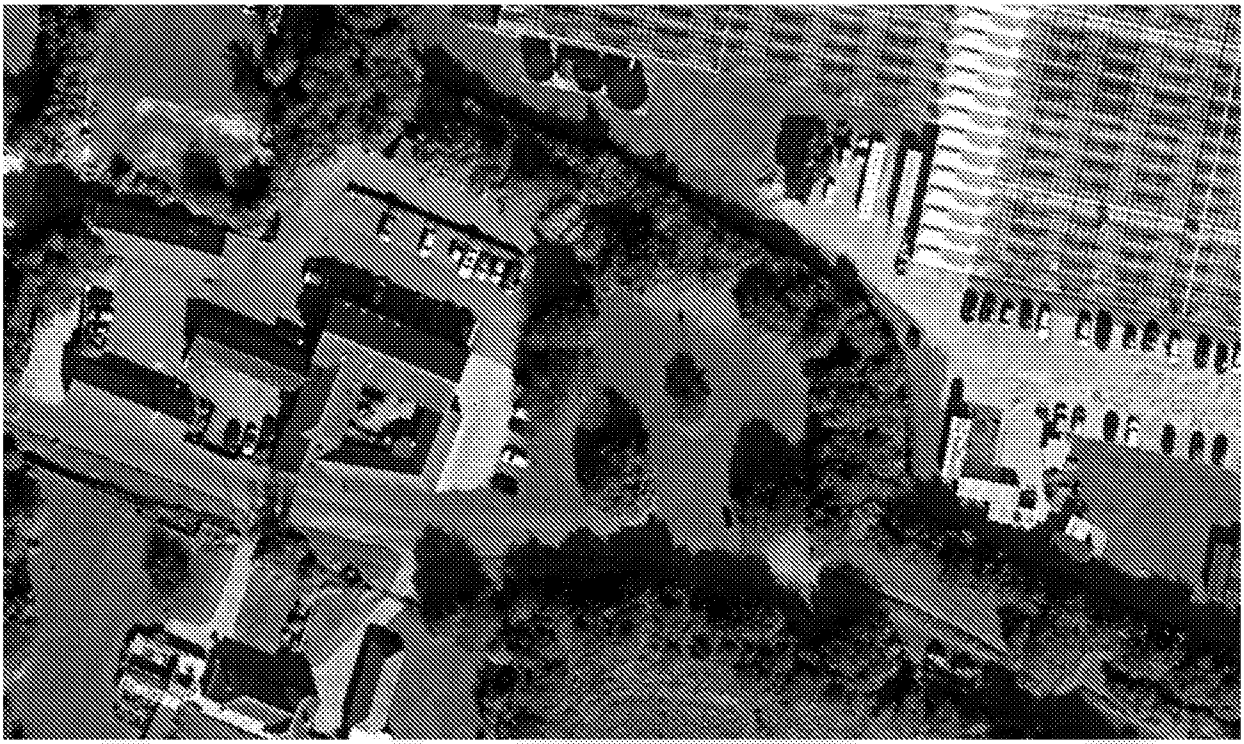
SIMON DENT ASSOCIATES

Consulting Engineers to the Civil and Water Industry



Drainage Strategy for proposed three terraced houses adjacent Sussex Business Centre Lake Lane Barnham PO22 0AL

Simon Dent Associates
Hove East Sussex
and **Gosport Hants**

[redacted]

CONTENTS

Compiled by Simon Dent B Eng (Hons) – Senior Partner

ISSUE	DATE	COMPILED	CHECKED
P1	24.02.2025	SAD	SDA

EXECUTIVE SUMMARY

- An existing greenfield site in Barnham is proposed for new residential development of three terraced houses.
- The site is within fluvial flood zone .
- The site does not suffer from surface water flooding issues and has no recorded surface water flooding within the SFRA.
- The SFRA does indicate a risk of groundwater flooding although no such recorded flooding has occurred on this site.
- Infiltration from this site is possible but subject to winter findings of porosity and groundwater monitoring.
- Shallow suds and raingardens are possible for this site where high groundwater levels are expected.
- A storm water culvert exists at the foot of the site which could be connected to subject to agreed flow limitations with the LLFA.
- The proposed site drainage can offer a scheme compliant with those requirements set out by Arun District Council within their checklist for outline planning approval.

Abbreviations

ADC	Arun District Council
AStGWF	Areas Susceptible to Groundwater Flooding
CFMP	Catchment Flood Management Plan
FRA	Flood Risk Assessment
GSPZ	Groundwater Source Protection Zones
LLFA	Lead Local Flood Authority
NPPF	National Planning Policy Framework
PHI	Pollution Hazard Index
SIRF	Storm Incident Report Form
SWMP	Storm Water Management Plan
WSCC	West Sussex County Council
SFRA	Strategic Flood Risk Assessment
SuDS	Sustainable Drainage Systems
uFMfSW	Updated Flood Map for Surface Water

1.0 PREAMBLE

1.0 An existing green field (hereinafter referred to as the 'site') in an area of Barnham offers opportunity for three terraced houses to be constructed.

1.1 An outline planning application is to be made for the houses which will require the storm and foul wate drainage to be scrutinised for development.

1.2 This drainage strategy is prepared to indicate that design can be provided and confirmed with further testing/surveying on site and that an outline planning approval can be safely offered with no compromise of the requirements of Arun District Council planning guidelines.

1.3 This strategy shall not be reproduced without the written consent of Simon Dent Associates (SDA)

2.0 EXISTING SITE AND DRAINAGE CHARACTERISTICS

2.0 The site is located in Lake Lane Barnham and is currently greenfield. The site grid reference is SU 97306 04584 and centres on OS easting and northing of 497306 104584 respectively.

2.1 The green field site grades from north west to south east from a nominal level of 11.2 – 10.70m AOSD (above ordnance survey datum) with an approximate 1.6% (1 in 64) slope.

2.2 The red line site boundary measures approximately 1233sq.m (0.12ha).

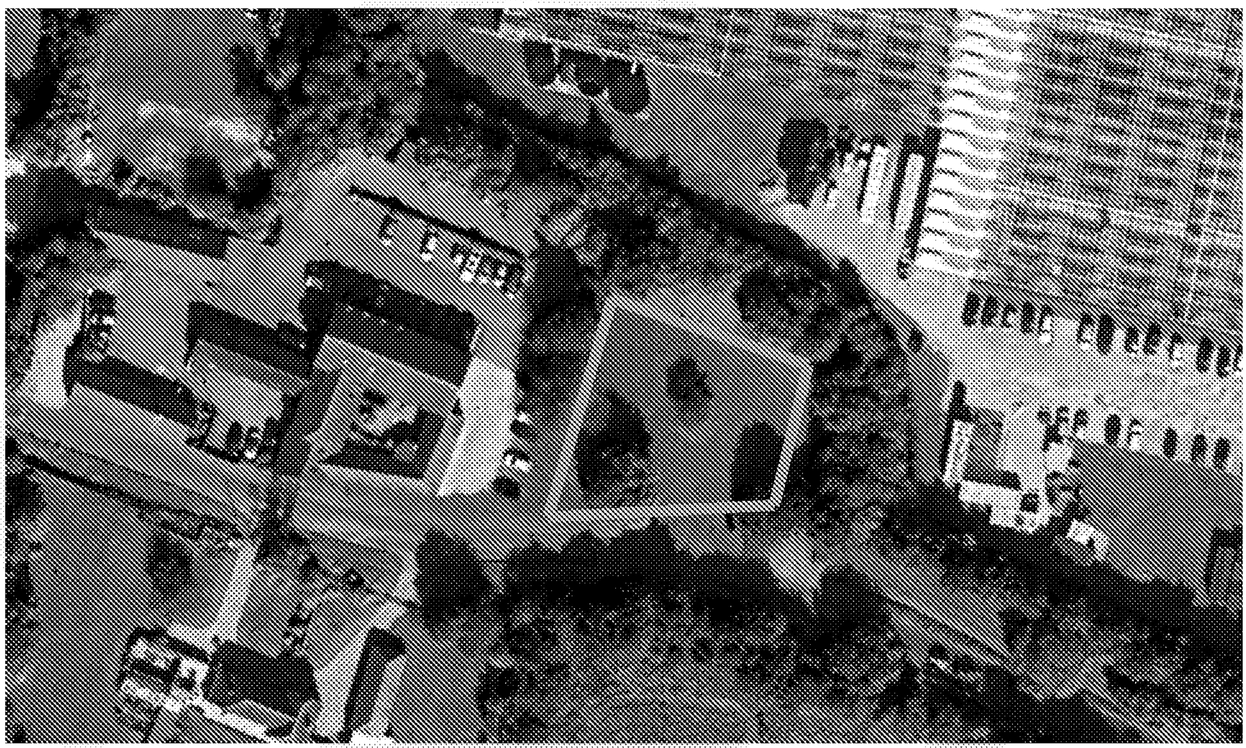


Fig 1 – Site location (From Google)

2.3 A Design and Access statement has been prepared by E Lawrence Ltd Planning Consultants which can be referred to for site description in more detail.

2.4 The site is within an area of London Clay at depth.

Fig 2 – Site bedrock geology (British Geological Society) – Site shown in red triangle

2.5 Superficial head and river deposits lie upon the London clay which offer good permeability through the medium for both rising and falling water.

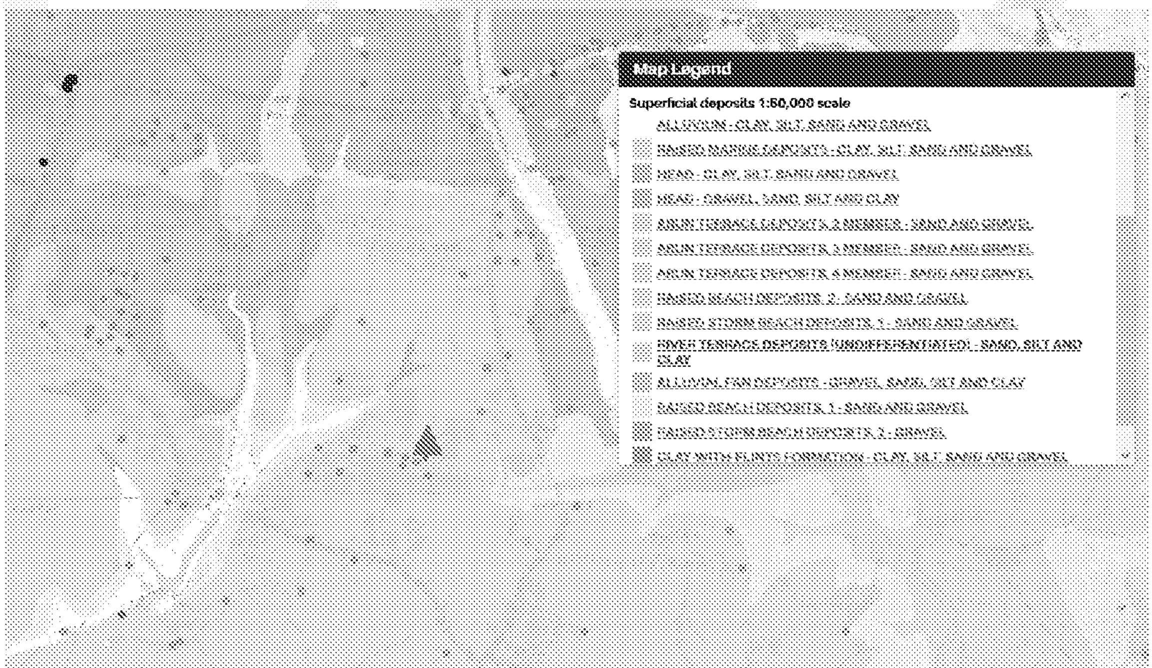


Fig 3 – Site superficial surface geology (British Geological Society) – Site shown in red triangle

2.6 The long-term Flood Risk was checked at https://check-long-term-flood-risk.service.gov.uk/risk# indicating the following categories for the address at Lake Lane PO22 0AL.

Rivers and Sea	**Very Low**	Low	Medium	High
Surface Water	**Very Low**	Low	Medium	High
Groundwater	**Unlikely**			
Reservoirs	**Unlikely**			

2.7 An overview of the SFRA and desktop research for historical flooding has been undertaken, with the findings indicated below. The following sources of flooding have been considered: Fluvial/Tidal, Surface Water, Sewer, Groundwater and Artificial sources.

2.8 From the National Planning Policy Framework (NPPF) Annex 3: Flood Risk vulnerability classification, the site classification for the proposed commercial is 'more vulnerable'. See tables below.

2.9 The site is wholly within a flood zone 1. The category for the '*more vulnerable*' site (shown in green below) indicates that the development can be permitted.

	Flood Risk Vulnerability Classification				
Flood Zone	**Essential Infrastructure**	**Highly Vulnerable**	**More Vulnerable**	**Less Vulnerable**	**Water Compatible**
1	✔	✔	✔	✔	✔
2	✔	**ETR**	✔	✔	✔
3a	**ETR**	✘	**ETR**	✔	✔
3b	**ETR**	✘	✘	✘	✔

ETR Exception Test is required
✔ Development is permitted
✘ Development is not permitted

2.10 River (Fluvial) & Coastal (Tidal) - Currently the site falls within Flood Zone 1 with no recorded or projected fluvial or tidal flooding.

2.11 The new site proposes to use the same ground levels as the existing and not interfere with the existing natural regime.

2.12 Surface Water (pluvial) – Surface Water flooding tends to occur due to poor maintenance of existing drainage features such as highway gullies, storm sewers, watercourses and culverts. The EA 'Risk of Flooding from Surface Water' map shown below indicates that the site is at low risk from surface water flooding with no recording of flooding upon the site from storm water.

2.13 Sewer – Sewer flooding occurs when intense rainfall overloads the sewer system capacity (surface water, foul or combined), and/or when sewers cannot discharge properly to watercourses due to high water levels. Sewer flooding can also be caused when problems such as blockages, collapses or equipment (such as pumps) failure occur in the sewerage system. Surface water inundation of manhole openings, entry of soil or groundwater into the sewer system via faults within the fabric of the sewerage system, is another cause of sewer flooding. Infiltration is often related to shallow groundwater, and may cause high flows for prolonged periods of time.

2.14 Southern Water records show 7 nr. sewer flooding incidents for the PO22 postcode area but none that are particular to the site.

2.15 Groundwater - Arun DC indicate groundwater maps upon their SFRA but in large pixels. The well known magic map website indicates similar groundwater risk and is shown below with the site location and key to pixellation. This area is shown to be at a medium to low risk of groundwater flooding.

Fig 4 – Groundwater map courtesy of Magic Maps – Site shown in red triangle

2.16 No recorded flooding has been recorded for this site. Groundwater flooding would be seen as water rising through the stratum. The SFRA indicates 44 nr. significant events of groundwater flooding reported in West Sussex in: -

- 1974, Winter 1993–1994
- Winter 2000–2001
- Winter 2002–2003,
- 2012 - Westergate/Barnham area
- 2013/14 – Westergate/Barnham area

- 2014 – Northfields Lane/Nyton Road/Level Mere Lane, Aldingbourne.

2.17 The SFRA shows the site is in excess of 500m from a zone III groundwater protection zone (GWPZ).

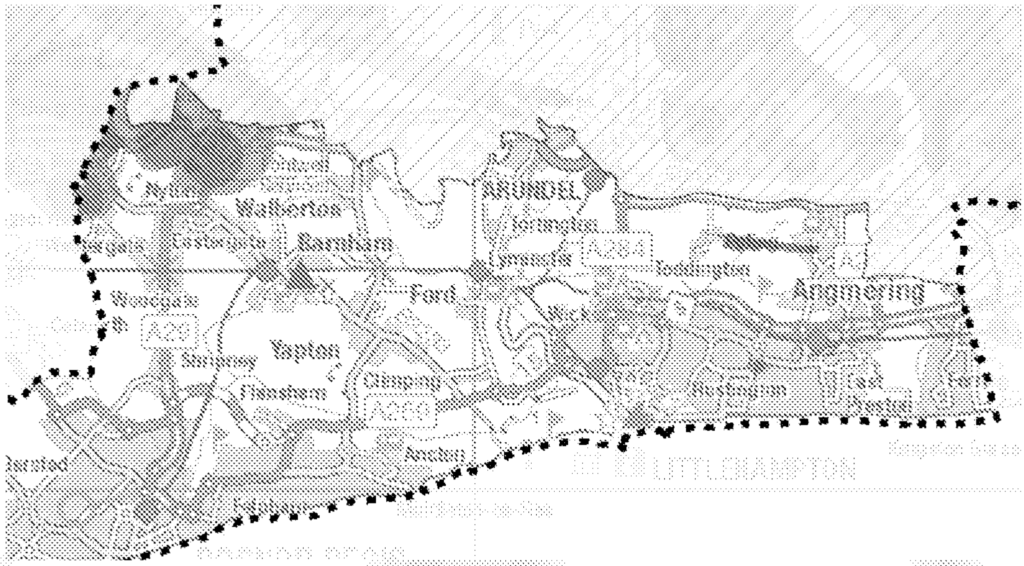


Fig 4 – Groundwater protection map (Extract from SFRA) – Site (red triangle)

2.18 Reservoirs – There are 3 nr reservoirs in the Arun District area; Swanbourne Lake, Bilsham Farm Reservoir and Pagham Reservoir all within the jurisdiction of the Solent and South Downs Environment Agency region and West Sussex County Council.

