



PENN FARM, CALNE
FLOOD RISK ASSESSMENT AND DRAINAGE STRATEGY

CASTLEWOOD PROPERTIES VENTURES LTD

05 JUNE 2026





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Date:	05 June 2026
Document Reference:	A325 – R004D

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1.0 Introduction

1.1 Context

- 1.1.1 This Flood Risk Assessment (FRA) has been prepared by Abley Letchford, on behalf of Castlewood Properties Ventures Ltd, to support an Outline planning application seeking planning permission for approximately 210 residential dwellings, alongside 0.75 hectares of commercial use. The site is located at Penn Hill Farm in Calne, Wiltshire.

1.2 Document Evolution and Planning Context

- 1.2.1 This Flood Risk Assessment and Drainage Strategy has evolved through several stages of the planning process, including earlier iterations prepared in support of previous submissions and subsequent review by the Lead Local Flood Authority (LLFA). The current revision has been prepared in response to consultation feedback, including a holding objection requesting additional information and greater alignment with the National Standards for Sustainable Drainage Systems (SuDS) (June 2025).
- 1.2.2 It is recognised that the planning application was originally submitted prior to the formal introduction of the updated National SuDS Standards. As such, in accordance with planning principles, the assessment of the application is based primarily on the Development Plan and national policy in force at the time of submission. The updated National SuDS Standards are therefore considered as a material consideration and have been taken into account where proportionate and practicable within the evolving design.
- 1.2.3 This updated FRA and Drainage Strategy seeks to respond positively to the LLFA's comments by incorporating SuDS principles consistent with current best practice and national guidance, whilst retaining a proportionate approach appropriate to the outline nature of the application. Detailed design elements will be further developed and secured through subsequent planning stages, including Reserved Matters and discharge of conditions, as is typical for developments of this scale.

1.3 Development Proposals

- 1.3.1 The proposals are for 210 residential dwellings, alongside 0.75 hectares of commercial use as depicted on the Framework Masterplan within **Appendix A**.

1.4 Requirement for a Flood Risk Assessment

- 1.4.1 The requirement for an FRA is set out in Section 14 of the revised National Planning Policy Framework (NPPF) as revised in December 2024.
- 1.4.2 The footnote accompanying Paragraph 181 states:
- 1.4.3 'A site-specific flood risk assessment should be provided for all development in Flood Zones 2 and 3. In Flood Zone 1, an assessment should accompany all proposals involving: sites of 1 hectare or more; land which has been identified by the Environment Agency as having critical drainage problems; land identified in a strategic flood risk assessment as being at increased flood risk in future; or land that may be subject to other sources of flooding, where its development would introduce a more vulnerable use.'
- 1.4.4 The site is a greenfield site that comprises of agricultural fields primarily used for grazing with established hedges and tree lined boundaries. The area of the site is approximately 15 hectares. As the site area extends greater than 1 hectare, a site-specific flood risk assessment is required. To comply with the requirements of the NPPF, matter related to flood risk and drainage are addressed within this report.

1.5 Report Aim and Formation

- 1.5.1 The principal aims of this report are to demonstrate that the proposed development complies with national and local planning policy in respect to flood risk and to demonstrate that a suitable drainage strategy can be provided as part of development.



- 1.5.2 This report will also summarise the impacts the development could have on flood risk to the surrounding area and outlines the mitigation strategies that will be implemented to minimise this risk.
- 1.5.3 The drainage design embraces the guiding principles of Sustainable Drainage Systems (SuDS) which are central to the design of the surface water drainage strategy for the proposed development.

1.6 Report Structure

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



2.0 Policy and Sources of Information

2.1 Introduction

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

2.2 National Planning Policy

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

- 2.2.2 Paragraphs 173 to 176 discuss the sequential approach with respect to individual applications. Paragraph 174 refers to the Strategic Flood Risk Assessment (SFRA) that would form the basis of applying the Sequential Test for local authorities to allocate developments, whilst Paragraphs 177-179 relate to Exception Tests.

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

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

Within the site, the most vulnerable development is located in areas of lowest flood risk unless there are overriding reasons to prefer a different location.

The development is appropriately flood resistant and resilient, such that, in the event of a flood, it could be quickly brought back into use without significant refurbishment.

It incorporates sustainable drainage systems, unless there is clear evidence that this would be inappropriate.

Any residual risk can be safely managed; and

Safe access and escape routes are included where appropriate, as part of an agreed emergency plan.'

- 2.2.5 The proposed development is for 210 residential dwellings, alongside 0.75 hectare of commercial use at the site which covers approximately 15.0 hectares and would, therefore, be classed as a Major development because the site is greater than 0.5 hectares. Paragraph 182 states:

- 'Sustainable drainage systems provided as part of proposals for major development should:
- Take account of advice from the lead local flood authority.
- Have appropriate proposed minimum operational standards; and
- Have maintenance arrangements in place to ensure an acceptable standard of operation for the lifetime of the development.'

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

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

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



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

2.3 National SuDS Standards (2025)

- 2.3.1 The National Standards for Sustainable Drainage Systems (SuDS) (DEFRA, June 2025) establish updated guidance and requirements relating to surface water management, including runoff destination hierarchy, interception, water quality, amenity, biodiversity, and long-term maintenance.
- 2.3.2 These Standards provide a framework for the design and assessment of drainage strategies for new development and represent current best practice in SuDS design.
- 2.3.3 It is recognised that the planning application was originally submitted prior to the introduction of the updated National SuDS Standards. As such, the determination of the application must be based primarily on the Development Plan and national policy in force at the time of submission.
- 2.3.4 The National SuDS Standards are therefore treated as a material consideration and have been taken into account where proportionate and practicable within the drainage strategy. Full compliance is not a prerequisite for determination at this stage, particularly given the outline nature of the application, with detailed design to be secured through subsequent planning stages.

2.4 Environment Agency

- 2.4.1 The Flood and Water Management Act (2010) provides the Environment Agency (EA) a strategic overview role for all forms of flooding and coastal erosion. They also have direct responsibility for the prevention, mitigation and remediation of flood damage for main rivers and coastal areas. The EA is a statutory consultee in relation to flood risk and planning dependent upon criteria.
- 2.4.2 The EA Flood Map for Planning, EA Long Term Flood Risk Mapping and the Catchment Data Explorer websites have been interrogated in respect to flood risk extents and sources.

2.5 Local Authorities

- 2.5.1 The site lies within the administrative area of Calne Town Council (CTC) and Wiltshire Council (WC). WC is the Local Planning Authority (LPA) and Lead Local Flood Authority (LLFA).
- 2.5.2 Planning guidance published by CTC and WC regarding the flood risk was referred to in order to assess the methodology best suited to suit the local area. The following key documents were reviewed:
 - Calne Community Neighbourhood Plan 2 2023 – 2038 (dated March 2025)
 - Wiltshire Core Strategy, Core Policy 67: Flood Risk (adopted January 2015),
 - Wiltshire Local Flood Risk Management Strategy (dated April 2015),
 - Wiltshire Council Preliminary Flood Risk Assessment (PFRA) (dated June 2011) and PFRA addendum (dated 2017),
 - Wiltshire Council Level 1 Strategic Flood Risk Assessment (SFRA) (dated November 2024) and
 - Wiltshire Council Level 2 Strategic Flood Risk Assessment (SFRA) (dated February 2025).
- 2.5.3 WC became the LLFA under the Flood and Water Management Act 2010. WC provide guidance to assess, manage and inform flood risk.
- 2.5.4 Wessex Water (WW) has permissive rights over any Ordinary Watercourses including land drainage ditches. If any work is required within the watercourse (improvements or crossings) then approval from the LLFA is required under the Flood and Water Management Act 1991.

2.6 Local Water Authority

- 2.6.1 WW is responsible for the supply of clean water and disposal of wastewater in the Calne area.



- 2.6.2 Information with regards to sewer and water main flooding contained within the SFRA has been reviewed as part of this FRA. All Water Companies have a statutory obligation to maintain a register of properties and areas which are at risk of flooding from the public sewerage system and is shown on the DG5 Flood Register.

2.7 Other Sources of Information

- 2.7.1 A desktop study of the site was carried out using the following websites to ascertain local features, hydrology and soil characteristics:
- DEFRA's Magic Map portal.
 - British Geological Survey (BGS) 'Geology of Britain' online viewer; and
 - Cranfield University 'Soilscapes' portal.
- 2.7.2 A site walkover was carried out in October 2025 which allowed observations of the ditches within the site boundary.
- 2.7.3 Guidance with respect to Sustainable Drainage Systems (SuDS) is contained within DEFRA document Sustainable Drainage Systems, Non-statutory technical standards for sustainable drainage systems March 2015, CIRIA C753 The SuDS Manual and within the NPPF Planning Practice Guidance (PPG) – 'Flood Risk and Coastal Change'.
- 2.7.4 Additional guidance on development and flood risk is contained within CIRIA C624 Development and Flood Risk – Guidance for the Construction Industry which identifies several key aims for a development to ensure it is sustainable in flood risk terms.

3.0 Site Setting

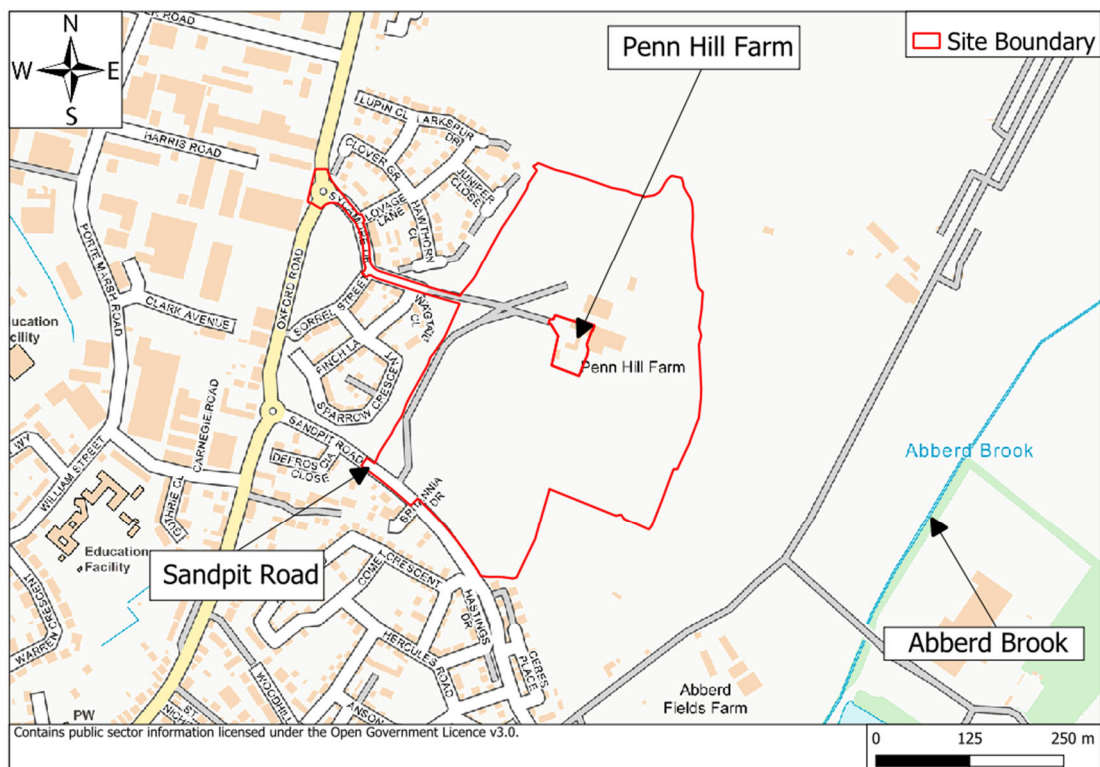
3.1 Introduction

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

3.2 Site Location

- 3.2.1 The site is located at land to the Penn Hill Farm, located approximately 1.4km to the northeast of Calne in Wiltshire. The nearest postcode is SN11 8RR. The site centre grid reference is 400810E, 17250N. The site location is shown in **Figure 3.1**.

Figure 3.1: Site Location

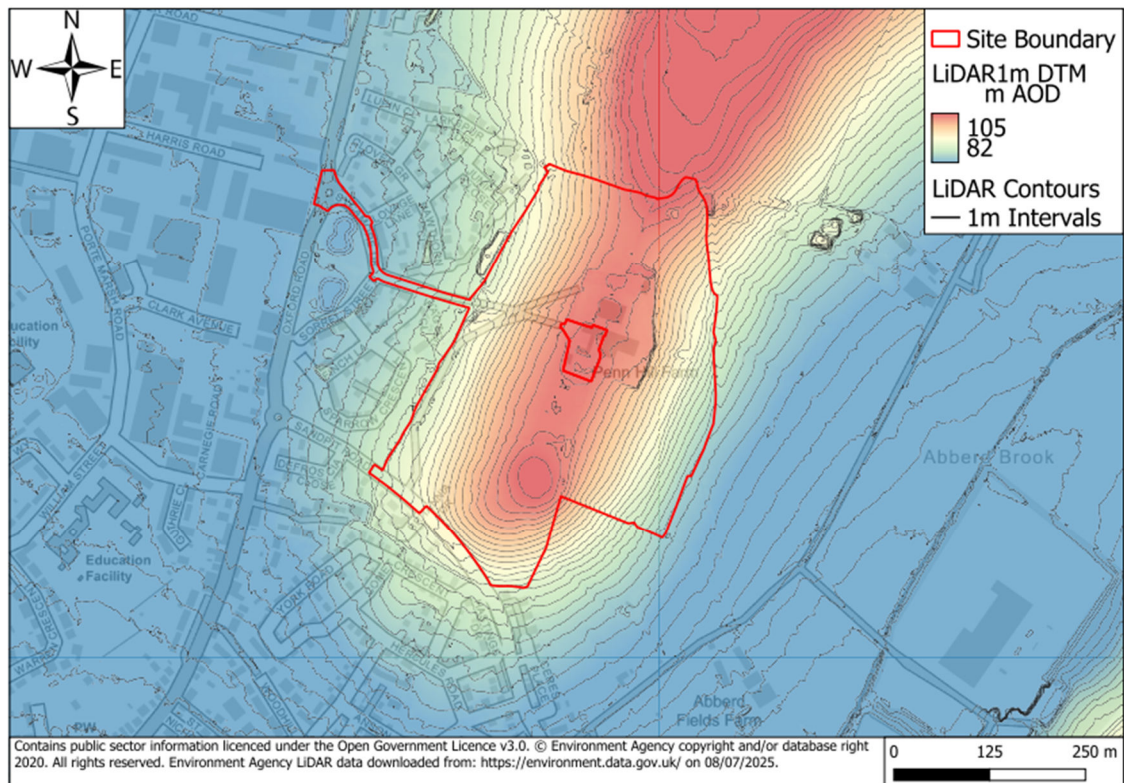


- 3.2.2 The site is bounded to the south by Sandpit Road. A residential area is located to the northwest of the site. Agricultural land is located to the north and east of the site. The site is located to the east of a new residential development by Hills Homes and to the north of a new residential development by Backhouse. The site shares common boundary features with these two developments.
- 3.2.3 The site consists predominantly of large agricultural fields, enclosed by mature hedgerow and tree boundaries. Penn Hill Farm and industrial estate are located at the centre of the site.

