

Vale Consultancy

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Canal Side Yard Modelling



WHS

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For and on behalf of Wallingford HydroSolutions Ltd.

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The WHS Quality & Environmental Management system is certified as meeting the requirements of ISO 9001:2015 and ISO 14001:2015 providing environmental consultancy (including monitoring and surveying), the development of hydrological software and associated training.



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1 Introduction

1.1 Background

Wallingford HydroSolutions (WHS) has been commissioned by Vale Consultancy to undertake hydraulic modelling to assess the compliance of the proposed development with aspects of TAN15¹. To complete this work, WHS have run a post-development scenario in the 1D-2D tidal-fluvial model of the River Neath².

Natural Resources Wales (NRW) have objected to a Flood Consequence Assessment submitted by Vale Consultancy for a proposed industrial development on brownfield land in Neath (E:274787, N:197303). NRW have objected on the grounds that the FCA did not comply with figures 5, 6 and section 11.4 of TAN15¹. The relevant aspects of TAN15 to this study are as follows:

- **Figure 5:** Less vulnerable development must be flood free for the 1.0%+Climate Change (CC) fluvial event and 0.5%+CC tidal event.
- **Figure 6:** During the 0.1% extreme flood event, less vulnerable development is flooded by a maximum of 600mm, with flood velocities of less than 0.3m/s.
- **Section 11.4:** There is no increase in flooding elsewhere caused by the development.

1.2 Proposed Development

The proposed development is a warehouse, its footprint is approximately 300sqm, located on paved land next to a pre-existing warehouse, approximately 150m along the Neath Canal Towpath, south of Canal Road in Neath. The new warehouse will be connected to the pre-existing warehouse via an elevated walkway. The site is surrounded by industrial development to the north and east, and the River Neath to the south and west. The site location is shown in Figure 1-1 below.

¹ Welsh Government. 2026. Technical Advice Note (TAN) 15: Development, flooding and coastal erosion. Available at: <https://www.gov.wales/technical-advice-note-tan-15-development-flooding-and-coastal-erosion>

² JBA Consulting. 2017. Neath - Phase 2 Modelling Report.

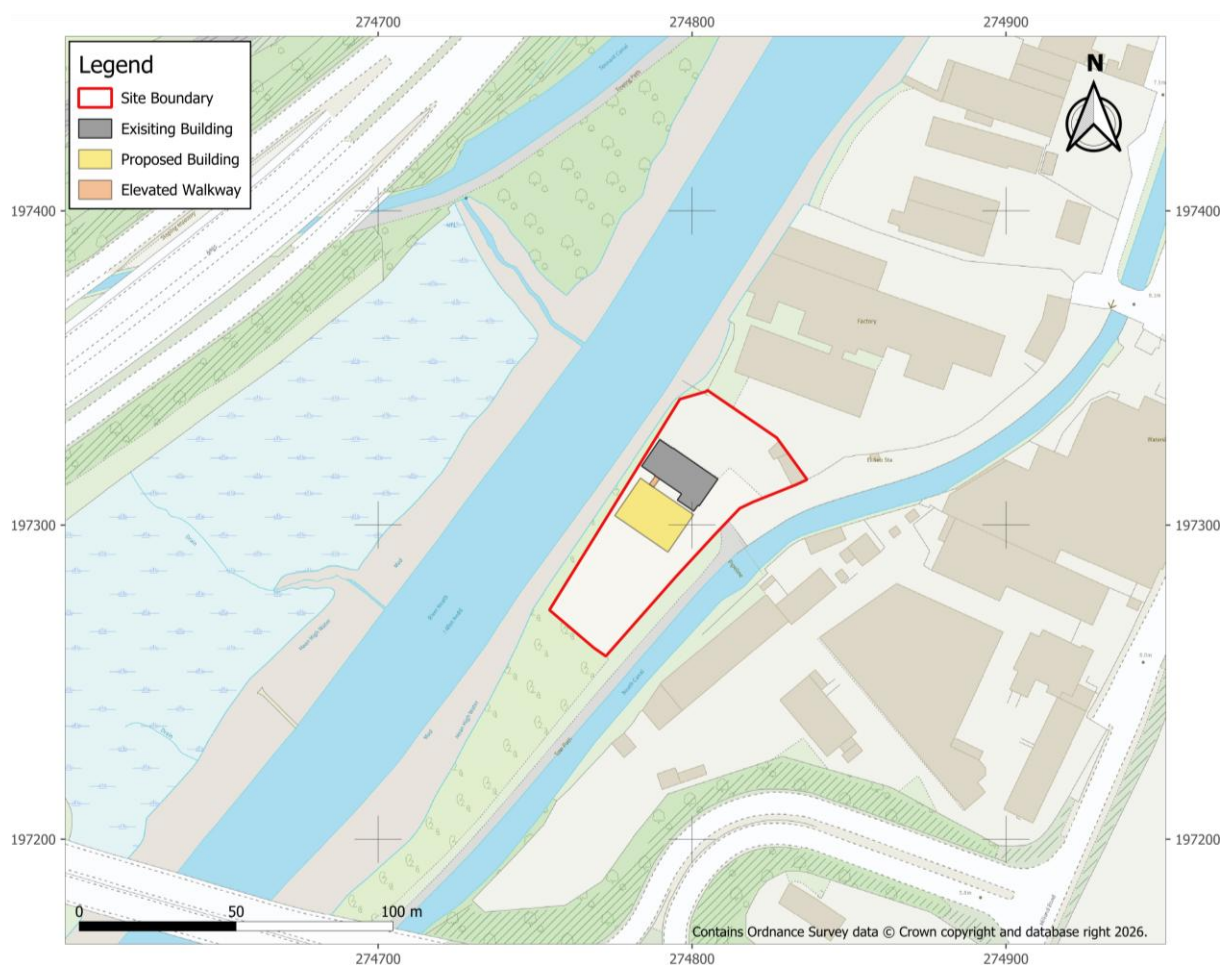


Figure 1-1 - Proposed Location of the Development

1.3 Assumptions

A series of assumptions have been made as part of this modelling work, which are outlined below.

- Aside from a few small amendments, the model received from NRW is suitable for this modelling work.
- The channel geometry is suitably represented in the model and has not changed significantly since the survey was undertaken.
- No significant changes to the channel or floodplain roughness has occurred since the model's release.
- The hydrology remains suitable for use and the adopted storm duration is appropriate for the site.

1.4 Summary of the Baseline Model

Product 5, 6 and 7 data for the Neath area was requested from NRW in May 2026. NRW provided product 7 model data for the Neath_5_v1.0_2015 model and product 6 data for the following models: Neath_5_v1.0_2015 and Neath_5_v1.1_2023.

The Neath_5_v1.1_2023 contains tidal re-runs of the 2015 model, wherein the tidal climate change allowance was updated to align with the most recent NRW guidance. While product 7 data was not available for the Neath_5_v1.1_2023 model data, the product 6 data contained the updated 1D flows

as a part of the 1D BC check file, which allowed climate change updates to be replicated as part of this modelling exercise, see Section 2.2 for further details on the implementation of the 0.5% AEP + CC event.

