

## The Spartan Group

Old Cottage, Start Hill Stane Street

Great Hallingbury Bishops Stortford Hertfordshire  
CM22 7TG

## Flood Risk Statement and Drainage Strategy

REPORT REF.  
2304451-R01

March 2024

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<b>REV</b>	<b>ISSUE PURPOSE</b>	<b>AUTHOR</b>	<b>CHECKED</b>	<b>APPROVED</b>	<b>DATE</b>
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### **Distribution**

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## **1. Introduction**

- 1.1. Ardent Consulting Engineers has been appointed by The Spartan Group to advise on flood risk and surface water management matters associated with the proposed redevelopment of the site situated at Old Cottage, Start Hill, Bishop's Stortford.
- 1.2. This Flood Risk & Surface Water Management Statement has been prepared to support a full planning application to redevelop the existing site and provide a 9-unit residential scheme with an access road, parking provision, landscaping and supporting infrastructure.
- 1.3. The site is situated within Flood Zone 1 and the developable area is less than one hectare. As such, a formal site-specific Flood Risk Assessment is not required, although the principles outlined within the National Planning Policy Framework (NPPF) and accompanying web-based Planning Practice Guidance, have continued to be adopted in this Flood Risk Statement (FRS)
- 1.4. The contents of this FRS assess the implications of flood risk on the proposed development. This FRS has been prepared with specific reference to the requirements of National Planning Policy Framework (NPPF) released in December 2023 and the Planning Guidance (PPG), which superseded the Technical Guidance to the NPPF in 2014, updated in August 2022.
- 1.5. This report also takes into consideration the requirements within the Non-statutory Technical Standards for Sustainable Drainage Systems (March 2015) and its Best Practice Guidance (July 2015).
- 1.6. Supporting evidence is provided in this report to enable the planning application to be determined in terms of flood risk and SuDS/surface water disposal. If additional and/or detailed information is required, it is anticipated that appropriate conditions will be recommended for future consideration.

## **2. Baseline Parameters**

### **Existing Site**

- 2.1. The application site is situated to the east of Bishop's Stortford as illustrated in Figure 2-1 below, located in the county of Hertfordshire.

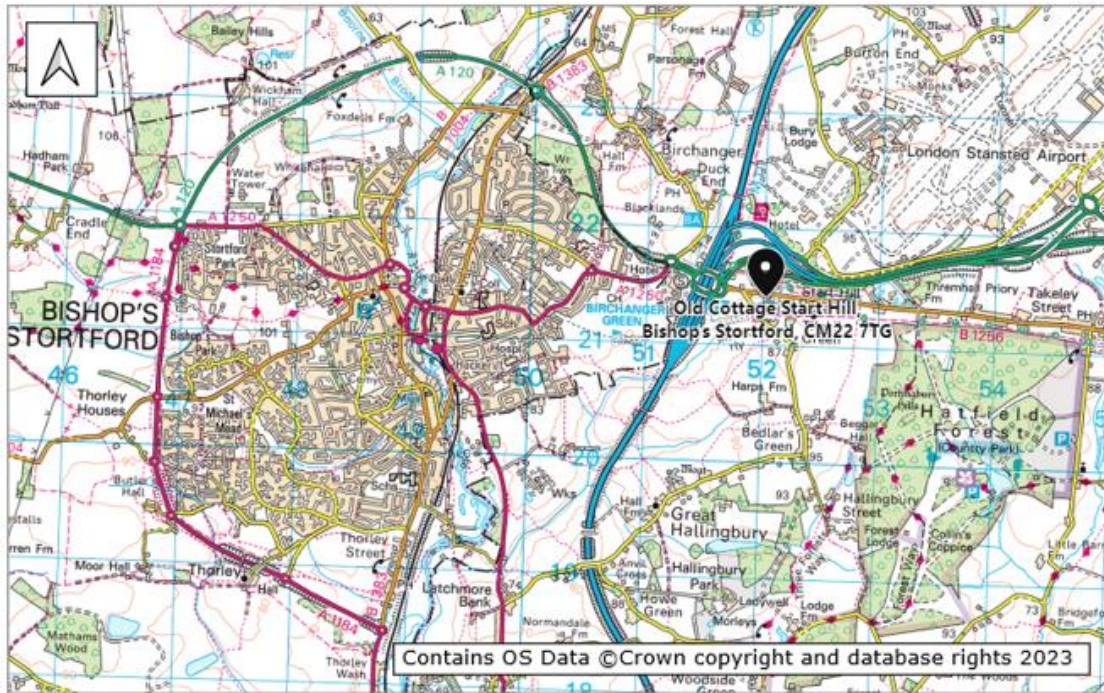


Figure 2-1: Site location

- 2.2. The site boundary is formed by the B1256 public highway to the north, residential properties to the east, commercial properties to the south and undeveloped private land to the west.
- 2.3. The application site is situated on an Ordnance Survey grid reference of 552021mE, 221420mN.
- 2.4. The application boundary comprises an area of circa 0.34 hectares and is a previously developed brownfield site. The existing site is partially impermeable, with impermeable areas calculated to be circa 0.06ha.
- 2.5. A detailed topographical survey/drainage investigation of the site was prepared by BRD Tech Ltd and all finished ground levels relate to an Ordnance Survey datum. The topographical survey confirms that there is an area of hard standing associated with the existing site comprising roof and vehicular access areas. See Figure 2-2 for details. A detailed version of the survey has been included in Appendix A.

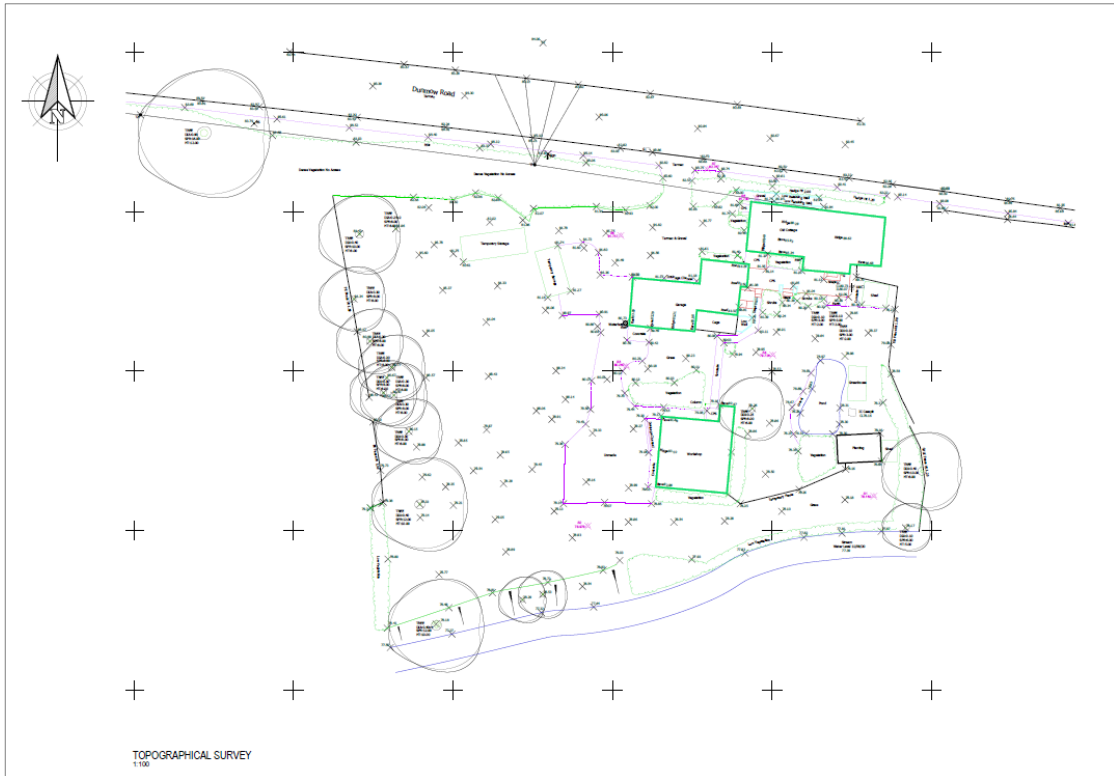


Figure 2-2: Topographical Survey

- 2.6. The public sewer asset record plan for the local area has been obtained from the Sewerage Undertaker for the region, Thames Water Utilities Ltd, which indicates that there is a foul water public sewer network present to the west of the application site, within the highway of Tilekiln Green, as indicated in Figure 2-3 below.
- 2.7. The asset record confirms that there are no strategic foul or surface water public sewers which traverse the application site and therefore no protection/diversion works are anticipated as a result of the scheme's implementation.
- 2.8. A copy of the public sewer asset record plans has been provided within Appendix B of this report for further reference.









Figure 2-4: Development Masterplan Layout

- 2.11. A detailed version of the layout plan has been provided in Appendix C.
- 2.12. The impermeable area associated with the proposed development scheme (roof area, access road, parking courtyard/bays, paving etc.) is calculated to be circa 0.186ha with the remainder being soft landscaping.

### **3. Policy Context**

#### **National Planning Policy Framework (December 2023)**

- 3.1. The National Planning Policy Framework (NPPF) was introduced on 27 March 2012. This document was revised most recently in December 2023; where paragraphs 165 to 175 inclusive, establish the Planning Policy relating to flood risk management. The Technical Guide to the NPPF was superseded by the Planning Practice Guidance (PPG) in March 2014.
- 3.2. It states all plans should apply a sequential, risk-based approach to the location of development – considering all sources of flood risk and the current and future impacts of climate change – to avoid where possible, flood risk to people and property. They should do this and manage residual risk, by:
- a) applying the sequential test and then, if necessary, the exception test as set out below;
  - b) safeguarding land from development that is required, or is likely to be required, for current or future flood management;
  - c) using opportunities provided by new development and improvements in green and other infrastructure to reduce the causes and impacts of flooding, (making as much use as possible of natural flood management techniques as part of an integrated approach to flood risk management); and,
  - d) where climate change is expected to increase flood risk so that some existing development may not be sustainable in the long-term, seeking opportunities to relocate development, including housing, to more sustainable locations.

- 3.3. The Planning Practice Guidance (PPG) provides the methodology required to undertake the Sequential and Exception Tests.

#### **Flood and Water Management Act (2010)**

- 3.4. The Flood and Water Management Act places a duty on all flood risk management authorities to co-operate with each other. The act also provides lead local flood authorities and the Environment Agency with a power to request information required in connection with their flood risk management functions.

#### **Sustainable Drainage Systems - Non-statutory technical standards for sustainable drainage systems (March 2015)**

- 3.5. The Non-statutory technical standards for sustainable drainage systems were published in March 2015. They should be used in conjunction with the Planning Practice Guidance. In addition, the Best Practice Guidance for the Planning Practice Guidance for the Non-Statutory Technical Standards was published in July 2015 by LASOO.
- 3.6. The Local Planning Authority (LPA) may set local requirements for planning permission that have the effect of more stringent requirements than these non-statutory technical standards.
- 3.7. In addition, SuDS should be designed in accordance with CIRIA 753 "The SuDS Manual", which represents current best practice.

