

LAND NORTH OF ARBORFIELD ROAD, SHINFIELD
FLOOD RISK ASSESSMENT AND DRAINAGE STRATEGY

BELLWAY HOMES LTD (THAMES VALLEY)

16 AUGUST 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:	A Simmons
Authorised by:	E Philpott
Date:	16 August 2024
Document Reference:	HD008 – R001

COPYRIGHT © ABLEY LETCHFORD PARTNERSHIP LIMITED
The material presented in this report is confidential. This report has been prepared for the exclusive use of Bellway Homes Ltd (Thames Valley) 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 Risk.....10

5.0 Proposed Development and the Sequential Test.....23

6.0 Flood Mitigation Strategy.....24

7.0 Surface Water Drainage26

8.0 Foul Water Drainage34

9.0 Conclusion.....35

Appendices

- Appendix 1 - Plans
- Appendix 2 - LLFA Developer Checklist
- Appendix 3 – 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 Bellway Homes Ltd (Thames Valley), to support a full planning application for 191 residential properties at Land North of Arborfield Road, Shinfield in Reading.

Development Proposals

- 1.2. The proposals are for the provision of 191 residential units as depicted on the Illustrative Masterplan within **Appendix 1**.

Requirement for a Flood Risk Assessment

- 1.3. The requirement for an FRA is set out in Section 14 of the revised National Planning Policy Framework (NPPF) as revised in December 2023.
- 1.4. 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..’
- 1.5. The site is a greenfield site that comprises of open fields with built development beyond the site to the west and north of the site. The A327 Eastern Relief Road is located to the east of the site. The B3349 Arborfield Road is located to the south of the site.
- 1.6. The area of the site is approximately 7 hectares. As the site area extends to 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, where required, to address this.
- 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: Proposed Development and Sequential Test – a description of the proposed development and a classification of the vulnerability in the context of the Sequential Test.
 - Section 6: Flood Risk Mitigation – the mitigation measures implemented, where required, 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 168-169 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 191 residential 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). WBC is also the 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:
 - Wokingham Borough Council Adopted Core Strategy Development Plan (dated 2010)
 - Wokingham Borough Council Local Flood Risk Management Strategy (dated April 2015)
 - Wokingham Borough Council Preliminary Flood Risk Assessment (PFRA) (dated June 2011) and PFRA addendum (dated 2017)
 - WBC Level 1 Strategic Flood Risk Assessment (SFRA) (published May 2024 but dated May 2023)
 - WBC Level 2 Strategic Flood Risk Assessment (SFRA) (published May 2024 but dated August 2023) and
 - WBC SuDS Strategy (dated January 2017).
- 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 Planning Application Drainage Checklists within the Wokingham SuDS Strategy guidance document 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 checklist for a Major Development Outline Application is included within **Appendix 2**.
- 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. Thames Water (TW) is responsible for the supply of clean water and disposal of wastewater for the Shinfield 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. A site walkover was conducted during May 2024 which included observations of the general topography across the site and surrounding area as well as inspection of watercourses, ditches and drainage features both within the site and beyond the site boundary.
- 2.18. Guidance with respect to 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'.
- 2.19. 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

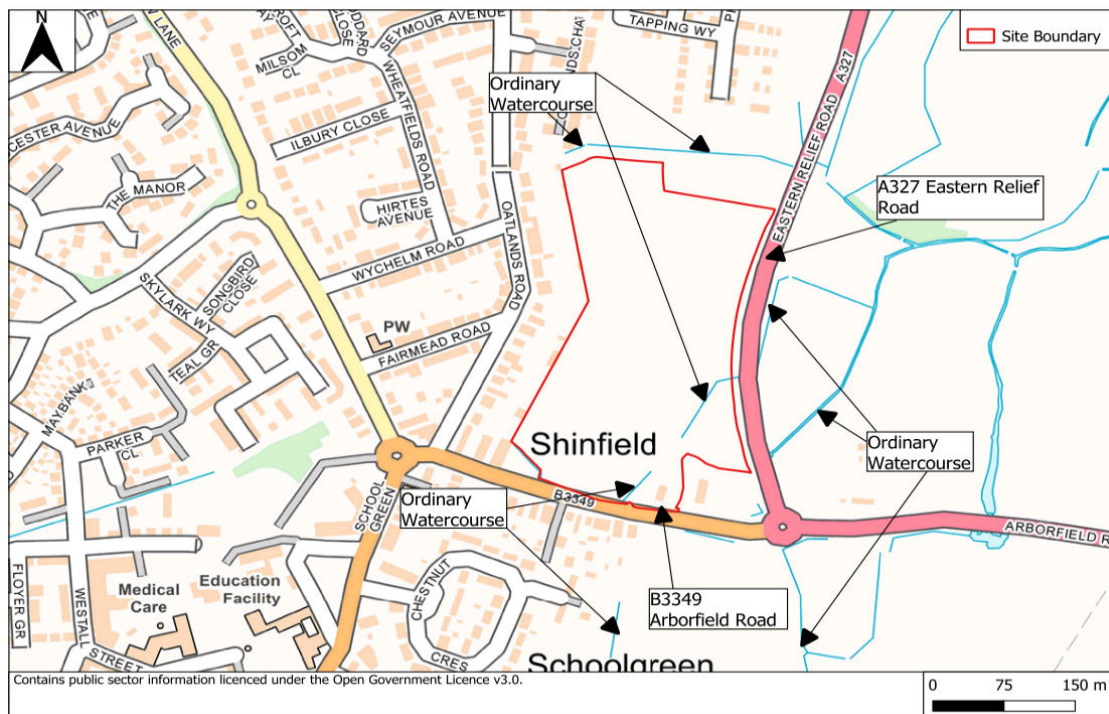
Introduction

- 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 north of the B3349 Arborfield Road, located approximately 0.5km to the northeast of the centre of Shinfield, Reading. The nearest postcode for the site is RD2 9DY. The site centre grid reference is 473697E 168059N. The site location is shown in **Figure 1**.

Figure 1 – Site Location



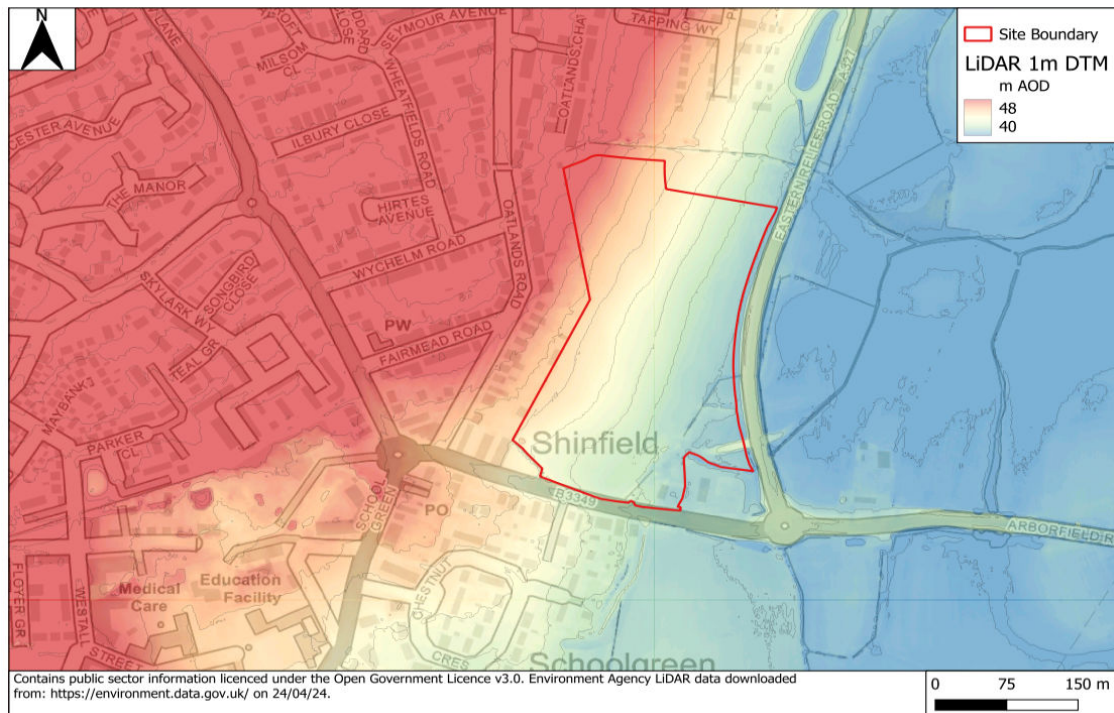
- 3.3. The site is bounded to the east by the A327 Eastern Relief Road and to the south by the B3349 Arborfield Road. There is a residential area to the south of Arborfield Road. To the west of the site is a residential area. To the north of the site is the Cutbush Lane development pursuant to application 181499. This development is nearing completion and comprises a residential development.
- 3.4. The site covers an area of approximately 7 hectares and is currently agricultural land with some trees and hedgerows along the site boundaries.

