Sustainable Drainage System Strategy

Site Address
99 Atbara Road
Teddington
TW11 9PA

Client
Jamie and Beverley McDaid

Report Reference
SWDS-2024-000036

Prepared By
STM Environmental Consultants Ltd

Date
21/08/2024

1 Document Control

Sustainable Drainage System Strategy

Site Address:	99 Atbara Road Teddington TW11 9PA
National Grid Reference:	517085, 170948
STM Reference:	SWDS – 2024 – 000036
Version No:	1.0
Prepared for:	Jamie and Beverley McDaid
Date:	21/08/2024
Report Author:	Yonas Makoni (BSc) **Junior Environmental Consultant** & Georgia Travers (BSc) **Environmental Consultant**
Authorised by:	Matthew Ashdown (BSc) **Senior Environmental Consultant**

Contents

List of Tables

List of Figures

2 Abbreviations

Abbreviation	Description
STM	STM Environmental Consultants Limited
BGS	British Geological Survey
EA	Environment Agency
OS	Ordnance Survey of Great Britain
FRA	Flood Risk Assessment
NPPF	National Planning Policy Framework
FWD	Floodline Warning Direct
FRMS	Flood Risk Management Strategy
LLFA	Lead Local Flood Authority
SWMP	Surface Water Management Plan
SFRA	Strategic Flood Risk Assessment
CDA	Critical Drainage Area
SuDS	Sustainable Drainage Systems
GWSPZ	Groundwater Source Protection Zone

3 Disclaimer

This report and any information or advice which it contains, is provided by STM Environmental Consultants Ltd (STM) and is solely for use by Jamie and Beverley McDaid (Client).

STM has exercised such professional skill, care and diligence as may reasonably be expected of a properly qualified and competent consultant when undertaking works of this nature. However, STM gives no warranty, representation or assurance as to the accuracy or completeness of any information, assessments or evaluations presented within this report. STM accepts no liability for the performance of any drainage system based upon the recommendations of this report. Furthermore, STM accepts no liability whatsoever for any loss or damage arising from the interpretation or use of the information contained within this report. Any party using or placing reliance upon any information contained in this report, do so at their own risk.

3.1 Executive Summary

BACKGROUND				
Location	99 Atbara Road, Teddington TW11 9PA Grid reference: 517085, 170948			
Site Area	374m^2			
Proposed Development	Demolition of the existing residential bungalow and construction of a new 2-storey residential dwelling with a loft space.			
Current Site and Surrounding Uses	The site is a residential dwelling with associated garden, garage and amenity space. It is located in a mainly residential area, with 2no. sports grounds and a small number of commercial uses within the vicinity.			
Topography	The ground level at the site ranges from 6.34mAOD (northeast) to 6.93mAOD (southwest).			
Hydrology	A watercourse connected with the River Thames is present approximately 80m east of the site. The River Thames is located approximately 340m northeast of the site.			
Geology	BGS information indicates that the superficial deposits at the site consist of Kempton Park Gravel Formation while the bedrock is classified as belonging to the London Clay Formation.			
Hydrogeology	BGS information indicates that the site is situated upon a Principal superficial and an Unproductive bedrock aquifer.			
Permeability	BGS information indicates that the superficial deposits are free draining and the bedrock is classified as poorly draining.			
Infiltration Potential	BGS information indicates that there are opportunities for bespoke infiltration SuDS. Infiltration testing was undertaken on the 10 – 12th June, 2024. TP01 encountered dark brown Top Soil to a depth of 0.3mbgl, becoming wet, light, brown/orange Sandy Clay to a level of 1.1mbgl. Groundwater was not detected. The infiltration rate obtained on site is indicated to be 1.4x10^{-6}m/s in TP01, which is considered to be a moderate rate. However, this rate is insufficient to discharge all surface waters to ground and ensure a suitable half drain down time. As such, a combined system allowing for infiltration and discharge to the public surface water sewer will be required.			
Fluvial Flood Risk	Medium – the site lies within EA Flood Zones 2 and 3. Further information regarding flood risk to the site is available in FRA – 2023 – 000041.			
Surface Water Flood Risk	Very Low – The site remains dry during all modelled scenarios. Further information regarding flood risk to the site is available in FRA – 2023 – 000041.			
Groundwater Flood Risk	Low - the EA mapping indicates that there is potential for groundwater flooding to occur for properties below ground surface. Groundwater is likely to be less than 3mbgl for at least part of the year.			
Existing and Proposed Site Layout	**Ground Cover**	**Existing (m^2)**	**Proposed (m^2) (Without SuDS)**	**Proposed (m^2) (With SuDS)**
	Buildings	107	118	118
	Driveways/Patio (Imermeable)	145	165	96
	Driveways/Patio (Permeable)	0	0	69
	Gardens/ Soft landscaping	122	91	91
	Total Impermeable Area	**252**	**283**	**214**

Changes in Impermeable	Without SuDS, the proposed development would increase the impermeable area of the site by 31m^2 (8.3%) and therefore increase the post development runoff rate and volume. With SuDS, the proposed development would decrease the impermeable area by 38m^2 (10.2%).		
PROPOSED SUDS			
Run-Off Rates	Greenfield (GF) (l/s)	MRM Pre - Development (l/s)	MRM Post Development Without SuDS (l/s)
Qbar	0.06	-	-
1 in 1	0.05	3.7	4.2
1 in 30	0.13	8.8	9.8
1 in 100	**0.18**	11.1	12.4
1 in 100 + CC (40%)	**0.27**	-	-
SuDS Target Requirement	As the development is taking place on a previously developed site, the non-statutory technical standards for sustainable drainage systems S3 (peak flow) and S5 and S6 (volume controls) apply. The proposal should aim to achieve the greenfield runoff rate of 0.06/s for all storm events. However, achieving a discharge a rate this low may not be practical, and may give rise to blockages in the proposed system.		
Drainage Hierarchy	The proposed development cannot discharge to a watercourse. The proposal will allow for infiltration and controlled discharge to the public surface water sewer to ensure suitable half drain down times are achieved.		
Storage Required to meet Planning Requirement	To achieve a discharge rate of 1.0 l/s post development, 8 - 12m^3 of storm water attenuation is required. When not including the permeable paving as part of the impermeable catchment area, 5 – 8m^3 of storm water attenuation is required.		
SuDS Strategy	The proposal will introduce permeable paving, a rainwater butt, geocellular attenuation within the rear garden and front of the property. The combination of the SuDS measures introduced will provide 200L rainwater re-use and 5.8m^3 of attenuation. The SuDS strategy introduced will implement a protected Orifice Control Chamber as to limit the discharge to 1.0 l/s for all storm events into the receiving surface water sewer.		
Conclusion	With the proposed SuDS mitigation measures which have been outline introduced into the scheme, we believe that the proposed development will reduce local flood risk and therefore be in compliance with the LLFA's current planning policy and the NPPF.		

4 Introduction

STM Environmental Consultants Limited have been appointed by Jamie and Beverley McDaid to undertake a Sustainable Drainage System (SuDS) Strategy for a proposed development at 99 Atbara Road, Teddington TW11 9PA.

4.1 Proposed Development

The SuDS report is required to support a planning application for the demolition of the existing residential bungalow and construction of a new 2-storey residential dwelling with a loft space. Copies of the development plans are presented in Appendix 1.

4.2 Report Aims and Objectives

This report sets out the proposed drainage strategy that will be employed in the designs to meet the requirements of the planning condition and the National Planning Policy Framework.

4.3 Legislative and Policy Context

4.3.1 Legislative Context

Section H3 of the Building Regulations 2010 requires that adequate provision is made for rainwater to be carried from the building roofs and paved areas. and be preferentially discharged to soakaways or some other adequate infiltration system. Where that is not reasonably practicable, a watercourse; or sewer can be used.

The Flood and Water Management Act was introduced in 2010. The Act defines the role of lead local flood authority (LLFA) for an area. All LLFA are required to develop, maintain, apply and monitor a strategy for local flood risk management in its area, called “local flood risk management strategy”.

Alongside the Act, Flood Risk Regulations (2009) outline the roles and responsibilities of the various authorities, which include preparing Flood Risk Management Plans and identifying how significant flood risks are to be mitigated.

4.3.2 Policy Context

The National Planning Policy Framework (NPPF) sets out the Government's economic, environmental and social planning policies for England. The policies set out in this framework apply to the preparation of local and neighbourhood plans and to decisions on planning applications.

Paragraph 173 of the National Planning Policy Framework (NPPF) states that:

> When determining any planning applications, local planning authorities should ensure that flood risk is not increased elsewhere. Where appropriate, applications should be supported by a site-specific flood-risk assessment (See Note 1) Development should only be allowed in areas at risk of flooding where, in the light of this assessment (and the sequential and exception tests, as applicable) it can be demonstrated that:
>
> - within the site, the most vulnerable development is located in areas of lowest flood risk unless there are overriding reasons to prefer a different location
> - the development is appropriately flood resistant and resilient such that, in the event of a flood, it could be quickly brought back into use without significant refurbishment;
> - it incorporates sustainable drainage systems, unless there is clear evidence that this would be inappropriate;
> - any residual risk can be safely managed; and
> - safe access and escape routes are included where appropriate, as part of an agreed emergency plan.

Applications for some minor development and changes of use (See Note.2) should not be subject to the sequential or exception tests but should still meet the requirements for site-specific flood risk assessments set out in (See Note 1).

Paragraph 175 states that:

> Major developments should incorporate sustainable drainage systems unless there is clear evidence that this would be inappropriate. The systems used should:
>
> - take account of advice from the lead local flood authority;

- have appropriate proposed minimum operational standards;
- have maintenance arrangements in place to ensure an acceptable standard of operation for the lifetime of the development; and
- where possible, provide multifunctional benefits.

A major development is defined as:

- a residential development: 10 dwellings or more or residential development with a site area of 0.5 hectares or more where the number of dwellings is not yet known
- a non-residential development: provision of a building or buildings where the total floor space to be created is 1000 square metres or more or where the floor area is not yet known, a site area of 1 hectare or more.

Note. 1 - A site-specific flood risk assessment should be provided for all development in Flood Zones 2 and 3. In Flood Zone 1, an assessment should accompany all proposals involving: sites of 1 hectare or more; land which has been identified by the Environment Agency as having critical drainage problems; land identified in a strategic flood risk assessment as being at increased flood risk in future; or land that may be subject to other sources of flooding, where its development would introduce a more vulnerable use.

Note. 2 - This includes householder development, small non-residential extensions (with a footprint of less than 250m^2) and changes of use; except for changes of use to a caravan, camping or chalet site, or to a mobile home or park home site, where the sequential and exception tests should be applied as appropriate.

4.3.3 The London Plan - Policy SI 13 Sustainable drainage

Lead Local Flood Authorities should identify – through their Local Flood Risk Management Strategies and Surface Water Management Plans – areas where there are particular surface water management issues and aim to reduce these risks. Increases in surface water run-off outside these areas also need to be identified and addressed.

Development proposals should aim to achieve greenfield run-off rates and ensure that surface water run-off is managed as close to its source as possible. There should also be a preference for green over grey features, in line with the following drainage hierarchy:

- rainwater use as a resource (for example rainwater harvesting, blue roofs for irrigation);
- rainwater infiltration to ground at or close to source;
- rainwater attenuation in green infrastructure features for gradual release (for example green roofs, rain gardens);
- rainwater discharge direct to a watercourse (unless not appropriate);
- controlled rainwater discharge to a surface water sewer or drain;
- controlled rainwater discharge to a combined sewer;

Development proposals for impermeable surfacing should normally be resisted unless they can be shown to be unavoidable, including on small surfaces such as front gardens and driveways.

Drainage should be designed and implemented in ways that promote multiple benefits including increased water use efficiency, improved water quality, and enhanced biodiversity, urban greening, amenity and recreation.

4.4 LLFA Planning Policy - Richmond upon Thames

4.4.1 Policy LP 21 - Flood Risk and Sustainable Drainage

"All developments should avoid, or minimise, contributing to all sources of flooding, including fluvial, tidal, surface water, groundwater and flooding from sewers, taking account of climate change and without increasing flood risk elsewhere. Unacceptable developments and land uses will be refused in line with national policy and guidance [and] the Council's Strategic Flood Risk Assessment (SFRA)".

Sustainable drainage

The Council will require the use of Sustainable Drainage Systems (SuDS) in all development proposals. Applicants will have to demonstrate that their proposal complies with the following:

1. A reduction in surface water discharge to greenfield run-off rates wherever feasible.
2. Where greenfield run-off rates are not feasible, this will need to be demonstrated by the applicant, and in such instances, the minimum requirement is to achieve at least a 50% attenuation of the site's surface water runoff at peak times based on the levels existing prior to the development.

Also relevant is policy S1 12 of the London Plan (2020) which outlines Flood Risk Management, it states that:

- Current and expected flood risk from all sources across London should be managed in a sustainable and cost-effective way in collaboration with the Environment Agency, the Lead Local Flood Authorities, developers and infrastructure providers;
- Development Plans should use the Mayor's Regional Flood Risk Appraisal and their Strategic Flood Risk Assessment as well as Local Flood Risk Management Strategies, where necessary, to identify areas where particular and cumulative flood risk issues exist and develop actions and policy approaches aimed at reducing these risks. Boroughs should cooperate and jointly address cross-boundary flood risk issues including with authorities outside London;
- Development proposals should ensure that flood risk is minimised and mitigated, and that residual risk is addressed. This should include, where possible, making space for water and aiming for development to be set back from the banks of watercourses;
- Developments Plans and development proposals should contribute to the delivery of the measures set out in Thames Estuary 2100 Plan. The Mayor will work with the Environment Agency and relevant local planning authorities, including authorities outside London, to safeguard an appropriate location for a new Thames Barrier;
- Development proposals for utility services should be designed to remain operational under flood conditions and buildings should be designed for quick recovery following a flood.

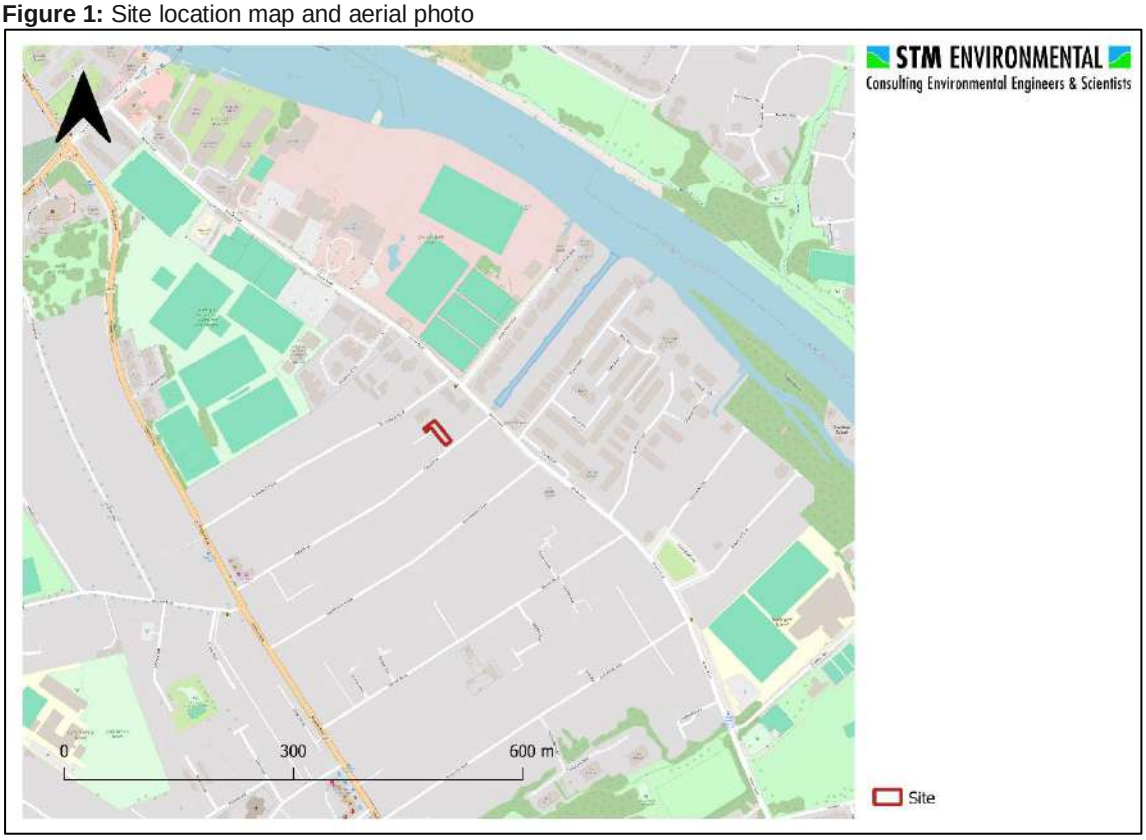
5 Site Characteristics

5.1 Location and Area

The site is centred at national grid reference 517085, 170948 and has an area of 374m^2.

It falls within the jurisdiction of the London Borough of Richmond upon Thames in terms of the planning consultation process on flood risk and surface water management. Figure 1 provides the site location map and aerial imagery.

Figure 1: Site location map and aerial photo



5.2 Current Site and Surrounding Uses

The site is currently used a residential dwelling. It is located in a mainly residential area, with 2no. sports grounds and a small number of commercial uses within the vicinity.

5.3 Site Topography

The mapping provided in Appendix 2 shows the 1m LiDAR DTM (2022) ground elevations within the site. A topographical survey is also available in Appendix 2.

The ground level at the site ranges from 6.34mAOD in the soft landscaping in the rear garden (northeast) to 6.93mAOD at the roadway (southwest). The surrounding area gradually rises in topography from the lowest elevation, where the River Thames is located, in the east.

5.4 Site Investigation

Infiltration testing was undertaken on the 10th to 12th June, 2024. A trial pit was excavated to a depth of 1.1mbgl for undertaking infiltration testing in accordance with BRE DG 365.

TP01 encountered dark brown Top Soil to a depth of 0.3mbgl, becoming wet, light, brown/orange Sandy Clay to a level of 1.1mbgl. Groundwater was not encounter.

The trial pit was rapidly filled with water from a 1.2m^3 water bowser. The trial pit was left to drain for a 24 - hour period or until nearly empty. The water level was continuously monitored using a water level logger. The water level achieved within the trial pit was used as the effective storage depth.

The data from the testing was used to calculate the infiltration rate. The infiltration rate was calculated to be 1.4x10^{-6}m/s in TP01. This is classified as a moderate rate of infiltration.

Full details including photos, graphs, location map and results of the infiltration testing are available in Appendix 6.

5.5 Flood Risk Summary

The overall flood risk to the site is considered to be Medium, with the main source of flooding being the River Thames.

Further information regarding flood risk to the site is available in FRA – 2023 – 000041.

The flood risk maps area available in Appendix 3

5.6 Existing Surface Water Drainage Features

Drainage plans showing the existing surface water drainage system at the site are presented in Appendix 5.

A utility search was undertaken which identified Thames Water as the local sewage undertaker.

Table 1: Asset Information

Asset ID	Asset Type	Distance (m) / Location	Manhole Cover Level (mAOD)*	Manhole Invert Level (mAOD)	Depth (m)
0908	SW	13m SW on Atbara Rd	7.09	N/A	N/A
1908	SW	63m NE on Broom Rd	6.27	N/A	N/A
0806	SW	111m SE on Atbara Rd	7.40	N/A	N/A

*Cover Levels taken from DTM LiDAR mapping

A CON29DW Drainage & Water Enquiry was undertaken, confirming the existing surface water connection, and is available in Appendix 5.

6 Hydrological Run-off Assessment

To minimise the impact of the new development on local flood risk, the NPPF requires that the water drainage arrangements for any development site are that the volumes and peak flow rates leaving the site post-development are improved upon those of the existing conditions. The following run-off assessment predicts the Greenfield, pre- and post-development run-off rates and provides the required SuDS necessary for complying with the relevant planning policies.

6.1 Existing and Proposed Ground Cover

Table 2: Breakdown of Ground Cover in the Proposed Development

Ground Cover	Existing Development Area		Proposed Development Area		Difference (m^2)
	m^2	%	m^2	%	
Buildings	107	28.6	118	31.6	11
Hard Standing	145	38.8	165	44.1	20
Soft landscaping	122	32.6	91	24.3	31
Total	374	100	374	100	

Table 3: Summary of Permeable and Impermeable Areas

	Impermeable Area		Permeable Area		Total Area
	m^2	%	m2	%	m^2
Existing Site	252	67.4	122	32.6	374
Proposed Site	283	75.7	91	24.3	374
Difference	31	8.3	-31	-8.3	

The proposed development increases the impermeable area of the site by 8.3% to 31m^2. As such this will have a negative impact on the runoff rate without the introduction of SuDS.

6.2 Peak Flow Control

With regard to peak flow control, the non-statutory technical standards for sustainable drainage systems state that:

- S3 For developments which were previously developed, the peak runoff rate from the development to any drain, sewer or surface water body for the 1 in 1 year rainfall event and the 1 in 100 year rainfall event must be as close as reasonably practicable to the greenfield runoff rate from the development for the same rainfall event, but should never exceed the rate of discharge from the development prior to redevelopment for that event.

The London Plan SI.13 states that development proposals should aim to achieve greenfield run-off rates and ensure that surface water run-off is managed as close to its source as possible. The London Plan Sustainable Design and Construction SPG (section 3.4.10) states that all developments on Greenfield sites must maintain Greenfield runoff rates. On previously developed sites, runoff rates should not be more than three times the calculated Greenfield rate.

6.3 Volume Control Requirements

With regard to volume control, the non-statutory technical standards for sustainable drainage systems state that:

- S5 Where reasonably practicable, for developments which have been previously developed, the runoff volume from the development to any highway drain, sewer or surface water body in the 1 in 100 year, 6 hour rainfall event must be constrained to a value as close as is reasonably practicable to the greenfield runoff volume for the same event, but should never exceed the runoff volume from the development site prior to redevelopment for that event.
- S6 Where it is not reasonably practicable to constrain the volume of runoff to any drain, sewer or surface water body in accordance with S4 or S5 above, the runoff volume must be discharged at a rate that does not adversely affect flood risk.

6.4 Run-off and Storage Calculations

The IH124 & MRM methods were applied to calculate the Greenfield, pre and post-development run-off rates including allowances for climate change. The full calculations and results are presented in Appendix 4. The table below gives a summary of the results:

Table 4: Calculation of post-development run-off rates for the site.

	Greenfield (l/s)	Pre - Development (l/s)	Post Development (l/s)
Qbar	0.06	0.15	0.16
1 in 1	0.05	0.13	0.14
1 in 30	0.13	0.35	0.37
1 in 100	0.18	0.48	0.52
1 in 100 + CC	0.27	0.71	0.77

Table 5: Modified Rational Method (MRM)

	Pre – Development (l/s)	Pre - Development No SuDS (l/s)
1 in 1	3.7	4.2
1 in 30	8.8	9.8
1 in 100	11.1	12.4

As the development is taking place on a previously developed site S3 (peak flow) and S5 and S6 (volume controls) apply.

The Qbar (0.06 l/s) for the greenfield runoff rate should be the aim for the post-development scenario. However, achieving a discharge a rate this low may not be practical, and may give rise to blockages in the proposed system.

The storage volume required to achieve the 1.0 l/s discharge rate for all storm events, is estimated to be up to **8 - 12m^3**.

When taking into consideration the installation of permeable paving, in place of hardstanding, the storm water attenuation volume reduces to **5 – 8m^3.**

Screenshots of the quick storage estimate and variables are available Appendix 4.

7 SuDS

7.1 SuDS Hierarchy

The SuDS Hierarchy sets out the preferred method of selecting which Sustainable Drainage System should be used.

- rainwater use as a resource (for example rainwater harvesting, blue roofs for irrigation);
- rainwater infiltration to ground at or close to source;
- rainwater attenuation in green infrastructure features for gradual release (for example green roofs, rain gardens);
- rainwater discharge direct to a watercourse (unless not appropriate);
- controlled rainwater discharge to a surface water sewer or drain;
- controlled rainwater discharge to a combined sewer;

The table outlined on the page below summarises the available SuDS, there potential suitability and the benefits.

7.2 Drainage Hierarchy Discussion

7.2.1 Rainwater Harvesting

The development has good potential to provide rainwater harvesting. As such, this is recommended in the form of rainwater butts.

7.2.2 Green, Blue or Brown Roofs

Based on the proposed roof design, which include pitched roofs, the use of alternative roofing is not deemed to be suitable.

7.2.3 Infiltration To Ground

On site infiltration testing was undertaken. The data from the testing was used to calculate the infiltration rate. The infiltration rate was calculated to be $1.4x10^{-6}$m/s in TP01. This is classified as a moderate rate of infiltration.

Based on these findings, infiltration SuDS methods are considered to be partially suitable for the site. The discharge rate achieved cannot ensure suitable half drain down times within 24 hours, so an alternative discharge point will be required.

7.2.4 Permeable Surfaces and Filter Drains

32% of the development will consist of outdoor space and patios, which can be formed from alternative permeable surfaces. On site infiltration has been shown to be successful, but is too low to accommodate additional inflow areas. As such the permeable surfaces may discharge directly to ground and will not be included in the total positive catchment area.

7.3 Appraisal of Potential SuDS Options

7.3.1 SuDS Options

Table 6: SuDS Appraisal; Feasibility of various SuDS and the potential uses on site.

