BROOKBANKS

Land at Gosford Oxfordshire

Flood Risk Assessment

Barwood Development Securities Limited

Document Control Sheet

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1 Introduction

1.1 Brookbanks is appointed by Barwood Development Securities Limited to complete a Flood Risk Assessment (FRA) for a proposed residential development at Kidlington, Oxfordshire.

1.2 The objective of the study is to demonstrate the development proposals are acceptable from a flooding risk and drainage viewpoint.

1.3 This report summarises the findings of the study and specifically addresses the following issues in the context of the current legislative regime:

- Flooding risk
- Surface water drainage
- Foul water drainage

1.4 Plans showing the existing and proposed development are contained within the appendices.

Planning Application

1.5 This FRA has been produced in order to provide information for an outline planning application.

1.6 Everything designed within this report is to illustrate that the a drainage strategy can be successfully designed and applied for the development site.

1.7 The FRA will then be the subject of a reserved matters application where detailed design layouts and criteria will be provided.

2 Background Information

Location and Details

2.1 The proposed development lies to the south east of the village of Kidlington. The site is bound to the north by an open field, to the east by agricultural fields, existing residential development and the A34/Water Eaton Lane road, to the south by Oxford road and to the west to Bicester Road.

2.2 The site is currently predominantly undeveloped agricultural land and is not thought to have been historically subject to any significant built development.

2.3 The site location and boundary is shown indicatively on **Figure 2-1**.

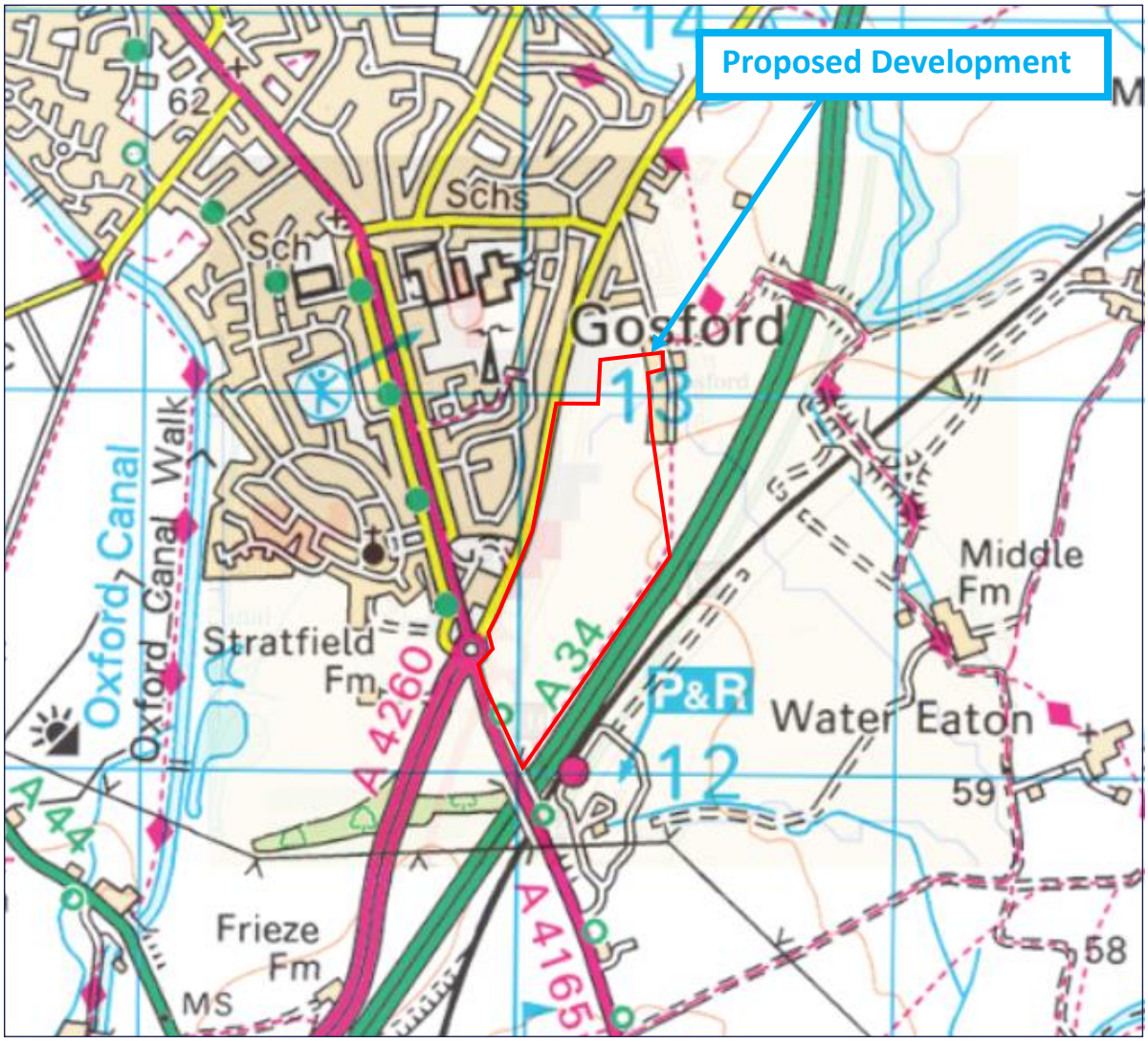

Figure 2-1: Site Location

Development Criteria

2.4 The following development is proposed at the site:

"Outline planning application for the development of up to 370 homes, public open space (including play areas and woodland planting), sports pitches and pavilion, drainage and engineering works, with all matters reserved (appearance, landscaping, layout and scale) except for vehicular and emergency accesses to Bicester Road."

Sources of Information

2.5 The following bodies have been consulted while completing the study:

- Thames Water - Storm & foul water drainage
- Environment Agency - Flood risk and storm drainage
- Cherwell District Council - Flood risk, drainage and associated policy

2.6 The following additional information has been available while completing the study:

- Mastermap Data - Ordnance Survey
- Published Geology - British Geological Survey
- Level 1 & 2 Strategic Flood Risk Assessment - Cherwell District Council

3 National and Local Planning Policy

3.1 The Development site under consideration is allocated. Therefore as a responsible Authority Oxfordshire County Council (OCC) are considered to have already applied the National and Regional Policy requirements for directing development away from flood zones and to generally reduce flood risk.

3.2 The following commentary on the National Policy is therefore provided for context only and considered to have already been applied and satisfied during the site allocation process. They are therefore not considered further in this Flood Risk Assessment.

National Planning Policy

3.3 The National Planning Policy Framework (NPPF), updated in July 2021, sets out Governmental Policy on a range of matters, including Development and Flood Risk. The policies were largely carried over from the former PPS25: Development & Flood Risk, albeit with certain simplification. The allocation of development sites and local planning authorities' development control decisions must be considered against a risk-based search sequence, as provided by the document.

3.4 Allocation and planning of development must be considered against a risk-based search sequence, as provided by the NPPF guidance. In terms of fluvial flooding, the guidance categorises flood zones in three principal levels of risk, as follows in **Table 3-1**.

Flood Zone	Annual Probability of Flooding
Zone 1: Low probability	< 0.1 %
Zone 2: Medium probability	0.1 – 1.0 %
Zone 3a / 3b: High probability	> 1.0 %

Table 3-1: NPPF Flood Risk Parameters

3.5 The Guidance states that Planning Authorities should:

"apply a sequential, risk-based approach to the location of development to avoid where possible flood risk to people and property and manage any residual risk, taking account of the impacts of climate change."

3.6 According to the NPPF guidance, residential development at the proposed site, being designated as "More Vulnerable" classifications, should lie outside the envelope of the predicted 1 in 100 year (1%) flood, with preference given to sites lying outside the 1 in 1,000 (0.1%) year events and within Flood Zone 1.

3.7 Sites with the potential to flood during a 1 in 100 (1%) year flood event (Flood Zone 3a) are not normally considered appropriate for proposed residential development unless on application of the "Sequential Test", the site is demonstrated to be the most appropriate for development and satisfactory flood mitigation can be provided. Additionally, proposed residential developments within Flood Zone 3a are required to pass the "Exception Test", the test being that:

- The development is to provide wider sustainability benefits
- The development will be safe, not increase flood risk and where possible reduce flood risk.

Local Planning Policy

3.8 Kidlington lies within Cherwell District Council in Oxfordshire, in which OCC is the Lead Local Flood Authority (LLFA). A **Preliminary Flood Risk Assessment** (PFRA) was produced in 2011 by OCC according to the guidance and information provided by DEFRA. The PFRA identifies flood risk from local flood sources and extreme events occurrence.

3.9 Indicative Flood Risk Areas consist of an area where flood risk is most concentrated, and over 30,000 people are predicted to be at risk of flooding. The PFRA reports of Essex being part of one of the flood risk areas, affecting parts of Basildon, Castle Point, Rochford and Southend-on-Sea.

3.10 **Strategic Flood Risk Assessment:** To support local planning policy, NPPF guidance recommends that local planning authorities produce a Strategic Flood Risk Assessment (SFRA). The SFRA should be used to help define the Local Plan and associated policies; considering potential development zones in the context of the sequential test defined in the guidance.

3.11 Cherwell District Council, published their Level 1 Strategic Flood Risk Assessment in May 2017. The document generally underpins national guidance and provides recommendations to developers with regards to SuDS and design which will be explored further in this report under the Storm Drainage section.

3.12 The SFRA identifies fluvial flooding in Kidlington in October-December 2012 and January-February 2014.

3.13 The Level 1 SFRA provides a "Study Area Flood Source & Data Review to enable application of the Sequential Test" and the Level 2 SFRA "Increases scope on SFRA to include development site assessments for Exception Testing.

3.14 The Local plan for the District and supporting guidance documents should continue to include policies to:

- *Protect the functional floodplain from development;*
- *Direct vulnerable development away from flood affected areas takin account of all flood sources;*
- *Ensure all new development is 'safe' for its lifetime. Dry pedestrian access to and from the development must be possible without passing thought flood waters where the hazard is greater than "very low" according to Defra/Environment Agency, and emergency vehicular access must be possible;*
- *Ensure that all new developments do not cause flood risk to be increased elsewhere;*
- *Promote the use of strategic, integrated and maintainable SuDS in all Flood Zones from both brownfield and greenfield sites, with space set-aside for SuDS; and*
- *Reduce flood risk from all sources where possible, for example through reduction of surface water runoff rates and volumes, increasing floodplain storage, setting development back from watercourses and de-culverting watercourses.*

3.15 An addendum of the Level 2 SFRA in 2018 has identified potential allocation sites for the housing needs of the District. The proposed development site is one of the sites identified as suitable for development in the document.

3.16 The guidance generally promotes good practice methodology in line with the more current SFRA's and Water Management SPD's. As such, the development proposals contained in this FRA are in full compliance with the Local Plan.

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Management SPD's. As such, the development proposals contained in this FRA are in full compliance with the Local Plan.

3.18 Oxfordshire County Council published the **Local Flood Risk Management Strategy** (LFRMS) which offers Guiding Principals in managing flood risk and a structure of managing strategy, in addition to that provided in the SFRA.

3.19 The management plan for Kidlington is:

- *Actively promote the use of storage reservoirs for non-potable water uses (e.g. irrigation storage reservoirs).*
- *Promote "Best Farming Practice", including the use of soil and nutrient management plans.*
- *Ensure the need for Water Cycle Studies are included in policies in regional strategies and local development frameworks where appropriate, particularly in growth and/or high risk areas.*
- *Further investigations to improve understanding of (the scale of) habitat restoration required to achieve GES / GEP.*

3.20 The Local Flood Risk Management Strategy Objectives are outlined below in italics

1. *Improve understanding of flood risks and ensure that all stakeholders understand their roles and responsibilities for flood risk management.*
2. *Take a collaborative approach to reducing flood risks, using all available resources and funds in an integrated way and in so doing derive enhanced overall benefit.*
3. *Prevent an increase in flood risk from development where possible, by preventing additional flow entering existing drainage systems and watercourses.*
4. *Take a sustainable and holistic approach to flood risk management, seeking to deliver wider environmental and social benefits, climate change mitigation and improvements under the Water Framework Directive.*

3.21 The objectives detailed above will be delivered through a series of local measures and actions. Site level Specific Management Actions are introduced so they could be implemented within locally important flood risk areas in order to translate the aims of the overall strategic actions onto a local scale.

3.22 The development has been adopted as an allocated site (PR7a) within the Cherwell **Local Plan** (September 2020), and includes the following policies in regards to flood risk and drainage that the site will need to be in compliance with. The responses in blue are how Brookbanks has addressed and accounted for the policy:

"Policy ESD 6: Sustainable Flood Risk Management

The Council will manage and reduce flood risk in the District through using a sequential approach to development; locating vulnerable developments in areas at lower risk of flooding. Development proposals will be assessed according to the sequential approach and where necessary the exceptions test as set out in the NPPF and NPPG. Development will only be permitted in areas of flood risk when there are no reasonably available sites in areas of lower flood risk and the benefits of the development outweigh the risks from flooding.

3.23 *The site has been allocated within the Local Plan and all infrastructure has been located within Flood Zone 1.*

In addition to safeguarding floodplains from development, opportunities will be sought to restore natural river flows and floodplains, increasing their amenity and biodiversity value. Building over or culverting of watercourses should be avoided and the removal of existing culverts will be encouraged.

3.24 *All existing watercourses and ditches will have a minimum 3m buffer surrounding them and will only be culverted where crossing are required.*

Existing flood defences will be protected from damaging development and where development is considered appropriate in areas protected by such defences it must allow for the maintenance and management of the defences and be designed to be resilient to flooding.

3.25 *There are no flood defences within the site.*

Site specific flood risk assessments will be required to accompany development proposals in the following situations:

- *All development proposals located in flood zones 2 or 3*
- *Development proposals of 1 hectare or more located in flood zone 1*
- *Development sites located in an area known to have experienced flooding problems*
- *Development sites located within 9m of any watercourses.*

3.26 *This document is the Flood Risk Assessment associated with the Land at Gosfield development.*

Flood risk assessments should assess all sources of flood risk and demonstrate that:

- *There will be no increase in surface water discharge rates or volumes during storm events up to and including the 1 in 100 year storm event with an allowance for climate change (the design storm event)*
- *Developments will not flood from surface water up to and including the design storm event or any surface water flooding beyond the 1 in 30 year storm event, up to and including the design storm event will be safely contained on site.*

3.27 *SuDS have been designed to accommodate the 1 in 100 year + 40% climate change storm event and to discharge at QBAR, a betterment on current greenfield runoff rates.*

Development should be safe and remain operational (where necessary) and proposals should demonstrate that surface water will be managed effectively on site and that the development will not increase flood risk elsewhere, including sewer flooding.

3.28 *The SuDS will store surface water onsite and discharge at QBAR which will reduce the risk of flood risk further downstream in the catchment. Sewers will also be designed to accommodate flow from the development.*

Policy ESD7: Sustainable Drainage Systems

All development will be required to use sustainable drainage systems (SuDS) for the management of surface water run-off.

3.29 *The drainage strategy proposed a combination of swales and detention basins.*

Where site specific Flood Risk Assessments are required in association with development proposals, they should be used to determine how SuDS can be used on particular sites and to design appropriate systems.

In considering SuDS solutions, the need to protect ground water quality must be taken into account, especially where infiltration techniques are proposed. Where possible, SuDS should seek to reduce flood risk, reduce pollution and provide landscape and wildlife benefits. SuDS will require the approval of Oxfordshire County Council as LLFA and SuDS Approval Body, and proposals must include an agreement on the future management, maintenance and replacement of the SuDS features.

3.30 In areas where groundwater is deemed to be high, the proposed SuDS can be lined in order to protect groundwater contamination and groundwater ingress into the basin. The basins have been designed to discharge surface water at QBAR therefore, reducing the risk of flooding further downstream and provide treatment to surface water before it enters the existing drainage network. A maintenance schedule for the SuDS has been provided in Chapter 8 of the FRA.

Policy ESD 8: Water Resources

The Council will seek to maintain water quality, ensure adequate water resources and promote sustainability in water use.

Water quality will be maintained and enhanced by avoiding adverse effects of development on the water environment. Development proposals which would adversely affect the water quality of surface or underground water bodies, including rivers, canals, lakes and reservoirs, as a result of directly attributable factors, will not be permitted.

3.31 The proposed SuDS will provided at least 2 stages of treatment on surface water before it is discharged into the existing drainage network.

Development will only be permitted where adequate water resources exist, or can be provided without detriment to existing uses. Where appropriate, phasing of development will be used to enable the relevant water infrastructure to be put in place in advance of development commencing.

3.32 Thames Water will ensure that the network can accommodate and supply the development before any dwellings are occupied.

The Cherwell Local Plan 2011-2031 – Partial Review

3.33 The partial review provides key development requirements. Those relating to flood risk and drainage are outlined below.

13. A Flood Risk Assessment shall be submitted with the application(s). The application shall be supported by a Flood Risk Assessment, informed by a suitable ground investigation and having regard to guidance contained within the Council's Level 2 SFRA. A surface water management framework shall be prepared to maintain run off rates to greenfield run off rates and volumes, with use of Sustainable Drainage Systems in accordance with adopted Policy ESD7, taking into account recommendations contained in the Council's Level 1 and Level 2 SFRAs. Residential development should be located outside the modelled Flood Zone 2 and 3 envelope which extends into the north eastern corner of the site.

3.34 This document forms the Flood Risk Assessment that is required for the application. While this application is still within the outline stage ground information has been obtained by Environment Agency mapping. A full ground investigation will be completed at reserved matters, however this Flood Risk Assessment is support by the Desk Based Geotechnical Report for ground conditions. The proposed SuDS have been designed to accommodate the 1 in 100 year + 40% climate change storm event and discharged to the existing greenfield runoff rates in accordance with Policy ESD7. The policy which is also covered in paragraphs 4.22 and 4.23 above. This FRA and illustrative drainage strategy demonstrates that all built development is located within flood zone 1.

