Appendix 1

Cyngor sir ddinbych denbighshire County Council

SECTION 19 FLOOD INVESTIGATION REPORT

20th OCTOBER 2023
FLOOD EVENT

LOCATION: DENBIGHSHIRE

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Revision History

Revision Ref/Date	Amendments	
	First Issue	May 2024

This report has been produced by Denbighshire County Council with the cooperation and assistance of Natural Resources Wales.

Executive Summary

This report has been produced in-line with the duties placed upon Denbighshire County Council (DCC) under Section 19 of the Flood and Water Management Act 2010. The Act states, "*On becoming aware of a flood in its area, a lead local flood authority (LLFA) must,to the extent that it considers it necessary or appropriate, investigate:*

> *a) which risk management authorities have relevant flood risk managementfunctions and*
>
> *b) whether each of those risk management authorities has exercised or is*
>
> *proposing to exercise those functions in response to the flood".*

This Section 19 investigation provides a factual report of the internal flooding to properties and businesses within Denbighshire, which occurred on 20th October 2023 as a result of Storm Babet. The investigation focuses on the flooding within the Communities of Rhyl, Prestatyn, Dyserth, St.Asaph an Denbigh, as well as isolated flooding incidents within Llandyrnog, Aberwheeler, Llanarmon Yn Ial, Nantglyn and Loggerheads Country Park Visitor Centre. It also reviews evidence provided by responders and residents regarding the Flood Event.

The arrival of Storm Babet on 20 October 2023 marked the first named storm to affect Wales this winter season. It was one of the most severe storms to hit the UK in recent years, causing widespread flooding and damage. Denbighshire experienced the effects of this Storm, with heavy and prolonged rain flooding around 62 homes and 6 businesses.There was also a large number of 'near misses' and significant damage caused to highway infrastructure. These last two points howeverdon't form part of the report as they fall outside the legislative framework for Section 19 Flood Investigations.

Following the flood event, DCC carried out a door knocking exercise to properties which were reported to have been flooded. This exercise identified that 62 homes had experienced internal flooding to living space, whereas 7 businesses had to close temporarily as a result of internal flooding.

The source of the flooding originated from the heavy Storm Event of the 20th, which caused fluvial and surface water flooding. The Maes Y Gog Drain in Rhyl an the Afon Ffyddion in Dyserth overtopped causing a number of properties to be flooded; surface water and sewerage systems were overwhelmed and surcharged causing flooding to properties in Rhyl, Prestatyn and St.Asaph. Other factors included blockages to highway drainage systems, causing systems to back-up and flood properties.

The Report examines the reasons why flooding occurred at each locaility, as well assess how likely it is for flooding to happen again. It also determines what improvements and actions are needed to ensure flood risk in the County is appropriately managed in future.

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Abbreviations

CSO – Combined System Overflow
DCC – Denbighshire County Council
DCWW – Dwr Cymru Welsh Water
LLFA – Lead Local Flood Authority
NR – Network Rail
NRW – Natural Resources Wales
PLP – Property Level Protection
RMA -- Risk Management Authority
WG – Welsh Government

Definitions

Annual Exceedance Probability: The probability that a given rainfall total accumulated over a given duration will be exceeded in any one year.

Non-return flap valve: a valve installed on drains that allows fluid to flow through it in only one direction. It is commonly used to prevent surcharge coming up through drainage systems into properties.

Risk: In flood risk management, risk is defined as a product of the probability or likelihood of a flood occurring, and the consequence of the flood.

Surface water flooding: Flooding as a result of surface water runoff as a result of high intensity rainfall when water is ponding or flowing over the ground surface before it enters the underground drainage network or watercourse or cannot enter it because the network is full to capacity, thus causing pluvial flooding.

Fluvial flooding: Flooding as a result of the water level in a river, lake or stream rising and overflowing onto the surrounding banks, shores and neighbouring land

1.0 Introduction

1.1 Background to the Investigation

As a Lead Local Flood Authority (LLFA), DCC has a duty to prepare and publish the results of investigations into significant flood incidents, as detailed within Section 19 (S19) of the Flood and Water Management Act 2010 (FWMA). The Act states, "On becoming aware of a flood in its area, a lead local flood authority (LLFA) must, to the extent that it considers it necessaryor appropriate, investigate:

a) *which risk management authorities have relevant flood risk management function and*

b) *whether each of those risk management authorities has exercised or is proposing to exercise those functions in response to the flood".*

This report has been prepared for the purpose of meeting the LLFA S19 requirements by providing a detailed, factual account of the flooding that occurred in October 2023 in the County of Denbighshire. During this event, it was reported that 62 properties and 7 businesses flooded internally. This report will focus on investigating the causes of the internal flooding of properties as a result of the storm event, known as Storm Babet.

To provide an accurate account of the flood event, this S19 Report will:

- Identify events leading up to the flood;
- Investigate the number of properties flooded;
- Investigate which Risk Management Authorities (RMAs) have flood risk management functions in respect of the flooding;
- Investigate whether each RMA has exercised or is proposing to exercise those functions in response to the flood

1.2 Site Locations

The Denbighshire County Council (DCC) administrative area in North Wales covers an area of approximately 846 km². Denbighshire is bounded by Conwy and Gwynedd unitary authorities to the West, Powys to the South, Wrexham to the South and East and Flintshire to the East.

There are a number of Main Rivers flowing through Denbighshire, fed by a number of tributaries. The geography of Denbighshire is defined by the broad valley of the Main River know as the River Clwyd, which is surrounded by rolling hills on all sides except the north, where it reaches the coast. Figure 1 below shows the topography of Denbighshire

The River Dee in the South of the County is the other significant river but as the impacts from Storm Babet were minimal here, it is not included within this report.

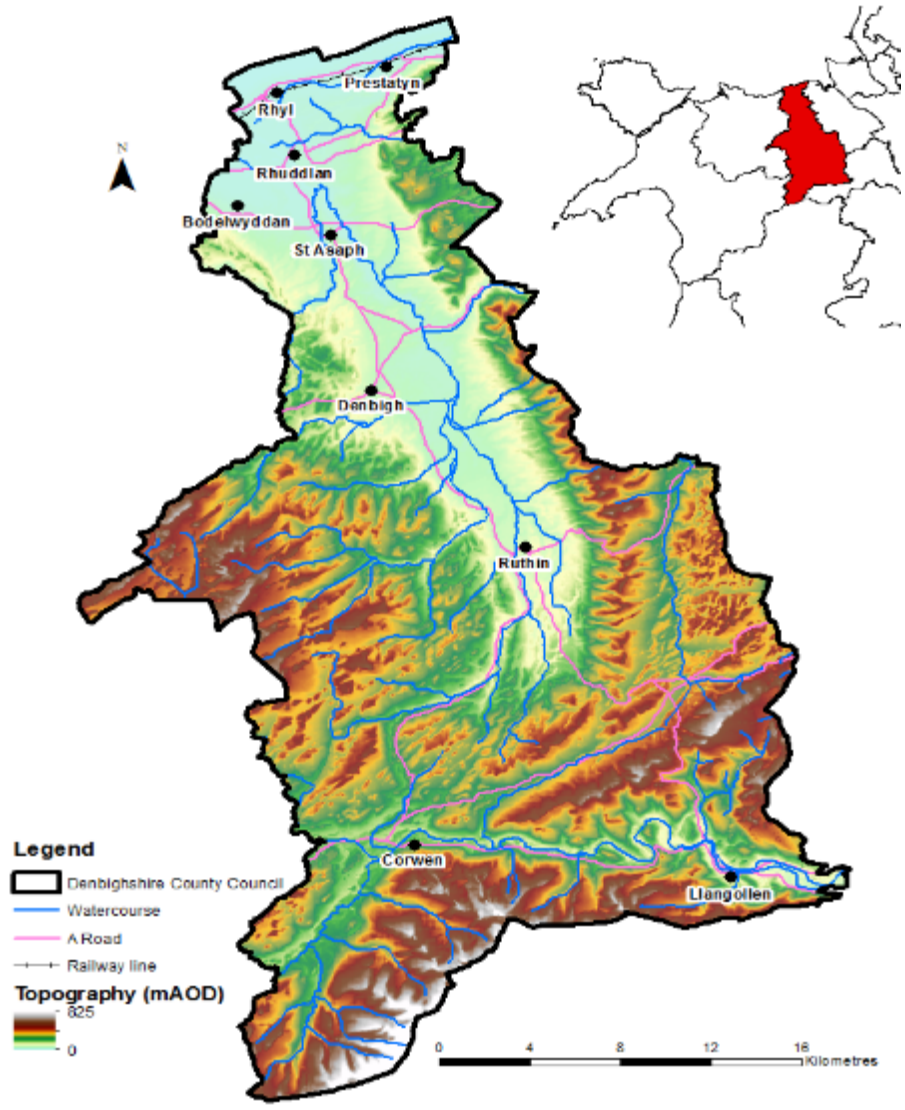

Figure 1: *Topography of Denbighshire*

This flood investigation report focuses on 10 communities within Denbighshire, with a breakdown of specific locations and property/business numbers flooded as shown in table 1 below, whereas Appendix 1 shows the locations of the flooded properties/businesses.

Location	No of Properties flooded	No of Businesses flooded
Rhyl		
Ffordd Derwen	1	0
Rhuddlan Rd Retail Park Area	0	3
River Street	2	0
Lon Eglan	6	0
Lon Gwernall	5	0
Maes Y Gog	1	0
Grange Road	1	0
Plas Cyril	3	0
Aspen Drive	1	0
Prestatyn/Meliden		
Winchester Drive	3	0
Ffordd Penwhylfa	6	0
Pwll Y Bont	5	0
Dyserth		
Waterfall Road	4	1
Pandy Lane	1	0
St.Asaph		
Llys Y Felin	7	0
Ashley Court	1	0
Denbigh		
Denbigh Green	4	0
Brookhouse	1	0
Llandyrnog/Aberwheeler		
	2	0
Llanarmon Yn Ial		
	1	0
Nantglyn		
	1	0

Table 1: *List of Flooded Properties per Community with Denbighshire*

2.0 Roles and responsibilities

2.1 Duties under 'Flood and Water Management Act (2010): Section 19 -Local Authorities: Investigations'

Under Section 19 of the Flood and Water Management Act 2010, the Lead Local Flood Authority, DCC, has a duty to investigate and publish reports on flood eventsthat occur within its area to the extent that it considers it necessary or appropriate.

1) On becoming aware of a flood in its area, a lead local flood authority must, to the extent that it considers it necessary or appropriate, investigate –

a) which risk management authorities have relevant flood risk management functions, and

b) whether each of those risk management authorities has exercised, or is proposing to exercise, those functions in response to the flood.

2) Where an authority carries out an investigation under subsection (1) it must-

a) publish the results of its investigation, and

b) notify any relevant risk management authorities.

2.2 Risk Management Authorities (RMAs)

A Welsh risk management authority is defined in Section 6 of the Flood and Water Management Act 2010 as the Environment Agency (now Natural Resources Wales), a Lead Local Flood Authority, a district council for an area for which there is no unitary authority, an IDB for an internal drainage district that is wholly or mainly in Wales and a water company that exercises functions in relation to an area in Wales

2.2.1 Lead Local Flood Authority

DCC has been established as the Lead Local Flood Risk Authority (LLFA) for its administrative area under the Flood and Water Management Act 2010. It is responsible for managing the risk of flooding from ordinary watercourses, surface water runoff and groundwater.

Additionally, the LLFA takes on the role of the Sustainable Drainage Systems (SuDS) Approval Body in which they are responsible for approving proposed SuDS systems on new developments and adopting and maintaining constructed systems.

As the LLFA, DCC has statutory duties:

1. to prepare local flood risk management strategies;
2. to comply with the National Strategy for Flood and Coastal Erosion Risk Management;

3. to co-operate with other authorities, including sharing data;

4. to investigate all flooding within its area, insofar as a LLFA consider itnecessary or appropriate;

5. to maintain a register of structures and features likely to affect flood risk;

6. to contribute to sustainable development; and

7. through consenting powers on ordinary watercourses.

2.2.2. Natural Resources Wales

Natural Resources Wales (NRW) has statutory duties and permissive powers including:

1) Operational powers to manage the risk of flooding from main rivers and the sea, and coastal erosion.

2) General supervision over all matters related to flood and coastal erosion risk management in Wales.

NRW's powers to manage flood risk include the management and maintenance of Main Rivers the construction of new flood risk management assets and maintaining existing flood assets.

NRW's powers to manage flood risk include the management and maintenance of Main Rivers the construction of new flood risk management assets and maintaining existing flood assets. NRW assesses developers' flood assessments (and supporting documentation) to decide whether developers have met the requirements of *Planning Policy Wales and Technical advice note 15: development and flood risk* (TAN15, 2004) in relation to the risks of flooding frommain rivers, the sea and reservoirs.

NRW is a statutory consultee in Local Authorities' planning processes and providessupport to Welsh Ministers in their preparation of the National Flood and Coastal Erosion Management (FCERM) Strategy.

NRW provides a direct flood warning service, primarily for areas at risk of fluvial and

coastal flooding.

Within Denbighshire's area of investigation, NRW have confirmed that maintenance work in the form of weed control was carried out in January 2023 on the Maes Gwilym Drain behind Maes Y Gog, whereas for the Afon Ystrad at Brookhouse, NRW using their permissive powers carried out routine maintenance work to the Brookfield Embankment, such as grass cutting, thining of riverside shrubbery and removal of fallen trees from the channel. This work was carried out in 2023, prior to Storm Babet.

Programmed maintenance work at the Maes Gwilym Drain falls under the maintenance regime for the Rhyl Cut Main River and appendix 2 shows an on overview of this regime for the Cut (and also the Prestatyn Gutter).

2.2.3 Highways Authority

DCC undertake the role of the Highways Authority, being responsible for the maintenance of all adopted highways in the County and associated infrastructure. This includes ensuring the highway has a drainage system that controls the surface water that enters onto the highway, providing and managing highway drainage and roadside ditches to ensure they are clear of obstructions. The above duties and responsibilities of the Highways Authority are not applicable to Trunk Roads, which are the responsibility of the Welsh Government.It is important to note that in mnay areas effected by Storm Babet, the highway systems feed into the Dwr Cymru Welsh Water (DCWW) drains as part of a duel function outfall.

Across Denbighshire, the Highways Authority undertake a cyclical maintenance regime, with cleansing of gullies carried out on a risk based approach, with gullies in flood prone areas being prioritised

2.2.4 Dŵr Cymru Welsh Water

DCWW as a risk management authority is to manage the risk of flooding to water supply and sewerage facilities and flood risk arising from their infrastructure. The main responsibilities of the Water Utility Company are to:

- Ensure their systems have the appropriate level of resilience to flooding, and
- maintain essential services during emergencies;
- maintain and manage their water supply and sewerage systems to manage the impact and reduce the risk of flooding and pollution to the environment;
- advise LLFAs on how their assets affect local flood risk and work with RMAs to

coordinate management of flood risk management assets; and

- work with developers, landowners and LLFAs to understand and manage risks

2.3 Other Authorities

2.3.1 Network Rail

Network Rail (NR) has an operational responsibility as a riparian owner and is required to undertake regular maintenance of all assets that pose a risk to flooding.

2.3.2 Landowners and riparian owners

Riparian Landowners are legally responsible under common law for the maintenance of the land generally up to the centreline of any watercourse adjacent to their property. This includes the maintenance of the bed, banks and any boundary features e.g., vegetated strips such as hedging, with routine clearance of debris and/or blockages. This does not mean that the owner must remove all debris from the watercourse, but it does require the owner to maintain as far as it does not pose a risk or 'nuisance' to a neighbour.

2.3.3 Residents

Residents and property owners are responsible for the protection of their own properties against flooding. Residents have the right to defend their property provided they do not increase the risk of flooding to other properties.

2.4 Permissive Powers

Risk Management Authorities have direct permissive powers under the Flood and Water Management Act 2010, as well as the Land Drainage Act 1991. For NRW and the LLFA, this includes:

- Powers to request information.
- The ability to raise levies for local flood risk management works (NRW only).
- Powers to designate certain structures or features that affect flood orcoastal erosion risk.
- expansion of powers to undertake works to include broader risk management actions.
- The ability to cause flooding or coastal erosion under certain conditions.

3.0 Stakeholder engagement

3.1 DCC Data Collection

Following Storm Babet on October 20th 2023, possible flooded property locations were listed with the help of the customer service database, which received 100s of flooding enquiries during the Storm Event. From this list, DCC conducted face to face interviews with property residents by means of a door knocking exercise. The following information was gained from the interviews:

- Date/time of flooding;
- extent of flooding to private land and properties;
- depth where possible of flooding on private land and in properties;
- perceived source/cause of flooding; and
- impacts

In addition, photographs and videos of the flooding were provided by residents,which were used in investigations for this report.

3.2 NRW Flood Reconnaissance

Following the 20th October flood event, NRW conducted flood reconnaissance work at targeted known flooding hotpots based on information and calls received. A door knocking exercise was carried out, which included a flood questionnaire to record flood related information. This S19 report draws on some of this information gathered from the NRW flood reconnaissance amd also from the Flood Risk Assessment, Asset Performance and Warning and Informing Teams

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NRW's flooding list matched the list ompiled by DCC staff.

3.3 Welsh Water

Post Storm Babet, communication with DCWW has taken place via e-mail and telephone/Teams to discuss the performance of their assets in terms of contributing to flooding.

4.0 Catchment characteristics

4.1 Rhyl & Prestatyn

The towns of Rhyl and Prestatyn lie side by side on the former Morfa (sea-marsh) on the North Wales coastal plain. Drainage channels cut in the 18th century drained the marshes enabling establishment of these two Towns – known as Rhyl Cut and Prestatyn Gutter. Over the decades both have expanded into their more elevated hinterlands and their current populations are c27,000 and c19,000 respectively. Meliden falls within the Community of Prestatyn.

Relevant to this report, is the issue of surface water/main river flooding within Rhyl and Prestatyn/Meliden. Historically this has been an issue that effects both Communities and to understand the problem, particularly in the urban areas of Rhyl and Prestatyn, we first need to look at their catchment characteristics

4.1.1 Main River

The Rhyl Cut and Prestatyn Gutter watercourses are the principal receptors and outlets for the majority of the surface water (SW) runoff for each town catchment. In Rhyl, the 'Cut' drains roughly east to west into the river Clwyd. In Prestatyn, the 'Gutter' drains roughly west from just below Meliden to east where a pumping station at Gronant discharges to the sea. Both Watercourses are classified as 'Main Rivers' and, as such, NRW is the RMA. A range of bodies hold a stake in the good performance of both drainage networks: NRW, DCC**,** DCWW, Network Rail (NR), riparian owners and owners of at-risk properties**.**

Figure 2 shows the location of the Cut, as well as other Main River drains feeding into It, such as the Maes Gwilym Drain, shown within the red rectangle.

***Figure 2**: Main River Network for Rhyl*[1]

Figure 3 below shows the location of the Prestatyn Gutter, from its origins south of Meliden, to where it interacts with the urban areas of Prestatyn Town.

Figure 3 *Main River Network for Prestatyn and Meliden*[1]

4.1.2 Drainage Systems

It should be noted that responsibility for different sections of drainage systems lies with individual RMA's, and that RMA's have different system capacity targets for their drainage networks. DCWW aim to maintain a 1 in 30 year (0.33% AEP) capacity, while the Highways Authority aims to maintain a 1 in 5 year (20% AEP) to 1 in 30 year capacity.It should also be noted that any DCWW surface water system is designed to take roof and yard drainage only, unless specifically designed to receive flows from the highway network. The highway network is designed to take flows from the highway only. These systems for Rhyl and Prestatyn have outfalls into The Cut and Gutter, respectively. Within the investigatory areas for Rhyl and Prestatyn there are very few standalone highway systems.

In terms of sewage systems, predominately Rhyl and Prestatyn/Meliden operate on a combined system, which spread extensively across the urban areas serving residential homes, business and highways, conveying waste and surface water to treatment works. Combined Sewer Overflows (CSOs), provide an NRW consented overflow release from

the drainage system into local watercourses or large surface water systems during times of high flows. Some areas may also be served by separate waste and surface water sewers which convey wastewater to treatment works and surface water into local watercourses, such as the Rhyl Cut and Prestatyn Gutter.

Without these release points, sewerage system could back up, and cause sewage flooding to streets, highways and cause toilets to overflow inside properties. Figures 4 & 5, respectively, show the location of CSOs for Rhyl & Prestatyn/Meliden within the associated river catchment boundary.

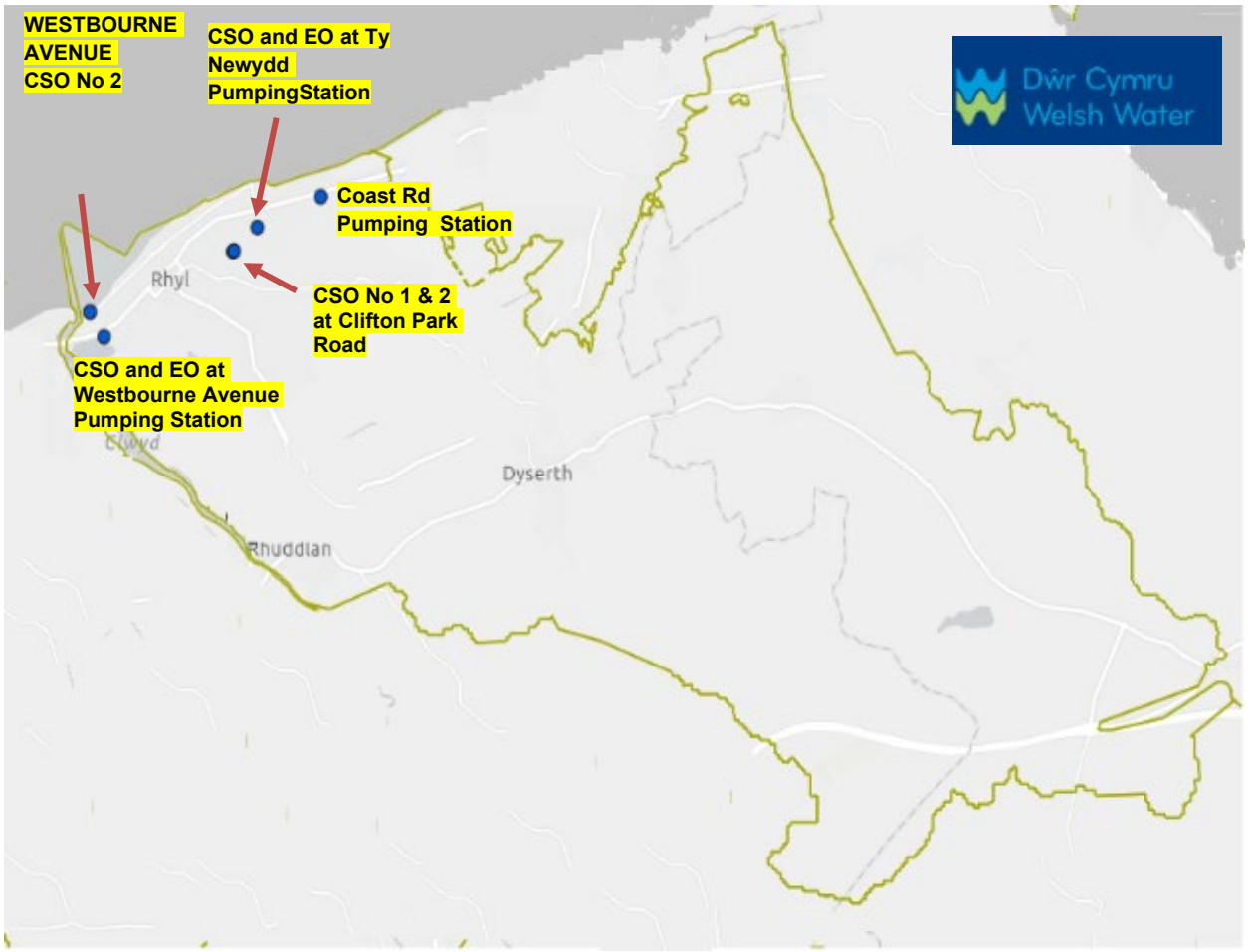

Figure 4: Location of CSOs for Rhyl within the river catchment boundary²

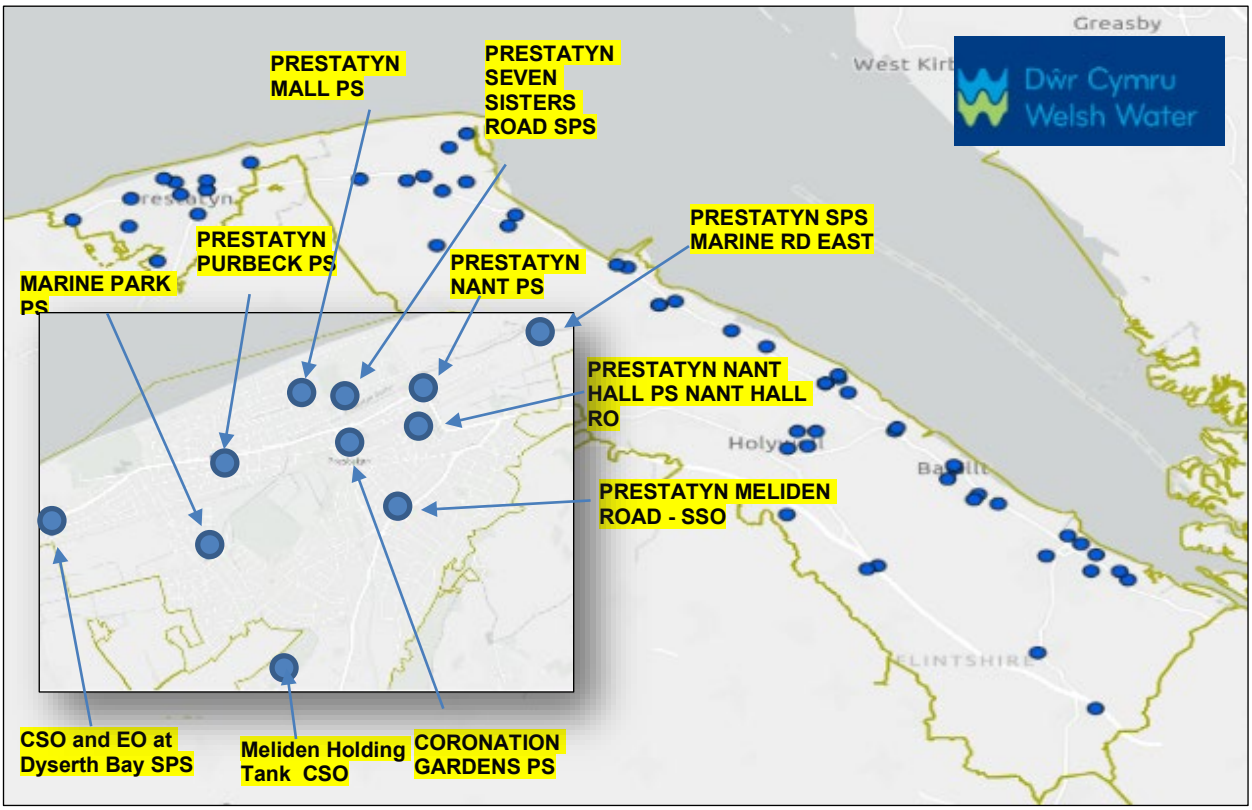

Figure 5: Location of CSOs for Prestatyn/Meliden within the river catchment boundary²

Across Denbighshire, the highway network is cleansed on a risk based system with flood priority based areas being done up to four times per annum, but othere locations perhaps being cleansed every two years. Most systems are not designed with the intention of receiving sheeting overland flows from greenfield areas or floodwater from fluvial systems.and can therefore get overwhelmed.

4.2. Dyserth

Dyserth lies on the slopes of the limestone hill Moel Hiraddug. The Afon Ffyddion rises 4.5 miles to the east of Dyserth, making its way to the village from the southeast to the north, via the 70ft Waterfalls immediately above Waterfalls Road. Past flood events at Dyserth have been the result of the village section of the watercourse over-topping. Surface water flooding has also contributed from highway drainage systems being blocked or over-whelmed.

