Monmouthshire County Council

Flood and Water Management Act 2010

Section 19 Flood Investigation Report

Llanwenarth

February 2020

Version: FINAL

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Contents

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Final	J. Woodier (Assistant Engineer)	R. Price (Project Engineer)	M. Hand (Head of Placemaking, Housing, Highways and Flooding)	July 2021

1. Executive Summary

In accordance with Section 19 of the Flood and Water Management Act 2010 Monmouthshire County Council (MCC) has a duty as Lead Local Flood Authority to investigate flooding within its area, insofar as it considers it necessary or appropriate. This report has been prepared specifically for the purpose of meeting the requirements of Section 19 and provides a factual account of the flood event that occurred in the early morning of Sunday 16th February 2020 at Llanwenarth, Monmouthshire.

On the 15th and 16th February, a period of heavy rain (Storm Dennis) fell on already saturated ground resulting in significant flooding in the low-lying alluvial plain of Llanwenarth. The flooding affected the majority of the Llanwenarth plain, with significant internal flooding to nine residential properties, two farms, a church, and a caravan site.

It has been established that the primary mechanism of flooding was from the River Usk which overtopped a historical un-adopted flood embankment (considered by NRW to be a private embankment) following persistent and heavy rainfall. Reports from residents suggest that the overtopping occurred at around 3am on 16th February and indicate that water levels continued to rise until around 2pm the same day, after which they then receded. The event caused the failure of a section of the embankment some 40 m in length, leaving in its place a crater of at least 3 m in depth. It is surmised that the embankment failed, and a crater formed as a result of scouring action as water overtopped the embankment. Minor damage was also caused to other sections of the embankment.

Following the flood event officers from MCC's Highways and Flood Risk Management Team visited the locations affected by flooding and collated information on the event from residents and landowners to gain an understanding of the nature of the flooding. It quickly became apparent that the partial failure of the embankment had left residents of Llanwenarth at increased risk of flooding. After representations from MCC, Natural Resources Wales (NRW) and elected representatives, Welsh Government, acting through the South Wales Trunk Road Agent, instructed emergency repair of the embankment by Alun Griffiths (Contractors) Limited.

Emergency repair works commenced on 28th February 2020. The works were hampered by further elevated water levels in the River Usk triggered by heavy rainfall on 28th and 29th February (Storm Jorge). The River Usk again overtopped its bank and water flowed through the breach in the embankment. The emergency repair works were complete by 5th March.

Information has been shared between MCC, as the Lead Local Flood Authority, and NRW, as the Risk Management Authority with powers to manage flood risk from the River Usk (a Main River). Additional supporting information on the weather patterns and rainfall at the time of the event has also been gathered from the Met Office.

To reduce the impact of future flood events, the report has made recommendations regarding future maintenance of the flood embankment.

2. Introduction

2.1 Purpose of Investigation

On 15th and 16th February 2020, following an already wet winter, Monmouthshire and the surrounding counties of South Wales were impacted by a significant weather event which resulted in heavy and prolonged rainfall across much of the county and in the counties to the north and the west (the upper catchments of the River Usk).

The heavy rainfall event resulted in significant flooding in many areas across Monmouthshire. This report will focus on the flooding caused by the River Usk on the alluvial plain of Llanwenarth Citra. Flooding caused by Ordinary Watercourses on the lower slopes of the Sugar Loaf mountain during the same period is not addressed by this report.

The reason for Monmouthshire County Council's (MCC) investigation is in response to the duties of the local authority in regard to Section 19 of the Flood and Water Management Act 2010, which states:

(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 Site Location

Llanwenarth Citra is located to the west of Abergavenny, in the north-west of Monmouthshire. The affected area is an alluvial plain to the north of the River Usk. At this location the Usk runs along the southern margin of the alluvial plain. The plain is primarily occupied by open fields, the majority of which are normally grazed. A single highway (Llanwenarth Church Road) runs east to west across the plain, terminating at either end with junctions to the A40 Brecon Road (trunk). The plain is defined to the north by the A40 which sits at the base of the lowest slopes of the Sugar Loaf Mountain, to the west by a meander of the River Usk as it moves from the north of the plain to the south, and to the east by an area of slightly higher ground around Red Barn Farm (Glaciofluvial Sheet Deposits).

Two working farms with farm buildings and houses are located in the west of the plain. Mardy Farm and Dyffryn Farm are operated as a single unit which includes two farmhouses which are occupied by different generations of the same family. Pyscodlyn Farm is located at the northern margin of the plain, as land slopes upwards to the Sugar Loaf. Accommodation here is understood to be spilt to accommodate different generations of the same family. As well as being a working farm, Pyscodlyn Farm operates a caravan site. During the winter this is not open for visitors but a number of caravans are stored on the site.

To the east, a total of eight further houses are spread along Llanwenarth Church Road. These include a cluster of three houses at Lower House Farm and a grouping of three houses either side of Saint Peters Church (14th Century, rebuilt 19th Century, Grade 2* listed). Further again to the east, four houses are located slightly above the level of the plain as slopes rise onto Alluvial Fan Deposits which underlie the western part of Abergavenny.

The plain is drained by a number of ditches and by the Nant Iago, a watercourse originating high on Sugar Loaf Mountain that crosses the eastern end of the plain. The plain is also crossed by a one metre diameter flood relief culvert for the Afon Cibi which discharges into the River Usk in the south-east of the plain. This culvert is maintained by NRW with the purpose of protecting Abergavenny from high flows. The Nant Iago, the Afon Cibi relief culvert and a small watercourse flowing alongside Llanwenarth Church Road (known as Llanwenarth Church Stream) are designated Main Rivers.

The River Usk upstream of Llanwenarth has a catchment of approximately 810 km² which is predominately rural in nature. The main tributaries of the River Usk above Llanwenarth are the Afon Hydfer, the Afon Crai, the Afon Senni, the Afon Cilieni, the Nant Bran, the Afon Ysgir, the Afon Tarrel, the Afon Honddu, the Afon Cynrig, the Nant Menasgin, the Caerfanell (which is dammed to form Talybont Reservoir), the Afon Crawnon, the Rhiangoll, the Grwyne Fawr and the Clydach. The nearest upstream bridge is a Bailey bridge at Glangrwyney, two kilometres to the west. The nearest downstream bridge is the Llanfoist Bridge, a multiple stone arch structure located one kilometre to the south-east.

A rudimentary but extensive flood defence embankment is situated at the western edge of the Llanwenarth plain. The flood embankment follows the line of the meandering river south from its northern extent close to the A40 and then turns east-south-east to follow what appears to be the line of a natural river terrace. The total length of the embankment is 1.6 km with a typical height of around 1.5 m. The embankment appears to be primarily formed of soil, with rubble and fragments of concrete visible in some sections. It stands entirely on private land in the same ownership as Mardy Farm. Historical maps indicate that the embankment has been present since at least 1901. The embankment is not known to have been inspected or maintained at any previous stage by either NRW or MCC.

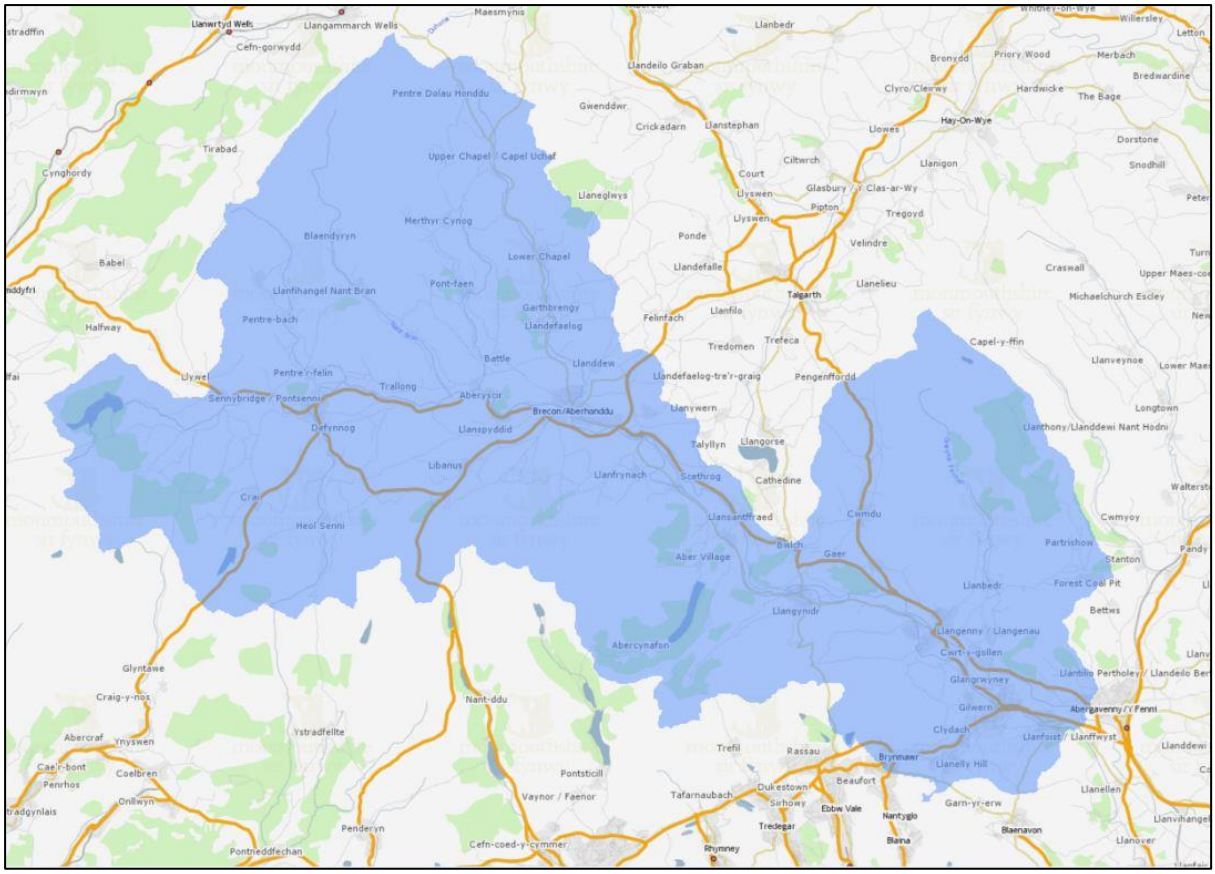


Figure 1: Location Plan (River Usk Catchment shown in Blue)

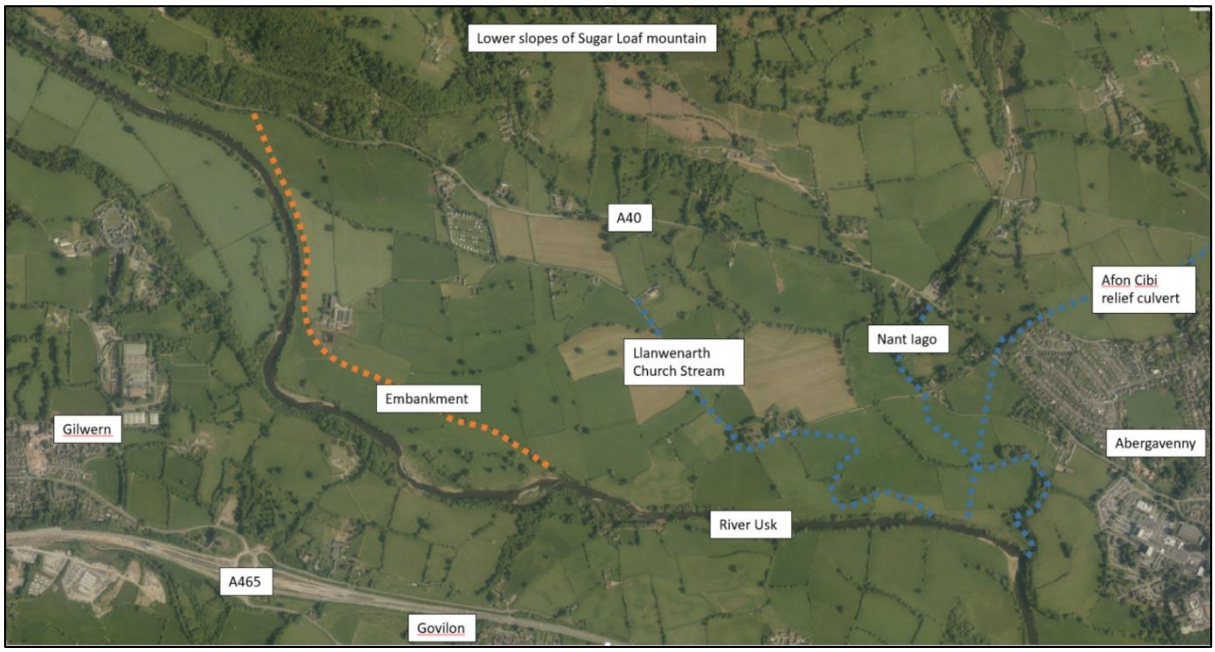


Figure 2: Llanwenarth aerial view with Main Rivers and embankment indicated.