14. The application should demonstrate that Thames Water, Natural England and the Environment Agency have been consulted regarding wastewater treatment capacity and agreement has been reached in principle that foul drainage from the site will be accepted into the drainage network.

3.35 A pre-development enquiry has been undertaken with Thames Water to determine the most appropriate connection point for the development. This enquiry will also determine if any upgrade works will be required on the sewers or at the treatment plant in order to accommodate the capacity. This enquiry will be submitted which will allow Natural England and the Environment Agency to review.

3.36 **Development Flood Risk Assessment**: At a local site by site level, the NPPF and guidance and supporting documents advocate the preparation of a Flood Risk Assessment (FRA). The NPPF requires that developments covering an area of greater than one hectare prepare a FRA in accordance with the guidance. The FRA is

required to be proportionate to the risk and appropriate to the scale, nature and location of the development.

3.37 This document forms a Flood Risk Assessment (FRA), to accord with current guidance and addresses national, regional and local policy requirements in demonstrating that the proposed development lies within the acceptable flood risk parameters.

Supplementary Planning Document (SPD)

3.38 Kidlington SPD was adopted by Cherwell District Council in December 2016.

3.39 In accordance with Policies ESD13 and ESD15 of the Local Plan the SPD requires provision for sustainable drainage, including SuDS. The proposed SuDS design for this development is outlined in further detail through this FRA.

PR7a Land South East of Kidlington Development Brief (Draft Jan 2022)

3.40 Cherwell District Council released their draft for consultation development brief in October 2021. This document outlines how the development site will comply with the local plan.

3.41 The following policy relates directly to the development site that the site will need to comply with. The advice provided in regards to flood risk and drainage is referenced in italics with Brookbanks response to how those criteria will be met in blue.

Sustainable Drainage Systems (SuDS) within the development site is to be designed in line with the principles provided in CIRIA SuDS Manual (C753), the Cherwell Residential Design Guide section 4.7 and the Local Standards and Guidance for Surface Water Drainage on Major Development in Oxfordshire (2018).

3.42 The outline application has designed the basins in accordance with CIRIA and local guidance. The basins have been designed to a depth of 1.5m with a 300mm freeboard and to accommodate the 1 in 100 year + 40% climate change storm event. The SuDS have accommodated for a 55% impermeable area across the residential areas with and additional 10% for urban creep.

It is expected that the site will drain towards the east side of the site, reflecting the topography of the site, with drainage attenuation features broadly in the locations indicated on figure 19 and to be agreed in detail with Oxfordshire County Council Drainage Team.

3.43 Two detention basins have been proposed along the eastern boundary, which will discharge into the existing drainage network

Existing watercourses and ditches are to be retained and incorporated into overall drainage strategy. A minimum of 3m landscape buffer is to be provided on either side of the existing watercourses and ditches. The buffer should be publicly accessible open space to ensure continued maintenance and access.

3.44 No development will be located within the 3m buffer zone of the existing watercourses. There will also be a 5m buffer around the SuDS for maintenance and earthworks.

Existing and retained drainage features are to be designed as an integral element of public open spaces and streets, creating environments for informal recreation and habitat creation.

3.45 The existing watercourse will remain in place across the site and be used as the proposed outfall for the

detention basins.

Open drainage systems including ponds and swales should be used wherever possible, rather than crates.

3.46 A series of swales and detention basins have been proposed to convey and store surface water on site or the majority of site uses.

Groundworks associated with drainage must avoid damage to existing trees and hedgerows and their root protection zones.

3.47 Groundworks associated with the SuDS will avoid the root protection areas of any trees and hedgerows that will be retained.

4 Baseline Conditions

Present Day

4.1 As identified above the majority of the site is currently undeveloped agricultural land. There is an ordinary watercourse that flows along the northern and eastern boundaries of the development site, which acts as the current drainage network for the Site.

4.2 **Figure 4-1** below illustrates the site at present.

Figure 4-1: Existing Site Conditions

Topography & Site Survey

4.3 Levels across the site are characterised by gradients falling generally in north easterly direction, with a high point of circa 65mAOD to a low point of circa 60mAOD.

Geology & Hydrogeology

4.4 With reference to the British Geological Survey, the site is shown to be underlain by clay bedrock geology belonging to the Oxford Clay Formation and West Walton Formation. There are no superficial deposits identified on site.

4.5 The published site geology is illustrated on **Figure 4-2**.

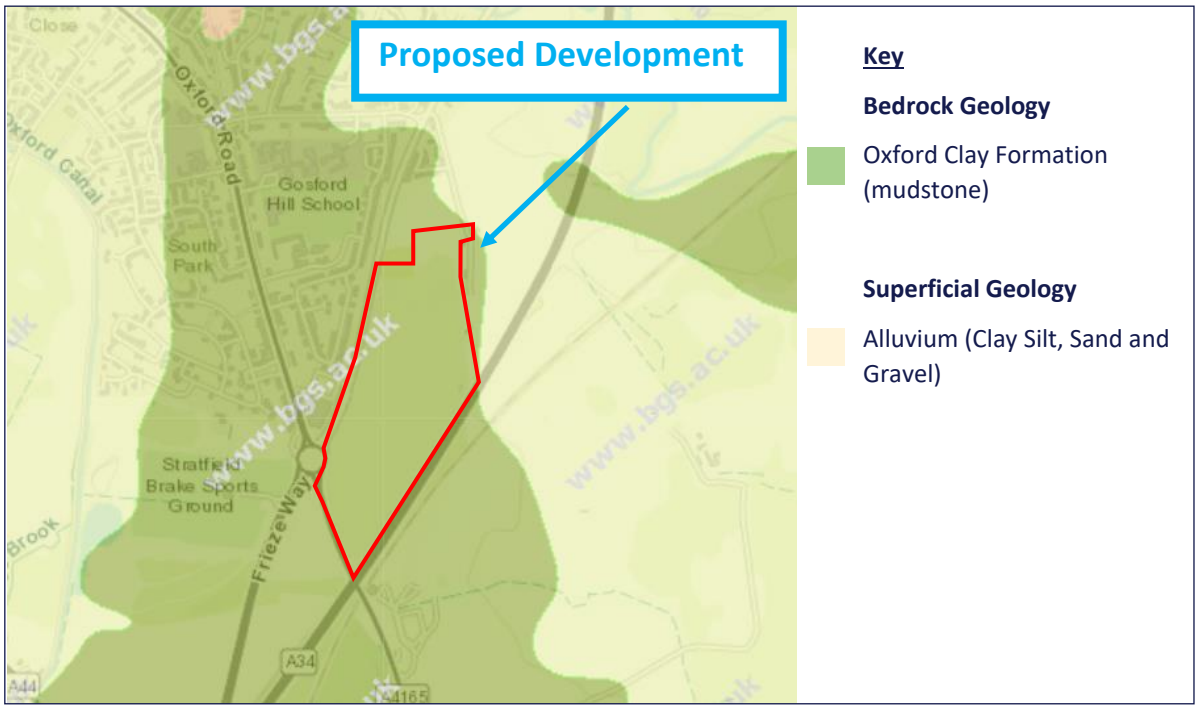


Figure 4-2: BGS Published Geology

4.6 The Aquifer designation map states that the superficial drift forms a Secondary A aquifer across the easterly region of the site. Most of the site lies on an Unproductive aquifer as is considered as slowly permeably loamy and clayey soils.

4.7 The EA provides the following definitions for Aquifers:

Secondary Aquifers *- These include a wide range of rock layers or drift deposits with an equally wide range of water permeability and storage. Secondary aquifers are subdivided into two types:*

Secondary A *- permeable layers capable of supporting water supplies at a local rather than strategic scale, and in some cases forming an important source of base flow to rivers. These are generally aquifers formerly classified as minor aquifers.*

Unproductive Strata *- These are rock layers or drift deposits with low permeability that have negligible significance for water supply or river base flow.*

4.8 The EA Groundwater Vulnerability Zones (GVZ) Mapping summarises the overall risk to groundwater, taking into account groundwater vulnerability, the types of aquifer present (superficial and/or bedrock) and their designation status, as discussed previously.

4.9 The site is shown (**Figure 4-3**) to be situated as 'unproductive', in terms of groundwater vulnerability.

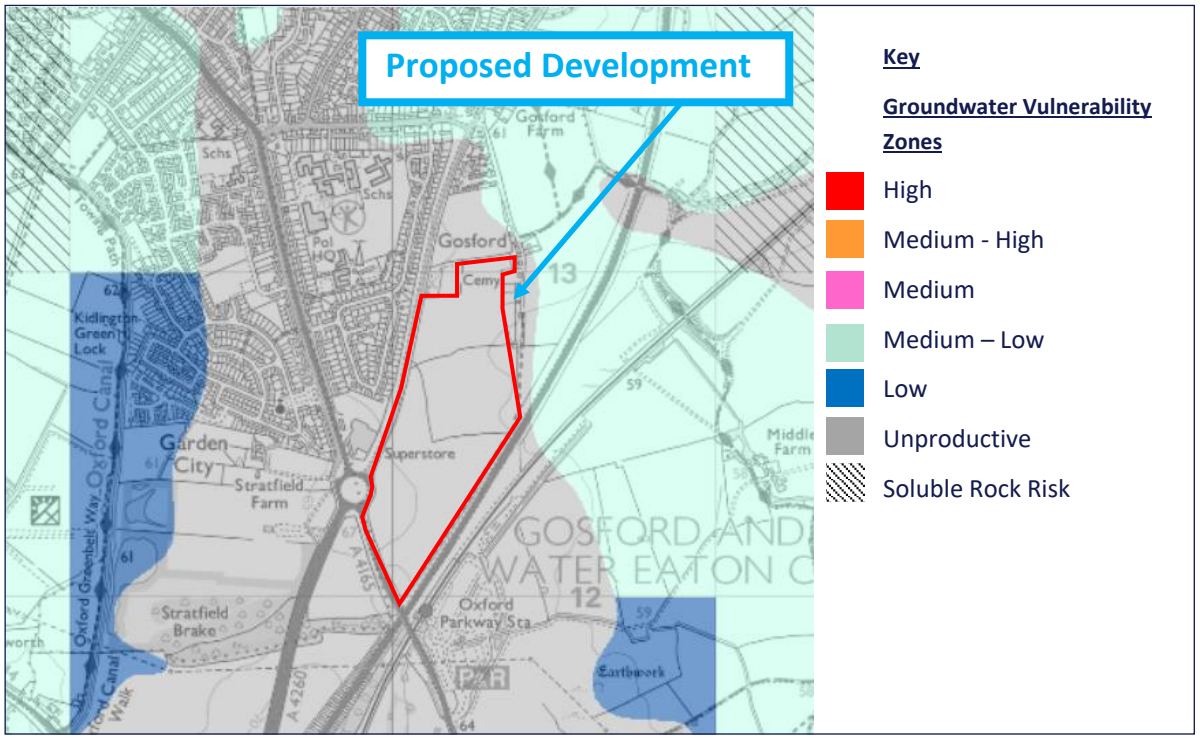


Figure 4-3: EA Groundwater Vulnerability Zones Map

4.10 It should be noted that the groundwater vulnerability mapping illustrated in Figure 7-3 of the Geo-Environmental Phase 1 Desk Study was taken from the Envirocheck. The Envirocheck mapping assesses the groundwater vulnerability risk for both Bedrock Geology and Superficial Deposits separately. Therefore. The risk surround the site in that mapping is shown as a "High Risk".

Drainage Network and FEH Catchment Data

4.11 The River Cherwell is located approximately 550m to the east of the site. Reference to the online Flood Estimation Handbook (FEH) shows the site to be the source of one of the tributaries of the River Cherwell flowing in a south east direction.

4.12 The site is shown to have limited development on site but located on the outskirts of the currently developed Kidlington. **Figure 4-4** illustrates the watercourse and feature described above.

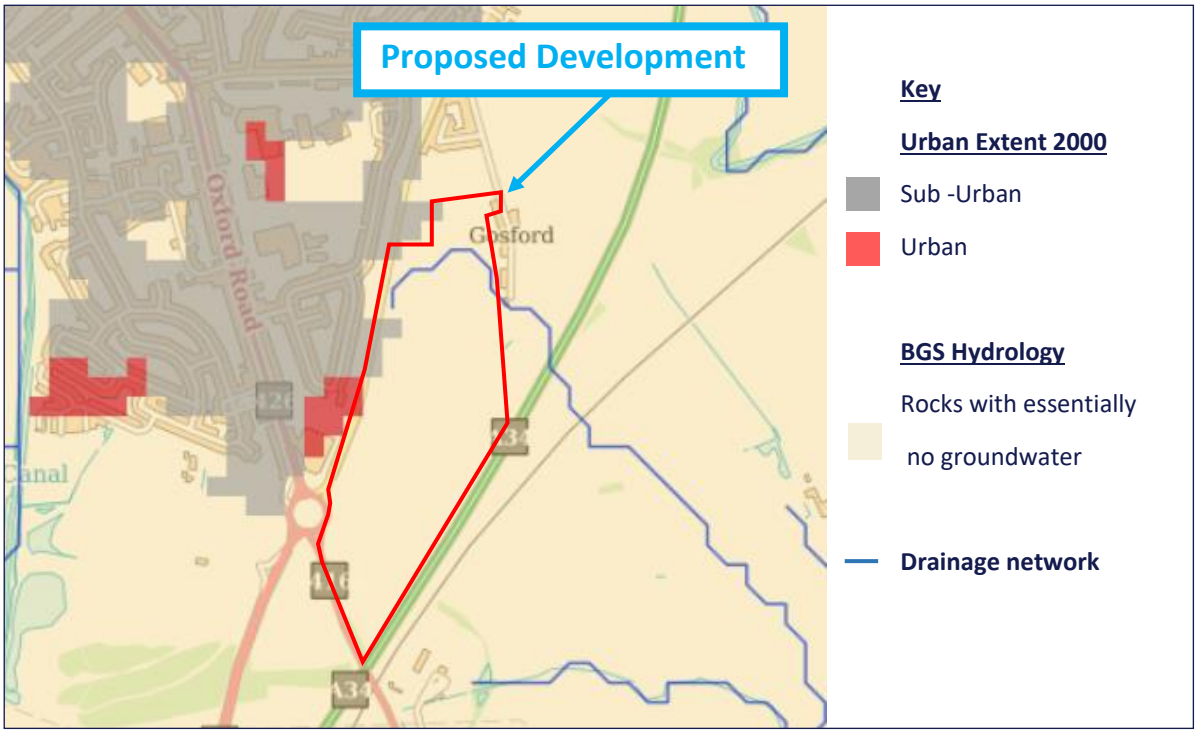


Figure 4-4: FEH web service – Urban Extent 2000 and BGS Hydrology and Drainage Network

5 Flood Risk

Flood Mechanisms

5.1 Having completed a site hydrological desk study and walk over inspection, the possible flooding mechanisms at the site are identified as follows in **Table 5-1**.

Mechanisms	Potential	Comment
Fluvial	N	The River Cherwell is located approximately 550m north east of the site and has the potential to impact upon the proposed development.
Coastal & Tidal	N	No tidal watercourses lie within an influencing distance of the proposed development.
Overland Flow (Pluvial)	Y	Surface water flood mapping illustrates a medium risk of surface water flooding along the western site boundary.
Groundwater	N	No groundwater flooding was identified within the SFRA and therefore the risk of same is considered low.
Sewers	N	No sewerage lies within the site.
Reservoirs, Canals etc	N	There are no nearby reservoirs or canals of the site.

Table 5-1: Flooding Mechanisms

5.2 Where potential risks are identified in **Table 6-1**, above, more detailed assessments have been completed and are outlined and discussed further within the following sections.

Fluvial Flooding

5.3 The Environment Agency's (EA) National Generalised Modelling (NGM) Flood Zones Plan indicates predicted flood envelopes of Main Rivers across the UK. In many circumstances, the NGM is based on basic catchment characteristic data and modelling techniques. Where appropriate, more accurate Section 105 / SFRM models are produced using more robust analysis techniques.

5.4 The mapping below on **Figure 5-1** shows that the site lies within Flood Zone 1; being an area of Low Probability of flooding and outside both the 1 in 100 (1% AEP) and 1 in 1,000 (0.1% AEP) year flood events.

