
# Westwood Mill

# Updated Masterplan

# Modelling addendum

**REVISION J**

**JANUARY 2021**

EdenvaleYoung

New Civil Engineer 100 COMPANIES OF THE YEAR 2018

WINNER Design Innovator

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# Quality Assurance

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| EVY0822_Westwood_Mill_Updated_Masterplan_Addendum_RevB.docx | A | 9/12/19 |

# Table of Contents

## Table of Figures

# 1 Introduction

This report serves as an addendum to the Westwood Mill Modelling Report Prepared by Edenvale Young in June 2016 (Revision F). In January 2021, Edenvale Young Associates Ltd. were supplied with a revised masterplan for the development as shown in Appendix C.

Hydraulic modelling has been undertaken to understand the flood risk to the latest proposed property layout with peak inflows applied using the 2017 JBA hydrology[1] as shown in Table 1. Hydraulic modelling has been undertaken to understand the flood risk to the latest proposed property layout. The main changes to the latest masterplan include:

- Adjustment to the position of property adjacent to the lake
- Explicit representation of the car parking and access road

*Table 1| Peak inflows applied in modelling ($m^3/s$) cc = climate change*

| Return Periods (years) | EVY 2016 peak inflows applied in previous modelling | JBA 2017 peak inflows applied in latest modelling |
|---|---|---|
| 1 in 25 | 46.25 | 52.47 |
| 1 in 100 | 64.22 | 70.05 |
| 1 in 100 + 30% cc | 83.48 | 91.07 |
| 1 in 100 + 50% cc | 105.08 | 105.08 |
| 1 in 1000 | 120.98 | 112.14 |

[1] Flood estimation report: Rivers Colne and Holme JBA Consulting: 2016s5068 - Colne and Holme hydrology report v2.2.docx October 2017

# 2 Modelling

## 2.1 Software

The post development modelling has now been simulated using the latest version of the software Flood modeller pro version: 4.5.1.6163 and TUFLOW version: 2020-01-AA-iDP-w64.

## 2.2 Model Baseline (Pre-Development Scenario)

There have been no updates to the baseline model which was run on Flood modeller pro version: 4.5.1.6163 and TUFLOW version: 2018-03-AC-iDP-w64.

## 2.3 Previous masterplan v2.6-L

The masterplan supplied in December 2019 has been simulated as scenario 'v2.6-L'. The changes reflected this updated masterplan which included:

- Updated model roughness (2d materials files) to reflect the new property layouts, areas of hardstanding and green spaces.
- Increased area for the mill pond and modelling of the proposed off-take structure from the mill pond into the Colne.
- Removal of the "southern wall" which is no longer present in the latest masterplan as the latest arrangement of property prevents flow through the site.
- Relocating the previously proposed house platforms to fit the updated masterplan.
- Representation of a flood compensation volume to compensate for raising the access road to the site for a 1 in 25 year event.

## 2.4 Updated masterplan v2.8-M

The latest masterplan (see Appendix C: Drawing 538.02/PLA21 Rev W) has been simulated as scenario 'v2.8-M', this includes the changes made at v2.6-L of the modelling. The changes have reflected the updated masterplan arrangement which includes:

- Changes made to road elevation at v2.8-L of the modelling (see revision H of this report). The two stage channel is present in this latest iteration of the modelling, the approximate location of this is shown in Figure 1.
- Adjustment of the material roughness for hardstanding, gardens and buildings to reflect Rev W of the Westwood Mill Masterplan

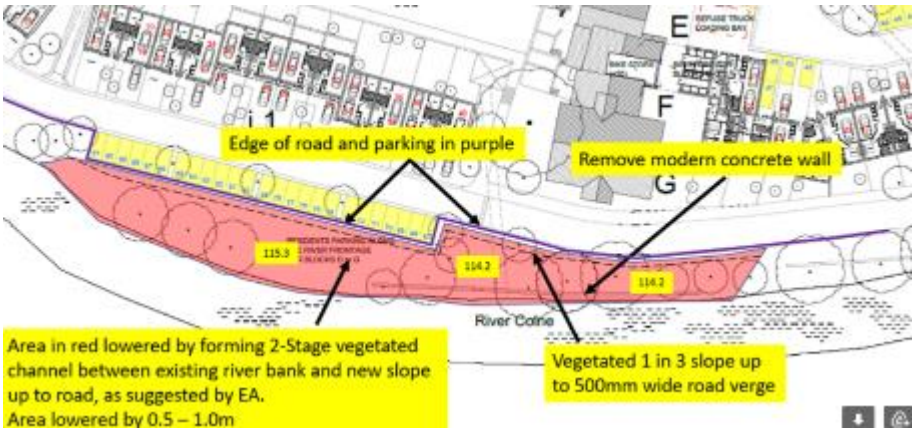



*Figure 1: Location of Two Stage Channel*

# 3 Model results

## 3.1 Baseline – Pre-development Scenario

The maximum flood depths for the baseline scenario are given in Appendix A for:

- 1 in 25-year return period
- 1 in 100-year return period
- 1 in 100-year return period plus an allowance of 30% for climate change
- 1 in 100-year return period plus an allowance of 50% for climate change
- 1 in 1000-year return period

## 3.2 Post Development Scenario – Revised Master Plan

### *1.1.1 Introduction*

Hydraulic modelling for the post development scenario incorporates the latest masterplan (Revision W) which has been altered from previous versions to move blocks i.1, i.2 and i.3 westwards to reduce flood risk to this group of properties. This has involved amending and rerunning the hydraulic model to reflect this alteration. The objective of the modelling is to confirm:

- that the development lies outside the functional floodplain,
- that safe access and egress is possible and
- confirm finished floor levels for the residential properties.

The full suite of results is given in Appendix B which includes mapping for maximum water depth, water level and flood hazard.

### 1.1.2 *Functional Flood Plain*

In relation to the functional floodplain, Figure 2 and Figure 3 shows the results of the modelling for a 1 in 25 year event in the post development scenario. In the post development scenario, all residential property (labelled A through to I) the road access and car parking lies outside the functional flood plain.

Figure 3 shows the relative peak water and road / car parking levels. Finished Floor Levels.

### 1.1.1 *Finished Floor Levels*

Figure 4 and Figure 5 shows the maximum water levels for a 100 year event plus 30% and 50% climate change, 19 properties in the "I.1, I.2 and I.3 blocks" would be at risk of flooding on the assumption that the ground floor levels of the buildings are set at the existing ground level. The latter figure gives representative spot levels showing the maximum water level adjacent to the buildings.

If ground floor levels within Block i.1, i.2 and i.3 are placed 0.3m above exiting ground level, then none of the properties within block i.1, i.2 and i.3 would be subject to flooding for a 100 year event plus 30% climate change event (see Table 2). It has also been assumed that properties adjacent to the Mill Pond in Block i.1, 1.2 and i.3 will have living accommodation on the first floor with non-residential (i.e. garages) on the ground floor.

Table 3 shows the design criteria for Blocks A to H. Block G has a small portion of flooding near the bin store at maximum flood depths of 0.84m.

Nevertheless. it is recommended that finished floor levels should be set as the maximum of the following criteria. The proposed FFLs are show in Table 3.

1. 1 in 100 year return period maximum water level with a climate change allowance of 30% plus a freeboard of 0.3m

Or

2. 1 in 100 year return period maximum water level with a climate change allowance of 50%

*Table 2| Proposed Ground Floor Levels to Block I (Non Residential Accommodation) 1 in 100 year return period with a 30 % climate change allowance (see Figure 1) shows the reference points used)*

| Block | Maximum Water Level (m AOD) | Existing Ground Level (m AOD) | Proposed Ground Floor Level (m AOD) |
|---|---|---|---|
| **I1** | 117.38 | 117.65 to 117.13 | 117.68 |
| **I2** | 117.18 | 117.23 to 116.88 | 117.48 |
| **I3** | 117.07 | 117.23 to 116.72 | 117.37 |

*Table 3| Proposed Finished Floor Levels to Block E to K (Residential Accommodation) 1 in 100 year return period with a 30 % and 50% climate change allowance*

| Block | 1 in 100 + 30% CC (m AOD) | Minimum FFL Criteria 1 (m AOD) | 1 in 100 + 50% CC (m AOD) | Minimum FFL Criteria 2 (m AOD) |
|---|---|---|---|---|
| **F to H** | 116.87 | 117.17 | 117.13 | 117.13 |


*Figure 2: Maximum flood level 1 in 25 year event*


*Figure 3: Maximum flood level: 1 in 25 year event with road (orange) and water levels labelled (blue)*


*Figure 4: Maximum flood level: 1 in 100 year event with an allowance of 30% on fluvial flows for climate change*

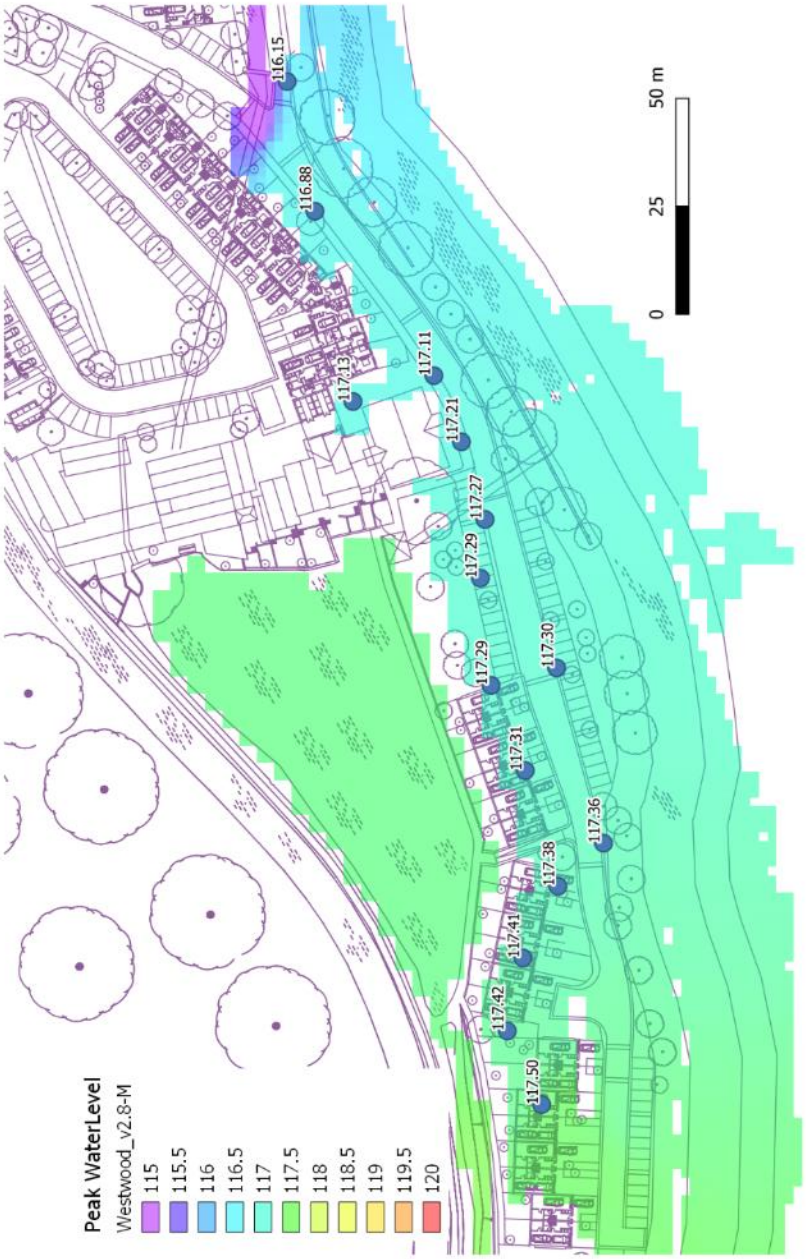



*Figure 5: Maximum flood level: 1 in 100 year event with an allowance of 50% on fluvial flows for climate change: Point Sample locations for key water levels*

### 1.1.3 *Flood Hazard; Safe Access and Egress*

Figure 6 and Figure 7 shows the flood hazard mapping for a 1 in 25 and 1 in 100 year event with an allowance of 30% for climate change. The modelling indicates that for properties in Blocks A to E, Block H and J to K, there is safe access and egress onto Low Westwood Lane and there are no restrictions associated with evacuation.

The access road adjacent to Block G has been elevated by 0.1m above the existing ground level as well as the car parking using a zsh region. Accordingly, there is no flooding to the road which would allow vehicular and pedestrian access to Blocks i.1, i.2 and i.3 in a 1 in 25 year event.

Evacuation of properties in Blocks i1, i2 and i3 in a 1 in 100 year event with an allowance of 30% on flow for climate change must be along the Mill Pond Embankment and across the mill leat via a new bridge to the canal tow path. Vehicular access along the road to the south of the buildings to Blocks I1, I2 and I3 will not be possible as the hazard is classified as dangerous to all in a 1 in 100 year return period with 30% climate change.

### 1.1.4 *Flood Difference Mapping*

The difference map for the 1 in 100 year plus 30% climate change which shows the impact of the proposals on flood water levels is as shown in Figure 8. The mapping shows the increases (red) and decreases (blue) in water level.

The modelling indicates that that the development does result in changes to water level within the development red line with slight increases upstream and around the settling pond.

