

ASW Scaffolding Wales, Abergawed - Flood Consequences Assessment

Version 1

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Prepared for:
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This report describes work commissioned by ASW Scaffolding Wales by an instruction dated 22nd April 2024. The Client's representative for the contract was Carl Hendy of ASW Scaffolding Wales. Hannah Booth of JBA Consulting carried out this work.

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Contents

1	Introduction	7
1.1	Terms of Reference	7
1.2	FCA Requirements	7
2	Site Description	8
2.1	Site Summary	8
2.2	Site Topography	9
2.3	Soils and Geology	10
2.4	Watercourses and flood defences	10
2.5	Proposed development	11
3	Planning Policy and Flood Risk	13
3.1	Planning context	13
3.2	Vulnerability classification	13
3.3	Lifetime of development	14
3.4	Development Advice Map Classification	14
3.5	Flood Map for Planning	15
3.6	Local Development Plan	16
3.7	Justification Test	16
4	Flood Risk Assessment	18
4.1	Flood Risk Summary	18
4.2	Historical Flooding	18
4.3	Flood Risk from Rivers	19
4.4	Flood Risk from the Sea	26
4.5	Flood Risk from Surface Water and Small Watercourses	26
4.6	Flood Risk from Groundwater	27
4.7	Flood Risk from Reservoirs	28
4.8	Flood Risk from Canals	28
4.9	Flood Risk from Sewers	29
5	Flood Mitigation	30
5.1	Proposed development design	30
5.2	Access and egress	30
5.3	Flood Warning	30

6	Assessment of Acceptability Criteria	31
7	Conclusions and Recommendations	33
A	Topographic Survey	34
B	Development Plan	35
C	Hydrology Calculation Record	36

List of Figures

Figure 2-1 Site Location	9
Figure 2-2 NRW 1m LiDAR elevation Data	10
Figure 2-3 Watercourses	11
Figure 2-4 Proposed development layout	12
Figure 3-1 Development Advice Map	15
Figure 3-2 Flood Map for Planning – Rivers	16
Figure 4-1 NRW Recorded flood extents	19
Figure 4-2 FRAW - Flood Risk from Rivers	20
Figure 4-3 Updated Resolven baseline model schematic	22
Figure 4-4 Baseline 1% AEP plus Climate Change event- Flood depths	23
Figure 4-5 Baseline 1% AEP plus Climate Change event- Flood hazard rating	24
Figure 4-6 Baseline 0.1% AEP event- Flood depths	25
Figure 4-7 Comparison of pre- and post-development 0.1% AEP results	26
Figure 4-8 FRAW- Flood Risk from Surface Water and Small Watercourses	27
Figure 4-9 FRAW- Flood Risk from Reservoirs	28

List of Tables

Table 2-1 Site Summary	8
Table 3-1 Development classification defined by TAN-15	13
Table 3-2 Justification Test applied to the proposed development	17
Table 4-1 Flood Risk Summary	18

Table 6-1 Acceptability Criteria

1 Introduction

1.1 Terms of Reference

JBA Consulting were commissioned by ASW Scaffolding Wales to undertake a Flood Consequences Assessment (FCA) for a proposed industrial unit, yarding and associated parking at their site off Neath Road, Abergawed (hereafter referred to as 'the site').

This FCA demonstrates the suitability of the proposed development and describes the flood mitigation measures recommended to manage flood risk at the site.

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 work
- 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 site is located off Neath Road in Abergawed, as shown in Figure 2-1. The site currently comprises of brownfield land used by ASW Scaffolding Wales for vehicle parking and storage. Several small buildings are present around the site and within the north of the site is a large, covered storage rack, recently constructed, and used for the scaffolding business. The site is accessed via the unnamed access road to the south of the site.

The approximately 1.0ha site is bounded by the B4242 Neath Road to the north, agricultural land to the east, the unnamed access road to the south beyond which is the River Neath and residential buildings to the west.

Table 2-1 gives a summary of the site particulars.

Table 2-1 Site Summary

Parameter	Description
Site Name	ASW Scaffolding Wales, Neath Road, Abergawed
Site area	1.0 ha
Existing land use	Brownfield land
Purpose of development	Industrial building, yarding and vehicle parking
OS NGR	SN 81816 02495
Local Planning Authorities	Neath Port Talbot Council
Lead Local Flood Authority	Neath Port Talbot Council

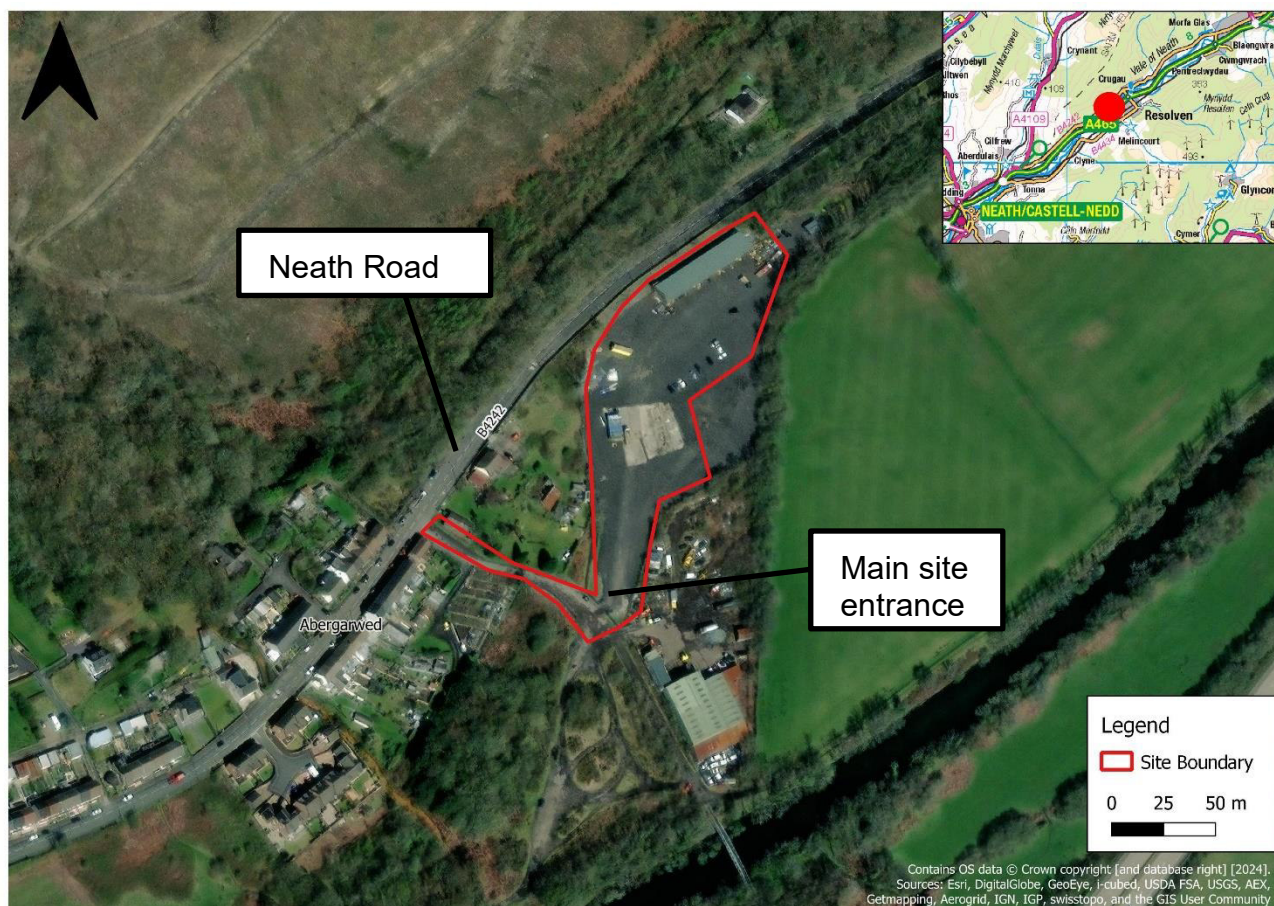


Figure 2-1 Site Location

2.2 Site Topography

A topographic survey was undertaken by Alpine Land Surveyors Ltd in August 2019 and is provided in Appendix A. Ground levels across the main part of the site are predominantly between 21.6m AOD at the southern main site entrance rising to 22.8m AOD in the north-west corner. The site access off Neath Road is at an elevation of 29.37mAOD and the access road falls to the main site entrance.

Figure 2-2 shows the topography across the wider area and shows the land rising to the west and falling sharply to the east towards the River Neath which is at an elevation of around 19.5m AOD. The site is effectively positioned on a plateau.

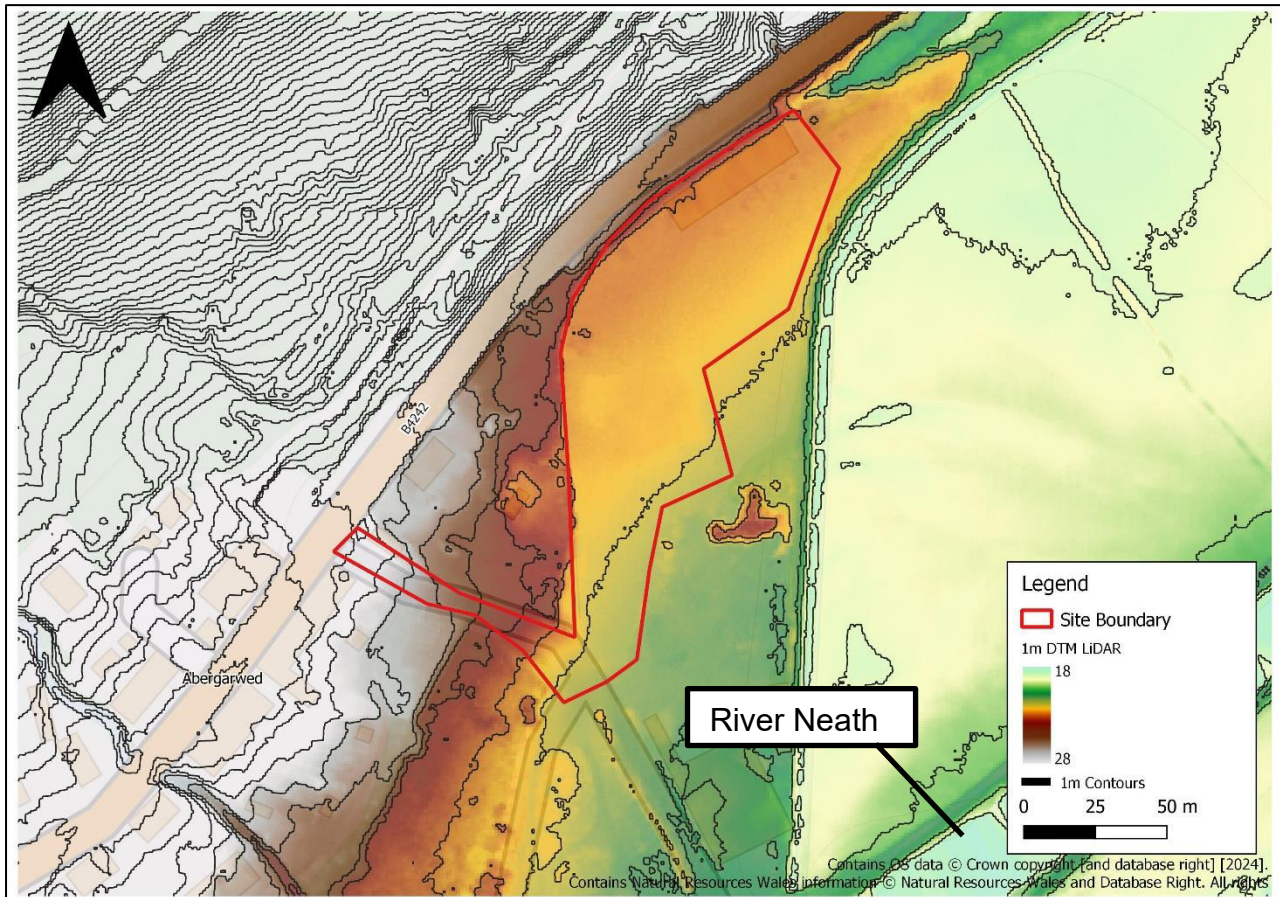


Figure 2-2 NRW 1m LiDAR elevation Data

2.3 Soils and Geology

The site's geology has been assessed using the British Geological Survey (BGS) GeoIndex¹. The bedrock is shown to be South Wales Upper Coal Measures Formation comprised of mudstone, siltstone and sandstone. The superficial geology comprises Alluvium containing clay, silt, sand and gravel.

The soils have determined from the Cranfield University Soilscape viewer² and are described as loamy and clayey floodplain soils with naturally high groundwater.

2.4 Watercourses and flood defences

The site is located near a number of NRW main rivers and ordinary watercourses as shown in Figure 2-3.

The River Neath, an NRW main river, flows in a south-westerly direction approximately 110m south-east of the site.

1 <https://www.bgs.ac.uk/map-viewers/geoindex-onshore/>

2 [Soilscales soil types viewer - Cranfield Environment Centre. Cranfield University \(landis.org.uk\)](https://landis.org.uk/)

The Neath Canal flows in a southerly direction in open channel before being culverted at the north-eastern site boundary and flowing beneath the site.

The Garwed Brook flows in a southerly direction 130m south of the site before reaching its confluence with the River Neath 170m south of the site.

The Melin Court Brook flows in a north westerly direction 155m south of the site before reaching its confluence with the River Neath 175m south west of the site.

A ditch is present close to the eastern site boundary where elevations drop sharply by ~2m.

The site is not protected by the presence of any formal flood defences.

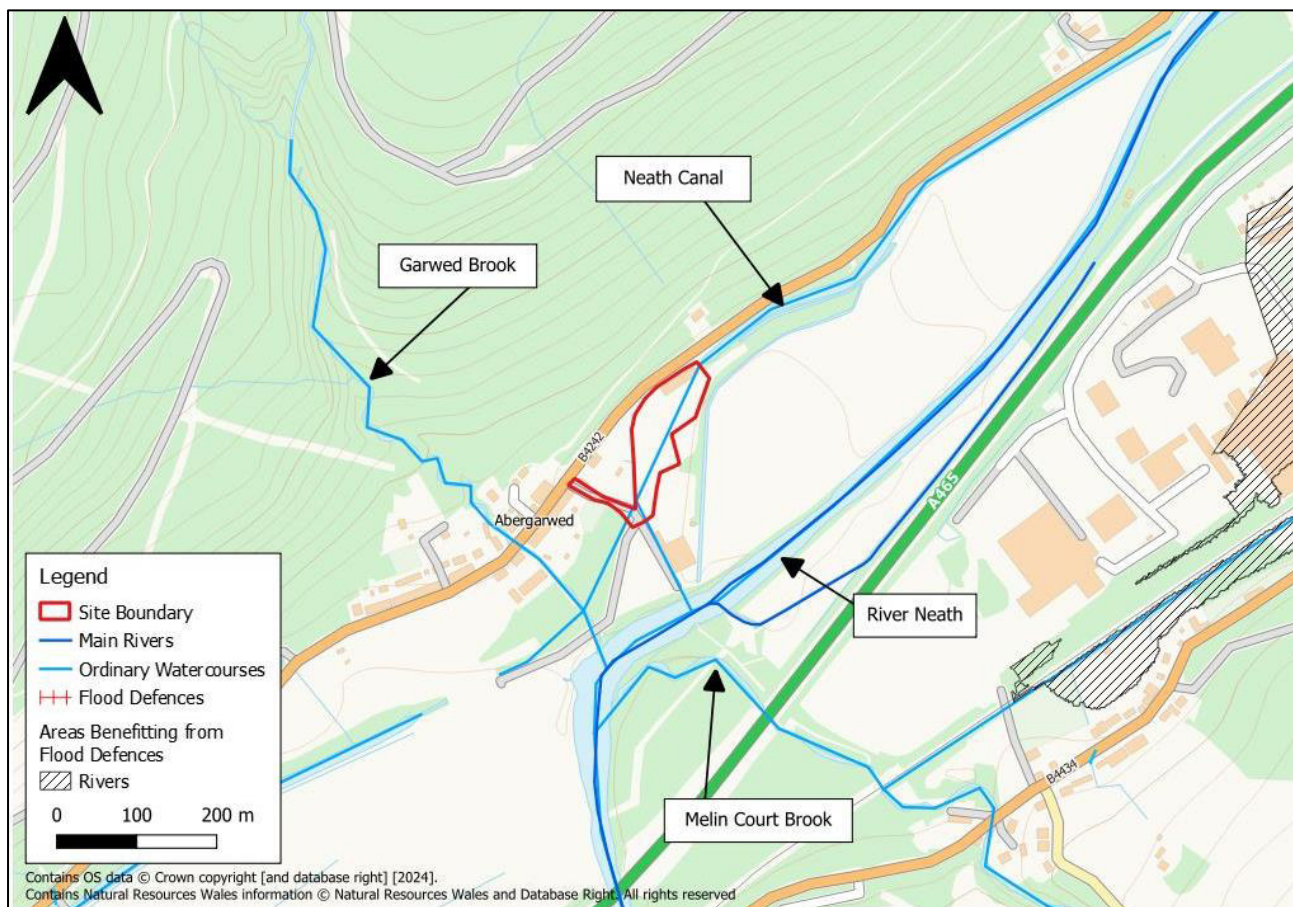


Figure 2-3 Watercourses

2.5 Proposed development

The proposal is for an industrial building located in the north of the site, as shown in Figure 2-4 and Appendix B. A septic tank may be located to the north of the building and associated vehicle parking spaces and yarding will also be provided. The building will be located on a ~200mm slab above existing ground level.