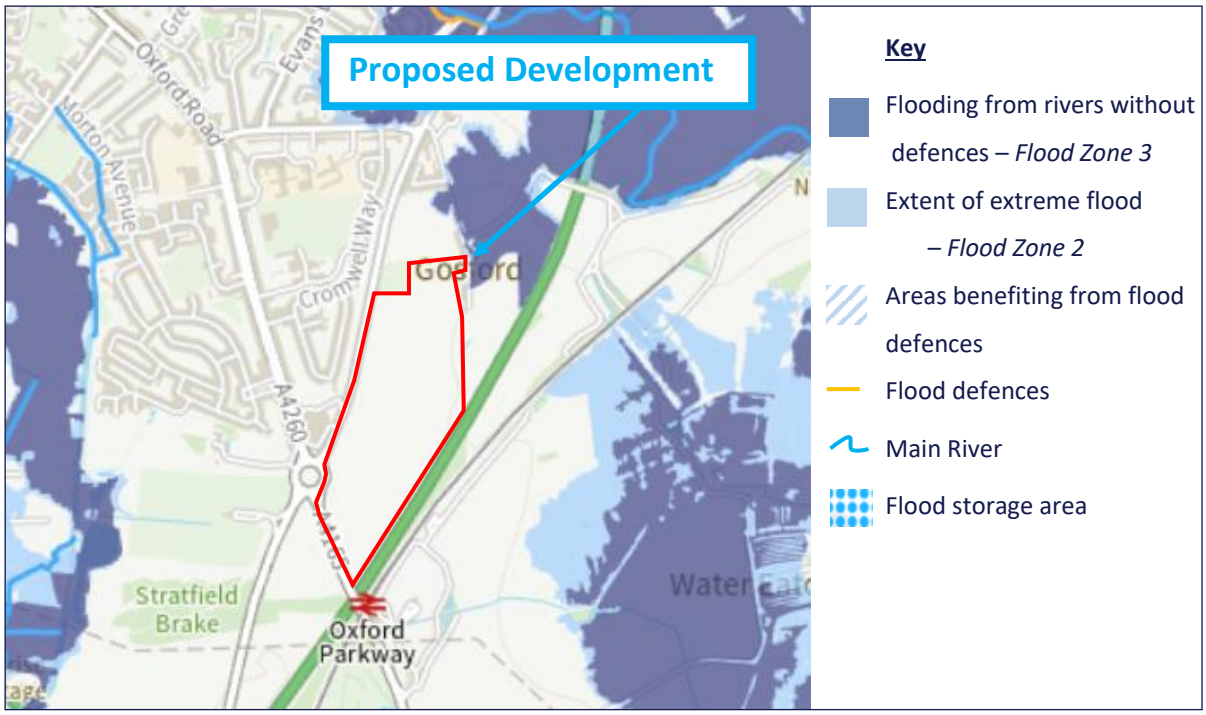


Figure 5-1: EA Flood Zone Plan showing 1 in 100 & 1 in 1,000 year floodplains

Surface Water Modelling

5.5 Surface water modelling is based on high level fluvial assessment models and terrain data. It is not based on observed or recorded flooding but is an extremely broad brush tool for seeing where water could collect given the topography.

Coastal Flooding

5.6 The site lies a significant distance from the nearest tidal watercourse and the coast. As such there is no risk of tidal or coastal flooding at this location.

Overland Flow (Pluvial)

5.7 Overland flow mechanisms result from the inability of unpaved ground to infiltrate rainfall or due to inadequacies of drainage systems in paved areas to accommodate flow directed to gullies, drainage downpipes or similar. In minor cases, local ponding may occur. In more extreme events, flows accumulate and may be conveyed across land following the topography.

5.8 The Environment Agency, in partnership with lead local flood authorities, produced a series of surface water flood maps for many parts of the UK.

5.9 **Figure 5-2**, illustrates areas of low to high risk from surface water flooding:

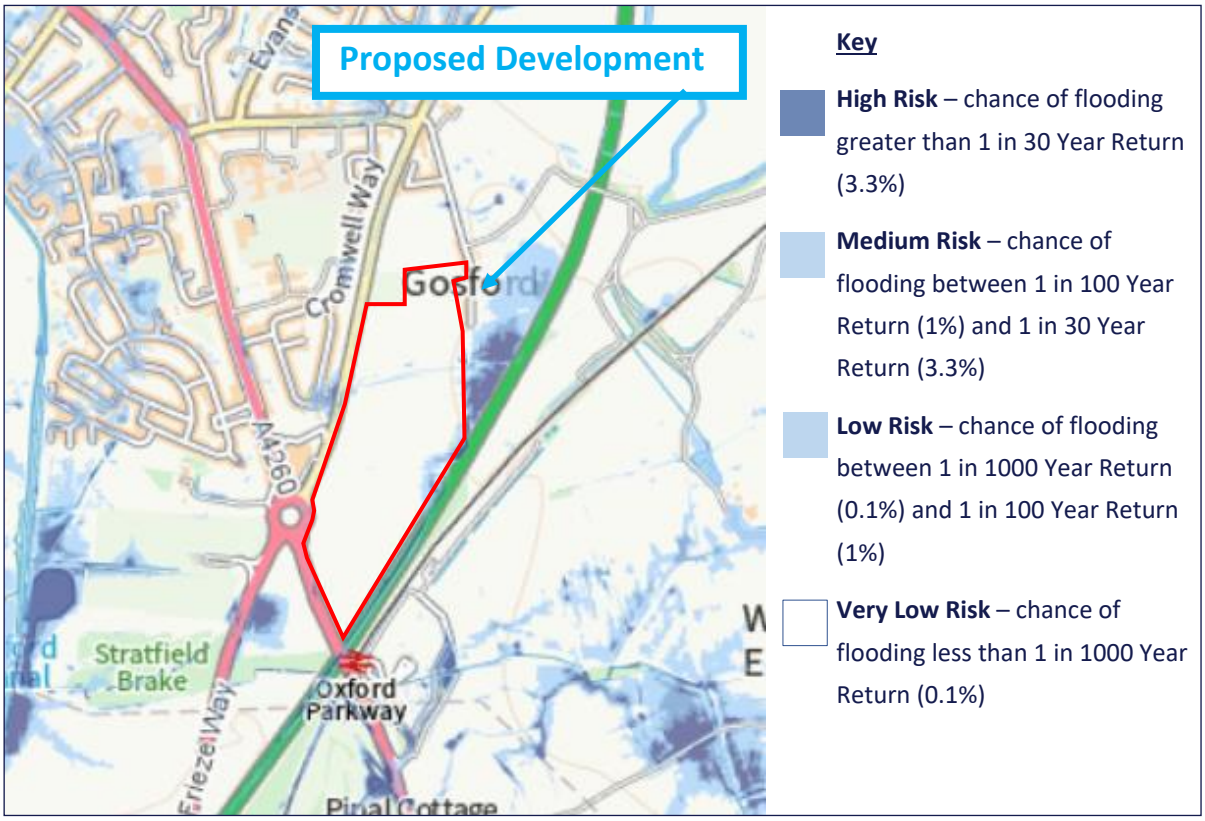


Figure 5-2: EA Long Term Flood Risk Maps – Flood risk from Surface Water (Gov.Uk website)

5.10 The mapping above identifies that most of the site has a very low risk of surface water flooding. However, a small area in the east is shown to have a medium to high risk from surface water flooding.

5.11 Initial investigations suggest that the risk of overland flow relates primarily to the topography of the site; low areas of the site naturally store water limiting the surface runoff in concentrated areas. As part of the development, the topography will be altered, providing a rationalised surface for water runoff.

5.12 Recognising the risk of overland flow mechanisms, published guidance in the form of the Design and Construction Guidance for Foul and Surface Water Sewers and the Environment Agency document Improving the Flood Performance of New Buildings: Flood Resilient Construction et al advocate the design of developments that implement infrastructure routes through the development that will safely convey flood waters resulting from sewer flooding or overland flows away from buildings and along defined corridors. Further to protect the Proposed Development, current good practice measures defined by guidance will be incorporated. However, given the nature of the development this is unlikely to be onerous or to have any material effect on layout.

5.13 Given the baseline site characteristics and further mitigating measures to be implemented residual flood risk from an overland flow mechanism is considered of a low probability.

Groundwater

5.14 Groundwater flooding is characterised by low-lying areas often associated with shallow unconsolidated sedimentary aquifers which overly non-aquifers. These aquifers are reported to be susceptible to flooding,

especially during the winter months, due to limited storage capacity.

5.15 Groundwater relating to flooding is fortunately quite rare, although where flooding is present, persistent issues can arise that are problematic to resolve. Such mechanisms often develop due to construction activities that may have an unforeseen effect on the local geology or hydrogeology.

5.16 DEFRA Flood Risk Maps show that the site lies within the unproductive aquifer, therefore low probability of flood risk of ground water flooding is identified at the development site.

5.17 Positive drainage systems incorporated into the Proposed Development will further reduce the risk as a result of permeable pipe bedding materials and filter drains incorporated within elements of the built development.

5.18 Given the baseline site characteristics and further mitigating measures to be implemented, residual flood risk from a ground water mechanism is considered to be of a low probability.

Sewerage Systems

5.19 Flooding related to sewerage systems is a result of there being insufficient capacity within an existing sewerage system (combined and surface water sewers) or from there being a blockage within the system.

5.20 Initial investigations with Thames Water provide no evidence of present or historic sewer flooding at the site.

5.21 The SFRA investigated flooding from sewers by collecting historic flooding incidents data from Thames Water. Thames Water identified between 25 and 30 incidents within the surrounding area, between 2006 and 2016.

5.22 Positive drainage measures incorporated on site, coupled with sustainable drainage systems (SuDS) will ensure that no increase in surface water will result from the site. Flood risk associated with sewer flooding is therefore considered to be a low probability.

Artificial Water Bodies - Reservoirs & Canals

5.23 Non-natural or artificial sources of flooding comprises of reservoirs, canals and lakes where water is retained above the natural ground level. However unlikely, reservoirs, canals and other artificial sources have a potential to cause flooding due to the release of large volumes of water, resulting from a dam or bank failure.

5.24 Within Kidlington town there are no canals and one major reservoir in Upper Buddington which is located approximately >40km north of the site.

5.25 The Environment Agency has produced mapping to indicate a worst-case scenario of flooding that would be caused, as a result of unlikely structural failure or damage of a reservoir. The site is shown to lie a considerable distance from the potential maximum extent of flooding from Upper Buddington Reservoir.

Summary

5.26 In terms of fluvial flood risk, the site lies within Flood Zone 1 with low probability of flood risk. Assessment of

other potential flooding mechanisms shows the land to have a low probability of flooding from groundwater and from sewer flooding.

5.27 The majority of the site lies within a very low probability of overland flow, with a small region in the south east being a medium to high flood risk.

5.28 In accordance with the above, the following FRA guidance is provided within the Cherwell SFRA:

"The Level 1 SFRA SuDS map illustrates that due to the underlying geological composition and groundwater vulnerability, infiltration SuDS techniques are unlikely to be suitable and development proposals for this area should seek to limit surface water runoff through the incorporation of attenuation SuDS techniques."

5.29 Accordingly, the Proposed Development land is in a preferable location for development when appraised in accordance with the NPPF Sequential Test and local policy.

Objectives

5.30 The key development objectives that are recommended in relation to flooding are:

- Work collaboratively with the Environment Agency to identify potential flooding.
- Compliance with the Design and Construction Guidance for Foul and Surface Water Sewers and EA guidance in relation to flood routing through the Proposed Development in the event of sewer blockages.

6 Storm Drainage

Background

6.1 As the site is currently greenfield, it is thought that storm water currently drains in a north-east direction towards an existing open channel watercourse.

SuDS Components

6.2 It is proposed to implement a SuDS scheme consistent with local and national policy at the proposed development.

6.3 At the head of the drainage network, across the site, source control measures could be implemented to reduce the amount of run-off being conveyed directly to piped drainage systems.

6.4 The nature of source control measures to be implemented will need to remain flexible, providing each house builder with a 'toolkit' of options to reach an agreed target for peak discharge reduction and water treatment.

6.5 **Table 6-1** is an extract of Table 7.1 from the CIRIA SuDS Manual C753 which outlines a number of options available.

Component Types	Description	Collection Mechanism	Design Criteria					
			Water Quantity			Water Quality	Amenity	Biodiversity
			Peak Runoff Rate	Runoff Volumes				
				Small Events	Large Events			
Rainwater Harvesting Systems	Systems that collect runoff from the roof of a building or other paved surface for use	P		●	●		●	
Green Roofs	Planted soil layers on the roof of buildings that slow and store runoff	S	○	●		●	●	●
Infiltration Systems	Systems that collect and store runoff, allowing it to infiltrate into the ground	P	●	●	●	●	●	●
Proprietary Treatment System	Subsurface structures designed to provide treatment of runoff	P				●		
Filter Strips	Grass strips that promote sedimentation and filtration as runoff is conveyed over the surface	L		●		●	○	○

Filter Drains	Shallow stone filled trenches that provide attenuation, conveyance and treatment of runoff	L	●	○		●	○	○
Swales	Vegetated channels (sometimes planted) used to convey and treat runoff	L	●	●	●	●	●	●
Bioretention Systems	Shallow landscaped depressions that allow runoff to pond temporarily on the surface, before filtering through vegetation and underlying soils	P	●	●	●	●	●	●
Trees	Trees within soil-filled tree pots, tree planters or structural soils used to collect, store and treat runoff	P	●	●		●	●	●
Pervious Pavements	Structural paving through which runoff can soak and subsequently be stored in the sub-base beneath, and/or allowed to infiltrate into the ground below	S	●	●	●	●	○	○
Attenuation Storage Tanks	Large, below ground voided spaces used to temporarily store runoff before infiltration, controlled release or use	P	●					
Detention Basins	Vegetated depressions that store and treat runoff	P	●	●		●	●	●
Ponds and Wetlands	Permanent pools of water used to facilitate treatment runoff – runoff can also be stored in an attenuation zone above the pool	P	●			●	●	●

Table 6-1: Ciria Guidance Table 7.1 (SuDS Component Delivery of Design Criteria)

*** Key**

P - Point, L - Lateral, S – Surface

● Likely Valuable Contribution ○ Some Potential Contribution to Delivery of Design Criterion **T**

Drainage Hierarchy

6.6 The following paragraphs in this section outline the proposed drainage strategy to meet national and local design requirements and guidance.

6.7 Current guidance[1] requires that new developments implement means of storm water control, known as SuDS (Sustainable Drainage Systems), to maintain flow rates discharged to the surface water receptor at the pre-development 'baseline conditions' and improve the quality of water discharged from the land.

6.8 When appraising suitable storm water discharge options for a development site, Part H of the Building Regulations 2002 (and associated guidance) provides the following search sequence for identification of the most appropriate drainage methodology.

"Rainwater from a system provided pursuant to sub-paragraphs (1) or (2) shall discharge to one of the following, listed in order of priority -

a) an adequate soakaway or some other adequate infiltration system; or where that is not reasonably practicable,

b) a watercourse; or where that is not reasonably practicable,

c) a sewer. "

6.9 Dealing with the search order in sequence:

a) Source control systems treat water close to the point of collection, in features such as soakaways, porous pavements, infiltration trenches and basins. The use of same can have the benefit of discharging surface water back to ground rather than just temporarily attenuating peak flows before discharging it to a receiving watercourse or sewer.

6.10 As source control measures generally rely upon the infiltration of surface water to ground, it is a prerequisite that the ground conditions are appropriate for such. Site ground investigations specific to flood risk have yet to be completed. However, published geology suggests the presence of potentially impermeable formations within the site.

6.11 Ground investigation have been completed within the cemetery that bounds the north of the Site. Investigations here determined that there was not any infiltration across the site for the cemetery extension and positive land drainage was required. The results of this investigation was confirmed by the Parish Council and will be provided upon receipt.

6.12 While the ground formations may not be possible for a wholesale infiltration-based drainage strategy, where subsequent investigations show infiltration is viable locally to work, this may be incorporated into the design.

6.13 As such, and for this assessment at outline stage, source control measures will therefore be primarily restricted to detention and conveyance systems placed close to source.

[1] NPPF, CIRIA C522, C609, C753 et al.

b) Next in the search sequence, defined by Part H, is discharge to a watercourse or suitable receiving water body. Where coupled with appropriate upstream attenuation measures, this means of discharge can provide a sustainable drainage scheme that ensures that peak discharges and flood risk in the receiving water body are not increased.

6.14 Two existing channels cross the proposed development flowing in an easterly direction into a wider drainage network that flows adjacent to the site boundary. This network then joins a tributary of the River Cherwell. These identified watercourses represents an appropriate receptor storm water discharge, having the potential to receive flows from the proposed development once restricted to the pre-existing 'greenfield' rates run-off.

c) Last in the search sequence is discharge to a sewer. In the context of SuDS this is the least preferable scheme as it relies on 'engineered' methods to convey large volumes of water from development areas, has a higher likelihood of flooding due to blockage and provides less intrinsic treatment to the water.

6.15 Thames Water records will be needed to confirm the presence of any public combined, storm and foul sewers in the surrounding area that could be employed should the need arise.

6.16 **Table 6-2** outlines which options will be used within the outline application and which will be considered at reserved matters.

Component Types	To be Considered at Outline	To be Considered at Reserved Matters
Rainwater Harvesting Systems		
Green Roofs		
Infiltration Systems		✓ (following SI)
Proprietary Treatment System		
Filter Strips		
Filter Drains		
Swales	✓	✓
Bioretention Systems		
Trees		✓
Pervious Pavements		✓
Attenuation Storage Tanks		
Detention Basins	✓	✓
Ponds and Wetlands		

Table 6-2: Types of SuDS Components to be Considered

6.17 The search sequence outlined above indicates that the existing ditch network onsite is the most appropriate receptor of storm water from the proposed development, having the potential to employ source control measures and on-line SuDS to control peak discharges to no greater than the baseline conditions.

6.18 It is proposed to maintain the existing drainage regime by draining the proposed development to the existing ditches and watercourses within and adjacent to the site. Proposals have been developed to inform the strategic drainage network across the development. It is proposed that the drainage system for the site utilises a SuDS system as the primary storm water management scheme.

6.19 Accordingly, a plan showing the conceptual drainage masterplan for the site is contained within **Appendix A** as drawing 10669-DR-01 B.

6.20 Coupled with the storm water control benefits, the use of SuDS can also provide betterment on water quality. National guidance in the form of CIRIA 753 outlines that by implementing SuDS, storm water from the site can be polished to an improved standard thus ensuring the development proposals have no adverse effects on the wider hydrology.

7 Preliminary Drainage Proposals

Primary Drainage Systems (source control)

7.1 The common aims of a Primary Drainage System are:

- Reduction in peak discharges to the agreed site wide run-off rate from the development areas.
- Provide water quality treatment where appropriate

7.2 Preliminary assessment of the requirements for storm drainage have been based on the following criteria as shown in **Table 7-1**.

