



Gavray Drive, Bicester

Hydraulic Modelling Report

*For L&Q Estates, Charles Brown & Simon
Digby and London & Metropolitan
International Developments*

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1. INTRODUCTION

In their consultation response to the Outline Planning application for the above site, the EA have highlighted the need for a detailed hydraulic modelling study to demonstrate that any ground raising as part of the development will in not result in an increase in flood levels in either the Langford Brook or to third party land.

The EA have stated that any modelling of the 'post development' scenario (i.e. to include proposed ground levels) should be based on the provided EA modelling of the Langford Brook that was undertaken by JBA Consultants. Any required compensation storage is to be provided for all ground raising within the provided 1 in 100-year plus 35% allowance for climate change return period event.

The current proposals are to lower an area on the right bank (when looking downstream) on the Langford Brook and to the eastern limit of what is referred to as 'Gavray West'. This area sits outside the proposed 'built area' of development and will ensure suitable volume is 'replaced' whilst also ensuring connectivity to the watercourse.

Much of the area where compensation storage is being proposed is proposed as being public open space (PoS) and crossed by a number of footpaths. It has now been confirmed that all of these are to be at existing (or proposed) site levels, rather than raised, so these result in no loss of floodplain storage.

Hydrock have obtained the Langford Brook model from the EA and, as requested, it is this approved model that has been used to assess the impacts of the areas of ground raising within the 1 in 100 year plus 35% climate change flood extent.

All the updated modelling files have been submitted to the EA for their review. The following provides a summary modelling report to highlight where any changes have been made to the original EA model to help aid review of the latest Hydrock baseline and post development modelling.

The report details the changes to modelling files only and should be read in conjunction with the submitted Flood Risk Assessment Report (Ref: 15114-HYD-XX-XX-RP-FR-0001_P03) that has been included within the submission. Outputs from the modelling exercise have been included within the previously submitted Flood Risk Assessment.

2. HYDROLOGY

The hydrology used within the updated model remains unchanged from that provided in the JBA Consulting modelling. The EA have confirmed that this modelling is the most up-to-date modelling available and remains as being fit for purpose.

It should be noted that this assessment was undertaken, and submitted, prior to July 2021 changes in climate change guidance and has been based on a 35% increase to the 1 in 100-year flows. However, on review of the latest climate change requirements for the Cherwell and Ray Management Catchment (in which the site is located) the assessed value contained within the JBA model already exceeds that latest 'Higher' climate change value. Therefore, it is considered that the JBA model provides a conservative assessment and thus, no amendments have been made to the hydrology used in the JBA model as supplied by the EA.

3. MODEL APPROACH AND SUMMARY

The EA's model is a linked 1D-2D model that uses Flood Modeller Pro and TUFLOW modelling programs. This approach has been maintained in the updated modelling.

The original model has been re-run using the most up-to-date versions of both Flood Modeller and TUFLOW to ensure consistency in any comparison of baseline and post development scenarios. It should be noted that the versions of software used are those that were correct at the time of original submission.

The EA's provided model is considered fit-for-purpose and as such no changes have been made to the 1D or 2D elements other than to model the post development scenario. For the proposed development scenario, all areas where ground raising (and subsequent compensation) is proposed have been included as requested by the EA. The post development scenario is covered by new files (provided in TCF, IEF file formats) and these have been run for the 1 in 100 year plus 35% and 1 in 1000 year events. It should be noted that within the provided files three storm durations (6.5hr, 13hr, and 26hr) have been run. As such, all of the proposed development scenarios have been run for all three of these storm durations to ensure compensation is provided across all durations for the two identified flood events.

The TCF references are as follows:

- Bicester_Pre_6.5hr_100yr(+35pct)_112_HYD_PROP
- Bicester_Pre_13hr_100yr(+35pct)_112_HYD_PROP
- Bicester_Pre_26hr_100yr(+35pct)_112_HYD_PROP
- Bicester_Pre_6.5hr_1000yr_112_HYD_PROP
- Bicester_Pre_13hr_1000yr_112_HYD_PROP
- Bicester_Pre_26hr_1000yr_112_HYD_PROP

All the updated modelling files have been provided to the EA via a sharefile link

4. EVENTS & SCENARIOS

The updated modelling has considered the 1 in 100 year plus 35% allowance for climate change and 1 in 1000 year events. As stated, the assessed climate change values were correct at the time of submission and exceed the current requirements and therefore are considered as being, if anything, a conservative assessment. This has been maintained so as to build in a 'factor of safety' within the compensation storage volumes - i.e. over predicted what is required.