The model is a 1D-2D ESTRY-TUFLOW model which was built and run in TUFLOW Classic. The domain of the model is centred around the River Neath; from Abergarwed to the railway north of Brynhyfryd. The model allows for both fluvial and tidal events to be run and therefore can be used to assess both fluvial and tidal risk to the site. Both a defended and an undefended scenario was provided by NRW, only the defended scenario was assessed as a part of this project, in-line with the FCA produced by Vale Consultancy.

2 Baseline Updates

The following updates were made to the 2015 model provided by NRW, to generate new baseline grids;

- Updated software version to version 2025.2.2 and switched from TUFLOW Classic to Heavily Parallelised Compute (HPC) solver,
- Flow constriction file updated to a layered flow constriction file and stipulated a preferred approach (Method B); the flow constriction file is obsolete in HPC,
- Initial condition files generated for both the 1D and 2D domains,
- Additional scenario option added to the control file to enable post-development runs,
- All flows updated to account for the latest climate change values and NRW methods in the 2023 P6 model data.

2.1 Software Version

The 1D-2D model was built and run using ESTRY-TUFLOW software. The previous model was run in version 2016-03-AD, which was updated to TUFLOW version 2025.2.2 for this study.

The solver was also switched from Classic to HPC, the former is a finite difference solver and the latter is a finite volume solver. This results in a significant time saving in model computational time, seeing a reduction in simulation run time from 11.3 hours down to 4.3 hours for the 0.5% Annual Exceedance Probability (AEP) + CC tidal event. One model file had to be updated on account of this change: The 2015 model contained 2D flow constriction shapes with a 90% blockage to represent buildings, this was updated to a 2D layered flow constriction shape with a 90% blockage. While the two were implemented to be functionally identical, the layered flow constriction shape has superseded the flow constriction shape when using the HPC solver.

2.2 Climate Change and Inflows

NRW periodically update their guidance on climate change uplift across Wales. The relevant, up-to-date guidance³ as of September 2026 is as follows:

- For fluvial flows, the central allowance (2080s epoch) should be applied for the West Wales River Basin District for less vulnerable development. This value is 35%.
- For tidal flows, the upper central allowance (70th percentile), 2007-2100 should be used to assess less vulnerable development with a 75-year lifetime. For Neath Port Talbot, this value is 0.86m.

³ NRW. 2026. Climate change allowances and flood consequence assessments. Available at: <https://www.gov.wales/climate-change-allowances-and-flood-consequence-assessments> [Accessed 27/07/2026]

2.2.1 Fluvial Scenario

During the modelled fluvial scenario, inflows for the 1.0% AEP +CC event were updated from 20% (as in the received model) to 35%, to reflect the most up-to-date guidance. The climate change uplift was applied by multiplying the hydrographs for the 1.0% AEP event in the received model by 1.35 (35% increase).

2.2.2 Tidal Scenario

As mentioned in Section 1.4, NRW provided product 6 data for two models; the original Neath_5_v1.0_2015 model and the updated Neath_5_v1.1_2023. While product 7 data was not available for the 2023 model, product 6 data contained model check files, where the applied boundary conditions in the 2023 model could be reviewed. Two key differences were identified when comparing the tidal boundaries between the Neath_5_v1.0_2015 and the Neath_5_v1.1_2023 model:

- During the tidally dominant event, constant fluvial inflows were applied in the 2015 model, whilst in the 2023 model the 2-year fluvial event hydrograph was applied.
- A modified tidal curve was implemented in the 2023 model. Figure 2-1 illustrates the difference between the 0.5% AEP tidal curve found in the 2015 and 2023 models.

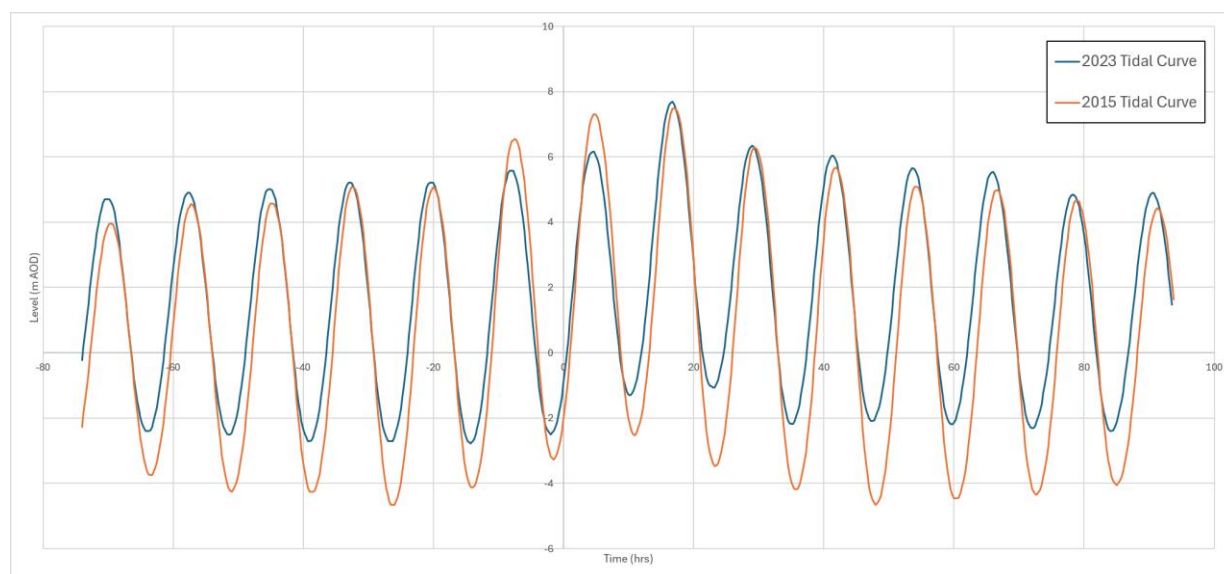


Figure 2-1 - Updated Tidal Curve, 0.5% AEP.

For this modelling exercise, updates were made to the tidal scenario to reflect the 2023 model. The 2-year fluvial inflows replaced the constant inflows used in the 2015 model during all tidal events. Additionally, the tidal curves were updated to match the tidal curves used in the Neath_5_v1.1_2023 model, shown in Figure 2-1 above. The tidal curves in the climate change model runs were then uplifted by 1m from their baseline forms (as done in the Neath_5_v1.1_2023 model) to account for future sea level rise. A 1m uplift exceeds the required 0.86m stipulated by NRW guidance and is therefore suitable for assessing the site, while also providing a 0.14m buffer above the required level.

It is assumed that the changes to the tidal curve were completed to incorporate the most up-to-date data in the modelling and the 2yr fluvial inflows were applied to ensure that storage from rivers were not being underestimated. No reporting is available to confirm these assumptions, however, because both the modifications to the tidal event are conservative, no further assessment was deemed necessary.

3 Post-Development Modelling

The development has been implemented as a z-shape, set to the proposed finished floor level of the building, 7.62 mAOD. The finished floor level is based on the 0.5% +CC tidal event, the derivation of the finished floor level is explained further in Section 4.3. The z-shape ensures that no flow passes through the proposed building below the finished floor level.