Criteria	Measure/Rate/Factor
Application Site Area	32.13 ha
Developed Area	13.80 ha
Landscaped Area	18.33 ha
Impermeability - Residential	0.55
Sewer design return period[2]	1 in 1 year
Sewer flood protection[2]	1 in 30 years
Fluvial / Development flood protection [1]	1 in 100 years
M5-60	20.00
Ratio r	0.400
Minimum cover to sewers [1]	1.2 m
Minimum velocity [1]	1.0 m/sec
Pipe ks value [1]	0.6 mm
Allowance for climate change [3]	40%

Table 7-1: Drainage Criteria and Measure

Detention Basins

7.3 To date no ground investigation (SI works) works have been completed. Full SI works will be completed at reserved matters.

[2] Design and Construction Guidance for Foul and Surface Water Sewers
[3] NPPF requirements for residential development

7.4 National policy[1] requires that new developments control the peak discharge of storm water from a site to the baseline, undeveloped, site conditions. Over very large development areas, the baseline rate of run-off is normally estimated using the FEH methodologies. However, Paragraph 3.1.2 of the FEH guidance states:

7.5 "The frequency estimation procedures can be used on any catchment, gauged or ungauged, that drains an area of at least 0.5km2. The flood estimation procedures can be applied on smaller catchments only where the catchment is gauged and offers simple flood peak or flood event data".

7.6 On undeveloped and ungauged catchments of less than 0.5km2 in area, it is correct to complete baseline site discharge assessments using the nationally accepted IoH124 methodology for small rural catchments. Local policy is to employ IoH124 in a manner set out by CIRIA C697. This methodology requires that, for catchments of less than 50ha, the IoH assessment is completed for a 50ha area with the results linearly interpolated to determine the flow rate value based on the ratio of the development to 50ha.

7.7 The baseline IoH run-off rates are shown on **Table 7-2** below:

Event	IoH 124 (32.13ha)	IoH 124 Scaled to 1ha
1 in 1 year (l/s)	67.48	2.10
Qbar (l/s)	79.48	2.47
1 in 100 year (l/s)	253.54	7.89

Table 7-2: IoH124 baseline discharge rates

7.8 In order to determine the permitted rates of run-off from the development, the future impermeable catchment areas must be derived. This has been based on a BCL measured ratio from previous projects. Calculations below show these ratios and areas and how these correlate to the rates of discharge.

7.9 The calculations for this are shown in **Table 7-3** below:

Catchment	Land Use	Developable Area (ha)	Impermeable Area (ha)	Urban Creep (10%)	Existing 100 Year Run-off (l/s)	Proposed 100 Year Run-off (l/s)
A	Residential	3.90	2.15	2.36	18.62	5.84
B	Residential	6.00	3.25	3.67	28.96	9.08
		9.90	**5.40**	**6.03**	**47.58**	**14.92**

Table 7-3: Run-off calculation

7.10 Using these methods, development at the site will comply with the requirements set out in paragraph 9 of the Technical Guide to the National Planning Policy Framework (NPPF), with the discharge of surface water from the proposed developments not exceeding that of the existing greenfield sites, thus ensuring that there is no material increase in the flood risk to surrounding areas.

7.11 Assessments have thereafter been completed to determine the characteristics of proposed SuDS features to be situated within the development. Best practice methods have been employed by performing detention routing calculations for both the 1 in 1 and 1 in 100 years + 40% climate change.

7.12 The summary calculations are contained in **Appendix B.**

Catchment A

7.13 Calculations demonstrate that storm water detention storage extending to maximum 1,903m^3 will be required to attenuate storm water discharges from the site during the critical 1 in 100 year event storm. This will limit the peak discharges to 5.84l/s, being equivalent to the mean annual storm (Qbar), estimated by the IoH124 calculations above, representing a circa 69% reduction on peak greenfield rates. **Table 7-4**, below summarises the overall detention requirements.

Catchment Area (ha)	Impermeable Area (ha)	1 in 100 Year Run-off (l/s)	Detention Volume for 1 in 100 Year Event (m^3)
3.90	2.36	5.84	1,903

Table 7-4: Summary run-off & detention assessment output

Catchment B

7.14 Calculations demonstrate that storm water detention storage extending to maximum 2,970m^3 will be required to attenuate storm water discharges from the site during the critical 1 in 100 year event storm. This will limit the peak discharges to 9.08l/s, being equivalent to the mean annual storm (Qbar), estimated by the IoH124 calculations above, representing a circa 69% reduction on peak greenfield rates. **Table 7-5**, below summarises the overall detention requirements.

Catchment Area (ha)	Impermeable Area (ha)	1 in 100 Year Run-off (l/s)	Detention Volume for 1 in 100 Year Event (m^3)
6.00	3.67	9.08	2,970

Table 7-5: Summary run-off & detention assessment output

7.15 In accordance with legislative requirements, the detention proposals have been assessed for the potential effects of climate change. The 1 in 100 year (1% AEP) return events have been modelled for 40% climate change (including peak rainfall intensity). Calculations for the climate change scenarios are contained within the Appendix. Climate change assessments show each detention feature to perform adequately by retaining the additional flows within the system without overflow.

7.16 A hydro-brake will be provided on the detention features, at a level above the 1 in 100 year + 40% flood level to allow more extreme event flows to safely be conveyed away from properties, while at the same time not increasing flood risk to surrounding areas, in line with current good practice recommendations. The detailed design stage will provide further detail into the positioning of overflows and direction of flow.

7.17 The proposed strategic drainage masterplan is shown illustratively on drawing 10669-DR-01 B contained in

Appendix A.

Summary

7.18 A strategy for storm drainage at the site has been developed to meet both national and local policy. The above options outline the viability of the site to employ means of drainage to comply with NPPF guidance, together with Cherwell Council and other national and local guidance.

7.19 The development drainage system will manage storm water by way of a SuDS management train and ensure peak discharges from the developed land is not increase from the appraised baseline rates. The system will also provide to maintain the quality of water discharged from the development.

Objectives

7.20 The key objectives for the site drainage will be:

- Implementation of a sustainable drainage scheme in accordance with current national and local policy together with principles of good practice design.
- Control of peak discharges from the site to a rate commensurate with the baseline conditions.
- Development of storm water management proposals that maintain water quality and biodiversity of the site.
- Implementation of the storm water management system prior to first use of the site.

8 SuDS Management

Water Quality

8.1 Impermeable surfaces collect pollutants from a wide variety of sources including cleaning activities, wear from car tyres, vehicle oil and exhaust leaks and general atmospheric deposition (source: CIRIA C609). The implementation of SuDS in development drainage provides a significant benefit in removal of pollutant from development run-off.

8.2 The SuDS Manual C753 describes a 'Simple Index Approach' for assessing the pollution risk of surface run-off to the receiving environment using indices for likely pollution levels for different land uses and SuDS performance capabilities.

8.3 CIRIA document C753 Table 26.2, as shown in **Table 8-1** below, indicates the minimum treatment indices appropriate for contributing pollution hazards for different land use classifications. To deliver adequate treatment, the selected SuDS components should have a total pollution mitigation index (for each contaminant type) that equals or exceeds the pollution hazard index.

Land Use	Pollution Hazard Level	Total suspended solids (TSS)	Metals	Hydro-carbons
Residential roofs	Very Low	0.2	0.2	0.05
Individual property driveways, residential car parks, low traffic roads (e.g. cul-de-sacs, home zones and general access roads) and non-residential car parking with infrequent change (e.g. schools, offices) i.e. < 300 traffic movements/day	Low	0.5	0.4	0.4
Other roofs (typically commercial/ industrial roofs)	Low	0.3	0.2 (up to 0.8 where there is potential for metals to leach from the roof)	0.05

Table 8-1: **CIRIA 753 Table 26.2 Pollution Hazard Indices**

8.4 For a residential type development, roof water requires a very low treatment of 0.2 for total suspended solids, 0.2 for heavy metals and 0.05 for hydrocarbons, and run-off from low traffic roads such as cul-de-sacs and individual property driveways requires low treatment of 0.5 for total suspended solids, 0.4 for heavy metals and 0.4 for hydrocarbons.

8.5 To provide the correct level of treatment, an assessment needs to be made of the mitigation provided by each SuDS feature. Table 26.3 of The SuDS Manual CIRIA document C753 shown as **Table 8-2** for discharges to surface waters and groundwater respectively indicate the treatment mitigation indices provided by each SuDS feature.

Type of SuDS component	Total suspended solids (TSS)	Metals	Hydro-carbons
Swale	0.5	0.6	0.6
Detention basin	0.5	0.5	0.6
Proprietary treatment systems	These must demonstrate that they can address each of the contaminant types to acceptable levels for frequent events up to approximately the one in 1-year return period event, for inflow concentrations relevant to the contributing drainage area.		

Table 8-2: CIRIA 753 Table 26.3 SuDS Mitigation Indices for discharges to surface waters.

8.6 Where more than one mitigation feature is to be used, CIRIA guidance states that the total mitigation index shall be calculated as follows:

Total SuDS mitigation index = Mitigation Index 1 + 0.5 x Mitigation Index 2

8.7 At present, the site and surrounding area does not benefit from any additional measures of stormwater treatment.

8.8 Due to the need to provide wider sustainability benefits and view the development at a strategic level, SuDS will be implemented to passively treat run off from the development so as to have a positive impact on the surrounding natural environment.

8.9 The site will employ SuDS features, such as formal swales and detention basins. These are widely accepted to be of high pollutant removal efficiency (CIRIA 609). This provides for at least two stages of treatment onsite. Coupled with this however, the unknown watercourse should also be seen as an additional stage of treatment as the sedimentation process is not limited to artificial drainage systems but is taken from the natural processes observed within the water cycle. This gives 2-3 stages of treatment, providing an extensive system by which to effectively decrease pollutant load within stormwater run-off.

8.10 As the site is not presently served by any means of storm water treatment mechanisms, by providing the afore mentioned SuDS within the proposed development it will be possible to maintain present water quality in the area and thus the development can be seen to be having no significant environmental impact in relation to water.

Exceedance Flows

8.11 Careful regard has to be made in respect of potential exceedance flows, being events that are more extreme than current design criteria. Various national guidance has been published on the matter of exceedance flows and measures that should be incorporated into a development to ensure the safety of occupiers and those using the infrastructure.

8.12 The principal aim is to direct any exceedance flows away from properties and along defined corridors. At a local level, this may mean water being conveyed along a length of highway, as long as the predicted flow depths and velocities are acceptable. More strategically, the implementation of conveyance corridors is important in avoiding deep and high velocity flows that present a high risk. The drainage system being

promoted for Kidlington provides a good opportunity to incorporate exceedance flow routes into the design.

Implementation Proposals

8.13 The conceptual drainage proposals have been developed in a manner that will allow the site wide system to be designed to encourage passive treatment of discharged flows and to improve the water quality by removing the low-level silts, oils which could be attributed to track/parking area run off of this nature. Final design will provide for appropriate geometry and planting to maximise this benefit.

8.14 The storm water management features will be constructed and operational prior to the first use of the site, derived on a phase-by-phase requirement.

8.15 It has previously been the case that the functionality of the storm water management system would be ensured by ongoing maintenance, completed by the Local Authority, Drainage Authority, or a private maintenance company as appropriate. It is proposed that, for this development, a private maintenance company will be appointed to carry out the maintenance regime below in **Table 8-3.**

8.16 It is usual for the following maintenance regime to be implemented:

Frequency	Operation
Post major storm events	Inspection and removal of debris.
Every two months	Grass mowing (growing season) & litter removal.
Annual	Weeding & vegetation maintenance. Minor swale clearance. Sweeping of
2 years	Tree pruning.
5-10 years	Desilting of channels. Remove silt around inlet and outlet structures.
15-20 years	Major vegetation maintenance and watercourse channel works.

Table 8-3: Framework maintenance of detention / retention system

8.17 The conceptual drainage masterplan proposals outlined in this report will be used for final drainage design and detailing. The storm water management system will be constructed and operational in full prior to first use of the relevant phase of development.

9 Foul Drainage

Background

9.1 A copy of Thames Water sewerage network records confirm that there are no adopted combined, storm, and foul sewers passing through the site. A copy of the records can be seen in **Appendix D**.

Design Criteria / Network Requirements

9.2 Peak design discharges have been calculated based on the current development criteria as described in Section 2 of this report and for the following:

Domestic peak (peak)	=	*4,000 litres / dwelling / day*

9.3 Assessed in accordance with the Design and Construction Guidance for Foul and Surface Water Sewers requirements, the development will have a design peak discharge of approximately 10.64l/s.

Network Requirements / Options

9.4 Discussions with Thames Water will be needed in order to confirm a connection from the development into their existing foul drainage infrastructure surrounding the site without the need for off-site reinforcements.

Treatment Requirements

9.5 Water companies have a statutory obligation through the Water Industry Act 1991, 2003 et al., to provide capital investment in strategic treatment infrastructure to meet development growth. This investment planning is managed and regulated by OFWAT through the Asset Management Plan (AMP) process. The five yearly cyclical process requires that water companies allocate finances to a range of strategic projects to meet their statutory obligations.

9.6 Where development programming requirements necessitate the reinforcement of facilities ahead of allocation in an AMP period, mechanisms are available to ensure the infrastructure can be delivered in a timely fashion, to meet the development programme.

Implementation Proposals

9.7 The proposed drainage network across the site will be designed to current Design and Construction Guidance for Foul and Surface Water Sewers standards, employing a point of connection agreed with Thames Water. The system will be offered for the adoption of Thames Water under S104 of the Water Industry Act 1991.

Summary

9.8 A site drainage strategy has been developed that meets with current regulatory requirements by discharging drainage to a sewerage network with capacity to accommodate the flows.

9.9 Once development is complete, the network conveying flows from the site will be adopted by Thames Water and be maintained as part of their statutory duties.

Objectives

9.10 The key development objectives required for the site drainage scheme are:

- Implementation of a drainage scheme to convey water to the local Thames Water network which is designed and maintained to an appropriate standard.

10 Summary

10.1 This FRA has been produced alongside the policy requirements set out by Oxfordshire council and has identified no prohibitive engineering constraints in developing the proposed site for the development.

10.2 The proposed FRA SuDS strategy has been designed in accordance with policies ESD 6,7 &8 of the local plan, guidance provided within the Draft for Consultation and the local plan Partial Review.

10.3 Policy ESD 6 requires that development is designed using a sequential approach, efforts should be made to restore and safeguard floodplains while encouraging amenity and biodiversity and surface water should be managed on site.

10.4 Built development is located within the lowest risk areas of flooding, which is reviewed in Chapter 5 and Chapters 6 through 8 describes how SuDS have been used throughout the development and what betterment they will provide to the site.

10.5 Policy ESD 7 is to ensure that all new development provides SuDS. Swales and detention basins have been proposed across the site in order to convey, store and discharge surface water to QBAR. The drainage hierarchy to determine the most appropriate discharge location is outlined in paragraphs 6.8 – 6.15. A outline maintenance schedule has also been provided at paragraph 8.16.

10.6 Policy ESD 8 is to maintain water quality and resources within new development. The FRA (Chapter 8: SuDS Management) has addressed how the use of SuDS will provide a surface water treatment train throughout the development. Chapter 9: Foul Drainage has determined that Water companies have a statutory obligation to ensure that local infrastructure can accommodate the flow from the site.

10.7 The Partial Review requires the development to be designed in accordance with the policies in the Local Plan (described above). The review also covers the need for development to be located within flood zone 1, SuDS to accommodate storage for climate change and discharge to no more than existing greenfield runoff rates and that wastewater will be accepted into the existing network.

10.8 Assessment of fluvial flood risk shows the land to lie within Flood Zone 1 and hence be a preferable location for residential development when considered in the context of the NPPF Sequential Test.

10.9 Assessment of other potential flooding mechanisms shows the land to have a low probability of flooding from overland flow, groundwater and sewer flooding.

10.10 Storm water discharged from development will be disposed of by way of SuDS into the existing ditch within the site boundaries. The proposed SuDS have been designed to accommodate the 1 in 100 year + 40% climate change storm event and discharged to the existing greenfield runoff rates in accordance with Policy ESD7.

10.11 Foul water will discharge to the existing network, following formal confirmation and a pre-development enquired from Thames Water. This enquiry will also determine if any upgrade works will be required on the sewers or at the treatment plant in order to accommodate the capacity.

10.12 The site is fully able to comply with NPPF guidance together with associated local and national policy guidance.

11 Limitations

11.1 The conclusions and recommendations contained herein are limited to those given the general availability of background information and the planned usage of the site.