### **Climate Change**

- 3.8. The Planning Practice Guidance states that to allow for the predicted impacts of climate change on Peak River Flow Allowances, consideration should be given to the catchment within which the site is located. The site is located within the Thames River Basin District, Upper Lee Management Catchment, and as such the following allowances detailed in Table 3-1 are applicable to the site.

	<b>Central</b>	<b>Higher Central</b>	<b>Upper End</b>
<b>2020s</b>	3%	9%	23%
<b>2050s</b>	-1%	7%	27%
<b>2080s</b>	10%	22%	59%

Table 3-1: Thames River Basin District, Upper Lee Management Catchment peak river flow allowances

- 3.9. The site is located within Flood Zone 1 and such there is no fluvial flood risk.
- 3.10. The Planning Practice Guidance states that to allow for the predicted impacts of climate change on surface water runoff within the Upper Lee Management Catchment, the following increases in rainfall intensity, detailed in Table 3-2, should be allowed for. For development with a lifetime beyond 2100, the upper end allowances should be used.

	<b>Central</b>	<b>Upper</b>
<b>3.3% annual exceedance rainfall event</b>		
<b>2050s</b>	20%	35%
<b>2070s</b>	20%	35%

<b>1% annual exceedance rainfall event</b>		
<b>2050s</b>	20%	40%
<b>2070s</b>	25%	40%

Table 3-2: Upper Lee Management Catchment peak rainfall allowances

3.11. Therefore, under the NPPF an allowance of 40% for the effects of climate change for the 1% annual exceedance rainfall event would achieve the policy requirements in designing the drainage elements for the proposed redevelopment.

## 4. Sources of Flooding /Surface Water Management

### Flood Risk Assessment

4.1. According to the Environment Agency's indicative floodplain mapping, the redevelopment site is not deemed to be situated within the indicative undefended floodplain of any nearby designated main river/watercourse and/or tidal estuary, as illustrated in Figure 4-1 below:



Figure 4-1: Indicative Fluvial/Tidal Floodplain Extent

4.2. The site is therefore classified as a Flood Zone 1 site, at a low probability of fluvial and/or tidal flooding. As the site is situated within a Flood Zone 1 area and the developable area is less than one hectare, a formal site-specific Flood Risk Assessment is not required, although the principles outlined within the National Planning Policy Framework and accompanying web-based Planning Practice Guidance, have continued to be adopted.

4.3. The NPPF uses the concept of sequential testing and the risk-based approach to flood risk and development. Development priorities are based on the specific flood risk zones outlined within Table 1 of the Planning Practice Guidance. These flood risk zones have been briefly outlined below for reference:

**Zone 1** - Low probability: Land assessed as having a less than 1 in 1,000-year annual probability of river and sea flooding (<0.1%) in any year;

**Zone 2** – Medium probability: Land assessed as having between a 1 in 100 and 1 in 1,000 annual probability of river flooding (1%-0.1%) and between a 1 in 200 and 1 in 1,000 annual probability of sea flooding (0.5%-0.1%) in any year;

**Zone 3a** – High probability: Land assessed as having a 1 in 100-year or greater annual probability of river flooding (>1%) and a 1 in 200-year or greater annual probability of flooding from the sea (>0.5%) in any year;

**Zone 3b** – Functional floodplain: Land where water has to flow or be stored in times of flood.

4.4. Consulting Table 2 contained within the NPPF's Planning Practice Guidance classifies a residential scheme to be a 'more vulnerable' land-class usage, in terms of flood risk. See Figure 4-2 for details.

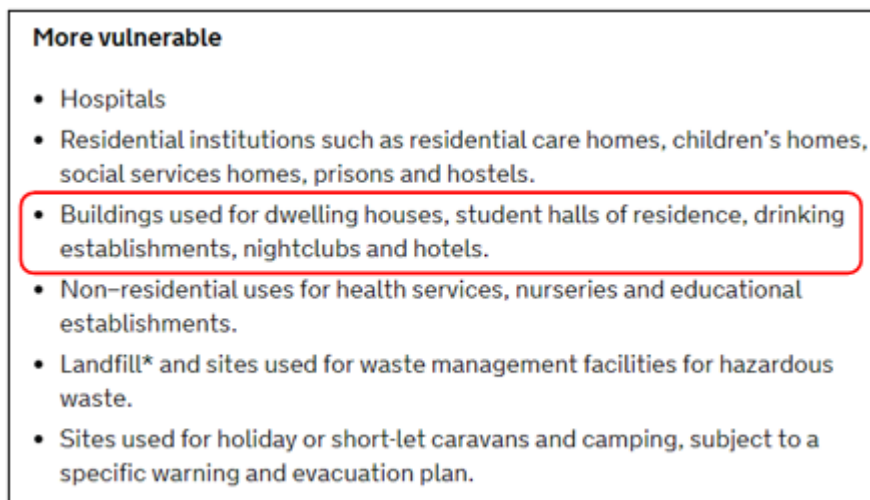


Figure 4-2: Vulnerability Classification

4.5. Table 3 of the Planning Practice Guidance (Flood Risk Vulnerability and Flood Zone 'Compatibility') determines that a residential scheme in a Flood Zone 1 area, is deemed to be appropriate. See Figure 4-3 for details.

Flood Zones	Flood Risk Vulnerability Classification				
	Essential infrastructure	Highly vulnerable	More vulnerable	Less vulnerable	Water compatible
Zone 1	✓	✓	✓	✓	✓
Zone 2	✓	Exception Test required	✓	✓	✓
Zone 3a †	Exception Test required †	x	Exception Test required	✓	✓
Zone 3b *	Exception Test required *	x	x	x	✓*

Key:

✓ Development is appropriate

x Development should not be permitted.

Figure 4-3: Flood Risk Vulnerability and Flood Zone 'Compatibility'

- 4.6. The EA Flood Risk from Surface Water map shows that the Site has limited risk of surface water flooding. There is only a small area, towards the southwest of the Site, noted as being at a "low" risk of shallow (<300mm) surface water flooding. The mapping also indicates that the site is not susceptible to pluvial/surface water flooding for the medium-risk scenario (1:100-year event), see Figure 4-4 for details.
- 4.7. Proposed finished floor levels for units adjacent to the low surface flood risk (Plot 7) will be set at minimum of 150mm higher than the lowest existing ground levels to mitigate against flood risk.



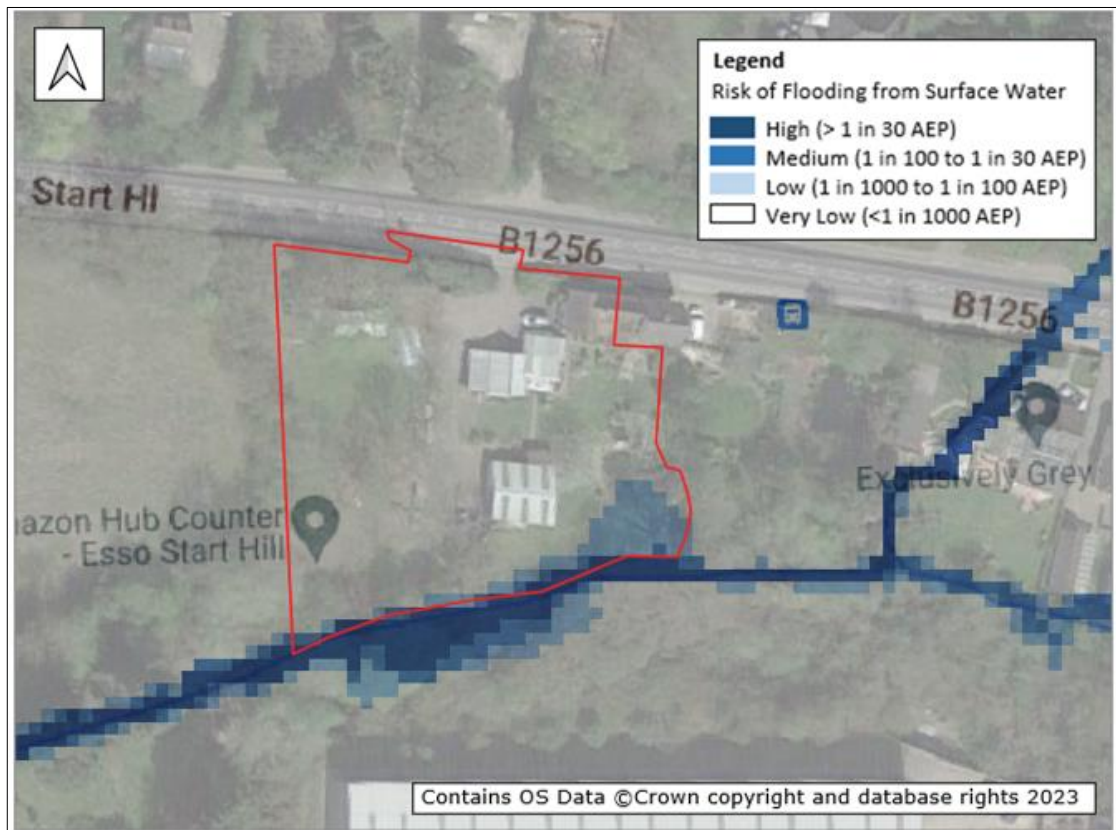


Figure 4-4: Localised Pluvial/Surface Water Flooding (source: google maps)

- 4.8. According to the records held on the British Geological Survey website, a borehole (BGS Reference TL52SW153) was drilled nearby to a depth of 6.95m to the south of this application site. Groundwater was encountered at a depth of 3.95m below the surface level. It is therefore concluded that the site is not at risk of any groundwater flooding, even allowing for seasonal variances. A copy of the borehole record has been included within Appendix D of this report for further reference.
- 4.9. The Environment Agency's mapping confirms that the site is not shown to be susceptible from flooding as a result of a breach of a nearby reservoir.

## **5. Sustainable Drainage Strategy**

- 5.1. DEFRA's Non-statutory technical guidance for Sustainable Drainage Systems and CIRIA Guidance C753 "The SuDS Manual" have been used to determine the appropriate SuDS Strategy, which considers the spatial and environmental constraints of the Site.
- 5.2. Under the NPPF an allowance of 40% for the effects of climate change will achieve the policy requirements for the proposed development.