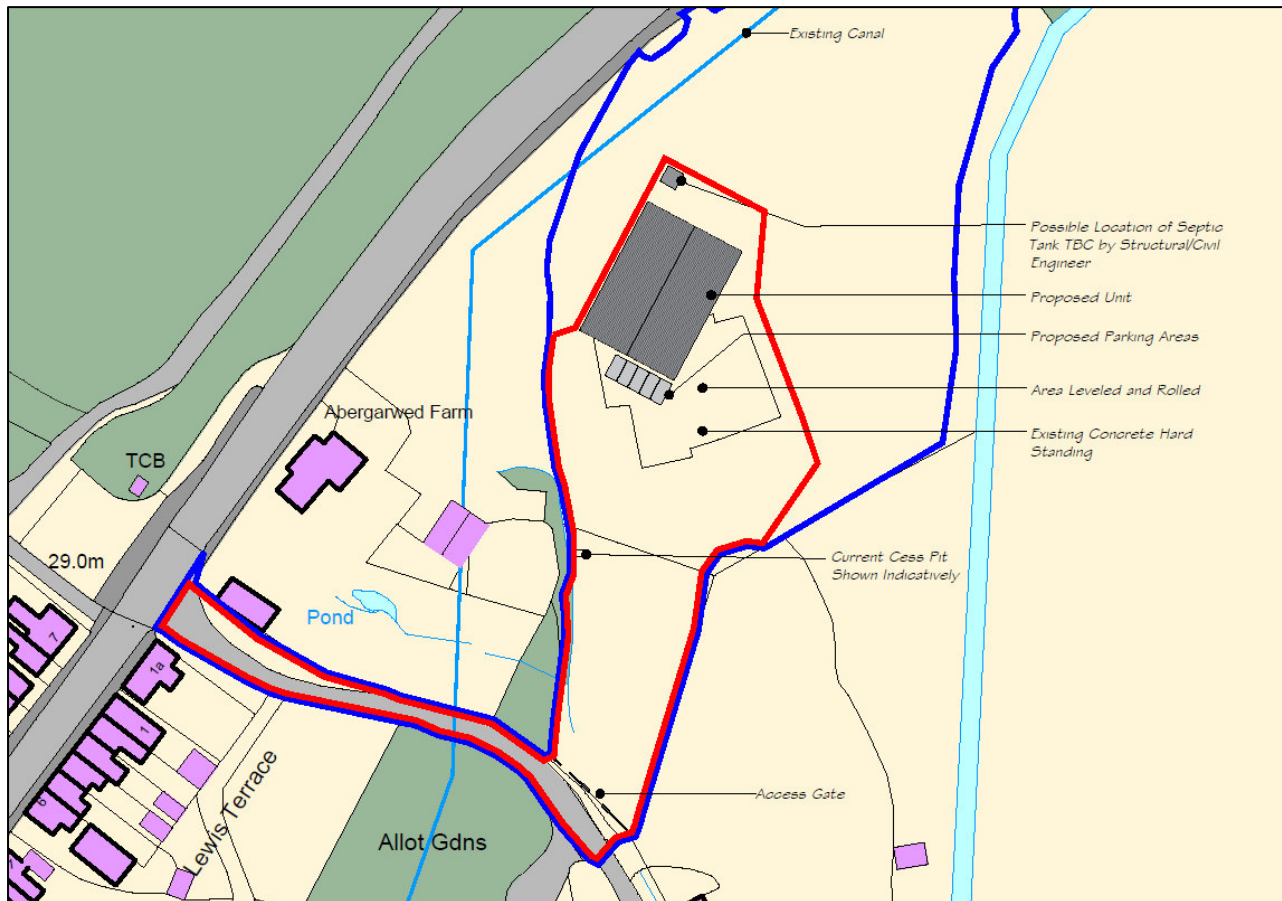


Figure 2-4 Proposed development layout

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 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 (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 the flood zones within the Development Advice Map (DAM) relevant to the proposed development, and to apply this information to the application of the Justification Test.

A draft update for TAN-15 was released in October 2021. However, Welsh Government subsequently suspended this, and it is not currently known when the new TAN-15 will be published in its final form and implemented. Although the new TAN-15 is not a material consideration, Welsh Government and NRW advise that some consideration is given to the 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 FMfP are considered as part of this FCA, although only the current TAN-15 has been applied to the assessment.

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 industrial purposes which is classified as **less vulnerable development**.

Table 3-1 Development classification 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 properties (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, mineral extraction sites and associated processing facilities, excluding waste disposal sites

3.3 Lifetime of development

The Welsh Government latest technical guidance for climate change states:

"When considering new development proposals, Technical Advice Note 15: Development, Flooding and Coastal Erosion (TAN-15) states that it is necessary to take account of the potential impacts of climate change over the lifetime of development. A rule of thumb is that residential development has a lifetime of 100 years whilst a lifetime of 75 years is assumed for all other developments."

As the proposal at the site is for industrial use, a 75-year lifetime of development has been considered in this assessment.

3.4 Development Advice Map Classification

The Development Advice Map (DAM) is used to trigger different planning actions based on a precautionary assessment of flood risk. Figure 3-1 shows that the site is partially located within DAM Zones A, B, and C2.

The north-western and western part of the site, including the location of the proposed building, is located in DAM Zone A described as areas "considered to be at little or no risk of fluvial or tidal/coastal flooding". The Justification Test is not applicable to proposed development within Dam Zone A and there is no need to consider flood risk further.

A small area in the north of the site is located in Zone B. This zone is based on the British Geological Survey (BGS) data and is defined as "Areas known to have been flooded in the past evidenced by sedimentary deposits". Zone B of the DAM is used as part of a precautionary approach to indicate where site levels should be checked against the extreme 0.1% Annual Exceedance Probability (AEP) flood level. If site levels are greater than the flood levels used to define adjacent extreme flood outline there is no need to consider flood risk further.

The central and eastern part of the site, including the main site entrance, is located in Zone C2. This area is described as "Areas of the floodplain without significant flood defence infrastructure". Less Vulnerable Development, such as that proposed, is permitted in Zone C2, subject to application of the Justification Test, including the Acceptability Criteria.

Whilst the proposed building location is not located in Zone C2, the proposal has been assessed against the Justification Test in Section 3.7 due to the presence of Zone C2 at the main site access.



Figure 3-1 Development Advice Map

3.5 Flood Map for Planning

The Flood Map for Planning (FMfP) is used to trigger different planning actions in support of the forthcoming TAN-15 update. Although the new TAN-15 is not a material consideration, the new FMfP is useful in that it shows the flood risk allowing for climate change over an assumed 100-year lifetime of development. Note that the industrial nature of the proposed development means that a 75-year development life is applicable and therefore the FMfP is precautionary.

The site is predominantly located within Flood Zones 2 and 3 of the FMfP for Rivers with a small area located in Flood Zone 1, as shown in Figure 3-2. The proposed building location is within Flood Zone 2.

Flood Zone 1 represents areas that have less than a 0.1% AEP chance of flooding in a given year, including climate change. This area is shown as transparent in the Flood Map for Planning.

Flood Zone 2 represents areas which have between a 0.1% - 1% AEP chance of flooding in a given year, including climate change.

Flood Zone 3 represents areas which have greater than a 1 in 100 (1%) chance of flooding in a given year, including climate change.

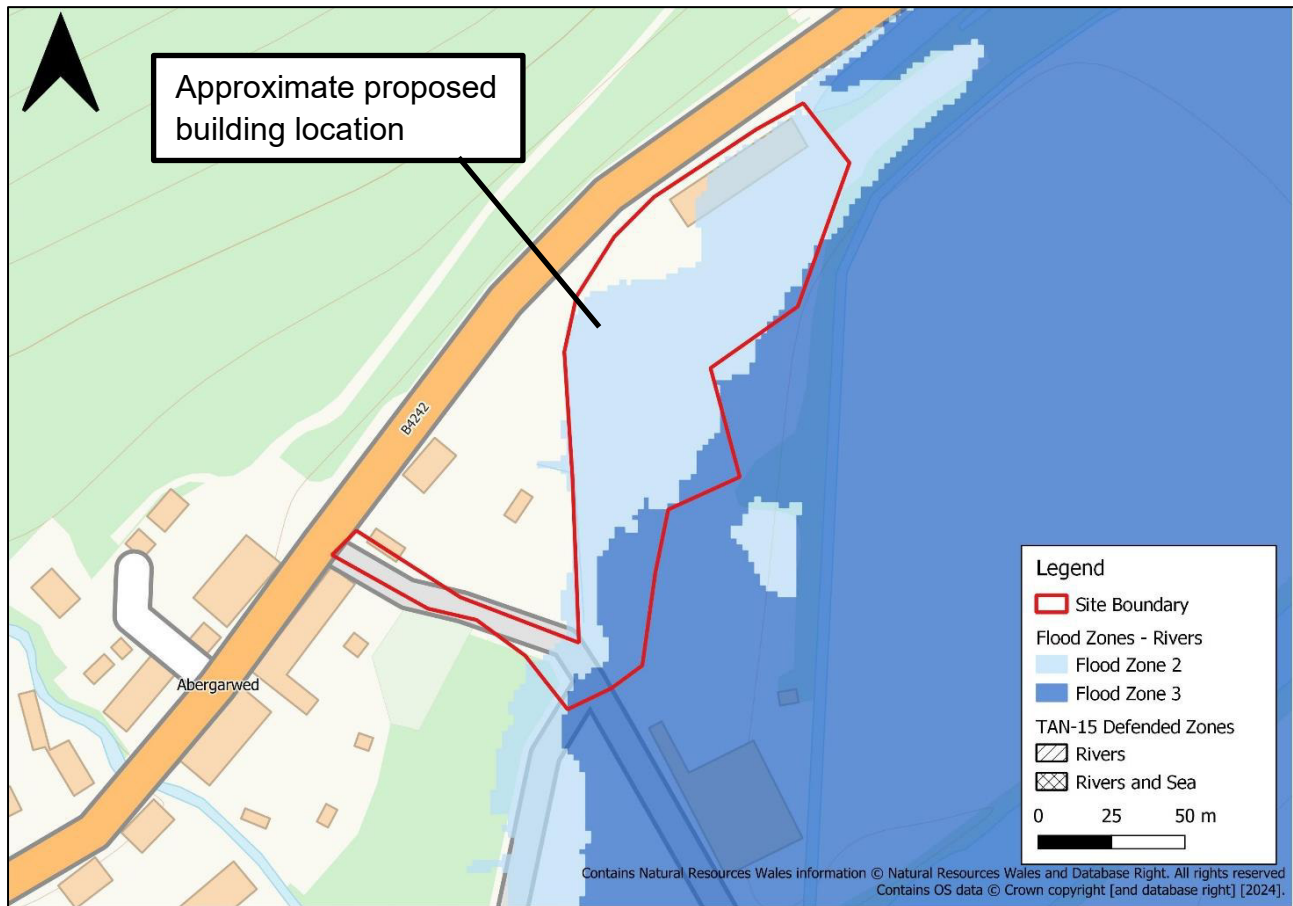


Figure 3-2 Flood Map for Planning – Rivers

3.6 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 Neath Port Talbot³ was adopted in 2016 and provides a framework to guide future development and set out where, when, and how new development can take place within the plan period (2011-2026). The development of the site will provide new employment opportunities and help to meet policy SP11 of the LDP which aims to ensure Neath Port Talbot achieves its economic potential.

3.7 Justification Test

Development in Zone C is subject to the Justification Test. TAN-15 states that development will be justified if it can be demonstrated that:

Its location in zone C is necessary to assist, or be part of, a local authority regeneration initiative or a local authority strategy required to sustain an existing settlement;

or

³ https://www.npt.gov.uk/media/7321/ldp_written_statement_jan16.pdf?v=20170727124344

Its location in zone C is necessary to contribute to key employment objectives supported by the local authority, and other key partners, to sustain an existing settlement or region;

and

It concurs with the aims of Planning Policy Wales and meets the definition of previously developed land;

and,

The potential consequences of a flooding event for the particular type of development have been considered and found to be acceptable.

The proposed development has been assessed against the requirements of the Justification Test, with the results summarised in Table 3-2. All the criteria have been satisfied.

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 proposed development will promote growth in the local economy, providing new employment and help to meet strategic policy SP11.	✓
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)	The proposal involves the development of brownfield land. The site therefore concurs with the aims of Planning Policy Wales.	✓
The potential consequences of a flooding event for the particular type of development have been considered and found to be acceptable.	A flood risk assessment, including detailed flood modelling, has been undertaken to demonstrate that the flood risk to the proposed development is acceptable. See sections 4 and 4.3.2.	✓

4 Flood Risk Assessment

This section assesses the risk to the site from all sources of flooding. Information is taken from publicly available data sources and the site-specific modelling undertaken to support this FCA.

4.1 Flood Risk Summary

A summary of the flood risk at the site is summarised in Table 4-1 below and discussed in the subsequent sections.

Table 4-1 Flood Risk Summary

Source of Flooding	Onsite Presence	Description
Flood Risk from Rivers	✓	The site is at low risk of fluvial flooding (Section 4.3).
Flood Risk from the Sea	✗	The site is at a very low risk of tidal flooding (Section 4.4).
Flood Risk from Surface Water and Small Watercourses	✗	The site is at a very low risk of flooding from surface water and small watercourses (Section 4.5).
Flood Risk from Groundwater	✗	The site is at low risk of flooding from groundwater (Section 4.6)
Flood Risk from Reservoirs	✗	The site is at a very low risk of flooding from reservoirs (Section 4.7).
Flood Risk from Canals	✗	The site is at a low risk of flooding from canals (Section 4.8).
Flood Risk from Sewers	✗	The site is at a very low risk of flooding from sewers (Section 4.9).

4.2 Historical Flooding

NRW's map of recorded flood extents, shown in Figure 4-1, does not show any evidence of historical flooding on the site. Neath Port Talbot Preliminary Flood Risk Assessment⁴ (PFRA) and Local Flood Risk Management Strategy⁵ (LFRMS) and Flood Risk Management Plan⁶ identified no records of historical flooding at the site.

4 https://www.npt.gov.uk/media/4629/pfra_report_2011.pdf?v=20171123145433

5 https://www.npt.gov.uk/media/4930/lfrms_npt_local_flood_risk_management_strategy.pdf?v=20170627002244

6 <https://www.npt.gov.uk/media/5399/floodriskmanagementplan15.pdf?v=20170627002320>

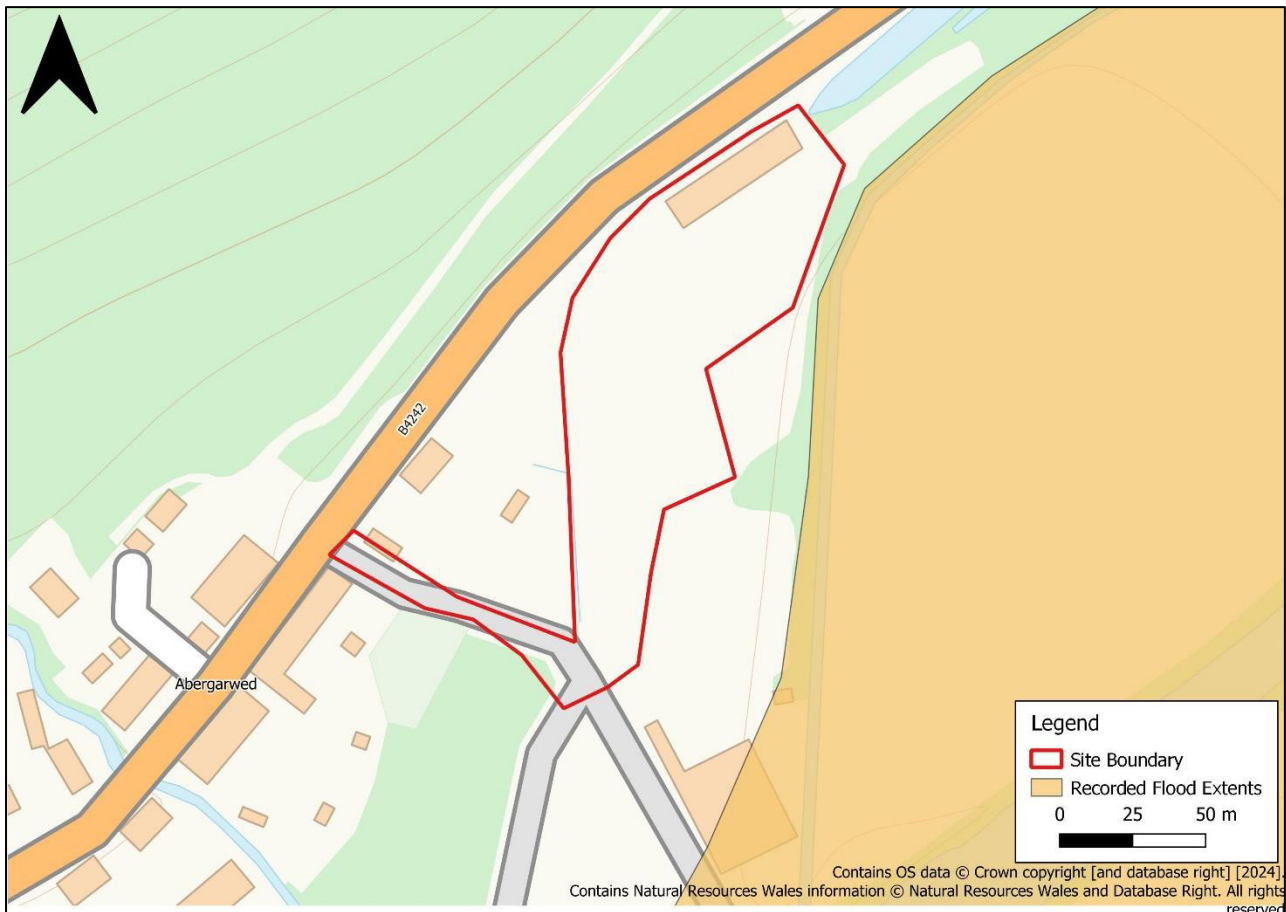


Figure 4-1 NRW Recorded flood extents

4.3 Flood Risk from Rivers

4.3.1 Existing fluvial flood risk data

As shown in Figure 3-2, NRW's Flood map for Planning for Rivers shows the site to be predominantly located within Flood Zones 2 and 3 with a small area located in Flood Zone 1. The proposed building location is within Flood Zone 2 and is therefore considered to be at risk of flooding during the 0.1% AEP plus climate change (100 years) fluvial flood event but not at risk during the 1% AEP plus climate change (100 years) fluvial flood event.

NRW's Flood Risk Assessment Wales (FRAW) map includes layers demonstrating high, medium and low fluvial flood risk which relate to the 3.3% AEP (1 in 30-year), 1% AEP (1 in 100-year) and 0.1% AEP (1 in 1000-year) events respectively, all without climate change. The FRAW data, shown in Figure 4-2, suggests that the site is at **low** (0.1-1% AEP) to **very low** (<0.1% AEP) risk of flooding from rivers.

It should be noted that the FRAW maps do not include an uplift for climate change which will need to be considered to fully assess the flood risk at the site for its lifetime.

