



NORTH STREET, READING

DRAINAGE STRATEGY STATEMENT

Project Title	70012984 – RBC Housing Sites – North Street
Subject	Drainage Strategy Advice
Date	03 October 2019
Client	Reading Borough Council
Prepared by	Barney Butler
Checked by	Kevin Ritter
Authorised by	Doug Barker
Notes	
File Reference	Central Data\70012984 - RBC Housing Sites, Reading\Water

CONTENTS

Background.....	2
Introduction.....	2
Planning Policy Guidance.....	2
Existing Development.....	3
Proposed Development.....	3
Drainage Strategy.....	3
Summary.....	4
Appendix A – Site Location	
Appendix B – Proposed Development	
Appendix C – Sewer Plans	
Appendix D – Topographical Survey	
Appendix E – Microdrainage Outputs	

BACKGROUND

- 1.1 WSP was commissioned by Reading Borough Council (the Client), to provide advice on the provision of drainage for land located at North Street, Reading, Berkshire, RG1 7BJ (the Site). It is understood that the client is intending to develop the land for residential purposes and requires this advice to confirm suitability for proposed use and support a planning application.

INTRODUCTION

- 2.1 The site is situated on a plot of brownfield land located in an area consisting of a mixture of industrial, commercial and residential uses. Reading Ambulance Station is located to the north of the site and residential flats are to the east. North Street and Weldale Street are adjacent to the eastern and southern boundaries of the Site respectively. The River Kennet lies approximately 770m to the south east of the development site and the River Thames lies approximately 780m north east.
- 2.2 A site location plan is shown below in Figure 1.

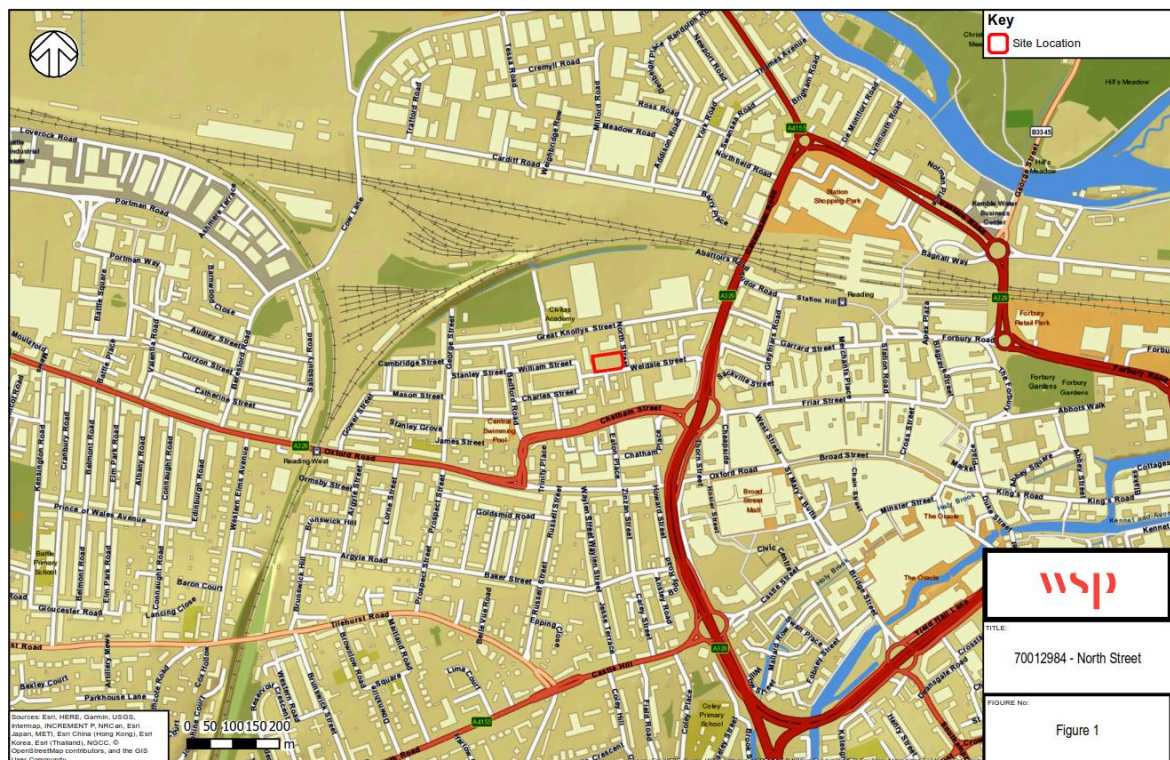


Figure 1: Site Location, attached as Appendix A

PLANNING POLICY GUIDANCE

- 3.1 Policies that are relevant to development at this location are outlined below.

RBC Core Strategy 2008 (Alterations Adopted 2015)

Policy CS1: Sustainable Construction and Design

- 3.2 *Developments incorporate sustainable urban drainage facilities and techniques as part of the layout of a development as appropriate and as advised by the Environment Agency, including minimising the size of impermeable areas so that peak run-off and annual water run-off is reduced where*

possible and in any case is no greater than the original conditions of the site. Particular care will be needed in areas of flood risk where different solutions may be required.

Sites and Detailed Policies Document 2012, (Alterations Adopted 2015)

Policy DM1: Adaption to Climate Change

- 3.3 *All development shall minimise the impact of surface water runoff from the development in the design of the drainage system.*

Pre-Submission Draft Local Plan (consultation closed, due to be submitted to SoS)

Policy CC3: ADAPTATION TO CLIMATE CHANGE

- 3.4 *All development shall minimise the impact of surface water runoff from the development in the design of the drainage system, and where possible incorporate mitigation and resilience measures for any increases in river flooding levels as a result of climate change.*

Policy EN18: FLOODING AND SUSTAINABLE DRAINAGE SYSTEMS

- 3.5 *Major developments* must incorporate sustainable drainage systems (SuDS) as appropriate and in line with the Government's Technical Standards. Runoff rates should aim to reflect greenfield conditions and, in any case, must be no greater than the existing conditions of the site. Schemes should ensure that the movement of water through vertical infiltration as well as horizontal run-off does not worsen contamination effects. Wherever possible, SuDS provision should maximise ecological benefits, link into the existing Green Network, incorporate tree planting and landscaping and avoid damage to existing significant trees, including through changes to the site hydrology. All new developments in areas of flood risk should give priority to SuDS.*

**10 or more dwellings or equivalent non-residential or mixed developments*

EXISTING DEVELOPMENT

- 4.1 The existing site is accessed from North Street. The site perimeter comprises a mixture of wire and wooden fencing. The ground surface appears to be generally level and consists of a mixture of hardstanding and overgrown vegetation. There is a vegetated bank along the southern boundary of the site which is elevated above the hardstanding. The site is set above the residential gardens to the west and slightly above the Ambulance Station to the north.
- 4.2 The site is set below residential gardens on the south-western and western edges. The site is adjacent to a public footpath from Lyndhurst Road to Thirlmere Avenue on its south-eastern boundary. The north-eastern area of the site is a slightly overgrown roadway and turning head, which is bounded by a residential apartment and associated grounds.
- 4.3 The vegetated bank along the southern boundary falls northwards from approximately 41.1mAOD to 40.0mAOD where it meets the hardstanding. The hardstanding ground surface slopes generally to the north from approximately 40.0mAOD adjacent to the bank to 39.3mAOD along the northern boundary. The total site area is approximately 0.219ha.
- 4.4 The current surface water and foul drainage arrangements for the site are not known.

