

PRIORS FARM

FLOOD RISK ASSESSMENT AND DRAINAGE STRATEGY

LIGHTWOOD STRATEGIC LTD

03 JULY 2024



Abley Letchford Partnership Limited
3 Tealgate
Charnham Park
Hungerford
RG17 0YT

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

Quality Management:

Prepared by:	R Moore
Authorised by:	E Philpott
Date:	03 July 2024
Document Reference:	A218-R020A

COPYRIGHT © ABLEY LETCHFORD PARTNERSHIP LIMITED
The material presented in this report is confidential. This report has been prepared for the exclusive use of Lightwood Strategic Ltd within the terms of the contract and shall not be distributed or made available to any other company or person without the knowledge and written consent of Abley Letchford Partnership Limited.
Any such party relies on the report at their own risk.



Contents

1.0 Introduction1

2.0 Policy and Sources of Information3

3.0 Site Setting6

4.0 Overview of Flood Risk15

5.0 Sequential Test and Exception Test26

6.0 Flood Mitigation Strategy27

7.0 Surface Water Drainage31

8.0 Foul Water Drainage40

9.0 Conclusion.....41

Appendices

- Appendix 1 - Plans
- Appendix 2 - EA Product 4 Data
- Appendix 3 - LLFA Developer Checklist
- Appendix 4 - Drainage Strategy

1.0 Introduction

Context

- 1.1. This Flood Risk Assessment (FRA) has been prepared by Abley Letchford Partnership Ltd (ALP), on behalf of Lightwood Strategic Ltd to support a Hybrid planning application seeking Outline planning permission for up to 850 units with all matters reserved (except for access to the site) and a full application for SANG land and associated facilities by Lightwood Strategic ("Lightwood Site"). The Site is located on the land to the West of Old Wokingham Road, Wokingham in Berkshire.
- 1.2. The Site is part of the South Wokingham Strategic Development Location (SDL) Extension.

Development Proposals

- 1.3. The proposals are for the provision of up to 850 units, SANG and associated facilities as depicted on the Illustrative Masterplan within Appendix 1.

Requirement for a Flood Risk Assessment

- 1.4. The requirement for a FRA is set out in Section 14 of the revised National Planning Policy Framework (NPPF) as revised in September 2023.
- 1.5. The footnote accompanying Paragraph 172 states:

‘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..’
- 1.6. The Site is a greenfield site that comprises of farmland with established hedges and tree lined boundaries. Priors Farm and associated buildings are located within the site boundary. The area of the Site is approximately 58 hectares. As the Site area extends greater than 1 hectare, a site-specific flood risk assessment is required. To comply with the requirements of the NPPF, matters related to flood risk and drainage are addressed within this report.

Report Aim and Formation

- 1.7. 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.
- 1.8. 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.



- 1.9. 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.

Report Structure

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

2.0 Policy and Sources of Information

Introduction

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

National Planning Policy

- 2.2. National Planning Policy in relation to Flood Risk is set out in Section 14 of the National Planning Policy Framework (NPPF) and Planning Practice Guidance (PPG) ID: 7 for Flood Risk and Coastal Change. Flood Risk is discussed in Paragraphs 165-175 of the NPPF.

- 2.3. Paragraphs 165-168 discuss the sequential approach. Paragraph 166 refers to a Strategic Flood Risk Assessment (SFRA) that would form the basis of applying the Sequential Test for local authorities to allocate development, whilst Paragraphs 169-170 relates to the Exception Test.

- 2.4. Paragraph 173 discusses the determination of planning applications stating:

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

- a) 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;*
- b) 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;*
- c) it incorporates sustainable drainage systems, unless there is clear evidence that this would be inappropriate;*
- d) any residual risk can be safely managed; and*
- e) safe access and escape routes are included where appropriate, as part of an agreed emergency plan.’*

- 2.5. The proposed development comprising of up to 900 units would be classed as a Major development providing more than 10 homes and the site is greater than 0.5 hectares. Paragraph 175 states:

‘Major developments should incorporate sustainable drainage systems unless there is clear evidence that this would be inappropriate. The systems used should:

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

d) Where possible, provide multifunctional benefits.'

Environment Agency

- 2.6. 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.
- 2.7. The EA Standing Advice has been consulted and reviewed within this FRA.
- 2.8. 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.

Local Authorities

- 2.9. The Site lies within the administrative area of Wokingham Borough Council (WBC). WBC is the Local Planning Authority (LPA) and Lead Local Flood Authority (LLFA).
- 2.10. Planning guidance published by WBC 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:
 - WBC Core Strategy, Core Policy CP1 'Sustainable Development' and CP3 'General Principles for Development' (adopted January 2010),
 - WBC Local Plan (dated February 2014),
 - WBC Local Flood Risk Management Strategy (dated April 2015),
 - WBC Preliminary Flood Risk Assessment (PFRA) (dated June 2011) and PFRA addendum (dated 2017),
 - WBC Level 1 Strategic Flood Risk Assessment (SFRA) (dated May 2023 and published May 2024), and
 - WBC Level 2 SFRA (dated August 2023 and published May 2024).
- 2.11. WBC became the LLFA under the Flood and Water Management Act 2010. WBC provide guidance to assess, manage and inform flood risk.
- 2.12. As LLFA, WBC's Flood and Water Management Team provide a Planning Application Drainage Checklist to assist developers seeking planning permission for new sites by setting criteria to be met as part of the design of the drainage strategy and a list of documentation to be presented in the associated Flood Risk Assessment. A completed Planning Application Drainage Checklist is included within Appendix 3.
- 2.13. WBC has permissive rights over any Ordinary Watercourses including land drainage ditches. If any work is required within the watercourse (improvements or crossings) then approval from the LLFA is required under the Flood and Water Management Act 1991.



Local Water Authority

- 2.14. South East Water is responsible for the supply of clean water in the South Wokingham area. Thames Water is responsible for the disposal of wastewater for the South Wokingham area.
- 2.15. 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.

Other Sources of Information

- 2.16. 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.
- 2.17. 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'.
- 2.18. 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

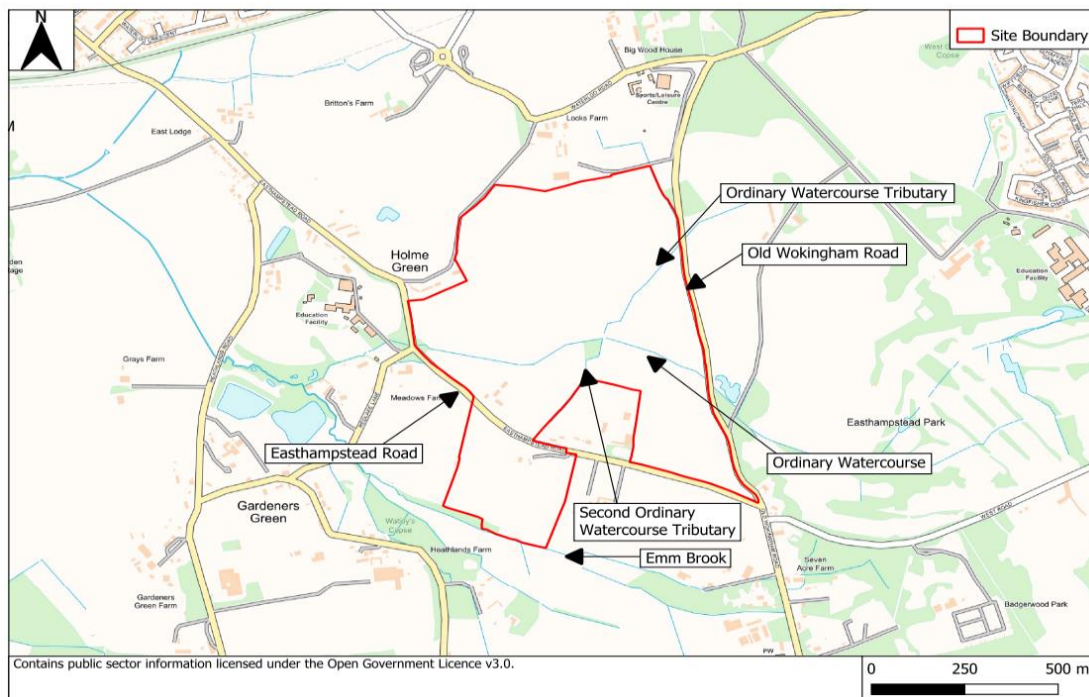
Introduction

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

Site Location

- 3.2. The Site is located at land to the west of Old Wokingham Road, located approximately 2.1km to the south of Wokingham in Berkshire. The nearest postcode is RG40 3BF. The Site centre grid reference is 483,390E, 167,180N. The Site location is shown in Figure 1.

Figure 1 – Site Location

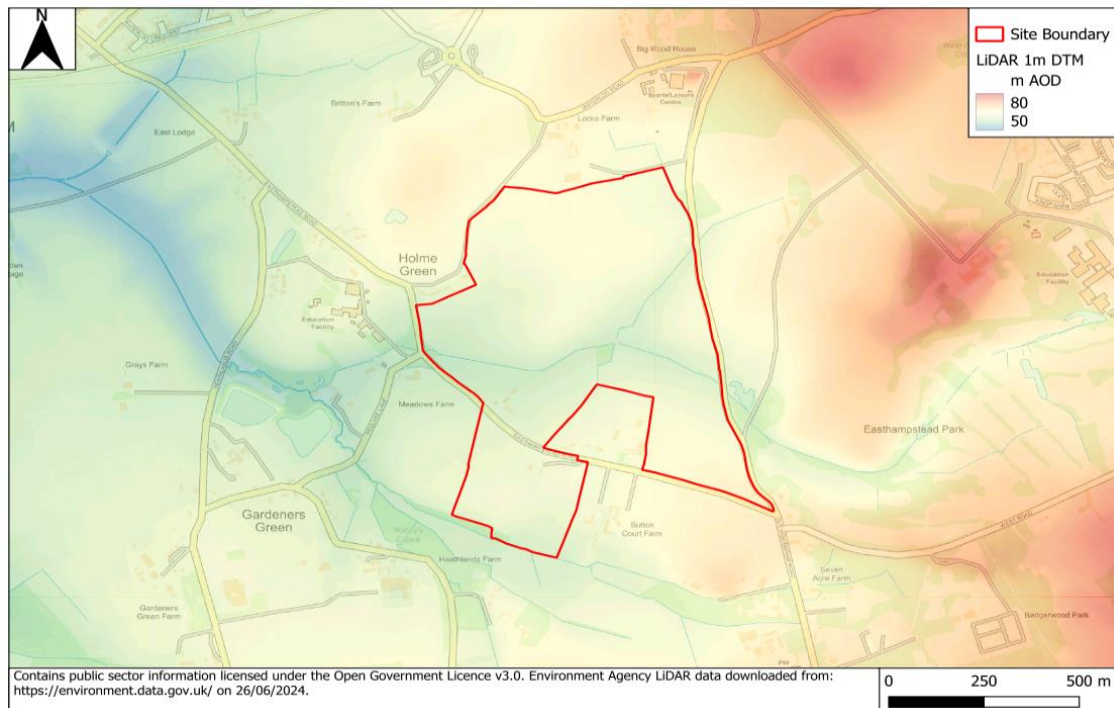


- 3.3. The northern part of the Site is located to the west of Old Wokingham Road and north of Easthampstead Road. The northern part of the Site is bounded by Locks Farm to the north. Holme Green village, Pearce's Farm and Meadows Farm are located to the west of the Site. The southern parcel is bound by Easthampstead Road to the north and Emm Brook to the south. Sutton Court Farm is located to the east of the southern parcel. Meadows Farm is located to the west of the southern parcel.
- 3.4. The Site consists predominantly of farmland, enclosed by mature hedgerow and tree boundaries. Priors Farm is located within the Site.
- 3.5. The Site covers an area of approximately 58 hectares.

Topography

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

Figure 2 – Site Topography



- 3.7. The LiDAR indicates that the ground levels across the Site slope downwards from north and south towards an Ordinary Watercourse that flows through the Site. Ground levels across the Site are between 56.7m AOD and 67.1m AOD. The highest ground level near the northern boundary of the Site is 65.2m AOD. The highest ground level in the southern part of the Site is 67.1m AOD.
- 3.8. A topographical survey of the Site has been carried out. A copy of the topographical survey is included in Appendix 1. It confirms that ground levels across the Site slope down from the north and south to a low area along the Ordinary Watercourse. The highest parts of the Site are near the northern boundary of the Site with an elevation of 65.3m AOD and in the south-east corner of the Site with an elevation of 66.8m AOD. The lowest part of the Site is in the south-east corner of the Site with an elevation of 57.2m AOD.
- 3.9. The topographical survey shows that ground levels along the northern bank of the Ordinary Watercourse are up to 1m higher than the ground levels along the southern bank.
- 3.10. Observations from the site walkover carried out in February 2023 support the difference between the ground levels to the north and south of the Ordinary Watercourse.

Watercourses and Ditches

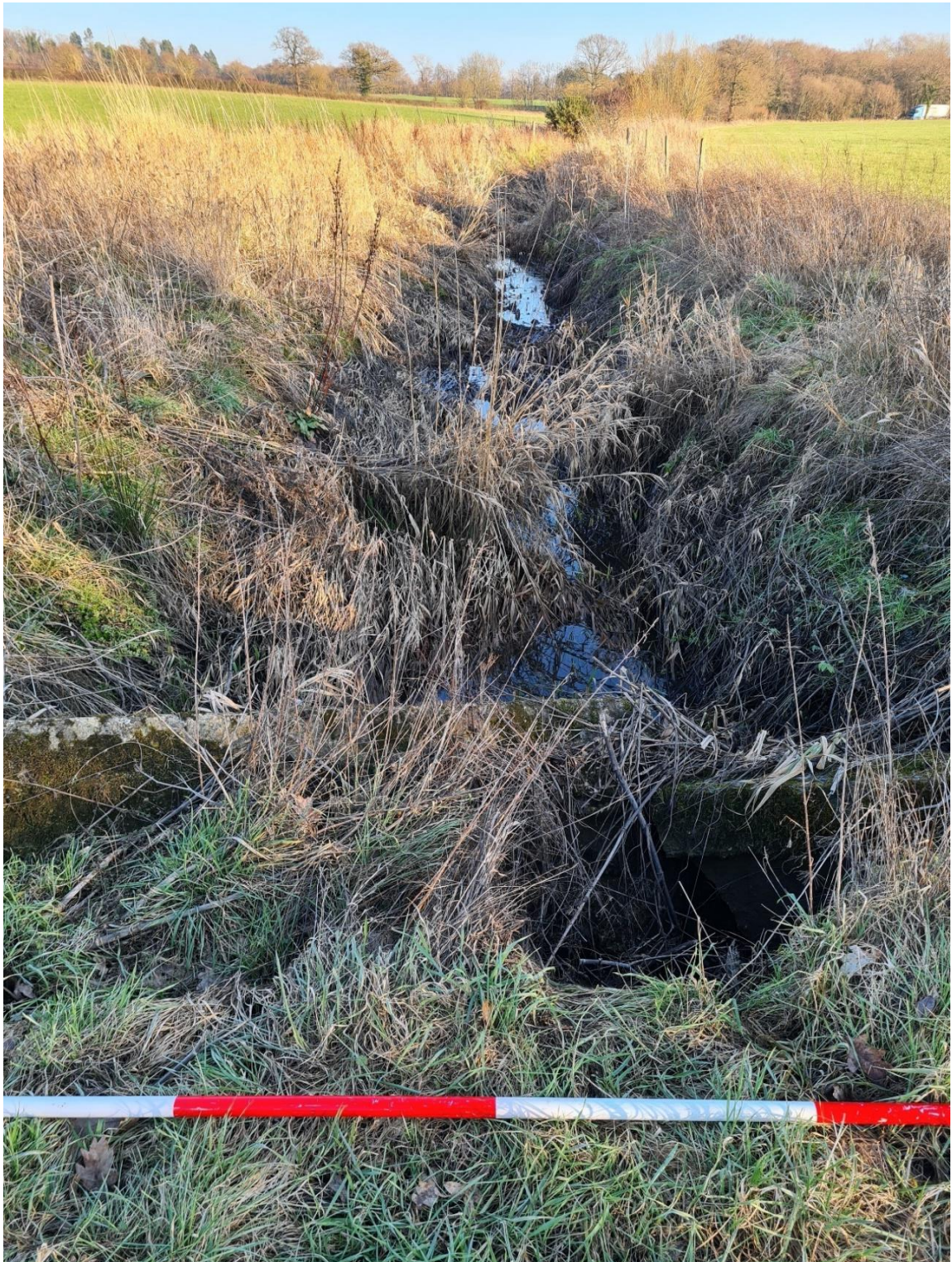
- 3.11. An Ordinary Watercourse flows from in a westerly direction through the centre of the Site. An Ordinary Watercourse tributary flows from the north-eastern part of the Site in a southerly direction towards the Ordinary Watercourse. A second tributary of the Ordinary Watercourse flows from the southern boundary of the Site in a northerly direction towards the Ordinary Watercourse. These are shown on Figure 1.

