BWB
A CAF GROUP COMPANY

ENVIRONMENT

Lone Star Land Ltd
Land off Balmoral Avenue
Banbury
Sustainable Drainage Statement

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Banbury
Sustainable Drainage Statement

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All Environment Agency mapping data used under special license. Data is current as of October 2021 and is subject to change.

The information presented, and conclusions drawn, are based on statistical data and are for guidance purposes only. The study provides no guarantee against flooding of the study site or elsewhere, nor of the absolute accuracy of water levels, flow rates and associated probabilities.

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APPENDICES

1. INTRODUCTION

1.1 A Sustainable Drainage Statement (SDS) sets out the principles of drainage design for a development and summarises the reasoning behind the chosen design. This includes consideration of national and local guidance, justification of specific flow rates, volumes of attenuated storage, as well as the appropriate level of treatment to be provided to surface water runoff.

1.2 This SDS has been produced by BWB Consulting on behalf of Lone Star Land Ltd in respect of a site at Land off Balmoral Avenue, Banbury.

1.3 A Flood Risk Assessment (FRA) has been produced for the site (ref: BP2-BWB-ZZ-XX-RP-YE_0001_FRA) and this SDS accompanies this overarching document.

1.4 This SDS is intended to support an outline planning application and as such the level of detail included is commensurate and subject to the nature of the proposals. A proposed site development plan is included as **Appendix 1**.

1.5 The greenfield site is located to the western extent of Banbury, Oxfordshire approximately 2km west of the town centre. As shown in **Figure 1.1**, the site is split into the indicative site boundary and the wider site ownership. Although the client is in ownership of the entire site, development is limited to the indicative site boundary. The rest of this report will concern only the indicative site boundary.

1.6 The greenfield site is surrounded by residential development to the north, the B4035 (Broughton Road) to the south and greenfield agricultural land to the east and west. The parcel of greenfield land to the north-east has already been granted outline planning permission (ref: 20/01643/OUT) for the construction of up to 49 units. Further contextual information provided within **Table 1.1**.

1.7 The proposed development is understood to comprise the erection of 49 dwellings, public open space, and associated infrastructure.

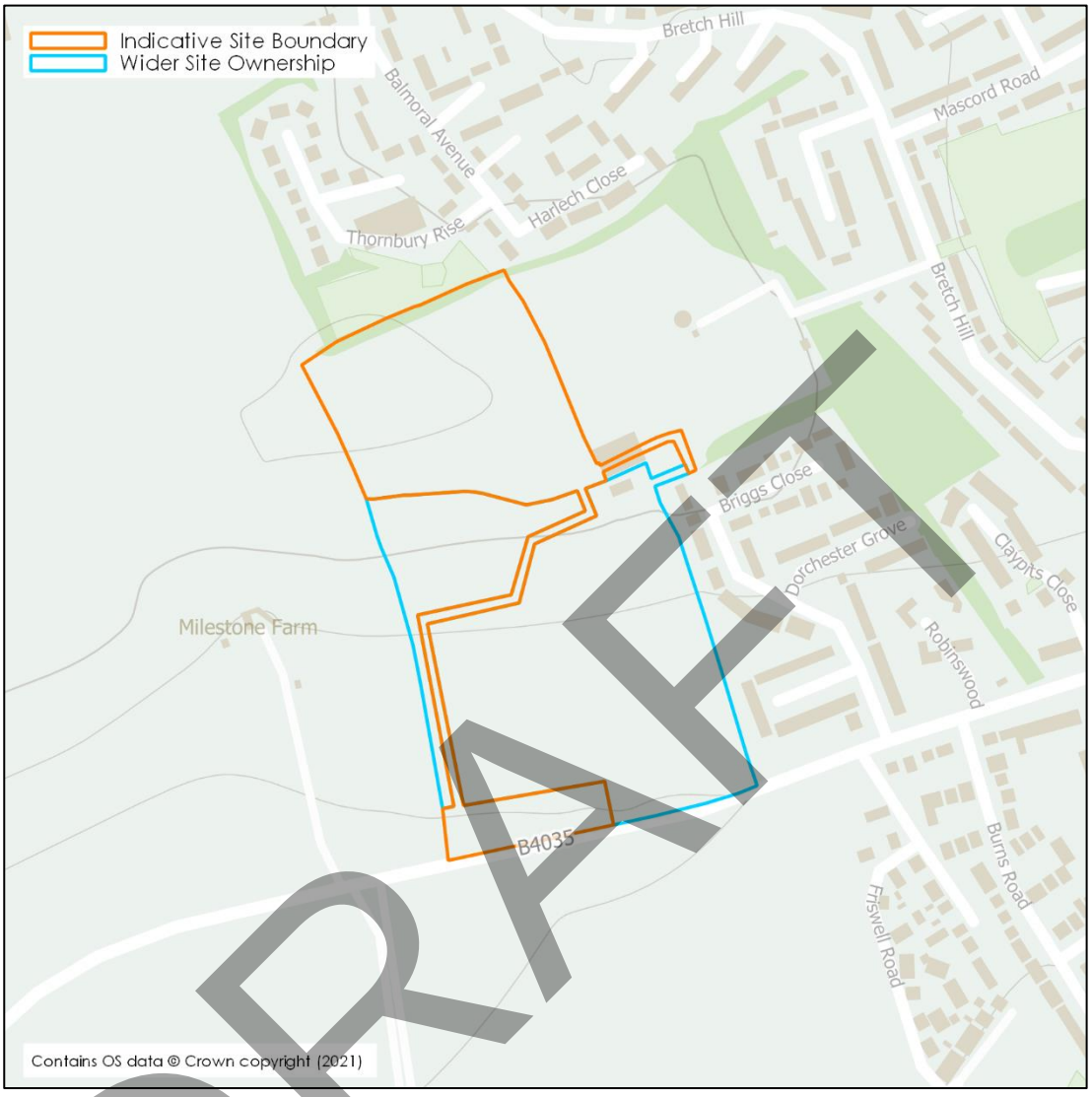


Figure 1.1: Site Location

Table 1.1: Site Details

Site Name	Land off Balmoral Avenue
Location	Banbury
NGR (approx.)	SP 4381 3982
Application Site Area (ha)	3.15 (Approx.)
Development Area (ha)	1.42 (Approx.)
Development Type	Residential
Lead Local Flood Authority	Oxfordshire County Council
Local Planning Authority	Cherwell District Council
Sewerage Undertaker	Thames Water

Sustainable Drainage Guidance

1.8 Sustainable Drainage Systems (SuDS) aim to reduce the impact of development by replicating the natural runoff regime in a sustainable, cost-effective manner, whilst protecting water quality and reducing pollution. The four key objectives of SuDS design are to achieve improvements in water quantity, water quality, amenity provision and biodiversity.

1.9 Oxfordshire County Council (OCC) have produced local SuDS guidance[1] which new development must abide by. The more pertinent requirements for an outline planning application are outlined below:

i. New development should restrict runoff rates to the equivalent greenfield runoff rate for events up to and included the 1 in 100-year event plus an allowance for climate change.

ii. An additional 10% allowance in impermeable surface area for urban creep should be made for all developments.

iii. Storage features must be designed to accommodate the 1 in 100-year event plus a 40% allowance for climate change.

iv. 300mm of freeboard must be provided for above ground storage features.

v. A minimum allowable discharge of 5l/s does not apply.

vi. Consideration of the drainage hierarchy must be made in the selection of an appropriate outfall.

1.10 Alongside the local guidance, the Non-Statutory Technical Standards for Sustainable Drainage Systems[2] as published by DEFRA have been utilised to inform the strategy.

1.11 A 40% allowance for the potential implications of climate change has been applied, in accordance with local guidance and the Environment Agency's (EA) guidance[3] (most recently updated in July 2021).

[1] Oxfordshire County Council Local Standards and Guidance for Surface Water Drainage on Major Development in Oxfordshire (Oxfordshire County Council, November 2018)
[2] 2015, DEFRA. Non-statutory technical standards for sustainable drainage systems
[3] Environment Agency, Flood risk assessments: climate change allowances: https://www.gov.uk/guidance/flood-risk-assessments-climate-change-allowances

2. EXISTING CONDITIONS

2.1 A topographical survey has been undertaken across the site and is included as **Appendix 2**. Across the main development site to the north, the survey demonstrates that levels fall relatively steeply towards the south and east, with maximum and minimum levels ranging between approximately 161.0 m Above Ordnance Datum (AOD) to 152.2m AOD. Between where the site boundary forms a corridor through the wider ownership towards the southern boundary levels fall steeply from 153.0m AOD to 129.1m AOD.

2.2 Mapping of bedrock geology provided by the British Geological Survey (BGS), demonstrates that the site is underlain by four different bedrock geologies: 'Chipping Norton Limestone Formation', 'Horsehay Sand Formation', 'Northampton Sand Formation' and predominately by 'Whitby Mudstone Formation', as shown in **Figure 2.1**. No superficial deposits are shown as being recorded at the site.

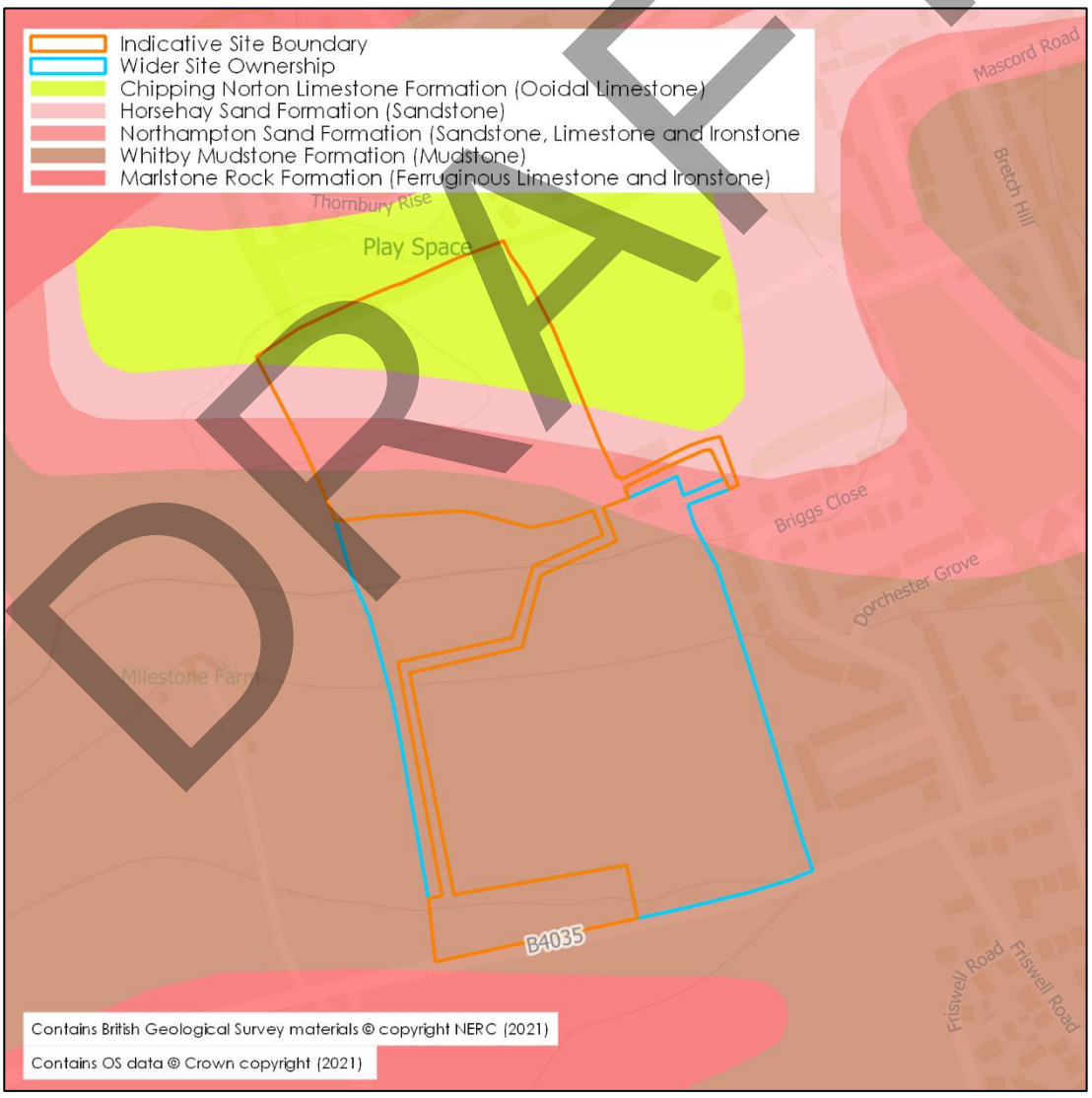


Figure 2.1: BGS Mapping of Bedrock Geology

2.3 Thames Water are the sewerage undertakers for the area. A copy of their asset plans has been included as **Appendix 3**. The records demonstrate the presence of a sewer network along Balmoral Avenue to the north and east. Both surface water and foul water sewers are shown, with pipe diameters for the former shown to range from 150-300mm, with diameters of the latter ranging from 100-225mm.

2.4 A ditch can also be seen adjacent to the southern boundary of the site, where Thames Water sewer records show 300mm surface water sewers outfalling into via a headwall.

2.5 Due to the site's existing greenfield condition, it is not expected to be positively drained. Infiltration is therefore expected to provide the primary means of surface water drainage for the site, which becomes overland flows when capacity of the soils is exceeded. Overland flows are expected to drain southwards in accordance with the site's topography before being received by the ditch along the southern boundary.

