

THAMES VALLEY SERVICE STATION, GEORGE STREET

CAVERSHAM

RG4 8DH

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FLOOD RISK ASSESSMENT & DRAINAGE STRATEGY

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FROWSBURY PROJECTS LIMITED

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2. Existing Site Conditions

2.1 Location

The site is located at Thames Valley Service Station, George Street, Caversham, Berkshire, RG4 8DH. The British National Grid Reference is E:471951 N:174409. The figures below show the Site in the wider area, more locally and then an aerial image to show the Site in its current context.

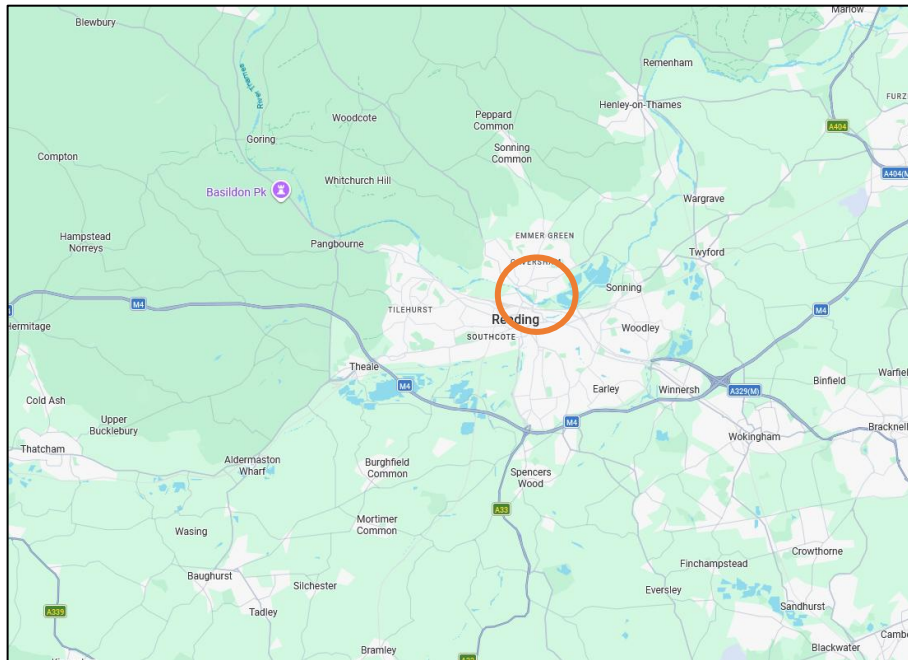


Figure 2-1 – Site Location (shown by orange circle) ©Google Maps

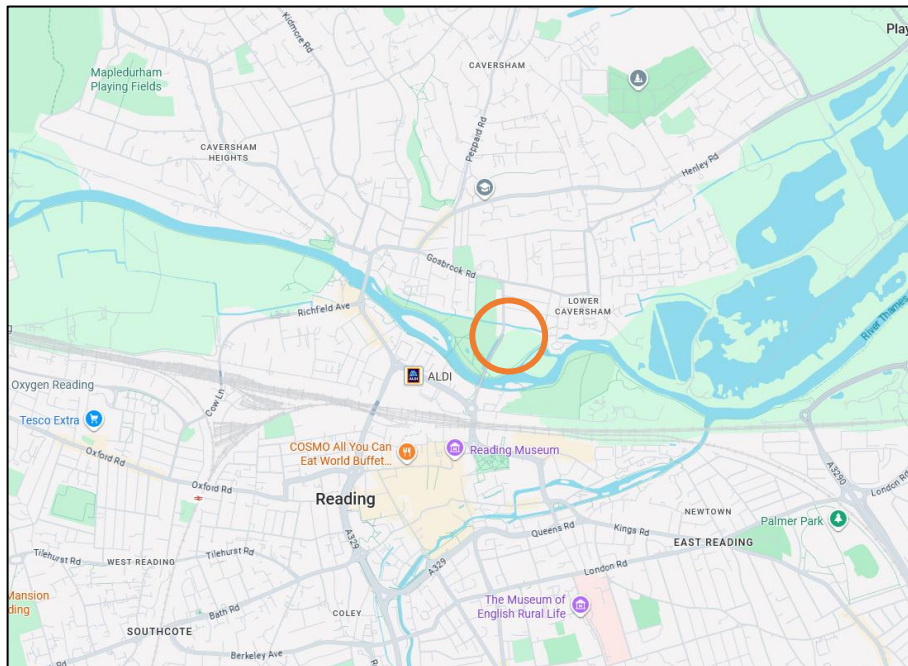


Figure 2-2 – Site Location (shown by orange circle) ©Google Maps

The following aerial image provides additional information about the context of the Site and surrounding areas.



Figure 2-3 – Site Location (approximate Site boundary in orange) ©Google Maps

The site is currently an active service station and is bounded by George Street to the West, residential properties to the north and a wooded publicly accessible park to the east and south.

The existing impermeable areas are shown in the following figure and can be summarised as follows:

Table 2-1 – Pre-Development Drained Areas

Area Description	Area (m ²)
Existing Impermeable Hardstandings (Positively Drained)	1,444
Existing Impermeable Hardstandings (Not Positively Drained)	0
Existing Fully Permeable Hardstandings (Type A)	0
Existing Permeable Hardstandings (Type B/C)	0
Existing Roof Area	524
Total Existing Drained Area	1,968
Total Site Area	2,422



Figure 2-4 – Drained Areas Analysis Extract – Pre-Development

2.2 Site Topography

The site is generally flat in nature.

2.3 Site Geology

A review of the BGS online bedrock mapping tool identified that the development is likely underlain by the Seaford Chalk Formation and Newhaven Chalk Formation (Chalk), with respect to bedrock. The BGS indicates that the site sits across two superficial deposit layers with a third to the north. The majority of the site is underlain by Langley Silt Member (Clay and Silt), with the minority underlain by Alluvium (Clay, silt, sand and gravel). The northern boundary of the site may be underlain by the Kempton Park Gravel Member (Sand and Gravel).

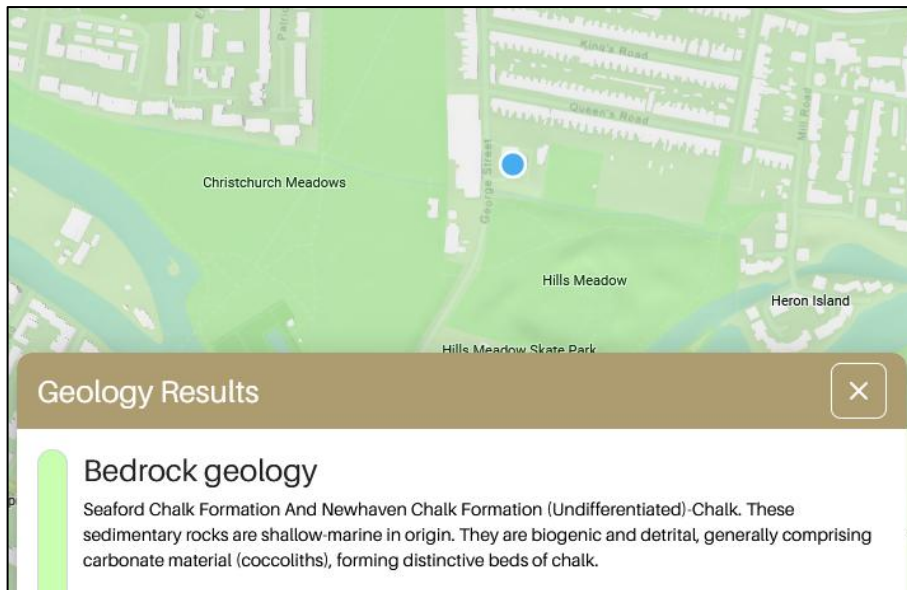


Figure 2-5 – British Geological Survey Extract – Bedrock Geology - ©BGS

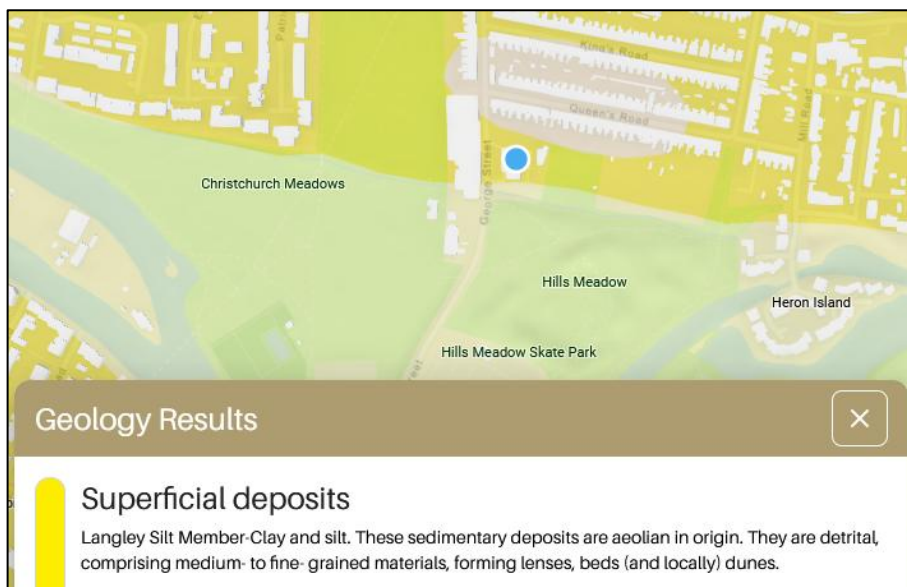


Figure 2-6 – British Geological Survey Extract – Bedrock Geology - ©BGS

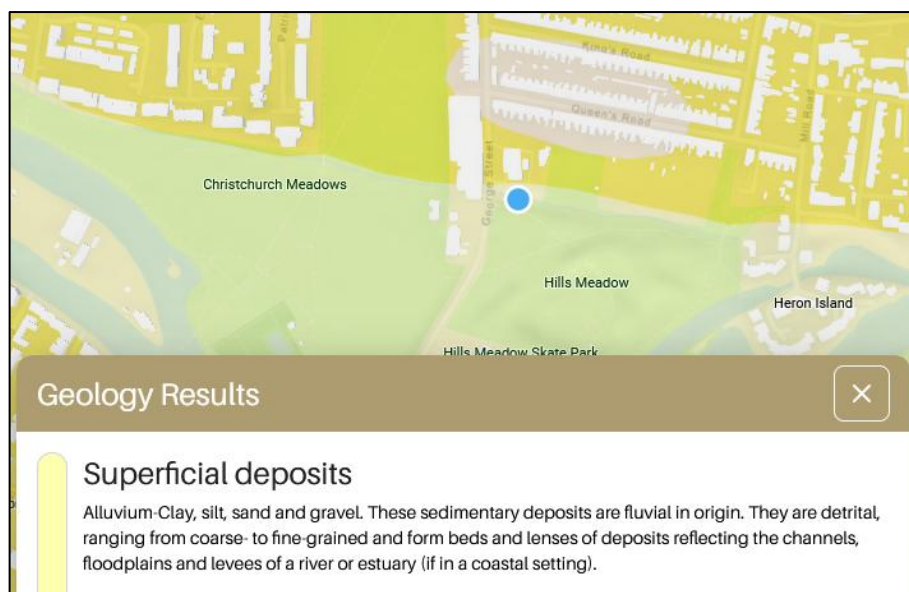


Figure 2-7 – British Geological Survey Extract – Bedrock Geology - ©BGS

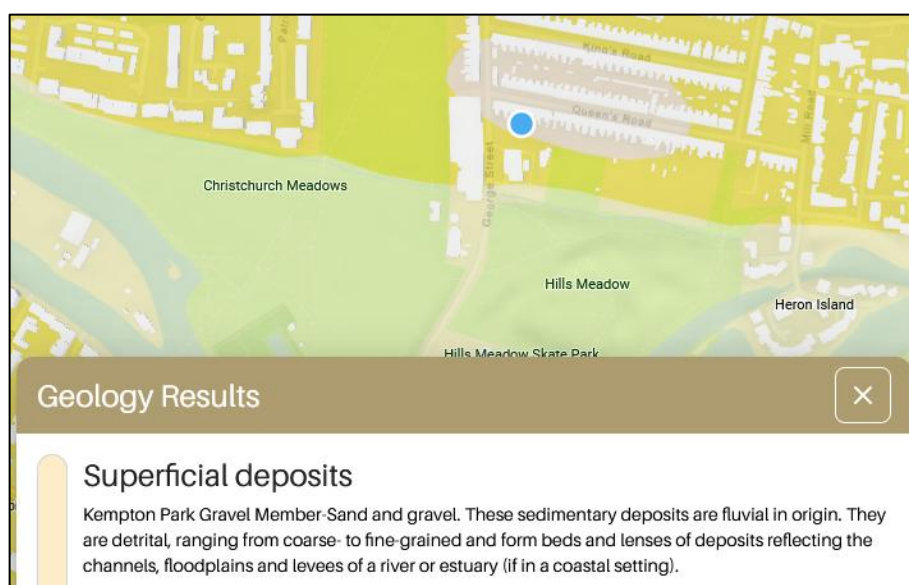


Figure 2-8 – British Geological Survey Extract – Superficial Geology - ©BGS

2.4 Hydrogeology and Hydrology

The Environment Agency provide information for groundwater and aquifers. The following extracts identify the groundwater source protection, aquifer designation and groundwater vulnerability at the Site.