PROPOSED DEVELOPMENT

- 5.1 It is understood that there are currently proposals to develop the site into 41 residential units, comprising one, two and three-bed apartments over 4 floors with associated car parking, bicycle storage and landscaping. Development plans for the site can be found in Appendix B.

DRAINAGE STRATEGY

- 6.1 The Environment Agency's Flood Map for Planning shows the site to be in Flood Zone 1, however there is an area of Flood Zone 2 approximately 25m north of the site. The elevation at the extent of Flood Zone 2 nearest the site is approximately 38.4mAOD, lower than the minimum elevation of the site. The site is also not affected by the modelled flood extents with 70% climate change allowance contained in Appendix C of the Reading Borough Council Strategic Flood Risk Assessment. Therefore, the risk of fluvial flooding, including an allowance for climate change is considered to be low.
- 6.2 The Environment Agency flood risk from surface water mapping shows that the site is at a very low risk of surface water flooding, however there is a low risk flowpath along Weldale Street and North Street, adjacent to the south and east of the site. Predicted depths within the low risk flow path are below 300 mm, with predicted velocities of over 0.25 m/s. A high risk flow path, with associated areas of medium risk, is present along Great Knollys Street, but this is at a lower elevation than the site.
- 6.3 Due to the presence of an existing manhole soakaway onsite and the underlaying chalk bedrock with possible superficial deposits of Clay, Silt, Sand and Gravels, infiltration is considered to be possible at this site. Infiltration should be considered as the first option for surface water drainage in accordance with the Planning Practice Guidance (PPG). Due to the presence of chalk, an offset of 10-20m should be applied between buildings and soakaways, in accordance with CIRIA 574. However, in the absence of soakaway testing in accordance with BRE 365 Digest and without investigation of contamination sources and ground water levels use of infiltration drainage solutions cannot be assumed at this location. It is therefore assumed that surface water from this site would discharge to the existing Thames Water sewer network located in North Street, see Appendix C.
- 6.4 Should the appropriate testing prove that infiltration drainage is viable at the site, this method should be used in preference to direct discharge to the Thames Water sewer network. Infiltration solutions could be utilised in the detailed design process.
- 6.5 The proposed surface water discharge rates to the Thames Water network will be limited as far as reasonably practicable to greenfield rates, in line with local policy.
- 6.6 Greenfield QBAR rates for the site were calculated as 0.1 l/s. This rate cannot be feasibly achieved as there would be a significant risk of blockage. A minimum practical discharge of 2.5 l/s, based on a 76mm diameter vortex flow control, has been applied which will be subject to agreement with Thames Water.
- 6.7 Using the rational method, based on a runoff coefficient of 2.78, 55% hardstanding and 50 mm/hr rainfall intensity, the existing brownfield discharge from the site was calculated to be 16.7 l/s. Therefore, the proposed discharge rate provides a betterment of 85% from existing brownfield discharge rates from the site.
- 6.8 The proposed hardstanding measures 0.147ha, which totals at 0.1617ha when including a 10% allowance for urban creep.
- 6.9 Drainage calculations determine that assuming an impermeable area of 1617m² with a restricted discharge rate of 2.5 l/s, the attenuation volume requirement for the 1 in 100 year storm event with a 40% allowance for climate change would be 75m³. Microdrainage calculations are contained in Appendix F. It is likely that the required attenuation volume could vary subject to detailed design and discharge agreements with Thames Water.
- 6.10 This volume is proposed to be accommodated in geo-cellular storage with a 76mm diameter vortex flow control to restrict discharge to 2.5l/s. The proposed drainage strategy is contained in Appendix E.

- 6.11 The foul water discharge from the site would be connected to the existing Thames Water foul network in North Street.
- 6.12 Finished floor levels should be set at an appropriate level so that existing overland flow routes are not impeded and any onsite flooding is directed away from buildings.

SUMMARY

- 7.1 The site current consists of a mixture of hardstanding and overgrown vegetation.
- 7.2 The proposed development is to provide 41 residential units of one, two and three-beds.
- 7.3 Infiltration drainage should be considered as the preference for surface water drainage subject to soakaway testing in accordance with BRE 365 Digest. Should infiltration drainage not be appropriate, it is proposed to discharge surface water to the Thames Water surface water sewer in North Street.
- 7.4 Surface Water runoff will be limited to 2.5 l/s (lowest possible engineered design, this level is subject to detailed design).
- 7.5 The volume required to attenuate surface water discharge to 2.5 l/s in the 1 in 100 year storm event with 40% allowance for climate change, would be approximately 75m³. This will be accommodated in geo-cellular storage and flow limited by a 76mm diameter vortex flow control.
- 7.6 Foul water drainage would be connected to the existing Thames Water infrastructure in North Street.
- 7.7 Finished floor levels should be set at an appropriate level so that existing overland flow routes are not impeded and any onsite flooding is directed away from buildings.

APPENDIX A

SITE LOCATION



APPENDIX B

PROPOSED DEVELOPMENT

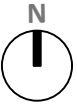
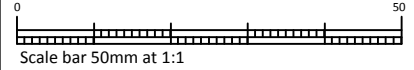
Typology	No. Units	Bed spaces	GIA (m2)	Total GIA (m2)	No. Parking	Comment
1B2P - Type A	10	20	50.8	508		
1B2P - Type B	1	2	51.9	51.9		
1B2P - Type C	6	12	52.5	315		
1B2P - Type D	1	2	56.7	56.7		
1B2P - Type E	1	2	57.4	57.4		
2B3P	2	6	64.4	128.8		
2B4P -Type A	1	4	70.0	70		
2B4P -Type B	4	16	70.4	281.6		
2B4P -Type C	3	12	70.6	211.8		
2B4P -Type D	3	12	77.6	232.8		
2B4P -Type E	1	4	77.2	77.2		
2B4P -Type F	1	4	76.6	76.6		
2B4P -Type G	2	8	81.6	163.2		
2B4P -Type H	3	12	81.7	245.1		
2B4P -Type J	1	4	76.4	76.4		
3B5P	1	5	89.7	89.7		
Totals	41	125		2642.2	9	

Site Area (ha)	0.23
Density (dph)	178



NOTES

This drawing to be read in accordance with the specification/Bills of Quantities and related drawings. No Dimensions to be scaled from this drawing. All stated dimensions to be verified on site and the Architect notified of any discrepancies.