2.19 Canals - There is only one canal located within Arun District SFRA area, the Portsmouth to Arundel Canal, intersecting the centre of the SFRA district between Lidsey, Yapton and Ford. Given that this canal is disused, it is not considered further within this strategy document.

3.0 PROPOSED STORM WATER DRAINAGE STRATEGIES

4.1 The residential plot requires run off from roof, car parking and patio/footway areas to be drained.

4.2 The site areas are shown below:-

The existing greenfield site measures some 0.12 ha in area. It is located in flood zone 1 area for fluvial and tidal flooding. The proposed development offers the following areas:-

Red line boundary area	1233 sq.m
Predevelopment soft area	1233 sq.m
House roof area	260 sq.m
New car parking area	75 sq.m
Paving at front of houses	71 sq.m
Patios at rear of houses	62 sq.m
TOTAL IMPERMEABLE AREAS	468 sq.m
Soft areas	765 sq.m
TOTAL SITE AREA	1233 sq.m

4.3 Design should always steer storm water run-off to comply with the order of preference drainage hierarchy as outlined by Arun DC in their checklist (see below and Appendix H).

1. Rainwater reuse where possible.
2. Complete discharge into the ground (infiltration).
3. Hybrid infiltration and restricted discharge to an appropriate water body.
4. Restricted discharge to an appropriate water body.
5. Restricted discharge to a surface water sewer.
6. Restricted discharge to a combined sewer.

4.4 The strategies chosen embrace these tenets of design and endeavours to ensure their use through the required evidence.

4.5 The two strategy options offered for the outline application are described below.

Infiltration Drainage Strategy

4.6 In this strategy all roof areas, car parking and patios drain to an infiltration device, whether shallow geocrate soakaway or raingarden.

Infiltration rates - The design utilises infiltration which has been tested on site resulting in a design infiltration rate of 1.94×10^{-5} m/s. Spring groundwater monitoring has been carried out with levels recorded as shallow as 1.45m. A factored infiltration rate using a factor of safety of 1.5. It is acknowledged that further winter monitoring is required to confirm the design suitability.

The roof downpipes at the rear of the houses will drop to low level channels with a rain diverter to a 210 lit water butt. The channel will then drain to a raingarden of 150mm depth and area of 20% of the contributing roof as required in the UK Raingarden Design Guidance.

Geocrate Soakaway - The soakaways located beneath the parking areas will assist in draining the parking bays and front portion of the house roofs. They will be shallow and a max of 500mm in depth. Their proximity to the new houses has been shown to not affect foundations where they are shallow as outlined in the CIRIA technical data sheet in Appendix G.

Raingardens - The raingardens will be max 150mm in depth and planted with various species as listed below. The area of the garden will match the 20% of the contributing roof area of 5 sq.m as a minimum but must be 7.5 sq.m to offer the 100 year + 45% climate change event.

Piped Storm Connection Strategy

4.7 In the event that infiltration strategy is obviated by high winter groundwater levels or poor porosity testing, then the run off can be drained with a piped system draining to a local culvert (shown in Appendix J) near the back of the site with offline attenuation storage. Upstream surface areas could be positively drained by gullies or permeable tanked areas could be introduced with underdrains to then feed to the outlets.

QBar rate - The Q bar rate is the established greenfield run off rate from the site. Arun require this rate to be that apportioned to the impermeable run off and not the whole site. As the impermeable run off area is only 468 sq.m, the Q bar rate of 0.11 lit/sec is very low and impracticable to achieve. Therefore, the outflow is controlled with a manufacturer of flow control device able to achieve a rate of 0.7 lit/sec.

Roof - The roof downpipes from the front of the houses shall be drained through a system of pipes and catchpits which connect to the positive storm drainage connection from the site. The roof downpipes at the rear of the houses will drop to drain with a rain diverter to a 210 lit water butt.

Geocrate Attenuation - The geocell attenuation tank provides the 100 year + 45% climate change event storage required for the outflow from the site of 0.7 lit/sec, established as 72 cu.m. This volume is provided in a 1.0m deep ceocellular module arrangement wrapped with an impermeable membrane. The tank will be required to overcome flotation due to probable high winter groundwater levels.

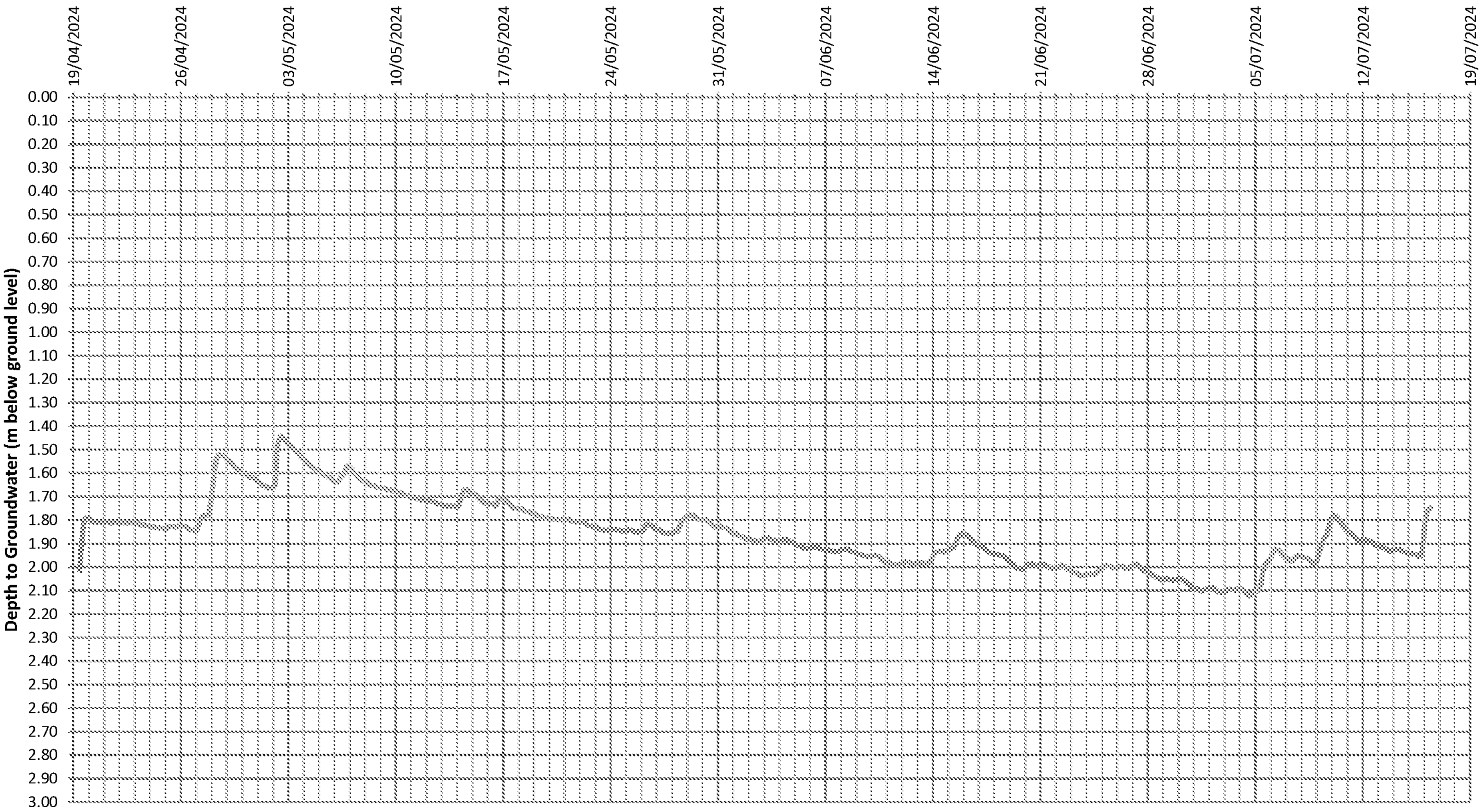
4.8 This strategy demonstrates that the development will be safe, without increasing flood risk elsewhere, and, where possible, will reduce flood risk overall.

Appendix A - Groundwater Monitoring results

Ashdown Site Investigation Limited

Site: Sussex Business Village, Lake Lane, Barnham, Bognor Regis, West Sussex	Project No. P16591

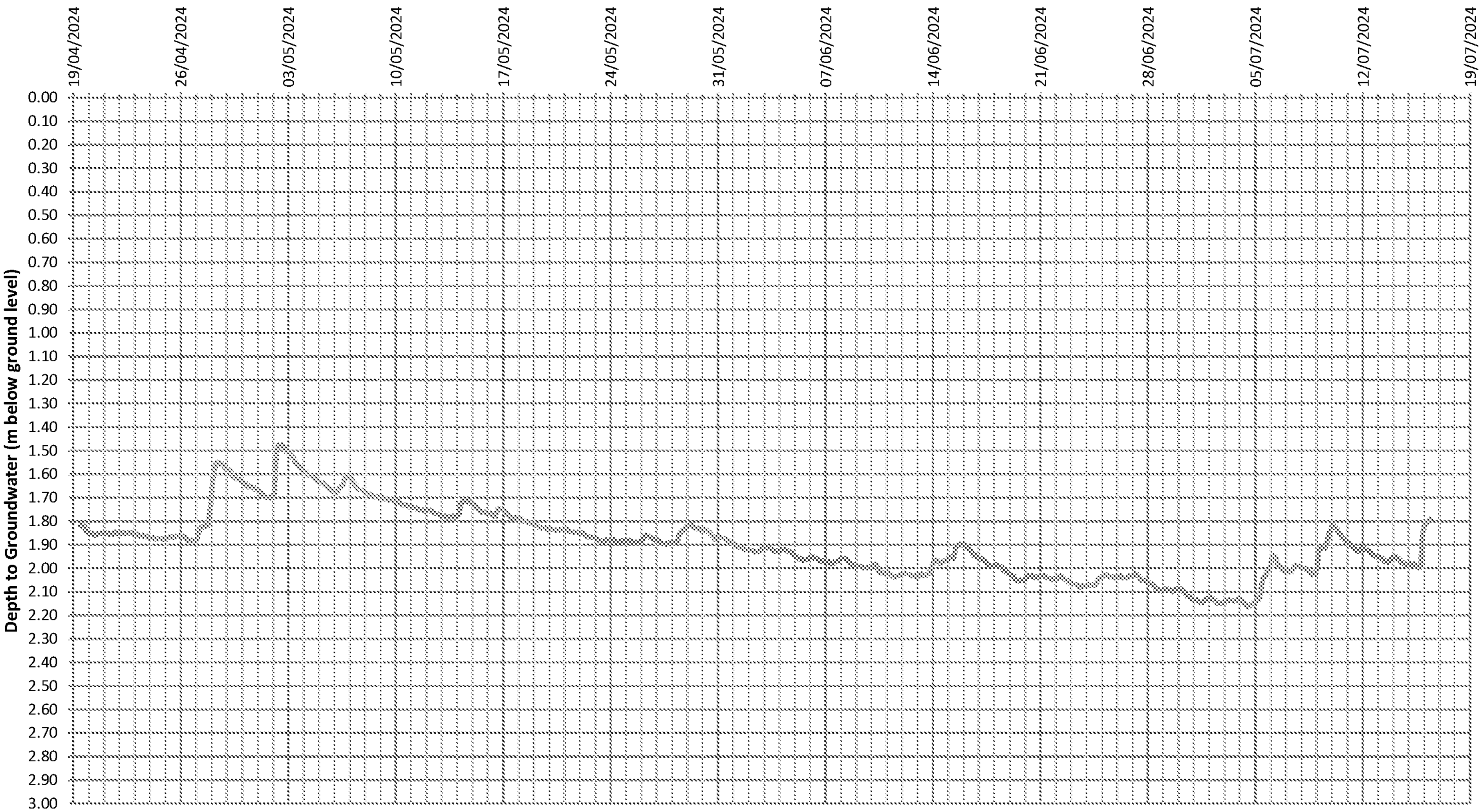
Groundwater Monitoring Results - WS01

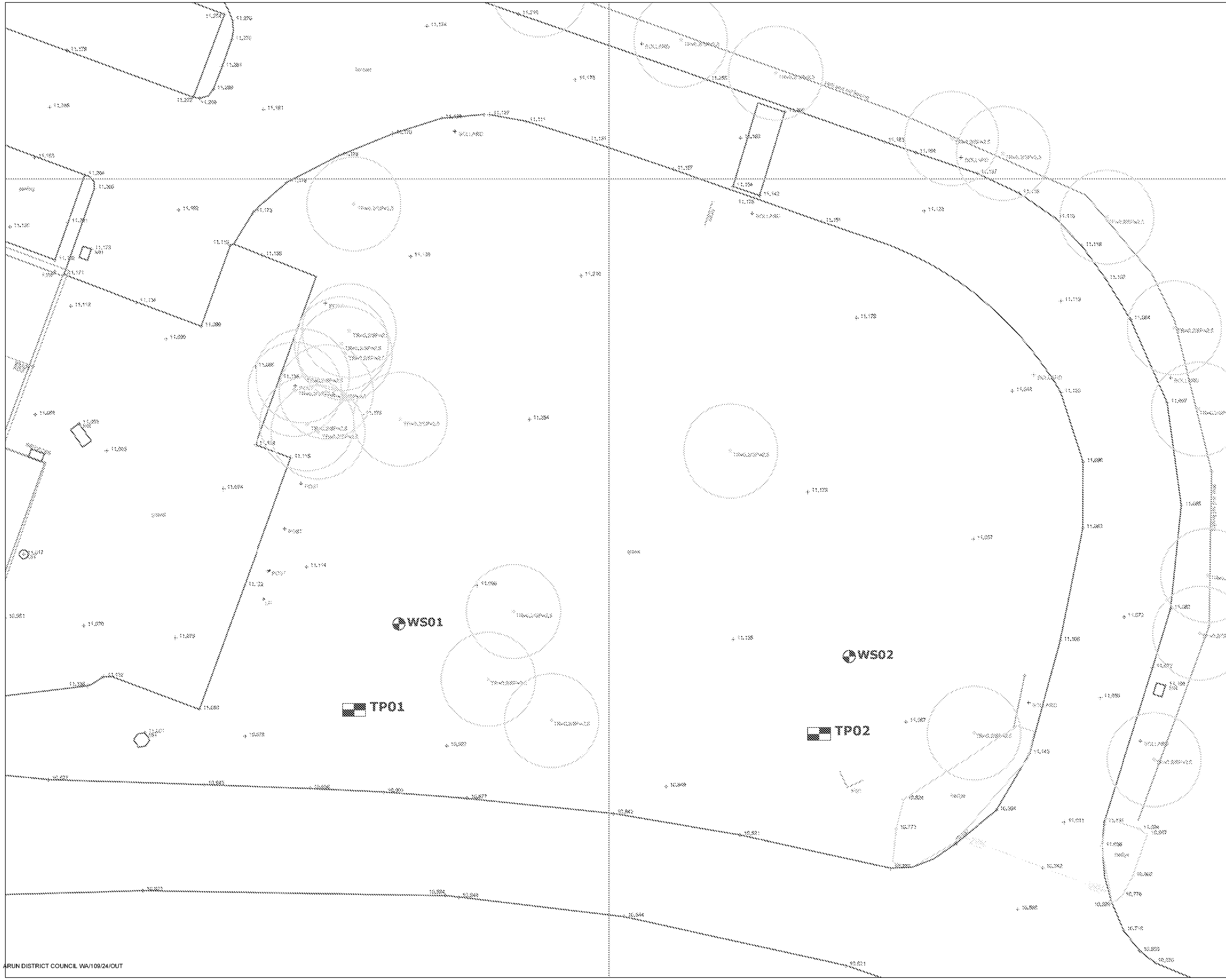


Ashdown Site Investigation Limited

Site: Sussex Business Village, Lake Lane, Barnham, Bognor Regis, West Sussex	Project No. P16591

Groundwater Monitoring Results - WS02





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Site:	Sussex Business Village Lake Lane Barnham West Sussex
Project Ref:	P16591
Figure No.	2
Drawing Title	Site Plan
Scale	NTS

Appendix B - Porosity testing results

ASHDOWN SITE INVESTIGATION LIMITED

Sussex Business Village
Lake Lane
Barnham

In Situ Infiltration Test Report

Report Beneficiary:
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Project Reference: P16591

Report Reference: R16187

Document Control			
Issue No.	**Status**	**Issue Date**	**Notes**
1	Final	3rd May 2024	

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FIGURES AND APPENDICES

1. INTRODUCTION

Ashdown Site Investigation Ltd was requested to undertake in situ infiltration testing and groundwater monitoring at Sussex Business Village, Lake Lane, Barnham, West Sussex.

The specific objectives of the works were to:

a) Investigate the shallow ground and groundwater conditions at the specified locations;
b) Undertake in situ infiltration testing in the specified locations and provide calculated infiltration rates to assist other with the drainage design; and
c) Undertake groundwater monitoring between April and July 2024.

The scope of the works covered by this report, and the terms and conditions under which they were undertaken, were set out within the offer letter Q13931, dated 12th March 2024. The instruction to proceed was received on from the client.

2. SITE CONTEXT

2.1 Site Location

The site is located at Sussex Business Village, Lake Lane, Barnham, West Sussex, and is centred on the approximate Ordnance Survey national grid reference 497310, 104580. A site location plan and site plan are presented as Figure 1 and Figure 2, respectively.

