SuDS STRATEGY

24 Ambleside Drive, Headington, OX3 0AQ

for

HSD

December 2023

Report Ref: DS001

Mont Arch Ltd

DOCUMENT RECORD

Document Ref: 1021-FR001				
Revision	Date	Remarks	Collaborators	Signature
-	12/12/23	Issued for Approval	Name *James Berryman* ***Director***	James Berryman [redacted]

CONTENTS PAGE

APPENDICES

1. APPOINTMENT AND BRIEF

1.1 Mont Arch Ltd (Mont Arch) have been appointed by HSD to undertake a Sustainable Drainage Systems (SuDS) Strategy to support the planning application for a proposed redevelopment at 24 Ambleside Drive, Headington. A Site Location Plan in provided in Appendix A.

1.2 Development Proposals consists of the demolition of the existing property and construction of a single new dwelling. Refer to Appendix B for the Site Masterplans.

REPORT SCOPE

1.3 This report sets out the proposed surface water drainage strategy for the scheme including design considerations and constraints. Whilst completing the assessment, consideration has been given to the National Planning Policy Framework (NPPF), Planning Practice Guidance, British Standard 8533:2011, Assessing and Managing Flood Risk in Development, British Standard 8582:2013 Code of Practice for Surface Water Management for Development Sites and Oxfordshire Lead Local Flood Authorities Local Standards and Guidance for Surface Water Drainage on Major Development In Oxfordshire (V1.2 December 2021).

LIMITATIONS

1.4 This report is based on the interpretation and assessment of data provided by third parties. Mont Arch Ltd cannot be held responsible for the accuracy of the third party data and the conclusions and findings of this report may change if the data is amended or updated after the date of consultation.

CONSTRUCTION (DESIGN AND MANAGEMENT) REGULATIONS

1.5 The revised Construction (Design and Management) Regulations 2015 (CDM Regulations) came into force on April 2015 to update certain duties on all parties involved in a construction project, including those promoting the development. One of the designer's responsibilities under clause 9 (1) is to ensure that the client organisation, in this instance HSD is made aware of their duties under the CDM Regulations.

2. DEVELOPMENT SITE DESCRIPTION

2.1 The development site is located at 24 Ambleside Drive, Headington, OX3 0AQ (refer to Appendix A), at approximate grid reference SP536077.

2.2 The total area of the development site within the red line boundary is in the region of 900 m^2 .

2.3 The proposed development comprises the demolition of the existing buildings and the construction of a new residential dwelling.

2.4 The site lies approximately 80m above ordnance datum and slopes from west to east with a fall of approx. 4.0m.

3. GEOLOGY & HYDROLOGY

3.1 British Geological Survey (BGS) online maps indicate this site not to be underlain by superficial deposits but underlain by the West Walton Formation - Mudstone.

3.2 BGS Borehole Data from approximately 105m to the north west of the site confirms the BGS mapping with the borehole noting the identified the Stratum set out in Table 3.1 (see Appendix B for full log).

TABLE 3.1: BGS BOREHOLE REFERENCE: SP50NW250 NAME: UNITED OXFORD RADCLIFFE INFIRMARY BH12

Depth (m)	Stratum Description and Observations
Ground level – 1′0″	Top Soil
1′0″– 15′0″	Firm mottled brown and grey silty clay with shell fragments
15′0″– 30′0″	Stiff to very stiff fissured grey silty clay
End of Borehole at 30′0″	

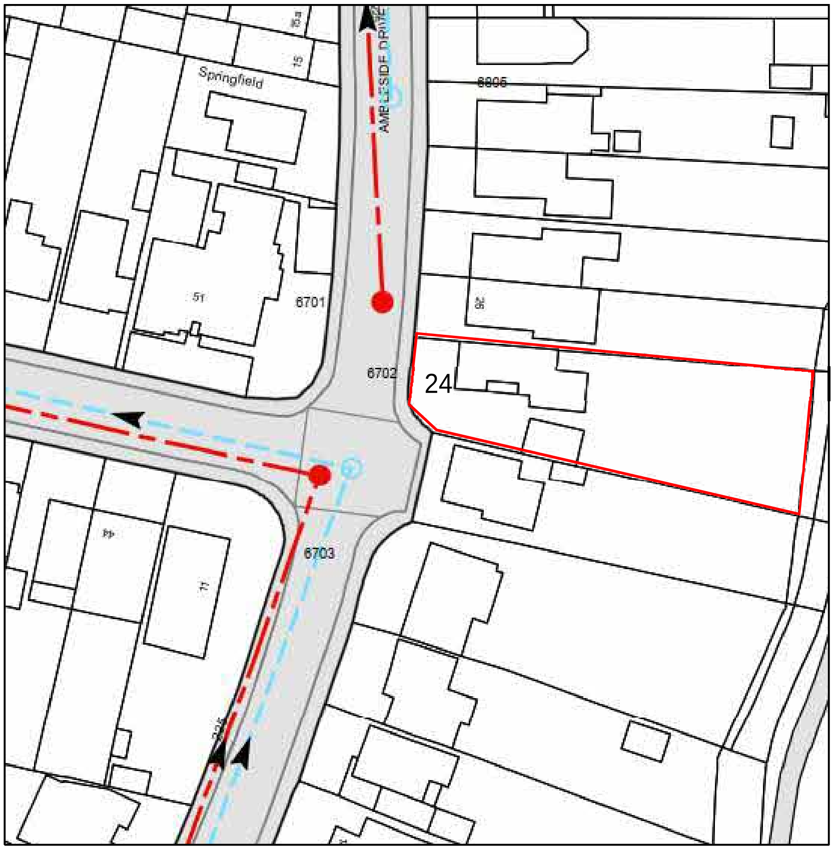
3.3 Ground water was identified within the borehole at 8ft depth.

3.4 The site is not located within a groundwater source protection zone as defined by the Environment Agencies mapping.

3.5 Mapping indicates a drainage ditch to the rear of the garden; however, no details have been identified as to where the ditch discharges. The closets main river is the Bayswater Brook to the north of the A40 approx. 0.7km.

3.6 Thames Water sewer records (see Appendix C for full details) indicate there are 225mm Foul and Surface Water sewers within Ambleside Drive – see figure 3-1.

FIGURE3.1: EXTRACT FROMTHAMES WATER SEWER RECORDS



4. SURFACE WATER MANAGEMENT - POLICY CONTEXT

NATIONAL PLANNING POLICY FRAMEWORK (NPPF) – JULY 2021

4.1 The Updated National Planning Policy Framework (NPPF) was published in July 2021 and sets out the Government's national policies for flood risk management in a land use planning context within England.

4.2 Paragraph 159 of the NPPF states "Inappropriate development in areas at risk of flooding should be avoided by directing development away from areas at highest risk (whether existing or future). Where development is necessary in such areas, the development should be made safe for its lifetime without increasing flood risk elsewhere.."

4.3 Paragraph 169 of the NPPF states "Major developments should incorporate sustainable drainage systems unless there is clear evidence that this would be inappropriate. The systems used should:

(a) take account of advice from the lead local flood authority;

(b) have appropriate proposed minimum operational standards;

(c) have maintenance arrangements in place to ensure an acceptable standard of operation for the lifetime of the development; and

(d) where possible, provide multifunctional benefits."

SUSTAINABLE DRAINAGE SYSTEMS WRITTEN STATEMENT HCWS161 (DECEMBER 2014)

4.4 The Secretary of State for Communities and Local Government laid a Written Ministerial Statement in the House of Commons on 18 December 2014 setting out changes to planning that will apply for major development from 6 April 2015. This confirms that in considering planning applications, local planning authorities should consult the relevant Lead Local Flood Authority on the management of surface water; satisfy themselves that the proposed minimum standards of operation are appropriate and ensure through the use of planning conditions or planning obligations that there are clear arrangements in place for ongoing maintenance over the lifetime of the development.

4.5 Therefore, from 6 April 2015 local planning policies and decisions on planning applications relating to major development are required to ensure that sustainable drainage systems (SuDS) are used for the management of surface water.

4.6 Major development is development involving any one or more of the following:

- The winning and working of minerals or the use of land for mineral-working deposits;
- Waste development;
- The provision of 10 dwellings or more;
- The provision of a building or buildings where the floor space to be created by the development is 1,000 square metres or more; or
- Development carried out on a site having an area of 1 hectare or more.

DEFRA Sustainable Drainage Systems Non-Statutory Technical Standards for Sustainable Drainage Systems (March 2015)

4.7 This document sets out non-statutory technical standards for sustainable drainage systems. It should be used in conjunction with the National Planning Policy Framework and Planning Practice Guidance.

4.8 For greenfield developments, the peak runoff rate from the development to any highway drain, sewer or surface water body for the 1 in 1 year rainfall event and the 1 in 100 year rainfall event should never exceed the peak greenfield runoff rate for the same event.

4.9 Where reasonably practicable, for greenfield development, 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 should never exceed the greenfield runoff volume for the same event.

4.10 Where it is not reasonably practicable to constrain the volume of runoff to any drain, sewer or surface water body in accordance with the above, the runoff volume must be discharged at a rate that does not adversely affect flood risk.

4.11 The drainage system must be designed so that, unless an area is designated to hold and/or convey water as part of the design, flooding does not occur on any part of the site for a 1 in 30 year rainfall event.

4.12 The drainage system must be designed so that, unless an area is designated to hold and/or convey water as part of the design, flooding does not occur during a 1 in 100 year rainfall event in any part of: a building (including a basement); or in any utility plant susceptible to water (e.g. pumping station or electricity substation) within the development.

4.13 The design of the site must ensure that, so far as is reasonably practicable, flows resulting from rainfall in excess of a 1 in 100 year rainfall event are managed in exceedance routes that minimise the risks to people and property.

ENVIRONMENT AGENCY - FLOOD RISK PLANNING PRACTICE GUIDANCE (PPG) – AUGUST 2022

4.14 Paragraphs 55 -61 of the updated 2022 guidance provide additional weight on the implementation of SuDS, notably the use of above-ground, multifunctional SuDS. These SuDS that offer biodiversity, amenity and water quality enhancements as well as the typical water quantity management element.

BRITISH STANDARD 8582:2013 CODE OF PRACTICE FOR SURFACE WATER MANAGEMENT FOR DEVELOPMENT SITES (NOVEMBER 2013)

4.15 In the absence of specific local guidance on the management of surface water run-off, BS 8582 should be considered as best practice guidance for the development of surface water drainage strategies for new development sites.

OXFORDSHIRE LEAD LOCAL FLOOD AUTHORITY - LOCAL STANDARDS AND GUIDANCE FOR SURFACE WATER DRAINAGE ON MAJOR DEVELOPMENT IN OXFORDSHIRE

4.16 This guidance document has been adopted by Oxfordshire County Council in its role as Lead Local Flood Authority as policy in relation to the review of Planning Applications. Therefore, this document forms a material planning consideration.

CLIMATE CHANGE

4.17 The Climate Change Adaptation Sub-Committee Progress Report 2014, increased flood risk is the greatest threat to the UK from climate change. Models of the climate system suggest floods of the type experienced in England and Wales in autumn 2000, and between December 2013 and February 2014, have become more likely as a consequence of increased concentrations of greenhouse gases in the atmosphere.

4.18 More frequent short-duration, high intensity rainfall and more frequent periods of long-duration rainfall could be expected. Sea levels are also expected to continue to rise.

4.19 New EA guidance "Flood risk assessments: climate change allowances" issued on the 19th February 2016 provides up to date information on expected changes in rainfall, river flows and sea level rise as a consequence of climate change. This guidance was last updated 27 May 2022.

4.20 A key change from the previous guidance is that the climate change allowances for peak river flows now are shown as variable on a regional basis; allowance are also now based on percentiles, whereby a percentile is a measure used in statistics to describe the proportion of possible scenarios that fall below an allowance level (e.g. a 50% percentile means that the allowance has 50% chances of not being exceeded).

4.21 On this basis key allowances for peak river flows based on percentiles are:

- central allowance, - based on the 50th percentile
- higher central - based on the 70th percentile
- upper end - based on the 90th percentile

These allowances are detailed in Table 1 (Peak river flow allowances by river basin district) of the EA guidance.

4.22 As discussed in the EA Guidance, the choice of the appropriate allowance for peak river flow (e.g. central or higher central) should reflect the risk for the proposed development and therefore is linked to the expected hazard, vulnerability and resilience of the scheme; recommendations on the appropriate allowances to be considered are provided in the EA Guidance.

4.23 For peak rainfall the EA Guidance provides an upper end and central allowance depending on epoch; the guidance recommends assessing both the central and upper end allowances to understand the range of impact. These allowances are detailed in Table 2 (Peak rainfall intensity allowance in small and urban catchments) of the EA guidance.

4.24 For this proposed site, based on the new guidance residential development (considered "More Vulnerable" in flood risk terms) should be reviewed against the following new climate change allowances:

Table 4.1 - Summary of Climate Change Factors

Flood Criteria	Climate change Factor
Peak Runoff	25% central allowance 40% upper end allowance

5. SURFACE WATER MANAGEMENT

EXISTING

5.1 It is understood that all surface water that falls upon the existing impermeable areas of the site currently freely discharge to the Thames Water sewer in Ambleside Drive. Further survey work is recommended to confirm if it is viable to reuse this connection. Table 5.1 sets out the results from indicative Micro Drainage modelling for the existing site (see Appendix D for full model details and analysis results) and the greenfield runoff rates. The brownfield runoff rates assume an unrestricted discharge via a 100mm pipe with an estimated existing impermeable area of 250m^2. The greenfield rate is based on the same 250m2 area as it is assumed the garden areas drain to the ground.

TABLE 5.1: RUNOFF RATES

Return Period	Brownfield Flow rates (l/s)	Greenfield Flow rates (l/s)
1yr	3.5	0.1
30yr	7.9	0.2
100yr	9.5	0.3

PROPOSED

SUSTAINABLE DRAINAGE SYSTEMS (SUDS)

5.2 A Sustainable Drainage Systems (SuDS) hierarchy has been followed in applying the use of sustainable drainage techniques to the proposed development. This has been set out in Table 7-2 below with justifications provided where particular techniques are deemed feasible.