Topography

- 3.5. Ground levels across the site are shown by LiDAR data in **Figure 2**.

- 3.6. The LiDAR indicates that there is an area of high ground in the northwest of the site and ground levels generally slope down from west to east, with ground levels lowest in the southeast and eastern parts of the site.
- 3.7. Ground levels vary from 49.0m AOD in the northwest to 41.2m AOD to the southeast.

Figure 2 – Site Topography



- 3.8. A topographical survey of the site has been carried out by Encompass Surveys November 2023. A copy of the topographical survey is included in **Appendix 1**.
- 3.9. The topographical survey provides a more detailed representation of the ground levels across the site as well as details of other key features. In general it agrees well with the LiDAR. From the topographical survey, the highest ground level within the site is in the northwest corner with an elevation of 49.2 m AOD and the lowest is in the southeast corner of the site with an elevation of 40.9 m AOD.
- 3.10. The Eastern Relief Road is elevated above the surrounding area. Alongside the site's southern boundary, Arborfield Road generally slopes down to the east towards the roundabout, typically with a grass/vegetated verge at a slightly higher level at the site boundary.

Watercourses and Ditches

- 3.11. The nearest Main River is the River Loddon approximately 600m to the east of the site.
- 3.12. A network of open channel ditches and watercourses form tributaries to the Loddon and some of these extend to the Eastern Relief Road.



- 3.13. Just beyond the site's northern boundary, and at the edge of the Cutbush Lane development is an open channel watercourse. This runs from west to east and is then culverted under the Eastern Relief Road. The culvert has a flap on the eastern side.
- 3.14. Running along both the western and eastern sides of the Eastern Relief Road are open channel features which were, in the main part, brought in when the road was constructed. These run almost the whole length of the road and for a section the western channel runs alongside the site's eastern boundary. There are a number of culverts running under the Eastern Relief Road connecting the two highways ditches and linking these to the network of tributaries of the Loddon to the east. From site observations it was evident that the 'downstream' eastern end of the culverts are flapped, meaning that there is only flow in an easterly direction through the culverts.
- 3.15. On site there are three key features which would be defined as Ordinary Watercourses.
- 3.16. An open watercourse runs from the site's southern boundary along the footpath for a length of approximately 50m, in part culverted and obscured by dense vegetation. From some mapping it is inferred that this watercourse extends upstream along the sites southern boundary, but no evidence of this was found on site. The watercourse commences at the site's boundary where flow emerges from a culvert from the direction of Arborfield Road.
- 3.17. There is a pond in the southeastern part of the site surrounded by dense vegetation. This appears to be a natural feature fed by the watercourse from the site's southern boundary. Survey and site observations were restricted due to the dense vegetation, but the pond appears to spill out towards the site's eastern boundary and the low lying area south of the farm access track. From here any flow joins the highways ditch on the western side of the Eastern Relief Road. There was no evidence of a connection from the southern ditch or the pond to the north under the farm access track.
- 3.18. The third feature is a recently constructed engineered cut off ditch which was part of the work associated with the Eastern Relief Road. It appears to convey any land drainage or surface water flow to the east around the trees. However, site observations showed this to be boggy and heavily vegetated rather than a flowing feature. This connects to the highways ditch alongside the Eastern Relief Road close to a culvert under the road.
- 3.19. In summary there is a natural watercourse and pond in the south eastern part of the site and an engineered cut off ditch north of the farm access track. All these features flow towards the east and join the highways ditch alongside the Eastern Relief Road, eventually flowing east towards the Loddon. As noted, there is a flow route east under the road through various culverts, but these are flapped and would not allow flow back towards the site from the direction of the Loddon.

Surface and Foul Water Sewers

- 3.20. It is currently unclear how the farmhouse and small outlet buildings to the southeast of the site dispose of their surface water. Ditch outfall points and general longitudinal falls were less obvious due to heavy vegetation and restricted access. An open field ditch to west of the Eastern Relief Road was observed during the site walk over.



- 3.21. Sewer Asset Records obtained from TW indicates that there is a foul water sewer running within the site boundary to the west, which connected along Arborfield Road to the south which then runs in an easterly direction. This southern pipe is located outside of the boundary of the site.
- 3.22. A copy of TW Asset Record is included within **Appendix 1**.

Geology and Hydrogeology

- 3.23. British Geological Survey (BGS) 'Geology of Britain' online viewer indicates that the bedrock geology underlying the south of the site is London Clay Formation – clay silt and sand. There are superficial Terrace deposits 3 – sand and gravel in the southern part of the site. There are no records of superficial deposits in the central or northern parts of the site.
- 3.24. The Cranfield University 'Soilscape' online viewer indicates the site overlays 'Soilscape 22' - loamy soils with naturally high groundwater.
- 3.25. The DEFRA Magic Map online viewer indicates that the site lies outside of any groundwater Source Protection Zone (SPZ). The southern part of the site is located within a Secondary A superficial drift aquifer
- 3.26. Minor secondary aquifers are associated with the underlying bedrock and superficial drift layers. These rocks can provide modest amounts of water, but the nature of the rock or the aquifer's structure limits their use. They support water supplies at local rather than strategic scale.

4.0 Overview of Flood Risk

EA Flood Map for Planning

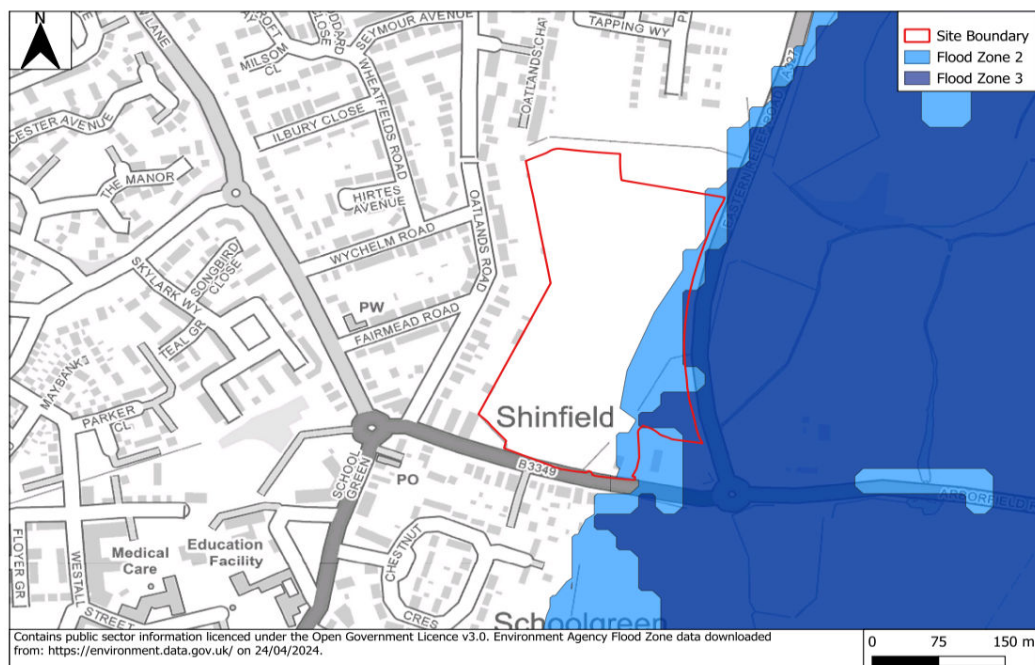
4.1. The EA Flood Map for Planning provides an initial indication of the extent of flood zones. In the NPPF, Flood Zones are defined as follows:

- 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 3** shows the EA flood zone mapping. It confirms that the majority of the site is located within Flood Zone 1 'Low Probability'.

