

# NOTE TO FILE

JBA Project Code 2020s1397  
Contract Julian Terrace Flood Modelling  
Client Kennedy James Griffiths  
Day, Date and Time 27 July 2021  
Author Paul Redbourne  
Subject Julian Terrace Flood Modelling - REVB

## 1 Introduction

JBA Consulting were commissioned by Kennedy James Griffiths in October 2020 to undertake a flood modelling study to gain a better understanding of the impact of flooding and potential displacement of flood water onto third parties from a development on Julian Terrace in Port Talbot. The proposed development consists of a ground floor commercial unit and two first floor residential units.

JBA licensed from Natural Resources Wales (NRW), their FCA Product 7 data for the area. This data consisted of the 1D-2D linked ESTRY-TUFLOW Model of Port Talbot, developed by JBA Consulting in August 2017.

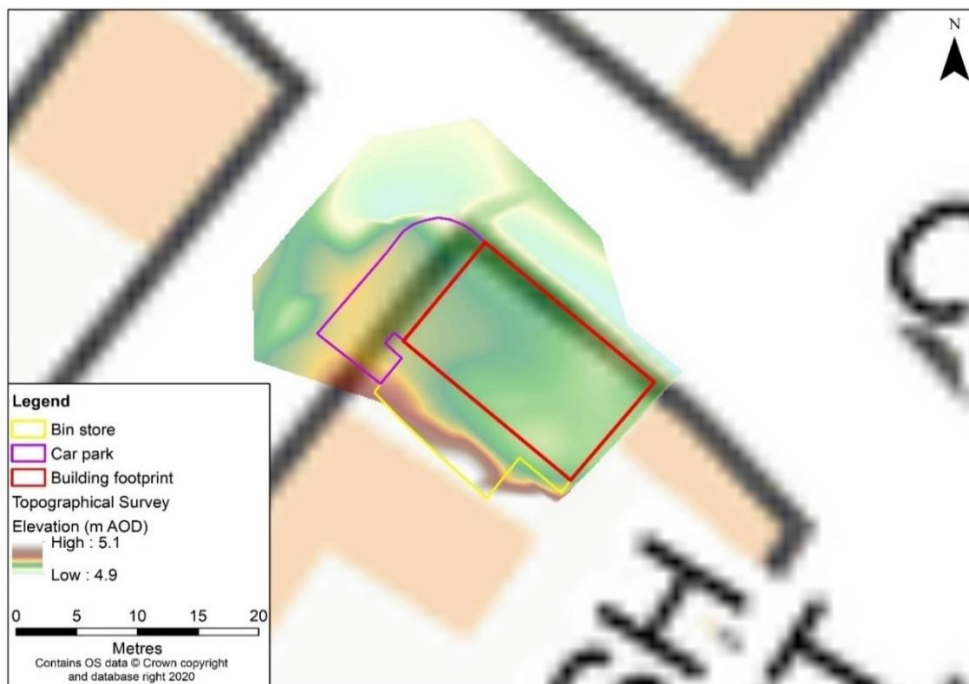
This technical note has been produced to provide an overview of the flood modelling work undertaken and analysis of the model outputs. The focus of the study is to address the comments raised by NRW following their review of the Flood Consequence Assessment<sup>1</sup>. Along with the assessment of third-party impacts, their review requested documentation regarding the proposed ground levels for the car parking area and the rate or rise and speed of inundation to the site. The technical note has looked to address these comments as well.

NRW completed a review of the flood modelling in May 2021<sup>2</sup> which identified a number of updates that were required in order to fully demonstrate that the risks and consequence of flooding can be managed to an acceptable level. This technical note (REVB) has been updated to reflect the additional flood modelling works that have been undertaken.

## 2 Modelling approach

The existing Port Talbot model as provided by NRW was last run in September 2017. The TUFLOW software executable has been updated since then, therefore the model has been re-run using the latest version of TUFLOW (2020-01-AB).

New site-specific topographical survey data collected by Kennedy James Griffiths in March 2020 has been provided. This survey data included a number of spot-levels across the site. These levels were used to create a triangulated Ascii grid which has been used to represent the site elevations in the baseline model, the extent of the Ascii grid is shown below in Figure 2-1.



<sup>1</sup> P2020 0303 – 1A Julian Terrace (V2). August 2020. Natural Resources Wales.

<sup>2</sup> P2020 0303 – 1A Julian Terrace (V3). May 2021. Natural Resources Wales.

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## Figure 2-1 Additional topographical survey data

### 2.1 NRW model review comments

The NRW review identified a number of concerns with the model that ideally needed to be addressed in order for the flood modelling to inform a fully compliant FCA. This section of the technical note summarises the updates that have been applied.

The review mention that a newer version of the TUFLOW executable has been released. This has not been used for the updated model runs, the focus of the TUFLOW executable update was on the TUFLOW HPC solver and therefore there are not expected to be any changes to the TUFLOW Classic outputs.

#### 2.1.1 Building representation

The NRW review highlighted that flow constriction had been used to represent buildings within the model, but a small buffer had been applied to each building footprint which has been queried. This was a remnant of the existing NRW flood mapping model and was originally used to help address a TUFLOW error that was associated with this layer type. It was decided to update the flow constriction building layer so that each footprint was based solely on the OS MasterMap layer. The new flow construction layer is being read into both the updated baseline and post-development models using the layer - 2d\_fcsh\_Buildings\_PT\_064. All buildings have a 90% blockage factor applied.

#### 2.1.2 Post-development schematisation

NRW highlighted that although the model topography had been updated to represent the post-development scenario, there had been no amendments to the 2d manning's n roughness coefficients at the proposed development. This has been updated using the 2D material layer - 2d\_mat\_PT\_065, which has applied a material code of 10021 for the building footprint and a material code of 10183 for the car park and bin store areas. The material code 10021 is used to represent buildings and uses a roughness coefficient of 0.1. The material code 10183 is used to represent hard standing roadside areas and uses a roughness coefficient of 0.02.

The NRW review highlighted that the proposed building footprint had not been represented within the flow constriction shape layer as has been used for all other buildings within the model extent. For the post-development model scenario a new flow constriction shape layer is now being read into the model - 2d\_fcsh\_Buildings\_PT\_065. This has applied flow constriction with a 90% blockage factor to the proposed building footprint.

#### 2.1.3 Tidal boundary conditions

The first phase of flood modelling focused solely on fluvial flood risk, but NRW correctly identified that the site is also at risk of tidal flooding. JBA consulting's in house coastal team have generated new tidal boundary conditions to be used to generate the tidal design event simulations.

The updated coastal flood boundary (CFB) extreme sea levels dataset<sup>3</sup> have been used to derive the tidal boundary conditions using the CFB chainage ID node 480\_1. For the purpose of this assessment, the 0.5% and 0.1% AEP events have been developed for the tidal design event simulations and the Mean-High-Water-Spring (MHWS) tidal boundary for the fluvial design events has been updated.

The Port Talbot MHWS has been used as the base tide with Mumbles Class A gauge design surge used to generate the design tidal cycles. For the assessment of flood risk, the application of climate change has been applied to the tidal boundary conditions using the Flood Consequence Assessments: Climate change allowances guidance<sup>4</sup>. The extreme sea level estimates from the CFB dataset have a base year of 2017 and therefore these have been uplifted to 2021 to represent present day conditions. The proposed development consists of a ground floor commercial unit and two first floor residential units and therefore climate change has been considered for the 2096 and 2121 epochs. For the commercial development, this has a design life of 75 years which is why the 2096 epoch has been adopted. Table 2-1 shows the maximum extreme sea level estimates that have been used within the updated hydraulic

<sup>3</sup> Coastal Design Sea Levels - Coastal Flood Boundary Extreme Sea Levels. 2018. Environment Agency.

<sup>4</sup> Climate change allowances and flood consequence assessments (CL-03-16). 2016. Welsh Government. [LINK](#)

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**Table 2-1: Modelled extreme sea level estimates**

|                 | 2017        | 2021        | 2096        | 2121        |
|-----------------|-------------|-------------|-------------|-------------|
| <b>MHWS</b>     | <b>4.49</b> | <b>4.50</b> | <b>5.26</b> | <b>5.63</b> |
| <b>0.5% AEP</b> | <b>6.37</b> | <b>6.38</b> | <b>7.14</b> | <b>7.51</b> |
| <b>0.1% AEP</b> | <b>6.69</b> | <b>6.70</b> | <b>7.46</b> | <b>7.83</b> |

## 2.1.4 Blockage analysis

NRW highlighted that the first phase of flood modelling had not investigated the residual risk associated with the blockage of key structures on the Afon Afan. As with previous flood consequence assessments within Port Talbot, the assessment of blockage has focused on the triple arch bridge located at the end of Station Road. This structure is the only non-clear spanning bridge and is also has the smallest opening area through all the structures within this reach and is therefore most susceptible to blockage. Using NRW's GN43 guidance<sup>5</sup> note on modelling blockage and breach scenarios and coupled with previous assessments within the area, a 25% blockage percentage has been applied to the Station Road arch bridge. This blockage percentage has been taken from Table 2 of the NRW blockage guidance to represent a medium bridge blockage scenario. In order to represent the 25% blockage, a skew angle of 41.4° has been applied. This has reduced the opening area of the structure from 50.8m<sup>2</sup> to 38.1m<sup>2</sup>. Figure 2-2 shows the upstream face of the Station Road bridge which has been assessed for blockage.



**Figure 2-2: Station Road arch bridge**

<sup>5</sup> GN43 - Flood Risk Management Modelling blockage and breach scenarios Guidance note. NRW. 2020. [LINK](#).

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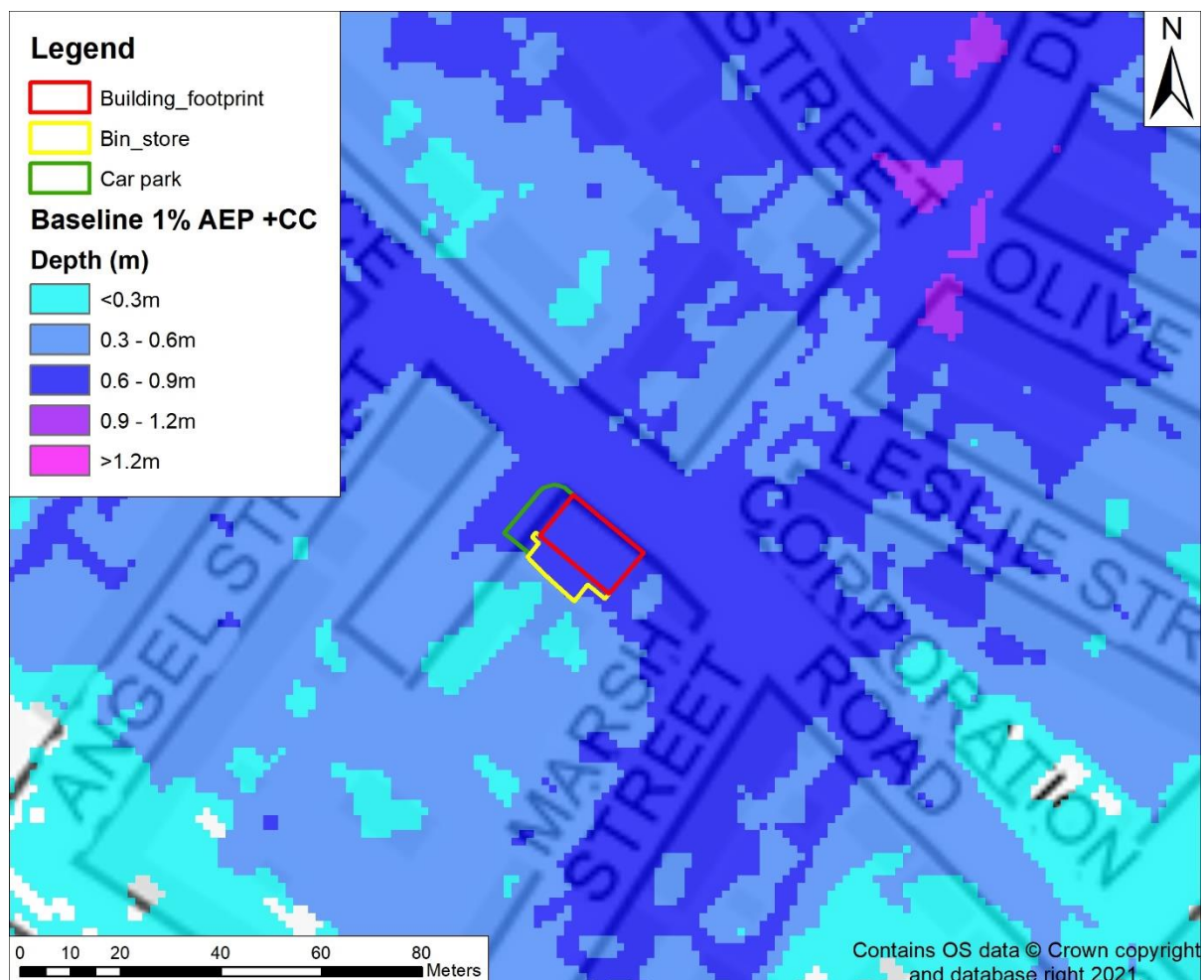
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## 3 Fluvial Model Results

### 3.1 Baseline

#### 3.1.1 Maximum Depths

The baseline model results show that the proposed building floods to a maximum depth of 0.69m in the 1% AEP plus climate change event which corresponds to a peak water level of 5.67mAOD. In the 0.1% AEP event, there is a maximum flood depth of 1.26m which corresponds to a peak water level of 6.25mAOD. The depth maps for both of these scenarios are shown below in Figure 3-1 and Figure 3-2.

