Depth Encountered (m bgl)		Typical Description
	Top	Base	
MG	0.00	0.25 – 0.40	TARMAC and CONCRETE overlying Grey slightly gravelly silty SAND. Gravel is sub angular to sub rounded fine, ash and clinker, concrete, and tarmac.
HD	0.25 – 0.40	>1.80[1]	Light brown slightly sandy, slightly gravelly silty CLAY and cream very gravelly CLAY. Gravel is angular to sub rounded fine to coarse flint and chalk.
TACH	N/A	N/A	Not encountered.

Notes: [1] encountered to base of trial hole.

Roots
Roots were not encountered within any of the trial holes.

Roots may be found at other locations on the site particularly close to trees and/or trees that have been removed both within the site and its close environs.

Groundwater
Groundwater was not encountered within any of the trial holes.

Changes in groundwater level occur for a number of reasons including seasonal effects and variations in drainage. The investigation was conducted in March 2022, when groundwater levels are at their annual maximum (highest) elevation. Groundwater levels are expected to fall to their annual minimum (lowest) elevation, which typically occurs around September.

Infiltration Testing
Infiltration testing was performed within trial pits TPSA1, TPSA2, TPSA3 and TPSA4 in order to provide guidance on the suitability of the ground for the adoption of a surface water drainage system. The tests were undertaken within the Head Deposits.

The tests comprised piping fresh water via a towed water bowser into the open trial hole, the drop in water level over time was then recorded to give an indication of soakage potential. BRE 365 requires that each test pit be tested three times in quick succession. In accordance with BRE 365, full compliance was achieved within all four trial holes. Three tests were performed in quick succession and the trial pit was refilled after each test when the head of water dropped below 25%.

Table 3 presents the infiltration test results performed within the trial pit.

Table 3 - Infiltration Test Results

Trial Hole	Test No.	Test Stratum	Fill Level (m bgl)	Infiltration Rate (m/sec)
TPSA1	1	HD	0.64	3.36×10^{-5}
	2		0.77	2.86×10^{-5}
	3		0.65	2.55×10^{-5}
TPSA2	1	HD	0.26	6.93×10^{-5}
	2		0.26	2.45×10^{-5}
	3		0.27	2.42×10^{-5}
TPSA3	1	HD	0.30	2.09×10^{-4}
	2		0.33	8.83×10^{-5}
	3		0.30	7.86×10^{-5}
TPSA4	1	HD	0.26	1.75×10^{-4}
	2		0.32	9.69×10^{-5}
	3		0.32	9.22×10^{-5}

Infiltration rates between 1.75×10^{-4} m/s and 9.69×10^{-5} m/s were calculated for the Head Deposits.

Field data are included within Appendix A.

Consultation with the Environment Agency must be sought regarding any use which may have an impact on groundwater resources.

Conclusion
Given observed infiltration rates within the Head Deposits, it is considered that traditional soakaways would be a viable method of surface water disposal.

The following attachments make up the remainder of this letter report.

Figure 1. Site Location Plan
Figure 2. Trial Hole Location Plan

Appendix A. Field Data

Should you have any further questions please do not hesitate to contact the undersigned.

Yours sincerely,



Georgia Booth BSc (Hons), MSc, GradIMMM, FGS
Graduate Geotechnical Engineer
gb@soilslimited.co.uk
For and on behalf of Soils Limited.

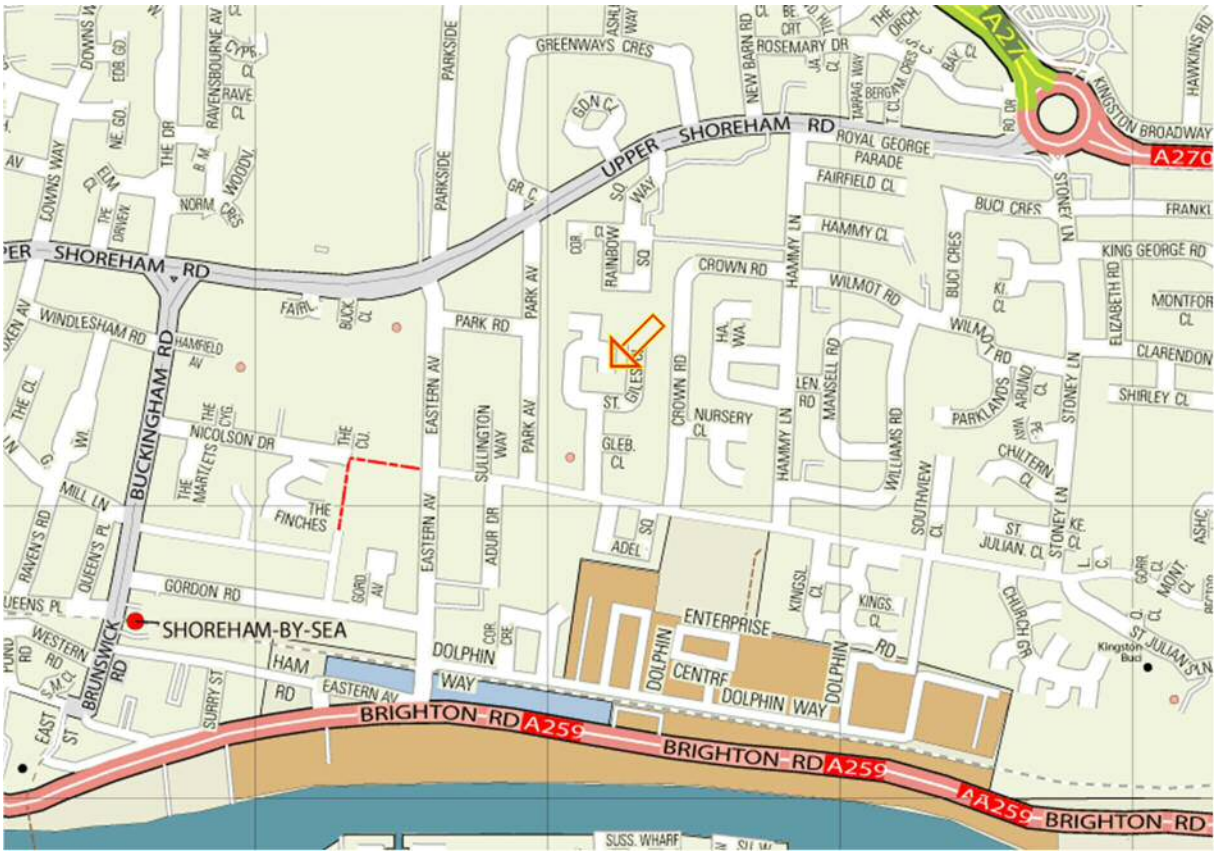


Figure 1 – Site location Plan

Figure number 1	**Title** Site Location Plan
Project St Giles Close, Shoreham by Sea, West Sussex BN42 6GU	**Date** April 2022
Client Adur Council	**Reference** 19922



Figure 2. Trial Hole Location Plan

Figure number 2	**Title** Trial Hole Location Plan
Project St Giles Close, Shoreham by Sea, West Sussex BN42 6GU	**Date** April 2022
Client Adur Council	**Reference** 19922

