

Project Title: Priors Farm

Project No/ Document Reference: A218-R049

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TECHNICAL NOTE SUMMARISING PRIORS MODELLING STUDY TO ADDRESS EA COMMENTS

1. Introduction

- 1.1. Abley Letchford has built a direct rainfall model and a fluvial model for Priors Farm and its catchment to refine the surface water flood extents and the fluvial flood extents across the site.
- 1.2. This Technical Note sets out the Environment Agency's (EA) comments on the Abley Letchford Flood Risk Assessment (FRA) (dated 3rd July 2024), the scope of works undertaken for the modelling study, the modelling methodology, the baseline model results and the 'with scheme' model results. The Technical Note sets out how Abley Letchford have addressed the EA's comments.

2. EA Comments

- 2.1. The EA issued a response to Abley Letchford's FRA dated 17th December 2024 (EA reference WA/2024/131745/01-L01). The EA objected to the application based on the following comments:

'The FRA fails to:

- *Take the impacts of climate change into account.*
- *Consider how a range of flooding events (including extreme events) will affect people and property,*
- *Consider whether flood risk will be increased in the surrounding area.*
- *Demonstrate that finished flood levels will be set about the 1% annual exceedance probability (AEP) flood level with an appropriate allowance for climate change.*
- *Demonstrate the development will be appropriately flood resistant and resilient for its lifetime.*
- *Establish the extent of functional floodplain.*
- *Assess and demonstrate any potential impacts of the proposed development on the watercourses and flood zone(s) within the site, with particular regard to any watercourse crossings; any roads within the flood zones and proposed open space/ SANG area.'*

- 2.2. The modelling study was completed to address the EA's comments. This Technical Note will summarise modelling methodology, results and how the EA's comments have been addressed. Full details of the modelling study are included within the direct rainfall model report and fluvial model report included within **Appendix A.**