5.3 Planning guidance requires drainage strategies for new developments to discharge surface water in line with the following hierarchy:

1. Reused
2. Infiltration
3. Existing Watercourse
4. Existing sewer

5.4 Where viable rainwater harvesting water butts should be positioned adjacent to down pipes to collect surface water for reuse within the garden.

5.5 The BGS mapping and borehole logs indicate the site is underlain with clays. Infiltration testing to BRE Digest 365 has been undertaken for 46 Ambleside Drive in March 2019 – see Appendix E for test results. The results show a limited rate of infiltration, modelling using this rate for the proposed impermeable area of the site indicate that infiltration is would not provide a viable means of discharge as it would not allow the attenuation to half drain within 24 hours. Therefore, as no suitable watercourses have been identified within the site boundary, it is recommended that the site discharge at a controlled rate to the Thames Water sewers. A permeable membrane may be used on any attenuation /SuDS to allow some infiltration to the ground, however with the low rate measured at number 4, the soil record data and the risk of sedimentation over time no allowance has been made within the modelling for infiltration.

TABLE 5:2 - SUDS FEASIBILITY

SuDS Technique	Can they be feasibly incorporated into the site?	Reason
Green Roofs	X	Proposed roof pitcheson residential buildingsare not suitable
Basins and Ponds	X/✓	An attenuation basin could provide storage prior to discharge.
Filter Strips and Swales	X/✓	Swales may be used to convey and/or attenuate surface water although may not be suitable due to the scale / masterplanning ofthe development.
Permeable Surfaces and Filter Drains	✓	Permeable paving will be utilised on the front drive. This will provide ar element of storage as well as a level of pre-treatment prior to discharge.
Rainwater Harvesting	X/✓	Rainwater harvesting could be utilised on site, but has not been allowed for within the attenuation calculations as it could be full during the critical event.
Bio Retention	✓	Bio retention planters couldbe used to drain hard standing areas and wil provide an element of water quality and biodiversity enhancement.
Tanked Systems	✓	Tank systems may be used toattenuate the critical event prior to discharge. Tank(s)could be located beneaththe driveway or rear garden.

SURFACE WATER DRAINAGE STRATEGY

5.6 SuDS will be implemented within this development scheme. The conceptual SuDS strategy for the proposed development has been derived using the principles outlined within the CIRIA C753 SuDS Design Manual along with BS 8582:2013 – Code of Practise for Surface Water Management for Development Sites.

5.7 The new driveway will be surfaced with permeable paving. This will provide treatment of contaminants and subsequent degradation by micro-organisms of hydrocarbons and organic matter within the subbase.

5.8 Rainwater from the building roof will be conveyed to the front of the property vie below ground pipes. The proposed piped drainage system should be designed such that there is no surcharging in the 1 in 2 year probability event, and no flooding in the 1 in 30 year probability event as per Sewers for Adoption criteria. The piped system will remain private and should be constructed in line with Building Regulations Part H.

5.9 Cellular storage may be cited either below the front drive or the front garden (subject to detailed design). Micro Drainage modelling

5.10 Micro Drainage modelling indicates that a 200 mm subbase can provide suitable storage for the 1 in 100 year storm plus 40% allowance for climate change. Appendix D sets out the Micro Drainage modelling and analysis results.

5.11

5.12 Offsite discharge will be controlled via a vortex flow control. The minimum discharge that can be achieved while maintaining a orifice opening within the flow control of at least 50mm to minimise the risk of blockage is 0.7 l/s for the 1:1 and 0.8 l/s 1:30 year critical storm events and 1.1 l/s for the 1:100 + 40% climate change. As set out in table 5-3 this provides between 80-90% betterment (subject to return period) over the estimated brownfield site discharge rates.

TABLE 5-3: EXISTING & PROPOSED RUNOFF RATES

	Runoff Rate (l/s)			
	1	30	100	100 + 40% CC
Greenfield	0.1	0.2	0.3	N/A
Existing	3.5	7.9	9.5	N/A
Proposed	0.7	0.8	N/A	1.1
Reduction (%) Existing to Proposed	80	90	88	

5.13 To prevent flooding should the vortex flow control become blocked, a bypass internal weir overflow should be fitted within the control chamber.

5.14 Further survey work is required to confirm if the existing offsite connection could be reused for the proposed redevelopment. Should this not be viable it is proposed that a Section 106 Sewer Connection Agreement and offsite works will be required to connect to Thames Water surface water manhole 6805 in Amberside Drive.

5.15 The proposed drainage strategy is provided on drawing **DS001_1001 SuDS Strategy** (Appendix E).

TABLE 5-4 –CELLULAR STORAGE TANK DETAILS

Cellular Storage Tank Location	Attenuation Volume Provided (m^3)	Invert Level (mAOD)	Depth (m)	Cover (m)
Under front lawn	8.8	80.35	0.50	0.74

5.1 In order to protect SuDS devices, catchpit manholes will be required prior to any SuDS structures.

5.2 To ensure the effectiveness of the proposed drainage network a robust maintenance regime, in accordance with CIRIA C693 Section 22, will be implemented to ensure future performance of all SuDS and drainage components. This will include regular cleaning of SuDS devices. The SuDS Maintenance and Management Plan along with the Method Statement regarding the Management of Surface Water During Construction can be found in Appendix F and Appendix G respectively.

6. CONCLUSIONS

6.1 Mont Arch Ltd have been commissioned by HSD to undertake a SuDS Strategy for the proposed development at 24 Ambleside Drive, Headington, OX3 0AQ.

6.2 The development site is on a residential road and comprises the demolition of the existing house and the construction of a single new dwelling. The site is located at approximate grid reference SP536077.

6.3 It is thought that the existing site is served by Thames Water sewers in Ambleside Drive. The development can accommodate within its boundaries and site constraints a surface water drainage network that can manage the 1 in 100 yr return period storm event plus a 40% allowance for climate change.

6.4 A proposed SuDS scheme for the development could provide source control, treatment, attenuation and controlled storm water discharge. The proposed SuDS will manage water quality prior to discharge to the receiving sewers.

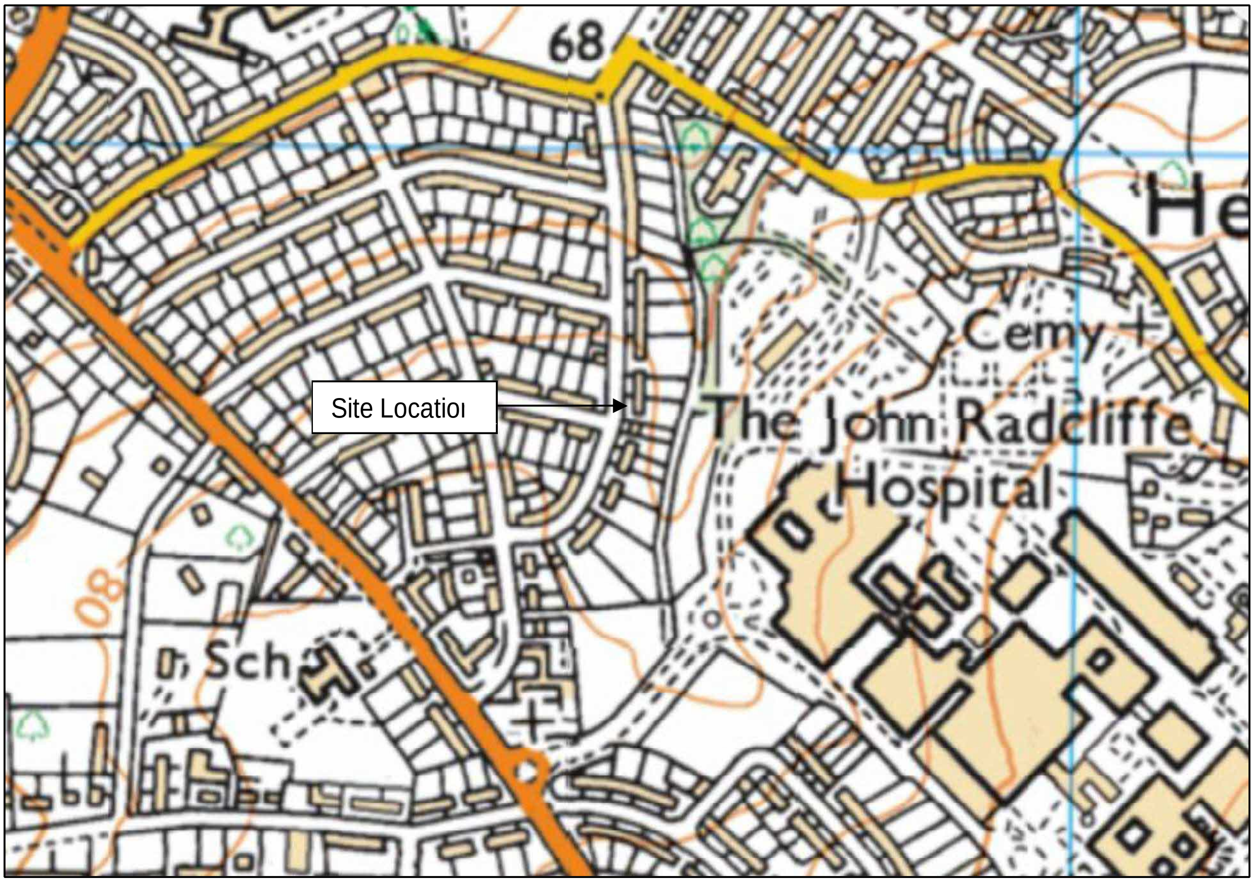
6.5 The proposed surface water drainage design principals set out in this document ensure that the development does not increase the risk of flooding to surrounding areas and reduces the risk downstream through the provision of SuDS techniques and attenuation. The proposed robust system is designed to deal with the impacts of climate change.

6.6 The outline drainage strategy has been designed to accommodate surface water runoff from the development for all events including the critical 1 in 100 year + 40% climate change. Discharge from the site into the existing Thames Water sewer will provide up to 91% betterment over the existing.

6.7 The sites drainage system is presented as sustainable and fully compliant with the criteria set out in NPPF.

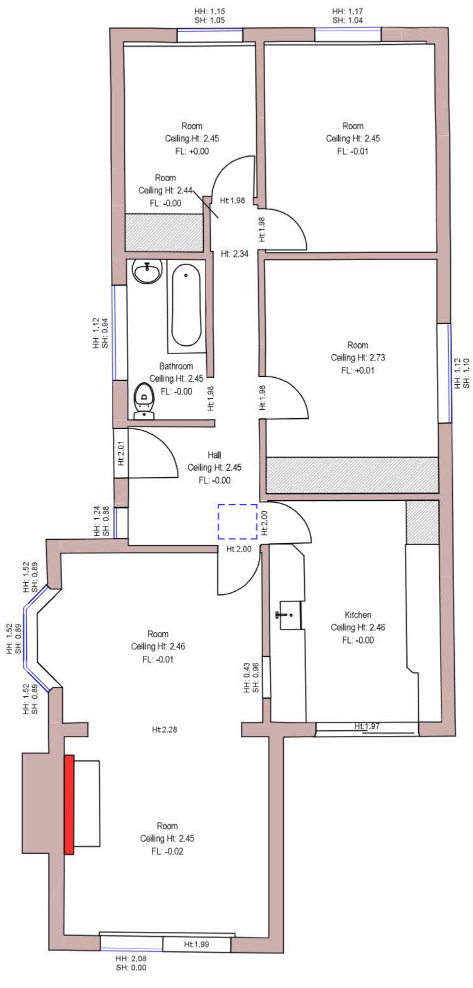
APPENDICES

Appendix A - Site Location Plan



Aerial View

Existing Site



1 Existing Ground Floor

1 : 50

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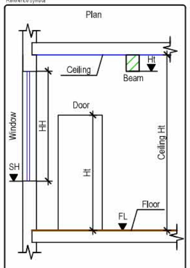

- Beam on plan view
- Fireplace
- Built-in storage
- Shower
- Ceiling hole, Ceiling level change

Elevation
- Roof

Section
- Ceiling
- Floor

Site plan
- Outline of a neighboring bld.
- Fence
- Landscaping
- Manhole

Abbreviations

FL - Floor Level
HT - Leaf Height (Door)
HT - Bottom Level (Beam)
SH - Window Sill Level
HH - Window Height
TL - Top Level
BL - Bottom Level

Section Number
1
3
Sheet Number

Notes

- All information contained in this drawing should be checked and verified prior to any fabrication or construction.
- Any discrepancies between this drawing and any other information should be reported to Measured Survey Pro within 60 days after the native CAD DWG drawings are released.