5. 1D MODEL BUILD

No changes have been made to the geometry data (chainage, elevation, panel markers etc) and all files remain as provided within the EA's Langford Brook model.

6. 1D BOUNDARY CONDITIONS

The latest modelling has made no changes to the boundary conditions within the provided EA Langford Brook 1D model.

7. 1D STRUCTURE

No alteration to the existing structures are proposed and as such the updated modelling makes no change to any structures included in the original Langford Brook 1D model.

8. 1D RUN PARAMETERS

All run parameters (timesteps, initial conditions, advanced parameters etc) remain as those used within the original approved EA model.

9. 2D MODEL BUILD

The only change made within the 2D element of the Langford Brook model is the inclusion of three additional ASC grid files. These grids are to reflect both the proposed ground and the inclusion of the proposed compensation storage area to the south east of the site. These changes only apply to the post development scenario. Where the baseline has been updated to reflect latest climate change allowances no changes to any 2D elements have been made and these remain as provided within the approved Langford Brook model.

These grids have been included within a new Tuflow Geometry Control (TGC file format) for the post development scenario (file ref: Bicester_extended_Post_001) with the following file name references.

- CompStorage2.asc -Previous LIDAR

All other elements of the 2D model build (based grid, domain, resolution, obstructions, flood defences embankments etc) are unchanged from the original model provided.

10. 2D BOUNDARY CONDITIONS & ROUGHNESS

10.1 2D Boundary Conditions

The proposed development site and areas where ground level alterations are proposed are not located near any 2D boundary. As such, no alteration is necessary to the boundaries used within the original EA model and these remain unaltered.

10.2 2D Roughness

No change has been made to the 2D roughness values used in the original model for the latest baseline scenarios.

The post development scenario has included alterations to ground levels within the 2D domain. Whilst these may result in a change to roughness (e.g. from pasture to roads), as these areas are raised outside of the flood storage area, they have no interaction with 2D flood levels or flow process and as such no change to roughness values in these areas have been made.

11. MODEL LINKS

The model received by the EA is a linked 1D/2D model with coupling achieved via the use of HX and CN lines and in line with standard modelling guidance. As the provided model is being relied upon (at the EA's request) this approach is unchanged within the recently submitted files. In addition, the post development scenario only results in alteration to ground levels at the location of the proposed development site and has no impact on the current 1D/2D linking.

12. MODEL STABILITY

12.1 1D Model Stability

A review of the 1D model outputs shows all errors/comments and warnings match those previously obtained within the original model. This is to be expected as no changes have been made to the 1D element or to the areas of linking. As such the comments relating to model stability and flood levels remain acceptable. All supporting output files (ZZD) have been included within the files submitted.

It should be noted that the errors/warnings are those within the provided modelling by the EA. As such these are considered as being acceptable (i.e. previously approved). In addition to this the errors and warnings have been reviewed and are not considered to have any impact on predicted flood levels/extents and, as such, remain within the model.

Convergence plots have been reviewed and are similarly considered as being acceptable. From a comparison of the original model outputs to those from Hydrock modelling no significant differences are identified. This is again as expected given that no changes to the 1D elements have been undertaken.

12.2 2D Model Stability

Whilst changes have been made within the 2D domain to account for the proposed ground level raising, no significant differences in the Mass Balance Errors, CE and dV values, Comments/Warnings etc have been identified when compared to those of the original approved EA modelling provided. As such the latest modelling is therefore also considered acceptable.

13. MODEL OUTPUTS AND CALIBRATION

Given that the original model is considered fit for purpose and no significant changes have been made to this original model as part of this latest modelling exercise, it is considered that no further calibration of the latest model is required.

Extracts from the modelling exercise undertaken have been included within the previously submitted Flood Risk Assessment (Ref: 15114-HYD-XX-XX-RP-FR-0001_P03).

14. MODEL SENSITIVITY

As with calibration, and as no alterations to the baseline model (other than additional return period events - climate change) have been made, further sensitivity testing is not considered as being required.