



Consulting Civil Engineers

Surface Water Drainage Report

Land at Eastergate Lane, Eastergate PO20 3SJ

For

Mr & Mrs Strudwick

Rev – **P1**

Reference **C2027**

Date **7th October 2022**

Revision	Date of Issue	Comments	Prepared By	Checked By
P	10.03.2022	Initial Issue	LH	CS
P1	07.10.2022	Revised	LH	CS

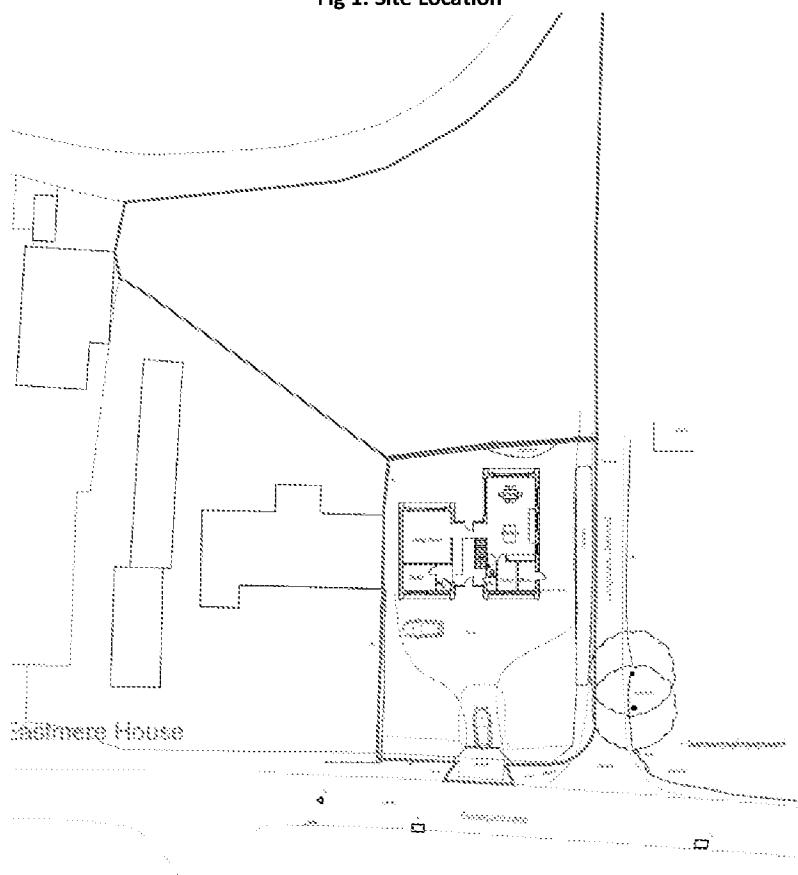
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1 Introduction

- 1.1.1 CGS Civils Ltd have been appointed by Mr & Mrs Strudwick to undertake a drainage strategy report for a proposed development at Land at Eastergate Lane, Eastergate PO20 3SJ.
- 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 undeveloped Greenland space. The proposed development will consist of the construction of a new two-storey four-bedroom domestic property with associated access and parking.
- 1.1.4 The proposed development is located as OS Grid Reference SU 95278 06066 and has the post code PO20 3SJ
- 1.1.5 The total green line boundary is approximately 0.072 Ha and the proposed development will result in a total of 0.031 Ha of impermeable area, 0.014 Ha of which is roof areas and the other 0.017 Ha will be hard paved areas.
- 1.1.6 The proposed site will make use of an existing access located along Eastergate Lane; the site is flanked by residential dwellings and greenfield areas.
- 1.1.7 The proposed site plan can be found in **Appendix A**.

Fig 1. Site Location

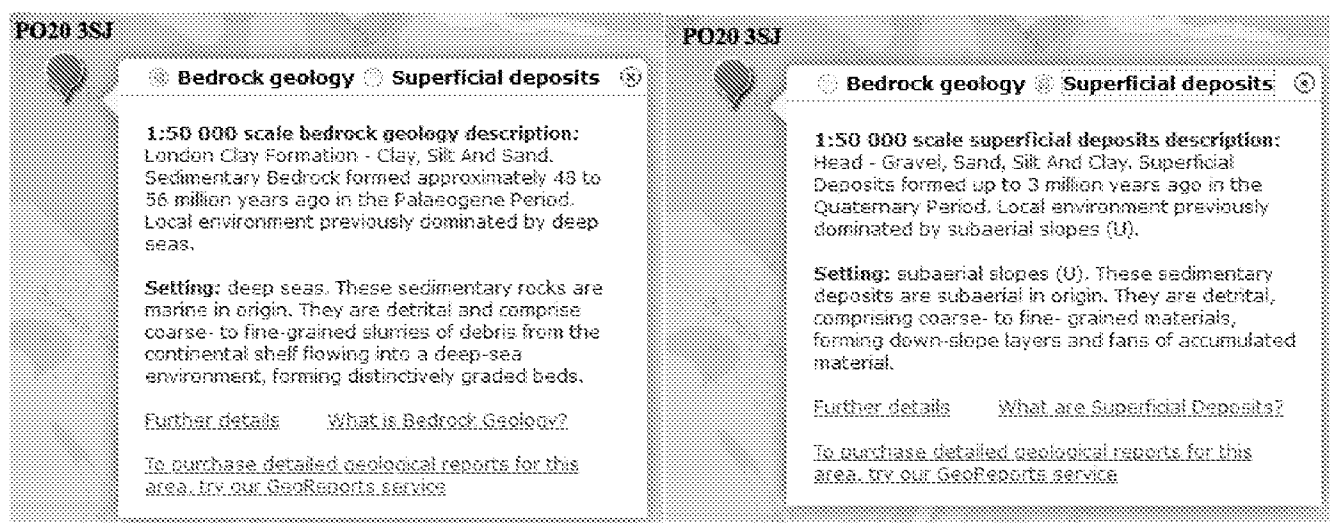


2 Site Geology

2.1 British Geological Survey information

- 2.1.1 The British Geological Survey confirms the bedrock geology to be made up of London Clay Formation, which is comprised of Clay, Silt and Sand. The BGS website confirms the superficial deposits on site to be made up of Head, which consists of Gravel, Sand, Silt and Clay.
- 2.1.2 The British Geological survey also holds records of historical boreholes near the site which give some insight into the ground geology.
- Borehole SU90NE32 (Located approx. 344m South East of the site) – Gravel, Clay and Sand