3.3 Topography

3.3.1 The ground levels across the site are shown by LiDAR in **Figure 3.2**.

Figure 3.2: Site Topography



3.3.2 There is a ridge which runs from northeast to southwest through the site, as shown in **Figure 3.2**. The site and surrounding land slopes away to the west and to the east.

3.3.3 The LiDAR indicates that the ridge is at an elevation of between 104m AOD and 105m AOD. The lowest point of the site is along the site's eastern boundary. Elevations along the site's eastern boundary are approximately 84.4m AOD.

3.3.4 A topographic survey was carried out by JOMAS Environmental Engineering in August 2022. A copy of the topographic survey has been included in **Appendix A**. The topographic survey confirms the levels within the LiDAR data. Elevations along the low point of the site, along the eastern boundary are between 84.7m AOD and 87.8m AOD. The ridge through the centre of the site is shown in the topographic survey to have an elevation of between 103.6m AOD and 105.7m AOD.

3.4 Watercourses and Ditches

3.4.1 There are no watercourses within the site boundary.

3.4.2 **Figure 3.3** shows a photograph of a ditch on the northwestern boundary taken during the site walkover which was carried out in October 2025.

Figure 3.3: Photograph of ditch





3.4.3 **Figure 3.3** shows the ditch that is along the northwestern boundary of the site. This ditch slopes down from the site, rises in the centre and then further slopes but remains lower than the public footpath running parallel to the site. It could be considered for water conveyance from the site.

3.5 Surface and Foul Water Sewers

3.5.1 Sewer Asset Records obtained from Wessex Water do not indicate the presence of any surface or foul water sewers within the site. The nearest public asset is a foul sewer located within Sandpit Road which runs along the southern frontage of the site.

3.6 A copy of Wessex Waters Asset Record is included within **Appendix A**.

3.7 Geology and Hydrogeology

3.7.1 British Geological Survey (BGS) 'Geology of Britain' online viewer indicates that the geology underlying the Site predominantly Kimmeridge Clay Formation. There is some Lower Greensand Group (sandstone) in the centre of the site.

3.7.2 There are no records of superficial deposits across the site. The Cranfield University 'Soilscapes' online viewer indicates the site overlies slowly permeable seasonally wet slightly acidic but base rich loamy and clayey soils.

3.7.3 The DEFRA Magic Map online viewer indicates that the majority of the site lies outside of a Groundwater Source Protection Zone (SPZ) and Principal Aquifer designation. The area immediately to the south of Penn Hill Farm is shown to be a Secondary A bedrock aquifer. The rest of the site is shown to be unproductive.

3.7.4 Minor secondary aquifers are associated with the underlying bedrock and superficial drift layers. These rocks can provide modest amounts of water, but the nature of the rock or the aquifer's structure limits their use. They support water supplies at local rather than strategic scale.

3.7.5 The DEFRA Magic Map indicates that the site does not lie within a Drinking Water Safeguard Zone for surface water or groundwater.

4.0 Overview of Flood Risk

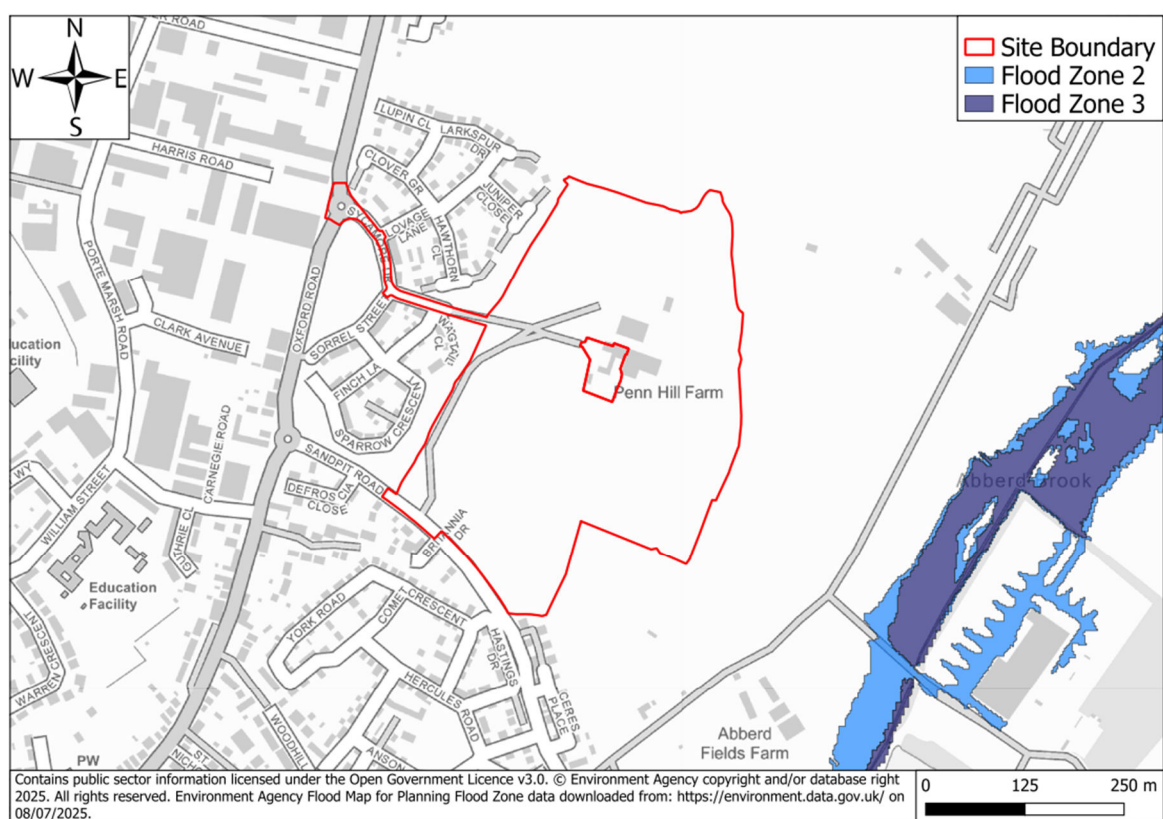
4.1 EA Flood Zone Map

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

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

4.1.2 **Figure 4.1** shows the EA Flood Zone mapping.

Figure 4.1: EA Flood Zone Map



4.1.3 **Figure 4.1** shows the entirety of the site lies within Flood Zone 1.

4.1.4 Therefore, the overall risk of flooding from rivers and sea is low.

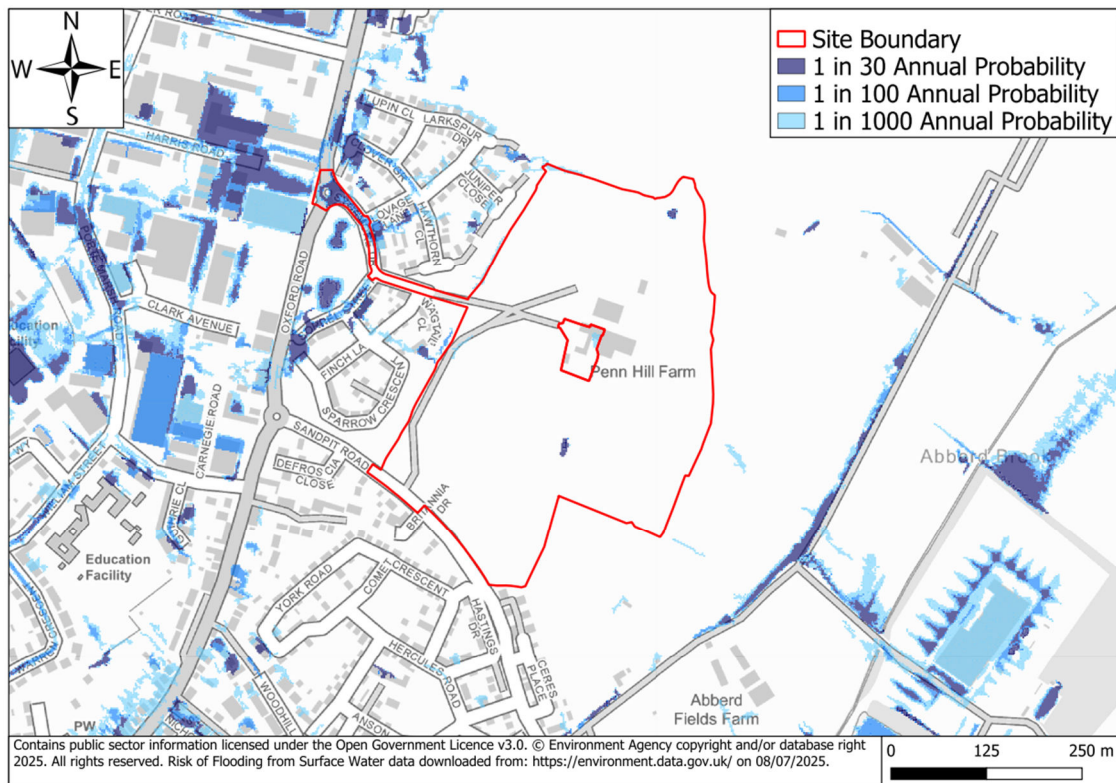
4.2 Flood Risk from Surface Water

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

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

- Lower than 1 in 1,000 (0.1%) annual probability 'Very Low Risk'.
- 4.2.2 The NPPF PPG – 'Flood Risk and Coastal Change' includes the 1 in 100 annual probability of surface water flood (including climate change) within the definition of the design flood event to be used to inform an FRA.
- 4.2.3 **Figure 4.2** shows the potential flood risk from surface water.

Figure 4.2: EA Flood Risk from Surface Water



- 4.2.4 The EA Flood Risk from Surface Water mapping shows there is limited risk of flooding from surface water. There are two areas within the site boundary wherein there appears to be ponding, in the northeastern corner of the site and in the lower central south of the site. Both these areas are classed as 1 in 30 Annual Probability of Flooding from Surface Water.
- 4.2.5 Overall, there does not appear to be any surface water flow pathways and limited surface water ponding, therefore the risk of flooding from surface water is deemed to be low.

4.3 Flood Risk from Groundwater

- 4.3.1 Groundwater flooding has the potential to occur after prolonged periods of unusually high rainfall. During such periods, more water than usual infiltrates through the ground, raising the water table above its normal depth below the surface. Where the water table is at a shallow depth in any case, the water table can reach the surface. This can cause groundwater to merge with rainfall and cause localised flooding.
- 4.3.2 The JBA groundwater emergence mapping within the WC Level 1 SFRA shows that none of the site is within the highest risk category therefore the risk of flooding is considered to be low. This mapping is shown in **Appendix B**.
- 4.3.3 The risk of groundwater flooding to the site is therefore considered to be low.

4.4 Flood Risk from Sewers

- 4.4.1 When exceeded, surcharged sewer networks can lead to flooding from backed up manholes and gully connections.

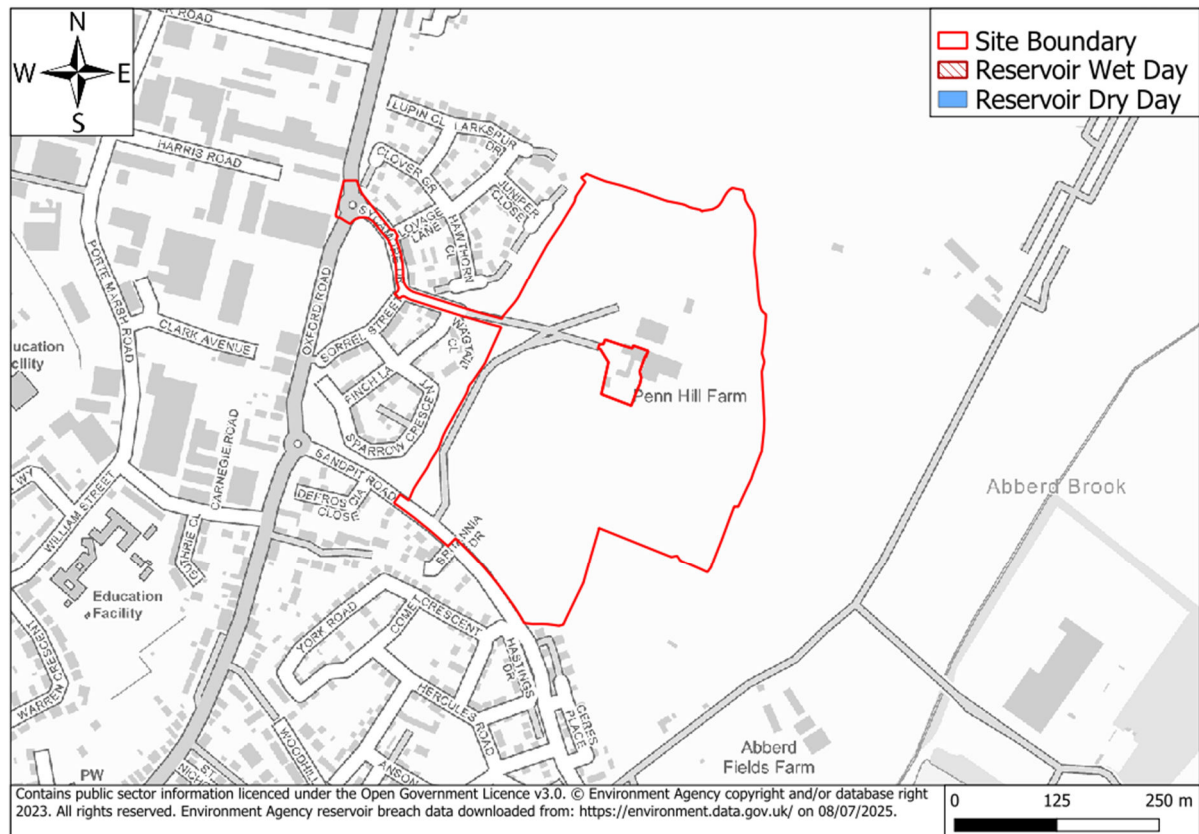
4.4.2 The WW asset location map shows that there are no sewers within the site. The risk of flooding from this source is therefore considered to be low. This mapping is shown in **Appendix A**.