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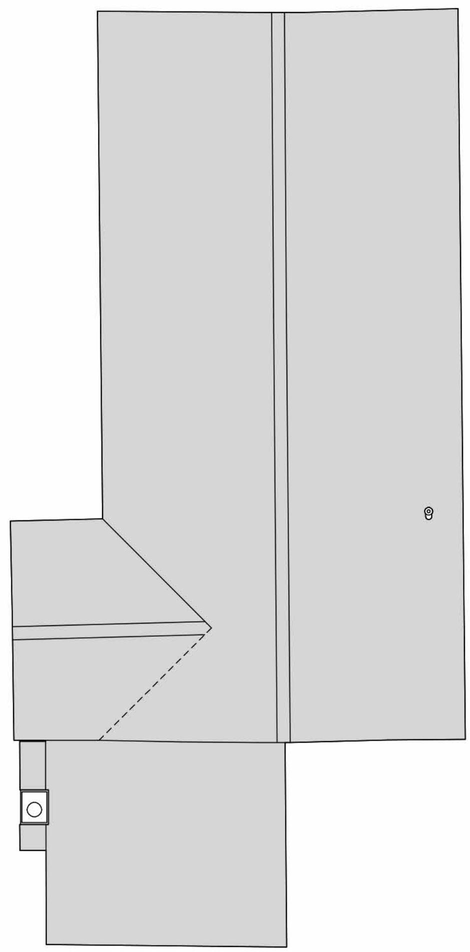

1 Existing Roof Plan

1 : 50

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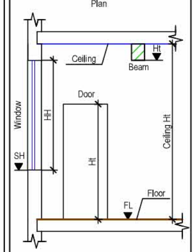

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1 Existing Front Elevation
1 : 50

2 Existing Rear Elevation
1 : 50

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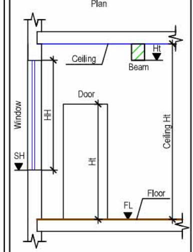

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- Some areas of the roof are based on assumption due to visibility restrictions

Project number	MS - 152020 - 2851
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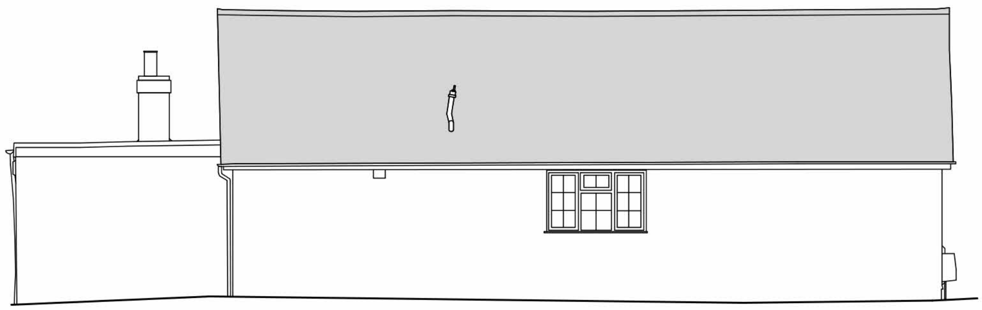
1 Existing Side 1 Elevation
1 : 50



2 Existing Side 2 Elevation
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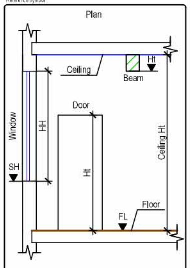

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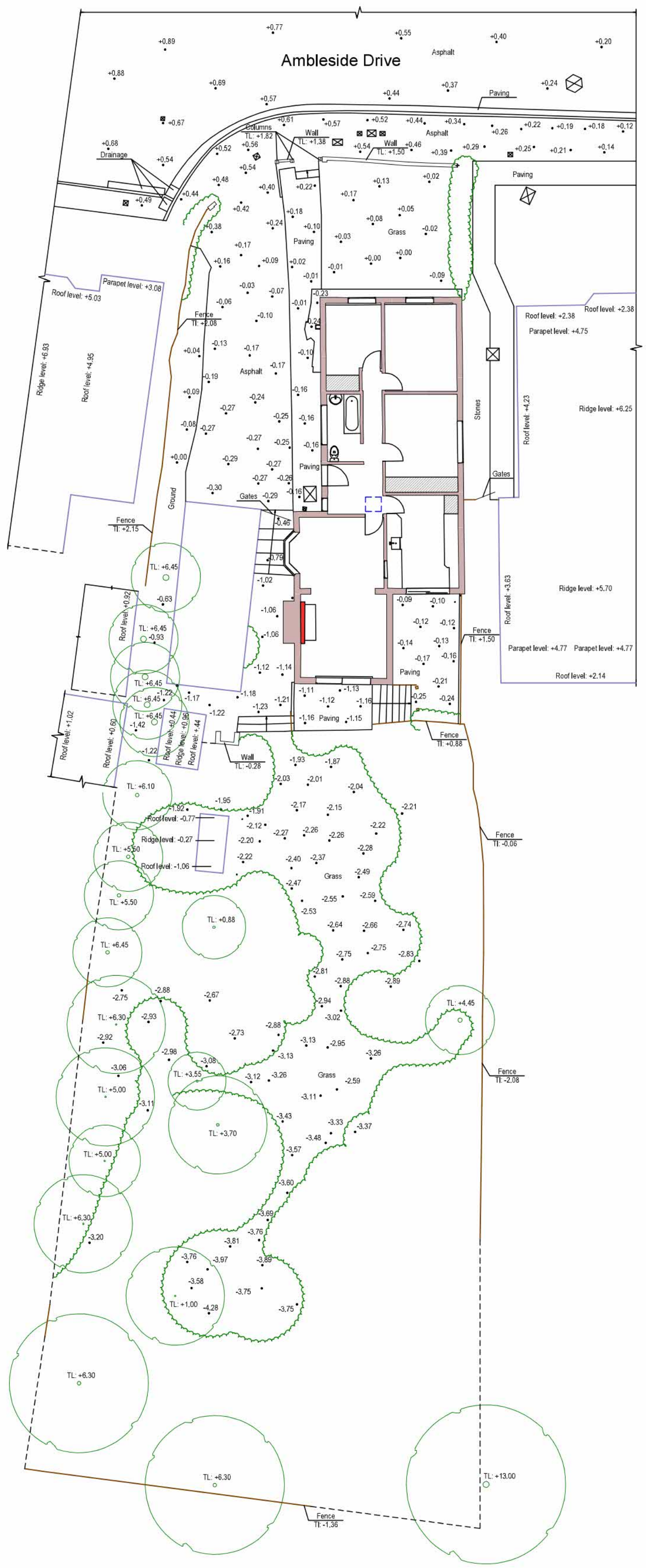

1 Existing Site Plan

1 : 100

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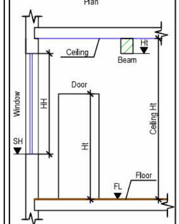

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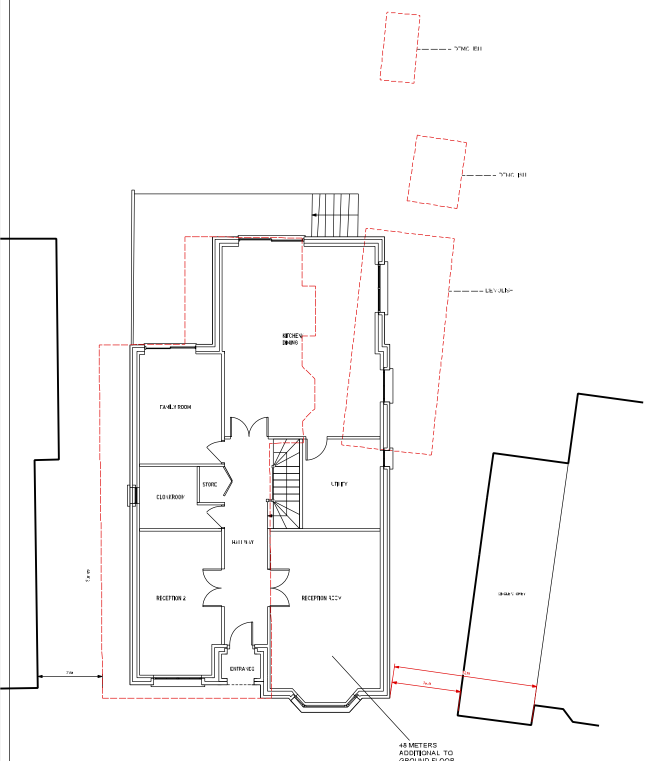
Proposed Development



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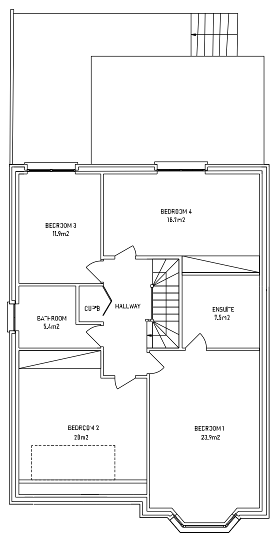
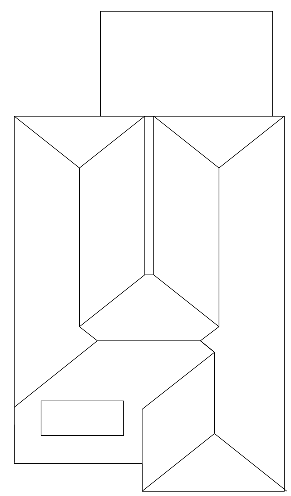


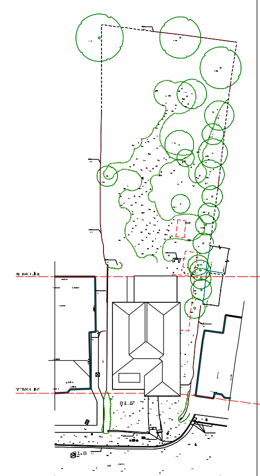
PROPOSED SECOND FLOOR PLAN

1:50 SCALE



PROPOSED ROOF FLOOR PLAN

1:50 SCALE



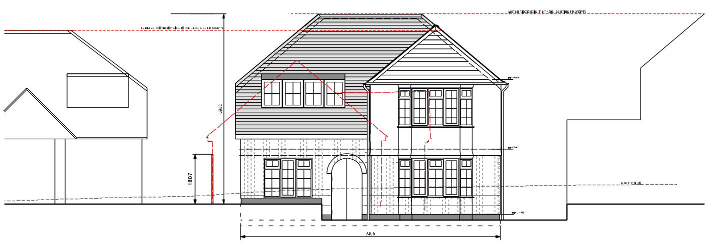
PROPOSED SITE BLOCK PLAN

1:200 SCALE

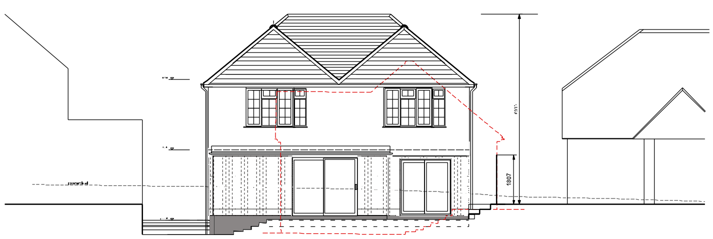
PRE APPLICATION - PLANNING

All dimensions to be verified on site by contractors.
Any discrepancies to be verified with the designer.
No scaled dimensions to be used only figured dimensions. Copyright of HSD.
Contractors to work to CDM 2015 if applicable

HSD	ARB RIBA		
Project: 24 Ambleside Drive, Headington, OX3 0AQ			
Title: Proposed Plans			
SCALE	DRAWN: H S SURI	REVISION	DATE
1:50 1:200@ A3	DG NO: DWG 01		



PROPOSED FRONT ELEVATION



PROPOSED REAR ELEVATION

PRE APPLICATION - PLANNING

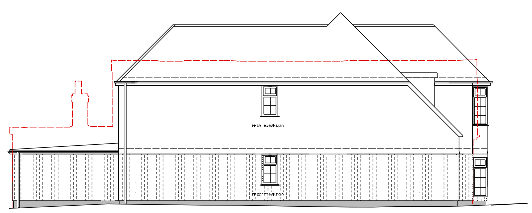
All dimensions to be verified on site by contractors.
Any discrepancies to be verified with the designer.
No scaled dimensions to be used only figured
dimensions. Copyright of HSD
Contractors to work to CDM 2015 if applicable

HSD ARB RIBA

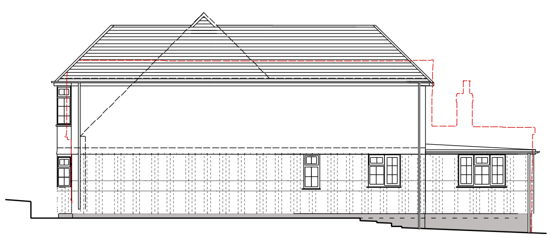
Project: 24 Ambleside Drive, Headington, OX3 0AQ

Title: Proposed Plans

SCALE	DRAWN:	REVISION	DATE
1:50 1:200@ A3	H S SURI		
	PG NO: DWG 02		



PROPOSED OTHER SIDE ELEVATION



PROPOSED SIDE ELEVATION

PRE APPLICATION - PLANNING

All dimensions to be verified on site by contractors.
Any discrepancies to be verified with the designer.
No scaled dimensions to be used only figured
dimensions. Copyright of HSD
Contractors to work to CDM 2015 if applicable

HSD	ARB RIBA		
Project: 24 Ambleside Drive, Headington, OX3 0AQ			
Title: Proposed Plans			
SCALE 1:50 1:200@ A3	DRAWN: H S SURI	REVISION	DATE
	PG NO: DWG 03		

Appendix B - Borehole Logs

RECORD OF BOREHOLE No.

SP 50 NW 250

243.3ft. above O.D. 74·16

Dia. of boring : 8in.
5369 0786

Snell and Auger

Lining tubes : 8in. to 21ft.6in.

Samples			Change of Strata			Description of Strata
	Depth	Type	Legend	Depth	O.D. Level	
	1'0"	D		1'0"	242.3	TOPSOIL 73.85
	1'6" - 3'0"	U(4)				
	3'0"	D				
	4'6"	D				
	6'6" - 8'0"	U(4)				Firm mottled brown and grey silty CLAY with shell fragments ? WW
	8'0"	D				
	10'0"	D				
	11'6" - 13'0"	U(4)				
	13'0"	D				
	15'0"	D		15'0"	228.3	68.98
	15'6" - 17'0"	U(4)				
	17'0"	D				
	19'0"	D				WW
	21'6" - 23'0"	U(4)				Stiff to very stiff fissured grey silty CLAY
	23'0"	D				
[illegible].4.64	24'6" - 26'0"	U(4)				
	26'0"	D				
[illegible].4.64	28'6" - 30'0"	U(4)		30'0"	213.3	65.01

Key to type of sample :
U(4) 4in. dia. undisturbed sample.
[illegible]
D Disturbed sample.
B Bulk disturbed sample.
W Water test.
[illegible] Standard penetration test.
[illegible] cone penetration test.
[illegible] penetration.

Remarks : (Observations on ground-water, etc.)

Ground-water was first encountered at depth of 8ft. below ground level.

