

Rock Street Flood Alleviation Scheme

Glynneath Flood Consequence Assessment

Neath Port Talbot County Borough Council

8 September 2021

NE06_001-ATK-GEN-SWMWREC-RP-LW-000002



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1. Introduction

1.1. Background

Atkins was commissioned by Neath Port Talbot County Borough Council (NPTCBC) to develop proposals for a flood alleviation scheme for Glynneath, Wales, known as the Rock Street Flood Alleviation Scheme (herein referred to as 'the Scheme'). The Scheme will comprise of two phases, with the aim to reduce risks associated with surface water and Ordinary Watercourse flooding within the town.

Properties on Rock Street and Robert Street experience flooding from the Gelliceibryn Brook because there is insufficient capacity in the existing drainage system (See Figure 1-1) to convey surface water during certain storm events and due to a blocked culvert. In addition, there is flooding to Glynneath from a ford located on the Nant Y Gwyddyl located to the east of Rock Street (Shown in Figure 1-2). The two phases will be split into Phase 1 for the works at Rock Street and Phase 2 for the works at Nant y Gwyddyl. It should be noted that other watercourses (such as the Addoldy Stream) do cause flooding to Glynneath however these sources are currently outside the scope of this study.

The Gelliceibryn Brook travels down a steep valley side where it passes through a semi natural ancient woodland to the north-east of Lancaster Close. From here, the watercourse travels through a series of culverts beneath the access roads to commercial properties and a series of open channels to the first property on Lancaster Close. From here the watercourse travels through two 600mm diameter culverts, one of which is blocked. These pass under the front gardens of the residential properties and discharge into an open channel before turning 90 degrees through a box culvert under Lancaster Close. From the exit point of the culvert at Lancaster Close, the watercourse enters an open channel which extends west past the care home, through a park and between residential and commercial properties. The watercourse eventually discharges to the Neath Canal approximately 850m downstream, which then discharges to the River Neath approximately 2.6km further downstream.

At the ford, the Nant y Gwyddyl flows in an open channel from a wooded upper catchment before passing through a series of culverts that act as access points to properties on Lon-y-Nant before passing over a ford on Glynmelyn Road. The watercourse then passes through a residential area before discharging to the River Neath approximately 250m downstream.

This report provides a Flood Consequences Assessment (FCA) for the flood alleviation scheme at Glynneath. The FCA has been produced in accordance with Technical Advice Note 15 (TAN15). Although TAN 15 relates to the siting and impact of new development it provides a framework within which risks arising from both river and coastal flooding can be assessed. TAN15 does not permit flood risk elsewhere to be increased as a result of developing a site. One of the key issues this FCA assesses is whether there is an adverse effect on fluvial flooding to third parties as a result of the proposed improvements associated with the alleviation scheme which in effect is reducing the amount of water being stored on the floodplain.

1.2. Scheme Location

Phase 1 is located around the residential area of Rock Street and Lancaster Close - grid reference SN8793006730. The site then continues to the south-west towards a parkland with a small area of trees adjacent to a car park and a residential home, beyond the B4242 road into poor semi-improved grassland ending in a dry ditch and plantation woodland. The section of the proposed culvert between Park Avenue (B4242) and the River Neath is semi-rural comprising of an undeveloped field and a tree lined embankment of the redundant A465. South of the old A465 embankment is the River Neath. The location and extent of the Scheme works are shown in white on Figure 1-1 below.

Phase 2 is located on Glynmelyn Road, at the site of the ford - grid reference SN 88356 06860. The location of the Scheme works is shown on Figure 1-2 and the works are detailed on drawing NE06_001-ATK-SWMWREC-DR-CD-000001 in the Appendix A.



Figure 1-1 – Phase 1: Culvert diversion from Gelliceibryn Brook

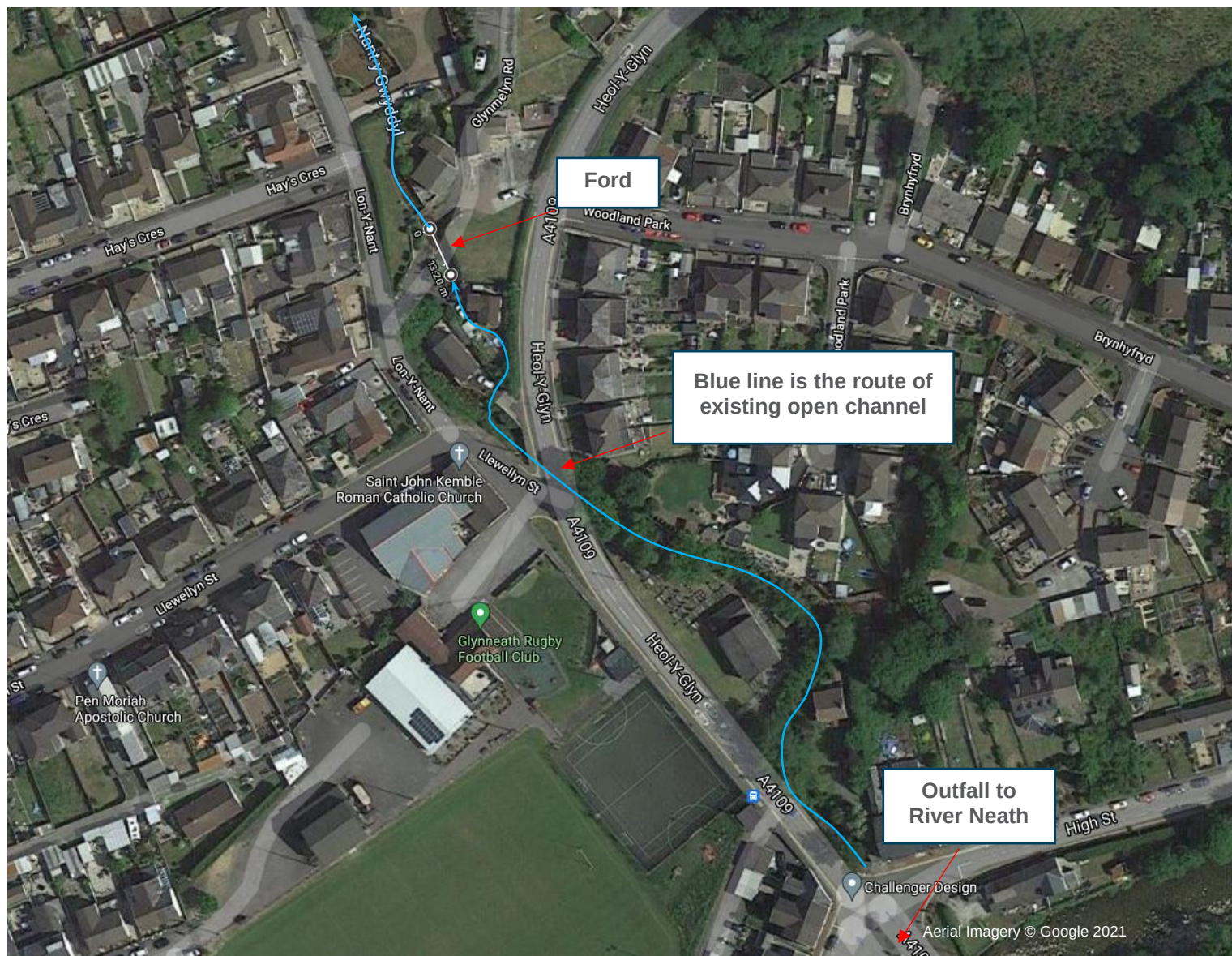


Figure 1-2 – Phase 2: Ford on the Nant Y Gwyddyl

1.3. Proposed Works

Phase 1 works will involve installation of a new culvert which will be buried underground in the highway and through fields. This will discharge to the River Neath. Phase 2 of the proposed works will involve construction of a bridge and supporting abutments to provide access for vehicles over the Nant Y Gwyddyl watercourse. Refer to drawing NE06_001-ATK-SWMWREC-DR-CD-000001 in Appendix A for scheme works.

1.3.1. Phase 1

The Phase 1 Scheme (Shown in Figure 1-1) comprises of the following elements:

- Construction of a new reinforced concrete inlet structure and trash screen structure at the edge of ancient woodland at the top of Lancaster Close.
- Reprofilng of Gelliceibryn Brook in the woodland area to prevent overland flow and ensure water enters the new inlet structure.
- Associated drainage works in the form of new ACO drains to pick up overland surface water and to discharge into the inlet structure.
- Laying a new buried 600mm diameter concrete culvert from the inlet structure (Lancaster Close) to the existing twin 600mm diameter culverts.
- The existing twin 600mm diameter culverts in the front gardens of Lancaster Close will be cleaned out to remove any blockages. However, only one of these culverts will remain in operation in the proposed scheme in order to maintain flow down the existing watercourse in normal flow conditions. Having both existing 600mm diameter culverts unblocked and in operation will result in further detriment downstream. Therefore, one of the 600mm diameter culverts in the gardens will only be used in the temporary situation where the contractor will need to divert and manage flows (i.e. over pumping) whilst constructing the new 600mm section of culvert upstream.
- Laying a new buried 900mm diameter overflow culvert (approx. 650m long) from Manhole 1 (MH 1 to MH8). This will be laid underground in the main highway of Lancaster Close and under an existing car park.
- Installation of a new wall adjacent to the open channel at the bottom of Lancaster Close to contain flows.
- Removal of the existing 1220 x 650 culvert on the line of the existing watercourse that crosses Lancaster close and connects the upstream 600mm diameter culverts to the open channel downstream.
- Installation of a new concrete box culvert to replace the above.
- For MH 8 to MH 9 a new 900mm diameter culvert will be thrust bored underground under the walkway between flats and houses, across the B4242 (adjacent to Chameleon Hair & Beauty shop) and through the undeveloped land into the field south of the B4242.
- From MH 9 to MH 11 a 900m diameter culvert will be laid in the existing field, under the disused A465 road embankment. and outlet to a new concrete outfall structure which will discharge the flood water to the River Neath.