2.6 The site does not lie within a source Protection Zone.

Existing Runoff Rates

2.7 An assessment of the existing surface water runoff rates from the area proposed for development has been undertaken and is summarised within **Table 2.1**. This has been measured from the masterplan to comprise an area of 1.42ha. Calculations are included within **Appendix 4**.

The runoff rates have been estimated using the IH124 method, with appropriate prorated adjustments for a site of less than 50ha, as recommended in Interim Code of Practice for Sustainable Drainage[4]. This was undertaken within Micro Drainage, which makes the necessary adjustments for small sites automatically.

Table 2.1: Existing Runoff Rate from the Developable Area of the Site

Return Period (Yrs.)	Runoff Rate (l/s)
1	4.0
Mean Annual Flow Rate (QBAR)	4.8
30	10.8
100	15.2

[4] The National SUDS Working Group (2004), Interim Code of Practice for Sustainable Drainage

Existing Runoff Volume

2.8 An assessment of the existing surface water runoff rates from the area proposed for development has been made for a 1 in 100-year, 6-hour storm.

2.9 As the existing site is permeable, the runoff volume has been calculated using the Source Control module within Micro Drainage to be **383.03m³**, results are included within **Appendix 5**.

3. SURFACE WATER DRAINAGE STRATEGY

Drainage Hierarchy

3.1 The Planning Policy Guidance[5] and the SuDS Manual[6] identify that surface water runoff from a development should be disposed of as high up the following hierarchy as reasonably practicable:

i. into the ground (infiltration);
ii. to a surface water body;
iii. to a surface water sewer, highway drain, or another drainage system;
iv. to a combined sewer.

3.2 The aim of this is approach is to manage surface water runoff close to where it falls and mimic natural drainage as closely as possible.

Infiltration

3.3 Mapping of bedrock geology demonstrates that the majority of the site including the central and southern portion are underlain by mudstone of the Whitby Mudstone Formation.

3.4 Due to the topography of the site, the most practical location to locate an attenuation would be towards the south of the site. As this area being underlain by mudstone, soakaways are not considered to be a feasible option.

Discharge to a Watercourse

3.5 Thames Water sewer records demonstrate that 300mm surface water sewers outfall into a ditch along the southern boundary of the site, via a headwall

3.6 Given its proximity and its position at the low point of the site, this ditch is considered to be the most appropriate discharge location, with runoff rates being limited to the equivalent greenfield (QBAR) rate. The site is considered to naturally drain towards this feature when capacity of the soils no longer permit infiltration. As such, this is considered to mimic the existing drainage regime.

3.7 In order to perform works in the vicinity of an ordinary watercourse, it may be necessary to acquire Land Drainage Consent (Land Drainage Act, 1991) from the LLFA.

[5] Planning Practice Guidance. http://planningguidance.planningportal.gov.uk/.
[6] The SuDS Manual (C753). CIRIA 2015.

Peak Flow Control

3.8 In order to comply with the Non-Statutory Technical Standards for Sustainable Drainage Systems S2-S3[7], runoff from greenfield developments should not exceed the equivalent greenfield rates for all events up to 100-year return period plus climate change event.

3.9 Local guidance requires the runoff rate from all new development on greenfield sites to be controlled at the greenfield (QBAR) rate during events up to and including the 1 in 100-year plus climate change event.

3.10 To comply with the peak flow control criterion, it is proposed to restrict all rainfall events to the equivalent greenfield QBAR rate up to the 1 in 100-year plus climate change event. This is summarised within **Table 3.1**.

Table 3.1: Existing & Proposed Runoff Rates

Return Period (Yr.)	Existing Runoff Rate (l/s)	Proposed Discharge Rate (l/s)
1	4.0	4.8
QBAR	4.8	
30	10.8	
100	15.2	
100 + 40%	-	

Attenuated Storage

3.11 As the development proposals require a restricted runoff rate, it will be necessary to provide attenuated storage to balance the excess volume in a safe manner within the site.

3.12 The surface water storage should be located within the site in a position where it can receive runoff from the development and discharge from the site by gravity, and also in a position where it is hydraulically isolated from any fluvial floodplain or external surface water floodplain/ overland flow route that may be present in the site.

3.13 Sufficient storage for events up to the 1 in 100-year storm with an allowance for climate change should be provided. A 10% allowance should be applied to the current proposed impermeable area to allow for urban creep over the lifetime of the development.

3.14 After considering the site constraints and development aspirations it is suggested that the necessary surface water storage volume is found within a detention basin located at the lowest elevation of the site, between the proposed development and the outfall location.

[7] 2015, DEFRA. Non-statutory technical standards for sustainable drainage systems

3.15 For the purposes of this outline assessment, it has been assumed that the basin will accommodate all of the necessary storage, but it may be possible to redistribute a portion of the storage within other drainage components during the detailed design of the development (e.g.: in the pipe network, swales, filter drains, etc).

3.16 A simulation has been run using Micro Drainage 'Source Control' to identify the necessary storage provision. A developable area of 1.42ha has been measured from the indicative site layout plan. It has been assumed that impermeable surfaces will form 65% of the developable area (1.42ha x 0.65 = 0.92ha).

3.17 Using a restriction of 4.8l/s and applying a 10% allowance to the proposed impermeable area (0.92ha x 10% = 1.0ha), the volume of attenuated storage required for the development has been calculated for storm events up to the 100 year + 40% storm. The results are summarised in **Table 3.2** and calculations are included as **Appendix 6**.

Table 3.2: Outline Attenuated Storage Requirements

Rainfall Method	Critical Storm	Maximum Volume (m^3)
FSR	720 min (Winter)	666.1
FEH	960 min (Winter)	774.2

3.18 The FEH rainfall distribution is shown to provide a more conservative estimate of the minimum attenuation storage required. Therefore, at this outline design stage, it is expected that a minimum of 774.2m^3 of attenuated storage will be provided to cater for the maximum anticipated runoff volume for all storm durations up to the 1 in 100-year return period storm, including a 40% climate change allowance and future urban creep.

3.19 It is envisaged that the final required attenuated storage volume will be determined during the detailed design stage, once the development layout and drainage areas are fixed.

Runoff Volume Control

3.20 The Non-Statutory Technical Standards for Sustainable Drainage Systems S4-S6[8] states that where reasonably practical the runoff volume from a development for the 1 in 100-year 6-hour rainfall event should not exceed the runoff volume prior to development or redevelopment. Where it is not reasonably practicable to constrain the volume of runoff from a development at or below the existing volume, then the runoff must be discharged in a manner that does not adversely affect flood risk, i.e.:

i. The additional runoff volume resulting from the development (the 'long term storage volume') should be discharged separately from the site at a rate of 2 l/s/ha or less. Or,

ii. All the runoff volume from the development should be discharged at a rate equivalent to the mean annual flow rate (QBAR) rate under greenfield conditions or less. Or,

[8] 2015, DEFRA. Non-statutory technical standards for sustainable drainage systems

iii. All the runoff volume from the development should be discharged at a rate of 2l/s/ha or less.

3.21 An estimate of the post-development runoff volume from the 1 in 100-year 6-hour storm can be derived from the Micro Drainage calculations, as provided within the storage calculations under the 360 min storm within **Appendix 6**. The existing and post-development runoff volumes for the developable areas of the site inclusive of urban creep (1.42ha), are compared within **Table 3.3**

3.22 As the entirety of the developable area is not proposed to be impermeable, the existing runoff volume has been prorated to account for the remaining permeable areas of the site. Inclusive of urban creep, the remaining permeable areas comprise an area of 0.42ha (1.42ha – 1.0ha = 0.42ha). This equates to a runoff volume of 113.0m^3 when prorated form the existing volume.

Table 3.3: Runoff Volume Comparison

Existing Volume (m^3)	Proposed Volume (m^3)	Difference (m^3)
383.03	872.30	+488.97

3.23 The 1 in 100-year 6-hour storm runoff volume from the site has been shown to increase as a result of the proposed development. However, as the runoff volume from the development will be discharged at a rate equivalent to the mean annual flow rate (QBAR) rate under greenfield conditions, the volume control criteria will be met.

Long Term Storage

3.24 It is proposed to discharge the runoff from the development at a rate equivalent to the mean annual flow rate (QBAR) rate under greenfield conditions or less. Therefore, provision for long term storage is not required.

Sustainable Drainage Systems

3.25 An Illustrative Drainage Strategy is included as **Appendix 7** (ref: BP2-BWB-ZZ-XX-CD-DR-0001), which demonstrates how the above requirements will be incorporated into the masterplan.

3.26 The proposed drainage strategy should be designed with the four pillars of SuDS in mind: amenity, biodiversity, water quality and water quantity. The treatment stages should be determined by the perceived hazard level of the runoff source and in accordance with national guidance.

3.27 After considering the site constraints and development aspirations, the necessary surface water storage volume is proposed to be provided within a detention basin.

3.28 The basin will provide one level of treatment to surface water prior to discharge. A second level of surface water treatment should be provided to trafficked areas, for example by a forebay within the detention basin, permeable paving or silt traps.

3.29 It is proposed for the basin to be deepened and lined to allow a waterbody to permanently establish itself. It is expected that this will enhance the provision of treatment provided by the feature, as well as providing additional biodiversity benefits.

3.30 The interception value (the first 5mm of runoff in a rainfall event), should be appropriately treated prior to release into the downstream network to prevent contamination from high pollutant concentrations. This will be achieved in part by soakage from the detention basin.

3.31 The detention basin has been designed to have an internal bank slope gradient of 1:3 to allow for maintenance. The detention basin should be appropriately planted to promote further treatment and be unlined, to promote localised infiltration. Planting of vegetation will also serve to improve aesthetic quality, providing amenity benefits.

3.32 The basins will also provide biodiversity benefits through the provision of habitat and food sources for wildlife.

Residual Risk and Designing for Exceedance

3.33 In line with OCC's local guidance, a minimum 300mm of freeboard has been accounted for in the sizing of the detention basin. The basin has been designed to provide this freeboard during the 1 in 100-year plus 40% climate change event.

3.34 It is recommended that the final layout uses the proposed road infrastructure to provide drainage exceedance (overland flood flow) routes through the development and towards Balmoral Avenue to the east, where highway drainage can intercept the excess flow.

3.35 In addition to the volume of storage provided within the main attenuation, there will be capacity within upstream pipes and manholes which has not been accounted for at this stage and a further level of redundancy to the network will therefore be provided.

4. MAINTENANCE

4.1 The drainage network should be constructed in accordance with the Design and Construction Guidance and proposed for adoption by Thames Water under a Section 104 agreement. Any elements not adopted should be maintained by a management company or homeowners.

4.2 Requirements for ongoing maintenance of the drainage network should form part of the Operation and Maintenance manual for the site and should be undertaken by the site management. Any specialist or proprietary products that are specified at detailed design should have a manufacturer specific maintenance regime which should be included within the document.

4.3 It is envisaged that the Operation and Maintenance manual will be developed at the detailed design stage, but some examples are included below.

i. All drainage features should be located in open areas which are readily accessible.
ii. Gullies should be inspected and de-silted at least once a year, where necessary.
iii. Pipes, manholes and silt traps should be inspected and de-silted at least once a year, where necessary.
iv. If permeable paving is incorporated within the layout, it should be swept a minimum of every six months to maintain flow capacity of the joints between blocks.
v. The surface water attenuation areas will be predominantly dry and the base will be seeded with a wildflower grass seed mix that can tolerate wet ground conditions.
vi. Regular inspections of the attenuation basin should be undertaken to remove litter/debris, invasive/colonising vegetation and silt build up as necessary. Inlet and outlet structures to be regularly inspected, with remedial work as required to maintain water flows and prevent silt/vegetation build up.
vii. Vegetation/grass with the attenuation basin should be maintained appropriately to allow establishment and promote habitat formation, without impeding the operation of the inlet and outlet structure.
viii. Flow controls should be inspected every six months, litter/debris and silt build up should be removed as necessary.

5. FOUL WATER DRAINAGE

5.1 It is proposed to drain used water from the development separately to surface water. An indicative foul sewer network has been provided within the Illustrative Drainage Strategy (**Appendix 7**)

5.2 Thames Water sewer records indicate the presence of 150mm foul sewers along Balmoral Avenue to the east. In view of the levels between the site and the existing sewerage assets, a gravity connection is proposed to convey flows from the development towards foul sewers located along Balmoral Avenue to the east (nearest manhole ref: 8801).

5.3 A Developer's Enquiry has been made to Thames Water; their response is included within **Appendix 3**. They confirm that there is currently only capacity to accept flows from 30 properties, but that further sewer modelling and upgrade works would be required before the remainder of the development could be accepted. Thames Water state that although they would front the cost for these works, the site would need to be accepted for either outline or full planning application before work could commence.

5.4 A S106 (Water Industry Act 1991) application should be made to Thames Water for approval prior to the connection being made.

6. SUMMARY

6.1 This statement and supporting appendices demonstrate that the drainage design for the development will comply with the relevant local and national standards, specifically the hierarchy of discharge, runoff rate and volume criterion.

6.2 This SDS is intended to support an outline planning application and as such the level of detail included is commensurate and subject to the nature of the proposals.

