



Consulting Civil Engineers

Surface Water Drainage Report

Land to r/o Highground House, Barnham

For

Michael and Nicky Bates

Application no. BN/114/21/PL

Rev - P

C1931

Date 14th January 2022

Revision	Date of Issue	Comments	Prepared By	Checked By
P	14.01.22	Initial Issue	CS	LH

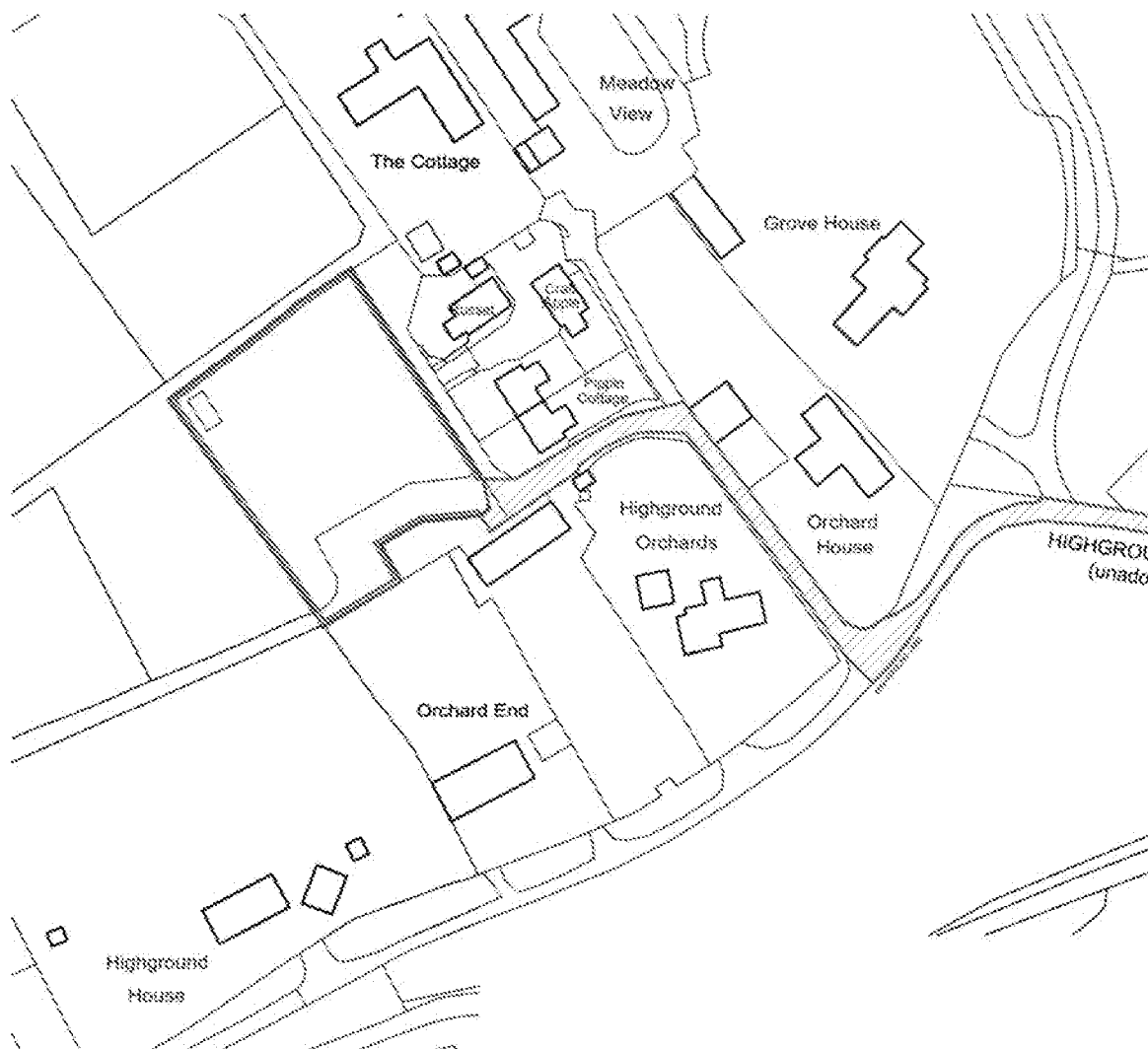
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1 Introduction

- 1.1.1 CGS Civils Ltd have been appointed by Michael and Nicky Bates to undertake a drainage strategy report for a proposed development at Land to r/o Highground House, Barnham.
- 1.1.2 The purpose of this drainage strategy is to demonstrate how the development area can be satisfactorily drained without increasing flood risk onsite and elsewhere.
- 1.1.3 The existing site consists of an area of greenfield land. The proposed development will consist of the erection of a new single storey dwelling.
- 1.1.4 The total red line boundary is approximately 0.21 Ha, and the proposed development will result in a total of 0.018 Ha of impermeable area i.e., the roof area. The driveway will be fully porous and is therefore not included.
- 1.1.5 The proposed site will make use of an existing access to the southeast.
- 1.1.6 The proposed site plan can be found in **Appendix A**.

Fig 1. Site Location



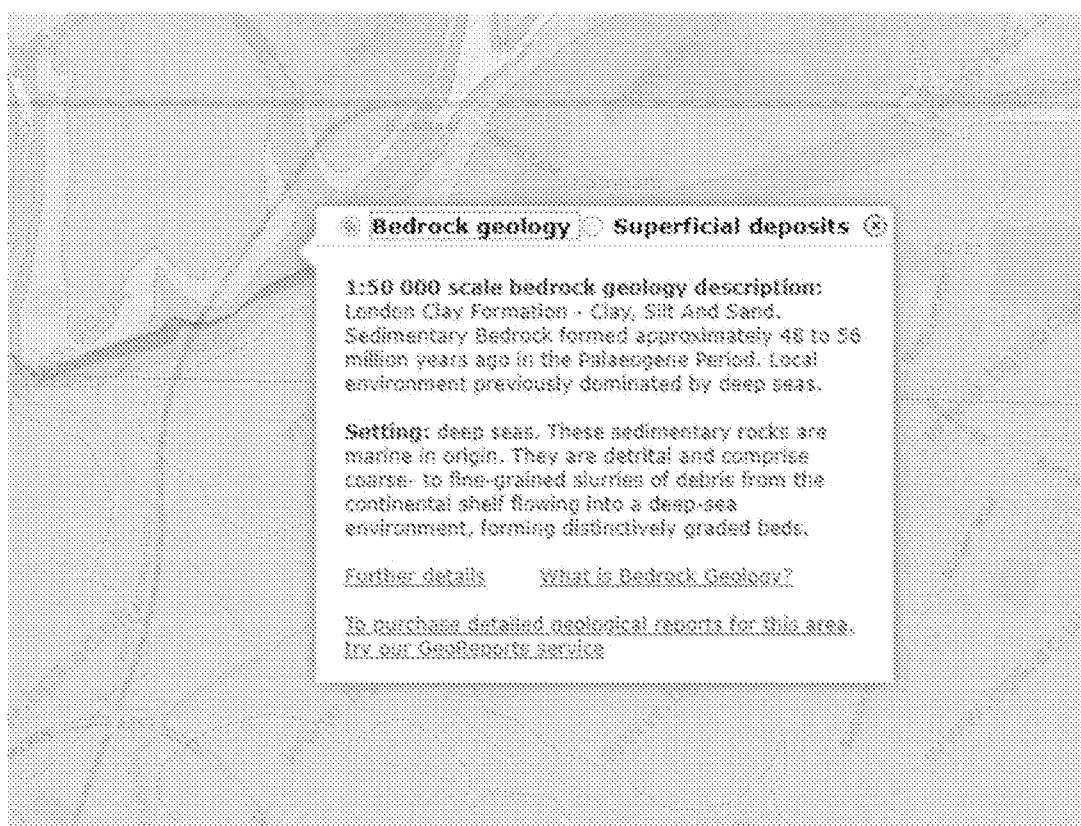
Richard Collier House, Lion Street, Chichester, West Sussex, PO19 1LW

2 Site Geology

2.1 British Geological Survey information

- 2.1.1 The British Geological Survey confirms the bedrock geology to be made up London Clay Formation i.e., Clay, silts, and sands. At the time of writing the British Geological Survey website does not have any recorded information of the Superficial deposits on site.
- 2.1.2 The British Geological survey also holds records of historical boreholes just north of the site which give some insight into the ground geology.
- Borehole SU90SE55 – Ground geology (Sandy Clay, Grey Clay)

Fig 2. British Geological Survey



Snippet from BGS Website showing Bedrock geology/superficial deposits <http://mapapps.bgs.ac.uk/geologyofbritain/home.html?>

2.2 Geological Assessment

- 2.2.1 A full site investigation has not been carried out at the time of writing however a soakage test to BRE 365 was undertaken on site on 3rd December 2021. The results confirmed a worst-case soakage test rate of **9.02x10⁻⁶m/s**.
- 2.2.2 As part of the soakaway test, a borehole was dug to 1.5m deep and monitored over 24 hours. Groundwater was noted at 1.2mbgl.