1.3.2. Phase 2

The Phase 2 Scheme (Shown in Figure 1-2) aims to mitigate flooding to Glynneath from the ford situated within the Nant Y Gwyddyl catchment. The Phase 2 scheme comprises of the following elements:

- Removal of a pedestrian footbridge upstream of the ford which is constricting the flow in the channel.
- Installation of a new bridge or culvert to maintain access for vehicles over the watercourse and to increase conveyance.
- Associated underpinning of voids and scour areas to the retaining wall foundations along the watercourse.

The overall Scheme will provide a 1% (1 in 100) AEP standard of protection against flooding.

1.4. Objectives of the FCA

The objectives of this assessment are to:

- Set out the planning policy context in terms of flood risk.
- Demonstrate the baseline flood outlines and overland flow paths in the area of, and around, the proposed scheme.
- Specifically assess the with-scheme risk and compare this with the baseline flood extent.
- Define the flood consequences for the scheme.
- Identify the flood risk to the proposed scheme itself and the consequences of the proposed scheme on the existing flood risk in the locality.
- Inform any options to mitigate adverse impacts on flood risk.

2. Planning Policy Guidance with respect to Flooding

2.1. Background

TAN15 seeks to provide technical guidance to the Local Planning Authority relating to national policy on development and flooding. The document provides advice on the risk and consequence of flooding to a number of categories of development. These include Emergency Services (hospitals, fire stations, police stations, etc), highly vulnerable development (residential premises, hotels, caravan parks etc) and less vulnerable development (industrial, commercial and retail sites).

The scheme at Glynneath falls outside the above categories. It is a flood defence scheme which by its nature will need to be built within the flood risk zone. The scheme will provide improved flood protection to the existing community in Glynneath.

It has been subject to a rigorous project justification process in which the financial benefits of the scheme are compared against the financial losses resulting from flooding. It has also been subject to an Ecological Impact Assessment (EclA) to identify potential impacts the Scheme proposal has on habitats, species and ecosystems.

The National Strategy on Flood and Coastal Erosion Risk Management (FCERM) for Wales (Welsh Government, 2020) sets out to reduce the risk of flooding to homes and businesses providing benefits are demonstrated in line with the Welsh Government's FCERM Business Case Guidance.

The consequences to the town of Glynneath are set out below:

- The scheme significantly reduces the flood risk to town. Properties which currently flood significantly in a 1 in 30 (3.33%) AEP event are offered protection up to and including a 1% (1 in 100) AEP.
- It will reduce the extent of flooding which will reduce the risk to life to people who live within the town.
- The scheme does not result in any detriment to any third parties.

The scheme has been designed to have no adverse consequences to the local community and the local environment. It follows the underlying principles of TAN 15;

- Uses government resources to reduce flood risk to existing communities.
- Manages the consequences of flooding.
- Makes provision for increased flood risk arising out of climate change.

Without the scheme, the town will suffer an increase in the frequency and extent of flooding. This report will demonstrate that there will be significant improvement to flood risk if the proposed scheme is implemented. The scheme will reduce the flood risk to people and properties located in the town of Glynneath.

The scheme is considered to comply with the overarching theme of the TAN and is recommended to your council for approval.

2.2. TAN 15

TAN 15 advises that new development is initially directed away from areas that are considered to be at high risk of flooding. Where development in a high-risk area is essential or strategically important, TAN 15 (Section 6) outlines the justification test that must be satisfied to support a positive decision for a development.

Where development in a flood risk area can be justified, the consequences of flooding of that development must be assessed against criteria laid out in TAN 15. The overall objective of the assessment is to identify if the consequences can be managed down to a level which is acceptable for the nature/type of development proposed; including its effects on existing development.

2.3. Development Advice Maps

TAN 15 is accompanied by a Development Advice Map (DAM), which demarcates flood risk zones, defined as follows:

- Zone A – Little or no risk of fluvial or tidal/coastal flooding;
- Zone B – Areas known to have been flooded in the past evidenced by sedimentary deposits;
- Zone C1 – Areas at risk of flooding from fluvial or tidal sources (based on EA extreme flood outline for 0.1% AEP event), but currently developed and served by significant infrastructure, including flood defences.
- Zone C2 – Areas at risk of flooding from fluvial or tidal sources (based on EA extreme flood outline for 0.1% AEP event) and without flood defence infrastructure.

Natural Resources Wales (NRW) flood risk maps have also been referenced in order to understand the flood risk profile for the proposed development site. NRW classifies areas as:

- Zone 3 – 1% AEP fluvial flood risk; 0.5% AEP tidal flood risk
- Zone 2 – 0.1% AEP fluvial and tidal flood risk.

Land that is not shown to be in either Zone 2 or Zone 3 is categorised as Zone 1, which indicates less than 0.1% AEP for fluvial and tidal flood risk. The DAM and NRW flood risk maps provide an initial indication for developers and planning authorities as to the flood risk profile of a proposed site. If the site is within a DAM Zone C or Flood Zone 2, then typically an FCA will be required in support of a planning application.

The site of the proposed works is shown on the Welsh Government's Development Advice Maps, published in conjunction with TAN15, as lying in both Zone B and Zone C2. This denotes an area within the extreme flood outline of the 0.1% (1 in 1000) annual chance event, equal to or greater than 0.1%. Within TAN 15's precautionary framework, only less vulnerable development should be considered, subject to the application of the justification test, including an assessment of the acceptability of the consequences. A section of the Development Advice Map is resented in Figure 2-1.