4.2.1 Ordinary Watercourse – Afon Ffyddion

Glanffyddion Stream drains an area of 37.8km2 in the Northern Clwydian Hills to the north of the A55 in Denbighshire and flows in a north-westerly direction towards a confluence with the River Clwyd. The catchment is predominantly rural, with only the lower reaches of the catchment influenced by the urban area of Dyserth and is relatively steep in the

upstream part. 1.8km of the watercourse passes through Dyserth, from Pandy Lane, via the Waterfall where the stream exits the upland catchment area to the south-east. The urban section of the River runs in close proximity to roads and properties and the status of the watercourse changes to main river at point of the highway bridge on Waterfall Road, by the New Inn Pub. Figure 5 below shows the catchment area for Afon Ffyddion, with a blue pin marked at the location of the investigation area, which can be seen in more detail in Figure 6

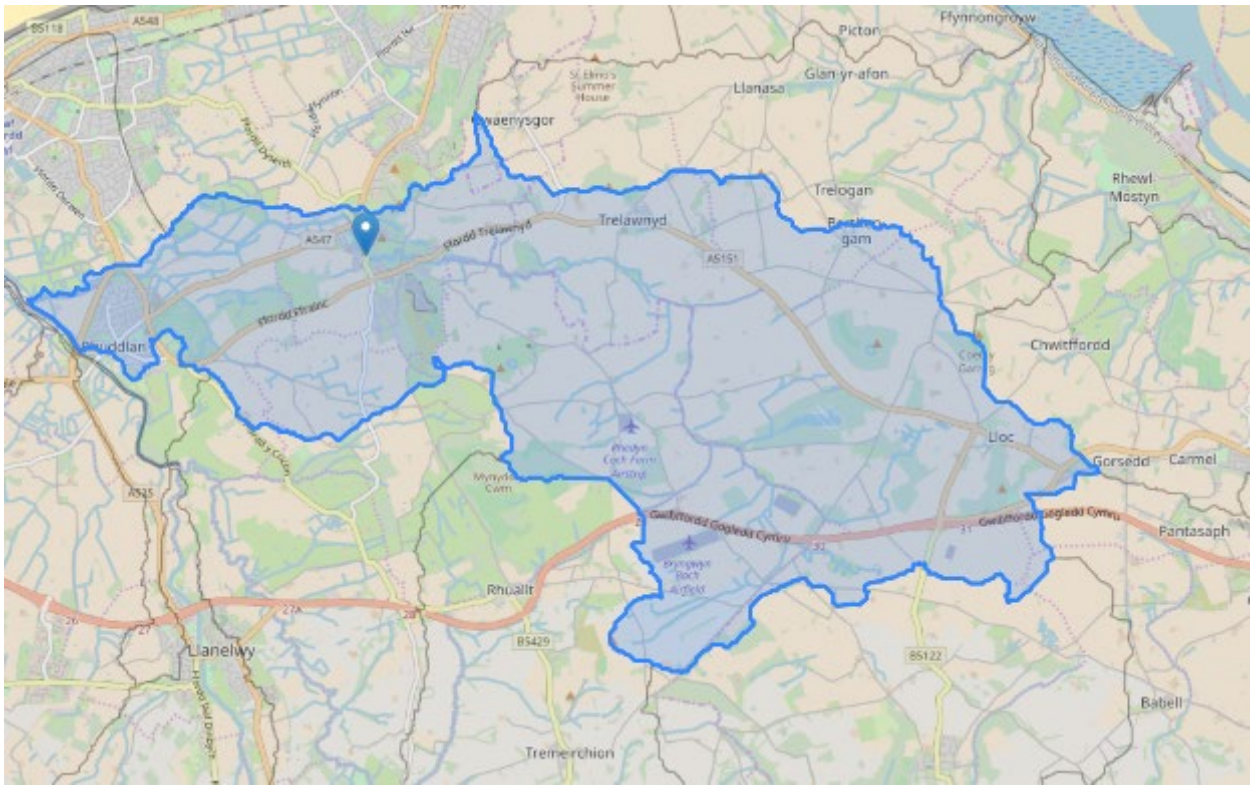

Figure 6: *Catchment area of the Afon Ffyddion* [3]

4.2.2 Drainage Systems

Highway drainage systems area relevant to the investigation area, as shown in figure 7 below:

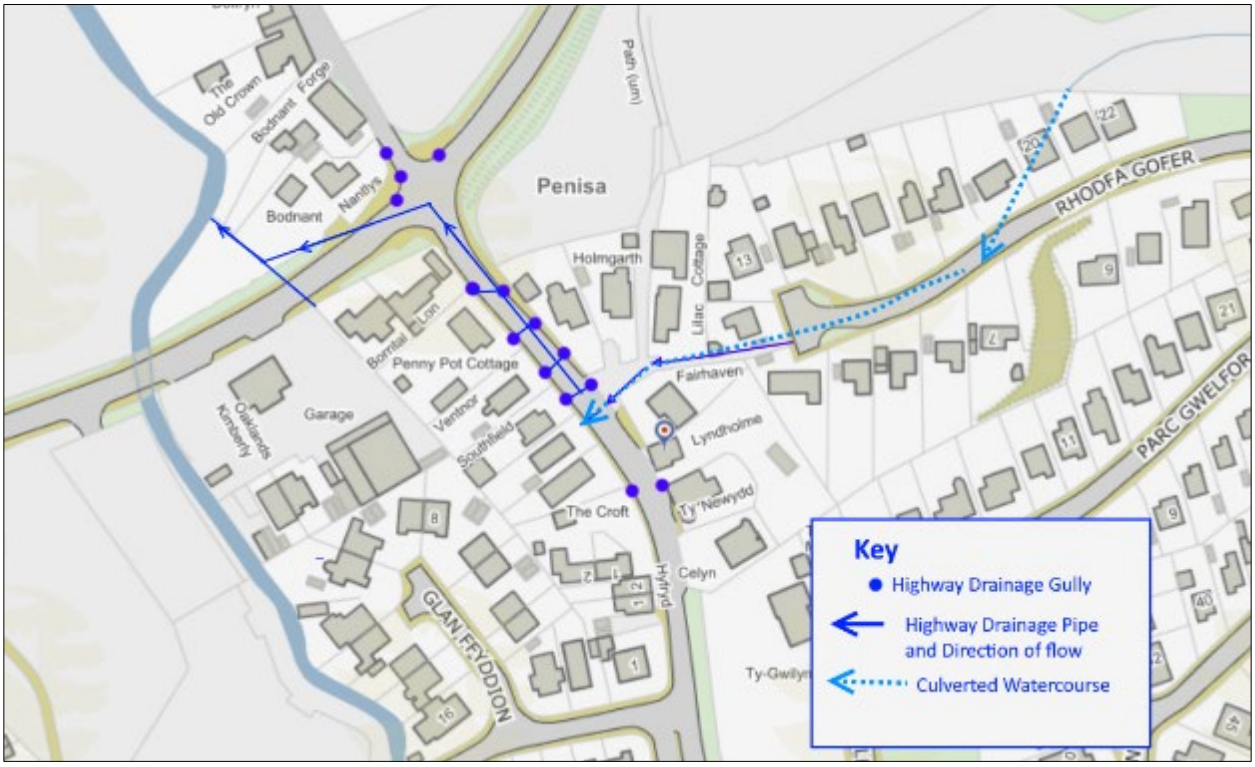

Figure 7: *Drainage systems opposite Lyndholme, Dyserth*

4.3 St Asaph

St Asaph is a city and community on the River Elwy in Denbighshire. This report will focus on lower St.Asaph, that is Llys y Felin and Ashley Court, which have a history of flooding due to the catchment characteristics explained below.

4.3.1 Main River

River Elwy passes through lower St.Asaph. The catchment for this River can be seen in figure 8 below and the usual depth range of the Elwy at St Asaph is between 0.95m and 2.05m. It has been between these levels for 90% of the time since monitoring began [4]. Llys y Felin (marked with a blue pin on figure 8) is indirectly effected by the fluctuating depths, which play a role in how storm water is drained into the Elwy via DCWW drainage systems, which will be looked in section 4.3.2 below.

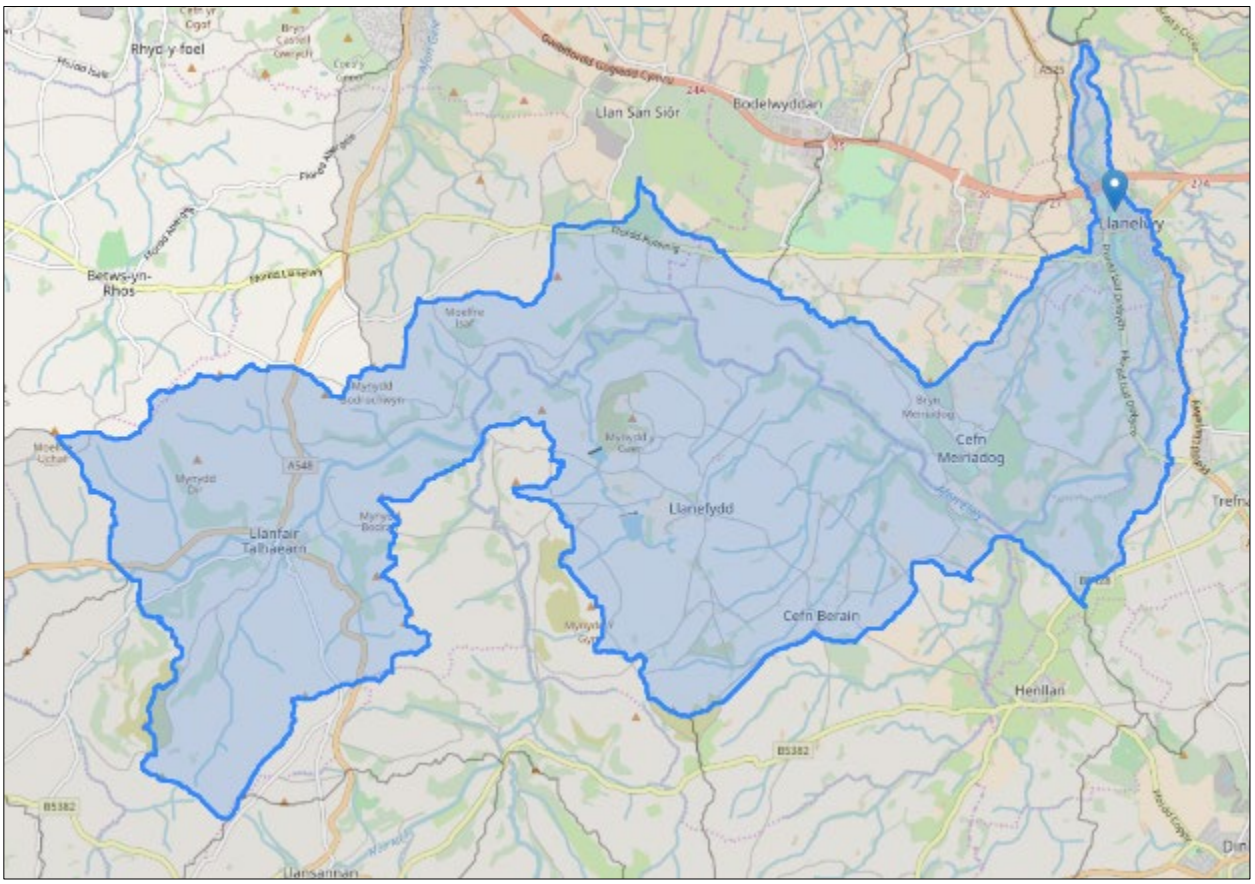

Figure 8: *River catchment for Afon Elwy*[3]

4.3.2 Drainage Systems

The drainage systems relevant to Llys y Felin is a DCWW combined system which utilises a CSO to prevent back up during heavy storms. A Storm overflow pipe discharges into the Elwy via an outfall with a non return flapvalve. Figure 9 below sows the layout of DCWW drainage systems. There is also highway drainage from the High Street feeding into the tank.

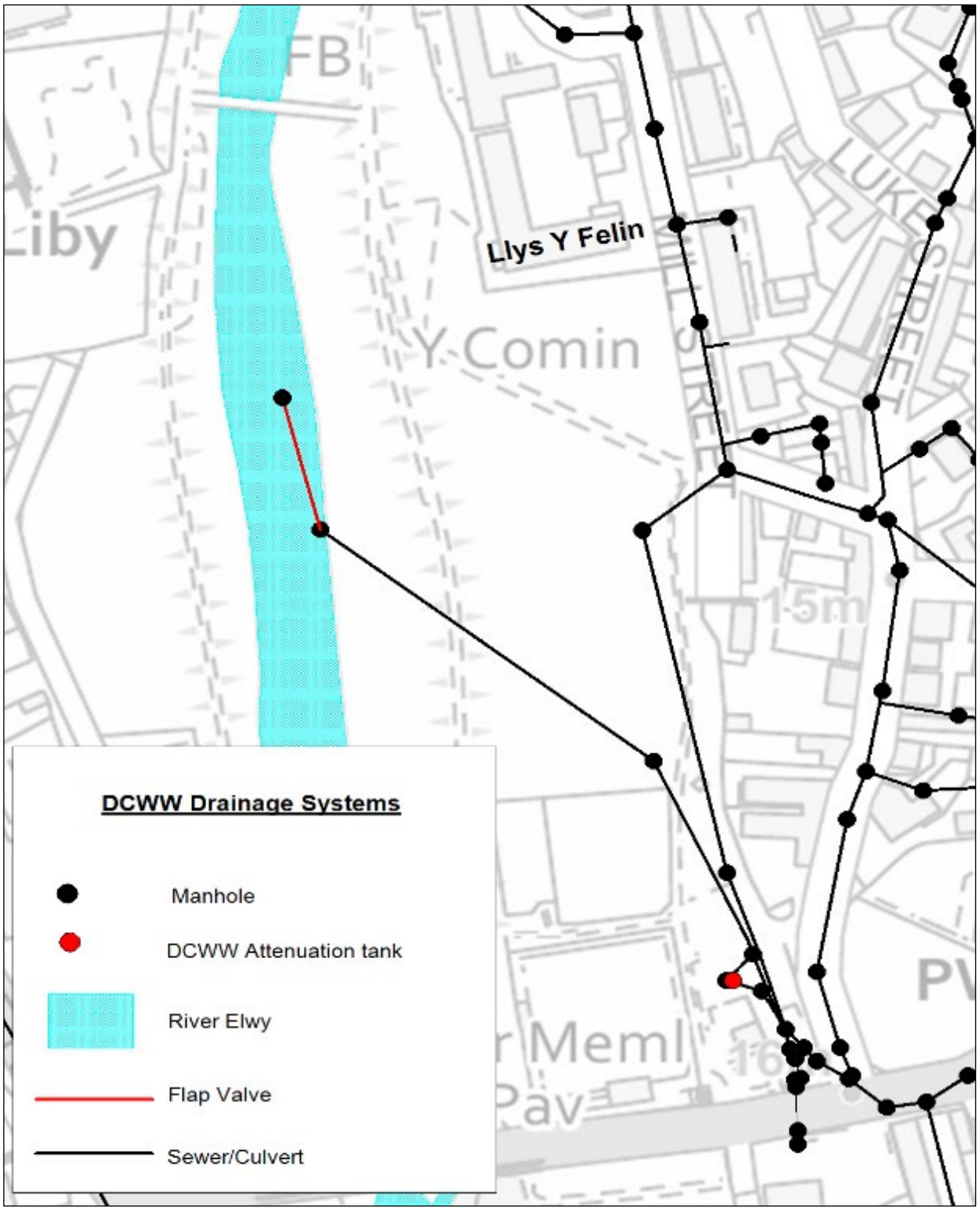

Figure 9: *DCWW drainage systems for the area around Llys Y Felin*

With regard to the catchment characteristics at Heol Esgob, a small stream from the land above Ashly Court (near to Heol Esgob), enters a piped system at the rear of a Wales and West gas installation as shown in Figure 10 below. The stream is piped for approximately 120m via a 225mm dia. pipe, into a manhole (termed hereafter 'connection

chamber') at the head of Heol Esgob, at the edge of the residential area. Within this chamber there are three other connections' - the first is a pipe to DCWW combined sewer system, a higher-level connection to a surface water sewer operated by DCC and a final outlet which flows to a series of drainage ditches and culverts in the rear gardens of the properties on the western side of Tan-y-Bryn road.

It is possible that the chamber originally served simply to turn the stream water through 90 degrees into the ditch line and the highway drain flowed into this chamber. The ditch now ceases to function, but at some time a cross connection to the combined sewer was installed to take the flow. However, it is understood that, when DCWW were alerted to the presence of this watercourse connection they installed a stopper to prevent stream water entering the combined sewer, on the basis that this increased the risk of foul water flooding. There is no record of where the DCC highway drain ultimately discharges, but it is believed to outfall into the River Elwy by the Roe.

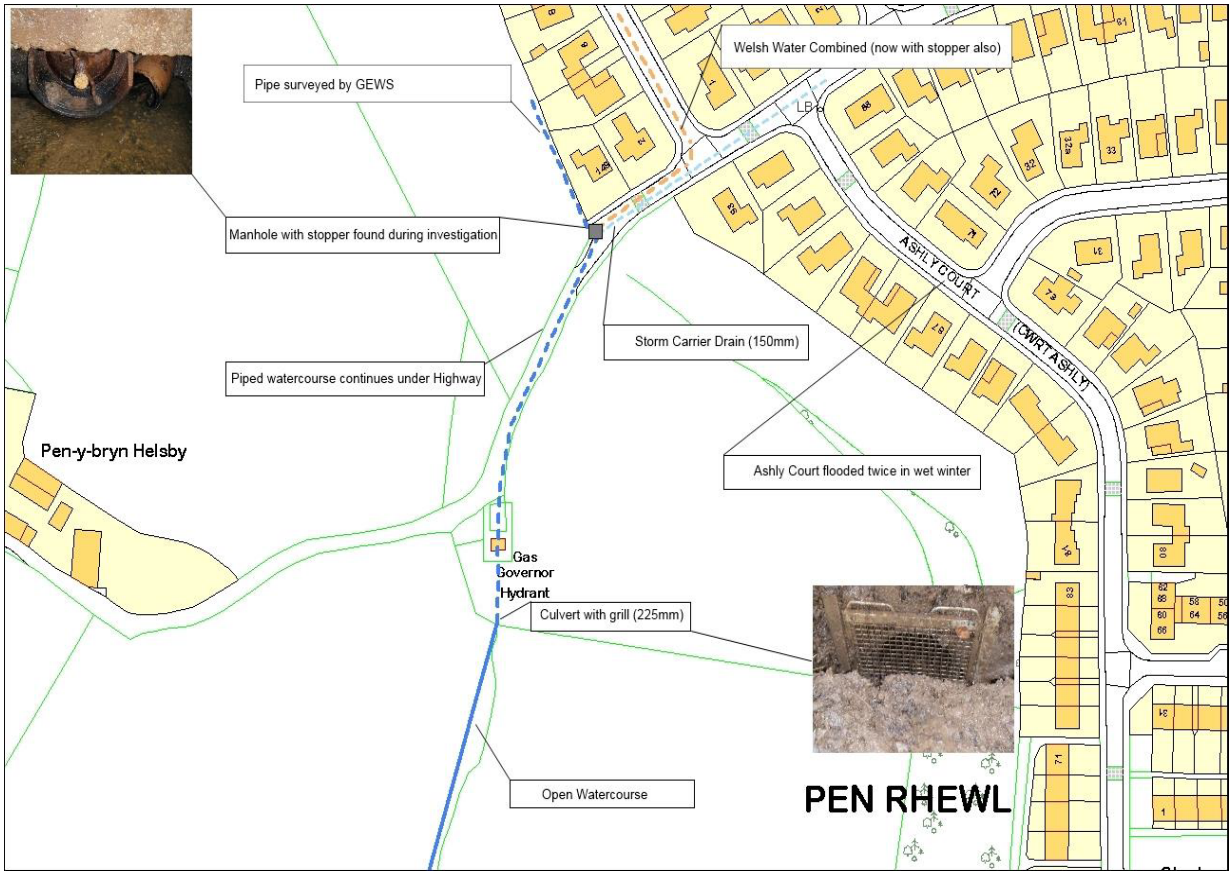

Figure 10: *Drainage systems for Hoel Esgob*

The highway drainage catchment for this drainage system is relatively small as shown by the lilac coloured area on figure 11 below.

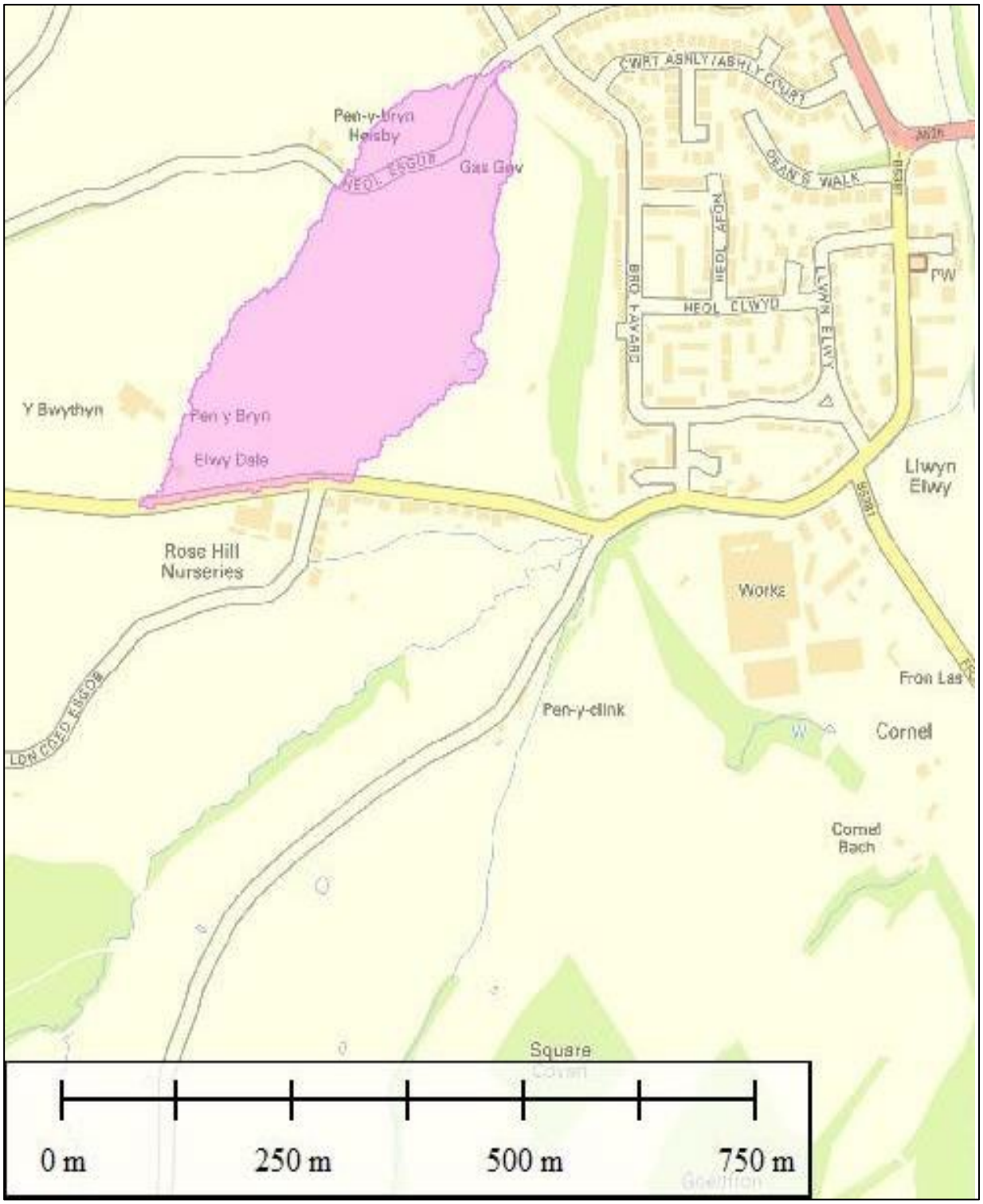

Figure 11: *Highway drainage catchment for Hoel Esgob*

4.4 Denbigh

The flooding investigation centres on Denbigh Green and Brookhouse. The former focuses on an ordinary watercourse and highway drainage, whereas the latter area lies adjacent to the Main River known as the Afon Ystrad.

4.4.1 Brookhouse

Main River

Figure 12 below shows the catchment for the Ystrad, with a blue pin marking the location of the confirmed flooded properties at Brookhouse.

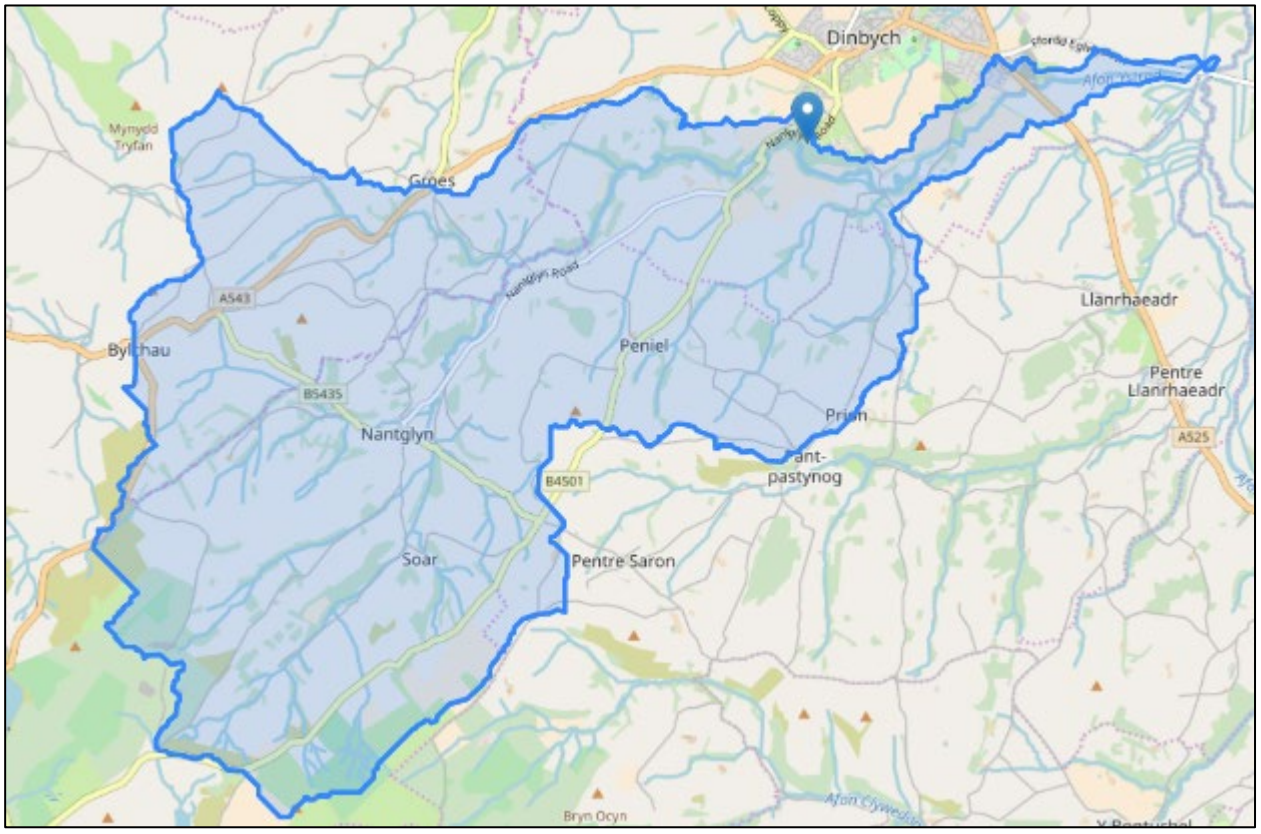

Figure 12: *River Catchment for the Afon Ystrad*[3]

4.4.2 Denbigh Green

Ordinary Watercourses

Within the investigation area for Denbigh Green, there are a number of watercourses which run from the fields behind the affected properties. One of the watercourses is culverted at the point where it leaves agricultural land, whereby it runs underneath the A525 to an open channel, parallel to a farm track.

The watercourses contribute to the Henllan Brook catchment as shown in figure 13, which also falls within the overall Clwyd Catchment. Figure 14 shows in more detail the location of the culverted section.