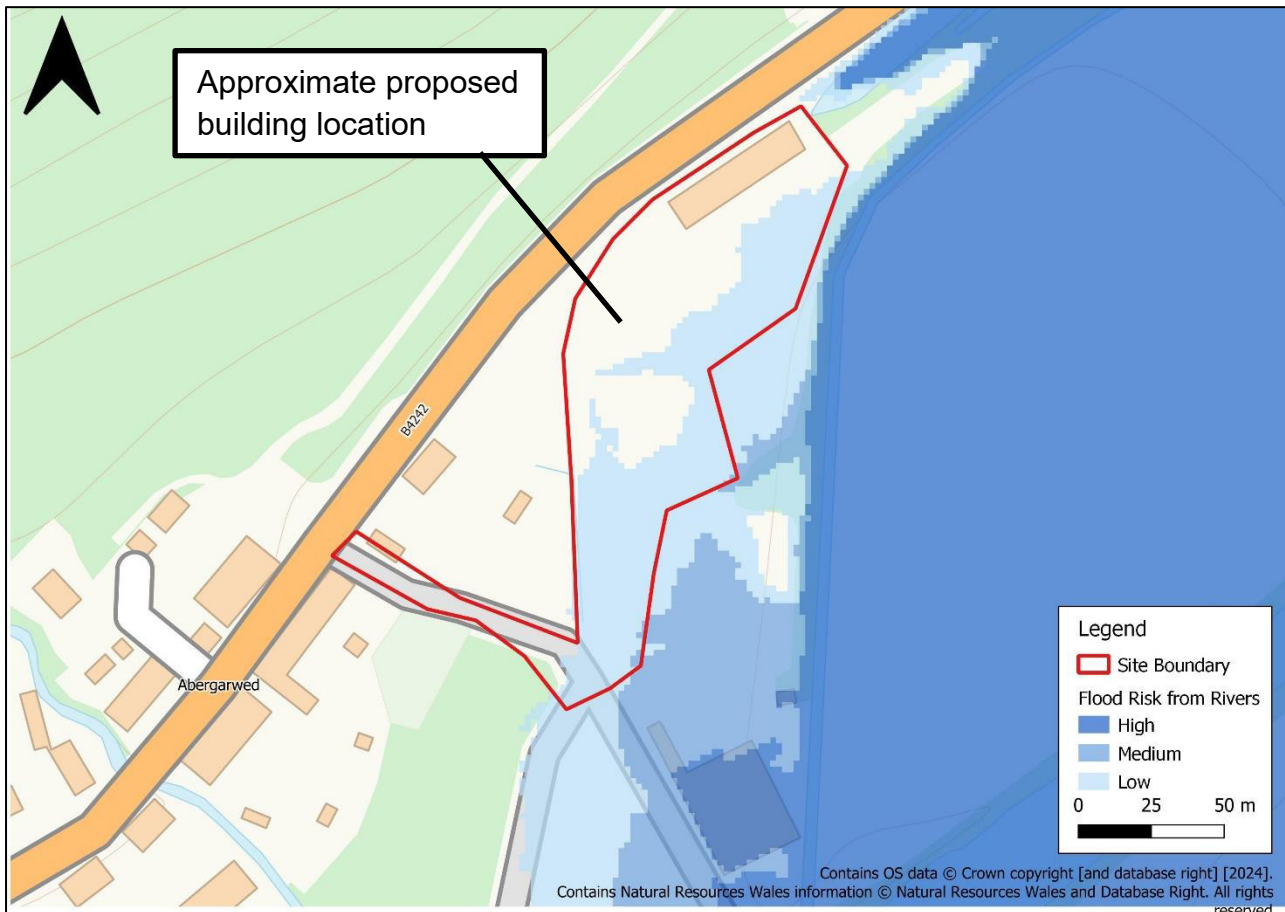


Figure 4-2 FRAW - Flood Risk from Rivers

The data which informs the DAM, FMfP and FRAW has been reviewed. The site is located within the vicinity of three NRW approved hydraulic models – the Neath, Resolven and the Melincourt models - all of which were developed by JBA for NRW and are of varying ages and contain different elements of the local fluvial system. However, the Flood Zone Mapping at the site is informed from generalised hydraulic modelling and is therefore unsuitable for a site-specific assessment.

To determine the fluvial flood risk at the site, site-specific detailed flood modelling has been undertaken and is described below.

4.3.2 Detailed Fluvial Flood Modelling

Site-specific hydraulic modelling has been undertaken to inform the assessment of fluvial flood risk. The hydraulic and hydrological model used to inform this assessment was originally developed by JBA Consulting for Natural Resources Wales (NRW) in 2017. This is a 1D-2D ESTRY-TUFLOW Resolven model of the River Neath watercourses originally developed to better understanding the flood frequency within the study area and to inform the potential for habitat creation.

A review of the existing 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.

4.3.2.1 Hydrology

- A new hydrological assessment has been completed to derive peak flow estimates and inflow hydrographs for the River Neath. Flow estimates have been calculated using the FEH statistical and the ReFH2 approaches for two locations, one at the upstream extent of the model and one at the Resolven gauge.
- The FEH statistical method has made use of the Resolven gauge data to provide an improved estimate of QMED, whereas the ReFH2 method is based solely on catchment descriptors. Due to the presence of hydrometric data, the FEH statistical method has been chosen as the preferred approach for the design event hydrology.
- The NRW flood estimation guidelines recommend using the ReFH2 ratio method to derive the peak flow estimates for the 0.1% AEP event, but this has not been adopted in this case. The results are very similar to the FEH statistical estimate, and the use of the statistical flows are slightly higher therefore, the approach taken is considered precautionary. Full details of the hydrological assessment are contained within Appendix C.
- It was decided not to derive inflows for the Melincourt Brook catchment which confluences with the River Neath just downstream of the site. The contribution from this catchment has been considered by using the model inflow from the 2015 NRW Melincourt Brook model. This is considered acceptable as the contributing flows from the catchment are negligible in comparison to the flows on the River Neath.

4.3.2.2 Baseline model updates

- The existing Resolven model has been extended downstream using the Environment Agency Wales S105 survey (1999) and the NRW River Neath channel survey data (2014). The Resolven model now extends to downstream of the Resolven gauge.
- A series of 1D model updates have been applied to the model including:
 - The additional of interpolate sections where there was a significant distance between the surveyed cross sections NEAT_10470 and NEAT_10021.
 - All bridge structures have been updated to use the 'BB' bridge unit with a form loss of 0.001 applied and the existing BG loss tables removed.
 - New initial conditions have been derived for the 1D domain through the use of the 1D initial water level layer.
- New 1D and 2D downstream HQ boundaries have been generated. The 1D HQ boundary has been derived using the ISIS/FM approximate QH boundary condition tool. The 2D HQ boundaries have been automatically generated using TUFLOW based on the 'b' slope attribute derived from LIDAR.

- To help address some localised areas of high mass error in the 2D domain, an additional energy loss value of 0.5 has been applied to some HX boundaries.
- The updated model schematic showing the model extent, key boundary condition information, and site location is shown in Figure 4-3.

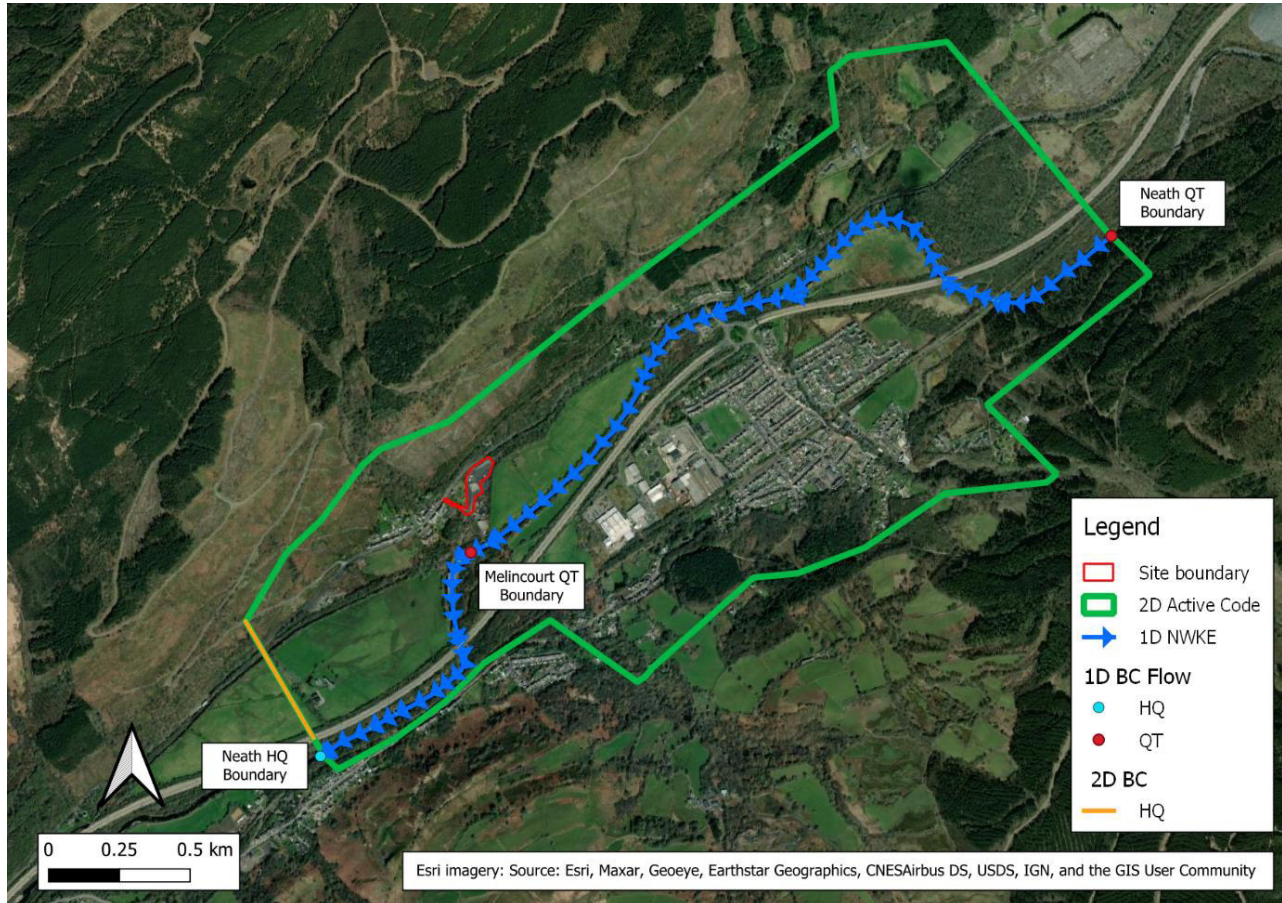


Figure 4-3 Updated Resolven baseline model schematic

4.3.2.3 Baseline model results

Figure 4-4 shows the modelled 1% AEP plus climate change (30%) fluvial flood depths. The site is largely flood-free during this modelled event, including the proposed building location. However, the far east part of the site floods to depths of up to 700mm. The peak depths around the main site access do not exceed 350mm. Peak water levels across the site are ~22.0m AOD during this design flood event.

The flood hazard rating is a combination of the modelled depth and velocities and is shown during the 1% AEP plus climate change (30%) event in Figure 4-5. The access is shown to be at a Caution to Dangerous for Most hazard category meaning access along part of the road may be restricted during a flood event. A flood-free emergency pedestrian access and egress route to the west, through the residential area, will be operational during the 1% AEP plus climate change (30%) event.

As the proposed building location is not predicted to flood in this event, the indicative guidance of TAN-15 A1.14 are met which states that “any proposed development should be flood-free in a 1% AEP fluvial event for the design life of the development.”

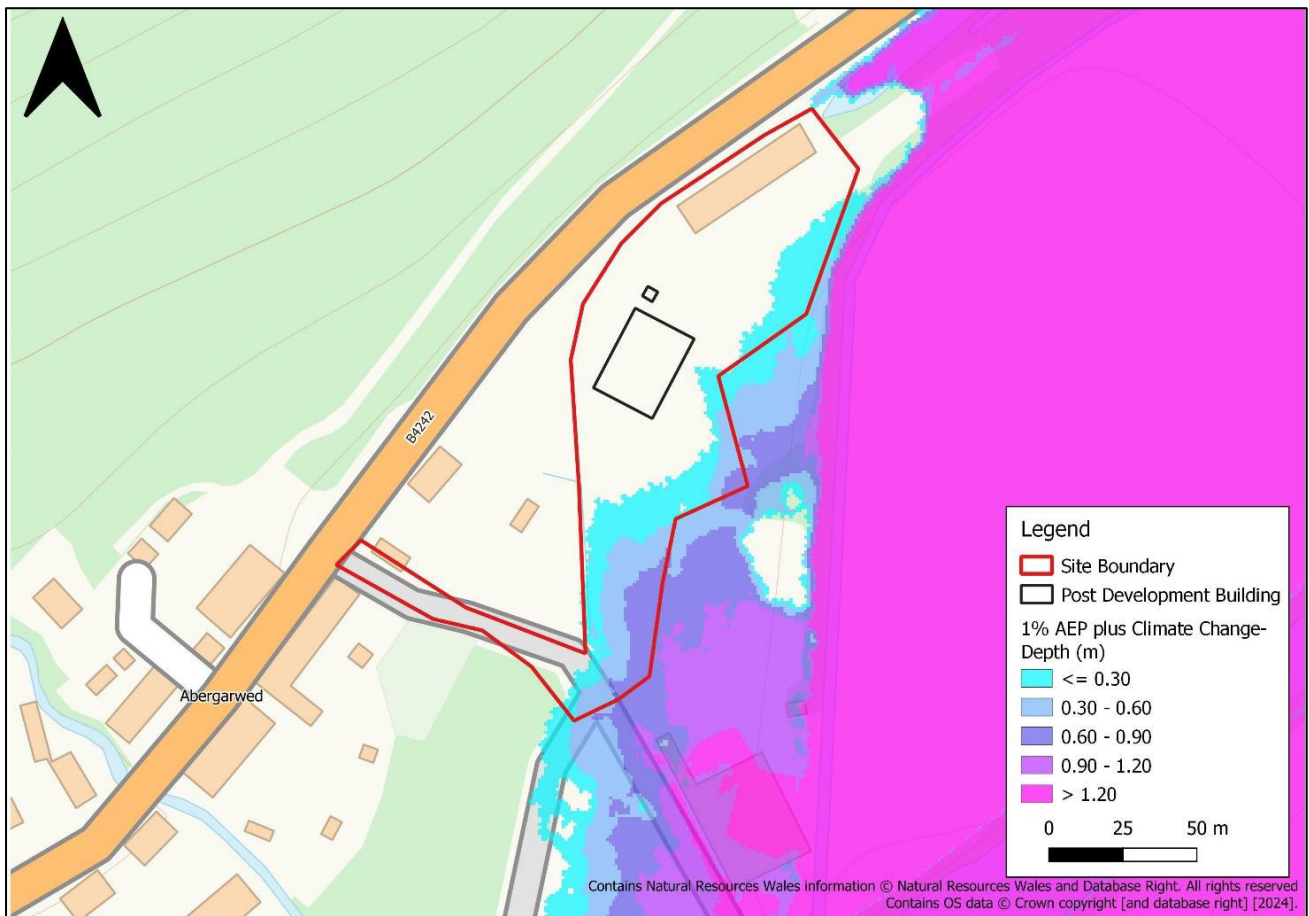


Figure 4-4 Baseline 1% AEP plus Climate Change event- Flood depths

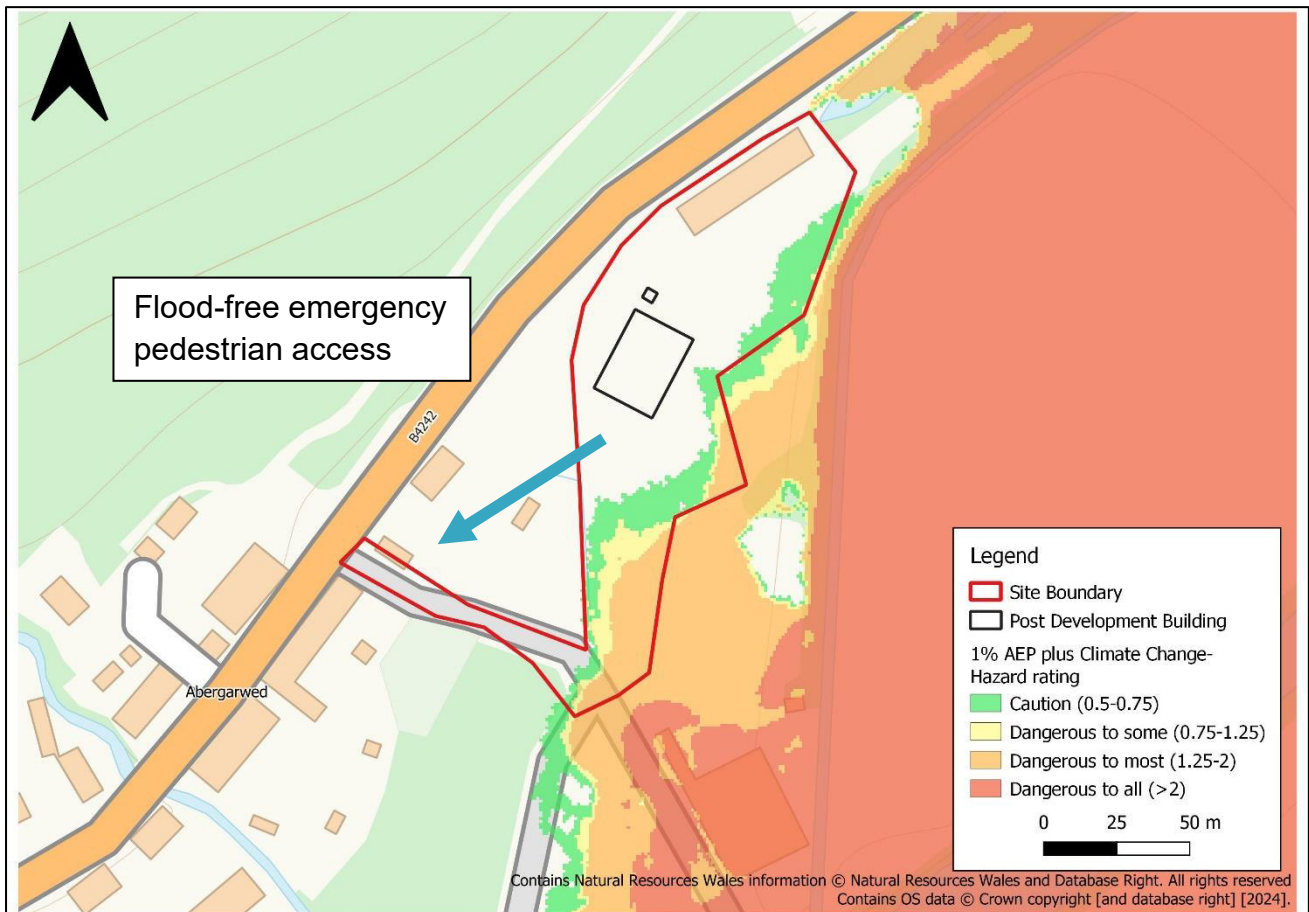


Figure 4-5 Baseline 1% AEP plus Climate Change event- Flood hazard rating

Figure 4-6 shows the modelled 0.1% AEP fluvial flood depths. The extent of flooding across the site increases during this event and a large area of the site is predicted to flood, including the proposed building location. Flood depths are an average of ~390mm and reach up to 1.22m at the far east part of the site. Peak water levels across the site are ~22.4m AOD.