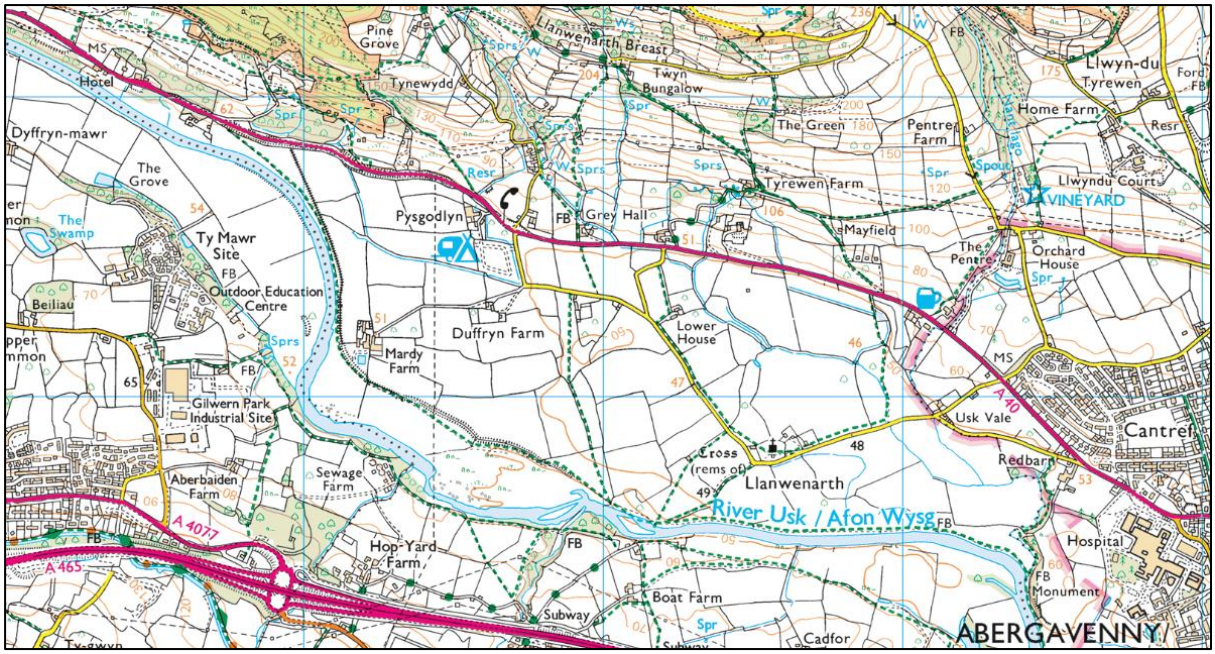


Figure 3: Ordnance Survey 1:25,000 scale mapping

Natural Resources Wales (NRW) flood maps show the majority of the Llanwenarth plain as being at High risk of flooding, mainly from the River Usk. High means that each year, this area has a chance of flooding of greater than 1 in 30 (3.3%). Localised areas, mostly remote from buildings are shown to be at Low to High risk from surface water flooding. Extracts from the flood maps are shown in Figures 4 and 5 below.

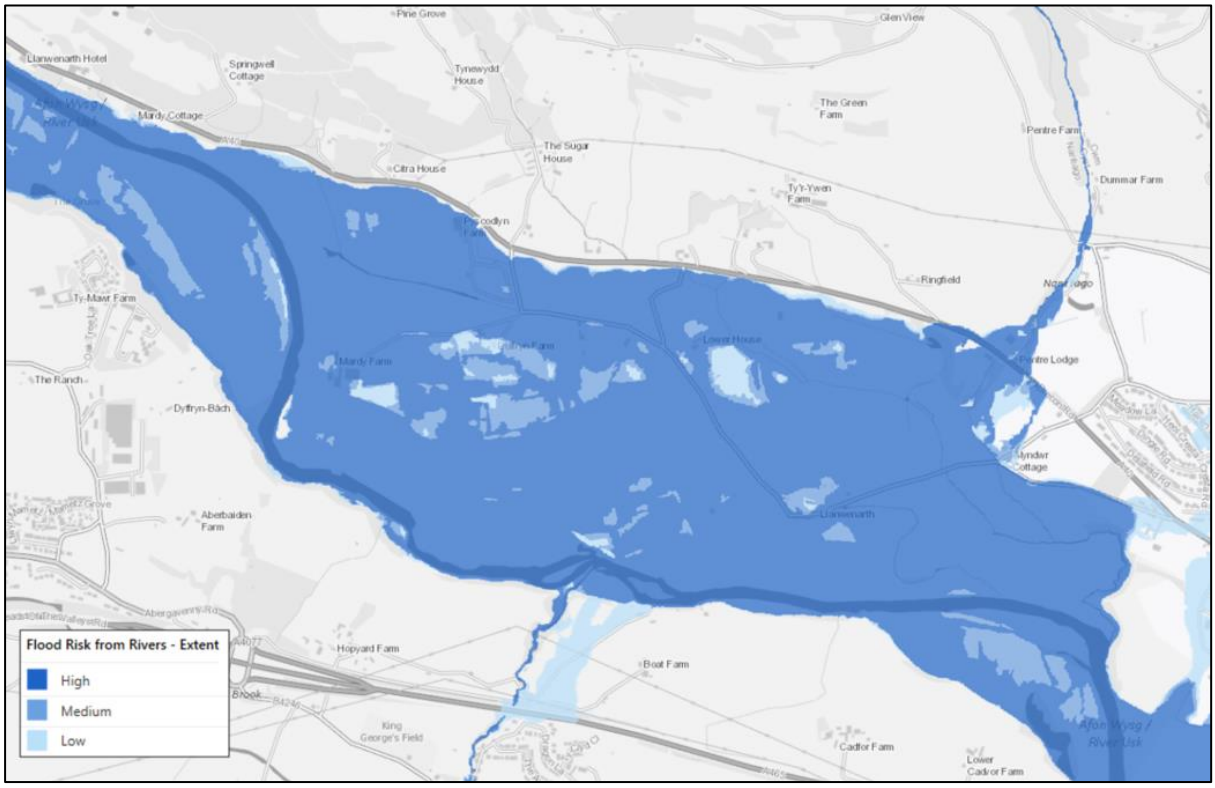


Figure 4: Extract from Natural Resources Wales Flood Map showing Risk of Flooding from Rivers

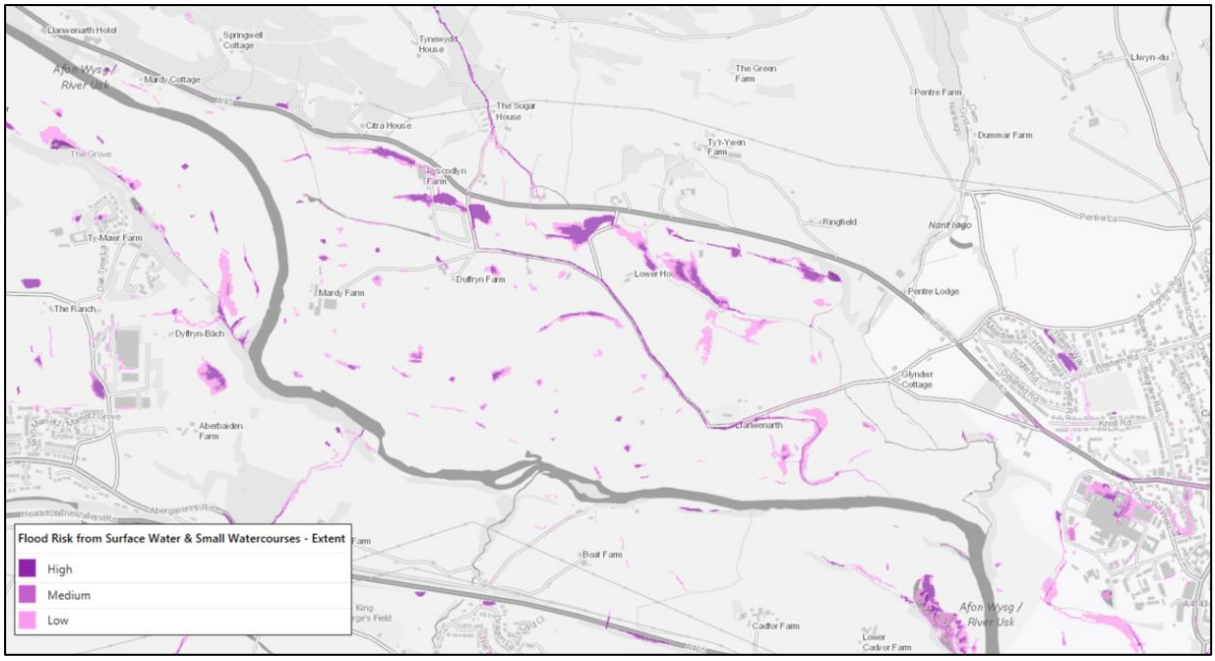


Figure 5: Extract from Natural Resources Wales Flood Map showing Risk of Flooding from Surface Water and Small Watercourses

2.3 Investigation Evidence

To support the investigation a range of qualitative and quantitative evidence has been gathered from numerous sources, the summary of which is listed below:

- Residents – photos, statements, written correspondence
- Surveys – site inspections
- Met Office Data – Weather warnings and reviews
- Natural Resources Wales – river gauge data
- Natural Resources Wales – rain gauges
- Monmouthshire County Council – Flood Risk Management Plan

3. Flooding History

3.1 Previous Flood Incidents

Monmouthshire County Council hold little information on previous flood events in Llanwenarth. Residents report that the previous flood event of a similar magnitude occurred in December 1979. On this occasion it is understood that the flood embankment at Mardy Farm was overtopped and damaged and a number of homes were flooded. Residents report that the failure occurred in a location where the embankment had recently been disturbed by the installation of a gas pipe (further north than the recent failure) and that the repairs to the embankment were consequently undertaken by the gas board shortly after the flood event.

Several of the homes on the Llanwenarth plain are fitted with property level resilience measures (such as flood gates). It is understood that Pant yr Onen Cottages (two flats) were previously re-built at a raised level to reduce flood risk.

Smaller scale flood events are understood to occur frequently, with inundation of fields and Llanwenarth Church Road occurring most years. These events (typically below 5.00 m on the Llanfoist gauge) are not thought to normally flood homes.

3.2 Flood Incident

Following an already wet winter, on the morning of Tuesday 11th February the Met Office issued a Yellow Warning for Rain anticipated to fall between midday on Saturday 15th February and midday on Sunday 16th February covering most of Wales, including the westernmost part of Monmouthshire and much of the upper catchment of the River Usk. On the morning of Wednesday 12th February this Yellow Warning was updated to include the whole of Monmouthshire and the English counties of Herefordshire and Gloucestershire to the east. On the morning of Thursday 13th February the Met Office issued an Amber Warning for Rain covering the western part of Monmouthshire and much of the upper catchment of the River Usk. Further amber warnings included much of Powys.

Heavy and persistent rain fell across much of south and mid Wales from 06:30 on the morning of Saturday 15th February to 06:30 on the morning of Sunday 16th February. The rainfall gauge at Tal y Maes in the Grwyne Fechan Valley of the Black Mountains recorded a rainfall of 79 mm over these 24 hours.

In the morning of 15th February levels in the River Usk, as measured by the NRW gauge at Llanfoist Bridge began to rise from the upper bound of normal levels (around 1.8 m) at 08:00. At 12:31 a Flood Alert was issued by NRW forecasting a predicted peak level of between 5.0 and 5.2 m. At 16:35 a Flood Warning was issued predicting a peak level between 4.9 and 5.1 m. The Usk continued to rise throughout the night and reached a peak at 5.67 m at 09:30 on 16th February.

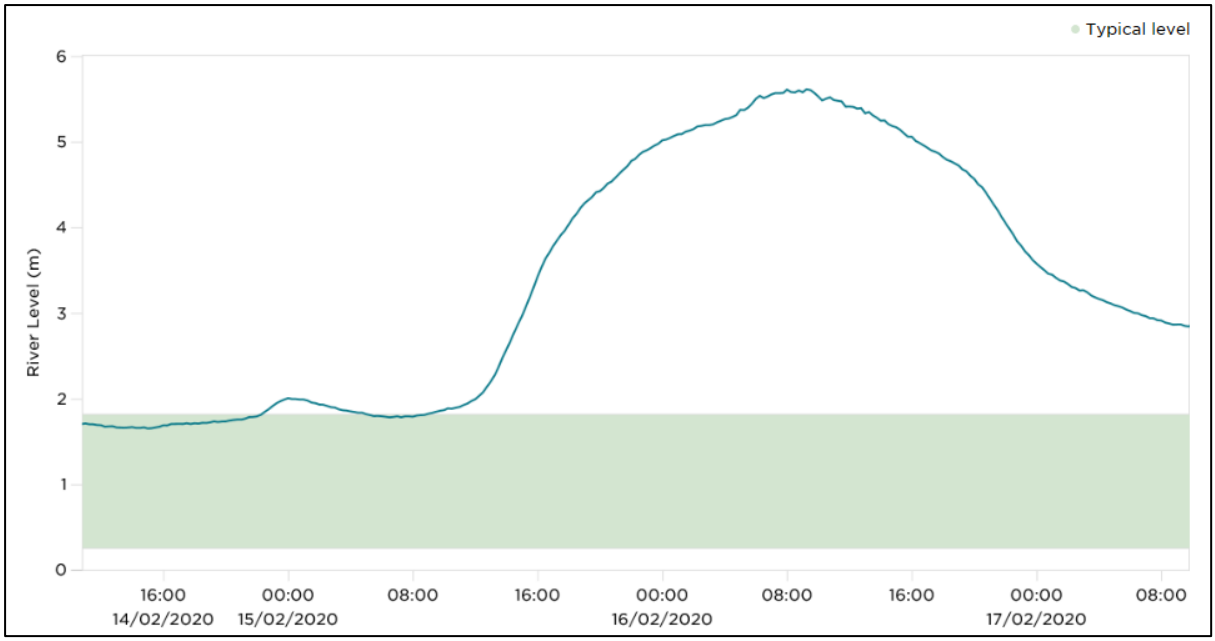


Figure 6: Extract from Natural Resources Wales' river level data for the Usk at Llanfoist Bridge.