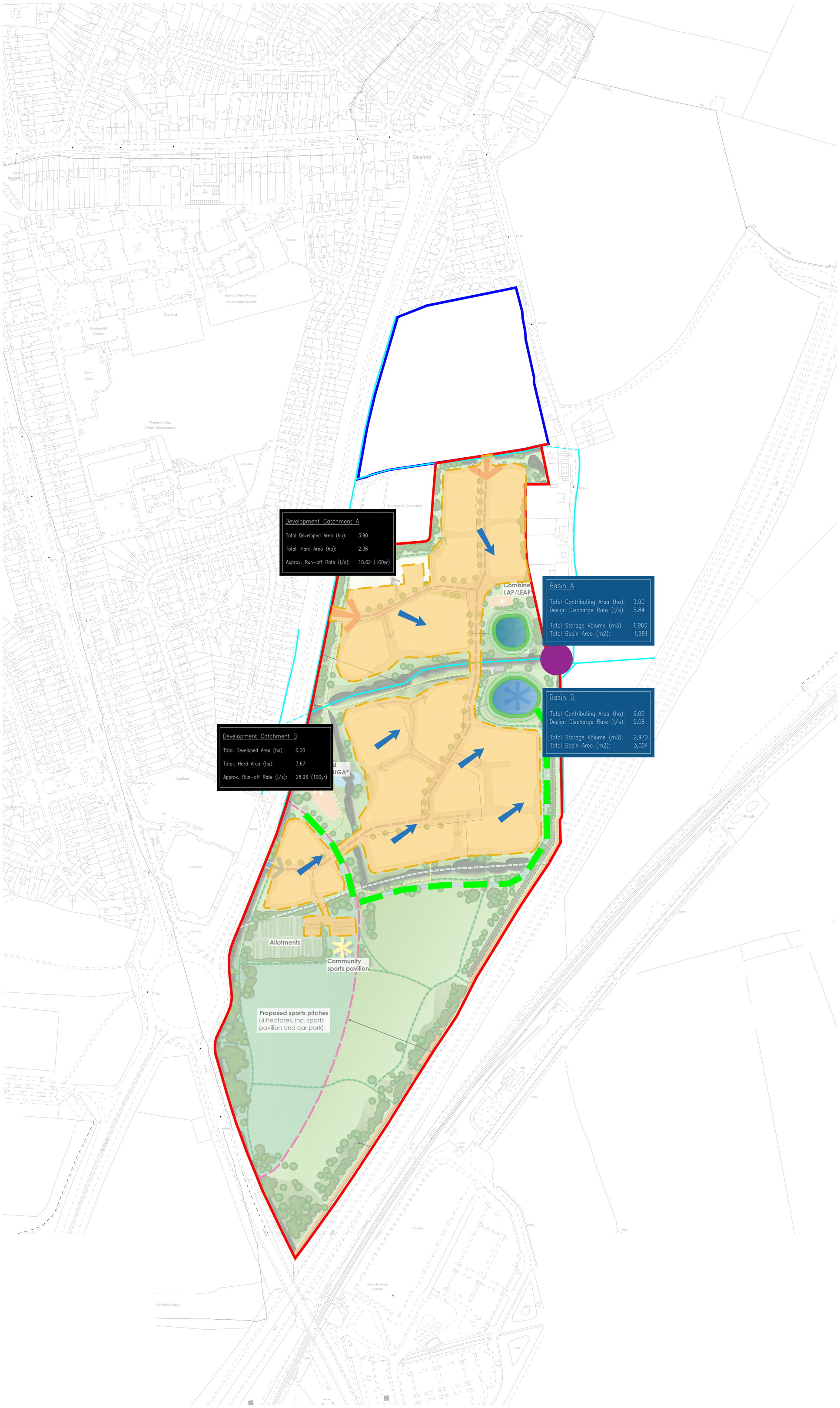
11.2 Third party information has been used in the preparation of this report, which Brookbanks, by necessity assumes is correct at the time of writing. While all reasonable checks have been made on data sources and the accuracy of data, Brookbanks accepts no liability for same.

11.3 The benefits of this report are provided solely to Barwood Development Securities Limited for the proposed development Kidlington, Oxfordshire only.

11.4 Brookbanks excludes third party rights for the information contained in the report.

Appendix A - Drainage Plan

Original Drawing Size A1



Construction Design and Management (CDM)
Key Residual Risks

Contractors entering the site should gain permission from the relevant land owners and/or principle contractor working on site at the time of entry. Contractors shall be responsible for carrying out their own risk assessments and for liaising with the relevant services companies and authorities. Listed below are Site Specific key risks associated with the project.

1) Overhead and underground services
2) Street Lighting Cables
3) Working adjacent to water courses and flood plain
4) Soft ground conditions
5) Working adjacent to live highways and railway line
6) Unchartered services
7) Existing buildings with potential asbestos hazards

NOTES:

1. Do not scale from this drawing.
2. All dimensions are in metres unless otherwise stated.
3. Brookbanks Consulting Ltd has prepared this drawing for the sole use of the client. The drawing may not be relied upon by any other party without the express agreement of the client and Brookbanks Consulting Ltd. Where any data supplied by the client or from other sources has been used, it has been assumed that the information is correct. No responsibility can be accepted by Brookbanks Consulting Ltd for inaccuracies in the data supplied by any other party. The drawing has been produced based on the assumption that all relevant information has been supplied by those bodies from whom it was requested.
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KEY:

- Red Line Boundary
- Blue Line Boundary
- Catchment Boundary
- Surface water flow direction
- Proposed SuDS Basin and Earthworks/ Maintenance Strip
- Existing Drainage Network
- Indicative Culvet/Pipe Locations
- Swale
- Proposed Surface Water Pipe Network
- Identified Outfall Locations

B	Updated Masterplan	KM	DS	15.02.22
A	Updated Masterplan	KM	DS	12.01.22
-	First Issue	AM	KM	30.09.20

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Land at Gosford, Oxfordshire

Illustrative Surface Water Drainage Strategy

Status		Status Date
Draft		FEB 2022
Drawn	**Checked**	**Date**
KM	DS	29.09.20
Scale	**Number**	**Rev**
1:2500	10669-DR-01	B

0 50 100 150 200 250
METRES

UNTIL TECHNICAL APPROVAL HAS BEEN OBTAINED FROM THE RELEVANT LOCAL AUTHORITIES, IT SHOULD BE UNDERSTOOD THAT ALL DRAWINGS ARE ISSUED AS PRELIMINARY AND NOT FOR CONSTRUCTION. SHOULD THE CONTRACTOR COMMENCE SITE WORK PRIOR TO APPROVAL BEING GIVEN, IT IS ENTIRELY AT HIS OWN RISK.

Appendix B - IoH Greenfield Runoff Rates

Greenfield runoff rate estimation for sites

www.uksuds.com | Greenfield runoff tool

Calculated by:	Katherine Miller
Site name:	Kidlington
Site location:	Oxfordshire

This is an estimation of the greenfield runoff rates that are used to meet normal best practice criteria in line with Environment Agency guidance "Rainfall runoff management for developments", SC030219 (2013) , the SuDS Manual C753 (Ciria, 2015) and the non-statutory standards for SuDS (Defra, 2015). This information on greenfield runoff rates may be the basis for setting consents for the drainage of surface water runoff from sites.

Site Details

Latitude:	51.81013° N
Longitude:	1.27306° W
Reference:	4001797701
Date:	Sep 29 2020 15:28

Runoff estimation approach

IH124

Site characteristics

Total site area (ha): 32.13

Methodology

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

Soil characteristics

	Default	Edited
SOIL type:	3	3
HOST class:	N/A	N/A
SPR/SPRHOST:	0.37	0.37

Hydrological characteristics

	Default	Edited
SAAR (mm):	616	616
Hydrological region:	6	6
Growth curve factor 1 year:	0.85	0.85
Growth curve factor 30 years:	2.3	2.3
Growth curve factor 100 years:	3.19	3.19
Growth curve factor 200 years:	3.74	3.74

Notes

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

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

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

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

(3) Is SPR/SPRHOST ≤ 0.3?

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

Greenfield runoff rates

	Default	Edited
Q_{BAR} (l/s):	79.48	79.48
1 in 1 year (l/s):	67.56	67.56
1 in 30 years (l/s):	182.8	182.8
1 in 100 year (l/s):	253.54	253.54
1 in 200 years (l/s):	297.25	297.25

Appendix C - WinDES Detention Calculations

Summary of Results for 1 year Return Period

Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
15 min Summer	0.100	0.100	3.8	134.5	O K
30 min Summer	0.128	0.128	4.9	173.3	O K
60 min Summer	0.158	0.158	5.2	215.3	O K
120 min Summer	0.189	0.189	5.4	258.6	O K
180 min Summer	0.207	0.207	5.5	283.1	O K
240 min Summer	0.218	0.218	5.6	299.1	O K
360 min Summer	0.230	0.230	5.6	315.9	O K
480 min Summer	0.235	0.235	5.6	323.7	O K
600 min Summer	0.239	0.239	5.6	329.2	O K
720 min Summer	0.242	0.242	5.6	332.9	O K
960 min Summer	0.245	0.245	5.7	336.9	O K
1440 min Summer	0.244	0.244	5.7	335.6	O K
2160 min Summer	0.235	0.235	5.6	323.0	O K
2880 min Summer	0.222	0.222	5.6	305.0	O K
4320 min Summer	0.196	0.196	5.5	267.9	O K
5760 min Summer	0.173	0.173	5.3	235.7	O K
7200 min Summer	0.154	0.154	5.2	209.5	O K
8640 min Summer	0.139	0.139	5.0	188.9	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
15 min Summer	30.991	0.0	106.2	26
30 min Summer	20.215	0.0	144.6	40
60 min Summer	12.800	0.0	208.1	70
120 min Summer	7.942	0.0	261.3	126
180 min Summer	5.979	0.0	296.5	186
240 min Summer	4.882	0.0	323.7	244
360 min Summer	3.646	0.0	363.5	360
480 min Summer	2.956	0.0	393.2	422
600 min Summer	2.511	0.0	417.6	486
720 min Summer	2.199	0.0	438.4	550
960 min Summer	1.782	0.0	472.6	682
1440 min Summer	1.326	0.0	522.5	958
2160 min Summer	0.988	0.0	615.5	1368
2880 min Summer	0.800	0.0	664.0	1764
4320 min Summer	0.595	0.0	734.3	2548
5760 min Summer	0.483	0.0	812.6	3280
7200 min Summer	0.410	0.0	862.2	3968
8640 min Summer	0.359	0.0	903.6	4672

Summary of Results for 1 year Return Period

Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
10080 min Summer	0.128	0.128	4.9	173.8	O K
15 min Winter	0.112	0.112	4.3	150.6	O K
30 min Winter	0.143	0.143	5.1	194.4	O K
60 min Winter	0.178	0.178	5.4	242.1	O K
120 min Winter	0.213	0.213	5.5	291.5	O K
180 min Winter	0.233	0.233	5.6	320.0	O K
240 min Winter	0.246	0.246	5.7	338.9	O K
360 min Winter	0.261	0.261	5.7	360.0	O K
480 min Winter	0.268	0.268	5.7	369.6	O K
600 min Winter	0.270	0.270	5.7	373.6	O K
720 min Winter	0.272	0.272	5.7	375.7	O K
960 min Winter	0.273	0.273	5.7	377.6	O K
1440 min Winter	0.267	0.267	5.7	369.3	O K
2160 min Winter	0.250	0.250	5.7	344.0	O K
2880 min Winter	0.228	0.228	5.6	313.5	O K
4320 min Winter	0.187	0.187	5.4	255.9	O K
5760 min Winter	0.155	0.155	5.2	210.4	O K
7200 min Winter	0.132	0.132	5.0	178.5	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
10080 min Summer	0.322	0.0	936.7	5352
15 min Winter	30.991	0.0	121.4	26
30 min Winter	20.215	0.0	164.4	40
60 min Winter	12.800	0.0	234.7	68
120 min Winter	7.942	0.0	294.2	126
180 min Winter	5.979	0.0	333.6	182
240 min Winter	4.882	0.0	364.1	240
360 min Winter	3.646	0.0	408.5	352
480 min Winter	2.956	0.0	441.7	460
600 min Winter	2.511	0.0	468.9	560
720 min Winter	2.199	0.0	492.0	586
960 min Winter	1.782	0.0	530.1	736
1440 min Winter	1.326	0.0	584.9	1044
2160 min Winter	0.988	0.0	690.4	1480
2880 min Winter	0.800	0.0	745.0	1904
4320 min Winter	0.595	0.0	824.9	2680
5760 min Winter	0.483	0.0	911.0	3400
7200 min Winter	0.410	0.0	966.8	4040

Summary of Results for 1 year Return Period

Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
8640 min Winter	0.119	0.119	4.5	160.4	O K
10080 min Winter	0.109	0.109	4.2	146.7	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
8640 min Winter	0.359	0.0	1013.7	4760
10080 min Winter	0.322	0.0	1051.9	5448

Rainfall Details

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

Time Area Diagram

Total Area (ha) 2.360

Time From:	(mins) To:	Area (ha)	Time From:	(mins) To:	Area (ha)	Time From:	(mins) To:	Area (ha)
0	4	0.787	4	8	0.787	8	12	0.787

Model Details

Storage is Online Cover Level (m) 1.500

Tank or Pond Structure

Invert Level (m) 0.000

Depth (m)	Area (m²)	Depth (m)	Area (m²)
0.000	1328.0	1.500	1981.0

Hydro-Brake® Optimum Outflow Control

Unit Reference	MD-SHE-0110-5800-1200-5800
Design Head (m)	1.200
Design Flow (l/s)	5.8
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	110
Invert Level (m)	0.000
Minimum Outlet Pipe Diameter (mm)	150
Suggested Manhole Diameter (mm)	1200

Control Points	Head (m)	Flow (l/s)	Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	1.200	5.8	Kick-Flo®	0.755	4.7
Flush-Flo™	0.357	5.8	Mean Flow over Head Range	-	5.1

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	3.8	1.200	5.8	3.000	8.9	7.000	13.3
0.200	5.5	1.400	6.2	3.500	9.6	7.500	13.8
0.300	5.8	1.600	6.6	4.000	10.2	8.000	14.2
0.400	5.8	1.800	7.0	4.500	10.8	8.500	14.6
0.500	5.7	2.000	7.4	5.000	11.3	9.000	15.0
0.600	5.5	2.200	7.7	5.500	11.9	9.500	15.4
0.800	4.8	2.400	8.0	6.000	12.4		
1.000	5.3	2.600	8.3	6.500	12.9		

Summary of Results for 30 year Return Period

Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
15 min Summer	0.241	0.241	5.6	331.2	O K
30 min Summer	0.309	0.309	5.8	429.5	O K
60 min Summer	0.378	0.378	5.8	529.9	O K
120 min Summer	0.444	0.444	5.8	629.3	O K
180 min Summer	0.480	0.480	5.8	684.1	O K
240 min Summer	0.504	0.504	5.8	719.6	O K
360 min Summer	0.533	0.533	5.8	764.8	O K
480 min Summer	0.550	0.550	5.8	792.0	O K
600 min Summer	0.561	0.561	5.8	808.4	O K
720 min Summer	0.567	0.567	5.8	817.6	O K
960 min Summer	0.570	0.570	5.8	822.2	O K
1440 min Summer	0.561	0.561	5.8	808.8	O K
2160 min Summer	0.543	0.543	5.8	780.3	O K
2880 min Summer	0.521	0.521	5.8	746.8	O K
4320 min Summer	0.474	0.474	5.8	674.8	O K
5760 min Summer	0.428	0.428	5.8	604.8	O K
7200 min Summer	0.385	0.385	5.8	540.2	O K
8640 min Summer	0.345	0.345	5.8	482.0	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
15 min Summer	76.035	0.0	286.8	26
30 min Summer	49.499	0.0	370.2	41
60 min Summer	30.811	0.0	517.4	70
120 min Summer	18.615	0.0	624.6	130
180 min Summer	13.715	0.0	688.1	188
240 min Summer	10.995	0.0	732.6	248
360 min Summer	8.034	0.0	795.2	366
480 min Summer	6.428	0.0	837.4	486
600 min Summer	5.404	0.0	865.1	604
720 min Summer	4.687	0.0	881.1	722
960 min Summer	3.743	0.0	884.9	960
1440 min Summer	2.723	0.0	851.5	1214
2160 min Summer	1.979	0.0	1236.0	1576
2880 min Summer	1.577	0.0	1308.1	1968
4320 min Summer	1.143	0.0	1398.7	2772
5760 min Summer	0.910	0.0	1537.6	3576
7200 min Summer	0.762	0.0	1607.9	4336
8640 min Summer	0.659	0.0	1665.3	5104

Summary of Results for 30 year Return Period

Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
10080 min Summer	0.310	0.310	5.8	430.3	O K
15 min Winter	0.269	0.269	5.7	371.4	O K
30 min Winter	0.345	0.345	5.8	481.8	O K
60 min Winter	0.421	0.421	5.8	595.0	O K
120 min Winter	0.496	0.496	5.8	707.8	O K
180 min Winter	0.537	0.537	5.8	770.8	O K
240 min Winter	0.563	0.563	5.8	812.1	O K
360 min Winter	0.598	0.598	5.8	866.1	O K
480 min Winter	0.619	0.619	5.8	900.1	O K
600 min Winter	0.633	0.633	5.8	922.1	O K
720 min Winter	0.642	0.642	5.8	936.2	O K
960 min Winter	0.650	0.650	5.8	949.1	O K
1440 min Winter	0.645	0.645	5.8	940.2	O K
2160 min Winter	0.616	0.616	5.8	895.2	O K
2880 min Winter	0.586	0.586	5.8	847.6	O K
4320 min Winter	0.516	0.516	5.8	739.5	O K
5760 min Winter	0.446	0.446	5.8	632.1	O K
7200 min Winter	0.380	0.380	5.8	534.1	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
10080 min Summer	0.583	0.0	1710.0	5848
15 min Winter	76.035	0.0	321.2	26
30 min Winter	49.499	0.0	408.7	41
60 min Winter	30.811	0.0	579.7	70
120 min Winter	18.615	0.0	697.6	128
180 min Winter	13.715	0.0	766.2	186
240 min Winter	10.995	0.0	812.7	244
360 min Winter	8.034	0.0	872.8	360
480 min Winter	6.428	0.0	904.1	478
600 min Winter	5.404	0.0	913.6	592
720 min Winter	4.687	0.0	910.0	708
960 min Winter	3.743	0.0	893.9	934
1440 min Winter	2.723	0.0	854.0	1370
2160 min Winter	1.979	0.0	1381.2	1712
2880 min Winter	1.577	0.0	1458.9	2164
4320 min Winter	1.143	0.0	1540.4	3032
5760 min Winter	0.910	0.0	1722.6	3864
7200 min Winter	0.762	0.0	1801.8	4680

Summary of Results for 30 year Return Period

Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
8640 min Winter	0.322	0.322	5.8	448.7	O K
10080 min Winter	0.273	0.273	5.7	376.9	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
8640 min Winter	0.659	0.0	1866.9	5368
10080 min Winter	0.583	0.0	1918.7	6064