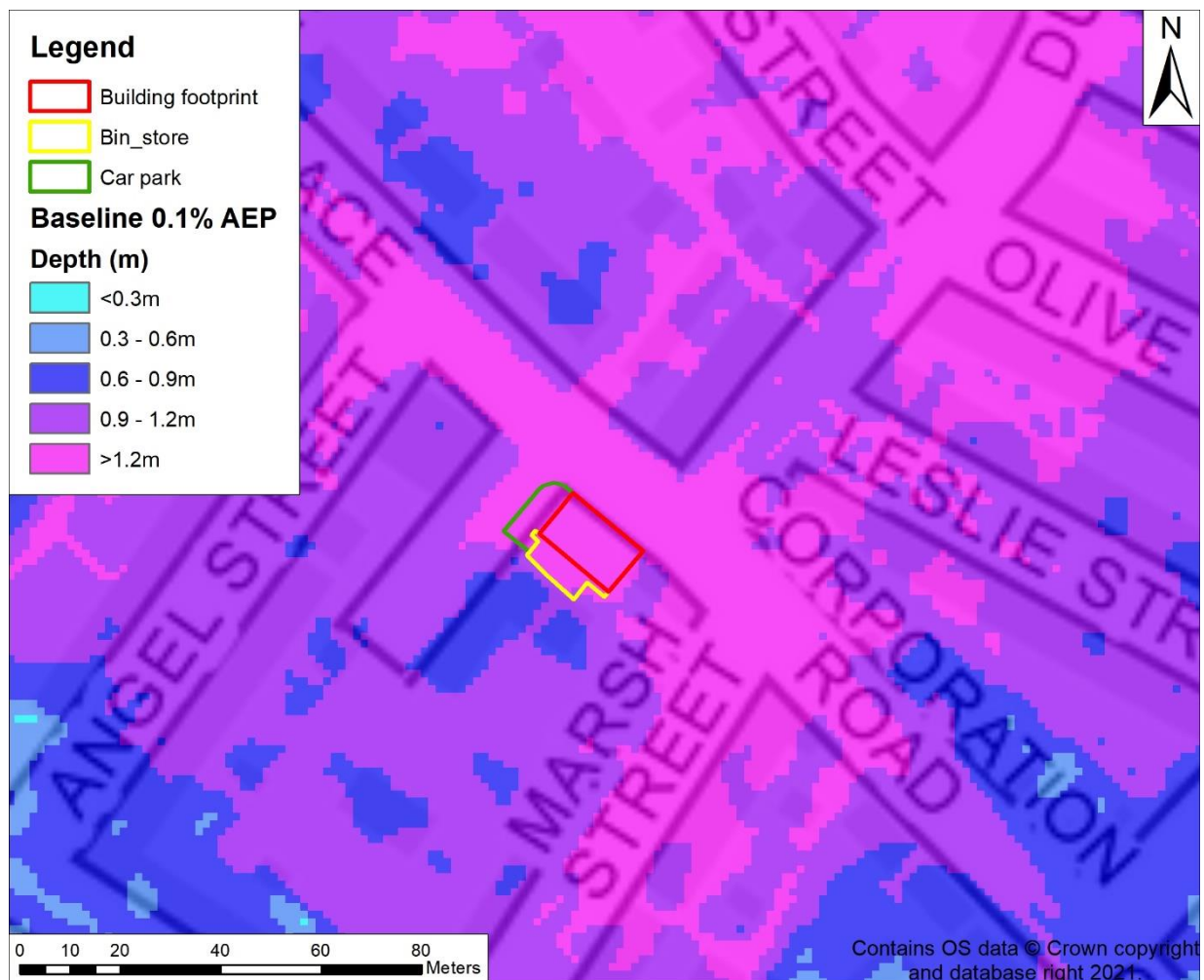


**Figure 3-1 Baseline scenario, 1% AEP plus climate change event - Maximum Depths**

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**Figure 3-2 Baseline scenario, 0.1% AEP event - Maximum Depths**

## 3.2 Post-Development

### 3.2.1 Maximum Depths

In order for the development to be compliant with TAN 15, the building finished floor level has been raised to 5.68mAOD during the post development scenario so that it is free from flooding during the 1% AEP plus climate change event.

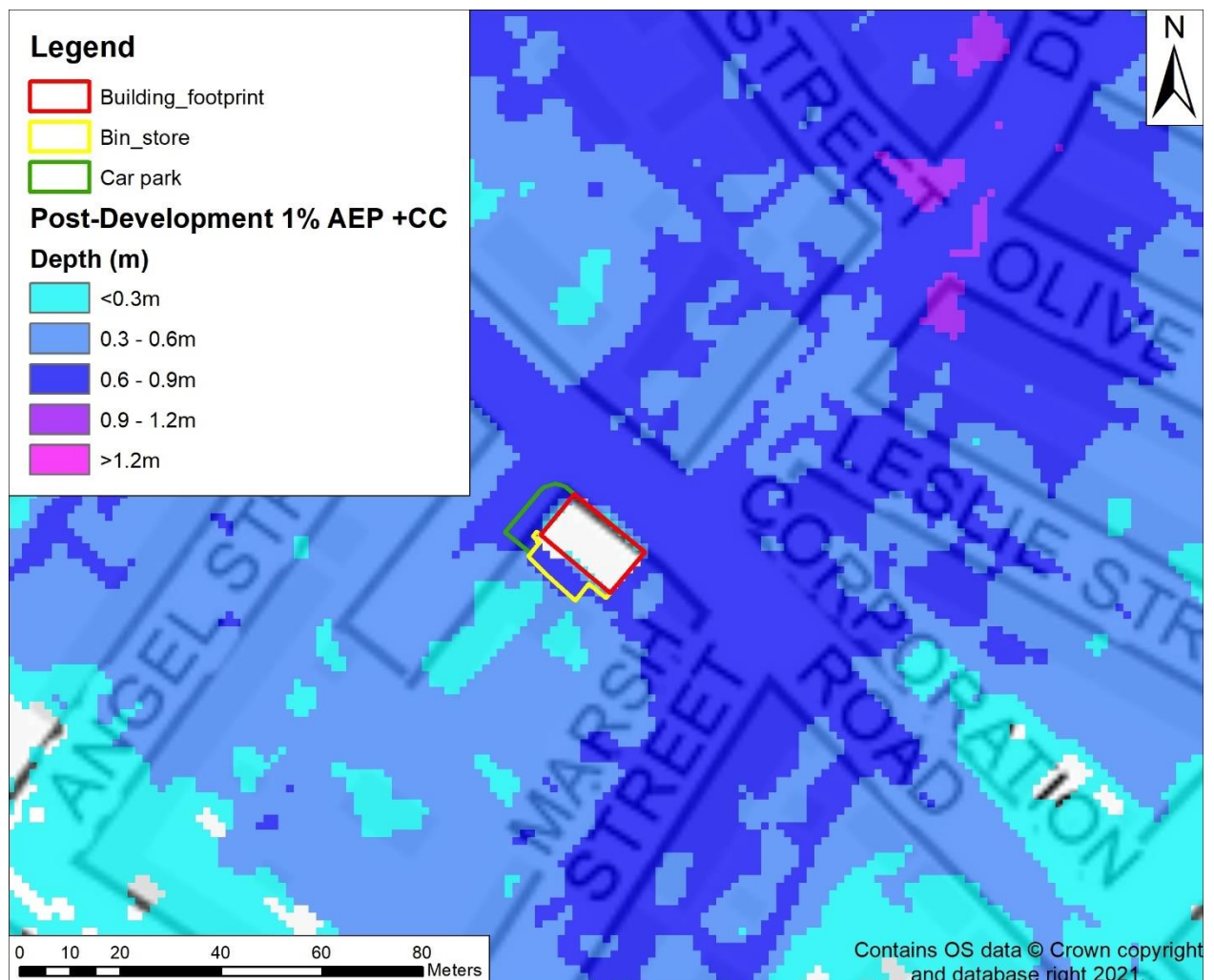
The car park area was set to a level of 4.87mAOD. This level has been chosen so that it aligns with the surrounding ground levels along Julian Terrace Road. NRW have queried why the car parking is not set to the same FFL elevation of the commercial unit (5.68mAOD). Unfortunately, it is not practical to raise the park spaces any further whilst providing a suitable tie-in with the adjacent highway. The vacant lot is currently used for car parking and only one of the park spaces is proposed to be allocated to the residential unit, the rest shall be allocated to the commercial property (less vulnerable development).

During the 1% AEP plus climate change event, the building remains free from flooding, while a maximum depth of 0.80m is experienced in the car park. The depth results for the post development scenario during the 1% AEP plus climate change event are shown below in Figure 3-3. The figure suggests that there is a small amount of flooding inside the building footprint for the 1% AEP plus climate change event. This is attributed to the modelled grid size and grid orientation. The modelled peak water level is 5.67mAOD which is below the recommended finished floor level and therefore the building is not actually experiencing flooding in this event.

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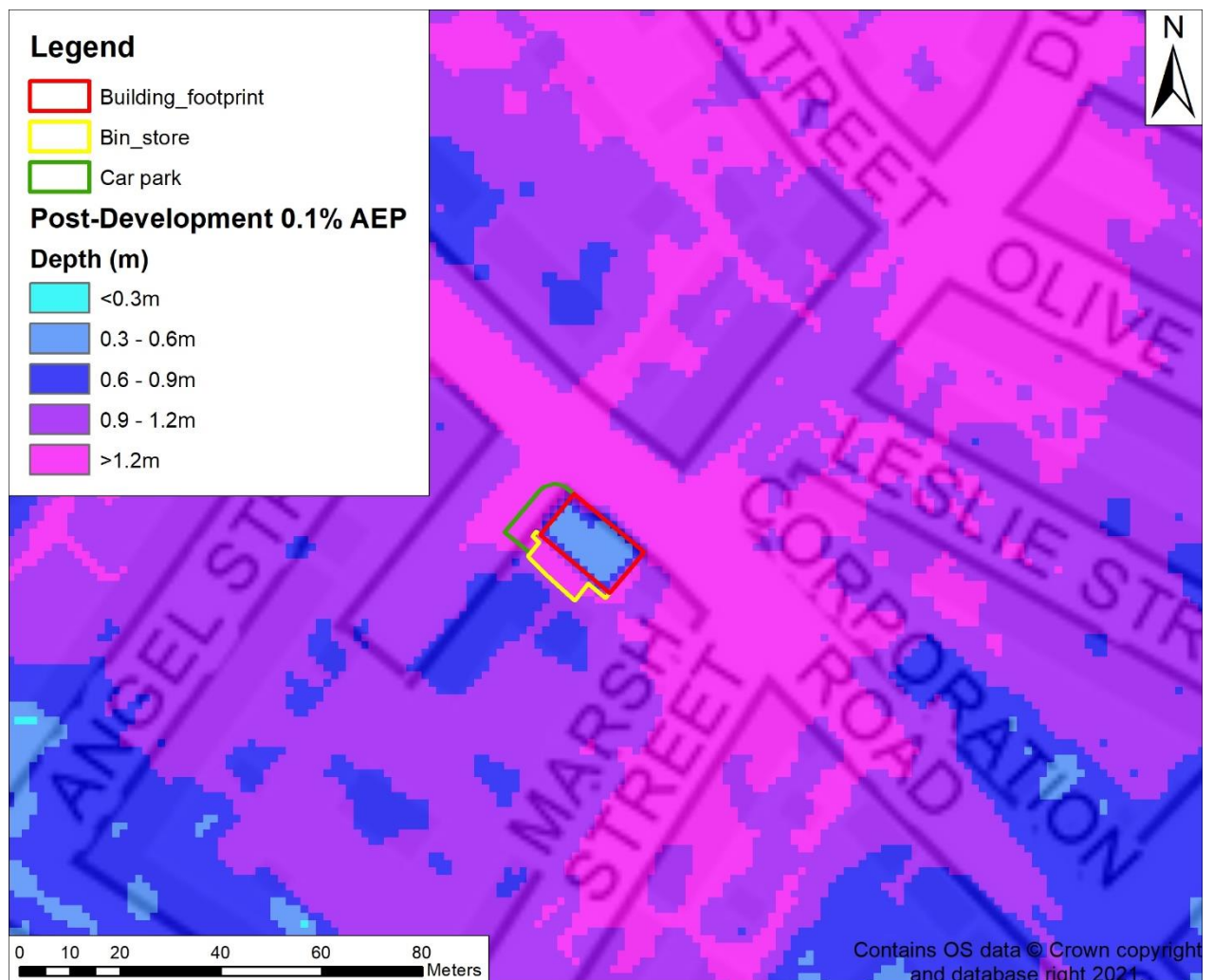
**Figure 3-3 Post-development scenario, 1% AEP plus climate change event - Maximum Depths**

During the 0.1% AEP event, the post-development results show that a maximum water level of 6.25mAOD is experienced in the commercial building footprint. This represents a maximum depth of 0.57m within the building, while the car park experiences a maximum depth of 1.38m. The post-development results for the 0.1% AEP event are shown below in Figure 3-4. As with Figure 3-3, the results indicate the flood depths exceed 0.6m but this is attributed to the modelled grid size and grid orientation impacting the boundary of the building footprint.