Residents of Mardy Farm in the west of Llanwenarth report that around 03:00 on 16th February houses in the west of Llanwenarth were swiftly inundated by flood water which reached a depth of 2 feet in the farmhouse. This time is likely to coincide with overtopping and subsequent breaching of the flood embankment (which is situated 75 m to the west). The embankment was breached in two main locations, both close to Mardy Farm.

One breach caused the formation of a crater at least 3 m in depth and approximately 40 m in width. It is assumed the crater was formed by turbulence forces during overtopping of the bund. The other breach, some 50 m to the south measured some 80 m in length. At this location a large proportion of the bund was scoured away but no crater was formed. Evidence of a further small amount of localised overtopping, without significant damage, was identified towards the northern end of the embankment, close to the A40.

Photo 1: The crater in the flood embankment.

Photo 2: The crater in the flood embankment showing a trail of cobbles running across the field. Buildings of Mardy Farm are obscured by evergreen trees at the right hand side of the picture.

Photo 3: The southern breach in the flood embankment.

Photo 4: Overtopping of the northern part of the flood embankment continuing at 11:52 am on Sunday 16th February 2020.

Further to the east, Pyscodlyn Caravan Park was inundated, with significant damage caused to in the region of 40 caravans stored at the car park over winter. Of 12 residences in the Llanwenarth plain, 3 escaped internal flooding, 2 suffered partial internal flooding, and 7 suffered full internal flooding. In addition St Peters Church and the farm buildings of Mardy Farm suffered significant internal flooding. Various other outbuildings and small agricultural buildings were also flooded. Residents report flows of water generally coming from the direction of the breached embankment.

Water levels peaked at around 09:30 on Sunday 16th February at a level of 5.67 m on the Llanfoist Bridge gauge. This is the highest level recorded on this gauge (installed 1994). NRW report that gauges installed earlier (Chainbridge and Llandetty) recorded their highest levels since 1979. Following the peak at 09:15 the level of the River Usk gradually fell and flood waters receded. A photograph provided by one of the residents shows that the northern part of the flood embankment continued to overtop until and beyond 11:52. The level on the Llanfoist Bridge gauge at 11:45 was 5.41 m.

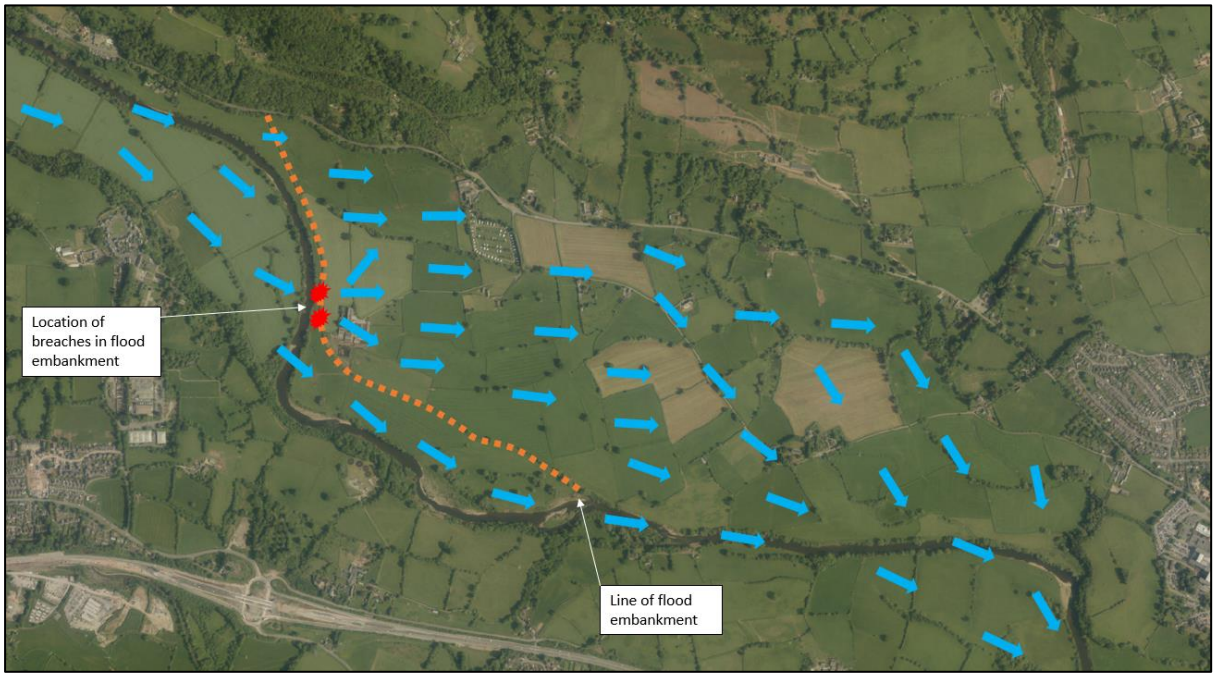


Figure 7: Indicative overland flow path based on evidence obtained by the LLFA. This diagram is highly conjectural as no modelling taking into account the flood embankment has been undertaken.

In the days following the flood event representatives of MCC spoke and corresponded with representatives of NRW. It became clear that neither body had significant knowledge of the flood embankment nor had previously been involved in its inspection or repair. In addition, neither body had the capability to make emergency repairs. Following representations from MCC and elected representatives Welsh Government instructed the South Wales Trunk Road Agent (SWTRA) to commission Alun Griffiths (Contractors) Limited to repair the existing bund.

Alun Griffiths (Contractors) Limited repaired the damaged and destroyed sections of the embankment with imported clay to a design based roughly on works undertaken for NRW on a flood bund at another site.

Repair works commenced on 28th February. Works were hampered when shortly after works commenced, on 29th February, the Usk rose again and poured through the hole in the bund, scouring out much of the material which had been placed to fill the crater. The contractors were alert to the rising river level and had moved plant to a safe location so work could start immediately after water levels had receded. Repair works were completed by 5th March.

The following table of observations has been prepared to gain an initial understanding of the protection which may be offered by the embankment.

Level at Llanfoist	Date and time	Observation
5.67 m	16/02/2020 09:30	Highest recorded level. Breach present and water overtopping bund.
5.45 m	16/02/2020 11:45	Breach present and water overtopping bund.
5.18 m	26/10/2019 19:00	No breach present. Likely overtop.
5.00 m	21/01/2021 04:45	Water just starting to overtop bund.
4.94 m	20/02/2021 12:00	Water just starting to overtop bund.
Bund begins to overtop at a level between 4.39 m and 4.94 m		
4.39 m	15/01/2020 01:15	No breach present. Water not overtopping bund.
4.21 m	29/02/2020 10:30	Water flowing through breach.
River reaches base of bund at a level between 3.64 m and 4.21 m.		
3.64 m	24/02/2020 17:15	Breach present. Water not flowing through breach.

Table 1: Comparison of gauged water levels with observations at the flood embankment (levels of subsequent events have been added for reference).

The following table lists flood events recording river levels on the Llanfoist gauge of 4.00 m or over between October 2008 and October 2020. These are events where, based on the empirical information above, the flood embankment appears to provide some level of protection to the Llanwenarth plain. 21 such events are recorded over the 12 year period.

List of flood events over 4.00 m between October 2008 and October 2020	
Date	**Peak level at Llanfoist**
10/11/2008	4.32 m
16/01/2010	4.07 m
03/01/2012	4.43 m
29/12/2012	4.57 m
27/01/2013	4.62 m
30/01/2013	4.42 m
23/12/2013	4.84 m
30/12/2013	4.39 m
02/01/2014	4.23 m
09/02/2014	4.61 m
12/02/2014	4.17 m
15/01/2015	4.78 m
04/12/2015	4.26 m
30/12/2015	4.07 m
06/02/2016	4.26 m
13/10/2018	5.07 m
26/10/2019	5.17 m
15/01/2020	4.39 m
09/02/2020	4.03 m
16/02/2020	5.67 m
29/02/2020	4.21 m

Table 2: List of flood events reaching over 4.00 m on Llanfoist gauge between October 2008 and October 2020.

The above levels suggest that overtopping of the bund would have occurred on 13th October 2018 (5.07 m) and 26th October 2019 (5.17 m). This overtopping was not reported to MCC and it is possible that the overtopping passed un-noticed.

Photo 5: Part of the reinstated embankment on 7th March 2020.

Photo 6: Part of the reinstated embankment on 7th March 2020.

3.3 Rainfall Analysis

During February 2020, Wales experienced several noteworthy rainfall events on the back of a very wet autumn and winter period. The named storms, Ciara, Dennis and Jorge, affected Wales within a period of just four weeks, with record rainfall and river flows causing some of the most significant flooding impacts in Wales since the 1970's.

February 2020 was the wettest February on record in Wales and the UK as well as the fifth wettest month ever recorded.

Rainfall in the catchment areas of Wales during these events was of such intensity that many rivers reacted extremely quickly, reaching record levels and flows. Notably, catchments were already saturated from the previous months of near continuous rain.

Storm Ciara and the week preceding Storm Dennis

Storm Ciara (8th and 9th February) impacted the catchments of North Wales most severely. However, significant rainfall was still recorded in South Wales, particularly on the uplands of the Brecon Beacons and Black Mountains, both of which are within the catchment of the Usk. The Tal y Maes rainfall gauge in the Black Mountains recorded 38 mm of rainfall between 20:00 on 8th February and 16:15 on 9th February. Further smaller rainfall events continued in the week preceding Storm Dennis, including a rainfall of 31 mm on 13th February. In the seven days prior to Storm Dennis the gauge at Tal y Maes recorded 93 mm of rain. A similar rainfall pattern was observed elsewhere in the upper catchment of the Usk but with even higher amounts of rainfall. The rainfall gauge at Crai Reservoir recorded 174 mm over the seven days prior to Storm Dennis.

Storm Dennis

Storm Dennis (15th and 16th February) saw even heavier rainfall fall on the already saturated catchment of the Usk. The Tal y Maes rainfall gauge recorded 84 mm over the two days with even higher rainfall recorded higher in the catchment of the Usk. The rainfall gauge at Crai Reservoir recorded 152 mm over the two days.

Date	**Rainfall at Tal y Maes (mm)**
8th February (Storm Ciara)	6
9th February (Storm Ciara)	33
10th February	13
11th February	1
12th February	8
13th February	31
14th February	2
15th February (Storm Dennis)	55
16th February (Storm Dennis)	29
Total (8th to 16th February)	*177*

Table 3: Daily rainfall totals for the nine days up to and including 16th February 2020.

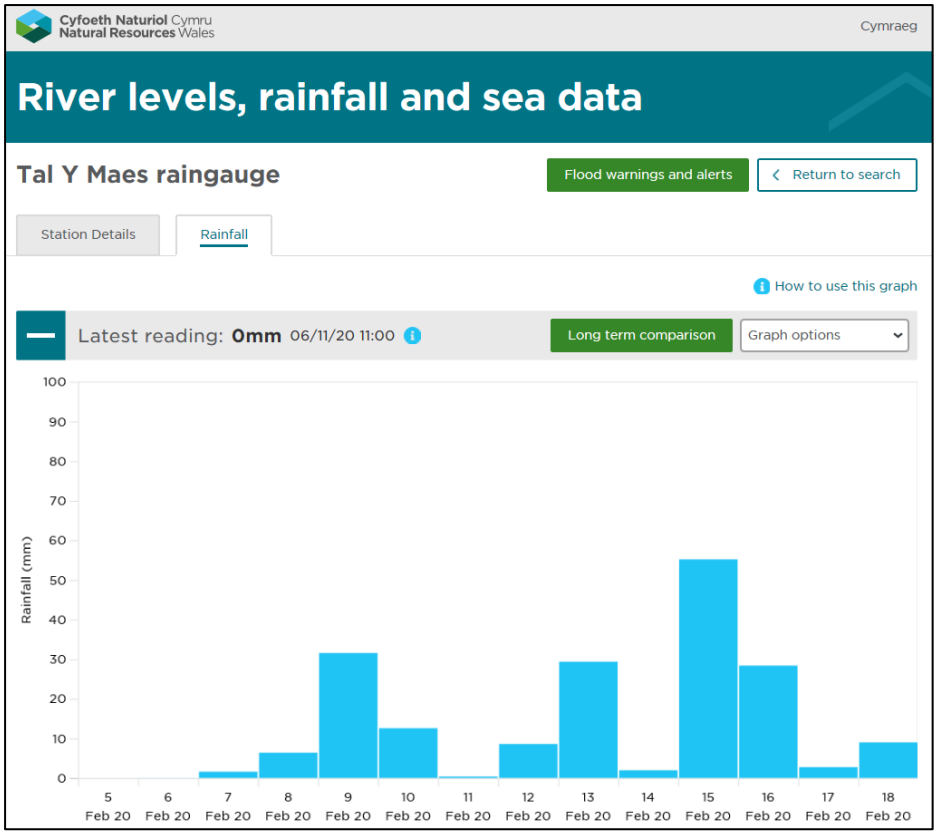


Figure 8: Rainfall gauge data from the Tal y Maes rain-gauge. 5th to 18th February 2020. Produced by NRW.