Appendix A. Field Data

Soils Limited
Newton House, Cross Road, Tadworth KT20 5SR
Tel: 01737 814221 Email: admin@soilslimited.co.uk

Trial Pit Log

Trial Pit No.
TPSA1
Sheet 1 of 1

Project Name: St Giles Close	Project No.: 19922	Method:	Hole Type: TP
Location: St Giles Close, Shoreham, West Sussex, BN42 6GU		Plant: 8tn tracked	Scale: 1:25
Client: Adur Council	Trial Pit Length: m	Support: Trial Pit Width: m	Logged By: CF
Dates: 28/03/2022 - 29/03/2022	Level:	Co-ords:	

Water Strike	Samples & In Situ Testing: Depth	Type	Results	Depth (m)	Level (mAOD)	Legend	Stratum Description
				0.04			TARMAC CONCRETE
	0.25	ES		0.24 0.28			Grey slightly gravelly silty SAND. Gravel is sub angular to sub rounded fine, ash and clinker, concrete and tarmac. (MADE GROUND)
	0.50	ES					Light brown slightly sandy, slightly gravelly silty CLAY. Gravel is angular to sub rounded flint. (HEAD DEPOSITS)
				0.70			
	0.80	ES					Cream very gravelly CLAY. Gravel is angular to sub rounded, fine to coarse flint and chalk. (HEAD DEPOSITS)
	1.20	ES					
	1.70	ES					
				1.80			End of Pit at 1.800m

1
2
3
4
5

General Remarks:
No rootlets observed

Groundwater Remarks: No groundwater encountered.

Sample Type
D: Disturbed
B: Bulk
J: Jar
W: Water

Soils Limited
Newton House, Cross Road, Tadworth KT20 5SR
Tel: 01737 814221 Email: admin@soilslimited.co.uk

Trial Pit Log

Trial Pit No.
TPSA2
Sheet 1 of 1

Project Name: St Giles Close	Project No.: 19922	Method:	Hole Type: TP
Location: St Giles Close, Shoreham, West Sussex, BN42 6GU		Plant: 8tn tracked	Scale: 1:25
Client: Adur Council	Trial Pit Length: m	Support: Trial Pit Width: m	Logged By: CF
Dates: 28/03/2022 - 29/03/2022	Level:	Co-ords:	

Water Strike	Samples & In Situ Testing: Depth	Type	Results	Depth (m)	Level (mAOD)	Legend	Stratum Description
				0.04			TARMAC CONCRETE
	0.24	ES		0.24 0.25			Grey slightly gravelly silty SAND. Gravel is sub angular to sub rounded fine, ash and clinker, concrete and tarmac. (MADE GROUND)
	0.50	ES		0.55			Light brown slightly sandy, slightly gravelly silty CLAY. Gravel is angular to sub rounded flint. (HEAD DEPOSITS) End of Pit at 0.550m

General Remarks:
No rootlets observed

Groundwater Remarks: No groundwater encountered.

Sample Type
D: Disturbed
B: Bulk
J: Jar
W: Water

Soils Limited
Newton House, Cross Road, Tadworth KT20 5SR
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Trial Pit Log

Trial Pit No.
TPSA3
Sheet 1 of 1

Project Name: St Giles Close	Project No.: 19922	Method:	Hole Type: TP
Location: St Giles Close, Shoreham, West Sussex, BN42 6GU		Plant: 8tn tracked	Scale: 1:25
Client: Adur Council	Trial Pit Length: m	Support: Trial Pit Width: m	Logged By: CF
Dates: 28/03/2022 - 29/03/2022	Level:	Co-ords:	

Water Strike	Samples & In Situ Testing: Depth	Type	Results	Depth (m)	Level (mAOD)	Legend	Stratum Description
				0.04			TARMAC CONCRETE
	0.25	ES		0.24			Grey slightly gravelly silty SAND. Gravel is sub angular to sub rounded fine, ash and clinker, concrete and tarmac. (MADE GROUND)
	0.50	ES		0.40			Light brown slightly sandy, slightly gravelly silty CLAY. Gravel is angular to sub rounded flint. (HEAD DEPOSITS)
				0.60			End of Pit at 0.600m

General Remarks:
No rootlets observed

Groundwater Remarks: No groundwater encountered.

Sample Type
D: Disturbed
B: Bulk
J: Jar
W: Water

Soils Limited
Newton House, Cross Road, Tadworth KT20 5SR
Tel: 01737 814221 Email: admin@soilslimited.co.uk

Trial Pit Log

Trial Pit No.
TPSA4
Sheet 1 of 1

Project Name: St Giles Close	Project No.: 19922	Method:	Hole Type: TP
Location: St Giles Close, Shoreham, West Sussex, BN42 6GU		Plant: 8tn tracked	Scale: 1:25
Client: Adur Council	Trial Pit Length: m	Support: Trial Pit Width: m	Logged By: CF
Dates: 28/03/2022 - 29/03/2022	Level:	Co-ords:	

Water Strike	Samples & In Situ Testing: Depth	Type	Results	Depth (m)	Level (mAOD)	Legend	Stratum Description
				0.04			TARMAC CONCRETE
	0.25	ES		0.24			Grey slightly gravelly silty SAND. Gravel is sub angular to sub rounded fine, ash and clinker, concrete and tarmac. (MADE GROUND)
	0.50	ES		0.40			Light brown slightly sandy, slightly gravelly silty CLAY. Gravel is angular to sub rounded flint. (HEAD DEPOSITS)
				0.60			End of Pit at 0.600m

General Remarks:
No rootlets observed

Groundwater Remarks: No groundwater encountered.

Sample Type
D: Disturbed
B: Bulk
J: Jar
W: Water

Soakaway Calculations

Soakaway Test No.	TPSA1 Test 1
Contract:	St Giles Close
Contract No.	19922

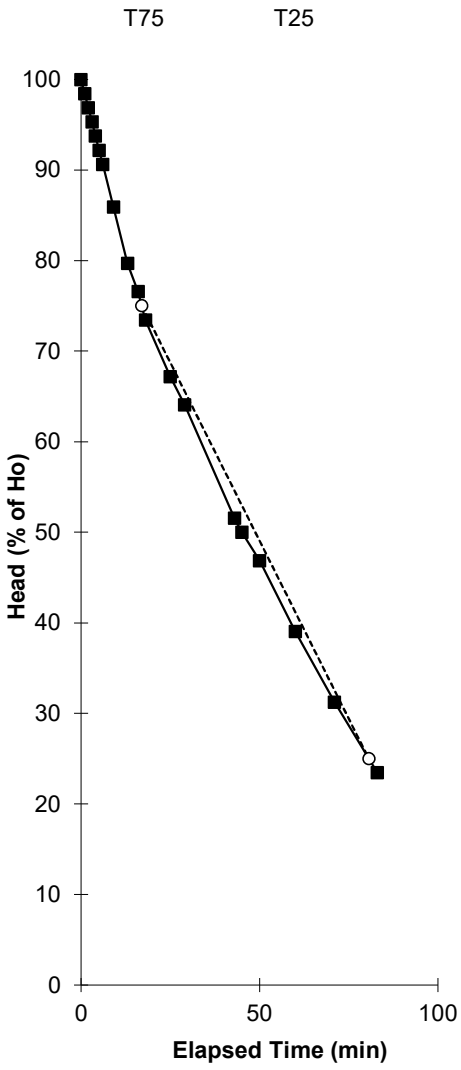
Field Test

Trial Pit Log (include details of groundwater):
See trial Pit record

Depth of Pit	1.85	m
Width of Pit	0.60	m
Length of Pit	1.50	m
Depth of Pit Soaked	0.64	m
ap50	2.244	m2
Vp75-25	0.288	m3
t75-25	63.6	min
water used	0.5760	m3
f	3.363E-05	m/sec.

