

FRA Addendum Report

Henley Road Phase 2 Flood Map Update

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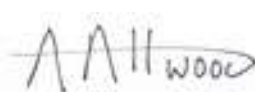
Lloyd Antony

Beaulieu Group,
199-207, Henley Road,
Caversham,
RG4 6LJ

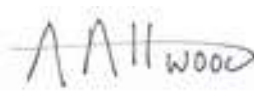


Quality Assurance

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1 Introduction

Edenvale Young Associates were commissioned by the Beaulieu Group to investigate the effect of implementing the new Environment Agency climate change guidance on peak flood levels at their proposed Phase 2 development site on Henley Road, Caversham. This new climate change guidance should be followed for flood risk assessment reports for all new planning applications. Figure 1.1 Shows the site location.

This document forms an appendix to the flood risk assessment (FRA), named "Henley Road Phase 2 FRA Rev C".

The original modelling work undertaken to inform the existing published EA flood map was undertaken by Jacobs for the Environment Agency (EA) in 2011.

The model shows how the River Thames flows generally west to east through Reading where it has a confluence with the River Kennet. Close to Shiplake the river has a further confluence with the River Loddon. Further downstream the river flows from north to south through Maidenhead. The Thames is joined by the River Wye to the north of Maidenhead, the Cut to the south of Maidenhead, before flowing on eastward towards Windsor and then London.

The River Thames is gauged upstream of Reading at Days Weir, in Reading itself at Reading Bridge and downstream at Maidenhead and Windsor. The major tributaries are also gauged; the Kennet at Theale, the Loddon at Twyford, the Wye at Hedsor and the Cut at Binfield.

As part of modelling work to support an FRA for an adjacent site at 199 – 203 Henley Road (2017), it was agreed that Edenvale Young would procure and review the existing Jacobs (2011) flood model, make improvements local to the site and include the latest climate change guidance. This model would then be used to enable more accurate flood mapping at the site. It should be noted that these modelling updates were approved by the Environment Agency (see appendix A). As a part of this study, the only new inclusion since the Environment Agency review is the latest topographic survey for the new site, but the previous Edenvale Young updates to the Jacobs model have been documented in this report.

In particular, using the updated model, more accurate peak flood levels adjacent to the site would be produced, which would enable more accurate flood zone extents to be calculated. The new model would then be used to run the amended climate change scenarios as required to supplement the Phase 2 FRA report.