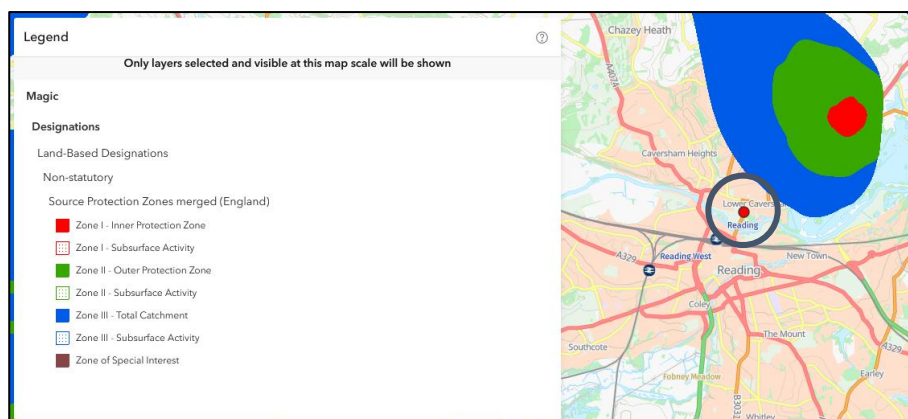


Figure 2-9 – Groundwater Source Protection Zones - ©Landmark Solutions

As defined within the figure above, the site is not within a source protection zone.

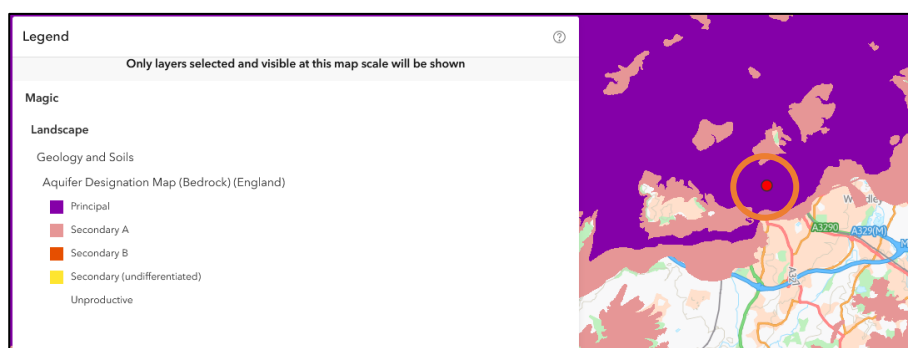


Figure 2-10 – Aquifer Designation Map - ©Landmark Solutions

As defined within the figure above, site is above a Principal Aquifer.

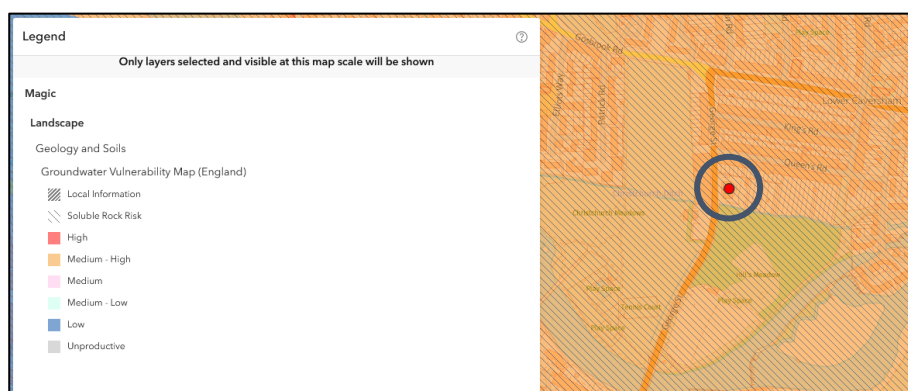


Figure 2-11 – Groundwater Vulnerability Map - ©Landmark Solutions

As defined within the previous figure, the site is in a Medium-High groundwater vulnerability zone and is denoted as a soluble rock risk.

2.4.1 Source, Pathway, Receptor Model

The risk of pollution can be assessed using the Source, Pathway, Receptor model as follows.

Source – there are two sources of potential contamination on the Site. Firstly, contamination as a result of current and previous Site activities and secondly from the proposed Site activities. The existing site is a service station with fuel and basic vehicle services. The proposal includes the addition of 4no. jet washes, three valeting bays and associated works. Thus, although this increases the risk, it is marginal when compared with the pre-development risk. The risk remains high.

Pathway – the pathway is the vertical movement of water through the subsoils and the bedrock. This can be by direct surface down soakage or from drainage features such as soakaways or other infiltration systems. Given the strata, it is likely that infiltration is poor at the site. Therefore, the risk is low.

Receptor – the receptor is the actual uses of groundwater that receives flow from the vicinity of the discharge, such as groundwater, watercourses etc. Relevant mapping suggests that the site is not above an aquifer or within a source protection zone. Therefore, the risk is low.

3. Proposed Development

The proposal is for the installation of 4no. jet washes, 3no. valeting bays and associated works. The following figure shows the Architect's current proposals.



Figure 3-1 – Development Proposals

The proposed impermeable areas are shown in the following figure and can be summarised as follows:

Table 3-1 – Post-Development Drained Areas

Area Description	Area (m ²)
Proposed Impermeable Hardstandings (Positively Drained)	1,193
Proposed Impermeable Hardstandings (Not Positively Drained)	0
Proposed Fully Permeable Hardstandings (Type A)	0
Proposed Permeable Hardstandings (Type B/C)	0
Proposed Roof Area	568
Total Proposed Drained Area	1,761
Total Site Area	2,422



Figure 3-2 – Drained Areas Analysis Extract – Post-Development

As can be seen within the previous extract and associated table, the drained areas reduce by 207m². However, the National Standards for SuDS applies to brownfield sites and any redeveloped areas requires a SuDS solution appropriate for the location. Therefore, an assessment has been made against the area that shall be redeveloped to allow for the determination of appropriate control measures.

The following identifies the area subject to redevelopment. The jet wash bays are to discharge foul flows and shall therefore be separated from the surface water network. All other areas of the site are to remain unchanged and therefore can drain as existing.



Figure 3-3 – Drained Areas Analysis Extract – Brownfield Development Area

It is evident that the brownfield development area to be positively drained is 265m².

As the site is for commercial use, urban creep does not need to be allowed for.

4. Flood Risk

This Flood Risk Assessment (FRA) has been produced in accordance with current best practice, recommendations and guidance set out in the National Planning Policy Framework (NPPF) and associated documents valid at the time of writing.

4.1 Criteria

As according to the NPPF, a site typically requires a site specific FRA for all development in Flood Zones 2 and 3. In Flood Zone 1, an assessment should accompany all proposals involving: sites of 1ha or more; land which has been identified by the Environment Agency as having critical drainage problems; land identified in a Strategic Flood Risk Assessment (SFRA) 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.

4.2 Flood Risk Zones

The PPG defines a number of flood zones based on the probability of flooding. It also provides guidance on the most appropriate form of development within each zone. The flood risk is summarised as below.

Table 4-1 – Flood Zone Definitions

Flood Zone	Definition
Zone 1 – Low Probability	Land having a less than 0.1% (1 in 1000) annual probability of river or sea flooding.
Zone 2 – Medium Probability	Land having between a 1% and 0.1% (1 in 100 and 1 in 1000) annual probability of river flooding; or land having between a 0.5% and 0.1% annual probability of sea flooding.
Zone 3a – High Probability	Land having a 1% (1 in 100) or greater annual probability of river flooding; or Land having a 0.5% (1 in 200) or greater annual probability of sea.
Zone 3b – The Functional Floodplain	This zone comprises land where water from rivers or the sea has to flow or be stored in times of flood. The identification of functional floodplain should take account of local circumstances and not be defined solely on rigid probability parameters. Functional floodplain will normally comprise: - land having a 3.3% or greater annual probability of flooding, with any existing flood risk management infrastructure operating effectively; or - land that is designed to flood (such as a flood attenuation scheme), even if it would only flood in more extreme events (such as 0.1% annual probability of flooding). Local planning authorities should identify in their Strategic Flood Risk Assessments areas of functional floodplain and its boundaries accordingly, in agreement with the Environment Agency.

4.3 Strategic Flood Risk Assessment (SFRA)

Reading Borough Council list a Level 1 SFRA, published in June 2017 and a Level 2 SFRA published in December 2017 which were prepared for Reading Borough Council by Peter Brett. This report is aware of more recent draft documentation partially available through online searches, but the information available is incomplete.

Therefore the officially published SFRA has been reviewed and used to inform this report.

4.4 Surface Water Management Plan (SWMP)

There does not appear to be a recent and applicable SWMP publicly available at the time of writing.

4.5 Historic Flooding

The SFRA reviews historic flooding and the following sections summarise the findings within these reports.

4.5.1 Fluvial Flooding

The SFRA reports historical flooding within the vicinity of the site in March 1947, August 1977 and January 2003. The site is denoted as a historic flood plain.

4.5.2 Surface Water Flooding

There was no historical flooding within the vicinity reported within the SFRA.

4.5.3 Flooding from Sewers

There was no historical flooding within the vicinity reported within the SFRA.

4.5.4 Groundwater Flooding

There was no historical flooding within the vicinity reported within the SFRA.

4.6 Flood Risk from Rivers & Sea

A review of the Environment Agency's online mapping tools has identified that the site is within Flood Zone 2 and 3, an area at medium and high probability of flooding from Rivers and Sea.

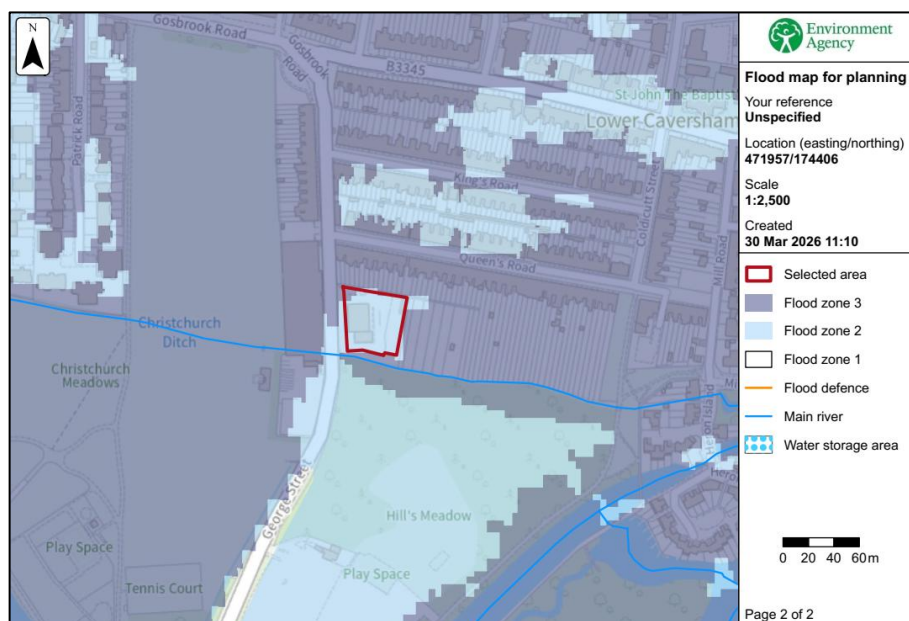


Figure 4-1 – Extract of the Environment Agency's Flood Map for Planning

Flood Zone 2 comprises land having between a 1% and 0.1% (1 in 100 and 1 in 1000) annual probability of river flooding; or land having between a 0.5% and 0.1% annual probability of sea flooding.