The peak depth at the proposed building location is 230mm. However, the proposed building will be built on a slab ~200mm above existing ground level.

The peak depths around the main site entrance do not exceed 500mm. Depths of <600mm are considered to be accessible for the emergency services. The flood-free emergency pedestrian access and egress route to the west will remain operational during the 0.1% AEP modelled fluvial event.

The indicative guidance within TAN-15 A1.15 states that peak depths of <1000mm are acceptable for industrial development during the 0.1% AEP event. Therefore, the proposed development meets this criterion.

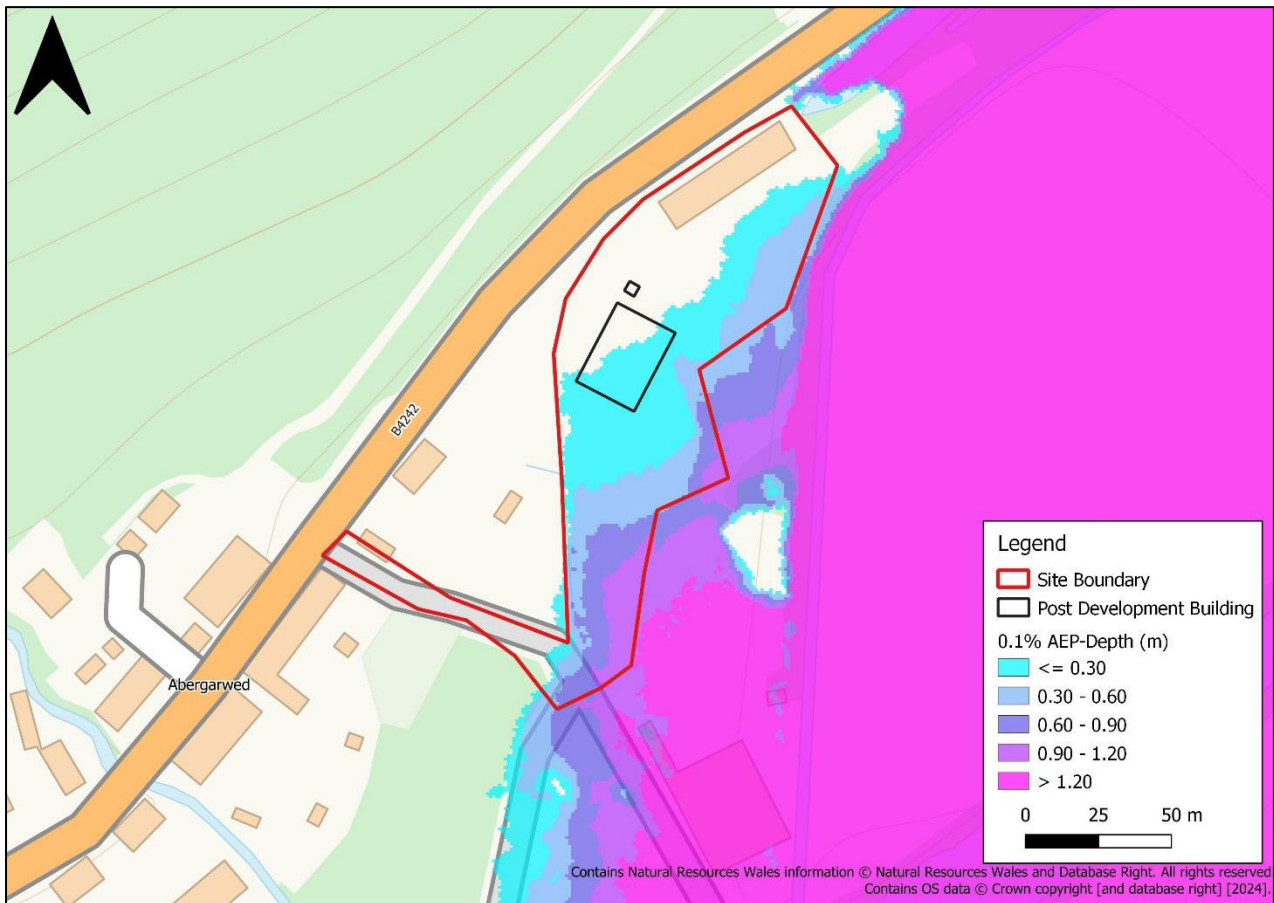


Figure 4-6 Baseline 0.1% AEP event- Flood depths

4.3.2.4 Post-development modelling

Following the completion of the baseline model updates, the proposed building footprint was shown to be flood free in the 1% AEP plus climate change event but floods to shallow depths (<300mm) in the 0.1% AEP event.

Ground raising risks displacing flood water, either by disrupting flow paths, reducing floodplain storage, or a combination of both. To understand if levelling and/or raising the building footprint would impact any neighbouring properties, a post-development scenario has been completed.

A post-developed model scenario was prepared which assumes the proposed building footprint is constructed to prevent flood water ingress (precautionary approach). Using the proposed development plan as shown in Figure 2-4, the building footprints have been added to the model and raised to a nominal elevation of 100m AOD using a 2D zshape layer. An elevation of 100m AOD has been chosen as to ensure that the building will remain flood free in the 0.1% AEP event and act as a precautionary approach to assess offsite flood risk detriment.

The 0.1% AEP event was re-simulated for the post-developed model scenario and the results were compared to the baseline results to determine the impact of the proposed development on fluvial flood risk elsewhere.

Figure 4-7 shows the impact of the proposed building on peak flood level during the 0.1% AEP event. Maximum water levels slightly increase by between 5mm and 10mm to the immediate east of the proposed building. There is no change in peak water levels outside of the site boundary, therefore, no third-party adverse flood risk impacts of the proposed development are predicted.

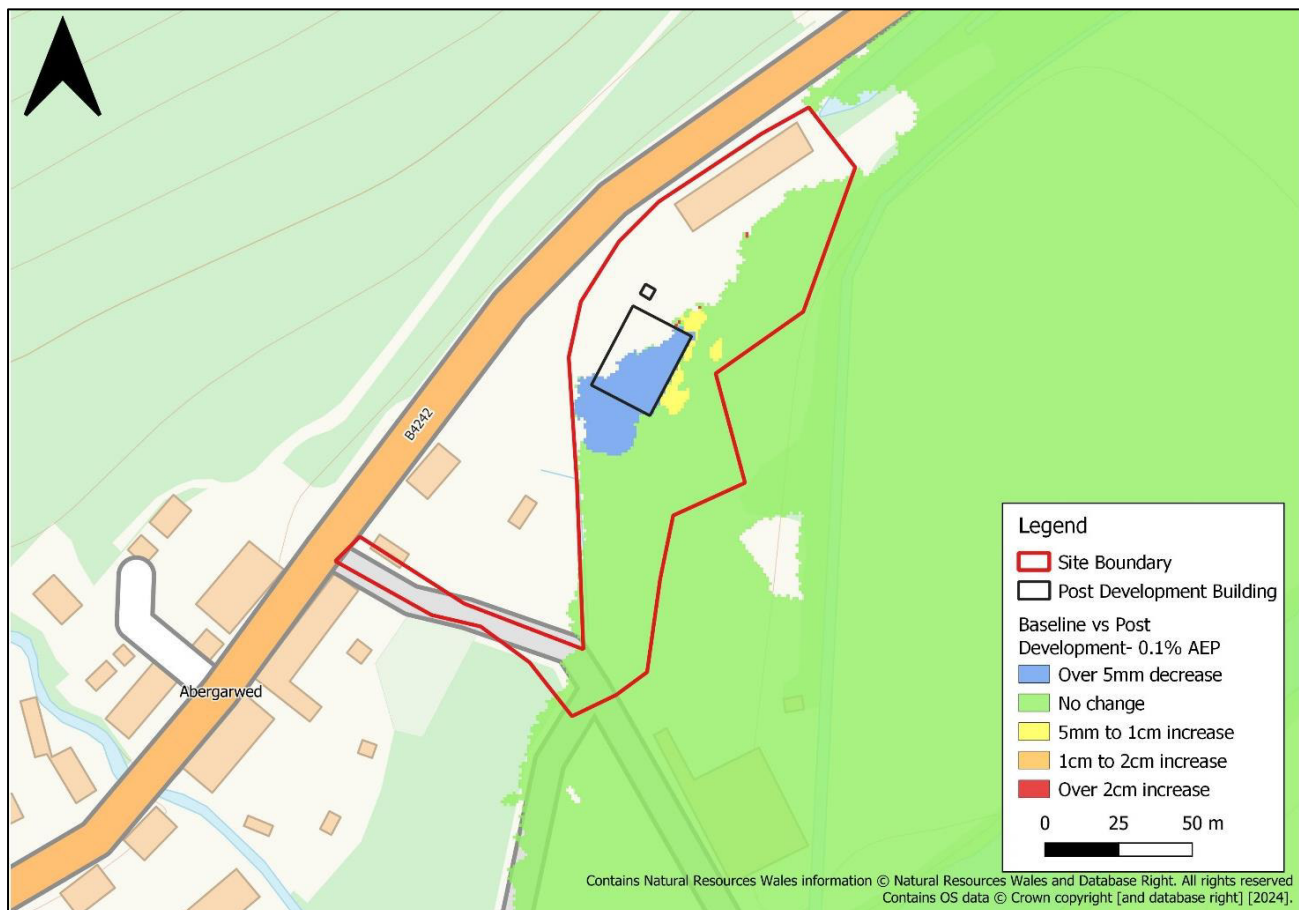


Figure 4-7 Comparison of pre- and post-development 0.1% AEP results

4.4 Flood Risk from the Sea

The site is located within Flood Zone 1 of the FMfP for the Sea. Flood Zone 1 represents areas that have less than a 0.1% AEP chance of tidal flooding in a given year, including climate change. The site is at very low risk of flooding from the sea according to NRW's FRAW Flood Risk from the sea. A very low risk means that the site is located within an area that has less than a 0.1% AEP chance of tidal flooding in any given year.

4.5 Flood Risk from Surface Water and Small Watercourses

The site is located within Flood Zone 1 of the FMfP for Surface Water and Small Watercourses. Flood Zone 1 represents areas that have less than a 0.1% AEP chance of

flooding from this source in a given year, including climate change. The NRW FRAW flood risk from Surface Water and Small Watercourses mapping shows that the site is at a **very low** risk of flooding from these sources, as shown in Figure 4-8. This means that there is a less than 0.1% AEP chance of flooding from this source in any given year.

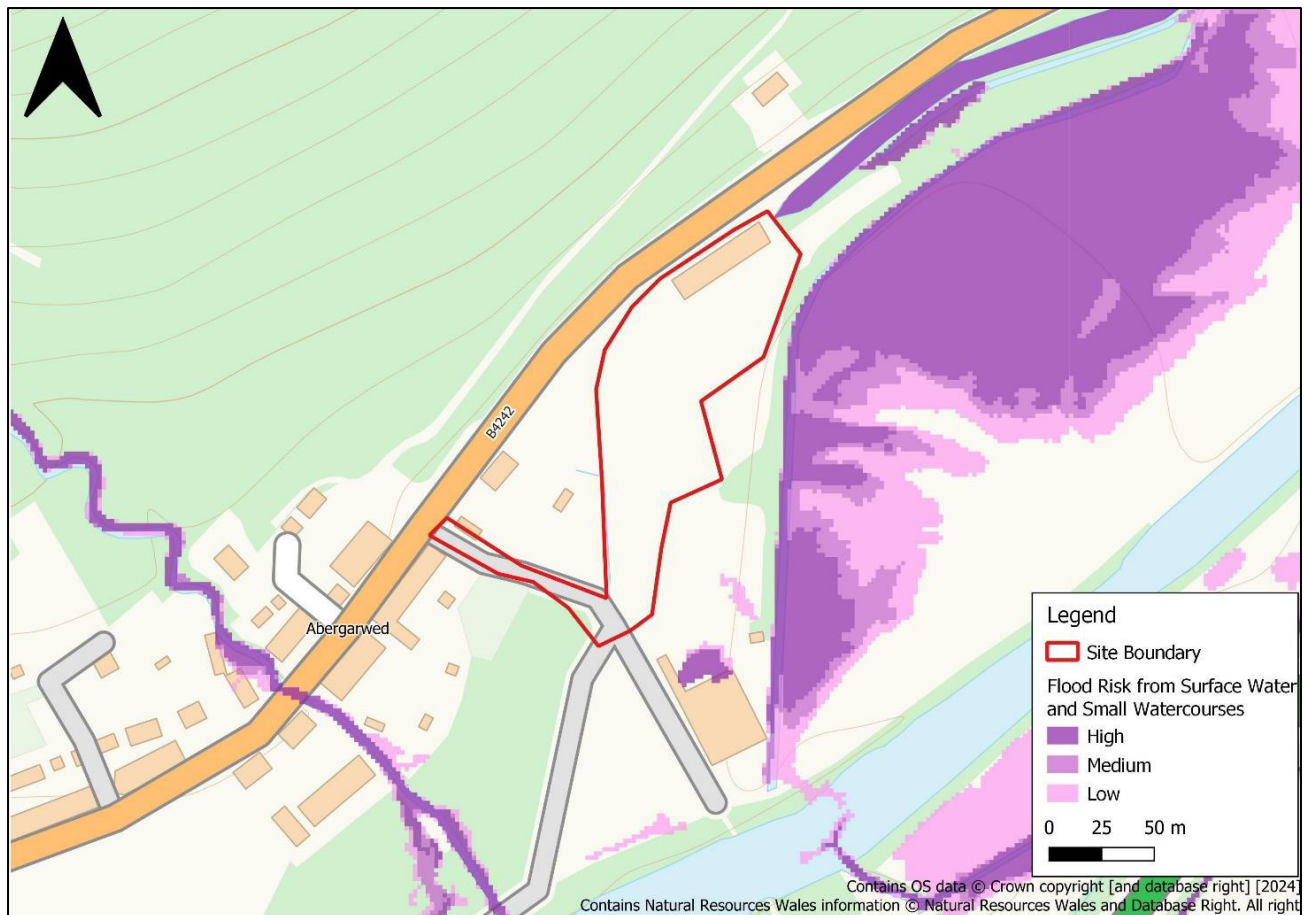


Figure 4-8 FRAW- Flood Risk from Surface Water and Small Watercourses

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, and can result in damage to property. This risk of groundwater flooding depends on the nature of the geological strata underlying the site and the local topography.

However, the Neath Port Talbot County Borough Council's SFRA⁷ (2014) and PFRA⁸ states that 'Groundwater flooding is known to occur in areas underlain by major aquifers, although

7 Strategic Flood Consequences Assessment Stage 1 & 2. 2014. Neath Port Talbot County Borough Council. https://www.npt.gov.uk/media/5137/ldp_submission_eb01.pdf

8 Preliminary Flood Risk Assessment Report. 2011. Neath Port Talbot County Borough Council. https://www.npt.gov.uk/media/4629/pfra_report_2011.pdf?v=20171123145433

increasingly it is also being associated with more localised floodplain sands and gravels. There are no specific areas of historical groundwater flooding recorded in the NPT area'. It can therefore be concluded that the risk of groundwater flooding at the site is **low**.

4.7 Flood Risk from Reservoirs

The NRW FRAW Flood Risk from Reservoirs map illustrates that a small part of the proposed development site is at risk of flooding from the failure of the Ystradfellte reservoir, ~20km upstream of the site. Reservoir flooding is extremely unlikely to happen. All large reservoirs must be inspected and supervised by reservoir panel engineers. As the enforcement authority for the Reservoirs Act 1975 in Wales, NRW ensure that reservoirs are inspected regularly, and essential safety work is carried out. Given this and the distance between the reservoir and site, it can be concluded that there is a **very low** risk of reservoir flooding at the site.

