ENVIRONMENTAL CONSULTING , SOFTWARE & TRAINING

Sustainable Drainage System Strategy

Site Address
18-20 Station Road
Longfield
Kent
DA3 7QH

Client
DCP Properties Limited

Report Reference
SWDS - 2023 - 000044

Prepared By
STM Environmental Consultants Ltd

Date
31/01/2024

1 Document Control

Sustainable Drainage System Strategy

Site Address:	18-20 Station Road Longfield Kent DA3 7QH
National Grid Reference:	560079, 169059
STM Reference:	SWDS – 2023 – 000044
Version No:	1.0
Prepared for:	DCP Properties Limited
Date:	31/01/2024
Report Author:	Geogia Travers (BSc) **Environmental Consultant**
Checked By:	Matthew Ashdown (BSc) **Senior 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 DCP Properties Limited (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.

4 Executive Summary

BACKGROUND			
Location	18-20 Station Road, Longfield, Kent, DA3 7QH Grid reference: 560079, 169059		
Site Area	716m^2		
Proposed Development	Demolition of existing mix use building and erection of new 4-storey mix use building with ground floor pharmacy with 12 residential dwellings above, parking, access, bin storage and cycle provision.		
Current Site and Surrounding Uses	The site is currently used as a pharmacy on ground floor and residential on the first floor. The surrounding uses consist of mainly mixed residential and commercial, with agricultural uses further away.		
Topography	The site is slightly sloped ranging from 50.62mAOD (N) to 51.28mAOD (S).		
Hydrology	No watercourses within 250m of the site.		
Geology	BGS information indicates that the superficial deposits at the site consist of Head (Clay, Silt, Sand and Gravel) while the bedrock is classified as belonging to the Lewes Nodular Chalk Formation, Seaford Chalk Formation and Newhaven Chalk Formation (Chalk)		
Hydrogeology	BGS information indicates that the site is situated upon a Secondary (undifferentiated) superficial and a Principal bedrock aquifer.		
Permeability	BGS information indicates that the superficial deposits are highly variable and the bedrock is classified as free draining.		
Infiltration Potential	BGS information indicates that site is probably compatible with infiltration SuDS. Infiltration testing was undertaken on site and was successful. The infiltration rate obtained on site was 1.0x10^{-5}m/s, which is considered to be a moderately rapid rate.		
Fluvial Flood Risk	Low – the site lies within EA Flood Zone 1.		
Surface Water Flood Risk	Very Low – During all flood events, the site remains dry.		
Groundwater Flood Risk	Very Low - EA mapping indicates that there is limited potential for groundwater flooding to occur on site; the groundwater table depth is likely greater than 5mbgl.		
Existing and Proposed Site Layout	**Ground Cover**	**Existing (m^2)**	**Proposed (m^2) (Without SuDS)**
	Buildings	225	377
	Driveways/Patio	431	339
	Gardens/ Soft landscaping	60	0
	Total Impermeable Area	**656**	**716**
Changes in Impermeable	Without SuDS, the proposed development would increase the impermeable area of the site and therefore increase the post development runoff rate and volume.		

PROPOSED SUDS			
Run-Off Rates	Greenfield (GF) (l/s)	MRM Pre - Development (l/s)	MRM Post Development Without SuDS (l/s)
Qbar	0.11	-	-
1 in 1	0.10	9.9	10.7
1 in 30	0.26	23.1	25.2
1 in 100	0.36	29.3	32.0
1 in 100 + CC (40%)	0.53	-	-
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 Qbar (0.11l/s) for the greenfield runoff rate should be the aim for the post-development scenario.		
Drainage Hierarchy	The proposed will discharge into the ground via infiltration.		
Storage Required to meet Planning Requirement	The site is estimated to require 19 - 55m^3 of storm water attenuation with an infiltration rate of 1.0x10^{-5}m/s.		
SuDS Strategy	The proposal has the potential to significantly reduce the storm water runoff rate and volume during the critical storm scenario. This may be achieved through a combination of multiple SuDS options which have been outlined within this scheme. The proposal will introduce green roofs, rainwater harvesting, permeable paving and a geocellular soakaway. All excess storm water will be dealt with on site via source control SuDS methods and will discharge to ground. The proposal will provide 36.2m^3 of attenuation storage and 7.5m^3 of rainwater re-use.		
Water Efficiency	Through the introduction of a rainwater harvesting unit and new fitting, the development will ensure water usage of 105 litres per day per person. This therefore will provide a significant reduction in the daily water consumption on site and would have potentially for long term sustainable solution.		
Conclusion	With the proposed SuDS mitigation measures which have been outline introduced into the scheme, including the usage of rainwater harvesting providing 105 litters per day per person, 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.		

5 Introduction

STM Environmental Consultants Limited have been appointed by DCP Properties Limited to undertake a Sustainable Drainage System (SuDS) Strategy for a proposed development at 18-20 Station Road, Longfield, Kent, DA3 7QH.

5.1 Proposed Development

The SuDS report is required to support a planning application (Reference: DA/23/01402/OUT) for the demolition of existing mix use building and erection of new 4-storey mix use building with ground floor pharmacy with 12 residential dwellings above, parking, access, bin storage and cycle provision.

Copies of the development plans are presented in Appendix 1.

5.2 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.

5.3 Legislative and Policy Context

5.3.1 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.

5.3.2 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 167 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 169 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.

5.4 LLFA Planning Policy - Dartford Borough Council

5.4.1 Policy CS 24: Flood Risk

To manage and mitigate flood risk the Council will:

- Ensure that sites in Flood Zone 2 and 3a, shown to be acceptable for development following application of the Sequential Test and parts A and B of the Exception Test, demonstrate that part C of the Exception Test can be passed and that residual risk is managed through a Flood Risk Assessment (FRA) and an

appropriate Flood Plan. Windfall sites will be subject to the same tests to assess whether they are appropriate for the development proposed.

- Engage with the Environment Agency and Defra in the further stages of the Thames Estuary 2100 Project (TE 2100), and seek not to foreclose any medium or long-term options through proposals in this Plan. In particular, the Council will protect the Dartford Marshes from development, in the event that the area is required to implement flood protection proposals or compensation freshwater habitats.
- Require the SUDS 'management train' to be applied, as appropriate, in all new development. In Water Source Protection Zones, SUDS will need to demonstrate that any surface water run-off infiltrating the ground will not lead to deterioration of groundwater quality.
- Identify and implement a green infrastructure network through the safeguarding of existing areas of open space and a requirement for generous provision

6 Site Characteristics

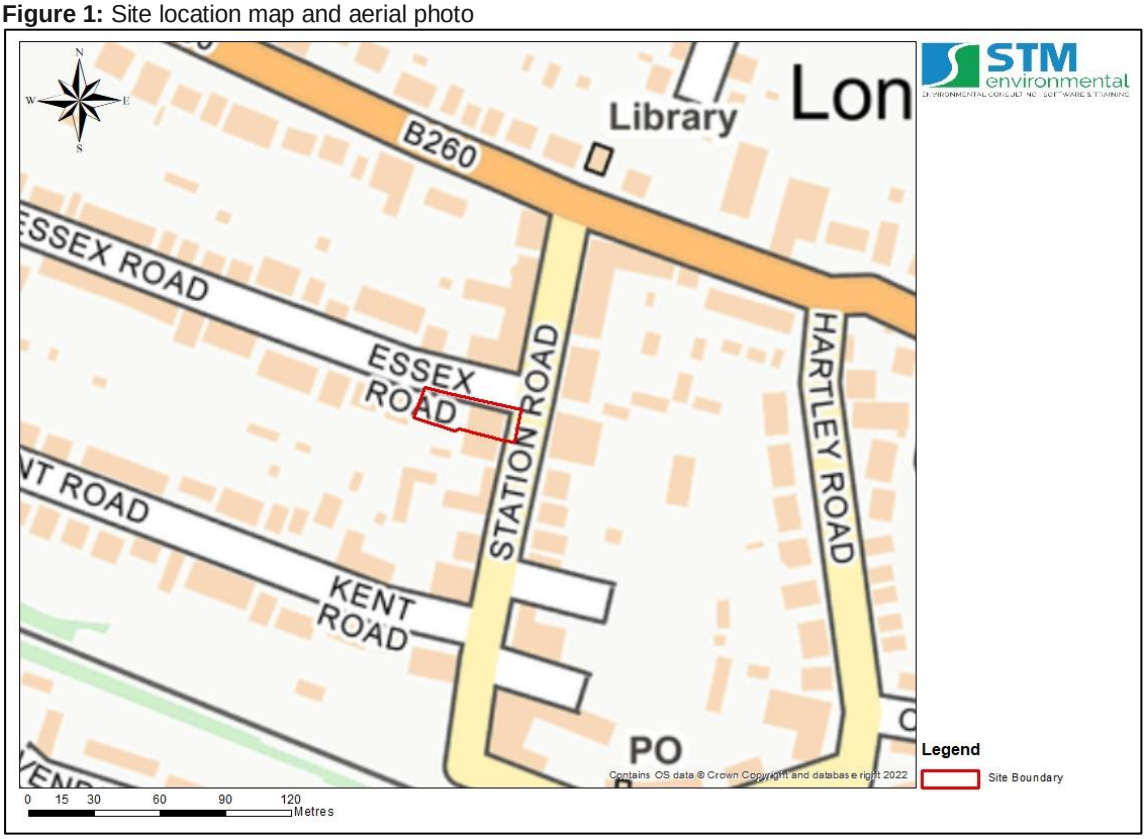
6.1 Location and Area

The site is centred at national grid reference 560079, 169059 and has an area of 716m^2

It falls within the jurisdiction of the Dartford Borough Council (DBC) 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



6.2 Current Site and Surrounding Uses

The site is currently used as a pharmacy on the ground floor with a residential dwelling on the first floor. The site is located on a small commercial stretch, with residential uses on upper floors, leading from Longfield train station. The surrounding area is mainly residential with scattered commercial uses, and a predominant agricultural use further away.

6.3 Site Topography

The mapping provided in Appendix 2 shows a topographic survey and the 1m LiDAR DTM (2022) ground elevations within the site.

The topographic survey has been used throughout the report given increased accuracy.

The rear of the site, where the current car parking is located, and entrance to the site maintain a similar pattern in ground level, being slightly sloped from 50.62mAOD (north) to 51.28mAOD (south).

6.4 Flood Risk Summary

The overall flood risk to the site is considered to be very low. No main source of flood risk to the development site was identified.

The flood risk maps are available in Appendix 3

6.5 Existing Surface Water Drainage Features

Drainage plans showing the existing surface water drainage system at the site are presented in Appendix 1 and Appendix 5.

A utility search was undertaken which identified Thames Water as the local sewage undertaker. This identified a foul drainage sewer run located on Station Road at the entrance of the property. There are also two foul drainage runs to the north and south of the property.

The manhole cover levels were estimated by using LiDAR DTM data.

Table 1: Asset Information

Asset ID	Asset Type	Location / Distance (m)	Manhole Cover Level (mAOD)	Manhole Invert Level (mAOD)	Depth (m)
Development Plans*	Foul	On Site (SE)	51.32	49.93	1.39
	Foul	On Site (SE)	51.15	50.46	0.69
	Foul	On Site (NE)	50.59	50.18	0.14
	Foul	On Site (N)	50.61	49.94	0.67
Thames* 101A	Foul	10m SE	51.70	n/a**	n/a
Thames 101B	Foul	10m NE	50.12	n/a	n/a

** Development Plans = Data provided by development plans; Thames = Data provided by Thames asset search. ** n/a = No information Provided*

7 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.

7.1 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	225	31.4	377	52.7	152
Hard Standing	431	60.2	339	47.3	-92
Soft landscaping	60	8.4	0	0.0	60
Total	716	100	716	100	

**Hardstanding is underneath the building overhang.*

Table 3: Summary of Permeable and Impermeable Areas

	Impermeable Area		Permeable Area		Total Area
	m^2	%	m2	%	m^2
Existing Site	656	91.6	60	8.4	716
Proposed Site	716	100.0	0	0.0	716
Difference	60	8.4	-60	-8.4	

The proposed development increases the impermeable area of the site by 8% to 716m^2. As such this will have a negative impact on the runoff rate without the introduction of SuDS.

7.2 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.

7.3 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.

7.4 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	0.11	0.37	0.39
1 in 1	0.10	0.31	0.33
1 in 30	0.26	0.84	0.89
1 in 100	0.36	1.17	1.24
1 in 100 + CC	0.53	1.73	1.84

Table 5: Modified Rational Method (MRM)

	Pre – Development (l/s)	Pre - Development No SuDS (l/s)
1 in 1	9.9	10.7
1 in 30	23.1	25.2
1 in 100	29.3	32.0

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

The Qbar (0.11 l/s) for the greenfield runoff rate should be the aim for the post-development scenario. However, as the greenfield rates are so low, achieving such a low rate may cause rise to blockages in the proposed system. Therefore, the discharge rate should be 2.0 l/s when discharging to a watercourse or public sewer.

The quick storage estimate tool in Causeway Flow was used. The storage volume required to achieve the 2l/s discharge rate for all storm events, is estimated to be up to **28 - 40m^3** when discharging to a watercourse or public sewer.

When discharging to ground via infiltration, the estimated storage volume is between **19 – 55m^3** when assigning the infiltration rate of 1.0x10^{-5}m/s.

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

8 SuDS

8.1 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.

8.2 Drainage Hierarchy Discussion

8.2.1 Rainwater Harvesting

The development has potential to provide rainwater harvesting. As such this is recommended.

8.2.2 Green Roofs

There is potential to include green roofs within the proposed.

8.2.3 Infiltration To Ground

The development site is suitable for infiltration SuDS following the on-site ground investigation that was undertaken.

Site investigation works were carried out on the 12 - 14th December 2023. A trial pit was excavated to a depth of 1.6mbgl for undertaking infiltration testing in accordance with BRE DG 365. 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. 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 rates. The infiltration rate was calculated to be $1.0x10^{-5}$ m/s (0.049m/hr). This is classified as a moderately rapid rate of infiltration.

Based on these findings, infiltration SuDS methods are considered to be suitable for the site.

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

8.2.4 Permeable Surfaces and Filter Drains

Approximately 47% (319m^2) of the development will consist of car parking and pathways which could be designed to be permeable.

8.3 Appraisal of Potential SuDS Options

8.3.1 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 Impact	Low Impact	Yes	Maybe	No	Not Applicable

Main Caterogory	SuDS Features	Total Suspended Solids Removal	Heavy Metals Removal	Nutrient Removal	Bacteria Removal	Disolved Pollutants	Runoff Volume Reduction		Flow Rate Control / Events: 1-2 Years	10 - 30 Years	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	Y	Y	145m2	5.8	5.8
	Rain Water harvesting	M	L	L	L	NA	M		M	H	L	Y	Y	7.5m3 Rainwater Reuse	0	0
Infiltration Methods	Infiltration trench	H	H	H	M	H	H		H	H	L	Y	N	Limited Space	0	0
	Permeable Pavement	H	H	H	H	H	H		H	H	H	Y	Y	234m2	19	19
	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	Y	Y	12m2 Geocellular Soakaway	11.4	11.4
Filtration Channels Features (Open)	Filtration Surface sand	H	H	H	M	H	L		H	H	L	N	N		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	N	N	Limited Space Limited Space	0	0
	Filter trench	H	H	H	M	H	L		H	H	L	N	N	Limited Space	0	0
	Open channels Conveyance	H	M	M	M	H	M		H	H	H	N	N		0	0
Filtration Wet SuDS	Enhanced dry swale	H	H	H	M	H	M		H	H	H	N	N		0	0
	Enhanced wet swale	H	H	M	H	H	L		H	H	H	N	N	Limited Space	0	0
	Wetland Shallow wetland	H	M	H	M	H	L		H	M	L	N	N	Limited Space Limited Space	0	0
	Extended detention wetland	H	M	H	M	H	L		H	M	L	N	N	Limited Space Limited Space	0	0
	Pond / wetland	H	M	H	M	H	L		H	M	L	N	N		0	0
Channels Features (Open)	Pocket wetland	H	M	H	M	H	L		H	M	L	N	N		0	0
	Submerged gravel wetland	H	M	H	M	H	L		H	M	L	N	N	Limited Space 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	N	N	Better Alternatives	0	0
															Total	36.2

8.4 SuDS Strategy

8.4.1 SuDS Options

The proposal will introduce a range of SuDS measures, these include green roofs, a rainwater harvesting tank, permeable block paving lain upon the car parking area, and a geocellular soakaway below the car parking. All excess storm water will discharge to ground via infiltration.

The measures provide water for re-use on site, water retention and ensure suitable water quality controls are in place prior to runoff discharging to ground.

The proposal will provide 36.2m^3 of attenuation, the summary details each SuDS feature are outlined in the table below.

Table 7: Proposed SuDS

Location	Proposed Area (m^2)	SuDS Option	Estimated Storage Provided (m^3)
Buildings	145	Green Roof (40mm Drainage Board)	5.8
Paved Area	234	Permeable Paving – 270mm Sub-base	19
Below Ground - Paved area	12	Geocellular Storage (0.5 – 1m thick)	11.4
Below Ground - Paved area	7.5	Rain Water Harvesting	-
Total			**36.2**

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

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

8.4.2 Green Roof

The proposed building will cover an area of 377m^2 which will be fitted with a biodiverse green roofing system.

The green roofs will cover a total area of 145m^2 across the rooftop in three sections. It will be formed from a Bauder Biointensive Green roof (or similar) along with 40mm drainage board, which provide roof level attenuation alongside the substrate and encourage flow.

The green roofs across the site will be constructed from vegetation ranging from sedum grasses and small flora. The vegetation will depend on the accessibility and depths and type of the underlying substrate. The substrates will be formed from a freely draining specifically designed roof growing medium. The depth of the substrate will vary depending on the growing medium it is intended to support (extensive, biodiverse or intensive).

Due to the size of the rooftop areas, location and extent of the development being undertaken on site, biodiverse extensive green roof systems are most suitable.

The substrate provides water retention and is typically lain onto a filter fleece, drainage board and a waterproof membrane. The filter prevents fines from being drained out of the substrate and into the drainage system. The drainage board provides further waterproofing, allowing for continuous drainage and increases the storage capacity of the green roof.

Table 8: Extensive Green Roofs

Building	Roof Type	Green Roof Coverage (m2)	Detailed	Roof Level Attenuation Cell (m^3)
1	Green/Brown	62	Biodiverse Extensive Green roof 150mm => Substrate & 40mm – Drainage Board	2.5
1	Green/Brown	60	Biodiverse Extensive Green roof 150mm => Substrate & 40mm – Drainage Board	2.4
1	Green/Brown	23	Biodiverse Extensive Green roof 150mm => Substrate & 40mm – Drainage Board	0.9
Total				**5.8**

As well as allowing for storage, the substrate and modular planting trays will slow the runoff rate from the rooftop by up to 30 - 60 minutes, depending on the level of saturation before the rainfall event.

The downpipes from the green roof will discharge onto the permeable paving which is described in more detail below.

8.4.3 Permeable Block Paving – Block Paving

Permeable Paving (Marshalls Prior or similar) combines hardstanding with SuDS and works in a very different way to traditional pavement. It is designed to allow rainfall to

percolate immediately through the surface near to where the raindrop lands – so surface ponding is completely eradicated without the need for an additional channel drainage system.

The construction will consist of 80mm interlocking concrete blocks with jointing, with a 50mm underlying bedding layer with a 270mm sub-base consisting of a graded aggregate (Marshalls Priora Aggregates or similar) with a porosity of 0.30. This 400mm construction depth will provide CBR value of <5% which will be designed for cars and light vans. This construction over 234m^2 will provide approximately 19m^3 of interception, attenuation, and treatment storage, and it will allow for direct infiltration. This has been designed in Microdrainage using the infiltration rate from TP01 (1.0x10^{-5}m/s).

8.4.4 Rainwater Harvesting

Rainwater harvesting is not feasible for the entire rooftop given the scale of the tank which would be necessary, however is feasible when considering only part (140m^2). When considering only part of the rooftop, the demand for non-potable water within the development will outstrip the average annual rainfall yield. Therefore, rainwater harvesting tanks are considered to be suitable for stormwater volume control.

The proposed rainwater harvesting tank will provide 7.5m^3 of water recycling within the building, ensuring a 3 – day non-potable water supply for the inhabitants of the flats, assuming a 40 litres per day consumption per person.

All excess storm water will be controlled via a pumping system. It will direct run-off to the permeable paving structure once water levels exceed the storage level required for reuse. The tanks have been simulated within the drainage modelling by creating tanked storage with a depth sensitive pumping system. Please note, the tank and pump have been simulated in the model to operate at low water levels (0.05m) to ensure adequate attenuation is provided elsewhere on site during all storm events.

8.4.5 Geocellular Soakaway

The geocellular storage structures will be placed below the main car parking area to the front of the dwelling. The structure will cover a total area of 12m^2 with a thickness of 1m. 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 of 11.4m^3.

8.4.6 Surface Water Discharge Points

The excess storm water will discharge to ground on site via infiltration.

8.4.7 Treatment of Run-off

Treatment of roof water runoff will be provided through the provision of the rainwater tank filtration unit, permeable paving and catchpit manholes, to intercept gross solids and sediment, guidance will be provided to the developer on appropriate maintenance requirements including regular cleaning and monitoring.

8.4.8 Exceedance Flows

The site is sloped from 50.62mAOD (north) to 51.28mAOD (south).

The elevation review of the LIDAR 1m DTM Mapping indicates that in the event of exceedance on the site upon completion, overland flows will flow towards north of the site to Essex Road, away from the building ensuring safe access and egress can be maintained during such an event.

8.5 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.

9 Water Efficiency

9.1.1 Water Consumption

The average UK daily consumption of water is 140 litres per day [5].

The introduction of the rainwater harvesting tanks will significantly reduce the water consumption per person within the proposal. As discussed in section 8.4.3, the daily non-potable water consumption is 40 litres per day, per person.

The introduction of the rainwater harvesting tank will reduce the average daily water usage to below the target value of 105 litres per day. Above and beyond this, the newly developed flats will introduce modernised fittings and appliances that will reduce the daily water consumption further still.

The developer will implement some or all of the following:

- Water-efficient showerhead - Reduces water consumption to 8 / 9 litres per minute
- Dual Flush Toilets or High Efficiency Toilet (HET);
- Taps - inexpensive aerators add air into the water – using less and the flow feels the same
- Garden - Drought resistance plant
- Appliances - choose energy and water efficient washing machines and dishwashers
- Greywater or rainwater harvesting; both these can generate water to flush the loo, wash the car or water the garden. They are much more efficient and cost effective when installed during construction.

10 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.

11 References

1. Communities and Local Government - National Planning Policy Framework NPPF, 2019.
2. CIRIA, Defra, Environment Agency – UK SuDS Manual, 2015.
3. Dartford Borough Council – Dartford Core Strategy, September 2011

12 Appendices

12.1 Appendix 1 – Development Plans & Photos

12.1.1 Development Plans

See next page.

0 5 10 25m 50m

Existing Site Plan Scale 1:500

IMPORTANT GENERAL NOTE
The specification is to be read in conjunction with the plans/section details, and other associated Structural details as may be provided.
All work is to be carried out to the Local Authority Planning and Building Regulations Approval, and the Codes of Practice and British Standards as necessary.
All dimensions, levels, sizes, positions and locations of particulars as indicated on drawings are to be verified by the appointed Contractor on site prior to engaging in works. Any discrepancies must be reported to the Architect/Surveyor/Engineer or responsible person/s immediately.
The Contractor is responsible for ensuring compliance with the CDM Regulations, and appropriate Health & Safety on site precautions.
The Client/Building Owner must obtain any necessary PARTY WALL AGREEMENTS, prior to engaging in the works on site.

Revision	Date	Description

PARTY WALL ACT 1996
OWNER/S MUST ENSURE ALL PARTY WALL AGREEMENTS ARE IN PLACE BEFORE ANY BUILDING WORKS ARE TO COMMENCE

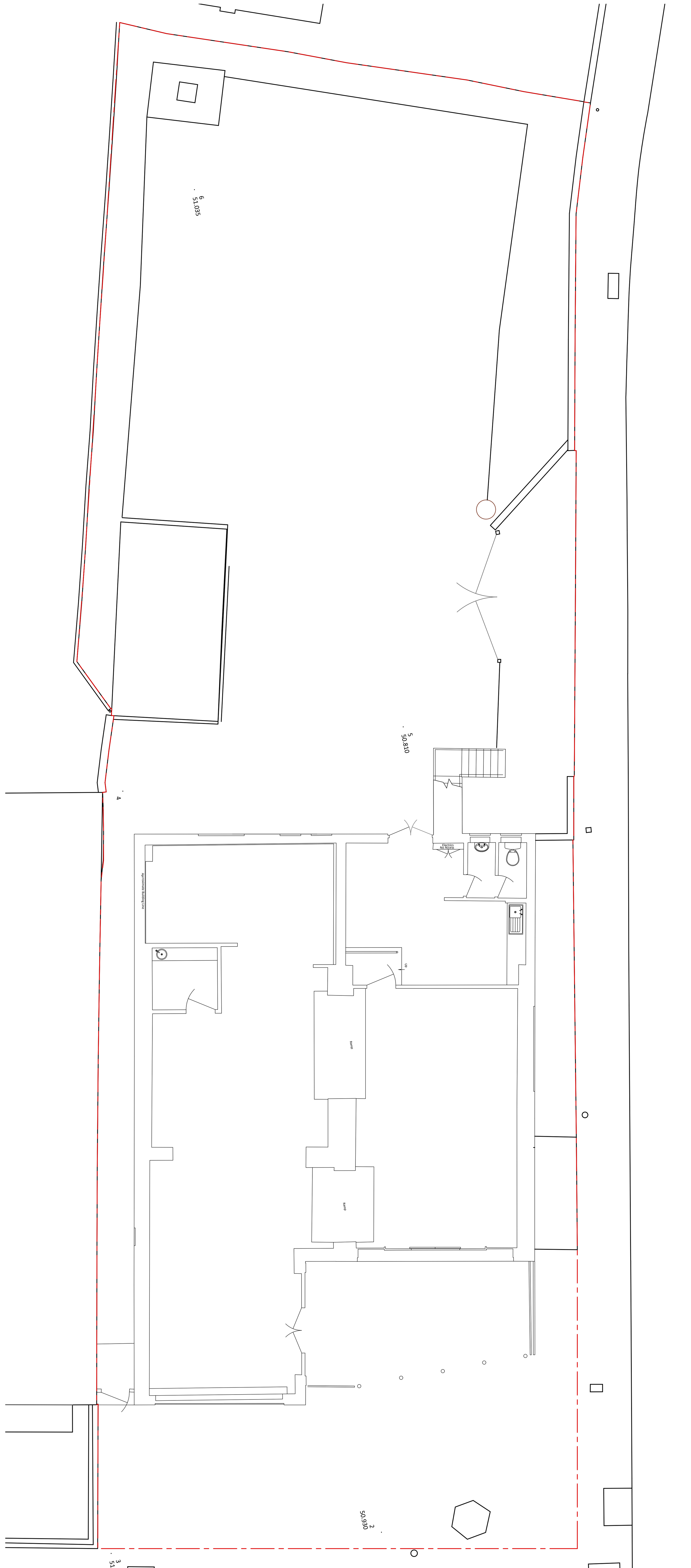
Paper Size: A3
Scale: 1:500
Revision: 1st
Oct-23
Drawn By: ---
Checked By:

B-12 Development
Architectural consultancy

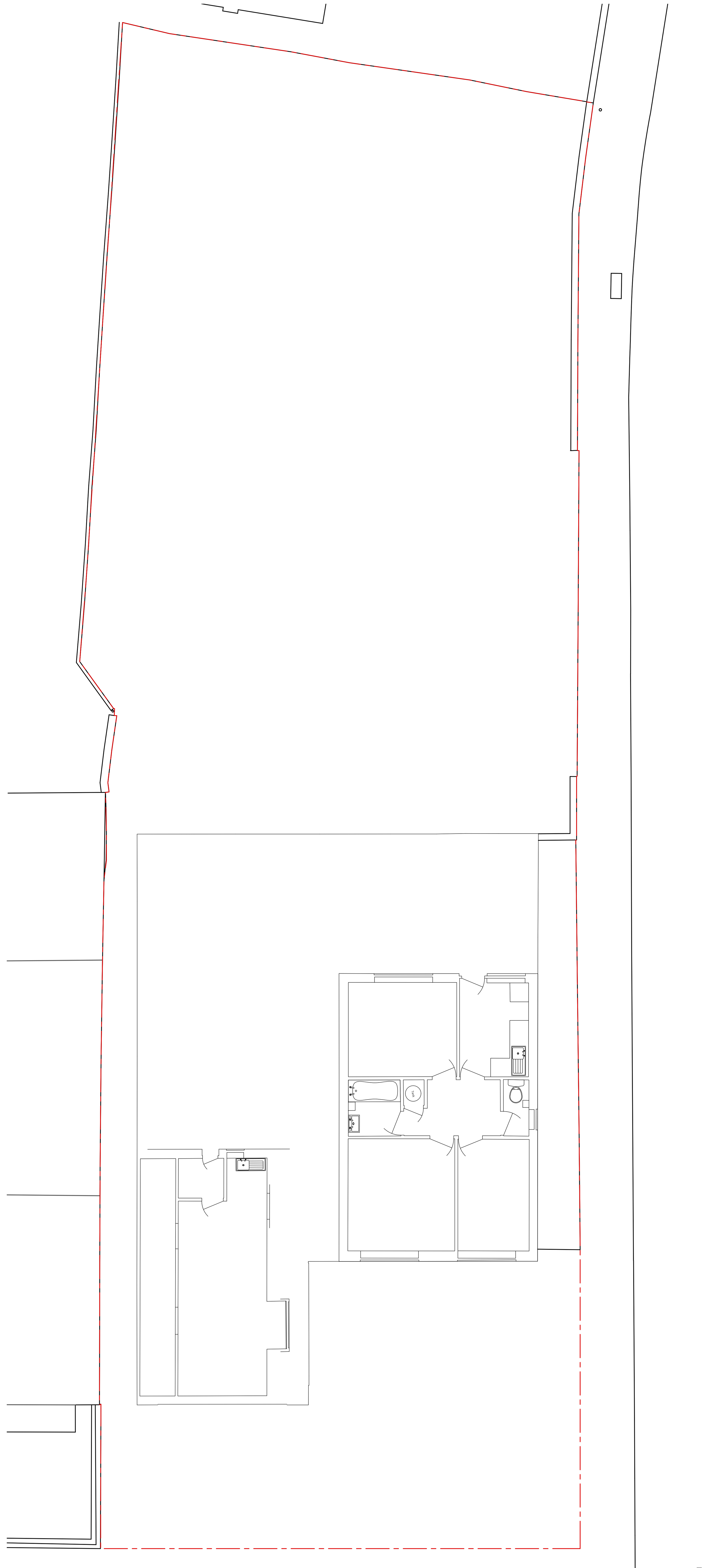
Site Address: 18-20 Station Rd, Longfield DA3 7QD

Existing Site Plan

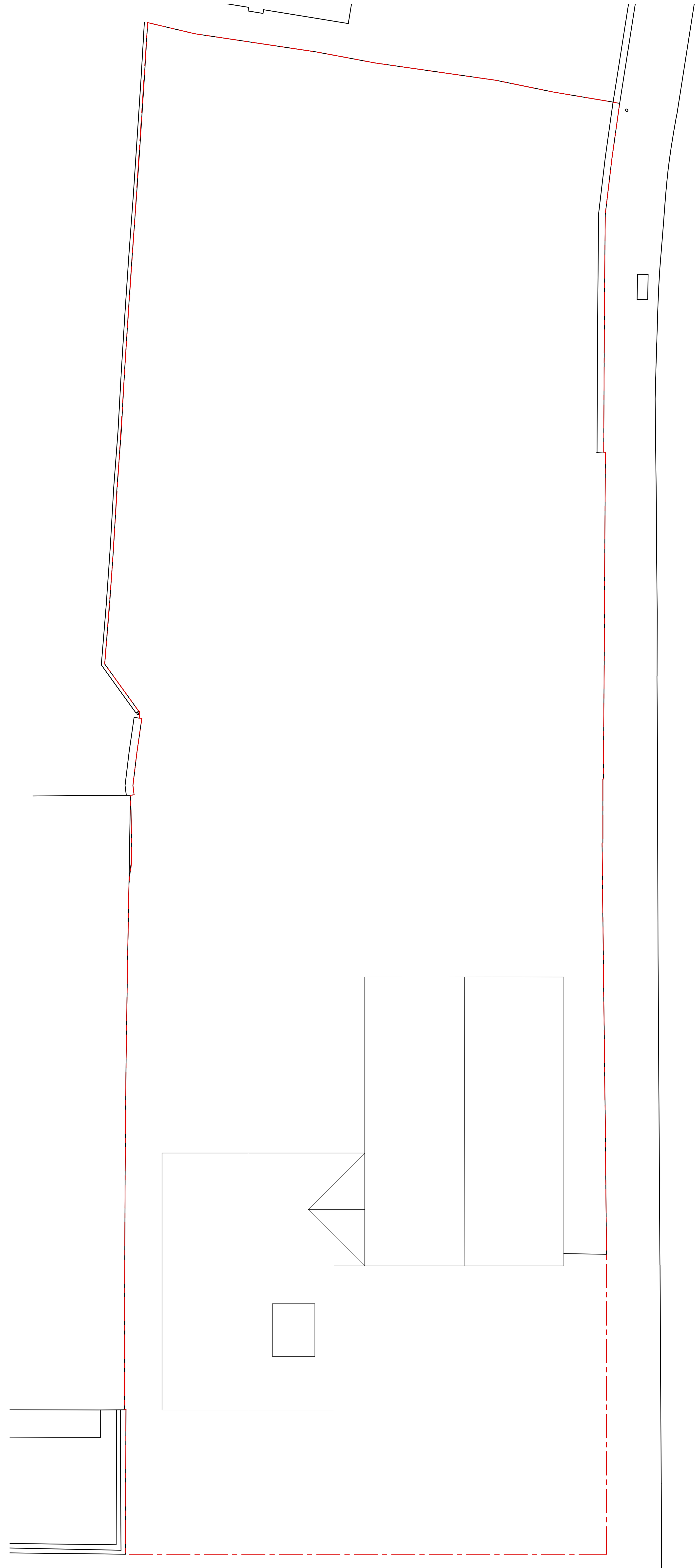
Drawing Number: SR18-AP1-103



Existing Ground Floor Plan
Scale 1:100



Existing First Floor Plan
Scale 1:100



Existing Roof Plan
Scale 1:100

Please note that construction must only commence once planning, building control and any other approvals have been received.
It is the responsibility of the owner/contractor to commence prior to these approvals.