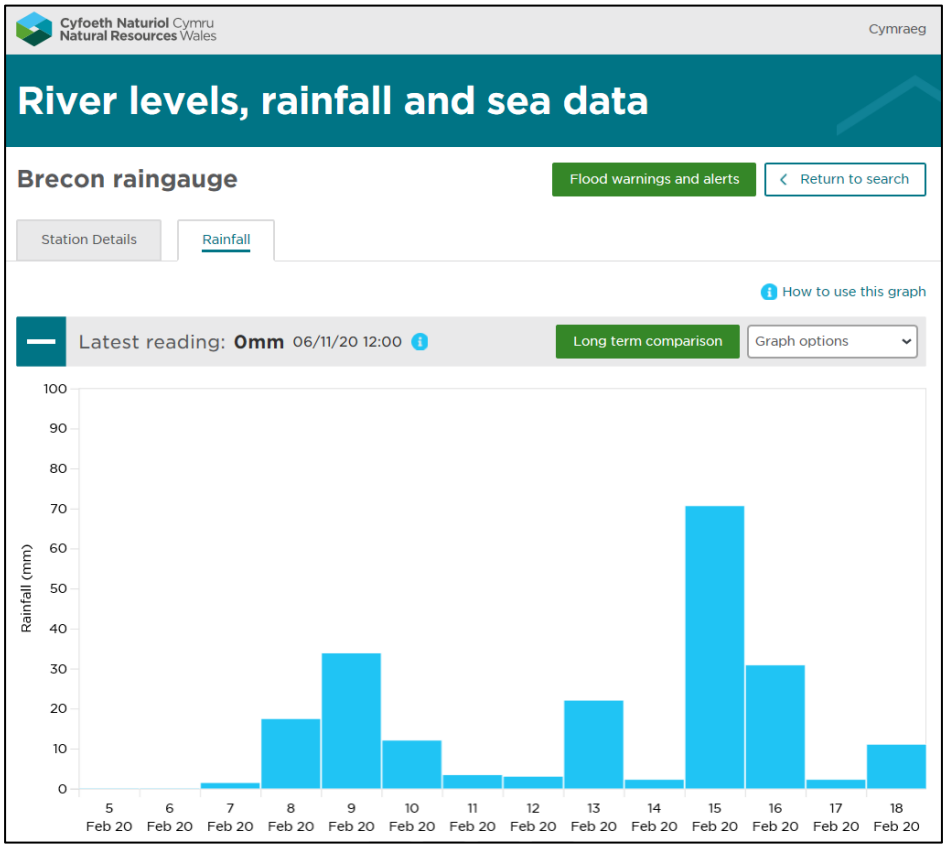


Figure 9: Rainfall gauge data from the Brecon rain-gauge. 5th to 18th February 2020. Produced by NRW.

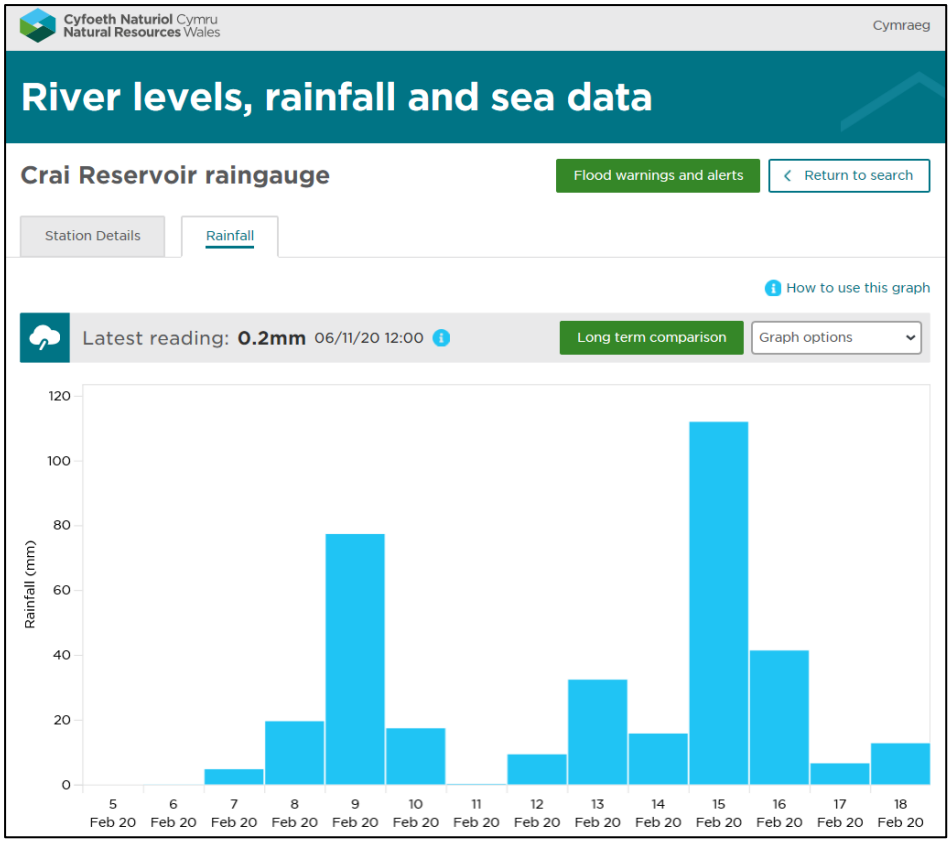


Figure 10: Rainfall gauge data from the Crai Reservoir rain-gauge. 5th to 18th February 2020. Produced by NRW.

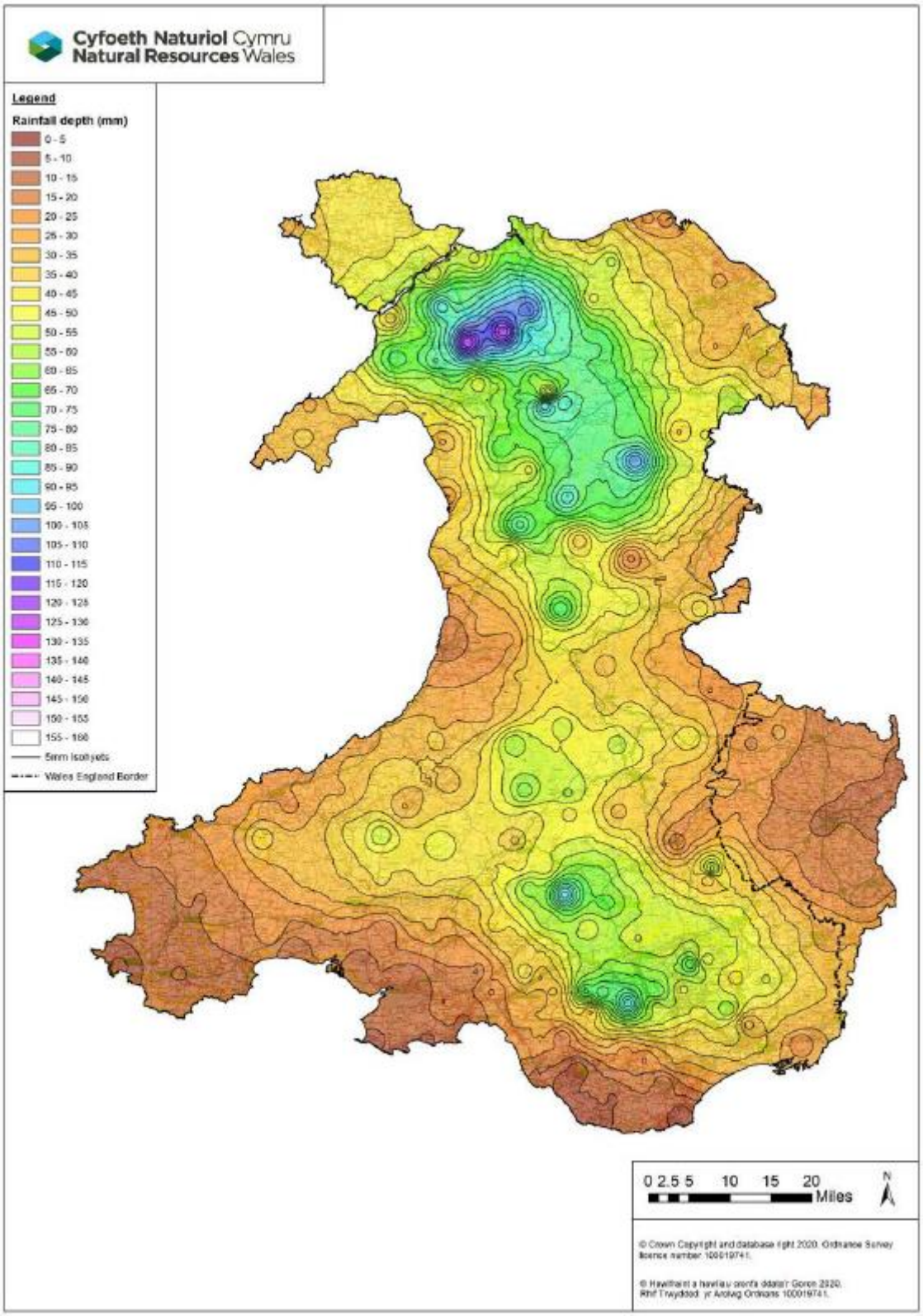


Figure 11: Rainfall Isohyet Map showing rainfall over a 48-hour period during Storm Ciara (produced by NRW).

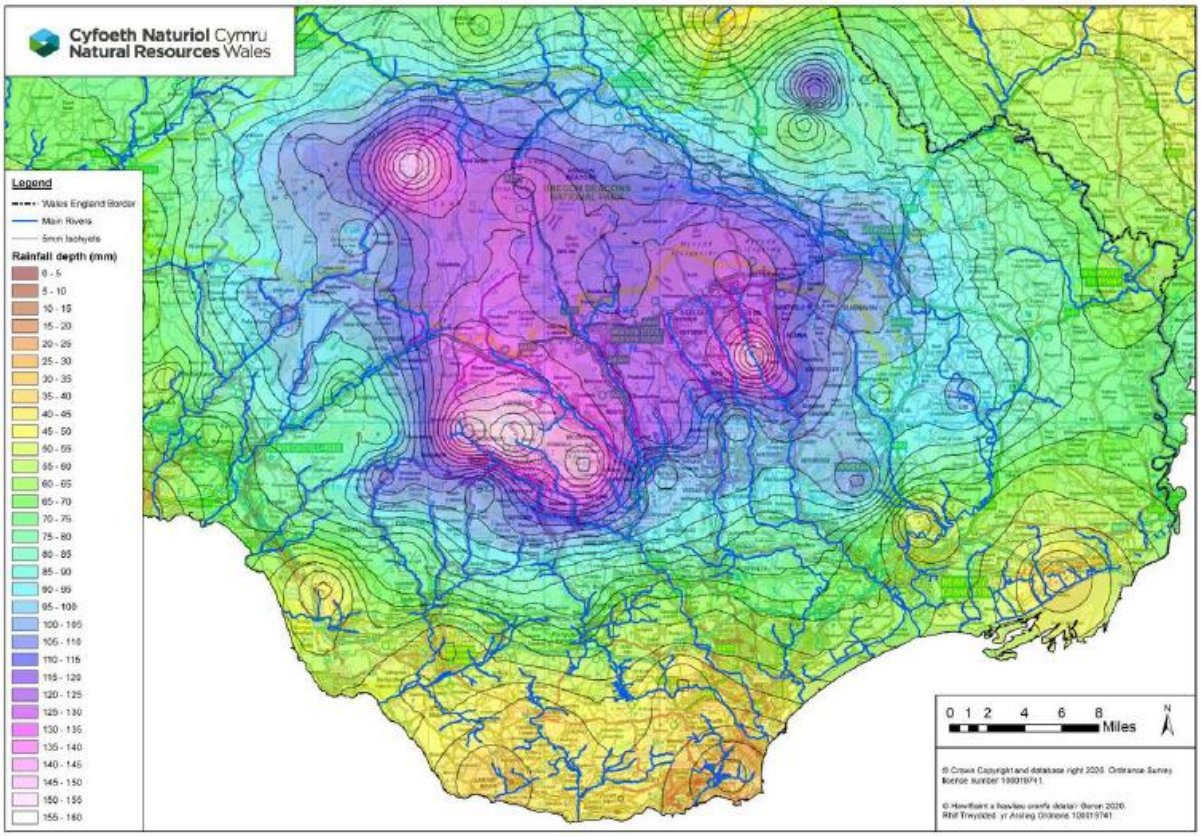


Figure 12: Rainfall Isohyet Map showing rainfall over a 48-hour period during Storm Dennis in South Wales (produced by NRW).