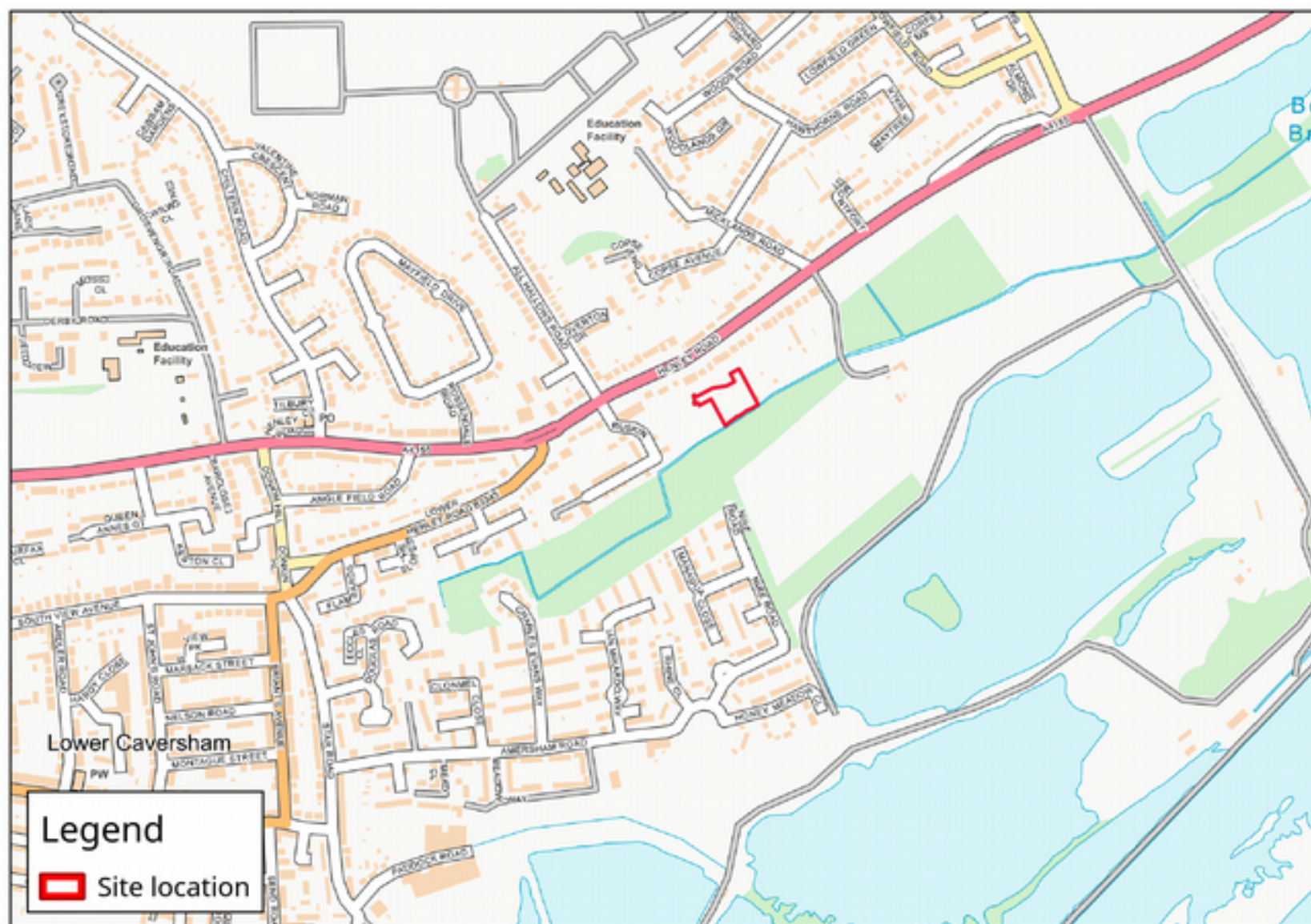


Figure 1.1: Site location

2 Preliminary Study

Initial modelling showed that using the latest version of TUFLOW 2017-09-AC-iDP-w64 and Flood Modeller Pro 4.3.0.290 double precision, did not allow the high return period events to be simulated successfully using the model as supplied. Consequently a series of improvements were suggested and summarised below:

- Modelling improvements to the existing ISIS data file to reflect current best practice.
- Reduction of the model grid size in the domain of interest to determine more accurate flood levels and extents on the site.
- Reduction of the time-step to aid model stability.
- Updating of the terrain data with the latest 1m resolution LiDAR data.
- Inclusion of the latest topographic survey of the site.

3 Hydrology

3.1 Hydrology Updates

The same hydrological inflows have been used as in the original model.

Only the inflow factors specified in the new climate change guidance were updated to the values of 35% and 70% as appropriate to the Reading area.

4 Model Scenarios

4.1.1 Model Run Parameters

The parameters implemented in the supplied ISIS model were updated so the new parameters keep in line with current best practice:

- Dflood=5
- Maxitr=6
- Minitr=2

As can be clearly seen below the ISIS model is stable even for large events such as the 100 years plus 70% climate change.

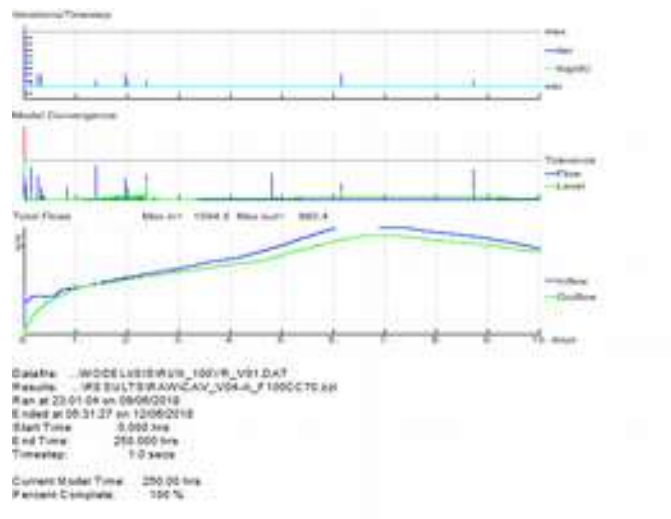


Figure 4.1: ISIS Convergence Bitmap

4.1.2 *Grid size*

The supplied model was large, complex and contained two different TUFLOW domains.

The larger domain was kept at a 30m grid size, as no additional accuracy was required in this area.

The smallest domain in the supplied model was set at 10m grid size and included the Reading area, where the proposed development site in Caversham site is located.

To improve model accuracy local to the development site, this domain was further split and a new even smaller 5m grid size domain replaced the old 10m domain to the north of the River Thames local to the site.

Figure 4.2 below shows the final TUFLOW domains and the location of the site within these.

