



LAND EAST AND WEST OF HYDE END ROAD, SHINFIELD

FLOOD RISK ASSESSMENT AND DRAINAGE STRATEGY

BLOOR HOMES (SOUTHERN) AND THE UNIVERSITY OF READING

04 SEPTEMBER 2025





Abley Letchford
3 Tealgate
Charnham Park
Hungerford
RG17 0YT

T: 01488 684390
E: contact@ableyletchford.co.uk
W: www.ableyletchford.co.uk

Quality Management:

Prepared by:	R Moore/ G Roinas/K Bush/J Shuttleworth
Authorised by:	L Abley
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Contents

1.0	Introduction	1
2.0	Policy and Sources of Information.....	3
3.0	Site Setting	6
4.0	Overview of Flood Risk	13
5.0	Sequential Test and Exception Test.....	24
6.0	Flood Mitigation Strategy	26
7.0	Surface Water Drainage.....	28
8.0	Foul Water Drainage.....	36
9.0	Conclusion	37

Appendices

Appendix A – Plans

Appendix B – LLFA Developer Checklist

Appendix C – Direct Rainfall Modelling Report

Appendix D – Drainage Strategy

Appendix E - Maintenance Schedule



1.0 Introduction

1.1 Context

- 1.1.1 This Flood Risk Assessment (FRA) which has been prepared by Abley Letchford on behalf Bloor Homes (Southern) and the University of Reading, relates to a "Full application for the erection of 183 no. dwellings (C3 Use Class) together with associated hard and soft landscaping, drainage infrastructure, parking, access and associated works" at Hyde End Road, Shinfield in Berkshire.

1.2 Development Proposals

- 1.2.1 The proposals are as depicted on the Detailed Site Layout within **Appendix A**.

1.3 Requirement for a Flood Risk Assessment

- 1.3.1 The requirement for an FRA is set out in Section 14 of the National Planning Policy Framework (NPPF) as revised in December 2024.
- 1.3.2 The footnote accompanying Paragraph 181 states:
- 1.3.3 'A site-specific flood risk assessment should be provided for all development in Flood Zones 2 and 3. In Flood Zone 1, an assessment should accompany all proposals involving: sites of 1 hectare or more; land which has been identified by the Environment Agency as having critical drainage problems; land identified in a strategic flood risk assessment as being at increased flood risk in future; or land that may be subject to other sources of flooding, where its development would introduce a more vulnerable use..'
- 1.3.4 The site is a greenfield site that comprises of agricultural fields and localised buildings. The area of the site is approximately 10.7 hectares. As the site area extends greater than 1 hectare, a site-specific flood risk assessment is required. To comply with the requirements of the NPPF, matters related to flood risk and drainage are addressed within this report.

1.4 Report Aim and Formation

- 1.4.1 This report also summarises all flood risk matters and outlines the proposed mitigation strategies that will be incorporated within the development to prevent potential, additional flood risks, both on site and within the surrounding area, that could otherwise be attributed to the development without such measures being put in place.
- 1.4.2 This report will also summarise the impacts the development could have on flood risk to the surrounding area and outlines the mitigation strategies that will be implemented to minimise this risk.
- 1.4.3 The drainage design embraces the guiding principles of Sustainable Drainage Systems (SuDS) which are central to the design of the surface water drainage strategy for the proposed development.

1.5 Report Structure

- 1.5.1 This report addresses the requirements of revised NPPF and considers the following aspects:



- Section 2: Policy and Sources of Information – a review of policy relevant to the assessment and sources of information used to inform the assessment.
- Section 3: Site Setting – a description of the site location, topography, geology and hydrology.
- Section 4: Overview of Flood Risk – a review of data for flooding from all sources to determine the baseline flood risk to the site and an assessment of the impacts of the development on flood risk.
- Section 5: Sequential Test and Exception Test – a description of the proposed development and a classification of the vulnerability in the context of the Sequential Test and Exception Test.
- Section 6: Flood Risk Mitigation – the mitigation measures implemented to manage the potential flood risk to the development.
- Sections 7 and 8: Drainage Strategy – a summary of appropriate strategies to manage the surface water and foul water from the site in the post development scenario.
- Section 9: Conclusion – a summary of the development proposals in the context of site vulnerability and the requirements of the NPPF.



2.0 Policy and Sources of Information

2.1 Introduction

- 2.1.1 This chapter provides a review of policy relevant to the assessment and the available information on all sources of flood risk.

2.2 National Planning Policy

- 2.2.1 National policy in relation to flood risk is set out in Section 14 of the National Planning Policy Framework, Dec 2024 (NPPF) and Planning Practice Guidance ID:7 for Flood Risk and Coastal Change, Aug 2022 (PPG). Flood risk is discussed in Paragraphs 170 to 182 of the NPPF.

- 2.2.2 Paragraphs 172 to 176 discuss the sequential approach with respect to individual applications. Paragraph 174 refers to the Strategic Flood Risk Assessment (SFRA) that would form the basis of applying the Sequential Test for local authorities to allocate developments, whilst Paragraphs 177-179 relate to Exception Tests.

- 2.2.3 Paragraph 181 discusses the determination of planning applications stating:

‘When determining any planning applications, local planning authorities should ensure that flood risk is not increased elsewhere. Where appropriate, applications should be supported by a site-specific flood-risk assessment. Development should only be allowed in areas at risk of flooding where, in the light of this assessment (and the sequential and exception tests, as applicable) it can be demonstrated that:

- *Within the site, the most vulnerable development is located in areas of lowest flood risk unless there are overriding reasons to prefer a different location;*
- *The development is appropriately flood resistant and resilient, such that, in the event of a flood, it could be quickly brought back into use without significant refurbishment;*
- *It incorporates sustainable drainage systems, unless there is clear evidence that this would be inappropriate;*
- *Any residual risk can be safely managed; and*
- *Safe access and escape routes are included where appropriate, as part of an agreed emergency plan.’*

- 2.2.4 The proposed development is for approximately 183 dwellings at the site which covers approximately 10.7 hectares and would, therefore, be classed as a major development because the site is greater than 0.5 hectares. Paragraph 182 states:

‘....Sustainable drainage systems provided as part of proposals for major development should:

- a) *Take account of advice from the lead local flood authority;*
- b) *Have appropriate proposed minimum operational standards; and*
- c) *Have maintenance arrangements in place to ensure an acceptable standard of operation for the lifetime of the development.’*



2.2.5 The PPG sets out more specific guidance on how to apply and implement the NPPF policies. This includes guidance on when a Sequential Test is required and considerations on how to apply the test. In paragraph 023 of the PPG the aim of the sequential approach is clarified and includes the following:

2.2.6 ‘The approach is designed to ensure that areas at little or no risk of flooding from any source are developed in preference to areas at higher risk. ‘

2.2.7 In applying the Sequential Test to planning applications, NPPF paragraph 175 confirms specific development cases when the test is not applicable:

‘The sequential test should be used in areas known to be at risk now or in the future from any form of flooding, except in situations where a site-specific flood risk assessment demonstrates that no built development within the site boundary, including access or escape routes, land raising or other potentially vulnerable elements, would be located on an area that would be at risk of flooding from any source, now and in the future (having regard to potential changes in flood risk).’

2.3 Environment Agency

2.3.1 The Flood and Water Management Act (2010) provides the Environment Agency (EA) a strategic overview role for all forms of flooding and coastal erosion. It also has direct responsibility for the prevention, mitigation and remediation of flood damage for main rivers and coastal areas. The EA is a statutory consultee in relation to flood risk and planning dependent upon criteria.

2.3.2 The EA Standing Advice has been consulted and reviewed within this FRA.

2.3.3 The EA Flood Map for Planning, EA Long Term Flood Risk Mapping and the Catchment Data Explorer websites have been interrogated in respect to flood risk extents and sources.

2.4 Local Authorities

2.4.1 The site lies within the administrative area of Wokingham Borough Council (WBC). WBC is the Local Planning Authority (LPA) and Lead Local Flood Authority (LLFA).

2.4.2 Planning guidance published by WBC regarding this site’s flood risk was referred to in order to assess the methodology best suited to suit the local area. The following key documents were reviewed:

- WBC Core Strategy, Core Policy CP1 ‘Sustainable Development’ and CP3 ‘General Principles for Development’ (adopted January 2010);
- WBC Local Plan (dated February 2014);
- WBC Local Plan Update 2023 – 2040 (dated September 2024);
- WBC Local Flood Risk Management Strategy (dated April 2015);
- WBC Preliminary Flood Risk Assessment (PFRA) (dated June 2011) and PFRA Addendum (dated 2017);
- WBC Level 1 Strategic Flood Risk Assessment (SFRA) (dated May 2023 and published May 2024); and
- WBC Level 2 SFRA (dated August 2023 and published May 2024).



- 2.4.3 WBC became the LLFA under the Flood and Water Management Act 2010. WBC provides guidance to assess, manage and inform flood risk.
- 2.4.4 As LLFA, WBC's Flood and Water Management Team provide a Planning Application Drainage Checklist to assist developers seeking planning permission for new sites by setting criteria to be met as part of the design of the drainage strategy and a list of documentation to be presented in the associated Flood Risk Assessment. A completed Planning Application Drainage Checklist is included within **Appendix B**.
- 2.4.5 WBC has permissive rights over any Ordinary Watercourses including land drainage ditches. If any work is required within the watercourse (improvements or crossings) then approval from the LLFA is required under the Flood and Water Management Act 1991.

2.5 Local Water Authority

- 2.5.1 Thames Water is responsible for the supply of clean water and for the disposal of wastewater in the Shinfield area.
- 2.5.2 Information with regards to sewer and water main flooding contained within the SFRA has been reviewed as part of this FRA. All water companies have a statutory obligation to maintain a register of properties and areas which are at risk of flooding from the public sewerage system and these are shown on the DG5 Flood Register.

2.6 Other Sources of Information

- 2.6.1 A desktop study of the site was carried out using the following websites to ascertain data relating local features, hydrology and soil characteristics:
- DEFRA's Magic Map portal;
 - British Geological Survey (BGS) 'Geology of Britain' online viewer; and
 - Cranfield University 'Soilscapes' portal.
- 2.6.2 A site walkover was carried out in August 2024 which allowed observations of the site and watercourses, to inform the FRA.
- 2.6.3 Guidance with respect to Sustainable Drainage Systems (SuDS) is contained within DEFRA document Sustainable Drainage Systems, Non-statutory technical standards for sustainable drainage systems March 2015, CIRIA C753 The SuDS Manual and within the NPPF Planning Practice Guidance (PPG) – 'Flood Risk and Coastal Change'.
- 2.6.4 Additional guidance on development and flood risk is contained within CIRIA C624 Development and Flood Risk – Guidance for the Construction Industry which identifies several key aims for a development to ensure it is sustainable in flood risk terms.

3.0 Site Setting

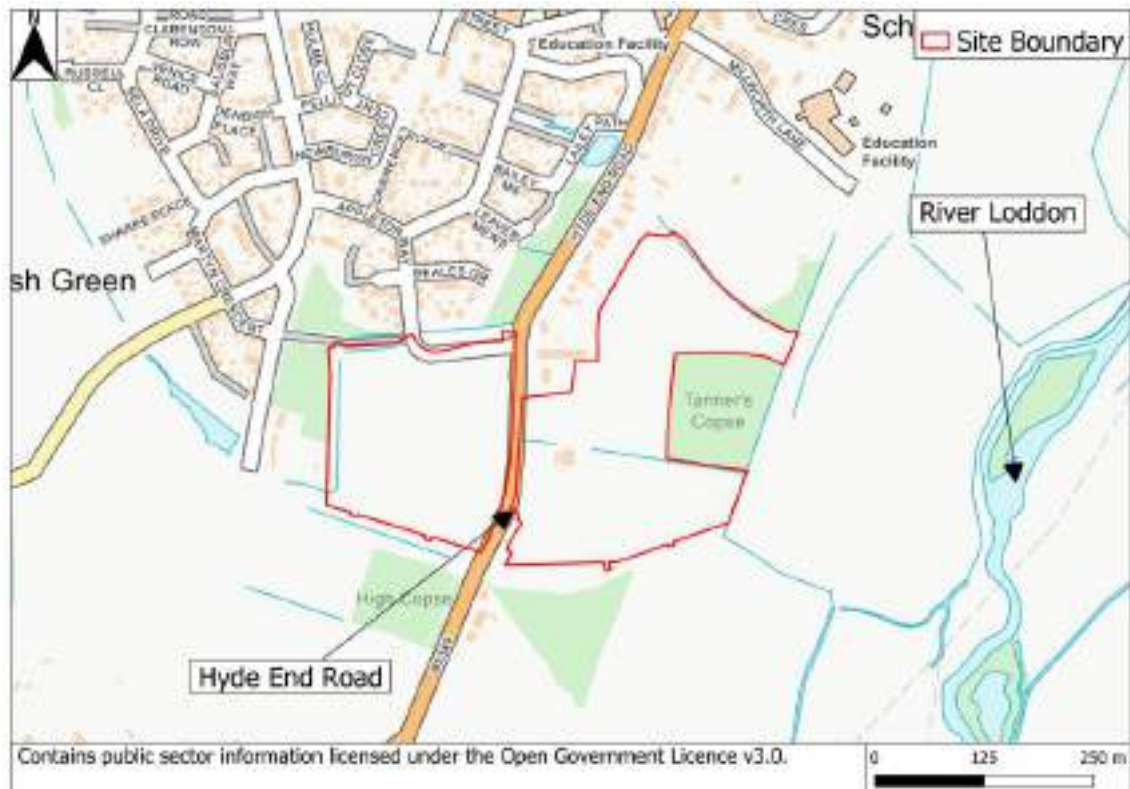
3.1 Introduction

3.1.1 This chapter provides a description of the site location, its topography, hydrological context, geology and hydrogeology.

3.2 Site Location

3.2.1 The site is comprised of two parcels of land, located at land to the east and west of Hyde End Road in Shinfield, Berkshire. The nearest postcode is RG2 9EP. The site centre grid reference is 473,180E, 167,225N. The site location including both the application boundary and the extent of land ownership is shown in **Figure 1**.

Figure 1 – Site Location



3.2.2 Residential development is located to the north and west of the site. There are fields located to the south and east of the site.

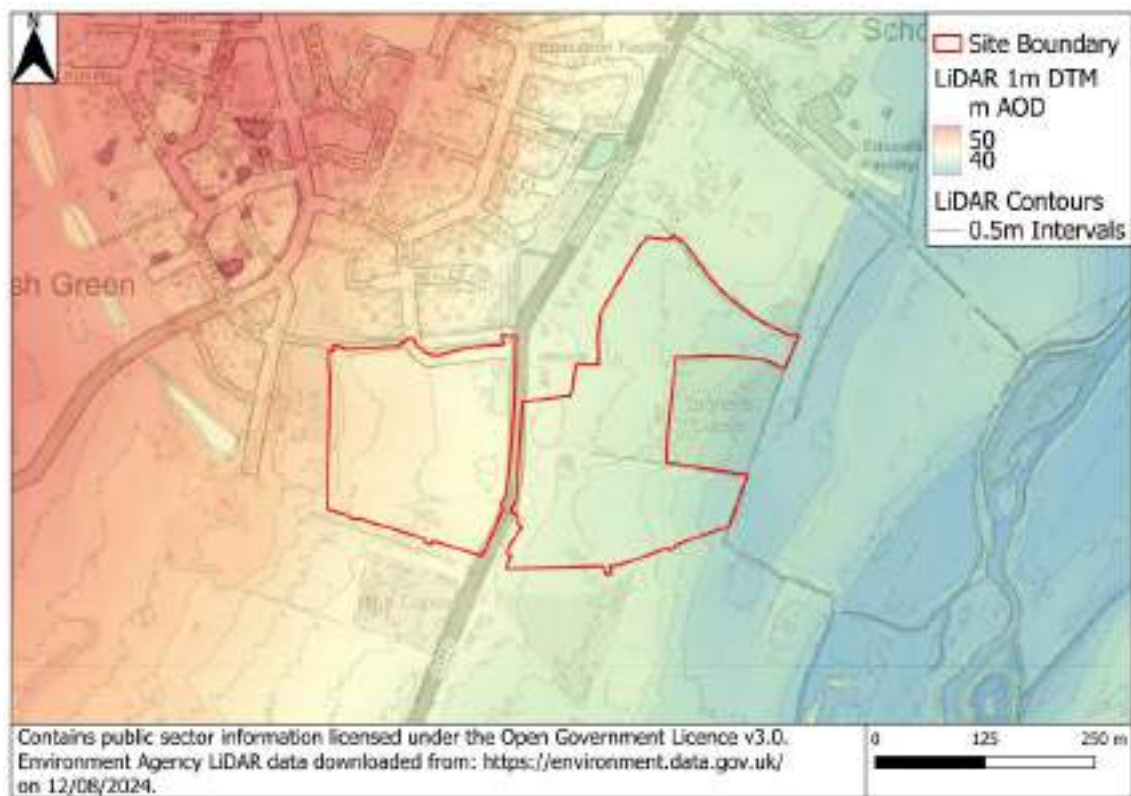
3.2.3 The site consists predominantly of agricultural fields with localised farm buildings. Hyde End Road runs between the east and west parcels.

3.2.4 The site covers an area of approximately 10.7 hectares.

3.3 Topography

3.3.1 The ground levels across the site are shown by LiDAR in Figure 2.

Figure 2 – Site Topography



3.3.2 The LiDAR indicates that the ground levels fall from west to east. Ground levels across the site are between 46.8m AOD and 41.1m AOD. The highest ground levels are along the western boundary whilst the lowest ground levels are along the eastern boundary.

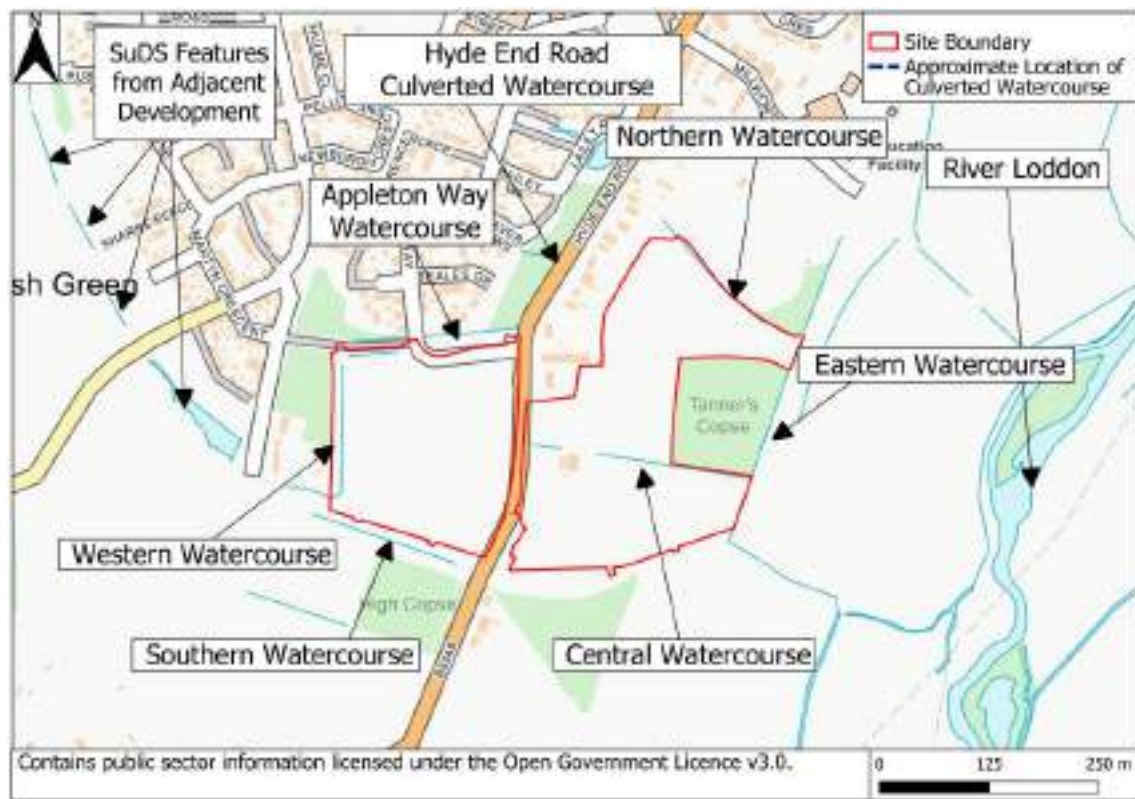
3.3.3 A topographical survey of the site has been carried out. A copy of the topographical survey is included in **Appendix A**. The detailed survey agrees with the LiDAR data but also includes further details of the channels within the site and surrounding area.

3.4 Watercourses and Ditches

3.4.1 There are a number of ordinary watercourses and ditches within the site and in adjacent areas.

3.4.2 **Figure 3** shows the location of the watercourses, and the names given to these watercourses for the purpose of discussing them within this report and in the modelling study.

Figure 3 – Key Watercourses



- 3.4.3 The western watercourse runs along the western boundary of the western parcel. The watercourse enters the site at its south-western corner and has a 90 degree turn as it enters the site to follow the site boundary. This watercourse receives flow from the SuDS basins constructed as part of the recent development to the west of the site. This watercourse connects to the Appleton Way watercourse along the northern boundary of the western parcel. The watercourse is culverted under Appleton Way where it leaves the site boundary and continues north up Hyde End Road then in an eastern direction, along the northern boundary of the eastern parcel, towards the River Loddon through a network of watercourses.
- 3.4.4 The southern watercourse is located to the southern boundary of the western parcel. This flows in a southeasterly direction to Hyde End Road where it then flows in a southerly direction, following Hyde End Road before continuing towards the River Loddon.
- 3.4.5 The central watercourse is in the centre of the eastern parcel of the site. It flows in an easterly direction. It joins the eastern watercourse just beyond the eastern boundary of the site; this watercourse then flows towards the River Loddon.
- 3.4.6 There is a northern watercourse that runs along the northern boundary of the eastern parcel. This is an important feature of the site as it is a key conveyor of surface water flow.
- 3.4.7 All of these watercourses are Ordinary Watercourses.
- 3.4.8 **Figures 4 to 6** shows photographs of the eastern, western and central watercourses taken during the site walkover which was carried out in August 2024.

Figure 4 – Photograph of the Western Watercourse



Figure 5 - Photograph of the Central Watercourse



Figure 6 - Photograph of the Eastern Watercourse





3.4.9 The nearest Main River is the River Loddon which is located 250m to the east of the site.

3.5 Surface and Foul Water Sewers

3.5.1 Sewer asset records obtained from Thames Water show that there is a foul water sewer along the northern boundary of the western parcel and several foul sewers within the eastern parcel. The records show that there is a surface water sewer along Appleton Way.

3.5.2 A copy of the Thames Water Asset Record is included within **Appendix A**.

3.6 Geology and Hydrogeology

3.6.1 The British Geological Survey (BGS) 'Geology of Britain' online viewer indicates that the geology underlying the site is predominantly London Clay Formation. London Clay formation does not support infiltration to the ground. There are also superficial deposits of River Terrace Deposits.

3.6.2 The Cranfield University 'Soilscapes' online viewer indicates that the majority of the site overlies loamy soils with naturally high groundwater.

3.6.3 The DEFRA Magic Map online viewer indicates that the site lies outside of any Groundwater Source Protection Zone (SPZ). The majority of the site is not underlain by a bedrock aquifer. The site is underlain by a Secondary A bedrock aquifer.

3.6.4 A Secondary A aquifer is described by the BGS as 'permeable layers capable of supporting water supplied at a local rather than strategic scale, and in some areas forming an importance source of base flow to rivers. There are generally aquifers formerly classed as minor aquifers'.

3.6.5 Additionally, on-site intrusive works corroborate with BGS mapping.

4.0 Overview of Flood Risk

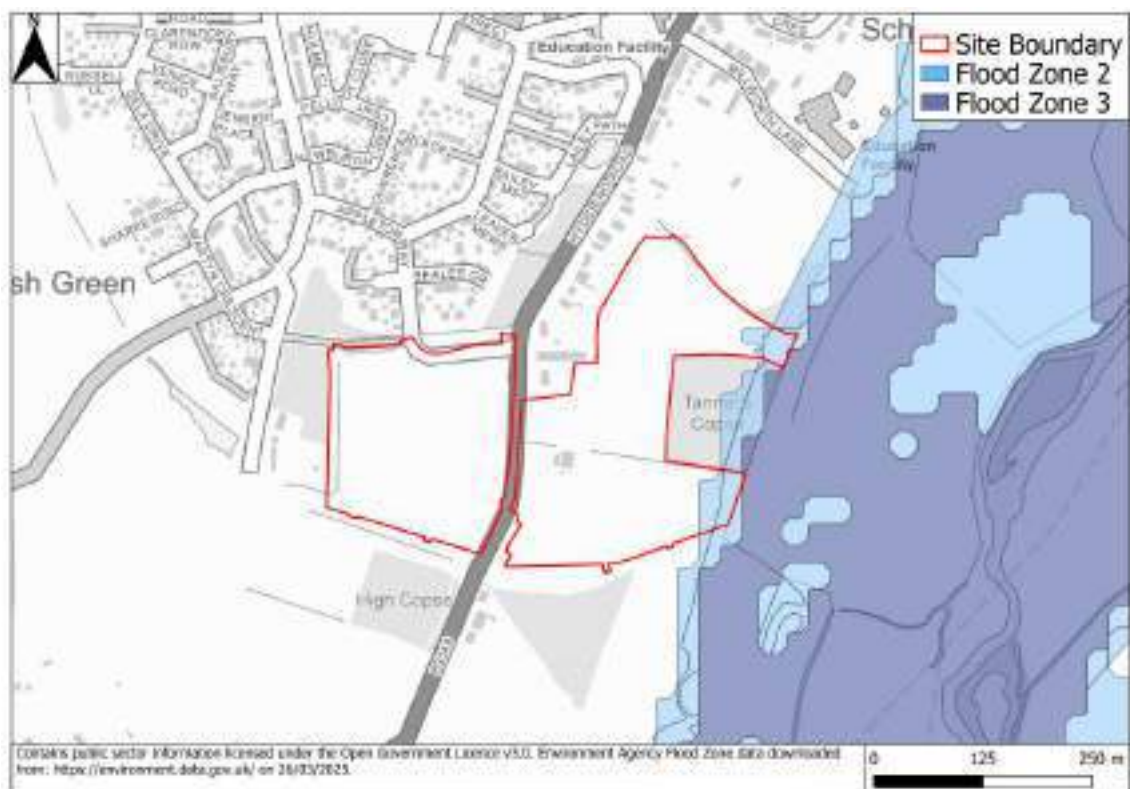
4.1 Flood Zones

4.1.1 The EA Flood Map for Planning provides an indication of the extent of flood zones. In the NPPF, flood zones are defined as follows:

- Flood Zone 1 'Low Probability' – Land less than 1 in 1,000 (0.1%) annual probability of river or sea flooding.
- Flood Zone 2 'Medium Probability' – Land between 1 in 100 (1%) and 1 in 1,000 (0.1%) annual probability of river flooding, or between 1 in 200 (0.5%) and 1 in 1,000 (0.1%) annual probability of sea flooding.
- Flood Zone 3 'High Probability' – Land at 1 in 100 (1%) or greater annual probability of river flooding, or 1 in 200 (0.5%) or greater annual probability of sea flooding.

4.1.2 Figure 7 shows the EA Flood Map for Planning mapping.

Figure 7 – EA Flood Map for Planning



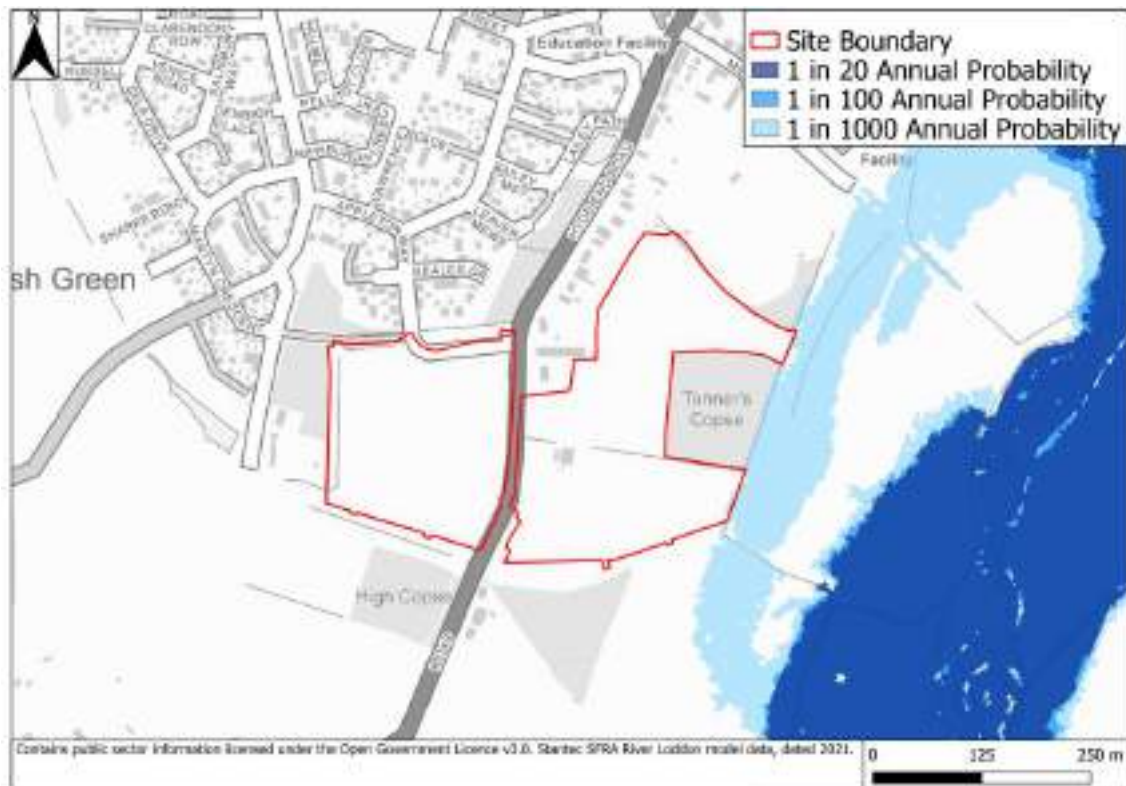


- 4.1.3 **Figure 7** confirms that the majority of the site is located within Flood Zone 1 ‘Low Probability’ of fluvial (or tidal) flooding, with only the eastern most areas of the site located within Flood Zone 2.
- 4.1.4 All of the site boundary is located within Flood Zone 1 ‘Low Probability’ of fluvial (or tidal) flooding. The eastern most areas of the site boundary are located within Flood Zone 2.
- 4.1.5 However, the EA Flood Map for Planning is strategic and only provides an initial indication of flood risk. A more detailed review of the potential for fluvial flooding is presented in the following section.

4.2 Flood Risk from Fluvial Sources

- 4.2.1 There have been a number of modelling studies for the River Loddon. These are summarised below and the most appropriate data for this site-specific FRA is confirmed.
- 4.2.2 Detailed modelling of the River Loddon was undertaken by WBC in support of the SFRA dated 2023. This modelling uses the EA’s 2009 River Loddon model, with updated hydrology data. The physical features within the catchment are the same as those within the 2009 model. This means that significant development features including the Eastern Relief Road in Shinfield are not included with this model.
- 4.2.3 WBC completed modelling in 2021 to support the 2021 SFRA which uses a more up to date ground model and includes recent physical features within the catchment such as the Eastern Relief Road. For the purpose of this site-specific FRA, the 2021 SFRA model is deemed to be the most representative of the current catchment and has therefore been used to inform the FRA. It is noted that the 2021 SFRA and model is part of the Local Plan Update informing the strategic site allocations.
- 4.2.4 **Figure 8** shows the 2021 SFRA modelled flood extents at the site.

Figure 8 – 2021 SFRA River Loddon Model Flood Extents



4.2.5 **Figure 8** shows that the majority of the site lies outside the modelled flood extents. The eastern boundary of the site is within the 1,1000 annual probability extent. .

4.2.6 Risk of flooding from fluvial sources to the site is therefore considered to be very low.

4.3 Flood Risk from Surface Water

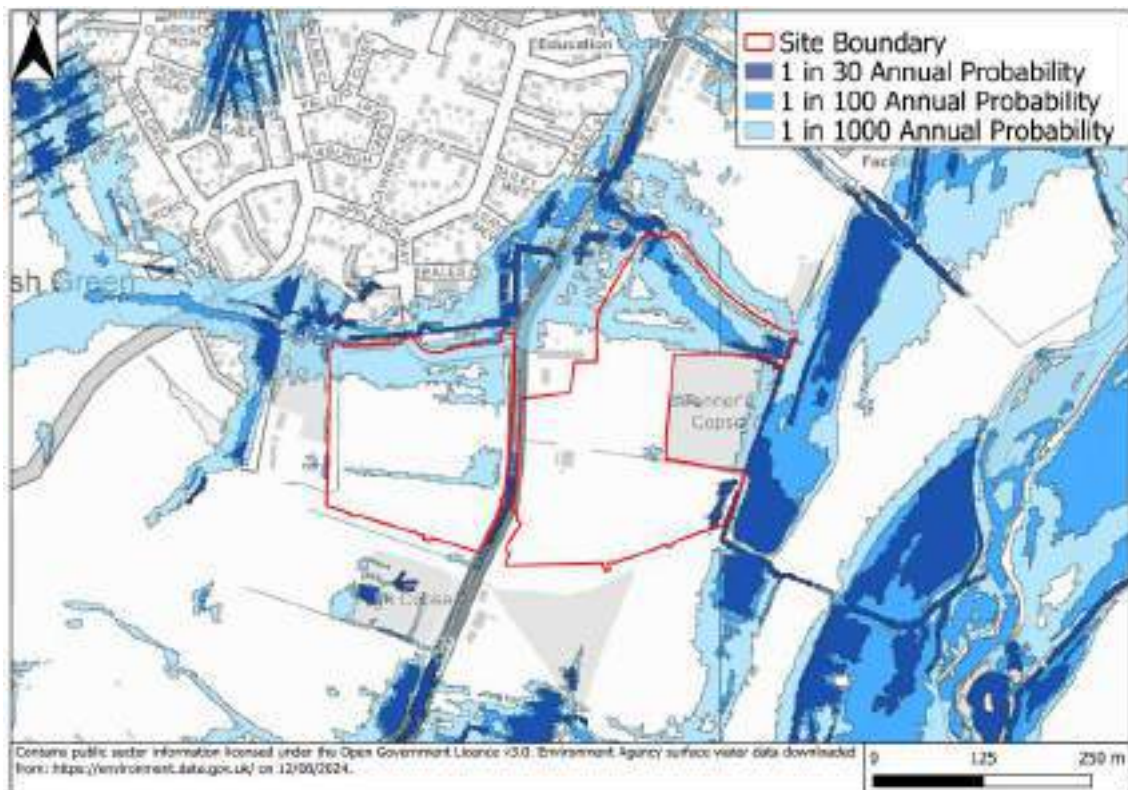
4.3.1 The EA's Risk of Flooding from Surface Water mapping indicates areas that could be susceptible to surface water flooding during extreme rainfall events. The EA surface water mapping defines rainfall events based on the following:

- 1 in 30 (3.3%) annual probability 'High Risk'
- 1 in 100 (1%) annual probability 'Medium Risk'
- 1 in 1,000 (0.1%) annual probability 'Low Risk'
- Lower than 1 in 1,000 (0.1%) annual probability 'Very Low Risk'.

4.3.2 The NPPF PPG – 'Flood Risk and Coastal Change' includes the 1 in 100 annual probability of surface water flood (including climate change) within the definition of the design flood event to be used to inform an FRA.

4.3.3 **Figure 9** shows the potential flood risk from surface water.

Figure 9 - EA Mapping of Surface Water Flooding (prior to January 28th 2025)



4.3.4

4.3.5 **Figure 9**, EA Flood Risk from Surface Water mapping pre-2025, shows that majority of the site is at a 'Very Low' (less than 0.1% annual probability) risk of surface water flooding. There is a flow route with 'Low' (between 1 in 30 and 1 in 1,000 annual probability) risk along the northern part of the western parcel and within the western parcel.

4.3.6 **Figure 9** shows that there is a flow route with a 'High' (greater than 3.3%), 'Medium' (between 3.3% and 1%) and 'Low' (between 1% and 0.1%) risk of surface water flooding along the northern part of the eastern parcel. However, the flow routes do not appear to consider the watercourses within the site, and adjacent development. It is likely the surface water extents were generated using LiDAR data flow prior to the recent development in the area. It is likely that the EA flow route from the west will be captured by the western watercourse. The flow route in the northern part of the western parcel will follow the location of the Appleton Way watercourse. The flow route in the northern part of the eastern parcel will likely follow the northern watercourse.

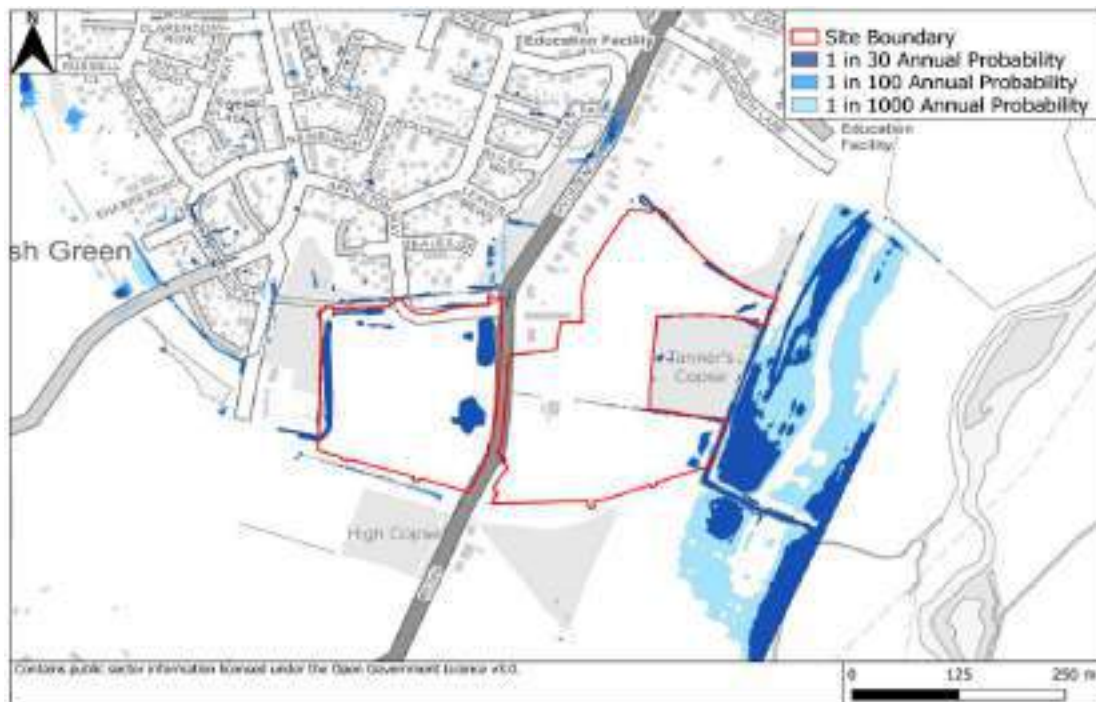
4.3.7 **Figure 10** shows the NaFRA surface water mapping which is based on the EA's most recent modelling published in January 2025.

Figure 10 - EA Mapping of Surface Water Flooding (from NaFRA data January 28th 2025)



- 4.3.8 In comparison to the previous mapping, the new NaFRA mapping (Figure 10) now shows that surface water flooding across the site is greatly reduced and is less extensive. However, in some areas where surface water flooding remains, the risk value has increased. Within the northeast of the eastern parcel, both the flood extent and risk factor has decreased.
- 4.3.9 Site observations partially confirmed the potential flow routes shown by EA mapping.
- 4.3.10 Abley Letchford has carried out direct rainfall modelling of the catchment, with defined channels to further refine the surface water flooding within the site. The modelling is based on the detailed topographical survey for the site and surrounding area as well as site observations and local catchment knowledge. The detailed modelling report is included within **Appendix C**.
- 4.3.11 There is relevance of showing both **Figure 9** and **Figure 10** of the surface water flood mapping. The updated mapping, shown in **Figure 10**, is more closely related to Abley Letchford's detailed modelling, which further validates the modelling undertaken.
- 4.3.12 **Figure 11** shows the baseline model results.

Figure 11 – Abley Letchford Direct Rainfall Model Baseline Surface Water Flood Extents



4.3.13 **Figure 11** shows that surface water flooding within the site is generally contained within the watercourses. There are two notable areas of ponding in the western parcel. The more northerly basin is associated with a pond, constructed as part of the recent residential development to the north. The southern area of ponding is associated with a low-lying area. The western part of the site slopes from west to east, and Hyde End Road is elevated slightly above the site. Surface water therefore ponds in this low point close to Hyde End Road. There are further small areas of potential surface water flooding in the western parcel of the site which are associated with localised low points in the topography.

4.3.14 Within the eastern parcel of the site, there are few areas of surface water flow or ponding. Along the northern boundary there are areas of surface water flow, which align with the site boundary. Within the eastern extremities of the site there are also areas of localised surface water ponding associated with localised depressions, however, there is no built form within this area. Overall, the majority of the eastern parcel has a low risk of surface water flooding.

4.4 Flood Risk from Groundwater

4.4.1 Groundwater flooding has the potential to occur after prolonged periods of unusually high rainfall. During such periods, more water than usual infiltrates through the ground, raising the water table above its normal level below the surface. Where the water table is at a shallow depth in any case, the water table can reach the surface. This can cause groundwater to merge with rainfall and cause localised flooding.

4.4.2 The WBC Level 1 SFRA provides data for susceptibility to groundwater flooding. This uses the EA areas susceptible to groundwater flooding mapping. The relevant mapping is provided in Appendix A of the SFRA, Page D1 and is reproduced in **Appendix A** of this report. It is described below.



- 4.4.3 The areas susceptible to groundwater flooding mapping indicates that the majority of the site is located within a 1km² grid square of which greater than 75% of the grid square is susceptible to groundwater flooding. The western part of the site is shown to be located within a 1km² grid square of which less than 25% of the grid square area is susceptible to groundwater flooding.
- 4.4.4 The WBC Level 1 SFRA also includes mapping of areas of groundwater emergence flooding which shows the depth of groundwater below the ground surface. The mapping is included within the SFRA in Appendix A, Page D1. The mapping indicates that the western parcel has a depth to groundwater of between 0.025m – 0.5m and the eastern parcel has a depth to groundwater of less than 0.025m.
- 4.4.5 A groundwater investigation is included within the groundwater investigation report dated 17/04/25. The investigation concluded that groundwater depths are generally between 0.7-1.7m bgl. This confirms that the risk of groundwater flooding is less than initially indicated within the WBC Level 1 SFRA.
- 4.4.6 Therefore, the risk of groundwater flooding across the majority of the site is therefore considered by the SFRA to be Medium. The risk of groundwater flooding is likely to be higher in the areas closer to the River Loddon, where no susceptible development is proposed. Additionally, ground levels will be raised as part of the mitigation strategy.