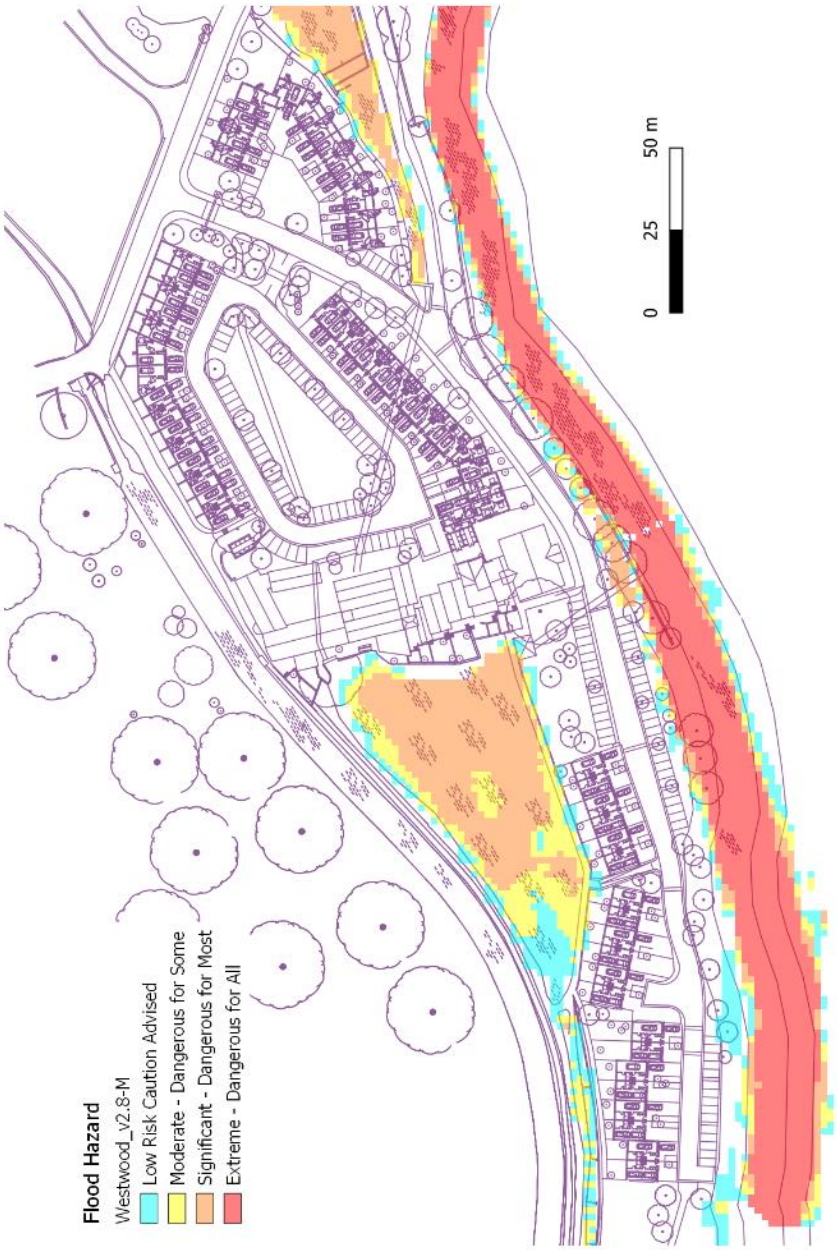



*Figure 6: Maximum Hazard: 1 in 25 year event*

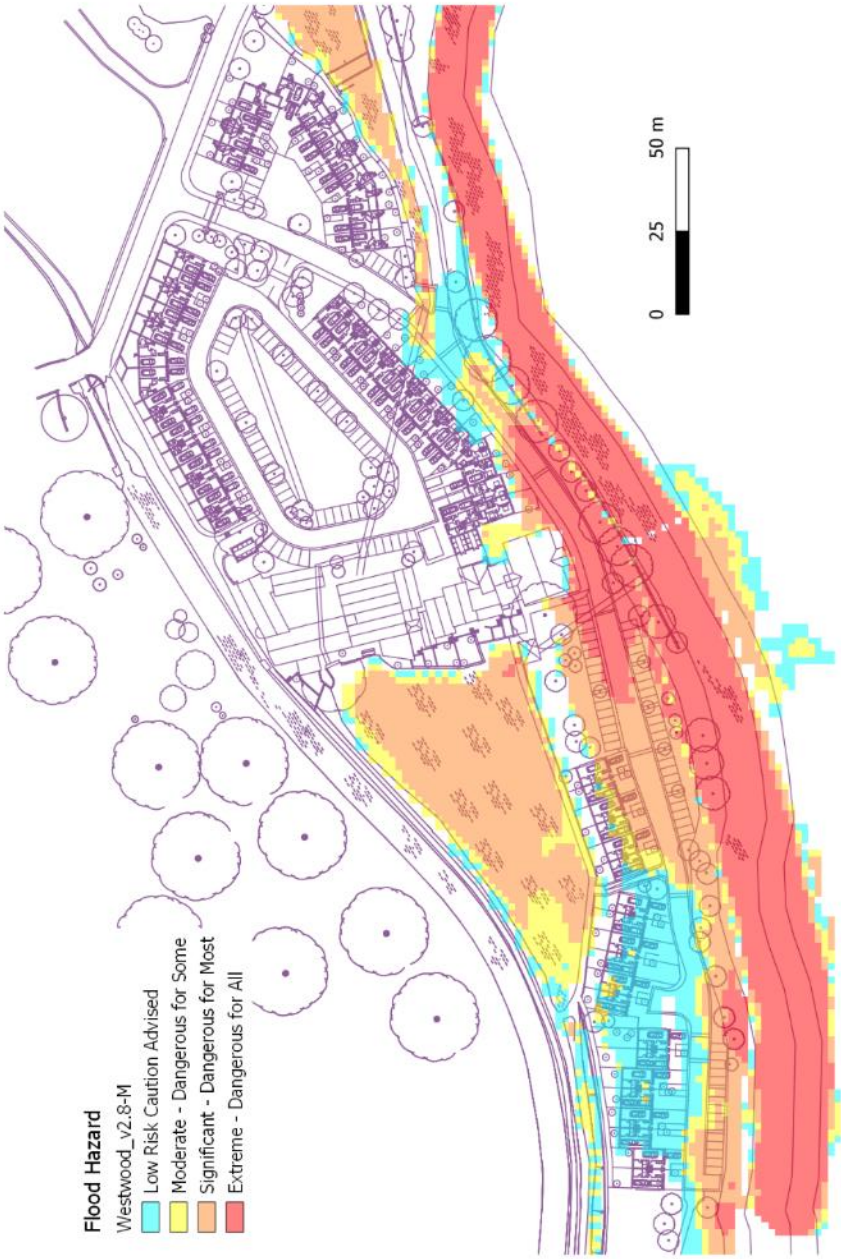



*Figure 7: Maximum Hazard: 1 in 100 year event with an allowance of 30% on fluvial flows for climate change*

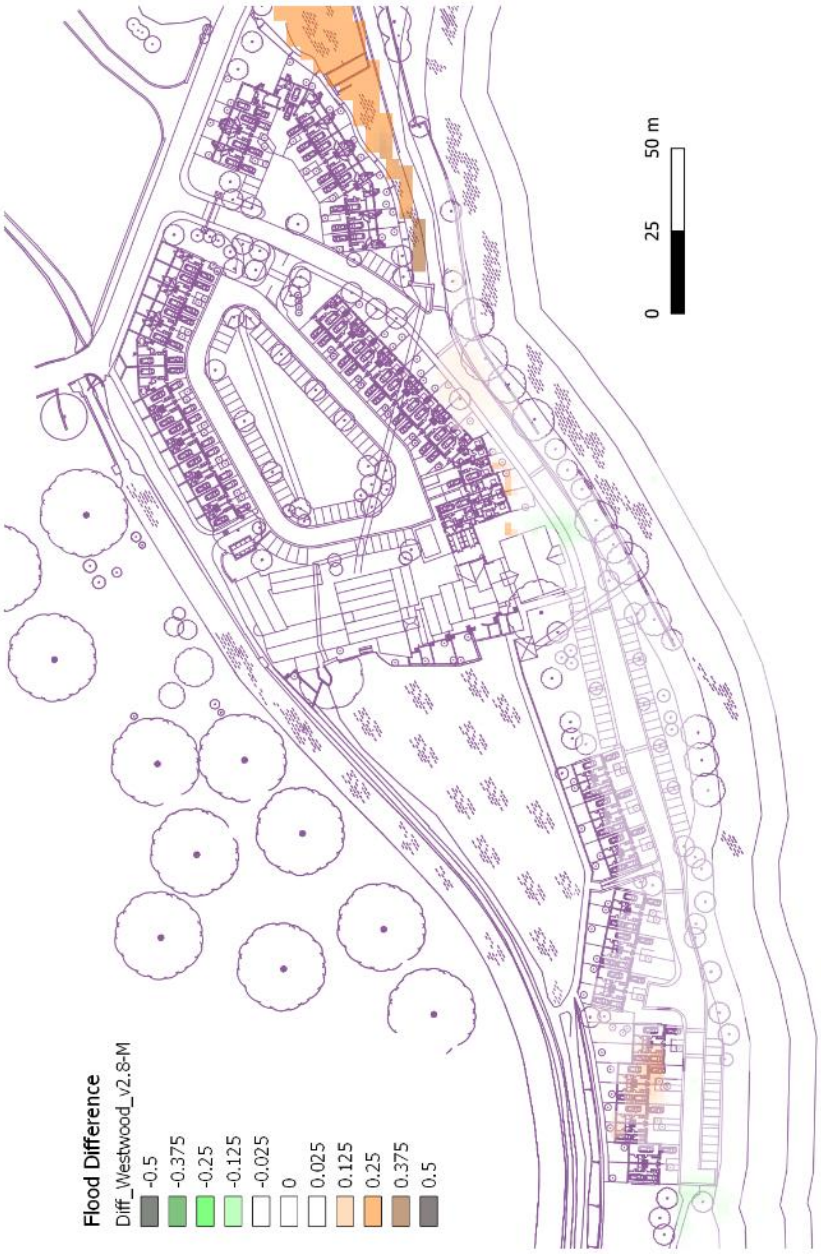



*Figure 8: Post development Water Level minus Pre-development Water Level for the 1 in 100 year plus 30% climate change event*

# 4 Conclusions and Recommendations

## 4.1 Conclusions

Property within the development is not within the functional flood plain (Flood Zone 3b) which is defined as a 1 in 25-year event. On the assumption that finished floor levels within Blocks I, I2 and I3 are set at 0.3m above the existing ground level then none of the properties would be internally flooded.

Assuming that finished floor levels are set correctly then Blocks J to K would be free of flooding in the 1 in 100 year event with allowances of 30% and 50% for climate change.

Safe access and egress from the Blocks F, G, H, I1, I2 and I3 can be achieved assuming provision is made for movement along the embankment to the Mill Pond over the mill leat and onto the canal towpath. Safe access and egress from all of the other blocks is achievable up to and including the 1 in 100 year return period.

## 4.2 Recommendations

It is recommended that:

- Finished ground Floor Levels for Blocks i1, i2 and i3 are as show in in Table 1.
- Ground floor within Blocks I1, I2 and I3 are set aside for non-residential purposes (i.e. garages). All living accommodation should be on the second and third floors of Blocks i.1, I.2 and i.3 and not vulnerable to flooding.
- Finished Floor Levels for Blocks E to H should be set at a minimum of 117.17m AOD
- Provision is made for safe access and egress for Blocks F, G,H, I1, I2 and I3 is made along the Mill Pond embankment and across the mill leat and onto the canal towpath.