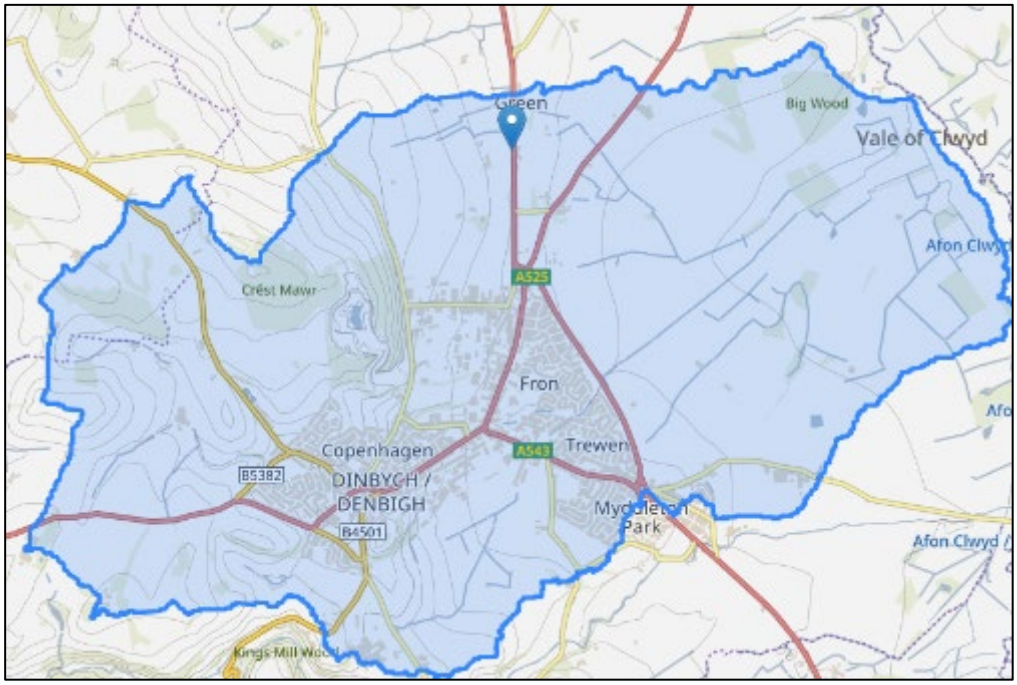

***Figure 13**: Catchment for the Henllan Brook[3]*

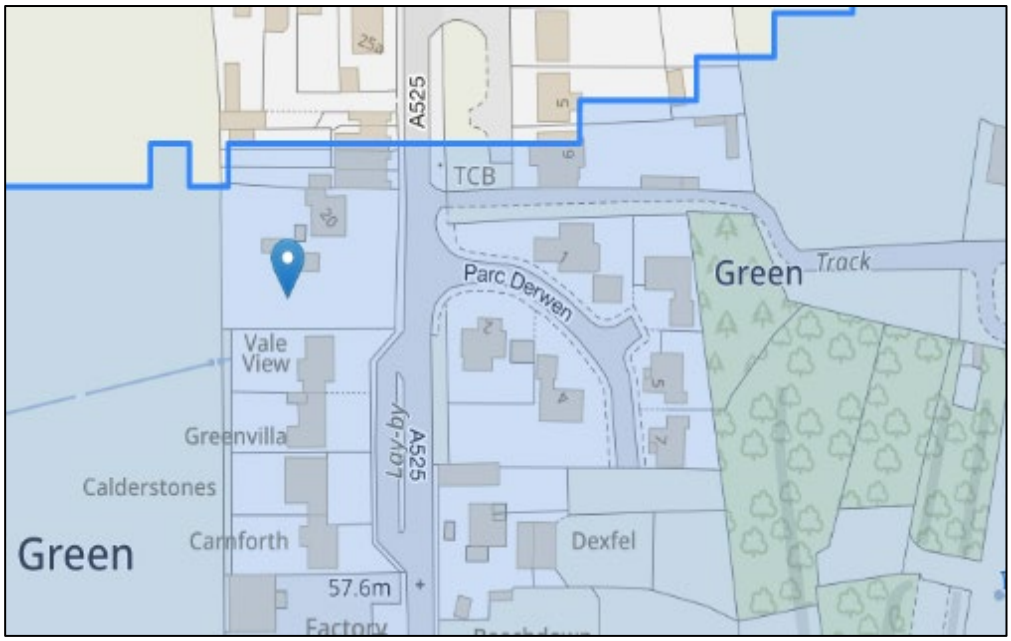

***Figure 14**: Location of the culverted watercourse.*

Drainage systems

The A525 cuts through Denbigh Green, which has a number of highway gullies located along this section of road.

4.5 Llandyrnog/Aberwheeler

For Llandyrnog and Aberwheeler, internal flooding occurred to one property each, with the focus is on highway driange systems and also a private system

4.5.1 Llandyrnog

Drainage Systems

For the investigatory area within Llandyrnog, there is highway culvert system and ditch, as well as private system taking roof water discharging into the highway ditch.

4.5.2 Aberwheeler

Drainage Systems

For Aberwheeler, there are a series of highway culverts/road gullies, which serve part of the B5429, adjacent to the effected Property.

4.6 Llanarmon/Lloggerheads

The investigatory areas for Llanarmon and Loggerheads centres around one property for former, whereas for the latter, the focus is on the DCC owned County Park visitor Centre/Café

4.6.1 Main River

Both Investigatory areas are impacted by the Main River known as the Alyn. Figure 15 below shows the catchment for this River, with two blue pins marking the location of the investigatory areas.

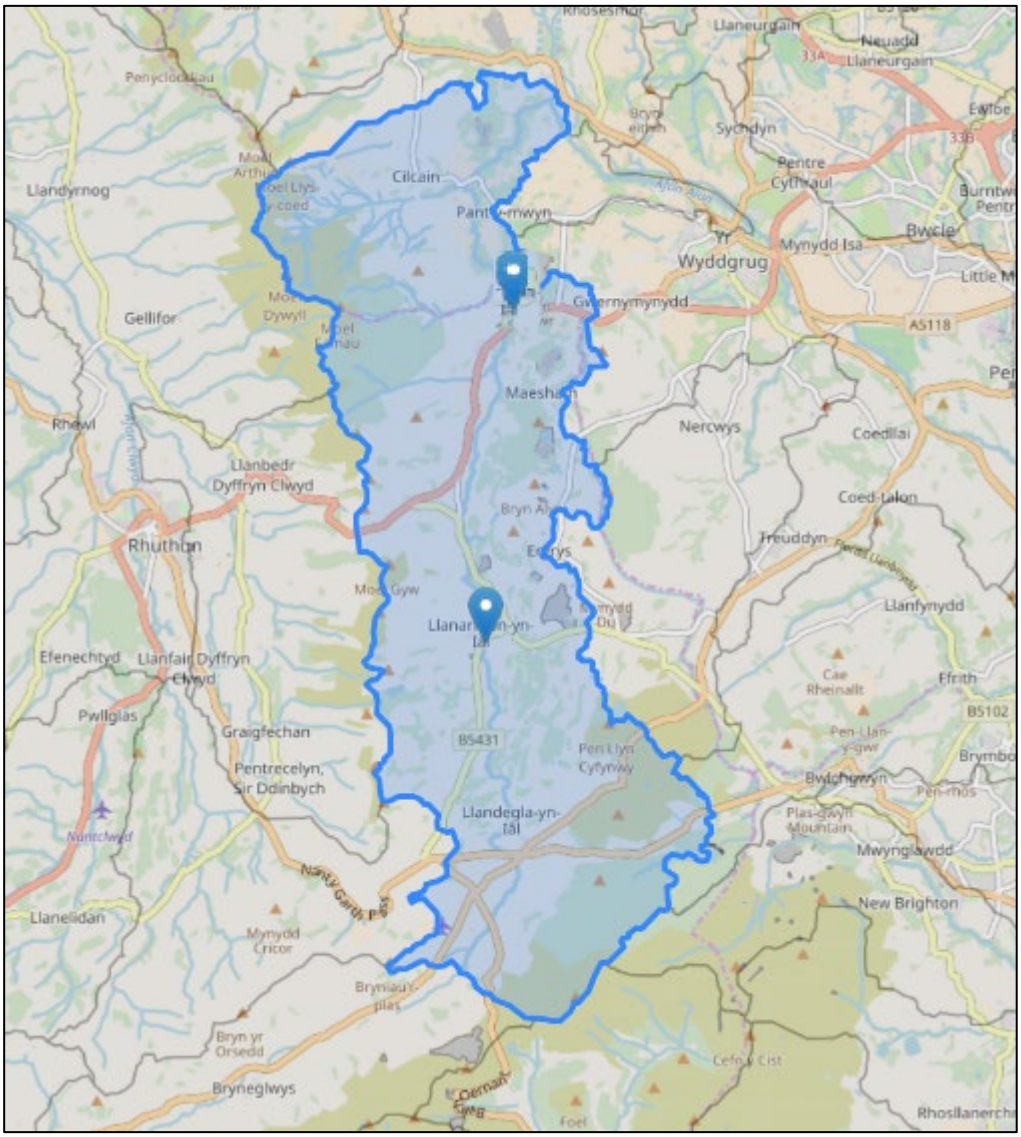

Figure 15: *River Catchment for the River Alyn – Upper River above Rhydymwyn*[3]

4.6.2 Drainage Systems

For the Property at Llanarmon Yn Ial, historically surface water highway drainage has caused issues, so much so that in 2007 DCC undertook work to install bespoke highway drains in front of the Property, as shown In photo 1.

Photo 1: *Bespoke highway drainage at Llanarmon Yn Ial flood investigation area*

4.7 Nantglyn

For the investigatory area of Nantglyn, one property was affected by the Afon Ystrad, which is Main River.

Historically, the Property suffered flooding from a surface water highway drainage system, but work was done in 2012 to a culvert inlet to alleviate this issue

4.7.1 Main River

Figure 16 below shows the catchment for the Ystrad, with a blue pin marking the location of the investigatory area.

Figure 16: *River Catchment for the River Ystrad*[3]

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1 https://datamap.gov.wales/layers/inspire-nrw:NRW_MAIN_RIVERS?lang=cy

2 https://corporate.dwrcymru.com/en/community/environment/combined-storm-overflows

3 https://datamap.gov.wales/maps/new?layer=geonode:nrw_wfd_cycle_3_classifications#/

4 https://riverlevels.uk/elwy-st-asaph-community-st-asaph

5.0 Information Gathering

5.1 Flood Risk

Historical flooding has occurred to most of the investigatory areas, notably Dyserth, Brookhouse, Rhyl & Prestatyn/ Meliden, Llys y Felin and Ashley Court. Hence, a long term flood risk exists

5.1.1 Long Term Flood risk for Denbighshire

Flooding from Main Rivers and Ordinary Watercourses

Historic flood data used in DCC's LFRMS shows that the majority of fluvial flood risk within Denbighshire is located along the Main Rivers of the River Clwyd, most notably in Ruthin; the River Elwy, at St Asaph; and the River Dee at Corwen. Historic data also shows the majority of fluvial flood risk is associated with numerous smaller, or Ordinary Watercourses, throughout the County. Figure 17 shows the extent of the main rivers and ordinary watercourses within DCC.

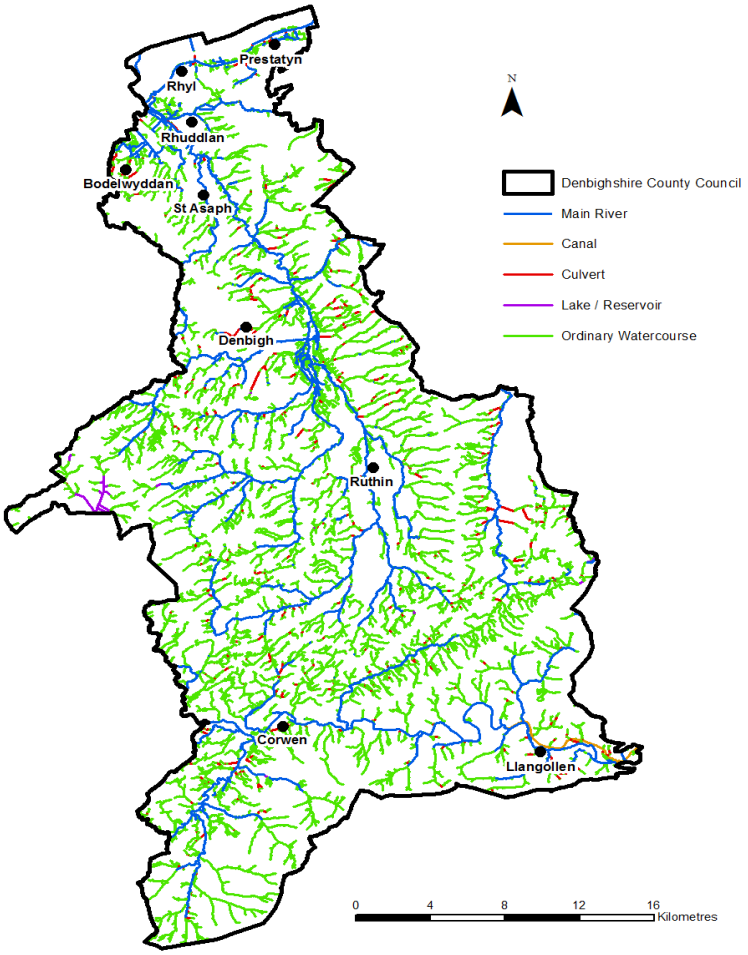

Figure 17: *Main Rivers and Ordinary Watrecourses within DCC*

Flooding from Surface Water

Surface water flooding, includes:

- Surface water runoff (also known as pluvial flooding), which can occur during an intense rainfall event; and
- Sewer flooding

There are certain locations, generally within urban areas, where the probability and consequence of pluvial and sewer flooding are more prominent due to the complex hydraulic interactions that exist in the urban environment. Urban watercourse connectivity, sewer capacity, and the location and condition of highway gullies all have a major role to play in surface water flood risk**.**

For DCC, it is estimated that 5,140 properties ae potentially risk from surface water flooding to a depth of 0.1 m and 1,579 properties were at risk from surface water flooding to a depth of 0.3 m⁴. Of these 1,579 properties, 89% were residential. This assessment was calculated in 2015 using NRW's second generation Flood Map for Surface Water (FMfSW). However, this data has now been replaced by NRW's New National Flood Hazard maps (2020), hence, the figures quoted could change. The Maps show flood depth, velocity (speed and direction), hazard and extent for High, Medium and Low risk scenarios without raised flood defences. They are based on the modelling of Surface Water Catchments

Flooding from the sewer network mainly occurs when flow entering the system, such as an urban storm water drainage system, exceeds its available discharge capacity, the system becomes blocked or it cannot discharge due to a high water level in the receiving watercourse. Pinch points and failures within the drainage network may also restrict flows. Water then begins to back up through the sewers and surcharge through manholes, potentially flooding highways and properties. It must be noted that once water enters a drainage infrastructure, it is the sole concern of the relevant drainage undertaker, such as DCWW.

5.1.2 Flood History

Historic flood events help to build a picture of where flooding occurs most frequently. Table 2 below shows a summary of past flooding events in Denbighshire over the last 20 years.

Year of Flood	Areas Effected	Type of Flood	Consequence
2021	18 communities were effected by Storm Christophe	Ordinary Watercourse/Main River/surface water	Approximately 70 properties were flooded. Areas effected relevant to this investigation are **Grange Road** in Rhyl, **Dyserth**, **Llys y Felin and Ashley Court** in St.Asaph, **Denbigh Green, Brookhouse, Llanarmon Yn Ial and Nantglyn**
2020	St.Asaph, Denbigh(Brookhouse), Llanynys, Llandrillo & Bodelwyddan	Ordinary Watercourse/Main River/surface water	35 residential homes and 6 businesses were flooded internally Areas effected relevant to this report include **Asley Court/Hoel Esgob, Llys Y Felin & Denbigh Brookhouse**
2017	Prestatyn, Rhyl, Rhuddlan & St.Asaph	Surface water	70 residential properties flooded incld **Ffordd Derwen and Walford Avenue in Rhyl.**
2016	Dyserth, Rhyl	Surface water	Strom Angus caused internal flooding to the **New Inn Pub**.
2012	St.Asaph, Rhuddlan & Ruthin	Main River	550 residential properties flooded across the County
2008	Prestatyn	Surface water	**Winchester Drive** & **Ffordd Pennwhylfa** were among flooded properties in Prestatyn
2007	Prestatyn	Surface water	13 residential properties flooded by surface water, including **Winchester Drive & Ffordd Penwhylfa**
2000	Corwen,Dyserth, St,Asaph,Llanbedr, Ruthin,	Ordinary Watercourse/Main River	62 residential properties flooded and 6 Businesses flooded

Table 2: *Historic Flooding within DCC*

Main River & Oridinary Watercourse Fluvial Flooding

The major floods in November 2012 were due in part to prolonged rainfall on already saturated ground in the Clwyd and Elwy catchments which led to both the Clwyd and Elwy Main Rivers overtopping.

2020 & 2021 brought Storm Ciara and Storm Christophe to the County, consequently causing widespread flooding from main river and ordinary watercourses, notably Dyserth, Brookhouse, Nantglyn and Llanarmon Yn Ial.

Surface Water Pluvial flooding

In recent years there have been two pluvial flood events which led to locally significant and harmful consequences from surface water flooding:

In 2016, 6 residential properties along Ffordd Derwen and 5 business units in Alitts Industrial Park, Rhyl were flooded due to blockages on local drainage networks.

In 2017, 6 residential properties along Ffordd Derwen and 5 properties along Garford Road, Rhyl were flooded following intense rainfall. The same event also led to 28 business properties flooding at various points on Prestatyn High Street.

2007/08 also saw intense rainfall cause internal flooding to properties at Winchester Drive and Ffordd Penwhylfa in Prestatyn.

Sewer Flooding

Records of historic flooding from sewers exist within DCWW's DG5 Register. This register was supplied for the 2018 Strategic Flood Consequence Assessment update and is displayed in figure 18 below. The register includes records for hydraulic failure dating back to 1992 and show that there are 490 incidents within Denbighshire between 1992 and 2017. The records entailing other causes begin in June 2003 with 441 incidents recorded across the County. Overall, Prestatyn has had the highest number of sewer flooding incidents with around 240 incidents recorded, followed by Rhyl with approximately 149 incidents recorded. Other communities with a significant number of incidents recorded include Denbigh with 87, St Asaph with 77, Llangollen with 66 and Ruthin with 57 incidents.

It must be noted that for the surface water flooding incidents within Denbighshire, some of these can be attributed to sewer flooding, be it from combined or surface water systems

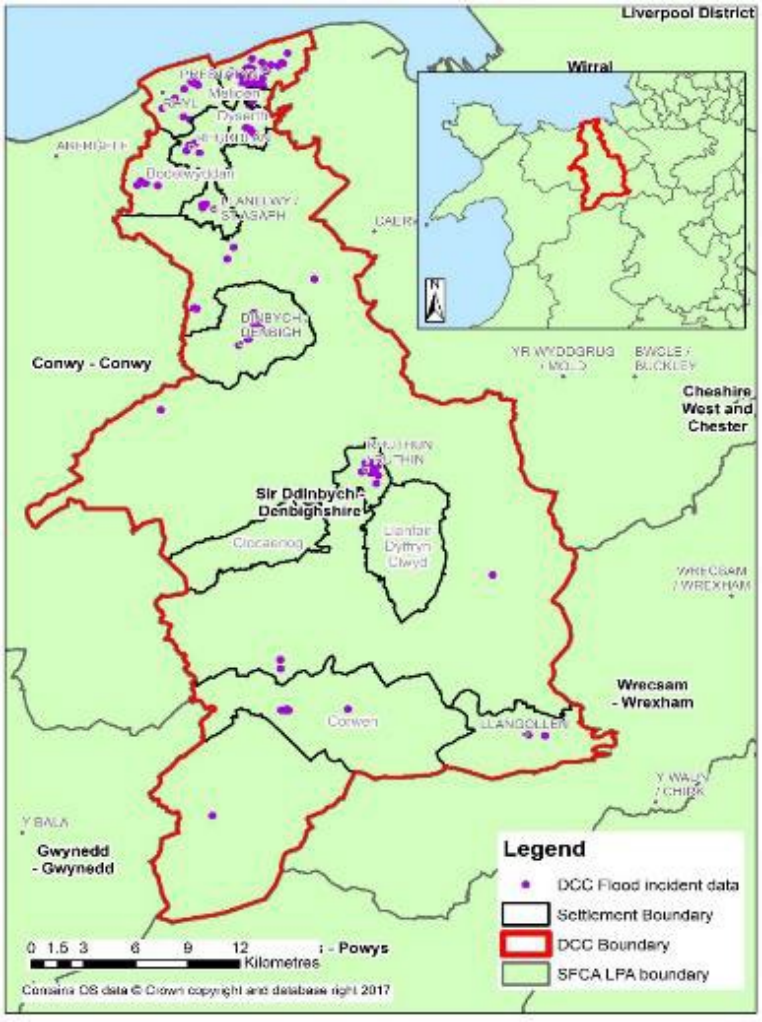

Figure 18: *DCWW's DG5 Register*

6.0 Hydrological analysis of the October 20th Event

Storm Babet brought heavy, persistent and widespread rain, which effected much of England, Wales and Northern Ireland from 18th to 20th October 2023, with 100mm falling fairly widely. This was the third-wettest independent 3-day period for England and Wales in a series from 1891 with 52.8mm of rain falling, 53% of the October whole-month 1991-2020 average, with the only wetter periods on record being 28 to 30 October 2000 and 23 to 25 September 2012[5]. The chart below (figure 19) shows the 10 wettest independent 3-day periods on record for England and Wales in the series

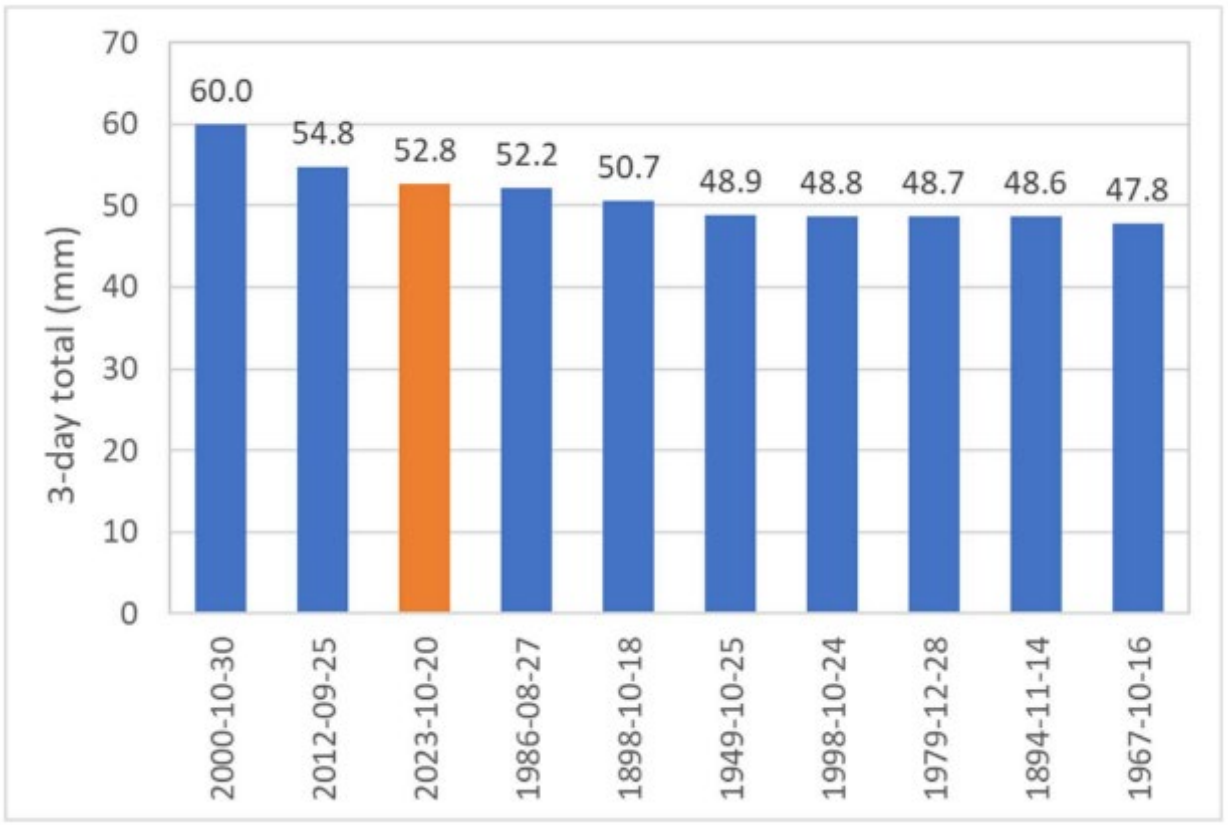

Figure 19: *10 wettest independent 3-day periods on record for England and Wales[5]*

Figure 20 below shows the accumulated daily rainfall for the 4-day period from the 18th to 21st October as actual totals in mm (left) and percentage of the October whole-month average (right). Large swathes of the UK received over 50mm of rain, with North Wales receiving 75 to 100mm, as shown in figure 21

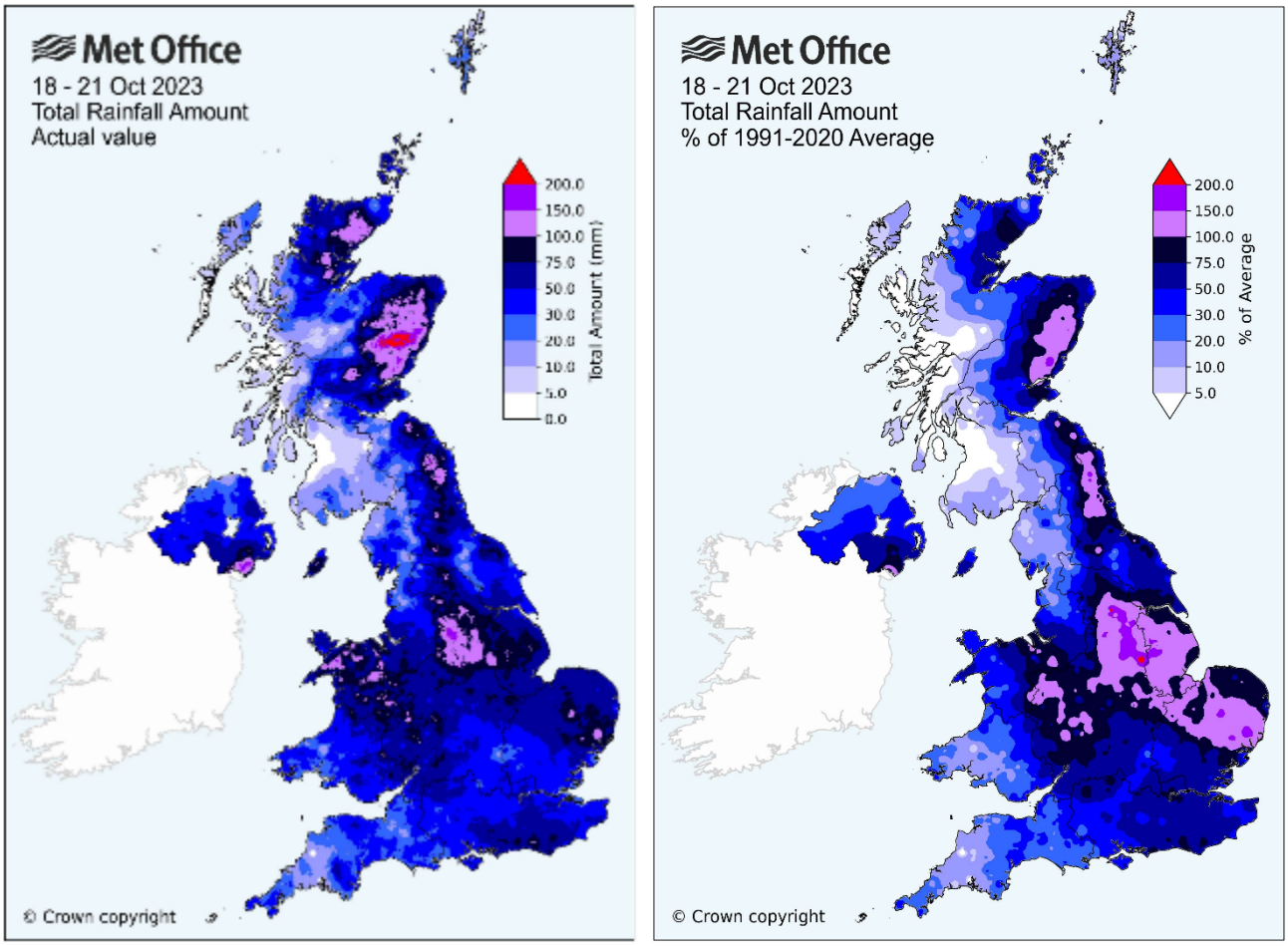

Figure 20 *18-21 Oct 2023 Total Rainfall Amount and Total Rainfall Amount as percentage of 1991-2020 Average*[5]

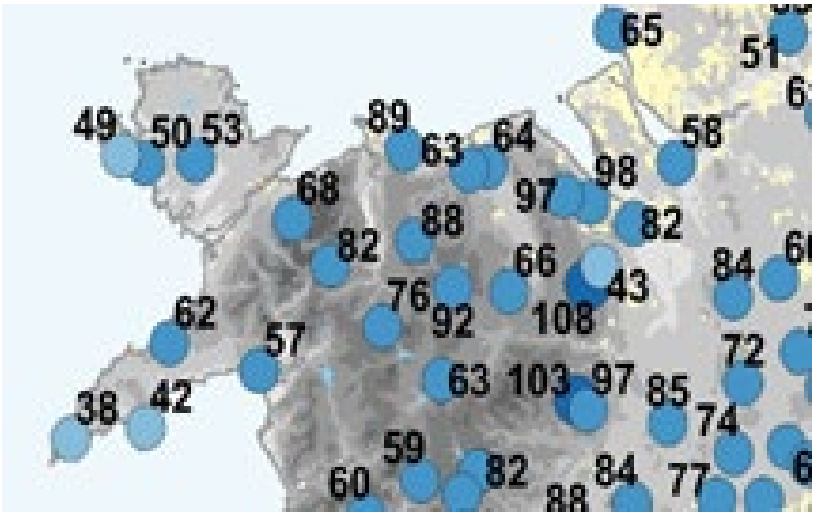

Figure 21: 4 day rain accumulation in mm from the 18th to 21st October for North Wales[5]

It is in this context that the flooding that affected communities in Denbighshire on 20th October must be viewed.