Field Data

Depth to Water (m)	Elapsed Time (min)	Head of Water (% of Ho)	Head of Water (m)
1.21	0	100	0.64
1.22	1	98	0.63
1.23	2	97	0.62
1.24	3	95	0.61
1.25	4	94	0.60
1.26	5	92	0.59
1.27	6	91	0.58
1.30	9	86	0.55
1.34	13	80	0.51
1.36	16	77	0.49
1.38	18	73	0.47
1.42	25	67	0.43
1.44	29	64	0.41
1.52	43	52	0.33
1.53	45	50	0.32
1.55	50	47	0.30
1.60	60	39	0.25
1.65	71	31	0.20
1.70	83	23	0.15



T75	17.000	75
T25	80.600	25
T75-25	63.600	Derived from Best Fit

Comments

SOILS LIMITED
Newton House, Cross Road, Tadworth
Surrey, KT20 5SR

Telephone: **01737 814 221**
Facsimile: **01737 812 557**

Soakaway Calculations

Soakaway Test No.	TPSA1 Test 2
Contract:	St Giles Close
Contract No.	19922

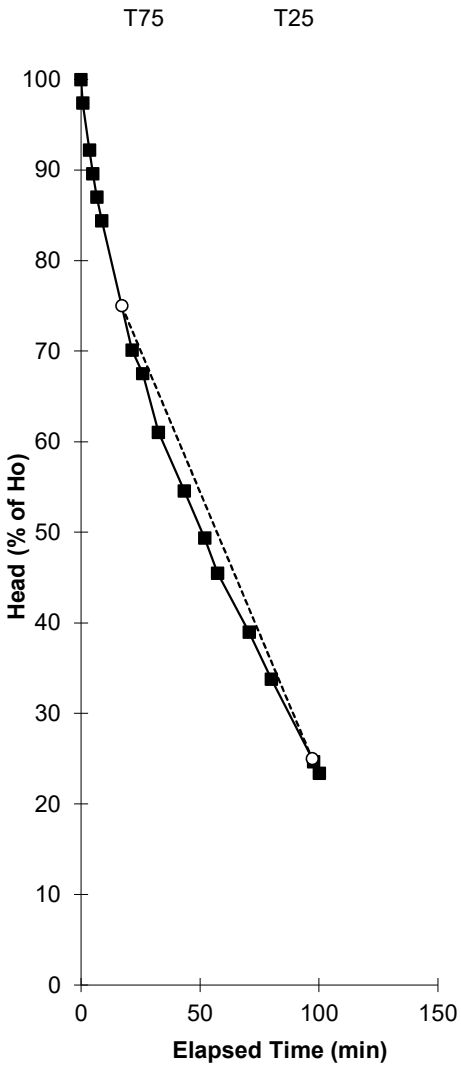
Field Test

Trial Pit Log (include details of groundwater):
See trial Pit record

Depth of Pit	1.81	m
Width of Pit	0.60	m
Length of Pit	1.50	m
Depth of Pit Soaked	0.77	m
ap50	2.517	m2
Vp75-25	0.3465	m3
t75-25	80.0	min
water used	0.6930	m3
f	2.867E-05	m/sec.

Field Data

Depth to Water (m)	Elapsed Time (min)	Head of Water (% of Ho)	Head of Water (m)
1.04	0	100	0.77
1.06	1	97	0.75
1.10	4	92	0.71
1.12	5	90	0.69
1.14	7	87	0.67
1.16	9	84	0.65
1.27	21	70	0.54
1.29	26	68	0.52
1.34	32	61	0.47
1.39	43	55	0.42
1.43	52	49	0.38
1.46	57	45	0.35
1.51	71	39	0.30
1.55	80	34	0.26
1.62	98	25	0.19
1.63	100	23	0.18



T75	17.070	75
T25	97.085	25
T75-25	80.014	Derived from Best Fit

Comments

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Soakaway Calculations

Soakaway Test No.	TPSA1 Test 3
Contract:	St Giles Close
Contract No.	19922

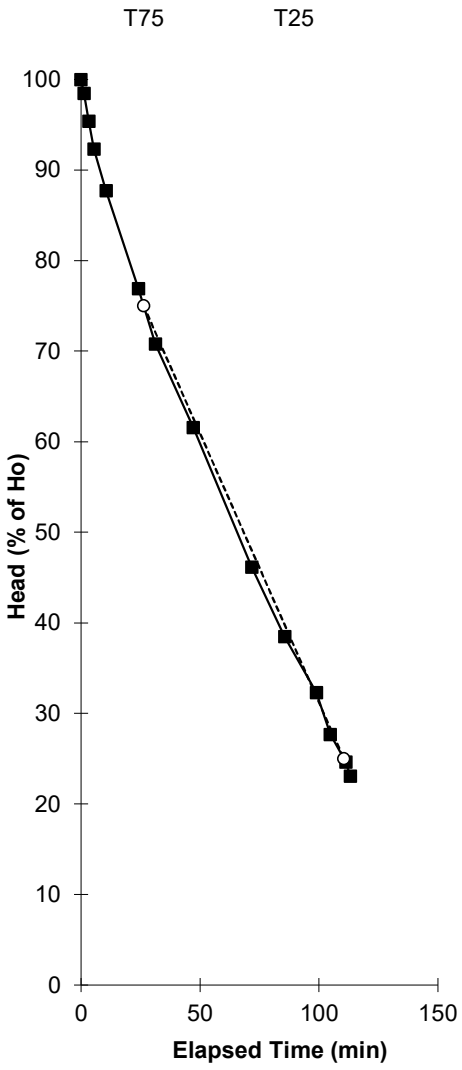
Field Test

Trial Pit Log (include details of groundwater):
See trial Pit record

Depth of Pit	1.79	m
Width of Pit	0.60	m
Length of Pit	1.50	m
Depth of Pit Soaked	0.65	m
ap50	2.265	m2
Vp75-25	0.2925	m3
t75-25	84.1	min
water used	0.5850	m3
f	2.558E-05	m/sec.