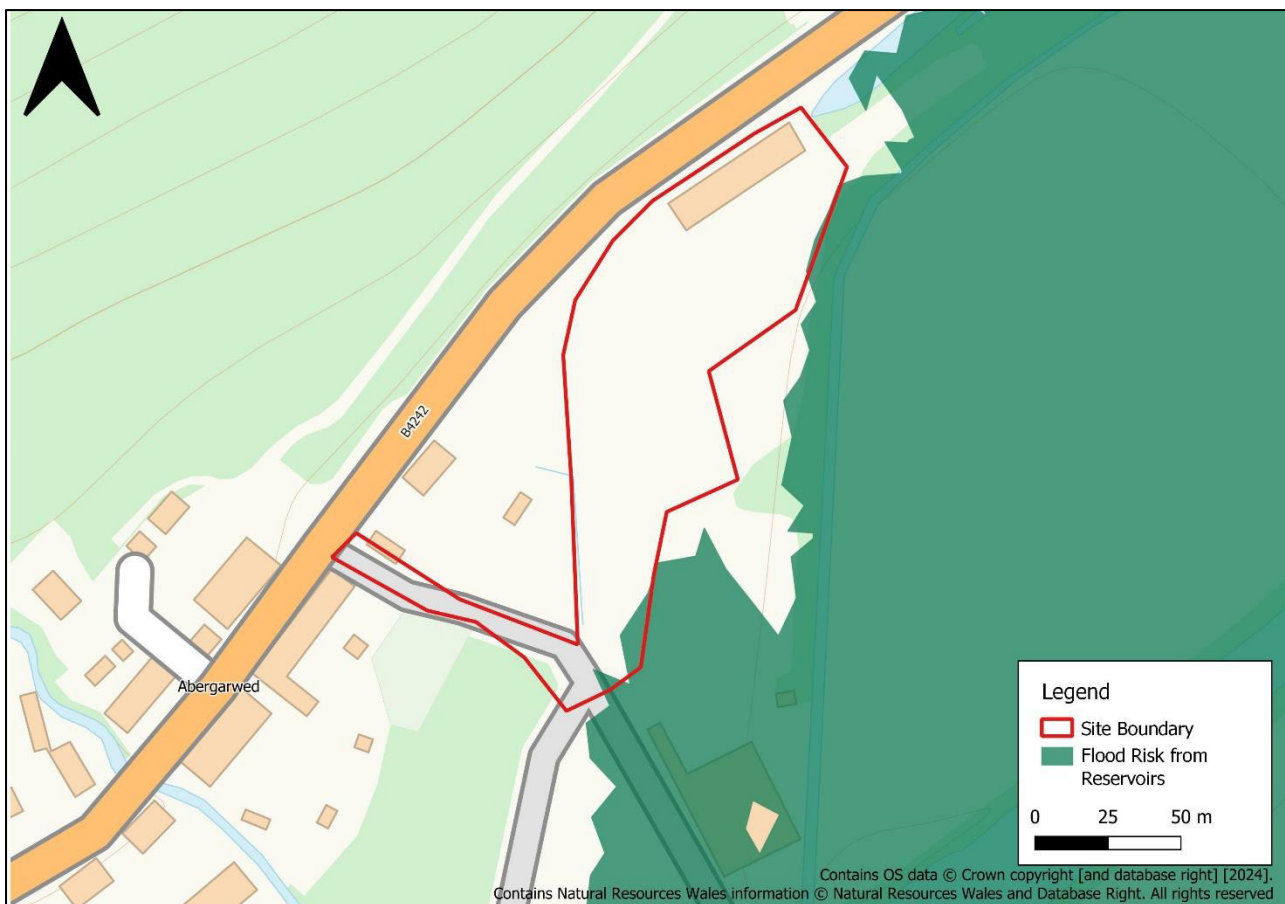


Figure 4-9 FRAW- Flood Risk from Reservoirs

4.8 Flood Risk from Canals

The Neath Canal flows in a southerly direction in open channel before being culverted at the north-eastern site boundary and flowing beneath the site. While the potential for canals to cause flooding is largely limited to breaches of their banks or other structures they do have the potential to channel flood water. However, the Neath Port Talbot County Borough

Council SFRA (2014) does not suggest there is any history of canal breaches or flooding in the vicinity of the site, therefore the risk of flooding from canals is considered to be **low**.

4.9 Flood Risk from Sewers

Neath Port Talbot County Borough Council's SFRA and PFRA do not suggest that there is any evidence of historical sewer flooding at the site. Therefore, it can be concluded that the risk of sewer flooding at the site is **very low**.

5 Flood Mitigation

5.1 Proposed development design

The proposed development is shown to be flood-free during the modelled 1% AEP plus climate change (30%) fluvial flood event and is at low or very low risk of flooding from all other sources. The proposed building may experience shallow flooding during the modelled 0.1% AEP fluvial flood event. In line with the indicative guidance within TAN-15 and given the proposed use of the building as a storage facility for a scaffolding business, shallow flooding during this extreme event is considered to be acceptable.

Hydraulic modelling demonstrates that the proposed development does not adversely impact flood risk to third parties, even if finished floor levels or flood resilience measures are implemented to exclude flood water from the building in the extreme flood event.

It is recommended that electrical sockets etc are raised within the proposed building to limit the disruption in the event of an extreme flood. No further mitigation is required as part of the building design to manage the flood risk at the site.

5.2 Access and egress

A flood-free emergency pedestrian access and egress route to the west, through the residential area, will be operational during all flood events considered.

Emergency service access will be operational during all flood events considered.

5.3 Flood Warning

The site is partially covered by an NRW Flood Alert Area- 'River Neath'. It is recommended that the occupants of the site sign up for these flood alerts to provide sufficient time for flood preparations to be made. The NRW Flood Alerts can be used to provide warning and ensure the site can be evacuated prior to the onset of a flood event.

6 Assessment of Acceptability Criteria

Section 3.7 details the assessment of the proposed development site against each criterion of the Justification Test. The requirements of the Acceptability Criteria within the Justification Test as set out in TAN-15, is summarised in Table 6-1 below. These criteria must be satisfied for the proposed development to comply with all aspects of TAN-15.

Table 6-1 Acceptability 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) including an allowance for climate change in accordance with TAN-15 table A1.14.	The proposed building location is predicted to be flood free during the 1% AEP plus climate change (30%) design flood event.	✓
The development should be designed so that in an extreme (1 in 1000) event there would be less than 600mm of water on access roads and within the property.	Depths on the access route and at the proposed building location are within acceptable tolerances during the 0.1% AEP extreme fluvial event.	✓
No flooding elsewhere.	The proposed development shall not impact upon the flood risk to third party land.	✓
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 site is not protected by flood defences.	✓
The developer must ensure that future occupiers of development are aware of the flooding risks and consequences.	The developer will provide future occupants with information on flood risk in the form of this report.	✓
Effective flood warnings are provided at the site.	The site is partially covered by an NRW Flood Alert Area- 'River Neath'	✓
Escape/evacuation routes are shown by the developer to be operational under all conditions.	A flood-free emergency pedestrian access and egress route to the west will be operational during all flood events considered.	✓

TAN-15 Justification Criteria	Comments	Achieved?
	Emergency service access will be operational during the all flood events considered. NRW Flood Alerts can be used to provide warning and ensure the site can be evacuated prior to a flood event.	
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.	It is recommended that electrical sockets etc are raised within the proposed building to limit the disruption in the event of an extreme flood.	✓
Development is designed to minimise structural damage during a flood event and is flood proofed to enable it to be returned to its prime use quickly in the aftermath of a flood.	The flood depths predicted at the building are such that there should be no impact on the structure of the building.	✓

7 Conclusions and Recommendations

JBA Consulting were commissioned by ASW Scaffolding Wales to undertake a Flood Consequences Assessment (FCA) for a proposed industrial unit, yarding and associated parking at their site off Neath Road, Abergawed.

The site is approximately 1.0ha in size and is currently comprised of brownfield land used for vehicle parking and storage by the scaffolding business.

The River Neath flows in a south-westerly direction approximately 110m south-east of the site. Ground levels across the main part of the site are between 21.6m AOD and 22.8m AOD. The topography across the wider area shows the land rising to the west and falling sharply to the east towards the River Neath.

Development proposals are for the construction of an industrial building located in the north of the site. A septic tank may be located to the north of the building and associated vehicle parking spaces and yarding will also be provided.

The site is located within Zones A, B, and Zone C2 of the Development Advice Map (DAM). The proposed building is located in Zone A. Less vulnerable development, such as that proposed, is permitted in Zone A, B and permitted in Zone C2, subject to application of the Justification Test, including the Acceptability Criteria.

The site is at low or very low risk of tidal, groundwater, sewer, and surface water flooding and flooding as a result of a reservoir or canal failure.

Detailed site-specific hydraulic modelling demonstrates that the proposed development, including the building, will be flood-free in the 1% AEP plus climate change (30%) fluvial flood event and that depths during the 0.1% AEP modelled fluvial event are <300mm at the proposed building (when the proposed concrete slab is considered) and <500mm at the main site entrance.

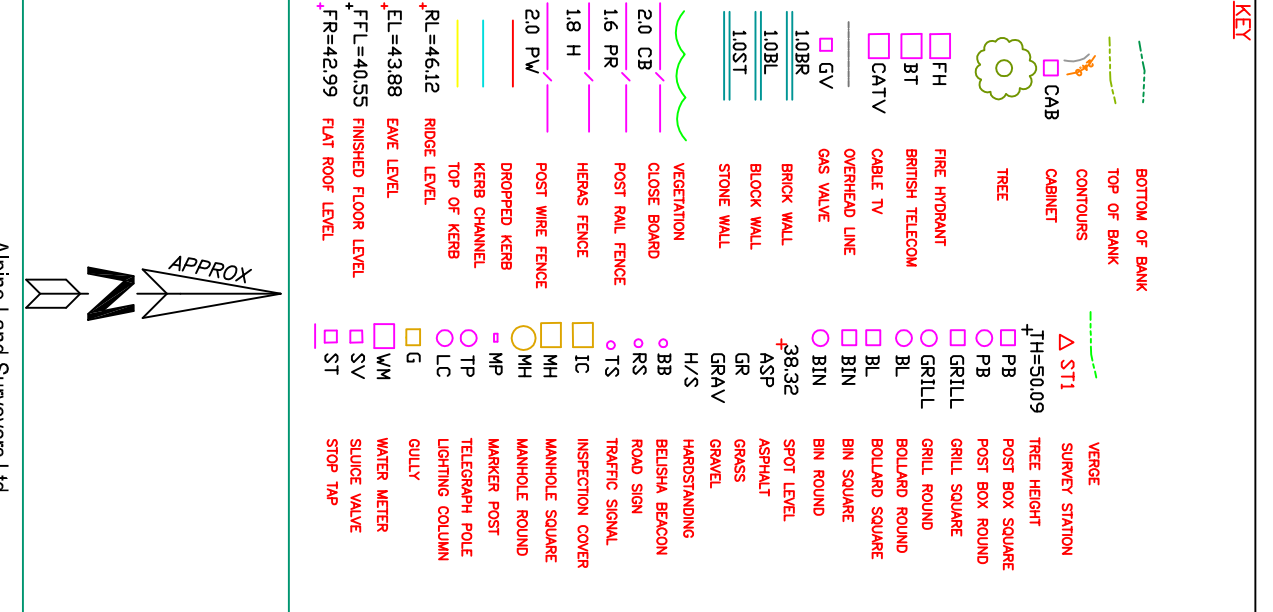
A post-development hydraulic modelling scenario has been completed which demonstrates that the proposed building will not adversely impact the flood risk of third-parties, even if finished floor levels of the building are raised or if resilience measures are used to exclude flood water ingress.

A flood-free emergency pedestrian access and egress route to the west will be operational during all flood events considered. Emergency service access will be operational during all flood events considered.

The development is proposed on brownfield land, will promote growth in the local economy, providing new employment and helping to meet strategic policy SP11 of the Local Plan. Therefore, the requirements of Justification Test, including the Acceptability Criteria are met.

Consequently, it can be concluded that on the grounds of flood risk, the proposed development meets the requirements set out in TAN-15 and the aims of Planning Policy Wales.

A Topographic Survey

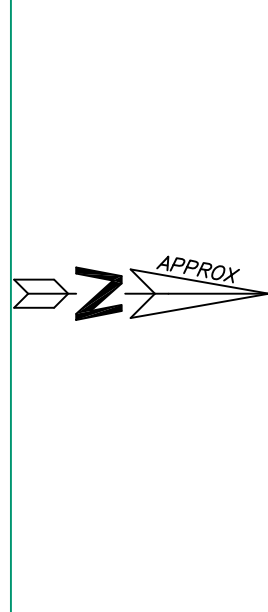


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PROJECT
TOPOGRAPHICAL SURVEY
AT
ABERGARWE

Drawn by: EJ Date: 04-06-23
Checked: TC
Scale: 1:200 @ A0
Project Reference No: ALS8811
Drawing Number: TSW/BERG/VN01

		1. Spot level 2. Contour 3. Boundary 4. Road 5. Filling 6. Structure 7. Tree 8. Water 9. Power line 10. Boundary 11. Road 12. Filling 13. Structure 14. Tree 15. Water 16. Power line
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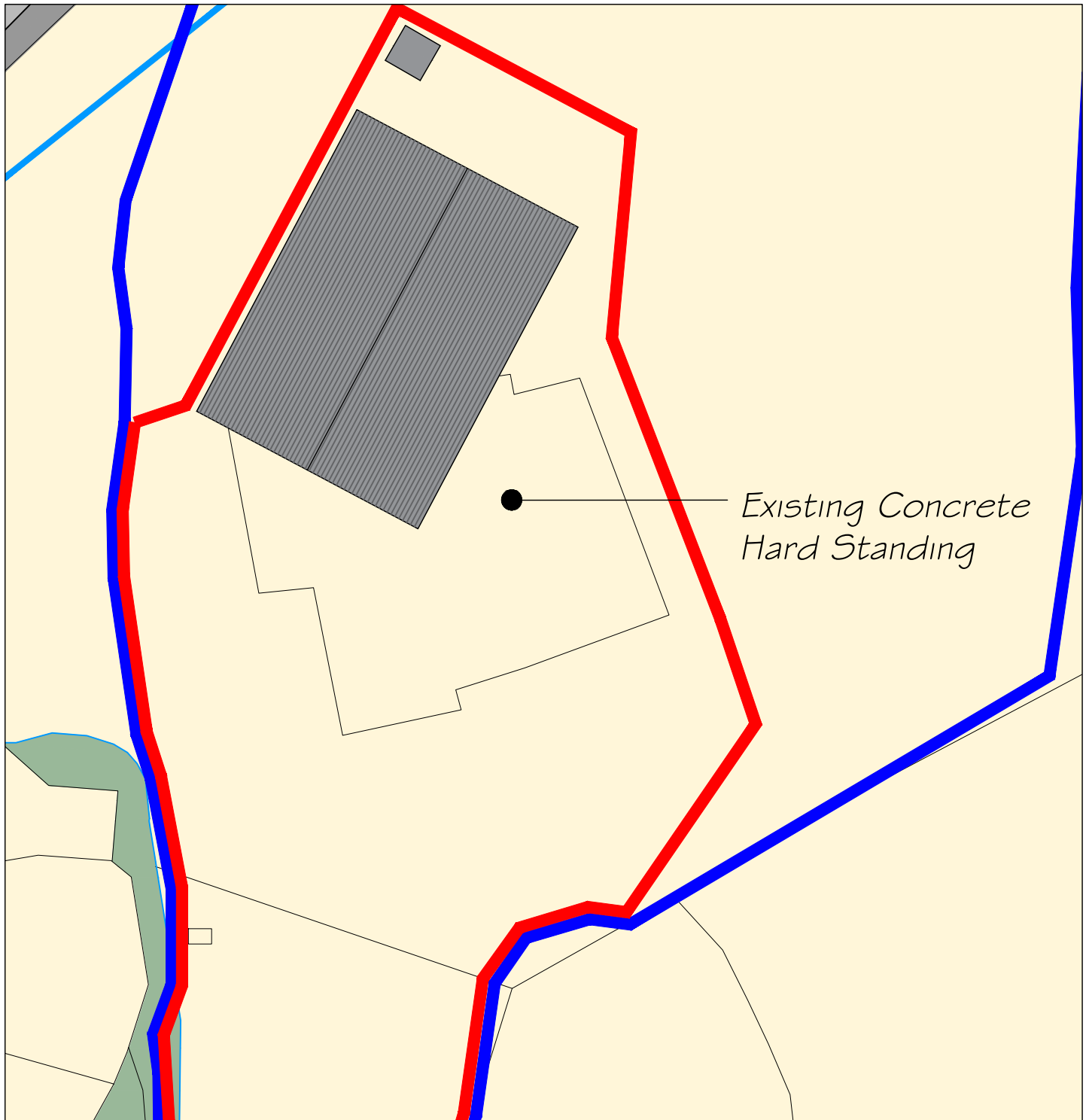
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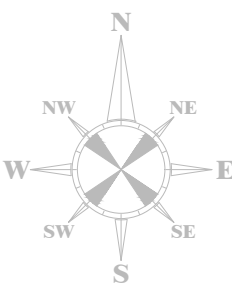
PROJECT
TOPOGRAPHICAL SURVEY
AT
ABERGARWED

Surveyed by: EJ	Date: 04-08-23
Drawn: EJ	Scale: 04-08-23
Checked: TC	

Project Reference No. ALS8811
Drawing Number: TSWABERG/VN02

B Development Plan



Notes		REVISIONS		Client: Absolute Scaffolding	
Ordnance Survey, (c) Crown Copyright 2019. All rights reserved. Licence number 100022432 	Rev	Comment	By	Date	Project Title: Industrial Units
	D	Existing Canal Shown	SJC	10.05.2021	Project Address 1: Land to South of Neath Road B4242
	C	Revised Location of Unit	SJC	06.05.2021	Project Address 2: SA11 4DL
	B	Unit position Adjusted	SJC	10/01/20	Drawing Title: Proposed Site Block Plan
	A	Position of Units Amended	SJC	18/09/19	Date: 16.09.2019 Scale: 1:500 Drawn By: SJC Ref: NC074 Drawing No: 003 Rev D
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C Hydrology Calculation Record

Flood Estimation Report

Abergarwed, Neath Port Talbot

Version 1

May 2024

www.jbaconsulting.com

Description

This report template is based on a supporting document to the Environment Agency's Flood Estimation Guidelines (LIT 11832). It provides a record of the hydrological context, the method statement, the calculations, the decisions made, and the results of flood estimation.

Contents

1	Summary of assessment	1
1.1	Summary	1
1.2	Flood frequencies	3
2	Method statement	4
2.1	Requirements for flood estimates	4
2.2	The catchment	4
2.3	Data review	10
2.4	Hydrological understanding of the catchment	13
2.5	Initial choice of approach	14
2.6	Selection of flood estimation locations	15
3	Locations where flood estimates are required	18
3.1	Catchment boundary checks and revisions	18
3.2	Other catchment descriptor checks and revisions	18
3.3	Catchment descriptors	19
4	Stationary statistical methods	20
4.1	Estimating QMED	20
4.2	Estimating growth curves	22
4.3	Final choice of QMED and growth curves	24
4.4	Final flood estimates from stationary statistical methods	24
5	Revitalised Flood Hydrograph 2 (ReFH2) method	25
5.1	Model parameters	25
5.2	Model inputs for design events	25
5.3	Final choice of ReFH2 flow estimates	26
6	Discussion and summary of results	27
6.1	Comparison of results from different methods	27
6.2	Final choice of method	27
6.3	Application of inflows to a hydraulic model	28
6.4	Checks	28
6.5	Assumptions, limitations, and uncertainty	30

6.6	Final results	30
7	Appendix	32
7.1	River Neath and Garwed Brook FEH Web Service descriptors	32
7.2	Pooling groups	32

Approval

Revision stage	Analyst	Approved by	Amendments	Date
Method statement	N/A	N/A	N/A	N/A
Calculations - Revision 1	Erica Godsland BSc	Jenni Essex BSc MSc PhD CEnv MCIWEM C.WEM	N/A	05/03/2024
Calculations - Revision 2				

Revision history

Revision reference	Date issued	Amendments	Issued to
Version 1	March 2024		ASW Scaffolding Wales

Abbreviations

AEP	annual exceedance probability
AMAX	annual maximum
AREA	catchment area (km ²)
ARF	areal reduction factor
BFI	baseflow index
BFIHOST19	baseflow index derived using the HOST soil classification, revised in 2019
CPRE	Council for the Protection of Rural England
FARL	FEH index of flood attenuation due to reservoirs and lakes
FEH	Flood Estimation Handbook
GL	Generalised Logistic (distribution)
HOST	Hydrology of Soil Types
KAP3	Kappa 3 (distribution)
NRFA	National River Flow Archive
NRW	Natural Resources Wales
OS	Ordnance Survey
POT	peaks over a threshold
QMED	median annual flood (with return period 2 years)
ReFH2	Revitalised Flood Hydrograph 2 method
SAAR	standard average annual rainfall (mm)
Tp	time to peak of the instantaneous unit hydrograph
URBAN	Flood Studies Report index of fractional urban extent
URBEXT2000	revised index of urban extent
WINFAP	Windows Frequency Analysis Package (software that can be used for FEH Statistical method)

1 Summary of assessment

1.1 Summary

Catchment location:

The main site of interest is the development site in Abergarwed alongside the B4242 (Neath Road) near Neath, South Wales.