Flood Zone 3 comprises land having a 1% (1 in 100) or greater annual probability of river flooding; or Land having a 0.5% (1 in 200) or greater annual probability of sea.

Therefore, the risk of flooding, for the wider site, from rivers or sea is medium to high. The development area is at medium risk of flooding.

4.7 Flood Risk from Surface Water

A review of the Environment Agency's online mapping tools suggests that the site is at very low risk of flooding from surface water, including consideration of climate change.



Figure 4-2 – Extract of the Environment Agency's Long Term Surface Water Flood Risk Mapping (including climate change allowance)

The risk of flooding from surface water is low.

4.8 Flood Risk from Groundwater

The SFRA suggests the site is within a 1km x 1km grid of which 25% to 50% of the area may be susceptible groundwater flooding. The Environment Agency website suggests that the site is not likely at risk of flooding from groundwater.

Therefore, the risk of flooding from groundwater is considered low.

4.9 Flood Risk from Reservoirs

The Environment Agency online resources suggests that flooding from the breach of a reservoir is possible at the site however, suggests the likelihood as extremely unlikely.

The reservoirs identified that could affect the site are:

Farmoor No.1, owned by Thames Water Limited
Farmoor No. 2, owned by Thames Water Limited

Given these assets will have a strict management regime, the likelihood of failure is very low.

Therefore, the risk of flooding from reservoirs is considered low.

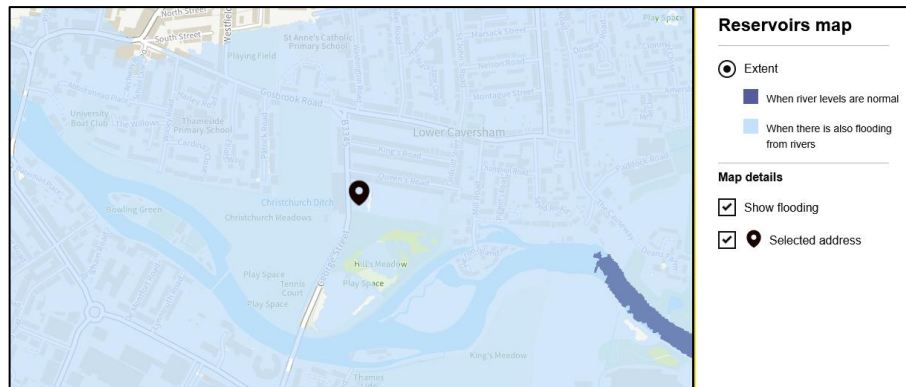


Figure 4-3 – Extract of the Environment Agency's Long Term Reservoir Flood Risk Mapping (including climate change allowance)

4.10 Flood Risk from Public Sewers, Highways and Private Drains

4.10.1 Public Sewers

There are no known historic flood events within the immediate vicinity of the Site, nor any known public sewers within the Site.

Thus, the risk to this development Site is considered low.

4.10.2 Highways Drainage

There are no known historic flood events at the Site, nor any known highways drainage within the Site.

Thus, the risk to this development Site is considered low.

4.10.3 Private Drainage

There are no known issues with the private drainage on Site. Any new drainage would be installed in accordance with current standards.

Thus, the risk for this development Site is considered low.

4.11 Sequential Test

4.11.1 Policy Context

The NPPF requires a sequential risk-based approach to individual applications in areas known to be at risk from any form of flooding (Paragraph 173). This requires the application of the sequential test to the consideration of planning applications if built development (including access or escape routes) is proposed on an area within the development Site at risk of flooding from any source, now or in the future (Paragraph 175).

The Planning Practice Guidance makes clear that in applying NPPF paragraph 175, a proportionate approach should be taken. Where a site-specific flood risk assessment demonstrates clearly that the proposed layout, design, and mitigation measures would ensure that occupiers and users would remain safe from current and future surface water flood risk for the lifetime of the development (therefore addressing the risks identified e.g. by EA flood risk mapping), without increasing flood risk elsewhere, then the sequential test need not be applied.

4.11.2 Implications for the Proposed Development

The primary risk to the site is fluvial flooding.

The proposed development includes the provision of 4no. jet washes, 3no. valeting bays and associated works to an existing vehicle service station. The site layout has been developed sequentially, siting the re-developed areas within Flood Zone 2, the lowest risk area within the site. There is no increased risk to the access or escape routes nor the function or vulnerability use of the site.

Accordingly, the provisions of the Sequential Test have been passed.

4.12 Vulnerability Classification

Although the existing site comprises a fuel station, the brownfield re-development area comprises only of non-essential services.

The technical guidance for the NPPF indicates that development of this nature, are classified as “less vulnerable”.

The technical guidance for the NPPF also includes a list of appropriate land uses in each flood zone dependant on vulnerability to flooding as represented in the following table.

Table 4-2 – Flood Risk Vulnerability and Flood Zone Compatibility

Flood Risk Vulnerability Classification		Essential Infrastructure	Water Compatible	Highly Vulnerable	More Vulnerable	Less Vulnerable
Flood Zone	Zone1	Development is appropriate	Development is appropriate	Development is appropriate	Development is appropriate	Development is appropriate
	Zone 2	Development is appropriate	Development is appropriate	Exception Test Required	Development is appropriate	Development is appropriate
	Zone 3a	Exception Test Required	Development is appropriate	Development should not be permitted	Exception Test Required	Development is appropriate
	Zone 3b Functional Floodplain	Exception Test Required	Development is appropriate	Development should not be permitted	Development should not be permitted	Development should not be permitted

4.13 Flood Risk Summary

The site has been assessed in accordance with the latest guidance provided within the NPPF and supplementary guidance documents.

The potential flood risk at the development Site has been summarised below:

Table 4-3 – Flood Risk Summary (Whole Site)

Source	Risk
Rivers (Fluvial)	Medium - High
Sea (Tidal)	Low
Surface Water (Pluvial)	Low
Groundwater	Low
Reservoirs	Low
Public Sewers	Low
Highways Drainage	Low
Private Drainage	Low

The potential flood risk to the brownfield re-development area has been summarised below:

Table 4-4 – Flood Risk Summary (Brownfield Re-Development Area)

Source	Risk
Rivers (Fluvial)	Medium
Sea (Tidal)	Low
Surface Water (Pluvial)	Low
Groundwater	Low
Reservoirs	Low
Public Sewers	Low
Highways Drainage	Low
Private Drainage	Low

Having considered the potential sources of flooding, most have been identified as having a low risk to the development area. It is believed that the main risk of flooding to the development area is Fluvial and Reservoir flooding.

5. Surface Water Strategy

5.1 Existing Surface Water Strategy

As identified earlier in this report, the site currently an active service station.

A review of the BGS online bedrock mapping tool identified that the development is likely underlain by the Seaford Chalk Formation and Newhaven Chalk Formation (Chalk), with respect to bedrock. The BGS indicates that the site sits across two superficial deposit layers with a third to the north. The majority of the site is underlain by Langley Silt Member (Clay and Silt), with the minority underlain by Alluvium (Clay, silt, sand and gravel). The northern boundary of the site may be underlain by the Kempton Park Gravel Member (Sand and Gravel). The geology suggests that infiltration potential would be low at the site.

The existing site drainage is understood to discharge surface water to the south into Christchurch Ditch (denoted as a Statutory Main River). It is unknown if the existing site discharge is restricted, however the lack of known attenuation infers that the discharge is at an unrestricted rate.

The existing runoff rates have been explored in the next section.

5.2 Existing Runoff Rates

The existing runoff rates have been calculated using HR Wallingford, specifically the IH124 methodology. The following table outlines the greenfield runoff rates for the existing Site.

Table 5-1 – Greenfield Runoff Rates obtained from HR Wallingford

Event	Proposed Drained Area (0.0265ha) (l/s)
Qbar	0.01
1:2 year (50% AEP)	0.01
1:30 year (3.3% AEP)	0.01
1:100 year (1% AEP)	0.01

In the event that surface water needs to be discharged offsite, it should be restricted to the greenfield runoff rates. In this instance and where practicable, any offsite discharge should be restricted to Qbar (0.01l/s) for all events up to and including 1:100 year event with climate change allowance.

Due to the operational constraints of flow controls, it is proposed that discharge is restricted to 1l/s to minimise the risk of blockages and failures. This is still a significant improvement against the pre-development brownfield scenario, whereby flows were entirely unrestricted. Thus, this offers alleviation to the downstream watercourse.

5.3 Managing Surface Water

The management of surface water has been considered in accordance with current best practice, recommendations and guidance set out in the National Planning Policy Framework (NPPF) and associated documents valid at the time of writing.

To mimic natural catchment processes as closely as possible, the following discharge hierarchy has been applied:

1. **Prevention** – Preventing runoff by reducing impermeable areas or good housekeeping measures for reducing pollution.
2. **Source Control** – Manage runoff at or near to its source. Examples include green roofs, permeable pavements, rainwater harvesting.
3. **Site Control** – Manage runoff within a development site. Examples include infiltration structures, attenuation structures, conveyance structures.
4. **Regional Control** – Manage runoff across a series of sites or within the wider strategic development. Strategic controls often include open structures such as ponds, basins, etc.
5. **Interception** – Methods for retaining the first 5mm of rainfall on site in accordance with the National SuDS Standards.

The following sections identify the methodologies applicable to this development Site.

5.3.1 Prevention

The following table identifies prevention methods considered.

Table 5-2 – Prevention Methods

Method	Notes	Applied?
Reduction in Impermeable Areas	The development area is fixed with consideration of wider stakeholder requirements. Impermeable areas have been kept to the minimum operational requirements.	Yes
Pollution Control	The control of pollution has been considered and the following measures have been applied: • Catchpits / Sumps on the drainage network. • Site Control of pollution through utilisation of a proprietary treatment system. Pollution indices calculations have been appended to this report.	Yes

5.3.2 Source Control

The following table identifies source control methods considered.

Table 5-3 – Source Control Methods

Method	Notes	Applied?
Permeable Pavements (Type A & B)	The site use precludes the use of permeable pavements.	No
Green Roofs	The proposed roofs do not lend themselves to facilitate green roofs due to the proposed rooflines.	No
Rainwater Harvesting	Due to the nature of the development, rainwater harvesting has been discounted.	No
Raingardens	Due to the existing nature of the development and associated site levels, there is limited opportunity for utilising raingardens to capture runoff from hardstandings.	No

5.3.3 Site Control

The following table identifies Site control methods considered.

Table 5-4 – Site Control Methods

Method	Notes	Applied?
Swales	The site layout does not naturally lend itself to the use of swales. Therefore, swales have been discounted from this development.	No
Soakaways	Given the anticipated ground conditions at the site, infiltration is unlikely viable and therefore soakaways discounted.	No
Infiltration Basins	There is insufficient space to utilise infiltration basins.	No
Raingardens	Due to the existing nature of the development and associated site levels, there is limited opportunity for utilising raingardens to capture runoff from hardstandings.	No
Filter Trenches	The Site layout does not naturally lend itself to the use of filter trenches. Therefore, filter trenches have been discounted from this development.	No
Filter Strips	The site layout does not naturally lend itself to the use of filter strips. Therefore, filter strips have been discounted from this development.	No
Attenuation Basins	There is insufficient space to utilise attenuation basins.	No
Ponds	There is insufficient space to utilise attenuation basins.	No
Attenuation Tanks	Attenuation tanks have been proposed at this development for volume control purposes.	Yes
Wetlands	The Site layout does not naturally lend itself to the use of wetlands. Therefore, wetlands have been discounted from this development.	No

5.3.1 Regional Control

The site does not benefit from any wider strategic regional control option.

5.3.2 Interception

Although the methodologies for control of surface water have been explored in the previous sections. The following table identifies how the selected control measures intercept the first 5mm of rainfall at the development.