4.3. The eastern part of the site is located within Flood Zone 2 'Medium Probability'. The eastern boundary of the site is located within Flood Zone 3 'High Probability'. This is purely fluvial flooding and associated with the River Loddon to the east. This is discussed in more detail in the following section.

Figure 3 – EA Flood Map for Planning



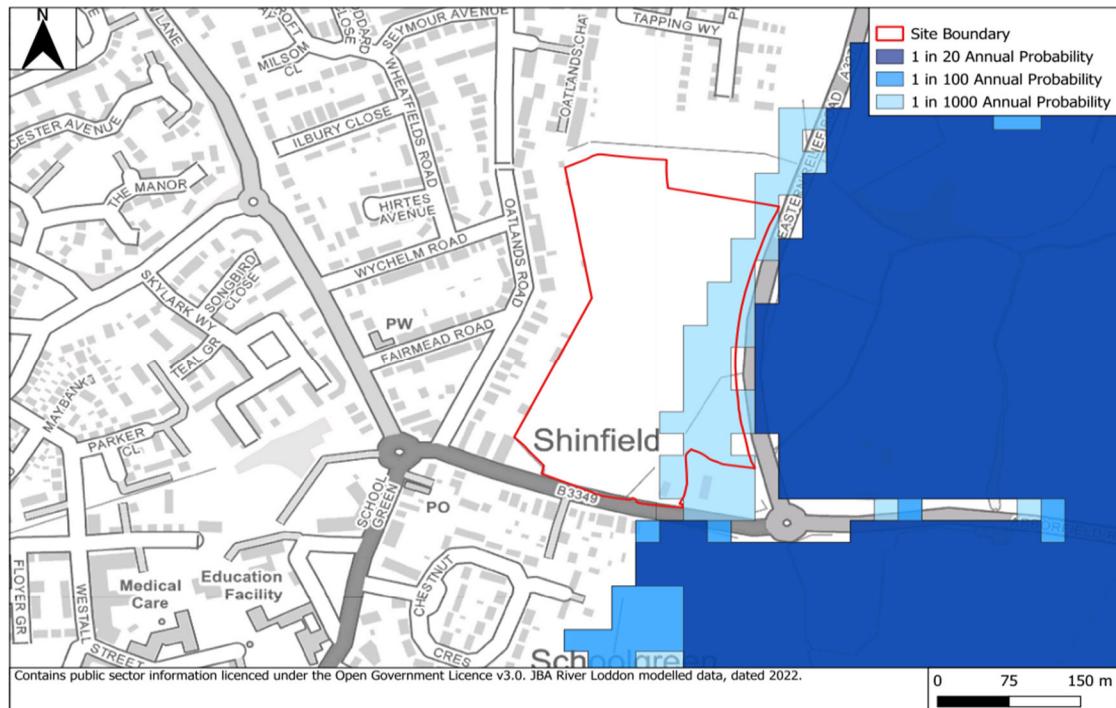
Flood Risk from Fluvial Sources

- 4.4. The eastern part of the site is shown to be within Flood Zone 2 and 3 of the EA Flood Map for Planning. The western and central part of the site is shown to be within Flood Zone 1 of the EA Flood Map for Planning. This indicates that the eastern site is affected by fluvial flooding in the 1 in 100 and 1 in 1000 annual probability scenarios. These maps are based on strategic modelling and do not take into consideration site specific information. Therefore it is appropriate for a site specific FRA to obtain or derive more detailed information to inform the analysis of actual flood risk at the site. The starting point for this is the EA and their detailed modelling, although in this location WBC has also commissioned extensive modelling of the Loddon.
- 4.5. Over the last few years there has been much analysis and modelling of the River Loddon, its floodplain and its contributing watercourses. The EA originally produced a model in 2009, which we understand still forms the basis of the published flood zone maps for planning. It is the 2009 model which was provided to us by the EA on request for modelling suitable to inform this FRA.
- 4.6. However, since 2009, modelling methods and practice have developed and more data has become available. There have also been some changes in the relevant infrastructure both in flood defence terms and the wider road and highway infrastructure. These have been absorbed into a more detailed and refined model produced by WBC, culminating in the model produced for WBC in 2021 (the *2021 SFRA Model*) which added a contemporary assessment of climate change allowances.
- 4.7. Since this date WBC completed an update to their SFRA to support the latest version of the Local Plan and a new model has been produced by JBA which uses the original EA 2009 model as a base but updates the hydrology to contemporary methods with contemporary allowances for climate change (the *2022 Loddon Model*). Critically this does not absorb the changes in data within the 2021 SFRA Model to reflect the physical changes or the more refined model grids.
- 4.8. WBC has confirmed that the 2022 Loddon model has been confirmed by the EA as '*sufficiently robust to inform policy and strategy decisions i.e. robust to underpin the SFRA. For site specific FRAs they have advised that an alternative model could be used to inform future planning applications following validation by the Environment Agency.*'
- 4.9. The 2022 Loddon and 2021 SFRA models have been reviewed and are discussed in turn, along with a commentary on the implications of each model for the site. The 2009 EA model is not discussed further as the later models are both deemed to be more representative as they include more recent information and also include current climate change allowances which directly informs the 'design event' to be considered for a FRA.

2022 Loddon Model

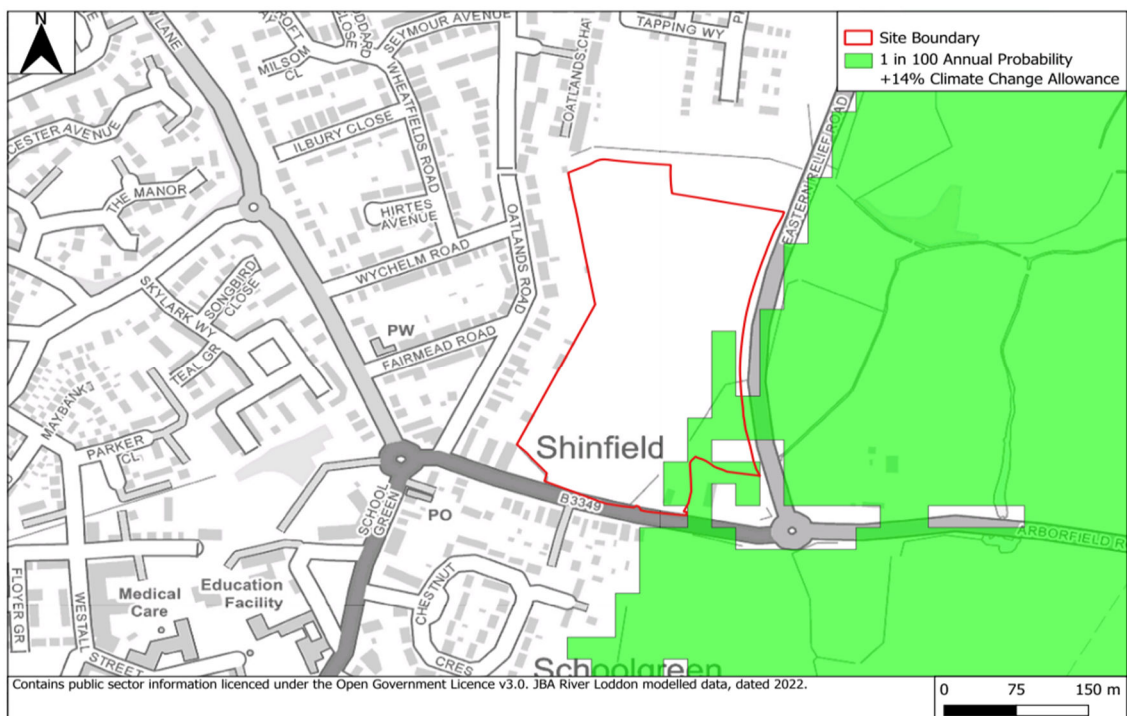
- 4.10. This model is the source of data for the current SFRA. As such it is deemed to be the key information to inform the strategic overview in planning terms of fluvial flood risk for the site.
- 4.11. As noted above this model uses the EA's 2009 model as a base and applies updated hydrology.
- 4.12. The 2023 SFRA present day flood extents are shown in **Figure 4**. This indicates the extents of flood zone 2 and 3 (1 in 1000 and 1 in 100 annual probability respectively).