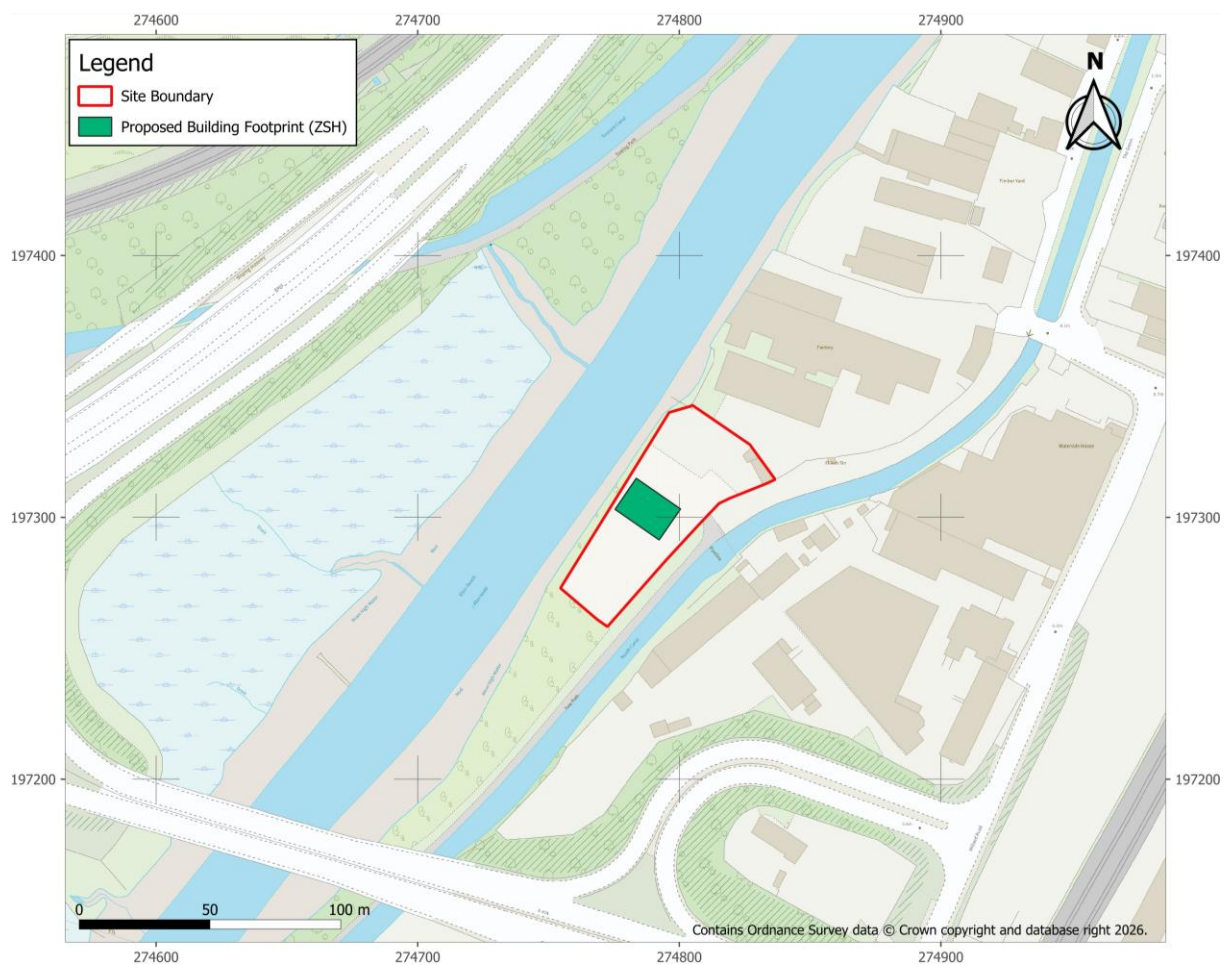


Figure 3-1 - Post-development layout.

4 Results

4.1 Summary of Design Runs

A summary of all the design runs simulated as a part of this study is provided in Table 4-1 below. For each of the runs stated in Table 4-1, both a post-development and baseline run was completed. In total there are 16 design runs. These events were chosen as they are the required durations to ensure compliance with TAN15.

Table 4-1 - Summary of design runs

Scenario	1.0%	1.0%+CC	0.5%	0.5%+CC	0.1%	0.1%+CC
Fluvial	✓	✓			✓	✓
Tidal			✓	✓	✓	✓

4.2 Fluvial Events

During all four of the modelled defended scenario fluvial events, the flooding does not encroach upon the development footprint. Because of this, it is concluded that the development is suitably safe from the design fluvial events and no further investigation is required. Figure 4-1, Figure 4-2 and Figure 4-3 illustrate the 1.0% AEP, 1.0% AEP +CC, and 0.1% AEP +CC modelled flood depths respectively. Because the fluvial flood extents do not overlap with the building, depth change analysis for the fluvial events is not required.