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**Figure 3-4 Post-development scenario, 0.1% AEP event - Maximum Depths**

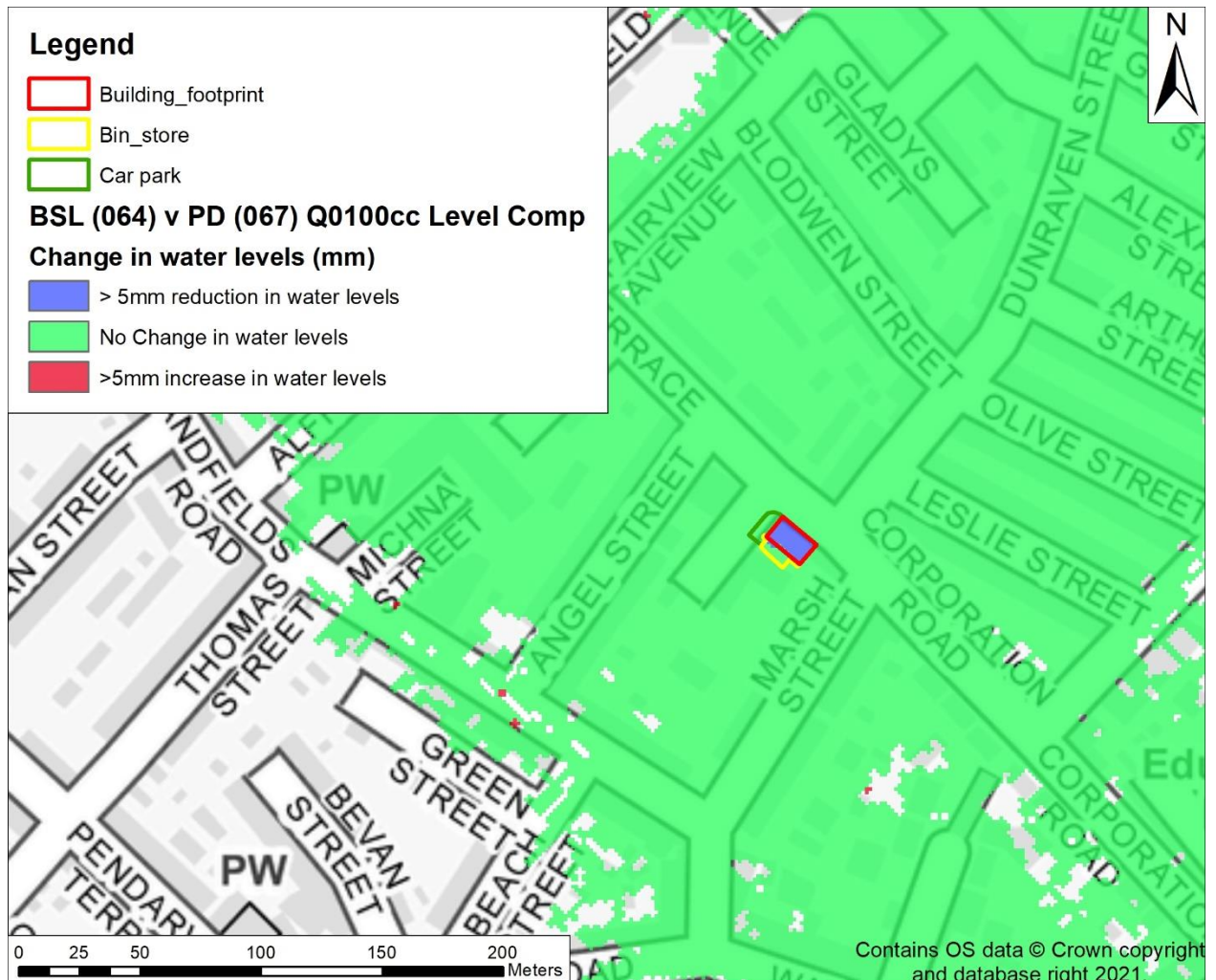
### 3.2.2 Third party impacts

During both the 1% AEP plus climate change and 0.1% AEP events, there is no increase in water levels to any third-party properties or the adjacent areas as a result of the proposed development. Level comparison maps for both events are shown below in Figure 3-5 and Figure 3-6.

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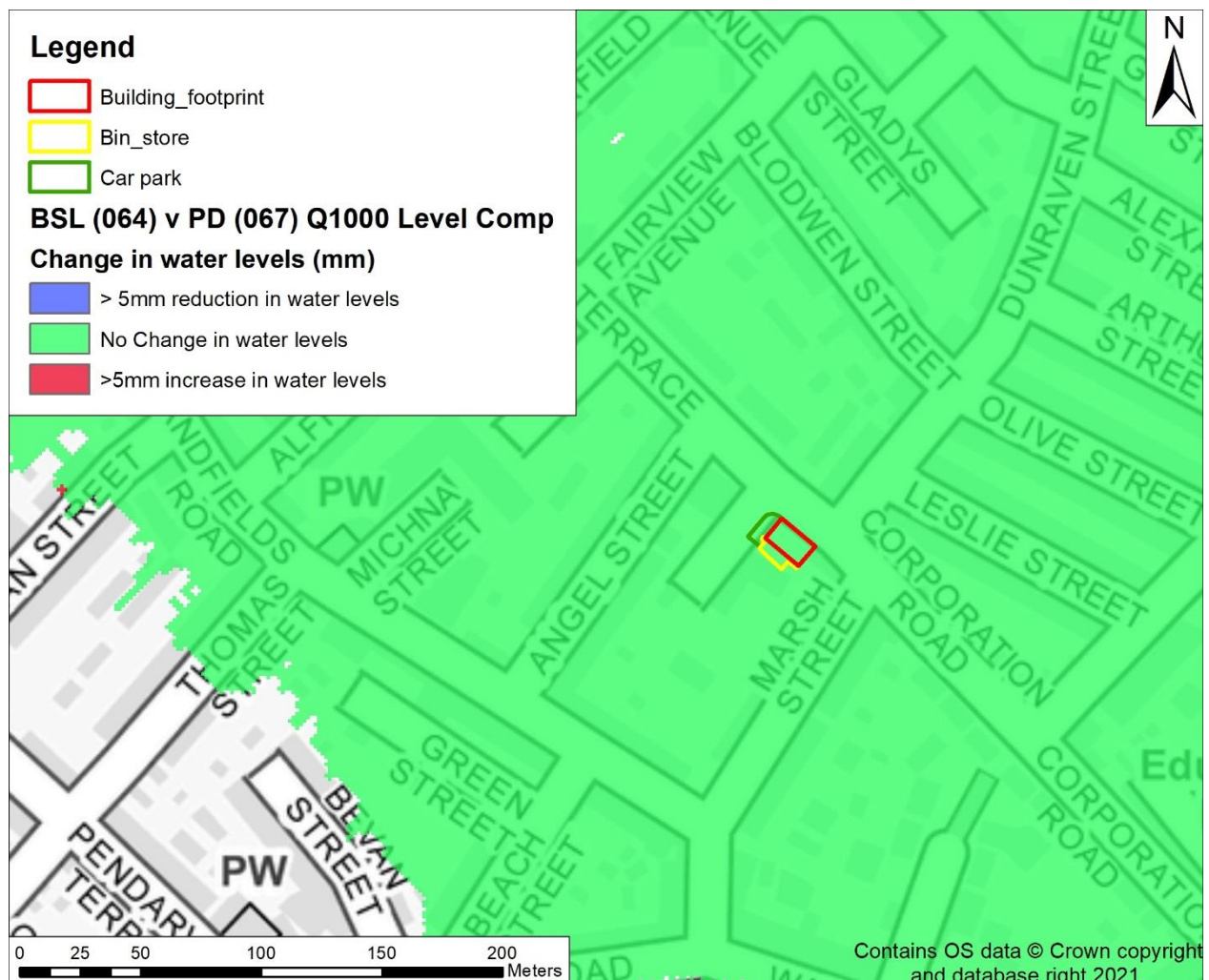
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**Figure 3-5 Third party impacts, 1% AEP plus climate change event**

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**Figure 3-6 Third party impacts, 0.1% AEP event**

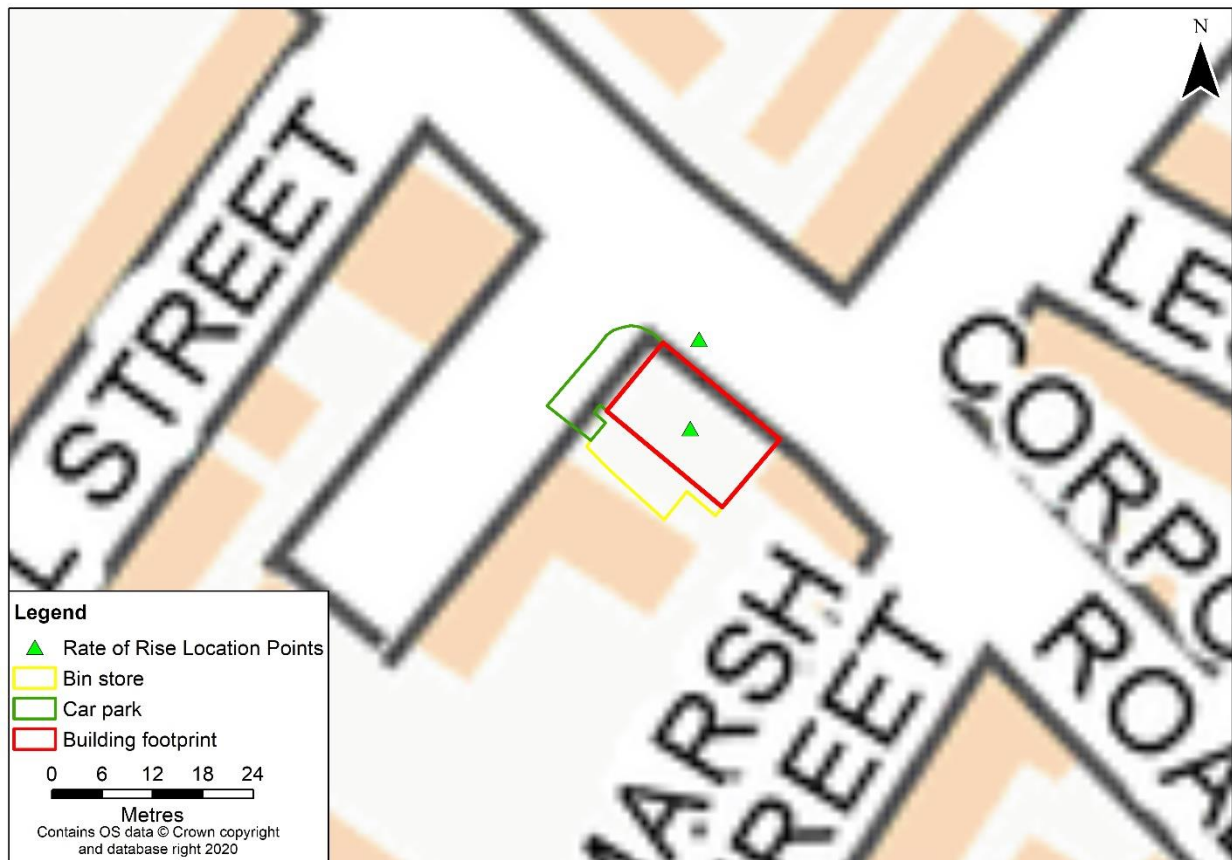
### 3.2.3 Rate of rise

The rate at which floodwater rises at the proposed development site, and the potential impact that this could have on the surrounding areas has been assessed. Figure 3-7 shows two locations at which water level data has been extracted from the model at 10-minute output intervals for the 0.1% AEP event.

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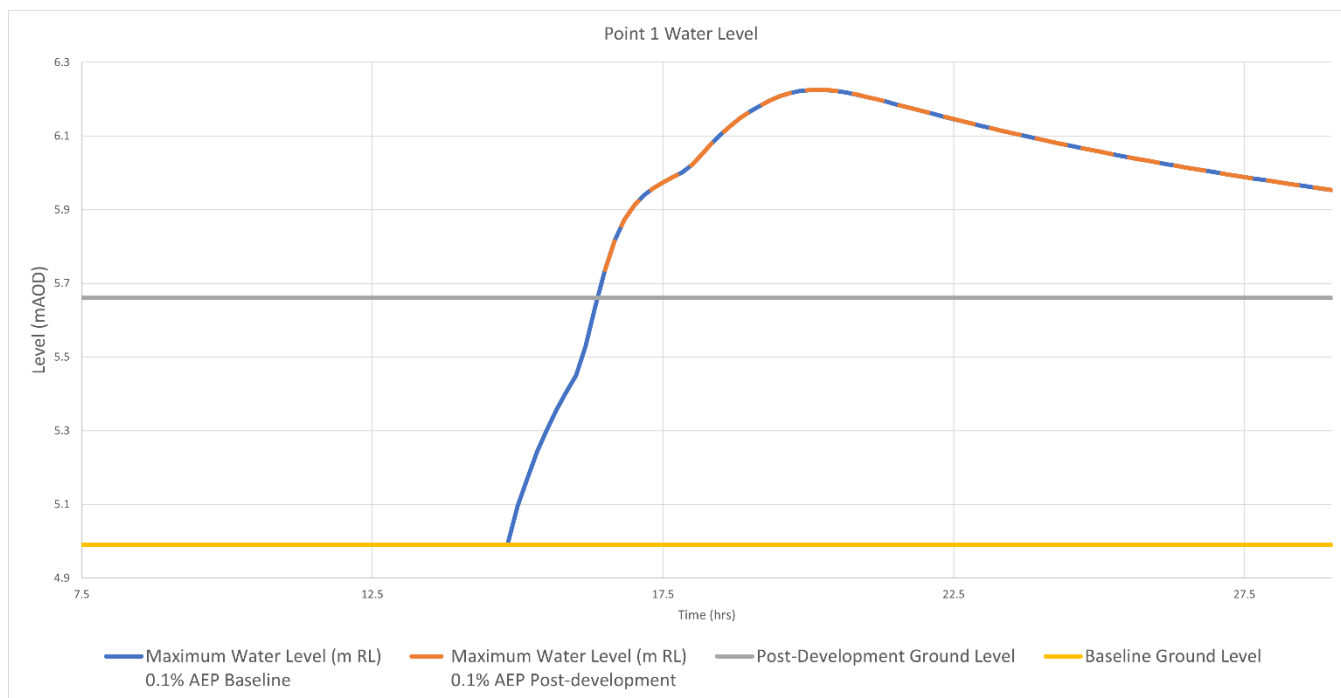
**Figure 3-7 Rate of Rise Location Points**

The extracted water level data has then been plotted in Figure 3-8 and Figure 3-9 to show the rate of rise and whether there are any discernible changes as a result of the proposed development. The rate of rise plots show that the proposed development site has no discernible impact on the onset of flooding or the rate of rise on or around the site during the 0.1% AEP event.