Rainfall Details

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

Time Area Diagram

Total Area (ha) 2.360

Time (mins) From:	To:	Area (ha)	Time (mins) From:	To:	Area (ha)	Time (mins) From:	To:	Area (ha)
0	4	0.787	4	8	0.787	8	12	0.787

Model Details

Storage is Online Cover Level (m) 1.500

Tank or Pond Structure

Invert Level (m) 0.000

Depth (m)	Area (m²)	Depth (m)	Area (m²)
0.000	1328.0	1.500	1981.0

Hydro-Brake® Optimum Outflow Control

Unit Reference	MD-SHE-0110-5800-1200-5800
Design Head (m)	1.200
Design Flow (l/s)	5.8
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	110
Invert Level (m)	0.000
Minimum Outlet Pipe Diameter (mm)	150
Suggested Manhole Diameter (mm)	1200

Control Points	Head (m)	Flow (l/s)	Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	1.200	5.8	Kick-Flo®	0.755	4.7
Flush-Flo™	0.357	5.8	Mean Flow over Head Range	-	5.1

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	3.8	1.200	5.8	3.000	8.9	7.000	13.3
0.200	5.5	1.400	6.2	3.500	9.6	7.500	13.8
0.300	5.8	1.600	6.6	4.000	10.2	8.000	14.2
0.400	5.8	1.800	7.0	4.500	10.8	8.500	14.6
0.500	5.7	2.000	7.4	5.000	11.3	9.000	15.0
0.600	5.5	2.200	7.7	5.500	11.9	9.500	15.4
0.800	4.8	2.400	8.0	6.000	12.4		
1.000	5.3	2.600	8.3	6.500	12.9		

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	0.428	0.428	5.8	605.2	O K
30 min Summer	0.551	0.551	5.8	793.1	O K
60 min Summer	0.674	0.674	5.8	986.9	O K
120 min Summer	0.793	0.793	5.8	1181.2	O K
180 min Summer	0.858	0.858	5.8	1289.3	O K
240 min Summer	0.899	0.899	5.8	1359.8	O K
360 min Summer	0.955	0.955	5.8	1455.2	O K
480 min Summer	0.992	0.992	5.8	1519.4	O K
600 min Summer	1.018	1.018	5.8	1564.5	O K
720 min Summer	1.036	1.036	5.8	1597.0	O K
960 min Summer	1.059	1.059	5.8	1638.0	O K
1440 min Summer	1.074	1.074	5.8	1664.8	O K
2160 min Summer	1.060	1.060	5.8	1639.0	O K
2880 min Summer	1.032	1.032	5.8	1590.6	O K
4320 min Summer	0.979	0.979	5.8	1497.7	O K
5760 min Summer	0.929	0.929	5.8	1410.5	O K
7200 min Summer	0.880	0.880	5.8	1326.9	O K
8640 min Summer	0.832	0.832	5.8	1245.5	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
15 min Summer	138.153	0.0	472.2	27
30 min Summer	90.705	0.0	490.6	42
60 min Summer	56.713	0.0	910.8	72
120 min Summer	34.246	0.0	931.3	130
180 min Summer	25.149	0.0	908.3	190
240 min Summer	20.078	0.0	892.2	250
360 min Summer	14.585	0.0	871.3	370
480 min Summer	11.622	0.0	858.2	488
600 min Summer	9.738	0.0	849.5	608
720 min Summer	8.424	0.0	843.6	728
960 min Summer	6.697	0.0	838.1	966
1440 min Summer	4.839	0.0	836.2	1444
2160 min Summer	3.490	0.0	1723.7	2160
2880 min Summer	2.766	0.0	1666.2	2480
4320 min Summer	1.989	0.0	1547.9	3240
5760 min Summer	1.573	0.0	2653.3	4040
7200 min Summer	1.311	0.0	2754.7	4896
8640 min Summer	1.129	0.0	2828.4	5704

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
10080 min Summer	0.782	0.782	5.8	1163.4	O K
15 min Winter	0.477	0.477	5.8	678.4	O K
30 min Winter	0.613	0.613	5.8	889.4	O K
60 min Winter	0.748	0.748	5.8	1107.6	O K
120 min Winter	0.880	0.880	5.8	1326.3	O K
180 min Winter	0.951	0.951	5.8	1448.4	O K
240 min Winter	0.997	0.997	5.8	1528.8	O K
360 min Winter	1.060	1.060	5.8	1638.7	O K
480 min Winter	1.102	1.102	5.8	1713.8	O K
600 min Winter	1.132	1.132	5.8	1767.5	O K
720 min Winter	1.153	1.153	5.8	1807.2	O K
960 min Winter	1.182	1.182	5.8	1859.6	O K
1440 min Winter	1.206	1.206	5.8	1903.1	Flood Risk
2160 min Winter	1.201	1.201	5.8	1894.6	Flood Risk
2880 min Winter	1.175	1.175	5.8	1846.1	O K
4320 min Winter	1.109	1.109	5.8	1726.1	O K
5760 min Winter	1.045	1.045	5.8	1612.2	O K
7200 min Winter	0.978	0.978	5.8	1496.1	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
10080 min Summer	0.994	0.0	2853.3	6552
15 min Winter	138.153	0.0	486.4	27
30 min Winter	90.705	0.0	487.9	41
60 min Winter	56.713	0.0	944.4	70
120 min Winter	34.246	0.0	908.9	130
180 min Winter	25.149	0.0	888.0	188
240 min Winter	20.078	0.0	876.6	246
360 min Winter	14.585	0.0	865.6	364
480 min Winter	11.622	0.0	862.8	482
600 min Winter	9.738	0.0	865.2	598
720 min Winter	8.424	0.0	871.2	716
960 min Winter	6.697	0.0	879.5	948
1440 min Winter	4.839	0.0	878.1	1406
2160 min Winter	3.490	0.0	1743.9	2080
2880 min Winter	2.766	0.0	1702.4	2712
4320 min Winter	1.989	0.0	1633.5	3384
5760 min Winter	1.573	0.0	2966.1	4328
7200 min Winter	1.311	0.0	3069.9	5264

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
8640 min Winter	0.911	0.911	5.8	1380.0	O K
10080 min Winter	0.842	0.842	5.8	1263.1	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
8640 min Winter	1.129	0.0	3097.7	6152
10080 min Winter	0.994	0.0	2983.6	7064

Rainfall Details

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

Time Area Diagram

Total Area (ha) 2.360

Time (mins) From:	To:	Area (ha)	Time (mins) From:	To:	Area (ha)	Time (mins) From:	To:	Area (ha)
0	4	0.787	4	8	0.787	8	12	0.787

Model Details

Storage is Online Cover Level (m) 1.500

Tank or Pond Structure

Invert Level (m) 0.000

Depth (m)	Area (m²)	Depth (m)	Area (m²)
0.000	1328.0	1.500	1981.0

Hydro-Brake® Optimum Outflow Control

Unit Reference	MD-SHE-0110-5800-1200-5800
Design Head (m)	1.200
Design Flow (l/s)	5.8
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	110
Invert Level (m)	0.000
Minimum Outlet Pipe Diameter (mm)	150
Suggested Manhole Diameter (mm)	1200

Control Points	Head (m)	Flow (l/s)	Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	1.200	5.8	Kick-Flo®	0.755	4.7
Flush-Flo™	0.357	5.8	Mean Flow over Head Range	-	5.1

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	3.8	1.200	5.8	3.000	8.9	7.000	13.3
0.200	5.5	1.400	6.2	3.500	9.6	7.500	13.8
0.300	5.8	1.600	6.6	4.000	10.2	8.000	14.2
0.400	5.8	1.800	7.0	4.500	10.8	8.500	14.6
0.500	5.7	2.000	7.4	5.000	11.3	9.000	15.0
0.600	5.5	2.200	7.7	5.500	11.9	9.500	15.4
0.800	4.8	2.400	8.0	6.000	12.4		
1.000	5.3	2.600	8.3	6.500	12.9		

Summary of Results for 1 year Return Period

Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
15 min Summer	0.095	0.095	4.6	210.1	O K
30 min Summer	0.122	0.122	6.4	271.1	O K
60 min Summer	0.151	0.151	8.0	336.6	O K
120 min Summer	0.181	0.181	8.4	404.0	O K
180 min Summer	0.198	0.198	8.6	442.7	O K
240 min Summer	0.209	0.209	8.7	468.3	O K
360 min Summer	0.221	0.221	8.7	495.8	O K
480 min Summer	0.227	0.227	8.8	509.3	O K
600 min Summer	0.232	0.232	8.8	519.2	O K
720 min Summer	0.235	0.235	8.8	526.4	O K
960 min Summer	0.238	0.238	8.8	535.1	O K
1440 min Summer	0.239	0.239	8.8	537.5	O K
2160 min Summer	0.233	0.233	8.8	523.0	O K
2880 min Summer	0.223	0.223	8.8	498.8	O K
4320 min Summer	0.199	0.199	8.6	445.6	O K
5760 min Summer	0.179	0.179	8.4	397.9	O K
7200 min Summer	0.162	0.162	8.2	359.9	O K
8640 min Summer	0.150	0.150	7.9	332.3	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
15 min Summer	30.991	0.0	147.8	26
30 min Summer	20.215	0.0	205.2	41
60 min Summer	12.800	0.0	310.5	70
120 min Summer	7.942	0.0	392.4	126
180 min Summer	5.979	0.0	446.5	186
240 min Summer	4.882	0.0	488.3	244
360 min Summer	3.646	0.0	549.3	360
480 min Summer	2.956	0.0	594.7	422
600 min Summer	2.511	0.0	631.7	484
720 min Summer	2.199	0.0	663.2	548
960 min Summer	1.782	0.0	714.8	682
1440 min Summer	1.326	0.0	788.9	956
2160 min Summer	0.988	0.0	946.4	1368
2880 min Summer	0.800	0.0	1020.4	1764
4320 min Summer	0.595	0.0	1124.8	2520
5760 min Summer	0.483	0.0	1257.5	3280
7200 min Summer	0.410	0.0	1333.5	3968
8640 min Summer	0.359	0.0	1396.0	4672

Summary of Results for 1 year Return Period

Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
10080 min Summer	0.140	0.140	7.4	311.1	O K
15 min Winter	0.106	0.106	5.4	235.2	O K
30 min Winter	0.137	0.137	7.3	303.7	O K
60 min Winter	0.170	0.170	8.3	377.9	O K
120 min Winter	0.204	0.204	8.6	455.3	O K
180 min Winter	0.223	0.223	8.8	500.3	O K
240 min Winter	0.236	0.236	8.8	530.6	O K
360 min Winter	0.251	0.251	8.9	564.7	O K
480 min Winter	0.258	0.258	8.9	581.0	O K
600 min Winter	0.261	0.261	8.9	588.5	O K
720 min Winter	0.264	0.264	8.9	593.1	O K
960 min Winter	0.266	0.266	9.0	598.6	O K
1440 min Winter	0.262	0.262	8.9	590.2	O K
2160 min Winter	0.247	0.247	8.9	556.0	O K
2880 min Winter	0.229	0.229	8.8	512.4	O K
4320 min Winter	0.192	0.192	8.5	427.9	O K
5760 min Winter	0.162	0.162	8.2	361.3	O K
7200 min Winter	0.144	0.144	7.6	320.5	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
10080 min Summer	0.322	0.0	1444.2	5360
15 min Winter	30.991	0.0	170.4	26
30 min Winter	20.215	0.0	235.1	40
60 min Winter	12.800	0.0	351.6	68
120 min Winter	7.942	0.0	443.2	126
180 min Winter	5.979	0.0	503.7	182
240 min Winter	4.882	0.0	550.5	240
360 min Winter	3.646	0.0	618.6	352
480 min Winter	2.956	0.0	669.2	460
600 min Winter	2.511	0.0	710.6	560
720 min Winter	2.199	0.0	745.7	584
960 min Winter	1.782	0.0	803.0	736
1440 min Winter	1.326	0.0	884.6	1042
2160 min Winter	0.988	0.0	1062.6	1480
2880 min Winter	0.800	0.0	1146.0	1900
4320 min Winter	0.595	0.0	1265.0	2680
5760 min Winter	0.483	0.0	1410.5	3352
7200 min Winter	0.410	0.0	1496.1	4040

Summary of Results for 1 year Return Period

Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
8640 min Winter	0.132	0.132	7.0	291.8	O K
10080 min Winter	0.122	0.122	6.4	269.8	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
8640 min Winter	0.359	0.0	1567.1	4760
10080 min Winter	0.322	0.0	1623.1	5456

Rainfall Details

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

Time Area Diagram

Total Area (ha) 3.670

Time From:	(mins) To:	Area (ha)	Time From:	(mins) To:	Area (ha)	Time From:	(mins) To:	Area (ha)
0	4	1.223	4	8	1.223	8	12	1.223

Model Details

Storage is Online Cover Level (m) 1.500

Tank or Pond Structure

Invert Level (m) 0.000

Depth (m)	Area (m²)	Depth (m)	Area (m²)
0.000	2184.0	1.500	3004.0

Hydro-Brake® Optimum Outflow Control

Unit Reference	MD-SHE-0137-9100-1200-9100
Design Head (m)	1.200
Design Flow (l/s)	9.1
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	137
Invert Level (m)	0.000
Minimum Outlet Pipe Diameter (mm)	150
Suggested Manhole Diameter (mm)	1200

Control Points	Head (m)	Flow (l/s)	Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	1.200	9.1	Kick-Flo®	0.773	7.4
Flush-Flo™	0.357	9.1	Mean Flow over Head Range	-	7.9

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	4.9	1.200	9.1	3.000	14.0	7.000	21.0
0.200	8.6	1.400	9.8	3.500	15.1	7.500	21.7
0.300	9.0	1.600	10.4	4.000	16.1	8.000	22.4
0.400	9.1	1.800	11.0	4.500	17.0	8.500	23.1
0.500	8.9	2.000	11.6	5.000	17.9	9.000	23.7
0.600	8.7	2.200	12.1	5.500	18.7	9.500	24.4
0.800	7.5	2.400	12.6	6.000	19.5		
1.000	8.4	2.600	13.1	6.500	20.3		

Summary of Results for 30 year Return Period

Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
15 min Summer	0.230	0.230	8.8	515.4	O K
30 min Summer	0.296	0.296	9.0	668.3	O K
60 min Summer	0.362	0.362	9.1	824.7	O K
120 min Summer	0.427	0.427	9.1	980.1	O K
180 min Summer	0.463	0.463	9.1	1066.0	O K
240 min Summer	0.486	0.486	9.1	1121.9	O K
360 min Summer	0.515	0.515	9.1	1193.6	O K
480 min Summer	0.533	0.533	9.1	1237.0	O K
600 min Summer	0.544	0.544	9.1	1263.6	O K
720 min Summer	0.550	0.550	9.1	1278.9	O K
960 min Summer	0.554	0.554	9.1	1288.0	O K
1440 min Summer	0.547	0.547	9.1	1272.5	O K
2160 min Summer	0.532	0.532	9.1	1234.4	O K
2880 min Summer	0.512	0.512	9.1	1186.4	O K
4320 min Summer	0.468	0.468	9.1	1078.9	O K
5760 min Summer	0.424	0.424	9.1	971.6	O K
7200 min Summer	0.382	0.382	9.1	871.8	O K
8640 min Summer	0.344	0.344	9.1	781.4	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
15 min Summer	76.035	0.0	422.2	26
30 min Summer	49.499	0.0	550.8	41
60 min Summer	30.811	0.0	787.0	70
120 min Summer	18.615	0.0	951.3	130
180 min Summer	13.715	0.0	1048.5	188
240 min Summer	10.995	0.0	1116.5	248
360 min Summer	8.034	0.0	1212.2	366
480 min Summer	6.428	0.0	1277.5	486
600 min Summer	5.404	0.0	1322.4	604
720 min Summer	4.687	0.0	1351.3	722
960 min Summer	3.743	0.0	1369.5	960
1440 min Summer	2.723	0.0	1318.2	1202
2160 min Summer	1.979	0.0	1905.3	1564
2880 min Summer	1.577	0.0	2013.9	1968
4320 min Summer	1.143	0.0	2146.2	2772
5760 min Summer	0.910	0.0	2384.1	3576
7200 min Summer	0.762	0.0	2492.2	4328
8640 min Summer	0.659	0.0	2579.0	5104

Summary of Results for 30 year Return Period

Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
10080 min Summer	0.310	0.310	9.1	701.1	O K
15 min Winter	0.257	0.257	8.9	578.0	O K
30 min Winter	0.331	0.331	9.1	749.7	O K
60 min Winter	0.405	0.405	9.1	925.9	O K
120 min Winter	0.478	0.478	9.1	1102.0	O K
180 min Winter	0.518	0.518	9.1	1200.4	O K
240 min Winter	0.544	0.544	9.1	1265.2	O K
360 min Winter	0.579	0.579	9.1	1350.2	O K
480 min Winter	0.600	0.600	9.1	1403.7	O K
600 min Winter	0.614	0.614	9.1	1438.5	O K
720 min Winter	0.623	0.623	9.1	1460.9	O K
960 min Winter	0.632	0.632	9.1	1482.1	O K
1440 min Winter	0.627	0.627	9.1	1470.5	O K
2160 min Winter	0.602	0.602	9.1	1407.9	O K
2880 min Winter	0.574	0.574	9.1	1338.4	O K
4320 min Winter	0.508	0.508	9.1	1175.9	O K
5760 min Winter	0.440	0.440	9.1	1011.3	O K
7200 min Winter	0.377	0.377	9.1	859.7	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
10080 min Summer	0.583	0.0	2644.2	5848
15 min Winter	76.035	0.0	475.0	26
30 min Winter	49.499	0.0	611.4	41
60 min Winter	30.811	0.0	882.7	70
120 min Winter	18.615	0.0	1063.4	128
180 min Winter	13.715	0.0	1168.3	186
240 min Winter	10.995	0.0	1239.9	244
360 min Winter	8.034	0.0	1334.8	360
480 min Winter	6.428	0.0	1390.2	476
600 min Winter	5.404	0.0	1416.3	592
720 min Winter	4.687	0.0	1420.1	708
960 min Winter	3.743	0.0	1396.3	932
1440 min Winter	2.723	0.0	1331.4	1364
2160 min Winter	1.979	0.0	2128.9	1696
2880 min Winter	1.577	0.0	2245.6	2160
4320 min Winter	1.143	0.0	2366.2	3032
5760 min Winter	0.910	0.0	2671.5	3864
7200 min Winter	0.762	0.0	2793.6	4624