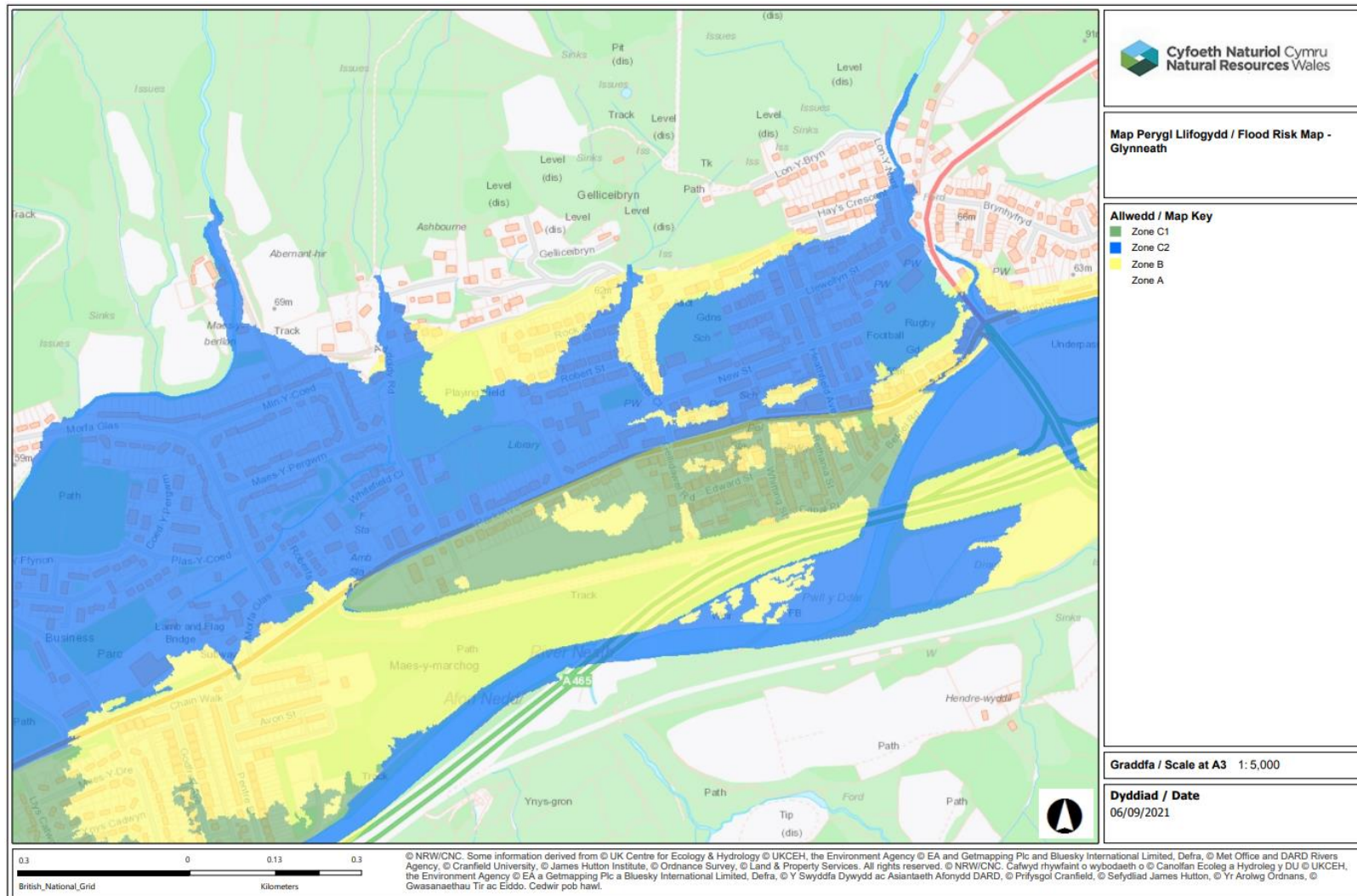


Figure 2-1 - DAM map, showing Zone C2 and Zone B at the site

2.4. Vulnerability of development and Justification Test

Section 5 of TAN15 lists three classes of development, denoted Emergency Services, Highly Vulnerable Development, and Less Vulnerable Development. TAN 15 does not classify proposed developments / land uses, i.e. the proposed works, that are required in a fluvial location by virtue of their nature. We consider that the proposed works fall within this category, such that they are not subject to the first part of the Justification Test as detailed in Section 6 of TAN 15.

3. Existing Flood Information

3.1. Fluvial Flood Risk

The NRW flood mapping (shown in the Figure 3-1 below) indicates that the fluvial risks to Glynneath are predominantly associated with the Nant y Gwyddyl (to the east) and Addoldy (to the west) watercourses. It should be noted that not all ordinary watercourses are included in the NRW floodmap therefore not all potential fluvial flood sources are represented in the figure below. The NRW fluvial flood risk map indicates that areas of Glynneath are at a High risk of flooding which is defined by NRW as a greater than 1 in 30 (3.3%) annual chance event.

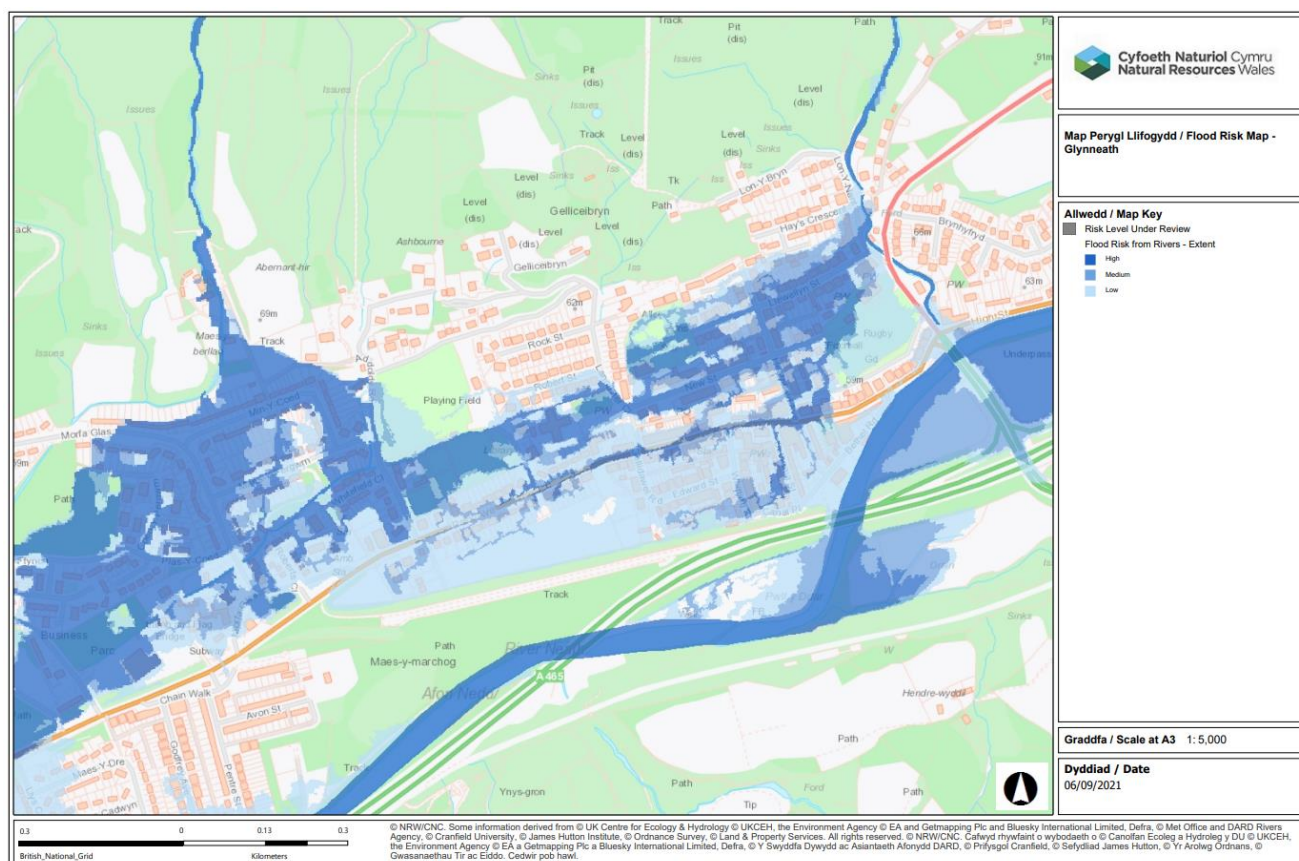


Figure 3-1 - Natural Resources Wales Flood Risk Map – Fluvial Flood Risk

3.2. Surface Water Flood Risk

The NRW flood mapping (shown in the figure below) indicates that areas of Glynneath are at a High risk of surface water flooding which is defined by NRW as a greater than 1 in 30 (3.3%) annual chance event. These sources of flooding are predominantly from the Gelliceibryn and Addoldy catchments.

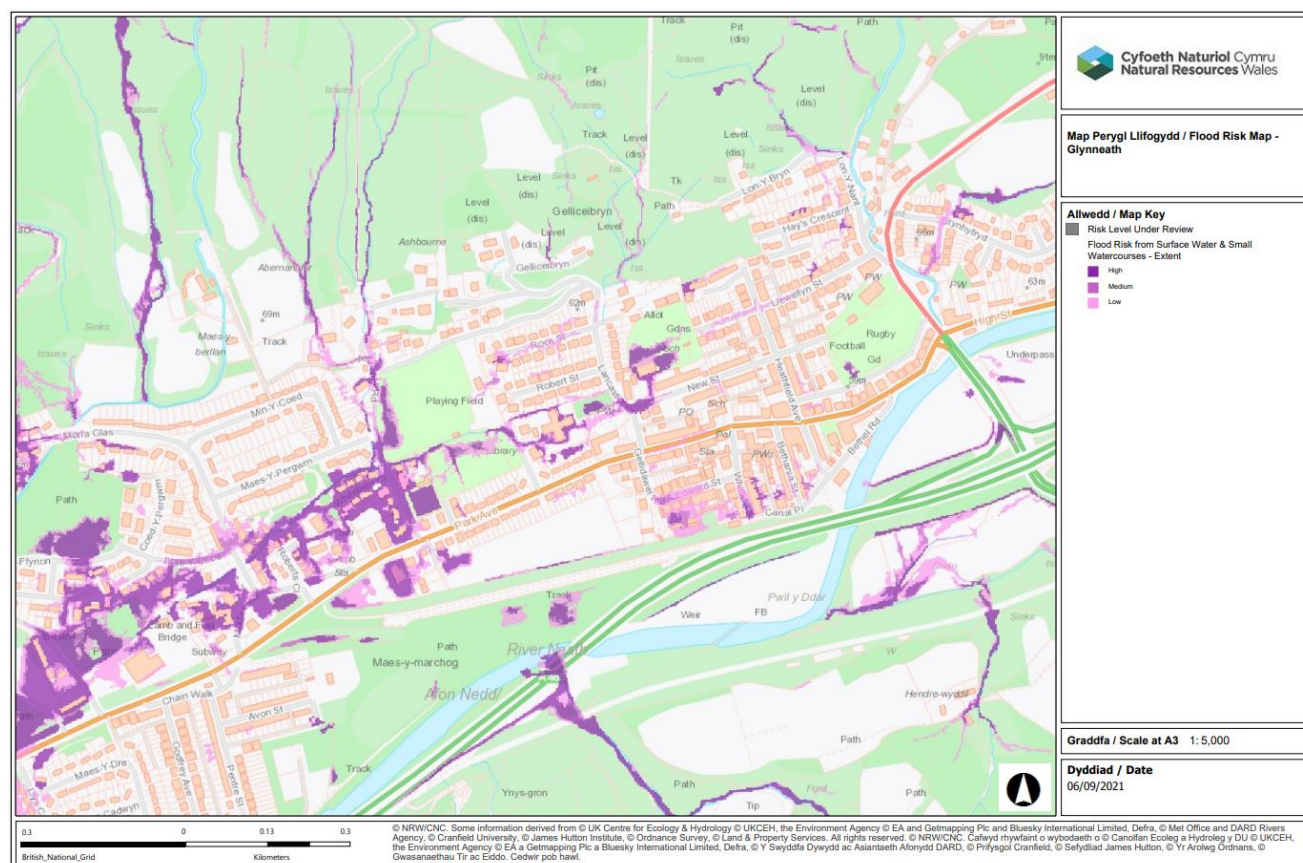


Figure 3-2 - Natural Resources Wales Flood Risk Map - Surface Water Flood Risk

4. Flood Risk Assessment

4.1. Assessment of Fluvial Flood Risk

Fluvial modelling was undertaken to assess the baseline flood risk impact and then to implement the scheme proposals so that the impacts of the proposed scheme could be fully understood.