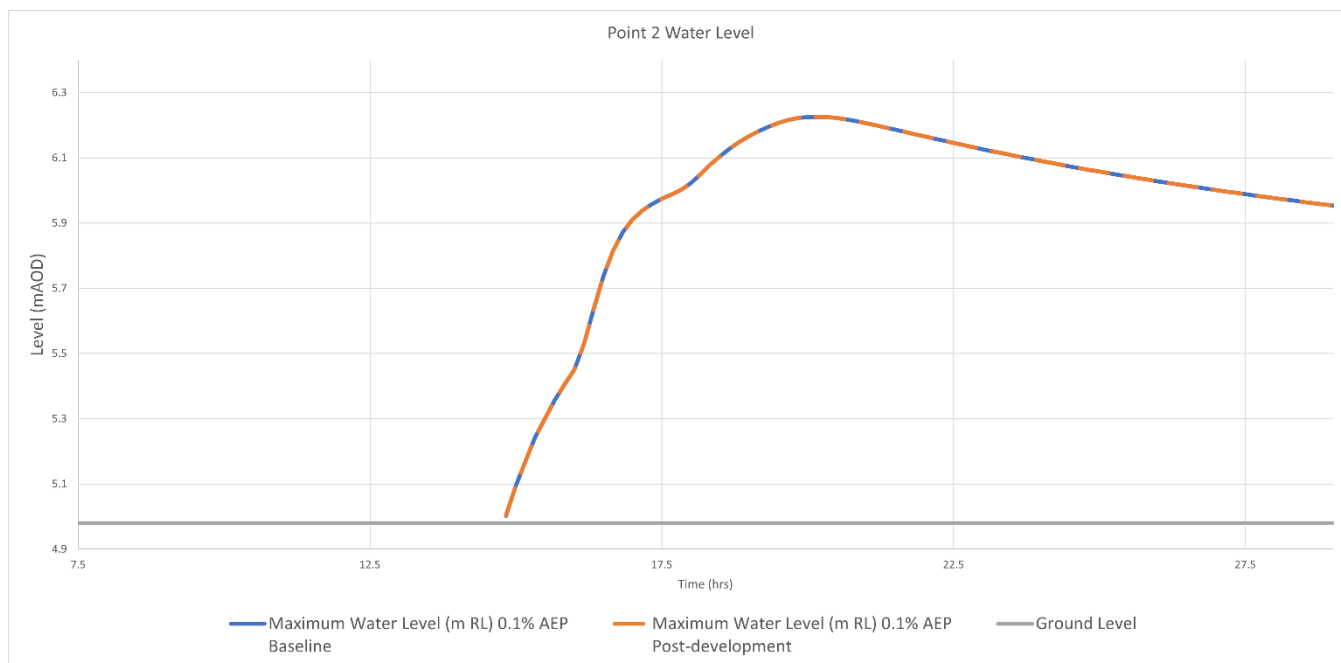
Out of bank flooding originates from the River Afan at 14 hours into the model simulation. It then takes 40 minutes for the floodwater to travel overland to reach the site location during the 0.1% AEP event. It then takes a further 1 hour and 40 minutes for the floodwater to rise to a level that is sufficient to cause flooding to the commercial building footprint. Once the building footprint is flooded, it takes a further 3.5 hours from the onset of flooding to reach its peak flood depth of 0.57m.

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**Figure 3-8 Rate of rise plot - location 1 (proposed building), 0.1% AEP event**



**Figure 3-9 Rate of rise plot - location 2 (road), 0.1% AEP event**

## 3.3 Blockage analysis

NRW requested the inclusion of blockage simulations to understand the residual risk associated with blockage of the triple arch bridge located at the end of Station Road. A blockage percentage of 25% has been applied to represent NRW's medium risk scenario for bridge blockage.

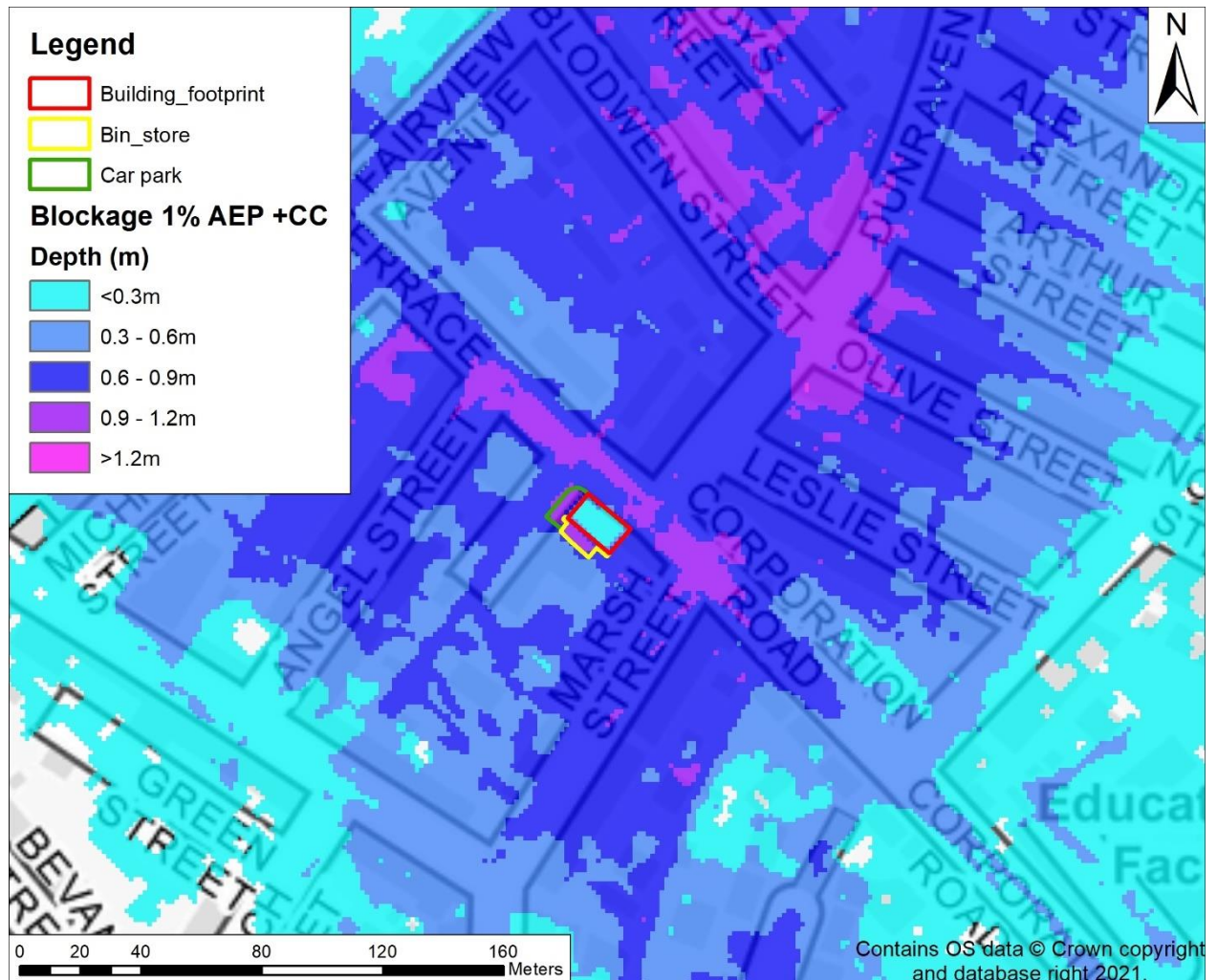
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Figure 3-10 shows the modelled flood depths for the 1% AEP plus climate change with the application of blockage to the Station Road bridge. The application of blockage causes an increase in out of bank flooding which will result in the proposed building footprint flooding to a maximum depth of 0.15m in the 1% AEP plus climate change event.

In terms of flood hazard, the peak hazard classification found within the building footprint in the 1% AEP plus climate change event with the application of blockage is 0.58. This value constitutes very low hazard which implies caution should be taken.



**Figure 3-10: 1% AEP plus climate change blockage**

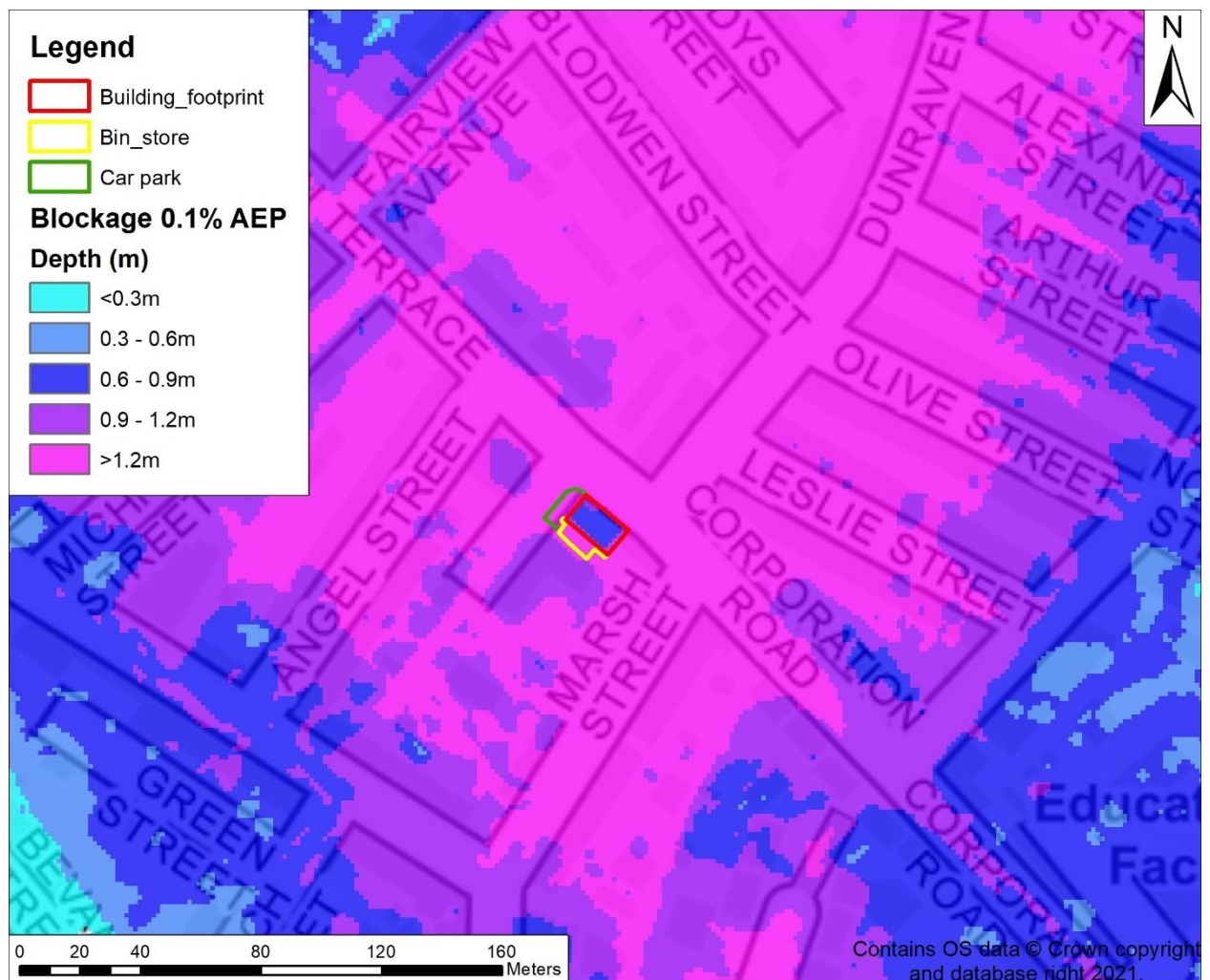
In the 0.1% AEP event, the application of blockage presents a residual flood risk maximum depth of 0.78m within the proposed building footprint. As with the 1% AEP plus climate change event, the application of blockage causing an increase in out of bank flooding which would impact the proposed development site. Figure 3-11 shows the modelled flood depths for the 0.1% AEP event with the application of blockage.

The peak flood hazard value in the 0.1% AEP event with the application of blockage is 1.42 within the building footprint. This value is considered a high hazard classification and is a danger for most. The post-development run without blockage applied has a flood hazard value of 1.30. Although this is lower, it represents the same 'High' hazard classification and therefore it can be concluded that the application of blockage does not increase the flood hazard to the proposed development in the 0.1% AEP event.