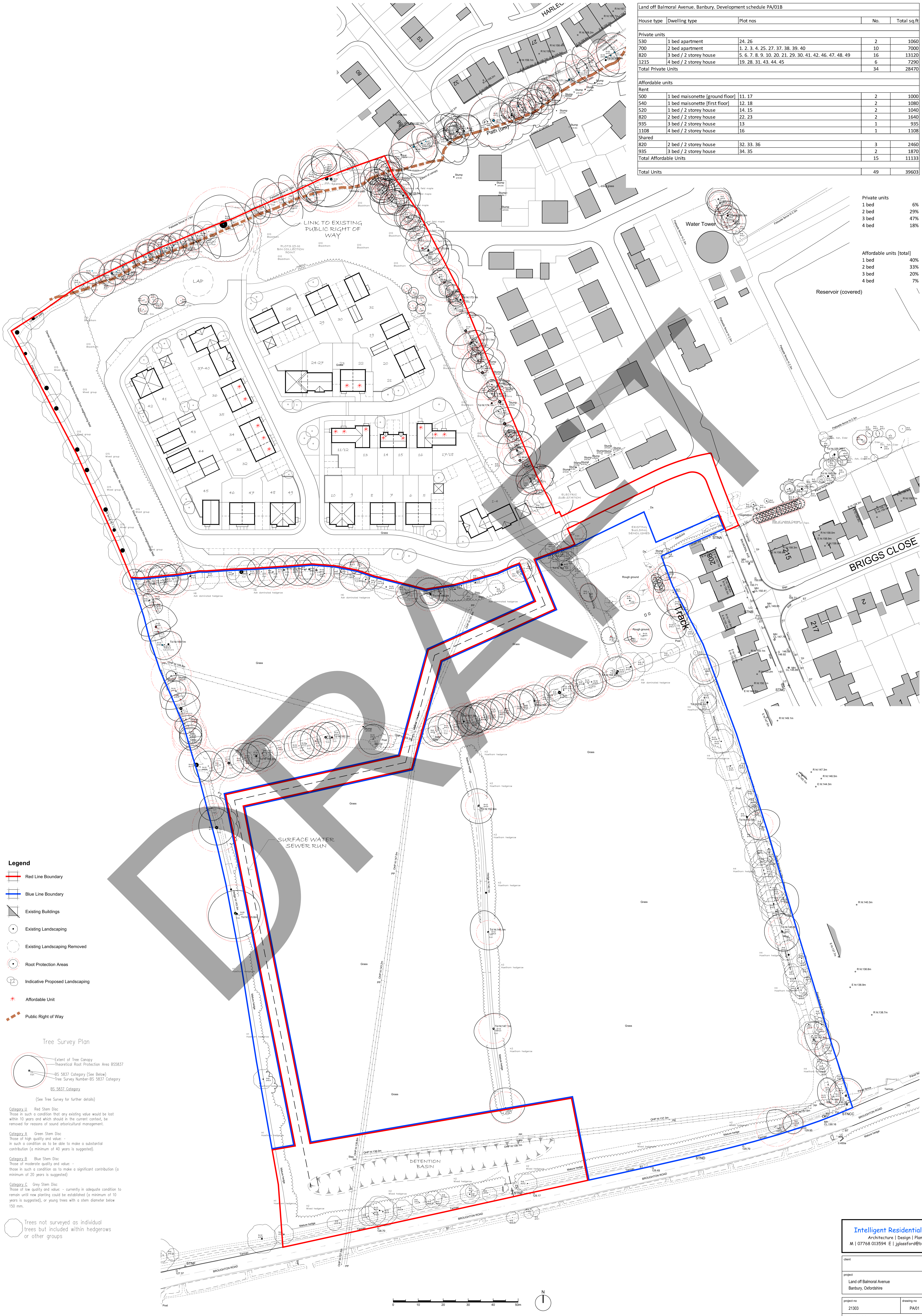
Table 6.1: Sustainable Drainage Statement Summary

		Existing Site	Proposed Development
Site Area (ha)		3.15	
Impermeable Area (ha)		0	1.0
Outfall Location		Infiltration/Watercourse	Watercourse
Peak Runoff Rate (l/s)	**QBAR**	4.8	4.8
	1 in 30-Year	10.8	
	1 in 100-Year	15.2	
	1 in 100-Year + CC	-	
Runoff Volume (100yr RP 6 hour Storm)		383.03m³	872.30m³
Volume Control		-	Discharge rate limited to QBAR
Proposed Storage Volume		-	774.2m³
Interception Volume		-	5m³
Flow Control Type		-	Vortex
SuDS Features		-	Detention Basin
Maintenance Responsibility		-	Management Company Sewerage Company

6.3 It is envisaged that the final drainage strategy will be determined during the detailed design stage, as the development layout is finalised.

APPENDICES

Appendix 1: Indicative Site Layout Plan



Land off Balmoral Avenue. Banbury. Development schedule PA/01B

House type	Dwelling type	Plot nos	No.	Total sq.ft
Private units				
530	1 bed apartment	24. 26	2	1060
700	2 bed apartment	1. 2. 3. 4. 25. 27. 37. 38. 39. 40	10	7000
820	3 bed / 2 storey house	5. 6. 7. 8. 9. 10. 20. 21. 29. 30. 41. 42. 46. 47. 48. 49	16	13120
1215	4 bed / 2 storey house	19. 28. 31. 43. 44. 45	6	7290
Total Private Units			34	28470
Affordable units				
Rent				
500	1 bed maisonette [ground floor]	11. 17	2	1000
540	1 bed maisonette [first floor]	12. 18	2	1080
520	1 bed / 2 storey house	14. 15	2	1040
820	2 bed / 2 storey house	22. 23	2	1640
935	3 bed / 2 storey house	13	1	935
1108	4 bed / 2 storey house	16	1	1108
Shared				
820	2 bed / 2 storey house	32. 33. 36	3	2460
935	3 bed / 2 storey house	34. 35	2	1870
Total Affordable Units			15	11133
Total Units			49	39603

Private units	
1 bed	6%
2 bed	29%
3 bed	47%
4 bed	18%

Affordable units [total]	
1 bed	40%
2 bed	33%
3 bed	20%
4 bed	7%

Legend

- Red Line Boundary
- Blue Line Boundary
- Existing Buildings
- Existing Landscaping
- Existing Landscaping Removed
- Root Protection Areas
- Indicative Proposed Landscaping
- Affordable Unit
- Public Right of Way

Tree Survey Plan

- Extent of Tree Canopy
- Theoretical Root Protection Area BS5837
- BS 5837 Category (See Below)
- Tree Survey Number-BS 5837 Category

BS 5837 Category

(See Tree Survey for further details)

Category U Red Stem Disc
Those in such a condition that any existing value would be lost within 10 years and which should in the current context, be removed for reasons of sound arboricultural management.

Category A Green Stem Disc
Those of high quality and value: - in such a condition as to be able to make a substantial contribution (a minimum of 40 years is suggested).

Category B Blue Stem Disc
Those of moderate quality and value: - those in such a condition as to make a significant contribution (a minimum of 20 years is suggested)

Category C Grey Stem Disc
Those of low quality and value: - currently in adequate condition to remain until new planting could be established (a minimum of 10 years is suggested), or young trees with a stem diameter below 150 mm.

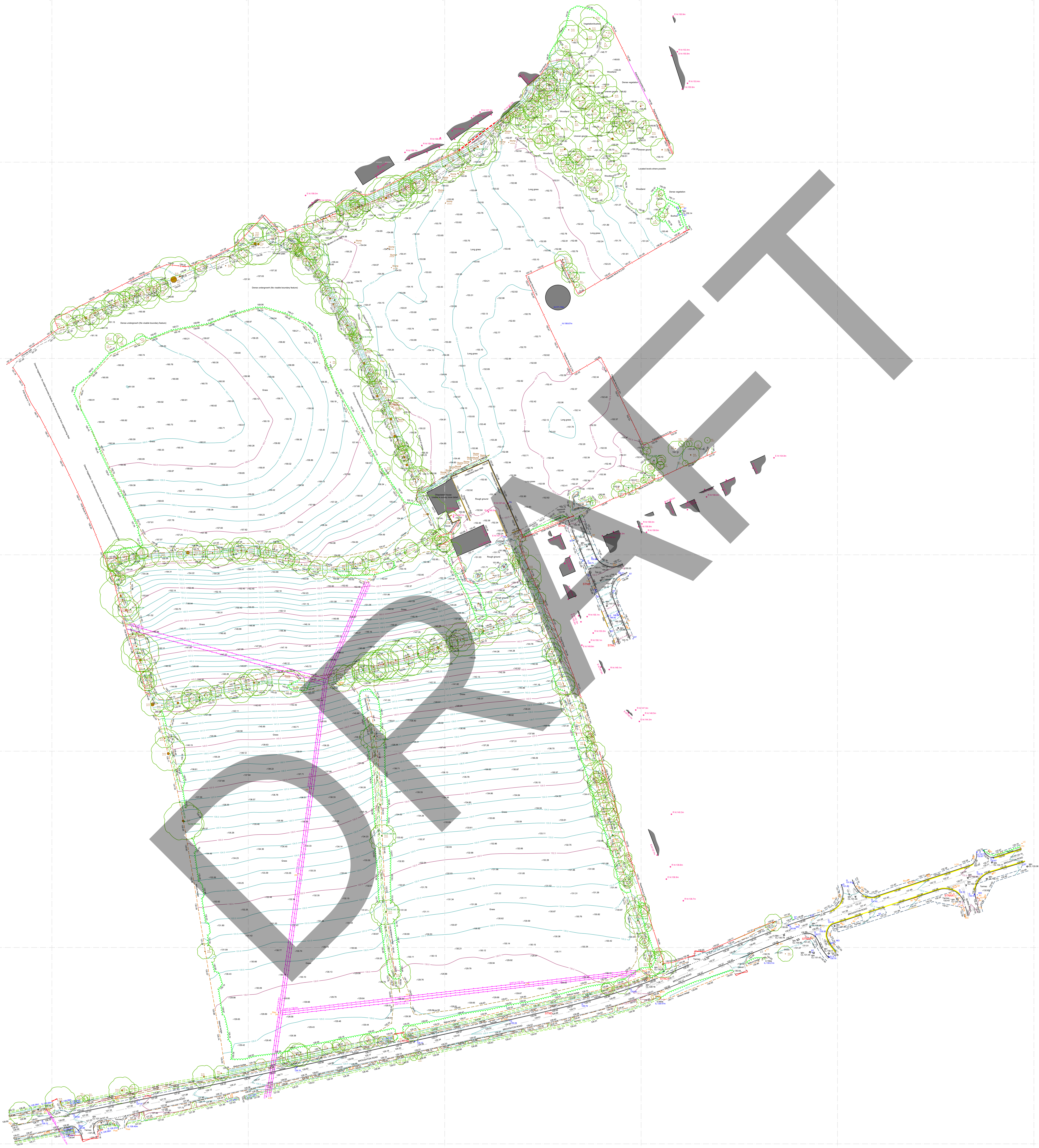
Trees not surveyed as individual trees but included within hedgerows or other groups

ILLUSTRATIVE MASTERPLAN - 1:500

Intelligent Residential Design
Architecture | Design | Planning
M | 07768 013594 E | jglassford@btinternet.com

client	
project	Land off Balmoral Avenue, Banbury, Oxfordshire
project no	21303
drawing no	PA/01
drawing description -	Illustrative Masterplan
scale	1:500 @ A0
date drawn	September 2021
rev	C

Appendix 2: Topographical Survey



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NOTES

Boundaries surveyed are physical features and may not necessarily represent the legally conveyed ownership.

Tree Spreads, Girths and Heights are approximate, any tree species identified should not be relied upon and checked by a specialist if critical

Underground drainage depths, pipe sizes and runs have been recorded from the surface and may have been estimated or assumed

Features surveyed off site such as buildings and trees may have been recorded remotely and may not be shown in full detail due to access / sighting restrictions

SURVEY CONTROL

CO-ORDINATES & DATUM DERRIVED
USING GEOID MODEL OSGM15(GB) &
HORIZONTAL TRANSFORMATION OSTN15

SURVEY STATIONS

Name	Easting	Northing	Height
STNA	443863.389	239915.780	152.527
STNAA	444059.231	239727.308	132.436
STNB	443875.476	239886.494	149.754
STNBB	443983.893	239705.479	130.944
STNC	443888.253	239855.719	144.951
STNCC	443911.192	239686.167	130.140
STND	443853.876	239668.089	129.717
STNE	443777.580	239652.201	129.320
STNF	443646.739	239623.305	127.575

CLIENT

ONE STAR LAND

SITE

Broughton Road
Banbury

PROJECT

Topographical
Survey

SCALE

1:750 @ A0

DATE

16/04/2021

DRAWING No.

11576

Appendix 3: Thames Water Correspondence

Asset location search

Property Searches

BWB Consulting Limited
5th Floor,Waterfront House Waterfront House

NOTTINGHAM
NG2 3DQ

Search address supplied Land North Of Broughton Road
Balmoral Avenue
Banbury
OX16 0BG

Your reference BMW3250

Our reference ALS/ALS Standard/2021_4406584

Search date 30 April 2021

Knowledge of features below the surface is essential for every development

The benefits of this knowledge not only include ensuring due diligence and avoiding risk, but also being able to ascertain the feasibility of any development.

Did you know that Thames Water Property Searches can also provide a variety of utility searches including a more comprehensive view of utility providers' assets (across up to 35-45 different providers), as well as more focused searches relating to specific major utility companies such as National Grid (gas and electric).

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0800 009 4540

Search address supplied: Land North Of Broughton Road, Balmoral Avenue, Banbury, OX16 0BG

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.

The following quartiles have been printed as they fall within Thames' sewerage area:

SP4339NE
SP4340SE
SP4439NW
SP4440SW

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.