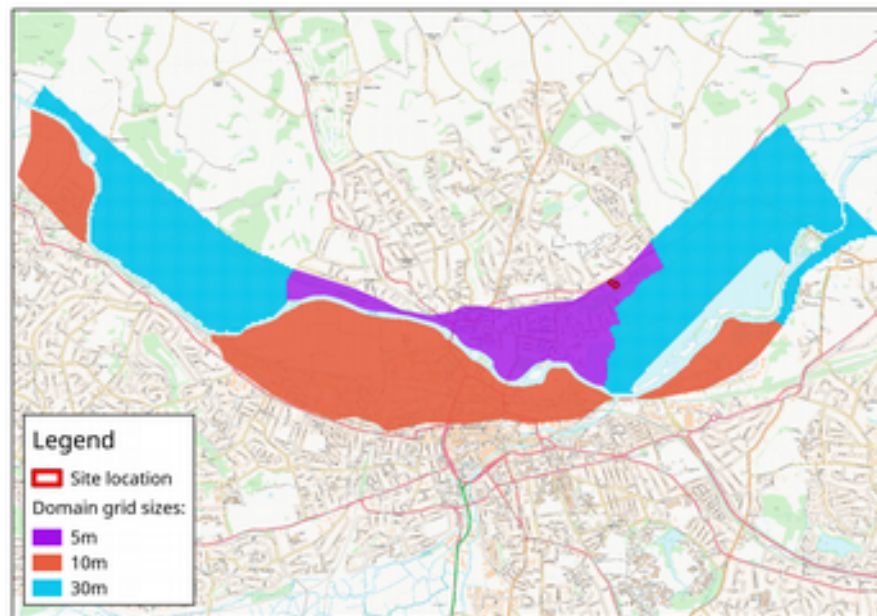


Figure 4.2: TUFLOW Model domains

4.1.3 *Time-step*

The ISIS 1D time-step was reduced to 1 second following the reduction in grid size. The 2D time-step is 2 seconds in order to match the minimum grid size of 5m.

4.1.4 *Boundary Conditions*

The previous ISIS model schematisation was causing problems with the high flows produced at the high return periods associated with the climate change events.

Several approaches were suggested, however in order to minimise changes to the existing model, the boundary was kept in place and a spill with the same shape as the previous river section was introduced upstream of the boundary. This modification has no effect on the results but allows the model to run stably at high return periods.

4.1.5 Terrain Data

The model makes use of 1m LiDAR data for the majority of the DTM. This is the latest available LiDAR made available from the Environment Agency Open data store.

4.1.6 Terrain Modification

In the updated model, topographic survey data of the site was included, that modifies the values of the corresponding LiDAR data and represents ground levels local to the site more accurately. This topographic survey data was processed and refined for use in the model.

4.1.7 Model Roughness

The roughness values in the 1D FMP and 2D TUFLOW model have been carried over from the original Jacobs model.

4.1.8 Improvements

The model has been reviewed and some issues amended. Gully lines were snapped to avoid creation of “friction barriers”. The original model contained all gullies and culverts separated by a short distance. This issue was corrected and now all the culverts and gullies pass flow with no restriction.

Another feature of the original model that has been amended was the existence of 1d networks in the 2D domain. This may not be an issue if they are coded out but the supplied model included a “double counting” of the flood path; one in the 1D with the network and another one in the 2D domain with the LiDAR.

5 Results

5.1 Flood maps

The flood events modelled were the 1 in 100 year, 1 in 100 year plus 35% climate change allowance, 1 in 100 year plus 70% climate change allowance and the 1 in 1000 year event return periods.

Figure 5.1 to Figure 5.4 show the maximum inundation extent results on a large scale, whilst Figure 5.5 to Figure 5.8 show the flooding on the site in greater detail:

- All properties are free from flooding in the 1 in 100 year event, 1 in 100 year return period flood event plus 35% climate change allowance and the 1 in 1000 year return period flood event.
- The 1 in 100 year return period flood event plus 70% climate change allowance, which can be used as a worst case sensitivity shows a small amount of flood water encroaching onto property 9, with the maximum modelled flood level of 36.80m AOD. However according to the survey, the levels where property 9 is situated are 36.84m AOD to 37.27m AOD. Therefore it is likely if an even higher resolution grid were to be modelled, the property would likely be shown as completely free from flooding. This has not been done as it causes model run times to become excessively long.

Figure 5.9 shows a maximum flood extent map, showing results for all the four modelled scenarios. It also gives the maximum modelled flood levels for each event:

1 in 100 year	36.32m AOD
1 in 100 year plus 35% climate change allowance	36.64m AOD
1 in 100 year plus 70% climate change allowance	36.80m AOD
1 in 1000 year event return periods.	36.76m AOD

The final two figures, Figure 5.10 and Figure 5.11 show a comparison between the flood zone extents for the Environment Agency supplied model and the updated, more detailed model developed for this study.

It can be seen that there is a slight reduction in flood zone extents produced from the updated model, which is likely to be associated with use of a smaller grid size and more accurate site survey data.