Figure 4 – 2022 Loddon Present Day Flood Extents



4.13. The 2023 SFRA 14% climate change flood extents are shown in Figure 5.

Figure 5 – 2022 Loddon 14% Climate Change Flood Extent



4.14. Figure 4 and 5 indicate that there is flooding in the south eastern corner of the site and along the eastern boundary in the 1 in 1,000 and the 1 in 100 + climate change flood events.

- 4.15. The 2022 Loddon model uses a coarse, 25m grid size and does not include the Eastern Relief Road as it uses LiDAR data flow prior to the Eastern Relief Road's construction in 2017.
- 4.16. The model results suggest that there are two possible flow routes into the site; from the south and from the east. Each of these possible flow routes has been assessed to confirm whether the flow route into the site is indeed viable.
- 4.17. The flow route from the south would be across Arborfield Road from the south.
- 4.18. **Table 1** shows a summary of the modelled flood levels across Arborfield Road.

Table 1 – Summary of 2022 Loddon Model Maximum Flood Levels Across Arborfield Road

Flood Event	Modelled Flood Level, m AOD
1 in 20 Annual Probability (5%)	No flooding
1 in 100 Annual Probability (1%)	No flooding
1 in 100 Annual Probability +14% Climate Change Allowance	41.59
1 in 1000 (0.1%) Annual Probability	41.74

- 4.19. The 1 in 100 annual probability +14% climate change modelled flood level along Arborfield Road is 41.593m AOD. This flood level was reviewed against the topographical survey and LiDAR data.
- 4.20. From this review it is concluded that the levels along the carriageway are such that floodwater at a level of 41.59mAOD would not exceed the ground levels along the road and there is no flow route into the site in this event.
- 4.21. In the 1 in 1000 annual probability event there could be a flow route into the site. However floodwater would not flow far into the site before entering the southern ditch and the pond area in the south east of the site; then flowing into the highway ditch alongside the Eastern Relief Road. Depths and volumes would be relatively small.
- 4.22. The second possible flow route into the site is from the east is across the Eastern Relief Road.
- 4.23. **Table 2** shows a summary of modelled flood levels at the Eastern Relief Road.

Table 2 – Summary of JBA Model Maximum Flood Levels At the Eastern Relief Road

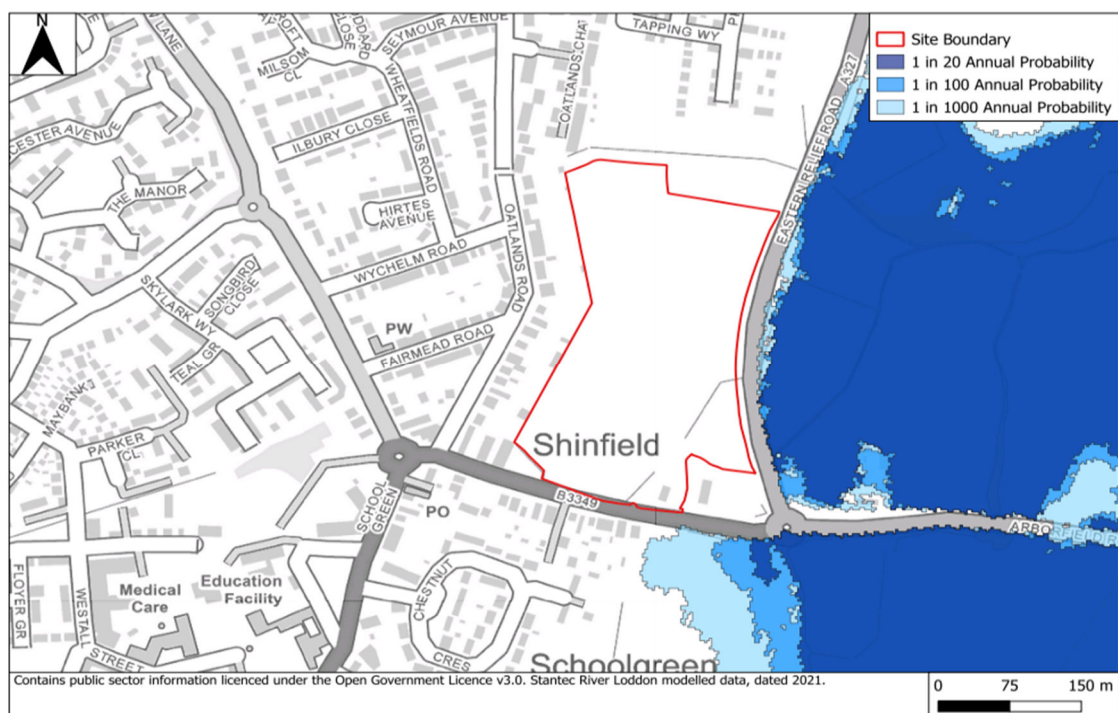
Flood Event	Modelled Flood Level, m AOD
1 in 20 Annual Probability (5%)	40.93
1 in 100 Annual Probability (1%)	41.11
1 in 100 Annual Probability +14% Climate Change Allowance	41.24
1 in 1000 (0.1%) Annual Probability	41.38

- 4.24. Ground levels along the Eastern Relief Road are between 41.99m AOD and 42.67m AOD adjacent to the site. The modelled flood levels are substantially below the Eastern Relief Road ground levels therefore the flooding would not flow freely across the road. There are three culverts under the Eastern Relief Road. However, as noted from the site observations the culverts are flapped on the eastern side. There is, therefore, no flow route under the Eastern Relief Road and into the site.
- 4.25. Therefore the 2022 Loddon modelling results show that the site is not affected by fluvial flooding in the design event (the 1 in 100 annual probability with 14% climate change) and only a small part of the south eastern area of the site could be affected in the 1 in 1000 annual probability. There is a small area of Flood Zone 2 in the site's south eastern corner but the remainder of the site is in Flood Zone 1.