4.5 Flood Risk from Reservoirs

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

4.5.2 **Figure 4.3** shows the flood risk from reservoirs.

Figure 4.3: EA Flood Risk from Reservoirs



4.5.3 The mapping shows that the entirety of the site lies outside of areas at risk of flooding from reservoir breach.

4.5.4 Overall, the risk of flooding from reservoirs is considered low.

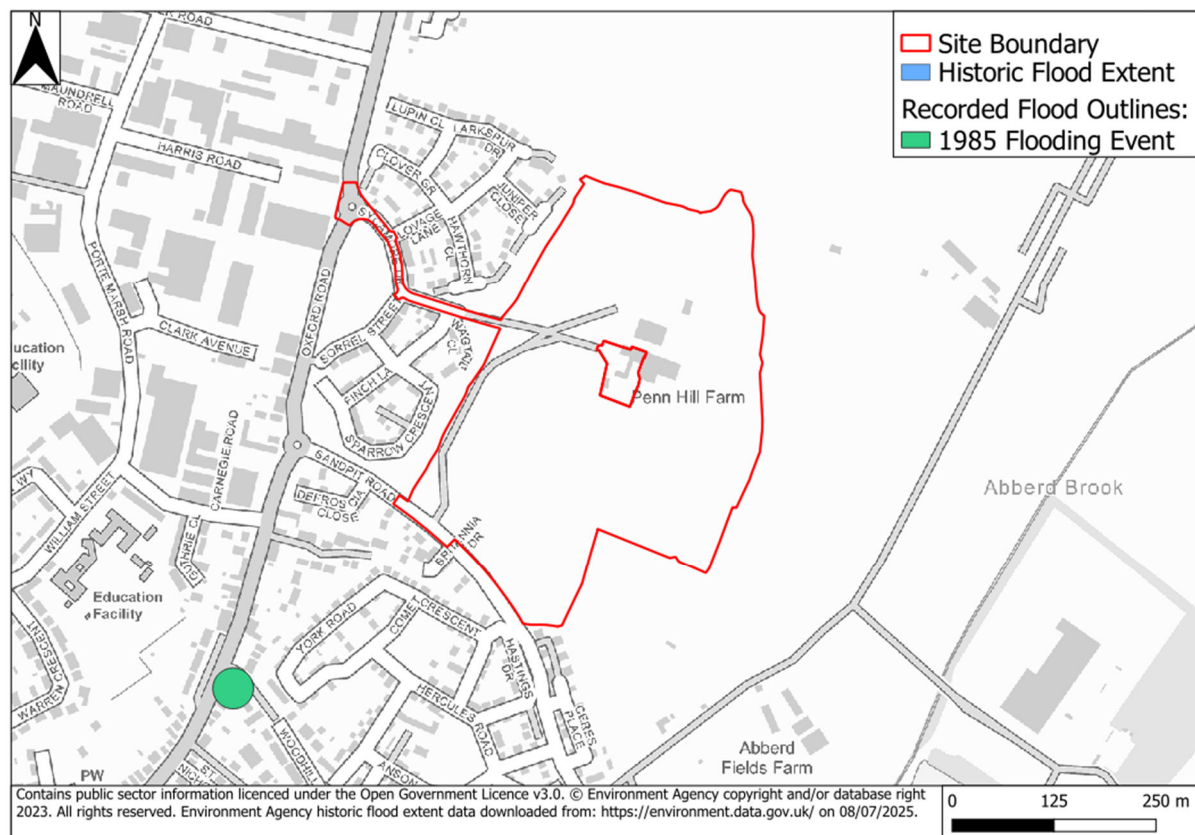
4.6 Flood Risk from Other Sources

4.6.1 The EA flood risk maps, WC PFRA and WC Level 1 and Level 2 SFRA indicate there is low risk from other sources of flooding.

4.7 Historic Flooding

4.7.1 **Figure 4.4** shows the historic flood extent records held by the EA. The EA Historic Flood Map shows the maximum extent of recorded flood events.

Figure 4.4: EA Historic Flood Extents



4.7.2 **Figure 4.5.** shows there are no recorded flooding extents or events that have occurred within the area of the site boundary.



4.8 Flood Risk Summary

4.8.1 A summary of flooding from all sources is provided in **Table 1.1**.

Table 1.1: Summary of Flood Risk

Source of Flooding	Risk of Flooding			Comments
	High	Medium	Low	
Fluvial			✓	The site is located entirely within Flood Zone 1. Therefore, the risk of flooding from fluvial sources is considered low.
Pluvial			✓	The majority of the site has a 'Very Low' risk of surface water flooding. With only two small areas of ponding with 1 in 30 Annual Probability of flooding from surface water. Overall, the risk of flooding from surface water is considered low.
Groundwater			✓	The JBA groundwater mapping within the WC Level 1 SFRA data explorer shows that none of the site is within the highest risk category and that less than 75% the site is within the second highest risk category.
Sewers			✓	The WW asset maps show that there are no sewers within the site boundary. The risk is therefore considered to be low.
Reservoirs, canals and other artificial sources			✓	EA and WC Level 1 SFRA mapping does not indicate the site to be at risk of flooding from other sources.



5.0 Sequential and Exception Test

5.1 NPPF Sequential Test

- 5.1.1 NPPF states that Local Planning Authorities allocating land for development should apply the Sequential Test to demonstrate that there are no reasonably available sites in areas with a lower probability of flooding that would be appropriate to the type of development or land use proposed.
- 5.1.2 The entire site is located with Flood Zone 1 and is confirmed to be at low risk of flooding from all sources.
- 5.1.3 On this basis, as the site is at a low risk of flooding, the Sequential Test is not required.

5.2 Exception Test

- 5.2.1 By extension of the Sequential Test not being required, the Exception Test also is deemed not to be required.



6.0 Flood Mitigation Strategy

6.1 Sequential Approach

- 6.1.1 The NPPF encourages a 'sequential approach' in master planning for new development: locating the more vulnerable uses of the development in the areas of lowest flood risk from all sources.
- 6.1.2 The masterplan reflects this sequential approach with all residential development located in Flood Zone 1.

6.2 Ground Floor Levels

- 6.2.1 The requirements for setting ground floor levels for new developments are set out in BS8533:2017 'Assessing and Managing Flood Risk in New Developments – Code of Practice'.
- 6.2.2 The WC Level 1 SFRA states that '*Finished Floor Levels (FFL) should be set to a minimum of whichever is higher of 600mm above the:*
 - *Average ground level of the site*
 - *Adjacent road level to the building*
 - *Estimated flood event level (1% AEP fluvial plus climate change although other sources of flood risk should also be considered).*
- 6.2.3 *Where this is a high level of certainty about the estimated flood level, it may be appropriate to reduce this to 300mm.'*
- 6.2.4 In addition, ground floor levels should be set a minimum of 150mm above the surrounding ground level to mitigate the residual flood risk from surface water runoff events. It is recommended that surrounding ground levels are appropriately contoured to direct surface water away from the development.

6.3 Floodplain Storage and Flow Routing

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

6.4 Safe Access

- 6.4.1 The proposed development areas are located outside of the fluvial flood extent. Continuous safe access for the development is located outside of the fluvial extent.

6.5 Residual Risk

- 6.5.1 The NPPF PPG – 'Flood Risk and Coastal Change' defined residual risk as coming from 'flood risk management infrastructure' and the 'residual risk to a development once any site-specific flood mitigation measures are taken into account'.
- 6.5.2 Residual risk to the site includes a breach in the raised flood defences, the failure of a reservoir and a flood event greater than the designed standards.
- 6.5.3 The residual risk to the site is low. The EA AIMS dataset which contains information of flood defences indicates that the site does not benefit from raised flood defences. The EA mapping for reservoir breaches indicates that the site is not located within an area at risk of flooding in the event of a reservoir breach. The residential development is located outside of the 1 in 1,000 annual probability flood extent.



7.0 Surface Water Drainage Strategy

7.1 Introduction

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

7.2 Overall Strategy

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



- 7.2.9 Supplemental to CIRIA guidance, Document H of the Building Regulations 2015 sets out three possible options to discharge surface water runoff. Rainwater shall discharge to one of the following, listed in order of priority:
- An adequate soakaway or some other adequate infiltration system; or where that is not reasonably practicable,
 - A watercourse; or where that is not reasonably practicable
 - A sewer.
- 7.2.10 As the underlying geology is not conducive to the use of infiltration type techniques (Ref: Para 3.8.2 above), the surface water drainage proposals will be designed to attenuate runoff with controlled discharge to the existing local watercourses.
- 7.2.11 Implementation of SuDS will ensure that flood risk downstream is not increased due to the proposed development. These features will also provide positive improvements to the quality of surface water runoff.
- 7.2.12 The following SuDS components are deemed applicable to the site:
- **Pervious surfacing systems** – structural surfaces that allow water to penetrate into a granular layer thus providing storage and treatment, e.g. pervious paving.
 - **Conveyance systems** – components that convey flows to downstream storage systems, e.g. swales and filter drains.
 - **Storage systems** – components that control flow, and possibly volumes, by storing water and releasing it slowly, e.g. geocellular units, attenuation basins and wetlands.
 - **Treatment systems** – components that remove or facilitate the degradation of contaminants present in runoff, e.g. filter strips and proprietary treatment systems.

7.3 National Standards for Sustainable Drainage Systems

- 7.3.1 Ongoing consultation with Wiltshire Council as Lead Local Flood Authority (LLFA) has informed the evolution of the drainage strategy, including review of the submitted Flood Risk Assessment and Drainage Strategy.
- 7.3.2 In June 2025, DEFRA published the National Standards for Sustainable Drainage Systems (SuDS), comprising a series of standards with accompanying principles and design guidance relating to runoff destination, interception, water quality, amenity, biodiversity, and long-term maintenance.
- 7.3.3 The LLFA has confirmed through consultation responses that the drainage strategy should demonstrate alignment with the principles of the National SuDS Standards. This includes consideration of source control measures, interception of the first 5mm of rainfall, and provision of multi-stage treatment through the SuDS management train.
- 7.3.4 Notwithstanding the above, it is recognised that the planning application predates the introduction of the National SuDS Standards. Accordingly, these Standards are treated as a material consideration and have been taken into account where proportionate and practicable. Full compliance is not considered a prerequisite at this outline stage, with detailed design to be developed and secured through subsequent planning stages.
- 7.3.5 This approach is consistent with national planning practice whereby emerging or recently introduced guidance may inform design development without altering the policy basis for determination.

7.4 Standard 1: Runoff Destinations

Site Investigations

- 7.4.1 British Geological Survey (BGS) 'Geology of Britain' online viewer indicates that the geology underlying the Site predominantly Kimmeridge Clay Formation. There is some Lower Greensand Group (sandstone) in the centre of the site.



- 7.4.2 There are no records of superficial deposits across the site. The Cranfield University ‘Soilscapes’ online viewer indicates the site overlies slowly permeable, seasonally wet, slightly acidic, but base-rich, loamy and clayey soils.
- 7.4.3 Infiltration techniques may therefore be possible in the sandstone area. However this area is located at the high point of the site and infiltration in this scenario is not recommended due to structural stability issues and the possibility of weeping occurring at lower elevation on site.
- 7.4.4 Depending on the outcome of groundwater monitoring and infiltration testing, it is expected that surface water will be managed through a combination of limited infiltration (if feasible) and restricted discharge to the adjacent watercourse.
- 7.4.5 For the purposes of this assessment, infiltration techniques will not be relied upon at outline stage, these techniques should be explored at later stages as a means to reduce site runoff volumes and basin sizes

Pre and Post Development Areas/Rates

- 7.4.6 To quantify any potential increase in surface water runoff, the existing Greenfield/Pre-Development runoff rate from the site must be determined. The rates of runoff have been determined using the current ‘industry best practice’ guidelines as outlined in the Flood Estimation Guidelines (FEG) Version 10 (September 2025).
- 7.4.7 The site is Greenfield in nature, and the full site area is approximately 15 hectares. Following guidance set out in the FEG for catchments smaller than 0.5 km², flow estimates should be derived by applying FEH methods to the nearest suitable catchment above 0.5 km² and then scaling them down by the ratio of catchment areas.
- 7.4.8 An assessment of existing surface water runoff has been undertaken to determine the potential surface water options and attenuation requirements for the site, utilising the following parameters taken from the UK Centre for Ecology & Hydrology Flood Estimation Handbook Web Service:
- **NGR:** SU 00741 71991
 - **BFIHOST:** 0.314
 - **BFIHOST19:** 0.311
 - **BFIHOST19SCALED :** 0.311
 - **PROPWET:** 0.34
 - **SAAR6190:** 710
 - **SAAR9120:** 798
- 7.4.9 The calculated Greenfield run-off discharge rates, based on a discharge rate per hectare of impermeable area, are presented in **Table 7.1**. The corresponding runoff outputs created with the H R Wallingford Greenfield Runoff Rate estimation tool can be found within **Appendix E**.

Table 7.1: Pre-Development Runoff Rates/ Volumes per Hectare

Annual Probability	Greenfield/Pre-Development Runoff Rate per hectare (l/s/ha)	Greenfield/Pre-Development Volume 360-minute storm (m ³ /ha)
1 in 1 year event	5.2	94.9
1 in 2 year event (50% AEP)	6.2	108.6
QBAR	6.7	-
1 in 30-year event (3.3%) + 40% CC	13.1	249.2
1 in 100-year event (1% AEP) + 45% CC	16.3	336.9



- 7.4.10 In line with Wiltshire Council policy, the peak allowable discharge rate from the development shall be restricted to the QBar rate with a 30% improvement of 4.7 l/s/ha.
- 7.4.11 In line with the Flood Estimation Guidelines (FEG) and National Standard 3.29, the entire development that could potentially drain to the surface water drainage system shall be used for greenfield runoff rates and volumes.
- 7.4.12 Depending on the outcome of groundwater monitoring, it is expected that surface water will be managed through a combination of infiltration (where feasible) and restricted discharge to the adjacent watercourses. Therefore, only those Greenfield areas within the site that actually contribute to surface water runoff will be considered as valid developable areas for discharge calculations, rather than the entire red line boundary.
- 7.4.13 As shown in the catchment area plans included in **Appendix E**, the valid developable area including the basins that will contribute to the surface water discharge is 5.291 ha. At a rate of 4.7 l/s/ha, this gives a surface water discharge rate of 40.8 l/s from the entire site for all storm events up to and including the 1 in 100 year event with a 45% allowance for climate change.
- 7.4.14 Based on the Illustrative Masterplan, it has been conservatively estimated that the impermeable surfaces will be approximately 65% of the developable area. Depending upon how future Reserved Matters site layouts evolve, this percentage typically reduces slightly to around 50-55%.
- 7.4.15 The use of 65% therefore provides for a robust assessment which allows for fluctuations in residential density, and future urban creep of up to 10% on private curtilage areas, which typically results in approximately 5% of the total area, in accordance with The SuDS Manual (CIRIA 753).
- 7.4.16 Outfalls will need to be provided to the ditches and watercourses that surround the site to the north, east and west. Permission will need to be sought from the LLFA to construct this outfall.
- 7.4.17 The site lies within an area classified as seriously water-stressed. As such, the potential for water efficiency measures, including rainwater harvesting, should be considered as part of the overall drainage and water management strategy.
- 7.4.18 Rainwater harvesting provides limited benefit in relation to extreme rainfall and peak flow control, and its contribution to effective upstream storage during design storm events is inherently uncertain. Accordingly, while rainwater harvesting may contribute to wider water-efficiency objectives, its suitability and effectiveness should be assessed and refined at the detailed design stage, rather than relied upon for flood risk mitigation.