## Figures

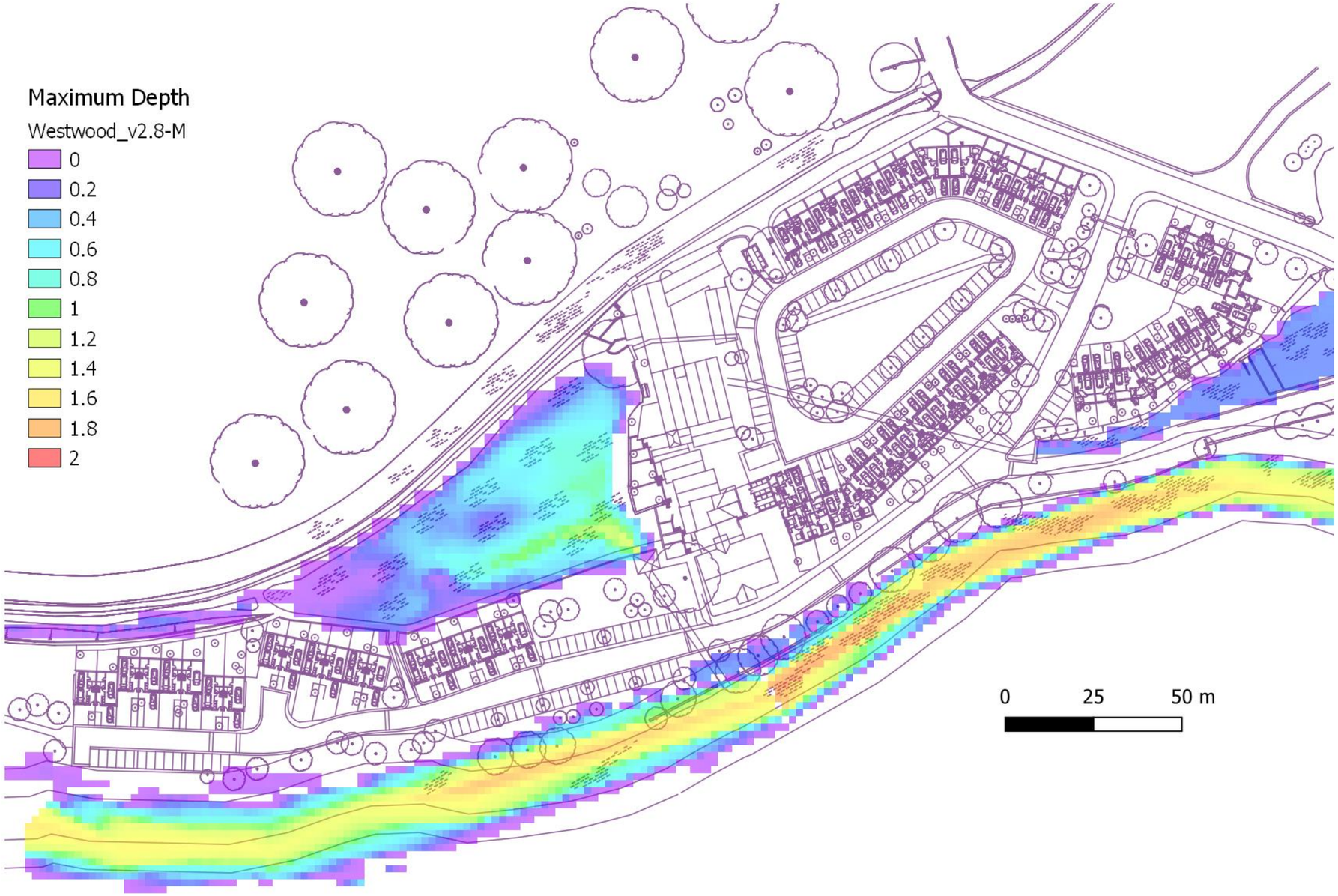



**Figure B1: Post -development Scenario: Maximum Modelled Flood Depths for the 1 in 25 year Event**

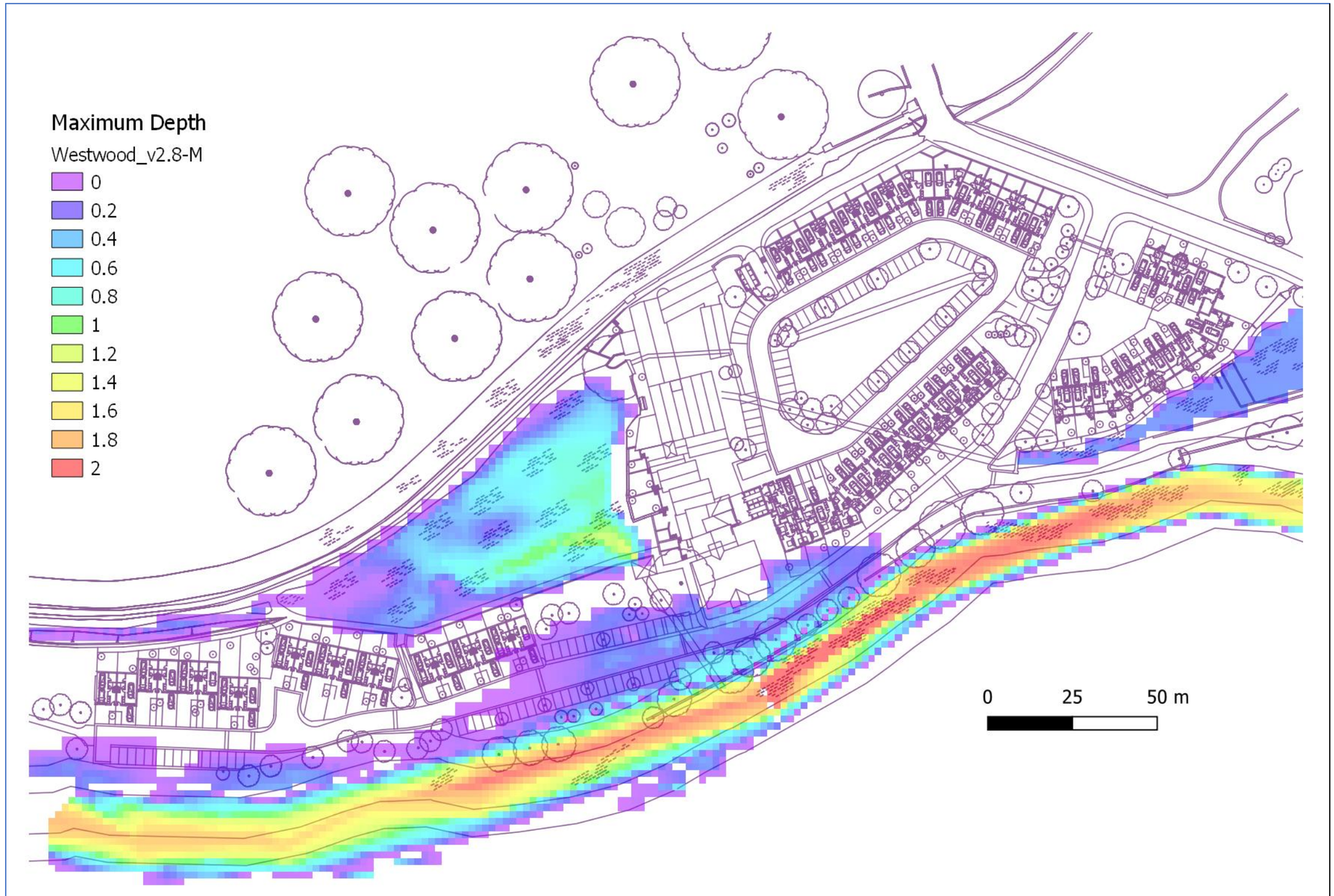



**Figure B2: Post -development Scenario: Maximum modelled flood depths for the 1 in 100 year event**

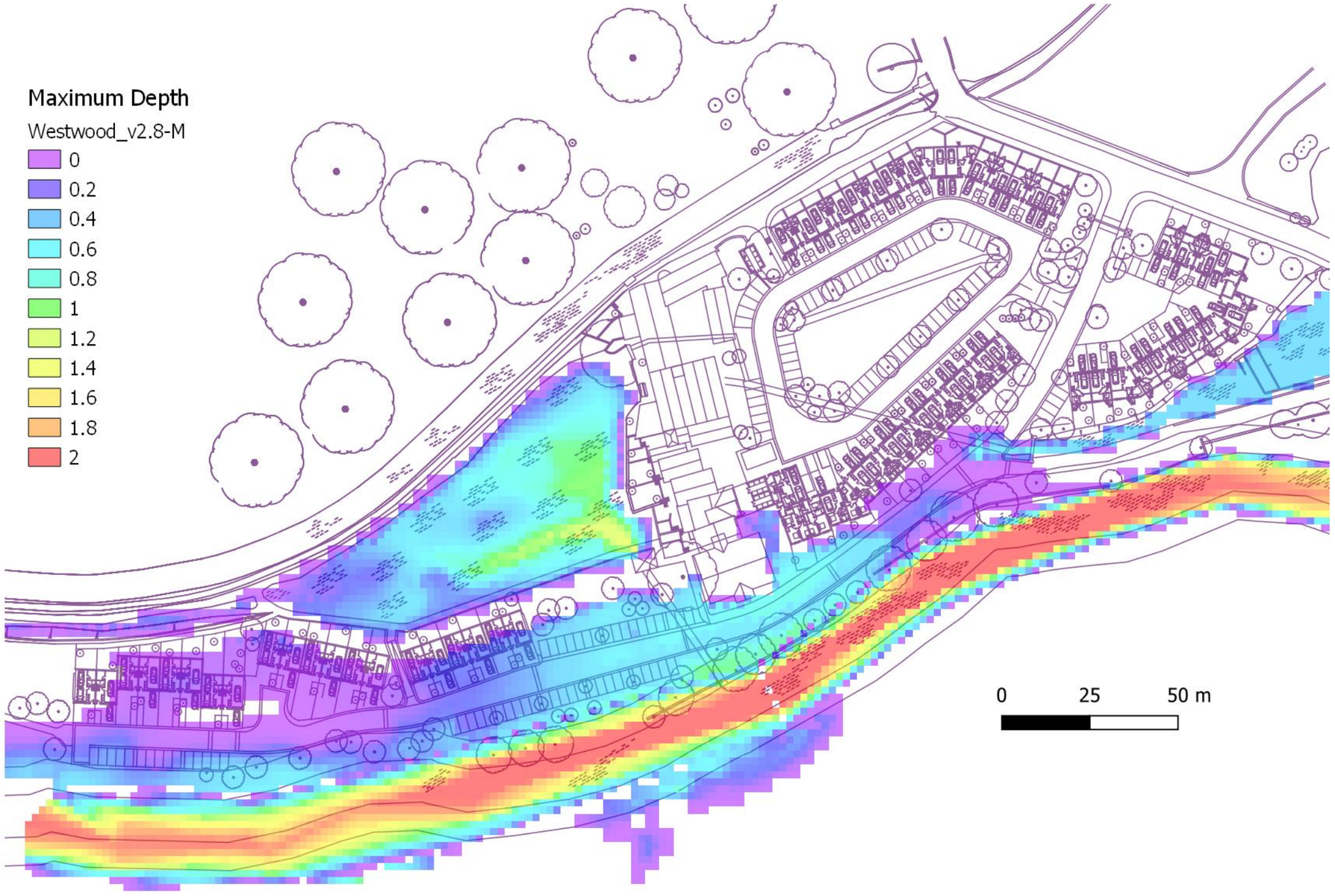



**Figure B3: Post -development Scenario: Maximum Modelled Flood Depths for the 1 in 100 year return period plus 30% allowance for climate change**

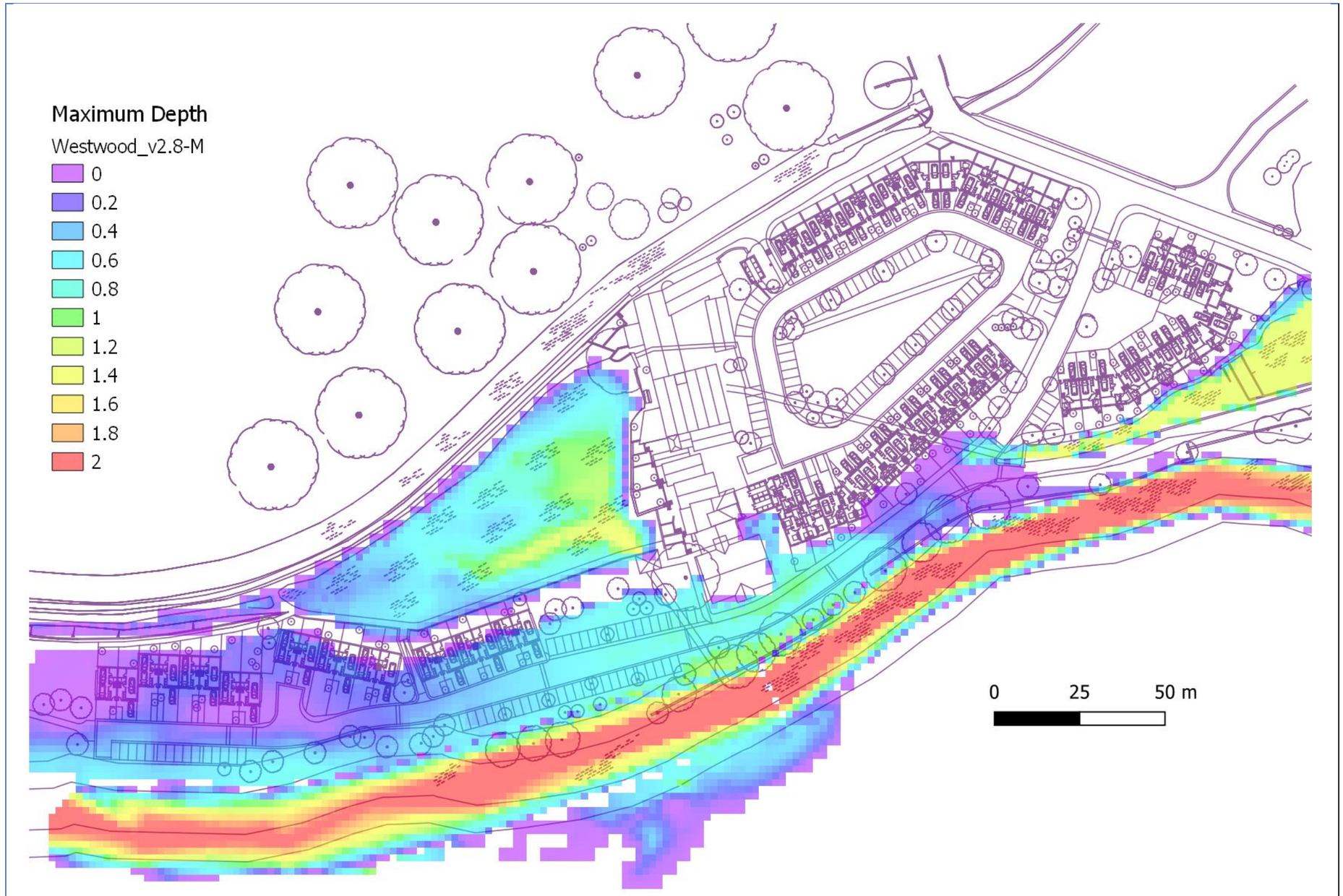



**Figure B4: Post -development Scenario: Maximum Modelled Flood Depths for the 1 in 100 year return period plus 50% allowance for climate change**

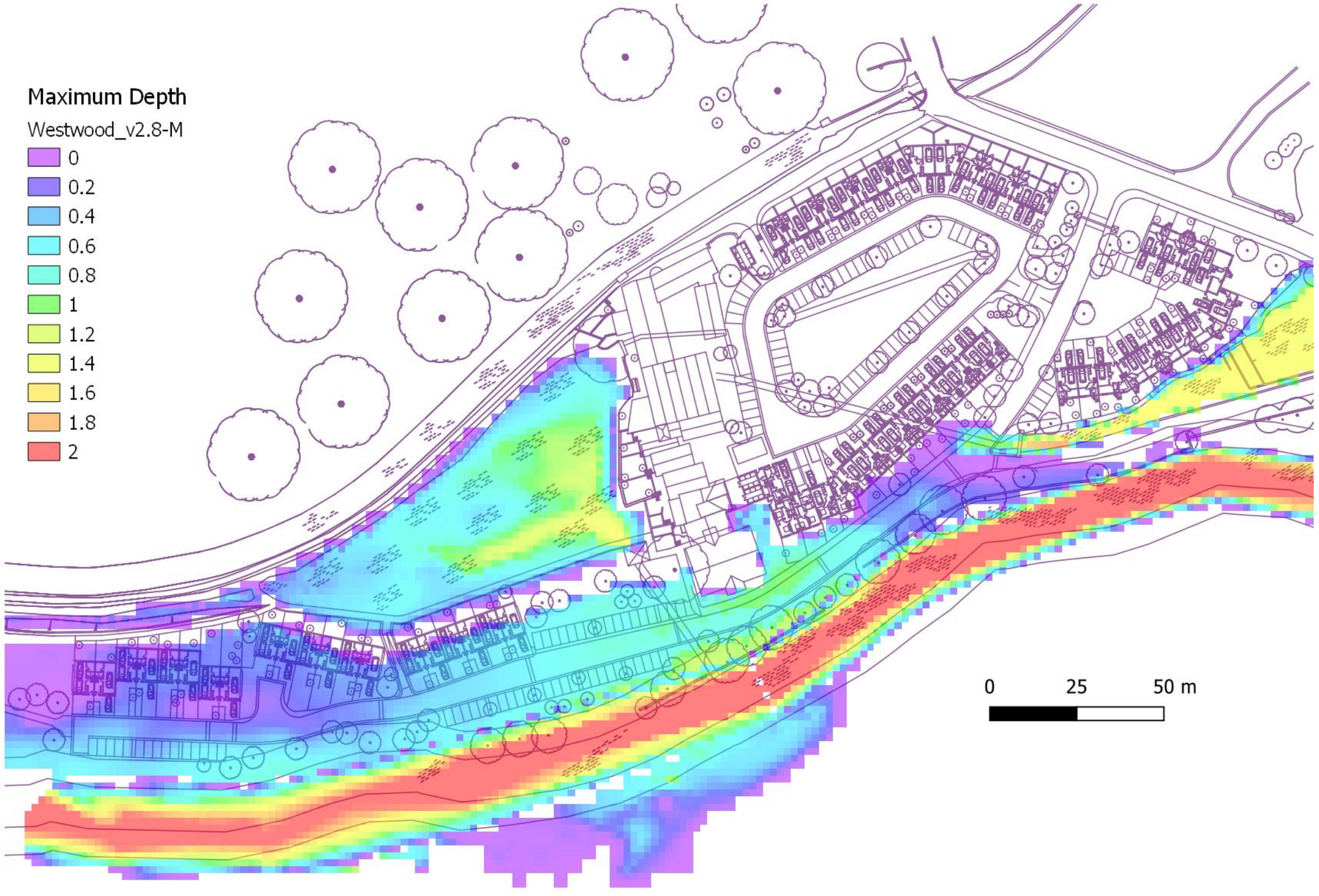



**Figure B5 : Post -development Scenario:  Maximum Modelled Flood Depths for the 1 in 1000 year return period**

**Figure B7: Post -development Scenario:  Maximum Modelled Flood Level for the 1 in 100 year return period**

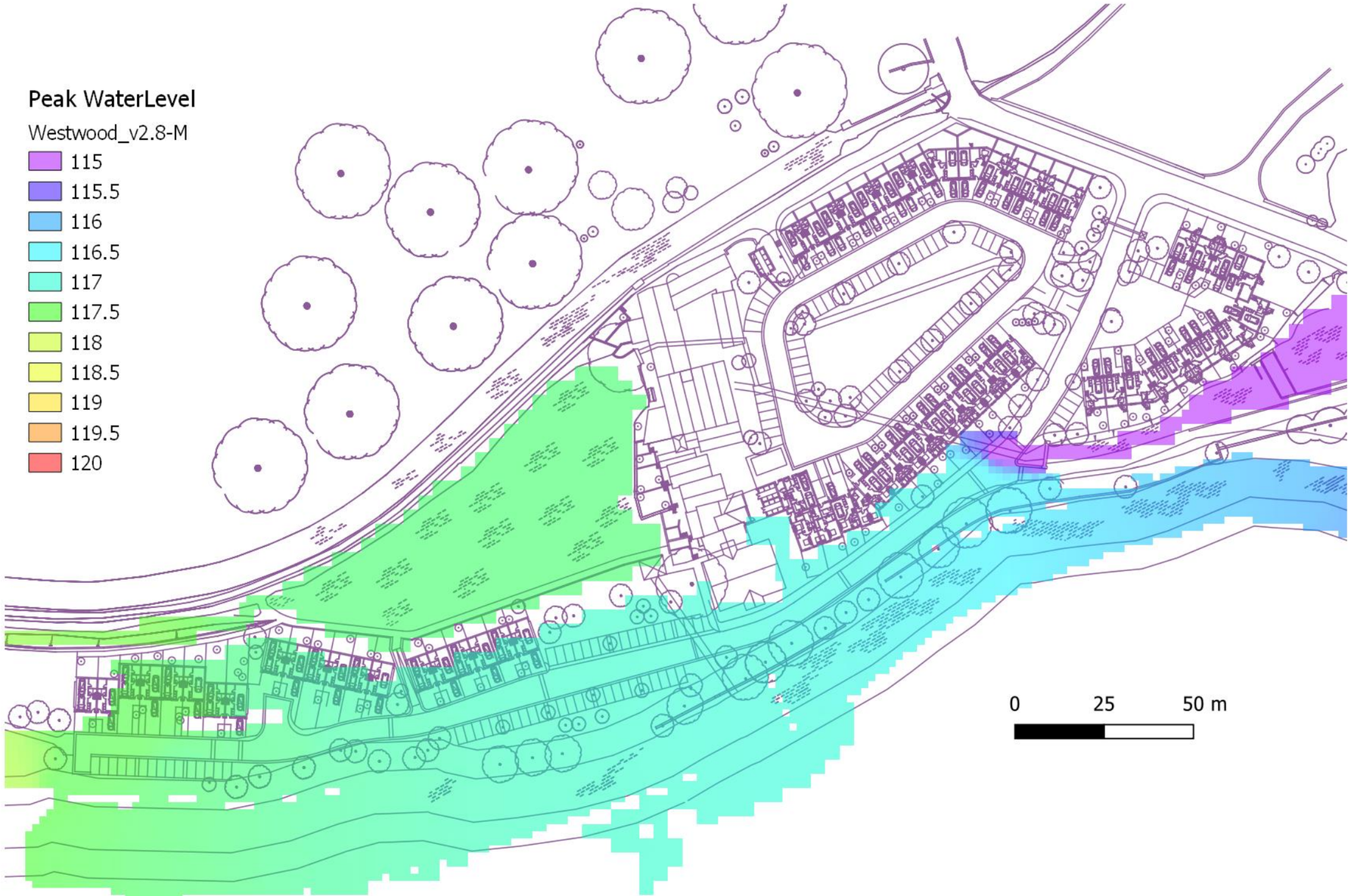


**Figure B8: Post -development Scenario:  Maximum Modelled Flood Level for the 1 in 100 year return period plus 30% allowance for climate change**

