Tata Steel Works, Pontarddulais - Flood Consequences Assessment

Version 1

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Contract

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This report describes work commissioned by Walters Land Limited by an instruction dated 14 December 2022. The Client's representative for the contract was Meryl Lewis.

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Contents

1 Introduction

1.1 Terms of reference

JBA Consulting (JBA) were commissioned by Walters Land Limited to undertake a Flood Consequences Assessment (FCA) for the proposed residential re-development of the former Tata Steelworks site, Pontarddulais.

1.2 FCA requirements

This FCA follows Welsh Government guidance on development and flood risk set out in Technical Advice Note 15: Development and Flood Risk (TAN-15). Where appropriate, the following aspects of flood risk should be addressed in all planning applications over their expected lifetime:

- The likely mechanisms of flooding
- The likely source of flooding
- The depths of flooding through the site
- The speed of inundation of the site
- The rate of rise of flood water through the site
- Velocities of flood water across the site
- Overland flow routes
- The effect of access and egress and infrastructure, for example, public sewer outfalls, combined sewer outflows, surface water sewers and effluent discharge pipes from wastewater treatment works
- The impacts of the development in terms of flood risk on neighbouring properties and elsewhere on the floodplain.

2 Site description

2.1 Site summary

The proposed development site is the former Tata Steelworks, Pontarddulais as shown in Figure 2-1. The site is currently brownfield consisting of several large industrial and office buildings, areas of hard standing and landscaping. The site is approximately 3.93 ha in area. The main site access is from High Street. The site is bounded by the Heart of Wales railway line to the west, High Street to the south and Woodville Street to the east.

There are two NRW Main Rivers located near the site. As shown in Figure 2-1, the tidal River Loughor flows in a southerly direction approximately 160m west of the site on the western side of the railway line. The River Dulais flows in a westerly direction through the centre of Pontarddulais approximately 270m south of the site. The River Dulais is heavily constrained through Pontarddulais, with river walls which run along the banks of the watercourse for most of the reach through Pontarddulais town before flowing into the Loughor to the south of the railway station.

Table 2-1 Site Summary

Site summary	Description
Site name	Tata Steelworks, Pontarddulais
Site area	3.93ha
Existing land use	Industrial building and car parking
Purpose of development	Residential
OS NGR	SN 93167 06176
Local Planning Authorities	Swansea Council
Lead Local Flood Authority	Swansea Council

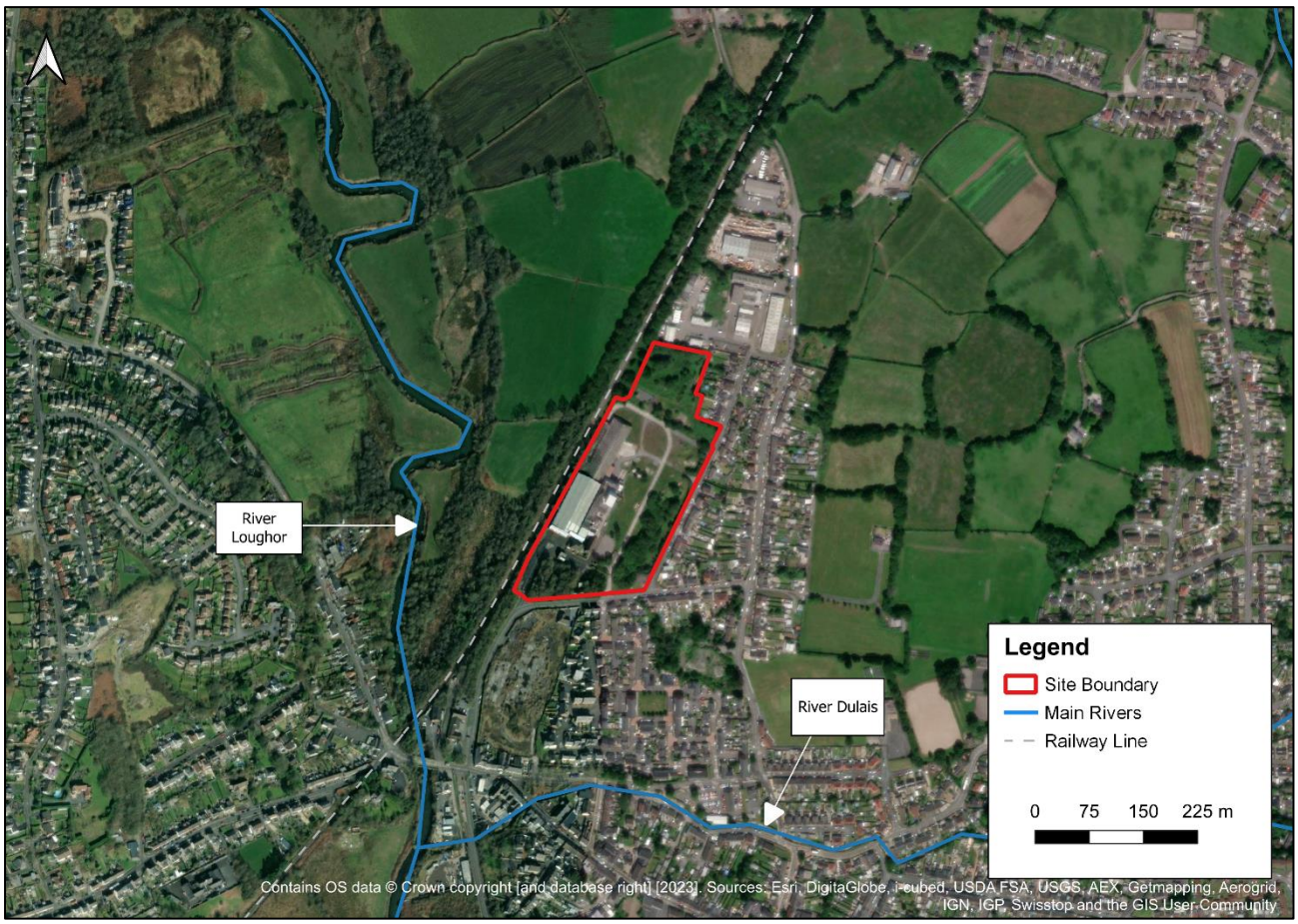


Figure 2-1: Site location

2.2 Site topography

The Natural Resources Wales (NRW) DTM Lidar DTM 1m dataset has been used in Figure 2-2 to display ground levels across the site and surrounding area. This information shows how the site generally slopes in a south westerly direction, with levels typically ranging between 13mAOD and 7mAOD.

A site-specific topographical survey was also collected for the site and is contained in Appendix A.

Lowered levels within the site boundary along the western boundary of the site are consistent with the freight railway spur connecting the works to the mainline railway.

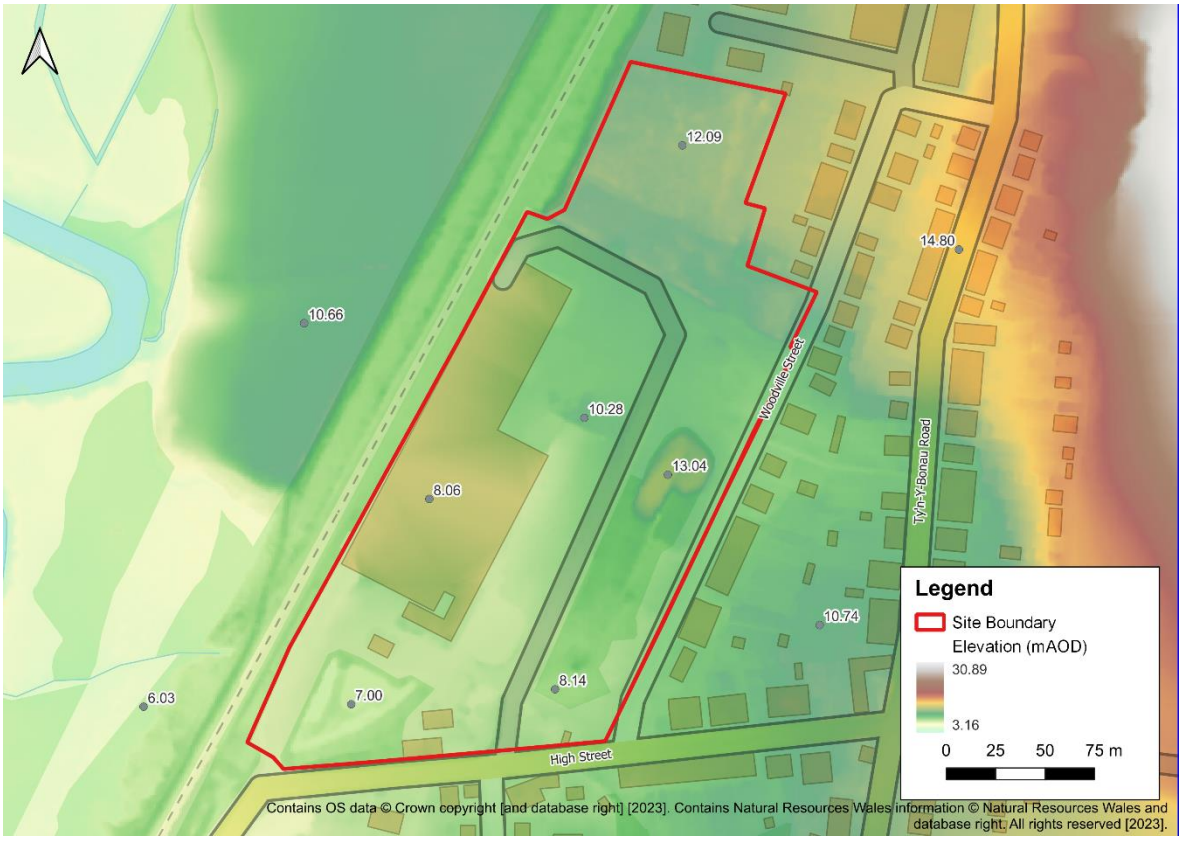


Figure 2-2 LiDAR Topographic data from NRW (1m resolution) with sample points

2.3 Soils and geology

British Geological Survey (BGS) data indicates that the site is underlain by bedrock comprised of sandstone. The superficial geology is formed of glaciofluvial deposits of Devensian sand and gravel.

The soils on site have been assessed on the Cranfield Soil and Agrifood Institute, Soilscapes viewer[1] and are shown to be freely draining slightly acid loamy soils.

2.4 Development proposal

The proposals are to redevelop the former Tata steel works site for residential development and associated infrastructure. At this outline stage, the development layout is not entirely fixed. However, aspects of layout, access, and extent of built development are fixed. Figure 2-3 shows an extract of the proposed site layout, a full version of which is contained in Appendix B.

Site access will primarily be to the south of the site, reusing the existing access on to High Street. A secondary vehicular access will be available from Woodville Street.

In order to address flood risk concerns, all residential development will be located on a development platform with a minimum ground level of 9.03mAOD. Consequently, areas

[1] Cranfield Soilscapes Viewer https://www.landis.org.uk/soilscapes/

within the southern section of the development platform will be raised above existing ground levels, although many areas to the northern end of the site are already above this level.

Figure 2-3 Site layout (extract)

3 Planning policy and flood risk

3.1 Planning context

Planning Policy Wales (PPW) sets out the land use planning policies of the Welsh Government. It is supplemented by a series of Technical Advice Notes (TANs), Welsh Government Circulars, and policy clarification letters, which together with PPW provide the national planning policy framework for Wales. These policies have the aim that all development in Wales is sustainable and improve the social, economic, environmental, and cultural wellbeing of Wales as set out in the Wellbeing of Future Generations Act 2015.

Technical Advice Note 15 (TAN-15), introduced by the Welsh Government in 2004, provides technical guidance relating to development planning and flood risk in Wales. The initial requirements of TAN-15 are to identify the vulnerability classification(s) and flood zones relevant to the proposed development, and to apply this information to the application of the justification tests.

An update for TAN-15 was released in October 2021 and was due to come in force on the 1st December 2021. However, Welsh Government have since suspended the implementation of the new TAN-15. Although the new TAN-15 is not yet a material consideration, Welsh Government and NRW advise that consideration is given to the draft Flood Map for Planning (FMfP) as best available information. Therefore, where a site is located in a FMfP flood risk zone it is recommended that an FCA is carried out.

As a result of the above, both the DAM and the FMfP are considered as part of this FCA, although only the policies of the existing TAN15 have been considered.

3.2 Vulnerability classification

TAN-15 assigns one of three flood risk vulnerability classifications to a development, as shown in Table 3-1. The proposed development is for residential use. Consequently, the development is classified as highly vulnerable development.

Table 3-1: Development categories defined by TAN-15

Development Category	Types
Emergency services	Hospitals, ambulance stations, fire stations, police stations, coastguard stations, command centres, emergency depots and buildings used to provide emergency shelter in time of flood.
Highly vulnerable development	**All residential premises** (including hotels and caravan parks), public buildings, (e.g. schools, libraries, leisure centres), especially vulnerable industrial development (e.g. power stations, chemical plants, incinerators), and waste disposal sites.
Less vulnerable development	General industrial, employment, commercial and retail development, transport and utilities infrastructure, car parks,

Development Category	Types
	mineral extraction sites and associated processing facilities, excluding waste disposal sites.

3.3 Development Advice Map (DAM)

DAM zone classification is used to trigger different planning actions based on a precautionary assessment of flood risk.

Figure 3-1 shows that the proposed development is located in DAM Zone C1. Zone C1 is described as “areas of the floodplain served by significant infrastructure, including flood defences”.

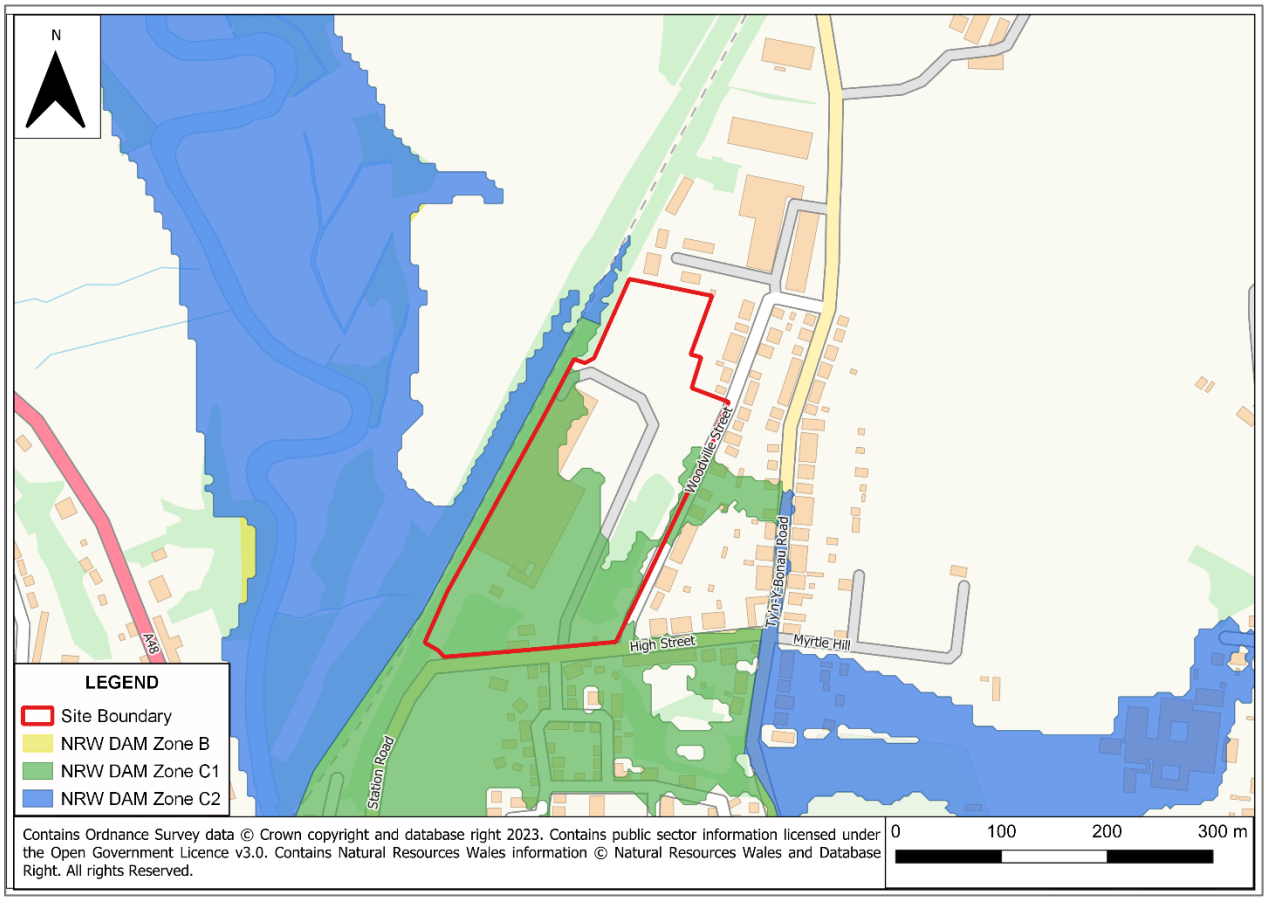


Figure 3-1 Development Advice Map

3.4 Justification test

Highly vulnerable development within Zone C1 is subject to the application the Justification Test (TAN15 Section 6). The justification criteria are reproduced below. As aspects of the Justification Tests should be satisfied for development to comply with the requirements of TAN15. Table 3-2 summaries how the proposed development complies with these tests.