2.2 Geological and Hydrogeological Data

2.2.1 Expected Geology and Aquifer Designation

The stratigraphic succession that may be expected to underlie the site has been established by reference to British Geological Survey (BGS) mapping and the BGS Lexicon of Named Rock Units. The expected stratigraphy is presented in the following table.

Table 1. Expected Strata and Aquifer Designation

Type	Stratum	Aquifer Designation
Superficial	River Terrace Deposits	Secondary A Aquifer
Bedrock	London Clay Formation	Unproductive Stratum

The River Terrace Deposits in this area were formerly denoted as the Brickearth and comprises brown sandy (fine) silt or clay largely originating from the solution weathering of the previously existing chalk. The material will have been reworked by water flow to produce some lateral variability in the grain size of the soil (sand and gravel) and can be expected to contain a variable content of flint.

The London Clay Formation forms part of the Thames Group. The formation is of Ypresian age (47.8 to 56 million years old; Early Eocene). The London Clay Formation mainly comprises bioturbated or poorly laminated, blue-grey or grey-brown, slightly calcareous, silty to very silty clay, clayey silt and sometimes silt, with some layers of sandy clay. It commonly contains thin courses of carbonate concretions ('cementstone nodules') and disseminated pyrite. It also includes a few thin beds of shells and fine sand partings or pockets of sand, which commonly increase towards the base and towards the top of the formation. At the base, and at some other levels, thin beds of black rounded flint gravel occurs in places. Glauconite is present in some of the sands and in some clay beds, and white mica occurs at some levels. The formation is recorded by the BGS to range in thickness up to 150m.

2.2.2 Groundwater Source Protection Zones (SPZ)

The Environment Agency defines SPZs as those areas where groundwater supplies are at risk from potentially polluting activities and accidental releases of pollutants. SPZs are primarily a policy tool used to control activities close to water supplies intended for human consumption.

The site does not lie within a SPZ.

3. SITE WORKS

The intrusive site works included the excavation of two hand dug trial pits, designated TP01 and TP02, to depths of 0.62m and 0.60m below ground level respectively. Two boreholes, denoted WS01 and WS02, were drilled using a dynamic sampler to a depth of 3.00m below ground level. The intrusive work was carried out on 19th April 2024. The exploratory hole locations are shown on Figure 2.

Falling head soakage tests were undertaken in the trial pits in general accordance with the test methodology given by BRE guidance[1].

Standpipes were installed on completion of boreholes WS01 and WS02, and dataloggers installed in the standpipes to enable groundwater monitoring to be undertaken up until July 2024. The data loggers were programmed to collect readings at 1-hour intervals. The results of the groundwater monitoring will be issued on completion of the monitoring period.

Descriptions of the strata encountered and comments on groundwater conditions are shown in the exploratory hole records given in the appendices to this report, together with notes to assist in their interpretation. The results of the in situ infiltration testing are also included in the appendices.

[1] Section 3.2.3 of Building Research Establishment (BRE) Digest 365, 2016.

4. GROUND CONDITIONS

4.1 Stratigraphy

4.1.1 Surface Covering

Each of the exploratory holes was excavated through a surface cover of topsoil.

4.1.2 Made Ground/Reworked Soils

Made ground, generally comprising gravelly/slightly gravelly, slightly sandy silty clay, was recorded to the full depths of the shallow trial pits and to a similar depth within the boreholes of around 0.60m below ground level. The gravel fraction comprised variable quantities of flint, brick, concrete, chalk, charcoal -like material, and wood fragments. Cobbles of flint and a large boulder of concrete was noted within these soils in trial pit TP02.

4.1.3 River Terrace Deposits

Underlying the made ground/reworked soils, where penetrated, the boreholes progressed into undisturbed silty clay deposits becoming clayey sands at depth.

These deposits, considered to represent the River Terrace Deposits indicated to underlie the site on BGS geological maps, continued to the full depth of the boreholes.

4.2 Stability

With the exception of borehole WS01, which was unstable in the coarse grained soils encountered at depth, each of the exploratory holes was recorded to remain stable during the course of drilling/excavation.

4.3 Groundwater Conditions

The shallow trial pits were recorded to be dry on completion of excavation.

Groundwater was recorded at depths of 2.16m and 1.83m below ground level on completion of the standpipe installations within boreholes WS01 and WS02, respectively.

It should be noted that water levels within the exploratory holes may not have equilibrated with the groundwater table at the time the readings were recorded and that groundwater levels should be expected to fluctuate seasonally.

The results of the groundwater monitoring will be issued separately on completion of the three-month monitoring period.

5. STORMWATER INFILTRATION SYSTEMS

In-situ infiltration testing[2] was carried out in trial pits TP01 and TP02.

For each test in trial pit TP02 the soil infiltration rate (f) was calculated by dividing the volume of water lost between 75% and 25% of the initial test depth by the sum of the average surface area of the sides of the trial pit in contact with the water during the test monitoring period, and its base area. This figure was then divided by the test duration (time taken for the water level to fall between 75% and 25% of the initial test depth) to give the soil infiltration rate in metres per second.

During the test performed within trial pit TP01, the water level within the test pit did not fall below 25% of the initial test depth and calculation of the soil infiltration rates in accordance with the BRE digest was not possible. For this test, the soil infiltration rate has therefore been calculated by dividing the volume of water lost during the test by the product of the average surface area of the trial pit in contact with water during the test period and the test duration in seconds.

The infiltration rates derived from the tests are summarised in the following table.

Table 2. Calculated Infiltration Rates

Exploratory Hole	Test Response Zone Depth (m)		Stratum	Infiltration Rate (f) (m/sec)
	Top	Bottom		
TP01 Test 1	0.30	0.62	Made Ground	6.70×10^{-6}
TP02 Test 1	0.29	0.60	Made Ground	3.27×10^{-5}
TP02 Test 2	0.27	0.60	Made Ground	2.23×10^{-5}
TP02 Test 3	0.30	0.60	Made Ground	1.62×10^{-5}

The value 'f' is equivalent to the soil infiltration coefficient 'q' quoted in the Construction Industry Research and Information Association (CIRIA) Report 156.

The results from the infiltration tests should be provided to engineers responsible for the design of the drainage system.

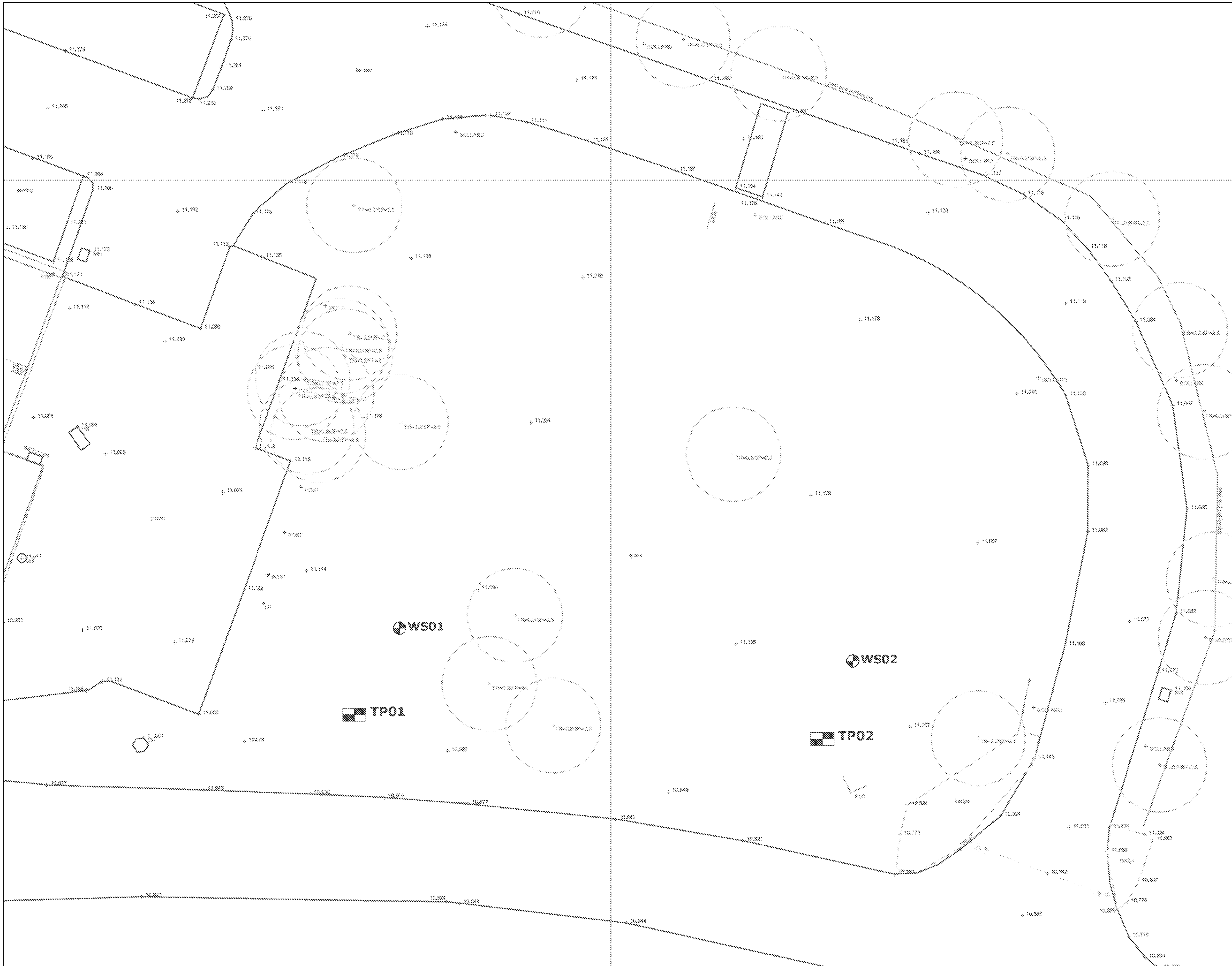
To comply with building regulations[3], point discharging infiltration systems (conventional ring or trench soakaways) are required to be constructed a minimum of 5.0m away from proposed or existing buildings.

Ashdown Site Investigation Ltd.

[2] Conducted in general accordance with the requirements of BRE 365, Soakaway Design.
[3] The Building Regulations 2010; Part H; Drainage and Waste Disposal

FIGURES AND APPENDICES

ASHDOWN SITE INVESTIGATION LIMITED	Site Name	Figure No.	Project Reference
Site Location Plan	Sussex Business Village, Lake Lane, Barnham, West Sussex	1	P16591



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Site:	Sussex Business Village Lake Lane Barnham West Sussex
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Explanatory Notes

Symbols and abbreviations on Exploratory Hole Records

Samples

U	'Undisturbed' Sample: - 100mm diameter by 450mm long. The number of blows to drive in the sampling tube is shown after the test index letter in the SPT column.
Pi	Piston Sample: 'Undisturbed' sample 100mm diameter by 600mm long.
D	Disturbed Sample
R	Root Sample
B	Bulk Disturbed Sample
W	Water Sample
ES	Environmental Suite (on older records may be referenced J T)

In Situ Testing

S	Standard penetration test (SPT): Using the split spoon sampler.
C	Standard Penetration Test (SPT): Using a solid cone instead of the sampler – conducted usually in coarse grained soils or weak rocks.
V	Shear Vane Test: Undrained shear strength (cohesion) (kN/m^2) shown within the Vane/Pen Test and N Value column.
H	Hand penetrometer Test: Undrained shear strength (cohesion) (kN/m^2) shown within the Vane/Pen Test and N Value column.
P	Perth Penetrometer Test: Number of blows for 300mm penetration shown under Vane/Pen Test and N Value column.

Excavation Method

CP	Cable Percussion Borehole
RC	Rotary Cored Borehole
WLS	Dynamic Sampler Borehole using windowless sampler tubes
WS	Dynamic Sampler Borehole using window sampler tubes
TP	Trial Pit excavated using mechanic excavator
HDP	Trial Pit excavated using hand tools

Soil Description

Description and classification of soils has been carried out using as a general basis the British Standard Geotechnical investigation and testing – Identification and classification of soil, Part 1 Identification and description (BS EN ISO 14688-1) and Part 2 Principles of classification (BS EN 14688-2) as well as the BS5930 code of Practice for Ground Investigations.

Rock Description

Description and classification of rocks has been carried out using as a general basis the British Standard Geotechnical investigation and testing – Identification and classification of rock, Part 1 Identification and classification (BS EN ISO 14689-1) as well as the BS5930 code of Practice for Ground Investigations. TCR – Total Core Recovery, SCR – Solid Core Recovery, RQD – Rock Quality Designation, NI – Non Intact, If – indicative fracture spacing (min/ave/max), FI – Fracture Index.

Chalk Description

Chalk description is based on BS EN ISO 14688, BS EN ISO 14689 and BS5930. The classification of chalk generally follows the guidance offered by the Construction Industry Research and Information Association (CIRIA) C574, 'Engineering in Chalk'. This is based on assessment of chalk density, discontinuity and aperture spacing, and the proportion of intact chalk to silt of chalk.

In Situ Strength Testing

Standard penetration testing (SPT) carried out in accordance with BS EN ISO 22476-3:2005.

Continuous dynamic probe testing conducted using a super heavy DPSH-B (As defined by BS EN ISO 22476-2:2005) probing geometry. The DPSH-B configuration is similar to that of the standard penetration test (SPT); the main differences being that the tip comprises a 90° cone, the driving rods are lighter than those used for SPT testing and the blow counts are recorded over 100mm increments rather than 300mm, as is the case for the SPT.

Perth penetrometer tests carried out in accordance with Australian Standard AS 1289:6.3.3-1997, Method of Testing Soils for Engineering Purposes; no equivalent European or British Standard having been published to date.

Undrained shear strength determinations made in-situ using a Geonor hand shear vane or a hand penetrometer.

Testing to determine the in-situ California Bearing Ratio (CBR) of soils conducted at shallow depths using a hand-held Transport Research Laboratory (TRL) cone penetrometer.

ASHDOWN SITE INVESTIGATION LIMITED

[redacted]

Site Name: Sussex Business Village, Lake Lane, Barnham, West Sussex

Job Number: P16591

Start Date: 19/04/2024

End Date: 19/04/2024

Borehole Number: **WS01**

Sheet 1 of 1

Standpipe	Samples and In Situ Testing: Sample/ Test Type	Depth From (m)	Depth To (m)	Test Result	Dynamic Probe (0 5 10 15 20 25 30)	Legend	Depth	Stratum Description
							0.00	Topsoil over, MADE GROUND: Brown gravelly silty clay. Gravel is subangular to subrounded fine to coarse flint, brick and rare chalk.
	D	0.20						
							0.35	MADE GROUND/REWORKED: Brown silty clay with occasional iron staining and rootlets.
							0.60	Brown and orange brown mottled silty CLAY with rare black iron staining. (River Terrace Deposits)
								becoming orange brown mottled below 1.00m depth.
	D	1.30						
								with rare fine gravel of flint below 2.00m depth.
	D	2.60						becoming sandy below 2.60m depth.
	D	2.95					2.95	Light brown and brown slightly gravelly clayey SAND. Gravel is subangular to subrounded fine flint. (River Terrace Deposits)
							3.00	End of borehole at 3.00m

Remarks

Groundwater: Groundwater recorded at 2.16m depth on completion of standpipe installation.

Stability: Borehole collapsed to 2.70m depth on completion.

Notes: Standpipe installed to 2.70m depth; 2.70m to 1.70m slotted pipe with gravel surround; 1.70m to ground level plain pipe with bentonite seal; completed with end cap and security cover concreted flush with ground surface.

Excavation Method: WLS

Borehole Diameter: Various

Made By: GRD

ASHDOWN SITE INVESTIGATION LIMITED

[redacted]

Site Name: Sussex Business Village, Lake Lane, Barnham, West Sussex

Job Number: P16591

Start Date: 19/04/2024

End Date: 19/04/2024

Borehole Number: **WS02**

Samples and In Situ Testing

Sample/ Test Type	Depth From (m)	Depth To (m)	Test Result
D	0.20		
D	0.90		
D	1.50		
D	2.70		
D	2.95		

Dynamic Probe: 0 5 10 15 20 25 30

Depth	Stratum Description
0.00	Topsoil over, MADE GROUND/REWORKED: Dark brown slightly gravelly slightly sandy silty subangular to subrounded fine to medium gravel of flint and rare brick.
0.40	MADE GROUND/REWORKED: Brown and light brown silty clay with occasional black speckling, dark brown/black iron staining and rootlets.
0.60	Brown and orange brown mottled silty CLAY with occasional iron staining. (River Terrace Deposits) with a band of flints at 2.55m depth.
2.60	Light brown slightly gravelly sandy silty CLAY with occasional iron staining. Gravel is subangular to subrounded fine to medium flint. (River Terrace Deposits)
2.90	Light brown clayey SAND with occasional iron staining. (River Terrace Deposits)
3.00	End of borehole at 3.00m

Remarks

Groundwater: Groundwater recorded at 1.83m depth on completion of standpipe installation.

Stability: Borehole stable on completion.

Notes: Standpipe installed to 3.00m depth; 3.00m to 2.00m slotted pipe with gravel surround; 2.00m to ground level plain pipe with bentonite seal; completed with end cap and security cover concreted flush with ground surface.