Field Data

Depth to Water (m)	Elapsed Time (min)	Head of Water (% of Ho)	Head of Water (m)
1.14	0	100	0.65
1.15	1	98	0.64
1.17	3	95	0.62
1.19	5	92	0.60
1.22	10	88	0.57
1.29	24	77	0.50
1.33	31	71	0.46
1.39	47	62	0.40
1.49	72	46	0.30
1.54	85	38	0.25
1.58	99	32	0.21
1.61	105	28	0.18
1.63	111	25	0.16
1.64	113	23	0.15



T75	26.268	75
T25	110.402	25
T75-25	84.134	Derived from Best Fit

Comments

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Soakaway Calculations

Soakaway Test No.	TPSA2 Test 1
Contract:	St Giles Close
Contract No.	19922

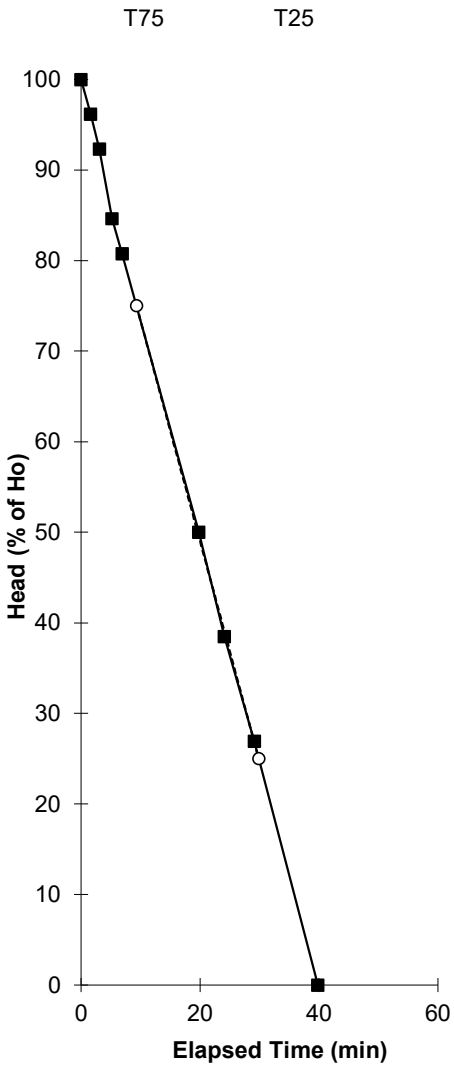
Field Test

Trial Pit Log (include details of groundwater):
See trial Pit record

Depth of Pit	0.55	m
Width of Pit	1.00	m
Length of Pit	1.00	m
Depth of Pit Soaked	0.26	m
ap50	1.52	m2
Vp75-25	0.13	m3
t75-25	20.5	min
water used	0.2600	m3
f	6.937E-05	m/sec.

Field Data

Depth to Water (m)	Elapsed Time (min)	Head of Water (% of Ho)	Head of Water (m)
0.29	0	100	0.26
0.30	2	96	0.25
0.31	3	92	0.24
0.33	5	85	0.22
0.34	7	81	0.21
0.42	20	50	0.13
0.45	24	38	0.10
0.48	29	27	0.07
0.55	40	0	0.00



T75	9.316	75
T25	29.864	25
T75-25	20.549	Derived from Best Fit

Comments

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Soakaway Calculations

Soakaway Test No.	TPSA2 Test 2
Contract:	St Giles Close
Contract No.	19922

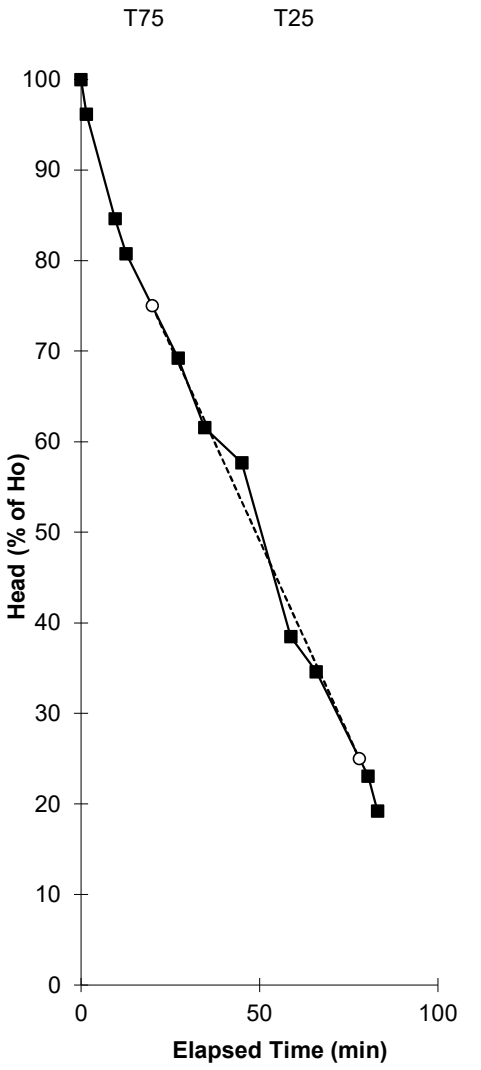
Field Test

Trial Pit Log (include details of groundwater):
See trial Pit record

Depth of Pit	0.55	m
Width of Pit	1.00	m
Length of Pit	1.00	m
Depth of Pit Soaked	0.26	m
ap50	1.52	m2
Vp75-25	0.13	m3
t75-25	58.0	min
water used	0.2600	m3
f	2.456E-05	m/sec.

Field Data

Depth to Water (m)	Elapsed Time (min)	Head of Water (% of Ho)	Head of Water (m)
0.29	0	100	0.26
0.30	1	96	0.25
0.33	10	85	0.22
0.34	13	81	0.21
0.37	27	69	0.18
0.39	35	62	0.16
0.40	45	58	0.15
0.45	59	38	0.10
0.46	66	35	0.09
0.49	80	23	0.06
0.50	83	19	0.05



T75	19.908	75
T25	77.958	25
T75-25	58.050	Derived from Best Fit

Comments

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Soakaway Calculations

Soakaway Test No.	TPSA2 Test 3
Contract:	St Giles Close
Contract No.	19922

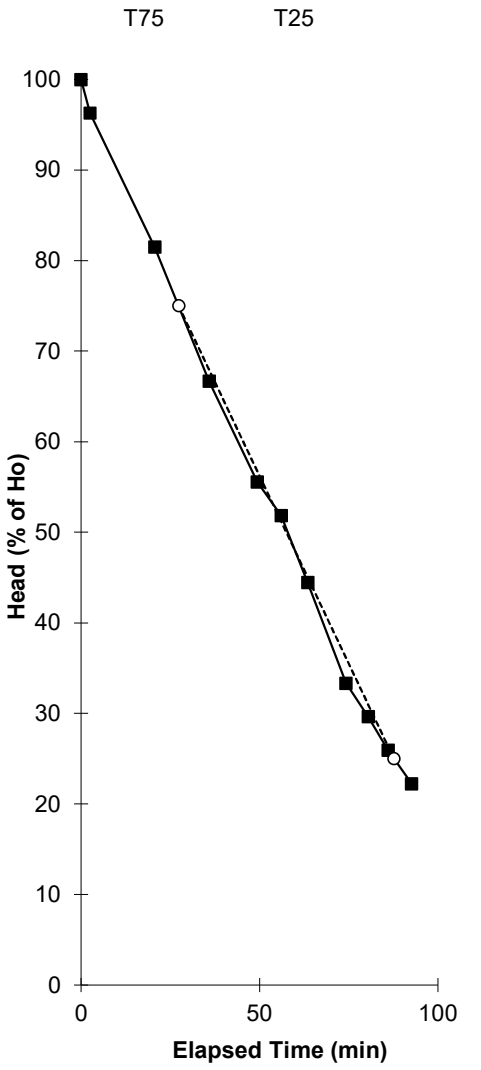
Field Test

Trial Pit Log (include details of groundwater):
See trial Pit record

Depth of Pit	0.55	m
Width of Pit	1.00	m
Length of Pit	1.00	m
Depth of Pit Soaked	0.27	m
ap50	1.54	m2
Vp75-25	0.135	m3
t75-25	60.3	min
water used	0.2700	m3
f	2.423E-05	m/sec.