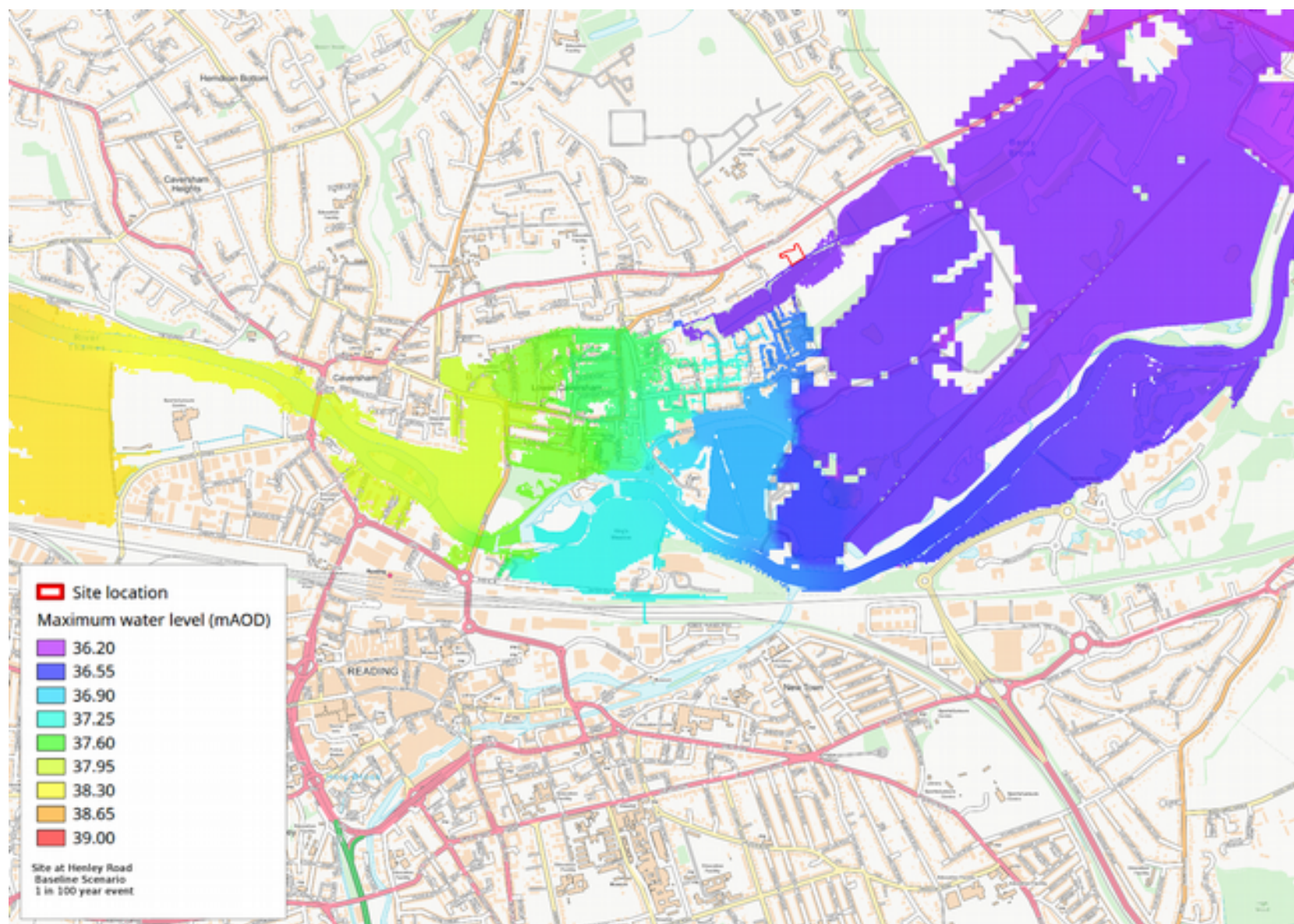


Figure 5.1: 1 in 100 year event return period flood extent

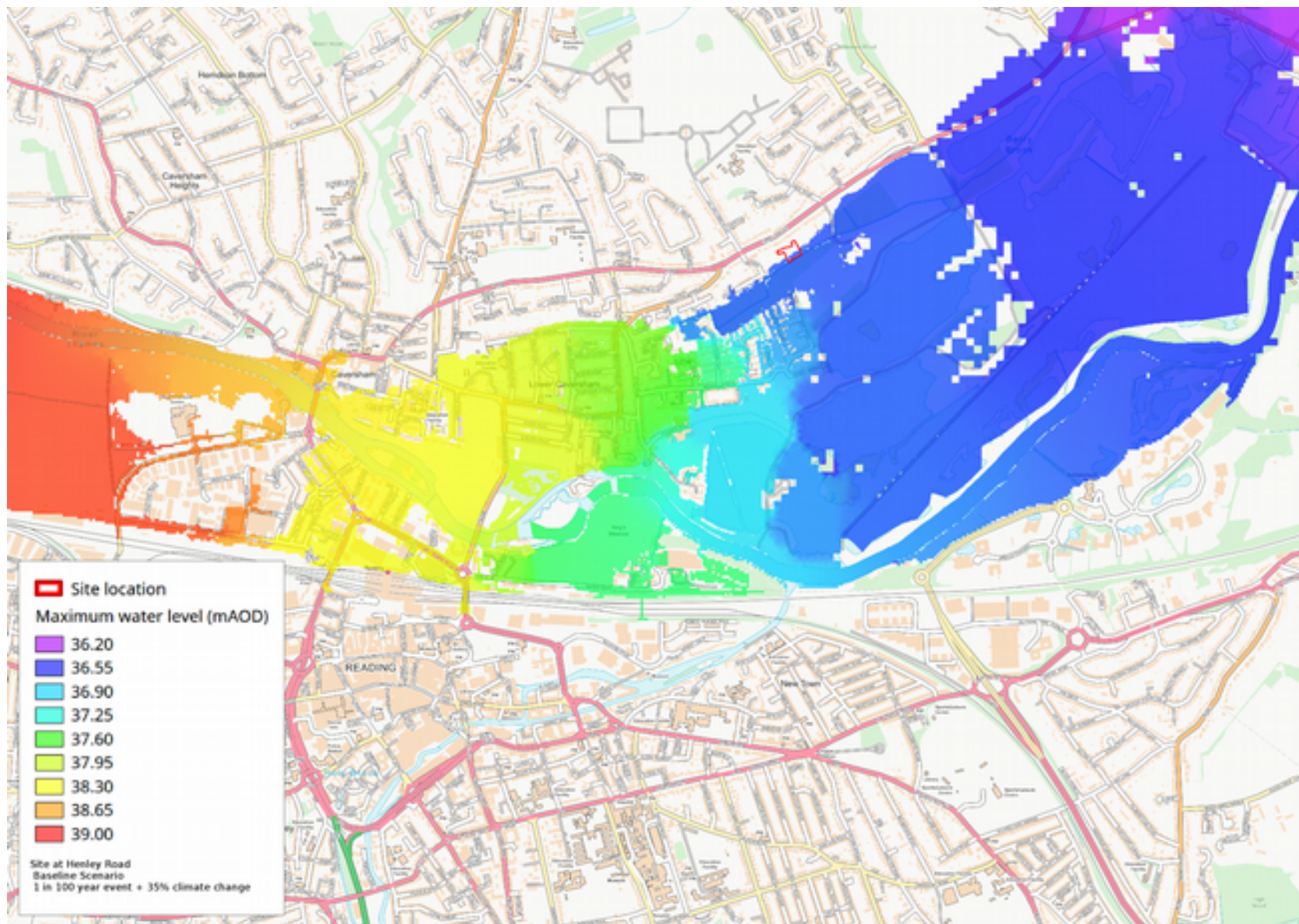


Figure 5.2: 1 in 100 year event