2021 SFRA Model

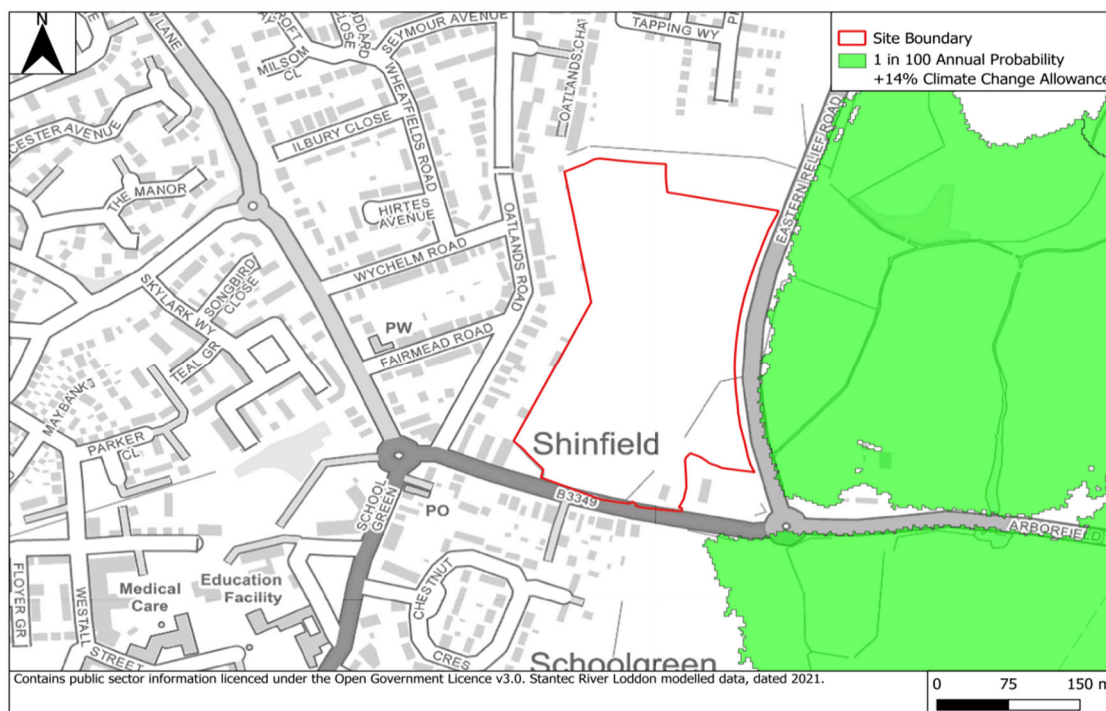
- 4.26. The 2021 SFRA model includes physical changes within the floodplain and catchment which have occurred since 2009, such as the construction of the eastern relief Road.
- 4.27. The 2021 SFRA present day model extents are shown in **Figure 6**.

Figure 6 – 2021 SFRA Present Day Flood Extents



- 4.28. The 2021 SFRA model considered the +70% climate change allowance. However, this allowance no longer adheres to the current guidance. The relevant climate change allowance for the site is +14%. ALP has rerun the 2021 SFRA model for the +14% change allowance.
- 4.29. The 2021 SFRA 14% climate change flood extents are shown in **Figure 7**.

Figure 7 – 2021 SFRA 14% Climate Change Flood Extents



- 4.30. **Figure 6 and 7** shows that the flood extent is located to the east of the Eastern Relief Road for all modelled scenarios using the 2021 SFRA.
- 4.31. **Table 2** summarises the modelled flood levels to the east of the Eastern Relief Road. The flood levels are relatively uniform in this area. The flood level was taken adjacent to the central culvert.

Table 2 – Summary of 2021 SFRA Model Maximum Flood Levels to the east of the Eastern Relief Road

Flood Event	Modelled Flood Level, m AOD
1 in 20 Annual Probability (5%)	40.36
1 in 100 Annual Probability (1%)	40.47
1 in 100 Annual Probability +14% Climate Change Allowance	40.52
1 in 1000 (0.1%) Annual Probability	40.74

- 4.32. The 1 in 100 annual probability +14% climate change scenario is the design event.
- 4.33. The 1 in 100 annual probability +14% climate change allowance flood level is 40.5m AOD. As noted above the Eastern Relief Road would not be overtopped and the flapped culverts under the Eastern Relief Road would prevent any flow towards the site from the eastern side of the road.
- 4.34. The 2021 SFRA model results confirm that the site is located entirely within Flood Zone 1 and is unaffected by flooding from the River Loddon.



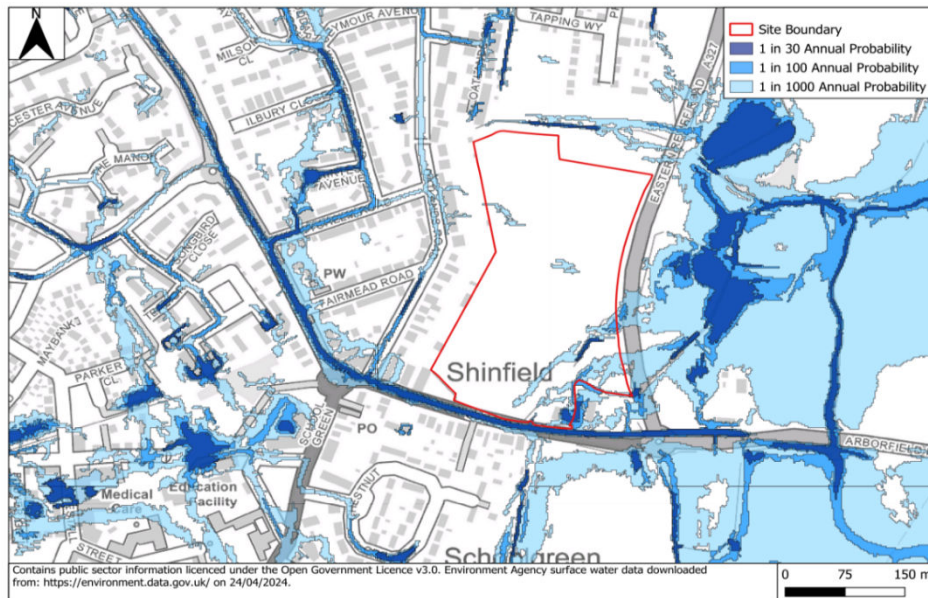
Summary of Fluvial Flood Risk

- 4.35. The 2021 SFRA model which includes the most up to date physical representation of the floodplain and catchment of the River Loddon shows the site to be in Flood Zone 1 and unaffected in the design event (1 in 100 annual probability with 14% climate change). The 2022 Loddon model which does not take account of changes in the catchment since 2009, such as the Eastern Relief Road construction suggests that the majority of the site is in Flood Zone 1 but a small area to the south eastern corner may be within Flood Zone 2, it confirms that the site is unaffected in the design event.
- 4.36. On balance, and given the presence of the Eastern Relief Road, the site is deemed to be within Flood Zone 1 with a Low Probability of fluvial flooding. This agrees with the findings in the Level 2 SFRA where the site, as a draft allocation, is not assessed as being at fluvial flood risk.

Flood Risk from Surface Water

- 4.37. 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'.
- 4.38. The NPPF PPG – 'Flood Risk and Coastal Change' includes the 1 in 100 annual probability of surface water flood (including climate change) within the definition of the design flood event to be used to inform an FRA.
- 4.39. **Figure 8** shows the flood risk from surface water. The EA Flood Risk from Surface Water mapping indicates that the majority of the site is at a 'Very Low Risk' of surface water flooding.

Figure 8 – EA Flood Risk from Surface Water



- 4.40. The EA surface water mapping is based on a national scale surface water ground surface model. 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.
- 4.41. The WBC Level 1 and Level 2 SFRAs indicate that there have been incidents of surface water flooding within the borough but all of these incidents are located outside of the site boundary..
- 4.42. The EA mapping shows possible flow routes for surface water across the site's south eastern corner. It also shows the flow route along the carriageway on Arborfield Road, with more frequent flooding and deeper flooding than that shown within the site.
- 4.43. Generally this suggests that the surface water flow routes within the site have been generated from land drainage and surface water runoff within the site itself rather than conveying surface water from off site.
- 4.44. Any surface water flooding across the site will likely be intercepted by the southern ditch or the cutoff drain associated with the Eastern Relief Road. It will then be conveyed towards the site's eastern boundary and into the highways ditch alongside the Eastern Relief Road. As noted from site observations this ditch is large and runs almost the entire length of the relief road and conveys flow onwards to the east and into the Loddon tributaries.
- 4.45. From a review of ground levels along the site's southern boundary and Arborfield Road, and from site observations confirming the nature of the verge, it is deemed to be unlikely that any surface water flowing along the road would divert into the site. However, even if this did occur, floodwater would likely end up in the southern ditch or pond and be restricted to the site's south eastern corner up to the farm access track. It would tend to flow into the highways ditch alongside the Eastern Relief Road and then onwards to the Loddon tributaries.