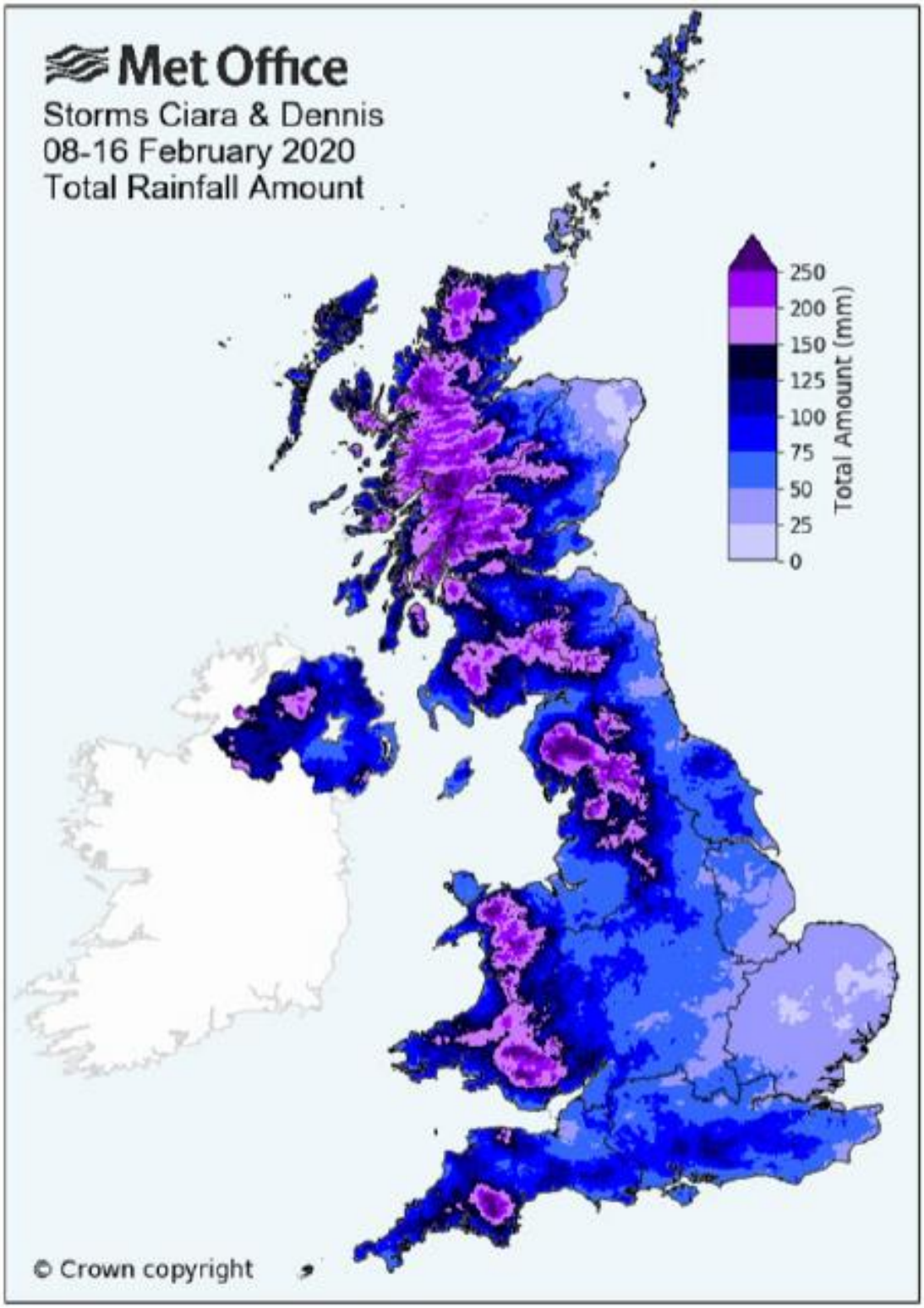


Figure 13: Total Rainfall amounts experienced during Storm Ciara and Dennis in the UK (produced by Met Office).

4 Mechanisms of Flooding

4.1 Fluvial Flooding

The mechanism of flooding at Llanwenarth appears to be relatively simple. The level of the River Usk reached a level high enough to overtop the flood embankment at Mardy Farm. Turbulent overtopping of the embankment caused significant scour which completely destroyed the embankment in one location and significantly damaged it close by. Water then flowed from west to east across the Llanwenarth plain. It is also likely that water overtopped the banks of the Usk onto the plain in the area to the east of the embankment. This is understood from residents to be the more frequent form of flooding of the plain, occurring when river levels are high but the flood embankment has not been overtopped or breached. Additional smaller flows would have also entered the plain from watercourses draining the Sugar Loaf mountain.

Photo 7: The flooded Llanwenarth Plain viewed from the north.

4.2 Land Drainage

There is a network of small watercourses (some of which are classified as Main River) and drainage ditches across the Llanwenarth plain. It is likely that prior to the main flood event these channels would have been full of water crossing the plain from the Sugar Loaf mountain. These systems are rapidly overwhelmed during large flood events and are not expected to manage additional out of bank flows from the River Usk.

4.3 Surface Water Drainage

Highway drainage in the Llanwenarth plain is largely accomplished by roadside ditches, part of the Land Drainage network described above. There is no significant system of piped drainage within the plain.

5 Rights and Responsibilities of Risk Management Authorities

5.1 Lead Local Flood Authority

Under the Flood and Water Management Act 2010, Monmouthshire County Council (MCC) has been established as the Lead Local Flood Risk Authority (LLFA) for its administrative area.

As defined in the Flood and Water Management Act 2010, MCC is responsible for 'Managing' what is termed, its 'local flood risk'. This includes the risk of flooding from ordinary watercourses, surface runoff and groundwater.

Local Authorities have always had certain responsibilities in relation to ordinary watercourses, and in practice most Local Authorities took the lead in dealing with surface water flooding incidents prior to the changes contained within the Flood and Water Management 2010.

The Flood and Water Management Act 2010 places a number of statutory duties on Local Authorities in their new role as LLFAs including:

- The preparation of local flood risk management strategies;
- A duty to comply with the National Strategy;
- To co-operate with other authorities, including sharing data;
- A duty to investigate all flooding within its area, insofar as a LLFA consider it necessary or appropriate;
- A duty to maintain a register of structures and features likely to affect flood risk;
- A duty to contribute to sustainable development; and
- Consenting powers on ordinary watercourses.

In addition to these, each LLFA has a number of permissive powers. These are powers that allow them to undertake certain activities to manage flood risk, they are discretionary and include:

- Powers to request information;
- Powers to designate certain structures or features that affect flood or coastal erosion risk;
- The expansion of powers to undertake works to include broader risk management actions; and
- The ability to cause flooding or coastal erosion under certain conditions.

LLFA's in Wales have also taken on the role of the SuDS Adopting and Approving Body in relation to sustainable drainage systems as of the 7th January 2019. In this role they are responsible for both approving the original design of the SuDS and adopting and maintaining the finished system in accordance with Welsh Government's National Standards for Sustainable Drainage.

The function of the LLFA during and after the flooding at Llanwenarth included a range of Response and Recovery functions:

- Officers investigated the initial flooding and have produced this report in line with Section 19 FWMA 2010. The flood team's initial site visit was on Tuesday 18th February and was followed by numerous further visits.

- Officers contacted residents affected by flooding to offer support and advice to assist in the recovery following the event and to ensure that residents were aware that there was a possibility of further flooding ahead of 29th February (Storm Jorge) when water flowed through the breached embankment.
- Sandbags were distributed ahead of Storm Jorge.

5.2 Natural Resources Wales

Under the Flood and Water Management Act 2010 and the Water Resources Act 1991, NRW has discretionary powers to manage the risk of flooding from main rivers and the sea. They are also recognised as a coastal erosion risk management authority under the Coast Protection Act 1949. The River Usk, Llanwenarth Church Stream, the Nant Iago, and the Afon Cibi relief culvert are all designated Main Rivers.

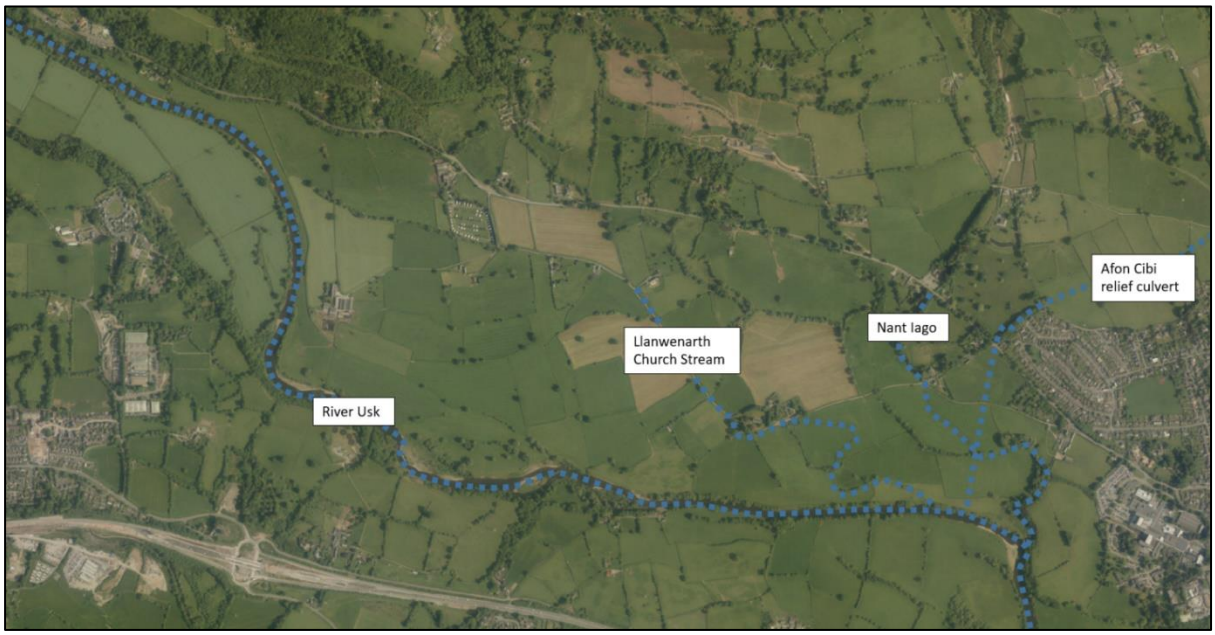


Figure 14: The Main Rivers of Llanwenarth.

Their strategic oversight role is about having a Wales-wide understanding of all sources of flooding, coastal erosion and the risks associated with them, on a consistent basis across Wales to help inform the RMAs and the public.

NRW is the internal drainage board, or carries out the functions of the internal drainage board, for the Internal Drainage Districts (IDDs) in Wales. It is granted powers under the Land Drainage Act 1991 to carry out works to manage the risk of flooding from ordinary watercourses and to regulate obstructions to ordinary watercourses within the IDD. Their main role is the management of water levels in ordinary watercourses for the purpose of reducing the risk from flooding. Llanwenarth is not close to or within an IDD.

5.3 Water / Sewerage Company

Sewerage Undertakers are responsible for maintaining the public sewerage systems, including adopted sewers carrying surface water run-off.

In flood conditions, the sewer systems can often become overloaded with a mixture of floodwater and sewage leading to overflow and flooding. Where applicable, Sewerage Undertakers are responsible for the removal of surface water from impermeable surfaces through their sewerage system. Where there is frequent and severe sewer flooding, Sewerage Undertakers are required to address this through their capital investment plans which are regulated by Ofwat. To prevent further flooding, water and sewer companies have a responsibility to: monitor the levels; prevent overloading sewer systems; maintain and repair drainage pipes as necessary. This investigation has not identified any assets or infrastructure belonging to a water or sewage company that may have contributed to the flood event.

Dwr Cymru Welsh Water (DCWW) is the water and sewage provider covering Monmouthshire and the remainder of the upstream catchment of the Usk. DCWW network plans show that they have no surface water, foul water, or combined sewage infrastructure in the Llanwenarth plain.

DCWW plans show that the Llanwenarth plain is served by a 110 mm HPPE water main which runs the full length of Llanwenarth Church Road. This investigation has not identified any suggestion or evidence that this main was in any way involved with the February flood event.

At least one resident has suggested that the flooding may have been influenced by release of water from DCWW's Talybont Reservoir. An enquiry was made with DCWW and a response dated 15th October 2020 and including gauge data from the reservoir was received. The response states that:

- The reservoir does not play a role in reducing flood risk at Llanwenarth
- During winter the reservoir is usually full. Excess water in the reservoir then travels down the spillway rather than overtopping the Dam and eroding the structure.
- The discharge capacity of the discharge valve at Talybont is relatively small (around 380 Ml/d with valves fully open) when compared with the NRW reported preliminary flow rate of over 60,000 Ml/d downstream of the reservoir on the River Usk at the Llandetty gauge.
- Normal flows from Talybont reservoir for February are 25Ml/d. These are classed as compensation releases legally controlled through abstraction licenses issued by NRW and specify the discharges that must be made. At the time of Storm Dennis DCWW also had a discharge consent in place with NRW to release up to 400Ml/d.

The highest rate of discharge recorded over the Nant Caerfanel Weir (measuring all flows immediately downstream of the reservoir) during February 2020 is around 650 Ml/d. This would account for just over one percent of the total flow in the Usk at Llandetty during Storm Dennis.

The full response from DCWW is included as Appendix B of this report.

5.4 Network Rail

Network Rail has an operational responsibility as a riparian owner and is required to undertake regular maintenance of all assets that pose a risk to flooding. This investigation has not identified any assets or infrastructure belonging to Network Rail that may have contributed to the flood event.

5.5 Highway Authority

The Highway Authority is responsible for ensuring the highway is clear of obstructions and has a drainage system that controls the surface water that falls onto the highway.

Monmouthshire County Council is the Highways Authority for all highways in Monmouthshire apart from Trunk Roads which are managed by the Welsh Government. Highways Authorities are also Risk Management Authorities in their own right according to the Flood and Water Management Act 2010 and must adhere to all the responsibilities of Risk Management Authorities.

Under the Highways Act 1980, the Highways Authority has a duty to maintain the highway. This includes ensuring that highway surface water drainage systems are clear and free from blockages.

This investigation has not identified any defects with the highway drainage system (largely comprising roadside ditches) which would have contributed to the flooding. These systems would be expected to become quickly overwhelmed by flows from the Usk and further compromised by a heavy debris load from the flood event.