Purpose of study and complexity:

JBA Consulting was commissioned by ASW Scaffolding Wales to update and run a hydraulic model of the River Neath for the proposed development site. The objective of the study is to update and accurately assess fluvial flood risk to the site and inform potential flood mitigation options. A new hydrological assessment is required to derive inflow hydrographs for input to the hydraulic model.

Key catchment features:

The study catchment is predominantly comprised of agricultural land and woodland/forestry. The catchment is sparsely populated, with Glynneath as the largest settlement.

The topography is steep, with limited floodplain extent through much of the catchment.

There are several reservoirs within the catchment.

The catchment has been historically mined and contains several quarries, and disused shafts, air shafts and tips. The catchment also contains a windfarm and two solar farms.

Flooding mechanisms:

The study site is at risk of fluvial and surface water flooding.

The site is shown to be in Flood Zone 2 and 3 for Rivers, affected by the River Neath.

This study will focus only on the risk of fluvial flooding from the above watercourse.

Flooding in this location is likely to be caused by peak flows exceeding the capacity of the watercourse.

Gauged / ungauged:

There is a river flow gauge (58002 – Neath at Resolven) located a short distance downstream of the site. The gauge is classified as suitable for pooling and QMED on the National River Flow Archive (NFRA), and therefore has been determined as suitable for use in the study.

Final choice of method:

FEH Statistical.

Key limitations / uncertainties in results:

There is no flood history information for the site against which to verify hydraulic model results based on the derived model inflows.

1.2 Flood frequencies

- The frequency of a flood can be quoted in terms of a return period, which is defined as the average time between years with at least one larger flood, or as an annual exceedance probability (AEP), which is the inverse of the return period.
- Return periods are output by the Flood Estimation Handbook (FEH) software and can be expressed more succinctly than AEP. However, AEP can be helpful when presenting results to members of the public who may associate the concept of return period with a regular occurrence rather than an average recurrence interval.
- Results tables in this document use AEP; if required, this can be changed to return period.
- The table below is provided to enable quick conversion between return periods and annual exceedance probabilities.

AEP (%)	50	20	10	5	3.33	2	1.33	1	0.5	0.1
AEP	0.5	0.2	0.1	0.05	0.033	0.02	0.013	0.01	0.005	0.001
Return period (yrs)	2	5	10	20	30	50	75	100	200	1,000

2 Method statement

2.1 Requirements for flood estimates

2.1.1 Overview

JBA Consulting was commissioned by ASW Scaffolding Wales to update and run a hydraulic model for the proposed development site. The proposed development site is a brownfield site currently used as a yard for a scaffolding company, alongside the B4242 (Neath Rd), Abergarwed. The objective of the study is to update and accurately assess fluvial flood risk to the site and inform potential flood mitigation options. A new hydrological assessment is required to derive inflow hydrographs for input to the hydraulic model. This document details the hydrological assessment, which has been undertaken using the latest methods, software, guidance, and data. The analysis was undertaken in accordance with the latest Natural Resources Wales (NRW) Flood Estimation technical guidance (GN008).

Design event peak flow estimates and hydrographs are required for the 3.33%, 1% and 0.1% AEP events. Peak flow estimates were also generated for the 50% AEP event, for information. The effects of climate change will be accounted for, using the latest guidance¹, by applying a 30% uplift to the 1% AEP event peak flow estimates. This represents the central estimate for the 2080s epoch for the West Wales River Basin District.

2.2 The catchment

Catchment description:

The study catchment (Figure 2-1) is large at 191km² and is predominantly comprised of agricultural land and woodland/forestry. The catchment is sparsely populated, with Glynneath as the largest settlement. The proposed development site is located west of Resolven, as shown in Figure 2-2.

The topography is steep, as shown in Figure 2-3, with limited floodplain extent through much of the catchment. The Terrain 50 DTM is displayed, as the 1m 2022 LiDAR and 2m 2018 LiDAR data do not fully cover the catchment.

There are several reservoirs within the catchment: the Llyn Fawr and Llyn Fach, Penderyn Reservoir and Ystradfellte Reservoir, and the Spring Valley lakes. The reservoirs are relatively small in comparison to the catchment size and as shown in

¹ https://www.gov.wales/sites/default/files/publications/2021-09/climate-change-allowances-and-flood-consequence-assessments_0.pdf

Figure 2-1 are located a minimum of 1km upstream of the site boundary. It is therefore unlikely the reservoirs will have a significant impact on flows at the development site.

The catchment has been historically mined and contains several quarries, and disused shafts, air shafts and tips. The catchment also contains a windfarm and two solar farms.

The study watercourse, the River Neath, rises just north of Pontneddfechan and flows in a south-westerly direction towards Neath, before discharging into Swansea Bay.

The Geology of Britain GeoIndex (onshore) Viewer² (shown in Figure 2-4) shows the catchment to be predominantly comprised of mudstone, siltstone and sandstone in the lower half of the catchment, and interbedded sandstone and conglomerate in the upper half. The superficial deposits consist of predominantly diamicton in the north and clay, silt and sandstone, and peat in the south.

The soils in the catchment³ are mixed and comprised of the following:

- Slowly permeable wet very acid upland soils with a peaty surface.
- Very acid loamy upland soils with a wet peaty surface.
- Freely draining very acid sandy and loamy soils.
- Slowly permeable seasonally wet acid loamy and clayey soils.
- Restored soils mostly from quarry and opencast spoil.
- Freely draining acid loamy soils over rock.
- Freely draining floodplain soils.
- Loamy and clayey floodplain soils with naturally high groundwater.

The catchment response to rainfall is likely to be rapid due to the steep topography and reasonably impermeable geology. The more permeable soils in the upper catchment may act to provide a small amount of storage and moderate runoff in more frequent events.

The NRFA webpage for the Neath at Resolven gauge (see Section 2.3.1) also states that runoff is reduced by industrial and/or agricultural abstraction. However, this is unlikely to significantly impact flood flows.

² <https://www.bgs.ac.uk/map-viewers/geoindex-onshore/>

³ <https://www.landis.org.uk/soilscapes/>

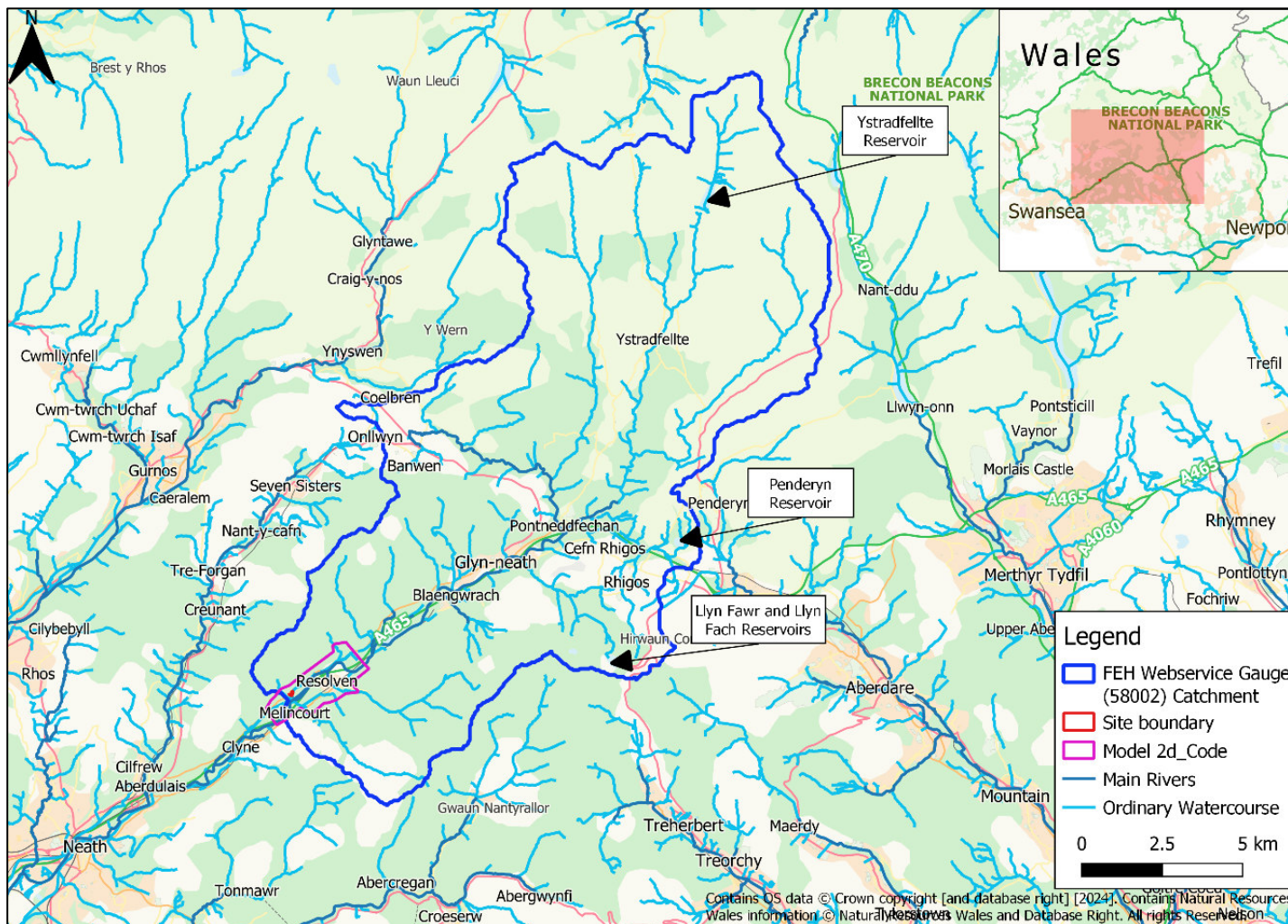


Figure 2-1: Catchment overview

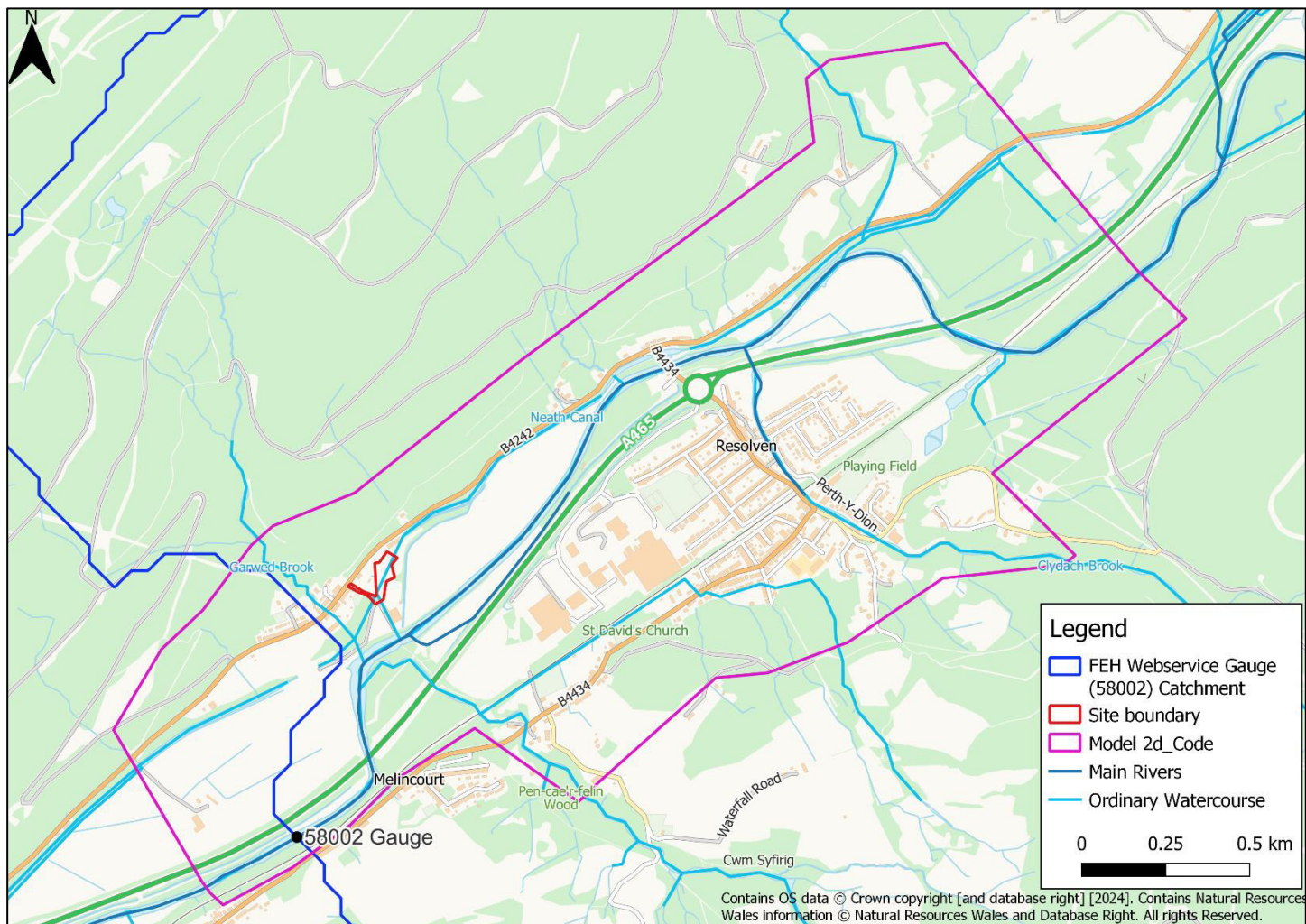


Figure 2-2: Site overview

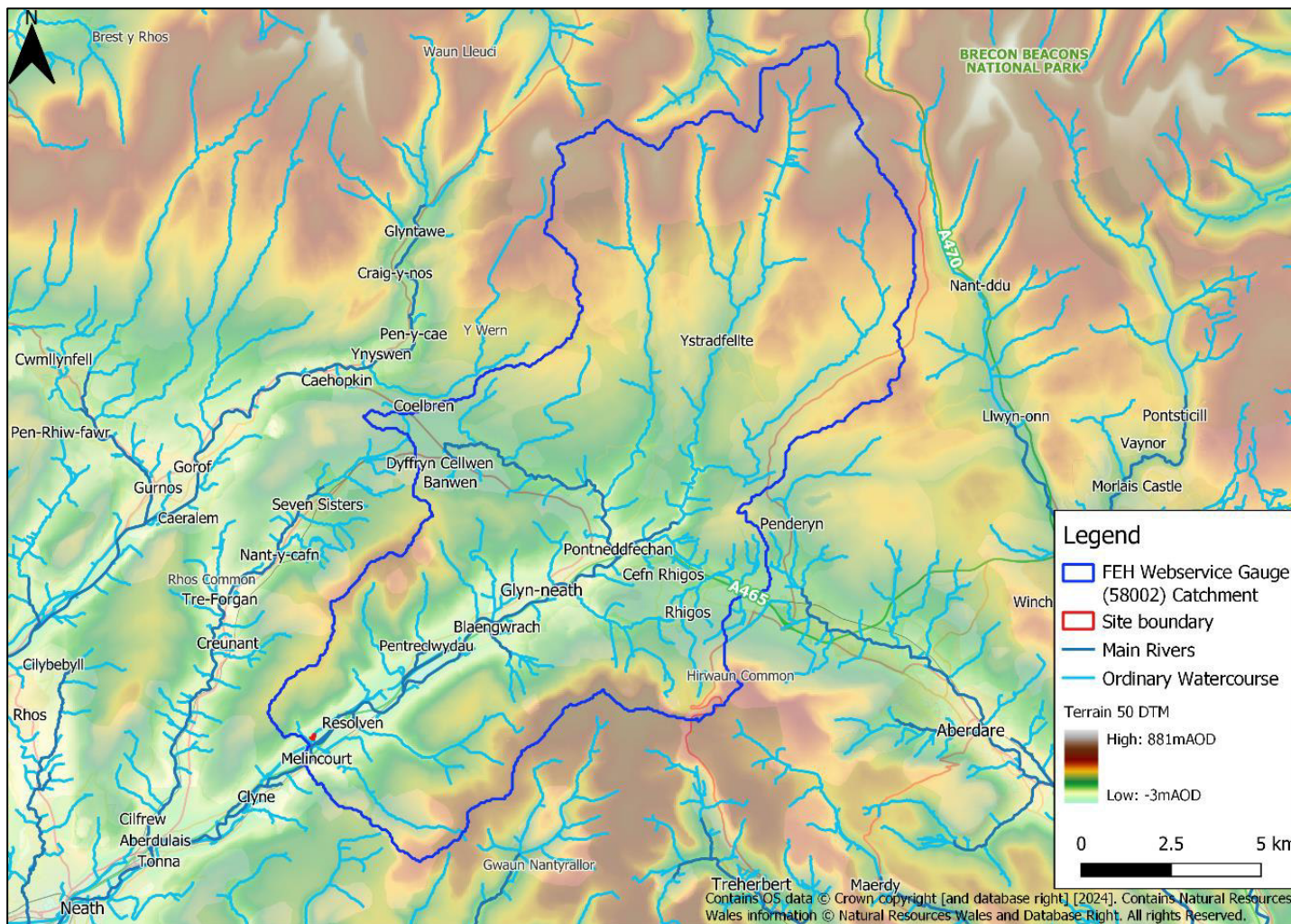


Figure 2-3: Catchment topography (Terrain 50 DTM)