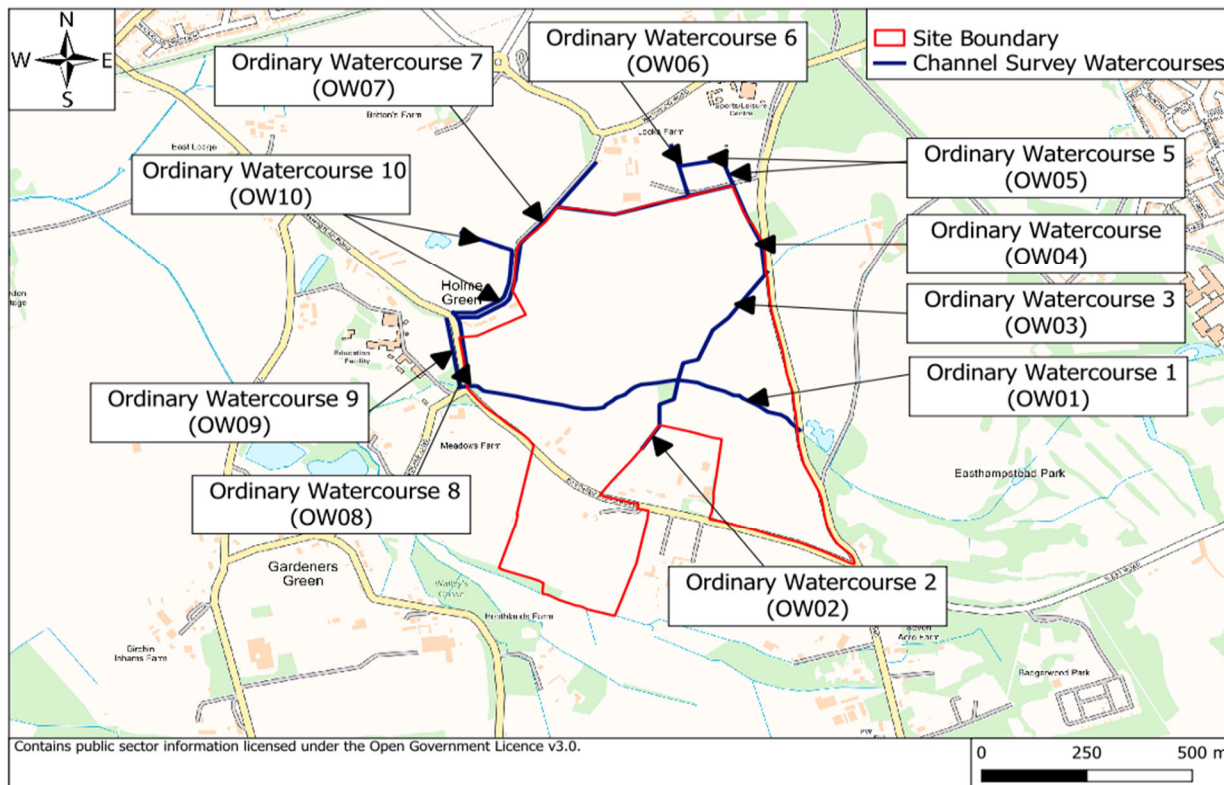
3. Modelling Methodology

- 3.1. Abley Letchford built two models; a direct rainfall model to refine the surface water flood extents across the site and a fluvial model to refine the fluvial flood extents across the site. It was decided that both modelling approaches should be used due to the nature of the site and the catchment which is a combination of overland flow routes, informal channels and ordinary watercourses.
- 3.2. The scope of works included the following:
- Undertake a hydrological assessment to estimate the catchment to the site and generate hyetographs for the direct rainfall model and hydrographs for the fluvial model for the relevant return periods.
 - Build a new direct rainfall model using the best available data to refine the surface water flood extents.
 - Build a new fluvial model using the best available data to refine the fluvial flood extents.
 - To assess the impact of climate change, the 1 in 100 annual probability scenario has been modelled using the most recent climate change allowances for the Loddon and Tributaries Management Catchment. A +40% climate change allowance has been applied for the 1 in 100 annual probability peak rainfall for the direct rainfall model. A +14% climate change allowance has been applied to the peak flows for the fluvial model. This is the Upper End allowance for the peak rainfall and Central allowance for the peak flow.
 - Model the 'with scheme' scenario for the fluvial model to demonstrate that there will not be a negative impact on offsite flood risk.

Direct Rainfall Model

- 3.3. A direct rainfall model with defined channels was built to refine the EA surface water flood extents using ESTRY-TUFLOW. The model used channel survey completed by MK Surveys in June 2025 and LiDAR data flown in 2020.
- 3.4. ReFH2 was used to calculate hyetographs for the following return periods: 1 in 30 annual probability, 1 in 100 annual probability, 1 in 1000 annual probability and 1 in 100 annual probability +40% climate change allowance.
- 3.5. The direct rainfall model included 10 watercourses within the catchment, as shown in **Figure 1**. The direct rainfall model included watercourses that had not been included within the EA surface water model due to the strategic nature of the EA model; the direct rainfall model also incorporates key structures including culverts under Old Wokingham Road and Easthampstead Road.

Figure 1: Watercourses Included within the Modelling Study



- 3.6. Full details of the direct rainfall modelling methodology are included within the direct rainfall model report in **Appendix A**.

Fluvial Model

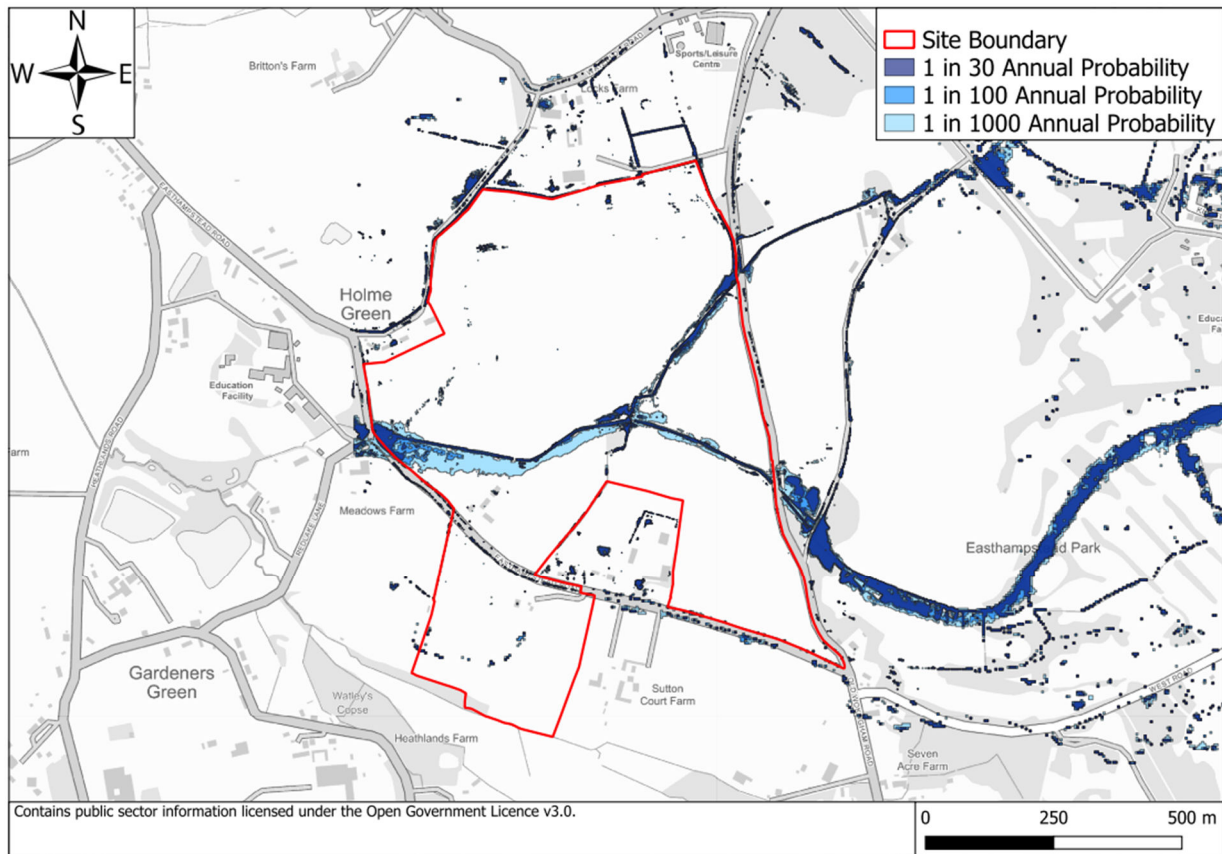
- 3.7. A fluvial model was built to refine the EA fluvial flood extents across the site using ESTRY TUFLOW. The model used channel survey completed by MK Surveys in June 2025 and LiDAR data flown in 2020.
- 3.8. ReFH2 was used to calculate hydrographs for the following return periods: 1 in 30 annual probability, 1 in 100 annual probability, 1 in 1000 annual probability, 1 in 100 annual probability +14% climate change allowance and 1 in 100 annual probability +23% climate change allowance.
- 3.9. The same watercourses and structures were included in the fluvial model, as for the direct rainfall model.
- 3.10. Full details of the fluvial modelling methodology and included within the fluvial modelling report in **Appendix A**.

