Figure 5A: EA Surface Water Flood Mapping

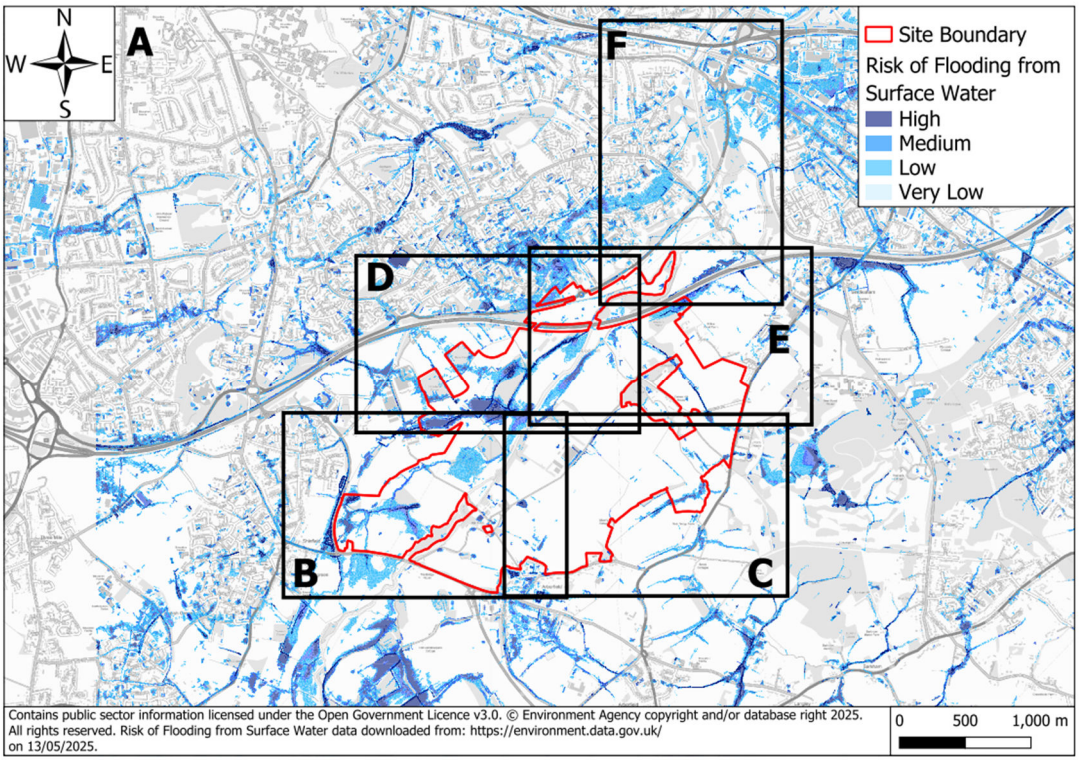


Figure 5B: EA Surface Water Flood Mapping

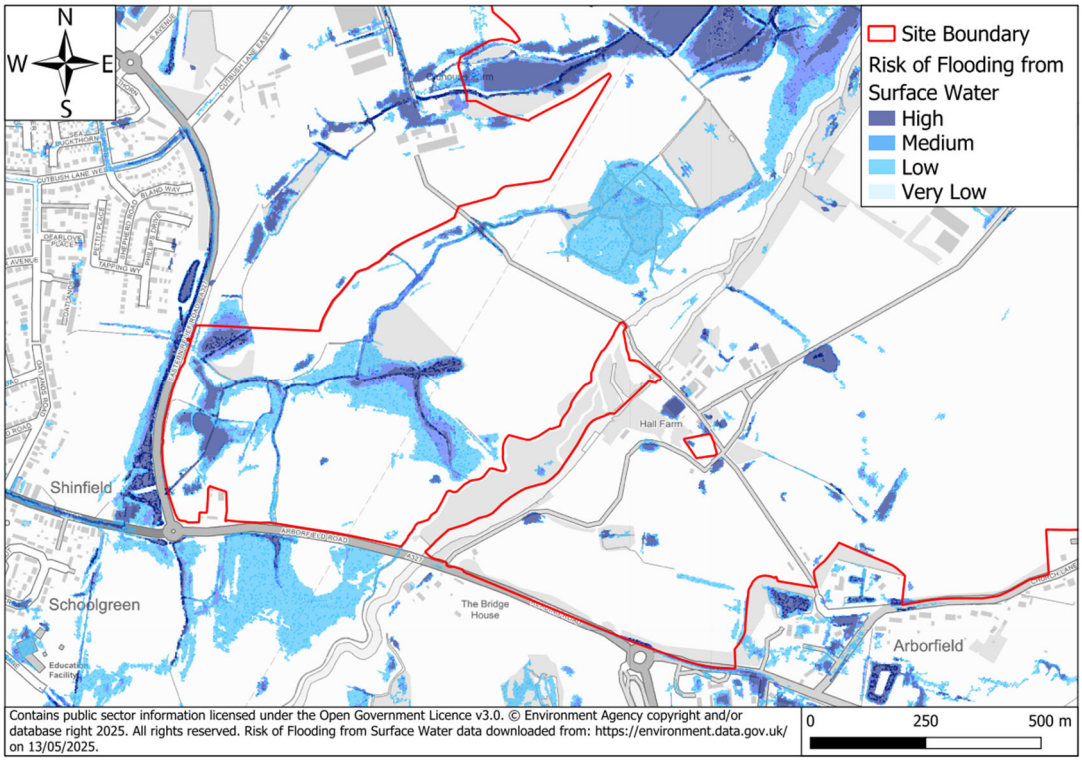


Figure 5C: EA Surface Water Flood Mapping

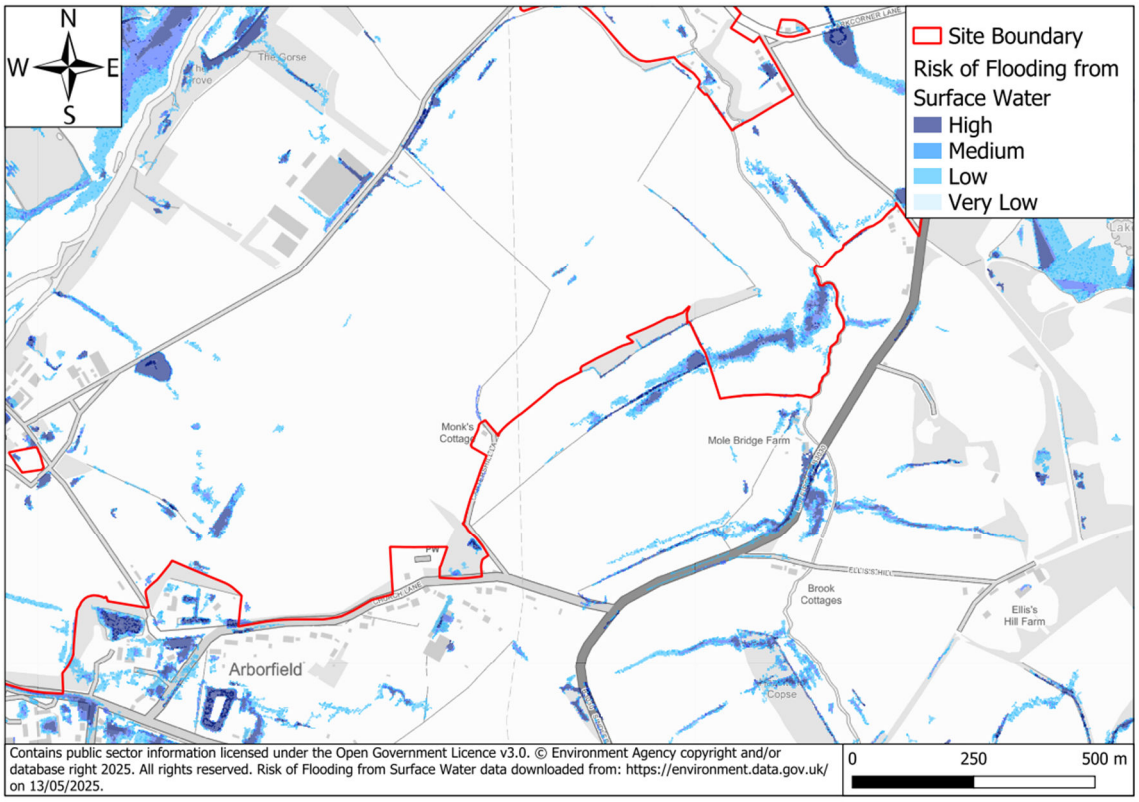


Figure 5D: EA Surface Water Flood Mapping

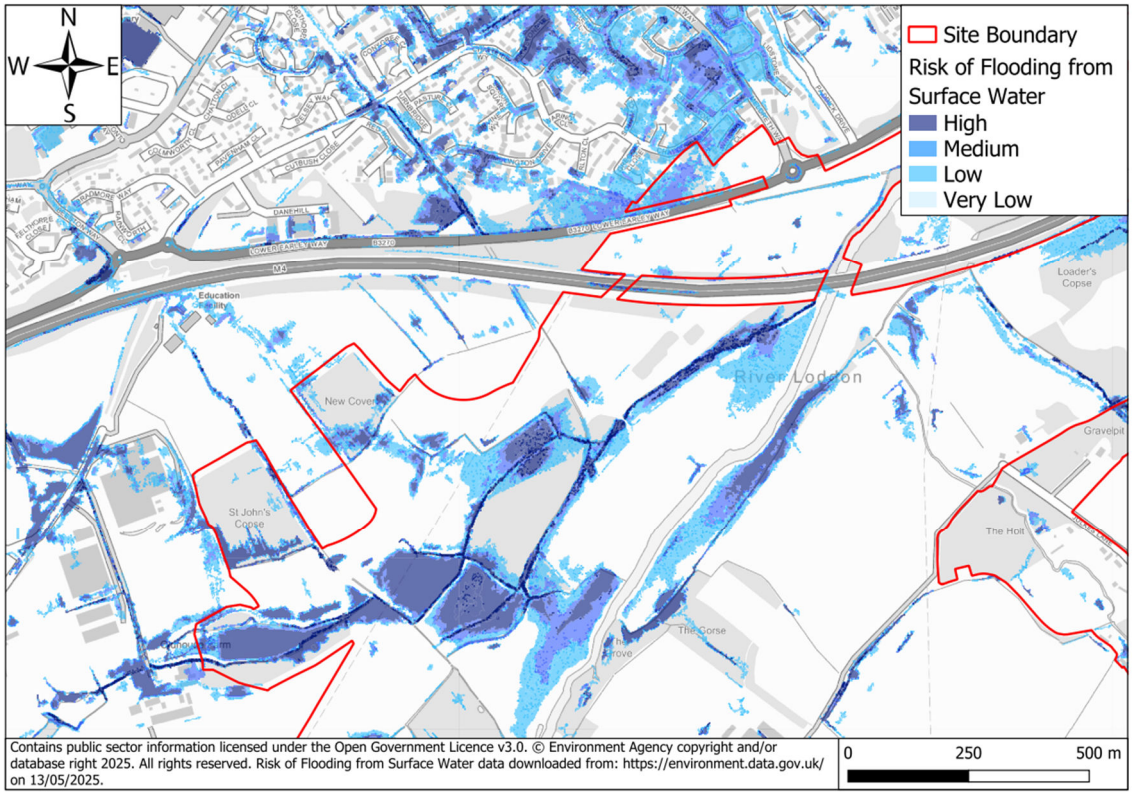


Figure 5E: EA Surface Water Mapping

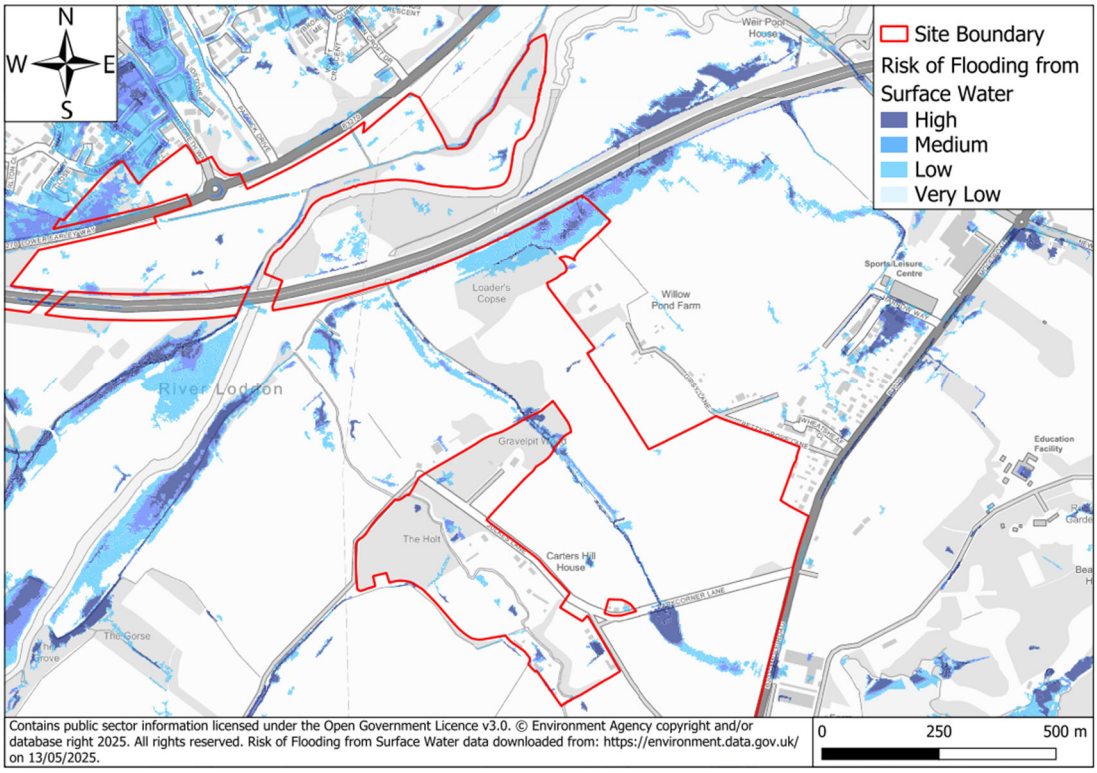
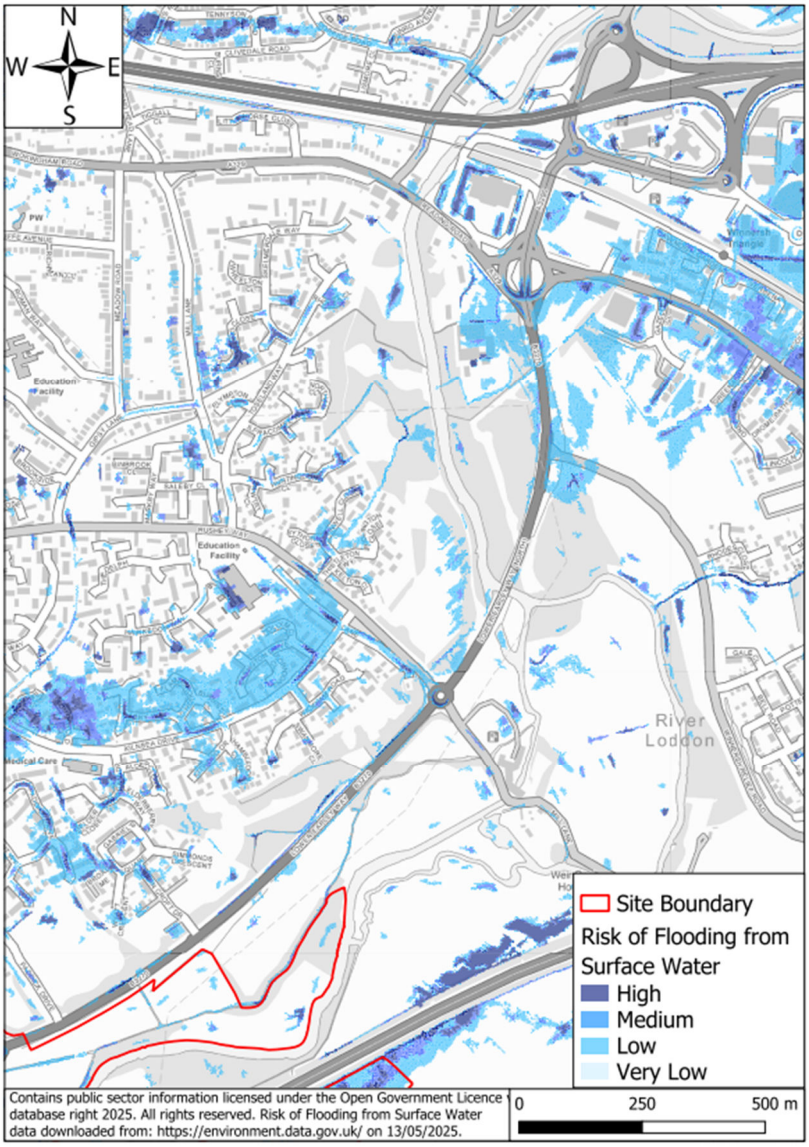


Figure 5F: EA Surface Water Mapping



4.3.6 The EA surface water flood mapping is generally picking up areas of potential fooding that are not shown by its fluvial flood mapping.

River Loddon through the Site

4.3.7 Fluvial flooding dominates much of the Loddon corridor. However there are areas of indicative surface water flooding shown in low lying parts of the western bank of the Loddon such as the woodland to the south-east of Oldhouse Farm, the area opposite CEDAR, an area just upstream of the M4 and an area on the eastern bank downstream of the dairy research centre.

River Loddon downstream of the Site

4.3.8 Again, fluvial flooding dominates the Loddon corridor itself. There are limited areas of potential surface water flooding generally associated with roads and low lying areas within Winnersh.

Western Watercourses

4.3.9 These watercourses have not been represented on the EA's fluvial flooding maps. The surface water flood mapping picks up low lying areas and ponding or overland flow routes but also channel flow within the natural or man made ditches in this area. The resulting mapping is similar to the detailed modelling completed for the Western Watercourses.

Barkham Brook

4.3.10 The EA's surface water flood mapping shows a significant overland flow route in an area north of Mole Road. No development is proposed in this part of the site. This flow route joins the Barkham Brook. Another flow route is shown from Mole Road towards Gravelpit Wood, which is in fact, for the most part, a channel that then joins the Barkham Brook as it flows under the M4. Otherwise there are small, isolated areas of potential ponding.

Arborfield Cut

4.3.11 The EA's mapping shows limited areas of ponding in the vicinity of the Arborfield Cut. One area is located where the watercourse flows under the road and into the River Loddon; the modelling here may not have accounted for the culvert at the road.

Detailed Surface Water Flood Modelling

4.3.12 Detailed models of the Barkham Brook and Arborfield Cut using a direct rainfall method provide a good representation of the potential surface water flooding risk across these parts of the site.

4.3.13 Model results are presented in the model reports in **Appendix D** and the differences with the EA mapping are summarised below.

Barkham Brook

4.3.14 The ditches and channels within this area are better represented and the modelling shows the flow routes within these. The main overland flow routes shown by the EA are also reflected in the model results.

Arborfield Cut

4.3.15 The direct rainfall approach shows the areas of ponding more clearly. The mapping also demonstrates how the watercourse itself is not well defined as a conveyance channel.