4.1.1. Existing Information

A review indicated that the following hydraulic models were available to inform the study:

1. JBA TUFLOW model of the Gelliceibryn Brook. The model does not include any tributaries or the Nant y Gwyddyl and extends from north of Lancaster Close to the Glynneath Workshops.
2. NRW TUFLOW model of Glynneath. A detailed hydraulic model for the River Neath at Glynneath developed by JBA in 2013. The purpose of the detailed hydraulic modelling was to produce Hazard Mapping for the study area. The model includes the River Neath and the Nant y Gwyddyl together with a number of other tributaries within Glynneath. The model does not include any representation of the Gelliceibryn Brook.

Neither the JBA nor NRW hydraulic models allow for the flood risks to the study site to be fully understood as unfortunately neither model includes all the watercourses that contribute to the flooding at Glynneath. Consequently, for the flood risk at Glynneath to be fully assessed, the JBA and NRW hydraulic models have been combined. In addition topographic survey of the Addoldy Stream was procured by Atkins in February 2020 that allowed for the additional watercourse to be integrated into the combined model. Further culvert surveys were undertaken between the Glynneath Workshops and the outfall to the Neath Canal. This additional information has been integrated into the revised hydraulic model.

Boundary conditions for the hydraulic model have been updated with the fluvial boundaries based on latest hydrological guidance. The revised model was utilised to redefine the baseline/current day risks. The model was then further updated to represent the proposed flood alleviation proposals to allow the impacts of the proposals to be quantified.

4.1.2. Flood Events and Boundaries Tested

The following annual exceedance probabilities (AEP) have been tested in the model:

- 1% AEP
- 1% AEP plus 30% climate change¹
- 0.1% AEP

Due to the difference in catchment characteristics of the Ordinary Watercourses that drain through Glynneath and the main Neath catchment, an approach has been adopted where extreme design events on the Ordinary Watercourses have been run in combination with a 3.33% (1 in 30) AEP annual chance flood event in the River Neath.

4.1.3. Hydraulic Modelling

The hydraulic models developed by JBA and NRW with the additional topographic survey of the Addoldy Stream and culvert downstream of Glynneath workshops have all been utilised to develop a TUFLOW hydraulic model for Glynneath. The extent of the hydraulic model is shown in the figure below:



Figure 4-1 - Extent of hydraulic model

4.1.4. Hydrology

The hydrological inputs included in the existing hydraulic models were reviewed in order to ascertain if the estimates needed to be updated. A copy of the hydrological review is included in Appendix B.1 which summarised that the Ordinary Watercourses within the study area needed to be updated whilst the flows

¹ 30% increase on peak flows is the central estimate or change factor for the Western Wales River Basin District, as defined in Welsh Government advice on Climate Change Allowances for Planning (CL-03-16).

assumed in the River Neath were adequate for use as part of the study. Copies of the hydrologic calculation records for the watercourses with updated estimates are included in Appendix B.2.

5. Model Results and Flood Consequences

5.1. Fluvial Flood Risk

As detailed in 4.1.2 the model was run to test flood events for the (i) baseline scenario and the (ii) proposed case with the alleviation scheme in place.

1 in 100 year (1% AEP) flood event

The figures below compare the flood extents for the two scenarios which evidently shows that during a 1% (1 in 100) AEP event, there is a significant improvement as a result of the proposals. Flows are contained within channel on both the upper reaches of the Gelliceibryn Brook and the Nant y Gwyddyl during a 1% (1 in 100) AEP event.