Development should be located only in an area of flood risk which is developed and served by significant infrastructure, including flood defences (Zone C1 of the DAM) **AND**

Its location is necessary to assist a local authority regeneration initiative or strategy, or contribute to key employment objectives, necessary to sustain an existing settlement or region **AND**

The site meets the definition of previously developed land (i.e. it is not a Greenfield site) and concurs with the aims of Planning Policy Wales (i.e. the presumption in favour of sustainable development). **AND**

A Flood Consequence Assessment has been produced to demonstrate that the potential consequences of a flood event up to the extreme flood event (1 in 1000 chance of occurring in any year) have been considered and meet the criteria below in order to be considered acceptable.

Table 3-2 Justification Test applied to the proposed development

TAN-15 Justification Criteria	Comments	Achieved
Its location is necessary to assist a local authority regeneration initiative or strategy or contribute to key employment objectives, necessary to sustain an existing settlement or region	The site is designated for residential development within the Swansea Local Development Plan (LDP)	✓
The site meets the definition of previously developed land and concurs with the aims of Planning Policy Wales (i.e. the presumption in favour of sustainable development)	The proposed development site is a former steelworks. The site therefore meets the criteria of previously developed land.	✓
A Flood Consequence Assessment has been produced to demonstrate that the potential consequences of a flood event up to the extreme flood event (1 in 1000 chance of occurring in any year) have been considered and meet the criteria below in order to be considered acceptable	An assessment of the flood consequences at the site has demonstrated the acceptability of the development. Refer to Section 4 & 5.	✓

3.5 Local Development Plan

The Local Development Plan (LDP) is a land-use document in which the council sets out its land use development over a 15-year period. The current LDP for Swansea was adopted in 2019 and provides a framework to guide future development and set out where, when, and how new development can take place within the plan period (2010-2025). The proposed development is an allocated LDP Strategic Housing Policy Zone.

3.6 Flood Map for Planning Classifications (FMfP)

The new TAN-15 will replace the DAM with the Flood Map for Planning (FMfP). Whilst the new TAN-15 is not a material consideration until implemented, it does illustrate the current

policy thinking of Welsh Government and in some cases the FMfP may constitute best available information. Consequently, information on the FMfP is provided for information only.

3.6.1 Flood Map for Planning- Rivers

Figure 3-2 shows that a significant portion of the site is located within Flood Zone 3 of the Flood Map for Planning for Rivers. Flooding is predicted to affect the South/Southwest areas of the site. Flood Zone 3 represents areas which have a greater than a 1% Annual Exceedance Probability (AEP) chance of flooding in a given year, including climate change.

Further areas of the site are located within Flood Zone 2 of the Flood Map for Planning for Rivers. Flood Zone 2 represents areas which have a less than 1% AEP chance of flooding but a greater than a 0.1% AEP chance of flooding in a given year, including climate change.

All areas of the site within Flood Zones 2 and 3 are also within a TAN15 defended zone (for rivers). Defended Zones identify areas that benefit from Risk Management Authority flood defences with the minimum Standard of Protection of 1 in 100 year (present day) for rivers and 1 in 200 year (present day) for the sea.

Within Pontarddulais, there are flood defence walls located on the bank of River Loughor near to the site of interest at the railway station. There are also formal flood defence walls located on the Camffrwd watercourse and there is a flood storage reservoir located on the River Dulais.

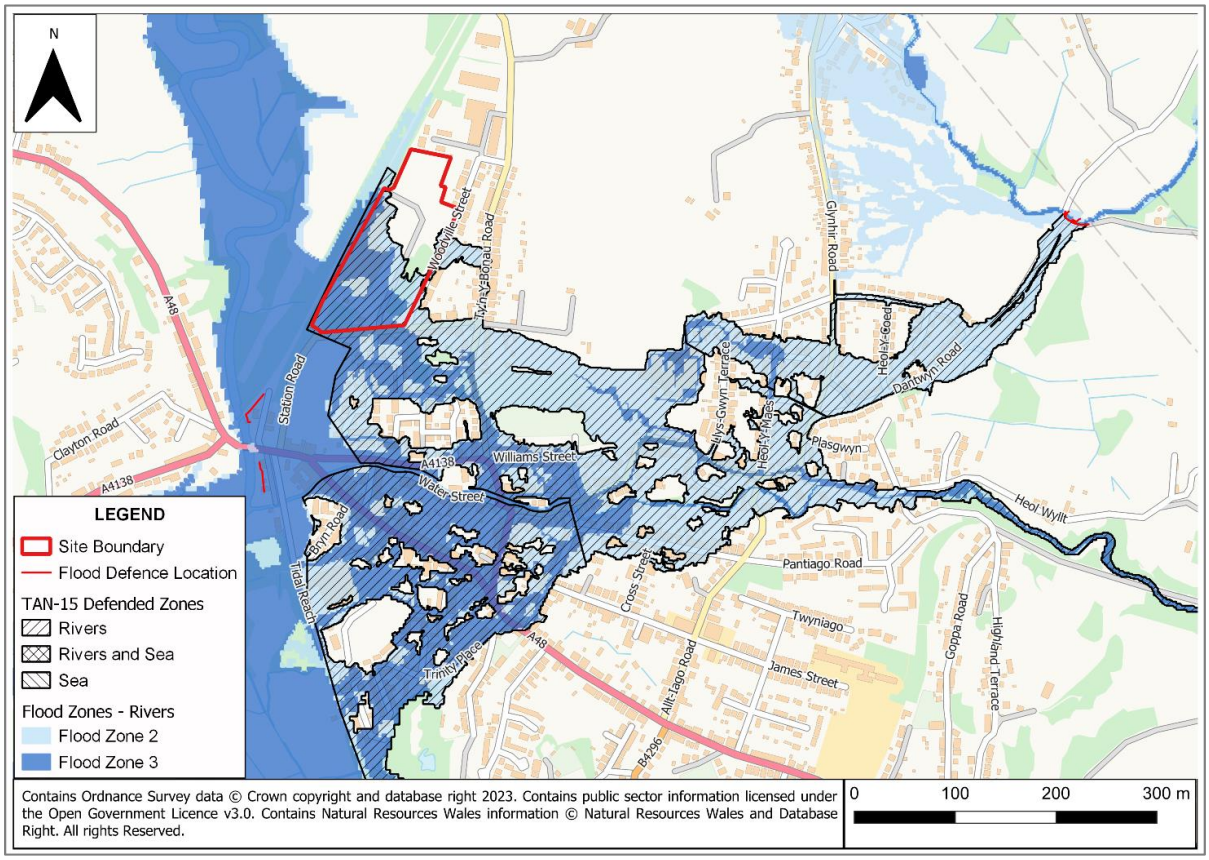


Figure 3-2 Flood Map for Planning – Rivers

The site is not at risk of tidal flooding as indicated by the Flood Map for Planning - Sea. Consequently, due to the absence of tidal flood risk, including allowance for climate change, the flood risk from the sea has not been mapped and will not be further assessed.

3.6.2 Flood Map for Planning- Surface Water and small watercourses

Figure 3-3 shows a surface water flow route in the southern half of the site. The flow route is shown both from Woodville Street and from the southeast, representative of a smaller watercourse to the east of Dantwyn Road which historically flowed in a westerly direction towards the Station prior to the creation of the Clayton Works (now Clayton Drive)[2].

These flow routes align with culverted watercourses and significant drainage infrastructure in the area, which will not be accounted for in the generalised flood modelling.

The ponded surface water flooding shown in the south of the site is representative of an existing pond within the site boundary but outside of the proposed development platform area.

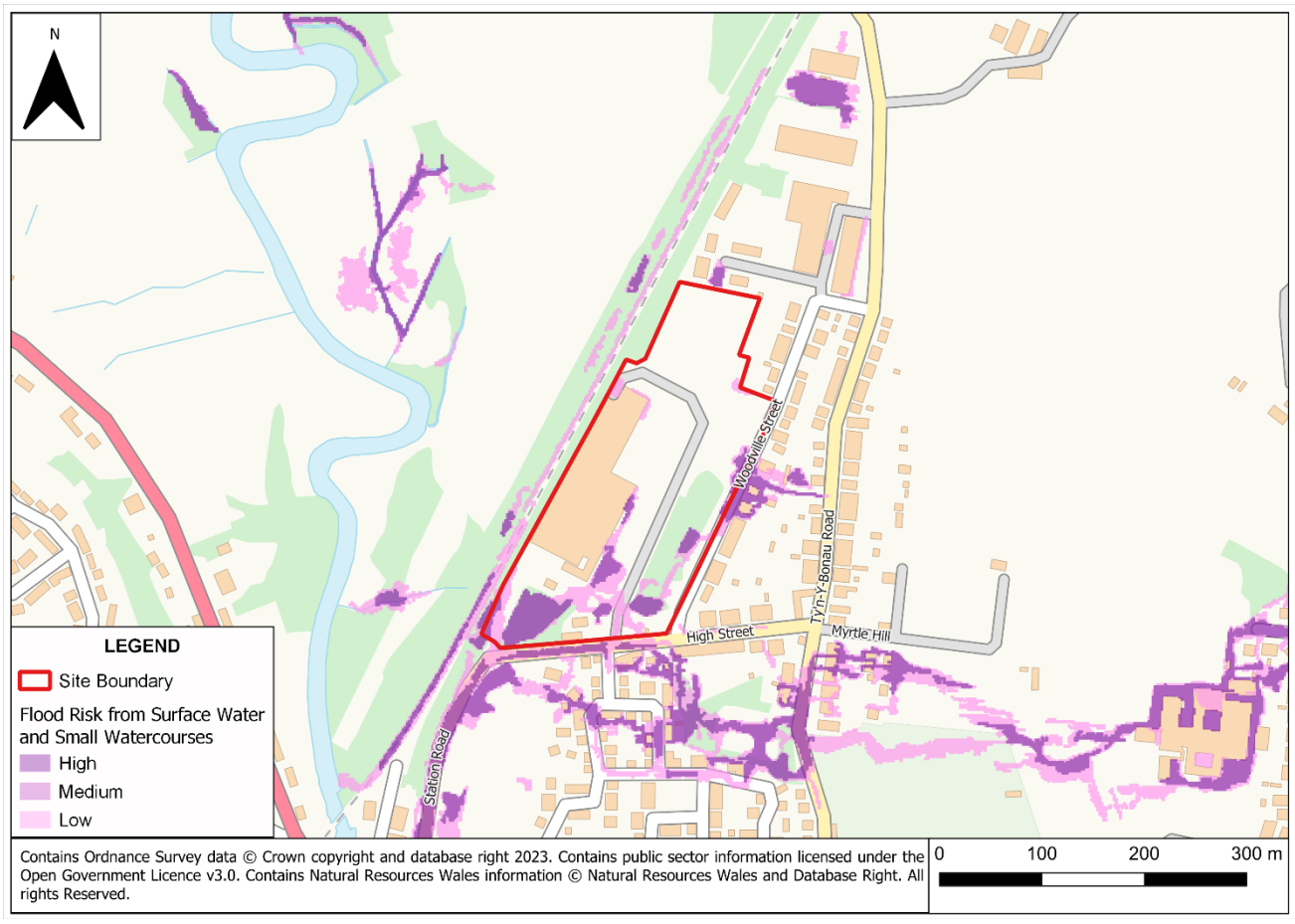


Figure 3-3 - Flood Map for Planning- Surface Water and Small Watercourses

[2] https://maps.nls.uk/

4 Flood risk assessment

This section assesses the risk to the proposed development from all sources of flooding, based solely on a desk-based analysis of existing publicly available flood risk data.

4.1 Review of existing flood data

The latest available information on flood risk at the site, published by Natural Resources Wales, is summarised in Table 4-1.

Table 4-1 Summary of flood risk

Source of flooding	Onsite Presence	Description
Flood Risk from Rivers	✓	The site is at risk of river flooding according to the NRW Flood Map for Planning. However, the site is within a TAN15 Defended Zone for rivers and therefore categorised as at low flood risk according to NRW's Flood Risk Assessment Wales mapping.
Flood Risk from the Sea	×	The site is not at risk of tidal flooding, including with an allowance for climate change over the lifetime of development.
Flood Risk from Surface Water and Small Watercourses	✓	Areas of the site is at high risk of surface water flooding.
Flood Risk from Groundwater	✓	The site is at moderate risk of flooding from groundwater. Generalised modelling of the groundwater risk suggests that the area will experience groundwater levels close to the surface, which indicates a potential for groundwater flooding.
Flood Risk from Reservoirs	×	The site is not at risk of flooding from reservoirs.
Flood Risk from Sewers	×	There is no evidence of flooding from sewers.

4.2 Historical flooding

NRW’s map of recorded flood extents does not show any evidence of historic flooding at the site and no records of historic flooding at the site are identified in Swansea Council's historic flooding map.

Historic flooding was recorded at the nearby River Loughor in 1979[3]. Furthermore, NRW analysis showed that the upstream water storage scheme at Pontarddulais Dam prevented flooding on 19 October 2021[4].

4.3 Flood risk from rivers

NRW's Flood Risk Assessment Wales (FRAW) flood mapping indicates that the south/ southwest areas of site are located within the **low risk** area of flooding from rivers, as shown in Figure 4-1. All areas of low risk are located in an Area Benefitting from Flood Defences. The north/northeast areas of the site are not at risk of flooding from rivers.