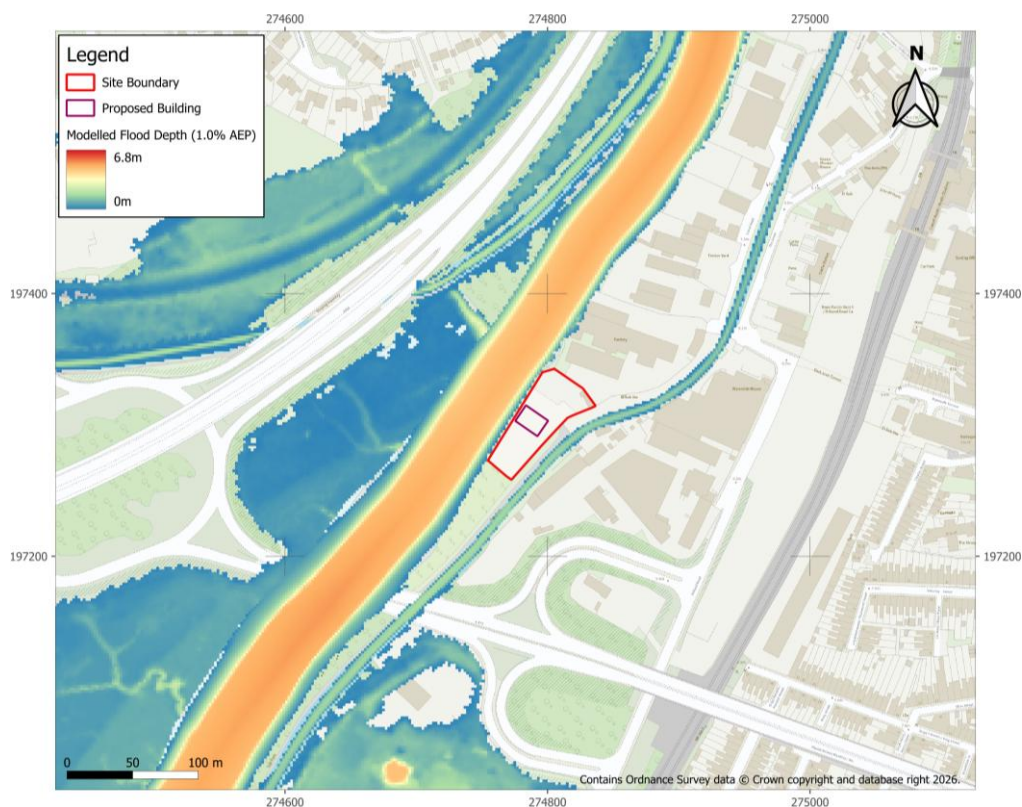


Figure 4-1 - Post-Development Flood Depths. 1.0% AEP. Fluvial

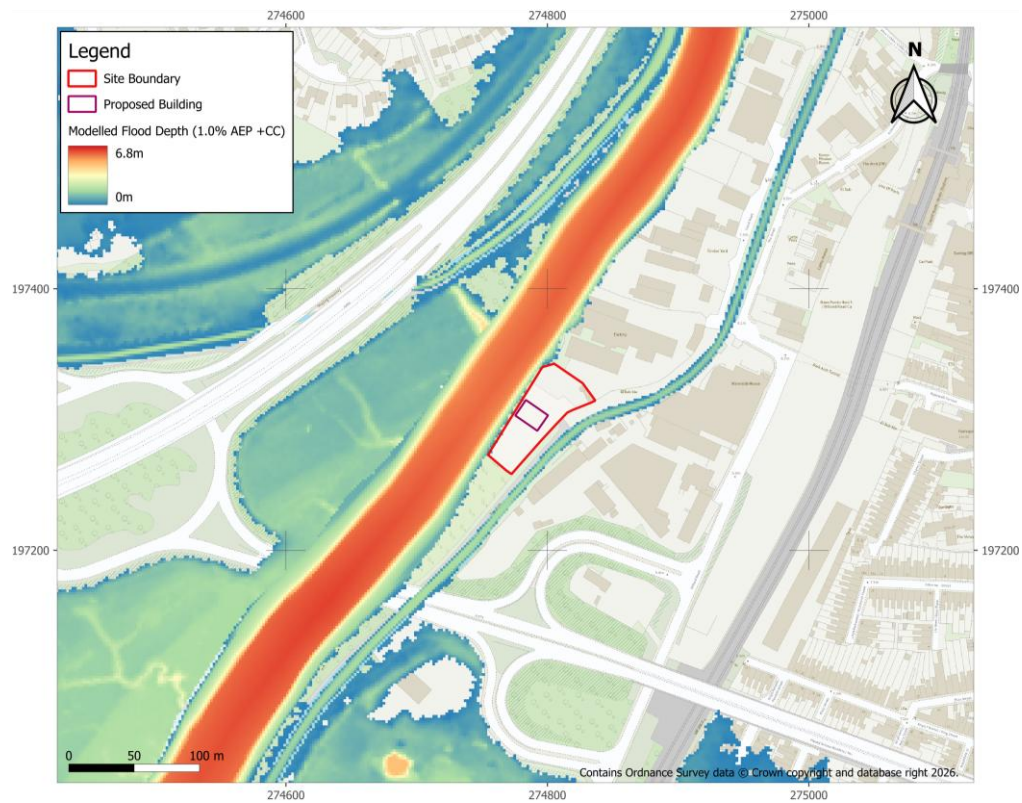


Figure 4-2 - Post-Development Flood Depths. 1.0% AEP +CC (35%). Fluvial.

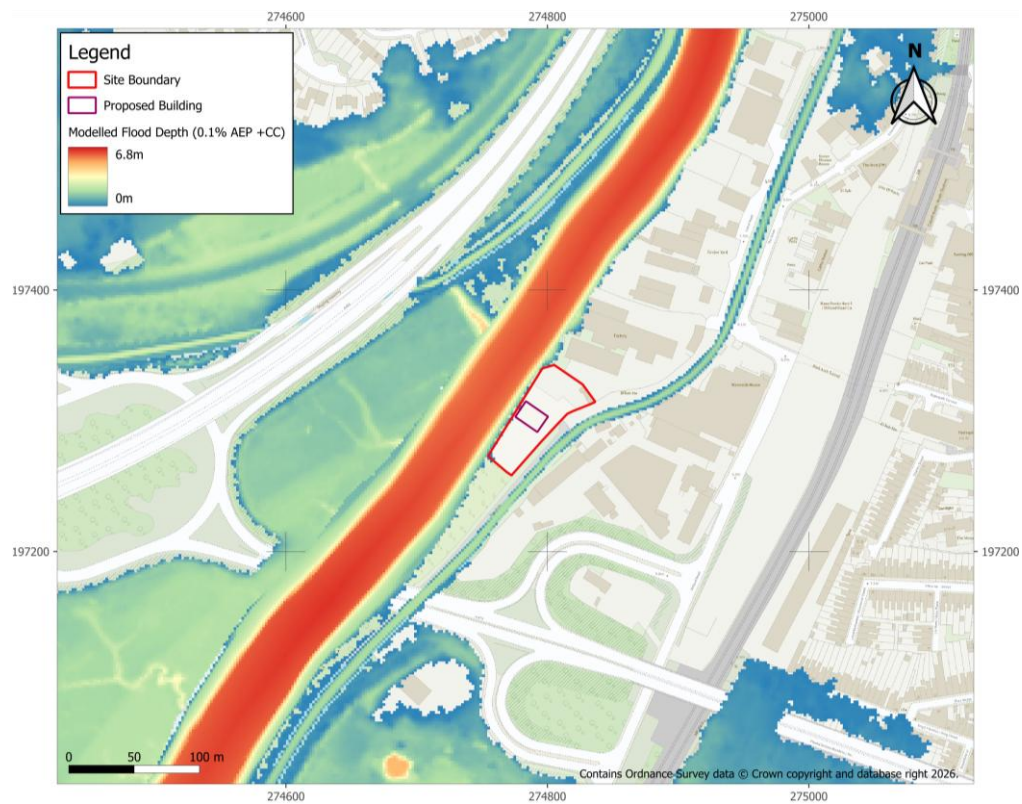


Figure 4-3 - Post-Development Flood Depth. 0.1% AEP +CC (35%). Fluvial.

4.3 Tidal Events

4.3.1 Depth

Flood depths for the 0.5% AEP and 0.5% AEP + CC (the design event) events have been presented in Figure 4-4 and Figure 4-5 respectively. The 0.5% AEP event shows no relevant flooding to the proposed building. Flood water during the 0.5% AEP + CC event surrounds the proposed building, this is associated with a maximum flood level of 7.32 mAOD. This level approximately equates to depths of between 0.4m-0.8m in the land adjacent to the proposed building. The 0.5% AEP + CC is the design event and therefore the finished floor level should be set based on the flood level identified during this event, plus a 300mm freeboard to account for any uncertainty in the model data. In this instance, the finished floor level of the building should be set to 7.62 mAOD.

The 0.1% AEP and 0.1% AEP + CC events can be seen in Figure 4-6 and Figure 4-7 respectively. During the 0.1% AEP event, flooding encroaches on the proposed building from the south. The modelled level is 6.77 mAOD which is significantly below the proposed finished floor level for the development (7.62 mAOD). The 0.1% AEP + CC event shows flooding with a very similar extent to the 0.5% AEP + CC associated with a maximum flood level of 7.60 mAOD. This level is below the proposed finished floor level of 7.62 mAOD for the development.



Figure 4-4 - Post-Development Flood Depths. 0.5% AEP. Tidal.