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**Figure 3-11: 0.1% AEP event blockage flood depth**

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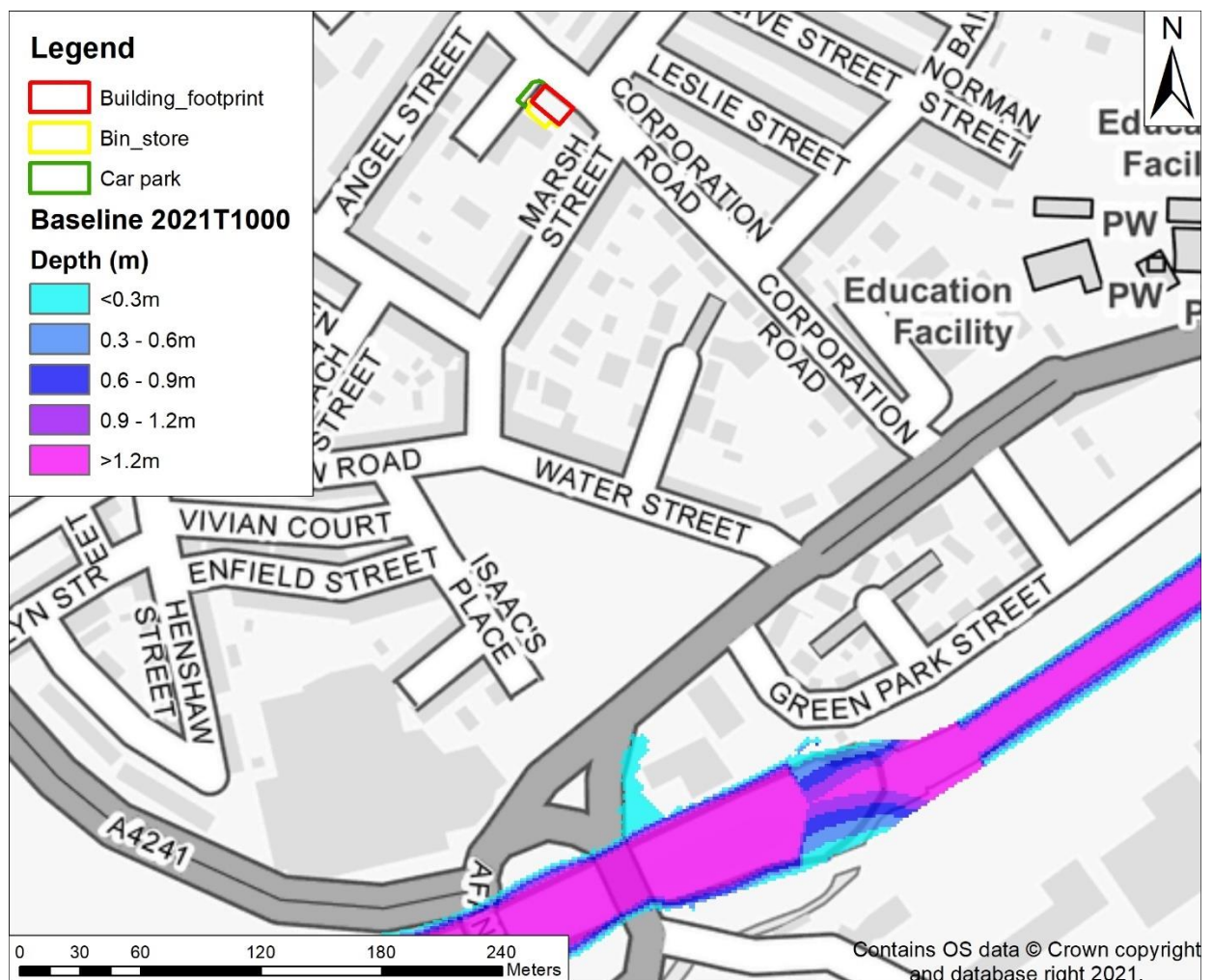
## 4 Tidal model results

### 4.1 Baseline model

#### 4.1.1 Maximum flood depths

NRW have highlighted in their review that the Julian Terrace flood modelling work had not included any assessment of tidal flood risk. As describe in section 2.1, new tidal boundaries have been generated for the Port Talbot model and design event simulations have been completed for the 0.5% and 0.1% AEP events looking at present day flood risk and with the application of climate change.

In the present-day design event simulations, there is no tidal flood risk to the site in either the 0.5% or 0.1% AEP events as shown in Figure 4-1. This shows the maximum flood depth for the present day (2021) 0.1% AEP event. Due to there being no tidal flood risk in the present-day design event simulations, it was decided not to undertake post-development simulations for the present-day tidal design events.



**Figure 4-1: 2021 0.1% AEP Baseline flood depth**

The proposed development consists of a commercial unit being constructed on the ground floor. A commercial development typically has a 75-year design life and therefore 75 years of sea level rise has been assessed to represent the impacts of climate change.

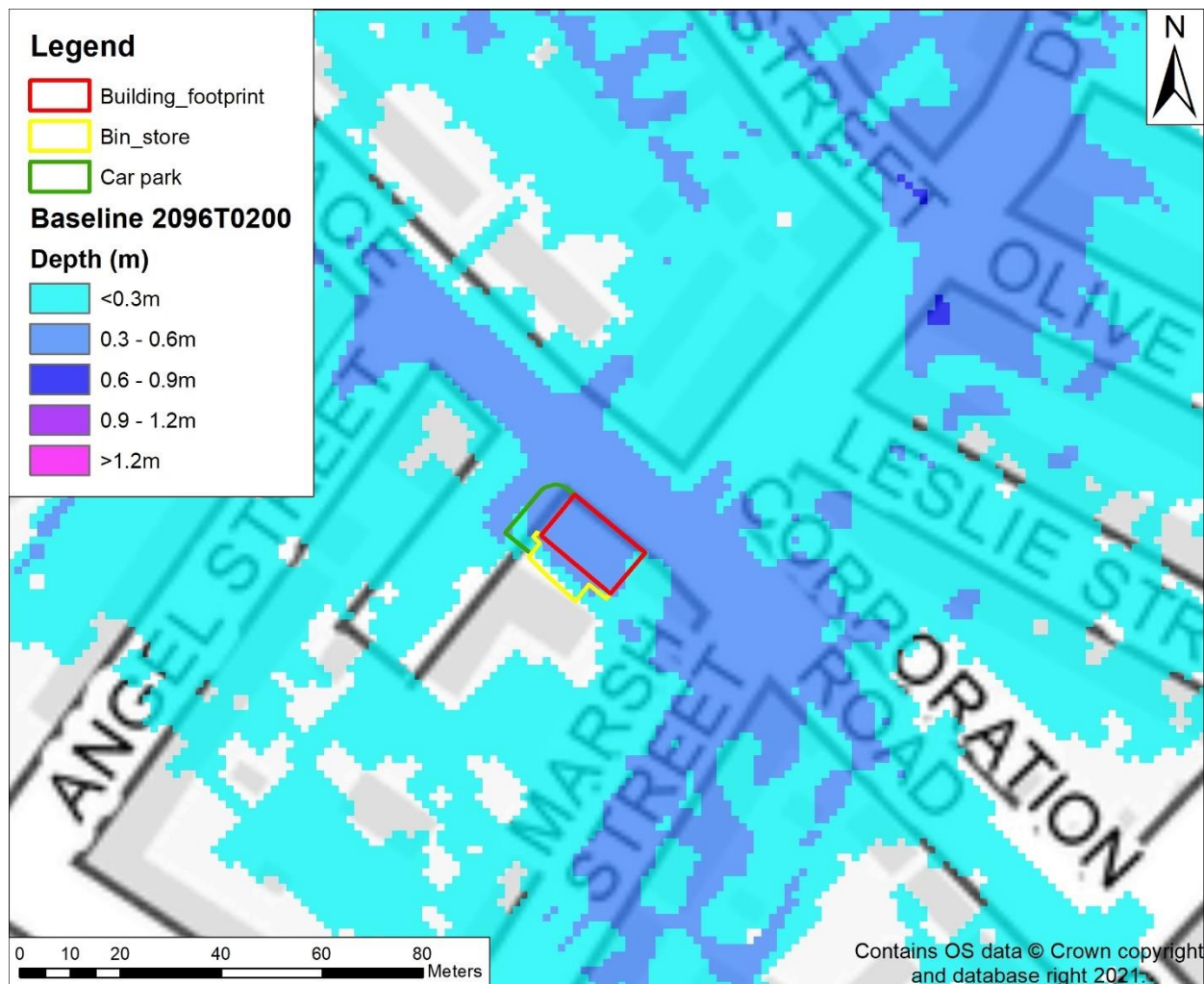
Figure 4-2 shows the modelled flood depths for the baseline 2096 0.5% AEP event. In the baseline

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scenario the proposed building footprint floods to a maximum depth of 0.31m which correlates to a water level of 5.30m AOD.



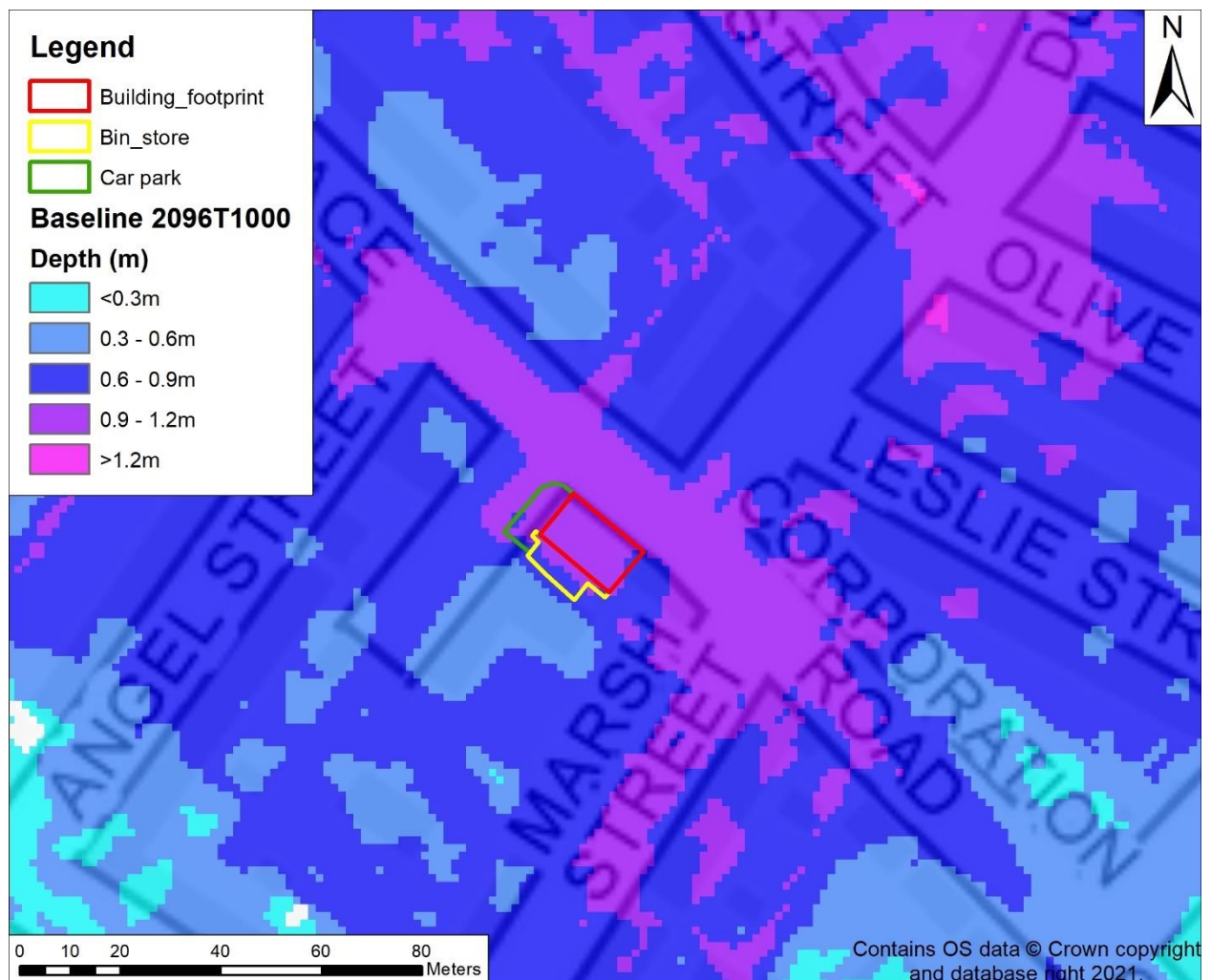
**Figure 4-2: 2096 0.5% AEP baseline flood depth**

In the 0.1% AEP event, the peak flood depth within the building footprint is 0.91m which correlates to a maximum water level of 5.90m AOD. Figure 4-3 show the maximum flood depths for the baseline 0.1% AEP 2096 simulation.

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**Figure 4-3: 2096 0.1% AEP baseline flood depth**

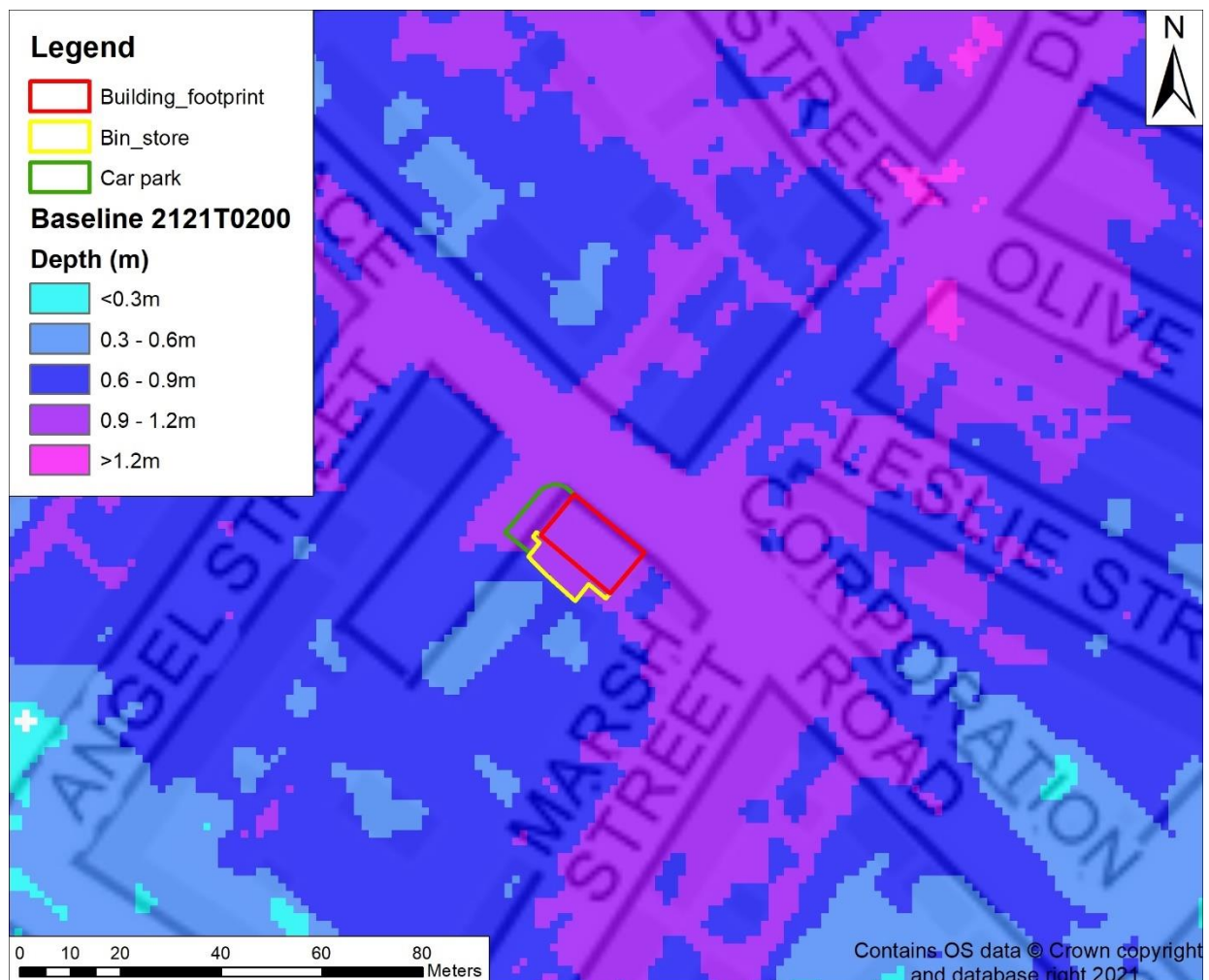
Although the ground floor of the development is for commercial use, the first floor is to contain residential flats and therefore it was decided to simulate the tidal design events with 100 years of sea level rise as well.