Key	H	M	L	Y	?	N	N/A
Details	High Impact	Medium	Low Impact	Yes	Maybe	No	Not Applicable

Main Category	SuDS Features	Total Suspended Solids Removal	Heavy Metals Removal	Nutrient Removal	Bacteria Removal	Dissolved Pollutants	Runoff Volume Reduction	Flow Rate Control / Events: 1-2 Years	Flow Rate Control / Events: 10 - 30 Years	Flow Rate Control / Events: 100 Years	Site Potential	Included	Discussion / Details	Potential Storage Provided	Potential Storage Provided
Source Control Measure	Green / Brown Roof	NA	NA	NA	NA	H	H	H	H	L	N	N	Poorly compatible with proposed;	0	0
	Rain Water harvesting	M	L	L	L	NA	M	M	H	L	Y	Y	Good compatibility - Rain Water Butts	200L	200L
Infiltration Methods	Infiltration trench	H	H	H	M	H	H	H	H	L	N	N	Limited Infiltration	0	0
	Permeable Pavement	H	H	H	H	H	H	H	H	H	Y	Y	Limited Space Available for Paving to be Useful. Will not act as impermeable catchment, and will act as conveyance route	0	0
	Infiltration basin	H	H	H	M	H	H	H	H	H	N	N	Limited Space	0	0
	Soakaway	H	H	H	M	H	H	H	H	L	N	N	Limited Infiltration	0	0
Filtration	Filtration Surface sand	H	H	H	M	H	L	H	H	L	N	N	Limited Space	0	0
	Sub-surface sand filter	H	H	H	M	H	L	H	H	L	N	N	Limited Space	0	0
	Perimeter sand filter	H	H	H	M	H	L	H	H	L	N	N	Limited Space	0	0
	Bioretention/filter strips	H	H	H	M	H	L	H	H	L	Y	N	Partially Suitable through SuDS Planters	0	0
	Filter trench	H	H	H	M	H	L	H	H	L	N	N	Limited Space	0	0
Channels Features (Open)	Open channels Conveyance	H	M	M	M	H	M	H	H	H	N	N	Limited Space	0	0
	Enhanced dry swale	H	H	H	M	H	M	H	H	H	N	N	Limited Space	0	0
	Enhanced wet swale	H	H	M	H	H	L	H	H	H	N	N	Limited Space	0	0
Wet SuDS	Wetland Shallow wetland	H	M	H	M	H	L	H	M	L	N	N	Limited Space	0	0
	Extended detention wetland	H	M	H	M	H	L	H	M	L	N	N	Limited Space	0	0
	Pond / wetland	H	M	H	M	H	L	H	M	L	N	N	Limited Space	0	0
	Pocket wetland	H	M	H	M	H	L	H	M	L	N	N	Limited Space	0	0
	Submerged gravel wetland	H	M	H	M	H	L	H	M	L	N	N	Limited Space	0	0
	Wetland channel	H	M	H	M	H	L	H	M	L	N	N	Limited Space	0	0
Retention	Retention pond	H	M	M	M	H	L	H	H	H	N	N	Limited Space	0	0
Detention	Detention basin	M	M	L	L	L	L	H	H	H	N	N	Limited Space	0	0
Tank Storage	Sub-surface storage (Tank)	L	L	L	L	L	L	H	H	H	Y	Y	Good Compatibility	5.8	5.8
														Total	5.8

7.4 SuDS Strategy

7.4.1 SuDS Options

The proposal will introduce a rainwater butt, permeable paving and Geocellular attenuation storage.

The SuDS strategy introduced will implement an protected Orifice Control Chamber, to limit the discharge to 1.0 l/s, during all storm events into the receiving surface water sewer. The combination of the SuDS measures introduced will provide 5.8m^3 of attenuation; the details are outline in the table below.

Table 7: Proposed SuDS

Option A			
Location	Proposed Area (m^2)	SuDS Option	Estimated Storage Provided (m^3)
Rear Garden	-	Rainwater Butt	200L
Rear Garden	20	0.25m thick Geocellular Attenuation	4.8
Front of Site	2	0.5m thick Geocellular Attenuation	1.0
Total			**5.8**

The drainage layout, model sections and model results are available in Appendix 7

The descriptions of the proposed SuDS and how they interact with the different features is outlined below.

7.4.2 Rainwater Butt

1no. Rainwater harvesting Butt (200 litre) will be fitted to the rear garden downpipe to allow for rainwater re-use within the garden.

Excess storm water will discharge into the geocellular attenuation structure, feeding into the attenuation once at capacity.

7.4.3 Geocellular Attenuation

The geocellular storage will be placed below the patio at the front of the property, and below the patio within the rear garden.

The front structure will cover a total area of 2m^2 with a thickness of 0.5m. The rear structure will cover a total area of 20m^2 with a thickness of 0.25m. The geocellular storage crates (AquaCell Drainage Crates or similar) will have a porosity of 95% and will be stacked together to create the desired storage volume 5.8m^3.

7.4.4 Surface Water Discharge Points

The surface water will discharge via the existing surface water connection into the public sewer network, as discussed is Section 5.6.

7.4.5 Treatment of Run-off

Treatment of roof water runoff will be provided through the provision of the permeable paving, rainwater butt and the inspection chamber sumps to intercept gross solids and sediment; guidance will be provided to the developer on appropriate maintenance requirements including regular cleaning of gullies.

7.4.6 Exceedance Flows

The ground level at the site ranges from 6.34mAOD (northeast) to 6.93mAOD (southwest).

The elevation review of the LIDAR 1m DTM Mapping indicates that in the event of exceedance on the site upon completion, overland flows will be retained within the soft landscaping on site, away from the building ensuring safe access and egress can be maintained during such an event. It should be noted that CFS will allow for the excavation of land to the rear of the site, providing a substantial area for storage within the soft landscaping.

7.5 Maintenance and Adoption of SuDS

All SuDS features will be properly installed by competent persons. They will be maintained regularly to ensure that their design capacity and attenuation characteristics provide the required storage volume.

Landscaping and adjacent areas will be designed such that they do not cause soil, mulch and other materials to be washed onto the permeable surfaces and into drains causing clogging.

Owners of the properties/persons responsible for maintenance of SuDS components will be provided with operation and maintenance manuals which will include information such as:

- the location of SuDS components;
- an explanation of design intent and objective of the SuDS;
- the requirements for regular and occasional inspection and maintenance;
- visual indicators that may trigger maintenance.

Regular maintenance of SuDS components is relatively straightforward with the main tasks consisting of:

- Regular visual inspections – checking inlets are not blocked and verifying that clogging has not occurred;
- Litter and debris removal;
- Grass cutting;
- Preventive sweeping;
- Weeding and invasive plant control;
- Oil and stain removal.

Occasional maintenance activities to ensure the long-term performance of the SuDS features include:

- Sediment removal
- Vegetation and plant replacement

These simple measures will ensure that the storage capacity of the system is maintained and that the need for reconstruction and replacement of components is minimised.

Further details on SuDS maintenance measures that will be employed at the site can be found in Appendix 8.

8 Conclusion and Recommendations

With the proposed SuDS mitigation measures in place, it is considered that the proposed development will reduce local flood risk and enhance the local environment and will therefore be in compliance with the LLFA's current planning policy and the NPPF.

9 References

1. Communities and Local Government - National Planning Policy Framework NPPF, 2019.
2. The London Plan – The Spatial Development Strategy for Greater London - March 2021
3. CIRIA, Defra, Environment Agency – UK SuDS Manual, 2015.
4. Local Plan, London Borough of Richmond upon Thames, 2018.
5. Sustainable drainage systems - https://new.enfield.gov.uk/services/planning/sustainable-drainage-systems/ - Accessed Nov 2023.

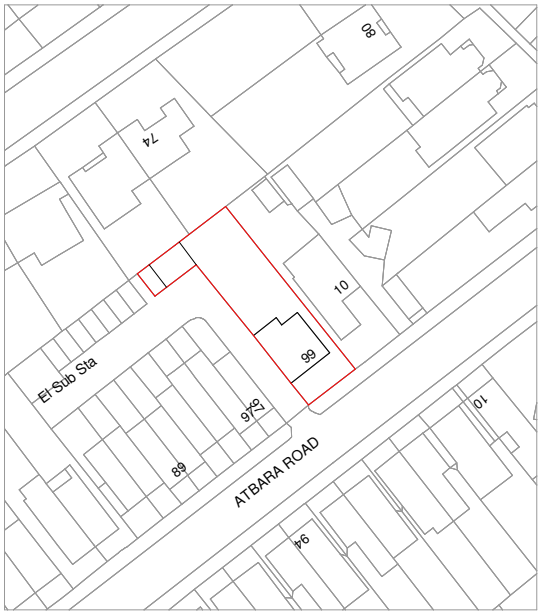
10 Appendices

10.1 Appendix 1 – Development Plans & Photos

10.1.1 Development Plans

PDF to follow this page.

Plot boundary



10 0 10 20 30 40 50

Metres

N

Location Map

1 : 1250

Extension Plans. Ealing Cross, 85 Uxbridge Rd, London W5 5BW	99 Atbara Road, Teddington TW11 9PA PROJECT ADDRESS:	Jamie & Beverley McDaid CLIENT:			
		12.05.2023 Date:	1:100 Scale (@ A4)	Rev. Date	Rev.
		Drawn by: GB	AR-R00-EX-101		
New 4 Bed House PROJECT:	LOCATION MAP DRAWING TITLE:	Checked by:	DRAWING NUMBER:		

Development

Property boundary

Site Plan

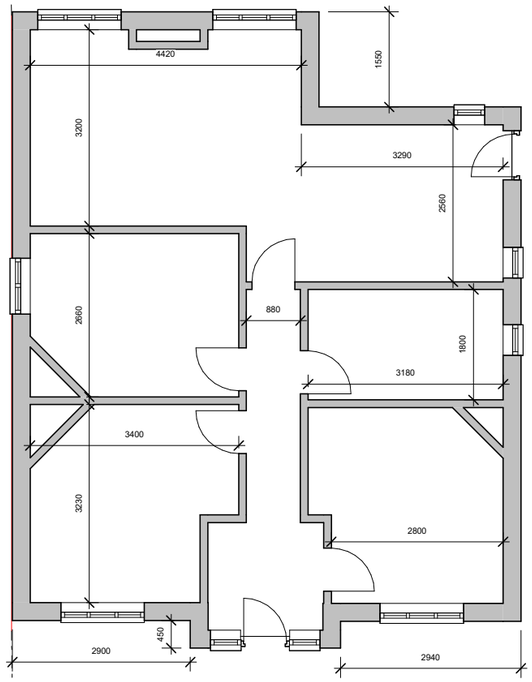
1 : 500

10 0 10 20 30 40 50

Metres

N

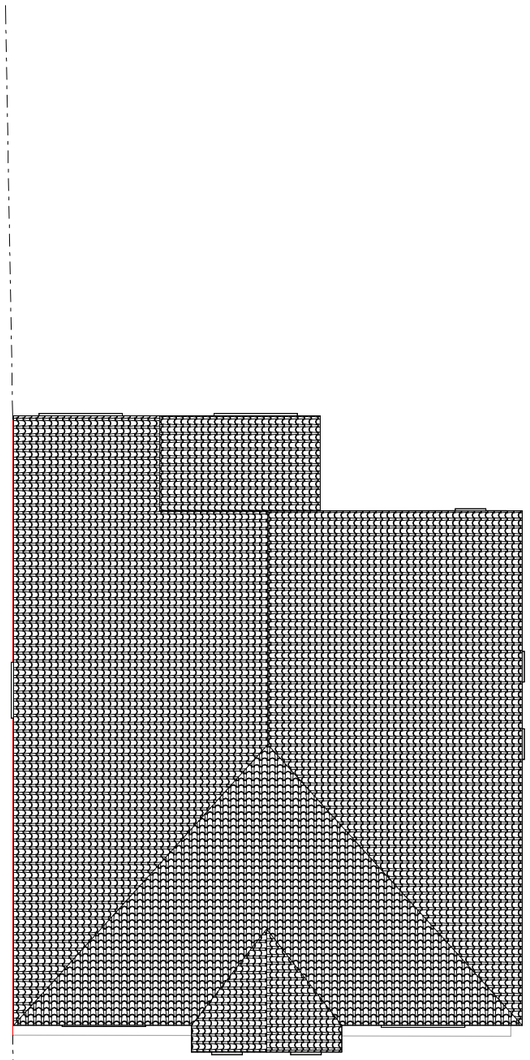
Extension Plans 16 Shakespeare Road W7 1LR	99 Atbara Road, Teddington TW11 9PA PROJECT ADDRESS:	Jamie & Beverley McDaid CLIENT:	
		22/09/2023 Date:	Scale (@ A4) / Rev. Date / Rev.
New 4 Bed House PROJECT:	SITE PLAN DRAWING TITLE:	Drawn by: LG Checked by: JH	AR-R00-PR-101 DRAWING NUMBER:



Boundary
Outline

GF Lvl

1 : 100



ROOF PLAN

1 : 100

0 1 2 3 4 5m 1:100

PROGRAMME:

REVISION NOTES:

REV:	DATE:	DESCRIPTION:

GENERAL NOTES:

1. All Dimensions are in millimetres unless otherwise stated
2. All work to be carried out in accordance with the current edition of the building regulations 1991 (including amendments) and all relevant british standards/codes of practice.
3. The Contractor is responsible for the correct setting out of the works on site, all dimensions to be checked prior to fabrication of materials and commencement of works.
4. This Drawing is to be read in conjunction with all relevant drawings and specifications
5. Exact SVP and Boiler position to be determined onsite by contractor
6. Steels imbedded into ceiling may be charged additionally by your contractor
7. All proposed materials are to be similar in appearance to that of the existing house, unless otherwise
8. Skylights mustn't protrude past the roof slope by more than 150mm
9. Glazing which exceeds 25% of the added floor area will result in extra charges for S.A.P Calculations

EXTENSION PLANS

Extension Plans. 16 Shakespeare Road W7 1LR

CLIENT: Jamie & Beverley McDaid

PROJECT: New 4 Bed House

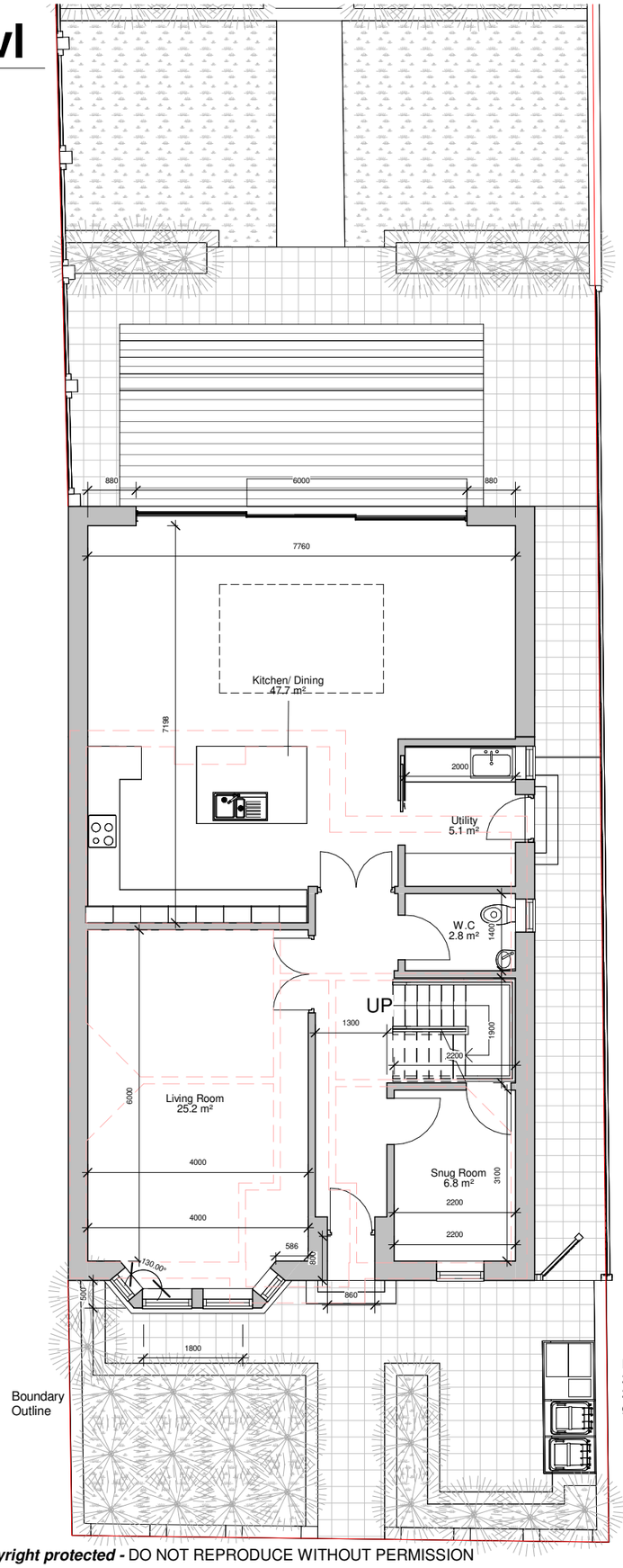
PROJECT ADDRESS: 99 Atbara Road,
Teddington
TW11 9PA

DRAWING TITLE: EXISTING FLOOR PLANS

DRAWN BY: LG	**CHECKED BY:** JH
DATE: 22/09/2023	**Rev:** **Rev. DATE:**
SCALE@A3: 1:100	**DRAWING No:** HR-R00-EX-102

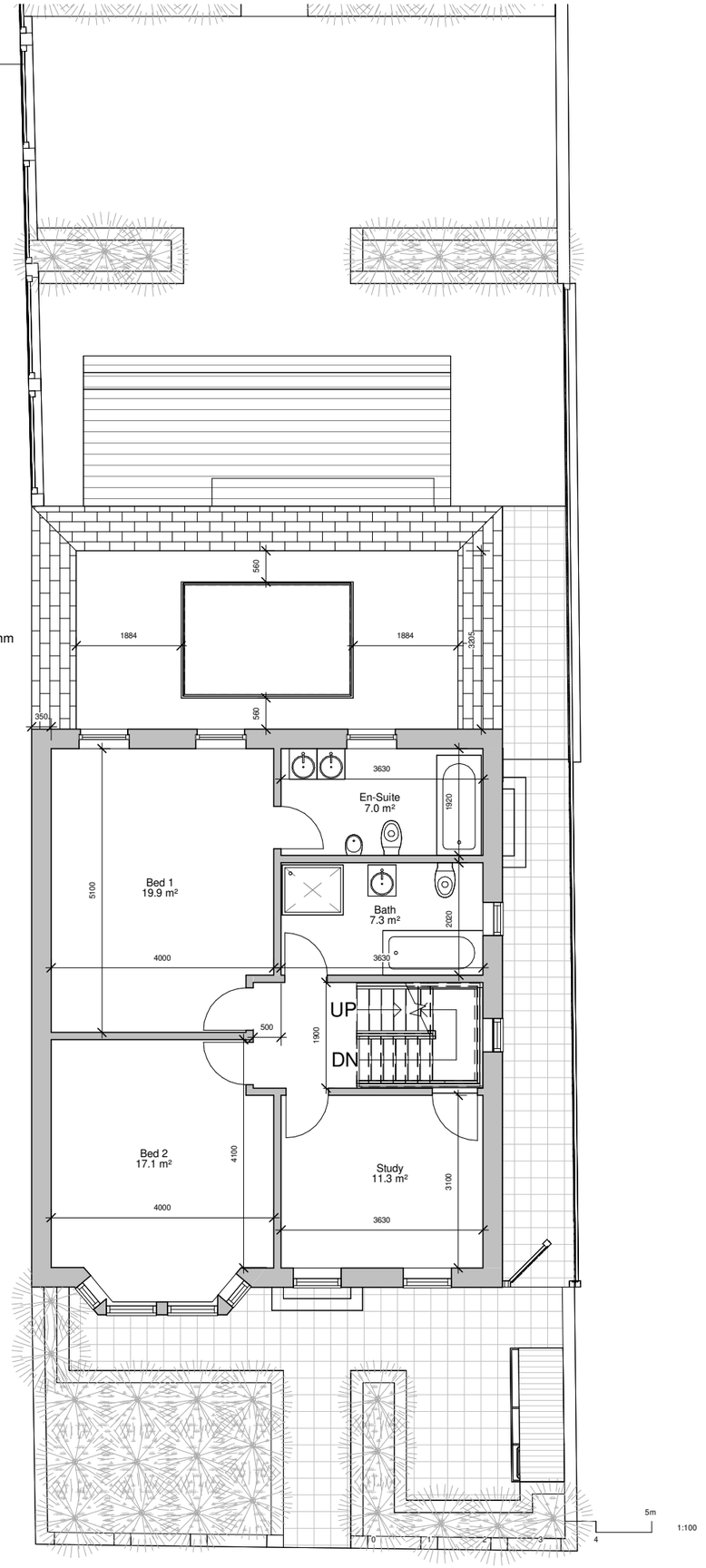
GF Lvl

1 : 100



FF Lvl

1 : 100



PROGRAMME:

KEY:

	Neighbouring context	**RWP**	Rain Water Pipe
	Existing walls	**SVP**	Soil Vent Pipe
	Proposed walls		Boundary line
	Proposed rooflight		Existing removed
MH	Manhole		Existing beam
B	Boiler		1.2 m head height
EM	Electric Meter		1.5 m head hieght
GM	Gas Meter		Ridge line

REVISION NOTES:

REV:	DATE:	DESCRIPTION:

GENERAL NOTES:

1. All Dimensions are in millimetres unless otherwise stated
2. All work to be carried out in accordance with current building regulations and all relevant british standards/codes of practice.
3. The Contractor is responsible for the correct setting out of the works on site, all dimensions to be checked prior to fabrication of materials and commencement of works.
4. This Drawing is to be read in conjunction with all relevant drawings and specifications
5. Exact SVP and Boiler position to be determined onsite by contractor
6. A 'macerator toilet' would be required for a certain designs if the toilet location is away from existing SVP
7. Steels imbedded into ceiling may be charged additionally by your contractor
8. All proposed materials are to be similar in appearance to that of the existing house, unless otherwise stated.
9. Skylights must not protrude past the roof slope by more than 150mm
10. Glazing which exceeds 25% of the added floor area will result in extra charges for S.A.P Calculations
11. Windows on a side elevation at first floor level or above must be obscured glazing and non openable below 1.7m
12. Load-bearing partitions and/or posts are shown in a rough position. The exact position is to be confirmed by a structural engineer prior to construction.

EXTENSION PLANS

Extension Plans. Ealing Cross, 85 Uxbridge Rd, London W5 5BW

CLIENT: Jamie & Beverley McDaid

PROJECT: New 4 Bed House

PROJECT ADDRESS: 99 Atbara Road, Teddington TW11 9PA

DRAWING TITLE: PROPOSED FLOOR PLANS

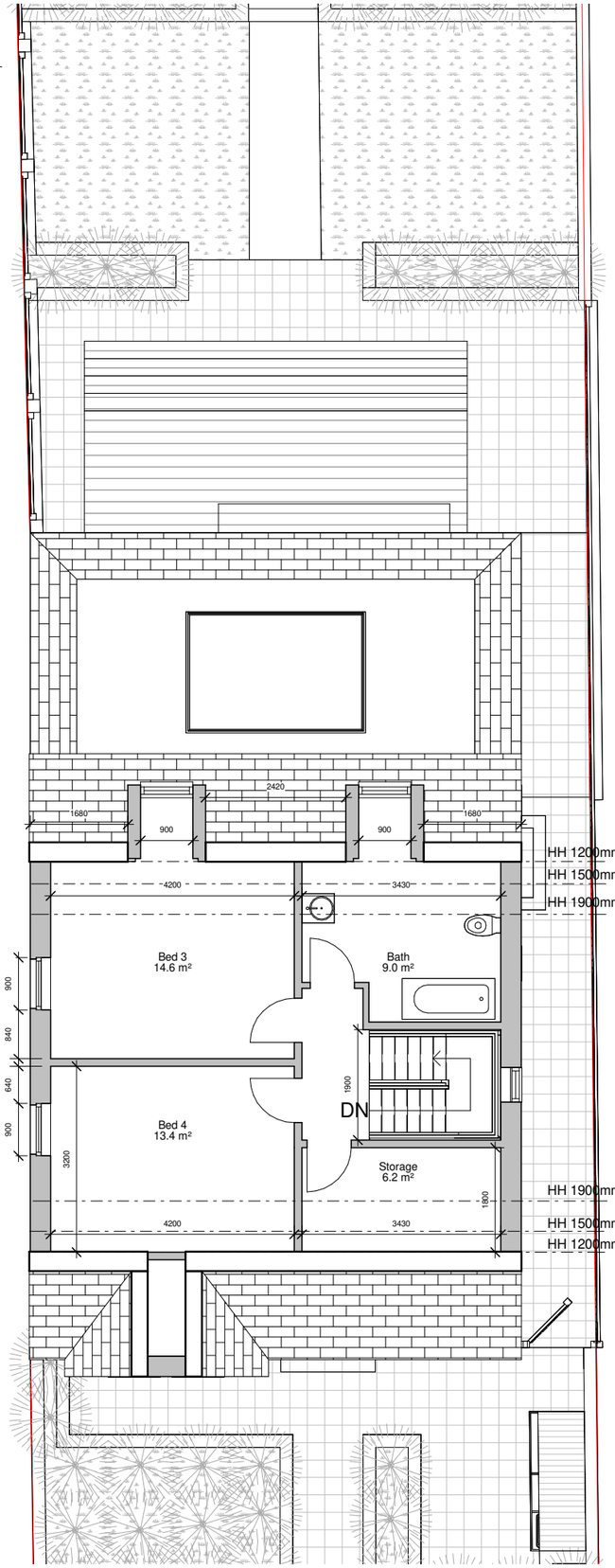
DRAWN BY: LG | **CHECKED BY:** JH

DATE: 22/09/2023 | **Rev:** | **Rev. DATE:**

SCALE@A3: 1:100 | **DRAWING No:** AR-R02-PR-102

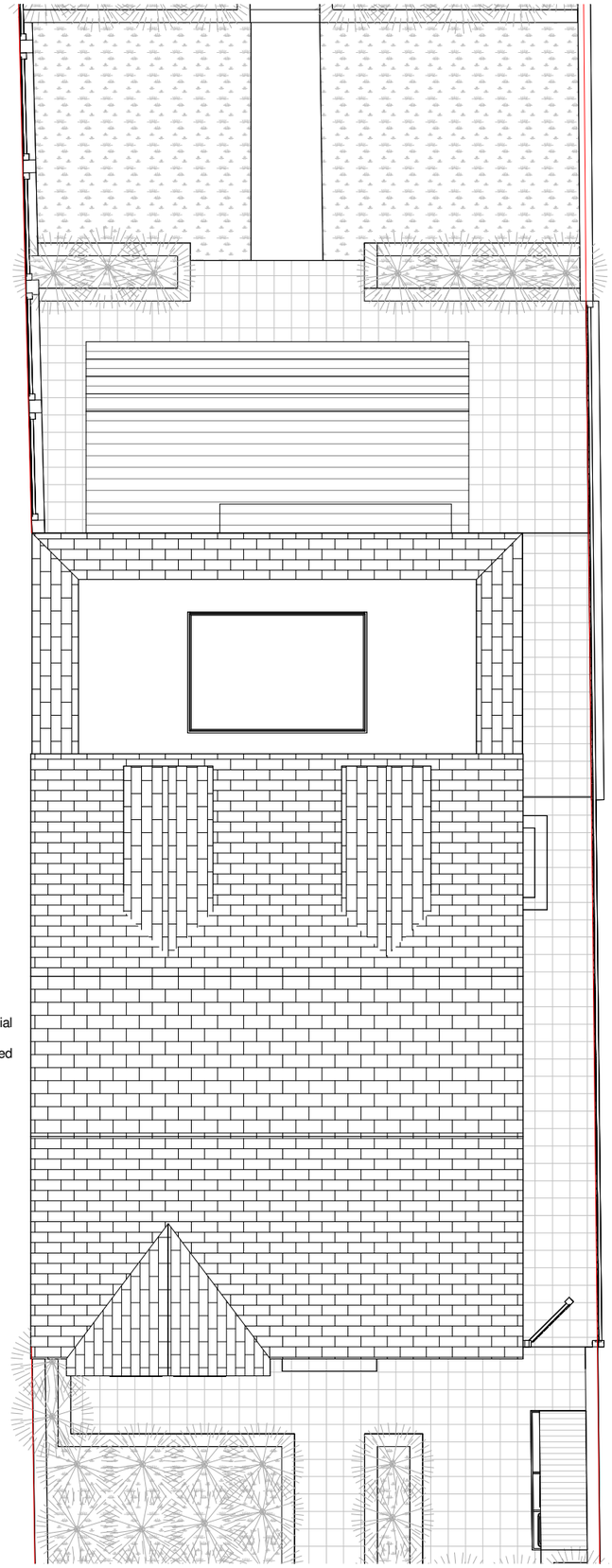
Loft Lvl

1 : 100



ROOF PLAN

1 : 100



Roof material to be gray slate with red ridge tiles

5m

0 1 2 3 4 1:100

PROGRAMME:

KEY:

	Neighbouring context	**RWP**	Rain Water Pipe
	Existing walls	**SVP**	Soil Vent Pipe
	Proposed walls		Boundary line
	Proposed rooflight		Existing removed
MH	Manhole		Existing beam
B	Boiler		1.2 m head height
EM	Electric Meter		1.5 m head hieght
GM	Gas Meter		Ridge line

REVISION NOTES:

REV:	DATE:	DESCRIPTION:

GENERAL NOTES:

1. All Dimensions are in millimetres unless otherwise stated
2. All work to be carried out in accordance with current building regulations and all relevant british standards/codes of practice.
3. The Contractor is responsible for the correct setting out of the works on site, all dimensions to be checked prior to fabrication of materials and commencement of works.
4. This Drawing is to be read in conjunction with all relevant drawings and specifications
5. Exact SVP and Boiler position to be determined onsite by contractor
6. A 'macerator toilet' would be required for a certain designs if the toilet location is away from existing SVP
7. Steels imbedded into ceiling may be charged additionally by your contractor
8. All proposed materials are to be similar in appearance to that of the existing house, unless otherwise stated.
9. Skylights must not protrude past the roof slope by more than 150mm
10. Glazing which exceeds 25% of the added floor area will result in extra charges for S.A.P Calculations
11. Windows on a side elevation at first floor level or above must be obscured glazing and non openable below 1.7m
12. Load-bearing partitions and/or posts are shown in a rough position. The exact position is to be confirmed by a structural engineer prior to construction.