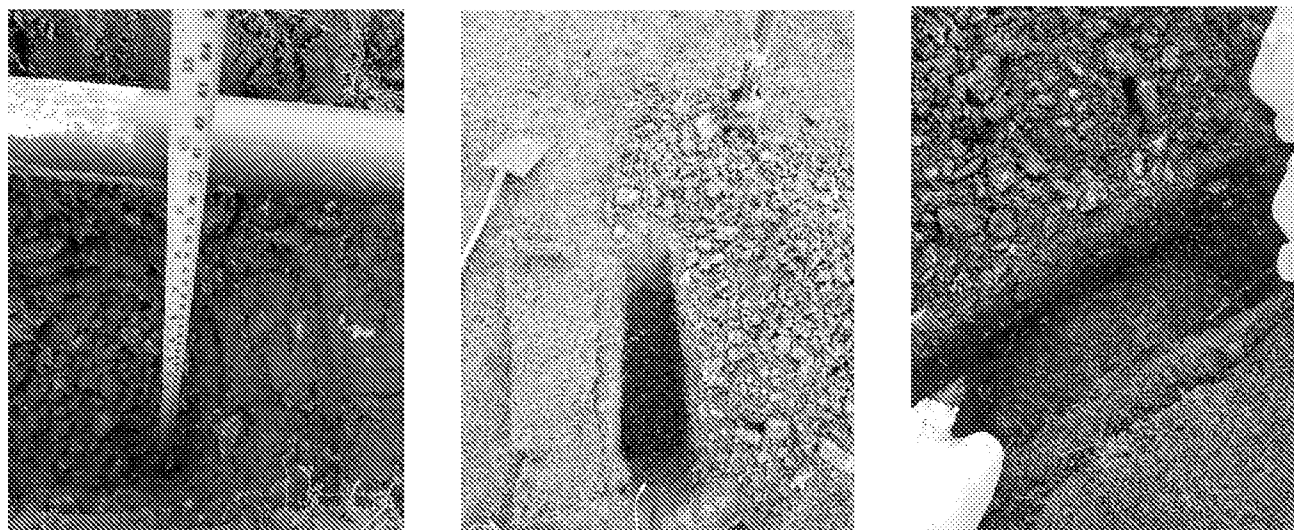
Fig 2. British Geological Survey



2.2 Geological Assessment

- 2.2.1 An infiltration test to BRE365 was carried out on site by CGS Civils in February 2022. The infiltration test yielded a worst-case recorded infiltration rate of 2.47×10^{-5} m/s which is considered to be a fair rate.
- 2.2.2 During the soakaway testing, a 2m deep borehole was installed to monitor groundwater. This was noted as being dry and remained dry during 24 hours of monitoring.

Fig 3. Soakaway test images



3 Existing Drainage

- 3.1.1 As the site is greenfield, there is no existing drainage on site.

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 – Recorded infiltration rate of $2.47 \times 10^{-5} \text{m/s}$
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 In order to follow the SuDS hierarchy, an infiltration test to BRE365 standards was undertaken on site. The test resulted in a confirmed infiltration rate of $2.47 \times 10^{-5} \text{m/s}$ which is considered to be a fair rate. It is therefore determined that all surface water runoff is to be discharged to ground via infiltration. Roof area runoff is to be collected into a positive drainage network before discharging into a geocellular soakaway which is designed to cater for the 1 in 100-year +40% storm. All hard paved areas are to be constructed of a porous surface to allow all runoff to discharge freely to ground via infiltration.
- 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

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

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., schools, offices) i.e., < 300 traffic movements/day	Low	0.5	0.4	0.4
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

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 not 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	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.

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 at Eastergate Lane, Eastergate PO20 3SJ

- 5.2.1 As listed above, in section 5.1.2, the SuDS features used on site will be **Soakaway and Permeable 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
Trim 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.

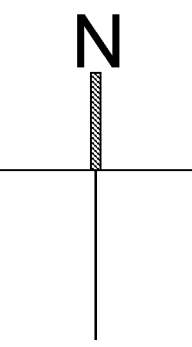
Below Ground Drainage Pipes	
Regular Maintenance	Frequency
Inspect and identify any areas that are not operating correctly. If required, take remedial action.	Monthly for 3 months then annually
Remove debris from the catchment surface (where it may cause risks to performance)	Monthly
Remove sediment 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 Mr & Mrs Strudwick to produce a Drainage statement under National Planning Policy Framework (NPPF) to support the Planning Application for the development of a two-storey 4-bedroom development with associated access and parking.
- 6.1.2 The Surface Water will discharge to ground via infiltration. Roof areas are to be collected into a positive drainage network before discharge via a geocellular soakaway and all hard paved areas are to freely drain to ground via infiltration. All SuDS features have been designed to an infiltration rate of $2.47 \times 10^{-5} \text{m/s}$ and to cater for the 1 in 100-year +40% storm.
- 6.1.3 The report has demonstrated that the proposed drainage measures ensure that suitable means of surface water drainage can be achieved for the proposed development.

7 Appendices

7.1 Appendix A – Site Plan



Block Plan 1:200

Party Wall etc. Act 1996

As you are building on or near a neighbouring building or structure, your works may be subject to the Party Wall Act. It is the clients responsibility to ensure all of your requirements under the Act are adhered to. You must ensure that you serve the relevant notice(s) on your adjoining neighbour(s) if you have any queries about this, then you should contact a Party Wall Surveyor to assist you.

7.2 Appendix B – Drainage Layout

DESIGN SUBJECT TO THE APPROVAL OF:
PLANNING AUTHORITY
BUILDING CONTROL

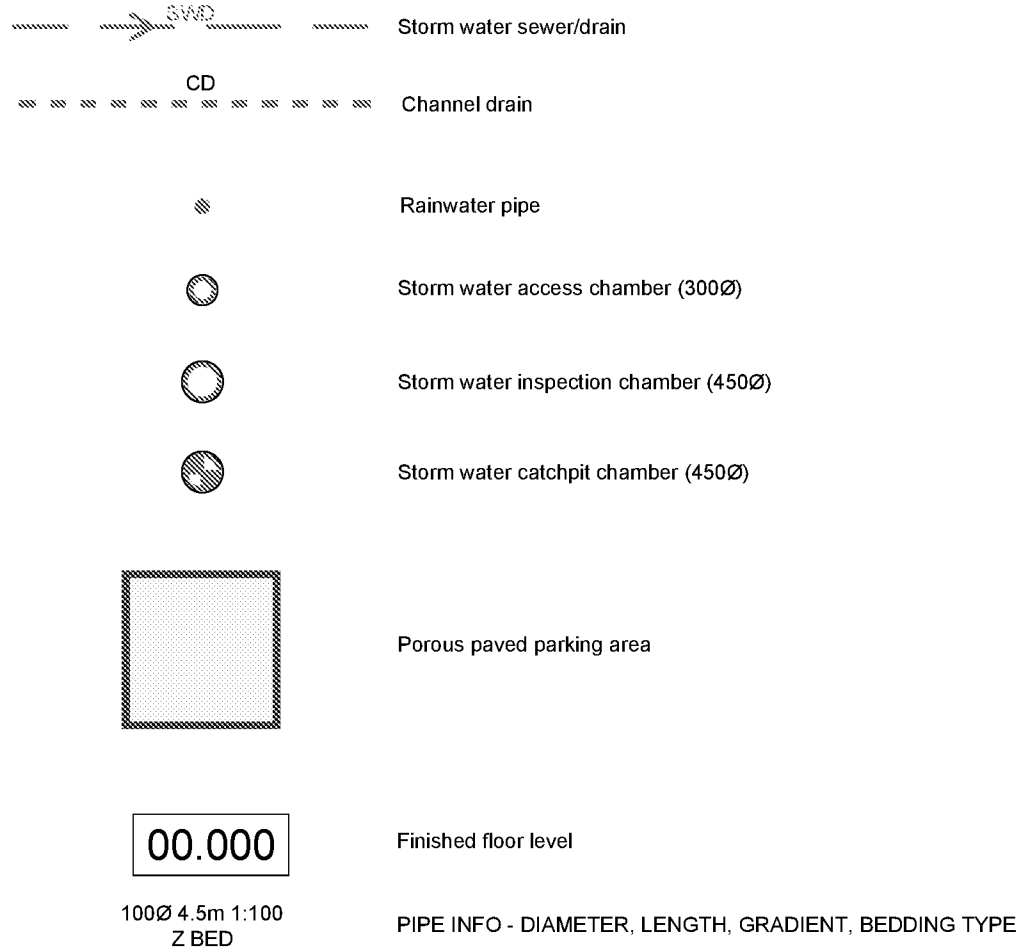
DESIGN SUBJECT TO THE CONFIRMATION OF:
RWP POSITIONS ASSUMED – TBC BY ARCHITECT
FFL TBC BY ARCHITECT