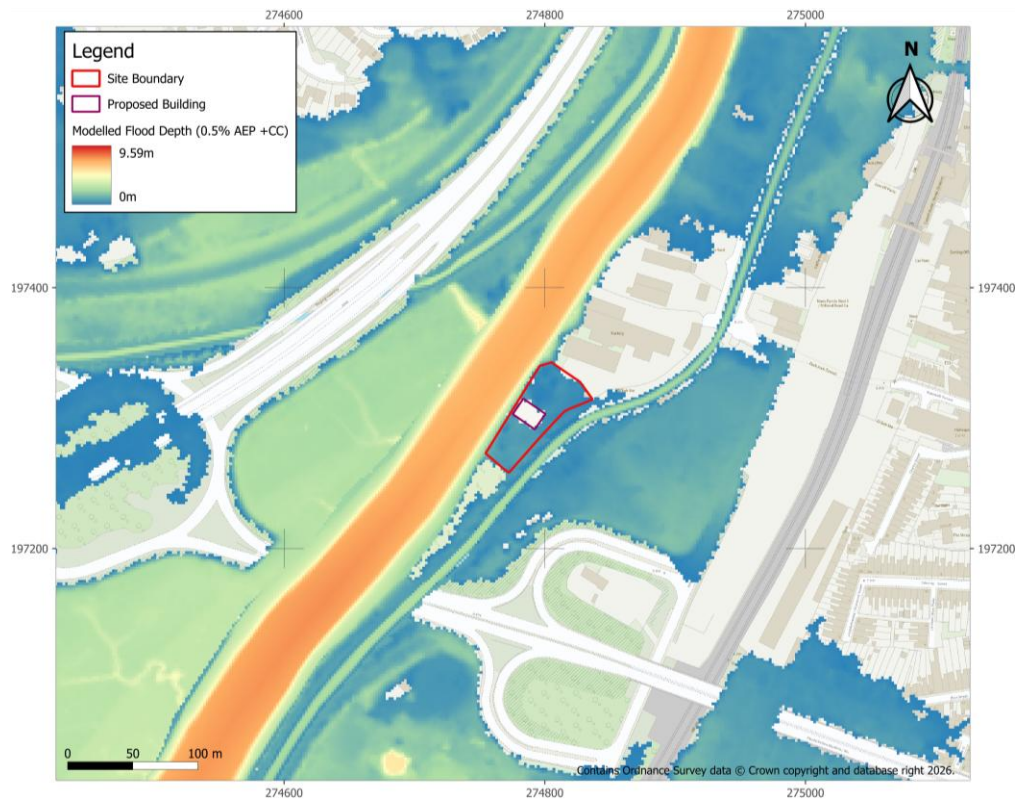


Figure 4-5 - Post-Development Flood Depths. 0.5% AEP + CC (1m). Tidal.



Figure 4-6 - Post-Development Flood Depths. 0.1% AEP. Tidal.

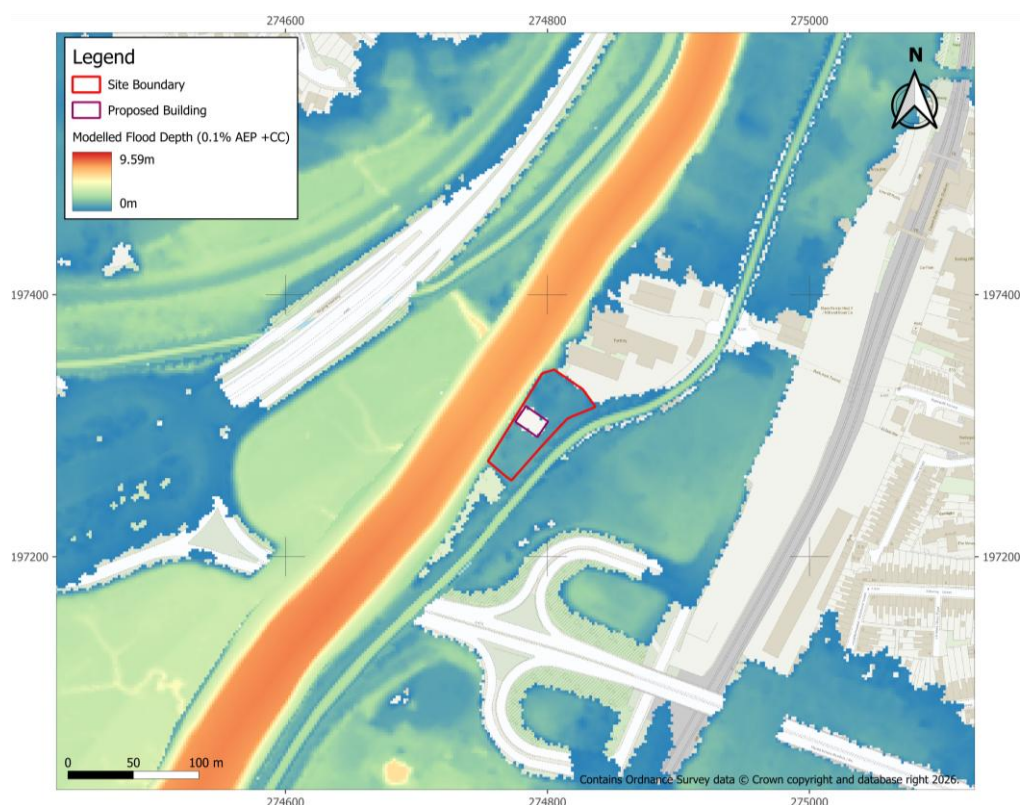


Figure 4-7 - Post-Development Flood Depths. 0.1% AEP + CC (1m). Tidal.

4.3.2 Depth Change

To assess the impact of the proposed building, depth change plots have been generated which compare the baseline to the post-development scenario. The depth change plots for the four key events; 0.5% AEP, 0.5% AEP +CC, 0.1% AEP and 0.1% AEP+CC are displayed in Figure 4-8, Figure 4-9, Figure 4-10 and Figure 4-11, respectively. All four events present a similar outcome, wherein flood levels remain very similar (<5mm) or identical to the baseline scenario on the land surrounding the site. As can be seen during all modelled events, there is a variable amount of depth change far to the west of the proposed building, centred around a bridge under the A465 (E:273786, N:197156). The depth change varies from positive to negative, without a consistent trend or area of impact, it is suspected that this is occurring due to an unstable section of structure in the model, which is amplifying the minor changes caused by the development. The investigation into this is described in in section 4.3.3.