Project
Reading Affordable Housing Sites

North Street
Reading

Title
Proposed Ground Floor Plan

Scale 1:200 @ A3	Date 03/05/2019
Drawn SB	Checked MS

Drawing Number 7916_PL_103	Revision -
-------------------------------	---------------

Saunders
Architecture + Urban Design

APPENDIX C

SEWER PLANS

Asset location search



Property
Searches

Atkins Telecoms
Stats Enquiries Team The Hub
500 Park Avenue
BRISTOL
BS32 4RZ

CHECKED

Search address supplied Site at North Street, Reading
RG1 7DA

Your reference 57007

Our reference ALS/ALS Standard/2017_3628702

Search date 9 August 2017

Keeping you up-to-date

Knowledge of features below the surface is essential in every development. The benefits of this not only include ensuring due diligence and avoiding risk, but also being able to ascertain the feasibility for any commercial or residential project.

An asset location search provides information on the location of known Thames Water clean and/or wastewater assets, including details of pipe sizes, direction of flow and depth. Please note that information on cover and invert levels will only be provided where the data is available.



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



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



0845 070 9148



Asset location search



Property Searches

Search address supplied: Site at North Street, Reading, RG1 7DA

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 search provides 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 0845 070 9148, 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

Asset location search



Property Searches

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.

Asset location search



Property Searches

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.

Asset location search



Property Searches

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: 0845 850 2777
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: 0845 850 2777
Email: developer.services@thameswater.co.uk

Asset Location Search Sewer Map - ALS/ALS Standard/2017 3628702



The width of the displayed area is 500 m and the centre of the map is located at OS coordinates 470911,173657
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.

Based on the Ordnance Survey Map with the Sanction of the controller of H.M. Stationery Office, License no. 100019345 Crown Copyright Reserved.

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
1751	n/a	n/a
1701	n/a	n/a
181B	38.5	36.63
1652	39.44	38.24
161A	n/a	n/a
1551	43.35	41.1
1402	44.41	41.28
141A	n/a	n/a
041E	n/a	n/a
041D	44.55	41.55
041C	44.5	41.5
041F	n/a	n/a
0451	43.06	42.02
0455	n/a	n/a
1453	43.69	41.86
1406	43.44	40.66
051G	n/a	n/a
051E	n/a	n/a
051F	n/a	n/a
951A	n/a	n/a
0551	36.74	34.98
1554	44.25	41.29
051C	n/a	n/a
051D	n/a	n/a
051A	44.6	41.03
9558	n/a	n/a
051B	44.07	40.63
9552	45.24	43.87
051H	n/a	n/a
1553	44.31	41.19
0555	44.07	42.09
1502	44.36	40.65
0558	44.6	41.79
9553	45.29	44.09
9559	n/a	n/a
0450	44.05	42.34
941D	n/a	n/a
941C	n/a	n/a
0462	n/a	n/a
1403	44.18	40.97
0403	44.24	41.02
0402	45.02	42.4
1404	44.11	40.93
1451	44.08	42.22
041G	n/a	n/a
041H	n/a	n/a
9403	44.2	41.3
9455	44.15	42.77
0475	n/a	n/a
041A	44.13	42.03
041B	44.5	41.84
0452	39.56	38.63
9402	44.35	41.7
9454	44.32	42.95
941A	n/a	n/a
941B	n/a	n/a
9453	44.4	43.06
9401	44.4	42.22
9452	44.36	43.14
7452	41.71	40.08
7402	41.47	38.28
7451	41.45	39.85
8451	42.54	41.01
7403	41.94	n/a
9451	44.41	43.25
8503	42.44	39.34
75JJ	n/a	n/a
8552	42.72	41.2
75JK	n/a	n/a
851D	n/a	n/a
8553	43.73	41.78
851C	n/a	n/a
8554	43.89	42.48
9566	n/a	n/a
8501	41.62	38.82
9554	44.65	43.23
7551	40.83	39.32
6551	40.75	39.46
851B	n/a	n/a
7552	40.8	38.39
7501	40.72	37.37
851A	n/a	n/a
7502	40.18	36.78
6652	38.51	36.42
6602	38.37	35.62
6601	38.49	35.58
6654	39.26	37.12
6604	39.23	36.23
6651	38.33	36.45
7553	40.02	38.9
76KJ	n/a	n/a

Manhole Reference	Manhole Cover Level	Manhole Invert Level
76JN	n/a	n/a
761A	n/a	n/a
771A	n/a	n/a
771B	n/a	n/a
7752	37.9	36.95
7751	38.03	36.43
76HL	n/a	n/a
7503	40.18	37.44
7554	40.12	39.27
761B	n/a	n/a
76FN	n/a	n/a
8752	n/a	37.17
8603	39.82	37.24
8602	41.18	38.42
8601	41.49	38.8
8751	37.91	37.04
9605	41.39	38.43
9655	41.34	40.04
9601	41.73	39.71
9654	41.81	40.38
7405	43.21	n/a
741A	n/a	n/a
741B	n/a	n/a
641A	n/a	n/a
741D	n/a	n/a
741C	n/a	n/a
7463	n/a	n/a
7464	n/a	n/a
7462	n/a	n/a
7401	42.06	38.84
7404	42.75	39.79
7465	n/a	n/a
9753	37.91	37.03
9701	38.07	35.13
9852	38.74	36.52
9755	38.48	36.64
9756	38.37	36.66
9754	38	36.98
9757	38.16	36.64
0751	38.24	37.06
0752	38.31	36.94
0760	38.44	36.9
1755	38.72	37.59
1754	38.43	37.53
1753	38.55	36.84
1862	38.34	34.4
1863	38.36	34.4
1761	n/a	36.29
0556	n/a	n/a
9560	43.88	40.72
0559	n/a	n/a
1556	n/a	n/a
0560	41.48	40.26
1555	n/a	n/a
0561	n/a	n/a
0651	42.03	39.38
1654	43.17	39.14
1657	42.13	39.43
1604	43.33	38.57
1656	n/a	n/a
1605	42.88	38.69
1606	n/a	n/a
1662	n/a	n/a
9651	41.04	39.67
1603	41.07	37.47
1653	39.51	38.65
06NL	n/a	n/a
9652	39.98	38.18
9604	39.96	36.78
1602	39.48	37.13
1601	39.77	36.86
1651	39.73	37.99
1702	39.32	36.22
1752	39.25	37.63
9752	37.99	37.13
9851	38.71	36.32
1801	38.37	36.13
1851	38.4	n/a
0802	n/a	n/a
0801	n/a	n/a
0851	n/a	n/a
0803	n/a	n/a
7753	38.18	36.67
7754	38.13	35.41
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.		