3 Existing Drainage

- 3.1.1 The site is greenfield and therefore no positive drainage system is in place. Any runoff therefore is deemed to discharge into the surrounding subsoils via infiltration.

4 Proposed Drainage Strategy

4.1 SuDS Hierarchy

- 4.1.1 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 – At a rate of 9.02x10⁻⁶m/s
Discharge to Watercourse	N/A
Discharge to Surface Water Sewer	N/A
Discharge to Other Sewer	N/A

4.2 Surface Water Drainage

- 4.2.1 Due to the information taken from the onsite soakaway test, it is proposed that all surface water runoff is to be discharged to ground via infiltration at the recorded rate of **9.02x10⁻⁶m/s**. All roof areas are to be collected into a positive drainage network before being discharged to ground through the use of a geocellular soakaway and all hard paved areas are to be freely drained to ground via porous construction. All infiltration features on site have been designed to cater for the 1 in 100 year +40% storm.
- 4.2.2 Hydraulic calculations have been carried out which can be found at **Appendix C**.

4.3 Water Quality

- 4.3.1 A key requirement of any SuDS system is that it protects the receiving water body from the risk of pollution.
- 4.3.2 Frequent and short duration rainfall events are those that are most loaded with potential contaminants (silts, fines, heavy metals, and various organic and inorganic contaminants) Therefore the first 5-10mm of rainfall should be adequately treated with SuDS.
- 4.3.3 The new SuDS Manual (Ciria C753, November 2015) introduces slightly different approach compared to the previous version for the water quality management of surface water. The Manual describes risks posed by the surface water runoff to the receiving environment as a function of:
- The pollution hazard at a particular site (i.e., the pollution source)
 - The effectiveness of SuDS treatment components in reducing levels of pollutants to environmentally acceptable levels
 - The sensitivity of the receiving environment
- 4.3.4 The EA website indicates that the site does not lie within a Source Protection Zone.

4.3.5 The recommended approaches for water quality risk management are given in the SuDS Manual Table 26.1.

Fig 5. Approaches to Water Quality Risk Management

Table 26.1 Approaches to Water Quality Risk Management			
Design method	Hazard Characterisation	Risk Reduction	
		For Surface Water	For Groundwater
Simple Index Approach	Simple pollution hazard indices based on land use (Table 26.2)	Simple SuDS hazard mitigation indices (Table 26.3)	Simple SuDS hazard mitigation indices (Table 26.4)
Risk Screening	Factors characterising traffic density and extent of infiltration likely to occur (Table 26.5)	N/A	Factors characterising unsaturated soil depth and type, and predominant flow type through the soils (Table 26.5)
Detailed Risk Assessment	Site specific information used to define likely pollutants and their significance	More detailed, component specific performance information used to demonstrate that the proposed SuDS components reduce the hazard to acceptable levels	
Process-based treatment modelling	Time series rainfall used with generic pollution characteristics to determine statistical distributions of likely concentrations and loadings in the runoff	Models that represent the treatment processes in the proposed SuDS components give estimates of reductions in even mean discharge concentrations and total annual load reductions delivered by the system	

4.3.6 As per Table 26.1 Simple Index approach will be used as a design method for this site.

4.3.7 Table 26.2 will provide hazard classification of different land uses. The land uses for the surface water drainage for this site are.

- Residential Roofs
- Individual Property driveways and residential car parks
- Low traffic roads

4.3.8 To deliver adequate treatment, the selected SuDS components should have a total pollution mitigation index for each contaminant type that equals or exceeds the pollution hazard index for each contaminant type. Therefore, the following must be achieved for the surface running off the site.

Total SuDS mitigation index $\geq$ pollution hazard index

4.3.9 Pollution Hazard Indices are given for different land uses in Table 26.2 of the SuDS manual;

Fig 6. Pollution Hazard Indices for Different Land Use Classifications

Table 26.2 Pollution Hazard indices for different land use classifications				
Land Use	Pollution Hazard Level	Total Suspended solids (TSS)	Metals	Hydro-Carbons
Residential roofs	Very Low	0.2	0.2	0.05
Other roofs (Typically commercial/industrial roofs)	Low	0.3	0.2 (up to 0.8 where there is potential for metals to leach from the roof)	0.05
Individual property driveways, residential car parks, low traffic roads (e.g., cul-de-sacs, homezones and general access roads) and non-residential car parking with infrequent change (e.g.,	Low	0.5	0.4	0.4

schools, offices) i.e., < 300 traffic movements/day				
Commercial yard and delivery areas, non-residential car parking with frequent change (e.g., hospitals, retail), all roads except low traffic roads and trunk roads/motorways	Medium	0.7	0.6	0.7
Sites with heavy pollution (e.g., haulage yards, lorry parks, highly frequented lorry approaches to industrial estates, waste sites), sites where chemicals and fuels (other than domestic fuel oil) are to be delivered, handled, stored, used or manufactured; industrial sites; trunk roads and motorways	High	0.8	0.8	0.9

4.3.10 From Table 26.2 the following information is tabulated in Table 1

Table 1: Pollution hazard index and destination of runoff for the proposed site

Table 1: Pollution hazard index and destination of runoff for the proposed site					
Land Use	Destination of Runoff	Pollution Hazard Level	Total Suspended Solids	Metals	Hydrocarbons
Residential Roof	Ground Water	Very Low	0.2	0.2	0.05
Individual driveways, residential car parks and low traffic roads	Ground water	Low	0.5	0.4	0.4

4.3.11 The SuDS mitigation index will be obtained from Table 26.4 (for groundwater) of the SuDS manual.

Figure 7 Indicative SuDS Mitigation Indices for discharges to ground waters.

4.3.12 SuDS mitigation index are tabulated in Table 5 as followed.

Table 26.4 Indicative SuDS mitigation indices for discharges to groundwater			
Characteristics of the material overlying the proposed infiltration surface, through which the runoff percolates	TSS	Metals	Hydrocarbons
A layer of dense vegetation underlain by a soil with good containment attenuation potential of at least 300mm in depth	0.6	0.5	0.6
A soil with good contaminant attenuation potential of at least 300mm in depth	0.4	0.3	0.3
Infiltration trench (where a suitable depth of filtration material is included that provides treatment, i.e., graded gravel with sufficient smaller particles but no single size coarse aggregate such as 20mm gravel) underlain by a soil with good contaminant attenuation potential of at least 300mm in depth.	0.4	0.4	0.4
Constructed permeable pavement (where a suitable filtration later is included that provides treatment, and including a geotextile at the base separating the foundation from the subgrade) underlain by a soil with good contaminant attenuation potential of at least 300mm in depth	0.7	0.6	0.7
Bioretention underlain by a soil with good contaminant attenuation potential of at least 300mm in depth	0.8	0.8	0.8
Proprietary treatment systems	These must demonstrate that they can address each of the contaminant types to acceptable levels for inflow concentrations relevant to the contributing drainage area		

Table 2: SuDS mitigation index

Mitigation Indices						
Runoff Source	Destination of Runoff	Mitigation Index Source	Type of SuDS Component	Total Suspended Solids (TSS)	Metals	Hydrocarbons
Individual driveways, residential car parks and low traffic roads	Ground water	Table 26.4 (for ground waters) Table 26.3 (for surface waters)	Permeable Pavement	0.7	0.6	0.7

- 4.3.13 The above analysis demonstrates that the SuDS devices within the design will mitigate any pollution present within the surface water system.

4.4 Foul water drainage

- 4.4.1 The foul water will discharge into the local foul water sewer via a new direct connection into an existing private chamber located on site.