Furthermore, the rain came on top of very wet weather earlier in October. The maps within Figure 22 show daily rainfall totals for each day of October 2023 from 1st to 23rd. The rainfall from 18th to 21st October from storm Babet occurred a week after an area of low pressure brought another very wet period for England and Wales from 10th to 13th in which 40 or 50mm fell widely across Wales, the Midlands and East Anglia, with locally over 70mm

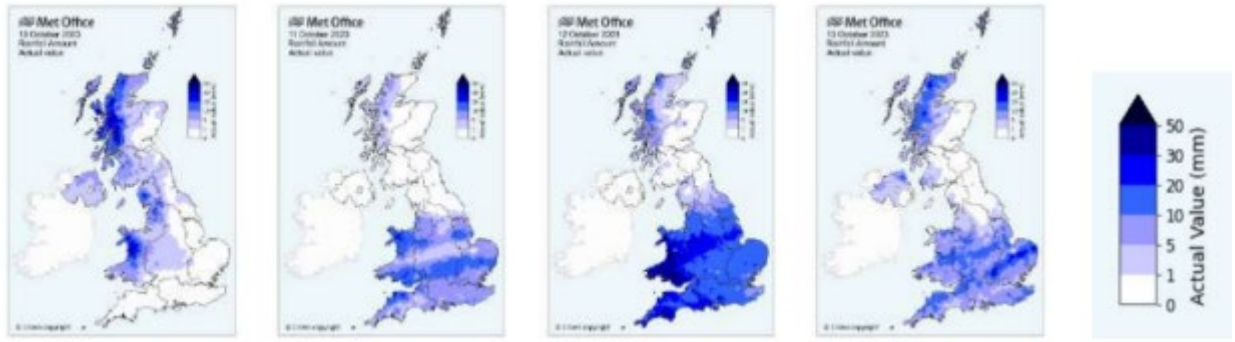

Figure 22: *Daily rainfall totals for October 10th to 13th 2023*[5]

Figure 23 below shows rainfall totals across Wales and central England for the first three weeks of October from 1st to 21st as anomalies relative to the 1991-2020 October long-term average.

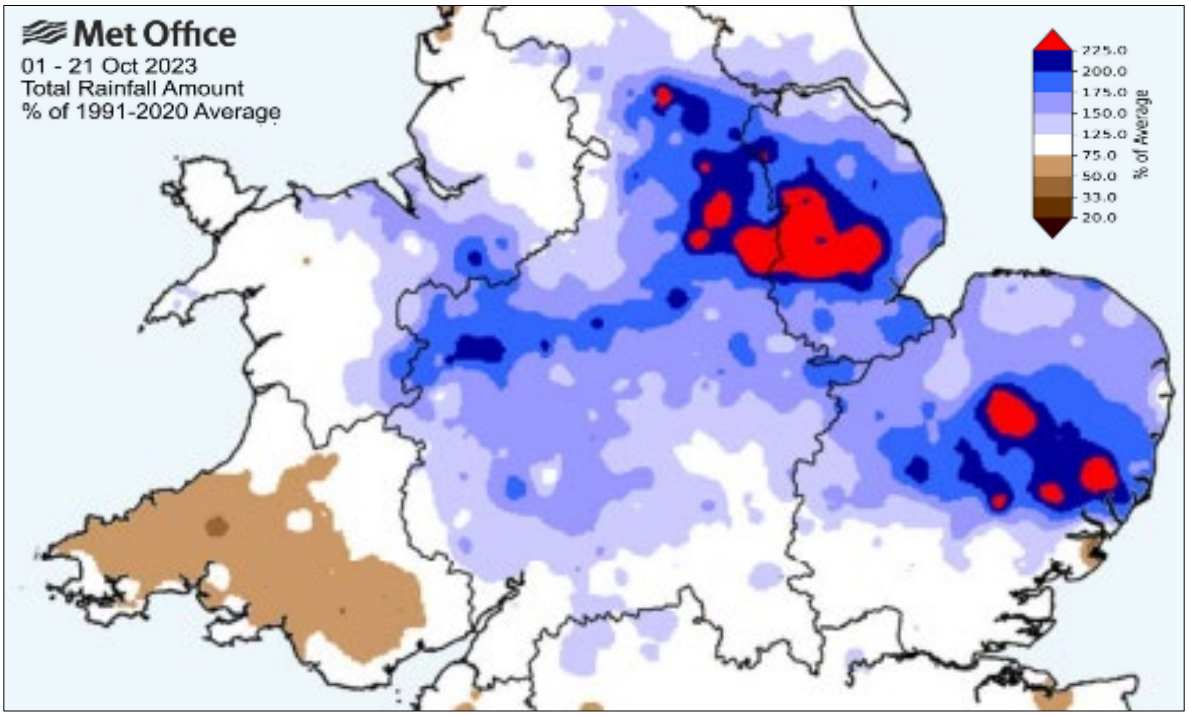

Figure 23: *01 – 21 Oct 2023 Total Rainfall Amount % of 1991-2020 Average*[5]

Specific to Denbighshire, figure 24 taken from NRWs St.Asaph rain gauge, shows approximately 130 mm of rain for October 2023 as opposed to the long term average total of approximately 75 mm. Figure 25 on the other hand, shows the cumulative actual up to the 20th October as being 138% higher than the monthly average.[6]

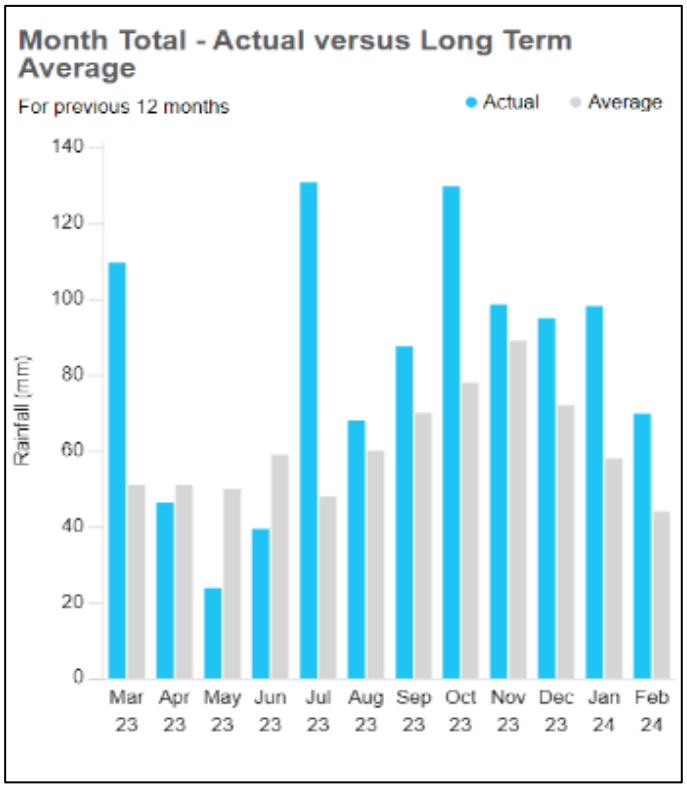

***Figure 24**: Monthly rainfall total for 2023 versus the long term average[6]*

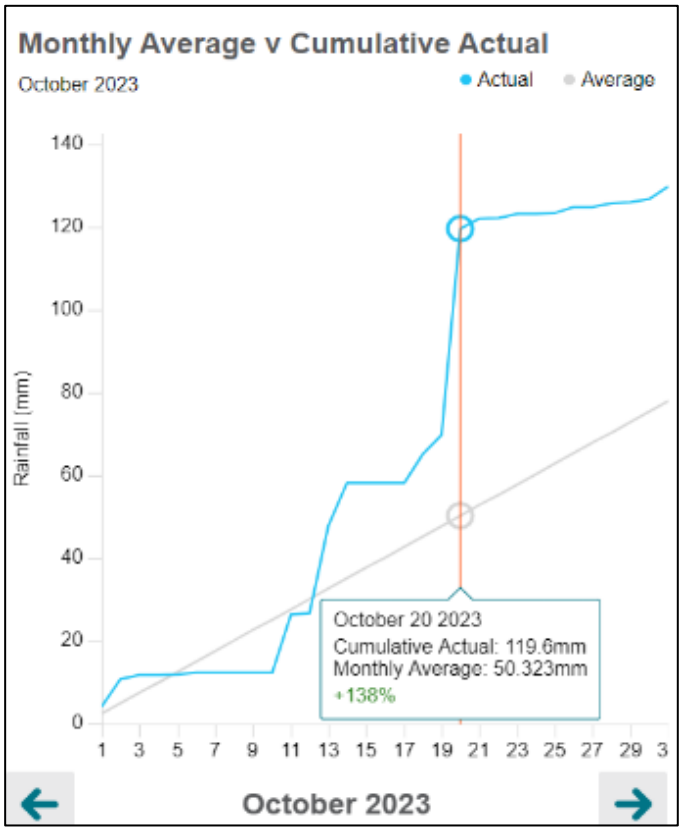

***Figure 25**: Cumulative Actual rainfall data up to the 20th October compared to the monthly average[6]*

The NRW rain gauge at Loggerheads had an accumulative actual rainfall up to the 20th October at 196.4mm, which was 267% above the average at 53.548mm[6]

In terms of a return period for Storm Babet, JBA Risk Management conducted Extreme Value Analysis on historic rainfall and streamflow data in order to estimate the return period of the Event.

A rainfall exceedance probability curve for Derby in the north Midlands and Mold in North Wales was produced from an observed 24-hour rainfall total of 41.4 mm in Derby, which suggests around a 1-in-40 year rainfall event and 39.6 mm of rainfall received in Mold, suggesting around a 1-in-30 year rainfall event.[7]

To put that into a more local context, the rainfall accumulation for St.Asaph over the 24 hour period for the 20th October accumulated to 49.8mm[6].

5.https://www.metoffice.gov.uk/binaries/content/assets/metofficegovuk/pdf/weather/learn-about/uk-past-events/interesting/2023/2023_08_storm_babet.pdf
6.https://rivers-and-seas.naturalresources.wales/Station/1005?parameterType=2
7.https://www.jbarisk.com/products-services/event-response/storm-babet-october-2023/

7.0 The Flood Event of the 20th October

The hydrological analysis in the previous section shows a period of prolonged, widespread heavy rain, which will inevitably result in significant flood impacts, as experienced by the locations in table 1 on the 20th October.

These locations are now discussed in more detail below, with three key questions considered, that is, why did the flooding happen? How likely it is for that scale of flooding to happen again? What improvement actions are needed to ensure flood risk in the County is appropriately managed in future?

For the second question, that is, how likely is it to happen again, this will be supported where possible by the NRW flood and coastal erosion risk maps for rivers, surface water and small watercourses, which has the following definitions:

- High risk is 1 in 30 or greater in a year;
- Medium risk is between 1 in 30 and 1 in 100 year; and
- Low risk is between 1 in 100 year and 1 in 1,000 year Annual Exceedance Probability (AEP).

7.1 Rhyl

7.1.1 Ffordd Derwen

Why did the flooding happen?

Property Number 53 Ffordd Derwen was flooded as a result of surface water build up making its way from the School playing field directly behind the Property and ingressing into living space in the form of a converted garage.

It was observed from the door knocking exercise that the back of the Property is a lot lower than School field, thus creating a pathway for the surface water to flow. Damage to the living space was minimal.

Although it did not cause internal property flooding, it needs to be mentioned that vehicles travelling through the flooded public highway at the front of the properties along Ffordd Derwen caused countless near misses due to wave effects of pushing the water off the highway (which leans on a gradient towards the properties), through into the properties' front gardens and drives. No property protection was present at all along Ffordd Derwen.

It is also important to note that during the Storm, DCC organised tankers to clear the watercourse adjacent to the front of the properties to alleviate potential flooding.

How likely it is for that scale of flooding to happen again?

Sections of Ffordd Derwen have been susceptible to flooding in the past, with a number of properties experiencing internal flooding in 2017. A DCC highway drainage improvement scheme was carried following this event

The low elevation of the properties along Ffordd Derwen compared to the surrounding area also makes them more susceptible to flooding, exacerbated further from the wave effects generated by vehicles using the road when it is in flood.

What improvement actions are needed to ensure flood risk in the County is appropriately managed in future?

- To Progress with the Welsh Government (WG) funded flood alleviation scheme at Ffordd Derwen, which is currently at the design stage.

- In the meantime, encourage property level protection (PLP) and consider applying to WG for flood barriers which will help control flood waters to the front of the Properties on Ffordd Derwen, in particular the wave effects caused by vehicles using the road, or, consider the option to close the road under emergency powers to prevent the potential flood effects caused by vehicles.

7.1.2 River Street

Why did the flooding happen?

Numbers 10 and 11 at the back of River Street were flooded internally by surface water as a result of a blocked drain (directly outside No.10), which takes rain water from the roof. Surface water therefore backed-up and ingressed into both properties via the front doors. It was observed during the initial door knocking that damage to one of the properties, No.10, was minimal and the tenant did not have to move out. No.11 could not be viewed as no one was at home at that time. It was also noted that there was an absence of property protection.

How likely it is for that scale of flooding to happen again?

Figure 26 from the NRW Flood and Coastal Erosion Risk Maps surface water and small watercourses flood map shows that the two properties have a low to medium risk of flooding from surface water and small watercourses.

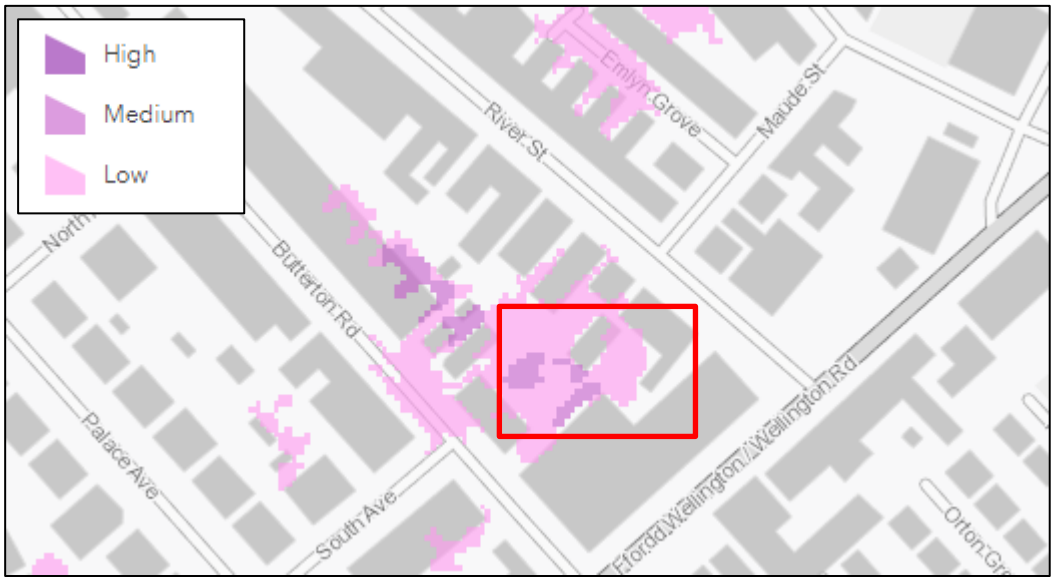

Figure 26: NRW Surface Flood and Coastal Risk Maps for surface water and small watercourses.

What improvement actions are needed to ensure flood risk in the County is appropriately managed in future?

- The two properties are rented. Therefore, encourage the owner to invest in PLP for the front doors.
- Also, point out to the owner that it maybe worthwhile carrying out a CCtv drain survey to check for blockages to the roof water drain.

7.1.3 Maes Y Gog/Llys Gwennol/Lon Eglyn

Why did the flooding happen?

The main source of flooding for Maes Y Gog/Llys Gwennol came from the Maes Gwilym Drain, which as stated in section 4 is a Main River and is therefore maintained by NRW. Lon Eglyn on the other hand, not only suffered flooding to the rear of the properties as a result of the Drain over-topping, but also from the front due to possible hydraulic overload from DCWW combined systems, as reported by some of the effected residents of Lon Eglyn.

It is important to note that NRW manage the Drain, hence they carried out their post Storm visit to investigate the cause and extent of the flooding. Therefore, given that they are the key stakeholder here, this report also utilises their post storm flood findings.

For Maes Y Gog, the majority of flooding was classed as external, with the Maes Gwilym Drain over-topping and sending flood waters into the back of Nos 37 to 81. The flood water then made its way to the front of the properties whereby it was reported that several

members of the public were pumping and brushing the water from around their properties onto the road.

This action by some of the residents at Maes y Gog inevitably sent water down towards Llys Gwennol and merged with flood waters from the Maes Gwilym Drain, which according to residents had entered Llys Gwennol from the back of Nos 2 and 3, as shown in Photo 2 below, which has been supplied by NRW

Photo 2 showing the direction water came from the Maes Gwilym Drain into Llys Gwennol.

Nos 2 & 3 suffered no internal flooding, but unfortunately this flow, coupled with the brushed/pumped water from Maes Y Gog, caused internal flooding to Nos 7, 8, 9, 11,12, 13 at Llys y Gwennol and 83 Maes Y Gog, as shown in figure 27

From NRW's on site investigation, it was evident that the watercourse had come out of channel where there were two sharp almost 90 degree changes in direction of the channel. Figure 27 shows the location of these bends along with the flood flow direction. Water in the Maes Gwilym Drain is at maximum vclocity at these two bends and overtopping occurs.

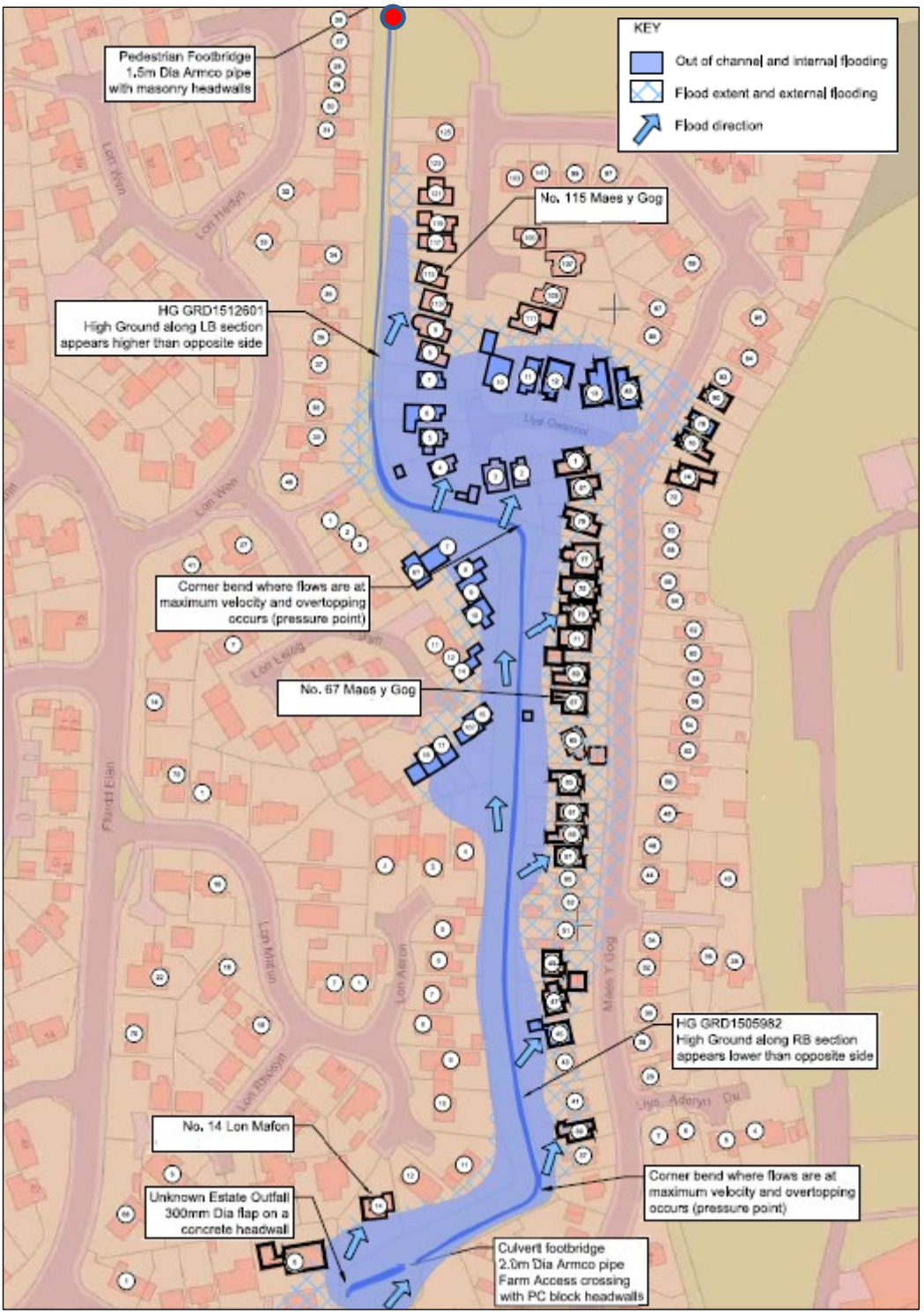

Figure 27: *Flood source map from the Maes Gwilym Drain, courtesy of NRW*

From the above Figure (27), the first bend is located behind No 39 Maes Y Gog and No 14 Lon Mafon. Here the water overtops and enters the back of properties at Maes Y Gog. Water also overtopped the left bank as witnessed by the resident of No 14 Lon Mafon who stated that the small culvert footbridge marked in the figure also restricted flows further and caused overtopping into the resident's back garden. The second bend is directly behind Nos 2 & 3 Llys Gwennol which would explain the anecdotal evidence from

residents at Llys y Gwennol that water came into the Estate from behind these two properties.

No other blockages were observed in the watercourse itself, although it might be that the footbridge culvert further down-stream of Llys y Gwennol (see red circle in figure 27 for location) may have restricted flows further, but there was no evidence of over-topping here. According to a resident of Maes Y Gog, there is also a possibility that the upstream culvert at the railway crossing and Lyons Holiday Park caused water to back-up to the Maes Gwilym Drain as both were aledgedly blocked with debris on the day of the flooding, Photo 3 and 4 show both culverts respectively, but were not taken on the day of the flooding.

Photo 3: Lyons Culvert

Photo 4: Railway Culvert

Referring back to figure 27, Lon Eglyn was also hit by the flood waters from the Drain, with up to 10 properties on the Estate experiencing internal flooding by the Drain, which ingressed in from the back gardens. It's worth pointing out that the ground is a lot higher on the left bank side of the channel compared to the Maes Y Gog side so the extent may have been on a slightly lesser scale.

During the door knocking exercise by DCC, some affected residents at Lon Eglyn reported surface water flooding from the front.

DCWW is responsible for the sewerage infrastructure serving Maes Y Gog/Llys Gwennol/Lon Eglyn, with figure 28 showing the sewerage network for this area as being combined, which drains to the main Rhyl Coast Road Pumping Station (see figure 4 for

location). This pumping station also has a storm overflow facility that discharges to the Rhyl Cut during storm conditions.

Some of the surface water for Lon Eglyn/Llys Y Gwennol/Maes Y Gog is collected and discharged into the local watercourse system.

The drains in the vicinity of the flooding at these locations may have surcharged during the event while the pumping station caught up, primarily due to the volume of flooding from other sources. DCWW deem this type of flooding to be coincidental where, flooding has occurred but the public sewer system is not at fault and has been inundated by an external source of water, in this case from the local watercourse system.

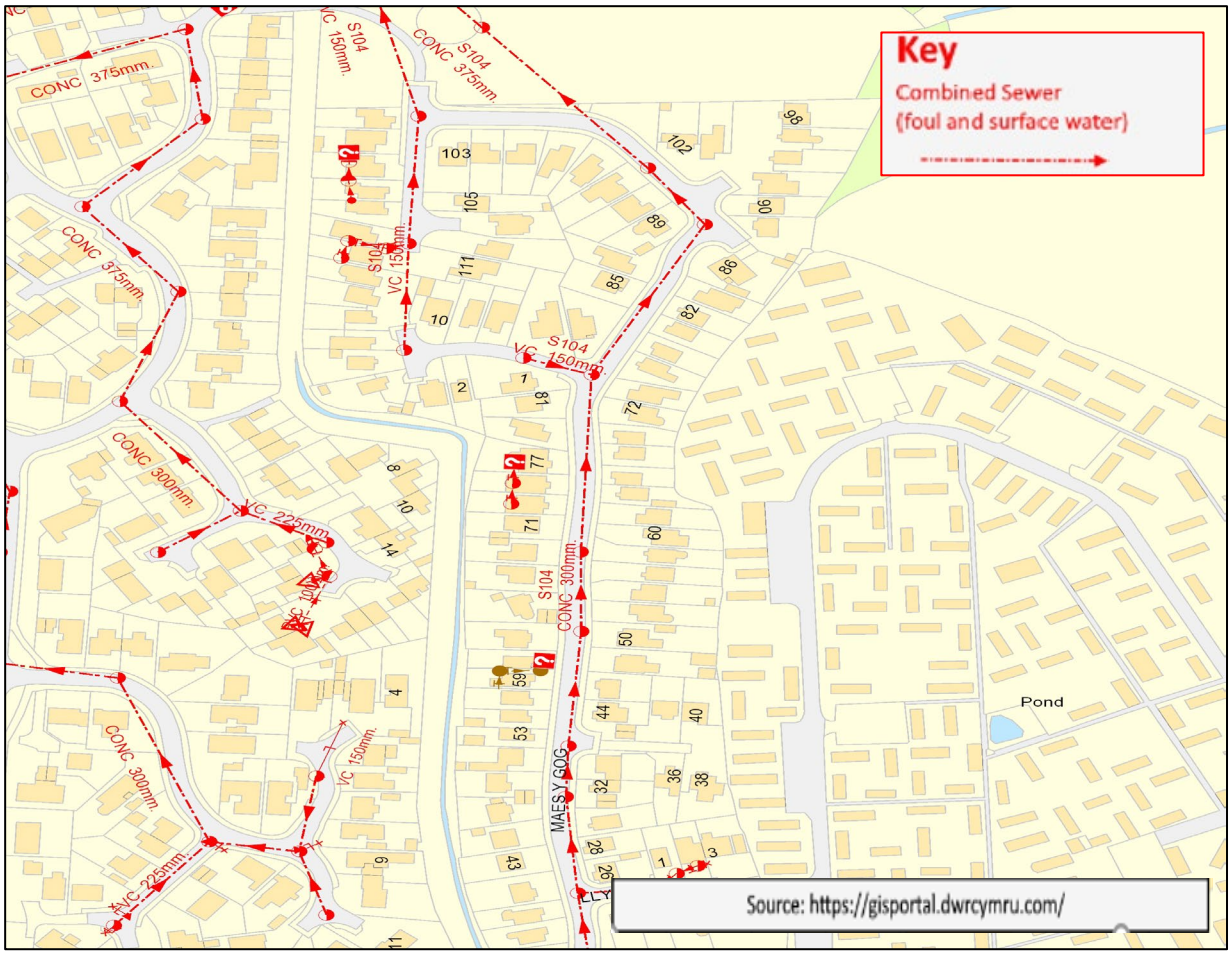

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Figure 28 : *DCWW apparatus at Maes y Gog/Llys Gwennol & Lon Eglyn*

How likely it is for that scale of flooding to happen again?

In terms of the likelihood of this type of flooding happening again, the NRW Flood and Coastal Erosion Risk Maps for Rivers shows in figure 29 parts of Llys Y Gwennol having a medium to high risk of being flooded by the Maes Gwilym Drain.

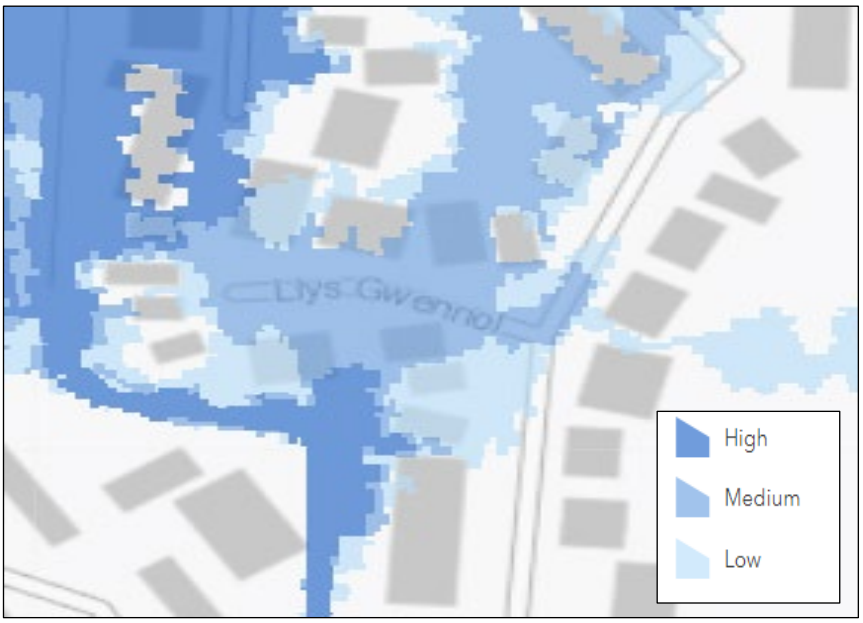


Figure 29: *The NRW Flood and Coastal Erosion Risk Maps for Rivers showing Llys y Gwennol*

For Lon Eglyn, figure 30 shows that the Risk Maps for rivers and surface water flooding does not currently have the effected houses as being at risk of flooding from these two flood sources. Hence, it is difficult to say how likely the scale of flooding from Storm Babet will happen again, but there is a potential contributing factor to flood risk through surface water, most notably the on-going housing development upstream of Maes Y Gog, which was granted planning permission prior to the statutory implementation of sustainable drainage (SuDS) for all new devlopements over 100 square metres.