ALS Sewer Map Key

Public Sewer Types (Operated & Maintained by Thames Water)

	Foul: A sewer designed to convey waste water from domestic and industrial sources to a treatment works.
	Surface Water: A sewer designed to convey surface water (e.g. rain water from roofs, yards and car parks) to rivers or watercourses.
	Combined: A sewer designed to convey both waste water and surface water from domestic and industrial sources to a treatment works.
	Trunk Surface Water
	Trunk Foul
	Storm Relief
	Trunk Combined
	Vent Pipe
	Bio-solids (Sludge)
	Proposed Thames Surface Water Sewer
	Proposed Thames Water Foul Sewer
	Gallery
	Foul Rising Main
	Surface Water Rising Main
	Combined Rising Main
	Sludge Rising Main
	Proposed Thames Water Rising Main
	Vacuum

Notes:

- 1) All levels associated with the plans are to Ordnance Datum Newlyn.
- 2) All measurements on the plans are metric.
- 3) Arrows (on gravity fed sewers) or flecks (on rising mains) indicate 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 level indicates that data is unavailable.

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
	Dam Chase
	Fitting
	Meter
	Vent Column

Operational Controls

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

	Control Valve
	Drop Pipe
	Ancillary
	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.

	Outfall
	Undefined End
	Inlet

Other Symbols

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

	Public/Private Pumping Station
	Change of characteristic indicator (C.O.C.I.)
	Invert Level
	Summit

Areas

Lines denoting areas of underground surveys, etc.

	Agreement
	Operational Site
	Chamber
	Tunnel
	Conduit Bridge

Other Sewer Types (Not Operated or Maintained by Thames Water)

	Foul Sewer
	Surface Water Sewer
	Combined Sewer
	Gully
	Culverted Watercourse
	Proposed
	Abandoned Sewer

- 6) The text appearing alongside a sewer line indicates the internal diameter of the pipe in millimetres. 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 present on the plan, please contact a member of Property Insight on 0845 070 9148.

Asset Location Search Water Map - ALS/ALS Standard/2017 3628702



The width of the displayed area is 500 m and the centre of the map is located at OS coordinates 470911, 173657.
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.

Based on the Ordnance Survey Map with the Sanction of the controller of H.M. Stationery Office, License no. 100019345 Crown Copyright Reserved.



ALS Water Map Key

Water Pipes (Operated & Maintained by Thames Water)

- 4"** **Distribution Main:** The most common pipe shown on water maps. With few exceptions, domestic connections are only made to distribution mains.
- 16"** **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.
- 3" SUPPLY** **Supply Main:** A supply main indicates that the water main is used as a supply for a single property or group of properties.
- 3" FIRE** **Fire Main:** Where a pipe is used as a fire supply, the word FIRE will be displayed along the pipe.
- 3" METERED** **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

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:** Indicates 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.

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 14 days from due 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. Thames Water does not accept post-dated cheques-any cheques received will be processed for payment on date of receipt.
5. In case of dispute TWUL's terms and conditions shall apply.
6. 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'.
7. Interest will be charged in line with current Court Interest Charges, if legal action is taken.
8. 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 not satisfied with the response, your complaint will be reviewed by the Customer Services Director. You can write to her at: Thames Water Utilities Ltd. PO Box 492, Swindon, SN38 8TU.

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 0121 345 1000 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	Cheque
Call 0845 070 9148 quoting your invoice number starting CBA or ADS / OSS	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	Made payable to ' Thames Water Utilities Ltd ' Write your Thames Water account number on the back. Send to: Thames Water Utilities Ltd., PO Box 3189, Slough SL1 4WW or by DX to 151280 Slough 13

Thames Water Utilities Ltd Registered in England & Wales No. 2366661 Registered Office Clearwater Court, Vastern Rd, Reading, Berks, RG1 8DB.



Search Code

IMPORTANT CONSUMER PROTECTION INFORMATION

This search has been produced by Thames Water Property Searches, Clearwater Court, Vastern Road, Reading RG1 8DB, which is registered with the Property Codes Compliance Board (PCCB) as a subscriber to the Search Code. The PCCB independently monitors how registered search firms maintain compliance with the Code.

The Search Code:

- provides protection for homebuyers, sellers, estate agents, conveyancers and mortgage lenders who rely on the information included in property search reports undertaken by subscribers on residential and commercial property within the United Kingdom
- sets out minimum standards which firms compiling and selling search reports have to meet
- promotes the best practise and quality standards within the industry for the benefit of consumers and property professionals
- enables consumers and property professionals to have confidence in firms which subscribe to the code, their products and services.

By giving you this information, the search firm is confirming that they keep to the principles of the Code. This provides important protection for you.

The Code's core principles

Firms which subscribe to the Search Code will:

- display the Search Code logo prominently on their search reports
- act with integrity and carry out work with due skill, care and diligence
- at all times maintain adequate and appropriate insurance to protect consumers
- conduct business in an honest, fair and professional manner
- handle complaints speedily and fairly
- ensure that products and services comply with industry registration rules and standards and relevant laws
- monitor their compliance with the Code

Complaints

If you have a query or complaint about your search, you should raise it directly with the search firm, and if appropriate ask for any complaint to be considered under their formal internal complaints procedure. If you remain dissatisfied with the firm's final response, after your complaint has been formally considered, or if the firm has exceeded the response timescales, you may refer your complaint for consideration under The Property Ombudsman scheme (TPOs). The Ombudsman can award compensation of up to £5,000 to you if he finds that you have suffered actual loss as a result of your search provider failing to keep to the Code.

Please note that all queries or complaints regarding your search should be directed to your search provider in the first instance, not to TPOs or to the PCCB.