EXTENSION PLANS

Extension Plans. Ealing Cross, 85 Uxbridge Rd, London W5 5BW

CLIENT: Jamie & Beverley McDaid

PROJECT: New 4 Bed House

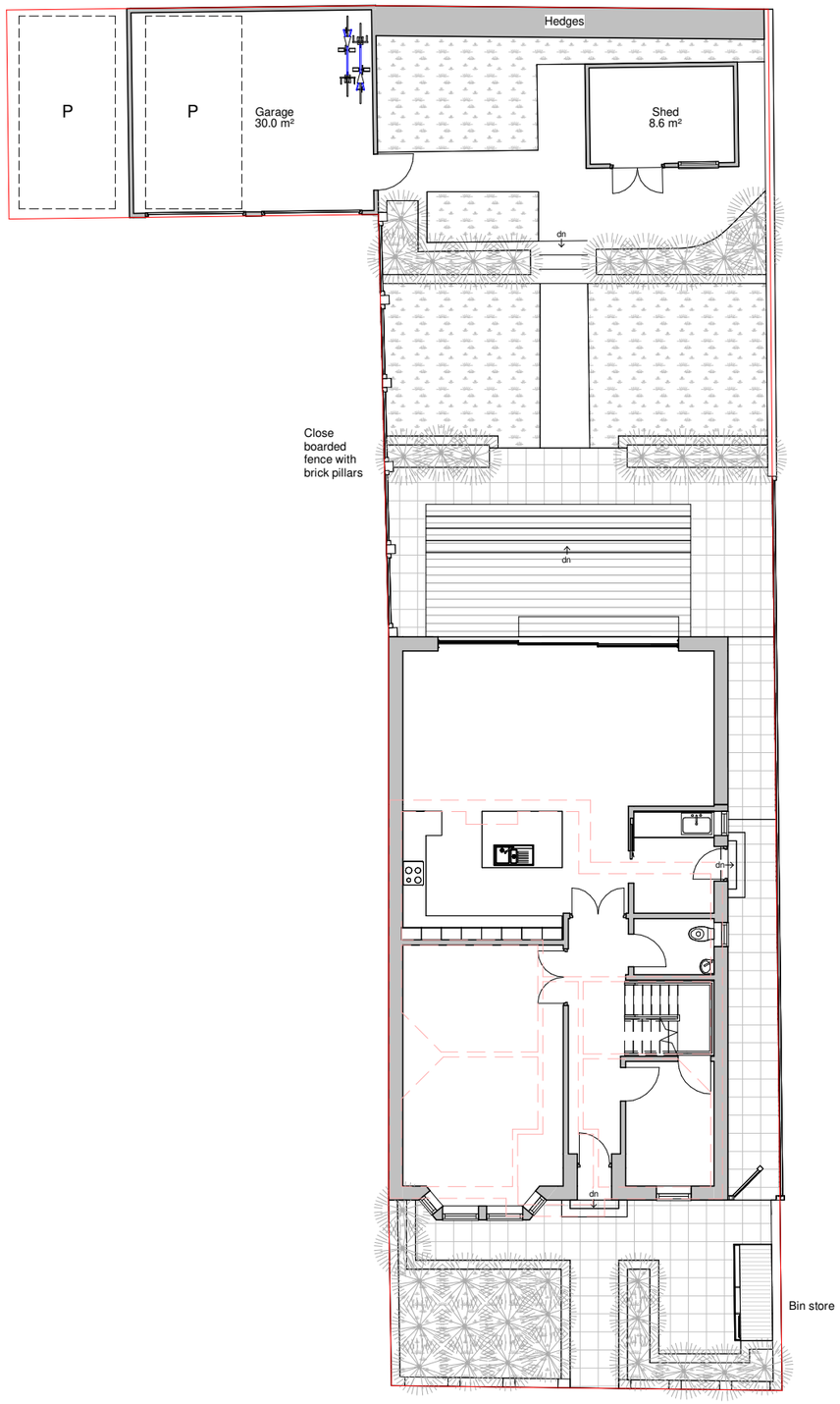
PROJECT ADDRESS: 99 Atbara Road, Teddington TW11 9PA

DRAWING TITLE: PROPOSED FLOOR PLANS 2

DRAWN BY:	LG	**CHECKED BY:**	JH
DATE:	22/09/2023	**Rev:**	**Rev. DATE:**
SCALE@A3:	1:100	**DRAWING No:**	AR-R02-PR-103

Full Plan

1 : 150



PROGRAMME:

KEY:

	Neighbouring context	**RWP**	Rain Water Pipe
	Existing walls	**SVP**	Soil Vent Pipe
	Proposed walls		Boundary line
	Proposed rooflight		Existing removed
MH	Manhole		Existing beam
B	Boiler		1.2 m head height
EM	Electric Meter		1.5 m head hieght
GM	Gas Meter		Ridge line

REVISION NOTES:

REV:	DATE:	DESCRIPTION:

GENERAL NOTES:

1. All Dimensions are in millimetres unless otherwise stated
2. All work to be carried out in accordance with current building regulations and all relevant british standards/codes of practice.
3. The Contractor is responsible for the correct setting out of the works on site, all dimensions to be checked prior to fabrication of materials and commencement of works.
4. This Drawing is to be read in conjunction with all relevant drawings and specifications
5. Exact SVP and Boiler position to be determined onsite by contractor
6. A 'macerator toilet' would be required for a certain designs if the toilet location is away from existing SVP
7. Steels imbedded into ceiling may be charged additionally by your contractor
8. All proposed materials are to be similar in appearance to that of the existing house, unless otherwise stated.
9. Skylights must not protrude past the roof slope by more than 150mm
10. Glazing which exceeds 25% of the added floor area will result in extra charges for S.A.P Calculations
11. Windows on a side elevation at first floor level or above must be obscured glazing and non openable below 1.7m
12. Load-bearing partitions and/or posts are shown in a rough position. The exact position is to be confirmed by a structural engineer prior to construction.

EXTENSION PLANS

Extension Plans. Ealing Cross, 85 Uxbridge Rd, London W5 5BW

CLIENT: Jamie & Beverley McDaid

PROJECT: New 4 Bed House

PROJECT ADDRESS: 99 Atbara Road, Teddington TW11 9PA

DRAWING TITLE: FULL PLAN

DRAWN BY: LG | **CHECKED BY:** JH

DATE: 22/09/2023 | **Rev:** | **Rev. DATE:**

SCALE@A3: 1:150 | **DRAWING No:** AR-R02-PR-104

PROPOSED STREET SCENE

1 : 100

5m
0 1 2 3 4 1:100

PROGRAMME:

KEY:

	Neighbouring context	**RWP**	Rain Water Pipe
	Existing walls	**SVP**	Soil Vent Pipe
	Proposed walls		Boundary line
	Proposed rooflight		Existing removed
MH	Manhole		Existing beam
B	Boiler		1.2 m head height
EM	Electric Meter		1.5 m head hieght
GM	Gas Meter		Ridge line

REVISION NOTES:

REV:	DATE:	DESCRIPTION:

GENERAL NOTES:

1. All Dimensions are in millimetres unless otherwise stated
2. All work to be carried out in accordance with current building regulations and all relevant british standards/codes of practice.
3. The Contractor is responsible for the correct setting out of the works on site, all dimensions to be checked prior to fabrication of materials and commencement of works.
4. This Drawing is to be read in conjunction with all relevant drawings and specifications
5. Exact SVP and Boiler position to be determined onsite by contractor
6. A 'macerator toilet' would be required for a certain designs if the toilet location is away from existing SVP
7. Steels imbedded into ceiling may be charged additionally by your contractor
8. All proposed materials are to be similar in appearance to that of the existing house, unless otherwise stated.
9. Skylights must not protrude past the roof slope by more than 150mm
10. Glazing which exceeds 25% of the added floor area will result in extra charges for S.A.P Calculations
11. Windows on a side elevation at first floor level or above must be obscured glazing and non openable below 1.7m
12. Load-bearing partitions and/or posts are shown in a rough position. The exact position is to be confirmed by a structural engineer prior to construction.

EXTENSION PLANS

Extension Plans. Ealing Cross, 85 Uxbridge Rd, London W5 5BW

CLIENT: Jamie & Beverley McDaid

PROJECT: New 4 Bed House

PROJECT ADDRESS: 99 Atbara Road,
Teddington
TW11 9PA

DRAWING TITLE: PROPOSED STREET SCENE

DRAWN BY: LG | **CHECKED BY:** JH

DATE: 22/09/2023 | **Rev:** | **Rev. DATE:**

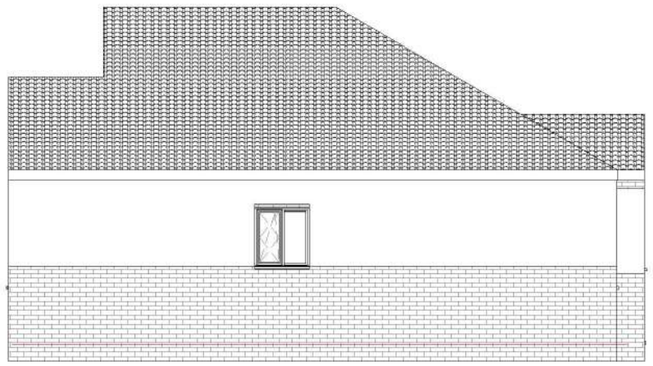
SCALE@A3: 1:100 | **DRAWING No:** AR-R02-PR-107

RH ELEVATION

1 : 100

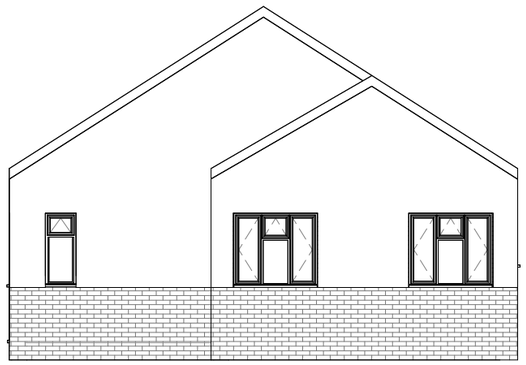
FRONT ELEVATION

1 : 100



LH ELEVATION

1 : 100



REAR ELEVATION

1 : 100

5m
0 1 2 3 4 1:100

PROGRAMME:

REVISION NOTES:

REV:	DATE:	DESCRIPTION:

GENERAL NOTES:

1. All Dimensions are in millimetres unless otherwise stated
2. All work to be carried out in accordance with the current edition of the building regulations 1991 (including amendments) and all relevant british standards/codes of practice.
3. The Contractor is responsible for the correct setting out of the works on site, all dimensions to be checked prior to fabrication of materials and commencement of works.
4. This Drawing is to be read in conjunction with all relevant drawings and specifications
5. Exact SVP and Boiler position to be determined onsite by contractor
6. Steels imbedded into ceiling may be charged additionally by your contractor
7. All proposed materials are to be similar in appearance to that of the existing house, unless otherwise
8. Skylights mustn't protrude past the roof slope by more than 150mm
9. Glazing which exceeds 25% of the added floor area will result in extra charges for S.A.P Calculations

EXTENSION PLANS

Extension Plans. 16 Shakespeare Road W7 1LR

CLIENT: Jamie & Beverley McDaid

PROJECT: New 4 Bed House

PROJECT ADDRESS: 99 Atbara Road, Teddington TW11 9PA

DRAWING TITLE: EXISTING ELEVATIONS

DRAWN BY: LG	**CHECKED BY:** JH
DATE: 22/09/2023	**Rev:** **Rev. DATE:**
SCALE@A3: 1:100	**DRAWING No:** HR-R00-EX-103

FRONT ELEVATION

1 : 100

RH ELEVATION

1 : 100

5m

0 1 2 3 4 1:100

PROGRAMME:

KEY:

	Neighbouring context	**RWP**	Rain Water Pipe
	Existing walls	**SVP**	Soil Vent Pipe
	Proposed walls		Boundary line
	Proposed rooflight		Existing removed
MH	Manhole		Existing beam
B	Boiler		1.2 m head height
EM	Electric Meter		1.5 m head hieght
GM	Gas Meter		Ridge line

REVISION NOTES:

REV:	DATE:	DESCRIPTION:

GENERAL NOTES:

1. All Dimensions are in millimetres unless otherwise stated
2. All work to be carried out in accordance with current building regulations and all relevant british standards/codes of practice.
3. The Contractor is responsible for the correct setting out of the works on site, all dimensions to be checked prior to fabrication of materials and commencement of works.
4. This Drawing is to be read in conjunction with all relevant drawings and specifications
5. Exact SVP and Boiler position to be determined onsite by contractor
6. A 'macerator toilet' would be required for a certain designs if the toilet location is away from existing SVP
7. Steels imbedded into ceiling may be charged additionally by your contractor
8. All proposed materials are to be similar in appearance to that of the existing house, unless otherwise stated.
9. Skylights must not protrude past the roof slope by more than 150mm
10. Glazing which exceeds 25% of the added floor area will result in extra charges for S.A.P Calculations
11. Windows on a side elevation at first floor level or above must be obscured glazing and non openable below 1.7m
12. Load-bearing partitions and/or posts are shown in a rough position. The exact position is to be confirmed by a structural engineer prior to construction.

EXTENSION PLANS

Extension Plans. Ealing Cross, 85 Uxbridge Rd, London W5 5BW

CLIENT: Jamie & Beverley McDaid

PROJECT: New 4 Bed House

PROJECT ADDRESS: 99 Atbara Road, Teddington TW11 9PA

DRAWING TITLE: PROPOSED ELEVATIONS

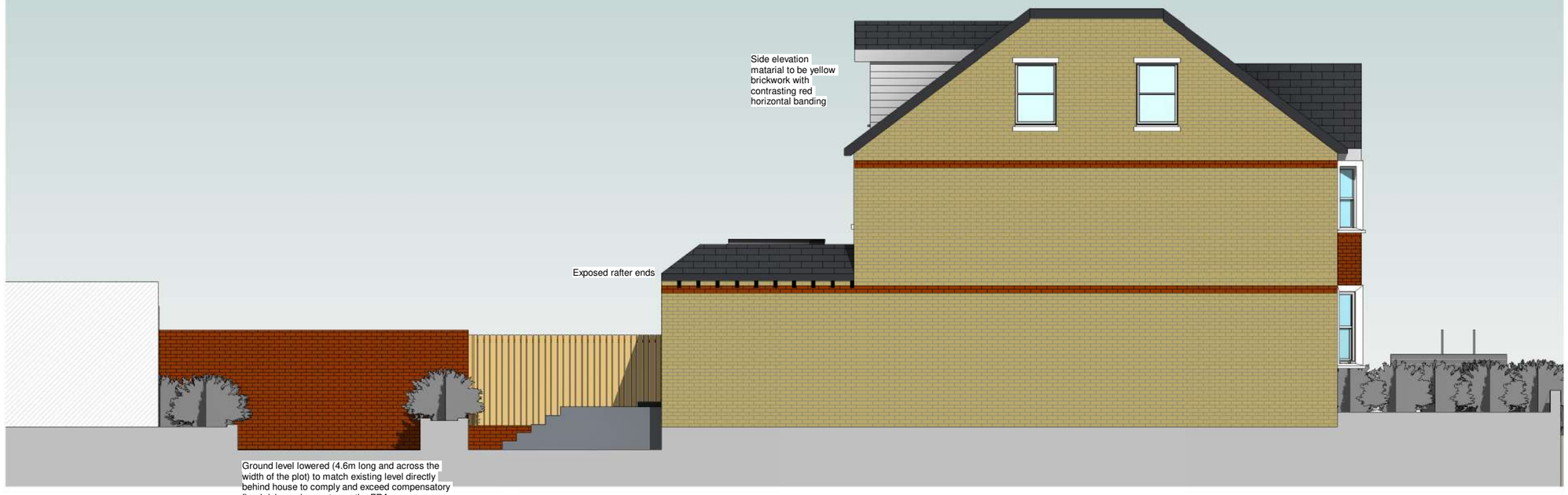
DRAWN BY:	LG	**CHECKED BY:**	JH
DATE:	22/09/2023	**Rev:**	**Rev. DATE:**
SCALE@A3:	1:100	**DRAWING No:**	AR-R02-PR-105

REAR ELEVATION

1 : 100

LH ELEVATION

1 : 100



PROGRAMME:

KEY:

	Neighbouring context	**RWP**	Rain Water Pipe
	Existing walls	**SVP**	Soil Vent Pipe
	Proposed walls		Boundary line
	Proposed rooflight		Existing removed
MH	Manhole		Existing beam
B	Boiler		1.2 m head height
EM	Electric Meter		1.5 m head hieght
GM	Gas Meter		Ridge line

REVISION NOTES:

REV:	DATE:	DESCRIPTION:

GENERAL NOTES:

1. All Dimensions are in millimetres unless otherwise stated
2. All work to be carried out in accordance with current building regulations and all relevant british standards/codes of practice.
3. The Contractor is responsible for the correct setting out of the works on site, all dimensions to be checked prior to fabrication of materials and commencement of works.
4. This Drawing is to be read in conjunction with all relevant drawings and specifications
5. Exact SVP and Boiler position to be determined onsite by contractor
6. A 'macerator toilet' would be required for a certain designs if the toilet location is away from existing SVP
7. Steels imbedded into ceiling may be charged additionally by your contractor
8. All proposed materials are to be similar in appearance to that of the existing house, unless otherwise stated.
9. Skylights must not protrude past the roof slope by more than 150mm
10. Glazing which exceeds 25% of the added floor area will result in extra charges for S.A.P Calculations
11. Windows on a side elevation at first floor level or above must be obscured glazing and non openable below 1.7m
12. Load-bearing partitions and/or posts are shown in a rough position. The exact position is to be confirmed by a structural engineer prior to construction.

EXTENSION PLANS

Extension Plans. Ealing Cross, 85 Uxbridge Rd, London W5 5BW

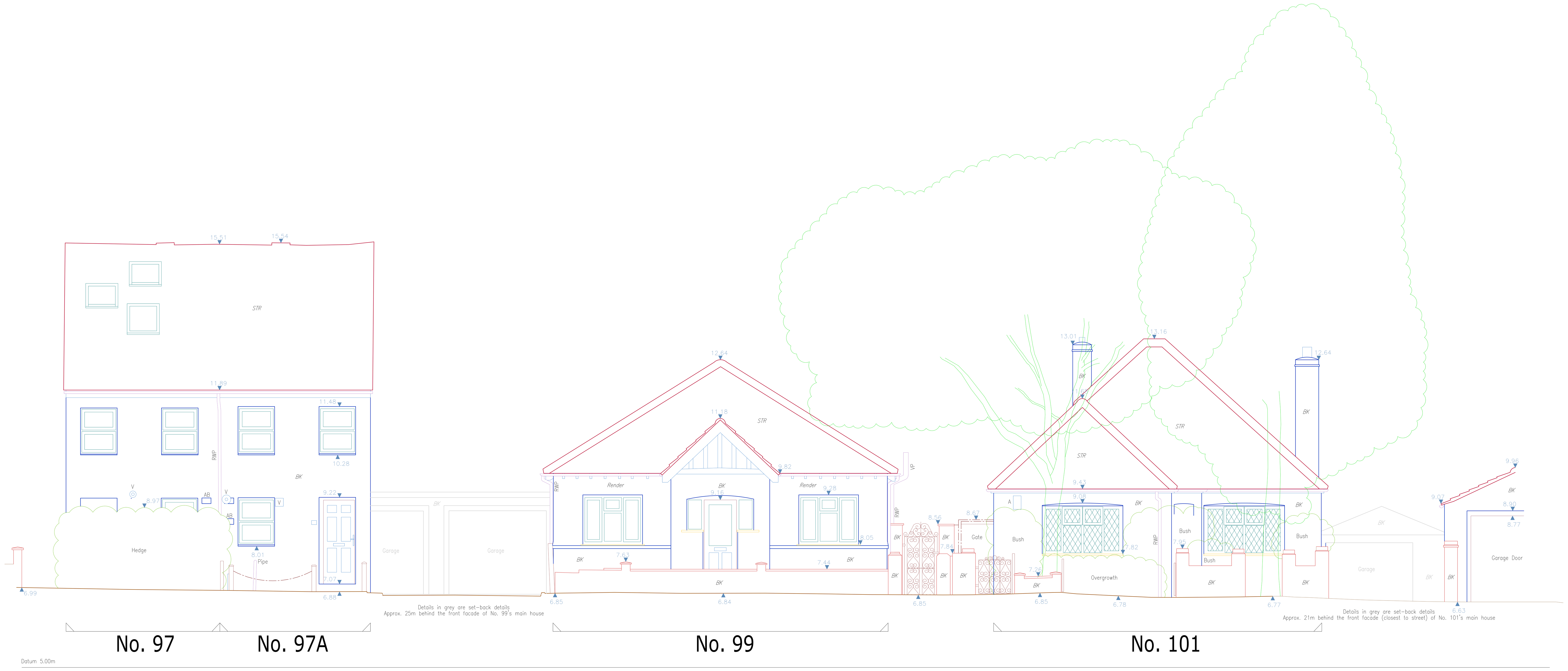
CLIENT: Jamie & Beverley McDaid

PROJECT: New 4 Bed House

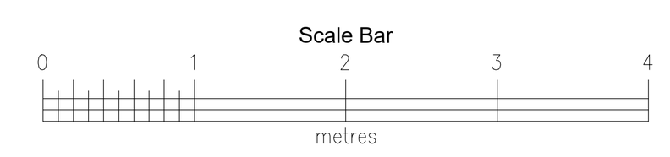
PROJECT ADDRESS: 99 Atbara Road, Teddington TW11 9PA

DRAWING TITLE: PROPOSED ELEVATIONS

DRAWN BY:	LG	**CHECKED BY:**	JH
DATE:	22/09/2023	**Rev:**	**Rev. DATE:**
SCALE@A3:	1:100	**DRAWING No:**	AR-R02-PR-106



Street Scene Elevation



Abbreviations

A	Alarm Box	L	Light
AB	Air Brick	RWP	Rain Water Pipe
ACU	Air Conditioning Unit	STR	Sloping Tiled Roof
BK	Brick	SVP	Soil Vent Pipe
CO	Column	TB	Telecoms Box
GM	Gas Meter	V	Vent
HR	Handrail	VP	Vent Pipe
JB	Junction Box	WP	Waste Pipe