7.5 Standard 2 - Management of everyday rainfall (interception)

- 7.5.1 Interception of the first 5mm of rainfall, representing the majority of frequent rainfall events within the UK, is a key principle of Sustainable Drainage Systems (SuDS) design. Effective interception reduces the generation of surface runoff, limits the mobilisation of pollutants, and supports the maintenance of natural hydrological processes.
- 7.5.2 The drainage strategy has been developed to incorporate source control measures where proportionate and practicable, with particular consideration given to the interception of runoff at or close to its source.
- 7.5.3 The proposed development incorporates permeable paving across private driveways and access roads. Permeable paving is designed to allow rainfall to infiltrate through the surface into an engineered sub-base, where water is temporarily stored and managed prior to discharge. In accordance with current SuDS guidance, permeable paving is considered an interception feature, as it enables rainfall to be retained and treated at source for a significant proportion of rainfall events.
- 7.5.4 Surface water from private dwellings will be directed towards these permeable surfaces, providing an opportunity for interception of runoff prior to entering the wider drainage network.
- 7.5.5 The extent to which infiltration can be relied upon will be confirmed through site-specific infiltration testing and groundwater monitoring. Where ground conditions are suitable, the permeable paving systems may provide both interception and partial infiltration.



- 7.5.6 In areas where infiltration is constrained, permeable paving will operate as a lined or partially lined system, providing interception and attenuation with discharge to downstream SuDS components at a controlled rate.
- 7.5.7 As part of the wider strategy, other SuDS components including swales and attenuation basins are proposed. Whilst these features primarily provide conveyance, storage, and wider biodiversity and amenity benefits, they contribute indirectly to the overall management of runoff generated from larger events.
- 7.5.8 Should site investigation demonstrate that infiltration-led interception is not feasible across sufficient areas of the site, alternative source control measures such as rainwater harvesting may be incorporated at the property level. These systems would capture roof runoff for reuse in non-potable applications, thereby reducing runoff volumes and supporting interception principles.
- 7.5.9 At this outline stage, detailed design of interception storage volumes has not been finalised. However, the strategy demonstrates that appropriate measures can be incorporated to support the principles of Standard 2, with further optimisation to be undertaken at subsequent design stages.

Standard 3 - Management of extreme rainfall and flooding

- 7.5.10 The proposed drainage strategy has been developed to ensure robust management of extreme rainfall and flood risk in accordance with National Standard 3
- 7.5.11 In line with Wiltshire guidance, and as covered previously, , the peak allowable discharge rate from the development shall be restricted to the QBar rate with a 30% improvement (4.7 l/s/ha).
- 7.5.12 For the calculations, the following assumptions have been made:
- FEH-22 rainfall;
 - CV values of 1.00 for both summer and winter storms;
 - 0m³ of additional storage;
 - Time of entry 5 minutes;
 - Maximum Time of concentration 30 minutes; and
 - Maximum Rainfall of 550mm/hr.
- 7.5.13 In line with National SUDS Standard 3.29 the entire development that could potentially drain into the proposed surface water drainage system in an extreme event is to be used to estimate the drainage runoff of volumes.
- 7.5.14 In accordance with the above, post development runoff volume estimation has been calculated using both the anticipated hardstanding and the anticipated greenfield areas (including future gardens) that will enter the drainage system. The contribution to the drainage system from greenfield areas has been calculated by using Dynamic ReFH2 input hydrographs to mimic the natural flatter and longer hydrographic output as compared to hardstanding runoff.
- 7.5.15 Calculations conducted on the software Causeway Flow have been undertaken to show that excess volumes are managed on site without flooding buildings, with exceedance flows routed towards attenuation features.
- 7.5.16 To demonstrate compliance with National Standard 3, the total storage requirements for the development have been calculated using Causeway Flow and are summarised within **Appendix C**.
- 7.5.17 The total post-development storage requirement for the 1 in 100-year rainfall event, including a 45% allowance for climate change, is approximately 7,125 m³. This volume has been apportioned between upstream SuDS features and site-wide attenuation basins in accordance with the drainage strategy principles.



- 7.5.18 Approximately 1100 m³ (circa 15%) of the required storage is provided through upstream SuDS components, including permeable paving, swales and rain gardens, which provide both interception and attenuation storage. The remaining c.6025 m³ of storage is provided within the proposed attenuation basins.
- 7.5.19 The combined provision of upstream SuDS storage and downstream attenuation ensures that the total required storage volume is achieved. Further detail, including catchment-specific storage requirements and basin sizing, is provided within the drainage calculations contained in **Appendix E**.
- 7.5.20 Calculations showing how the upstream storage capacity may be achieved have been included in the appendix together with the relevant basin sizing calculations.
- 7.5.21 For the 1 in 100-year storm event, including a 45% allowance for climate change, exceedance flows may enter the site road network. The site levels will be designed to accommodate these flows, such that runoff from the majority of the site will be conveyed by gravity towards the final attenuation basin.
- 7.5.22 Surface water depths within the road network will be controlled to a maximum of 300mm, and exceedance routing will ensure that no flooding of buildings occurs. Flow pathways will follow the natural topography of the site, directing runoff away from built development and towards designated attenuation features. The area near the site entrance represents a local exception and will require further detailed design assessment to confirm suitable exceedance routing.
- 7.5.23 It is considered that the requirements for Standard 3 have been met.

Standard 4 – Water Quality

7.6 Water Quality Improvements

- 7.6.1 Standard 4 of the National SuDS Standards focuses on protecting and enhancing the quality of surface water leaving a development site. The primary aim is to ensure that runoff from new developments does not cause pollution or degrade the quality of receiving water bodies. This is achieved by integrating sustainable drainage features that provide effective treatment of surface water at source, along the flow path, and before final discharge. By managing water quality through a series of SuDS components—such as permeable paving, swales, and attenuation basins—the strategy removes or reduces pollutants, supports compliance with environmental regulations, and helps safeguard local rivers, streams, and groundwater resources for the long term.
- 7.6.2 CIRIA report C753 The SuDS Manual outlines the methodology for assessing water quality risks associated with new development. This is a simple index approach that provides a high-level scoping analysis of land use and guidelines for appropriate treatment stages.
- 7.6.3 This process identifies features necessary to provide adequate substance removal in line with Environment Agency requirements. This is a three-step process: Allocation, Mitigation, and Review.
- 7.6.4 Surfaces generating runoff are ‘graded’ on their potential to contribute to various harmful pollutants, and gives each surface a risk of pollution from each element. An extract of Table 26.2 within the SuDS Manual is set out overleaf.

Table 7.2: Extract from Table 26.2 of SuDS Manual

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



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

- 7.6.5 Historically, PPG 3 documentation would recommend that pollutants were removed utilising oil separators, but more recent guidance has shifted to the use of SuDS features to remove pollutants; thereby providing significant improvements in treatment.
- 7.6.6 The use of non-mechanical features decreases the requirements for maintenance and has benefits for biodiversity. That said, the SuDS Manual does not remove the possibility of utilising separators, so long as they are considered in partnership with a comprehensive overall SuDS regime.
- 7.6.7 Without adequate treatment, the pollutants would cause damage if they were to enter the watercourse or water table in large volumes. The use of SuDS features to slow down and degrade these pollutants is critical to the provision of an acceptable discharge.
- 7.6.8 The respective cleansing abilities of common SuDS features are given by corresponding mitigation indices within the SuDS Manual. An extract of Table 26.3 is set out below.

Table 7.3: Extract from Table 26.3 SuDS Manual

Type of SuDS Component	Total Suspended Solids	Metals	Hydrocarbons
Filter Strip	0.4	0.4	0.5
Filter Drain	0.4	0.4	0.4
Swale	0.5	0.6	0.6
Bioretention System	0.8	0.8	0.8
Permeable Paving	0.7	0.6	0.7
Detention Basin	0.5	0.5	0.6
Pond	0.7	0.7	0.5
Wetland	0.8	0.8	0.8

- 7.6.9 The individual pollution indices are totalled, with the first SuDS component utilising its full value and subsequent downstream SuDS features acting with 50% efficiency. This provides a realistic strategy which mimics the reduced cleansing effectiveness as the concentration of a pollutant decreases along the SuDS train.
- 7.6.10 The drainage proposals included in the appendix show that residential units will be served by permeable paving providing treatment at source for driveways and parking areas.
- 7.6.11 It is considered that the most trafficked roads at the entrance of the site will be utilised more than 300 times a day and such can be classed as medium pollution hazard level.
- 7.6.12 Outline plans show that for these areas a swale is utilised to provide the first treatment, with basins with permanently wetted features providing secondary and tertiary stages of treatment.
- 7.6.13 In line with the Environment Guidance, before the design phase is concluded, the proposals will be reviewed and analysed in order to identify potential shortcomings and to ensure that an adequate volume of SuDS features is provided to mitigate the risk of pollution from each source.
- 7.6.14 It is considered that the requirements for Standard 4 have been met.

Standards 5 & 6 – Amenity & Biodiversity

- 7.6.15 The proposed SuDS strategy has been developed to ensure that drainage features contribute positively to the amenity and biodiversity of the site, in accordance with the principles of the SuDS Manual (CIRIA C753).
- 7.6.16 The attenuation basins have been designed as multi-functional landscape features, forming an integral part of the wider green infrastructure network rather than isolated engineered elements.



- 7.6.17 Basin profiles have been developed with variable side slopes (up to a maximum gradient of 1 in 3), split-level arrangements, and integrated terracing. These features allow the basins to respond to a range of storm events whilst also creating a more naturalistic landform and providing opportunities for informal seating and amenity use.
- 7.6.18 The basins incorporate areas of permanent and seasonally wet conditions through the use of level variation and shallow aquatic shelves. These features will support wetland planting and habitat creation, contributing to biodiversity enhancement and water quality improvement.
- 7.6.19 The use of varied gradients, planting zones, and stepped profiles will reduce the visual appearance of engineered infrastructure and provide a more diverse landscape character, improving the usability and integration of SuDS features within the development.
- 7.6.20 Upstream SuDS components, including swales and rain gardens, will further contribute to amenity and biodiversity by providing distributed green corridors, enhancing visual interest, and supporting ecological connectivity across the site.
- 7.6.21 Open SuDS features will be designed with appropriate consideration of safety, including shallow side slopes, clear delineation through planting, and suitable freeboard above design water levels, ensuring that features remain safe for residents whilst maintaining an open and accessible character.
- 7.6.22 Detailed planting strategies, including species selection and habitat creation measures, will be developed at the detailed design stage. These will be informed by ecological input and will seek to maximise biodiversity value in accordance with best practice.
- 7.6.23 Overall, the SuDS strategy demonstrates that the proposed drainage features can deliver multiple benefits, including flood risk management, water quality improvement, amenity provision, and biodiversity enhancement, with further refinement to be undertaken at subsequent design stages.

Standard 7 – design of drainage for construction, operation, maintenance, decommissioning and structural integrity

- 7.6.24 For the water treatment effects of SuDS features to remain effective, a comprehensive maintenance strategy should be implemented.
- 7.6.25 During construction, maintenance of SuDS features should be undertaken by the contractor. Upon completion, the assets should be transferred to the management company, the statutory authority, or the community group commissioned to maintain the features in perpetuity.
- 7.6.26 As part of the strategy, a regular maintenance regime will be created, which consists of several primary measures required to ensure the longevity of the system. These should be undertaken regularly to ensure consistent performance. Typical maintenance activities consist of:
 - Inspecting and reporting; relatively regular review of the condition, identifying issues and providing resolutions, or periodic review from the maintenance contractor.
 - Litter and debris removal;
 - Grass trimming, overall cutting and localised strimming preventing blockages;
 - Weed and evasive plant control;
 - Shrub management;
 - Aquatic and shoreline vegetation management;
 - Sweeping pervious surfaces; and
 - Oil removal from proprietary systems.
- 7.6.27 A remedial maintenance schedule would be recommended as part of the handover of the SuDS features. Remedial maintenance is required to provide repairs to the system and monitor long-term damage, ensuring the system remains consistently productive. The schedule could consist of;



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

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

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

7.7 Adoption and Ownership

7.7.1 The drainage system is designed to the appropriate standards, the Building Regulations and the requirements of the National Planning Policy Framework.

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

- Surface water sewers within development parcels to be offered for adoption by either Wessex Water or a NAV, in the first instance and failing that, to a private maintenance company, funded by residential properties or subject to agreement with the Local Authority.
- Above-ground attenuation (i.e. swales and basins) to be maintained by a private maintenance company funded by residential properties or subject to agreement with the Local Authority.
- SuDS features serving single properties, for example, permeable paved driveways to single dwellings, will be owned and maintained by the owner of that property.

7.7.3 A separate adoption and maintenance regime for SuDS will be submitted in support of the Reserved Matters application.