Figure 30**:** *The NRW Flood and Coastal Erosion Risk Maps for Rivers and surface water showing Lon Eglyn*

What improvement actions are needed to ensure flood risk in the County is appropriately managed in future?

- Include Maes Y Gog, Llys Gwennol & Lon Eglyn in a WG funded scheme, which looks at ways to reduce and manage urban water catchments
- The low spots on the right bank wall of the Maes Gwilym Drain need to be addressed by NRW.
- Consider the merits of installing flood sensors at various points along the Maes Gwilym Drain to monitor river levels, although for this to have a benefit it would need to be managed by a Local Flood Action Group
- Encourage and assist with a potential Local flood Action Group.
- Carry out further engagement with relevant stakeholders to see what improvements can be made, for example, NRW will ensure that the Maes Gwilym Drain will still get the one annual weed cut although this will be brought this forward in the programme so that it is now in line with the section alongside the railway and into Rhyl Cut East. This change means that it will now get cut in September instead of November, which will be monitored as part of NRW's asset inspection and if a second cut is needed in early Winter, NRW will carry out the necessary work.
- NRW to carry out modelling work at Lon Eglyn at Maes y Gog to show the increased flood extent areas folloing Storm Babet.
- Look at funding avenues with Welsh Governemnt to investigate the potential for retrospective SuDS at the Aberkinsey devlopement, as well as nature based flood management solutions. It could lead to partnership working with the other relevant stakeholders such as DCWW and NRW

7.1.4 Walford Avenue – Plas Cyril/Inferno Dance Studio

Why did the flooding happen?

The DCC owned sheltered housing complex know as Plas Cyril suffered internal flooding to 5 ground floor flats. The Inferno Dance Studio also experienced internal flooding

From investigations carried out by the Council and Natural Resources Wales at these two locations, it was determined that for Plas Cyril, all 5 ground floor flats were flooded internally by surface water alone, predominately flowing off Walford Avenue. The surface water flow pooled outside the homes in the lowered gardens and entered the properties

via the front doors. The gardens in front of the properties are lower than the threshold of the properties.

Upon further investigation of the drainage here, no surface water connections were identified as connecting directly to the Rhyl Cut, which had high levels at the time of the flood. The entire area around Plas Cyril is in fact drained by the combined sewer network which was overwhelmed during the Storm Event.

The surface water which effected Plas Cyril also flowed towards the Dance studio with water entering from the rear and rapidly spreading throughout the ground floor area. The Owner of the Dance Studio told NRW during their post storm data gathering that flooding had been anticipated due to similar events in the past. All dance items were therefore boxed and moved upstairs where possible. Flooding continued throughout the day and only receded on the Saturday. Skips were organised to remove carpets and flooring materials

The sewage and drainage pipes had also reached capacity and raw sewage was present in a yard to the side of the Studio. Apparently DCWW had been in to jet and empty pipes and chambers within the vicinity and were due back at some point to continue cleaning the yard area located alongside the Dance Studio.

Figure 31 shows the flow route and flooding extent for the Plas Cyril and the Dance studio.

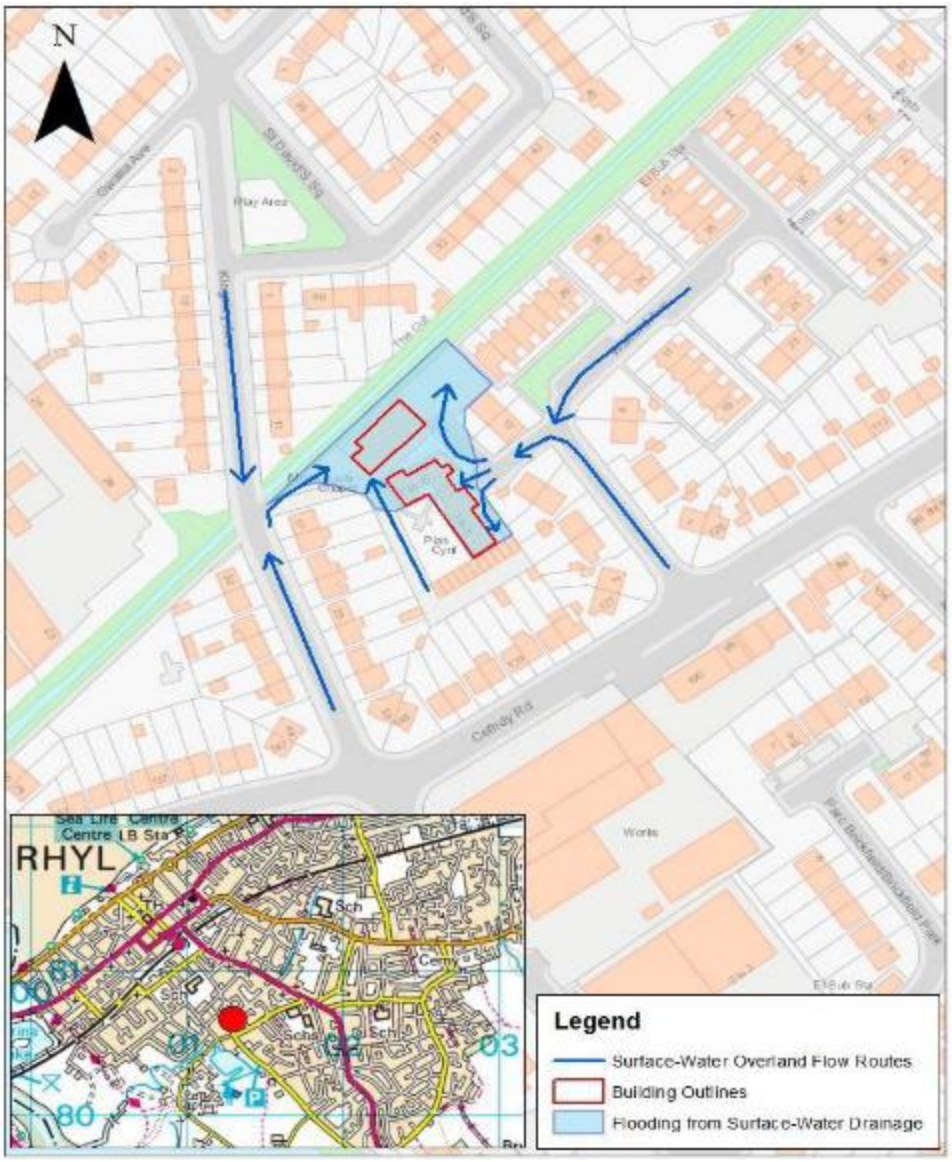


***Figure 31**: Flood outline and direction for Plas Cyril and the Dance Studio*

How likely it is for that scale of flooding to happen again?

For Plas Cyril and the Dance Studio, the chances of surface water flooding occurring again is at low to medium risk as shown in figure 32 below, which was taken from NRW's Flood and Coastal Risk Maps.

Both properties were flooded in 2017, with the Dance Studio in particular suffering further flooding in the past from the Rhyl Cut. Indeed, figure 33, from the Flood and Coastal Risk Maps for Rivers puts both properties at medium to high risk of flooding from rivers, that is, the Rhyl Cut.

Figure 32: *Surface Water Flood Map at Plas Cyril and the Dance Studio*

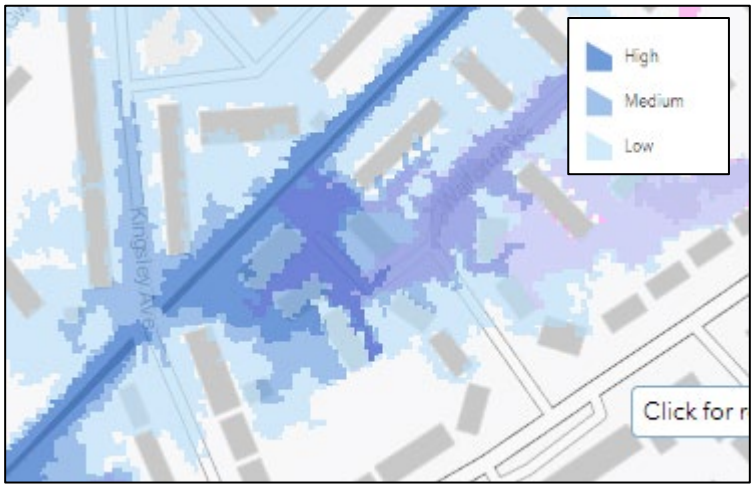


Figure 33: *NRW Flood and Coastal Risk Maps for Rivers at Plas Cyril and the Dance Studio*

What improvement actions are needed to ensure flood risk in the County is appropriately managed in future?

- Encourage the use of PLP for Plas Cyril and work with DCC Housing in the short term in relation to this.

- Work with relevant stakeholders to understand better the flood risk to the Dance Studio in terms of the maintenance of the Rhyl Cut and capacity issues of the sewer systems.

7.1.5 Locations in Rhyl that experienced near misses

Although these are classed as near misses, it is important to mention such loactions within this Report, especially given the impact on residents and DCC in trems of dealing with flooding issues.

In particular, the East of Rhyl experienced extreme highway flooding with countless near misses to dwellings at Lon Wen, Llys Y Twysog, Walnut Crescent, Fern Close, Aspen Walk, Sholing Drive, Eastville Avenue, Oakville Avenue, Edgbaston Road and Brynheddyd.Road, to name but a few. There were also some reports of sewage within the surface water, especailly at Edgbaston Road.

The Marine Caravan Park in the West of Rhyl also suffered serious flooding, with residents having to be evacuated. NRW are working with Marine Camp Holiday Park and undertaking CCTV works at Culvert Location. Work starts shortly.

A primary school also had to close after rain caused its toilets to "over flow".

A property on Grange Road suffered from water ingress under the floorboards, which also caused the electric to go off. This is a historic issue with the back garden of that Property experiencing flooding in the past from the playing field at Rhyl High School. Drianage work has been carried out by DCC, hence, further investigation is required as to why Storm Babet resulted in a reoccurance of the flooding.

7.2 Prestatyn/Meliden

7.2.1 Winchester Drive

Why did the flooding happen?

Based on the door knocking data gathering by DCC, Property Numbers 1 and 3 on Winchester Drive experienced internal flooding as a result of a hydraulic overload of the DCWW drainage systems.

Residents of Property number 1 were visited to discuss the flooding, which had caused severe internal damage to the Property. Photos 5 and 6 below show the extent of the flood at this Property.

Photo 5 – Flooding at No 1 Winchester Drive

Photo 6 – Flooding at No 1 Winchester Drive

At the time of the data collection, we were unable to speak to the owner of number 3, but the residents of No 1 confirmed that they had suffered the same fate.

NRW data collection at Winchester Drive also confirmed internal flooding to No 5, which stated that water entered the property from the rear and suggested that the source was the Prestatyn Gutter. Further flooding occurred via the property airbricks, with possible surface water flooding via the front door.

Welsh Water are responsible for the sewerage infrastructure at Winchester Drive. Figure 34 shows the the network at this location to area be combined, which drains to the main Marine Park Pumping Station (see figure 5 for the location). This pumping station also has a storm overflow facility that discharges to the Prestatyn Cut during storm conditions.

Some of the surface water for this area is collected and discharged into the Prestatyn Cut system. Local resident reports suggest the Gutter was high on the day of the Storm, hence surface water would have struggled to drain

The drains in the vicinity of the flooding may have surcharged during the event while our pumping station caught up, primarily due to the volume of flooding from other sources. We deem this type of flooding to be coincidental where, flooding has occurred but the public sewer system is not at fault and has been inundated by an external source of water, in this case from the local watercourse system both in the close proximity of the properties

but also the wider catchment area.

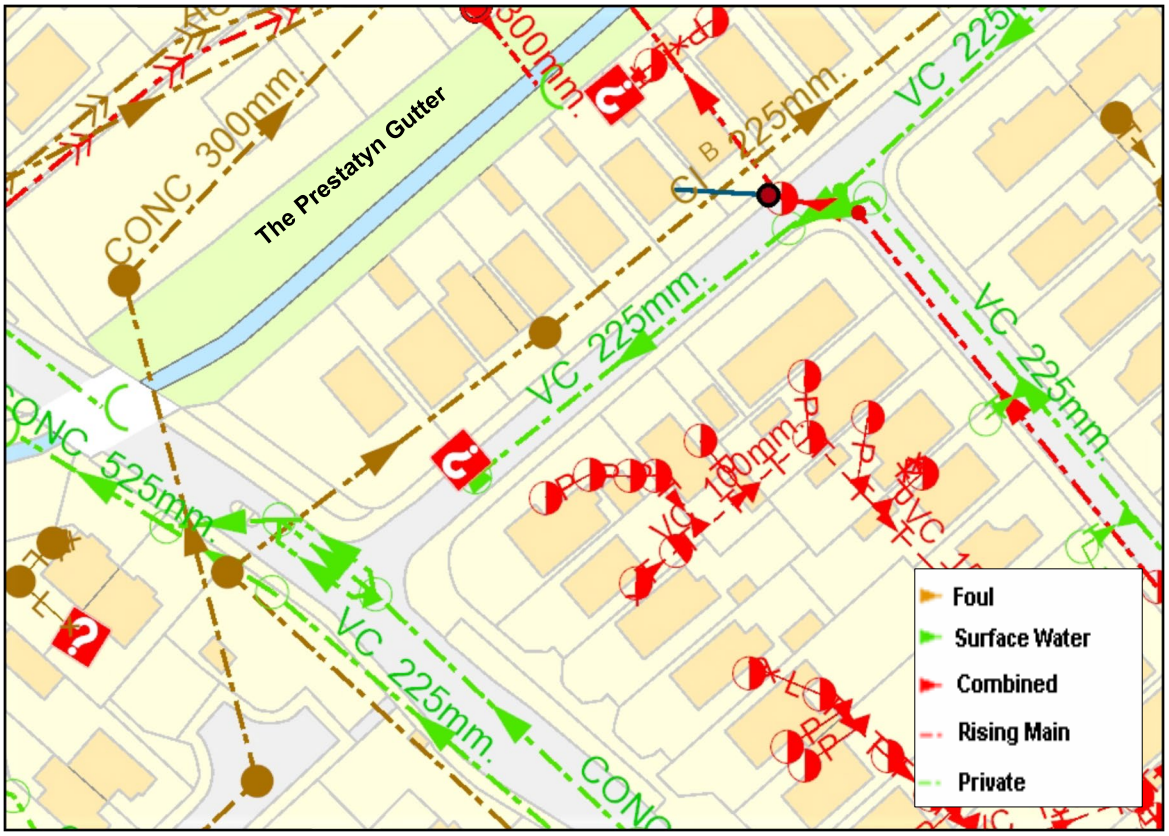


Figure 34: DCWW drainage apparatus map for Winchester Drive

How likely it is for that scale of flooding to happen again?

Historically sewer flooding has occurred at this location on Winchester Drive on a number of occasions, notably 2007 & 2008, with near misses as recently as 2017.

Figure 35 below taken from the NRW Flood and Coastal Erosion Risk Maps, shows Winchester Drive from numbers 1 to 17 having a high risk of being flooded from the Main River, that is the Prestatyn Gutter.

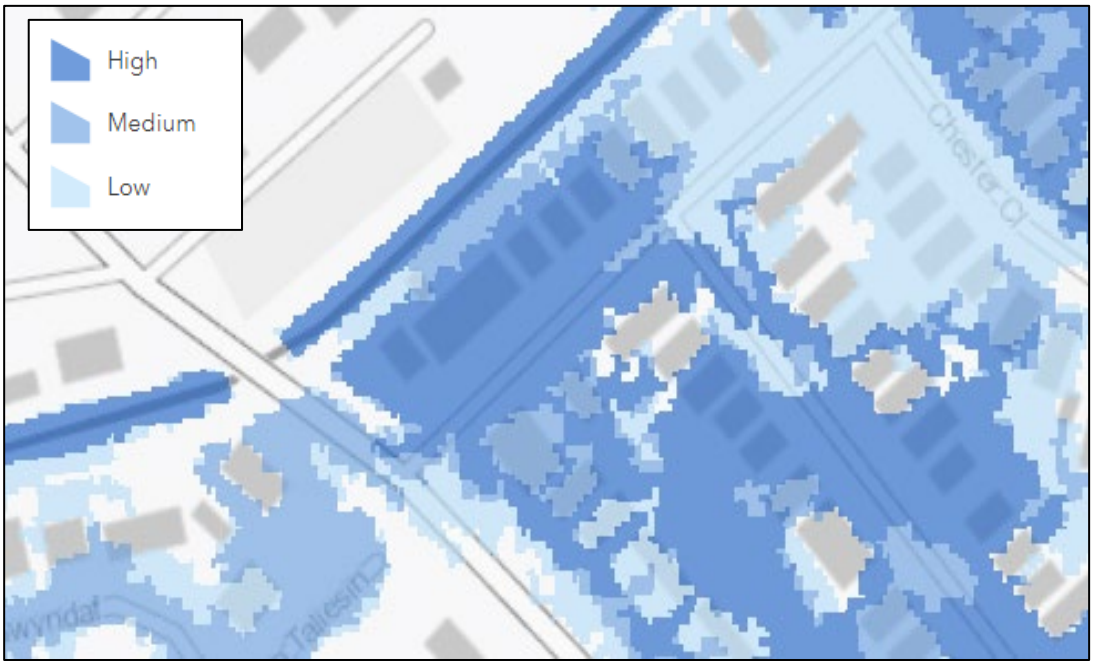


***Figure 35**: NRW Flood and Coastal Erosion Risk Maps for Rivers at Winchester Drive*

On the other hand, for surface water, the NRW Risk Maps in figure 36 show a low to medium risk of surface water flooding occurring for properties 1 to 7 on Winchester Drive.

***Figure 36:** : NRW Flood and Coastal erosion Risk Maps for Surface Water at Winchester Drive*

What improvement actions are needed to ensure flood risk in the County is appropriately managed in future?

- To engage with all relevant stake-holders to understand how the drainage systems work and what can be done to improve the flood risk issue

- Affected properties should also consider PLP.

7.2.2 Ffordd Penwhylfa

Why did the flooding happen?

All the ground floor flats from No 88 to No 102 experienced internal flooding on the 20th October as a result of Storm Babet**.**

Highway gullies feed into the DCWW surface water system which discharges into the Prestatyn Gutter. It's Likely that due to high levels in the Gutter, water was unable to discharge effectively, hence water backed up and flooded the highway, which then made its way to the ground floor flats as shown by the blue arrows in figure 37 below.

Figure 37: **Flow direction of flood waters at Ffordd Penwhylfa**

Gravity made the situation worse since as photo 7 below shows, the flats are a lot lower than the adjacent road

Photo 7: *Photo showing the drop in gradient in front of the flooded ground floor flats at Ffordd Penwhylfa*

How likely it is for that scale of flooding to happen again?

Figure 38 from The NRW flood risk maps shows a low risk of surface water flooding for Ffordd Penwhylfa, although historically some these ground floor flats flooded in 2007 and 2008.

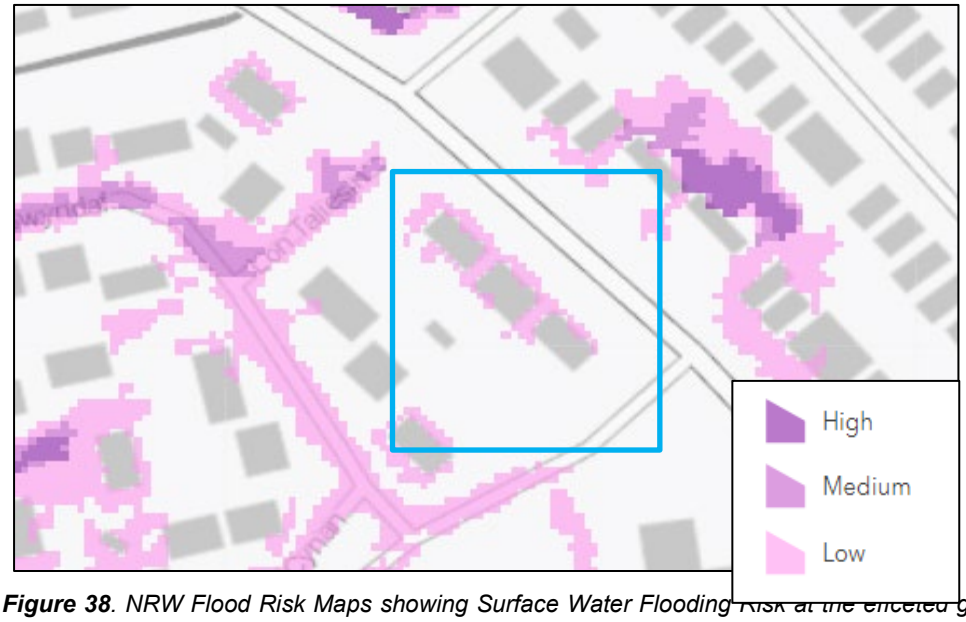


Figure 38*. NRW Flood Risk Maps showing Surface Water Flooding Risk at the elected ground floor flats on Ffordd Penwhylfa*

What improvement actions are needed to ensure flood risk in the County is appropriately managed in future?

- To engage with all relevant stake-holders to understand how the drainage systems work and what can be done to improve the flood risk issue
- DCC strongly recommend residents investigate PLP

7.2.3 Meliden – Pwll y Bont

Why did the flooding happen?

Pwll y Bont is a street in the town of Meliden, Denbighshire. The Flood investigation area comprises a mixture of residential properties and greenfield land.

The Prestatyn Gutter flows north-east through the northern extent of the site and is culverted under Ffordd Penrhwylfa directly north-east of the site. The Gutter is also culverted beneath several property driveways leading off Pwll y Bont.

A total of five properties were flooded as a result of Storm Babet, with anecdotal evidence suggesting that the flood water came from upland area behind Pwll y Bont and flowed overland towards the Gutter, flooding 3 properties along the way, before entering the Gutter, which then over-top and flooded two further properties.

Figure 39 below shows the ground elevations for the investigation area, which confirms the higher ground behind.

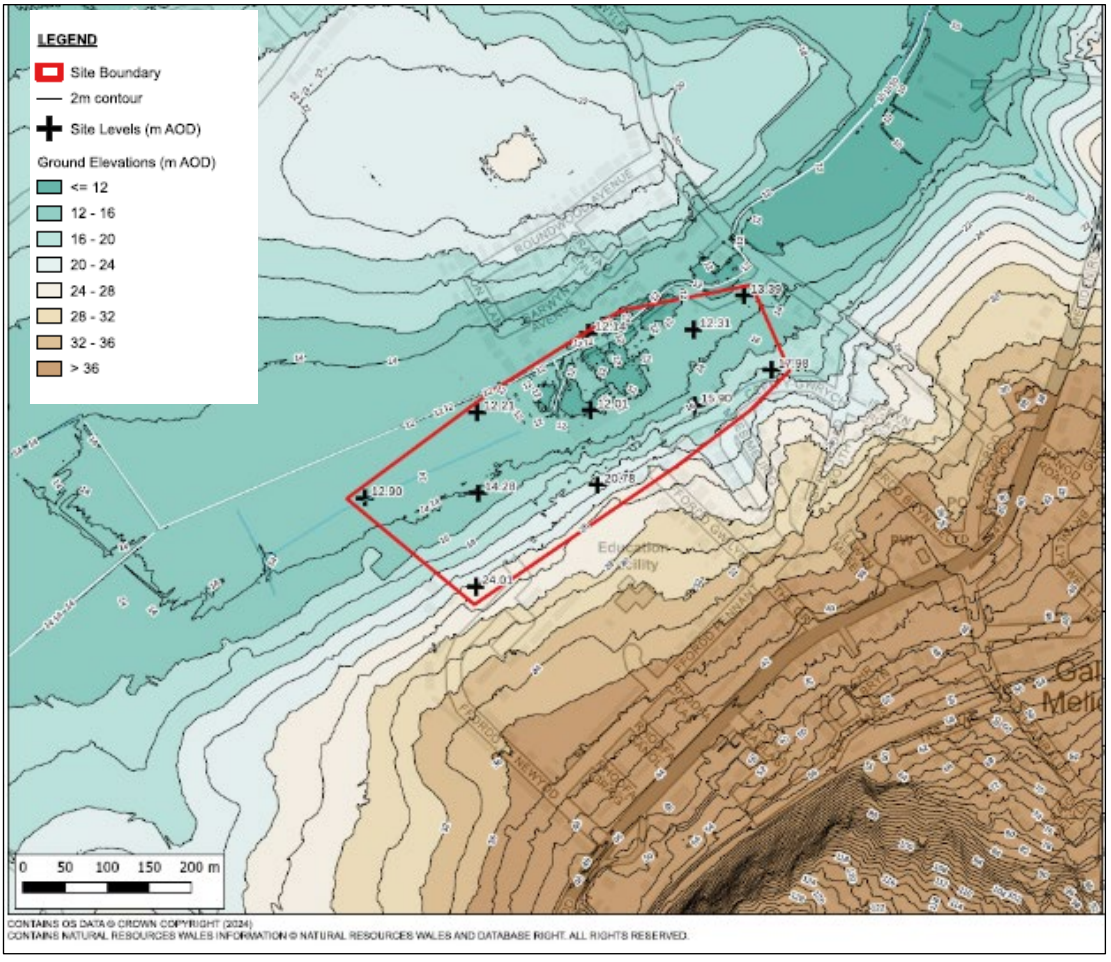


Figure 39: *Ground elevations in relation to the flood investigation area at Pwll y Bont*

Hence, it is likely that surface water inflow upstream of the site from ditches (minor watercourses) and runoff from the upland area flowing towards Prestatyn Gutter caused and contributed to the internal flooding of 5 properties at Pwll y Bont.

How likely it is for that scale of flooding to happen again?

3 properties were flooded at Pwll Y Bont as a result of Storm Christophe 2021. Residents commented at post Christophe that the Prestatyn Gutter was blocked, causing a restriction to flow. The depth of water outside “The Mallows” flooded to a depth of almost 2 foot and remained in place for about three hours.

Figure 40 below shows the Fluvial flood extent at Pwll Y Bont taken from the NRW Flood Risk Maps for Rivers.

***Figure 40**: NRW Flood Risk from Rivers at the Pwll y Bont Investigation area*

Approximately 9 properties along Pwll y Bont are within the fluvial flood extent

With regard to the flood risk extent from surface water at Pwll Y Bont, there is a low to medium risk of such flooding occurring for 4 of the properties within the investigation area, as shown in figure 41 below.

***Figure 41**: Flood risk from surface water at Pwll Y Bont, taken from the NRW flood risk Maps*

Furthermore, a Flood Risk and Drainage Review at Mindale Farm, which is south-west of the investigation site at Pwll y Bont was undertaken by flood consultants in 2017. The report detailed that the Farm received surface water from the upstream urban drainage catchment. The report also mentions previous issues surrounding groundwater flooding.

Anecdotal evidence provided by residents also suggest that flooding incidents have become more frequent since new developments along Meliden Road and at Llwyn Mesen have taken place,

What improvement actions are needed to ensure flood risk in the County is appropriately managed in future?

- Further investigation is required to ascertain how the surface water drainage connections from the new housing developments nearby were made to the Prestatyn Gutter and if they are contributing to the flooding at Pwll y Bont.

- To include Pwll y Bont In the WG funded scheme, which looks at ways to reduce and manage urban water catchments for Prestatyn/Meliden

7.3 Dyserth

7.3.1 The section of Waterfall Road running parallel with the Afon Ffyddion

Why did the flooding happen?

The upstream catchment (see section 4.2.1) for the Afon Ffyddion during storm events such as Babet brings a high volume of water to the lower reaches of the Watercourse where it passes through the Village of Dyserth. Given this volume, the main cause of

flooding is lack of capacity within the channel to cope, as well as crossings/culverts along this section restricting flows further. Therefore, on the 20th October, this scenario played out, which caused the Afon Ffyddion to over-top onto Waterfall Road and consequently cause internal flooding to 3 properties and 1 business.

