

LAND EAST OF LONGWATER ROAD, FINCHAMPSTEAD

Flood Risk Assessment and Conceptual Drainage Strategy

794-DES-ARC-30429
Longwater Road,
Finchampstead
3
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REPORT

Quality Management

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Approval for issue

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1 INTRODUCTION

- 1.1 RPS was commissioned by Catesby Strategic Land Ltd and Stonebond Properties (Guildford) Ltd to undertake a Flood Risk Assessment (FRA) for Land to the east of Longwater Road, Finchampstead, RG40 3TT, in relation to the proposed development of up to 40 dwellings and associated infrastructure.
- 1.2 The aim of the FRA is to outline the potential for the site to be impacted by flooding, the impacts of the proposed development on flooding in the vicinity of the site, and the proposed measures which could be incorporated into the development to mitigate the identified risk. The report has been produced in accordance with the guidance detailed in the National Planning Policy Framework (NPPF)¹ and the associated Planning Practice Guidance (PPG). Reference has also been made to the CIRIA SuDS manual (C753)², Wokingham Borough Local Development Framework³ and the Wokingham Borough Council Strategic Flood Risk Assessment (SFRA)⁴.
- 1.3 This report has been produced in consultation with the Environment Agency and the Lead Local Flood Authority (LLFA). The site is not located within an Internal Drainage Board (IDB) District.
- 1.4 This report is not intended to provide formal details of the final drainage design for the development. However, it provides information regarding the capabilities of the conceptual surface water drainage strategy to meet the requirements of the NPPF.
- 1.5 The desk study was undertaken by reference to information provided / published by the following bodies:
- Environment Agency (EA);
 - Wokingham Borough Council (WBC);
 - Centre for Ecology and Hydrology;
 - British Geological Survey (BGS);
 - Ordnance Survey (OS);
 - Multi-Agency Geographic Information for the Countryside (MAGIC); and
 - Thame Water (TW).

¹ <https://www.gov.uk/government/publications/national-planning-policy-framework--2>

² https://www.ciria.org/CIRIA/CIRIA/Item_Detail.aspx?iProductCode=C624&Category=BOOK

³ <https://www.wokingham.gov.uk/sites/wokingham/files/2023-06/Final%20adopted%20Core%20Strategy%20inc.%20cover.pdf>

⁴ <https://www.wokingham.gov.uk/sites/wokingham/files/2023-07/1.%20WBC%20SFRA%202020%20Report.pdf>

2 PLANNING POLICY CONTEXT

National Planning Policy

2.1 The National Planning Policy Framework (NPPF) was released in March 2012 and was updated in December 2023. The document advises of the requirements for a site-specific Flood Risk Assessment (FRA) for any of the following cases (Planning and Flood Risk paragraph 173 (footnote 59)):

- All proposals (including minor development and change of use) located within the EA designated floodplain, recognised as either Flood Zone 2 (medium probability) or Flood Zone 3 (high probability);
- All proposals of 1 hectare (ha) or greater in an area located in Flood Zone 1 (low probability);
- All proposals within an area which has critical drainage problems (as notified to the Local Planning Authority by the EA);
- Land identified in a strategic flood risk assessment as being at increased flood risk in future; and
- Where proposed development may be subject to other sources of flooding, where its development would introduce a more vulnerable use.

2.2 Paragraph 175 of the updated NPPF identifies that major developments (developments of 10 homes or more and to major commercial development) should incorporate Sustainable Drainage Systems unless there is clear evidence that this would be inappropriate. The systems used should:

Take account of advice from the Lead Local Flood Authority;

Have appropriate proposed minimum operational standards;

Have maintenance arrangements in place to ensure an acceptable standard of operation for the lifetime of the development; and

Where possible, provide multifunctional benefits.

2.3 Defra published their 'Non-statutory technical standards for sustainable drainage systems'⁵ in March 2015. These are supported by the revised NPPF.

Climate Change

2.4 The NPPF and supporting planning practice guidance on Flood Risk and Coastal Change⁶ explain when and how flood risk assessments should be used. This includes demonstrating how flood risk will be managed now and over the development's lifetime, taking climate change into account.

Peak River Flow Allowances

2.5 Peak river flow allowances show the anticipated changes to peak flow by management catchment. Management catchments are sub-catchments of river basin districts. Peak River Flow Allowances should be considered for locations that are currently in Flood Zone 1 but might be in Flood Zone 2 or 3 in the future.

⁵ <https://www.gov.uk/government/publications/sustainable-drainage-systems-non-statutory-technical-standards>

⁶ <https://www.gov.uk/guidance/flood-risk-assessments-climate-change-allowances>

2.6 EA guidance on the application of climate changes allowance is dependent on the proposed developments vulnerability. As the development is residential, this application is deemed as 'More Vulnerable'. The EA require that for 'More Vulnerable' developments located in Flood Zones 2, 3a or 3b, the central allowance should be used to assess climate change. Residential developments have a lifetime of 100 years therefore, the 2080s epoch will be considered.

2.7 The proposed site is located within the Loddon and Tributaries Management Catchment for which the following peak river flow allowances in Table 1 are applicable.

Table 1: Loddon and Tributaries Management Catchment Peak River Flow Allowances

Epoch	Central	Higher Central	Upper End
2020s	7%	11%	23%
2050s	4%	10%	25%
2080s	14%	23%	46%

2.8 Based on the lifetime of the development and the vulnerability classification, an allowance of 14% is appropriate. The Peak River Flow Allowances are considered to ensure the safety of people using the development when planning safe access, escape routes and places of refuge.

Peak Rainfall Allowances

2.9 Peak Rainfall Allowances are used to consider how increased rainfall affects surface water flood risk and the design of drainage systems to manage the increased rainfall.

2.10 New guidance requires that for developments with a lifetime beyond 2100, Flood Risk Assessments and Strategic Flood Risk Assessments should assess the upper end allowances for the 2070s epoch for both the 1% and 3.3% annual exceedance probability events. The proposed site is located within the Loddon and Tributaries Management Catchment for which the following Peak Rainfall Allowances⁷ in Table 2 are applicable.

Table 2: Loddon and Tributaries Management Catchment Peak Rainfall Allowances

3.3% Annual Exceedance Rainfall Event		
Epoch	Central	Upper
2050s	20%	35%
2070s	25%	35%
1% Annual Exceedance Rainfall Event		
Epoch	Central	Upper
2050s	20%	40%
2070s	25%	40%

2.11 Based on the above information, RPS have added 40% to all attenuation / runoff calculations for the development to account for climate change.

⁷ <https://environment.data.gov.uk/hydrology/climate-change-allowances/rainfall>

Local Planning Policy

- 2.12 The site is located within the administrative boundary of Wokingham Borough Council. The Wokingham Borough Local Development Framework⁸ was adopted in 2010 and contains the following Policies relating to flood risk and drainage:

CP1 Sustainable Development

- 2.13 *Planning permission will be granted for development proposals that:*

- 1. Maintain or enhance the high quality of the environment;*
- 2. Minimise the emission of pollutants into the wider environment;*
- 3. Limit any adverse effects on water quality (including ground water);*
- 4. Ensure the provision of adequate drainage;*
- 5. Minimise the consumption and use of resources and provide for recycling;*
- 6. Incorporate facilities for recycling of water and waste to help reduce per capita water consumption;*
- 7. Avoid areas of best and most versatile agricultural land;*
- 8. Avoid areas where pollution (including noise) may impact upon the amenity of future occupiers;*
- 9. Avoid increasing (and where possible reduce) risks of or from all forms of flooding (including from groundwater);*
- 10. Provide attractive, functional, accessible, safe, secure and adaptable schemes;*
- 11. Demonstrate how they support opportunities for reducing the need to travel, particularly by private car in line with CP6; and*
- 12. Contribute towards the goal of reaching zero-carbon developments as soon as possible by:*
 - a. Including appropriate on-site renewable energy features; and*
 - b. Minimising energy and water consumption by measures including the use of appropriate layout and orientation, building form, design and construction, and design to take account of microclimate so as to minimise carbon dioxide emissions through giving careful consideration to how all aspects of development form.*

- 2.14 *Proposals that enhance the quality of the environment of the borough could include those that improve the openness of the areas outside of development limits defined under Policy CP9. Landowners and developers have the primary responsibility for protecting their land against the risk of flooding. They are also responsible for managing the drainage of their land such that they do not adversely affect adjoining properties. It is essential that future development is planned carefully, in accordance with PP25 (and the accompanying Good Practice Guide), the Flood Direction 2007 and the Wokingham Borough Strategic Flood Risk Assessment, steering it away from areas that are most at risk from flooding and ensuring that it does not exacerbate existing flooding problems. A planning solution to flood risk management should be sought wherever possible. At the planning application stage, the developer/ applicant is responsible for preparing a detailed site based Flood Risk Assessment or Drainage Impact Assessment depending upon the location and scale of development. It is essential that the developer/ applicant consider the possible change in flood risk over the lifetime of the development because of climate change. Sustainable Urban Drainage*

⁸ <https://www.wokingham.gov.uk/planning-policy/adopted-development-plan/local-plans>

Systems can be used to minimise the risk and impact of flooding. Developers will be expected to provide and fund effective SUDS maintenance regimes. New development should be designed to be resilient to flooding as appropriate.

- 2.15 The Planning Policies and Constraints Map⁹ spatially illustrates the policies of the development plan on an ordnance survey base. The map also allows you to investigate potential site constraints which may be relevant to those considering proposed development and the submission of a future planning application. Information relevant to the site is referenced within this FRA.
- 2.16 The WBC SFRA¹⁰, updated in January 2020, provides the background information on flood risk and flood risk policy for the borough, as well as the requirements for site-specific development proposals, land-use planning and flood risk mitigation. The SFRA also provides individual flood risk information for over 266 potential allocation sites. Relevant information from the SFRA has been referenced throughout this FRA report.

⁹ <https://www.wokingham.gov.uk/planning-policy/adopted-development-plan/policies-map>

¹⁰ <https://www.wokingham.gov.uk/sites/wokingham/files/2023-07/1.%20WBC%20SFRA%202020%20Report.pdf>

3 CONSULTATION

Environment Agency

- 3.1 Consultation was undertaken with the Environment Agency on 20th March 2024 and a response was received on 15th April 2024. The EA provided a Product 4 information pack for the site, which included data from the Blackwater (Sandhurst to Bramshill) model, completed in May 2009. Modelled flood flow and levels, detailed flood mapping, historic flood mapping and hazard mapping are provided, these are discussed further in Section 6. The full response is included as Appendix A.

Lead Local Flood Authority

- 3.2 Consultation was undertaken with Wokingham Borough Council as the LLFA on 20th March 2024. A response is awaited and will be included within the report once received.

Internal Drainage Board

- 3.3 The site is not located within an IDB District.

Thames Water

- 3.4 Thames Water were contacted to obtain sewer records for the site, these are discussed further in Section 9.

4 SITE DESCRIPTION

Site Description

- 4.1 The site is located at National Grid Reference SU 79644 62704, is irregular in shape and occupies an area of approximately 2.3 hectares (ha). The site location is presented in Figure 1.

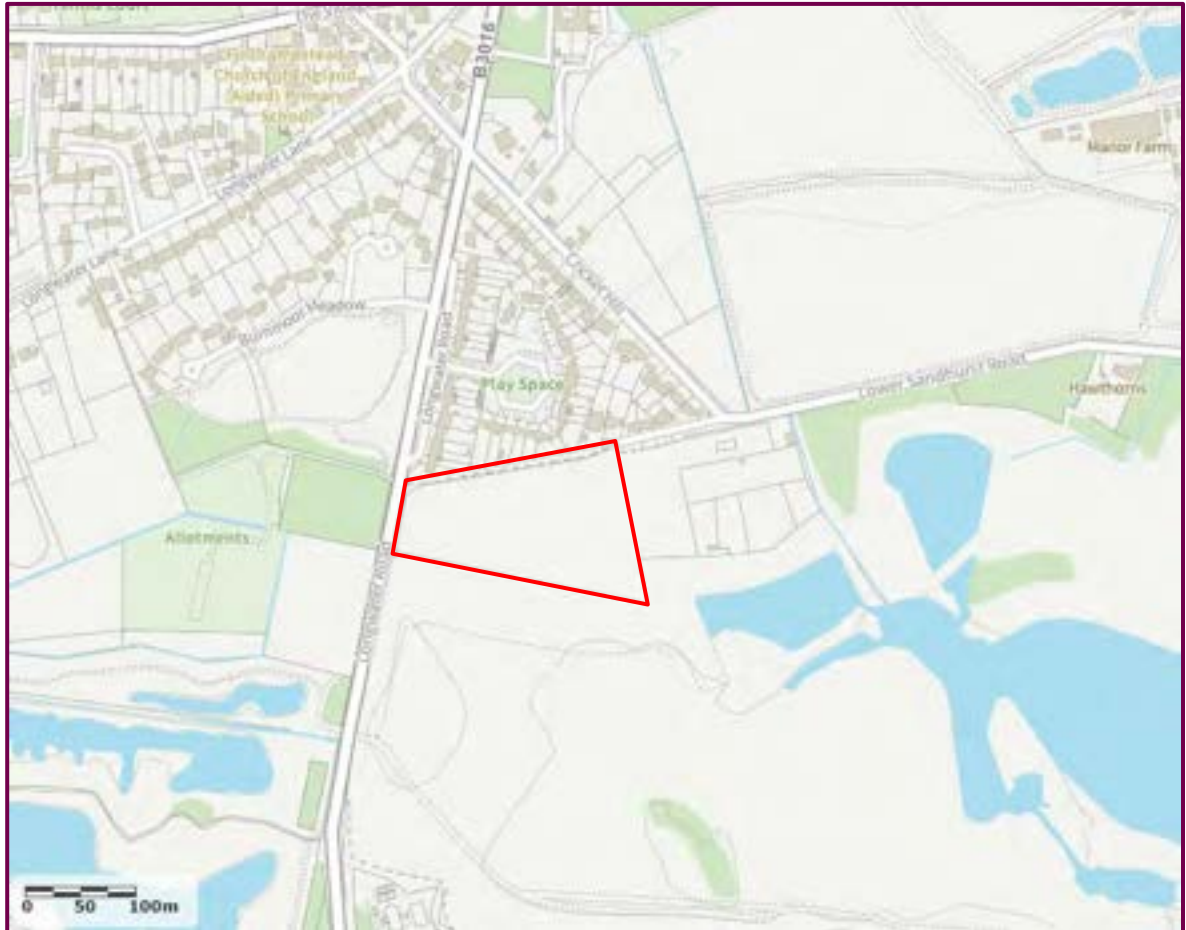


Figure 1. Site Location

- 4.2 The site is currently occupied by greenfield land.

Surrounding Land Uses

- 4.3 Residential properties associated with Longwater Road and Wood Moor are located adjacent to the northern boundary. Longwater Road delineates the western boundary of the site, whilst further greenfield land is located to the south and east. An unnamed ordinary watercourse borders the southern boundary.
- 4.4 There are no designated sensitive areas (e.g. Special Area of Conservation (SAC), Special Protection Area (SPA) or Site of Special Scientific Interest (SSSI)) within 1km of the site.

Topography

- 4.5 The site generally falls towards the south from a level of approximately 57.0m Above Ordnance Datum (AOD) in the northeast corner, to approximately 52.2m AOD at the southernmost tip of the site. The Topographical Survey of the site is included within Appendix B for reference.

Site Observations

- 4.6 A site visit was undertaken by RPS on 3rd April 2024. The site is greenfield land currently occupied by open fields, as shown in Figure 2 below.



Figure 2. View of the site (facing south)

- 4.7 During the site visit, a drainage ditch (unnamed ordinary watercourse) was observed along the southern boundary, as illustrated in Figure 3. The ditch contained water however it was unclear which direction it was flowing.



Figure 3. Drainage ditch on southern boundary

- 4.8 The site was generally dry when the walkover was undertaken, apart from one area of surface water ponding that was observed in the northwest corner of the site. This is shown in Figure 4 below.



Figure 4. Surface water ponding in northwest corner (facing east)

5 PROPOSED DEVELOPMENT

- 5.1 The proposed development comprises *“Erection of 40 no. residential dwellings, together with associated parking, landscaping and open space”*.
- 5.2 Development plans are shown in Appendix C.
- 5.3 Based on the development plans, RPS estimate that the development will have an impermeable area of 0.73ha (including a 10% allowance for urban creep where appropriate). Based on this plan RPS also estimate that the site will comprise approximately 32% hardstanding and 68% soft landscaping.
- 5.4 The proposed use of the site is classified as ‘More Vulnerable’ within the PPG.
- 5.5 The potential to provide surface water attenuation, including the use of Sustainable Drainage Systems (SuDS), has been considered as part of the preliminary design process (see Section 9 – Drainage Strategy).

6 HYDROLOGICAL SETTING

Nearby Watercourses

- 6.1 OS Mapping indicates that the nearest watercourse to the site is an unnamed ordinary watercourse located adjacent to the southern site boundary. The FEH Web Service indicates this watercourse is flowing in an easterly direction. Further ordinary watercourses are located within the vicinity of the site, the closest being situated approximately 180m to the east and 100m to the west.
- 6.2 Blackwater River is designated as an EA main river and is located approximately 360m south of the site.
- 6.3 Numerous ponds/lakes are located to the south of the site, along the route of Blackwater River, the nearest water body is located 50m to the southeast.
- 6.4 No significant artificial water features (e.g. canals, reservoirs) have been identified within 1km of the site.

Fluvial / Tidal Flood Risk Classification

- 6.5 The EA Flood Map for Planning¹¹, which is available online, indicates that the site is located within Flood Zone 1, whereby the annual probability of flooding from fluvial or tidal sources is classified as less than 1 in 1,000 (0.1%) chance of flooding from rivers or the sea in any given year. The EA Flood Map for Planning is provided in Figure 5.

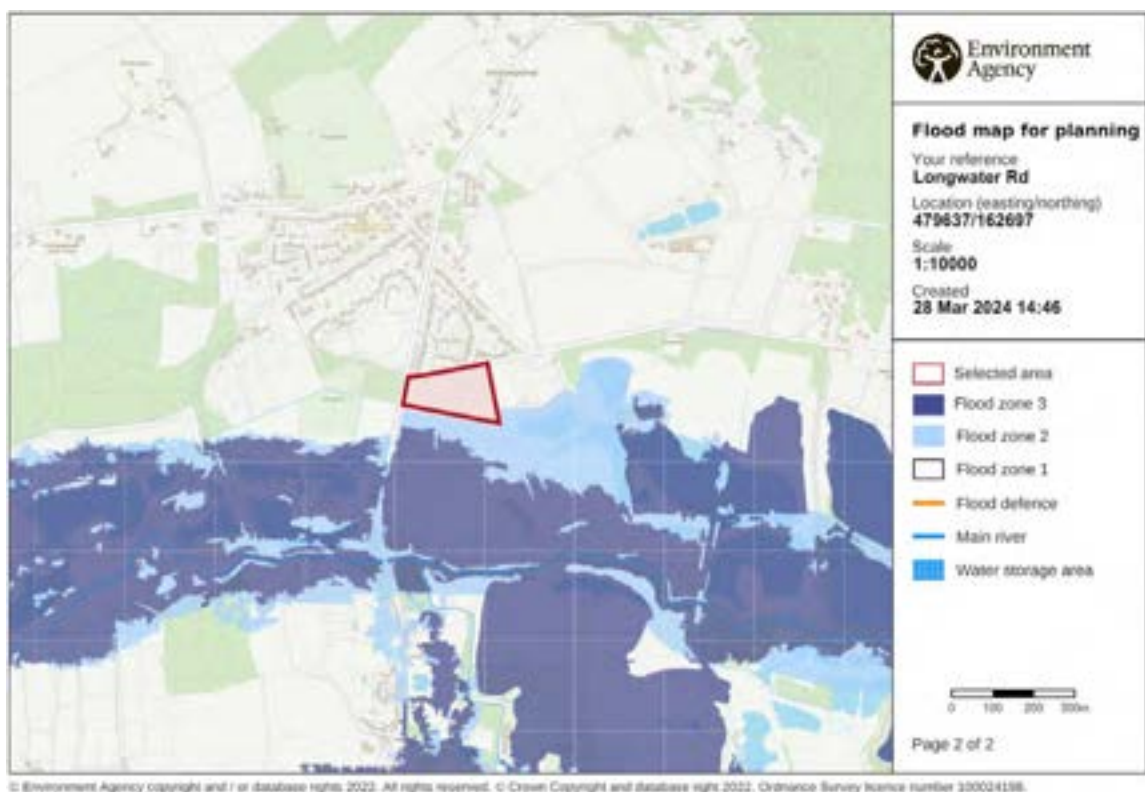


Figure 5. EA Flood Map for Planning

¹¹ <https://flood-map-for-planning.service.gov.uk/>

Product 4 Data

- 6.6 Consultation was undertaken with the EA. The EA provided modelled flood levels and extents for the Blackwater River as part of the Product 4 response.
- 6.7 The EA indicated that there are no defences along Blackwater River.
- 6.8 The EA's historic flood map illustrates that there are no recorded flood events within the site boundary. The 2007 historic flood extents impacted up to the southern site boundary but did not impact the site.
- 6.9 Flood extent mapping have been provided for the site and include up to the 100 year + 70% climate change extent. This indicates the entire site is situated outside of this flood extent. This is shown in Figure 6 below.