- Site Specific Notes
1. RWP positions assumed - Architect to confirm final locations.
 2. FFL TBC by Architect



DRAINAGE LEGEND (1:100)

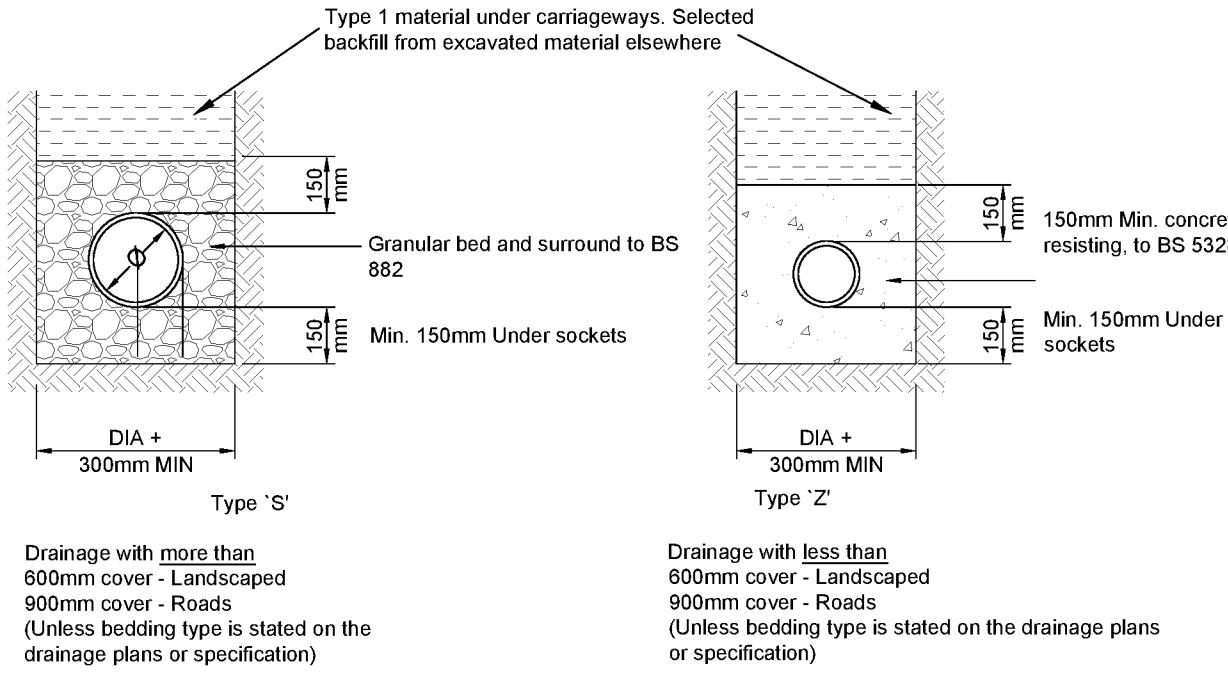
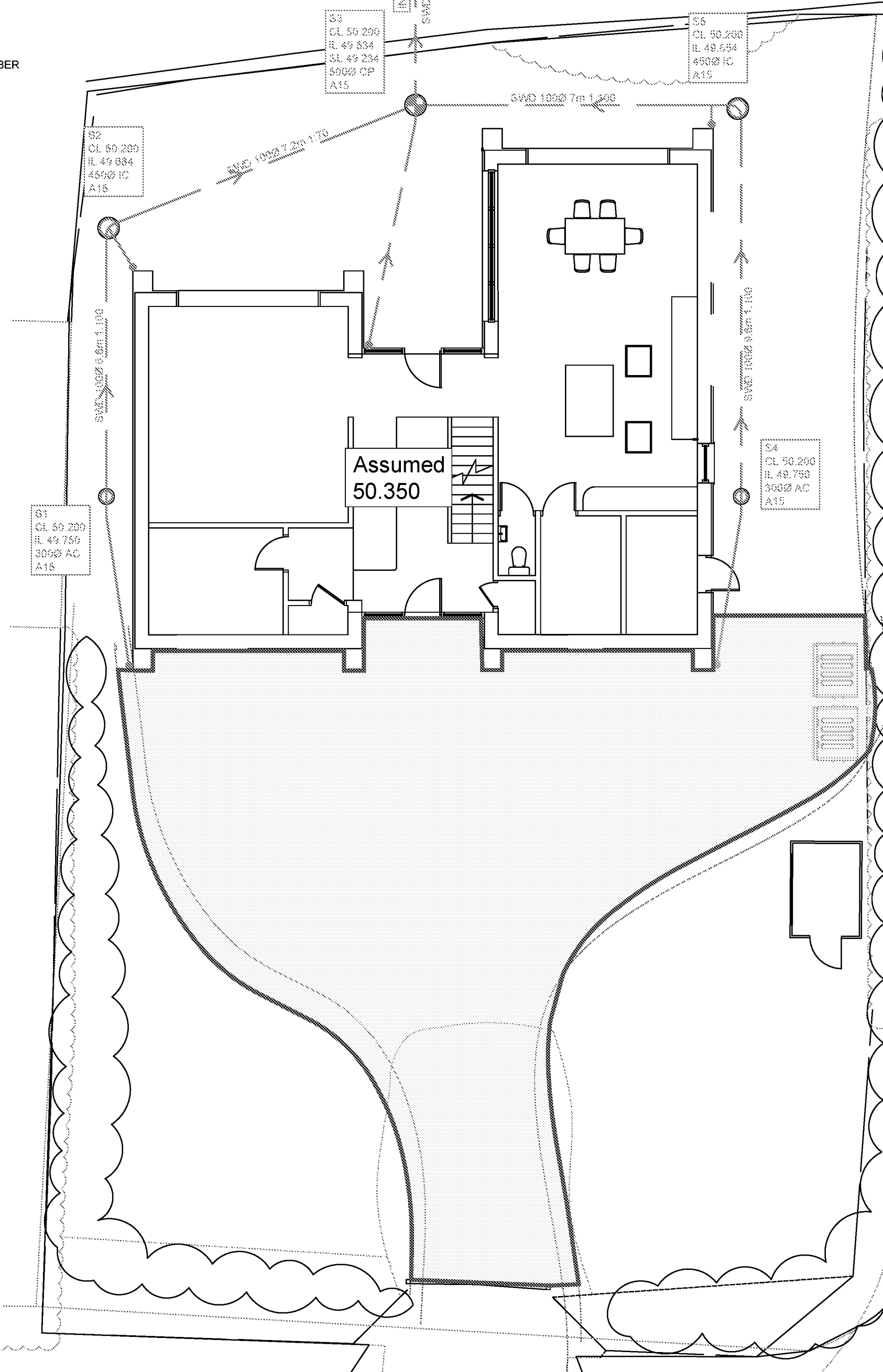
PROPOSED FEATURES