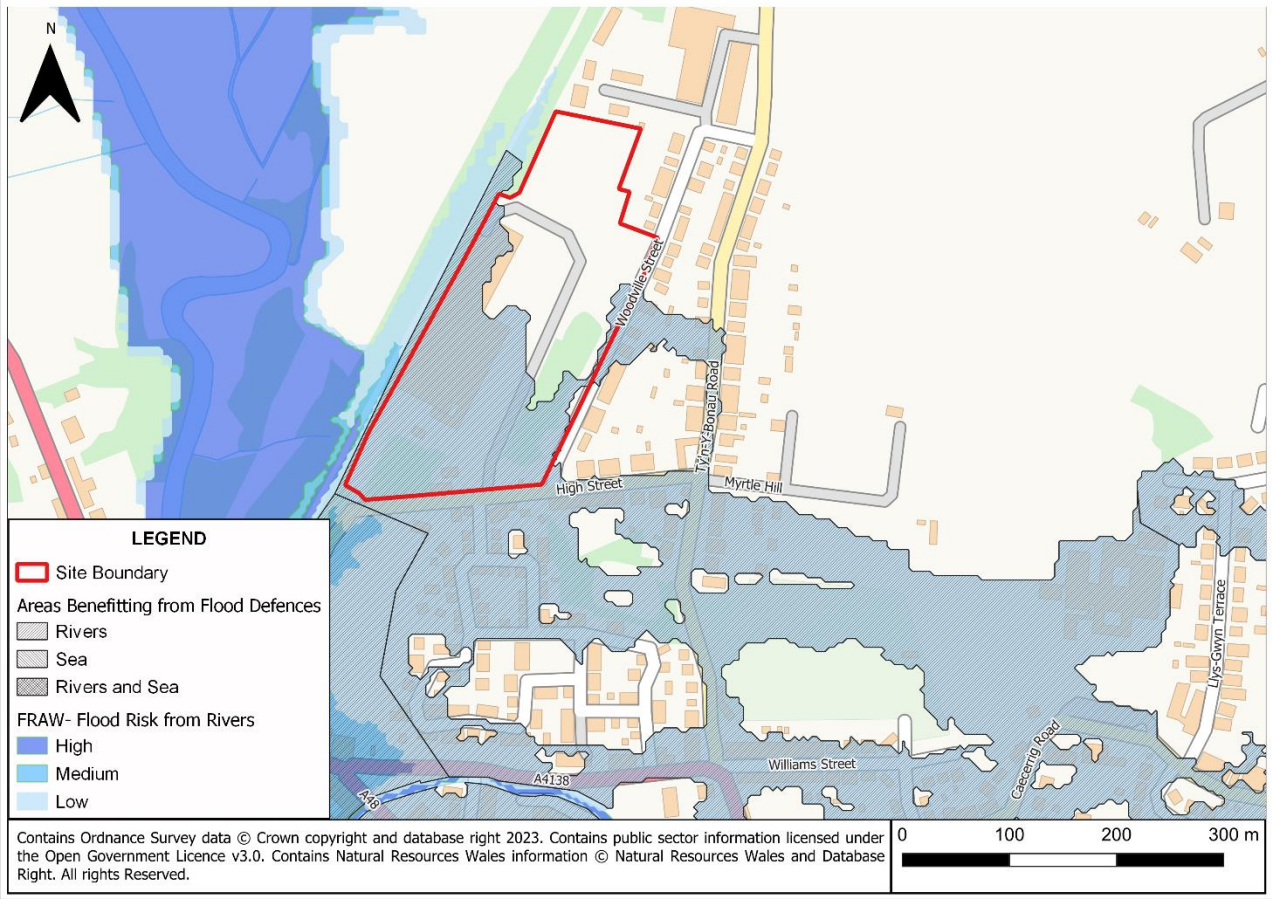


Figure 4-1 FRAW map – risk of flooding from rivers

4.4 Flood risk from the sea

The NRW FRAW Flood Risk from the Sea mapping shows that the site is **not at risk** of tidal flooding.

[3] NRW recorded flood extents. Available at: https://naturalresources.wales/flooding/managing-flood-risk/flood-risk-map-guidance/recorded-flood-extents/?lang=en

[4] Natural Resources Wales / Upstream storage scheme prevents flooding at Pontarddulais

4.5 Flood risk from surface water and small watercourses

The NRW FRAW Flood Risk from Surface Water and Small Watercourse map, shown in Figure 4-2, indicates that around 10% of the site is at **high risk** of surface water flooding. Further, limited areas, are at **low risk** of surface water flooding.

As previously discussed in Section 3.6.2, surface water and small watercourse flooding is likely to be overestimated within the area because the modelling does not account adequately for the culverted watercourses and drainage infrastructure in the area. What flooding is predicted in generally located away from the proposed residential areas and otherwise manageable through good site design and the appropriate application of sustainable drainage systems (SUDS).

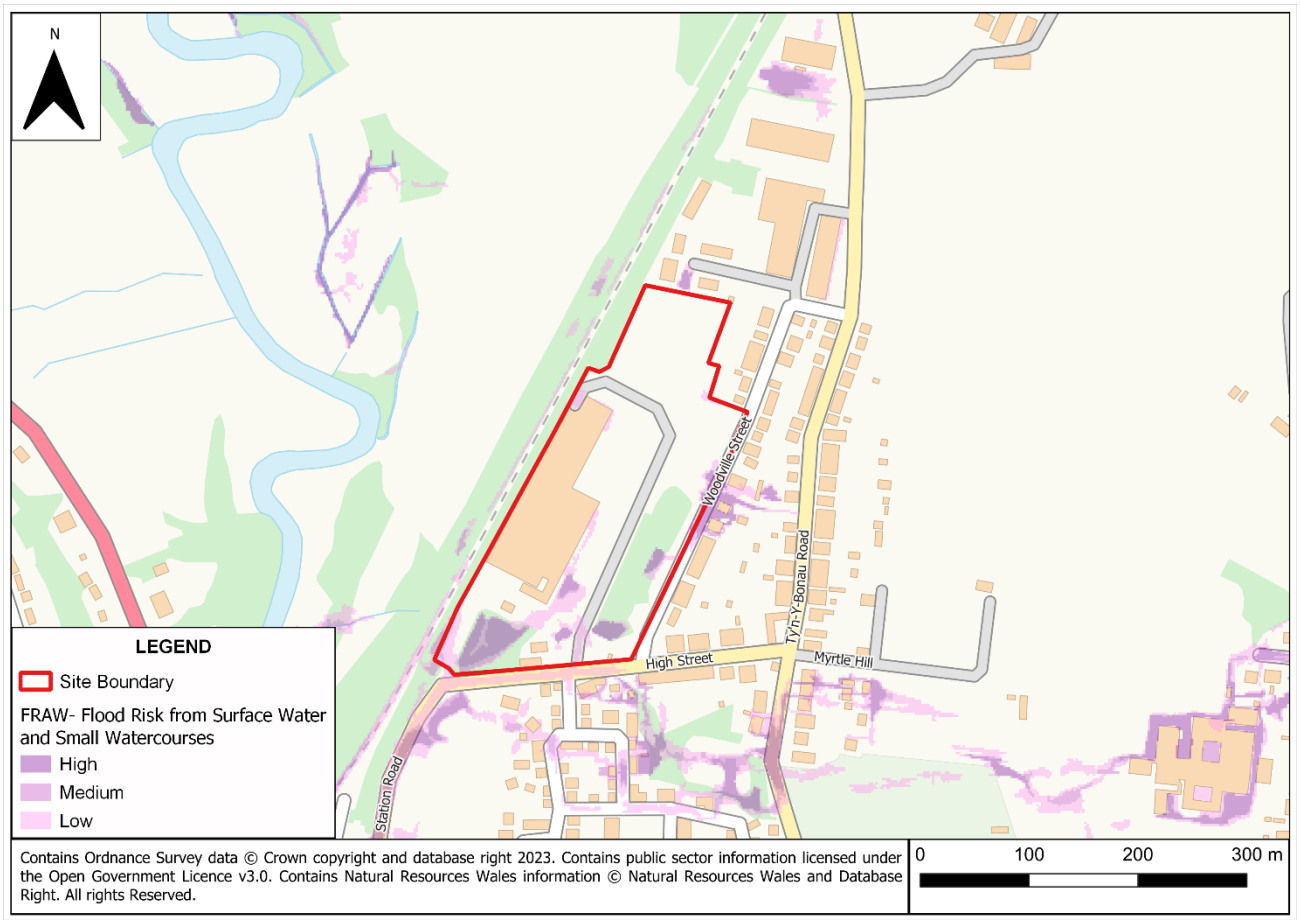


Figure 4-2 FRAW map - Risk of flooding from surface water and small watercourses

4.6 Flood risk from groundwater

Groundwater flooding is caused by unusually high groundwater levels. It occurs as excess water emerges at the ground surface or within manmade structures such as basements. Groundwater flooding tends to be more persistent than surface water flooding, in some cases lasting for weeks or months. This risk of groundwater flooding depends on the nature of the geological strata underlying the site and the local topography.

The South West Wales SFCA shows that groundwater levels are within 0.025m of the surface in this area, most likely due to the presence of superficial deposits in the area. The

site and surrounding areas have also been subject to mining, which can make groundwater flooding more likely due to the construction of preferential flow paths within the bedrock. That said, groundwater flooding is exceptional rare in South Wales and there is no known history or evidence of groundwater flooding at the site. The development site is therefore considered to have a **moderate risk** of groundwater flooding. The risk of groundwater flood should therefore be further considered in the geotechnical appraisal of the site.

4.7 Flood risk from reservoirs

NRW flood maps indicate that the proposed development site is not at risk of flooding due to reservoir failure. It can therefore be concluded that the risk of reservoir flooding at the site is **very low.**

4.8 Flood risk from sewers

There is no evidence of historic sewer flooding on or close to the site and it can therefore be concluded that the risk of sewer flooding at the site is **low**.

5 Detailed flood risk assessment

The following section sets out the detailed assessment of fluvial flood risk which is considered the primary source of flood risk to the site. This section also includes an appraisal of tidal flood risk. These assessments are based on a detailed flood modelling.

5.1 Detailed flood modelling

The hydraulic and hydrological model used to inform this assessment was originally developed by JBA Consulting for Natural Resources Wales (NRW) in 2018. This is a 1D-2D ESTRY-TUFLOW model of the River Loughor, Dulais and Camffrwd watercourses developed to provide an improved understanding of both fluvial and tidal flood risk in Pontarddulais and produce new flood mapping outputs.

5.2 Hydraulic model update

A review of the existing NRW model was completed which concluded that the model is fundamentally suitable to inform the site specific FCA. However, the following updates have been made to make best use of the latest available data and align with current best practice. A detailed overview of the flood modelling study can be found in the modelling technical in Appendix C.

- The model has been updated to use TUFLOW executable 2023-03-AB, which is the latest available release of the software.
- The 2D-2D boundary condition that links the two 2D model domains has been updated by extending its length along the railway line located adjacent to the site. This was completed due to early testing of the model that considered the 0.1% AEP plus climate change event which was found to flood a greater portion of the railway. However, this event is no longer required as part of this assessment and this change will have no bearing on the findings of the FCA.
- A topographical survey was collected by Alpine Land surveyors Ltd in March 2023 and this data has been used to provide an improved representation of the site topography. This has been converted into an Ascii Digital Terrain Model (DTM) to be read directly into TUFLOW.
- The existing building floor levels weren't represented very well in the triangulation process used to derive the site DTM mentioned above. Therefore, the building floor levels have been stamped into the model using a series of 2D zshape features.
- The tidal boundary conditions have been updated to reflect the changes to the Coastal Flood Boundary dataset and the latest Welsh Government climate change guidance. Given the development proposals consists of residential development, 100-years of sea level rise has been considered using the latest sea level rise projections from the UKCP18 use interface. The 2018 model

incorporated a tidal prism uplift to the tidal boundary conditions which has been retained for this study.

5.3 Pre-development flood model results

This section provides a detailed summary of the flood risk to the site in the baseline scenario looking at both the 1% AEP plus climate change and 0.1% AEP fluvial events. This section also includes a section to assess the tidal flood risk to the site.

5.3.1 1% AEP plus climate change fluvial event

Figure 5-1 shows the modelled flood depths for the 1% AEP plus climate change baseline scenario. In this event, flooding is expected to encroach into the site boundary with the highest depths exhibited in the southern portion of the site.

Floodwater impacts the site due to a combination of overland flow from the River Loughor and the River Dulais. The majority of the site experiences less than 600mm depth of flooding, except for the pond feature located in the southern end of the site. Flooding occurs along High Street which is the primary vehicular access to the site. Woodville street located along the eastern boundary of the site remains flood free in this event.

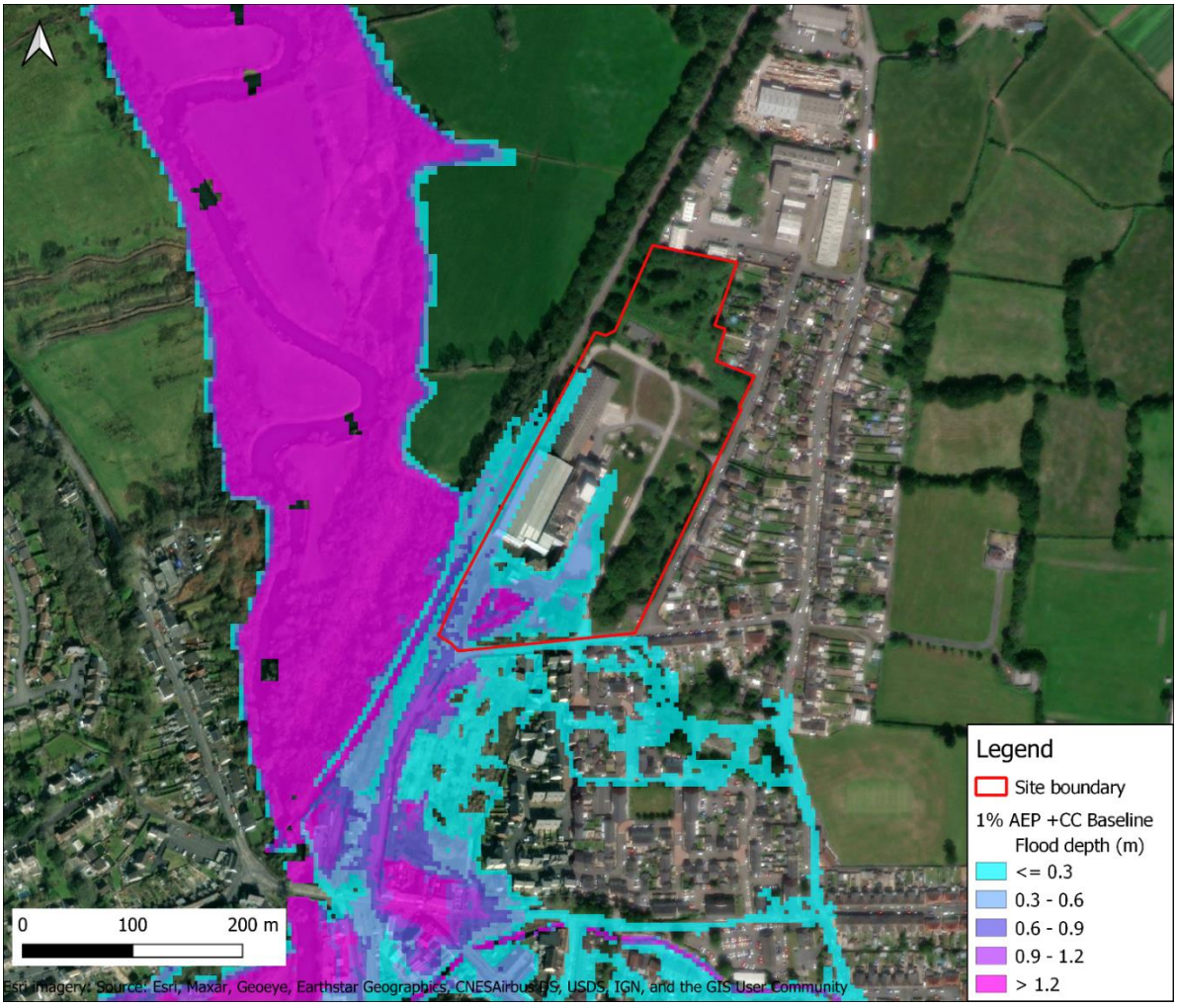


Figure 5-1: 1% AEP plus climate change fluvial event flood depths

5.3.2 0.1% AEP fluvial event

Figure 5-2 shows the modelled flood depths for the 0.1% AEP fluvial event for the baseline model scenario. The flood extent and flood depth increase in comparison to the 1% AEP plus climate change event as expected, but the flood mechanisms from the River Loughor and River Dulais remain the same.