### **Pre-Development Run-off**

- 5.3. According to the topographical survey, there is an area of hardstanding associated with the existing property and access of 0.06 hectares, which is calculated to generate a peak surface water run-off rate of 8.17 litres/sec when subjected to a 1:1-year rainfall event with a 50mm per hour rainfall intensity (based on the parameters specified within the 'Wallingford Procedure, Volume 4 – The Modified Rational Method', see Appendix E for details):

$$Q \text{ Discharge} = 3.61 C_v i A$$

$$Q \text{ Discharge} = 3.61 \times 0.75 \times 50\text{mm} \times 0.06 \text{ hectares (existing)}$$

Where:

$C_v$  = volumetric run-off coefficient

$i$  = rainfall intensity

$A$  = area

- 5.4. It is therefore concluded that the existing site can generate a total surface water run-off rate of 8.17 litres/sec. However, for the purposes of this assessment, alternative methods of disposal and discharge rates will also be considered.

### **Proposed Sustainable Drainage Systems (SuDS)**

- 5.5. In accordance with the Planning Practice Guidance, surface water runoff should be disposed of according to the following hierarchy:

1. into the ground (infiltration);
2. to a surface water body;
3. to a surface water sewer, highway drain, or another drainage system;
4. to a combined sewer.

Infiltration Feasibility Assessment

- 5.6. The British Geological Survey record plans for the Uttlesford area indicate the site is underlain by the London Clay Formation which is described as Clay, Silt and Sand, as illustrated in Figure 5-1.
- 5.7. Reviewing the borehole log mentioned earlier in this report, this investigation encountered the presence of clay material. In view of the anticipated soil conditions at the site, there is a risk that the soil may not be suitable for supporting the use of infiltration drainage techniques and therefore an alternative method of disposal may be required.

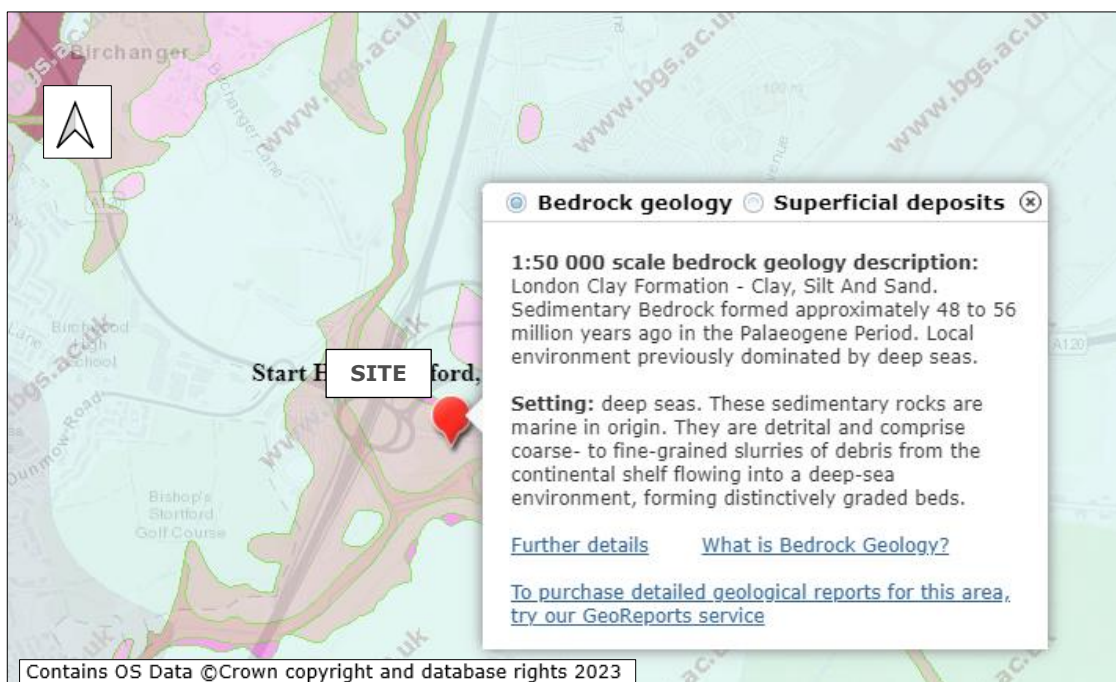


Figure 5-1: Extract of BGS's Geology Record Plan

To a surface water body

- 5.8. Adopting the national SuDS hierarchy, the next preferred option is to utilise any existing open-channel watercourse network. There is an ordinary watercourse present on this site and runs adjacent to the southern boundary of the application site.

To a Surface Water Sewer or To a Combined Sewer

- 5.9. As there is a watercourse running adjacent to the southern boundary, and this is higher up the hierarchy, discharge to a surface water sewer or combined sewer has not been considered.

**Post-Development Run-off**

5.10. The proposed development will have a total impermeable area of 0.186ha.

5.11. As previously mentioned in this report, the existing site would generate a peak run-off rate of 8.17 litres/sec during a 1 in 1 year storm event. However, to provide betterment to the receiving system and reduce flood risk elsewhere, consideration was given to the potential of restricting the post-development flow to a commensurate greenfield run-off rate of 0.44 litres/sec. See Table 5-1 for details.

Site Area (ha)	Impermeable Area (ha)	Surface Water Run-off (l/s)		
		1 year	30 year	100 year
0.34	0.06	8.17	18.17	23.14
0.34	Greenfield	0.44	1.18	1.66

Table 5-1: Greenfield and Existing Surface Water Run-Off Rates

5.12. As Greenfield rates for the lower order events are considered low and unable to achieve self-cleaning velocities (see Table 5-2) it is proposed to discharge at a maximum rate of 2.0 l/s for all storm events (up to and including the 100 year plus a 40% allowance for climate change). This provides betterment to all existing storm events and is also lower than the higher order Greenfield rates.

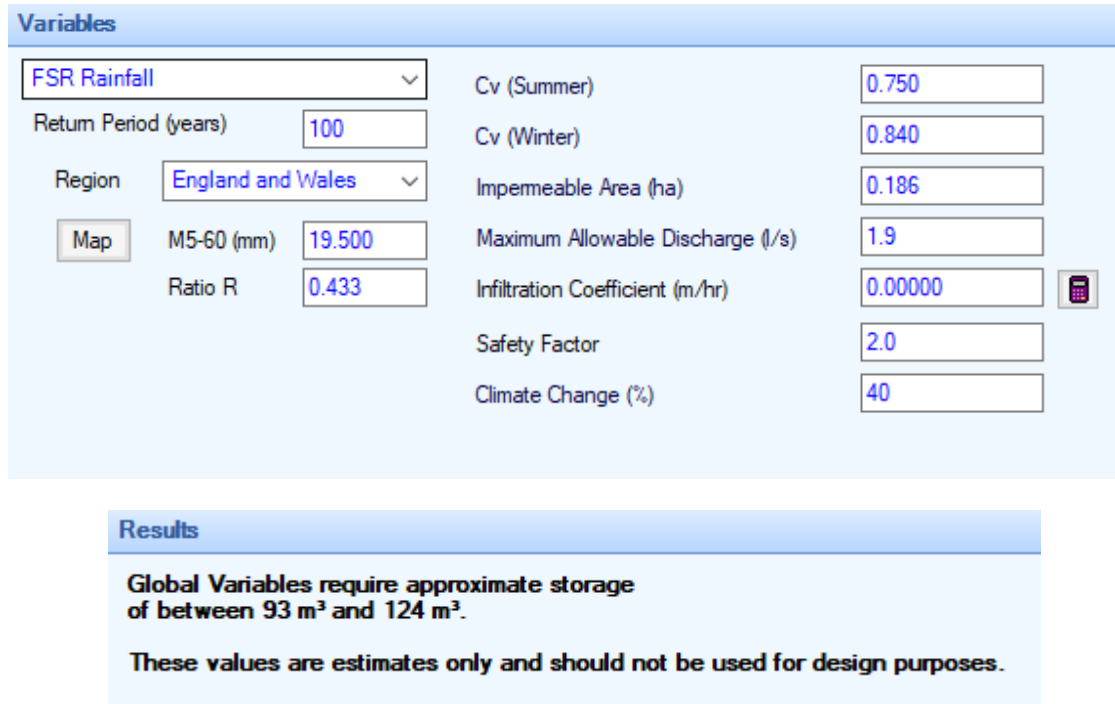
Return Period	Existing Runoff Rates (l/s)	Proposed Runoff Rates (l/s)	Runoff Reduction
1 in 1 year	8.17	2.00	-75.51
1 in 30 years	18.17	2.00	-88.99
1 in 100 year	23.14	2.00	-91.36
1 in 100 year + 40%	-	2.00	-

Table 5-2: Existing and Proposed Surface Water Runoff Rates

**Attenuation Provision**

5.13. To drain the site in a sustainable manner whilst complying with the requirements of the NPPF, the strategy will adopt an appropriate form of sustainable drainage system (SuDS).

5.14. Adopting the design parameters outlined below, the following preliminary assessment has been conducted using 'Micro Drainage' computer hydraulic modelling suite. A 40% allowance has been included for any potential climate change impact. See Figure 5-2 for details.



Variables	
FSR Rainfall	
Return Period (years)	100
Region	England and Wales
Map	
M5-60 (mm)	19.500
Ratio R	0.433
Cv (Summer)	0.750
Cv (Winter)	0.840
Impemeable Area (ha)	0.186
Maximum Allowable Discharge (l/s)	1.9
Infiltration Coefficient (m/hr)	0.00000
Safety Factor	2.0
Climate Change (%)	40

Results
<b>Global Variables require approximate storage of between 93 m<sup>3</sup> and 124 m<sup>3</sup>.</b>
<b>These values are estimates only and should not be used for design purposes.</b>

Figure 5-2: Preliminary Attenuation Simulation

5.15. Based on the above assessment, the preliminary attenuation simulations predict that a volume of storage in the region of 93m<sup>3</sup> to 124m<sup>3</sup> will be required to facilitate the surface water run-off from the redevelopment site.

5.16. The above assessment merely provides an initial preliminary estimate of the volume required at this stage of the report. Detailed MicroDrainage calculations have been included within the SuDS/Surface Water Drainage Strategy section of this report that follows.

### **SuDS/Surface Water Drainage Strategy**

5.17. For the purposes of this assessment, a SuDS/surface water drainage strategy has been prepared to demonstrate how the run-off will be disposed of, and that the system will be capable of withstanding a 1:100-year rainfall event (including an additional 40% as an allowance for climate change).

5.18. To dispose of the surface water run-off generated by the redevelopment scheme, it is anticipated that a connection will be made to the existing open-channel watercourse that runs adjacent to the application site's southern boundary.

5.19. To facilitate the connection works, it is acknowledged that ordinary watercourse consent will be required from the LLFA prior to commencing the works under S23 of the Land Drainage Act 1991.