4.5 Flood Risk from Sewers

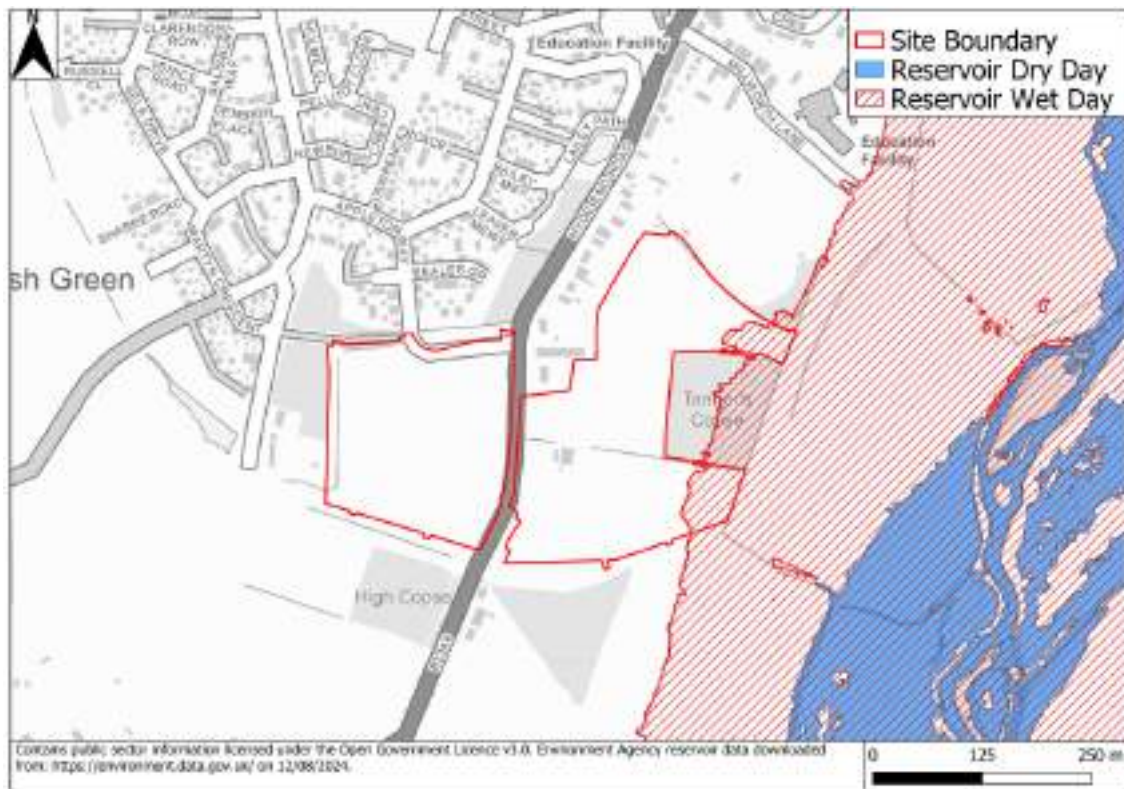
- 4.5.1 When exceeded, surcharged sewer networks can lead to flooding from backed up manholes and gully connections.
- 4.5.2 Thames Water Asset Location Plans (reference 2024_5024941) show that there are several foul water sewers within the site boundary. The plans show that there is a surface water sewer along Appleton Way. A copy of the Thames Water Asset Plans is included within **Appendix A**.
- 4.5.3 There is no data provided within the WBC Level 1 SFRA that flooding has occurred specially within the site boundary. However, the WBC Level 1 SFRA shows that the site is located within a postcode area (RG2 9) with 172 incidents of sewer flooding between 2000 and 2022.
- 4.5.4 This provides evidence of historic sewer flooding and therefore the risk is considered to be medium.

4.6 Flood Risk from Reservoirs

4.6.1 The EA flood risk from reservoirs mapping indicates areas that would be at risk of flooding in the event of a reservoir breach.

4.6.2 **Figure 13** shows the flood risk from reservoirs.

Figure 13 – EA Flood Risk from Reservoirs



4.6.3 The mapping indicates that the majority of the site is not at risk of flooding in the event of a reservoir breach. However, the eastern edge of the eastern parcel are shown to be potentially impacted by reservoir flooding in the event that reservoir flooding occurs at the same time as fluvial flooding.

4.6.4 The EA Long Term Flooding description states that 'Flooding from reservoirs is unlikely in this area'.

4.6.5 Overall, the risk from reservoir flooding is low.

4.7 Flood Risk from Other Sources

4.7.1 The EA flood risk maps, WBC PFRA and WBC Level 1 SFRA indicate that the site is not at risk of flooding from canals or other artificial sources.

4.8 Historic Flooding

4.8.1 **Figure 14** shows the historic flood extent records held by the EA. The EA Historic Flood Map shows the maximum extent of recorded flood events

Figure 14 – Historic Flood Extents



4.8.2 The EA historic flood outlines dataset indicates that the majority of the site has been unaffected by flooding, with the exception of the extreme eastern boundary, where flooding occurred during the winter of 1990 and 1991, and July 2007. However, no vulnerable elements of the development are proposed within the identified areas.

4.9 Flood Risk Summary

4.9.1 A summary of flooding from all sources is provided in Table 1.

Table 1 – Summary of Flood Risk

Source of Flooding	High	Medium	Low	Comments
Tidal			✓	The site is inland and not influenced by tidal levels.
Fluvial			✓	The majority of the site is located within Flood Zone 1, with the extreme eastern edge sited within Flood Zone 2 according to the EA's strategic flood zone mapping. No development is proposed in this part of the site. However, a more recent model completed for the 2021 SFRA R shows that the entire site is located outside of the 1 in 1,000 annual probability flood



				extent from the Loddon. This modelling is deemed to be more representative of the potential flooding at the site. Therefore, the site and specifically the part of the site for development, is at low risk of fluvial flooding according to the available data.
Pluvial		✓		The EA Flood Risk from Surface Water mapping and NaFRA mapping indicates that majority of the site is at a 'Very Low' risk of surface water flooding. There are a few surface water flow routes within the site with a 'Low', 'Medium' and 'High' risk of surface water flooding. Detailed modelling, completed as part of this FRA, shows that the majority of the site has a 'Very Low' risk of surface water flooding. The surface water flood risk is generally contained within the drainage ditches and pond. There are a couple of areas of surface water flooding which correspond with the location of localised low points in the topography.
Groundwater		✓		The groundwater mapping within the WBC Level 1 SFRA indicates that the risk of groundwater flooding across the majority of the site is considered to be high. However, groundwater monitoring confirms that the risk of groundwater flooding is less than initially indicated within the WBC Level 1 SFRA. Therefore, risk of flooding from groundwater is considered to be medium risk
Sewers		✓		The Thames Water asset location maps show that there are foul water sewers within the site boundary and a surface water sewer along Appleton Way. Due to historic sewer flooding events, the risk of flooding from sewers is considered to be medium risk.
Reservoirs, canals and other artificial sources			✓	EA and WBC Level 1 SFRA mapping do not indicate the site to be at risk of flooding from other sources.



- 4.9.2 For the purposes of this FRA, the fluvial flooding design flood event should be taken as the floodplain extent and flood levels for the 2021 SFRA River Loddon 1 in 100 annual probability scenario plus an allowance for climate change. In this instance the relevant fluvial climate change allowance is 14% which is the central allowance for the Loddon and Tributaries Management Catchment from the DEFRA Climate Change Allowances Website.
- 4.9.3 The design event for surface water flooding design flood event should be informed by the surface water 1 in 100 annual probability scenario plus an allowance for climate change. The 2070 Upper End allowance of 40% has been used for the direct rainfall modelling. This is from the Loddon and Tributaries Management Catchment peak rainfall allowances from the DEFRA Climate Change Allowances Website.



5.0 Sequential Test and Exception Test

5.1 NPPF Sequential Test and Exception Test

- 5.1.1 NPPF states that Local Planning Authorities allocating land for development should apply the Sequential Test to demonstrate that there are no reasonably available sites in areas with a lower probability of flooding that would be appropriate to the type of development or land use proposed.
- 5.1.2 The majority of the site is located within Flood Zone 1, albeit according to the EA Strategic Flood Mapping, the extreme eastern parts of the site are shown to be located within Flood Zone 2. However, the 2021 SFRA River Loddon modelling, which is based upon more detailed assessment of the site and its' surroundings, shows that the majority of the site is located outside of the modelled 1 in 1,000 annual probability flood extent and therefore within Flood Zone 1.
- 5.1.3 The majority of the site is located within an area with a 'Very Low' risk of surface water flooding with only areas of 'High', 'Medium' and 'Low' flooding along the Ordinary Watercourse corridors, as would be expected.
- 5.1.4 The WBC Level 1 SFRA indicates that the risk of groundwater flooding is High. However, groundwater monitoring confirms that the risk of groundwater flooding is less than initially indicated within the WBC Level 1 SFRA. Therefore, risk of flooding from groundwater is considered to be medium risk.
- 5.1.5 The flood risk from other sources is low.
- 5.1.6 The proposed development is for a residential use. It is classed within the NPPF as 'More Vulnerable' development.
- 5.1.7 All of the built residential and vulnerable elements of the development will be located within Flood Zone 1 and areas of Very Low risk of surface water flooding, once the surface water drainage strategy is in place.
- 5.1.8 Notwithstanding the above, the site is a draft allocation within the emerging WBC Local Plan Update. The Sequential and Exception Tests were carried out for the site (5SH023 and 5SH027 – Land East and West of Hyde End Road) by Wokingham Borough Council, and whilst yet to be formally allocated as part of the Development Plan, the Sequential and Exception Tests have been used to inform Wokingham Borough's housing strategy, which includes the inclusion of the application site.

5.2 Exception Test

- 5.2.1 Given the amendments to the NPPF in December 2024, and that it is proposed for development to be sited in areas of low flood risk, an Exception Test is no longer required. However, due to this policy change occurring following much of the evidence to support the Local Plan Review being undertaken, the Exception Test has already been carried out by the LPA, which concluded the following.
- 5.2.2 The built residential development is located within Flood Zone 1. The vulnerability of the development is 'More Vulnerable'. Table 2 in the NPPF PPG sets out when the Exception Test is required.



- 5.2.3 The WBC Level 2 SFRA states ‘the exception test is required for this site because the development classified as ‘More Vulnerable’ is within Flood Zone 3a or at significant risk of surface water flooding.’
- 5.2.4 Paragraph 170 of the NPPF states that to pass the Exception Test it should be demonstrated that:
- a) *the development would provide wider sustainability benefits to the community that outweigh the flood risk; and*
 - b) *the development will be safe for its lifetime taking account of the vulnerability of its users, without increasing flood risk elsewhere, and, where possible, will reduce flood risk overall.*
- Both elements of the exception test should be satisfied for development to be allocated or permitted.***
- 5.2.5 The site is proposed as a housing allocation within the WBC Local Plan Update. The Sequential and Exception Tests were carried out for the site (5SH023 and 5SH027 – Land East and West of Hyde End Road) and passed accordingly.
- 5.2.6 The WBC Local Plan Update states that ‘sites allocated in the Local Plan Update do not need to apply the Sequential Test again but may need to reapply the Exception Test if relevant aspects of the proposal have changed since this was undertaken at the plan making stage, or if more recent information about the existing or potential flood risk has become available’.



6.0 Flood Mitigation Strategy

6.1 Sequential Approach

- 6.1.1 The NPPF advocates a 'sequential approach' in master planning for new development: locating the more vulnerable uses of the development in the areas of lowest flood risk from all sources.
- 6.1.2 The masterplan reflects this sequential approach with all residential development located in Flood Zone 1. Whilst the surface water flood maps indicate some areas within the site to be potentially affected by surface water flooding, suggested development, including escape routes or land raising, will not be sited here and further analysis and site observations have confirmed the risk is low or will be managed through the surface water drainage strategy. The parcels for development are therefore within areas of low surface water flood risk.
- 6.1.3 The design event for fluvial flooding has been taken from the 2021 SFRA modelling. The floodplain for this modelling is slightly less extensive than the older modelling used to inform the EA flood zones. Using the 2021 SFRA data, the proposed development is all located outside the floodplain for the design event; indeed, the entire site is outside this floodplain. It is understood that the EA has not reviewed the 2021 SFRA model for the purposes of informing a site-specific FRA. If such a review were undertaken, then the floodplain extent may be subject to some changes, and it is possible that the final floodplain outline could be either less extensive than the 2021 SFRA shows or could be closer to the EA flood zone mapping. However, the principle for the development strategy is robust in that the residential built for is more than 50m beyond the floodplain extent for the design event from the 2021 SFRA and more than 25m from the edge of the EA flood zones. The design approach is therefore robust even given a precautionary approach to interpreting the available modelling data and establishing the areas for development; the strategy is not reliant on approval of the 2021 SFRA model.

6.2 Ground Floor Levels

- 6.2.1 The requirements for setting ground floor levels for new developments are set out in BS8533:2017 'Assessing and Managing Flood Risk in New Developments – Code of Practice'. A finished floor level of at least 300mm above the modelled level for the 1 in 100 annual probability plus climate change allowance is recommended in the WBC Level 1 SFRA.
- 6.2.2 The built residential development will be located outside of the fluvial floodplain for the design event, as defined by the worst-case EA Flood Map for Planning. Where required, finished floor levels will be set with an appropriate freeboard, according to WBC guidance, above the potential flood levels determined at the detailed design phase.
- 6.2.3 In addition, ground floor levels should be set a minimum of 150mm above the surrounding ground level to mitigate the residual flood risk from surface water runoff events. Wherever possible, surrounding ground levels should be contoured away from the development.

6.3 Floodplain Storage and Flow Routing

- 6.3.1 The proposed built development areas are located outside of the fluvial flood extents for the design event. There is therefore no impact on fluvial floodplain storage or conveyance as a result of the proposed built development.



- 6.3.2 As discussed in paragraphs 4.17 to 4.20, the EA surface water flow routes do not tie in with the topographical data and site observations. A more detailed analysis of flows has been carried out to ensure that there are no detrimental offsite impacts.
- 6.3.3 The surface water flow in the Ordinary Watercourse and Ordinary Watercourse tributary will be managed within a watercourse corridor.
- 6.3.4 There is a watercourse along the northern boundary of the site. This watercourse collects surface water from the land to the north of the site. The watercourse channels flow to the north-east corner of the site where it flows along the eastern boundary of the Site where it joins the Ordinary Watercourse tributary.
- 6.3.5 The flow route on land west of Hyde End Road will be managed by the surface water mitigation strategy. The flow originates from within the site, therefore the flow is accommodated within the surface water drainage strategy.
- 6.3.6 Once implemented, the built residential development will have no detrimental offsite impact on surface water floodplain storage or flow routes.

6.4 Safe Access

- 6.4.1 The site is located outside of the fluvial flood design event of 100 plus climate change extent. Continuous safe access for the development via Hyde End Road is located outside of the fluvial extent.

6.5 Residual Risk

- 6.5.1 The NPPF PPG – ‘Flood Risk and Coastal Change’ defined residual risk as coming from ‘flood risk management infrastructure’ and the ‘residual risk to a development once any site-specific flood mitigation measures are taken into account’.
- 6.5.2 Residual risk to the site includes a breach in the raised flood defences, the failure of a reservoir and a flood event greater than the designed standards, all of which are considered to be low probability events.
- 6.5.3 The residual risk to the site is low. The EA AIMS dataset which contains information of flood defences indicates that the site does not benefit from raised flood defences. The EA mapping for reservoir breaches indicates that, whilst the eastern edge of the site may be affected. However, the built residential development is not located within an area at risk of flooding in the event of a reservoir breach.



7.0 Surface Water Drainage

7.1 Introduction

- 7.1.1 This chapter provides details on the surface drainage strategy and includes measures to drain the proposed development site.

7.2 Overall Strategy

- 7.2.1 The proposed drainage strategy has been designed to meet the requirements of the NPPF by providing a comprehensive drainage system which embraces the SuDS philosophy and key principles. The utilisation of Sustainable Drainage Systems (SuDS) not only provides the benefit of controlling waters at source and online treatment of collected surface water but also allows enhanced aesthetics through improved landscaping, biodiversity, and ecological opportunities.
- 7.2.2 These features offer a holistic treatment train and management system to the benefit of new residents, members of the wider community, downstream receptors and the environment.
- 7.2.3 The alteration of natural surface water flow patterns through developments can lead to problems elsewhere in the catchment, particularly flooding downstream. Changes of land uses can have significant downstream impacts where existing drainage systems may not have sufficient capacity for any additional surface water flow.
- 7.2.4 A surface water management strategy is therefore required to manage and reduce the flood risk posed by the surface water runoff from the site. The surface water drainage arrangements for any development site should be such that the volumes and peak flow rates of surface water leaving a developed site are no greater than the rates to the pre-development scenario, unless specific off-site arrangements are made and result in the same net effect.
- 7.2.5 Sustainable water management measures (SuDS) should be introduced to control the surface water runoff from the proposed development site therefore, managing the flood risk to the site and surrounding areas from the surface water runoff.
- 7.2.6 The Construction Industry Research and Information Association, CIRIA's C690 states the following:
- **Prevention** – the use of good site design and housekeeping measures on individual sites to prevent runoff and pollution (e.g. minimise areas of hard standing surfaces)
 - **Source Control** – control of runoff at or very near its source
 - **Site Control** – management of water from several sub-catchments (including routing water from roofs and car parks to one or several soakaways for the entire site)
 - **Regional Control** – management of runoff from several sites, typically in a detention basin or wetland.
- 7.2.7 The SuDS Manual 2015 (C753) provides best practice guidance on the planning, design, construction, operation and maintenance of SuDS. This document provides guidance to ensure that SuDS are planned and designed to maximise the opportunities and benefits of surface water management.



- 7.2.8 The four main categories of benefits that can be achieved by SuDS, referred to as the four pillars of SuDS design, are:
- **Water quantity** – control the quantity of runoff to support the management of flood risk, and maintain and protect the natural water cycle;
 - **Water quality** – manage the quality of the runoff to prevent pollution
 - **Amenity** – create and sustain better places for people
 - **Biodiversity** – create and sustain better places for nature.
- 7.2.9 Supplemental to CIRIA guidance, Document H of the Building Regulations 2015 sets out three possible options to discharge surface water runoff. Rainwater shall discharge to one of the following, listed in order of priority:
- An adequate soakaway or some other adequate infiltration system; or where that is not reasonably practicable,
 - A watercourse; or where that is not reasonably practicable
 - A sewer.
- 7.2.10 High groundwater(Ref: Para 4.25 above) and the underlying geology is not conducive to the use of infiltration type techniques (Ref: Para 3.17 above), the surface water drainage proposals will be designed to attenuate runoff with controlled discharge to the existing local watercourses i.e. the existing open field ditch on site which would be feasible point of discharge.
- 7.2.11 Implementation of SuDS will ensure that flood risk downstream is not increased due to the proposed development. These features will also provide positive improvements to the quality of surface water runoff.
- 7.2.12 The following SuDS components are deemed applicable to the site:
- 7.2.13 Conveyance systems – components that convey flows to downstream storage systems, e.g. swales and filter drains.
- 7.2.14 Storage systems – components that control flow, and possibly volumes, by storing water and releasing it slowly, e.g. geocellular units, attenuation basins and wetlands.
- 7.2.15 Treatment systems – components that remove or facilitate the degradation of contaminants present in runoff, e.g. filter strips and proprietary treatment systems.
- 7.3 Pre and Post Development Areas/Rates**
- 7.3.1 To quantify any potential increase in surface water runoff, the existing Greenfield/Pre-Development runoff rate from the site must be determined. The rates of runoff have been determined using the current ‘industry best practice’ guidelines as outlined in the Interim Code of Practice for SuDS.
- 7.3.2 An assessment of existing surface water runoff has been undertaken, to determine the potential surface water options and attenuation requirements for the site utilising the following parameters taken from the UK Centre for Ecology & Hydrology Flood Estimation Handbook Web Service:



- NGR: SU 73023 67223
- BFIHOST: 0.534
- BFIHOST19: 0.607
- PROPWET: 0.29
- SAAR6190: 640mm

7.3.3 Based on the masterplan, the developable area of the site has been calculated at a total of 7.9 ha as illustrated in the catchment drawings HD068-058 & HD068-059 included in the appendix.

7.3.4 The calculated Greenfield run off discharge rates, are as presented in **Table 2**. The corresponding runoff outputs created with HR Wallingford Greenfield runoff rate estimation tool can be found within **Appendix D**.

Table 2 – Pre-Development Runoff Rates/Volumes per Hectare

Annual Exceedance Probability	Greenfield/Pre-Development Runoff Rate and Storage Volume per hectare
1 in 1 year event (l/s)	3.76
QBar (l/s)	4.42
1 in 30 year event (l/s)	10.16
1 in 100 year event (l/s)	14.1

7.3.5 Based on the developable area of 7.9ha, the proposed total discharge rate of the site will be restricted to QBar or 34.9 l/s, which will be divided between the two proposed outfalls to the site located on the eastern side of the development.

7.3.6 Based on the Masterplan, the impermeable area of the proposed development is approximately 4.238ha. This is based on the assumption that 65% of the developed area will be considered to be hardstanding. This figure acknowledges that the SuDS Manual (CIRIA 753) suggests that a 10% urban creep be accounted for all proposed dwellings, for potential future expansion of those dwellings, and is considered a robust approach. Furthermore, it is assumed that the areas of the basins will add an additional 100% of their area to the impermeable area calculations.

7.4 Surface Water Proposals

7.4.1 It is proposed to provide a network of trapped gullies, pipes and Sustainable Drainage (SuDS) features to collect the surface water runoff from impermeable areas such as roads, roofs and driveways. The traditional system will work in combination with such features as, roadside swales and enhanced swales, within the residential parcels and Green Blue corridors, to filtrate, store and transport water to attenuation basins to provide attenuation storage and high-quality water benefits.



- 7.4.2 SuDS features such as series of swales and enhanced swales will form treatment trains and blue corridors that will enhance the water quality and aesthetic amenity of the proposed residential development and mimic the existing drainage regime.
- 7.4.3 The final attenuation basins will drain, with a controlled greenfield discharge or QBar into the existing ordinary watercourses.
- 7.4.4 Drawing HD068-FA-051 Drainage Layout Sheet 1 & HD068-FA-052 Drainage Layout Sheet 2 Drainage Layout Sheet 2 provide an overview to the surface water proposals together with the estimated requirements for the required storage and SuDS features for the parcels within the various zones of the proposed development and can be found within **Appendix D** together with the accompanying calculations.
- 7.4.5 The surface water runoff from the site (refer to HD068-FA-052 Drainage Layout Sheet 1 & HD068-FA-053 Drainage Layout Sheet 2 Drainage Layout Sheet 2 in **Appendix D**), will be collected via a network of pipes, swales and filter drains and transferred to Basins 1, 2, 3 and 4 via their associated networks. In addition, the manhole chambers of the proposed network could utilise multiple catchpits to minimize the amount of silt entering the proposed attenuation basins.
- 7.4.6 The banks of the SuDS basins will be designed in accordance with the SuDS Manual C753 in respect to having a maximum gradient of 1 in 3 to accommodate the 1 in 1 year storage level and an appropriate 300mm freeboard above the maximum water level. Above the level of the 1 in 1 year event, side slopes have been reduced to allow easy access to the basins so that for the majority of their lifespan they can be utilized as green space with extra storage being provided for only the larger storms. This allows landscaping of both wetland and wildflower mixes to provide an appropriate landscape context in the vicinity of the features through the provision of an aquatic shelf.
- 7.4.7 Open SuDS features will be designed so as not to compromise the safety of residents, visitors and their property. Generally open boundaries are provided, and perimeter planting could be utilised to define the extents of the features.
- 7.4.8 Proposed discharge rates will be restricted to greenfield runoff rates or QBAR for all storm events up to and including the 1 in 100 year storm event plus 40% allowance for climate change. Flows would be attenuated on site and discharged utilising an on-site flow control device such as a Hydrobrake.
- 7.4.9 All conveyance systems will be designed to cater for the 1:30 year storm event, in accordance with industry standard, with all attenuation features designed to allow for the 1 in 100 year storm event plus 40% climate change allowance.
- 7.4.10 The proposals draw reference to the DEFRA document Sustainable Drainage Systems, Non-statutory technical standards for sustainable drainage systems March 2015, as well as CIRIA C753 The SuDS Manual.
- 7.4.11 Current uncontrolled pluvial runoff exhibited onsite during high rainfall events will be mitigated as a result of the Development. This will occur by virtue of the change in surface from greenfield to positively drained impermeable areas, which will serve to capture, attenuate and delay surface water runoff. This will be a benefit to downstream receptors.



- 7.4.12 There is scope to utilise source control techniques (such as swales, granular strips and permeable paving) that will assist with the volume reduction of the basins, which are the largest attenuation storage features for this residential development. This should be embraced and investigated as the project progresses.
- 7.4.13 Due to high groundwater, attenuation basins may require lining to protect against water ingress. Such lining provides the ability to create localised, small permanent bodies of water, which adds landscaping, biodiversity and treatment opportunities to the scheme.
- 7.4.14 To provide a robust drainage strategy and ensure the development does not contribute to off-site flooding, the attenuation basins have been designed to accommodate all excess surface water flows generated by the 1 in 100-year storm event, including a 40% allowance for climate change, even under surcharged conditions at the outfall. In the event that the outfall—located within Flood Zones—becomes submerged due to the 1 in 100-year fluvial flooding of the River Loddon, discharge from the basins will be delayed until water levels within the basins exceed the river flood level. During such periods, discharges will be limited to QBar to ensure controlled release.

7.5 Exceedance Flood Routing

- 7.5.1 Flows in excess of the above design storms, which may flood from the network for storms in excess of the 1 in 100 year storm plus 40% climate change, will be kept within the internal road network, until such time as they can be directed into adjacent landscaping areas or existing vegetation/woodland.
- 7.5.2 The attenuation basins within the Development are designed to provide 300mm freeboard and therefore can accept additional flood water from manholes upstream.

7.6 Water Quality Improvements

- 7.6.1 CIRIA report C753 The SuDS Manual outlines the methodology for assessing water quality risks associated with new development. This is a simple index approach which provides a high level scoping analysis of the land usage and gives guidelines for appropriate treatment stages.
- 7.6.2 This process identifies features necessary to provide adequate substance removal in line with Environment Agency requirements. This is a three step process of Allocation, Mitigation and Review.
- 7.6.3 Surfaces generating runoff are 'graded' on their potential to contribute to various harmful pollutants and gives each surface a risk of pollution from each element. An extract of Table 26.2 within the SuDS Manual is set out overleaf.

Table 7 – Extract from Table 26.2 SuDS Manual

Land Use	Pollution Hazard Level	Total Suspended Solids	Metals	Hydrocarbons
Residential Roofs	Very Low	0.2	0.2	0.05
Other Roofs	Low	0.3	0.2-0.8	0.05
Low traffic residential roads and non-residential parking with infrequent change.	Low	0.5	0.4	0.4



Commercial yard, parking with frequent change, other roads,	medium	0.7	0.6	0.7
Sites with heavy pollution	High	0.8	0.8	0.9

- 7.6.4 Historically, PPG3 documentation would recommend that pollutants were removed utilising oil separators, but since its superseding, more recent guidance has shifted to the use of SuDS features to remove pollutants; thereby providing significant improvements in treatment.
- 7.6.5 The use of non-mechanical features decreases the requirements for maintenance and increase natural biodiversity. That said, the SuDS Manual does not remove the possibility of utilising separators, so long as they are considered in partnership with a comprehensive overall SuDS regime.
- 7.6.6 Without adequate treatment, the pollutants would cause damage if they were to enter the watercourse or water table in large volumes. The use of SuDS features to slow down and degrade these pollutants is critical to the provision of an acceptable discharge.
- 7.6.7 The Residential Roofs of the proposed development are classified as 'Very Low' in accordance with the Pollution Hazard Level, which equals to Total Suspended Solids: 0.2, Metals: 0.2 and Hydrocarbons: 0.05.
- 7.6.8 In addition, the low traffic residential roads of the proposed development are classified as 'Low' in accordance with the Pollution Hazard Level, which equals to Total Suspended Solids: 0.5, Metals: 0.4 and Hydrocarbons: 0.4.
- 7.6.9 The respective cleansing abilities of common SuDS features are given by corresponding mitigation indices within the SuDS Manual. An extract of Table 26.3 is set out below.

Table 8 – Extract from Table 26.3 SuDS Manual

Type of SuDS component	Total Suspended Solids	Metals	Hydrocarbons
Filter strip	0.4	0.4	0.5
Filter Drain	0.4	0.4	0.4
Swale	0.5	0.6	0.6
Bioretention system	0.8	0.8	0.8
Permeable Paving	0.7	0.6	0.7
Detention Basin	0.5	0.5	0.6
Pond	0.7	0.7	0.5
Wetland	0.8	0.8	0.8

- 7.6.10 The individual pollution indices are totalled, with the first SuDS component utilising its full value and subsequent downstream SuDS features acting with 50% efficiency. This provides a realistic strategy which mimics the reduced cleansing effectiveness as the concentration of a pollutant decreases along the SuDS train.
- 7.6.11 The attenuation basins (TSS:0.5, Metals:0.5, Hydrocarbons:0.6), as a standalone feature only, offers more than adequate pollution mitigation. However, wherever possible flows have been directed towards the green blue features to ensure additional treatment for and to slow the progress surface of surface water runoff prior to entering the receiving watercourse.



7.6.12 The access road to the eastern parcel may be subjected to an excess of 300 movements a day and therefore may be classified as a medium pollution hazard level (TSS:0.7, Metals:0.6, Hydrocarbons:0.7). In order to mitigate against this, permanent wetted areas will need to be provided in Basin 2 to provide sufficient treatment (TSS:0.7, Metals:0.7, Hydrocarbons:0.5), this provided in tandem with the basin (0.5 x (TSS:0.5, Metals:0.5, Hydrocarbons:0.6)) giving a total (TSS:0.95, Metals :0.95, Hydrocarbons 1) gives adequate treatment for this potential hazard.

7.6.13 In line with Environment Agency guidance, before the design phase is concluded, the proposals are to be reviewed and analysed in order to identify potential shortcomings and to ensure that adequate volume of SuDS features are provided to mitigate the risk of pollution from each source.

7.7 SuDS Maintenance Strategy

7.7.1 For the water treatment effects of SuDS features to remain effective, a comprehensive maintenance strategy should be implemented.

7.7.2 During construction, maintenance of SuDS features should be undertaken by the Contractor. Upon completion, the assets should be passed over to the Management Company, statutory authority, or community group commissioned to maintain the features in perpetuity.

7.7.3 As part of the strategy, a regular maintenance regime will be created, which consists of several primary measures required to ensure the longevity of the system. These should be undertaken on a regular basis to ensure consistent performance. Typical maintenance activities consist of:

- Inspecting and reporting; relatively regular review of the condition identifying issues and providing resolutions. Periodic review from the maintenance contractor;
- Litter and debris removal;
- Grass trimming, overall cutting and localised strimming preventing blockages;
- Weed and evasive plant control;
- Shrub management;
- Aquatic and shoreline vegetation management;
- Sweeping pervious surfaces; and
- Oil removal from proprietary systems.

7.7.4 A remedial maintenance schedule would be recommended as part of the handover of the SuDS features, remedial maintenance is required to provide repairs to the system and monitor long term damage ensuring the system remains consistently productive. The schedule could consist of;

- Structure rehabilitation and repair;
- Infiltration surface rehabilitation;
- Scarifying to remove “Thatch”;
- Spiking or Tining the soil;
- Air pressure treatment.



7.7.5 The maintenance schedule contents and timing will depend upon multiple factors including usage, contents of water utilising the system, location and biology. To this end, it is suggested that the schedule be finalised as part of detailed design; ensuring the most comprehensive maintenance schedule is incorporated for the phase in hand.

7.7.6 Community outreach can be undertaken as part of the development, which will raise awareness on the importance of SuDS to both flood risk and water quality in the local area. Imparting the new residents with knowledge on the risks associated with pollution to the surface water drainage system is key, as is the direct effect their actions may have on water quality and biodiversity in the area.

7.8 Adoption and Ownership

7.8.1 The drainage system is designed to the appropriate standards including the new Sewerage Sector Guidance (SSG), the Building Regulations and the requirement of the National Planning Policy Framework.

7.8.2 The intention of adoption and ownership of drainage and SuDS is as follows:

- Surface water sewers within development parcels are expected to be offered for adoption to Thames Water or NAV under the Section 104 process of the Water Industry Act.
- Surface water highway drains, gullies and leads within adopted roads are likely to be maintained by the Highway Authority.
- Above ground attenuation (i.e. swales and basins) to be maintained by a private maintenance company funded by residential properties or subject to agreement with the Local Authority.
- SuDS features serving single properties, for example, permeable paved driveways to single dwellings, will be owned and maintained by the owner of that property.



8.0 Foul Water Drainage

8.1 Introduction

- 8.1.1 This chapter provides details on the proposed foul water drainage strategy and measures to convey effluent.

8.2 Overall Strategy

- 8.2.1 The site is split into two distinct areas, East of Hyde End Road and West. The Eastern area of the site is crossed by two existing Thames Water Sewers. A foul sewer also runs adjacent to the Western area of the site to the north. A copy of the Thames water asset plan is included in the appendix and their location has been confirmed by the topographical survey.
- 8.2.2 It is proposed to connect both areas of the site to the foul sewers, crossing the eastern area of the site at multiple locations. All connections will be via gravity.
- 8.2.3 It is also proposed to redirect some of the existing sewers so that they work in harmony with the proposed site layout.
- 8.2.4 Discussions are currently ongoing with Thames Water as to the best possible location for the final connections and for the redirection of the existing sewers depending on the capacity of the existing sewers.
- 8.2.5 Notwithstanding this, the delivery of the proposed on-site foul water sewers will be designed in collaboration with Thames Water and the dedicated NAV provider as approving body in accordance with the new Sewerage Sector Guidance (SSG) and the new sewers will be offered to the NAV provider for adoption under S104 Agreement of the Water Industry Act. The connection to the existing public sewer system will be made via a S106 Agreement of the Water Industry Act with Thames Water as part of the overall adoption process.

Adoption and Ownership

- 8.2.6 The drainage system is designed to the appropriate standards including the new Sewerage Sector Guidance (SSG), the Building Regulations and British Standards.
- 8.2.7 Foul water sewers within development parcels and offsite to the point of connection are likely to be offered for adoption to Thames Water or NAV under the Section 104 process of the Water Industry Act.



9.0 Conclusion

9.1 Flood Risk

9.1.1 The EA Flood Risk mapping has been reviewed alongside the Wokingham Borough Council (WBC) Preliminary Flood Risk Assessment (PFRA) and Level 1 and Level 2 Strategic Flood Risk Assessment (SFRA).

9.1.2 This Flood Risk Assessment (FRA) concludes that:

- The majority of the site is located within Flood Zone 1, albeit according to the EA Strategic Flood Mapping, the extreme eastern parts of the site are shown to be located within Flood Zone 2. However, the 2021 SFRA River Loddon modelling, which is based upon more detailed assessment of the site and its' surroundings, shows that the majority of the site is located outside of the modelled 1 in 1,000 annual probability flood extent and therefore within Flood Zone 1.
- The EA Flood Risk from Surface Water mapping indicates that majority of the site is at a 'Very Low' of surface water flooding. There are flow routes of 'Low', 'Medium' and 'High' risk of surface water flooding which is associated with the watercourses through the site. However further analysis and site observations suggest that these flow routes would not actually be realised on site given the physical features and watercourse at the site boundaries. It is likely that the surface water flow routes will follow the location of the watercourses within the site. Abley Letchford has carried out direct rainfall modelling for the catchment to refine the surface water flood risk to the site.
- The WBC Level 1 SFRA mapping indicates the potential susceptibility to groundwater flooding and also the expected depth to groundwater. In assessing the site allocation, the WBC Level 2 SFRA suggests that an appropriate assessment of the groundwater regime may be require. Therefore, groundwater monitoring at the site is being undertaken and is still ongoing.
- Thames Water asset maps shows that there are several foul water sewers within the site boundary. The mapping shows that there is a surface water sewer along Appleton Way. The site is considered to be at medium risk of flooding from sewers.
- The majority of the site is not at risk of flooding in the event of a reservoir breach. The eastern part of the site is at risk of flooding in the event that a reservoir breach occurs at the same time as a fluvial flood event. However, all built residential development will be located outside of the reservoir flood extent.

9.1.3 In summary the majority of the site is at a low risk of flooding from fluvial and surface water flood risk. The risk of flooding from groundwater may require further assessment may be required at a detailed design stage.



9.2 Sequential Test and Exception Test

- 9.2.1 The majority of the site is located within Flood Zone 1. The site is outside of the 2021 River Loddon modelled flood extents. In accordance with paragraph 175 of the NPPF, it is proposed that no built development, including access, escape routes, land raising or other potential vulnerable elements will be located outside of Flood Zone 1 and therefore, as part of this application, a Sequential Test is not required.
- 9.2.2 Notwithstanding the above, the site forms part of the land east and west of Hyde End Road which is a draft allocation within the WBC Local Plan, which was informed by a Sequential Test undertaken by WBC. The Sequential Test is therefore deemed to have been carried out as part of this.

9.3 Mitigation Strategy

- 9.3.1 The sequential approach has been applied in developing the masterplan for the scheme. This draws on the flood data from the 2021 SFRA for fluvial flooding from the River Loddon. However, the strategy is not reliant on this modelling as the edge of the proposed built residential properties is more than 50m from the floodplain edge and more than 25m from the edge of the EA strategic mapping of flood zones. The development strategy is therefore robust with regards to fluvial flooding, even in the absence of a full EA review of the 2021 SFRA modelling.
- 9.3.2 For any dwellings located to the east of the site, finished floor levels will be set a minimum of 300mm above the modelled level for the 1 in 100 annual probability plus climate change allowance in line with the WBC Level 1 SFRA.
- 9.3.3 Ground floor levels should be set a minimum of 150mm above the surrounding ground level to mitigate the residual flood risk from surface water runoff events. Surrounding ground levels should also be appropriately contoured to direct surface water away from houses.
- 9.3.4 The surface water flow along the Ordinary Watercourses will be managed through watercourse corridors which maintain the conveyance of flow. Flow coming from the north onto the Site is collected by a drain to the north of the northern boundary of the Site and channelled in an easterly direction within the extending drainage ditch network. The western flow route will be managed through the surface water drainage strategy.
- 9.3.5 The proposed surface water drainage strategy will manage the flood risk posed by uncontrolled surface water runoff from the Site. Any increase in surface water run-off can be managed using SuDS source control techniques as well as attenuation features to provide storage in extreme storm events. This provides the minimum of two treatment storage stages which is in accordance with the recommendations of CIRIA C753.
- 9.3.6 All surface water drainage systems will be designed to restrict drainage discharge rates to QBAR runoff rates and store the balance of water for all events up to and including the 1 in 100 year event including an allowance for a 40% increase in rainfall intensities as a result of climate change and a 10% increase due to urban creep.



9.4 Summary

- 9.4.1 All conveyance systems will be designed to cater for the 1:30 year storm event, in accordance with industry standard, with all attenuation features designed to allow for the 1 in 100 year storm event plus 40% climate change allowance.
- 9.4.2 Proposed discharge rates will be restricted to QBAR for all storm events up to and including the 1 in 100 year storm event plus 40% allowance for climate change. This would negate the requirement for Long Term Storage and flows would be attenuated on site and discharged utilising an on-site flow control devices such as a Hydrobrake.
- 9.4.3 This FRA demonstrates that the proposed development complies with national and local planning policy with respect to flood risk and drainage. The risk of flooding is adequately managed, and, with the implementation of a suitable surface water drainage strategy, the offsite flood risk is not increased.