Construction Phase Drainage

- 4.4.2 It is an offence to cause or knowingly permit the entry of any polluting, poisonous or noxious material in the water environment. If the pollution is serious enough to lower the ecological status of the water body as set out in terms by the Water Framework Directive (2000/60/EC) than prosecution may occur.
- 4.4.3 Remediation of any damage caused will not require the polluter to be prosecuted first. If the water pollution is serious enough to be classed an environmental damage, the damage will require to be remediated such that the area is returned to the condition it would have been in if the damage had not occurred.
- 4.4.4 If any pollution has not been reported or the polluter has not taken actions to prevent any further damage; they would then be causing an offence. Third parties (e.g., Private water supply users, landowners, recreation users and the public) who may be affected by possible damage may also report the risk of any environmental damage to the enforcing authority.
- 4.4.5 The principles of SuDS (Sustainable Drainage Systems) shall be applied to all components of design and construction regarding surface water management. Any design or site works that may impact on the site drainage or the water quality shall:
- Soakaway where soils allow
 - Consider and manage erosion
 - Remove pollutants in surface water
 - Retain any silts on site and prevent silts from discharging to watercourses or drains
 - Keep runoff rates at existing greenfield runoff
 - Prevent accidental spillages reaching watercourse
- 4.4.6 As infiltration on site is viable, the temporary drainage for the development will be in the form of land drains which will discharge into the ground.
- 4.4.7 Pollution will be controlled via the use of catchpit manholes and geotextiles.
- 4.4.8 Any potential hazardous substances will be within a controlled compound with a separate drainage system that will contain a penstock valve / containment kit in the event of a spillage.

5 Maintenance

5.1 Introduction

- 5.1.1 During construction, the Contractor will be responsible for maintaining the drainage and SuDS (Sustainable Drainage Systems). Upon handover, the occupier will take on the responsibility of these duties as laid out in this report.
- 5.1.2 The maintenance schedule for the proposed development will be split down into two separate categories; SuDS features and regular private drainage.

5.2 SuDS at Land to r/o Highground House, Barnham

- 5.2.1 As listed above, in section 5.1.2, the SuDS features used on site will be **porous paving**.
- 5.2.2 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

5.3 SuDS Drainage Maintenance Specification

5.3.1 Soakaway

In order to maintain the functioning of the 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

5.3.2 Permeable Paving

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 paving		
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

5.4 General Drainage Maintenance Specification

5.4.1 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 allow 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.	Monthly
Strim vegetation 1m min surround to structures and keep area free from silt and debris	
Inspection 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.	Annually
Undertake inspection after leaf fall in Autumn	
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

5.4.2 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

6 Summary and Conclusions

- 6.1.1 CGS Civils has been instructed by to produce a Drainage statement under National Planning Policy Framework (NPPF) to support the Planning Application for a new single storey dwelling.
- 6.1.2 The Surface Water will discharge to a geocellular soakaway that has been sized to cater for the 1 in 100 year storm plus 40%.
- 6.1.3 The Foul water will discharge into an existing private system on site.
- 6.1.4 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.

7 Appendices

7.1 Appendix A – Site Plan

Prior to any works being undertaken on this site the protective fencing is to be erected as shown on the Tree Protection Plan BJH 03/04 - provided by Bernie Harverson Arboricultural Consultant.

Barriers are to be 'Fit For Purpose' to comply with BS5837 requirements to exclude construction activity and must be maintained to ensure that they remain rigid and complete and in the original setting out positions.

NOTES:
1. The site is located within the Highground Lane Conservation Area.
2. The site is located within the Highground Lane Conservation Area.
3. The site is located within the Highground Lane Conservation Area.
4. The site is located within the Highground Lane Conservation Area.

The Cottage

Grove House

Russet

Crab Apple

Pippin Cottage

Orchard House

Highground Orchards

Orchard End

Key

- Site Development boundary
- Access over unadopted road back to highway (Church Lane)

PROPOSED BLOCK PLAN 1:500 @A3



P1 Wildflower species added + bat and bird boxes added to East Gable as recommended by the Ecological Assessment
Tree/ Hedgerow Protection note added

REVISION NOTES

RPS
DESIGN GROUP

0845 5442005
rpsdesigngroup.co.uk
Project No: 21.21
Client: Mr & Mrs Bates
Site Address: Land North of Highground House, accessed via Private Drive off Highground Lane
Drawing Title: Proposed Block Plan
Date: 05.03.21 Scale: 1:500@A3
Drawn by: AC Checked by: RM

Drawing No: **L102_P01**
Status: **PLANNING**

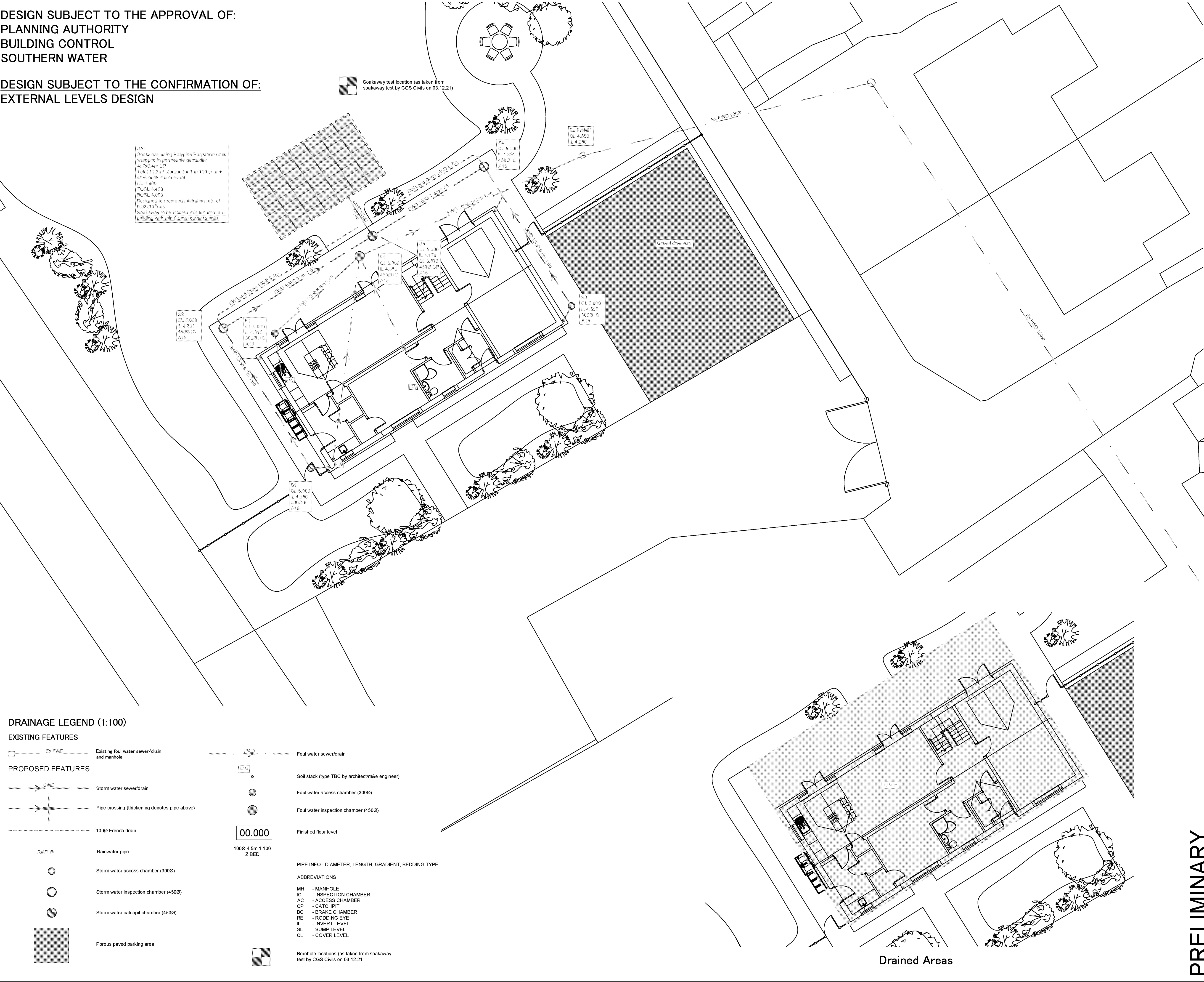
7.2 Appendix B – Drainage Layout

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

DESIGN SUBJECT TO THE CONFIRMATION OF:
EXTERNAL LEVELS DESIGN

S41
Soakaway using Polypropylene Polypropylene units
wrapped in permeable geotextile
42750 4m CP
Total 11.2m³ storage for 1 in 100 year +
40% peak storm event
CL 4.905
TCCL 4.400
BCCL 4.000
Designed to recorded infiltration rate of
9.02x10⁻⁶ m/s
Soakaway to be located min 5m from any
building with min 5.0m cover to units.