5.20. The principles of the strategy will comprise:

- Surface water run-off will be restricted to a reduced discharge rate no greater than 2 litres/sec for all events, up to and including the 1:100-year (plus 40% climate change) rainfall event;
- A suitable flow-control device (such as a hydro-brake or similar device) will be utilised at the site's outfall to ensure the post-development discharge is not exceeded for events up to and including the 1:100-year event (including 40% climate change);
- To accommodate the attenuated volume generated by the 1:100-year rainfall event (including an additional 40% as an allowance for climate change), the run-off will be contained within an area of permeable paving.
- The storage provisions equate to a total storage volume of 185.4m<sup>3</sup> to restrict the discharge for all storm events (up to and including the 100 year plus a 40% allowance for climate change) to 2.0 l/s. Refer to the drawing 2304451-D-01 provided in Appendix F.
- To mitigate the risk of the run-off being polluted, the parking areas will be constructed as a lined permeable paving system to allow any contaminants to be filtered as the run-off passes through the granular drainage reservoir course. A 30% void ratio is associated with the granular reservoir material.

5.21. The principles of the SuDS/surface water drainage strategy have been presented on Drawing No. 2304451-D-01 and appended to this report for further reference. MicroDrainage hydraulic calculations confirm that the SuDS proposals can withstand the impact of a 1:100-year rainfall event (including an additional 40% as an allowance for potential climate change). A copy of the MicroDrainage simulation output files has been included within Appendix F of this report for reference.

**Water Quality Assessment**

5.22. A residential housing scheme comprising 9 no. residential dwellings with car parking bays, would fall within the low-pollution indices, as outlined in Table 26.2 of Chapter 26 within the CIRIA SuDS Manual 753.

5.23. The following tables outline the water quality assessment in accordance with CIRIA SuDS Manual 753.

<b>Land-use</b>	<b>Pollution hazard level</b>	<b>Total suspended solids (TSS)</b>	<b>Metals</b>	<b>Hydro-carbons</b>
Residential roofs	Very low	0.2	0.2	0.05
Other roofs (typically commercial/industrial roofs)	Low	0.3	0.2 (up to 0.8 where there is potential for metals to leach from the roof)	0.05
<b>Individual property driveways, residential car parks, low traffic roads (e.g. cul-de-sacs, home zones and general access roads) and non-residential car parking with infrequent change (e.g. schools, offices) i.e. &lt; 300 traffic movements/day</b>	<b>Low</b>	<b>0.5</b>	<b>0.4</b>	<b>0.4</b>
Commercial yard and delivery areas, non-residential car parking with frequent change (e.g. hospitals, retail), all roads except low traffic roads and trunk roads/motorways	Medium	0.7	0.6	0.7
Sites with heavy pollution (e.g. haulage yards, lorry parks, highly frequented lorry approaches to industrial estates, waste sites), sites where chemicals and fuels (other than domestic fuel oil) are to be delivered, handled, stored, used or manufactured; industrial sites; trunk roads and motorways	High	0.8	0.8	0.9

Table 5-3: Pollution hazard indices for different land-use classifications (land-use shaded yellow applicable for the development)

5.24. To ensure the target-indices are met, the following performance can be expected from the SuDS/surface water drainage strategy:



Type of SuDS component	Mitigation indices		
	TSS	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
Bio retention system	0.8	0.8	0.8
<b>Permeable pavement</b>	<b>0.7</b>	<b>0.6</b>	<b>0.7</b>
Detention basin	0.5	0.5	0.6
Pond	0.7	0.7	0.5
Wetland	0.8	0.8	0.8
Downstream Defender (Proprietary Treatment System*)	0.5	0.4	0.8
*Proprietary treatment systems	These must demonstrate that they can address each of the contaminant types to acceptable levels for frequent events up to approximately the 1 in 1-year return period event, for inflow concentrations relevant to the contributing drainage area.		

Table 5-4: Indicative SuDS mitigation indices for discharges to surface waters (SuDS components shaded yellow applicable to this development)

<b>Individual property driveways, residential car parks, low traffic roads (e.g. cul-de-sacs, home zones and general access roads) and non-residential car parking with infrequent change (e.g. schools, offices) i.e. &lt; 300 traffic movements/day</b>			
	Required mitigation indices		
Source	TSS	Metals	Hydrocarbons
Low	0.5	0.4	0.4
Mitigation Indices			
Permeable Pavement (Mitigation index <sub>1</sub> )	0.7	0.6	0.7
Proprietary Product (Mitigation index <sub>2</sub> )	N/A	N/A	N/A
Total Performance	0.7	0.6	0.7
Check	Criteria Exceeded	Criteria Exceeded	Criteria Exceeded

**Total SuDS mitigation index = mitigation index<sub>1</sub> + (0.5 x mitigation index<sub>2</sub>)**

Table 5-5: Indicative SuDS mitigation indices for discharge to surface waters

5.25. As demonstrated in Table 5-3 to Table 5-5 above, the mitigation of pollution provided by the development is appropriate for the low risk, it represents. The performance criteria can be met by implementing a permeable paving system.

**Maintenance Regime**

5.26. To ensure that the system is regularly maintained, it is anticipated that the external drainage systems will be placed under a formal agreement with an independent Maintenance Company to carry out periodic inspections and any necessary remediation/maintenance works, thus safeguarding the development for the on-going future.

5.27. It is anticipated that a formal Maintenance & Management Plan/Statement will be required to protect the longevity of the scheme's drainage infrastructure and it is recommended a planning condition is assigned to the Decision Notice/planning permission to fulfil these criteria.

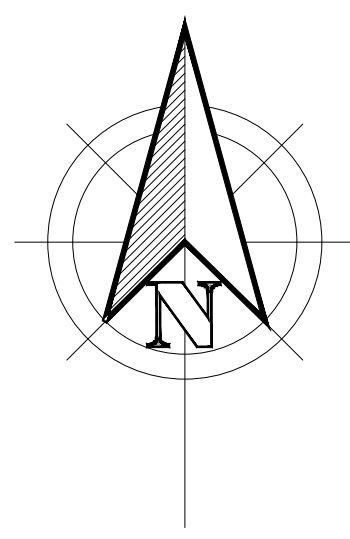
## **6. Foul Water**

- 6.1. The existing site is undeveloped with two residential units and such the existing peak foul water flow rates from the site is considered to be 0.092l/s.
- 6.2. The proposed development will provide 9 residential units. Based on the Thames Water Foul Flow Rates Criteria, it is estimated that the peak Foul Flow discharged rate for the proposed development is calculated to be 0.413/s from the Site. Refer to the Foul Loading Calculations provided in Appendix G.
- 6.3. The public sewer asset record plan for the local area has been obtained from the Sewerage Undertaker for the region, Thames Water Utilities Ltd, which indicate that there is a foul water public sewer network present to the west of the application site, within the highway of Tilekiln Green, as previously illustrated in Figure 2-3 of this report. A copy of the public sewer asset record plan has been obtained and provided within Appendix B of this report for further reference.
- 6.4. As the record plans indicate that no suitable connection point to the existing public sewer network is available, it is proposed that foul water effluent generated by the proposed development will be treated on site via a proprietary package treatment plant. The treated foul water effluent will then be discharged into the existing open channel watercourse via the proposed surface water outfall.
- 6.5. The proposed discharge of treated foul water effluent into an existing open channel watercourse will require consent from the Environment Agency.

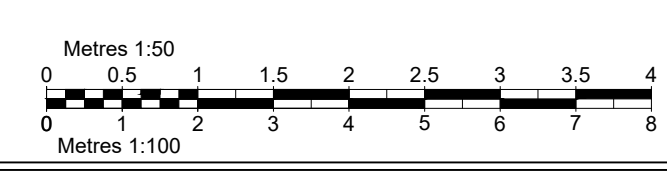
## **7. Summary**

- 7.1. The proposal to redevelop the existing site is considered to follow the national planning legislation which prefers the redevelopment of previously developed brownfield sites.
- 7.2. A residential scheme which is located in a Flood Zone 1 area is deemed to be suitable for development, as defined by the NPPF.
- 7.3. The site is not at risk of flooding from a fluvial source and/or tidal estuary, groundwater, pluvial/surface water (with the introduction of suitable mitigation measures) or a breach of any nearby reservoir.
- 7.4. No strategic foul or surface water public sewer networks traverse the site and therefore no protection/diversion works are anticipated.
- 7.5. The post-development discharge rate will be reduced by a maximum of 91.36% to provide betterment to the existing scenario and reduce the risk of flooding to others as a result of the development's implementation.
- 7.6. A detailed Maintenance & Management Plan/Statement will be required to protect the longevity of the scheme's drainage infrastructure. This could be secured by a suitably worded planning condition.
- 7.7. Ordinary Watercourse Consent will be sought from the LLFA for the construction of the outfall and associated works once planning permission is granted under the Land Drainage Act 1991.
- 7.8. In view of this assessment, the report concludes that:
  - The redevelopment scheme and its occupants will not be at an increased risk of flooding;
  - The redevelopment scheme will not increase the risk of flooding elsewhere;
  - A sustainable drainage scheme can be implemented.
- 7.9. The findings of this report identify the opportunity to provide a scheme which fully adopts the principles outlined within the NPPF. In this respect, it is anticipated that planning permission can be granted for this application on flood risk and drainage matters. Where additional or further information is required, appropriate planning conditions should be recommended for future consideration.

## **Appendix A Topographical Survey**



TOPOGRAPHICAL SURVEY  
1:100



SCALE FROM THIS DRAWING AT YOUR OWN RISK.

1A Church Street  
Sawbridgeworth  
Hertfordshire  
CM21 9AB

T.01279 600110  
enquiries@brdtech.co.uk  
www.brdtech.co.uk

SUSTAINABLE ARCHITECTURE

Project  
**OLD COTTAGE  
START HILL  
BISHOP'S SORTFORD  
ESSEX, CM22 7TG**

Title  
**TOPOGRAPHICAL SURVEY**

Scale @ A1  
**1:200**

Date  
**JULY 21**

Drawn By  
**TAC**

Status  
**PLANNING**

Ref  
**BRD/20/032/002**

## **Appendix B Thames Water Asset Record Plans**



# Asset location search



## Property Searches

Ardent Consulting Engineers  
Felaw Maltings  
44 Felaw Street  
IPSWICH  
IP2 8SJ

**Search address supplied** Old Cottage  
Start Hill  
Bishop'S Stortford  
CM22 7TG

**Your reference** 2005260 - Old Cottage Start Hill Bishops Stortfo

**Our reference** ALS/ALS Standard/2021\_4503194

**Search date** 13 September 2021

### Knowledge of features below the surface is essential for every development

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

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

Contact us to find out more.



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



[searches@thameswater.co.uk](mailto:searches@thameswater.co.uk)  
[www.thameswater-propertysearches.co.uk](http://www.thameswater-propertysearches.co.uk)



0800 009 4540

**Search address supplied:** Old Cottage, Start Hill, Bishop'S Stortford, CM22 7TG

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](mailto:searches@thameswater.co.uk)

Web: [www.thameswater-propertysearches.co.uk](http://www.thameswater-propertysearches.co.uk)

## Waste Water Services

**Please provide a copy extract from the public sewer map.**

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

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

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

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

For your guidance:

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

## Clean Water Services

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

With regard to the fresh water supply, this site falls within the boundary of another water company. For more information, please redirect your enquiry to the following address:

Affinity Water Ltd  
Tamblin Way  
Hatfield  
AL10 9EZ  
Tel: 0345 3572401

# Asset location search



## Property Searches

For your guidance:

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

### **Payment for this Search**

A charge will be added to your suppliers account.