- 3.12. Figures 3 and 4 shows photographs of the Ordinary Watercourse taken during the Site walkover which was carried out in February 2023.

Figure 3 – Photograph of the Ordinary Watercourse



Figure 4 – Photograph of the Ordinary Watercourse



- 3.13. The photographs in Figures 3 and 4 show that the Ordinary Watercourse channel is well defined, with steep sides. The flow was well contained within the banks of the channel during the site walkover.
- 3.14. There are three existing crossing of the Ordinary Watercourse within and leading onto the Site. These are shown in Figure 5 The crossings are field access tracks with culverts, as shown in Figures 6, 7 and 8. The culverts are 900mm in diameter. There is between 500mm cover for the western and eastern culverts and 900mm cover for the central culvert. Photographs and measurements of the culverts were taken during a site walkover in February 2023.

Figure 5 Ordinary Watercourse Crossings

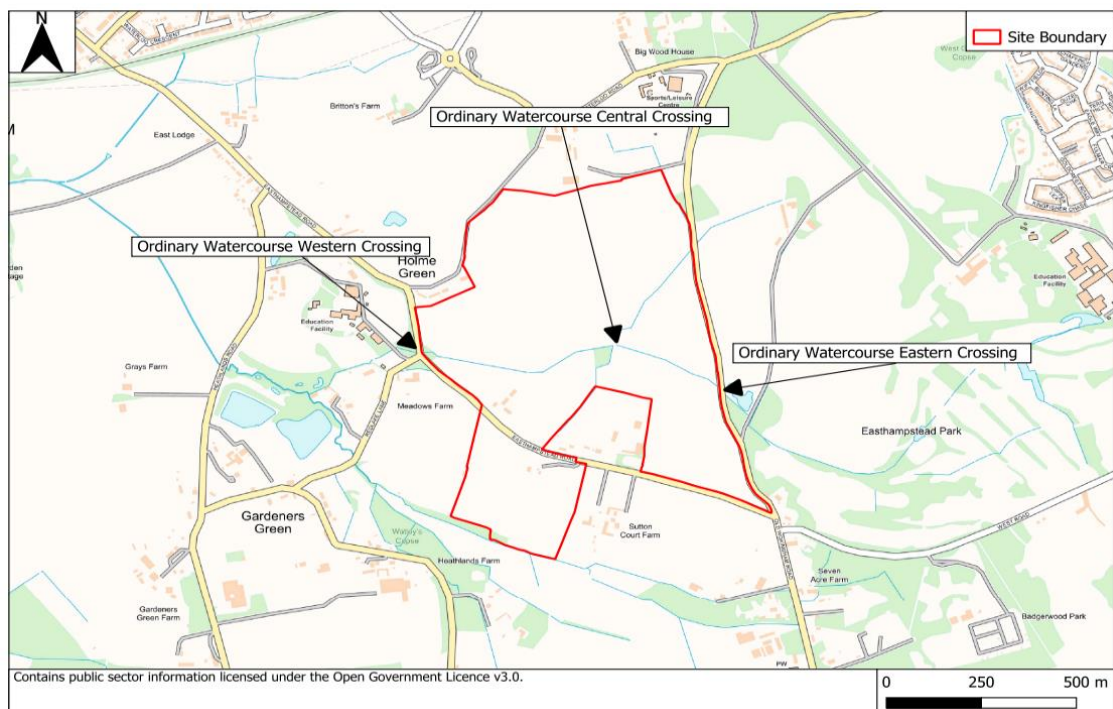


Figure 6 – Ordinary Watercourse Western Crossing



Figure 7 – Ordinary Watercourse Central Crossing



Figure 8 – Ordinary Watercourse Eastern Crossing



- 3.15. Emm Brook flows along the southern parcel's southern boundary. Emm Brook is classed as an Ordinary Watercourse in this location.



- 3.16. The nearest EA Main River is the downstream reach of the Emm Brook. Emm Brook flows as an Ordinary Watercourse from the Site's southernmost boundary in a north westerly direction and is designated as Main River approximately 1.4km to the north-west of the Site. The Ordinary Watercourse flows into Emm Brook at Chapel Green, at the point where the Emm Brook becomes a Main River.

Surface and Foul Water Sewers

- 3.17. Sewer Asset Records obtained from Thames Water do not indicate the presence of any surface or foul water sewers within the Site or within the road network immediately adjoining the Site. The nearest public asset is a foul sewer located adjacent to the Easthampstead Sewage Treatment Works on Old Wokingham Road to the south-east of the Site.
- 3.18. A copy of Thames Waters Asset Record is included within Appendix 1.

Geology and Hydrogeology

- 3.19. The British Geological Survey (BGS) 'Geology of Britain' online viewer indicates that the geology underlying the Site predominantly London Clay Formation. There is some Bagshot Formation – Sand in the south-west corner of the Site. There are superficial deposits of Head – clay, silt, sand and gravel adjacent to the Ordinary Watercourse. There are some areas of superficial deposits – sand and gravel across the Site. There are no superficial deposits across the rest of the Site.
- 3.20. The Cranfield University 'Soilscapes' online viewer indicates that the majority of the Site overlies slowly permeable seasonally wet slightly acidic but base rich loamy and clayey soils. There is an area in the south-west corner of the site which overlays freely draining slightly acid loamy soils.
- 3.21. The DEFRA Magic Map online viewer indicates that the Site lies outside of any Groundwater Source Protection Zone (SPZ). The majority of the Site is not underlain by a bedrock aquifer. The south-west corner of the Site is underlain by a Secondary A bedrock aquifer. Parts of the Site are underlain by a Secondary A superficial aquifer. The area adjacent to the Ordinary Watercourse is underlain by a Secondary (undifferentiated) bedrock aquifer.
- 3.22. A Secondary A aquifer is described by the BGS as 'permeable layers capable of supporting water supplied at a local rather than strategic scale, and in some areas forming an importance source of base flow to rivers. There are generally aquifers formerly classed as minor aquifers'.

4.0 Overview of Flood Risk

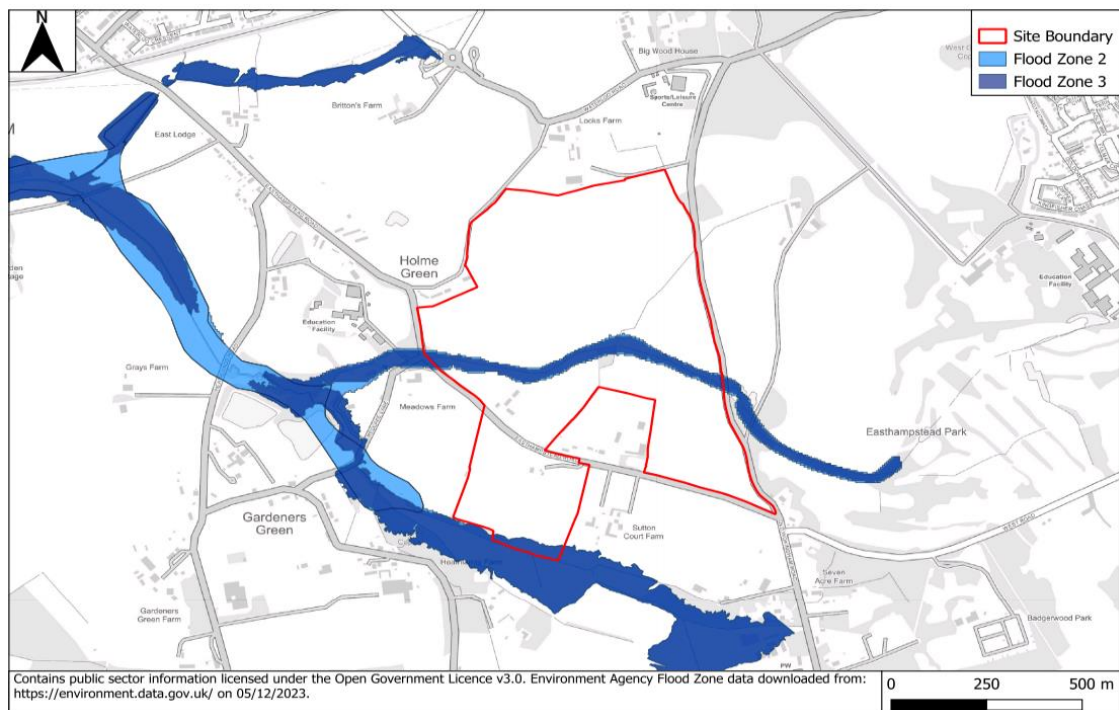
EA Flood Zone Map

4.1. 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 1000 (0.1%) annual probability of river or sea flooding.
- Flood Zone 2 'Medium Probability' – Land between 1 in 100 (1%) and 1 in 1000 (0.1%) annual probability of river flooding, or between 1 in 200 (0.5%) and 1 in 1000 (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.

4.2. Figure 9 shows the EA Flood Zone mapping. It confirms that the majority of the Site is located within Flood Zone 1 'Low Probability' of fluvial (or tidal) flooding. According to the mapping, the area adjacent to the Ordinary Watercourse is located within Flood Zone 2 'Medium Probability' of fluvial (or tidal) flooding and Flood Zone 3 'High Probability' of fluvial (or tidal) flooding.

Figure 9 – EA Flood Zone Map



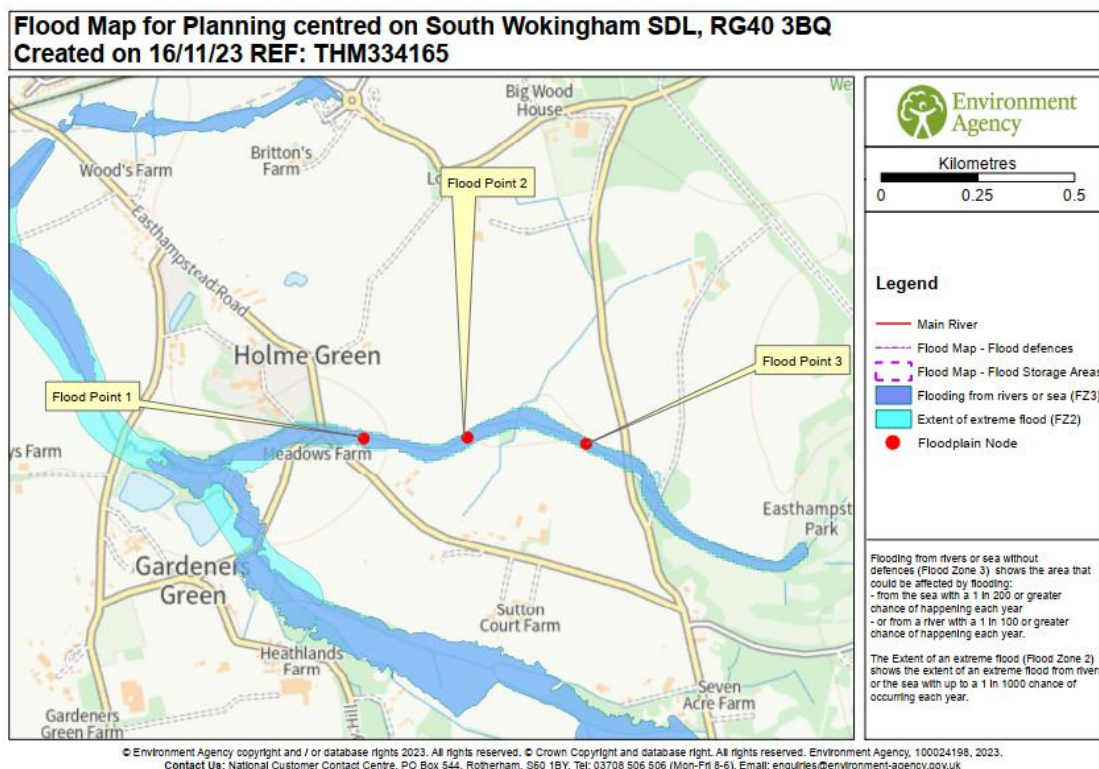


- 4.3. The floodplain for the Ordinary Watercourse is shown to be between 25m and 55m in width. This does not tie in with observations during the site walkover, or the topographical survey. The Ordinary Watercourse channel is well defined with ground levels rising quickly beyond the channel banks. Furthermore, the nature of the vegetation within the channel indicates that that channel is not frequently full.
- 4.4. The three culverts observed during the site walkover, are shown in Figures 6-8. The EA Flood Zone mapping is a strategic model therefore site specific features such as these culverts are not included within in. In reality, flow would back up behind the 900mm diameter culvert under Old Wokingham Road and the culvert would act as a control for flow entering the Site.
- 4.5. Therefore it is concluded that the fluvial flood extents in reality across the Site are likely to be smaller than those shown in the Flood Map for Planning. In the absence of detailed modelling, the EA Flood Zone data as been taken to inform the masterplan and this is deemed to be a precautionary approach. A detailed modelling study may be completed at a later stage to inform detailed design.

Flood Risk from Fluvial Sources

- 4.6. The majority of the Site is shown to be within Flood Zone 1 of the EA Flood Map for Planning. The area adjacent to the Ordinary Watercourse and the area adjacent to Emm Brook in the Site's southern parcel are shown to be located within Flood Zone 2 and 3 of the EA Flood Map for Planning. This indicates that the area adjacent to Ordinary Watercourse and the southern part of the Site's southern parcel is affected by fluvial flooding in the 1 in 100 and 1 in 1000 annual probability scenarios respectively. These maps are based on strategic modelling and do not take into consideration Site specific information.
- 4.7. The EA has provided modelled flood levels and extents for the Site as part of their Product 4 'Detailed Flood Risk Assessment Map' dataset (EA reference: THM334165). A copy of this is provided in Appendix 2. The model is a strategic JFLOW model of the Site. An extract of this Product 4 data is shown in Figure 10.

Figure 10 – EA Product 4 Extract – EA Flood Zone Flood Extents with Flood Points Labeled on Identifying the Location of the JFLOW Flood Levels in Table 1



4.8. Figure 10 shows the Flood Zone 2 and 3 extents from the EA Flood Map for Planning and shows the locations where model data has been provided.

Table 1 summarises the modelled flood levels at the nearest EA model nodes.

Table 1 – EA Modelled JFLOW Levels for the Ordinary Watercourse

Flood Event	Flood Point 1 Modelled Flood Level, m AOD	Flood Point 2 Modelled Flood Level, m AOD	Flood Point 3 Modelled Flood Level, m AOD
1 in 100 Annual Probability (1%)	56.27	58.30	59.59
1 in 100 Annual Probability +20% Climate Change Allowance	56.27	58.30	59.59
1 in 1000 (0.1%) Annual Probability	56.34	58.45	59.79

4.9. The EA has provided this data. However, in this case, the outputs from the JFLOW model will not be used to inform the FRA because, according to the EA, the level data from the model is not considered to be suitable for use in Site specific FRAs. Furthermore, a review of ground levels at Flood Points 1 to 3 indicates that the modelled levels are below bank level.