Table 5-5 – Interception Methods

Method	Notes	Applied?
Green Roofs or Walls	The Site layout does not naturally lend itself to the use of green roofs or walls. Therefore, green roofs and walls have been discounted from this development.	No
Rainwater Harvesting	Due to the nature of the development, rainwater harvesting has been discounted.	No
Infiltration Systems	Given the anticipated ground conditions at the site, infiltration is unlikely viable and therefore infiltration techniques have been discounted.	No
Permeable / Porous surfaces	The site use precludes the use of permeable pavements.	No
Swales	The Site layout does not naturally lend itself to the use of swales. Therefore, swales have been discounted from this development.	No
Attenuation Basins	There is insufficient space to utilise attenuation basins.	No
Bio-retention / Rain Gardens	Due to the existing nature of the development and associated site levels, there is limited opportunity for utilising raingardens to capture runoff from hardstandings.	No

5.4 Development Surface Water Proposals

5.4.1 Climate Change

The national policy for climate change allowance changed in 2022, requiring developments to consider the 1:30 year event plus an allowance for climate change allowance and the 1:100 year event plus an allowance for climate change. The climate change allowance varies between areas and a site-specific assessment of the required climate change allowance is required by referring to the Department for Environment, Food and Rural Affairs (DEFRA) online tool. Designs should consider the upper end climate change allowance for the relevant design epoch.

A summary of the allowances for this particular Site can be found within the following table.

Table 5-6 – Climate Change Allowances

Peak Rainfall Climate Change Allowances		
Epoch	2050s	2070s
1:30 year (3.3% AEP)	35%	35%
1:100 year (1% AEP)	40%	40%

Based on the previous table, the following events and respective climate change allowance should be considered for the development: 1:30 year event plus 35% climate change allowance, and the 1:100 year event plus 40% climate change allowance.

5.4.2 Overall Strategy

It is proposed that the brownfield redevelopment area positively discharges to the existing onsite network at a restricted rate of 1l/s.

At the time of writing, it is anticipated that the discharge may need to be pumped. However, opportunities for a gravity connection should be explored during the detailed design stage.

Pollution will be managed through the utilisation of catchpits and a proprietary treatment system (Turtle Enviro – Storm Shark, or equivalent).

The site wide drainage strategy layout that identifies key features has been appended to this report.



Figure 5-1 – Drainage Strategy Extract

The individual elements have been explored further throughout the following sections.

5.4.3 Attenuation Tank & Flow Control

As can be seen within the appended drainage strategy layout and Site3D calculations, 1no. attenuation tank with effective dimensions of 13m x 3m x 0.4m and 95% voids shall fully accommodate all storms up to and including the 1:100 year event plus 40% climate change allowance. This equates to an effective volume of 29.64m³.

The flow control has been modelled as a Hydro-Brake for the purposes of this strategy report. However, the opportunity for a gravity connection to the existing network should be confirmed through the detailed design stage. If a pump is required, this is more hydraulically efficient and therefore the tank would not likely need to increase when compared with the Hydro-Brake scenario.

During detailed design and network modelling, and prior to construction, it may be possible to refine the network through the use of oversized pipes, which may result in less overall attenuation within the tank.

5.4.4 Pollution Control

As per the appended pollution indices calculations, it is proposed that the site utilises catchpits and a proprietary treatment system (Turtle Enviro – Storm Shark, or equivalent).

5.5 Exceedance and Surface Water Conveyance

Exceedance routes shall be provided by appropriate external levels design during the detailed design stage. The exceedance routes shall need to accommodate system failure and events greater than the 1:100-year event inclusive of climate change allowance.

5.6 Surface Water Drainage Strategy Summary

The existing on-site drainage demonstrates that the site positively drains to the Christchurch Ditch (denoted as a Statutory Main River). It is believed to discharge at an unrestricted rate. It is, however, treated through an interceptor.

It is proposed that the brownfield redevelopment area positively discharges to the existing onsite network at a restricted rate of 1l/s for all events up to and including the 1:100 year event plus 40% climate change allowance.

Pollution will be managed through the utilisation of catchpits, and an interceptor.

It is evident from the aforementioned that a suitable surface water network can be provided that accords with national and local policy.

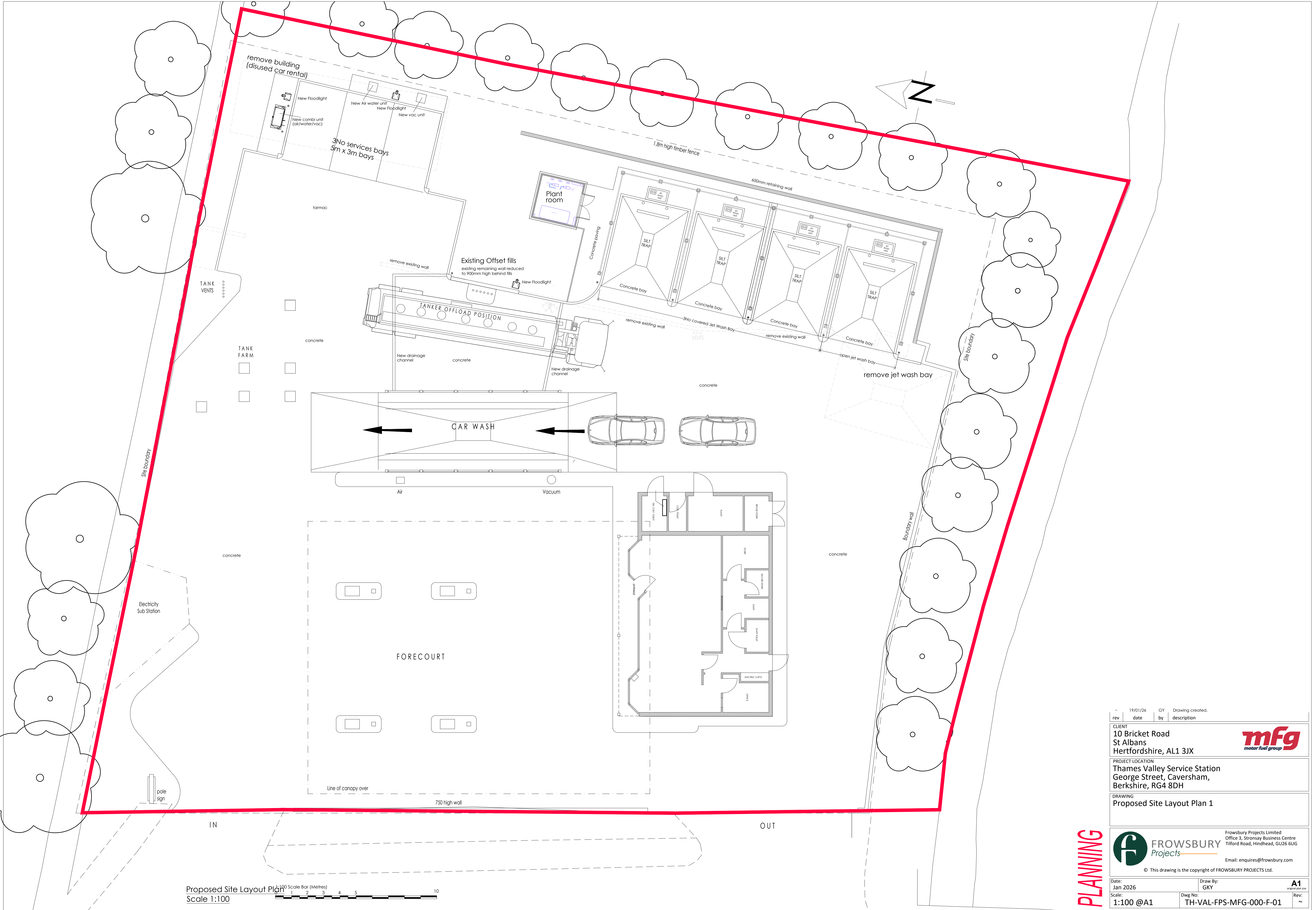
6. Conclusions

This document has been produced in accordance with current best practice, recommendations and guidance set out in the National Planning Policy Framework (NPPF) and associated documents valid at the time of writing.

This report concludes:

1. The site is currently an active service station and is bounded by George Street to the West, residential properties to the north and wooded publicly accessible park to the east and south.
2. A review of the BGS online bedrock mapping tool identified that the development is likely underlain by the Seaford Chalk Formation and Newhaven Chalk Formation (Chalk), with respect to bedrock. The BGS indicates that the site sits across two superficial deposit layers with a third to the north. The majority of the site is underlain by Langley Silt Member (Clay and Silt), with the minority underlain by Alluvium (Clay, silt, sand and gravel). The northern boundary of the site may be underlain by the Kempton Park Gravel Member (Sand and Gravel).
3. The proposal is for the installation of 4no. jet washes, 3no. valeting bays and associated works.
4. A review of the available Environment Agency Flood Maps, SFRA conclude that:
 - a. The site is in Flood Zone 2 and susceptible to Fluvial flooding.
 - b. All other sources of flooding have been identified as having a low risk to the development area.
 - c. It is believed that the main risks of flooding to the development area is Fluvial flooding.
5. It is proposed that the brownfield redevelopment area positively discharges to the existing onsite network at a restricted rate of 1l/s for all events up to and including the 1:100 year event plus 40% climate change allowance.
6. Pollution will be managed through the use of catchpits and a proprietary treatment system (Turtle Enviro – Storm Shark, or equivalent).
7. It is evident from the aforementioned that a suitable surface water network can be provided that accords with national and local policy.

Appendix 1 – Proposed Site Plan



CAD file ref:

Proposed Site Layout Plan
Scale 1:100

PLANNING

rev	19/01/26	GY	Drawing created.
date	by	description	
CLIENT			
10 Bricket Road St Albans Hertfordshire, AL1 3JX			
PROJECT LOCATION			
Thames Valley Service Station George Street, Caversham, Berkshire, RG4 8DH			
DRAWING			
Proposed Site Layout Plan 1			
FROWSBURY Projects			
Frowsbury Projects Limited Office 3, Stronsay Business Centre Tilford Road, Hindhead, GU26 6UG Email: enquires@frowsbury.com			
© This drawing is the copyright of FROWSBURY PROJECTS Ltd.			
Date:	Jan 2026	Drawn By:	GKY
Scale:	1:100 @A1	Dwg No:	TH-VAL-FPS-MFG-000-F-01
			Rev: ~



Appendix 2 – Flood Risk Maps

Flood map for planning

Your reference
Unspecified

Location (easting/northing)
471957/174406

Created
30 March 2026 11:10

Your selected location is in flood zone 3, an area with a high probability of flooding.

This means:

- you must complete a flood risk assessment for development in this area
- you should follow the Environment Agency's standing advice for carrying out a flood risk assessment (see <https://www.gov.uk/guidance/flood-risk-assessment-standing-advice>)

Notes

The flood map for planning shows river and sea flooding data only. It doesn't include other sources of flooding. It is for use in development planning and flood risk assessments.

This information relates to the selected location and is not specific to any property within it. The map is updated regularly and is correct at the time of printing.

Flood risk data is covered by the Open Government Licence which sets out the terms and conditions for using government data. <https://www.nationalarchives.gov.uk/doc/open-government-licence/version/3>

Use of the address and mapping data is subject to Ordnance Survey public viewing terms under Crown copyright and database rights 2026 AC0000807064. <https://flood-map-for-planning.service.gov.uk/os-terms>



Flood map for planning

Your reference

Unspecified

Location (easting/northing)
471957/174406

Scale
1:2,500

Created
30 Mar 2026 11:10

-  Selected area
-  Flood zone 3
-  Flood zone 2
-  Flood zone 1
-  Flood defence
-  Main river
-  Water storage area



0 20 40 60m

Appendix 3 – Drained Areas Analysis Sketches

PRE-DEVELOPMENT DRAINED AREAS

- SOFT LANDSCAPING AREA = 454m²
- IMPERMEABLE HARDSTANDING AREA (POSITIVELY DRAINED) = 1,444m²
- IMPERMEABLE HARDSTANDING AREA (NOT POSITIVELY DRAINED) = 0m²
- PERMEABLE HARDSTANDING AREA (TYPE A) = 0m²
- PERMEABLE HARDSTANDING AREA (TYPE B/C) = 0m²
- ROOF AREA = 524m²

TOTAL DRAINED AREA = 1,968m²

TOTAL AREA = 2,422m²



DO NOT SCALE THIS DRAWING. ALL SETTING OUT TO ARCHITECT'S DETAILS AND DRAWINGS

THIS DRAWING IS TO BE READ IN CONJUNCTION WITH ALL OTHER RELEVANT DRAWING ISSUES AND THE SPECIFICATION.