0 1 2 3 4 5 10m

IMPORTANT GENERAL NOTE
The specification is to be read in conjunction with the plans/section details, and other associated Structural details as may be provided.
All work is to be carried out to the Local Authority Planning and Building Regulations Approval, and the Codes of Practice and British Standards as necessary.
All dimensions, levels, sizes, positions and locations of particulars as indicated on drawings are to be verified by the appointed Contractor on site prior to engaging in works. Any discrepancies must be reported to the Architect/Surveyor/Engineer or responsible person/s immediately.
The Contractor is responsible for ensuring compliance with the CDM Regulations, and appropriate Health & Safety on site precautions.
The Client/Building Owner must obtain any necessary PARTY WALL AGREEMENTS, prior to engaging in the works on site.

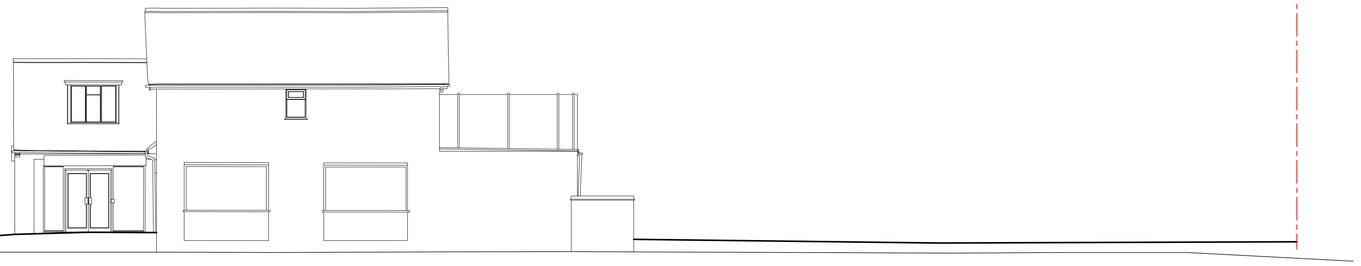
PARTY WALL ACT 1996
OWNER/S MUST ENSURE ALL PARTY WALL AGREEMENTS ARE IN PLACE BEFORE ANY BUILDING WORKS ARE TO COMMENCE

Revision	Date	Description

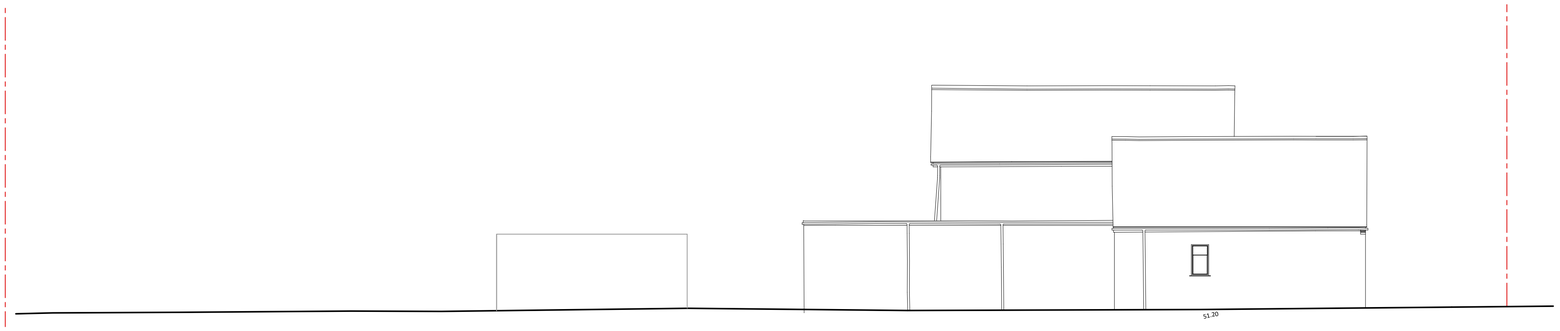
Paper Size	Scale	
A1	1:100	B-12 Development Architectural consultancy
	Revision: 1st	
	Oct-23	Site Address: 18-20 Station Rd, Longfield DA3 7QD
	Drawn By / Checked By: ----	Existing Plans
		Status:
		Drawing Number: SR18-AP1-104

Existing Front Elevation
Scale 1:100

Existing Rear Elevation
Scale 1:100



Existing Side Elevation
Scale 1:100



Existing Side Elevation
Scale 1:100

IMPORTANT GENERAL NOTE
The specification is to be read in conjunction with the plans/section details, and other associated Structural details as may be provided.
All work is to be carried out to the Local Authority Planning and Building Regulations Approval, and the Codes of Practice and British Standards as received.
Figured dimensions are to be taken in preference to scaling. All dimensions noted on drawings are to be verified by the appointed Contractor on site prior to engaging in works. Any discrepancies must be reported to the Architect/Surveyor/Engineer or responsible person/s immediately.
The Contractor is responsible for ensuring compliance with the CDM Regulations, and appropriate Health & Safety on site precautions.
The Client/Building Owner must obtain any necessary PARTY WALL AGREEMENTS, prior to engaging in the works on site.

Revision	Date	Description

Please note that construction must only commence once planning, building control and any other approvals have been received. It is the responsibility of the owner/ contractor to commence prior to these approvals.

0 1 2 3 4 5 10m

PARTY WALL ACT 1996
OWNER/S MUST ENSURE ALL PARTY WALL AGREEMENTS ARE IN PLACE BEFORE ANY BUILDING WORKS ARE TO COMMENCE

Paper Size: A1
Scale: 1:100
Revision: 1st
Date: Oct-23
Drawn By: ****
Checked By:

B-12 Development
Architectural consultancy

Project: 18-20 Station Rd. Longfield DA3 7QD

Existing Elevations

Drawing Number: SR18-AP1-105

0 5 10 25m 50m

Proposed Site Plan Scale 1:500

IMPORTANT GENERAL NOTE
The specification is to be read in conjunction with the plans/section details, and other associated Structural details as may be provided.
All work is to be carried out to the Local Authority Planning and Building Regulations Approval, and the Codes of Practice and British Standards as necessary.
All dimensions, levels, sizes, positions and locations of particulars as indicated on drawings are to be verified by the appointed Contractor on site prior to engaging in works. Any discrepancies must be reported to the Architect/Surveyor/Engineer or responsible person/s immediately.
The Contractor is responsible for ensuring compliance with the CDM Regulations, and appropriate Health & Safety on site precautions.
The Client/Building Owner must obtain any necessary PARTY WALL AGREEMENTS, prior to engaging in the works on site.

Revision	Date	Description

PARTY WALL ACT 1996
OWNER/S MUST ENSURE ALL PARTY WALL AGREEMENTS ARE IN PLACE BEFORE ANY BUILDING WORKS ARE TO COMMENCE

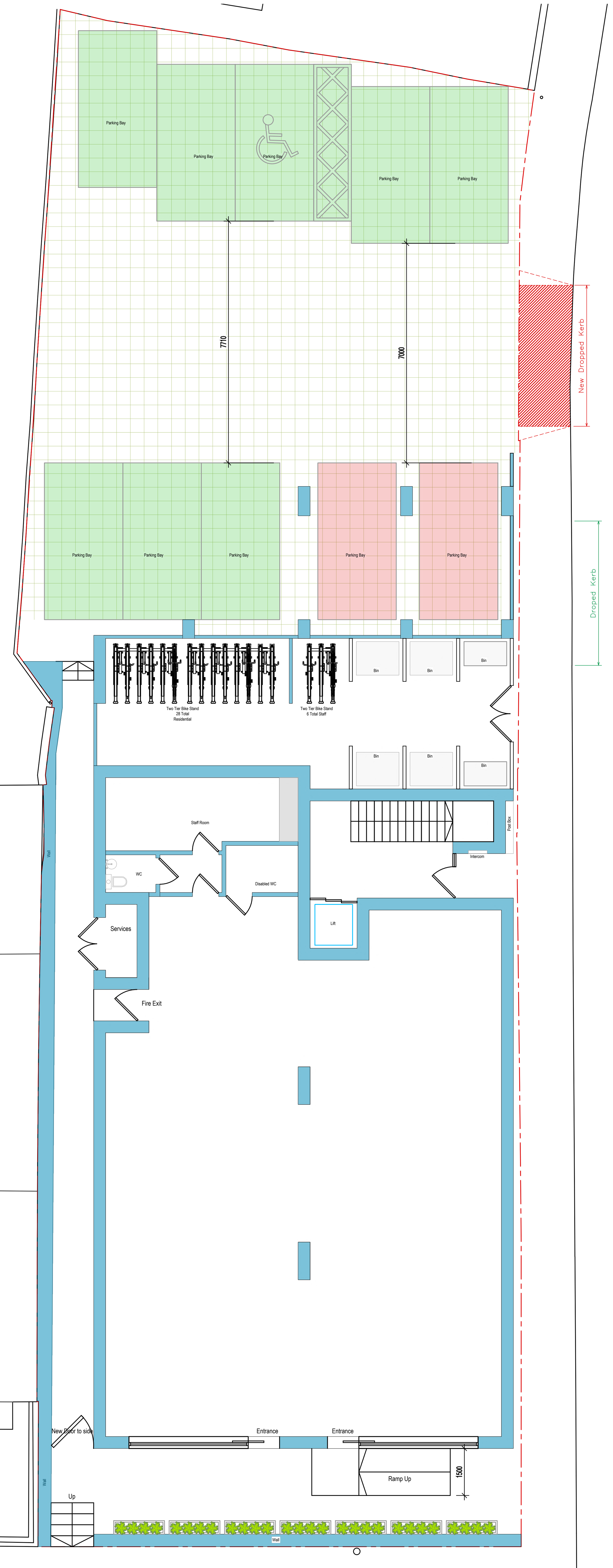
Paper Size: A3
Scale: 1:500
Revision: 1st
Oct-23
Drawn By: ---
Checked By:

B-12 Development
Architectural consultancy

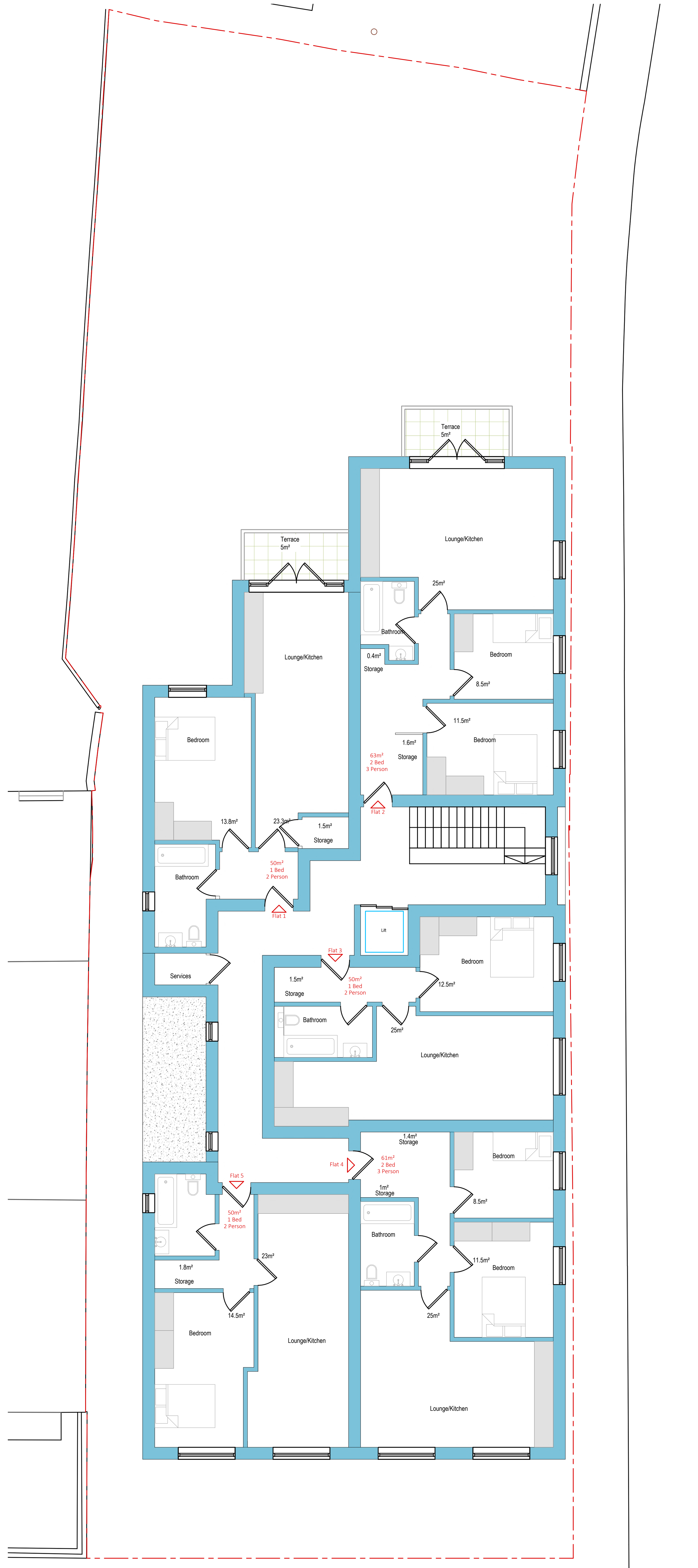
Site Address: 18-20 Station Rd, Longfield DA3 7QD

Proposed Site Plan

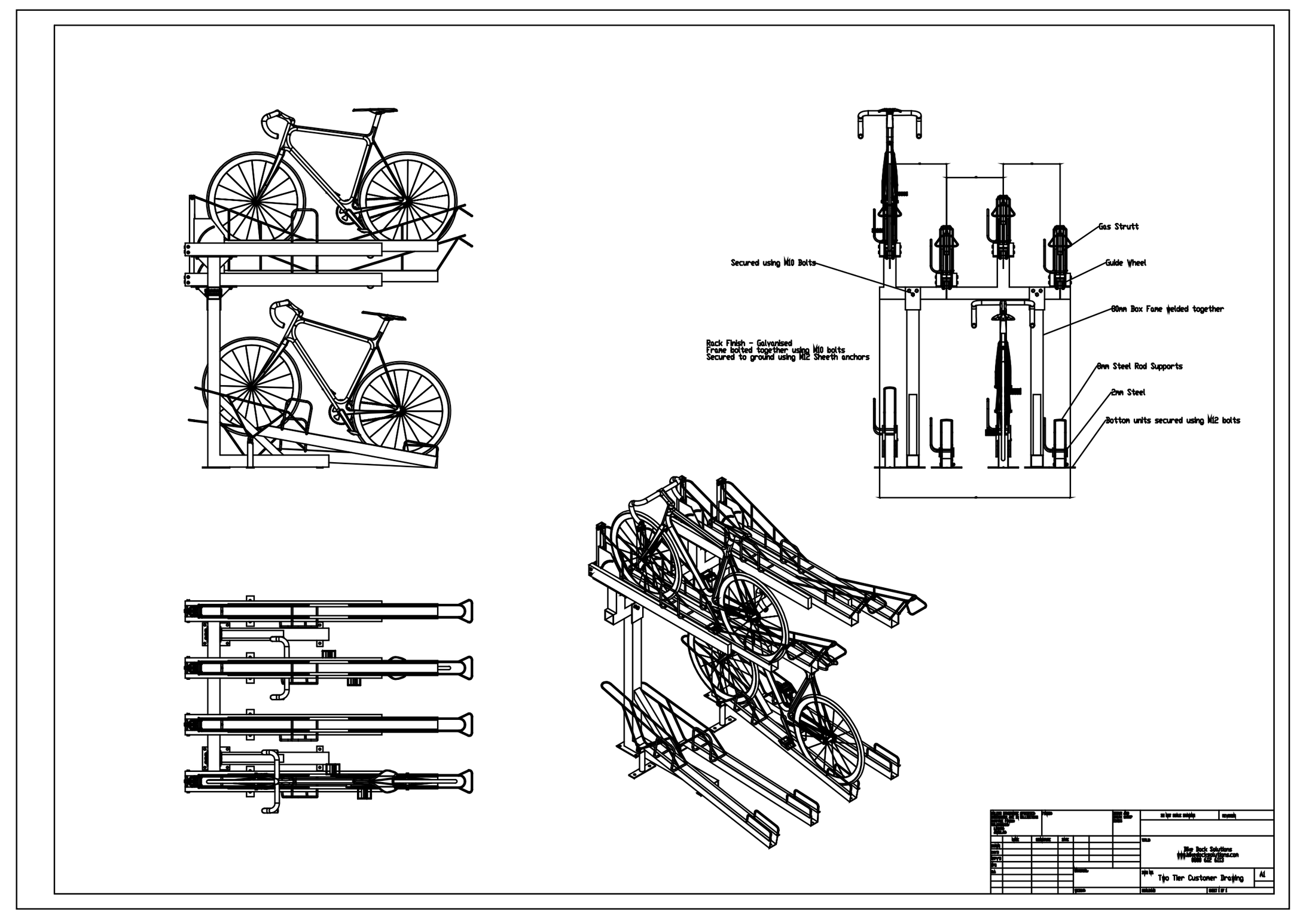
Drawing Number: SR18-AP1-107

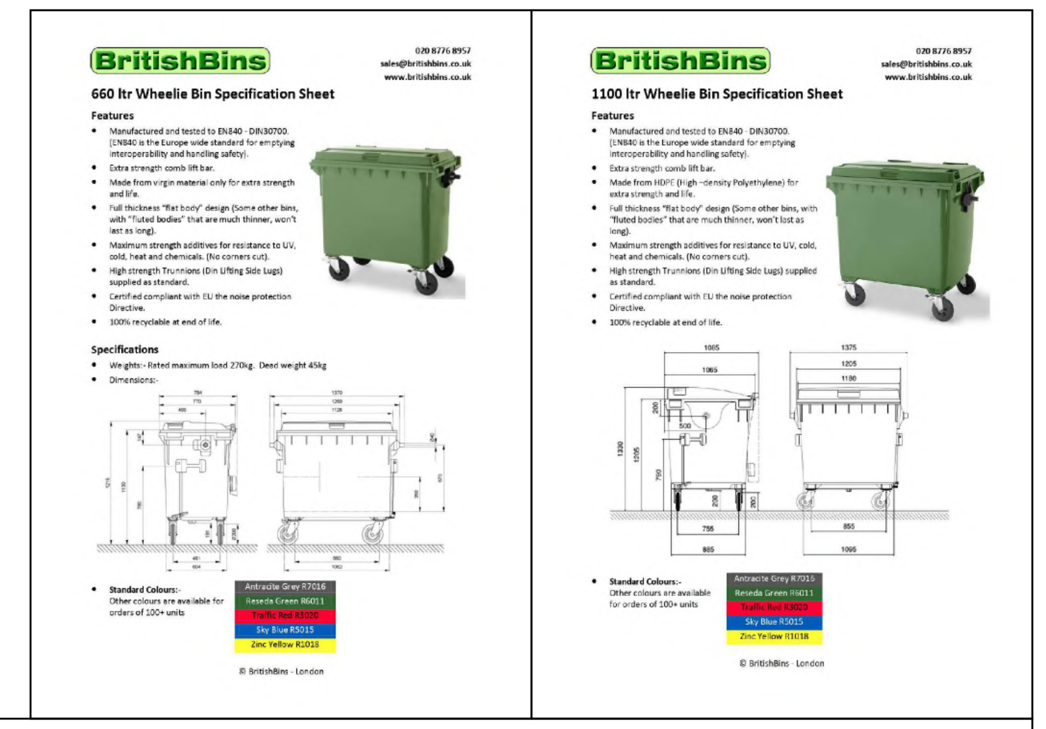


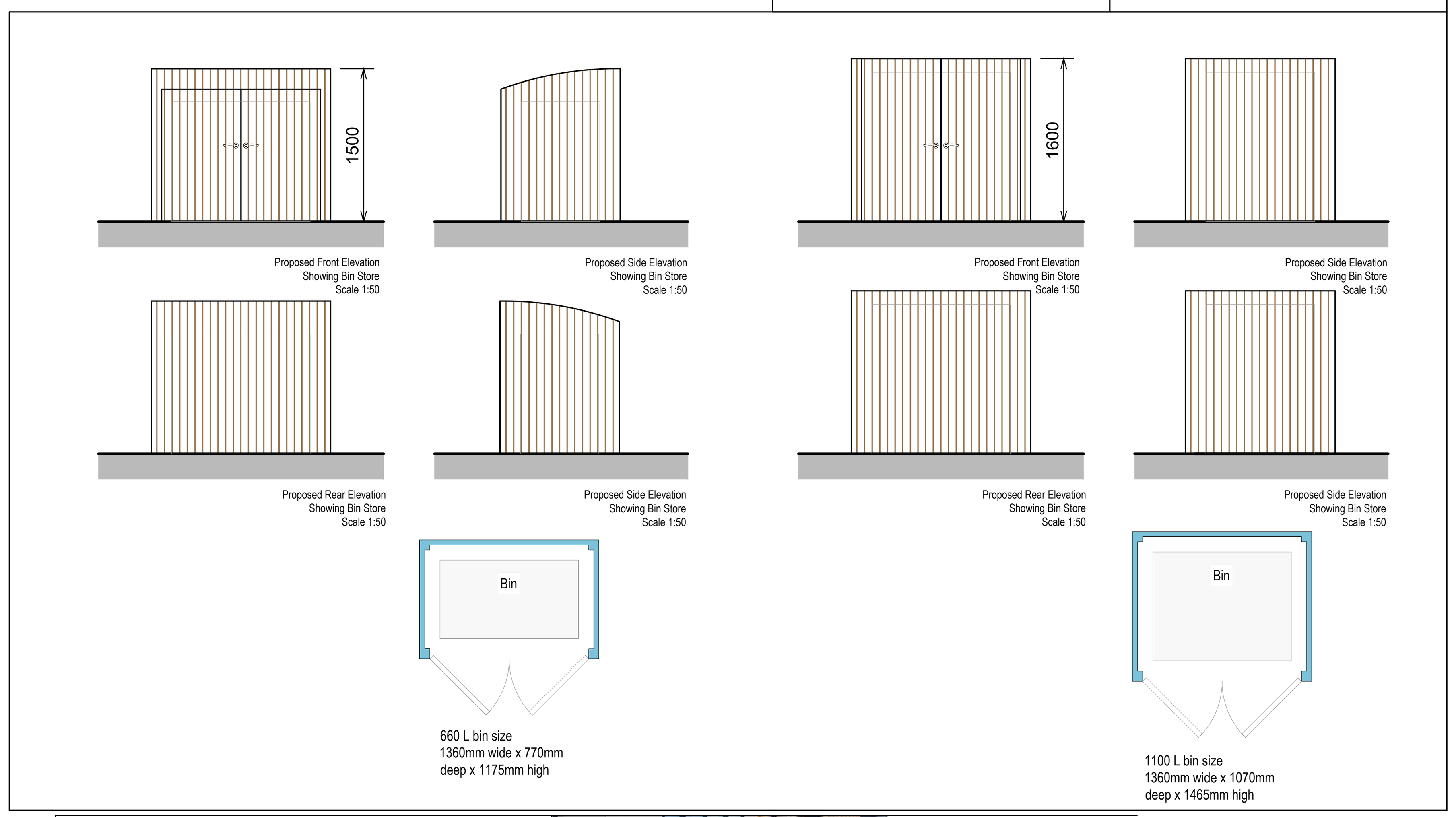
Proposed Ground Floor Plan
Scale 1:100

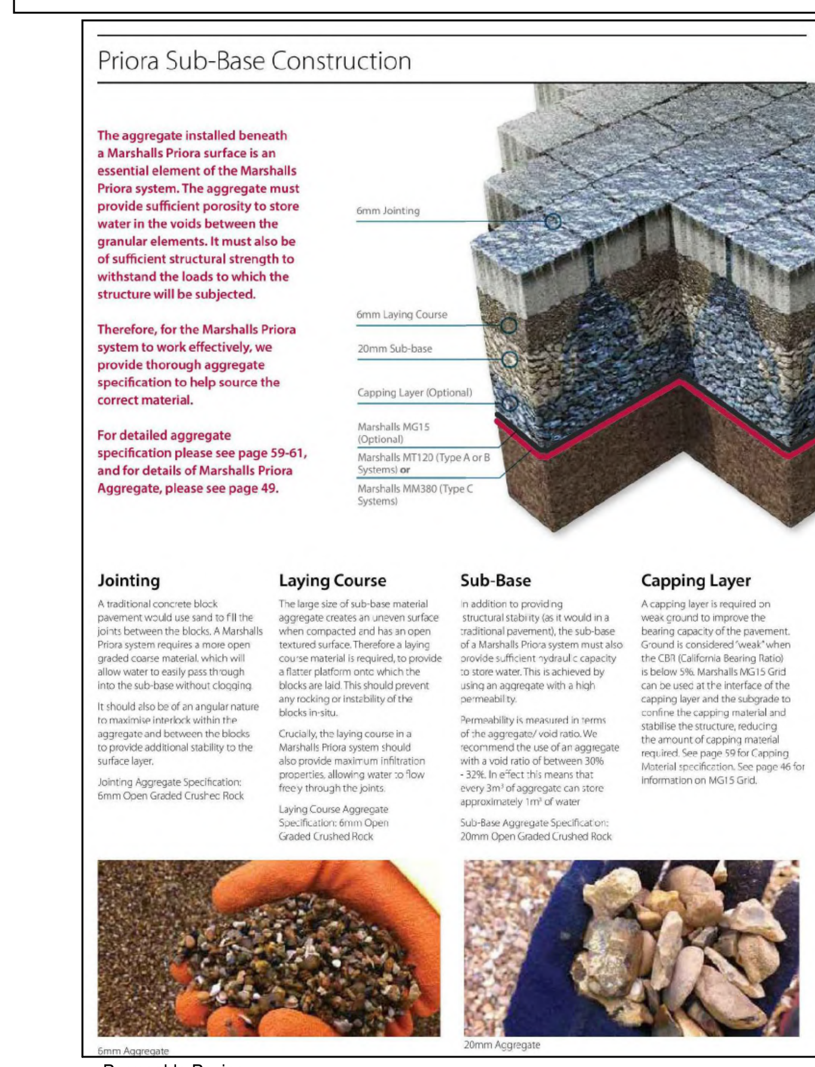


Proposed First Floor Plan
Scale 1:100









Permeable Paving

Please note that construction must only commence once planning, building control and any other approvals have been received. It is the responsibility of the owner/contractor to commence prior to these approvals.

0 1 2 3 4 5 10m

IMPORTANT GENERAL NOTE
The specification is to be read in conjunction with the plans/section details, and other associated Structural details as may be provided.
All work is to be carried out to the Local Authority Planning and Building Regulations Approval, and the Codes of Practice and British Standards as necessary.
All dimensions, levels, sizes, positions and locations of particulars as indicated on drawings are to be verified by the appointed Contractor on site prior to engaging in works. Any discrepancies must be reported to the Architect/Surveyor/Engineer or responsible person/s immediately.
The Contractor is responsible for ensuring compliance with the CDM Regulations, and appropriate Health & Safety on site precautions.
The Client/Building Owner must obtain any necessary PARTY WALL AGREEMENTS, prior to engaging in the works on site.