Summary of Results for 30 year Return Period

Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
8640 min Winter	0.321	0.321	9.1	727.5	O K
10080 min Winter	0.273	0.273	9.0	615.8	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
8640 min Winter	0.659	0.0	2892.5	5368
10080 min Winter	0.583	0.0	2968.7	6056

Rainfall Details

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

Time Area Diagram

Total Area (ha) 3.670

Time From:	(mins) To:	Area (ha)	Time From:	(mins) To:	Area (ha)	Time From:	(mins) To:	Area (ha)
0	4	1.223	4	8	1.223	8	12	1.223

Model Details

Storage is Online Cover Level (m) 1.500

Tank or Pond Structure

Invert Level (m) 0.000

Depth (m)	Area (m²)	Depth (m)	Area (m²)
0.000	2184.0	1.500	3004.0

Hydro-Brake® Optimum Outflow Control

Unit Reference	MD-SHE-0137-9100-1200-9100
Design Head (m)	1.200
Design Flow (l/s)	9.1
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	137
Invert Level (m)	0.000
Minimum Outlet Pipe Diameter (mm)	150
Suggested Manhole Diameter (mm)	1200

Control Points	Head (m)	Flow (l/s)	Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	1.200	9.1	Kick-Flo®	0.773	7.4
Flush-Flo™	0.357	9.1	Mean Flow over Head Range	-	7.9

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	4.9	1.200	9.1	3.000	14.0	7.000	21.0
0.200	8.6	1.400	9.8	3.500	15.1	7.500	21.7
0.300	9.0	1.600	10.4	4.000	16.1	8.000	22.4
0.400	9.1	1.800	11.0	4.500	17.0	8.500	23.1
0.500	8.9	2.000	11.6	5.000	17.9	9.000	23.7
0.600	8.7	2.200	12.1	5.500	18.7	9.500	24.4
0.800	7.5	2.400	12.6	6.000	19.5		
1.000	8.4	2.600	13.1	6.500	20.3		

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	0.411	0.411	9.1	941.3	O K
30 min Summer	0.532	0.532	9.1	1233.6	O K
60 min Summer	0.653	0.653	9.1	1535.1	O K
120 min Summer	0.771	0.771	9.1	1837.5	O K
180 min Summer	0.836	0.836	9.1	2006.7	O K
240 min Summer	0.878	0.878	9.1	2117.3	O K
360 min Summer	0.934	0.934	9.1	2267.0	O K
480 min Summer	0.972	0.972	9.1	2368.2	O K
600 min Summer	0.998	0.998	9.1	2439.5	O K
720 min Summer	1.017	1.017	9.1	2491.3	O K
960 min Summer	1.041	1.041	9.1	2557.1	O K
1440 min Summer	1.058	1.058	9.1	2602.5	O K
2160 min Summer	1.045	1.045	9.1	2567.2	O K
2880 min Summer	1.019	1.019	9.1	2496.1	O K
4320 min Summer	0.967	0.967	9.1	2356.7	O K
5760 min Summer	0.917	0.917	9.1	2222.1	O K
7200 min Summer	0.868	0.868	9.1	2090.6	O K
8640 min Summer	0.818	0.818	9.1	1960.2	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
15 min Summer	138.153	0.0	722.8	27
30 min Summer	90.705	0.0	769.0	42
60 min Summer	56.713	0.0	1398.5	72
120 min Summer	34.246	0.0	1478.8	130
180 min Summer	25.149	0.0	1442.1	190
240 min Summer	20.078	0.0	1414.7	250
360 min Summer	14.585	0.0	1377.5	370
480 min Summer	11.622	0.0	1352.9	488
600 min Summer	9.738	0.0	1335.1	608
720 min Summer	8.424	0.0	1321.5	728
960 min Summer	6.697	0.0	1302.6	966
1440 min Summer	4.839	0.0	1286.6	1444
2160 min Summer	3.490	0.0	2690.5	2160
2880 min Summer	2.766	0.0	2594.1	2480
4320 min Summer	1.989	0.0	2394.7	3208
5760 min Summer	1.573	0.0	4112.3	4032
7200 min Summer	1.311	0.0	4266.3	4840
8640 min Summer	1.129	0.0	4378.0	5704

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
10080 min Summer	0.764	0.764	9.1	1820.8	O K
15 min Winter	0.458	0.458	9.1	1055.2	O K
30 min Winter	0.592	0.592	9.1	1383.3	O K
60 min Winter	0.726	0.726	9.1	1722.5	O K
120 min Winter	0.857	0.857	9.1	2063.5	O K
180 min Winter	0.929	0.929	9.1	2254.1	O K
240 min Winter	0.976	0.976	9.1	2379.7	O K
360 min Winter	1.039	1.039	9.1	2551.6	O K
480 min Winter	1.082	1.082	9.1	2669.4	O K
600 min Winter	1.112	1.112	9.1	2753.9	O K
720 min Winter	1.135	1.135	9.1	2816.5	O K
960 min Winter	1.164	1.164	9.1	2899.5	O K
1440 min Winter	1.189	1.189	9.1	2969.9	O K
2160 min Winter	1.186	1.186	9.1	2960.5	O K
2880 min Winter	1.160	1.160	9.1	2888.4	O K
4320 min Winter	1.095	1.095	9.1	2707.1	O K
5760 min Winter	1.032	1.032	9.1	2531.4	O K
7200 min Winter	0.965	0.965	9.1	2349.9	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
10080 min Summer	0.994	0.0	4435.8	6472
15 min Winter	138.153	0.0	758.2	27
30 min Winter	90.705	0.0	767.8	41
60 min Winter	56.713	0.0	1483.9	70
120 min Winter	34.246	0.0	1443.6	130
180 min Winter	25.149	0.0	1407.6	188
240 min Winter	20.078	0.0	1386.8	246
360 min Winter	14.585	0.0	1363.7	364
480 min Winter	11.622	0.0	1352.7	482
600 min Winter	9.738	0.0	1348.8	598
720 min Winter	8.424	0.0	1350.1	716
960 min Winter	6.697	0.0	1359.9	948
1440 min Winter	4.839	0.0	1355.9	1406
2160 min Winter	3.490	0.0	2723.1	2080
2880 min Winter	2.766	0.0	2649.2	2712
4320 min Winter	1.989	0.0	2519.9	3380
5760 min Winter	1.573	0.0	4595.3	4328
7200 min Winter	1.311	0.0	4751.4	5264

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
8640 min Winter	0.896	0.896	9.1	2166.2	O K
10080 min Winter	0.825	0.825	9.1	1978.2	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
8640 min Winter	1.129	0.0	4806.5	6152
10080 min Winter	0.994	0.0	4674.4	7064

Rainfall Details

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

Time Area Diagram

Total Area (ha) 3.670

Time (mins) From:	To:	Area (ha)	Time (mins) From:	To:	Area (ha)	Time (mins) From:	To:	Area (ha)
0	4	1.223	4	8	1.223	8	12	1.223

Model Details

Storage is Online Cover Level (m) 1.500

Tank or Pond Structure

Invert Level (m) 0.000

Depth (m)	Area (m²)	Depth (m)	Area (m²)
0.000	2184.0	1.500	3004.0

Hydro-Brake® Optimum Outflow Control

Unit Reference	MD-SHE-0137-9100-1200-9100
Design Head (m)	1.200
Design Flow (l/s)	9.1
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	137
Invert Level (m)	0.000
Minimum Outlet Pipe Diameter (mm)	150
Suggested Manhole Diameter (mm)	1200

Control Points	Head (m)	Flow (l/s)	Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	1.200	9.1	Kick-Flo®	0.773	7.4
Flush-Flo™	0.357	9.1	Mean Flow over Head Range	-	7.9

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	4.9	1.200	9.1	3.000	14.0	7.000	21.0
0.200	8.6	1.400	9.8	3.500	15.1	7.500	21.7
0.300	9.0	1.600	10.4	4.000	16.1	8.000	22.4
0.400	9.1	1.800	11.0	4.500	17.0	8.500	23.1
0.500	8.9	2.000	11.6	5.000	17.9	9.000	23.7
0.600	8.7	2.200	12.1	5.500	18.7	9.500	24.4
0.800	7.5	2.400	12.6	6.000	19.5		
1.000	8.4	2.600	13.1	6.500	20.3		

Appendix D – Thames Water Sewer Records

Asset location search

Property Searches

Brookbanks Consulting Limited
Knights Court,6150 Knights Court

BIRMINGHAM
B37 7WY

Search address supplied Kidlington
OX5 2LS

Your reference 10669 - Kidlington

Our reference ALS/ALS Standard/2021_4433358

Search date 20 May 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).

Contact us to find out more.

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

0800 009 4540

Search address supplied: Kidlington, OX5 2LS

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:

SP4912NE
SP4912SE
SP5013SW
SP5012NW

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.

The following quartiles have not been printed as they contain no assets:

SP5012SW

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:

SP4912NE
SP4912SE
SP5013SW
SP5012SW
SP5012NW

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_4433358

SP4912NE

The width of the displayed area is 500m and the centre of the map is located at OS coordinates 449750,212750

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
791B	n/a	n/a
5801	61.12	58.79
5901	60.85	59.04
581B	n/a	n/a
581C	n/a	n/a
5803	61.97	n/a
591A	n/a	n/a
581A	n/a	n/a
591B	n/a	n/a
591C	n/a	n/a
5902	n/a	n/a
5903	n/a	n/a
6907	n/a	n/a
6905	n/a	n/a
6906	n/a	n/a
6902	64.64	63.24
6903	64.38	63.02
6802	64.38	62.9
681A	n/a	n/a
6904	n/a	n/a
6803	64.28	62.78
6804	64.35	62.64
6805	64.34	62.36
6806	n/a	n/a
7801	64.99	62.07
791C	n/a	n/a
7803	65.54	63.61
7802	65.72	63.61
781A	n/a	n/a
7804	66.43	63.76
8801	66.54	64.44
891A	n/a	n/a
5802	61.31	58.44
9607	63.31	62.9
9606	64	63.27
9601	64.1	63.43
9603	63.71	63.15
9702	n/a	n/a
9701	63.55	n/a
971A	n/a	n/a
971B	n/a	n/a
9703	64.38	63.63
871C	n/a	n/a
871D	n/a	n/a
871B	n/a	n/a
981E	n/a	n/a
9801	66.19	65.1
9802	65.96	65.23
9803	66.16	65.41
9804	65.98	65.56
981A	n/a	n/a
981B	n/a	n/a
981D	n/a	n/a
981C	n/a	n/a
9902	66.88	65.79
9901	66.7	65.83
8901	n/a	n/a
9903	n/a	n/a
661E	n/a	n/a
6701	63.2	n/a
6702	64.47	62.22
6801	63.69	61.49
6601	66.12	63.95
661C	n/a	n/a
661A	n/a	n/a
661B	n/a	n/a
761A	n/a	n/a
761B	n/a	n/a
7701	65.33	62.54
7602	65.71	62.99
7805	66.1	64.34
861I	100.22	99.12
861D	n/a	n/a
861H	100.25	99.13
861F	n/a	n/a
861C	n/a	n/a
861A	n/a	n/a
861E	n/a	n/a
861G	n/a	n/a
8802	66.59	64.59
8804	n/a	n/a
8602	n/a	n/a
8601	64.41	65.78
8803	66.59	64.73
8701	66.59	64.79
871A	n/a	n/a
871E	n/a	n/a
561A	n/a	n/a
551C	n/a	n/a
561B	n/a	n/a
551B	n/a	n/a

Manhole Reference	Manhole Cover Level	Manhole Invert Level
551D	n/a	n/a
551A	n/a	n/a
551F	n/a	n/a
551E	n/a	n/a
661D	n/a	n/a
661F	n/a	n/a
6602	66.46	64.31
7601	66.46	64.19
7604	66.27	63.68
7603	65.87	63.32
751A	n/a	n/a
851A	n/a	n/a
8501	65.76	n/a
9609	n/a	n/a
9608	n/a	n/a
9602	63.98	63.36
9604	64	63.3
9605	63.82	63.2

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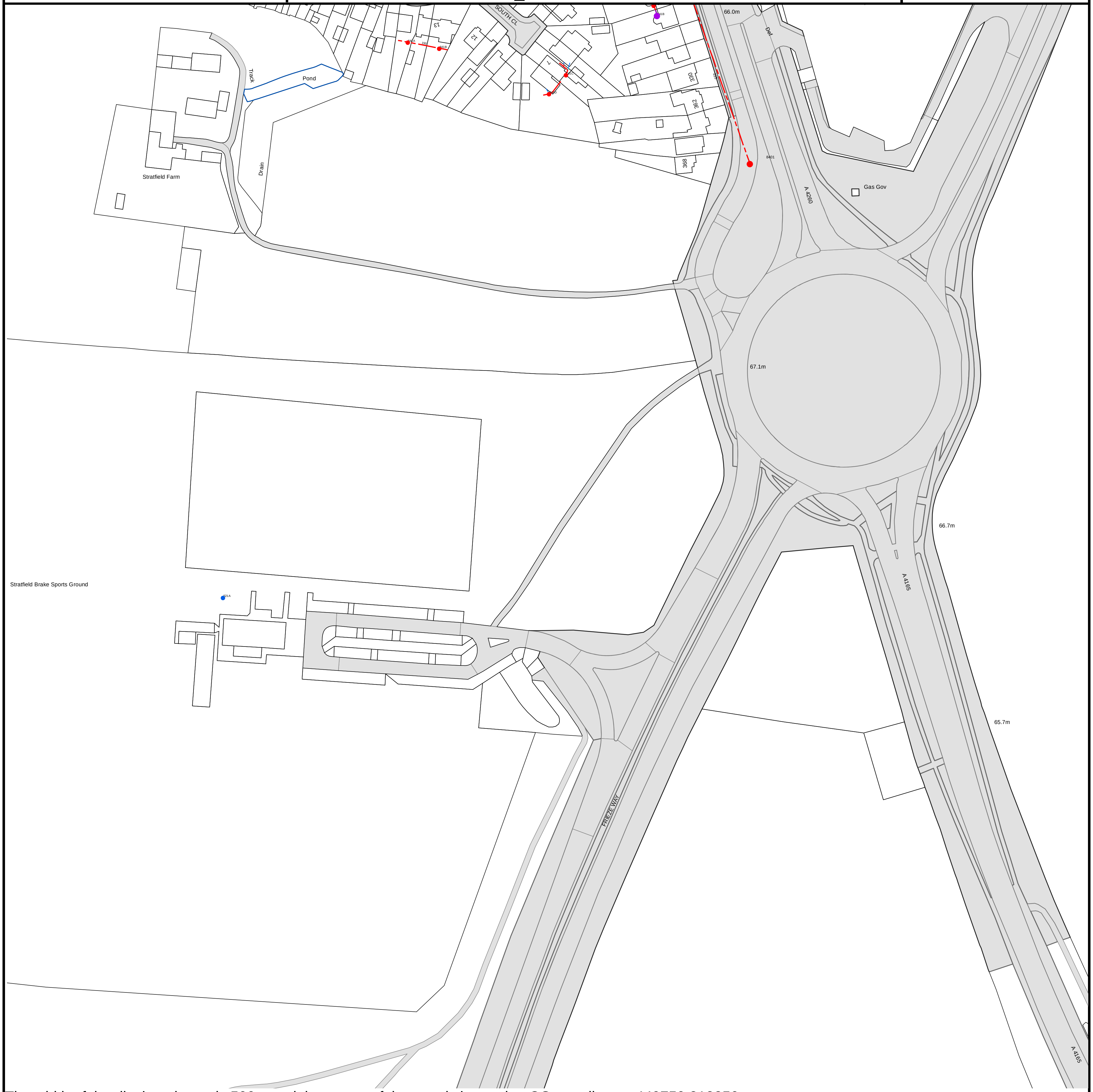
Asset Location Search Sewer Map - ALS/ALS Standard/2021_4433358	SP4912SE



The width of the displayed area is 500m and the centre of the map is located at OS coordinates 449750,212250

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
641A	n/a	n/a
641B	n/a	n/a
741D	n/a	n/a
741C	n/a	n/a
741A	n/a	n/a
741B	n/a	n/a
8401	66.53	64.46
521A	n/a	n/a