Survey Datum

Ordnance Datum Newlyn (ODN) - GPS Derived Orthometric Heights related to OSGM15

Location Plan

Rev	Notes	Date	By
A	Added set-back details	13/07/23	LW

CURA SURVEYS
MEASURED SURVEYS SPECIALISTS

Registered Address: 12 John Prince's Street, London, United Kingdom, W1G 0JR
Website: curasurveys.co.uk
Telephone: 0203 488 5858
Mobile: 07403 697 410
Email: enquiry@curasurveys.co.uk

Regulated by RICS

Client: Jamie McDaid

Drawing Title: Street Scene Elevation

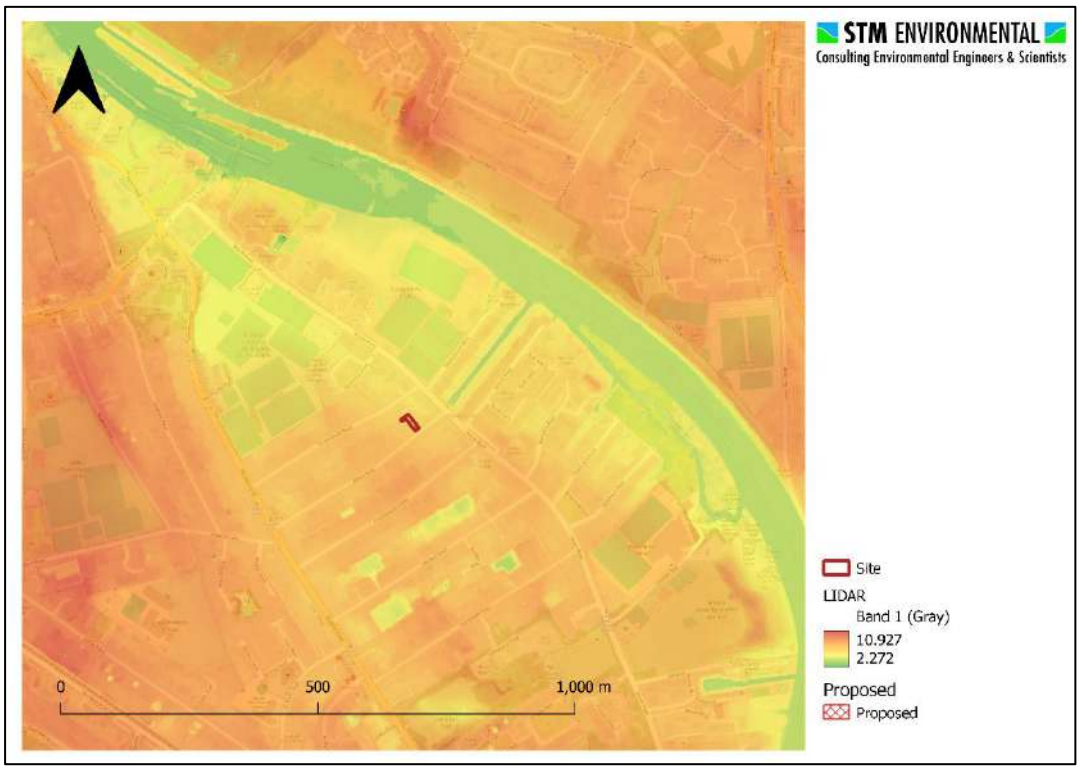
Project: 99 Atbara Road, Teddington TW11 9PA

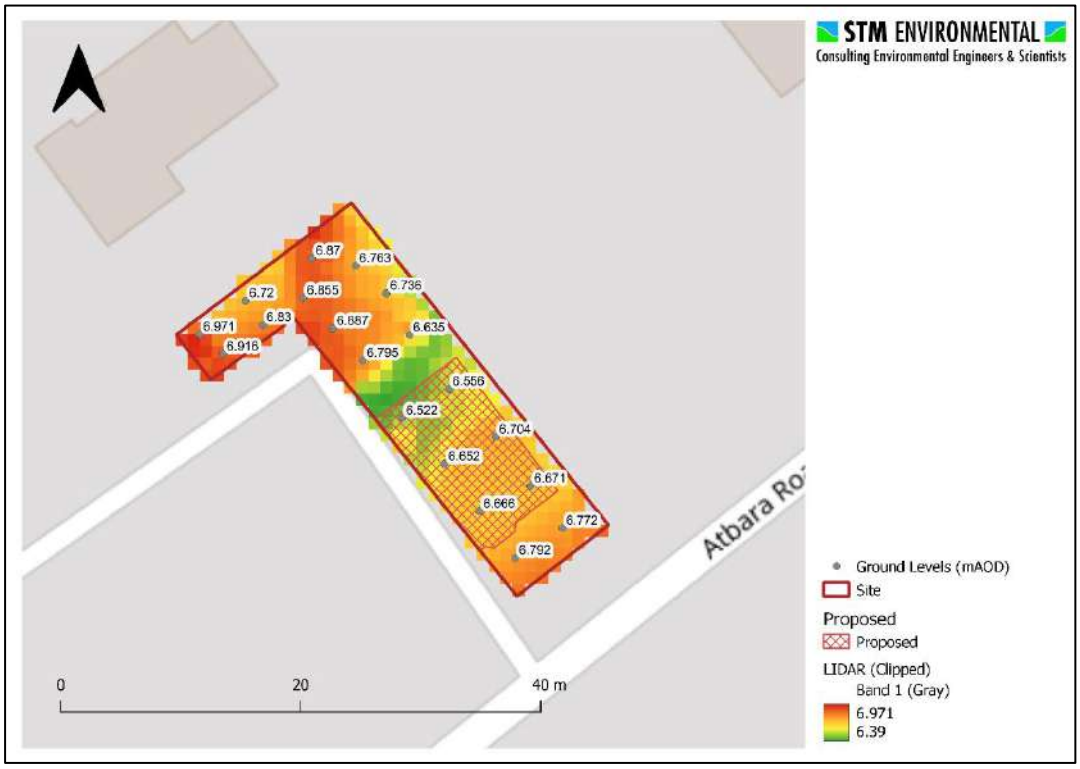
Surveyed: MG	Checked: LW	Status: FINAL	Size: A0 Scale: 1:50
Date: Jul 2023	Ref No: 2391_01	Sheet: 01 of 01	

10.1.2 Site Photos

10.2 Appendix 2– Site Topography and Drainage Characteristics

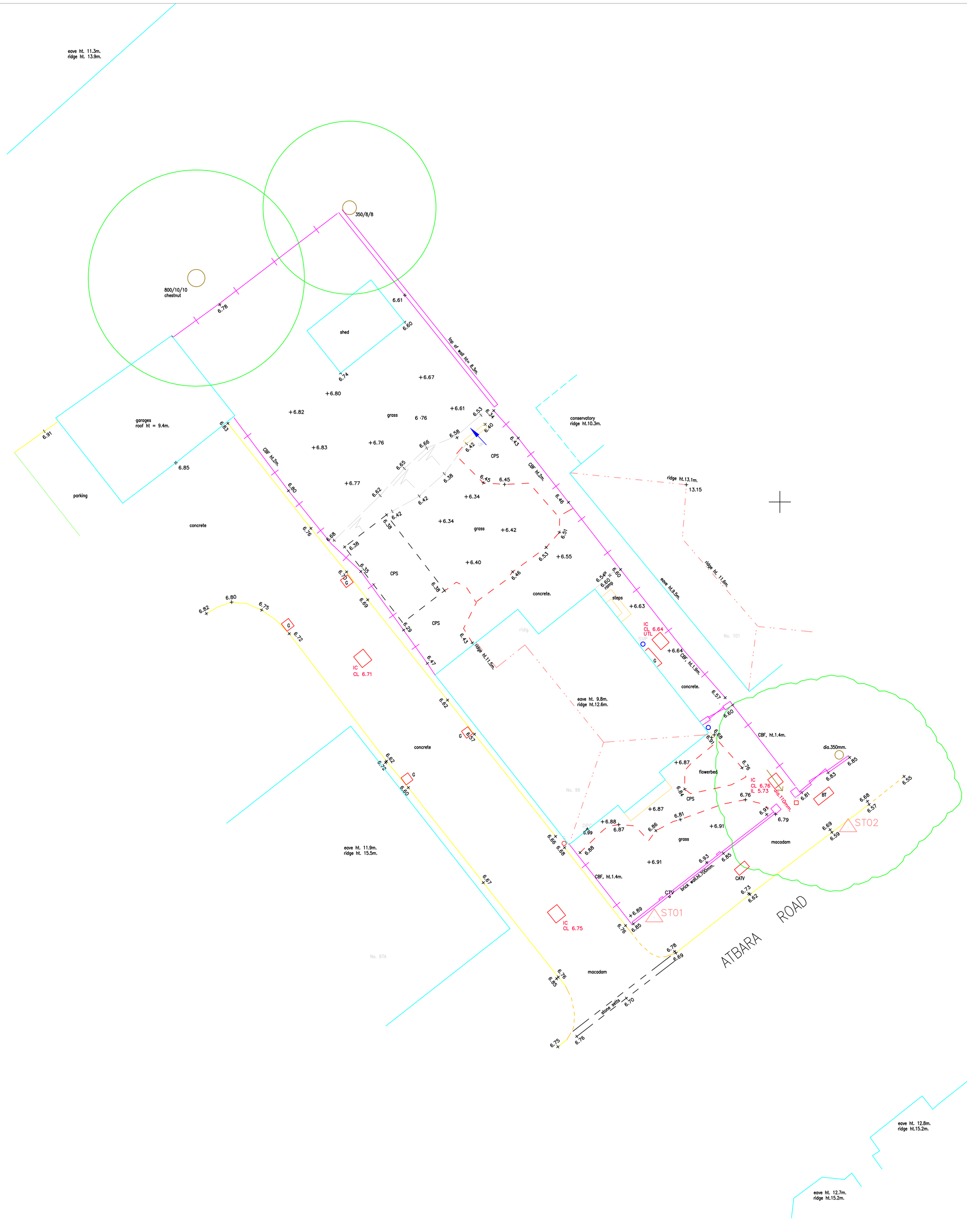
10.2.1 LIDAR Mapping showing Site Topography - (Source: LiDAR DTM 2022)





10.2.2 Topographic Survey

PDF to follow this page.



LEGEND

Kerb Drop kerb	AP	Anchor Point	LP Lamp Post
Overhead /canopy	AV	Air Valve	LPS Lamp Post Short
Building	BH	Borehole	MH Manhole
Surface Change	BL	Bollard	MK Service Marker Post
FENCES	BT	British Telecom cover	OBF Open Board Fence
Chain Link	BWF	Barbed Wire Fence	PM Parking Meter
Board	CATV	Cable Television Cover	PRF Post and Rail Fence
Wooden rail	CTV	Cable Television Point	PWF Post and Wire Fence
Wire	CBF	Close Board Fence	RE Rodding Eye
Security	CLF	Chainlink Fence	RS Road Sign
Iron Railing	CPS	Concrete paving slabs	SC Stop Cock
	CN	Column	SV Sluice Valve
	DP	Downpipe	TCB Telephone Call Box
	DPC	Damp Proof Course	TPAV Tactile Paving
	EC	Electricity Cover	TKT Ticket Machine
	EP	Electricity Pole	TP Telephone Pole
	FFL	Finished Floor Level	TS Traffic Signal
	FH	Fire Hydrant	UL Soffit/upper level
	FP	Fence Post	UTL Unable to lift
	GP	Gate Post	VP Vent Pipe
	G	Gully	WO Wash Out
	KO	Kerb Outlet	WM Water Meter
	LB	Letter Box	WMF Wire Mesh Fence

NOTE. The Survey has been oriented to the O.S. National Grid (OSGB36) via a Global Position System and the O.S. Active Network (OS Net) OSGB36.
True OSGB36 coordinates have been established at a point near the site centre and a further OSBG36 point established to create a true O.S. bearing for angle orientation.All levels are based on O.S.Datum.
No scale factor has been applied to the survey and thus the Coordinate System is Arbitrary and not a true O.S. Coordinate System which would require scale factors to be applied to all distances.
The Survey Station Table should be used to establish any on-site coordinates.

NOTE.
1. This is a topographic survey and as such the physical features shown are not necessarily legal boundaries.
2. Drainage information is by surface inspection only and cannot be guaranteed.
3. This survey has been carried out at an accuracy commensurate with the scale shown on the title block of this drawing. Enlarging the drawing by digital means will not increase the accuracy of the survey.

Tree Information
400/7/8 bole dia.(mm)/spread(m)/height(m)
Tree species should be checked by an expert if identification is critical.
Trees show average spread unless otherwise shown.
Tree heights are by visual estimation and are not measured

SURVEY STATIONS

Station	Easting	Northing	Level	Type
ST01	517094.19	170930.78	6.85	Nail
ST02	517103.16	170934.95	6.61	Nail

Revision	Suff	App	Date
Trees removed	A	ot	May 2024

AT LAND SURVEYS
PRECISION AND RELIABILITY
AT LAND SURVEYS
86,Hightown Gardens,
Ringwood,Hampshire
BH24 3EJ
Office +44 (0) 1425 479480
Mob +44 (0) 7901 686777
Email alan@atlandsurveys.com
Web www.atlandsurveys.com

Project
99, ATBARA ROAD
TEDDINGTON
TW11 9PA

Drawing Title
SITE SURVEY

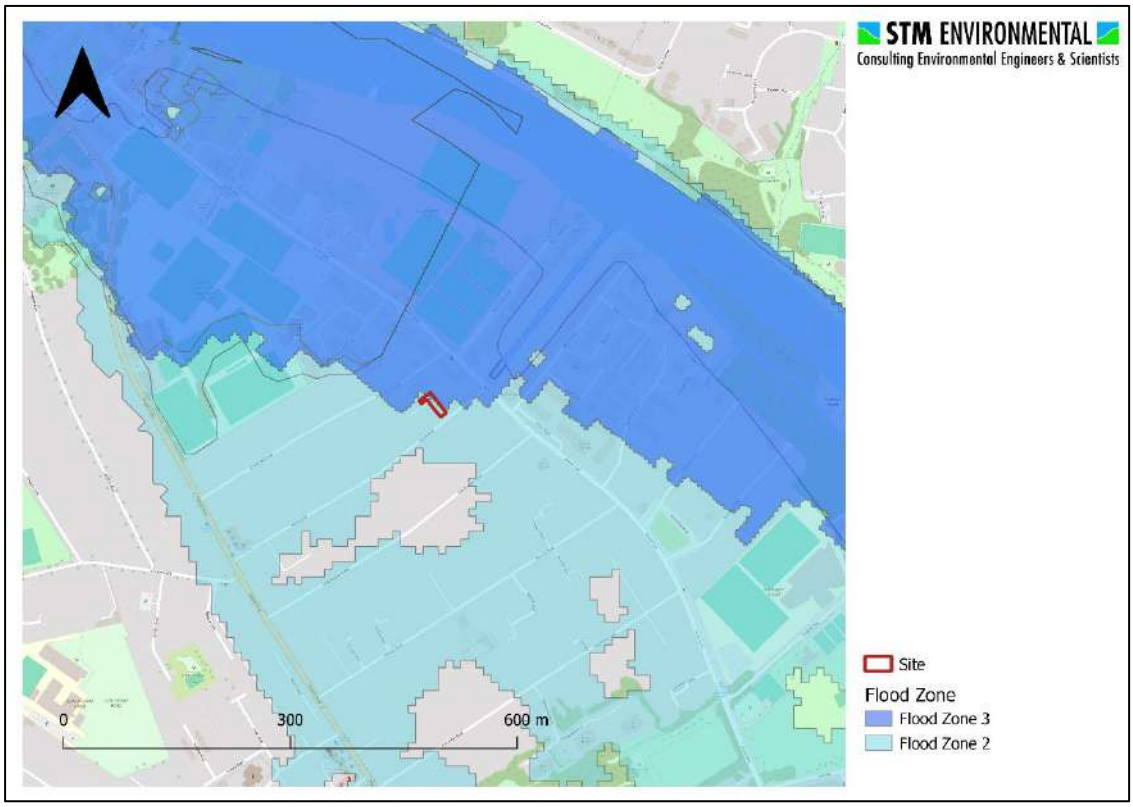
Drawn	Date	Checked	Date
AT	MAY 2023	AT	MAY 2023

Scale
1:100 (AT A1 SIZE)

Drawing Number
2320-S20

Rev
A

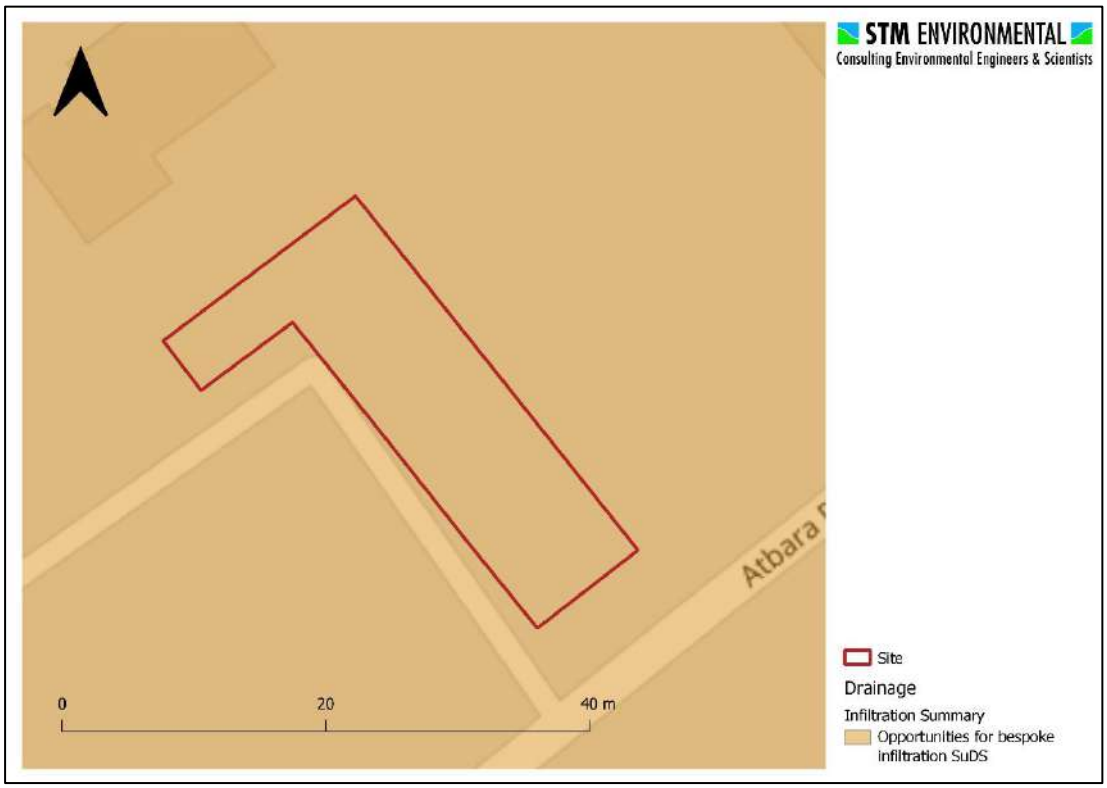
10.2.3 Hydrology Map



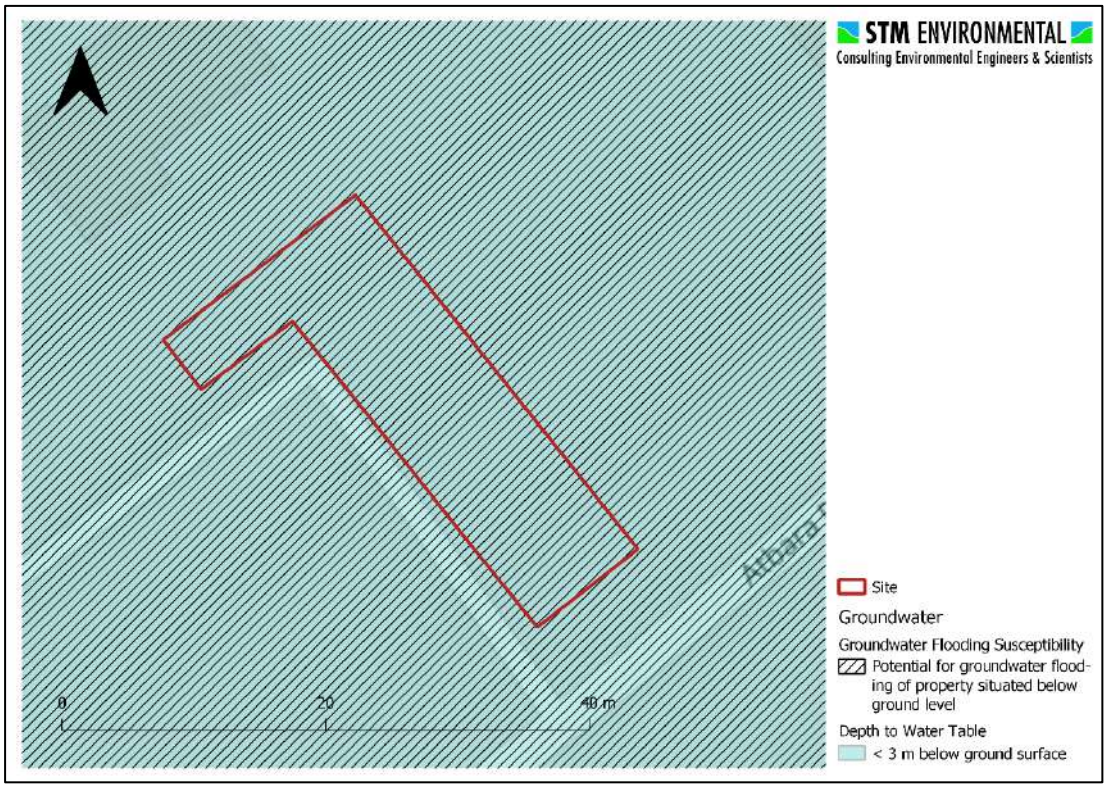
10.2.4 Bedrock Geology, Hydrogeology & Permeability (Source: BGS, 2016)

10.2.5 Superficial Deposits, Hydrogeology, & Permeability (Source: BGS, 2016)

10.2.6 Infiltration Drainage Potential (Source: BGS, 2016)



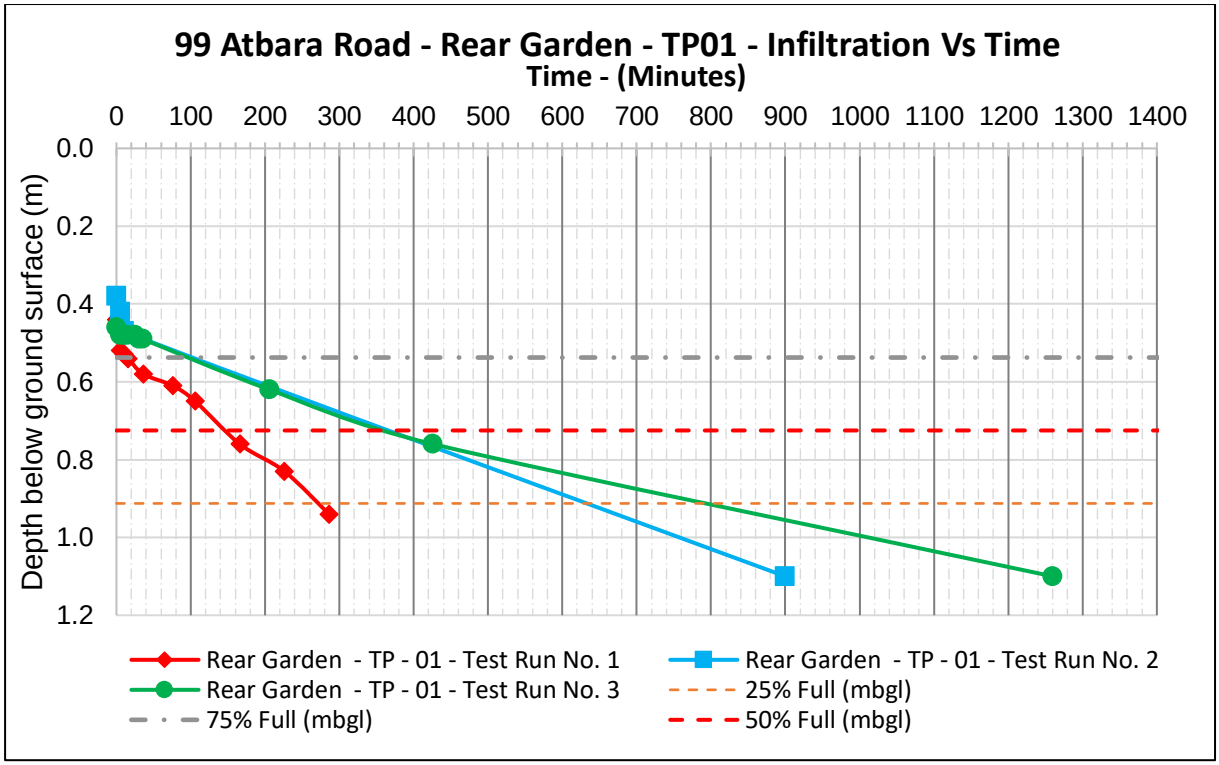
10.2.7 Groundwater Susceptibility and Table Depth (Source: BGS 2016)



10.2.8 Site Investigation Photos

PDF to follow this page.

10.2.9 Infiltration Testing Graph



10.2.10 Infiltration Data and Results

Rear Garden - TP - 01 - Test Run No. 1

insert time according to the measured units

Dip Readng	Water Level Above Base	Depth (mbgl)	Time (hours)	Time (minutes)	Time (s)	Time	25% Full (mbgl)	50% Full (mbgl)	75% Full (mbgl)
	0.66	0.4	0.00	0	0	0:00 11:44:00	0.9125	0.73	0.5375
	0.58	0.5	0.08	5	300.00	0:05 11:49:00	0.9125	0.73	0.5375
	0.57	0.5	0.17	10	600.00	0:10 11:54:00	0.9125	0.73	0.5375
	0.56	0.5	0.27	16	960.00	0:16 12:00:00	0.9125	0.73	0.5375
	0.52	0.6	0.60	36	2160.00	0:36 12:20:00	0.9125	0.73	0.5375
	0.49	0.6	1.27	76	4560.00	1:16 13:00:00	0.9125	0.73	0.5375
	0.45	0.7	1.77	106	6360.00	1:46 13:30:00	0.9125	0.73	0.5375
	0.34	0.8	2.77	166	9960.00	2:46 14:30:00	0.9125	0.73	0.5375
	0.27	0.8	3.77	226	13560.00	3:46 15:30:00	0.9125	0.73	0.5375
	0.16	0.9	4.77	286	17160.00	4:46 16:30:00	0.9125	0.73	0.5375
				496	8:16	20:00:00	0.9125	0.73	0.5375
				1560	02:00	20:00:00	0.9125	0.73	0.5375
			Reached 25% within 24 hours. Second run undertaken.						