Figure 4-4 shows the 2121 0.5% AEP event flood depth for the baseline model scenario. The maximum flood exhibited within the building footprint is 0.98m which correlates to a peak water level of 5.96mAOD.

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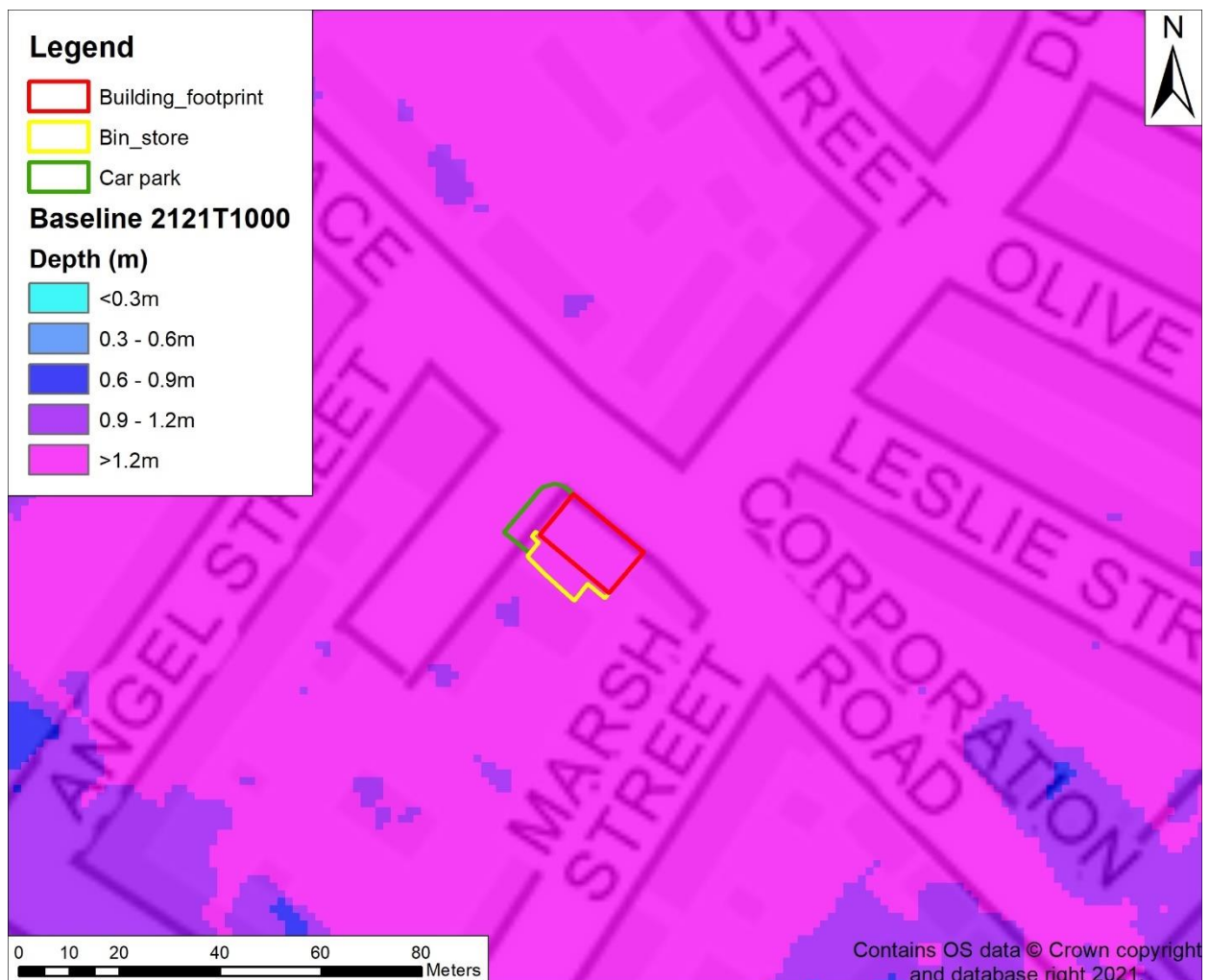
**Figure 4-4: 2121 0.5% AEP baseline flood depth**

In the 2121 0.1% AEP event, the maximum flood depth within the building footprint is 1.65m which correlates to a peak water level of 6.63mAOD. Figure 4-5 shows the modelled flood depths for the baseline 2121 0.1% AEP event simulation.

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**Figure 4-5: 2121 0.1% AEP baseline flood depth**

## 4.2 Post-development

### 4.2.1 Maximum flood depths

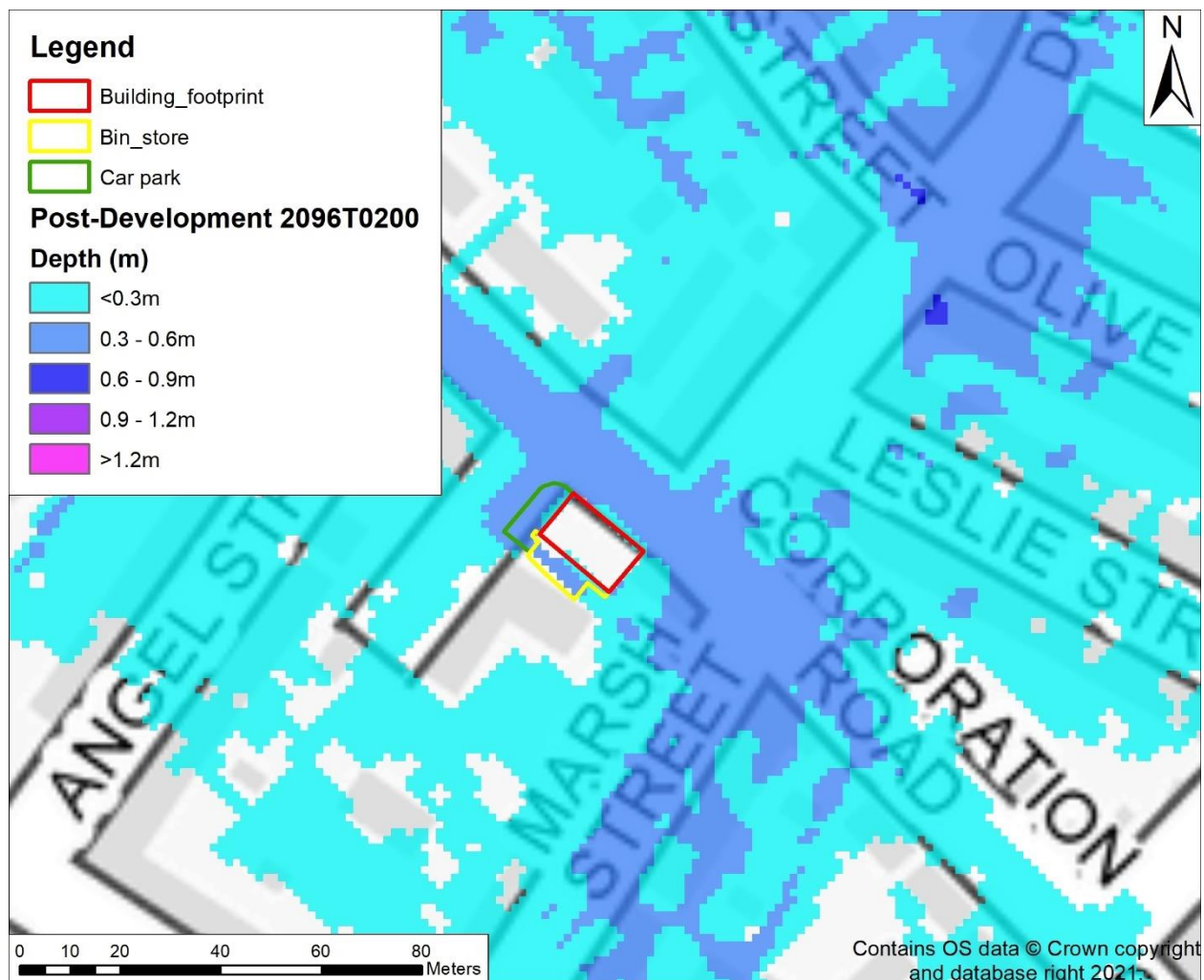
The post-development consists of raising the proposed building footprint to an elevation 5.68mAOD with the car parking area set a level of 4.87mAOD. These levels were determined based on the analysis of the fluvial design event simulations, but the post-development scenario has also been simulated for the tidal design events.

Figure 4-6 shows the modelled flood depths for the 2096 0.5% AEP event for the post-development scenario. There is no flooding to the proposed building footprint in this event and is therefore compliant with the requirements of TAN-15 given the requirements for 75 years of sea level rise for commercial development. The building footprint elevation is 5.68mAOD with a peak water level of 5.30mAOD exhibited adjacent to the proposed development. The maximum flood depth experience in the car parking area is 0.43m.

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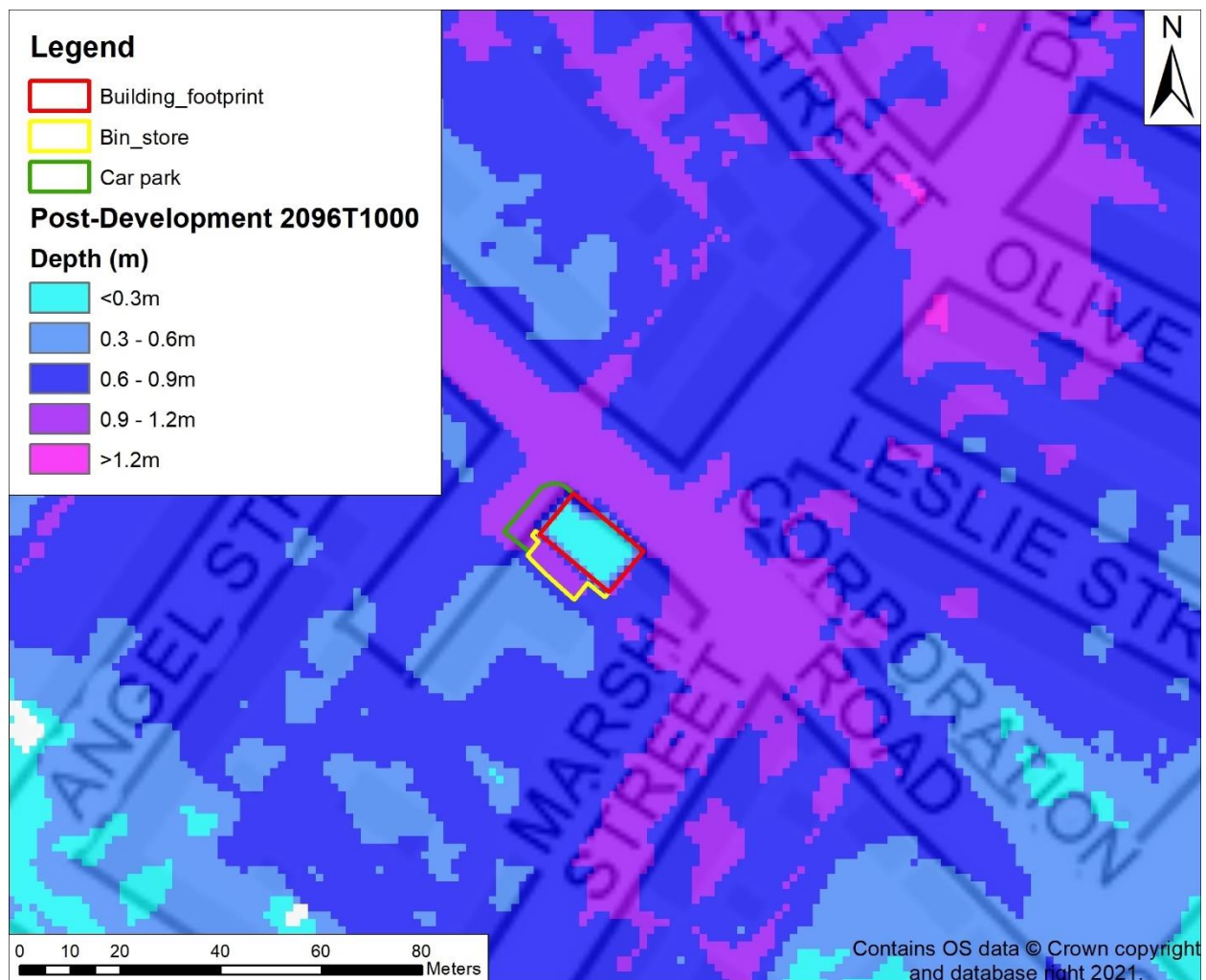
**Figure 4-6: 2096 0.5% AEP post-development flood depth**

Figure 4-7 shows the post-development model flood depths for the 2096 0.1% AEP event. The proposed building footprint experiences shallow flooding up to a maximum flood depth of 0.23m which means the site is compliant with the requirements of TAN-15 which indicates it needs to be less than 600mm of flooding for a commercial development. The car parking area experiences a maximum flood depth of 1.03m which correlates to a peak water level of 5.90mAOD.