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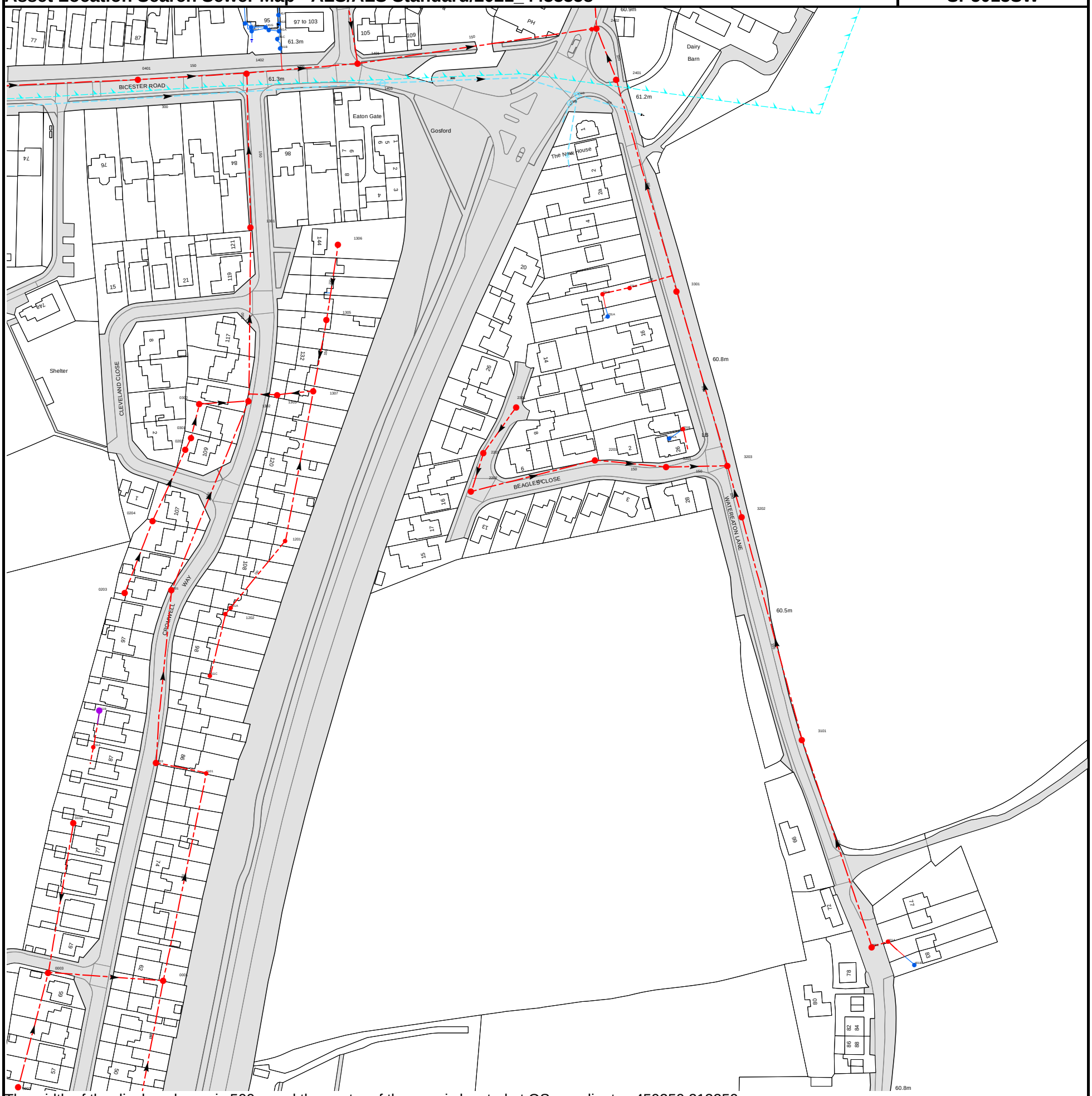
Asset Location Search Sewer Map - ALS/ALS Standard/2021_4433358

SP5013SW



The width of the displayed area is 500m and the centre of the map is located at OS coordinates 450250,213250

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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
141I	n/a	n/a
141H	n/a	n/a
141J	n/a	n/a
141G	n/a	n/a
141D	n/a	n/a
141C	n/a	n/a
141F	n/a	n/a
141E	n/a	n/a
141A	n/a	n/a
141B	n/a	n/a
2402	61.34	57.7
0401	61.51	59.91
0302	n/a	n/a
1402	61.36	59.21
1302	64.24	60.14
1301	63.02	59.91
1303	64.29	61.93
1307	64.05	61.97
1305	63.59	62.1
1306	63.37	62.49
1401	61.38	59.38
1403	n/a	n/a
2301	n/a	n/a
241C	n/a	n/a
241B	n/a	n/a
241D	n/a	n/a
231B	n/a	n/a
231A	n/a	n/a
2401	61.27	57.83
231C	n/a	n/a
3301	60.93	58.18
0001	65.8	61.24
401B	n/a	n/a
3001	60.54	59.48
401A	n/a	n/a
0101	65.96	n/a
0103	n/a	n/a
011A	n/a	n/a
3101	60.45	59.08
011B	n/a	n/a
011C	n/a	n/a
1202	n/a	n/a
121A	n/a	n/a
0203	n/a	n/a
0201	65.67	60.51
1201	n/a	n/a
0204	n/a	n/a
3202	60.51	58.66
2202	62.99	61.01
3201	61.19	59.56
3203	n/a	n/a
2201	61.76	60.33
2203	n/a	n/a
0202	n/a	n/a
331A	n/a	n/a
0301	n/a	n/a
331B	n/a	n/a
0002	n/a	n/a
0003	n/a	n/a
0102	n/a	n/a

Asset Location Search Sewer Map - ALS/ALS Standard/2021_4433358

SP5012NW

The width of the displayed area is 500m and the centre of the map is located at OS coordinates 450250,212750

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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
0902	65.8	61.58
0701	64.33	62.66
0801	65.02	62.36
0802	65.51	61.99

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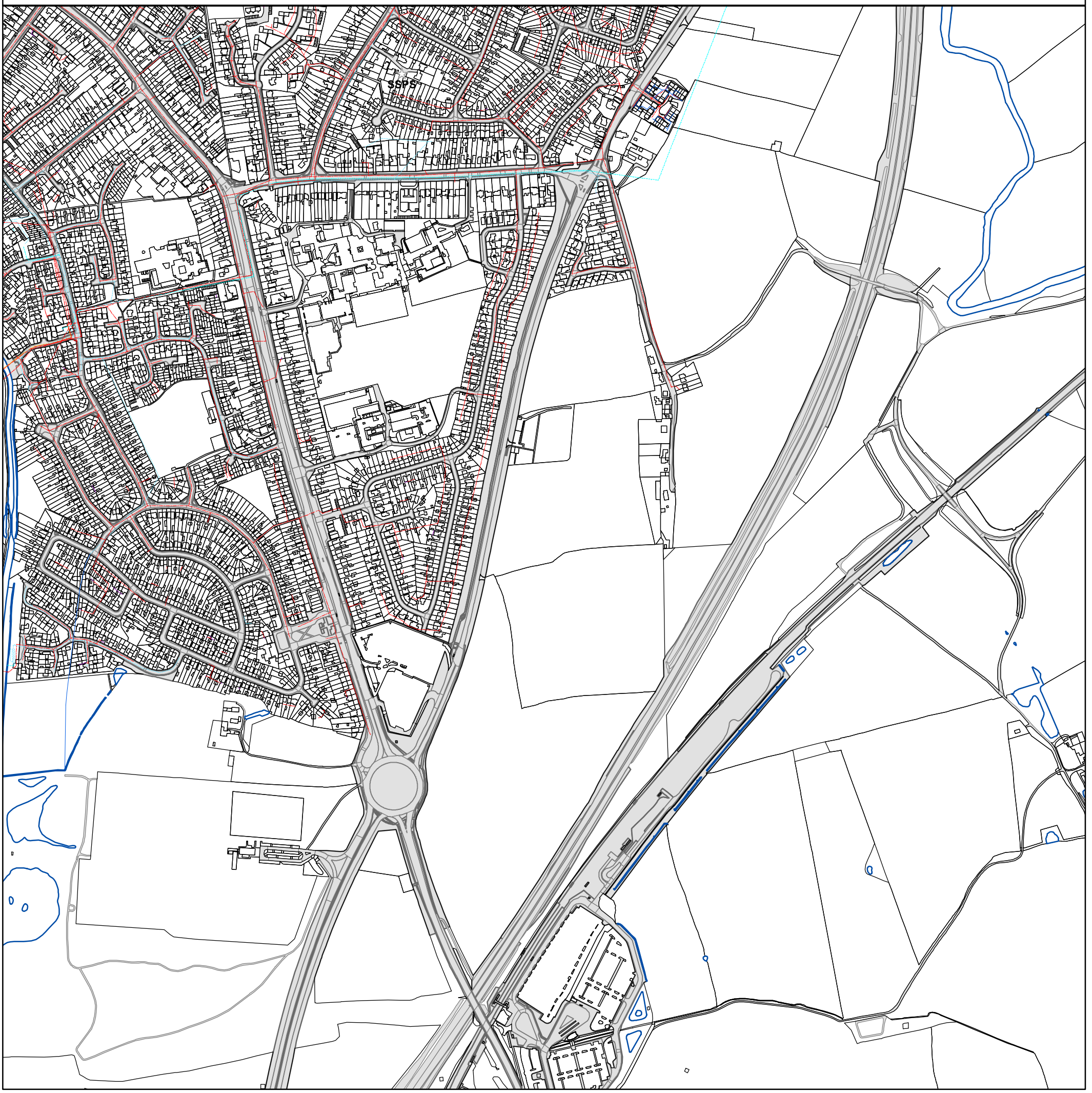
Based on the Ordnance Survey Map with the sanction of the Controller of H.M Stationary Office License Number 10019345

ALS/ALS Standard/2021_4433358



0 45 90 180 270 360
Meters

Scale:	1:7161
Width:	2000m
Printed By:	Rveldhur
Print Date:	20/05/2021
Map Centre:	450162,212770
Grid Reference:	SP5012NW

Comments:

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_4433358

SP4912NE

The width of the displayed area is 500m and the centre of the map is located at OS coordinates 449750,212750

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Asset Location Search Water Map - ALS/ALS Standard/2021_4433358

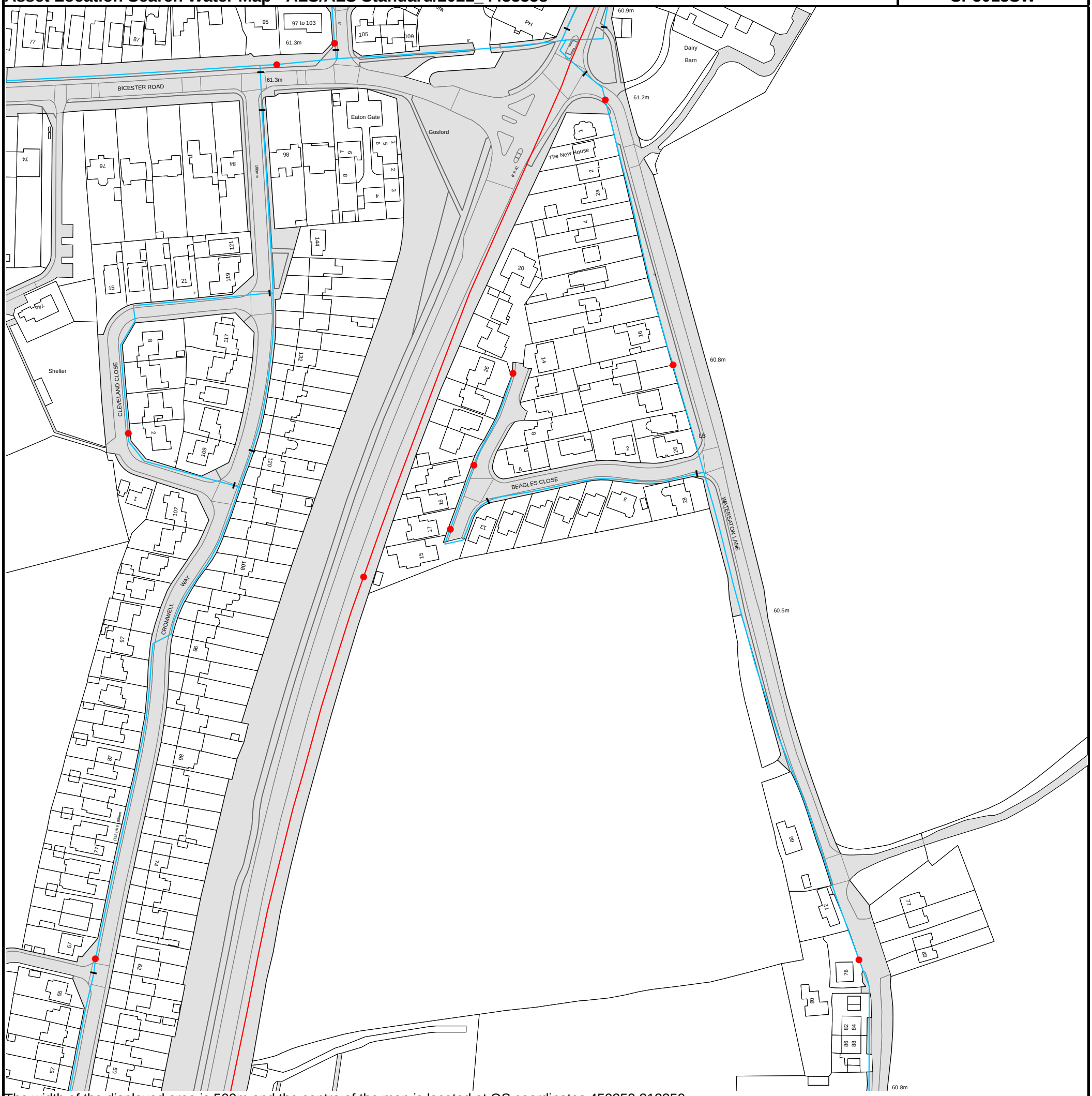
SP4912SE

The width of the displayed area is 500m and the centre of the map is located at OS coordinates 449750,212250

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_4433358

SP5013SW



The width of the displayed area is 500m and the centre of the map is located at OS coordinates 450250,213250

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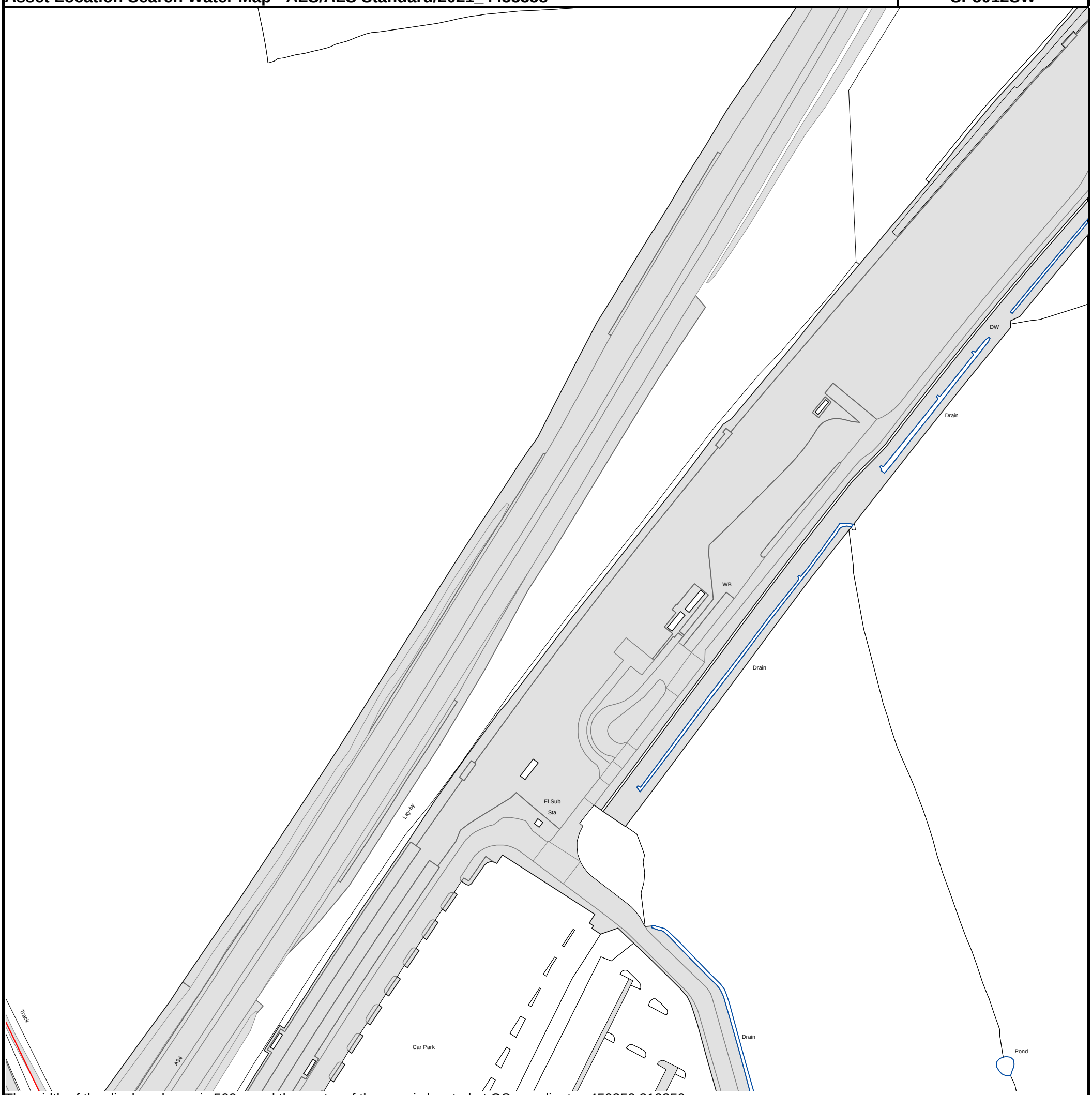
Based on the Ordnance Survey Map with the Sanction of the controller of H.M. Stationery Office, License no. 100019345 Crown Copyright Reserved.

Asset Location Search Water Map - ALS/ALS Standard/2021_4433358	SP5012SW



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Asset Location Search Water Map - ALS/ALS Standard/2021_4433358

SP5012NW

The width of the displayed area is 500m and the centre of the map is located at OS coordinates 450250,212750

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.

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

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')

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**

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