## 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

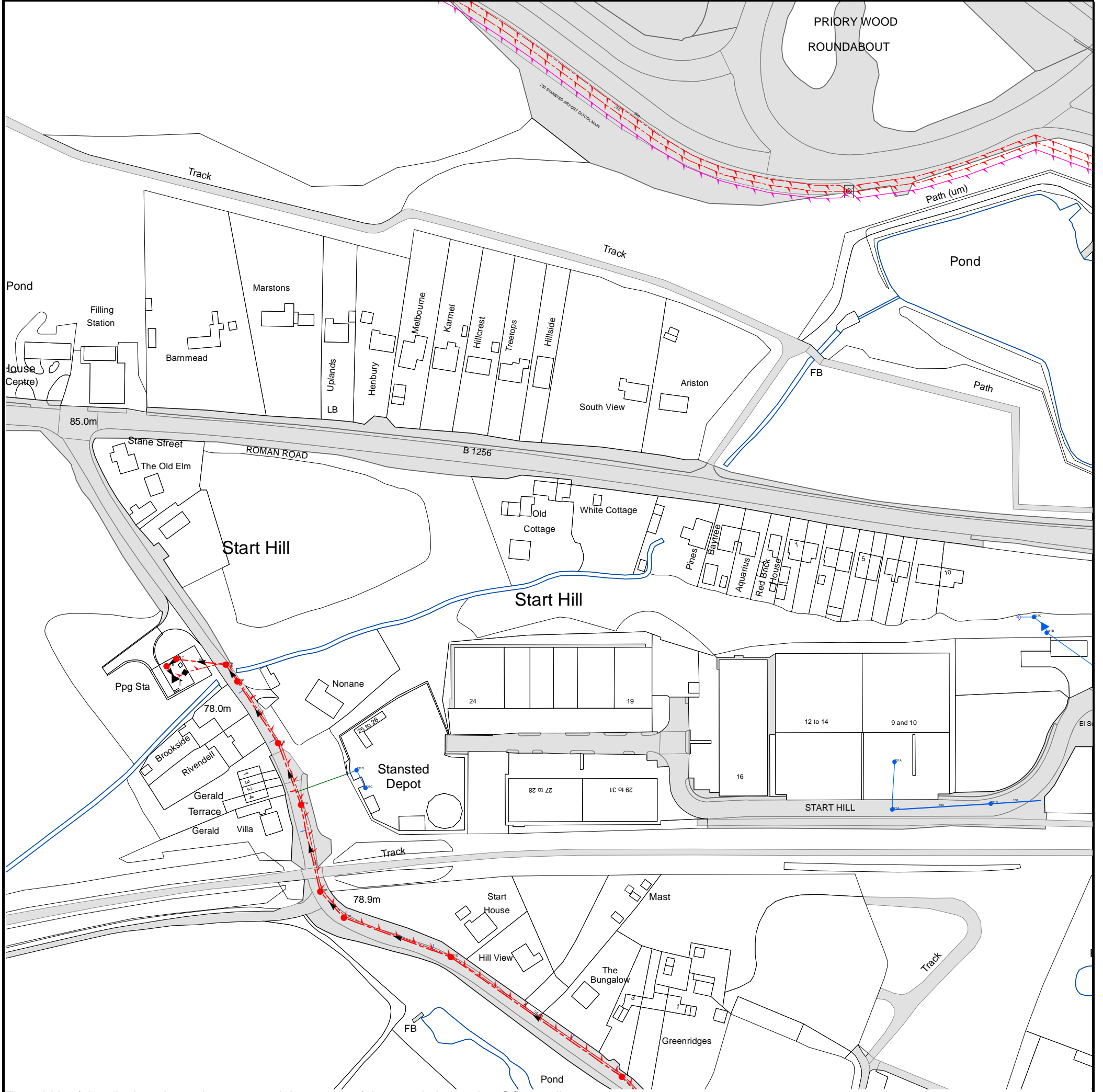
Tel: 0800 009 3921  
Email: [developer.services@thameswater.co.uk](mailto:developer.services@thameswater.co.uk)

### 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](mailto:developer.services@thameswater.co.uk)



The width of the displayed area is 500 m and the centre of the map is located at OS coordinates 552045,221412

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

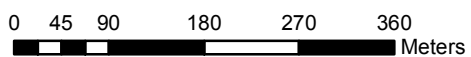
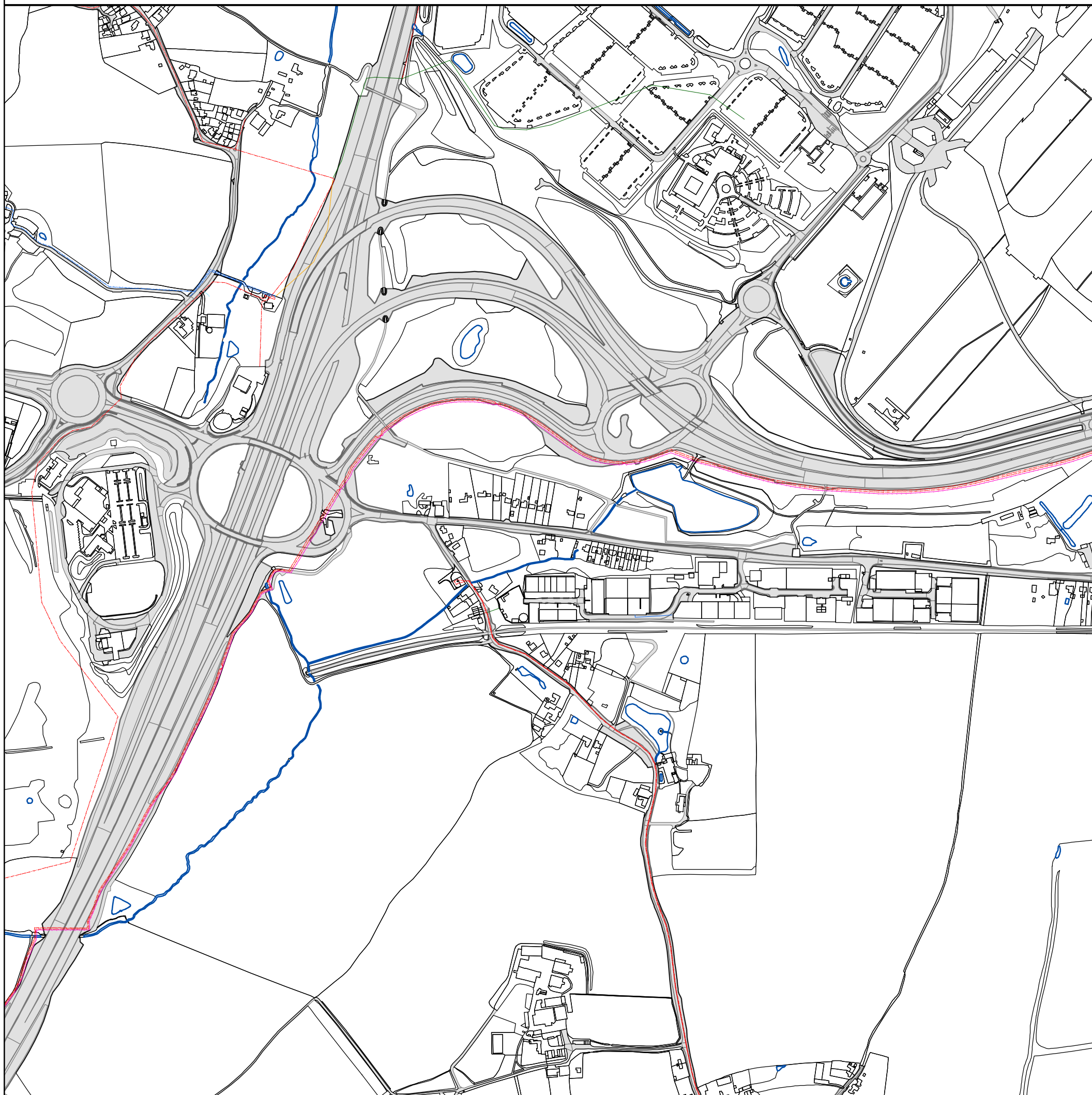
Based on the Ordnance Survey Map with the Sanction of the controller of H.M. Stationery Office, License no. 100019345 Crown Copyright Reserved.

NB. Levels quoted in metres Ordnance Newlyn Datum. The value -9999.00 indicates that no survey information is available

Manhole Reference	Manhole Cover Level	Manhole Invert Level
221B	n/a	n/a
231C	n/a	n/a
231B	n/a	n/a
921C	78.899	77.49
931D	n/a	n/a
931C	n/a	n/a
921D	81.132	79.037
011A	81.745	80.15
221A	n/a	n/a
231A	n/a	n/a
921B	78.359	76.966
921A	78.147	76.663
931B	78.184	76.13
931A	77.339	74.405
831B	76.897	73.711
831A	77.325	74.2
831C	77.013	73.823

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.





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 before any works are undertaken. Crown copyright Reserved



















**Scale:** 1:7158  
**Width:** 2000m  
**Printed By:** G1KANAGA  
**Print Date:** 13/09/2021  
**Map Centre:** 552045,221412  
**Grid Reference:** TL5221SW

**Comments:**



# ALS Sewer Map Key

## Public Sewer Types (Operated & Maintained by Thames Water)

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

### Notes:

- 1) All levels associated with the plans are to Ordnance Datum Newlyn.
- 2) All measurements on the plans are metric.
- 3) Arrows (on gravity fed sewers) or flecks (on rising mains) indicate direction of flow.
- 4) Most private pipes are not shown on our plans, as in the past, this information has not been recorded.
- 5) 'na' or 'D' on a manhole level indicates that data is unavailable.

## Sewer Fittings

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

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




## Operational Controls

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

-  Control Valve
-  Drop Pipe
-  Ancillary
-  Weir





## End Items

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

-  Outfall
-  Undefined End
-  Inlet


## Other Symbols

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








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

### Areas

Lines denoting areas of underground surveys, etc.

-  Agreement
-  Operational Site
-  Chamber
-  Tunnel
-  Conduit Bridge

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

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

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

## Terms and Conditions

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

1. All goods remain in the property of Thames Water Utilities Ltd until full payment is received.
2. Provision of service will be in accordance with all legal requirements and published TWUL policies.
3. All invoices are strictly due for payment 14 days from due date of the invoice. Any other terms must be accepted/agreed in writing prior to provision of goods or service, or will be held to be invalid.
4. Thames Water does not accept post-dated cheques-any cheques received will be processed for payment on date of receipt.
5. In case of dispute TWUL's terms and conditions shall apply.
6. Penalty interest may be invoked by TWUL in the event of unjustifiable payment delay. Interest charges will be in line with UK Statute Law 'The Late Payment of Commercial Debts (Interest) Act 1998'.
7. Interest will be charged in line with current Court Interest Charges, if legal action is taken.
8. A charge may be made at the discretion of the company for increased administration costs.