Rear Garden - TP - 01 - Test Run No. 2

insert time according to the measured units

Dip Readng	Water Level Above Base	Depth (mbgl)	Time (hours)	Time (minutes)	Time (s)	Time	25% Full (mbgl)	50% Full (mbgl)	75% Full (mbgl)
	0.72	0.4	0.00	0	0	0:00 16:40:00	0.9125	0.73	0.5375
	0.68	0.4	0.08	5	300.00	0:05 16:45:00	0.9125	0.73	0.5375
	0.63	0.5	0.17	10	600.00	0:10 16:50:00	0.9125	0.73	0.5375
	0	1.1	15.00	900	54000.00	15:00			
			Reached 25% within 24 hours. Second run undertaken.						

Rear Garden - TP - 01 - Test Run No. 3

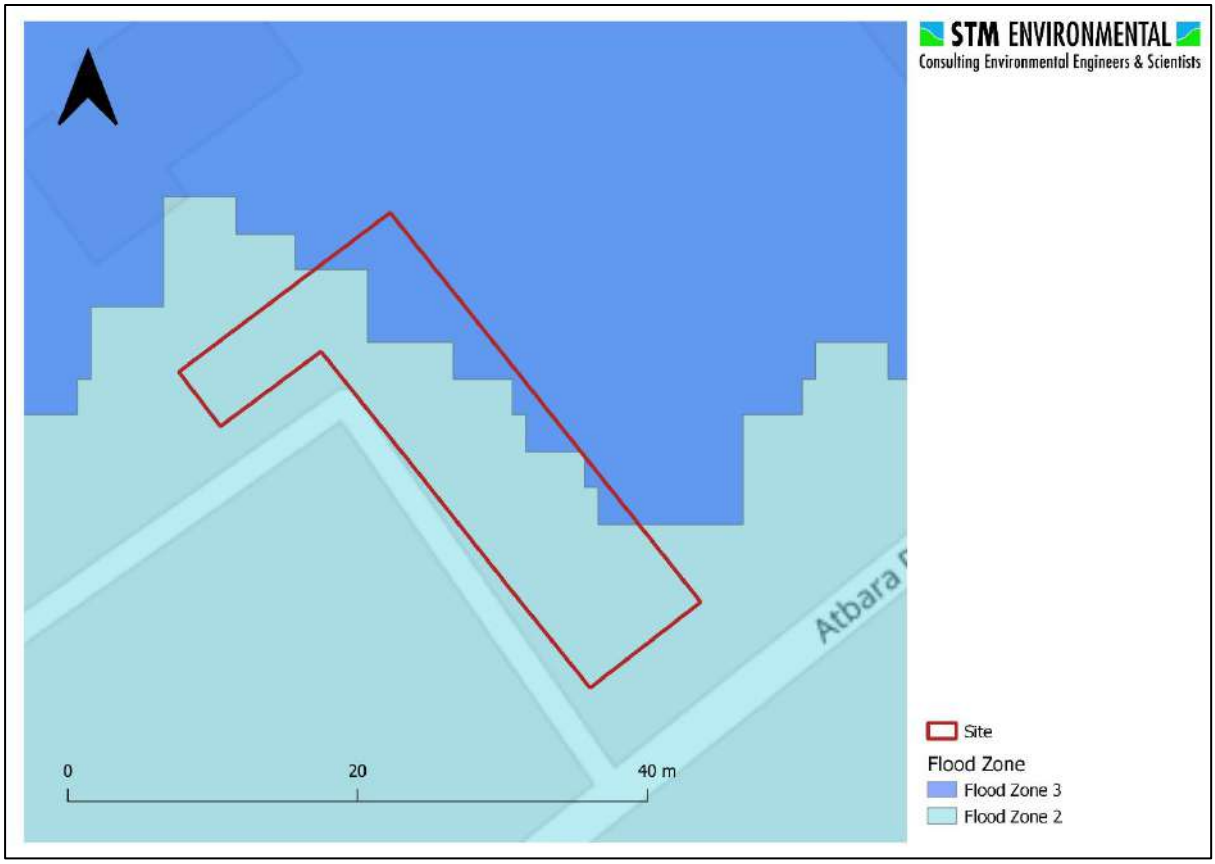
insert time according to the measured units

Dip Readng	Water Level Above Base	Depth (mbgl)	Time (hours)	Time (minutes)	Time (s)	Time	25% Full (mbgl)	50% Full (mbgl)	75% Full (mbgl)
	0.64	0.5	0.00	0	0	0:00 08:54:00	0.9125	0.73	0.5375
	0.62	0.5	0.08	5	300.00	0:05 08:59:00	0.9125	0.73	0.5375
	0.62	0.5	0.17	10	600.00	0:10 09:04:00	0.9125	0.73	0.5375
	0.62	0.5	0.25	15	900.00	0:15 09:09:00	0.9125	0.73	0.5375
	0.62	0.5	0.42	25	1500.00	0:25 09:19:00	0.9125	0.73	0.5375
	0.61	0.5	0.50	30	1800.00	0:30 09:24:00	0.9125	0.73	0.5375
	0.61	0.5	0.58	35	2100.00	0:35 09:29:00	0.9125	0.73	0.5375
	0.48	0.6	3.43	206	12360.00	3:26 12:20:00	0.9125	0.73	0.5375
	0.34	0.8	7.10	426	25560.00	7:06 16:00:00	0.9125	0.73	0.5375
	0	1.1	21.00	1260	75600.00	21:00			

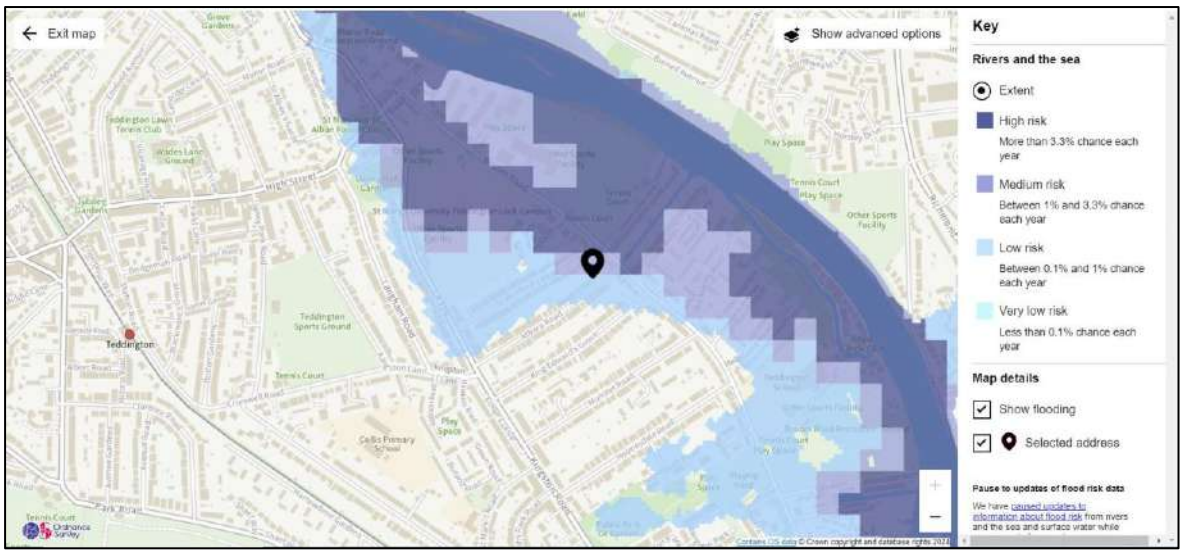
10.2.11 Soakaway Test Location Map

10.3 Appendix 3 – Flood Risk Mapping

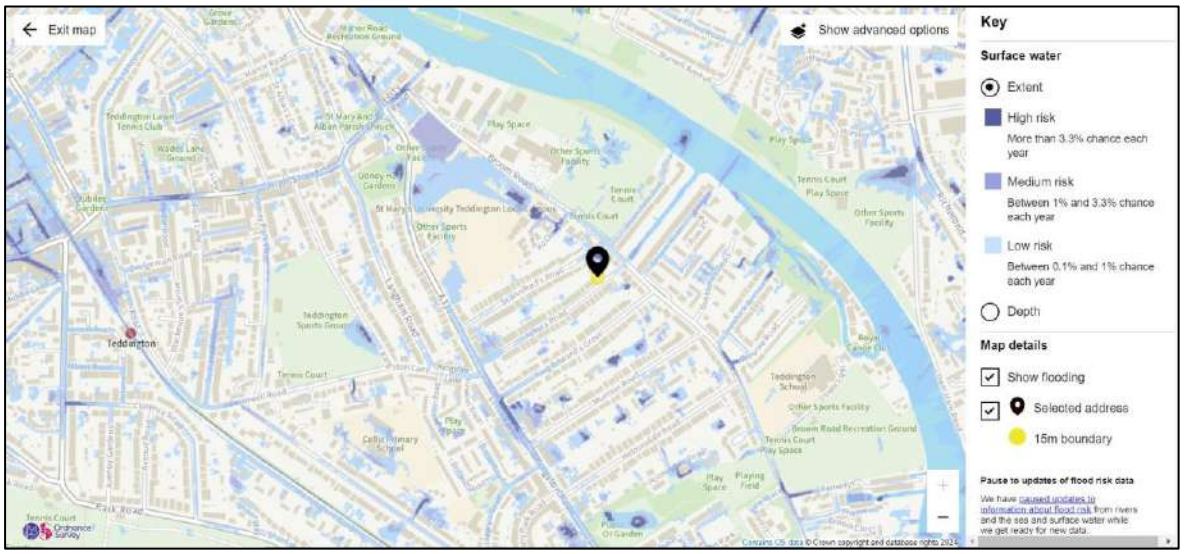
10.3.1 Flood Map For Planning (EA)



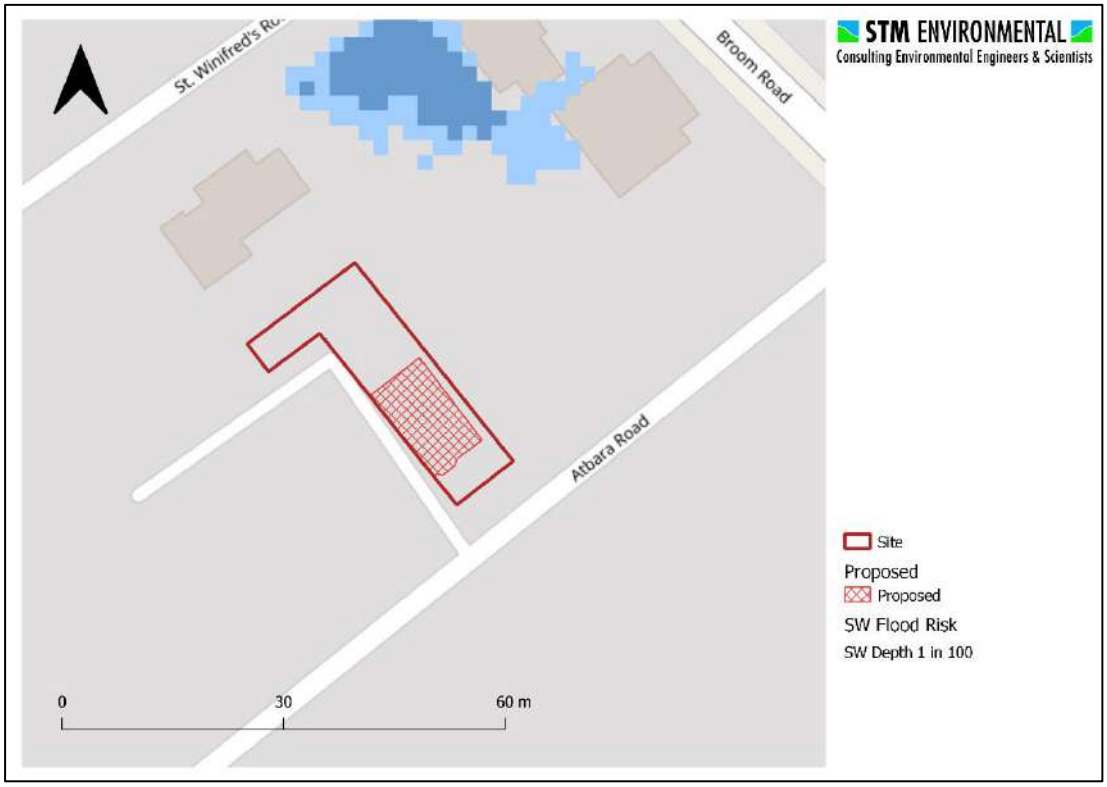
10.3.2 Long Term Fluvial Flood Risk Map (EA)

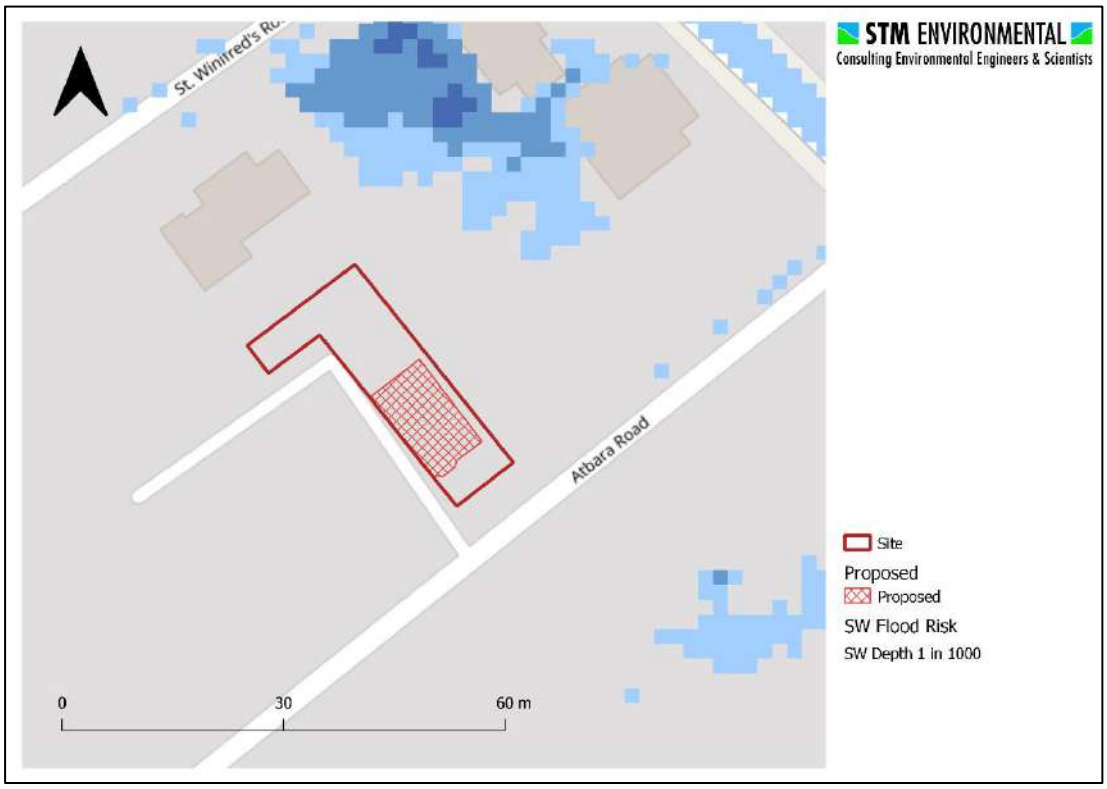


10.3.3 Long Term Pluvial Flood Risk Map (EA)

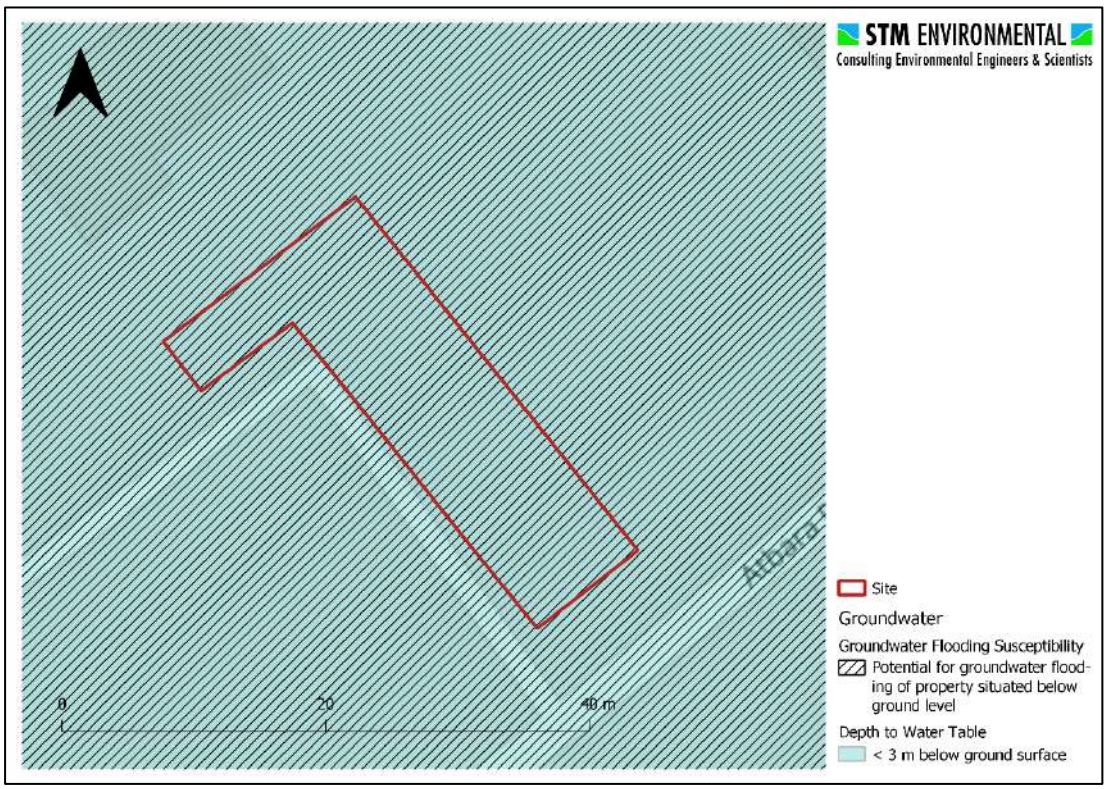


10.3.4 Surface water flood depth during the 1 in 100 and 1 in 1000 year rainfall return periods (Source: EA, 2016).





10.3.5 Groundwater flooding susceptibility (Source: BGS, 2016).



10.4 Appendix 4 – Runoff Rate and Storage Calculations

10.4.1 UK SuDS

PDF to follow this page.

Greenfield runoff rate estimation for sites

www.uksuds.com | Greenfield runoff tool

Calculated by:	Yonas Makoni
Site name:	TW11 9PA
Site location:	TW11 9PA

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:	51.42536° N
Longitude:	0.31715° W
Reference:	2775768639
Date:	Jul 24 2024 15:44

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):	600	600
Hydrological region:	6	6
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):	0.15	0.15
1 in 1 year (l/s):	0.13	0.13
1 in 30 years (l/s):	0.35	0.35
1 in 100 year (l/s):	0.49	0.49
1 in 200 years (l/s):	0.57	0.57

Surface water storage requirements for sites

www.uksuds.com | Storage estimation tool

Calculated by:	Yonas Makoni
Site name:	TW11 9PA
Site location:	TW11 9PA

This is an estimation of the storage volume requirements that are needed 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). It is not to be used for detailed design of drainage systems. It is recommended that hydraulic modelling software is used to calculate volume requirements and design details before finalising the design of the drainage scheme.

Site Details

Latitude:	51.42536° N
Longitude:	0.31712° W
Reference:	3638428206
Date:	Jul 24 2024 15:48

Site characteristics

Total site area (ha):	0.0374
Significant public open space (ha):	0.0091
Area positively drained (ha):	0.028300000000000002
Impermeable area (ha):	0.0283
Percentage of drained area that is impermeable (%):	100
Impervious area drained via infiltration (ha):	0
Return period for infiltration system design (year):	10
Impervious area drained to rainwater harvesting (ha):	0
Return period for rainwater harvesting system (year):	10
Compliance factor for rainwater harvesting system (%):	66
Net site area for storage volume design (ha):	0.03
Net impermable area for storage volume design (ha):	0.03
Pervious area contribution to runoff (%):	30

* where rainwater harvesting or infiltration has been used for managing surface water runoff such that the effective impermeable area is less than 50% of the 'area positively drained', the 'net site area' and the estimates of Q_{BAR} and other flow rates will have been reduced accordingly.

Methodology

esti	IH124
Q_{BAR} estimation method:	Calculate from SPR and SAAR
SPR estimation method:	Calculate from SOIL type

Soil characteristics

	Default	Edited
SOIL type:	2	2
SPR:	0.3	0.3

Hydrological characteristics

	Default	Edited
Rainfall 100 yrs 6 hrs:	--	63
Rainfall 100 yrs 12 hrs:	--	97.79
FEH / FSR conversion factor:	1.27	1.27
SAAR (mm):	600	600
M5-60 Rainfall Depth (mm):	20	20
'r' Ratio M5-60/M5-2 day:	0.4	0.4
Hydological region:	6	6
Growth curve factor 1 year:	0.85	0.85
Growth curve factor 10 year:	1.62	1.62
Growth curve factor 30 year:	2.3	2.3

Design criteria

Climate change allowance factor:	1.4	Growth curve factor 100 years:	3.19	3.19
Urban creep allowance factor:	1.1	Q_{BAR} for total site area (l/s):	0.06	0.06
Volume control approach	Use long term storage	Q_{BAR} for net site area (l/s):	0.04	0.04
Interception rainfall depth (mm):	5			
Minimum flow rate (l/s):	2			

Site discharge rates

	Default	Edited
1 in 1 year (l/s):	2	2
1 in 30 years (l/s):	2	2
1 in 100 year (l/s):	2	2

Estimated storage volumes

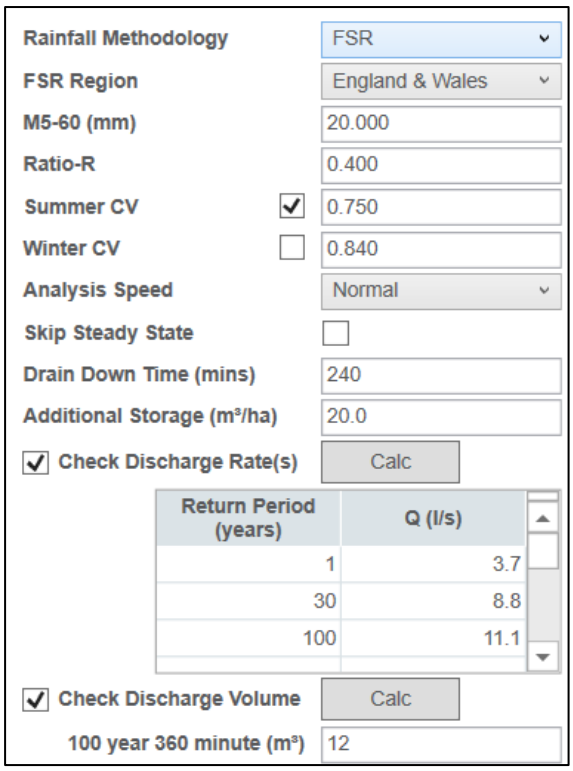
	Default	Edited
Attenuation storage 1/100 years (m^3):	7	7
Long term storage 1/100 years (m^3):	0	0
Total storage 1/100 years (m^3):	7	7

10.4.2 IH24 Method

Item	Value		Greenfield Run-off Rate -1 in 100 + CC (l/s)	0.2691	
Climate Change Allowance Factor	1.40		Total Post Development Run-off Rate - 1 in 100 + CC (l/s)	0.7656	
SAAR(mm) - Current	600.00		Difference between Greenfield and Post Development Run Off Rates - 1 in 100 + CC (l/s)	0.4965	
SAAR (mm) + CC	840.00		Volume of Storage Required to meet Greenfield Discharge - Difference between Post Development and Greenfield 1 in 100 + CC volumes (m3)	10.7248	
SPR (Greenfield)	0.30		Difference between 3 * Greenfield and Post Development 1 in 100 + CC Run Off Rates	-0.0417	
SPR (Impermeable)	0.53		Volume of Storage Required to meet 3 * Greenfield Discharge - Difference between Proposed Development and 3 * Greenfield 1 in 100 +CC (m3)	-0.9015	
Site Area (ha)	0.0374				
Impermable Area (Pre Development - ha)	0.02520				
Permeanble Area (Pre Development - ha))	0.0122000		Greenfield (l/s)	Pre - Development (l/s)	Post Development (l/s)
Impermable Area (Post Development - ha)	0.0283000	Qbar	0.06	0.15	0.16
Permeanble Area (Post Development - ha)	0.0091000	1 in 1	0.05	0.13	0.14
GCF (1 in 1)	0.85	1 in 30	0.13	0.35	0.37
GCF (1 in 30)	2.30	1 in 100	0.18	0.48	0.52
GCF (1 in 100)	3.19	1 in 100 + CC	0.27	0.71	0.77
Hyrdological Region	6				
Soil Type	2				
Rainfall 100 Yrs 6 hours mm	63				