Revision	Date	Description

PARTY WALL ACT 1996
OWNER/S MUST ENSURE ALL PARTY WALL AGREEMENTS ARE IN PLACE BEFORE ANY BUILDING WORKS ARE TO COMMENCE

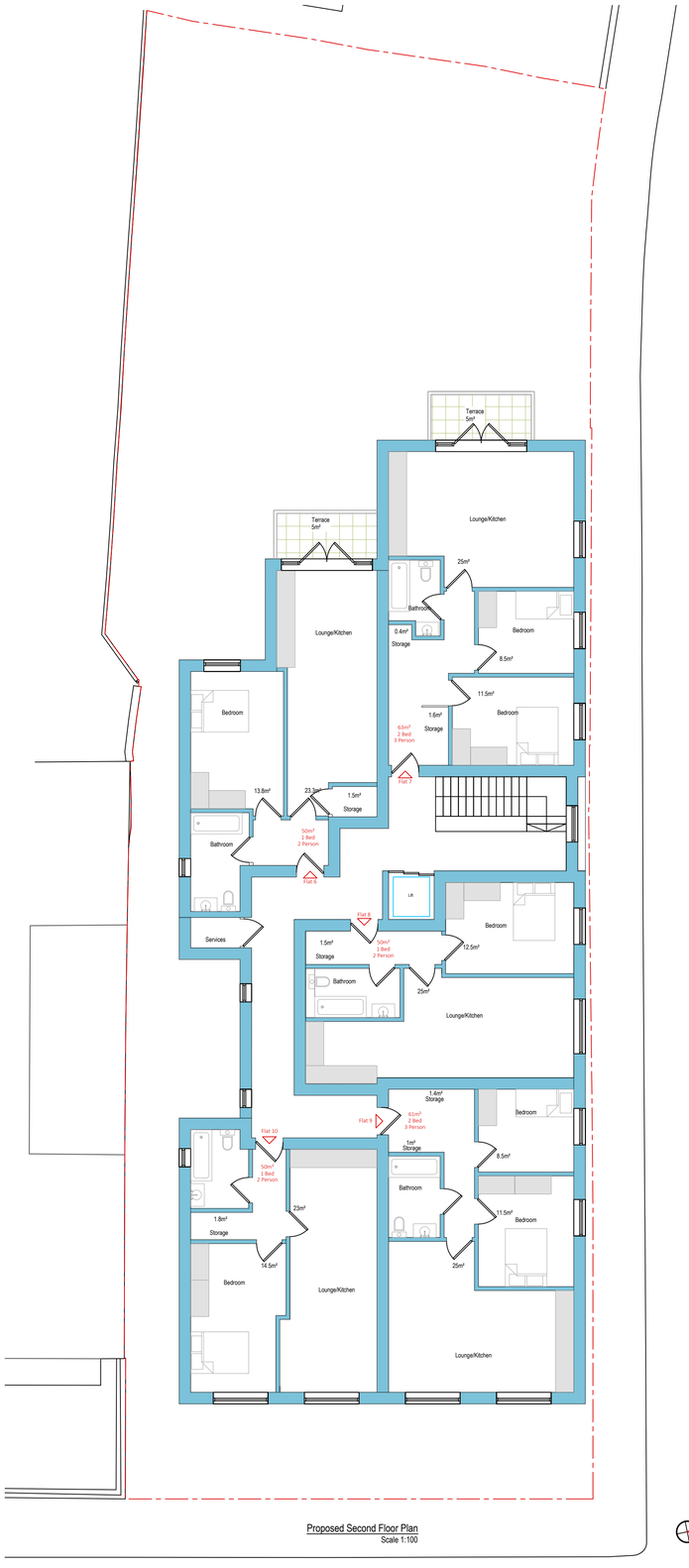
Paper Size	A1
Scale	1:100
Revision	1st
	Oct-23
Drawn By / Checked By	----

B-12 Development
Architectural consultancy

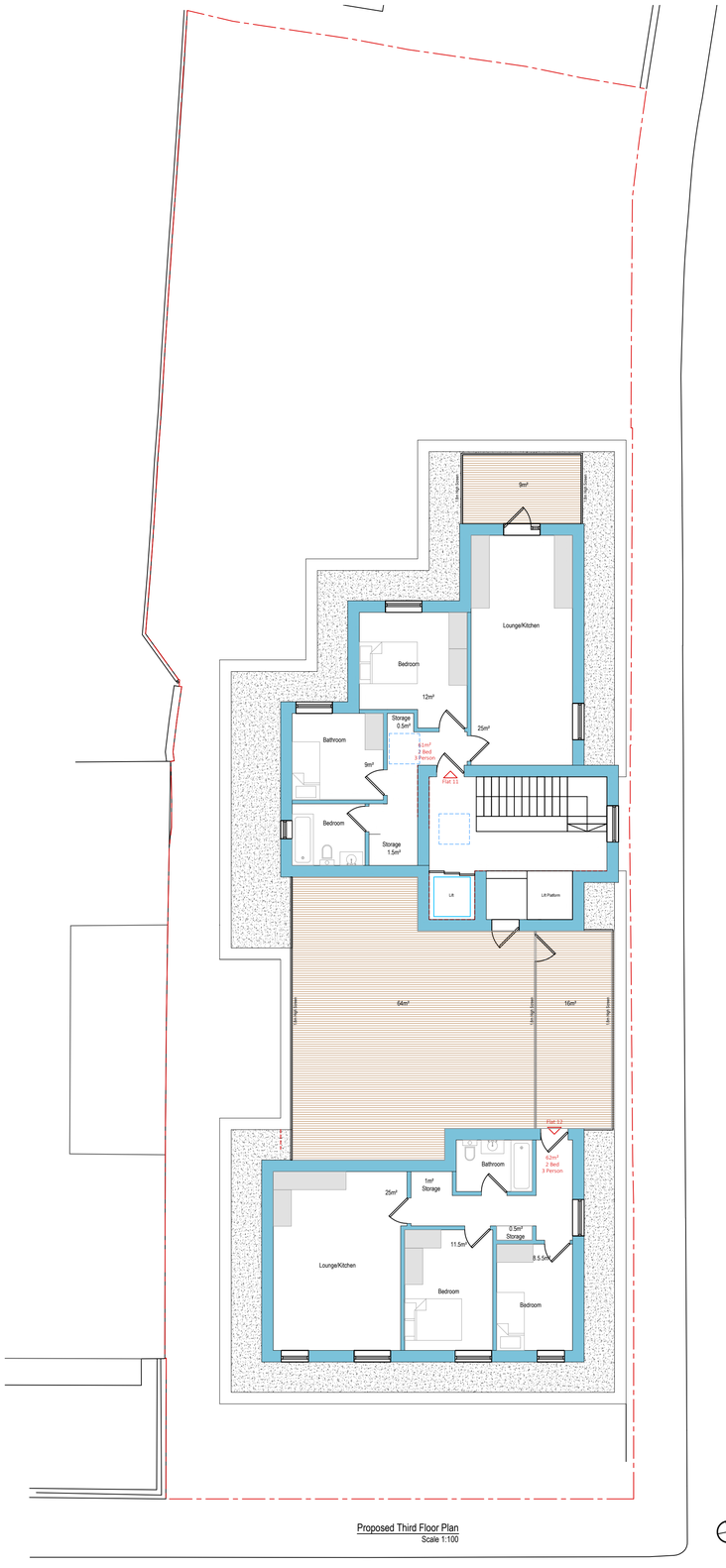
Site Address: 18-20 Station Rd, Longfield DA3 7QD

Proposed GF & FF Plan

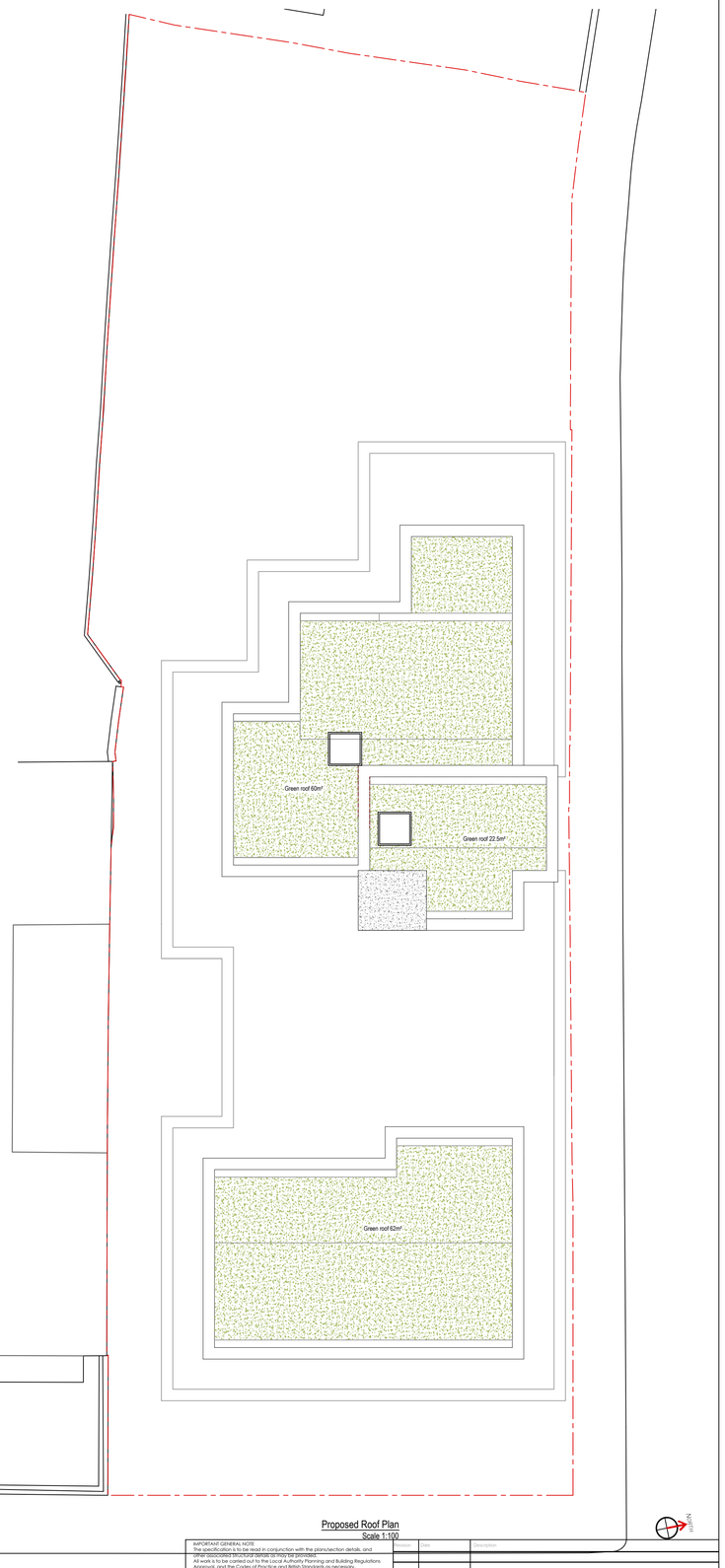
Drawing Number: SR18-AP1-108



Proposed Second Floor Plan
Scale 1:100



Proposed Third Floor Plan
Scale 1:100



Proposed Roof Plan
Scale 1:100

IMPORTANT GENERAL NOTE
The specification is to be read in conjunction with the plans/section details, and any discrepancies are to be brought to our attention.
All work is to be carried out to the Local Authority Planning and Building Regulations Approval, and the Codes of Practice and British Standards as necessary.
All dimensions, levels, sizes, positions and locations of particulars as indicated on drawings are to be verified by the appointed Contractor on site prior to engaging in the works. Any discrepancies are to be reported to the Architect/Surveyor/Engineer or responsible person/s immediately.
The Contractor is responsible for ensuring compliance with the CDM Regulations, and appropriate Health & Safety on site precautions.
The Client/Building Owner must obtain any necessary PARTY WALL AGREEMENTS, prior to engaging in the works on site.

Please note that construction must only commence once planning, building control and any other approvals have been received. It is the responsibility of the owner/contractor to commence prior to these approvals.

0 1 2 3 4 5 10m

PARTY WALL ACT 1996
OWNER/S MUST ENSURE ALL PARTY WALL AGREEMENTS ARE IN PLACE BEFORE ANY BUILDING WORKS ARE TO COMMENCE

No.	Date	Description

Drawing Size: A1
Scale: 1:100
Drawing Status: 1st
Date: Oct-23
Drawn By:
Checked By:

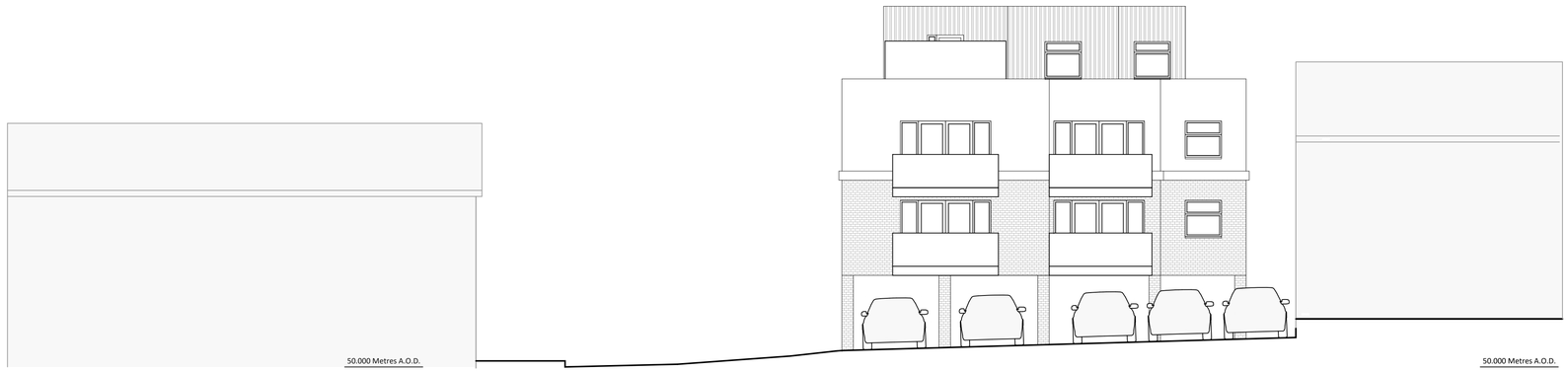
Project: 18-20 Station Rd, Longfield DA3 7QD

B-12 Development
Architectural consultancy

Proposed
SF & TF & Roof Plan

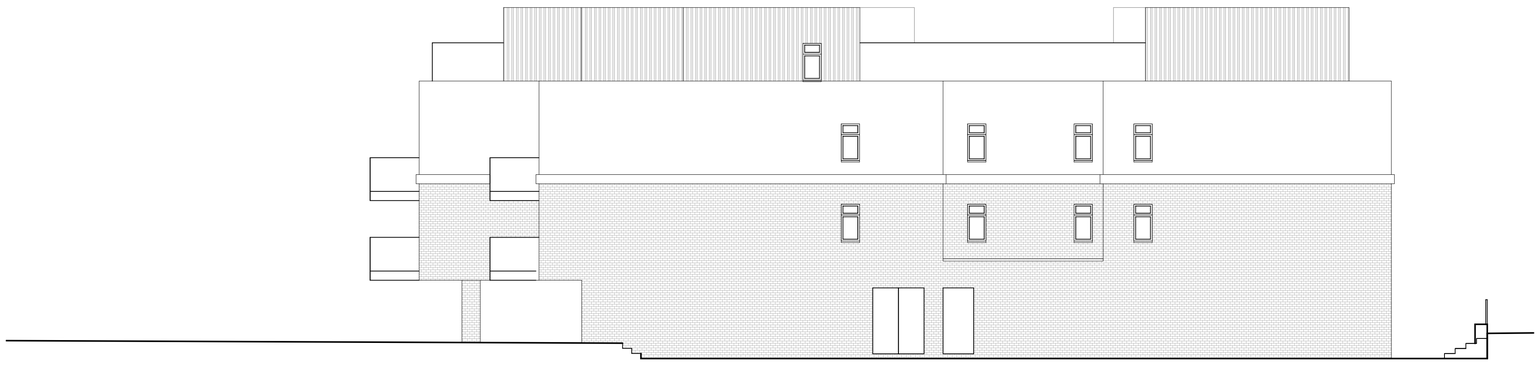
Drawing Number: SR18-AP1-109

Proposed Front Elevation
Scale 1:100



Proposed Rear Elevation
Scale 1:100

Proposed Side Elevation
Scale 1:100



Proposed Side Elevation
Scale 1:100

Please note that construction must only commence once planning, building control and any other approvals have been received. It is the responsibility of the owner/contractor to commence prior to these approvals.

0 1 2 3 4 5 10m

PARTY WALL ACT 1996
OWNER/S MUST ENSURE ALL PARTY WALL AGREEMENTS ARE IN PLACE BEFORE ANY BUILDING WORKS ARE TO COMMENCE

IMPORTANT GENERAL NOTE
The specification is to be read in conjunction with the plans/section details, and other associated Structural details as may be provided.
All work is to be carried out to the Local Authority Planning and Building Regulations Approval, and the Codes of Practice and British Standards as necessary.
All dimensions, levels, sizes, positions and locations of particulars as indicated on drawings are to be checked by the Contractor on site before any work is put in hand or works. Any discrepancies must be reported to the Architect/Surveyor/Engineer or responsible person's immediately.
The Contractor is responsible for ensuring compliance with the CDM Regulations, and appropriate Health & Safety on site precautions.
The Client/Building Owner must obtain any necessary PARTY WALL AGREEMENTS, prior to engaging in the works on site.

Revision	Date	Description

Paper Size: A1

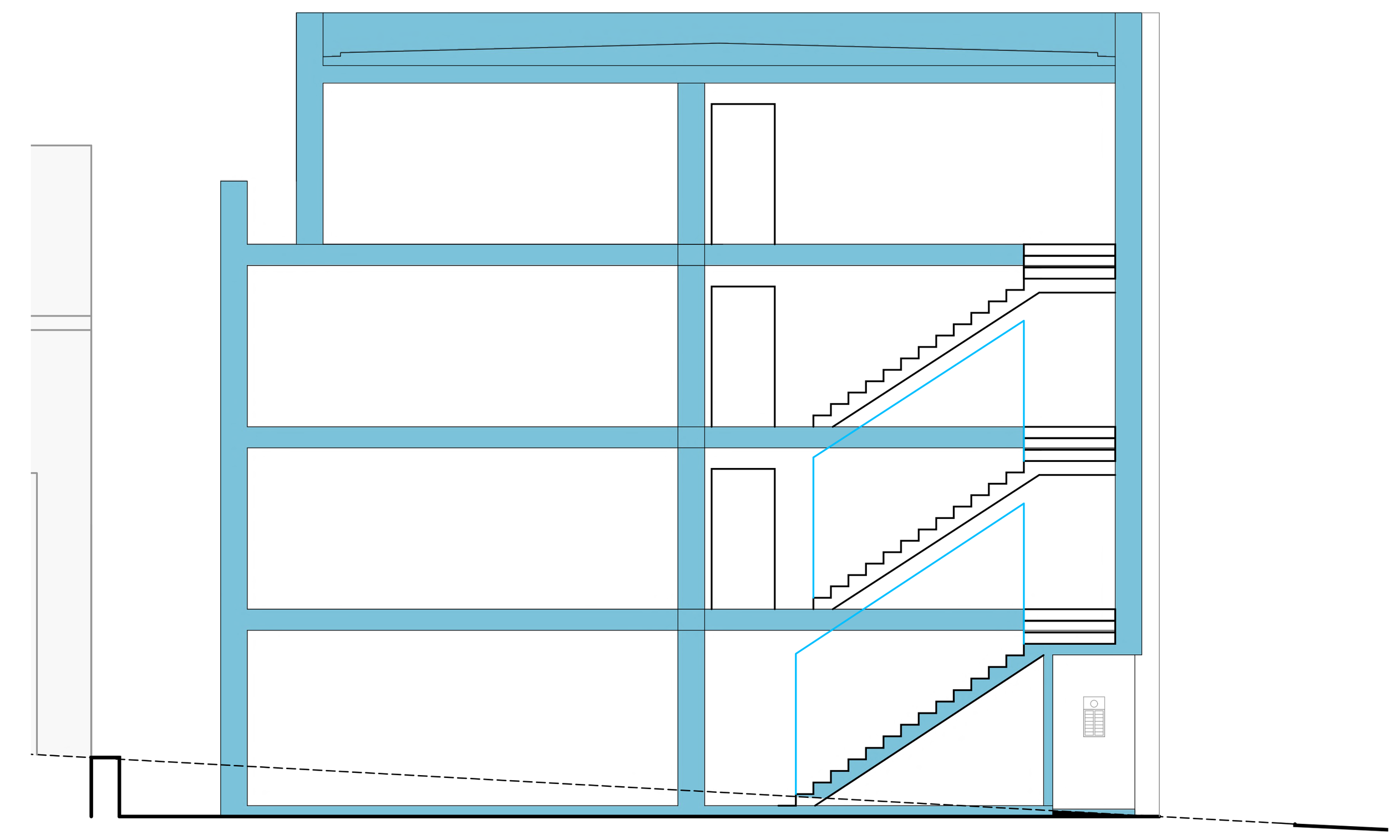
Scale: 1:100
Drawing No: 1st
Date: Oct-23
Drawn By:
Checked By:

B-12 Development
Architectural consultancy

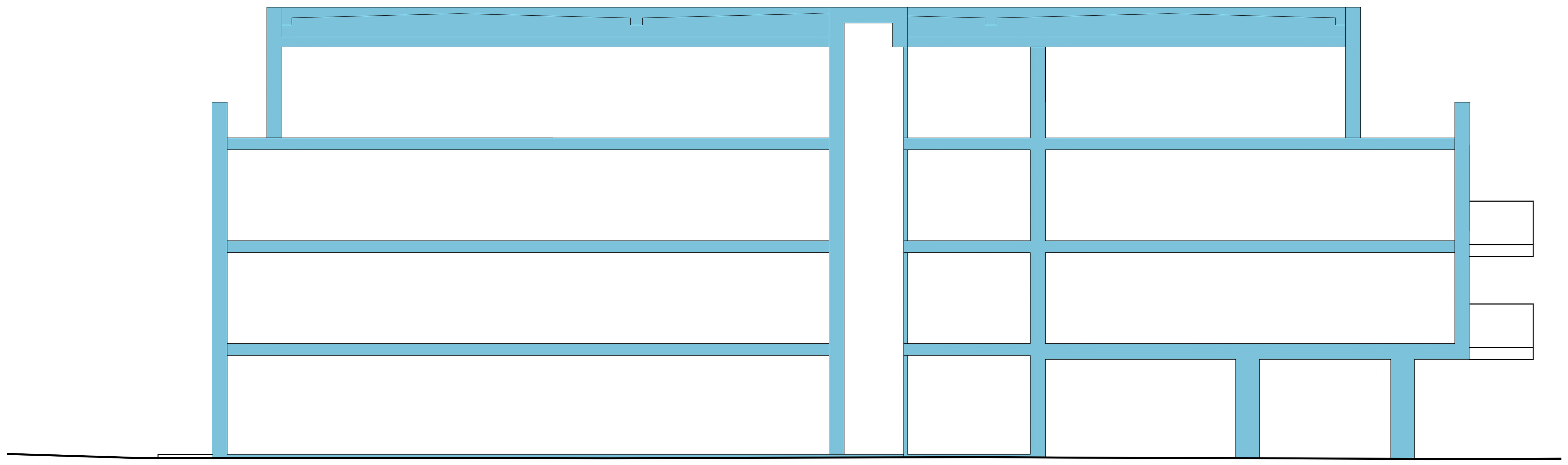
Project: 18-20 Station Rd, Longfield DA3 7QD

Drawing Title: Proposed Elevations

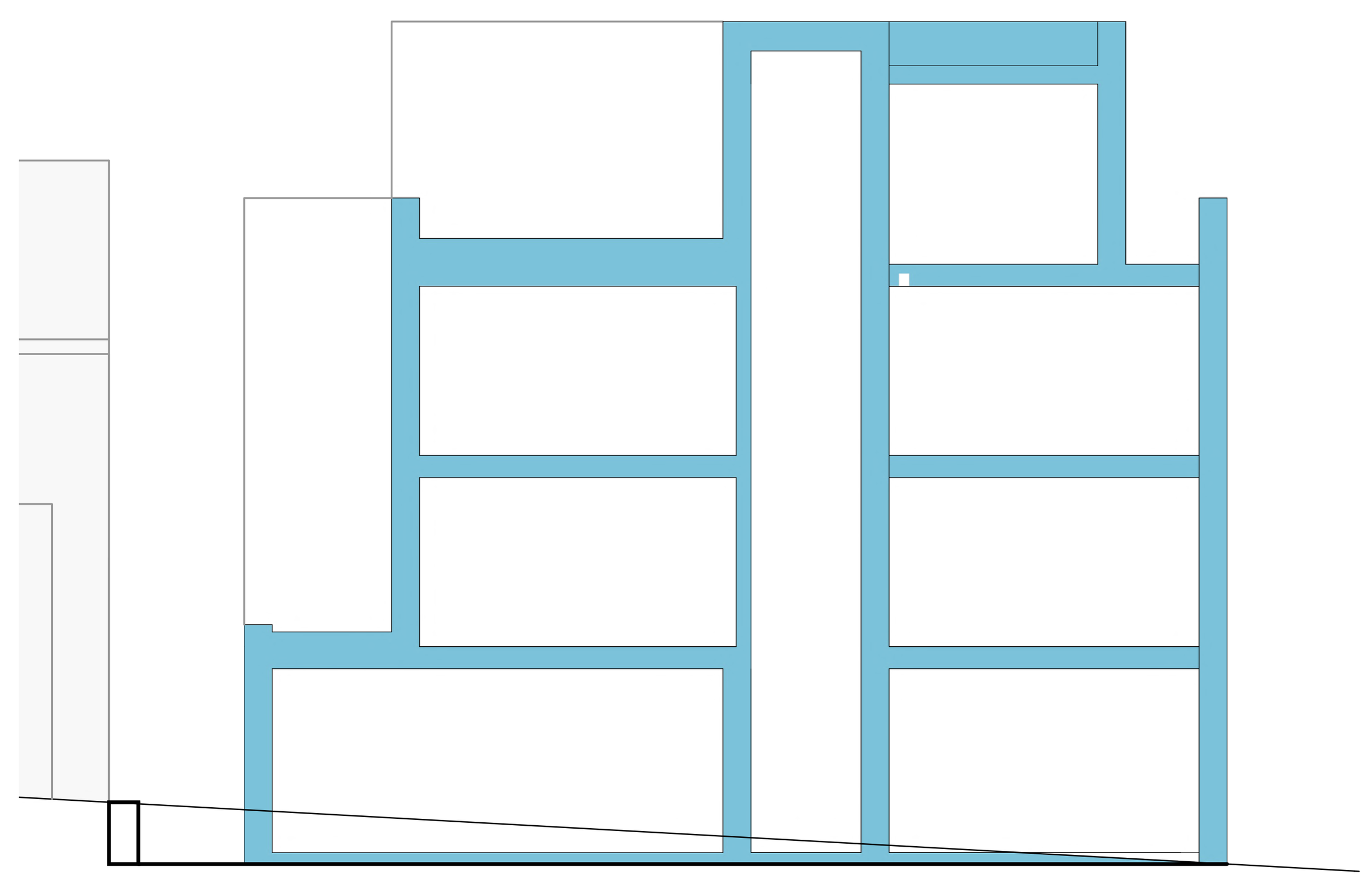
Drawing Number: SR18-AP1-110



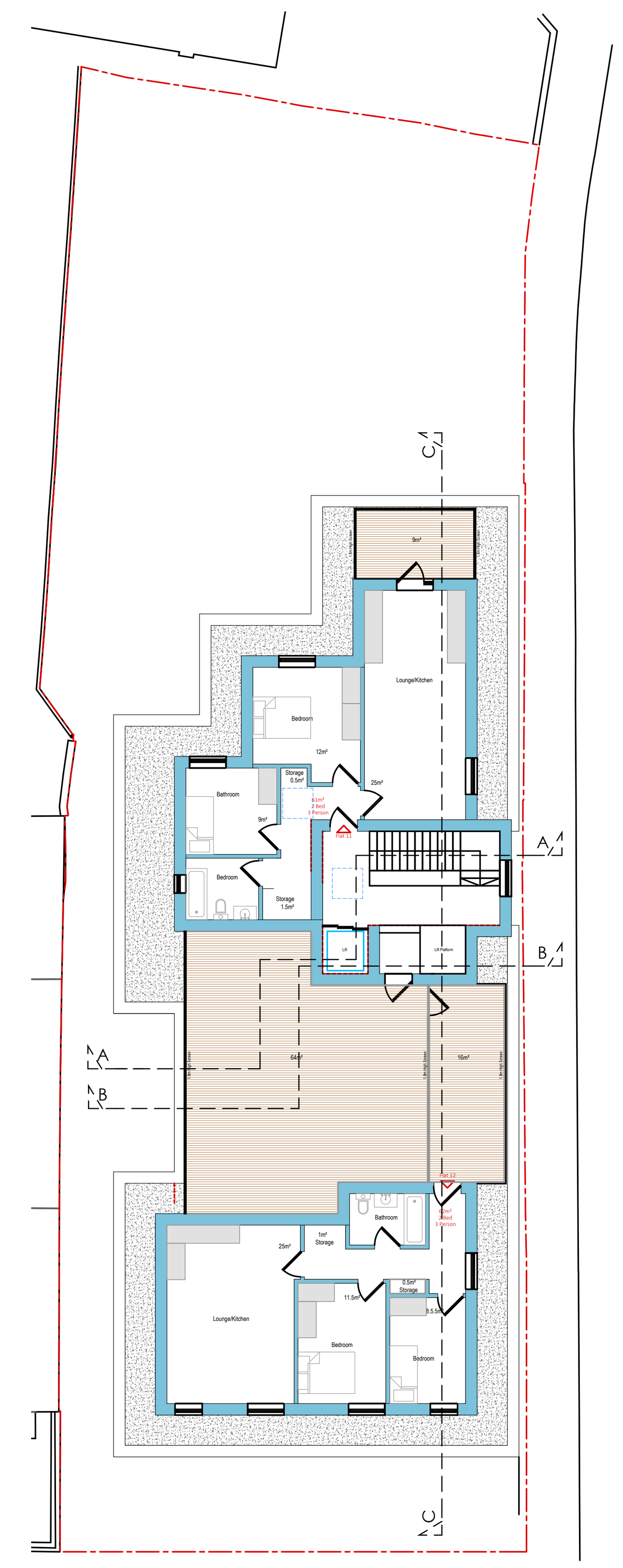
Section A-A
Scale 1:100



Section B-B
Scale 1:100



Section C-C
Scale 1:100



Please note that construction must only commence once planning, building control and any other approvals have been received.
It is the responsibility of the owner/contractor to commence prior to these approvals.

0 1 2 3 4 5 10m

IMPORTANT GENERAL NOTE
The specification is to be read in conjunction with the plans/section details, and other associated Structural details as may be provided.
All work is to be carried out to the Local Authority Planning and Building Regulations Approval, and the Codes of Practice and British Standards as necessary.
All dimensions, levels, sizes, positions and locations of particulars as indicated on drawings are to be verified by the appointed Contractor on site prior to engaging in works. Any discrepancies must be reported to the Architect/Surveyor/Engineer or responsible person/s immediately.
The Contractor is responsible for ensuring compliance with the CDM Regulations, and appropriate Health & Safety on site precautions.
The Client/Building Owner must obtain any necessary PARTY WALL AGREEMENTS, prior to engaging in the works on site.