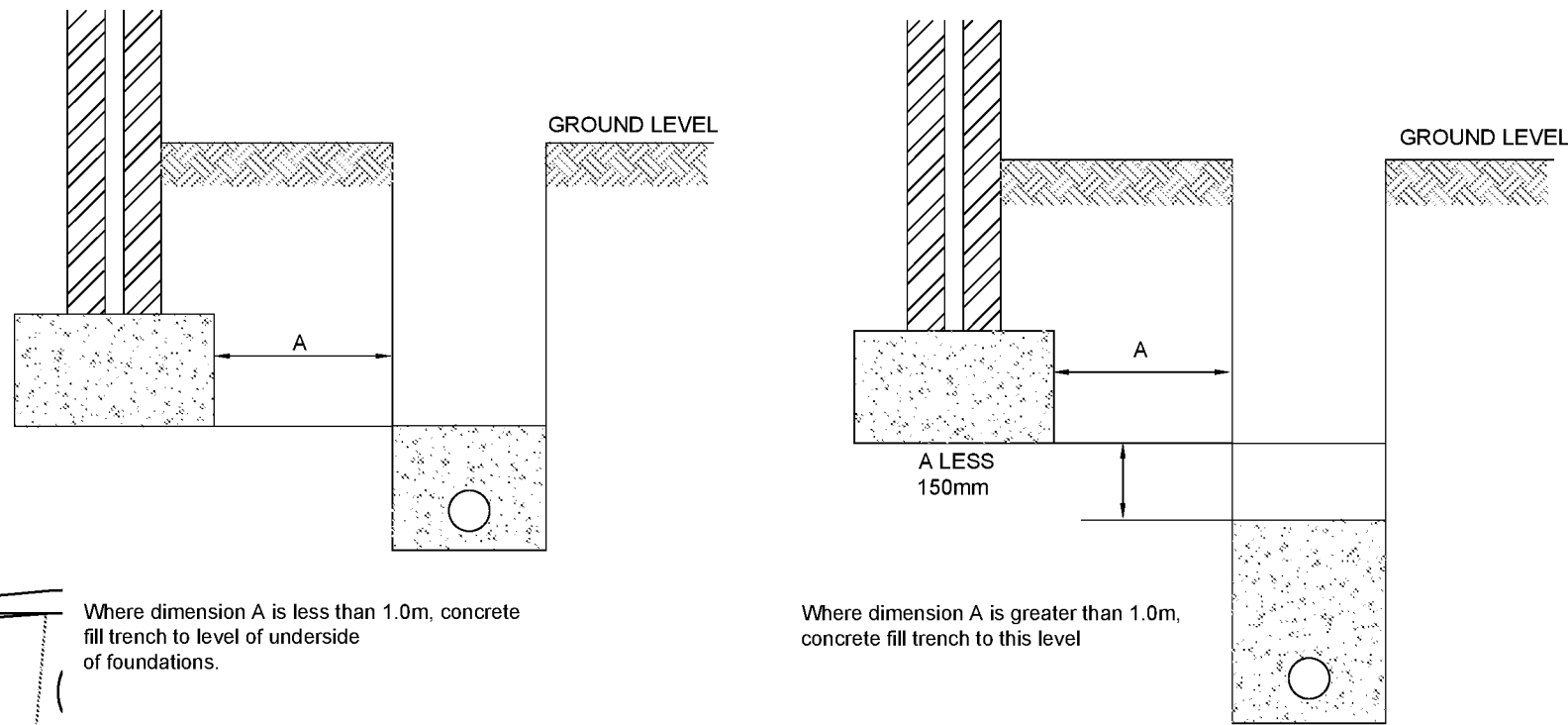
- ABBREVIATIONS
- MH - MANHOLE
 - IC - INSPECTION CHAMBER
 - AC - ACCESS CHAMBER
 - CP - CATCHPIT
 - BC - BRAKE CHAMBER
 - RE - RODDING EYE
 - IL - INVERT LEVEL
 - SL - SUMP LEVEL
 - CL - COVER LEVEL

STANDARD DRAINAGE NOTES

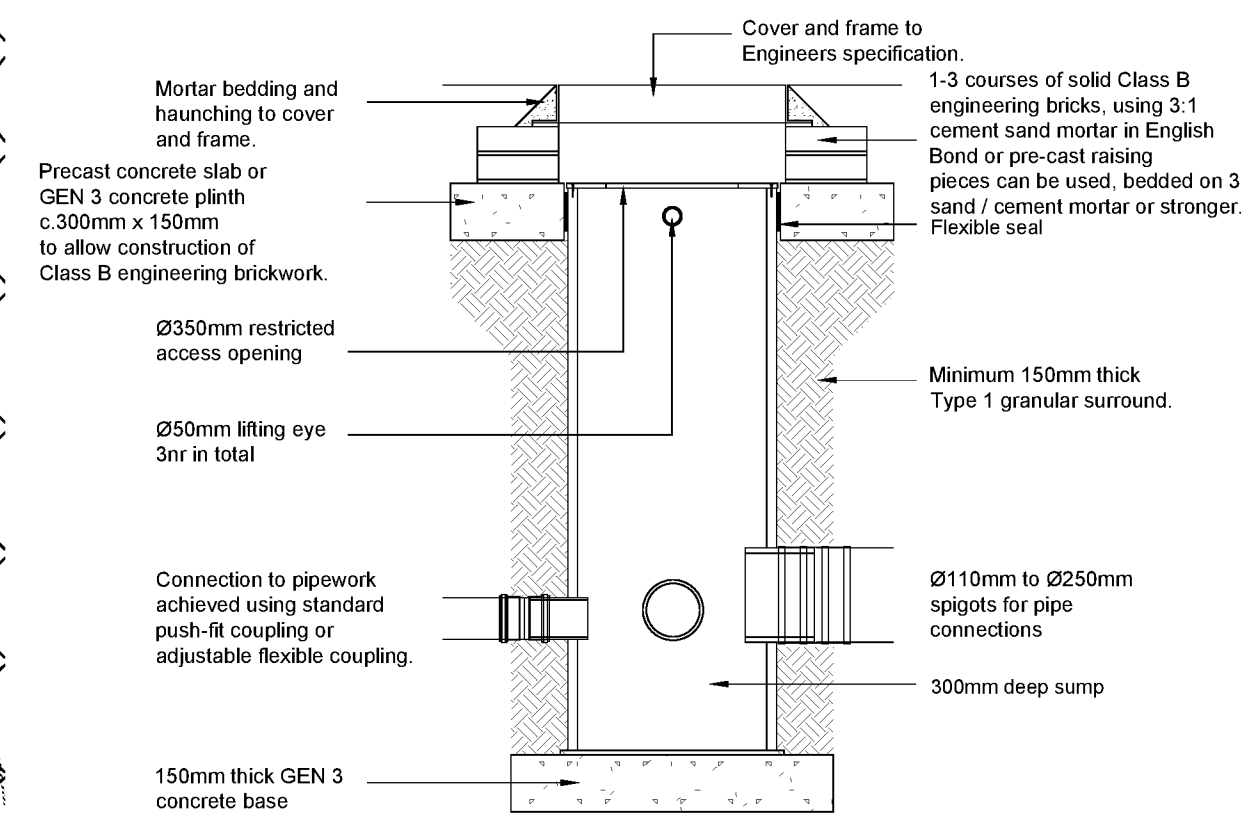
1. DO NOT SCALE FROM THIS DRAWING. REFER TO FIGURED DIMENSIONS ONLY. THE CONTRACTOR SHOULD CHECK ALL DIMENSIONS ON SITE.
2. ALL DIMENSIONS IN MILLIMETRES AND ALL LEVELS ARE IN METERS UNLESS NOTED OTHERWISE.
3. THIS DRAWING SHOULD BE READ IN CONJUNCTION WITH ALL OTHER RELEVANT ARCHITECT AND ENGINEERING DETAILS, DRAWINGS AND SPECIFICATIONS.
4. ANY DISCREPANCIES SHOULD BE REPORTED TO THE ARCHITECT AND/OR ENGINEER IMMEDIATELY. SO THAT CLARIFICATION CAN BE SOUGHT PRIOR TO THE COMMENCEMENT OF WORK.
5. BEFORE COMMENCING CONSTRUCTION THE CONTRACTOR MUST CHECK THE INVERT LEVELS OF EXISTING SEWERS TO WHICH CONNECTIONS ARE MADE. IN ADDITION THE CONTRACTOR MUST LOCATE AND DETERMINE INVERT LEVELS OF THE EXISTING SPURS TO WHICH CONNECTIONS ARE PROPOSED. ANY DISCREPANCIES ARE TO BE NOTIFIED TO THE ENGINEER IMMEDIATELY. PRIOR TO CONSTRUCTION.
6. ALL DRAINAGE WORKS SHOULD COMMENCE AT THE PROPOSED DOWNSTREAM CONNECTION POINT. THE WORKS CONTINUING UPSTREAM FOLLOWING CONFIRMATION OF THE TIE-IN INVERT LEVELS TO THE ENGINEER. CONNECTIONS TO MANHOLES OR LARGER SIZED PIPES ETC. SHOULD BE SOFFIT TO SOFFIT UNLESS OTHERWISE INSTRUCTED BY THE ENGINEER. IF THIS IS NOT POSSIBLE INFORM THE ENGINEER IMMEDIATELY.
7. COVER LEVELS SHOWN ARE APPROXIMATE. COVERS AND FRAMES SHALL BE SET TO FINISHED GROUND LEVELS AND FALLS.
8. ALL UN-REFERENCED PIPES ARE ASSUMED TO BE 100mm DIA
9. ALL PIPES TO BE ADOPTED, OR CONNECTING TO ADOPTED SEWERS, TO BE VITRIFIED CLAY TO BS EN 295 AND BS85 (SWS ONLY), OR CONCRETE PIPES TO BE EN 1916 AND BS5911 PART 1.
10. ROAD GULLY OUTLET PIPES ARE TO BE 150mm DIA. WITH CONCRETE SURROUND AND FLEXIBLE JOINTS. ALL GULLIES SHALL BE FITTED WITH GRADE D400 GRATINGS AND FRAMES TO BS EN124, UNLESS OTHERWISE STATED.
11. ALL ADOPTABLE SEWERS SHALL BE CONSTRUCTED TO THE STANDARDS AND SPECIFICATION LAID DOWN DOWN IN 'SEWERS FOR ADOPTION' 8th EDITION, WITH A VIEW TO ADOPTION UPON COMPLETION OF WORKS.
12. ALL PRIVATE DRAINAGE TO BE IN ACCORDANCE WITH THE BUILDING REGULATIONS APPROVED DOCUMENT PART-H, AND TO THE SATISFACTION OF THE BUILDING CONTROL INSPECTOR.
13. THE CONTRACTOR IS TO KEEP A RECORD OF ANY VARIATIONS MADE ON SITE, INCLUDING THE RELOCATION OF SEWERS OR DRAINS, SO THAT AN AS CONSTRUCTED DRAWING CAN BE PREPARED UPON COMPLETION OF THE PROJECT.
14. STUB CONNECTIONS TO ADOPTABLE MANHOLES SHALL BE MADE FROM VITRIFIED CLAY AND CONSIST OF TWO ROCKER PIPES LAID AT THE SAME GRADIENT AS THE UP OR DOWNSTREAM PIPE.
15. IF ANY SUB SOIL DRAINAGE SYSTEMS ARE UNCOVERED DURING THE WORKS CONTACT THE ENGINEER FOR INSTRUCTIONS. SUB SOIL DRAINS ARE TO BE DIVERTED AROUND NEW WORKS AND CONNECTED INTO THE SURFACE WATER.
16. NO PRIVATE AREAS ARE TO DRAIN ONTO ADOPTABLE AREAS AND VICE VERSA.
17. ALL EXISTING MANHOLE COVER'S, GULLIES, ETC. ARE TO BE RAISED/LOWERED TO SUIT NEW LEVELS.
18. IT IS THE RESPONSIBILITY OF THE CONTRACTOR TO CONFIRM THE LOCATION AND DEPTH OF ALL EXISTING SERVICES AND UTILITIES THAT MAY BE PRESENT
19. UPON COMPLETION BUT PRIOR TO HANDOVER, CONTRACTOR TO CARRY OUT FULL CCTV SURVEY OF DRAINAGE SYSTEM WHICH IS TO BE REVIEWED BY ENGINEER TO ENSURE SATISFACTORY INSTALLATION
20. MANHOLE AND CHAMBER COVER GRADES:
 - 'A15' IN ALL LANDSCAPED AREAS AND ON FOOTPATHS
 - 'B125' IN ALL DRIVEWAYS
 - 'C250' IN PRIVATE PARKING AREAS
 - 'D400' IN CARRIAGEWAY/ACCESS ROAD