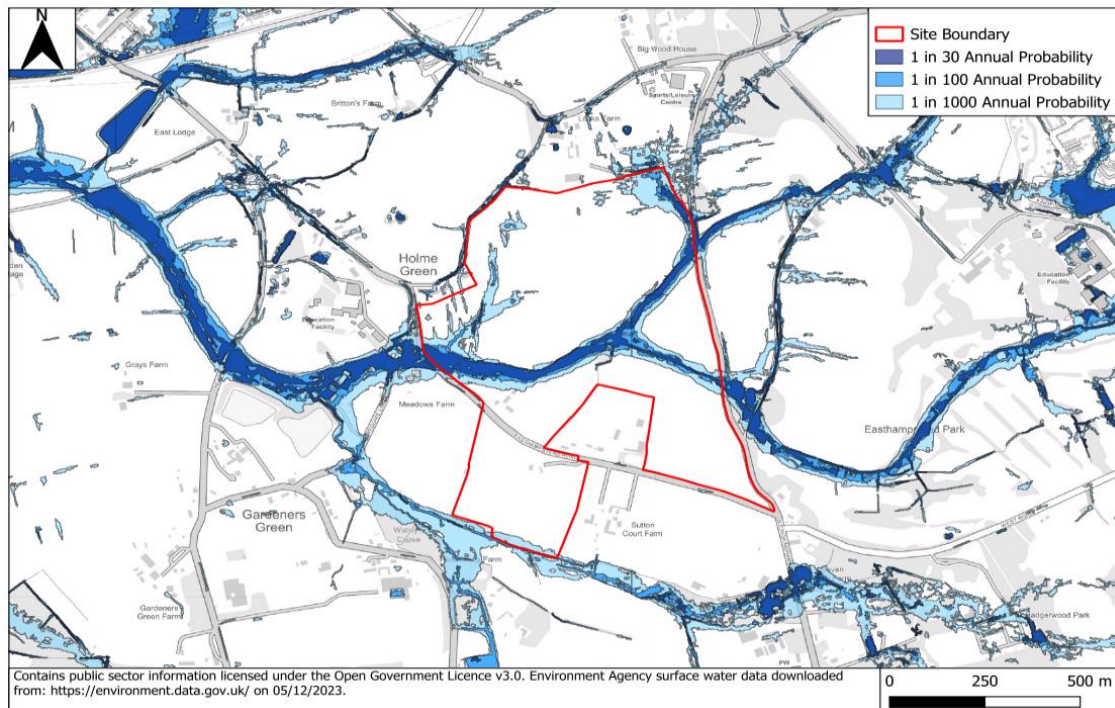


- 4.10. Instead, the EA Flood Map for Planning flood extents will be used to inform the masterplan at this stage and as a precautionary approach in the absence of a detailed model.
- 4.11. The Wokingham Borough Council Level 1 and 2 SFRA (dated August 2023) includes fluvial flood risk mapping. This confirms the EA Flood Zone mapping.
- 4.12. The Site is allocated within the WBC local Plan, this is referred to as the South Wokingham Master Planning Area extension within the Level 2 WBC SFRA Appendix A.
- 4.13. The Level 2 SFRA *Appendix A* states within the site specific summary table for the South Wokingham Master Planning Area extension *'in the absence of detailed hydraulic modelling, Flood Zones 2 and 3a have been taken from the Environment Agency's Flood Map for Planning.'* As such the EA mapping has been taken as the best available data.
- 4.14. The residential development will be located to avoid the fluvial flood extents shown on the Flood Map for Planning. A more detailed analysis will need to be carried out at the detailed design phase to inform the crossings of the Ordinary Watercourses at the detailed design phase.

Flood Risk from Surface Water

- 4.15. 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 1000 (0.1%) annual probability 'Low Risk'
 - Lower than 1 in 1000 (0.1%) annual probability 'Very Low Risk'.
- 4.16. 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 a FRA.
- 4.17. Figure 11 shows the potential flood risk from surface water. The EA Flood Risk from Surface Water mapping indicates that majority of the Site is at a 'Very Low' (less than 0.1% annual probability) of surface water flooding. There is a flow route with 'Low' (between 1% and 0.1% annual probability), 'Medium' (between 3.3% and 1% annual probability) and 'High' (greater than 3.3% annual probability) of surface water flooding which is associated with the flow route of the Ordinary Watercourse.

Figure 11 - EA Flood Risk from Surface Water



- 4.18. There is an Ordinary Watercourse tributary which flows from the north-east part of the Site towards the Ordinary Watercourse. There is an area of 'High', 'Medium' and 'Low' risk associated with this watercourse and follows its flow route.
- 4.19. The channels of the Ordinary Watercourse and Ordinary Watercourse tributary appear to be poorly defined within the surface water mapping. This is overestimating the width of the surface water flow route. The EA surface water mapping is strategic scale which does not pick-up site-specific detail or small features due to the resolution of the modelling. The flow routes will be further analysed at the detailed design phase.
- 4.20. One key feature that hasn't been represented in this mapping is a ditch that runs along the northern boundary of the Site. This ditch was noted during the site walkover. It would effectively intercept overland flow from the north and direct it to the north-eastern corner of the Site where flows would continue along the ditch line and into the Ordinary Watercourse tributary. The extent of surface water flooding in the north-eastern corner of the Site has been overestimated by the mapping.
- 4.21. Furthermore, the surface water flood mapping does not tie in with the topographical survey and Site observations. As shown in Figures 3 – 8, the Ordinary Watercourse and Ordinary Watercourse tributary are well defined channels with ground levels generally sloping quite steeply from the channel banks and into the Site. The land to the north of the Ordinary Watercourse is approximately 1m higher than the land to the south of the watercourse. There is also a 900mm diameter culvert under Old Wokingham Road as the Ordinary Watercourse and Ordinary Watercourse tributary enters the Site which is not represented within the surface water modelling. This would hold back high flows flowing from east of Old Wokingham Road to the west of Old Wokingham Road, therefore controlling the flow coming into the Site.



- 4.22. There is a surface water flow route in the north-east corner of the Site which flows down through the eastern part of the Site where it joins the Ordinary Watercourse tributary. The flow route here begins to the north of the Site, within Lock's Farm. Site observations carried out during a Site walkover confirmed that there is a ditch along the boundary of Lock's Farm and land to the west of Old Wokingham Road which collects surface water flow flowing in a southerly direction and channels it in an easterly direction towards the north-eastern corner of the Site. This detail is not picked up within the strategic scale EA surface water modelling due to resolution of the ground model used. The EA mapping therefore does not represent the reality of the Site.
- 4.23. There is a flow route in the western part of the Site which flows in a southerly direction into the Ordinary Watercourse. The catchment for this flow route is entirely within the Site boundary.
- 4.24. There is an area of 'Low' and 'Medium' risk of surface water flooding along the Site's southern parcel's southern boundary, associated with Emm Brook which flows to the south of the Site.
- 4.25. There are a few isolated areas which have a 'Low' risk of surface water flooding. These areas are associated with localised low ground where surface water would potentially pond.
- 4.26. The EA surface water mapping is based on a national scale surface modelling. The model does not consider any site-specific local information or below ground drainage infrastructure. The mapping therefore provides a guide to vulnerable areas based on the topography of the area and not a detailed assessment of surface water flooding for a specific site.
- 4.27. Appendix A states that the EA Risk of Surface Water mapping is used as its data set. The WBC Level 2 SFRA indicates that there have been no incidents of surface water flooding within the Site boundary.

Flood Risk from Groundwater

- 4.28. 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.
- 4.29. The WBC Level 1 SFRA assesses the area for susceptibility to groundwater flooding this has been undertaken using the EA areas susceptible to groundwater flooding mapping. The relevant mapping is provided in Appendix A of the SFRA, Pages D3 and E3 and is described below.
- 4.30. The areas susceptible to groundwater flooding mapping indicates that the northern part of the Site is located within a 1km² grid square of which between 25% and 50% of the grid square is susceptible to groundwater flooding. The area to the south of the Ordinary Watercourse is shown to be located within a 1km² grid square of which between 50% and 75% of the grid square area is susceptible to groundwater flooding. There is an area in the western part of the Site that is located within a 1km² grid square of which less than 25% of the grid square is susceptible to groundwater flooding.



- 4.31. The WBC Level 1 SFRA includes areas of groundwater emergence flooding which shows the depth below the ground surface. The mapping is included within Appendix A, Pages D3 and E3. The mapping indicates that there is an area to the north of the Ordinary Watercourse there is an area where groundwater is between 0.025m and 0.5m below the ground surface and less than 0.025m below the ground surface. The area to the south of Easthampstead Road and south-eastern corner of the site is shown to have a groundwater level of between 0.025m and 0.5m below the ground surface and less than 0.025m below the ground surface. The mapping does not include data for the rest of the Site.
- 4.32. The risk of groundwater flooding across the majority of the Site is therefore considered to be medium. The risk of groundwater flooding is likely to be higher in the areas adjacent to the Ordinary Watercourse.
- 4.33. In assessing the site allocation, the WBC Level 2 SFRA suggests that an appropriate assessment of the groundwater regime may be required. If necessary this can be completed at detailed design.

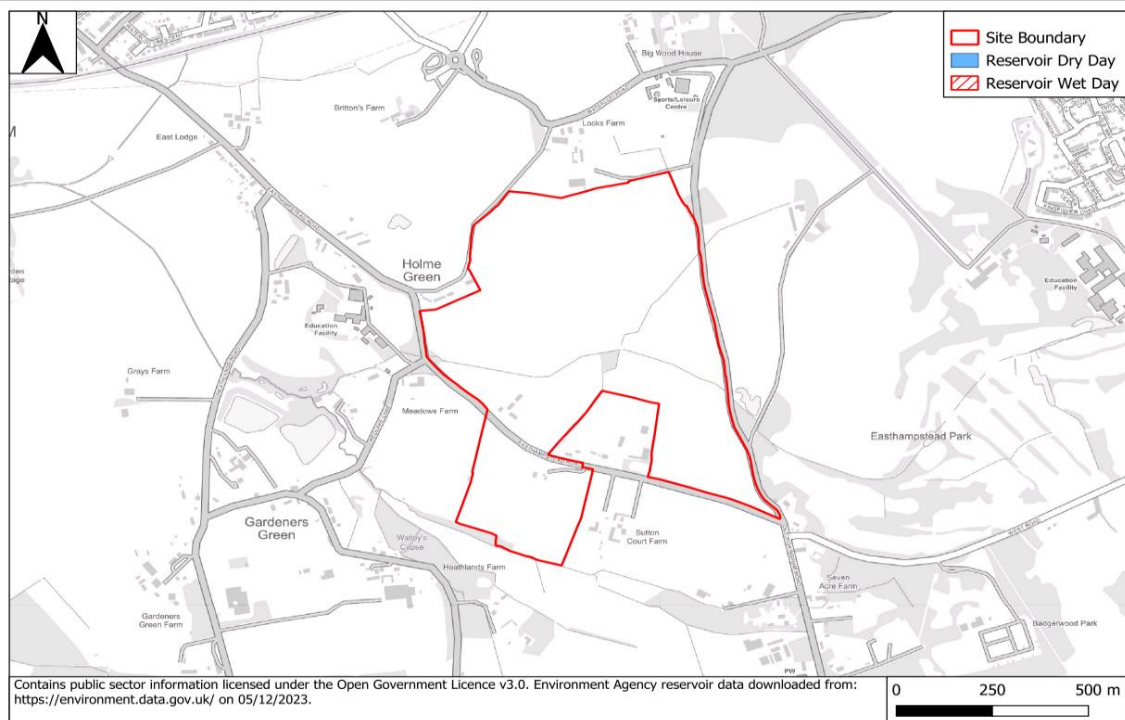
Flood Risk from Sewers

- 4.34. When exceeded, surcharged sewer networks can lead to flooding from backed up manholes and gully connections.
- 4.35. Thames Water Asset Location Plans (reference 2018_3887954) show that there are no sewers within the Site boundary. A copy of the Thames Water Asset Plans is included within Appendix 1.
- 4.36. The WBC Level 2 SFRA states that the Site *'is in a postcode area of (RG40 3) with no recorded historic sewer flooding incidents, according to available incident records from Thames Water (from 2000 up to 1 May 2022)'*.

Flood Risk from Reservoirs

- 4.37. The EA flood risk from reservoirs mapping indicates areas that would be at risk of flooding in the event of a reservoir breach.
- 4.38. Figure 12 shows the flood risk from reservoirs.

Figure 12 – EA Flood Risk from Reservoirs



- 4.39. The mapping indicates that the Site is not at risk of flooding in the event of a reservoir breach. The Site is therefore at low risk of flooding from reservoirs.

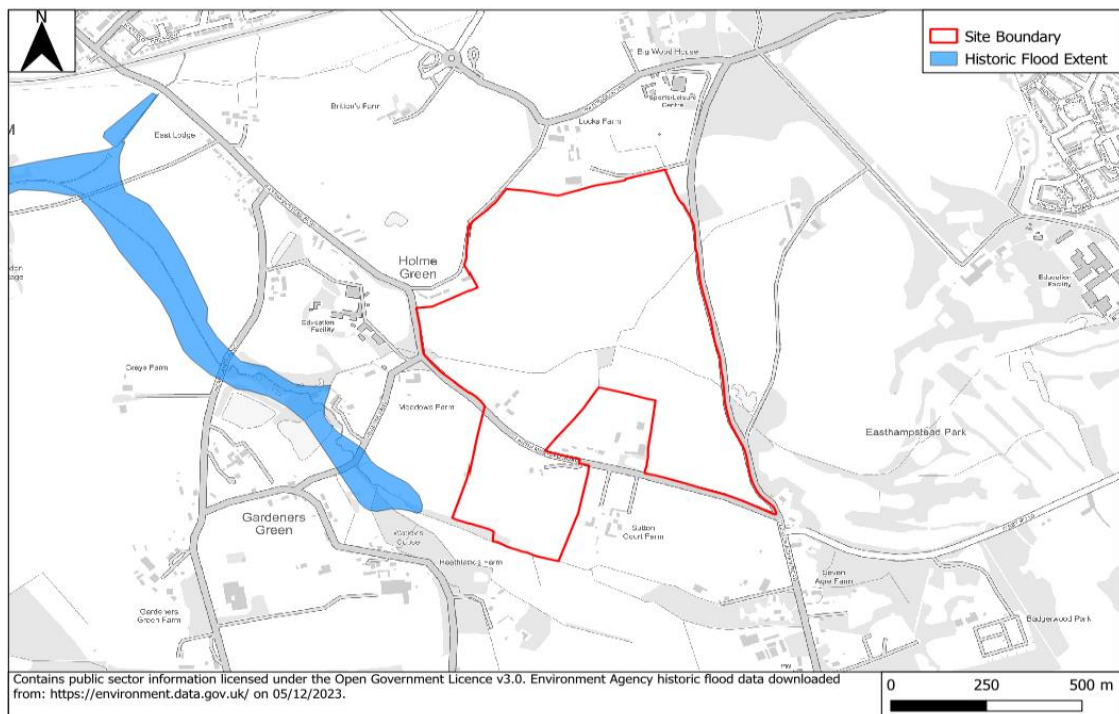
Flood Risk from Other Sources

- 4.40. The EA flood risk maps, WBC PFRA and WBC Level 1 and Level 2 SFRA indicate that the Site is not at risk of flooding from canals or other artificial sources.

Historic Flooding

- 4.41. Figure 13 shows the historic flood extent records held by the EA. The EA Historic Flood Map shows the maximum extent of recorded flood events.

Figure 13 – Historic Flood Extents



- 4.42. The EA historic flood outlines dataset indicates that land to the west of the Site was impacted by fluvial flooding from the Emm Brook in March 1947. Flooding occurred when the channel capacity was exceeded.

Flood Risk Summary

- 4.43. A summary of flooding from all sources is provided in Table 2.

Table 2 – Summary of Flood Risk

Source of Flooding	High	Medium	Low	Comments
Tidal			✓	The Site is inland and not influenced by tidal levels.
Fluvial		✓		The majority of the Site is located within Flood Zone 1. The areas adjacent to the Ordinary Watercourses are located within Flood Zones 2 and 3. The WBC Level 1 and Level 2 SFRA's confirm the EA Flood Zones. The WBC Level 2 SFRA states that the Flood Zones should be used in the absence of detailed modelling.
Pluvial		✓		The EA Flood Risk from Surface Water mapping indicates that majority of the Site is at a 'Very Low' of surface water flooding. There are a few surface water flows route within the Site with a 'Low', 'Medium' and 'High' of surface water flooding. These are associated with the watercourse corridors of the Ordinary Watercourses. There are a few isolated areas which have a 'Low' risk of surface water flooding. These areas are associated with low ground where surface water is ponding.
Groundwater		✓		The risk of groundwater flooding across the majority of the Site is considered to be medium.
Sewers			✓	There are no sewers within the Site boundary.
Reservoirs, canals and other artificial sources			✓	EA and WBC Level 1 and Level 2 SFRA mapping do not indicate the Site to be at risk of flooding from other sources.

- 4.44. The Site is deemed to be at low risk of flooding except for the Ordinary Watercourses corridors which are shown in the EA mapping to be affected by fluvial and surface water flooding and have a higher risk of groundwater flooding. Some other parts of the Site also provide flow routes for surface water.
- 4.45. For the purposes of this FRA, the fluvial flooding design flood event should be taken as the floodplain extent and flood levels derived in the fluvial 1 in 100 annual probability scenario plus an allowance for climate change for the tributary of the Emm Brook. In this instance the relevant fluvial climate change allowance is 14% which is the Central allowance for the Loddon and Tributaries Management Catchment.



- 4.46. The surface water flooding design flood event should be informed by the surface water 1 in 100 annual probability scenario plus an allowance for climate change. The 2070 Upper End allowance of 40% has been used for the design of the surface water drainage strategy. The is from the Loddon and Tributaries Management Catchment peak rainfall allowances.
- 4.47. The available data does not include the 1 in 100 annual probability plus climate change scenario modelling for either fluvial or surface water flooding. The EA Flood Map for Planning has therefore been used to inform the masterplan and a detailed site specific analysis will be undertaken at detailed design stage as necessary. This is deemed to be a precautionary approach at this stage.