4. Baseline Model Results

Direct Rainfall Model

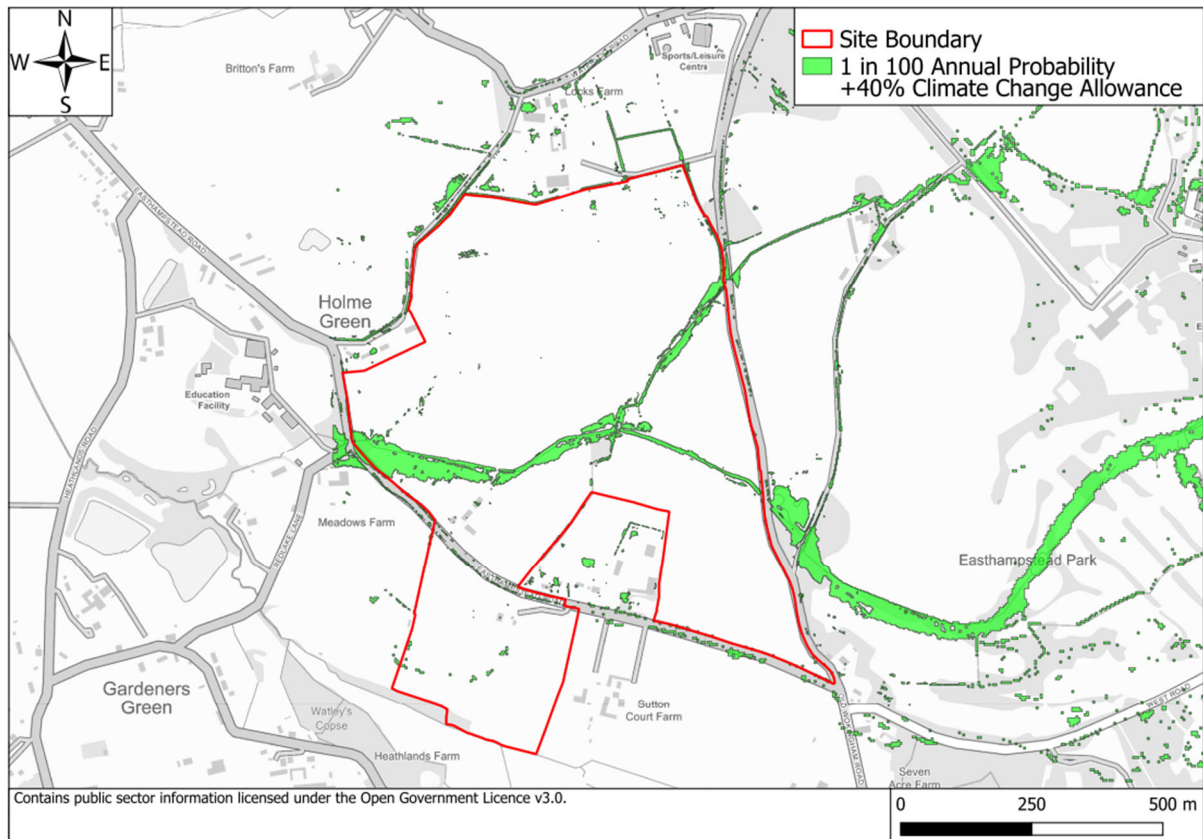
- 4.1. **Figure 2** shows the baseline model results from the direct rainfall model.

Figure 2: Direct Rainfall Model - Baseline Flood Extents



- 4.2. **Figure 2** shows that surface water flooding is generally located along the watercourse corridors. The most notable area of flooding is in the west of the site to the south of watercourse 1. This is expected based on site observations as the area is generally flat, lower than the road and flow is constrained by the culvert under Easthampstead Road.
- 4.3. There are also some areas of surface water ponding, associated with localised low lying areas across the site.
- 4.4. **Figure 3** shows the 1 in 100 annual probability +40% climate change allowance baseline model results for the direct rainfall model.