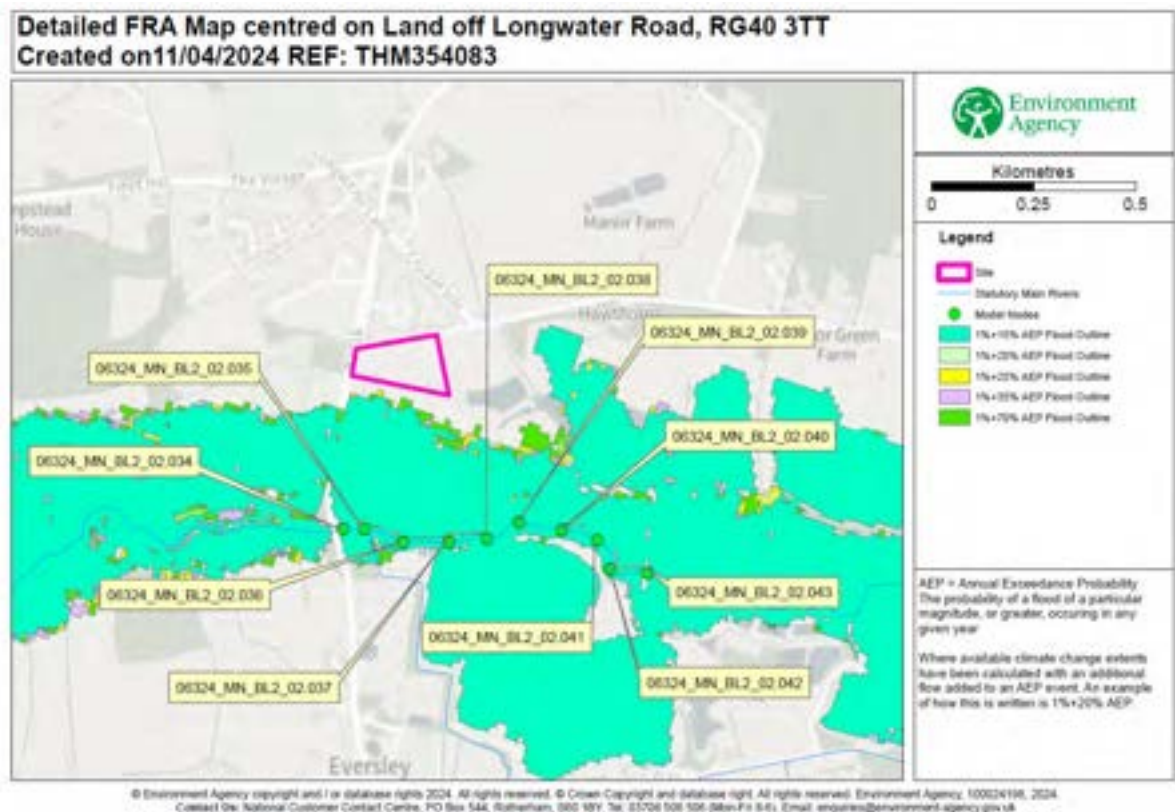


Figure 6. EA Product 4 Climate Change Extents for the Site

- 6.10 The nearest model node to the site is node 06324_MN_BL2_02.037. The 1 in 100 year flood level for this node is 51.85mAOD, whilst the 1 in 100 year +70% climate change flood level is 51.91mAOD. The lowest elevation at the site based on the topographic survey (Appendix B) is 52.20mAOD. Therefore, this further confirms that the entire site is located outside of the flood extent for the 1 in 100 year +70% climate change event.

EA Flood Warning Area

- 6.11 The EA defines a Flood Warning Area as “geographical areas where we expect flooding to occur and where we provide a Flood Warning Service. They generally contain properties that are expected to flood from rivers or the sea and in some areas, from groundwater.”
- 6.12 The site is not located in a Flood Warning Area; however the River Blackwater and The Cove Brook Flood Warning Area is located immediately adjacent to the southern site boundary.

Surface Water Flood Risk Classification

6.13 Surface water flood risk is defined by the EA as:

- 'Very low' risk of surface water flooding; land assessed as having less than 1 in 1,000 (0.1%) chance of flooding in any given year.
- 'Low' risk of surface water flooding; land assessed as having between a 1 in 1000 (0.1%) and a 1 in 1,00 (1%) chance of flooding in any given year.
- 'Medium' risk of surface water flooding; land assessed as having between 1 in 100 (1%) and 1 in 30 (3.3%) chance of flooding in any given year.
- 'High' risk of surface water flooding; land assessed as having greater than 1 in 30 (3.3%) chance of flooding in any given year.

6.14 The EA's Flood Map for Surface Water¹², which is available online, indicates that the majority of the site is at 'Very Low' risk of surface water flooding. The southeast corner of the site and southern boundary are at predominantly 'low' risk of surface water flooding, with some very small patches of 'medium' risk. The Flood Map for Surface Water is presented in Figure 7.

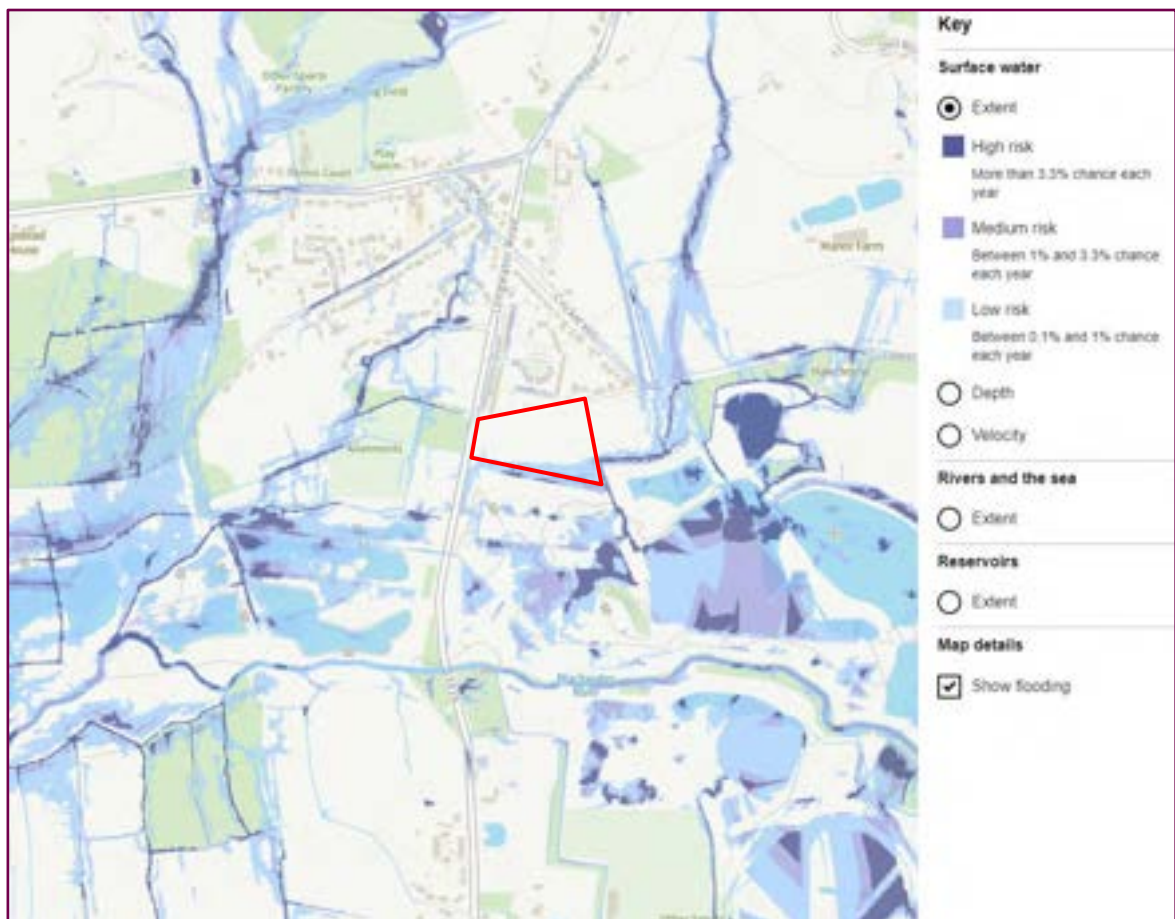


Figure 7. Flood Map for Surface Water

6.15 The area of surface water flood risk in the south appears to be fed by a surface water flow path, the flow path originates offsite and enters the site from the east.

¹² <https://www.gov.uk/check-long-term-flood-risk>

Reservoir Flood Risk Classification

- 6.16 EA reservoir mapping¹³, illustrated in Figure 8 below, indicates that the site is not located within an area potentially at risk from reservoir flooding.

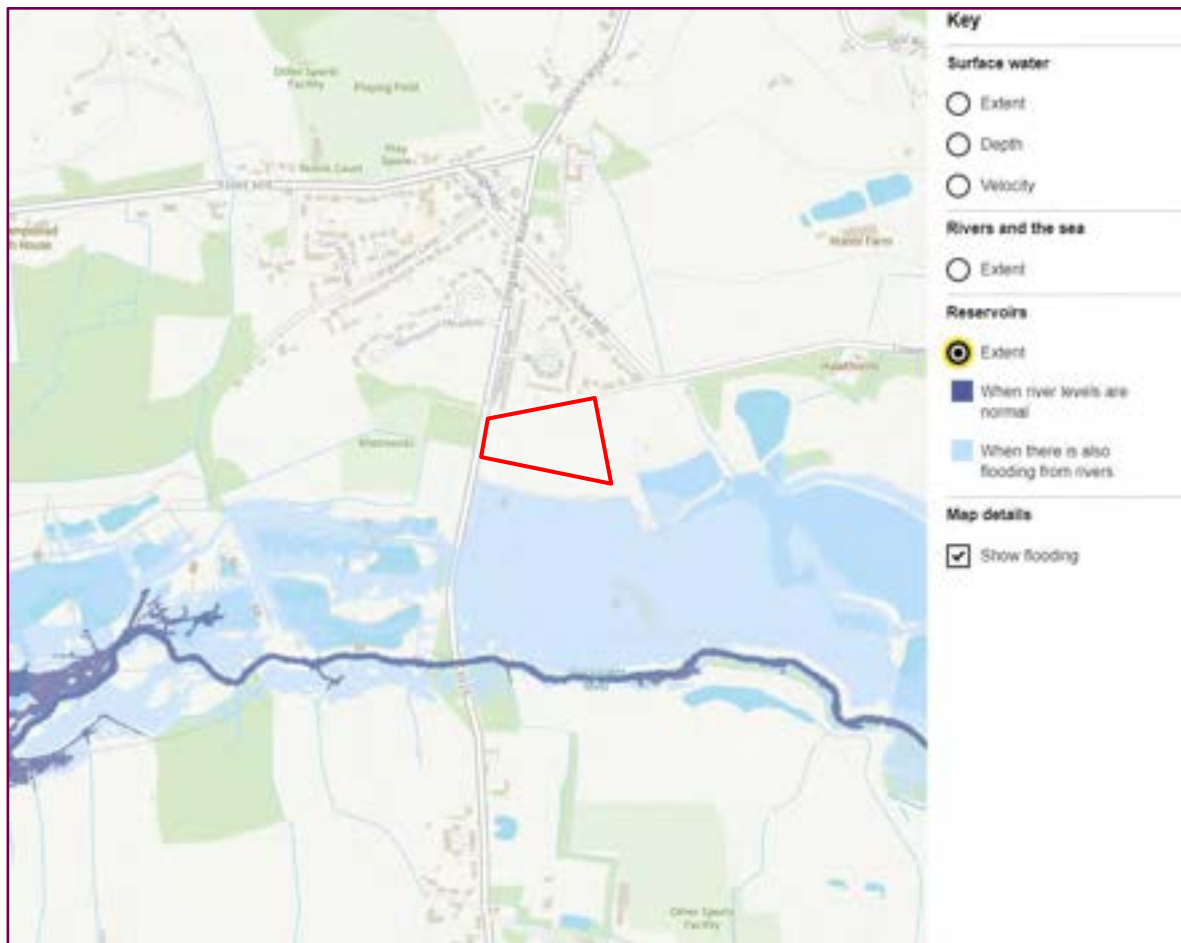


Figure 8. Flood Map for Reservoirs

Local Authority SFRA

- 6.17 The WBC SFRA¹⁴, updated in January 2020, provides an overview of flood risk from various sources within the area. The SFRA does not identify any historic incidents of groundwater flooding in Finchampstead. The Thames Catchment Flood Management Plan identifies that Wokingham has between 500 to 1,000 properties at risk from a 1%AEP fluvial flooding event.
- 6.18 The SFRA assesses the proposed development site, referred to as '5FI047 Land at Longwater Road'. The flood risk from this site-specific assessment is summarised below:
- The site is fully located in Flood Zone 1.
 - There is potential for basements flooding due to the groundwater flood risk.
 - 12.74% of the site is located in the 1 in 1000 year surface water extent.

¹³ <https://www.gov.uk/check-long-term-flood-risk>

¹⁴ <https://www.wokingham.gov.uk/sites/wokingham/files/2023-07/1.%20WBC%20SFRA%202020%20Report.pdf>

- 1.35% of the site is located in the 1 in 100 year surface water extent.
- 0.08% of the site is located in the 1 in 30 year surface water extent.

6.19 The WBC Planning Policies and Constraints Map¹⁵ provides the following information relevant to the site:

- The site is located outside of Flood Zones 2 and 3.
- The site is not located in a historic flood extent.
- An ordinary watercourse is located along the southern boundary.
- The southeast corner of the site is at risk from surface water flooding.

6.20 The Thames Valley Flood Scheme is looking to provide some flood mitigation in the area to reduce flood risk across the Thames valley catchment. Limited details are currently available on the scope of work to be undertaken.

¹⁵ <https://www.wokingham.gov.uk/planning-policy/adopted-development-plan/policies-map>

7 HYDROGEOLOGICAL SETTING

- 7.1 British Geological Survey (BGS)¹⁶ online mapping (1:50,000 scale) indicates that the site is underlain by bedrock geology of Bagshot Formation - Sand. The northern half of the site has no superficial deposits, whereas the southern half of the site is situated on River Terrace Deposits, 2 - Sand and gravel.
- 7.2 The nearest BGS borehole records to the site are SU76SE12, located approximately 200m to the southwest and SU86SW3, located approximately 600m to the east. Groundwater was struck at 1.2 and 1m below ground level (bgl) in these boreholes.
- 7.3 Soakaway testing was undertaken by GRM Development Solutions in June 2017 at the site. Four soakaway trial pits were excavated to depths between 1.7m to 2.0m bgl. Topsoil was recorded to depths of between 0.3m to 0.4m bgl, the River Terrace Deposits were recorded below the topsoil in all four holes as either brown or light grey very clayey fine to coarse sand or very sandy clay with gravel of quartzite and chert and were recorded to depths of 1.7m to depths exceeding 1.9m bgl. The underlying Bagshot Formation was only recorded in SA-04 from 1.7m bgl as a light brown slightly clayey fine to coarse SAND.
- 7.4 An infiltration to 75% was unachievable and an accurate infiltration rate could not be calculated for any of the soakaways. High fines content of the soils has resulted in low infiltration rates. Accordingly, it is recommended that an alternative method of disposing of surface water is sought. The results of the soakaway testing are provided in Appendix D.
- 7.5 The soils are described as 'Loamy soils with naturally high groundwater' by Soilsclapes¹⁷.
- 7.6 According to the MAGIC's Aquifer Designation Mapping¹⁸, the bedrock and superficial deposits are classified as a 'Secondary A' aquifer. These formations comprise permeable layers that can support local water supplies and may form an important source of base flow to rivers.
- 7.7 MAGIC's groundwater Source Protection Zone (SPZ) mapping indicates that the site is not located within a groundwater SPZ.
- 7.8 MAGIC's groundwater Vulnerability Map indicates that the site is classified medium - high vulnerability.

¹⁶ <https://www.bgs.ac.uk/map-viewers/bgs-geology-viewer/>

¹⁷ <https://www.landis.org.uk/soilsclapes/>

¹⁸ <https://magic.defra.gov.uk/magicmap.aspx>

8 FLOOD RISK AND MITIGATION

- 8.1 The key sources of flooding that could potentially impact the site are discussed below:

Fluvial / Tidal Flooding

- 8.2 The EA Flood Map for Planning, as seen in Figure 5, indicates that the site is located within Flood Zone 1. The annual probability of flooding is classified as less than 0.1% chance of flooding from rivers or the sea, in the absence of any defences.
- 8.3 EA Product 4 data indicates the site is outside of the 1 in 100 year +70% climate change extent.
- 8.4 The lowest proposed finished floor level for the residential dwellings is 53.80m AOD, which is 1.89m above the 1 in 100 year +70% climate change flood level for the Blackwater River.
- 8.5 The EA's historic flood map illustrates that there are no recorded flood events within the site boundary.
- 8.6 The PPG details the suitability of different land uses within each flood zone. The proposed land use is classified as 'More Vulnerable' and such uses are generally considered appropriate within Flood Zone 1.
- 8.7 Considering that the site is in Flood Zone 1 and above the 1 in 100 year +70% climate change flood level, flood risk from fluvial and tidal flooding is considered to be low and no mitigation is required.

Flooding from Sewers

- 8.8 Sewer flooding can occur during periods of heavy rainfall when a sewer becomes blocked or is of inadequate capacity.
- 8.9 The TW sewer records indicate that there are currently no surface water sewers located within the site boundary. These records are included in Appendix E. Once the site is developed, the drainage system will be designed to accommodate flows up to the 1 in 100 year +40% climate change storm event.
- 8.10 Flood risk from Sewer flooding is considered to be low and no mitigation is required.

Surface Water Flooding (Overland Flow)

- 8.11 This can occur during intense rainfall events, when water cannot soak into the ground or enter drainage systems.
- 8.12 The area of surface water flood risk in the south appears to be fed by a surface water flow path, the flow path originates offsite and enters the site from the east. Based on the proposed layout (Appendix B) the development will be located away from the areas of surface water flood risk, with the proposed SuDS feature and open space located in the southern part of the site.
- 8.13 Once the site is developed, the proposed surface water drainage strategy will intercept and manage surface water runoff. This will provide a betterment on the existing situation and ensure flood risk does not increase for existing or proposed properties. The management of surface water at the site is considered in Section 9 of this report.
- 8.14 Flood risk from surface water flooding is considered to be 'Very low' for the majority of the site, with areas of 'Low' risk and some 'Medium' risk within the southeast portion of the site. With a surface water management plan in place, the risk is considered low.

Groundwater Flooding

- 8.15 This can occur in low-lying areas when groundwater levels rise above surface levels, or within underground structures. The River Terrace Deposits and Bagshot Formation are classified as a 'Secondary A' aquifer. These formations comprise permeable layers that can support local water supplies and may form an important source of base flow to rivers.
- 8.16 The SFRA does not identify any historic incidents of groundwater flooding in Finchampstead. The SFRA Susceptibility to Groundwater Flooding Map indicates that the site is located in an area with limited potential for groundwater flooding to occur. The site-specific assessment of the site in the SFRA indicates that there is potential for basement flooding as a result of the groundwater flood risk. No basements are proposed on the site.
- 8.17 BGS borehole logs indicate that the groundwater table is approximately 1-1.2m bgl. It is recommended that a groundwater monitoring study is undertaken in winter months prior to the commencement of construction.

Other Sources

- 8.18 As with any urban location, there is the risk of a break in a water main causing localised flooding at the site. A burst pipe can result in flooding of roads and property. Areas at most risk are low points in topography along open roads and tunnels. The development proposals will be designed to ensure that any overland flows are routed away from buildings and intercepted by gullies and or drainage channels, therefore potential risks posed by a break in a water main can be considered negligible.
- 8.19 EA mapping identified the site is not considered to be at risk from reservoir flooding.

Proposed Mitigation

- 8.20 Due to the potentially shallow groundwater table in the area, the proposed SuDS features may need to be lined to prevent groundwater ingress. Groundwater monitoring is recommended at the site to inform this.

9 DRAINAGE STRATEGY

Introduction

- 9.1 To demonstrate that all forms of flooding have been considered as required by the NPPF a conceptual surface water and foul drainage strategy has been developed. The aim of including this strategy as part of the FRA is so that it can easily be demonstrated that the Proposed Development will not adversely affect the surface water regime in the area and that overall, the current situation will be improved.
- 9.2 For developments with a lifetime beyond 2100, FRA's should assess the upper end allowances for the 2070s epoch for both the 1% and 3.3% annual exceedance probability events. The proposed site is located within the Loddon and Tributaries Management Catchment. RPS have added 40% to all attenuation / runoff calculations for the development to account for climate change.