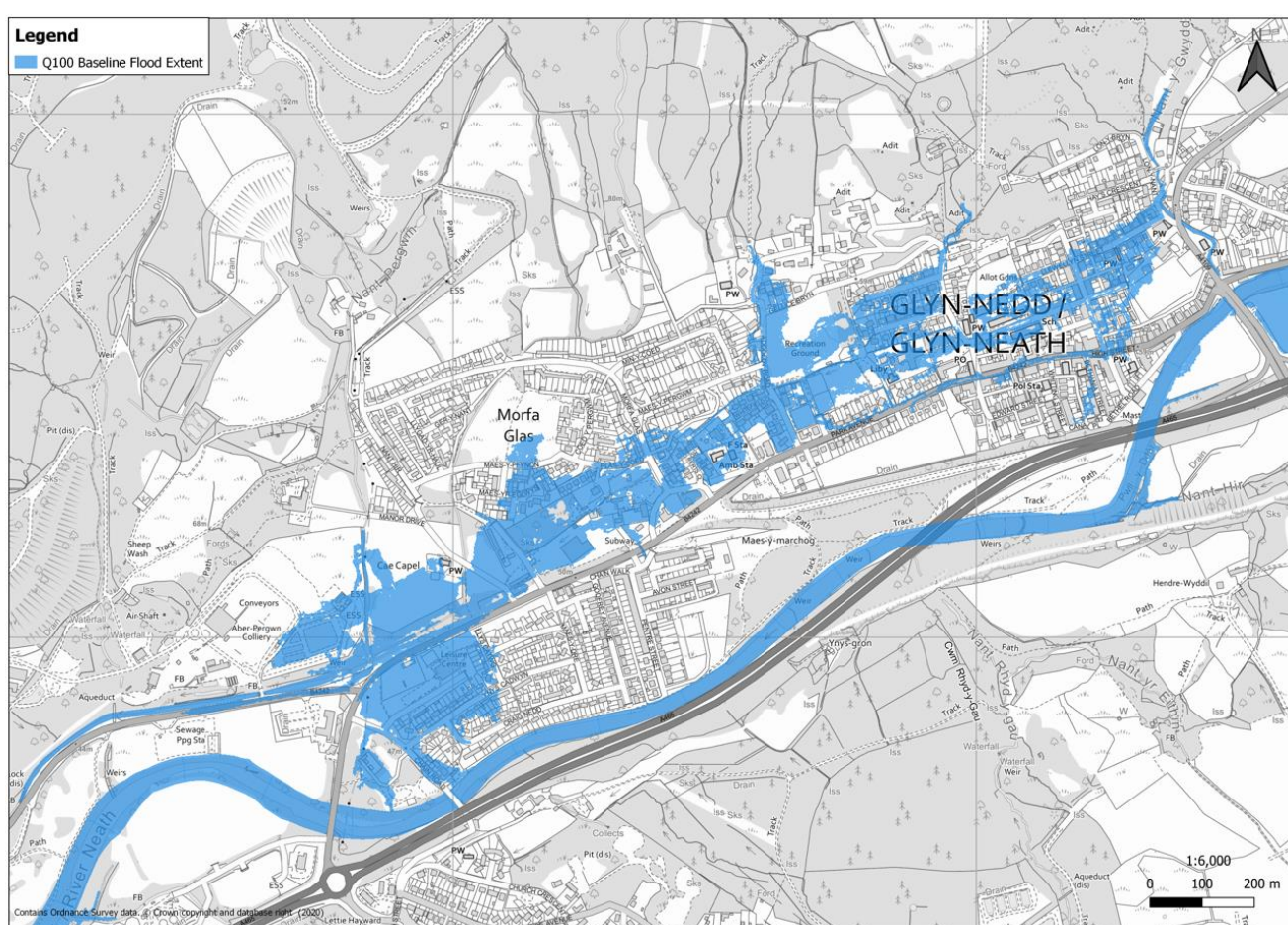


Figure 5-1 - 1% AEP flood extents for baseline scenarios

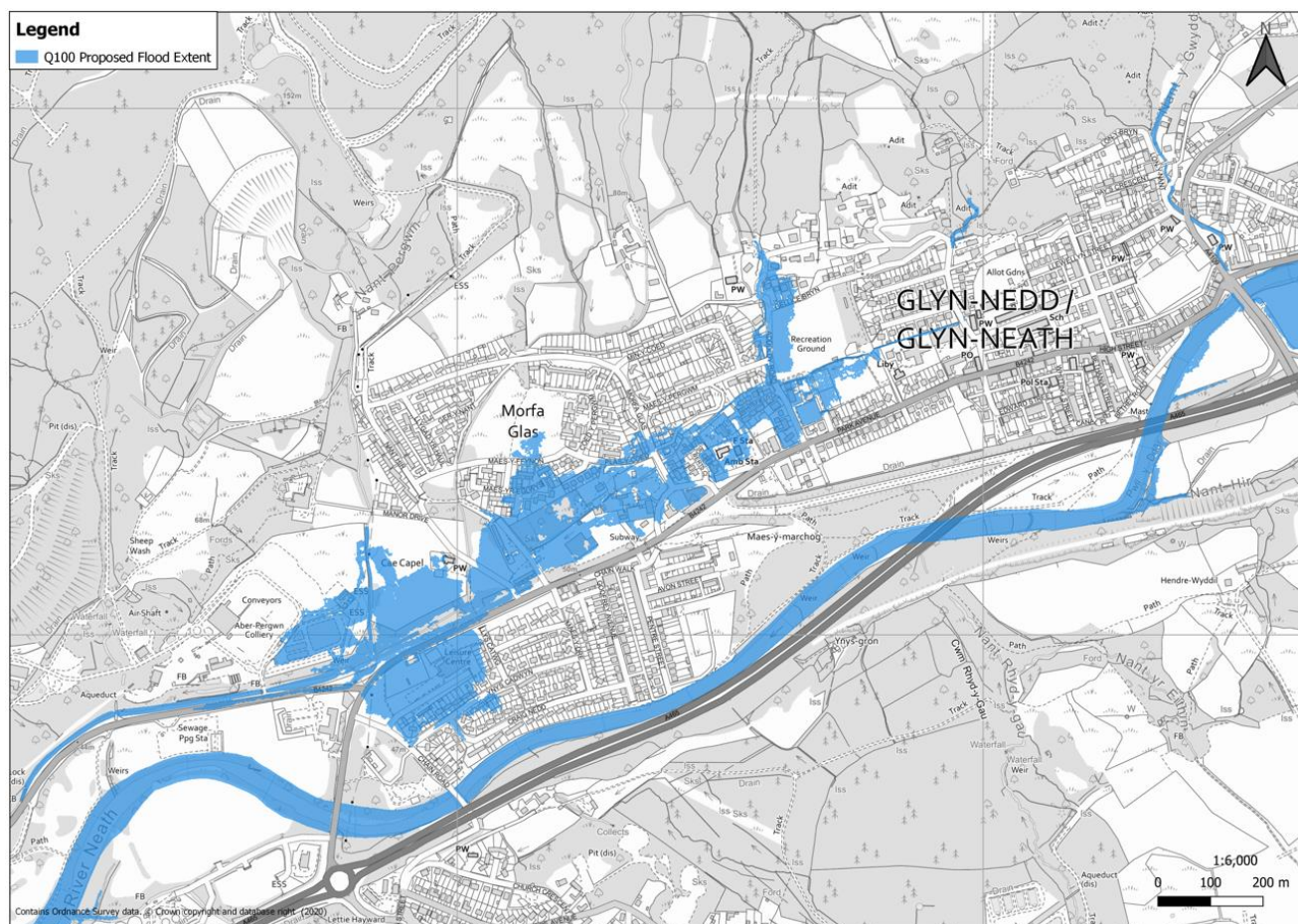


Figure 5-2 - 1% AEP flood extents for the proposed case

A plot of the difference in the flood level as a result of the flood alleviation works is presented in Figure 5-3 below. The results show that during a 1% annual chance flood event in the Ordinary Watercourses, there is no negative impact on flood levels as a result of the proposed works.

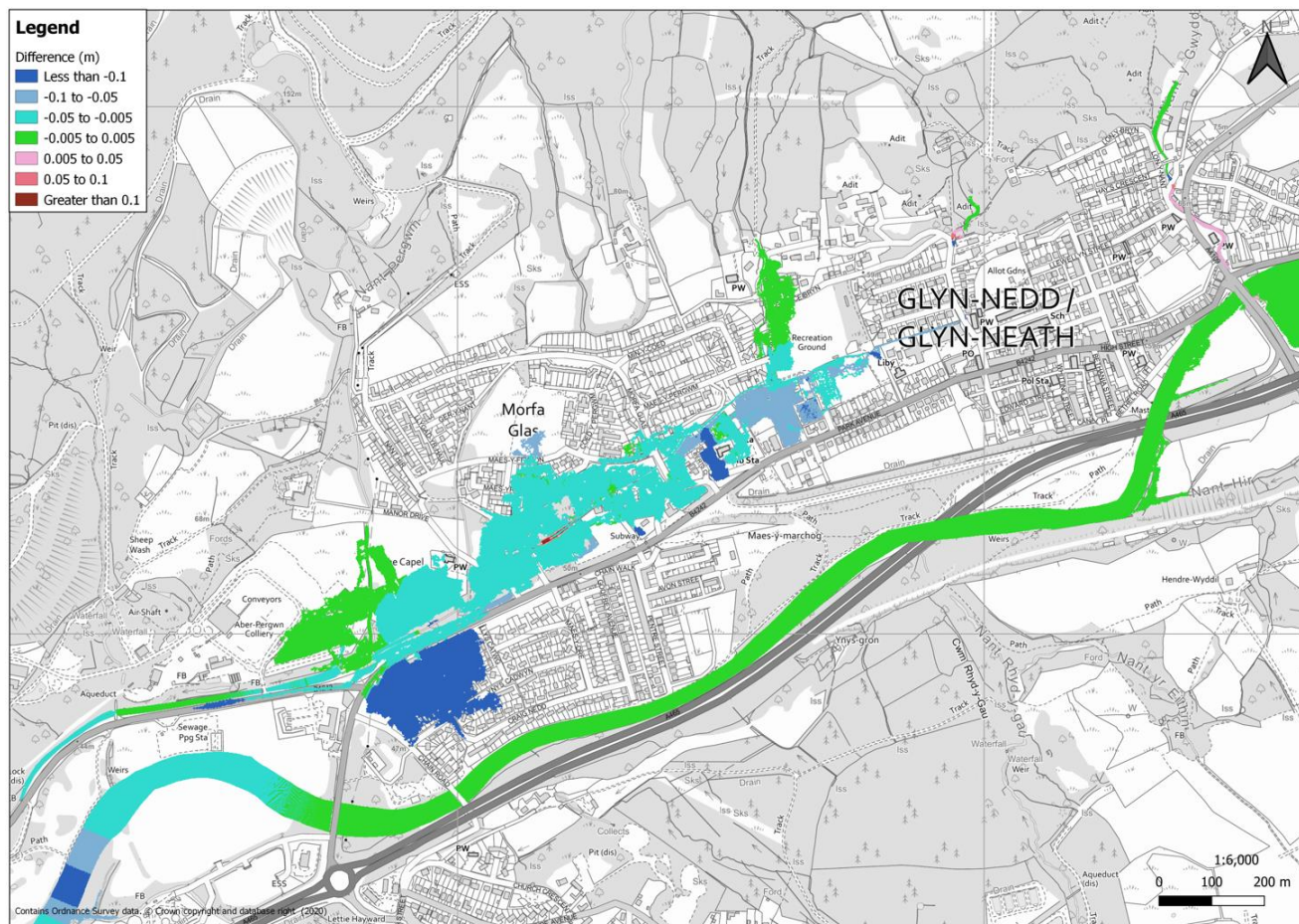


Figure 5-3 - Comparison of 1% AEP flood depths for baseline and proposed scenarios

1 in 100 year (1% AEP) flood event plus 30% climate change to 2121

During a 1% fluvial event with an allowance for climate change this results in the proposed scheme not being able to contain the flows within channel. However, although there is flooding predicted in the proposed case (see Figure 5-5), it is less extensive than that predicted in the baseline condition (Figure 5-4).