return period flood extent plus 35% climate change

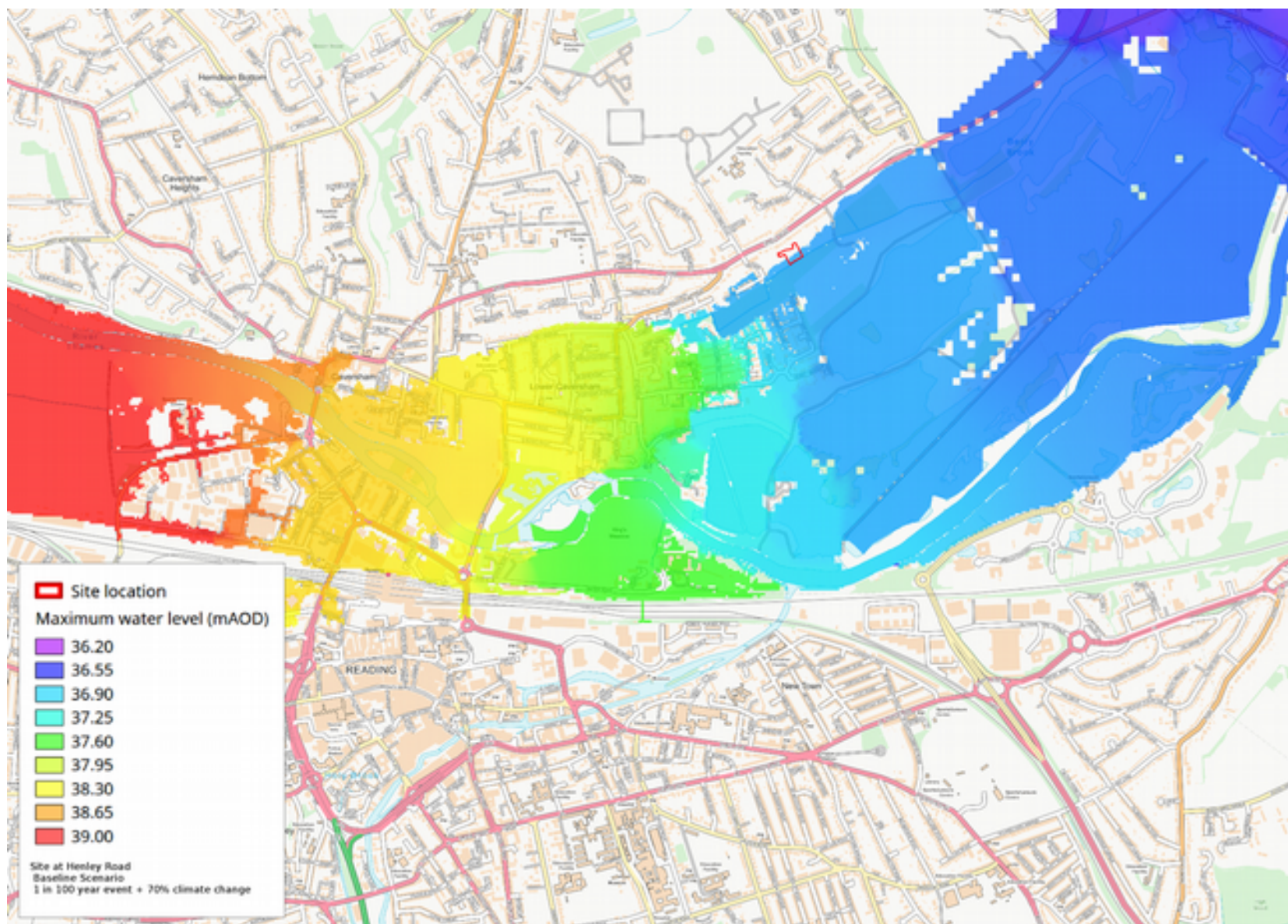


Figure 5.3: 1 in 100 year event return period flood extent plus 70% climate change