5.0 Sequential Test and Exception Test

NPPF Sequential Test

- 5.1. 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.
- 5.2. The majority of the Site is located within Flood Zone 1. The areas adjacent to the Ordinary Watercourses are located within Flood Zones 2 and 3.
- 5.3. The majority of the Site is located within an area with a 'Very Low' risk of surface water flooding. There are therefore areas of 'High', 'Medium' and 'Low' flooding along the Ordinary Watercourse corridors.
- 5.4. The flood risk from other sources is low.
- 5.5. The proposed development is for a residential use. It is classed within the NPPF as 'More Vulnerable' development.
- 5.6. All of the built residential development will be located within Flood Zone 1 and areas of a 'Very Low' risk of surface water flooding, once the surface water drainage strategy is in place.
- 5.7. The Site is allocated with the WBC Local Plan. As the Site is allocated with the WBC Local Plan, the Sequential Test is deemed to have been passed as part of this. Reg19 evidence shows that development in this part of the site land is justified for development compared to alternatives. safe

Exception Test

- 5.8. The built residential development is located within Flood Zone 1. The vulnerability of the development is 'More Vulnerable'. Table 2 in the NPPF PPG sets out when the Exception Test is required.
- 5.9. The WBC Level 2 SFRA states '*the exception test is required for this site because the development classified as 'More Vulnerable' is within Flood Zone 3a or at significant risk of surface water flooding.*'
- 5.10. Paragraph 170 of the NPPF states that to pass the exception test it should be demonstrated that:
- 5.11. *a) the development would provide wider sustainability benefits to the community that outweigh the flood risk; and*
- 5.12. *the development will be safe for its lifetime taking account of the vulnerability of its users, without increasing flood risk elsewhere, and, where possible, will reduce flood risk overall.*
- 5.13. *Both elements of the exception test should be satisfied for development to be allocated or permitted.*

6.0 Flood Mitigation Strategy

Sequential Approach

- 6.1. 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.
- 6.2. The masterplan reflects this sequential approach with all residential development located in Flood Zone 1. Whilst the surface water flood maps indicate some areas within the Site to be potentially affected by surface water flooding, further analysis and site observations have confirmed the risk is actually low or will be managed through the surface water drainage strategy. The parcels for development are therefore within areas of low surface water flood risk.

Ground Floor Levels

- 6.3. The requirements for setting ground floor levels for new developments are set out in BS8533:2017 'Assessing and Managing Flood Risk in New Developments – Code of Practice'. A finished floor level of at least 300mm above the modelled level for the 1 in 100 annual probability plus climate change allowance is recommended in the WBC Level 1 SFRA.
- 6.4. The built residential development will be located outside of the fluvial floodplain for the design event, as defined by the EA Flood Map for Planning. Where required, finished floor levels will be set with an appropriate freeboard, according to WBC guidance, above the potential flood levels determined at the detailed design phase.
- 6.5. 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.

Floodplain Storage and Flow Routing

- 6.6. The proposed built residential 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.
- 6.7. Due to the nature of the crossings, some parts of the crossings may be located within the fluvial floodplain. The proposed crossings of the Ordinary Watercourse and Ordinary Watercourse tributary will be designed as part of the detailed design phase. The crossings will be designed to ensure no detrimental offsite impact and no significant impact on fluvial floodplain storage or flow routes. If necessary, floodplain compensation will be provided for any part of the crossings within the floodplain for the design flood event.
- 6.8. Some areas of the residential development are located within areas of 'High', 'Medium' and 'Low' risk of surface water flooding. The surface water flooding will be dealt with within the surface water drainage strategy and through Ordinary Watercourse corridors within the development to allow the storage and conveyance of flow.



- 6.9. As discussed in paragraphs 4.17 to 4.20, the surface water flow routes do not tie in with the topographical data and Site observations. A more detailed analysis of flows will be carried out at the detailed design phase to ensure that there are no detrimental offsite impacts.
- 6.10. The surface water flow in the Ordinary Watercourse and Ordinary Watercourse tributary will be managed within a watercourse corridor. The flows will be further analysed at the detailed design phase.
- 6.11. There is an existing ditch along the northern boundary of the Site. This ditch collects surface water from the land to the north of the Site. The ditch channels flow to the north-east corner of the Site where it flows along the eastern boundary of the Site where it joins the Ordinary Watercourse tributary.
- 6.12. The flow route in the western part of the Site will be managed by the surface water mitigation strategy. The flow originates from within the Site, therefore the flow accommodated within the surface water drainage strategy.
- 6.13. Once implemented, the built residential development will have no detrimental offsite impact on surface water floodplain storage or flow routes.
- 6.14. As with fluvial flooding, the crossings will be designed so that they have no detrimental offsite impact on surface water floodplain storage or flow routes.

Safe Access

- 6.15. The residential development areas are located outside of the fluvial flood extent. Continuous safe access for the development to the north of the Ordinary Watercourse will be via Old Wokingham Road to the east of the Site. This is located outside of the fluvial extent.
- 6.16. Vehicular access to/from the parcel to the south of the Ordinary Watercourse requires crossing of the floodplain. Subject to detailed design, the carriageway will be set above the design flood level and safe access will be available using the new crossing. The parcel to the south of the Ordinary Watercourses will also have a number of footpaths which connect the site to Easthampstead Road and which are outside the potential floodplain extent. Safe pedestrian access is available to the south of the Site.

Residual Risk

- 6.17. 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’.
- 6.18. 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.
- 6.19. 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. The ‘More Vulnerable’ residential development is located outside of the 1 in 1000 annual probability flood extent.

WBC Requirements

- 6.20. As part of the WBC Level 2 SFRA there is a site specific guidance for the South Wokingham Master Planning Area extension allocation that sets out what is required for site design and making development safe. This has been used to inform this FRA. This guidance and how this FRA demonstrates this is set out below in Table 3.

Table 3 – WBC Level 2 SFRA Guidance

WBC Level 2 SFRA Guidance	Summary of Mitigation Measures
The developer will need to show, through an FRA, that future users of the development will not be placed in danger from flood hazards throughout its lifetime. It is for the applicant to show that the development meets the objectives of the NPPF's policy on flood risk. For example, how the operation of any mitigation measures can be safeguarded and maintained effectively through the lifetime of the development. (Para 048 Flood Risk and Coastal Change PPG).	This FRA has been completed and presents a development strategy in accordance with WBC guidelines within the WBC Level 1 and Level 2 SFRA using flood risk datasets from the WBC Level 1 and Level 2 SFRA, alongside using the EA flood risk mapping. Residential development will be located within Flood Zone 1 and at a 'Very Low' risk of surface water flooding. A finished floor level of 300mm above the 1 in 100 annual probability plus climate change allowance will be applied to development which is adjacent to areas of potential fluvial flooding. Development away from areas of fluvial flood risk will have a finished floor level of 150mm above the finished ground level to mitigate the residual risk of surface water flooding. The ground will be contoured away from buildings to mitigate the residual risk of surface water flooding. All crossings of the watercourses will be designed to provide a suitable freeboard above the design flood level. Floodplain compensation will be provided, if required. The detailed design phase will include a further site specific assessment of fluvial flood risk to inform these measures.
The risk from surface water flow routes should be quantified as part of a site-specific FRA, including a drainage strategy, so runoff magnitudes from the development are not increased by development across any ephemeral surface water flow routes. A drainage strategy should help inform site layout and design to ensure runoff rates areas close as possible to pre-development greenfield rates.	There are a few surface water flow routes through the site. There is no residential development within the watercourse corridors. The surface water drainage strategy has been designed to restrict the discharge to pre development greenfield run off rates.
Arrangements for safe access and egress will need to be provided for the 1% AEP fluvial and rainfall events with an appropriate allowance for climate change, considering depth, velocity, and hazard. Design and access arrangements will need to incorporate measures, so development and occupants are safe.	Safe access is available to the north of the Ordinary Watercourse via Old Wokingham Road, which is dry during the fluvial flood event. Safe access is available to the parcel to the south of the Ordinary Watercourse via pedestrian footpaths



	which connect the development to Easthampstead Road. All built residential development will be located outside of the fluvial extent.
Provisions for safe access and egress should not impact on surface water flow routes or contribute to loss of floodplain storage. Consideration should be given to the siting of access points with respect to areas of surface water flood risk.	Safe access to the site is located within Flood Zone 1. Therefore, there is no loss of floodplain storage.
Flood resilience and resistance measures should be implemented where appropriate during the construction phase, e.g. raising of floor levels and use of boundary walls. These measures should be assessed to make sure that flooding is not increased elsewhere.	All residential properties are located outside of the fluvial flood extent. However, some properties are located adjacent to the potential floodplain. The finished flood levels at these properties should be set 300mm above the 1 in 100 annual probability plus appropriate climate change allowance. The properties that are located away from the fluvial floodplain should have a finished flood levels set at a minimum of 150mm above the finished ground level to mitigate for residual risk of surface water flooding.

7.0 Surface Water Drainage

Introduction

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

Overall Strategy

- 7.2. 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 principals. 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.
- 7.3. 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.
- 7.4. 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.
- 7.5. A surface water management strategy is therefore required to manage and reduce the flood risk posed by the surface water runoff from the site. The surface water drainage arrangements for any development site should be such that the volumes and peak flow rates of surface water leaving a developed site are no greater than the rates to the pre-development scenario, unless specific off-site arrangements are made and result in the same net effect.
- 7.6. 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.
- 7.7. 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.



- 7.8. 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.
- 7.9. 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.
- 7.10. 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.
- 7.11. As the underlying geology is not conducive to the use of infiltration type techniques (Ref: Para 3.19 above), the surface water drainage proposals will be designed to attenuate runoff with controlled discharge to the existing local watercourses i.e. the existing open field ditch on site which would be feasible point of discharge.
- 7.12. 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.
- 7.13. 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.

Pre and Post Development Areas/Rates

- 7.14. To quantify any potential increase in surface water runoff, the existing Greenfield/Pre-Development runoff rate from the site must be determined. The rates of runoff have been determined using the current 'industry best practice' guidelines as outlined in the Interim Code of Practice for SuDS. The recommended methodology for sites up to 50 hectares in area is the ICP SuDS method.
- 7.15. 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 83354 671164
 - BFIHOST: 0.395
 - BFIHOST19: 0.389
 - PROPWET: 0.29
 - SAAR6190: 662mm
 - Q_{BAR} / Q_{MED} Factor: 1.14
- 7.16. The calculated Greenfield run off discharge rates, based on a discharge rate per hectare of impermeable area, are as presented in Figure 13. The corresponding runoff outputs created with H R Wallingford Greenfield runoff rate estimation tool can be found within Appendix 4.

Table 4 – Pre-Development Runoff Rates/Volumes per Hectare

Annual Probability	Greenfield/Pre-Development Runoff Rate per hectare (l/s)	Greenfield/Pre-Development Volume 360 minute storm (m ³)
1 in 2 year event	3.3	106
QBar	3.9	-
1 in 30 year event	8.9	253
1 in 100 year event	12.4	328

- 7.17. Based on the Illustrative Masterplan, it has been conservatively estimated that the impermeable surfaces will be approximately 60% of the developable area. Depending upon how future Reserved Matters Site Layouts evolve, this percentage typically reduces slightly to around 50-55%.
- 7.18. The use of 60% 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).
- 7.19. In order to comply with best practice as stipulated in EA Report SC030219 'Rainfall Runoff Management for Developments', proposed discharge rates should be restricted to one of two methods for all storms up to and including the 1 in a 100 year storm event plus a 40% allowance for climate change.

1. Variable Greenfield discharge rates

- 7.20. This would require traditional on-site attenuation to hold back flows controlled by a complex control device, such as multiple vortex control devices. Discharge rates would be set so as not to exceed the pre-development 1in1, 1in30 and 1in100 year runoff rates set out in Figure 13 based upon the appropriate catchment area.
- 7.21. In addition to this onsite attenuation, consideration of Long Term Storage would also be necessary given the increase in discharge volume generated by the proposed development, over and above that pre-development. This storage would need to be release into the surrounding watercourses at a low rate of 2.0 l/s/ha. This would normally be controlled by a secondary attenuation area and supplemental control device.
- 7.22. The Long Term Storage (LTS) requirement calculations based upon CIRIA EQ 24.10, have been included in Appendix 4 with the calculated value being 42.4m³/ha.
- 7.23. The drainage simulation software Causeway Flow has been used to determine the combined 100 + 40% Climate Change Long Term and basic attenuation requirements per hectare of impermeable catchment. The output of this model can be seen within Appendix 4.

Table 5 – Variable Rate Discharge Attenuation Storage Volumes

Attenuation	Volume requirements (per hectare of impermeable catchment)
Attenuation Volume	857.6 m ³
Long Term Storage (Discharged at 2 l/s/ha)	42.4 m ³
Total Attenuation Required	890 m³

2. Qbar Greenfield discharge rate

- 7.24. Alternatively, all discharge flows could be restricted to Qbar. This would negate the requirement for Long Term Storage and again flows would be attenuated on site and discharged utilising an onsite control device, such as a vortex control device. This normally requires a greater volume of attenuation.
- 7.25. For the purposes of this report and to provide a robust analysis, all attenuation requirements have been calculated utilising all discharge flows restricted to Qbar, as this is normally the worst case scenario. Appendix 4 establishes the 'per hectare' calculation of Qbar as being 3.9 litres/second.
- 7.26. The use of Qbar gives a value for the average annual peak runoff rate, this provides a comprehensive SuDS scheme with the volume runoff being reduced for intense storms. However, either method described above is viable and will be investigated further during detailed design.
- 7.27. With the above in mind, and having assessed limiting the offsite discharge rate to Qbar, the anticipated attenuation volumes for a 100 year storm with a 40% allowance for climate change are as follows:

Table 6 – Calculated Attenuation Volumes based upon Qbar

Attenuation	Volume requirements (per hectare of impermeable catchment)
Total Attenuation Required	990 m³



- 7.28. It likely that at the detailed design a mixture of both strategies may be beneficial as complexities can lie within the use of the variable discharge rates especially when used at source but the reduction of the required storage volumes can have other benefits for the use of the development such as dedicated green space areas and play areas.

Surface Water Proposals

- 7.29. It is proposed to provide a network of trapped gullies, pipes and Sustainable Drainage (SuDS) features to collect the surface water runoff from impermeable areas such as roads, roofs and driveways. The traditional system will work in combination with such features as permeable paving, roadside swales and filter drains, within the residential parcels and Green Blue corridors, to filtrate, store and transport water to attenuation basins to provide attenuation storage and high-quality water benefits.
- 7.30. The final attenuation basins will drain, with a controlled discharge into the existing ordinary watercourse which traverses the site and flows under Easthampstead Road to the west.
- 7.31. The end point attenuation basins located across the site will not provide the full storage requirements on their own to attenuate the flows at the proposed discharge rate. It will therefore be necessary to provide storage features upstream of these basins to facilitate the function of the surface water drainage system. These features may come in the form of permeable paving, swales, filter drains, crate storage or even smaller attenuation basins and provide filtration at source and on plot SuDS to mimic the existing Greenfield conditions as well as enhance the Green Blue corridors through the site.
- 7.32. Drawing A218-025, a copy of which is included within Appendix 4, provides a high level overview of the drainage proposals together with the estimated requirements for the required storage and SuDS features for the parcels within the various zones of the proposed development.
- 7.33. The banks of the SuDS basins will be designed in accordance with the SuDS Manual C753 in respect to having a maximum gradient of 1 in 4 and an appropriate freeboard above the maximum water level. This allows landscaping of both wetland and wildflower mixes to provide an appropriate landscape context in the vicinity of the features through the provision of an aquatic shelf.
- 7.34. Open SuDS features will be designed so as not to compromise the safety of residents, visitors and their property. Generally open boundaries are provided, and perimeter planting could be utilised to define the extents of the features.
- 7.35. Proposed discharge rates will be restricted to QBAR for all storm events up to and including the 1 in 100 year storm event plus 40% allowance for climate change. This would negate the requirement for Long Term Storage and flows would be attenuated on site and discharged utilising an on-site flow control device such as a Hydrobrake.
- 7.36. All conveyance systems will be designed to cater for the 1:30 year storm event, in accordance with industry standard, with all attenuation features designed to allow for the 1 in 100 year storm event plus 40% climate change allowance.
- 7.37. The proposals draw reference to the DEFRA document Sustainable Drainage Systems, Non-statutory technical standards for sustainable drainage systems March 2015, as well as CIRIA C753 The SuDS Manual.



- 7.38. Current uncontrolled pluvial runoff exhibited onsite during high rainfall events will be mitigated as a result of the Development. This will occur by virtue of the change in surface from greenfield to positively drained impermeable areas, which will serve to capture, attenuate and delay surface water runoff eastwards beyond Green Lane. This will be a benefit to downstream receptors.
- 7.39. This proposal identifies the principal components of the surface water strategy and is subject to further detailed localised investigations as part of the subsequent Reserved Matters applications. These assumptions are subject to evolution as the design develops and the individual parcels are further realised.
- 7.40. There is scope to utilise source control techniques (such as swales, granular strips and permeable paving) which will assist with the reduction of larger attenuation storage features. This should be embraced and investigated as the project progresses.
- 7.41. Subject to the provision of additional geotechnical information, the attenuation basins may require partial lining to protect against the ingress of natural groundwater. Such lining provides the ability to create localised, small permanent bodies of water which adds landscaping and biodiversity opportunities to the scheme.