Summary of Surface Water Flood Risk

4.3.16 Review of all available data confirms that surface water flooding is has less impact on the site than fluvial flooding across the site. There are a number of overland flow routes, some of which are, in fact, ditches or defined channels. There are also areas of ponding where there is low lying land. These areas are more extensive on the western side of the River Loddon.

4.3.17 For the purposes of this FRA the key principles demonstrating the suitability of the site for development are proven through applying both the EA strategic mapping and the findings of the detailed modelling. Key to the development strategy is the sequential approach to locate the proposed built development in areas outside of the potential flood risk areas indicated through

modelling. In the current development strategy a significant buffer is provided between the edge of the modelling floodplain and the edge of the proposed development. Therefore, these key principles are not reliant on the model review.

4.3.18 The detailed modelling, where appropriate, will be used to inform the design of features such as bridge crossings and flood mitigation measures. At this stage in the planning process the results from the detailed models are sufficiently robust.

4.4 Flood Risk from Groundwater

4.4.1 Groundwater flooding has the potential to occur after prolonged periods of unusually high rainfall. During such periods, more water than usual infiltrates through the ground, raising the water table above its normal depth below the surface. Where the water table is at a shallow depth in any case, the water table can reach the surface. This can cause groundwater to merge with rainfall and cause localised flooding.

4.4.2 The Level 1 SFRA, 2023, includes mapping of the risk of groundwater flooding showing areas susceptible to groundwater flooding based on geological and hydrogeological conditions; it shows the potential degree of hazard (indicating that flooding may be possible) but does not indicate the actual likelihood of groundwater flooding occurring (risk of flooding).

4.4.3 This suggests that there is a potential for groundwater flooding particularly along the Loddon corridor, although the data is coarse and limited to 1km grid squares. As such it is useful as an indicator but not for determining actual risk.

4.4.4 The Level 1 and 2 SFRAs, 2023, show mapping of predicted groundwater depths which is used as an indicator for the risk of groundwater flooding. This suggests that groundwater is at a shallow depth in an area to the west of the Loddon and between 0.5m and 5m below the surface in specific areas south of the M4 and an area near Oldhouse Farm to the west of the Loddon.

4.4.5 **Appendix A** shows this mapping.

4.4.6 As noted in the WBC Level 2 SFRA, this mapping only identifies areas likely to be at risk of groundwater emergence and where this water may flow. However, it does not predict the likelihood of groundwater emerging or attempt to quantify the volumes of groundwater that might be expected to emerge.