Existing Surface Water Drainage

- 9.3 TW sewer records, included for reference in Appendix E, indicate that there are no public surface water sewers located within the site boundary. Public surface water sewers are located within the vicinity of the site, most notably a 225mm diameter sewer located in Burnmoor Meadow to the northwest.
- 9.4 The greenfield nature of the site means that surface water will slowly soak into the ground (infiltrate), be intercepted by vegetation or run off by way of overland flow, according to the soil characteristics and following the topography of the site.
- 9.5 Greenfield runoff rates for the site have been calculated by way of Interim Code of Practice for Sustainable Drainage Systems (ICP SUDS). This implements a pro rata IH124 methodology, for sites below 50ha in size. The greenfield rate has been based on the site area of 2.29ha. The calculation has been included for reference within Appendix F and outputs are summarised within Table 2.

Return Period	Greenfield Runoff Rate (l/s)
Q1	5.35
QBar	6.29
Q30	14.48
Q100	20.08

Table 3 – Greenfield Runoff Rates (Based on a 2.29ha area)

Existing Foul Water Drainage

- 9.6 TW sewer records are included for reference in Appendix E, indicating that a 150mm diameter public foul water sewer is located in the site. This sewer is located along the northern boundary, flowing in a westerly direction to a foul pumping station located approximately 130m west of the site.

Consideration of Drainage Hierarchy

9.4 The PPG advises of the following hierarchy for the disposal of surface water;

1. Infiltration;
2. To a surface water body;
3. To a surface water sewer, highway drain or another drainage system; or
4. To a combined sewer.

The drainage hierarchy has been considered as follows.

Infiltration

9.5 The soakaway testing (Appendix D) undertaken at the site concluded that an infiltration to 75% was unachievable and an accurate infiltration rate could not be calculated for any of the soakaway tests. As a result, an alternative method for disposing of surface water will be considered.

To a Surface Water Body

9.6 It is proposed to discharge surface water to a nearby watercourse, located to the southwest of the site.

To a Surface Water Sewer, Highway Drain or Another Drainage System

9.7 TW records indicate that the closest surface water sewer is located on Burnmoor Meadow, to the northwest of the site. This is at a higher elevation and may require pumping, however, as an outfall to a surface water body is proposed, discharging to a surface water sewer has not been considered.

To a Combined Sewer

9.8 TW records indicate there are no combined sewers located in the vicinity of the site. As an outfall is proposed to a surface water body, discharging to a combined sewer has not been considered.

Proposed Surface Water Drainage

9.9 Based on the current information available, the proposed surface water drainage strategy will make use of local attenuation with a positive outfall.

9.10 The Conceptual Drainage Strategy illustrating drainage proposals based upon a discharge to a nearby ordinary watercourse is provided within Appendix G. The strategy has been designed based upon the following parameters:

- Total Site Area = 2.290 ha
- Total Impermeable Area plus 10% Urban Creep Allowance = 0.73 ha
- Greenfield Runoff Rate = 6.29 l/s
- Restriction Rate = 4.6 l/s
- Storage requirement for 1 in 100 year +40% Climate Change event = 502m³

9.11 It is proposed that surface water will be collected and conveyed, by a gravity sewer system and attenuated prior to discharge in an attenuation basin located in the southeast corner of the site. Surface water will outfall to an ordinary watercourse located to the southwest of the site at a restricted rate of 4.6l/s. The restricted rate of 4.6l/s is based on the greenfield runoff rate for the proposed impermeable area of the development.

9.12 Surface water storage is provided within an attenuation basin, providing a total storage volume of 502m³. Surface water calculations are provided in Appendix H for reference, demonstrating that the

proposed drainage network can accommodate flows up to the 1 in 100 year +40% climate change storm event.

- 9.13 A surface water outfall is proposed to an ordinary watercourse located approximately 250m to the southwest of the site. A 300mm diameter surface water sewer will be installed in Longwater Road, with a headwall outfall into the watercourse as it passes under the road. An ordinary watercourse consent will be required from the LLFA for the outfall.
- 9.14 It should be noted that both the Conceptual Drainage Strategy indicated within Appendix G, and supporting calculations within Appendix H, are preliminary, and as such, subject to further detailed design and approval by the relevant authorities. However, the designs illustrate that surface water arising from the development may be sustainably managed such that it does not pose a flood risk, either to proposed or existing development, up to and including the 1 in 100 year +40% climate change storm event.

Site Specific SuDS Benefits

- 9.16 Sustainable drainage is a departure from the traditional approach to draining sites. There are some key principles that influence the planning and design process enabling SuDS to mimic natural drainage by:
- storing run-off and releasing it slowly (attenuation);
 - allowing water to soak into the ground (infiltration);
 - slowly transporting (conveying) water on the surface;
 - filtering out pollutants;
 - allowing sediments to settle out by controlling the flow of water.
- 9.17 CIRIA has produced several guidance documents covering a range of water management scenarios. A summary of the publications used as reference when the site drainage strategy was produced are listed below.
- Planning for SUDS – making it happen (C687)
 - Site handbook for the construction of SUDS (C698)
 - The SUDS Manual 2015 (C753)
 - Sustainable Drainage Systems – Hydraulic, structural and water quality advice (C609)

Attenuation Basin

- 9.18 The attenuation basin will allow peak flow rates to be reduced and enable flows to be limited to significantly below the existing run-off rate during storm events. The SuDS features are also useful in providing water treatment predominantly through the settlement of silts and suspended sediments. The basin will take the form of a depression within the application site and can be landscaped to provide aesthetic and amenity value. Planting can be used to improve biodiversity and attract wildlife.

Water Quality

- 9.19 Surface water run-off should be managed by SuDS that are designed to attenuate flows and to avoid water quality impacts downstream. To demonstrate that surface water arising from the development will be appropriately treated prior to discharge, the Simple Index Approach, as outlined within the SuDS Manual (CIRIA C753) has been followed.
- 9.20 As stated in the SuDS Manual 2015 (C753), the risk posed by surface water runoff to the receiving environment is a function of:

- the pollution hazard at a particular site (i.e. the *pollutant source*)
- the effectiveness of SuDS treatment components in reducing levels of pollutants to environmentally acceptable levels, groundwater (i.e. the *pollutant pathway*)
- the sensitivity of the receiving environment (i.e. the *environmental receptor*).

9.21 The most significant pollutant load within the site will arise from individual property driveways, residential car parks, low traffic roads and non-residential car parking with infrequent change. These have an identified pollutant hazard level of 'Low' as per the SuDS Manual (CIRIA C753) Table 26.2, with identified pollutant hazard indices of 0.5 for Total Suspended Solids (TSS), 0.4 for Metals, and 0.4 for Liquid Hydrocarbons.

9.22 The attenuation basin, as proposed, has identified mitigation indices (The SuDS Manual, CIRIA C753, Table 26.3), of 0.5 for TSS, 0.5 for Metals and 0.6 for Liquid Hydrocarbons. Mitigation indices therefore exceed maximum anticipated pollutant hazard indices. This confirms that surface water arising from the development will receive an appropriate level of treatment in advance of discharge from site.

9.23 The maintenance and adoption of the SuDS features are described below.

Proposed Foul Water Drainage

9.24 As illustrated by the Conceptual Drainage Strategy in Appendix G, it is proposed that foul water will be conveyed by a gravity sewer system to a foul water pumping station located in the south of the site. Foul flows will then be pumped to the existing 150mm diameter public foul water sewer located in Longwater Road to the northwest.

9.25 It is recommended that a pre-planning enquiry is submitted to TW, to confirm whether there is capacity within the local sewer network to accommodate foul water from the proposed development.

9.26 The foul water connection into the existing network will be subject to the successful submission of a Section 106 agreement under the Water Industry Act and approval from TW.

Maintenance and Adoption

9.27 A specialist management company will be identified at the detailed design stage and appointed to maintain the SuDS features for the lifetime of the development.

9.28 Tables 4 to 6, below, indicate the envisaged maintenance activities associated with the proposed attenuation basin, associated headwalls and the flow control manhole, along with the approximate frequency within which they should be completed.

Table 4. Attenuation Basin Suggested Maintenance Schedule

Maintenance schedule	Require Action	Typical Frequency
Regular Maintenance	Remove litter and debris	As required potentially monthly
	Cut grass – public areas	Monthly (during growing season)
	Cut grass – meadow grass in and around basin	Half yearly (spring, before nesting season, and autumn)
	Inspect vegetation to pond edge and remove nuisance plants (for first 3 years)	Monthly (at start, then as required)
	Hand cut submerged and emergent aquatic plants (at minimum of 0.1m above pond base; include max 25% of pond surface)	Annually
	Remove 25% of bank vegetation from waters edge to a minimum of 1m above water level	Annually
	Tidy all dead growth before start of growing season	Annually
	Remove sediment from forebay	1 – 5 years, or as required
	Remove sediment from one quadrant of the main body of ponds without sediment forebays	2 – 10 years (usually)
Occasional Maintenance	Remove sediment from the main body of big ponds, when pool volume is reduced by 20%	>25 years (usually)
Remedial Actions	Repair of erosion or other damage	As required
	Aerate pond when signs of eutrophication are detected	As required
	Realignment of rip rap or other damage	As required
	Repair/rehabilitation of inlets, outlets and overflows	As required
Monitoring	Inspect structures for evidence of poor operation	Monthly/after large storms
	Inspect banksides, structures, pipework etc. for evidence of physical damage	Monthly/after large storms
	Inspect water body for signs of eutrophication	Monthly (May - October)
	Inspect silt accumulation rates and establish appropriate removal frequencies	Half yearly
	Check penstocks and other mechanical devices	Half yearly

Table 5. Flow Control Manhole Suggested Maintenance Schedule

Maintenance schedule	Require Action	Typical Frequency
Regular Maintenance	Inspect vegetation above and around flow control chamber and remove nuisance plants (for first 3 years)	Monthly (at start, then as required)
	Remove sediment from flow control chambers	Annually
	Flow control devices: Check for and clear obstructions	Quarterly
Remedial Actions	Repair of Penstock and flow control device	As required
Monitoring	Inspect structures for evidence of poor operation	Monthly/after large storm
	Inspect structures, flow control and pipework etc. for evidence of physical damage	Monthly/after large storm
	Inspect silt accumulation rates and establish appropriate removal frequencies	Half yearly

Table 6. Inlet and Outlet Headwalls Suggested Maintenance Schedule

Maintenance schedule	Require Action	Typical Frequency
Regular Maintenance	Litter removal	As required
	Inspect vegetation above and around headwall and remove nuisance plants (for first 3 years)	Monthly (at start, then as required)
	Tidy all dead growth before start of growing season	Annually
	Remove sediment from aprons	Annually
	Flap valves and grilles: Check for and clear obstructions	Quarterly
Remedial Actions	Repair of erosion or other damage around headwalls	As required
Monitoring	Inspect structures for evidence of poor operation	Monthly/after large storms
	Inspect structures, pipework etc. for evidence of physical damage	Monthly/after large storms
	Inspect silt accumulation rates and establish appropriate removal frequencies	Half yearly
	Check flap valves	Half yearly

10 SEQUENTIAL TEST AND EXCEPTION TEST

Vulnerability Classification

- 10.1 In accordance with the Flood Risk Vulnerability Classification in Table 2 of the Planning Practice Guidance Flood Risk and Coastal Change, a housing development is classified as a 'More Vulnerable' development in flood risk terms.

Sequential Test

- 10.2 The NPPF requires the Local Authority to apply the Sequential Test in consideration of new development. The aim of the Test is to steer new development to areas at the lowest probability of flooding.
- 10.3 The revised section of the NPPF (December 2023) on "planning and flood risk" makes it clear that the flood sequential test is intended to be applied to all sources of flood risk, not just river/sea flooding. Paragraph 167 NPPF states:
- 10.4 *"All plans should apply a sequential, risk-based approach to the location of development – taking into account all sources of flood risk and the current and future impacts of climate change – so as to avoid, where possible, flood risk to people and property. They should do this and manage any residual risk."*
- 10.5 The approach we have taken is to look at all sources of flooding at the site, to determine whether a flood sequential test is required – i.e. we have assessed the development to establish whether it is an area with the lowest risk of flooding from any source.
- 10.6 The development itself is in Flood Zone 1, the majority of the site is at 'Very Low' risk of surface water flooding and a small proportion of the site at low to medium risk of surface water flooding in the southeast corner. Based on our assessment of the best available information for all sources of flooding for this site, we conclude that the development is at the "lowest risk of flooding" from any source.
- 10.7 Based on the above it can be concluded that the development has been sequentially steered to land of low risk of flooding, passing the Sequential Test.

Exception Test

- 10.8 According to Table 3 of the PPG, more vulnerable developments are considered appropriate within Flood Zone 1 without the requirement to apply the Exception Test.

11 SUMMARY AND CONCLUSIONS

- 11.1 The aim of the FRA is to outline the potential for the site to be impacted by flooding, the potential impacts of the development on flooding both onsite and in the vicinity, and the proposed measures which can be incorporated into the development to mitigate the identified risks. The report has been produced in accordance with the guidance detailed in the NPPF. Reference has also been made to the CIRIA SuDS manual (C753), Wokingham Borough Local Development Framework and the Wokingham Borough Council SFRA.
- 11.2 The potential flood risks to the site, and the measures proposed to mitigate the identified risks, are summarised in Table 7.

Table 7. Proposed mitigation

Source of Flooding	Identified Risk			Mitigation Proposed	Residual Risk		
	L	M	H		L	M	H
Fluvial/ Tidal	✓			No mitigation required	✓		
Sewers	✓			No mitigation required	✓		
Surface Water	✓			All residential dwellings have been located outside of the surface water flood extents. The proposed drainage strategy will intercept and manage surface water run off at the site to the 1 in100 year+40% event.	✓		
Groundwater	✓			Potentially high groundwater table may require SuDS features to be lined to prevent groundwater ingress.	✓		
Other Sources (e.g. reservoirs, water mains)	✓			No mitigation required	✓		

- 11.3 The EA Flood Map for Planning, which is available online, indicates that the site is located within Flood Zone 1, whereby the annual probability of flooding from fluvial or tidal sources is classified as less than 1 in 1000 year.
- 11.4 It is proposed that surface water will be conveyed and attenuated prior to discharge within an attenuation basin. Surface water will be discharged to a nearby watercourse at the greenfield runoff rate. Surface water arising from the development will be sustainably managed such that it does not pose a flood risk, either to proposed or existing development, to the 1 in 100 year +40% climate change storm event.
- 11.5 It has been demonstrated that the development meets the Sequential and Exception Tests imposed under the NPPF.
- 11.6 Overall, it has been demonstrated that the flood risks to the development can be managed, without increasing flood risk elsewhere, and will not result in an increase in flood risk off-site.

APPENDICES

Appendix A

EA Consultation Response

From: Enquiries_THM
To: Josh.Hughes@rpsgroup.com
Subject: THM354083_SM - Product 4 Request - Land off Longwater Road, Finchampstead, RG40 3TT
Date: 15 April 2024 11:42:52
Attachments: image001.png
image002.jpg
image003.png
THM354083.pdf

You don't often get email from enquiries_thm@environment-agency.gov.uk. [Learn why this is important](#)

CAUTION: This email originated from outside of RPS.

Dear Josh,

Reference: THM354083

Provision of Modelled Flood Levels for: Land off Longwater Road, RG40 3TT

Thank you for your request for modelled flood levels. We respond to these requests under the Freedom of Information Act 2000 and Environmental Information Regulations 2004. Please find attached the requested data (referred to as product 4).

Please be aware that the Environment Agency supply data, but we do not interpret it for use in a Flood Risk Assessment. Flood Risk Assessment's should be completed by a suitably competent and qualified person.

You may be interested in the following guidance / information publicly available:

- **'Planning Practice Guidance'** - provides information about planning considerations in areas at risk of flooding. <https://www.gov.uk/government/collections/planning-practice-guidance>
- **'Planning applications: assessing flood risk'** - information about completing Flood Risk Assessments. <https://www.gov.uk/guidance/flood-risk-assessment-for-planning-applications>
- **'Site specific flood risk assessment: Checklist'** – a checklist to help ensure you have considered all the relevant factors in your flood risk assessment. <https://www.gov.uk/guidance/flood-risk-and-coastal-change#Site-Specific-Flood-Risk-Assessment-checklist-section>

Please be aware that from 20th July 2021 the climate change allowances required in flood risk assessments have been updated. Please see <https://www.gov.uk/guidance/flood-risk-assessments-climate-change-allowances#contents> for more information.

We recommend that you discuss your proposals with the Local Planning Authority at the earliest opportunity. They will be able to advise you on a wide range of planning matters in addition to flood risk.

Please note: Due to recent changes in guidance on the allowances for climate change, the 20% increase in river flows should no longer to be used for development design purposes. The data included in this product can be used for interpolation of levels as part of an intermediate level assessment. For further advice on the new allowances please visit <https://www.gov.uk/guidance/flood-risk-assessments-climate-change-allowances>.

Please refer to the table below for the permitted use of the supplied information.

Name	Product 4
Description	Detailed Flood Risk Assessment Map for Land off Longwater Road, RG40 3TT
Licence	Open Government Licence
Information Warning - OS background mapping	<i>The mapping of features provided as a background in this product is © Ordnance Survey. It is provided to give context to this product. The Open Government Licence does not apply to this background mapping. You are granted a non-exclusive, royalty free, revocable licence solely to view the Licensed Data for non-commercial purposes for the period during which the Environment Agency makes it available. You are not permitted to copy, sub-license, distribute, sell or otherwise make available the Licensed Data to third parties in any form. Third party rights to enforce the terms of this licence shall be reserved to OS.</i>
Attribution	Contains Environment Agency information © Environment Agency and/or database rights. Contains Ordnance Survey data © Crown copyright 2017 Ordnance Survey 100024198.

I hope that we have correctly interpreted your request.

Please get in touch if you have any further queries or contact us within two months if you'd like us to review the information we have sent.

Kind regards,

Customers & Engagement Team - **Thames**

 **External: 0203 0259 804**

 enquiries_THM@environment-agency.gov.uk

 **Environment Agency** | Red Kite House, Howbery Park, Wallingford, OX10 8BD



From: Josh Hughes <Josh.Hughes@rpsgroup.com>
Sent: Wednesday, March 20, 2024 3:52 PM
To: Enquiries_THM <enquiries_THM@environment-agency.gov.uk>
Subject: THM354083_SM - Product 4 Request - Land off Longwater Road, Finchampstead, RG40 3TT

Good Afternoon,

We wish to enquire with you regarding flood information for a proposed residential development located at land off Longwater Road, Finchampstead, RG40 3TT. A location plan is attached for reference illustrating the site boundary.

Please could you provide a Product 4 information pack. Could you also provide any historic flood records in the vicinity of the site.

We will be preparing a Flood Risk Assessment and Sustainable Drainage Strategy to support a planning application for this site, therefore please confirm if you have any site specific requirements for this.

If you require any further information then let me know.

Kind Regards,
Josh

Josh Hughes
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Product 4 (Detailed Flood Risk) for Land off Longwater Road, RG40 3TT

Our Ref: THM354083

Product 4 is designed for developers where Flood Risk Standing Advice FRA (Flood Risk Assessment) Guidance Note 3 Applies. This is:

- i) "all applications in Flood Zone 3, other than non-domestic extensions less than 250 sq metres; and all domestic extensions", and
- ii) "all applications with a site area greater than 1 ha" in Flood Zone 2.

Product 4 includes the following information:

Ordnance Survey 1:25k colour raster base mapping;
Flood Zone 2 and Flood Zone 3;
Relevant model node locations and unique identifiers (for cross referencing to the water levels, depths and flows table);
Model extents showing *defended* scenarios;
FRA site boundary (where a suitable GIS layer is supplied);
Flood defence locations (where available/relevant) and unique identifiers; (supplied separately)
Flood Map flood storage areas (where available/relevant);
Historic flood events outlines (where available/relevant, not the Historic Flood Map) and unique identifiers;

Statutory (Sealed) Main River (where available within map extents);

A table showing:

- i) Model node X/Y coordinate locations, unique identifiers, and levels and flows for *defended* scenarios.
- ii) Flood defence locations unique identifiers and attributes; (supplied separately)
- iii) Historic flood events outlines unique identifiers and attributes; and
- iv) Local flood history data (where available/relevant).

Please note:

If you will be carrying out computer modelling as part of your Flood Risk Assessment, please request our guidance which sets out the requirements and best practice for computer river modelling.

This information is based on that currently available as of the date of this letter. You may feel it is appropriate to contact our office at regular intervals, to check whether any amendments/ improvements have been made. Should you re-contact us after a period of time, please quote the above reference in order to help us deal with your query.

This information is provided subject to the enclosed notice which you should read.