Within the site boundary, the model results exhibit a maximum flood depth of 1.15m, which increases to 1.98m within the pond feature in the southern end of the site.

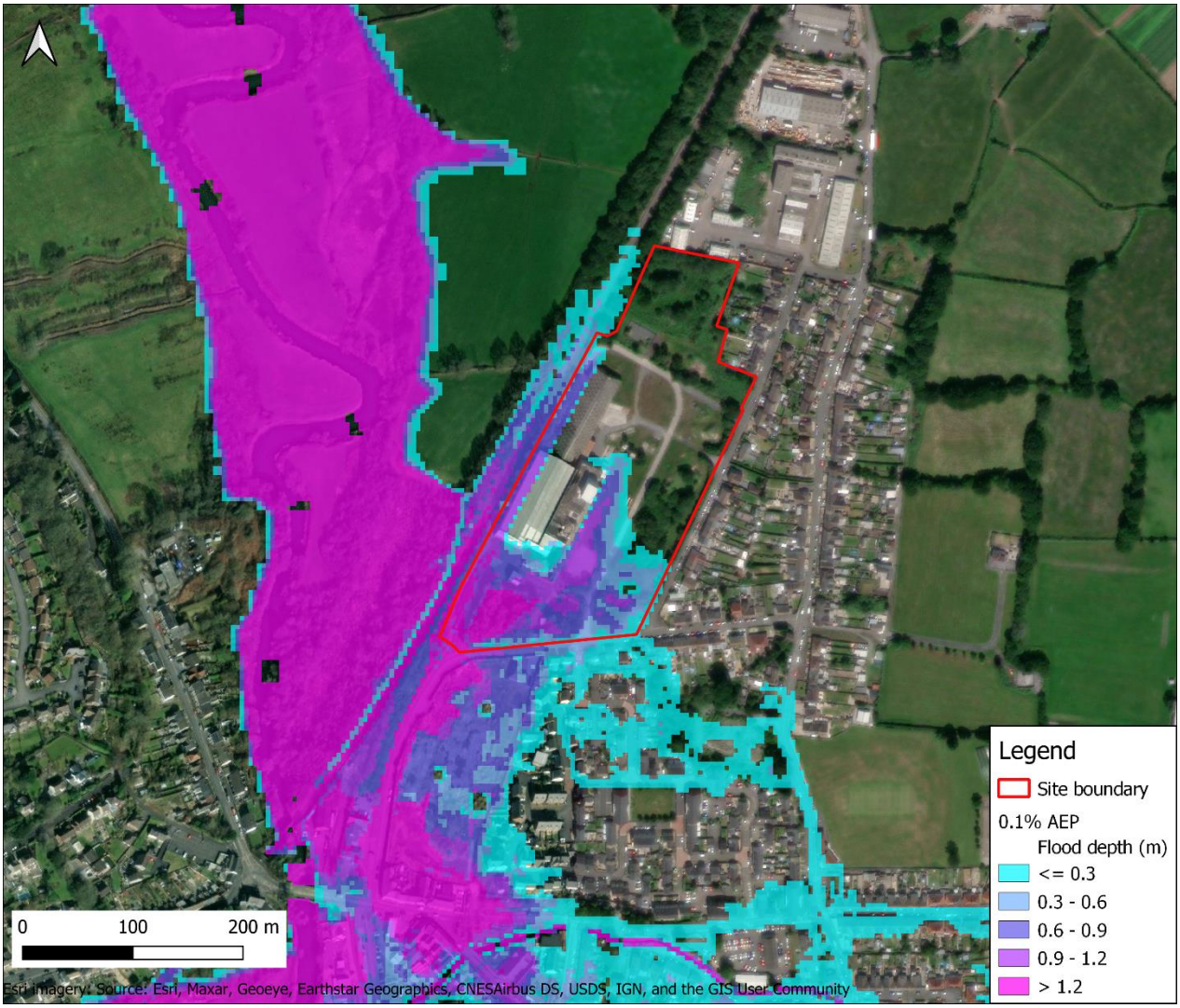


Figure 5-2: 0.1% AEP fluvial event flood depths

5.3.3 0.1% AEP 2123 tidal event

The Pontarddulais model assesses the risk from both fluvial and tidal sources and therefore the model has been re-run for the 0.1% AEP event plus 100-years of climate change for the tidal scenario. This has been completed to confirm the evidence of the flood map for planning which shows no flooding from the sea.

Figure 5-3 shows the modelled flood depths of the 0.1% AEP event plus climate change tidal design event which demonstrates that the site is not at risk of tidal flooding. Given the

site is flood free in the largest tidal design event simulation, no further tidal simulations have been undertaken.

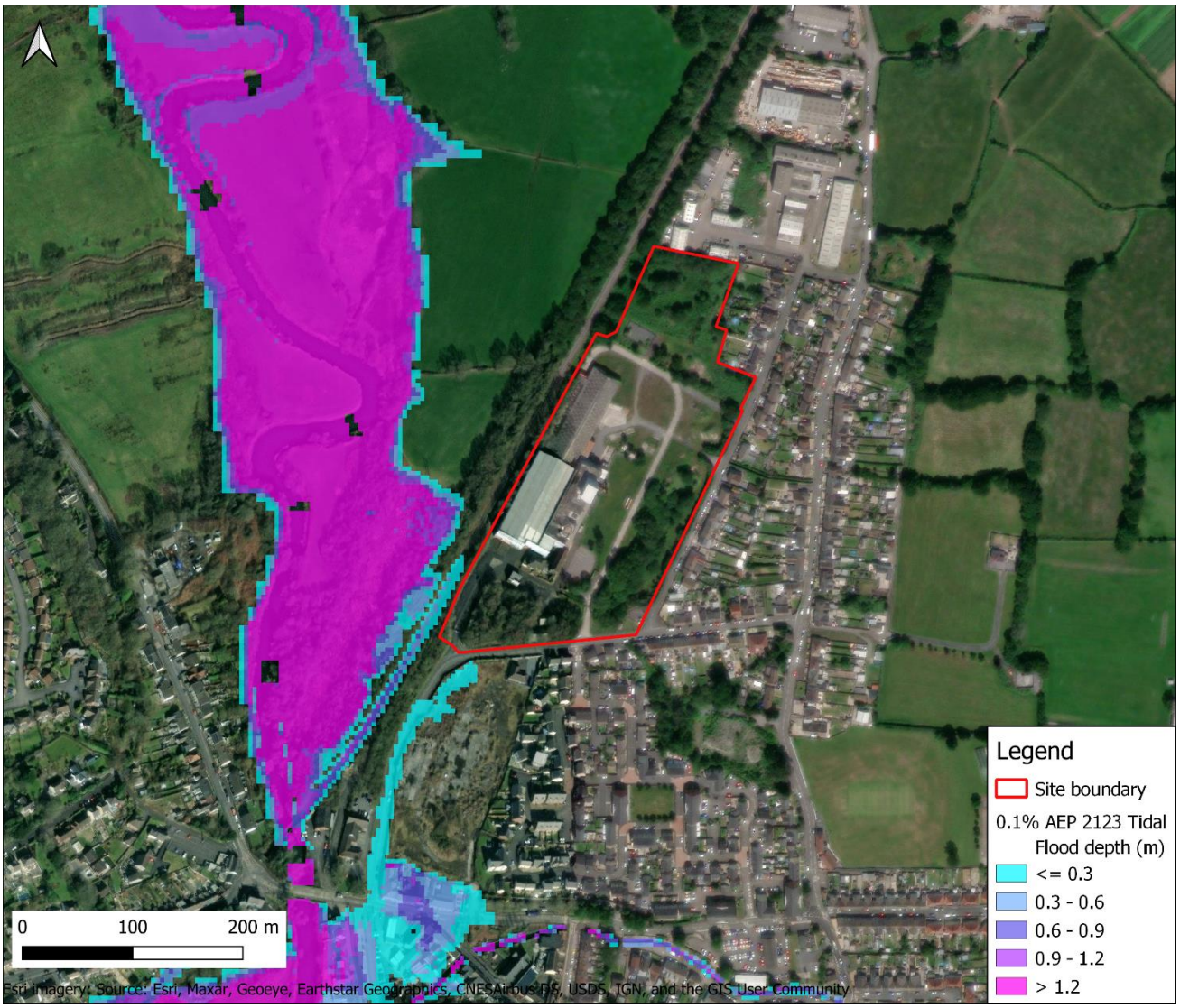


Figure 5-3: 0.1% AEP 2123 Tidal flood depth

5.4 Post-development model results

This section provides a detailed summary of the flood risk to the site in the post-development scenario looking at both the 1% AEP plus climate change and 0.1% AEP events.

5.4.1 Post-development model schematisation

For the post-development model scenario, a development platform has been represented within the model with an elevation set to 100mAOD. The site elevation will not be constructed to this elevation, but this enables the site to remain flood free for all design event simulations and therefore help determine the maximum water level surrounding the site and necessary level of ground raising required to achieve a flood free development.

Along the western boundary of the site, the existing development is bounded by buildings that have a significant step change between their respective floor levels. For the post-development model scenario, the step change between these buildings has been smoothed, enabling a consistent gradient along the parcel of land on the western boundary.

Figure 5-4 shows the modelled water level grid with a series of spot water levels taken around the site boundary for the 0.1% AEP fluvial event. This identifies the ground levels required to prevent flooding of the site in the most extreme TAN15 flood event. From this information it is recommended that the development plateau is set to a minimum level of 9.03mAOD.

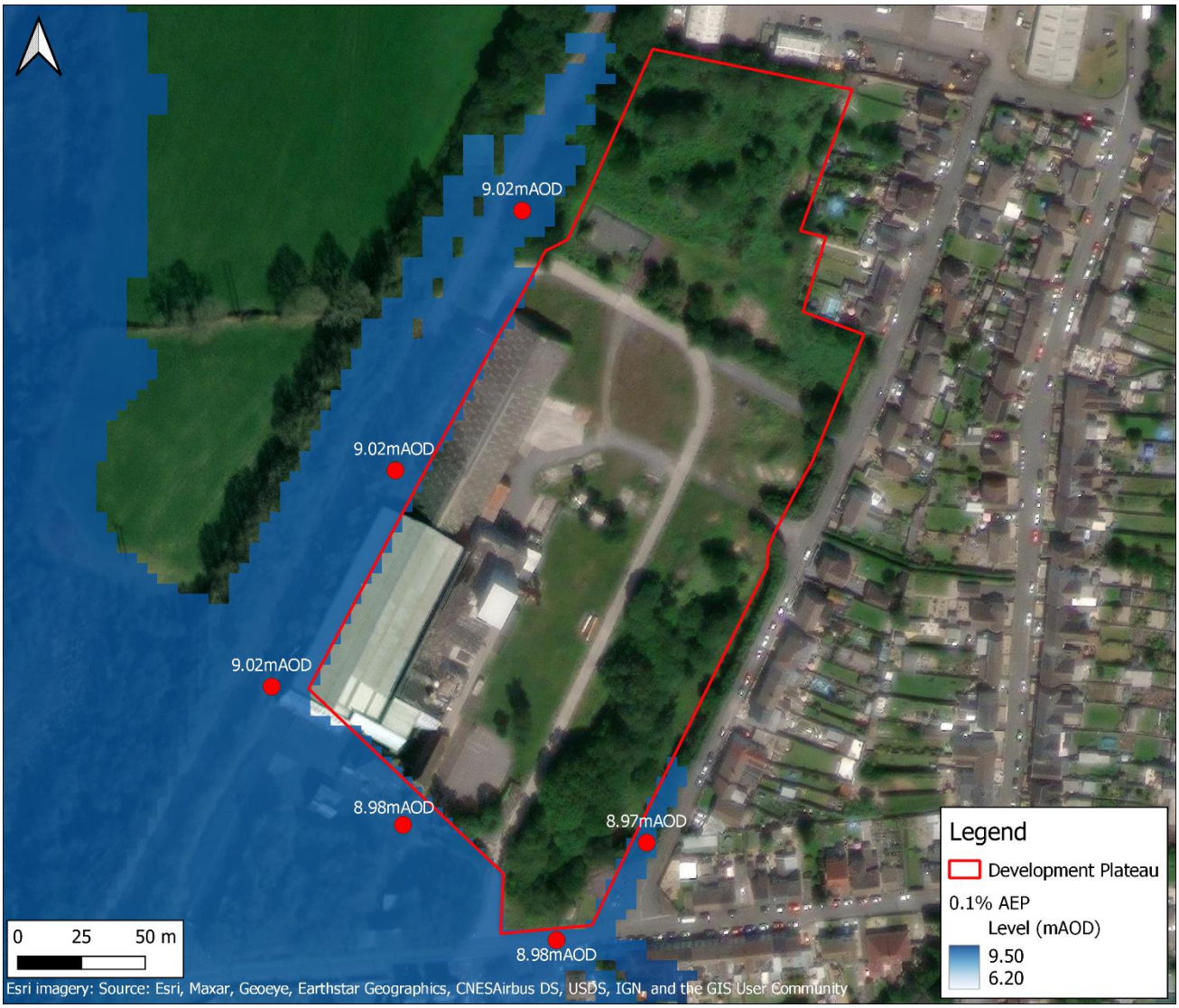


Figure 5-4: 0.1% AEP event maximum water levels

5.4.2 1% AEP plus climate change fluvial event

Figure 5-5 shows the modelled flood depth results for the 1% AEP plus climate change event for the post-development scenario. Raising the development platform above a level 9.03mAOD shall allow this area to be remain flood free in this design event.

In the 1% AEP plus climate change event there is flooding to High Street at the location of the primary vehicle access. However, flood depths at this location are very shallow (4cm). Woodville Street along the western boundary of the site is completely flood free during this event and will allow for an alternative safe access and egress during including vehicular, pedestrian, and emergency access.