4.4.7 Overall groundwater flooding is deemed to be a low risk. This was also the conclusion in WBC's own SFRA.

4.4.8 In areas where groundwater is found to be close to the surface there are mitigation measures that can be taken with regards to the construction of buildings and foundations. If groundwater flooding were to occur then the mitigation measures already put in place for fluvial and pluvial flooding would also manage water flows away from the buildings.

4.5 Flood Risk from Sewers

4.5.1 When exceeded, surcharged sewer networks can lead to flooding from backed up inspection chambers and gully connections.

4.5.2 Thames Water Asset Location Plans confirm that there are very few sewers within the site itself. A copy of the Thames Water Asset Plans is included within **Appendix A**.

4.5.3 DG5 records have been reported in the WBC SFRA. This suggests that since 2000, there have been 60 recorded incidences of sewer flooding within the vicinity of the site. These have occurred along Mole Road to the east of the site, and Arborfield Road along the southern boundary.

4.5.4 Since 2000, there are over 386 recorded incidences of sewer flooding within 500m of the site. The majority of these occurred on the urban centres of Lower Earley, Shinfield, Winnersh and Sindlesham.

4.5.5 Thames Water have also identified clusters of flooding within the Arborfield STW catchment. Thames Water recognise that Arborfield and Wokingham Sewage Treatment Works will reach quality and/or flow exceedance over the coming Asset Management Periods. Thames Water is obliged to address these matters.

4.5.6 Overall sewer flooding is a low risk to the site.

4.6 Flood Risk from Reservoirs

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

4.6.2 **Figure 6A** shows the overall flood risk from reservoirs. **Figures 6B – 6F** show the flood risk in specific areas.