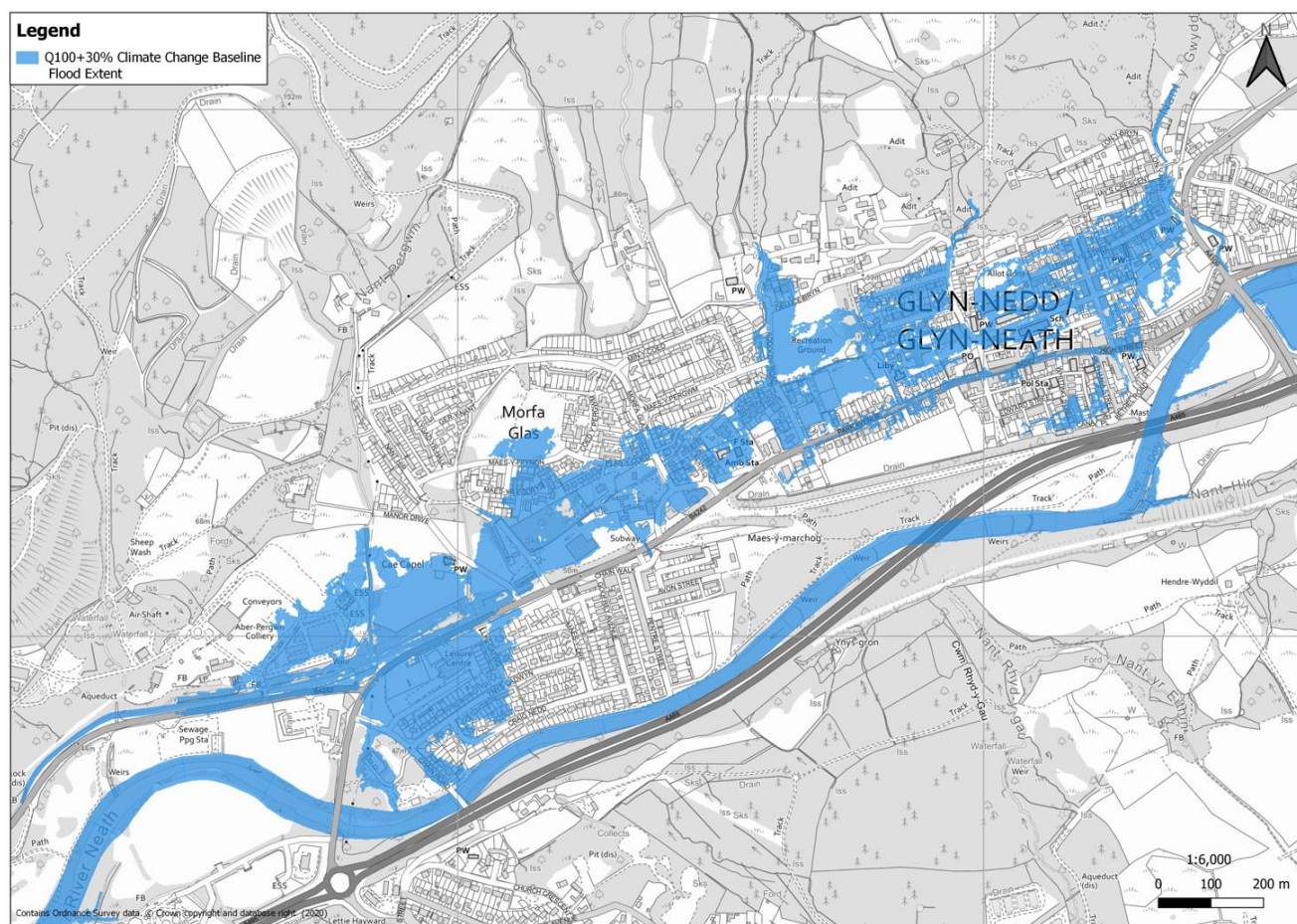


Figure 5-4 - 1% climate change AEP extents for the baseline scenario

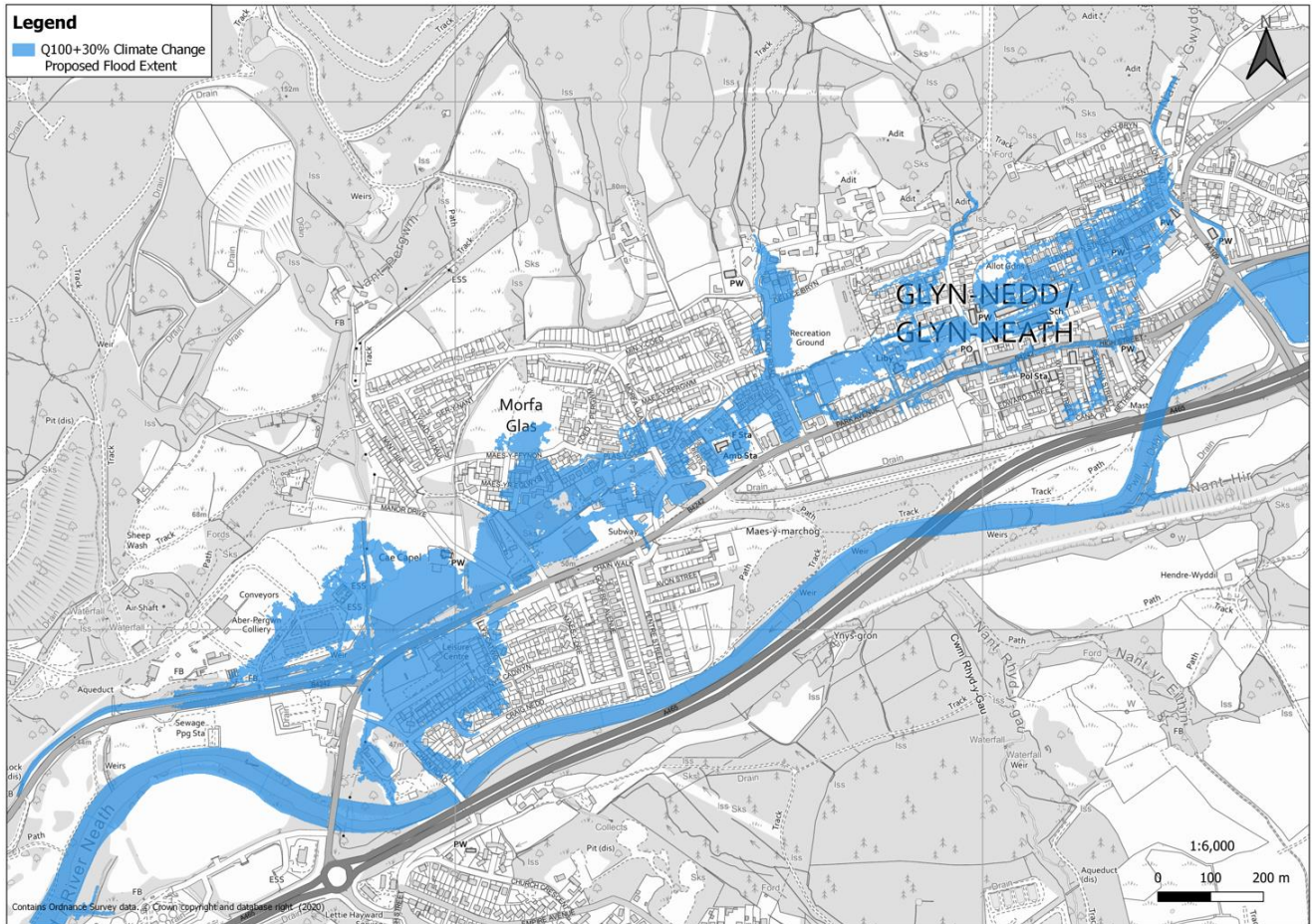


Figure 5-5 - 1% climate change AEP extents for proposed case

A plot of the difference in the flood levels as a result of the flood alleviation works is presented in Figure 5-6 below. The results show that during a 1% annual chance flood event (in the Ordinary Watercourses) with an allowance for climate change, there is no negative impact on flood levels as a result of the proposed works with flood levels shown to be lower.