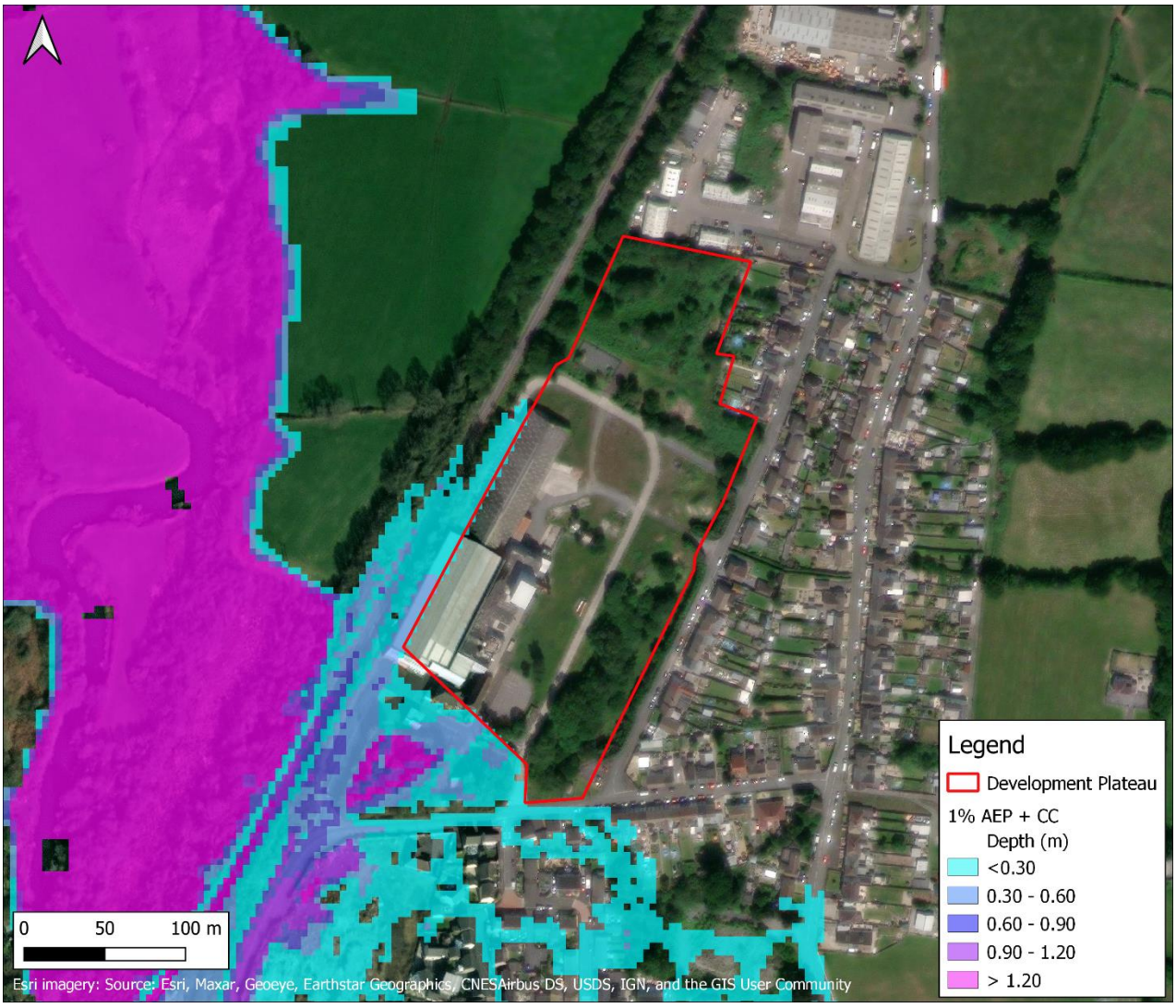


Figure 5-5: 1% AEP plus climate change fluvial post-development flood depth

Figure 5-6 shows the modelled flood hazard outputs for the post-development scenario for the 1% AEP plus climate change event. As the site is now flood free, there is no flood hazard within the site boundary or along Woodville Street. Along High Street, the model experiences shallow flood depths of up to 4cm adjacent to the primary site access. This constitutes a very low flood hazard classification meaning that access and egress can be maintained.

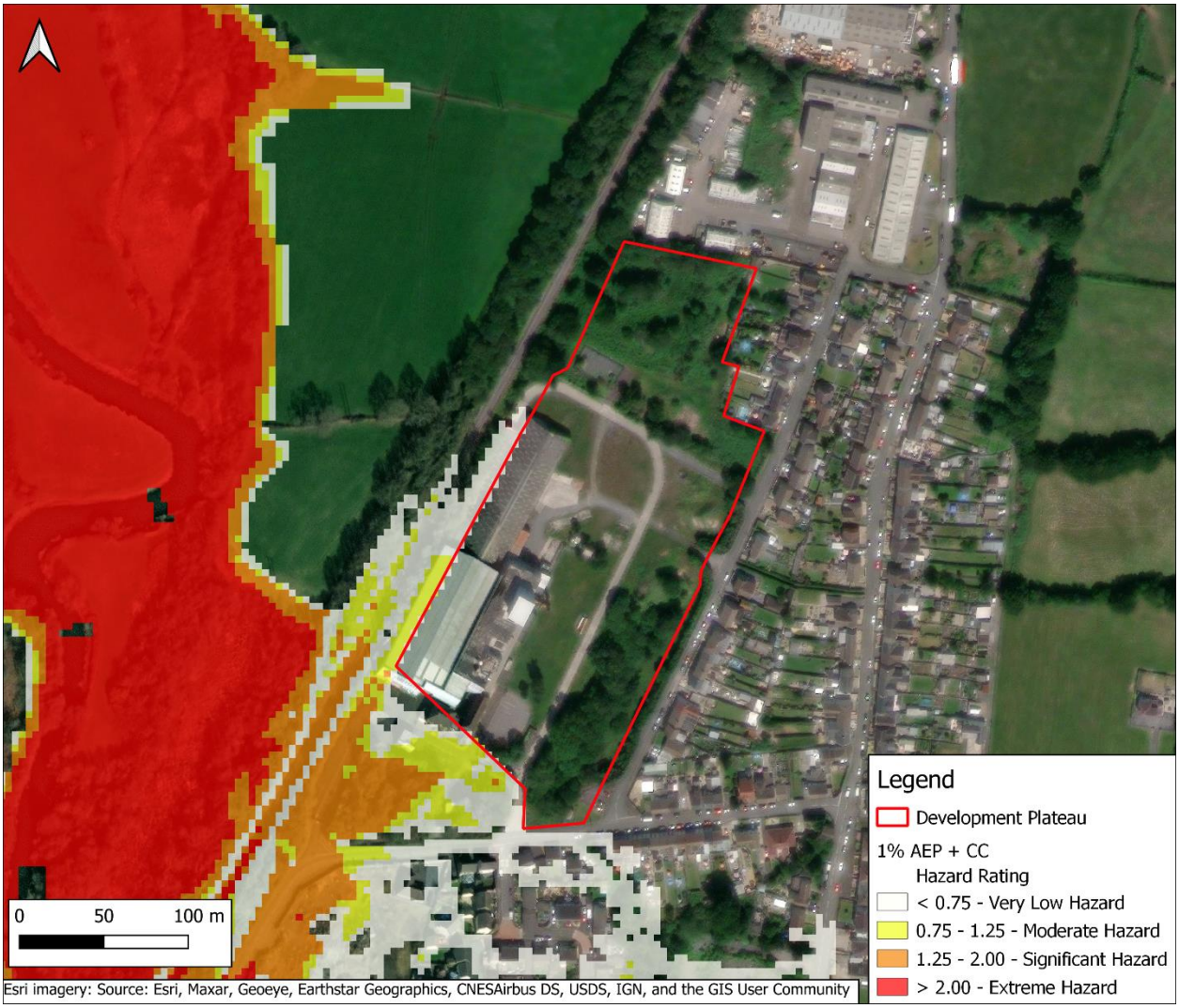


Figure 5-6: 1% AEP plus climate change fluvial post-development flood hazard

5.4.3 0.1% AEP fluvial event

Figure 5-7 shows the modelled flood depths for the 0.1% AEP event for the post-development model scenario. Due to the rising of the development plateau, the site will remain flood free in this design event. The maximum water level along the site boundary is 9.02mAOD.

Flood depths and flood extents along the site boundary increase in comparison to the 1% AEP plus climate change event. In this event, flood water begins to encroach onto Woodville Street but importantly it doesn't extend to the secondary vehicular access point in the north-east part of the site. The model results demonstrate that flood free access and egress can be maintained by exiting the site onto Woodville Street and travelling north before joining Tyn-n-Bonau Road.

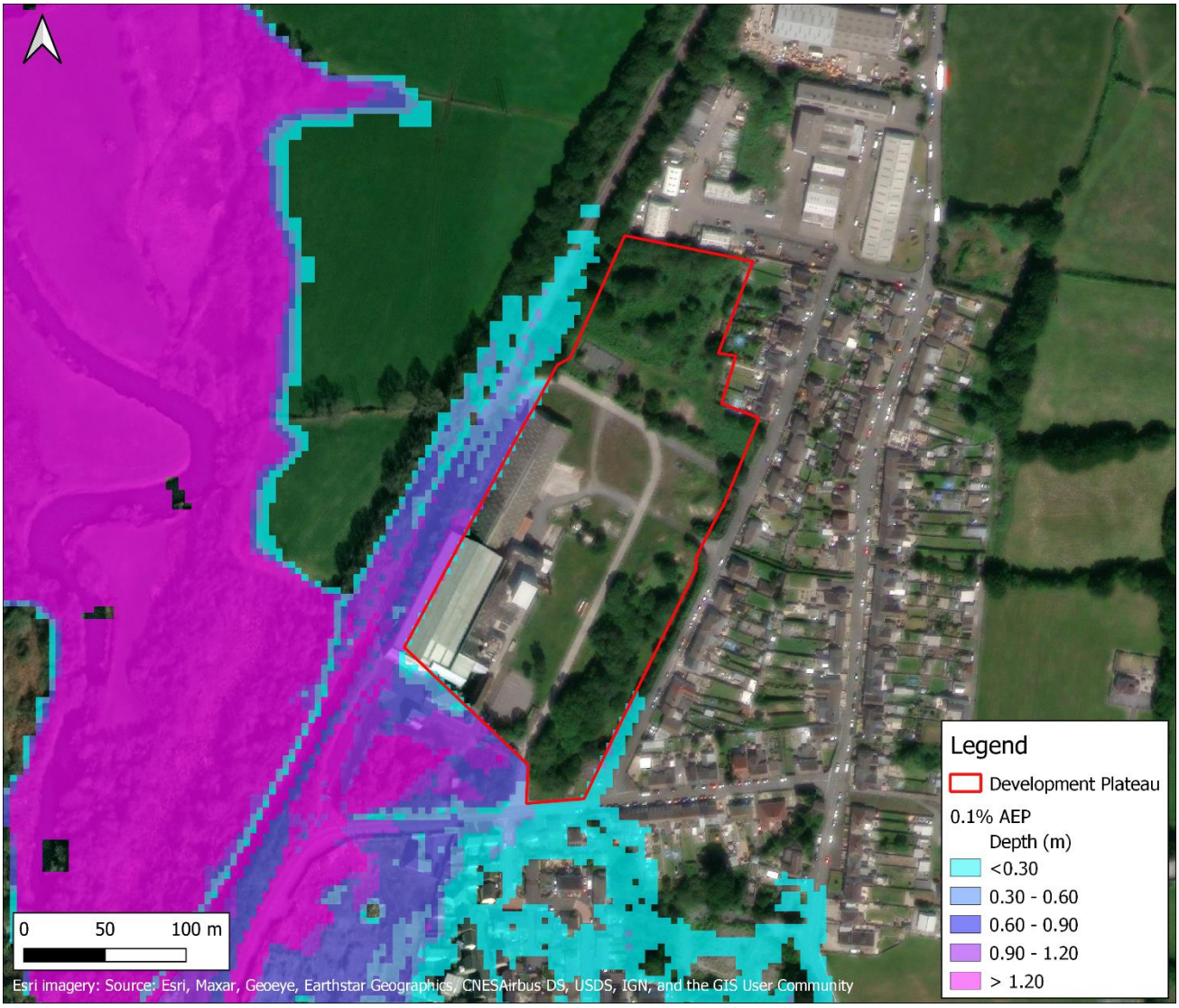


Figure 5-7: 0.1% AEP fluvial post-development flood depth

Figure 5-8 shows the modelled flood hazard results for the 0.1% AEP event for the post-development scenario. There is no flood hazard within the development platform as this portion of the site will remain flood free. Along the southern and western boundaries, the flood hazard classification has increased in comparison to the 1% AEP plus climate change event due to the increase in flood depth.

In the 0.1% AEP event, the modelled flood extent encroaches onto Woodville Street, but the depths are shallow which means that the flood hazard is classified as very low hazard to danger to some. Vehicles can typically safely pass through very low hazard flood waters, as experienced at the main entrance. However, it is generally advisable to avoid all floodwater and residents would therefore be advised to make use of the alternate access which remains flood free for all TAN15 design events.

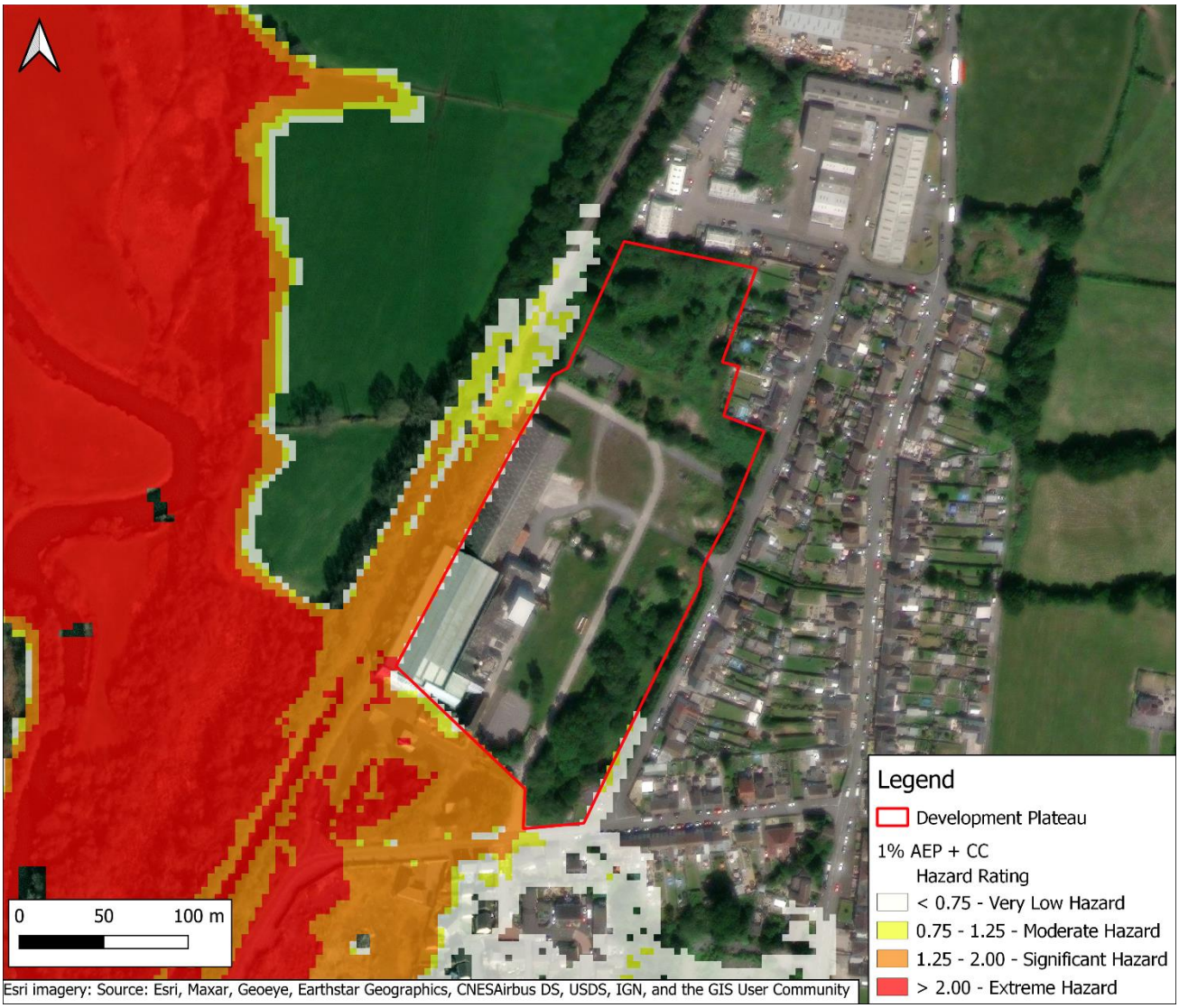


Figure 5-8: 0.1% AEP fluvial post-development flood hazard

5.5 Flood risk elsewhere

5.5.1 1% AEP plus climate change event

The flood modelling exercise involved multiple iterations of different development plateau sizes and orientations. The final iteration of the development plateau has enabled the maximum amount of developable area whilst preventing any increase in flood risk elsewhere.

Figure 5-9 shows the modelled depth comparison outputs between the baseline and post-development scenarios for the 1% AEP plus climate change event. This analysis shows that the proposed development will not cause any increase in flood risk outside of the site red line boundary.