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

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

If you are unhappy with our service you can speak to your original goods or customer service provider. If you are not satisfied with the response, your complaint will be reviewed by the Customer Services Director. You can write to her at: Thames Water Utilities Ltd. PO Box 492, Swindon, SN38 8TU.

If the Goods or Services covered by this invoice falls under the regulation of the 1991 Water Industry Act, and you remain dissatisfied you can refer your complaint to Consumer Council for Water on 0121 345 1000 or write to them at Consumer Council for Water, 1st Floor, Victoria Square House, Victoria Square, Birmingham, B2 4AJ.

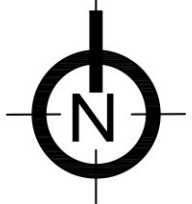
## Ways to pay your bill

Credit Card	BACS Payment	Telephone Banking	Cheque
Call <b>0800 009 4540</b> quoting your invoice number starting CBA or ADS / OSS	Account number <b>90478703</b> Sort code <b>60-00-01</b> A remittance advice must be sent to: <b>Thames Water Utilities Ltd., PO Box 3189, Slough SL1 4WW.</b> or email <a href="mailto:ps.billing@thameswater.co.uk">ps.billing@thameswater.co.uk</a>	By calling your bank and quoting: Account number <b>90478703</b> Sort code <b>60-00-01</b> and your invoice number	Made payable to ' <b>Thames Water Utilities Ltd</b> ' Write your Thames Water account number on the back. Send to: <b>Thames Water Utilities Ltd., PO Box 3189, Slough SL1 4WW</b> or by DX to <b>151280 Slough 13</b>

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

## **Appendix C Site layout**





NOTE: All drawings to be read in conjunction with consultant structural engineers, mechanical and electrical consultants, acoustic engineers, energy consultants, specification, and detailed drawings. Drawing to be issued for the purposes shown within the drawing status box.

NOTE: Drawing to not be scale and written dimensions to be used only. Refer to drawing scale, paper size and scale bar.



LOCATION PLAN  
0 25 50 1:1250

- KEY**
- PROPOSED HEDGES
  - PROPOSED TREES
  - EXISTING TREES
  - PATHS
  - PARKING SPACES
  - REFUSE
  - SHED (CYCLE SPACES)
  - ELECTRIC CHARGING POINTS
  - TIMBER 1.8M GATE
  - 1.8M CB FENCE
  - GRASSCRETE

0 2 4 6 8 10  
1:200

**jbell design and conservation ltd**  
Suite 02, Holly House Business Centre  
220-224 New London Road, Chelmsford, CM2 9AE  
T: 07484 791734  
E: jbell@designandconservation.co.uk  
www.designandconservation.co.uk

Client:	Scale: 1:200 @ A1
Project: Start Hill Takeley, CM22 7TG	Status: Planning <b>A</b>
Drawing: Proposed Site Plan	Dwg No: 2023-740-002
<small>© THIS DRAWING IS THE COPYRIGHT OF J BELL DESIGN AND CONSERVATION LTD. It shall not be in any way used or reproduced without their prior written consent. All dimensions are to be checked on site or in the workshop prior to commencing any work. Work only to figure dimensions. Any discrepancies are to be reported to the Architect. C:\Users\jbell\OneDrive - designandconservation.co.uk\000\Projects\2023-740-Start Hill Takeley\Planning Houses V3 Rev02</small>	



## **Appendix D Borehole logs**



**British  
Geological  
Survey**

*Version 2.0.6.3*

BGS ID: 15934454 : BGS Reference: TL52SW153

British National Grid (27700) : 551980,221330

[Report an issue with this borehole](#)

<<

< **Prev**

Page 1 of 2 ▾

Next >

>>

---

Rust Environmental				Project		TKL Site, Stansted		Borehole		2			
Contractor				Drillco		Client		Mantle Estates Limited		Project No.		EGMLS258	
Method Equipment				Light Cable Percussion		Co-ordinates		G.L.		82.55mOD			
Boring Diameter				150mm to 5.95m		Start Date		11.09.96		Logged By		GRD	
Casing Diameter				150mm to 4.50m		Finish Date		11.09.96		Checked By		[Signature]	
Sample Depth	Sample Type	Casing Depth	Water Depth	S.P.T. N Value	Description	Depth	Legend	Level O.D.					
0.35	J	NIL	DRY	10	Very stiff desiccated brown and yellow-brown slightly sandy clay with some fine to medium chalk gravel, occasional quartz gravel and brick fragments (MADE GROUND)	0.00	[Cross-hatched Legend]	82.55					
0.50	S					0.70		81.85					
0.95	J	1.50	DRY	5	Stiff to very stiff brown slightly sandy silty clay with some chalk quartz gravel, brick and asphalt (MADE GROUND)	1.50	[Cross-hatched Legend]	81.05					
1.25	J					1.75		80.80					
1.50	S	1.50	DRY	6	Firm to stiff dark yellow-brown silty sandy clay with some chalk gravel (MADE GROUND)	2.00	[Cross-hatched Legend]	80.55					
1.95	J					2.50		80.55					
2.25	J	1.50	DRY	6	Brick rubble in a black clayey silty sand matrix (MADE GROUND)	2.95	[Cross-hatched Legend]	79.05					
2.50	S					3.25							
2.95	J	1.50	DRY	7	Very stiff, locally stiff to very stiff dark grey and dark grey-brown slightly sandy silty clay with a little chalk and quartz gravel and a little asphalt and brick fragments (MADE GROUND)	3.50	[Cross-hatched Legend]	78.05					
3.25	J					4.25							
3.50	S	1.50	DRY	7	Soft to firm dark yellow-brown and brown slightly sandy silty organic CLAY with occasional fine gravel. Occasional lenses of brown fibrous peat (ALLUVIUM)	4.50	[Cross-hatched Legend]	76.55					
3.95	J					4.50			76.55				
4.25	J	4.50	DAMP	(20)	Soft to firm brown, light brown and light grey slightly sandy silty CLAY with occasional fine chalk gravel (ALLUVIUM)	4.90	[Cross-hatched Legend]	76.05					
4.50	J					6.00			76.05				
4.50	U	4.50	DAMP	(35)	Firm to stiff brown and light grey slightly sandy silty CLAY (WEATHERED LONDON CLAY)	6.50	[Cross-hatched Legend]	75.60					
4.90	J					6.50			75.60				
6.00	J	4.50	DAMP	(35)	Very stiff fissured dark grey silty CLAY (LONDON CLAY)	6.95	[Cross-hatched Legend]	75.60					
6.50	U					6.95							
6.50	J	4.50	DAMP	(35)	Base of Borehole	6.95	[Cross-hatched Legend]	75.60					
6.95	J					6.95							

Progress/Groundwater							Remarks	
Date/Time	Hole Depth	Casing Depth	Water Depth	Depth Struck	Depth After 20 mins	Depth Sealed		
11.09.96 1:00pm	4.00	NIL	4.00	3.95	SEEPAGE	4.50	Pushing brick ahead of drilling from 5.20m to 6.00m (¼ hour chiselling). Borehole backfilled with site spoil from 6.95m to 6.00m depth. Standpipe installed to 6.00m depth with pea gravel response zone to 0.50m depth. Bentonite seal to ground level. Standpipe topped with gas valve and stopcock cover.	
11.09.96 2:00pm	6.95	4.50	DRY					
11.09.96 2:30pm	6.95	NIL	6.70					

Ref:RBHLS95.1



## **Appendix E Existing Surface Water Calculations**

EXISTING SURFACE WATER



Existing site information:

Site Boundary Area	3380.829	m2
Developable Area	0.34	ha
Impermeable Area	0.06	ha

Modified Rational Method Equation:

$$Q_n = 2.78 CiA$$

where:

- C      *Runoff Coeffic* =            1 (in this case 1 as using impermeable area)
- $i_n$       *Rainfall Intensity for n return period (mm/hr)*
- A      *Impermeable Area (Ha)*
- $Q_n$       *Runoff for n return period (l/s)*

The rainfall intensities for various return periods were extracted from Table 1(a) of the Transport and Road Research Laboratory Report - Estimated rainfall for drainage calculations in the United Kingdom (TRRL Report LR 595) by C. P. Young. For the 5 min duration.

$i_1$	50.8 mm/hr
$i_{30}$	113.02 mm/hr
$i_{100}$	143.9 mm/hr

Existing Surface Water Runoff:

Therefore:

				C		$i_n$		A		$Q_n$	
$Q_1$	2.78	x	1	x	50.8	x	0.06	=	<b>8.17</b>	<b>l/s</b>	
$Q_{30}$	2.78	x	1	x	113.0	x	0.0578325	=	<b>18.17</b>	<b>l/s</b>	
$Q_{100}$	2.78	x	1	x	143.9	x	0.0578325	=	<b>23.14</b>	<b>l/s</b>	

3rd Floor, The Hallmark Building  
52-56 LeadenHall Street  
London, EC3M 5JE



Date 03/07/2023 16:19

Designed by mgrabowiecka

File Source Control\_Porous Paving\_...

Checked by

Innovyze

Source Control 2020.1

### Greenfield Runoff Volume

#### FSR Data

Return Period (years)	100
Storm Duration (mins)	360
Region	England and Wales
M5-60 (mm)	19.500
Ratio R	0.433
Areal Reduction Factor	1.00
Area (ha)	1.000
SAAR (mm)	605
CWI	87.900
Urban	0.000
SPR	30.000

#### Results

Percentage Runoff (%)	24.30
Greenfield Runoff Volume (m <sup>3</sup> )	144.016

3rd Floor, The Hallmark Building  
52-56 LeadenHall Street  
London, EC3M 5JE



Date 03/07/2023 16:15

Designed by mgrabowiecka

File Source Control\_Porous Paving\_...

Checked by

Innovyze

Source Control 2020.1

ICP SUDS Mean Annual Flood

Input

Return Period (years) 100 SAAR (mm) 603 Urban 0.000  
Area (ha) 1.000 Soil 0.300 Region Number Region 6

**Results 1/s**

QBAR Rural 1.5

QBAR Urban 1.5

Q100 years 4.9

Q1 year 1.3

Q30 years 3.5

Q100 years 4.9

## **Appendix F Proposed Surface Water Calculations**

3rd Floor, The Hallmark Building  
52-56 LeadenHall Street  
London, EC3M 5JE



Date 29/02/2024 11:32  
File 2304451\_OldCottage\_DRAFT.SRCX

Designed by Mgrabowiecka  
Checked by

Innovyze

Source Control 2020.1

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

Half Drain Time : 426 minutes.