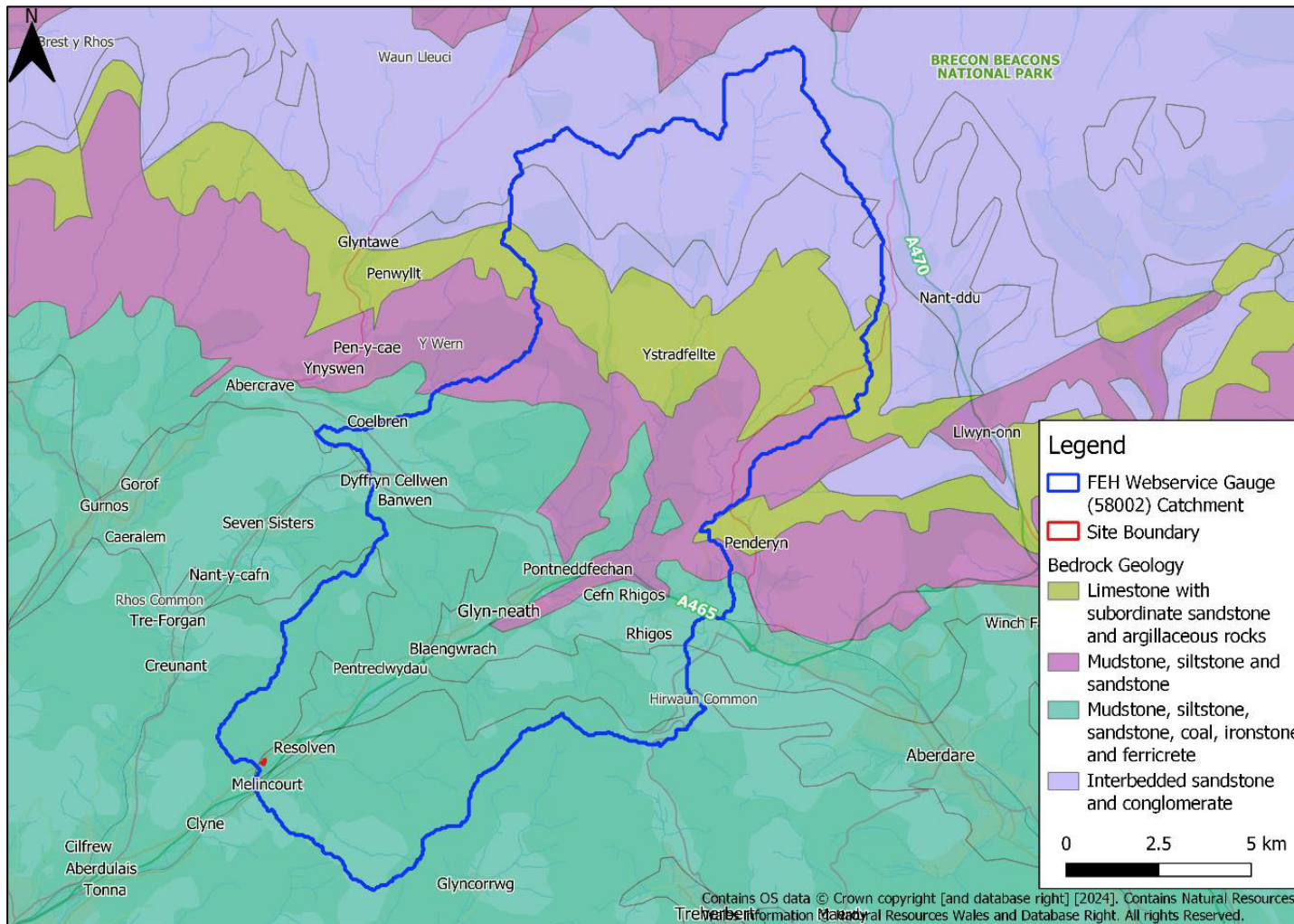


Figure 2-4: Catchment geology

2.3 Data review

This section provides a summary of the data available for the study, initial discussion of data quality, and identifies potential uses of the data for the hydrological assessment. Where relevant an indication is provided regarding other potential uses of the data, for example, hydraulic model calibration. Where applicable, the data is examined in more detail in Section 2.4.

Please note that only gauges at or near to the site of interest, and on the River Neath, are documented below. Any gauges substantially upstream or downstream of the site, or on unmodelled tributaries have not been documented. Rain gauges have also not been documented as it is not within the scope of the study to undertake flood event analysis.

2.3.1 River flow

Gauging station details

Watercourse	Station name	Grid reference	Gauging authority number	NRFA number	Catchment area (km ²)
River Neath	Neath at Resolven	SN815016	058002	58002	191

Data available

Station name	Type	Start and end dates of supplied data and source of data	Start and end of NRFA flood peak record	Data resolution
Neath at Resolven	Rated	N/A – no data requested for this study	1959 - Present	Annual maximum for NRFA flood peak record

Data quality

Station name	OK for QMED?	OK for pooling?	Other comments on station and flow data quality
Neath at Resolven	Yes - From 1978. Not gauged at QMED, but the quantity of gaugings and their consistent relationship give confidence in the rating at QMED and above.	Yes - From 1978. No gaugings above QMED but station expected to perform well. Some bypassing in 1979, but not in 1998 due to road construction. Modular limit unknown, likely to be less than bankfull and possibly less than the 1986 peak. Station suitability is borderline.	Data before 1978 rejected due to unstable channel and low flow gaugings only. Water spills from right bank during floods; stored on floodplain and does not bypass the gauge.

Ratings

Station name	Type of rating	Rating review needed?
Neath at Resolven	Theoretical	Not within scope to undertake rating review

Uses of the data for this study: Estimation of QMED and growth curve for the Statistical method.

2.3.2 Flood history

Data available

Event date	Flooding source	Details
1979	Fluvial	NRW's recorded flood outlines layer states that 'large areas of farmland/general agricultural land were flooded when the Neath breached and overtopped its banks. Multiple locations were flooded e.g. Llanwit Road, Neath; Lock House, Tonna; Ynys y Gerwyn Ffarm.'
1938	Fluvial	NRW's recorded flood outlines layer states that 'Flooding of Neath Catchment Wide, including Glynneath, Resolven and Cwmgwrach. No actual month or day of flooding known.'

Uses of the data for this study:

No reports of flooding at or near to the study site were found, therefore no historical flood data will be used as part of this study.

2.3.3 Other relevant data

A similar study was previously undertaken in the catchment on the Melin Court Brook south of the site (opposite the confluence with the Garwed Brook). These previous results will therefore be used to inform point inflows for this tributary to the River Neath. This watercourse will not have any impact on flood risk to the proposed development site.

2.3.4 Conclusions of data review:

Data type	Suitability for flood estimation calculations	Suitability for hydraulic modelling	Any further comments
River flow	58002 (Neath at Resolven) to be used for FEH Statistical method QMED estimate and growth curve derivation.	N/A	N/A
Flood history	N/A	N/A	N/A

2.4 Hydrological understanding of the catchment

2.4.1 Flood statistics

Plots of flood peak data and interpretation:

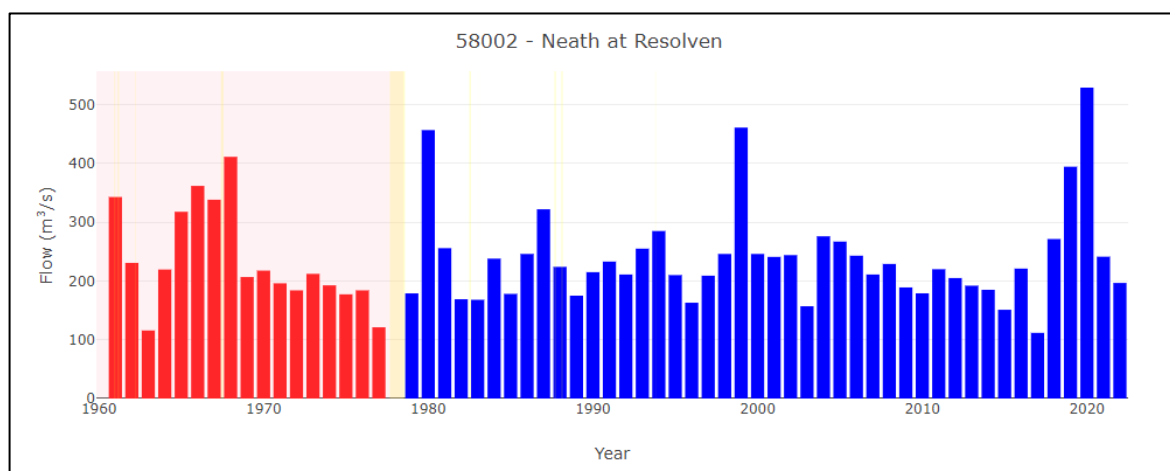


Figure 2-5 Neath at Resolven AMAX series

Figure 2-5 (source: <https://nrfa.ceh.ac.uk/data/station/peakflow/58002>) shows the annual maximum (AMAX) flow series at the Neath gauge, taken from the NFRA website. Data is available from 1959, however only from 1978 is recommended for use in analysis.

It is not within the scope to look at gauge event data, or to undertake a detailed assessment of the data, only to check that the data is suitable for use within the study. The gauge is classified as suitable for pooling and QMED on the NFRA, and therefore has been determined as suitable for use in the study.

2.4.2 Conceptual model

The main site of interest is the development site in Abergarwed alongside the B4242 (Neath Road) near Neath. Flooding in this location is likely to be caused by peak flows exceeding the capacity of the watercourse.

Surface water may be another source of flood risk to the study site; this study considers only fluvial flooding.

2.4.3 Unusual catchment features

There are several reservoirs within the catchment.

The catchment has been historically mined and contains several quarries, and disused shafts, air shafts and tips. The catchment also contains a windfarm and two solar farms.

2.5 Initial choice of approach

Are FEH methods appropriate?: Yes

Initial choice of method(s) and reasons:

Both the Statistical method and the ReFH2 method will be applied as both are appropriate for the study catchment.

There is an NFRA gauge within the model extent, slightly downstream of the site of interest. It is therefore proposed to generate peak flow estimates at the gauge location as well as at the site of interest on the Neath. QMED can be estimated from the AMAX series at the gauge and should represent the influence of catchment characteristics such as reservoirs and lakes. An enhanced single-site analysis can be undertaken at the gauge location to provide the growth curve for the upstream estimation point. This means that more weight is given to the local gauge site.

The FEH Statistical method is the preferred method due to the availability of good quality peak flow data close to the site of interest. ReFH2 flows will be generated for reference. Modelled peak flows at the gauge location will be compared to the target flows and reconciled, if necessary and / or appropriate.

How will hydrograph shapes be derived, if needed?:

Hydrographs will be derived using the ReFH2 model. As the FEH Statistical method is the preferred method to derive peak flow estimates, ReFH2 hydrographs will be fitted to the Statistical peaks. It is not within the scope to use the gauge data to derive an average hydrograph shape.

Will the catchment be split into sub-catchments? If so, how?:

The catchment will not be split into sub-catchments as only one inflow will be applied at the start of the model reach. Inflows for Melin Court Brook will be supplied by a previous study.

Software to be used:

- FEH Web Service⁴
- WINFAP 5.1⁵
- ReFH 2.3-FEH22 Calibrated

⁴ CEH 2015. The Flood Estimation Handbook (FEH) Online Service, Centre for Ecology & Hydrology, Wallingford, UK.

⁵ WINFAP 5.1 © Wallingford HydroSolutions Limited 2023.

2.6 Selection of flood estimation locations

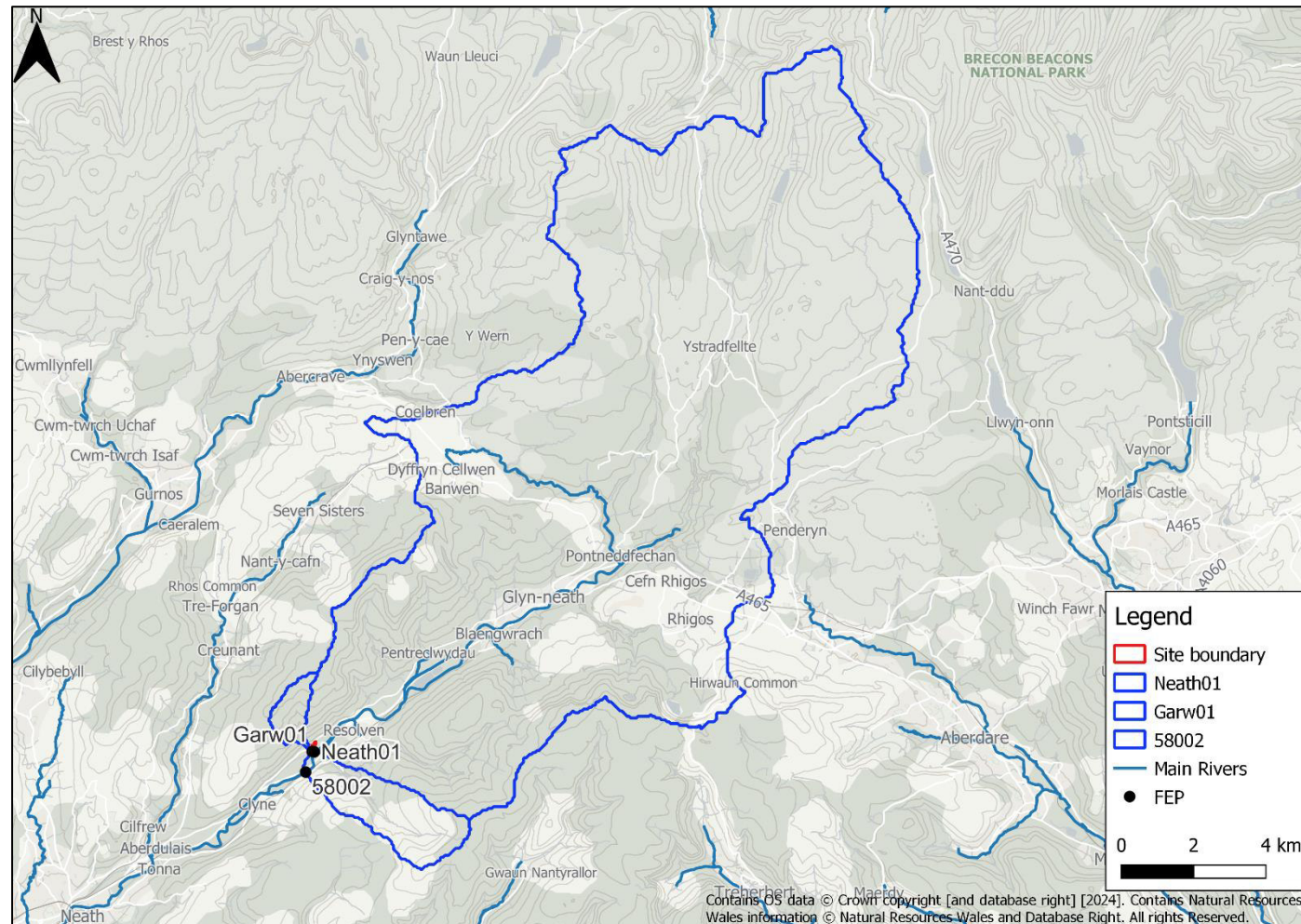


Figure 2-6 Flow estimation points (overview)

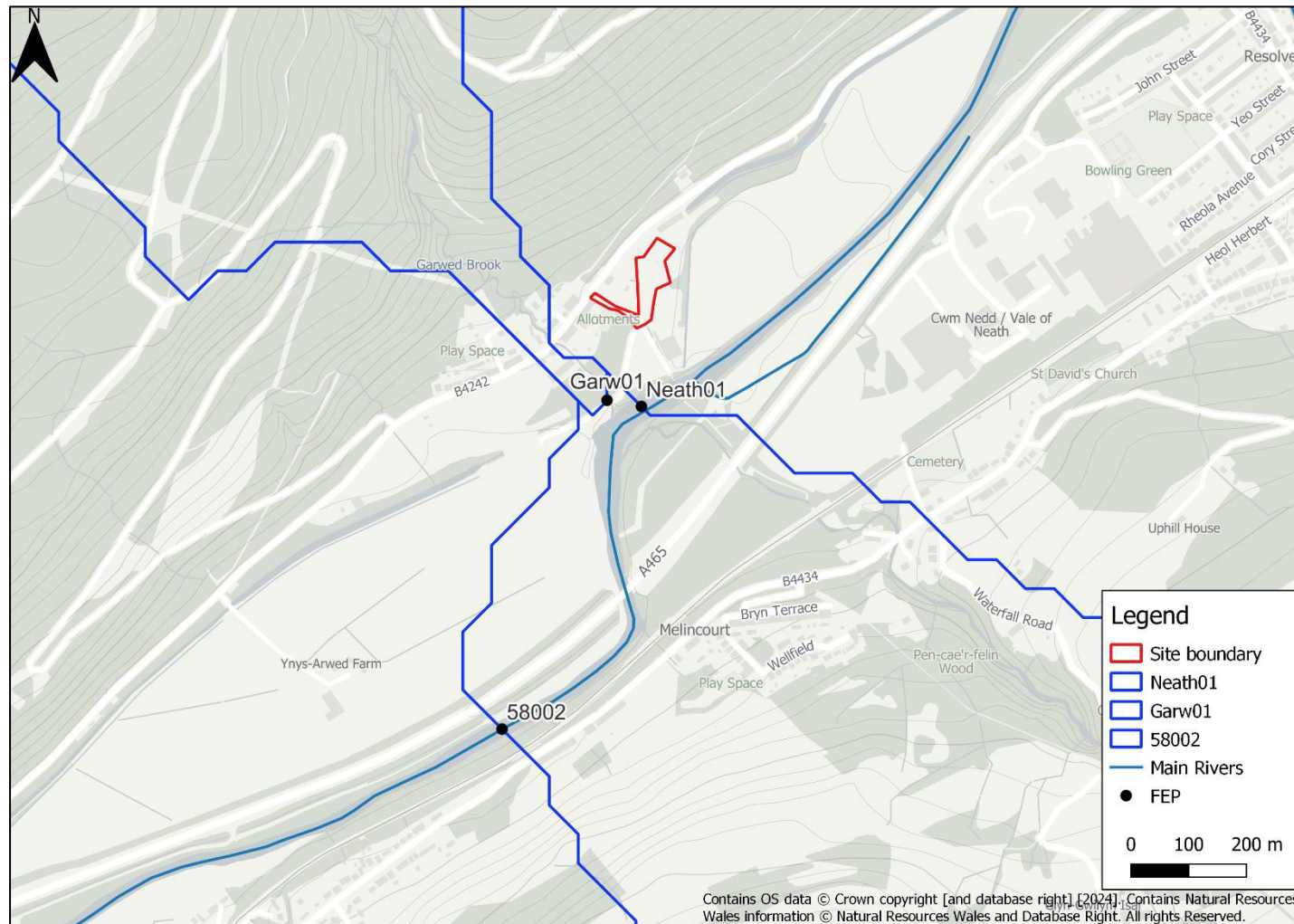


Figure 2-7 Flow estimation points

Table 2-1 Flow estimation points

Site code	Type of estimate:	Watercourse	Site name / description	Easting	Northing
Neath01	L	River Neath	Confluence of the River Neath and Garwed Brook	281800	202250
58002	L	River Neath	Resolven gauge	281550	201700

L = lumped catchment

Further details on flood estimation location selection:

Neath01 is the main flow estimation point for the study, it is on the River Neath close to the site of interest. However, as there is a flood peak gauge suitable for QMED and pooling just downstream (Resolven), this was also selected for estimation of peak flows. This will provide a check on the modelled flows at the gauge site.