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**Figure 4-7: 2096 0.1% AEP post-development flood depth**

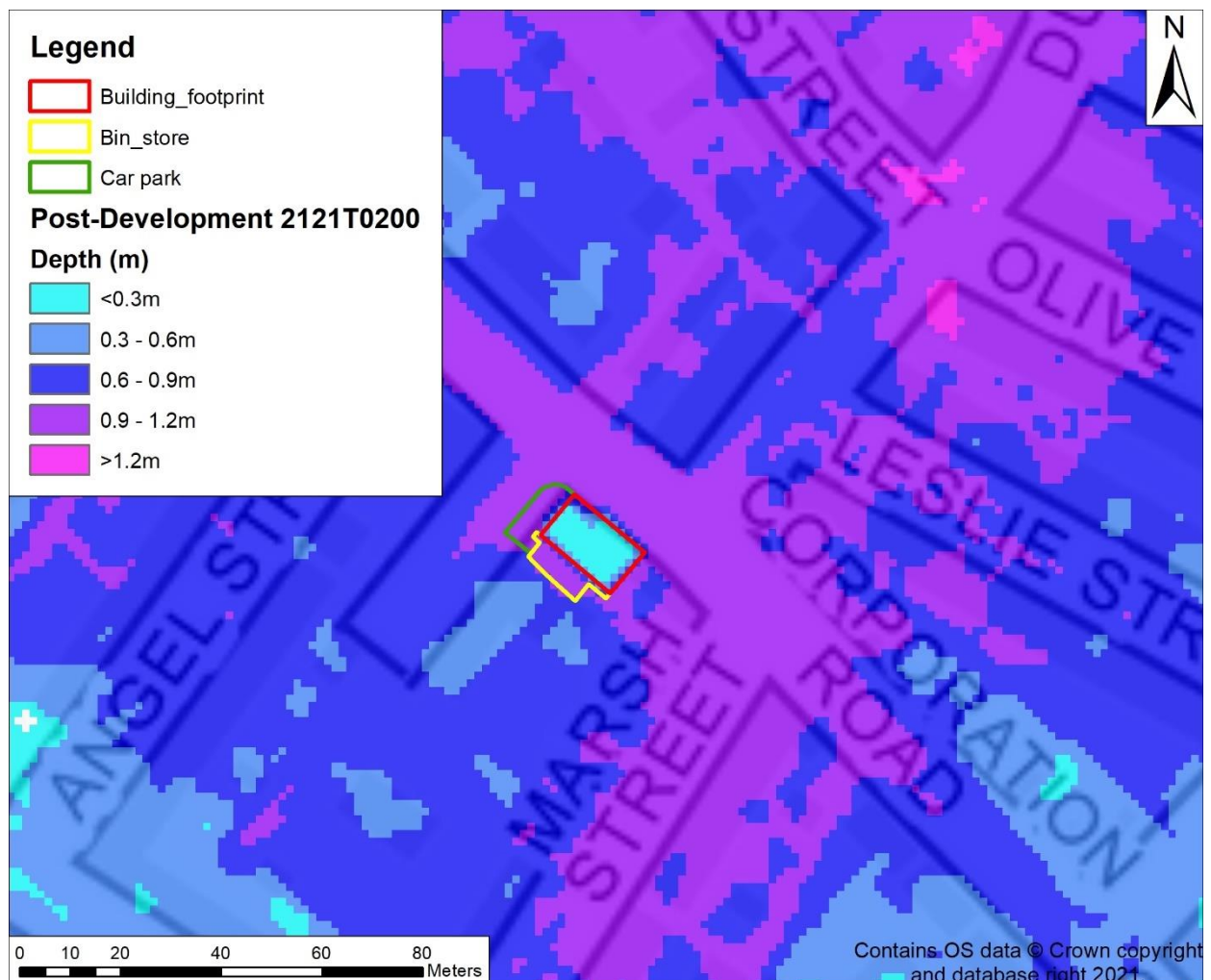
Due to the first-floor development comprising of residential development, the post-development scenario has also been simulated with 100 years of sea level rise applied. Figure 4-8 shows the 2121 0.5% AEP event flood depths. A maximum depth of 0.28m is exhibited within the proposed building footprint, this correlates to a peak water level of 5.96mAOD.

Typically, the 0.5% AEP event would be expected to be flood free in order to be compliant with TAN-15 but due to the ground floor consisting of commercial development only, the development proposals are deemed to be acceptable. The 2121 0.5% AEP event simulation shows that the water level would not be sufficient to impact the residential development located on the first floor.

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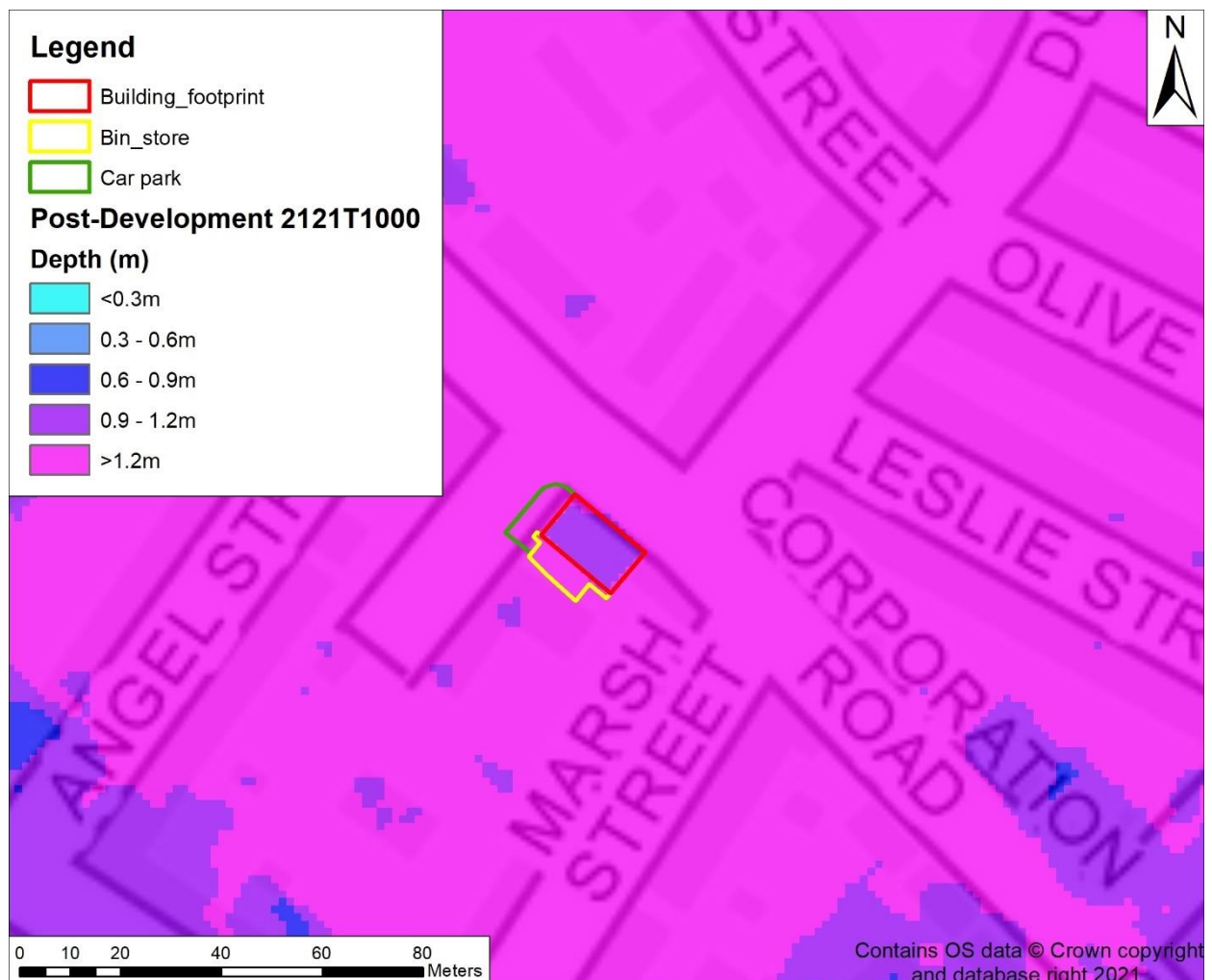
**Figure 4-8: 2121 0.5% AEP post-development flood depth**

Figure 4-9 shows the post-development flood depths for the 2121 0.1% AEP event. A maximum flood depth of 0.95m is exhibited which correlates to a peak water level of 6.63mAOD. The water levels projected from the flood modelling would not be sufficient to cause flooding to the residential development located on the first floor of the proposed building.

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Client Kennedy James Griffiths  
Day, Date and Time 27 July 2021  
Author Paul Redbourne  
Subject Julian Terrace Flood Modelling - REVB

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**Figure 4-9: 2121 0.1% AEP post-development flood depth**

## 4.2.2 Third party impacts

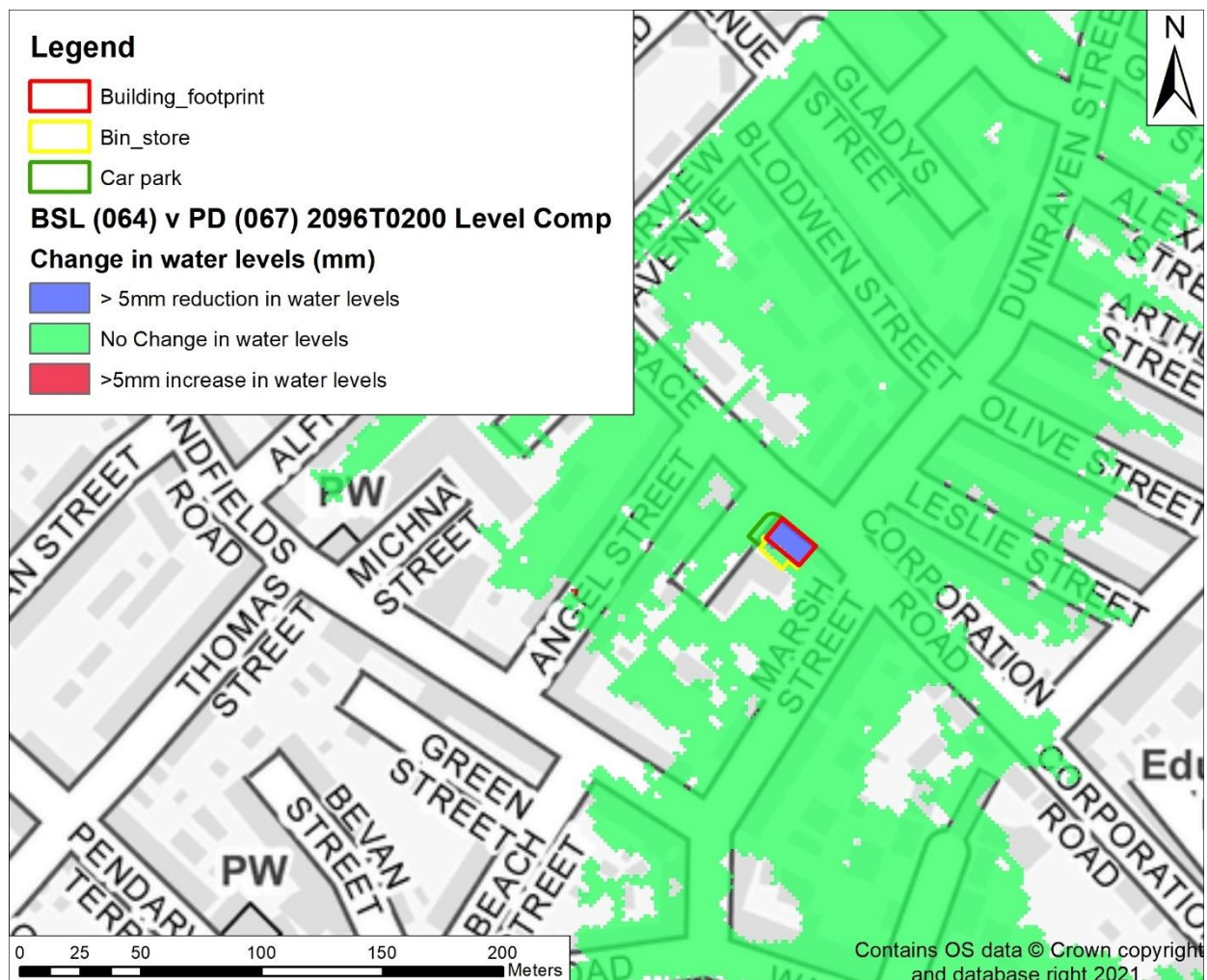
For each of the tidal design event simulations, the baseline and post-development water level grids have been compared to show that the proposed development will not increase flood risk to neighbouring third parties.

Figure 4-10 shows the water level grid comparison between the baseline and post-development model scenarios for the 2096 0.5% AEP event. As shown, the proposed development does not cause any change in water levels to the neighbouring properties and is therefore deemed to be compliant with the requirements of TAN-15.