This letter is not a Flood Risk Assessment. The information supplied can be used to form part of your Flood Risk Assessment. Further advice and guidance regarding Flood Risk Assessments can be found on our website at:

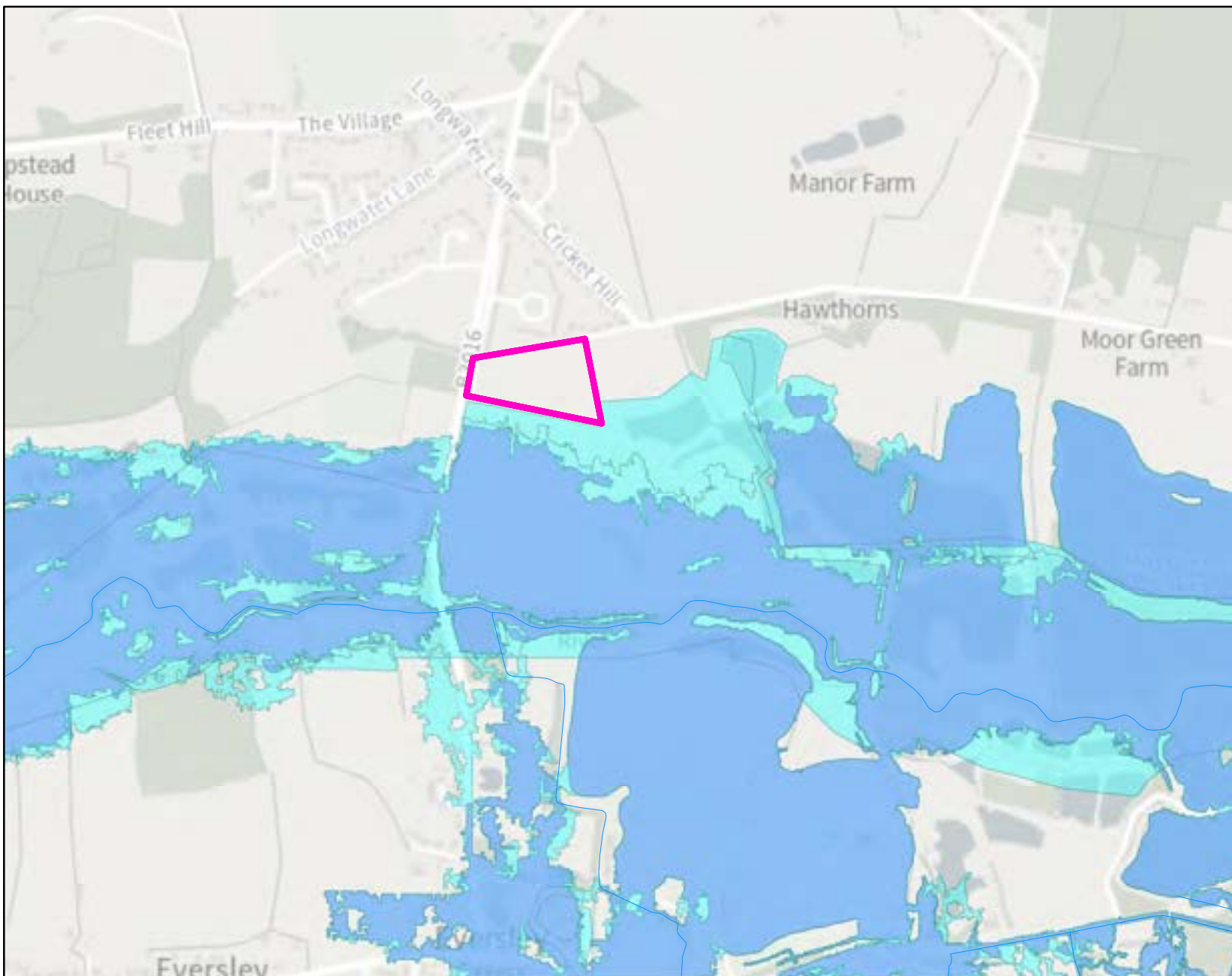
<https://www.gov.uk/guidance/flood-risk-assessment-local-planning-authorities>

If you would like advice from us regarding your development proposals you can complete our pre application enquiry form which can be found at:

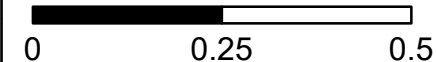
<https://www.gov.uk/government/publications/pre-planning-application-enquiry-form-preliminary-opinion>

Flood Map for Planning centred on Land off Longwater Road, RG40 3TT

Created on 11/04/2024 REF: THM354083



Kilometres



Legend

- Site
- Statutory Main Rivers
- Flood Map - Flood defences
- Flood Map - Flood Storage Areas
- Flooding from rivers or sea (FZ3)
- Extent of extreme flood (FZ2)

Flooding from rivers or sea without defences (Flood Zone 3) shows the area that could be affected by flooding:

- from the sea with a 1 in 200 or greater chance of happening each year
- or from a river with a 1 in 100 or greater chance of happening each year.

The Extent of an extreme flood (Flood Zone 2) shows the extent of an extreme flood from rivers or the sea with up to a 1 in 1000 chance of occurring each year.

Defence information

Defence Location: No defences on Main River

Description: This location is not currently protected by any formal defences and we do not currently have any flood alleviation works planned for the area. However we continue to maintain certain watercourses and the schedule of these can be found on our internet pages.

Model information

THM354083

Model: **Blackwater (Sandhurst to Bramshill) 2009**

Description: The data provided is from the Blackwater Model Update which was completed in May 2009. A 2D TUFLOW model was developed to update the existing 1D Blackwater 2007 model between Sandhurst (NGR SU 84160 60780) and Bramshill (NGR SU 74160 63550), the River Whitewater confluence. The model results for the 13, 21 and 65 hour simulations were combined to provide the maximum flood extents for all the design events. Model re-run to include new climate change allowances in July 2017.

Model design runs and Mapped Outputs:

- 1 in 5 / 20% AEP
- 1 in 20 / 5% AEP
- 1 in 100 / 1% AEP
- 1 in 100+15% / 1% AEP with 15% AEP climate change allowance
- 1 in 100+25% / 1% AEP with 20% AEP climate change allowance
- 1 in 100+35% / 1% AEP with 25% AEP climate change allowance
- 1 in 100+35% / 1% AEP with 35% AEP climate change allowance
- 1 in 100+70% / 1% AEP with 70% AEP climate change allowance
- 1 in 1000 / 0.1% AEP

Model accuracy:

Levels $\pm$ 250mm

Modelled in-channel flood flows and levels

THM354083

The modelled flood levels and flows for the closest most appropriate model node points for your site that are within the river channel are provided below:

				Flood Levels (mAOD)								
Node label	Model	Easting	Northing	20% AEP	5% AEP	1% AEP	1% AEP (+15% increase in flows)	1% AEP (+20% increase in flows)	1% AEP (+25% increase in flows)	1% AEP (+35% increase in flows)	1% AEP (+70% increase in flows)	0.1% AEP
06324_MN_BL2_02.043	Blackwater (Sandhurst to Bramshill) 2009	480245	162186	52.38	52.49	52.53	0.00	52.54	52.55	52.55	52.57	0.00
06324_MN_BL2_02.042	Blackwater (Sandhurst to Bramshill) 2009	480154	162195	52.28	52.39	52.43	0.00	52.45	52.45	52.45	52.47	0.00
06324_MN_BL2_02.041	Blackwater (Sandhurst to Bramshill) 2009	480122	162266	52.18	52.29	52.32	0.00	52.34	52.34	52.35	52.36	0.00
06324_MN_BL2_02.040	Blackwater (Sandhurst to Bramshill) 2009	480035	162291	52.08	52.18	52.21	0.00	52.23	52.23	52.23	52.24	0.00
06324_MN_BL2_02.039	Blackwater (Sandhurst to Bramshill) 2009	479930	162309	51.95	52.06	52.09	0.00	52.10	52.10	52.10	52.12	0.00
06324_MN_BL2_02.038	Blackwater (Sandhurst to Bramshill) 2009	479850	162270	51.84	51.94	51.97	0.00	51.98	51.99	52.00	52.02	0.00
06324_MN_BL2_02.037	Blackwater (Sandhurst to Bramshill) 2009	479757	162260	51.72	51.82	51.85	0.00	51.88	51.88	51.89	51.91	0.00
06324_MN_BL2_02.036	Blackwater (Sandhurst to Bramshill) 2009	479645	162260	51.58	51.68	51.71	0.00	51.73	51.74	51.74	51.77	0.00
06324_MN_BL2_02.035	Blackwater (Sandhurst to Bramshill) 2009	479551	162294	51.44	51.54	51.57	0.00	51.60	51.60	51.61	51.64	0.00
06324_MN_BL2_02.034	Blackwater (Sandhurst to Bramshill) 2009	479497	162293	51.34	51.43	51.46	0.00	51.48	51.48	51.49	51.51	0.00

				Flood Flows (m3/s)								
Node label	Model	Easting	Northing	20% AEP	5% AEP	1% AEP	1% AEP (+15% increase in flows)	1% AEP (+20% increase in flows)	1% AEP (+25% increase in flows)	1% AEP (+35% increase in flows)	1% AEP (+70% increase in flows)	0.1% AEP
06324_MN_BL2_02.043	Blackwater (Sandhurst to Bramshill) 2009	480245	162186	10.46	11.95	12.53	0.00	12.82	12.89	13.02	13.44	0.00
06324_MN_BL2_02.042	Blackwater (Sandhurst to Bramshill) 2009	480154	162195	10.46	11.95	12.53	0.00	12.82	12.89	13.02	13.44	0.00
06324_MN_BL2_02.041	Blackwater (Sandhurst to Bramshill) 2009	480122	162266	10.47	11.95	12.53	0.00	12.81	12.88	13.02	13.44	0.00
06324_MN_BL2_02.040	Blackwater (Sandhurst to Bramshill) 2009	480035	162291	10.47	11.94	12.53	0.00	12.81	12.88	13.01	13.43	0.00
06324_MN_BL2_02.039	Blackwater (Sandhurst to Bramshill) 2009	479930	162309	10.47	11.94	12.40	0.00	12.63	12.68	12.77	12.85	0.00
06324_MN_BL2_02.038	Blackwater (Sandhurst to Bramshill) 2009	479850	162270	10.47	11.93	12.38	0.00	12.54	12.48	12.54	12.70	0.00
06324_MN_BL2_02.037	Blackwater (Sandhurst to Bramshill) 2009	479757	162260	10.47	11.93	12.38	0.00	12.54	12.48	12.54	12.71	0.00
06324_MN_BL2_02.036	Blackwater (Sandhurst to Bramshill) 2009	479645	162260	10.47	11.93	12.50	0.00	12.90	13.03	13.20	13.63	0.00
06324_MN_BL2_02.035	Blackwater (Sandhurst to Bramshill) 2009	479551	162294	10.47	11.87	12.26	0.00	12.41	12.43	12.49	12.60	0.00
06324_MN_BL2_02.034	Blackwater (Sandhurst to Bramshill) 2009	479497	162293	10.47	11.92	12.50	0.00	12.97	13.09	13.26	13.93	0.00

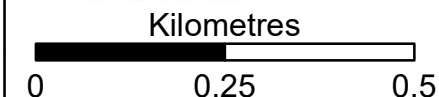
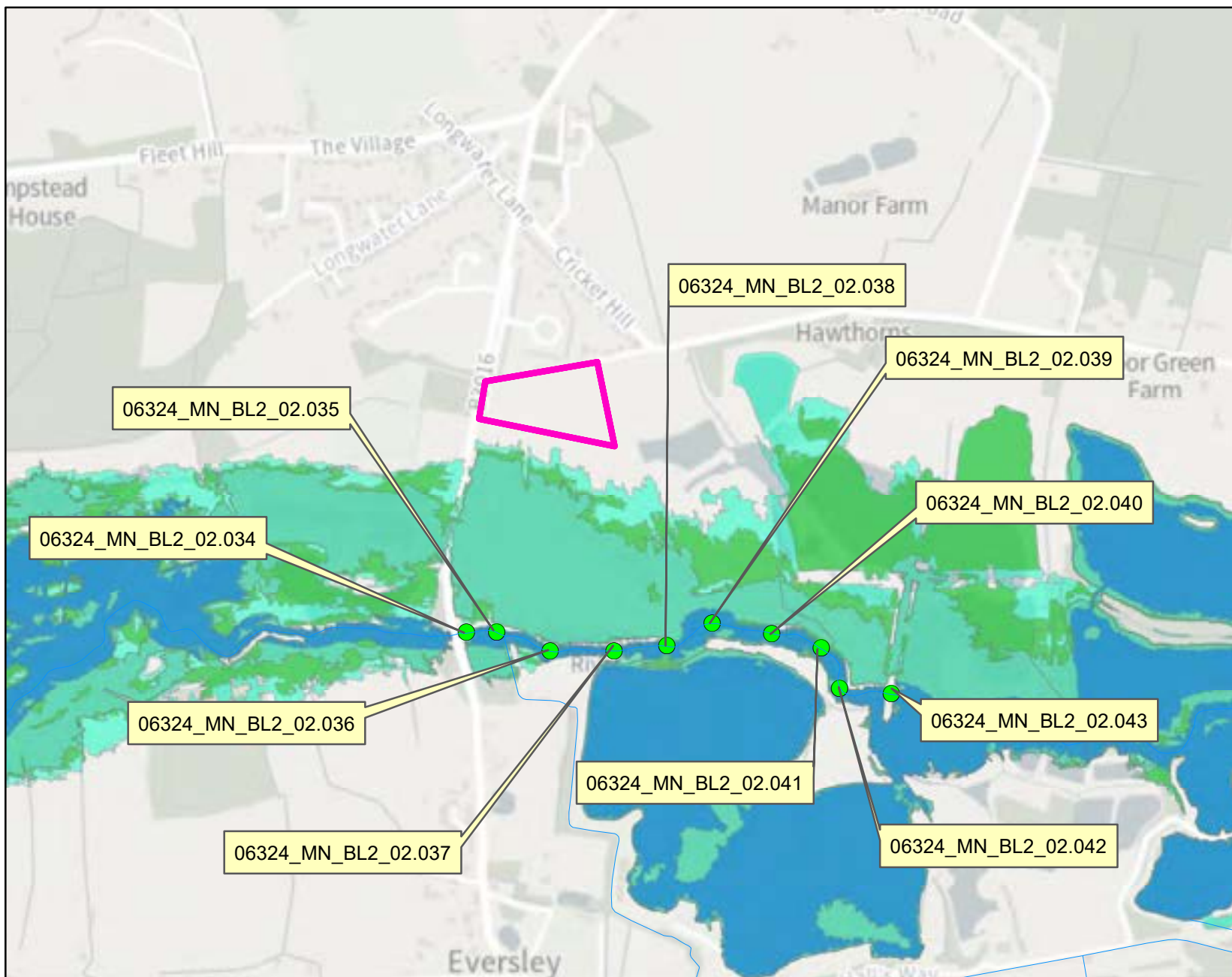
Note:

Due to changes in guidance on the allowances for climate change, the percentage increase in river flows above should no longer to be used for development design purposes. The data included in this Product can be used for interpolation of levels as part of an intermediate level assessment.

For further advice on the new allowances please visit <https://www.gov.uk/guidance/flood-risk-assessments-climate-change-allowances>

Detailed FRA Map centred on Land off Longwater Road, RG40 3TT

Created on 11/04/2024 REF: THM354083



Legend

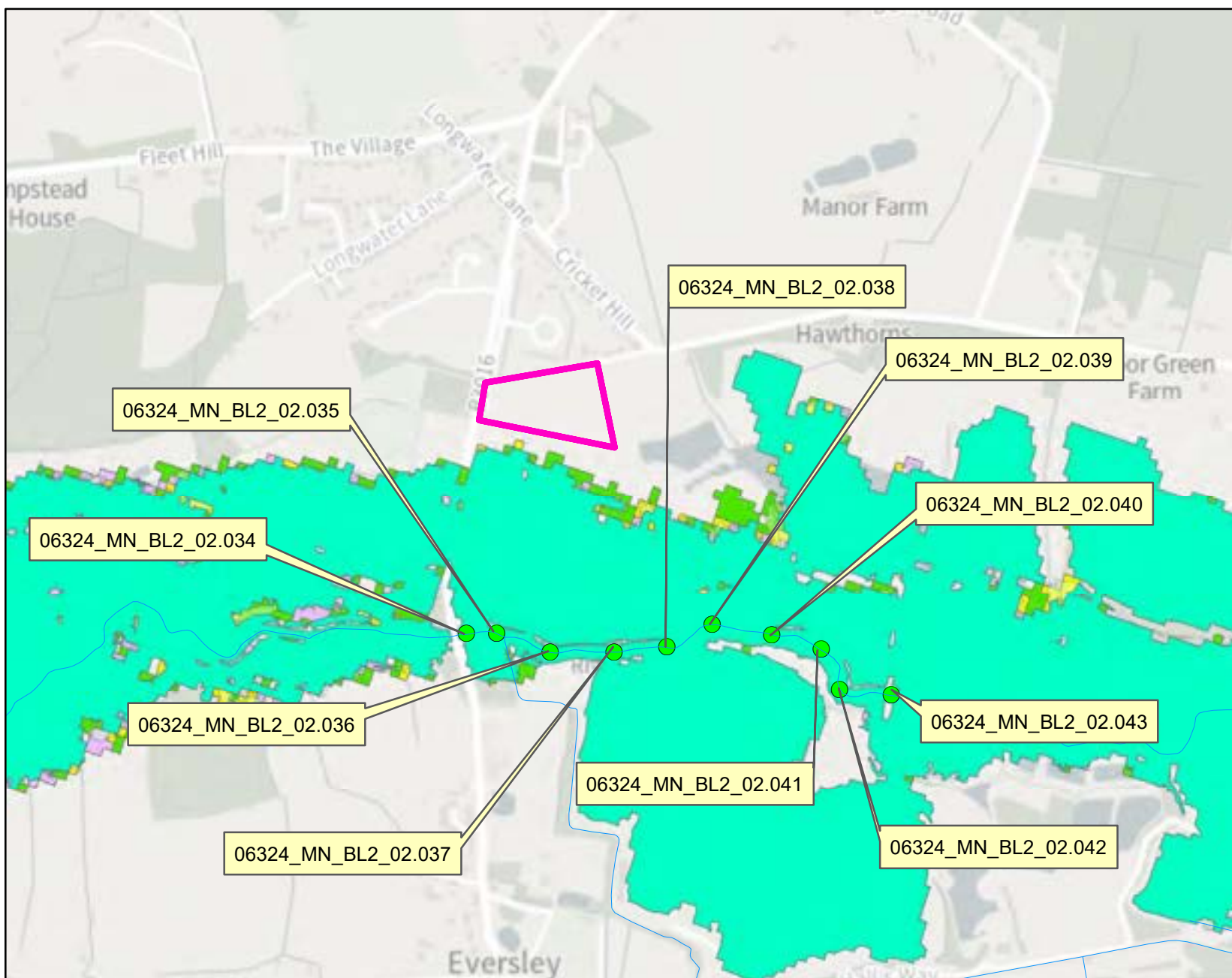
- Site
- Statutory Main Rivers
- Model Nodes
- 20% AEP Flood Outline
- 5% AEP Flood Outline
- 1% AEP Flood Outline
- 0.1% AEP Flood Outline

AEP = Annual Exceedance Probability
The probability of a flood of a particular magnitude, or greater, occurring in any given year

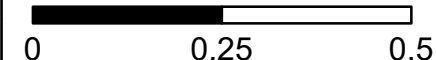
Where available climate change extents have been calculated with an additional flow added to an AEP event. An example of how this is written is 1%+20% AEP.

Detailed FRA Map centred on Land off Longwater Road, RG40 3TT

Created on 11/04/2024 REF: THM354083



Kilometres



Legend

- Site
- Statutory Main Rivers
- Model Nodes
- 1%+15% AEP Flood Outline
- 1%+20% AEP Flood Outline
- 1%+25% AEP Flood Outline
- 1%+35% AEP Flood Outline
- 1%+70% AEP Flood Outline

AEP = Annual Exceedance Probability
The probability of a flood of a particular magnitude, or greater, occurring in any given year

Where available climate change extents have been calculated with an additional flow added to an AEP event. An example of how this is written is 1%+20% AEP.