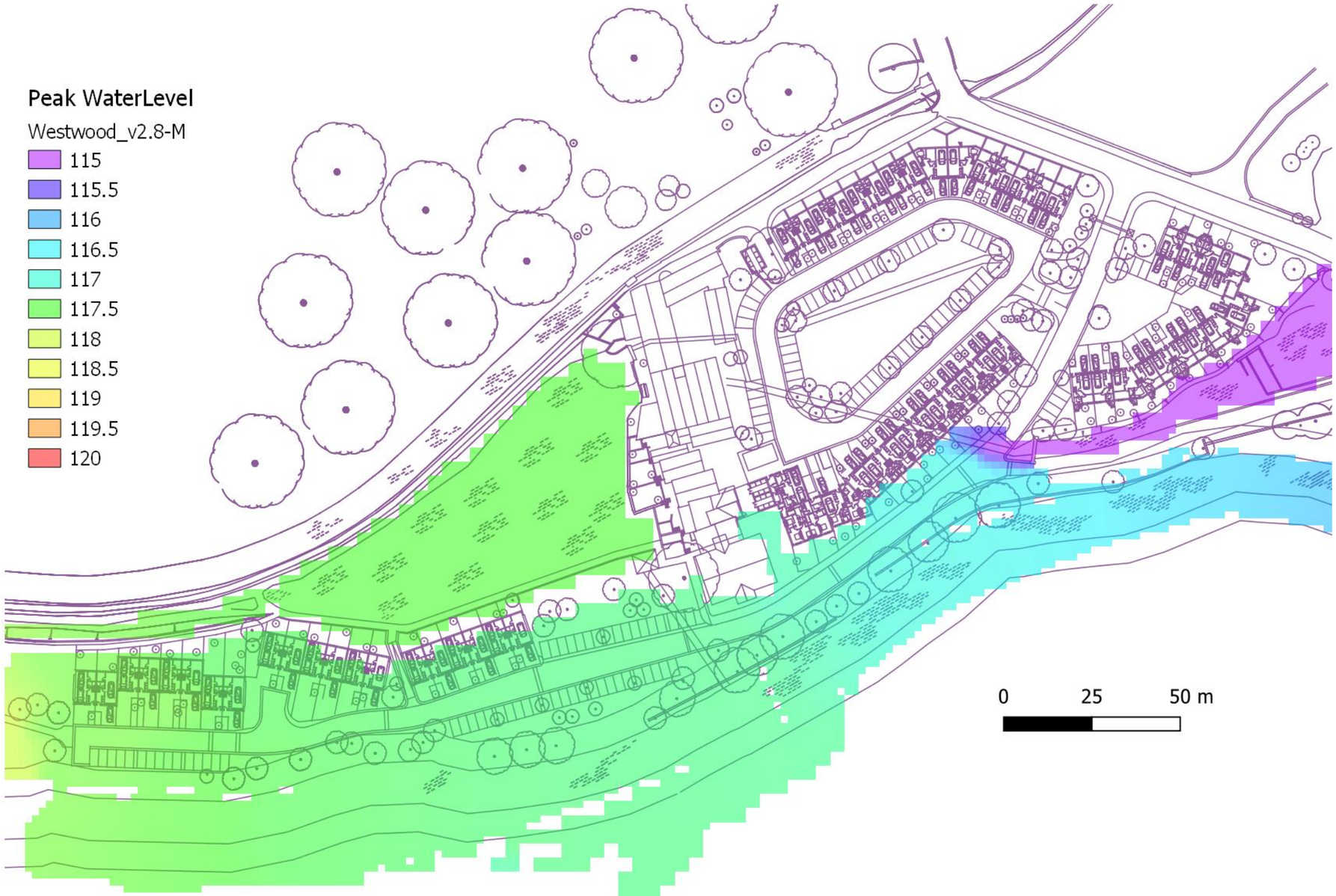
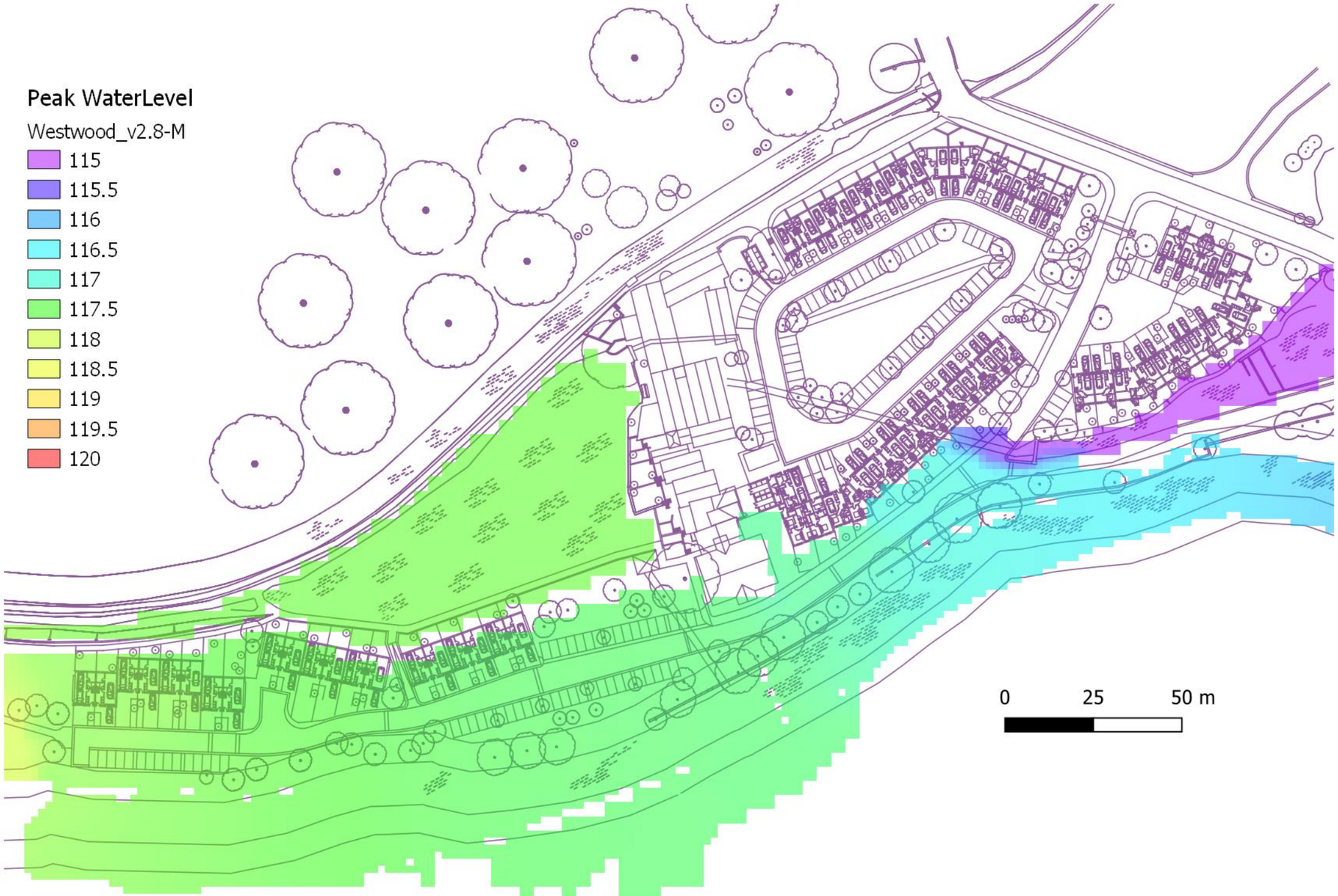


**Figure B9: Post -development Scenario:  Maximum Modelled Flood Level for the 1 in 100 year return period plus 50% allowance for climate change**



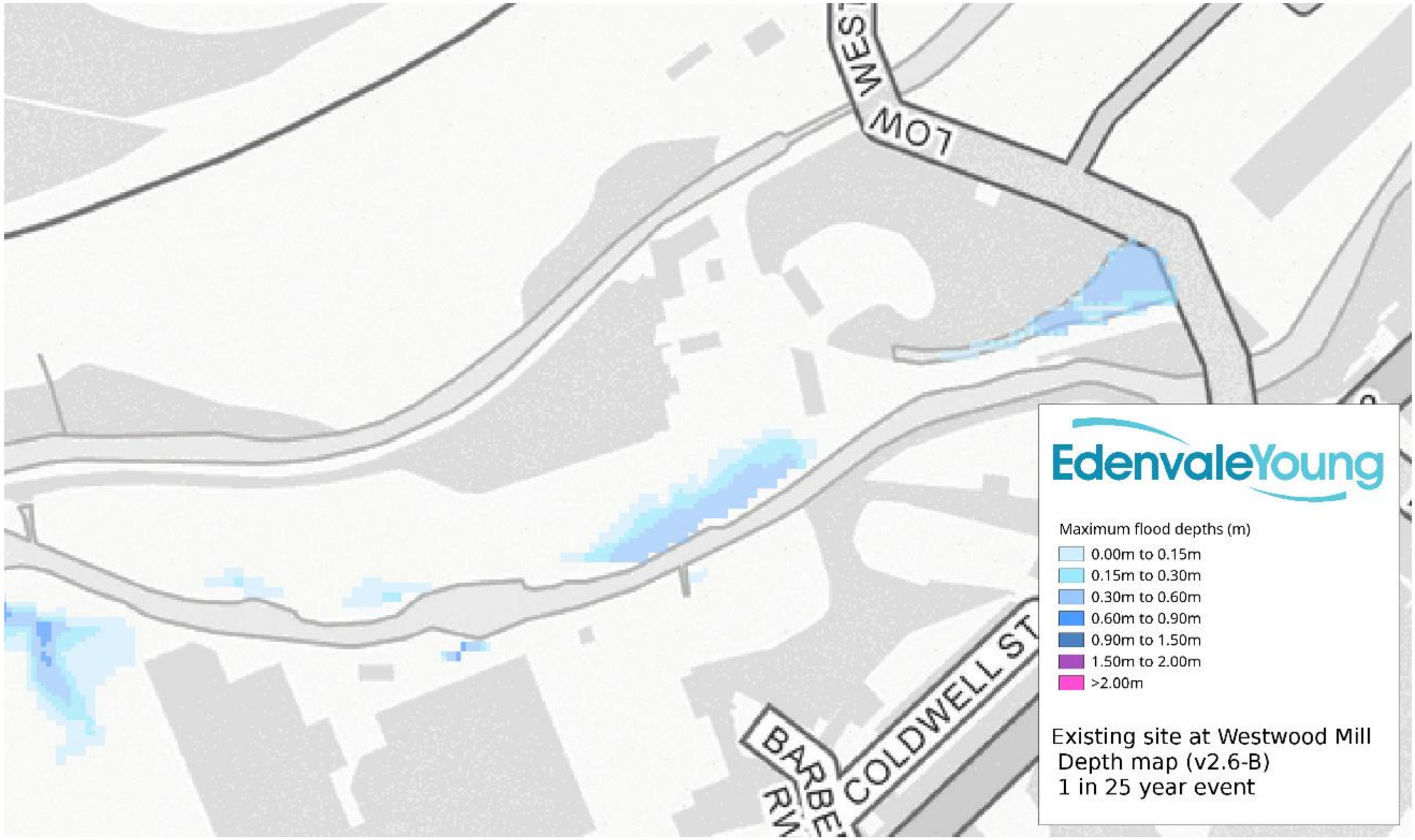



*Figure A1: Pre -development Scenario: Maximum Modelled Flood Depths for the 1 in 25 year return period*

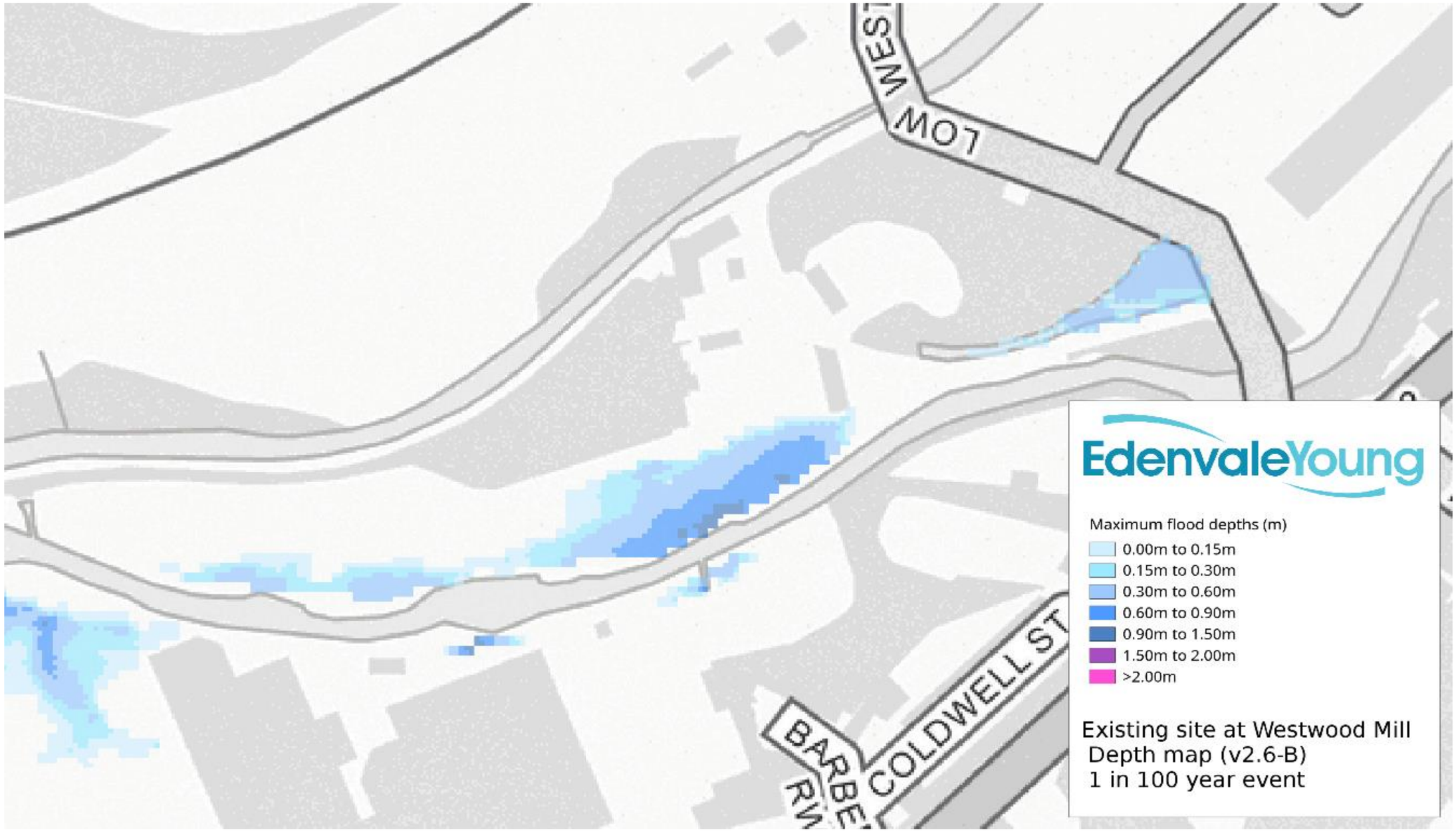



*Figure A2: Pre -development Scenario:  Maximum Modelled Flood Depths for the 1 in 100 year return period*

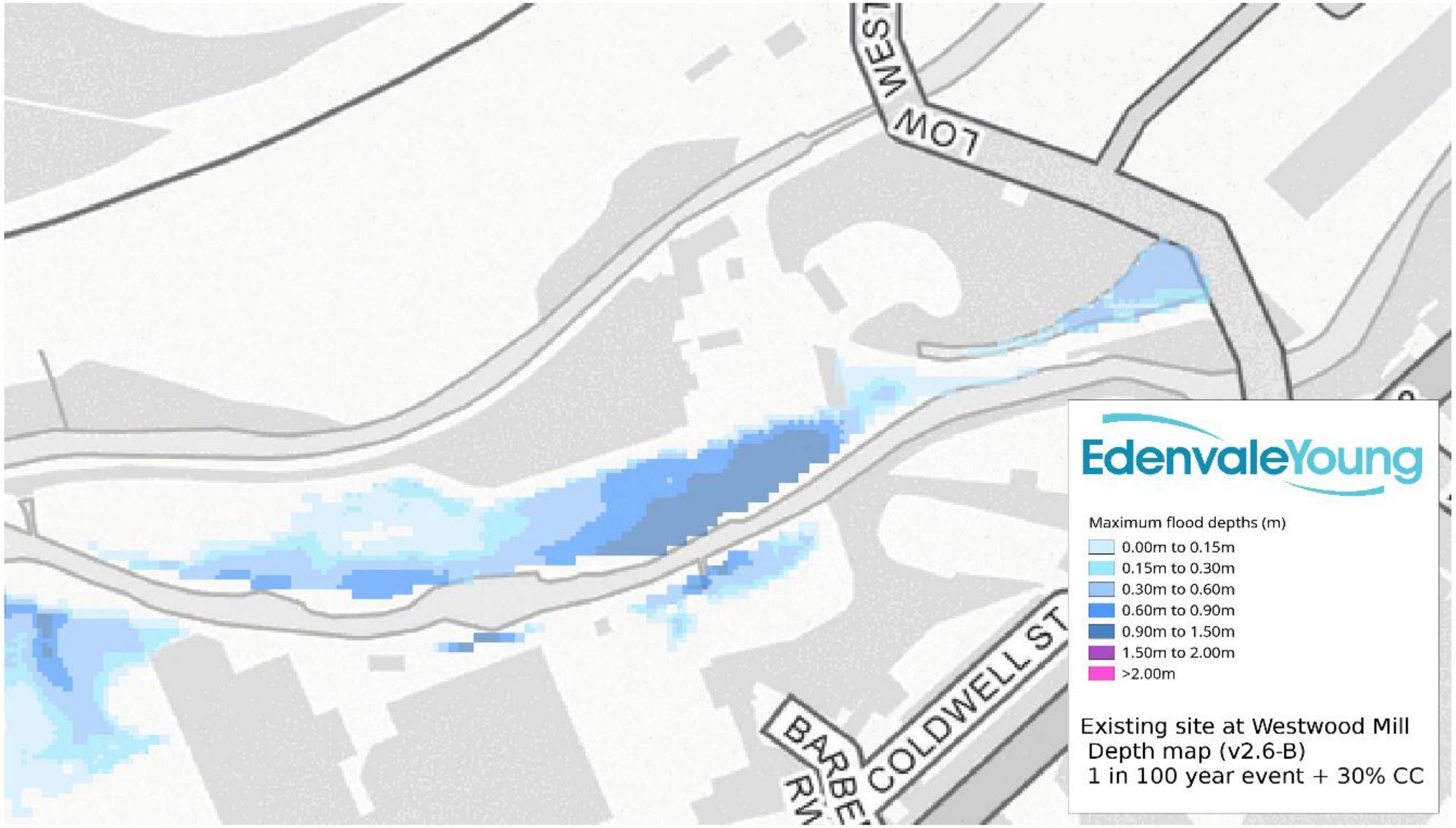



*Figure A3: Pre -development Scenario: Maximum Modelled Flood Depths for the 1 in 100 year return period plus 30% allowance for climate change*