Figure 3: Direct Rainfall Model - 1 in 100 Annual Probability +40% Climate Change Allowance Baseline Flood Extent

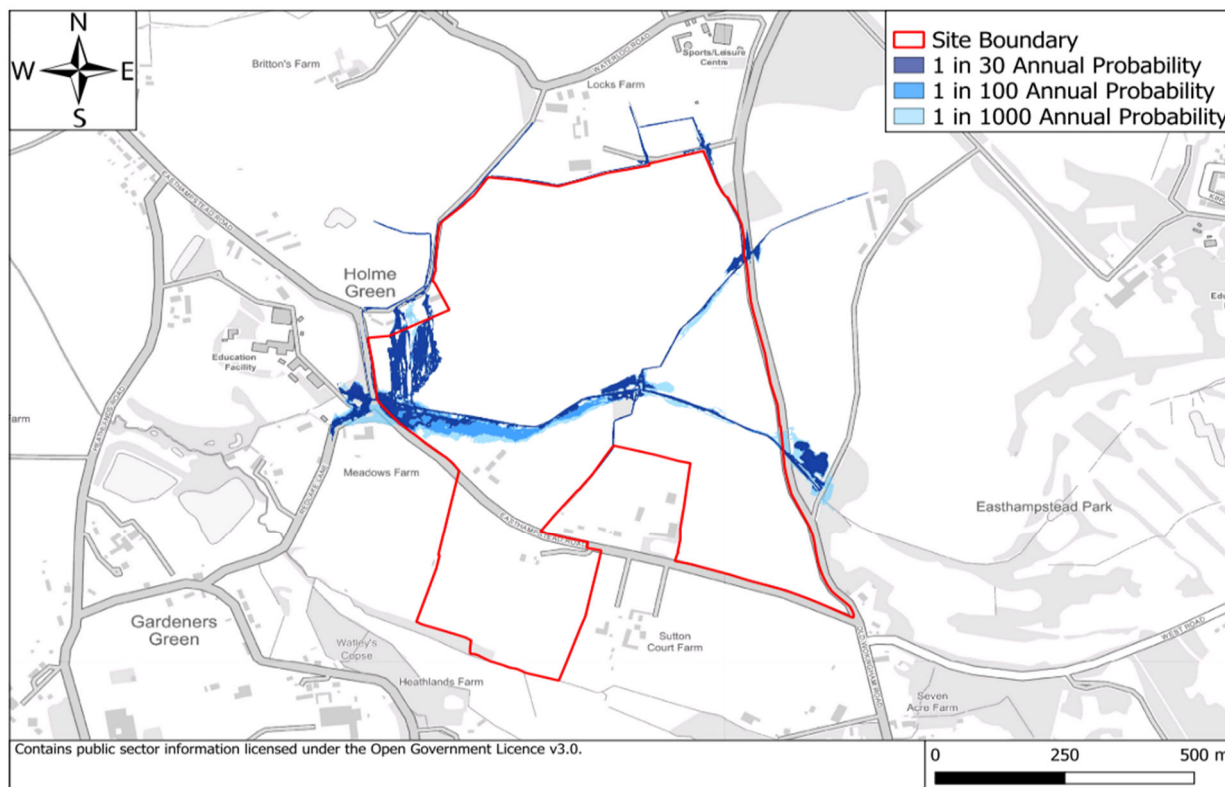


4.5. **Figure 3** shows a similar flooding regime to the baseline model, which is as expected.

Fluvial Model

4.6. **Figure 4** shows the baseline model results for the fluvial model.

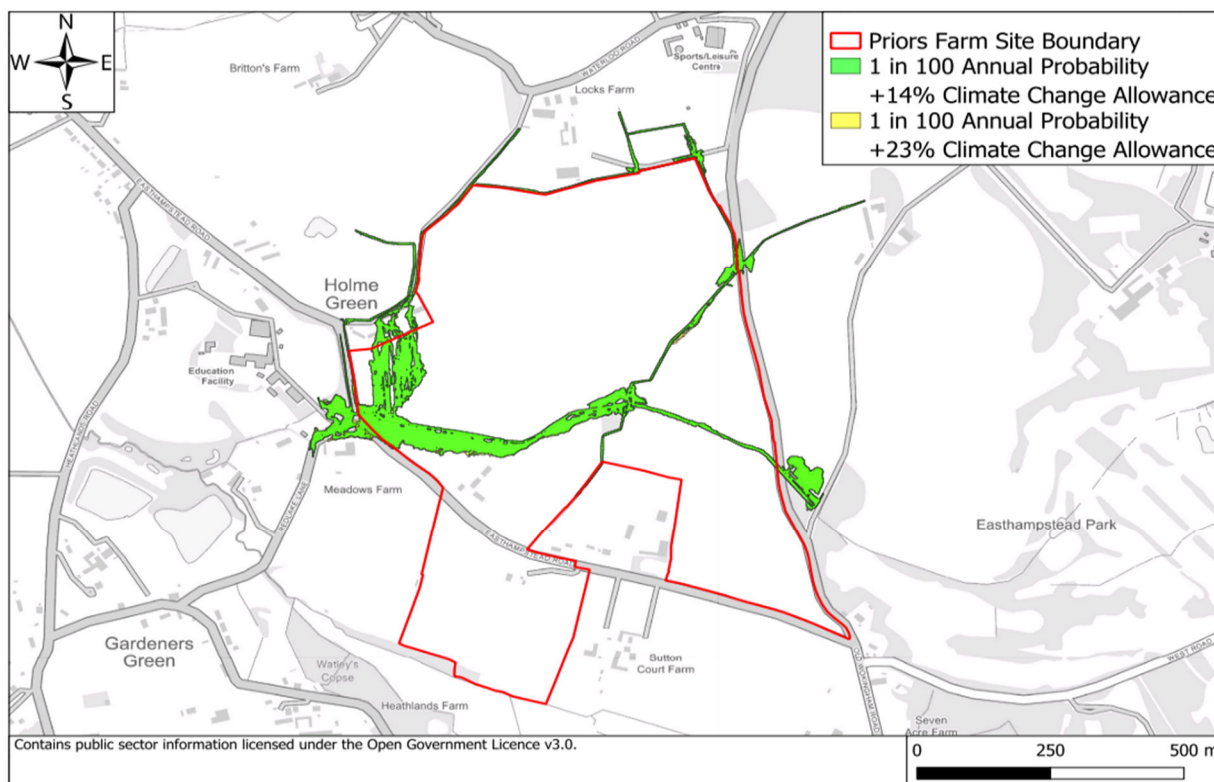
Figure 4: Fluvial Model - Baseline Flood Extents