TPOs Contact Details

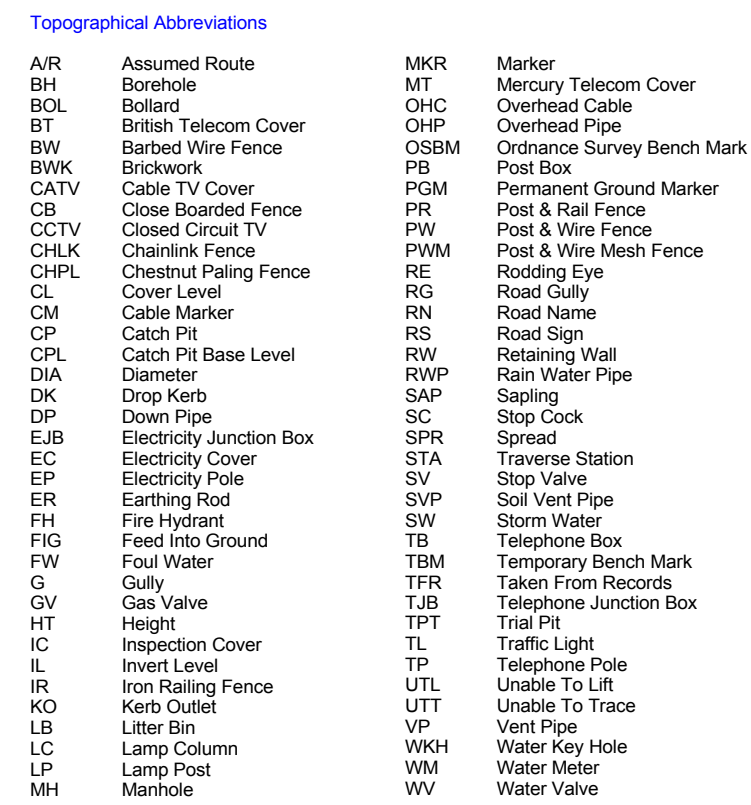
The Property Ombudsman scheme
Milford House
43-55 Milford Street
Salisbury
Wiltshire SP1 2BP
Tel: 01722 333306
Fax: 01722 332296
Email: admin@tpos.co.uk

You can get more information about the PCCB from www.propertycodes.org.uk

PLEASE ASK YOUR SEARCH PROVIDER IF YOU WOULD LIKE A COPY OF THE SEARCH CODE

APPENDIX D

TOPOGRAPHICAL SURVEY



Survey Station Information				
<u>STA No.</u>	<u>Easting</u>	<u>Northing</u>	<u>Level</u>	<u>Type</u>
STN01	470900.124	173656.464	39.497	Nail
STN02	470922.877	173673.984	39.508	Nail
STN03	470952.108	173649.669	40.846	Nail
STN04	470893.009	173637.213	41.361	Nail

Notes

The Grid is related to OS using GPS
All Levels are related to OS using GPS

Electromagnetic and/or Ground Penetrating Radar techniques have been used to locate map underground utilities and features on this drawing. Subsurface Technology Ltd has made every endeavour to ensure the information is accurate and reliable, but cannot accept any responsibility for the information. Subsurface Technology Ltd has used any record drawings provided by the client or by the Statutory Utility Providers, at the client's request, at the client's risk. The information is provided as a guide only. The accuracy of the information (depth and position) is not guaranteed. Historic record information is often incomplete and inaccurate and cannot be relied upon.

Subsurface Technology Ltd does not accept any legal liability for any data that has not been undertaken by us. Any inaccuracies relating to topographical plans/development plans/Ordinance Survey data that have no control points or any other data that is not a statutory requirement for underground services/features is stated. Depths are generally within +/-10% accuracy, but cannot be guaranteed. Any depths shown are drains are not to be used for any purpose other than the intended purpose.

At Subsurface Technology Ltd we use skilled staff and modern, calibrated equipment to perform our surveys. However, the completeness of any survey is dependent on the nature of the site and the type of services. In these types of surveys are not infallible. If the location or depth of services/features is of particular importance to a project then it is strongly recommended that a further investigation is carried out. We cannot accept any possible limitations or anomalies. It is also strongly advised that trial excavations should be undertaken to confirm survey results. We cannot be held responsible for any damage to property or persons that could not be reasonably expected by a competent company.

ABBREVIATIONS (Land & Utilities)

[illegible]

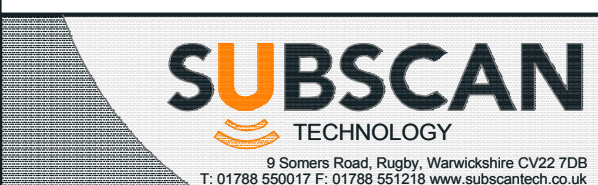
KEY

	CCTV / CABLE TELEVISION
	COMBINED DRAINAGE
	COMMUNICATIONS CABLE
	COMPRESSED AIR
	DUCTING
	EARTH CABLE
	ELECTRIC CABLE
	END OF TRACE
	FOUL DRAINAGE
	FUEL PIPE
	GAS PIPE
	GAUGE LINE
	HEATING
	OFFSET FILL PIPE
	PUMPING MAIN
	RADAR AREA ANOMALY
	RADAR UTILITY TRACE
	SURFACE DRAINAGE
	SURVEY BOUNDARY
	TELECOM CABLE
	TRAFFIC LIGHTS
	UNIDENTIFIED
	VAPOUR RECOVERY
	VENT PIPE
	WATER PIPE

A SINGLE LINE INDICATING A UTILITY MAY INDICATE THE PRESENCE OF MULTIPLE SERVICES WITHIN CLOSE PROXIMITY TO EACH OTHER. WHERE A SINGLE LINE TYPE IS SHOWN WE RECOMMEND HAND DIGGING WITHIN 0.5m TO EXPOSE HIDDEN SERVICES.