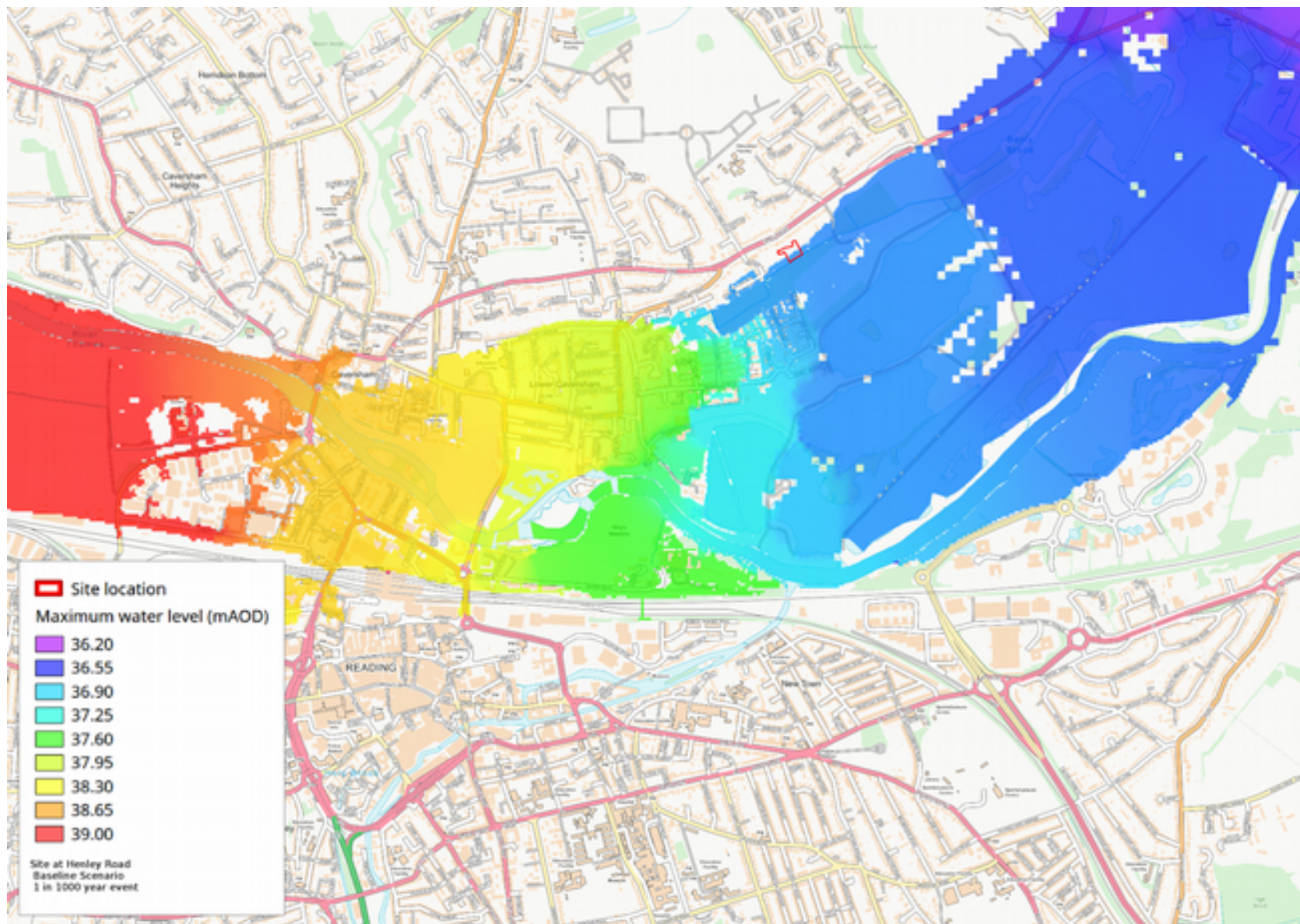


Figure 5.4: 1 in 1000 year event return period flood extent



Figure 5.5: Site Level Detailed flood extent for 1 in 100 year return period flood



Figure 5.6: Site Level Detailed flood extent for 1 in 100 year return period flood event plus 35% climate change allowance



Figure 5.7: Site Level Detailed flood extent for 1 in 100 year return period flood event plus 70% climate change allowance



Figure 5.8: Site Level Detailed flood extent for 1 in 1000 year return period flood event