Appendices



Appendix A – Plans

Illustrative Masterplan

Topographical Survey

Thames Water Sewer Asset Plan



Appendix B – LLFA Developer Checklist

Wokingham Borough Council Planning Application Drainage Checklist



Appendix C – Direct Rainfall Modelling Report

Direct Rainfall Modelling Report



Appendix D – Drainage Strategy

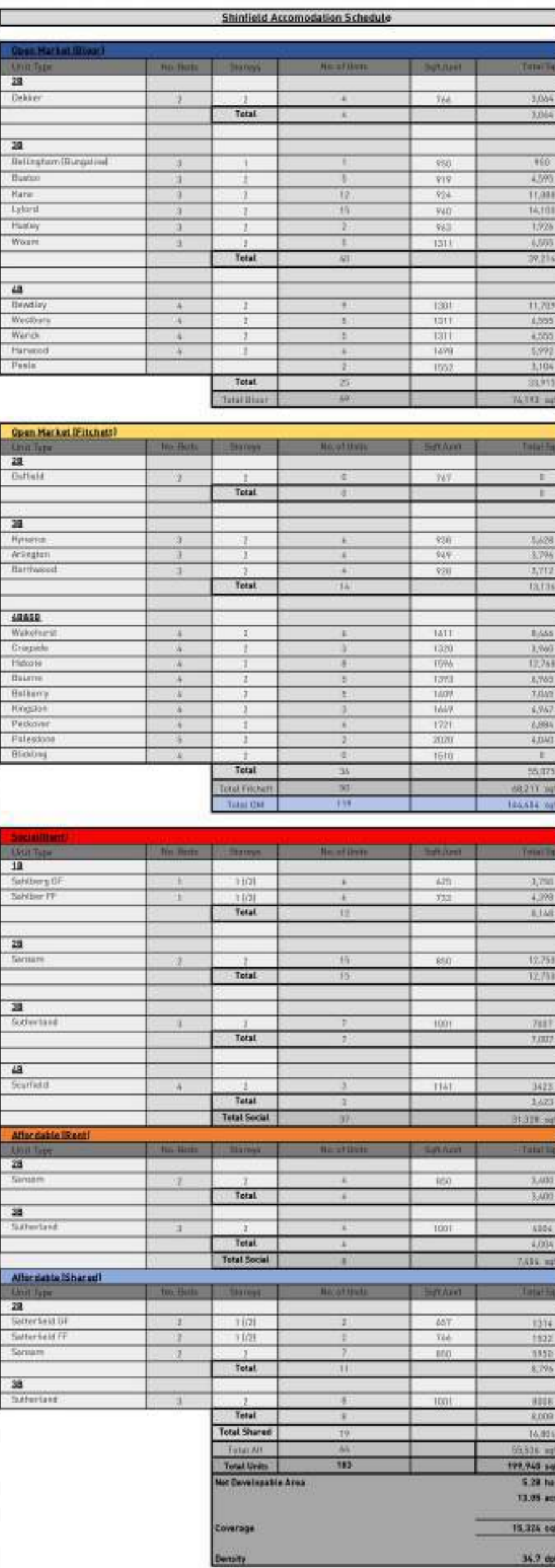
Greenfield Runoff Rates

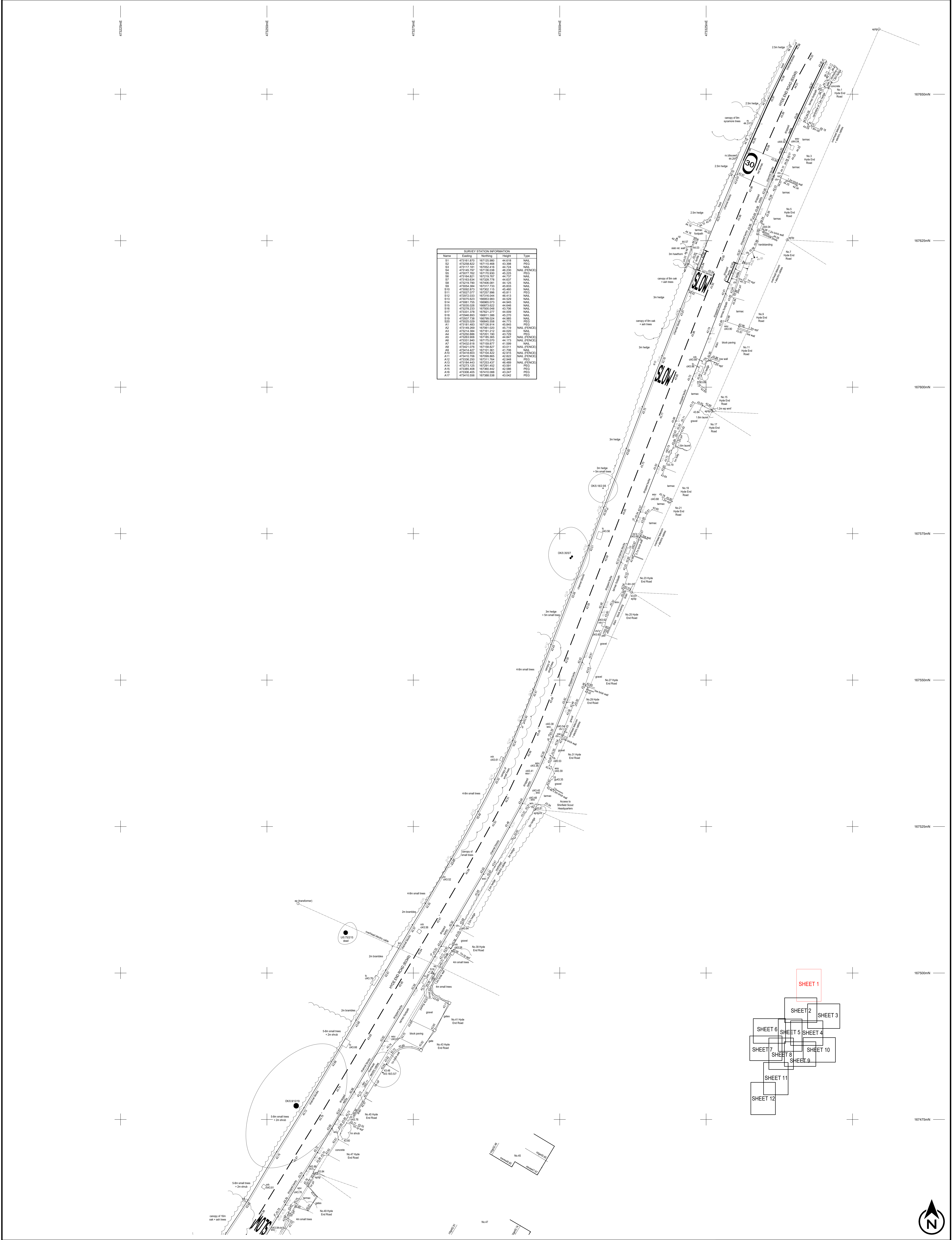
Long Term Storage Calculations



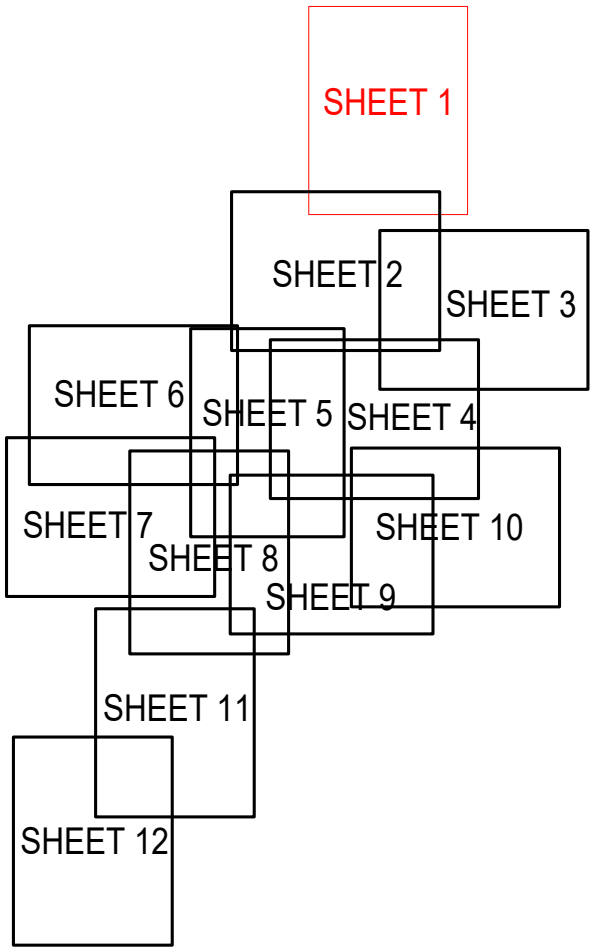
Appendix E - Maintenance Schedule

SuDs Maintenance





SURVEY STATION INFORMATION				
Name	Eastings	Northings	Height	Type
S1	473181.878	167123.390	44.818	NAIL
S2	473258.622	167110.488	43.388	PEG
S3	473171.167	167152.416	44.794	PEG
S4	473142.767	167138.038	46.230	NAIL (FENCE)
S5	472977.762	167170.020	45.220	PEG
S6	473168.621	167219.797	44.737	NAIL
S7	473163.624	167158.718	44.837	NAIL
S8	473178.798	167166.581	44.120	NAIL
S9	473054.384	167317.733	45.833	NAIL
S10	473062.879	167321.142	45.690	NAIL
S11	473027.077	167297.896	45.811	PEG
S12	472972.033	167316.044	46.413	NAIL
S13	473075.623	166963.983	44.329	NAIL
S14	472887.768	166963.973	44.843	NAIL
S15	473050.028	166971.822	44.846	NAIL
S16	473278.233	167000.048	43.706	NAIL
S17	473278.378	167011.217	44.089	NAIL
S18	473248.893	166811.386	45.270	NAIL
S19	473257.738	167039.054	44.985	NAIL
S20	473025.623	166945.558	44.773	PEG
A1	473181.483	167123.514	44.865	NAIL (FENCE)
A2	473188.298	167091.020	45.718	NAIL (FENCE)
A3	473214.384	167161.212	44.030	NAIL
A4	473248.893	167111.180	44.173	NAIL (FENCE)
A5	473253.896	167182.395	44.847	NAIL (FENCE)
A6	473231.840	167175.070	44.173	NAIL (FENCE)
A7	473428.818	167159.877	41.589	NAIL
A8	473427.076	167158.827	41.511	NAIL (FENCE)
A9	473424.427	167111.321	41.768	NAIL
A10	473418.625	167104.422	42.915	NAIL (FENCE)
A11	473410.798	167099.860	42.822	NAIL (FENCE)
A12	473338.260	167311.784	42.848	PEG
A13	473186.443	167263.427	42.489	PEG
A14	473273.126	167291.492	43.586	PEG
A15	473388.448	167366.642	42.589	PEG
A16	473388.448	167410.088	43.247	PEG
A17	473410.558	167388.038	43.042	PEG



KEY

a/c
av
bh
bs
ctv
el
ep
ept
er
fh
fwh
g
gsv
h
hud
ip
lt
mh
mer
mw
oh

air conditioning
air valve
borehole
bollard
bus stop
cable tv cover
electric box
electricity pole
transformer pole
earth rod
fire hydrant
foul water manhole
gully
gas stop valve
inspection cover
kerb drain
litter bin
lamp post
light
manhole
marker post
monitoring well
overhead

pb
pc
re
rp
rs
rwp
sa
st
sv
svp
swmh
tb
tc
th
ti
tp
uti
vp
wm
wo
wv
yg

post box
pram crossing
rodding eye
road name plate
road sign
rain water pipe
soakaway
stay / strut
stop valve
soil vent pipe
storm water manhole
telephone box
telecoms cover
trial hole
traffic light
telegraph pole
unable to lift
vent pipe
water meter
wash out
water stop valve
yard gully

AL
AS
AP
BA
BT
C
CB
CH
CY
E
EL
FM
FR
HB
HC
HO
HW
HY
HZ
IBT
JM
LB
LM
LO

alder
aspens
apple
beech
bay
cedar
copper beech
elm
cypress
pear
elder
eucalyptus
field maple
fruit (generic)
hornbeam
horse chestnut
holm oak
cherry
hazel
indian bean tree
japanese maple
laburnum
lime
louse

LR
M
MG
MP
OK
PA
P
PL
PLM
PO
PR
R
RH
RO
SB
SC
SP
SY
TU
U
W
WB
WN
Y

barbed wire fence
closed-board fence
concrete post
chestnut paling fence
chicken wire fence
iron railing fence
picket fence
post and rail fence
post and wire fence
security fence
steel post
wire mesh fence
wood panel fence

laurel
maple
magnolia
oak
pine
palm
plane
plum
poplar
pear
redwood
rowan
rhododendron
silver birch
sweet chestnut
scots pine
spruce
sycamore
tulip
unidentifed
willow
whitebeam
walnut
yew

TREES (species / trunk diameter / max. spread / height)

alder
aspens
apple
beech
bay
cedar
copper beech
elm
cypress
pear
elder
eucalyptus
field maple
fruit (generic)
hornbeam
horse chestnut
holm oak
cherry
hazel
indian bean tree
japanese maple
laburnum
lime
louse

LR
M
MG
MP
OK
PA
P
PL
PLM
PO
PR
R
RH
RO
SB
SC
SP
SY
TU
U
W
WB
WN
Y

barbed wire fence
closed-board fence
concrete post
chestnut paling fence
chicken wire fence
iron railing fence
picket fence
post and rail fence
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steel post
wire mesh fence
wood panel fence

laurel
maple
magnolia
oak
pine
palm
plane
plum
poplar
pear
redwood
rowan
rhododendron
silver birch
sweet chestnut
scots pine
spruce
sycamore
tulip
unidentifed
willow
whitebeam
walnut
yew

FENCES

barbed wire fence
closed-board fence
concrete post
chestnut paling fence
chicken wire fence
iron railing fence
picket fence
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laurel
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rowan
rhododendron
silver birch
sweet chestnut
scots pine
spruce
sycamore
tulip
unidentifed
willow
whitebeam
walnut
yew

LEVELS

cover level
dpc
floor level
gully level
invert level
overhead cable level
soffit level
threshold level
underside level
water level
wall top

cl
dpc
fl
gu
il
oh
sof
th
u/s
wt

cover level
damp-proof course
floor level
gully level
invert level
overhead cable level
soffit level
threshold level
underside level
water level
wall top

NOTES

The survey grid has been related to OS National Grid using a flat earth projection and metric scale factor of 1, centred on Station [91]. Levels are related to OS datum determined from the National GPS Network using OSGM15.

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The position and height of adjacent buildings have been obtained using higher level reflectorless measurement and may not take account of single storey extensions or conservatories below the line of sight.

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w: siteline.co.uk

Drawing Title

SITE SURVEY

01LA01

BLOOR HOMES

HYDE END ROAD SHINFIELD

Scale

1:200 at A0

Date

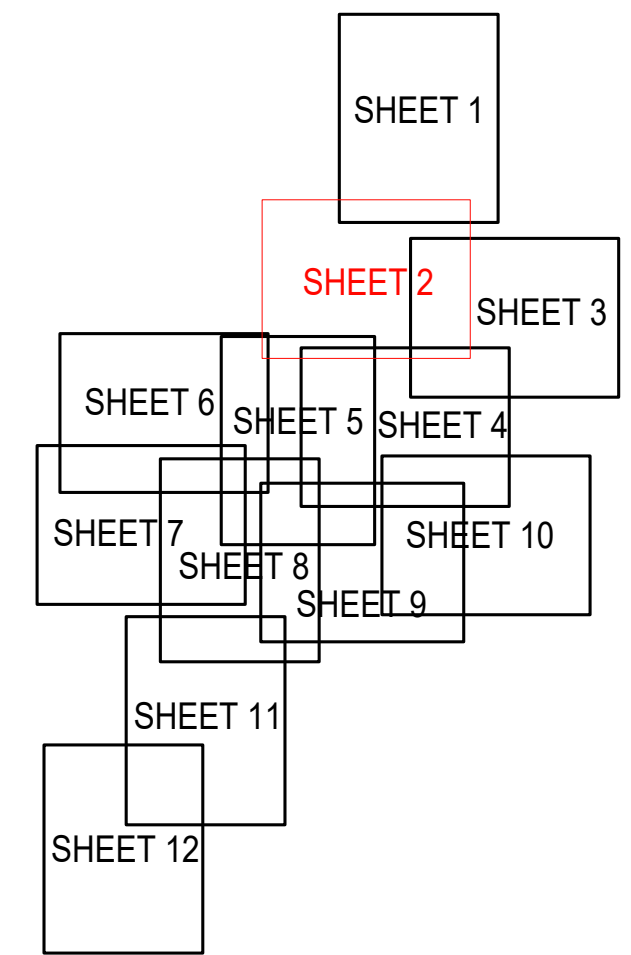
JUNE 2024

Drawn by

HB AB

Checked by

IA



a/c	air conditioning	pb	post box
av	air valve	pc	pram crossing
bn	bench	pe	rodding eye
bol	bollard	rp	road name plate
bs	bus stop	rs	road sign
bt	butte	rw	rain water pipe
ca	cable tv cover	sa	soakaway
el	electric box	st	slay / strut
ep	electricity pole	sv	stop valve
er	earth rod	sw	soil vent pipe
fm	fire hydrant	swm	storm water manhole
fw	foul water manhole	tb	telephone box
g	gully	tc	telecoms cover
gv	gas stop valve	th	trial hole
ic	inspection cover	tl	traffic light
kd	kerb drain	tp	telegraph pole
ld	litter bin	ul	unable to lift
lp	lamp post	vp	vent pipe
lt	light	vm	water meter
mh	manhole	wo	wash out
mk	marker post	ws	water stop valve
mw	monitoring well	wsv	yard gully
oh	overhead		

TREES (species / trunk diameter / max. spread / height)	
AL	ash
AS	alder
AP	apple
BA	bay
BT	blackthorn
CB	copper beech
CH	cherry
CY	cypress
EL	elm
EU	eucalyptus
FM	field maple
FR	fruit (genetic)
HB	hornbeam
HC	horse chestnut
HCO	holm oak
HW	hawthorn
HY	holly
HZ	hazel
IBT	indian bean tree
JM	japanese maple
LB	laburnum
LJ	lime
LO	locust
LR	laurel
M	maple
MG	magnolia
MP	monkey puzzle
OK	oak
P	pine
PA	palmer
PL	plane
PM	plum
PQ	poplar
R	pear
RD	redwood
RH	rhododendron
RO	rowan
SB	silver birch
SC	sweet chestnut
SP	scots pine
SU	spruce
SU	sycamore
TU	tulip
U	undetermined
W	willow
WB	whitebeam
WN	walnut
Y	yew

FENCES	
bwf	barbed wire fence
cbf	closed-board fence
cp	concrete post
cpr	chestnut paling fence
cwf	chicken wire fence
if	iron railing fence
pkf	picket fence
prf	post and rail fence
pwf	post and wire fence
scf	security fence
sp	steel post
wmf	wire mesh fence
wpf	wood panel fence

LEVELS	
cl	cover level
dpc	damp-proof course
fl	floor level
gl	gully level
il	invert level
oh	overhead cable level
sof	soffit level
th	threshold level
uls	underside level
uls	water level
wt	wall top

NOTES

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Drawing Title

SITE SURVEY

Drawing Number
01LA01 SHEET 2 OF 12

Client
BLOOR HOMES

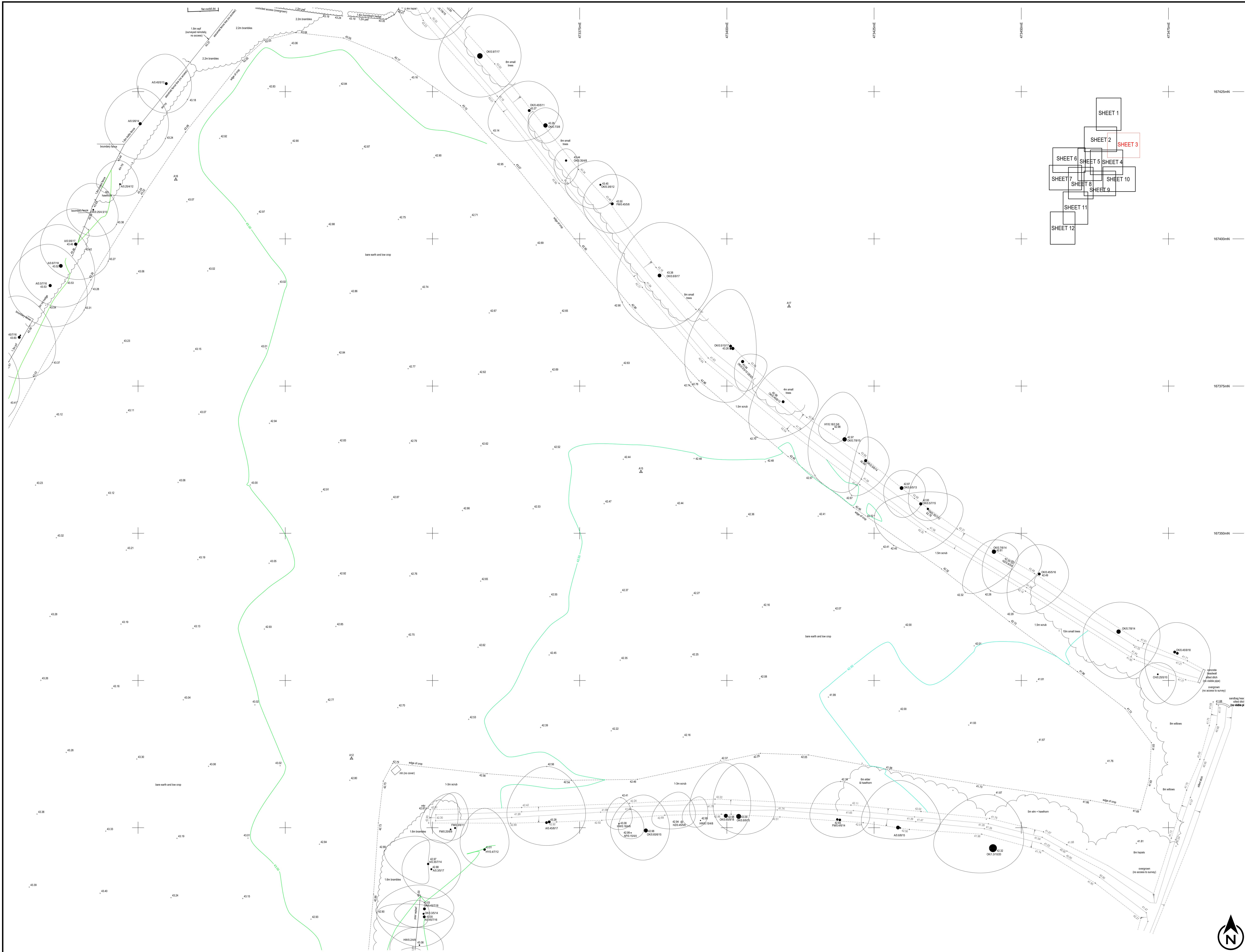
Contact
HYDE END ROAD
SHINFIELD

Scale
1:200 at A0

Date
JUNE 2024

Surveyed by
HB AB

Checked by
HB AB IA



KEY			
alc	air conditioning	pb	post box
alv	air valve	pc	press crossing
borehole	av	ns	rooming eye
bol	bol	mp	road name
bs	bus stop	rs	road sign
cab	cable tv	rw	rain water pipe
el	electric box	sa	saw machine
ep	electricity pole	st	stay / stair
ex	exchange	sv	swamp
er	earth road	sl	soil vent pipe
f	fire	swmh	storm water manhole
fmh	ford water manhole	na	name
g	gully	tc	television cover
gav	gasp	th	trial hole
g	gasp	th	traffic light
kd	kerb drain	tp	telegraph pole
l	letter bin	u	unable to lift
l	lamp post	vp	vent pipe
l	litter	wm	water meter
mh	manhole	w	wash out
ms	manor	wp	water stop
mw	monitoring well	yg	yard gully

ON	breast	max	height
TR	ash		
AS	asp	LR	laur
AP	asp	MC	magn
BP	asp		mon
BA	asp	BY	OK
CP	black		pl
OC	cedar	PA	pal
RL	cedar		pl
CH	cherry	PM	plum
CP	cypress	PR	pop
E	elm	PR	pear
EU	elm	RD	red
FR	field	RD	rhod
FR	fruit (generic)	RO	row
HB	hamborn	SB	silver
HC	horne	CH	cherry
HO	holm oak	SP	scots
HW	hol		sc
IZ	holly	SY	sycamore
IBT	indian tree	U	unidentified
JP	japanese	UN	unidentified
LB	laburnum	WB	whitebark
LN	locust	YN	yellow
LO	locust		yellow

FENCES		LEVELS	
bwf	barbed wire fence	cl	cover level
cbf	closed-board fence	df	damp-proof course
cp	concrete post	fl	floor level
cpf	chestnut paling fence	gu	gully level
cwf	chicken wire fence	il	invert level
crf	iron railing fence	oh	overhead cable level
pkf	picket fence	sof	soffit level
prf	post and rail fence	th	threshold level
pwf	post and wire fence	u/s	underside level
scf	security fence	wl	water level
stf	steel post	wt	wall top
wmf	wire mesh fence		
wpf	wood panel fence		

NOTES

The survey grid has been related to OS National Grid using a flat earth projection and metric scale factor of 1, centred on Station [S1]. Levels are related to OS datum determined from the National GPS Network using OSGM15.

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Drawing Title

SITE SURVEY

Drawing Number
01LA01

SHEET 3 OF 12

Client

BLOOR HOMES

Contract

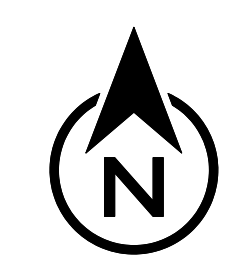
HYDE END ROAD
QUINFIELD

SHINFIELD

Scale	Date
1:200 at 40	JUNE 2024

Surveyor(s) _____ Drawn by _____ Checked by _____

HB AB	HB AB	IA
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KEY			
a/c	air conditioning	pb	post box
av	air valve	pc	pram crossing
bn	barthole	rd	rodding eye
bol	bollard	rs	road name plate
be	bus stop	rw	rain water pipe
ch	cable tv cover	sa	soakaway
el	electric box	st	slay / strut
ep	electricity pole	sv	stop valve
est	transformer pole	sw	soil vent pipe
er	earth rod	swmh	storm water manhole
fn	fire hydrant	tb	telephone box
fwmh	foul water manhole	tc	telecoms cover
g	gully	th	trial hole
gv	gas stop valve	tl	traffic light
ic	inspection cover	tp	telegraph pole
kd	kerb drain	un	unable to lift
ls	litter bin	up	vent pipe
lp	lamp post	vm	water meter
lt	light	wo	wash out
mh	manhole	ws	water stop valve
mk	marker post	yw	yard gully
mkr	monitoring well		
oh	overhead		

FENCES		LEVELS	
bwf	barbed wire fence	cl	cover level
cbf	closed-board fence	dpc	damp-proof course
cp	concrete post	fl	floor level
cpf	chestnut paling fence	gu	gully level
pkf	chicken wire fence	il	invert level
irf	iron railing fence	oh	overhead cable level
ptf	picket fence	sof	soffit level
prf	post and rail fence	th	threshold level
pwf	post and wire fence	u/s	underside level
scf	security fence	wl	water level
spf	steel post	wt	wall top
wmf	wire mesh fence		
wpf	wood panel fence		

FENCES		LEVELS	
bwf	barbed wire fence	cl	cover level
cbf	closed-board fence	dpc	damp-proof course
cp	concrete post	fl	floor level
cpr	chestnut paling fence	gu	gully level
cwf	chicken wire fence	il	invert level
irf	iron railing fence	oh	overhead cable level
pkf	picket fence	sof	soffit level
prf	post and rail fence	th	threshold level
pwf	post and wire fence	us	underside level
scf	security fence	wl	water level
sp	steel post	wt	wall top
wmf	wire mesh fence		
wpf	wood panel fence		

NOTES

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Site	
Drawing Number	
01LA01	SHEET 4 OF 12
Client	
BLOOR HOMES	
Contract	
HYDE END ROAD SHINFIELD	
Scale	Date
1:200 at A0	JUNE 2024
Surveyed by	Drawn by
HB AB	HB AB
	Checked by
	IA



KEY		TREES (species / trunk diameter / max. spread / height)		FENCES		LEVELS	
a/c	air conditioning	AL	alder	LR	laurel	cl	cover level
av	air valve	AS	aspens	M	maple	dpc	damp-proof course
bh	borehole	re	rodding eye	AP	apple	fl	floor level
bol	bollard	BA	road name plate	MG	magnolia	gu	gully level
bs	bus stop	B	road sign	MP	monkey puzzle	il	invert level
ctv	cable tv cover	rw	rain water pipe	OK	oak	oh	overhead cable level
el	electric box	BT	telecoms cover	PA	palm	sof	soffit level
ep	electricity pole	C	cable	PL	plane	th	threshold level
ept	transformer pole	CB	soakaway	PM	plum	u/s	underside level
er	earth rod	CH	slab / strut	PO	poplar	wt	water level
fh	fire hydrant	CY	stop valve	PR	pear	wt	water level
fwmh	foul water manhole	EL	storm water manhole	R	redwood	wt	water level
g	gully	EU	eucalyptus	RH	rhododendron	wt	water level
gs	gas stop valve	FJ	fruit (generic)	RO	rowan	wt	water level
gsv	gas stop valve	HB	hormbeam	SB	silver birch	wt	water level
ic	inspection cover	HC	horse chestnut	SC	sweet chestnut	wt	water level
kud	kerb drain	HO	holm oak	SP	scots pine	wt	water level
lb	litter bin	HW	hawthorn	SU	spice	wt	water level
lp	lamp post	HT	holly	SY	sycamore	wt	water level
lt	light	IBT	indian bean tree	TU	tulip	wt	water level
mh	manhole	JM	japanese maple	U	unidentifed	wt	water level
mer	marker post	LB	laburnum	WB	whitebeam	wt	water level
mw	monitoring well	LS	lime	WN	whitebeam	wt	water level
oh	overhead	LO	locust	Y	yew	wt	water level

NOTES

The survey grid has been related to OS National Grid using a flat earth projection and metric scale factor of 1, centred on Station 911. Levels are related to OS datum determined from the National GPS Network using OSGM15.

All setting out should be referenced to the permanent control stations shown on this survey. Do not use GNSS/GPS operating on the OS Active Network without first carrying out a site calibration.

No assumptions should be made regarding the interconnection of manholes. Drainage details have been obtained from surface inspection and should be verified if of critical importance.

The position and height of adjacent buildings have been obtained using higher level reflectorless measurement and may not take account of single storey extensions or conservatories below the line of sight.

SITE SURVEY

Drawing Number: 011A01

Client: BLOOR HOMES

Contract: HYDE END ROAD SHINFIELD

Scale: 1:200 at A0

Date: JUNE 2024

Surveyed by: HB AB

Checked by: IA



a/c	air conditioning	pb	post box
av	air valve	pc	pram crossing
bn	booth	rd	rodding eye
bol	bollard	rm	road name plate
bs	bus stop	rs	road sign
cb	cable tv cover	rwp	rain water pipe
el	electric box	sa	soakaway
ep	electricity pole	st	slay / strut
ep	transformer pole	sv	stop valve
er	earth rod	svp	soil vent pipe
fn	fire hydrant	swmh	storm water manhole
fwmh	foul water manhole	tb	telephone box
g	gully	tc	telecoms cover
gv	gas stop valve	trh	trial hole
ic	inspection cover	tl	traffic light
kd	kerb drain	tp	telegraph pole
ld	litter bin	ul	unable to lift
lp	lamp post	vp	vent pipe
lt	light	vm	water meter
mh	manhole	wo	wash out
mkr	marker post	wsv	water stop valve
mww	monitoring well	yg	yard gully
oh	overhead		

TREES (species / trunk diameter / max. spread / height)

AL	ash	LR	laurel
AS	alder	M	maple
AP	apple	MG	magnolia
BA	beech	MP	monkey puzzle
BT	bay	OK	oak
BT	blackthorn	P	pine
C	cedar	PM	plum
CB	copper beech	PL	plane
CH	cherry	PO	poplar
CY	cypress	PR	pear
EL	elm	R	redwood
EL	elder	RD	red oak
FM	field maple	RH	rhododendron
FR	fruit (genetic)	RO	rowan
H	hornbeam	SB	silver birch
HC	horse chestnut	SC	sweet chestnut
HO	holm oak	SP	scots pine
HW	hawthorn	SU	spruce
HY	holly	SY	sycamore
HZ	hazel	TU	tulip
IB	indian bean tree	U	untidied
JM	japanese maple	W	willow
LB	lime	WB	whitebeam
LJ	locust	Y	yew

FENCES

bwf	barbed wire fence	cl	cover level
cbf	closed-board fence	dpc	damp-proof course
cp	concrete post	fl	floor level
cpf	chestnut paling fence	gu	gully level
cwf	chicken wire fence	il	invert level
irf	iron railing fence	oh	overhead cable level
pkf	picket fence	sdf	soffit level
prf	post and rail fence	th	threshold level
pwf	post and wire fence	ul	underside level
scf	security fence	us	water level
sp	steel post	wt	wall top
wmf	wire mesh fence		
wpf	wood panel fence		

LEVELS

cl	cover level
dpc	damp-proof course
fl	floor level
gu	gully level
il	invert level
oh	overhead cable level
sdf	soffit level
th	threshold level
ul	underside level
us	water level
wt	wall top

NOTES

The survey grid has been related to OS National Grid using a flat earth projection and metric scale factor of 1, centred on Station [S1]. Levels are related to OS datum determined from the National GPS Network using OSGM15.

All setting out should be referenced to the permanent control stations shown on this survey. Do not use GNSS/GPS operating on the OS Active Network without first carrying out a site calibration.

No assumptions should be made regarding the interconnection of manholes. Drainage details have been obtained from surface inspection and should be verified if of critical importance.

The position and height of adjacent buildings have been obtained using higher level reflectorless measurement and may not take account of single storey extensions or conservatories below the line of sight.

t: 023 8081 1081 w: siteline.co.uk

Drawing Title

SITE SURVEY

Drawing Number

01LA01 SHEET 6 OF 12

Client

BLOOR HOMES

Contact

HYDE END ROAD
SHINFIELD

Scale

1:200 at A0

Date

JUNE 2024

Surveyor(s)

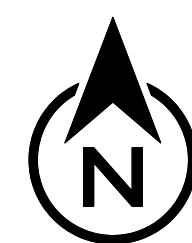
HB AB

Drawn by

HB AB

Checked by

IA

[illegible]

LEVELS

cl	cover level
dpc	damp-proof course
fl	floor level
gu	gully level
il	invert level
oh	overhead cable level
sos	soffit level
th	threshold level
uls	underside level
wl	water level
wt	wall top

NOTES

The survey grid has been related to OS National Grid using flat earth projection and metric scale factor of 1, centred on Station [51]. Levels are related to OS datum determined by the National GPS Network using OSGM15.

All setting out should be referenced to the permanent control stations shown on this survey. Do not use GNSS/GPS operating on the OS Active Network without first carrying out a site calibration.

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The position and height of adjacent buildings have been obtained using higher level reflectorless measurement and may not take account of single storey extensions or conservatories below the line of sight.

NOTES

The survey grid has been related to OS National Grid using a flat earth projection and metric scale factor of 1, centred on Station [S1]. Levels are related to OS datum determined from the National GPS Network using OSGM15.

No assumptions should be made regarding the interconnection of manholes. Drainage details have been obtained from surface inspection and should be verified if of critical importance.

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Geospatial



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Drawing Title	
SITE SURVEY	
Drawing Number	
01LA01	SHEET 8 OF 12
Client	
BLOOR HOMES	
Contract	
HYDE END ROAD SHINFIELD	
Scale	Date
1:200 at A0	JUNE 2024
Surveyor(s)	Drawn by
HB AB	IA



KEY	air conditioning	pb	post box
av	air valve	pc	pram crossing
bn	bartholomew	pe	redding eye
bol	border	rp	road name plate
bs	bus stop	rs	road sign
cb	cable tv cover	rw	rain water pipe
el	electric box	sa	soakaway
ep	electricity pole	st	slay / strut
er	earth rod	sv	stop valve
er	fire hydrant	sw	storm water manhole
er	foul water manhole	tb	telephone box
er	gas stop valve	tc	telecoms cover
g	gully	th	trial hole
g	gas stop valve	ti	traffic light
ic	inspection cover	tp	telegraph pole
kd	kerb drain	un	unable to lift
lp	litter bin	un	unable to lift
lp	lamp post	vp	vent pipe
lp	light	wm	water meter
mh	manhole	wo	wash out
mkr	marker post	ws	water stop valve
mw	monitoring well	yg	yard gully
oh	overhead		

FENCES		LEVELS	
bwf	barbed wire fence	cl	cover level
cbf	closed-board fence	dpc	damp-proof course
cp	concrete post	fl	floor level
cpf	chestnut paling fence	gu	gully level
cwf	chicken wire fence	il	invert level
irf	iron railing fence	oh	overhead cable level
pf	picket fence	so	soffit level
prf	post and rail fence	th	threshold level
pwf	post and wire fence	u/s	underside level
scf	security fence	wl	water level
sp	steel post	wt	wall top
wmf	wire mesh fence		
wnf	wood nagen fence		

FENCES	barbed wire fence	cl	cover level
bwf	barbed wire fence	dpc	damp-proof course
cbf	closed-board fence	fl	floor level
cp	concrete post	gu	gully level
cpf	chestnut paling fence	il	invert level
cwf	chicken wire fence	oh	overhead cable level
if	iron railing fence	sof	soffit level
pkf	picket fence	th	threshold level
prf	post and rail fence	th	threshold level
pwf	post and wire fence	usl	underside level
scf	security fence	usl	underside level
sp	steel post	wt	wall top
wmf	wire mesh fence		
wpf	wood panel fence		

LEVELS	cover level
cl	cover level
dpc	damp-proof course
fl	floor level
gu	gully level
il	invert level
oh	overhead cable level
sof	soffit level
th	threshold level
usl	underside level
usl	underside level
wt	wall top

NOTES

The survey grid has been related to OS National Grid using a flat earth projection and metric scale factor of 1, centred on Station 151. Levels are related to OS datum determined from the National GPS Network using OSGM15.

All setting out should be referenced to the permanent control stations shown on this survey. Do not use GNSS/GPS operating on the OS Active Network without first carrying out a site calibration.

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Drawing Title
SITE SURVEY

Drawing Number
01LA01 SHEET 9 OF 12

Client
BLOOR HOMES

Contact
HYDE END ROAD
SHINFIELD

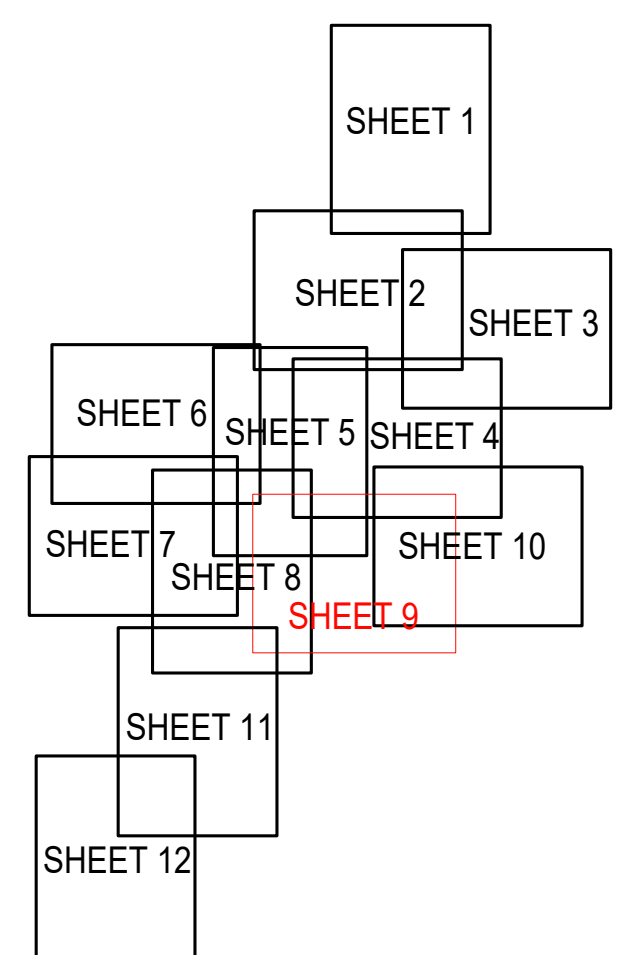
Scale
1:200 at A0

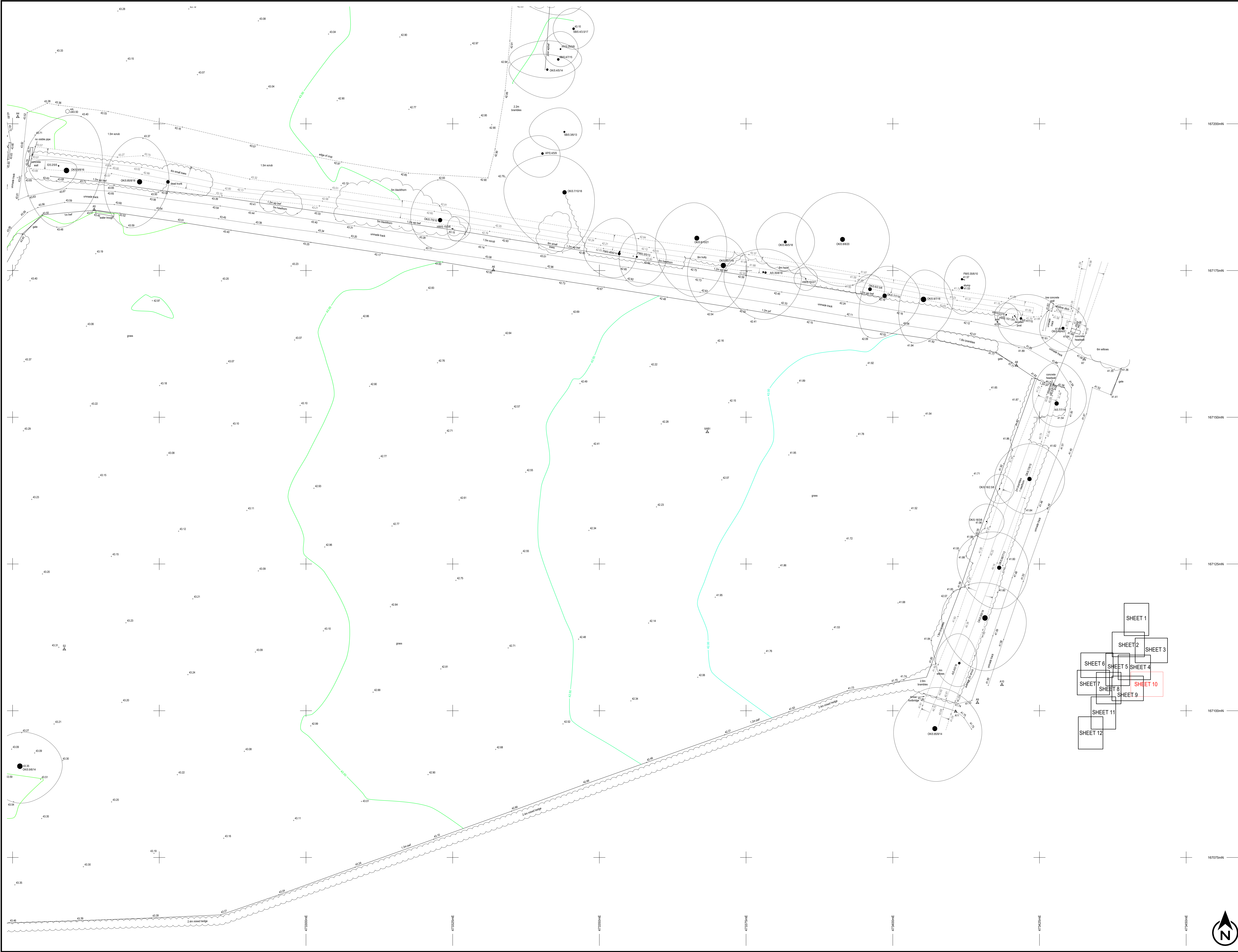
Date
JUNE 2024

Surveyed by
HB AB

Drawn by
HB AB

Checked by
IA





KEY	air conditioning	pb	post box
av	air valve	pc	pram crossing
bn	barthole	rd	roading eye
br	bollard	rs	road name plate
bs	bus stop	rs	road sign
cb	cable tv cover	rwp	rain water pipe
el	electric box	sa	soakaway
ep	electricity pole	st	slay / struts
er	earth rod	sv	stop valve
fm	fire hydrant	swm	storm water manhole
fwmh	foul water manhole	tb	telephone box
g	gully	tc	telecoms cover
gv	gas stop valve	th	trial hole
ic	inspection cover	tl	traffic light
kd	kerb drain	tp	telegraph pole
ld	litter bin	ul	unable to lift
lp	lamp post	vp	vent pipe
lt	light	vm	water meter
mh	manhole	wo	wash out
mr	marker post	wsv	water stop valve
mkr	monitoring well	yg	yard gully
oh	overhead		

FENCES		LEVELS	
bwl	barbed wire fence	cl	cover level
cbsf	closed-board fence	dpc	damp-proof course
cc	ccrete post	fl	floor level
cpw	chestnut paling fence	gu	gully level
ckf	chicken wire fence	il	invert level
irf	iron railing fence	oh	overhead cable level
pkf	picket fence	sof	soffit level
prf	post and rail fence	th	threshold level
pwf	post and wire fence	u/s	underside level
scf	security fence	wl	water level
sp	steel post	wt	wall top
wmf	wire mesh fence		
wpf	wood panel fence		

FENCES	barbed wire fence	LEVELS	cover level
bwf	barbed wire fence	cl	damp-proof course
cbf	closed-board fence	dpc	floor level
cp	concrete post	fl	gully level
cpr	chestnut paling fence	gu	invert level
cwf	chicken wire fence	il	overhead cable level
irf	iron railing fence	oh	soffit level
pkf	picket fence	sd	threshold level
prf	post and rail fence	th	underside level
pwf	post and wire fence	us	water level
scf	security fence	wl	wall top
sp	wire mesh fence	wt	
wmf	wood panel fence		

NOTES

The survey grid has been related to OS National Grid using a flat earth projection and metric scale factor of 1, centred on Station [S1]. Levels are related to OS datum determined from the National GPS Network using OSGM15.

All setting out should be referenced to the permanent control stations shown on this survey. Do not use GNSS/GPS operating on the OS Active Network without first carrying out a site calibration.

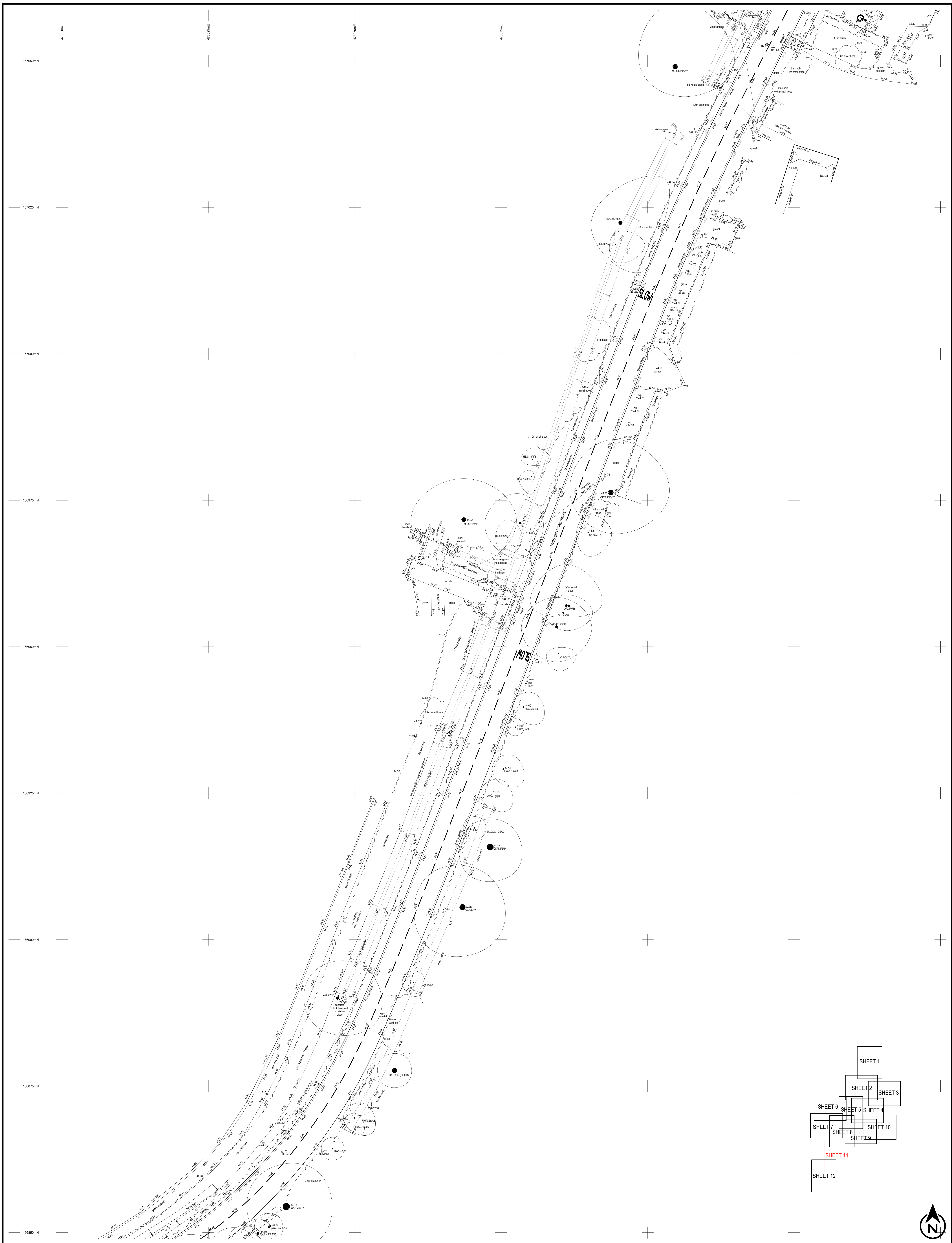
No assumptions should be made regarding the intersection of manholes. Drainage details have been obtained from surface inspection and should be verified if of critical importance.