[illegible]

CLIENT	DWG No	REVISION
Hampshire County Council	24716	A
TITLE		SCALE
Car Park North Street/ Wealdale Street Reading		1:200@A
		SURVEYED
		J
		DRAWN
		D
PAGE	DATE	
1 of 1	18/06/11	
SURVEY TYPE		
TOPOGRAPHICAL ☐		
DRAINAGE ☒		
UTILITY ☒		



APPENDIX E

PROPOSED DRAINAGE STRATEGY

File name \\UK\WSPGROUP\COM\CENTRAL DATA\PROJECTS\70012\XXXX\70012884 - RBC HOUSING SITES, READING\03 WPC\CVL ENGINEERING\02 CAD BIM MODEL\2884-WSP-XX-00-C-500 DRAINAGE STRATEGY NS REV1.DWG, printed on 03 October 2019 12:28:45, by Butler, Barney

NOTES

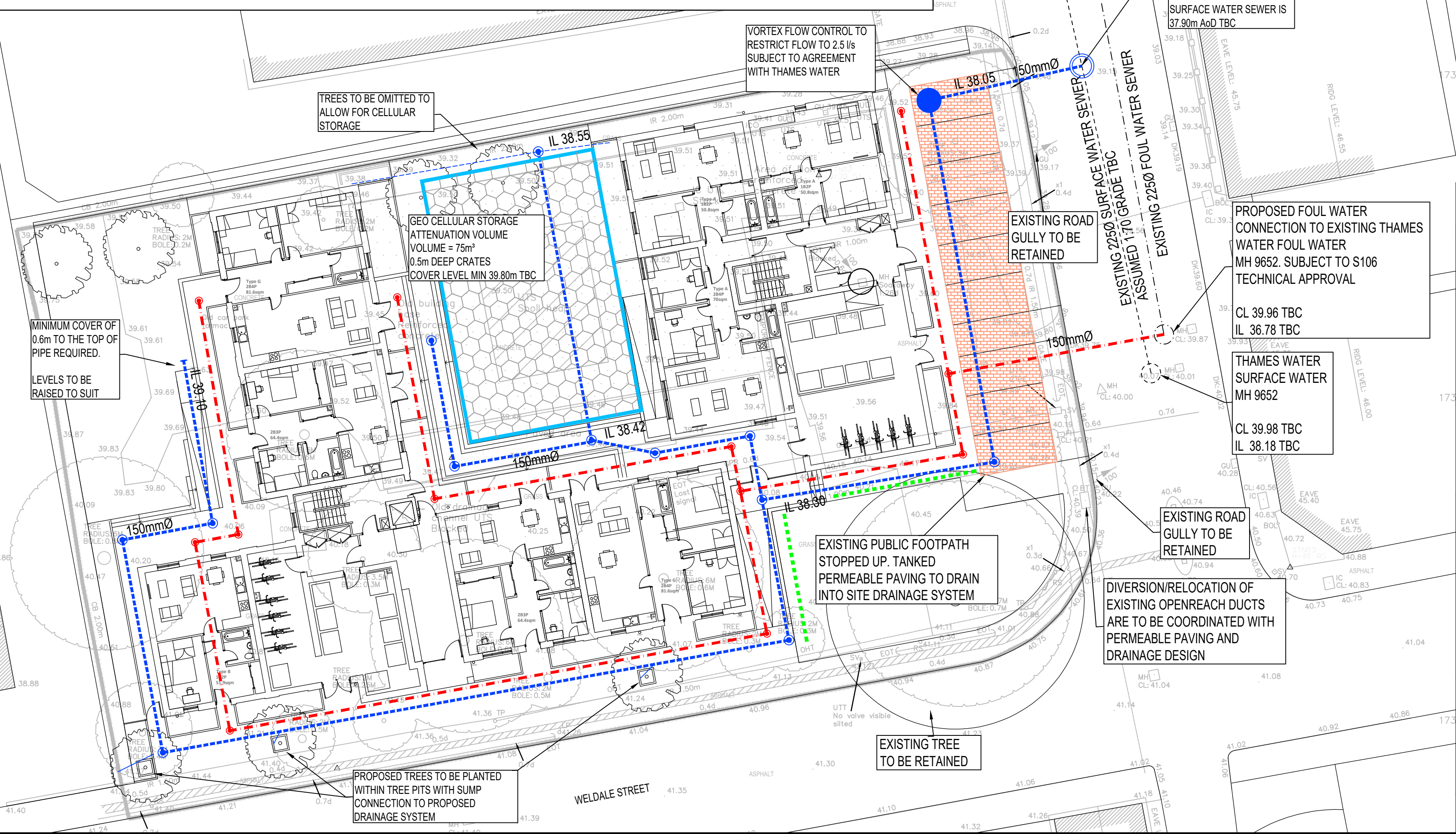
- ALL LEVELS AND DIMENSIONS ARE IN METERS UNLESS SPECIFIED OTHERWISE.
- ARCHITECTURAL LAYOUT IS BY SAUNDERS ARCHITECTS. ARCHITECT TO SHOW FINISHED FLOOR LEVELS AND EXTERNAL LEVELS FOR THE DEVELOPMENT. BUILDING LOCATION WILL BE POSITIONED BY THE ARCHITECT WHICH SHOULD TAKE ACCOUNT OF THE TOPOGRAPHICAL SURVEY.
- THE DRAINAGE DESIGN WILL BE LOCATED BASED ON THE TOPOGRAPHICAL SURVEY. ANY DISCREPANCY SHOULD BE REPORTED TO THE ENGINEER AS SOON AS POSSIBLE.
- THE EXISTING SITE AREA MEASURES 0.219 HA. THIS CONSISTS OF APPROXIMATELY 55% HARDSTANDING. THE PROPOSED HARDSTANDING MEASURES 0.147ha AND 0.1617ha INCLUDING 10% ALLOWANCES FOR URBAN CREEP.
- EXISTING FOUL AND SURFACE WATER SPURS ARE NOT SHOWN ON THE SURVEY. THEREFORE A NEW CONNECTION HAS BEEN SHOWN SUBJECT TO THAMES WATER AGREEMENT. IF EXISTING SPURS ARE LOCATED THEY WILL REQUIRE A CCTV AND MAPPING/DETECTION SURVEY TO IDENTIFY THEIR CONDITION, LINE AND LEVEL. THE PROPOSED DRAINAGE SHOULD THEN BE REVISED TO SUIT IF APPROPRIATE.
- THE SURFACE WATER DRAINAGE STRATEGY IS BASED ON A POSITIVE CONNECTION TO THAMES WATER SEWER LOCATED IN NORTH STREET. THE PROPOSED SURFACE WATER DISCHARGE

RATE IS BASED ON A 76mm DIAMETER VORTEX FLOW CONTROL PRODUCING A FLOW RATE OF 2.5 l/s. BASED UPON A 50mm/hr RAINFALL INTENSITY, THE EXISTING SW DISCHARGE RATE IS CALCULATED TO BE 16.7 l/s WHICH WILL RESULT IN A BETTERMENT OF 85%. THE STRATEGY IS SUBJECT TO LEVELS AND THAMES WATER S106 TECHNICAL APPROVAL. THE SURFACE WATER DRAINAGE CALCULATIONS HAVE BEEN ASSESSED UP TO THE 100 YEAR PLUS 40% CLIMATE CHANGE EVENT. IT IS NOTED THAT DUE TO THE SIZE OF THE SITE THE GREEN FIELD RUN OFF RATES, WHICH EQUATES TO 0.4 l/s, HAS BEEN CONSIDERED AND SUBSEQUENTLY DISCOUNTED AS IT WOULD CAUSE FREQUENT BLOCKAGE DUE TO THE SIZE OF THE FLOW CONTROL OPENING.