8.0 Foul Water Drainage

8.1 Introduction

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

8.2 Overall Strategy

- 8.2.1 Due to the topography of the site and location of the existing foul sewer point of connection, wastewater from the site will require pumping to the receiving public sewer.
- 8.2.2 There are currently no public sewers located within the adjacent roads bordering the site, therefore construction of the infrastructure necessary to service the site will be required.
- 8.2.3 Discussions are currently ongoing with Wessex Water as to the best possible location for the final connection for the foul water coming from the site depending on capacity of the sewage treatment works and incoming pipework.
- 8.2.4 Discussions are ongoing with Wessex Water regarding the exact location(s) and specifications of possible pump stations that will be required to provide sufficient capacity to service the development.
- 8.2.5 Notwithstanding this, the delivery of the proposed onsite foul water sewers will be designed in collaboration with Wessex Water as approving body in accordance with the new Sewerage Sector Guidance (SSG) and will be offered to Wessex Water for adoption under S104 Agreement of the Water Industry Act. The connection to the existing public sewer system will be made via a S106 Agreement of the Water Industry Act with Wessex Water as part of the overall adoption process.
- 8.2.6 Refer to drawing A325-001 Drainage Strategy Layout in **Appendix C** to see indicative location for the pumping station and indicative route of the rising mains, prior connection to the Wessex Water network. The closest available Wessex Water public foul manhole chamber is located in Sand Pitt Road.

8.3 Adoption and Ownership

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



9.0 Conclusion

9.1 Flood Risk

- 9.1.1 The EA Flood Risk mapping has been reviewed alongside the Wiltshire Council (WC) Preliminary Flood Risk Assessment (PFRA) and WC Level 1 and Level 2 Strategic Flood Risk Assessment (SFRA).
- 9.1.2 This Flood Risk Assessment (FRA) concludes that:
- The entire site is located within Flood Zone 1 'Low Probability' (land at less than 1 in 1,000 (0.1%) annual probability of river or sea flooding').
 - The site is at low risk of tidal flooding due to its inland location.
 - The majority of the site is located in an area with a 'Very Low' (land lower than 1 in 1000 (0.1%) annual probability) risk of flooding from surface water.
 - The WC Level 1 SFRA data explorer shows that the majority of the site has a low risk of groundwater flooding.
 - The site is not at risk of flooding in the event of a reservoir breach.
 - In summary, the site is at a low risk of flooding from all sources.

9.2 Sequential Test and Exception Test

- 9.2.1 The site is located within Flood Zone 1.
- 9.2.2 The Sequential Test and by extension the Exception Test are deemed unnecessary.

9.3 Mitigation Strategy

- 9.3.1 Where the site is located away from the edge of the extent of the fluvial design flood, ground floor levels should be set a minimum of 150mm above the surrounding ground level to mitigate the residual flood risk from surface water runoff events. Surrounding ground levels should also be appropriately contoured to direct surface water away from houses.
- 9.3.2 The proposed surface water drainage strategy will manage the flood risk posed by uncontrolled surface water runoff from the site. Any increase in surface water run-off can be managed using SuDS source control techniques as well as attenuation features to provide storage in extreme storm events. This provides the required treatment stages in accordance with the recommendations of CIRIA C753. All surface water drainage systems will be designed to restrict drainage discharge rates to QBAR runoff rates with a 30% improvement and store the balance of water for all events up to and including the 1 in 100-year event including an allowance for a 45% increase in rainfall intensities as a result of climate change and urban creep.

9.4 Summary

- 9.4.1 This FRA demonstrates that the proposed development complies with national and local planning policy with respect to flood risk and drainage. The risk of flooding is adequately managed, and, with the implementation of a suitable surface water drainage strategy, the offsite flood risk is not increased.



Appendices



Appendix A – Plans and Background Information

Masterplan

Wessex Water Asset Record

Topographical Survey



 Site Boundary	 Employment	 Proposed Allotments	 Enhanced Tree Belt with Woodland Edge Planting	 Picnic & Seating Areas	 Swales or Rain Gardens
 Existing / Retained Public Right of Way	 Green Infrastructure and Public Open Space (POS)	 Proposed Swales	 Local Equipped Area of Play (LEAP)	 Woodland Copse Planting	 Proposed Pumping Station
 Rerouted Public Right of Way	 Indicative Pedestrian Routes within POS	 Proposed Access	 Wildflower Meadows	 Proposed Attenuation Basin	 Trim Trail Play Features
 Indicative location of pedestrian or ped/cycle access to neighbouring scheme	 Existing Trees and Hedgerows	 Employment Access	 Established Hedgerow Linked to Green Network	 Wet Pond & Wetland Habitat	
 Residential Development	 Proposed Tree Planting	 Retained Farmhouse Access	 Community Orchard	 Street Trees	

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CLIENT Castlewood Properties Ventures Ltd

PROJECT Land at Penn Farm, Calne

DRAWING: Framework Masterplan

PROJECT NO. CASS3002

DRAWING NO. 3001

REVISION T

STATUS Draft

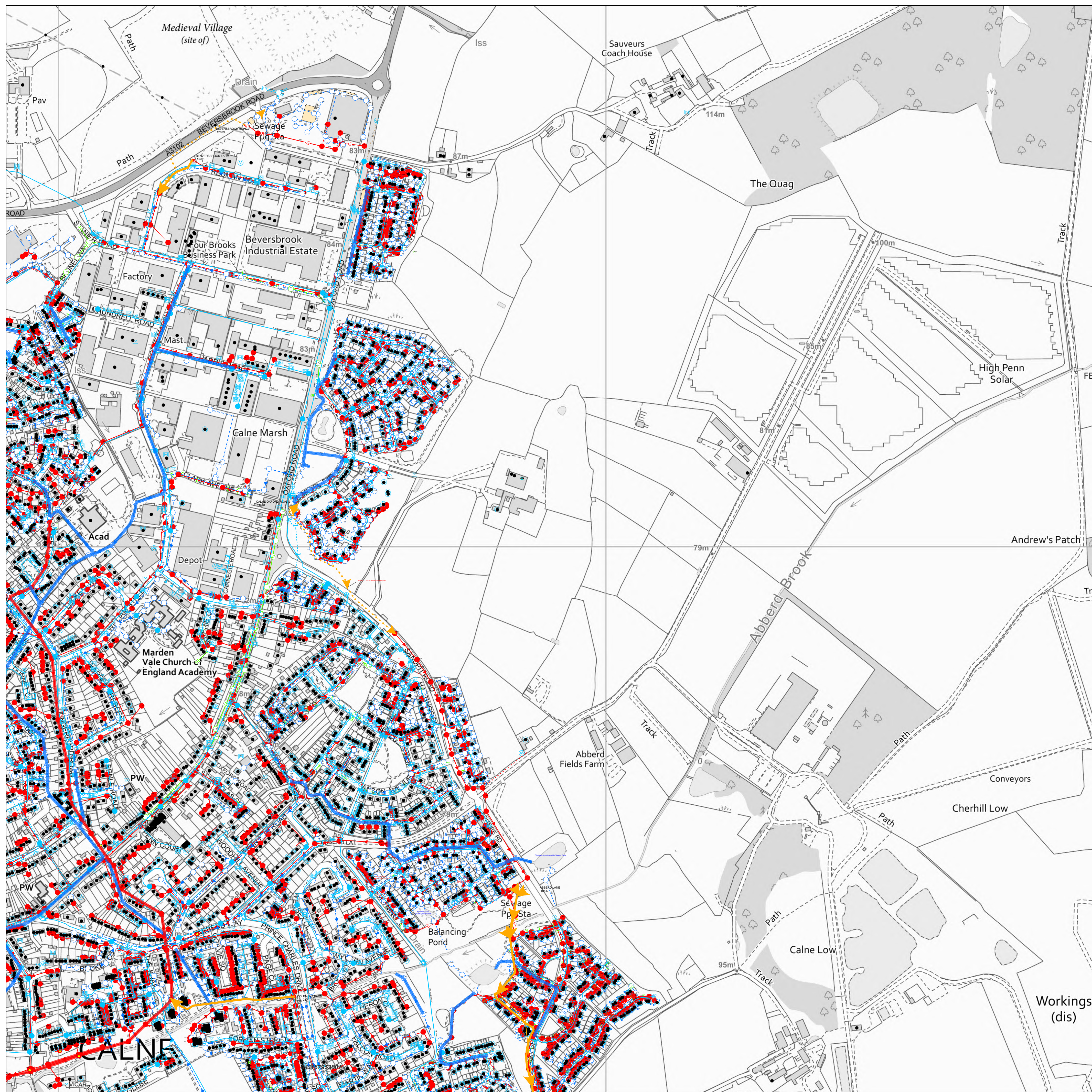
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DATE May 2026

CHECKED BY CD/DH

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Wessex Water Web Map



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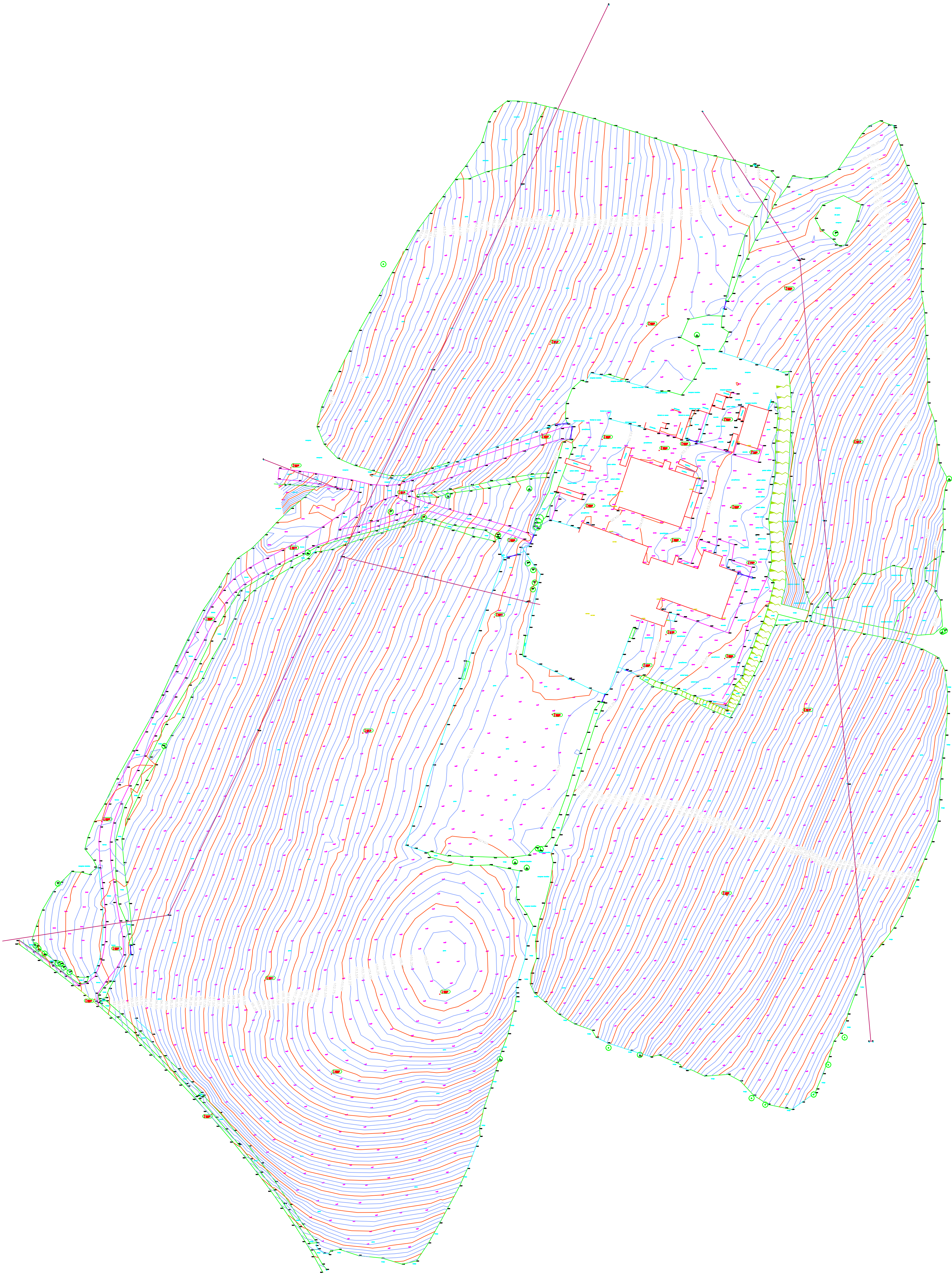
WATER MAINS		SEWERS	PUBLIC	PRIVATE	SECTION 104	OTHER WESSEX PIPES	NON-WESSEX / UNKNOWN
	Distribution Main						
	Washout Main						
	Raw Water Main						
	Abandoned Main						
	Private Main						
		Colours generally indicate the use of the sewer/drain (i.e Red - Foul, Dark Blue - Surface, Magenta - Combined/Dual Use, Light Green - Highway Drain, Mid Green - Overflow) styles of line are shown on the key in sample/typical colours.					
SITES		STRUCTURES		OTHER STRUCTURES			
	Source		Manhole - Foul		Pumping Station - Surface		Chamber
	Reservoir		Manhole - Surface		Pumping Stn - Foul/Combined		Tunnel
	Pump		Manhole - Combined		Gully		Interceptor
	Treatment Works		Outfall		Vent Column		
			Inlet		Rodding Eye		
			Lamphole		Catchpit		
			Bifurcation - Foul		Flushing Chamber		
			Bifurcation - Surface		Soakaway		
			Bifurcation - Combined		Non Return Valve		
			Combined Sewage Overflow		Washout		
					Air Valve		Hatch Box

Information in this plan is provided for identification purposes only. No warranty as to accuracy is given or implied. The precise route of pipe work may not exactly match that shown. Wessex Water does not accept liability for inaccuracies. Sewers and lateral drains adopted by Wessex Water under the Water Industry (Schemes for Adoption of Private Sewers) Regulations 2011 are to be plotted over time and may not yet be shown. In carrying out any works, you accept liability for the cost of any repairs to Wessex Water apparatus damaged as a result of your works. You are advised to commence excavations using hand tools only. Mechanical digging equipment should not be used until pipe work has been precisely located. If you are considering any form of building works and pipe work is shown within the boundary of your property or a property to be purchased (or very close by) a surveyor should plot its exact position prior to commencing works or purchase. Building over or near Wessex Water's apparatus is not normally permitted.

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Job No.

P4549JJ2629

Rev.

Legend

AM apex height

BS benchmark

CB control box

CL cover level

D drain

EDC electric TC

EP electricity pole

ER earth rise

EH eave height

FB foot bridge

FM fire hydrant

F1 flood light

G gully

GP gate post

GV gas valve

IC inspection cover

IL level

KO kerb outlet

L1 light post

LP lamp post

NI northline

OSM benchmark

P post

RB pillar box

RE reading eye

RH roof height

RP reflector post

SS road sign

SAP sapling

SC security covers

SK sky light

SL soft level

SP sign post

SV stop valve

TC telephone TC

TP telegraph pole

TM street machine

VM water meter

UTL utility to lift

VP vent pipe

Notes.

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Key dimensions to be checked by engineer before major structural works commence on site.