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SITE SURVEY	
Drawing Number	01LA01 SHEET 10 OF 12
Client	BLOOR HOMES
Contact	HYDE END ROAD SHINFIELD
Scale	1:200 at A0
Date	JUNE 2024
Surveyed by	HB AB
Checked by	IA



				TREES (species / trunk diameter / max. spread / height)						FENCES			
alc	air conditioning	pb	post box	AL	alder	MR	laurel	bwf	barbed wire				
av	air valve	pc	pram	AS	asp	magnolia	mistle	cbt	close-board				
av	axe	pe	pecking	re	elm	OK	concrete	cm	concrete				
boll	bollard	mp	road name plate	BA	beech	OK	monkey puzzle	gpf	garden path				
bs	bullet	rs	road sign	BT	blackthorn	PA	blackthorn	cwf	chicken wire				
bt	but	wp	water pump	CB	cedar	PL	plane	plf	post and rail				
cl	electric stop	st	soakaway	CB	copper beech	PL	plane	plf	post and rail				
ep	electrically powered	st	stop / stay	CH	chestnut	CH	cherry	prf	pruned				
ev	transformer pole	sv	stop valve	CL	elm	OK	concrete	plf	post and rail				
es	earth rod	svp	stop vit pipe	EL	elm	OK	concrete	plf	post and rail				
fh	fire hydrant	sw	swamp	EU	eucalyptus	field maple	red oak	wmf	wire mesh				
fsmh	foul water machine	tu	telephone box	EU	eucalyptus	field maple	red oak	wmf	wire mesh				
g	gully	tu	telecoms cover	FR	fruit (genetic)	SB	scots pine	wmf	wire mesh				
g	gas stop valve	tu	telephone box	FR	fruit (genetic)	SB	scots pine	wmf	wire mesh				
id	inspection cover	tr	traffic light	HC	horse chestnut	SC	sweet chestnut						
kd	kick drain	tu	telephone box	HS	holm oak	SP	scots pine						
lh	light	tu	unstable to	HW	hawthorn	SP	scots pine						
lp	lamp post	vp	vent pipe	HY	holly	SY	sydney wattle						
lt	light	wp	water meter	IZ	ivy	UZ	unidentified						
mh	manhole	wt	wash out	IBT	indian bean tree	JA	japanese maple						
mkr	marker post	ws	water stop valve	LB	laburnum	WB	whitebeam						
mr	manor	wy	wire yard	LY	larch	WN	walnut						
ov	overhead			LO	locust		yew						

LEVELS	
ci	cover level
dpc	damp-proof course
fl	floor level
gu	gully level
inv	invert level
oh	overhead cable level
sof	soffit level
th	threshold level
u/s	underside level
wl	water level
wit	wall top

NOTES

The survey grid has been related to OS National Grid using a flat earth projection and metric scale factor of 1, centred on Station [S1]. Levels are related to OS datum determined from the National GPS Network using OSGM15.

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The position and height of adjacent buildings have been obtained using higher level reflectorless measurement and may not take account of single storey extensions or conservatories below the line of sight.



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Geospatial



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w: siteline.co.uk

Drawing Title

SITE SURVEY

Drawing Number

01LA01

SHEET 11 OF 12

BLOOR HOMES

Contract

HYDE END ROAD
SHINFIELD

Case

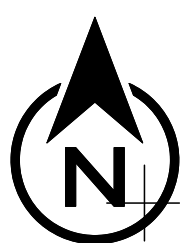
1:200 et

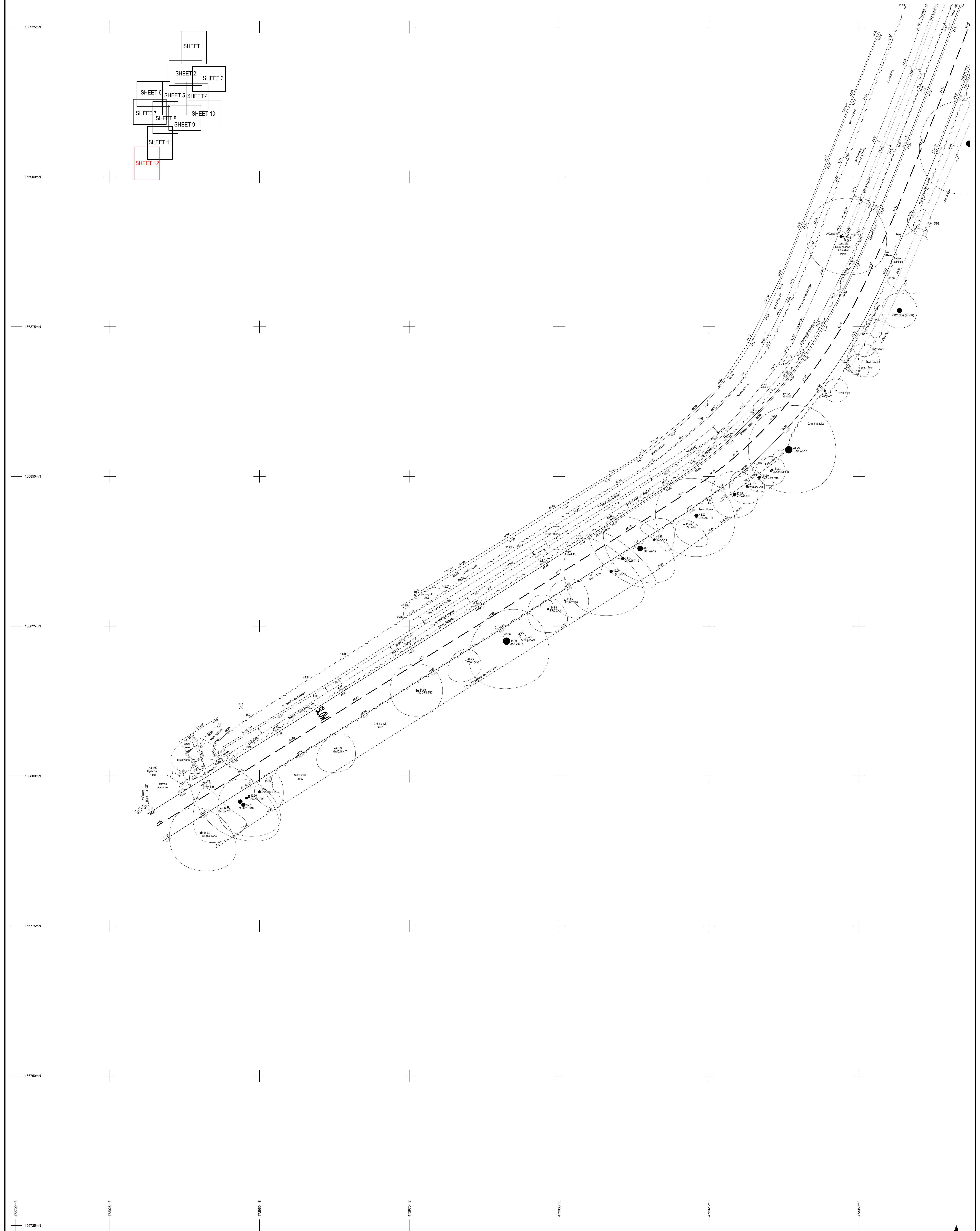
Date _____

JUNE 2024

JUNE 2024

Drawn by: _____ Checked by: _____





KEY	
a/c	air conditioning
av	air valve
bh	borehole
bol	bollard
bs	bus stop
ctv	cable tv cover
el	electric box
ep	electricity pole
ept	transformer pole
er	earth rod
fh	fire hydrant
fwmh	foul water manhole
g	gully
gsv	gas stop valve
ic	inspection cover
kd	kerb drain
ld	litter bin
lp	lamp post
lt	light
mh	manhole
mr	marker post
mw	monitoring well
oh	overhead
pb	post box
pc	pram crossing
re	rodding eye
rp	road name plate
rs	road sign
rwp	rain water pipe
sa	soakaway
st	stay / strut
sv	stop valve
sv	soil vent pipe
swmh	storm water manhole
tb	telephone box
tc	telecoms cover
th	trial hole
ti	traffic light
tp	telegraph pole
un	unable to lift
vp	vent pipe
wm	water meter
wo	wash out
wv	water stop valve
yg	yard gully

TREES (species / trunk diameter / max. spread / height)	
AL	alder
AS	aspen
AP	apple
B	beech
BA	bay
BT	blackthorn
C	cedar
CB	copper beech
CH	cherry
CY	cypress
E	elder
EL	eucalyptus
FM	field maple
FRR	fruit (generic)
HB	hornbeam
HC	horse chestnut
HO	holm oak
HW	hawthorn
HY	holly
HZ	hazel
IBT	indian bean tree
JM	japanese maple
LB	laburnum
LM	lime
LO	louse
LR	laurel
M	maple
MG	magnolia
MP	monkey puzzle
Oak	oak
P	palm
PA	plane
PL	plum
PM	poplar
PO	pear
PR	redwood
R	rowan
RH	rhododendron
RO	rowan
SB	silver birch
SC	sweet chestnut
SP	scots pine
SU	spruce
SY	sycamore
TU	tulip
U	unidentified
W	willow
WB	whitebeam
WN	walnut
Y	yew

FENCES	
bwf	barbed wire fence
cbf	close-board fence
cp	concrete post
cpl	chestnut paling fence
cwf	chicken wire fence
irf	iron railing fence
pkf	picket fence
prf	post and rail fence
pwf	post and wire fence
scf	security fence
sp	steel post
wmf	wire mesh fence
wpf	wood panel fence

LEVELS	
cl	cover level
dpc	damp-proof course
fl	floor level
gu	gully level
il	invert level
oh	overhead cable level
sof	soffit level
th	threshold level
u/s	underside level
wt	water level
wt	wall top

NOTES

The survey grid has been related to OS National Grid using a flat earth projection and metric scale factor of 1, centred on Station [91]. Levels are related to OS datum determined from the National GPS Network using OSGM15.

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Siteline Geospatial



chartered
ICES



THE SURVEY ASSOCIATION

t: 023 8081 1081 w: siteline.co.uk

SITE SURVEY

Drawing Number: 01LA01 SHEET 12 OF 12

Client: BLOOR HOMES

Contract: HYDE END ROAD SHINFIELD

Scale: 1:200 at A0 Date: JUNE 2024

Surveyed by: HB AB Drawn by: HB AB Checked by: IA

Abley Letchford Partnership Ltd
3 Tealgate 3 Tealgate

HUNGERFORD
RG17 0YT

Search address supplied 1
Hyde End Road
Shinfield
Reading
RG2 9EP

Your reference HD068

Our reference ALS/ALS Standard/2024_5024941

Search date 30 July 2024

Notification of Price Changes

From 1st April 2024 Thames Water Property Searches will be increasing the prices of its CON29DW Residential and Commercial searches along with the Asset Location Search. Costs will rise in line with RPI as per previous years, which is sat at 6%.

Customers will be emailed with the new prices by February 28th 2024.

Any orders received with a higher payment prior to the 1st April 2024 will be non-refundable. For further details on the price increase please visit our website at www.thameswater-propertysearches.co.uk.



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



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



0800 009 4540

Search address supplied: 1, Hyde End Road, Shinfield, Reading, RG2 9EP

Dear Sir / Madam

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

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

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

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

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

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

Contact Us

If you have any further queries regarding this enquiry please feel free to contact a member of the team on 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:

SU7267SE
SU7367SW
SU7367NW
SU7367SE
SU7367NE

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

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

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

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

For your guidance:

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

Clean Water Services

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

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

SU7267SE

SU7367SW
SU7367NW
SU7367NE

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.

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

SU7367SE

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

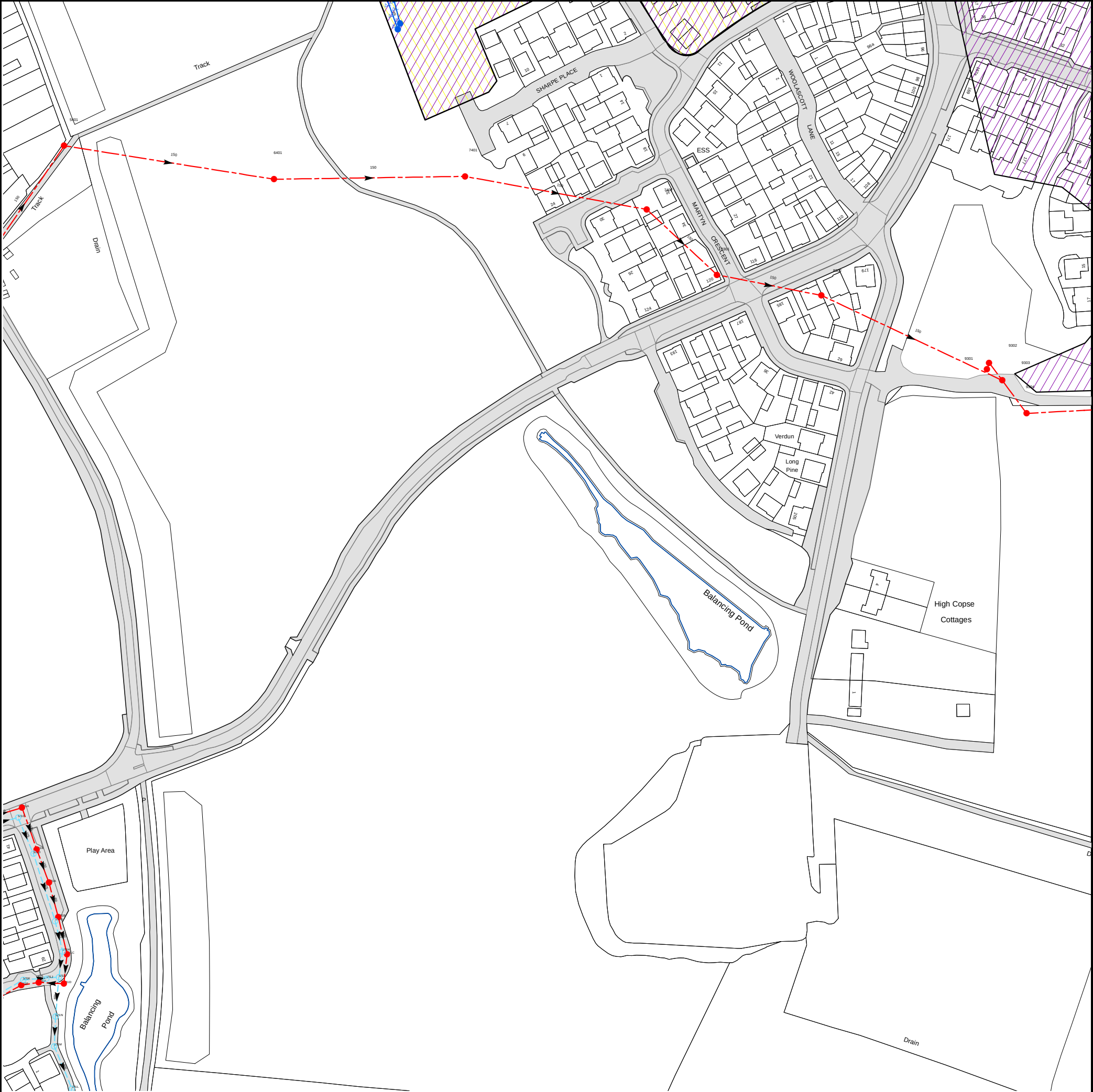
Tel: 0800 009 3921
Email: developer.services@thameswater.co.uk

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



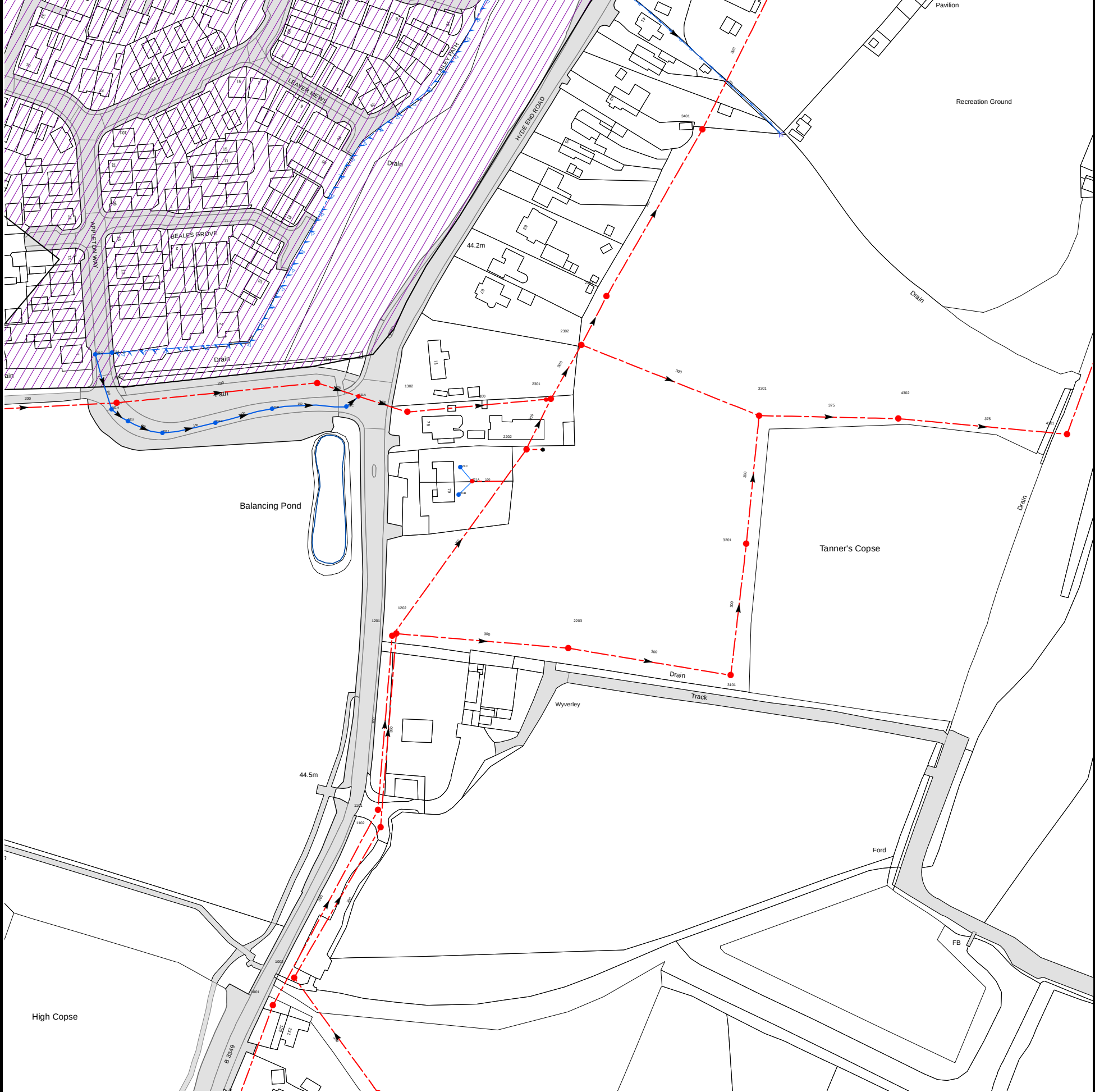
The width of the displayed area is 500m and the centre of the map is located at OS coordinates 472750,167250

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

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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
8301	47.94	45.58
7402	48.08	45.91
6401	n/a	n/a
7401	48.63	46.29
5401	49.24	47.22
n/a	n/a	n/a
n/a	n/a	n/a
n/a	n/a	n/a
8302	47.46	45.1
501G	n/a	n/a
501B	n/a	n/a
501A	n/a	n/a
511D	n/a	n/a
511B	n/a	n/a
511C	n/a	n/a
511A	n/a	n/a
501M	n/a	n/a
501N	n/a	n/a
501F	n/a	n/a
501D	n/a	n/a
501E	n/a	n/a
501K	n/a	n/a
501J	n/a	n/a
501I	n/a	n/a
501C	n/a	n/a
501H	n/a	n/a
9304	46.39	44.3
9303	46.6	44.49
9301	46.62	45.94
9302	46.64	45.8
501L	n/a	n/a
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The width of the displayed area is 500m and the centre of the map is located at OS coordinates 473250,167250

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

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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
4302	42.41	40.26
4301	41.73	40.09
031A	n/a	n/a
1301	44.72	43.03
2302	43.52	41.22
2303	43.53	41.17
3401	43.12	40.85
1001	45.1	42.35
1002	44.86	41.92
1102	44.44	41.61
1101	44.78	42.03
3101	42.95	40.82
2203	43.47	41.06
1201	44.97	41.74
1202	44.94	41.32
3201	42.99	40.65
221B	n/a	n/a
221A	n/a	n/a
221C	n/a	n/a
2202	44.42	41.47
031J	n/a	n/a
031K	n/a	n/a
3301	42.85	40.44
1302	44.22	42.74
131B	n/a	n/a
131C	n/a	n/a
2301	43.9	41.41
131A	n/a	n/a
031I	n/a	n/a
031H	n/a	n/a
0301	45.76	43.71
031G	n/a	n/a
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The width of the displayed area is 500m and the centre of the map is located at OS coordinates 473250,167750

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

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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
3901	47.81	46.5
4901	46.38	44.76
3701	45.11	43.6
381C	n/a	n/a
381B	n/a	n/a
3750	45.11	43.2
481J	n/a	n/a
4805	45.32	43.84
4707	45.27	44.27
481F	n/a	n/a
4806	46.41	44.93
481A	n/a	n/a
481E	n/a	n/a
481B	n/a	n/a
4807	46.83	45.59
481D	n/a	n/a
481C	n/a	n/a
481I	n/a	n/a
4706	45.32	44.73
4705	45.22	44.2
481H	n/a	n/a
481G	n/a	n/a
4703	45.06	44.69
4704	44.89	44.32
4804	45.72	45.23
4750	n/a	n/a
4803	45.76	45.08
4802	45.72	44.88
4801	45.35	44.39
5709	44.3	43.36
4850	44.65	43.36
4607	43.18	41.83
4608	42.71	41.51
4702	43.33	42.14
461K	n/a	n/a
461G	n/a	n/a
461J	n/a	n/a
4654	42.9	42.15
461I	n/a	n/a
4656	42.87	41.34
461L	n/a	n/a
4657	43.02	41.41
461M	n/a	n/a
4601	43.09	40.28
461F	n/a	n/a
461A	n/a	n/a
4652	43.02	42.09
461C	n/a	n/a
461E	n/a	n/a
4655	43.38	42.51
461B	n/a	n/a
4602	43.09	41.27
461D	n/a	n/a
4651	43.58	42.3
4603	43.34	42.22
4604	43.66	42.47
4653	43.01	42.09
4650	43.86	42.57
4605	43.74	42.69
4606	43.47	42.36
4752	43.52	42.27
4701	44.64	43.6
4753	44.04	43.26
4751	44.63	42.91
3502	43.49	40.46
451A	n/a	n/a
4553	42.65	41.2
461H	n/a	n/a
4501	42.85	40.16
4550	42.79	41.87
4552	42.79	41.02
371A	n/a	n/a
371B	n/a	n/a
3852	46.11	43.98
3854	46.35	43.71
181A	n/a	n/a
3853	n/a	n/a
3855	45.72	43.28
3850	n/a	n/a
3851	46.15	44.12
2850	46.88	43.92
381A	46.56	45.29
291H	48.5	45.6
291D	48.68	46.05
2950	48.72	46.87
291A	48.58	45.94
291B	48.01	45.83
291J	n/a	n/a
291C	48.11	46.92
291I	n/a	n/a

Manhole Reference	Manhole Cover Level	Manhole Invert Level
3902	48.24	47.18
291G	49.29	46.21
291E	48.82	46.14
291F	48.87	46.35
391A	n/a	n/a
301D	48.78	47.57
201E	49.22	46.9
201A	49.28	46.56
171A	n/a	n/a
271A	n/a	n/a
271C	n/a	n/a
271B	n/a	n/a
261F	n/a	n/a
261A	n/a	n/a
261G	n/a	n/a
261B	n/a	n/a
261D	n/a	n/a
271D	n/a	n/a
271E	n/a	n/a
371C	n/a	n/a
3702	46.32	44.73
3751	46.04	43.83
3752	44.4	42.32
3601	43.85	42.42
3650	43.87	41.99
3703	44.38	42.86
3501	43.62	40.69
351A	n/a	n/a
351C	n/a	n/a
351B	n/a	n/a
351E	n/a	n/a
251A	n/a	n/a
351D	n/a	n/a
361A	n/a	n/a
261J	n/a	n/a
261H	n/a	n/a
261C	n/a	n/a
261I	n/a	n/a
261E	n/a	n/a
9021	53.23	51.64
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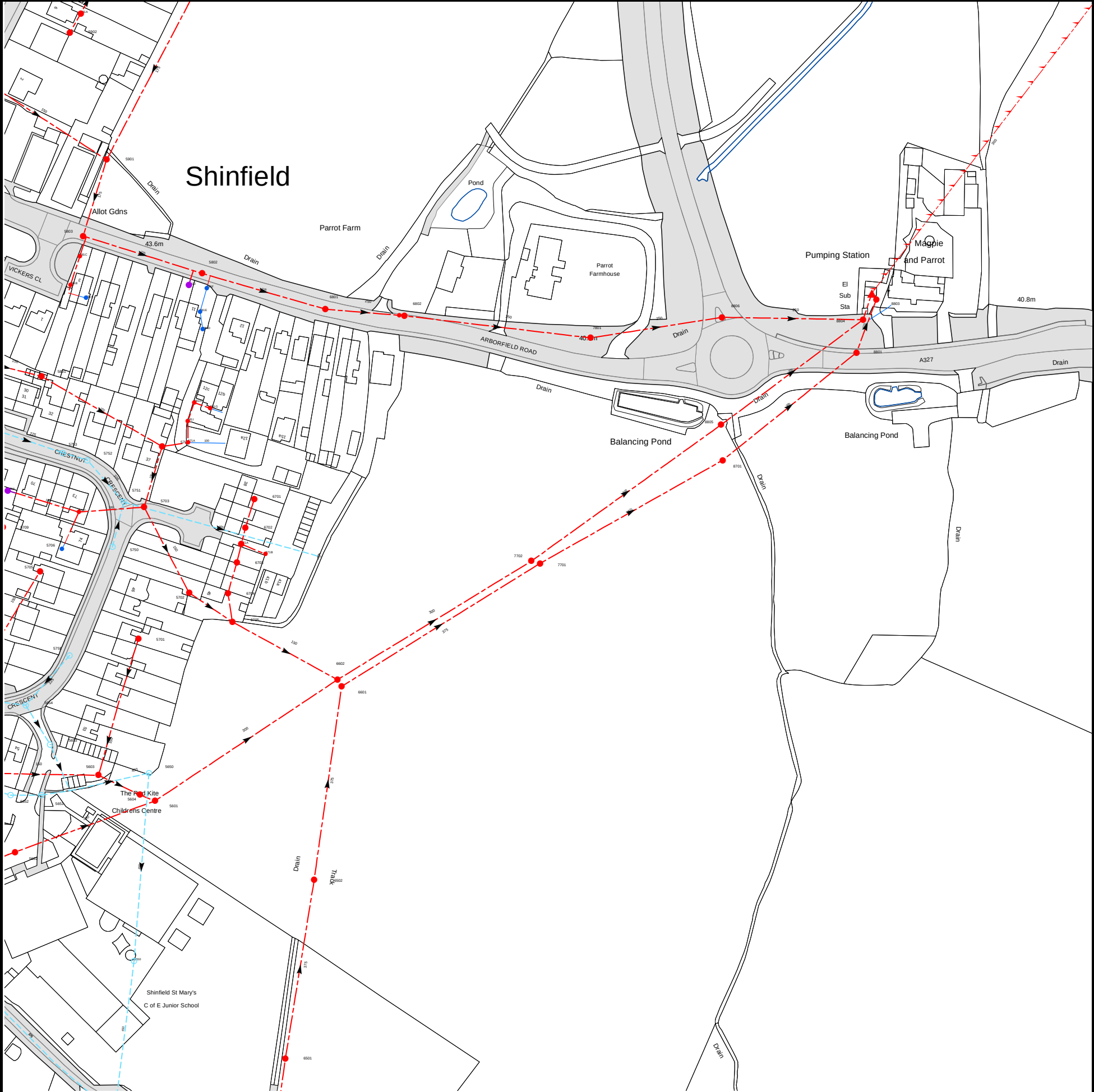
The width of the displayed area is 500m and the centre of the map is located at OS coordinates 473750,167250

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

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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
5301	41.97	39.87
5451	42.15	40.78
5401	42.16	39.62
5402	41.6	39.47
6401	41.89	39.36
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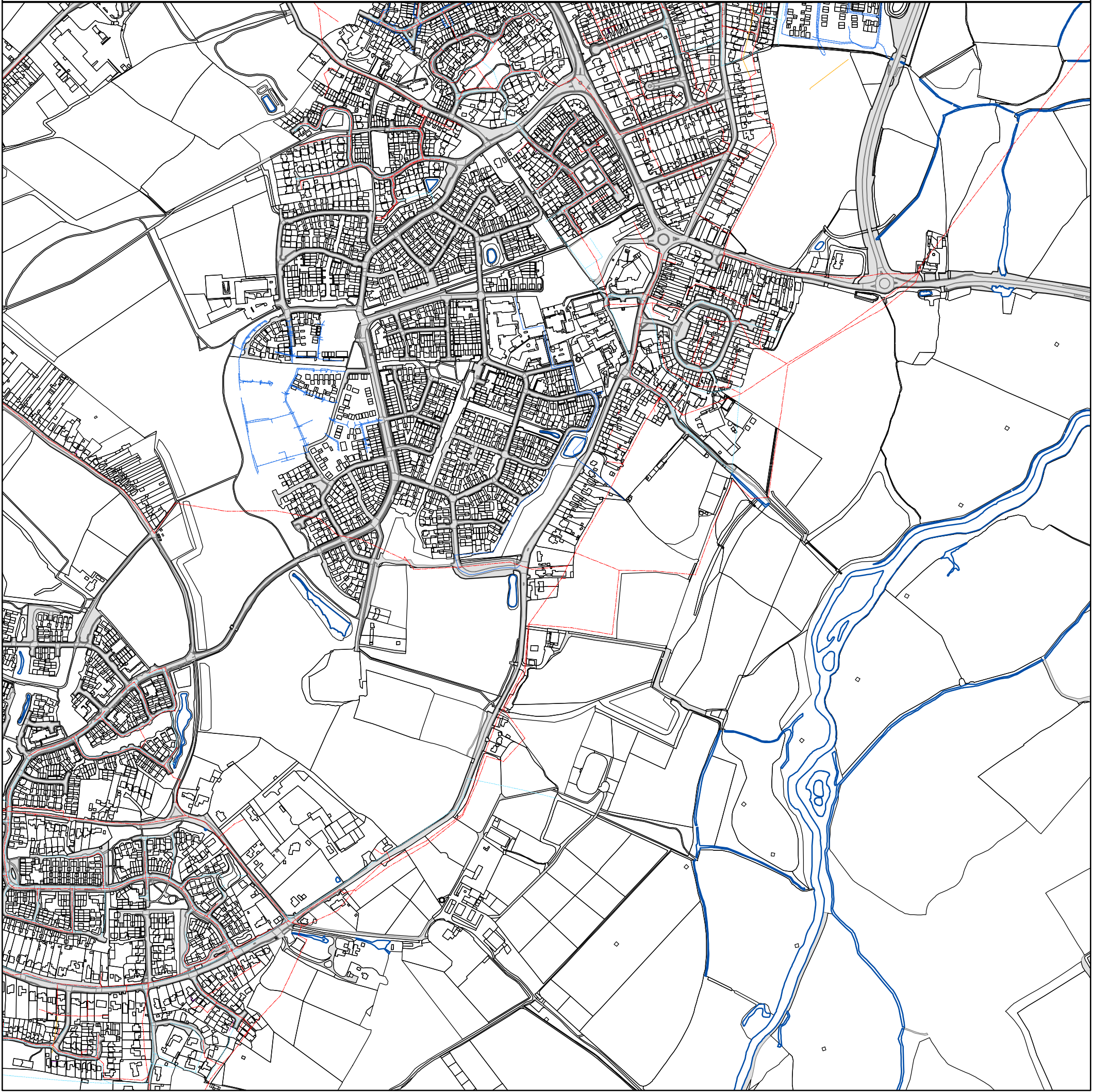
The width of the displayed area is 500m and the centre of the map is located at OS coordinates 473750,167750

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

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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
5902	47.48	47.12
591A	n/a	n/a
5803	44.22	42.31
5901	n/a	n/a
581H	n/a	n/a
581E	n/a	n/a
5802	42.89	41.44
581D	n/a	n/a
581F	n/a	n/a
581G	n/a	n/a
6701	n/a	n/a
6801	42.19	40.73
6802	41.73	39.21
7801	41.04	38.97
8805	41.1	38.89
8806	41.03	38.75
8701	40.86	38.26
8801	41.777	37.957
8804	40.71	38.57
8803	40.84	37.53
5709	44.3	43.36
5707	44.32	42.51
5703	43.55	41.78
5751	43.77	41.47
5708	44.68	43.49
5752	44.01	41.7
5753	44.19	41.87
5704	43.79	42.39
571A	n/a	n/a
581I	n/a	n/a
5801	45.4	43.64
581A	n/a	n/a
581J	n/a	n/a
581B	n/a	n/a
581C	n/a	n/a
5652	42.65	41.65
5602	42.4	39.96
5654	42.7	42
5705	43.74	42.75
5651	42.75	41.43
5653	42.85	41.93
5706	44.15	42.95
5755	43.03	42.08
5603	42.8	40.17
5750	43.62	41.78
5701	43.36	42.51
5604	n/a	n/a
5650	42.46	41.4
5601	42.12	39.8
5702	42.87	41.14
6704	42.63	41.49
6705	42.27	40.75
6703	42.51	41.54
671A	n/a	n/a
6702	42.6	41.61
671B	n/a	n/a
6602	41.56	39.48
6601	41.71	38.74
7702	41.3	39.15
7701	41.35	38.49
5550	42.47	40.88
6501	41.37	39.19
6502	41.5	38.98
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Scale: 1:7160
Width: 2000m
Printed By: Krishna1
Print Date: 30/07/2024
Map Centre: 473211,167352
Grid Reference: SU7367SW

Comments:

ALS/ALS Standard/2024_5024941

NB: Level quoted in metres Ordnance Newlyn Datum. The value -9999.00 indicates no Survey information is available.

REFERENCE	COVER LEVEL	INVERT LEVEL
9002	55.26	52.13
9021	53.23	51.64
0039	55.04	53.14
0040	54.89	53.26
9012	55.2	52.42
9010	55.2	51.98
9101	56.47	53.06
4203	52.69	51.41
3451	49.26	37.38
3554		
3404	49.32	47.25
3406	49.26	47.9
1902	43.96	42.12
1201	44.97	41.74
7609	45.96	44.04
2451		47.7
2303	43.53	41.17
4307	48.2	46.6
4551	48.19	46.52
4552	48.22	46.52
9304	46.39	44.3
4355	48.31	46.81
7652	46.23	45.33
8301	47.94	45.58
8301	57.83	55.16
6502	47.25	45.6
6602	46.76	44.47
6702	46.538	44.638
9802	44.97	43.06
9302	46.64	45.8
2202	53.27	51.55
0851	44.68	43.37
0802	44.35	42.77
1901	44.09	42.32
8704	45.76	43.56
3502	48.59	46.33
3352		46.6
3457		
5401	47.22	45.51
5302	46.99	45.14
2501	51.06	49.54
2350		
2450	49.23	47.9
3551	48.56	46.92
4306	48.5	47.16
6401	47.62	44.7
7401	48.63	46.29
3456		
3401	49.36	48.48
2401	49.18	48.13
9303	46.6	44.49
2201	42.91	41.9
5501	48.11	45.26
6452	47.46	46.23
6501	47.09	45.35
5504	47.79	46.27
5553	47.75	46.66
7302	56.8	54.47
3401	43.12	40.85
2350	56.58	55.04
5503	47.88	46.11
5451	47.39	45.95
5450	47.19	45.79
8751	45.27	44.12
9702	45.3	43.32
4350	48.29	46.59
5352	47.24	45.56
6504	47.69	45.58
4451	48.04	45.84
4450	48.02	45.77
3453	48.41	47.13
2202	44.42	41.47
7402	48.08	45.91
5551	47.87	46.69
8702	45.73	43.74
2301	43.9	41.41
4304	48.09	46.53
4550	48.11	47.11
4452		
7603	46.1	44.1
4401	49.27	48.14

REFERENCE	COVER LEVEL	INVERT LEVEL
9020	53.59	51.68
0045	55.07	52.57
0038	54.94	52.6
9103	56.75	55.19
9106	56.73	55.33
8008	56.19	53.62
4202	52.56	51.2
4204	52.7	51.59
3501	48.99	46.97
3555		
3351		
3550	48.96	47.26
1102	44.44	41.61
1202	44.94	41.32
2403	49.29	48.26
5452	47.67	46.31
4401	48.3	45.93
4402	48.24	46.04
4403	48.17	46.19
3405	49.25	47.99
4801	48.198	46.528
7501	46.81	44.52
7653		
8601	45.91	43.84
1001	45.1	42.35
6650	46.85	45.63
6405	47.58	44.76
9801	45.01	43.2
9301	46.62	45.94
2302	43.52	41.22
7602		
0301	45.76	43.71
0801	44.33	42.92
1002	44.86	41.92
3350	48.35	46.85
3454	48.5	47.01
4402	49.31	47.9
1302	44.22	42.74
5502	47.86	46.45
2550	49.5	47.9
1903	44.57	42.42
2501	49.46	47.69
2402	49.23	48.48
4404	48.41	47.34
4308	48.1	46.57
6503	47.11	46.06
3501	49.73	48.79
3408	48.41	47.44
3409		
6505		
2203	43.47	41.06
2801	49.44	47.89
6403	47.45	45.19
6404	47.79	45.07
2502	50.36	49.13
5552	47.87	46.52
5303	46.92	45.1
0901	44.62	42.63
3450	49.27	47.5
2302	56.21	54.64
5554	47.9	46.49
5550	47.51	46.29
5402	47.35	45.91
9701	45.52	43.47
8750	45.9	44.24
3455	48.8	47.61
6551	47.73	46.39
4353	47.95	46.09
4301	49.22	47.61
3210	54.52	53.38
0850	44.47	43.35
8302	47.46	45.1
5453	47.91	46.6
5401	49.24	47.22
8703	45.96	43.69
4501	48.43	45.59
4352	48.09	46.23
4454	47.98	46.41
7604	46.16	
7601	46.27	
8701	45.79	43.67

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ALS/ALS Standard/2024_5024941

NB: Level quoted in metres Ordnance Newlyn Datum. The value -9999.00 indicates no Survey information is available.