- 4.7. **Figure 4** shows that flooding typically occurs along the watercourse corridors. The most notable area of flooding is in the west of the site to the south of watercourse 1 although there is also a flow route in the western part of the site from watercourse 7, which is on the eastern side of the track along Holme Green Lane. The flooding in the downstream part of the site is expected based on site observations as the area is generally flat, lower than the road and flow is constrained by the culvert under Easthampstead Road.
- 4.8. From site observations and survey data, watercourse 7, which is on the eastern side of the track, flows south towards the houses to the south of Holme Green track but there was no evidence of a culvert under the track or other structure conveying the flow. Even though there may be a structure here, the modelling assumes there is none, as a precautionary approach. As such, water is shown to spill out of bank and flows along the track, flowing in a southerly direction from low points in the access track through the houses/gardens and towards watercourse 1. It is notable that the depths of flooding along this flow route are less than 0.02m and this is a very shallow sheet flow.
- 4.9. **Figure 5** shows the 1 in 100 annual probability +14% and +23% climate change allowance baseline model results for the fluvial model.

Figure 5: Fluvial Model – 1 in 100 Annual Probability +14% and +23% Climate Change Allowance Baseline

Flood Extent



4.10. **Figure 5** shows a similar flooding regime to the baseline model, which is as expected.

5. With Scheme Model Results

5.1. To represent the proposed development, various elements have been included in the fluvial model to test the impact of the development on off-site flood risk. This also provides data for a review of the changes to the flooding regime within the site to inform masterplanning and the proposed layout.

5.2. The following features were included within the 'with scheme' model.

- Holme Green Lane swale – a 2m wide by 0.3m deep 'V' shaped swale has been included in the model to convey flow from watercourse 7 to watercourse 1.
- Proposed crossing of Watercourse 1 – a 1050mm diameter circular culvert was added to the model to represent the road access crossing into the southern development parcel. The deck was set above the modelled flood level to ensure safe, dry access into the parcel.
- Proposed crossing of watercourse 3 – two crossings have been included along watercourse 3 to represent the proposed road crossings. A 675mm diameter culvert has been used at the upstream crossing and a 900mm diameter culvert at the downstream crossing. The deck levels have been set above the modelled flood levels to ensure safe, dry access into the parcel.
- Ground reprofiling – the bank level along watercourse 3 has been reprofiled to a level of 61.5m AOD between the two watercourse 3 crossings.
- Local Landscaped Play Area (LLPA) raised area – ground levels within the LLPA have been raised by 1m to represent the raised ground here.



- Reprofiling around drainage basins – a 0.5m bank has been included around the drainage basins within the floodplain to represent proposed reprofiling to ensure that the basins remain outside the floodplain.

- 5.3. Full details of these are included within the fluvial model report, included within **Appendix A**.
- 5.4. **Figure 6** shows the 'with scheme' model results for the fluvial model compared with the baseline model results. **Figure 7** shows the 'with scheme' extent overlain on the masterplan.