- IT IS NOTED FROM AN EXISTING DESK TOP STUDY ON THE READING PLANNING PORTAL THAT THERE IS A PRESENCE OF CHALK INCLUDING THE READING CHALK MINE LOCATED CIRCA 652m FROM THE SITE. CIRIA 574 GUIDANCE STATES A MINIMUM OFFSET OF 10-20m SHOULD BE APPLIED TO ANY SOAKAWAYS IN CHALK IN LIEU OF ANY INFORMATION OF THE CHALK SUBSOILS. AS SUCH UNTIL A GROUND INVESTIGATION IS UNDERTAKEN ON THE SITE INFILTRATION IS TO HIGH A RISK AND THEREFORE NOT APPROPRIATE FOR THE PROPOSED DEVELOPMENT.

- ON SITE INFILTRATION TESTING TO BRE 365 IS REQUIRED AS EARLY AS POSSIBLE TO DEMONSTRATE IF SOAKAWAYS ARE SUITABLE AS A METHOD OF DISCHARGE FOR THE PROPOSED DEVELOPMENT.
- FURTHER BOREHOLES SHOULD BE COMPLETED AS PART OF A GEOTECHNICAL INVESTIGATION TO CONFIRM ONSITE CONDITIONS.

- BASED UPON THE FRA SUMMARY, THE SITE IS WITHIN FLOOD ZONE 1 AND IS AT VERY LOW RISK OF SURFACE WATER FLOODING. IT IS ADVISED TO SET THE FINISHED FLOOR LEVELS AT LEAST 150mm ABOVE THE EXISTING GROUND LEVELS AND THAT LEVELS ARE SHAPED SUCH THAT OVERLAND FLOOD FLOW ROUTES ARE DIRECTED AWAY FROM BUILDING THRESHOLDS AND THE DEVELOPMENT.
- FFLS AND EXTERNAL LEVELS ARE TO BE CONFIRMED BY THE ARCHITECT. NOTE MIN COVER LEVEL REQUIRED 39.80m AOD TBC AT DETAILED DESIGN.
- ALL PROPOSED FOUL WATER PIPE WORK IS TO BE 100mmØ UNLESS OTHERWISE SPECIFIED.
- ALL PROPOSED SURFACE WATER PIPE WORK TO BE 150mmØ UNLESS OTHERWISE SPECIFIED.
- THIS DRAINAGE SHOULD BE READ IN CONJUNCTION WITH ALL OTHER ARCHITECTURAL/ENGINEERING DRAWINGS AND DOCUMENTATION
- ARCHITECT TO CONFIRM IF THERE ARE ANY DRAINAGE REQUIREMENTS FOR LIFT PITS
- ADDITIONAL CHAMBERS WILL BE REQUIRED TO RECEIVE FOUL DRAINS FROM INSIDE THE BUILDING. THE NUMBER AND LOCATION OF THESE ADDITIONAL CHAMBERS ARE SUBJECT TO RECEIPT OF FINALISED ARCHITECTURAL DESIGN.



DO NOT SCALE

KEY

- SURFACE WATER DRAINAGE
- FOUL WATER DRAINAGE
- RODDING EYE
- FLOW CONTROL CHAMBER
- SURFACE WATER MANHOLE
- SURFACE WATER INSPECTION CHAMBER
- FOUL WATER INSPECTION CHAMBER
- GEO CELLULAR ATTENUATION SYSTEM WITH PERFORATED COLLECTION DRAIN
- TANKED PERMEABLE PAVING ON PARKING BAYS TO HAVE POSITIVE CONNECTION TO SURFACE WATER DRAINAGE
- ROOT PROTECTION BARRIER
- EXISTING FOUL WATER DRAINAGE
- EXISTING SURFACE WATER DRAINAGE

P02	25/09/2019	GBB	UPDATED MASTERPLAN	DB	KR
P01	03/07/2019	JCM	FIRST ISSUE	PH	KR
REV	DATE	BY	DESCRIPTION	CHK	APP

DRAWING STATUS:	S0 - WORK IN PROGRESS
-----------------	-----------------------



3rd Floor, Kings Orchard, 1 Queen St, Bristol, BS2 0HQ, UK
T+ 44 (0) 1179 306 200
wsp.com

CLIENT:	READING BROUGH COUNCIL
---------	------------------------

ARCHITECT:	SAUNDERS ARCHITECTS
------------	---------------------

PROJECT:	NORTH STREET
----------	--------------

TITLE:	NORTH STREET DRAINAGE STRATEGY
--------	--------------------------------

SCALE @ A2:	1:200	CHECKED:	DH	APPROVED:	KR
-------------	-------	----------	----	-----------	----

PROJECT No:	70012984	DESIGNED:	JCM	DRAWN:	JCM	DATE:	October 19
-------------	----------	-----------	-----	--------	-----	-------	------------

DRAWING No:	2984-WSP-XX-00-C-500	REV:	P02
-------------	----------------------	------	-----

© WSP UK Ltd

APPENDIX F

MICRODRAINAGE OUTPUT



Date 03/07/2019 08:15
File NORTH_STREET.SRCX

Designed by UKJXM200
Checked by

XP Solutions

Source Control 2018.1

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

Half Drain Time : 271 minutes.