Figure 6A: EA Reservoir Flood Mapping

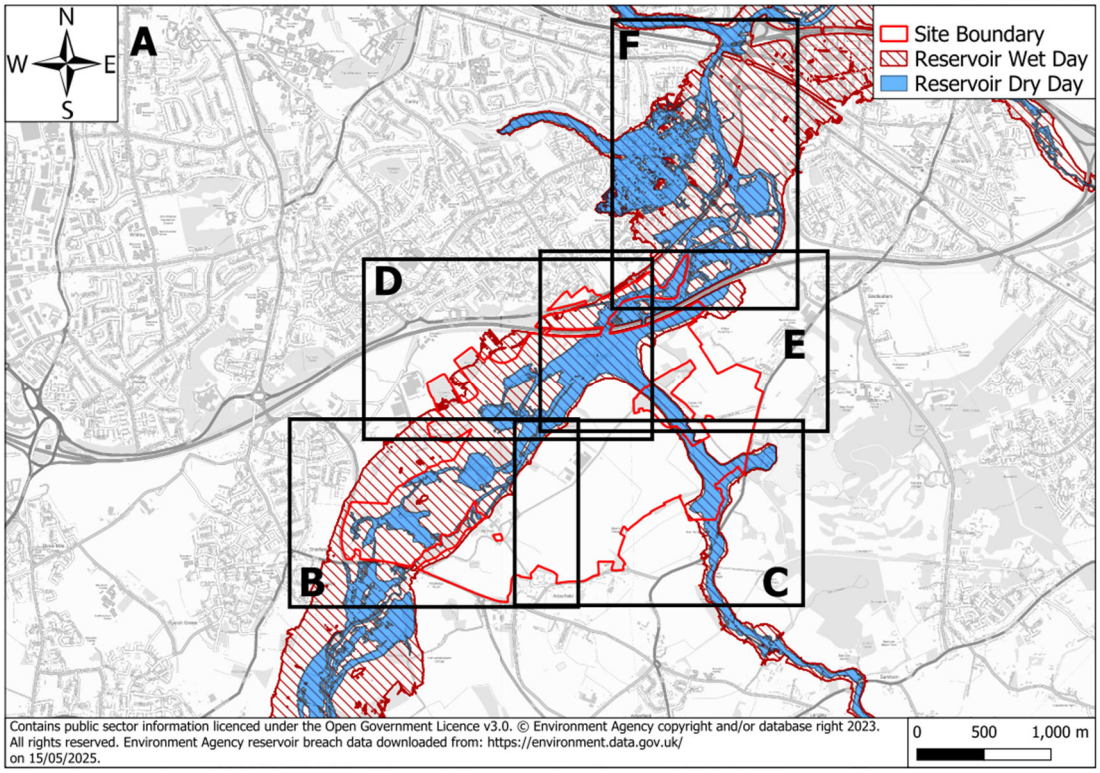


Figure 6B: EA Reservoir Flood Mapping

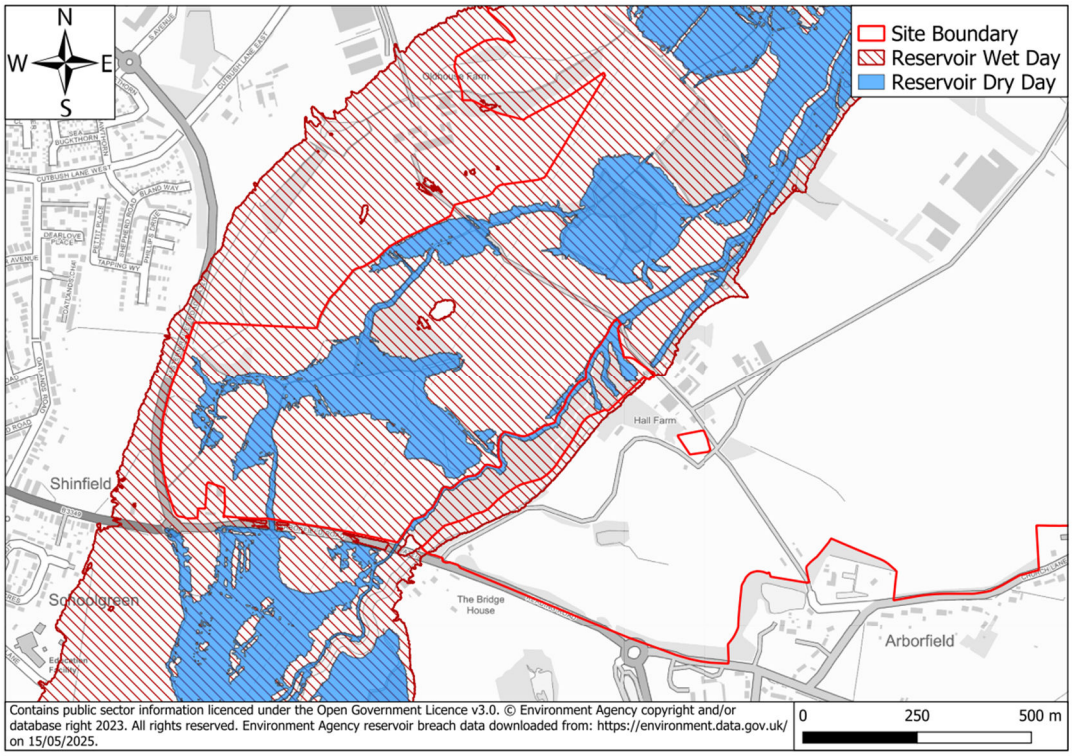


Figure 6C: EA Reservoir Flood Mapping

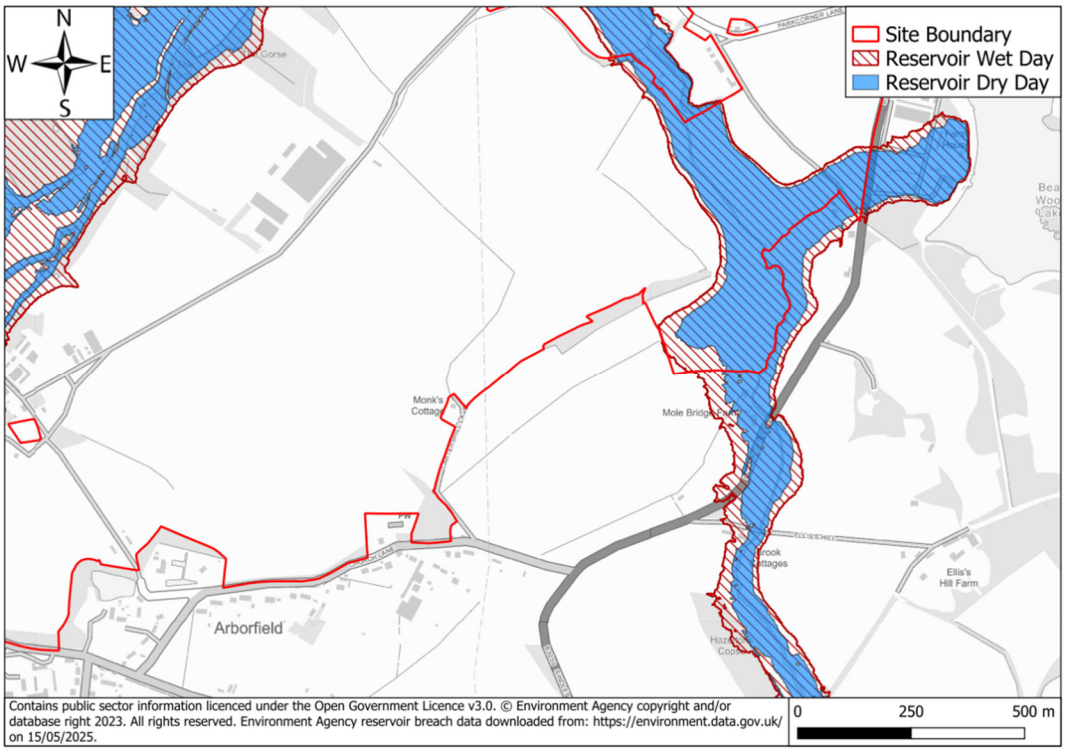


Figure 6D: EA Reservoir Flood Mapping

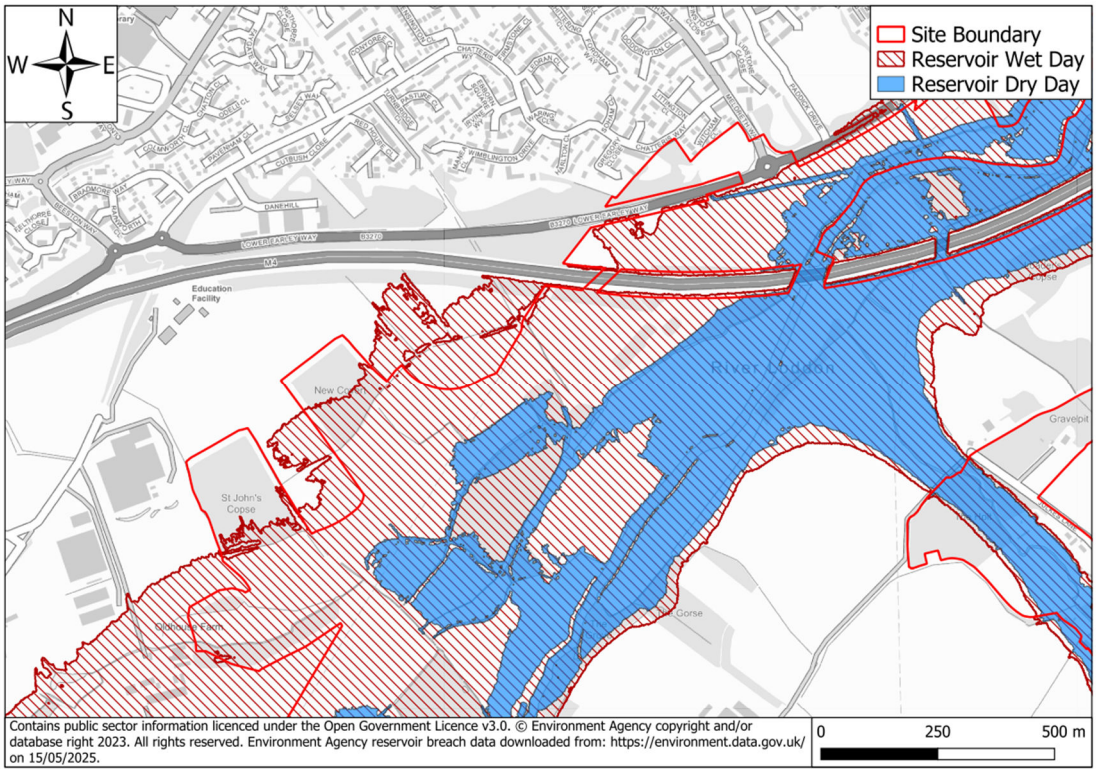


Figure 6E: EA Reservoir Flood Mapping

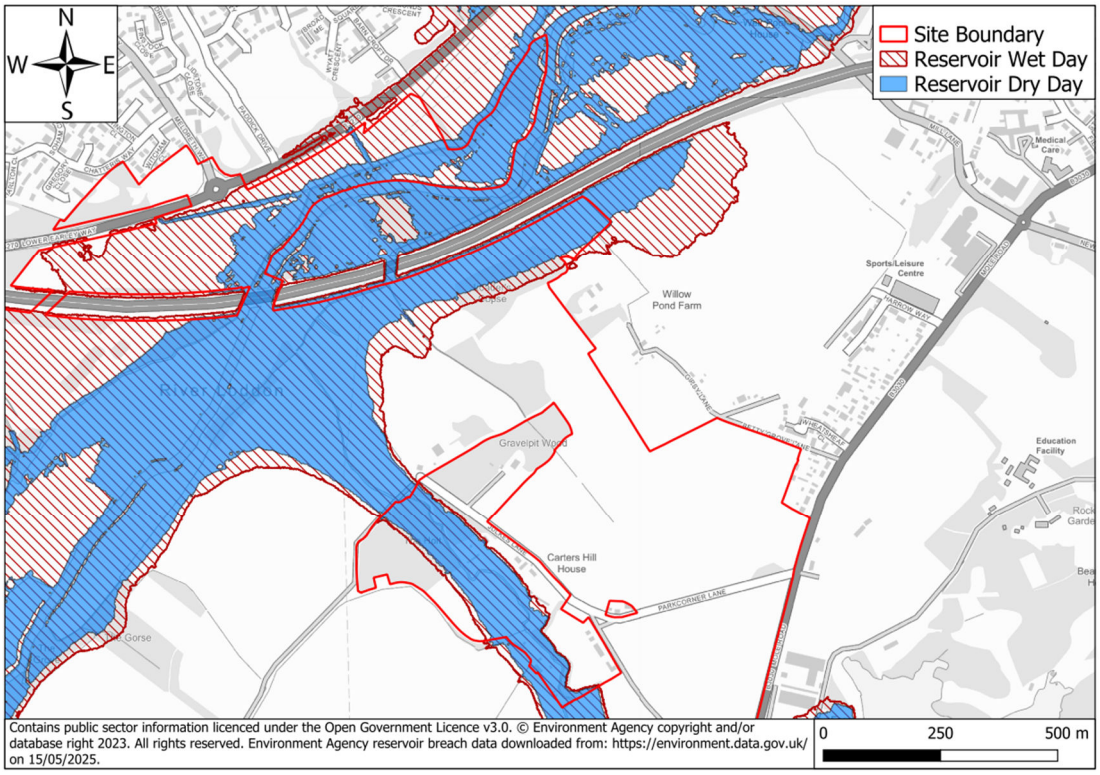
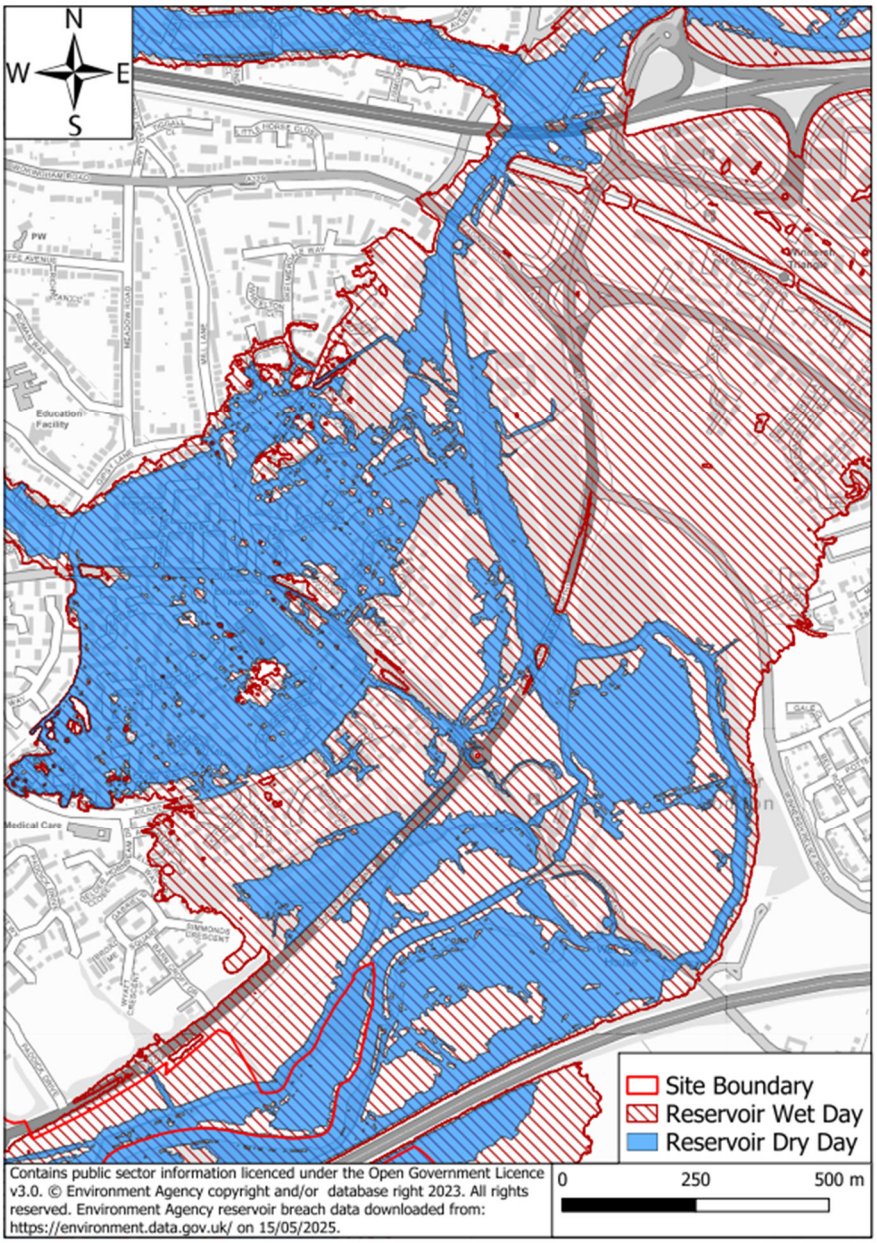


Figure 6F: EA Reservoir Flood Mapping



4.6.3 The mapping shows that areas within the site boundary are impacted by both wet and dry reservoir breach days. The closest reservoir to the site is Bear Wood Lake, which lies approximately 130m to the east of the site boundary and Mole Road. If a reservoir breach were to occur the extent of the flooding broadly follows the fluvial floodplain extent and therefore is not an additional concern.

4.6.4 For the dry day the potential impact is similar to the fluvial flood zone 2 for the Barkham Brook, but less extensive for the Loddon corridor. On a wet day, the extent is broadly the same as flood zone 2.

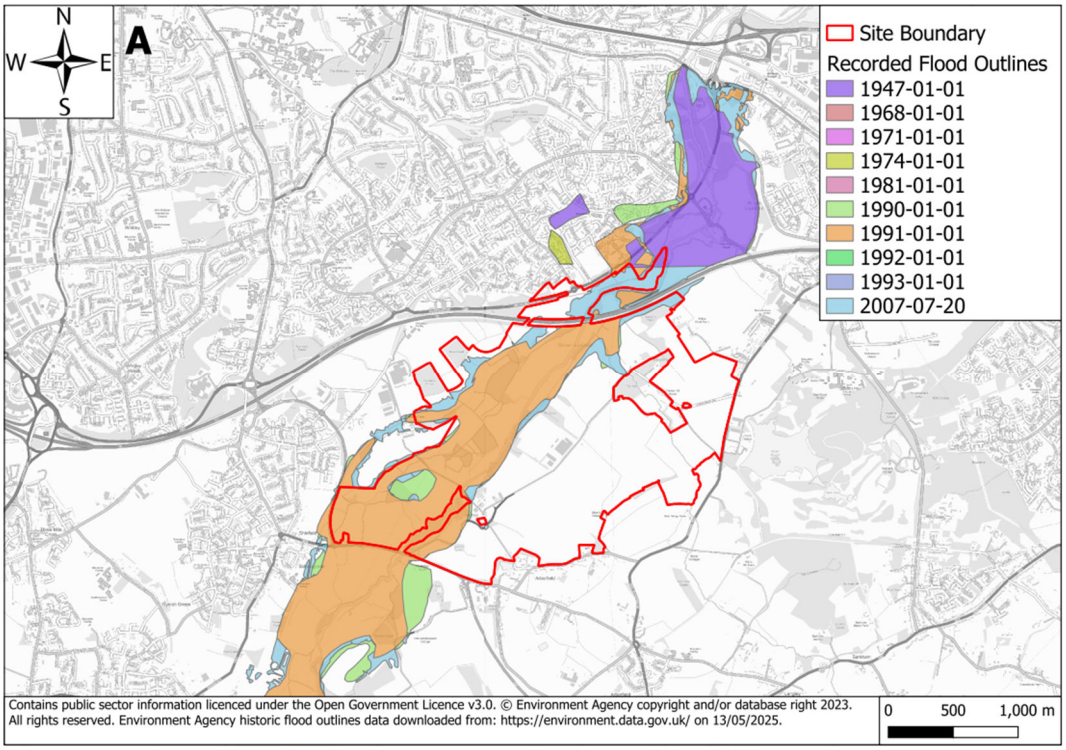
4.6.5 Given the requirements for inspection and maintenance of reservoirs, the chance of a breach or failure is very low. For this to occur in conjunction with the peak of an extreme flood event is an

even lower likelihood. Overall, the reservoir flood risk is low. Mitigation measures in place for fluvial and pluvial flooding would manage floodwater in the same way regardless of its source.