REFERENCE	COVER LEVEL	INVERT LEVEL
4305	48.04	46.3
7605	46.13	44.03
7608	46.15	44.12
1101	44.78	42.03
3407	48.59	47.62
3302	55.99	54.32
1301	44.72	43.03
6401		
6451	47.9	45.99
6601	47.04	44.75
6453	47.46	46.31
4250	53.6	52.26
6705	42.27	40.75
5250	51.99	51.26
5902	47.48	47.12
8804	40.71	38.57
4701	44.64	43.6
3104	51.32	49.35
3201	51.68	50.05
6401	41.89	39.36
6501	41.37	39.19
3103	51.34	49.09
3601	43.85	42.42
5603	42.8	40.17
3902	48.24	47.18
5103	47.86	46.64
3206		
5002	47.11	45.41
5402	41.6	39.47
3207	54.16	52.37
5003	47.22	45.59
5601	42.12	39.8
3101	42.95	40.82
3301	42.85	40.44
5750	43.62	41.78
5751	43.77	41.47
5604		
5705	43.74	42.75
5801	45.4	43.64
5653	42.85	41.93
4606	43.47	42.36
4253		
5652	42.65	41.65
5602	42.4	39.96
5208	52.66	51.68
5210	52.87	52.11
5253		
5206	52.55	51.37
4803	45.76	45.08
4214	53.29	52.2
8805	41.1	38.89
8701	40.86	38.26
4704	44.89	44.32
4252		
4804	45.72	45.23
5709	44.3	43.36
4607	43.18	41.83
4850	44.65	43.36
4302	42.41	40.26
4751	44.63	42.91
4306	54.4	53.21
4207	53.65	52.88
6602	41.56	39.48
4301	41.73	40.09
4105	52.36	51.63
4801	45.35	44.39
4602	43.09	41.27
4608	42.71	41.51
4206	52.94	52.18
4251	53.19	52.03
4308	54.1	53.22
7702	41.3	39.15
3106	51.5	49.59
3204	53.51	52.66
4603	43.34	42.22
4706	45.32	44.73
4604	43.66	42.47
4656	42.87	41.34
4205	53	51.96
3901	47.81	46.5
4655	43.38	42.51

REFERENCE	COVER LEVEL	INVERT LEVEL
4556		
7651	46.14	44.92
7650	46.22	45.28
3452		37.22
2301	56.09	54.59
3301	55.94	54.2
1950	43.56	42.46
6450	47.89	45.95
6406	47.49	45.33
6402	47.43	44.94
9850	44.74	43.62
4651	43.58	42.3
6704	42.63	41.49
5755	43.03	42.08
5252		
5753	44.19	41.87
3703	44.38	42.86
3202	52.05	50.5
6701		
6101	46.16	44.87
6001	45.49	44.32
3650	43.87	41.99
5752	44.01	41.7
5005	48.76	47.67
5001	45.45	43.86
3752	44.4	42.32
5704	43.79	42.39
5702	42.87	41.14
3209		
5703	43.55	41.78
5650	42.46	41.4
3208	54.31	52.1
3201	42.99	40.65
5901		
5401	42.16	39.62
5701	43.36	42.51
5301	41.97	39.87
5651	42.75	41.43
5254		
4213		
4212		
4211		
5105		
5107	52.17	50.98
5209	52.84	51.84
5654	42.7	42
5205	52.19	51.27
4750		
4802	45.72	44.88
4653	43.01	42.09
8806	41.03	38.75
4103	52.17	51.17
4216		
4215	53.33	52.4
4702	43.33	42.14
5106		
4552	42.79	41.02
4707	45.27	44.27
4307	54.38	53.2
4806	46.41	44.93
4101	51.93	50.22
6601	41.71	38.74
4652	43.02	42.09
4901	46.38	44.76
4210	52.95	51.38
4209	52.6	51.25
4550	42.79	41.87
4753	44.04	43.26
4752	43.52	42.27
4703	45.06	44.69
4553	42.65	41.2
7701	41.35	38.49
3502	43.49	40.46
8801	41.777	37.957
4705	45.22	44.2
4351	54.22	53.04
4654	42.9	42.15
4305	54.5	53.27
3105	51.21	49.8
3750	45.11	43.2
4208	53.7	52.71

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REFERENCE	COVER LEVEL	INVERT LEVEL
6502	41.5	38.98
4304	54.37	53.02
4352		
3304	54.53	53.38
5304	52.33	51
5211		
5102	50.67	49.77
5801	47.607	45.727
511D		
461B		
461D		
461C		
6102		
2502	49.38	47.54
6301	47.19	45.08
3205	53.84	52.53
8803	40.84	37.53
4002	49.36	47.83
5204		
7801	41.04	38.97
6801	42.19	40.73
8007	55.9	53.58
9907	53.5	51.75
9014	54.9	52.07
9903	53.37	51.18
9105	56.98	55.62
9905	53.81	52
9008	53.9	51.38
9016	55.37	53.37
9015	55.14	52.95
7113	56.11	54.84
7115	56.36	54.36
8004	55.79	53.36
8112	57.81	54.3
8003	56.38	52.83
8107	57.38	53.95
8002	56.22	52.76
8113	57.59	54.31
7116	56.59	54.26
7106	56.86	54.52
7102	56.88	54.15
8111	57.98	54.25
8011	56.63	54.02
8012	56.87	54.07
8102	57.29	53.25
8110	57.89	54.21
8109	57.57	54.15
8101	57.62	53.37
9003	55.77	54.29
9004	55.3	52.45
001A	54.4	
001C	54.86	
1001	53.38	51.72
2008	51.09	49.71
3850		
3851	46.15	44.12
301D	48.78	47.57
3853		
3102	50.12	48.34
201M	50.8	49
381A	46.56	45.29
201C	51.04	49.86
201E	49.22	46.9
121B	58.36	56.54
211A	52.66	51.15
291B	48.01	45.83
211D	52.48	51.07
201G	50.68	48.16
301A	49.2	47.33
3852	46.11	43.98
201A	49.28	46.56
201I	51.14	49.59
2950	48.72	46.87
101A	52.51	50.83
291G	49.29	46.21
201P	52.15	50.32
021C	59.49	57.42
201H	51.42	48.34
2002	51.31	48.69
291D	48.68	46.05
2015	50.92	49.16

REFERENCE	COVER LEVEL	INVERT LEVEL
4807	46.83	45.59
4657	43.02	41.41
4605	43.74	42.69
5303	52.18	50.85
5006	48.68	47.89
5101	50.04	49.4
321E		
4501	42.85	40.16
461A		
351A		
461E		
5350		46.41
4201	52.02	50.95
3402	48.6	47.54
3501	43.62	40.69
4102	52.02	50.62
5207	52.5	51.55
4104	52.24	51.58
5803	44.22	42.31
6802	41.73	39.21
8001	55.93	52.67
9904	53.41	51.29
9013	55.05	52.37
9104	56.99	55.41
9006	54.89	51.64
9019	54.25	52.06
9007	54.42	51.5
9906	53.4	51.91
9011	55.31	52.49
9005	55.07	52.29
7002	55.42	54.16
8010	55.69	53.95
8105	57.79	53.75
8009	56.38	53.64
7105	56.95	54.45
8114	57.43	54.41
8106	57.57	53.84
7114	56.43	54.71
7107	56.62	54.69
7001	55.23	53.63
7101	56.99	54.1
8104	57.97	53.54
8108	57.26	54.11
9009	55	51.84
8005	56.59	53.02
8006	56.93	53.13
8103	57.85	53.46
9107	56.6	55.15
9001	55.85	52.87
9108	56.42	54.96
001B	54.98	
111A	53.95	
201K	51.02	49.3
3101	49.89	48.92
3702	46.32	44.73
301C	48.79	47.15
3751	46.04	43.83
3855	45.72	43.28
3701	45.11	43.6
291H	48.5	45.6
201N	52.02	50.27
201L	50.78	49.43
0101	56.54	54.33
201D	50.91	49.16
211B	52.64	51.06
211C	52.44	50.72
201F	50.71	48.53
211G	52.87	51.5
3854	46.35	43.71
301B	49.11	46.88
2850	46.88	43.92
201J	51.08	49.1
2102	51.87	50.87
201B	51	49.68
211E	52.8	51.49
291E	48.82	46.14
211F	52.28	50.82
291A	48.58	45.94
111C	53.48	51.83
201O	52.05	50
131A	57.52	55.56

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REFERENCE	COVER LEVEL	INVERT LEVEL
0201	59.42	57.4
121C	58.4	54.7
021A	59.55	57.02
921A	58.27	56.59
021M	58.03	54.13
131B	58	55.41
021E	57.28	55.91
021D	58.87	57.29
2201	55.51	52.74
021J	58.01	56.62
031A	60.62	56.66
7303	57.05	54.8
121F	58.37	54.15
131G	58.52	55.6
1206	56.18	53.37
9102	56.62	53.2
021T	57.94	54.56
021H	57.62	56.17
011B	54.37	
021P	57.99	56.23
1114	56.19	54.16
021I	58.26	56.89
121G	56.71	53.83
121D	58.31	55.36
9111	56.6	53.56
121E	58.4	57.16
2101	54.39	52.47
021N	57.24	55.47
5203	51.08	49.96
6701	46.82	45.02
581A		
5451	42.15	40.78
1204	55.71	54.24
1201	56.23	53.67
1104	54.9	52.6
1102	55.29	53.29
1202	56.25	53.91
521J		
0102		
011D	56.46	55.26
1107	55.87	53.55
481A		
481C		
481E		
451A		
3203	52	
4650	43.86	42.57
291I		
291F	48.87	46.35
621A	49.15	47.76
521G		
531A	50.519	50.25
631G	50.46	48.463
631J	49.469	48.25
631W		
531I		
631Y		
632A		
632C		
632L		49.45
632N		49.28
632P		49.45
632R		49.36
811C		
4001	48.49	47.32
501A		
6703	42.51	41.54
671A		
5802	42.89	41.44
331C		
341A		
341C		
311C		
521L		
521H		
311A		
301E	50.88	49.81
451B		
701A		
701C		
811B		

REFERENCE	COVER LEVEL	INVERT LEVEL
021F	57.18	54.77
021K	58.92	57.22
9112	56.76	53.45
131F	58.05	55.71
011A	54.82	
021G	59.42	57.8
111B	53.83	51.98
131C	58.44	55.22
0301	60.45	57.16
0220	58.1	53.93
0207	57.93	54.82
021R	57.64	55
121A	58.3	54.96
011C	56.44	55.1
1209	55.74	52.85
021B	58.86	56.77
1106	55.89	53.55
021O	57.66	55.82
131D	57.51	55.86
1210	57	54.29
1208	55.93	53.01
131E	58.55	55.48
1207	56.23	53.2
9038	54.91	52.32
021L	57.63	54.17
1301	58.53	55.11
021S	59.93	54.48
021Q	58.9	56.88
5201	49.62	48.37
5802	47.482	45.652
4802	47.666	46.126
5550	42.47	40.88
1101	55.94	53.6
1103	55.07	52.91
1203	55.89	54.05
1205	57	54.43
1105	54.98	52.33
521F		
4351	47.98	47
011E	56.78	55.8
0107	56.51	54.71
481B		
481D		
481F		
221A		
4805	45.32	43.84
0902	44.29	42.55
291C	48.11	46.92
5301	51.2	50.1
631E	50.519	48.962
631F	50.38	49.027
531B	51.9	50.15
631H	50.34	48.483
631R		
531G		
631X		
631Z		
632B		
632K		49.214
632M		49.389
632O		49.159
632Q		49.5
701D		
5004	48.4	45.94
401B		
401C		
6702	42.6	41.61
321D		
401D		
341D		
341B		
821A		
521K		
5251	51.64	50.89
521I		
311B		
301F		
701E		
701B		
811A		
511E		

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REFERENCE	COVER LEVEL	INVERT LEVEL
611B		
5706	44.15	42.95
511B		
221A		
221B		
701F		
821B		
811D		
0950	44.49	43.04
431D		
611A		
581C		
461G		
461I		
4601	43.09	40.28
641A		
281B		
201R		
321B		
2601	51.38	49.81
441B		
011F		
011H		
911A		
9109	57	53.37
431E		
441C		
3401	48.71	47.86
331A		
881A		
971A		
481G		
481I		
351D		
581B		
381B		
381C		
351A		
9902	53.09	
581E		
171A		
271B		
261B		
261D		
031A		
031G		
031I		
031K		
131C		
261F		
261H		
261J		
251A		
341E		
341G		
391A		
201T		
581H		
571A		
641B		
551B		
541A		
331E		
521M		
641C		
641E		
241A		
811F		
711A		
341I		
351E		
551D		
281C		
351B		
501B		
811G		
371L		
361F		
281H	49.85	48.14
371K	49.54	47.34
271L	50.15	47.6

REFERENCE	COVER LEVEL	INVERT LEVEL
5707	44.32	42.51
5708	44.68	43.49
5104	51.68	50.07
221C		
511C		
511A		
821C		
431C		
021U		
531P		
581B		
581A		
461H		
461J		
461F		
3801	48.71	46.99
201Q		
321A		
321C		
441A		
441C		
011G		
011I		
011J		
431F		
611C		
441B		
441A		
331B		
971B		
381A		
481H		
351C		
591A		
371A		
481J		
581C		
351B		
581D		
581F		
271A		
261A		
261C		
261E		
131A		
031H		
031J		
131B		
271C		
261G		
261I		
361A		
181A		
341F		
551A		
201S		
581G		
581I		
671A	47	45.3
581J		
551C		
331D		
331F		
671B		
641D		
241C		
241B		
711B		
811E		
341J		
351F		
281D		
351C		
351A		
501C		
591A		
261C	50.03	47.8
361B	49.6	47.38
271M		
371Q	49.02	47.8
471A	49.17	46.03

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REFERENCE	COVER LEVEL	INVERT LEVEL
371N		
271E	50.12	46.64
261A	49.91	48.43
281F		
361J	49.34	47.79
361D	49.29	47.01
471C	49.22	47.09
271H	49.99	47.86
281J	50.25	48.05
271K	50.4	47.7
271C	50.16	47.1
271I	50.23	47.83
281G	50.24	47.71
361G		
371B	49.7	46.38
361C	49.56	47.29
271J	50.29	48.2
371P	49.12	47.86
371G	49.12	47.27
271G	50.07	47.94
471D	48.95	46.98
271B	50.04	47.2
371A	49.91	47.46
371H	49.03	47.21
371J		
551F		
661B		
561E		
551L	47.79	46.42
581D	48.62	47.42
571F		
561D		
481C		
471F	48.68	45.7
661I	46.84	45.81
551K	47.91	46.37
471K	48.76	47.43
561M	47.86	46.52
571I		
661H	47.02	45.87
561F		
561G	48.03	46.36
671C	48.14	46.46
551M	47.76	46.45
551G		
551E		
661C		
561L	47.67	46.14
571K	48.35	46.59
571N	48.22	46.5
551I		
661G	47.31	45.98
671E		
581E	48.72	47.51
571O	48.19	46.66
471L	48.7	47.57
571B	49.03	47.21
571E	48.3	45.47
641F		
331I		
351D		
471N	48.75	47.7
401Z		
301E		
401K		
401E		
491A		
281O		
501I		
491K		
401Y		
491C		
501N		
411C		
301D		
511C		
301G		
401B		
301C		
501A		
291F		

REFERENCE	COVER LEVEL	INVERT LEVEL
271A	50.07	47.49
371M		
261E	50.07	48.1
281I	50.04	48.11
361A	49.61	48.35
371F		
361H		
261D	50.36	48.53
261B		48.23
261G	49.92	48.32
371O		
261F	49.92	47.97
271F	50	48.33
281K	50.23	48
471B	48.99	45.9
371I	49.56	46.83
371R	49.142	47.63
271D	50.29	47.02
371E		
361I	49.21	48.07
361E	49.28	47.85
281E		
371C	49.51	46.25
371D	49.35	46.11
661F	47.62	46.08
661A		
571G		
671D		
571H		
471G	48.85	46.93
571C	48.48	46.69
671F		
561N	47.97	46.67
561K	47.31	46.79
471E	48.77	45.77
561A		
571A	48.25	45.59
471I		
571J	48.29	46.64
481B	48.86	47.66
571D	48.5	47.3
561H	47.83	46.53
551J	47.89	46.21
661E	47.82	46.17
561O	47.99	46.78
561J		
561B		
561I	48.03	46.23
661D		
471J	48.64	46.87
571L	48.37	46.57
571M	48.34	46.55
471M	48.93	47.44
561C		
551H		
471H		
481A	48.92	47.61
641G		
641H		
331H		
671G	48.1	46.46
391N		
411A		
591F		
391H		
411B		
391I		
591C		
401A		
391C		
501B		
381B		
401S		
401V		
301F		
491M		
491D		
411E		
401G		
401N		
391B		

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REFERENCE	COVER LEVEL	INVERT LEVEL
491E		
401P		
291G		
411D		
281M		
281P		
401C		
301H		
491F		
401O		
491L		
501E		
391E		
401U		
501F		
501K		
291E		
301I		
291H		
391K		
591K		
401X		
401Q		
401J		
391F		
281L		
411F		
591H		
391L		
501C		
401M		
491H		
281Q		
591D		
391P		
281S		
391A		
391G		
591J		
032B		
031O		
933R	61.87	59.91
931C	61.65	59.62
921P		
932E		
933E		
921N		
032K	60.59	57.53
932H		
031Y		
032C		
933N	61.7	57.86
933C		
921M		
932B		
931F	62.08	60.63
031D	60.98	57.82
921S	60.72	59.22
931D	61.61	60.01
932A		
031E	60.65	57.24
931E	61.49	60.27
921F		
831C	61.58	58.92
932C		
032D		
921K		
932F		
831B		
032O		
922F		
933X		
033Q		
935C		
935A		
033G		
922C		
033R		
933T		
032Z		
831J		

REFERENCE	COVER LEVEL	INVERT LEVEL
281R		
401D		
401F		
291A		
501L		
501G		
511B		
391D		
291D		
301A		
391J		
591I		
391O		
401R		
401W		
301B		
501D		
501M		
402A		
591L		
291B		
491I		
491J		
391M		
401T		
491G		
591E		
401H		
511A		
501H		
511D		
381C		
401I		
491B		
402B		
501J		
591G		
291C		
401L		
933O	61.81	58.48
933B		
932D		
921U	61.05	59.71
031Z		
921R	61.55	59.07
931Y		
933D		
931B	61.97	59.77
932I		
921H		
933P	61.66	58.08
931Z		
933M	62.01	58.56
932G		
921G		
933Q	61.5	58.62
931X		
921L		
921T	60.61	59.33
031X		
921I		
931A	61.65	59.62
921O		
032E		
921J		
921Q		
032J	61.15	57.74
933F		
031N		
021V		
935I		
831H		
033H		
032V		
033M		
935B		
033J		
933V		
033F		
922E		
033P		

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ALS/ALS Standard/2024_5024941

NB: Level quoted in metres Ordnance Newlyn Datum. The value -9999.00 indicates no Survey information is available.

REFERENCE	COVER LEVEL	INVERT LEVEL
922D		
933Y		
831D		
921V		
831E		
933U		
921X		
934V		
935D		
831F		
934R		
033O		
032U		
933W		
921W		
922G		
934X		
934T		
811H		
451A		
461M		
371C		
271D		
681D		
681C		

REFERENCE	COVER LEVEL	INVERT LEVEL
933S		
935E		
934U		
934W		
922A		
033I		
934Y		
032W		
033K		
922B		
933Z		
831I		
831G		
921Y		
033N		
033L		
934S		
351E		
291J		
461K		
461L		
271E		
371B		
681B		
681A		



Asset Location Search - Sewer Key

Public Sewer Types (Operated and maintained by Thames Water)

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

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

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

Notes:

- 1) All levels associated with the plans are to Ordnance Datum Newlyn.
- 2) All measurements on the plan are metric.
- 3) Arrows (on gravity fed sewers) or flecks (on rising mains) indicate the direction of flow.
- 4) Most private pipes are not shown on our plans, as in the past, this information has not been recorded.

Sewer Fittings

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

	Air Valve		Meter
	Dam Chase		Vent
	Fitting		

Operational Controls

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

	Ancillary		Drop Pipe
	Control Valve		Weir

End Items

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

	Inlet		Outfall
	Undefined End		

Other Symbols

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

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

Areas

Lines denoting areas of underground surveys, etc.

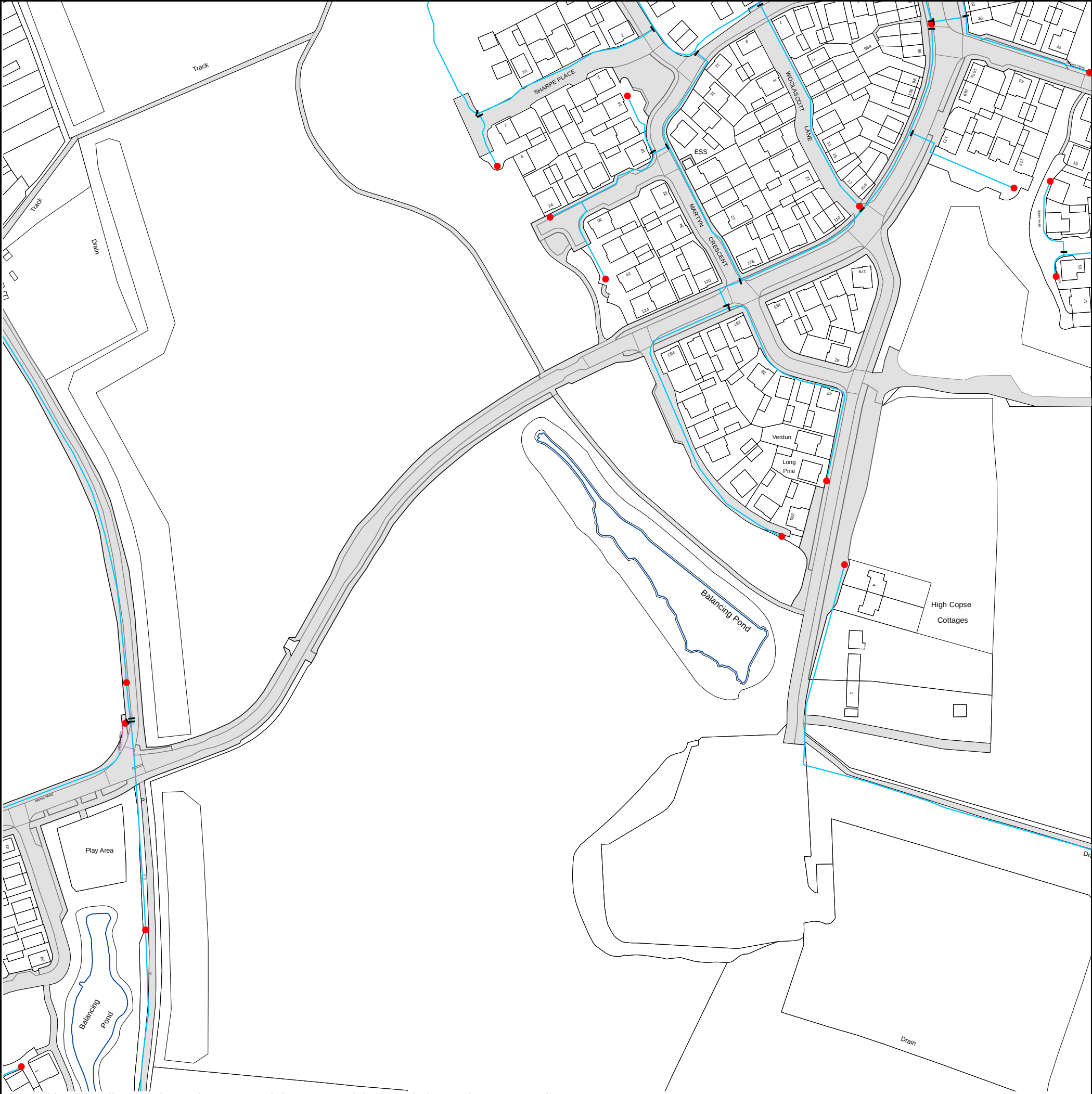
	Agreement
	Chamber
	Operational Site

Ducts or Crossings

	Casement	Ducts may contain high voltage cables. Please check with Thames Water.
	Conduit Bridge	
	Subway	
	Tunnel	

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

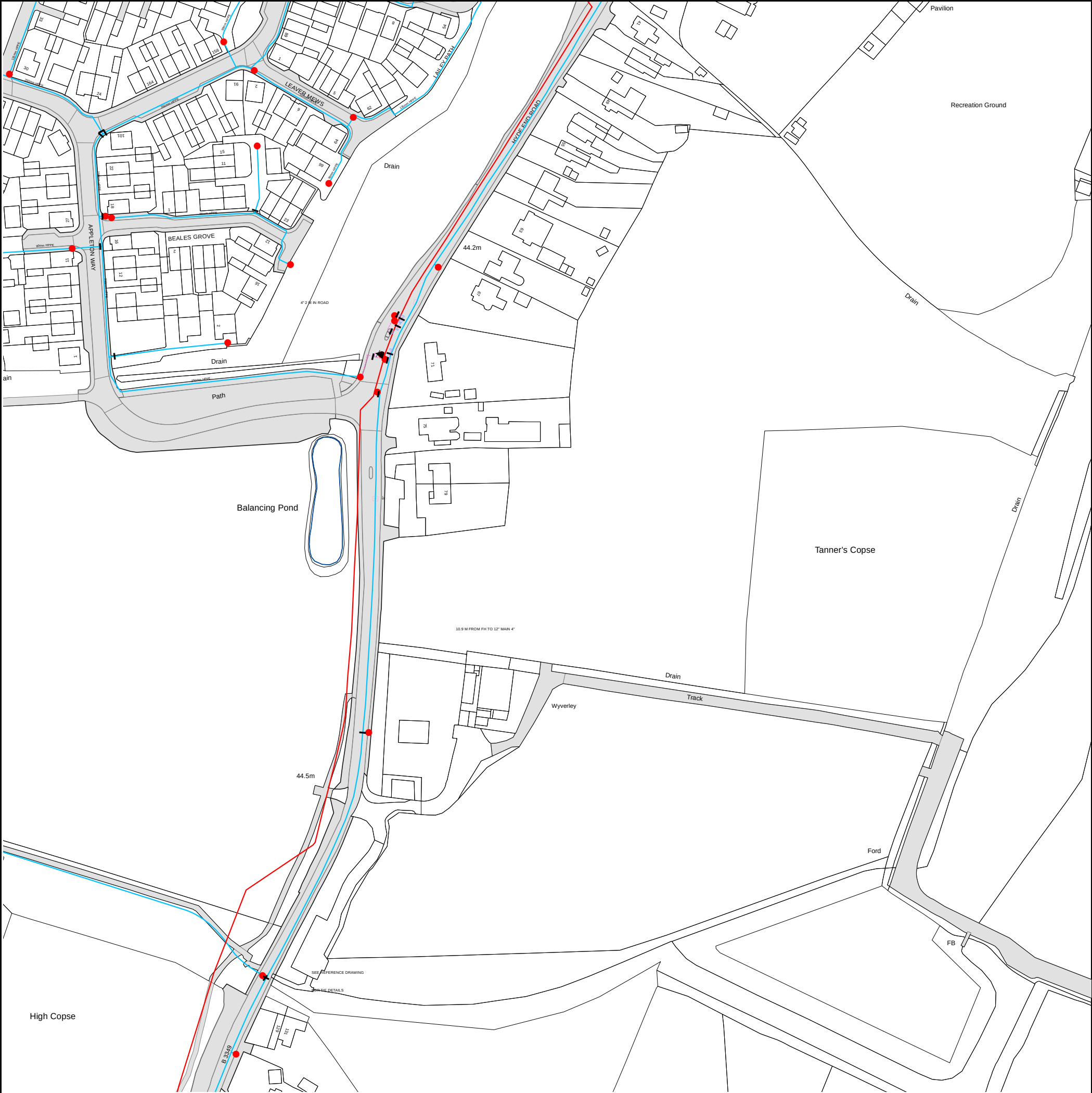
6) The text appearing alongside a sewer line indicates the internal diameter of the pipe in millimeters. Text next to a manhole indicates the manhole reference number and should not be taken as a measurement. If you are unsure about any text or symbology, please contact Property Searches on 0800 009 4540.



The width of the displayed area is 500m and the centre of the map is located at OS coordinates 472750,167250

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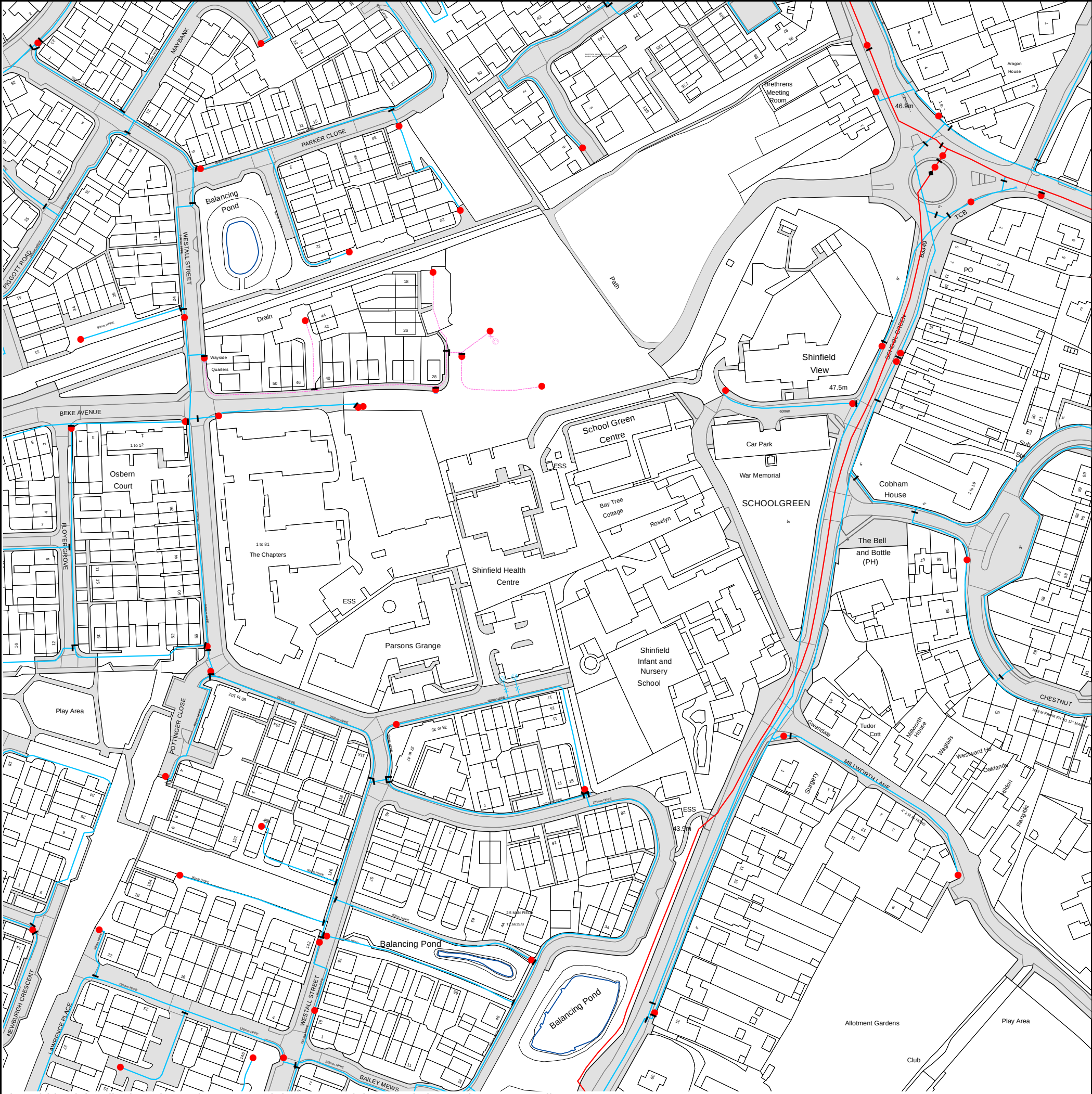
Based on the Ordnance Survey Map (2020) with the Sanction of the controller of H.M. Stationery Office, License no. 100019345 Crown Copyright Reserved.



The width of the displayed area is 500m and the centre of the map is located at OS coordinates 473250,167250

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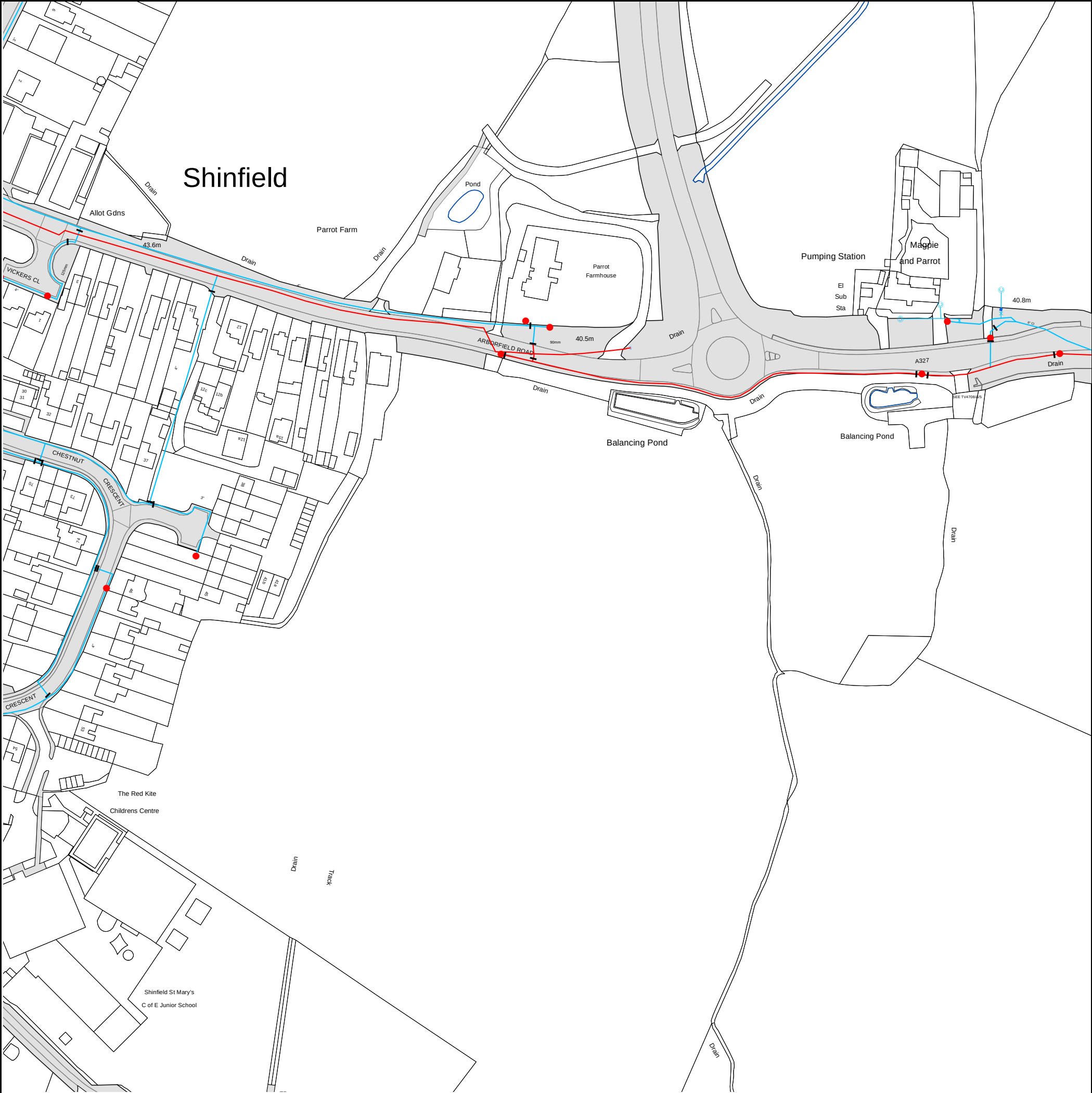
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The width of the displayed area is 500m and the centre of the map is located at OS coordinates 473250,167750

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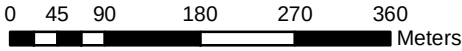
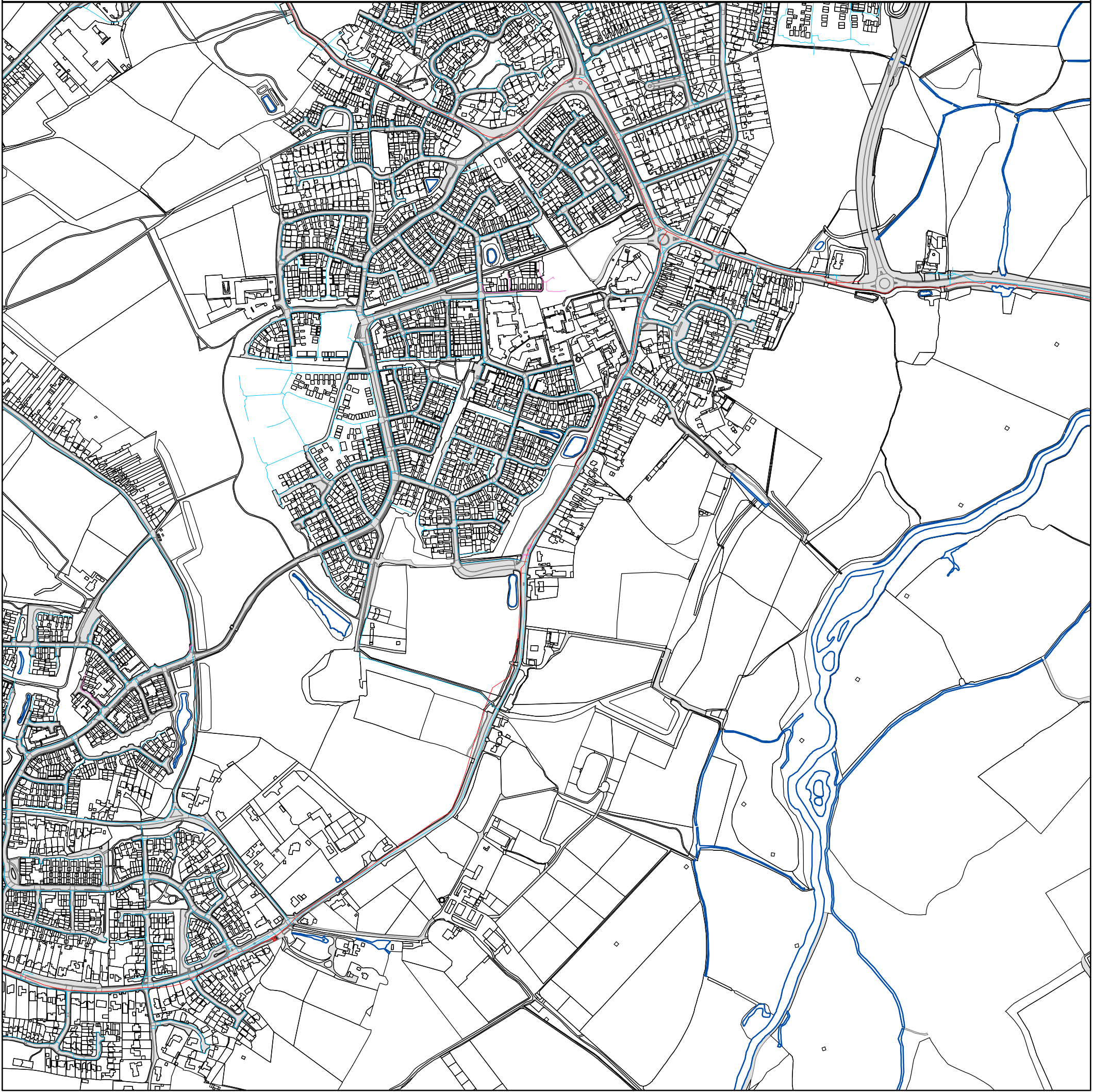
Based on the Ordnance Survey Map (2020) with the Sanction of the controller of H.M. Stationery Office, License no. 100019345 Crown Copyright Reserved.



The width of the displayed area is 500m and the centre of the map is located at OS coordinates 473750,167750

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Scale: 1:7160
Width: 2000m
Printed By: Krishna1
Print Date: 30/07/2024
Map Centre: 473211,167352
Grid Reference: SU7367SW

Comments:



Asset Location Search - Water Key

Water Pipes (Operated & Maintained by Thames Water)

- 4"** **Distribution Main:** The most common pipe shown on water maps. With few exceptions, domestic connections are only made to distribution mains.
- 16"** **Trunk Main:** A main carrying water from a source of supply to a treatment plant or reservoir, or from one treatment plant or reservoir to another. Also a main transferring water in bulk to smaller water mains used for supplying individual customers.
- 3" SUPPLY** **Supply Main:** A supply main indicates that the water main is used as a supply for a single property or group of properties.
- 3" FIRE** **Fire Main:** Where a pipe is used as a fire supply, the word FIRE will be displayed along the pipe.
- 3" METERED** **Metered Pipe:** A metered main indicates that the pipe in question supplies water for a single property or group of properties and that quantity of water passing through the pipe is metered even though there may be no meter symbol shown.
- Transmission Tunnel:** A very large diameter water pipe. Most tunnels are buried very deep underground. These pipes are not expected to affect the structural integrity of buildings shown on the map provided.
- Proposed Main:** A main that is still in the planning stages or in the process of being laid. More details of the proposed main and its reference number are generally included near the main.

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

Valves

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

Hydrants

- Single Hydrant

Meters

- Meter

End Items

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

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

Operational Sites

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

Other Symbols

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

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

- Other Water Company Main:** Occasionally other water company water pipes may overlap the border of our clean water coverage area. These mains are denoted in purple and in most cases have the owner of the pipe displayed along them.
- Private Main:** Indicates that the water main in question is not owned by Thames Water. These mains normally have text associated with them indicating the diameter and owner of the pipe.

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1. All goods remain in the property of Thames Water Utilities Ltd until full payment is received.
2. Provision of service will be in accordance with all legal requirements and published TWUL policies.
3. All invoices are strictly due for payment within 14 days of the date of the invoice. Any other terms must be accepted/agreed in writing prior to provision of goods or service or will be held to be invalid.
4. Penalty interest may be invoked by TWUL in the event of unjustifiable payment delay. Interest charges will be in line with UK Statute Law 'The Late Payment of Commercial Debts (Interest) Act 1998'.
5. Interest will be charged in line with current Court Interest Charges, if legal action is taken.
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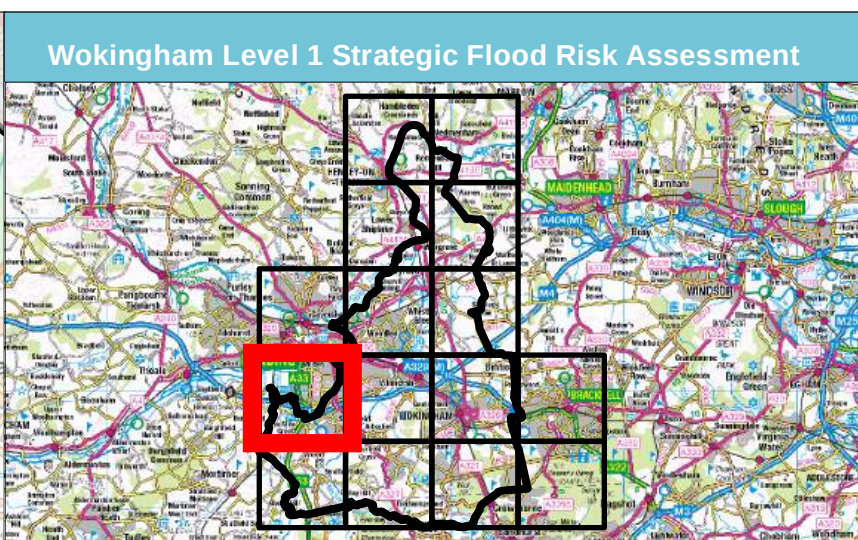
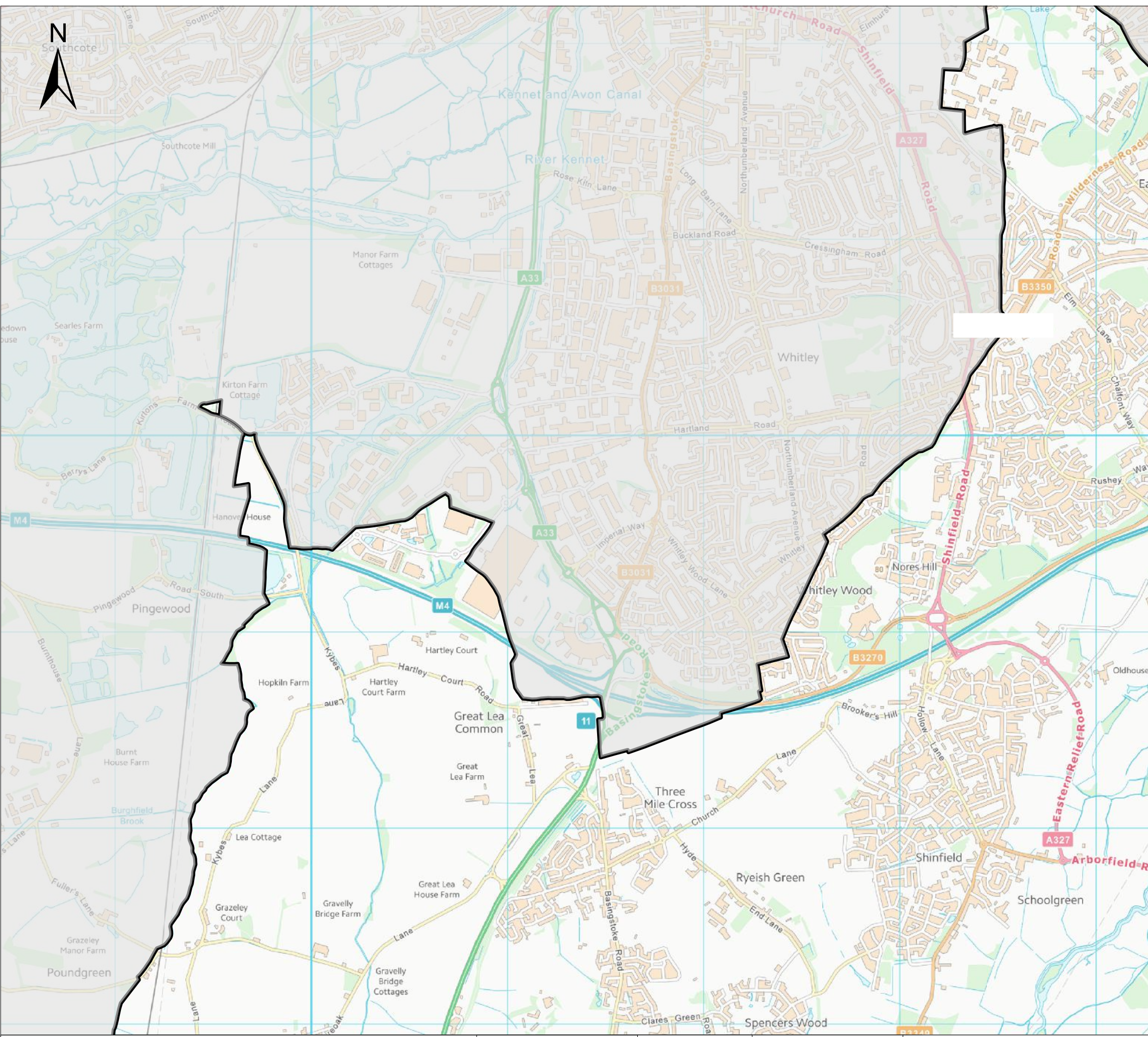
If you are still dissatisfied with our final response, and in certain circumstances such as you are buying a residential property or commercial property within certain parameters, The Property Ombudsman will investigate your case and give an independent view. The Ombudsman can award compensation of up to £25,000 to you if he finds that you have suffered actual financial loss and/or aggravation, distress, or inconvenience because of your search not keeping to the Code. Further information can be obtained by visiting www.tpos.co.uk or by sending an email to admin@tpos.co.uk.