Figure 6: Fluvial Model – 'With Scheme' 1 in 100 Annual Probability +14% Climate Change Allowance

Modelled Flood Extent

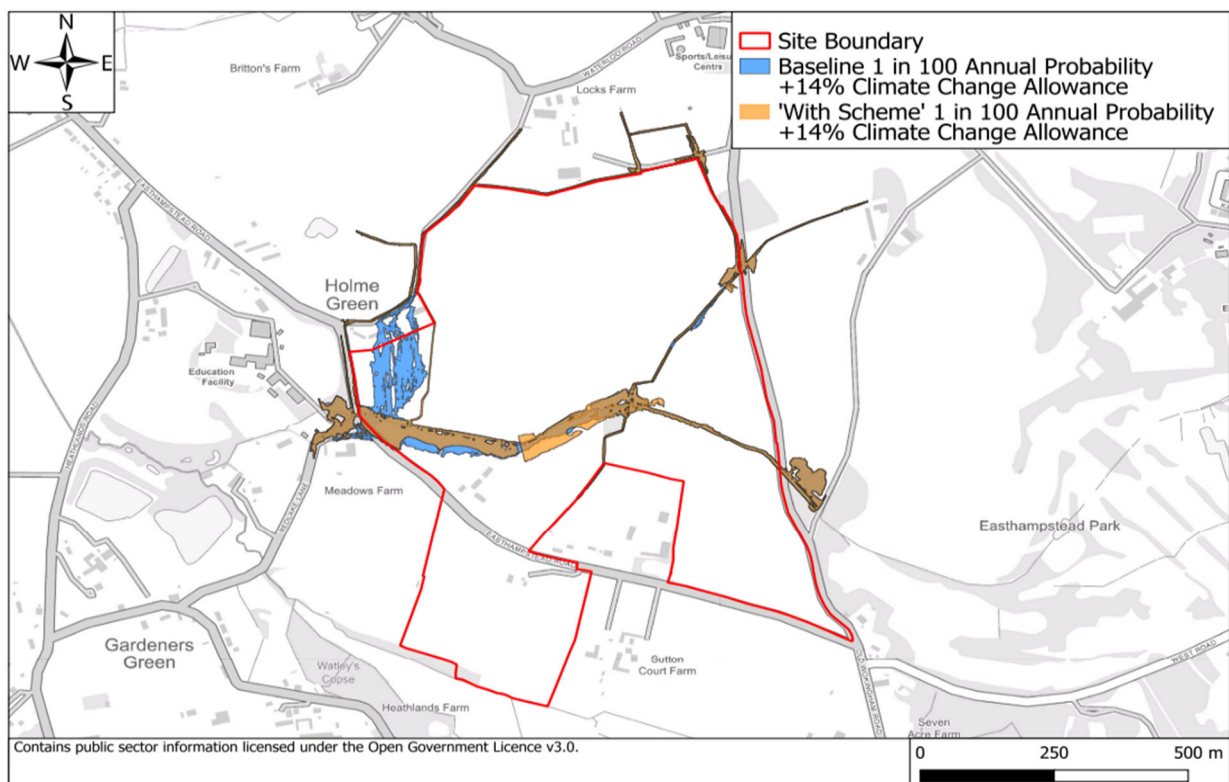
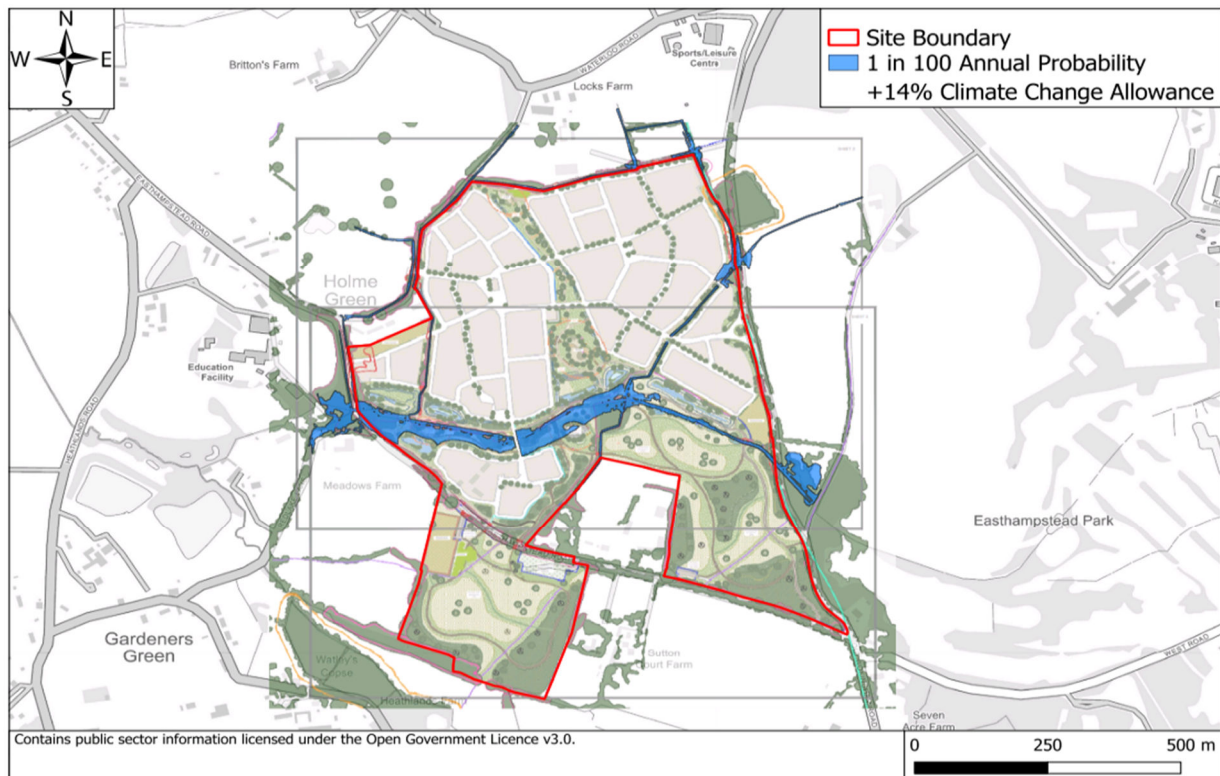