4.7 Historic Flooding

4.7.1 **Figure 7A** shows the historic flood extent records held by the EA. The EA Historic Flood Map shows the maximum extent of recorded flood events.

Figure 7A: EA Historic Flooding



4.7.2 The EA historic flooding and recorded flood outline datasets show a number of instances of fluvial flooding from the River Loddon affecting parts of the site. The data shows maximum flood extents as being up to 920m wide at the southern end of the site.

4.7.3 **Table 1** outlines the dates of historical flooding events which is based on historic flood mapping, EA recorded flood outlines, and LLFA historic flood points. The events below are within the areas of Arborfield, Arborfield Green and Barkham.

Date of Flooding	Description
February 1990	Fluvial flooding of the River Loddon on the western border.
February 1991	Fluvial flooding of the River Loddon on the western border.
July 2007	Fluvial flooding of the River Loddon on the western border.
2007	Flooding due to surface water run-off in numerous locations within the character area, mostly centred around Arborfield.
2013	Flooding due to surface water run-off in numerous locations within the character area, mostly centred around Arborfield.

2015	Flooding due to surface water run-off in numerous locations within the character area, mostly to the east of Arborfield.

4.7.4 The WBC Preliminary Flood Risk Assessment includes mapping that outlines historical flooding incidents from local sources of flooding. This indicates that historical flooding within the site boundary, has been mainly from main rivers. To the south of the site, towards the Arborfield area, here there have been several surface water run-off historical flooding events. This mapping is provided in **Appendix A**.

4.7.5 It is widely accepted that parts of the site may be subject to frequent and sometimes prolonged flooding from the River Loddon. All the available data also confirms that this primarily impacts the areas to the west of the Loddon, with limited floodplain extents on the eastern banks, and therefore does not affect the parts of the site to be developed.

4.8 WBC Level 2 SFRA, Aug 2023: Detailed Site Summary

4.8.1 As part of the Local Plan Update the Level 2 SFRA produced by WBC includes a detailed site summary for each allocation in the draft plan. This included a review of all sources of flooding and commentary on the requirements for an FRA to support development of the site. As such this is a useful overview of flood risk for the site and a consideration for this FRA.

4.8.2 The WBC summary concluded that the NPPF Sequential Test will need to be applied by the council, and, if passed, the Exception Test would need to be satisfied as part of the development proposals. It is also noted that 'More Vulnerable' and 'Less Vulnerable' uses should not be permitted within Flood Zone 3b, the functional floodplain.

4.8.3 It states that an FRA for the site must satisfy the following criteria:

- *At the planning application stage, a site-specific FRA will be required as the proposed development site is located in Flood Zone 3a and Flood Zone 3b, and at significant surface water flood risk.*
- *All sources of flooding should be considered as part of a site-specific FRA.*
- *Consultation with the Local Authority, Lead Local Flood Authority, Water Company, and the Environment Agency should be undertaken at an early stage.*
- *Any FRA should be carried out in line with the National Planning Policy Framework (NPPF); Flood Risk and Coastal Change Planning Practice Guidance (PPG); Wokingham Borough Council's Local Plan Policy's and Wokingham Borough Council's SuDS Strategy.*
- *The development should be designed with mitigation measures in place where required.*
- *A detailed hydraulic model of Barkham Brook may be required at FRA stage to accurately represent the risk from these watercourses.*

4.8.4 And guidance for site design and making development safe includes the following:

- *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).

- *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 are as close as possible to pre-development greenfield 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.*
- *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.*
- *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.*
- *Opportunities should be explored at the earliest possible stage to reduce flood risk (from all sources) on and off the site.*

4.9 Summary of Flood Risk to Site

4.9.1 Assessment of available data and review of WBC's own detailed site summary confirms that parts of the site can be significantly affected by fluvial and pluvial flooding. However, the potential extent and severity of this flooding is well understood through modelling. The flooding is primarily associated with areas to the west of the River Loddon.

4.9.2 The site is large and given the nature and extent of potential flooding there is more than adequate scope for developing the site in a sustainable and robust way from a flood risk perspective, with development avoiding the key flood risk areas.

4.9.3 The key principles for the development can be evidenced from the EA approved strategic modelling and mapping, and the findings of the detailed modelling are adequate to inform the necessary constraints planning and mitigation design at this stage.

5 Sequential and Exception Test

5.1 NPPF Sequential Test

5.1.1 The NPPF states that Local Planning Authorities allocating land for development should apply the Sequential Test to demonstrate that there are no reasonably available sites in areas with a lower probability of flooding that would be appropriate to the type of development or land use proposed.

5.1.2 It is evident, from the review of flood risk, that some parts of the site are at significant potential risk of both fluvial and pluvial flooding; however, in applying the Sequential Test to planning applications, NPPF paragraph 175 confirms specific development cases when the test is not applicable:

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

5.1.4 In the Local Plan Update, WBC Policy SS13: Loddon Valley Garden Village is clear in that development of the site is appropriate if built development is located in appropriate locations with regards to flood risk.

5.1.5 The proposed development strategy and masterplanning has been led, in part, by the understanding of flood risk across the site. The areas for proposed built development shown in the Parameter Plan in **Appendix A** are located accordingly, outside of the floodplain defined through modelling. The proposed development is located generally 50m to 150m from the edge of the floodplain defined through modelling and generally 4 to 5m higher than the modelled flood level. As such, even if the floodplain defined through the detailed modelling studies is revised as part of the EA detailed review process, the proposed development will still be located away from the areas of potential flood risk. The principle for development is, therefore, demonstrated to be sound, even without a full EA review of the detailed modelling studies.

5.1.6 Furthermore, the proposed access routes from the surrounding roads to the proposed development do not cross areas of potential flood risk, as indicated through modelling and from strategic mapping. The proposed crossing of the Loddon does pass through the floodplain, but safe access is already available from all parts of the development to an area outside the floodplain without relying on this crossing.

5.1.7 As such, the proposed development satisfies the requirements of paragraph 175 of NPPF.

5.1.8 Furthermore, WBC has completed the Sequential Test for allocated sites as part of the Local Plan Update, 2024 and this includes the LGV site.

5.1.9 The Sequential Test confirms the level of flood risk from different sources across the site and identifies the areas where a sequential approach to development may be appropriate. In Table 3a (pages 104-105) it confirms the key findings of the Level 2 SFRA that development on site is likely to be able to proceed if:

- *The area of the site located in Flood Zone 3a and 3b, immediately surrounding the River Loddon and Barkham Brook remains undeveloped.*
- *Development is steered away from surface water flow paths, particularly towards the south and south-west of the site. A carefully considered and integrated flood resilient and sustainable drainage design is put forward, to carefully consider, manage and mitigate existing flood risk both to and from the site.*
- *Safe access and egress can be demonstrated in the 1% AEP plus climate change surface water and fluvial events. This includes measures to reduce flood risk along these routes such as raising access, but not displacing floodwater elsewhere. At present, safe access and egress cannot be demonstrated in the 1% AEP plus 40% climate change surface water event. Additionally, safe access and egress can only be demonstrated in the 1% AEP plus 23% climate change fluvial event when accessing the site from the north via Shinfield Eastern Relief Road, and from the South via Mole Road.*
- *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.*
- *If flood mitigation measures are implemented then they are tested to check that 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).*

5.1.10 The development guidelines proposed in the LPU for the LGV are set out (Table 3a pages 105 to 106) as:

- *To ensure new buildings (except for compatible uses) are located, wherever possible, outside of areas of higher flood risk, by placing the most vulnerable development in the lowest areas of flood risk.*
- *Create a continuous high-quality, safe, attractive, accessible and multifunctional green and blue infrastructure network designed and planned in from the outset. The new garden village will be structured around a coordinated and comprehensive landscape-led approach drawing on the recreational and ecological opportunities of the River Loddon and Barkham Brook and their tributaries by utilising their role and function in natural flood management and biodiversity enhancement; and the landscape attributes and characteristics of the River Loddon Valued Landscape and Barkham and Bearwood Valued Landscape. Accessibility to and along watercourses should be increased as part of the provision of continuous, high-quality and attractive and accessible open space and ecological networks, where possible, linking to those beyond the garden village.*
- *Address the potential changes associated with climate change and flood risk, providing safe access and egress, taking account potential increases in severity and frequency of flooding, and ensure buildings and homes are designed to be safe for the intended lifetime. A comprehensive and integrated site-wide sustainable drainage network must be provided that makes use of the existing topography and natural features of the site. All opportunities should be further explored to achieve flood betterment, reducing risk within and beyond the garden village.*

5.1.11 The conclusion is that the development passes the Sequential Test:

- *The development passes the sequential test for allocation because there is a need to identify a sufficient supply of dwellings and employment floorspace to meet needs. In line with the preferred spatial strategy, a strategic site is required to help meet development needs.*
- *Given the scale of the site, a significant area of land is located within FZ1 and areas with low risk of flooding, and this area is capable of accommodating the proposed quantum of development. The Proposed-Submission LPU requires development to both reduce and minimise flood risk on site; in particular by sequentially locating development within the site. There are also opportunities to manage flood risk at the site, and provide localised betterment downstream.*

5.2 Exception Test

5.2.1 Paragraph 177 of the NPPF states that to pass the Exception Test it should be demonstrated that:

a) the development would provide wider sustainability benefits to the community that outweigh the flood risk; and

b) 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.

5.2.2 Both elements of the exception test should be satisfied for development to be allocated or permitted.

5.2.3 The WBC Local Plan Update states that "*the site has been demonstrated to pass the Exception Test for allocation for mixed use as it offers notable wider sustainability benefits and is capable of being made safe for its lifetime*."

5.2.4 In any case, the need for the development and the wider benefits that it provides has been demonstrated through the planning process and this FRA provides evidence, through the mitigation strategy, that the development will be safe for its users.

5.2.5 Therefore the Sequential Test and the Exception Test are satisfied.

6 Flood Mitigation Strategy

6.1 Overall Approach to Mitigation

6.1.1 The principle for the suitability of the site for development is shown through the Sequential Test being satisfied. The Exception Test requires the development to be safe. This is demonstrated through the provision of a robust mitigation strategy.

6.1.2 The mitigation strategy is based on the modelled data for the design event. For fluvial and pluvial flooding, this is the 1 in 100 year with the relevant climate change allowance. This will ultimately be defined through the results derived through the detailed modelling as this is geared towards a site specific FRA. It is noted that, at this stage in the planning application, the EA has not completed a full review of the detailed modelling.