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Ways to pay your bill

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

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



Wokingham Level 1 Strategic Flood Risk Assessment

Legend

- Wokingham Borough Council boundary

Watercourses
 - Main Rivers
 - All Watercourses

Fluvial Flood Zones
 - Indicative Flood Zone 3b
 - Flood Zone 3b
 - Flood Zone 3a
 - Flood Zone 2

Fluvial Flood Extent with Climate Change
 - 1% AEP with Central Climate Change allowance
 - 1% AEP with Higher Central Climate Change allowance

Risk of Flooding from Surface Water

Surface Water Extent
 - 3.3% AEP
 - 1% AEP
 - 0.1% AEP

Surface Water Extent plus climate change
 - 3.3% AEP plus 35% Climate Change
 - 1% AEP plus 40% Climate Change

Risk of Groundwater Flooding

EA Areas Susceptible to Groundwater Flooding
 - < 25%
 - >= 25% <50%
 - >= 50% <75%
 - >= 75%

JBA Groundwater Emergence Map (5m Resolution)
Depth below ground surface
 - Less than 0.025m below surface
 - Between 0.025m - 0.5m below surface
 - Between 0.5m - 5m below surface
 - At least 5m below surface
 - No risk

Risk of Flooding from Reservoirs
 - Wet Day
 - Dry Day

Flood Defences
 - Demountable Defence
 - Embankment
 - Wall
 - Natural High Ground

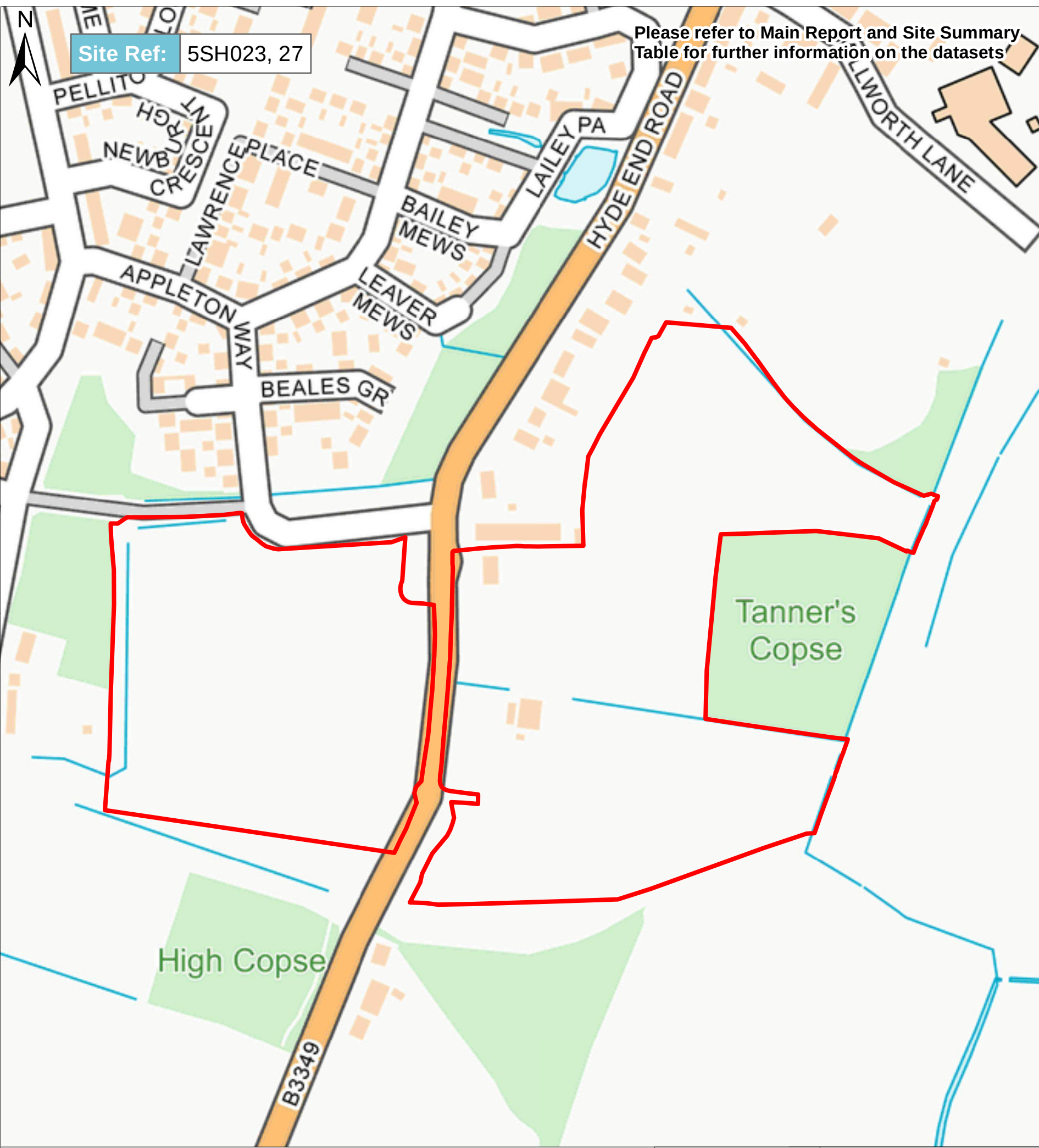
Flood Mitigation
 - Flood Alert Areas
 - Flood Warning Areas

Flood History
 - EA Historic Flood map



Site Ref: 5SH023, 27

Please refer to Main Report and Site Summary Table for further information on the datasets



Wokingham Level 2 Strategic Flood Risk Assessment

All layers are automatically off

Legend

Wokingham Borough Council boundary

Level 2 SFRA Sites

5SH023, 27

Watercourses

Main Rivers
All Watercourses

Fluvial Flood Zones

Flood Zone 3b
Flood Zone 3a
Flood Zone 2

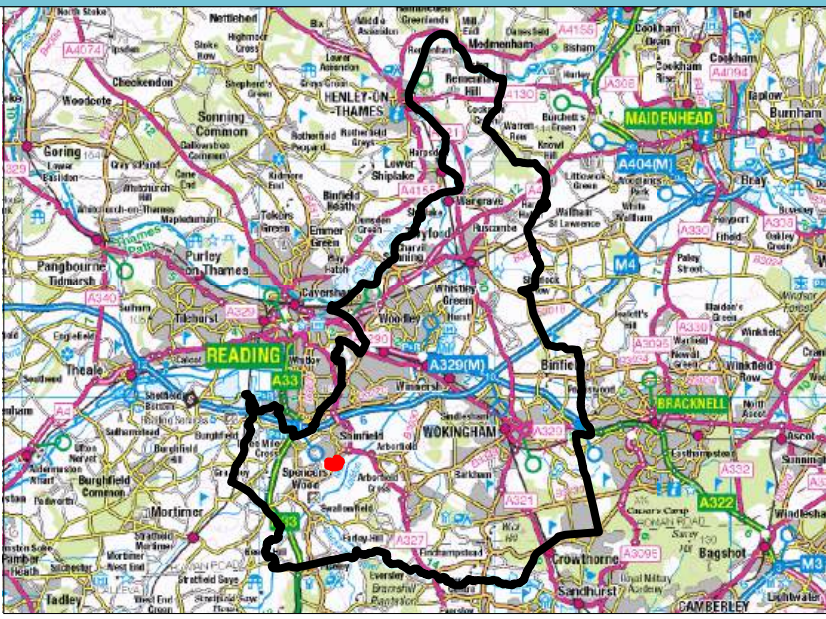
Modelled River Loddon

River Loddon-Flood Depth- 1% AEP plus 46% climate change

0.00 - 0.15
0.15 - 0.3
0.30 - 0.60
0.60 - 0.90
0.90 - 1.20
>1.20

River Loddon-Flood Depth- 1% AEP plus 46% climate change

0 - 0.25
0.25 - 0.5
0.5 - 0.75
>0.75



Risk of Flooding from Surface Water

Surface Water Extent
3.3% AEP
1% AEP
0.1% AEP

Risk of Flooding from Surface Water plus climate change

Surface Water Depth (m)- 1% AEP plus 40% climate change

0.00 - 0.15
0.15 - 0.3
0.30 - 0.60
0.60 - 0.90
0.90 - 1.20
>1.20

Surface Water Velocity (m/s)- 1% AEP plus 40% climate change

0 - 0.25
0.25 - 0.5
0.5 - 0.75
>0.75

Surface Water Hazard- 1% AEP plus 40% climate change

Caution
Dangerous for some
Dangerous for most
Dangerous for all

Risk of Groundwater Flooding

JBA Groundwater Emergence Map (5m Resolution)
Depth below ground surface

=/-0.025m
0.025m - 0.5m
0.5m - 5m
= /5m+
No risk

Risk of Flooding from Reservoirs

Risk of Reservoir flooding- Wet Day
Risk of Reservoir flooding- Dry Day

Flood Defences

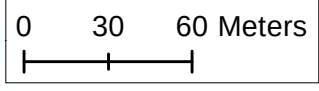
Natural High Ground

Flood Mitigation

Flood Alert Areas
Flood Warning Areas

Flood History

EA Historic Flood map



IDT-JBAU-XX-XX-MP-HM-0002-GeoPDF_5SH023, 27

Notes
Please see the accompanying user guide of the SFRA report for further guidance on the sources of data included within the map.
This map should be opened using Adobe Acrobat Reader.



LAND EAST AND WEST OF HYDE END ROAD, SHINFIELD

DIRECT RAINFALL MODELLING REPORT

BLOOR HOMES (SOUTHERN) AND THE UNIVERSITY OF READING

08 MAY 2025





Abley Letchford
3 Tealgate
Charnham Park
Hungerford
RG17 0YT

T: 01488 684390
E: contact@ableyletchford.co.uk
W: www.ableyletchford.co.uk

Quality Management:

Prepared by:	R Moore
Authorised by:	E Philpott
Date:	08 May 2025
Document Reference:	HD068-R007

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Any such party relies on the report at their own risk.



Contents

1.0 Introduction..... 1

2.0 Hydrological Assessment..... 7

3.0 Model Approach and Input Data 12

4.0 Sensitivity Testing 25

5.0 Model Results..... 29

6.0 Conclusions..... 35

Appendices

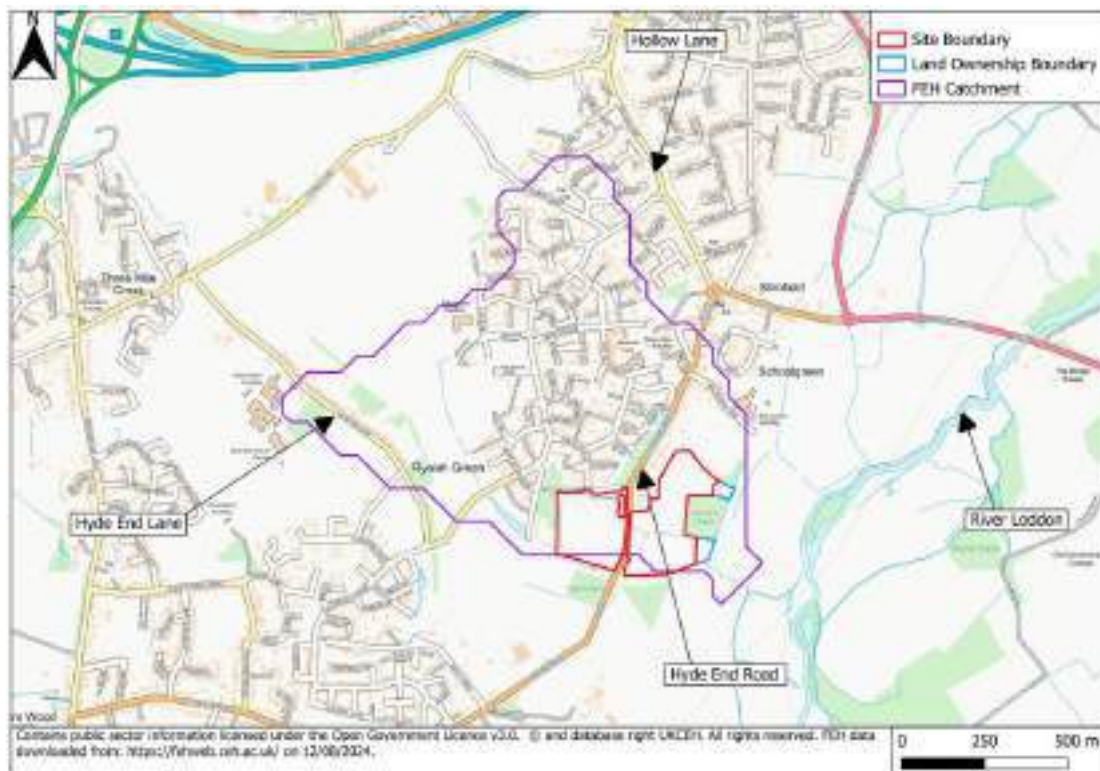
- Appendix 1 - Hydrological Report
- Appendix 2 - Model Log
- Appendix 3 - Topographical Survey

1.0 Introduction

Background

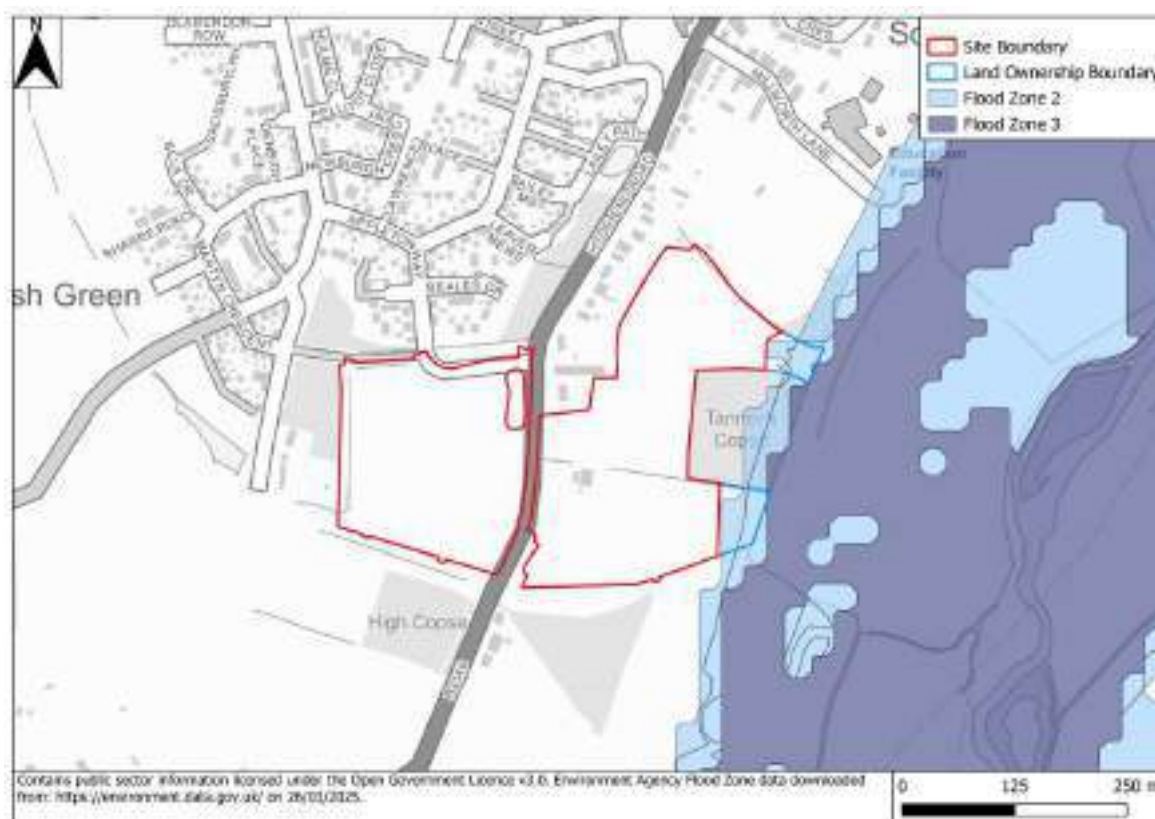
- 1.1. This direct rainfall modelling report has been prepared by Abley Letchford, on behalf of Bloor Homes (Southern) and the University of Reading, in relation to the proposed residential development at Land to the east and west of Hyde End Road at Shinfield located to the south of Reading.
- 1.2. This direct rainfall modelling report sets out the data and methods used to create a site-specific baseline model to represent the site-specific conditions. This report also sets out the baseline model results to define the surface water flood extents.
- 1.3. **Figure 1** shows the location of the site and catchment.

Figure 1 - Site Location Plan



- 1.4. The Environment Agency (EA) Flood Map for Planning shows that the entire site is located with Flood Zone 1, as show in **Figure 2**.

Figure 2 – EA Flood Map for Planning



1.5. **Figure 3** shows the NaFRA Risk of Flooding from Rivers and Sea mapping.

Figure 3 – NaFRA Risk of Flooding from Rivers and Sea

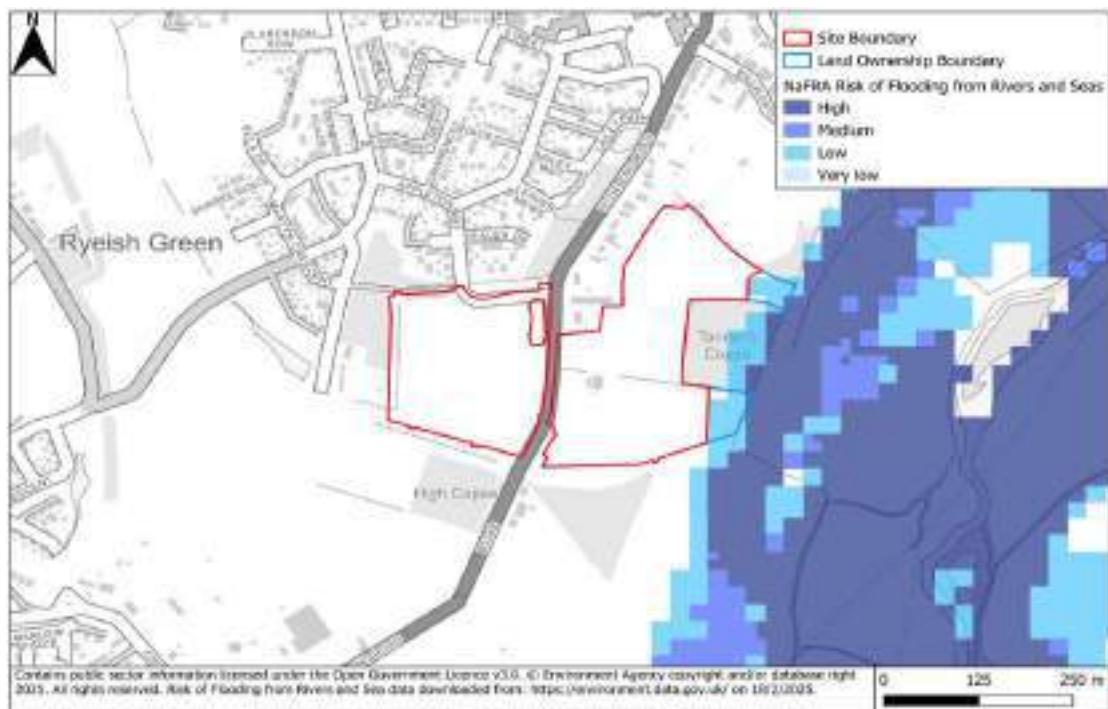
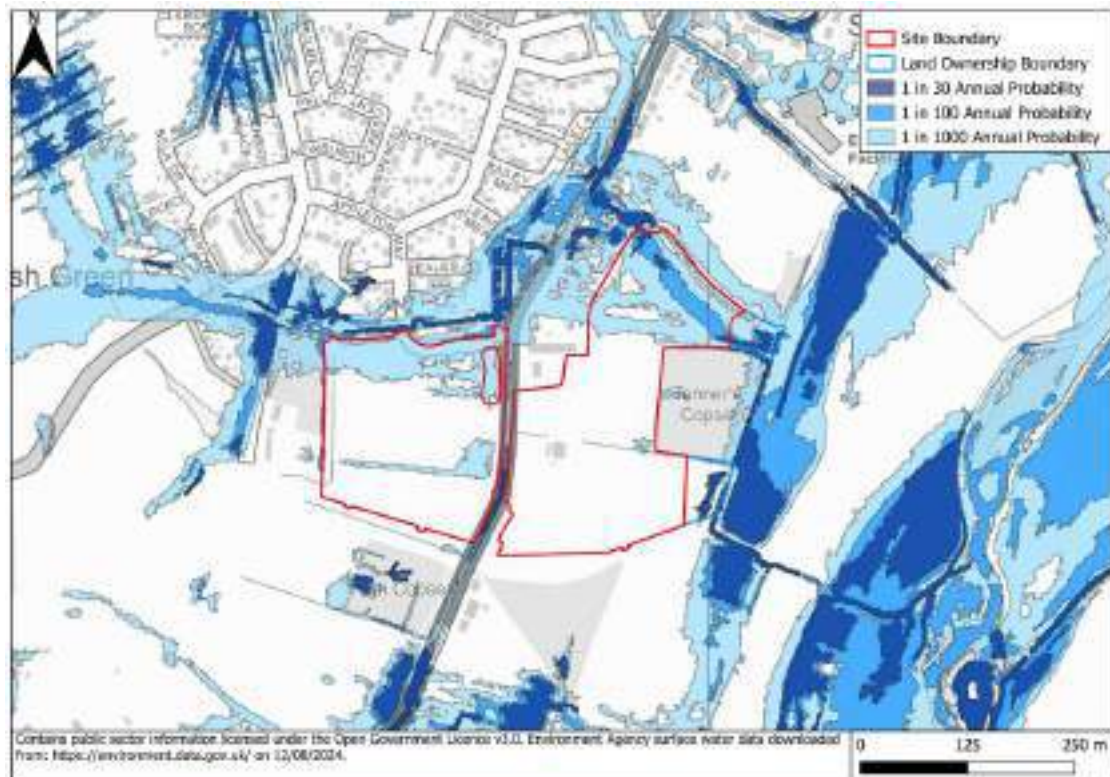


Figure 3 shows that the site is located outside of the extent of the River Loddon floodplain.

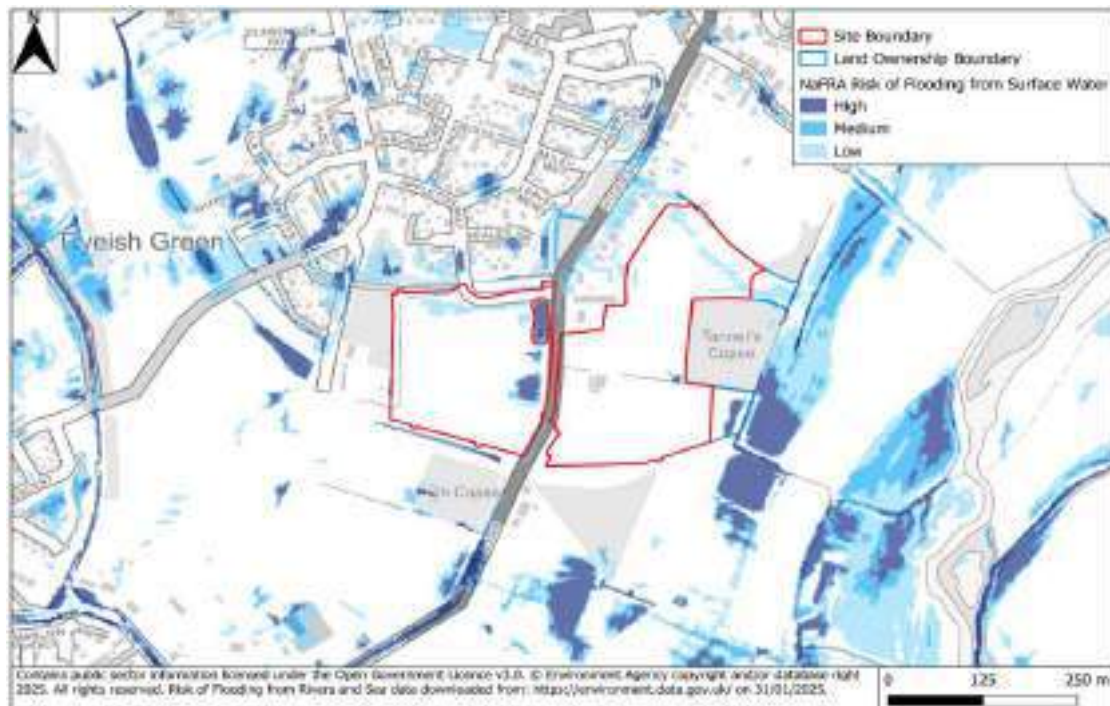
Figure 4 shows the EA Risk of Flooding from Surface Water mapping, sourced before January 2025. This dataset has now been superseded by the NaFRA Risk of Flooding from Surface Water dataset, as of January 2025. However, at the time of completing this study, the EA Risk of Flooding from Surface Water was the current data set, therefore it has been included for completeness and to give context to this study and how the understanding of surface water flooding has progressed.

Figure 4 – EA Risk of Flooding from Surface Water



- 1.6. **Figure 4** indicates that there is a flow route in the northern part of the eastern and western parcels. It also shows that there is an area of flooding in the central part of the western parcel.
- 1.7. The flow routes shown by the EA surface water mapping do not appear to consider the watercourses within the site, nor the impact of the adjacent development which was constructed recently. It is likely that the EA surface water flood extents were generated using LiDAR data flown prior to the recent development within the local area and the hydrological catchment.
- 1.8. It was considered likely that the EA flow route from the west would be intercepted by the western watercourse. The flow route in the northern part of the western parcel was thought to likely follow the location of the Appleton Way watercourse.
- 1.9. The flow route in the northern part of the eastern watercourse was considered likely to follow the northern watercourse.
- 1.10. **Figure 5** shows the NaFRA Risk of Flooding from Surface Water extent.

Figure 5 – NaFRA Risk of Flooding from Surface Water



- 1.11. **Figure 5** shows that there is a flow route along the northern part of the western parcel with a 'Low' risk of surface water flooding. There are a few areas of surface water ponding along the eastern boundary of the western parcel. These correspond with a drainage basin and low-lying ground. There is a flow route along the northern part of the eastern parcel.
- 1.12. As with the EA surface water mapping, the flow routes in the NaFRA surface water mapping do not appear to consider the watercourses within the site, nor the adjacent development. It is likely that the NaFRA surface water flood extents were generated using LiDAR data flown prior to the recent development within this area.
- 1.13. It was considered likely that the NaFRA flow route from the west would be captured by the western watercourse. The flow route in the northern part of the western parcel was thought to likely follow the location of the Appleton Way watercourse.
- 1.14. The flow route in the northern part of the eastern watercourse was considered likely to follow the northern watercourse.
- 1.15. The key aim of this modelling study is to refine the flood extents using site specific topographical data which considers the local features within the site and catchment in conjunction with local knowledge and site observations.

Scope

- 1.16. The scope of works includes the following:
 - Undertake a hydrological assessment to estimate the catchment to the site and generate rainfall hyetograph for the relevant return periods.



- Build a new direct rainfall model with defined channels for the catchment using the best available data to refine the baseline surface water flood extents.
- Run the model for the following return periods; 1 in 30, 1 in 100, 1 in 1,000 annual probability scenarios.
- To assess the impact of climate change, the 1 in 100 annual probability scenario has been modelled with the most recent climate change allowances for the Loddon and Tributaries Management Catchment. A +40% climate change allowance has been applied for the 1 in 100 annual probability scenario which represents the Upper End peak rainfall allowance for the Loddon and Tributaries Management Catchment.



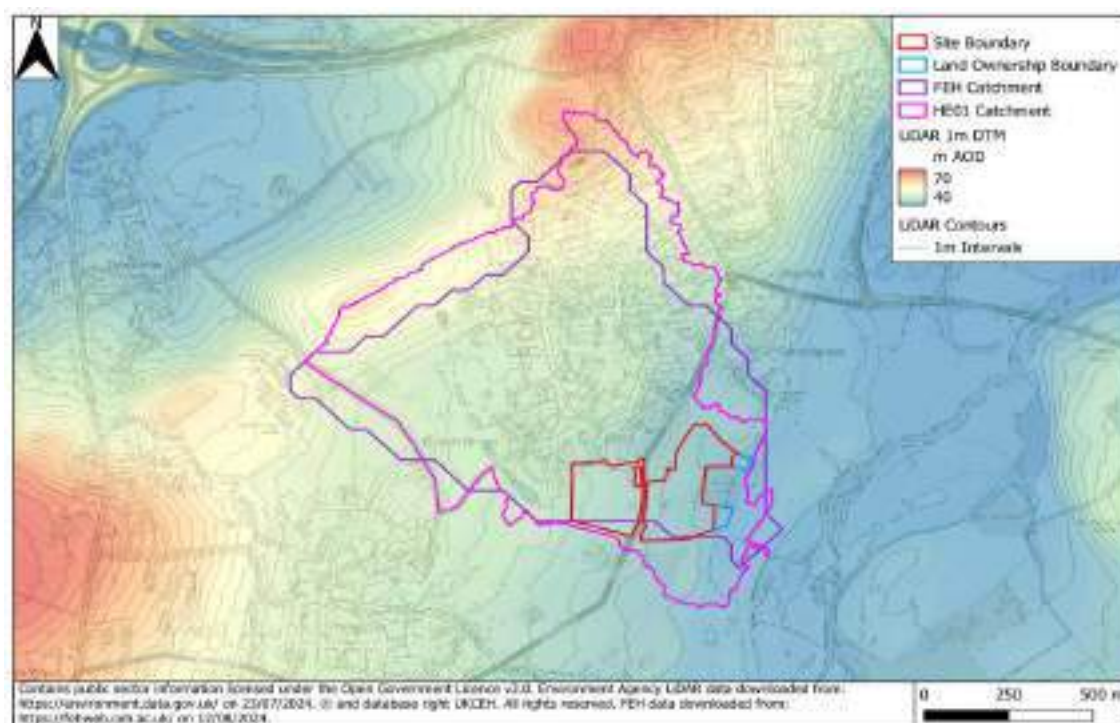
2.0 Hydrological Assessment

- 2.1. Full details for the hydrological assessment methodology and application can be found in the Abley Letchford Hydrological Assessment in **Appendix 1**. A summary of the hydrological assessment is included within this chapter.
- 2.2. The hydrological study derived peak flow estimates the peak flow at key locations. A lumped catchment was obtained from the Flood Estimation Handbook (FEH) webservice and updated where appropriate.
- 2.3. The study derived hyetographs for the following return periods; 1 in 30, 1 in 100 and 1 in 1000 annual probability. To assess the impact of climate change, the 1 in 100 annual probability scenario was modelled with the most recent climate change allowances for the Loddon and Tributaries Management Catchment which is 40%.
- 2.4. The hydrological analysis was completed using ReFH2 version 2.3.

Hydrological Inflow Boundaries

- 2.5. The catchment was downloaded from the FEH Webservice.
- 2.6. The FEH catchment was adjusted using OS mapping, LiDAR data and a review of the EA indicative watershed dataset to derive the HE01 catchment deemed to be most representative of the actual catchment. The FEH catchment area was 0.98km². The HE01 catchment has an area of 1.1km².
- 2.7. **Figure 6** shows the extent of the FEH catchment and HE01 catchment.

Figure 6 – FEH Catchment and Hyde End (HE01) Catchment Extents



Catchment Descriptors

- 2.8. A review of the FEH Webservice catchment descriptors was carried out. A summary of key catchment descriptors and updates and summarised in **Table 1**. Further details of the checks and updates made to the catchment descriptors are provided below the table.



Table 1 – Catchment Descriptors

Catchment Descriptor	FEH Catchment Descriptor	HE01 Catchment Descriptor
AREA	0.98	1.1
BFIHOST	0.477	0.477
BFIHOST19	0.542	0.542
DPLBAR	1.02	1.05
DPSBAR	11.3	11.3
FARL	1	1
FPEXT	0.223	0.223
LDP	1.69	1.69
PROPWET	0.29	0.29
SAAR	640	640
SPRHOST	34.74	34.74
URBEXT1990	0.0242	0.268
URBEXT2000	0.0774	0.268

Area

- 2.9. The FEH catchment area was adjusted for the HE01 catchment using OS mapping, LiDAR data and the EA watershed dataset. The FEH catchment area was 0.98km². The HE01 catchment area is 1.1km².

BFIHOST and BFIHOST19

- 2.10. BFIHOST base flow index is a measure of catchment responsiveness based on the Hydrology of Soil Types (HOST) classification. It indicates the relationship between soil types and the runoff response. Permeable soils and geology tend to yield a higher baseflow.
- 2.11. BFIHOST19 is an updated method of classifying BFIHOST which improves on the classification of rarer soil types.
- 2.12. The BFIHOST values were reviewed using the Cranfield Soils online viewer. The FEH values were deemed to be reasonable and were accepted.

SPRHOST

- 2.13. SPRHOST is the standard percentage runoff associated with each HOST soil class.
- 2.14. The FEH SPRHOST values were reviewed using the Cranfield Soils online viewer. The FEH values were deemed to be reasonable and were accepted.



PROPWET

- 2.15. PROPWET is a measure of the proportion of the time that the catchment soils are defined as wet. Wetter regions have higher PROPWET values. Drier regions have lower PROPWET values. The PROPWET value for the FEH catchment is 0.29. The value is considered to be representative of the region that the HE01 catchment is in.

FARL

- 2.16. FARL is a measure of the degree of flood attenuation provided by reservoirs and lakes within a catchment. A value of 1 represents the absence of lakes or reservoirs within the catchment. There are no lakes or reservoirs within the FEH catchment or the HE01 catchment. The FARL value of 1 is therefore considered to be representative for the HE01 catchment.

URBEXT and URBEXT2000

- 2.17. URBEXT and URBEXT2000 is an index of the concentration of urban and suburban areas in 1990 and 2000 respectively expressed as a fraction.
- 2.18. OS mapping and aerial photography was reviewed for the HE01 catchment and the URBEXT2000 value adjusted to reflect the suburban areas within the HE01 catchment. The URBEXT2000 value was updated using the FEH Volume 5 Equation 6.2.
- 2.19. The URBEXT2000 value was adjusted to 0.268 to reflect the recent residential development within the catchment.

SAAR

- 2.20. SAAR is a measure of the average annual rainfall between 1961 and 1990 in millimetres. The FEH catchment is adjacent to the HE01 catchment therefore both catchments will have received similar average rainfall. The SAAR value for the FEH catchment appears reasonable therefore it has been accepted for use for the TF01 catchment.

DPSBAR

- 2.21. DPSBAR is an index for the overall catchment steepness. A value of greater than 300 represents mountainous regions. A value of less than 25 represents flatter regions. The DPSBAR value for the FEH catchment is 11.3. The FEH catchment and HE01 catchment are both relatively flat therefore the DPSBAR for the sites is considered representative.

ReFH2 Method

- 2.22. The ReFH2 method was used to derive hyetographs for the HE01 catchment. The ReFH2 method uses the FEH Webservice catchment descriptors to generate the design hyetographs for the return periods.



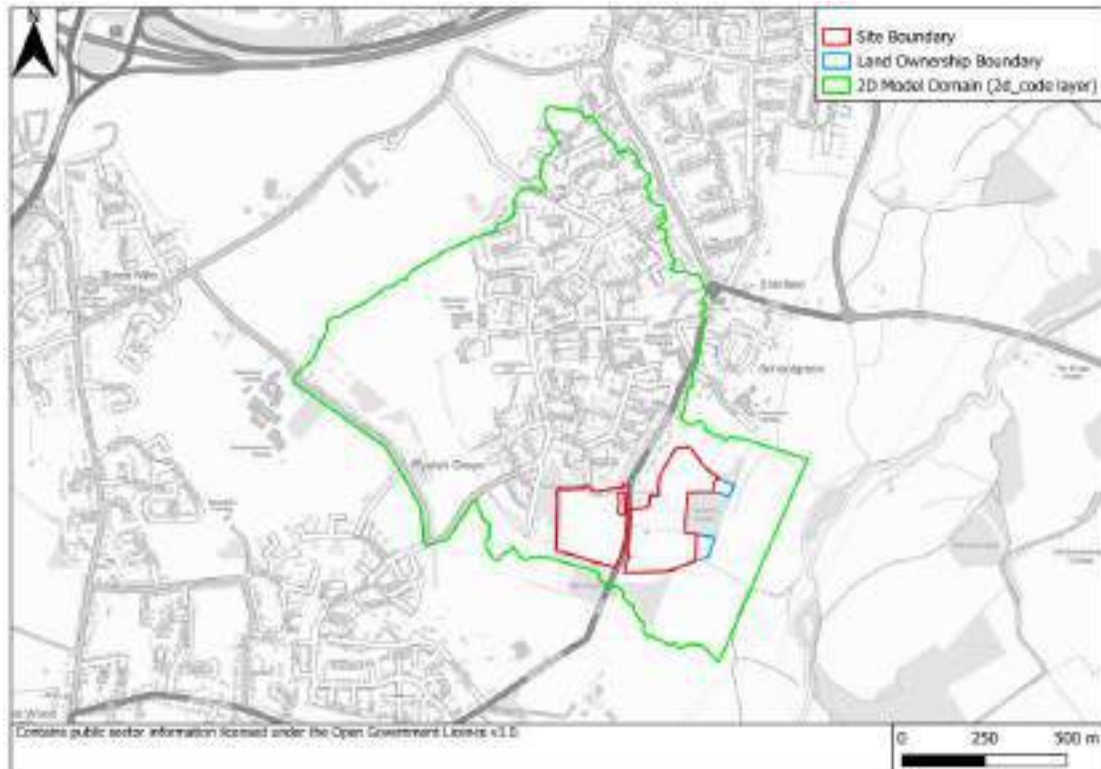
Storm Duration

- 2.23. The default ReFH2 rainfall parameters were applied. This approach is an industry standard approach. Rainfall parameters are not typically adjusted unless there is a specific reason to do so. These gave a storm duration of 6.5 hours and a timestep of 0.5 hours.
- 2.24. The ReFH2 Seasonal Correction Factor (SCF) of 0.98 was used. This was the ReFH2 default value. This approach is industry standard. Parameters are not typically adjusted unless there is a specific reason to do so.
- 2.25. The ReFH2 Areas Reduction Factor (ARF) of 0.68 was used. This was the ReFH2 default value. This approach is industry standard. Parameters are not typically adjusted unless there is a specific reason to do so.

Rainfall Estimates

- 2.26. The winter seasonality was selected. This is the appropriate storm profile for rural catchments in England, according to the ReFH2 guidance.
- 2.27. The site is located in the Loddon and Tributaries Management Catchment. The relevant climate change allowance is +40% which is the upper end allowance.

Figure 8 – 2D Model Extent



Input Data

- 3.8. The latest available software and data has been used in the hydraulic model. The data is summarised below.

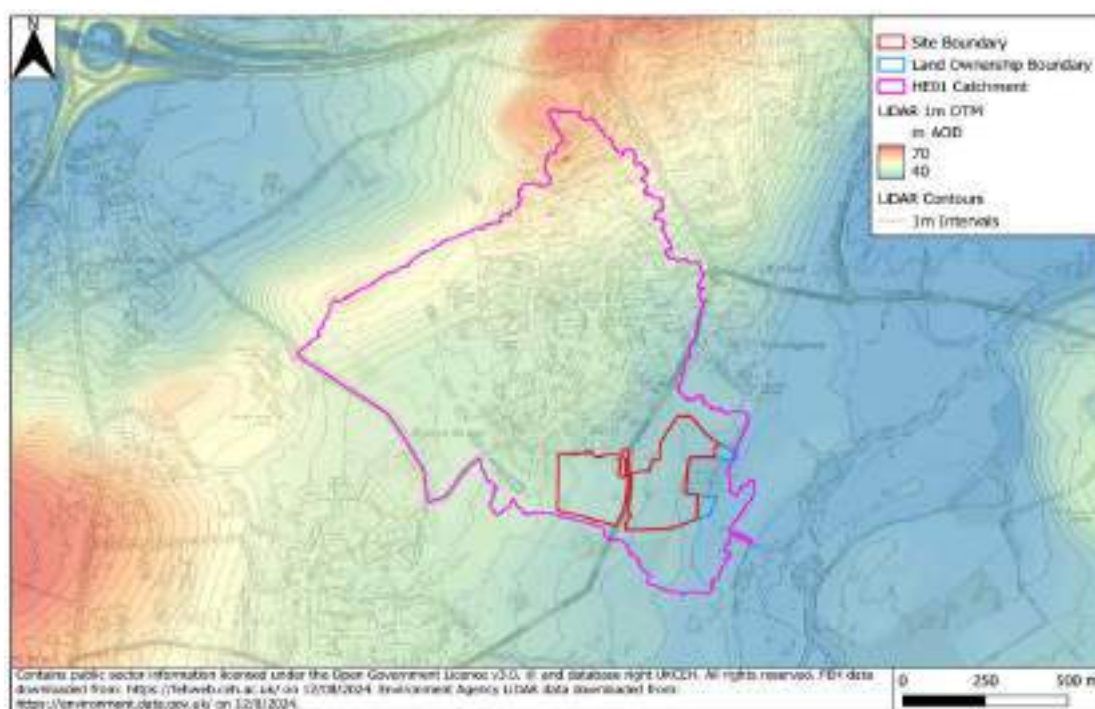
Hydraulic Software and Data

- 3.9. TUFLOW version 2023-03-AD-iDP-w64 were used. These are the latest versions of the software.
- 3.10. The hydrological inflows were updated using ReFH2 version 2.3. This is the latest versions of the software. LiDAR Data

LiDAR Data

- 3.11. 1m DTM LiDAR flown in 2007 and 2010 was used. This is the best available data at the finest available resolution. The LiDAR data was downloaded from the Defra open-source data service platform on 12th August 2024. **Figure 9** shows the extent of the LiDAR available for the site.