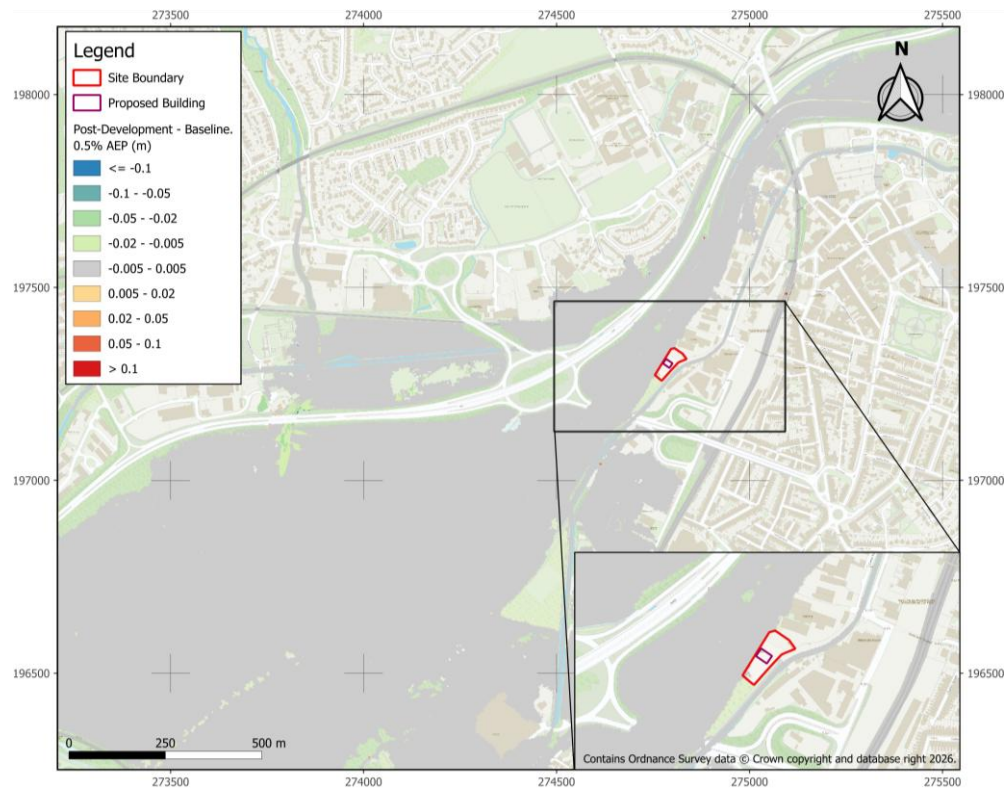


Figure 4-8 - Depth Change Plot. 0.5% AEP. Tidal.

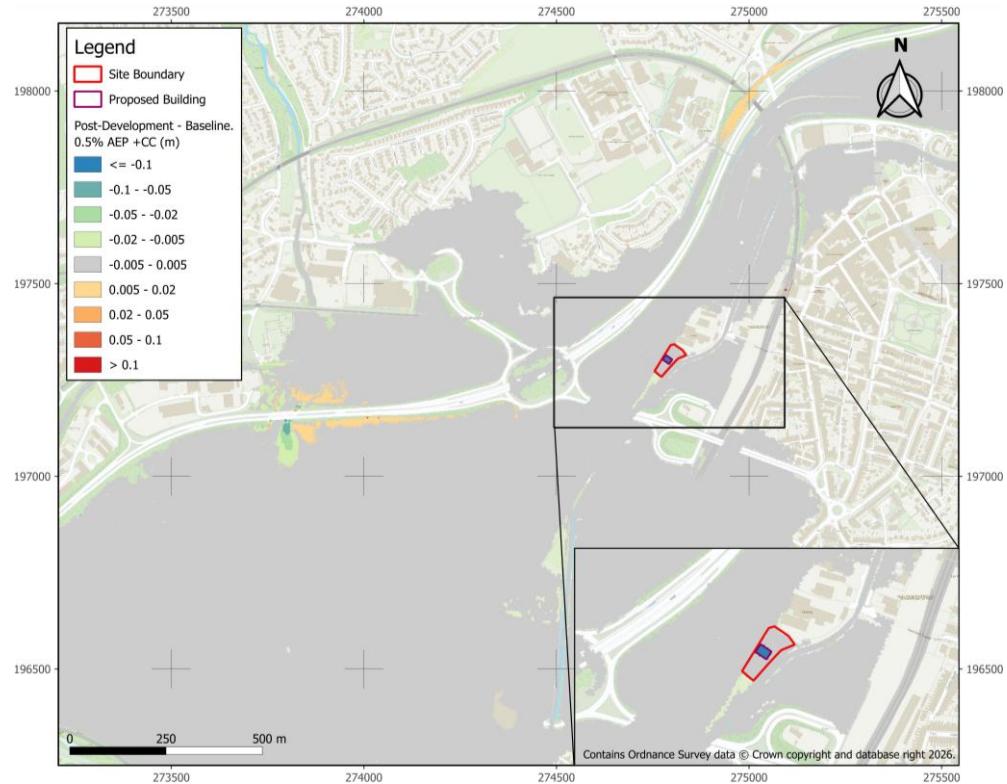


Figure 4-9 - Depth Change Plot. 0.5% AEP + CC (1m). Tidal.

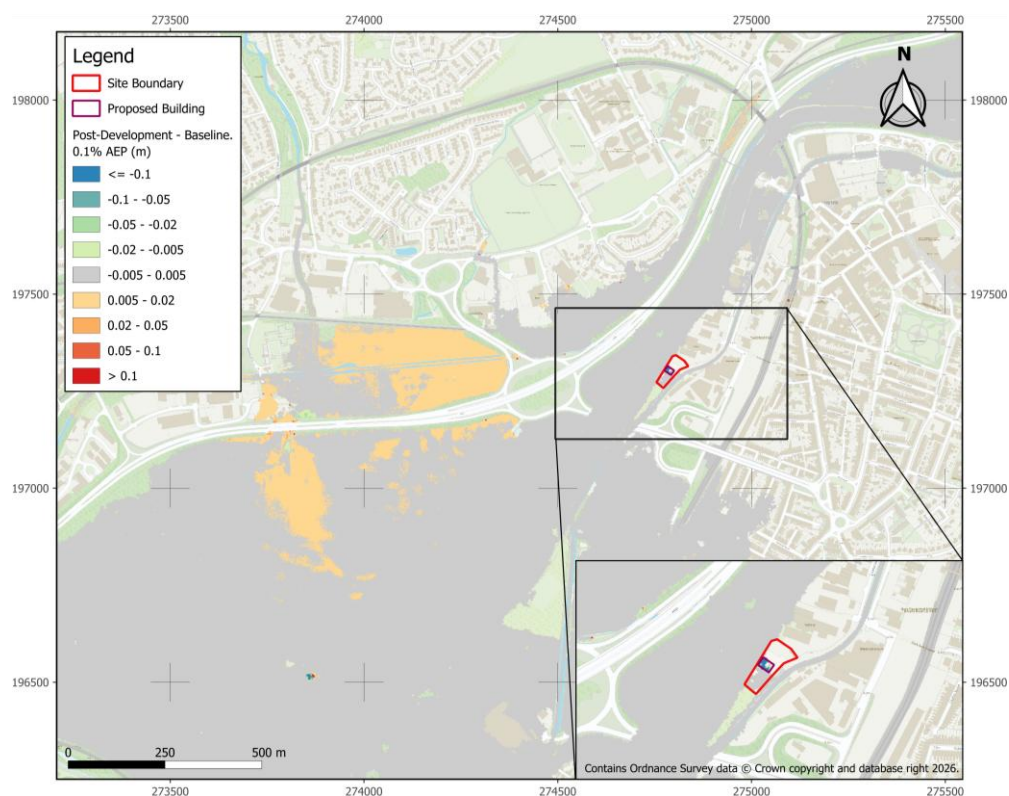


Figure 4-10 - Depth Change Plot. 0.1% AEP. Tidal.