Figure 5.9: Maximum modelled flood levels for all modelled events



Figure 5.10: Comparison of updated and existing model flood zone 3 extents

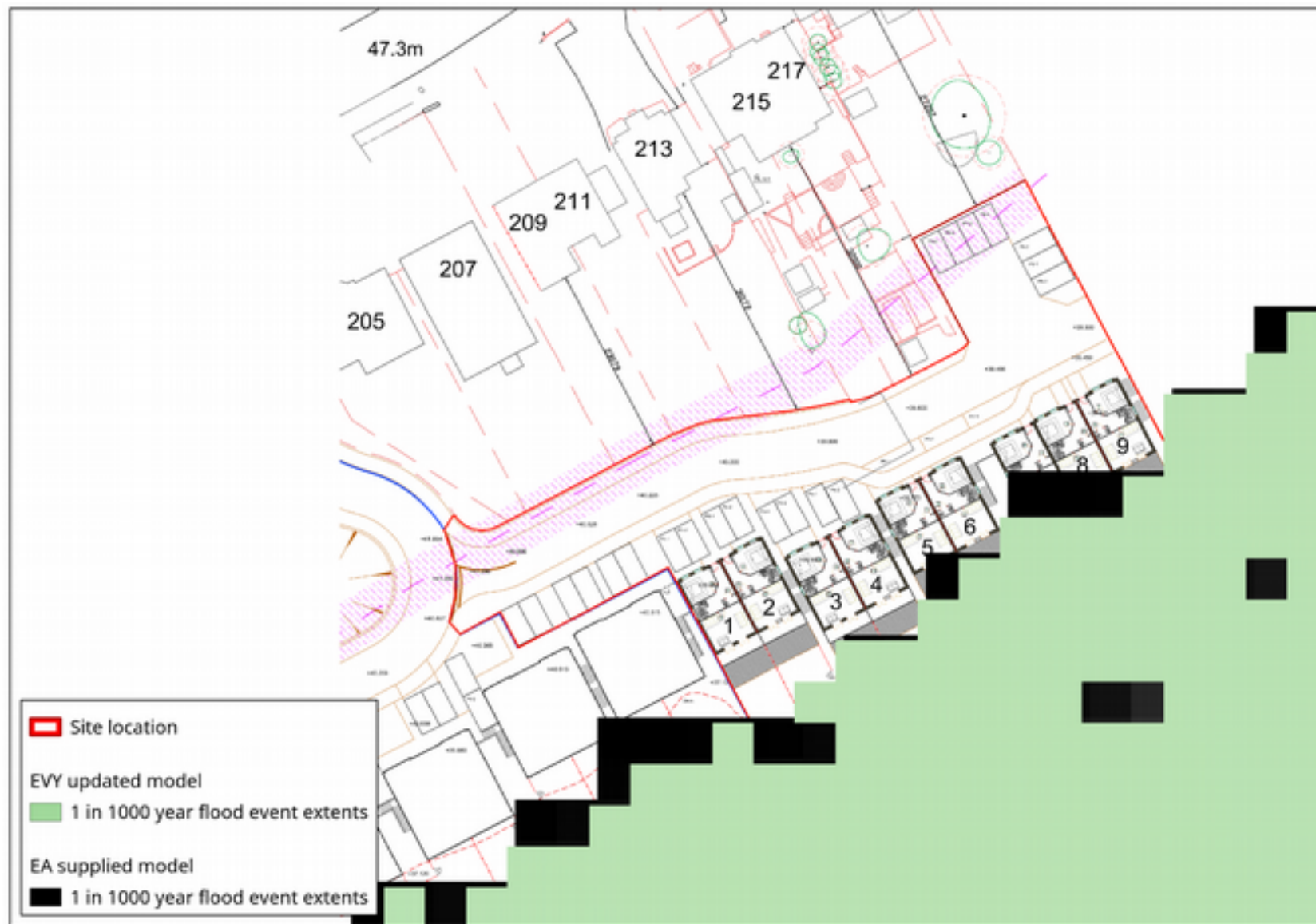


Figure 5.11: Comparison of updated and existing model flood zone 2 extents

6 Conclusions

- An updated FMP/TUFLOW flood model has been developed from an original model supplied by the Environment Agency and constructed by Jacobs in 2011. The updated model was developed initially by Edenvale Young to inform a flood risk assessment for the site at 199-203 Henley Road. This model was submitted to the Environment Agency and subsequently approved, as the Environment Agency agreed that the Edenvale Young model updates had successfully applied climate change. (See appendix A). The only new inclusion since the Environment Agency review is the latest topographic survey for the new site.
- The updated model includes a higher resolution model domain in the Caversham area as well as the most up to date LiDAR data and detailed topographic survey of the proposed development site.
- Improvements were introduced to the model as supplied so that it would run successfully for the required high return period flood events using up to date versions of the FMP and TUFLOW software.
- The original hydrology has been used to minimise differences between the updated model and that supplied by the Environment Agency.
- The updated model was run successfully for the 1 in 100 year flood event, 1 in 100 year return period flood event plus allowances of 35% and 70% for climate change together with the 1 in 1000 year return period flood event.
- The updated model local to the proposed Phase 2 development site shows a slight reduction in flood extents when compared to the original, Environment Agency supplied model. This is likely to be due to the higher grid resolution and incorporation of detailed topographic survey data in this location.
- All properties are free from flooding in the 1 in 100 year event, 1 in 100 year return period flood event plus 35% climate change allowance and the 1 in 1000 year return period flood event. The 1 in 100 year return period flood event plus 70% climate change allowance, which can be used as a worst case sensitivity shows a small amount of flood water encroaching onto property 9.