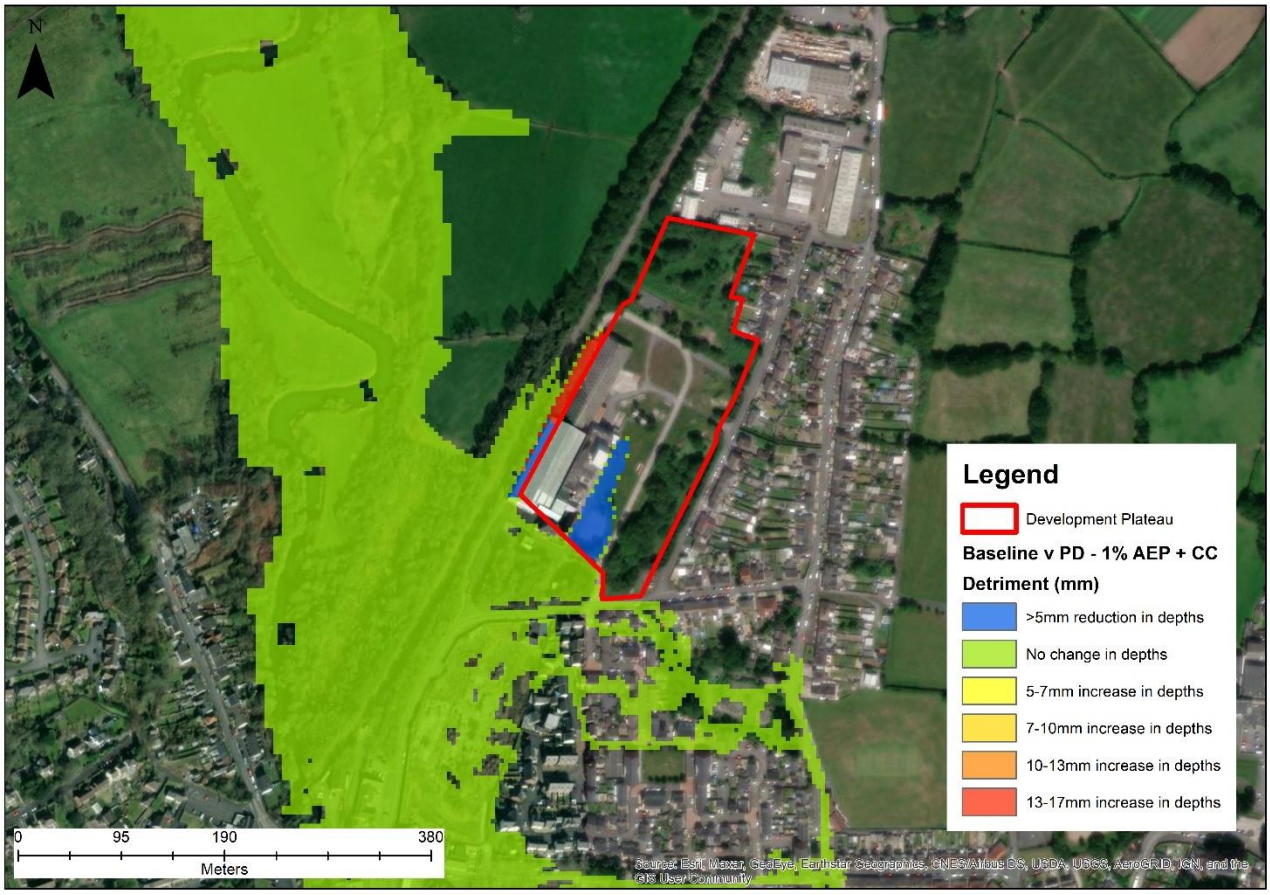


Figure 5-9: 1% AEP plus climate change event depth comparison

5.5.2 0.1% AEP event

Figure 5-10 shows the modelled flood depth comparison output between the baseline and post-development scenarios for the 0.1% AEP event. As with the 1% AEP pus climate change event, the proposed ground raising will not result in any third-party detriment to neighbouring properties.

To the south of the site, immediately upstream of Water Street Bridge, there are some small pockets of differing flood depths. This can be linked to a minor localised instability in the model associated with this structure, present only in this extreme design event. Such changes in modelled water levels is not reflective actual real-world hydraulic effects resulting from the proposed development and has therefore been treated as an acceptable limitation with the model.

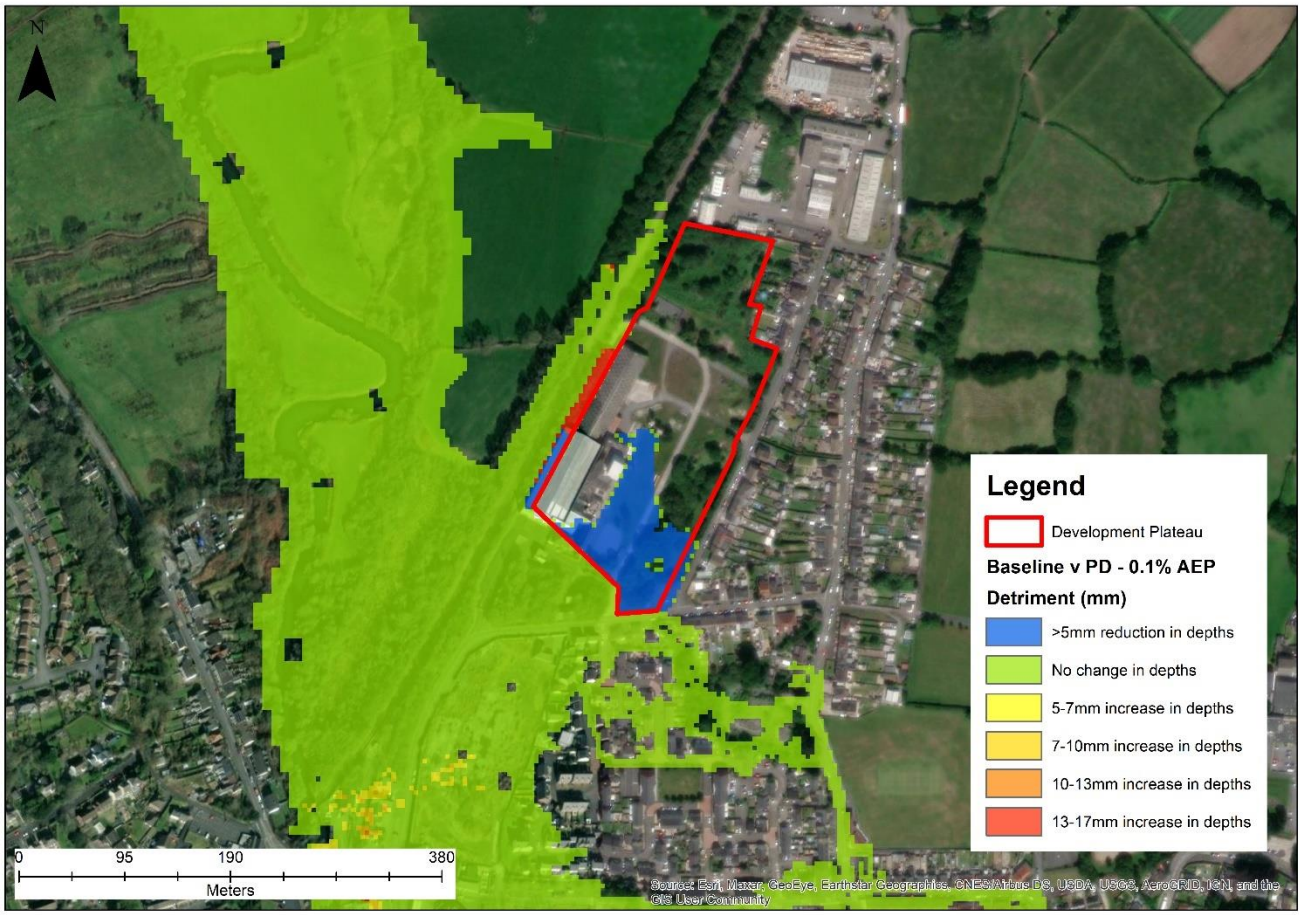


Figure 5-10: 0.1% AEP event depth comparison

6 Assessment of acceptability criteria

TAN-15 states that for highly vulnerable development to be considered within zone C1, the site must meet both the Justification Test and the acceptability criteria. Section 3.4 details the assessment of the proposed development site against each criteria of the Justification Test. Our assessment of the acceptability criteria, as set out in TAN-15, is summarised in Table 6-1 below.

Table 6-1 Assessment of accessibility criteria

TAN-15 Justification Criteria	Comments	Achieved
Developer is required to demonstrate that the site is designed to be flood free for the lifetime [Ref: TAN-15 A1.5] of development for a 1 in 100 (1%) chance (fluvial) and 1 in 200 (0.5%) chance (tidal) flood event including an allowance for climate change in accordance with TAN-15 table A1.14.	The proposed development plateau is predicted to be flood free during the 1% AEP fluvial flood event plus climate change. Flooding may occur in areas of water compatible public open space.	Yes
The development should be designed so that in an extreme (1 in 1000 chance) event there would be less than 600mm of water on access roads and within the property.	The proposed development plateau is predicted to be flood free during the 0.1% AEP event. Flood depths of up to 0.38m are identified on High Street immediately adjacent to the site access in the 0.1% AEP event. Flooding may occur in areas of water compatible public open space.	Yes
No flooding elsewhere.	Existing ground levels on site will be increased to provide a flood-free development platform in the 0.1% AEP event. Flood modelling has demonstrated that the proposed development will not increase the extent or depths of flooding outside of the site.	Yes
Flood defences must be shown by the developer to be structurally adequate particularly under extreme overtopping conditions (i.e. that flood with a 1 in 1000 chance of occurring in any given year).	The proposed development is served by flood defences on the River Dulais and Afon Camffwrd. These defences are both newly constructed and built to present day design standards.	Yes
The developer must ensure that future occupiers of development	The site owners should sign up to the NRW Flood Warning Service to	Yes

TAN-15 Justification Criteria	Comments	Achieved
are aware of the flooding risks and consequences	provide warning in the event of an extreme flood event or defence failure. The development platform is designed to be flood free in all design events. Similarly, provision has been made for dry access and egress under all conditions.	
Effective flood warnings are provided at the site	The site is within the River Dulais at Pontarddulais flood warning zone.	Yes
Escape/evacuation routes are shown by the developer to be operational under all conditions.	Both site access points are flood free during the 1% AEP plus climate change event. During the 0.1% AEP event, flooding on the primary access roads remains within a very low flood hazard. Furthermore, a secondary access to the east will provide flood free access and egress in this event.	Yes
The development is designed by the developer to allow the occupier of the facility for rapid movement of goods/possessions to areas away from flood waters.	Not applicable. The development will be flood free in all design events.	Yes
Development is designed to minimise structural damage during a flooding event and is flood proofed to enable it to be returned to its prime use quickly in the aftermath of the flood.	Not applicable. The development will be flood free in all design events.	Yes

7 Conclusions

JBA Consulting (JBA) were commissioned by Walters Land Limited to undertake a Flood Consequences Assessment (FCA) for the proposed residential re-development of the former Tata Steelworks site in Pontarddulais.

The proposed area of development is 3.93 ha in size and is brownfield land, currently comprising of hard standing and former industrial buildings.

The River Loughor flows in a southerly direction west of the site. The River Dulais flows in a westerly direction through the centre of Pontarddulais south of the site, before flowing into the River Loughor to the west of the railway station.

The development proposals are classed as highly vulnerable development by TAN-15.

The site is located in DAM Zone C1. Zone C1 is described as “areas of the floodplain served by significant infrastructure, including flood defences”. Highly vulnerable development within Zone C1 is permitted, subject to the application of a Justification Test.

The site is at low to moderate risk of groundwater flooding, river flooding and surface water flooding. There is no risk of flooding from reservoirs or tidal flooding. Finally, there is no evidence of flooding from sewers.

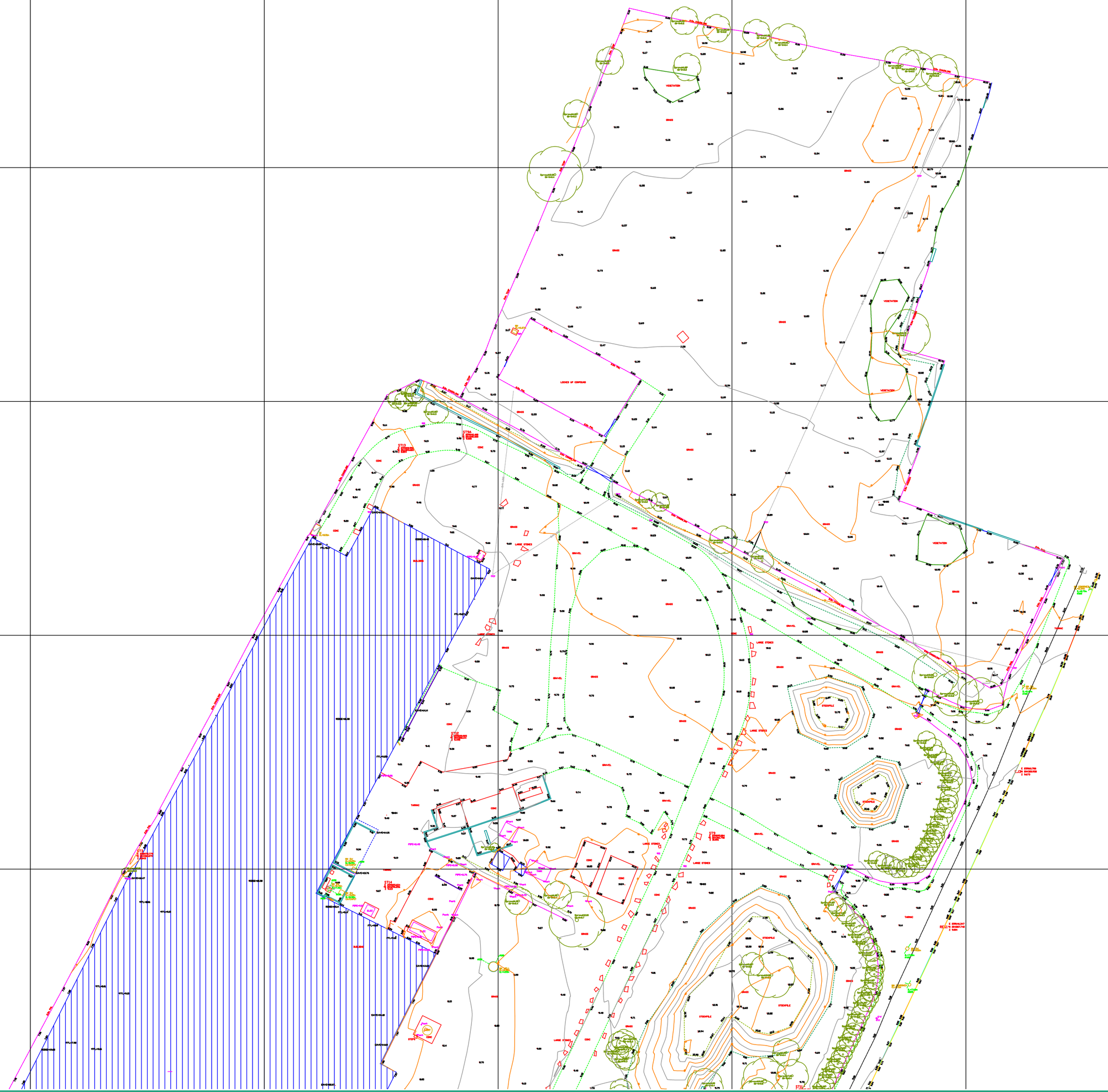
The proposed development benefits from flood defences at both the River Dulais and River Camffwrd. These defences are newly constructed and built to present day design standards.

Ground levels on site will be increase in some areas to provide a minimum ground level of 9.03mAOD. This will result in a development plateau free of flooding in all TAN15 design events, including the extreme 0.1% AEP event. Flooding within the site will be limited to areas of water compatible public open space.