OXFORD, HEADINGTON

Soils No : S/4089

FIG. 10

CENTRAL LABORATORY HAYES

John Radcliffe Hospital

SP 50 NW ~~25~~ 224 - 250

Ft (m)

Bh	Base BeS		base TC		WW		TD		SL	
224	304.2		>274.2				274.2	83.58	334.2	101.86
225	>308.2	>93.94					308.2	93.94	338.2	103.08
226	>320.9	>97.81					320.9	97.81	350.9	106.95
227	> 318.4	>97.05					318.4	97.05	348.4	106.19
228	302.0	92.05	> 300.0				300.0	91.4	330.0	100.53
229	> 299.1	91.17					299.0		329.1	100.31
230	286.8	(87.70)	? > 243.8	(?74.55)			243.8		303	(92.9)
231	283.2	(86.60)	> 264.7	(80.95)			264.7		294.7	(90.12)
232	? 302	? 92.0	> 281	(>85.65)			281	85.65	341	(103.94)
233	? 303	? 92.36	> 273	(> 83.2)			273	83.2	333	(101.50)
234	296	89.6			??	78.94	255	77.7	315	(96.01)
235	298	90.21					297	90.52	332	(101.19)
236	302	92.04					298	91.13	334	(101.8)
237	> 306	> 93.27					306		346	
238	> 304	> 92.66					304	92.66	344	
239	301.5	91.90					287.6	87.63	347.5	105.92
240	> 313.3							–	343.3	104.64
241	> 317.6							–	347.6	105.95
242	303.9 OR 312.4	92.63 95.22					282.1		342.4	104.36
243	> 308.1						308.1		339.6	
244	> 309.4						309.4		339.4	103.45
245	> 310	>94.49					310	94.49	340.0	103.63
246	297	90.53	263.5 >	> 80.92			263.5	80.92	325.5	99.21
247	291.7	88.91					283.7	86.47	313.7	95.62
248	absent		267.4	81.50	213.9	> 65.2	213.9	65.2	213.9	65.20
249			> 264.4	> 80.59			264.4	80.59	294.4	89.73
250	absent				>213.3	> 65.01	213.3	65.01	243.3	74.16

Base

Thickess

~~30~~+

Thickness.

30
30

J R. 92.05 87.7 86.6 89.6

BcS 90.21 90.53 88.91

533.55

~~88.9~~
89.37

92.0
92.26
92.04
91.9
92.63
~~368.2~~
460.83

92.16.

SP 50 NW [redacted]
224-250

> 9.1 m

~~90.4 m~~ OD.
90.5m OD.

TC - 267.4 81.5m.

63.5
64.4
64.7

take 264 = 80.5m.

9.6
79.8
77.0
78.0

NW 15.3+ 16m

Irregularities on base of drillers lith base BcS.

BcS 10m+

TC. 9.6 to 10m.

WW 15m+

Appendix C - *Thames Water Sewer Records*

Asset location search

Thames Water Property Searches

JWB
14Oakhill Drive
WELWYN
AL6 9NW

Search address supplied	24 Ambleside Drive Headington Oxford OX3 0AQ
Your reference	Ambleside Drive
Our reference	ALS/ALS Standard/2023_4918128
Search date	29 November 2023

Notification of Price Changes

From 1st April 2023 Thames water Property Searches will be increasing the prices of its CON29DW, CommercialDW Drainage & Water Enquiries and Asset Location Searches. Historically costs would rise in line with RPI but as this currently sits at 14.2%, we are capping it at 10%.

Customers will be emailed with the new prices by January 1st 2023.

Any orders received with a higher payment prior to the 1st April 2023 will be non-refundable. For further details on the price increase please visit our website at www.thameswater-propertysearches.co.uk

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

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

0800 009 4540

Search address supplied: 24, Ambleside Drive, Headington, Oxford, OX3 0AQ

Dear Sir / Madam

An Asset Location Search is recommended when undertaking a site development. It is essential to obtain information on the size and location of clean water and sewerage assets to safeguard against expensive damage and allow cost-effective service design.

The following records were searched in compiling this report: - the map of public sewers & the map of waterworks. Thames Water Utilities Ltd (TWUL) holds all of these.

This searchprovides maps showing the position, size of Thames Water assets close to the proposed development and also manhole cover and invert levels, where available.

Please note that none of the charges made for this report relate to the provision of Ordnance Survey mapping information. The replies contained in this letter are given following inspection of the public service records available to this company. No responsibility can be accepted for any error or omission in the replies.

You should be aware that the information contained on these plans is current only on the day that the plans are issued. The plans should only be used for the duration of the work that is being carried out at the present time. Under no circumstances should this data be copied or transmitted to parties other than those for whom the current work is being carried out.

Thames Water do update these service plans on a regular basis and failure to observe the above conditions could lead to damage arising to new or diverted services at a later date.

Contact Us

If you have any further queries regarding this enquiry please feel free to contact a member of the team on 0800 009 4540, or use the address below:

Thames Water Utilities Ltd
Property Searches
PO Box 3189
Slough
SL1 4WW

Email: searches@thameswater.co.uk
Web: www.thameswater-propertysearches.co.uk

Waste Water Services

Please provide a copy extract from the public sewer map.

Enclosed is a map showing the approximate lines of our sewers. Our plans do not show sewer connections from individual properties or any sewers not owned by Thames Water unless specifically annotated otherwise. Records such as "private" pipework are in some cases available from the Building Control Department of the relevant Local Authority.

Where the Local Authority does not hold such plans it might be advisable to consult the property deeds for the site or contact neighbouring landowners.

This report relates only to sewerage apparatus of Thames Water Utilities Ltd, it does not disclose details of cables and or communications equipment that may be running through or around such apparatus.

The sewer level information contained in this response represents all of the level data available in our existing records. Should you require any further Information, please refer to the relevant section within the 'Further Contacts' page found later in this document.

For your guidance:

- The Company is not generally responsible for rivers, watercourses, ponds, culverts or highway drains. If any of these are shown on the copy extract they are shown for information only.
- Any private sewers or lateral drains which are indicated on the extract of the public sewer map as being subject to an agreement under Section 104 of the Water Industry Act 1991 are not an ‘as constructed’ record. It is recommended these details be checked with the developer.

Clean Water Services

Please provide a copy extract from the public water main map.

Enclosed is a map showing the approximate positions of our water mains and associated apparatus. Please note that records are not kept of the positions of individual domestic supplies.

For your information, there will be a pressure of at least 10m head at the outside stop valve. If you would like to know the static pressure, please contact our Customer Centre on 0800 316 9800. The Customer Centre can also arrange for a full flow and pressure test to be carried out for a fee.

For your guidance:

- Assets other than vested water mains may be shown on the plan, for information only.
- If an extract of the public water main record is enclosed, this will show known public water mains in the vicinity of the property. It should be possible to estimate the likely length and route of any private water supply pipe connecting the property to the public water network.

Payment for this Search

A charge will be added to your suppliers account.

Further contacts:

Waste Water queries

Should you require verification of the invert levels of public sewers, by site measurement, you will need to approach the relevant Thames Water Area Network Office for permission to lift the appropriate covers. This permission will usually involve you completing a TWOSA form. For further information please contact our Customer Centre on Tel: 0845 920 0800. Alternatively, a survey can be arranged, for a fee, through our Customer Centre on the above number.

If you have any questions regarding sewer connections, budget estimates, diversions, building over issues or any other questions regarding operational issues please direct them to our service desk. Which can be contacted by writing to:

Developer Services (Waste Water)
Thames Water
Clearwater Court
Vastern Road
Reading
RG1 8DB

Tel: 0800 009 3921
Email: developer.services@thameswater.co.uk

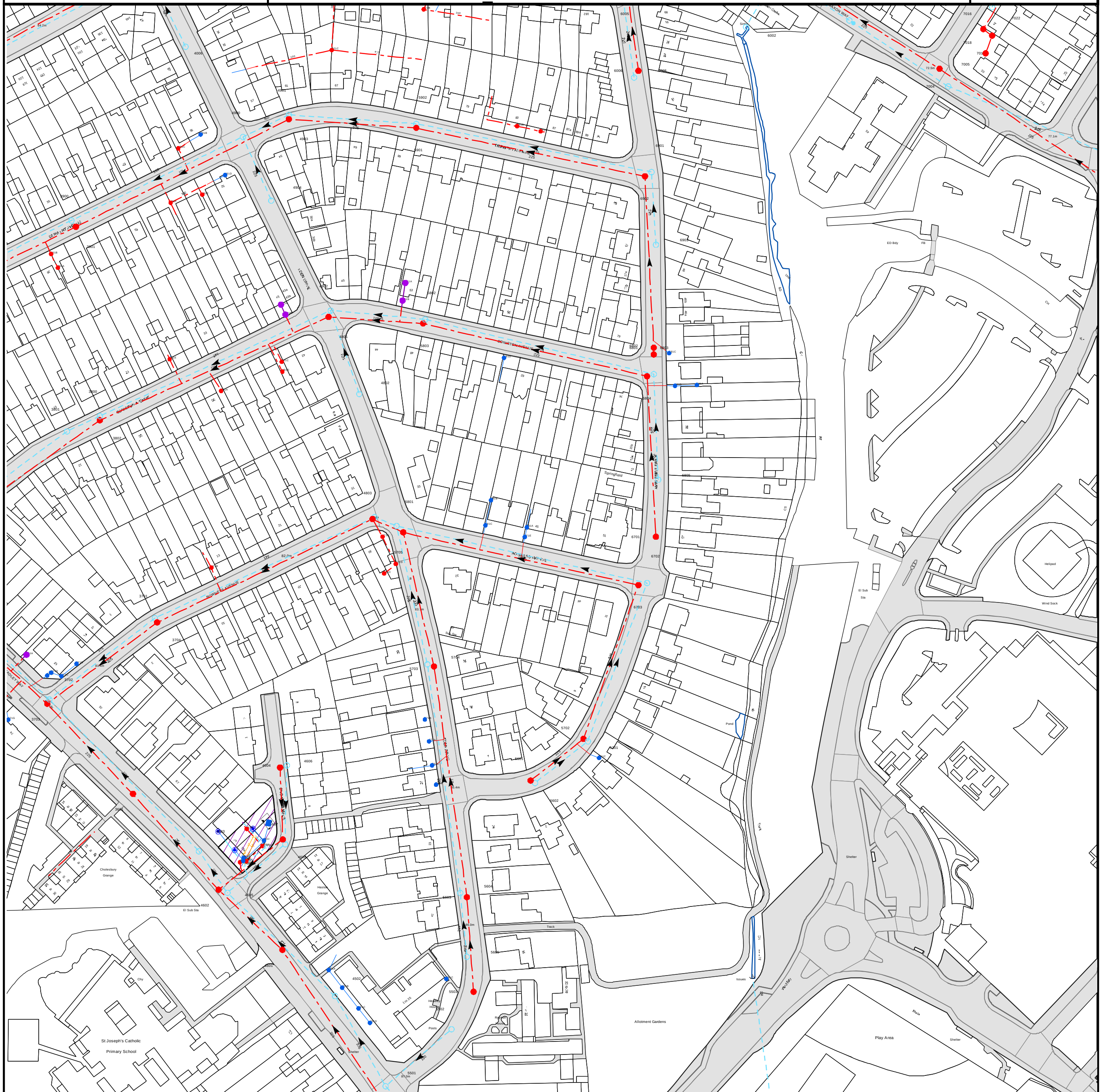
Clean Water queries

Should you require any advice concerning clean water operational issues or clean water connections, please contact:

Developer Services (Clean Water)
Thames Water
Clearwater Court
Vastern Road
Reading
RG1 8DB

Tel: 0800 009 3921
Email: developer.services@thameswater.co.uk

Asset Location Search Sewer Map - ALS/ALS Standard/2023_4918128



The width of the displayed area is 500 m and the centre of the map is located at OS coordinates 453578,207791

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
7018	75.23	74.13
7017	74.73	74.02
7022	74.28	73.32
561C	n/a	n/a
5701	84.22	82.33
5702	84.23	n/a
6703	82.9	80.52
6702	82.85	80.97
6701	81.83	79.19
6805	80.83	78.93
681B	n/a	n/a
681A	n/a	n/a
6804	78.69	76.63
6803	78.67	76.63
6802	78.21	77.61
681C	49.76	48.73
6801	n/a	n/a
591D	n/a	n/a
591C	n/a	n/a
6008	70.04	68.5
6006	69.83	67.9
6902	73.64	71.58
6901	73.51	71.67
6903	75.51	73.91
6002	68.55	n/a
7090	69.8	66.62
7004	73.02	70.82
7005	73.5	n/a
7016	74.24	73.86
391B	n/a	n/a
391A	n/a	n/a
3900	71.5	68.21
3901	71.53	68.29
491F	n/a	n/a
491C	n/a	n/a
4006	67.12	64.44
491B	n/a	n/a
491E	n/a	n/a
491D	n/a	n/a
4900	71.13	68.71
4904	73.35	71.66
4901	71.22	68.83
4903	71.27	68.87
401C	n/a	n/a
591A	n/a	n/a
5901	71.95	70.02
5902	71.9	69.99
501B	n/a	n/a
3801	76.58	n/a
3800	76.66	73.68
3802	76.63	73.75
3701	81.49	79.02
481E	n/a	n/a
471B	n/a	n/a
481A	n/a	n/a
491A	n/a	n/a
481C	n/a	n/a
481D	n/a	n/a
481B	n/a	n/a
4801	76.5	74.49
4902	76.49	74.41
4802	n/a	n/a
4804	81.99	79.22
4803	81.99	79.69
471A	n/a	n/a
571C	n/a	n/a
571D	n/a	n/a
5801	82.35	80.05
591B	n/a	n/a
5705	82.43	79.59
5803	77.58	75.18
5802	77.57	75.2
581C	n/a	n/a
581B	n/a	n/a
581D	n/a	n/a
571E	n/a	n/a
581A	n/a	n/a
371G	n/a	n/a
371A	n/a	n/a
371E	n/a	n/a
3703	80.99	78.03
3702	80.93	78.28
371D	n/a	n/a
371C	n/a	n/a
371B	n/a	n/a
3601	83.73	81.06
3704	81.53	78.56
461B	n/a	n/a
461I	n/a	n/a
4606	84.83	83.76
4608	85.24	83.55

Manhole Reference	Manhole Cover Level	Manhole Invert Level
4604	84.88	83.62
571B	n/a	n/a
5704	84.8	83.17
571A	n/a	n/a
561A	n/a	n/a
5703	84.83	82.79
561B	n/a	n/a
5601	85.05	n/a
5602	85.02	83.06
4603	85.09	82.37
4602	n/a	n/a
4605	85.66	82.84
461C	n/a	n/a
461K	n/a	n/a
461J	n/a	n/a
461E	n/a	n/a
461F	n/a	n/a
461H	n/a	n/a
461G	n/a	n/a
4601	86.03	83.22
4607	85.31	83.36
451A	n/a	n/a
451B	n/a	n/a
551C	n/a	n/a
5604	85.8	84.27
5603	85.82	83.83
5605	86.04	84.4
5503	86.27	84.63
5501	86.79	84.82
5502	86.47	85.09
451D	n/a	n/a
451C	n/a	n/a
4502	86.24	83.98

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

Asset Location Search - Sewer Key

Public Sewer Types (Operated and maintained by Thames Water)

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

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

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

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

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

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

Sewer Fittings

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

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

Operational Controls

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

- Ancillary
- Drop Pipe
- Control Valve
- Weir

End Items

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

- Inlet
- Outfall
- Undefined End

Other Symbols

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

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

Areas

Lines denoting areas of underground surveys, etc.