- The National Planning Policy Framework (NPPF) Sequential Test is used to, where possible, steer development toward sites at the lowest risk of flooding. Given that all proposed dwellings in the proposed site have been shown to be located in Flood Zone 1 and thus at the lowest possible risk of flooding, there is consequently no need for the Sequential Test to be passed.

7 Recommendations

The Environment Agency should use the updated modelling for the Phase 2 development to provide minor revisions to the existing flood map local to the Caversham area.

For flood resilience purposes it is recommended that finished floor level for all developments is 37.1mAOD. This is 300mm above the 1 in 100 year + 70% climate change event flood level of 36.80mAOD.

Appendix A

Environment Agency agreement that the Edenvale Young model updates have successfully applied climate change.

From: Planning_THM <Planning_THM@environment-agency.gov.uk>
Sent: 18 October 2017 15:11
To: Bedford, Susanna
Cc: 'ksconsultancy@btinternet.com'
Subject: 170959
Attachments: 170959.pdf

This is an EXTERNAL EMAIL. STOP. THINK before you CLICK links or OPEN attachments.

Dear Susanna
I attach our response.

Kind Regards

Cathy Harrison
Planning Advisor
Sustainable Places
Internal: 59601
External: 0203 025 9601
Email: planning_THM@environment-agency.gov.uk

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Ms Susanna Bedford
Reading Borough Council
Development Control
PO Box 17
Reading
Berkshire
RG1 7TD

Our ref: WA/2017/124117/03-L01
Your ref: 170959
Date: 18 October 2017

Dear Ms Bedford

Demolition of nos. 199-203 Henley Road and erection of 60 dwellings at 199-203 Henley Road and to the rear of 205-207 Henley Road with associated access from Henley Road and landscaping at 199 Henley Road, Caversham, Reading, RG4 6LJ.

We have reviewed the submitted hydraulic flood model and we agree that this has appropriately analysed climate change. The model has demonstrated that the 35% climate change level does not reach the proposed built development.

Environment Agency position

We have **no** objections to the proposed development providing the following conditions are applied to any planning permission granted.

Condition 1

The proposed development will only meet the requirements of the National Planning Policy Framework if the following measures as detailed in the Flood Risk Assessment, the FRA Addendum Report and the Proposed Site Section drawing submitted with this application are implemented and secured by way of a planning condition on any planning permission.

1. Finished flood levels are set no lower than 37.12 metres above Ordnance Datum.

The mitigation measures shall be fully implemented prior to occupation and subsequently in accordance with the timing / phasing arrangements embodied within the scheme, or within any other period as may subsequently be agreed, in writing, by the local planning authority.

Reason 1

To reduce the risk of flooding to the proposed development and future occupants.

Cont/d..

Condition 2

Any walls or fencing constructed within or around the site within the 1% annual probability (1 in 100) flood extent with a 35% allowance for climate change shall be designed to be permeable to flood water.

Reason 2

Walls and fences can have a significant impact on the flow and storage of flood water, especially if they are constructed across a flood flow route. This can lead to higher levels of flood water on the upstream side of the fence or wall which will potentially increase the flood risk to nearby areas. This condition is necessary to prevent obstruction to the flow and storage of flood water, with a consequent increased risk of flooding.

Advice to applicant

We recommend the use of post and rail fencing, hit and miss fencing (vertical slats fixed alternately on each side of horizontal posts) or hedging. If a solid wall is proposed there must be openings below the 1% annual probability (1 in 100) flood level with an appropriate allowance for climate change to allow the movement of flood water. The openings should be at least 1 metre wide by the depth of flooding and there should be one opening in every 5-metre length of wall.

Ground Raising

There should be no ground raising within the 1% annual probability (1 in 100) flood extent with a 35% allowance for climate change. This is to prevent a loss of flood plain storage and an obstruction to flood flows.

Environmental permitting regulations (EPR)

This development may require an Environmental Permit from the Environment Agency under the terms of the Environmental Permitting (England and Wales) (Amendment) (No. 2) Regulations 2016 for any proposed works or structures, in, under, over or within 8 metres of the top of the bank of designated 'main rivers'. This was formerly called a Flood Defence Consent. Some activities are also now excluded or exempt. An environmental permit is in addition to and a separate process from obtaining planning permission. Further details and guidance are available on the GOV.UK website: <https://www.gov.uk/guidance/flood-risk-activities-environmental-permits>.

Please provide a copy of the decision notice for our records. This would be greatly appreciated.

If you have any queries regarding this letter please do not hesitate to contact me.

Yours sincerely

Mrs Cathy Harrison
Planning Advisor

Direct dial 0203 025 9601

Direct e-mail planning_THM@environment-agency.gov.uk

cc Kevin Scott Consultancy