Photo 8 below shows the extent of the flooding on Waterfall Road, which also shows one of the crossing points causing restriction issue within the Channel.

***Photo 8**: Flooding from the Afon Ffyddion onto Waterfall Road*

How likely it is for that scale of flooding to happen again?

There is a long history of flooding at Dyserth. Old photographs reveal that significant flooding has occurred during most decades since the 1930's. The most recent major flood event occurred in 2000, when more than 30 properties were affected, although there have been several incidents since, most recently in 2021 following Strom Christophe.

Figure 42 below from the NRW Flood Risk Maps for Rivers shows the investigation area to have a high risk of fluvial flooding

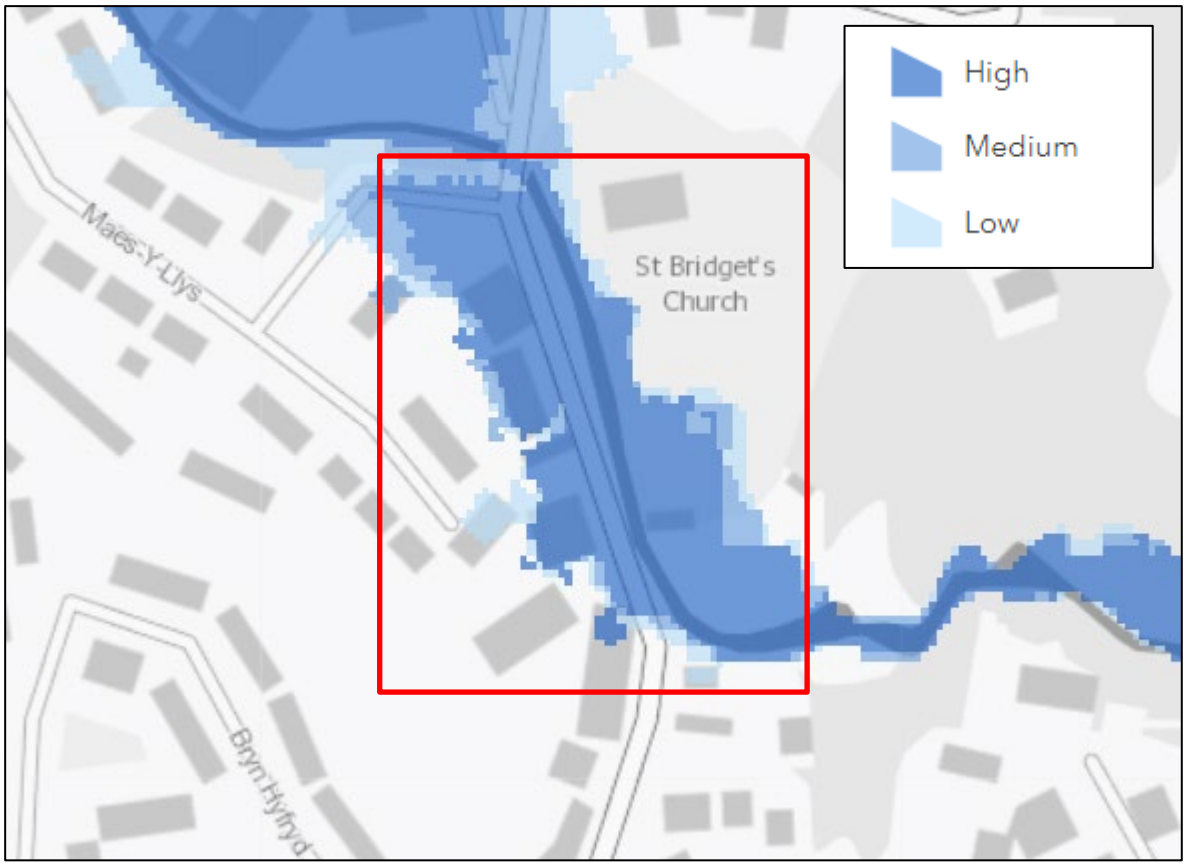


Figure 42: *NRW Flood Risk Maps for Rivers for the investigation area at Waterfall Road*

What improvement actions are needed to ensure flood risk in the County is appropriately managed in future?

- Progress with the detailed design element of a flood alleviation scheme for Dyserth. This includes work to both the upper and lower catchments, with a view to construction of the Scheme commencing in 2025/26, subject to viable funding and agreements.

- Smaller elements of the Scheme to be brought forward for construction if the full detailed design has to be shelved.

- Work with the local flood action group and provide assistance where possible.

- DCC has secured WG funding for PLP for those at risk in the lower catchment reaches of the Afon Ffyddion. Therefore, the aim is for DCC to purchase suitable flood barrier protection in the 2024/25 financial year and to arrange for the Local Flood Action Group to manage the installation of the barriers when required.

7.3.2 Lower Waterfall Road opposite Lyndholme

Why did the flooding happen?

The highway drainage system within this section of the Road couldn't cope with the excess water as a result of Storm Babet and therefore water surcharged from the man-hole opposite the property known as Lyndholme and caused internal flooding.

How likely it is for that scale of flooding to happen again?

This is the second time Lyndholme as experienced internal flooding, the first being as a result of Storm Christophe in 2021.

What improvement actions are needed to ensure flood risk in the County is appropriately managed in future?

- Post Storm Babet, the effected drainage systems have been cleaned out

- Another man-hole has also been installed.

- Further investigation required in terms of line of culvert, with the possibility of a feasibility study to divert the line of the culvert.

7.3.3 Pandy Lane – Glan y Afon Cottage

Why did the flooding happen?

Glan y Afon Cottage on Pandy lane suffered internal flooding due to the Afon Ffyddion overtopping as a result of the storm conditions, as shown in photo 9

Photo 9: *Flooding from the Afon Ffyddion at Glan y Afon Cottage*

The floodwater flowed out of the river bank and made its way around Glan y Afon Cottage before being impounded by the garden wall, which may have caused the flood water to back-up and increase the depth of flooding. This however will need further investigation via modelling to confirm the flood outlines.

There was also debris build up at the highway bridge adjacent to the Cottage, caused mainly by fallen trees which had washed down from the heavily wooded catchment as a result of the Storm. DCC operatives cleared debris build-up during the morning of the Storm.

How likely it is for that scale of flooding to happen again?

Glan Y Afon was flooded in 2021 as a result of Storm Christophe. The NRW Flood and Coastal Risk Maps for Rivers has it classed as high risk as shown in figure 43 below.

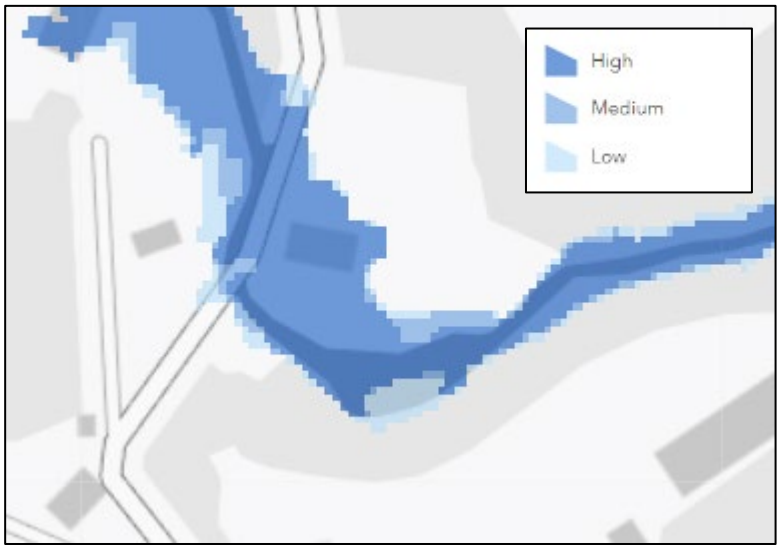


Figure 43: *NRW Flood and Coastal Risk Maps for Rivers at Glan y Afon*

What improvement actions are needed to ensure flood risk in the County is appropriately managed in future?

- The owner of Glan Y Afon Cottage is hoping to construct a bund in the garden to protect the Property, but this would require modelling prior to construction in order to determine what level of protection is required. Consideration of flows should also be taken into account to ensure any works do not increase flood risk elsewhere.

- DCC to therefore provide possible assistance, through revisiting the hydraulic model for the Dyserth Flood Risk Management Scheme so as to advise what level of work to the river can be carried out by the owner of Glan Y Afon.

- Keep the owner of Glan Y Afon updated on the Dyserth Flood Risk Management Scheme

- Provide the owner with details of companies who install PLP.

7.4 St.Asaph

7.4.1 Llys y Felin

Why did the flooding happen?

The Intense rainfall experienced during Storm Babet, caused spilling from the DCWW tank (CSO) into the system which outfalls into the Elwy via a non return flapvalve. However, the River Elwy was high, that is, showing a maximum level of 4.44 metres[2],

which consequently caused water to back-up in the system and eventually surcharge out through a man-hole. The floodwater then flowed in a northerly direction towards the DCC owned flats at Llys y Felin and caused internal flooding to 6 flats.

Following flood modelling done by flood consultants, minimal input is shown into the gullies along St.Asaph High Street and therefore, it is the incapacity of the DCWW sewer system and tank (CSO) which caused the flooding.

Figure 44 below, taken from the modelling shows the flow extent and maximum flood depth during Storm Babet.

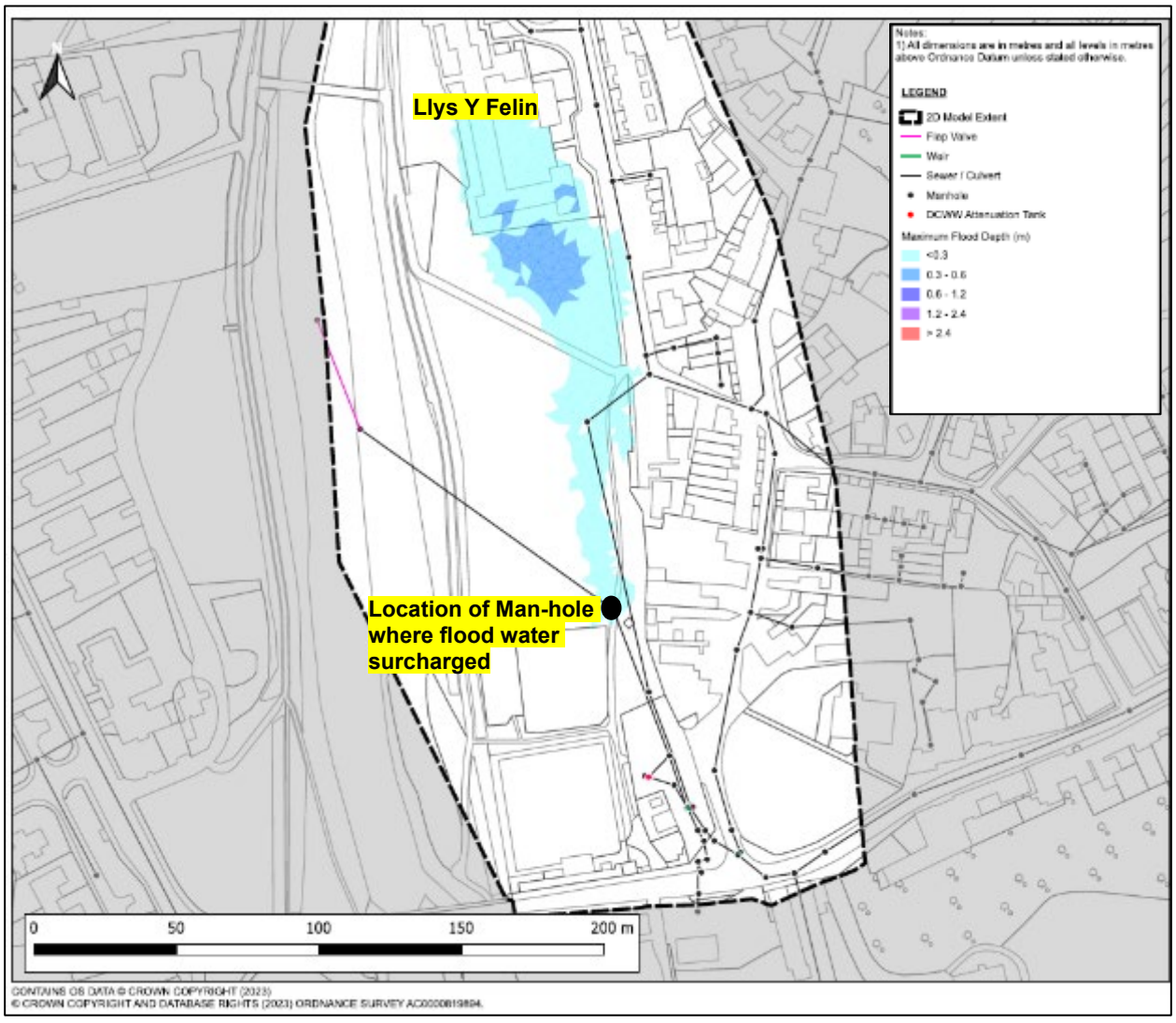


Figure 44. *Maximum Flood Depth during Storm Babet at Llys y Felin*

How likely it is for that scale of flooding to happen again?

Flooding to Llys y Felin also occurred in 2021 following Storm Christophe. Figures 45 and 46 from The NRW Flood and Coastal Risk Maps show that for Llys y Felin it has a high

risk of flooding from surface water and small watercourses, whereas for for flooding from rivers, it is low risk.

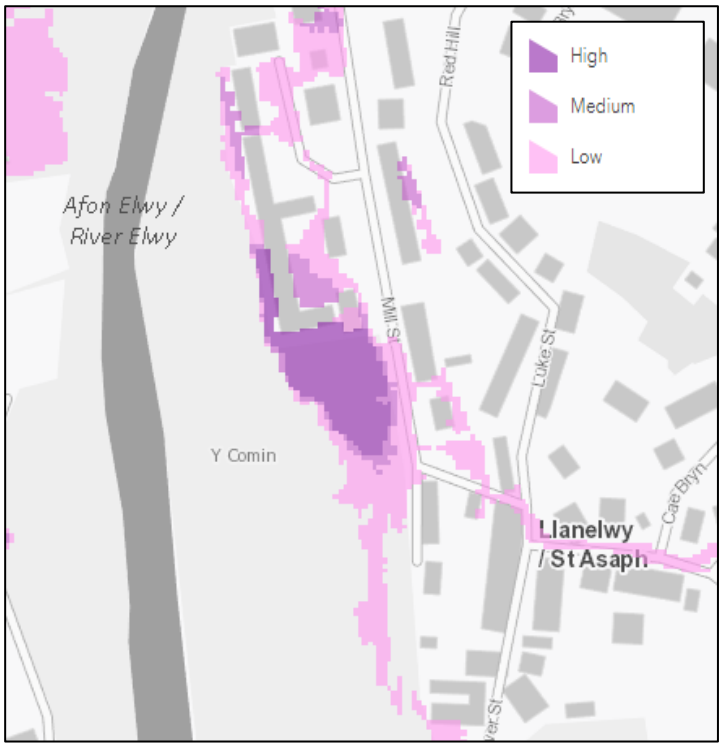


Figure 45: *NRW Flood and Coastal Risk Maps for Llys y Felin showing risk of flooding from surface water and small watercourses.*

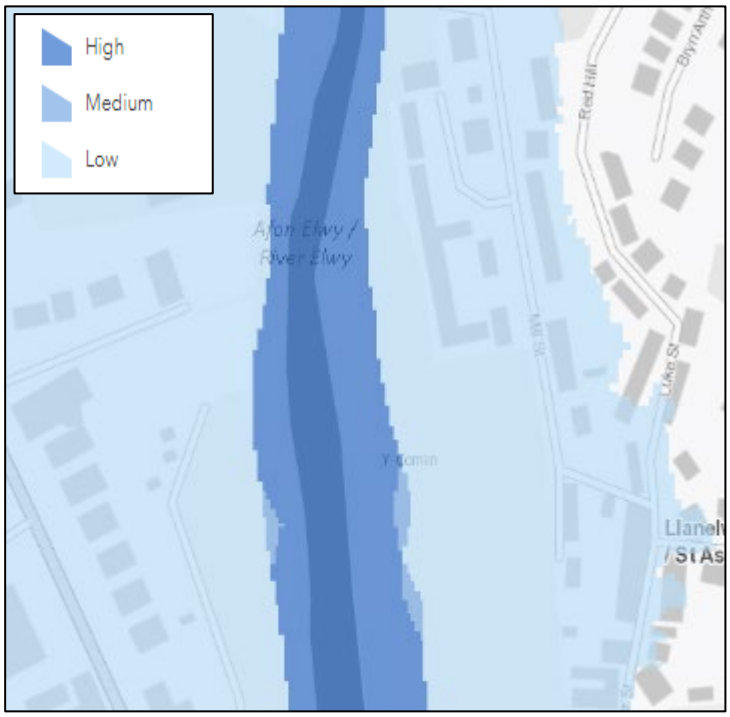


Figure 46: *NRW Flood and Coastal Risk Maps for Llys y Felin showing risk of flooding from rivers*

What improvement actions are needed to ensure flood risk in the County is appropriately managed in future?

- Flood consultants have been employed by DCC to come up with feasible options for mitigating the flooding. Continue this arrangement and also work with DCWW to come up with suitable options.

- DCC housing who manage the Llys y Felin are considering property level protection until a more sustainable solution can be determined

7.4.2. Hoel Esgob/Ashley Court

Why did the flooding happen?

As discussed in Section 4.3.2, the highway surface water connection to the DCWW combined system has been stoppered off. Consequently, this is now contributing to a more frequent localised flooding issue in and around Hoel Esgob/Ashley Court, as experienced during Storm Babet.

One property on Ashely Court suffered internal flooding, but there were also numerous near misses as a result of flooding to gardens and roads.

How likely it is for that scale of flooding to happen again?

Localised flooding occurs on a frequent level at Hoel Esgob, but usually it is to the roads and gardens in this area.

Figure 47 from the NRW Flood and Coastal Risk Maps has Hoel Esgob and Ashley Court as high to low risk from surface water and small watercourse flooding.

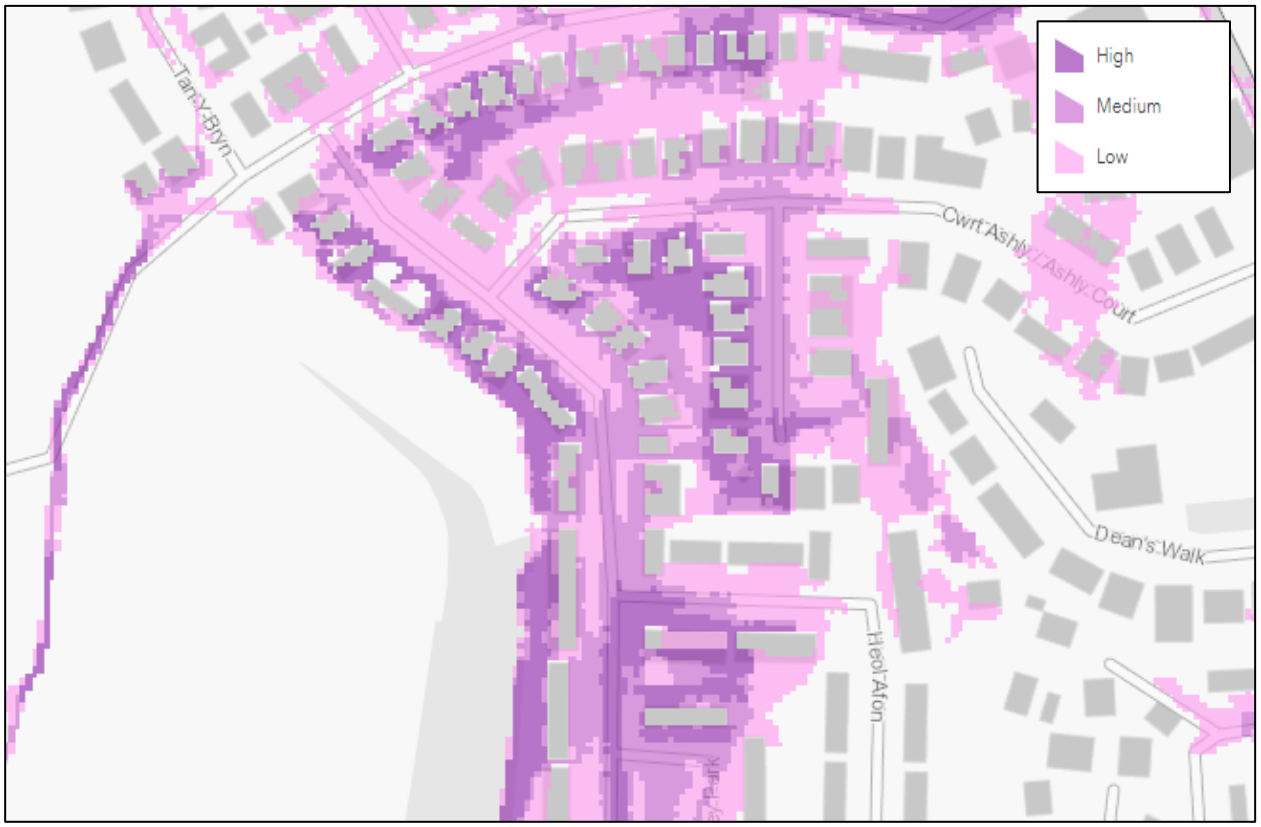


Figure 47: *NRW Flood and Coastal Risk Maps showing flood risk from surface water and small watercourses at Hoel Esgob/Ashley Court*

What improvement actions are needed to ensure flood risk in the County is appropriately managed in future?

- To encourage properties at Ashley Court and Hoel Esgob to consider PLP
- Re-visit the 2016 DCC commissioned Study Report by flood consultants to come up with a long term option to reduce flood risk at Hoel Esgob/Ashely Court.
- A possible solution could be to explore Natural Flood Management (NFM) within the catchment, as in potential storage, an option discussed in the 2016 Report.
- Apply to WG for funding in the 2025/26 application window to carry out a design for potential (NFM).

7.5 Denbigh

7.5.1 Denbigh Green

Why did the flooding happen?

Flooding occurred to multiple properties along the A525 in the Denbigh Green Area, with the flood water entering properties from the rear via numerous watercourses/ditches, which flow from the West to the East. DCC's current understanding of the causes of this flooding relates to issues with culverts under private landownership, notably the one within described in section 4.4.2. Either blockage or capacity led to the flooding, with culverts unable to cope with the large volumes of water.

Residents were observed pumping water out of their properties through their front doors and the fire service attended to one property.

How likely it is for that scale of flooding to happen again?

In 2021, Storm Christophe caused a number of near misses to properties within the Green area.

Figure 48 below from the NRW Risk Maps has the effected properties in close proximity to being at high risk from surface water and small watercourse flooding.

Figure 48: *NRW Flood Risk Maps showing flood risk from surface water and small watercourses at Denbigh Green*

What improvement actions are needed to ensure flood risk in the County is appropriately managed in future?

- to work with landowners and assess what improvements can be made to these culverts, which may include reconstruction of headwalls or complete replacements of the culverts.

7.5.2 Denbigh – Brookhouse

Why did the flooding happen?

According to NRW post Storm Babet data collection, one property was confirmed to have suffered internal flooding.

The Property known as Glan Llyn experienced flood water from the Main River, that is, the Afon Ystrad. Flood water entered the Property from the rear, through a private river flood defence wall, which then spread throughout the ground floor and out through the front door.

It could be that the flooding was not directly as a result of the rain experienced on the 20th October since the already heavily saturated conditions within the Ystrad catchment as a result of the weeks leading up to the 20th may have contributed to the flooding experienced at Glan Llyn.

How likely it is for that scale of flooding to happen again?

It is the third time In the last four years that the Brookhouse area has experienced issues with flooding.

The NRW Flood and Coastal Risk Maps confirms that Brookhouse is at high risk of flooding from rivers, that is, the River Ystrad, as shown in figure 49

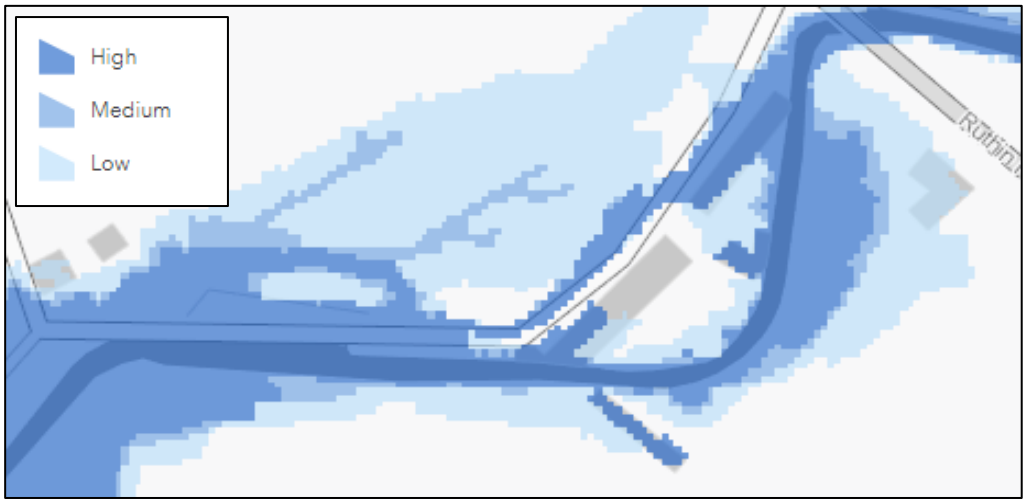


Figure 49: *NRW Flood and Coastal Risk Maps for Rivers at Brookhouse*

What improvement actions are needed to ensure flood risk in the County is appropriately managed in future?

Liaise with NRW who manage the River Ystrad to see whether proposals laid out by them following the 2020 Flooding event at Brookhouse have been acted upon. That is:

- Consideration of the ability to provide improved warning and informing to residents, allowing additional time to prepare for flooding, could provide significant betterment at this location.

- Whilst including up to date hydrological and topographical datasets will increase confidence in the understanding of risk to the community of Brookhouse, this will most likely confirm the existing understanding and mechanisms of flooding. Consideration of improved warning and informing services to the community may result in more timely provision of service improvements at this location.

- Given the high risk of flooding associated with Brookhouse, It is likely that properties at Brookhouse will flood again from the Main River unless NRW undertake a flood alleviation scheme at this location.

7.6 Nantglyn – Segrwyd Mill

Why did the flooding happen?

The River Ystrad broke its banks behind the Property known as Sergwyd Mill and made its way into the Property via the back and front door. Photo 10 below shows the extent of the flooding from the back of the house

Photo 10: *Flooding from the Afon Ystrad at Segrwyd Mill, Nantglyn*

As with the Brookhouse, it is likely that the heavily saturated conditions within the Ystrad catchment contributed to the flooding experienced at Sergwyd Mill.

How likely it is for that scale of flooding to happen again?

Sergwyd Mill was flooded in 2020 on the back of Storm Ciara, but not to same extent as the flooding experienced from Storm Babet.

The NRW Flood and Coastal Risk Maps puts the Mill at high risk from river flooding, as shown in figure 50 below.

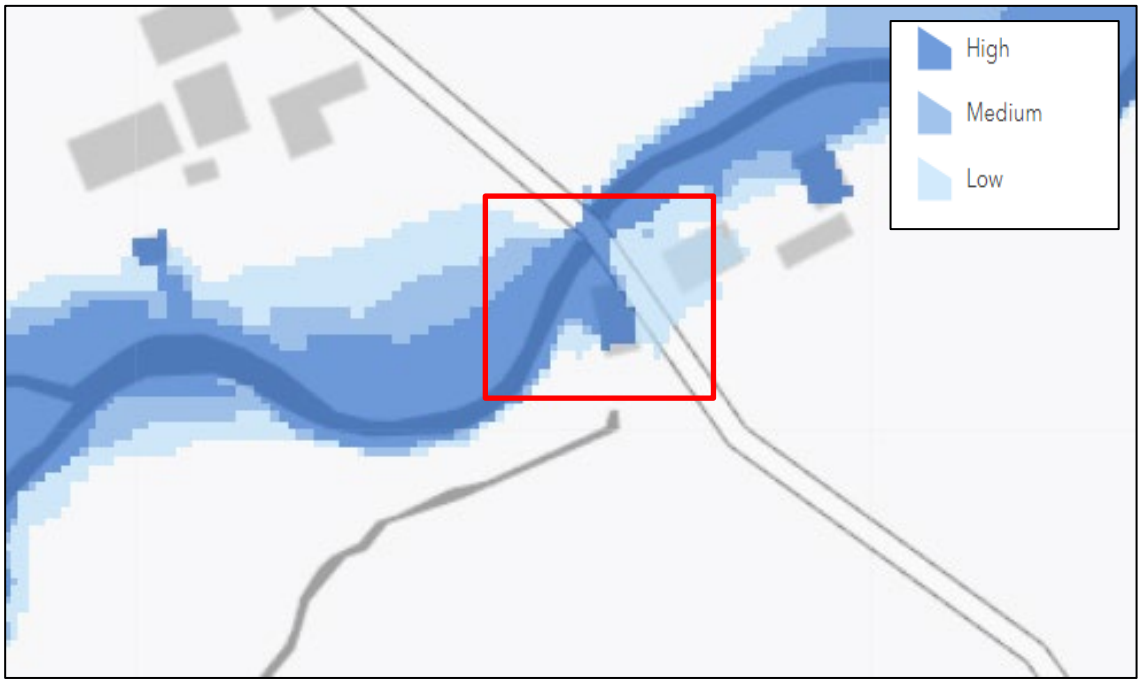


Figure 50: *NRW Flood and Coastal Risk Maps for Rivers at Sergwyd Mill*

What improvement actions are needed to ensure flood risk in the County is appropriately managed in future?