GREENFIELD RUN-OFF	QBAR50	Run-Off Rate l/s	l/s/ha (QBarA)	3 times greenfield (l/s)	Volume (6 hr) - Standard (m3)
Qbar	76.0847	**0.0569**	1.5217		
1 in 1		**0.0484**	1.2934	0.1451	1.0449
1 in 30		**0.1309**	3.4999	0.3927	2.8274
1 in 100		**0.1815**	4.8542	0.5446	3.9214
GREENFIELD RUN-OFF + CC					
Qbar Impermeable	112.7891	0.0844	2.2558	0.2531	1.8223
1 in 1 +CC		0.0717	1.9174	0.2151	1.5490
1 in 30 + CC		0.1940	5.1883	0.5821	4.1913
1 in 100 + CC		**0.2691**	**7.1959**	**0.8074**	**5.8132**
PRE -DEVELOPMENT RUN-OFF (i.e. same rainfall)		**Impermeable Surface Run-Off (l/s**	**l/s/ha (QBarA)**		**Volume (6 hr)**
Impermeable Surface Calculation					
Qbar Impermeable	261.5909	0.1318	5.2318	0.3955	2.8478
1 in 1		0.1121	4.4470	0.3362	2.4206
1 in 30		0.3032	12.0332	0.9097	6.5499
1 in 100		0.4206	16.6895	**1.2617**	**9.0844**
Permeable Surface Calculation		**Permeable Surface Run-off (l/s)**			
Qbar Permeable	76.0847	0.0186	2.0401	0.0557	
1 in 1		0.0158	1.7341	0.0473	0.3408
1 in 30		0.0427	4.6922	0.1281	0.9223
1 in 100		0.0592	6.5078	**0.1777**	**1.2792**
Impermeable Surface Calculation + Permeable Surface Calculation					
Qbar	337.6756	0.1504	7.2719	0.4512	2.8478
1 in 1		0.1278	6.1811	0.3835	2.7615
1 in 30		0.3459	16.7253	1.0378	7.4722
1 in 100		0.4798	23.1973	1.4394	10.3636
PRE DEVELOPMENT RUN-OFF + CC (increased rainfall)		**Impermeable Surface Run-Off (l/s)**			
Impermeable Surface Calculation					
Qbar Impermeable	387.7863	0.1954	6.9062		4.2216
1 in 1 +CC		0.1661	5.8702		3.5884
1 in 30 + CC		0.4495	15.8842		9.7097
1 in 100 + CC		**0.6235**	22.0306		**13.4669**
Permeable Surface Calculation		**Permeable Surface Run-off (l/s)**			
Qbar Permeable	112.7891	0.0275	3.0242	0.0826	
1 in 1 +CC		0.0234	2.5706	0.0702	0.5053
1 in 30 + CC		0.0633	6.9557	0.1899	1.3672
1 in 100 + CC		**0.0878**	9.6473	**0.2634**	**1.8963**
Impermeable Surface Calculation + Permeable Surface Calculation					
Qbar	**500.5754**	**0.2230**	**9.9304**	**0.0826**	**4.2216**
1 in 1 +CC		**0.1895**	**8.4408**	**0.0702**	**4.0936**
1 in 30 + CC		**0.5128**	**22.8399**	**0.1899**	**11.0769**
1 in 100 + CC		**0.7113**	**31.6780**	**0.2634**	**15.3632**
POST DEVELOPMENT RUN-OFF (i.e. same rainfall)		**Impermeable Surface Run-Off (l/s**	**l/s/ha (QBarA)**		**Volume (6 hr)**
Impermeable Surface Calculation					
Qbar Impermeable	261.5909	0.1481	5.2318	0.4442	
1 in 1		0.1259	4.4470	0.3776	2.7184
1 in 30		0.3405	12.0332	1.0216	7.3556
1 in 100		0.4723	16.6895	**1.4169**	**10.2020**
Permeable Surface Calculation		**Permeable Surface Run-off (l/s)**			
Qbar Permeable	76.0847	0.0138	1.5217	0.0415	
1 in 1		0.0118	1.2934	0.0353	0.2542
1 in 30		0.0318	3.4999	0.0955	0.6879
1 in 100		0.0442	4.8542	**0.1325**	**0.9541**
		Impermeable Surface Calculation + Permeable Surface Calculation			
Qbar Permeable	**337.6756**	**0.1619**	**6.7535**	**0.4857**	
1 in 1	**0.0000**	**0.1376**	**5.7405**	**0.4129**	**2.9726**
1 in 30	**0.0000**	**0.3724**	**15.5331**	**1.1172**	**8.0436**
1 in 100	**0.0000**	**0.5165**	**21.5437**	**1.5495**	**11.1561**
POST DEVELOPMENT RUN-OFF + CC (increased rainfall)		**Impermeable Surface Run-Off (l/s)**			
Impermeable Surface Calculation					
Qbar Impermeable	387.7863	0.2195	7.7557		4.7409
1 in 1 +CC		0.1866	6.5924		4.0298
1 in 30 + CC		0.5048	17.8382		10.9041
1 in 100 + CC		**0.7002**	24.7408		**15.1235**
Permeable Surface Calculation		**Permeable Surface Run-off (l/s)**			
Qbar Permeable	112.7891	0.0205	2.2558	0.0616	
1 in 1 +CC		0.0174	1.9174	0.0523	0.3769
1 in 30 + CC		0.0472	5.1883	0.1416	1.0198
1 in 100 + CC		**0.0655**	7.1959	**0.1964**	**1.4144**
Impermeable Surface Calculation + Permeable Surface Calculation					
Qbar	**500.5754**	**0.2400**	**10.0115**	**0.0616**	**4.7409**
1 in 1 +CC		**0.2040**	**8.5098**	**0.0523**	**4.4067**
1 in 30 + CC		**0.5520**	**23.0265**	**0.1416**	**11.9239**
1 in 100 + CC		**0.7656**	**31.9367**	**0.1964**	**16.5380**

10.4.3 MRM – Pre - Development

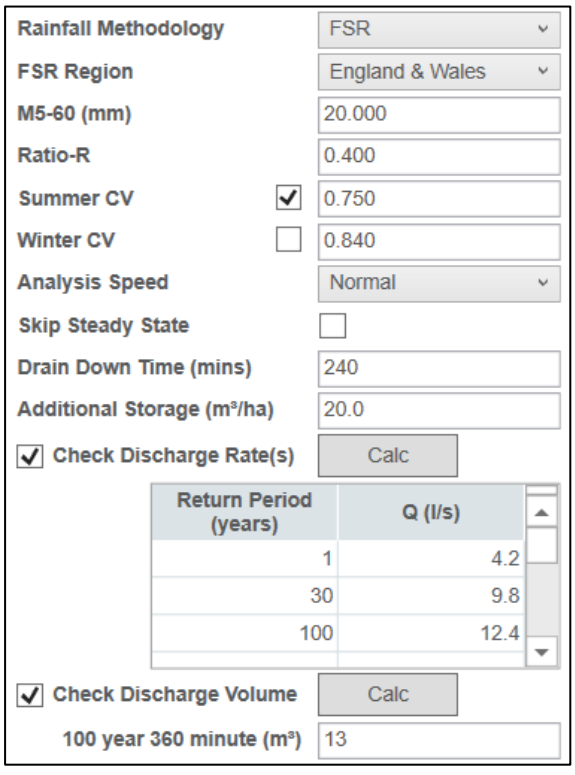


Rainfall Methodology	FSR
FSR Region	England & Wales
M5-60 (mm)	20.000
Ratio-R	0.400
Summer CV	0.750
Winter CV	0.840
Analysis Speed	Normal
Skip Steady State	
Drain Down Time (mins)	240
Additional Storage (m³/ha)	20.0
Check Discharge Rate(s)	Calc

Return Period (years)	Q (l/s)
1	3.7
30	8.8
100	11.1

Check Discharge Volume	Calc
100 year 360 minute (m³)	12

10.4.4 MRM – Post - Development

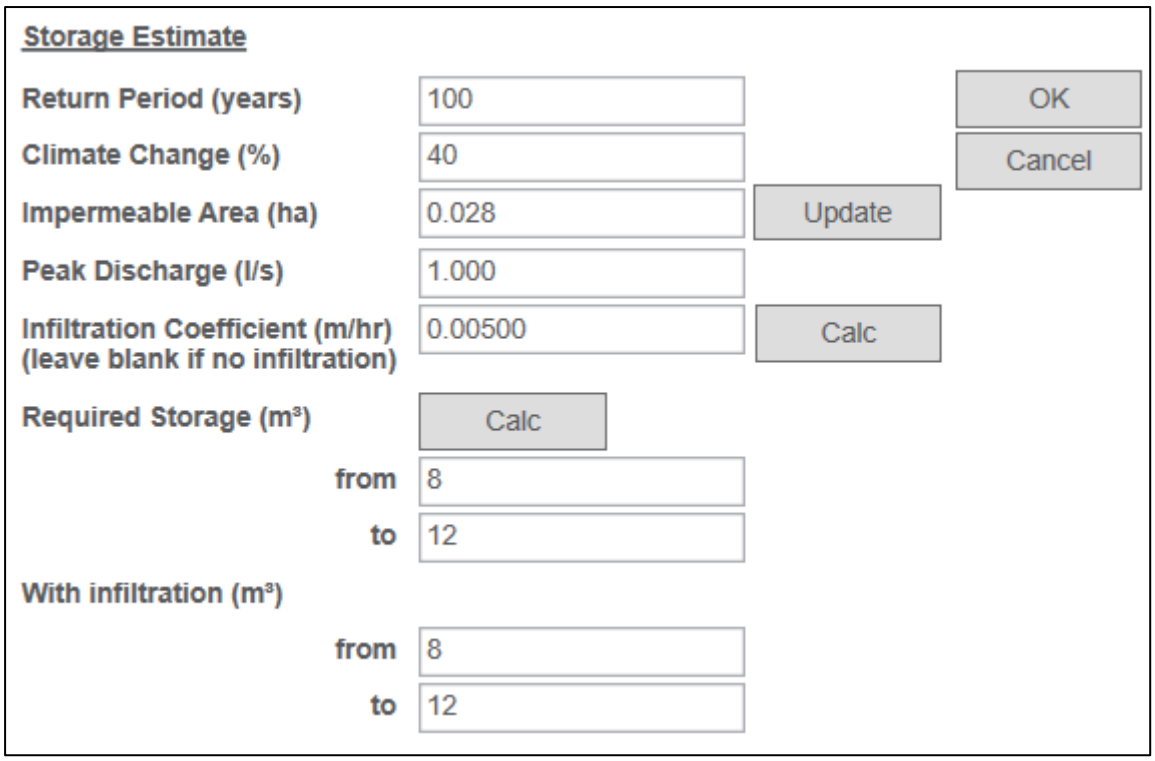


Rainfall Methodology	FSR
FSR Region	England & Wales
M5-60 (mm)	20.000
Ratio-R	0.400
Summer CV	0.750
Winter CV	0.840
Analysis Speed	Normal
Skip Steady State	
Drain Down Time (mins)	240
Additional Storage (m³/ha)	20.0
Check Discharge Rate(s)	Calc

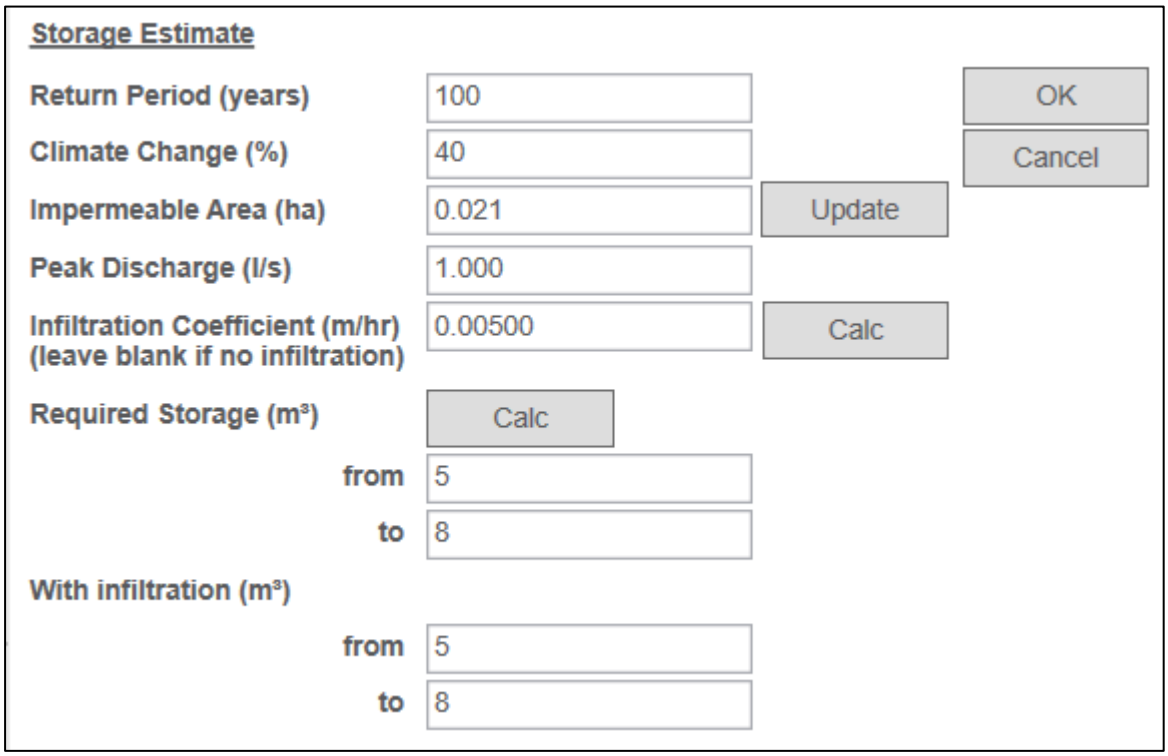
Return Period (years)	Q (l/s)
1	4.2
30	9.8
100	12.4

Check Discharge Volume	Calc
100 year 360 minute (m³)	13

10.4.5 Causeway Flow Calculations – With Permeable Paving



10.4.6 Causeway Flow Storage Calculations – Without Permeable Paving

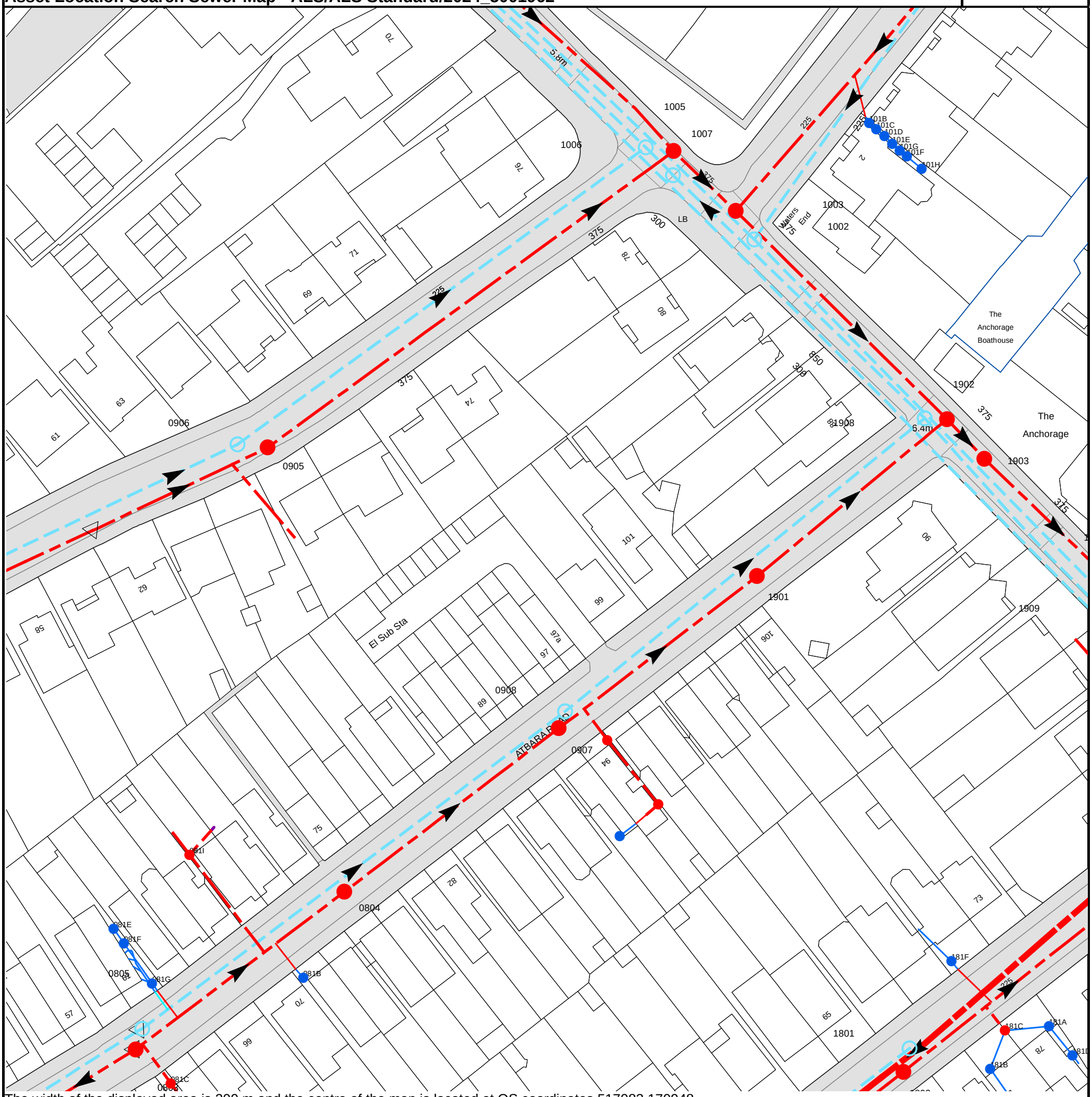


10.5 Appendix 5 – Drainage

10.5.1 Drainage Asset Search

PDF to follow this page.

Asset Location Search Sewer Map - ALS/ALS Standard/2024_5001962



The width of the displayed area is 200 m and the centre of the map is located at OS coordinates 517083,170948

The position of the apparatus shown on this plan is given without obligation and warranty, and the accuracy cannot be guaranteed. Service pipes are not shown but their presence should be anticipated. No liability of any kind whatsoever is accepted by Thames Water for any error or omission. The actual position of mains and services must be verified and established on site before any works are undertaken.

NB. Levels quoted in metres Ordnance Newlyn Datum. The value -9999.00 indicates that no survey information is available

Manhole Reference	Manhole Cover Level	Manhole Invert Level
1006	n/a	n/a
1007	n/a	n/a
1005	n/a	n/a
1003	n/a	n/a
1002	n/a	n/a
1901	n/a	n/a
101B	n/a	n/a
101C	n/a	n/a
101D	n/a	n/a
101E	n/a	n/a
101G	n/a	n/a
101F	n/a	n/a
101H	n/a	n/a
1908	n/a	n/a
1902	n/a	n/a
1903	n/a	n/a
191A	n/a	n/a
081E	n/a	n/a
081F	n/a	n/a
0803	n/a	n/a
0805	n/a	n/a
081G	n/a	n/a
081I	n/a	n/a
0906	n/a	n/a
0905	n/a	n/a
081B	n/a	n/a
0804	n/a	n/a
0907	n/a	n/a
0908	n/a	n/a
09ZX	n/a	n/a
08ZT	n/a	n/a
18ZY	n/a	n/a
1803	n/a	n/a
1801	n/a	n/a
181F	n/a	n/a
181B	n/a	n/a
181C	n/a	n/a
181A	n/a	n/a
181D	n/a	n/a
081C	n/a	n/a

The position of the apparatus shown on this plan is given without obligation and warranty, and the accuracy cannot be guaranteed. Service pipes are not shown but their presence should be anticipated. No liability of any kind whatsoever is accepted by Thames Water for any error or omission. The actual position of mains and services must be verified and established on site before any works are undertaken.

Asset Location Search - Sewer Key

Public Sewer Types (Operated and maintained by Thames Water)

Foul Sewer: A sewer designed to convey waste water from domestic and industrial sources to a treatment works.

Surface Water Sewer: A sewer designed to convey surface water (e.g. rain water from roofs, yards and car parks) to rivers or watercourses.

Combined Sewer: A sewer designed to convey both waste water and surface water from domestic and industrial sources to a treatment works.

- Storm Sewer
- Sludge Sewer
- Foul Trunk Sewer
- Surface Trunk Sewer
- Combined Trunk Sewer
- Foul Rising Main
- Surface Water Rising Main
- Combined Rising Main
- Vacuum
- Thames Water Proposed
- Vent Pipe
- Gallery

Other Sewer Types (Not operated and maintained by Thames Water)

- Sewer
- Culverted Watercourse
- Proposed
- Decommissioned Sewer
- Content of this drainage network is currently unknown
- Ownership of this drainage network is currently unknown

Sewer Fittings

A feature in a sewer that does not affect the flow in the pipe. Example: a vent is a fitting as the function of a vent is to release excess gas.

- Air Valve
- Meter
- Dam Chase
- Vent
- Fitting

Operational Controls

A feature in a sewer that changes or diverts the flow in the sewer. Example: A hydrobrake limits the flow passing downstream.

- Ancillary
- Drop Pipe
- Control Valve
- Weir

End Items

End symbols appear at the start or end of a sewer pipe. Examples: an Undefined End at the start of a sewer indicates that Thames Water has no knowledge of the position of the sewer upstream of that symbol. Outfall on a surface water sewer indicates that the pipe discharges into a stream or river.

- Inlet
- Outfall
- Undefined End

Other Symbols

Symbols used on maps which do not fall under other general categories.

- Change of Characteristic Indicator
- Public / Private Pumping Station
- Invert Level
- Summit

Areas

Lines denoting areas of underground surveys, etc.

- Agreement
- Chamber
- Operational Site

Ducts or Crossings

- Casement — Ducts may contain high voltage cables. Please check with Thames Water.
- Conduit Bridge
- Subway
- Tunnel

Notes:

1) All levels associated with the plans are to Ordnance Datum Newlyn.
2) All measurements on the plan are metric.
3) Arrows (on gravity fed sewers) or flecks (on rising mains) indicate the direction of flow.
4) Most private pipes are not shown on our plans, as in the past, this information has not been recorded.
5) 'na' or '0' on a manhole indicates that data is unavailable.
6) The text appearing alongside a sewer line indicates the internal diameter of the pipe in millimeters. Text next to a manhole indicates the manhole reference number and should not be taken as a measurement.

If you are unsure about any text or symbology, please contact Property Searches on 0800 009 4540.

10.5.2 Thames Water Drainage Enquiry (2016)

PDF to follow this page.

Residential

The Law Society's CON29DW Drainage & Water Enquiry

Thames Water Property Searches

PALI
27
Woodstock Road
Croydon
CR0 8YD

Search address supplied	99, Atbara Road, Teddington, TW11 9PA
Your reference	5989
Our reference	DWS/DWS Standard/2016_3333104
Received date	20 May 2016
Search date	20 May 2016

Important information – changes effective from 9 May …

The content of the Law Society's CON29DW is being updated to reflect changes to legislation impacting the water industry. In summary, from 9th May the key changes to both the CON29DW and CommercialDW enquiries will be as follows:

1. Inclusion of details on private pumping stations (Q. 2.4.1 and 2.5.1)
2. Impact of sustainable drainage systems (SUDs) on newly adopted sewerage networks (Q. 2.2)
3. Removal of water quality information as this is not property specific; however this information will still be available on individual water companies' web sites (was Q. 3.5)
4. Provision of water hardness information (will become the new Q. 3.5)

For further information please visit www.thameswater-propertysearches.co.uk

Thames Water Utilities Ltd
Property Searches, PO Box 3189, Slough SL1 4WW
DX 151280 Slough 13

searches@thameswater.co.uk
www.thameswater-propertysearches.co.uk

0845 070 9148

CON29DW
DRAINAGE AND WATER ENQUIRY

SearchCode™

Residential

CON29DW Drainage & Water Enquiry

Thames Water Property Searches

	Question	Summary Answer
Maps		
1.1	Where relevant, please include a copy of an extract from the public sewer map.	Map Provided
1.2	Where relevant, please include a copy of an extract from the map of waterworks.	Map Provided
Drainage		
2.1	Does foul water from the property drain to a public sewer?	Connected
2.2	Does surface water from the property drain to a public sewer?	Connected
2.3	Is a surface water drainage charge payable?	Charge Payable
2.4	Does the public sewer map indicate any public sewer, disposal main or lateral drain within the boundaries of the property?	No
2.4.1	Does the public sewer map indicate any public pumping station or any other ancillary apparatus within the boundaries of the property?	No
2.5	Does the public sewer map indicate any public sewer within 30.48 metres (100 feet) of any buildings within the property?	Yes
2.5.1	Does the public sewer map indicate any public pumping station or any other ancillary apparatus within the 50metres of any buildings within the property?	No
2.6	Are any sewers or lateral drains serving, or which are proposed to serve the property, the subject of an existing adoption agreement or an application for such an agreement?	No
2.7	Has a sewerage undertaker approved or been consulted about any plans to erect a building or extension on the property over or in the vicinity of a public sewer, disposal main or drain?	No
2.8	Is the building which is or forms part of the property, at risk of internal flooding due to overloaded public sewers?	Not At Risk
2.9	Please state the distance from the property to the nearest boundary of the nearest sewage treatment works.	3.54 Kilometres
Water		
3.1	Is the property connected to mains water supply?	Connected
3.2	Are there any water mains, resource mains or discharge pipes within the boundaries of the property?	No
3.3	Is any water main or service pipe serving or which is proposed to serve the property, the subject of an existing adoption agreement or an application for such an agreement?	No
3.4	Is the property at risk of receiving low water pressure or flow?	No
3.5	What is the classification of the water supply for the property?	Hard
3.6	Please include details of the location of any water meter serving the property.	No Meter
Charging		
4.1.1	Who are the sewerage undertakers for the area?	Thames Water
4.1.2	Who are the water undertakers for the area?	Thames Water
4.2	Who bills the property for sewerage services?	Thames Water
4.3	Who bills the property for water services?	Thames Water
4.4	What is the current basis for charging for sewerage and/or water services at the property?	See Details
4.5	Will the basis for charging for sewerage and water services at the property change as a consequence of a change of occupation?	No

Residential

CON29DW Drainage & Water Enquiry

Thames Water Property Searches

Search address supplied: 99, Atbara Road, Teddington, TW11 9PA

Any new owner or occupier will need to contact Thames Water on 0800 316 9800 or log onto our website www.thameswater.co.uk and complete our online form to change the water and drainage services bills to their name.