- Agreement
- Chamber
- Operational Site

Ducts or Crossings

- Casement
- Conduit Bridge
- Subway
- Tunnel

Ducts may contain high voltage cables. Please check with Thames Water.

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.

Asset Location Search Water Map - ALS/ALS Standard/2023_4918128

The width of the displayed area is 500 m and the centre of the map is located at OS coordinates 453578, 207791.

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

Asset Location Search - Water Key

Water Pipes (Operated & Maintained by Thames Water)

Distribution Main: The most common pipe shown on water maps. With few exceptions, domestic connections are only made to distribution mains.

Trunk Main: A main carrying water from a source of supply to a treatment plant or reservoir, or from one treatment plant or reservoir to another. Also a main transferring water in bulk to smaller water mains used for supplying individual customers.

Supply Main: A supply main indicates that the water main is used as a supply for a single property or group of properties.

Fire Main: Where a pipe is used as a fire supply, the word FIRE will be displayed along the pipe.

Metered Pipe: A metered main indicates that the pipe in question supplies water for a single property or group of properties and that quantity of water passing through the pipe is metered even though there may be no meter symbol shown.

Transmission Tunnel: A very large diameter water pipe. Most tunnels are buried very deep underground. These pipes are not expected to affect the structural integrity of buildings shown on the map provided.

Proposed Main: A main that is still in the planning stages or in the process of being laid. More details of the proposed main and its reference number are generally included near the main.

PIPE DIAMETER	DEPTH BELOW GROUND
Up to 300mm (12")	900mm (3')
300mm - 600mm (12" - 24")	1100mm (3' 8")
600mm and bigger (24" plus)	1200mm (4')

Valves

- General Purpose Valve
- Air Valve
- Pressure Control Valve
- Customer Valve

Hydrants

- Single Hydrant

Meters

- Meter

End Items

Symbol indicating what happens at the end of a water main.

- Blank Flange
- Capped End
- Emptying Pit
- Undefined End
- Manifold
- Customer Supply
- Fire Supply

Operational Sites

- Booster Station
- Other
- Other (Proposed)
- Pumping Station
- Service Reservoir
- Shaft Inspection
- Treatment Works
- Unknown
- Water Tower

Other Symbols

- Data Logger
- **Casement:** Ducts may contain high voltage cables. Please check with Thames Water.

Other Water Pipes (Not Operated or Maintained by Thames Water)

Other Water Company Main: Occasionally other water company water pipes may overlap the border of our clean water coverage area. These mains are denoted in purple and in most cases have the owner of the pipe displayed along them.

Private Main: Indiates that the water main in question is not owned by Thames Water. These mains normally have text associated with them indicating the diameter and owner of the pipe.

Payment Terms and Conditions

All sales are made in accordance with Thames Water Utilities Limited (TWUL) standard terms and conditions unless previously agreed in writing.

1. All goods remain in the property of Thames Water Utilities Ltd until full payment is received.
2. Provision of service will be in accordance with all legal requirements and published TWUL policies.
3. All invoices are strictly due for payment within 14 days of the date of the invoice. Any other terms must be accepted/agreed in writing prior to provision of goods or service or will be held to be invalid.
4. Penalty interest may be invoked by TWUL in the event of unjustifiable payment delay. Interest charges will be in line with UK Statute Law 'The Late Payment of Commercial Debts (Interest) Act 1998'.
5. Interest will be charged in line with current Court Interest Charges, if legal action is taken.
6. A charge may be made at the discretion of the company for increased administration costs.

A copy of Thames Water's standard terms and conditions are available from the Commercial Billing Team (cashoperations@thameswater.co.uk).

We publish several Codes of Practice including a guaranteed standards scheme. You can obtain copies of these leaflets by calling us on 0800 316 9800.

If you are unhappy with our service, you can speak to your original goods or customer service provider. If you are still not satisfied with the outcome provided, we will refer the matter to a Senior Manager for resolution who will provide you with a response.

If you are still dissatisfied with our final response, and in certain circumstances such as you are buying a residential property or commercial property within certain parameters, The Property Ombudsman will investigate your case and give an independent view. The Ombudsman can award compensation of up to £25,000 to you if he finds that you have suffered actual financial loss and/or aggravation, distress, or inconvenience because of your search not keeping to the Code. Further information can be obtained by visiting www.tpos.co.uk or by sending an email to admin@tpos.co.uk.

If the Goods or Services covered by this invoice falls under the regulation of the 1991 Water Industry Act, and you remain dissatisfied you can refer your complaint to Consumer Council for Water on 0300 034 2222 or write to them at Consumer Council for Water, 1st Floor, Victoria Square House, Victoria Square, Birmingham, B2 4AJ.

Ways to pay your bill

Credit Card	BACS Payment	Telephone Banking
Please Call **0800 009 4540** quoting your invoice number starting CBA or ADS	Account number **90478703** Sort code **60-00-01** A remittance advice must be sent to: **Thames Water Utilities Ltd., PO Box 3189, Slough SL1 4WW.** or email ps.billing@thameswater.co.uk	By calling your bank and quoting: Account number **90478703** Sort code **60-00-01** and your invoice number

Appendix D - Micro Drainage Modelling – Existing Site

STORM SEWER DESIGN by the Modified Rational Method

Design Criteria for Storm

Pipe Sizes STANDARD Manhole Sizes STANDARD

FSR Rainfall Model - England and Wales

Return Period (years)	1	Add Flow / Climate Change (%)	0
M5-60 (mm)	20.000	Minimum Backdrop Height (m)	0.200
Ratio R	0.400	Maximum Backdrop Height (m)	1.500
Maximum Rainfall (mm/hr)	50	Min Design Depth for Optimisation (m)	1.200
Maximum Time of Concentration (mins)	30	Min Vel for Auto Design only (m/s)	1.00
Foul Sewage (l/s/ha)	0.000	Min Slope for Optimisation (1:X)	500
Volumetric Runoff Coeff.	0.750		

Designed with Level Soffits

Network Design Table for Storm

PN	Length (m)	Fall (m)	Slope (1:X)	I.Area (ha)	T.E. (mins)	Base Flow (l/s)	k (mm)	HYD SECT	DIA (mm)
S1.000	10.000	0.171	58.5	0.025	5.00	0.0	0.600	o	100
S1.001	10.000	0.171	58.5	0.000	0.00	0.0	0.600	o	100

Network Results Table

PN	Rain (mm/hr)	T.C. (mins)	US/IL (m)	Σ I.Area (ha)	Σ Base Flow (l/s)	Foul (l/s)	Add Flow (l/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
S1.000	50.00	5.17	78.700	0.025	0.0	0.0	0.0	1.01	7.9	3.4
S1.001	50.00	5.33	78.529	0.025	0.0	0.0	0.0	1.01	7.9	3.4

Free Flowing Outfall Details for Storm

Outfall Pipe Number	Outfall Name	C. Level (m)	I. Level (m)	Min I. Level (m)	D,L (mm)	W (mm)
S1.001	S	80.000	78.358	0.000	0	0

1 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Storm

Simulation Criteria

Areal Reduction Factor	1.000	Additional Flow - % of Total Flow	0.000
Hot Start (mins)	0	MADD Factor * 10m³/ha Storage	2.000
Hot Start Level (mm)	0	Inlet Coeffiecient	0.800
Manhole Headloss Coeff (Global)	0.500	Flow per Person per Day (l/per/day)	0.000
Foul Sewage per hectare (l/s)	0.000		

Number of Input Hydrographs	0	Number of Offline Controls	0	Number of Time/Area Diagrams	0
Number of Online Controls	0	Number of Storage Structures	0	Number of Real Time Controls	0

Synthetic Rainfall Details

Rainfall Model	FSR	Ratio R	0.400
Region	England and Wales	Cv (Summer)	0.750
M5-60 (mm)	20.000	Cv (Winter)	0.840

Margin for Flood Risk Warning (mm)	300.0	DVD Status	OFF
Analysis Timestep	Fine	Inertia Status	OFF
DTS Status	ON		

Profile(s)	Summer and Winter
Duration(s) (mins)	15, 30, 60, 120, 180, 240, 360, 480, 600, 720, 960, 1440, 2160, 2880, 4320, 5760, 7200, 8640, 10080
Return Period(s) (years)	1, 30, 100
Climate Change (%)	0, 0, 0

PN	Storm	Return Period	Climate Change	First X Surcharge	First Y Flood	First Z Overflow	O/F Act.	Lvl Exc.
S1.000	15 Winter	1	0%	30/15 Summer				
S1.001	15 Winter	1	0%	30/15 Summer				

PN	US/MH Name	Water Level (m)	Surch'ed Depth (m)	Flooded Volume (m³)	Flow / Cap.	O'flow (l/s)	Pipe Flow (l/s)	Status
S1.000	S1	78.749	-0.051	0.000	0.47	0.0	3.4	OK
S1.001	S2	78.578	-0.051	0.000	0.47	0.0	3.5	OK

30 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Storm

Simulation Criteria

Areal Reduction Factor 1.000 Additional Flow - % of Total Flow 0.000
Hot Start (mins) 0 MADD Factor * 10m³/ha Storage 2.000
Hot Start Level (mm) 0 Inlet Coeffiecient 0.800
Manhole Headloss Coeff (Global) 0.500 Flow per Person per Day (l/per/day) 0.000
Foul Sewage per hectare (l/s) 0.000

Number of Input Hydrographs 0 Number of Offline Controls 0 Number of Time/Area Diagrams 0
Number of Online Controls 0 Number of Storage Structures 0 Number of Real Time Controls 0

Synthetic Rainfall Details

Rainfall Model FSR Ratio R 0.400
Region England and Wales Cv (Summer) 0.750
M5-60 (mm) 20.000 Cv (Winter) 0.840

Margin for Flood Risk Warning (mm) 300.0 DVD Status OFF
Analysis Timestep Fine Inertia Status OFF
DTS Status ON

Profile(s) Summer and Winter
Duration(s) (mins) 15, 30, 60, 120, 180, 240, 360, 480, 600, 720, 960, 1440, 2160, 2880, 4320, 5760, 7200, 8640, 10080
Return Period(s) (years) 1, 30, 100
Climate Change (%) 0, 0, 0

PN	Storm	Return Period	Climate Change	First X Surcharge	First Y Flood	First Z Overflow	O/F Act.	Lvl Exc.
S1.000	15 Winter	30	0%	30/15 Summer				
S1.001	15 Winter	30	0%	30/15 Summer				

PN	US/MH Name	Water Level (m)	Surch'ed Depth (m)	Flooded Volume (m³)	Flow / Cap.	O'flow (l/s)	Pipe Flow (l/s)	Status
S1.000	S1	78.848	0.048	0.000	1.09	0.0	8.0	SURCHARGED
S1.001	S2	78.649	0.020	0.000	1.07	0.0	7.9	SURCHARGED

100 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Storm

Simulation Criteria

Areal Reduction Factor 1.000 Additional Flow - % of Total Flow 0.000
Hot Start (mins) 0 MADD Factor * 10m³/ha Storage 2.000
Hot Start Level (mm) 0 Inlet Coeffiecient 0.800
Manhole Headloss Coeff (Global) 0.500 Flow per Person per Day (l/per/day) 0.000
Foul Sewage per hectare (l/s) 0.000

Number of Input Hydrographs 0 Number of Offline Controls 0 Number of Time/Area Diagrams 0
Number of Online Controls 0 Number of Storage Structures 0 Number of Real Time Controls 0

Synthetic Rainfall Details

Rainfall Model FSR Ratio R 0.400
Region England and Wales Cv (Summer) 0.750
M5-60 (mm) 20.000 Cv (Winter) 0.840

Margin for Flood Risk Warning (mm) 300.0 DVD Status OFF
Analysis Timestep Fine Inertia Status OFF
DTS Status ON

Profile(s) Summer and Winter
Duration(s) (mins) 15, 30, 60, 120, 180, 240, 360, 480, 600, 720, 960, 1440, 2160, 2880, 4320, 5760, 7200, 8640, 10080
Return Period(s) (years) 1, 30, 100
Climate Change (%) 0, 0, 0

PN	Storm	Return Period	Climate Change	First X Surcharge	First Y Flood	First Z Overflow	O/F Act.	Lvl Exc.
S1.000	15 Winter	100	0%	30/15 Summer				
S1.001	15 Winter	100	0%	30/15 Summer				

PN	US/MH Name	Water Level (m)	Surch'ed Depth (m)	Flooded Volume (m³)	Flow / Cap.	O'flow (l/s)	Pipe Flow (l/s)	Status
S1.000	S1	79.035	0.235	0.000	1.32	0.0	9.7	SURCHARGED
S1.001	S2	78.736	0.107	0.000	1.28	0.0	9.5	SURCHARGED

Greenfield Runoff Rates

ICP SUDS Mean Annual Flood

Input

Return Period (years)	1	SAAR (mm)	622	Urban	0.000
Area (ha)	0.025	Soil	0.450	Region Number	Region 6

Results	**l/s**
QBAR Rural	0.1
QBAR Urban	0.1
Q1 year	0.1
Q1 year	0.1
Q30 years	0.2
Q100 years	0.3

Proposed Development

Summary of Results for 1 year Return Period

Half Drain Time : 15 minutes.