6.1.3 Whilst there is always some uncertainty in modelling and there can always be debate about the technical parameters it is clear that by adopting the sequential approach to the layout of the site, no matter which data is used the entirety of more and less vulnerable development is outside of the area of fluvial flood risk now and in the future. Thus, final resolution of the models does not affect the suitability of the development in principle. Where the models are more important is where they are used to assess the location and design of the bridge crossings. They are sufficiently detailed to assess these designs and potential mitigation at this stage of the planning process. However, it will ultimately be necessary to undertake more detailed design work and secure flood defence consent from the EA and it is recognised that further discussion and debate on modelling approaches and detail may be required at that time in the future

6.2 Sequential Approach

6.2.1 The baseline flood risk overview confirms that the vast majority of the Site is at little or no risk of flooding from any source. However, some parts of the site, particularly on the western side of the River Loddon, and also the watercourse corridors for the Barkham Brook and its tributaries, may be prone to fluvial and pluvial flooding. The masterplanning approach for the proposed development has been heavily influenced by an understanding of these areas and the nature of the potential flooding.

6.2.2 A sequential approach, as set out in NPPF has been applied across the Site, with both more vulnerable uses such as residential development and less vulnerable development such as commercial development and educational uses located in the areas with lower potential for flooding.

6.2.3 The main source of flooding is from the River Loddon with an extensive floodplain to the west of the river. In this area is the EcoValley which will form part of the wider country park area. This is deemed to be a water compatible land use.

6.2.4 To the east of the River Loddon the floodplain is relatively narrow with ground levels generally rising quickly beyond the river channel. The proposed residential development is located beyond the floodplain in Flood Zone 1. In most locations it is between 50m and 200m beyond the floodplain extent and on ground where the levels are 4 to 5m higher than the modelled flood level.

6.2.5 A key exception to this approach is the proposed new vehicular crossing of the River Loddon. Whilst the need for this crossing has been led by the wider access requirements the route and the design of the road crossing have been developed to ensure that there is no impact on flood storage or flood conveyance. However, this road and associated embankments do, necessarily, pass through the floodplain on both the western and eastern sides of the River Loddon.

6.2.6 The road to the north of the M4 from the M4 crossing to the connection at Lower Earley Way also passes through an area of floodplain in the design event. This will be designed to ensure no detrimental impact on conveyance and floodplain storage.

6.2.7 New infrastructure associated with the proposed new pedestrian/cycle crossing of the River Loddon is also within the floodplain for the design event. Again, the design of the crossing and associated works will ensure no detrimental impact on the channel conveyance or on floodplain function.

6.2.8 There are other potential sources of flooding which have been considered in applying the sequential approach for development and these are discussed below.

6.2.9 With regards both fluvial and pluvial flooding associated with the western watercourses, this area does not comprise any residential development and includes the EcoValley, part of the country park, therefore satisfying the sequential approach.

6.2.10 With regards fluvial flooding from the Barkham Brook and pluvial flooding within this catchment, residential development, commercial development and schools have been located outside the floodplain and away from areas of potential flooding. To allow for access within the development, there are a number of crossings of the Barkham Brook and its tributaries but these have been kept to a minimum and located to minimise their impact on the floodplain. In most cases these crossings are at points where the design flood is retained within the main river channel or where the floodplain is limited to the river corridor.

6.2.11 With regards flooding from the Arborfield Cut and within this catchment, again residential, commercial development and schools are located outside the fluvial floodplain and away from areas of potential pluvial flooding. Again, there is a requirement for a new crossing of the Arborfield Cut but this has been located where there would be minimal intrusion into areas of potential flooding.

6.2.12 The general approach in masterplanning has been to retain the key watercourses in their current location and protect the watercourses and floodplains through maintaining green corridors. This also allows for opportunities to enhance the river corridors where appropriate and to maximise the social and biodiversity potentials for these features which are a key element of the aspirations for Loddon Garden Village. **Figures 8-10** show how the masterplan has responded to the assessment of flood risk.

Figure 8: Sequential Approach to Development: southern area

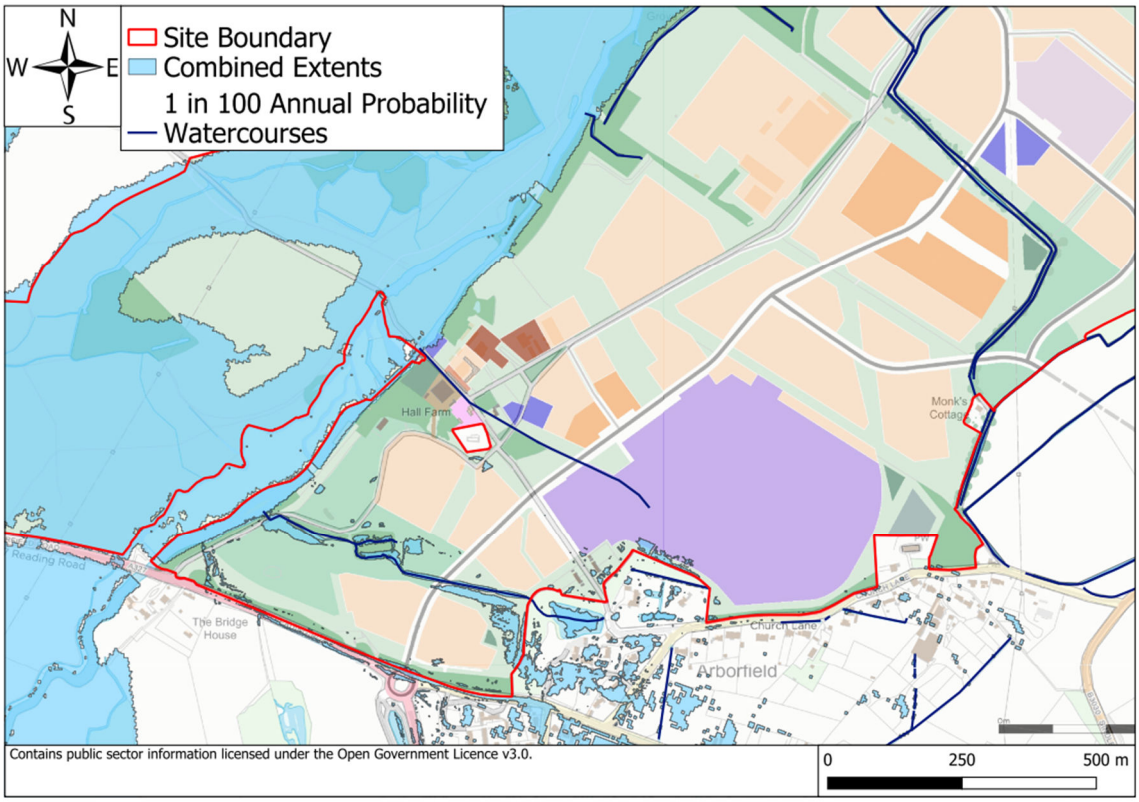


Figure 9: Sequential Approach to Development: central area

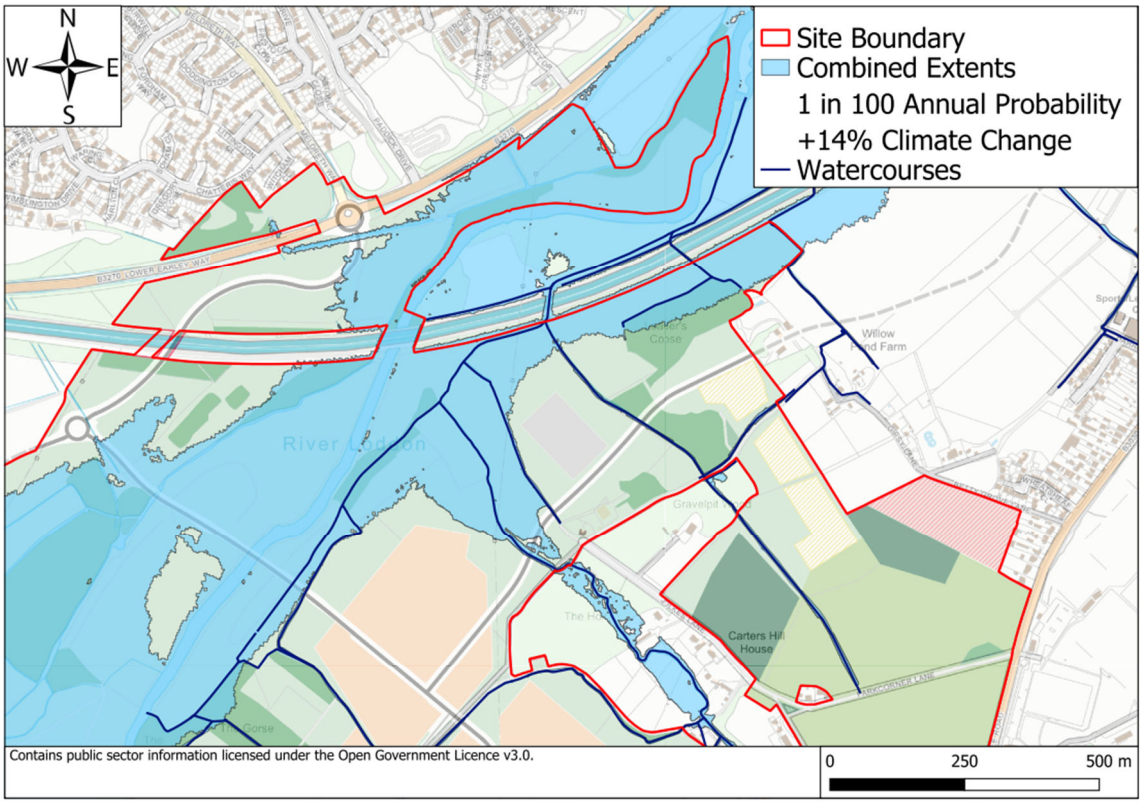
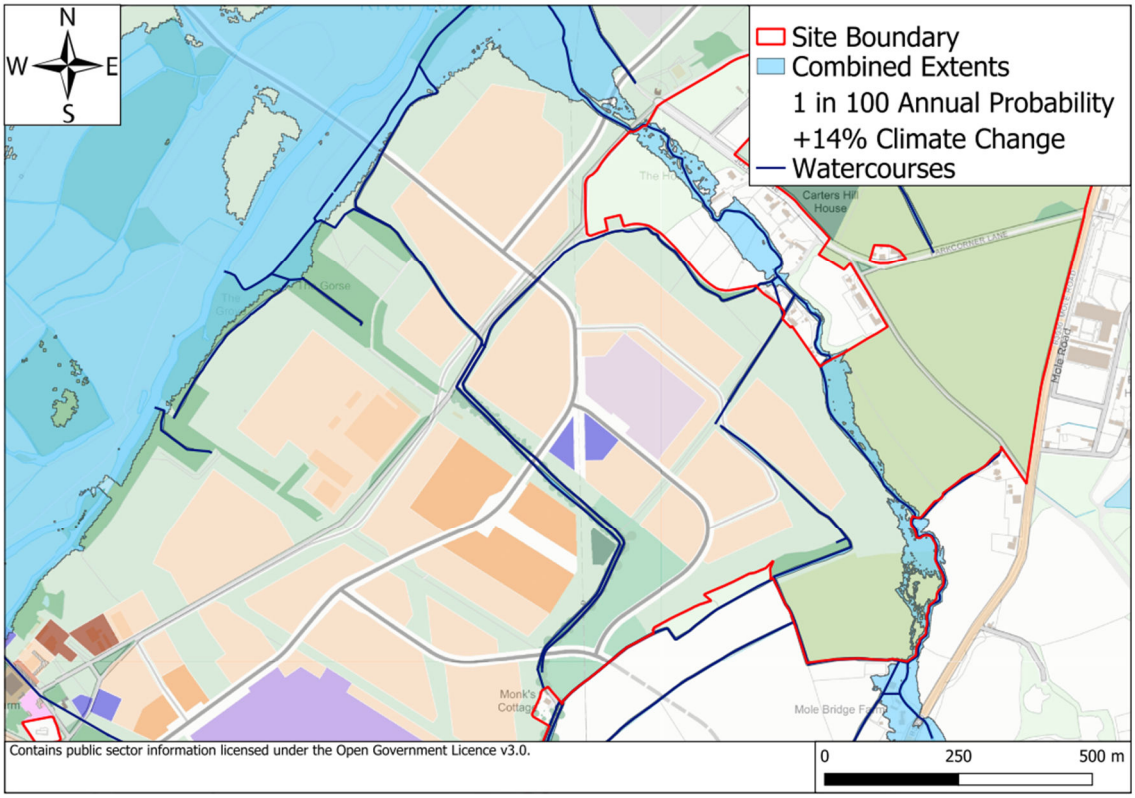