Excavation Method: WLS

Borehole Diameter: Various

Made By: GRD

ASHDOWN SITE INVESTIGATION LIMITED

[redacted]

Site Name: Sussex Business Village, Lake Lane, Barnham, West Sussex	
Job Number: P16591	
Start Date: 19/04/2024	**Trial Pit Number:** **TP01** Sheet 1 of 1
End Date: 19/04/2024	

Samples and In Situ Testing						
Sample/ Test Type	Depth From (m)	Depth To (m)	Test Result	Legend	Depth/ Reduced Level	Stratum Description
D	0.05				0.00	Topsoil with rare subangular to subrounded fine to medium gravel of flint.
					0.10	MADE GROUND: Brown gravelly slightly sandy clay. Gravel is subangular to subrounded fine to coarse brick, flint, chalk and charcoal-like material.
D	0.45					
					0.62	End of trial pit at 0.62m

Remarks

Groundwater: Trial pit dry on completion.

Stability: Trial pit stable on completion.

Notes: n/a

Excavation Method:	HDP
Pit Length:	1.04m
Pit Width:	0.33m
Made By:	GRD

ASHDOWN SITE INVESTIGATION LIMITED

[redacted]

Site Name: Sussex Business Village, Lake Lane, Barnham, West Sussex

Job Number: P16591

Start Date: 19/04/2024
End Date: 19/04/2024

Trial Pit Number: **TP02**

Sample/ Test Type	Depth From (m)	Depth To (m)	Test Result	Legend	Depth/ Reduced Level	Stratum Description
					0.00	Topsoil over, MADE GROUND: Dark brown slightly gravelly silty clay. Gravel is subangular to subrounded fine to coarse flint, concrete, brick and charcoal-like material. with a concrete boulder at 0.30m depth.
D	0.20					
					0.40	MADE GROUND/REWORKED: Brown and orange brown slightly gravelly silty clay. Gravel is subangular to subrounded fine to coarse flint and charcoal-like material with rare concrete and wood/root fragments. With occasional cobbles of flint.
D	0.50					
					0.60	End of trial pit at 0.60m

Remarks

Groundwater: Trial pit dry on completion.

Stability: Trial pit stable on completion.

Notes: n/a

Excavation Method: HDP

Pit Length: 1.06m

Pit Width: 0.33m

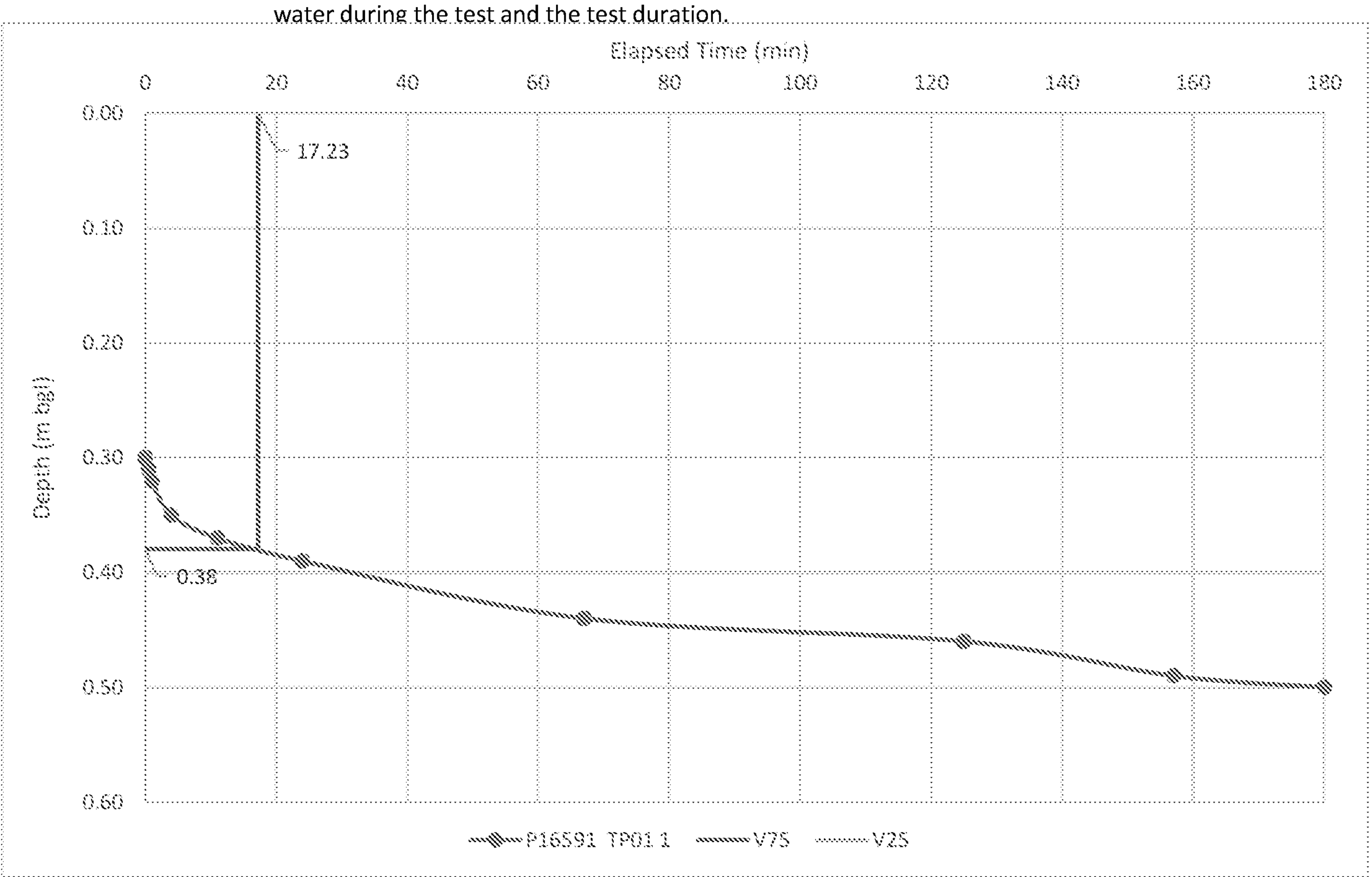
Made By: GRD

Infiltration Test Results

Test Position	TP01
Test No.	1
Project No.	P16591
Project Name	Sussex Business Village, Lake Lane, Barnham, West Sussex

Width of Pit	0.33	m	W
Length of Pit	1.04	m	L
Depth of Pit	0.62	m	D
Pit type	Open		
Volume of water introduced into pit	0.107	m^3	
Initial head of water	0.32	m	h_o
Water level at start of test	0.30	m	
Water level at end of test	0.50	m	
Volume of water discharged from pit	0.067	m^3	
Duration of test	180	min	
Average soaked surface area	0.93	m^2	
Time for water level to fall to 75% of initial head	17.23	min	t_{p75}
Time for water level to fall to 25% of initial head	Not reached	min	t_{p25}
Depth to water at 75% of initial head	0.38	m	d_{75}
Depth to water at 25% of initial head	Not reached	m	d_{25}
Time for the water level to fall from 75% to 25% of initial head	Not reached	min	t_{p75-25}
Effective storage volume of water in the soakage trial pit between 75% and 25% of initial head	Not reached	m^3	V_{p75-25}
Internal surface area of the soakage trial pit up to 50% of initial head and including the base area	0.77	m^2	a_{s50}
Infiltration rate	**6.70E-06**	**m/sec**	**f**

Calculation method: The water level did not fall below 25% of the effective storage depth. 'f' has been calculated by dividing the volume of water lost during the test by the product of the average surface area in contact with water during the test and the test duration.

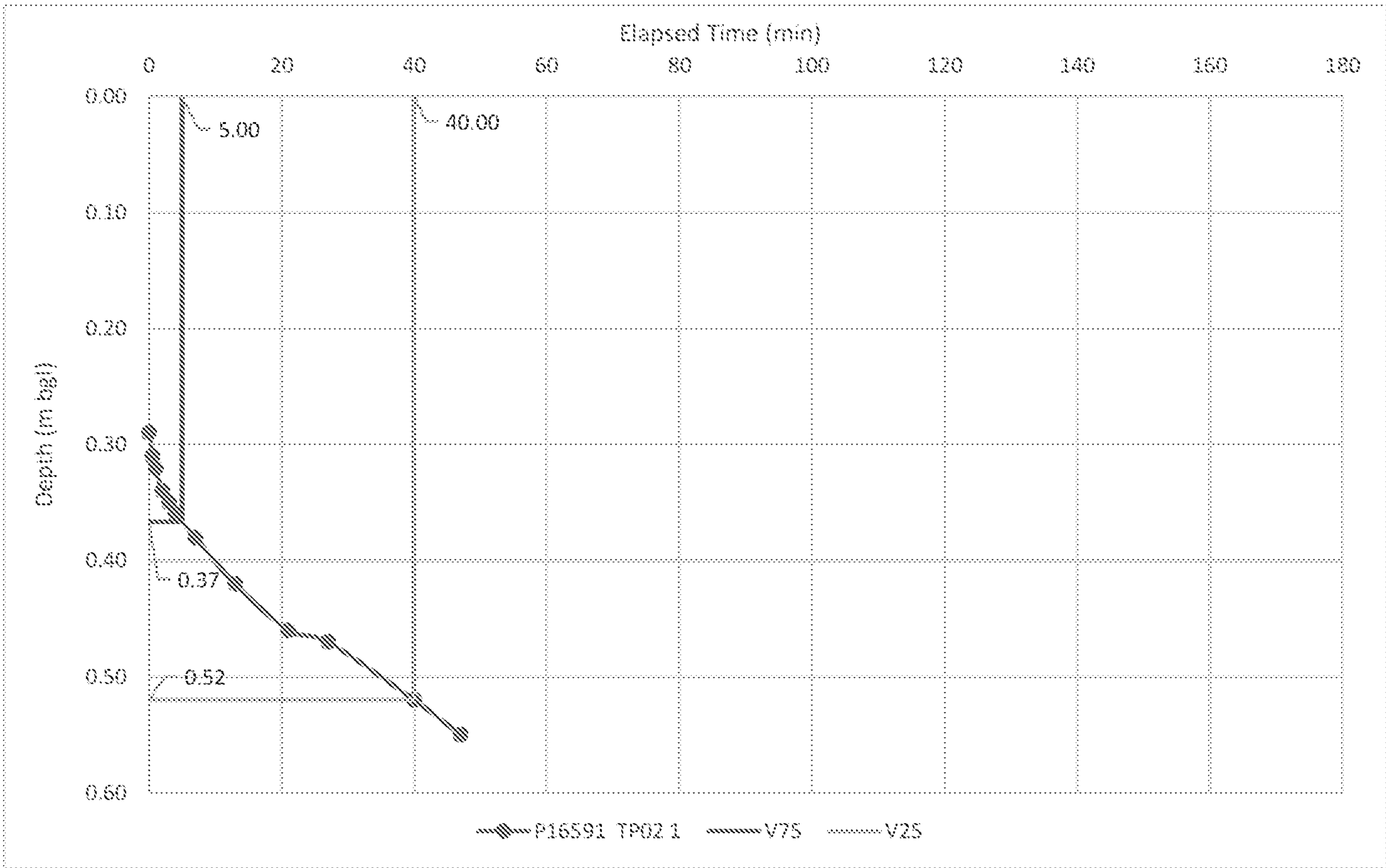


Infiltration Test Results

Test Position	TP02
Test No.	1
Project No.	P16591
Project Name	Sussex Business Village, Lake Lane, Barnham, West Sussex

Width of Pit	0.33	m	W
Length of Pit	1.06	m	L
Depth of Pit	0.60	m	D
Pit type	Open		
Volume of water introduced into pit	0.105	m^3	
Initial head of water	0.31	m	h_o
Water level at start of test	0.29	m	
Water level at end of test	0.55	m	
Volume of water discharged from pit	0.089	m^3	
Duration of test	47	min	
Average soaked surface area	0.83	m^2	
Time for water level to fall to 75% of initial head	5.00	min	t_{p75}
Time for water level to fall to 25% of initial head	40.00	min	t_{p25}
Depth to water at 75% of initial head	0.37	m	d_{75}
Depth to water at 25% of initial head	0.52	m	d_{25}
Time for the water level to fall from 75% to 25% of initial head	35.00	min	t_{p75-25}
Effective storage volume of water in the soakage trial pit between 75% and 25% of initial head	0.053	m^3	V_{p75-25}
Internal surface area of the soakage trial pit up to 50% of initial head and including the base area	0.77	m^2	a_{s50}
Infiltration rate	**3.27E-05**	**m/sec**	**f**

Calculation method: BRE 365

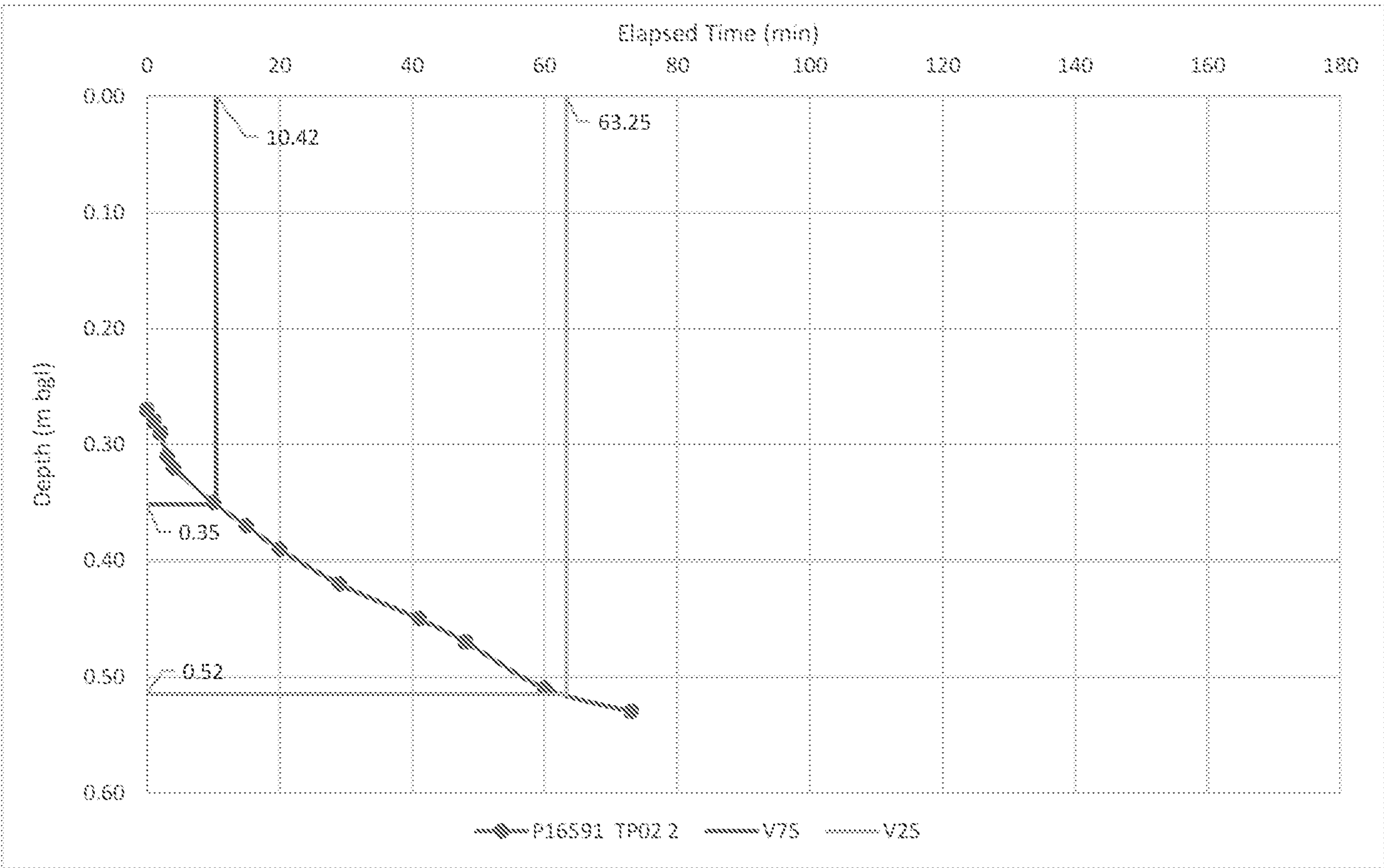


Infiltration Test Results

Test Position	TP02
Test No.	2
Project No.	P16591
Project Name	Sussex Business Village, Lake Lane, Barnham, West Sussex

Width of Pit	0.33	m	W
Length of Pit	1.06	m	L
Depth of Pit	0.60	m	D
Pit type	Open		
Volume of water introduced into pit	0.112	m^3	
Initial head of water	0.33	m	h_o
Water level at start of test	0.27	m	
Water level at end of test	0.53	m	
Volume of water discharged from pit	0.089	m^3	
Duration of test	73	min	
Average soaked surface area	0.89	m^2	
Time for water level to fall to 75% of initial head	10.42	min	t_{p75}
Time for water level to fall to 25% of initial head	63.25	min	t_{p25}
Depth to water at 75% of initial head	0.35	m	d_{75}
Depth to water at 25% of initial head	0.52	m	d_{25}
Time for the water level to fall from 75% to 25% of initial head	52.83	min	t_{p75-25}
Effective storage volume of water in the soakage trial pit between 75% and 25% of initial head	0.056	m^3	V_{p75-25}
Internal surface area of the soakage trial pit up to 50% of initial head and including the base area	0.79	m^2	a_{s50}
Infiltration rate	**2.23E-05**	**m/sec**	f