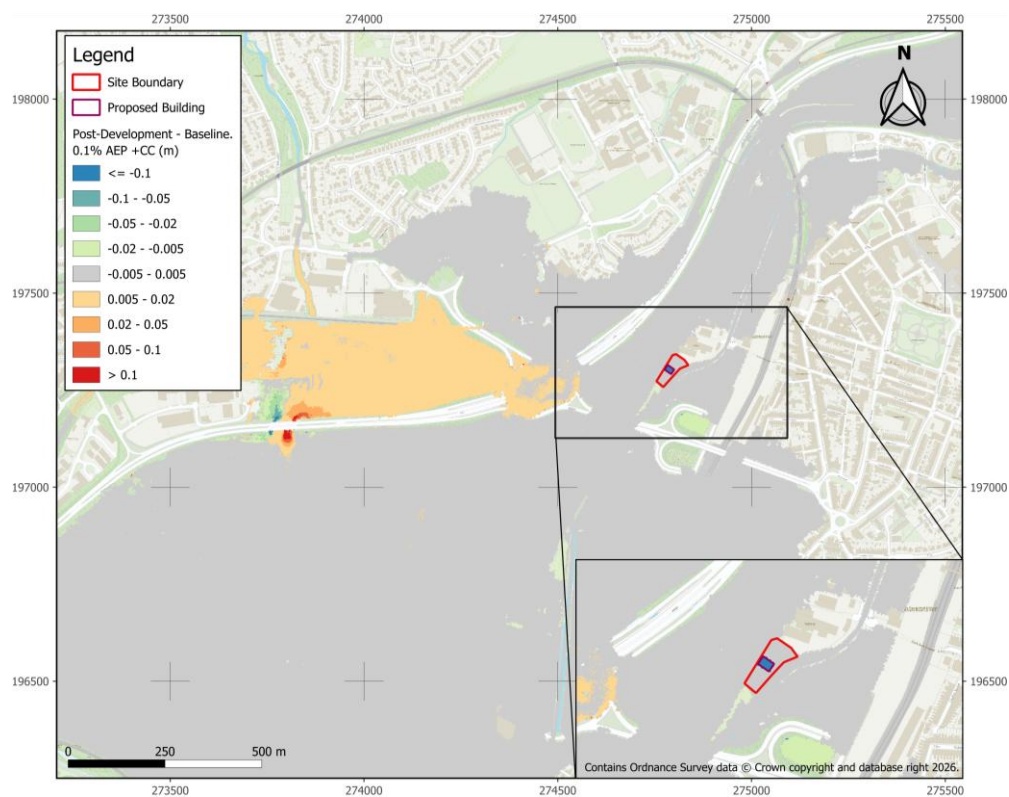


Figure 4-11 - Depth Change Plot. 0.1% AEP +CC (1m). Tidal.

4.3.3 Instability

Through the depth change analysis it was identified that detriment is present in the wider floodplain. These changes largely occur north of the A465 and not near to the site. These changes do not appear proportionate considering the size and scale of the development and because of this, the depth change was investigated further. The area north of the A465 is fairly isolated from the remainder of the floodplain, with only two entry points near the site; located at (E:274653, N:197388) and (E:273787, N:197155), these are both road bridges to allow the Tennant Canal and Clydach River to flow under the road. A series of the 1D cross-sections from the hydraulic model were investigated to understand the reason for the depth changes. Figure 4-12 illustrates the location of each selected cross-section. The reason each section was selected is as follows:

- TIDAL_02U and NCAN1187M3 were selected because they are directly adjacent to the proposed development on either side. These would be expected to be impacted the most by the development.
- Tidal_05D was selected as a node far from the site (800m), to observe whether the impacts are dissipating as they travel away from the site.
- CLYD0564B (along with BL and BR) and TCAN1495U were selected as they are the only two entries near the site, below the A465.

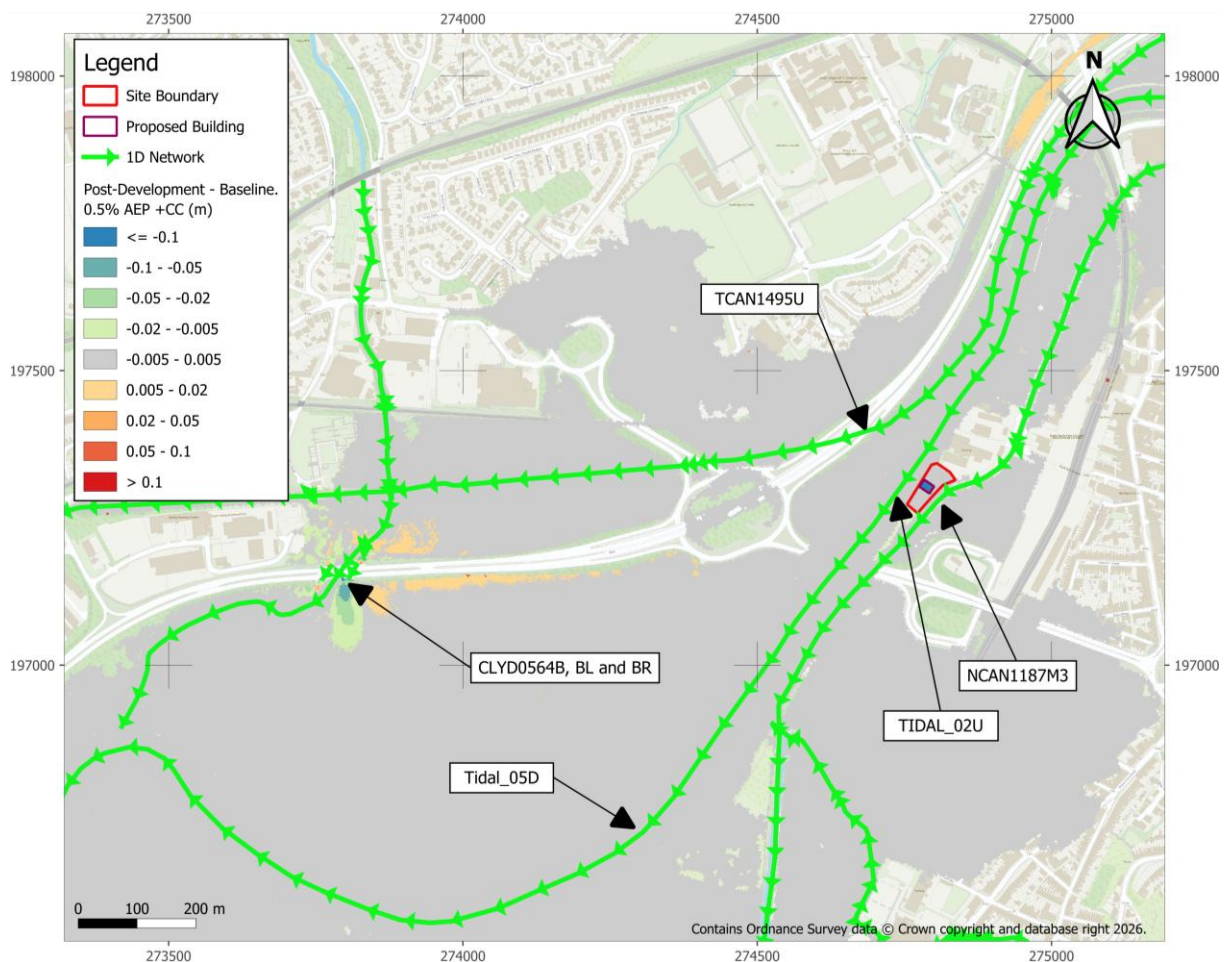


Figure 4-12 - Locations for Further Assessment. Underlain by the Wider 0.5% +CC Tidal Depth Change Plot.