Figure 10: Sequential Approach to Development: northern area



6.2.13 Overall the sequential approach has been applied throughout the development and the masterplanning strategy satisfies the requirements of NPPF as well as local policy.

6.3 Floodplain Compensation Strategy

6.3.1 In order to satisfy NPPF and the associated PPG, it is a requirement of any development strategy and FRA to demonstrate that any development and/or ground raising within the floodplain is adequately compensated to ensure no detrimental impact on flooding elsewhere.

6.3.2 The proposed vehicular crossing of the River Loddon comprises sections of road and associated embankments within the floodplain of the Loddon. The proposed road from the M4 crossing to Lower Earley Way also passes through a small section of the Loddon floodplain. These would result in a loss of floodplain storage and conveyance in these areas.

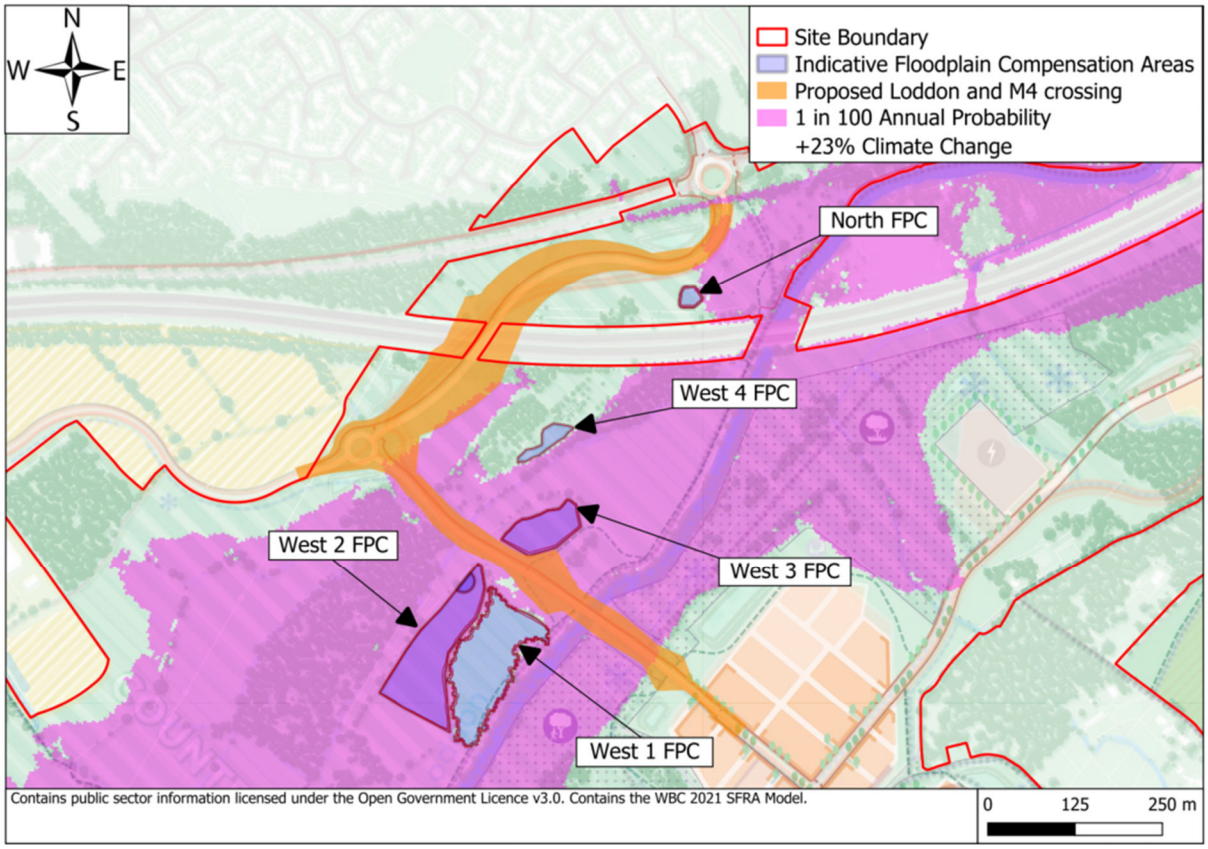
6.3.3 A floodplain storage compensation strategy has been developed to address the potential impacts. Given that these elements constitute essential infrastructure the design flood event to be used in these calculations is the 1 in 100 year flood with the higher central climate change allowance. In this location that allowance is 23%. The results from the relevant run from the WBC 2021 SFRA model have been assessed to determine the floodplain lost and to test the proposed compensation strategy.

6.3.4 The flood level at the Loddon crossing and across the floodplain is taken as 40.1 mAOD for the 1 in 100 year + 23% climate change allowance. Analysis has been completed to determine the volume of floodplain lost to the construction of this road and embankment in 100mm bands between the ground level of 38.9 mAOD and the flood level of 40.1 mAOD.

6.3.5 There is an area to the south of the proposed road which is currently higher than the floodplain for the River Loddon (West 1 FPC on **Figure 11**). This area has been identified to provide the compensatory floodplain at the highest levels. An adjoining area and an area to the north of the proposed road which are in the floodplain will also provide compensation at the lower bands (West 2 FPC and West 3 FPC). East of the River Loddon an additional area will provide compensation in the upper bands (East FPC). Similarly in the area north of the M4, a floodplain storage compensation strategy has been devised (North FPC).

6.3.6 **Figure 11** shows the location of the road and embankment, indicating the 'lost' floodplain area and the identified compensatory areas.

Figure 11: Indicative Floodplain Storage Compensation Strategy at Loddon Crossing



6.3.7 Ground levels in area West 1 FPC are currently between 40.1 and 41.2mAOD. Reprofiling here will provide floodplain storage in the upper bands from 39.9mAOD to 40.1mAOD.

6.3.8 Ground levels in area West 2 FPC are currently between 39 and 40mAOD. Reprofiling here will provide floodplain storage in the bands from 39.4mAOD to 39.9mAOD.

6.3.9 Ground levels in area West 3 FPC are currently between 39.7 and 39.9mAOD. Reprofiling here will provide floodplain storage in the bands from 38.9 to 39.7mAOD.

6.3.10 Ground levels in area East FPC are currently between 40.1 and 40.4mAOD. Reprofiling here will provide floodplain storage in the upper bands from 39.9mAOD to 40.1mAOD.

6.3.11 Ground levels in area North FPC are currently between 39.7 and 40mAOD. Reprofiling here will provide floodplain storage in the upper bands from 39.7mAOD to 39.9mAOD. The design flood level in this location is 39.9mAOD.

6.3.12 Whilst the final details of the floodplain compensation strategy are to be developed at a later stage, this analysis confirms that the proposed areas are adequate to provide compensatory floodplain storage on a level for level and volume for volume basis to replicate the design flood event. A detailed design and reprofiling strategy will be developed in conjunction with landscape and ecology teams at the next stage.

6.3.13 These are the two key areas where floodplain mitigation is required for the River Loddon. There will be other locations within the wider development where ground raising or construction of access roads etc may result in a loss of floodplain of the Barkham Brook or other Loddon tributaries. In these locations there will be a similar approach to provide floodplain compensation. At this stage further details are not available as the design of the proposed crossings is still at an early stage.

6.3.14 As well as floodplain storage, the conveyance across the floodplain could also be affected by the construction of the Loddon crossing and the roads and embankments both south and north of the M4. The WBC 2021 SFRA model has been run with the proposed crossing, road and embankment and with the floodplain compensation areas included to indicate if the conveyance across the floodplain has been compromised. This demonstrates that the impact is localised within the Site itself and the resulting rise in flood levels is adequately accommodated within the proposed development areas.

6.3.15 The proposed development includes suitable floodplain compensatory elements and will have no detrimental impact on flooding elsewhere.

6.4 Design of Watercourse Crossings

6.4.1 All proposed crossings of the River Loddon and of the smaller watercourses would be designed to ensure that channel conveyance and floodplain function are maintained.

6.4.2 For the main proposed Loddon crossing this includes the following:

- Soffit at least 100yr+CC+600mm (higher central CC of 23%)
- Open span over channel but not across floodplain
- Open span extends beyond bank by at least 8m and ideally 10m on both banks

6.4.3 For other crossings, the key design parameters apply:

- Soffit of culvert or bridge opening to be at least 300mm above the 1 in 100 year + 23% climate change level
- Where opening is a culvert (pipe or box) this is sized to convey the 1 in 100 year +23% climate change design flow
- Where floodplain extends beyond channel banks design opening to convey floodplain flow

6.4.4 At each crossing location an appropriate design approach would be taken to meet the flood risk requirements as well as any specific landscape, ecology or other requirements.

6.5 Finished Floor Levels

6.5.1 The proposed residential and commercial developments will be located outside the floodplain, and, in most cases, some distance from the floodplain both in distance and change in elevation.

6.5.2 At this stage none of the buildings is envisaged to require basements and the finished floor levels for the ground floor of the buildings will be set to a suitable level to satisfy both flood risk requirements and wider design considerations. As a minimum the finished floor level should be 150mm above surrounding ground level.

6.6 Safe Access

6.6.1 A safe access route must be provided from all parts of the built development to the boundary of the site and onto areas outside the floodplain as defined through modelling for the design event.

6.6.2 **Figure 12 and 13** shows that the key access points into the development are all in FZ1 and outside areas of potential pluvial flooding. Furthermore, these show that all development parcels have an access route through to the main site accesses that avoids areas of potential flooding.