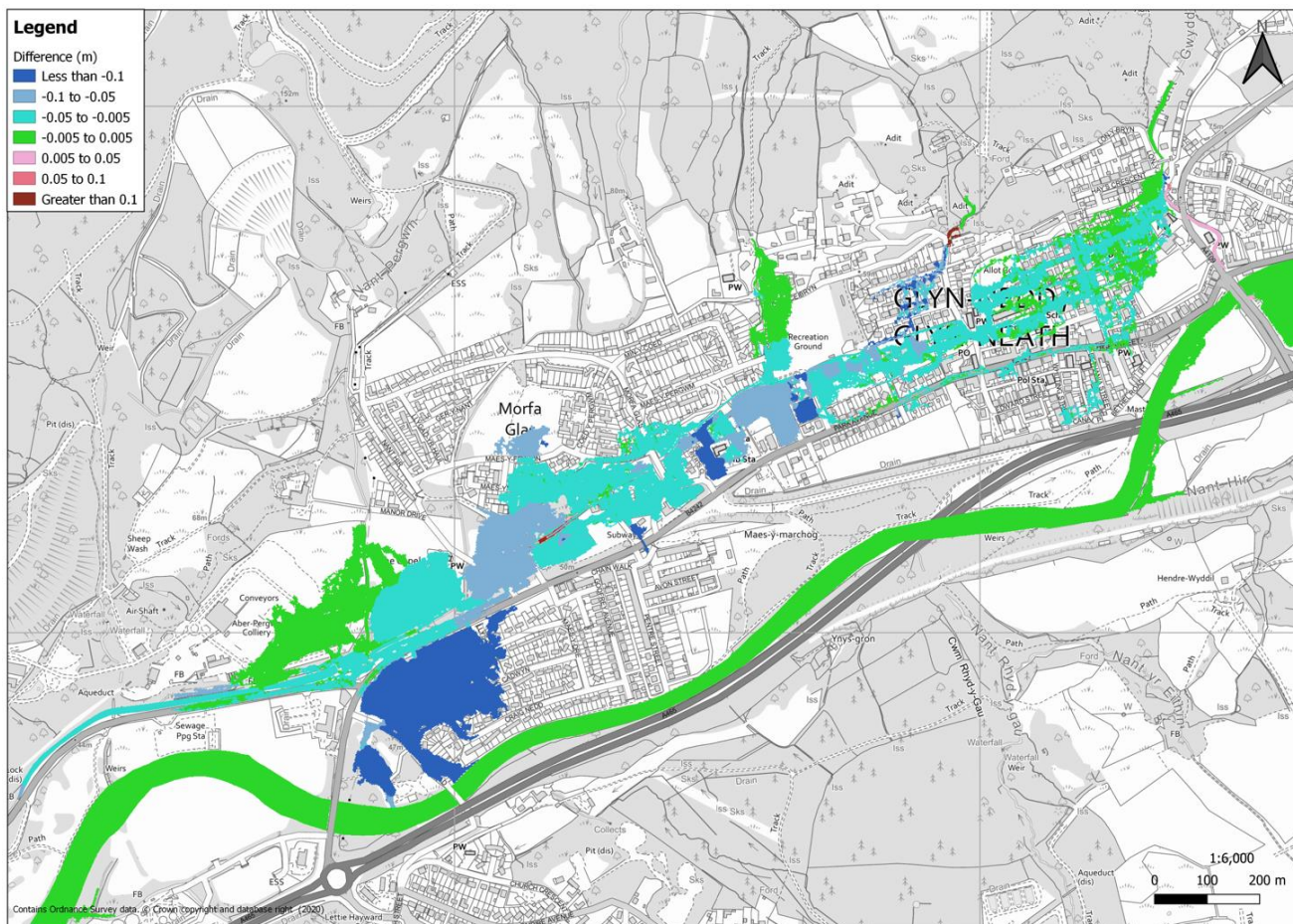
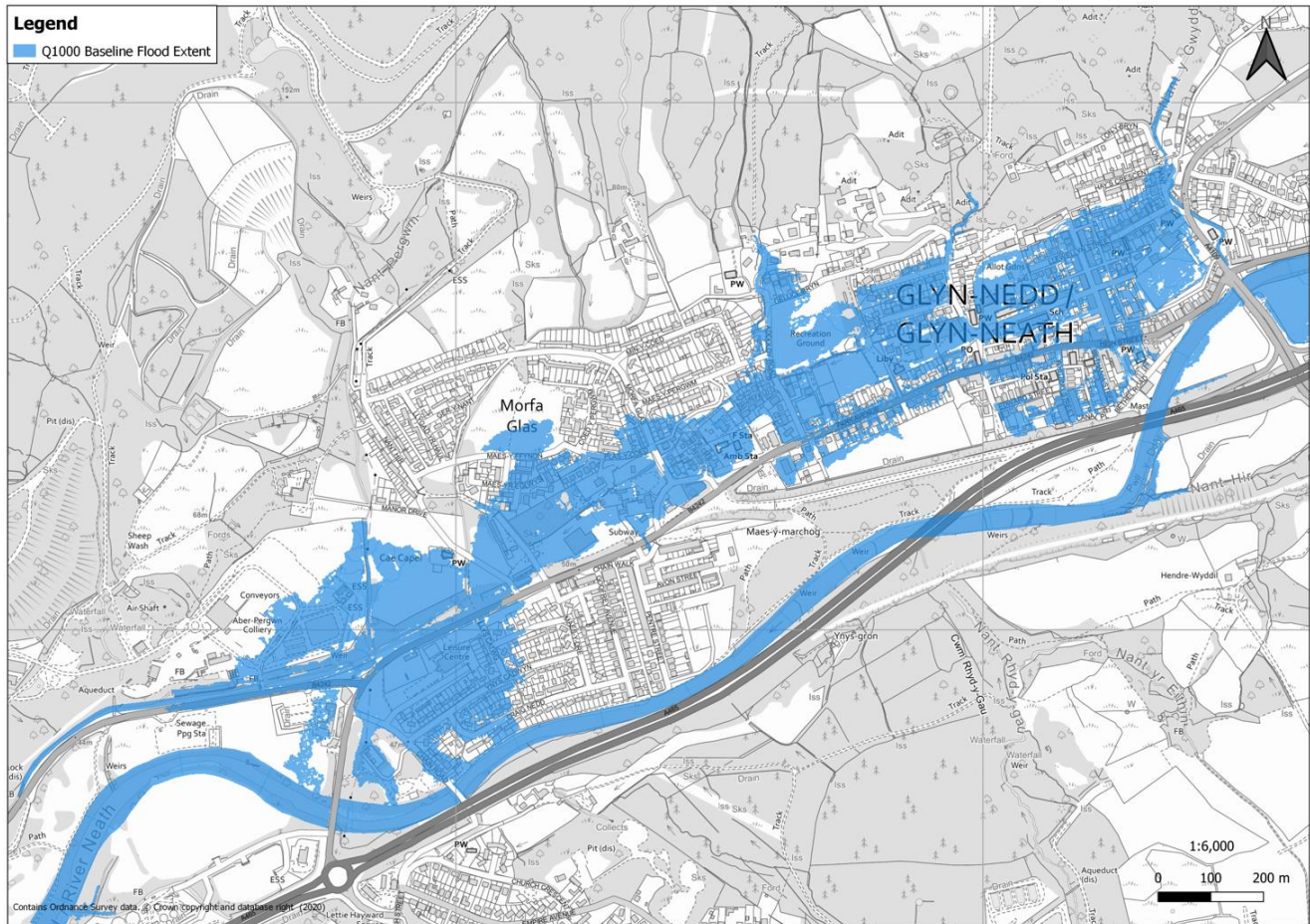


Figure 5-6 - Comparison of 1% climate change AEP depths for baseline and proposed scenarios

1 in 1000 year (0.1% AEP) flood event

The figures below compare the flood extents for the two scenarios which evidently shows similar extents for a 0.1% AEP flood event with and without the proposed flood alleviation works. In both these scenarios the 0.1% AEP flood overtops the banks of all the Ordinary Watercourses as the capacity of the streams are exceeded. Although the flood extents for both scenarios are broadly similar, the proposed works ensure that the flood extents are less extensive than that if the current situation was maintained.



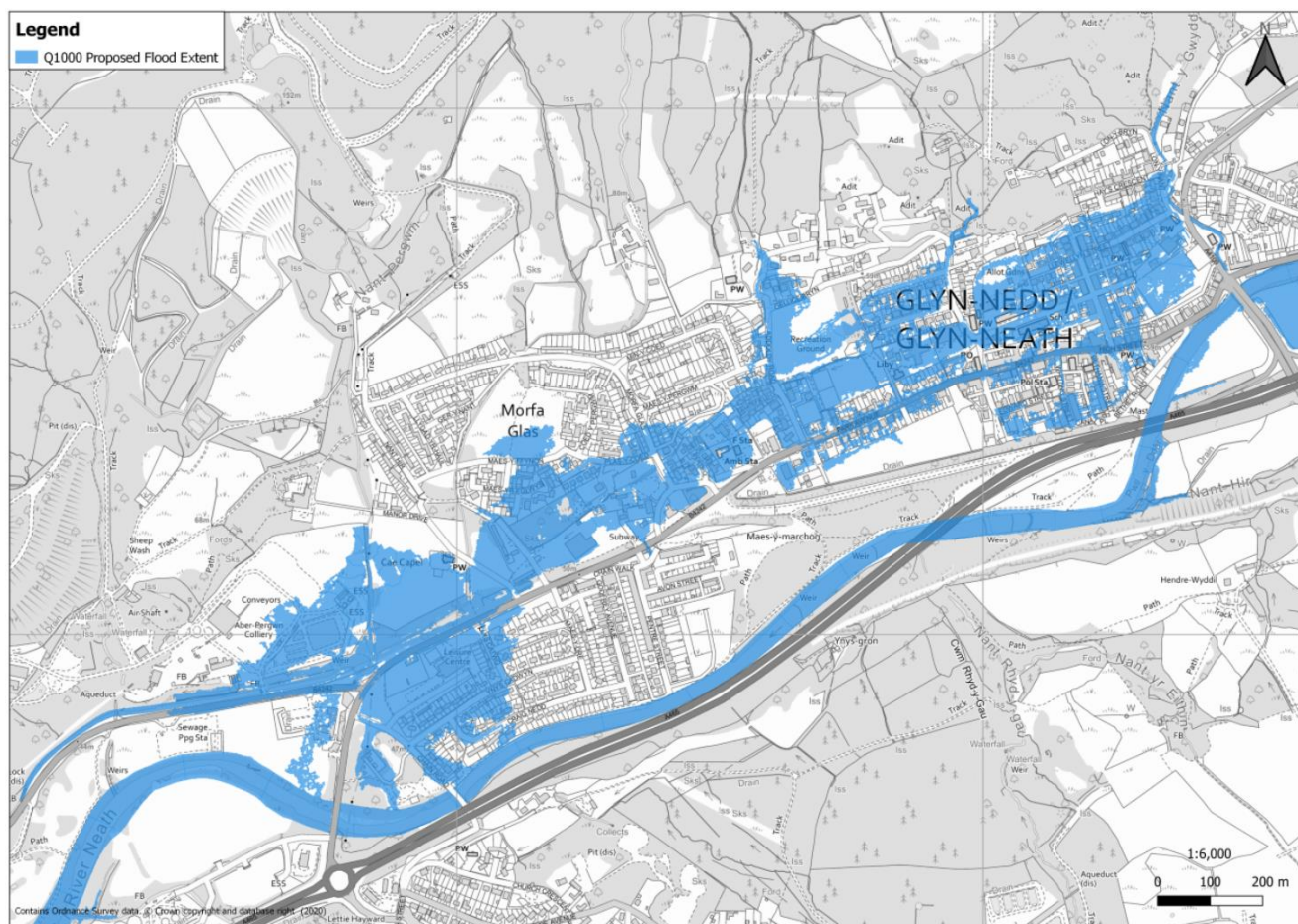


Figure 5-8 - 0.1% AEP flood extents for the proposed case

A plot of the difference in the flood levels as a result of the flood alleviation works is presented in Figure 5-6 below. The results show that during a 0.1% annual chance flood event (in the Ordinary Watercourses), there is no negative impact on flood levels as a result of the proposed works with flood levels shown to be lower.