Calculation method: BRE 365



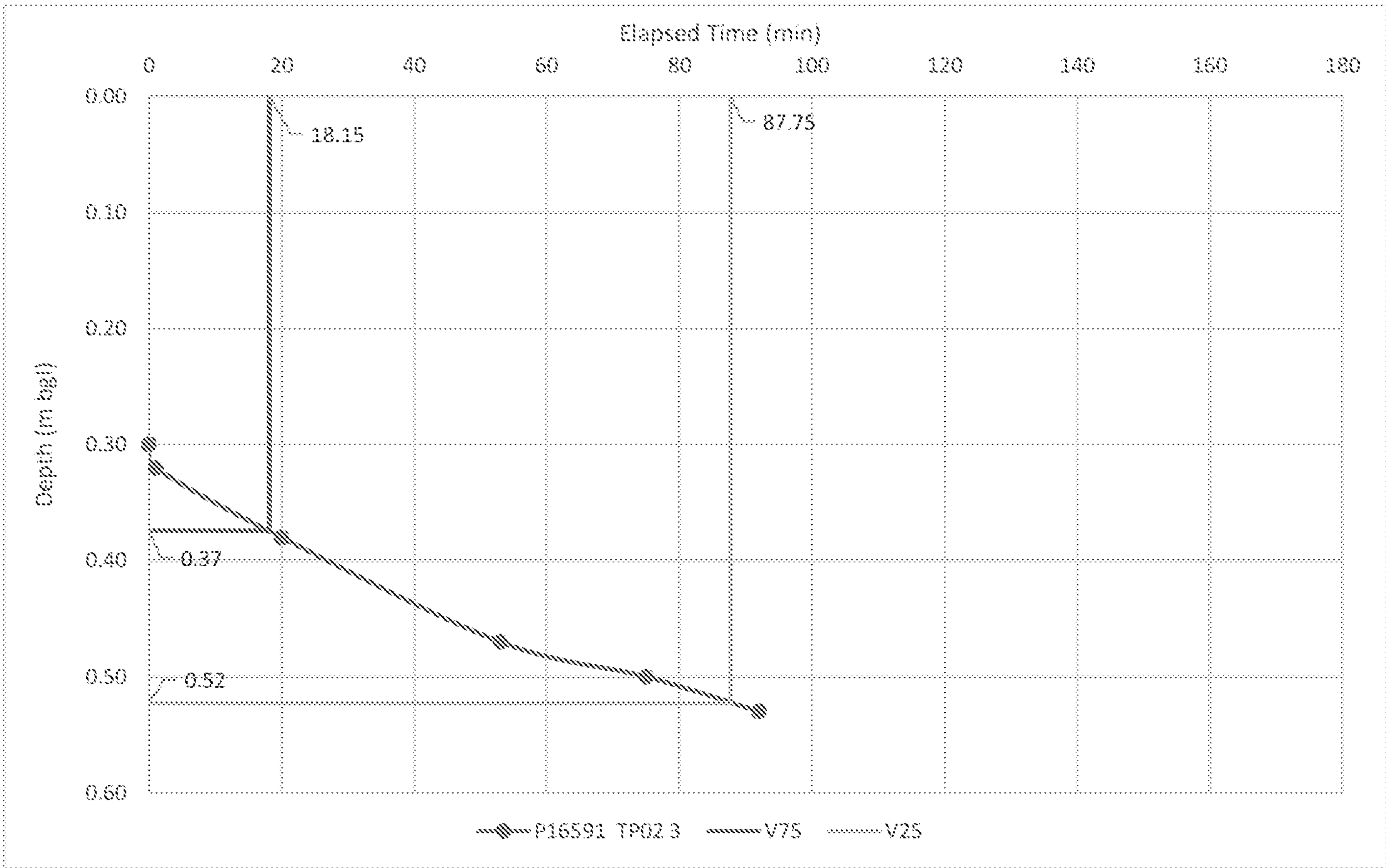
Infiltration Test Results

Test Position	TP02
Test No.	3
Project No.	P16591
Project Name	Sussex Business Village, Lake Lane, Barnham, West Sussex

Width of Pit	0.33	m	W
Length of Pit	1.06	m	L
Depth of Pit	0.60	m	D
Pit type	Open		

Volume of water introduced into pit	0.102	m^3	
Initial head of water	0.30	m	h_o
Water level at start of test	0.30	m	
Water level at end of test	0.53	m	
Volume of water discharged from pit	0.079	m^3	
Duration of test	92	min	
Average soaked surface area	0.84	m^2	
Time for water level to fall to 75% of initial head	18.15	min	t_{p75}
Time for water level to fall to 25% of initial head	87.75	min	t_{p25}
Depth to water at 75% of initial head	0.37	m	d_{75}
Depth to water at 25% of initial head	0.52	m	d_{25}
Time for the water level to fall from 75% to 25% of initial head	69.60	min	t_{p75-25}
Effective storage volume of water in the soakage trial pit between 75% and 25% of initial head	0.051	m^3	V_{p75-25}
Internal surface area of the soakage trial pit up to 50% of initial head and including the base area	0.75	m^2	a_{s50}
Infiltration rate	**1.62E-05**	**m/sec**	**f**

Calculation method: BRE 365



Appendix C - Greenfield Run-off rate

Greenfield runoff rate estimation for sites

www.uksuds.com | Greenfield runoff tool

Calculated by:	Simon Dent
Site name:	Sussex Business Centre
Site location:	Lake Lane Barnham

This is an estimation of the greenfield runoff rates that are used to meet normal best practice criteria in line with Environment Agency guidance "Rainfall runoff management for developments", SC030219 (2013) , the SuDS Manual C753 (Ciria, 2015) and the non-statutory standards for SuDS (Defra, 2015). This information on greenfield runoff rates may be the basis for setting consents for the drainage of surface water runoff from sites.

Site Details

Latitude:	50.83259° N
Longitude:	0.61972° W
Reference:	3839508400
Date:	Feb 21 2025 12:46

Runoff estimation approach

IH124

Site characteristics

Total site area (ha): 0.1

Methodology

Q_{BAR} estimation method:	Calculate from SPR and SAAR
SPR estimation method:	Calculate from SOIL type

Soil characteristics

	Default	Edited
SOIL type:	2	2
HOST class:	N/A	N/A
SPR/SPRHOST:	0.3	0.3

Hydrological characteristics

	Default	Edited
SAAR (mm):	756	756
Hydrological region:	7	7
Growth curve factor 1 year:	0.85	0.85
Growth curve factor 30 years:	2.3	2.3
Growth curve factor 100 years:	3.19	3.19
Growth curve factor 200 years:	3.74	3.74

Notes

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

When Q_{BAR} is < 2.0 l/s/ha then limiting discharge rates are set at 2.0 l/s/ha.

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

Where flow rates are less than 5.0 l/s consent for discharge is usually set at 5.0 l/s if blockage from vegetation and other materials is possible. Lower consent flow rates may be set where the blockage risk is addressed by using appropriate drainage elements.

(3) Is SPR/SPRHOST ≤ 0.3?

Where groundwater levels are low enough the use of soakaways to avoid discharge offsite would normally be preferred for disposal of surface water runoff.

Greenfield runoff rates

	Default	Edited

Q_{BAR} (l/s):	0.2	0.2
1 in 1 year (l/s):	0.17	0.17
1 in 30 years (l/s):	0.46	0.46
1 in 100 year (l/s):	0.64	0.64
1 in 200 years (l/s):	0.75	0.75

Appendix D - Attenuated Storage for 100 year + 40 % CC

SIMON DENT ASSOCIATES

Offices in Hove and Gosport

[redacted]

Project Title: Sussex Business Centre Barnham **Job no.** 1859 **Date** Feb-25

ATTENUATION STORAGE DESIGN USING FEH 22 RAINFALL DATA

CLIMATE CHANGE FACTOR 1.40 Area of catchment (sq.m) 468 Max outflow 0.70 lit/sec

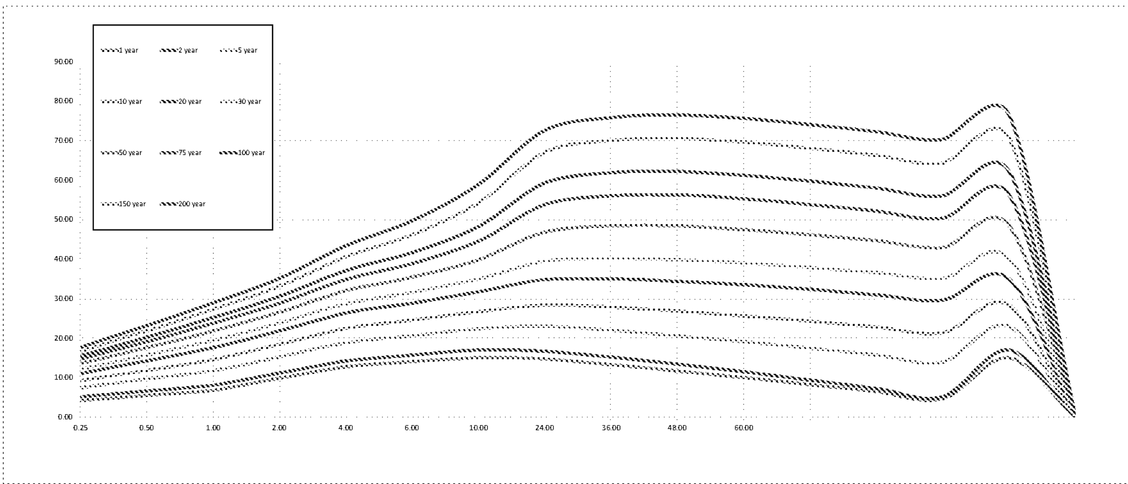
RAINFALL DEPTH MM FOR DIFFERENT DURATION STORMS USING FEH 22 DATA

Duration (hrs)	1 year	2 year	5 year	10 year	20 year	30 year	50 year	75 year	100 year	150 year	200 year	500 year	1000 year	10000 year	
0.25	9.34	11.45	16.24	20.08	23.84	26.18	29.12	31.54	33.33	36.02	38.01	45.14	51.80	83.16	
0.50	12.14	14.67	20.99	25.76	30.97	33.99	37.97	41.26	43.69	47.29	50.01	59.78	68.98	112.53	
1.00	15.37	18.20	25.86	31.99	38.37	42.27	47.32	51.51	54.59	59.15	62.57	74.97	86.70	142.42	
2.00	22.60	25.30	34.08	40.94	48.08	52.49	58.27	63.14	66.79	72.31	76.55	92.79	108.53	173.36	
4.00	30.09	33.17	43.06	50.88	59.15	64.27	71.23	77.36	82.15	89.68	95.70	118.93	139.58	211.71	
6.00	34.19	37.76	48.36	56.81	65.93	71.78	79.91	87.35	93.30	102.90	110.54	138.57	161.48	237.13	
10.00	39.20	43.30	54.85	64.25	74.84	81.89	92.29	102.26	110.33	123.13	132.90	165.55	190.29	270.37	
24.00	48.26	52.53	66.05	77.52	91.25	101.19	116.97	131.89	143.40	160.03	171.93	209.13	236.35	322.80	1 day
36.00	53.76	57.74	72.30	84.77	100.02	111.03	128.63	144.97	157.35	174.90	187.36	225.97	254.16	343.17	
48.00	58.66	62.24	77.74	90.99	107.20	118.80	137.09	153.90	166.56	184.48	197.16	236.52	265.27	355.89	2 days
60.00	63.46	66.50	82.89	96.85	113.61	125.40	143.53	160.17	172.79	190.78	203.57	243.47	272.66	364.52	
72.00	68.11	70.55	87.79	102.38	119.53	131.36	149.16	165.54	178.04	195.97	208.81	249.00	278.43	371.14	3 days
84.00	72.63	74.44	92.51	107.67	125.10	136.92	154.29	170.34	182.67	200.49	213.30	253.62	283.18	376.52	
96.00	77.10	78.25	97.10	112.78	130.44	142.21	159.12	174.80	186.93	204.58	217.34	257.66	287.25	381.01	4 days

Permitted Discharge from site: **0.001** cu.m/h = **0.7** Lit/sec = **2520** lit/hour

INFLOW VOLUME - OUTFLOW VOLUME – (cu.m)

Duration (hrs)	1 year	2 year	5 year	10 year	20 year	30 year	50 year	75 year	100 year	150 year	200 year	500 year	1000 year	10000 year	
0.25	4.29	5.28	7.52	9.31	11.08	12.17	13.55	14.68	15.52	16.78	17.71	21.04	24.16	38.84	
0.50	5.52	6.70	9.66	11.89	14.33	15.74	17.61	19.14	20.28	21.97	23.24	27.81	32.12	52.50	
1.00	6.87	8.19	11.77	14.64	17.63	19.45	21.82	23.78	25.22	27.35	28.95	34.76	40.25	66.33	
2.00	9.92	11.18	15.29	18.50	21.84	23.91	26.61	28.89	30.60	33.19	35.17	42.77	50.14	80.48	
4.00	12.77	14.21	18.84	22.50	26.37	28.77	32.03	34.90	37.14	40.66	43.48	54.35	64.01	97.77	
6.00	14.03	15.71	20.67	24.62	28.89	31.63	35.43	38.91	41.70	46.19	49.77	62.89	73.61	109.01	
10.00	15.07	16.99	22.39	26.79	31.75	35.05	39.91	44.58	48.36	54.35	58.92	74.20	85.78	123.26	
24.00	14.72	16.72	23.05	28.42	34.84	39.50	46.88	53.86	59.25	67.03	72.60	90.01	102.75	143.21	1 day
36.00	13.37	15.23	22.04	27.88	35.01	40.17	48.41	56.05	61.84	70.06	75.89	93.96	107.15	148.81	
48.00	11.73	13.41	20.66	26.86	34.44	39.88	48.43	56.30	62.22	70.61	76.55	94.96	108.42	150.83	2 days
60.00	10.04	11.47	19.14	25.67	33.51	39.03	47.52	55.31	61.21	69.63	75.62	94.29	107.95	150.94	
72.00	8.29	9.43	17.50	24.33	32.35	37.89	46.22	53.88	59.73	68.13	74.14	92.95	106.72	150.11	3 days
84.00	6.47	7.32	15.78	22.87	31.03	36.56	44.69	52.20	57.97	66.31	72.31	91.18	105.01	148.69	
96.00	4.63	5.17	14.00	21.33	29.60	35.11	43.02	50.36	56.03	64.29	70.26	89.13	102.98	146.86	4 days
PEAK VOL	15.07	16.99	23.05	28.42	35.01	40.17	48.43	56.30	62.22	70.61	76.55	94.96	108.42	150.94	



Appendix E - Site Drainage Infiltration drawing - 100

DRAINAGE STRATEGY
FOUL & STORM WATER DESIGN -

GENERAL - The storm water drainage scheme shown is designed to conform with the those requirements as set out in SuDS manual CIRIA document 753, ensuring run off water is source controlled appropriately.

Foul water is shown as connecting to a public sewer but may connect via a nearer public or indirectly through a private system subject to further detailed survey. Note, NOT ALL PUBLIC SEWERS ARE INDICATED ON THE SEWERAGE AUTHORITY MAPS.

STORM WATER - The existing greenfield site measures some 0.12 ha in area. It is located in flood zone 1 area for fluvial and tidal flooding. The proposed development adds offer the following areas:-

Red line boundary area	1233 sq.m
Predevelopment soft area	1233 sq.m
House roof area	260 sq.m
New car parking area	75 sq.m
Paving at front of houses	71 sq.m
Patios at rear of houses	62 sq.m
Soft areas	765 sq.m

Infiltration rates - The design utilises infiltration which has been tested on site resulting in an design infiltration rate of 1.94 x 10^{-5} m/s. Spring groundwater monitoring has been carried out with levels recorded as shallow as 1.45m. A factored infiltration rate using a factor of safety of 1.5.

Roof - The roof downpipes from the front of the houses shall be drained through a system of pipes and catchpits into shallow geocrate soakways beneath the car parking areas.

The roof downpipes at the rear of the houses will drop to low level channels with a rain diverter to a 210 lit water butt. The channel will then drain to a raingarden of 150mm depth and area of 20% of the contrbuting roof as required in the UK Raingarden Design Guidance.

Geocrate Soakaway - The soakaways located beneath the parking areas will assist in draining the parking bays and front portion of the house roofs. They will be a max of 500mm in depth and constructed to detail no. 7.

Raingardens - The raingardens will be max 150mm in depth and planted with various species as listed below. The area of the garden will match the 20% of the contributing roof area of 5 sq.m as a minimum but must be 7.5 sq.m tooffer the 100 year + 45% climate change event. See detail no. 11 also.

DESIGN EXCEEDANCE FLOWS - Where design storms and attenuation volumes are exceeded, such flows will run down the road towards the lowest part of the site and to the highway.