An estimation point was not selected at the upstream model extent. Instead, the Neath01 peak flow / hydrograph will be applied at this location. This is a simplification but one which is reasonable for the scope of this study.

The FEH Web Service drainage network shows Garwed Brook, a tributary of the Neath entering on the right bank, and Melin Court Brook, which enters the Neath on the left bank, to join at exactly the same location. In reality the Melin Court Brook enters the Neath about 50m downstream of Garwed Brook. This means that a point on the Neath cannot be selected which includes Garwed Brook but not Melin Court Brook. As inflows from Melin Court Brook are to be supplied from a previous study (discussed previously), this needs to be excluded from the Neath catchment. Therefore, a location just upstream of the confluence was selected for the Neath on the FEH Web Service and the catchment for Garwed Brook added to this to provide the catchment for Neath01. It should be noted that this is for completeness only. The tributary catchment is much smaller (<1%) of the Neath catchment at this point and will make little difference to the results.

The River Neath and Garwed Brook catchment descriptors used to generate the combined Neath01 descriptors are tabulated in the Appendix (Section 7.1).

As Neath01 is to be applied at the upstream model extent, and there is little increase in catchment area between Neath01 and the Resolven gauge, no intervening area hydrograph will be generated.

3 Locations where flood estimates are required

3.1 Catchment boundary checks and revisions

The FEH Web Service catchment boundary was checked against LiDAR (Terrain 50 DTM), contour mapping and Ordnance Survey (OS) mapping and has been accepted without change.

3.2 Other catchment descriptor checks and revisions

URBEXT:

The URBEXT2000 values were checked against the urban extent 2000 layer on the FEH Web Service and current OS mapping and appear appropriate.

The URBEXT2000 values were updated to the current year (2024).

BFIHOST:

The FEH BFIHOST19 values for the study catchment appear to be a reasonable representation of local base flow conditions when compared with the geology and soils described in Section 2.2. Therefore, these values have been retained without amendment.

FARL:

The FARL value is just below 1 at 0.983, which seems reasonable given there are reservoirs and lakes within the catchment shown on the FEH Web Service.

Version of URBEXT: URBEXT2000

Method for updating URBEXT: CPRE formula from 2006 CEH report on URBEXT2000

Version of BFIHOST: BFIHOST19

3.3 Catchment descriptors

Final catchment descriptors at each subject site:

Site code	AREA on FEH Web Service (km ²)	Revised AREA (km ²)	BFIHOST19	DPLBAR (km)	DPSBAR (m/km)	FARL	FPEXT	PROPWET	SAAR (mm)	URBEXT 2000
Neath01	-	184	0.328	17.44	145.9	0.983	0.04	0.62	1944	0.0121
58002	191	-	0.327	17.56	146.9	0.983	0.04	0.62	1946	0.0119

Manually updated descriptors are shown in red.

Neath01 values have been calculated based on the combination of Neath01 and Garw01 downloaded from the FEH Web Service.

FARL was not recalculated as Garw01 has a very small area in comparison to Neath01 and would make minimal impact, therefore the original Neath01 FARL value has been used without change.

DPLBAR was calculated using the UK average equation stated in FEH Volume 5, Section 7.2.4.

4 Stationary statistical methods

4.1 Estimating QMED

4.1.1 QMED at gauged and ungauged subject sites

Site code	Method	Initial QMED (rural) from CDs (m ³ /s)	Donors used (NRFA numbers)	Donor distance from subject centroid (km)	Moderation term (α) value	Final donor adjustment factor	Urban adjustment factor	Final QMED (m ³ /s)
Neath01	DT	182	58002	0.49	1.000	1.174	1.011	216
58002	AM	-	58002	0.00	1.000	-	-	223

QMED estimation methods: **AM** – Annual maxima; **DT** - catchment descriptors with donor transfer

Donor distance weighting method:

58002 - Estimation point is at the Resolven gauge location and AMAX data can be used for QMED estimation.

Neath01 – Moderation term was not applied in this case as the subject site is so close to the gauge that it makes sense to apply the adjustment in full. This also follows NRW guidance.

Parameters used for WINFAP v4 urban adjustment:

Urban adjustment of QMED method (subject site and donors): WINFAP v4⁶

Impervious fraction for built-up areas (IF): 0.3

Percentage runoff for impervious surfaces (PR_{imp}): 0.7

Method for calculating fractional urban cover (URBAN): From updated URBEXT2000

4.1.2 Search for donor sites

Discussion of selected donor sites / rejected donor sites:

Station 58002 is just downstream of the site and is therefore the most appropriate donor for Neath01.

Donor sites chosen and QMED adjustment factors:

NRFA no.	Method	Adjustment for climatic variation?	QMED from flow data (m ³ /s)	Urban adjustment factor	De-urbanised QMED from flow data (m ³ /s) (A)	QMED from catchment descriptors (m ³ /s) (B)	Adjustment ratio (A/B)
58002	AM	No	223	1.010	220	188	1.174

Methods: **AM** – Annual maxima

⁶ Wallingford HydroSolutions (2016). WINFAP 4 Urban adjustment procedures.

4.2 Estimating growth curves

4.2.1 Derivation of pooling groups

Name of group	Small catchment pooling procedure applied?	Site code from whose descriptors group was derived	Subject site treated as gauged? (ESS)	URBEXT2000 threshold applied to pooling group selection	L-moments deurbanised (including subject site for ESS)?
58002	No	58002	Yes	<0.30 – as per NRW guidance	L-CV: 0.173 L-Skew: 0.200

Methods: Unless otherwise stated, pooling groups were derived using the procedures from Science Report SC050050 (2008).

4.2.2 Pooling group composition

Name of group	Changes made to default pooling group	Weighted average L-moments
58002	None	L-CV: 0.173 L-Skew: 0.200

4.2.3 Derivation of growth curves at subject sites

Site code	Method	If P or ESS, name of pooling group	Distribution used and reason for choice	Any urban or non-flood years adjustments	Parameters of distribution (location, scale and shape after adjustments)	Growth factor for 1% AEP
58002	ESS	58002	Generalised Logistic (GL) - GL and Kappa 3 (KAP3) distributions gave an acceptable fit to the data. The z-value for GL was closest to zero, indicating the best fit, and this is also the recommended distribution for UK catchments.	Urban adjustment has been applied. The growth curve has not been adjusted for non-flood years as there were no stations with >15% non-flood years in the pooling group.	Location: 1.000 Scale: 0.170 Shape: -0.202	2.29
Neath01					Location: 1.000 Scale: 0.170 Shape: -0.202	2.29

Methods: **ESS** - Enhanced Single Site

Pooled and ESS growth curves were derived using the procedures from Science Report SC050050 (2008). Urban adjustments are carried out using the method of Kjeldsen (2010) which is used within the WINFAP v4 urban adjustment procedures using URBAN rather than URBEXT2000.

4.3 Final choice of QMED and growth curves

Site code	Final choice of QMED and reasons	Final choice of flood growth curve method and reasons
Neath01	QMED derived from donor transfer at 58002.	ESS growth curve at Station 58002 using GL distribution.
58002	QMED derived using AMAX data at 58002.	

4.4 Final flood estimates from stationary statistical methods

Site code	50%	3.3%	1%	0.1%
Neath01	215.7	392.6	493.5	766.9
58002	222.5	404.9	509.0	791.0

Flood peak in m³/s for the AEP (%) events

5 Revitalised Flood Hydrograph 2 (ReFH2) method

5.1 Model parameters

5.1.1 Summary of rural model parameters:

Site code	Method	Tp (hours) rural	Cmax (mm)	BL (hours)
Neath01	CD	3.49	230.21	36.68
58002	CD	3.50	229.61	36.66

Methods: **CD**: Catchment descriptors

5.1.2 Summary of urban model parameters:

Site code	Area modelled as urban (km ²)	TP urban scaling factor	IF	IRF	DS
Neath01	3.50	0.75	0.4	0.7	0.5
58002	3.56	0.75	0.4	0.7	0.5

Analysis undertaken to derive model parameters:

N/A - Not within scope to derive model parameters

5.2 Model inputs for design events

Design events for lumped catchments:

Site code	Urban or rural	Season of design event	Storm duration (hrs)	Initial soil moisture, Cini	Initial baseflow, BF0
Neath01	Rural	Winter	10.5	115.95	19.28
58002	Rural	Winter	10.5	116.15	19.99

Is the catchment groundwater-dominated?:

No - BFIHOST19 values are <0.65 and are therefore not defined as groundwater-dominated.

Which rainfall DDF model has been used?: FEH22

5.3 Final choice of ReFH2 flow estimates

Method choice and reasons:

Site code	Final choice of design inputs and model parameters
Neath01	Rural design inputs used. Winter season design events used. Catchment descriptors (CDs) used for model parameters. No changes to initial conditions (Cini and BF0).
58002	

Details for distributed modelling using a hydraulic model are provided in Section 6.3.

Final rural flood estimates from ReFH2 method:

Site code	50%	3.3%	1%	0.1%
Neath01	189.6	340.1	418.2	636.4
58002	196.6	352.0	433.1	659.5

Flood peak in m³/s for AEP (%) events

6 Discussion and summary of results

6.1 Comparison of results from different methods

Site code	ReFH2 Method (X) peak flow (m ³ /s), 50% AEP	FEH Statistical method (Y) peak flow (m ³ /s), 50% AEP	ReFH2 Method (X) peak flow (m ³ /s), 1% AEP	FEH Statistical method (Y) peak flow (m ³ /s), 1% AEP
Neath01	189.6	215.7	418.2	493.5
58002	196.6	222.5	433.1	509.0

Site code	Ratio (X / Y), 50% AEP	Ratio (X / Y), 1% AEP
Neath01	0.88	0.85
58002	0.88	0.85

6.2 Final choice of method

Choice of method and reasons:

Comparison of the results from the two methods show that the FEH Statistical method produces larger flows for both the 50% AEP and 1% AEP events, with the difference increasing for the 1% AEP event.

The Statistical Method uses the Resolven 58002 Gauge data to adjust QMED and within the growth curve, whilst the ReFH2 method is based on catchment descriptors alone.

The Statistical method is often preferred to design event approaches as it is based on a much larger dataset of flood events and has been more directly calibrated to reproduce flood frequency on UK catchments.

The FEH Statistical method is the preferred method for this study due to the availability of good quality peak flow data close to the site of interest.

How will the 0.1% AEP flows be estimated?

NRW advises that the FEH Statistical method 1% AEP event peak flow estimates should have the ReFH2 0.1%/1% ratio applied for the 0.1% AEP event. However, as the FEH Statistical method is preferred, the FEH Statistical method flows will be used, as there is very little difference in 0.1%/ 1% growth factors between the FEH Statistical and ReFH2 flows. Using the FEH Statistical method 0.1% AEP event flows directly gives slightly more conservative results.

6.3 Application of inflows to a hydraulic model

How will the flows be applied to a hydraulic model?

Neath01 ReFH2 hydrographs will be scaled to fit the Statistical method peaks and applied as a point inflow to the upstream hydraulic model extent.

No intervening area has been produced as part of this study due to the proportionally insignificant area (0.2%) between Neath01 and the Gauge (58002).

Peak flow estimates derived for the Resolven gauge location can be used as a sense check on modelled flows.

Design events for hydraulic model testing:

Season of design event	Storm duration (hrs)	ARF	Details of reasons for selection
Winter	10.5	0.91	It is not within the scope of the study to undertake storm duration testing. The storm duration selected is the ReFH2 recommended value, which is the same at both the gauge location and Neath01.

6.4 Checks

Growth factor checks:

Site code	1% AEP growth factor	0.1% AEP / 1% AEP ratio	Comments
Neath01	2.29	1.55	The FEH Statistical growth factors are within the typical range of 2.1 – 4.0 (based on FSR regional growth curves), although at the lower end of the range.
58002	2.29	1.55	

Spatial consistency of results:

Peak flow estimates derived for all design events increase downstream, this is as expected.

Frequency of notable historical floods:

The largest five AMAX values in the gauge record have been compared to the results to identify the indicative frequency of the events, as shown in Table 6-1. For the AMAX1 event the ESS method results indicate that this lies between the 1% and 0.5% AEP event. This is a known large event and so this estimate is not unrealistic.

However, it must be noted that there will also be uncertainty in the rating for larger events and that the observed flow may not be accurate.

Table 6-1: Indicative frequency for Resolven gauge largest AMAX events

AMAX	Water Year	Flow	ESS AEP
1	2019-2020	528.999	1% - 0.5%
2	1998-1999	461	2.5% - 1.33%
3	1979-1980	456.725	2.5% - 1.33%
4	2018-2019	394.446	5% - 3.33%
5	1986-1987	322	20% - 10%

Compatibility with longer-term flood history:

There is no reported flooding of the study area against which to compare the results. Investigating flood events which occurred earlier than the start of the gauge record was not within the scope of the study.

Comparisons with previous studies:

The results for a previous study undertaken by JBA in 2015 along the River Neath near the current Neath01 location are shown below in Table 6-2. The results highlight that the 50% AEP event peak flows are similar for both studies, with the difference increasing for the 1% AEP event.

The 2024 results are preferred as they use the latest methods, data, software and guidance available.

Table 6-2 Previous study peak flow comparisons

Study	50% AEP	1% AEP
Previous study 2015	213	445
Current study 2024	216	494

A previous study was also undertaken along the Melin Court Brook opposite the confluence of the Garwed Brook. New peak flow estimates were not derived for Melin Court Brook as part of this study, instead the previous study estimates were used to supply an inflow to the hydraulic model.

Checks on hydraulic model results:

Modelled levels and flood extents will be sense-checked to ensure that flow inputs result in realistic outputs. Modelled flows can also be checked against the frequency analysis results at the Neath gauge location.

6.5 Assumptions, limitations, and uncertainty

Assumptions:

- The previous hydrological study results for the Melin Court Brook are appropriate and accurate to add into the model.
- Applying the Neath01 peak flow estimate and hydrograph in full to the upstream model extent is reasonable and that it will not overestimate flooding between the upstream model extent and Neath01.
- It is appropriate to apply the donor adjustment in full for the Neath01 QMED estimate due to the relatively short distance between this and the gauge location.

Limitations:

- There is no flood history information for the site against which to verify hydraulic model results based on the derived model inflows.

Uncertainty:

- There is no simple approach for calculating the uncertainty for the ESS growth curve, therefore it is not within the scope of the study to generate the confidence intervals for the gauge location.

6.6 Final results

Final method applied: FEH Statistical peak flow estimates

Site code	50%	3.3%	1%	0.1%
Neath01	215.7	392.6	493.5	766.9
Gauge	222.5	404.9	509.0	791.0

Flood peak in m³/s for the AEP (%) events

Uncertainty:

The FEG states that 'It is not possible to present equivalents to the above tables of confidence limits for flood frequency estimates that incorporate at-site gauged data. This is because the confidence limits depend on the record length, the value of QMED and the L-moments and/or distribution parameters.'

It is therefore not within the scope of the study to generate the confidence intervals for the gauge location.

Climate change estimates:

The climate change estimates will be applied to the 1% AEP event as part of the hydraulic modelling process.

Suitability of results for future studies:

The design peak flow estimates were derived for the purposes of this study. If peak flow estimates and hydrographs are required for a different purpose, it is recommended that, at a minimum, a review of the results is carried out.

Recommendations for future work:

It was not within the scope to undertake a detailed assessment of gauge data or to assess the previous hydrology for the Melin Court Brook. This could be considered in future studies.

7 Appendix

7.1 River Neath and Garwed Brook FEH Web Service descriptors

Catchment Descriptors	River Neath (Neath01)	Garwed Brook (Garw01)
AREA	182.80	1.49
BFIHOST19	0.327	0.398
DPLBAR	17.53	1.46
DPSBAR	145.4	205.0
FARL	0.983	1.000
FPEXT	0.043	0.0101
PROPWET	0.62	0.62
SAAR	1945	1762
URBEXT2000	0.0117	0.0000

7.2 Pooling groups

Resolven Gauge - ESS - URBEXT2000 threshold <0.30								
Station	Distance (SDM)	Years of data	QMED AM	L-CV Deurbanised	L-SKEW Deurbanised	Non-flood years	Percentage Non-flood years	Discordancy
58002 (Neath @ Resolven)	0.000	44	222.5	0.171	0.303	0	0.00	1.274
59001 (Tawe @ Ynystanglws)	0.279	48	255.3	0.131	0.227	0	0.00	1.482
56006 (Usk @ Trallong)	0.325	44	163.6	0.200	0.183	1	2.27	0.614
58001 (Ogmore @ Bridgend)	0.336	62	117.9	0.150	0.026	1	1.61	1.178
3002 (Carron @ Sgodachail)	0.356	48	177.6	0.146	0.166	0	0.00	0.339
72005 (Lune @ Killington)	0.365	53	271.6	0.194	0.121	2	3.77	0.664
73012 (Kent @ Victoria Bridge)	0.369	42	144.1	0.203	0.258	1	2.38	0.338
55026 (Wye @ Ddol Farm)	0.372	53	115.5	0.170	0.114	0	0.00	0.415
46003 (Dart @ Austins Bridge)	0.432	64	232.8	0.165	0.100	2	3.12	0.672
73005 (Kent @ Sedgwick)	0.446	54	164.9	0.217	0.282	0	0.00	0.873
27096 (Wharfe @ Netherside Hall)	0.449	19	216.1	0.149	0.113	0	0.00	2.495
54080 (Severn @ Dolwen)	0.538	22	100.5	0.252	0.251	1	4.55	1.656
Total		553						
Weighted means				0.173	0.200			

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