Figure 4-13 below illustrates the flow modelled for the critical event (0.5% AEP +CC) at each of the chosen cross-sections, comparing the post-development with the baseline runs. The majority of the cross-sections show a negligible change in flow from baseline to post-development. The locations directly adjacent to the proposed development (Tidal_02U and NCAN1187M3) saw minimal ($<0.5\text{m}^3/\text{s}$) changes when compared to the baseline. These minor changes are reflective of the previously identified changes in peak flood level surrounding the site which were less than 5mm and near identical to the baseline for the most case.

The three cross-sections which showed notable deviations in flow from the baseline were those surrounding the CLYD0564B structure (CLYD0564B, CLYD0564BL, CLYD0564BR). In CLYD0564BL and CLYD0564BR, flow reverses on very short frequencies during the peak of the tidal event. This oscillation is present in both the baseline and post-development runs, which is indicative of poor model stability at the structures, rather than the poor stability related to the post-development runs. At CLYD0564B, flow increased by $18.5\text{m}^3/\text{s}$ during the peak and decreased by $13.8\text{m}^3/\text{s}$ when the river receded, prior to the peak. Besides model instabilities in this area, there is no other clear reason why such a small modification should cause such a dramatic difference in flow, especially when the impacted 1D node is located 1km away from the site. Furthermore, the detriment during all events is concentrated near to or north of CLYD0564B.

It has been concluded that the detriment north of the A465 should be ignored because this is a result of existing instabilities present in CLYD0564B, CLYD0564BL, CLYD0564BR which are not responding realistically to change implemented in the post-development scenario. An assessment of the 1D network and 2D domain showed that changes in flood level near to the development are negligible, and have a negligible impact on the land surrounding the site which is are considered realistic for the scale of the development.

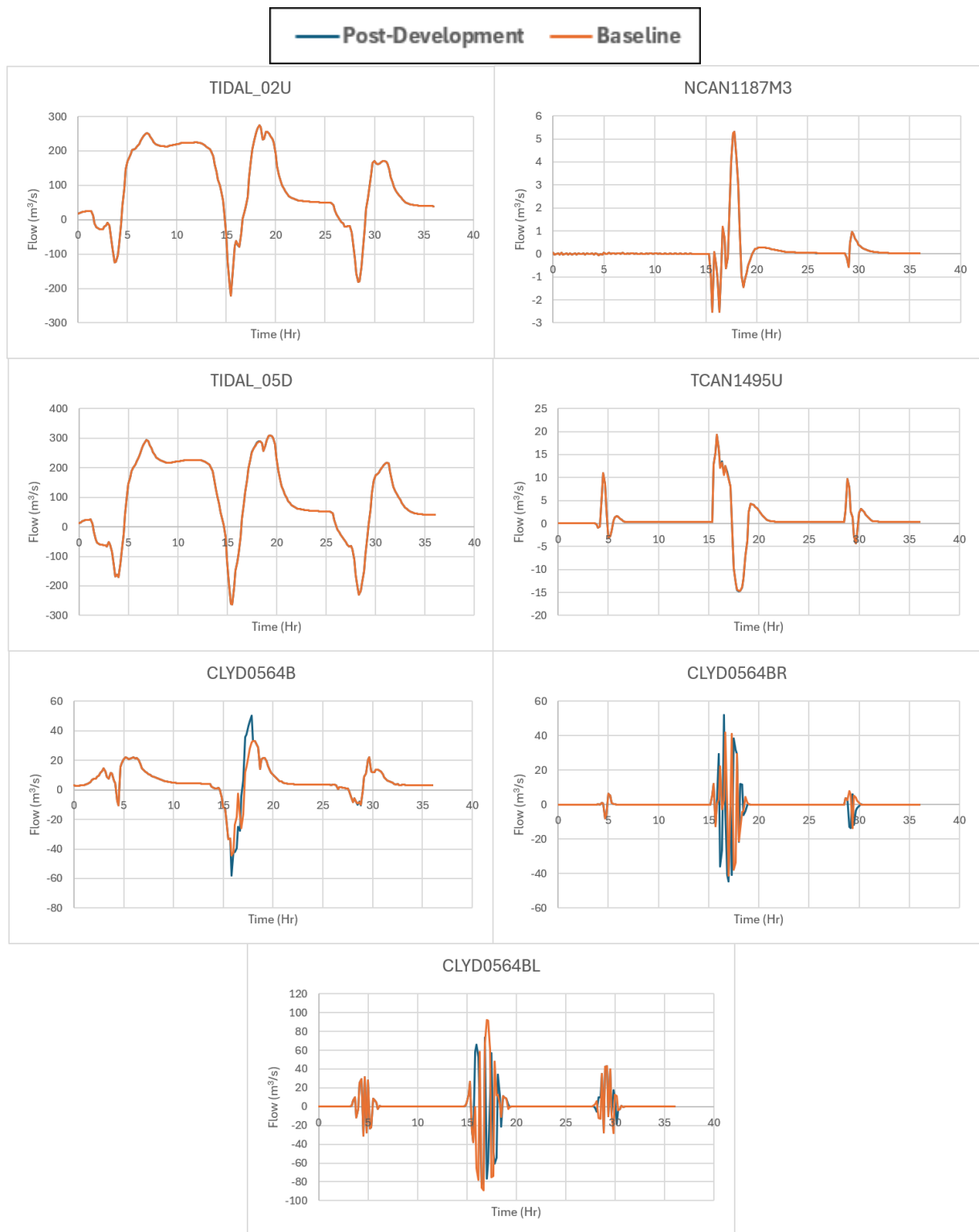


Figure 4-13 - 1D Network Graphs at each selected location.

5 Summary and Conclusion

This report has detailed the methodology used to complete the modelling assessment for Canal Side Yard. The following points summarise the modelling undertaken and the conclusions drawn from the work:

- WHS obtained product 7 data for the River Neath from NRW. The hydraulic model has been converted to HPC and minor updates have been made to the 2D domain and the tidal inflows.
- The hydraulic model has been run for the relevant design events, which are required to comply with the TAN15 guidelines.
- WHS have implemented and run a post-development scenario, raising the proposed building using a z-shape to a proposed finished floor level.
- Results from the hydraulic modelling show that the proposed building is not inundated for any event if an appropriate finished floor level is set.
- The finished floor level should be set at 7.62 mAOD. The flood level for the design event (Tidal 0.5% AEP + CC) is 7.32 mAOD, plus a 300mm freeboard to account for any uncertainties in the model.
- When comparing the baseline results to the post-development, depth changes are not observed on the land directly adjacent to the site. During all events depth change is observed centred around a bridge structure under the A465 (nodes CLYD0564B/BL/BR). These changes are attributed to model instability at the structures. Model flows through these nodes show unrealistic flow increases and rapid directional reversals, indicating instability.
- It is concluded that Figure 5 of TAN15 is satisfied because the development is flood free for the 0.5% AEP +CC tidal and 1.0% AEP +CC fluvial flood events, due to the finished floor levels.
- It is concluded that Figure 6 of TAN15 is satisfied because the finished floor level of the site is set so that no flooding occurs during the 0.1% AEP plus climate change event for fluvial or tidal flooding.
- The model shows that the development does not cause impacts outside of the site boundary (considering the mitigating circumstance of the unstable structure) and is therefore compliant with the aspects of Section 11.4 relevant to this modelling study.