The following quartiles have been printed as they fall within Thames' water area:

SP4339NE
SP4340SE
SP4439NW
SP4440SW

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

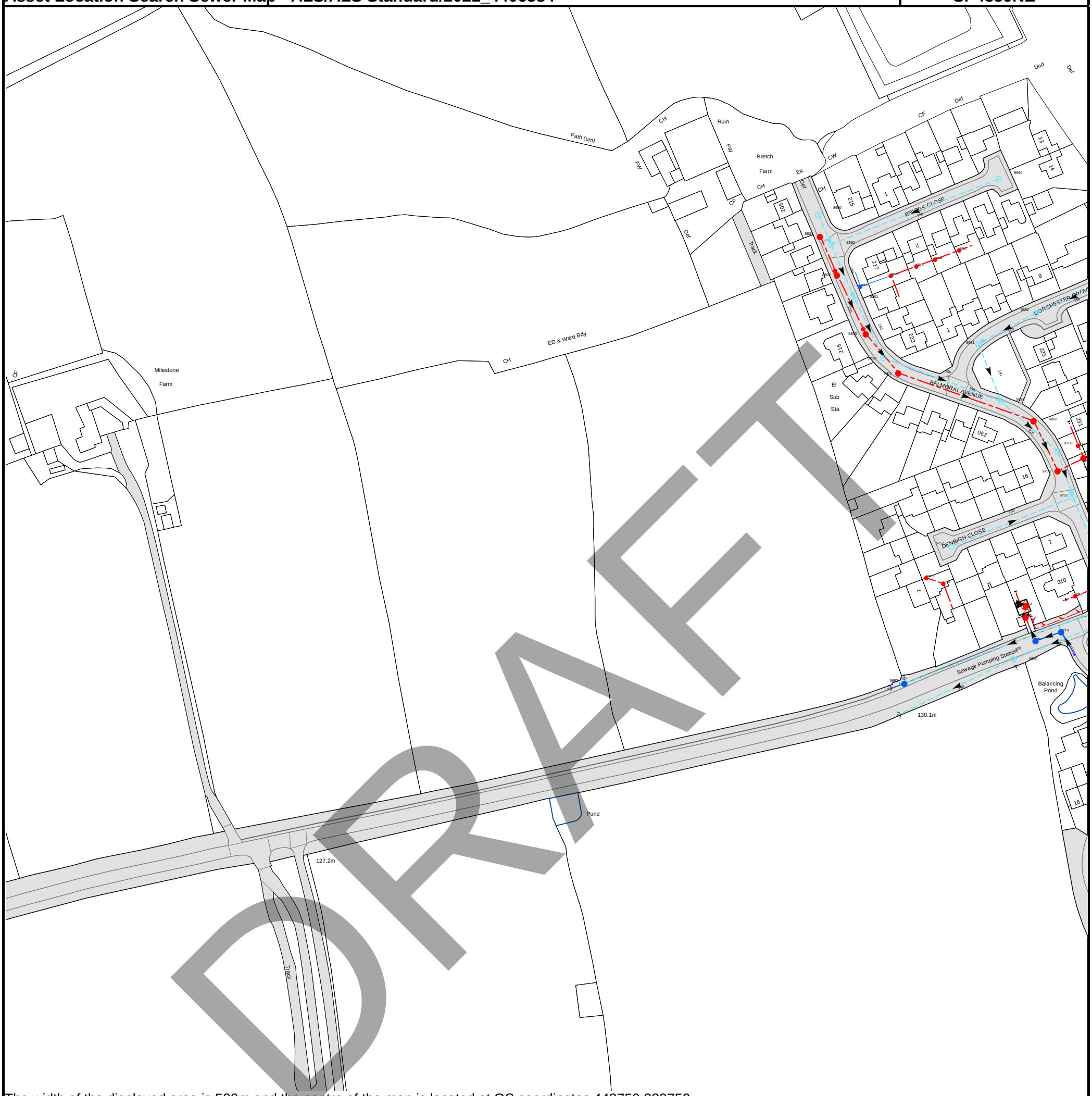
Should you require any advice concerning clean water operational issues or clean water connections, please contact:

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/2021_4406584

SP4339NE



The width of the displayed area is 500m and the centre of the map is located at OS coordinates 443750,239750

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
8950	151.53	149.6
8801	150.41	148.56
8850	149.62	146.79
8802	147.72	145.16
8851	145.85	143.3
881A	n/a	n/a
8803	143.5	140.68
9850	141.9	139.57
981D	n/a	n/a
9801	140.05	137.4
981A	n/a	n/a
981B	n/a	n/a
981C	n/a	n/a
9851	140.68	138.25
9950	150.32	148.72
9853	137.31	135.24
9802	136.2	134.96
9852	142.69	141.06
971A	n/a	n/a
9652	130.41	129.76
971D	n/a	n/a
971E	n/a	n/a
9752	132.58	131.58
9650	130.6	129.97
971G	131.18	128.94
971F	131.3	128.9
971I	n/a	n/a
9750	135.08	133.26
9703	134.76	134
971H	n/a	n/a
9751	133.92	130.76
971C	n/a	n/a
9702	134.67	133.81
971B	n/a	n/a

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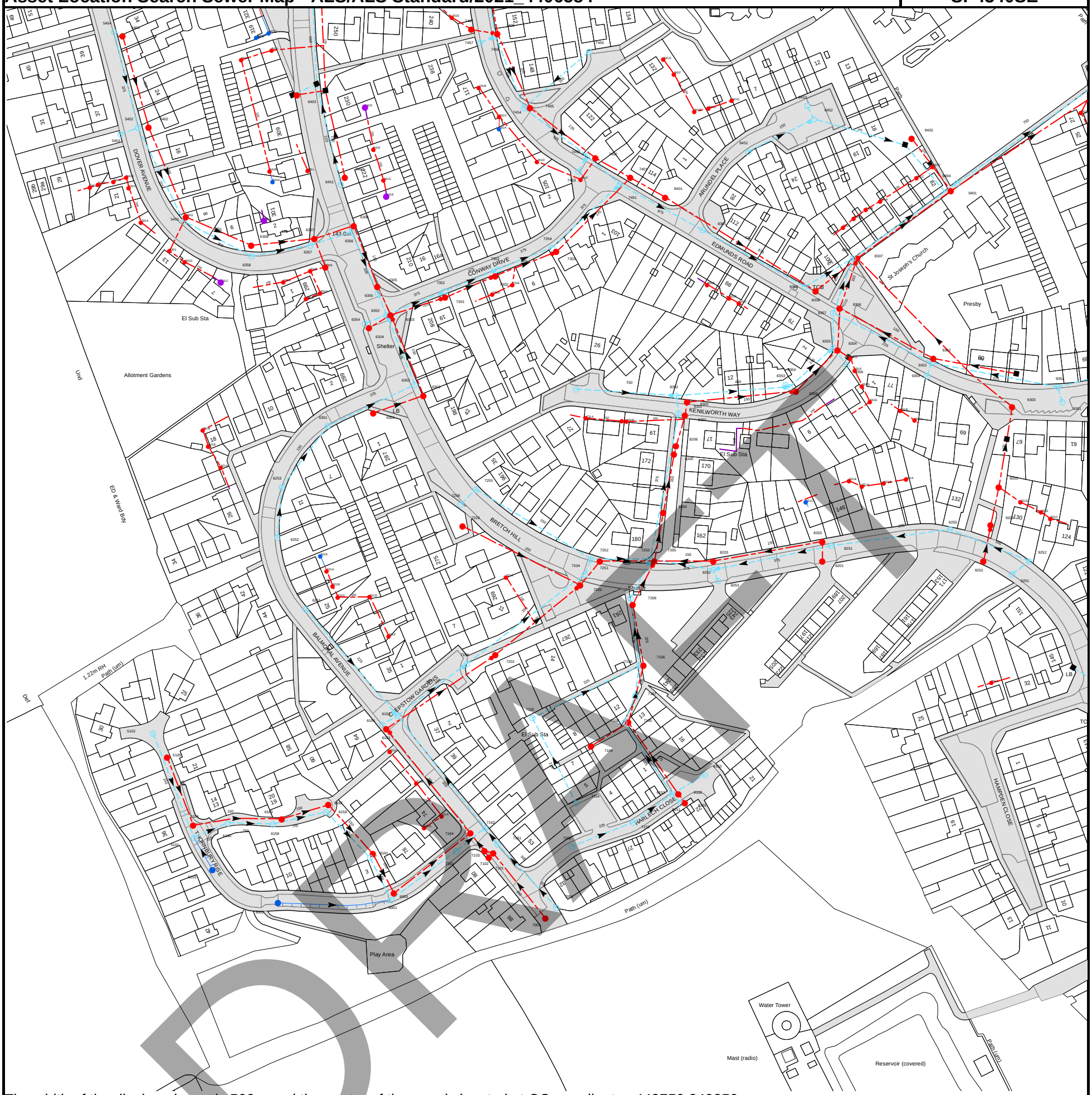
Asset Location Search Sewer Map - ALS/ALS Standard/2021_4406584

SP4340SE



The width of the displayed area is 500m and the centre of the map is located at OS coordinates 443750,240250

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

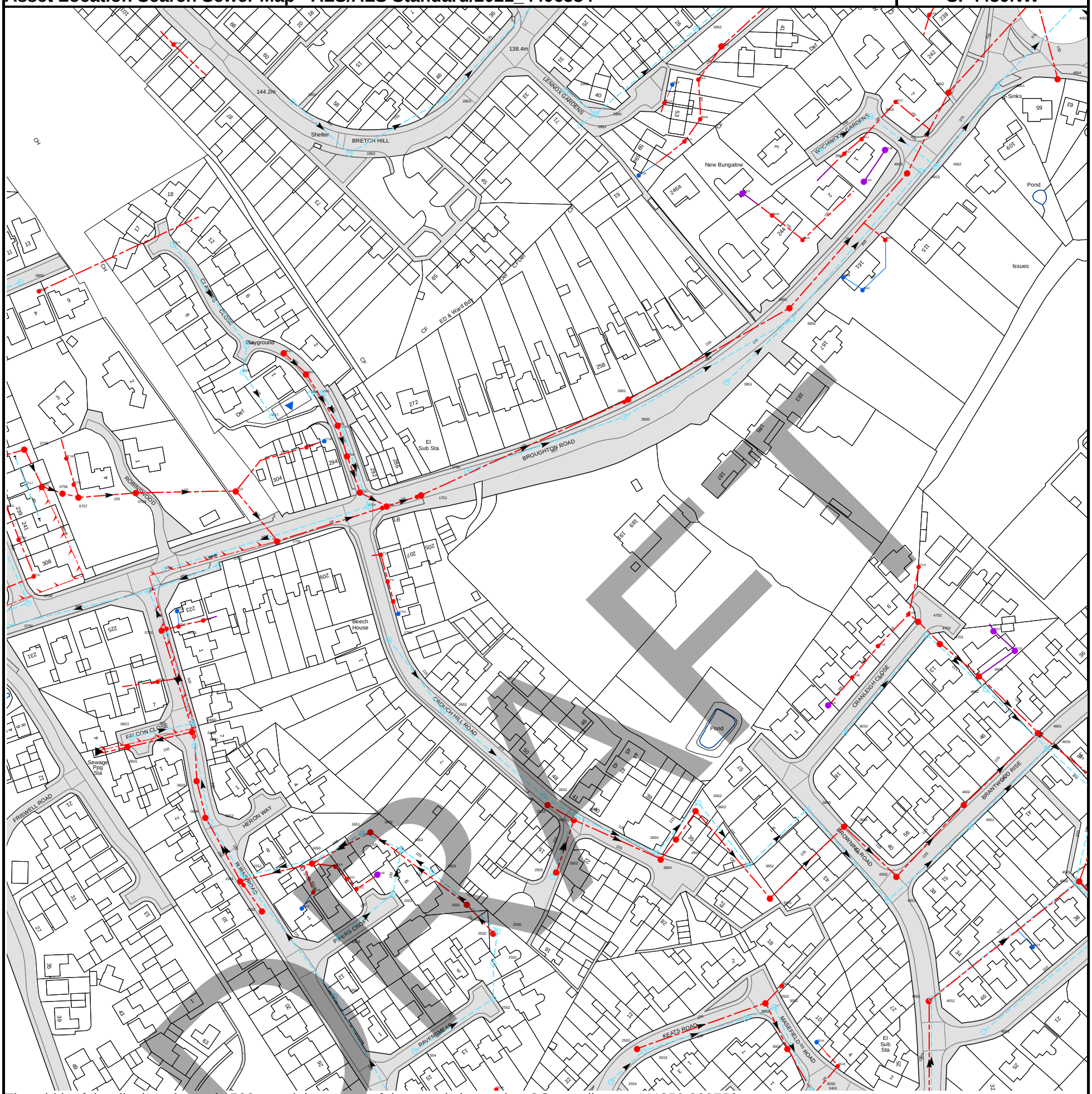
Manhole Reference	Manhole Cover Level	Manhole Invert Level
841F	n/a	n/a
841G	n/a	n/a
7455	134.52	132.66
741B	n/a	n/a
7457	136.25	134.16
7456	136.19	131.25
7406	136.07	131.04
7407	136.31	134.15
741E	n/a	n/a
641P	n/a	n/a
8358	130.09	126.95
8307	130.03	127.44
7303	137.07	133.9
7354	137.15	133.97
8361	132.88	129.97
831A	n/a	n/a
841A	n/a	n/a
841B	n/a	n/a
941A	n/a	n/a
8401	133.82	130.12
7451	134.71	130.3
741F	n/a	n/a
7401	134.43	130.29
7453	135.58	133.57
741D	n/a	n/a
7402	135.28	130.64
7452	135.46	130.63
8451	132.23	130.74
741A	n/a	n/a
8452	131.33	128.85
741C	n/a	n/a
841E	n/a	n/a
841C	n/a	n/a
7405	136.14	130.92
7454	136.22	131.05
8453	131.47	129
841D	n/a	n/a
9402	130.37	129.14
931A	n/a	n/a
941C	n/a	n/a
9354	132.59	130.15
9353	132.46	129.74
941D	n/a	n/a
9302	132.23	129.63
9255	n/a	n/a
9401	129	125.77
9494	n/a	n/a
9201	142.87	141.09
9202	142.77	138.84
911A	n/a	n/a
9203	140.18	137.06
9251	143.56	140.97
9303	n/a	n/a
921D	n/a	n/a
9252	143.3	140.45
921E	n/a	n/a
921C	n/a	n/a
9352	134.23	130.8
9351	134.13	131.07
941E	n/a	n/a
8252	139.1	135.99
8253	139.47	136.42
831C	n/a	n/a
831D	n/a	n/a
8353	132.86	130.92
8354	132.97	130.63
8303	132.83	130.17
8359	131.1	128.41
821C	n/a	n/a
8308	131.01	127.85
8201	141.55	138.51
8202	141.46	138.12
8251	141.52	138.58
8357	130.9	128.85
8355	131.71	129.2
8304	131.61	128.71
8306	130.81	128.43
8356	131.84	129.64
821B	n/a	n/a
8305	131.75	129.43
831F	n/a	n/a
821A	n/a	n/a
831G	n/a	n/a
831E	n/a	n/a
921B	n/a	n/a
931B	n/a	n/a
921A	n/a	n/a
7352	141.87	138.83
7256	143.32	141.05
7203	143.74	141.59