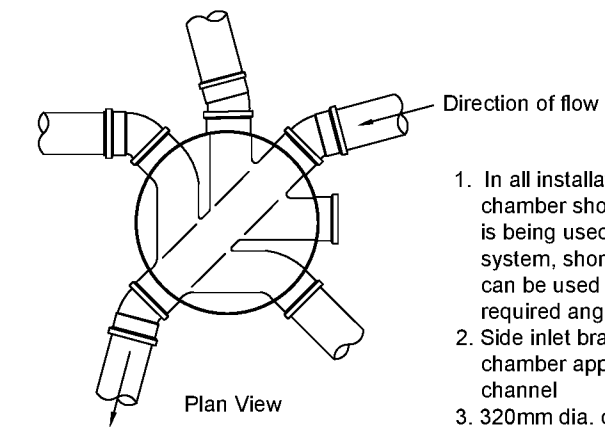
Pipe bedding details in private Areas



Pipes near buildings



Pipes near buildings



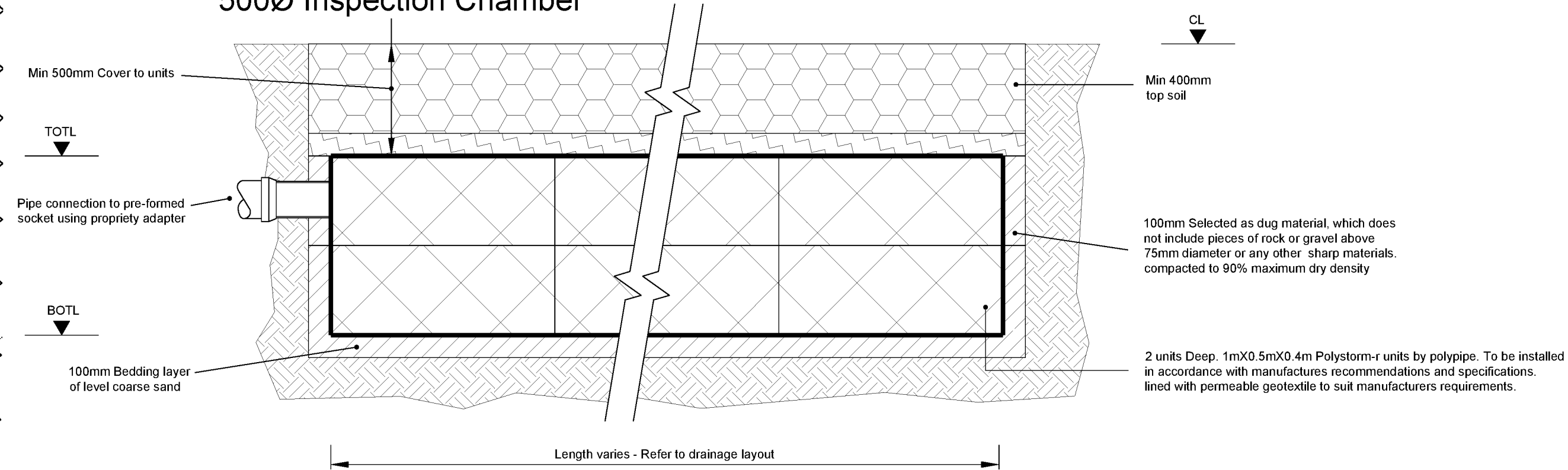
1. In all installations, the main channel of the inspection chamber should always be used. Where the chamber is being used as a change of direction for the drainage system, short radius bends of 11½°, 15°, 30° and 45° can be used in the inlet and outlet to achieve the required angle.
2. Side inlet branch 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 2no. blanking plugs.