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Control (l/s)	Max Overflow (l/s)	Max Σ Outflow (l/s)	Max Volume (m³)	Status
15 min Summer	80.448	0.048	0.0	0.7	0.0	0.7	0.8	O K
30 min Summer	80.453	0.053	0.0	0.7	0.0	0.7	0.9	O K
60 min Summer	80.451	0.051	0.0	0.7	0.0	0.7	0.9	O K
120 min Summer	80.439	0.039	0.0	0.7	0.0	0.7	0.7	O K
180 min Summer	80.429	0.029	0.0	0.7	0.0	0.7	0.5	O K
240 min Summer	80.421	0.021	0.0	0.7	0.0	0.7	0.4	O K
360 min Summer	80.410	0.010	0.0	0.6	0.0	0.6	0.2	O K
480 min Summer	80.404	0.004	0.0	0.5	0.0	0.5	0.1	O K
600 min Summer	80.400	0.000	0.0	0.5	0.0	0.5	0.0	O K
720 min Summer	80.400	0.000	0.0	0.4	0.0	0.4	0.0	O K
960 min Summer	80.400	0.000	0.0	0.4	0.0	0.4	0.0	O K
1440 min Summer	80.400	0.000	0.0	0.3	0.0	0.3	0.0	O K
2160 min Summer	80.400	0.000	0.0	0.2	0.0	0.2	0.0	O K
2880 min Summer	80.400	0.000	0.0	0.2	0.0	0.2	0.0	O K
4320 min Summer	80.400	0.000	0.0	0.1	0.0	0.1	0.0	O K
5760 min Summer	80.400	0.000	0.0	0.1	0.0	0.1	0.0	O K
7200 min Summer	80.400	0.000	0.0	0.1	0.0	0.1	0.0	O K
8640 min Summer	80.400	0.000	0.0	0.1	0.0	0.1	0.0	O K
10080 min Summer	80.400	0.000	0.0	0.1	0.0	0.1	0.0	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Overflow Volume (m³)	Time-Peak (mins)
15 min Summer	30.991	0.0	1.3	0.0	15
30 min Summer	20.215	0.0	1.7	0.0	23
60 min Summer	12.800	0.0	2.2	0.0	40
120 min Summer	7.942	0.0	2.8	0.0	74
180 min Summer	5.979	0.0	3.2	0.0	104
240 min Summer	4.882	0.0	3.5	0.0	134
360 min Summer	3.646	0.0	3.9	0.0	192
480 min Summer	2.956	0.0	4.2	0.0	252
600 min Summer	2.511	0.0	4.5	0.0	308
720 min Summer	2.199	0.0	4.8	0.0	0
960 min Summer	1.782	0.0	5.1	0.0	0
1440 min Summer	1.326	0.0	5.7	0.0	0
2160 min Summer	0.988	0.0	6.4	0.0	0
2880 min Summer	0.800	0.0	6.9	0.0	0
4320 min Summer	0.595	0.0	7.6	0.0	0
5760 min Summer	0.483	0.0	8.2	0.0	0
7200 min Summer	0.410	0.0	8.6	0.0	0
8640 min Summer	0.359	0.0	9.0	0.0	0
10080 min Summer	0.322	0.0	9.3	0.0	0

Summary of Results for 1 year Return Period

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Control (l/s)	Max Overflow (l/s)	Max Σ Outflow (l/s)	Max Volume (m³)	Status
15 min Winter	80.457	0.057	0.0	0.7	0.0	0.7	1.0	O K
30 min Winter	80.462	0.062	0.0	0.7	0.0	0.7	1.1	O K
60 min Winter	80.456	0.056	0.0	0.7	0.0	0.7	1.0	O K
120 min Winter	80.437	0.037	0.0	0.7	0.0	0.7	0.7	O K
180 min Winter	80.422	0.022	0.0	0.7	0.0	0.7	0.4	O K
240 min Winter	80.413	0.013	0.0	0.6	0.0	0.6	0.2	O K
360 min Winter	80.402	0.002	0.0	0.5	0.0	0.5	0.0	O K
480 min Winter	80.400	0.000	0.0	0.4	0.0	0.4	0.0	O K
600 min Winter	80.400	0.000	0.0	0.4	0.0	0.4	0.0	O K
720 min Winter	80.400	0.000	0.0	0.3	0.0	0.3	0.0	O K
960 min Winter	80.400	0.000	0.0	0.3	0.0	0.3	0.0	O K
1440 min Winter	80.400	0.000	0.0	0.2	0.0	0.2	0.0	O K
2160 min Winter	80.400	0.000	0.0	0.1	0.0	0.1	0.0	O K
2880 min Winter	80.400	0.000	0.0	0.1	0.0	0.1	0.0	O K
4320 min Winter	80.400	0.000	0.0	0.1	0.0	0.1	0.0	O K
5760 min Winter	80.400	0.000	0.0	0.1	0.0	0.1	0.0	O K
7200 min Winter	80.400	0.000	0.0	0.1	0.0	0.1	0.0	O K
8640 min Winter	80.400	0.000	0.0	0.1	0.0	0.1	0.0	O K
10080 min Winter	80.400	0.000	0.0	0.0	0.0	0.0	0.0	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Overflow Volume (m³)	Time-Peak (mins)
15 min Winter	30.991	0.0	1.5	0.0	15
30 min Winter	20.215	0.0	2.0	0.0	25
60 min Winter	12.800	0.0	2.5	0.0	44
120 min Winter	7.942	0.0	3.2	0.0	78
180 min Winter	5.979	0.0	3.6	0.0	108
240 min Winter	4.882	0.0	3.9	0.0	138
360 min Winter	3.646	0.0	4.4	0.0	194
480 min Winter	2.956	0.0	4.8	0.0	0
600 min Winter	2.511	0.0	5.1	0.0	0
720 min Winter	2.199	0.0	5.3	0.0	0
960 min Winter	1.782	0.0	5.8	0.0	0
1440 min Winter	1.326	0.0	6.4	0.0	0
2160 min Winter	0.988	0.0	7.2	0.0	0
2880 min Winter	0.800	0.0	7.7	0.0	0
4320 min Winter	0.595	0.0	8.6	0.0	0
5760 min Winter	0.483	0.0	9.2	0.0	0
7200 min Winter	0.410	0.0	9.7	0.0	0
8640 min Winter	0.359	0.0	10.2	0.0	0
10080 min Winter	0.322	0.0	10.6	0.0	0

Rainfall Details

Rainfall Model	FSR	Winter Storms	Yes
Return Period (years)	1	Cv (Summer)	0.750
Region	England and Wales	Cv (Winter)	0.840
M5-60 (mm)	20.000	Shortest Storm (mins)	15
Ratio R	0.400	Longest Storm (mins)	10080
Summer Storms	Yes	Climate Change %	+0

Time Area Diagram

Total Area (ha) 0.025

Time (mins) From:	To:	Area (ha)
0	4	0.025

Model Details

Storage is Online Cover Level (m) 81.590

Complex Structure

Cellular Storage

Invert Level (m) 80.400 Safety Factor 2.0
Infiltration Coefficient Base (m/hr) 0.00000 Porosity 0.95
Infiltration Coefficient Side (m/hr) 0.00000

Depth (m)	Area (m²)	Inf. Area (m²)	Depth (m)	Area (m²)	Inf. Area (m²)
0.000	18.5	18.0	0.501	0.0	26.5
0.500	18.5	26.5			

Porous Car Park

Infiltration Coefficient Base (m/hr)	0.00000	Width (m)	6.0
Membrane Percolation (mm/hr)	1000	Length (m)	5.0
Max Percolation (l/s)	8.3	Slope (1:X)	100.0
Safety Factor	2.0	Depression Storage (mm)	5
Porosity	0.30	Evaporation (mm/day)	3
Invert Level (m)	81.200	Cap Volume Depth (m)	0.200

Hydro-Brake® Outflow Control

Design Head (m) 1.000 Hydro-Brake® Type Md6 SW Only Invert Level (m) 80.350
Design Flow (l/s) 1.3 Diameter (mm) 47

Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.100	0.7	1.200	1.4	3.000	2.2	7.000	3.3
0.200	0.7	1.400	1.5	3.500	2.4	7.500	3.5
0.300	0.7	1.600	1.6	4.000	2.5	8.000	3.6
0.400	0.8	1.800	1.7	4.500	2.7	8.500	3.7
0.500	0.9	2.000	1.8	5.000	2.8	9.000	3.8
0.600	1.0	2.200	1.9	5.500	3.0	9.500	3.9
0.800	1.1	2.400	2.0	6.000	3.1		
1.000	1.3	2.600	2.0	6.500	3.2		

Weir Overflow Control

Discharge Coef 0.544 Width (m) 0.600 Invert Level (m) 81.190

Summary of Results for 30 year Return Period

Half Drain Time : 47 minutes.

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Control (l/s)	Max Overflow (l/s)	Max Σ Outflow (l/s)	Max Volume (m³)	Status
15 min Summer	80.557	0.157	0.0	0.8	0.0	0.8	2.8	O K
30 min Summer	80.585	0.185	0.0	0.8	0.0	0.8	3.3	O K
60 min Summer	80.589	0.189	0.0	0.8	0.0	0.8	3.3	O K
120 min Summer	80.573	0.173	0.0	0.8	0.0	0.8	3.1	O K
180 min Summer	80.553	0.153	0.0	0.8	0.0	0.8	2.7	O K
240 min Summer	80.530	0.130	0.0	0.8	0.0	0.8	2.3	O K
360 min Summer	80.490	0.090	0.0	0.8	0.0	0.8	1.6	O K
480 min Summer	80.461	0.061	0.0	0.8	0.0	0.8	1.1	O K
600 min Summer	80.441	0.041	0.0	0.8	0.0	0.8	0.7	O K
720 min Summer	80.428	0.028	0.0	0.8	0.0	0.8	0.5	O K
960 min Summer	80.414	0.014	0.0	0.7	0.0	0.7	0.2	O K
1440 min Summer	80.401	0.001	0.0	0.5	0.0	0.5	0.0	O K
2160 min Summer	80.400	0.000	0.0	0.4	0.0	0.4	0.0	O K
2880 min Summer	80.400	0.000	0.0	0.3	0.0	0.3	0.0	O K
4320 min Summer	80.400	0.000	0.0	0.2	0.0	0.2	0.0	O K
5760 min Summer	80.400	0.000	0.0	0.2	0.0	0.2	0.0	O K
7200 min Summer	80.400	0.000	0.0	0.2	0.0	0.2	0.0	O K
8640 min Summer	80.400	0.000	0.0	0.1	0.0	0.1	0.0	O K
10080 min Summer	80.400	0.000	0.0	0.1	0.0	0.1	0.0	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Overflow Volume (m³)	Time-Peak (mins)
15 min Summer	76.035	0.0	3.4	0.0	17
30 min Summer	49.499	0.0	4.5	0.0	31
60 min Summer	30.811	0.0	5.6	0.0	48
120 min Summer	18.615	0.0	6.8	0.0	82
180 min Summer	13.715	0.0	7.6	0.0	116
240 min Summer	10.995	0.0	8.1	0.0	150
360 min Summer	8.034	0.0	8.9	0.0	210
480 min Summer	6.428	0.0	9.4	0.0	268
600 min Summer	5.404	0.0	9.9	0.0	324
720 min Summer	4.687	0.0	10.4	0.0	382
960 min Summer	3.743	0.0	11.0	0.0	500
1440 min Summer	2.723	0.0	12.0	0.0	734
2160 min Summer	1.979	0.0	13.1	0.0	0
2880 min Summer	1.577	0.0	13.9	0.0	0
4320 min Summer	1.143	0.0	15.0	0.0	0
5760 min Summer	0.910	0.0	15.9	0.0	0
7200 min Summer	0.762	0.0	16.5	0.0	0
8640 min Summer	0.659	0.0	17.1	0.0	0
10080 min Summer	0.583	0.0	17.6	0.0	0