The following records were searched in compiling this report: - the Map of Public Sewers, the Map of Waterworks, Water and Sewer billing records, Adoption of Public Sewer records, Building Over Public Sewer records, the Register of Properties subject to Internal Foul Flooding, the Register of Properties subject to Poor Water Pressure and the Drinking Water Register. Thames Water Utilities Ltd (TWUL), Clearwater Court, Vastern Road, Reading RG1 8DB, holds all of these.

TWUL, trading as Property Searches, are responsible in respect of the following:-

(i) any negligent or incorrect entry in the records searched;

(ii) any negligent or incorrect interpretation of the records searched;

(iii) and any negligent or incorrect recording of that interpretation in the search report

(iv) compensation payments

Please refer to the attached Terms & Conditions.

COPSO EXECUTIVE MEMBER

Thames Water Property Searches is an Executive member of CoPSO (Council of Property Search Organisations).

Residential

CON29DW Drainage & Water Enquiry

Thames Water Property Searches

Interpretation of CON29DW Drainage and Water Search

Appendix 1 contains definitions of terms and expressions used in this report.

For your guidance:

- Thames Water Property Searches Complaints Procedure:
  - Thames Water Property Searches offers a robust complaints procedure. Complaints can be made by telephone, in writing, by email (searches@thameswater.co.uk) or through our website (www.thameswater-propertysearches.co.uk)

As a minimum standard Thames Water Property Searches will:

- endeavour to resolve any contact or complaint at the time of receipt. If this isn't possible, we will advise of timescales;
- investigate and research the matter in detail to identify the issue raised (in some cases third party consultation will be required);
- provide a response to the customer within 10 working days of receipt of the complaint;
- provide compensation, if no response or acknowledgment that we are investigating the case is given within 10 working days of receipt of the complaint;
- keep you informed of the progress and, depending on the scale of investigation required, update with new timescales as necessary;
- provide an amended search, free of charge, if required;
- provide a refund if we find your complaint to be justified; take the necessary action within our power to put things right.

If you want us to liaise with a third party on your behalf, just let us know.

If you are still not satisfied with the outcome provided we will refer the matter to a Senior Manager for resolution who will respond again within 5 working days.

If you remain dissatisfied with our final response you may refer your complaint for consideration under The Property Ombudsman scheme (TPOs). Please refer to the final page of the search for further details.

Residential

CON29DW Drainage & Water Enquiry

Thames Water Property Searches

Maps

1.1 – Where relevant, please include a copy of an extract from the public sewer map.

A copy of an extract of the public sewer map is included, showing the public sewers, disposal mains and lateral drains in the vicinity of the property.

For your guidance:

- The Water Industry Act 1991 defines Public Sewers as those which Thames Water have responsibility for. Other assets and rivers, watercourses, ponds, culverts or highway drains may be shown for information purposes only.
- The company is not generally responsible for rivers, watercourses, ponds, culverts or highway drains. If any of these are shown on the copy extract they are shown for information only.
- Any private sewers or lateral drains which are indicated on the extract of the public sewer map as being subject to an agreement under Section 104 of the Water Industry Act 1991 are not an 'as constructed' record. It is recommended these details be checked with the developer.
- Assets other than public sewers may be shown on the copy extract, for information.

1.2 – Where relevant, please include a copy of an extract from the map of waterworks.

A copy of an extract of the map of waterworks is included, showing water mains, resource mains or discharge pipes in the vicinity of the property.

For your guidance:

- The "water mains" in this context are those, which are vested in and maintainable by the water company under statute.
- Assets other than public water mains may be shown on the plan, for information only.
- Water companies are not responsible for private supply pipes connecting the property to the public water main and do not hold details of these. These may pass through land outside of the control of the seller, or may be shared with adjacent properties. The buyer may wish to investigate whether separate rights or easements are needed for their inspection, repair or renewal.
- If an extract of the public water main record is enclosed, this will show known public water mains in the vicinity of the property. It should be possible to estimate the likely length and route of any private water supply pipe connecting the property to the public water network.

Residential

CON29DW Drainage & Water Enquiry

Thames Water Property Searches

Drainage

2.1 – Does foul water from the property drain to a public sewer?

Records indicate that foul water from the property drains to a public sewer.

For your guidance:

- Water companies are not responsible for any private drains that connect the property to the public sewerage system and do not hold details of these. The property owner will normally have sole responsibility for private drains serving the property. These may pass through land outside the control of the seller and the buyer may wish to investigate whether separate rights or easements are needed for their inspection, repair or renewal.
- If foul water does not drain to the public sewerage system, the property may have private facilities in the form of a cesspit, septic tank or other type of treatment plant.
- An extract from the public sewer map is enclosed. This will show known public sewers in the vicinity of the property and it should be possible to estimate the likely length and route of any private drains and/or sewers connecting the property to the public sewerage system.

2.2 – Does surface water from the property drain to a public sewer?

Records indicate that surface water from the property drains to a public sewer.

For your guidance:

- Sewerage Undertakers are not responsible for any private drains that connect the property to the public sewerage system, and do not hold details of these.
- The property owner will normally have sole responsibility for private drains serving the property. These private drains may pass through land outside of the control of the seller and the buyer may wish to investigate whether separate rights or easements are needed for their inspection, repair or renewal.
- In some cases, 'Sewerage Undertakers' records do not distinguish between foul and surface water connections to the public sewerage system.
- At the time of privatisation in 1989, Sewerage Undertakers were sold with poorly-kept records of sewerage infrastructure. The records did not always show which properties were connected for surface water drainage purposes. Accordingly, billing records have been used to provide an answer for this element of the drainage and water search.
- Due to the potential inadequacy of 'Sewerage Undertakers' infrastructure records with respect to surface water drainage, it is the customer's responsibility to inform the Sewerage Undertaker that they do not receive the surface water drainage service. If on inspection, the buyer finds that surface water from the property does not drain to a public sewer, then the property may be eligible for a rebate of the surface water drainage charge. For further information, please contact Thames Water on Tel: 0800 316 9800, or refer to the website at www.thameswater.co.uk.
- If surface water from the property does not drain to the public sewerage system, the property may have private facilities in the form of a soakaway or private connection to a watercourse.
- An extract from the public sewer map is enclosed. This will show known public sewers in the vicinity of the property and it should be possible to estimate the likely length and route of any private drains and/or sewers connecting the property to the public sewerage system.

10.6 Appendix 6 – SuDS Suitability Assessment

SuDS Technique	Typical Uses	Potential Issues	Potential Suitability
Rainwater harvesting	Capture of rainwater into a tank(s) for use (usually non-potable) such as irrigation, toilet flushing, vehicle or plant cleansing.	Care is needed to prevent the development of bacteria, algae and insect infestation.	Suitable – Rainwater Butt
Infiltration: Soakaways Infiltrations trenches and basins	Infiltration components are used to capture surface water runoff and allow it to infiltrate (soak) and filter through to the subsoil layer, into the groundwater.	Limited Space away from Foundations; Contamination; Could increase flood risk. Maintenance	Suitable – Partially
Green/brown /blue roofs	Used on flat or shallow pitched roofs to provide a durable roof covering which also provides thermal insulation, amenity space, biodiversity habitat as well as attenuation of rainwater.	Maintenance - Ensuring safe access	Suitable – Partially
Raingardens	Creation of planted landscaped areas to allow the diversion of a portion of rainwater from either downpipes or surrounding paved surfaces. Raingardens can either allow infiltration into the ground or have tanked systems for water retention.	Space Required; Require maintenance;	Suitable - Partially
Permeable pavements / surfaces	Permeable hard surfaces that allow rainwater to pass through either into the ground or to tanked systems. Good as interception storage.	Potential impact of saturation on pavement stability to be considered. May require extensive use of impermeable membranes and under-drainage. Maintenance required.	Suitable – Partial infiltration – Connection to other SuDS features/discharge point;
Swales	Dry ditches used as landscape features to allow the storage and infiltration of rainwater. Often used as linear features alongside roads, footpaths or rail lines but capable of being integrated into the design of many open spaces.	Finding available space in proposed site layout	Unsuitable - Space
Detention basin/ponds	Landscape features designed to store and in some cases infiltrate rainwater. Detentions basins are usually dry, whereas a pond should retain water. These features need areas of open space but can often be combined with other sustainable drainage techniques.	Potential health and safety issues. Finding available space in proposed site layout	Unsuitable - Space
Storage tanks/ Geocellular storage	Usually below ground level, they attenuate rainwater for later slow release back into the drainage system.	Pumping may sometimes be required to empty the tank into the drainage system	Suitable
Oversized piping	Using larger than necessary pipework creates additional space to store rainwater.	Lacks the wider benefits of the green infrastructure-based techniques	Suitable

10.7 Appendix 7 – Details of Proposed Of SuDS

10.7.1 Rainwater Butt

PDF to follow this page.

Ecosure
Etills Ltd
Unit 1, Whiting Way
Melbourn, Royston
SG8 6NA

Phone: 01763 261781
Email: sales@ecosure.co.uk
Website: www.ecosure.co.uk

MADE IN BRITAIN

PILLAR
WATER BUTTS
INSTALLATION GUIDE

THANK YOU

Thank you for purchasing the Ecosure Pillar Water Butt. We hope that you are happy with your purchase.

Although your water butt has been tested in accordance with our quality control procedures, please check it thoroughly to ensure that no damage has occurred in transit and report any damage within 48 hours of delivery.

PLEASE NOTE

The hole at the front of the 525 litre mini pillar water butt is part of the manufacturing process and is not intended to be used as an inlet or outlet. It is covered when the lid is in place.

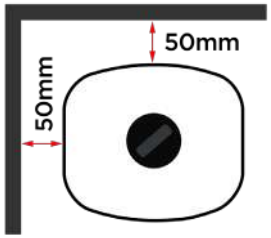
IMPORTANT SAFETY INSTRUCTIONS.

- When fixing your tap or valve to the brass moulded outlets, use 4 or 5 layers of PTFE tape and **DO NOT OVERTIGHTEN**. Hand tighten only; do not use a spanner or wrench.
- When using any power tools, be aware of others around you and wear suitable PPE.

PILLAR WATER BUTT INSTALLATION GUIDE

a. The water butt must be sited on a flat, level paved or concrete base.

b. Please leave at least a 50mm gap all around the water butt. This will allow for the natural expansion of the water butt when full of water. In particular, be sure to leave at least 50mm between the centre of the back of the water butt and any wall it is sited against.



c. Choose which threaded outlet you wish to use and drill out the plastic behind the brass insert using a hole-saw or a spade bit.
Be careful not to damage the outlet itself.

d. When fixing a tap or a hose connector to a threaded outlet, use PTFE tape and do not overtighten. If the tap points in the wrong direction after tightening, more tape is required. We recommend about 5 full turns of PTFE tape as a good starting point.

e. Rainwater diverters can be installed approximately 40mm below the top of the water butt and away from edges and corners. Please remember to keep the connecting hose running from the water butt to the down-pipe level, to act as an overflow.

10.7.2 SuDS Planters

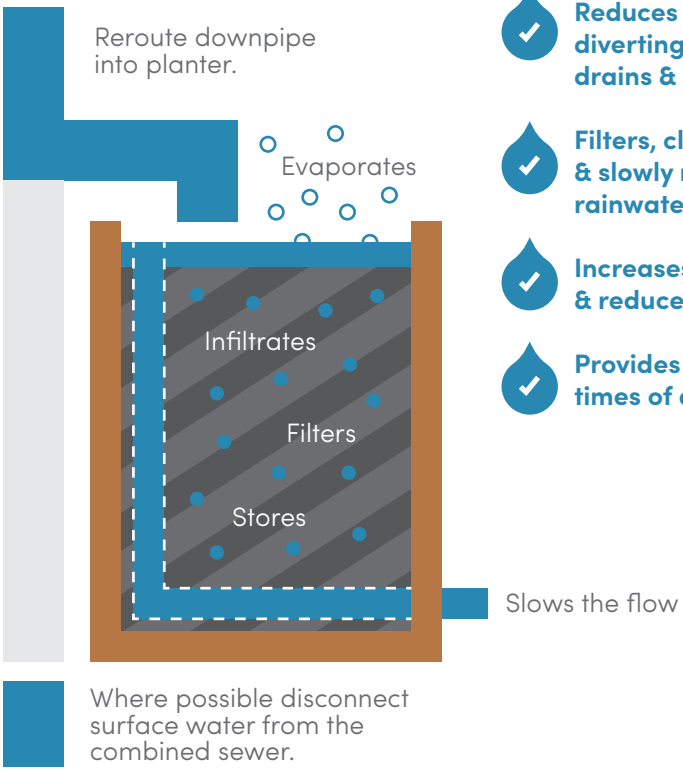
PDF to follow this page.

Meet the SuDSPlanter

SuDSPlanter is a uniquely designed rain garden which captures rainwater runoff from roofs, rather than leaving it to flow into the drains and sewers, potentially overloading the system. It's a cleaner, greener more sustainable way to guard against today's increasing risk of flooding and contamination.

The SuDSPlanter provides water storage in dry or drought conditions, as well as storm storage designed to cope in wet environments. This makes the planter ideal for our changing weather patterns, combatting the increasing flood risk and water scarcity which we face.

How it works



Reduces flood risk by diverting water from drains & sewers.

Filters, cleans, stores & slowly releases rainwater run-off.

Increases biodiversity & reduces pollution.

Provides storage in times of drought.

The SuDSPlanter is designed to capture rainwater run-off from roofs by rerouting the downpipe into the planter instead of directly into the drains. The planter is made up of a series of layers, acting as both a sponge and a natural filter, attenuating flow and removing sediment and bird poo as the water soaks through to the reservoir below.

Our specially designed growing media provides the perfect environment for plants to thrive; nutrient and water retention, filtration and soil volume to sustain plant growth in both wet and dry conditions.

Options

Recycled lumber

These are manufactured using a plastic coated metal frame with recycled plastic lumber infills. All materials are 100% recycled or recyclable.

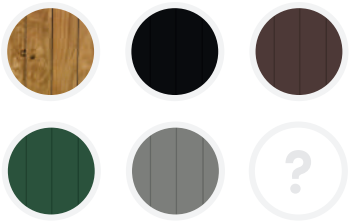
Sizes

1200mm x 600mm x 950mm

1600mm x 600mm x 950mm

2000mm x 600mm x 950mm

Colours



Bespoke colours available on request.

- **100% recycled materials.**
- **No treatment required prior to use.**
- **Minimum 15 year life expectancy.**
- **Fully recyclable at the end of its use.**
- **Graffiti resistant.**

Installation

For DIY installations, we provide an instruction manual with your planter, which has handy maintenance tips too. If you would like us to install your SuDSPlanter for you, simply ask us when you place your order

Solid timber

Our timber planters are made from the finest water resistant softwoods naturally impregnated with natural oils to reduce the need for tanalith.

Sizes

1200mm x 600mm x 950mm

1600mm x 600mm x 950mm

Colours

Bespoke colours available on request.

- **UK sourced, FSC accredited wood.**
- **No treatment required prior to use.**
- **Minimum 15 year life expectancy.**
- **Fully recyclable at the end of its use.**

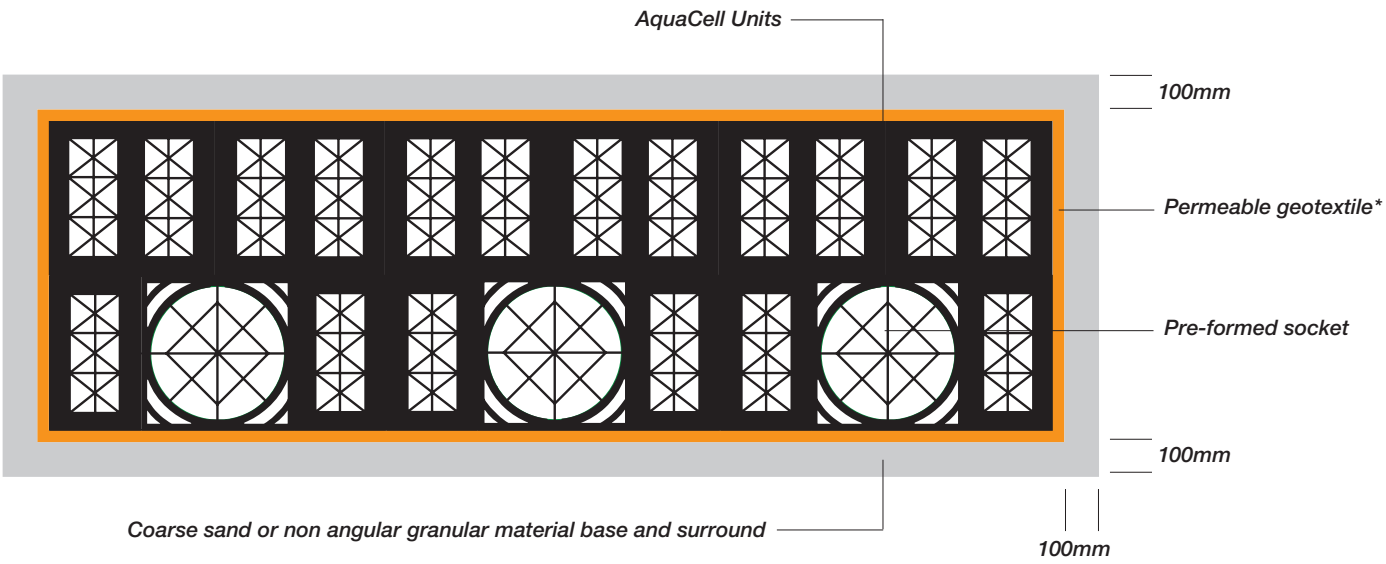
Planting

Your SuDSPlanter is a great way to increase biodiversity, as it works best with as wide a variety of plants as possible. For the best results, choose from our list of suitable plants, or we can supply you with a selection of young plants for establishing: simply ask when you place your order.

10.7.3 Geocellular Storage

PDF to follow this page.

Guidance Note 1 – Typical Soakaway Installation Method



Example shows the use of AquaCell Eco. However, a soakaway can also be installed as shown using either of the other versions of AquaCell units (Prime, Core or Plus) as appropriate.

**** The geotextile should be selected according to specific site conditions. Typically, however, a 300g non-woven material will be suitable. Specialist advice should be sought if surrounding soil characteristics exhibit a high degree of fines/low infiltration capacity and/or there is a high risk of damage from ground contaminants.***

Typical Installation Procedure

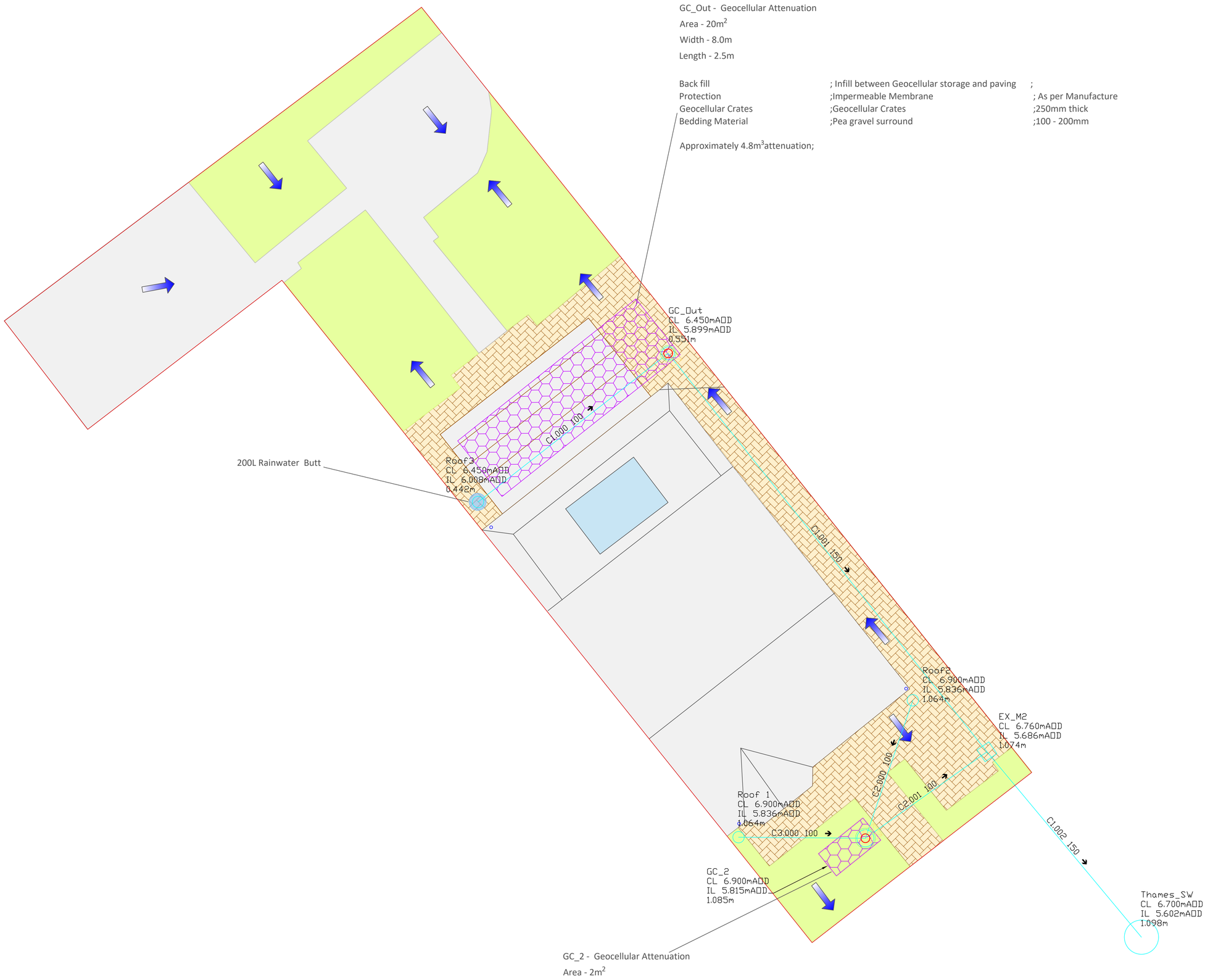
1. Excavate the trench to the required depth ensuring that the plan area is slightly greater than that of the AquaCell units.
2. Lay 100mm bed of coarse sand or non angular granular material, level and compact.
3. Lay the geotextile* over the base and up the sides of the trench.
4. Lay the AquaCell units parallel with each other. In multiple layer applications, wherever possible, continuous vertical joints should be avoided. AquaCell units can be laid in a 'brick bonded' formation (i.e. to overlap the joints below). For single layer applications use the AquaCell Clips and for multi layers use the AquaCell Clips and the AquaCell Shear Connectors (vertical rods).
5. Fix the Adaptors to the AquaCell units as required and connect pipework.
6. In order to prevent silt from entering the tank, clogging inlet pipework and reducing storage capacity, it is recommended that the Domestic Silt Trap (6LB300) or the standard Silt Trap (6LB600) is installed prior to the inlet pipework.
7. Wrap and overlap the geotextile covering the entire AquaCell structure.
8. Lay 100mm of coarse sand or non angular granular material between the trench walls and the AquaCell structure and compact.
9. Lay 100mm of coarse sand or non angular granular material over the geotextile and compact.
10. Backfill with suitable material.
11. Rainwater from roof areas may discharge directly into the soakaway but rainwater from carparks must discharge through a catchpit manhole and/or a petrol interceptor.

10.8 Appendix 7 - Drainage Modelling

10.8.1 Drainage Layout

PDF to follow this page.

North



GC_Out - Geocellular Attenuation
Area - 20m^2
Width - 8.0m
Length - 2.5m

Back fill	; Infill between Geocellular storage and paving	;
Protection	;Impermeable Membrane	; As per Manufacture
Geocellular Crates	;Geocellular Crates	;250mm thick
Bedding Material	;Pea gravel surround	;100 - 200mm

Approximately 4.8m^{3}attenuation;

GC_2 - Geocellular Attenuation
Area - 2m^2
Width - 2.0m
Length - 1.0m

Back fill	; Infill between Geocellular storage an paving	;
Protection	;Impermeable Membrane	; As per Manufacture
Geocellular Crates	;Geocellular Crates	;500mm thick
Bedding Material	;Pea gravel surround	;100 - 200mm

Approximately 1.0m^{3}attenuation;

Project :SWDS - 2024 - 000036
Site :99 Atbara Road,
:Teddington
:TW11 9PA
Company :STM Environmental
Client :Jamie and Beverley McDaid
Issue :No.1.0
By :Georgia Travers

Map Legend

- Surface Water Manhole
- Surface Water Inspection Manhole
- Flow Control Chamber
- Rainwater Down Pipe
- Rainwater Butt
- Soft Landscaping
- Permeable Paving
- Hardstanding (Impermeable Catchment)
- Geocellular Storage
- Surface Water Pipe
- Perforated Pipe
- Slot Drainage Channel
- Overflow Flow Route

10.8.2 Drainage Results

PDF to follow this page.