- 4.46. The Level 2 SFRA assessment of the draft allocation site confirms that there is 'limited risk on the site itself' of surface water flooding but flags the potential issues in the south eastern corner. This assessment has shown that the flow route is not a key concern due to the presence of physical features to intercept or divert the flow.

Flood Risk from Groundwater

- 4.47. 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.
- 4.48. The WBC Level 1 SFRA has assessed the area for susceptibility to groundwater flooding based off 1km grid squares. The SFRA does not contain any records of groundwater flooding to the site.
- 4.49. The Level 2 SFRA assessment of the draft allocation site suggests that there is a >75% susceptibility to groundwater flooding across the south end of the site; however the remainder of the site is at a <25% susceptibility. As this data is coarse (1km grid squares) it is reasonable to assume that the site itself is likely to be at a lower susceptibility than >75%. The mapping also suggests that groundwater could be less than 5m below the ground surface for a small area in the southern part of the site but this is not clear.
- 4.50. The southern part of the site is on the edge of the area of concern for groundwater flooding and the data is, as stated in the Level 2 SFRA, not a detailed assessment. Furthermore, the area affected is towards the boundary of the site with a large portion of it allocated for open space or roads.
- 4.51. The risk of flooding from groundwater sources to any built development is therefore considered to be low.

Flood Risk from Sewers

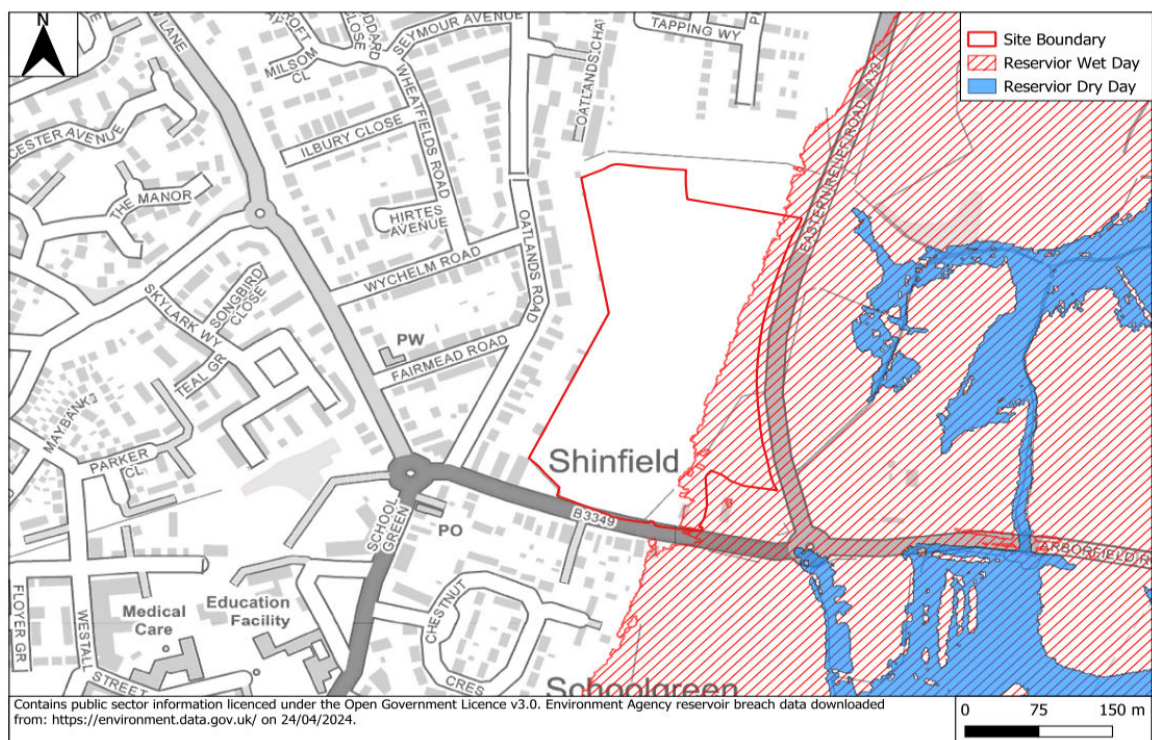
- 4.52. When exceeded, surcharged sewer networks can lead to flooding from backed up manholes and gully connections.
- 4.53. The WBC Level 1 SFRA confirms that the borough has flooded previously due to surcharging of foul, combined or surface water sewers. The number of reported incidents for the RG2 9 postcode area was 172. However, it is unclear if any of these area's affected the site as the SFRA does not specify the locations. The site itself is greenfield although there are sewers nearby. On balance the risk from sewers is deemed to be relatively low although it is recommended that the condition of sewers is confirmed at a later stage potentially as part of detailed design.

Flood Risk from Reservoirs

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

- 4.55. **Figure 9** shows the flood risk from reservoirs. The mapping indicates the site is at risk of flooding from the 'Wet Day' scenario in the event of a reservoir breach. The 'Wet Day' scenario occurs when a reservoir breach occurs at the same time as fluvial flooding. The site is not at risk of flooding in the 'Dry Day' scenario.
- 4.56. The risk of reservoir flooding is primarily from Bearwood Lake which is a reservoir located east of the River Loddon and more than 3km from the site. The Level 2 SFRA assessment of the draft allocation site also suggests that Bramshill House Pond, Tundry Pond and Wellington Country Park Lake could also pose a risk of reservoir flooding for the general area; however these are located between 5 and 10km from the site to the south and are not considered further. If there were to be a breach of the Bearwood Lake reservoir, this flow would likely follow the mechanism of the fluvial event. From a review of levels and a review of the potential for water to reach the site from the eastern side of the relief road, this risk is deemed very low.

Figure 9 – EA Flood Risk from Reservoirs



- 4.57. The probability of flooding from a reservoir breach is very small. The Reservoir Act (1975) set out a mandatory requirement for all large (greater than 25,000m³) raised reservoirs to be supervised and inspected by reservoir engineers.