Revision	Date	Description

PARTY WALL ACT 1996
OWNER/S MUST ENSURE ALL PARTY WALL AGREEMENTS ARE IN PLACE BEFORE ANY BUILDING WORKS ARE TO COMMENCE

Paper Size: A1
Scale: 1:100
Revision: 1st
Oct-23
Drawn By: ---- Checked By:

B-12 Development
Architectural consultancy

Site Address: 18-20 Station Rd, Longfield DA3 7QD
Status:

Existing & Proposed Plans & Elevations
Drawing Number: SR18-AP1-111

Existing Street Scene
Scale 1:100

Proposed Street Scene
Scale 1:100

IMPORTANT GENERAL NOTE
The specification is to be read in conjunction with the plans/section details, and other associated Structural details as may be provided.
All work is to be carried out to the Local Authority Planning and Building Regulations Approval, and the Codes of Practice and British Standards as necessary.
All dimensions, levels, sizes, positions and locations of particulars as indicated on drawings are to be verified by the appointed Contractor on site prior to engaging in works. Any discrepancies must be reported to the Architect/Surveyor/Engineer or responsible person/s immediately.
The Contractor is responsible for ensuring compliance with the CDM Regulations, and appropriate Health & Safety on site precautions.
The Client/Building Owner must obtain any necessary PARTY WALL AGREEMENTS, prior to engaging in the works on site.

Revision	Date	Description

Please note that construction must only commence once planning, building control and any other approvals have been received.
It is the responsibility of the owner/contractor to commence prior to these approvals.

0 1 2 3 4 5 10m

PARTY WALL ACT 1996
OWNER/S MUST ENSURE ALL PARTY WALL AGREEMENTS ARE IN PLACE BEFORE ANY BUILDING WORKS ARE TO COMMENCE

Paper Size: A2
Scale: 1:100
Revision: 1st
Oct-23
Drawn By: ----
Checked By:

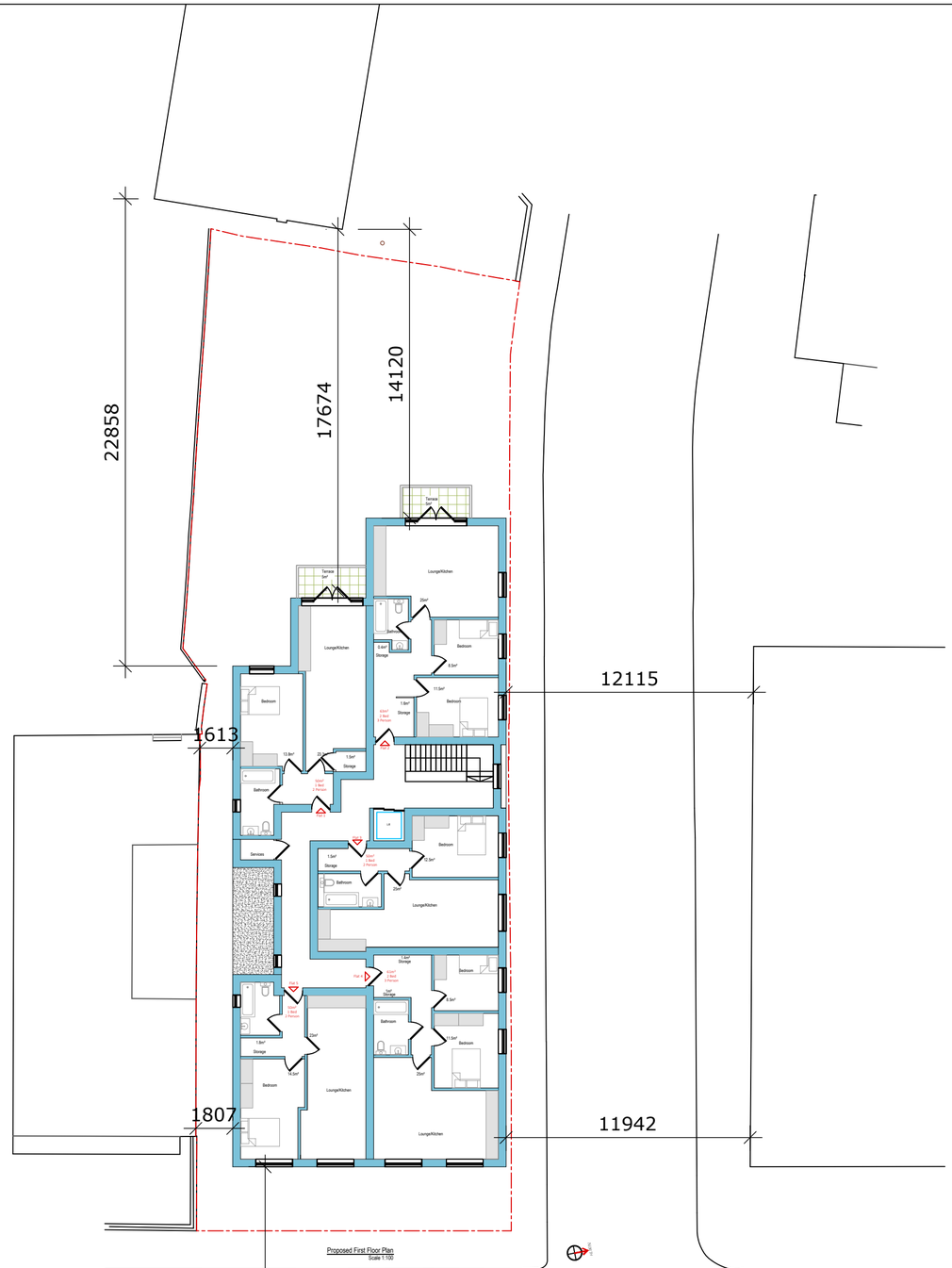
B-12 Development

Architectural consultancy

Address: 18-20 Station Rd, Longfield DA3 7QD

Existing & Proposed Street Scene

Drawing Number: SR18-AP1-112



0 1 2 3 4 5 10 20m

IMPORTANT GENERAL NOTE
The specification is to be read in conjunction with the plans/section details, and other associated Structural details as may be provided.
All work is to be carried out to the Local Authority Planning and Building Regulations Approval, and the Codes of Practice and British Standards as necessary.
All dimensions, levels, sizes, positions and locations of particulars as indicated on drawings are to be verified by the appointed Contractor on site prior to engaging in works. Any discrepancies must be reported to the Architect/Surveyor/Engineer or responsible person/s immediately.
The Contractor is responsible for ensuring compliance with the CDM Regulations, and appropriate Health & Safety on site precautions.
The Client/Building Owner must obtain any necessary PARTY WALL AGREEMENTS, prior to engaging in the works on site.

Revision	Date	Description

PARTY WALL ACT 1996
OWNER/S MUST ENSURE ALL PARTY WALL AGREEMENTS ARE IN PLACE BEFORE ANY BUILDING WORKS ARE TO COMMENCE

Paper Size: A2
Scale: 1:200
Revision: 1st
Date: Oct-23
Drawn By: ---
Checked By:

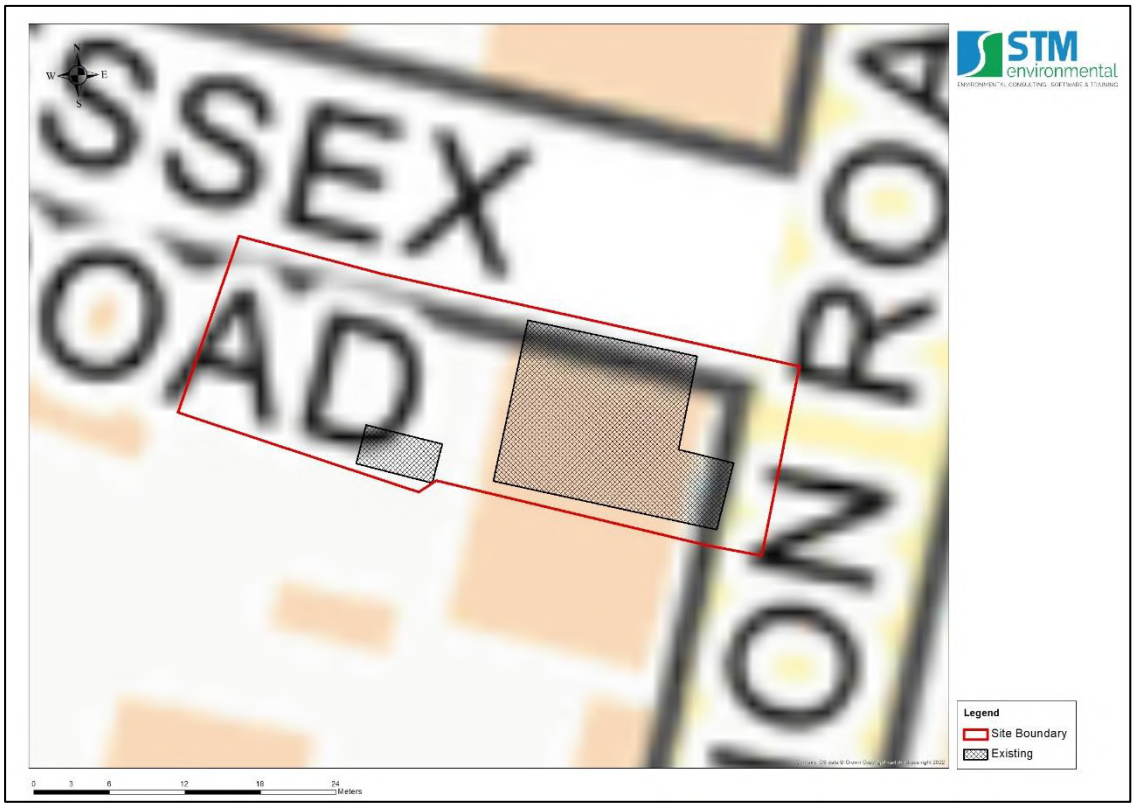
B-12 Development
Architectural consultancy

Site Address:
18-20 Station Rd,
Longfield
DA3 7QD

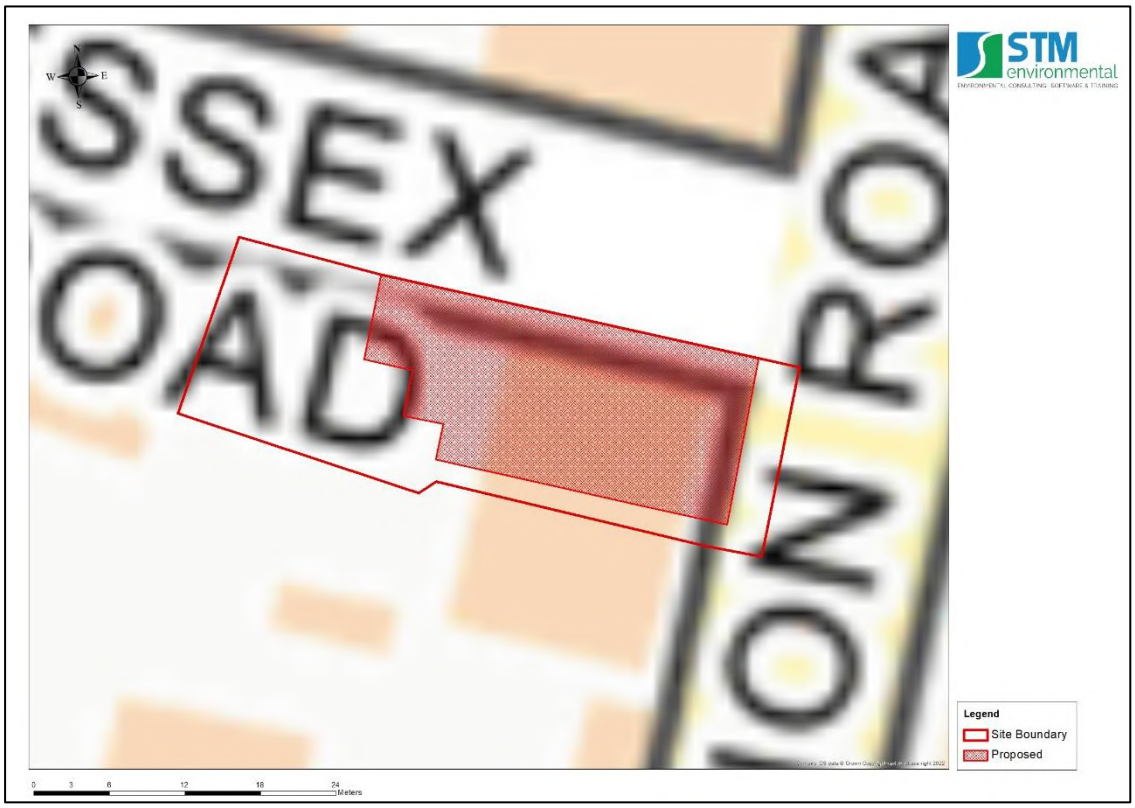
Distances

Drawing Number:
SR18-AP1-113

12.1.2 Existing Development



12.1.3 Proposed (No Additional SuDS)

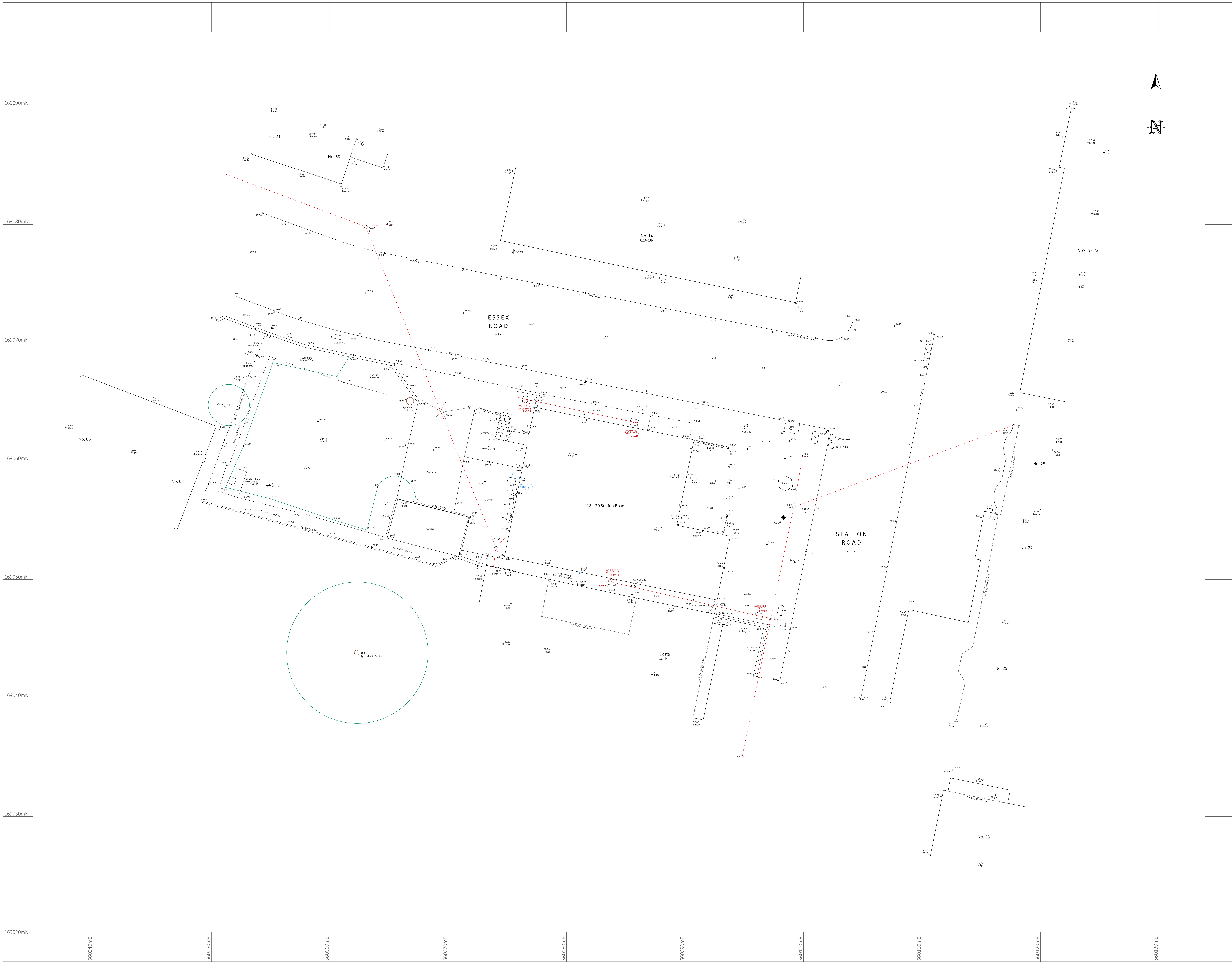


12.2 Appendix 2– Site Topography and Drainage Characteristics

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

12.2.2 Topographic Survey

See next page.



NOTES

1. LEVELS ARE RELATED TO ORDNANCE SURVEY BY GPS OBSERVATION.
2. SURVEY ORIENTATED NORTH BY GPS OBSERVATION.
3. GIRTH, SPREADS, HEIGHTS AND SPECIES OF TRESS ARE INDICATIVE ONLY.
4. SURVEY HAS BEEN CARRIED OUT TO AN ACCURACY COMMENSURATE WITH A 1:100 SCALE DRAWING.
5. DETAILS IN ADJACENT PROPERTIES ARE APPROXIMATE WHERE WE HAVE NO ACCESS.
6. LEVELS SHOWN ON KERB LINES ARE ROAD (CHANNEL) LEVELS.
7. ALL CRITICAL DIMENSIONS AND LEVELS SHOULD BE CHECKED PRIOR TO DESIGN AND/OR CONSTRUCTION.

ABBREVIATION LIST

AV AIR VALVE
B BOLLARD
CL COVER LEVEL
DK DROP KERB
DPC DAMP PROOF COURSE
ECB ELECTRIC CABLE CABINET
ECP ELECTRIC CABLE PIT
EP ELECTICITY POLE
ER EARTH ROD
FAI FRESH AIR INLET
FH FIRE HYDRANT
GC GAS COCK
GU GULLY
GUS GULLY SURROUND
IC INSPECTION COVER
IL INVERT LEVEL
LC LAMP COLUMN
M SERVICE MARKER
MH MANHOLE COVER
NPV NO PIPES VISIBLE
OHC OVERHEAD CABLES
RS ROAD SIGN
RWP RAIN WATER PIPE
SC STOP COCK
SV STOP VALVE
SVP SOIL AND VENT PIPE
TBM TEMPORARY BENCH MARK
TCB TELEPHONE CABLE CABINET
TC TELEPHONE CABLE PIT
TP TELEPHONE POLE
TOS TOP OF SILT
TOP TOP OF PILLAR
TOW TOP OF WALL
TV CABLE TV PIT
UTL UNABLE TO LIFT
VP VENT PIPE
WL WATER LEVEL
WM WATER METER
WO WASH OUT

STATION CO-ORDINATES

NO.	EASTING	NORTHING	LEVEL
1	560075.523	169077.691	50.200
2	560098.309	169055.245	50.930
3	560097.248	169046.605	51.322
4	560073.328	169051.847	51.121
5	560073.095	169061.080	50.810
6	560054.850	169057.947	51.035

2
122.11 SURVEY STATION

STATIONS IN HARD SURFACES ARE CROSS HEAD GALVANISED BOLTS.

STATIONS IN SOFT GROUND ARE PEGS AT GROUND LEVEL WITH CROSS HEAD GALVANIZED SCREWS.

NO.	DATE	DETAILS

REVISIONS

KND SURVEYS LTD

74 WATCHET LANE
HOLMER GREEN
HIGH WYCOMBE
BUCKINGHAMSHIRE
HP15 6UG

Tel: 01494 718453
Fax: 01494 717576
e-mail: admin.office@kndsurveys.com

CLIENT

HODGSON PHARMACY LTD
59 STATION ROAD
LONGFIELD

JOB TITLE

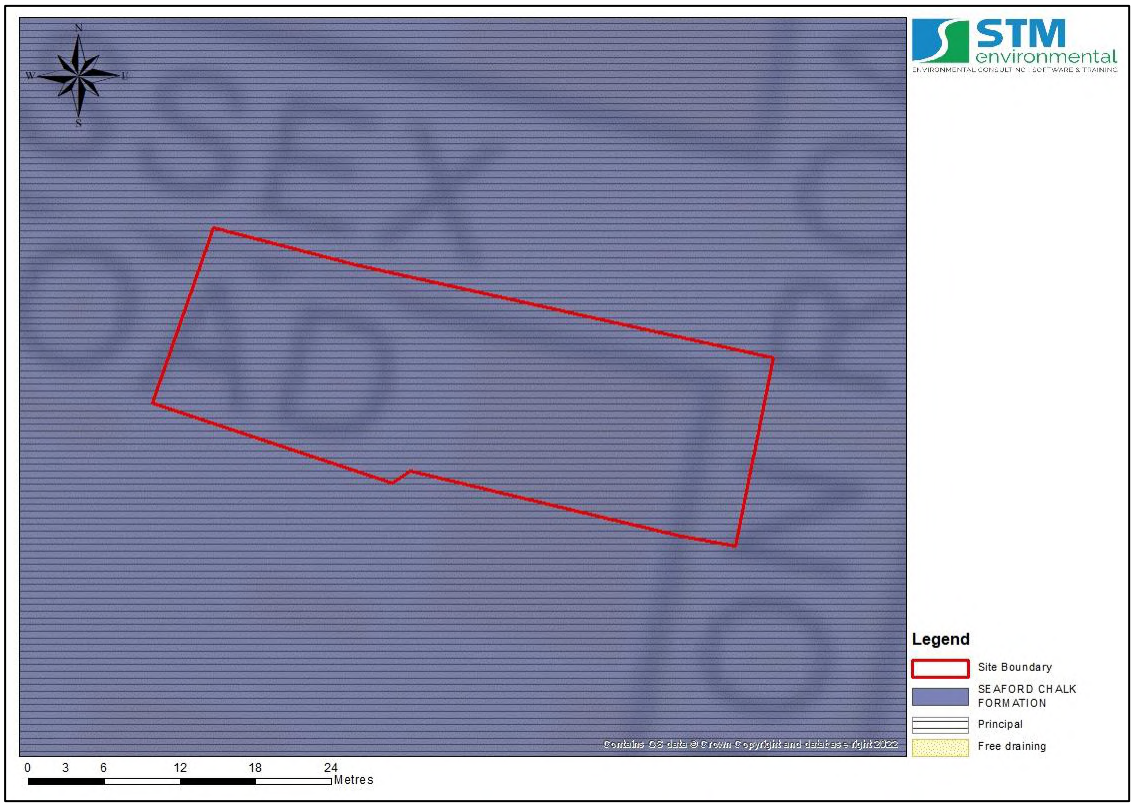
18 - 20 STATION ROAD
LONGFIELD
DARTFORD
KENT
DA3 7QD

DRAWING TITLE

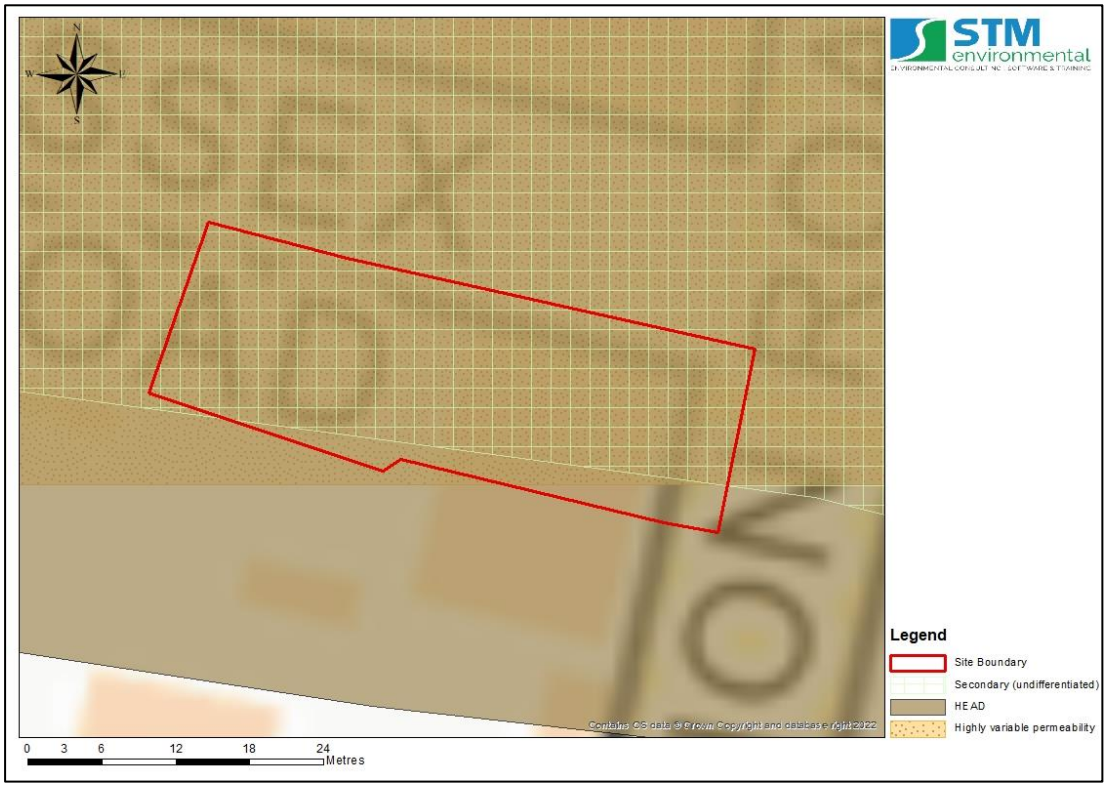
SITE SURVEY

DRAWING No.	DRAWN BY	DATE
G1723 - T	MTP	26 JUL 2023
SURVEYED BY DJH / ML		SCALE 1:100 A0 Sheet

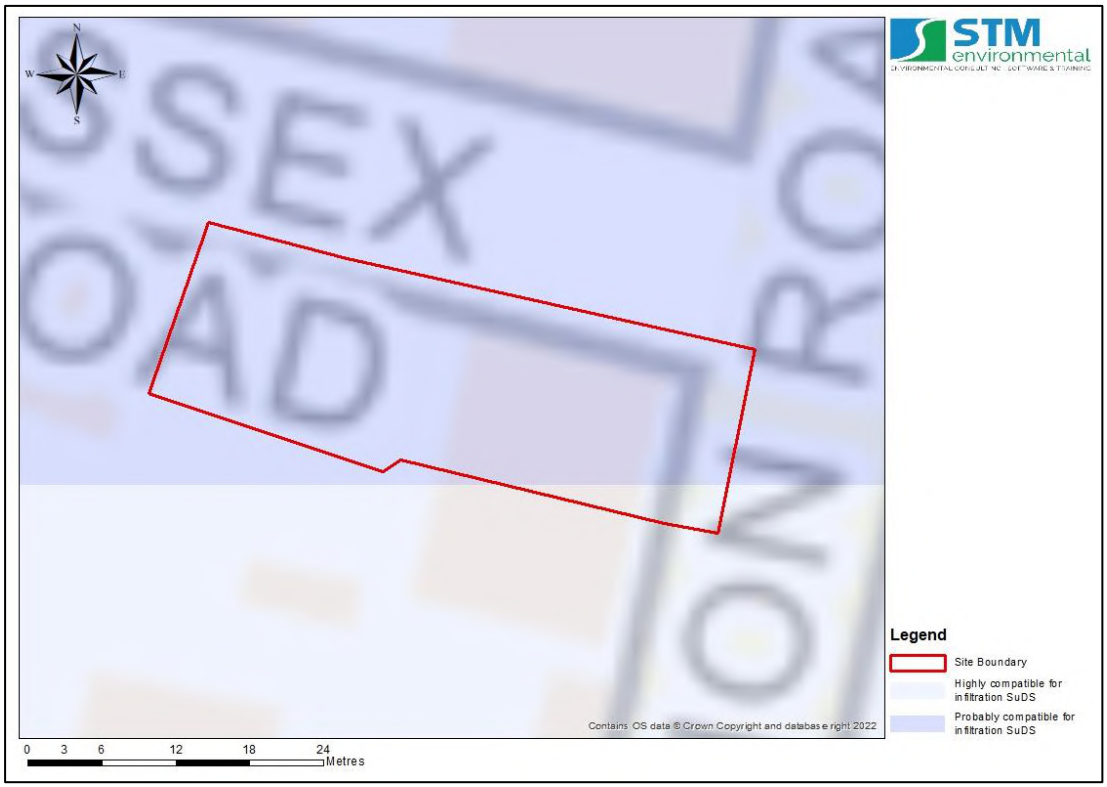
12.2.3 Bedrock Geology, Hydrogeology & Permeability (Source: BGS, 2016)



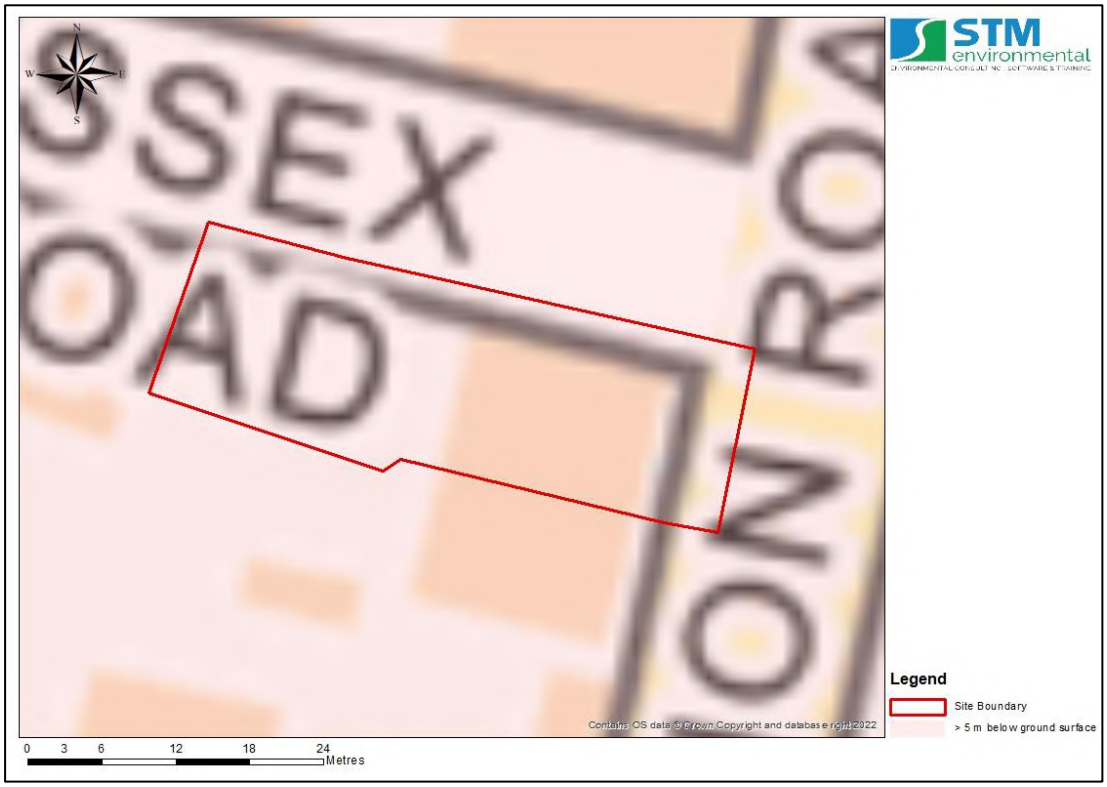
12.2.4 Superficial Deposits, Hydrogeology, & Permeability (Source: BGS, 2016)



12.2.5 Infiltration Drainage Potential (Source: BGS, 2016)

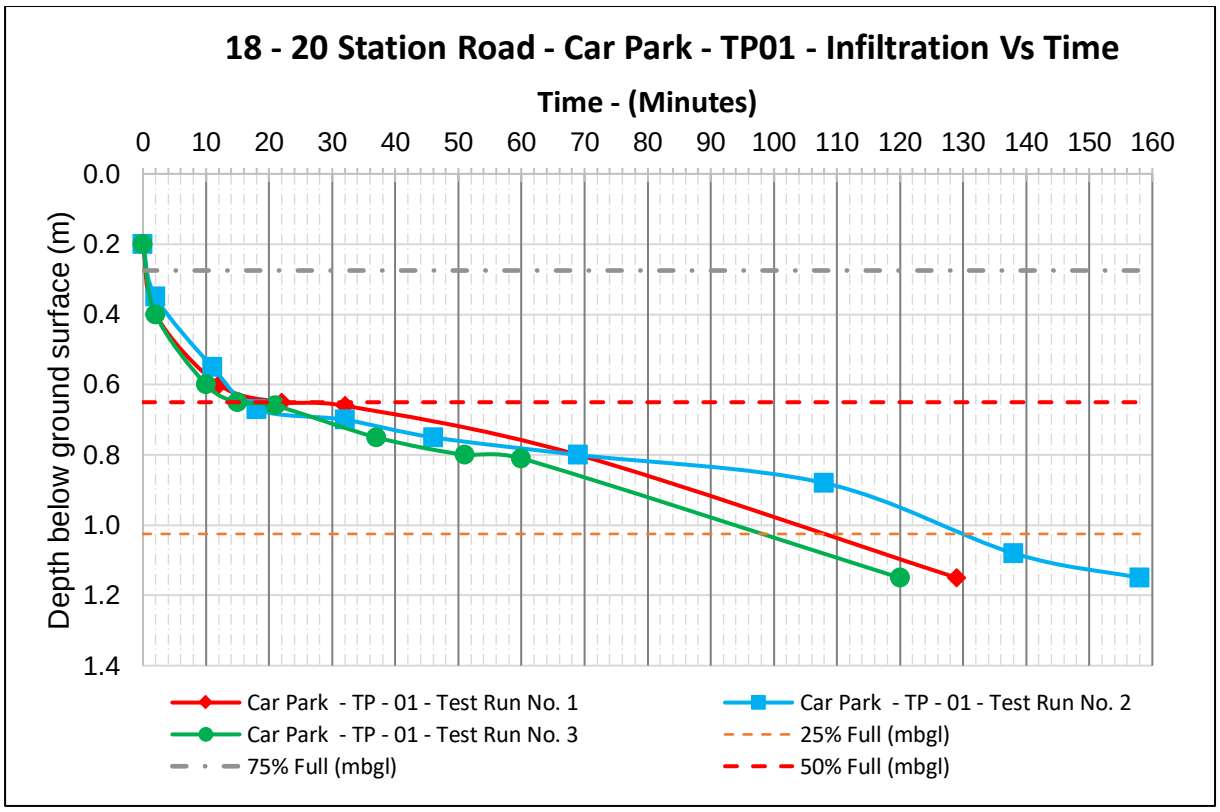


12.2.6 Groundwater Table Depth (Source: BGS 2016)



12.2.7 Site Investigation Photos

12.2.8 Infiltration Testing Graph



12.2.9 Infiltration Data and Results

Car Park - TP - 01 - Test Run No. 1

insert time according to the measured units

Dip Reading	Water Level Above Base	Depth (mbgl)	Time (hours)	Time (minutes)	Time (s)	Time	25% Full (mbgl)	50% Full (mbgl)	75% Full (mbgl)
	1.2	0.2	0.00	0	0	0:00	13:51:00	1.025	0.65	0.275
	1	0.4	0.03	2	120.00	0:02	13:53:00	1.025	0.65	0.275
	0.8	0.6	0.20	12	720.00	0:12	14:03:00	1.025	0.65	0.275
	0.75	0.7	0.37	22	1320.00	0:22	14:13:00	1.025	0.65	0.275
	0.74	0.7	0.53	32	1920.00	0:32	14:23:00	1.025	0.65	0.275
	0.6	0.8	1.15	69	4140.00	1:09	15:00:00	1.025	0.65	0.275
	0.25	1.2	2.15	129	7740.00	2:09	16:00:00	1.025		

Reached 25% within 24 hours. Second run undertaken.