5.6 Riparian Landowners

A riparian owner possesses rights over and responsibilities for the stretch of a watercourse that forms the boundary of their property. A riparian owner is anyone who owns a property where there is a watercourse within or adjacent to the boundaries of their property. A watercourse includes a river, stream or ditch. Riparian owners, (householders and businesses) are responsible for maintaining their rivers, streams, ditches, pipes culverts and bridges.

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. Any works to modify the watercourse by the landowner will first require the necessary consents or permits from the relevant Risk Management Authority, Lead Local Flood Authority (LLFA) or Natural Resources Wales (NRW).

Landowners are responsible for ditches and land drainage assets upon their land at Llanwenarth. NRW has permissive powers to maintain watercourses which are designated as Main Rivers and MCC has permissive powers to maintain the ordinary watercourses.

This investigation has not identified any defects with watercourses (Main River or Ordinary Watercourse) under riparian ownership which would have contributed to the flooding. These systems would be expected to become quickly overwhelmed by flows from the Usk and further compromised by a heavy debris load from the flood event.

5.7 Residents and Property Owners

Residents and property owners are responsible for the maintenance and operation of drainage assets and connecting pipework falling within their ownership. They are also responsible for the protection of their own properties against flooding. Where safe to do so, they should take measures to protect themselves and their property from flooding. Residents and property owners have the right to defend their property as long as they do not subsequently increase the risk of flooding to other properties.

6 Permissive Powers of Risk Management Authorities

Natural Resources Wales has permissive powers under the Flood and Water Management Act 2010 and Water Resources Act 1991 to carry out works to manage the risk of flooding from main rivers. These discretionary powers include the ability to undertake works to clear watercourses, as well as developing and implementing flood alleviation schemes when justifiable.

MCC also has similar permissive powers under the Land Drainage Act 1991 on ordinary watercourses.

7 Flood Alleviation Scheme / Drainage Improvements

There are currently no formal flood defences for the Llanwenarth plain or planned schemes to implement such measures. A number of individual properties have forms of flood barriers but these were generally overwhelmed by the scale of the Storm Dennis event.

It appears that the flood embankment at the west of the Llanwenarth plain plays a significant role in protecting properties from flooding although the specifics of this are unknown. The embankment is a historic asset (identified on maps going back to at least 1901) and was not previously known to NRW or MCC.

It is recommended that hydraulic modelling is undertaken to ascertain the nature of the protection afforded by the embankment. Consideration should also be given to the future management of the embankment, such as possible adoption of the embankment by the Risk Management Authority for the River Usk (Natural Resources Wales). If NRW cannot adopt the structure it would be beneficial for advice to be given to the landowners on future maintenance.

8 Conclusion

The investigation has identified the flooding that affected the Llanwenarth plain on 16th February 2020 was the result of a prolonged and significant rainfall event, with the largest accumulations of rain falling on already wet ground resulting in a rise in the level of the River Usk (a Main River) to its highest known level.

The Usk overtopped a flood embankment which was not at the time recognised as a significant flood defence feature by either NRW or MCC. The overtopping appears to have caused scouring to the embankment, resulting in the failure of a 40 metre long section and also formed a deep crater. Water then flowed largely unencumbered through the main embankment breach and over parts of the embankment (which also suffered damage) towards the homes and businesses on the Llanwenarth plain.

Of 12 residences in the Llanwenarth plain, 3 escaped internal flooding, 2 suffered partial internal flooding, and 7 suffered full internal flooding. In addition, Pyscodlyn Caravan Park was flooded with damage caused to many caravans. St Peters Church and the farm buildings of Mardy Farm suffered significant internal flooding. Various other outbuildings and small agricultural buildings were also flooded.

Recommendations for investigation and maintenance of the flood defence embankment have been given in Section 9 of this report.

9 Recommendations

In accordance with Section 19 of the Flood and Water Management Act 2010, as Lead Local Flood Authority Monmouthshire County Council has investigated this flood event and identified which Risk Management Authorities have relevant flood risk management functions. As a result of the findings of this investigation and discussions with residents and other Authorities, the following recommendations have been made.

Reference	Recommendation	Responsible Risk Management Authority(s)
LL01 (Flood Risk)	Undertake an initial assessment of the effectiveness of the flood embankment at the west of the Llanwenarth plain. The assessment should include (but not be limited to): - The standard of protection it currently provides to local residents, businesses and infrastructure. - The structural condition of the embankment. - The extent of works required to upgrade it to an adoptable standard. - Options for future management, inspection and maintenance. - Consideration of adoption by the Risk Management Authority.	NRW
LL02 (Flood Risk)	Investigate the history of the embankment with a particular view to determining whether the embankment was erected by a private landowner or as a community enterprise.	MCC and NRW
LL03 (Flood Risk)	In order to ensure the flood embankment is not altered in such a way that could increase flood risk, consideration should be given by the Risk Management Authority to formally designating the embankment as a structure or feature that serves a flood risk management purpose using powers under the Flood and Water Management Act 2010.	NRW

Table 4: Recommendations made by MCC as Lead Local Flood Authority

10 Useful Links and Contacts

- Monmouthshire County Council Flood Pages:
  www.monmouthshire.gov.uk/flood-risk-management

- Natural Resources Wales:
  www.naturalresources.wales/flooding

- Welsh Government:
  www.gov.wales/flooding-coastal-erosion

- Blue Pages
  www.bluepages.org.uk

- Flood Re (Insurance):
  www.floodre.co.uk

monmouthshire
sir fynwy

Appendix A – Met Office Report on Storm Dennis

Storm Dennis

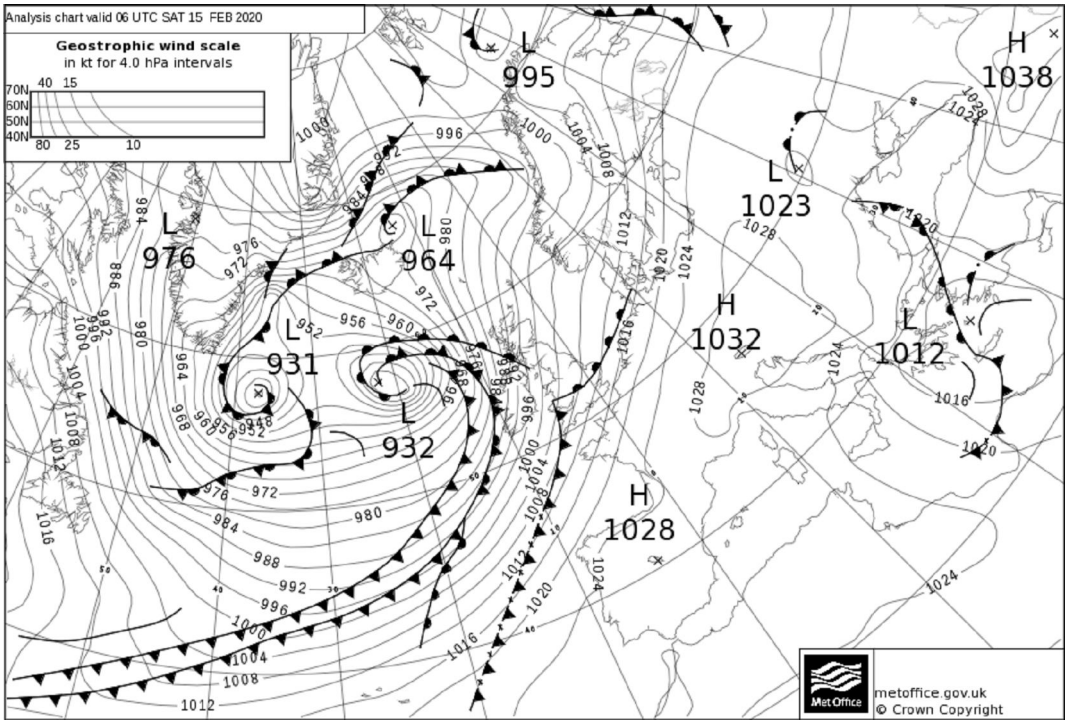
Storm Dennis was the fourth named storm of the 2019/2020 season. Arriving one week after storm Ciara, Dennis brought heavy and persistent rain across much of the UK – especially Wales and western England. Western upland parts of the UK received 50 to 100mm or more of rain falling on saturated ground. The Met Office issued a Red Warning for rain across parts of south Wales and there was major and widespread flooding. Storm Dennis also brought very strong winds, but the worst of the impacts were from the rain.

Impacts

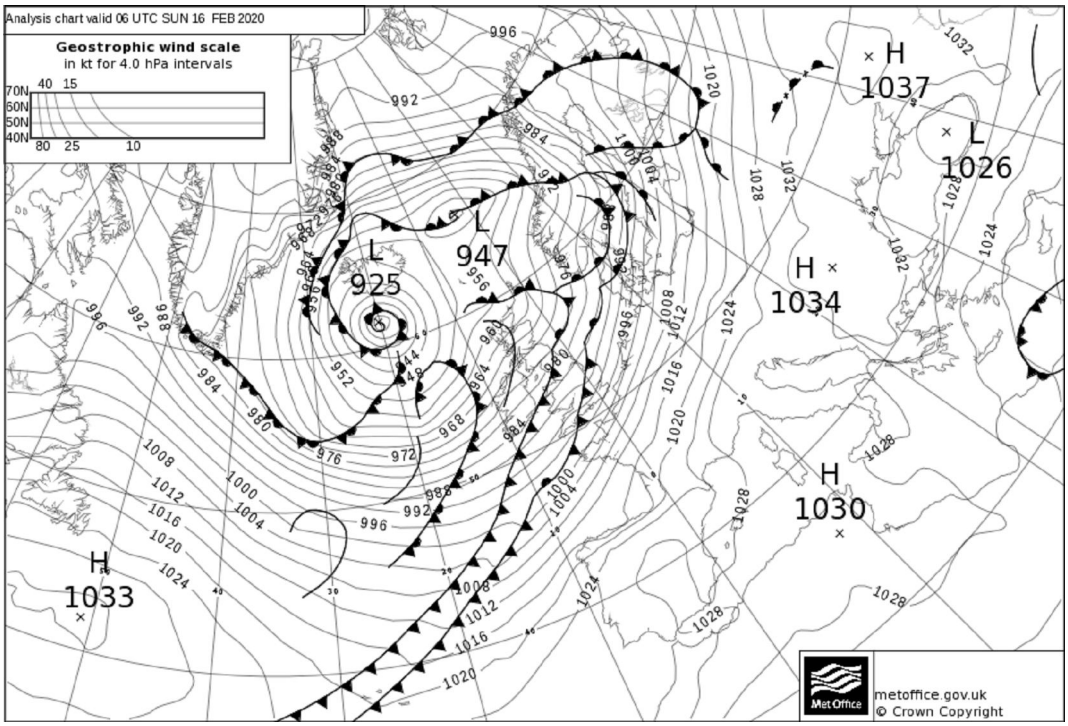
South Wales, Herefordshire, Worcestershire and Shropshire were worst affected by flooding and major incidents declared. The River Wye and River Severn which were reported to have reached their highest-ever levels. Areas of several towns including Hereford and Pontyprydd were inundated. The Environment Agency issued over 600 flood warnings and alerts including several severe flood warnings. A woman was swept away by floodwater in Worcestershire and over 1400 homes and businesses were flooded across several counties. The flooding also caused major travel disruption with roads blocked, damaged railway lines and hundreds of flights cancelled. Large areas of farmland were also underwater. Strong winds and large waves battered exposed coastlines, and in County Cork an abandoned 'ghost' cargo ship was washed ashore.

Weather data

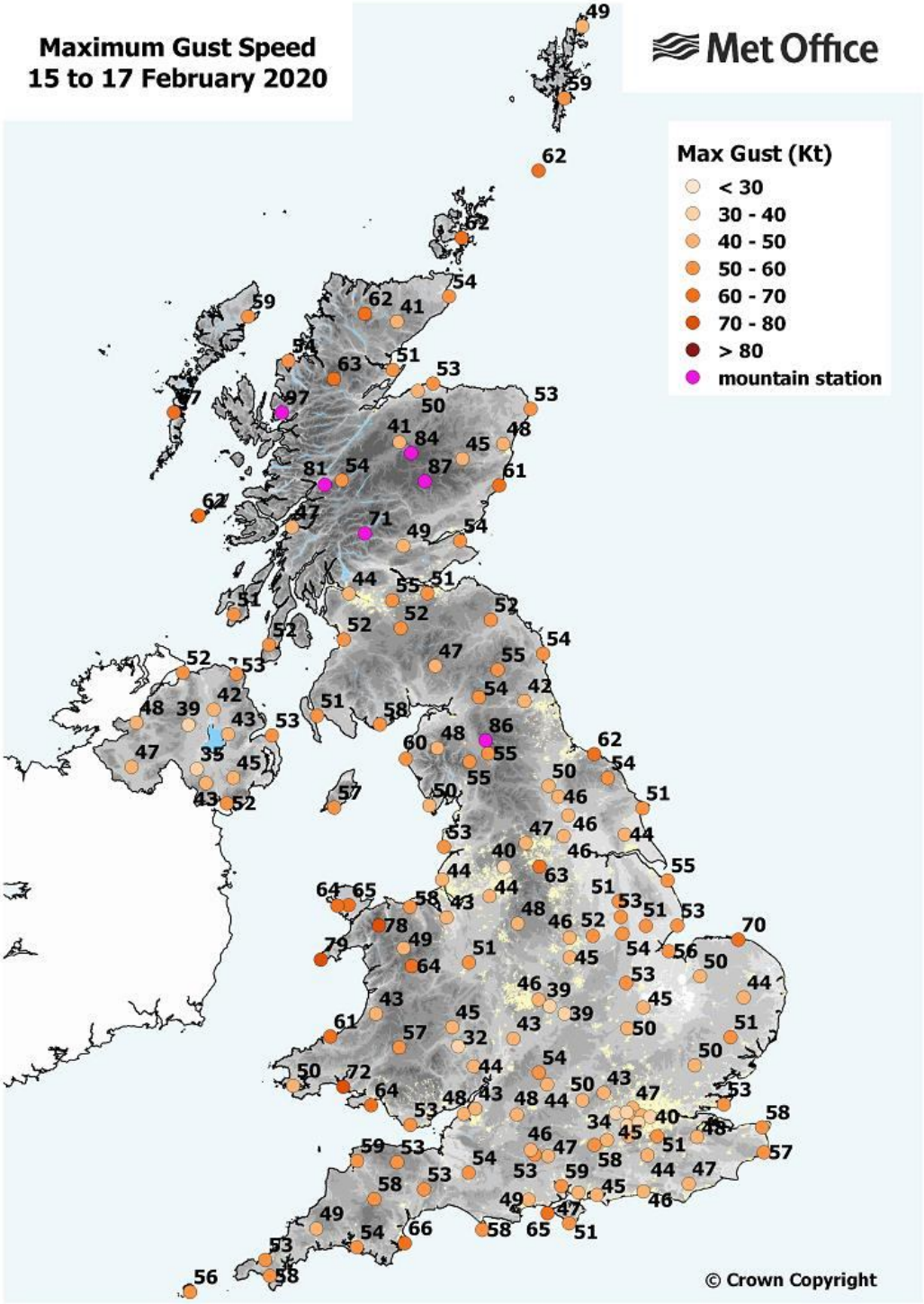
The analysis chart at 06 UTC 15 February 2020 shows storm Dennis as the deepening area of low pressure to the north-west of the UK, driven by a powerful Atlantic jet stream.