Historic flood data

THM354083

Our records show that the area of your site has been affected by flooding.
Information on the floods that have affected your site is provided in the table below:

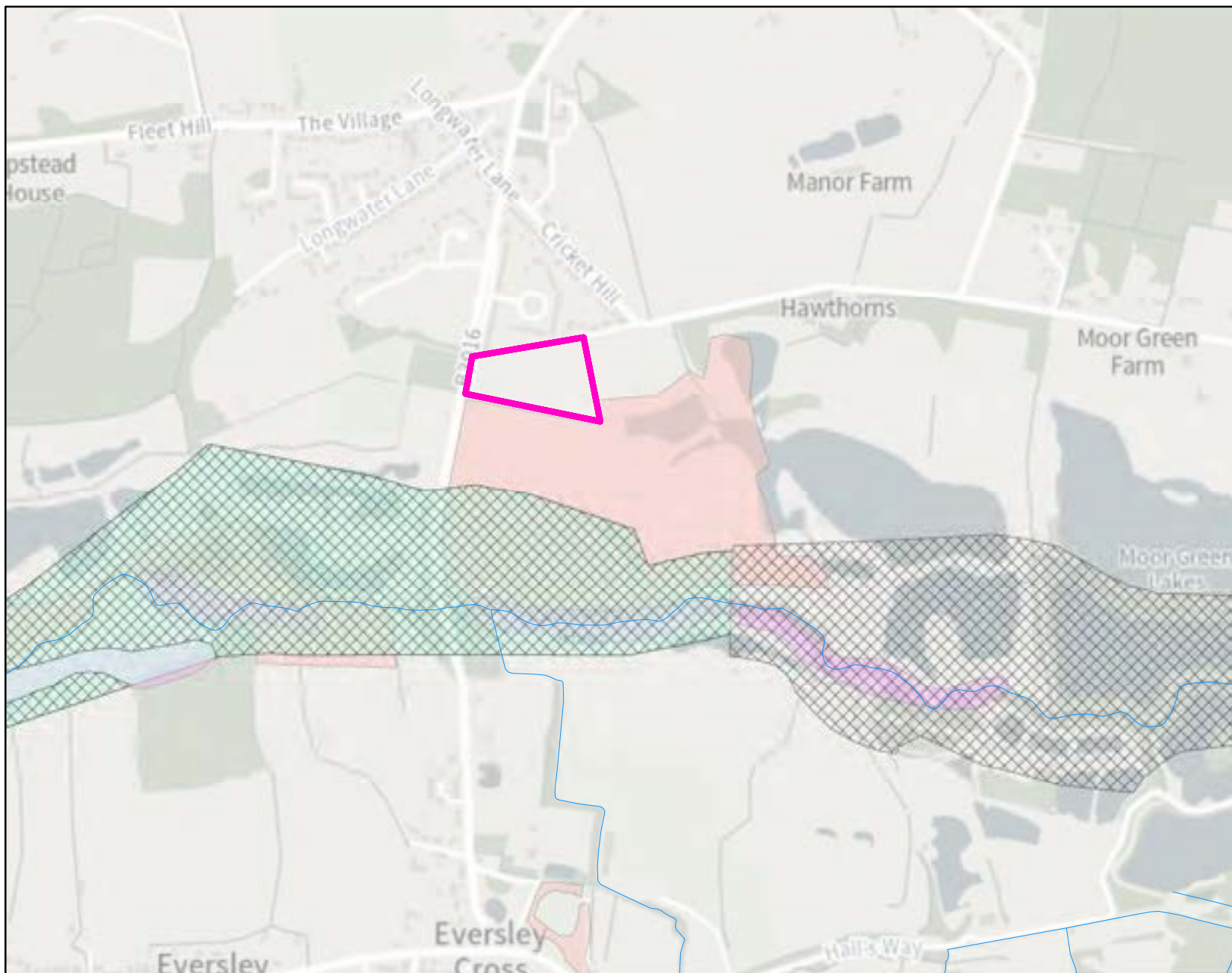
Flood Event Code	Flood Event Name	Start Date	End Date	Source of Flooding	Cause of Flooding
No Historic Information					

Please note the Environment Agency maps flooding to land not individual properties. Floodplain extents are an indication of the geographical extent of a historic flood. They do not provide information regarding levels of individual properties, nor do they imply that a property has flooded internally.

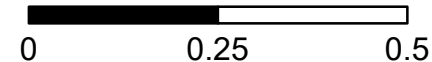
Start and End Dates shown above may represent a wider range where the exact dates are not available.

Historic Flood Map centred on Land off Longwater Road, RG40 3TT

Created on 11/04/2024 REF: THM354083



Kilometres



Legend

- Site
- Statutory Main Rivers
- 1947
- 1968
- 1990
- 2007

Flooding from rivers or sea without defences (Flood Zone 3) shows the area that could be affected by flooding:

- from the sea with a 1 in 200 or greater chance of happening each year
- or from a river with a 1 in 100 or greater chance of happening each year.

The Extent of an extreme flood (Flood Zone 2) shows the extent of an extreme flood from rivers or the sea with up to a 1 in 1000 chance of occurring each year.

Hazard Mapping

THM354083

Hazard Mapping methodology:

To calculate flood hazard with the debris factor we have used the supplementary note to Flood Risk to People Methodology (see below).

The following calculation is used:

$$HR = d \times (v+0.5) + DF$$

Where HR = flood hazard rating

d = depth of flooding (m)

v = velocity of floodwaters (m/sec)

DF = debris factor calculated (0, 0.5, 1 depending on probability that debris will lead to a hazard)

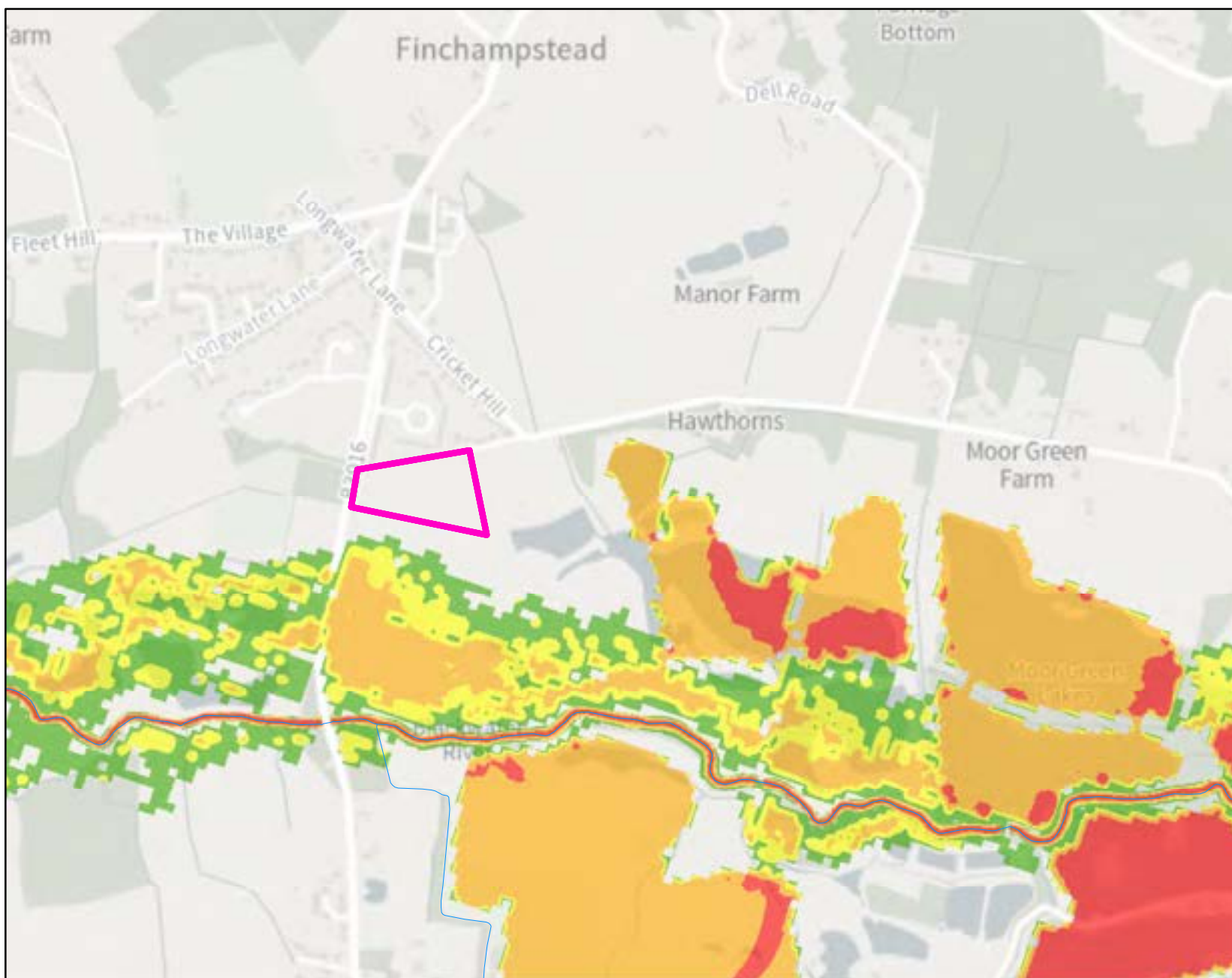
The resultant hazard rating is then classified according to:

Flood Hazard	Colour	Hazard to People Classification
Less than 0.75	Green	Very low hazard - Caution
0.75 to 1.25	Yellow	Danger for some - includes children, the elderly and the infirm
1.25 to 2.0	Orange	Danger for most - includes the general public
More than 2.0	Red	Danger for all - includes the emergency services

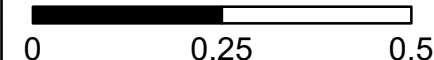
REF: HR Wallingford and Environment Agency (May 2008) Supplementary note of flood hazard ratings and thresholds for development planning and control purpose – Clarification of the Table 113.1 of FD2320/TR2 and Figure 3.2 of FD2321/TR1

Hazard Map (for 1%+15% climate change) centred on Land off Longwater Road, RG40 3TT

Created on 11/04/2024 REF: THM354083



Kilometres



Legend

- Site
- Statutory Main Rivers
- Low Hazard
- Hazard to some
- Hazard to most
- Hazard to all

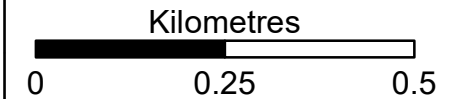
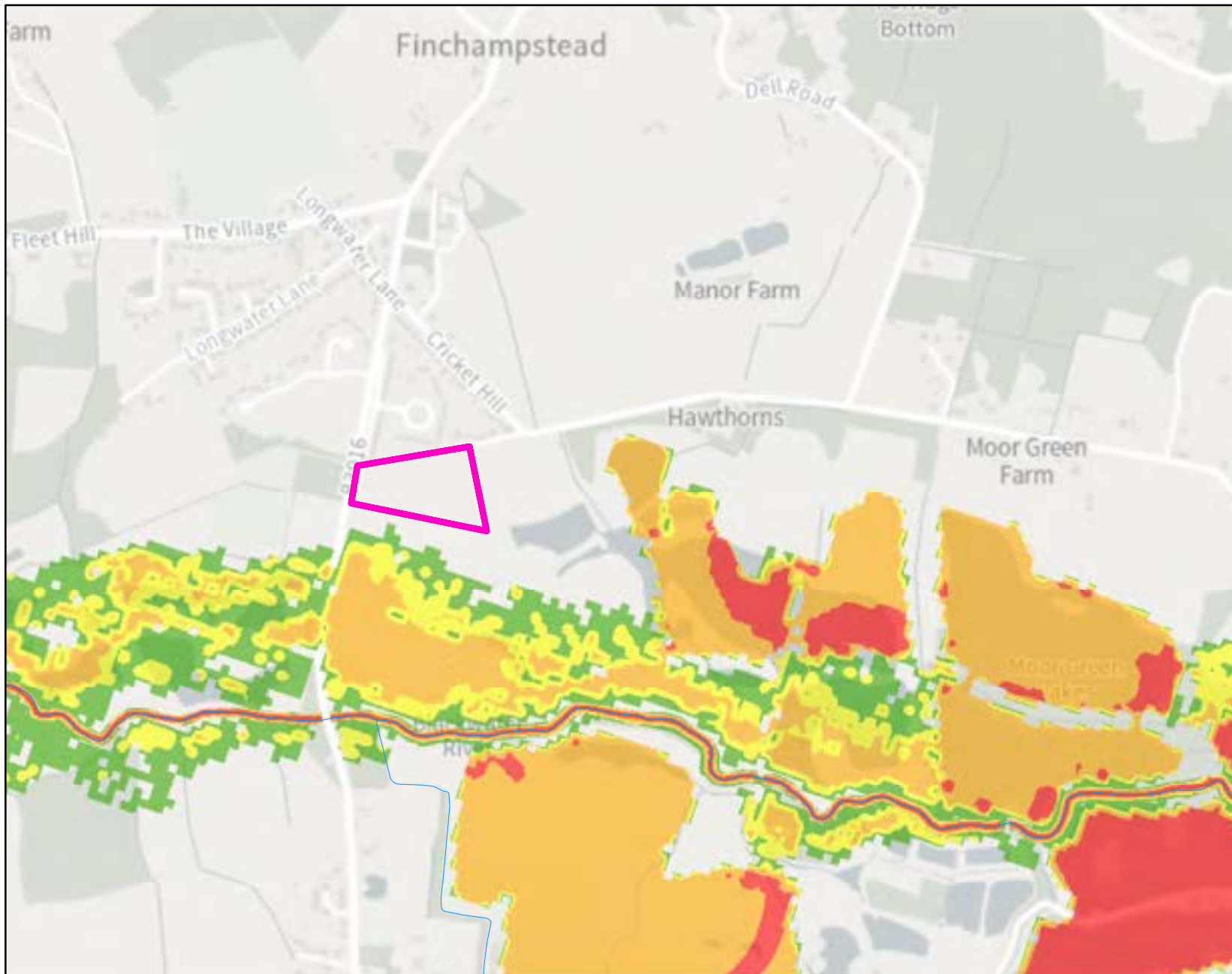
For hazard and debris factor we used HR Wallingford and Environment Agency (May 2008) supplementary note on flood hazard ratings and thresholds for development planning and control purpose. The following calculation is used:

$$HR = d \times (v + 0.5) + DF$$

HR = flood hazard rating
d = depth of flooding (m)
v = velocity of floodwaters (m/sec)
DF = debris factor calculated (0, 0.5, 1 depending on probability that debris will lead to a hazard)

Hazard Map (for 1%+25% climate change) centred on Land off Longwater Road, RG40 3TT

Created on 11/04/2024 REF: THM354083



Legend

- Site
- Statutory Main Rivers
- Low hazard
- Hazard to some
- Hazard to most
- Hazard to all

For hazard and debris factor we used HR Wallingford and Environment Agency (May 2008) supplementary note on flood hazard ratings and thresholds for development planning and control purpose. The following calculation is used:

$$HR = d \times (v + 0.5) + DF$$

HR = flood hazard rating
d = depth of flooding (m)
v = velocity of floodwaters (m/sec)
DF = debris factor calculated (0, 0.5, 1 depending on probability that debris will lead to a hazard)

Appendix B

Topographic Survey



OS Note:
Some services may have been omitted due to parked vehicles.
The Ordnance Survey tile is to be used as a guide only.

OS Buildings **Surveyed Buildings** 

This building has been orientated to the Ordnance Survey (O.S.) National Grid OSGB36 (15) via Global Navigational Satellite Systems (GNSS) and the O.S. Active Network (OS Net).

A true OSGB36 coordinate has been established near to the site centre via a transformation using the OSTN15GB & OSTN15GB transformation models.

The survey has been correlated to this point and a further one or more OSGB36 (15) points established to create a true O.S. bearing for angle orientation:

No scale factor has been applied to the survey therefore the coordinates shown are arbitrary & not true O.S. Coordinates which have a scale factor applied.

Please refer to Survey Station Table to enable establishment

1	10.07.17	Survey ditch	LC	
Rev	Date	Description	Drawn	Q. Ref.

**Catesby Estates
Limited**

TITLE **Topographical
Survey**

Level datum	See note
Grid orientation	See note
Job number	27194

Comments

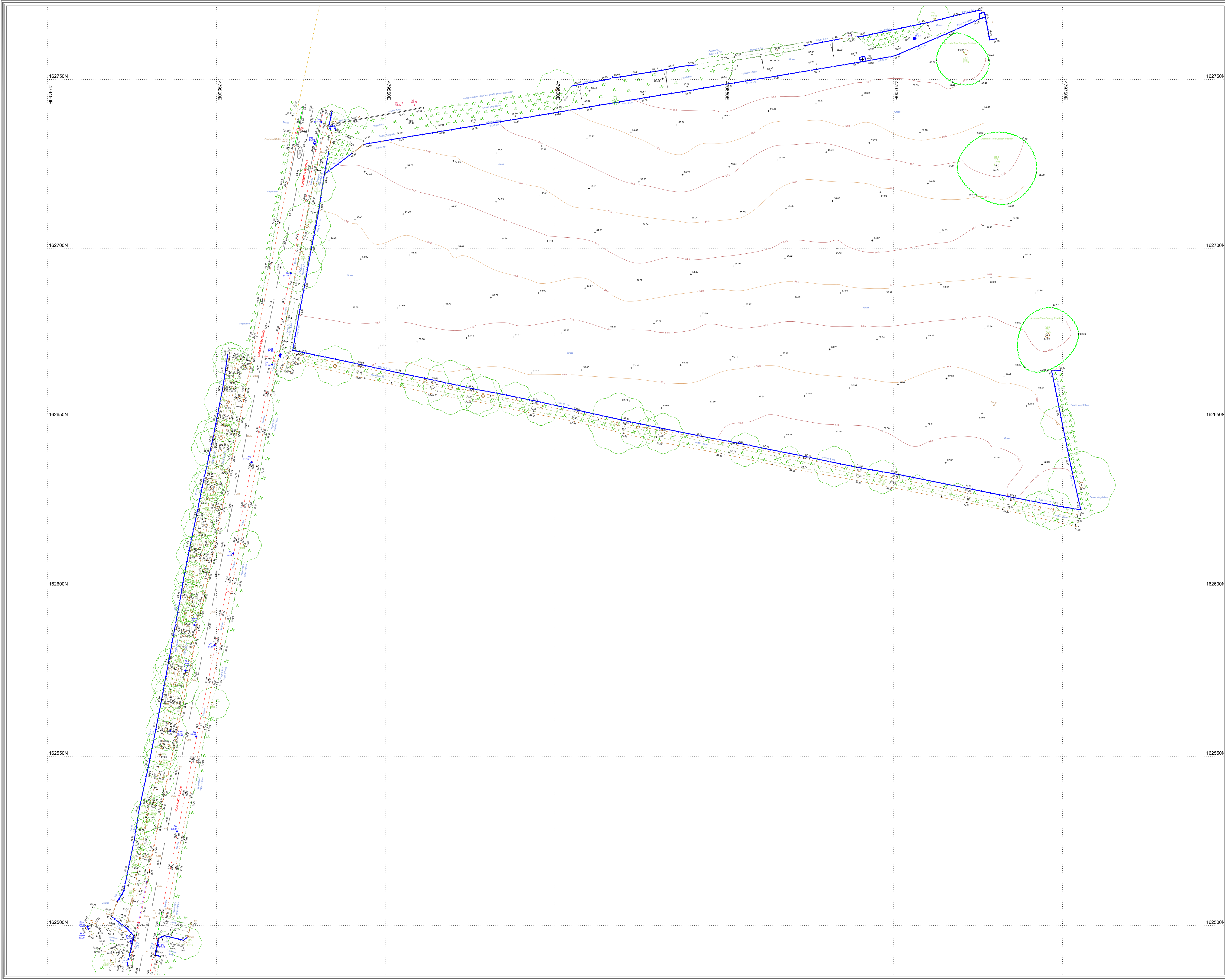
This plan should only be used for its original purpose. Greenhatch Group accepts no responsibility for this plan if supplied to any party other than the original client.

All dimensions should be checked on site prior to design and construction.

Drainage information (where applicable) has been visually inspected from the surface and therefore should be treated as approximate only.