Field Data

Depth to Water (m)	Elapsed Time (min)	Head of Water (% of Ho)	Head of Water (m)
0.28	0	100	0.27
0.29	2	96	0.26
0.33	21	81	0.22
0.37	36	67	0.18
0.40	49	56	0.15
0.41	56	52	0.14
0.43	63	44	0.12
0.46	74	33	0.09
0.47	80	30	0.08
0.48	86	26	0.07
0.49	93	22	0.06



T75	27.331	75
T25	87.633	25
T75-25	60.302	Derived from Best Fit

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Soakaway Calculations

Soakaway Test No.	TPSA3 Test 1
Contract:	St Giles Close
Contract No.	19922

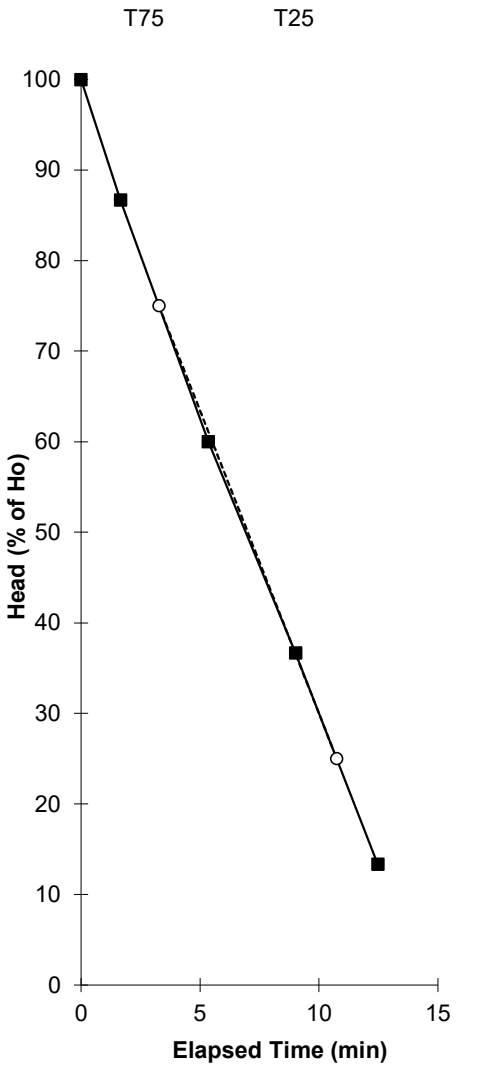
Field Test

Trial Pit Log (include details of groundwater):
See trial Pit record

Depth of Pit	0.64	m
Width of Pit	1.00	m
Length of Pit	1.00	m
Depth of Pit Soaked	0.30	m
ap50	1.6	m2
Vp75-25	0.15	m3
t75-25	7.5	min
water used	0.3000	m3
f	2.091E-04	m/sec.

Field Data

Depth to Water (m)	Elapsed Time (min)	Head of Water (% of Ho)	Head of Water (m)
0.34	0	100	0.3
0.38	2	87	0.26
0.46	5	60	0.18
0.53	9	37	0.11
0.60	12	13	0.04



T75	3.269	75
T25	10.742	25
T75-25	7.473	Derived from Best Fit

Comments

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Soakaway Calculations

Soakaway Test No.	TPSA3 Test 2
Contract:	St Giles Close
Contract No.	19922

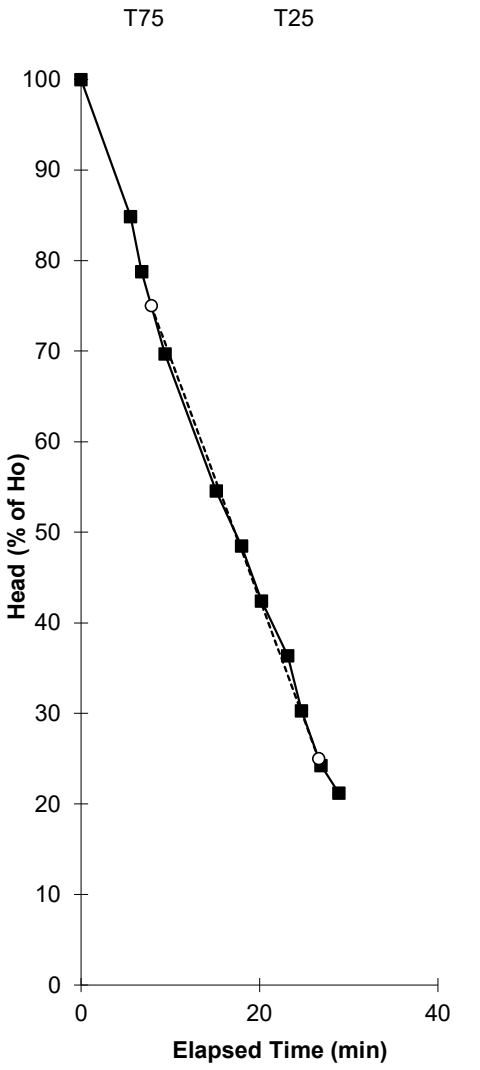
Field Test

Trial Pit Log (include details of groundwater):
See trial Pit record

Depth of Pit	0.60	m
Width of Pit	1.00	m
Length of Pit	1.00	m
Depth of Pit Soaked	0.33	m
ap50	1.66	m2
Vp75-25	0.165	m3
t75-25	18.7	min
water used	0.3300	m3
f	8.837E-05	m/sec.