Car Park - TP - 01 - Test Run No. 2

insert time according to the measured units

Dip Reading	Water Level Above Base	Depth (mbgl)	Time (hours)	Time (minutes)	Time (s)	Time	25% Full (mbgl)	50% Full (mbgl)	75% Full (mbgl)
	1.2	0.2	0.00	0	0	0:00	08:22:00	1.025	0.65	0.275
	1.05	0.4	0.03	2	120.00	0:02	08:24:00	1.025	0.65	0.275
	0.85	0.6	0.18	11	660.00	0:11	08:33:00	1.025	0.65	0.275
	0.73	0.7	0.30	18	1080.00	0:18	08:40:00	1.025	0.65	0.275
	0.7	0.7	0.53	32	1920.00	0:32	08:54:00	1.025	0.65	0.275
	0.65	0.8	0.77	46	2760.00	0:46	09:08:00	1.025	0.65	0.275
	0.6	0.8	1.15	69	4140.00	1:09	09:31:00	1.025	0.65	0.275
	0.52	0.9	1.80	108	6480.00	1:48	10:10:00	1.025	0.65	0.275
	0.32	1.1	2.30	138	8280.00	2:18	10:40:00	1.025	0.65	0.275
	0.25	1.2	2.63	158.00	9480.00	2:38	11:00:00	1.025	0.65	0.275

Reached 25% within 24 hours. Second run undertaken.

Car Park - TP - 01 - Test Run No. 3

insert time according to the measured units

Dip Reading	Water Level Above Base	Depth (mbgl)	Time (hours)	Time (minutes)	Time (s)	Time	25% Full (mbgl)	50% Full (mbgl)	75% Full (mbgl)
	1.2	0.2	0.00	0	0	0:00	11:00:00	1.025	0.65	0.275
	1	0.4	0.03	2	120.00	0:02	11:02:00	1.025	0.65	0.275
	0.8	0.6	0.17	10	600.00	0:10	11:10:00	1.025	0.65	0.275
	0.75	0.7	0.25	15	900.00	0:15	11:15:00	1.025	0.65	0.275
	0.74	0.7	0.35	21	1260.00	0:21	11:21:00	1.025	0.65	0.275
	0.65	0.8	0.62	37	2220.00	0:37	11:37:00	1.025	0.65	0.275
	0.6	0.8	0.85	51	3060.00	0:51	11:51:00	1.025	0.65	0.275
	0.59	0.8	1.00	60	3600.00	1:00	12:00:00	1.025	0.65	0.275
	0.25	1.2	2.00	120	7200.00	2:00	13:00:00	1.025	0.65	0.275

Reached 25% within 24 hours. Second run undertaken.

$f = V_{p75-25} * 0.3 / a_{s50} * t_{p75-25}$

Infiltration Coef. Calculations

Width	0.30	m
Depth	1.40	m
Length	1.60	m
Total Volume	0.67	m3
Effective Storage Depth	1.50	m
25% Full	1.03	mbgl
50% Full	0.65	mbgl
75% Full	0.28	mbgl
Pipe Depth	**1.85**	
a_{50}	3.36	m^2
V_{p75-25}	0.36	m^3
t_{p75-25} *(read from graph)*	130.00	mins
f	**0.00001**	m/s
f	49.45055	mm/hr
f	0.04945	m/hr

Infiltration Rate (mm/hr)

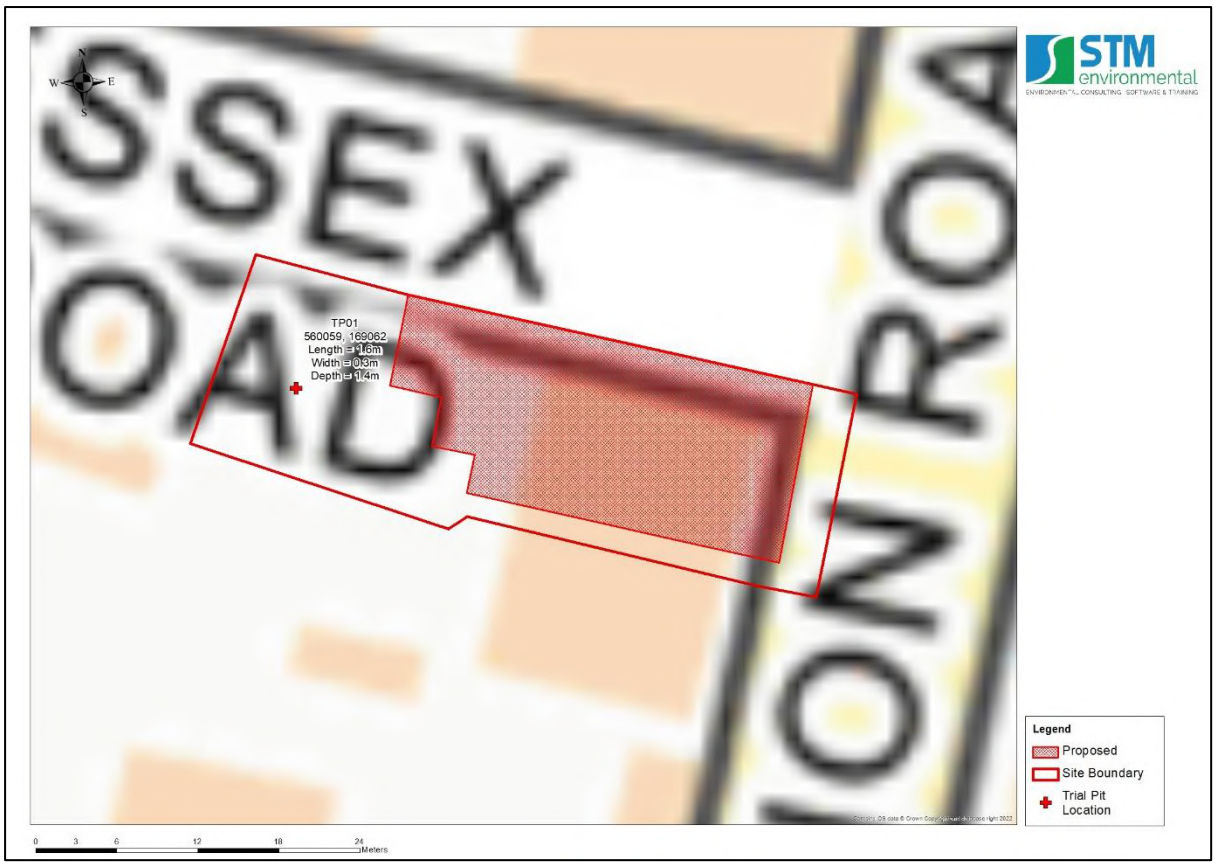
IR < 0.036	IMPERMEABLE
0.036 < IR < 0.38	VERY SLOW
0.38 < IR < 3.7	MODERATELY SLOW
3.7 < IR < 37	MODERATE
37 < IR < 370	MODERATELY RAPID
IR > 370	RAPID

BASIC INFILTRATION RATES FOR VARIOUS SOIL TYPES

Soil type	Basic infiltration rate (mm/hour)
sand	less than 30
sandy loam	20 - 30
loam	10 - 20
clay loam	5 - 10
clay	1 - 5

Water level = Pipe Depth - Dip

12.2.10 Soakaway Test Location Map



12.2.11 Rainwater Harvesting Estimations

Entire Rooftop Area:

Rooftop Area when limited to 140m^2:

12.3 Appendix 3 – Flood Risk Mapping

12.3.1 Flood Map For Planning (EA)

PDF to follow this page.

Flood map for planning

Your reference	Location (easting/northing)	Created
<Unspecified>	**560075/169058**	**22 Jan 2024 16:37**

Your selected location is in flood zone 1, an area with a low probability of flooding.

You will need to do a flood risk assessment if your site is **any of the following:**

- bigger that 1 hectare (ha)
- In an area with critical drainage problems as notified by the Environment Agency
- identified as being at increased flood risk in future by the local authority's strategic flood risk assessment
- at risk from other sources of flooding (such as surface water or reservoirs) and its development would increase the vulnerability of its use (such as constructing an office on an undeveloped site or converting a shop to a dwelling)

Notes

The flood map for planning shows river and sea flooding data only. It doesn't include other sources of flooding. It is for use in development planning and flood risk assessments.

This information relates to the selected location and is not specific to any property within it. The map is updated regularly and is correct at the time of printing.

Environment Agency

Flood map for planning

Your reference
<Unspecified>

Location (easting/northing)
560075/169058

Scale
1:2500

Created
22 Jan 2024 16:37

- Selected area
- Flood zone 3
- Flood zone 2
- Flood zone 1
- Flood defence
- Main river
- Water storage area

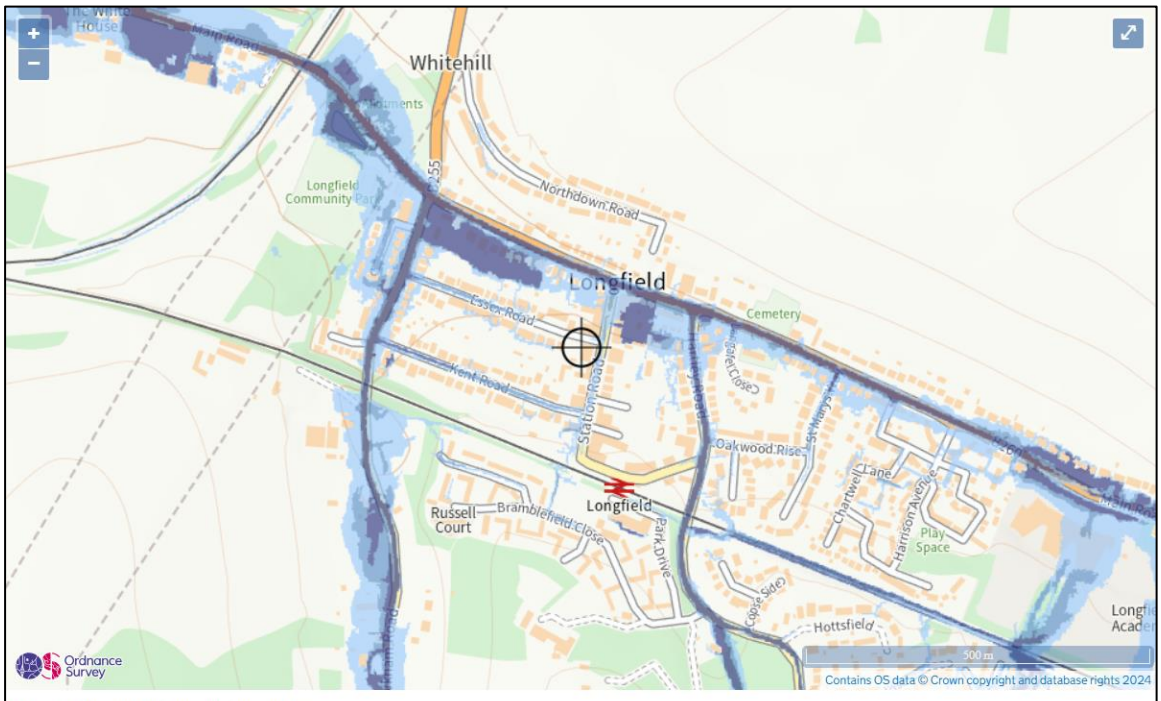
0 20 40 60m

12.3.2 Long Term Fluvial Flood Risk Map (EA)

Extent of flooding from rivers or the sea

High Medium Low Very low Location you selected

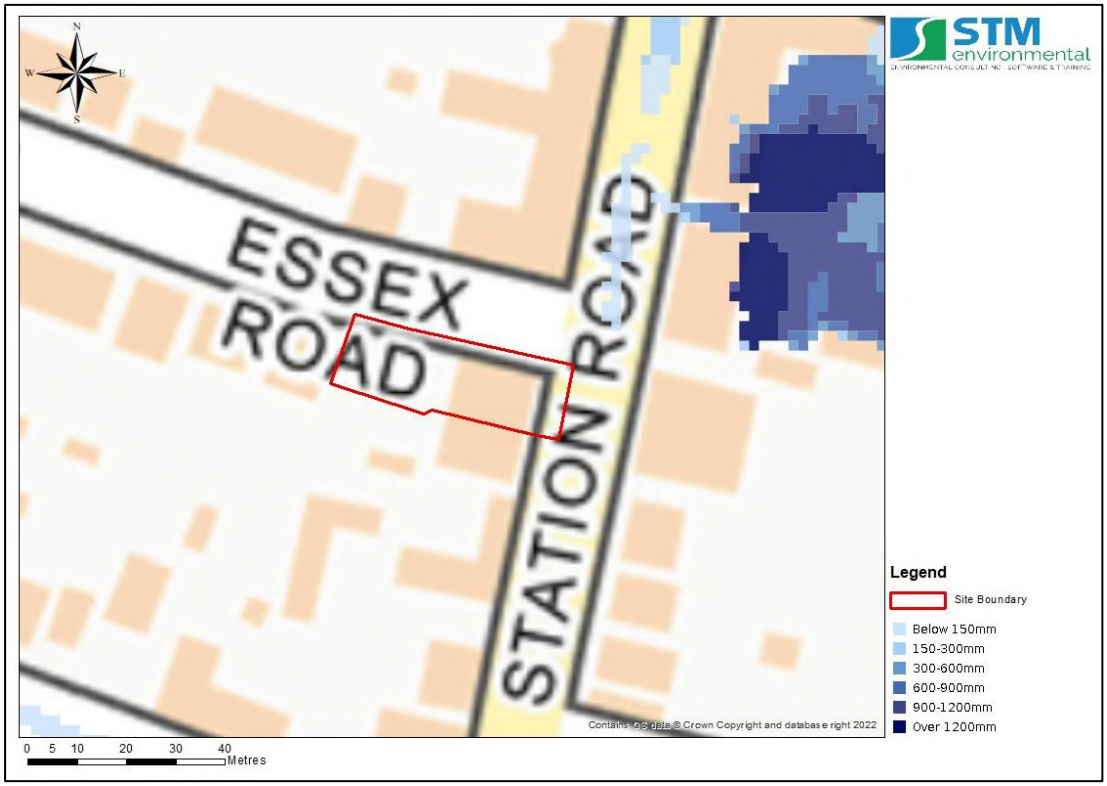
12.3.3 Long Term Pluvial Flood Risk Map (EA)

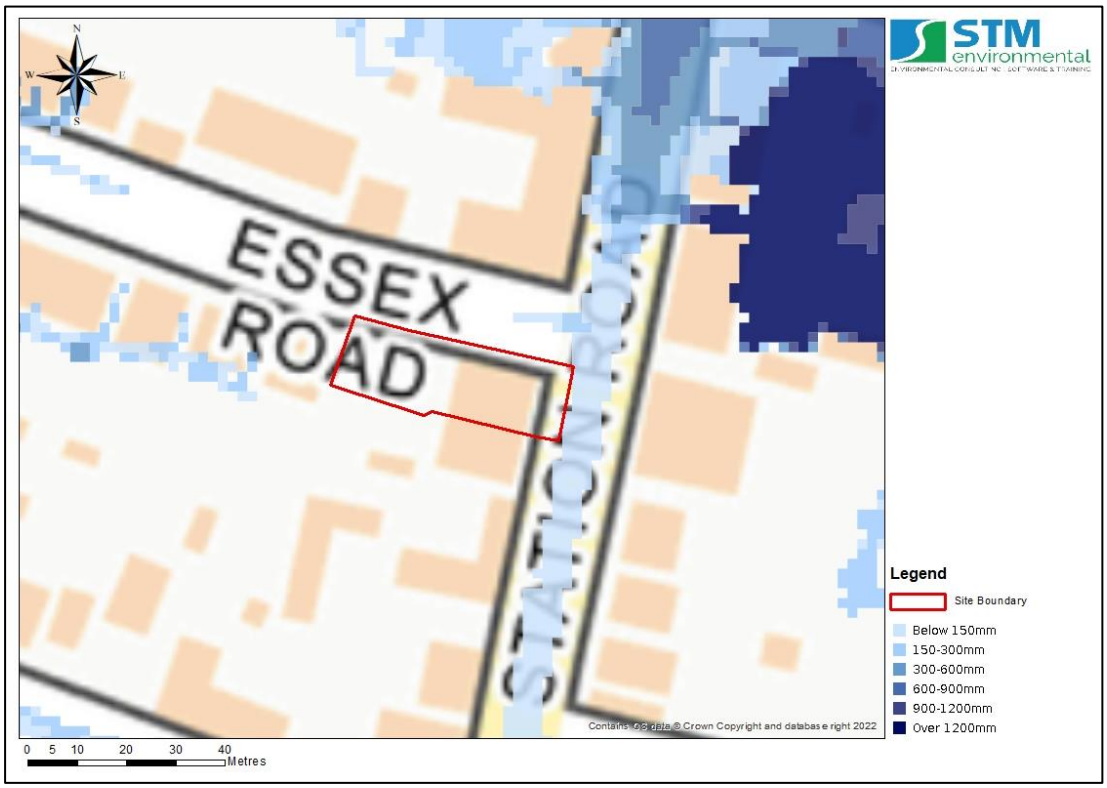


Extent of flooding from surface water

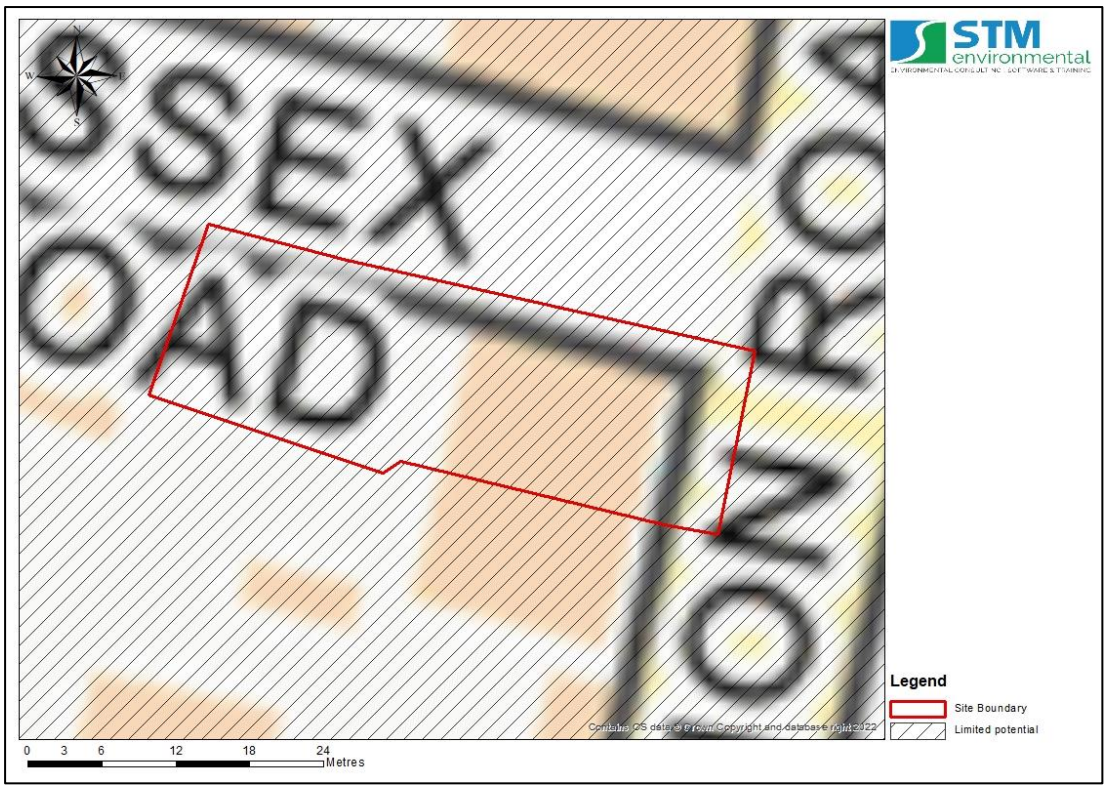
High Medium Low Very low Location you selected

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





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



12.4 Appendix 4 – Runoff Rate and Storage Calculations

12.4.1 UK SuDS

See next page.

Greenfield runoff rate estimation for sites

www.uksuds.com | Greenfield runoff tool

Calculated by:	Georgia Travers
Site name:	18-20 Station Road
Site location:	DA3 7QH

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:	51.39797° N
Longitude:	0.29985° E
Reference:	280507998
Date:	Jan 23 2024 10:11

Runoff estimation approach

IH124

Site characteristics

Total site area (ha):	0.0716

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):	619	619
Hydrological region:	7	7
Growth curve factor 1 year:	0.85	0.85
Growth curve factor 30 years:	2.3	2.3
Growth curve factor 100 years:	3.19	3.19
Growth curve factor 200 years:	3.74	3.74

Notes

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

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

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

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

(3) Is SPR/SPRHOST ≤ 0.3?

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

Greenfield runoff rates

	Default	Edited

Q_{BAR} (l/s):	0.11	0.11
1 in 1 year (l/s):	0.1	0.1
1 in 30 years (l/s):	0.26	0.26
1 in 100 year (l/s):	0.36	0.36
1 in 200 years (l/s):	0.42	0.42

Surface water storage requirements for sites

www.uksuds.com | Storage estimation tool

Calculated by:	Georgia Travers
Site name:	18-20 Station Road
Site location:	DA3 7QH

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:	51.39797° N
Longitude:	0.29985° E
Reference:	2319232404
Date:	Jan 23 2024 10:14

Site characteristics

Total site area (ha):	0.0716
Significant public open space (ha):	0
Area positively drained (ha):	0.0716
Impermeable area (ha):	0.0716
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):	0.07
Net impermable area for storage volume design (ha):	0.07
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:	--	91.63
FEH / FSR conversion factor:	1.19	1.19
SAAR (mm):	619	619
M5-60 Rainfall Depth (mm):	20	20
'r' Ratio M5-60/M5-2 day:	0.4	0.4
Hydological region:	7	7
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):	0.11	0.11
Volume control approach	Use long term storage		Q_{BAR} for net site area (l/s):	0.11	0.11
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

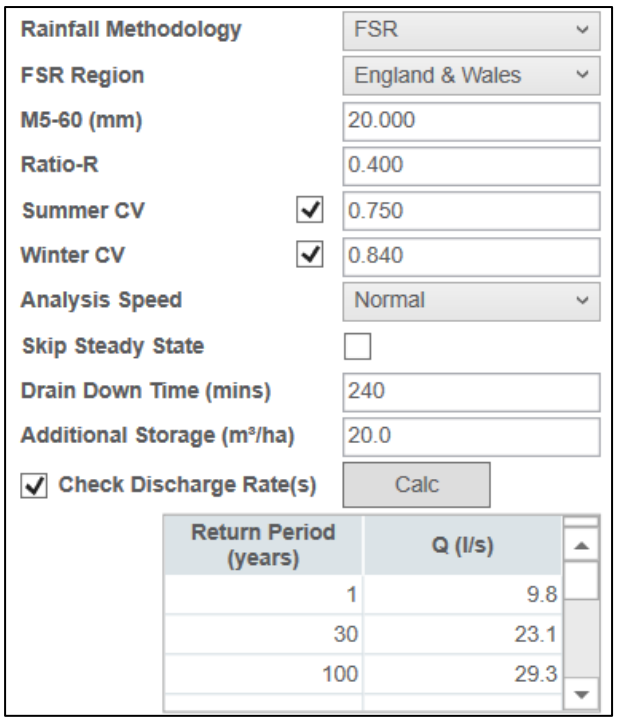
	Default	Edited
Attenuation storage 1/100 years (m^3):	34	34
Long term storage 1/100 years (m^3):	0	0
Total storage 1/100 years (m^3):	34	34

12.4.2 IH24 Method

Item	Value		Greenfield Run-off Rate -1 in 100 + CC (l/s)	0.5344	
Climate Change Allowance Factor	1.40		Total Post Development Run-off Rate - 1 in 100 + CC (l/s)	1.8372	
SAAR(mm) - Current	619.00		Difference between Greenfield and Post Development Run Off Rates - 1 in 100 + CC (l/s)	1.3029	
SAAR (mm) + CC	866.60		Volume of Storage Required to meet Greenfield Discharge - Difference between Post Development and Greenfield 1 in 100 + CC volumes (m3)	28.1421	
SPR (Greenfield)	0.30		Difference between 3 * Greenfield and Post Development 1 in 100 + CC Run Off Rates	0.2341	
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)	5.0574	
Site Area (ha)	0.0716				
Impermable Area (Pre Development - ha)	0.06560				
Permeanble Area (Pre Development - ha))	0.0060000		Greenfield (l/s)	Pre - Development (l/s)	Post Development (l/s)
Impermable Area (Post Development - ha)	0.0716000	Qbar	0.11	0.37	0.39
Permeanble Area (Post Development - ha)	0.0000000	1 in 1	0.10	0.31	0.33
GCF (1 in 1)	0.85	1 in 30	0.26	0.84	0.89
GCF (1 in 30)	2.30	1 in 100	0.36	1.17	1.24
GCF (1 in 100)	3.19	1 in 100 + CC	0.53	1.73	1.84
Hyrdological Region	7				
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	78.9111	**0.1130**	1.5782		
1 in 1		**0.0961**	1.3415	0.2882	2.0747
1 in 30		**0.2599**	3.6299	0.7797	5.6139
1 in 100		**0.3605**	5.0345	1.0814	7.7862
GREENFIELD RUN-OFF + CC					
Qbar Impermeable	116.9790	0.1675	2.3396	0.5025	3.6183
1 in 1 +CC		0.1424	1.9886	0.4272	3.0756
1 in 30 + CC		0.3853	5.3810	1.1558	8.3221
1 in 100 + CC		**0.5344**	**7.4633**	**1.6031**	**11.5424**
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	271.3087	0.3560	5.4262	1.0679	7.6887
1 in 1		0.3026	4.6122	0.9077	6.5354
1 in 30		0.8187	12.4802	2.4561	17.6839
1 in 100		1.1355	17.3095	**3.4065**	**24.5269**
Permeable Surface Calculation		Permeable Surface Run-off (l/s)			
Qbar Permeable	78.9111	0.0095	#DIV/0!	0.0284	
1 in 1		0.0080	#DIV/0!	0.0241	0.1739
1 in 30		0.0218	#DIV/0!	0.0653	0.4704
1 in 100		0.0302	#DIV/0!	**0.0906**	**0.6525**
Impermeable Surface Calculation + Permeable Surface Calculation					
Qbar	350.2198	0.3654	#DIV/0!	1.0963	7.6887
1 in 1		0.3106	#DIV/0!	0.9318	6.7092
1 in 30		0.8405	#DIV/0!	2.5214	18.1544
1 in 100		1.1657	#DIV/0!	3.4971	25.1793
PRE DEVELOPMENT RUN-OFF + CC (increased rainfall)		Impermeable Surface Run-Off (l/s)			
Impermeable Surface Calculation					
Qbar Impermeable	402.1921	0.5277	7.3698		11.3978
1 in 1 +CC		0.4485	6.2643		9.6881
1 in 30 + CC		1.2137	16.9505		26.2149
1 in 100 + CC		**1.6833**	23.5096		**36.3590**
Permeable Surface Calculation		Permeable Surface Run-off (l/s)			
Qbar Permeable	116.9790	0.0140	#DIV/0!	0.0421	
1 in 1 +CC		0.0119	#DIV/0!	0.0358	0.2577
1 in 30 + CC		0.0323	#DIV/0!	0.0969	0.6974
1 in 100 + CC		**0.0448**	#DIV/0!	**0.1343**	**0.9672**
Impermeable Surface Calculation + Permeable Surface Calculation					
Qbar	**519.1712**	**0.5417**	**#DIV/0!**	**0.0421**	**11.3978**
1 in 1 +CC		**0.4605**	**#DIV/0!**	**0.0358**	**9.9459**
1 in 30 + CC		**1.2459**	**#DIV/0!**	**0.0969**	**26.9123**
1 in 100 + CC		**1.7281**	**#DIV/0!**	**0.1343**	**37.3262**
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	271.3087	0.3885	5.4262	1.1655	
1 in 1		0.3302	4.6122	0.9907	7.1331
1 in 30		0.8936	12.4802	2.6807	19.3014
1 in 100		1.2394	17.3095	**3.7181**	**26.7702**
Permeable Surface Calculation		Permeable Surface Run-off (l/s)			
Qbar Permeable	78.9111	0.0000	#DIV/0!	0.0000	
1 in 1		0.0000	#DIV/0!	0.0000	0.0000
1 in 30		0.0000	#DIV/0!	0.0000	0.0000
1 in 100		0.0000	#DIV/0!	**0.0000**	**0.0000**
		Impermeable Surface Calculation + Permeable Surface Calculation			
Qbar Permeable	**350.2198**	**0.3885**	**#DIV/0!**	**1.1655**	
1 in 1	**0.0000**	**0.3302**	**#DIV/0!**	**0.9907**	**7.1331**
1 in 30	**0.0000**	**0.8936**	**#DIV/0!**	**2.6807**	**19.3014**
1 in 100	**0.0000**	**1.2394**	**#DIV/0!**	**3.7181**	**26.7702**
POST DEVELOPMENT RUN-OFF + CC (increased rainfall)		Impermeable Surface Run-Off (l/s)			
Impermeable Surface Calculation					
Qbar Impermeable	402.1921	0.5759	8.0438		12.4403
1 in 1 +CC		0.4895	6.8373		10.5742
1 in 30 + CC		1.3247	18.5008		28.6127
1 in 100 + CC		**1.8372**	25.6599		**39.6845**
Permeable Surface Calculation		Permeable Surface Run-off (l/s)			
Qbar Permeable	116.9790	0.0000	#DIV/0!	0.0000	
1 in 1 +CC		0.0000	#DIV/0!	0.0000	0.0000
1 in 30 + CC		0.0000	#DIV/0!	0.0000	0.0000
1 in 100 + CC		**0.0000**	#DIV/0!	**0.0000**	**0.0000**
Impermeable Surface Calculation + Permeable Surface Calculation					
Qbar	**519.1712**	**0.5759**	**#DIV/0!**	**0.0000**	**12.4403**
1 in 1 +CC		**0.4895**	**#DIV/0!**	**0.0000**	**10.5742**
1 in 30 + CC		**1.3247**	**#DIV/0!**	**0.0000**	**28.6127**
1 in 100 + CC		**1.8372**	**#DIV/0!**	**0.0000**	**39.6845**