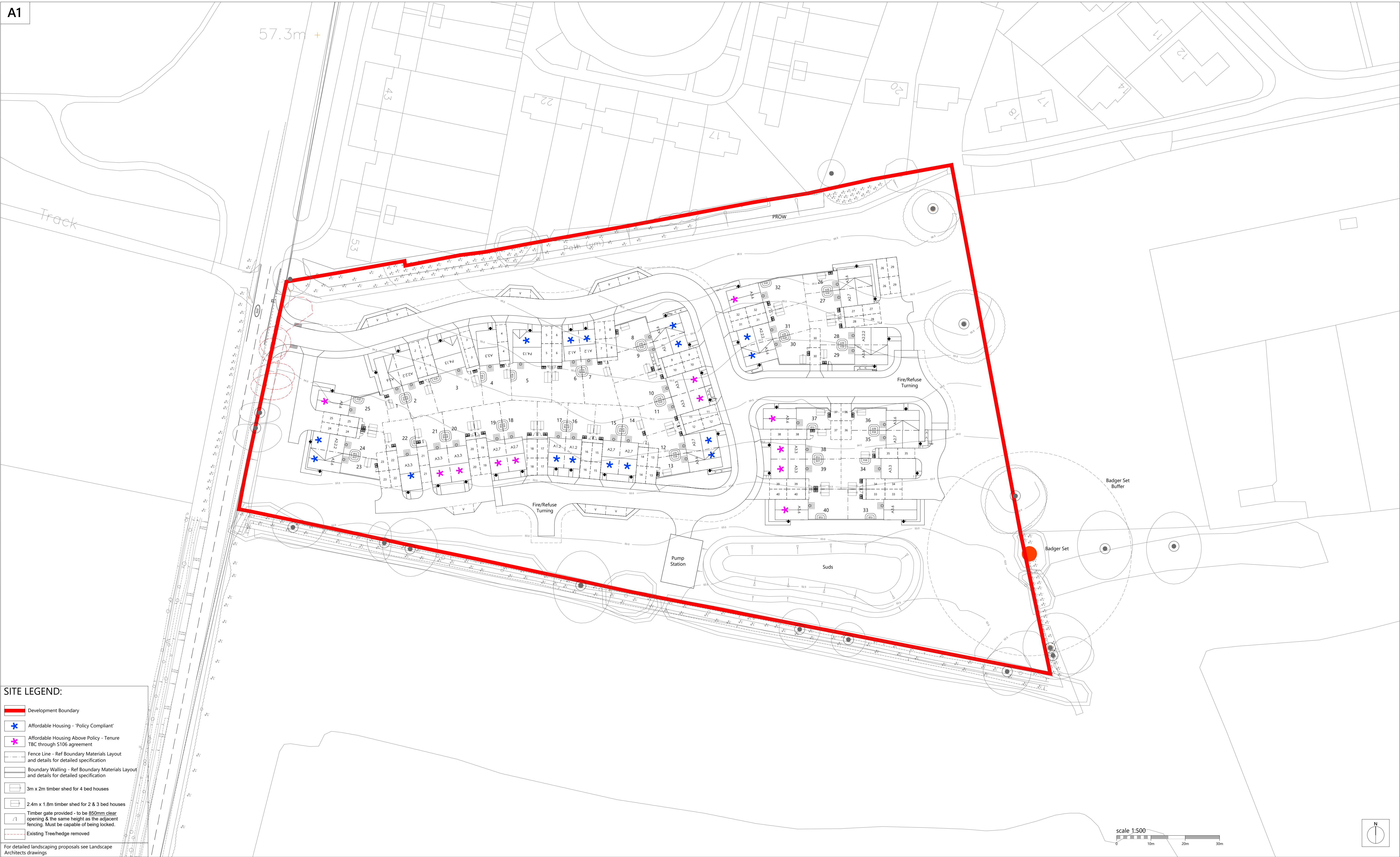
Notes:

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Appendix C

Development Plans



Romsey T:01794 367703
Portishead T:01275 407000
London T:01794 367703

Rev	Description	Date	Au	Ch
A	Issued for Planning	31.05.24	MK	

www.thrivearchitects.co.uk

This drawing is the copyright of Thrive Architects Ltd ©. All rights reserved. Ordnance Survey Data © Crown Copyright. All rights reserved. Licence No. 100007359. Permission is granted to scale from this drawing for the purposes of **Local Authority Planning Applications only**. For all other purposes DO NOT scale from this drawing. Contractors, Sub-contractors and suppliers are to check all relevant dimensions and levels of the site and building before commencing any shop drawings or building work. Any discrepancies should be recorded to the Architect. Where applicable this drawing is to be read in conjunction with the Consultants' drawings / Clients' Construction Specification.

Project	Land at Longwater Road, Finchampstead		
Drawing	Site Layout		
Client	Catesby Estates PLC & Stonebond Properties (Guildford) Limited		
Job no.	CATE230603	Date	26.03.24
Dwg no.	SL01	Rev.	A
Author	MK	Checked	
Status	PLANNING	Scale	1:500 at A1
Client ref.		Office	Romsey



Appendix D

Soakaway Testing



GRM Development Solutions
Limited
Laurus House
Centrum 100
First Avenue
Burton On Trent
DE14 2WH

Telephone: (01283) 551249
Facsimile: (01283) 211968
Email: info@grm-uk.com
Web Site: www.grm-uk.com

Our Ref: P7995 SA.1
Date: 28/06/2017

Mr James Finlay,
Catesby Property Group,
Catesby House,
5B Tournament Drive
Edgehill Drive,
Warwick
CV34 6LG

Dear James,

RE: Longwater Road, Finchampstead – Soakaway Testing

Further to your instruction, GRM attended site between the 20th and 21st June 2017 to undertake soakaway infiltration testing at the above location. Testing was undertaken at four locations (SA-01 to SA-04) to test the underlying strata and determine the feasibility of the use of soakaway drainage. The tests were undertaken in general accordance with the methodology outlined within BRE 365.

Ground Conditions

The British Geological Survey (BGS) map for the area indicates that River Terrace Deposits (comprising sand and gravel) overly the Bagshot Formation (comprising sand).

The four soakaway trial pits were excavated to depths of between 1.7m to 2.0m begl. Topsoil was recorded to depths of between 0.3m to 0.4m begl, the River Terrace Deposits were recorded below the topsoil in all four holes as either brown or light grey very clayey fine to coarse SAND or very sandy CLAY with gravel of quartzite and chert and were recorded to depths of 1.7m to depths exceeding 1.9m begl. The underlying Bagshot Formation was only recorded in SA-04 from 1.7m begl as a light brown slightly clayey fine to coarse SAND. An exploratory hole location plan, the exploratory hole logs and site photographs are enclosed for reference.

Groundwater was encountered in all holes as damp strata between 1.2m and 1.5m begl, SA-04 recorded ingress at 1.7m begl.

A land drain was encountered within SA-04 at a depth of 1.1m begl on the northern and southern face of the soakaway pit, and it is believed to have run north to south following local topography. No water was observed within the drain throughout the site works.

Soakaway Testing

The following table below indicates the calculated infiltration rates:-

Location	Depth of Soakaway Pit (m)	Infiltration Material	25% Effective Drainage	75% Effective Drainage	Infiltration Rate (m/s)
SA01 Test 1	1.80	River Terrace Deposits	NO	NO	-
SA02 Test 1	1.70	River Terrace Deposits	YES	NO	-
SA03 Test 1	1.9	River Terrace Deposits	YES	NO	-
SA04 Test 1	2.0	River Terrace Deposits and Bagshot Formation	YES	NO	-

Results have been enclosed for reference.

Summary

An infiltration to 75% was unachievable and an accurate infiltration rate could not be calculated for any of the soakaways. High fines content of the soils has resulted in low infiltration rates, as none of the soakaways were close to 75% an estimated rate calculated by extrapolation could not be undertaken.

Accordingly, it is recommended that an alternative method of disposing of surface water is sought.

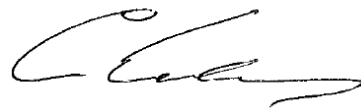
This report should be forwarded to the projects drainage engineer for review and consideration in the design process. The use of permeable paving, or shallow swales, where granular strata is present, may be possible.

I trust that the above is sufficient for your current purposes, however if you have any queries please do not hesitate to contact us.

Yours sincerely



George Salloway
Geo-Environmental Scientist



Clive Kirby
Principal Geologist

Enclosed:

- Exploratory Hole Location Plan
- Exploratory Hole Logs
- Site Photographs
- Soakaway Results

DO NOT SCALE



GRM Development Solutions Ltd
Laurus House, Centrum 100
Burton-on-Trent, Staffs, DE14 2WH
Tel: 01283 551249 Fax: 01283 211968
info@grm-uk.com www.grm-uk.com

CLIENT:

Catesby Estates Ltd

PROJECT:

**Longwater Road,
Finchampstead**

TITLE:

**Soakaway Location
Plan**

SCALE@SIZE

NTS

ISSUE:

1

DESIGN/DRAWN:

GS

DATE:

June 2017

PROJECT No:

P7995

DRAWING No:

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		GRM Development Solutions Ltd Laurus House, First Avenue, Centrum 100, Burton-on-Trent, DE14 2WH Tel (HQ): 01283 551249 Email: info@grm-uk.com		Trial Pit Log			Trial Pit No SA-01 Sheet 1 of 1	
Site Name: Longwater Road, Finchampstead							Ground Level (mAOD)	
Client: Catesby Estates Ltd					GRM Project Ref: P7995		Coordinates 479684 E 162722 N	

Water Strike	Samples & In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
	Depth	Type	Results					
				0.30			Light brown clayey, slightly gravelly fine to coarse SAND. Gravel is fine to coarse, subangular to subrounded chert. TOPSOIL	
	0.70 - 0.80	D		0.70			Orange brown mottled grey, very clayey, slightly gravelly fine to coarse SAND with pockets of sandy clay throughout. Gravel is fine to coarse, subrounded quartzite. RIVER TERRACE DEPOSITS	
							Firm orange brown mottled grey, very sandy CLAY. Sand is fine to coarse. Pockets of sandy silt and rare organic material observed. RIVER TERRACE DEPOSITS	1
	1.60 - 1.70	D		1.80			Becoming grey mottled brown and slightly gravelly from 1.8m. Gravel is fine to medium subangular to subrounded chert.	
							End of Pit at 1.80m	2
								3
								4

Date Excavated: 20/06/2017		Groundwater Observations:	
Date Backfilled: 21/06/2017		Pockets of damp clayey sand recorded from 1.4m begl.	
Shoring: Not used.			
Stability: Stable during excavation.			
Plant Used: JCB 3CX		Reason for termination of Trial Pit:	
Logged by: GS		Target depth acquired.	

Trial Pit Dimensions (m):

0.60

1.80

General Remarks: Soak away test undertaken.

Strata consistencies/densities determined by observation only	Version: FINAL	Scale: 1:25
---	----------------	-------------

		GRM Development Solutions Ltd Laurus House, First Avenue, Centrum 100, Burton-on-Trent, DE14 2WH Tel (HQ): 01283 551249 Email: info@grm-uk.com		Trial Pit Log		Trial Pit No SA-02 Sheet 1 of 1	
Site Name: Longwater Road, Finchampstead						Ground Level (mAOD)	
Client: Catesby Estates Ltd				GRM Project Ref: P7995		Coordinates 479660 E 162675 N	

Water Strike	Samples & In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
	Depth	Type	Results					
				0.30			Light brown clayey, slightly gravelly fine to coarse SAND. Gravel is fine to medium, subangular to subrounded chert and quartzite. TOPSOIL	
	0.60 - 0.70	D		0.60			Light brown very clayey fine to coarse SAND. RIVER TERRACE DEPOSITS	
				0.80			Soft brown very sandy, slightly gravelly CLAY. Sand is fine to coarse, gravel is fine to coarse, subrounded quartzite and chert. RIVER TERRACE DEPOSITS	
	1.10 - 1.20	D		1.00			Firm orangish brown mottled grey sandy CLAY with pockets of grey sandy silt. Sand is fine to coarse. RIVER TERRACE DEPOSITS	1
							Light grey clayey to very clayey, slightly gravelly fine to coarse SAND. Gravel is fine to coarse, subangular to subrounded chert and quartzite. RIVER TERRACE DEPOSITS	
	1.60 - 1.70	D		1.70			End of Pit at 1.70m	2
								3
								4

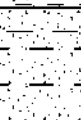
Date Excavated: 20/06/2017 Date Backfilled: 21/06/2017 Shoring: Not used. Stability: Stable during excavation.	Groundwater Observations: Becoming damp at approximately 1.2m begl
Plant Used: JCB 3CX Logged by: GS	Trial Pit Dimensions (m): 0.60  1.90 Reason for termination of Trial Pit: Target depth acquired.

General Remarks: Soak away test undertaken.	
--	--

Strata consistencies/densities determined by observation only	Version: FINAL	Scale: 1:25
---	-----------------------	--------------------

		GRM Development Solutions Ltd Laurus House, First Avenue, Centrum 100, Burton-on-Trent, DE14 2WH Tel (HQ): 01283 551249 Email: info@grm-uk.com		Trial Pit Log			Trial Pit No SA-03 Sheet 1 of 1	
Site Name: Longwater Road, Finchampstead							Ground Level (mAOD)	
Client: Catesby Estates Ltd					GRM Project Ref: P7995		Coordinates 479610 E 162718 N	
Water Strike	Samples & In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
	Depth	Type	Results					
	0.10 - 0.20	D					Light brown clayey, slightly gravelly fine to coarse SAND. Gravel is fine to coarse, subangular to subrounded chert. TOPSOIL	
	0.40 - 0.50	D		0.30			Light brown, very clayey, fine to coarse SAND, with pockets of sandy clay throughout. RIVER TERRACE DEPOSITS	
	0.90 - 1.00	D		0.70			Firm light brown mottled grey, very sandy, slightly gravelly CLAY, with pockets of clayey sand observed. Sand is fine to coarse, gravel is fine to coarse, subangular to subrounded chert and quartzite. RIVER TERRACE DEPOSITS	1
	1.50 - 1.60	D		1.90			End of Pit at 1.90m	2
								3
								4
Date Excavated: 20/06/2017 Date Backfilled: 21/06/2017 Shoring: Not used. Stability: Stable during excavation. Plant Used: JCB 3CX Logged by: GS				Groundwater Observations: Pockets of damp clayey sand recorded from 1.4m begl.				
				Trial Pit Dimensions (m): 0.60  1.80		Reason for termination of Trial Pit: Target depth acquired.		
General Remarks: Soak away test undertaken.								
Strata consistencies/densities determined by observation only					Version: FINAL		Scale: 1:25	

		GRM Development Solutions Ltd Laurus House, First Avenue, Centrum 100, Burton-on-Trent, DE14 2WH Tel (HQ): 01283 551249 Email: info@grm-uk.com		Trial Pit Log		Trial Pit No SA-04 Sheet 1 of 1	
Site Name: Longwater Road, Finchampstead						Ground Level (mAOD)	
Client: Catesby Estates Ltd				GRM Project Ref: P7995		Coordinates 479582 E 162676 N	

Water Strike	Samples & In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
	Depth	Type	Results					
▼	0.30 - 0.40	D		0.40			Light brown clayey, slightly gravelly fine to coarse SAND. Gravel is fine to coarse, subangular to subrounded chert. TOPSOIL	1
	0.50 - 0.60	D						
						<i>Land drain observed between 1.0m to 1.2m begl.</i>		
	1.30 - 1.40	D				Light grey clayey to very clayey, slightly gravelly fine to coarse SAND. Gravel is fine to coarse, subangular to subrounded chert and quartzite. RIVER TERRACE DEPOSITS <i>Becoming slightly clayey and very gravelly at 1.5m begl.</i>		
	1.50 - 1.60	D						
	1.80 - 1.90	D					Light brown slightly clayey fine to coarse SAND. BAGSHOT FORMATION	
			2.00		End of Pit at 2.00m		2	
							3	
								4

Date Excavated: 20/06/2017		Groundwater Observations:	
Date Backfilled: 21/06/2017		Damp strata recorded at 1.5m begl, ingress observed at 1.7m begl and pooling at base of pit.	
Shoring: Not used.			
Stability: Stable during excavation.			
Plant Used: JCB 3CX		Reason for termination of Trial Pit:	
Logged by: GS		Target depth acquired.	
General Remarks: Soak away test undertaken.			

Strata consistencies/densities determined by observation only	Version: FINAL	Scale: 1:25
---	-----------------------	--------------------



SA-01



SA-01 excavated material



SA-02



SA-02 excavated material

DO NOT SCALE



GRM Development Solutions Ltd
Laurus House, Centrum 100
Burton-on-Trent, Staffs, DE14 2WH
Tel: 01283 551249 Fax: 01283 211968
info@grm-uk.com www.grm-uk.com

CLIENT:

Catesby Estates Ltd

PROJECT:

**Land off Longwater
Road, Finchampstead**

TITLE:

Site Work Photographs

SCALE@SIZE
NTS

ISSUE:

DESIGN/DRAWN :
GS

DATE:
June 2017

PROJECT No:
P7995

DRAWING No:

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SA-03 with soakaway crate



SA-03 excavated material



SA-04



SA-04 (+1hrs)



SA-04 excavated material

DO NOT SCALE



GRM Development Solutions Ltd
Laurus House, Centrum 100
Burton-on-Trent, Staffs, DE14 2WH
Tel: 01283 551249 Fax: 01283 211968
info@grm-uk.com www.grm-uk.com

CLIENT:

Catesby Estates Ltd

PROJECT:

**Land off Longwater
Road, Finchampstead**

TITLE:

Site Work Photographs

SCALE@SIZE
NTS

ISSUE:

DESIGN/DRAWN :
GS

DATE:
June 2017

PROJECT No:
P7995

DRAWING No:

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NAME OF SITE	Longwater Road, Finchampstead	
Project No.	P7995	
Soakaway Test No.	SA01 TEST 1	
Depth of pit begl	1.800	m
Pipe above ground	0.000	m
Water level at start of test	0.700	m
Start depth begl	0.700	m

Time (mins)	Depth begl	% empty
0	0.700	0.00
5	0.700	
10	0.700	
48	0.705	0.45
98	0.720	1.82
137	0.740	3.64
205	0.760	5.45
1186	0.930	20.91
1269	0.940	21.82
1347	0.960	23.64
1429	0.960	23.64
1440	0.960	23.64
	0.000	
	0.000	
	0.000	
	0.000	
	0.000	
	0.000	
	0.000	
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	0.000	
	0.000	
	0.000	
	0.000	
	0.000	
	0.000	
	0.000	
	0.000	
	0.000	

Pit width	0.600	m
Pit length	1.900	m
Volume	1.254	m3
Base area	1.140	m2
Side area	2.090	m2

Depth at 25% empty	0.975	m
Depth at 75% empty	1.525	m

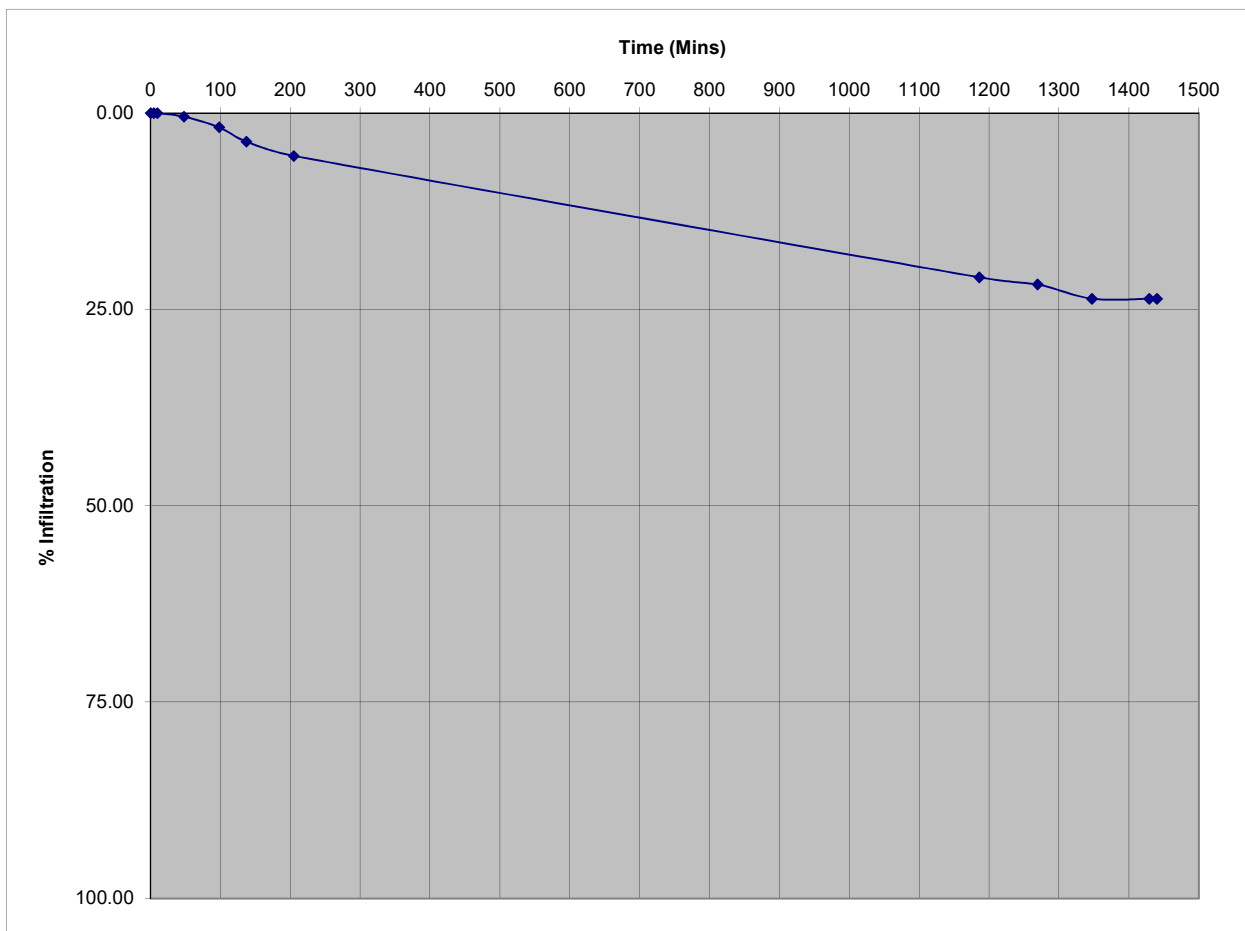
Vp75-25	0.627	m3
---------	-------	----

Depth at 50% empty	1.250	m
Area of base at 50% empty	1.140	m2
Area of sides at 50% empty	2.750	m2
Area of pit at 50% empty	3.890	m2

Time at 25% empty	n/a	Mins
Time at 75% empty	n/a	Mins
tp75-25	#VALUE!	Mins

Soil Infiltration (q) =	#VALUE!	m/min
	#VALUE!	m/sec

The data used for the time at 75% empty has been estimated using engineering judgement from the data recorded on site.