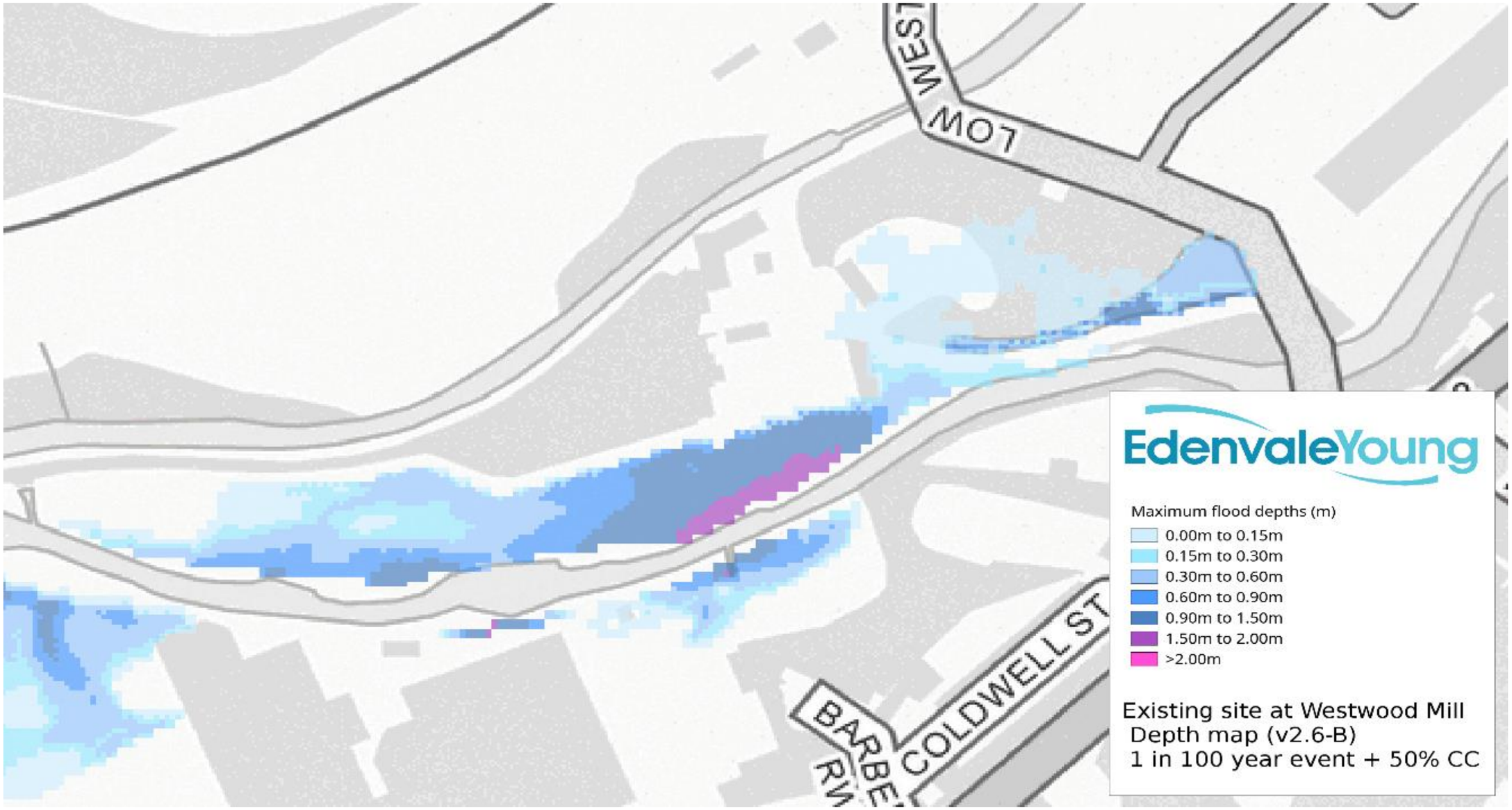



*Figure A4: Pre -development Scenario: Maximum Modelled Flood Depths for the 1 in 100 year return period plus 50% allowance for climate change*

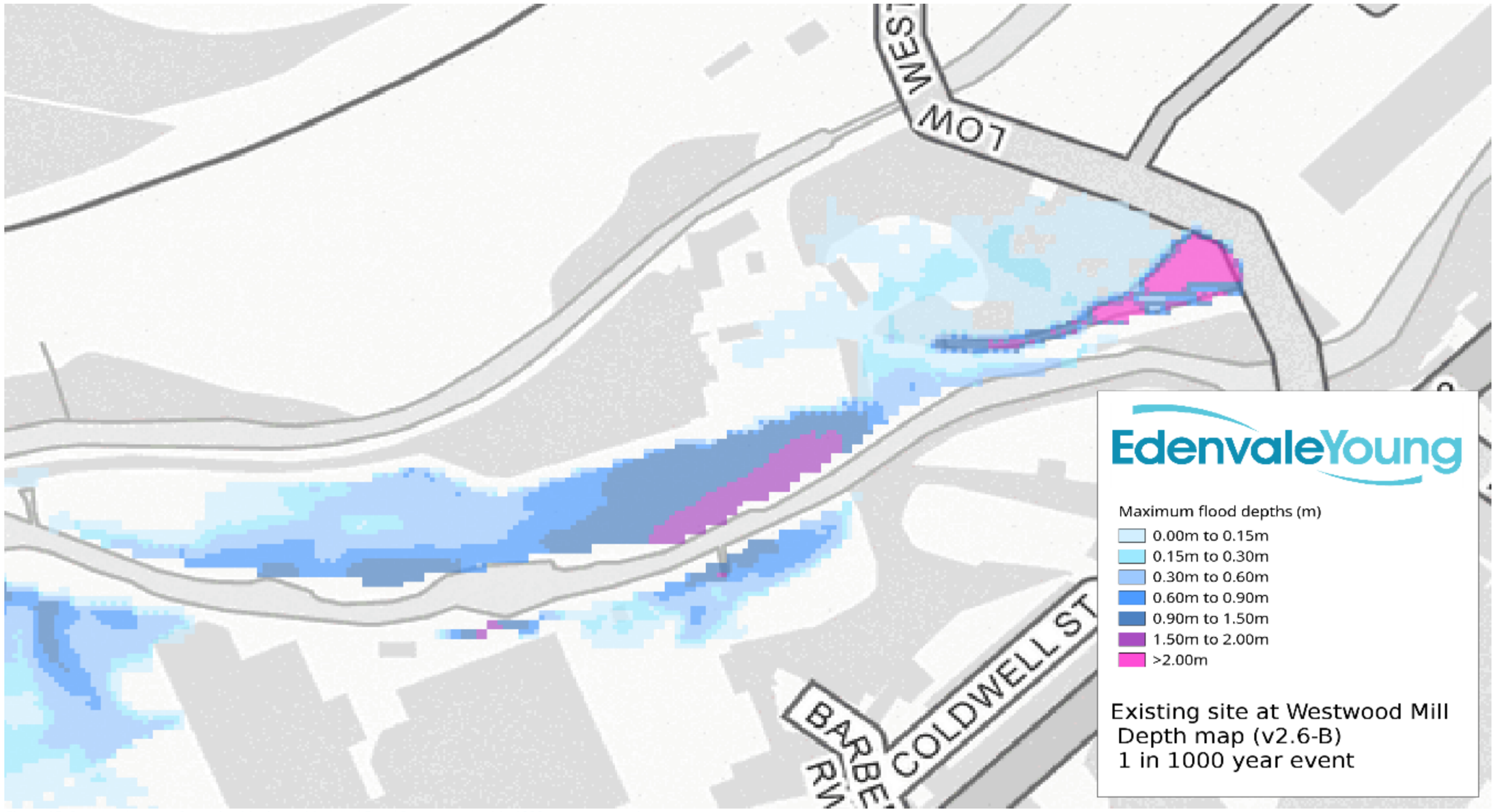



*Figure A5: Pre -development Scenario: Maximum Modelled Flood Depths for the 1 in 1000 year return period*

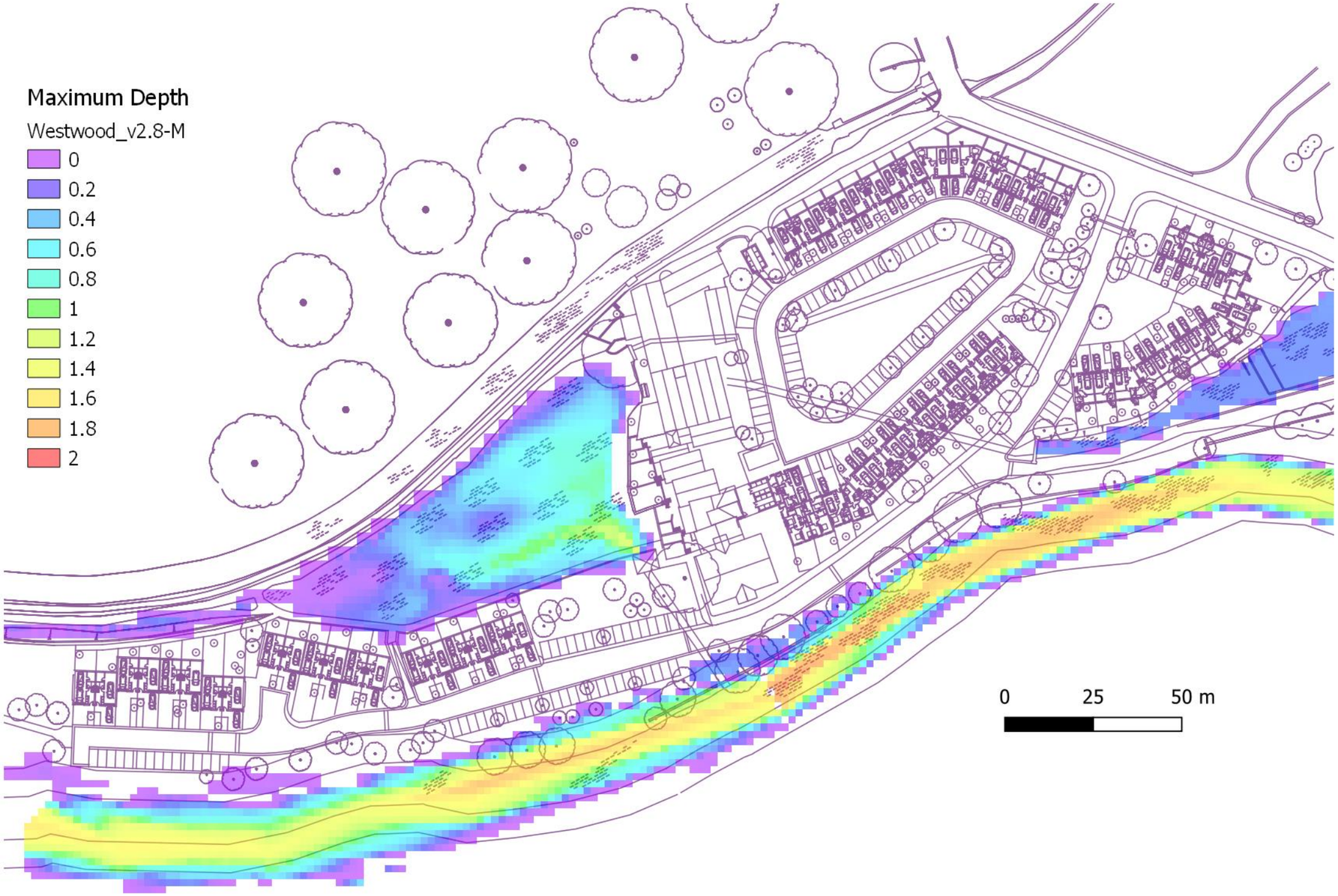



*Figure B1: Post -development Scenario: Maximum Modelled Flood Depths for the 1 in 25 year Event*

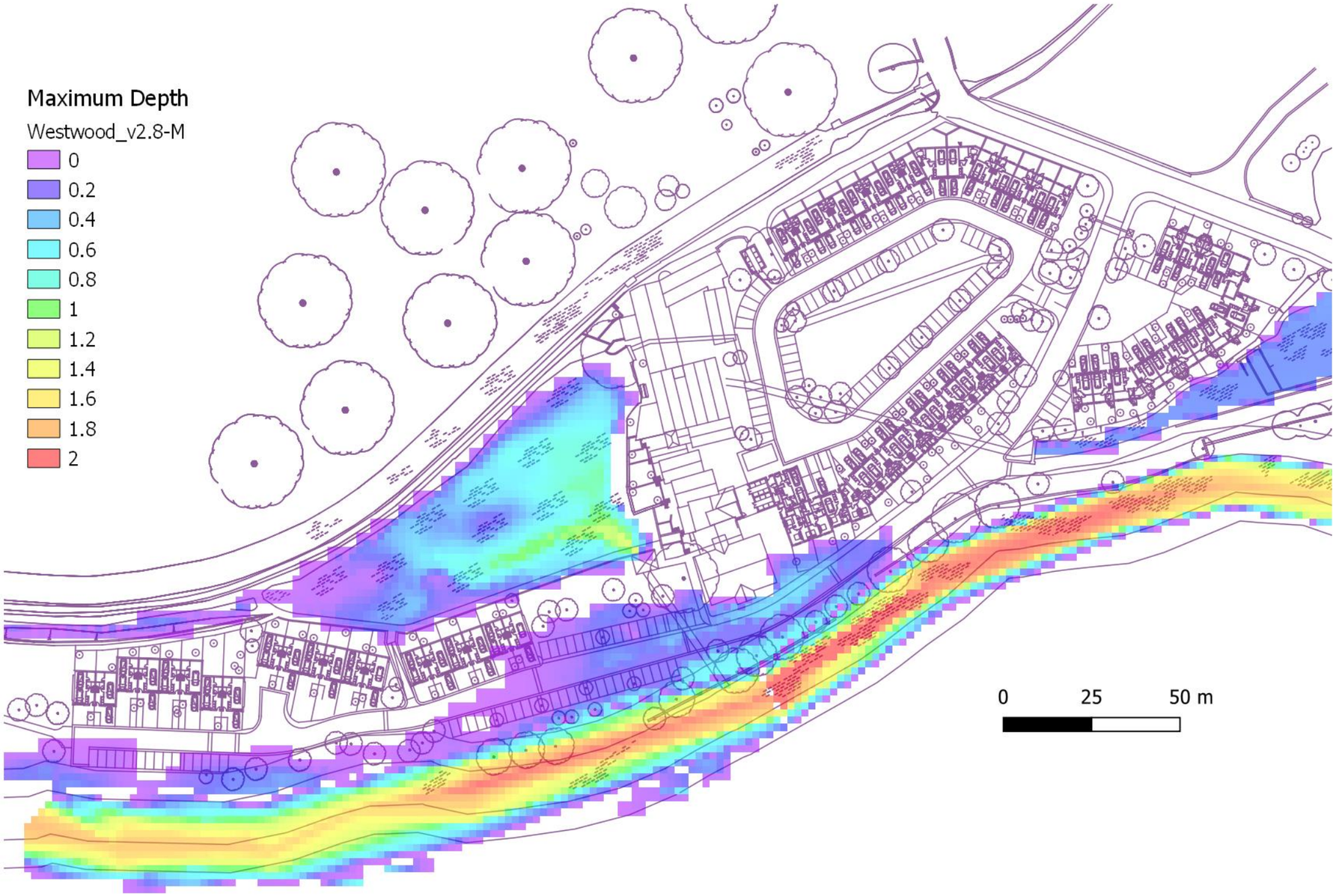



*Figure B2: Post -development Scenario: Maximum modelled flood depths for the 1 in 100 year event*