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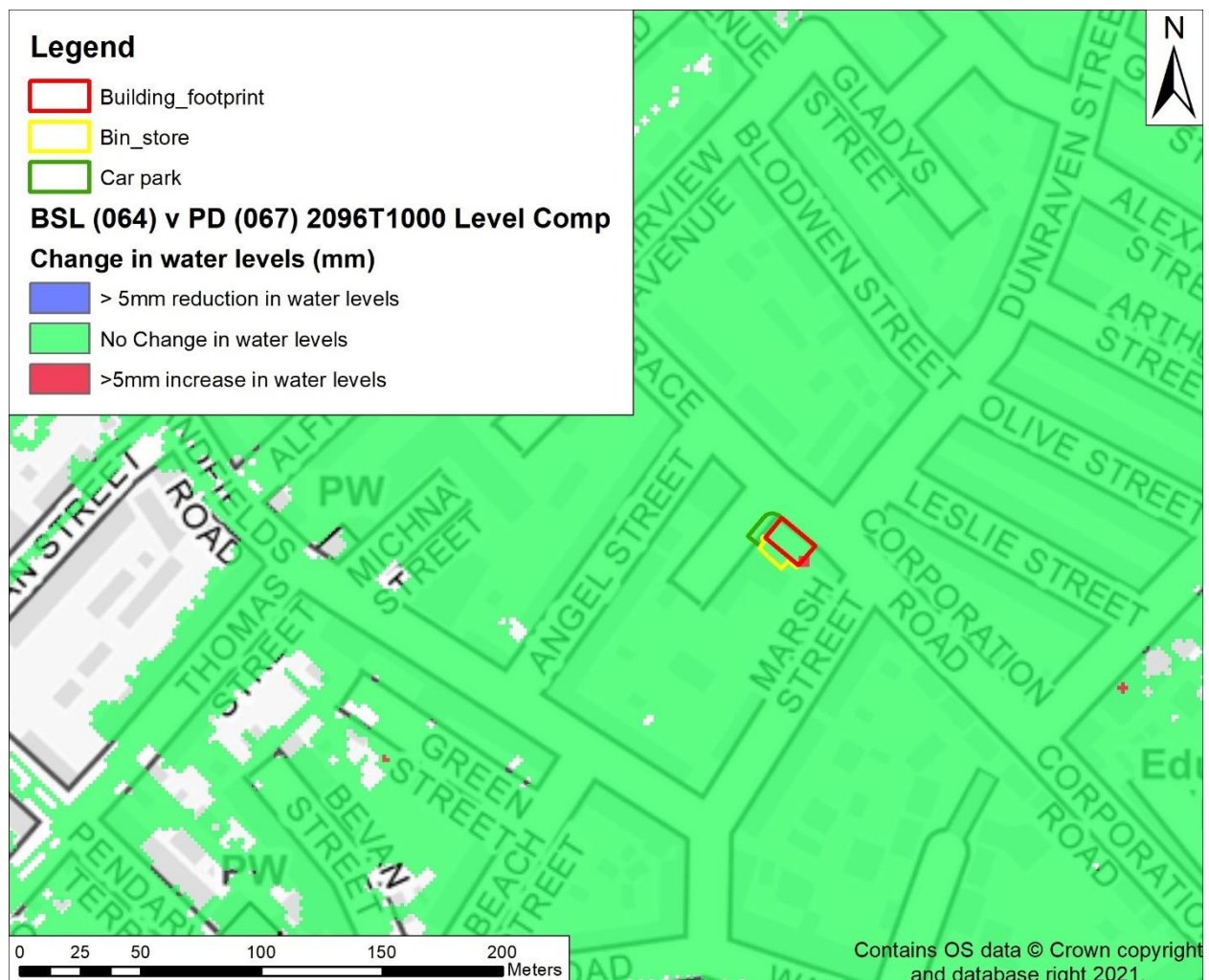
**Figure 4-10: 2096 0.5% AEP tidal event level grid comparison**

Figure 4-11 shows the modelled level grid comparison between the baseline and post-development model scenarios for the 2096 0.1% AEP event. This shows that there is no change in water levels to the neighbouring properties adjacent to the proposed development and is therefore considered compliant with the requirements of TAN-15.

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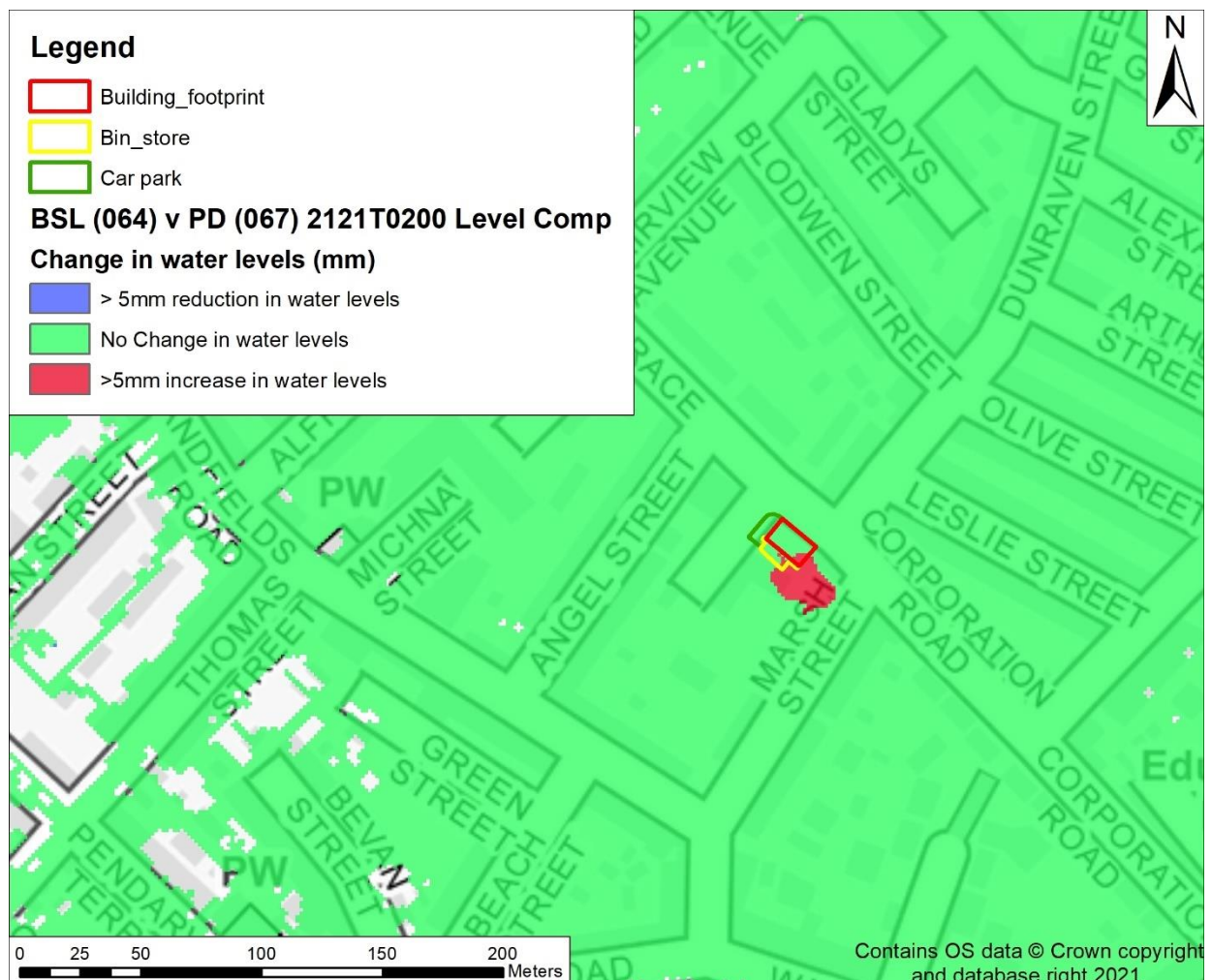
**Figure 4-11: 2096 0.1% AEP tidal event level grid comparison**

Figure 4-12 shows the modelled level grid comparison between the baseline and post-development model scenarios for the 2121 0.5% AEP event. This shows that there is a small area directly to the south of the proposed development that may exhibit an increase in water levels of greater than 5mm. Within this area, the increase in water levels peaks at 7mm. At this location, flood depths are predicted to exceed 1m in this event. Consequently, an increase of just 7mm will result in a negligible increase in flood risk; with no impact on frequency or extent of flooding and no change in flood damages. Such small changes in hydraulic modelling results are typically unavoidable in densely populated communities, being more a modelling aberration rather than a real-world effect.

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**Figure 4-12: 2121 0.5% AEP tidal event level grid comparison**

Figure 4-13 shows the modelled water level grid comparison between the baseline and post-development model scenarios for the 2121 0.1% AEP event. This shows there is no change in water levels to the adjacent properties and therefore the development is considered fully compliant with the requirements of TAN-15 in this design event simulation.

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**Figure 4-13: 2121 0.1% AEP tidal event level grid comparison**

|                    |                                       |
|--------------------|---------------------------------------|
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| Subject            | Julian Terrace Flood Modelling - REVB |

## 5 Assumptions and limitation

NRW's model review comments highlighted that although the model is considered stable, there are a number of warning messages present in the TUFLOW messages layer that should be investigated to show that they are acceptable.

The checks and warning messages present are a remnant of the existing flood mapping model, but each have been reviewed to ensure that their inclusion is suitable. The following section provides an overview of each message:

- WARNING 2079 - 3D break line failed to modify any Zpts. Check elevations, snapping and correct GIS projection. This warning message occurs once and is located upstream of the cycle path bridge on the Afon Afan. The message is implying that the z-line used to represent the cycle path isn't applied correctly. Although this should be addressed for a flood mapping model, this has no bearing on the assessment of flood risk at Julian Terrace and is therefore deemed to be an acceptable limitation.
- CHECK 1152 - For channel FF\_0139I, using centre cross-section and ignoring end cross-section(s). This message occurs 51 times and is used to highlight where the structure geometry have been specified using centre cross sections instead of end cross sections. This is the correct approach to take.
- CHECK 1037 - Channel "BG\_3562M1" interpolated from XS 00111 (62%) and XS 00112 (38%). This message occurs 28 times in and highlights where an interpolated channel section is located, and the percentage split used to generate the cross-sectional opening geometry for that reach. This is considered to be the correct approach to take.
- CHECK 2099 - Ignored repeat application of boundary to 2D cell. This message occurs 23 times during the model simulation and is associated with the location where HX boundaries are snapped to one another, and both try to activate the same cell. This is an acceptable check message.
- WARNING 2118 - Lowered SX ZC Zpt by 0.37m to 1D node bed level. This message occurs 24 times as a check and 4 times as a warning message. It highlights locations where the base LIDAR elevations have been altered to align with the invert level of a floodplain culvert unit. These messages are considered acceptable given survey data has been used to derive the culvert invert levels.
- WARNING 1100 - Structure FF\_1581B crest/invert (27.390) is below bed (27.394) of primary upstream channel FF\_1647. This message layer occurs 31 times and highlights where the invert level of a structure differs from the upstream or downstream channel section. This is caused due the invert levels being specified to two decimal places whereas the cross section .csv geometry is typically set to 3 decimal places. This is not considered to be an issue.

The NRW review highlighted that the model is considered stable with no 1D or 2D negative depths in the fluvial design event simulations with the cumulative ME% within the recommended +/-1% range. However, for the tidal design event simulations, there are some minor instabilities present with both 1D and 2D negative depths identified in the tidal climate change simulations.

The 1D negative depths occur at the start of the model simulation and are associated with the initial conditions. Due to the large number of runs, it was decided to adopt the same initial conditions as used in the fluvial design events, but this causes some problems in the tidal model. However, given these occur are the start of the simulation (first 5 hours), they have no bearing on the peak results and are therefore deemed to be an acceptable limitation.

For the post-development simulation (Run 067) 2121 0.1% AEP event, the model went unstable near to the downstream end of the Nant Ffrwd Wylt. This is a very hydraulically complex area and in order to get the model to run, the manning's n roughness values for the culvert units between Culv\_In1 and C\_Sect\_6 were increased from 0.016 to 0.02. It was decided not to re-run all of the model simulations for this change given the long model run times and given the issue is present on the Nant Ffrwd Wylt and therefore has no bearing on the flood risk assessment at Julian Terrace.

The peak ME% for all of the tidal design event simulations is within the recommended +/-1% range and therefore the model is deemed to be stable and fit for purpose.

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## 6 Conclusions

- JBA Consulting were commissioned by Kennedy James Griffiths to undertake flood modelling to gain a better understanding of the potential displacement of flood water onto third party land as a result of the development at Julian Terrace.
- The NRW Port Talbot model was updated to run with the latest version of TUFLOW and to include updated topographic levels on the site.
- Fluvial design event simulations have been completed looking at the 1% AEP plus climate change and 0.1% AEP events.
  - The baseline model results show a maximum water level of 5.67mAOD during the 1% AEP plus climate change event and 6.25mAOD during the 0.1% AEP event occur at the site.
  - The post development scenario was represented by raising the building footprint to 5.68mAOD and setting the car park and bin storage areas to 4.87mAOD.
  - During the post-development scenario, the building is flood free during the 1% AEP plus climate change event.
  - During the 0.1% AEP event for the post development scenario, the building footprint experiences a maximum depth of 0.57m.
  - There is no third-party detriment as a result of the proposed development in the fluvial design event simulations.
  - Blockage analysis of the Station Road arch bridge has been completed to understand the residual risk to the site.
- Tidal design event simulations have been completed looking at both present day flood risk and with the application of climate change:
  - The site is not at any tidal flood risk during the present-day model simulations.
  - As the ground floor development will consist of commercial development only, 75 years of sea level rise has been applied to the 0.5% and 0.1% AEP events .
  - This showed that the proposed development will be flood free in the 2096 0.5% AEP event and exhibit a peak flood depth of 0.23m in the 0.1% AEP event.
  - Due to the first flood development consisting of residential use, the tidal design event simulations have also been simulated with 100 years of sea level rise.
  - This showed that the site will flood in both the 0.5% and 0.1% AEP events to a depth of 0.28m in the 0.5% AEP event and to a depth of 0.95m in the 0.1% AEP event. This will not cause any flood risk to the residential development located on the first floor.
  - There is no third-party detriment as a result of the proposed development during the 2096 model simulations. In the 2121 0.5% AEP event there is a small increase of 7mm identified to a small area located immediately south of the development. This is deemed to be within the tolerable limits of the flood modelling work and is located at an area which exhibits over 1m of flooding in the baseline model scenario.
- Raising the car park level to 5.68mAOD so that it aligns with the floor level of the commercial unit is not feasible given the need to tie-in with surrounding road levels.