The analysis chart at 06 UTC 16 February 2020 (24 hours later) shows storm Dennis as the large area of low pressure still dominating the north Atlantic with rain-bearing fronts and strong winds sweeping across the UK.

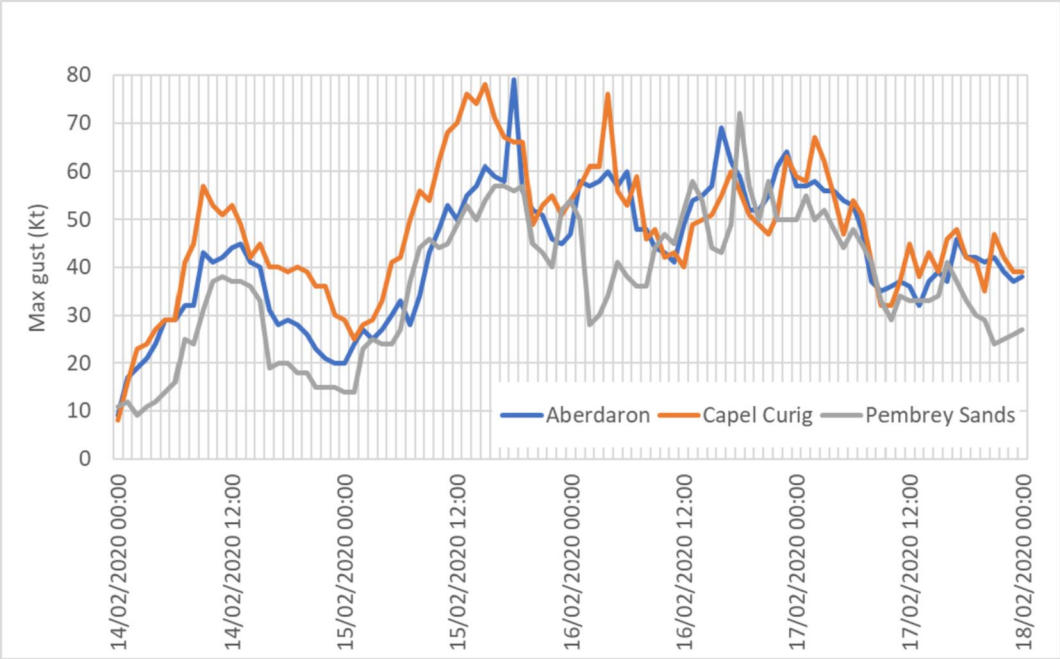


The map below shows maximum gust speeds from storm Dennis. Winds were comparable to storm Ciara, gusting at over 50 Kt (58 mph) across the UK and over 60 Kt (69 mph) around exposed coastlines. In total over 20 stations recorded gusts exceeding 60 Kt. The highest gusts were 79 Kt (91 mph) at Aberdaron, Lleyn Peninsula, 78 Kt (90 mph) at Capel Curig, Conwy, 72 Kt (83 mph) at Pembrey Sands, Dyfed and 70 Kt (81 mph) at Weybourne, Norfolk. Wind speeds reached around 100 mph across the tops of the Pennines and Scottish mountains.

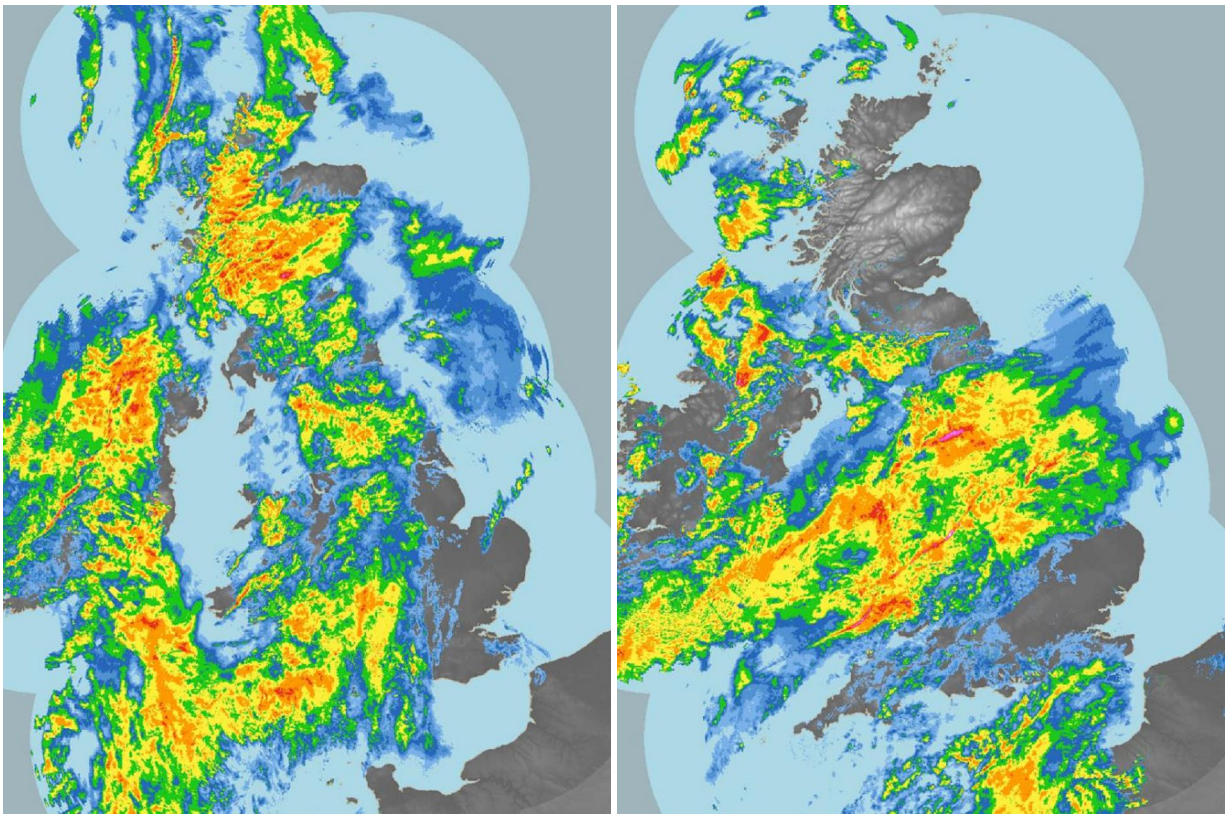


In terms of wind speeds, this was a notable although not exceptional storm for the time of year. However, one feature of storm Dennis was the persistence of the strong winds across the UK for several days, with the low pressure centre to the north-west slow to clear. The strongest winds on 15th to 16th were across England and Wales, transferring to Scotland on the 17th as the low's centre finally pulled away east toward Norway. The chart below shows hourly maximum gust speeds for three stations in Wales – Aberdaron, Capel Curig and Pembrey Sands – all three being

exposed locations. Hourly maximum gust speeds reached 50 Kt during the morning of the 15th and remained mostly above 50 Kt until the morning of the 17th – being sustained at this level for around two days.



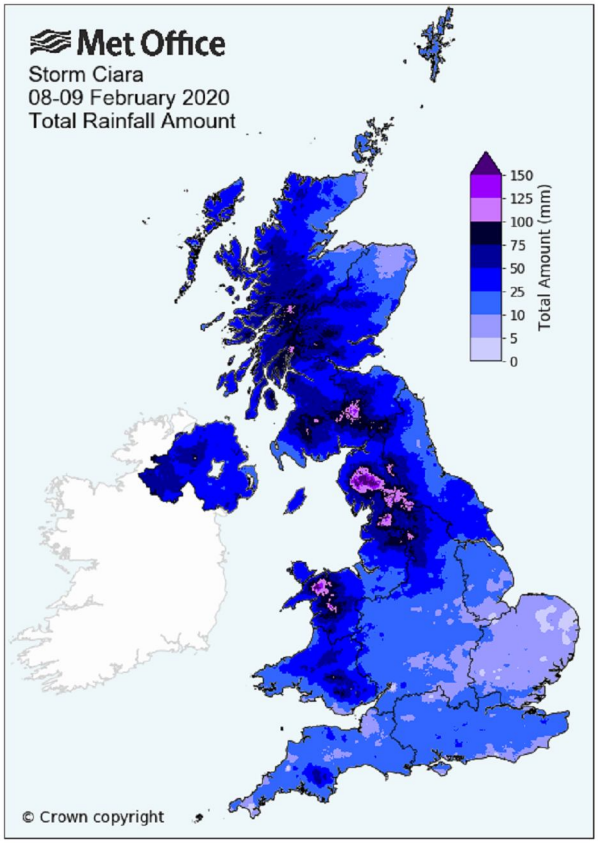
The rain-radar images at 12 UTC 15th and 00 UTC 16th February 2020 show the heavy and persistent rainfall from storm Dennis with the fronts sweeping across the UK.

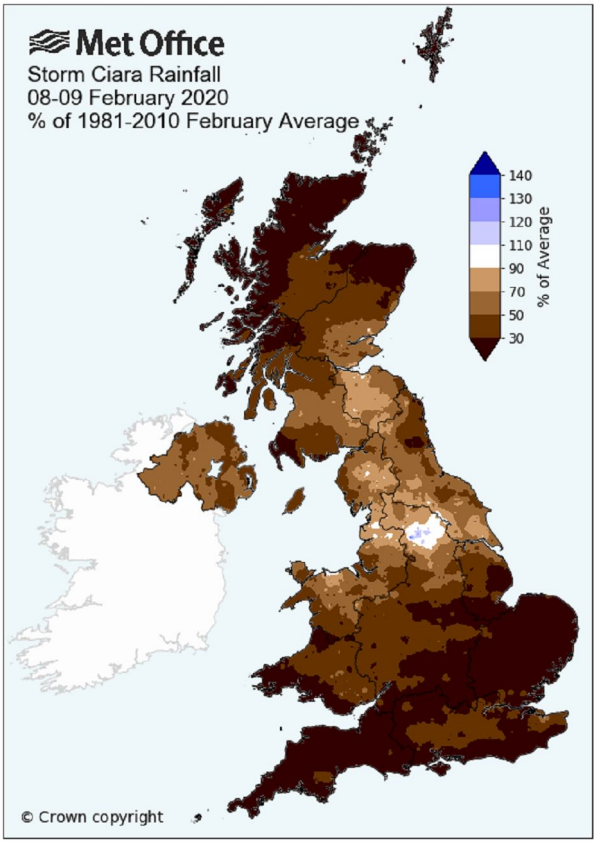


The map below shows rainfall totals for a) storm Ciara and b) storm Dennis, as actuals and % of 1981-2010 February long-term average. Storm Dennis brought 50 to 100mm or more of rain across the high ground of Dartmoor, parts of Wales, the Lake District and Highlands. 100 to 150mm of rain fell across parts of the Brecon Beacons and south Wales valleys. More than the February whole-month average rain fell for the rain-days 15-16 February (09 UTC 15th to 09 UTC 17th) across parts of the west and north Midlands.