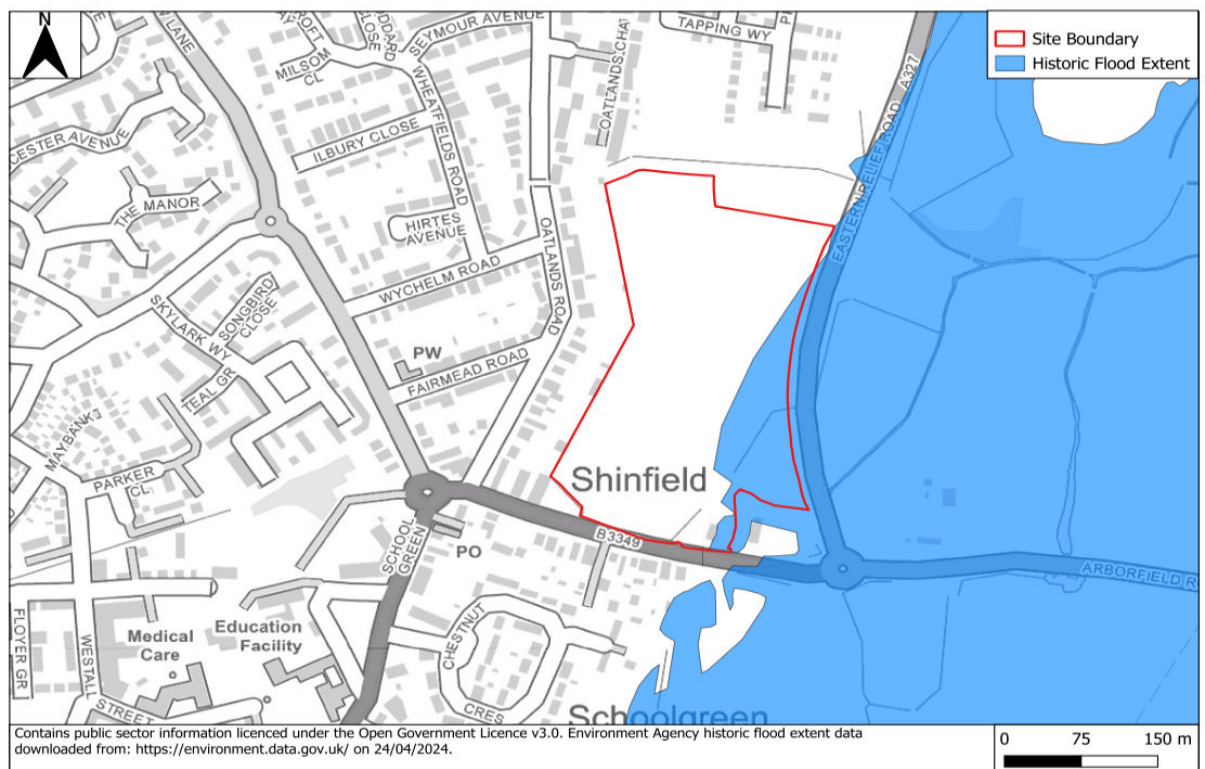
Flood Risk from Other Sources

- 4.58. The EA flood risk maps, WBC Level 1 & 2 SFRA indicate that the site is not at risk of flooding from canals or other artificial sources. The level 2 SFRA confirms that the data used is the National Inundation Reservoir Mapping (long term flood risk map) from the EA.

Historic Flooding

- 4.59. The EA Historic Flood Map shows the maximum extent of recorded flood events. The mapping indicates that the eastern part of the site has been affected by historic flooding. **Figure 10** shows this. It is likely that this flooding occurred before the Eastern Relief Road was constructed and the flow route is no longer achievable to the site.
- 4.60. The WBC Level 1 SFRA reports flooding in the borough but none of this affected the site.

Figure 10 Historic flood Extent



Flood Risk Summary

- 4.61. A summary of flooding from all sources is provided in **Table 4**.

Table 4 – Summary of Flood Risk

Source of Flooding	High	Medium	Low	Comments
Tidal			✓	The site is inland and not influenced by tidal levels.
Fluvial			✓	The Flood map for Planning suggests that the site is predominantly in Flood Zone 1 with an area in Flood Zone 2 and Flood Zone 3 to the site's south eastern corner and eastern boundary. However, analysis of detailed modelling commissioned by WBC suggests that the site is entirely in Flood Zone 1.
Pluvial		✓		The majority of the site is at a 'Very Low' risk of surface water flooding. There are areas of potential surface water flooding within the site and these correspond to potential flow routes for overland flow towards the sites eastern boundary. However it appears that the overland flow is generated purely within the site and is not reaching the site form elsewhere. This can be fully addressed through the site's water management and drainage strategy.
Groundwater			✓	From the available data the potential for groundwater flooding in the areas for built development is generally very low.
Sewers			✓	From the available data the potential for sewer flooding appears to be low.
Reservoirs			✓	The probability of reservoir flooding is very low. The available data suggests that any flooding resulting from a breach would emanate from the Loddon corridor and review of site data confirms that the Eastern Relief Road would likely prevent this from reaching the site.
Canals and other artificial sources			✓	The PFRA confirmed that there are no canals in the Borough and there was no mention in the WBC Level 1 & Level 2 SFRA.

- 4.62. The site is deemed to be at generally low risk of flooding. For the purposes of this FRA, the design flood event should be taken as the fluvial 1 in 100 annual probability scenario plus an allowance for climate change allowance. In this instance the relevant climate change allowance is 14% which is the Upper Central allowance for the Loddon and Tributaries Management Catchment.



- 4.63. The Masterplan for the proposed development has been designed with consideration of the potential for flooding and built development is not located in the site's south eastern corner. It is therefore in accordance with national and local planning policy concerning flood risk and, as such, the site is suitable for the proposed development.



5.0 Proposed Development and the Sequential 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 proposed development is a draft allocation site and will therefore be subject to WBC's Sequential Test process. The Level 2 SFRA has assessed the site as having limited flooding risk and this FRA confirms it is within Flood Zone 1 with a generally low surface water flood risk and low potential of flooding from other sources.

Exception Test

- 5.3. The Level 2 SFRA has classified the draft allocation site as an 'Amber' site given the limited risk of surface water flooding and its location in Flood Zone 1. The Level 2 SFRA confirms that the Exception Test does not apply to these sites.
- 5.4. The proposed development is therefore appropriate for this site with respect to flood risk concerns.

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. The masterplan for this development has followed this approach.

Ground Floor Levels

- 6.2. 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 1 in 100 annual probability plus climate change allowance is recommended.
- 6.3. The WBC Level 1 SFRA states FFL (finished floor levels) should be set 300mm above the 1% AEP plus climate change peak flood level. This site has been shown to be unaffected by the design event for fluvial flooding. Therefore there is no flood level.
- 6.4. Where the site is located outside of the fluvial flood extents, 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

- 6.5. The site has been shown to be unaffected by fluvial flooding for the design flood event. There is no requirement for floodplain storage as part of the development.

Safe Access

- 6.6. The site has been shown to be unaffected by fluvial flooding for the design flood event. There is no requirement for providing a safe access as part of the development.

Watercourses

- 6.7. To accommodate the proposed access and footpath arrangement at Arborfield Road the southern ditch will be culverted for a short section, essentially an extension of the pipe from which the channel commences. This will be sized to match the existing pipe.
- 6.8. A short section of the engineered cut off ditch north of the farm access track will be removed to provide the SuDS basin. A compensatory ditch of equivalent form will be provided. Details will be confirmed at a later stage and will also address any BNG elements.
- 6.9. The modifications to these watercourses will have no overall impact on the hydrology and conveyance mechanisms for overland flow or flood risk through the site.



Residual Risk

- 6.10. 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’.
- 6.11. Residual risk to the site includes a breach or failure of a reservoir and a flood event greater than the designed standards. The Bearwood Lake is located more than 3km to the northeast of the site, on the eastern side of the River Loddon and beyond the Eastern Relief Road. The mechanism for this to reach the site follows that of the fluvial extent and, as noted earlier, the Eastern Relief Road would prevent this flow route to the site.
- 6.12. The EA AIMS dataset which contains information of flood defences indicates that the site does not benefit from raised flood defences. There are no flood defences within the site boundary.
- 6.13. The EA mapping for reservoir breaches indicates that the eastern part of the site is located within an area at risk of flooding in the event of a reservoir breach occurring at the same time of a fluvial flood event. The probability of flooding from a reservoir breach is very small. The Reservoir Act (1975) set out a mandatory requirement for all large (greater than 25,000m³) raised reservoirs to be supervised and inspected by reservoir engineers. The residual risk is therefore confirmed to be low.

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 in line with 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 infiltration is highly unlikely to be a viable method of disposal (Ref: Para 3.21 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.
- Average Annual Rainfall (SAAR): 646mm
 - Soil: 0.470
 - Region No.: 6
- 7.16. With an overall site area of 7.0 hectares (ha), the calculated Greenfield run off discharge rates and volumes are as presented in Figure 8. The corresponding runoff outputs created within Flow can be found within Appendix 3.