- Notes:**
- G1. All building materials, components and workmanship to comply with the appropriate public health acts, building regulations, british standards and codes of practice and the appropriate manufacturer's recommendations.
 - G2. For all specialist work see relevant drawings.
 - G3. Any discrepancies, errors or omissions to be reported to the project co-ordinator for further instructions before commencement of works.
 - G4. The Engineer is not responsible for dimensions, except where shown on his drawings. All setting out information, dimensions, etc, shall be calculated from the Architect's drawings.

P01	PRELIMINARY ISSUE	MJF	JEM	JEM	31.03.26
Rev	Amendment	Drn	Chk	Apr	Date

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www.moss-ce.co.uk

Client:
FROWSBURY PROJECTS LIMITED

Project:
THAMES VALLEY SERVICE STATION,
GEORGE STREET, CAVERSHAM,
RG4 8DH

Drawing Title:
DRAINED AREAS ANALYSIS
PRE-DEVELOPMENT

MCE ref	drawn by	date	drawing scales	original paper size
26-0059	MJF	MAR26	1:200@A1	A1

drawing reference :	originator	volume	level	type	role	number
project	26-0059	- MCE	- 00	- 00	- DR	- C - 1200

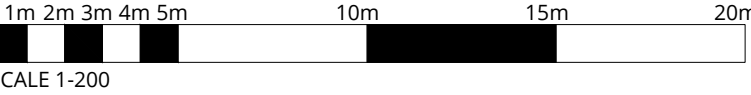
status :	status description :
S0	SUITABLE FOR INFORMATION
revision :	revision status :
P01	PRELIMINARY

PRE-DEVELOPMENT DRAINED AREAS

- SOFT LANDSCAPING AREA = 454m²
- IMPERMEABLE HARDSTANDING AREA (POSITIVELY DRAINED) = 1,193m²
- IMPERMEABLE HARDSTANDING AREA (NOT POSITIVELY DRAINED) = 0m²
- PERMEABLE HARDSTANDING AREA (TYPE A) = 0m²
- PERMEABLE HARDSTANDING AREA (TYPE B/C) = 0m²
- ROOF AREA = 568m²

TOTAL DRAINED AREA = 1,761m²

TOTAL AREA = 2,422m²



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Notes:

- G1.

All building materials, components and workmanship to comply with the appropriate public health acts, building regulations, british standards and codes of practice and the appropriate manufacturer's recommendations.
- G2.

For all specialist work see relevant drawings.
- G3.

Any discrepancies, errors or omissions to be reported to the project co-ordinator for further instructions before commencement of works.
- G4.

The Engineer is not responsible for dimensions, except where shown on his drawings. All setting out information, dimensions, etc, shall be calculated from the Architect's drawings.

P01	PRELIMINARY ISSUE	MJF	JEM	JEM	31.03.26
Rev	Amendment	Drn	Chk	Apr	Date

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Client:
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THAMES VALLEY SERVICE STATION,
GEORGE STREET, CAVERSHAM,
RG4 8DH

Drawing Title:
DRAINED AREAS ANALYSIS
POST-DEVELOPMENT

MCE ref	drawn by	date	drawing scales	original paper size
26-0059	MJF	MAR26	1:200@A1	A1

drawing reference :	originator	volume	level	type	role	number
26-0059 - MCE - 00 - 00 - DR - C - 1201						

status :	status description :
S0	SUITABLE FOR INFORMATION
revision :	revision status :
P01	PRELIMINARY

BROWNFIELD DEVELOPMENT AREAS

BROWNFIELD DEVELOPMENT AREA = 265m²

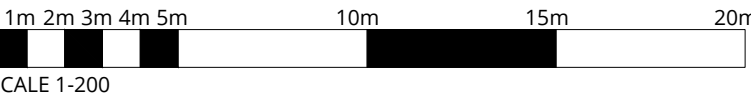


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THIS DRAWING IS TO BE READ IN CONJUNCTION WITH ALL OTHER RELEVANT DRAWING ISSUES AND THE SPECIFICATION.

Notes:

- G1. All building materials, components and workmanship to comply with the appropriate public health acts, building regulations, british standards and codes of practice and the appropriate manufacturer's recommendations.
- G2. For all specialist work see relevant drawings.
- G3. Any discrepancies, errors or omissions to be reported to the project co-ordinator for further instructions before commencement of works.
- G4. The Engineer is not responsible for dimensions, except where shown on his drawings. All setting out information, dimensions, etc, shall be calculated from the Architect's drawings.



P01	PRELIMINARY ISSUE	MJF	JEM	JEM	31.03.26
Rev	Amendment	Drm	Chk	Apr	Date

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Client:
FROWSBURY PROJECTS LIMITED

Project:
THAMES VALLEY SERVICE STATION,
GEORGE STREET, CAVERSHAM,
RG4 8DH

Drawing Title:
DRAINED AREAS ANALYSIS
BROWNFIELD DEVELOPMENT AREAS

MCE ref	drawn by	date	drawing scales	original paper size
26-0059	MJF	MAR26	1:200@A1	A1

drawing reference :	originator	volume	level	type	role	number
26-0059 - MCE - 00 - 00 - DR - C - 1202						

status :	status description :
S0	SUITABLE FOR INFORMATION
revision :	revision status :
P01	PRELIMINARY

Appendix 4 – Drainage Strategy Layouts

CDM 2015 RESIDUAL RISKS

1. It is assumed that a competent Principal Contractor with the relevant skills, knowledge and experience of construction of this type of work and location will be appointed, and will be aware of the typical hazards.

The above residual risks are for non-standard hazards. It is assumed that a competent contractor familiar with the construction of this type of work will be appointed who will be aware of the standard hazards.

KEY:

- Proposed Private Surface Water Pipe
- Proposed Private Surface Water PPIC
- CP Proposed Catchpit
- HB Proposed Hydro-Brake
- Proposed Geo-Cellular Attenuation
- NRV Proposed Non Return Valve



DO NOT SCALE THIS DRAWING. ALL SETTING OUT TO ARCHITECT'S DETAILS AND DRAWINGS

THIS DRAWING IS TO BE READ IN CONJUNCTION WITH ALL OTHER RELEVANT DRAWING ISSUES AND THE SPECIFICATION.

Notes:

- G1. All building materials, components and workmanship to comply with the appropriate public health acts, building regulations, british standards and codes of practice and the appropriate manufacturer's recommendations.
- G2. For all specialist work see relevant drawings.
- G3. Any discrepancies, errors or omissions to be reported to the project co-ordinator for further instructions before commencement of works.
- G4. The Engineer is not responsible for dimensions, except where shown on his drawings. All setting out information, dimensions, etc, shall be calculated from the Architect's drawings.

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Rev	Amendment	Drn	Chk	Apr	Date

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Client:
FROWSBURY PROJECTS LIMITED

Project:
THAMES VALLEY SERVICE STATION,
GEORGE STREET, CAVERSHAM,
RG4 8DH

Drawing Title:
DRAINAGE STRATEGY LAYOUT

MCE ref	drawn by	date	drawing scales	original paper size
26-0059	MJF	MAR26	1:200@A1	A1

drawing reference :	originator	volume	level	type	role	number
project						
26-0059	- MCE	- 00	- 00	- DR	- C	- 1100

status :	status description :
S0	SUITABLE FOR INFORMATION
revision :	revision status :
P01	PRELIMINARY

Appendix 5 – Surface Water Strategy Calculations

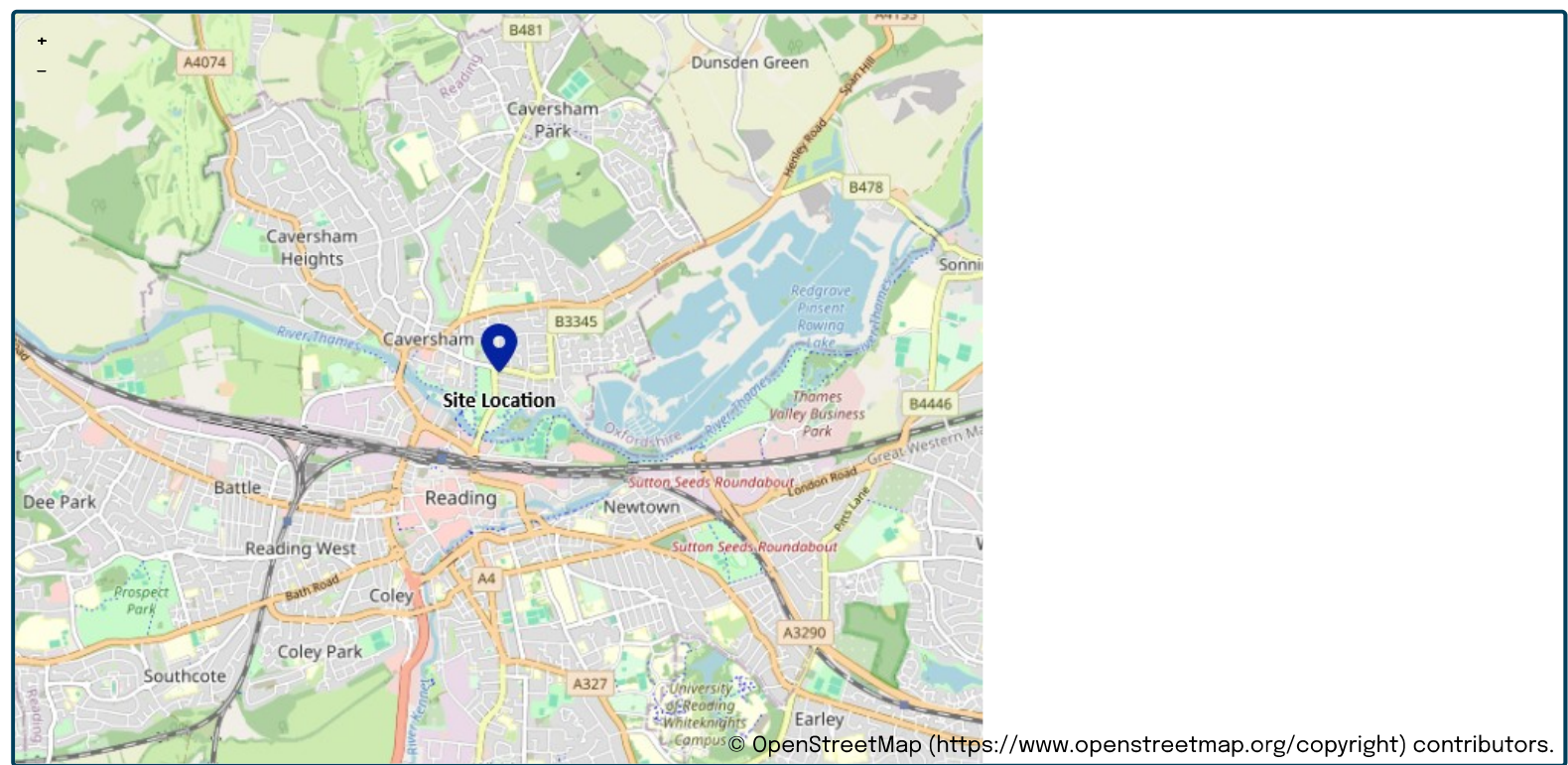
This is an estimation of the greenfield runoff rates that are used to meet normal best practice criteria in line with Environment Agency guidance “Rainfall runoff management for developments”, SC030219 (2013), the SuDS Manual C753 (CIRIA, 2015) and the non-statutory standards for SuDS (Defra, 2015).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

Project details

Date	30/03/2026
Calculated by	MJF
Reference	26-0059
Model version	2.2.3

Location

Site name	Thames Valley Service Station
Site location	George Street, Caversham



Site easting (British National Grid)	471954
Site northing (British National Grid)	174405

Site details

Total site area (ha)	0.0265	ha
----------------------	--------	----

Greenfield runoff

Method

Method

IH124

Please select a value.

FEH statistical (2025)

FEH statistical (2008)

IH124

IH124

SAAR (mm)

My value

645

mm

Map value

645

How should SPR be derived?

WRAP soil type

Please select a value.

WRAP soil type

Estimate using BFI

WRAP soil type

1

Please select a value.