Exceedance Flood Routing

- 7.42. Flows in excess of the above design storms, which may flood from the network for storms in excess of the 1 in 100 year storm plus 40% climate change, will be kept within the internal road network, until such time as they can be directed into adjacent landscaping areas or existing vegetation/woodland. This ensures that no onsite or offsite residential units are afforded an increased level of protection from flood waters until such time as the rain events become significant.
- 7.43. The attenuation basins along the eastern edge of the Development are designed to provide 300mm freeboard and therefore can accept additional flood water from manholes upstream.

Water Quality Improvements

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

Table 7 – Extract from Table 26.2 SuDS Manual

Land Use	Pollution Hazard Level	Total Suspended Solids	Metals	Hydrocarbons
Residential Roofs	Very Low	0.2	0.2	0.05
Other Roofs	Low	0.3	0.2-0.8	0.05
Low traffic residential roads and non-residential parking with infrequent change.	Low	0.5	0.4	0.4
Commercial yard, parking with frequent change, other roads,	medium	0.7	0.6	0.7
Sites with heavy pollution	High	0.8	0.8	0.9

- 7.47. Historically, PPG3 documentation would recommend that pollutants were removed utilising oil separators, but since its superseding, more recent guidance has shifted to the use of SuDS features to remove pollutants; thereby providing significant improvements in treatment.
- 7.48. The use of non-mechanical features decreases the requirements for maintenance and increase natural biodiversity. That said, the SuDS Manual does not remove the possibility of utilising separators, so long as they are considered in partnership with a comprehensive overall SuDS regime.
- 7.49. 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.
- 7.50. The respective cleansing abilities of common SuDS features are given by corresponding mitigation indices within the SuDS Manual. An extract of Table 26.3 is set out below.

Table 8 – Extract from Table 26.3 SuDS Manual

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

Pond	0.7	0.7	0.5
Wetland	0.8	0.8	0.8

- 7.51. 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.
- 7.52. In line with Environment Agency guidance, before the design phase is concluded, the proposals are reviewed and analysed in order to identify potential shortcomings and to ensure that adequate volume of SuDS features are provided to mitigate the risk of pollution from each source.

SuDS Maintenance Strategy

- 7.53. For the water treatment effects of SuDS features to remain effective, a comprehensive maintenance strategy should be implemented.
- 7.54. During construction, maintenance of SuDS features should be undertaken by the Contractor. Upon completion, the assets should be passed over to the Management Company, statutory authority, or community group commissioned to maintain the features in perpetuity.
- 7.55. As part of the strategy, a regular maintenance regime will be created, which consists of several primary measures required to ensure the longevity of the system. These should be undertaken on a regular basis to ensure consistent performance. Typical maintenance activities consist of:
- Inspecting and reporting; relatively regular review of the condition identifying issues and providing resolutions. Periodic review from the maintenance contractor;
 - Litter and debris removal;
 - Grass trimming, overall cutting and localised strimming preventing blockages;
 - Weed and evasive plant control;
 - Shrub management;
 - Aquatic and shoreline vegetation management;
 - Sweeping pervious surfaces; and
 - Oil removal from proprietary systems.
- 7.56. A remedial maintenance schedule would be recommended as part of the handover of the SuDS features, remedial maintenance is required to provide repairs to the system and monitor long term damage ensuring the system remains consistently productive. The schedule could consist of;
- Structure rehabilitation and repair;
 - Infiltration surface rehabilitation;
 - Scarifying to remove "Thatch";



- Spiking or Tining the soil;
 - Air pressure treatment.
- 7.57. 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.
- 7.58. 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.

Adoption and Ownership

- 7.59. The drainage system is designed to the appropriate standards including the new Sewerage Sector Guidance (SSG), the Building Regulations and the requirement of the National Planning Policy Framework.
- 7.60. The intention of adoption and ownership of drainage and SuDS is as follows:
- Surface water sewers within development parcels to be offered for adoption to Thames Water under the Section 104 process of the Water Industry Act.
 - Surface water highway drains, gullies and leads within adopted roads to be maintained by the Highway Authority.
 - Above ground attenuation (i.e. swales and basins) to be maintained by a private maintenance company funded by residential properties or subject to agreement with the Local Authority.
 - SuDS features serving single properties, for example, permeable paved driveways to single dwellings, will be owned and maintained by the owner of that property.
- 7.61. Suitable adoption and maintenance regimes for SuDS should be submitted in support of the Reserved Matters application.

8.0 Foul Water Drainage

Introduction

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

Overall Strategy

- 8.2. 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.
- 8.3. 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.
- 8.4. Discussions are currently ongoing with Thames 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.
- 8.5. Two possibilities for the general direction of the ultimate foul discharge point currently exist. Option one is to pump flows North, to the strategic pump station located on the SDL which pumps flows underneath the existing railway line eventually discharging to the Sewage Treatment plant to the North of Dalley Road in Wokingham. The alternative option is to pump flows South, eventually discharging to the Easthampstead Sewage Treatment works located to the East of Old Wokingham Road.
- 8.6. The topography of the Site and the location and invert of the existing foul sewers in either direction will requires wastewater from the development to be pumped as it cannot drain by gravity.
- 8.7. Discussions are ongoing with Thames Water regarding the exact location(s) and specifications of possible pump stations that will be required to provide sufficient capacity to service the development.
- 8.8. Notwithstanding this, the delivery of the proposed on-site foul water sewers will be designed in collaboration with Thames Water as approving body in accordance with the new Sewerage Sector Guidance (SSG) and will be offered to Thames 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 Thames Water as part of the overall adoption process.

Adoption and Ownership

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

9.0 Conclusion

Flood Risk

- 9.1. The EA Flood Risk mapping has been reviewed alongside the Wokingham Borough Council (WBC) Preliminary Flood Risk Assessment (PFRA) and Level 1 and Level 2 Strategic Flood Risk Assessment (SFRA).
- 9.2. This Flood Risk Assessment (FRA) concludes that:
- The majority of the Site is shown to be within Flood Zone 1 according to the EA Flood Map for Planning. The areas adjacent to the Ordinary Watercourse and Emm Brook are shown to be located within Flood Zones 2 and 3. As there is no detailed modelling the EA Flood Map for Planning extent has therefore been used to inform the masterplan, with all residential built development located outside of the flood extents.
 - The EA Flood Risk from Surface Water mapping indicates that majority of the Site is at a 'Very Low' of surface water flooding. There are flow routes of 'Low', 'Medium' and 'High' risk of surface water flooding which is associated with the Ordinary Watercourses through the Site. However further analysis and site observations suggest that these flow routes would not actually be realised on Site given the physical features at the Site boundaries.
 - The WBC Level 1 SFRA mapping indicates the potential susceptibility to groundwater flooding and also the expected depth to groundwater. In assessing the site allocation, the Level 2 SFRA suggests that an appropriate assessment of the groundwater regime may be required. If necessary this can be completed at detailed design.
 - Thames Water asset maps show no sewers within the Site boundary. The Site is considered to be at low risk of flooding from sewers.
 - The Site is not at risk of flooding in the event of a reservoir breach.
- 9.3. In summary the majority of the Site is at a low risk of flooding from all sources although there are some areas particularly along the Ordinary Watercourse and Emm Brook where further assessment may be required at a detailed design stage.

Sequential Test and Exception Test

- 9.4. The majority of the Site is located within Flood Zone 1. The areas adjacent to Emm Brook and the Ordinary Watercourses are located within Flood Zones 2 and 3 as shown from EA strategic mapping.
- 9.5. The Site forms part of the South Wokingham Strategic Development Land which is allocated within the WBC Local Plan. The Sequential Test is deemed to have been carried out as part of this.
- 9.6. The WBC Level 2 SFRA states '*The Local Authority will need to confirm that the sequential test has been carried out in line with national guidelines. The sequential test will need to be passed before the exception test is applied*'.

- 9.7. The residential development is classed as 'More Vulnerable'. The WBC Level 2 SFRA states '*The exception test is required for this site because the development classified as 'More Vulnerable' is within Flood Zone 3a or at significant risk from surface water flooding*'.

Mitigation Strategy

- 9.8. For any dwellings located close to the floodplain for the design event, finished floor levels will be set 300mm above the modelled level for the 1 in 100 annual probability plus climate change allowance in line with the WBC Level 1 SFRA.
- 9.9. 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.
- 9.10. The watercourse crossings will be designed at the detailed design phase. The design will ensure that there are no negative off-site impacts. If necessary, floodplain compensation will be provided.
- 9.11. The surface water flow along the Ordinary Watercourses will be managed through watercourse corridors which maintain the conveyance of flow. Flow coming from the north onto the Site is collected by a drain to the north of the northern boundary of the Site and channelled in an easterly direction within the extending drainage ditch network. The western flow route will be managed through the surface water drainage strategy.
- 9.12. The proposed surface water drainage strategy will manage the flood risk posed by uncontrolled surface water runoff from the Site. Any increase in surface water run-off can be managed using SuDS source control techniques as well as attenuation features to provide storage in extreme storm events. This provides the minimum of two treatment storage stages which is in accordance with the recommendations of CIRIA C753. All surface water drainage systems will be designed to restrict drainage discharge rates to QBAR runoff rates and store the balance of water for all events up to and including the 1 in 100 year event including an allowance for a 40% increase in rainfall intensities as a result of climate change and urban creep.
- 9.13. The WBC Level 2 SFRA has considered this Site (South Wokingham Master Planning Area extension) and sets out key criteria to be addressed as part of any development of the Site. These are summarised in Table 9.

Table 9 - WBC Level 2 SFRA Key Message For The South Wokingham Master Planning Area Extension

Key Message	The FRA Demonstrates That
Development is steered away from the south border of the Site as this affected by both fluvial flooding and surface water flooding.	The residential areas of the Site are located away from the south border of the wider allocated development site.
A carefully considered and integrated flood resilient and sustainable drainage design is put forward, with development to be steered away from the areas identified to be at risk from both fluvial and surface	Residential areas of the Site are located away from the south border and south-east corner of the wider allocated site.

water flooding, particularly along the southern border and south east corner of the site.	The residential development will be located outside of the fluvial floodplain and an area of 'Very Low' risk of surface water flooding.
Safe access and egress can be demonstrated in the 1% AEP plus 40% climate change surface water event. This includes measures to reduce flood risk along these routes such as raising access, but not displacing flood water elsewhere. A detailed hydraulic model of Emm Brook along the southern border of the site and the unnamed watercourse within the site may be required at FRA stage to accurately represent the risk from these watercourses.	The majority of the Site is located within Flood Zone 1. To the centre of the Site there is an Ordinary Watercourse with an area of Flood Zone 2 and Flood Zone 3 associated with this. To the north of the Ordinary Watercourse, safe access and egress during a fluvial flood event can be achieved via Old Wokingham Road. This is outside the fluvial extent. The parcel to the south of the Ordinary Watercourses has a number of pedestrian footpaths which connect the Site to Easthampstead Road. A more detailed assessment of fluvial flooding for the Site will be undertaken as part of the detailed design.
A site-specific FRA demonstrates that the site is not at an increased risk of flooding in the future and that development of the site does not increase the risk of surface water flooding on the site and to neighbouring properties.	This FRA has reviewed all sources of flooding. The residential development is located outside of the fluvial and surface water flood extents. There will be no increase in offsite flood risk as a result of the Proposed Development.
If any flood mitigation measures implemented are tested to check they will not displace water elsewhere (for example if land is raised to permit development on one area, compensatory flood storage will be required in another.	The crossings of the watercourses will be designed a suitable freeboard above the design flood event and in line with local guidance. If required, floodplain compensation will be provided.
The development reviews the suitability of the Emm Brook model to inform this site and carries out any further modelling work deemed necessary.	Crossings of the Emm Brook will be set a suitable freeboard above the design flood event. If further modelling work or other detailed assessment is required to inform this, it will be carried out at the detailed design stage.

Summary

- 9.14. 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 1 - Plans

Illustrative Masterplan

Topographical Survey

Thames Water Pre-Planning Capacity Enquiry

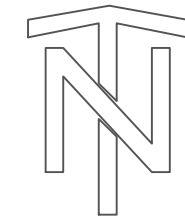
Thames Water Sewer Asset Plan



WKH2104
22/12/2023

PROJECT EIA ILLUSTRATIVE MASTERPLAN
PHASE 4B, 4C & 4C(i) OF THE SOUTH
WOKINGHAM SDL EXTENSION

Drawing No: SK02.4.1G
Scale: 1:2500 @A1



1. This drawing is copyright and its use or reproduction without the written permission of Usk Land Survey is prohibited
2. Due to unavoidable inaccuracies during the reproduction process these drawings should be checked. Where discrepancies are critical Usk Land Survey should be requested to confirm dimensions based on survey information. Scales appearing at the base of this plan are only indicative of the scale of the drawing.
3. This plan has been prepared in accordance with B.S. 1192, Part 1 in relation to scale and dimension. Tolerances permitted within the British Standard should be observed.
4. All dimensions and particulars should be checked on site. Any discrepancies should be reported to Usk Land Survey before any work commences.

SURVEY LEGEND

AB	AIR BRICK	LP	LAMP POST
AV	B	MB	MOORING BOLLARD
B	BOLLARD	MF	MOCELLANEOUS FENCING
BA	BELTIN BEACON	MM	MANHOLE
BO	BOUNDARY	MKR	MARKER
BY	BURNED FENCE	MR	MORNING LINE
BL	BEL LEVEL	MF	METAL RAILING FENCE
BRK	BROOK	MS	MILE STONE
BS	BUS STOP	NC	NOTICE BOARD
BSK	BUS STOP	NB	NATURAL BARRIER AUTHORITY
BW	BRICK WALL	OH	OVERHEAD CABLE
BWF	BARRIED WIRE FENCE	OS	ORNANCE SURVEY
CB	CABLE CROSSING FENCE	OR	OPEN STATE RAILINGS
CC	CORRUGATED IRON FENCE	P	PILE
CD	COVER	PR	PILLAR BOX
CLF	CHAIN LINK FENCE	PM	PARKING MARKER
CONC	CONCRETE	PT	POST
CP	CONCRETE POST	PRF	POST & RAIL FENCE
CR	CORNER	PS	POST & SIGN FENCING
CTV	CYCLE TRACK	PWF	POST & WIRE FENCE
CU	CULVERT	RB	RIGHT BANK
CUV	CULVERT	RD	ROADSIDE EYE
DK	ROAD KERB	RS	ROAD SIGN
DR	DECK LEVEL	RTW	RETAINING WALL
DP	DOWNPURSE	RWP	RANNAHUR PIER
DPC	DRIP PROOF FLOORING	RO	ROAD CLOSURE
DR	DRIVE	SD	STAND PIPE
DWB	DRAIN WASTE BIN	SK	SKAFFARY
EA	ENVIRONMENT AGENCY	SL	SOFTT LEVEL
ED	ELECTRICITY BOX	SMH	SMALL WATER MANHOLE
ECB	ELECTRICITY CABLE FENCE	SN	SIGN
ECP	ELECTRICITY CABLE PIT	SP	SIGN POST
EMH	ELECTRICITY MANHOLE	ST	STATION
EL	ELECTRICITY POLE	SV	SWITCH VAULT
ETL	ELECTRICITY TRANSMISSION LINE	SW	SWEEP WIRE FENCE
FA	FOOTPATH	SWB	SWEEP WIRE MARK
FR	FOOTBRIDGE	TCP/TP	TELEPHONE CALL BOX/POST
FH	FIRE HYDRANT	TC	TELECOM CABINET
FMM	FLOOD MARKER	TM	TELECOM MANHOLE
FL	FLOOR LEVEL	TL	THRESHOLD LEVEL
FM	FLOOD MARK	TRF	TRAFFIC LIGHT
FWM	FOUL WATER MANHOLE	TLB	TRAFFIC LIGHT BOX
GL	GROUND LEVEL	TR	TRAMWAY POLE
GM	GROUND MARK	TRS	TRIMMER RUBBING STRIP
Q	QUAD	TRU	TRUSS
QL	QUAD LEVEL	TUB	TUBULAR STEEL RAILINGS
QW	QUAD MARKER	VN	VENT PIPE
QV	QUAD VALVE	W	WASTE BIN
IC	INSULATION CHAMBER	WL	WATER LEVEL/WATER LINE
IR	IRON RAILING FENCE	WM	WATER METER
IRF	IRON RAILING FENCE	WMF	WIRE MESH FENCE
IT	INTERFERENCE FENCE	WR	WIRE ROPE POST
JB	JUNCTION BOX	WPR	WATER POST & RAIL FENCE
KL	KILN	YD	YARD GULLY
LB	LEFT BANK		
LF	LEAFPOST		

(Abbreviations apply to survey data only)

STN	CO-ORDINATES	LEVEL	STN	CO-ORDINATES	LEVEL
NATIONAL GRID.			CONTROL USED:		
			TYPE REFERENCE		VALUE(M)
ALL LEVELS RELATE TO ORDNANCE DATUM NEWLYN.					