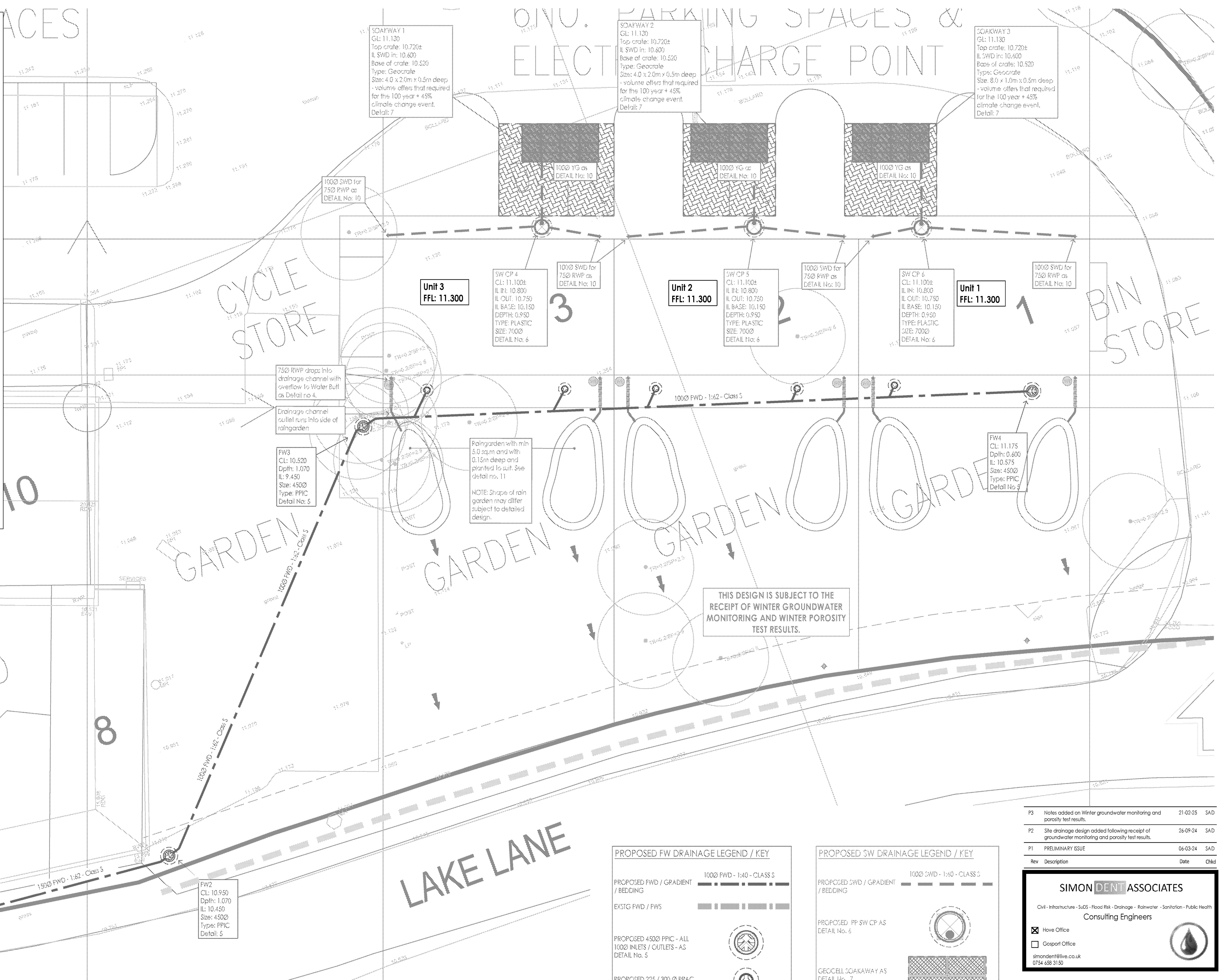
OWNERS SUDS DRAINAGE MAINTENANCE PLAN - Where attenuated volumes are provided in permeable construction make ups which are inaccessible without conventional excavation, it is important to provide features on the drainage system which minimise silt migration.

- All rainwater hopperheads, pipes and gutters should be cleaned twice a year.
- Empty and clean the rainwater butts yearly.
- Remove weeds and debris from any raingardens, keep soil agitated and plants tended.
- All pipes should be cleaned/jetted once a year.

FOUL WATER - The new houses may connect direct to the public sewer as indicated. However due to the 2011 regulations of adoption of pipes draining two properties or more, closer public foul sewers, not recorded on the Sewerage Undertaker maps, may be present. The foul design is therefore subject to further survey findings on site.

ABBREVIATIONS / LEGEND

AAV	AIR ADMITTANCE VALVE
AC	ACCESS CHAMBER
ACC	ACCESS
ASBC	ASBESTOS CEMENT
AFFL	ABOVE FINISHED FLOOR LEVEL
BD	BACKDROP
BIG	BACK INLET GULLY
BGL	BELOW GROUND LEVEL
BR	BRANCH
BSSL	BELOW SLAB SOFFIT LEVEL
CE	CLEANING EYE
CI	CAST IRON
CL	COVER LEVEL
CP	CATCHPIT
DC	DRAINAGE CHANNEL
DCO	DRAINAGE CHANNEL OUTLET
DTC	DRAINAGE THRESHOLD CHANNEL
DP	DRAIN POINT
FA	FROM ABOVE
FB	FROM BELOW
FC	FLEXIBLE CONNECTION
FAI	FRESH AIR INLET
FWD	FOUL WATER DRAIN
FWG	FOUL WATER GULLY
FWS	FOUL WATER SEWER
GL	GROUND LEVEL
GT	GREASE TRAP
HL	HIGH LEVEL
IC	INSPECTION CHAMBER
IL	INVERT LEVEL
IT	INTERCEPTING TRAP
LL	LOW LEVEL
LWG	LIGHTWELL GULLY
MH	MANHOLE
ML	MID LEVEL
OD	OVERDRAIN
OTG	OPEN TOP GULLY
OTBIG	OPEN TOP BACK INLET GULLY
PE	POLYETHYLENE
PF	PITCH FIBRE
PM	PUMP MAIN
PP	POLYPROPYLENE
PPAC	POLYPROPYLENE AC
PPIC	POLYPROPYLENE IC
PCC	PRECAST CONCRETE
PVC	POLYVINYL CHLORIDE
RE	RODDING EYE
RG	ROAD GULLY
RWH	RAINWATER HARVESTING
RWP	RAINWATER PIPE
SP	SOIL PIPE
SHG	SHOWER GULLY
STBIG	SEALED TOP BACK INLET GULLY
STP	SEWAGE TREATMENT PLANT
SuDS	SUSTAINABLE DRAINAGE SYSTEMS
SVP	SOIL VENT PIPE
SS	STUB STACK
SWD	STORM WATER DRAIN
SWS	STORM WATER SEWER
SWTD	STORM WATER TREATMENT DEVICE
TA	TO ABOVE
TB	TO BELOW
TBC	TO BE CONFIRMED
TD	TO DRAIN
UB	URINAL BOWL
UD	UNDERDRAIN
UTL	UNABLE TO LIFT
UTT	UNABLE TO TRACE
UTS	UNABLE TO SURVEY
VC	VITRIFIED CLAYWARE
VTA	VENT TO ATMOSPHERE
WC	WATER CLOSET
WHB	WASH HAND BASIN
WG	WASTE GULLY
WP	WASTE PIPE
WVP	WASTE VENT PIPE
YG	YARD GULLY



PROPOSED FW DRAINAGE LEGEND / KEY

PROPOSED FWD / GRADIENT / BEDDING	100Ø FWD - 1:40 - CLASS S
EXSTG FWD / FWS	
PROPOSED 450Ø PPIC - ALL 100Ø INLETS / OUTLETS - AS DETAIL No. 5	
PROPOSED 225 / 300 Ø PPAC AS DETAIL No. 4	
PROPOSED FW DP - SVP - SS AS DETAIL No. 1	

PROPOSED SW DRAINAGE LEGEND / KEY

PROPOSED SWD / GRADIENT / BEDDING	100Ø SWD - 1:60 - CLASS S
PROPOSED PP SW CP AS DETAIL No. 6	
GEOCELL SOAKAWAY AS DETAIL No. 7	
PROPOSED DRAINAGE CHANNEL (DC) & (DCO) AS DETAIL No. 4	
PROPOSED RWP AND WATER BUTT AS DETAIL No. 4 & 10	WB
DESIGN EXCEEDANCE FLOW DIRECTION	

This drawing should be read in conjunction with the design team's relevant documents, drawings & details.

Existing public & private utility services and drainage locations shown have been derived from non-intrusive survey techniques. Their location is not accurate and the contractor must satisfy himself using open excavation where the location of such plant and apparatus is critical in construction.

If the contractor has constructed from this drawing without necessary approvals from Local Planning Authorities, Building Control, Sewerage Undertakers, Environment Agency etc then any abortive work shall be at his own financial risk and not the responsibility of SDA.

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Rev	Description	Date	Chkd
P3	Notes added on Winter groundwater monitoring and porosity test results.	21-02-25	SAD
P2	Site drainage design added following receipt of groundwater monitoring and porosity test results.	26-09-24	SAD
P1	PRELIMINARY ISSUE	06-03-24	SAD

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0754 658 3150

Client: Sussex Business, Village Lake Lane Barnham Bognor Regis PO22 0AL

Project: Sussex Business Centre Barnham

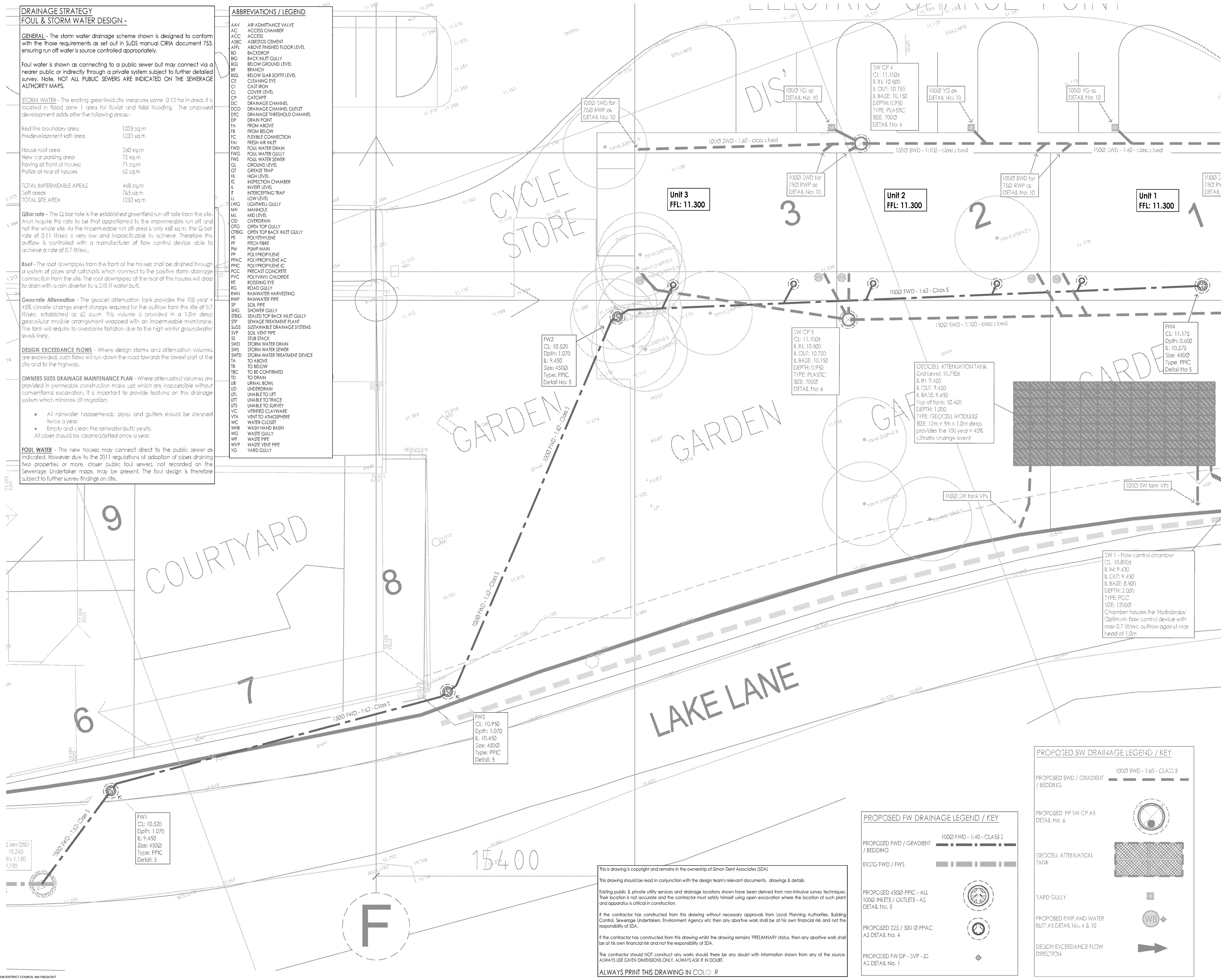
Drawing title: Proposed Site Drainage - Infiltration

Drawing status: PLANNING ISSUE

Project no	Scales	Drawing no	Rev
1859	A1 - 1:100 A3 - 1:200	100	P3

Appendix F - Site Drainage SW connection drawing – 101

Houses adjacent Sussex Business Centre Barnham PO22 0AL	Date	Job No.
	P1 – Feb 2025	1859



DRAINAGE STRATEGY
FOUL & STORM WATER DESIGN -

GENERAL - The storm water drainage scheme shown is designed to conform with the those requirements as set out in SuDS manual CIRIA document 753, ensuring run off water is source controlled appropriately.

Foul water is shown as connecting to a public sewer but may connect via a nearer public or indirectly through a private system subject to further detailed survey. Note, NOT ALL PUBLIC SEWERS ARE INDICATED ON THE SEWERAGE AUTHORITY MAPS.

STORM WATER - The existing greenfield site measures some 0.12 ha in area. It is located in flood zone 1 area for fluvial and tidal flooding. The proposed development adds offer the following areas:-

Red line boundary area	1233 sq.m
Predevelopment soft area	1233 sq.m
House roof area	260 sq.m
New car parking area	75 sq.m
Paving at front of houses	71 sq.m
Patios at rear of houses	62 sq.m
TOTAL IMPERMEABLE AREAS	468 sq.m
Soft areas	765 sq.m
TOTAL SITE AREA	1233 sq.m

QBar rate - The Q bar rate is the established greenfield run off rate from the site. Arun require this rate to be that apportioned to the impermeable run off and not the whole site. As the impermeable run off area is only 468 sq.m, the Q bar rate of 0.11 lit/sec is very low and impracticable to achieve. Therefore the outflow is controlled with a manufacturer of flow control device able to achieve a rate of 0.7 lit/sec.

Roof - The roof downpipes from the front of the houses shall be drained through a system of pipes and catchpits which connect to the positive storm drainage connection from the site. The roof downpipes at the rear of the houses will drop to drain with a rain diverter to a 210 lit water butt.

Geocrate Attenuation - The geocell attenuation tank provides the 100 year + 45% climate change event storage required for the outflow from the site of 0.7 lit/sec. established as 62 cu.m. This volume is provided in a 1.0m deep geocellular module arrangement wrapped with an impermeable membrane. The tank will require to overcome flotation due to the high winter groundwater levels likely.

DESIGN EXCEEDANCE FLOWS - Where design storms and attenuation volumes are exceeded, such flows will run down the road towards the lowest part of the site and to the highway.

OWNERS SUDS DRAINAGE MAINTENANCE PLAN - Where attenuated volumes are provided in permeable construction make ups which are inaccessible without conventional excavation, it is important to provide features on the drainage system which minimise silt migration.

- All rainwater hopperheads, pipes and gutters should be cleaned twice a year.
- Empty and clean the rainwater butts yearly.

All pipes should be cleaned/jetted once a year.

FOUL WATER - The new houses may connect direct to the public sewer as indicated. However due to the 2011 regulations of adoption of pipes draining two properties or more, closer public foul sewers, not recorded on the Sewerage Undertaker maps, may be present. The foul design is therefore subject to further survey findings on site.

ABBREVIATIONS / LEGEND

AAV	AIR ADMITTANCE VALVE
AC	ACCESS CHAMBER
ACC	ACCESS
ASBC	ASBESTOS CEMENT
AFFL	ABOVE FINISHED FLOOR LEVEL
BD	BACKDROP
BIG	BACK INLET GULLY
BGL	BELOW GROUND LEVEL
BR	BRANCH
BSSL	BELOW SLAB SOFFIT LEVEL
CE	CLEANING EYE
CI	CAST IRON
CL	COVER LEVEL
CP	CATCHPIT
DC	DRAINAGE CHANNEL
DCO	DRAINAGE CHANNEL OUTLET
DTC	DRAINAGE THRESHOLD CHANNEL
DP	DRAIN POINT
FA	FROM ABOVE
FB	FROM BELOW
FC	FLEXIBLE CONNECTION
FAI	FRESH AIR INLET
FWD	FOUL WATER DRAIN
FWG	FOUL WATER GULLY
FWS	FOUL WATER SEWER
GL	GROUND LEVEL
GT	GREASE TRAP
HL	HIGH LEVEL
IC	INSPECTION CHAMBER
IL	INVERT LEVEL
IT	INTERCEPTING TRAP
LL	LOW LEVEL
LWG	LIGHTWELL GULLY
MH	MANHOLE
ML	MID LEVEL
OD	OVERDRAIN
OTG	OPEN TOP GULLY
OTBIG	OPEN TOP BACK INLET GULLY
PE	POLYETHYLENE
PF	PITCH FIBRE
PM	PUMP MAIN
PP	POLYPROPYLENE
PPAC	POLYPROPYLENE AC
PPIC	POLYPROPYLENE IC
PCC	PRECAST CONCRETE
PVC	POLYVINYL CHLORIDE
RE	RODDING EYE
RG	ROAD GULLY
RWH	RAINWATER HARVESTING
RWP	RAINWATER PIPE
SP	SOIL PIPE
SHG	SHOWER GULLY
STBIG	SEALED TOP BACK INLET GULLY
STP	SEWAGE TREATMENT PLANT
SuDS	SUSTAINABLE DRAINAGE SYSTEMS
SVP	SOIL VENT PIPE
SS	STUB STACK
SWD	STORM WATER DRAIN
SWS	STORM WATER SEWER
SWTD	STORM WATER TREATMENT DEVICE
TA	TO ABOVE
TB	TO BELOW
TBC	TO BE CONFIRMED
TD	TO DRAIN
UB	URINAL BOWL
UD	UNDERDRAIN
UTL	UNABLE TO LIFT
UTT	UNABLE TO TRACE
UTS	UNABLE TO SURVEY
VC	VITRIFIED CLAYWARE
VTA	VENT TO ATMOSPHERE
WC	WATER CLOSET
WHB	WASH HAND BASIN
WG	WASTE GULLY
WP	WASTE PIPE
WVP	WASTE VENT PIPE
YG	YARD GULLY

This drawing should be read in conjunction with the design team's relevant documents, drawings & details.