- The owner of Sergwyd Mill is intending to invest in PLP for the front and back of the Property.
- NRW to carry out further investigation on this flood event

7.7 Llanarmon Yn Ial – Plas Isaf

Why did the flooding happen?

Flooding occurred as a consequence of both high flow levels in the River Alyn (Main River) and significant surface water flows coming off the highway being conveyed to an individual property known as Plas Isaf via its access track. Measures previously constructed by DCC (see photo 1 in section 4.6.2) to help reduce the risk of the water coming off the highway were overwhelmed, but predominately, the main source of flooding was the River flowing around a private wall structure.

Flood water entered the Property from the front via a low sitting floor, as shown in photo 11 below

Photo 11 *showing flood waters at the front door of Plas Isaf*

How likely it is for that scale of flooding to happen again?

This is the second time the Property has been flooded, the first being from Storm Christophe 2021

The NRW Risk Maps for rivers, as shown in figure 51, has the effected Property at high risk from flooding.

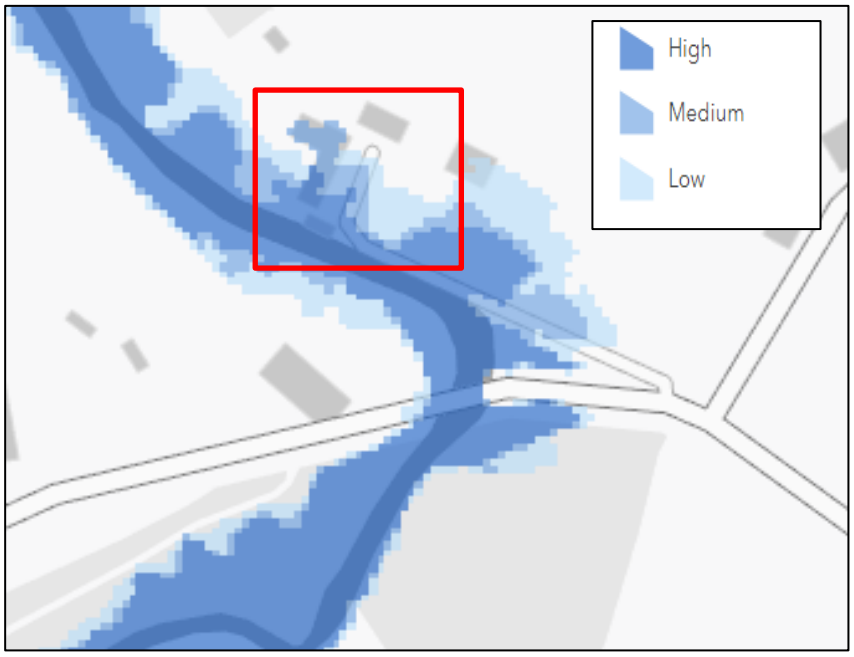


Figure 51: *NRW Flood and Coastal Risk Maps for Rivers at Plas Isaf*

What improvement actions are needed to ensure flood risk in the County is appropriately managed in future?

- Advice and guidance to be provided to the property owner and minor improvements to be made on the highway drainage.
- Encourage the uptake of individual PLP, in the form of flood barriers.
- Recommend imporovements or maintenance to be carried out to the private wall structure, which runs adjacent to the the River Alyn.
- NRW to carry out further investigation to get a better understanding of flooding from the River Alyn.

7.8 Llanferres – Loggerheads Country Park Café/Visitor Centre

Why did the flooding happen?

Flooding occurred due to the River Alyn overtopping its banks following the heavy rain of the 19th/20th, plus the already saturated catchment from the weeks leading up to Storm Babet[6].

How likely it is for that scale of flooding to happen again?

The Café/Visitor centre was also flooded in 2021 as a result of Storm Christophe.

The NRW Flood and Coastal Risk Maps for rivers as shown in figure 52 below puts the investigatory area in the high risk bracket for flooding

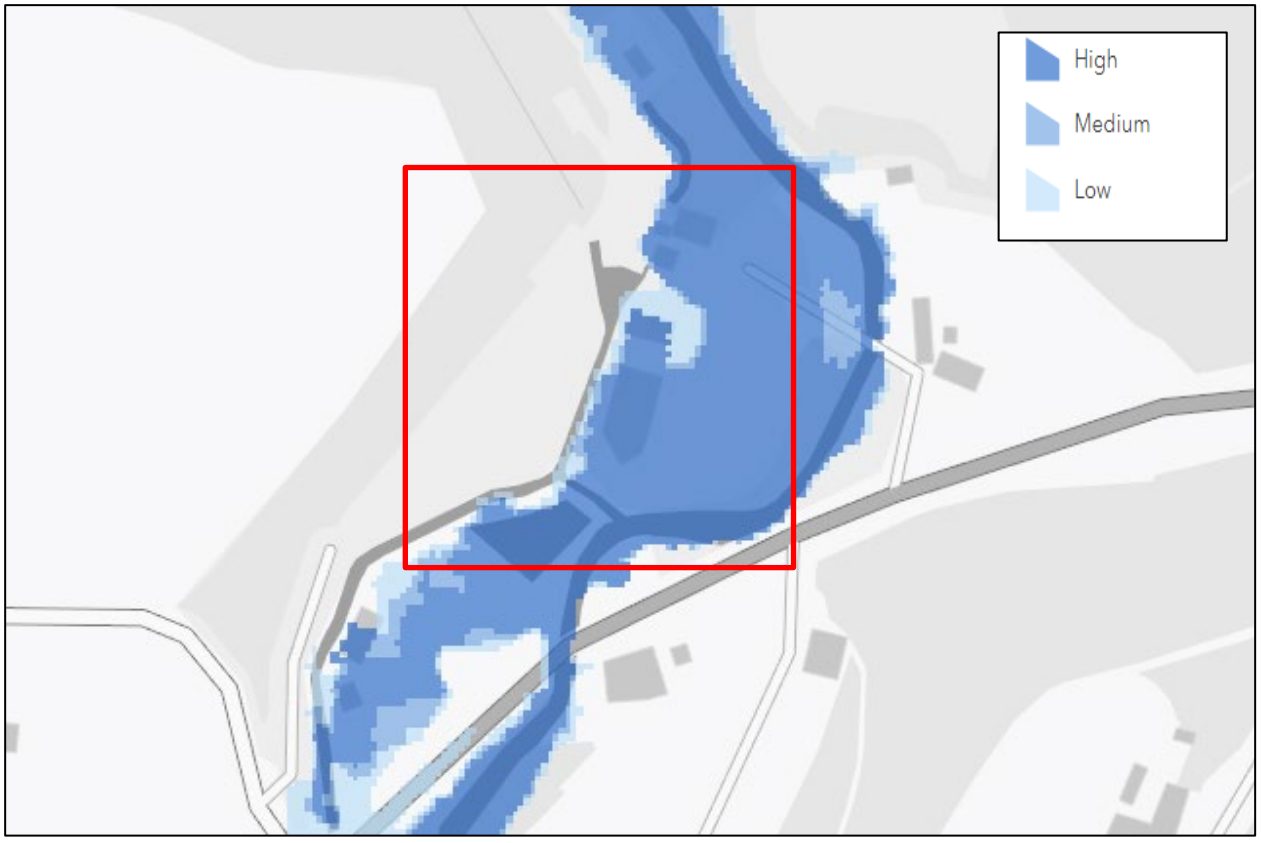


Figure 52: *NRW Flood and Coastal Risk Maps for Rivers at Lloggerheads Country Park*

What improvement actions are needed to ensure flood risk in the County is appropriately managed in future?

- DCC's Countryside Service have employed Flood Consultants to look at measures to reduce flood risk
- Since the River Alyn is Main River, Natural Resources Wales should work with DCC's Countryside Service section in terms of suitable flood alleviation options to take forward.
- NRW to liaise with DCC Countryside Services and consider options and proposals going forward.

7.9 Llandyrnog – Glan Y Wern

Why did the flooding happen?

There was a blockage of a highway culvert, which became overwhelmed with flood water, which was conveyed towards multiple properties via the highway. Consequently, one property known as Glan Y Wern flooded as water accumulated in a private yard against the properties low sitting floor to ceiling windows. The private surface water drainage system serving this property also failed due to it discharging into a blocked highway ditch.

How likely it is for that scale of flooding to happen again?

The NRW Flood Risk Maps for surface water and small watercourses does not have the flooded Property at risk of flooding.

The flooding occurred primarily because of the over-reliance of the private system to be able to discharge into the highway ditch. Therefore, regular inspection/maintenance of the dict should prevent further flooding.

What improvement actions are needed to ensure flood risk in the County is appropriately managed in future?

- Reconstruction and realignment of the highway culvert headwall to improve capacity, reduce the risk of it surcharging and to improve access for future maintenance.

- NRW to look into adding the Property to the NRW Flood Risk Mapping for Surface Water and small watercourses.

7.10 Aberwheeler – Geinas

Why did the flooding happen?

Blocked highway culverts in the proximity of Aberwheeler Village , caused floodwater to flow along the highway network to the Property know as Pen Y Bont, which then ingressed into the House via the front door. The owner, an elderly gentleman had to leave the Property and stay at his daughters for a few days.

How likely it is for that scale of flooding to happen again?

The NRW Flood and Risk Maps for surface water and small watercourses do not have the Property down as a flood risk.

Furthermore, there is also a degree of exceptionality with Storm Babet due to the amount of sediment/scour washed into structures, not only at Aberwheeler, but Countywide.

Lack of maintenance to highway drainage structures in Aberwheeler Village area also contributed, but through careful monitoring, surface water flood risk to Geinas can be reduced in the future.

There is however a high risk that the Property could be flooded by the Main River known as the Afon Wheeler, which is located close by, as shown by figure 53 below

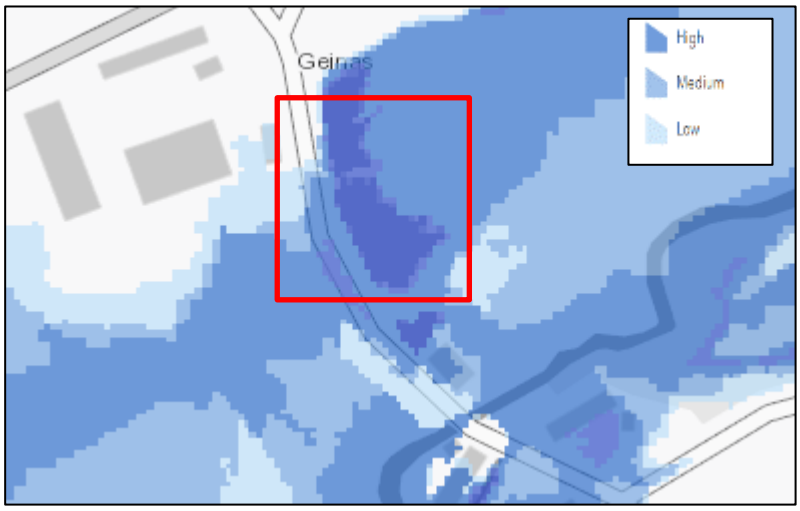


Figure 53: *NRW Flood and Coastal Risk Maps for Rivers at Geinas, Aberwheeler*

What improvement actions are needed to ensure flood risk in the County is appropriately managed in future?

- Culvert since unblocked
- location to be monitored
- NRW to look into adding the Property to the NRW Flood Risk Mapping for Surface Water and small watercourses

7.11 Significant near miss locations

Corwen

A crew had to continually clear out the flood alleviation culvert below Pen y Pigyn for a number of hours on the morning of Storm Babet. Without this level of maintenance, a large proportion of Corwen Town would have been flooded by water over-toppping the culvert. Photo 12 below shows the intensity of the water almost over-topping the flood alleviation culvert.

Photo 12: *Flood Alleviation Culvert below Pen y Pigyn at Corwen during Storm Babet*

Nantglyn

There was extensive damage to highway infrastructure in and around the Village of Nantglyn as a result of the Storm, which in some instances caused near misses to residential properties.

The highway culvert within the Village, which historically overtops during storm events, flooding properties in the process, had just been replaced prior to Storm Babet. Its replacement came on the back of a recommendation in the Section 19 report for Storm Christophe in 2021, which caused flooding to a couple of properties within the Village. The new structure coped well during Storm Babet despite the torrential amount of water entering the inlet, as shown by photo 13 below.

Photo 13: *New culvert structure at Nantglyn Village during Storm Babet*

Gwyddelwern

The flood alleviation culvert at Gwyddelwern Village was continually blocking up with debris on the morning of the 20th October and consequently was in danger of over-topping and flooding parts of the Village. Hence, a team had to be deployed to continually un-block the culvert

8.0 Summary of Improvements required to ensure flood risk in the County is appropriately managed in future

Storm Babet was the third major storm to cause internal property flooding in the County of Denbighshire over the last 4 years. Hence, it is likely that a similar storm will hit the County again in the future.

Therefore, it is vital that the recommended improvements in the previous section should be acted to not only mitigate the impacts of future storm events, but to also understand better the flood risk at certain locations within this report, which in turn can lead to more effective solutions to alleviate the risk.

Below is a summary of the recommended flood risk improvements for each location in the Report.

8.1 Rhyl

8.1.1 Ffordd Derwen

- To Progress with the Welsh Government (WG) funded flood alleviation scheme at Ffordd Derwen, which is currently at the design stage.

- In the meantime, encourage property level protection (PLP) and consider applying to WG for flood barriers which will help control flood waters to the front of the Properties on Ffordd Derwen, in particular the wave effects caused by vehicles using the road, or, consider the option to close the road under emergency powers to prevent the potential flood effects caused by vehicles.

8.1.2 River Street

- Encourage the owner of the flooded rented properties to invest in PLP for the front doors.

- Also, point out to the owner that it maybe worthwhile carrying out a CCtv drain survey to check for blockages to the roof water drain.

8.1.3 Maes Y Gog/Llys Gwennol/Lon Eglyn

- Include Maes Y Gog, Llys Gwennol & Lon Eglyn in a WG funded scheme, which looks at ways to reduce and manage urban water catchments
- The low spots on the right bank wall of the Maes Gwilym Drain need to be addressed by NRW.
- Consider the merits of installing flood sensors at various points along the Maes Gwilym Drain to monitor river levels, although for this to have a benefit it would need to be managed by a Local Flood Action Group
- Encourage and assist with a potential Local flood Action Group.
- Carry out further engagement with relevant stakeholders to see what improvements can be made, for example, NRW will ensure that the Maes Gwilym Drain will still get the one annual weed cut although this will be brought this forward in the programme so that it is now in line with the section alongside the railway and into Rhyl Cut East. This change means that it will now get cut in September instead of November, which will be monitored as part of NRW's asset inspection and if a second cut is needed in early Winter, NRW will carry out the necessary work.
- NRW to carry out modelling work at Lon Eglyn at Maes y Gog to show the increased flood extent areas folloing Storm Babet.
- Look at funding avenues with Welsh Governemnt to investigate the potential for retrospective SuDS at the Aberkinsey devlopement, as well as nature based flood management solutions. It could lead to partnership working with the other relevant stakeholders such as DCWW and NRW

8.1.4 Walford Avenue – Plas Cyril/ Inferno Dance Studio

- Encourage the use of PLP for Plas Cyril and work with DCC Housing in the short term in relation to this.
- Consider applying to WG for funding to explore possible long term solutions at Plas Cyril
- Work with relevant stakeholders to understand better the flood risk to the Dance Studio in terms of the maintenance of the Rhyl Cut and capacity issues of the sewer systems

8.2 Prestatyn/Meliden

8.2.1 Winchester Drive

- To engage with all relevant stake-holders to understand how the drainage systems work and what can be done to improve the flood risk issue
- Affected properties should also consider PLP.

8.2.2 Ffordd Penwhylfa

- To engage with all relevant stake-holders to understand how the drainage systems work and what can be done to improve the flood risk issue
- Affected properties should also consider PLP

8.2.3 Meliden – Pwll y Bont

- Further investigation is required to ascertain how the surface water drainage from the new housing developments nearby connect to the Prestatyn Gutter were made and if they are contributing to the flooding at Pwll y Bont.
- To include Pwll y Bont In the WG funded scheme, which looks at ways to reduce and manage urban water catchments for Prestatyn/Meliden

8.3 Dyserth

8.3.1 The section of Waterfall Road running parallel with the Afon Ffyddion

- Progress with the detailed design element of a flood alleviation scheme for Dyserth. This includes work to both the upper and lower catchments, with a view to construction of the Scheme commencing in 2025/26, subject to viable funding and agreements.
- Smaller elements of the Scheme to be brought forward for construction if the full detailed design has to be shelved.
- Work with the local flood action group and provide assistance where possible.
- DCC has secured WG funding for PLP for those at risk in the lower catchment reaches of the Afon Ffyddion. Therefore, the aim is for DCC to purchase suitable

flood barrier protection in the 2024/25 financial year and to arrange for the Local Flood Action Group to manage the installation of the barriers when required.

8.3.2 Lower Waterfall Road opposite Lyndholme

- Post Storm Babet, the effected drainage systems have been cleaned out
- Another man-hole has also been installed.
- Further investigation required in terms of line of culvert, with the possibility of a feasibility study to divert the line of the culvert.

8.3.3 Pandy Lane – Glan y Afon Cottage

- The owner of Glan Y Afon Cottage is considering constructing a bund in the garden to protect the Property, but this would require modelling prior to construction to determine what level of protection is required. Consideration of flows should also be taken into account to ensure any works do not increase flood risk elsewhere.
- DCC to therefore provide possible assistance, through revisiting the hydraulic model for the Dyserth Flood Risk Management Scheme so as to advise what level of work to the river can be carried out by the owner of Glan Y Afon.
- Keep the owner of Glan Y Afon updated on the Dyserth Flood Risk Management Scheme
- Provide the owner with details of companies who install PLP

8.4 St.Asaph

8.4.1 Llys y Felin

- Flood consultants have been employed by DCC to come up with feasible options for mitigating the flooding. Continue this arrangement and also work with DCWW to come up with suitable options.
- DCC housing who manage the Llys y Felin are considering PLP until a more sustainable solution can be determined.

8.4.2 Hoel Esgob/Ashley Court

- To encourage properties at Ashley Court and Hoel Esgob to consider property level protection.

- Re-visit the 2016 DCC commissioned Study Report by flood consultants to come up with a long term option to reduce flood risk at Hoel Esgob/Ashely Court.

- A possible solution could be to explore Natural Flood Management (NFM) up the catchment, as in potential storage, an option discussed in the 2016 Report.

- Apply to WG for funding in the 2025/26 application window to carry out a design for potential (NFM).

8.5 Denbigh

8.5.1 Denbigh Green

- to work with landowners and assess what improvements can be made to these culverts, which may include reconstruction of headwalls or complete replacements of the culverts.

8.5.2 Brookhouse

- Consideration of the ability to provide improved warning and informing to residents, allowing additional time to prepare for flooding, could provide significant betterment at this location.

- Whilst including up to date hydrological and topographical datasets will increase confidence in the understanding of risk to the community of Brookhouse, this will most likely confirm the existing understanding and mechanisms of flooding. Consideration of improved warning and informing services to the community may result in more timely provision of service improvements at this location.

8.6 Nantglyn – Sergwyd Mill

- The owner of Sergwyd Mill is intending to invest in PLP for the front and back of the Property

- NRW to carry out further investigation on this flood event

8.7 Llanarmon Yn Ial – Plas Isaf

- Advice and guidance to be provided to the property owner and minor improvements to be made on the highway drainage.
- Encourage the uptake of individual PLP, in the form of flood barriers.
- Recommend imporovements or maintenance to be carried out to the private wall structure, which runs adjacent to the the River Alyn.
- NRW to carry out further investigation to get a better understanding of flooding from the River Alyn.

8.8 Llanferres – Lloggerheads Country Park Café/Visitor Centre

- DCC's Countryside Service have employed Flood Consultants to look at measures to reduce flood risk
- Since the River Alyn is Main River, Natural Resources Wales should work with DCC's Countryside Service section in terms of suitable flood alleviation options to take forward.
- NRW to liaise with DCC Countryside Services and consider options and proposals going forward.

8.9 Llandyrnog – Glan Y Wern

- Reconstruction and realignment of the highway culvert headwall to improve capacity, reduce the risk of it surcharging and to improve access for future maintenance.
- NRW to look into adding the Property to the NRW Flood Risk Mapping for Surface Water and small watercourses.

8.10 Aberwheeler – Pen y Bont

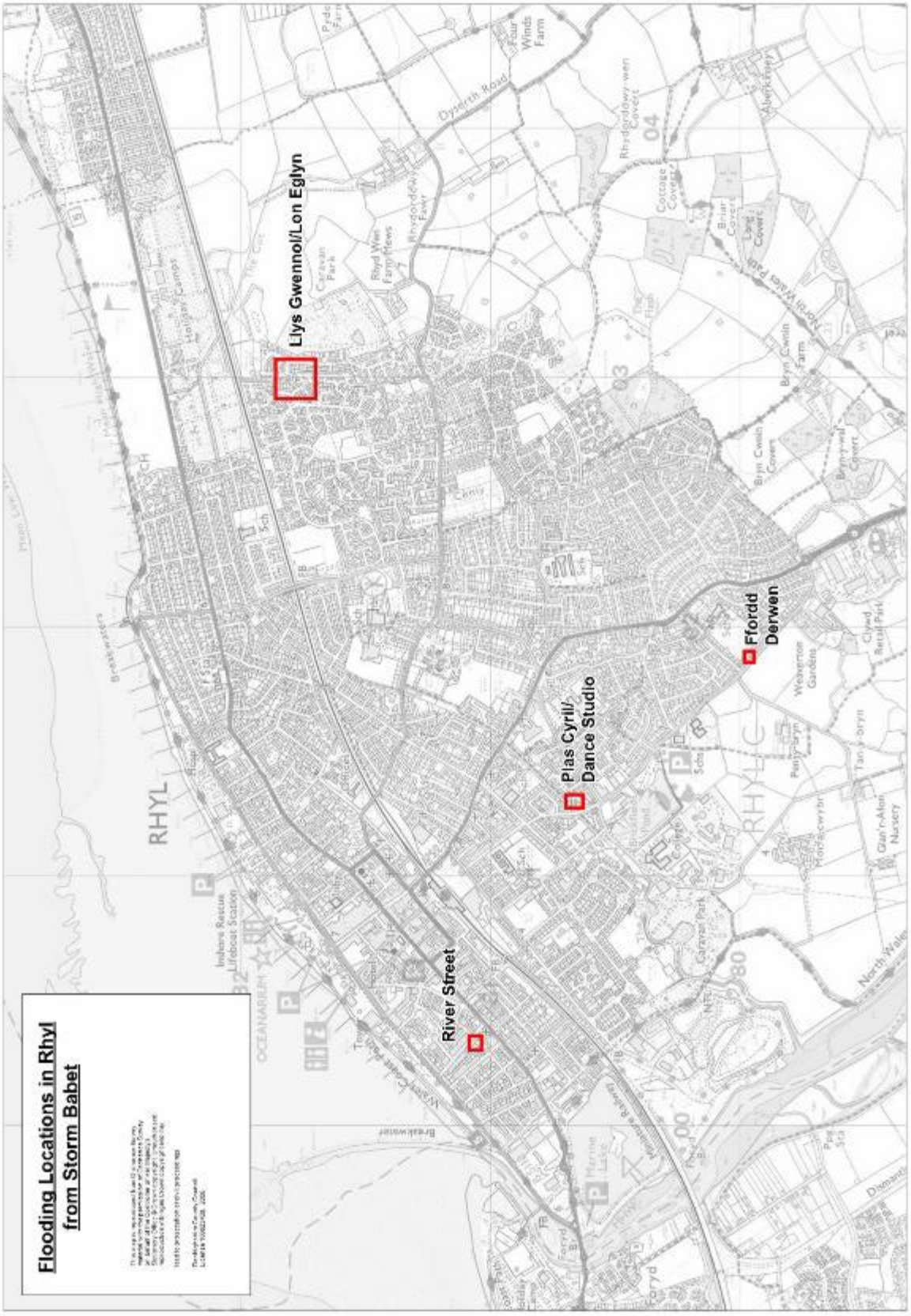
- Culvert since unblocked
- location to be monitored
- NRW to look into adding the Property to the NRW Flood Risk Mapping for Surface Water and small watercourses

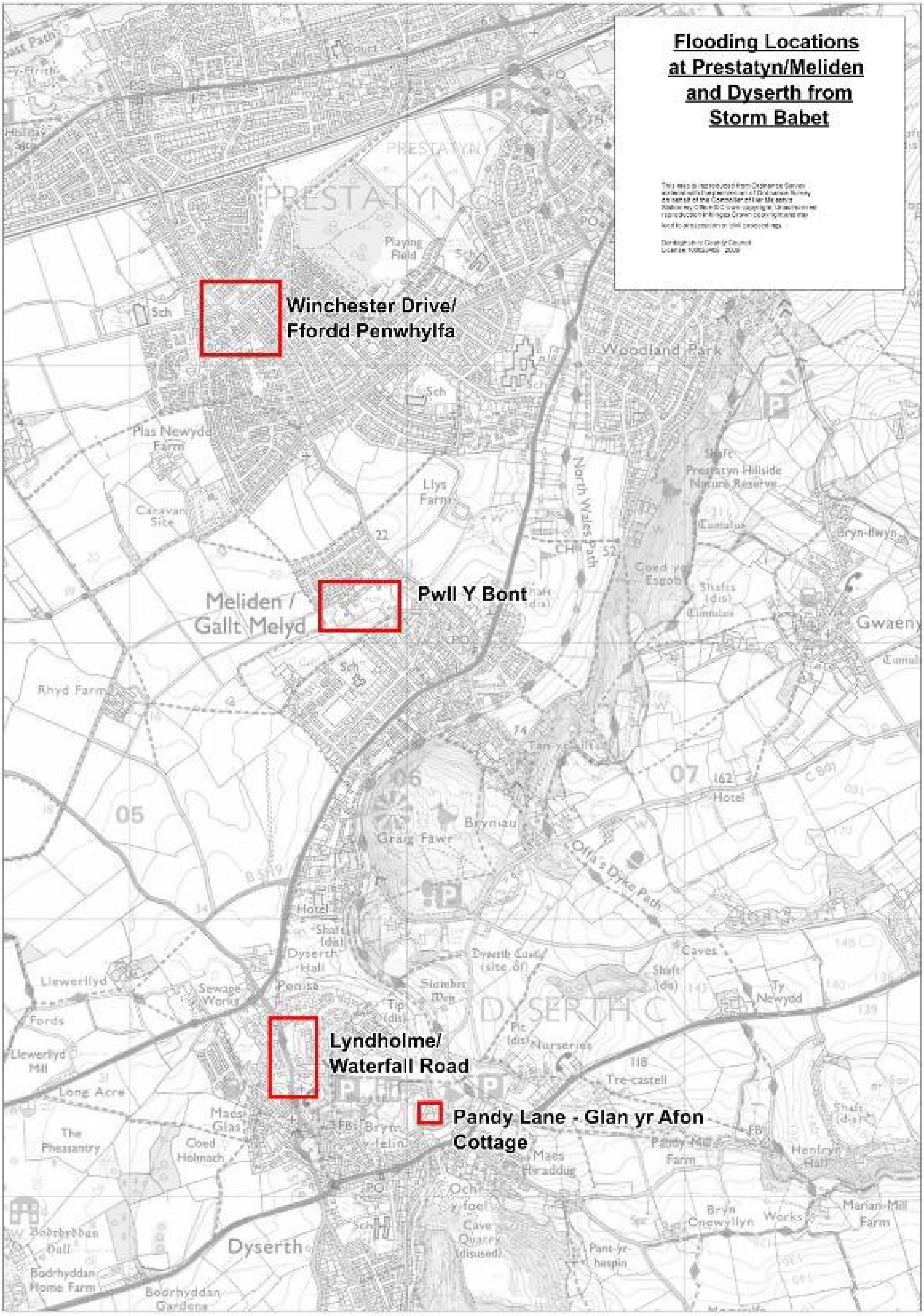
9.0 Conclusion

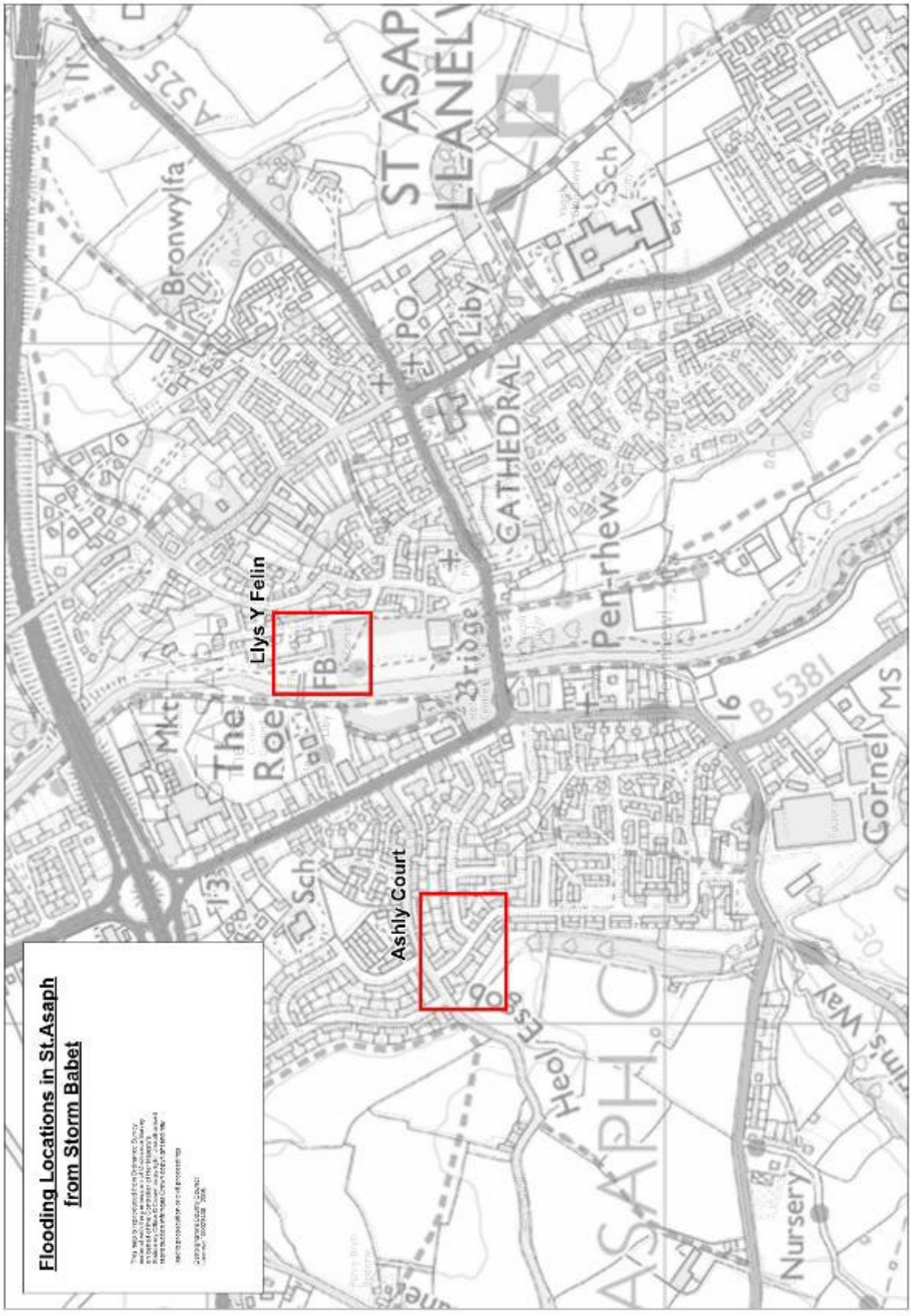
The flooding that affected Denbighshire on 20th October 2023 was the result of a significant rainfall event, with a possible higher than 1 in 40 likelihood of occurring in any one year. Whilst this was a statistically a rare event, its impacts covered a wide area and around 60 plus properties were flooded internally as a consequence.