Appendix E

Thames Water Sewer Records

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 no survey information is available.

Manhole Reference	Manhole Cover Level	Manhole Invert Level
6701	56.7	54.5
7702	56.91	55.02
6704	58.4	57.12
6703	58.53	56.65
6801	59.58	57.53
5701	55.01	53.76
5702	55.04	53.84
571A	n/a	n/a
571B	n/a	n/a
5703	n/a	n/a
5704	n/a	n/a
5705	57.63	56.31
581A	n/a	n/a
5706	57.84	56.22
5707	58.29	56.05
6702	58.49	56.17

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.



Sewer Key - Commercial Drainage and Water Enquiry

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 '0' 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

Appendix F

Greenfield Runoff Rates

Calculated by:	Craig Walker
Site name:	Finchamstead
Site location:	Finchamstead

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

Site Details

Latitude:	51.35739° N
Longitude:	0.85818° W
Reference:	104911559
Date:	Mar 18 2024 16:51

Runoff estimation approach

IH124

Site characteristics

Total site area (ha):	2.29
-----------------------	------

Methodology

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

Notes

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

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

Soil characteristics

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

(2) Are flow rates $< 5.0 \text{ l/s}$?

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

Hydrological characteristics

	Default	Edited
SAAR (mm):	674	674
Hydrological region:	6	6
Growth curve factor 1 year:	0.85	0.85
Growth curve factor 30 years:	2.3	2.3
Growth curve factor 100 years:	3.19	3.19
Growth curve factor 200 years:	3.74	3.74

(3) Is $\text{SPR/SPRHOST} \leq 0.3$?

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

Greenfield runoff rates

Default

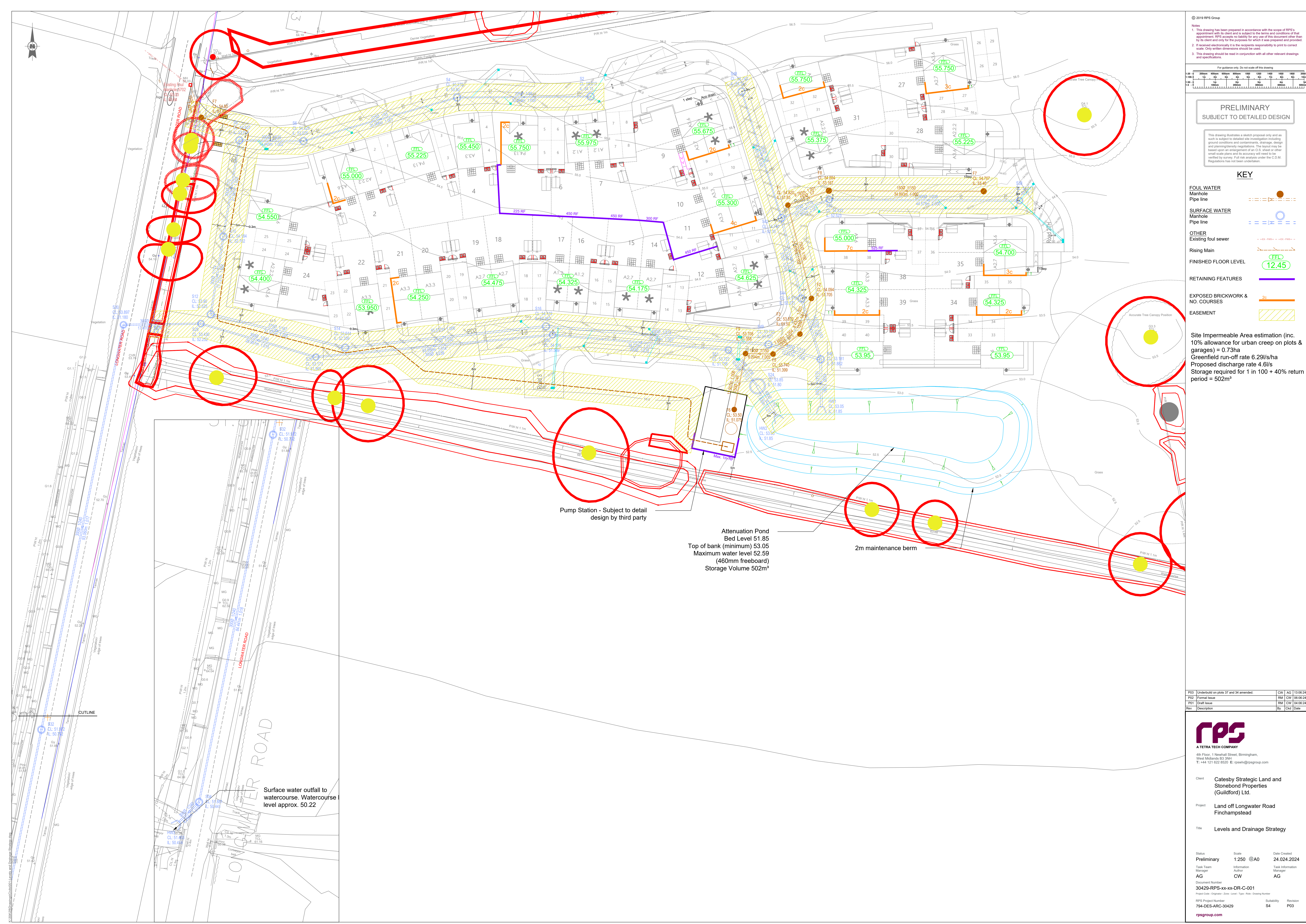
Edited

Q_{BAR} (l/s):	6.29	6.29
1 in 1 year (l/s):	5.35	5.35
1 in 30 years (l/s):	14.48	14.48
1 in 100 year (l/s):	20.08	20.08
1 in 200 years (l/s):	23.54	23.54

This report was produced using the greenfield runoff tool developed by HR Wallingford and available at 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 www.uksuds.com/terms-and-conditions.htm. The outputs from this tool are estimates of 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, CEH, Hydrosolutions or any other organisation for the use of this data in the design or operational characteristics of any drainage scheme.

Appendix G

Conceptual Drainage Strategy



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Notes

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2. If received electronically it is the recipient's responsibility to print to correct scale. Only written dimensions should be used.
3. This drawing should be read in conjunction with all other relevant drawings and specifications.

For guidance only. Do not scale off this drawing

1:250

0 25 50 75 100 125 150 175 200 225 250 275 300 325 350 375 400 425 450 475 500 525 550 575 600 625 650 675 700 725 750 775 800 825 850 875 900 925 950 975 1000

PRELIMINARY
SUBJECT TO DETAILED DESIGN

This drawing illustrates a sketch proposal only and as such is subject to detailed site investigation including ground conditions and contaminants, drainage, design and planning/conservation regulations. The layout may be based upon an enlargement of an O.S. sheet or other small scale plans and its accuracy will need to be verified by survey. Full risk analysis under the C.D.M. Regulations has not been undertaken.

- KEY
- FOUL WATER
Manhole
Pipe line
 - SURFACE WATER
Manhole
Pipe line
 - OTHER
Existing foul sewer
 - Rising Main
 - FINISHED FLOOR LEVEL
12.45
 - RETAINING FEATURES
 - EXPOSED BRICKWORK & NO. COURSES
2c
 - EASEMENT

Site Impermeable Area estimation (inc. 10% allowance for urban creep on plots & garages) = 0.73ha
Greenfield run-off rate 6.29l/s/ha
Proposed discharge rate 4.6l/s
Storage required for 1 in 100 + 40% return period = 502m³

P03	Underbuild on plots 31 and 34 amended.	CW	AG	13.06.24
P02	Formal issue	RM	CW	08.06.24
P01	Draft issue	RM	CW	04.06.24
Rev	Description	By	Ckd	Date

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Client Catesby Strategic Land and Stonebond Properties (Guildford) Ltd.

Project Land off Longwater Road Finchampstead

Title Levels and Drainage Strategy

Status	Scale	Date Created
Preliminary	1:250 @A0	24.02.2024
Task Team Manager	Information Author	Task Information Manager
AG	CW	AG
Document Number		
30429-RPS-xx-xx-DR-C-001		
Project Code - Originator - Zone - Level - Type - Role - Drawing Number		
RPS Project Number	Subsidiary	Revision
794-DES-ARC-30429	S4	P03
rpsgroup.com		

Appendix H

Surface Water Calculations



Design Settings

Rainfall Methodology	FEH-22	Minimum Velocity (m/s)	1.00
Return Period (years)	2	Connection Type	Level Soffits
Additional Flow (%)	0	Minimum Backdrop Height (m)	1.000
CV	1.000	Preferred Cover Depth (m)	1.200
Time of Entry (mins)	5.00	Include Intermediate Ground	✓
Maximum Time of Concentration (mins)	30.00	Enforce best practice design rules	x
Maximum Rainfall (mm/hr)	50.0		

Nodes

Name	Area (ha)	T of E (mins)	Cover Level (m)	Diameter (mm)	Easting (m)	Northing (m)	Depth (m)
S2	0.055	5.00	55.643	1350	479608.821	162728.548	1.493
S4	0.035	5.00	55.270	1350	479589.176	162728.450	1.470
S6	0.071	5.00	54.625	1350	479554.574	162718.639	1.550
S8	0.000		54.607	1350	479540.130	162718.795	1.593
S10	0.029	5.00	54.184	1350	479536.531	162697.104	1.482
S12	0.000		53.900	1350	479533.696	162679.606	1.375
S14	0.008	5.00	53.644	1350	479563.965	162672.079	1.305
S16	0.164	5.00	54.119	1350	479609.228	162676.877	2.037
S49	0.000		53.753	1350	479659.323	162672.816	1.832
S38	0.063	5.00	54.517	1200	479717.592	162705.201	1.807
S40	0.040	5.00	54.833	1200	479673.015	162705.430	2.310
S48	0.031	5.00	55.743	1350	479653.293	162729.795	1.593
S42	0.032	5.00	54.740	1350	479662.270	162701.325	2.390
S44	0.051	5.00	54.119	1350	479666.728	162683.161	1.844
S46	0.063	5.00	53.181	1350	479671.105	162669.474	1.299
HW1			53.050	1500	479671.231	162658.828	1.350
HW2			53.050	1500	479661.050	162656.807	1.360
S24			53.850	1500	479656.866	162663.431	2.210
S51			53.722	1200	479650.307	162671.552	2.126
S50			54.116	1200	479610.682	162674.977	2.687
S26			53.173	1200	479557.365	162669.971	1.968
S28			53.430	1200	479531.484	162677.491	2.360
S30			53.897	1200	479514.016	162677.242	2.877
S32			51.972	1350	479495.536	162586.035	1.340
S34			51.881	1350	479478.864	162503.256	1.601
HW3			51.453	1500	479474.400	162498.833	1.199

Links

Name	US Node	DS Node	Length (m)	ks (mm) / n	US IL (m)	DS IL (m)	Fall (m)	Slope (1:X)	Dia (mm)	T of C (mins)	Rain (mm/hr)
1.000	S2	S4	19.645	0.600	54.150	53.800	0.350	56.1	225	5.19	50.0
1.001	S4	S6	35.966	0.600	53.800	53.150	0.650	55.3	225	5.53	49.3
1.002	S6	S8	14.445	0.600	53.075	53.014	0.061	236.8	300	5.76	48.2
1.003	S8	S10	21.987	0.600	53.014	52.702	0.312	70.5	300	5.96	47.4
1.004	S10	S12	17.727	0.600	52.702	52.600	0.102	173.8	300	6.21	46.4
1.005	S12	S14	31.075	0.600	52.525	52.339	0.186	167.1	375	6.58	45.2
1.006	S14	S16	45.529	0.600	52.339	52.157	0.182	250.2	375	7.24	43.0
1.007	S16	S49	50.259	0.600	52.082	51.921	0.161	312.2	450	7.98	40.9
1.008	S49	S46	12.247	0.600	51.921	51.882	0.039	314.0	450	8.15	40.4
2.000	S38	S40	44.578	0.600	52.710	52.523	0.187	238.4	300	5.73	48.4
2.001	S40	S42	11.502	0.600	52.523	52.425	0.098	117.4	300	5.87	47.8
3.000	S48	S42	29.851	0.600	54.150	52.500	1.650	18.1	225	5.16	50.0
2.002	S42	S44	18.704	0.600	52.350	52.275	0.075	249.4	375	6.14	46.7
2.003	S44	S46	14.370	0.600	52.275	51.957	0.318	45.2	375	6.23	46.4
1.009	S46	HW1	10.647	0.600	51.882	51.850	0.032	332.7	450	8.31	40.0
1.010	HW1	HW2	10.380	0.600	51.700	51.690	0.010	1038.0	600	8.55	39.5
1.011	HW2	S24	7.835	0.600	51.690	51.640	0.050	156.7	600	8.61	39.3
1.012	S24	S51	10.439	0.600	51.640	51.596	0.044	237.3	300	8.78	38.9
1.013	S51	S50	39.773	0.600	51.596	51.429	0.167	238.2	300	9.44	37.4
1.014	S50	S26	53.361	0.600	51.429	51.205	0.224	238.2	300	10.31	35.7
1.015	S26	S28	32.133	0.600	51.205	51.070	0.135	238.0	300	10.84	34.7
1.016	S28	S30	11.897	0.600	51.070	51.020	0.050	237.9	300	11.04	34.3
1.017	S30	S32	93.060	0.600	51.020	50.632	0.388	239.8	300	12.57	31.9
1.018	S32	S34	84.441	0.600	50.632	50.280	0.352	239.9	300	13.97	30.0

Name	Vel (m/s)	Cap (l/s)	Flow (l/s)	US Depth (m)	DS Depth (m)	Σ Area (ha)	Σ Add Inflow (l/s)	Pro Depth (mm)	Pro Velocity (m/s)
1.000	1.749	69.5	9.9	1.268	1.245	0.055	0.0	58	1.253
1.001	1.762	70.0	16.0	1.245	1.250	0.090	0.0	73	1.431
1.002	1.017	71.9	28.1	1.250	1.293	0.161	0.0	130	0.955
1.003	1.875	132.5	27.6	1.293	1.182	0.161	0.0	92	1.489
1.004	1.189	84.1	31.9	1.182	1.000	0.190	0.0	128	1.110
1.005	1.399	154.5	31.0	1.000	0.930	0.190	0.0	113	1.101
1.006	1.141	126.0	30.8	0.930	1.587	0.198	0.0	126	0.947
1.007	1.145	182.1	53.5	1.587	1.382	0.362	0.0	167	1.000
1.008	1.142	181.6	52.9	1.382	0.849	0.362	0.0	166	0.995
2.000	1.014	71.7	11.0	1.507	2.010	0.063	0.0	79	0.738
2.001	1.450	102.5	17.8	2.010	2.015	0.103	0.0	84	1.095
3.000	3.091	122.9	5.6	1.368	2.015	0.031	0.0	32	1.570
2.002	1.143	126.2	28.0	2.015	1.469	0.166	0.0	120	0.926
2.003	2.701	298.3	36.4	1.469	0.849	0.217	0.0	88	1.850
1.009	1.109	176.3	92.9	0.849	0.750	0.642	0.0	232	1.123
1.010	0.747	211.3	91.6	0.750	0.760	0.642	0.0	276	0.721
1.011	1.943	549.2	91.2	0.760	1.610	0.642	0.0	164	1.455
1.012	1.016	71.8	90.2	1.910	1.826	0.642	0.0	300	1.029
1.013	1.014	71.7	86.9	1.826	2.387	0.642	0.0	300	1.027
1.014	1.014	71.7	82.8	2.387	1.668	0.642	0.0	300	1.027
1.015	1.015	71.7	80.5	1.668	2.060	0.642	0.0	300	1.028
1.016	1.015	71.7	79.7	2.060	2.577	0.642	0.0	300	1.028
1.017	1.011	71.4	74.1	2.577	1.040	0.642	0.0	259	1.141
1.018	1.011	71.4	69.7	1.040	1.301	0.642	0.0	241	1.146

Links

Name	US Node	DS Node	Length (m)	ks (mm) / n	US IL (m)	DS IL (m)	Fall (m)	Slope (1:X)	Dia (mm)	T of C (mins)	Rain (mm/hr)
1.019	S34	HW3	6.284	0.600	50.280	50.254	0.026	241.7	300	14.07	29.9

Name	Vel (m/s)	Cap (l/s)	Flow (l/s)	US Depth (m)	DS Depth (m)	Σ Area (ha)	Σ Add Inflow (l/s)	Pro Depth (mm)	Pro Velocity (m/s)
1.019	1.007	71.2	69.4	1.301	0.899	0.642	0.0	241	1.141

Pipeline Schedule

Link	Length (m)	Slope (1:X)	Dia (mm)	Link Type	US CL (m)	US IL (m)	US Depth (m)	DS CL (m)	DS IL (m)	DS Depth (m)
1.000	19.645	56.1	225	Circular	55.643	54.150	1.268	55.270	53.800	1.245
1.001	35.966	55.3	225	Circular	55.270	53.800	1.245	54.625	53.150	1.250
1.002	14.445	236.8	300	Circular	54.625	53.075	1.250	54.607	53.014	1.293
1.003	21.987	70.5	300	Circular	54.607	53.014	1.293	54.184	52.702	1.182
1.004	17.727	173.8	300	Circular	54.184	52.702	1.182	53.900	52.600	1.000
1.005	31.075	167.1	375	Circular	53.900	52.525	1.000	53.644	52.339	0.930
1.006	45.529	250.2	375	Circular	53.644	52.339	0.930	54.119	52.157	1.587
1.007	50.259	312.2	450	Circular	54.119	52.082	1.587	53.753	51.921	1.382
1.008	12.247	314.0	450	Circular	53.753	51.921	1.382	53.181	51.882	0.849
2.000	44.578	238.4	300	Circular	54.517	52.710	1.507	54.833	52.523	2.010
2.001	11.502	117.4	300	Circular	54.833	52.523	2.010	54.740	52.425	2.015
3.000	29.851	18.1	225	Circular	55.743	54.150	1.368	54.740	52.500	2.015
2.002	18.704	249.4	375	Circular	54.740	52.350	2.015	54.119	52.275	1.469
2.003	14.370	45.2	375	Circular	54.119	52.275	1.469	53.181	51.957	0.849
1.009	10.647	332.7	450	Circular	53.181	51.882	0.849	53.050	51.850	0.750
1.010	10.380	1038.0	600	Circular	53.050	51.700	0.750	53.050	51.690	0.760
1.011	7.835	156.7	600	Circular	53.050	51.690	0.760	53.850	51.640	1.610
1.012	10.439	237.3	300	Circular	53.850	51.640	1.910	53.722	51.596	1.826
1.013	39.773	238.2	300	Circular	53.722	51.596	1.826	54.116	51.429	2.387

Link	US Node	Dia (mm)	Node Type	MH Type	DS Node	Dia (mm)	Node Type	MH Type
1.000	S2	1350	Manhole	Adoptable	S4	1350	Manhole	Adoptable
1.001	S4	1350	Manhole	Adoptable	S6	1350	Manhole	Adoptable
1.002	S6	1350	Manhole	Adoptable	S8	1350	Manhole	Adoptable
1.003	S8	1350	Manhole	Adoptable	S10	1350	Manhole	Adoptable
1.004	S10	1350	Manhole	Adoptable	S12	1350	Manhole	Adoptable
1.005	S12	1350	Manhole	Adoptable	S14	1350	Manhole	Adoptable
1.006	S14	1350	Manhole	Adoptable	S16	1350	Manhole	Adoptable
1.007	S16	1350	Manhole	Adoptable	S49	1350	Manhole	Adoptable
1.008	S49	1350	Manhole	Adoptable	S46	1350	Manhole	Adoptable
2.000	S38	1200	Manhole	Adoptable	S40	1200	Manhole	Adoptable
2.001	S40	1200	Manhole	Adoptable	S42	1350	Manhole	Adoptable
3.000	S48	1350	Manhole	Adoptable	S42	1350	Manhole	Adoptable
2.002	S42	1350	Manhole	Adoptable	S44	1350	Manhole	Adoptable
2.003	S44	1350	Manhole	Adoptable	S46	1350	Manhole	Adoptable
1.009	S46	1350	Manhole	Adoptable	HW1	1500	Manhole	Adoptable
1.010	HW1	1500	Manhole	Adoptable	HW2	1500	Manhole	Adoptable
1.011	HW2	1500	Manhole	Adoptable	S24	1500	Manhole	Adoptable
1.012	S24	1500	Manhole	Adoptable	S51	1200	Manhole	Adoptable
1.013	S51	1200	Manhole	Adoptable	S50	1200	Manhole	Adoptable