Manhole Reference	Manhole Cover Level	Manhole Invert Level
7255	142.92	140.72
731D	n/a	n/a
7302	139.77	135.92
7353	139.44	136.27
721A	n/a	n/a
731E	n/a	n/a
7351	138.79	136.47
7202	139.73	137.4
7251	139.63	137.68
731A	n/a	n/a
7252	139.35	137.13
7204	139.13	136.84
731B	n/a	n/a
7253	138.56	134.89
7205	138.82	134.75
8204	137.16	134.26
8205	136.03	133.63
8206	135.97	133.52
8352	135.05	132.29
8351	135.31	133.35
8301	135.17	133.19
8302	134.78	131.88
831B	n/a	n/a
8203	139.02	135.39
5102	151.57	150.22
5105	151.6	149.6
5104	152.56	149.43
5101	152.85	149.66
5103	n/a	n/a
6160	152.49	149
6159	151.47	148.84
6002	n/a	n/a
6163	151.35	149.15
6251	148.54	146.14
6158	150.3	148.66
6162	n/a	n/a
621B	n/a	n/a
621C	n/a	n/a
621D	n/a	n/a
6157	151.693	148.343
6161	151.3	148.81
6151	146.91	144.2
6101	146.93	143.84
621F	n/a	n/a
611C	n/a	n/a
6001	150.87	148.32
6003	n/a	n/a
6152	146.54	143.91
611B	n/a	n/a
611A	n/a	n/a
711A	n/a	n/a
7163	n/a	n/a
7159	143.64	139.95
7164	n/a	n/a
7103	150.29	148.44
7162	n/a	n/a
7102	150.51	148.82
7101	150.36	148.7
7201	142.87	140.38
7151	150.29	147.02
7155	144.11	141.78
7051	152.9	149.44
7152	150.54	149.14
7154	148.93	145.83
7104	144.76	143.22
7158	144.45	142.34
7105	144.64	141.88
7254	139.37	137.67
7206	139.36	137.99
7153	149.7	148.21
7157	143.39	141.41
7156	141.73	140.34
7106	141.93	140.44
8152	149.04	146.44
8102	149.07	146.47
8151	150.3	149.03
8101	150.31	148.79
8153	148.76	146.85
7001	152.9	149.7
621A	n/a	n/a
621E	n/a	n/a
6252	149.22	147.69
6253	148.58	146.8
521A	n/a	n/a
521B	n/a	n/a
531B	n/a	n/a
6351	146.62	144.4
6301	145.36	143.22
6302	144.08	142.23
6352	144.31	141.8
6304	144.01	140.46
6354	143.98	140.74
6353	143.8	140.24

Manhole Reference	Manhole Cover Level	Manhole Invert Level
6303	143.87	140.1
631C	n/a	n/a
7301	141.99	138.18
6355	143.63	140.57
631D	n/a	n/a
6305	143.77	140.79
531C	n/a	n/a
631A	n/a	n/a
631B	n/a	n/a
6308	144.19	142.68
531D	n/a	n/a
6358	145.06	141.18
5301	146.09	142.69
6309	145	142.04
6357	143.75	141.12
6307	143.66	141.62
6356	143.036	140.956
6306	142.91	141.34
531A	n/a	n/a
5451	145.88	141.41
641C	n/a	n/a
5403	145.69	142.49
641E	n/a	n/a
541C	n/a	n/a
541D	n/a	n/a
541E	n/a	n/a
6451	142.36	140.12
541A	n/a	n/a
641A	n/a	n/a
641G	n/a	n/a
6401	142.03	139.81
541B	n/a	n/a
641B	n/a	n/a
641L	n/a	n/a
641F	n/a	n/a
5453	145.87	142.01
5402	145.52	143.06
5452	145.88	141.95
641D	n/a	n/a
6403	141.23	138.52
5454	144.95	143.25
5401	144.94	143.75
641H	n/a	n/a
641N	n/a	n/a
641O	n/a	n/a
641I	n/a	n/a

Asset Location Search Sewer Map - ALS/ALS Standard/2021_4406584

SP4439NW



The width of the displayed area is 500m and the centre of the map is located at OS coordinates 444250,239750

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Manhole Reference	Manhole Cover Level	Manhole Invert Level
451A	n/a	n/a
4550	131.59	127.57
4501	131.52	127.38
4650	130.09	128.13
4601	130.04	127.57
4652	n/a	n/a
4603	129.96	127.88
471D	n/a	n/a
471C	n/a	n/a
3952	130.93	n/a
3953	n/a	n/a
491A	n/a	n/a
4904	120.84	119.23
4950	121.7	118.62
3851	129.14	128.47
3850	127.52	125.72
3801	127.18	125.08
381C	n/a	n/a
381B	n/a	n/a
381A	n/a	n/a
481A	n/a	n/a
391E	n/a	n/a
391D	n/a	n/a
391H	n/a	n/a
291A	n/a	n/a
4903	122.66	120.88
4953	122.39	120.71
4952	122.4	120.47
391I	n/a	n/a
3951	121.7	120.99
491B	n/a	n/a
391A	n/a	n/a
391J	n/a	n/a
391B	n/a	n/a
3950	121.76	120.79
391G	n/a	n/a
491C	n/a	n/a
4902	121.19	118.68
4951	121.13	120.18
391F	n/a	n/a
391C	n/a	n/a
171E	n/a	n/a
181F	n/a	n/a
181I	n/a	n/a
2850	131.71	130.15
181C	n/a	n/a
2801	131.54	128.67
181D	n/a	n/a
181E	n/a	n/a
181H	n/a	n/a
181G	n/a	n/a
181A	n/a	n/a
1950	143.65	141.81
2951	135.8	n/a
2950	135.26	133.06
1951	144.28	142.91
2953	141.23	139.45
2952	136.92	135.35
0850	143.93	142.5
081B	n/a	n/a
081A	n/a	n/a
091A	n/a	n/a
181B	n/a	n/a
071G	n/a	n/a
0750	131.25	130.31
071H	n/a	n/a
0705	135.1	133.64
071J	n/a	n/a
0754	131.47	130.37
071I	n/a	n/a
0702	131.52	130.58
0756	n/a	n/a
071B	n/a	n/a
071C	n/a	n/a
0757	n/a	n/a
0758	n/a	n/a
0751	132.41	130.56
061A	n/a	n/a
0701	132.6	129.25
071A	n/a	n/a
0753	132.6	130.6
071F	n/a	n/a
071E	n/a	n/a
0650	133.03	130.71
0602	133.12	128.87
071D	n/a	n/a
0752	133.1	132.28
1703	133.94	132.27
1702	133.92	132.02
171F	n/a	n/a

Manhole Reference	Manhole Cover Level	Manhole Invert Level
171B	n/a	n/a
171C	n/a	n/a
171A	n/a	n/a
171J	n/a	n/a
171D	135.7	131.22
171I	n/a	n/a
1750	136.64	135.02
171H	n/a	n/a
171G	n/a	n/a
1701	135.8	130.96
2653	136.39	134.84
2750	135.47	133.93
2650	132.79	130.85
3604	132.65	130.71
3603	131.99	130.4
3602	131.73	130.14
3652	131.82	130.33
3651	131.27	129.7
3502	131.96	130.76
3503	131.05	129.54
3551	131.97	130.21
351C	n/a	n/a
3650	130.55	129.05
361A	n/a	n/a
3601	130.35	128.85
3653	130.04	128.8
361B	n/a	n/a
371A	n/a	n/a
4552	130.66	128.8
4503	130.45	128.62
471B	n/a	n/a
4702	129.36	128.17
471A	n/a	n/a
4750	129.4	128.46
4502	131.57	128.05
4551	131.53	128.26
4701	129.67	128.09
4602	130.32	128.1
4651	130.36	128.55
0601	132.48	128.51
0653	132.53	130.9
0651	133.35	132.11
0603	134	131.59
0604	134.88	131.95
0652	135.03	132.47
1501	136.86	132.1
1551	136.84	132.81
1502	138.03	136.07
151A	n/a	n/a
1601	138.32	132.33
151E	n/a	n/a
1650	138.31	132.92
1550	139.91	137.05
161A	n/a	n/a
1553	138.61	136.85
151D	n/a	n/a
151C	n/a	n/a
1651	137.75	133
1602	137.69	132.43
151B	n/a	n/a
1552	137.54	135.56
1652	n/a	n/a
1554	138.61	136.36
1653	137	133.27
251A	n/a	n/a
2554	134.42	132.96
2552	135.63	134
2551	135.33	n/a
2502	n/a	n/a
2550	135.71	133.53
2501	136.17	132.93
2555	134.54	133.09
2602	134.51	133.09
2601	134.16	132.46
2651	134.28	132.61
2603	134.71	133.12
2652	134.84	133.5
3550	132.54	129.97
351B	n/a	n/a
2553	133.48	132
3501	132.17	130.41
2503	133.59	132.26
351A	n/a	n/a
4553	132.18	129.98
3552	132.25	130.36

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Asset Location Search Sewer Map - ALS/ALS Standard/2021_4406584

SP4440SW

The width of the displayed area is 500m and the centre of the map is located at OS coordinates 444250,240250

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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
4301	109.12	105.85
4401	108.41	106.32
0403	n/a	n/a
0452	126.27	124.5
0453	126.03	123.11
2405	128.74	127.07
1403	129.43	127.51
141D	n/a	n/a
241A	n/a	n/a
141E	n/a	n/a
2452	126.97	125.28
241L	n/a	n/a
2451	125.11	123.81
1401	127.62	n/a
2404	126.43	124.8
241K	n/a	n/a
1450	127.59	126.15
1402	127.51	126.35
241D	n/a	n/a
241E	n/a	n/a
241F	n/a	n/a
3450	115.11	112.44
3457	118.91	117.15
341G	n/a	n/a
3456	118.77	117.01
3451	116.28	114.73
341H	n/a	n/a
3455	118.82	n/a
341D	n/a	n/a
3452	119.49	117.32
341F	n/a	n/a
3402	114.77	113.12
341E	n/a	n/a
3403	117.61	116.27
341C	n/a	n/a
3454	115.3	113.4
3404	119.96	117.55
341B	n/a	n/a
3401	114.39	112.03
3453	122.99	121.6
241M	n/a	n/a
2403	124.1	121.77
341A	n/a	n/a
4402	114.01	111.3
131C	n/a	n/a
131D	n/a	n/a
131B	n/a	n/a
241I	n/a	n/a
241J	n/a	n/a
2402	127.78	125.74
2450	127.37	125.12
1451	131.55	129.69
141C	n/a	n/a
1404	131.55	129.51
2401	127.29	125.41
241G	n/a	n/a
241C	n/a	n/a
241H	n/a	n/a
2453	129.79	128.11
241B	n/a	n/a
031K	n/a	n/a
031C	n/a	n/a
131L	n/a	n/a
031E	n/a	n/a
031F	n/a	n/a
031B	n/a	n/a
0350	133.1	130.55
031A	n/a	n/a
131E	n/a	n/a
131F	n/a	n/a
131G	n/a	n/a
0302	130.01	128.63
1352	131.88	129.52
1406	131.55	130.37
0454	127.45	126.27
1453	130.33	128.95
041D	n/a	n/a
041E	n/a	n/a
041A	n/a	n/a
1405	131.62	130.19
1452	n/a	n/a
041F	n/a	n/a
0402	127.92	127.03
141B	n/a	n/a
0451	128.06	127.02
141A	n/a	n/a
0401	128.06	126.87
0450	127.92	126.62
3202	116.92	114.94
321D	n/a	n/a