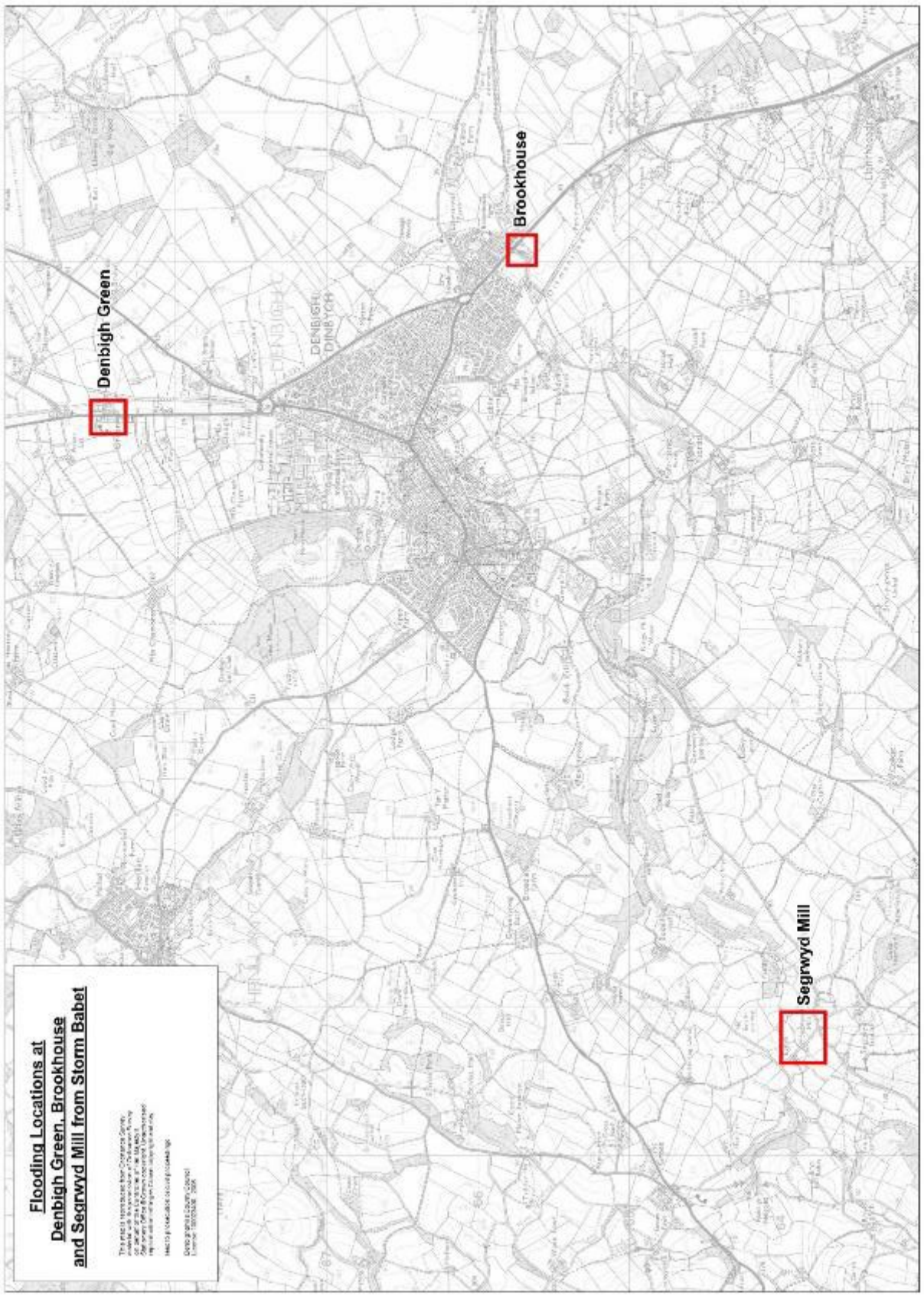
This report provides an overview of the Council's current understanding of what caused the flooding and how likely it is for flooding to occur again at the effected locations. Most importantly though, the Investigation Report outlines recommendations and actions that various organisations and authorities can do to minimise future flood risk, although It is important to note that a Section 19 report is not an in-depth analysis of flooding risks or mechanisms.

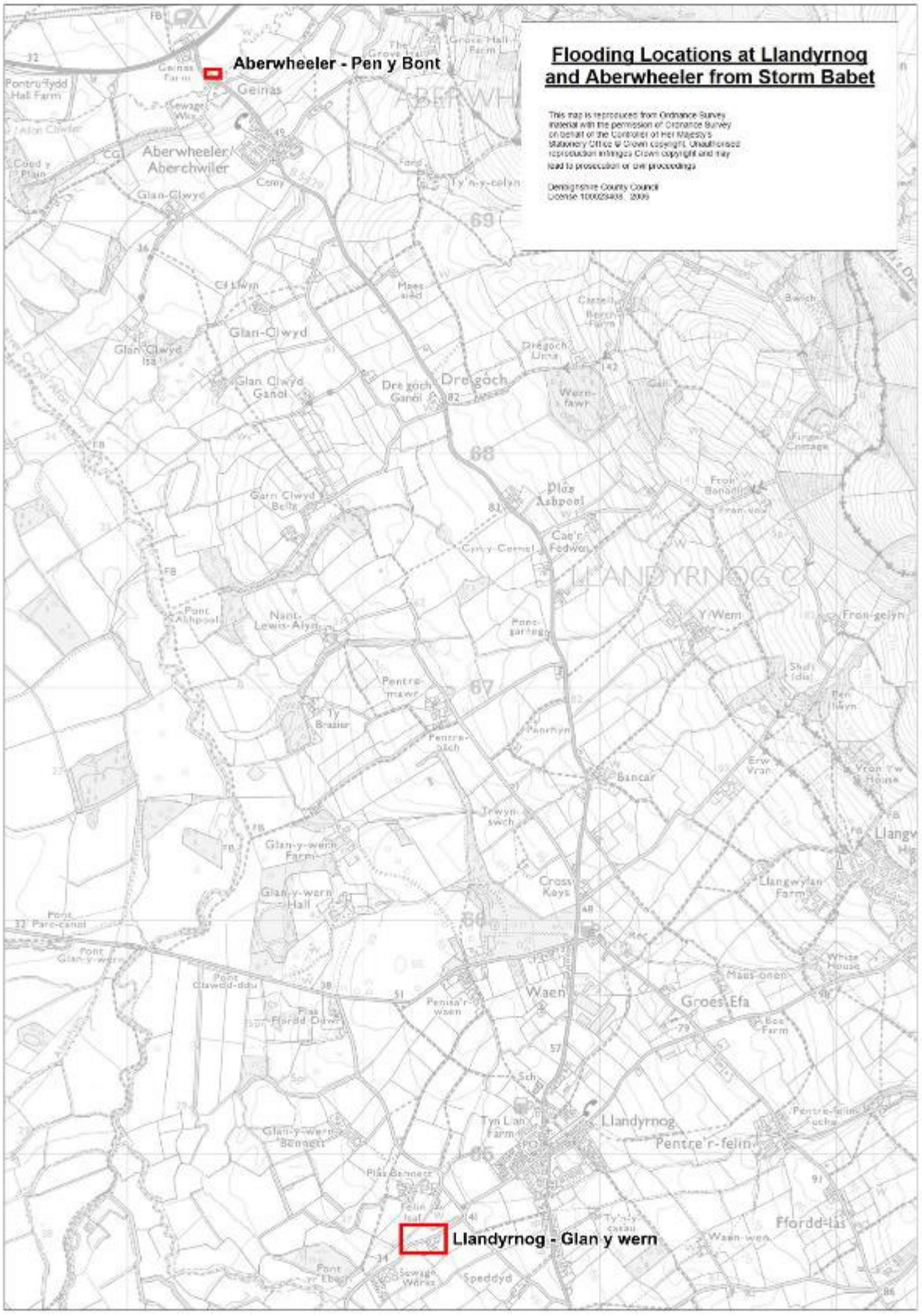
APPENDIX 1 – FLOODING LOCATIONS FROM STORM BABET


Flooding Locations in Rhyl from Storm Babet
Llys Gwennol/Lon Eglyn
Plas Cyril/ Dance Studio
Ffordd Derwen
River Street
RHYL


Flooding Locations at Prestatyn/Meliden and Dyserth from Storm Babet
Winchester Drive/ Ffordd Penwhylfa
Pwll Y Bont
Lyndholme/ Waterfall Road
Pandy Lane - Glan yr Afon Cottage


Flooding Locations in St.Asaph
from Storm Babet
Llys Y Felin
Ashly Court
ST ASAPH
LLANELW
CATHEDRAL
Bronwylfa
Pen-rhew
The Roe
Mkt
Sch
FB
Bridge
PO
Liby
Sch
A525
B5381
Cornel MS
Nursery
Heol Esgob
Williams Way
ASAPH CP


Flooding Locations at
Denbigh Green, Brookhouse
and Segrwyd Mill from Storm Babet
Denbigh Green
Brookhouse
Segrwyd Mill
DENBIGH
DINBYCH


Flooding Locations at Llandyrnog and Aberwheeler from Storm Babet
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Denbighshire County Council
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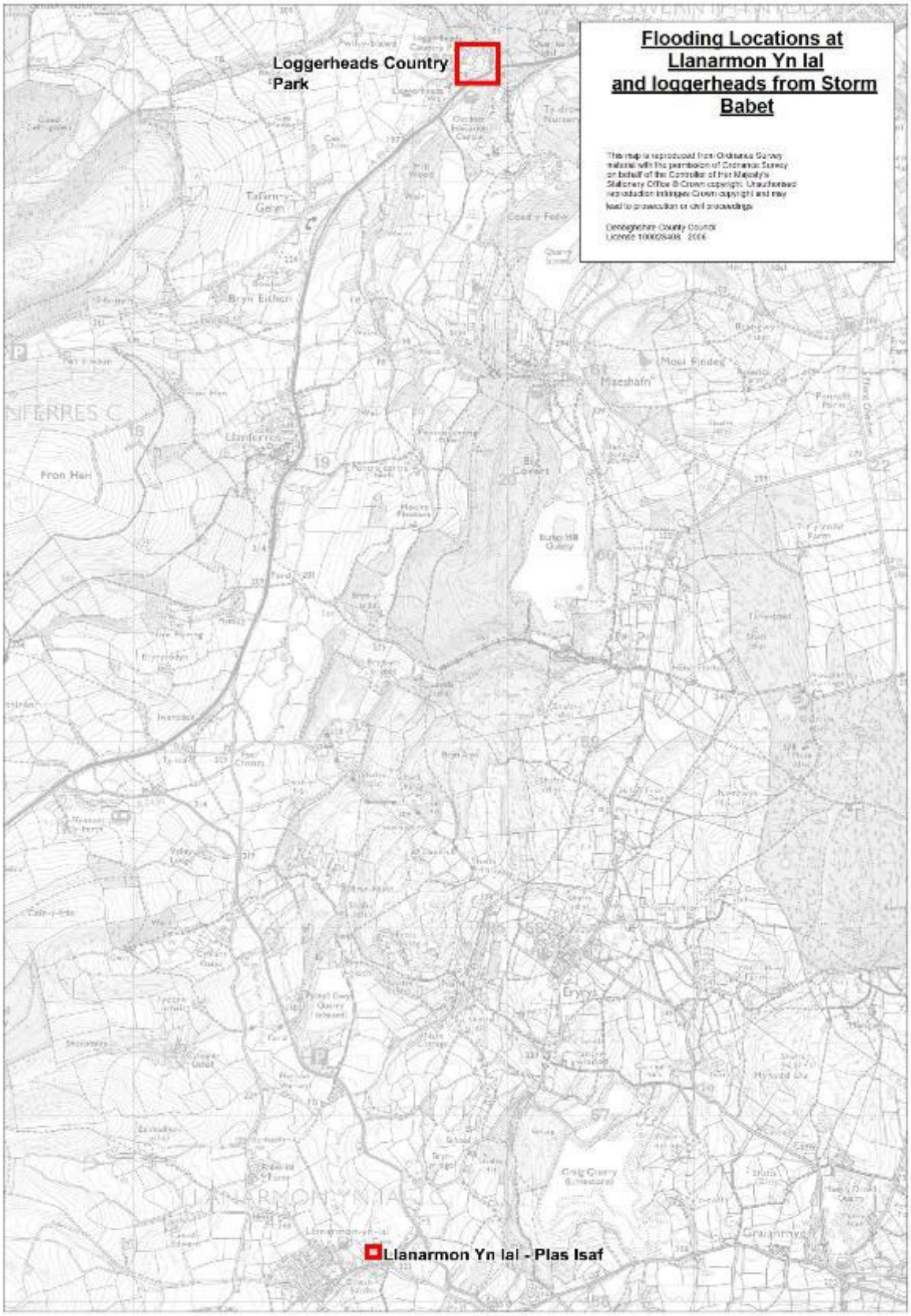
Aberwheeler - Pen y Bont
Llandyrnog - Glan y wern
Aberwheeler
Aberchwiler
Glan-Clwyd
Dreigoch
Llandyrnog
Pentre'r-felin
Waen
Groes Efa
Ffordd-las
Bancar
Cross Keys


Flooding Locations at Llanarmon Yn Ial and loggerheads from Storm Babet
Loggerheads Country Park
Llanarmon Yn Ial - Plas Isaf

APPENDIX 2 – NRW MAINTENANCE REGIME FOR RHYL CUT AND PRESTATYN GUTTER

Cyfoeth Naturiol Cymru
Natural Resources Wales

Maintenance at Rhyl Cut and Prestatyn Gutter

Overview

version 1.2 | 17 October 2022

digital version with links recommended

We have produced this document to help the public and other parties understand what we maintain and why.

We have taken an evidence-based approach using detailed hydraulic modelling. Flooding in Rhyl and Prestatyn is complex and can be from many sources. While river maintenance generally reduces flood risk, there are places where channel maintenance in one area could make flooding worse in another area.

Rhyl Cut and Prestatyn Gutter are split into reaches and each reach has a separate maintenance summary sheet. Public safety measures on NRW structures will be inspected annually and maintained or improved as necessary.

maintenance responsibilities

incident reporting and flood risk info

riverbed level management

Reach	Location
R1	Prestatyn Gutter confluence to Ffordd Penrhwylfa
R2	Ffordd Penrhwylfa to Maes Gwilym
R3	Rhyl Pumping Station leg
R4	Railway culvert to Tynewedd Road
R5	Tynewydd Road to Grange Road
R6	Grange Road to Vale Road
R7	Vale Road to Ffordd Las
R8	Ffordd Las to Rhyl outfall sluice
R9	Rhyl outfall sluice to River Clwyd
P1	Rhyd Farm to Pwll-Y-Bont
P2	Pwll-Y-Bont to Fforddisa
P3	Fforddisa to Rhyl Cut confluence
P4	Rhyl Cut to Sandy Lane railway culvert
P5	Sandy Lane railway culvert to Bastion Road
P6	Bastion Road to Barkby Avenue
P7	Barkby Avenue to Gronant Pumping Station
P8	Gronant Pumping Station to coast

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Maintenance at Rhyl Cut and Prestatyn Gutter

Maintenance Responsibilities

Natural Resources Wales is the risk management authority for 'main rivers'. Main rivers are usually larger streams and rivers, but some of them are small watercourses of significance (main river map). All other watercourses are classed as 'ordinary watercourses'. The Local Authority has a similar role for 'ordinary watercourses'.

If you own property alongside a watercourse, the likelihood is you are a 'riparian owner'. Responsibilities of riparian owners include: maintaining riverbeds and banks, allowing the flow of water to pass without obstruction, and controlling invasive species such as Japanese knotweed.
A guide to your rights and responsibilities of riverside ownership in Wales

NRW can utilise Permissive Powers under the Water Resources (1991) Act to carry out maintenance, improvement, or construction work for the purpose of managing flood risk. The decision to utilise permissive powers depends on a number of factors, including: property numbers at risk, mechanisms of flooding (frequency, depth, speed of inundation etc.), environmental impact, and local and national strategy & guidance. NRW will often remove large blockages from main river channels, and we request that the public report major blockages. NRW will also manage invasive non-native species (INNS) where there is an impact on flood risk maintenance. All necessary licences and permits will be obtained.

The responsibility for a selection of other maintenance activities and incidents that we do not deal with are highlighted below.

Maintenance Activity	Responsibility
Clearance of drains/ditches	Riparian landowner
River erosion	Riparian landowner
Litter picking	Landowner or Denbighshire County Council
Dog mess	Landowner or Denbighshire County Council
Amenity vegetation management	Landowner or Denbighshire County Council
Other outfall maintenance	Asset owner (Dŵr Cymru Welsh Water, Denbighshire County Council, private)

Incidents We Do Not Deal With

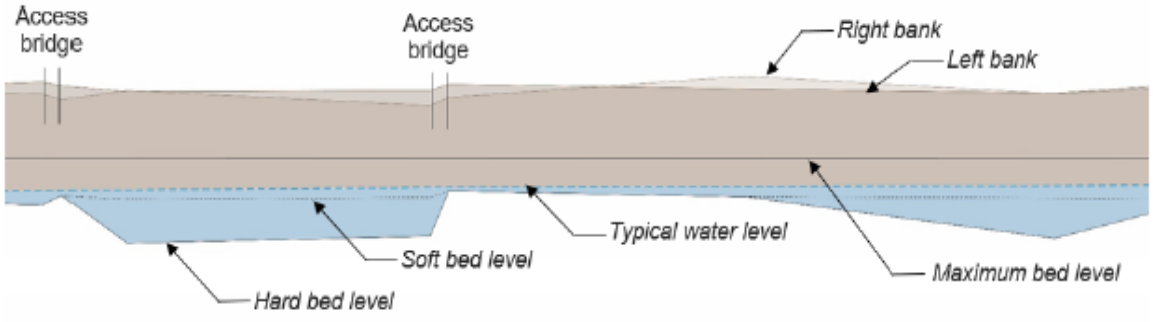
- road and highway drainage maintenance
- blocked domestic drains and sewers
- burst water mains
- discolouration or other drinking water problems
- fly-tipping of household rubbish
- vermin and infestations
- dead animals (unless potentially leading to flooding)
- domestic noise nuisance
- odours from domestic or small commercial premises
- burning of domestic or garden waste
- smoke emissions from vehicles

Maintenance at Rhyl Cut and Prestatyn Gutter

Riverbed Level Management

We have completed modelling of a range of riverbed levels from the lowest to the highest levels recorded since the 1960s. Property flooding is sensitive to riverbed levels in some places, while in other areas bed levels have no significant impact on main river flooding and raised bed levels can even reduce flood risk downstream.

A long section is provided on the maintenance summary sheet for each reach (except R3 and P8 where not available). See example long section below with key features. The right and left bank are as viewed when looking downstream.



Current soft riverbed levels (top level of soft silt/sand) and hard riverbed levels (top level of hard gravels/rock) are generally based on the most recent topographical survey undertaken in 2018, with older data used to infill gaps. The long sections may therefore not be fully up to date, but a selection of spot checks was undertaken at key locations in 2021.

The maximum bed level is the highest level that the surface of the soft bed can reach before there is a significant impact on flooding of properties. We will monitor riverbed levels and will plan removal of riverbed material when the maximum bed level is reached.

In many places drainage into the watercourses could be affected by silt levels. In these locations, the maximum bed level is often set by the invert level of outfalls. The main outfalls into the watercourses are shown on the long sections but not all outfalls have been surveyed.

For information about dredging and deshoaling click here.

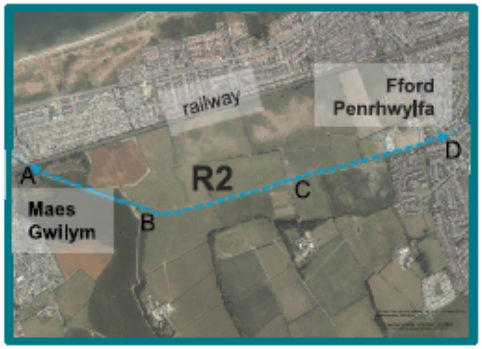
Cyfoeth Naturiol Cymru Natural Resources Wales

Maintenance at Rhyl Cut and Prestatyn Gutter

Rhyl Cut R2

Ffordd Penrhwylfa to Maes Gwilym

Main River Flood Risk Summary	There is no significant flood risk to properties from Rhyl Cut but there is flooding of farmland, in particular to the south of the cut. Properties around Maes-Y-Gog and Lon Hedyn are at risk of flooding from Maes Gwilym (MG) drain.
Current River Condition	Rhyl Cut is currently in good (if unnatural) condition with channel clearance undertaken relatively frequently. There can be substantial invasive weed growth. There could be significant benefits if the river was restored to a more natural state. Maes Gwilym drain is currently in reasonably good condition, except for a culvert under the railway which is partially collapsed (see impact below).
Maintenance Impacts	Maintaining the Rhyl Cut in this reach has no significant impact on property flooding from the main river. Reducing maintenance will lead to some additional flooding of farmland to the south and north of the cut. Drainage could be affected by silt levels. Maes Gwilym drain channel vegetation and raised bed levels increase flood risk. Maes Gwilym drain railway culvert increases flood risk downstream and will therefore not be maintained.



NRW Maintenance Activity	Main Constraints	Frequency
channel vegetation and weed clearance	bird nesting, water vole habitat	Rhyl Cut: partial clearance 5 yearly or as required for silt clearance Maes Gwilym drain: partial clearance annually (Sep/Oct)
bankside tree and hedge management	bird nesting, bats	Rhyl Cut: 5 yearly or as required for silt clearance Maes Gwilym drain: annually (Jan/Feb)
channel blockage removal	biosecurity, hazardous waste	Rhyl Cut: not required (riparian responsibility) Maes Gwilym drain: reactively before heavy rain
riverbed level management	fish spawning, water vole habitat	annual monitoring (both watercourses)

No long section available for Maes Gwilym drain. Max bed level to minimise reduction in capacity of culverts and other crossings.

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Maintenance at Rhyl Cut and Prestatyn Gutter

Rhyl Cut R3

Rhyl Pumping Station leg	
Main River Flood Risk Summary	There is no significant risk of flooding from Rhyl Cut in this reach but high water levels could affect properties in reach R4. A few caravans are at risk of flooding during infrequent floods (above approximately 1 in 30 annual chance).
Current River Condition	The river is currently in good condition with channel clearance undertaken relatively frequently. The left hand bore of the Ash Grove culvert upstream is partially blocked but the culvert has spare capacity.
Maintenance Impacts	Rhyl Pumping Station will continue to be operated and maintained (subject to pumping station review and impact of set-back sea defences), as it reduces flood risk to a large area and lots of properties. Maintaining the river channel in this reach has minimal impact on main river flooding but some clearance is required for Rhyl pumping station to operate effectively. Drainage could also be affected by silt levels.

NRW Maintenance Activity	Main Constraints	Frequency
channel vegetation and weed clearance	bird nesting, water vole habitat	partial clearance annually (Sep/Oct)
channel blockage removal	biosecurity, hazardous waste	reactively before heavy rain
Rhyl Pumping Station debris screen clearance	biosecurity, hazardous waste	weekly and before heavy rain
riverbed level management	fish spawning, water vole habitat	annual monitoring

No long section available for Rhyl Pumping Station leg. Max bed level of 2.13m AOD at pumping station culvert inlet (50mm above pumping station debris screen lip); max bed level of 2.32m AOD in at least one pipe of the Ash Grove culvert (200mm above invert).

Maintenance at Rhyl Cut and Prestatyn Gutter

Rhyl Cut R4

Maes Gwilym to Tynewedd Road	
Main River Flood Risk Summary	The highest point of Rhyl Cut is near Brynhedydd Road and can therefore flow in both directions along this reach. Properties near Brynhedydd Road and Edgbaston Road and some caravans are at risk of flooding during infrequent floods (above approximately 1 in 30 annual chance) from both Rhyl Cut and Fron Hall drain.
Current River Condition	This reach of Rhyl Cut and Fron Hall drain are in fair condition but there has been siltation between Tynewydd Road and Brynhedydd Road which requires clearance. Maintenance is difficult due to poor access in some locations along both watercourses.
Maintenance Impacts	Maintaining conveyance along this reach of Rhyl Cut slightly reduces the extent of flooding and reduces peak water levels, which may benefit incoming drainage; drainage could also be affected by silt levels. Channel vegetation and raised bed levels along Fron Hall drain increases flood risk.

NRW Maintenance Activity	Main Constraints	Frequency
channel vegetation and weed clearance	access, bird nesting, water vole habitat	Railway Culvert to Fron Hall drain: partial clearance annually (Sep/Oct) Fron Hall drain to Tynewydd Road: twice annually (Jun/Jul and Sep/Oct)
bankside tree and hedge management	access, bird nesting, bats	Rhyl Cut and Fron Hall drain: annually (Jan/Feb)
channel blockage removal	access, biosecurity, hazardous waste	Rhyl Cut and Fron Hall drain: reactively before heavy rain
riverbed level management	access, fish spawning, water vole habitat	Rhyl Cut and Fron Hall drain: annual monitoring (clearance currently required)

No long section available for Fron Hall drain. Max bed level to minimise reduction in capacity of culverts and other crossings.