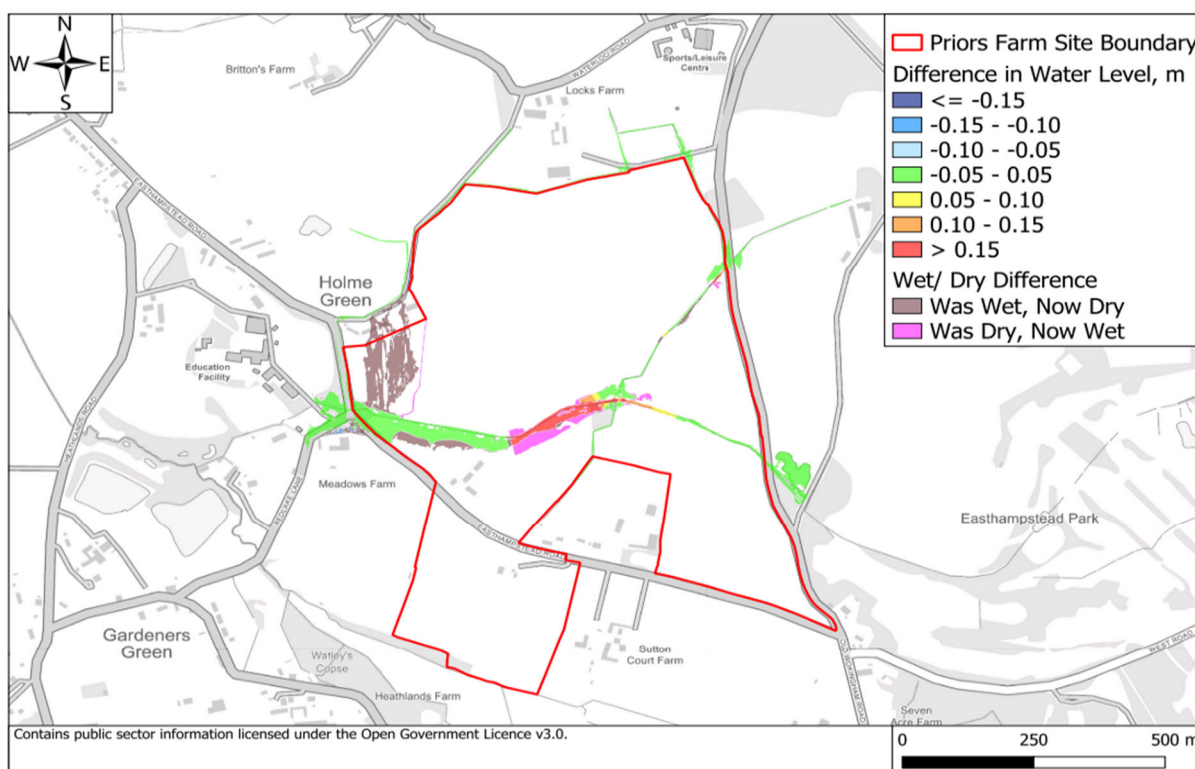
Figure 7: Fluvial Model – ‘With Scheme’ 1 in 100 Annual Probability +14% Climate Change Allowance
Modelled Flood Extent Overlain on the Masterplan



- 5.5. **Figure 6** and **Figure 7** show that the swale conveys flows from watercourse 7 to watercourse 1 therefore the western flow route is no longer present. This swale has been included in the development proposals to manage the flow and ensure that off site flood risk is not exacerbated. In this case it actually reduces the flood risk off site, potentially removing the flow route through the houses and gardens at Holme Green Lane.
- 5.6. The proposed crossing of watercourse 1 has been designed to cause some backing up and help to manage flows downstream and at the western site boundary. Whilst there is an increase in flooding upstream of the culvert, the impact is limited to areas wholly within the site. There is a slight decrease in flooding downstream of the southern development parcel culvert, including offsite, downstream of Easthampstead Road.
- 5.7. Upstream of the proposed crossing of watercourse 1 the area for the raised LLPA no longer floods. Similarly the reprofiling around the drainage basins ensures that these features are no longer in the floodplain.
- 5.8. There is a slight increase in flooding upstream of the watercourse 3 northern culvert. The increase is contained within the site boundary. There is an increase in the modelled flood extents at the confluence of watercourse 2 and 3 with watercourse 1 as a result of the scheme. This was observed as a low area during the site walkover.
- 5.9. Overall, any increase in flood extent or levels as a result of these interventions which form part of the proposed development are limited to the site. There are some benefits off site as a result of the proposed works with reduced flooding at Holme Green Lane and beyond the western boundary of the site.