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Control (l/s)	Max E Outflow (l/s)	Max Volume (m³)	Status
15 min Summer	78.812	0.552	0.0	1.8	1.8	41.8	O K
30 min Summer	78.892	0.632	0.0	1.9	1.9	54.8	Flood Risk
60 min Summer	78.958	0.698	0.0	1.9	1.9	66.7	Flood Risk
120 min Summer	79.006	0.746	0.0	1.9	1.9	75.9	Flood Risk
180 min Summer	79.022	0.762	0.0	1.9	1.9	79.1	Flood Risk
240 min Summer	79.025	0.765	0.0	1.9	1.9	79.7	Flood Risk
360 min Summer	79.012	0.752	0.0	1.9	1.9	77.2	Flood Risk
480 min Summer	78.997	0.737	0.0	1.9	1.9	74.3	Flood Risk
600 min Summer	78.982	0.722	0.0	1.9	1.9	71.3	Flood Risk
720 min Summer	78.968	0.708	0.0	1.9	1.9	68.6	Flood Risk
960 min Summer	78.943	0.683	0.0	1.9	1.9	63.8	Flood Risk
1440 min Summer	78.895	0.635	0.0	1.9	1.9	55.3	Flood Risk
2160 min Summer	78.827	0.567	0.0	1.8	1.8	44.0	O K
2880 min Summer	78.761	0.501	0.0	1.8	1.8	34.3	O K
4320 min Summer	78.638	0.378	0.0	1.7	1.7	19.6	O K
5760 min Summer	78.528	0.268	0.0	1.6	1.6	9.9	O K
7200 min Summer	78.431	0.171	0.0	1.5	1.5	4.0	O K
8640 min Summer	78.343	0.083	0.0	1.5	1.5	0.9	O K
10080 min Summer	78.260	0.000	0.0	1.3	1.3	0.0	O K
15 min Winter	78.849	0.589	0.0	1.8	1.8	47.5	O K
30 min Winter	78.934	0.674	0.0	1.9	1.9	62.3	Flood Risk
60 min Winter	79.005	0.745	0.0	1.9	1.9	75.8	Flood Risk
120 min Winter	79.063	0.803	0.0	2.0	2.0	87.0	Flood Risk
180 min Winter	79.084	0.824	0.0	2.0	2.0	91.1	Flood Risk

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
15 min Summer	138.148	0.0	43.7	26
30 min Summer	89.527	0.0	58.0	40
60 min Summer	55.250	0.0	72.5	68
120 min Summer	32.985	0.0	87.4	126
180 min Summer	24.100	0.0	96.1	184
240 min Summer	19.192	0.0	102.2	242
360 min Summer	13.831	0.0	110.7	334
480 min Summer	10.972	0.0	117.1	390
600 min Summer	9.161	0.0	122.3	452
720 min Summer	7.903	0.0	126.6	516
960 min Summer	6.256	0.0	133.4	652
1440 min Summer	4.494	0.0	143.4	924
2160 min Summer	3.224	0.0	153.6	1320
2880 min Summer	2.545	0.0	160.6	1704
4320 min Summer	1.821	0.0	170.6	2424
5760 min Summer	1.435	0.0	177.1	3112
7200 min Summer	1.193	0.0	181.9	3752
8640 min Summer	1.025	0.0	185.5	4416
10080 min Summer	0.901	0.0	188.3	0
15 min Winter	138.148	0.0	49.5	26
30 min Winter	89.527	0.0	65.5	40
60 min Winter	55.250	0.0	81.7	68
120 min Winter	32.985	0.0	98.4	124
180 min Winter	24.100	0.0	108.2	182

3rd Floor, The Hallmark Building  
52-56 LeadenHall Street  
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Innovyze

Source Control 2020.1

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

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (1/s)	Max Control (1/s)	Max E Outflow (1/s)	Max Volume (m³)	Status
240 min Winter	79.091	0.831	0.0	2.0	2.0	92.5	Flood Risk
360 min Winter	79.084	0.824	0.0	2.0	2.0	91.0	Flood Risk
480 min Winter	79.066	0.806	0.0	2.0	2.0	87.6	Flood Risk
600 min Winter	79.048	0.788	0.0	1.9	1.9	84.0	Flood Risk
720 min Winter	79.029	0.769	0.0	1.9	1.9	80.5	Flood Risk
960 min Winter	78.994	0.734	0.0	1.9	1.9	73.8	Flood Risk
1440 min Winter	78.929	0.669	0.0	1.9	1.9	61.2	Flood Risk
2160 min Winter	78.830	0.570	0.0	1.8	1.8	44.5	O K
2880 min Winter	78.733	0.473	0.0	1.7	1.7	30.6	O K
4320 min Winter	78.546	0.286	0.0	1.6	1.6	11.2	O K
5760 min Winter	78.368	0.108	0.0	1.5	1.5	1.6	O K
7200 min Winter	78.260	0.000	0.0	1.3	1.3	0.0	O K
8640 min Winter	78.260	0.000	0.0	1.1	1.1	0.0	O K
10080 min Winter	78.260	0.000	0.0	1.0	1.0	0.0	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
240 min Winter	19.192	0.0	115.0	238
360 min Winter	13.831	0.0	124.6	348
480 min Winter	10.972	0.0	131.8	448
600 min Winter	9.161	0.0	137.6	480
720 min Winter	7.903	0.0	142.4	556
960 min Winter	6.256	0.0	150.2	708
1440 min Winter	4.494	0.0	161.4	1002
2160 min Winter	3.224	0.0	172.9	1412
2880 min Winter	2.545	0.0	181.2	1796
4320 min Winter	1.821	0.0	192.5	2472
5760 min Winter	1.435	0.0	200.3	3056
7200 min Winter	1.193	0.0	206.1	0
8640 min Winter	1.025	0.0	210.4	0
10080 min Winter	0.901	0.0	213.9	0

3rd Floor, The Hallmark Building  
52-56 LeadenHall Street  
London, EC3M 5JE



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Source Control 2020.1

### Rainfall Details

Rainfall Model	FSR	Winter Storms	Yes
Return Period (years)	100	Cv (Summer)	0.750
Region	England and Wales	Cv (Winter)	0.840
M5-60 (mm)	19.500	Shortest Storm (mins)	15
Ratio R	0.433	Longest Storm (mins)	10080
Summer Storms	Yes	Climate Change %	+40

### Time Area Diagram

Total Area (ha) 0.186

Time (mins)	Area	Time (mins)	Area	Time (mins)	Area
From: To:	(ha)	From: To:	(ha)	From: To:	(ha)
0 4	0.062	4 8	0.062	8 12	0.062



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Model Details

Storage is Online Cover Level (m) 79.160

Porous Car Park Structure

Infiltration Coefficient Base (m/hr)	0.00000	Width (m)	60.9
Membrane Percolation (mm/hr)	1000	Length (m)	14.5
Max Percolation (l/s)	245.3	Slope (1:X)	15.0
Safety Factor	2.0	Depression Storage (mm)	5
Porosity	0.30	Evaporation (mm/day)	3
Invert Level (m)	78.260	Membrane Depth (m)	200

Hydro-Brake® Optimum Outflow Control

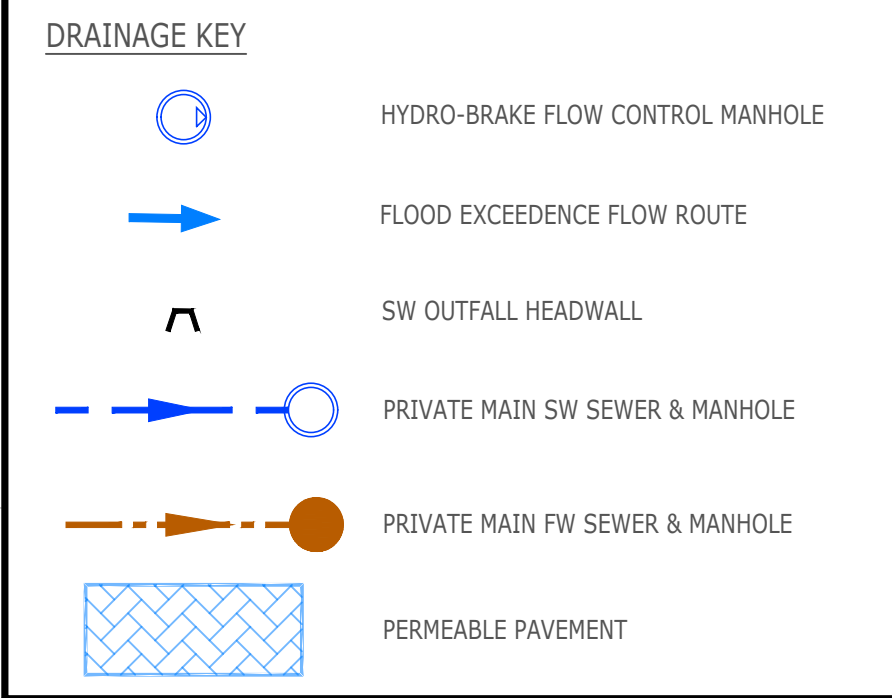
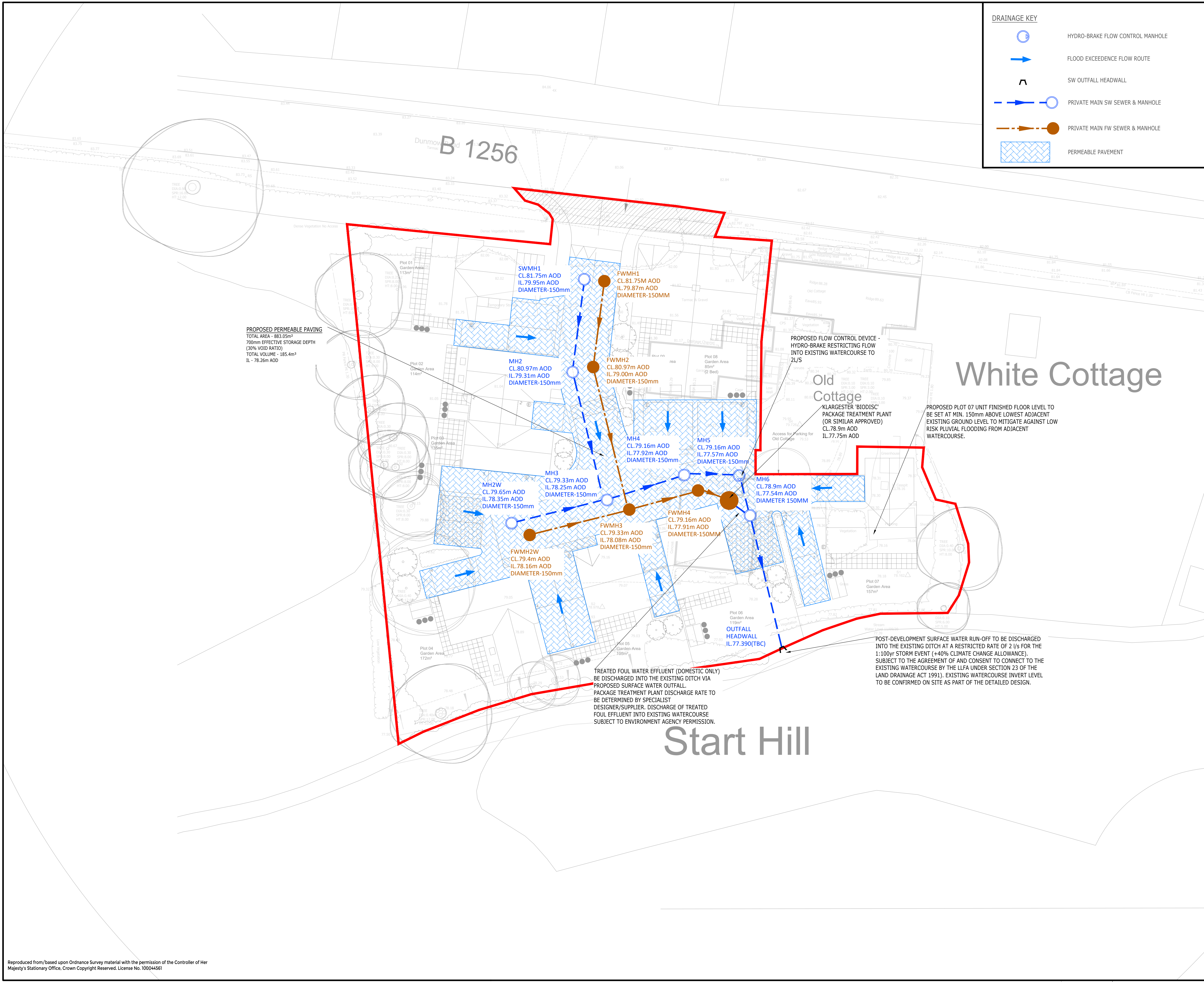
Unit Reference	MD-SHE-0060-1900-1390-1900
Design Head (m)	1.390
Design Flow (l/s)	1.9
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	60
Invert Level (m)	77.570
Minimum Outlet Pipe Diameter (mm)	75
Suggested Manhole Diameter (mm)	1200