1

2

3

4

5

1

SPR

0.1

QBar (IH124) (l/s)

0.01

l/s

Growth curve factors

Hydrological region

My value

6

Please select a value.

1

2

3

4

5

6

7

8

9

10

11

12

13

Map value

6

1 year growth factor

0.85

2 year growth factor

0.88

10 year growth factor

1.62

30 year growth factor

2.3

100 year growth factor

3.19

200 year growth factor

3.74

Results

Method

IH124

Flow rate 1 year (l/s)

0.01

l/s

Flow rate 2 year (l/s)

0.01

l/s

Flow rate 10 years (l/s)

0.01

l/s

Flow rate 30 years (l/s)

0.01

l/s

Flow rate 100 years (l/s)

0.01

l/s

Flow rate 200 years (l/s)

0.02

l/s

Please note runoff estimation is subject to significant uncertainty. Results are therefore normally reported to only 1 decimal place. Where 2 decimal places are provided, this does not indicate accuracy to this level, it has been adopted to prevent 'zero' figures from being reported. Outputs less than 0.01 l/s are reported as 0.01 l/s.

Disclaimer

This report was produced using the Greenfield runoff rate estimation tool (2.2.3) developed by HR Wallingford and available at [uksuds.com](https://www.uksuds.com) (<https://www.uksuds.com/>). The use of this tool is subject to the UK SuDS terms and conditions and licence agreement, which can both be found at [uksuds.com/terms-conditions](https://www.uksuds.com/terms-conditions) (<https://www.uksuds.com/terms-conditions>). The outputs from this tool have been used to estimate Greenfield runoff rates. The use of these results is the responsibility of the users of this tool. No liability will be accepted by HR Wallingford, the Environment Agency, Centre for Ecology and Hydrology, Wallingford Hydrosolutions or any other organisation for the use of these data in the design or operational characteristics of any drainage scheme.

Network Details

Manhole Schedule

Manhole	Catchment Area (ha)	Size (mm)	Type	CL (m)	IL (m)	Depth To Soffit (m)	Easting (m)	Northing (m)
S1	0.026	1500	Type B	100.000	98.000	1.850	90.000	70.000
S2	0.000	1500	Type B	100.000	97.000	2.850	100.000	70.000
S3	0.000	1500	Type B	100.000	96.999	2.851	105.000	70.000
S4	0.000	1200	Type A	100.000	96.250	3.600	160.000	70.000

Pipe Schedule

Pipe Number	US Manhole	US IL (m)	DS Manhole	DS IL (m)	Shape	Dimension (mm)	Length (m)	Gradient (1:x)	Roughness (mm)	US Depth To Soffit (m)	DS Depth To Soffit (m)
1.000	S1	98.000	S2	97.000	Circ	150	10.000	10	0.600	1.850	2.850
1.001	S2	97.000	S3	96.999	Circ	150	5.000	5000	0.600	2.850	2.851
1.002	S3	96.999	S4	96.250	Circ	150	55.000	73	0.600	2.851	3.600

Outfall Details

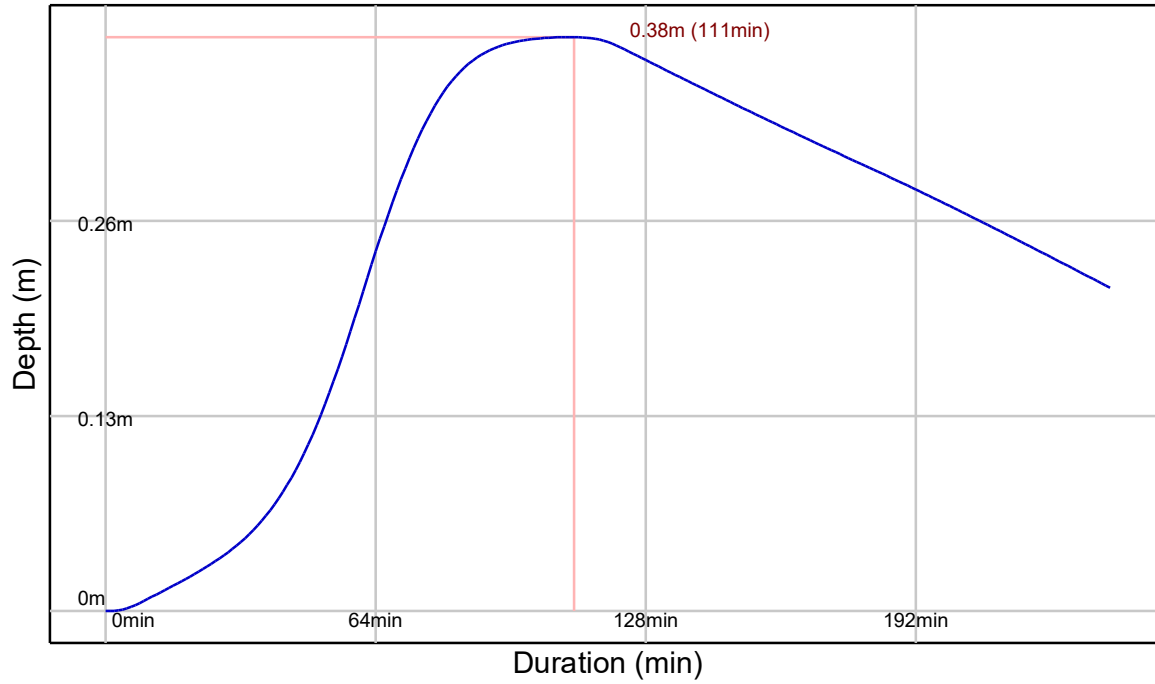
Outfall Manhole S4 : Free Discharge

Flow Control Details

Tank Structure at Manhole S2

Tank Invert (m)	Tank Height (m)	Porosity Ratio (%)	Area (m2)	Effective Area (m2) Area x Porosity Ratio	Max Storage (m3) Effective Area x Height	Infil Base (m/hr)	Infil Side (m/hr)	Safety Factor
97.000	0.400	95.00	39.000	37.050	14.820	0.00000000	0.00000000	2.00

Tank 1 at S2 (100Yr+40% 120Min Winter)

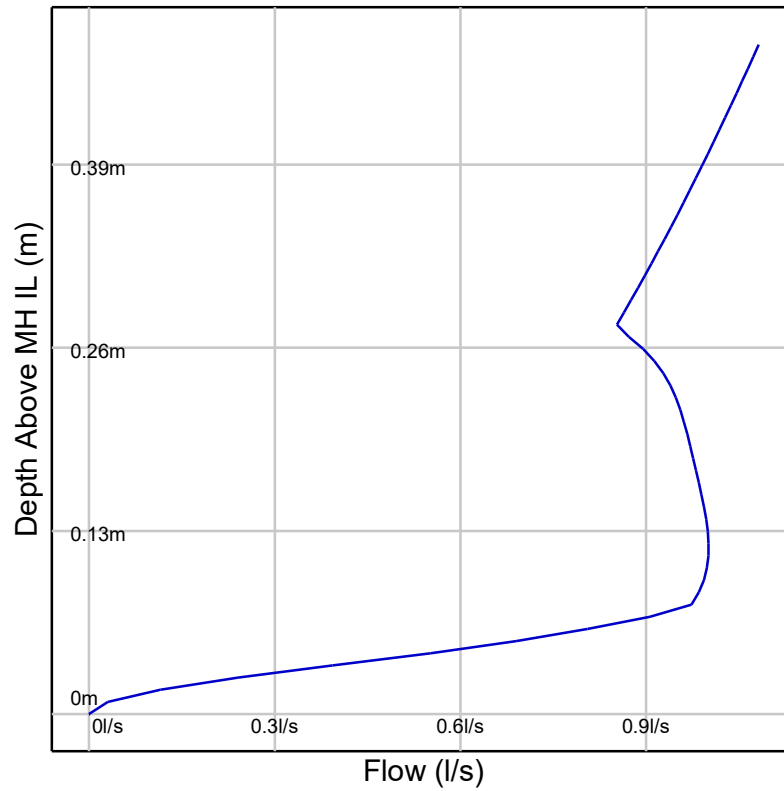


Controls within Manhole S3

Hydro-Brake® Optimum Control

Model Ref	Design Depth (m)	Design Flow (l/s)	Invert Offset (m)	FF Head (m)	FF Flow (l/s)	KF Head (m)	KF Flow (l/s)
SHE-0055-1000-0400-1000	0.400	1.000	0.000	0.118	1.001	0.274	0.850

Hydro-Brake® Optimum Control from S3 to S4



Simulation Settings

FEH2022 (point): Filename=FEH_Point_Descriptors_471956_174409_v5_1_0.xml

Summer (Cv: 1.00), Winter (Cv: 1.00)

Global Time of Entry: 5.0 mins

Durations (mins): 15, 30, 60, 120, 180, 240, 360, 480, 600, 720, 960, 1440, 2160, 2880, 4320, 5760, 7200, 8640, 10080

Return Periods (yrs) + Climate Change: (2, +0%), (30, +0%), (30, +35%), (100, +0%), (100, +40%)