Manhole Reference	Manhole Cover Level	Manhole Invert Level
4203	n/a	n/a
4252	111.42	108.27
3251	116.46	113.46
321E	n/a	n/a
4250	110.92	107.84
421A	n/a	n/a
4201	111.17	107.86
321F	n/a	n/a
421B	n/a	n/a
431C	n/a	n/a
431B	n/a	n/a
431A	n/a	n/a
4302	111.1	107.46
4350	109.9	106.92
3350	117.09	114.32
4351	113.48	110.81
4303	115.17	111.69
3303	118.74	115.23
4304	109.28	107.66
4352	109.94	107.78
3351	117.14	115.43
3304	118.03	116.31
3353	118.6	117.29
3352	117.58	115.99
4450	108.63	106.54
3203	119.47	117.61
3204	122.78	120.7
3252	119.31	117.49
3253	122.96	120.85
2201	123.6	121.46
221B	n/a	n/a
331H	n/a	n/a
331I	n/a	n/a
331F	n/a	n/a
331J	n/a	n/a
331E	n/a	n/a
331G	n/a	n/a
331D	n/a	n/a
331C	n/a	n/a
331B	n/a	n/a
3358	n/a	n/a
3355	124.23	122.09
331A	n/a	n/a
2301	125.49	123.64
3354	122.51	120.74
3305	n/a	n/a
3357	122.81	121.08
3356	121.48	118.78
3461	120.4	118.12
3460	119.07	117.7
3459	119.07	117.68
3458	118.88	117.29
221E	n/a	n/a
1201	135.53	134.11
221F	n/a	n/a
221A	n/a	n/a
2251	131.03	129.18
2202	130.13	127.87
2250	127.19	124.18
231D	n/a	n/a
1351	133.83	131.65
231E	n/a	n/a
231F	n/a	n/a
2350	126.73	124.48
231C	n/a	n/a
231G	n/a	n/a
231H	n/a	n/a
231B	n/a	n/a
041G	n/a	n/a
041C	n/a	n/a
0153	143.24	141.68
041B	n/a	n/a
021J	n/a	n/a
021I	n/a	n/a
021H	n/a	n/a
021G	n/a	n/a
021F	n/a	n/a
0250	138.59	136.82
021L	n/a	n/a
021K	n/a	n/a
021C	n/a	n/a
021D	n/a	n/a
021A	n/a	n/a
121A	n/a	n/a
021B	n/a	n/a
131K	n/a	n/a
031G	n/a	n/a
131J	n/a	n/a
131N	n/a	n/a
031J	n/a	n/a
0351	135.69	n/a
131M	n/a	n/a
131I	n/a	n/a

Manhole Reference	Manhole Cover Level	Manhole Invert Level
031I	n/a	n/a
031D	n/a	n/a
0352	133.14	131.58
131H	n/a	n/a
031H	n/a	n/a
0301	132.5	131.31
311C	n/a	n/a
3102	118.52	115.58
2101	120.18	117.64
4150	117.62	115.42
3151	119.91	117.67
3103	119.74	117.45
3153	119.24	116.97
2150	119.43	117.3
2158	119.41	117.95
311I	n/a	n/a
311F	n/a	n/a
2157	119.87	118.36
3101	116.34	114.03
2159	119.98	118.32
311G	n/a	n/a
311H	n/a	n/a
3150	116.27	114.41
2254	120.03	118.53
3255	119.95	118.71
321G	n/a	n/a
3201	116.17	113.66
3250	115.44	113.22
4202	112.59	110.52
321H	n/a	n/a
4251	112.29	109.55
321C	n/a	n/a
421C	n/a	n/a
0050	141.14	136.76
0001	140.29	136.53
2002	129.79	127.86
2001	129.01	n/a
001A	n/a	n/a
2051	128.92	125.48
0151	138.65	133.86
211A	n/a	n/a
0150	137.76	n/a
011B	n/a	n/a
2103	124.95	123.51
2102	124.54	122.05
1151	136.77	129.2
2151	124.19	121.27
011D	n/a	n/a
011C	n/a	n/a
011A	n/a	n/a
1150	135.75	127.21
2152	127.63	121.13
0102	142.97	140.34
0152	141.05	138.5
0101	138.95	136.94
021E	n/a	n/a
1252	136.66	134.95
1253	136.69	135.22
221D	n/a	n/a
1251	134.6	132.92
201A	n/a	n/a
3052	127.88	125.69
301C	n/a	n/a
301D	n/a	n/a
3051	124.29	121.24
301B	n/a	n/a
3003	125.3	123.77
301A	n/a	n/a
311D	n/a	n/a
311E	n/a	n/a
3002	122.02	120.69
311A	n/a	n/a
3053	125.82	124.02
3057	n/a	n/a
311J	n/a	n/a
3001	124.55	122.76
311K	n/a	n/a
4003	n/a	n/a
4002	119.77	116.71
401A	n/a	n/a
401B	n/a	n/a
4050	119.74	117.16
4001	120.18	117.39
4004	121.44	118.05
2050	136.57	133.98
2003	139.16	137.11
2052	137.06	135.5
1002	137.46	134.17
201C	n/a	n/a
201B	n/a	n/a
201D	n/a	n/a
101A	n/a	n/a
1003	n/a	n/a

Manhole Reference	Manhole Cover Level	Manhole Invert Level
101B	n/a	n/a
1051	133.9	131.02
1001	134.28	131.64
1050	133.86	130.78
0002	142.87	141.39
0051	142.32	139.08
441A	n/a	n/a

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

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

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

Gulley

Culverted Watercourse

Proposed

Abandoned Sewer

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.

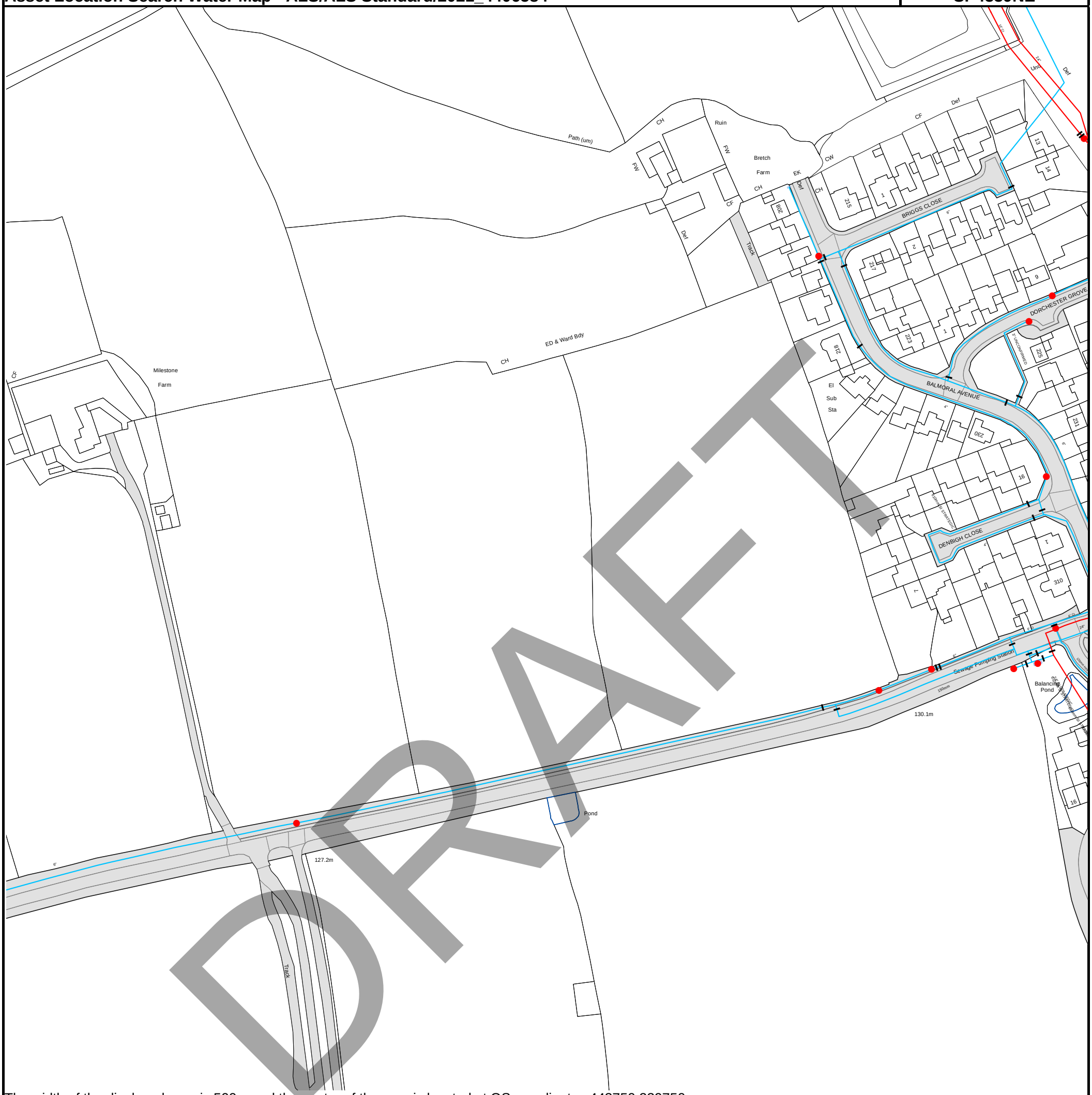
4) Most private pipes are not shown on our plans, as in the past, this information has not been recorded.

5) 'na' or '0' on a manhole level indicates that data is unavailable.

6) The text appearing alongside a sewer line indicates the internal diameter of the pipe in milimetres. 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 Searches on 0800 009 4540.

Asset Location Search Water Map - ALS/ALS Standard/2021_4406584

SP4339NE



The width of the displayed area is 500m and the centre of the map is located at OS coordinates 443750,239750

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.

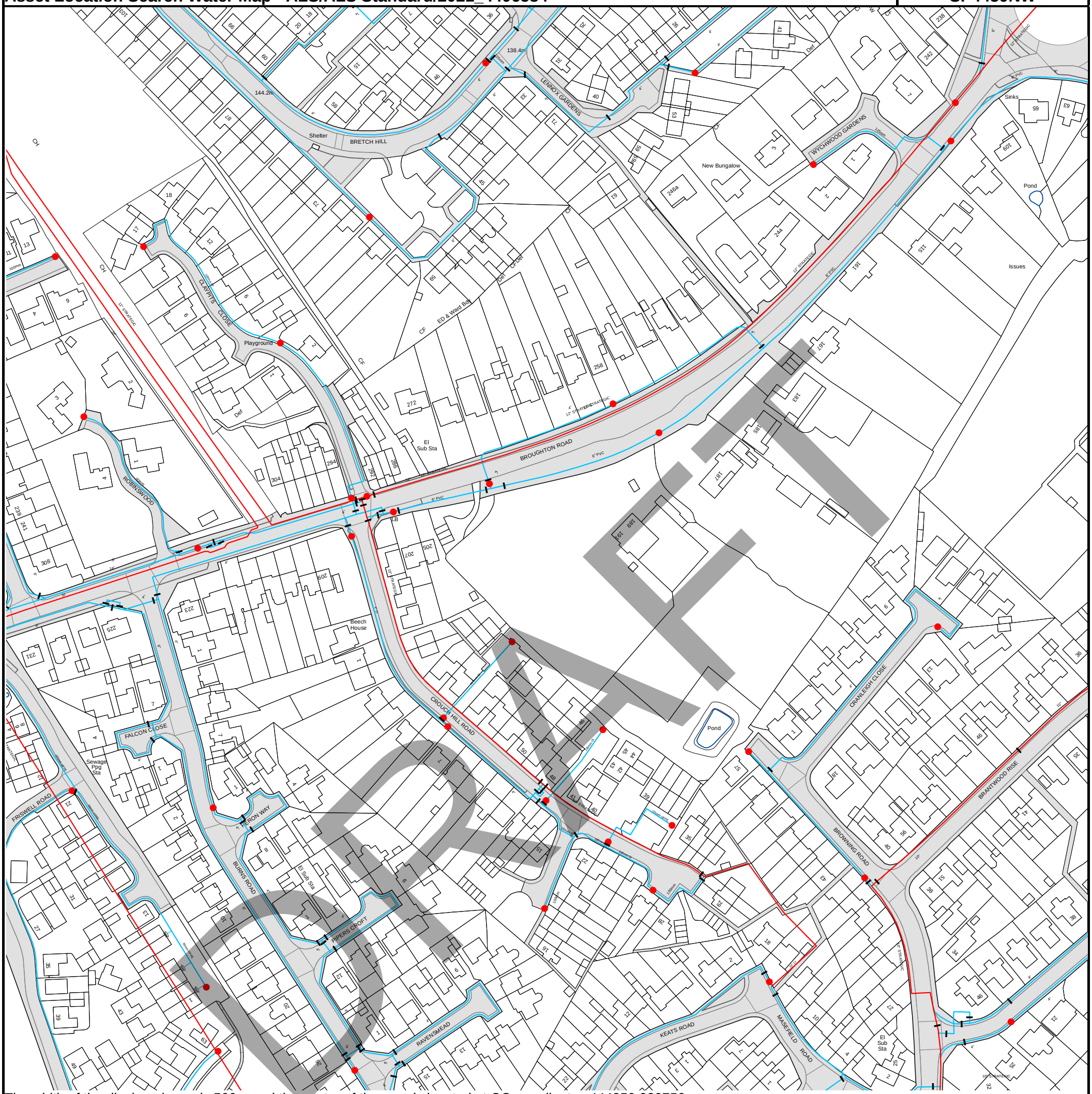
Asset Location Search Water Map - ALS/ALS Standard/2021_4406584

SP4340SE

The width of the displayed area is 500m and the centre of the map is located at OS coordinates 443750,240250

Asset Location Search Water Map - ALS/ALS Standard/2021_4406584

SP4439NW



The width of the displayed area is 500m and the centre of the map is located at OS coordinates 444250,239750

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.