 **Usk Land Survey**
No.40 ABERGAVENNY ROAD, USK, NP15 1SB
TEL: 01291 673491 MOB: 0787 2560386
EMAIL jonbarton@usklandsurvey.co.uk

Site Easthampstead Road
Wokingham
RG40 3BQ

Drawing No.	Revision
-------------	----------

Sheet 5 | —

Drawing Scale: 1:1250 Job Ref 1328

CAD Filename: 1328.dwg Plot Scale: 1=1

©2022 Usk Land Survey. All rights Reserved



Jonathan Shuttleworth

Abley Letchford Partnership
3 Tealgate
Charnham Park
Hungerford
RG17 0YT



29th November 2023

Pre-planning enquiry: Capacity concerns

Site: Land to the East of Easthampton Road and West of Old Wokingham Road, Priors Farm, Wokingham, Berkshire, RG40 3BQ

Dear Jonathan

Thank you for providing the information on your proposal, the construction of 5250 general houses over a 10-year period. The preferred ultimate connection point would be to the Waste Treatment Works to the south, located at co-ordinates 484171, 166256. This would reduce pumping or eliminate the need for it entirely. A more complex alternative would be to utilise multiple pump stations to join the infrastructure located to the north passing through the railway line with the ultimate destination being the waste water treatment works located at co-ordinates 481346, 169950.

We have completed the assessment of the foul water flows based on the information submitted in your application with the purpose of assessing sewer capacity within the existing Thames Water sewer network.

Foul Water

We've assessed your **foul water** proposals and concluded from our initial review, that our sewerage network may not have sufficient capacity to meet your requirements.

In order to ensure we make the appropriate upgrades – or 'off-site reinforcement' – to serve your development, we'll need to carry out modelling work and, if required, design a solution and build the necessary improvements. This work is done at our cost. Once we've begun modelling, we may need to contact you to discuss changing the connection point for capacity reasons. Please note that we'll pay the cost of covering any extra distance if the connection needs to be made at a point further away than the nearest practicable point of at least the same diameter.

How long could modelling and reinforcement take?

Typical timescales for a development of your size are:

Modelling: 8 months

Design: 6 months

Construction: 6 months

Total: 20 months

If the time you're likely to take from planning and construction through to first occupancy is longer than this, we'll be able to carry out the necessary upgrades in time for your development. If it's shorter, please contact me on the number below to discuss the timing of our activities.

What do you need to tell us before we start modelling?

We're responsible for funding any modelling and reinforcement work. We need, though, to spend our customers' money wisely, so we'll only carry out modelling once we're confident that your development will proceed.

To have this confidence, we'll need to know that you **own the land and have either outline or full planning permission. The proposed build programme will also be useful.** Please provide this information to us as soon as you have it.

If the modelling shows we need to carry out reinforcement work, then before we start construction, we'll need you to supply us with notification that you've confirmed your F10 – Notification of construction project - submission to the Health and Safety Executive.

Surface Water

Where disposal of surface water is other than to a public sewer, the applicant shall ensure that approval for the discharge has been obtained from the appropriate authorities.

Please Note

All connection requests are subject to a full Section 106 (Water Industry Act 1991) application before the Company can confirm approval to the connection itself. Please also note that capacity in the public sewerage system cannot be reserved. Please make sure you submit your connection application giving us at least 21 days' notice of the date you wish to make your new connection/s.

The discharge of non-domestic is not permitted until a consent has been issued by Thames Water. If anything, other than domestic sewage is discharged into the public sewers without the above agreement an offence is committed, and the applicant will be liable to the penalties contained in Section 109(1) (WIA 1991).

If discharge of effluent from trade processes is sort applicants should contact Trade Effluent prior to seeking a connection approval, to discuss trade effluent consent and conditions of discharge. For Trade Effluent queries and to apply for Discharge Consents please call 0203 577 9200 or email trade.effluent@thameswater.co.uk.

The views expressed by Thames Water in this letter are in response to this pre-development enquiry at this time and do not represent our final views on any future planning applications made in relation to this site.

Regards

Steve Knight

Developer Services – Adoptions Engineer

0800 009 3921 – Help Desk

Further contacts:

Waste Water queries

Should you require verification of the invert levels of public sewers, by site measurement, you will need to approach the relevant Thames Water Area Network Office for permission to lift the appropriate covers. This permission will usually involve you completing a TWOSA form. For further information please contact our Customer Centre on Tel: 0845 920 0800. Alternatively, a survey can be arranged, for a fee, through our Customer Centre on the above number.

If you have any questions regarding sewer connections, budget estimates, diversions, building over issues or any other questions regarding operational issues please direct them to our service desk. Which can be contacted by writing to:

Developer Services (Waste Water)
Thames Water
Clearwater Court
Vastern Road
Reading
RG1 8DB

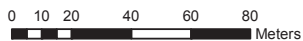
Tel: 0800 009 3921
Email: developer.services@thameswater.co.uk

Clean Water queries

Should you require any advice concerning clean water operational issues or clean water connections, please contact:

Developer Services (Clean Water)
Thames Water
Clearwater Court
Vastern Road
Reading
RG1 8DB

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



Scale: 1:1790
Width: 500m
Printed By: SASirvat
Print Date: 09/10/2018
Map Centre: 482750,168250
Grid Reference: SU8268SE

Comments:

ALS/ALS Standard/2018_3887954

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

REFERENCE	COVER LEVEL	INVERT LEVEL
711A		
5450	62.13	60.58
7050	61.15	57.55
6250		
6151	60.28	58.3
6154	59.72	58.72
6251	61.6	59.95
7153	61.64	60.35
8150	62.17	59.12
5152	59.72	57.23
7155	60.99	57.97
6102	59.7	58.4
8050	61.5	58.62
7156	61.2	59.9
7151	61.17	58.77
5101	59.42	57.57
8151	62.05	59.45
6451	62.83	61.34
6155	60.05	59.14
521C		
521K		
521G		
6152	60	58.35
521B		
7157	61.13	58.93
521D		
521F		
711B		
541A		

REFERENCE	COVER LEVEL	INVERT LEVEL
7158	60.72	58.77
7159	60.43	57.69
7101	60.71	58.71
6350	62.38	60.25
6103	60.31	58.31
6450	62.11	60.43
7152	61.62	60.32
7350	62.13	60.07
5050	59.15	57.29
7102	61.15	58.9
6153	59.67	57.92
6101	59.8	58.03
8250		
7250	61.46	60.39
7154	61.22	60.02
7150	62.17	59.4
5151	58.92	56.4
5150	58.25	55.86
6150	60.02	57.2
521J		
521I		
521H		
521A		
531A		
5201	60.15	58.99
521E		
711D		
711C		



0 45 90 180 270 360
Meters

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

Scale: 1:7161
Width: 2000m
Printed By: SAsirvat
Print Date: 09/10/2018
Map Centre: 483465,167688
Grid Reference: SU8367NW

Comments:



Public Sewer Types (Operated & Maintained by Thames Water)

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

Notes:

- 1) All levels associated with the plans are to Ordnance Datum Newlyn.
- 2) All measurements on the plans are metric.
- 3) Arrows (on gravity fed sewers) or flecks (on rising mains) indicate direction of flow.
- 4) Most private pipes are not shown on our plans. as in the past, this information has not been recorded.
- 5) 'na' or '0' on a manhole level indicates that data is unavailable.

Sewer Fittings

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

	Air Valve
	Dam Chase
	Fitting
	Meter
	Vent Column

Operational Controls

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

	Control Valve
	Drop Pipe
	Ancillary
	Weir

End Items

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

	Outfall
	Undefined End
	Inlet

Other Symbols

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

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

Areas
Lines denoting areas of underground surveys, etc.

	Agreement
	Operational Site
	Chamber
	Tunnel
	Conduit Bridge

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

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

Terms and Conditions

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

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

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

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

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

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

Ways to pay your bill

Credit Card	BACS Payment	Telephone Banking	Cheque
Call 0845 070 9148 quoting your invoice number starting CBA or ADS / OSS	Account number 90478703 Sort code 60-00-01 A remittance advice must be sent to: Thames Water Utilities Ltd., PO Box 3189, Slough SL1 4WW. or email ps.billing@thameswater. co.uk	By calling your bank and quoting: Account number 90478703 Sort code 60-00-01 and your invoice number	Made payable to ' Thames Water Utilities Ltd ' Write your Thames Water account number on the back. Send to: Thames Water Utilities Ltd., PO Box 3189, Slough SL1 4WW or by DX to 151280 Slough 13

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



Search Code

IMPORTANT CONSUMER PROTECTION INFORMATION

This search has been produced by Thames Water Property Searches, Clearwater Court, Vastern Road, Reading RG1 8DB, which is registered with the Property Codes Compliance Board (PCCB) as a subscriber to the Search Code. The PCCB independently monitors how registered search firms maintain compliance with the Code.

The Search Code:

- provides protection for homebuyers, sellers, estate agents, conveyancers and mortgage lenders who rely on the information included in property search reports undertaken by subscribers on residential and commercial property within the United Kingdom
- sets out minimum standards which firms compiling and selling search reports have to meet
- promotes the best practise and quality standards within the industry for the benefit of consumers and property professionals
- enables consumers and property professionals to have confidence in firms which subscribe to the code, their products and services.

By giving you this information, the search firm is confirming that they keep to the principles of the Code. This provides important protection for you.

The Code's core principles

Firms which subscribe to the Search Code will:

- display the Search Code logo prominently on their search reports
- act with integrity and carry out work with due skill, care and diligence
- at all times maintain adequate and appropriate insurance to protect consumers
- conduct business in an honest, fair and professional manner
- handle complaints speedily and fairly
- ensure that products and services comply with industry registration rules and standards and relevant laws
- monitor their compliance with the Code

Complaints

If you have a query or complaint about your search, you should raise it directly with the search firm, and if appropriate ask for any complaint to be considered under their formal internal complaints procedure. If you remain dissatisfied with the firm's final response, after your complaint has been formally considered, or if the firm has exceeded the response timescales, you may refer your complaint for consideration under The Property Ombudsman scheme (TPOs). The Ombudsman can award compensation of up to £5,000 to you if he finds that you have suffered actual loss as a result of your search provider failing to keep to the Code.

Please note that all queries or complaints regarding your search should be directed to your search provider in the first instance, not to TPOs or to the PCCB.

TPOs Contact Details

The Property Ombudsman scheme
Milford House
43-55 Milford Street
Salisbury
Wiltshire SP1 2BP
Tel: 01722 333306
Fax: 01722 332296
Email: admin@tpos.co.uk

You can get more information about the PCCB from www.propertycodes.org.uk

PLEASE ASK YOUR SEARCH PROVIDER IF YOU WOULD LIKE A COPY OF THE SEARCH CODE



Appendix 2 - EA Product 4 Data

EA Product 4 Data

**National generalised (JFLOW) flood levels for
Our Ref: THM334165**

JFLOW includes the following information:

Ordnance Survey 1:25k colour raster base mapping;
Flood Zone 2 and Flood Zone 3;
Unique identifiers (for cross referencing to the water levels);

Flood defence locations (where available/relevant) and unique identifiers;
Flood Map flood storage areas (where available/relevant);
Statutory (Sealed) Main River (where available within map extents);

A table showing:

i) X/Y coordinate locations, unique identifiers and levels for *undefended* scenarios.

South Wokingham SDL, RG40 3BQ

Please note:

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

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

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

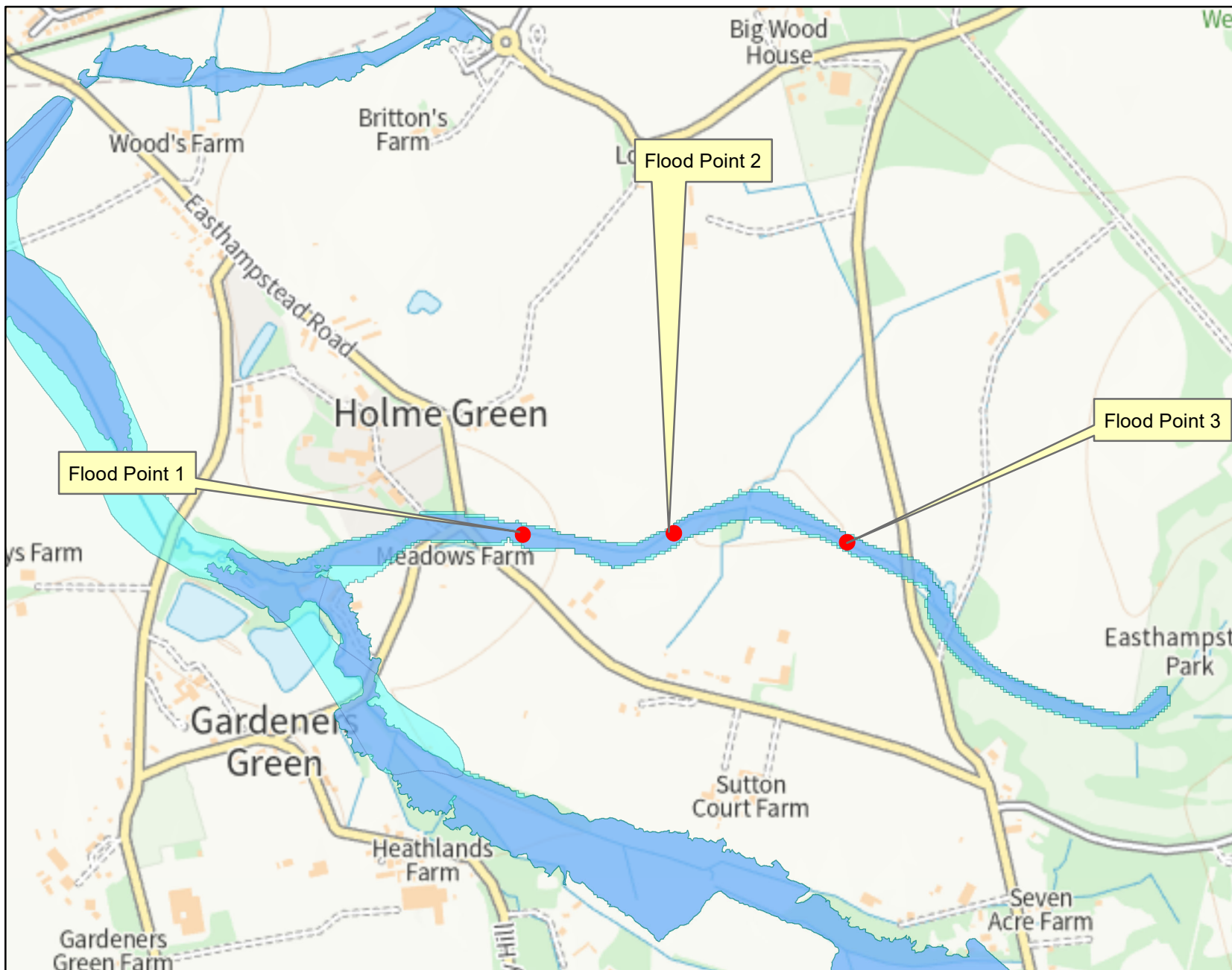
This letter is not a Flood Risk Assessment. The information supplied can be used to form part of your Flood Risk Assessment. Further advice and guidance regarding Flood Risk Assessments can be found on our website at:

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

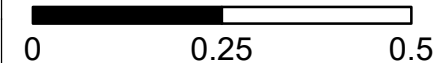
If you would like advice from us regarding your development proposals you can complete our pre application enquiry form [application-enquiry-form-preliminary-opinion](#)

Flood Map for Planning centred on South Wokingham SDL, RG40 3BQ

Created on 16/11/23 REF: THM334165



Kilometres



Legend

- Main River
- Flood Map - Flood defences
- Flood Map - Flood Storage Areas
- Flooding from rivers or sea (FZ3)
- Extent of extreme flood (FZ2)
- Floodplain Node

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

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

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

National generalised (JFLOW) flood levels

THM334165

The modelled flood levels for the closest most appropriate points for your site that are provided below:

Grid cell reference	Easting	Northing	Maximum Depths (m)		
			1% annual probability	1% annual probability + (20%)	0.1% annual probability
Flood Point 1	483060	167055	1.10	1.10	1.37
Flood Point 2	483333	167043	0.19	0.19	0.34
Flood Point 3	483637	167035	0.50	0.50	0.70

Grid cell reference	Easting	Northing	Maximum Levels (mAOD)		
			1% annual probability	1% annual probability + (20%)	0.1% annual probability
Flood Point 1	483060	167055	56.27	56.27	56.34
Flood Point 2	483333	167043	58.30	58.30	58.45
Flood Point 3	483637	167035	59.59	59.59	59.79



Appendix 3 - LLFA Developer Checklist

Wokingham Borough Council Developer Checklist

Planning Application Drainage Checklists

Major Development Outline Applications

Outline planning applications for Major Developments must include the following information and details on the proposed drainage strategy and system(s).