Existing public & private utility services and drainage locations shown have been derived from non-intrusive survey techniques. Their location is not accurate and the contractor must satisfy himself using open excavation where the location of such plant and apparatus is critical in construction.

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Rev	Description	Date	Chkd
P1	PRELIMINARY ISSUE	21-02-25	SAD

SIMON DENT ASSOCIATES

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Client: Sussex Business, Village Lake Lane Barnham Bognor Regis PO22 0AL

Project: Sussex Business Centre Barnham

Drawing title: Proposed Site Drainage - Piped Storm connection

Drawing status: PLANNING ISSUE

Project no	Scales	Drawing no	Rev
1859	A1 - 1:100 A3 - 1:200	101	P1

ARUN DISTRICT COUNCIL WA/159/24/OUT

Appendix G - CIRIA Tech Sheet 'Using SuDS close to buildings'

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Using SuDS close to buildings

In this fact sheet Steve Wilson summarises the role of the designer in overcoming any potential challenges related to using SuDS components that rely on infiltration close to buildings.

The author

Steve Wilson is a Chartered Civil Engineer with 30 years' experience of geotechnical engineering. He has a Masters Degree in geotechnical engineering and has wide experience of foundation design and construction. Steve provided advice to the former Commission for New Towns on subsidence and settlement issues with their housing stock in the south east and this often involved in the investigation and assessment of subsidence and heave caused by trees in clay soils (especially London Clay). He has extensive experience in the design and construction of infiltration drainage and has investigated many soakaway failures. He has also provided advice on settlement of foundations caused by water consolidation of loose sand infill to Chalk solution features.

Introduction

Permeable pavements are a widely used SuDS approach that can allow water to infiltrate into the ground. They allow source control to be included in dense developments. Similarly rain gardens are one of the simplest ways of retrofitting SuDS to existing buildings. However space constraints mean that both approaches often need to allow water to soak into the ground near to building foundations.

The Building Regulations state that *"Infiltration devices should not be built within 5m of a building or road or in areas of unstable land"*. This is to prevent water that soaks into the ground from adversely affecting soil properties and causing excessive movement of foundations. Complying with this guidance means that it often proves difficult for designers to locate permeable pavements, small basins and similar infiltration systems close to buildings and the benefits of allowing water to soak into the ground are lost (groundwater recharge, water availability to nearby trees, etc). Some SuDS methods such as rain gardens do not have to rely on infiltration to work, but will allow some water to soak into the ground if they are not lined. Similarly shallow tanks and permeable pavements may be designed as leaky or partial infiltration systems even on clayey soils.

Unlined rain garden close to building foundations (deliberately filled for research)

Many designers do not realise it is possible to override the crude rule of thumb in the Building Regulations with appropriate geotechnical assessment. In some instances

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SuDS infiltration systems and unlined storage systems (such as rain gardens) can even be located immediately next to buildings. This is useful if disconnecting downpipes as it makes the process easier and less costly.

However, allowing water to soak into the ground close to foundations should always be done in consultation with a Geotechnical Adviser or Registered Ground Engineering Professional[i].

The "5m rule" in the Building Regulations was originally devised as a rule of thumb to be applied to traditional soakaways that are relatively deep in relation to foundations and concentrate runoff into a quite small area of ground. Many SuDS methods differ to the traditional soakaway in that they are shallow and act as a blanket or plane infiltration system. They keep infiltrating water spread out over a wider area, unlike traditional solutions. Also remember that in some areas of the UK a traditional soakaway at 5m may be too close to foundations, for example where solution features are present in Chalk (CIRIA 2002).

The Building Regulations – what is the objective of the 5m rule

In 2002, as part of a research project by CIRIA, advice was sought from the Department for Transport, Local Government and the Regions (DTLR) Building Regulations Division (now Communities and Local Government) regarding the statement in the Building Regulations that soakaways should be located at least 5m from buildings. They provided the following statement in relation to permeable pavements that allow dispersed infiltration and evaporation of rainwater:

"As pervious paving permits dispersed absorption of rainfall it should not create any problems with concentrated outflow of water gathered over an area but discharged at a single point as in the case of soakaways. If the paving is combined with a storage system the outlet must be at a sufficient distance to ensure that discharged water does not impair the stability of any building. 5 metres is given as a guideline, if foundation details and geotechnical data are available to show that a shorter distance is safe then it can be used."

It is clear that the "5m rule" was intended to be a guideline and that infiltration or unlined attenuation can be allowed closer to building foundations if it can be demonstrated that it is safe to do so.

Permeable pavement with infiltration close to house foundations

Further evidence that rainwater can be allowed to soak into the ground close to building foundations is given in a response to an appeal made by an applicant against the enforcement of Requirement H3 in the Building Regulations. The Department for Communities and Local Government considered the possible effects of rainwater in foundations and concluded that distributed rainwater soaking into the ground will reduce the risk of saturation and erosion (Appeal against refusal in respect of a 5 bay aircraft hangar port –DETR, 1998 Reference 45/3/125). As part of this assessment they also considered the risk of collapse without warning of the structure. Where there is the potential for this (eg where solution features could develop unnoticed below the surface) a rigorous geotechnical assessment would be required even a normal soakaway located 5m from a building.

Comparison of SuDS to traditional soakaways

Well-designed shallow SuDS that are at or close to the ground surface are quite different from traditional soakaway drainage. They are designed on the principle of source control and the roof area draining to these SuDS features (or area of hardstanding) should not be that large compared to the infiltration area.

A traditional soakaway will typically drain between $30m^2$ and $300m^2$ of impermeable area to every $1m^2$ area in the base of the soakaway (ie a ratio of between 30:1 and 300:1). SuDS features close to buildings should normally be designed with a ratio of impermeable area to base area of less than 10:1 and the depth of the stored water should not be greater than 300mm. Thus the flow of water from the base of the SuDS features is much less concentrated than in a normal soakaway.

A traditional soakaway will have a ratio at the higher end of scale where it drains a road or several houses. Therefore it is a concentrated point source of water in the ground and the height of these types of soakaways means that water also flows out sideways. As a result the risk of water affecting the soils under shallow foundations can be quite high if the soakaway is located close to buildings. Because infiltration from a plane feature is much more dispersed, has a shallow height and has a short retention time there is less potential for flow to occur laterally in any significant quantities.

It is possible to analyse water flow into the ground using computer programmes. This is known as numerical modelling. A model of water flow from a SuDS permeable pavement that was constructed close to foundations is shown in Figure 1. The water flows vertically (shown by the black arrows) and the velocity is low until it meets the groundwater table just below the foundations.

How can infiltrating water cause problems?

Freeman et al (2002) identified the most common causes of settlement or subsidence to buildings. Those that can be associated with infiltrating water are listed below:

- Erosion - soil can be washed by infiltrating water into open features such as broken pipes, gullies, joints, solution features or faults. Water flow through the ground on its own does not wash soil particles out – the particles need somewhere to go. SUDS will not cause erosion if there is nowhere to wash soil particles out to.

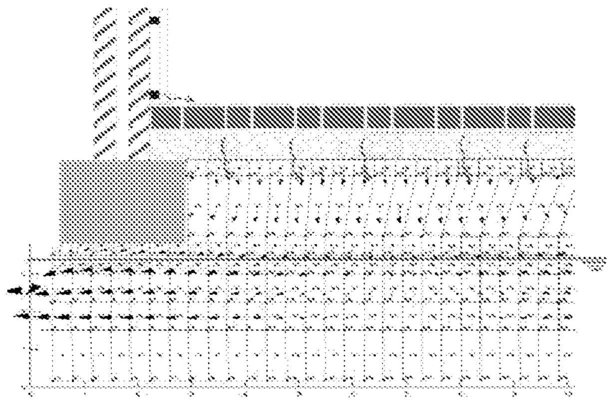

Figure 1 Numerical model of water flow from a SuDS permeable pavement

- Settlement of filled or loose ground by water flow (made ground or infill to solution features[ii]). This is most likely in low density material with high void ratios. It is less likely to occur in well compacted or dense fill, especially where infiltrating water is spread out.

- Collapse of mine workings and natural cavities – this can be caused by infiltrating water.

- Soil softening - clays in particular that can be softened leading to reduced strength and increased settlement. The effects on slope stability may also need to be assessed if the foundations are close to the top of a slope. Softening of clay soils will occur if the moisture content increases. Clay has a very low permeability and in normal circumstances the softening caused by water does not extend to a great depth. For example this normally occurs for 200mm to 300mm or so below the surface of clay with a perched water table above it. Softening of clay soils next to broken drainage pipes has been reported. However in these cases the pipe has been located very close to the foundations and most of the runoff from every rainfall event from a large drained area (typically at least half of the roof of a house) has been collecting and standing in contact with the clay for a long period of time. This is different to shallow plane infiltration where the water is soaking into the ground at around 300mm to 400mm depth and the foundations are typically at least 1m below that. Most of the rainfall in a correctly designed plane infiltration or attenuation system will be held in the shallow surface soils or blocks and will evaporate. Thus there will be limited softening of clay at depth and it is not likely to affect the foundations.

- Variations in groundwater level – this relates to a loss of bearing capacity in granular soils where the groundwater level increases. Groundwater mounding (an increase in water level) can occur below soakaways. This rarely happens to any great degree under normal small soakaways and is even less likely to occur below shallow plane SuDS, again because of the dispersed nature of the water storage and the effects of evapotranspiration.

- Shrinkage and heave - clay soils that are desiccated (dried out) can heave when the moisture content is increased or the soils can be dried out by trees for example and cause subsidence. Heave is generally only a problem where trees are removed prior to construction of buildings.

- Swelling occurs when a clay soil has a suction in the soil pores that draws water into the soil and it increases in volume. Swelling only occurs in response to suction pressure, ie the clay must be dry and below its equilibrium moisture content, or where soil overburden has been removed (eg heave in basement excavations). Clay at its natural equilibrium moisture content will not swell signifcantly. Heave is normally a major problem when trees have been removed from a site prior to constructing a building.

  Thus water from small rain gardens or similar features will not cause swelling over and above that which occurs over the natural cycle. The water from shallow plane SuDS will actually reduce the soil moisture deficit caused by trees and potentially reduce the adverse effects. Where rain gardens are located in areas already affected by trees they may reverse some of the shrinkage that has occurred. This may cause some heave of the foundations, but again because of the dispersed nature of the water the effects will not be concentrated locally at one point. Instead any effect will be uniformly distributed over a wide area. This reduces the risk of cracks occurring in the building due to localised differential ground movement.

For adverse effects to occur as a result of water soaking into the ground, the foundations also need to be of a form that can be affected (for example piled foundations are likely to be far less susceptible to any adverse impacts of infiltrating water, if at all). Permeable paving that only collects and drains rainwater falling directly on it can be used against any building providing there is no point source of water from any other impermeable surfaces connected into it.

Conclusion

The “5m rule” in the Building Regulations is a guideline and many designers do not realise it is possible to override the crude rule of thumb when using shallow SuDS infiltration systems and unlined storage systems (such as rain gardens). The problems caused by large volumes of water from relatively deep point soakaways are not likely to occur with shallow

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SuDS draining small areas and with appropriate design and assessment they can be located closer to buildings than 5m. This is useful if disconnecting downpipes as it makes the process easier and less costly.

For further advice on designing SuDS schemes close to buildings please contact

[redacted]

epg

References

DETR (1998). Requirement H3: Appeal against refusal in respect of a 5 bay aircraft hangar port (Ref: 45/3/125)

Freeman TJ, Driscoll RMC and Littlejohn GS (2002). Has your house got cracks? Second Edition. BRE and ICE, Thomas Telford Publishing, London.

Her Majesty's Government, (2010). The Building Regulations. Approved Document H. Drainage and waste disposal DTLR, London

CIRIA (2002). Engineering in Chalk, CIRIA Report C574.

[ii] A Geotechnical Adviser is defined by the Site Investigation Steering Group as a Chartered Engineer or Geologist with a minimum of 10 years post charter experience in geotechnical engineering (5 years acting as a geotechnical specialist).
The Register of Ground Engineering Professionals is administered by The Institution of Civil Engineers.

[ii] Solution features are common phenomena within Chalk areas. They are formed by dissolution of the Chalk as a result of chemical weathering, probably during the Quaternary period. This results in sinkholes in the chalk surface or pipes within the chalk mass. These features are often infilled with soft or loose materials. (For more information see CIRIA, 2002).

OUTLINE APPLICATIONS ONLY
Surface Water Drainage Design

This checklist has been created to assist designers, by clearly defining our expectations and requirements for surface water drainage designs that are submitted to support **outline** planning applications – where the layout and scale of the proposed development is not being decided.

It is recommended that applicants and their designers take time, at the outset of the planning process, to familiarise themselves with the checklist and our guidance.

For details of our expectations for a fully detailed surface water drainage design, to support a full or reserved matter planning application, or an application to discharge a surface water drainage design condition, please refer to our Full Surface Water Drainage Design Checklist.

It is expected that surface water drainage information is submitted with all planning applications. Surface water drainage information may be requested for smaller proposals where drainage is expected to affect determination – for example, in the Lidsey Wastewater Treatment Catchment.

Applicants who submit all the information requested by the checklist, as early as possible in the planning process, benefit from quicker review times and less delays caused by requests for further information. The omission of information may lead to objection to, or refusal of planning applications or applications to discharge conditions.

Applicants for major development sites must be aware that West Sussex County Council [WSCC] acting as Lead Local Flood Authority [LLFA] are a statutory consultee for flood risk and surface water drainage design. It is important to consult WSCC guidance in addition to our guidance and this checklist.

A major planning application is defined as:

- The creation of 10 or more residential units,
- Residential development of on a site of 0.5 hectares or more (where the number of residential units is not yet known i.e. for outline applications),
- Non-Residential development or change of use on a site of at least 1 hectare,
- Creation or change of use of 1000 square metres or more of gross floor space (not including housing).

Applicants have the option to apply for confidential pre-application advice relating to their surface water drainage design from either Arun District Council or WSCC. Bespoke advice is not offered outside of a fee-paying application.

ADC pre-application advice: https://www.arun.gov.uk/pre-application-advice

WSCC pre-application advice: https://www.westsussex.gov.uk/roads-and-travel/information-for-developers/flood-risk-management-pre-application-advice/

Critical Items for Detailed Surface Water Drainage Design
A detailed checklist of our requirements follows this advice. However, we highlight that the failure to adequately address the following critical items **will** result in an **objection** to an outline planning application. It is expected that if any of these items are inadequately addressed by a submission then this may render a proposed outline planning proposal unviable.

Critical Item	Reason
The hierarchy for sustainable drainage.	The proposed discharge method must accord with the SuDS hierarchy as given below. Evidence must be supplied to justify the proposed discharge method. 1. Rainwater reuse where possible. 2. Complete discharge into the ground (infiltration). 3. Hybrid infiltration and restricted discharge to an appropriate water body. 4. Restricted discharge to an appropriate water body. 5. Restricted discharge to a surface water sewer. 6. Restricted discharge to a combined sewer. A water body may be defined as a river, watercourse, ditch, culverted watercourse, reservoir, wetland or the sea. Where infiltration has not been adequately investigated but is proposed, a second sustainable disposal method must be identified. **Engineers cannot support any proposed connection of surface water to the foul sewer.** The drainage schemes have been proposed with 1,2 & 3 used where possible and subject to further winter testing.
Natural catchments design.	The submission must define the natural drainage characteristics within, and hydraulically linked to, the site and demonstrate that the drainage proposals will integrate with and not compromise the function of the natural and existing drainage systems. The condition, performance (including capacity where appropriate) and ownership of any existing site surface water or land drainage infrastructure must be accurately reported.

	Appropriate easements to watercourses and other services must be shown on all plans. Where there are areas of flood risk from any source on the site, it must be shown how a sustainable surface water drainage design can be accommodated on the site without conflicting with those areas of flood risk. The use of pumps in surface water drainage designs is not supported by our engineers. Pumping does not mimic natural flow characteristics. The risk of pump failure and flood risk that this would cause is unsustainable.
Proposed design.	The suggested design criteria and calculation inputs must conform to best practice, use the most recent relevant modelling data and current allowances for climate change and urban creep at the time of submission.