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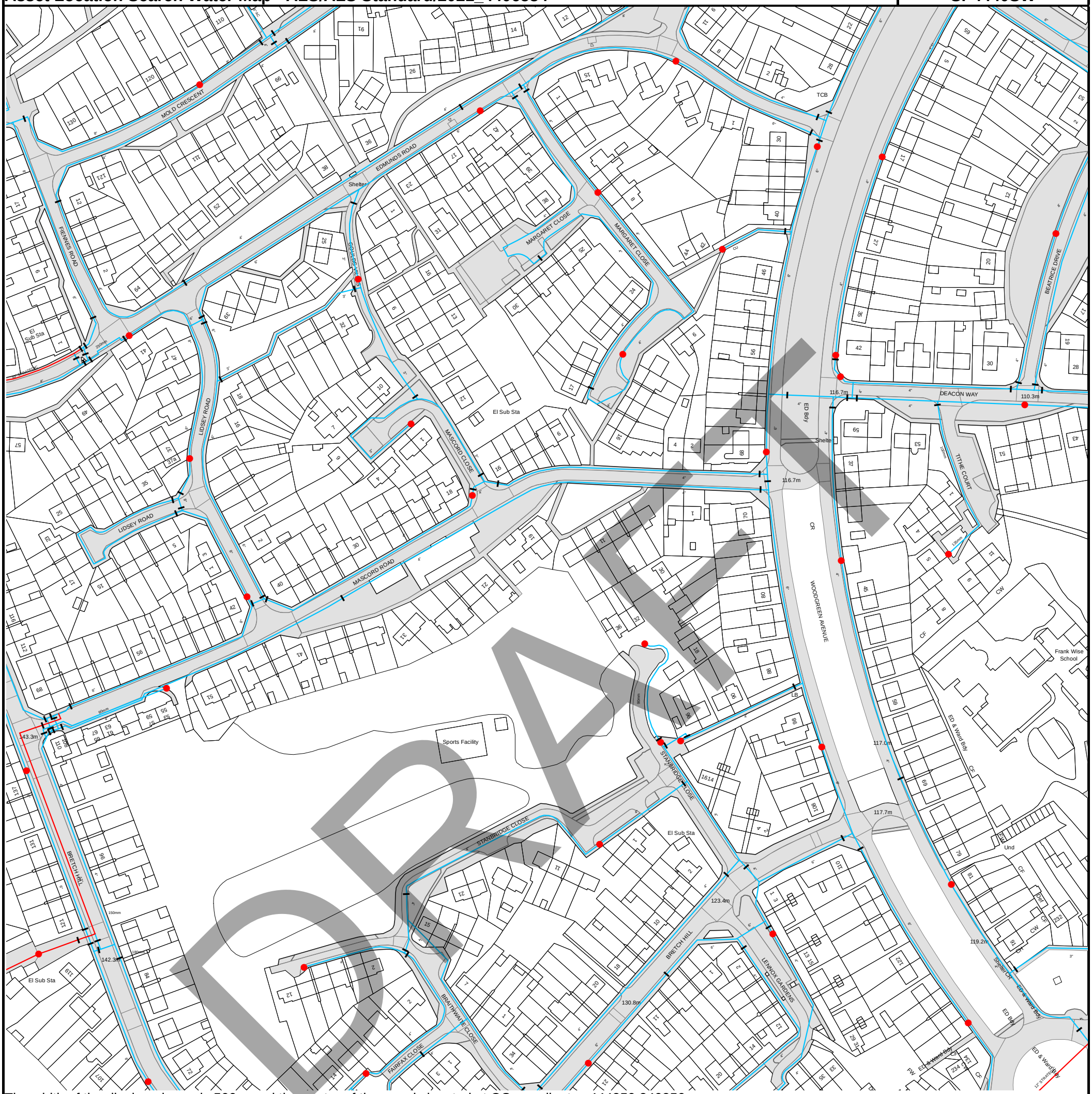
Asset Location Search Water Map - ALS/ALS Standard/2021_4406584

SP4440SW



The width of the displayed area is 500m and the centre of the map is located at OS coordinates 444250,240250

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.

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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: 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.

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 **0800 009 4540** 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.

Mr Ryan Davies
BWB Consulting
Ryan.Davies@bwbconsulting.com

Wastewater pre-planning
Our ref DS6086716

09 September 2021

Pre-planning enquiry: Capacity concerns

Site address: Land north of Balmoral Avenue, Phase 2, Banbury, OX16 0BG

Dear Mr Davies,

Thank you for providing information on your development for the proposed 48no. residential units on previously Greenfield land. We have based our assessment on the information you provided to us and have copied below for clarity:-

Proposed foul water flows to discharge via gravity into foul water manhole ref. 8801.

We've assessed your **foul water** proposals and concluded from our initial review, that our sewerage network does have sufficient capacity for **30no. residential units**, however, we're unable to meet the needs of the remaining units at this time.

As you've not supplied us with details of your **surface water** proposals, we've assumed you **don't** intend to discharge your surface water to the public sewerage system.

In order to ensure we make the appropriate upgrades – or 'off-site reinforcement' – to serve the remainder of your development, we'll need to carry out modelling work, design a solution and build the necessary improvements. Typical timescales for a development of your size are:

Modelling: 8 months
Design: 6 months
Construction: 6 months
Total: 20 months

If the time you're likely to take from planning and construction through to first occupancy is longer than this, we'll be able to carry out the necessary upgrades in time for your development. If it's shorter, please contact me on the number below to discuss the timing of our activities.

What do you need to tell us before we start modelling?

We're responsible for funding any modelling and reinforcement work. We need, though, to spend our customers' money wisely, so we'll only carry out modelling once we're confident that your development will proceed.

In order to have this confidence, we'll need to know that you **own the land and have either outline or full planning permission**. Please email this information to us as soon as you have it.

If the modelling shows we need to carry out reinforcement work, then before we start construction, we'll need you to supply us with notification that you've confirmed your 'nominated competent person' (NCP) submission to the Health and Safety Executive.

Please note that you must keep us informed of any changes to your design – for example, an increase in the number or density of homes. Such changes could mean there is no longer sufficient supply capacity.

If you have any further questions, please do not hesitate to contact me.

Yours sincerely

Rahim Khan
Thames Water – Adoptions Engineer
rahim.khan@thameswater.co.uk

Appendix 4: Greenfield Runoff Rate Calculations

ICP SUDS Mean Annual Flood

Input

Return Period (years)	100	Soil	0.400
Area (ha)	1.400	Urban	0.000
SAAR (mm)	700	Region Number	Region 6

Results l/s

QBAR Rural	4.8
QBAR Urban	4.8
Q100 years	15.2
Q1 year	4.0
Q30 years	10.8
Q100 years	15.2

Appendix 5: Greenfield Runoff Volume Calculations

Greenfield Runoff Volume

FEH Data

Return Period (years)	100
Storm Duration (mins)	360
FEH Rainfall Version	1999
Site Location	GB 443350 239550 SP 43350 39550
C (1km)	-0.024
D1 (1km)	0.315
D2 (1km)	0.328
D3 (1km)	0.236
E (1km)	0.300
F (1km)	2.484
Areal Reduction Factor	1.00
Area (ha)	1.420
SAAR (mm)	646
CWI	95.280
SPR Host	40.720
URBEXT (1990)	0.0617

Results

Percentage Runoff (%)	39.23
Greenfield Runoff Volume (m^3)	383.027

Appendix 6: Microdrainage Storage Calculations

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

Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
15 min Summer	99.352	0.352	4.8	370.8	O K
30 min Summer	99.400	0.400	4.8	424.9	O K
60 min Summer	99.452	0.452	4.8	484.1	O K
120 min Summer	99.506	0.506	4.8	546.3	O K
180 min Summer	99.536	0.536	4.8	582.0	O K
240 min Summer	99.556	0.556	4.8	606.1	O K
360 min Summer	99.581	0.581	4.8	636.0	O K
480 min Summer	99.595	0.595	4.8	652.7	O K
600 min Summer	99.603	0.603	4.8	661.5	O K
720 min Summer	99.606	0.606	4.8	665.2	O K
960 min Summer	99.606	0.606	4.8	665.9	O K
1440 min Summer	99.588	0.588	4.8	643.8	O K
2160 min Summer	99.557	0.557	4.8	607.1	O K
2880 min Summer	99.528	0.528	4.8	573.1	O K
4320 min Summer	99.447	0.447	4.8	478.2	O K
5760 min Summer	99.378	0.378	4.8	400.3	O K
7200 min Summer	99.319	0.319	4.8	334.3	O K
8640 min Summer	99.268	0.268	4.8	278.1	O K
10080 min Summer	99.224	0.224	4.8	231.4	O K
15 min Winter	99.392	0.392	4.8	415.9	O K
30 min Winter	99.446	0.446	4.8	477.0	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
15 min Summer	200.975	0.0	365.2	27
30 min Summer	115.798	0.0	393.1	41
60 min Summer	66.721	0.0	499.9	70
120 min Summer	38.443	0.0	576.2	130
180 min Summer	27.846	0.0	626.0	190
240 min Summer	22.150	0.0	664.0	248
360 min Summer	16.044	0.0	721.1	368
480 min Summer	12.763	0.0	746.3	486
600 min Summer	10.687	0.0	757.0	606
720 min Summer	9.244	0.0	757.3	724
960 min Summer	7.381	0.0	746.9	962
1440 min Summer	5.375	0.0	721.2	1316
2160 min Summer	3.914	0.0	1056.1	1632
2880 min Summer	3.125	0.0	1124.4	2016
4320 min Summer	2.192	0.0	1183.0	2776
5760 min Summer	1.705	0.0	1226.6	3576
7200 min Summer	1.402	0.0	1261.7	4328
8640 min Summer	1.196	0.0	1290.9	5024
10080 min Summer	1.045	0.0	1316.1	5752
15 min Winter	200.975	0.0	389.1	26
30 min Winter	115.798	0.0	403.1	41

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

Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
60 min Winter	99.504	0.504	4.8	544.3	O K
120 min Winter	99.565	0.565	4.8	616.0	O K
180 min Winter	99.600	0.600	4.8	658.4	O K
240 min Winter	99.624	0.624	4.8	687.7	O K
360 min Winter	99.655	0.655	4.8	725.2	O K
480 min Winter	99.673	0.673	4.8	747.1	O K
600 min Winter	99.683	0.683	4.8	760.1	O K
720 min Winter	99.689	0.689	4.8	767.3	O K
960 min Winter	99.695	0.695	4.8	774.2	O K
1440 min Winter	99.685	0.685	4.8	762.5	O K
2160 min Winter	99.649	0.649	4.8	717.9	O K
2880 min Winter	99.611	0.611	4.8	671.4	O K
4320 min Winter	99.492	0.492	4.8	530.9	O K
5760 min Winter	99.391	0.391	4.8	415.0	O K
7200 min Winter	99.305	0.305	4.8	318.5	O K
8640 min Winter	99.233	0.233	4.8	240.6	O K
10080 min Winter	99.176	0.176	4.7	180.4	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
60 min Winter	66.721	0.0	559.9	70
120 min Winter	38.443	0.0	645.3	128
180 min Winter	27.846	0.0	701.3	186
240 min Winter	22.150	0.0	735.3	244
360 min Winter	16.044	0.0	759.0	362
480 min Winter	12.763	0.0	757.2	478
600 min Winter	10.687	0.0	750.9	594
720 min Winter	9.244	0.0	743.7	710
960 min Winter	7.381	0.0	728.8	938
1440 min Winter	5.375	0.0	700.9	1380
2160 min Winter	3.914	0.0	1182.9	1968
2880 min Winter	3.125	0.0	1259.5	2228
4320 min Winter	2.192	0.0	1320.9	3036
5760 min Winter	1.705	0.0	1374.1	3864
7200 min Winter	1.402	0.0	1413.1	4608
8640 min Winter	1.196	0.0	1445.8	5280
10080 min Winter	1.045	0.0	1474.1	5952

Rainfall Details

Rainfall Model	FEH
Return Period (years)	100
FEH Rainfall Version	1999
Site Location	GB 443350 239550 SP 43350 39550
C (1km)	-0.024
D1 (1km)	0.315
D2 (1km)	0.328
D3 (1km)	0.236
E (1km)	0.300
F (1km)	2.484
Summer Storms	Yes
Winter Storms	Yes
Cv (Summer)	0.750
Cv (Winter)	0.840
Shortest Storm (mins)	15
Longest Storm (mins)	10080
Climate Change %	+40

Time Area Diagram

Total Area (ha) 1.000

Time (mins) From:	To:	Area (ha)	Time (mins) From:	To:	Area (ha)	Time (mins) From:	To:	Area (ha)
0	4	0.333	4	8	0.333	8	12	0.333

Model Details

Storage is Online Cover Level (m) 100.000

Tank or Pond Structure

Invert Level (m) 99.000

Depth (m)	Area (m²)	Depth (m)	Area (m²)
0.000	993.3	1.000	1356.7

Hydro-Brake® Optimum Outflow Control

Unit Reference	MD-SHE-0103-4800-1050-4800
Design Head (m)	1.050
Design Flow (l/s)	4.8
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	103
Invert Level (m)	98.950
Minimum Outlet Pipe Diameter (mm)	150
Suggested Manhole Diameter (mm)	1200

Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	1.050	4.8
Flush-Flo™	0.311	4.8
Kick-Flo®	0.666	3.9
Mean Flow over Head Range	-	4.2

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)
0.100	3.4	1.200	5.1	3.000	7.8	7.000	11.7
0.200	4.6	1.400	5.5	3.500	8.4	7.500	12.1
0.300	4.8	1.600	5.8	4.000	9.0	8.000	12.5
0.400	4.7	1.800	6.2	4.500	9.5	8.500	12.9
0.500	4.6	2.000	6.5	5.000	10.0	9.000	13.2
0.600	4.3	2.200	6.8	5.500	10.4	9.500	13.6
0.800	4.2	2.400	7.1	6.000	10.9		
1.000	4.7	2.600	7.3	6.500	11.3		

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

Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
15 min Summer	99.242	0.242	4.8	250.5	O K
30 min Summer	99.312	0.312	4.8	326.6	O K
60 min Summer	99.380	0.380	4.8	402.7	O K
120 min Summer	99.444	0.444	4.8	474.6	O K
180 min Summer	99.476	0.476	4.8	511.5	O K
240 min Summer	99.494	0.494	4.8	533.2	O K
360 min Summer	99.515	0.515	4.8	556.9	O K
480 min Summer	99.525	0.525	4.8	568.7	O K
600 min Summer	99.528	0.528	4.8	573.0	O K
720 min Summer	99.528	0.528	4.8	572.3	O K
960 min Summer	99.519	0.519	4.8	561.7	O K
1440 min Summer	99.494	0.494	4.8	533.1	O K
2160 min Summer	99.460	0.460	4.8	492.9	O K
2880 min Summer	99.427	0.427	4.8	455.4	O K
4320 min Summer	99.367	0.367	4.8	387.2	O K
5760 min Summer	99.312	0.312	4.8	327.0	O K
7200 min Summer	99.265	0.265	4.8	274.7	O K
8640 min Summer	99.223	0.223	4.8	230.0	O K
10080 min Summer	99.188	0.188	4.7	192.9	O K
15 min Winter	99.271	0.271	4.8	281.3	O K
30 min Winter	99.348	0.348	4.8	366.8	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
15 min Summer	136.710	0.0	255.9	26
30 min Summer	89.520	0.0	335.2	41
60 min Summer	55.837	0.0	418.2	70
120 min Summer	33.658	0.0	504.5	130
180 min Summer	24.706	0.0	555.4	188
240 min Summer	19.726	0.0	591.2	248
360 min Summer	14.299	0.0	643.0	366
480 min Summer	11.384	0.0	682.6	486
600 min Summer	9.532	0.0	714.4	604
720 min Summer	8.241	0.0	731.2	722
960 min Summer	6.546	0.0	747.7	956
1440 min Summer	4.725	0.0	736.5	1154
2160 min Summer	3.404	0.0	918.5	1520
2880 min Summer	2.696	0.0	970.0	1932
4320 min Summer	1.937	0.0	1045.5	2728
5760 min Summer	1.531	0.0	1102.0	3512
7200 min Summer	1.275	0.0	1146.8	4256
8640 min Summer	1.097	0.0	1184.6	4944
10080 min Summer	0.966	0.0	1217.3	5656
15 min Winter	136.710	0.0	286.6	26
30 min Winter	89.520	0.0	364.3	41

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

Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
60 min Winter	99.425	0.425	4.8	453.0	O K
120 min Winter	99.496	0.496	4.8	535.5	O K
180 min Winter	99.533	0.533	4.8	578.8	O K
240 min Winter	99.556	0.556	4.8	605.3	O K
360 min Winter	99.581	0.581	4.8	636.0	O K
480 min Winter	99.596	0.596	4.8	653.5	O K
600 min Winter	99.604	0.604	4.8	662.6	O K
720 min Winter	99.606	0.606	4.8	666.1	O K
960 min Winter	99.603	0.603	4.8	662.4	O K
1440 min Winter	99.577	0.577	4.8	631.0	O K
2160 min Winter	99.529	0.529	4.8	573.5	O K
2880 min Winter	99.483	0.483	4.8	519.8	O K
4320 min Winter	99.393	0.393	4.8	416.8	O K
5760 min Winter	99.311	0.311	4.8	325.9	O K
7200 min Winter	99.242	0.242	4.8	249.9	O K
8640 min Winter	99.185	0.185	4.7	189.3	O K
10080 min Winter	99.140	0.140	4.6	142.9	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
60 min Winter	55.837	0.0	468.6	70
120 min Winter	33.658	0.0	565.0	128
180 min Winter	24.706	0.0	622.1	186
240 min Winter	19.726	0.0	662.3	244
360 min Winter	14.299	0.0	720.2	360
480 min Winter	11.384	0.0	745.9	478
600 min Winter	9.532	0.0	757.0	594
720 min Winter	8.241	0.0	757.8	708
960 min Winter	6.546	0.0	749.5	934
1440 min Winter	4.725	0.0	729.0	1360
2160 min Winter	3.404	0.0	1028.8	1668
2880 min Winter	2.696	0.0	1086.5	2108
4320 min Winter	1.937	0.0	1171.1	2948
5760 min Winter	1.531	0.0	1234.1	3752
7200 min Winter	1.275	0.0	1284.4	4472
8640 min Winter	1.097	0.0	1326.8	5184
10080 min Winter	0.966	0.0	1363.3	5848

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)	19.700	Shortest Storm (mins)	15
Ratio R	0.407	Longest Storm (mins)	10080
Summer Storms	Yes	Climate Change %	+40

Time Area Diagram

Total Area (ha) 1.000

Time (mins) From:	To:	Area (ha)	Time (mins) From:	To:	Area (ha)	Time (mins) From:	To:	Area (ha)
0	4	0.333	4	8	0.333	8	12	0.333

Model Details

Storage is Online Cover Level (m) 100.000

Tank or Pond Structure

Invert Level (m) 99.000

Depth (m)	Area (m²)	Depth (m)	Area (m²)
0.000	993.3	1.000	1356.7

Hydro-Brake® Optimum Outflow Control

Unit Reference	MD-SHE-0103-4800-1050-4800
Design Head (m)	1.050
Design Flow (l/s)	4.8
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	103
Invert Level (m)	98.950
Minimum Outlet Pipe Diameter (mm)	150
Suggested Manhole Diameter (mm)	1200

Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	1.050	4.8
Flush-Flo™	0.311	4.8
Kick-Flo®	0.666	3.9
Mean Flow over Head Range	-	4.2

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)
0.100	3.4	1.200	5.1	3.000	7.8	7.000	11.7
0.200	4.6	1.400	5.5	3.500	8.4	7.500	12.1
0.300	4.8	1.600	5.8	4.000	9.0	8.000	12.5
0.400	4.7	1.800	6.2	4.500	9.5	8.500	12.9
0.500	4.6	2.000	6.5	5.000	10.0	9.000	13.2
0.600	4.3	2.200	6.8	5.500	10.4	9.500	13.6
0.800	4.2	2.400	7.1	6.000	10.9		
1.000	4.7	2.600	7.3	6.500	11.3		

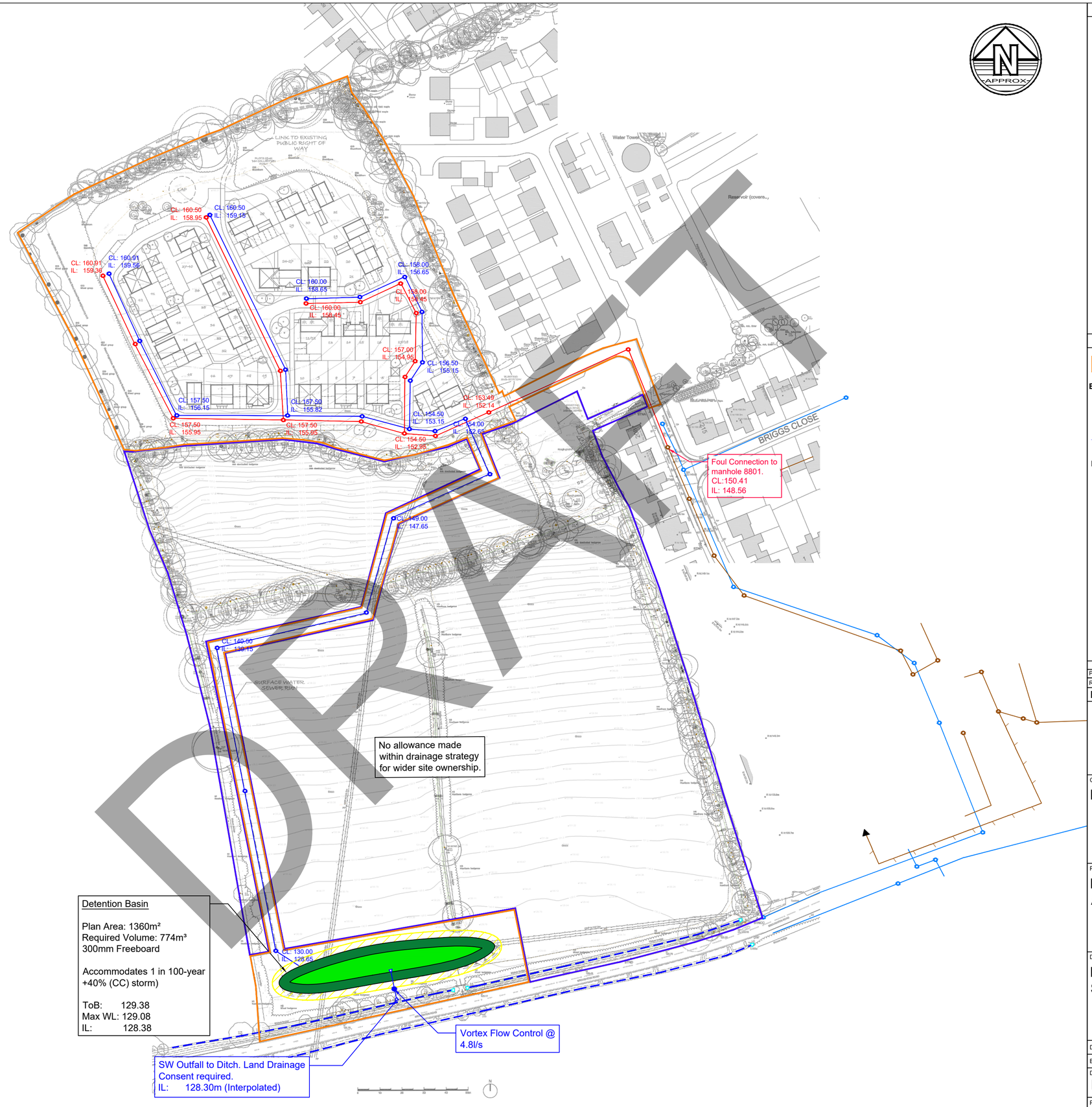
Appendix 7: Illustrative Drainage Strategy

SITE SUMMARY

DEVELOPABLE AREA = 1.42ha
GREENFIELD QBAR RATE = 4.8l/s
IMPERMEABLE AREA (inc. URBAN CREEP) = 1.0ha
REQUIRED STORAGE PLAN AREA = 1360m²

DRAINAGE STRATEGY STANDARD

MIN FREEBOARD = 300mm
BASIN DEPTH = 1.0m
BANK GRADIENT = 1:3



Detention Basin

Plan Area: 1360m²
Required Volume: 774m³
300mm Freeboard

Accommodates 1 in 100-year +40% (CC) storm)

ToB: 129.38
Max WL: 129.08
IL: 128.38

Notes

1. Do not scale this drawing. All dimensions must be checked/ verified on site. If in doubt ask.
2. This drawing is to be read in conjunction with all relevant architects, engineers and specialists drawings and specifications.
3. All dimensions in millimetres unless noted otherwise. All levels in metres unless noted otherwise.
4. Any discrepancies noted on site are to be reported to the engineer immediately.
5. This drawing is illustrative, only to be used to inform masterplanning. This drawing should not be used for construction purposes.
6. Impermeable area is assumed to be 65% of the developable area, An additional 10% allowance has been made to account for urban creep.
7. Attenuation has been sized to accommodate the 1 in 100-year storm with a 40% allowance for the effects of climate change. A 300mm freeboard has also been allowed for in the design.
8. In line with local guidance, a 3m easement around SuDS features, has been accounted for.

Legend

- Indicative Site Boundary
- Wider Site Ownership

Existing Drainage

- Foul Water Sewer
- Surface Water Sewer
- Ditch
- Headwall
- Foul Water Manhole
- Surface Water Manhole

Proposed Drainage

- Surface Water Sewer
- Foul Water Sewer
- Vortex Flow Control
- Foul Water Manhole
- Surface Water Manhole
- Easement
- Detention Basin
- Headwall

Rev	Date	Details of issue / revision	Drw	Rev
P1	12.10.21	PRELIMINARY ISSUE	RD	RJ

Issues & Revisions

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Client
LONE STAR LAND LTD

Project Title
LAND OFF BALMORAL AVENUE, BANBURY

Drawing Title
ILLUSTRATIVE DRAINAGE STRATEGY

Drawn:	R. Davies		Reviewed:	R. Jobling	
BWB Ref:	BMW 3250	Date:	12.10.21	Scale@A2:	1:1250

Drawing Status
PRELIMINARY

Project - Originator - Zone - Level - Type - Role - Number	Status	Rev
BP2-BWB-ZZ-XX-DR-CD-0001	**S2**	**P1**

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