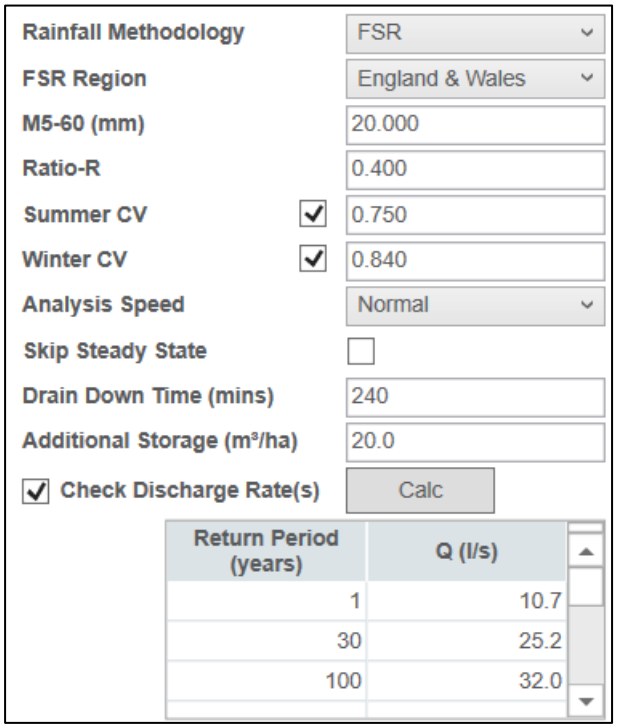
12.4.3 MRM – Pre - Development



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	9.8
30	23.1
100	29.3

12.4.4 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	10.7
30	25.2
100	32.0

12.4.5 Causeway Flow Storage Calculations

Storage Estimate

Return Period (years)	100		OK
Climate Change (%)	40		Cancel
Impermeable Area (ha)	0.072	Update	
Peak Discharge (l/s)	2.000		
Infiltration Coefficient (m/hr) (leave blank if no infiltration)		Calc	
Required Storage (m³)	Calc		
from	28		
to	40		

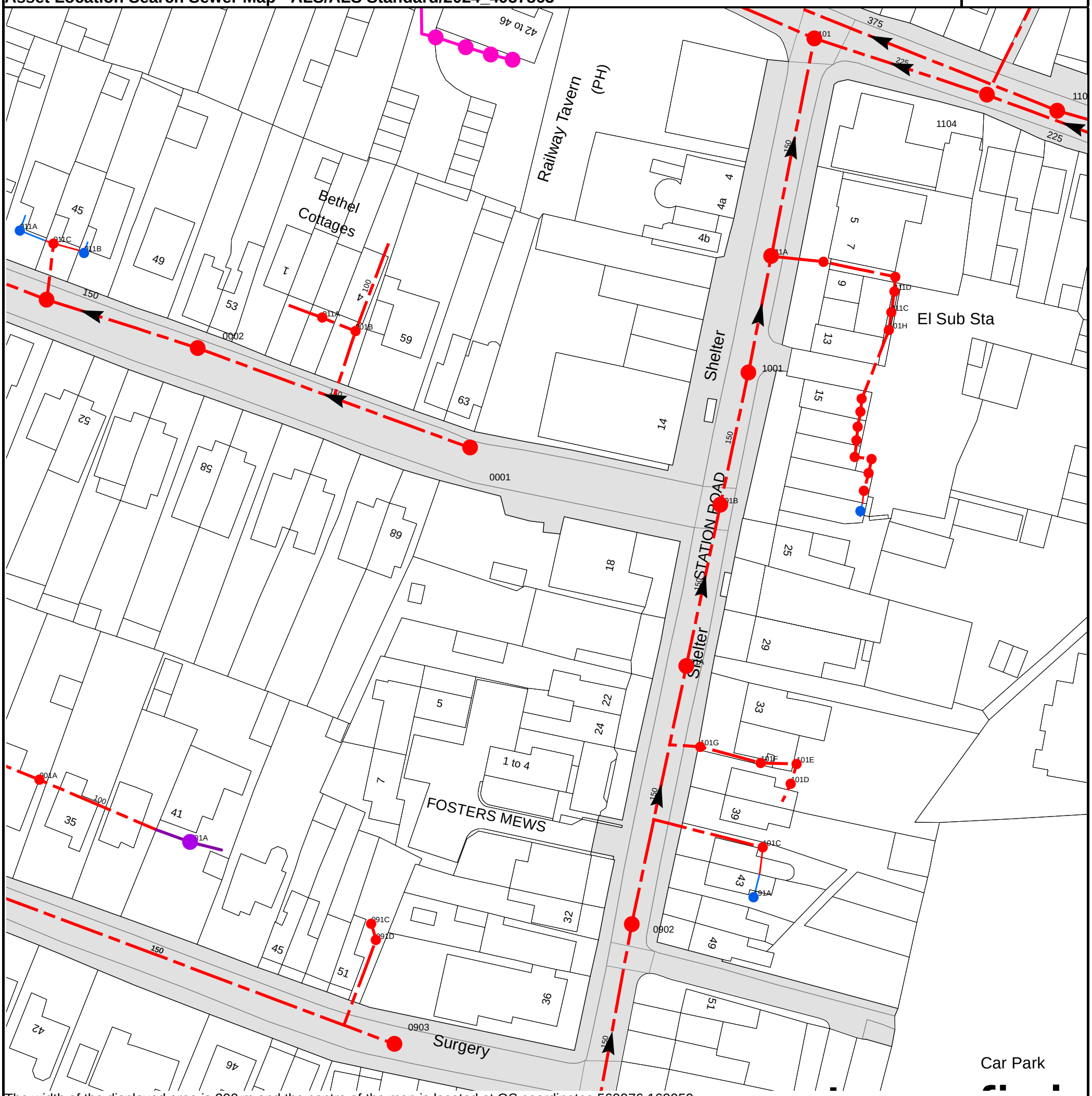
Storage Estimate

Return Period (years)	100		OK
Climate Change (%)	40		Cancel
Impermeable Area (ha)	0.072	Update	
Peak Discharge (l/s)	0.000		
Infiltration Coefficient (m/hr) (leave blank if no infiltration)	0.04900	Calc	
Required Storage (m³)	Calc		
from	70		
to	70		
With infiltration (m³)			
from	19		
to	55		

12.5 Appendix 5 – Drainage Asset Search

See next page.

Asset Location Search Sewer Map - ALS/ALS Standard/2024_4937863



The width of the displayed area is 200 m and the centre of the map is located at OS coordinates 560076,169059

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
111C	n/a	n/a
111D	n/a	n/a
1106	n/a	n/a
0903	55.74	52.96
091D	n/a	n/a
0902	54.34	52.41
091C	n/a	n/a
191A	n/a	n/a
101C	n/a	n/a
101D	n/a	n/a
101E	n/a	n/a
101F	n/a	n/a
101G	n/a	n/a
101A	n/a	n/a
1003	n/a	n/a
011A	n/a	n/a
001B	n/a	n/a
0001	50.1	48.47
101B	n/a	n/a
1001	49.07	46.35
111A	n/a	n/a
1107	n/a	n/a
1007	n/a	n/a
1008	n/a	n/a
1009	n/a	n/a
1010	n/a	n/a
1002	n/a	n/a
1004	n/a	n/a
1005	n/a	n/a
1006	n/a	n/a
101H	n/a	n/a
0105	n/a	n/a
0104	n/a	n/a
0103	n/a	n/a
0102	n/a	n/a
1101	48.29	45.84
1104	48.47	46.11
1102	48.51	46.06
001A	n/a	n/a
901A	n/a	n/a
911A	n/a	n/a
9101	49.2	47.57
911C	n/a	n/a
911B	n/a	n/a
0002	49.58	47.97

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.

12.6 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
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.	Contamination; Could increase flood risk. Maintenance	Suitable
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
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;	Unsuitable - Space
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 – 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

12.7 Appendix 7 – Details of Proposed Of SuDS

12.7.1 Green Roofs

MODULAR GREENROOF SYSTEM

CT Modular Green Roof System combines the aesthetics and performance of continuous green roof systems with the simplicity of pre-vegetated trays. Slotted sidewalls encourage plant root growth between modules, creating a natural-looking meadow with invisible boundaries. Slotted flat bottoms permit water to move freely both in and out of the modules with assistance from an underlying water-retaining capillary mat that maintains uniform moisture levels across the roof. Stormwater is carried away in integral drainage channels that double as conduits for drip irrigation. Adjacent modules interlock with easily removable connectors. Fully saturated system weights as low as 12 lbs/ft^2 make it possible to retrofit existing roofs that cannot support the weight of continous systems.

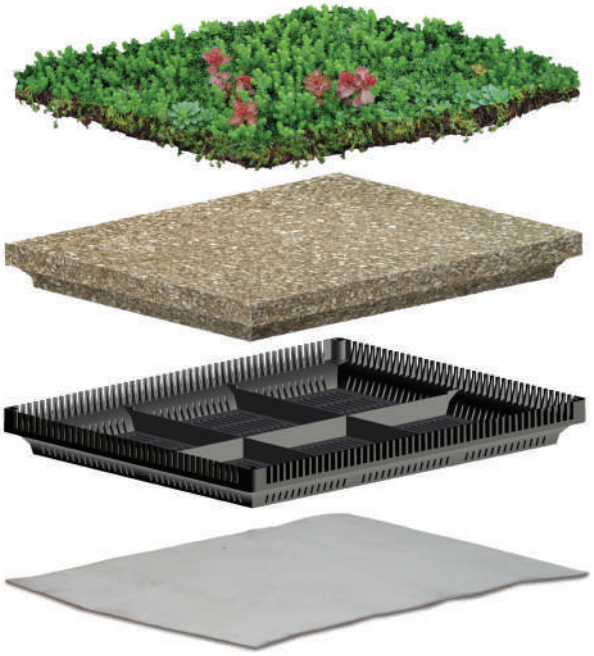
pre-planted module on capillary mat

SYSTEM ANATOMY

The system has four principal components:

- a thick, water-retaining capillary protection mat
- a support tray made from a tough, flexible, recycled polypropylene copolymer with slots in the sidewall and bottom surfaces small enough to retain growing media, yet large enough to allow plant roots and water to pass freely
- a lightweight growing media with enhanced water retention, capillarity, and drainage characteristics
- an optional fully-vegetated organic mat planted with drought-resistant sedum

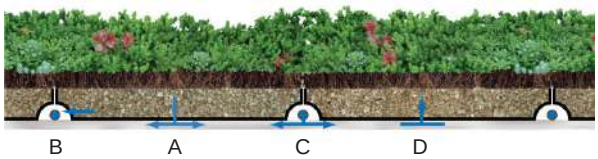
The trays are filled with the lightweight growing media, which is then compacted and stacked on pallets for shipping to the jobsite. On the rooftop, the modules are laid on capillary protection mat, a heavy-duty water-retaining geotextile that can distribute water in all directions. After installation, the trays are directly planted with cuttings or plugs or overlaid with sedum mats.



exploded view of system components

WATER MANAGEMENT

Rainwater drains freely through the bottom slots and into the water-retaining capillary mat which spreads the water uniformly across the roof (A). When the mat becomes fully saturated, excess water is carried away through the high-volume semi-circular drainage conduits formed by adjacent tray edges (B). During periods of dry weather, drip irrigation lines passing invisibly through the drainage conduits are used to wet the water storage mat (C). The irrigation water spreads across the mat and rises into the trays by capillarity and by vapor diffusion (D).



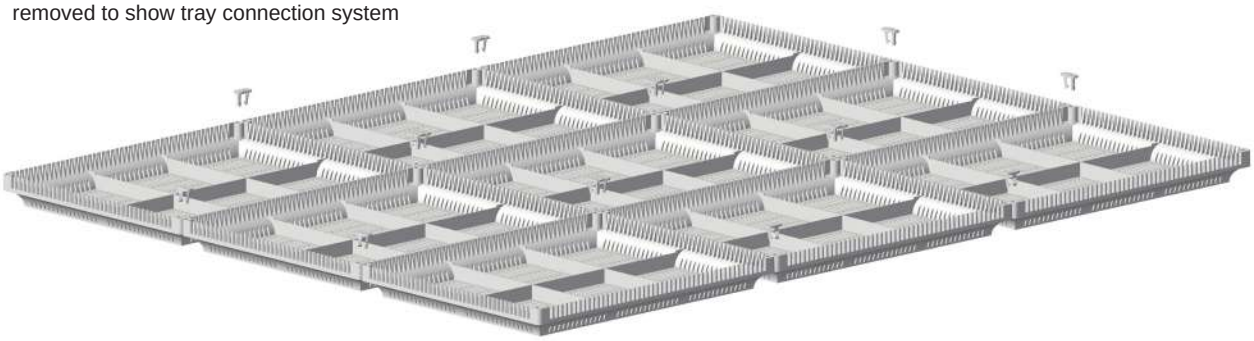
cross-section showing water flow

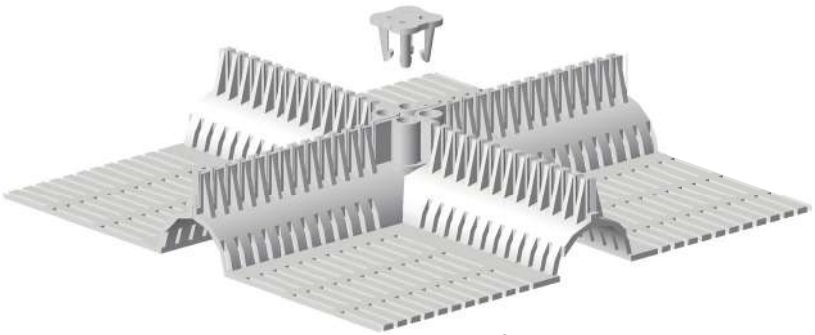
CONNECTING MODULES

Adjacent modules are joined with plastic connectors that snap into holes at the corners of the trays: four-prong connectors are used in the center of the roof, and two-prong connectors are used at the edges. The holes that receive the connectors are open at the bottom, so any growth media or plant matter that enters the top falls straight through without blocking the holes. Since the connectors tolerate significant variations in fit, it is not necessary to carefully fit or clean tray edges, and roof surfaces do not need to be perfectly clean or flat. The connectors lock securely in place without tools and can be easily removed with an ordinary flat-blade screwdriver. Since the trays do not overlap, any module can be removed quickly for replacement or for access to the underlying waterproofing.

interconnected modules on capillary mat with drip-irrigation system in drainage channels

modules with plants and growing media removed to show tray connection system





four-prong center connector at intersection of four trays

two-prong edge connector at intersection of two trays

MODULAR SYSTEM COMPONENTS

Root Barrier is a 30 mil (0.75mm) thick LLDPE sheet that provides exceptional resistance to root penetration, puncture, and tearing, yet offers good flexibility for ease of installation. It is highly resistant to environmental stresses on green roofs including air pollution, summer heat, and winter cold, and does not contain any recycled resins or plasticizers that can lead to premature aging or plant toxicity. Standard sizes are 10, 15, and 20 ft wide by 50 ft or 100 ft long. All sizes are folded so that the roll lengths are less than six feet. Seams should be taped or welded.

Capillary Mat is a thick, 28 oz/yd^2 (950 g/m^2), non-woven geotextile made from 100% polyester fiber. It is non-biodegradable, is highly puncture resistant, has a water storage capacity of 0.1 gal/ft^2 (4.2 l/m^2), and spreads water in all directions including more than six inches vertically. These properties make it ideal for protection, water storage, and water distribution in green roof systems. Rolls measure 6' x 50' (1.8m x 15.3m) and are electrically scanned for metal debris. A 6" (15 cm) overlap is recommended).

Modular Trays are made of black recycled polyproplene plastic and have continuous slotting on the bottom and all sides. Each tray is 19-3/4" (50 cm) long, 15-3/4" (40 cm) wide and 2" (5 cm) tall. The unique edge design creates drainage channels to drain excess water and to provide a conduit for drip irrigation lines. Adjacent modules interlock with easily removable connectors.

Drain Boxes are sturdy plastic roof drain covers made of black recycled ABS. Narrow slots on the sides and small holes on the top permit water to flow freely but retain growing and drainage medias. A wide base flange prevents flotation during repeated wet/dry and freeze/thaw cycling, and a 12" hole in the base provides unobstructed drain access. Triangular knockouts in each sidewall panel accept Triangular Drainage Conduit.

Aluminum Edge securely retains green roof planting media at roof edges and separates planting media from gravel, decks, or pavers. Slots in the vertical face provide unrestricted water drainage in the critical first inch off the roof while retaining virtually all green roof planting media. Large holes in the base permit penetration-free fastening to underlying waterproofing, root barriers, or geotextiles. Wide bases resist rollover, and optional diagonal braces are available to minimize bending under heavy soil loading. Prefabricated internal and external fittings provide strong, attractive corners. A unique connector also slides into the folds of both the lineals and corners, locking into the vertical slots to provide tight joints that allow thermal movement.

Drip Irrigation Tubing is typically installed at the base of a granular drainage system, either directly on the Capillary Mat or over the Granular Drainage Media. Anti-siphon, pressure-compensating, self-flushing emitters embedded in the tubing provide a controlled application rate of only 100 gallons per 1000 squre feet per hour. At this rate, the Capillary Mat captures all of the applied water and distribute it uniformly across the roof. Bottom-irrigation encourages deeper root growth than surface or sub-surface irrigation and reduces evaporative losses.

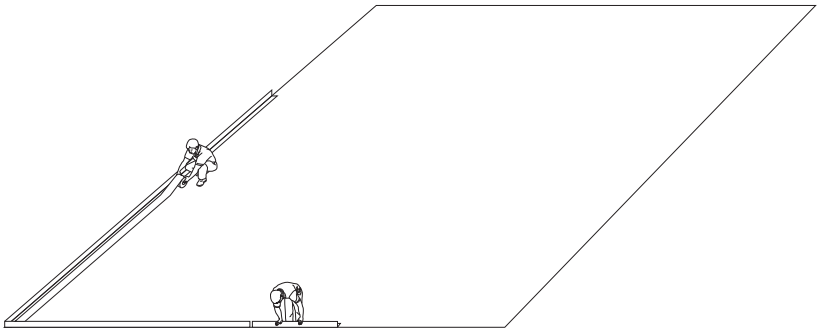
Single-Course Growing Media is a blend of inorganic and organic components with a saturated, compacted density of 5 to 6 lb/ ft^2 per inch of thickness (10-12 kg/m^2 per cm of thickness). The inorganic components are typically heat-expanded clay or natural pumice selected for high water retention, neutral pH, and low salt content. To minimize long-term settling and separation, inorganic particle sizes are uniformly and accurately graded from the several hundredths of an inch (coarse sand) to 1/2" (12mm). A small amount of compost is blended with this inorganic base, typically 6% to 12% by weight depending on the plant palette. Coverage is typically 275 ft^2 one-inch thick per cubic yard (15m^2 one centimeter thick per cubic meter).

Extensive Roof Fertilizer is an ultra-slow-release micro-fertilizer specifically formulated to meet the nutritional requirement of sedum on extensive green roofs. It should be applied twice yearly beginning the second year, typically in April and July, at the rate of 2500 square feet per 10 lb pail.

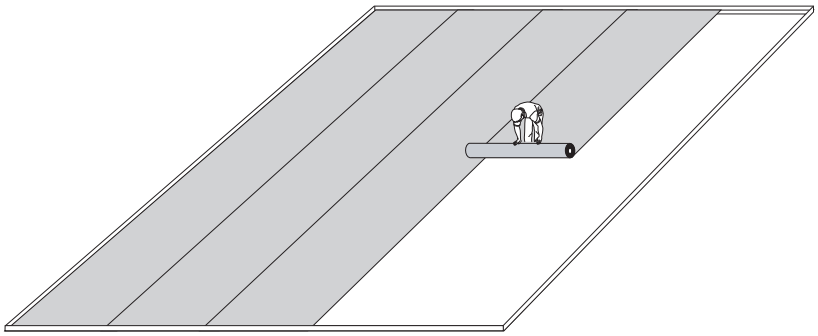
FlexDrain is a flexible, tough, dimpled polypropylene sheet that can be installed beneath the Capillary Mat to create a drainage and ventilation cavity. This allows stormwater from adjacent roof areas to flow under the modular system to reach drains. When the green roof is used over a protected membrane (inverted) roof, it preserves the thermal value of the polystyrene insulation. Adjacent sheets precisely overlap and interlock for gap-free coverage, and six-foot wide rolls minimize the number of seams.

MODULAR SYSTEM INSTALLATION

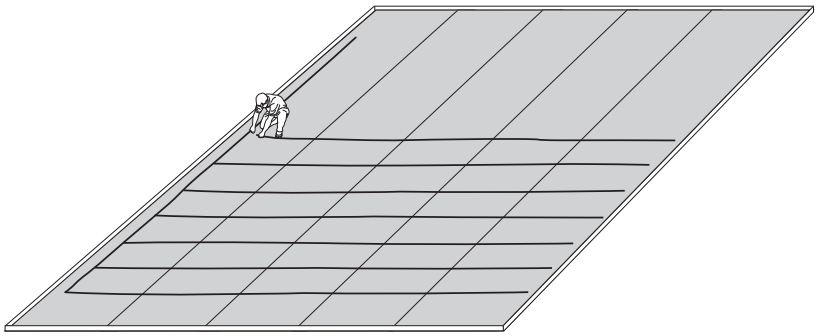
Install Aluminum Edge: Position Aluminum Edge near the roof edge and tape or weld it to the waterproofing membrane through the large holes in the base flange. Use fabricated corners for strength and join all parts with locking connectors. If the roof is surrounded by parapet walls, aluminum edge is not required



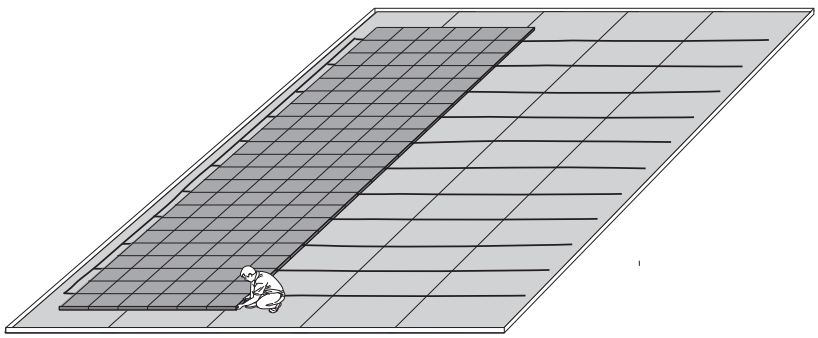
Lay root barrier and capillary mat: If the primary roof waterproofing is not root resistant, first apply Root Barrier, either welding or overlapping three feet with sealing tape in the overlap. Then unroll Capillary Mat, overlapping adjacent sheets at least six inches. The mat should fully cover the base flange of the aluminum edge but should not turn up the vertical legs.



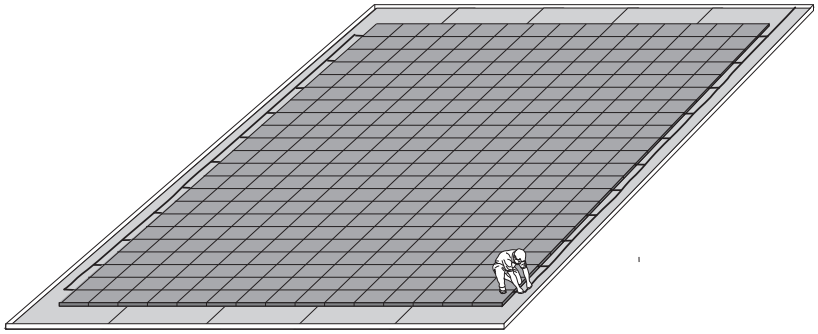
Place Drip Irrigation Tubing: Drip irrigation lines should be installed between every other tray. Cut the drip lines longer than required and create a header on one side using tee and elbow fittings to connect to plain drip tubing (without emitters).



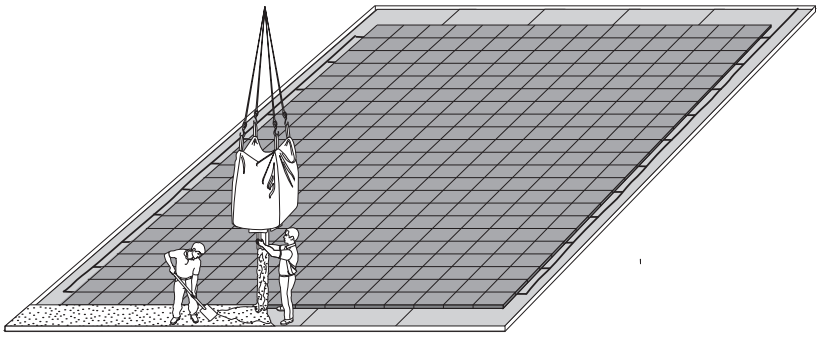
Begin Tray Installation: Starting at the end of the roof with the drip header, place trays tightly butted together. After each row is placed, insert tray connectors between the last two rows. If a connector does not seat fully, clean out the holes with a blunt, small diameter object such as a wood dowel. Make certain the drip lines fit between the trays without binding.



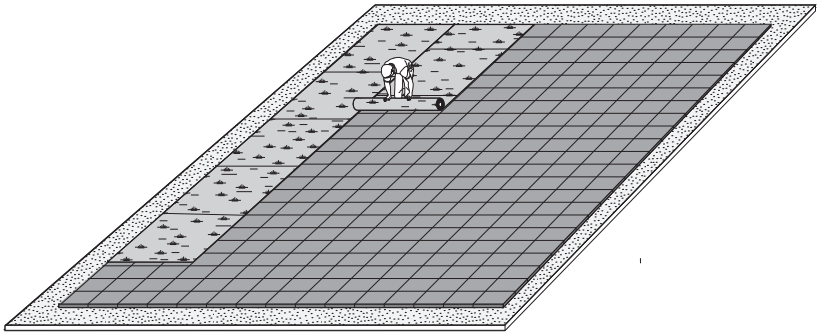
Finish Tray Installation: After placing and connecting all of the trays, trim the drip lines as required and create a header on the second side using tee and elbow fittings to connect to plain drip tubing. Connect one end of the header to the water supply.



Spread Gravel Perimeter: Spread well-washed gravel screened to 3/8" minimum particle size. Be careful not to create concentrated roof loads.



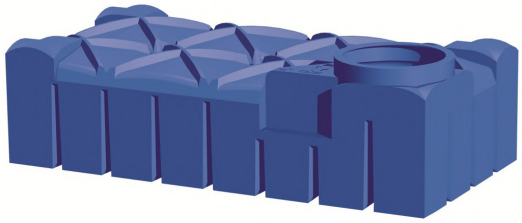
Plant: Unnroll sedum mats to cover the trays. The mat joints can fall anywhere – they do not need to line up with the tray edges. Water thoroughly after installation to fully saturate the mats and planting media; then water as needed to prevent excessive drying until the plants are fully established. Broadcast Intensive Roof Fertilizer twice yearly.