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Control (l/s)	Max Outflow (l/s)	Max Volume (m³)	Status
15 min Summer	38.805	0.195	0.0	2.2	2.2	36.2	0 K
30 min Summer	38.861	0.251	0.0	2.3	2.3	46.5	0 K
60 min Summer	38.910	0.300	0.0	2.4	2.4	55.6	0 K
120 min Summer	38.942	0.332	0.0	2.4	2.4	61.4	0 K
180 min Summer	38.943	0.333	0.0	2.4	2.4	61.8	0 K
240 min Summer	38.933	0.323	0.0	2.4	2.4	59.9	0 K
360 min Summer	38.914	0.304	0.0	2.4	2.4	56.3	0 K
480 min Summer	38.900	0.290	0.0	2.3	2.3	53.7	0 K
600 min Summer	38.886	0.276	0.0	2.3	2.3	51.2	0 K
720 min Summer	38.873	0.263	0.0	2.3	2.3	48.7	0 K
960 min Summer	38.848	0.238	0.0	2.3	2.3	44.0	0 K
1440 min Summer	38.800	0.190	0.0	2.2	2.2	35.1	0 K
2160 min Summer	38.737	0.127	0.0	2.2	2.2	23.6	0 K
2880 min Summer	38.688	0.078	0.0	2.2	2.2	14.4	0 K
4320 min Summer	38.621	0.011	0.0	2.2	2.2	2.0	0 K
5760 min Summer	38.610	0.000	0.0	2.0	2.0	0.0	0 K
7200 min Summer	38.610	0.000	0.0	1.6	1.6	0.0	0 K
8640 min Summer	38.610	0.000	0.0	1.4	1.4	0.0	0 K
10080 min Summer	38.610	0.000	0.0	1.3	1.3	0.0	0 K
15 min Winter	38.831	0.221	0.0	2.3	2.3	40.9	0 K
30 min Winter	38.895	0.285	0.0	2.3	2.3	52.7	0 K
60 min Winter	38.953	0.343	0.0	2.4	2.4	63.5	0 K
120 min Winter	38.994	0.384	0.0	2.5	2.5	71.1	0 K
180 min Winter	39.002	0.392	0.0	2.5	2.5	72.7	0 K
240 min Winter	38.997	0.387	0.0	2.5	2.5	71.7	0 K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
15 min Summer	128.336	0.0	38.9	22
30 min Summer	84.360	0.0	51.2	36
60 min Summer	52.892	0.0	64.2	64
120 min Summer	32.091	0.0	77.9	122
180 min Summer	23.662	0.0	86.3	180
240 min Summer	18.958	0.0	92.0	218
360 min Summer	13.760	0.0	100.3	278
480 min Summer	10.974	0.0	106.5	344
600 min Summer	9.199	0.0	111.7	412
720 min Summer	7.961	0.0	116.1	480
960 min Summer	6.333	0.0	123.1	616
1440 min Summer	4.580	0.0	133.5	882
2160 min Summer	3.307	0.0	144.5	1260
2880 min Summer	2.622	0.0	152.8	1620
4320 min Summer	1.888	0.0	165.1	2252
5760 min Summer	1.494	0.0	174.3	0
7200 min Summer	1.245	0.0	181.6	0
8640 min Summer	1.073	0.0	187.7	0
10080 min Summer	0.946	0.0	193.0	0
15 min Winter	128.336	0.0	43.6	22
30 min Winter	84.360	0.0	57.3	36
60 min Winter	52.892	0.0	71.9	64
120 min Winter	32.091	0.0	87.2	120
180 min Winter	23.662	0.0	96.4	178
240 min Winter	18.958	0.0	103.2	232

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 Outflow (l/s)	Max Volume (m³)	Status
360 min Winter	38.970	0.360	0.0	2.4	2.4	66.6	0 K
480 min Winter	38.950	0.340	0.0	2.4	2.4	63.0	0 K
600 min Winter	38.931	0.321	0.0	2.4	2.4	59.5	0 K
720 min Winter	38.912	0.302	0.0	2.4	2.4	55.9	0 K
960 min Winter	38.873	0.263	0.0	2.3	2.3	48.8	0 K
1440 min Winter	38.801	0.191	0.0	2.2	2.2	35.4	0 K
2160 min Winter	38.710	0.100	0.0	2.2	2.2	18.5	0 K
2880 min Winter	38.633	0.023	0.0	2.2	2.2	4.3	0 K
4320 min Winter	38.610	0.000	0.0	1.8	1.8	0.0	0 K
5760 min Winter	38.610	0.000	0.0	1.4	1.4	0.0	0 K
7200 min Winter	38.610	0.000	0.0	1.2	1.2	0.0	0 K
8640 min Winter	38.610	0.000	0.0	1.0	1.0	0.0	0 K
10080 min Winter	38.610	0.000	0.0	0.9	0.9	0.0	0 K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
360 min Winter	13.760	0.0	112.3	296
480 min Winter	10.974	0.0	119.4	370
600 min Winter	9.199	0.0	125.0	446
720 min Winter	7.961	0.0	129.8	522
960 min Winter	6.333	0.0	137.7	670
1440 min Winter	4.580	0.0	149.4	952
2160 min Winter	3.307	0.0	162.0	1340
2880 min Winter	2.622	0.0	171.2	1640
4320 min Winter	1.888	0.0	185.0	0
5760 min Winter	1.494	0.0	195.2	0
7200 min Winter	1.245	0.0	203.4	0
8640 min Winter	1.073	0.0	210.2	0
10080 min Winter	0.946	0.0	216.2	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)	18.700	Shortest Storm (mins)	15
Ratio R	0.400	Longest Storm (mins)	10080
Summer Storms	Yes	Climate Change %	+40

Time Area Diagram

Total Area (ha) 0.162

Time (mins) Area			Time (mins) Area		
From:	To:	(ha)	From:	To:	(ha)
0	4	0.081	4	8	0.081

Model Details

Storage is Online Cover Level (m) 39.610

Cellular Storage Structure

Invert Level (m) 38.610 Safety Factor 1.0
 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)	Depth (m)	Area (m²)	Inf. Area (m²)
0.000	195.0	0.0	0.400	195.0	0.0	0.401	0.0	0.0

Hydro-Brake® Optimum Outflow Control

Unit Reference MD-SHE-0076-2500-0975-2500
 Design Head (m) 0.975
 Design Flow (l/s) 2.5
 Flush-Flo™ Calculated
 Objective Minimise upstream storage
 Application Surface
 Sump Available Yes
 Diameter (mm) 76
 Invert Level (m) 38.050
 Minimum Outlet Pipe Diameter (mm) 100
 Suggested Manhole Diameter (mm) 1200

Control Points	Head (m)	Flow (l/s)	Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	0.975	2.5	Kick-Flo®	0.610	2.0
Flush-Flo™	0.295	2.5	Mean Flow over Head Range	-	2.2

The hydrological calculations have been based on the Head/Discharge relationship for the Hydro-Brake® Optimum as specified. Should another type of control device other than a Hydro-Brake Optimum® be utilised then these storage routing calculations will be invalidated

Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.100	2.1	0.800	2.3	2.000	3.5	4.000	4.8	7.000	6.2
0.200	2.4	1.000	2.5	2.200	3.6	4.500	5.1	7.500	6.5
0.300	2.5	1.200	2.7	2.400	3.8	5.000	5.3	8.000	6.7
0.400	2.5	1.400	2.9	2.600	3.9	5.500	5.6	8.500	6.8
0.500	2.3	1.600	3.1	3.000	4.2	6.000	5.8	9.000	7.0
0.600	2.1	1.800	3.3	3.500	4.5	6.500	6.0	9.500	7.2