Soakaway test location (as taken from
soakaway test by CGS Civils on 03.12.21)



DRAINAGE LEGEND (1:100)

EXISTING FEATURES

Ex FWD Existing foul water sewer/drain
and manhole

PROPOSED FEATURES

SWD Storm water sewer/drain
Pipe crossing (thickening denotes pipe above)
1000 French drain
RWP Rainwater pipe
Storm water access chamber (3000)
Storm water inspection chamber (4500)
Storm water catchpit chamber (4500)
Porous paved parking area

FWD Foul water sewer/drain
Soil stack (type TBC by architect/m&e engineer)
Foul water access chamber (3000)
Foul water inspection chamber (4500)
Finished floor level
00.000
1000 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

Borehole locations (as taken from soakaway
test by CGS Civils on 03.12.21)

STANDARD DRAINAGE NOTES

- DO NOT SCALE FROM THIS DRAWING. REFER TO FIGURED DIMENSIONS ONLY. THE CONTRACTOR SHOULD CHECK ALL DIMENSIONS ON SITE.
- ALL DIMENSIONS IN MILLIMETRES AND ALL LEVELS ARE IN METERS UNLESS NOTED OTHERWISE.
- THIS DRAWING SHOULD BE READ IN CONJUNCTION WITH ALL OTHER RELEVANT ARCHITECT AND ENGINEERING DETAILS, DRAWINGS AND SPECIFICATIONS.
- ANY DISCREPANCIES SHOULD BE REPORTED TO THE ARCHITECT AND/OR ENGINEER IMMEDIATELY, SO THAT CLARIFICATION CAN BE SOUGHT PRIOR TO THE COMMENCEMENT OF WORK.
- 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.
- 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.
- COVER LEVELS SHOWN ARE APPROXIMATE. COVERS AND FRAMES SHALL BE SET TO FINISHED GROUND LEVELS AND FALLS.
- ALL UN-REFERENCED PIPES ARE ASSUMED TO BE 100mm DIA.
- ALL PRIVATE DRAINAGE TO BE IN ACCORDANCE WITH THE BUILDING REGULATIONS APPROVED DOCUMENT PART-H, AND TO THE SATISFACTION OF THE BUILDING CONTROL INSPECTOR.
- 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.
- STUB CONNECTIONS TO ADAPTABLE MANHOLES SHALL BE MADE FROM VITRIFIED CLAY AND CONSIST OF TWO ROCKER PIPES LAID AT THE SAME GRADIENT AS THE UP OR DOWNSTREAM PIPE.
- 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.
- ALL EXISTING MANHOLE COVERS, GULLIES, ETC. ARE TO BE RAISED/LOWERED TO SUIT NEW LEVELS.
- IT IS THE RESPONSIBILITY OF THE CONTRACTOR TO CONFIRM THE LOCATION AND DEPTH OF ALL EXISTING SERVICES AND UTILITIES THAT MAY BE PRESENT.
- 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.
- 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

Prefix to drawing numbers shall signify the following:-
P = PRELIMINARY Shall not be used for contract or construction purposes
T = TENDER Shall not be used for construction purposes
C = CONSTRUCTION These are the only drawings that shall be used for construction purposes
R = RECORD Record of actual completed work

P-	14.12.21	PRELIMINARY ISSUE	CS	CS	CS
REV	DATE	DESCRIPTION	BY	CHK	APP

cgscivils
Consulting Civil Engineers

CLIENT
MICHAEL AND NICKY BATES

ARCHITECT
RPS

JOB TITLE
HIGHGROUND HOUSE
BARNHAM

DRAWING TITLE
DRAINAGE LAYOUT

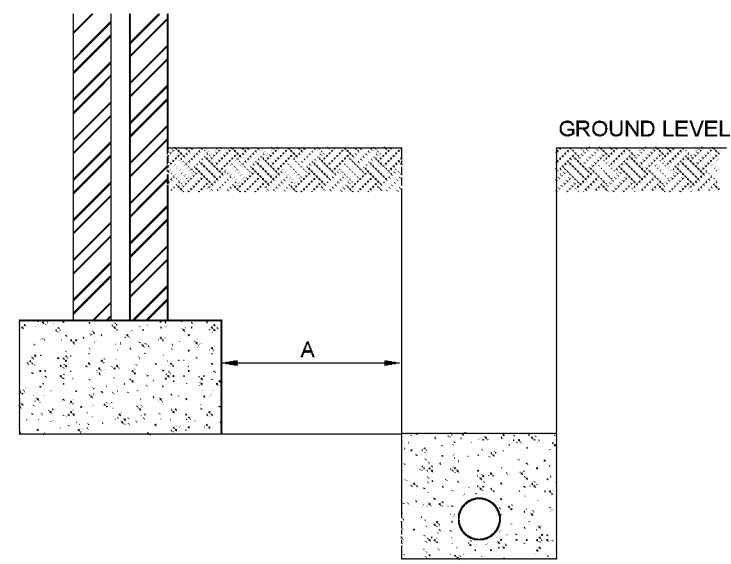
DRAWN CS	ENGINEER C SLADE	CHECKED TZ	APPROVED CS
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DATE DEC 2021	SCALE @ A1 1:100
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JOB No. C1931	STATUS P	DRAWING No. 100	REV P-
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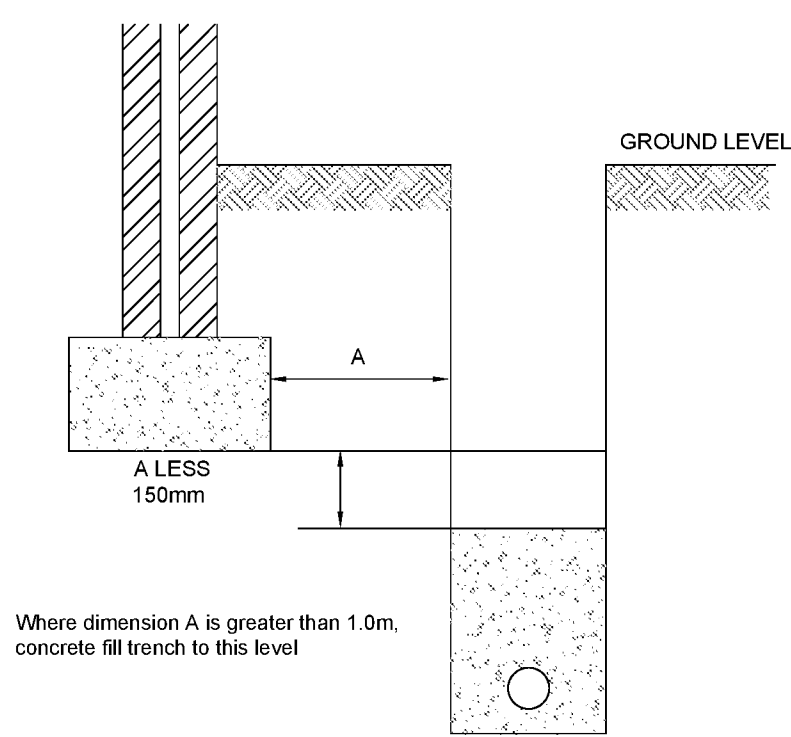
PRELIMINARY

Drained Areas



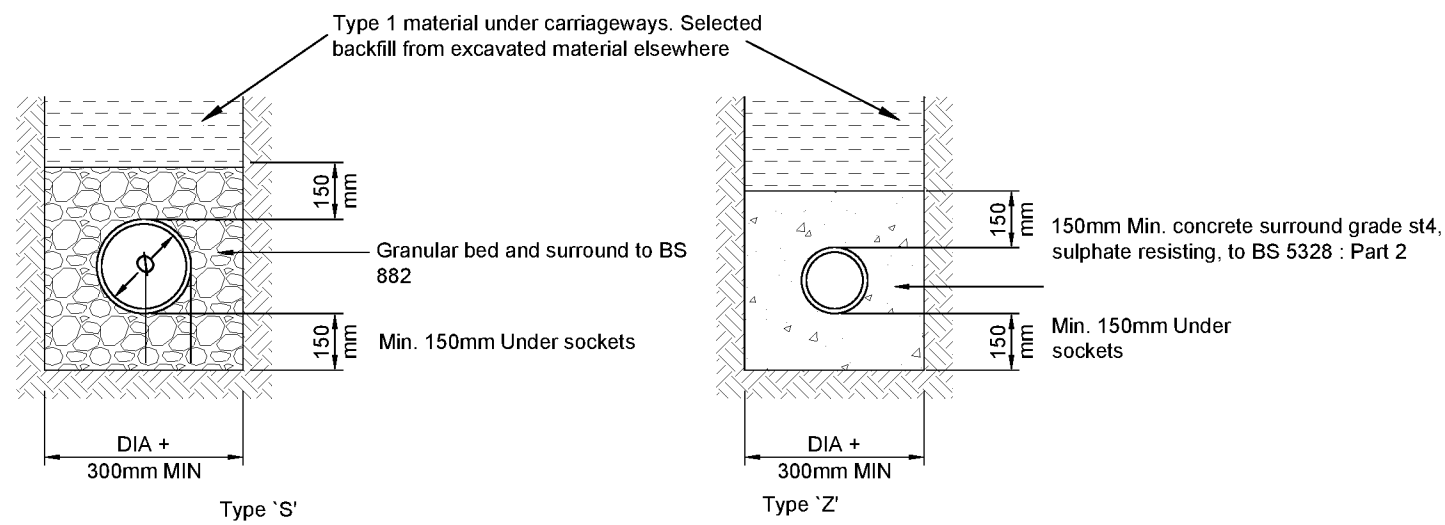
Where dimension A is less than 1.0m, concrete fill trench to level of underside of foundations.