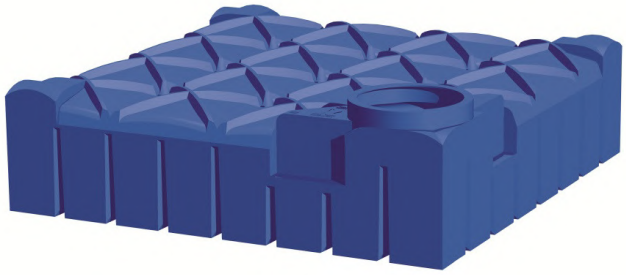


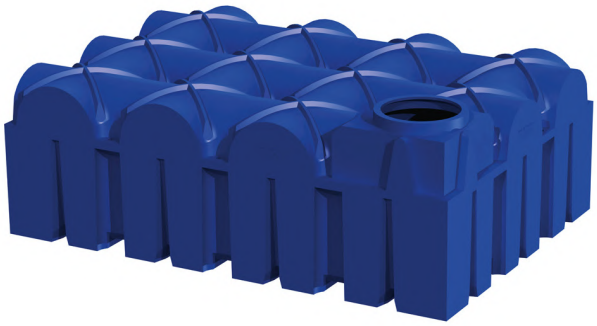
12.7.2 Rain Water Harvesting

Installation Manual for the F-Line underground tank

1,500 litre
3,000 litre
5,000 litre
7,500 litre







Rainwater Harvesting Limited, Unit A Harrier Park, Southgate Way, Orton Southgate, Peterborough, PE2 6YQ,UK
Phone +44 (0) 1733 405111 – Fax +44 (0) 1733 230996
Email : info@rainwaterharvesting.co.uk – Website : www.rainwaterharvesting.co.uk
January 2019

Tank Dimensions and inverts

With the tank you will have received one of three different shafts dependent on your order. Please note which has been received and refer to the relevant shaft in the grid below :

- VS20 – 235mm shaft and pedestrian lid
- VS60 – 635mm shaft and pedestrian lid - The overall height difference below is because up to 400mm can be cut off the 635mm shaft on site so as to achieve your exact invert level
- Driveable shaft & lid – Steel lid and shaft for vehicle loading

	1500 L	3000 L	5000 L	7500 L
Weight KG	80	170	250	310
Length	2400	2400	2960	3340
Width	1200	2400	2220	2310
Overall Height (VS20 – 235mm shaft)	1015	1015	1350	1415
Overall Height (VS60 – 635mm shaft)	1015 – 1415	1015 – 1415	1350 – 1750	1415 – 1815
Overall Height (Driveable shaft and lid)	1415	1415	1750	1815
Ground to Invert (VS20 – 235mm shaft)	320	320	345	310
Ground to Invert (VS60 – 635mm shaft)	320 – 720	320 – 720	345 – 745	310 – 710
Ground to Invert (Driveable shaft & lid)	720	720	745	710
Invert to Outlet	162	162	162	162

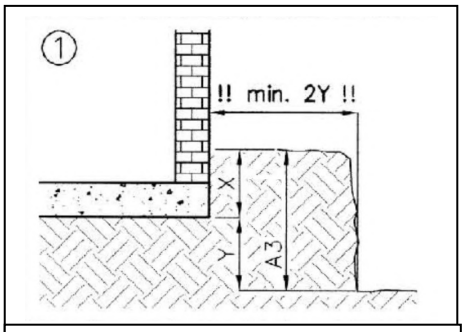
Excavation

	1500 L	3000 L	5000 L	7500 L
Length	2800	2800	3360	3740
Width	1600	2800	2620	2710
***Overall Height VS20**	1115	1115	1450	1515
***Overall Height VS60**	1115 – 1515	1115 – 1515	1450 – 1850	1515 – 1915
***Overall Height Driveable shaft & lid**	1515	1515	1850	1915

***The overall excavated height allows for a base of 100mm compacted aggregate**

Rainwater Harvesting Limited, Unit A Harrier Park, Southgate Way, Orton Southgate, Peterborough, PE2 6YQ,UK
Phone +44 (0) 1733 405111 – Fax +44 (0) 1733 230996
Email : info@rainwaterharvesting.co.uk – Website : www.rainwaterharvesting.co.uk
January 2019

1. Location



Please refer to the table on Page 2. A3 relates to the 'Excavated Overall Height' dependent on shaft and tank type

1.1 Position to the building

- The excavation must not be within the minimum distance to the building. See Image 1.
- The tank may not be built over by any loads greater than vehicle loads.

1.2 Traffic Conditions

- Loading Class A15 e.g pedestrian or cyclist – The standard pedestrian lid is suitable.
- Loading Class B e.g car, minibus, max axle load of 2.2 tonnes – Vehicle loading shaft and lid required. Minimum distance from top of tank body to earth surface must be 600mm

1.3 Ground conditions

- The tanks may lie in ground water and / or surface water up to the top of the body of the tank. Please refer to the table below to see the maximum depth dependent on your tank and shaft type.

	1500 L	3000 L	5000 L	7500 L
Max water table depth (VS20 – 235mm shaft)	365	365	430	290
Max water table depth (VS60 – 635mm shaft)	365 - 765	365 – 765	430 - 830	290 - 690
Max water table depth (Driveable shaft & lid)	765	765	830	690

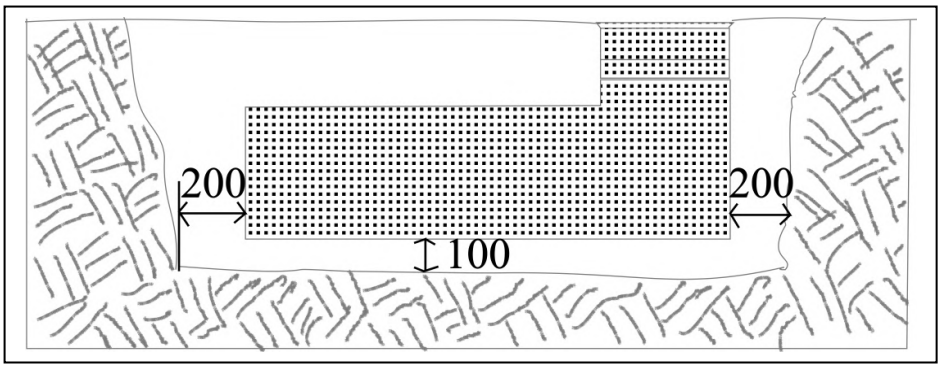
1.4 Hillside location

- The soil within the area where the tank is to be positioned must be checked for possible soil movement (DIN 1054 edition 1/2003, E DIN 4084 edition 11/2002) and if necessary will need to be secured with a supporting structure (eg retaining wall)
- Consultation with local authorities is recommended.

1.5 Installation details

1.51 In clay ground conditions:

- The excavated area should be wide enough to allow the compression of the filling material (200mm) See Image below.



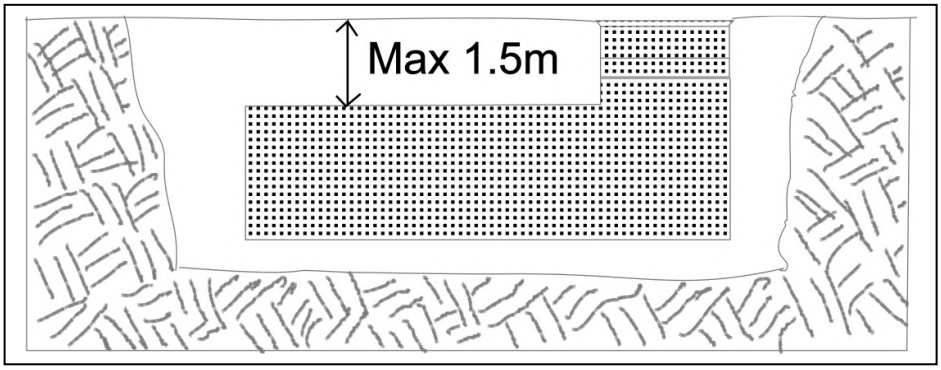
- With installations deeper than 1.75m (ground to base of tank) use 500mm width of the filling material.
- The tank should be covered with at least 300mm of filling material.

1.52 In loose ground conditions:

- Up to 1.75m depth of excavation use 200mm of filling material around the sides of the tank.
- With installations deeper than 1.75m use 500mm width of the filling material
- The tank should be covered with at least 300mm of filling material

1.6 Further criteria

- Existing pipelines, pipes, vegetation and other specifics must be considered so that damage or hazards will be avoided.
- The maximum soil coverage on top of the tank body is 1.5m
- If it is not guaranteed that the ground water level will remain below the permitted maximum level, a drainage system must be installed around the tank, which reliably drains the water. If a drainage system is not possible then contact your supplier about an alternative tank.



2. Installation

2.1 Backfill around and below the tank

- Backfill material around the tank has to be well compacted and permeable to water allowing close packing and no damage to the surface of the tank
- If the filling material contains sharp of sharp-edged components, the wall of the tank must be protected by a sandy coating.

2.1.1
- Gravel mixtures are the preferred filling material. The recommended sizes 8mm-16mm

2.1.2
- Concrete gravel with a particle size of up to 16mm is recommended for use in clay / loam soil conditions with ground water and high water table.
- When ground water and a high water table are present it is important to ensure good compaction when applying the filling material.

2.1.3
- Stone Chippings – crushed rock particles between 4mm and 16mm in size are suitable filling material. However due to the sharp edges the tank must be protected against damage, for example using a sand coating.

2.1.4
- Excavation – sand and gravel mixtures with mixed particle sizes is suitable as a filling material providing they meet the criteria listed under 2.1

2.1.5
- Top soil, clay, loam and other types of cohesive soils are not suitable as filling material.

2.2 Backfill on top of the tank
- Excavated soil or other material can be used if it is stable and permeable

2.3 Backfilling and compaction methods
- The backfilling and compaction methods to be used are described in Section 3 (Installation Instructions)

2.3.1
- Adding water to the filling material is not recommended as this will make the compacting unstable
- The base layer for driveable situations must use a grain size of 2/45

2.4 Pipes
2.4.1
- The feed pipe should be laid with a fall to the tank of greater than 1 degree
- Ensure that underground rainwater pipes come from sealed gullies (do not use open gullies)

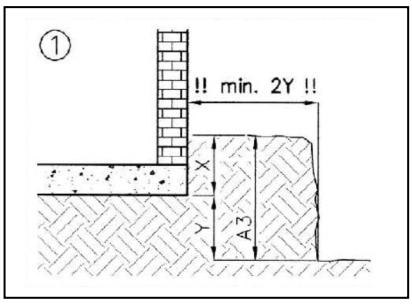
2.4.2
- The overflow pipe / drain pipe should have a deeper fall away from the tank than the fall from the feed pipe to the tank

2.4.3
- The service pipe is to be installed using the provided seals to ensure a tight fixture to avoid contaminants entering the tank. All electrical and other cables are laid through this service pipe back to the property.

2.4.4
- The pipes must be laid in such a way to avoid frost damage.

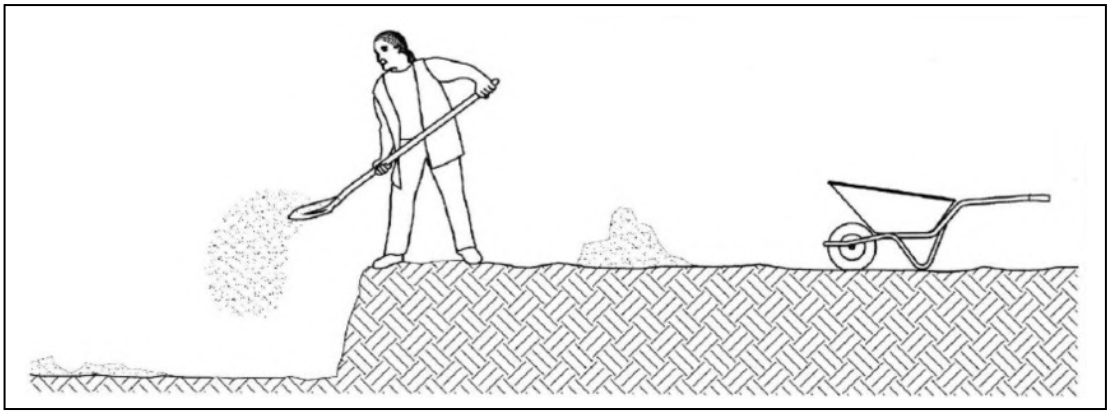
3. Installation Instructions

1. **Establish distance from the property.**

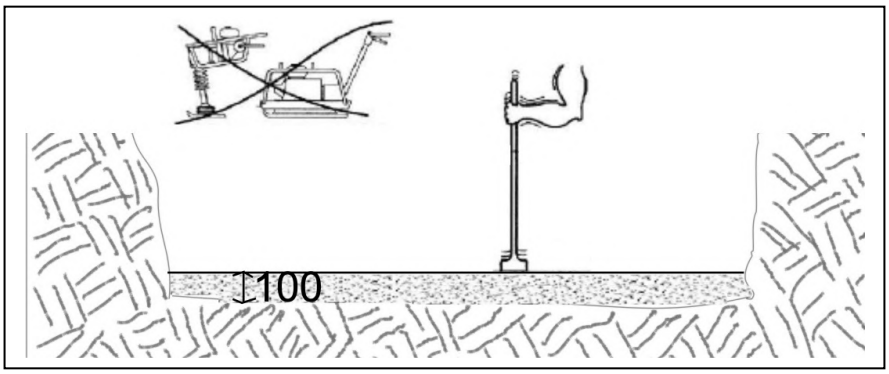


2. **Dig hole**

3. **Lay 100mm base**

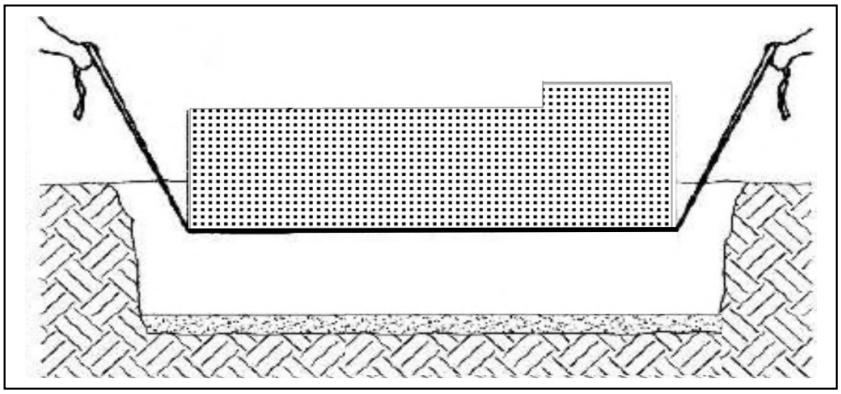


4. **Compact the base by hand only. Ensure you have a level base.**

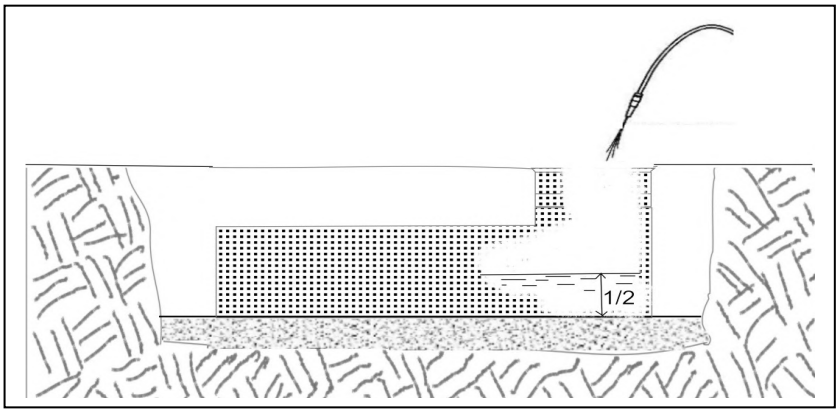


Rainwater Harvesting Limited, Unit A Harrier Park, Southgate Way, Orton Southgate, Peterborough, PE2 6YQ,UK
Phone +44 (0) 1733 405111 – Fax +44 (0) 1733 230996
Email : info@rainwaterharvesting.co.uk – Website : www.rainwaterharvesting.co.uk
January 2019

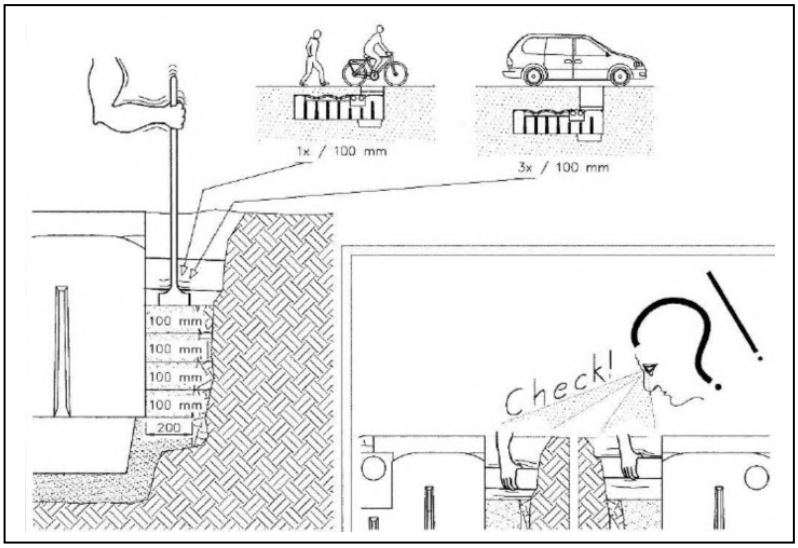
5. **Lower the tank carefully into the hole ensuring that you are achieving the necessary widths around the tank for the filling material.**



6. **Fill the tank with water up to half way**



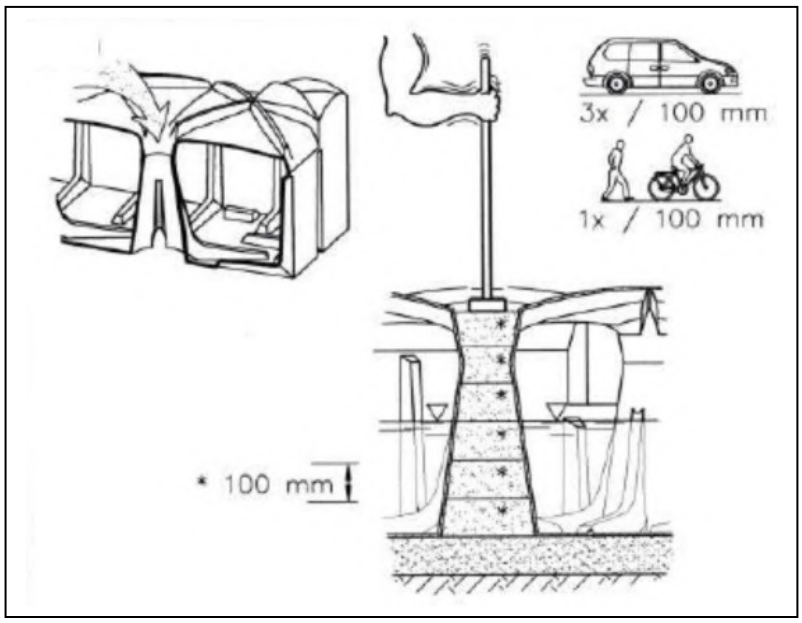
7. **Apply filling material**



- Do not use a mechanical whacker plate.
- Hand tap the material to compress it.
- Lay in 100mm layers for pedestrian install
- Lay in 300mm layers for driveable install
- Check to ensure the minimum width between the tank and excavation wall is correct (min 200mm)

Rainwater Harvesting Limited, Unit A Harrier Park, Southgate Way, Orton Southgate, Peterborough, PE2 6YQ,UK
Phone +44 (0) 1733 405111 – Fax +44 (0) 1733 230996
Email : info@rainwaterharvesting.co.uk – Website : www.rainwaterharvesting.co.uk
January 2019

8. Hand compress the filling material into the central columns



To link tanks together do the following:

- Drill a hole using a 127mm drill bit into a flat part of the tank at low level.
- Insert the supplied grommets (seals) into the hole.
- Feed a 4" pipe into the hole allowing at least 500mm to be inside of the tank.
- Use washing up liquid if necessary to assist with pushing the pipe through the grommet.

NOTES :

- **Please refer to the individual installations documents for the shafts, extension sleeve and driveable shaft and lid.**

Rainwater Harvesting Limited, Unit A Harrier Park, Southgate Way, Orton Southgate, Peterborough, PE2 6YQ,UK
Phone +44 (0) 1733 405111 – Fax +44 (0) 1733 230996
Email : info@rainwaterharvesting.co.uk – Website : www.rainwaterharvesting.co.uk

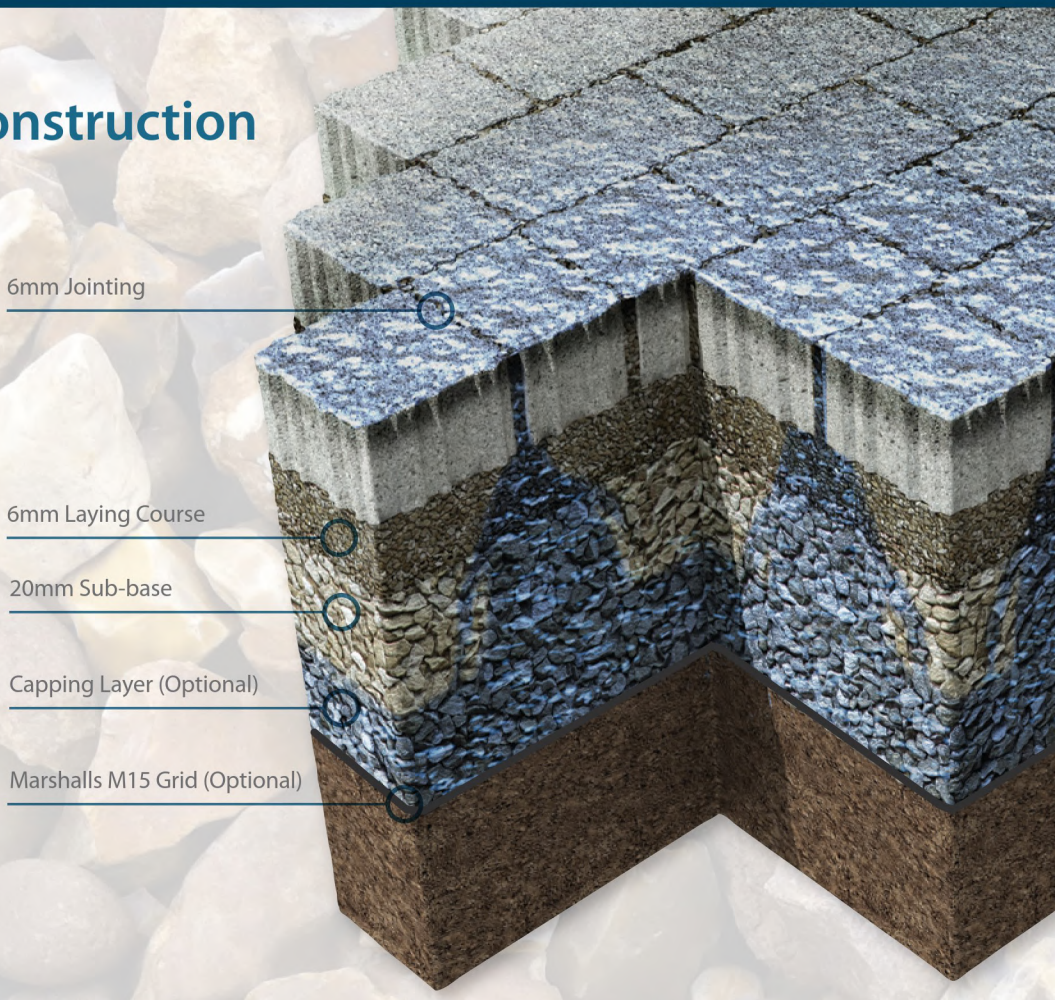
12.7.3 Permeable Paving

Priora Sub-Base Construction

The aggregate installed beneath a Marshalls Priora surface is an essential element of the Marshalls Priora system. The aggregate must provide sufficient porosity to store water in the voids between the granular elements. It must also be of sufficient structural strength to withstand the loads to which the structure will be subjected.

Therefore, for the Marshalls Priora system to work effectively, we provide thorough aggregate specification to help source the correct material.

For detailed aggregate specification please see page 45, and for details of Marshalls Priora Aggregate, please see page 34.



Jointing

A traditional concrete block pavement would use sand to fill the joints between the blocks. A Marshalls Priora system requires a more open graded coarse material, which will allow water to easily pass through into the sub-base without clogging.

It should also be of an angular nature to maximise interlock within the aggregate and between the blocks to provide additional stability to the surface layer.

Jointing Aggregate Specification: 6mm Open Graded Crushed Rock

Laying Course

The large size of sub-base material aggregate creates an uneven surface when compacted and has an open textured surface. Therefore a laying course material is required, to provide a flatter platform onto which the blocks are laid. This should prevent any rocking or instability of the blocks in-situ.

Crucially, the laying course in a Marshalls Priora system should also provide maximum infiltration properties, allowing water to flow freely through the joints.

Laying Course Aggregate Specification: 6mm Open Graded Crushed Rock

Sub-Base

In addition to providing structural stability (as it would in a traditional pavement), the sub-base of a Marshalls Priora system must also provide sufficient hydraulic capacity to store water. This is achieved by using an aggregate with a high permeability.

Permeability is measured in terms of the aggregate/ void ratio. We recommend the use of an aggregate with a void ratio of between 30% - 32%. In effect this means that every $3m^3$ of aggregate can store approximately $1m^3$ of water

Sub-Base Aggregate Specification: 20mm Open Graded Crushed Rock

Capping Layer

A capping layer is required on weak ground to improve the bearing capacity of the pavement. Ground is considered "weak" when the CBR (California Bearing Ratio) is below 5%. Marshalls M15 Grid can be used at the interface of the capping layer and the subgrade to confine the capping material and stabilise the structure, reducing the amount of capping material required. See page 45 for Capping Material specification. See page 33 for information on M15 Grid.

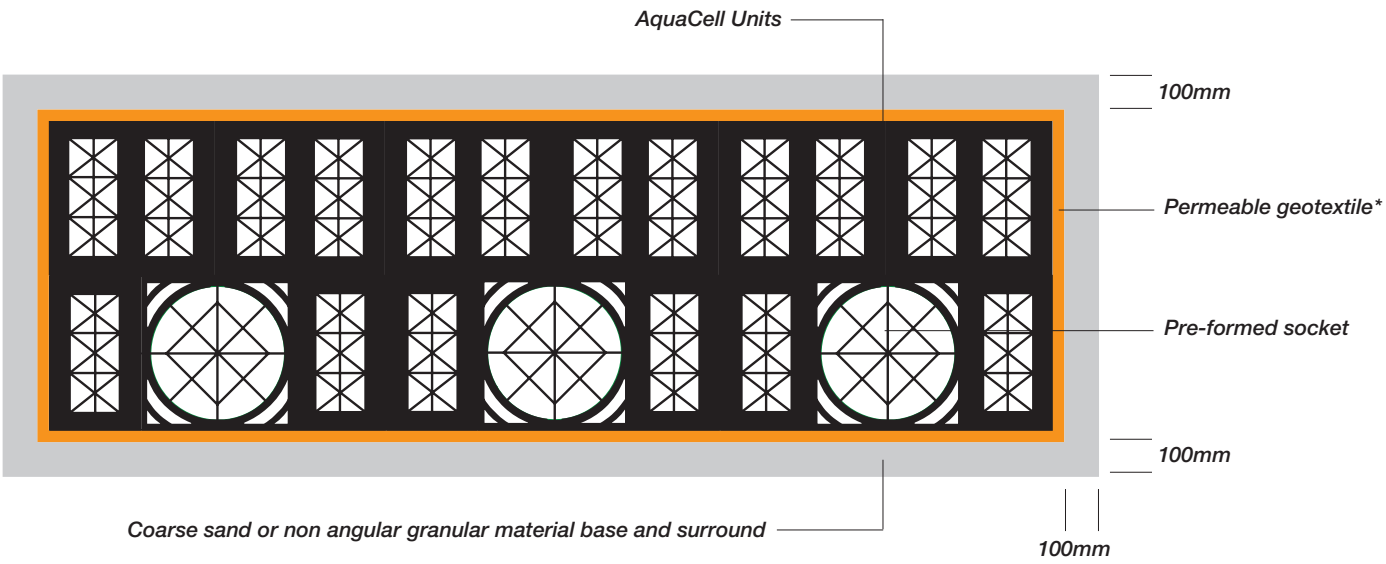

6mm Aggregate


20mm Aggregate

Full specification of suitable aggregate is set out in EN 13242: 2002

12.7.4 Geocellular Storage

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.