460mmØ INSPECTION CHAMBER DETAIL

Prefixed to drawing numbers shall signify the following:-

PL = PLANNING	Shall not be used for contract or construction purposes
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

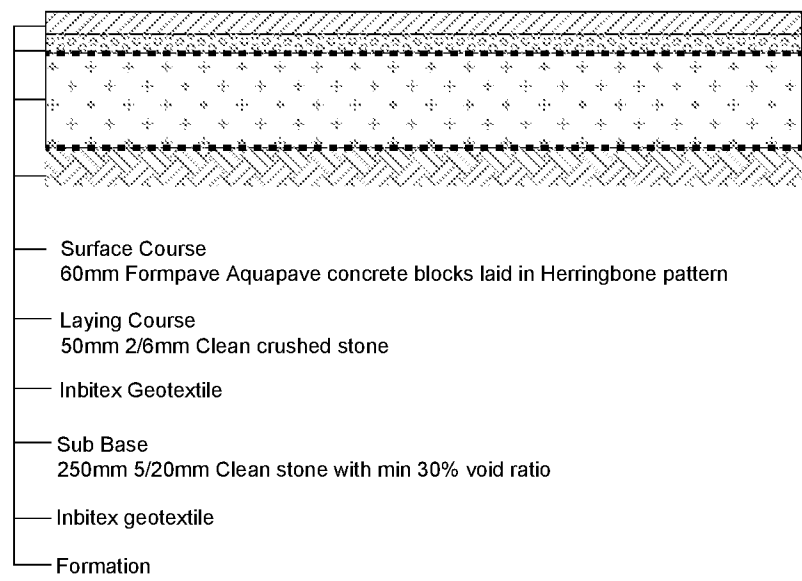
SEL WASP05050 500Ø Inspection Chamber



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

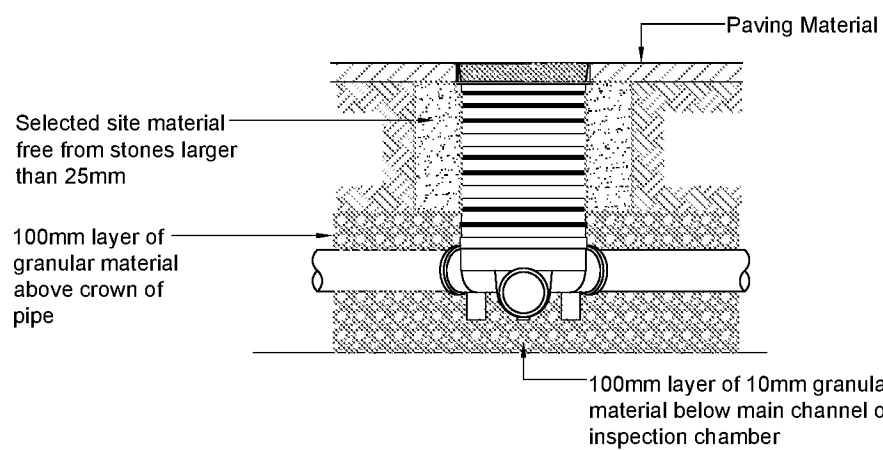
All storage tank drainage works shall be carried out in accordance with the specifications, method statements and recommendations of Polypipe