Pipes near buildings



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

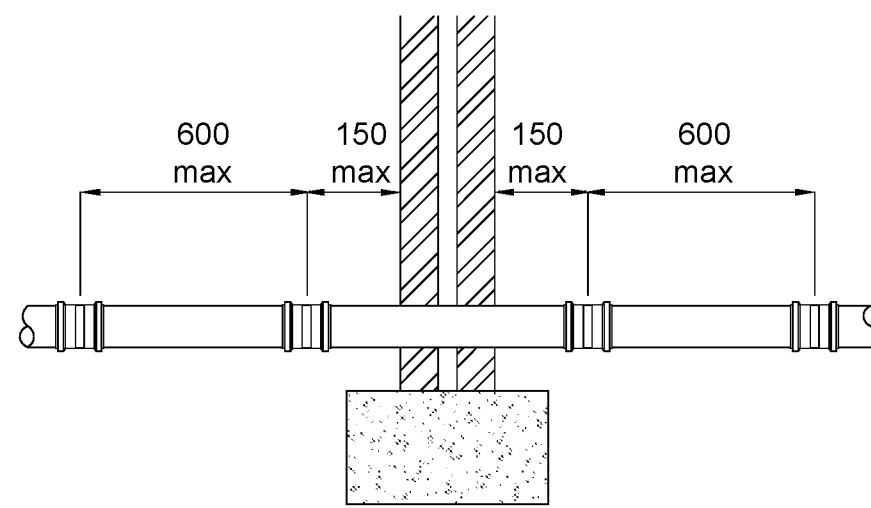
Pipes near buildings



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

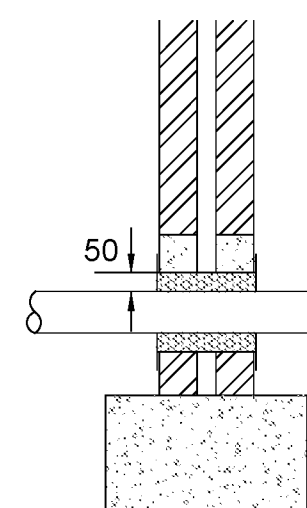
Drainage with less than 600mm cover - Landscaped 900mm cover - Roads (Unless bedding type is stated on the drainage plans or specification)

Pipe bedding details in private Areas



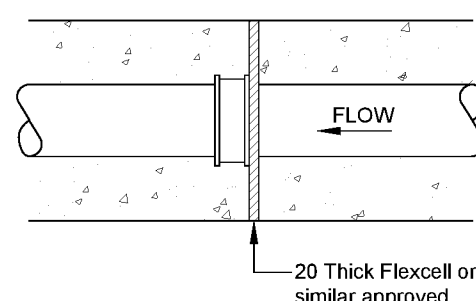
A. Short length of pipe bedded in wall with joints formed within 150mm of each wall face. Adjacent rock pipes of 600mm max. length with flexible joints.

Pipes through wall detail

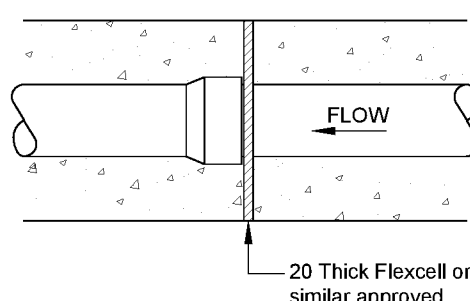


B. Arch or lintelled opening to give min 50mm space all round the pipe. Mask opening on both sides of the wall with rigid sheet material to prevent entry of fill or vermin. Important: Fill void with compressible material to prevent entry of gas.