Manhole Flood Risk Freeboard: 0.300m

Simulated Rainfall Events

Storm	Average Intensity (mm/hr)	Runoff Continuity %	Flow Continuity %	Storm	Average Intensity (mm/hr)	Runoff Continuity %	Flow Continuity %
2Yr 15Min Winter	28.000	0.00	0.00	30Yr+35% 720Min Winter	6.845	0.00	0.00
2Yr 15Min Summer	28.000	0.00	0.00	30Yr+35% 960Min Summer	5.367	0.00	0.00
2Yr 30Min Winter	17.919	0.00	0.00	30Yr+35% 960Min Winter	5.367	0.00	0.00
2Yr 30Min Summer	17.919	0.00	0.00	30Yr+35% 1440Min Summer	3.808	0.00	0.00
2Yr 60Min Summer	11.059	0.00	0.00	30Yr+35% 1440Min Winter	3.808	0.00	0.00
2Yr 60Min Winter	11.059	0.00	0.00	30Yr+35% 2160Min Summer	2.710	0.00	0.00
2Yr 120Min Winter	7.930	0.00	0.00	30Yr+35% 2160Min Winter	2.710	0.00	0.00
2Yr 120Min Summer	7.930	0.00	0.00	30Yr+35% 2880Min Summer	2.136	0.00	0.00
2Yr 180Min Winter	6.389	0.00	0.00	30Yr+35% 2880Min Winter	2.136	0.00	0.00
2Yr 180Min Summer	6.389	0.00	0.00	30Yr+35% 4320Min Summer	1.545	0.00	0.00
2Yr 240Min Summer	5.233	0.00	0.00	30Yr+35% 4320Min Winter	1.545	0.00	0.00
2Yr 240Min Winter	5.233	0.00	0.00	30Yr+35% 5760Min Summer	1.242	0.00	0.00
2Yr 360Min Summer	3.972	0.00	0.00	30Yr+35% 5760Min Winter	1.242	0.00	0.00
2Yr 360Min Winter	3.972	0.00	0.00	30Yr+35% 7200Min Summer	1.057	0.00	0.00
2Yr 480Min Winter	3.251	0.00	0.00	30Yr+35% 7200Min Winter	1.057	0.00	0.00
2Yr 480Min Summer	3.251	0.00	0.00	30Yr+35% 8640Min Summer	0.932	0.00	0.00
2Yr 600Min Summer	2.754	0.00	0.00	30Yr+35% 8640Min Winter	0.932	0.00	0.00
2Yr 600Min Winter	2.754	0.00	0.00	30Yr+35% 10080Min Summer	0.842	0.00	0.00
2Yr 720Min Summer	2.391	0.00	0.00	30Yr+35% 10080Min Winter	0.842	0.00	0.00
2Yr 720Min Winter	2.391	0.00	0.00	100Yr 15Min Summer	111.869	0.00	-0.58
2Yr 960Min Summer	1.916	0.00	0.00	100Yr 15Min Winter	111.869	0.00	-0.58
2Yr 960Min Winter	1.916	0.00	0.00	100Yr 30Min Summer	73.596	0.00	-0.48
2Yr 1440Min Summer	1.403	0.00	0.00	100Yr 30Min Winter	73.596	0.00	-0.48
2Yr 1440Min Winter	1.403	0.00	0.00	100Yr 60Min Summer	46.029	0.00	-0.27
2Yr 2160Min Summer	1.033	0.00	0.00	100Yr 60Min Winter	46.029	0.00	-0.28
2Yr 2160Min Winter	1.033	0.00	0.00	100Yr 120Min Summer	27.066	0.00	-0.27
2Yr 2880Min Summer	0.835	0.00	0.00	100Yr 120Min Winter	27.066	0.00	-0.26
2Yr 2880Min Winter	0.835	0.00	0.00	100Yr 180Min Summer	19.645	0.00	0.00
2Yr 4320Min Summer	0.631	0.00	0.00	100Yr 180Min Winter	19.645	0.00	0.00
2Yr 4320Min Winter	0.631	0.00	0.00	100Yr 240Min Summer	15.683	0.00	0.00
2Yr 5760Min Summer	0.524	0.00	0.00	100Yr 240Min Winter	15.683	0.00	0.00
2Yr 5760Min Winter	0.524	0.00	0.00	100Yr 360Min Summer	11.287	0.00	0.00
2Yr 7200Min Summer	0.459	0.00	0.00	100Yr 360Min Winter	11.287	0.00	0.00
2Yr 7200Min Winter	0.459	0.00	0.00	100Yr 480Min Summer	8.900	0.00	0.00
2Yr 8640Min Summer	0.414	0.00	0.00	100Yr 480Min Winter	8.900	0.00	0.00
2Yr 8640Min Winter	0.414	0.00	0.00	100Yr 600Min Summer	7.388	0.00	0.00
2Yr 10080Min Summer	0.381	0.00	0.00	100Yr 600Min Winter	7.388	0.00	0.00
2Yr 10080Min Winter	0.381	0.00	0.00	100Yr 720Min Summer	6.334	0.00	0.00
30Yr 15Min Winter	86.036	0.00	-0.53	100Yr 720Min Winter	6.334	0.00	0.00
30Yr 15Min Summer	86.036	0.00	-0.54	100Yr 960Min Summer	4.955	0.00	0.00
30Yr 30Min Summer	55.959	0.00	-0.53	100Yr 960Min Winter	4.955	0.00	0.00
30Yr 30Min Winter	55.959	0.00	-0.53	100Yr 1440Min Summer	3.493	0.00	0.00
30Yr 60Min Summer	34.887	0.00	-0.48	100Yr 1440Min Winter	3.493	0.00	0.00
30Yr 60Min Winter	34.887	0.00	-0.48	100Yr 2160Min Summer	2.466	0.00	0.00
30Yr 120Min Winter	21.053	0.00	0.00	100Yr 2160Min Winter	2.466	0.00	0.00
30Yr 120Min Summer	21.053	0.00	0.00	100Yr 2880Min Summer	1.927	0.00	0.00
30Yr 180Min Summer	15.501	0.00	0.00	100Yr 2880Min Winter	1.927	0.00	0.00
30Yr 180Min Winter	15.501	0.00	0.00	100Yr 4320Min Summer	1.374	0.00	0.00
30Yr 240Min Summer	12.384	0.00	0.00	100Yr 4320Min Winter	1.374	0.00	0.00
30Yr 240Min Winter	12.384	0.00	0.00	100Yr 5760Min Summer	1.092	0.00	0.00
30Yr 360Min Summer	8.975	0.00	0.00	100Yr 5760Min Winter	1.092	0.00	0.00
30Yr 360Min Winter	8.975	0.00	0.00	100Yr 7200Min Summer	0.920	0.00	0.00
30Yr 480Min Summer	7.112	0.00	0.00	100Yr 7200Min Winter	0.920	0.00	0.00
30Yr 480Min Winter	7.112	0.00	0.00	100Yr 8640Min Summer	0.805	0.00	0.00

Simulated Rainfall Events

Storm	Average Intensity (mm/hr)	Runoff Continuity %	Flow Continuity %	Storm	Average Intensity (mm/hr)	Runoff Continuity %	Flow Continuity %
30Yr 600Min Summer	5.913	0.00	0.00	100Yr 8640Min Winter	0.805	0.00	0.00
30Yr 600Min Winter	5.913	0.00	0.00	100Yr 10080Min Summer	0.722	0.00	0.00
30Yr 720Min Summer	5.070	0.00	0.00	100Yr 10080Min Winter	0.722	0.00	0.00
30Yr 720Min Winter	5.070	0.00	0.00	100Yr+40% 15Min Summer	156.616	0.00	-0.32
30Yr 960Min Summer	3.976	0.00	0.00	100Yr+40% 15Min Winter	156.616	0.00	-0.35
30Yr 960Min Winter	3.976	0.00	0.00	100Yr+40% 30Min Summer	103.035	0.00	0.00
30Yr 1440Min Summer	2.821	0.00	0.00	100Yr+40% 30Min Winter	103.035	0.00	0.00
30Yr 1440Min Winter	2.821	0.00	0.00	100Yr+40% 60Min Summer	64.441	0.00	0.31
30Yr 2160Min Summer	2.008	0.00	0.00	100Yr+40% 60Min Winter	64.441	0.00	0.30
30Yr 2160Min Winter	2.008	0.00	0.00	100Yr+40% 120Min Summer	37.892	0.00	0.00
30Yr 2880Min Summer	1.582	0.00	0.00	100Yr+40% 120Min Winter	37.892	0.00	0.00
30Yr 2880Min Winter	1.582	0.00	0.00	100Yr+40% 180Min Summer	27.503	0.00	-0.22
30Yr 4320Min Summer	1.145	0.00	0.00	100Yr+40% 180Min Winter	27.503	0.00	-0.22
30Yr 4320Min Winter	1.145	0.00	0.00	100Yr+40% 240Min Summer	21.956	0.00	0.00
30Yr 5760Min Summer	0.920	0.00	0.00	100Yr+40% 240Min Winter	21.956	0.00	0.00
30Yr 5760Min Winter	0.920	0.00	0.00	100Yr+40% 360Min Summer	15.801	0.00	0.00
30Yr 7200Min Summer	0.783	0.00	0.00	100Yr+40% 360Min Winter	15.801	0.00	0.00
30Yr 7200Min Winter	0.783	0.00	0.00	100Yr+40% 480Min Summer	12.459	0.00	0.00
30Yr 8640Min Summer	0.690	0.00	0.00	100Yr+40% 480Min Winter	12.459	0.00	0.00
30Yr 8640Min Winter	0.690	0.00	0.00	100Yr+40% 600Min Summer	10.344	0.00	0.00
30Yr 10080Min Summer	0.623	0.00	0.00	100Yr+40% 600Min Winter	10.344	0.00	0.00
30Yr 10080Min Winter	0.623	0.00	0.00	100Yr+40% 720Min Summer	8.868	0.00	0.00
30Yr+35% 15Min Summer	116.149	0.00	-0.59	100Yr+40% 720Min Winter	8.868	0.00	0.00
30Yr+35% 15Min Winter	116.149	0.00	-0.59	100Yr+40% 960Min Summer	6.937	0.00	0.00
30Yr+35% 30Min Summer	75.545	0.00	-0.46	100Yr+40% 960Min Winter	6.937	0.00	0.00
30Yr+35% 30Min Winter	75.545	0.00	-0.46	100Yr+40% 1440Min Summer	4.891	0.00	0.00
30Yr+35% 60Min Summer	47.098	0.00	0.00	100Yr+40% 1440Min Winter	4.891	0.00	0.00
30Yr+35% 60Min Winter	47.098	0.00	-0.24	100Yr+40% 2160Min Summer	3.452	0.00	0.00
30Yr+35% 120Min Summer	28.422	0.00	-0.30	100Yr+40% 2160Min Winter	3.452	0.00	0.00
30Yr+35% 120Min Winter	28.422	0.00	-0.29	100Yr+40% 2880Min Summer	2.698	0.00	0.00
30Yr+35% 180Min Summer	20.927	0.00	0.00	100Yr+40% 2880Min Winter	2.698	0.00	0.00
30Yr+35% 180Min Winter	20.927	0.00	0.00	100Yr+40% 4320Min Summer	1.924	0.00	0.00
30Yr+35% 240Min Summer	16.719	0.00	0.00	100Yr+40% 4320Min Winter	1.924	0.00	0.00
30Yr+35% 240Min Winter	16.719	0.00	0.00	100Yr+40% 5760Min Summer	1.528	0.00	0.00
30Yr+35% 360Min Summer	12.116	0.00	0.00	100Yr+40% 5760Min Winter	1.528	0.00	0.00
30Yr+35% 360Min Winter	12.116	0.00	0.00	100Yr+40% 7200Min Summer	1.288	0.00	0.00
30Yr+35% 480Min Summer	9.602	0.00	0.00	100Yr+40% 7200Min Winter	1.288	0.00	0.00
30Yr+35% 480Min Winter	9.602	0.00	0.00	100Yr+40% 8640Min Summer	1.127	0.00	0.00
30Yr+35% 600Min Summer	7.982	0.00	0.00	100Yr+40% 8640Min Winter	1.127	0.00	0.00
30Yr+35% 600Min Winter	7.982	0.00	0.00	100Yr+40% 10080Min Winter	1.011	0.00	0.00
30Yr+35% 720Min Summer	6.845	0.00	0.00	100Yr+40% 10080Min Summer	1.011	0.00	0.00

Simulation Results

Return Period (yrs) + Climate Change (%):
2yr+0%

Manholes

Manhole	Critical Storm	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Flood (m3)	Status
S1	15 min Summer	7	98.030	0.030	4.175		OK
S2	180 min Summer	110	97.071	0.071	0.707		OK
S3	180 min Summer	110	97.070	0.071	0.700		OK
S4	180 min Summer	111	96.269	0.019	0.699		Outfall

Conduits

Pipe No.	Critical Storm	Peak (mins)	US Manhole	DS Manhole	Flow Depth (m)	Max Velocity (m/s)	Max Flow (l/s)	Flow / Capacity	Status
1.000	180 min Summer	106	S1	S2	0.041	1.315	1.794	0.032	OK
1.001	180 min Summer	110	S2	S3	0.071	0.094	0.703	0.300	OK
1.002	180 min Summer	111	S3	S4	0.019	0.553	0.699	0.034	OK

Return Period (yrs) + Climate Change (%):
30yr+0%

Manholes

Manhole	Critical Storm	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Flood (m3)	Status
S1	15 min Summer	7	98.049	0.049	12.838		OK
S2	120 min Summer	86	97.185	0.185	0.974		Surcharged
S3	120 min Summer	86	97.185	0.186	0.985		Surcharged
S4	360 min Summer	200	96.272	0.022	1.001		Outfall

Conduits

Pipe No.	Critical Storm	Peak (mins)	US Manhole	DS Manhole	Flow Depth (m)	Max Velocity (m/s)	Max Flow (l/s)	Flow / Capacity	Status
1.000	60 min Summer	35	S1	S2	0.089	1.949	8.732	0.154	OK
1.001	30 min Winter	24	S2	S3	0.150	0.295	1.391	0.594	Surcharged
1.002	360 min Summer	200	S3	S4	0.022	0.615	1.001	0.048	OK

Return Period (yrs) + Climate Change (%):
30yr+35%

Manholes

Manhole	Critical Storm	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Flood (m3)	Status
S1	15 min Summer	7	98.057	0.057	17.334		OK
S2	120 min Summer	99	97.268	0.268	0.914		Surcharged
S3	120 min Summer	99	97.268	0.269	0.919		Surcharged
S4	480 min Winter	258	96.272	0.022	1.001		Outfall

Conduits

Pipe No.	Critical Storm	Peak (mins)	US Manhole	DS Manhole	Flow Depth (m)	Max Velocity (m/s)	Max Flow (l/s)	Flow / Capacity	Status
1.000	30 min Summer	17	S1	S2	0.099	2.300	15.808	0.279	OK
1.001	15 min Winter	12	S2	S3	0.150	0.412	1.745	0.746	Surcharged
1.002	480 min Winter	258	S3	S4	0.022	0.615	1.001	0.048	OK

Return Period (yrs) + Climate Change (%):
100yr+0%

Manholes

Manhole	Critical Storm	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Flood (m3)	Status
S1	15 min Summer	7	98.056	0.056	16.696		OK
S2	120 min Summer	95	97.252	0.252	0.952		Surcharged
S3	120 min Summer	95	97.251	0.252	0.942		Surcharged
S4	480 min Winter	278	96.272	0.022	1.001		Outfall