Detailed hydraulic modelling has been used to inform the design of the development and to ensure that the proposals will not increase flooding elsewhere.

This FCA has demonstrated that all requirements of TAN-15, including all acceptability criteria, have been satisfied. Consequently, it is concluded that on the grounds of flood risk, the proposed development meets the requirement set out in TAN-15 and the aims of Planning Policy Wales.

Appendix A: Topographic survey



Rev	Amendments	Date	By

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NOTES:

1. SITE GRID AND LEVELS ARE BASED UPON ORDNANCE SURVEY VIA THE ACTIVE GPS NETWORK.

KEY

	BOTTOM OF BANK		VERGE
	TOP OF BANK	△ ST1	SURVEY STATION
	CONTOURS	TH=50.09	TREE HEIGHT
CAB	CABINET	PB	POST BOX SQUARE
	TREE	PB	POST BOX ROUND
FH	FIRE HYDRANT	GRILL	GRILL SQUARE
BT	BRITISH TELECOM	GRILL	GRILL ROUND
CATV	CABLE TV	BL	BOLLARD ROUND
	OVERHEAD LINE	BL	BOLLARD SQUARE
GV	GAS VALVE	BIN	BIN SQUARE
1.0BR	BRICK WALL	BIN	BIN ROUND
1.0BL	BLOCK WALL	38.32	SPOT LEVEL
1.0ST	STONE WALL	ASP	ASPHALT
		GR	GRASS
	VEGETATION	GRAV	GRAVEL
2.0 CB	CLOSE BOARD	H/S	HARDSTANDING
1.6 PR	POST RAIL FENCE	BB	BELISHA BEACON
1.8 H	HERAS FENCE	RS	ROAD SIGN
2.0 PW	POST WIRE FENCE	TS	TRAFFIC SIGNAL
	DROPPED KERB	IC	INSPECTION COVER
	KERB CHANNEL	MH	MANHOLE SQUARE
	TOP OF KERB	MH	MANHOLE ROUND
RL=46.12	RIDGE LEVEL	MP	MARKER POST
EL=43.88	EAVE LEVEL	TP	TELEGRAPH POLE
FFL=40.55	FINISHED FLOOR LEVEL	LC	LIGHTING COLUMN
FR=42.99	FLAT ROOF LEVEL	G	GULLY
		VM	WATER METER
		SV	SLUICE VALVE
		ST	STOP TAP

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CLIENT

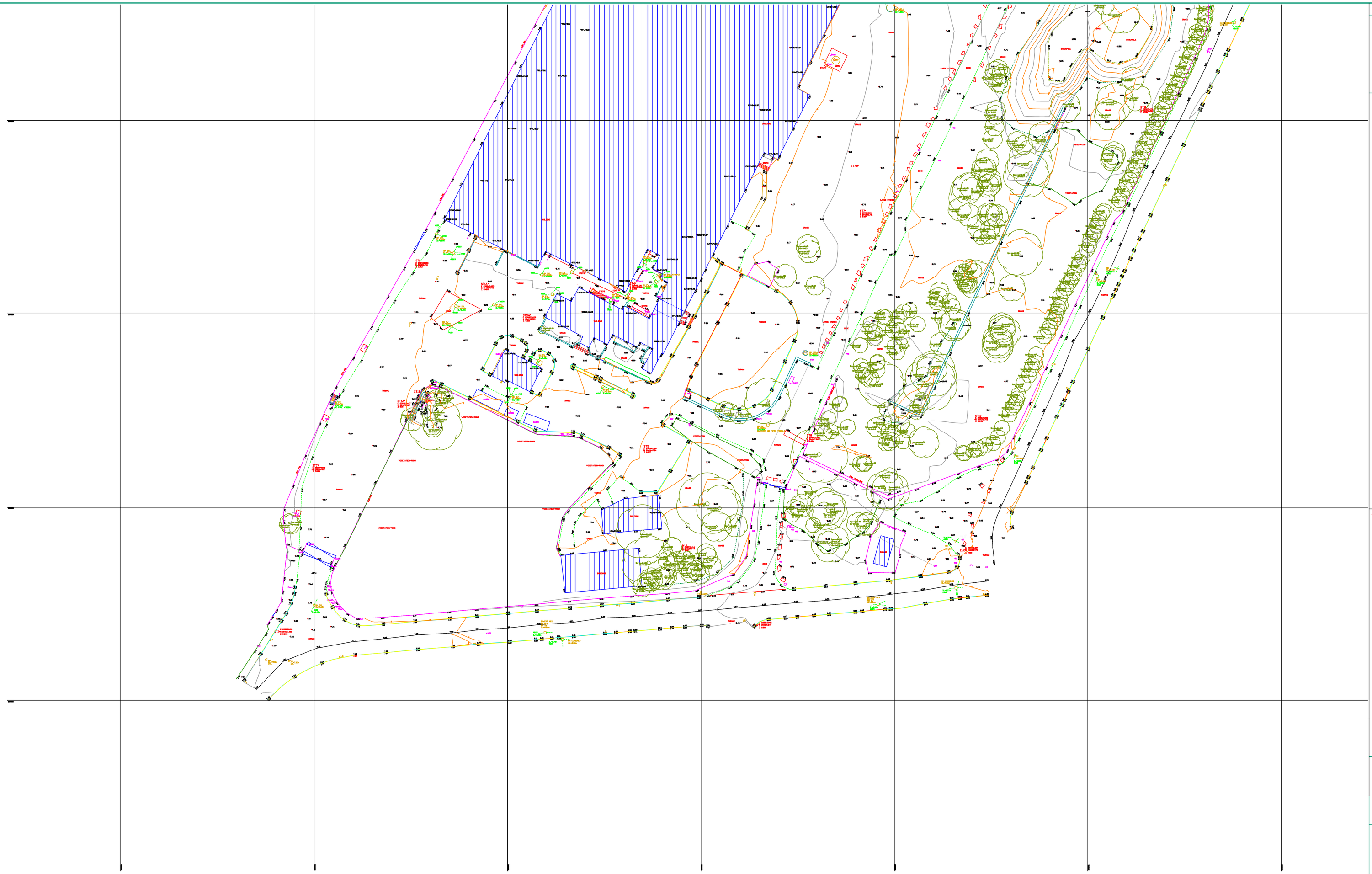
WALTERS-GROUP

PROJECT

TOPOGRAPHICAL SURVEY
FORMER TATA SITE,
PONTARDDULAIS.

Surveyed by	MH	Date	06/03/23
Drawn	MH	Date	14/03/23
Scales	1:500@A1	Checked:	TC
Project Reference No.	ALS/5425		
Drawing Number	WAL/001		

A1



Rev	Amendments	Date	By

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KEY

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	TOP OF BANK	△ ST1	SURVEY STATION
	CONTOURS	TH=50.09	TREE HEIGHT
CAB	CABINET	PB	POST BOX SQUARE
	TREE	PB	POST BOX ROUND
FH	FIRE HYDRANT	GRILL	GRILL SQUARE
BT	BRITISH TELECOM	GRILL	GRILL ROUND
CATV	CABLE TV	BL	BOLLARD ROUND
	OVERHEAD LINE	BL	BOLLARD SQUARE
GV	GAS VALVE	BIN	BIN SQUARE
1.0BR	BRICK WALL	BIN	BIN ROUND
1.0BL	BLOCK WALL	38.32	SPOT LEVEL
1.0ST	STONE WALL	ASP	ASPHALT
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1.6 PR	POST RAIL FENCE	BB	BELISHA BEACON
1.8 H	HERAS FENCE	RS	ROAD SIGN
2.0 PW	POST WIRE FENCE	TS	TRAFFIC SIGNAL
	DROPPED KERB	IC	INSPECTION COVER
	KERB CHANNEL	MH	MANHOLE SQUARE
	TOP OF KERB	MH	MANHOLE ROUND
RL=46.12	RIDGE LEVEL	MP	MARKER POST
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FR=42.99	FLAT ROOF LEVEL	G	GULLY
		WM	WATER METER
		SV	SLUICE VALVE
		ST	STOP TAP

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CLIENT
WALTERS-GROUP

PROJECT
TOPOGRAPHICAL SURVEY
FORMER TATA SITE,
PONTARDDULAIS.

Surveyed by	MH	Date	06/03/23
Drawn	MH	Date	14/03/23
Scales	1:500@A1	Checked:	TC
Project Reference No.	ALS/5425		
Drawing Number	WAL/002		

A1

Appendix B: Site plan

N

Scale 1:500

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REV.	DESCRIPTION	DATE
A	Revised Layout - Northern SS link	05.10.23

CLIENT

Walters

JOB TITLE

Tata Steel Pontardulais

DRAWING TITLE

Illustrative Masterplan

SCALE @ A1	DATE	DRAWN BY
1:500	Sept ‘ 23	PC
JOB NO.	DRAWING NO.	REVISION
2360	IM-01	A

hammond Architectural Ltd

10 Gold Tops
Newport
NP20 4PH

t. 01633 844970
e. info@hammond-ltd.co.uk

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Appendix C: Modelling technical note

TECHNICAL NOTE

JBA Project Code	2022s1615
Contract	Tata Steelworks, Pontarddulais FCA
Client	Walters Land Limited
Day, Date and Time	October 2023
Author	Arran Bright MSc BSc
Reviewer / Sign-off	Paul Redbourne BSc PGCert, MCIWEM, C.WEM
Subject	Tata Steelworks, Pontarddulais Flood Modelling

1 Introduction

1.1 Project requirements

JBA Consulting were commissioned by Walters Land Limited in December 2022 to undertake flood modelling works to better understand the flood risk constraints to the former Tata steelworks site located in Pontarddulais.

Following this initial work, a more detailed flood modelling assessment has been completed to aid with the production of a Flood Consequences Assessment (FCA) for a proposed residential development at the site.

The Natural Resources Wales product 7 model of Pontarddulais has been licensed for this study and updated to provide an improved understanding of flood risk. The model was originally developed by JBA Consulting in 2018 to assess both fluvial and tidal flood risk throughout Pontarddulais.

This technical note has been produced to summarise the flood modelling work completed, outlining the updates applied to the existing NRW model, the representation of the post-development scenario, and any assumptions and limitations associated with the model outputs. This technical note does not include analysis of the model results as this has been included within the FCA report.

The site is located at the former Tata Steelworks site in Pontarddulais as shown in Figure 1-1.

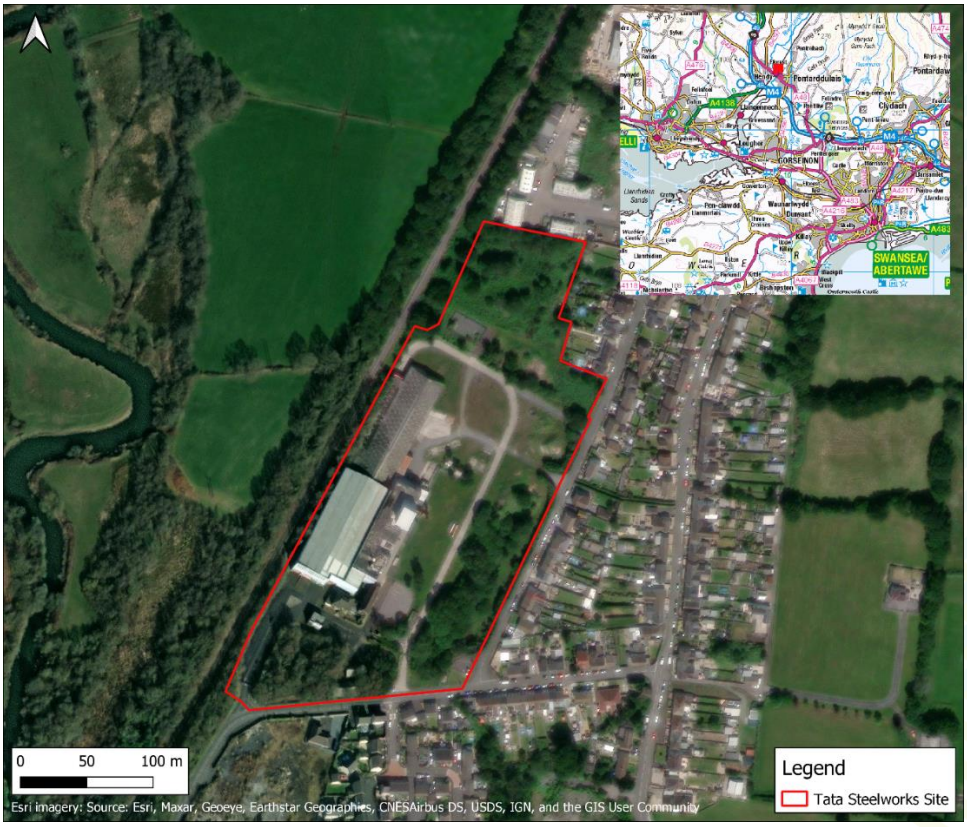


Figure 1-1 Site location

2 Model Approach

A review of the 2018 NRW model confirmed that it is considered suitable for the assessment of flood risk on a site-specific scale for the Pontarddulais Steelworks site. However, the model review identified a series of updates to make use of best available data and align with current best practice. This section of the report summarises the updates applied to the NRW model to produce a new baseline model scenario.

2.1 General Schematisation

The new flood model has utilised the latest TUFLOW executable release of 2023-03-AB. This is considered an improvement on the previous modelling that had adopted the TUFLOW executable 2018-03-AC. The 2023-03-AB release includes a bug issue that incorrectly maps in channel results due to a water level line problem. This is not considered a concern for this study as the site is not located immediately adjacent to the one of the modelled watercourses, and therefore will have no bearing on the model results analysis.

The model grid resolution, model timesteps, and use of a multi-domain approach have been retained from the 2018 model as there was no justification to amend these parameters. However, due to the 2D-2D boundary that links the two model domains being located along the railway line adjacent to this site, this was reviewed and updated. The new 2D-2D boundary has been extended further to the north as the original model testing looked at the 0.1% AEP plus climate change event which had not been simulated in the 2018 NRW study. The increase in overland flow during this event meant the 2D-2D boundary had to be amended to allow the transfer of flow from one domain to another. Although this design event is not currently required under the current TAN15, the updated 2D-2D boundary was retained for the final design event simulations.

2.2 Tidal Boundary Conditions

The 2018 NRW model is a combined fluvial - tidal model that can represent both sources of flooding. Since the construction of that model, the extreme sea level coastal flood boundary (CFB) dataset and the Welsh government climate change guidance have been updated and therefore the tidal boundary conditions applied to the model have been amended.

The CFB data node point 542, located in the mouth of the Afon LLwchwr estuary has been used to extract the extreme sea levels for use within the hydraulic model. The CFB data has a base year of 2017 and therefore this has been uplifted to 2023 to represent present day conditions. Due to the proposed development consisting of residential housing, a design life of 100 years has been adopted and 100-years of sea level rise has been calculated using the climate change projections downloaded from the UKCP18 interface.

The 2018 NRW model included an analysis of tidal prism effect whereby the tidal water level rises as it propagates up the LLwchwr estuary. This was completed in collaboration with NRW and has been retained for the new flood modelling of the former steelworks site. An increase of 0.18m to account for the prism effect between CFB point 542 and Llanelli, with a further 0.3m applied to account for the prism effect between Llanelli and Pontarddulais has been applied to the tidal boundary conditions.

The combination of the tidal prism effect and the new climate change uplifts have resulted in the peak tide levels shown in Table 2-1. For reference, the fluvial design event simulations using the Mean High Water Spring tide curve for the downstream boundary conditions, and the tidal design events use the QMED inflows as the fluvial inflow boundary conditions. For climate change simulations, climate change has been applied to both the fluvial and tidal boundary conditions.