Pipes through wall with lintel detail

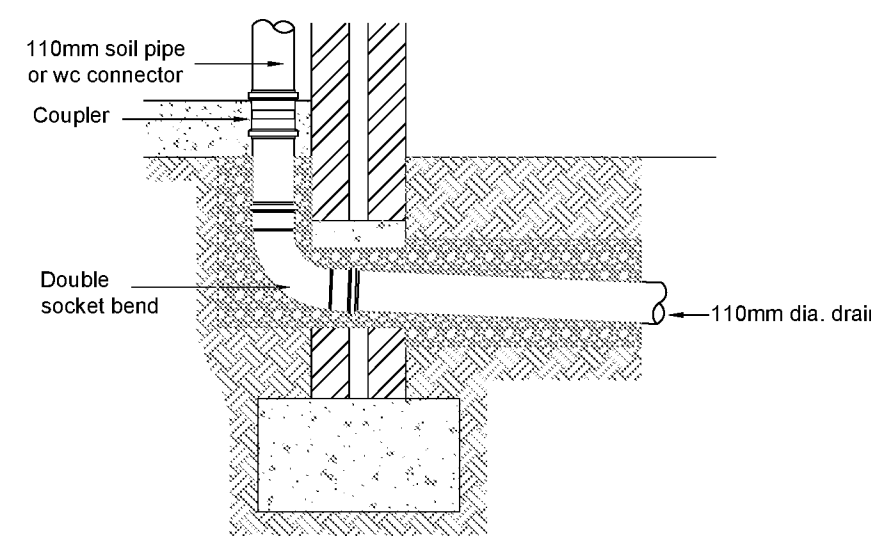


Flexible joint detail for sleeved pipes

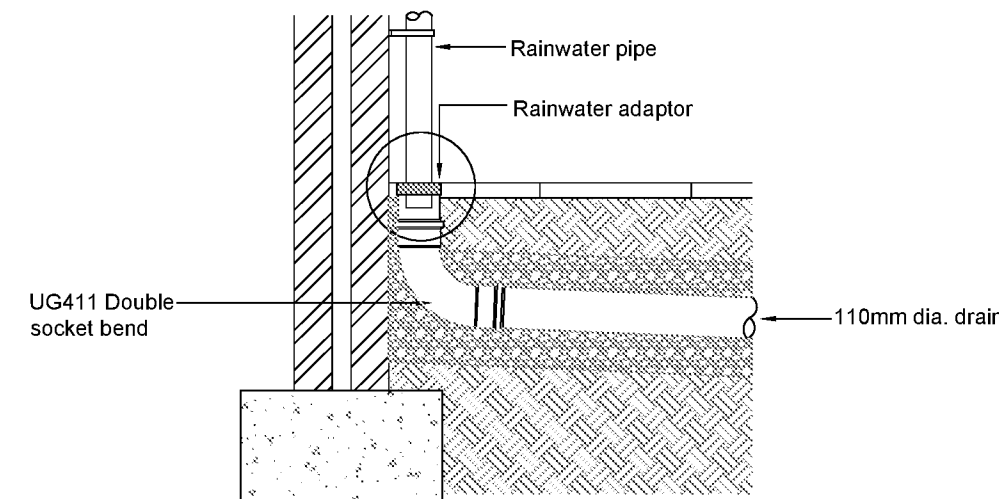


Flexible joint detail for socketed pipes

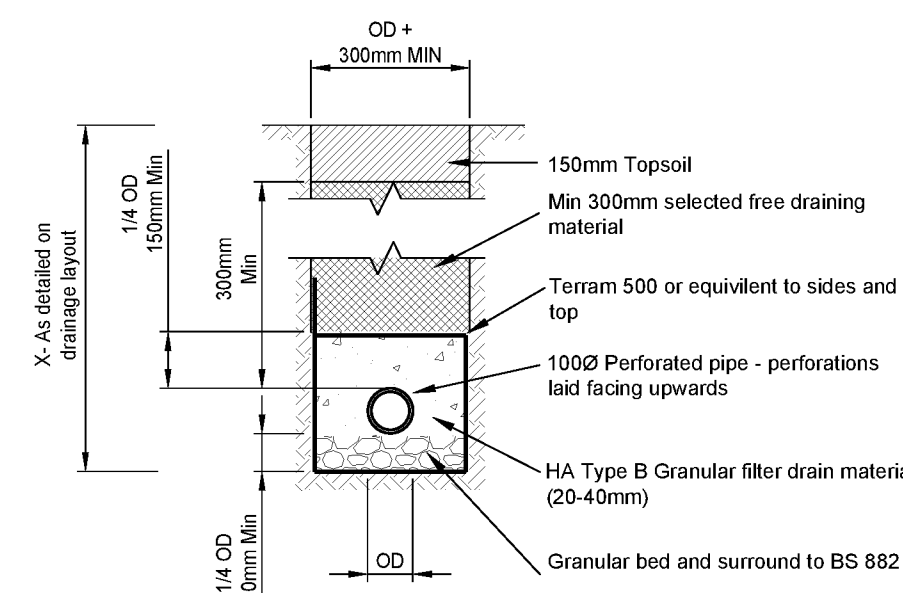
Joints for concrete encased pipes



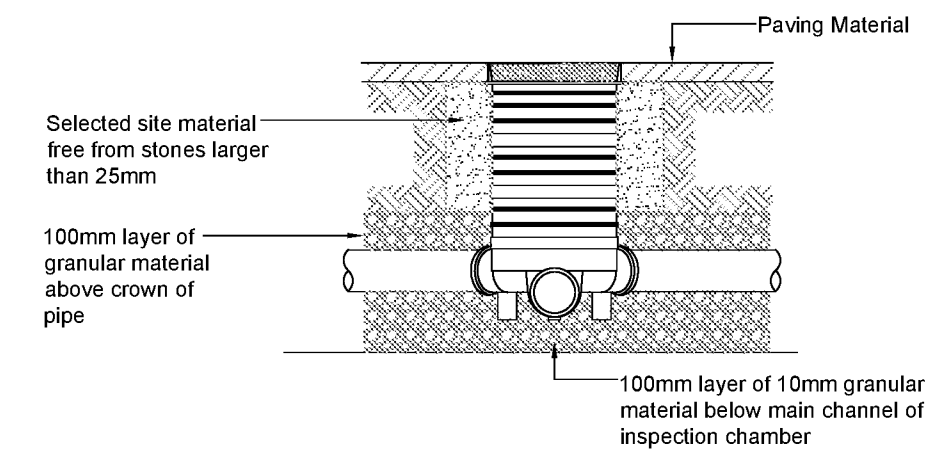
Soil pipe / wc connection



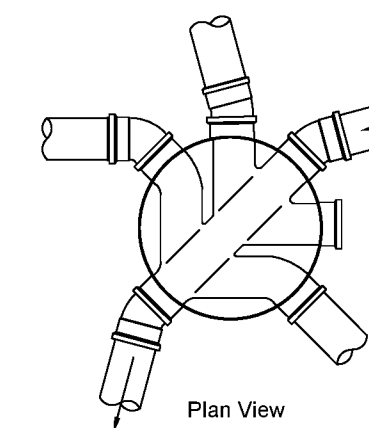
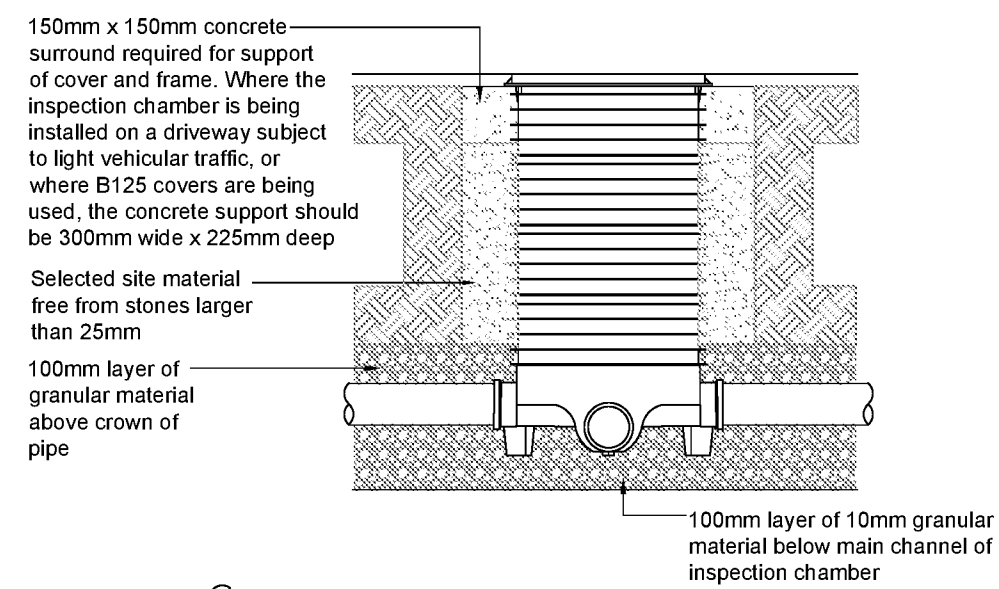
Rainwater pipe connection