12.7.5 Drainage Plan

S1 - Geocellular Storage Crates

12m^{2}Geocellular Storage

1m thick;

0.95 Porosity;

Approximately 11.4m^{3}Attenuation within Geocellular Storage Crates

P1A - Permeable Paving

245m^2 Permeable Paving

270mm Thick;

0.3 Porosity;

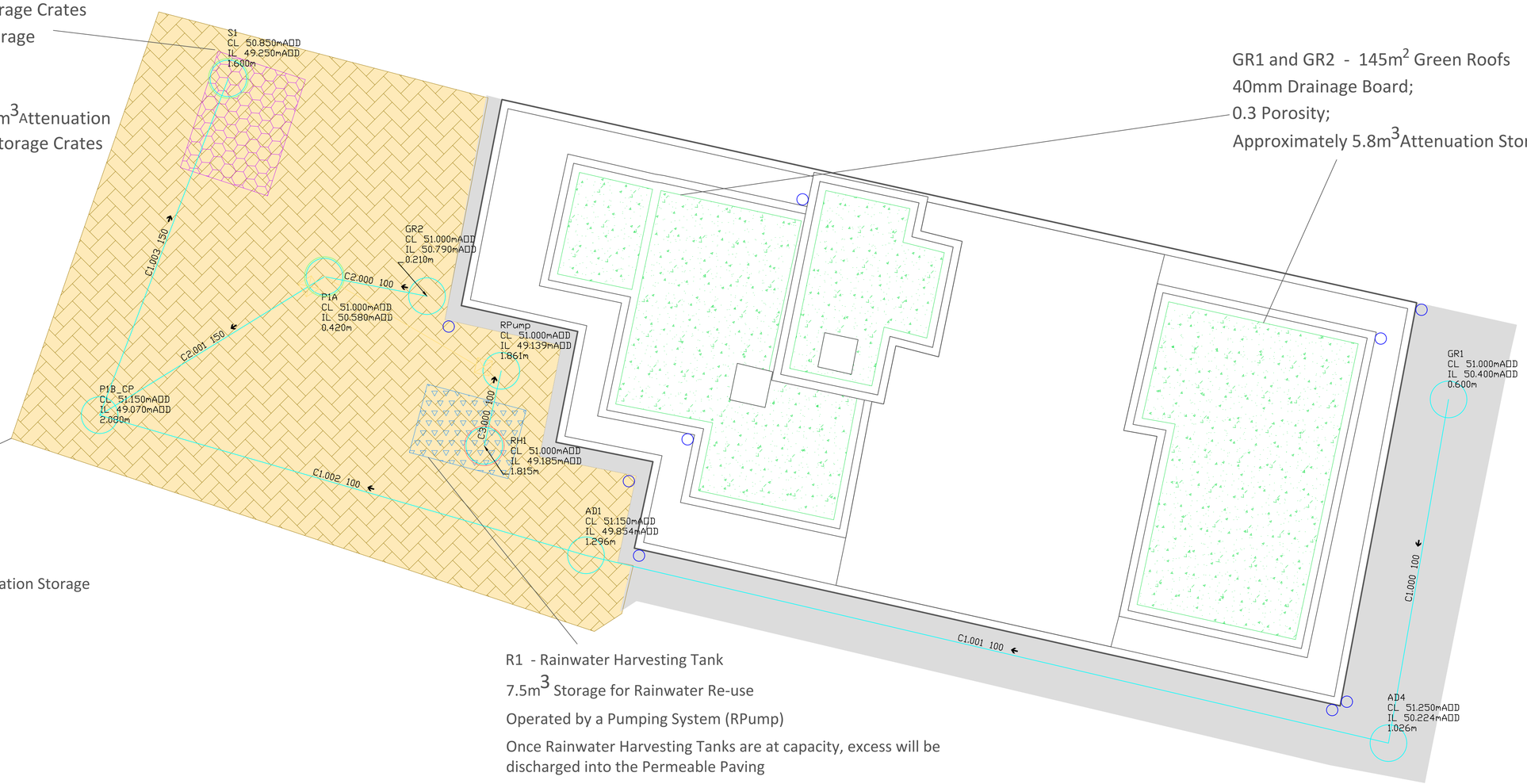
Approximately 19m^{3}Attenuation Storage

GR1 and GR2 - 145m^2 Green Roofs

40mm Drainage Board;

0.3 Porosity;

Approximately 5.8m^{3}Attenuation Storage



R1 - Rainwater Harvesting Tank

7.5m^3 Storage for Rainwater Re-use

Operated by a Pumping System (RPump)

Once Rainwater Harvesting Tanks are at capacity, excess will be discharged into the Permeable Paving

Will assist in providing the required 105l per day per person

Map Legend

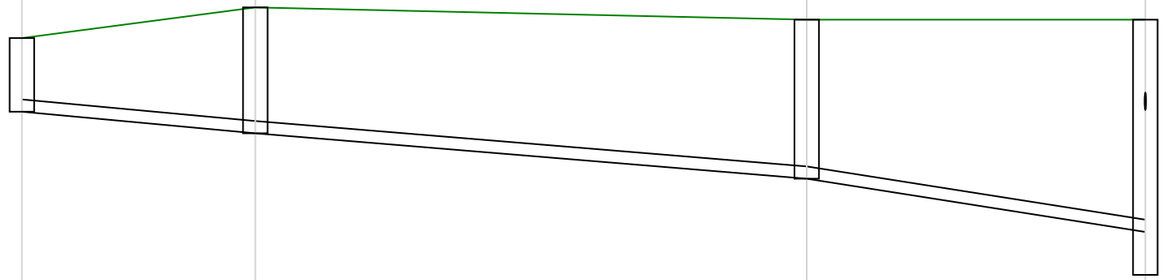
- Surface Water Manhole
- Surface Water Inspection Manhole
- Rainwater Down Pipe
- Foul Water Manhole
- Geocellular Infiltration Tank
- Rainwater Harvesting Tank
- Permeable Paving
- Impermeable Paving
- Bauder Biointensive Green Roof
- Surface Water Pipe
- Perforated Pipe
- Acco Drainage Channel
- Overflow Flow Route

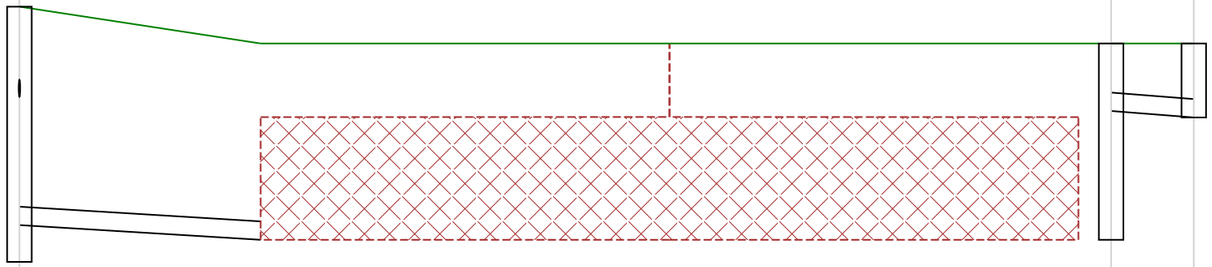
North

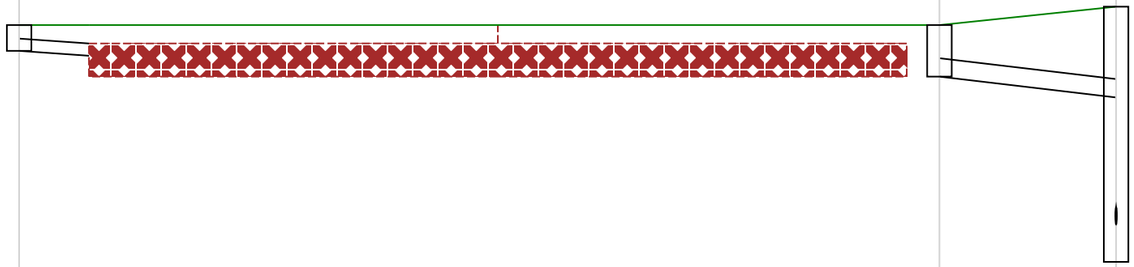
Project	:SWDS - 2023 - 000044
Site	:18-20 Station Road Longfield Kent DA3 7QH
Company	:STM Environmental
Client	:DCP Properties Limited
Issue	:No.1.0
By	:Georgia Travers

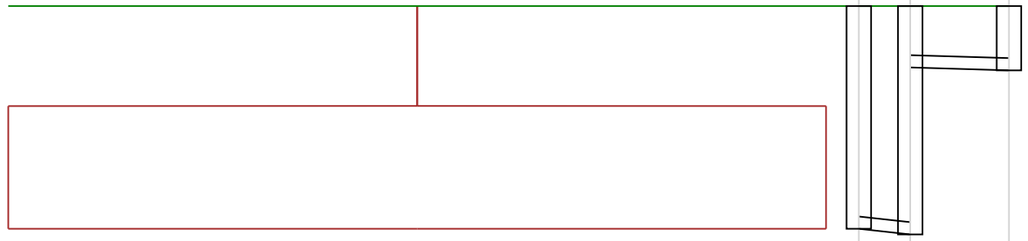
12.7.6 Flow Plot

See next page.

Node Name		GR1	4	1	P1B_CP
A3 drawing Hor Scale 300 Ver Scale 50 Datum (m) 45.000					
Link Name		1.000	1.001	1.002	
Section Type		100mm	100mm	100mm	
Slope (1:X)		64.9	72.9	38.2	
Cover Level (m)		51.000	51.250	51.150	51.150
Invert Level (m)		50.400	50.224 / 50.224	49.854 / 49.854	49.420
Length (m)		11.417	26.970	16.563	

Node Name		P1B_CP		S1	Dummy 1
A3 drawing Hor Scale 300 Ver Scale 50 Datum (m) 45.000					
Link Name		1.003		1.004	
Section Type		150mm		150mm	
Slope (1:X)		98.3		76.3	
Cover Level (m)		51.150		50.850	50.850
Invert Level (m)		49.370	49.250	50.300	50.247
Length (m)		11.797		4.044	

Node Name		GR2	P1A	P1B_CP
A3 drawing Hor Scale 300 Ver Scale 50 Datum (m) 45.000				
Link Name		2.000	2.001	
Section Type		100mm	150mm	
Slope (1:X)		85.4	50.8	
Cover Level (m)		51.000	51.000	51.150
Invert Level (m)		50.790 50.750	50.580	50.410
Length (m)		3.416	8.641	

Node Name		RH1	RPump	DummyOut
A3 drawing Hor Scale 300 Ver Scale 50 Datum (m) 45.000				
Link Name		3.000	3.001	
Section Type		100m	100mm	
Slope (1:X)		54.7	201.2	
Cover Level (m)		51.000	51.000	51.000
Invert Level (m)		49.185 49.139	50.500	50.476
Length (m)		2.516	4.828	

12.7.7 Flow Results

See next 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 (%)	40	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

Nodes

Name	Area (ha)	T of E (mins)	Cover Level (m)	Diameter (mm)	Easting (m)	Northing (m)	Depth (m)
GR1	0.013	5.00	51.000	1200	560097.932	169058.656	0.600
4	0.000	5.00	51.250	1200	560095.964	169047.409	1.026
P1A	0.036	5.00	51.000	1200	560061.145	169062.671	0.420
P1B_CP			51.150	1200	560053.788	169058.140	2.080
S1	0.000	5.00	50.850	1200	560058.002	169069.159	1.600
Dummy 1			50.850	1200	560061.798	169067.766	0.603
1			51.150	1200	560069.703	169053.553	1.296
RH1	0.014	5.00	51.000	1200	560066.376	169057.137	1.815
RPump	0.000	5.00	51.000	1200	560066.931	169059.591	1.861
DummyOut			51.000	1200	560062.347	169058.077	0.524
GR2	0.012	5.00	51.000	1200	560064.501	169062.034	0.210

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)
1.004	S1	Dummy 1	4.044	0.600	50.300	50.247	0.053	76.3	150	6.17	50.0
1.003	P1B_CP	S1	11.797	0.600	49.370	49.250	0.120	98.3	150	6.11	50.0
1.002	1	P1B_CP	16.563	0.600	49.854	49.420	0.434	38.2	100	5.92	50.0
2.001	P1A	P1B_CP	8.641	0.600	50.580	50.410	0.170	50.8	150	5.17	50.0
2.000	GR2	P1A	3.416	0.600	50.790	50.750	0.040	85.4	100	5.07	50.0
1.001	4	1	26.970	0.600	50.224	49.854	0.370	72.9	100	5.70	50.0
1.000	GR1	4	11.417	0.600	50.400	50.224	0.176	64.9	100	5.20	50.0
3.001	RPump	DummyOut	4.828	0.600	50.500	50.476	0.024	201.2	100	5.19	50.0
3.000	RH1	RPump	2.516	0.600	49.185	49.139	0.046	54.7	100	5.04	50.0

Name	Vel (m/s)	Cap (l/s)	Flow (l/s)	US Depth (m)	DS Depth (m)	Σ Area (ha)	Σ Add Inflow (l/s)	Pro Depth (mm)	Pro Velocity (m/s)
1.004	1.152	20.4	11.6	0.400	0.453	0.061	0.0	81	1.189
1.003	1.013	17.9	11.6	1.630	1.450	0.061	0.0	88	1.075
1.002	1.252	9.8	2.5	1.196	1.630	0.013	0.0	34	1.039
2.001	1.414	25.0	9.1	0.270	0.590	0.048	0.0	62	1.303
2.000	0.833	6.5	2.3	0.110	0.150	0.012	0.0	41	0.761
1.001	0.902	7.1	2.5	0.926	1.196	0.013	0.0	41	0.824
1.000	0.957	7.5	2.5	0.500	0.926	0.013	0.0	39	0.858
3.001	0.538	4.2	2.7	0.400	0.424	0.014	0.0	57	0.569
3.000	1.044	8.2	2.7	1.715	1.761	0.014	0.0	39	0.935

Pipeline Schedule

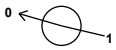
Link	Length (m)	Slope (1:X)	Dia (mm)	Link Type	US CL (m)	US IL (m)	US Depth (m)	DS CL (m)	DS IL (m)	DS Depth (m)
1.004	4.044	76.3	150	Circular	50.850	50.300	0.400	50.850	50.247	0.453
1.003	11.797	98.3	150	Circular	51.150	49.370	1.630	50.850	49.250	1.450
1.002	16.563	38.2	100	Circular	51.150	49.854	1.196	51.150	49.420	1.630
2.001	8.641	50.8	150	Circular	51.000	50.580	0.270	51.150	50.410	0.590
2.000	3.416	85.4	100	Circular	51.000	50.790	0.110	51.000	50.750	0.150
1.001	26.970	72.9	100	Circular	51.250	50.224	0.926	51.150	49.854	1.196
1.000	11.417	64.9	100	Circular	51.000	50.400	0.500	51.250	50.224	0.926
3.001	4.828	201.2	100	Circular	51.000	50.500	0.400	51.000	50.476	0.424
3.000	2.516	54.7	100	Circular	51.000	49.185	1.715	51.000	49.139	1.761

Link	US Node	Dia (mm)	Node Type	MH Type	DS Node	Dia (mm)	Node Type	MH Type
1.004	S1	1200	Manhole	Adoptable	Dummy 1	1200	Manhole	Adoptable
1.003	P1B_CP	1200	Manhole	Adoptable	S1	1200	Manhole	Adoptable
1.002	1	1200	Manhole	Adoptable	P1B_CP	1200	Manhole	Adoptable
2.001	P1A	1200	Manhole	Adoptable	P1B_CP	1200	Manhole	Adoptable
2.000	GR2	1200	Manhole	Adoptable	P1A	1200	Manhole	Adoptable
1.001	4	1200	Manhole	Adoptable	1	1200	Manhole	Adoptable
1.000	GR1	1200	Manhole	Adoptable	4	1200	Manhole	Adoptable
3.001	RPump	1200	Manhole	Adoptable	DummyOut	1200	Manhole	Adoptable
3.000	RH1	1200	Manhole	Adoptable	RPump	1200	Manhole	Adoptable

Manhole Schedule

Node	Easting (m)	Northing (m)	CL (m)	Depth (m)	Dia (mm)	Connections	Link	IL (m)	Dia (mm)
GR1	560097.932	169058.656	51.000	0.600	1200	 0	1.000	50.400	100
4	560095.964	169047.409	51.250	1.026	1200	 1	1.000	50.224	100
						0	1.001	50.224	100
P1A	560061.145	169062.671	51.000	0.420	1200	1	2.000	50.750	100
						 0	2.001	50.580	150
P1B_CP	560053.788	169058.140	51.150	2.080	1200	 1	2.001	50.410	150
						2	1.002	49.420	100
						0	1.003	49.370	150
S1	560058.002	169069.159	50.850	1.600	1200	1	1.003	49.250	150
						 0	1.004	50.300	150
Dummy 1	560061.798	169067.766	50.850	0.603	1200	1	1.004	50.247	150
									

Manhole Schedule

Node	Easting (m)	Northing (m)	CL (m)	Depth (m)	Dia (mm)	Connections	Link	IL (m)	Dia (mm)
1	560069.703	169053.553	51.150	1.296	1200	1	1.001	49.854	100
									
						0	1.002	49.854	100
RH1	560066.376	169057.137	51.000	1.815	1200				
						0	3.000	49.185	100
RPump	560066.931	169059.591	51.000	1.861	1200	1	3.000	49.139	100
									
						0	3.001	50.500	100
DummyOut	560062.347	169058.077	51.000	0.524	1200	1	3.001	50.476	100
									
GR2	560064.501	169062.034	51.000	0.210	1200				
						0	2.000	50.790	100

Simulation Settings

Rainfall Methodology	FSR	Drain Down Time (mins)	240
FSR Region	England and Wales	Additional Storage (m³/ha)	20.0
M5-60 (mm)	20.000	Check Discharge Rate(s)	✓
Ratio-R	0.400	1 year (l/s)	10.7
Summer CV	0.750	30 year (l/s)	25.2
Analysis Speed	Normal	100 year (l/s)	32.0
Skip Steady State	x	Check Discharge Volume	x

Storm Durations

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

Return Period (years)	Climate Change (CC %)	Additional Area (A %)	Additional Flow (Q %)
1	0	0	0
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)	0.072	Q 1 year (l/s)	10.7
PIMP (%)	100	Q 30 year (l/s)	25.2
CV	0.750	Q 100 year (l/s)	32.0

Node P1A Online Orifice Control

Flap Valve	x	Invert Level (m)	50.580	Diameter (m)	0.026
Downstream Link	2.001	Design Depth (m)	0.500	Discharge Coefficient	0.600
Replaces Downstream Link	✓	Design Flow (l/s)	1.0		

Node RPump Offline Pump Control

Flap Valve	x	Design Depth (m)	1.000	Switch off depth (m)	0.030
Loop to Node	P1A	Design Flow (l/s)	1.0		
Invert Level (m)	49.139	Switch on depth (m)	0.050		

Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.200	1.000	1.000	1.000

Node S1 Depth/Area Storage Structure

Base Inf Coefficient (m/hr)	0.04900	Safety Factor	2.0	Invert Level (m)	49.250
Side Inf Coefficient (m/hr)	0.04900	Porosity	0.95	Time to half empty (mins)	

Depth (m)	Area (m²)	Inf Area (m²)	Depth (m)	Area (m²)	Inf Area (m²)	Depth (m)	Area (m²)	Inf Area (m²)
0.000	12.0	12.0	1.000	12.0	13.0	1.001	0.0	13.0

Node P1A Depth/Area Storage Structure

Base Inf Coefficient (m/hr)	0.04900	Safety Factor	2.0	Invert Level (m)	50.580
Side Inf Coefficient (m/hr)	0.04900	Porosity	0.30	Time to half empty (mins)	

Depth (m)	Area (m²)	Inf Area (m²)	Depth (m)	Area (m²)	Inf Area (m²)	Depth (m)	Area (m²)	Inf Area (m²)
0.000	234.0	234.0	0.270	234.0	234.8	0.271	0.0	234.8

Node RH1 Depth/Area Storage Structure

Base Inf Coefficient (m/hr)	0.00000	Safety Factor	2.0	Invert Level (m)	49.185
Side Inf Coefficient (m/hr)	0.00000	Porosity	1.00	Time to half empty (mins)	

Depth (m)	Area (m²)	Inf Area (m²)	Depth (m)	Area (m²)	Inf Area (m²)	Depth (m)	Area (m²)	Inf Area (m²)
0.000	7.5	0.0	1.000	7.5	0.0	1.001	0.0	0.0

12.8 Appendix 8 – SuDS Maintenance Manual

All maintenance activities will be the responsibility of GMP Designs. 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.

12.8.1 Pervious Pavements

Maintenance Schedule	Required Action	Typical Frequency	Responsibility
Regular maintenance	Brushing and vacuuming (standard cosmetic sweep over whole surface).	Once a year, after autumn leaf fall, or reduced frequency as required, based on site-specific observations of clogging or manufacturer's recommendations - pay particular attention to areas where water runs onto pervious surface from adjacent impermeable areas as this area is most likely to collect the most sediment.	DCP Properties Limited will be responsible for setting up the management company.
Occasional maintenance	Stabilise and mow contributing and areas.	As required.	
	Removal of weeds or manage using weed killer applied directly into the weeds rather than spraying.	As required - once per year on less frequently used pavements.	
Remedial actions	Remediate any landscaping which, through vegetation maintenance or soil slip, has been raised to within 50 mm of the level of the paving.	As required.	
	Remedial work to any depressions, rutting and cracked or broken blocks considered detrimental to the structural performance or a hazard to users, and lost material.	As required.	

Maintenance Schedule	Required Action	Typical Frequency	Responsibility
	Rehabilitation of surface and upper substructure by remedial sweeping.	Every 10 to 15 years or as required (if infiltration performance is reduced due to significant clogging).	DCP Properties Limited will be responsible for setting up the management company.
Monitoring	Initial Inspection.	Monthly for three months after installation.	
	Inspect for evidence of poor operation and/or weed growth - if required, take remedial action.	Three-monthly, 48h after large storms in first six months.	
	Inspect silt accumulation rates and establish appropriate brushing frequencies.	Annually.	
	Monitor Inspection chambers.	Annually.	

Many of the specific maintenance activities for pervious pavements can be undertaken as part of a general site cleaning contract (many car parks or roads are swept to remove litter and for visual reasons to keep them tidy). Therefore, if litter management is already required at the site, this should have marginal cost implications.

12.8.2 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.	DCP Properties Limited 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	DCP Properties Limited 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.

12.8.3 Soakaway 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.	DCP Properties Limited 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 of silted soakaway and/or replace or clean fill, if performance failure occurs	As required	DCP Properties Limited will be responsible for setting up the management company.
	Replacement of pipes / gutters / manholes / remove vegetation /	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 after heavy rainfall	After Storm events / 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 soakaway will be necessary if the system becomes blocked with silted. 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.

12.8.4 Rain Water Harvesting Maintenance

Maintenance Schedule	Required Action	Typical Frequency	Responsibility
Regular maintenance	Inspect for sediment and debris in inlet and outlet components;	Monthly;	DCP Properties Limited will be responsible for setting up the management company.
	Inspection & Cleaning of gutters and any filters on downpipes feeding into the Rain Water Butts.	Monthly; Increase freq. to weekly during Autumn; After storm events;	
Remedial actions	Cleaning of the rainwater Tanks. Fully drain the clear out debris and enable access; Scrub / Pressure wash out the inside of the tank if accessible, use appropriate cleaning product Rinse with clean water; Cleaning of Gutters; Clean or fit a new filter;	2 - 5 years;	
Monitoring	Check Correct pumping operations; Check volume of water being held in tank after storm events; Replace parts as required; Replace pump as required	Quartlery	

Maintenance will be carried out manually. All monitoring and maintenance will be carried out by the appointed the Owner (Lars Mosesson) who will instruct a management company to undertake the tasks.

12.8.5 Green & Blue Roof Maintenance

Maintenance Schedule	Required Action	Typical Frequency	Responsibility
Maintenance Procedures	Remove any dead vegetation and debris from the roof surface, ensure that any gutters, chute outlets and downpipes are free from blockages and that water can flow freely.	Bi-Annually - Spring and Autumn	DCP Properties Limited will be responsible for setting up the management company.
	Cleaning of gutters and any filters on downpipes.		
	Ensure that any new items of plant/equipment on the roof are mounted on suitable isolated slabs and that any fixings used to secure the plant/equipment in place do not penetrate the waterproofing. If in doubt, please contact Bauder for further advice.		
	Ensure that all protective metal flashings and termination bars remain securely fixed in place. Advise the client of the need to repair or renew as necessary.		
	Examine all mastic sealant and mortar pointing for signs of degradation. Advise the client of the need to repair or renew as necessary.		
General Horticultural Information	Any vegetation which has encroached into the vegetation barriers (pebbles) should be removed. If movement/settlement of the pebble vegetation barrier has occurred, additional washed 20/40 mm grade stone pebbles similar to the existing are to be added. Flint ballast with sharp edges is unsuitable and may damage the waterproofing.	As required	DCP Properties Limited will be responsible for setting up the management company.
	The cultivation of intensive green roof substrate may be carried out in the same way as with any normal horticultural growing medium. However, care must be taken not to mechanically damage the either the waterproofing system or any of the green roof components, as this would invalidate the guarantee. The use of fertilizers and weed killers will have no detrimental effect on either the waterproofing or the green roof system.	As required	DCP Properties Limited will be responsible for setting up the management company.

Remedial actions	The Building owner should keep a record of all inspections and maintenance carried out on the roof. Any signs of damage or degradation to either the waterproofing or the green roof installation should be reported to Bauder Ltd (or chosen provider) immediately, in order that arrangements can be made for remedial work to be carried out if necessary.	As required	DCP Properties Limited will be responsible for setting up the management company.
	Works to adjoining areas - When carrying out any maintenance to adjoining roof areas, care must be taken not to damage either the green roof landscaping or the waterproofing system. If it is considered that either element has been affected, then Bauder (or provider) should be contacted for advice. Any waterproofing damage caused after completion of the original installation may invalidate the guarantee.	As required.	

12.8.6 Flow Control Maintenance

Maintenance Schedule	Required Action	Typical Frequency	Responsibility
Regular maintenance	Inspect for sediment and debris;	Quarterly; As required.	DCP Properties Limited 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;	

12.8.7 After Sales Service Contract:

“We strongly recommend that you take advantage of our Service Contract to give your pumping station a long and trouble-free life.

The Contract provides for regular service visits, and our standard Contract includes for labour and travel.

Any additional parts and materials are changed at the quoted price.
(Please note: Any parts replaced during the first 12 months as a result of a proved warranty claim will be covered by our standard warranty replacement procedure).

I would suggest that 2 visits per year would be required to maintain your pumping station in its optimum condition.

Price per visit: £395.00 (Three hundred and ninety-five pounds) nett (this nett price allows for your agreed discount) plus VAT.

The above price of a Service visit is subject to our “Service contract” terms, Ref: “SERVICE/150416/SCM/TD” to be issued at a later date.

If you have any further queries about our After Sales Service, please contact us on 01322 357080 or e-mail to service@pts-jung.co.uk and we will be pleased to assist.

If you require any further assistance regarding this or any other application, please do not hesitate to contact the Office.

Yours sincerely,
Jason Inglin - Head of Sales, A.D.
Sales & Estimating Department”

12.9 Appendix 9 - Water Efficiency

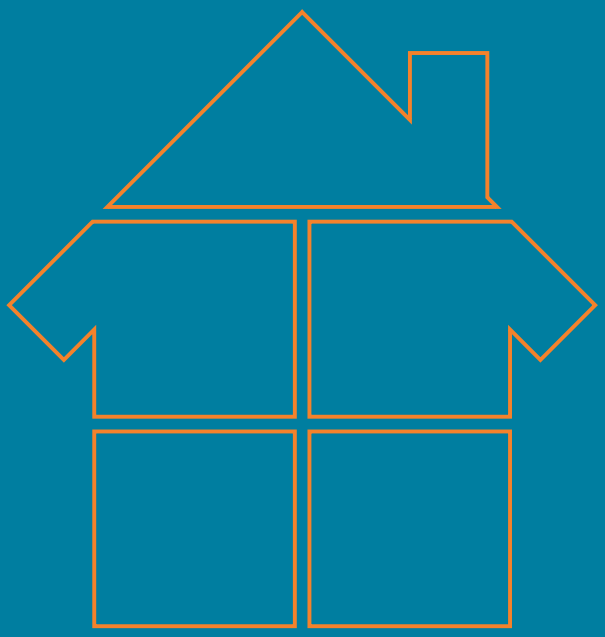
WaterSafe
LOCAL APPROVED PLUMBERS

HBF
HOME BUILDERS FEDERATION

Without action, there is a 1 in 4 chance in the next 30 years that large numbers of households will have their water supply cut off for an extended period because of severe drought.
National Infrastructure Commission report (2018)

We want to see water use in England fall. New homes will be built in a way that reduces demands for water, energy and material resources.
25-Year Environment Plan, launched by the Prime Minister in 2018

Developing water efficient homes



Why build water efficient homes?

Water is vital for our daily lives – for drinking, washing, generating energy and growing the food we eat.

However, this precious resource is coming under growing pressure as we build more homes for more people and feel the effects of climate change and a greater risk of droughts.

If we don't take action to reduce water use now, our daily lives, communities, nature and the wider economy will all suffer.

Here's a few reasons why it's important to make new homes water efficient.

Your customers

All new homes should have a water meter, but some of your customers might not have had one before, so they'll thank you for doing everything you can to help them lower their water and energy bills. Protecting the environment is also important to them – especially for their children's future.

Planning – locally and nationally

Planning authorities expect limits of 125 litres of water per person per day on new developments, as part of the Building Regulations Part G. They can also ask for a lower limit of 110 litres as a planning condition. The Government is currently reviewing water use targets.

Protecting the environment

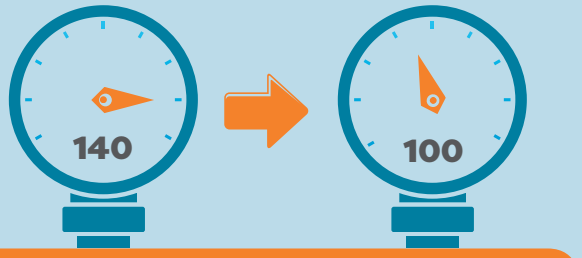
It's the right thing to do for people, nature and the economy. We all need to leave more water in the environment to protect rivers, streams and wildlife. The South East and East of England are already water-stressed and other areas are likely to follow.

Cost savings to you

Many water companies are offering to reduce or waiver water infrastructure charges, if you build water efficient homes. You pay these charges per property when you connect to the water network, to contribute to the cost of providing water services.

Your reputation

Your customers, communities and governing bodies will think more of you and your work if you show their needs and values are important to you.



The average UK water use is about 140 litres per person right now. The National Infrastructure Commission is recommending 118 litres for everyone – new homes and old – and water companies are setting ambitious targets in their long-term plans – some as low as 100.

All new homes must have a water meter – these helpful guidelines share best practice on meters. **water.org.uk/developer-services/guidelines**

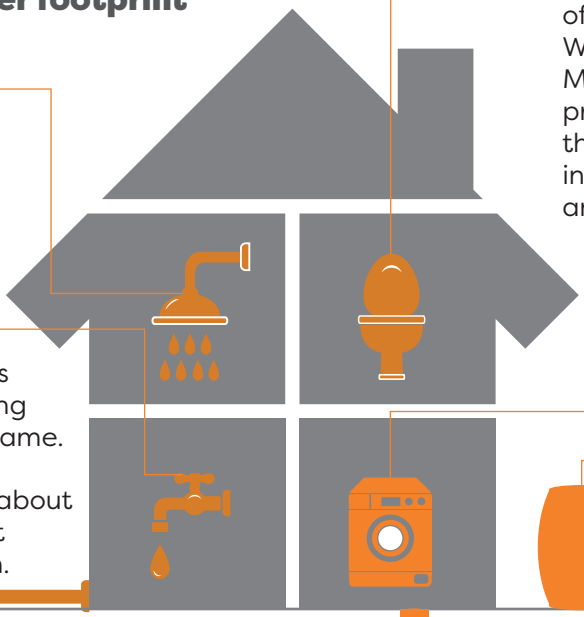
How to create water efficient homes

A few simple choices can make a big difference to the water footprint of a new house.

Showers – water efficient showerheads can save more than a third of water, and the energy to heat it, while still providing a great shower experience.

Taps – inexpensive aerators add air into the water – using less and the flow feels the same.

Gardens – think about drought-resistant plants and mulch.



Toilets – dual flush toilets should have a maximum flush of six litres to comply with the Water Fittings Regulations. Make sure they are installed properly to avoid leaks – one of the biggest causes of water loss in homes. Flushes as low as 4 and 2.6 litres are available.

Appliances – choose energy and water efficient washing machines and dishwashers.

Water butts – installing a water butt on a down pipe is a great gift for new homeowners.

Ask your local water supplier about a **'trickle feed'** before a full connection.

Greywater or rainwater harvesting – both these can generate water to flush the loo, wash the car or water the garden. They are much more efficient and cost effective when installed during construction. Take care to install them correctly so they don't illegally cross-connect to the water supply. Find out more at **watersafe.org.uk/alternativewater.**

Tools to help

Contact your local water supplier - they have lots of advice and incentives to share. Other help includes:

We need more ambitious water efficiency – for customers, the environment, society and the economy. It's perfectly doable to get down to 100 litres per person per day in the next 20 to 25 years.
Nicci Russell, Managing Director, Waterwise

The Water Label

The European Water Label rates bathroom products in terms of their water efficiency. Visit europeanwaterlabel.eu and look for A rated products.

The Calculator

This free calculator helps work out how much water your development will use and how you can reduce it to meet guidelines – you can access it at thewatercalculator.org.uk

Waterwise

Waterwise is an independent, not-for-profit organisation focused on reducing water consumption in the UK. Visit waterwise.org.uk for advice and support.

WaterSafe®
LOCAL APPROVED PLUMBERS

Who can support you?

WaterSafe is the national register of approved plumbers in the UK, supported by all the UK water companies and the drinking water quality regulators.

Plumbing businesses on its register are all trained in the Water Fittings Regulations – the national requirements which govern the design, installation, operation and maintenance of plumbing systems, water fittings and appliances which use water.

As well as protecting the quality of drinking water, the regulations are designed to prevent the 'waste and undue consumption of water'.

For most types of plumbing work, plumbers have a legal duty to notify the local water supplier before they start work and this can lead to delays. Approved plumbers can carry out some work without advanced notification.

Some water companies may also provide incentives if you use an approved plumber or groundworker to carry out work. A 'work completed' certificate issued by a WaterSafe plumber also provides a defence if challenged by a supplier enforcing the Water Fittings Regulations.

Approved products

WaterSafe-approved plumbers can also offer advice on approved plumbing products – both to avoid waste and protect water quality. You should make sure products you use have been tested against appropriate standards.

One easy way to check if a product is suitable is to look for an approval mark from organisations like the Water Regulations Advisory Scheme (WRAS) or Kiwa. Both provide directories of approved products at **wras.co.uk** or **kiwa.co.uk/waterproducts**.

Find WaterSafe plumbers at watersafe.org.uk