Ref.	Documentation required	Requirement met/included
	The applicant shall submit a description of the proposed drainage system(s) with an explanation of key operating principles and design decisions including but not necessarily limited to: ■ Identification of the destination of discharge (in accordance with Building Regulation Part H hierarchy) with appropriate justification for the selection; ■ Identification of proposed points of connection(s) to water bodies, sewers, public surface water sewers or highway drains etc.; ■ Evidence of agreement in principal from key third parties whose systems the proposed drainage system will need to connect / impact (Environment Agency, Lead Local Flood Authority, Thames Water or adjacent landowner); ■ Identification of the SuDS techniques that will be applied at the site with appropriate justification for the selection; ■ A description of how water will be collected and dealt with across the site by the proposed SuDS techniques including what volumes are to be stored where; ■ A description of the water quality treatment measures applied to surface water as it drains the site; ■ Where necessary a description of how the proposed system(s) will deal with surface water overland flow flooding originating from off-site areas; ■ Where necessary, an explanation of why it is not reasonably practicable to achieve any of the non-statutory technical standards for sustainable drainage systems (March 2015); ■ Where proposing discharge to ground; evidence to support proposed infiltration rates used in initial calculations. This should include nearby borehole logs, geological mapping and if available any geotechnical investigations, infiltration tests and records of groundwater monitoring. Consideration shall also be given to the implications of any local Source Protection Zones; ■ Where necessary, identification of any mechanical or electrical features necessary for the effective operation of the drainage strategy; and; ■ Proposals for the adoption and maintenance of the entire drainage system(s), including a schedule, with written agreement in principal from the adopting/maintaining body.	
	Plans & Drawings Required	

	The applicant shall submit plans defining the proposed drainage system including but not necessarily limited to: ■ Topographic survey of the site including local surface water drainage features; ■ Position of the site relative to surrounding flood sources, including where necessary identification of surface water/groundwater flows entering the development from adjacent land; ■ Where necessary definition of sub-catchments within the site; ■ A conceptual plan of the proposed drainage system(s) identifying the proposed point(s) of outfall, position of SuDS techniques / drainage features, the attenuation features, conveyance routes (including exceedance routes) comprising the drainage system(s); and ■ A thematic plan of the existing and proposed developments identifying land uses / coverings significant in informing discharge rates.	
	Calculations Required	
	Overview design calculations and design parameters to demonstrate conformity with the design criteria for the site. These should include: ■ Demonstration through calculation of the existing and proposed (unmitigated) development discharge rates for the 1, 30 and 100 year (including allowance for the effects of climate change) design storm events; ■ Demonstration through calculation(s) of the volumes of surface water storage required to attenuate site discharges to pre-development / agreed discharge rates; ■ Demonstration through calculation(s) that the proposed drainage system(s) will not result in flooding off site under the 100 year return period design storm including allowance for climate change; and ■ Demonstration through calculation(s) that provision is made to meet long term storage volumes required for the site, unless discharge rates have been restricted to QBar for all storm events up to and including the 1 in 100 year including allowance for climate change	

Additional requirements for a large site or multi-plot development (including Strategic Development Locations).

Ref.	Detail required	Requirement met/included
	■ Plans demonstrating the phasing of drainage infrastructure (in keeping with wider development phasing proposals, demonstrating how flood risks and drainage will be managed throughout and on completion of the development.	



Appendix 4 - Drainage Strategy

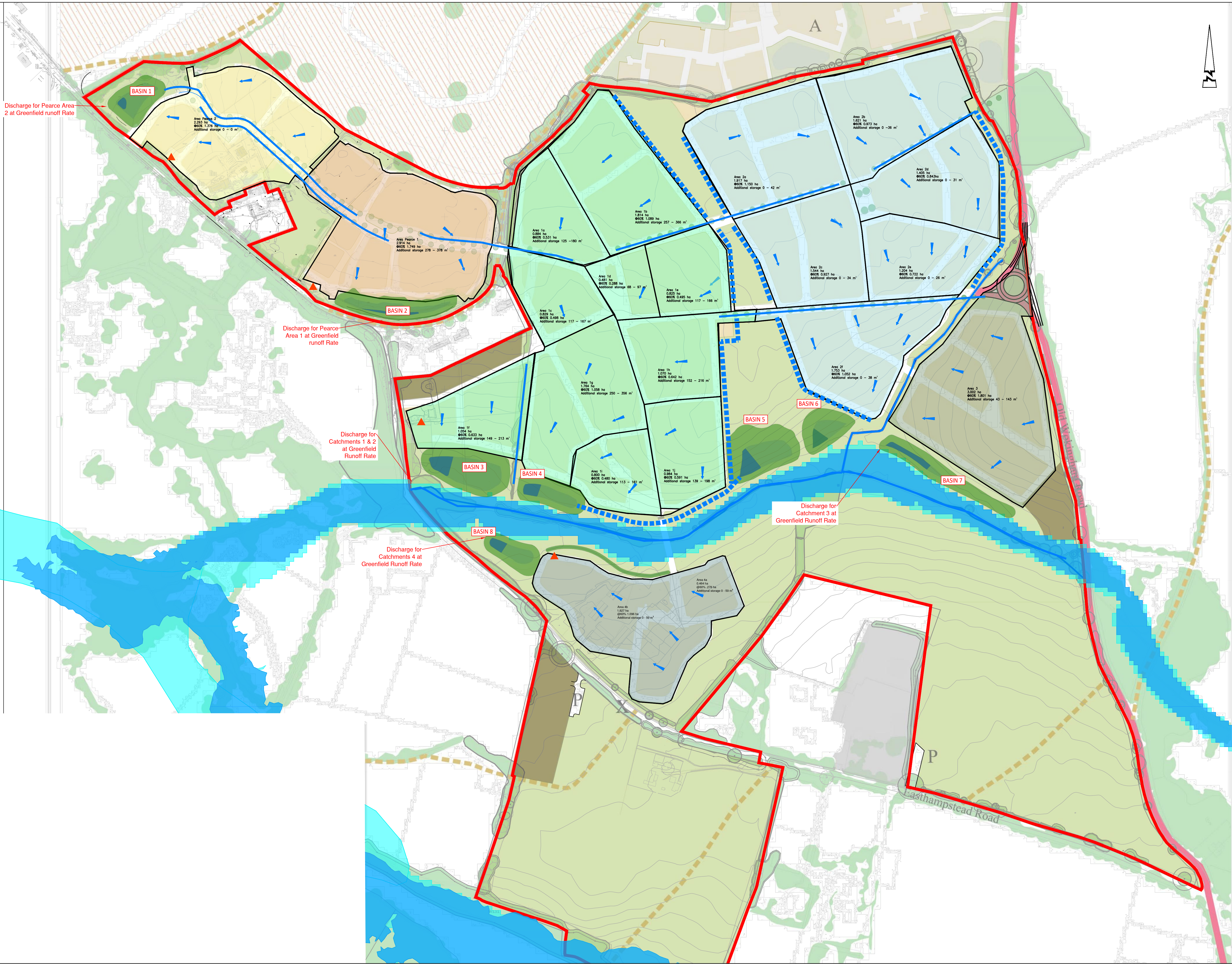
Drainage Strategy Plan

Greenfield Runoff Rates

Long Term Storage Calculations

Per Hectare Storage Calculations

Storage Calculator



© ABLE LETCHFORD PARTNERSHIP LTD.
This drawing should not be reproduced without consent.

- NOTES:
1. Do not scale.
 2. Refer to all other Project Drawings and supporting notes.
 3. All levels are in meters above Ordinance Datum.
 4. Surface Water Strategy is indicative and based on masterplanning information at the time of production.
 5. All Surface Water Calculations were Undertaken Using Causeway Flow Drainage Software and are subject to detailed design.
 6. All Outfalls have been visually determined during site walkover and are assumed viable to be utilized as surface water outfalls.

Return Period	Flow (l/s/ha)
0.5yr	3.87
1 in 2	5.29
1 in 50	8.91
1 in 100	12.36

Longterm Storage	
rate	2 l/s/ha
Volume	42.4 m ³ /ha

	Estimated storage required	Estimated storage required
	using 0.5yr flow	using 1 in 100 flow
Zone 1	6893 m³	6893 m³
Zone 2	5043 m³	5043 m³
Zone 3	1789 m³	1789 m³
Zone 4	1055 m³	1055 m³
Zone 5	1055 m³	1055 m³
Zone 6	1055 m³	1055 m³

Key:

- Application Boundary

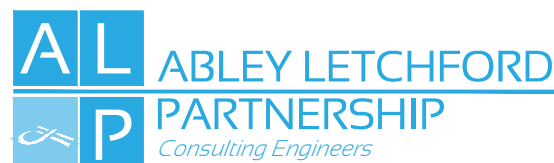
- Flood Zone 2
- Flood Zone 3

Proposed Drainage

- Attenuation Basin
- Flow Arrow
- Basin 1 Catchment
- Basin 2 Catchment
- Basin 3 & 4 Catchment
- Basin 5 & 6 Catchment
- Basin 7 Catchment
- Basin 8 Catchment
- Potential Foul Pump Station Location

- 2m wide Swale/Filter Drain
- 3m - 5m wide Swale/Filter Drain

P5	07/24	Layout updated to latest version	LC	JS
P4	07/24	Discharge Points added	LC	JS
P3	03/24	Basins 1 & 2 updated	LC	JS
P2	01/24	Swales/filter drain added showing basin connections.	LC	JS
P1	12/23	First Issue	LC	JS
Rev	Date	Description	Drawn	Checked



3 Tealgate, Charnham Park
Hungerford, Berkshire RG17 0YT
www.alpce.co.uk Tel: 01488 684390

Client

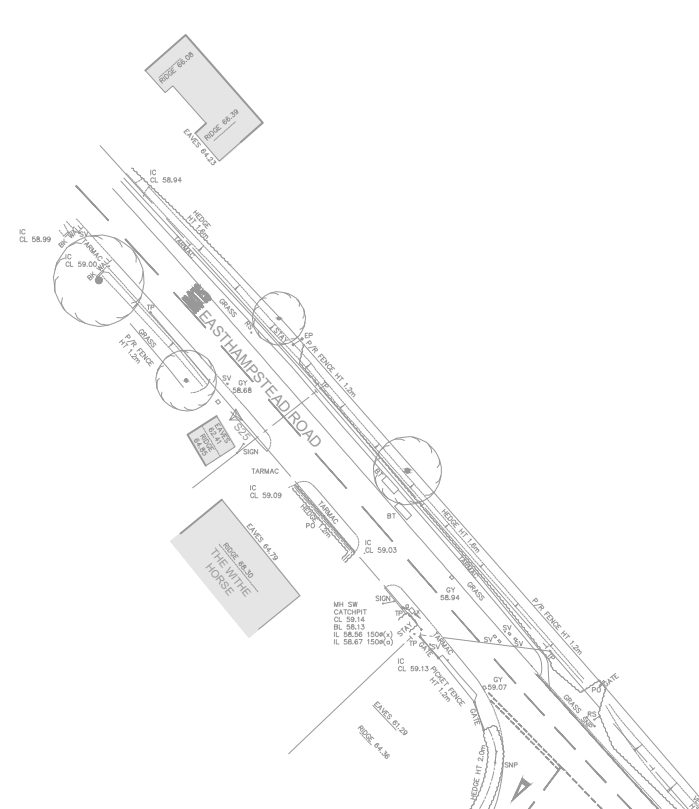
LIGHTWOOD STRATEGIC

Project
PRIORS FARM,
SOUTH WOKINGHAM SDL

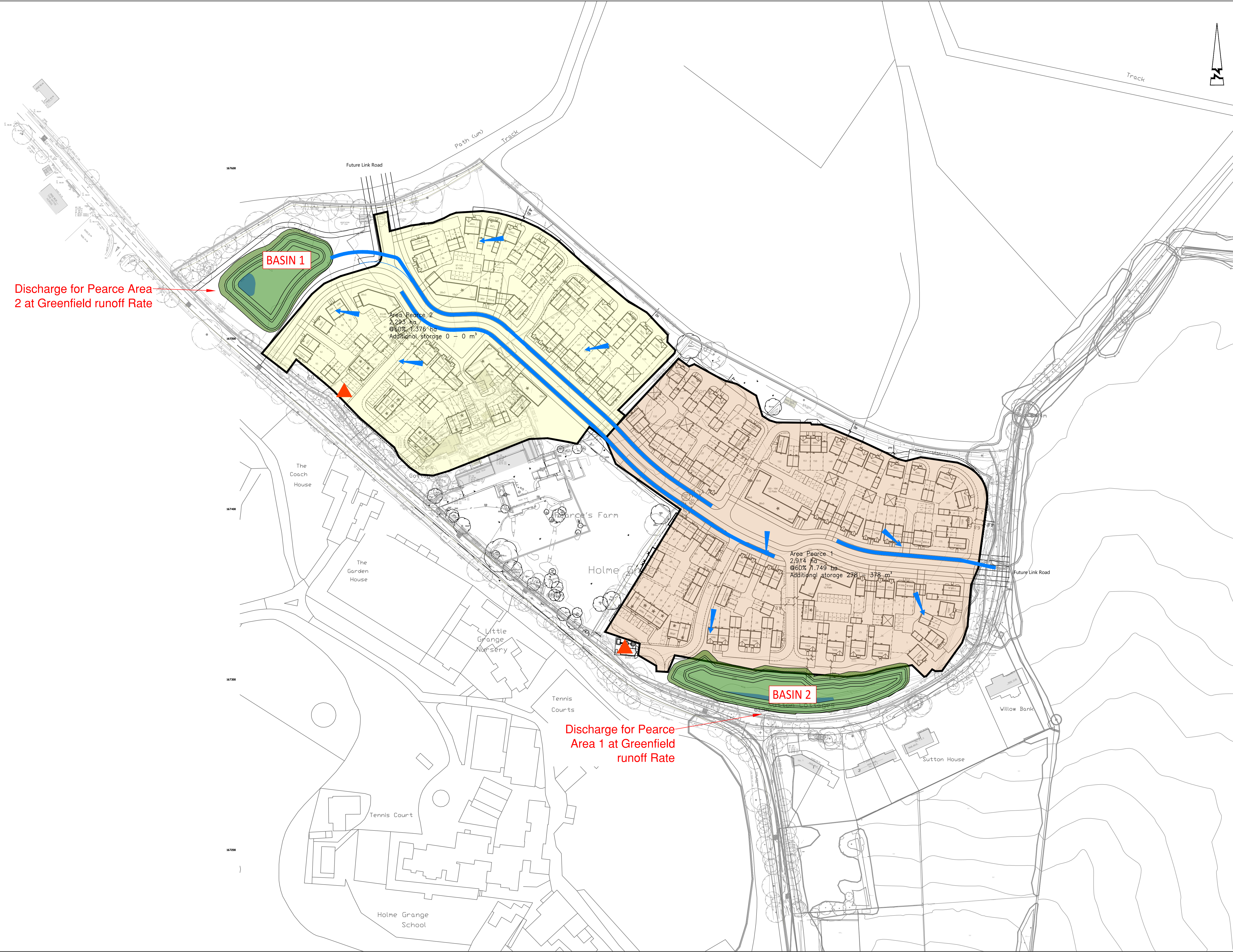
Title
SITE WIDE DRAINAGE
CATCHMENT STRATEGY

Status
FOR INFORMATION

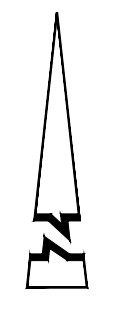
Scale	Date	Drawn	Checked
1:2000 @ A1	DEC 2023	LC	JS
Drawing No			Revision
A218-025			P5



Discharge for Pearce Area 2 at Greenfield runoff Rate



Discharge for Pearce Area 1 at Greenfield runoff Rate



© ABLE LETCHFORD PARTNERSHIP LTD.
This drawing should not be reproduced without consent.

NOTES:

1. Do not scale.
2. Refer to all other Project Drawings and supporting notes.
3. All levels are in meters above Ordinance Datum.
4. Surface Water Strategy is indicative and based on masterplanning information at the time of production.
5. All Surface Water Calculations were Undertaken Using Causeway Flow Drainage Software and are subject to detailed design.
6. All Outfalls have been visually determined during site walkover and are assumed viable to be utilized as surface water outfalls.