Land drain detail

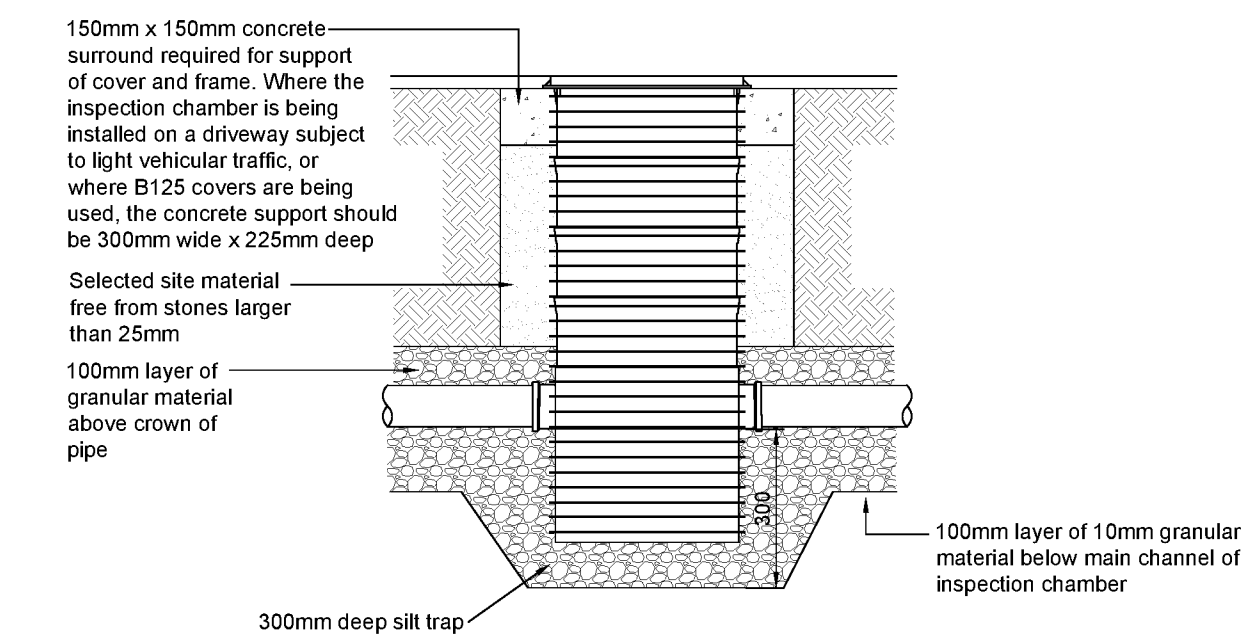


300mmØ SHALLOW INSPECTION CHAMBER DETAIL



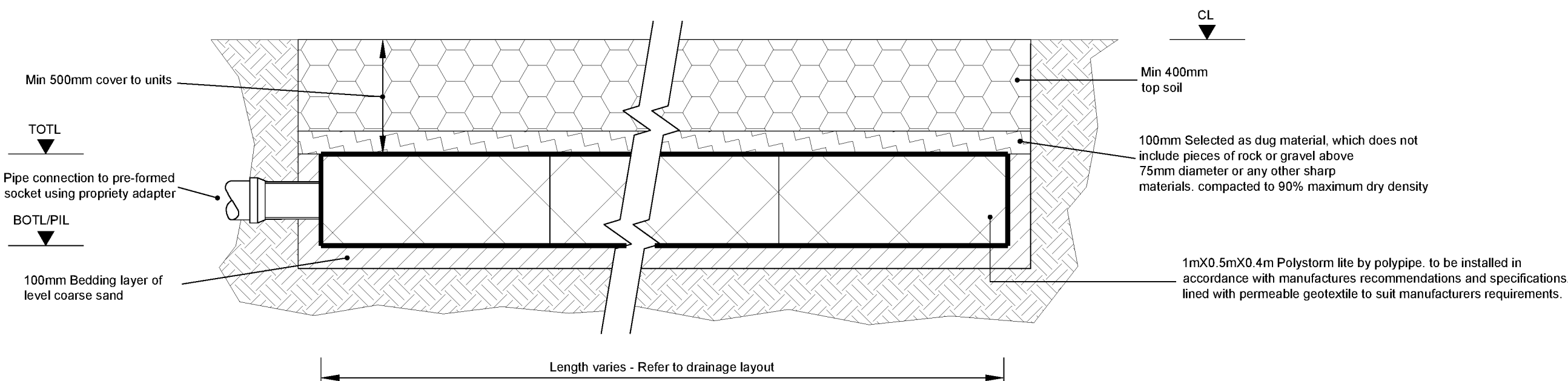
1. In all installations, the main channel of the inspection chamber should always be used. Where the chamber is being used as a change of direction for the drainage system, short radius bends of 11¼°, 15°, 30° and 45° can be used in the inlet and outlet to achieve the required angle.
2. Side inlet branch 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.

450mmØ INSPECTION CHAMBER DETAIL



450mmØ POLYPIPE BASIC SILT TRAP DETAIL

Prefixed to drawing numbers shall signify the following:-			
P = PRELIMINARY	Shall not be used for contract or construction purposes		
T = TENDER	Shall not be used for construction purposes		
C = CONSTRUCTION	These are the only drawings that shall be used for construction purposes		
R = RECORD	Record of actual completed work		



Trench soakaway using Polystorm Lite Geomodular units
Landscaped areas only
0.4m deep

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

PRELIMINARY

P-	14.12.21	PRELIMINARY ISSUE	CS	CS	CS
REV	DATE	DESCRIPTION	BY	CHK	APP
CLIENT MICHAEL AND NICKY BATES					
ARCHITECT RPS					
JOB TITLE HIGHGROUND HOUSE BARNHAM					
DRAWING TITLE DRAINAGE DETAILS					
DRAWN	CS	ENGINEER	C SLADE	CHECKED	TZ
DATE	DEC 2021	SCALE @ A1	1:20	APPROVED	CS
JOB No.	C1931	STATUS	P	DRAWING No.	200
REV					P-

7.3 **Appendix C – Surface Water Calculations**

Design Settings

Rainfall Methodology	FSR	Maximum Time of Concentration (mins)	30.00
Return Period (years)	2	Maximum Rainfall (mm/hr)	50.0
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)	0.200
Ratio-R	0.400	Preferred Cover Depth (m)	1.200
CV	0.750	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)
S5	0.018	5.00	5.000	150	426.161	-98.591	0.824
SA1			5.000	1200	424.780	-96.388	0.850

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)
1.000	S5	SA1	2.600	0.600	4.176	4.150	0.026	100.0	150	5.04	50.0

Name	Vel (m/s)	Cap (l/s)	Flow (l/s)	US Depth (m)	DS Depth (m)	Σ Area (ha)	Σ Add Inflow (l/s)	Pro Depth (mm)	Pro Velocity (m/s)
1.000	1.005	17.8	2.4	0.674	0.700	0.018	0.0	38	0.709

Pipeline Schedule

Link	Length (m)	Slope (1:X)	Dia (mm)	Link Type	US CL (m)	US IL (m)	US Depth (m)	DS CL (m)	DS IL (m)	DS Depth (m)
1.000	2.600	100.0	150	Circular	5.000	4.176	0.674	5.000	4.150	0.700

Link	US Node	Dia (mm)	Node Type	MH Type	DS Node	Dia (mm)	Node Type	MH Type
1.000	S5	150	Manhole	Adoptable	SA1	1200	Manhole	Adoptable

Manhole Schedule

Node	Easting (m)	Northing (m)	CL (m)	Depth (m)	Dia (mm)	Connections	Link	IL (m)	Dia (mm)
S5	426.161	-98.591	5.000	0.824	150		0	1.000	4.176
SA1	424.780	-96.388	5.000	0.850	1200		1	1.000	4.150

Simulation Settings

Rainfall Methodology	FSR	Analysis Speed	Normal
FSR Region	England and Wales	Skip Steady State	x
M5-60 (mm)	20.000	Drain Down Time (mins)	240
Ratio-R	0.400	Additional Storage (m ³ /ha)	20.0
Summer CV	0.750	Check Discharge Rate(s)	x
Winter CV	0.840	Check Discharge Volume	x

Storm Durations

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

Return Period (years)	Climate Change (CC %)	Additional Area (A %)	Additional Flow (Q %)
1	0	0	0
10	40	0	0
30	0	0	0
100	40	0	0

Node SA1 Soakaway Storage Structure

Base Inf Coefficient (m/hr)	0.03247	Invert Level (m)	4.000	Depth (m)	0.400
Side Inf Coefficient (m/hr)	0.03247	Time to half empty (mins)	607	Inf Depth (m)	0.400
Safety Factor	2.0	Pit Width (m)	4.000	Number Required	1
Porosity	0.95	Pit Length (m)	7.000		

Results for 1 year Critical Storm Duration. Lowest mass balance: 99.47%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
15 minute winter	S5	10	4.218	0.042	2.5	0.0189	0.0000	OK
360 minute winter	SA1	256	4.074	-0.076	0.4	1.9616	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 winter	S5	1.000	SA1	2.5	0.666	0.140	0.0097
360 minute winter	SA1	Infiltration		0.1			

Results for 10 year +40% CC Critical Storm Duration. Lowest mass balance: 99.47%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
15 minute winter	S5	10	4.250	0.074	6.9	0.0336	0.0000	OK
360 minute winter	SA1	344	4.215	0.065	0.9	5.7954	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 winter	S5	1.000	SA1	6.8	0.864	0.385	0.0206
360 minute winter	SA1	Infiltration		0.1			

Results for 30 year Critical Storm Duration. Lowest mass balance: 99.47%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
15 minute winter	S5	10	4.245	0.069	6.2	0.0315	0.0000	OK
360 minute winter	SA1	328	4.196	0.046	0.9	5.2598	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 winter	S5	1.000	SA1	6.2	0.841	0.347	0.0190
360 minute winter	SA1	Infiltration		0.1			

Results for 100 year +40% CC Critical Storm Duration. Lowest mass balance: 99.47%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
360 minute winter	S5	352	4.385	0.209	1.5	0.0949	0.0000	SURCHARGED
360 minute winter	SA1	352	4.385	0.235	1.5	10.4953	0.0000	OK

Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)
360 minute winter	S5	1.000	SA1	1.5	0.572	0.084	0.0458
360 minute winter	SA1	Infiltration		0.2			

7.4 **Appendix D – Borehole Logs**

D Strata log

Geological classification (BGS only)	Description of strata	Thickness m	Depth (to base of strata) m
	* Brown Sandy Clay	7	7
	* Grey Clay	52	59
	* Mottled Clay Red/Green/Blue	13	72
	* Thanet Sand	2	74
	* Chalk and Flint	20	94
	(continue on separate page if necessary)		
	Other comments (for example, gas encountered, saline water intercepted)		

E Completing this form

7.5 **Appendix E – Soakage Test Results**

Ref: C1931/CS

Michael Bates

12th January 2022**Re: Highround House, Barnham – Soakaway Testing – Infiltration Test Result Summary**

Dear Michael

The following investigation was carried out at the above location in accordance with our quotation.

1. Site Works

The purpose of the investigation was to supply soakaway test data in general accordance with BRE document 365 (Soakaway Design) at one location which would be the approximate intended location for a possible infiltration device to serve a new replacement dwelling.

The appended drawing illustrates the position of the test pit. The BRE365 pit was excavated to a depth of 0.9m in line with the approximate depth of the proposed soakaway.

In addition to the BRE 365 test a hand augured borehole has dug to a depth of 1.5mbgl. It was monitored over 24 hours and water was noted at the base at 1.2mbgl.

The testing commenced on 3rd December 2021 with three tests being undertaken in accordance with BRE 365.