OUTLINE APPLICATIONS ONLY
Surface Water Drainage Design Checklist

Site Name/Address:	Sussex Business Centre Barnham
Application Description:	Lake Lane Barnham PO22 0AL

Policy and Guidance Information
Arun District Council Surface Water Drainage Guidance - https://www.arun.gov.uk/surfacewater Land Drainage Consent – https://www.westsussex.gov.uk/fire-emergencies-and-crime/dealing-with-extreme-weather/flooding/flood-risk-management/ordinary-watercourse-land-drainage-consent/ and https://www.arun.gov.uk/land-drainage-consent/ Arun District Council surface water pre-commencement conditions - https://www.arun.gov.uk/planning-pre-commencement-conditions The SuDs Manual [C753] by CIRIA Sustainable drainage systems: non-statutory technical standards' https://assets.publishing.service.gov.uk/media/5a815646ed915d74e6231b43/sustainable-drainage-technical-standards.pdf

Ground Investigation Results
Ideally site-specific ground investigation results - to support a desk study - will be submitted with an outline planning application. If infiltration is proposed at the outline planning application stage and there are no winter infiltration tests and winter groundwater monitoring available to prove that the strategy is viable, then alternative proposals for discharge must be provided. This will ensure that if subsequent site-specific winter ground investigations show that infiltration is not possible, then the site can still be sustainably and effectively drained.

If there are no alternative sustainable means of disposing of surface water, apart from using infiltration, then site-specific winter ground investigation results are essential prior to determination.

Groundwater monitoring

☒ Plan showing location of monitoring points.
☒ Depths of holes detailed.
☒ Dates of observations and depth to groundwater recorded.
☒ Evidence of the strata within borehole or monitoring pits.

Requested to aid speed of assessment

☐ Plan showing the peak groundwater levels at each monitoring point in mAOD.
☒ Peak groundwater levels recorded in m below ground level and mAOD.
☐ If in an area of possible tidal influence, provide a comparison of readings against tide times/levels.

Infiltration testing

☒ Completed strictly in accordance with BRE DG 365, CIRIA R156 or a similar approved method.
☒ Plan showing location of trial pits provided.
☒ Pit dimensions provided.
☒ Depths of testing provided.
☒ Dates, times and readings of each test recorded.
☒ Calculations for the infiltration rate for each test provided.
☒ Evidence of the strata within trial pits provided.
☒ Test locations, and depths correspond with the expected location and depths of proposed infiltration features.

Requested to aid speed of assessment

☒ Depths of testing provided in m below ground level and mAOD.

Other

As appropriate, dependent upon specific site conditions

☐ Geotechnical advice relating to the siting of infiltration features and risk of dissolution. (Usually where chalk strata is evidenced.)
☐ Geotechnical advice relating to the risk of slope instability due to infiltration.
☐ Geotechnical and structural advice where infiltration is proposed closer than 5m to buildings or structures.
☐ Contamination evaluation assessment where infiltration is proposed in ground that may be contaminated.
☐ Geotechnical advice where infiltration is proposed into made ground (to be generally avoided).
☐ Geotechnical advice relating to infiltration capacity, and risk of settlement or instability where careful use of ground raising is proposed.

Surface Water Drainage Statement

Disposal method

☒ Rainwater reuse is proposed where possible.
☒ Infiltration is proposed and maximised wherever possible.
☒ **Where infiltration has not been adequately investigated but is proposed, a second sustainable disposal method has been identified.**

☐ Hybrid infiltration and restricted discharge to an appropriate surface water body is proposed where a full infiltration design is not possible.
☐ Restricted discharge to a water body is proposed where an infiltration design is not possible.
x Restricted discharge to a surface water sewer is proposed where an infiltration design is not possible and there are no nearby water bodies.
☐ Restricted discharge to a public or private highway drainage network is proposed where an infiltration design is not possible and there are no nearby water bodies or surface water sewers.
☐ Restricted discharge to a public combined sewer is proposed where an infiltration design is not possible and there are no water bodies, surface water sewers, highway, or private drainage systems nearby.

Disposal method justification
☐ Infiltration has been adequately investigated, in winter, at appropriate and varying depths where appropriate, above peak recorded winter groundwater levels at the given location.
☒ Onsite and boundary, open and culverted water bodies are investigated (location, mapping, network, flow direction, ownership/responsibility, depth, and condition).
☐ Offsite nearby downstream water bodies are investigated (location, mapping, network, flow direction, ownership/responsibility, depth, and condition).
☒ Surface water sewer network is investigated (location, mapping, network, flow direction, ownership/responsibility, depth, capacity, and condition).
☐ Public and private downstream highway drainage networks are investigated (location, mapping, network, flow direction, ownership/responsibility, depth, capacity, and condition).
☐ Combined downstream sewer network is investigated (location, mapping, network, flow direction, ownership/responsibility, depth, capacity, and condition).
☐ Any relevant permissions or legal agreements from asset or landowners that are needed are identified and evidence of permission in principle provided.

<u>Requested to aid speed of assessment</u>
☐ Any previous relevant correspondence or pre-application advice from the Local Planning Authority [LPA] or the Lead Local Flood Authority [LLFA] regarding the surface water drainage design is included with the statement.

Existing Site
<u>Essential</u>
☒ It is clear what the natural drainage characteristics of the site and hydraulically linked areas are.
☐ Natural flow paths are identified on a plan (where applicable).
☒ Existing site drainage features are investigated – condition, performance, and ownership.
☒ Environmentally sensitive receiving water bodies are identified – for example groundwater source protection zones.
☒ 3m easements shown from the top of the bank of all ordinary watercourses, and from the edge of all culverted watercourses on all plans.
☐ 8m easements shown from the top of the bank of all main rivers on all plans - unless an alternative easement has been stipulated by the Environment Agency.
☐ Any appropriate easements as stipulated by any public or private utility provider shown on all plans.

It is suggested that the above is achieved with the following, which may be combined where appropriate:
☐ An existing topographical plan.
☐ An existing drainage catchment plan.
☐ An existing site surface water drainage plan (where applicable).
☐ Flood maps (fluvial, tidal, pluvial, groundwater, sewer, and reservoir) are supplied (or FRA referred to).
☐ Confirmation and surveys of any existing drainage infrastructure on the site.

☐ Full details of any known flooding on the site.

Proposed Design

☐ Statement confirming the proposed design criteria including fixed design calculation inputs for the SuDS system. Examples include:

- Climate change allowances,
- Urban creep,
- CV values,
- Rainfall data,
- MADD factor or additional storage

☒ Natural catchments can be followed.
☒ Existing drainage features are considered, used, or protected where appropriate.
☐ Relevant restrictions relating to discharging to an environmentally sensitive receiving water body – for example a groundwater source protection zone - are investigated and reported.
☒ It is shown how a surface water drainage design will not conflict with additional areas of flood storage or compensation.
☒ The design is committed to the use of multifunctional SuDS to meet community and environmental requirements.
☒ It is confirmed what the adoption arrangements for SuDS components will be.
☒ It is confirmed what elements of the SuDS will be private.
☒ Details of necessary off-site works and 'in principle' consents are provided.

This checklist is designed to aid an applicant with their submission. The list is not exhaustive, and our engineers may request additional information to enable them to review a proposal to their satisfaction.

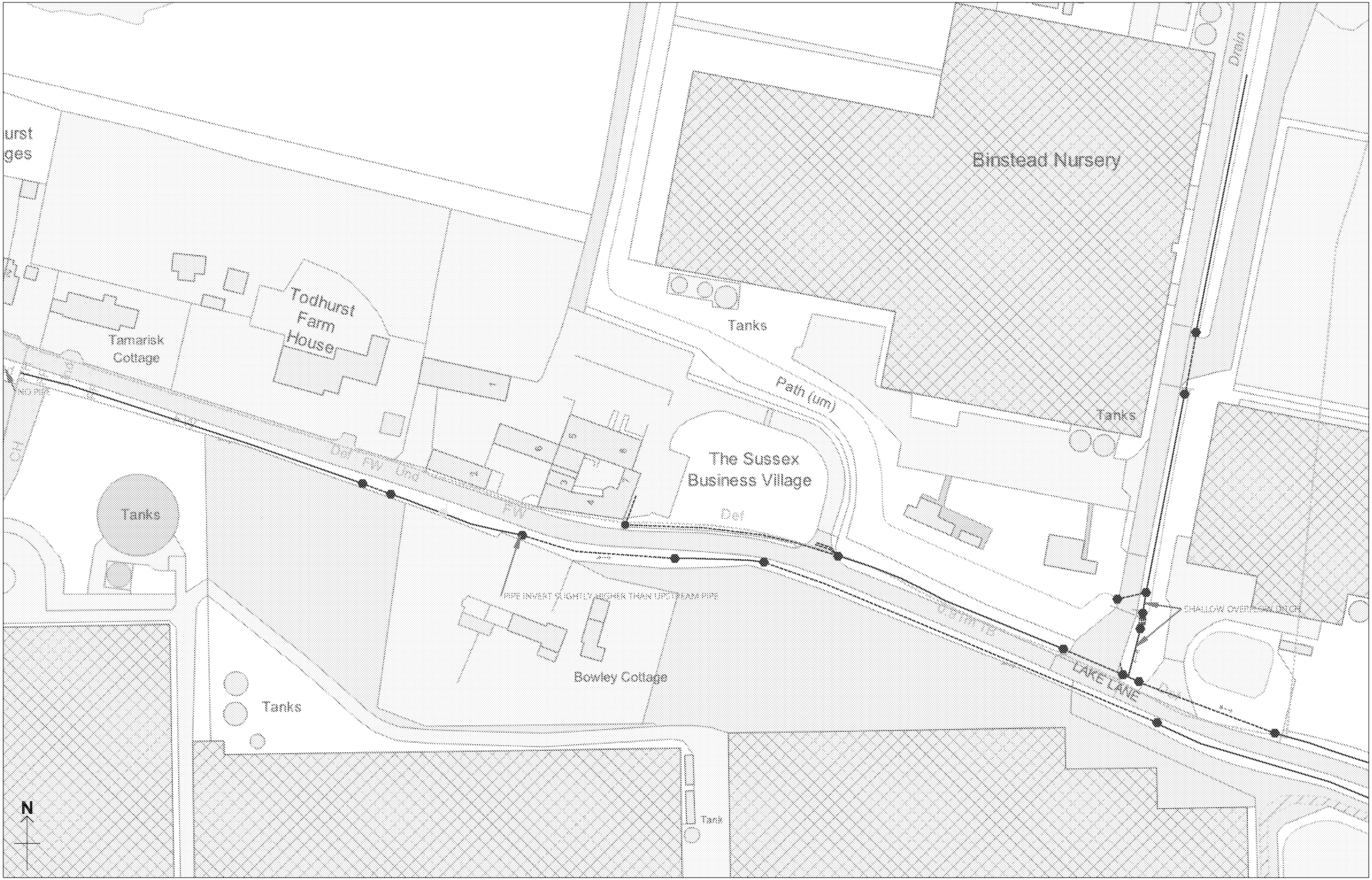
Where an outline planning application proposes to determine more than the principle of development and access, the applicant is encouraged to refer to our full detailed design checklist for more information on what may be required.

The checklist may also request information that an applicant does not feel is relevant to their submission. In this case the applicant can provide an explanation as to why they have omitted certain information in their drainage statement. However, the appraising engineer reserves the right to request this information if they believe it is necessary for their review.

Appendix J - Arun DC Storm Water culvert and watercourse map

Houses adjacent Sussex Business Centre Barnham PO22 0AL	Date	Job No.
	P1 – Feb 2025	1859

Arun District Council Maps



Mapping produced by Arun District Council

Production Date: 14 January 2025

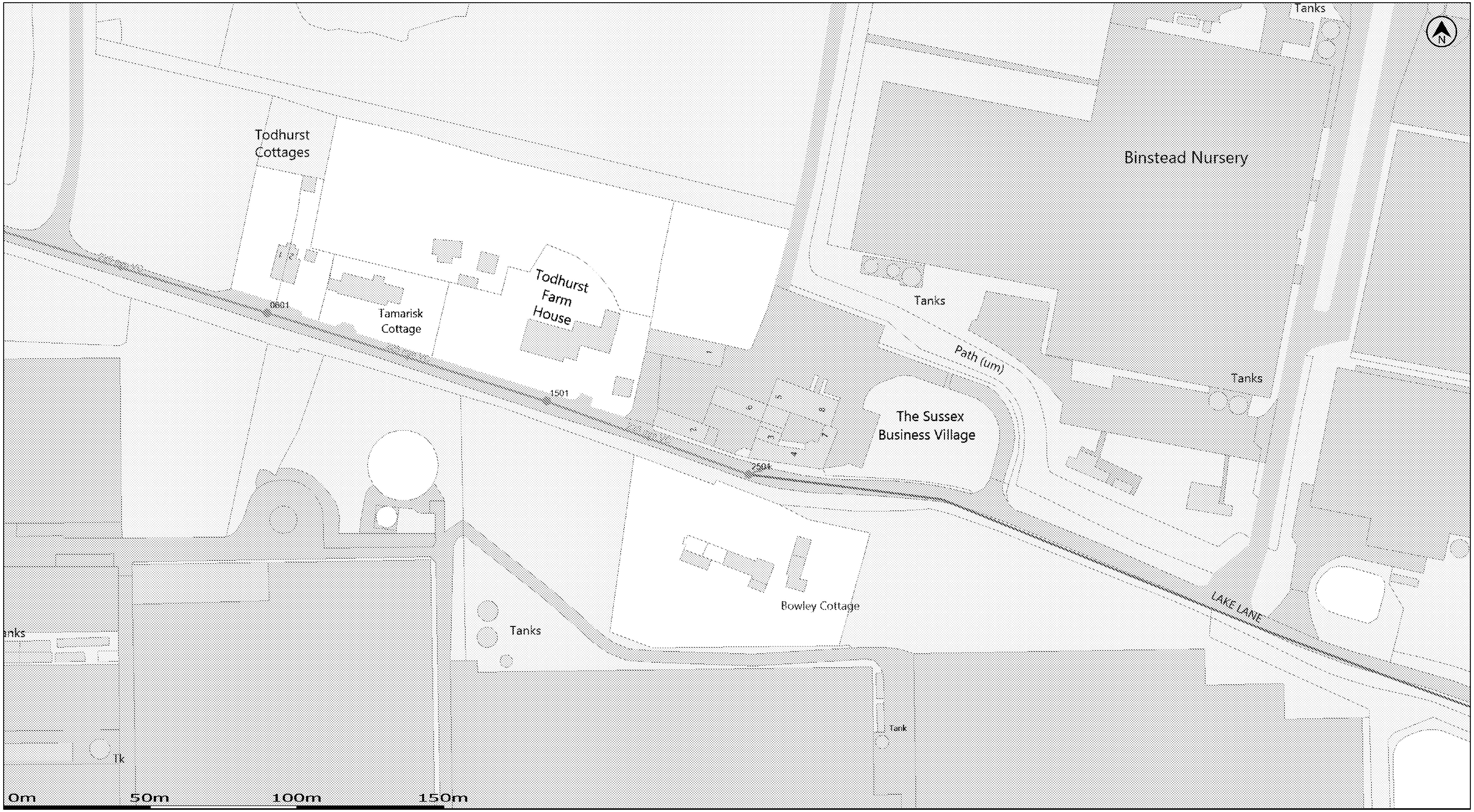
Scale: 1:1000 @ A3

www.arun.gov.uk

ARUN DISTRICT COUNCIL

Appendix K - Southern Water Sewer Map

Houses adjacent Sussex Business Centre Barnham PO22 0AL	Date	Job No.
	P1 – Feb 2025	1859



 Date: 06/03/24 Scale: 1:1250 Map Centre: 497236,104593 Data updated: 12/01/24 Our Ref: 1413911 - 1 Wastewater Plan A3

The positions of pipes shown on this plan are believed to be correct, but Southern Water Services Ltd accept no responsibility in the event of inaccuracy. The actual positions should be determined on site. This plan is produced by Southern Water Services Ltd (c) Crown copyright and database rights 2024 Ordnance Survey 100031673 .This map is to be used for the purposes of viewing the location of Southern Water plant only. Any other uses of the map data or further copies is not permitted.

WARNING: BAC pipes are constructed of Bonded Asbestos Cement.

WARNING: Unknown (UNK) materials may include Bonded Asbestos Cement.

Foul Gravity Sewer
Combined Gravity Sewer
Culverted Water Course or Treated Effluent
Surface Water Gravity Sewer
Rising Main, Vacuum or Syphon
Combined Outfall
Surface Water Outfall
Foul Outfall
Surface Water Inlet
Combined Pumping Station
Surface Water Pumping Station
Foul Pumping Station
Water Treatment Works
Section 104 Area
Building Over Agreement Area
Foul Manhole
Combined Manhole
Surface Water Manhole
Side Entry Manhole, Decantation Chamber, Dummy Manhole or Surface Water Soakaway

simondent@live.co.uk

1859 - SBV sewers

Southern Water

Manhole Reference	Liquid Type	Cover Level	Invert Level	Depth to Invert
0601	F	10.45	8.28	
1501	F	10.86	8.93	
2501	F	10.34	9.19	

Manhole Reference	Liquid Type	Cover Level	Invert Level	Depth to Invert

Manhole Reference	Liquid Type	Cover Level	Invert Level	Depth to Invert