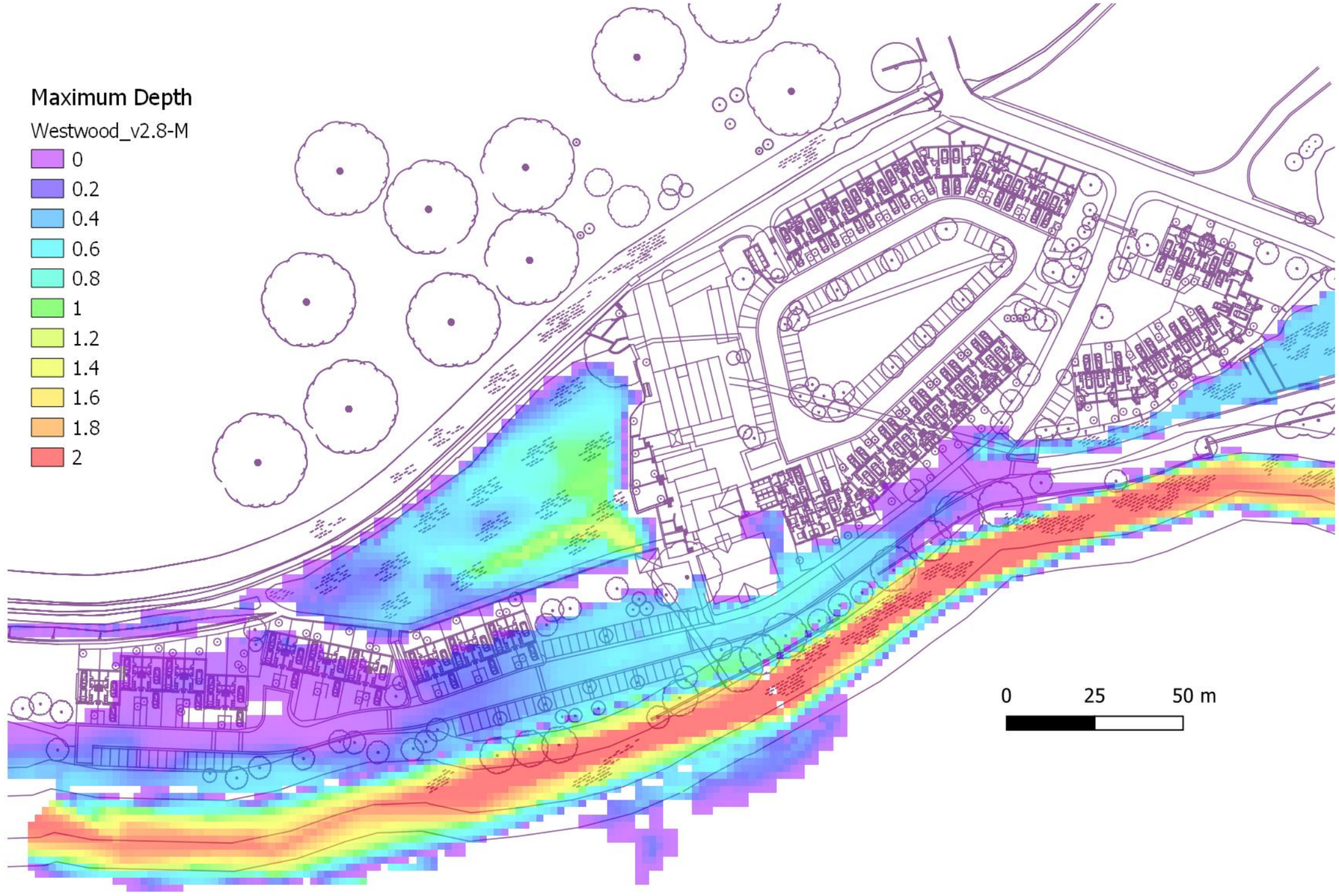



*Figure B3: Post -development Scenario:  Maximum Modelled Flood Depths for the 1 in 100 year return period plus 30% allowance for climate change*

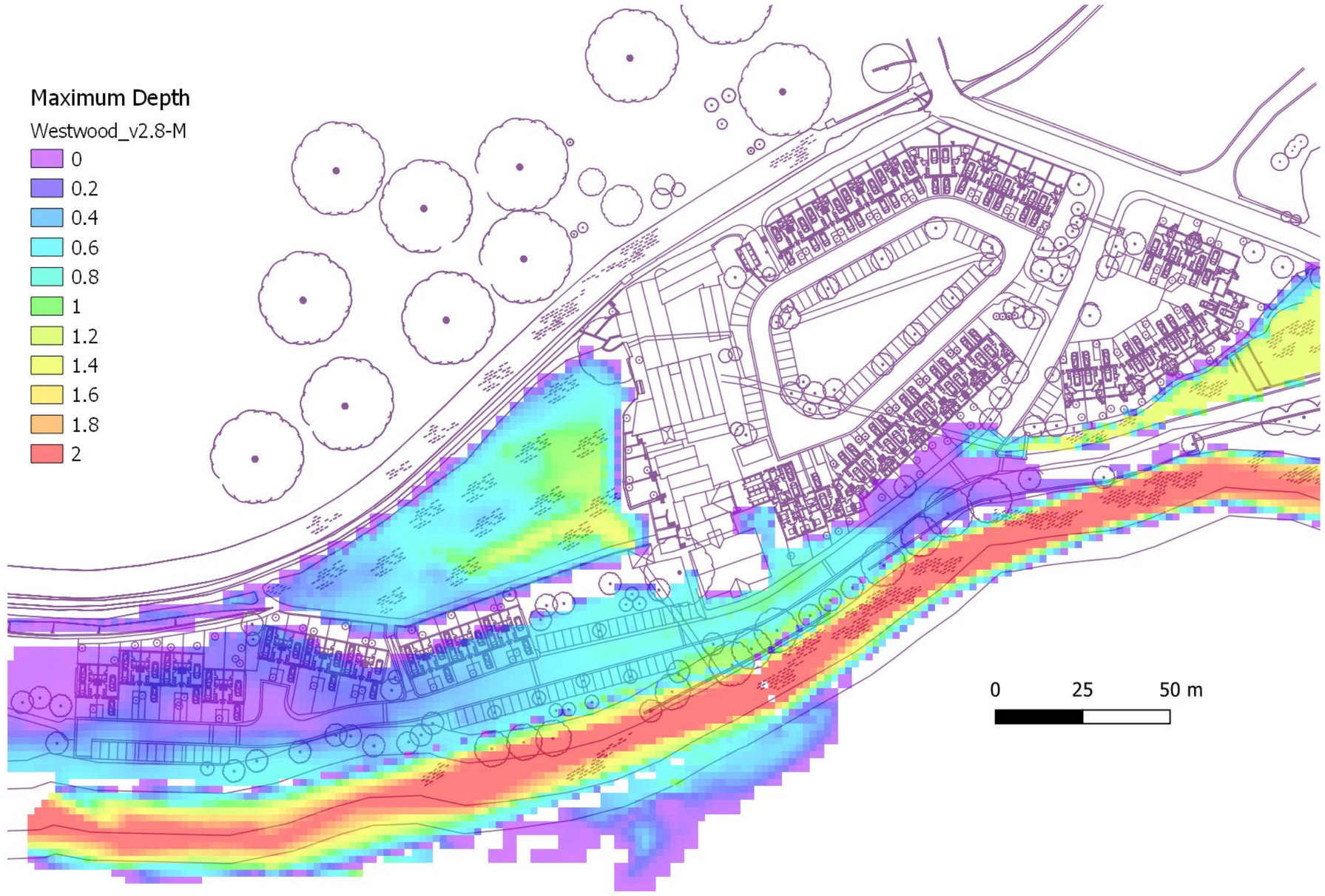



*Figure B4: Post -development Scenario:*

*Maximum Modelled Flood Depths for the 1 in 100 year return period plus 50% allowance for climate change*

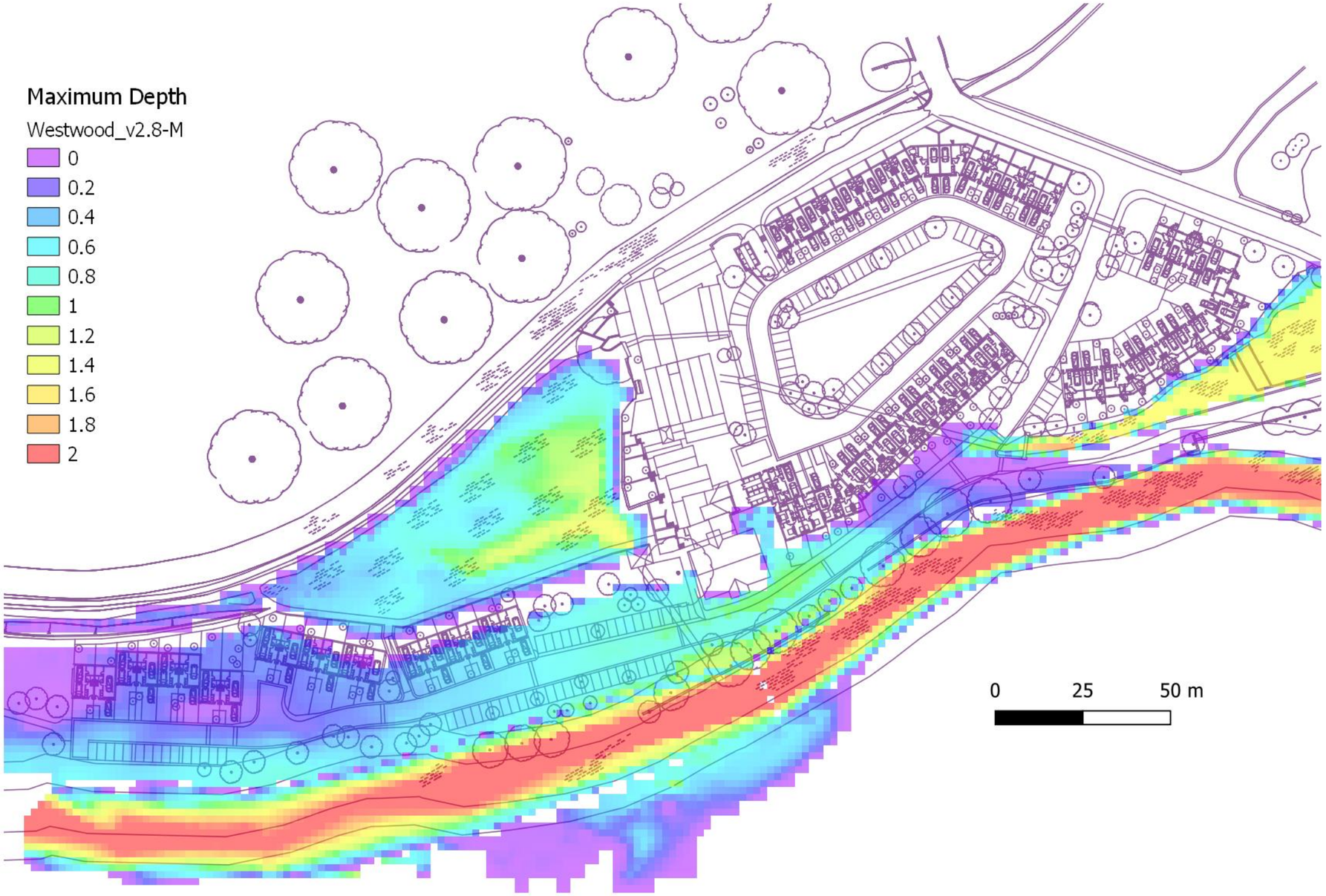



*Figure B5 : Post -development Scenario:  Maximum Modelled Flood Depths for the 1 in 1000 year return period*

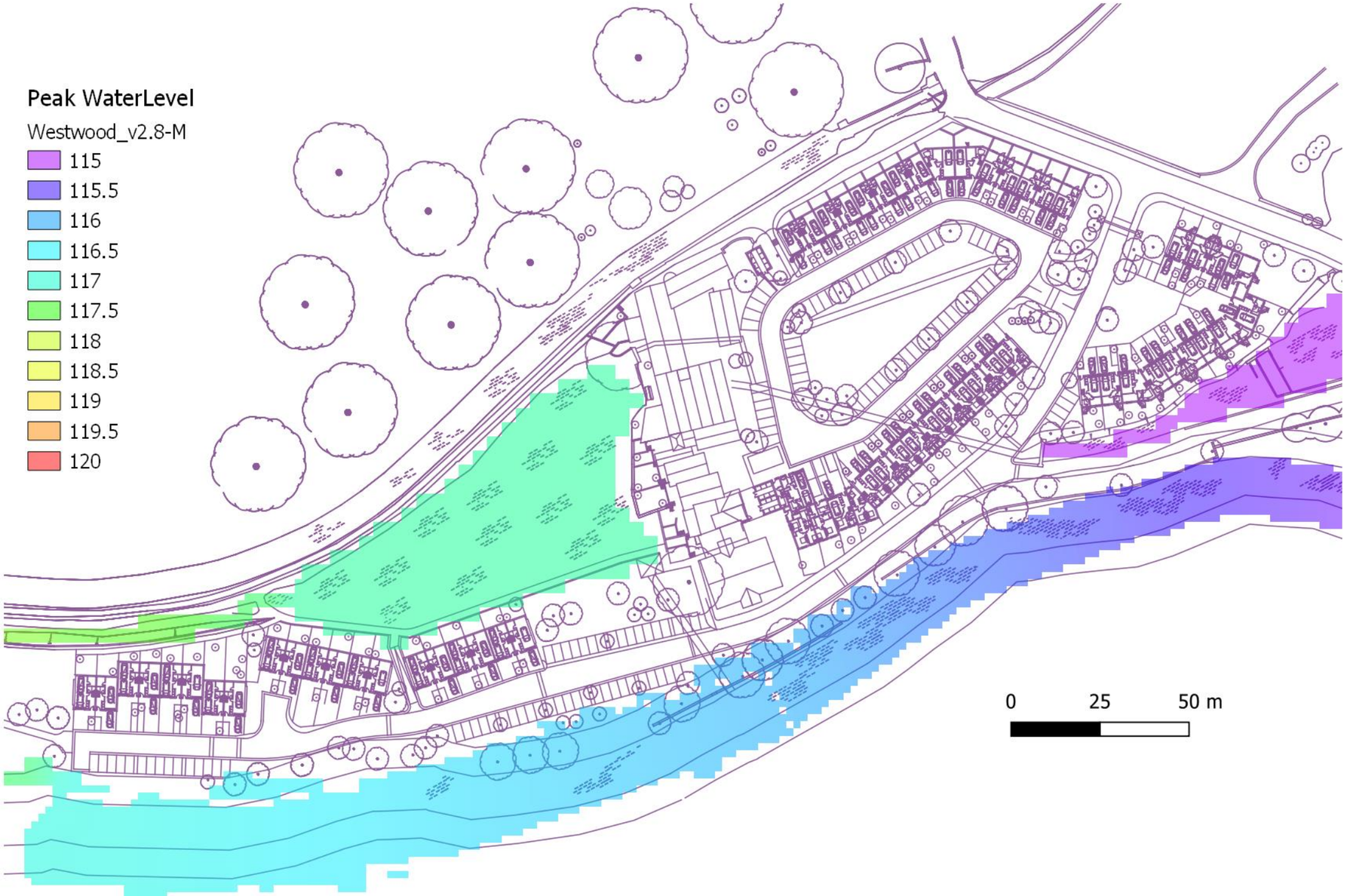



*Figure B6: Post -development Scenario:  Maximum Modelled Flood Level for the 1 in 25 year return period*