Design Settings

Rainfall Methodology	FSR	Maximum Time of Concentration (mins)	30.00
Return Period (years)	100	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	x

Adoptable Manhole Type

Max Width (mm)	Diameter (mm)	Max Width (mm)	Diameter (mm)
374	1200	749	1500
499	1350	900	1800

>900 Link+900 mm

Max Depth (m)	Diameter (mm)	Max Depth (m)	Diameter (mm)
1.500	1050	99.999	1200

Circular Link Type

Shape	Circular	Auto Increment (mm)	75
Barrels	1	Follow Ground	x

Available Diameters (mm)

100	150

Nodes

Name	Area (ha)	T of E (mins)	Cover Level (m)	Diameter (mm)	Width (mm)	Easting (m)	Northing (m)	Depth (m)
Roof3	0.016	5.00	6.450	400		517081.188	170946.540	0.692
EX_M2			6.760	500	500	517099.372	170937.337	1.074
Thames_SW			6.700	1200		517104.795	170930.827	1.098
GC_Out			6.450	450		517088.279	170951.651	0.801
GC_2			6.900	600		517095.103	170934.301	1.335
Roof 1	0.002	5.00	6.900	400		517090.649	170934.338	1.064
Roof2	0.003	5.00	6.900	400		517096.768	170939.143	1.064

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	Roof3	GC_Out	8.741	0.600	6.008	5.899	0.109	80.0	100	5.17	50.0
1.001	GC_Out	EX_M2	18.110	0.600	5.900	5.686	0.214	84.6	150	5.45	50.0
2.000	Roof2	GC_2	5.120	0.600	5.836	5.815	0.021	243.8	100	5.17	50.0
3.000	Roof 1	GC_2	4.454	0.600	5.836	5.815	0.021	212.1	100	5.14	50.0
2.001	GC_2	EX_M2	5.238	0.600	5.815	5.686	0.129	40.6	100	5.25	50.0
1.002	EX_M2	Thames_SW	8.472	0.600	5.686	5.602	0.084	100.9	150	5.59	50.0

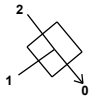
Name	Vel (m/s)	Cap (l/s)	Flow (l/s)	US Depth (m)	DS Depth (m)	Σ Area (ha)	Σ Add Inflow (l/s)	Pro Depth (mm)	Pro Velocity (m/s)
1.000	0.861	6.8	2.2	0.342	0.451	0.016	0.0	39	0.764
1.001	1.093	19.3	2.2	0.400	0.924	0.016	0.0	34	0.722
2.000	0.488	3.8	0.4	0.964	0.985	0.003	0.0	22	0.316
3.000	0.524	4.1	0.3	0.964	0.985	0.002	0.0	18	0.293
2.001	1.213	9.5	0.7	0.985	0.974	0.005	0.0	18	0.704
1.002	1.000	17.7	2.8	0.924	0.948	0.021	0.0	41	0.736

Pipeline Schedule

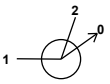
Link	Length (m)	Slope (1:X)	Dia (mm)	Link Type	US CL (m)	US IL (m)	US Depth (m)	DS CL (m)	DS IL (m)	DS Depth (m)
1.000	8.741	80.0	100	Circular	6.450	6.008	0.342	6.450	5.899	0.451
1.001	18.110	84.6	150	Circular	6.450	5.900	0.400	6.760	5.686	0.924
2.000	5.120	243.8	100	Circular	6.900	5.836	0.964	6.900	5.815	0.985
3.000	4.454	212.1	100	Circular	6.900	5.836	0.964	6.900	5.815	0.985
2.001	5.238	40.6	100	Circular	6.900	5.815	0.985	6.760	5.686	0.974
1.002	8.472	100.9	150	Circular	6.760	5.686	0.924	6.700	5.602	0.948

Link	US Node	Dia (mm)	Width (mm)	Node Type	MH Type	DS Node	Dia (mm)	Width (mm)	Node Type	MH Type
1.000	Roof3	400		Manhole	Adoptable	GC_Out	450		Manhole	Adoptable
1.001	GC_Out	450		Manhole	Adoptable	EX_M2	500	500	Manhole	Adoptable
2.000	Roof2	400		Manhole	Adoptable	GC_2	600		Manhole	Adoptable
3.000	Roof 1	400		Manhole	Adoptable	GC_2	600		Manhole	Adoptable
2.001	GC_2	600		Manhole	Adoptable	EX_M2	500	500	Manhole	Adoptable
1.002	EX_M2	500	500	Manhole	Adoptable	Thames_SW	1200		Manhole	Adoptable

Manhole Schedule

Node	Easting (m)	Northing (m)	CL (m)	Depth (m)	Dia (mm)	Width (mm)	Connections	Link	IL (m)	Dia (mm)
Roof3	517081.188	170946.540	6.450	0.692	400					
							0	1.000	6.008	100
EX_M2	517099.372	170937.337	6.760	1.074	500	500		1	2.001	5.686	100
								2	1.001	5.686	150
							0	1.002	5.686	150
Thames_SW	517104.795	170930.827	6.700	1.098	1200			1	1.002	5.602	150

Manhole Schedule

Node	Easting (m)	Northing (m)	CL (m)	Depth (m)	Dia (mm)	Width (mm)	Connections	Link	IL (m)	Dia (mm)
GC_Out	517088.279	170951.651	6.450	0.801	450		1	1.000	5.899	100
										
							0	1.001	5.900	150
GC_2	517095.103	170934.301	6.900	1.335	600		1	3.000	5.815	100
										
							2	2.000	5.815	100
							0	2.001	5.815	100
Roof 1	517090.649	170934.338	6.900	1.064	400					
										
							0	3.000	5.836	100
Roof2	517096.768	170939.143	6.900	1.064	400					
										
							0	2.000	5.836	100

Simulation Settings

Rainfall Methodology	FSR	Additional Storage (m³/ha)	20.0
FSR Region	England and Wales	Check Discharge Rate(s)	✓
M5-60 (mm)	20.000	1 year (l/s)	4.2
Ratio-R	0.400	30 year (l/s)	9.8
Summer CV	0.750	100 year (l/s)	12.4
Analysis Speed	Normal	Check Discharge Volume	✓
Skip Steady State	x	100 year 360 minute (m³)	13
Drain Down Time (mins)	240		

Storm Durations

15	60	360	2160

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

Pre-development Discharge Rate

Site Makeup	Brownfield	Time of Concentration (mins)	5.00
Brownfield Method	MRM	Betterment (%)	0
Contributing Area (ha)	0.028	Q 1 year (l/s)	4.2
PIMP (%)	100	Q 30 year (l/s)	9.8
CV	0.750	Q 100 year (l/s)	12.4

Pre-development Discharge Volume

Site Makeup	Brownfield	CV	0.750	Betterment (%)	0
Brownfield Method	MRM	Return Period (years)	100	PR	0.750
Contributing Area (ha)	0.028	Climate Change (%)	0	Runoff Volume (m³)	13
PIMP (%)	100	Storm Duration (mins)	360		

Node GC_Out Online Orifice Control

Flap Valve	x	Design Depth (m)	0.350	Discharge Coefficient	0.600
Replaces Downstream Link	✓	Design Flow (l/s)	1.0		
Invert Level (m)	5.900	Diameter (m)	0.028		

Node GC_2 Online Orifice Control

Flap Valve	x	Invert Level (m)	5.815	Diameter (m)	0.021
Downstream Link	2.001	Design Depth (m)	1.000	Discharge Coefficient	0.600
Replaces Downstream Link	✓	Design Flow (l/s)	1.0		

Node GC_Out Depth/Area Storage Structure

Base Inf Coefficient (m/hr)	0.00500	Safety Factor	2.0	Invert Level (m)	5.899
Side Inf Coefficient (m/hr)	0.00500	Porosity	0.95	Time to half empty (mins)	77

Depth (m)	Area (m²)	Inf Area (m²)	Depth (m)	Area (m²)	Inf Area (m²)	Depth (m)	Area (m²)	Inf Area (m²)
0.000	20.0	12.0	0.250	20.0	24.0	0.251	0.0	24.0

Node GC_2 Depth/Area Storage Structure

Base Inf Coefficient (m/hr)	0.00500	Safety Factor	2.0	Invert Level (m)	5.815
Side Inf Coefficient (m/hr)	0.00500	Porosity	0.95	Time to half empty (mins)	14

Depth (m)	Area (m²)	Inf Area (m²)	Depth (m)	Area (m²)	Inf Area (m²)	Depth (m)	Area (m²)	Inf Area (m²)
0.000	2.0	6.0	0.500	2.0	6.0	0.501	0.0	7.0

Other (defaults)

Entry Loss (manhole)	0.250	Entry Loss (junction)	0.000	Apply Recommended Losses	x
Exit Loss (manhole)	0.250	Exit Loss (junction)	0.000	Flood Risk (m)	0.300

Approval Settings

Node Size	✓	Proportional Velocity	✓
Node Losses	✓	Return Period (years)	100
Link Size	✓	Minimum Proportional Velocity (m/s)	0.750
Minimum Diameter (mm)	150	Maximum Proportional Velocity (m/s)	3.000
Link Length	✓	Surcharged Depth	✓
Maximum Length (m)	100.000	Return Period (years)	100
Coordinates	✓	Maximum Surcharged Depth (m)	0.100
Accuracy (m)	1.000	Flooding	✓
Crossings	✓	Return Period (years)	30
Cover Depth	✓	Time to Half Empty	✓
Minimum Cover Depth (m)	1.200	Return Period (years)	60
Maximum Cover Depth (m)	3.000	Discharge Rates	✓
Backdrops	✓	1 year (l/s)	2.0
Minimum Backdrop Height (m)	0.200	30 year (l/s)	2.0
Maximum Backdrop Height (m)	1.500	100 year (l/s)	2.0
Full Bore Velocity	✓	Discharge Volume	✓
Minimum Full Bore Velocity (m/s)	1.000	100 year +40% 360 minute (m³)	20
Maximum Full Bore Velocity (m/s)	3.000		

Rainfall

Event	Peak Intensity (mm/hr)	Average Intensity (mm/hr)	Event	Peak Intensity (mm/hr)	Average Intensity (mm/hr)
1 year 15 minute summer	109.521	30.991	100 year 15 minute summer	348.738	98.681
1 year 60 minute summer	48.435	12.800	100 year 60 minute summer	153.288	40.510
1 year 360 minute summer	14.169	3.646	100 year 360 minute summer	40.484	10.418
1 year 2160 minute summer	3.574	0.988	100 year 2160 minute summer	9.021	2.493
30 year 15 minute summer	268.706	76.035	100 year +40% CC 15 minute summer	488.233	138.153
30 year 60 minute summer	116.589	30.811	100 year +40% CC 60 minute summer	214.603	56.713
30 year 360 minute summer	31.221	8.034	100 year +40% CC 360 minute summer	56.677	14.585
30 year 2160 minute summer	7.160	1.979	100 year +40% CC 2160 minute summer	12.630	3.490

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

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
15 minute summer	Roof3	9	6.051	0.043	2.1	0.0367	0.0000	OK
60 minute summer	EX_M2	42	5.704	0.018	0.5	0.0044	0.0000	OK
60 minute summer	Thames_SW	42	5.619	0.017	0.5	0.0000	0.0000	OK
60 minute summer	GC_Out	43	5.952	0.053	1.4	1.0067	0.0000	OK
60 minute summer	GC_2	41	5.869	0.054	0.4	0.1175	0.0000	OK
60 minute summer	Roof 1	38	5.869	0.033	0.2	0.0054	0.0000	OK
60 minute summer	Roof2	40	5.869	0.033	0.3	0.0060	0.0000	OK

Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
15 minute summer	Roof3	1.000	GC_Out	2.1	1.070	0.312	0.0205	
60 minute summer	EX_M2	1.002	Thames_SW	0.5	0.439	0.029	0.0098	1.8
60 minute summer	GC_Out	Orifice	EX_M2	0.3				
60 minute summer	GC_Out	Infiltration		0.0				
60 minute summer	GC_2	Orifice	EX_M2	0.2				
60 minute summer	GC_2	Infiltration		0.0				
60 minute summer	Roof 1	3.000	GC_2	0.2	0.173	0.045	0.0146	
60 minute summer	Roof2	2.000	GC_2	0.3	0.334	0.068	0.0167	

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

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
15 minute summer	Roof3	10	6.080	0.072	5.3	0.0611	0.0000	OK
60 minute summer	EX_M2	44	5.709	0.023	0.9	0.0058	0.0000	OK
60 minute summer	Thames_SW	44	5.625	0.023	0.9	0.0000	0.0000	OK
60 minute summer	GC_Out	47	6.032	0.133	3.5	2.5396	0.0000	OK
60 minute summer	GC_2	41	5.952	0.137	0.7	0.2999	0.0000	SURCHARGED
60 minute summer	Roof 1	41	5.952	0.116	0.4	0.0190	0.0000	SURCHARGED
60 minute summer	Roof2	41	5.952	0.116	0.7	0.0212	0.0000	SURCHARGED

Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
15 minute summer	Roof3	1.000	GC_Out	5.3	1.178	0.778	0.0510	
60 minute summer	EX_M2	1.002	Thames_SW	0.9	0.517	0.050	0.0145	4.7
60 minute summer	GC_Out	Orifice	EX_M2	0.6				
60 minute summer	GC_Out	Infiltration		0.0				
60 minute summer	GC_2	Orifice	EX_M2	0.3				
60 minute summer	GC_2	Infiltration		0.0				
60 minute summer	Roof 1	3.000	GC_2	0.2	0.131	0.056	0.0348	
60 minute summer	Roof2	2.000	GC_2	0.5	0.334	0.130	0.0401	

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

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
15 minute summer	Roof3	10	6.097	0.089	6.8	0.0760	0.0000	OK
60 minute summer	EX_M2	45	5.711	0.025	1.0	0.0063	0.0000	OK
60 minute summer	Thames_SW	45	5.627	0.025	1.0	0.0000	0.0000	OK
60 minute summer	GC_Out	49	6.075	0.176	4.6	3.3795	0.0000	SURCHARGED
60 minute summer	GC_2	42	6.009	0.194	0.9	0.4233	0.0000	SURCHARGED
60 minute summer	Roof 1	42	6.009	0.173	0.6	0.0282	0.0000	SURCHARGED
60 minute summer	Roof2	42	6.009	0.173	0.9	0.0315	0.0000	SURCHARGED

Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
15 minute summer	Roof3	1.000	GC_Out	6.7	1.203	0.991	0.0634	
60 minute summer	EX_M2	1.002	Thames_SW	1.0	0.542	0.059	0.0164	6.2
60 minute summer	GC_Out	Orifice	EX_M2	0.7				
60 minute summer	GC_Out	Infiltration		0.0				
60 minute summer	GC_2	Orifice	EX_M2	0.4				
60 minute summer	GC_2	Infiltration		0.0				
60 minute summer	Roof 1	3.000	GC_2	0.3	0.228	0.077	0.0348	
60 minute summer	Roof2	2.000	GC_2	0.6	0.327	0.160	0.0401	

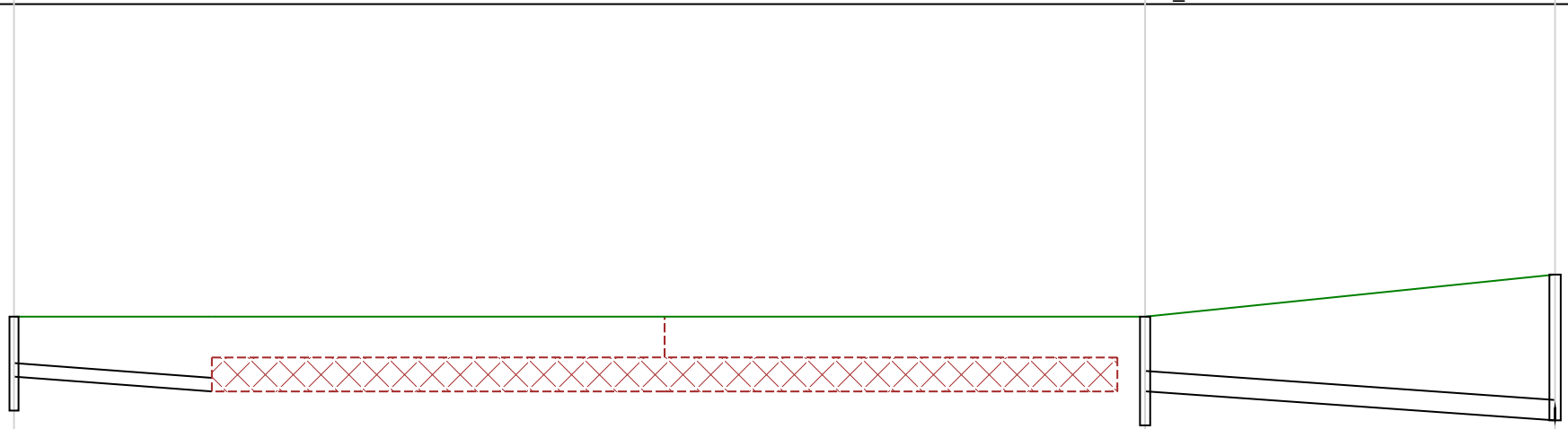
Results for 100 year +40% CC Critical Storm Duration. Lowest mass balance: 100.00%

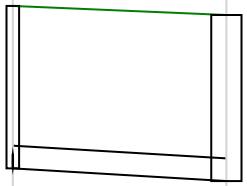
Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
15 minute summer	Roof3	11	6.244	0.236	9.6	0.2005	0.0000	FLOOD RISK
60 minute summer	EX_M2	51	5.714	0.028	1.3	0.0070	0.0000	OK
60 minute summer	Thames_SW	51	5.629	0.027	1.3	0.0000	0.0000	OK
60 minute summer	GC_Out	52	6.164	0.265	6.1	4.8016	0.0000	FLOOD RISK
60 minute summer	GC_2	44	6.102	0.287	1.2	0.6276	0.0000	SURCHARGED
60 minute summer	Roof 1	44	6.103	0.267	0.8	0.0435	0.0000	SURCHARGED
60 minute summer	Roof2	44	6.103	0.267	1.2	0.0485	0.0000	SURCHARGED

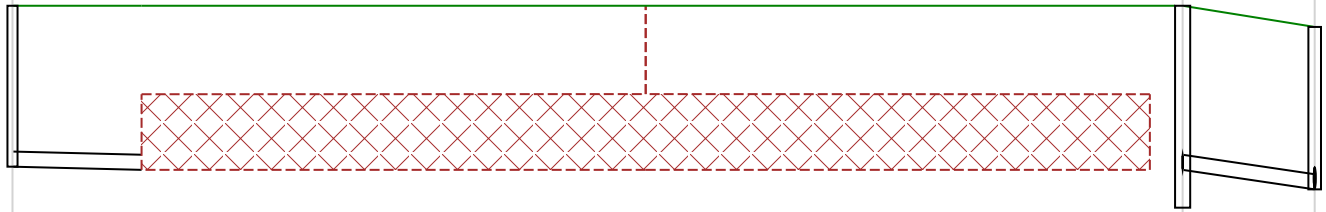
Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
15 minute summer	Roof3	1.000	GC_Out	9.0	1.182	1.335	0.0684	
60 minute summer	EX_M2	1.002	Thames_SW	1.3	0.575	0.073	0.0190	8.6
60 minute summer	GC_Out	Orifice	EX_M2	0.8				
60 minute summer	GC_Out	Infiltration		0.0				
60 minute summer	GC_2	Orifice	EX_M2	0.5				
60 minute summer	GC_2	Infiltration		0.0				
60 minute summer	Roof 1	3.000	GC_2	0.4	0.273	0.107	0.0348	
60 minute summer	Roof2	2.000	GC_2	0.8	0.323	0.213	0.0401	

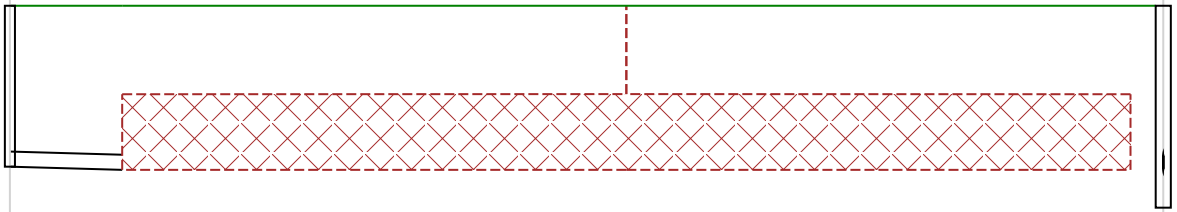
10.8.3 Drainage Sections

PDF to follow this page.

Node Name	Roof3		GC_Out	EX_M2
A4 drawing Hor Scale 300 Ver Scale 50 Datum (m) 3.000				
Link Name	1.000		1.001	
Section Type	100mm		150mm	
Slope (1:X)	80.0		84.6	
Cover Level (m)	6.450		6.450	6.760
Invert Level (m)	6.008	5.899	5.900	5.686
Length (m)	8.741		18.110	

Node Name		EX_M2	Thames_SW
A4 drawing Hor Scale 300 Ver Scale 50 Datum (m) 3.000			
Link Name		1.002	
Section Type		150mm	
Slope (1:X)		100.9	
Cover Level (m)		6.760	6.700
Invert Level (m)		5.686	5.602
Length (m)		8.472	

Node Name		Roof2		GC_2	EX_M2
A4 drawing Hor Scale 300 Ver Scale 50 Datum (m) 3.000					
Link Name		2.000		2.001	
Section Type		100mm		100mm	
Slope (1:X)		243.8		40.6	
Cover Level (m)		6.900		6.900	6.760
Invert Level (m)		5.836	5.815	5.815	5.686
Length (m)		5.120		5.238	

Node Name		Roof 1 GC_2
A4 drawing Hor Scale 300 Ver Scale 50 Datum (m) 3.000		
Link Name		3.000
Section Type		100mm
Slope (1:X)		212.1
Cover Level (m)		6.900 6.900
Invert Level (m)		5.836 5.815
Length (m)		4.454

10.9 Appendix 8 – SuDS Maintenance Manual

All maintenance activities will be the responsibility of Jamie and Beverley McDaid. They will appoint a management company to undertake the general maintenance duties within the site and will join service agreements with the suppliers and manufactures of the SuDS/Pumps when required.

The information presented below is taken from the CIRIA SuDS Manual (Report c753) and SuDS. Further details on installation and maintenance can be found detailed below and online.

10.9.1 Geo-Cellular Maintenance

Maintenance Schedule	Required Action	Typical Frequency	Responsibility
Regular maintenance	Inspect for sediment and debris in pre-treatment components and floor of inspection tube or chamber and inside of concrete manhole rings.	Annually.	will be responsible for setting up the management company.
	Cleaning of gutters and any filters on downpipes.	Annually (or as required based on inspections).	
	Trimming any roots that may be causing blockages.	Annually (or as required).	
Occasional maintenance	Remove sediment and debris from manhole, storage structure and components and floor of inspection tube or chamber and inside of concrete manhole rings.	As required, based on Inspections.	
Remedial actions	Reconstruct geocellular and/or replace or clean void fill, if performance failure occurs	As required	will be responsible for setting up the management company.
	Replacement of clogged geotextile (will require reconstruction of soakaway).	As required.	
Monitoring	Inspect silt raps and note rate of sediment accumulation.	Monthly in the first year and then annually.	
	Check soakaway to ensure emptying is occurring.	Annually.	

Maintenance will usually be carried out manually, although a suction tanker can be used for sediment / debris removal for large systems. If maintenance is not undertaken for long periods, deposits can become hard-packed and require considerable effort to remove.
Replacement of the geocellular units will be necessary if the system becomes blocked with silt. Effective monitoring will give information on changes in infiltration rate and provide a warning of potential failure in the long term.

Areas draining to infiltration components should be regularly swept to prevent silt being washed off the surface. This will minimize the need for maintenance.

Maintenance responsibility should be placed with an appropriate organisation, and maintenance schedules should be developed during the design phase.

10.9.2 SuDS Planters Maintenance

Maintenance Schedule	Required Action	Typical Frequency	Responsibility
Regular maintenance	Inspect for sediment and debris in inlet and outlet components	Quarterly; As required.	CompanyName will be responsible for setting up the management company.
	Inspection & Cleaning of gutters and any filters on downpipes feeding into rain gardens as required.	Quarterly; As required.	
	Remove, replace and maintain vegetation as required; Ensuring cuttings are removed to prevent debris build up; Weeding of flower bed to maintain the desired vegetation, density and biodiversity - Vegetation management	Monthly inspections during Spring / Summer Autumn / Winter - As required. .	
Remedial actions	Replace dead vegetation as required. Cut back vegetation as required.	As required.	
Monitoring	Inspect silt traps / discharge points and note rate of sediment accumulation and ensure no erosion pathways forming.	Monthly in the first year and then annually.	
	Check Planters are emptying as required following a storm event occurring.	After storms; When possible.	

Maintenance will be carried out manually. All monitoring and maintenance will be carried out by the appointed estate management company that undertakes the general landscaping maintenance.

10.9.3 SuDS Rain Water Butt Maintenance

Maintenance Schedule	Required Action	Typical Frequency	Responsibility
Regular maintenance	Inspect for sediment and debris in inlet and outlet components;	Quarterly; As required. Increase freq. to Monthly during Autumn;	will be responsible for setting up the management company.
	Inspection & Cleaning of gutters and any filters on downpipes feeding into the Rain Water Butts.	Quarterly; Increase freq. to Monthly during Autumn;	
Remedial actions	Cleaning of the water butt. Fully drain the water butt and clear out debris and enable access; Scrub out the inside of the butt or tank with a coarse brush, if accessible, using a proprietary cleaning product such as Just Water Butt Cleaner or garden disinfectant; Rinse with clean water; Cleaning of Gutters; Clean or fit a new filter;	Annually; Or as required.	
Remedial actions	Use water/empty water butts - to clean, water plants (inside & out); Empty water Butt more frequently during the winter, to allow for storage during storms and to keep the water fresh;	Once every two weeks; as required	

Maintenance will be carried out manually. All monitoring and maintenance will be carried out by the appointed estate management company that undertakes the general landscaping maintenance.

10.9.4 Flow Control Maintenance

Maintenance Schedule	Required Action	Typical Frequency	Responsibility
Regular maintenance	Inspect for sediment and debris;	Quarterly; As required.	will be responsible for setting up the management company.
	Inspection & Cleaning of SuDS components upstream of flow control element.	Quarterly; Increase freq. to Monthly during Autumn;	
Remedial actions	Removal of debris and sediment;	Annually; Or as required.	
Remedial actions	Replacement of parts; Manhole cover, filters or components of flow control device;	As required;	
Monitoring	Ensure flow control device is function correctly during and after storm events; Check water levels up stream and downstream of flow control device	Monthly; During 1st year of installation or during and after storm event; When possible Reduce to Quarterly following the 1st year;	
	Check for damage to flow control components	Annually;	
	Check for securely fitting manhole lid; Ensures debris cannot enter the system unfiltered;	Annually;	