Control Points	Head (m)	Flow (l/s)	Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	1.390	1.9	Kick-Flo®	0.540	1.2
Flush-Flo™	0.268	1.5	Mean Flow over Head Range	-	1.5

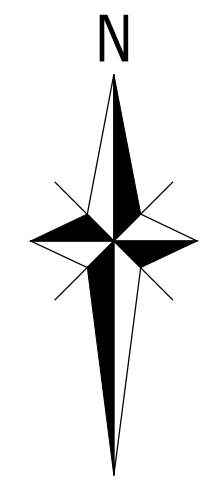
The hydrological calculations have been based on the Head/Discharge relationship for the Hydro-Brake® Optimum as specified. Should another type of control device other than a Hydro-Brake Optimum® be utilised then these storage routing calculations will be invalidated

Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.100	1.3	0.800	1.5	2.000	2.2	4.000	3.1	7.000	4.0
0.200	1.5	1.000	1.6	2.200	2.3	4.500	3.3	7.500	4.1
0.300	1.5	1.200	1.8	2.400	2.4	5.000	3.4	8.000	4.3
0.400	1.5	1.400	1.9	2.600	2.5	5.500	3.6	8.500	4.4
0.500	1.3	1.600	2.0	3.000	2.7	6.000	3.7	9.000	4.5
0.600	1.3	1.800	2.1	3.500	2.9	6.500	3.9	9.500	4.6





- NOTES**
- THIS DRAWING IS TO BE READ IN CONJUNCTION WITH THE RELEVANT SPECIFICATION AND ALL OTHER RELATED DRAWINGS ISSUED BY THE ENGINEER.
  - DO NOT SCALE FROM THIS DRAWING. WORK FROM FIGURED DIMENSIONS ONLY.
  - ALL DIMENSIONS SHOWN ON THIS DRAWING ARE IN METRES UNLESS OTHERWISE STATED.
  - ALL DIMENSIONS, LEVELS AND SURVEY GRID CO-ORDINATES ARE TO BE CHECKED ON SITE AND THE ENGINEER NOTIFIED IMMEDIATELY OF ANY DISCREPANCIES PRIOR TO THE COMMENCEMENT OF THE WORKS.
  - NO DEVIATION FROM THE DETAILS SHOWN ON THIS DRAWING IS PERMITTED WITHOUT PRIOR PERMISSION FROM THE ENGINEER.
  - BACKFILL SHOULD BE PLACED IN LAYERS NOT EXCEEDING 300mm (UNCOMPACTED THICKNESS), EACH LAYER BEING WELL COMPACTED. MECHANICAL COMPACTION EQUIPMENT SHOULD NOT BE USED UNTIL THERE IS A MINIMUM OF 450mm OF COMPACTED MATERIAL ABOVE THE CROWN OF THE PIPE.
  - THE DRAINAGE PROPOSALS HAVE BEEN BASED ON THE DEVELOPMENT MASTERPLAN LAYOUT PRODUCED BY JBELL DESIGN AND CONSERVATION LTD ARCHITECTURE, 2023-740-002, AS RECEIVED IN FEBRUARY 2024.
  - THIS DRAWING HAS BEEN BASED UPON A TOPOGRAPHICAL SURVEY PRODUCED BY BRD SUSTAINABLE ARCHITECTURE, DRAWING NUMBER BRD/20/032/002 FROM JULY 2021.



**PROPOSED PERMEABLE PAVING**  
 TOTAL AREA - 883.05m<sup>2</sup>  
 700mm EFFECTIVE STORAGE DEPTH  
 (30% VOID RATIO)  
 TOTAL VOLUME - 185.4m<sup>3</sup>  
 IL - 78.26m AOD

**PROPOSED FLOW CONTROL DEVICE -**  
 HYDRO-BRAKE RESTRICTING FLOW  
 INTO EXISTING WATERCOURSE TO  
 2 L/S

# White Cottage

PROPOSED PLOT 07 UNIT FINISHED FLOOR LEVEL TO BE SET AT MIN. 150mm ABOVE LOWEST ADJACENT EXISTING GROUND LEVEL TO MITIGATE AGAINST LOW RISK PLUVIAL FLOODING FROM ADJACENT WATERCOURSE.

**Old Cottage**  
 'KLARGESTER BIODISC' PACKAGE TREATMENT PLANT (OR SIMILAR APPROVED)  
 CL.78.9m AOD  
 IL.77.75m AOD

TREATED FOUL WATER EFFLUENT (DOMESTIC ONLY) BE DISCHARGED INTO THE EXISTING DITCH VIA PROPOSED SURFACE WATER OUTFALL. PACKAGE TREATMENT PLANT DISCHARGE RATE TO BE DETERMINED BY SPECIALIST DESIGNER/SUPPLIER. DISCHARGE OF TREATED FOUL EFFLUENT INTO EXISTING WATERCOURSE SUBJECT TO ENVIRONMENT AGENCY PERMISSION.

POST-DEVELOPMENT SURFACE WATER RUN-OFF TO BE DISCHARGED INTO THE EXISTING DITCH AT A RESTRICTED RATE OF 2 L/S FOR THE 1:100yr STORM EVENT (+40% CLIMATE CHANGE ALLOWANCE). SUBJECT TO THE AGREEMENT OF AND CONSENT TO CONNECT TO THE EXISTING WATERCOURSE BY THE LPA UNDER SECTION 23 OF THE LAND DRAINAGE ACT 1991). EXISTING WATERCOURSE INVERT LEVEL TO BE CONFIRMED ON SITE AS PART OF THE DETAILED DESIGN.

NOTE: DETAILS STATED ARE INDICATIVE AT THIS STAGE AND SUBJECT TO DETAILED DESIGN ONCE THE DEVELOPMENT PROPOSALS HAVE BEEN FINALISED

NOTE: ALL PIPE SIZES AND GRADIENTS ARE INDICATIVE AND ARE SUBJECT TO DETAILED MODELING INCLUDING ACCURATE PIPE SIZING. ALL LEVELS SHOWN ARE INDICATIVE AND SUBJECT TO A DETAILED LEVEL REVIEW.

NOT FOR CONSTRUCTION FOR INFORMATION ONLY

Rev	Description	Dm	Chk	App	Date
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**ARDENT CONSULTING ENGINEERS**

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 E-mail: enquiries@ardent-ce.co.uk



Client: **The Spartan Group**

Project Title: **Old Cottage, Start Hill Stane Street**

Drawing Title: **PRELIMINARY FOUL & SURFACE WATER DRAINAGE STRATEGY**

Scale	Date	Designed by
1:100	FEBRUARY 2024	MG
Drawn by	Checked by	Approved by
MG	VL	CC

Drawing Number: **2304451-D-01** Rev: -



## **Appendix G Foul Water Calculations**



EXISTING FOUL WATER

Unit Type	Existing Area/Units		Hours (hrs)	Foul Water Flow Rate l/day		Peak Factor	Peaked Loading l/s		Loading (l/s)
The existing site is occupied by 2 residential properties	2	per property	24	600	per property	6.6	0.0458333	per property	0.092
<b>TOTAL PROPOSED FOUL LOADING</b>									<b>0.092</b>

PROPOSED FOUL WATER

Unit Type	Proposed Area/Units		Hours (hrs)	Foul Water Flow Rate l/day		Peak Factor	Peaked Loading l/s		Loading (l/s)
General housing	9	per property	24	600	per property	6.6	0.045833	per property	0.413
<b>TOTAL PROPOSED FOUL LOADING</b>									<b>0.413</b>

**PRELIMINARY DRAINAGE CALCULATIONS**

05/07/2023

	<b>Dry weather flow (in litres per day)</b>	<b>Daily Discharge (in litres)</b>
General Housing per property	600	4000
School per pupil	80	528
Assembly Hall per seat	10	66
Cinema per seat	10	66
Theatre per seat	10	66
Sports Hall per person	50	330
Hotel per room	550	3630
Guest House per room	200	1320
Motel per room	300	1980
Holiday Apartment per person	150	990
Leisure Park per person	220	1452
Caravan Pk standard per space	250	1650
Caravan Site serviced per space	450	2970
Camping site standard per space	200	1320
Camping site serviced per space	350	2310
Restaurant/Day Care Centre per person	270	1782
Drive in restaurant per seat	380	2508
Hospital per bed	750	4950
Nursing/Care Home per bed	375	2475
Offices per 100m sq	750	4950
Shopping Centre per 100m sq	400	2640
Warehouse per 100m sq	150	990
Commercial premises per 100 m sq	300	1980
Manufacturing unit per 100m sq	550	3630
General Housing per person	150	-
Toilet Facilities (WC) per use	10	-