1. This survey has been computed and drawn about O. S. National Grid.

2. All levels are in metres and relate to O. S. National Datum by GPS instruments.

3. This survey was measured for a scale of 1:200, any subsequent enlargements should be verified on site.

Amendments

Rev	Date	By	Chkd

JOMAS ENGINEERING ENVIRONMENTAL

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Unit 24 Sarum Complex
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Upton
W88 2RZ
Tel. 0843 2892167

Client

Castletwood Commercial Properties Ltd

Project

Penn Hill Farm

Drawing

Topographic Survey
3D

Dwg no

Figure 1

Date

Job No.

Checked

BH

24-08-22

P4549JJ2629

Surveyor

JH

Scale 1:1000 @ A1

Rev 01

Grid

Contours

Level Datum



Appendix B – Wiltshire Council SFRA Extracts

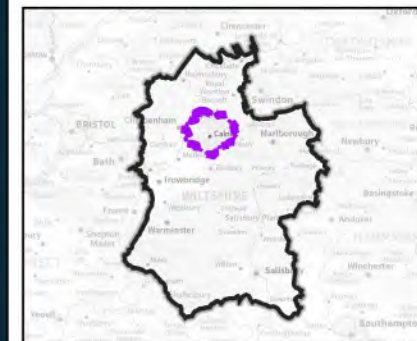
Groundwater Emergence Mapping



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consulting

Wiltshire Council



Groundwater Emergence: Calne

Legend

-  Wiltshire boundary
-  Community Partnership Area

Groundwater Emergence

-  This zone is deemed as having a negligible risk from groundwater flooding due to the nature of the local geological deposits.
-  Flooding from groundwater is not likely.
-  There is a risk of flooding to subsurface assets but surface manifestation of groundwater is unlikely.
-  Within this zone there is a risk of groundwater flooding to surface and subsurface assets. There is the possibility of groundwater emerging at the surface locally.
-  Within this zone there is a risk of groundwater flooding to both surface and subsurface assets. Groundwater may emerge at significant rates and has the capacity to flow overland and/or pond within any topographic low spots.

0 1 2 km



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Appendix C – Drainage Strategy

Greenfield Runoff Rates

Discharge Volumes

Proposed Drainage Modelling Calculations

Proposed Drainage Strategy Layout

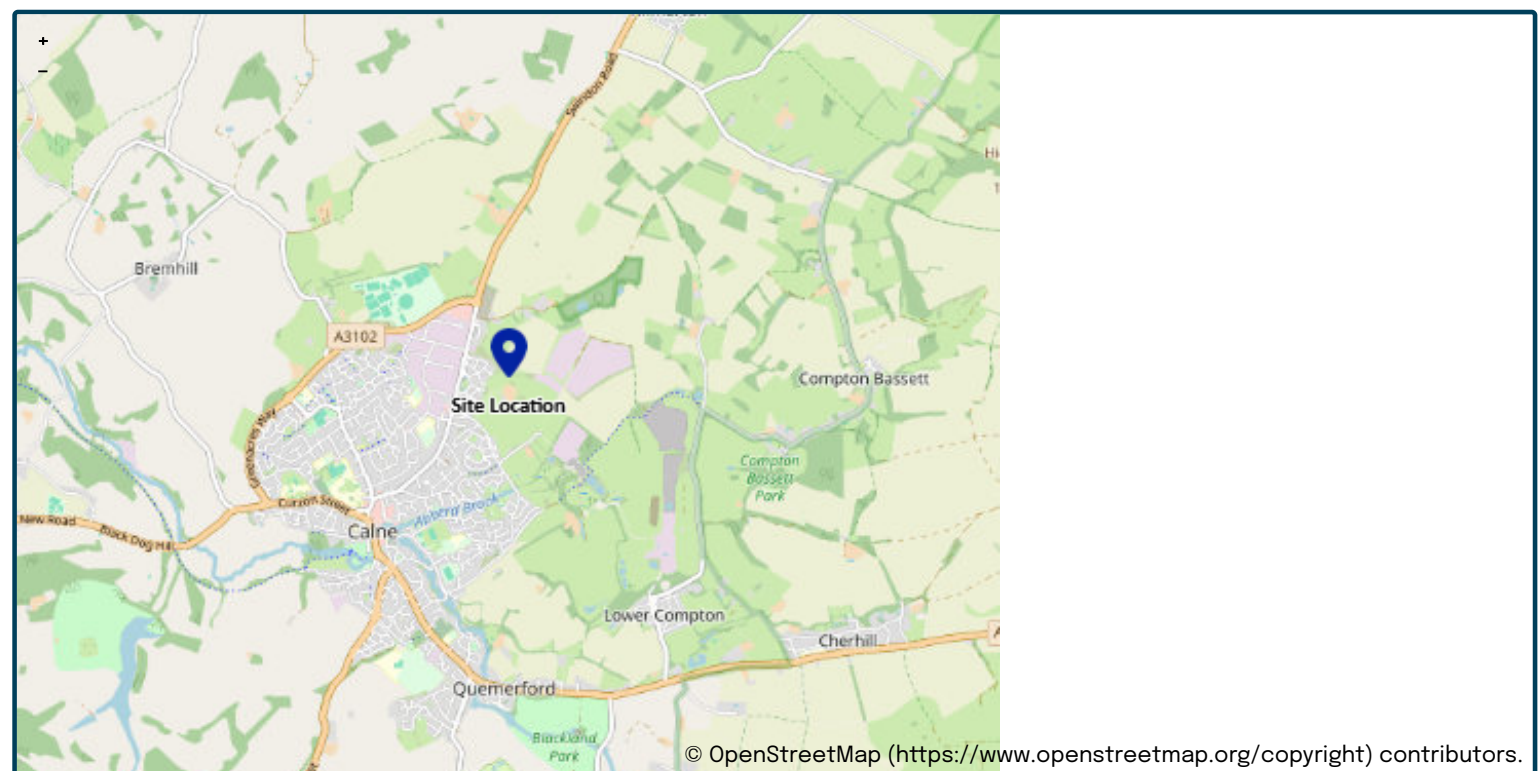
This is an estimation of the greenfield runoff rates that are used to meet normal best practice criteria in line with Environment Agency guidance “Rainfall runoff management for developments”, SC030219 (2013), the SuDS Manual C753 (CIRIA, 2015) and the non-statutory standards for SuDS (Defra, 2015).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

Project details

Date	12/05/2026
Calculated by	Jonathan Shuttleworth
Reference	A325
Model version	2.2.3

Location

Site name	Penn Farm
Site location	Calne



Site easting (British National Grid)	400837
Site northing (British National Grid)	172059

Site details

Total site area (ha)	1	ha
----------------------	---	----

Greenfield runoff

Method

Method	FEH statistical (2025)
--------	-----------------------------------

FEH statistical (2025)

	<u>My value</u>	<u>Map value</u>
SAAR9120 (mm)	798	mm
BFIHOST19scaled	0.311	
QMed-QBar conversion	1.075	1.075
QMed (l/s)	6.2	l/s
QBar (FEH statistical 2025) (l/s)	6.7	l/s

Growth curve factors

	<u>My value</u>	<u>Map value</u>
Hydrological region	8	8
1 year growth factor	0.78	
2 year growth factor	0.93	
10 year growth factor	1.49	
30 year growth factor	1.95	
100 year growth factor	2.43	
200 year growth factor	2.78	

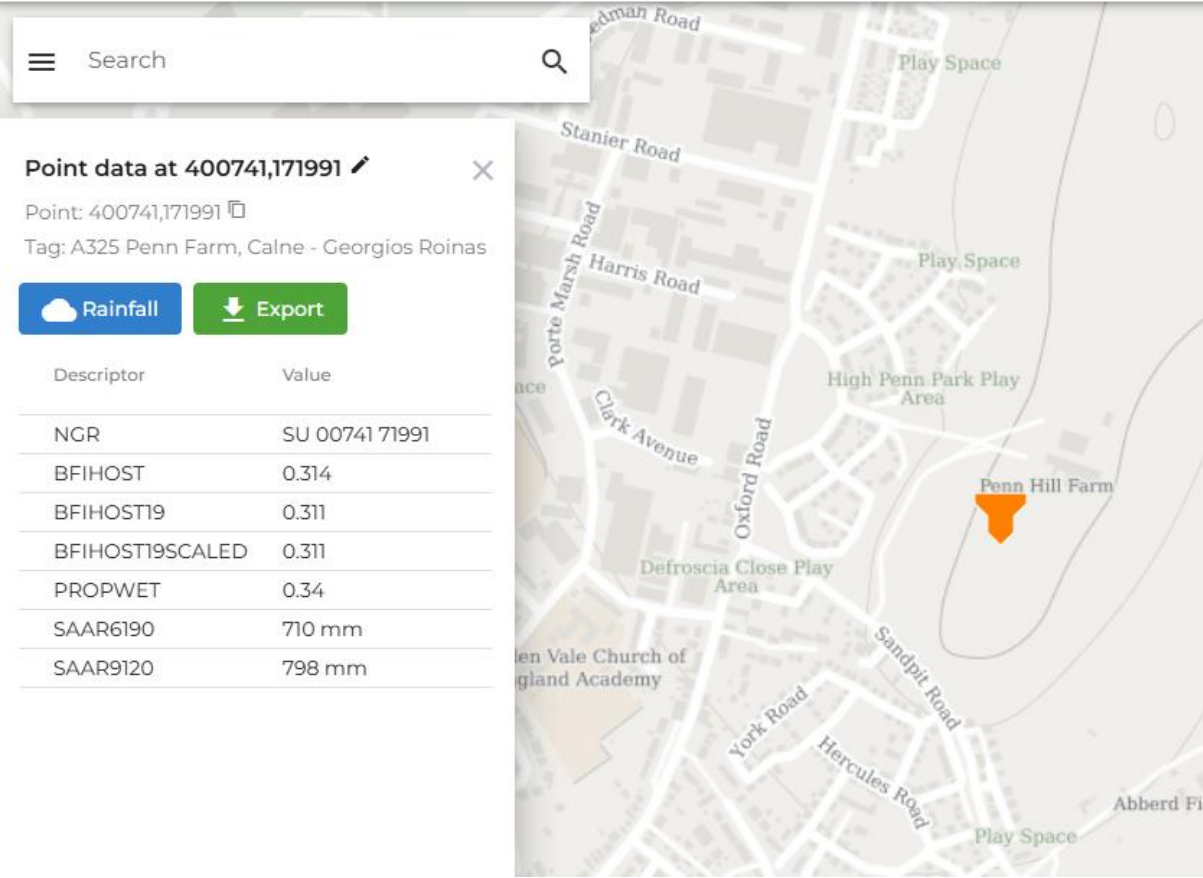
Results

Method	FEH statistical (2025)	
Flow rate 1 year (l/s)	5.2	l/s
Flow rate 2 year (l/s)	6.2	l/s
Flow rate 10 years (l/s)	10.0	l/s
Flow rate 30 years (l/s)	13.1	l/s
Flow rate 100 years (l/s)	16.3	l/s
Flow rate 200 years (l/s)	18.7	l/s

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

Disclaimer

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



Design Settings

Rainfall Methodology	FEH-22	Maximum Time of Concentration (mins)	30.00	Preferred Cover Depth (m)	1.200
Return Period (years)	1	Maximum Rainfall (mm/hr)	50.0	Include Intermediate Ground	✓
Additional Flow (%)	0	Minimum Velocity (m/s)	1.00	Enforce best practice design rules	✓
CV	1.000	Connection Type	Level Soffits		
Time of Entry (mins)	5.00	Minimum Backdrop Height (m)	9.999		

Nodes

Name	Area (ha)	T of E (mins)	Cover Level (m)	Easting (m)	Northing (m)	Depth (m)	Invert Level (m)
Basin A	0.911		100.000	11.347	85.085	1.000	99.000
Basin B	2.252		100.000	11.981	71.951	1.000	99.000
Basin C	1.995		100.000	12.170	55.814	1.000	99.000
Greenfield in		5.00	100.000	10.836	99.267	1.500	98.500
Greenfield out			100.000	23.378	98.451	1.712	98.288

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	Greenfield in	Greenfield out	12.569	0.600	98.500	98.288	0.212	59.3	300	5.10	33.3

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	2.045	144.6	0.0	1.200	1.412	0.000	0.0	0	0.000

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	12.569	59.3	300	PH1	100.000	98.500	1.200	100.000	98.288	1.412

Link	US Node	Node Type	DS Node	Node Type
1.000	Greenfield in	Junction	Greenfield out	Junction

Manhole Schedule

Node	Easting (m)	Northing (m)	CL (m)	Depth (m)	Connections	Link	IL (m)	Dia (mm)	
Basin A	11.347	85.085	100.000	1.000					
Basin B	11.981	71.951	100.000	1.000					
Basin C	12.170	55.814	100.000	1.000					
Greenfield in	10.836	99.267	100.000	1.500					
					0	1.000	98.500	300	
Greenfield out	23.378	98.451	100.000	1.712		1	1.000	98.288	300

Simulation Settings

Rainfall Methodology	FEH-22	Winter CV	1.000	Drain Down Time (mins)	10080	Check Discharge Rate(s)	x
Rainfall Events	Singular	Analysis Speed	Normal	Additional Storage (m ³ /ha)	0.0	Check Discharge Volume	x
Summer CV	1.000	Skip Steady State	✓	Starting Level (m)			

Storm Durations

360

Return Period (years)	Climate Change (CC %)	Additional Area (A %)	Additional Flow (Q %)	Return Period (years)	Climate Change (CC %)	Additional Area (A %)	Additional Flow (Q %)
1	0	0	0	30	40	0	0
2	0	0	0	100	0	0	0
30	0	0	0	100	45	0	0

Node Basin A ReFH2 Dynamic Hydrograph

Overrides Design Area	x	Depression Storage Depth (mm)	0	Region	England, Wales, NI
Overrides Design Additional Inflow	x	Evapo-transpiration (mm/day)	0	Include Baseflow	x
Depression Storage Area (m ²)	0	Area (ha)	0.920		

Applies to All storms

Node Basin B ReFH2 Dynamic Hydrograph

Overrides Design Area	x	Depression Storage Depth (mm)	0	Region	England, Wales, NI
Overrides Design Additional Inflow	x	Evapo-transpiration (mm/day)	0	Include Baseflow	x
Depression Storage Area (m ²)	0	Area (ha)	1.260		

Applies to All storms

Node Basin C ReFH2 Dynamic Hydrograph

Overrides Design Area	x	Depression Storage Depth (mm)	0	Region	England, Wales, NI
Overrides Design Additional Inflow	x	Evapo-transpiration (mm/day)	0	Include Baseflow	x
Depression Storage Area (m ²)	0	Area (ha)	4.310		