Field Data

Depth to Water (m)	Elapsed Time (min)	Head of Water (% of Ho)	Head of Water (m)
0.27	0	100	0.33
0.32	6	85	0.28
0.34	7	79	0.26
0.37	9	70	0.23
0.42	15	55	0.18
0.44	18	48	0.16
0.46	20	42	0.14
0.48	23	36	0.12
0.50	25	30	0.10
0.52	27	24	0.08
0.53	29	21	0.07



T75	7.867	75
T25	26.612	25
T75-25	18.746	Derived from Best Fit

Comments

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Soakaway Calculations

Soakaway Test No.	TPSA3 Test 3
Contract:	St Giles Close
Contract No.	19922

Field Test

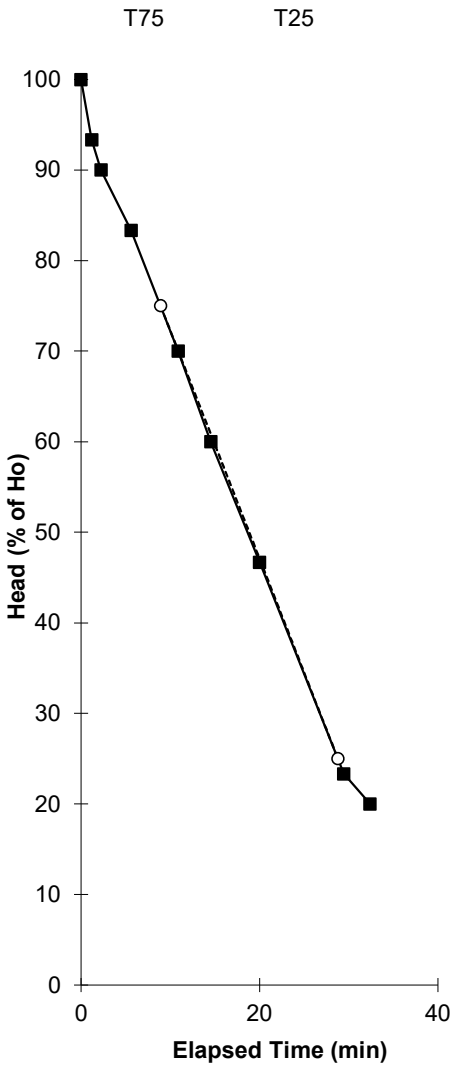
Trial Pit Log (include details of groundwater):
See trial Pit record

Depth of Pit	0.60	m
Width of Pit	1.00	m
Length of Pit	1.00	m
Depth of Pit Soaked	0.30	m
ap50	1.6	m2
Vp75-25	0.15	m3
t75-25	19.9	min
water used	0.3000	m3
f	7.863E-05	m/sec.

Field Data

Depth to Water (m)	Elapsed Time (min)	Head of Water (% of Ho)	Head of Water (m)
0.30	0	100	0.3
0.32	1	93	0.28
0.33	2	90	0.27
0.35	6	83	0.25
0.39	11	70	0.21
0.42	15	60	0.18
0.46	20	47	0.14
0.53	29	23	0.07
0.54	32	20	0.06

T75	8.902	75
T25	28.774	25
T75-25	19.872	Derived from Best Fit



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Soakaway Calculations

Soakaway Test No.	TPSA4 Test 1
Contract:	St Giles Close
Contract No.	19922

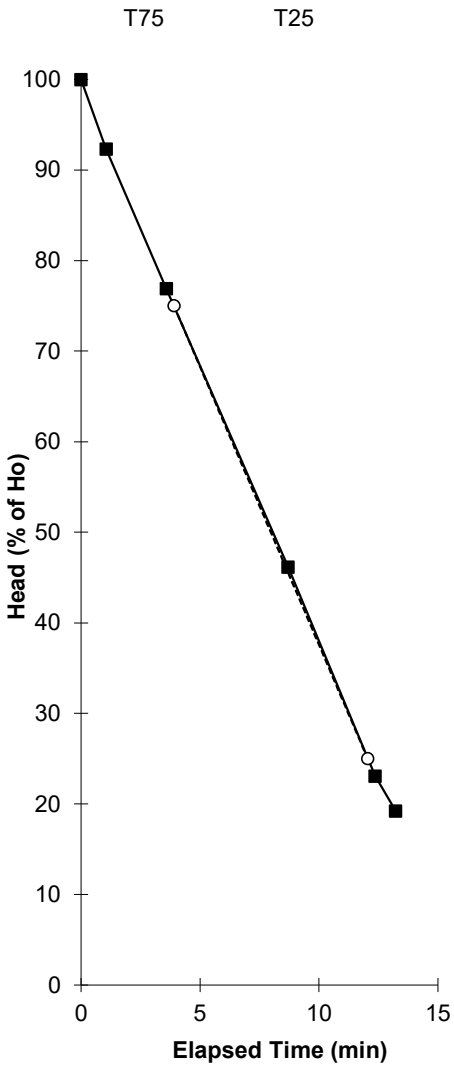
Field Test

Trial Pit Log (include details of groundwater):
See trial Pit record

Depth of Pit	0.72	m
Width of Pit	1.00	m
Length of Pit	1.00	m
Depth of Pit Soaked	0.26	m
ap50	1.52	m2
Vp75-25	0.13	m3
t75-25	8.1	min
water used	0.2600	m3
f	1.751E-04	m/sec.

Field Data

Depth to Water (m)	Elapsed Time (min)	Head of Water (% of Ho)	Head of Water (m)
0.46	0	100	0.26
0.48	1	92	0.24
0.52	4	77	0.20
0.60	9	46	0.12
0.66	12	23	0.06
0.67	13	19	0.05



T75	3.903	75
T25	12.046	25
T75-25	8.143	Derived from Best Fit

Comments

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Soakaway Calculations

Soakaway Test No.	TPSA4 Test 2
Contract:	St Giles Close
Contract No.	19922

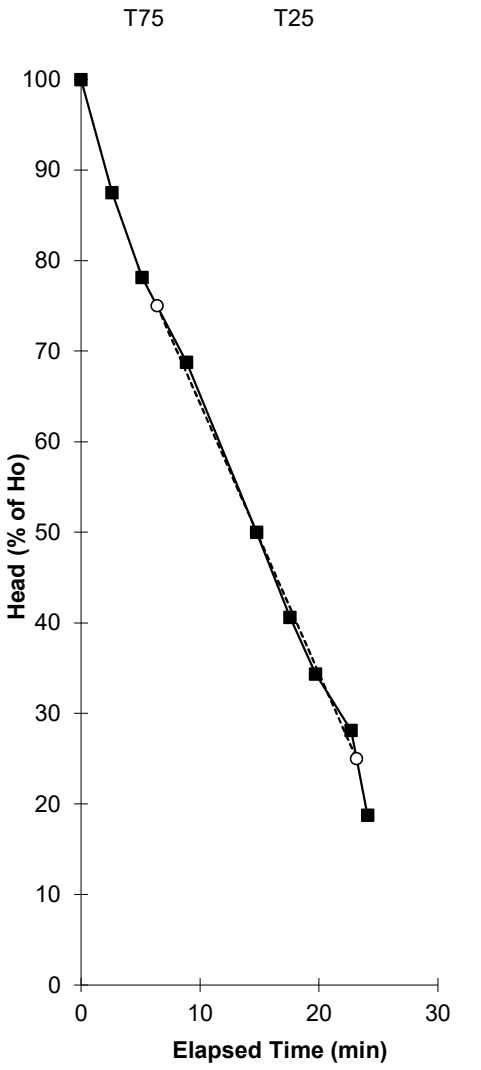
Field Test

Trial Pit Log (include details of groundwater):
See trial Pit record

Depth of Pit	0.72	m
Width of Pit	1.00	m
Length of Pit	1.00	m
Depth of Pit Soaked	0.32	m
ap50	1.64	m2
Vp75-25	0.16	m3
t75-25	16.8	min
water used	0.3200	m3
f	9.695E-05	m/sec.