Summary of Results for 30 year Return Period

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Control (l/s)	Max Overflow (l/s)	Max Σ Outflow (l/s)	Max Volume (m³)	Status
15 min Winter	80.581	0.181	0.0	0.8	0.0	0.8	3.2	O K
30 min Winter	80.616	0.216	0.0	0.8	0.0	0.8	3.8	O K
60 min Winter	80.623	0.223	0.0	0.8	0.0	0.8	3.9	O K
120 min Winter	80.599	0.199	0.0	0.8	0.0	0.8	3.5	O K
180 min Winter	80.567	0.167	0.0	0.8	0.0	0.8	2.9	O K
240 min Winter	80.532	0.132	0.0	0.8	0.0	0.8	2.3	O K
360 min Winter	80.471	0.071	0.0	0.8	0.0	0.8	1.3	O K
480 min Winter	80.437	0.037	0.0	0.8	0.0	0.8	0.6	O K
600 min Winter	80.420	0.020	0.0	0.7	0.0	0.7	0.4	O K
720 min Winter	80.411	0.011	0.0	0.7	0.0	0.7	0.2	O K
960 min Winter	80.401	0.001	0.0	0.5	0.0	0.5	0.0	O K
1440 min Winter	80.400	0.000	0.0	0.4	0.0	0.4	0.0	O K
2160 min Winter	80.400	0.000	0.0	0.3	0.0	0.3	0.0	O K
2880 min Winter	80.400	0.000	0.0	0.2	0.0	0.2	0.0	O K
4320 min Winter	80.400	0.000	0.0	0.2	0.0	0.2	0.0	O K
5760 min Winter	80.400	0.000	0.0	0.1	0.0	0.1	0.0	O K
7200 min Winter	80.400	0.000	0.0	0.1	0.0	0.1	0.0	O K
8640 min Winter	80.400	0.000	0.0	0.1	0.0	0.1	0.0	O K
10080 min Winter	80.400	0.000	0.0	0.1	0.0	0.1	0.0	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Overflow Volume (m³)	Time-Peak (mins)
15 min Winter	76.035	0.0	3.8	0.0	17
30 min Winter	49.499	0.0	5.0	0.0	31
60 min Winter	30.811	0.0	6.3	0.0	54
120 min Winter	18.615	0.0	7.6	0.0	90
180 min Winter	13.715	0.0	8.4	0.0	126
240 min Winter	10.995	0.0	9.1	0.0	160
360 min Winter	8.034	0.0	9.9	0.0	220
480 min Winter	6.428	0.0	10.6	0.0	272
600 min Winter	5.404	0.0	11.2	0.0	326
720 min Winter	4.687	0.0	11.6	0.0	382
960 min Winter	3.743	0.0	12.4	0.0	492
1440 min Winter	2.723	0.0	13.5	0.0	0
2160 min Winter	1.979	0.0	14.7	0.0	0
2880 min Winter	1.577	0.0	15.6	0.0	0
4320 min Winter	1.143	0.0	16.9	0.0	0
5760 min Winter	0.910	0.0	17.8	0.0	0
7200 min Winter	0.762	0.0	18.6	0.0	0
8640 min Winter	0.659	0.0	19.2	0.0	0
10080 min Winter	0.583	0.0	19.8	0.0	0

Rainfall Details

Rainfall Model	FSR	Winter Storms	Yes
Return Period (years)	30	Cv (Summer)	0.750
Region	England and Wales	Cv (Winter)	0.840
M5-60 (mm)	20.000	Shortest Storm (mins)	15
Ratio R	0.400	Longest Storm (mins)	10080
Summer Storms	Yes	Climate Change %	+0

Time Area Diagram

Total Area (ha) 0.025

Time From:	**(mins) To:**	**Area (ha)**
0	4	0.025

Model Details

Storage is Online Cover Level (m) 81.590

Complex Structure

Cellular Storage

Invert Level (m) 80.400 Safety Factor 2.0
Infiltration Coefficient Base (m/hr) 0.00000 Porosity 0.95
Infiltration Coefficient Side (m/hr) 0.00000

Depth (m)	**Area (m²)**	**Inf. Area (m²)**	**Depth (m)**	**Area (m²)**	**Inf. Area (m²)**
0.000	18.5	18.0	0.501	0.0	26.5
0.500	18.5	26.5			

Porous Car Park

Infiltration Coefficient Base (m/hr)	0.00000	Width (m)	6.0
Membrane Percolation (mm/hr)	1000	Length (m)	5.0
Max Percolation (l/s)	8.3	Slope (1:X)	100.0
Safety Factor	2.0	Depression Storage (mm)	5
Porosity	0.30	Evaporation (mm/day)	3
Invert Level (m)	81.200	Cap Volume Depth (m)	0.200

Hydro-Brake® Outflow Control

Design Head (m) 0.550 Hydro-Brake® Type Md6 SW Only Invert Level (m) 80.350
Design Flow (l/s) 1.1 Diameter (mm) 50

Depth (m)	**Flow (l/s)**	**Depth (m)**	**Flow (l/s)**	**Depth (m)**	**Flow (l/s)**	**Depth (m)**	**Flow (l/s)**
0.100	0.8	1.200	1.6	3.000	2.5	7.000	3.8
0.200	0.8	1.400	1.7	3.500	2.7	7.500	3.9
0.300	0.8	1.600	1.8	4.000	2.9	8.000	4.0
0.400	0.9	1.800	1.9	4.500	3.0	8.500	4.2
0.500	1.0	2.000	2.0	5.000	3.2	9.000	4.3
0.600	1.1	2.200	2.1	5.500	3.3	9.500	4.4
0.800	1.3	2.400	2.2	6.000	3.5		
1.000	1.4	2.600	2.3	6.500	3.6		

Weir Overflow Control

Discharge Coef 0.544 Width (m) 0.600 Invert Level (m) 81.190

Summary of Results for 100 year Return Period (+40%)

Half Drain Time : 92 minutes.

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Control (l/s)	Max Overflow (l/s)	Max Σ Outflow (l/s)	Max Volume (m³)	Status
15 min Summer	80.717	0.317	0.0	0.9	0.0	0.9	5.6	O K
30 min Summer	80.791	0.391	0.0	1.0	0.0	1.0	6.9	O K
60 min Summer	80.828	0.428	0.0	1.0	0.0	1.0	7.5	O K
120 min Summer	80.820	0.420	0.0	1.0	0.0	1.0	7.4	O K
180 min Summer	80.798	0.398	0.0	1.0	0.0	1.0	7.0	O K
240 min Summer	80.773	0.373	0.0	0.9	0.0	0.9	6.6	O K
360 min Summer	80.727	0.327	0.0	0.9	0.0	0.9	5.8	O K
480 min Summer	80.684	0.284	0.0	0.8	0.0	0.8	5.0	O K
600 min Summer	80.644	0.244	0.0	0.8	0.0	0.8	4.3	O K
720 min Summer	80.606	0.206	0.0	0.8	0.0	0.8	3.6	O K
960 min Summer	80.533	0.133	0.0	0.8	0.0	0.8	2.3	O K
1440 min Summer	80.446	0.046	0.0	0.8	0.0	0.8	0.8	O K
2160 min Summer	80.414	0.014	0.0	0.7	0.0	0.7	0.2	O K
2880 min Summer	80.402	0.002	0.0	0.6	0.0	0.6	0.0	O K
4320 min Summer	80.400	0.000	0.0	0.4	0.0	0.4	0.0	O K
5760 min Summer	80.400	0.000	0.0	0.3	0.0	0.3	0.0	O K
7200 min Summer	80.400	0.000	0.0	0.3	0.0	0.3	0.0	O K
8640 min Summer	80.400	0.000	0.0	0.2	0.0	0.2	0.0	O K
10080 min Summer	80.400	0.000	0.0	0.2	0.0	0.2	0.0	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Overflow Volume (m³)	Time-Peak (mins)
15 min Summer	138.153	0.0	6.3	0.0	18
30 min Summer	90.705	0.0	8.4	0.0	32
60 min Summer	56.713	0.0	10.5	0.0	60
120 min Summer	34.246	0.0	12.7	0.0	90
180 min Summer	25.149	0.0	14.0	0.0	126
240 min Summer	20.078	0.0	14.9	0.0	160
360 min Summer	14.585	0.0	16.2	0.0	228
480 min Summer	11.622	0.0	17.3	0.0	296
600 min Summer	9.738	0.0	18.1	0.0	362
720 min Summer	8.424	0.0	18.7	0.0	426
960 min Summer	6.697	0.0	19.9	0.0	548
1440 min Summer	4.839	0.0	21.5	0.0	752
2160 min Summer	3.490	0.0	23.3	0.0	1104
2880 min Summer	2.766	0.0	24.6	0.0	1468
4320 min Summer	1.989	0.0	26.4	0.0	0
5760 min Summer	1.573	0.0	27.8	0.0	0
7200 min Summer	1.311	0.0	28.9	0.0	0
8640 min Summer	1.129	0.0	29.8	0.0	0
10080 min Summer	0.994	0.0	30.5	0.0	0

Summary of Results for 100 year Return Period (+40%)

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Control (l/s)	Max Overflow (l/s)	Max Σ Outflow (l/s)	Max Volume (m³)	Status
15 min Winter	80.760	0.360	0.0	0.9	0.0	0.9	6.3	O K
30 min Winter	80.848	0.448	0.0	1.0	0.0	1.0	7.9	O K
60 min Winter	80.898	0.498	0.0	1.1	0.0	1.1	8.8	O K
120 min Winter	80.891	0.491	0.0	1.0	0.0	1.0	8.6	O K
180 min Winter	80.860	0.460	0.0	1.0	0.0	1.0	8.1	O K
240 min Winter	80.823	0.423	0.0	1.0	0.0	1.0	7.5	O K
360 min Winter	80.755	0.355	0.0	0.9	0.0	0.9	6.2	O K
480 min Winter	80.691	0.291	0.0	0.9	0.0	0.9	5.1	O K
600 min Winter	80.631	0.231	0.0	0.8	0.0	0.8	4.1	O K
720 min Winter	80.570	0.170	0.0	0.8	0.0	0.8	3.0	O K
960 min Winter	80.466	0.066	0.0	0.8	0.0	0.8	1.2	O K
1440 min Winter	80.415	0.015	0.0	0.7	0.0	0.7	0.3	O K
2160 min Winter	80.400	0.000	0.0	0.5	0.0	0.5	0.0	O K
2880 min Winter	80.400	0.000	0.0	0.4	0.0	0.4	0.0	O K
4320 min Winter	80.400	0.000	0.0	0.3	0.0	0.3	0.0	O K
5760 min Winter	80.400	0.000	0.0	0.2	0.0	0.2	0.0	O K
7200 min Winter	80.400	0.000	0.0	0.2	0.0	0.2	0.0	O K
8640 min Winter	80.400	0.000	0.0	0.2	0.0	0.2	0.0	O K
10080 min Winter	80.400	0.000	0.0	0.1	0.0	0.1	0.0	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Overflow Volume (m³)	Time-Peak (mins)
15 min Winter	138.153	0.0	7.1	0.0	17
30 min Winter	90.705	0.0	9.4	0.0	31
60 min Winter	56.713	0.0	11.7	0.0	58
120 min Winter	34.246	0.0	14.2	0.0	96
180 min Winter	25.149	0.0	15.7	0.0	134
240 min Winter	20.078	0.0	16.7	0.0	172
360 min Winter	14.585	0.0	18.2	0.0	246
480 min Winter	11.622	0.0	19.3	0.0	318
600 min Winter	9.738	0.0	20.2	0.0	388
720 min Winter	8.424	0.0	21.0	0.0	452
960 min Winter	6.697	0.0	22.3	0.0	542
1440 min Winter	4.839	0.0	24.1	0.0	750
2160 min Winter	3.490	0.0	26.1	0.0	0
2880 min Winter	2.766	0.0	27.5	0.0	0
4320 min Winter	1.989	0.0	29.7	0.0	0
5760 min Winter	1.573	0.0	31.2	0.0	0
7200 min Winter	1.311	0.0	32.4	0.0	0
8640 min Winter	1.129	0.0	33.4	0.0	0
10080 min Winter	0.994	0.0	34.3	0.0	0

Rainfall Details

Rainfall Model	FSR	Winter Storms	Yes
Return Period (years)	100	Cv (Summer)	0.750
Region	England and Wales	Cv (Winter)	0.840
M5-60 (mm)	20.000	Shortest Storm (mins)	15
Ratio R	0.400	Longest Storm (mins)	10080
Summer Storms	Yes	Climate Change %	+40

Time Area Diagram

Total Area (ha) 0.025

Time From:	**(mins) To:**	**Area (ha)**
0	4	0.025

Model Details

Storage is Online Cover Level (m) 81.590

Complex Structure

Cellular Storage

Invert Level (m) 80.400 Safety Factor 2.0
Infiltration Coefficient Base (m/hr) 0.00000 Porosity 0.95
Infiltration Coefficient Side (m/hr) 0.00000

Depth (m)	Area (m²)	Inf. Area (m²)	Depth (m)	Area (m²)	Inf. Area (m²)
0.000	18.5	18.0	0.501	0.0	26.5
0.500	18.5	26.5			

Porous Car Park

Infiltration Coefficient Base (m/hr)	0.00000	Width (m)	6.0
Membrane Percolation (mm/hr)	1000	Length (m)	5.0
Max Percolation (l/s)	8.3	Slope (1:X)	100.0
Safety Factor	2.0	Depression Storage (mm)	5
Porosity	0.30	Evaporation (mm/day)	3
Invert Level (m)	81.200	Cap Volume Depth (m)	0.200

Hydro-Brake® Outflow Control

Design Head (m) 0.550 Hydro-Brake® Type Md6 SW Only Invert Level (m) 80.350
Design Flow (l/s) 1.1 Diameter (mm) 50

Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.100	0.8	1.200	1.6	3.000	2.5	7.000	3.8
0.200	0.8	1.400	1.7	3.500	2.7	7.500	3.9
0.300	0.8	1.600	1.8	4.000	2.9	8.000	4.0
0.400	0.9	1.800	1.9	4.500	3.0	8.500	4.2
0.500	1.0	2.000	2.0	5.000	3.2	9.000	4.3
0.600	1.1	2.200	2.1	5.500	3.3	9.500	4.4
0.800	1.3	2.400	2.2	6.000	3.5		
1.000	1.4	2.600	2.3	6.500	3.6		

Weir Overflow Control

Discharge Coef 0.544 Width (m) 0.600 Invert Level (m) 81.190

Appendix E - SuDS Strategy

HEALTH, SAFETY & ENVIRONMENT

It is the responsibility of the client to ensure that those undertaking the works are competent and experienced in the type of work to be undertaken.

In addition to the hazards usually associated with the types of work detailed on this drawing, the following specific hazards have been identified through design risk assessment. The planning and execution of the works should take into account all usual and specific hazards.

Hazards should also be taken into account in the maintenance, operation, decommissioning and demolition of the works.