Applies to All storms

Node Greenfield in ReFH2 Dynamic Hydrograph

Overrides Design Area	x	Depression Storage Depth (mm)	0	Region	England, Wales, NI
Overrides Design Additional Inflow	x	Evapo-transpiration (mm/day)	0	Include Baseflow	x
Depression Storage Area (m ²)	0	Area (ha)	1.000		

Applies to All storms

Node Basin A Offline Hydro-Brake® Control

Flap Valve	x	Design Flow (l/s)	9.1	Min Outlet Diameter (m)	0.225
Loop to Node		Objective	(HE) Minimise upstream storage	Min Node Diameter (mm)	1200
Invert Level (m)	99.000	Sump Available	✓		
Design Depth (m)	1.000	Product Number	CTL-SHE-0140-9100-1000-9100		

Node Basin B Offline Hydro-Brake® Control

Flap Valve	x	Design Flow (l/s)	17.4	Min Outlet Diameter (m)	0.225
Loop to Node		Objective	(HE) Minimise upstream storage	Min Node Diameter (mm)	1500
Invert Level (m)	99.000	Sump Available	✓		
Design Depth (m)	1.000	Product Number	CTL-SHE-0187-1740-1000-1740		

Node Basin C Offline Hydro-Brake® Control

Flap Valve	x	Design Flow (l/s)	31.3	Min Outlet Diameter (m)	0.300
Loop to Node		Objective	(HE) Minimise upstream storage	Min Node Diameter (mm)	1800
Invert Level (m)	99.000	Sump Available	✓		
Design Depth (m)	1.000	Product Number	CTL-SHE-0241-3130-1000-3130		

Node Basin A Depth/Area Storage Structure

Base Inf Coefficient (m/hr)	0.00000	Safety Factor	2.0	Invert Level (m)	99.000
Side Inf Coefficient (m/hr)	0.00000	Porosity	1.00	Time to half empty (mins)	1384

Depth (m)	Area (m ²)	Inf Area (m ²)	Depth (m)	Area (m ²)	Inf Area (m ²)
0.000	1400.0	1400.0	1.000	1400.0	1532.6

Node Basin B Depth/Area Storage Structure

Base Inf Coefficient (m/hr)	0.00000	Safety Factor	2.0	Invert Level (m)	99.000
Side Inf Coefficient (m/hr)	0.00000	Porosity	1.00	Time to half empty (mins)	1512

Depth (m)	Area (m ²)	Inf Area (m ²)	Depth (m)	Area (m ²)	Inf Area (m ²)
0.000	2930.0	2930.0	1.000	2930.0	3121.9

Node Basin C Depth/Area Storage Structure

Base Inf Coefficient (m/hr)	0.00000	Safety Factor	2.0	Invert Level (m)	99.000
Side Inf Coefficient (m/hr)	0.00000	Porosity	1.00	Time to half empty (mins)	1200

Depth (m)	Area (m ²)	Inf Area (m ²)	Depth (m)	Area (m ²)	Inf Area (m ²)
0.000	4365.0	4365.0	1.000	4365.0	4599.2

Results for 1 year Critical Storm Duration. Lowest mass balance: 100.00%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
360 minute summer	Basin A	344	99.128	0.128	34.2	178.6984	0.0000	OK
360 minute summer	Basin B	360	99.142	0.142	80.7	414.8383	0.0000	OK
360 minute summer	Basin C	368	99.142	0.142	84.0	620.5107	0.0000	OK
360 minute summer	Greenfield in	248	98.550	0.050	8.9	0.0000	0.0000	OK
360 minute summer	Greenfield out	248	98.338	0.050	8.9	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)
360 minute summer	Basin A	Hydro-Brake®		7.0				255.3
360 minute summer	Basin B	Hydro-Brake®		11.4				525.5
360 minute summer	Basin C	Hydro-Brake®		14.6				749.1
360 minute summer	Greenfield in	1.000	Greenfield out	8.9	1.152	0.062	0.0971	94.9

Results for 2 year Critical Storm Duration. Lowest mass balance: 100.00%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
360 minute summer	Basin A	344	99.157	0.157	43.7	220.4954	0.0000	OK
360 minute summer	Basin B	352	99.175	0.175	103.7	513.0439	0.0000	OK
360 minute summer	Basin C	368	99.169	0.169	106.0	737.4661	0.0000	OK
360 minute summer	Greenfield in	256	98.553	0.053	10.1	0.0000	0.0000	OK
360 minute summer	Greenfield out	256	98.341	0.053	10.1	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)
360 minute summer	Basin A	Hydro-Brake®		8.4				317.8
360 minute summer	Basin B	Hydro-Brake®		14.9				666.1
360 minute summer	Basin C	Hydro-Brake®		19.2				916.7
360 minute summer	Greenfield in	1.000	Greenfield out	10.1	1.196	0.070	0.1062	108.6

Results for 30 year Critical Storm Duration. Lowest mass balance: 100.00%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
360 minute summer	Basin A	368	99.384	0.384	90.9	537.5838	0.0000	OK
360 minute summer	Basin B	368	99.402	0.402	214.8	1176.5060	0.0000	OK
360 minute summer	Basin C	384	99.367	0.367	221.1	1601.1600	0.0000	OK
360 minute summer	Greenfield in	256	98.580	0.080	23.1	0.0000	0.0000	OK
360 minute summer	Greenfield out	256	98.368	0.080	23.1	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)
360 minute summer	Basin A	Hydro-Brake®		9.1				681.7
360 minute summer	Basin B	Hydro-Brake®		17.4				1423.3
360 minute summer	Basin C	Hydro-Brake®		31.2				2029.1
360 minute summer	Greenfield in	1.000	Greenfield out	23.1	1.523	0.160	0.1906	249.2

Results for 30 year +40% CC Critical Storm Duration. Lowest mass balance: 100.00%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
360 minute summer	Basin A	400	99.584	0.584	127.6	818.0398	0.0000	OK
360 minute summer	Basin B	376	99.598	0.598	301.3	1752.2060	0.0000	OK
360 minute summer	Basin C	408	99.566	0.566	311.7	2469.8680	0.0000	OK
360 minute summer	Greenfield in	248	98.599	0.099	34.8	0.0000	0.0000	OK
360 minute summer	Greenfield out	256	98.387	0.099	34.8	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)
360 minute summer	Basin A	Hydro-Brake®		9.1				978.8
360 minute summer	Basin B	Hydro-Brake®		17.4				2029.4
360 minute summer	Basin C	Hydro-Brake®		31.2				2968.1
360 minute summer	Greenfield in	1.000	Greenfield out	34.8	1.710	0.241	0.2558	375.7

Results for 100 year Critical Storm Duration. Lowest mass balance: 100.00%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
360 minute summer	Basin A	392	99.523	0.523	116.8	732.5463	0.0000	OK
360 minute summer	Basin B	368	99.539	0.539	275.8	1580.0280	0.0000	OK
360 minute summer	Basin C	408	99.505	0.505	285.0	2202.6480	0.0000	OK
360 minute summer	Greenfield in	256	98.594	0.094	31.2	0.0000	0.0000	OK
360 minute summer	Greenfield out	256	98.382	0.094	31.2	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)
360 minute summer	Basin A	Hydro-Brake®		9.1				890.0
360 minute summer	Basin B	Hydro-Brake®		17.4				1849.3
360 minute summer	Basin C	Hydro-Brake®		31.2				2685.7
360 minute summer	Greenfield in	1.000	Greenfield out	31.2	1.659	0.216	0.2364	336.9

Results for 100 year +45% CC Critical Storm Duration. Lowest mass balance: 100.00%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
360 minute summer	Basin A	424	99.833	0.833	170.2	1166.5270	0.0000	OK
360 minute summer	Basin B	400	99.837	0.837	401.2	2452.1350	0.0000	OK
360 minute summer	Basin C	432	99.824	0.824	417.3	3597.3500	0.0000	OK
360 minute summer	Greenfield in	256	98.621	0.121	50.1	0.0000	0.0000	OK
360 minute summer	Greenfield out	256	98.409	0.121	50.1	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)
360 minute summer	Basin A	Hydro-Brake®		9.1				1337.5
360 minute summer	Basin B	Hydro-Brake®		17.4				2748.9
360 minute summer	Basin C	Hydro-Brake®		31.2				4125.9
360 minute summer	Greenfield in	1.000	Greenfield out	50.1	1.891	0.347	0.3330	539.5

Design Settings

Rainfall Methodology	FEH-22	Maximum Time of Concentration (mins)	30.00	Preferred Cover Depth (m)	1.200
Return Period (years)	1	Maximum Rainfall (mm/hr)	50.0	Include Intermediate Ground	✓
Additional Flow (%)	0	Minimum Velocity (m/s)	1.00	Enforce best practice design rules	✓
CV	1.000	Connection Type	Level Soffits		
Time of Entry (mins)	5.00	Minimum Backdrop Height (m)	9.999		

Nodes

Name	Area (ha)	Cover Level (m)	Easting (m)	Northing (m)	Depth (m)	Invert Level (m)
Basin A	0.911	100.000	11.347	85.085	1.000	99.000
Basin B	2.252	100.000	11.981	71.951	1.000	99.000
Basin C	1.995	100.000	12.170	55.814	1.000	99.000

Simulation Settings

Rainfall Methodology	FEH-22	Analysis Speed	Normal	Starting Level (m)		30 year (l/s)	18.1
Rainfall Events	Singular	Skip Steady State	✓	Check Discharge Rate(s)	✓	100 year (l/s)	23.8
Summer CV	1.000	Drain Down Time (mins)	240	1 year (l/s)	6.0	Check Discharge Volume	✓
Winter CV	1.000	Additional Storage (m³/ha)	0.0	2 year (l/s)	7.1	100 year 360 minute (m³)	450

Storm Durations

15 | 30 | 60 | 120 | 180 | 240 | 360 | 480 | 600 | 720 | 960 | 1440 | 2160 | 2880 | 4320 | 5760

Return Period (years)	Climate Change (CC %)	Additional Area (A %)	Additional Flow (Q %)	Return Period (years)	Climate Change (CC %)	Additional Area (A %)	Additional Flow (Q %)
1	0	0	0	30	40	0	0
2	0	0	0	100	0	0	0
30	0	0	0	100	45	0	0

Pre-development Discharge Rate

Site Makeup	Greenfield	Positively Drained Area (ha)	1.000	Q 30 year (l/s)	18.1
Greenfield Method	ReFH2	Betterment (%)	0	Q 100 year (l/s)	23.8
Region	England, Wales, NI	Q 1 year (l/s)	6.0		
Include Baseflow	x	Q 2 year (l/s)	7.1		

Pre-development Discharge Volume

Site Makeup	Greenfield	Include Baseflow	x	Storm Duration (mins)	360
Greenfield Method	ReFH2	Positively Drained Area (ha)	1.000	Betterment (%)	0
Region	England, Wales, NI	Return Period (years)	100	Runoff Volume (m³)	282

Node Basin A ReFH2 Dynamic Hydrograph

Overrides Design Area	x	Depression Storage Depth (mm)	0	Region	England, Wales, NI
Overrides Design Additional Inflow	x	Evapo-transpiration (mm/day)	0	Include Baseflow	x
Depression Storage Area (m²)	0	Area (ha)	0.920		
Applies to All storms					

Node Basin B ReFH2 Dynamic Hydrograph

Overrides Design Area	x	Depression Storage Depth (mm)	0	Region	England, Wales, NI
Overrides Design Additional Inflow	x	Evapo-transpiration (mm/day)	0	Include Baseflow	x
Depression Storage Area (m²)	0	Area (ha)	1.260		
Applies to All storms					

Node Basin C ReFH2 Dynamic Hydrograph

Overrides Design Area	x	Depression Storage Depth (mm)	0	Region	England, Wales, NI
Overrides Design Additional Inflow	x	Evapo-transpiration (mm/day)	0	Include Baseflow	x
Depression Storage Area (m²)	0	Area (ha)	1.380		
Applies to All storms					

Node Basin A Offline Hydro-Brake® Control

Flap Valve	x	Design Flow (l/s)	9.1	Min Outlet Diameter (m)	0.225
Loop to Node		Objective	(HE) Minimise upstream storage	Min Node Diameter (mm)	1200
Invert Level (m)	99.000	Sump Available	✓		
Design Depth (m)	1.000	Product Number	CTL-SHE-0140-9100-1000-9100		

Node Basin B Offline Hydro-Brake® Control

Flap Valve	x	Design Flow (l/s)	17.4	Min Outlet Diameter (m)	0.225
Loop to Node		Objective	(HE) Minimise upstream storage	Min Node Diameter (mm)	1500
Invert Level (m)	99.000	Sump Available	✓		
Design Depth (m)	1.000	Product Number	CTL-SHE-0187-1740-1000-1740		

Node Basin C Offline Hydro-Brake® Control

Flap Valve	x	Design Flow (l/s)	16.8	Min Outlet Diameter (m)	0.225
Loop to Node		Objective	(HE) Minimise upstream storage	Min Node Diameter (mm)	1500
Invert Level (m)	99.000	Sump Available	✓		
Design Depth (m)	1.000	Product Number	CTL-SHE-0184-1680-1000-1680		

Node Basin A Depth/Area Storage Structure

Base Inf Coefficient (m/hr)	0.00000	Safety Factor	2.0	Invert Level (m)	99.000
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	1400.0	1400.0	1.000	1400.0	1532.6

Node Basin B Depth/Area Storage Structure

Base Inf Coefficient (m/hr)	0.00000	Safety Factor	2.0	Invert Level (m)	99.000
Side Inf Coefficient (m/hr)	0.00000	Porosity	1.00	Time to half empty (mins)	

Depth (m)	Area (m ²)	Inf Area (m ²)	Depth (m)	Area (m ²)	Inf Area (m ²)
0.000	2930.0	2930.0	1.000	2930.0	3121.9

Node Basin C Depth/Area Storage Structure

Base Inf Coefficient (m/hr)	0.00000	Safety Factor	2.0	Invert Level (m)	99.000
Side Inf Coefficient (m/hr)	0.00000	Porosity	1.00	Time to half empty (mins)	

Depth (m)	Area (m ²)	Inf Area (m ²)	Depth (m)	Area (m ²)	Inf Area (m ²)
0.000	4365.0	4365.0	1.000	4365.0	4599.2

Results for 1 year Critical Storm Duration. Lowest mass balance: 99.98%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
960 minute summer	Basin A	645	99.139	0.139	19.4	194.6496	0.0000	OK
960 minute summer	Basin B	660	99.158	0.158	43.5	462.0977	0.0000	OK
1440 minute summer	Basin C	990	99.116	0.116	30.5	506.4138	0.0000	OK