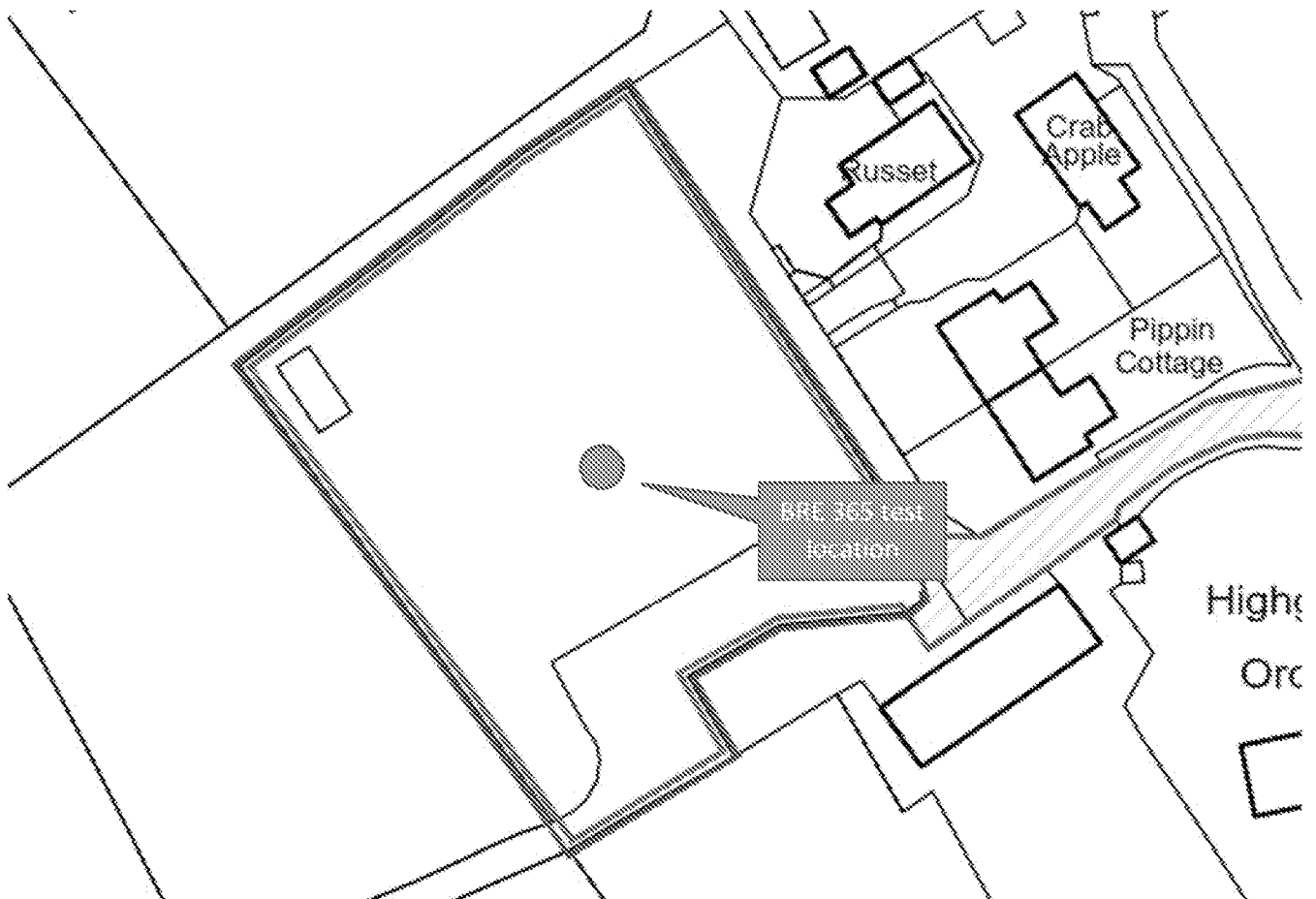
2. BRE 365 Soakaway Test Findings

Testing of the sub soils which was noted as chalk produced a BRE 365 design infiltration rate of **9.02x10⁻⁶m/s**. This rate was the slowest taken from all three tests. This is considered a moderate to poor rate and will likely be suitable for infiltration devices with a large surface area.

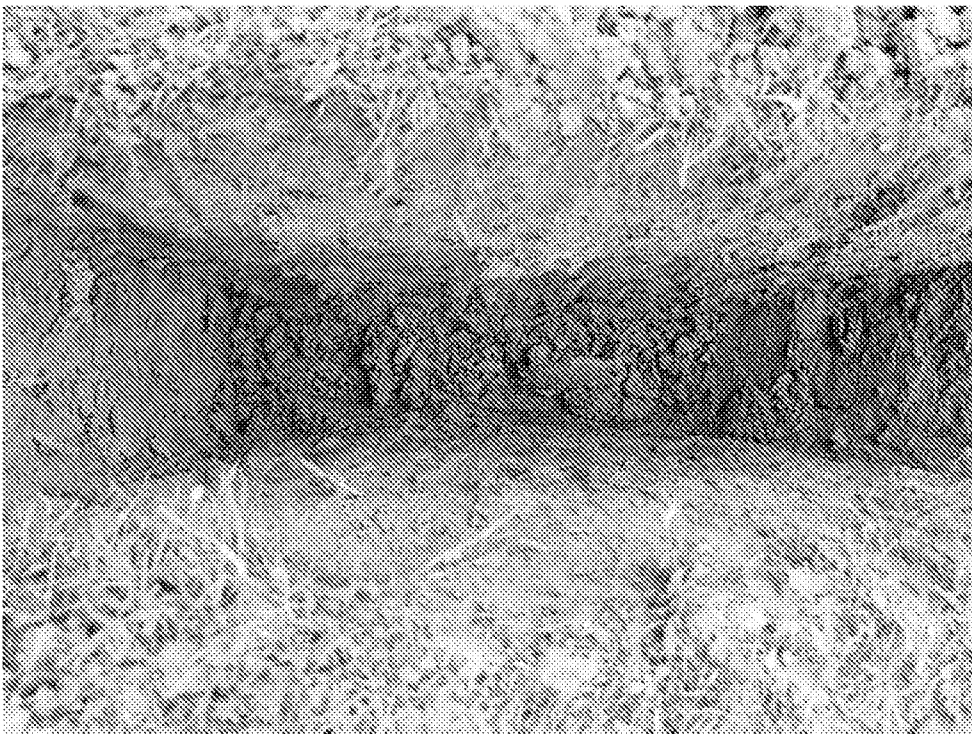
3. BRE 365 Soakaway Test Results

Test Pit No	Infiltration Rate (1-3 Tests)			Depth of Test	Soil Type
SAT1	1.31x10 ⁻⁵ m/s	1.09x10 ⁻⁵ m/s	9.02x10⁻⁶m/s	0.9m	Sandy clay

Appendix A – Soakaway Test Location Plan



Appendix B – Site Photographs



Richard Cobden House, Lion Street, Chichester, West Sussex, PO19 1LW



Consulting Civil Engineers

Appendix C – Soakaway Test Results

Richard Cobden House, Lion Street, Chichester, West Sussex, PO19 1LW



Creating Civil Engineers

Job: Highground House - Test 1

Infiltration Calculator

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

V_{p75-25} = Effective storage volume between 75% and 25% effective depth

a_{p50} = Internal surface area of the trial pit up to 50% effective depth and including the base area

t_{p75-25} = The time for the water level to fall from 75% to 25% effective depth

f = Infiltration rate

Trial pit width	=	0.3
Trial pit depth	=	0.9
Trial pit length	=	1

a_{p50} =

1.32

 m/squared

t_{p75-25} =

7800

 seconds

V_{p75-25} =

0.135

 m/cubed

F =

1.31E-05



Consulting Civil Engineers

Job: Highground House - Test 2

Infiltration Calculator

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

V_{p75-25} = Effective storage volume between 75% and 25% effective depth

a_{p50} = Internal surface area of the trial pit up to 50% effective depth and including the base area

t_{p75-25} = The time for the water level to fall from 75% to 25% effective depth

f = Infiltration rate

Trial pit width	=	0.3
Trial pit depth	=	0.9
Trial pit length	=	1

a_{p50} =

1.32

 m/squared

t_{p75-25} =

9420

 seconds

V_{p75-25} =

0.135

 m/cubed

F =

1.09E-05



Creating Civil Engineers

Job: Highground House - Test 3

Infiltration Calculator

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

V_{p75-25} = Effective storage volume between 75% and 25% effective depth

a_{p50} = Internal surface area of the trial pit up to 50% effective depth and including the base area

t_{p75-25} = The time for the water level to fall from 75% to 25% effective depth

f = Infiltration rate

Trial pit width	=	0.3
Trial pit depth	=	0.9
Trial pit length	=	1

a_{p50} =

1.32

 m/squared

t_{p75-25} =

11340

 seconds

V_{p75-25} =

0.135

 m/cubed

F =

9.02E-06