Field Data

Depth to Water (m)	Elapsed Time (min)	Head of Water (% of Ho)	Head of Water (m)
0.40	0	100	0.32
0.44	3	88	0.28
0.47	5	78	0.25
0.50	9	69	0.22
0.56	15	50	0.16
0.59	18	41	0.13
0.61	20	34	0.11
0.63	23	28	0.09
0.66	24	19	0.06



T75	6.378	75
T25	23.150	25
T75-25	16.772	Derived from Best Fit

Comments

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Soakaway Calculations

Soakaway Test No.	TPSA4 Test 3
Contract:	St Giles Close
Contract No.	19922

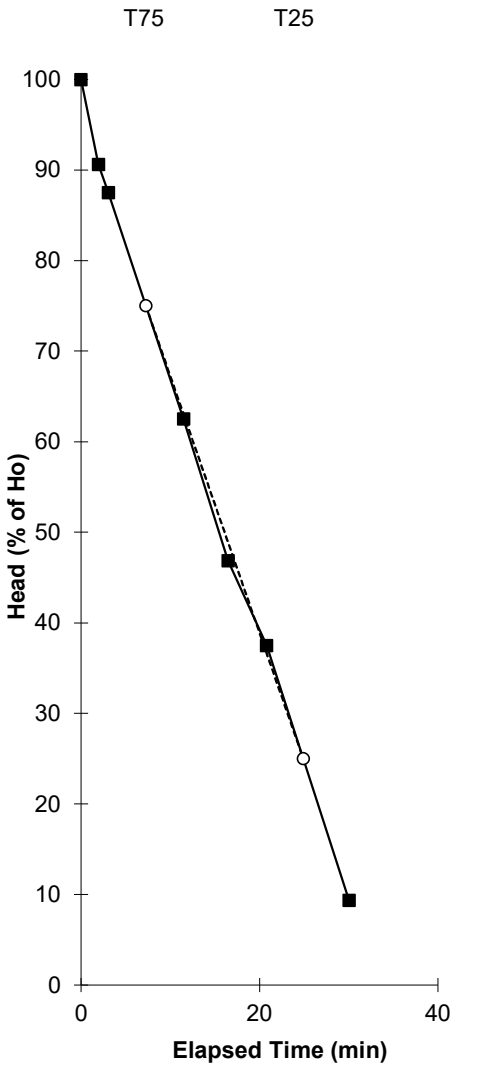
Field Test

Trial Pit Log (include details of groundwater):
See trial Pit record

Depth of Pit	0.72	m
Width of Pit	1.00	m
Length of Pit	1.00	m
Depth of Pit Soaked	0.32	m
ap50	1.64	m2
Vp75-25	0.16	m3
t75-25	17.6	min
water used	0.3200	m3
f	9.220E-05	m/sec.

Field Data

Depth to Water (m)	Elapsed Time (min)	Head of Water (% of Ho)	Head of Water (m)
0.40	0	100	0.32
0.43	2	91	0.29
0.44	3	88	0.28
0.52	11	63	0.20
0.57	16	47	0.15
0.60	21	38	0.12
0.69	30	9	0.03



T75	7.258	75
T25	24.894	25
T75-25	17.636	Derived from Best Fit

Comments

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3.4 **Appendix D – Drainage Design Calculations**

Design Settings

Rainfall Methodology	FSR	Maximum Time of Concentration (mins)	30.00
Return Period (years)	100	Maximum Rainfall (mm/hr)	500.0
Additional Flow (%)	0	Minimum Velocity (m/s)	1.00
FSR Region	England and Wales	Connection Type	Level Soffits
M5-60 (mm)	20.000	Minimum Backdrop Height (m)	2.000
Ratio-R	0.350	Preferred Cover Depth (m)	0.600
CV	1.000	Include Intermediate Ground	✓
Time of Entry (mins)	5.00	Enforce best practice design rules	✓

Nodes

Name	Area (ha)	T of E (mins)	Cover Level (m)	Diameter (mm)	Easting (m)	Northing (m)	Depth (m)
roofs	0.016	5.00	10.400	1200	0.000	0.000	0.600
SA			10.400	1200	10.000	0.000	1.200

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	roofs	SA	10.000	0.600	9.800	9.200	0.600	16.7	225	5.05	151.4

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	3.220	128.0	8.8	0.375	0.975	0.016	0.0	40	1.871

Simulation Settings

Rainfall Methodology	FSR	Skip Steady State	x
FSR Region	England and Wales	Drain Down Time (mins)	240
M5-60 (mm)	20.000	Additional Storage (m³/ha)	20.0
Ratio-R	0.350	Check Discharge Rate(s)	x
Summer CV	1.000	Check Discharge Volume	x
Analysis Speed	Normal		

Storm Durations

15	60	180	360	600	960	2160
30	120	240	480	720	1440	2880

Return Period (years)	Climate Change (CC %)	Additional Area (A %)	Additional Flow (Q %)
10	0	0	0
100	45	0	0

Node SA Soakaway Storage Structure

Base Inf Coefficient (m/hr)	0.00000	Invert Level (m)	8.800	Depth (m)	0.800
Side Inf Coefficient (m/hr)	0.34900	Time to half empty (mins)	309	Inf Depth (m)	
Safety Factor	3.0	Pit Width (m)	1.500	Number Required	1
Porosity	0.95	Pit Length (m)	8.000		

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Results for 10 year 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
15 minute summer	roofs	10	9.832	0.032	5.3	0.0534	0.0000	OK
720 minute summer	SA	450	9.183	-0.017	0.7	4.3694	0.0000	OK

Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)
15 minute summer	roofs	1	SA	5.3	1.561	0.041	0.0338
720 minute summer	SA	Infiltration		0.2			

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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
15 minute summer	roofs	10	9.850	0.050	12.6	0.0832	0.0000	OK
360 minute summer	SA	256	9.816	0.616	2.7	9.8227	0.0000	OK

Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)
15 minute summer	roofs	1	SA	12.5	1.988	0.098	0.0630
360 minute summer	SA	Infiltration		0.5			

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Design Settings

Rainfall Methodology	FSR	Maximum Time of Concentration (mins)	30.00
Return Period (years)	100	Maximum Rainfall (mm/hr)	500.0
Additional Flow (%)	0	Minimum Velocity (m/s)	1.00
FSR Region	England and Wales	Connection Type	Level Soffits
M5-60 (mm)	20.000	Minimum Backdrop Height (m)	2.000
Ratio-R	0.350	Preferred Cover Depth (m)	0.600
CV	1.000	Include Intermediate Ground	✓
Time of Entry (mins)	5.00	Enforce best practice design rules	✓

Nodes

Name	Area (ha)	T of E (mins)	Cover Level (m)	Diameter (mm)	Easting (m)	Northing (m)	Depth (m)
IMP	0.015	5.00	10.200	500	0.000	0.000	0.400
TANK			10.200	500	20.000	0.000	0.800
outfall			10.200	500	25.000	0.000	0.830