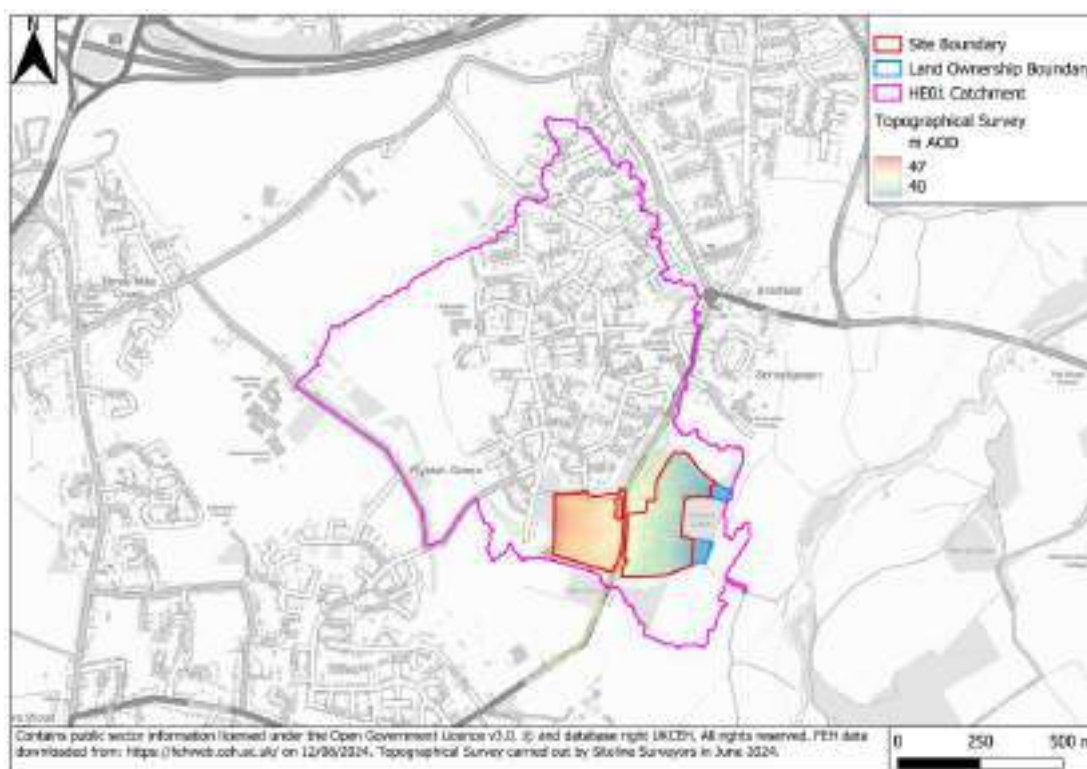
Figure 9 – EA LiDAR Coverage



Ground Model Data

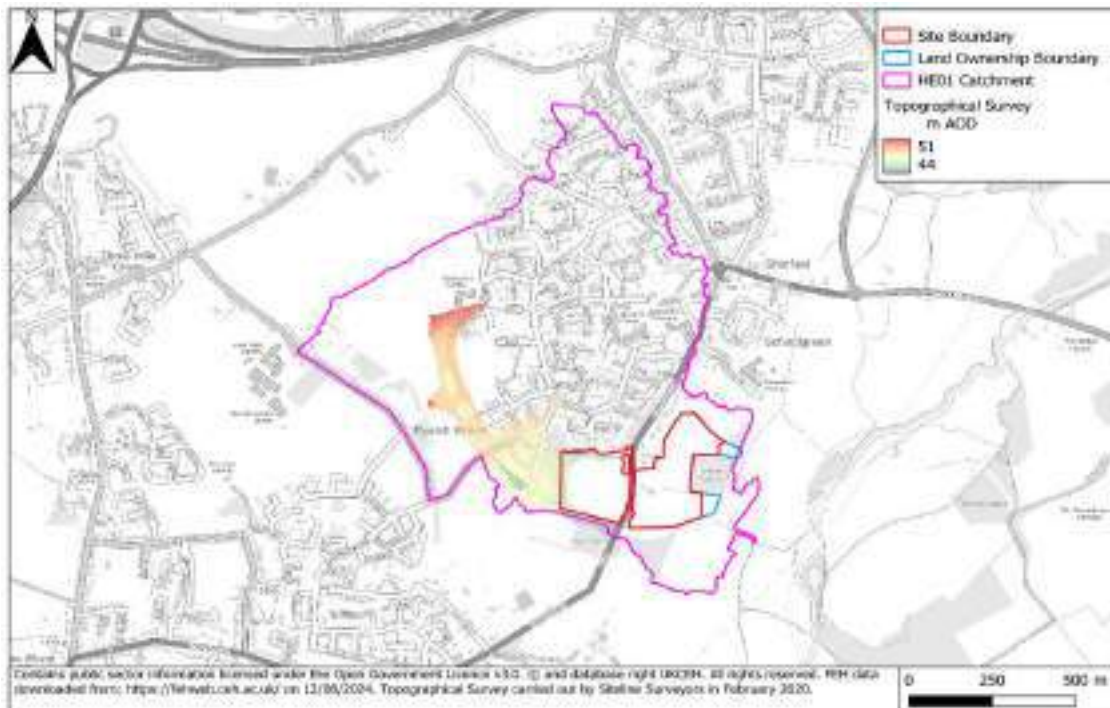
- 3.12. A topographic survey of the site was carried out by Sitrine Geospatial surveyors in June 2024. The extent of the topographic survey is shown in **Figure 10**. A copy of the full topographic survey is appended in **Appendix 3**.

Figure 10 – Topographical Survey of the Site



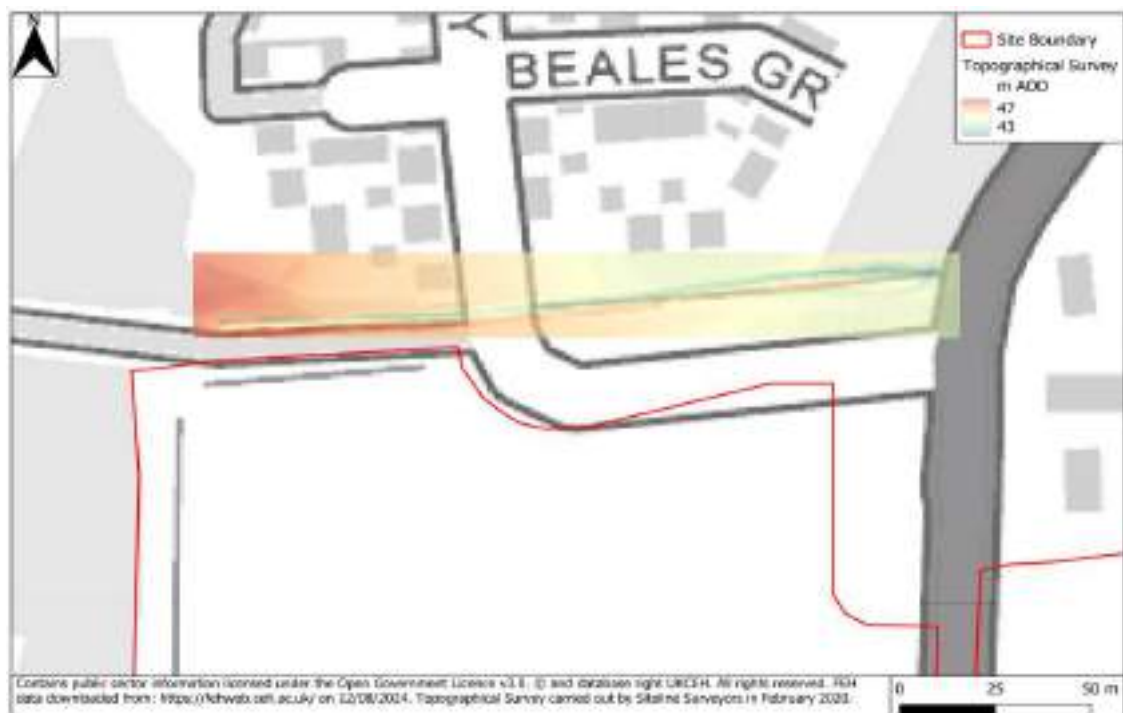
- 3.13. A topographical survey was carried of the adjacent site by Siteline Surveyors in February 2020. The extent of the topographic survey is shown in **Figure 11**. A copy of the full topographic survey is appended in **Appendix 3**.

Figure 11 – Topographical Survey of the Adjacent Site



- 3.14. A topographical survey which included the Appleton Way watercourse was carried out in May 2015. An extract of the topographical survey that was included in the model is shown in **Figure 12**.

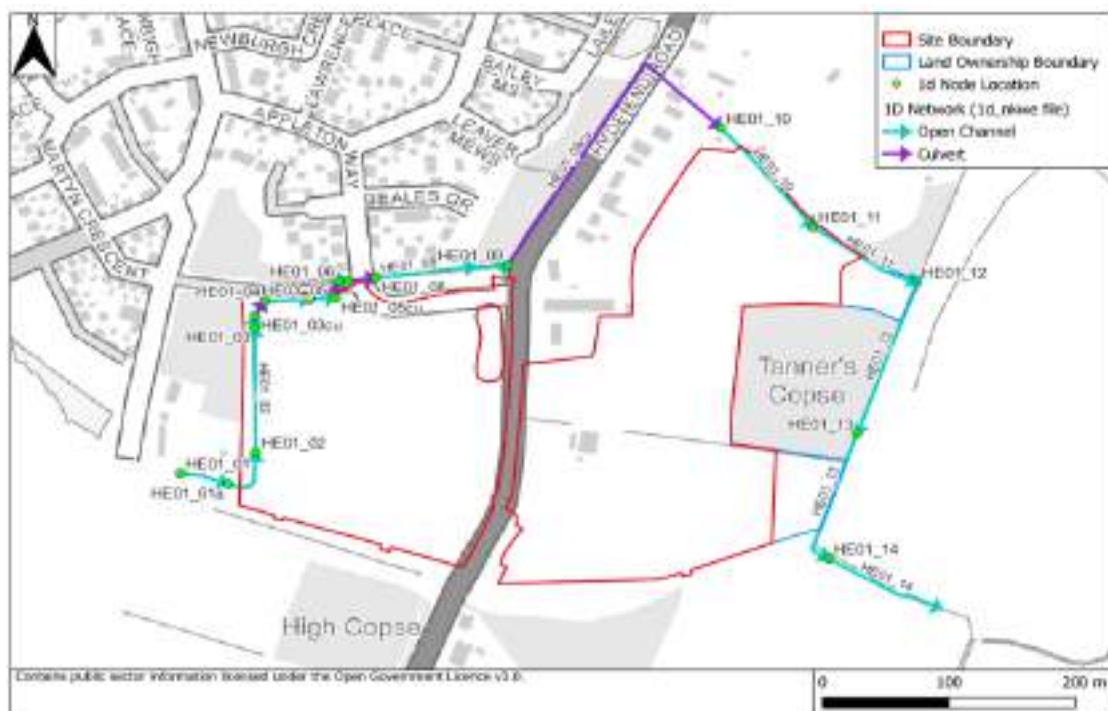
Figure 12 – Topographical Survey of Appleton Way Watercourse



1D Model Domain

- 3.15. The channel sections in the 1D model domain were 'cut' from the topographical surveys and LiDAR data. There are 14 open channel sections and 4 culverts in the model.
- 3.16. **Figure 13** shows the location of the 1D channel sections.

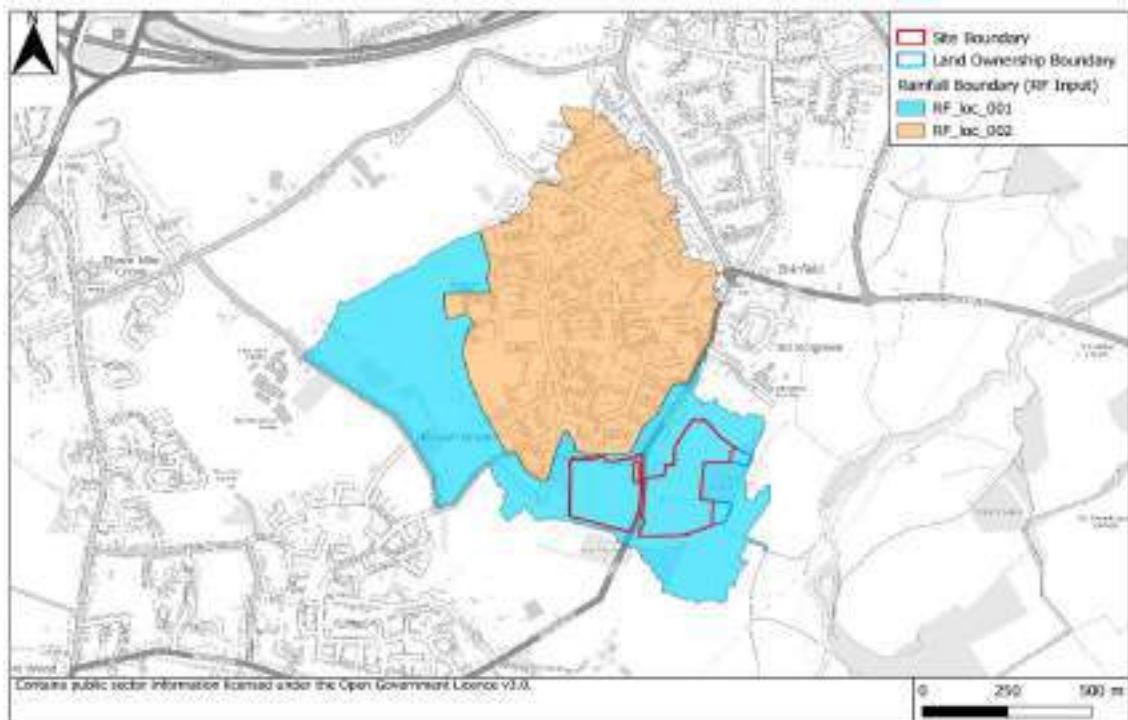
Figure 13 – 1D Channel Section Location



Inflow Boundaries

- 3.17. The net rainfall was added to the model using a 2d_RF boundary across the HE01 catchment. The RF represents the net rainfall.
- 3.18. **Figure 14** shows the extent of the rainfall input.

Figure 14 – Rainfall Input Location



- 3.19. The catchment was split into two rainfall polygons, RF_loc_001 and RF_loc_002. RF_loc_001 represents the rural part of the catchment where 100% of the rainfall becomes surface water runoff. RF_loc_002 represents the urban part of the catchment where 35% of the rainfall which lands within the area becomes surface water runoff. The remaining 65% is accounted for within the development's surface water drainage strategy.
- 3.20. The adjacent sites have already been developed and incorporate surface water drainage strategies which attenuate runoff and discharge at a controlled rate into the watercourses within the catchment. The development in the northeastern part of the catchment has 65% of the rainfall which lands on it accommodated by the surface water drainage strategy. The development to the west of the site discharges, at a restricted rate, into the western watercourse.
- 3.21. The flow rates into these watercourses are unknown. As a conservative approach the full pipe flow of the culverts outfalling into the watercourses has been considered.
- 3.22. **Figure 15** shows the location of these three inflow pipes. **Table 2** shows the calculated full pipe flow.

Figure 15 – Pipe Inflow Locations

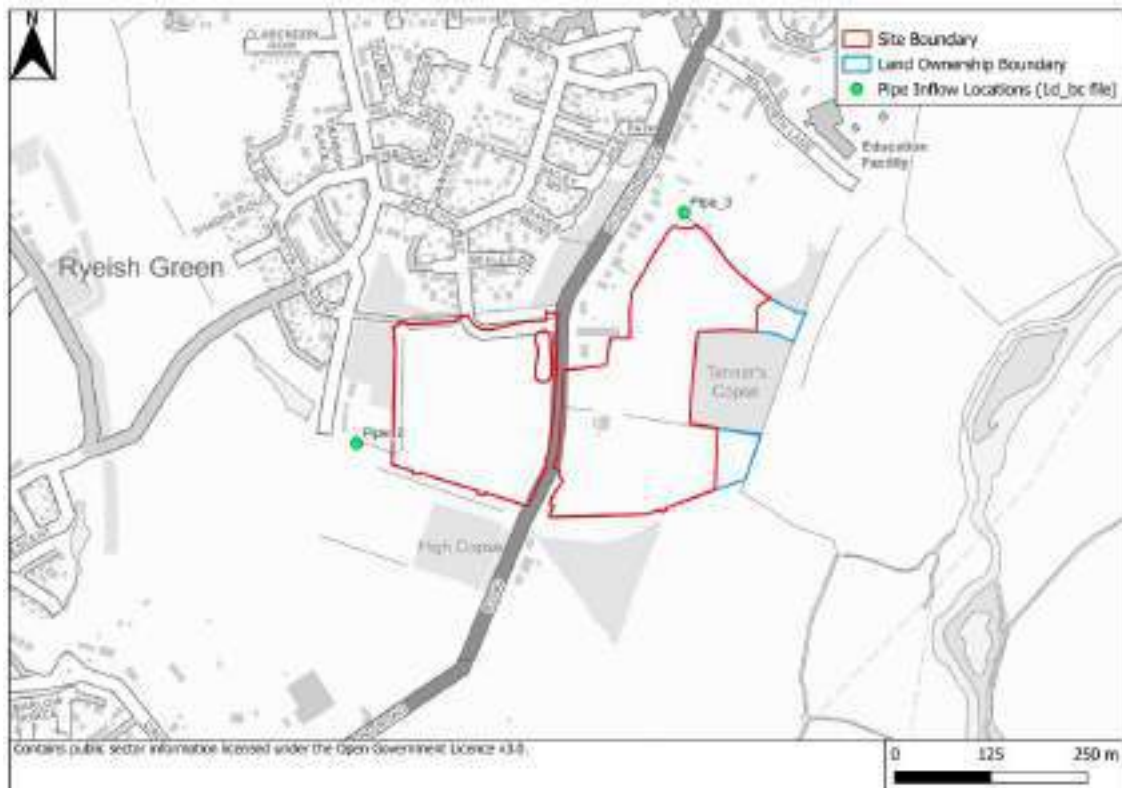


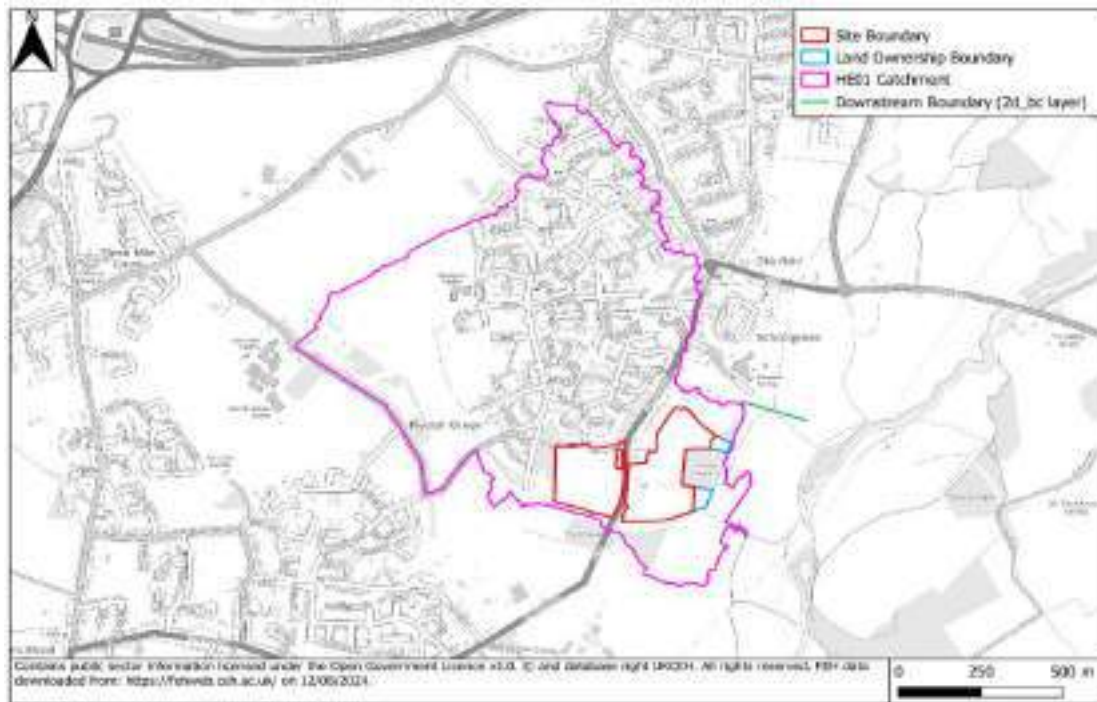
Table 2 – Pipe Inflow Flows

Pipe Name	Pipe Full Flow, m ³ /s
Pipe_2	0.31
Pipe_3	0.19

Downstream Boundary

- 3.23. The downstream boundary of the model has been set approximately 140m to the east of the site. A 2d_bc boundary was used to allow flow to exit the downstream boundary of the model domain and prevent any glass walling along the boundary.
- 3.24. A second downstream boundary was used in the northeastern corner of the model to allow flow to exit the model. The downstream part of the model is dominated by the River Loddon flooding. The downstream flood level is dictated by the River Loddon flood level.
- 3.25. **Figure 16** shows the location of the downstream boundary within the model.

Figure 16 – Downstream Boundary of the Model Domain



Roughness

- 3.26. The hydraulic roughness can impact the conveyance of flood within the floodplain.
- 3.27. Polygons were downloaded from eMapSite to inform the land use types. eMapSite uses OS mapping to classify the land use types.
- 3.28. Manning's 'n' roughness values were assigned to the land use types within the model domain using Chow 1959 industry standard guidance, satellite imagery of the site, photographs from a site walkover and professional judgement.
- 3.29. Roughness values were applied using 2d_mt files within the .tmf file. **Figure 17** shows the location of each material layers.

Figure 17 – Materials Layers



3.30. **Table 3** summarises the land use types, and roughness values selected.

Table 3 – Summary of Manning's 'n' Roughness Values

ID	Description	Manning's 'n' Roughness Value
1	General Surface/ Grass	0.06
2	Roads and Pavements	0.022
3	Buildings	1
4	Waterbodies	0.03
5	Natural Environment	0.10

3.31. A high Manning's 'n' value of 1 was used to represent the building locations within the model and direct flow around the buildings.

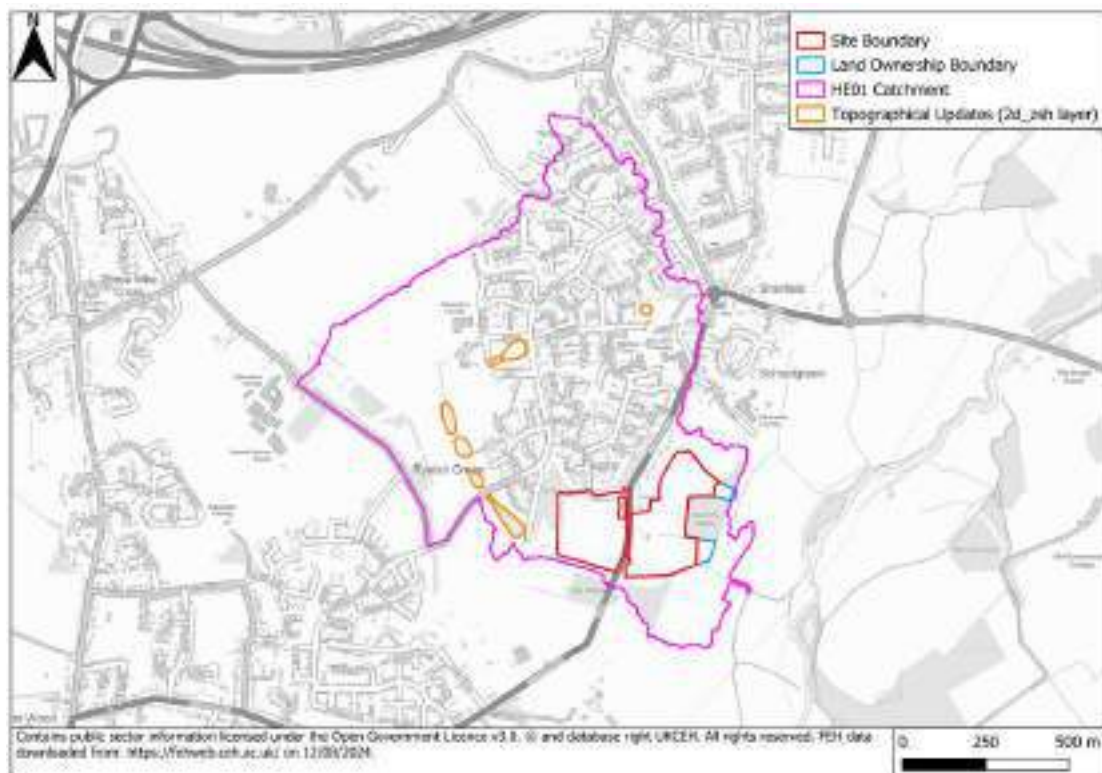
Topographical Changes

3.32. LiDAR and topographical survey data was used to inform the topography of the model, as discussed in paragraphs 3.10 to 3.13.

Western Basins

- 3.33. The western basins were removed from the topographical survey using a zsh polygon. As a conservative approach, it has been assumed that the drainage basins will be completely full in the event of a flood event. The western basins were smoothed over to prevent surface water from ponding within them.
- 3.34. **Figure 18** shows the location of these areas.
- 3.35. There were a couple of areas of inconsistent ground elevations within the LiDAR. These areas were reviewed using OS mapping and satellite imagery. Where necessary, these areas were smoothed using a zsh polygon.
- 3.36. **Figure 18** shows the location of these areas.

Figure 18 – Topographical Updates



Western Ditch

- 3.37. Bank levels along the western corner of the ditch were updated to 46.4m AOD, tying in with the upstream bank levels. The bed level of the ditch in this corner was raised during construction causing water to spill out. Works will be undertaken to correct the bed levels in this ditch to prevent any flooding.
- 3.38. **Figure 19** shows the location and bank levels along this reach.

Figure 1 is a map of the study area showing the proposed drainage system. The map includes a site boundary, a channel, a culvert, and various data points labeled with codes like 'td_mwke_HE01_07_L' and '2d_bc_hsi_HE01_07_L'. A scale bar indicates 0 to 20 meters.

3.39. No structures have been included within the 2D domain.

3.40. The 1D in-channel and 2D floodplain components of the model are connected along the tops of the banks using HX lines.

3.41. Topographical survey data was used to inform the bank level representation.

3.42. **Table 4** summarises the layers used within the model domain.



Table 4 – 2D Model Layers

Layer	Purpose
1d_nwke_HE01	Defines the location of the 1d channel and structures.
1d_xs_HE01	Defines the 1d channel geometry.
1d_bc_HE01_inflows	Defines the 1d model inflows.
1d_WLL_HE01	WLL interpolate the 1d water levels across the 1d domain.
2d_code_TF01	Defines the 2d model extent.
2d_code_river_TF01	Defines the 1d model extent.
2d_bc_TF01	Defines the floodplain boundary.
2d_bc_hxi_HE01	Defines the link between the 1d and 2d model domains.
2d_rf_TF01	Applies a rainfall hyetograph to the defined polygon.
2d_zsh_TF01_P	Points defining levels along the zsh line which informs the bank levels.
2d_zsh_TF01_L	Line informing the bank location. The levels are taking from the zsh points layer.
2d_zsh_TF01_R	Polygon to interpolate ground levels.
2d_loc_TF01	Defines the model orientation.
2d_mat_TF01_buildings	Defines the 2d roughness area for buildings.
2d_mat_TF01_general_surface	Defines the 2d roughness area for the general surface (grass).
2d_mat_TF01_natural environment	Defines the 2d roughness area for the natural environment (woodlands).
2d_mat_TF01_roads	Defines the 2d roughness area for roads and paths.
2d_mat_TF01_waterbody	Defines the 2d roughness area for waterbodies.

Model Runs

- 3.43. The model was run for 15 hours with a fixed 1D timestep of 0.2 seconds and a fixed 2D timestep of 0.4 seconds.
- 3.44. The model was run for the following return periods:
- 1 in 30 annual probability;
 - 1 in 100 annual probability;
 - 1 in 1,000 annual probability; and
 - 1 in 100 annual probability +40% climate change allowance.
- 3.45. The site is located within the Loddon and Tributaries Management Catchment. The relevant climate change allowance is the upper end allowance which is +40% for this management catchment.

4.0 Sensitivity Testing

- 4.1. Sensitivity testing has been undertaken to assess the impact of uncertainty within the model and assumptions made.

Manning's 'n' Roughness

- 4.2. A 20% increase and decrease in the Manning's 'n' roughness estimations was modelled.
- 4.3. **Figure 20** and **Figure 21** shows the difference in the maximum flood extents for a $\pm 20\%$ increase and decrease in the Manning's 'n' roughness values.

**Figure 20 – 1 in 100 Annual Probability Manning's Roughness Sensitivity
20% Increase**

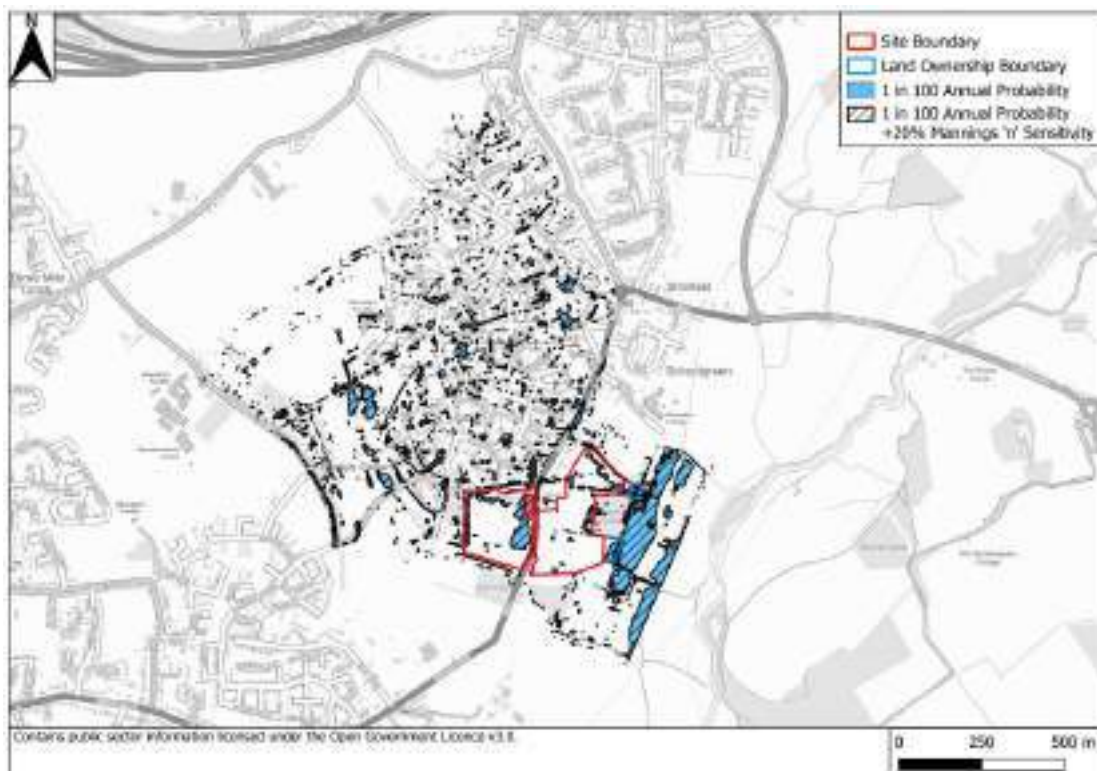
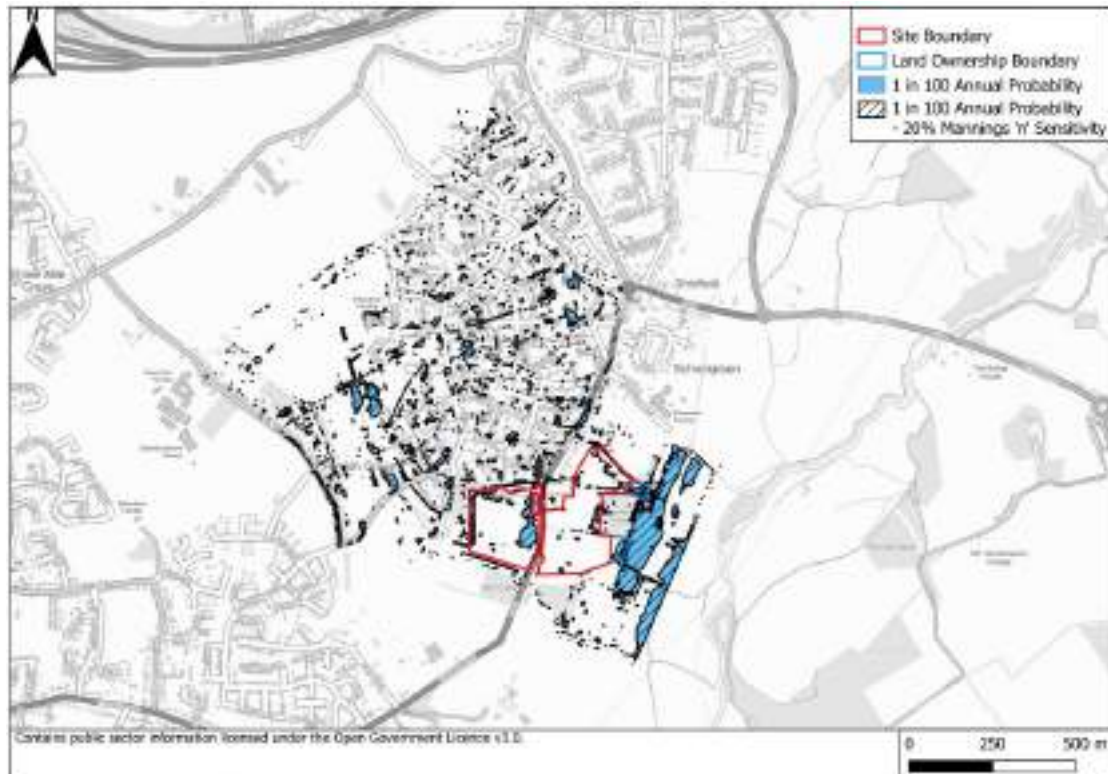


**Figure 21 – 1 in 100 Annual Probability Manning’s Roughness Sensitivity
20% Decrease**



- 4.4. **Figure 20** shows that there is a slight increase in the modelled flood extents for the scenario with a 20% increase in the Manning’s ‘n’ roughness. This is as expected. However, the model is deemed to be insensitive to a 20% increase in the Manning’s ‘n’ roughness values.
- 4.5. **Figure 21** shows that there is a slight decrease in the modelled flood extents for the scenario with a 20% decrease in the Manning’s ‘n’ roughness. This is as expected. However, the model is deemed to be insensitive to a 20% decrease in the Manning’s ‘n’ roughness values.

Rainfall

- 4.6. A 20% increase and decrease in rainfall was applied to the model.
- 4.7. **Figures 22 and 23** shows the difference in the maximum flood extents for a $\pm 20\%$ increase and decrease in the Manning’s ‘n’ roughness values.

Figure 22 – 1 in 100 Annual Probability 20% Increase in Rainfall

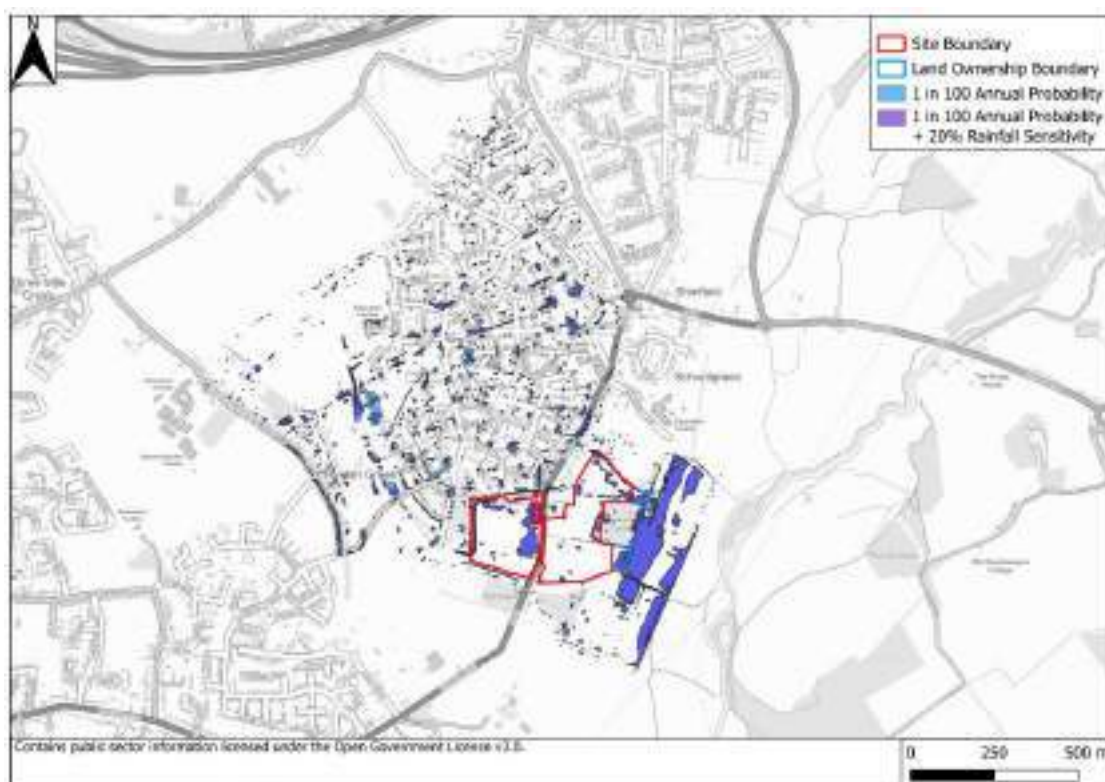
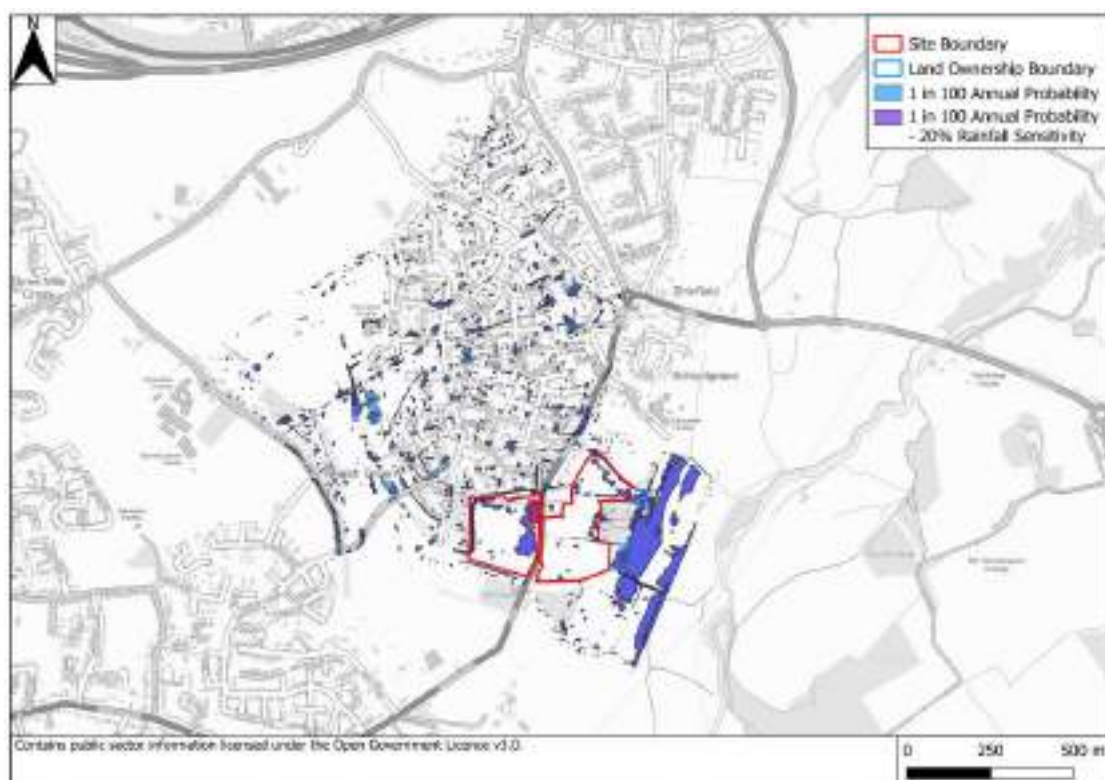


Figure 23 – 1 in 100 Annual Probability 20% Decrease in Rainfall

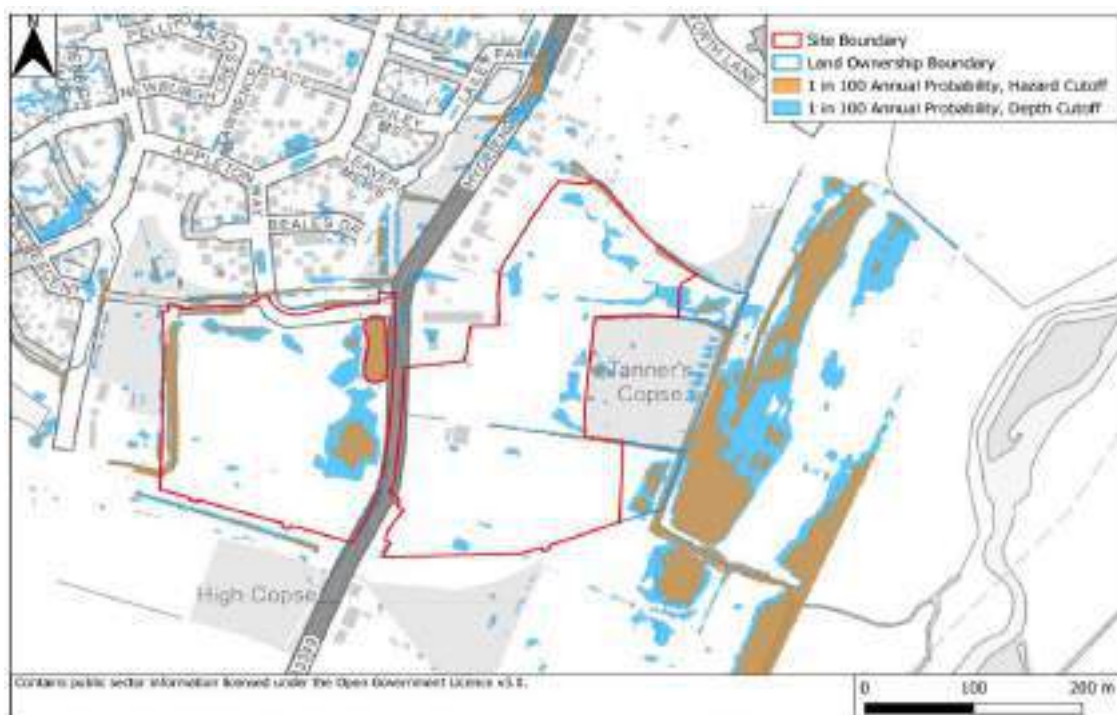


- 4.8. **Figure 22** shows that there is a slight increase in the modelled flood extents with a 20% increase in rainfall. This is as expected. However, the model is not deemed to be highly sensitive to flow.
- 4.9. **Figure 23** shows that there is a slight decrease in the modelled flood extents with a 20% decrease in rainfall. This is as expected. However, the model is not deemed to be highly sensitive to flow.

Results Filtering

- 4.10. **Figure 24** shows the 1 in 100 annual probability modelled extents using a 0.05m cutoff depth, and a 0.575 hazard rating cutoff.

Figure 24 – 1 in 100 Annual Probability Comparison Between Depth and Hazard Cutoffs



- 4.11. The filtering of results was carried out due to the nature of direct rainfall models. The entire 2D model domain is shown to be wet in the raw model results (as rain falls across the whole model domain). The raw model results are filtered which removes all cells with flood depths below a certain depth to show areas of flooding and remove areas that are wet due to the direct rainfall modelling method. In direct rainfall modelling, the threshold depth is generally accepted as 0.05m. This approach leads to some isolated areas of ponding.



5.0 Model Results

Flood Extents

Overview

5.1. The model was run and the results were extracted for the following events:

- 1 in 30 annual probability;
- 1 in 100 annual probability;
- 1 in 1,000 annual probability; and
- 1 in 100 annual probability plus 40% climate change allowance.

Summary of the Model Outputs

5.2. The model is a direct rainfall model. Due to the nature of direct rainfall models, the entire 2D model domain is shown to be wet in the raw model results (as rain falls across the whole model domain). The raw model results are filtered which removes all cells with flood depths below a certain depth to show areas of flooding and remove areas that are wet due to the direct rainfall modelling method. In direct rainfall modelling, the threshold depth is generally accepted as 0.05m. This approach leads to some isolated areas of ponding.