CONSTRUCTION DETAILS 1:20

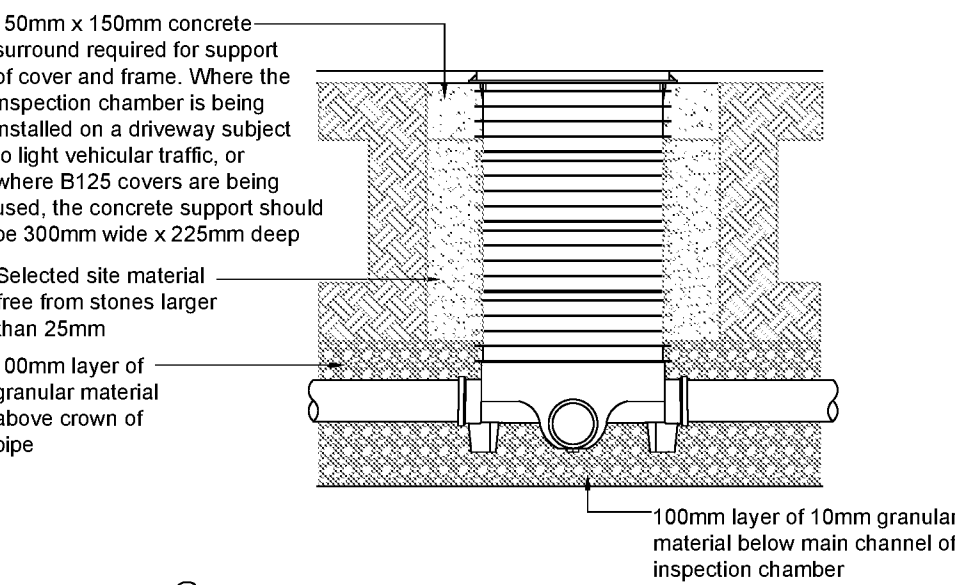


Formpave permeable block paving private driveway construction

To be read in accordance with Formpave details and specification



300mmØ SHALLOW INSPECTION CHAMBER DETAIL

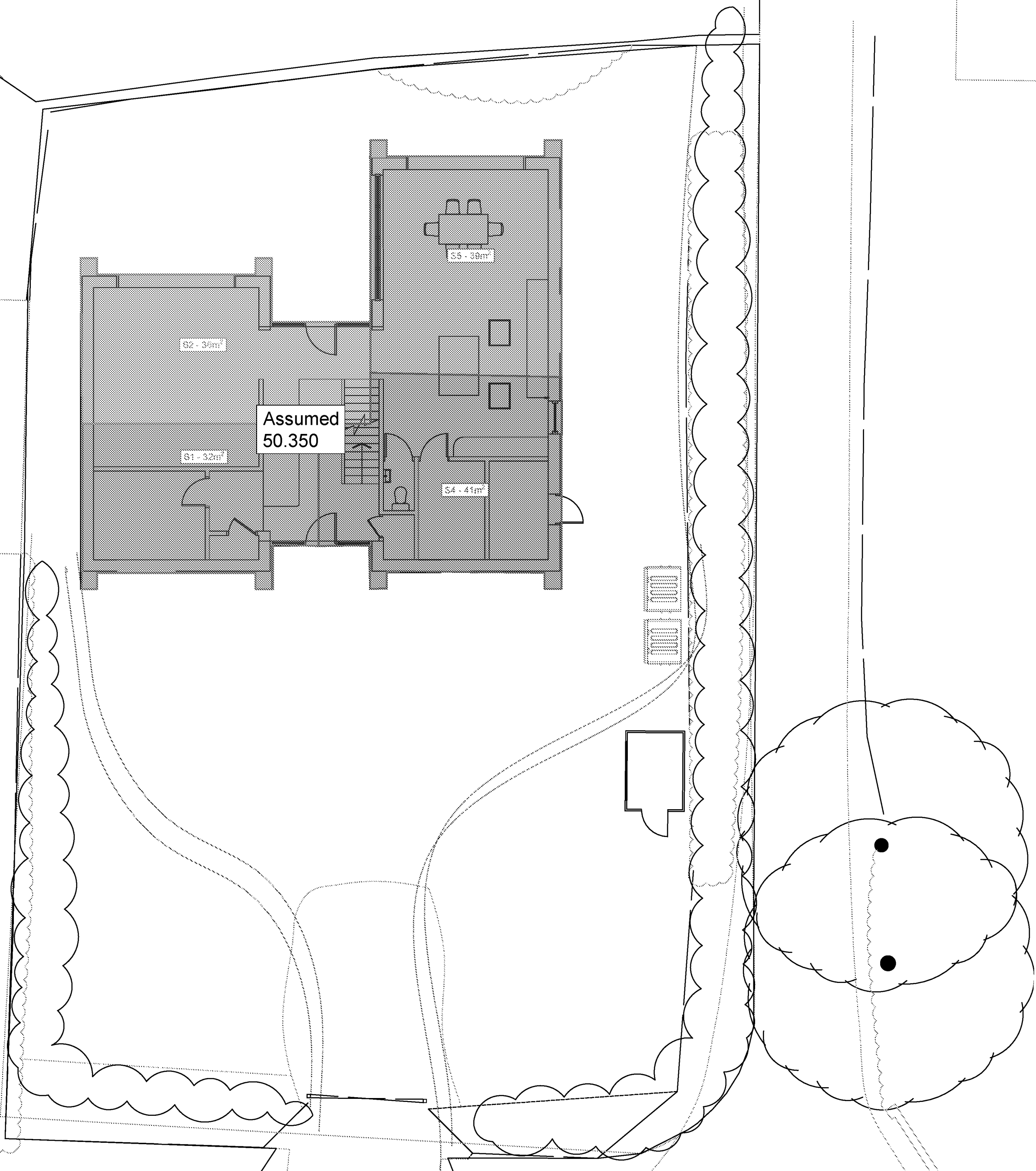


FOR PLANNING ONLY

PL1	07.10.22	REVISED TO SUIT ADC COMMENTS	LH	CS	CS
PL-	10.03.22	PRELIMINARY ISSUE	LH	CS	CS

REV	DATE	DESCRIPTION	BY	CHK	APP
-----	------	-------------	----	-----	-----

CLIENT		MR & MRS STRUDWICK			
ARCHITECT		FOLKES ARCHITECTS			
JOB TITLE		LAND AT EASTERGATE LANE EASTERGATE			
DRAWING TITLE		SURFACE WATER DRAINAGE LAYOUT			
DRAWN	LH	ENGINEER	C SLADE	CHECKED	CS
DATE	MARCH 2022	SCALE @ A1	1:100	APPROVED	CS
JOB No.	C2027	STATUS	PL	DRAWING No.	100
REV					PL1



Prefixed to drawing numbers shall signify the following:-

PL = PLANNING	Shall <u>not</u> be used for contract or construction purposes
P = PRELIMINARY	Shall <u>not</u> be used for contract or construction purposes
T = TENDER	Shall <u>not</u> be used for construction purposes
C = CONSTRUCTION	These are the <u>only</u> drawings that shall be used for construction purposes
R = RECORD	Record of actual completed work

PL-	10.03.22	PRELIMINARY ISSUE			LH	CS	CS
REV	DATE	DESCRIPTION			BY	CHK	APP
cgs civils Consulting Civil Engineers							
CLIENT		MR & MRS STRUDWICK					
ARCHITECT		FOLKES ARCHITECTS					
JOB TITLE		LAND AT EASTERGATE LANE EASTERGATE					
DRAWING TITLE		IMPERMEABLE AREAS PLAN					
DRAWN	ENGINEER	CHECKED		APPROVED			
LH	C SLADE	CS		CS			
DATE		SCALE @ A1					
MARCH 2022		1:100					
JOB No.		STATUS	DRAWING No.		REV		
C2027		PL	400		PL-		

FOR PLANNING ONLY

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)	0.350
CV	1.000	Include Intermediate Ground	✓
Time of Entry (mins)	5.00	Enforce best practice design rules	✓

Nodes

Name	Area (ha)	T of E (mins)	Cover Level (m)	Diameter (mm)	Easting (m)	Northing (m)	Depth (m)
S1	0.003	5.00	50.200	300	483.099	1022.429	0.450
S2	0.004	5.00	50.200	450	483.966	1029.578	0.516
S3			50.200	500	490.900	1032.312	0.666
SA1			50.050	150	490.900	1036.818	0.675
S4	0.004	5.00	50.200	300	499.123	1022.429	0.450
S5	0.004	5.00	50.200	450	498.136	1032.312	0.546

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)
2.000	S1	S2	7.201	0.600	49.750	49.684	0.066	109.1	100	5.16	50.0
2.001	S2	S3	7.454	0.600	49.684	49.584	0.100	74.5	100	5.30	50.0
1.002	S3	SA1	4.506	0.600	49.534	49.375	0.159	28.3	150	5.42	50.0
1.000	S4	S5	9.932	0.600	49.750	49.654	0.096	103.5	100	5.22	50.0
1.001	S5	S3	7.236	0.600	49.654	49.584	0.070	103.4	100	5.38	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)
2.000	0.735	5.8	0.5	0.350	0.416	0.003	0.0	21	0.458
2.001	0.892	7.0	1.3	0.416	0.516	0.007	0.0	29	0.672
1.002	1.898	33.5	2.7	0.516	0.525	0.015	0.0	29	1.149
1.000	0.756	5.9	0.7	0.350	0.446	0.004	0.0	24	0.512
1.001	0.756	5.9	1.4	0.446	0.516	0.008	0.0	34	0.627

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)
2.000	7.201	109.1	100	Circular	50.200	49.750	0.350	50.200	49.684	0.416
2.001	7.454	74.5	100	Circular	50.200	49.684	0.416	50.200	49.584	0.516
1.002	4.506	28.3	150	Circular	50.200	49.534	0.516	50.050	49.375	0.525
1.000	9.932	103.5	100	Circular	50.200	49.750	0.350	50.200	49.654	0.446
1.001	7.236	103.4	100	Circular	50.200	49.654	0.446	50.200	49.584	0.516

Link	US Node	Dia (mm)	Node Type	MH Type	DS Node	Dia (mm)	Node Type	MH Type
2.000	S1	300	Manhole	Adoptable	S2	450	Manhole	Adoptable
2.001	S2	450	Manhole	Adoptable	S3	500	Manhole	Adoptable
1.002	S3	500	Manhole	Adoptable	SA1	150	Manhole	Adoptable
1.000	S4	300	Manhole	Adoptable	S5	450	Manhole	Adoptable
1.001	S5	450	Manhole	Adoptable	S3	500	Manhole	Adoptable

Node SA1 Soakaway Storage Structure

Base Inf Coefficient (m/hr)	0.08892	Invert Level (m)	48.750	Depth (m)	0.800
Side Inf Coefficient (m/hr)	0.00000	Time to half empty (mins)	513	Inf Depth (m)	
Safety Factor	2.0	Pit Width (m)	4.000	Number Required	1
Porosity	0.95	Pit Length (m)	3.000		

Results for 1 year +40% CC Critical Storm Duration. Lowest mass balance: 100.00%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
15 minute summer	S1	10	49.775	0.025	0.8	0.0050	0.0000	OK
15 minute summer	S2	11	49.719	0.035	1.8	0.0111	0.0000	OK
15 minute summer	S3	11	49.570	0.036	3.8	0.0071	0.0000	OK
720 minute winter	SA1	480	48.991	-0.384	0.4	2.7456	0.0000	OK
15 minute summer	S4	11	49.778	0.028	1.0	0.0069	0.0000	OK
15 minute summer	S5	11	49.696	0.042	2.0	0.0128	0.0000	OK

Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)
15 minute summer	S1	2.000	S2	0.8	0.390	0.132	0.0142
15 minute summer	S2	2.001	S3	1.8	0.725	0.250	0.0180
15 minute summer	S3	1.002	SA1	3.8	1.198	0.112	0.0141
720 minute winter	SA1	Infiltration		0.1			
15 minute summer	S4	1.000	S5	1.0	0.416	0.168	0.0242
15 minute summer	S5	1.001	S3	2.0	0.665	0.336	0.0217

Results for 10 year +40% CC Critical Storm Duration. Lowest mass balance: 100.00%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
15 minute summer	S1	10	49.784	0.034	1.5	0.0070	0.0000	OK
15 minute summer	S2	10	49.735	0.051	3.4	0.0161	0.0000	OK
15 minute summer	S3	11	49.585	0.051	7.0	0.0101	0.0000	OK
240 minute summer	SA1	220	49.271	-0.104	1.9	5.9356	0.0000	OK
15 minute summer	S4	10	49.789	0.039	1.9	0.0096	0.0000	OK
15 minute summer	S5	10	49.715	0.061	3.8	0.0186	0.0000	OK

Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)
15 minute summer	S1	2.000	S2	1.5	0.460	0.255	0.0231
15 minute summer	S2	2.001	S3	3.3	0.850	0.470	0.0289
15 minute summer	S3	1.002	SA1	7.0	1.405	0.209	0.0225
240 minute summer	SA1	Infiltration		0.1			
15 minute summer	S4	1.000	S5	1.9	0.482	0.315	0.0385
15 minute summer	S5	1.001	S3	3.7	0.770	0.621	0.0347

Results for 30 year +40% CC Critical Storm Duration. Lowest mass balance: 100.00%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
15 minute summer	S1	11	49.788	0.038	1.8	0.0078	0.0000	OK
15 minute summer	S2	10	49.744	0.060	4.3	0.0188	0.0000	OK
15 minute summer	S3	11	49.593	0.059	9.0	0.0116	0.0000	OK
360 minute winter	SA1	344	49.440	0.065	1.1	7.8648	0.0000	OK
15 minute summer	S4	10	49.795	0.045	2.5	0.0111	0.0000	OK
15 minute summer	S5	10	49.727	0.073	4.9	0.0225	0.0000	OK

Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)
15 minute summer	S1	2.000	S2	1.8	0.477	0.312	0.0275
15 minute summer	S2	2.001	S3	4.2	0.897	0.602	0.0350
15 minute summer	S3	1.002	SA1	9.0	1.493	0.268	0.0271
360 minute winter	SA1	Infiltration		0.1			
15 minute summer	S4	1.000	S5	2.4	0.509	0.413	0.0474
15 minute summer	S5	1.001	S3	4.8	0.811	0.805	0.0427

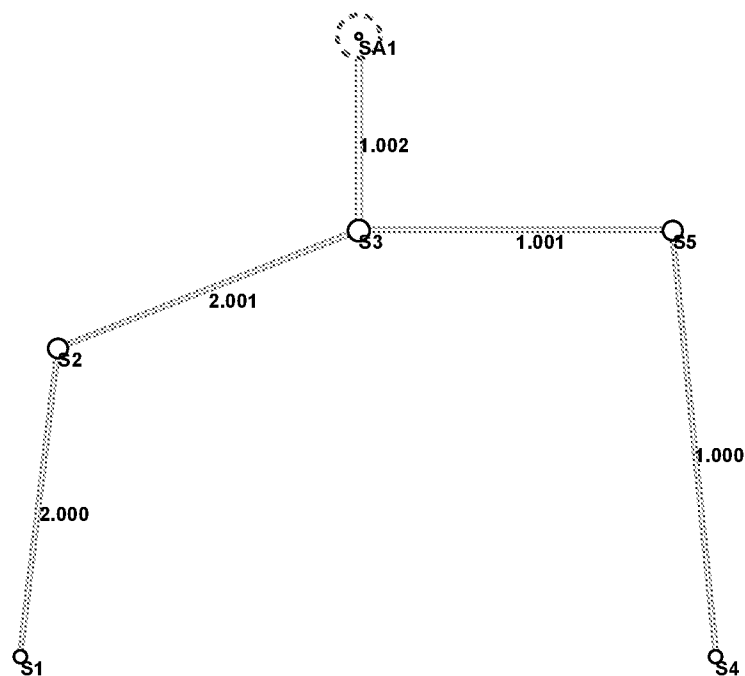
Results for 100 year +40% CC Critical Storm Duration. Lowest mass balance: 100.00%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
360 minute winter	S1	352	49.870	0.120	0.3	0.0244	0.0000	SURCHARGED
360 minute winter	S2	352	49.869	0.185	0.7	0.0582	0.0000	SURCHARGED
360 minute winter	S3	352	49.869	0.335	1.5	0.0658	0.0000	SURCHARGED
360 minute winter	SA1	352	49.869	0.494	1.5	9.1346	0.0000	OK
360 minute winter	S4	352	49.869	0.119	0.4	0.0296	0.0000	SURCHARGED
360 minute winter	S5	352	49.869	0.215	0.8	0.0659	0.0000	SURCHARGED

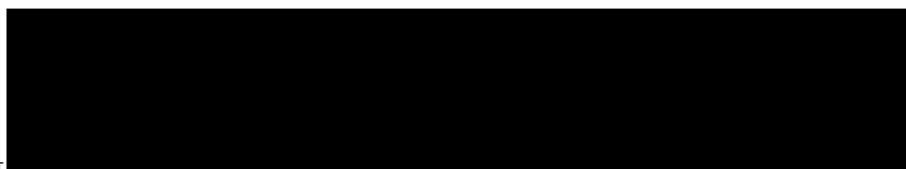
Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)
360 minute winter	S1	2.000	S2	0.3	0.316	0.052	0.0563
360 minute winter	S2	2.001	S3	0.7	0.564	0.100	0.0583
360 minute winter	S3	1.002	SA1	1.5	0.932	0.045	0.0793
360 minute winter	SA1	Infiltration		0.1			
360 minute winter	S4	1.000	S5	0.4	0.324	0.067	0.0777
360 minute winter	S5	1.001	S3	0.8	0.520	0.135	0.0566

Node Name	S4	S5	S3	SA1
A4 drawing Hor Scale 150 Ver Scale 100 Datum (m) 44.000				
Link Name	1.000		1.001	1.002
Section Type	100mm		100mm	150mm
Slope (1:X)	103.5		103.4	28.3
Cover Level (m)	50.200	50.200	50.200	50.050
Invert Level (m)	49.750	49.654 49.654	49.584 49.534	49.375
Length (m)	9.932		7.236	4.506

Node Name	S1	S2	S3
A4 drawing Hor Scale 150 Ver Scale 100 Datum (m) 44.000			
Link Name	2.000		2.001
Section Type	100mm		100mm
Slope (1:X)	109.1		74.5
Cover Level (m)	50.200	50.200	50.200
Invert Level (m)	49.750	49.684	49.584
Length (m)	7.201	7.454	



7.4 **Appendix D – Borehole Logs**



DATE PH

GEOLOGICAL CLASSIFICATION

If measurements start below ground surface, state how far.

THICKNESS

Order Online Now

7.5 **Appendix E – Soakage Test Results**



Job: Eastergate Lane, Eastergate - 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} = 3900 seconds

V_{p75-25} = 0.135 m/cubed

F = 2.62E-05

Job: Eastergate Lane, Eastergate - 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} = 4140 seconds

V_{p75-25} = 0.135 m/cubed

F = 2.47E-05



Job: Eastergate Lane, Eastergate - 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} = 240 seconds

V_{p75-25} = 0.135 m/cubed

F = 0.000426