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	IMP	TANK	20.000	0.600	9.800	9.400	0.400	50.0	225	5.18	150.1
2	TANK	outfall	5.000	0.600	9.400	9.370	0.030	166.7	225	5.26	149.3

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	1.854	73.7	8.1	0.175	0.575	0.015	0.0	51	1.234
2	1.010	40.1	8.1	0.575	0.605	0.015	0.0	68	0.792

Simulation Settings

Rainfall Methodology	FSR	Skip Steady State	x
FSR Region	England and Wales	Drain Down Time (mins)	240
M5-60 (mm)	20.000	Additional Storage (m³/ha)	20.0
Ratio-R	0.350	Check Discharge Rate(s)	x
Summer CV	1.000	Check Discharge Volume	x
Analysis Speed	Normal		

Storm Durations

15	60	180	360	600	960	2160
30	120	240	480	720	1440	2880

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

Node TANK Online Orifice Control

Flap Valve	x	Design Depth (m)	0.800	Discharge Coefficient	0.600
Replaces Downstream Link	✓	Design Flow (l/s)	1.2		
Invert Level (m)	8.200	Diameter (m)	0.025		

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Node TANK Depth/Area Storage Structure

Base Inf Coefficient (m/hr)	0.00000	Safety Factor	3.0	Invert Level (m)	8.600
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	8.0	0.0	0.800	8.0	0.0	0.810	0.0	0.0

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Results for 100 year +45% CC Critical Storm Duration. Lowest mass balance: 92.14%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
240 minute summer	IMP	152	10.148	0.348	3.4	0.3291	0.0000	FLOOD RISK
240 minute summer	TANK	152	10.148	0.748	3.4	6.2685	0.0000	FLOOD RISK
15 minute summer	outfall	1	9.370	0.000	0.0	0.0000	0.0000	OK

Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
240 minute summer	IMP	1	TANK	3.4	0.940	0.046	0.7954	
240 minute summer	TANK	Orifice	outfall	1.2				6.7

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Design Settings

Rainfall Methodology	FSR	Maximum Time of Concentration (mins)	30.00
Return Period (years)	100	Maximum Rainfall (mm/hr)	500.0
Additional Flow (%)	0	Minimum Velocity (m/s)	1.00
FSR Region	England and Wales	Connection Type	Level Soffits
M5-60 (mm)	20.000	Minimum Backdrop Height (m)	2.000
Ratio-R	0.350	Preferred Cover Depth (m)	0.600
CV	1.000	Include Intermediate Ground	✓
Time of Entry (mins)	5.00	Enforce best practice design rules	✓

Nodes

Name	Area (ha)	T of E (mins)	Cover Level (m)	Diameter (mm)	Easting (m)	Northing (m)	Depth (m)
PS	0.003	5.00	10.400	1200	0.000	0.000	0.600

Simulation Settings

Rainfall Methodology	FSR	Skip Steady State	x
FSR Region	England and Wales	Drain Down Time (mins)	240
M5-60 (mm)	20.000	Additional Storage (m³/ha)	20.0
Ratio-R	0.350	Check Discharge Rate(s)	x
Summer CV	1.000	Check Discharge Volume	x
Analysis Speed	Normal		

Storm Durations

15	60	180	360	600	960	2160
30	120	240	480	720	1440	2880

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

Node PS Carpark Storage Structure

Base Inf Coefficient (m/hr)	0.34900	Invert Level (m)	9.800	Slope (1:X)	999.0
Side Inf Coefficient (m/hr)	0.00000	Time to half empty (mins)	19	Depth (m)	0.250
Safety Factor	3.0	Width (m)	3.600	Inf Depth (m)	
Porosity	0.30	Length (m)	7.100		

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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
30 minute summer	PS	22	9.878	0.078	2.2	0.6643	0.0000	OK

Link Event (Upstream Depth)	US Node	Link	Outflow (l/s)
30 minute summer	PS	Infiltration	0.8

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Design Settings

Rainfall Methodology	FSR	Maximum Time of Concentration (mins)	30.00
Return Period (years)	100	Maximum Rainfall (mm/hr)	500.0
Additional Flow (%)	0	Minimum Velocity (m/s)	1.00
FSR Region	England and Wales	Connection Type	Level Soffits
M5-60 (mm)	20.000	Minimum Backdrop Height (m)	2.000
Ratio-R	0.350	Preferred Cover Depth (m)	0.600
CV	1.000	Include Intermediate Ground	✓
Time of Entry (mins)	5.00	Enforce best practice design rules	✓

Nodes

Name	Area (ha)	T of E (mins)	Cover Level (m)	Diameter (mm)	Easting (m)	Northing (m)	Depth (m)
IMP	0.040	5.00	10.200	500	0.000	0.000	0.400
TANK			10.200	1200	20.000	0.000	2.000
outfall			10.200	500	25.000	0.000	2.030

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	IMP	TANK	20.000	0.600	9.800	8.200	1.600	12.5	225	5.09	151.0
2	TANK	outfall	5.000	0.600	8.200	8.170	0.030	166.7	225	5.17	150.2

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	3.721	147.9	21.8	0.175	1.775	0.040	0.0	58	2.692
2	1.010	40.1	21.7	1.775	1.805	0.040	0.0	118	1.030

Simulation Settings

Rainfall Methodology	FSR	Skip Steady State	x
FSR Region	England and Wales	Drain Down Time (mins)	240
M5-60 (mm)	20.000	Additional Storage (m³/ha)	20.0
Ratio-R	0.350	Check Discharge Rate(s)	x
Summer CV	1.000	Check Discharge Volume	x
Analysis Speed	Normal		

Storm Durations

15	60	180	360	600	960	2160
30	120	240	480	720	1440	2880

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

Node TANK Online Hydro-Brake® Control

Flap Valve	x	Objective	(HE) Minimise upstream storage
Replaces Downstream Link	✓	Sump Available	✓
Invert Level (m)	8.200	Product Number	CTL-SHE-0084-3300-1200-3300
Design Depth (m)	1.200	Min Outlet Diameter (m)	0.100
Design Flow (l/s)	3.3	Min Node Diameter (mm)	1200

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Node TANK Depth/Area Storage Structure

Base Inf Coefficient (m/hr)	0.00000	Safety Factor	3.0	Invert Level (m)	8.200
Side Inf Coefficient (m/hr)	0.00000	Porosity	0.95	Time to half empty (mins)	51

Depth (m)	Area (m²)	Inf Area (m²)	Depth (m)	Area (m²)	Inf Area (m²)	Depth (m)	Area (m²)	Inf Area (m²)
0.000	10.5	0.0	1.200	10.5	0.0	1.210	0.0	0.0

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Results for 100 year +45% CC Critical Storm Duration. Lowest mass balance: 99.64%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
15 minute summer	IMP	10	9.870	0.070	31.5	0.1540	0.0000	OK
60 minute summer	TANK	49	9.379	1.179	22.2	13.0919	0.0000	SURCHARGED
15 minute summer	outfall	1	8.170	0.000	3.3	0.0000	0.0000	OK

Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
15 minute summer	IMP	1	TANK	31.4	1.992	0.212	0.5032	
60 minute summer	TANK	Hydro-Brake®	outfall	3.3				23.5

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