Return Period		Flow (l/s/ha)
Clear	3.37	
1 in 2	3.29	
1 in 30	8.91	
1 in 100	12.36	

Longterm Storage	
Rate	2 l/s/ha
Volume	62.4 m ³ /ha

Basin	Estimated storage required (m ³)	Estimated storage required (m ²)
Basin 1	1000	1000
Basin 2	1000	1000

- Key:
- Application Boundary
 - Proposed Drainage
 - Attenuation Basin
 - Flow Arrow
 - Basin 1 Catchment
 - Basin 2 Catchment
 - Potential Foul Pump Station Location
 - 2m wide Swale/Filter Drain

P3	07/24	EASTERN BOUNDARY SWALE REMOVED	LC	JS
P2	07/24	DISCHARGE POINTS ADDED	LC	JS
P1	12/23	FIRST ISSUE	LC	JS
Rev	Date	Description	Drawn	Checked

AL ABLE LETCHFORD PARTNERSHIP
Consulting Engineers

3 Tealgate, Charnham Park
Hungerford, Berkshire RG17 0YT
www.alpce.co.uk Tel: 01488 684390

Client

NICHOLAS KING HOMES

Project

PRIORS FARM,
SOUTH WOKINGHAM SDL

Title

PEARCE FARM DRAINAGE
CATCHMENT STRATEGY

Status

FOR INFORMATION

Scale	Date	Drawn	Checked
1:1000 @ A1	DEC 2023	LC	JS
Drawing No	Revision		
A218-026	P2		

Calculated by:	Jonathan Shuttleworth
Site name:	Priors Farm
Site location:	Wokingham

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

Site Details

Latitude:	51.39600° N
Longitude:	0.80342° W
Reference:	721263223
Date:	Oct 02 2023 12:25

Runoff estimation approach

FEH Statistical

Site characteristics

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

Methodology

Q_{MED} estimation method:	Calculate from BFI and SAAR
BFI and SPR method:	Specify BFI manually
HOST class:	N/A
BFI / BFIHOST:	0.389
Q_{MED} (l/s):	
Q_{BAR} / Q_{MED} factor:	1.14

Hydrological characteristics

	Default	Edited
SAAR (mm):	667	662
Hydrological region:	6	6
Growth curve factor 1 year:	0.85	0.85
Growth curve factor 30 years:	2.3	2.3
Growth curve factor 100 years:	3.19	3.19
Growth curve factor 200 years:	3.74	3.74

Notes

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

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

(2) Are flow rates < 5.0 l/s?

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

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

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

Q_{BAR} (l/s):		3.87
1 in 1 year (l/s):		3.29
1 in 30 years (l/s):		8.91
1 in 100 year (l/s):		12.36
1 in 200 years (l/s):		14.49

This report was produced using the greenfield runoff tool developed by HR Wallingford and available at www.uksuds.com. The use of this tool is subject to the UK SuDS terms and conditions and licence agreement , which can both be found at www.uksuds.com/terms-and-conditions.htm. The outputs from this tool are estimates of greenfield runoff rates. The use of these results is the responsibility of the users of this tool. No liability will be accepted by HR Wallingford, the Environment Agency, CEH, Hydrosolutions or any other organisation for the use of this data in the design or operational characteristics of any drainage scheme.

Long Term Storage (LTS) Volume Calculation



Project No.	A218
Project Title	Priors Farm, Wokingham
Client	Lightwood Strategic

Calcs by	JS
Checked	SL
Date	11/12/2023
Revision	A

LTS calculation method based on equation 24.10 from CIRIA C753 - The SuDS Manual

Where;	Vol_{xs}	Extra runoff volume from a development site compared to the greenfield equivalent during the 100 yr 6		
	RD	Rainfall Depth	74.67 mm	(for 100 year 6 hour storm)
	A	Site Area	1.67 ha	(Exc. Large undeveloped areas)
		Impermeable Catchment	1 ha	
	PIMP	Percentage Impermeable	60 %	
	α	Proportion Impermeable to Network	1	
	Cv	Impermeable Runoff Coefficient	0.84	(0.84 Modified Rational Method)
		Permeable Catchment	0.67 ha	
		Permeable Catchment to Network	0.00	
	β	Proportion Perm to Network	0.00	
	SPR	Soil Proportion Runoff	0.47	(Based on data provided by HR Wallingford)

$$Vol_{xs} = \frac{RD}{100} \times A \times \left(\frac{PIMP}{100} \right) \times \left(\frac{\alpha}{1} \times \frac{Cv}{0.84} \right) + \left(1 - \frac{PIMP}{100} \right) \times \left(\frac{\beta}{1} \times \frac{SPR}{0.47} \right) - \frac{SPR}{0.47}$$

Volume_{xs} = 42.40 m³/ha

Design Settings

Rainfall Methodology	FEH-22	Maximum Time of Concentration (mins)	30.00	Preferred Cover Depth (m)	1.200
Return Period (years)	2	Maximum Rainfall (mm/hr)	550.0	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)	8.00	Minimum Backdrop Height (m)	0.200		

Nodes

Name	Area (ha)	Cover Level (m)	Diameter (mm)	Easting (m)	Northing (m)	Depth (m)
Per Ha LTS	1.000	100.000	1200	-60.353	378.274	1.500
Per Ha Storage QBar	1.000	100.000	1200	46.023	381.354	1.500

Simulation Settings

Rainfall Methodology	FEH-22	Skip Steady State	x	2 year (l/s)	3.3	100 year 360 minute (m ³)	328
Summer CV	1.000	Drain Down Time (mins)	240	30 year (l/s)	8.9		
Winter CV	1.000	Additional Storage (m ³ /ha)	0.0	100 year (l/s)	12.4		
Analysis Speed	Detailed	Check Discharge Rate(s)	✓	Check Discharge Volume	✓		

Storm Durations

60	180	360	600	960	2160	4320	7200	10080
120	240	480	720	1440	2880	5760	8640	

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

Pre-development Discharge Rate

Site Makeup	Greenfield	Region	6	QMed	3.4
Greenfield Method	FEH	QBar/QMed conversion factor	1.136	QBar	3.9
Positively Drained Area (ha)	1.000	Growth Factor 2 year	0.88	Q 2 year (l/s)	3.4
SAAR (mm)	662	Growth Factor 30 year	2.30	Q 30 year (l/s)	8.9
Host	1	Growth Factor 100 year	3.19	Q 100 year (l/s)	12.4
BFIHost	0.389	Betterment (%)	0		

Pre-development Discharge Volume

Site Makeup	Greenfield	SPR	0.47	Storm Duration (mins)	360
Greenfield Method	FSR/FEH	CWI	99.556	Betterment (%)	0
Positively Drained Area (ha)	1.000	Return Period (years)	100	PR	0.457
Soil Index	1	Climate Change (%)	0	Runoff Volume (m³)	328

Node Per Ha Storage QBar Offline Hydro-Brake® Control

Flap Valve	x	Objective	(HE) Minimise upstream storage
Loop to Node		Sump Available	✓
Invert Level (m)	98.500	Product Number	CTL-SHE-0094-3900-1000-3900
Design Depth (m)	1.000	Min Outlet Diameter (m)	0.150
Design Flow (l/s)	3.9	Min Node Diameter (mm)	1200

Node Per Ha LTS Offline Hydro-Brake® Control

Flap Valve	x	Objective	(HE) Minimise upstream storage
Loop to Node		Sump Available	✓
Invert Level (m)	98.500	Product Number	CTL-SHE-0079-2000-0125-2000
Design Depth (m)	0.125	Min Outlet Diameter (m)	0.100
Design Flow (l/s)	2.0	Min Node Diameter (mm)	1200

Node Per Ha LTS Online Hydro-Brake® Control

Flap Valve	x	Objective	(HE) Minimise upstream storage
Replaces Downstream Link	✓	Sump Available	✓
Invert Level (m)	98.900	Product Number	CTL-SHE-0096-4200-1100-4200
Design Depth (m)	1.100	Min Outlet Diameter (m)	0.150
Design Flow (l/s)	4.2	Min Node Diameter (mm)	1200

Node Per Ha LTS Online Weir Control

Flap Valve	x	Invert Level (m)	99.400	Design Flow (l/s)	2.9	Discharge Coefficient	0.590
Replaces Downstream Link	✓	Design Depth (m)	0.100	Width (m)	0.050		

Node Per Ha Storage QBar Depth/Area Storage Structure

Base Inf Coefficient (m/hr)	0.00000	Safety Factor	2.0	Invert Level (m)	98.500
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	990.0	0.0	1.500	990.0	0.0

Node Per Ha LTS Depth/Area Storage Structure

Base Inf Coefficient (m/hr)	0.00000	Safety Factor	2.0	Invert Level (m)	98.500
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	890.0	0.0	1.500	890.0	0.0

Results for 2 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
720 minute winter	Per Ha LTS	690	98.880	0.380	24.8	338.7560	0.0000	OK

600 minute winter	Per Ha Storage QBar	570	98.823	0.323	28.6	320.5976	0.0000	OK
-------------------	---------------------	-----	--------	-------	------	----------	--------	----

Link Event (Upstream Depth)	US Node	Link	Outflow (l/s)	Discharge Vol (m³)
720 minute winter	Per Ha LTS	Hydro-Brake®	0.0	0.0
720 minute winter	Per Ha LTS	Weir	0.0	0.0
720 minute winter	Per Ha LTS	Hydro-Brake®	3.3	136.0
600 minute winter	Per Ha Storage QBar	Hydro-Brake®	3.9	148.6

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
480 minute winter	Per Ha LTS	464	99.286	0.786	73.6	700.7449	0.0000	OK

720 minute winter	Per Ha Storage QBar	705	99.277	0.777	51.8	770.3555	0.0000	OK
-------------------	---------------------	-----	--------	-------	------	----------	--------	----

Link Event (Upstream Depth)	US Node	Link	Outflow (l/s)	Discharge Vol (m³)
480 minute winter	Per Ha LTS	Hydro-Brake®	4.2	117.4
480 minute winter	Per Ha LTS	Weir	0.0	0.0
480 minute winter	Per Ha LTS	Hydro-Brake®	4.7	151.0
720 minute winter	Per Ha Storage QBar	Hydro-Brake®	3.9	169.4

Results for 100 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
480 minute winter	Per Ha LTS	464	99.487	0.987	91.5	879.6086	0.0000	OK

720 minute winter	Per Ha Storage QBar	720	99.482	0.982	64.1	973.6196	0.0000	OK
-------------------	---------------------	-----	--------	-------	------	----------	--------	----

Link Event (Upstream Depth)	US Node	Link	Outflow (l/s)	Discharge Vol (m³)
480 minute winter	Per Ha LTS	Hydro-Brake®	4.2	118.3
480 minute winter	Per Ha LTS	Weir	2.4	20.4
480 minute winter	Per Ha LTS	Hydro-Brake®	5.2	168.6
720 minute winter	Per Ha Storage QBar	Hydro-Brake®	3.9	184.5

Area 1	Parcel	Total Area (ha)	Hardstanding (ha)	l/s/ha			
	1a	0.8843	0.53058	Flow Rates	Qbar	3.87	24.3944676 l/s
	1b	1.8142	1.08852		LTS	2	12.60696 l/s
	1c	0.8293	0.49758		1 in 2	3.4	21.431832 l/s
	1d	0.4806	0.28836		1 in 30	8.9	56.100972 l/s
	1e	0.8253	0.49518		1 in 100	12.4	78.163152 l/s
	1f	1.0543	0.63258		LTS vol	42.4	267.267552 m ³
	1g	1.7637	1.05822	Downstream Storage			
	1h	1.0703	0.64218				
	1i	0.7995	0.4797	Pond 3	2670 m ³		
	1j	0.9843	0.59058	Pond 4	1452 m ³		
	Total	10.5058	6.30348		4122 m ³		
	Estimated Storage Required						
Using Long Term Storage			5610.0972 m ³				
Using Qbar			6240.4452 m ³				
Estimated Required Additional Storage							
Using Long Term Storage			1488.0972 m ³	or	236.075501 m ³ /ha		
Using Qbar			2118.4452 m ³	or	336.075501 m ³ /ha		
Additonal Storage							
Area 1	Parcel	Total Area (ha)	Hardstanding (ha)	using Qbar (m ³)	Using method LTS (m ³)		
	1a	0.8843	0.53058	125.2569394	178.3149394		
	1b	1.8142	1.08852	256.9729045	365.8249045		
	1c	0.8293	0.49758	117.4664479	167.2244479		
	1d	0.4806	0.28836	68.07473151	96.91073151		
	1e	0.8253	0.49518	116.8998667	166.4178667		
	1f	1.0543	0.63258	149.3366405	212.5946405		
	1g	1.7637	1.05822	249.8198168	355.6418168		
	1h	1.0703	0.64218	151.6029653	215.8209653		
	1i	0.7995	0.4797	113.2454179	161.2154179		
	1j	0.9843	0.59058	139.4214695	198.4794695		
	Total	10.5058	6.30348	1488.0972	2118.4452		

Area 2	Parcel	Total Area (ha)	Hardstanding (ha)	l/s/ha			
	2a	1.917	1.1502	Flow Rates	Qbar	3.87	21.9296646 l/s
	2b	1.6213	0.97278		LTS	2	11.33316 l/s
	2c	1.5443	0.92658		1 in 2	3.4	19.266372 l/s
	2d	1.405	0.843		1 in 30	8.9	50.432562 l/s
	2e	1.2041	0.72246		1 in 100	12.4	70.265592 l/s
	2f	1.7526	1.05156		LTS vol	42.4	240.262992 m ³
	Total	9.4443	5.66658				
Downstream Storage							
				Pond 5		3660 m ³	
				Pond 6		1743 m ³	
				Total		5403 m ³	
Estimated Storage Required							
	Using Long Term Storage		5043.2562 m ³				
	Using Qbar		5609.9142 m ³				
Estimated Required Additional Storage							
	Using Long Term Storage		0 m ³	or		0 m ³ /ha	
	Using Qbar		206.9142 m ³	or		36.5148291 m ³ /ha	
Additional Storage							
	Parcel	Total Area (ha)	Hardstanding (ha)	using Qbar (m ³)	Using method LTS (m ³)		
	2a	1.917	1.1502	0	41.99935637		
	2b	1.6213	0.97278	0	35.5208954		
	2c	1.5443	0.92658	0	33.8339103		
	2d	1.405	0.843	0	30.78200089		
	2e	1.2041	0.72246	0	26.3805034		
	2f	1.7526	1.05156	0	38.39753364		
	Total	9.4443	5.66658	0	206.9142		

Area 3	Parcel	Total Area (ha)	Hardstanding (ha)	l/s/ha			
	3	3.0017	1.80102	Flow Rates	Qbar	3.87	6.9699474 l/s
					LTS	2	3.60204 l/s
					1 in 2	3.4	6.123468 l/s
					1 in 30	8.9	16.029078 l/s
					1 in 100	12.4	22.332648 l/s
					LTS vol	42.4	76.363248 m ³
	Total	3.0017	1.80102				
				Downstream Storage			
				Pond 7		1525 m ³	
				Total		1525 m ³	
	Estimated Storage Required						
	Using Long Term Storage		1602.9078 m ³				
	Using Qbar		1783.0098 m ³				
	Estimated Required Additional Storage						
	Using Long Term Storage		77.9078 m ³	or	43.2575985 m ³ /ha		
	Using Qbar		258.0098 m ³	or	143.257598 m ³ /ha		

Area 4	Parcel	Total Area (ha)	Hardstanding (ha)	l/s/ha			
	4a	0.4635	0.2781	Flow Rates	Qbar	3.87	5.3194698 l/s
	4b	1.8274	1.09644		LTS	2	2.74908 l/s
					1 in 2	3.4	4.673436 l/s
					1 in 30	8.9	12.233406 l/s
					1 in 100	12.4	17.044296 l/s
					LTS vol	42.4	58.280496 m ³
	Total	2.2909	1.37454				
					Downstream Storage		
					Pond 8	1280 m ³	
				Total	1280 m ³		
Estimated Storage Required							
Using Long Term Storage			1223.3406 m ³				
Using Qbar			1360.7946 m ³				
Estimated Required Additional Storage							
Using Long Term Storage			0 m ³	or	0 m ³ /ha		
Using Qbar			80.7946 m ³	or	58.7793735 m ³ /ha		

Transport
Development Planning
Sustainable
Deliver
Trusted
Enable
Site Appraisal
Hydrology
Highways
Civil Engineering
Successful
Travel Planning
Support
Drainage
Dynamic
Masterplanning
Flood Risk Assessment
Infrastructure Design

Abley Letchford Partnership Ltd (Hungerford)
3 Tealgate, Charnham Park,
Hungerford RG17 0YT
T: 01488 684 390
E: contact@alpce.co.uk

Abley Letchford Partnership Ltd (Reading)
40 Caversham Rd,
Reading RG1 7EB
T: 0118 237 1736
E: contact@alpce.co.uk

W: www.alpce.co.uk