Link Event (Upstream Depth)	US Node	Link	Outflow (l/s)	Discharge Vol (m³)
960 minute summer	Basin A	Hydro-Brake®	7.6	262.5
960 minute summer	Basin B	Hydro-Brake®	13.2	471.0
1440 minute summer	Basin C	Hydro-Brake®	8.3	409.5

Results for 2 year Critical Storm Duration. Lowest mass balance: 99.98%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m ³)	Flood (m ³)	Status
960 minute summer	Basin A	660	99.168	0.168	23.7	234.6133	0.0000	OK
960 minute summer	Basin B	660	99.190	0.190	53.8	556.2480	0.0000	OK
1440 minute summer	Basin C	990	99.136	0.136	37.0	594.9974	0.0000	OK

Link Event (Upstream Depth)	US Node	Link	Outflow (l/s)	Discharge Vol (m ³)
960 minute summer	Basin A	Hydro-Brake®	8.6	322.5
960 minute summer	Basin B	Hydro-Brake®	16.2	597.8
1440 minute summer	Basin C	Hydro-Brake®	10.6	523.9

Results for 30 year Critical Storm Duration. Lowest mass balance: 99.98%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
720 minute summer	Basin A	645	99.407	0.407	56.8	569.5867	0.0000	OK
960 minute summer	Basin B	780	99.429	0.429	107.9	1258.2020	0.0000	OK
960 minute summer	Basin C	780	99.278	0.278	98.3	1214.6630	0.0000	OK

Link Event (Upstream Depth)	US Node	Link	Outflow (l/s)	Discharge Vol (m³)
720 minute summer	Basin A	Hydro-Brake®	9.1	371.3
960 minute summer	Basin B	Hydro-Brake®	17.4	859.8
960 minute summer	Basin C	Hydro-Brake®	16.7	768.2

Results for 30 year +40% CC Critical Storm Duration. Lowest mass balance: 99.99%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
960 minute summer	Basin A	930	99.657	0.657	67.9	919.3937	0.0000	OK
960 minute summer	Basin B	960	99.675	0.675	152.2	1979.1550	0.0000	OK
960 minute summer	Basin C	915	99.428	0.428	138.9	1866.8540	0.0000	OK

Link Event (Upstream Depth)	US Node	Link	Outflow (l/s)	Discharge Vol (m³)
960 minute summer	Basin A	Hydro-Brake®	9.1	449.2
960 minute summer	Basin B	Hydro-Brake®	17.4	857.4
960 minute summer	Basin C	Hydro-Brake®	16.8	815.2

Results for 100 year Critical Storm Duration. Lowest mass balance: 99.99%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m ³)	Flood (m ³)	Status
960 minute summer	Basin A	885	99.593	0.593	63.4	830.7617	0.0000	OK
960 minute summer	Basin B	885	99.616	0.616	142.2	1803.4380	0.0000	OK
960 minute summer	Basin C	885	99.392	0.392	129.8	1712.5340	0.0000	OK

Link Event (Upstream Depth)	US Node	Link	Outflow (l/s)	Discharge Vol (m ³)
960 minute summer	Basin A	Hydro-Brake®	9.1	459.7
960 minute summer	Basin B	Hydro-Brake®	17.4	868.6
960 minute summer	Basin C	Hydro-Brake®	16.8	809.2

Results for 100 year +45% CC Critical Storm Duration. Lowest mass balance: 99.99%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
960 minute summer	Basin A	960	99.992	0.992	93.6	1389.3960	0.0000	OK
960 minute summer	Basin B	960	100.000	1.000	208.6	2929.7830	0.0000	OK
1440 minute summer	Basin C	1350	99.643	0.643	144.8	2805.5470	0.0000	OK

Link Event (Upstream Depth)	US Node	Link	Outflow (l/s)	Discharge Vol (m³)
960 minute summer	Basin A	Hydro-Brake®	9.1	496.8
960 minute summer	Basin B	Hydro-Brake®	17.4	937.9
1440 minute summer	Basin C	Hydro-Brake®	16.8	1127.2

Catchment	Sub-Catchment	Catchment Area (ha)	1 in 2 year (h)	Development Area (ha)	Development Type	Assumed Impermeable (%)	Impermeable Contribution From Development (%)	Impermeable Area including Basins (ha)	Permeable Area (ha)	at SPR of 51.3185	Modelled Area	Pre-Development Development Runoff Rate				Post Development Runoff Rate 1 in 100 year (1% ADP)		Runoff Volumes - 360 minute storm 1 in 1 year (100% ADP)		Runoff Volumes - 360 min (1 in 2 year (50% ADP)		Runoff Volumes - 360 minute storm 1 in 30 year (3.3% ADP)		Runoff Volumes - 360 minute storm 1 in 100 year (1% ADP)		Total Area Entering the Drainage System (ha)	Total Storage requirement (m³) 1 in 30 year + 45%	Total Storage requirement (m³) 1 in 100 year + 45%	Basin	Depth (m)	Slope (1 in 1)	Volume (m³)	Cover (m²/ADP)	Invert (m/ADP)	Base Area (m²)	Surface Area (m²)	Upstream Storage Requirement (m³)	Anticipated Upstream Storage from Residential Parcels			
												1 in 1 year (100% ADP)	Qbar (5% ADP)	1 in 30 year (3.3% ADP)	1 in 100 year (1% ADP)	All Basins @ 70% Qbar	Pre-Development	Post Development After Intersection	Pre-Development	Post Development	Post Development After Intersection	Pre-Development	Post Development	Post Development After Intersection	Pre-Development														Post Development	Post Development After Intersection	
												1 in 1 year (100% ADP)	Qbar (5% ADP)	1 in 30 year (3.3% ADP)	1 in 100 year (1% ADP)	All Basins @ 70% Qbar	Pre-Development	Post Development After Intersection	Pre-Development	Post Development	Post Development After Intersection	Pre-Development	Post Development	Post Development After Intersection	Pre-Development														Post Development	Post Development After Intersection	
A	-	1.83	13.0	1.19	Residential	65	0.77	0.93	0.92	1.38	11.0	13.0	33.2	43.6	9.1	179.9	255.2	230.6	339.0	517.8	293.2	456.5	681.7	657.1	617.2	880.1	865.5	1.83	920	1380	A	1.5	Variable	1106	94.3	92.8	201	1408	284.0	288.21	
B	-	3.50	24.9	3.12	Residential	65	2.03	2.38	1.12	2.96	21.0	24.9	63.4	83.4	17.4	332.5	525.4	460.5	380.5	666.0	601.1	873.1	1423.1	1358.2	1180.4	1890.2	1784.3	3.50	1980	2930	B	1.5	Variable	737	96.5	95	151	1185	627.0	787.34	
C	C1	3.37	23.9	1.33	Residential	65	0.87	1.99	1.38	2.70	20.2	23.9	61.0	80.3	16.8	320.0	749.2	690.9	366.2	516.7	858.4	890.4	2029.5	1971.2	1136.2	2086.2	2627.9	3.37	1870	2805	C	1.5	variable	2636	71.6	70.2	1235	2275	180.0	161.56	
	C2			0.81	Commercial	85	0.69																																		
	C3			0.33	Existing	65	0.21																																		
Sub-Total		2.47	-	-	-	-	1.76	-	-	-	52.2	61.8	107.6	207.3	43.3	628.4	1028.0	1392.0	945.7	1900.5	1792.7	2170.1	4134.3	3985.5	2933.8	5425.5	5277.7	8.7	4770	7126	-	-	-	9026	-	-	-	2280	7250	1100	1830.678

Catchment	Total Volume of interception for first 5mm of rainfall	Basin Lined (Y/N) *subject to groundwater monitoring	Interception provided by Basin(s) (m³)	Anticipated Plot numbers	Total Permeable Driveway (m²)	Assumed total area of housing draining in to permeable driveways (m²)	Interception provided by permeable driveway (m³)	Assumed total area draining into permeable shared road (m²)	Assumed Interception from permeable road (m³)	Volume of Storage from Permeable Paving	Total plot rain garden area	Total Plot Rain Garden Interception	Total Plot Rain Garden Storage	Adoptable Swale length (m)	Interception provided by highway swale (m³)	Swale Depths (m)	Swale Base widths	Surface Volume from swale	Filter Depth Below Swale	Volume from gravel beneath swale	Total Inception Achieved (m³)	Total Upstream Storage (m³)	Volume provided by Storage and Interception (m³)	% of 5mm interception achieved	Additional volume of interception required to comply with Standard 2 (m³)	Estimated number of plots requiring additional interception measures to comply with Standard 2 (To be assessed at detailed design stage)	Additional Road Interception Measures Likely to be required (To be assessed at detailed design stage)
A	45.6	N	6.5	35	612.5	875	7.4	350.0	1.8	129.9	210.0	5.3	35.0	144	3.60	0.30	1.0	82.08	0.35	16.63	24.56	263.65	288.21	53.88	22.77	35	YES
B	119.1	N	15.3	97	1997.5	2425	20.6	970.0	4.9	390.1	582.0	14.6	97.0	387	9.68	0.30	1.0	220.59	0.35	44.70	69.94	722.40	787.34	54.50	59.05	97	YES
C	96.6	N	30.9	45	787.5	1125	9.6	490.0	2.3	167.0	270.0	6.8	45.0	355	8.88	0.50	1.0	443.75	0.35	41.00	58.31	666.82	755.13	56.55	43.63	45	YES
TOTAL	264.3	-	52.7	177	2485.0	3500.0	30.2	1420.0	7.1	527.2	852.0	21.3	142.0	742.00	18.55	-	-	664.34	-	85.70	123.25	1419.22	-	-	102.58	142.00	YES

Assumptions	
Average plot size	255 m²
Average driveway area	17.5 m²
Average house area	103 m²
Average Adopted Road Area Per Plot	45 m²
Assumed Road Adopted Total Width	9 m
Swale Slopes (1 in)	3
Swale Granular Underdrain - 0.35m deep / 1m wide	
Assumed area of housing draining in to permeable driveway	25 m²
Assumed average permeable private road	10 m²
Assumed rain Garden storage per plot	1 m³
Assumed rain Garden area per plot	6 m²
Assumed Commercial SUDS Storage	200 m³/ha
No Infiltration	

BASIN A:
SPLIT-LEVEL DETENTION BASIN COMPRISING A LOWER WET BASIN DESIGNED TO ACCOMMODATE RUNOFF UP TO THE 1 IN 30 YEAR + CLIMATE CHANGE EVENT.
ADDITIONAL UPPER STORAGE AREA PROVIDED ABOVE THIS LEVEL TO ACCOMMODATE RUNOFF UP TO THE 1 IN 100 YEAR + CLIMATE CHANGE EVENT.
THE LOWER BASIN AREA TO BE OVER-EXCAVATED AND LANDSCAPED TO FORM A PERMANENT/WET HABITAT FEATURE TO SUPPORT BIODIVERSITY.
THE UPPER BASIN AREA WILL TO DRY UNDER NORMAL CONDITIONS AND INTEGRATED WITHIN THE LANDSCAPE.
STEPS TO BE PROVIDED ON THE DEVELOPMENT-FACING SIDE OF THE BASIN TO PROVIDE INFORMAL SEATING AND AMENITY SPACE.

SWALES:
SWALES TO BE DESIGNED TO CONVEY AND STORE RUNOFF UP TO THE 1 IN 100 YEAR + CLIMATE CHANGE EVENT.
CHECK DAMS SHALL BE INCORPORATED AS REQUIRED TO CONTROL FLOW VELOCITIES AND PROMOTE ATTENUATION AND INFILTRATION ALONG THE SWALE.

PRIVATE DRIVES:
ALL PRIVATE DRIVES TO HAVE PERMEABLE PAVING

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TURLEY - CASS3002 - 3000 - F
JOMAS - P4549J2629

- NOTES:
- QBAR Greenfield Runoff rate = 4.9 l/s/ha. Discharge rate = 3.5 l/s/ha (30% WCC Betterment Policy).
 - CV Value of 0.75 for summer and 0.84 for winter used for storage estimates.
 - Invert level of basins subject to confirmation of ditch levels.
 - Employment Site based on 65% impermeable area of the developable area and 100% impermeable area from the basins.

Pre-Development Drainage Parameters	
Storm	Rate (l/s/ha)
1 in 1	6
Qbar	7.1
1 in 30	18.1
1 in 100	23.8
Run-off volumes (360 minute - storm)	
Storm	Volume (m³/ha)
1 in 1	94.9
1 in 2	108.6
30+cc	249.2
100+cc	336.9
BF	0.311
SPR	51.3185

- KEY:
- Catchment Boundary
 - Catchment A
 - Catchment B
 - Catchment C
 - Existing Greenfield Catchment Area
 - Natural Overland Flow Route (to be within proposed development)
 - Natural Overland Flow Route (captured by drainage system)
 - Natural Overland Flow Route (remaining as existed)
 - Attenuation basin
 - Proposed Swales
 - Existing Site Contours
 - Indicative Network
 - Headwall
 - Proposed Pumping Station
 - Proposed Rising Main
 - Existing Foul Network
 - Existing Rising Main

P11	05.26	MASTERPLAN UPDATED	JS	JS
P10	05.26	ALTERNATE SOLUTION FOR BASIN B1 SHOWN	JS	JS
P9	05.26	DRAINAGE STRATEGY UPDATED FOLLOWING COMMENTS FROM LLFA	RP	JS
P8	11.25	LAYOUT AMENDED	GR	SI
P7	10.25	LAYOUT AMENDED	GR	SI
P6	08.24	UPDATED TO SUIT CATCHMENTS	GR	KW
P5	02.23	UPDATED TO SUIT ROAD ALIGNMENT	GR	KW
P4	02.23	DRAINAGE STRATEGY UPDATED TO SUIT LATEST LAYOUT	GR	KW
P3	12.22	DRAINAGE STRATEGY UPDATED TO SUIT LATEST LAYOUT INFORMATION. EMPLOYMENT SITE CATCHMENT ADDED.	TR	KW
P2	09.22	FOUL STRATEGY ADDED	KW	PJ
P1	09.22	FIRST ISSUE	KW	PJ
Rev	Date	Description	Drawn	Checked



Client
CASTLEWOOD COMMERCIAL

Project
PENN FARM CALNE

Title
INDICATIVE DRAINAGE STRATEGY

Status
FOR INFORMATION

Scale 1:1000 @ A1	Date SEPT 2022	Drawn KLW	Checked PJ
Drawing No A325-001	Revision P11		



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