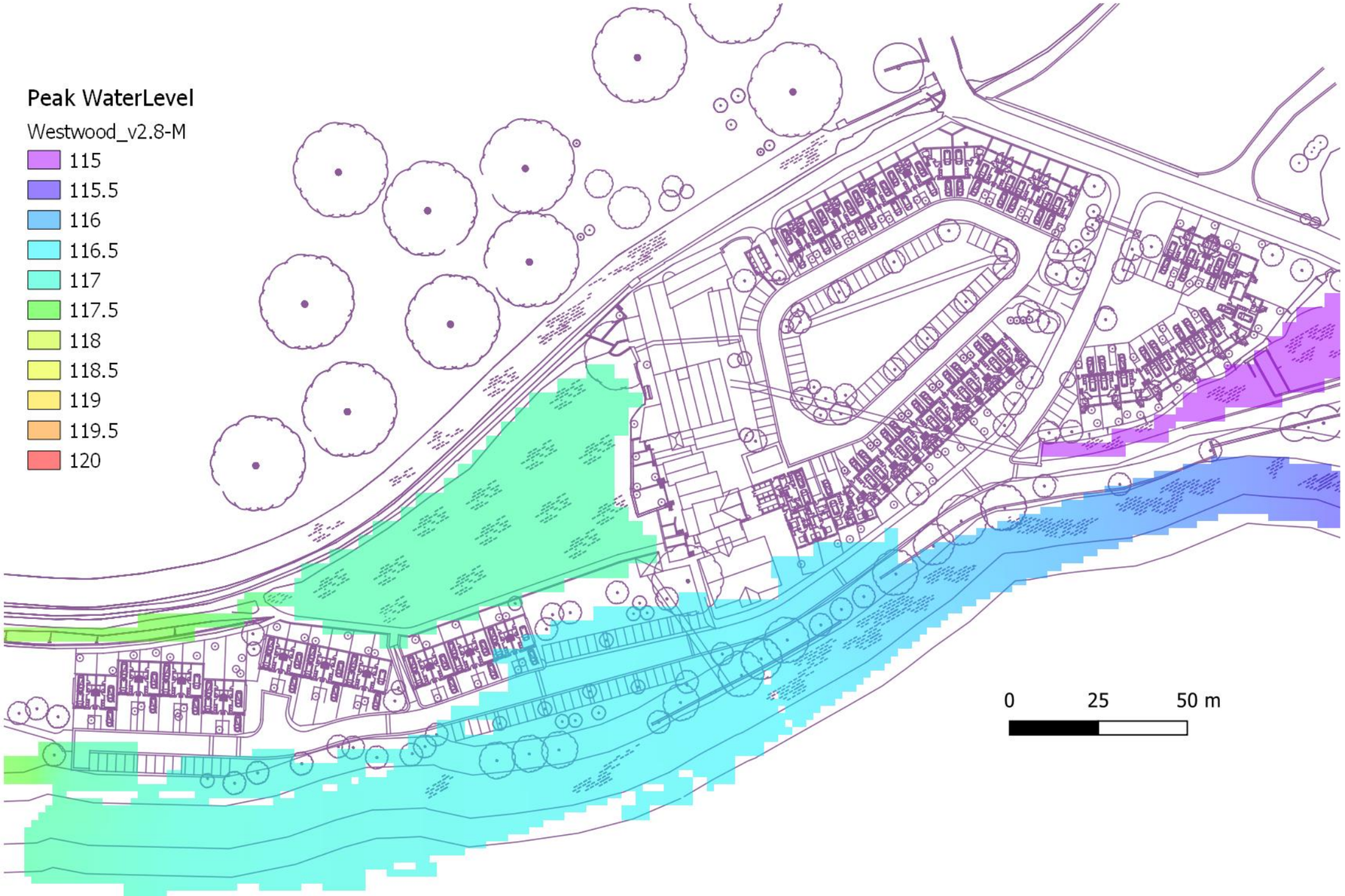



*Figure B7: Post -development Scenario:  Maximum Modelled Flood Level for the 1 in 100 year return period*


*Figure B8: Post -development Scenario:  Maximum Modelled Flood Level for the 1 in 100 year return period plus 30% allowance for climate change*


*Figure B9: Post -development Scenario:  Maximum Modelled Flood Level for the 1 in 100 year return period plus 50% allowance for climate change*

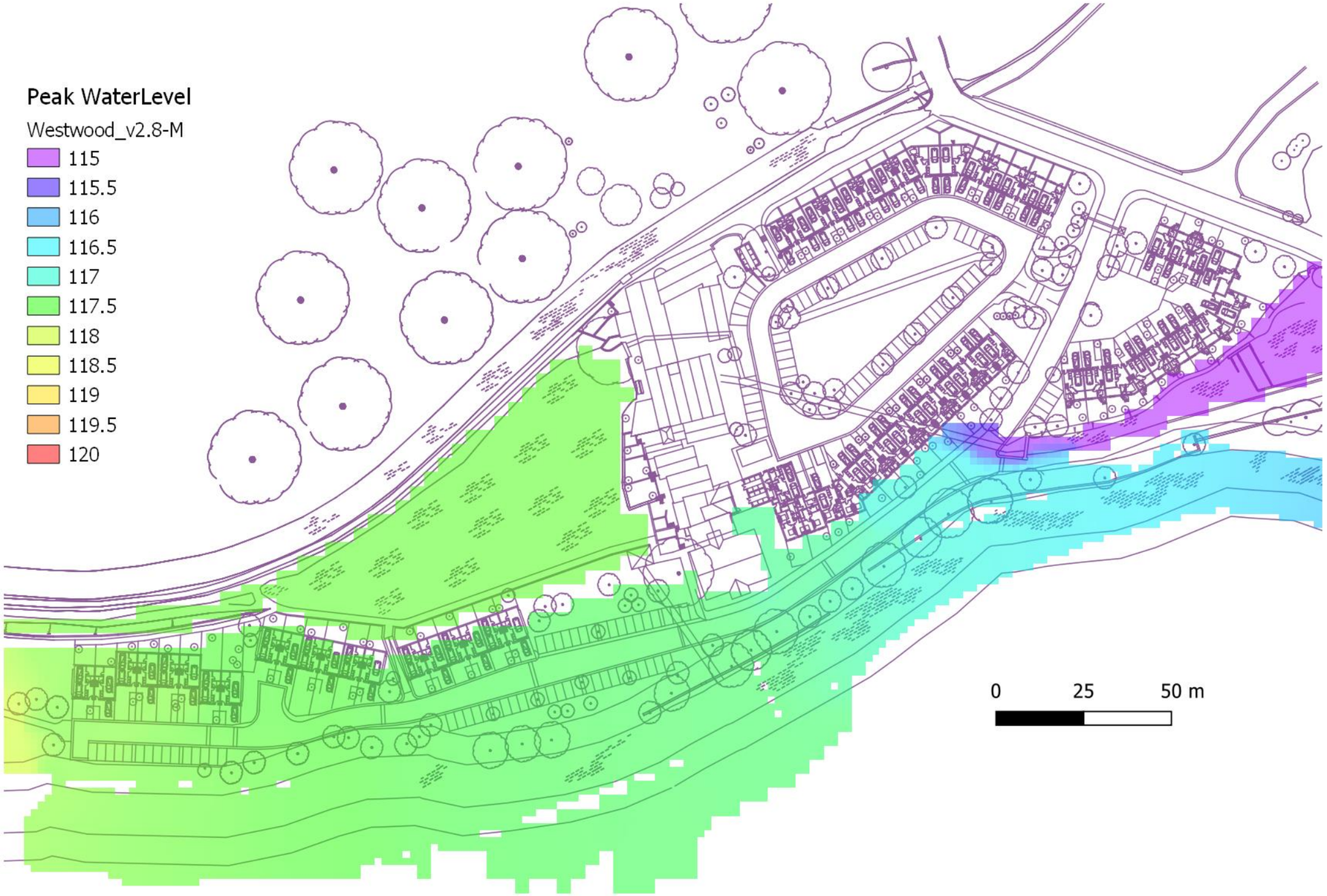



*Figure B10: Post -development Scenario:  Maximum Modelled Flood Level for the 1 in 1000 year return period*

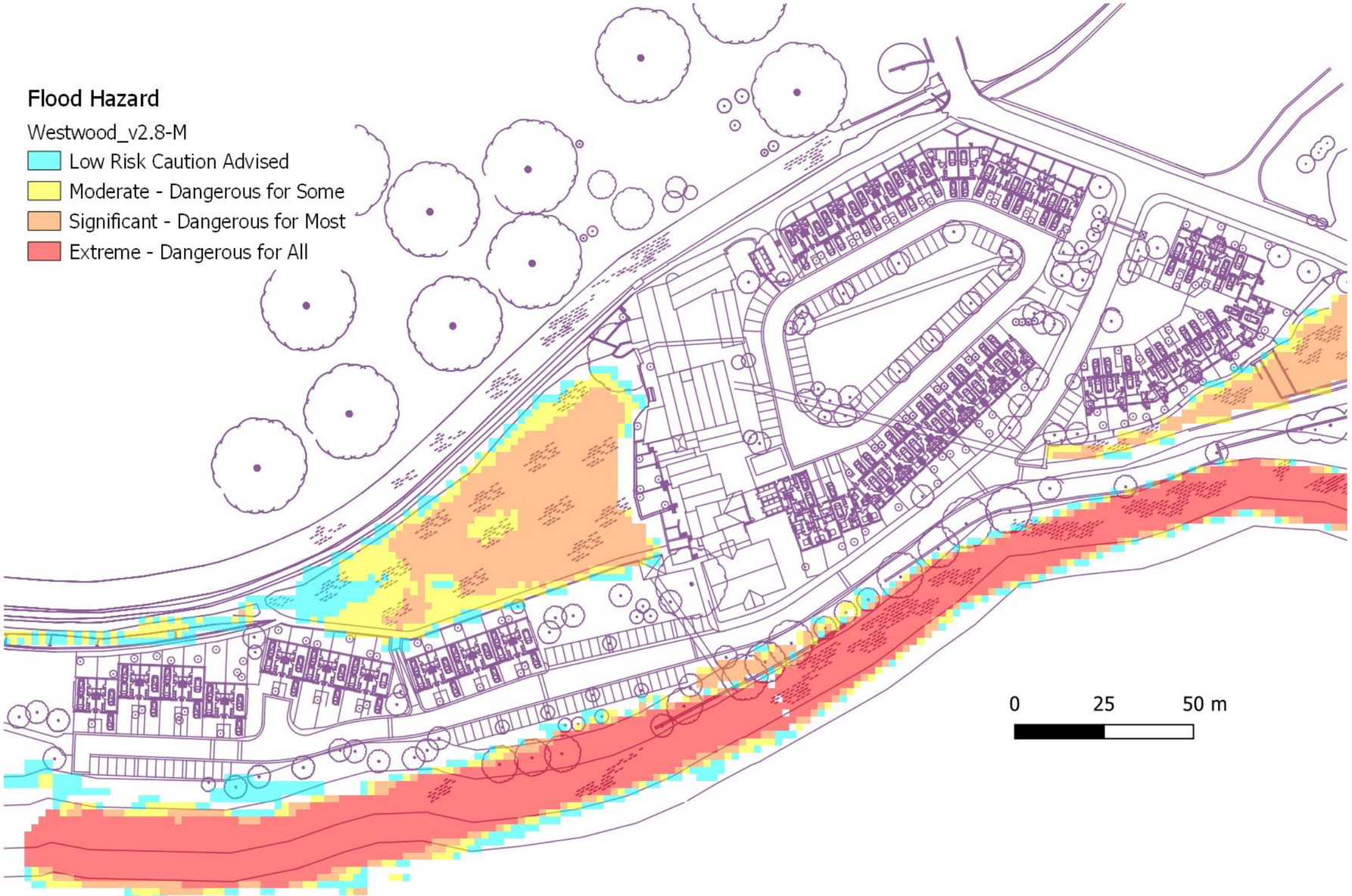



*Figure B11: Post -development Scenario:  Maximum Hazard for the 1 in 25 year return period*

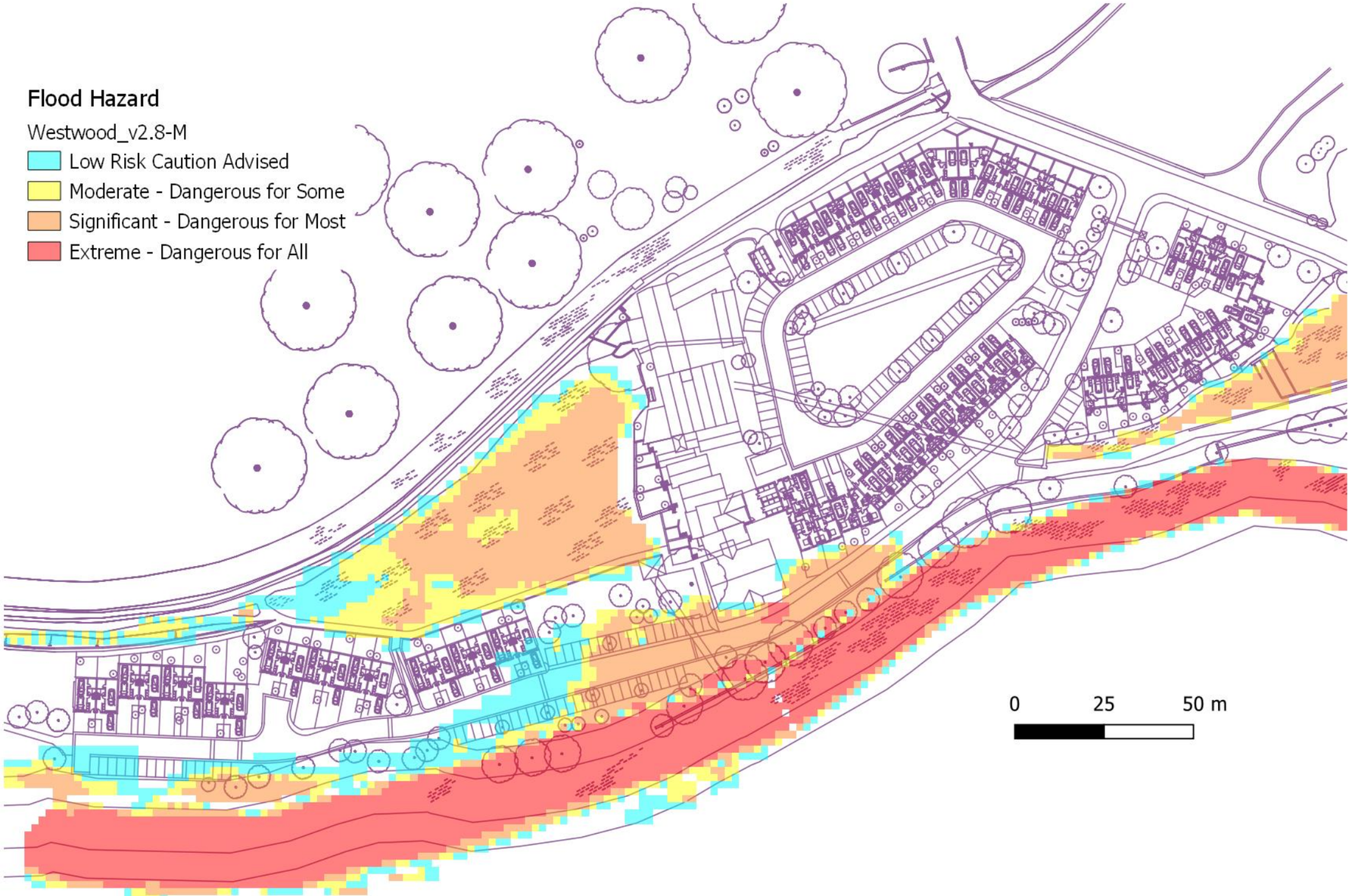



*Figure B12: Post -development Scenario:  Maximum Hazard for the 1 in 100 year return period*