5.10. **Figure 8** shows a difference plot of the 1 in 100 annual probability baseline model and the 1 in 100 annual probability 'with scheme' model.

Figure 8: Difference Plot for the 1 in 100 Annual Probability Baseline Model and the 1 in 100 Annual Probability 'With Scheme' Model



5.11. **Figure 8** confirms that there is no increase in flooding offsite. There is a reduction on flooding at Holme Green Lane and a slight reduction in flooding downstream of Easthampstead Road.

6. Summary

- 6.1. Abley Letchford has completed a direct rainfall model and a fluvial model to more accurately define the baseline flood extents across the site using site specific information and detailed survey data.
- 6.2. The models were built using the latest version of ESTRY-TUFLOW at the time of the model build. They make use of the best available data including channel survey completed by MK Surveys in June 2025 which allowed for the inclusion of site specific structures and the latest EA LiDAR data flown in 2020.
- 6.3. Hyetographs and hydrographs were calculated for the direct rainfall model and fluvial model using ReFH2.
- 6.4. The baseline direct rainfall model shows the flows were typically located within the watercourse corridors, which some localised areas of ponding associated with localised low lying areas in the topography. The fluvial model also showed that flows were typically located within the watercourse corridors, however there was a flow route from watercourse 7 through the site and into watercourse 1.
- 6.5. The 'with scheme' scenario includes the Holme Green swale, proposed crossing of watercourse 1, proposed crossings of watercourse 3, bank reprofiling along watercourse 3, raised local landscaped play area and



reprofiling around the drainage basins within the floodplain. The 'with scheme' scenario demonstrates that there is no negative offsite impact, but there is betterment at Home Green Lane and slight betterment downstream of Easthampstead Road as a result of these measures.

- 6.6. **Table 1** sets out the EA comments and summarises the actions undertaken by Abley Letchford to address each of the EA comments.

Table 1: Summary of the EA Comments and Abley Letchford Actions to Address the EA Comments

EA Comment	Abley Letchford Action to Address the EA Comment
Take the impacts of climate change into account.	Abley Letchford has applied a climate change allowance of +40% to the input rainfall for the 1 in 100 annual probability scenario as part of the direct rainfall model study. This is the Upper End allowance for the Loddon and Tributaries management catchment. Abley Letchford has applied a climate change allowance of +14% and +23% to the inflow hydrographs for the 1 in 100 annual probability scenario for the fluvial model. These are the Central allowance and Higher allowance respectively for the Loddon and Tributaries management catchment.
Consider how a range of flooding events (including extreme events) will affect people and property,	Both models have been run for the following return periods: 1 in 30, 1 in 100 and 1 in 1000 annual probability. Also for the 1 in 100 annual probability with appropriate climate change allowances (as noted above). As shown in Figure 7, all residential development is located outside of the design flood extent. The watercourse crossings have been shown to allow for safe, and continuous access across them.
Consider whether flood risk will be increased in the surrounding area.	The 'with scheme' flood extent has been compared with the baseline model. The difference plot in Figure 8 shows that there is an insignificant impact on the modelled flood extents upstream of the site. There is a slight decrease in the flood extents downstream of Easthampstead Road and a significant decrease in flooding at Holme Green Lane.
Demonstrate that finished floor levels will be set above the 1% annual exceedance probability (AEP) flood level with an appropriate allowance for climate change.	The 1 in 100 annual probability +14% climate change allowance is the design flood extent. All residential development is located outside of the design event and above the design event flood level. The Flood Risk Assessment and Drainage Strategy sets out the finished floor levels.



Demonstrate the development will be appropriately flood resistant and resilient for its lifetime.	Chapter 6 of the Flood Risk Assessment and Drainage Strategy sets out the flood mitigation strategy, including any flood resistant and resilient measures. However it is noted that the built development is located outside the floodplain.
Establish the extent of functional floodplain.	The baseline fluvial model established the functional floodplain. This is presented in Figure 4 .
Assess and demonstrate any potential impacts of the proposed development on the watercourses and flood zone(s) within the site, with particular regard to any watercourse crossings; any roads within the flood zones and proposed open space/ SANG area.	The 'with scheme' model demonstrates the impact of the development and incorporated mitigation measures. This is presented in Figure 6 and Figure 7 .

- 6.7. In summary, the modelling study has more accurately defined the baseline surface water and fluvial flood extents across the site using detailed, and site specific information. The fluvial baseline model has been used to model the impact of the development, and to demonstrate the impact of proposed interventions within the watercourses or floodplain and mitigation measures to ensure that the development does not result in an increase in flood risk offsite.
- 6.8. The 'with scheme' modelling demonstrates that there is no offsite increase in flooding and that the scheme actually provides significant betterment at Holme Green Lane and a slight betterment downstream of Easthampstead Road.



Appendices

Abley Letchford Priors Farm Direct Rainfall Modelling Report

Abley Letchford Priors Farm Fluvial Modelling Report