Conduits

Pipe No.	Critical Storm	Peak (mins)	US Manhole	DS Manhole	Flow Depth (m)	Max Velocity (m/s)	Max Flow (l/s)	Flow / Capacity	Status
1.000	30 min Summer	18	S1	S2	0.097	2.290	15.400	0.272	OK
1.001	30 min Summer	18	S2	S3	0.150	0.298	1.721	0.736	Surcharged
1.002	480 min Winter	278	S3	S4	0.022	0.615	1.001	0.048	OK

Return Period (yrs) + Climate Change (%):

100yr+40%

Manholes

Manhole	Critical Storm	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Flood (m3)	Status
S1	15 min Summer	7	98.066	0.066	23.378		OK
S2	120 min Winter	110	97.382	0.382	0.949		Surcharged
S3	120 min Winter	110	97.382	0.383	0.959		Surcharged
S4	720 min Winter	367	96.272	0.022	1.001		Outfall

Conduits

Pipe No.	Critical Storm	Peak (mins)	US Manhole	DS Manhole	Flow Depth (m)	Max Velocity (m/s)	Max Flow (l/s)	Flow / Capacity	Status
1.000	15 min Summer	9	S1	S2	0.107	2.832	24.476	0.432	OK
1.001	15 min Winter	9	S2	S3	0.150	0.440	2.089	0.893	Surcharged
1.002	720 min Winter	367	S3	S4	0.022	0.615	1.001	0.048	OK

Appendix 6 – Pollution Indices Calculations

CIRIA C753
POLLUTION INDICES



Project No: 26-0059 Sheet No. 1
Made By: MJF Revision: P01
Date: 30/03/2026 Project: THAMES VALLEY SERVICE STATION

Land Use	Pollution Hazard Level	Total Suspended Suspended Solids (TSS)	Metals	Hydrocarbons	Applicable
Residential Roofs	Very Low	0.20	0.20	0.05	
Other Roofs (typically commercial/industrial roofs)	Low	0.30	0.20	0.05	X
Individual property driveways, residential car parks, low traffic roads, (eg cul de sacs, homezones and general access roads) and non-residential car parking with infrequent change (eg schools, offices) ie < 300 traffic movements/day	Low	0.50	0.40	0.40	
Commercial yard and delivery areas, non-residential car parking with frequent change (eg hospitals, retail), all roads except low traffic roads and trunk roads/motorways	Medium	0.70	0.60	0.70	
Sites with heavy pollution (eg 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	0.80	0.80	0.90	

Up to 0.8 where there is potential for metals to leach from the roof
These should only be used if considered appropriate as part of a detailed risk assessment. Refer to CIRIA C753

Total Pollution Hazard Indices	Total Suspended Suspended Solids (TSS)	Metals	Hydrocarbons
	0.30	0.20	0.05

CIRIA C753
POLLUTION INDICES



0

Project No: 26-0059 Sheet No. 2
Made By: MJF Revision: P01
Date: 30/03/2026 Project: THAMES VALLEY SERVICE STATION

Type of SuDS Component	Total Suspended Suspended Solids (TSS)	Metals	Hydrocarbons	Applicable
Filter Strip	0.40	0.40	0.50	
Filter Drain	0.40	0.40	0.40	
Swale	0.50	0.60	0.60	
Bioretention System	0.80	0.80	0.80	
Permeable Pavement	0.70	0.60	0.70	
Detention Basin	0.50	0.50	0.60	
Pond	0.70	0.70	0.50	
Wetland	0.80	0.80	0.80	
Downstream Defender® Vortex	0.30	0.20	0.20	
Downstream Defender® Vortex Plus	0.50	0.40	0.50	
Downstream Defender® Advanced Vortex	0.50	0.40	0.50	
Turtle Enviro - Storm Shark	0.80	0.60	0.96	X
Klargester AquaTreat®	0.80	0.60	0.90	
Standard Catchpit	0.10	0.00	0.00	

Select Primary Mitigation: Turtle Enviro - Storm Shark

Total Mitigation Indices	Total Suspended Suspended Solids (TSS)	Metals	Hydrocarbons
	0.80	0.60	0.96
Total Polution Hazard Indices	0.30	0.20	0.05
Indices Balance	-0.5	-0.4	-0.91

ACCEPTABLE ACCEPTABLE ACCEPTABLE

Appendix 7 – Sewer Records

Moss Consulting Engineers Ltd
THE CARRIAGE HOUSE, MILL STREE
MAIDSTONE
ME15 6YE

Search address supplied Thames Valley Service Station
George Street
Caversham
Reading
RG4 8DH

Your reference 26-0059

Our reference ALS/ALS Standard/2026_5304341

Search date 19 March 2026

Keeping you up-to-date

Notification of price changes

We're changing our report prices from 4th June 2025. The price will increase by 3.5% based on Retail Price Index (RPI).

Find our new prices on our website thameswater.co.uk/property-searches

Any Questions? We're happy to talk through the changes with you – give our Property Searches team a call on 0800 009 4540 .



Thames Water Utilities Ltd
Property Searches,
Clearwater Court, Vastern Road, Reading RG1 8DB



property.searches@thameswater.co.uk
thameswater.co.uk/propertysearches



0800 009 4540

Search address supplied: Thames Valley Service Station, George Street, Caversham, Reading, RG4 8DH

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 and 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 contact details below:

Thames Water Utilities Ltd
Property Searches
Clearwater Court
Vastern Road
Reading
RG1 8DB

Email: property.searches@thameswater.co.uk

Web: thameswater.co.uk/propertysearches

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. The public sewer map relates only to sewerage apparatus of Thames Water Utilities Ltd, it does not disclose details of cables and or communications equipment that may be running through or around such apparatus. The sewer level information contained in this response represents all of the level data available in our existing records. Should you require any further Information, please refer to the relevant section within the 'Further Contacts' page found later in this document.

For your guidance:

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

Clean Water Services

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

Enclosed is a map showing the approximate positions of our water mains and associated apparatus. Please note that records are not kept of the positions of individual domestic supplies. For your information, there will be a pressure of at least 10m head at the outside stop valve. If you would like to know the static pressure, please contact our Customer Centre on 0800 316 9800. The Customer Centre can



also arrange for a full flow and pressure test to be carried out for a fee.

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.

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. You can do this by emailing customer.feedback@thameswater.co.uk with the email subject header 'Enquiry – TWOSA', along with details of the request.

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

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

Manhole Reference	Manhole Cover Level	Manhole Invert Level
94YZ	n/a	n/a
94ZP	n/a	n/a
941F	n/a	n/a
94ZQ	n/a	n/a
941D	n/a	n/a
941E	n/a	n/a
94YV	n/a	n/a
94YT	n/a	n/a
941G	n/a	n/a
94VX	n/a	n/a
94YX	n/a	n/a
94WQ	n/a	n/a
94WP	n/a	n/a
8303	36.5	35.23
8302	36.45	34.7
8301	36.48	35.18
9402	37.63	36.03
94YQ	n/a	n/a
9301	37.99	35.1
0403	37.48	36.38
9350	38.24	36.04
04YR	n/a	n/a
04YT	n/a	n/a
04RX	n/a	n/a
04RY	n/a	n/a
04ZQ	n/a	n/a
04RW	n/a	n/a
0401	n/a	n/a
04RZ	n/a	n/a
04SY	n/a	n/a
04SS	n/a	n/a
04SW	n/a	n/a
04TQ	n/a	n/a
04SZ	n/a	n/a
841A	n/a	n/a
841B	n/a	n/a
9450	37.73	36.51
9401	37.73	36.07
94ZR	n/a	n/a
95WV	n/a	n/a
94ZS	n/a	n/a
94ZT	n/a	n/a
04YZ	n/a	n/a
04YY	n/a	n/a
04YW	n/a	n/a
931B	n/a	n/a
94YR	n/a	n/a
94XY	n/a	n/a
9302	n/a	n/a
931A	n/a	n/a
941C	n/a	n/a
941B	n/a	n/a
941A	n/a	n/a
041G	n/a	n/a
0451	37.69	36.79
041F	n/a	n/a
0301	n/a	n/a
The position of the apparatus shown on this plan is given without obligation and warranty, and the accuracy cannot be guaranteed. Service pipes are not shown but their presence should be anticipated. No liability of any kind whatsoever is accepted by Thames Water for any error or omission. The actual position of mains and services must be verified and established on site before any works are undertaken.		



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.

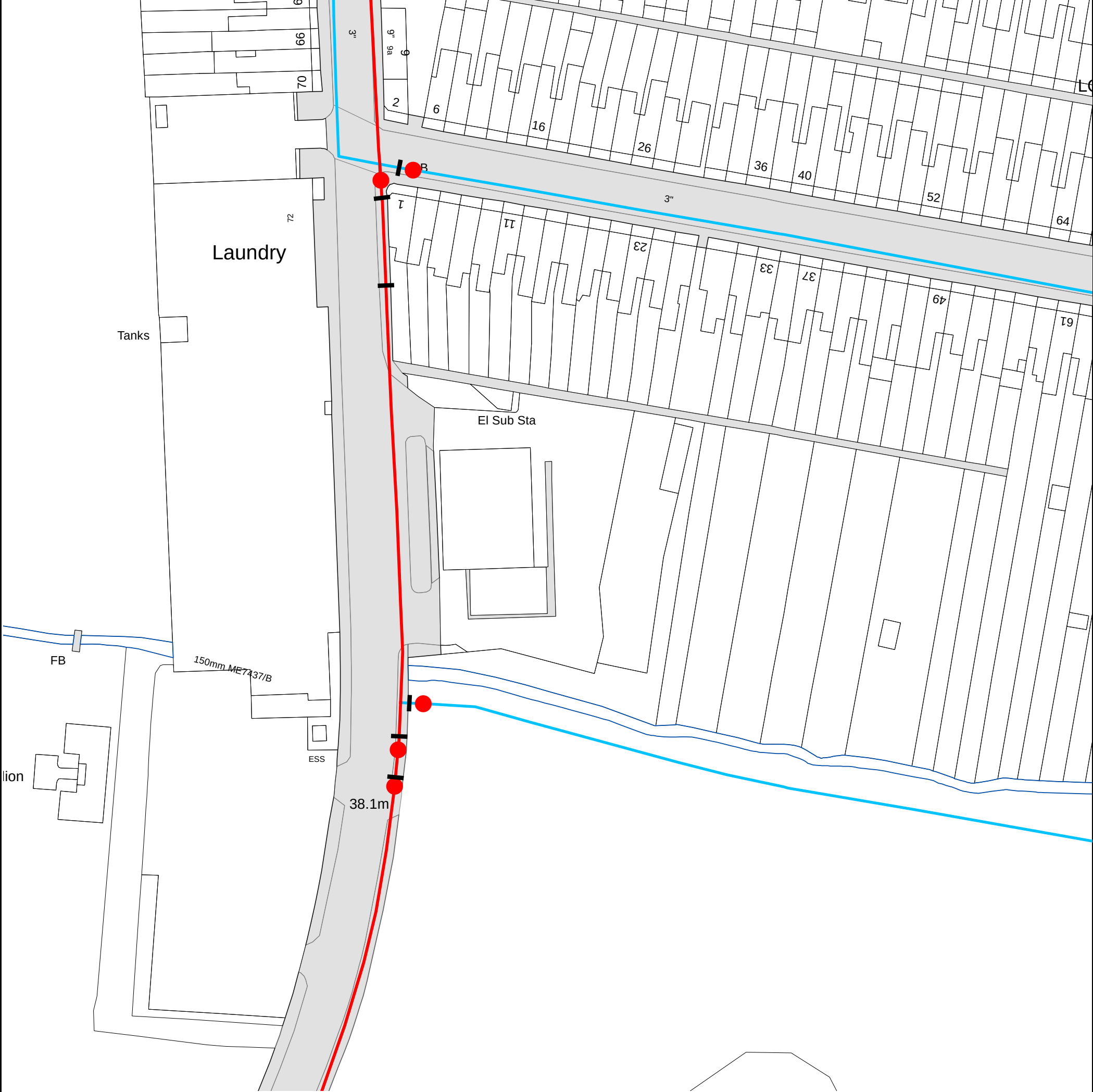
	Agreement
	Chamber
	Operational Site

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 200 m and the centre of the map is located at OS coordinates 471957, 174403.

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

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Asset Location Search - Water 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.