Figure 8 – Pre-Development Runoff Rates/Volumes

Annual Probability	Greenfield/Pre-Development Runoff Rate per hectare (l/s)	Greenfield/Pre-Development Volume 360 minute storm
1 in 1 year event	3.8	
QBar	4.4	
1 in 30 year event	10.2	
1 in 100 year event	14.1	2051

- 7.17. Based on the Masterplan, Impermeable areas have been calculated for the development with urban creep added to dwellings as appropriate.
- 7.18. The overall Post developed Impermeable area amounts to 2.90 hectares (ha) plus 0.29 hectares attributed to the proposed attenuation basin.
- 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. In this instance the development will be attenuated with discharge rates set at greenfield run off rates for each storm event.

1. Greenfield discharge rates

- 7.20. Discharge flows are to be regulated using a complex control manhole system. This manhole includes two hydrobrakes and a weir, which together allow for precise management of flow rates, ensuring they align with the greenfield runoff rate.
- 7.21. For the purposes of this report and to provide a robust analysis, the complex control manhole system is designed to achieve greenfield runoff rates during different storm events. The system ensures that the flow rates during various storm intensities 1 in 1 year, 1 in 30 year, and 1 in 100 year events are controlled to match the pre-development greenfield runoff rates. The achieved flow rates are detailed below:
- 1 in 1 year storm: 12.01 L/s
 - 1 in 30 year storm: 32.44 L/s
 - 1 in 100 year storm: 45.02 L/s
 - Long term Storage output: 6.39 L/s
- 7.22. The design ensures that even during more intense storms, the system controls the discharge to match the greenfield runoff rates, thereby preventing the risk of flooding upstream and discharging at prior development rates.
- 7.23. With the above measures in place, and having assessed the ability to limit the offsite discharge rate using the complex control manhole, the anticipated long term storage volumes for a for the site are as follows:

Formular:
$$VOL = 10 \times RD \times A \times \left[0.8 \times \left(\frac{PIMP}{100} \right) - \left(\frac{PIMP}{100} \right) \times SOIL \right]$$

Figure 9 – Calculated Long Term Storage Volume

Catchment	Catchment Area (ha)	Impermeable Area (ha)	Long Term Storage Required Per Ha (m³)	Long term Storage (m³)
1	5.57	3.19	225.06	717.94
Totals	5.57	3.19		

Surface Water Proposals

- 7.24. 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 and basins to provide attenuation storage and high-quality water benefits.



- 7.25. Minimal sections of existing ditch are to be retained with the exception of those outlined on the application drawings.
- 7.26. Drawings HD008-FA-501 and 502 provide an overview to the proposals, copies of which are included within **Appendix 3**.
- 7.27. 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.
- 7.28. 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.
- 7.29. Discharge rates will be controlled to match greenfield runoff rates for all storm events up to and including the 1 in 100 year storm with a 40% climate change allowance. This is achieved using a complex control manhole with hydrobrakes and a weir. While effective flow control is provided, long-term storage is still required to manage runoff volumes.
- 7.30. 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.
- 7.31. Current uncontrolled pluvial runoff exhibited onsite during high rainfall events (Ref: para 3.25 above) 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 towards the Relief Road. This will be a benefit to downstream receptors.
- 7.32. This proposal provides suitable details of the principal components of the surface water strategy for this application and may be subject to further refinement to address any conditions. These assumptions are subject to evolution as the design is finalised with individual parcels being realised.
- 7.33. There is scope to utilise source control techniques (such as 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.
- 7.34. 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.
- 7.35. Simulation results for the proposed surface water network are included within **Appendix 3**.

Exceedance Flood Routing

- 7.36. 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.
- 7.37. The attenuation basin on the eastern edge of the Development is designed to provide 300mm freeboard and therefore can accept additional flood water from manholes upstream.

Water Quality Improvements

- 7.38. 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.
- 7.39. 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.
- 7.40. 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 in **Figure 2**.

Figure 2 – 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

- 7.41. 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.
- 7.42. 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.
- 7.43. 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.

- 7.44. The Residential Roof of the proposed development is classified as 'Very Low' in accordance with the Pollution Hazard Level, which equals to Total Suspended Solids: 0.2, Metals: 0.2 & Hydrocarbons: 0.05.
- 7.45. The Residential Roads and parking of the proposed development is classified as 'Low' in accordance with the Pollution Hazard Level, which equals to Total Suspended Solids: 0.5, Metals: 0.4 & Hydrocarbons: 0.4.
- 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 in **Figure 3**.

Figure 3 – Extract from Table 26.3 SuDS Manual

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

- 7.46. The pollution indices for the proposed development do not exceed the "Low Pollution Hazard" (TSS:0.5, Metals:0.4, Hydrocarbons:0.4) level and the proposed detention basins (TSS: 0.5, Metals: 0.5, Hydrocarbons: 0.6) provides adequate pollution treatment.
- 7.47. Finally, silt traps will be utilised before the attenuation basin, which will further enhance the water quality of the proposed development.

SuDS Maintenance Strategy

- 7.48. For the water treatment effects of SuDS features to remain effective, a comprehensive maintenance strategy should be implemented. Refer to **Appendix G** for more details.
- 7.49. During construction, maintenance of SuDS features should be undertaken by the Contractor. Upon completion, the assets should be passed over to the client to maintain the features in perpetuity.
- 7.50. 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.

7.51. 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.

Adoption and Ownership

7.52. 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

7.53. 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 Southern 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.

7.54. Suitable adoption and maintenance regimes for SuDS will be provided to address any planning conditions.



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 can flow entirely by gravity to the receiving public sewer located along the southern boundary of the site
- 8.3. The proposed foul water sewers will be designed in collaboration with Thames Water or independent adopting authority as approving body in accordance with the new Sewerage Sector Guidance (SSG) and will be offered to Thames Water, or alternative, for adoption under S104 Agreement of the Water Industry Act.

Adoption and Ownership

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

9.0 Conclusion

Flood Risk

- 9.1. The EA Flood Risk mapping was 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 located within Flood Zone 1 'Low Probability' (land at less than 1 in 1000 (0.1%) annual probability of river or sea flooding'). The east of the site is located within Flood Zone 2 'Medium Probability' (Land between 1 in 100 (1%) and 1 in 1000 (0.1%) annual probability of river or sea flooding. Along the eastern boundary of the site is located within Flood Zone 3 'High probability' land at 1 in 100 (1%) annual probability of river or sea flooding.
 - The site is at negligible risk of tidal flooding due to its inland location.
 - Detailed fluvial flood modelling results and site specific topographical data and site observations confirm that the site is not affected in the 1 in 1000 year annual probability event or in the design event (1 in 100 annual probability event with 14% climate change).
 - The EA Flood Risk from Surface Water mapping indicates that the majority of the site is at a 'Very Low Risk' of surface water flooding. Possible surface water flow routes across the south eastern part of the site are shown to be associated with flow generated within the site and, therefore will be completely accommodated by the development surface water drainage strategy.
 - The Level 2 SFRA suggests that the southern part of the site may be a potential risk of groundwater flooding. However, the site is on the edge of the potential risk area and the data is very coarse. Furthermore, this part of the site is generally providing open space and the access so there is little potential impact on built development.
 - Other sources of flooding are found to be a low risk for the site.
 - No specific flood risk mitigation measures are required and finished floor levels will be set an appropriate level above the surrounding ground level (minimum of 150mm).

Sequential Test and Exception Test

- 9.3. The Sequential Test will be applied by WBC for this draft allocation site. The Level 2 SFRA already confirms the low level of flood risk and the detailed assessment in this FRA demonstrates that the actual risk is even lower than the SFRA mapping suggests.
- 9.4. The Level 2 SFRA confirms that the Exception Test is not required.



Surface Water Drainage Strategy

- 9.5. 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 allowance for a 40% increase in rainfall intensities as a result of climate change and urban creep.

Summary

- 9.6. 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

Topographic Survey

Thames Water Sewer Asset Plan

Level 2 SFRA Extract

Planting Plans