Flood Extents and Depths

5.3. The maximum modelled flood extents for all modelled return periods are included in **Figure 25** and **Figure 26**.

5.4. The EA raw model results are filtered using the hazard rating.

5.5. The hazard rating is defined in the TUFLOW manual as:

$$\text{Hazard} = \text{Depth (Velocity} + 0.5) + \text{Debris Factor}$$

5.6. The EA use a hazard rating of 0.575 as the cutoff for mapping purposes (not the depth of 0.05m which is generally applied in direct rainfall modelling) as defined in the 'What is the Risk of Flooding from Surface Water' map guidance (dated April 2019). Therefore, to allow a direct comparison, **Figure 25** to **Figure 26** show the Abley Letchford results filtered using a hazard rating of 0.575.

Figure 25 – Abley Letchford Baseline Flood Extents

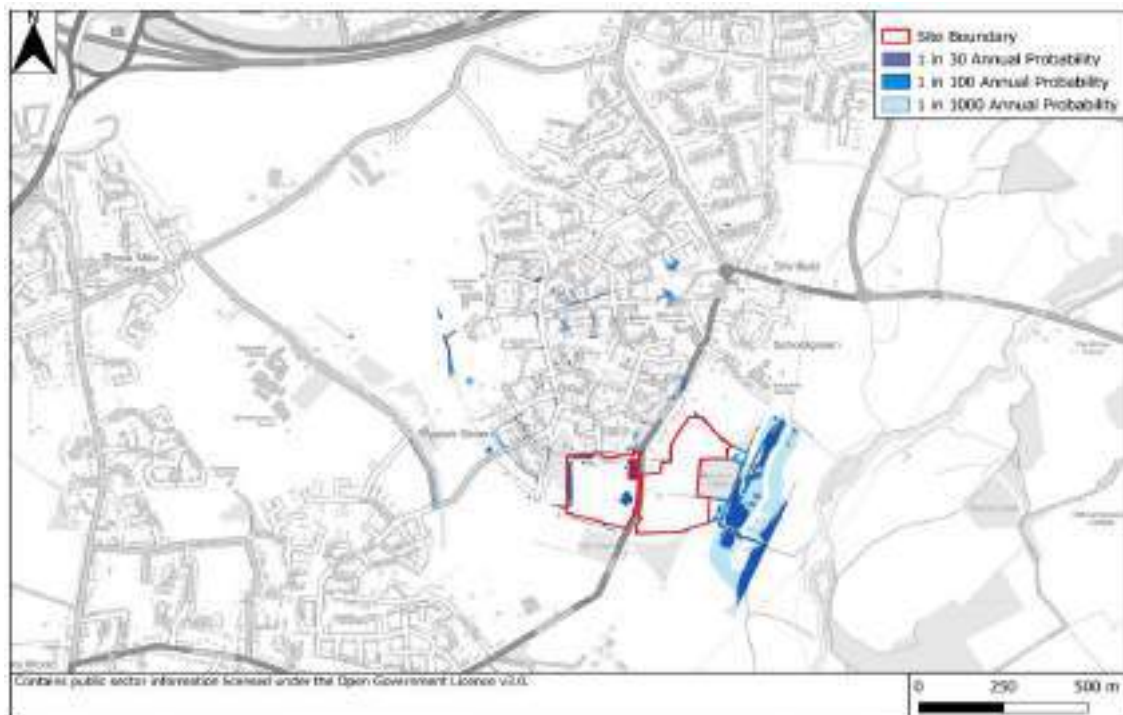
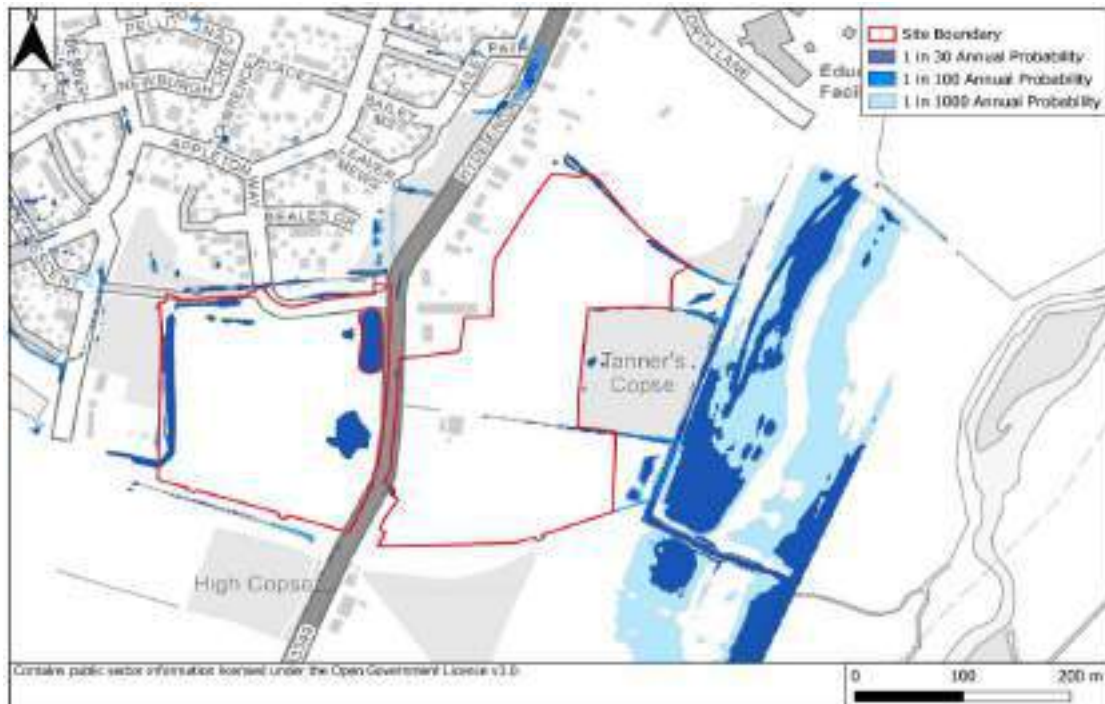
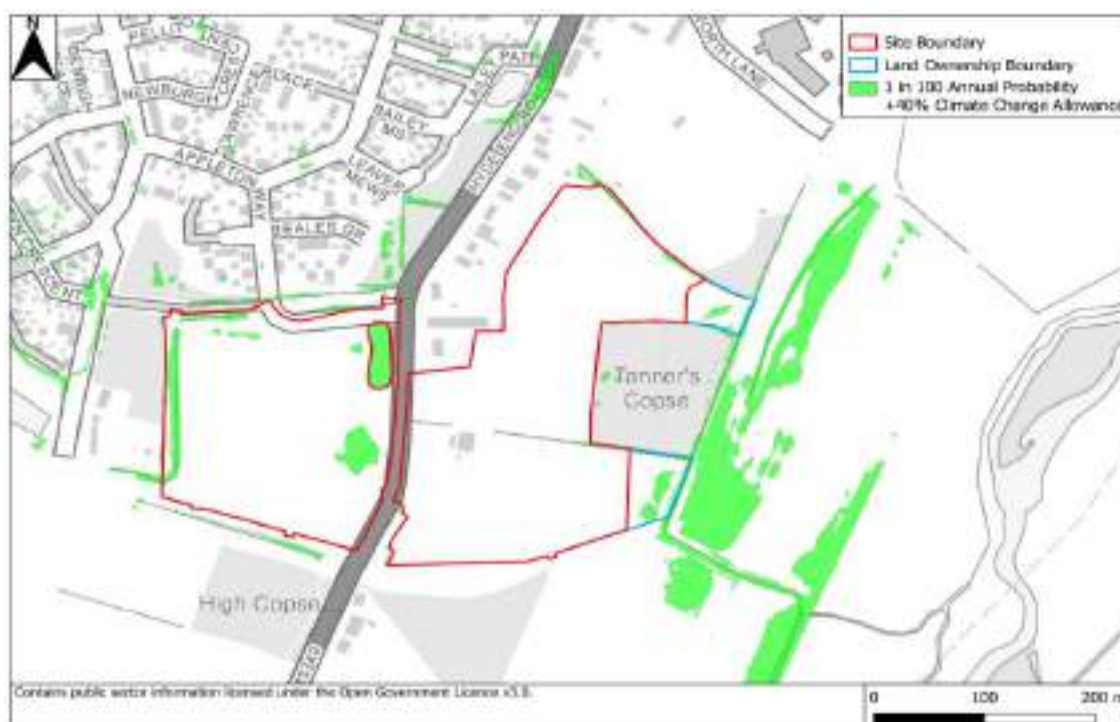


Figure 26 – Abley Letchford Baseline Flood Extents, Site



- 5.7. The model results show that the surface water flow route shown on the EA and NaFRA Risk of Flooding from Surface Water mapping along the northern boundary of the site is not representative of actual site conditions. This is likely due to the surface water drainage system in place in the adjacent development and the impact of including the associated watercourses in detail.
- 5.8. There is a more significant area of flooding in the eastern part of the western parcel. This is associated with a low point within the site, and a pond. Surface water flows unimpeded across the site in an easterly direction to this area. However, the footpath and carriageway at Hyde End Road are higher than the site and therefore prevent overland flow to the east away from the western parcel.
- 5.9. A review of the topographical survey of the central watercourse indicates that it is poorly picked up in this location, likely due to the heavy vegetation.
- 5.10. The River Loddon dominates the downstream conditions of the model. The model uses the River Loddon levels as the downstream boundary. As expected, the flood extents downstream of the site closely match the River Loddon modelled flood extent.
- 5.11. **Figure 27** shows the modelled flood extents for the 1 in 100 annual probability +40% climate change allowance scenario.

Figure 27 – Abley Letchford Climate Change Flood Extents



- 5.12. The 1 in 100 annual probability +40% climate change allowance scenario shows a similar pattern of flooding to the baseline model scenarios.

Message Layers

- 5.13. No negative depth layers are present for all model runs. The model is therefore considered to be healthy and stable.
- 5.14. Model warning and check files were reviewed. All messages were checked and are as expected.

1D Model Run Performance

- 5.15. The 1D and 2D mass balance errors for all of the modelled events are summarised in **Table 5**.

Table 5 – 1D and 2D Mass Balance Error Summary

Return Period	1D Mass Balance
1 in 30 Annual Probability	-0.5%
1 in 100 Annual Probability	-0.5%
1 in 1000 Annual Probability	-0.5%

- 5.16. The 1D mass balance is within the acceptable range of $\pm 1\%$. It was noted that after the first hour of the model simulation, the 1D mass balance decreased to within $\pm 0.1\%$.



- 5.17. Warnings and checks prior and during the simulation are saved within the TUFLOW '.tlf'. These messages were reviewed for each model run. The locations of the model warning and check files were reviewed, and they were considered to be insignificant.

TUFLOW Model Run Performance

- 5.18. The model is set up to run for the full range of events required. **Table 6** provides a summary of the 2D domain performance parameters.

Table 6 – Model Run Parameters

Model Parameter	Value
Start time (hours)	0
End time (hours)	15
Model run time (hours)	13
Volume error	~9%
Mass balance error	~9%

- 5.19. **Table 6** shows that the mass error for the 1 in 100 annual probability for the 2D domain. This is above the $\pm 2\%$ error which is generally considered to be the acceptable limit. The reason for the higher mass and volume errors was investigated and is attributed to the high downstream boundary, set at the River Loddon peak level. A higher mass and volume error would be expected in this instance as water backs up at the downstream boundary.
- 5.20. All of the modelled simulations were run for the full 15 hours. The model runs were run beyond the peak of the event. Therefore, the maximum flood extents from the model are representative of the peaks for each modelled scenario.



Limitations and Assumptions

5.21. Key limitations and assumptions of the study are listed below:

- The FEH catchment descriptors are representative of the catchment.
- The LiDAR data is representative of the elevations across the catchment (for this study a sense check was undertaken but not a detailed review).
- The topographical survey of the elevations across the site are representative (for this study a sense check was undertaken but not a detailed review).
- The materials data is representative of the roughness of the catchment (for this study a sense check was undertaken but not a detailed review).
- A 2m grid size was used to represent the floodplain. This grid size is considered to be appropriate for the rural location and proposed development. The grid size provides a reasonable balance between the model resolution and the model run time.
- As with all hydraulic modelling, there remains some residual uncertainty within the model results. However, we have tried to mitigate this through the sensitivity testing.



6.0 Conclusions

- 6.1. This modelling report has been prepared by Abley Letchford, on behalf of Bloor Homes (Southern) and the University of Reading to refine the surface water extents for the land to the east and west of Hyde End Road in Shinfield, Berkshire.
- 6.2. The model was run for the following return periods: 1 in 30, 1 in 100, and 1 in 1000 annual probability. The maximum flood levels and extents were extracted for all of the modelled return periods. The results are presented in **Appendix 3**.
- 6.3. The site is located within the Loddon and Tributaries Management Catchment. The latest (July 2021) climate change allowances for the catchment is +40% for the upper end allowance which is to be used to inform FRA studies. The maximum flood levels and extents were extracted for all the modelled climate change scenario. The results are presented in **Appendix 3**.
- 6.4. A hydrological assessment was undertaken to provide net rainfall inflows for the site. The FEH catchment descriptors were reviewed and refined using a desk-based assessment. ReFH2 software was used for the hydrological assessment.
- 6.5. Sensitivity testing was carried out to determine the impact of uncertainty and assumptions made within the modelling. Sensitivity tests were carried out for Manning's 'n' roughness values, and flow. Sensitivity results showed that the model was not sensitive to a $\pm 20\%$ increase or decrease in the Manning's 'n' roughness values. The sensitivity results showed that there was a slight increase in the modelled flood extents for the 20% increase in rainfall, and a slight decrease in the modelled flood extents for the 20% decrease in rainfall. This was as expected and shows that the model is not overly sensitive to rainfall, and the assumptions made within the hydrological study.



Appendices



Appendix 1 - Hydrological Report

HD068-R007 Abley Letchford Hydrological Report



Appendix 2 - Model Log



Appendix 3 - Topographical Survey



LAND EAST AND WEST OF HYDE END ROAD, SHINFIELD

DIRECT RAINFALL MODELLING REPORT

BLOOR HOMES (SOUTHERN) AND THE UNIVERSITY OF READING

08 MAY 2025





Abley Letchford
3 Tealgate
Charnham Park
Hungerford
RG17 0YT

T: 01488 684390
E: contact@ableyletchford.co.uk
W: www.ableyletchford.co.uk

Quality Management:

Prepared by:	R Moore
Authorised by:	E Philpott
Date:	08 May 2025
Document Reference:	HD068-R007

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Contents

1.0 Introduction..... 1

2.0 Hydrological Assessment..... 7

3.0 Model Approach and Input Data 12

4.0 Sensitivity Testing 25

5.0 Model Results..... 29

6.0 Conclusions..... 35

Appendices

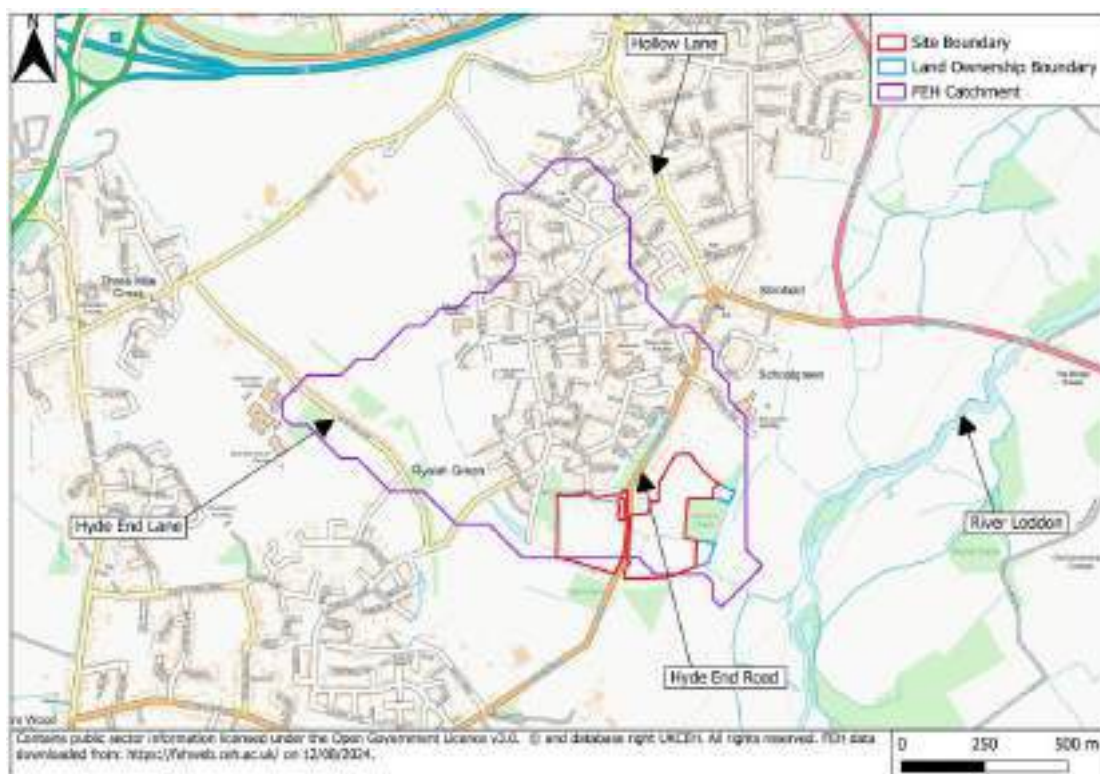
- Appendix 1 - Hydrological Report
- Appendix 2 - Model Log
- Appendix 3 - Topographical Survey

1.0 Introduction

Background

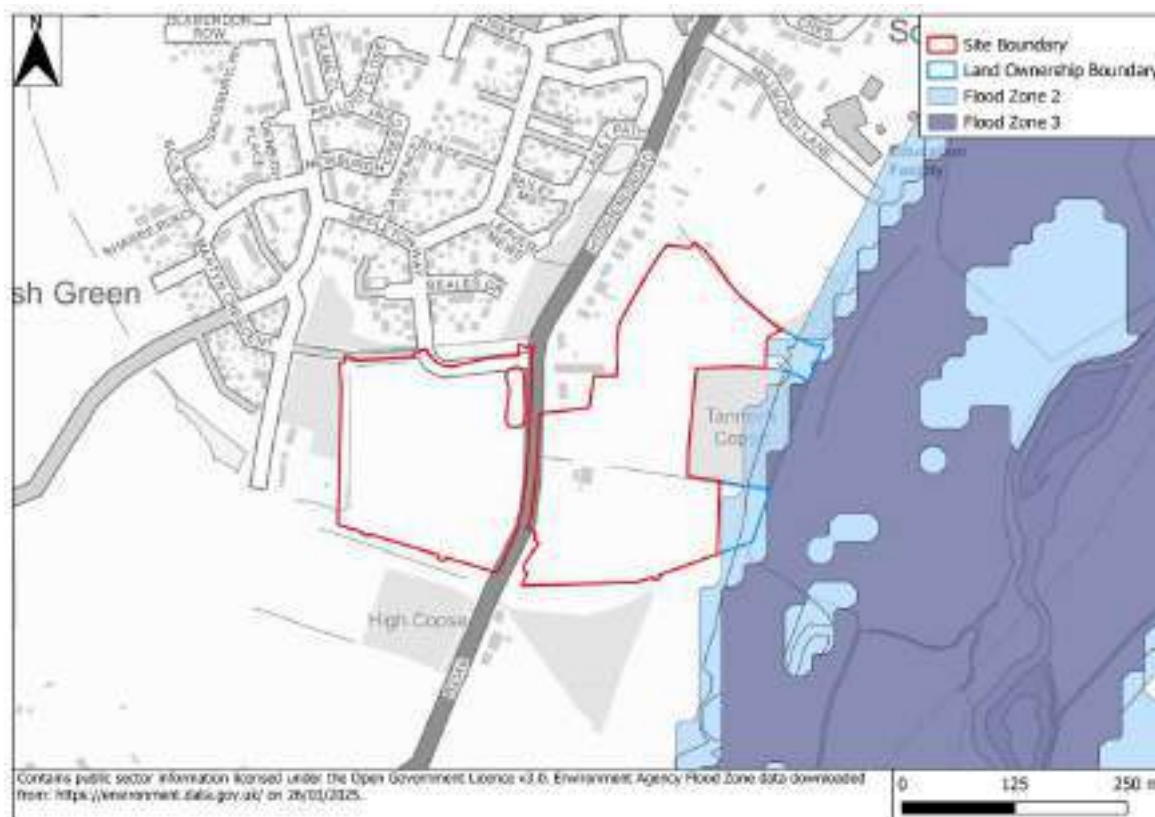
- 1.1. This direct rainfall modelling report has been prepared by Abley Letchford, on behalf of Bloor Homes (Southern) and the University of Reading, in relation to the proposed residential development at Land to the east and west of Hyde End Road at Shinfield located to the south of Reading.
- 1.2. This direct rainfall modelling report sets out the data and methods used to create a site-specific baseline model to represent the site-specific conditions. This report also sets out the baseline model results to define the surface water flood extents.
- 1.3. **Figure 1** shows the location of the site and catchment.

Figure 1 - Site Location Plan



- 1.4. The Environment Agency (EA) Flood Map for Planning shows that the entire site is located with Flood Zone 1, as show in **Figure 2**.

Figure 2 – EA Flood Map for Planning



1.5. **Figure 3** shows the NaFRA Risk of Flooding from Rivers and Sea mapping.

Figure 3 – NaFRA Risk of Flooding from Rivers and Sea

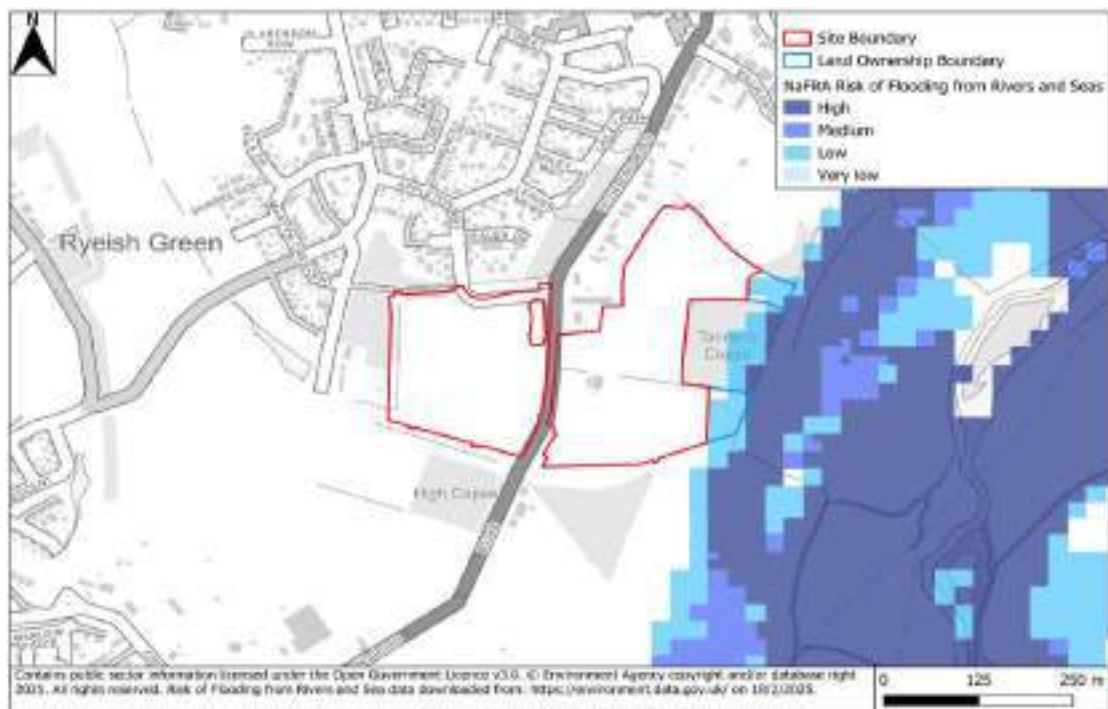
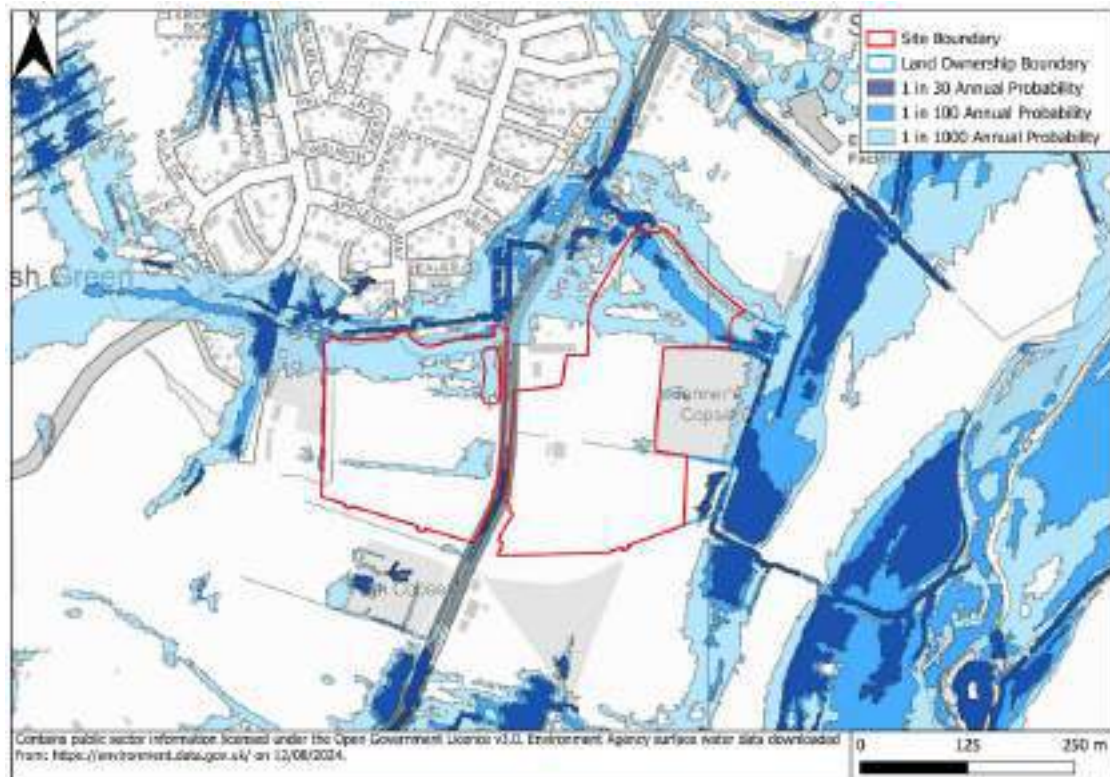


Figure 3 shows that the site is located outside of the extent of the River Loddon floodplain.

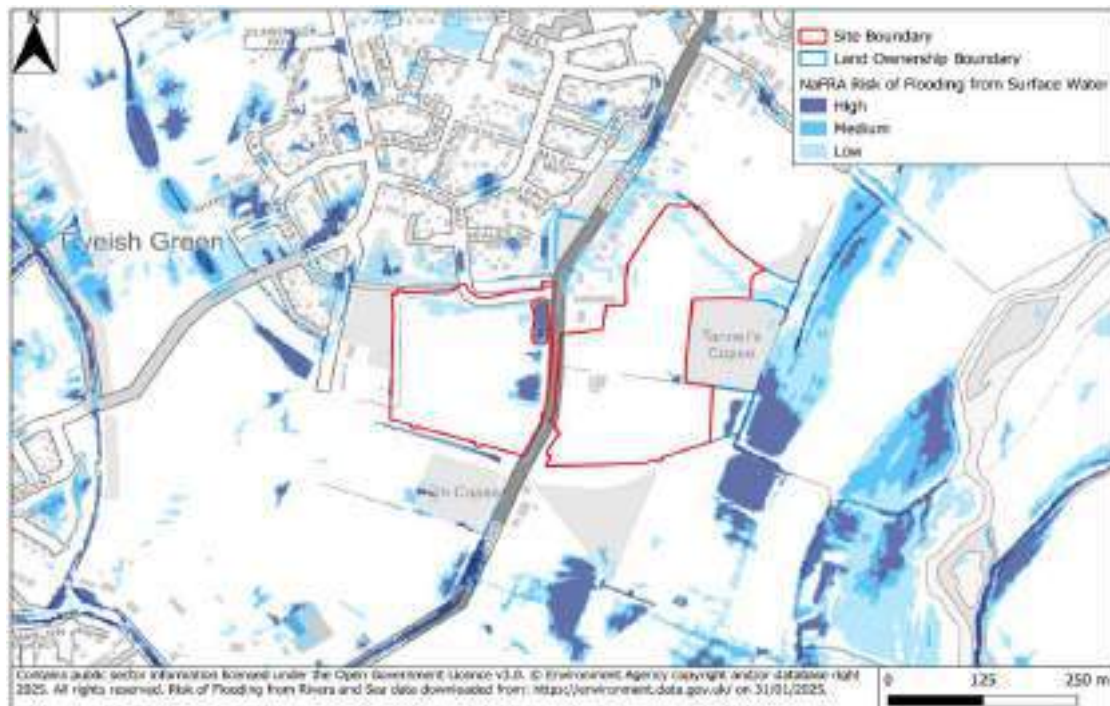
Figure 4 shows the EA Risk of Flooding from Surface Water mapping, sourced before January 2025. This dataset has now been superseded by the NaFRA Risk of Flooding from Surface Water dataset, as of January 2025. However, at the time of completing this study, the EA Risk of Flooding from Surface Water was the current data set, therefore it has been included for completeness and to give context to this study and how the understanding of surface water flooding has progressed.

Figure 4 – EA Risk of Flooding from Surface Water



- 1.6. **Figure 4** indicates that there is a flow route in the northern part of the eastern and western parcels. It also shows that there is an area of flooding in the central part of the western parcel.
- 1.7. The flow routes shown by the EA surface water mapping do not appear to consider the watercourses within the site, nor the impact of the adjacent development which was constructed recently. It is likely that the EA surface water flood extents were generated using LiDAR data flown prior to the recent development within the local area and the hydrological catchment.
- 1.8. It was considered likely that the EA flow route from the west would be intercepted by the western watercourse. The flow route in the northern part of the western parcel was thought to likely follow the location of the Appleton Way watercourse.
- 1.9. The flow route in the northern part of the eastern watercourse was considered likely to follow the northern watercourse.
- 1.10. **Figure 5** shows the NaFRA Risk of Flooding from Surface Water extent.

Figure 5 – NaFRA Risk of Flooding from Surface Water



- 1.11. **Figure 5** shows that there is a flow route along the northern part of the western parcel with a 'Low' risk of surface water flooding. There are a few areas of surface water ponding along the eastern boundary of the western parcel. These correspond with a drainage basin and low-lying ground. There is a flow route along the northern part of the eastern parcel.
- 1.12. As with the EA surface water mapping, the flow routes in the NaFRA surface water mapping do not appear to consider the watercourses within the site, nor the adjacent development. It is likely that the NaFRA surface water flood extents were generated using LiDAR data flown prior to the recent development within this area.
- 1.13. It was considered likely that the NaFRA flow route from the west would be captured by the western watercourse. The flow route in the northern part of the western parcel was thought to likely follow the location of the Appleton Way watercourse.
- 1.14. The flow route in the northern part of the eastern watercourse was considered likely to follow the northern watercourse.
- 1.15. The key aim of this modelling study is to refine the flood extents using site specific topographical data which considers the local features within the site and catchment in conjunction with local knowledge and site observations.

Scope

- 1.16. The scope of works includes the following:
 - Undertake a hydrological assessment to estimate the catchment to the site and generate rainfall hyetograph for the relevant return periods.



- Build a new direct rainfall model with defined channels for the catchment using the best available data to refine the baseline surface water flood extents.
- Run the model for the following return periods; 1 in 30, 1 in 100, 1 in 1,000 annual probability scenarios.
- To assess the impact of climate change, the 1 in 100 annual probability scenario has been modelled with the most recent climate change allowances for the Loddon and Tributaries Management Catchment. A +40% climate change allowance has been applied for the 1 in 100 annual probability scenario which represents the Upper End peak rainfall allowance for the Loddon and Tributaries Management Catchment.



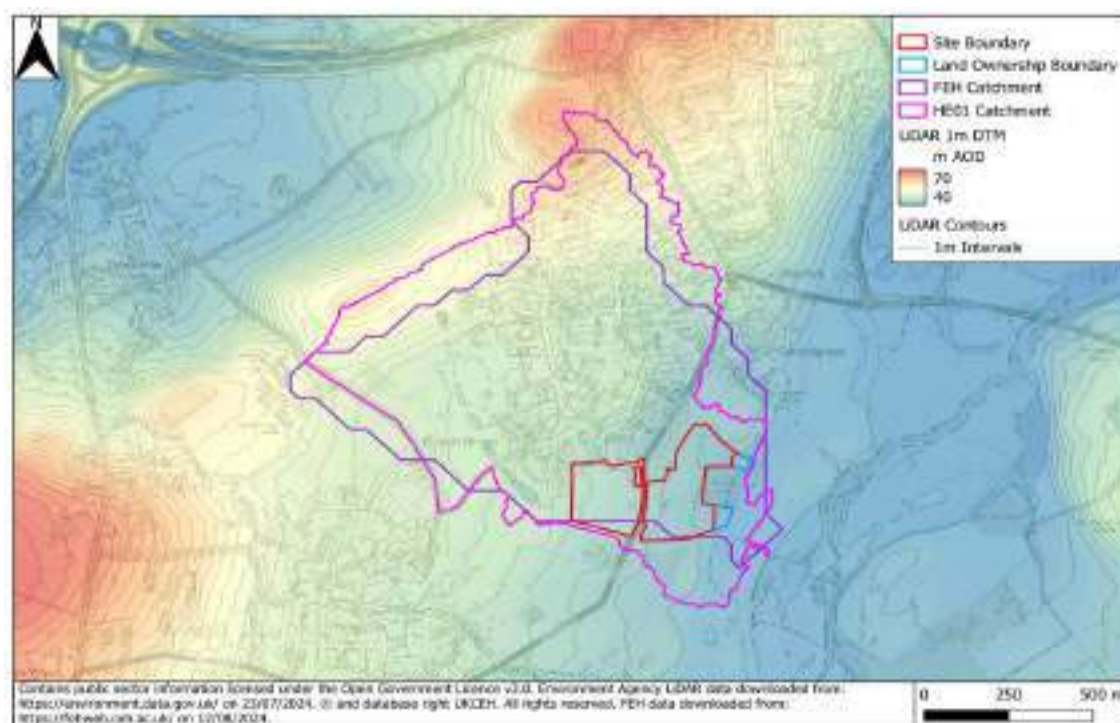
2.0 Hydrological Assessment

- 2.1. Full details for the hydrological assessment methodology and application can be found in the Abley Letchford Hydrological Assessment in **Appendix 1**. A summary of the hydrological assessment is included within this chapter.
- 2.2. The hydrological study derived hyetograph estimates. A lumped catchment was obtained from the Flood Estimation Handbook (FEH) webservice and updated where appropriate.
- 2.3. The study derived hyetographs for the following return periods; 1 in 30, 1 in 100 and 1 in 1000 annual probability. To assess the impact of climate change, the 1 in 100 annual probability scenario was modelled with the most recent climate change allowances for the Loddon and Tributaries Management Catchment which is 40%.
- 2.4. The hydrological analysis was completed using ReFH2 version 2.3.

Hydrological Inflow Boundaries

- 2.5. The catchment was downloaded from the FEH Webservice.
- 2.6. The FEH catchment was adjusted using OS mapping, LiDAR data and a review of the EA indicative watershed dataset to derive the HE01 catchment deemed to be most representative of the actual catchment. The FEH catchment area was 0.98km². The HE01 catchment has an area of 1.1km².
- 2.7. **Figure 6** shows the extent of the FEH catchment and HE01 catchment.

Figure 6 – FEH Catchment and Hyde End (HE01) Catchment Extents



Catchment Descriptors

- 2.8. A review of the FEH Webservice catchment descriptors was carried out. A summary of key catchment descriptors and updates and summarised in **Table 1**. Further details of the checks and updates made to the catchment descriptors are provided below the table.



Table 1 – Catchment Descriptors

Catchment Descriptor	FEH Catchment Descriptor	HE01 Catchment Descriptor
AREA	0.98	1.1
BFIHOST	0.477	0.477
BFIHOST19	0.542	0.542
DPLBAR	1.02	1.05
DPSBAR	11.3	11.3
FARL	1	1
FPEXT	0.223	0.223
LDP	1.69	1.69
PROPWET	0.29	0.29
SAAR	640	640
SPRHOST	34.74	34.74
URBEXT1990	0.0242	0.268
URBEXT2000	0.0774	0.268

Area

- 2.9. The FEH catchment area was adjusted for the HE01 catchment using OS mapping, LiDAR data and the EA watershed dataset. The FEH catchment area was 0.98km². The HE01 catchment area is 1.1km².

BFIHOST and BFIHOST19

- 2.10. BFIHOST base flow index is a measure of catchment responsiveness based on the Hydrology of Soil Types (HOST) classification. It indicates the relationship between soil types and the runoff response. Permeable soils and geology tend to yield a higher baseflow.
- 2.11. BFIHOST19 is an updated method of classifying BFIHOST which improves on the classification of rarer soil types.
- 2.12. The BFIHOST values were reviewed using the Cranfield Soils online viewer. The FEH values were deemed to be reasonable and were accepted.

SPRHOST

- 2.13. SPRHOST is the standard percentage runoff associated with each HOST soil class.
- 2.14. The FEH SPRHOST values were reviewed using the Cranfield Soils online viewer. The FEH values were deemed to be reasonable and were accepted.



PROPWET

- 2.15. PROPWET is a measure of the proportion of the time that the catchment soils are defined as wet. Wetter regions have higher PROPWET values. Drier regions have lower PROPWET values. The PROPWET value for the FEH catchment is 0.29. The value is considered to be representative of the region that the HE01 catchment is in.

FARL

- 2.16. FARL is a measure of the degree of flood attenuation provided by reservoirs and lakes within a catchment. A value of 1 represents the absence of lakes or reservoirs within the catchment. There are no lakes or reservoirs within the FEH catchment or the HE01 catchment. The FARL value of 1 is therefore considered to be representative for the HE01 catchment.

URBEXT and URBEXT2000

- 2.17. URBEXT and URBEXT2000 is an index of the concentration of urban and suburban areas in 1990 and 2000 respectively expressed as a fraction.
- 2.18. OS mapping and aerial photography was reviewed for the HE01 catchment and the URBEXT2000 value adjusted to reflect the suburban areas within the HE01 catchment. The URBEXT2000 value was updated using the FEH Volume 5 Equation 6.2.
- 2.19. The URBEXT2000 value was adjusted to 0.268 to reflect the recent residential development within the catchment.

SAAR

- 2.20. SAAR is a measure of the average annual rainfall between 1961 and 1990 in millimetres. The FEH catchment is adjacent to the HE01 catchment therefore both catchments will have received similar average rainfall. The SAAR value for the FEH catchment appears reasonable therefore it has been accepted for use for the HE01 catchment.

DPSBAR

- 2.21. DPSBAR is an index for the overall catchment steepness. A value of greater than 300 represents mountainous regions. A value of less than 25 represents flatter regions. The DPSBAR value for the FEH catchment is 11.3. The FEH catchment and HE01 catchment are both relatively flat therefore the DPSBAR for the sites is considered representative.

ReFH2 Method

- 2.22. The ReFH2 method was used to derive hyetographs for the HE01 catchment. The ReFH2 method uses the FEH Webservice catchment descriptors to generate the design hyetographs for the return periods.



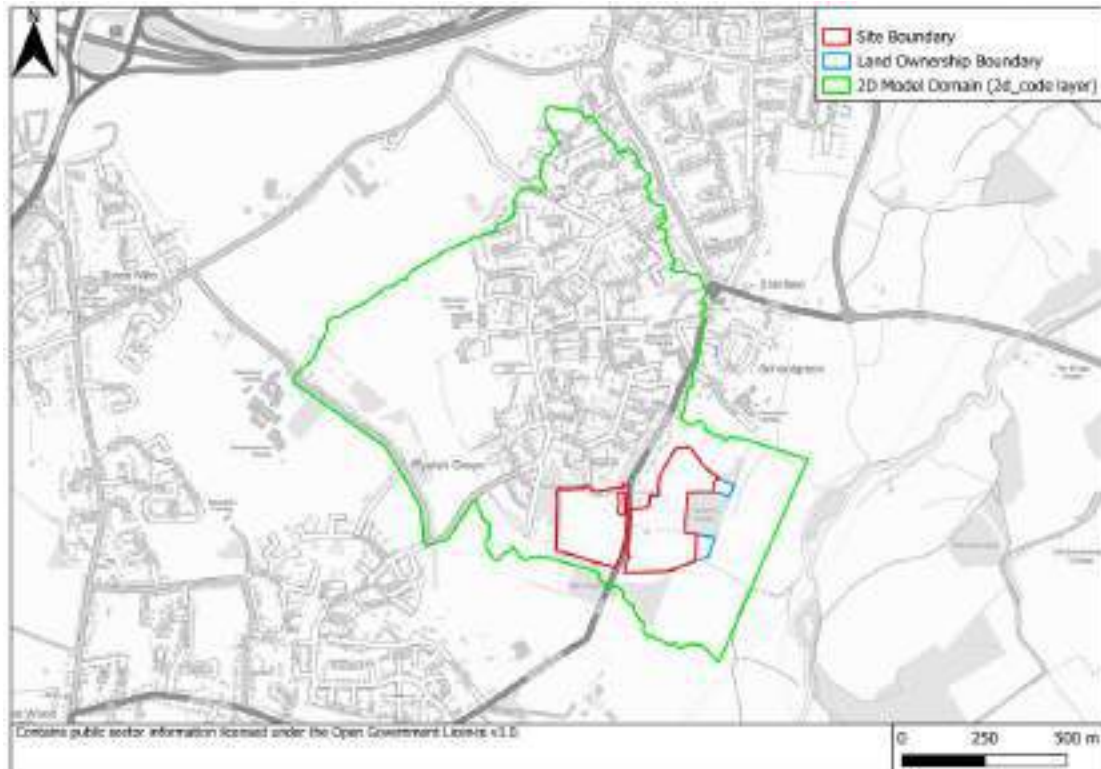
Storm Duration

- 2.23. The default ReFH2 rainfall parameters were applied. This approach is an industry standard approach. Rainfall parameters are not typically adjusted unless there is a specific reason to do so. These gave a storm duration of 6.5 hours and a timestep of 0.5 hours.
- 2.24. The ReFH2 Seasonal Correction Factor (SCF) of 0.98 was used. This was the ReFH2 default value. This approach is industry standard. Parameters are not typically adjusted unless there is a specific reason to do so.
- 2.25. The ReFH2 Areas Reduction Factor (ARF) of 0.68 was used. This was the ReFH2 default value. This approach is industry standard. Parameters are not typically adjusted unless there is a specific reason to do so.

Rainfall Estimates

- 2.26. The winter seasonality was selected. This is the appropriate storm profile for rural catchments in England, according to the ReFH2 guidance.
- 2.27. The site is located in the Loddon and Tributaries Management Catchment. The relevant climate change allowance is +40% which is the Upper End allowance.

Figure 8 – 2D Model Extent



Input Data

- 3.8. The latest available software and data has been used in the hydraulic model. The data is summarised below.

Hydraulic Software and Data

- 3.9. TUFLOW version 2023-03-AD-iDP-w64 were used. These are the latest versions of the software.
- 3.10. The hydrological inflows were updated using ReFH2 version 2.3. This is the latest versions of the software. LiDAR Data

LiDAR Data

- 3.11. 1m DTM LiDAR flown in 2007 and 2010 was used. This is the best available data at the finest available resolution. The LiDAR data was downloaded from the Defra open-source data service platform on 12th August 2024. **Figure 9** shows the extent of the LiDAR available for the site.