Pipeline Schedule

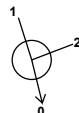
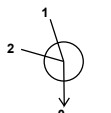
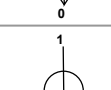
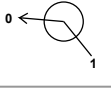
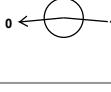
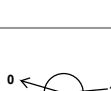
Link	Length (m)	Slope (1:X)	Dia (mm)	Link Type	US CL (m)	US IL (m)	US Depth (m)	DS CL (m)	DS IL (m)	DS Depth (m)
1.014	53.361	238.2	300	Circular	54.116	51.429	2.387	53.173	51.205	1.668
1.015	32.133	238.0	300	Circular	53.173	51.205	1.668	53.430	51.070	2.060
1.016	11.897	237.9	300	Circular	53.430	51.070	2.060	53.897	51.020	2.577
1.017	93.060	239.8	300	Circular	53.897	51.020	2.577	51.972	50.632	1.040
1.018	84.441	239.9	300	Circular	51.972	50.632	1.040	51.881	50.280	1.301
1.019	6.284	241.7	300	Circular	51.881	50.280	1.301	51.453	50.254	0.899

Link	US Node	Dia (mm)	Node Type	MH Type	DS Node	Dia (mm)	Node Type	MH Type
1.014	S50	1200	Manhole	Adoptable	S26	1200	Manhole	Adoptable
1.015	S26	1200	Manhole	Adoptable	S28	1200	Manhole	Adoptable
1.016	S28	1200	Manhole	Adoptable	S30	1200	Manhole	Adoptable
1.017	S30	1200	Manhole	Adoptable	S32	1350	Manhole	Adoptable
1.018	S32	1350	Manhole	Adoptable	S34	1350	Manhole	Adoptable
1.019	S34	1350	Manhole	Adoptable	HW3	1500	Manhole	Adoptable

Manhole Schedule

Node	Easting (m)	Northing (m)	CL (m)	Depth (m)	Dia (mm)	Connections	Link	IL (m)	Dia (mm)
S2	479608.821	162728.548	55.643	1.493	1350				
						0	1.000	54.150	225
S4	479589.176	162728.450	55.270	1.470	1350		1	1.000	53.800
						0	1.001	53.800	225
S6	479554.574	162718.639	54.625	1.550	1350		1	1.001	53.150
						0	1.002	53.075	300
S8	479540.130	162718.795	54.607	1.593	1350		1	1.002	53.014
						0	1.003	53.014	300
S10	479536.531	162697.104	54.184	1.482	1350		1	1.003	52.702
						0	1.004	52.702	300
S12	479533.696	162679.606	53.900	1.375	1350		1	1.004	52.600
						0	1.005	52.525	375
S14	479563.965	162672.079	53.644	1.305	1350		1	1.005	52.339
						0	1.006	52.339	375
S16	479609.228	162676.877	54.119	2.037	1350		1	1.006	52.157
						0	1.007	52.082	450

Manhole Schedule

Node	Easting (m)	Northing (m)	CL (m)	Depth (m)	Dia (mm)	Connections	Link	IL (m)	Dia (mm)	
S49	479659.323	162672.816	53.753	1.832	1350	1  0	1	1.007	51.921	450
						0  1	0	1.008	51.921	450
S38	479717.592	162705.201	54.517	1.807	1200	0  1	0	2.000	52.710	300
S40	479673.015	162705.430	54.833	2.310	1200	0  1	1	2.000	52.523	300
						0  1	0	2.001	52.523	300
S48	479653.293	162729.795	55.743	1.593	1350	0  1	0	3.000	54.150	225
S42	479662.270	162701.325	54.740	2.390	1350	1  2 0  1	1 2 0	3.000 2.001 2.002	52.500 52.425 52.350	225 300 375
S44	479666.728	162683.161	54.119	1.844	1350	1  0	1	2.002	52.275	375
						0  1	0	2.003	52.275	375
S46	479671.105	162669.474	53.181	1.299	1350	1  2 0  1	1 2 0	2.003 1.008 1.009	51.957 51.882 51.882	375 450 450
HW1	479671.231	162658.828	53.050	1.350	1500	1  0	1	1.009	51.850	450
						0  1	0	1.010	51.700	600
HW2	479661.050	162656.807	53.050	1.360	1500	0  1	1	1.010	51.690	600
						0  1	0	1.011	51.690	600
S24	479656.866	162663.431	53.850	2.210	1500	0  1	1	1.011	51.640	600
						0  1	0	1.012	51.640	300
S51	479650.307	162671.552	53.722	2.126	1200	0  1	1	1.012	51.596	300
						0  1	0	1.013	51.596	300
S50	479610.682	162674.977	54.116	2.687	1200	0  1	1	1.013	51.429	300
						0  1	0	1.014	51.429	300
S26	479557.365	162669.971	53.173	1.968	1200	0  1	1	1.014	51.205	300
						0  1	0	1.015	51.205	300

Manhole Schedule

Node	Easting (m)	Northing (m)	CL (m)	Depth (m)	Dia (mm)	Connections	Link	IL (m)	Dia (mm)	
S28	479531.484	162677.491	53.430	2.360	1200		1	1.015	51.070	300
							0	1.016	51.070	300
S30	479514.016	162677.242	53.897	2.877	1200		1	1.016	51.020	300
							0	1.017	51.020	300
S32	479495.536	162586.035	51.972	1.340	1350		1	1.017	50.632	300
							0	1.018	50.632	300
S34	479478.864	162503.256	51.881	1.601	1350		1	1.018	50.280	300
							0	1.019	50.280	300
HW3	479474.400	162498.833	51.453	1.199	1500		1	1.019	50.254	300

Simulation Settings

Rainfall Methodology	FEH-22	Analysis Speed	Normal	Additional Storage (m³/ha)	0.0
Summer CV	1.000	Skip Steady State	x	Check Discharge Rate(s)	x
Winter CV	1.000	Drain Down Time (mins)	240	Check Discharge Volume	x

Storm Durations

15 | 30 | 60 | 120 | 180 | 240 | 360 | 480 | 600 | 720 | 960 | 1440

Return Period (years)	Climate Change (CC %)	Additional Area (A %)	Additional Flow (Q %)
2	0	0	0
30	0	0	0
100	40	0	0

Node S24 Online Hydro-Brake® Control

Flap Valve	x	Objective	(HE) Minimise upstream storage
Replaces Downstream Link	✓	Sump Available	✓
Invert Level (m)	51.640	Product Number	CTL-SHE-0102-4600-0950-4600
Design Depth (m)	0.950	Min Outlet Diameter (m)	0.150
Design Flow (l/s)	4.6	Min Node Diameter (mm)	1200

Node HW2 Depth/Area Storage Structure

Base Inf Coefficient (m/hr)	0.00000	Safety Factor	2.0	Invert Level (m)	51.690
Side Inf Coefficient (m/hr)	0.00000	Porosity	1.00	Time to half empty (mins)	

Depth (m)	Area (m²)	Inf Area (m²)	Depth (m)	Area (m²)	Inf Area (m²)
0.000	396.0	0.0	1.200	846.3	0.0

Results for 2 year Critical Storm Duration. Lowest mass balance: 99.52%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
15 minute summer	S2	10	54.205	0.055	9.1	0.0781	0.0000	OK
15 minute summer	S4	10	53.871	0.071	14.8	0.1012	0.0000	OK
15 minute summer	S6	10	53.201	0.126	26.2	0.1810	0.0000	OK
15 minute summer	S8	11	53.104	0.090	26.0	0.1291	0.0000	OK
15 minute summer	S10	11	52.835	0.133	30.8	0.1908	0.0000	OK
15 minute summer	S12	11	52.642	0.117	30.9	0.1676	0.0000	OK
15 minute summer	S14	12	52.469	0.130	32.1	0.1860	0.0000	OK
15 minute summer	S16	11	52.246	0.164	54.7	0.2348	0.0000	OK
15 minute summer	S49	10	52.172	0.251	53.7	0.3586	0.0000	OK
15 minute summer	S38	10	52.786	0.076	10.5	0.0862	0.0000	OK
15 minute summer	S40	11	52.610	0.087	16.9	0.0984	0.0000	OK
15 minute summer	S48	10	54.182	0.032	5.2	0.0452	0.0000	OK
15 minute summer	S42	11	52.469	0.119	26.8	0.1707	0.0000	OK
15 minute summer	S44	11	52.361	0.086	35.0	0.1230	0.0000	OK
15 minute summer	S46	10	52.163	0.281	103.4	0.4022	0.0000	OK
15 minute summer	HW1	10	52.122	0.422	106.9	0.7459	0.0000	OK
360 minute summer	HW2	264	51.903	0.213	27.6	93.1952	0.0000	OK
360 minute winter	S24	320	51.912	0.272	12.7	0.4812	0.0000	OK
360 minute summer	S51	272	51.648	0.052	4.6	0.0584	0.0000	OK
360 minute summer	S50	264	51.480	0.051	4.6	0.0582	0.0000	OK
360 minute summer	S26	264	51.257	0.052	4.6	0.0583	0.0000	OK
360 minute summer	S28	264	51.123	0.053	4.6	0.0600	0.0000	OK
360 minute summer	S30	264	51.071	0.051	4.6	0.0581	0.0000	OK
360 minute summer	S32	272	50.683	0.051	4.6	0.0731	0.0000	OK
360 minute summer	S34	272	50.334	0.054	4.6	0.0776	0.0000	OK
Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
15 minute summer	S2	1.000	S4	9.0	1.006	0.130	0.1776	
15 minute summer	S4	1.001	S6	14.5	1.384	0.207	0.3777	
15 minute summer	S6	1.002	S8	26.0	1.139	0.361	0.3316	
15 minute summer	S8	1.003	S10	26.2	1.096	0.198	0.5282	
15 minute summer	S10	1.004	S12	30.9	1.069	0.368	0.5126	
15 minute summer	S12	1.005	S14	30.8	1.021	0.200	0.9670	
15 minute summer	S14	1.006	S16	31.3	0.948	0.249	1.5059	
15 minute summer	S16	1.007	S49	53.7	0.804	0.295	3.4492	
15 minute summer	S49	1.008	S46	58.2	0.668	0.321	1.1929	
15 minute summer	S38	2.000	S40	10.3	0.672	0.144	0.6870	
15 minute summer	S40	2.001	S42	16.7	1.035	0.163	0.1858	
15 minute summer	S48	3.000	S42	5.1	1.524	0.042	0.1000	
15 minute summer	S42	2.002	S44	27.0	1.105	0.214	0.4592	
15 minute summer	S44	2.003	S46	35.2	1.281	0.118	0.5802	
15 minute summer	S46	1.009	HW1	106.9	1.200	0.606	1.0887	
15 minute summer	HW1	1.010	HW2	112.1	2.092	0.530	1.1124	
360 minute summer	HW2	1.011	S24	13.3	0.358	0.024	0.8283	
360 minute winter	S24	Hydro-Brake®	S51	4.6				
360 minute summer	S51	1.013	S50	4.6	0.571	0.064	0.3197	
360 minute summer	S50	1.014	S26	4.6	0.572	0.064	0.4285	
360 minute summer	S26	1.015	S28	4.6	0.559	0.064	0.2638	
360 minute summer	S28	1.016	S30	4.6	0.561	0.064	0.0974	
360 minute summer	S30	1.017	S32	4.6	0.576	0.064	0.7415	
360 minute summer	S32	1.018	S34	4.6	0.554	0.064	0.7003	
360 minute summer	S34	1.019	HW3	4.6	0.559	0.065	0.0517	128.4



Results for 2 year Critical Storm Duration. Lowest mass balance: 99.52%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
360 minute summer	HW3	272	50.304	0.050	4.6	0.0000	0.0000	OK
Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)

Results for 30 year Critical Storm Duration. Lowest mass balance: 99.52%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
15 minute summer	S2	10	54.241	0.091	23.3	0.1300	0.0000	OK
15 minute summer	S4	10	53.918	0.118	37.9	0.1683	0.0000	OK
15 minute summer	S6	10	53.297	0.222	67.7	0.3178	0.0000	OK
15 minute summer	S8	10	53.177	0.163	67.3	0.2331	0.0000	OK
15 minute summer	S10	11	52.959	0.257	79.5	0.3679	0.0000	OK
15 minute summer	S12	11	52.730	0.205	79.6	0.2939	0.0000	OK
15 minute summer	S14	12	52.570	0.231	83.1	0.3307	0.0000	OK
15 minute summer	S16	12	52.494	0.412	148.1	0.5896	0.0000	OK
15 minute summer	S49	12	52.393	0.472	140.9	0.6753	0.0000	SURCHARGED
15 minute summer	S38	10	52.836	0.126	26.7	0.1426	0.0000	OK
15 minute summer	S40	11	52.672	0.149	43.4	0.1682	0.0000	OK
15 minute summer	S48	10	54.200	0.050	13.1	0.0718	0.0000	OK
15 minute summer	S42	10	52.547	0.197	69.0	0.2823	0.0000	OK
15 minute summer	S44	10	52.414	0.139	90.2	0.1992	0.0000	OK
15 minute summer	S46	11	52.351	0.469	245.5	0.6708	0.0000	SURCHARGED
15 minute winter	HW1	8	52.256	0.556	230.0	0.9829	0.0000	OK
360 minute winter	HW2	352	52.184	0.494	39.7	242.4666	0.0000	OK
360 minute winter	S24	352	52.187	0.547	13.8	0.9659	0.0000	SURCHARGED
15 minute winter	S51	11	51.648	0.052	4.6	0.0591	0.0000	OK
15 minute summer	S50	14	51.481	0.052	4.6	0.0585	0.0000	OK
15 minute summer	S26	17	51.257	0.052	4.6	0.0584	0.0000	OK
15 minute summer	S28	19	51.123	0.053	4.6	0.0601	0.0000	OK
15 minute summer	S30	19	51.074	0.054	4.6	0.0605	0.0000	OK
15 minute summer	S32	23	50.683	0.051	4.7	0.0737	0.0000	OK
15 minute summer	S34	27	50.334	0.054	4.7	0.0778	0.0000	OK

Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
15 minute summer	S2	1.000	S4	23.1	1.287	0.333	0.3536	
15 minute summer	S4	1.001	S6	37.6	1.575	0.537	0.8718	
15 minute summer	S6	1.002	S8	67.3	1.421	0.936	0.6860	
15 minute summer	S8	1.003	S10	67.3	1.297	0.507	1.1251	
15 minute summer	S10	1.004	S12	79.6	1.324	0.947	1.0612	
15 minute summer	S12	1.005	S14	79.9	1.215	0.517	2.0425	
15 minute summer	S14	1.006	S16	81.8	1.064	0.649	3.9987	
15 minute summer	S16	1.007	S49	140.9	0.912	0.774	7.8030	
15 minute summer	S49	1.008	S46	142.0	0.910	0.782	1.9405	
15 minute summer	S38	2.000	S40	26.4	0.841	0.369	1.4019	
15 minute summer	S40	2.001	S42	42.9	1.315	0.418	0.3749	
15 minute summer	S48	3.000	S42	13.0	1.998	0.105	0.1937	
15 minute summer	S42	2.002	S44	68.8	1.444	0.545	0.8969	
15 minute summer	S44	2.003	S46	89.7	1.373	0.301	1.0593	
15 minute summer	S46	1.009	HW1	244.0	1.617	1.384	1.5436	
15 minute winter	HW1	1.010	HW2	256.3	2.604	1.213	1.4281	
360 minute winter	HW2	1.011	S24	13.8	0.327	0.025	2.0300	
360 minute winter	S24	Hydro-Brake®	S51	4.6				
15 minute winter	S51	1.013	S50	4.6	0.701	0.064	0.3201	
15 minute summer	S50	1.014	S26	4.6	0.657	0.064	0.4292	
15 minute summer	S26	1.015	S28	4.6	0.567	0.064	0.2643	
15 minute summer	S28	1.016	S30	4.6	0.676	0.064	0.1004	
15 minute summer	S30	1.017	S32	4.7	0.709	0.066	0.7481	
15 minute summer	S32	1.018	S34	4.7	0.603	0.065	0.7030	
15 minute summer	S34	1.019	HW3	4.6	0.559	0.065	0.0519	63.9



Results for 30 year Critical Storm Duration. Lowest mass balance: 99.52%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
15 minute summer	HW3	27	50.305	0.051	4.6	0.0000	0.0000	OK
Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)

Results for 100 year +40% CC Critical Storm Duration. Lowest mass balance: 99.52%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
15 minute summer	S2	12	54.756	0.606	42.4	0.8673	0.0000	SURCHARGED
15 minute summer	S4	12	54.649	0.849	65.1	1.2147	0.0000	SURCHARGED
15 minute summer	S6	12	54.157	1.082	112.4	1.5481	0.0000	SURCHARGED
15 minute summer	S8	12	53.983	0.969	107.0	1.3867	0.0000	SURCHARGED
15 minute summer	S10	12	53.737	1.035	119.0	1.4816	0.0000	SURCHARGED
15 minute summer	S12	12	53.445	0.920	120.3	1.3166	0.0000	SURCHARGED
15 minute summer	S14	11	53.304	0.965	129.1	1.3816	0.0000	SURCHARGED
15 minute summer	S16	11	53.110	1.028	236.1	1.4717	0.0000	SURCHARGED
15 minute summer	S49	11	52.779	0.858	235.6	1.2275	0.0000	SURCHARGED
15 minute summer	S38	11	53.002	0.292	48.6	0.3301	0.0000	OK
15 minute summer	S40	11	52.925	0.402	79.7	0.4551	0.0000	SURCHARGED
15 minute summer	S48	10	54.217	0.067	23.9	0.0957	0.0000	OK
15 minute summer	S42	11	52.861	0.511	112.4	0.7306	0.0000	SURCHARGED
15 minute summer	S44	11	52.779	0.504	146.2	0.7211	0.0000	SURCHARGED
15 minute summer	S46	11	52.656	0.774	427.3	1.1074	0.0000	SURCHARGED
600 minute winter	HW1	585	52.594	0.894	45.4	1.5804	0.0000	SURCHARGED
600 minute winter	HW2	585	52.595	0.905	45.1	513.6486	0.0000	SURCHARGED
600 minute winter	S24	585	52.595	0.955	14.5	1.6875	0.0000	SURCHARGED
15 minute summer	S51	10	51.649	0.053	4.6	0.0602	0.0000	OK
15 minute summer	S50	13	51.481	0.052	4.6	0.0591	0.0000	OK
15 minute winter	S26	15	51.257	0.052	4.6	0.0585	0.0000	OK
1440 minute winter	S28	600	51.123	0.053	4.6	0.0601	0.0000	OK
15 minute winter	S30	17	51.074	0.054	4.6	0.0607	0.0000	OK
30 minute winter	S32	24	50.683	0.051	4.7	0.0732	0.0000	OK
720 minute winter	S34	285	50.334	0.054	4.6	0.0777	0.0000	OK

Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
15 minute summer	S2	1.000	S4	39.4	1.389	0.567	0.7813	
15 minute summer	S4	1.001	S6	60.2	1.556	0.860	1.4304	
15 minute summer	S6	1.002	S8	107.0	1.522	1.488	1.0172	
15 minute summer	S8	1.003	S10	101.5	1.442	0.766	1.5483	
15 minute summer	S10	1.004	S12	120.3	1.709	1.431	1.2483	
15 minute summer	S12	1.005	S14	126.1	1.241	0.816	3.4275	
15 minute summer	S14	1.006	S16	135.6	1.230	1.076	5.0217	
15 minute summer	S16	1.007	S49	235.6	1.487	1.294	7.9632	
15 minute summer	S49	1.008	S46	235.1	1.484	1.295	1.9405	
15 minute summer	S38	2.000	S40	48.9	0.920	0.682	3.1262	
15 minute summer	S40	2.001	S42	73.7	1.315	0.719	0.8100	
15 minute summer	S48	3.000	S42	23.8	1.995	0.194	0.7408	
15 minute summer	S42	2.002	S44	113.2	1.411	0.897	2.0630	
15 minute summer	S44	2.003	S46	146.4	1.453	0.491	1.5850	
15 minute summer	S46	1.009	HW1	427.1	2.696	2.422	1.6677	
600 minute winter	HW1	1.010	HW2	45.1	0.879	0.213	2.9238	
600 minute winter	HW2	1.011	S24	14.5	0.311	0.026	2.2069	
600 minute winter	S24	Hydro-Brake®	S51	4.6				
15 minute summer	S51	1.013	S50	4.6	0.725	0.065	0.3228	
15 minute summer	S50	1.014	S26	4.7	0.661	0.065	0.4293	
15 minute winter	S26	1.015	S28	4.6	0.573	0.064	0.2636	
1440 minute winter	S28	1.016	S30	4.6	0.561	0.064	0.0976	
15 minute winter	S30	1.017	S32	4.7	0.719	0.066	0.7380	
30 minute winter	S32	1.018	S34	4.6	0.598	0.064	0.6943	
720 minute winter	S34	1.019	HW3	4.6	0.559	0.065	0.0518	230.1



Results for 100 year +40% CC Critical Storm Duration. Lowest mass balance: 99.52%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
720 minute winter	HW3	285	50.305	0.051	4.6	0.0000	0.0000	OK

Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
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