Table 2-1: Tidal boundary extreme sea levels (mAOD)

	MHWS	T0200	T1000
2017	4.4	6.07	6.22
2023	4.43	6.10	6.25
2123	5.45	7.12	7.27

2.3 Site topography

A topographic survey was obtained from Alpine Land Surveyors Ltd covering the former Tata Steelworks site. This data has been used to create a Digital Terrain Model (DTM) Ascii grid to represent current site elevations directly within the hydraulic model. Improvements were made to the representation of Woodville Street to the east of the site, with erroneous road elevations removed prior to the creation of the DTM. The topographical survey data is shown in Figure 2-1 and has been provided in Appendix A of the FCA report.

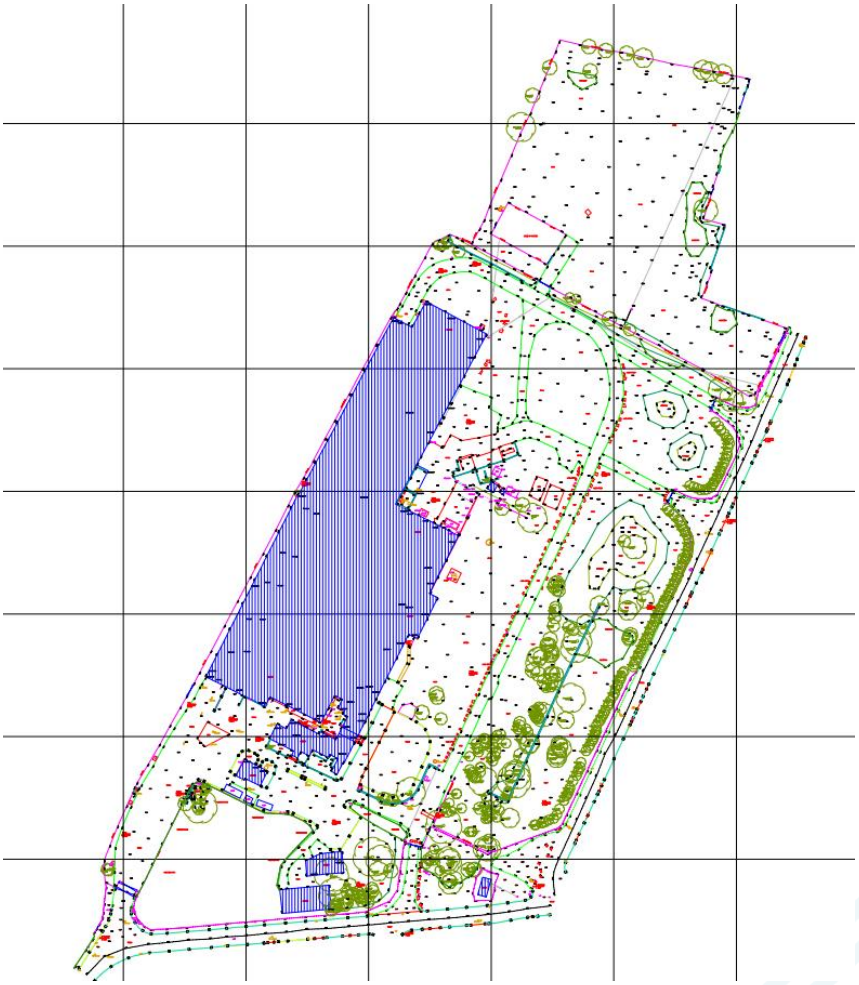


Figure 2-1: Topographical survey

2.4 Building representation

The topographical survey data provided an improved representation of the site topography in comparison to the base LIDAR data and was therefore used within the model. However, the triangulation process to generate the DTM provided questionable outputs within the building footprints. Therefore, it was decided to use the survey data to specify floor levels for each of the key buildings within the site boundary.

These have been applied within the model using 2D zshape features to stamp the ground floor levels of each building as shown in Figure 2-2. For simplicity average floor levels have been taken from the survey data where there are changes throughout the building footprint.

Figure 2-2 - Baseline model set up with building FFL's

2.5 Post-Development representation

For the post-development model scenario, it was decided to raise the proposed development to 100mAOD to represent a flood free scenario in all design events. The initial post-development testing showed that if the entirety of the site was raised to be flood free, this may result in a detrimental increase in flood risk to neighbouring third parties.

Therefore, the post-development model testing culminated in the production of a raised development plateau as shown in Figure 2-3. The FCA report discusses the model results analysis and demonstrates that raising this portion of the site to above the maximum water level in the 0.1% AEP event will enable the site to be fully compliant with the requirements of TAN15.

The development plateau has been represented within the model using a 2D zshape feature with an elevation set to 100mAOD and the NO MERGE command specified.

Along the western boundary of the site, the existing development is bounded by buildings that have a significant step change between their respective floor levels. For the post-development model scenario, the step change between these buildings has

been smoothed, enabling a consistent gradient along the parcel of land on the western boundary.

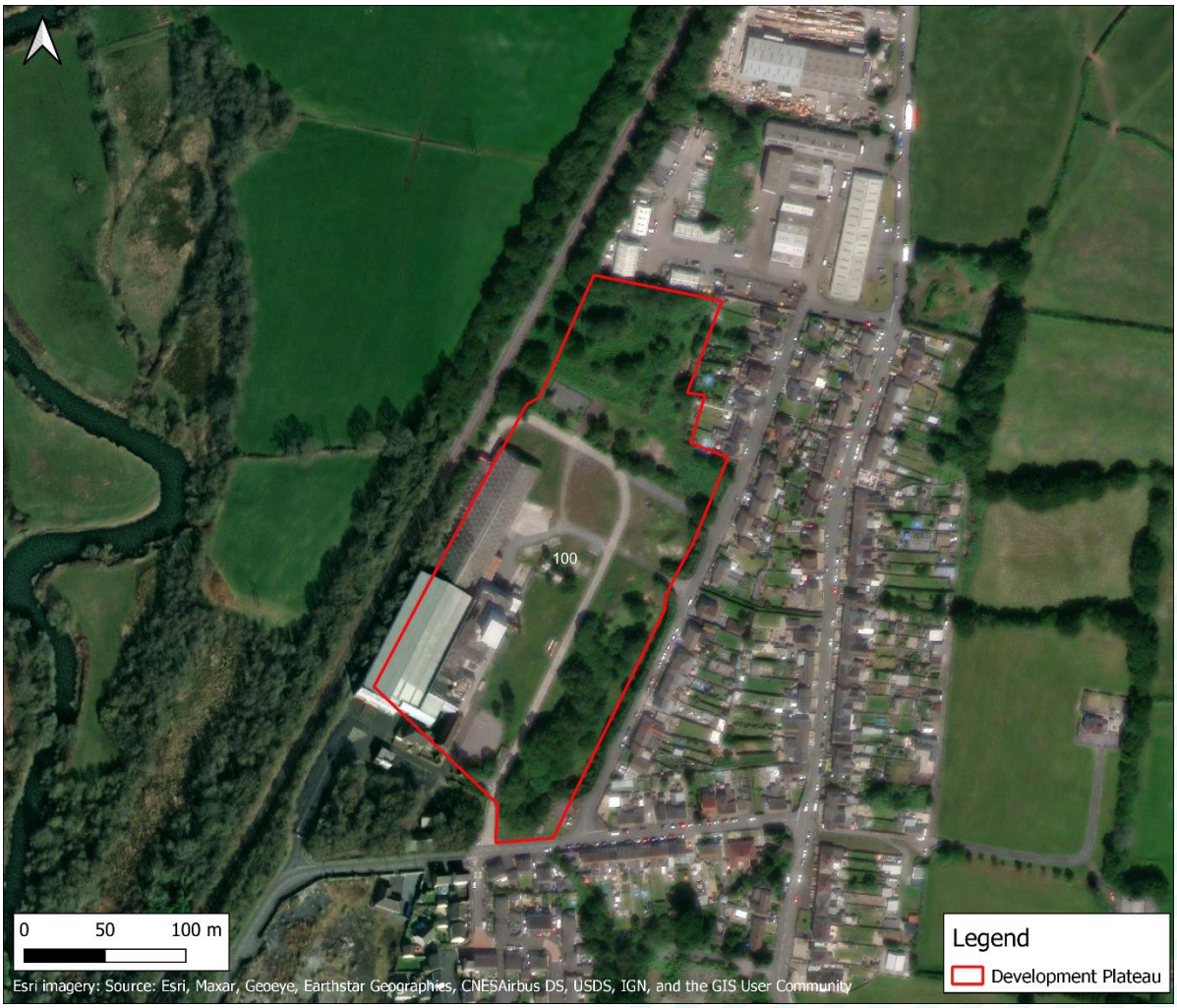


Figure 2-3 - Post-development plateau with site FFL

3 Model runs

3.1 Baseline model scenario

Run reference	Baseline - PDS_~s1~_~s2~_~e1~_~e2~_147
Purpose of runs:	To model the 1% plus climate change and 0.1% AEP events
TUFLOW file names:	PDS_~s1~_~s2~_~e1~_~e2~_147.tcf PDS_~s1~_~s2~_~e1~_~e2~_147.ecf PDS_TOWN_2m_143.tgc PDS_TOWN_125.tbc PDS_LLWC_8m_139.tgc PDS_LLWC_125.tbc
Run time:	Simulation time: 24 hours
AEP events:	1% plus climate change and 0.1% AEP
Boundary conditions:	PDS_bc_dbase_2023_147.csv PDS_bc_dbase_2123_147.csv
Run settings:	TUFLOW version: 2023-03-AB-iSP-w64

3.2 Post-development model scenario

Run reference	Post-development - PDS_~s1~_~s2~_~e1~_~e2~_148
Purpose of runs:	To model the 1% plus climate change and 0.1% AEP events
TUFLOW file names:	PDS_~s1~_~s2~_~e1~_~e2~_148.tcf PDS_~s1~_~s2~_~e1~_~e2~_148.ecf PDS_TOWN_2m_146.tgc PDS_TOWN_125.tbc PDS_LLWC_8m_139.tgc PDS_LLWC_125.tbc
Run time:	Simulation time: 24 hours
AEP events:	1% plus climate change and 0.1% AEP
Boundary conditions:	PDS_bc_dbase_2023_147.csv PDS_bc_dbase_2123_147.csv
Run settings:	TUFLOW version: 2023-03-AB-iSP-w64

4 Model performance, assumptions, and limitations

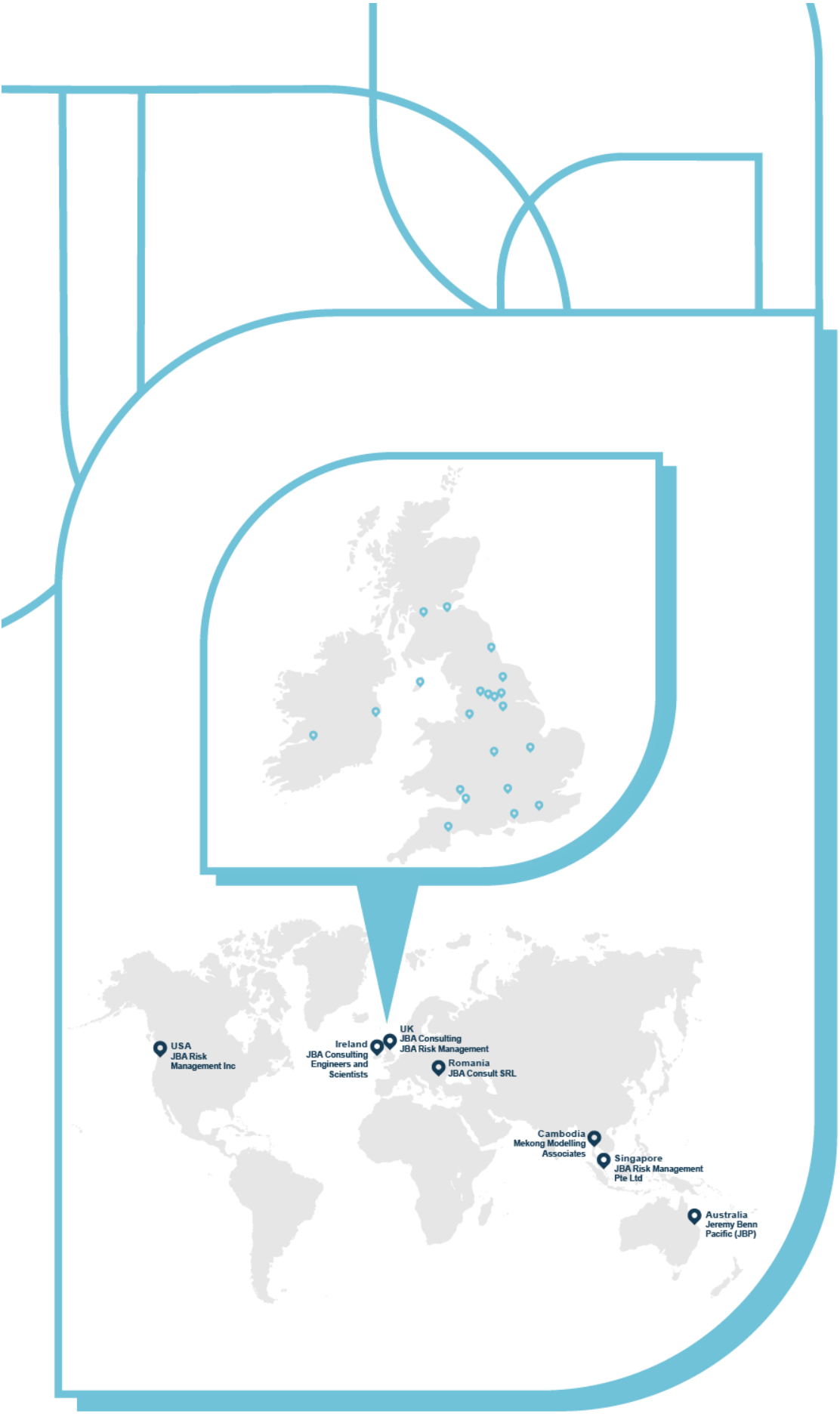
Developing a hydraulic model requires the application of simplifications and generalisations. As such, several assumptions are made when building the model, which can lead to model uncertainties and subsequent limitations of the results. This section summarises the model performance and some of the outstanding assumptions and limitations with the model.

The model does not experience any 1D or 2D negative depths, this indicates that the model can be considered stable. However, the ME% in both the 1% AEP plus climate change and the 0.1% AEP events for both the baseline and post-development scenarios are outside the typically recommended +/-1% range.

The TUFLOW log files (.TLF) shows that the ME% peaks at -1.23% in the 1% AEP event plus climate change event and peaks at -1.7% in the 0.1% AEP event. Analysis of the model performance outputs indicates that the higher ME% is not linked to the 1D or 2D domains specifically and is instead linked to the application of the model boundary conditions at two locations. The MB2 output shows that the model experiences high mass error at the 2D HT boundary located at the downstream end of the model as well as immediately upstream of the Dulais flood storage reservoir. The issue at both locations is circulation of depth floodwater within the 2D domain interacting with cells used by boundary conditions.

The 2018 model made attempts to improve the model performance in these areas using localised high roughness patches, LIDAR smoothing polygons, and additional energy loss applied to the HX 1D-2D linkage, but the high mass error remained. Model testing for the Pontarddulais Steelworks study included realigning the 2d_loc grid orientation line to see if this would allow for a smoother transition of flow from one cell to another but this was unsuccessful. It was decided that due to the high mass error being located away from our site of interest, it will not influence our assessment of site-specific flood risk and is therefore considered an acceptable limitation.

New LIDAR data has recently been flown for the entirety of Wales. At the time this project was commissioned, this data was not available commercially and therefore the model has retained the base LIDAR data that was used in the 2018 NRW flood mapping project. This is considered an acceptable limitation as the site topography has been updated using detailed topographical survey data which provides an improved representation of the site.



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