- LIVE SERVICES MAY BE PRESENT ON SITE
- DEEP EXCAVATIONS NECESSARY

DRAWING NOTES

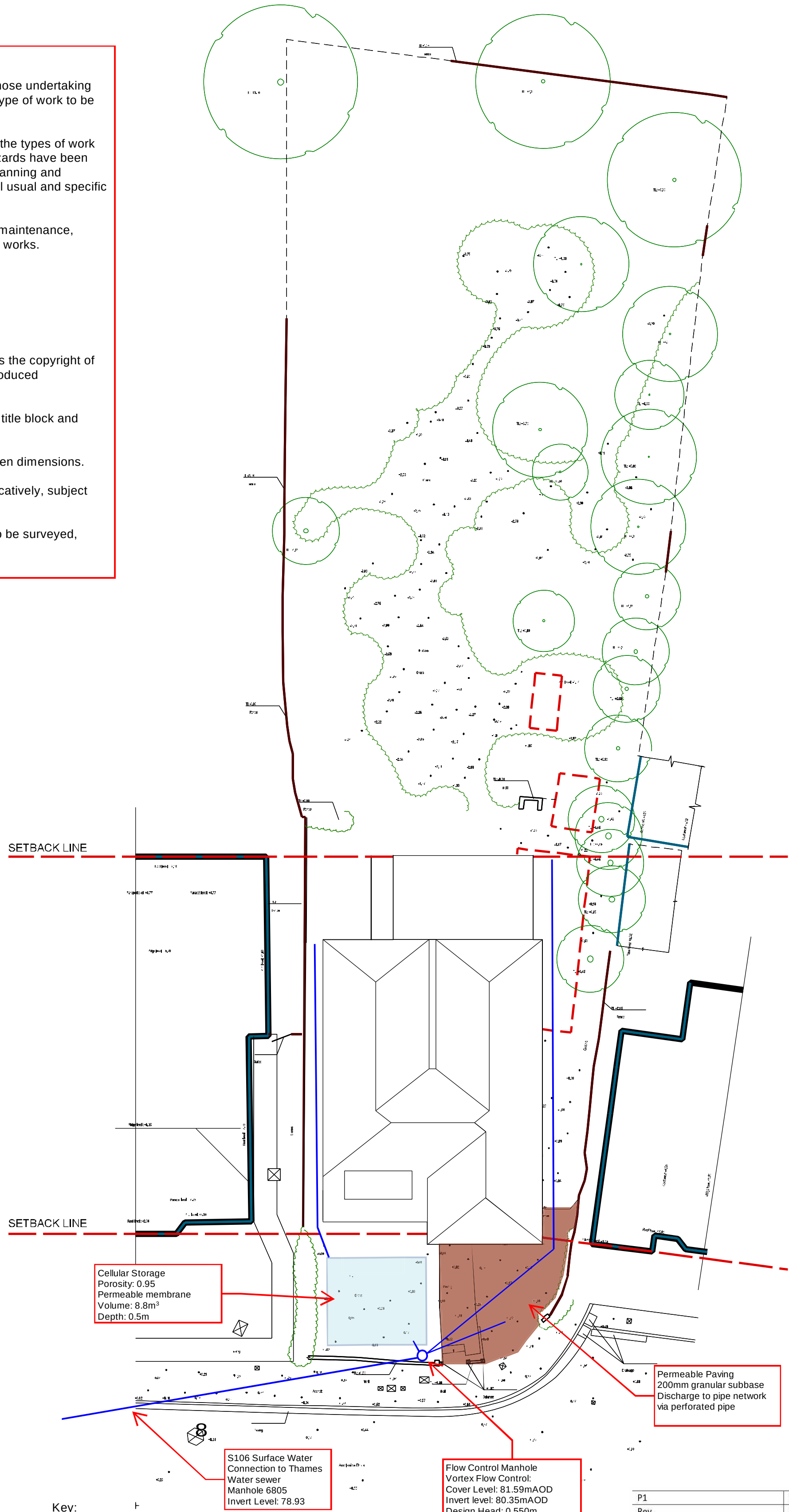
1. This drawing and information contained within is the copyright of Mont Arch Ltd and must not be distributed or reproduced without explicit written consent.

2. Information is specific to the site detailed in the title block and must not be replicated for any other project.

3. Do not scale from this drawing, only work to given dimensions.

4. Building drainage connection points shown indicatively, subject to architect design.

5. Sewers from records - location, line and level to be surveyed, and condition verified by CCTV inspection.



Key:

- Cellular Storage
- Permeable PAving
- Surface Water Pipework

P1	12.12.23	First Issue
Rev.	Date	Description

Preliminary

26 Ambleside Drive,
Headington

SuDS Strategy

Mont Arch Ltd
Ph: 07761 810496
James.w.berryman@gmail.com

Mont Arch Ltd

Drawing No: DS001-1001 Revision: P2

Appendix F - Method Statement - Managing Surface Water during Construction

METHOD STATEMENT - MANAGING SURFACE WATER DURING CONSTRUCTION

24 Ambleside Drive, Headington, OX3 0AQ

for

HSD

December 2023

Report Ref: DS001

CONTENTS **PAGE**

1. INTRODUCTION

1.1 This document has been produced on behalf of HSD for the proposed development of land at 24 Ambleside Drive, Headington, OX3 0AQ. The proposed development comprises the demolition of the existing buildings and the construction of a new residential dwelling.

1.2 This report gives outline guidance on the managing of surface water during construction. It is generally accepted that a high proportion of the perceived failures of SuDS components are as a direct result of either poor quality workmanship at the installation stage or damage during construction.

2. METHOD STATEMENT

2.1 The drainage will be constructed during the earthworks phase however final construction of the SuDS should not take place until the end of the development programme, unless adequate provision is made to remove any silt that is deposited during construction operations, and refurbish any areas that have been subject to over-compaction, siltation etc.

Pollution and sediment control

2.2 Surface water runoff from the construction site should not drain into SuDS components. Construction runoff can be heavily laden with silt, which can clog infiltration systems, build up in storage systems and pollute receiving waters. No traffic should be allowed to run on permeable surface components as it is likely to cause clogging of the pavement surface or result in over-compaction.

2.3 Clogging of infiltration systems – If appropriate programming is not possible (ie phased developments), careful management of construction runoff and storage of materials should reduce the chances of binding and clogging of infiltration components (permeable pavements, filter drains etc. Rehabilitation may be necessary.

Access and storage areas

2.4 Traditional car parking and other paved areas are usually constructed (or partially constructed) during the initial stages of the development, and then used as access roads and storage areas. If permeable surfaces are proposed, pavement construction should be carried out at the end of the development programme, unless adequate protection is provided to prevent clogging or blinding once it has been constructed, otherwise rehabilitation to remove clogging (i.e. suction sweeping for permeable pavements) may be required.

2.5 A temporary running course is to be utilised in areas where the permeable paving is to be installed until completion of each phase at which point the permeable paving may be laid (unless access is required across it for the next phase of the development).

Skills and understanding

2.6 The contractor and all relevant operatives should have an understanding of the purpose, operation and function of the SuDS components to ensure appropriate construction practice and protection is used. This relates to the conveyance (gradients), infiltration (quality of soil) and storage of surface water runoff.

Infiltration System Protection

2.7 If SuDS components are to be lined, the use of hardcore for structural purposes below the level of the liner can be accepted. However the use of hardcore is not advised where infiltration is intended, due to the high proportion of fines generally present. Sensitive ground may require the use of total exclusion zones for construction traffic to prevent compaction and other damage to the ground that will affect the infiltration performance. This may include protection from runoff during construction if the component is located at a low point on the site. Risks primarily relate to compaction and siltation of infiltration components.

Landscaping

2.8 The importance of good landscaping should be emphasised. As SuDS are normally at, or on the surface attention to detail and aesthetics must be given a high priority. The seasonal and physical requirements of planting and establishing vegetation and prevention of soil erosion should be programmed appropriately. Appropriate operative skills with an understanding of all aspects of vegetation are required.

2.9 Appropriate attention to detailing and ground levels for components should prevent any overland sediment wash off during high intensity rainfall events or groundwater seepage during wet periods. It should also allow the appropriate overland flow of water around the SuDS scheme, ie water flows downhill.

Erosion control

2.10 Before runoff is allowed to flow through on the surface vegetated SuDS components (eg swales) they should be stabilised by planting or temporary erosion protection. This will reduce erosion and the clogging of other parts of the system by the entrained silt.

Handover Inspection

2.11 Provision should be made in the construction contract to review the performance of the SuDS when it is completed, and to allow for minor adjustments and refinements to be made to optimise the physical arrangements, based on observed performance.

2.12 Suitable site supervision and inspection is also useful to ensure the SuDS components and scheme have been constructed as designed.

Inspections

2.13 Inspection during and after the construction of SuDS components and the overall scheme should be carried out to ensure that the system is being constructed correctly, and that design assumptions and criteria are not invalidated, for example, by the construction methods used, by changes made on site or by variations in ground conditions. Usual times of inspection include:

- Pre-excavation inspection to ensure that construction runoff is being adequately dealt with on site and will not cause clogging of the SuDS components.
- Inspections of excavations for ponds, infiltration devices, swales, etc.
- Inspection of manufacturers details of membranes, inlets, outlets and any control structures associated with components.
- Confirmation of sources for materials, ie soil, planting lists and material specifications.
- Inspections during laying of any pipework.
- Inspections and testing during the placing of earthworks materials or filter materials.
- Inspection of the prepared SuDS components before planting begins.

- Inspection of completed planting.
- Final inspection before handover to client.

2.14 The contractor installing the SuDS scheme should be made fully aware of the requirement for inspections, to time meetings and avoid work being undertaken that cannot be validated.

2.15 It is likely that any client or adopting organisation would require verification that the SuDS have been constructed in accordance with the agreed design and specification. Verification is likely to include documentation from the designer and contractor and appropriate inspection during construction.

2.16 Method statements should be kept simple and emphasise the differences from traditional construction activities, setting out the justification behind the construction programming (in relation to the drainage components), describe important construction processes, and specify the installation of critical items, eg where geotextiles and geomembranes are to be placed in the construction.

Appendix G - SuDS Maintenance and Management Plan

SuDS Maintenance and Management Plan

24 Ambleside Drive, Headington, OX3 0AQ

for

HSD

December 2023

Report Ref: DS001

CONTENTS PAGE

1. INTRODUCTION

1.1 This document has been produced on behalf of HSD for the proposed development of land at 24 Ambleside Drive, Headington, OX3 0AQ. The proposed development comprises the demolition of the existing buildings and the construction of a new residential dwelling.

1.2 This report gives guidance on the maintenance of Sustainable Drainage Systems (SuDS) and outlines who will be responsible for the maintenance.

2. INVENTORY OF SURFACE WATER DRAINAGE COMPONENTS

PERMEABLE PAVING

2.1 Permeable block paving allows water to infiltrate through gaps between the blocks into a layer of gravel, from which it infiltrates into the ground.

2.2 The hard standing within the close is to be constructed in permeable paving. The maintenance of each driveway is the responsibility of the respective property owner(s) and the shared road areas is the responsibility of the private management company set up by the developer.

2.3 The operation and maintenance requirements are given in the table below:

MAINTENANCE SCHEDULE	REQUIRED ACTION	RECOMMENDED FREQUENCY
Regular maintenance	Sweeping. **Note:** Any jointing material between the blocks that is lost or displaced as a result of sweeping must be replaced. New jointing material must be the same type as that removed or a suitable replacement.	Three times a year at the end of winter, mid-summer and after autumn leaf fall. Also as required based on site-specific observations.
Occasional maintenance	Stabilise and mow contributing and adjacent areas to prevent excess sediment being washed into the paving.	As required.
	Removal of weeds.	As required.
Remedial actions	Remedial work to any depressions, rutting and cracked or broken blocks considered detrimental to the structural performance or a hazard to users.	As required.
	Rehabilitation of surface and underlying sand and geotextile	As required (if infiltration performance is significantly reduced as a result of significant clogging).
Monitoring	Inspect for evidence of poor operation and/or weed growth. If required take remedial action.	Monthly for three months after installation, then during regular maintenance visits.

ATTENUATION STORAGE TANKS

2.4 Used to create a below ground void space for the temporary storage of surface water before infiltration, controlled release or use.

2.5 The operation and maintenance requirements are given in the table below:

MAINTENANCE SCHEDULE	REQUIRED ACTION	RECOMMENDED FREQUENCY
Regular Maintenance	Inspect and identify any areas that are not operating correctly. If required take remedial action.	Monthly for 3 months then annually
	Remove debris from the catchment surface (where it may cause risks to performance).	Monthly
	For systems where rainfall infiltrates into the tank from above, check surface of filter for blockages by sediment, algae or other matter; remove and replace surface infiltration medium as necessary.	Monthly
	Remove sediment from pre-treatment structures and/or internal forebays.	Annually
Remedial Actions	Repair sediment from pre-treatment structures and/or internal forebays.	Annually or as required
Monitoring	Inspect/check all inlets, outlets, vents and overflows to ensure they are in good condition and operating as designed.	Annually
	Survey inside of tank for sediment buildup and remove if necessary.	Every 5 years or as required

Flow Controls

2.6 These are proprietary systems which are custom made to control the discharge off site to approved levels. Some of the proposed flow controls may be prone to blocking and should be monitored closely.

2.7 The operation and maintenance requirements are given in the table below:

MAINTENANCE SCHEDULE	REQUIRED ACTION	RECOMMENDED FREQUENCY
Regular maintenance	Remove litter and debris and grass cutting and removal of cuttings from the upstream SuDS to prevent these being washed into the control. Inspection of control chamber and removal of any sediments, debris etc.	Quarterly or as required following Monitoring
Remedial actions	Check emergency overflow is clear, check the orifice flow control fixings to manhole and access into the control chamber is functional.	Quarterly or as required following Monitoring
Monitoring	Inspect flow controls and check flow are not impeded.	Monthly or after periods of heavy rainfall

Design Life

2.8 The design life of the development is likely to exceed the design life of each of the SuDS components listed above.

2.9 During the routine inspections of any drainage components it may become apparent that they have reached the end of their functional lifetime. In the interest of sustainability repairs should be the first choice solution where practicable. If this is not the case then it will be necessary for the property owners to undertake complete replacement of the component in question.