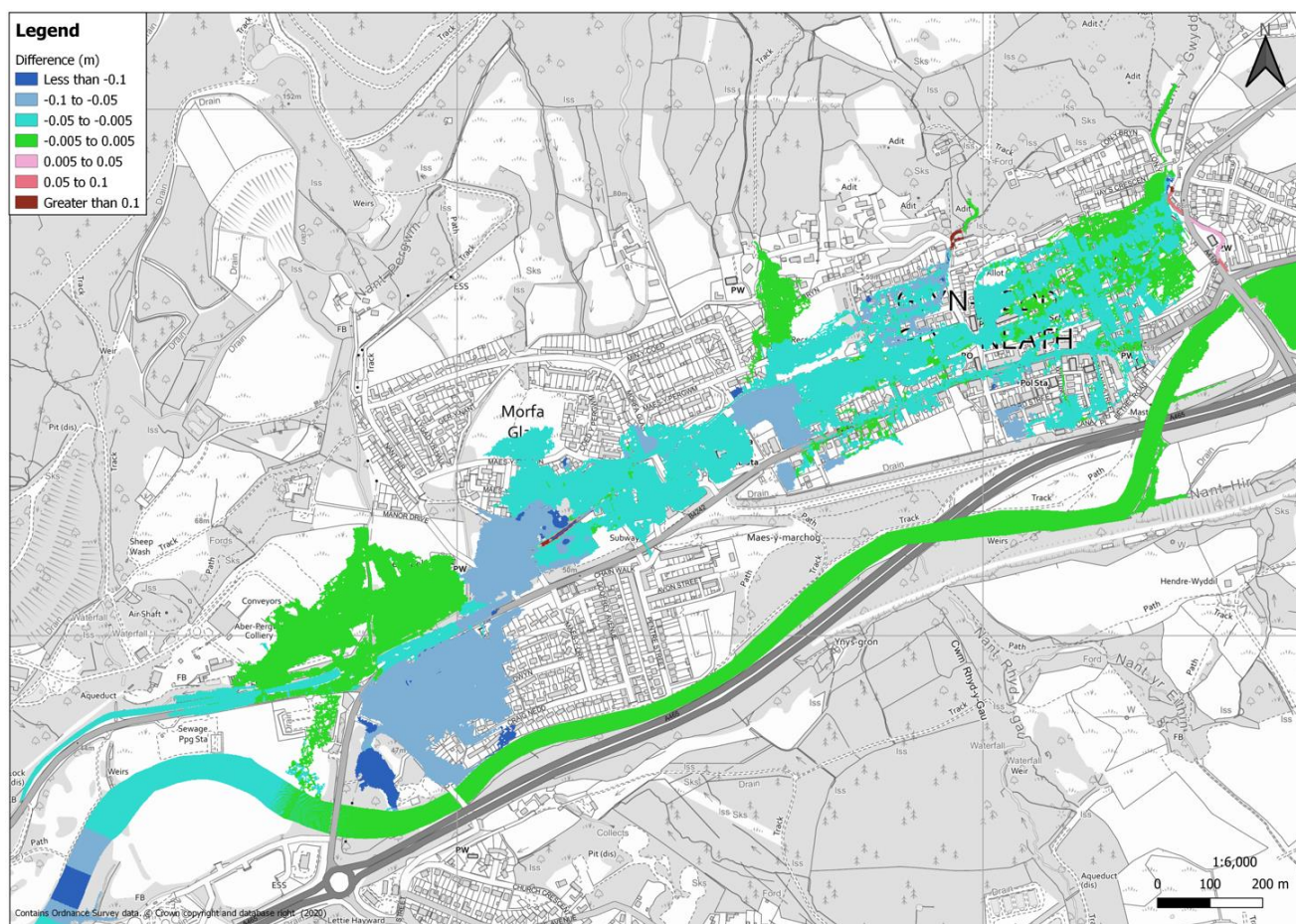


Figure 5-9 - Comparison of 0.1% AEP flood depths for baseline and proposed scenarios

5.2. With-Scheme Model Results and Flood Consequences

This section considers the assessed consequences associated with the proposed flood alleviation scheme. TAN 15 requires that the development should remain flood free during a 1% AEP fluvial event for the lifetime of the development. TAN15 also does not permit flood risk elsewhere to be increased as a result of developing a scheme.

The requirement for a 1% AEP fluvial event for the lifetime of the scheme should not apply to an existing community where improvements can be brought in line with the National Strategy on Flood and Coastal Erosion Risk Management (FCERM) for Wales (Welsh Government, 2020) in order to reduce the risk of flooding to homes and businesses and providing benefits are demonstrated in line with the Welsh Government's FCERM Business Case Guidance.

1% AEP Fluvial Flood Event

- There is reduction of flooding to the town, with the flows in the Gelliceibryn Brook and Nant y Gwyddyl being contained within the channel.
- The proposed works do not result in any detriment to any third parties. Peak carry-on flow in the River Neath reduces from 311.8m³/s in the baseline case to 311.3m³/s in the proposed case.

1 in 100 year (1% AEP) flood event plus 30% climate change

- There is flooding to Glynneath in the proposed case during a 1% AEP plus climate change event although the depths are up to 150mm lower than those predicted for the baseline case.

- There is no detriment or negative effects to fluvial flooding as a result of the scheme that would increase flood risk elsewhere.
- Peak carry on flow in the River Neath reduces from 315.9m³/s in the baseline case to 315.3m³/s in the proposed case.

0.1% AEP Fluvial Flood Event

- There is flooding to Glynneath in the proposed case during a 0.1% AEP although the depths are up to 240mm lower than those predicted for the baseline case.
- There is no detriment or negative effects to fluvial flooding as a result of the scheme that would increase flood risk elsewhere.
- Peak carry-on flow in the River Neath reduces from 317.0m³/s in the baseline case to 316.6m³/s in the proposed case.

5.3. Acceptability of consequences

The structures proposed in this scheme, lying in both Zone C2 and Zone B (shown in Section 2.3) are known to flood, and the risks will need to be managed. Section 7 and Appendix 1 of TAN 15 describe the acceptability criteria of the consequences of flooding that should be considered. TAN 15 requires that for any new development, that there is:

- Minimal risk to life
- Minimal disruption to people living and working in the area
- Minimal potential damage to property
- Minimal impact of the proposed development on flood risk generally
- Minimal risk to natural heritage

These are discussed briefly below.

Flood protection

The project removes over 200 properties from the predicted 1% (1 in 100) AEP flood extent and in comparison to the Do Minimum (Business as Usual) scenario provides a very high level of economic flood benefits.

Minimal risk to life

The proposed scheme reduces flood risk at Glynneath to the 1% (1 in 100) AEP event, and therefore reduces the risk to life.

Minimal disruption to people living and working in the area

By minimising the flood risk at Glynneath, disruption to residents, workers and visitors will be reduced.

Minimal potential damage to property

The proposed scheme will reduce the expected damages to residential and commercial properties.

Minimal impact of the proposed development on flood risk generally

Flood risk has been shown to reduce at Glynneath with no detriment to any third parties being predicted as a result of the with scheme proposals.

Minimal disruption to natural heritage

There are no designated heritage assets within the Scheme extent. There is one conservation area, Glynneath Woollen Mill, approximately 350m west of the Scheme. There are two non-designated heritage assets within the Site extent. There are 16 non-designated heritage assets in the Study Area. Most of the heritage assets within the Study Area relate to the town's industrial and ecclesial heritage.

6. Conclusions

This assessment has demonstrated that the consequences of flooding of the proposed scheme are acceptable and that the flood risk can be managed. In addition, the scheme will reduce the flood risk to the people and properties of Glynneath.

- The proposed works have been shown to provide a 1% (1 in 100) AEP standard of service.
- Over 200 properties are removed from the 1% (1 in 100) AEP flood extents.
- The 0.1% AEP fluvial events have been tested in the hydraulic model for the current day pre-scheme (Baseline), and With-scheme situations.
- A 100-year development lifetime has been assumed. Climate change effects on fluvial flows up to a 1% AEP event have been applied.
- There is no detriment or negative effects to fluvial flooding as a result of the scheme that would increase flood risk elsewhere.