Figure 12: Access Locations in the Southern Site Area

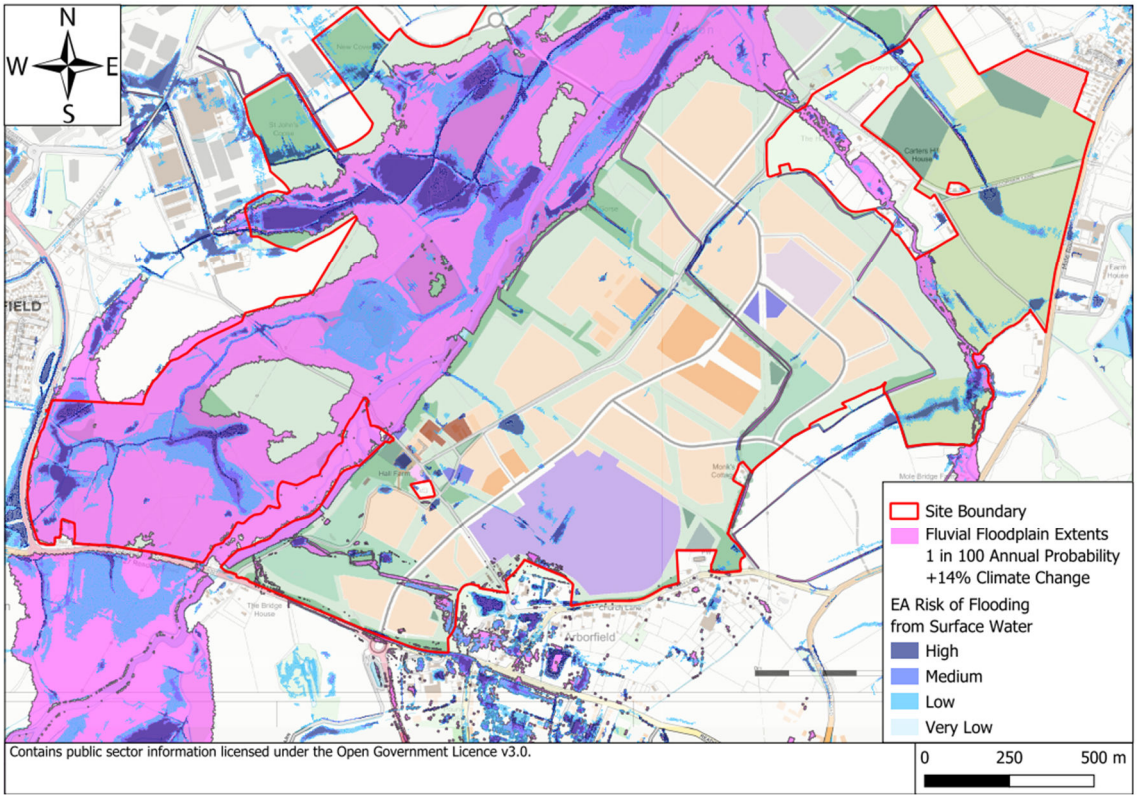
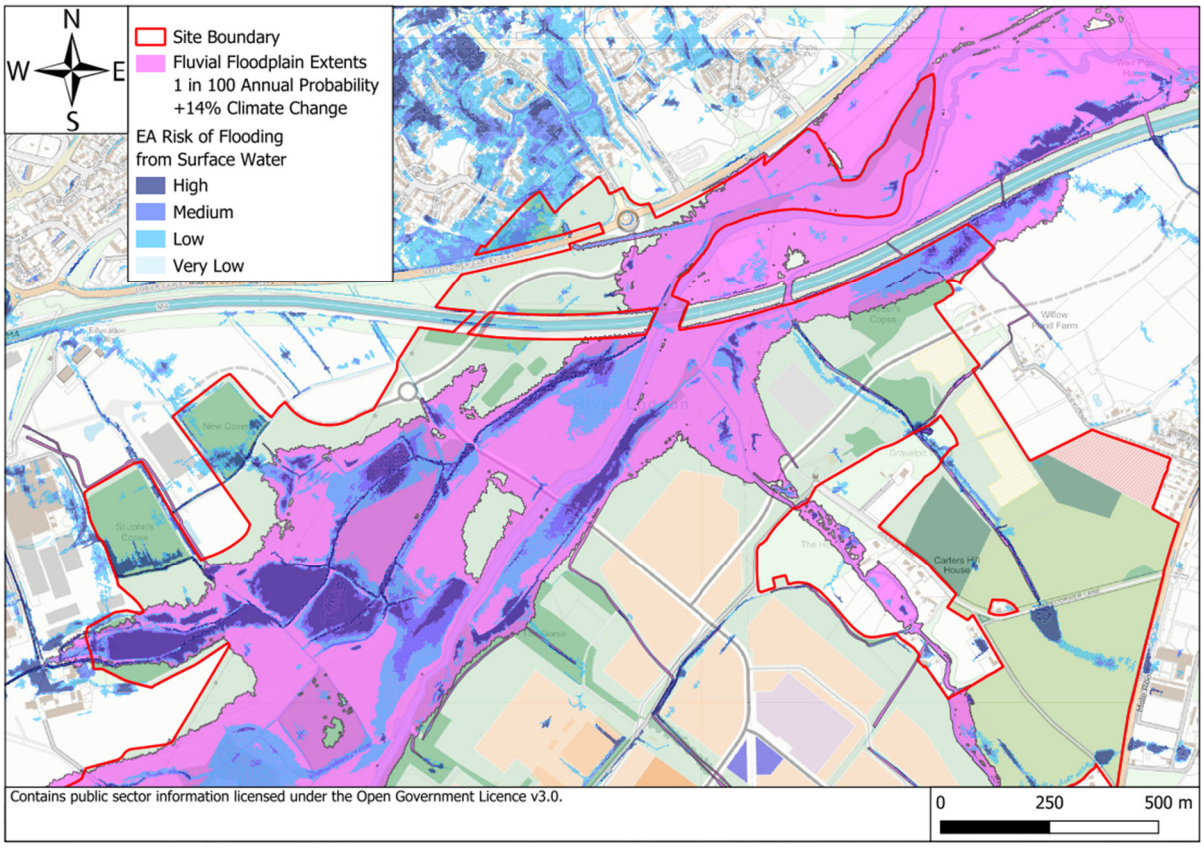


Figure 13: Access Locations in the Northern Site Area



6.7 Flood Alleviation/Benefits Downstream

6.7.1 To satisfy policy SS13: Loddon Valley Garden Village, and in line with NPPF, as part of the development strategy there must be an assessment of the potential opportunity to provide flood alleviation benefits off site.

6.7.2 As shown in the overview of flood risk, there are areas to the north of the site and within Winnersh where modelling has shown there to be a significant fluvial flood risk from the River Loddon.

6.7.3 One option that has previously been considered by WBC is to effectively throttle the flow in the Loddon by constructing an embankment upstream of the M4. This would result in an increase in flood levels and floodplain extent upstream of the M4 with a reduction on flows downstream of the M4. For a significant reduction in flooding downstream, the extent of the throttling is such that the upstream impacts extend beyond the site boundary, resulting in flooding of new areas, contrary to EA policy. As well as creating a detrimental flood risk beyond the site area, the works would permanently change the flooding regime within sensitive habitats both upstream and downstream of the site. Furthermore, WBC has confirmed that this option is unlikely to be feasible due to prohibitive costs, with the EA raising concerns over the impacts on flood levels.

6.7.4 This option has, therefore, been discounted in light of the WBC and EA concerns as well as the potentially detrimental impacts on and off site.

6.7.5 Areas within the control of the Applicant and within the masterplan are therefore targeted to provide some level of flood alleviation. The key focus is to provide interventions and measures on the Barkham Brook and Western watercourses.

6.7.6 The masterplan already allows for a generous corridor around the Barkham Brook and its tributaries. This offers opportunities for channel widening, in channel structures such as leaky dams and other flow controls as well as floodplain works. In conjunction with ecology, biodiversity and landscape considerations, these interventions could be designed to change the flow regime entering the River Loddon and reducing the flow at certain times during a flood event. Whilst such measures may not reduce the peak flood flows and levels in extreme events, there could be significant benefits in lower return periods and in early stages of the flood event. This may reduce the impacts of flooding or allow for slightly more warning time.

6.7.7 Similarly, there may be options for such interventions within the EcoValley, which would also contribute to betterment in certain events downstream.

6.7.8 Options are being tested through modelling and are being developed in conjunction with the landscape, ecology and biodiversity needs and aspirations.

6.7.9 Notwithstanding any channel and floodplain works, the implementation of a positive surface water drainage strategy will, over time, lead to a reduction in the peak flow of surface water runoff entering the River Loddon from the site. This will contribute to benefits elsewhere in the catchment.

7 Conclusion

7.1 Flood Risk

7.1.1 This FRA has confirmed the potential flood risk across the site through review of available data and completion of detailed modelling. It is, however, accepted that the results of the modelling may be refined in the future following review by the EA as statutory consultee. That said, the development strategy and mitigation measures are sufficiently robust to remain sound even if there are later changes to the detailed model output. This means that the principle for development is not subject to the review of the detailed modelling.

7.1.2 The majority of the site is in Flood Zone 1 and with low risk of all sources of flooding.

7.1.3 Areas of potential fluvial and pluvial flooding are primarily located to the west of the River Loddon with some areas around the Barkham Brook and its tributaries. These areas are to remain free of built development with the more vulnerable and less vulnerable residential, commercial and educational land uses located in Flood Zone 1 and areas of low pluvial flood risk.

7.1.4 WBC has completed a detailed site summary for flood risk and confirms that, whilst there is some potential for flooding, the site is suitable for development with an appropriate approach to development masterplanning and a robust mitigation strategy.

7.1.5 The development proposals set out in the FRA satisfy the requirements of the WBC Local Plan Update site allocation as set out in policy SS13.

7.2 Sequential and Exception Test

7.2.1 The proposed development strategy satisfies paragraph 175 of the NPPF such that the Sequential Test is not applicable.

7.2.2 In any case, for this site, WBC has completed a Sequential Test as part of the Local Plan Update and this confirms the site as suitable for development.

7.2.3 WBC confirms the Exception Test to be satisfied by the inclusion of suitable mitigation measures within the development strategy and masterplan.

7.3 Conclusion

7.3.1 This FRA satisfies the requirements of NPPF with regards to flooding and confirms that the development strategy and masterplan confirm to the requirements set out in local policy, specifically policy SS13 of the WBC Local Plan Update.

Appendices

Appendix A - Plans

PP01 LGV Parameter Plan: Land Use

Thames Water Asset Plans

Groundwater Flood Maps (WBC SFRA)

Historic Incidents from Local Sources of Flooding (WBC PFRA)

Appendix B - Site Walkover Note

Appendix C - Groundwater Monitoring Report

RPS JER9890 Ground Investigation and Groundwater Level Monitoring Factual Report

Appendix D - Flood Modelling Reports

River Loddon WBC 2021 SFRA Model and Updates

Western Watercourses

Barkham Brook (Fluvial)

Barkham Brook (Direct Rainfall Model)

Arborfield Cut