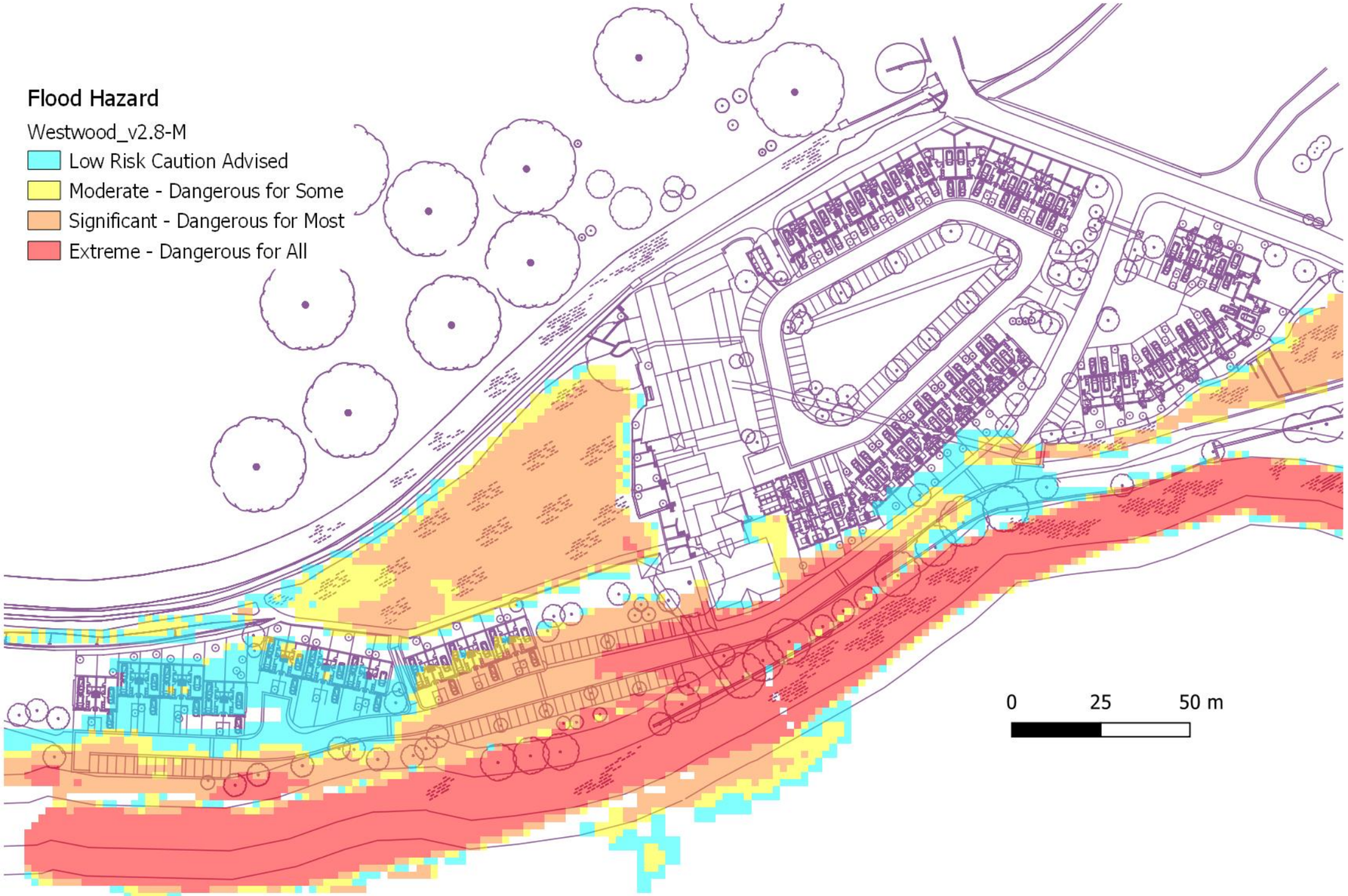



*Figure B13: Post -development Scenario:  Maximum Hazard for the 1 in 100 year return period plus 30% allowance for climate change*

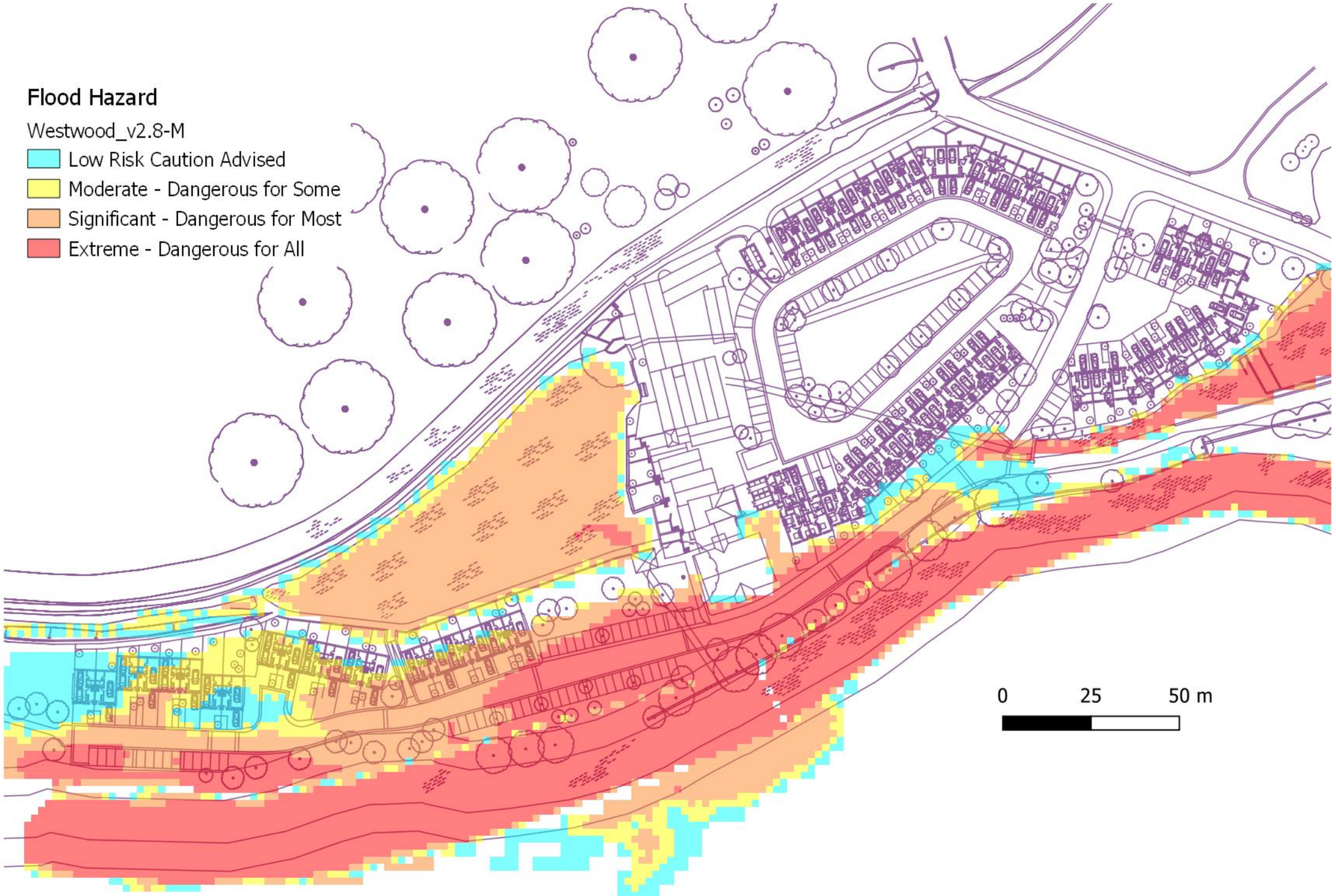



*Figure B14: Post -development Scenario: Maximum Hazard for the 1 in 100 year return period plus 50% allowance for climate change*

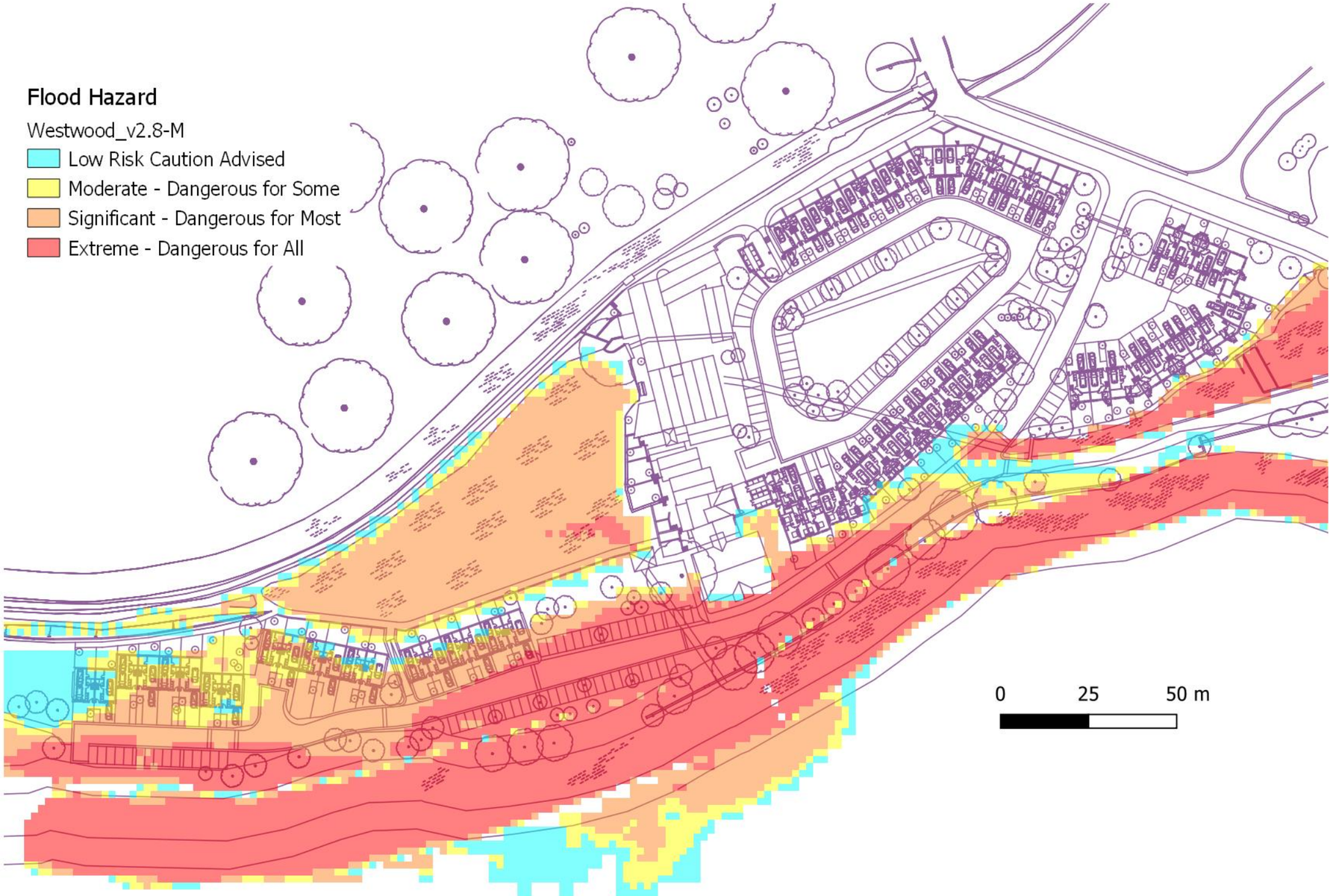
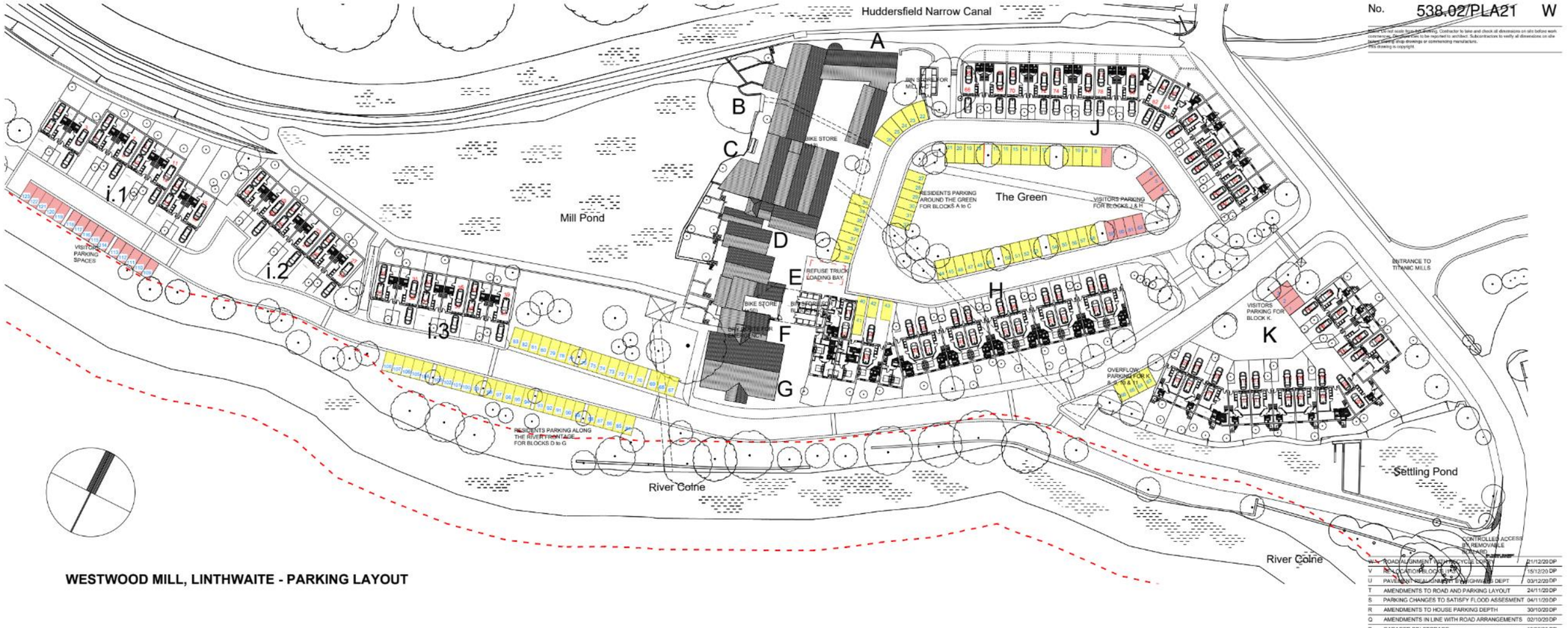



*Figure B15: Post -development Scenario:  Maximum Hazard for the 1 in 1000 year return period*

EdenvaleYoung




**WESTWOOD MILL, LINTHWAITE - PARKING LAYOUT**


**WESTWOOD MILL, LINTHWAITE - SITE LAYOUT**

Resident Parking Space

Visitors Parking Space. To be permeable shingles/ grasscrete type material

0 5 10 15 25 50m

Scale 1:500

No. 538.02/PLA21 W

Please do not scale from this drawing. Contractor to take and check all dimensions on site before work commences. Discrepancies to be reported to architect. Subcontractors to verify all dimensions on site before making shop drawings or commencing manufactures.
This drawing is copyright

| Rev | Description | Date | Initial |
|---|---|---|---|
| W | ROAD ALIGNMENT AND CYCLE DOCK | 21/12/20 | DP |
| V | RELOCATION BLOCK J,H,K | 15/12/20 | DP |
| U | PAVEMENT REALIGNMENT & HIGHWAYS DEPT | 03/12/20 | DP |
| T | AMENDMENTS TO ROAD AND PARKING LAYOUT | 24/11/20 | DP |
| S | PARKING CHANGES TO SATISFY FLOOD ASSESMENT | 04/11/20 | DP |
| R | AMENDMENTS TO HOUSE PARKING DEPTH | 30/10/20 | DP |
| Q | AMENDMENTS IN LINE WITH ROAD ARRANGEMENTS | 02/10/20 | DP |
| P | GARAGED BIN STORAGE | 19/08/20 | DP |
| O | HANDED HOUSES & NEW PLANTERS | 05/08/20 | DP |
| N | UPDATED SITE, BLOCK H & K, BIN STORES | 09/07/20 | DP |
| M | UPDATED VISUAL | 04/07/20 | DP |
| L | AMENDMENTS TO SITE & BIN STORES | 24/06/20 | DP |
| K | AMENDMENTS TO BLOCK I1, I2 & SITE | 07/06/20 | DP |
| J | NEW RIVER COURSE | 26/03/20 | DP |
| I | NEW KEY FOR VISITORS PARKING | 24/02/20 | DP |
| H | NEW TURNING HEAD | 20/02/20 | DP |
| G | NEW GF LAYOUT | 30/01/20 | DP |
| F | AMENDMENTS TO CARPARK AND ROAD | 12/12/19 | DP |
| E | NEW PARKING LAYOUT | 14/11/19 | DP |
| D | NEW VISUAL | 14/03/19 | DP |
| C | GENERAL AMENDMENTS | 30/01/19 | DP |
| B | NEW PAGE LAYOUT | 19/12/18 | DP |
| A | NEW COLOURED SCHEME | 15/12/18 | DP |

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Client: **WESTWOOD WILSON LTD.**

Project: **WESTWOOD MILL LINTHWAITE**

Title: **CARPARK ARRANGEMENT & OVERALL SITE PLAN**

Date: DECEMBER '18
Scale: 1:500@A1
Drawn: DP

No. 538.02/PLA21 W