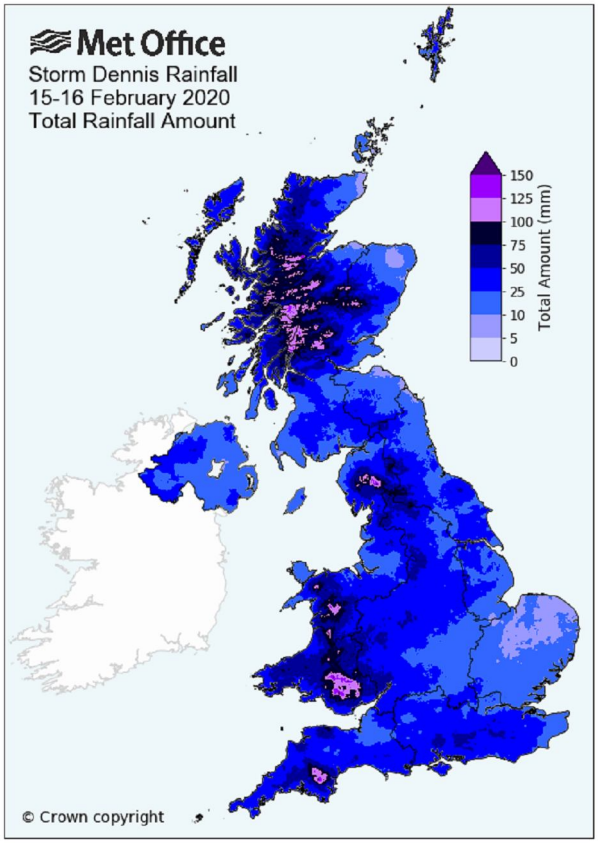
Storm Ciara one week earlier brought 100mm+ of rain across the high ground of Snowdonia, the Lake District and parts of the Pennines. More than the February whole-month average rain fell for the rain-days 8 to 9 February (09 UTC 8th to 09 UTC 10th) across parts of the south Pennines

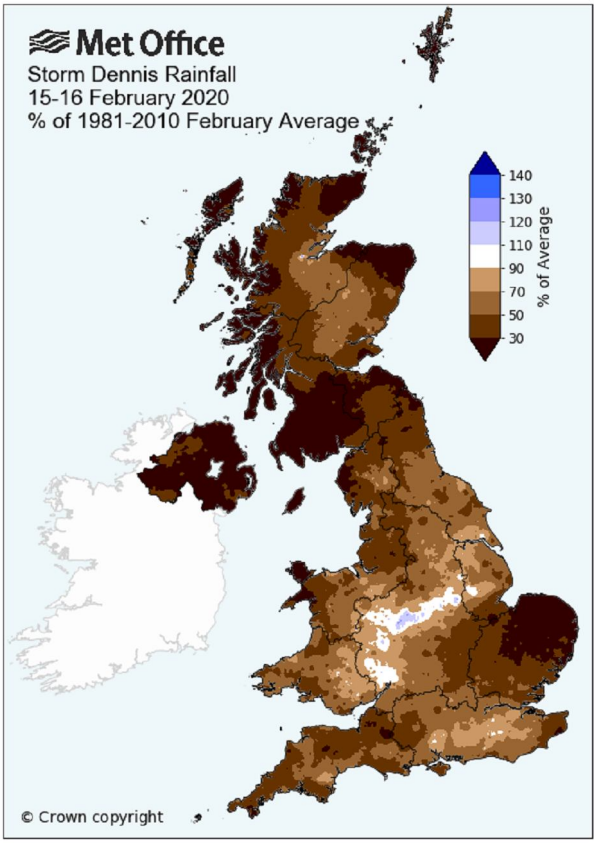
a) – storm Ciara rainfall



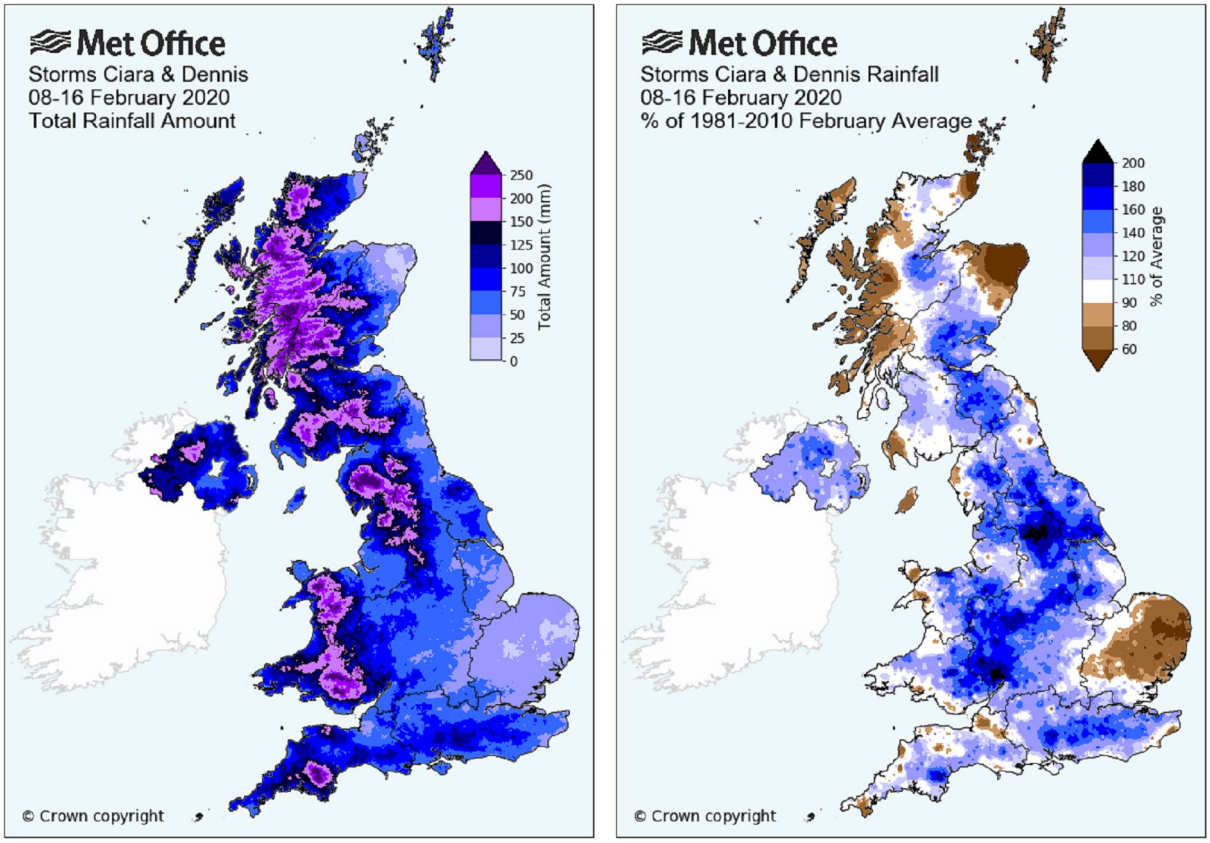


b) – storm Dennis rainfall

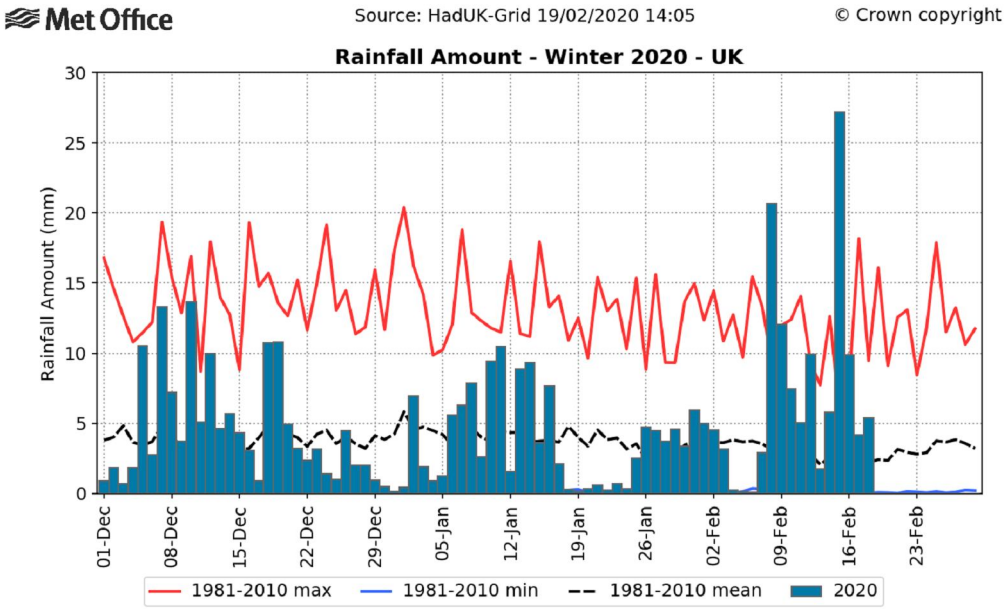




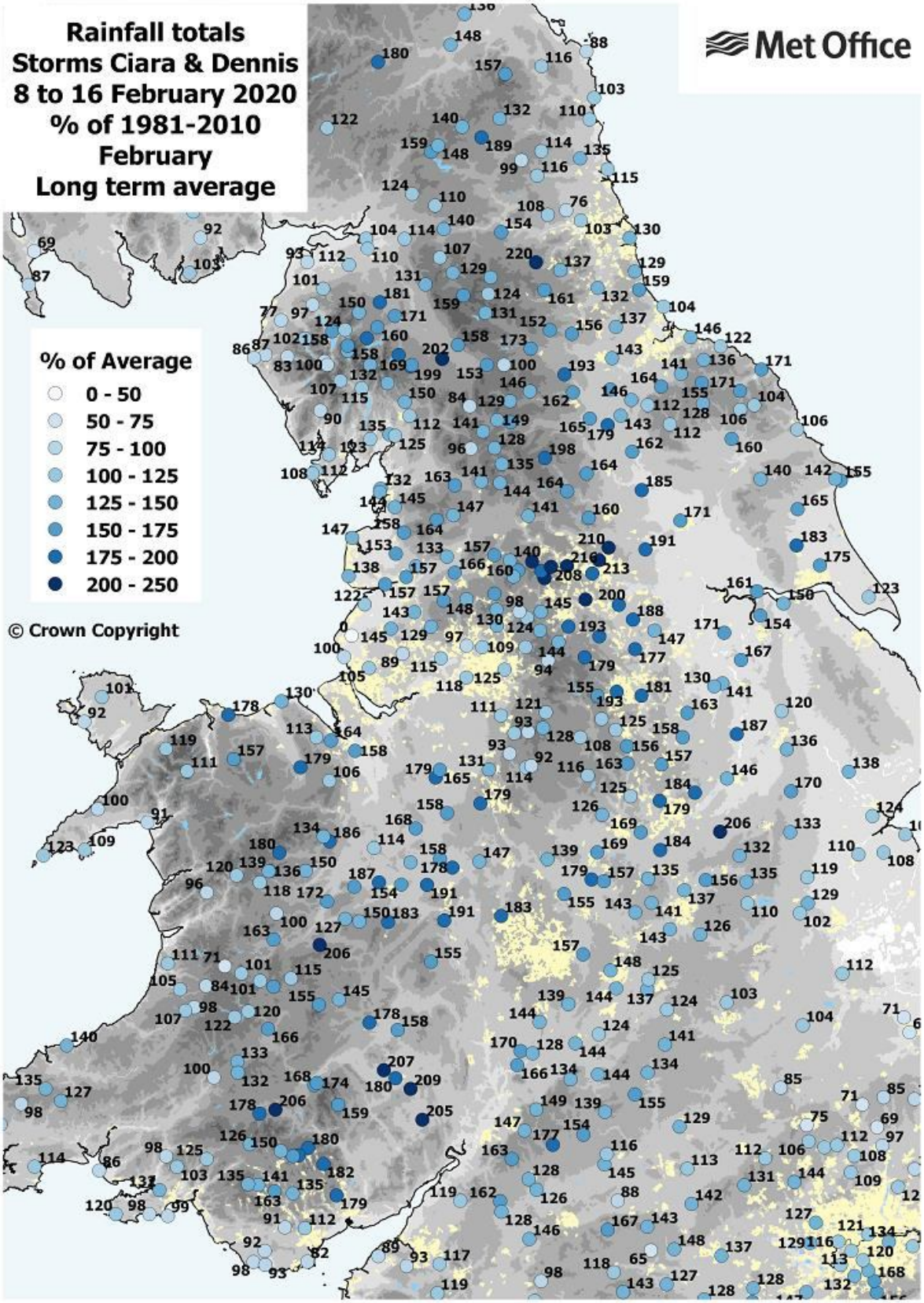
The maps below show how much rain fell across the UK overall for the 9-day period from 8th to 16th February, including both storms Ciara and Dennis. Over 100mm of rain fell across many western parts of the UK through this period with 150 to 250mm or more across the high ground of Dartmoor, Wales, northern England, Southern Uplands, West Highlands and parts of Northern Ireland. Most of the UK received the February whole-month average rainfall over this 9-day period, with around 150% fairly widely across east Wales, the West Midlands and a swathe of the Pennines through to Edinburgh and over 200% locally in the Pennines and parts of Gloucestershire and Herefordshire.



The chart below shows UK areal-average rainfall totals for each day of winter 2020 so far (1 December 2019 to 18 February 2020), with the exceptionally wet days of 8 and 15 February associated with storms Ciara and Dennis.



The map below shows rainfall totals at individual stations for storms Ciara and Dennis combined as % of 1981-2010 February long term average.



Author: Mike Kendon, Met Office National Climate Information Centre

Last updated 20/02/2020

Met Office

Appendix B – Response from Dwr Cymru/Welsh Water

Dŵr Cymru
Welsh Water

Linea
Fortran Road
St Mellons
Cardiff
CF3 0LT

Tel: +44 (0)800 052 0145
Web site: www.dwrcymru.com

Linea
Heol Fortran
Llaneirwg
Caerdydd
CF3 0LT

Ffôn: +44 (0)800 052 0145
Safle gwe: www.dwrcymru.com

James Woodier
Monmouthshire County Council
[redacted]

Our Ref: S19/Llanwenarth/2020
Contact: R Hiscock
[redacted]

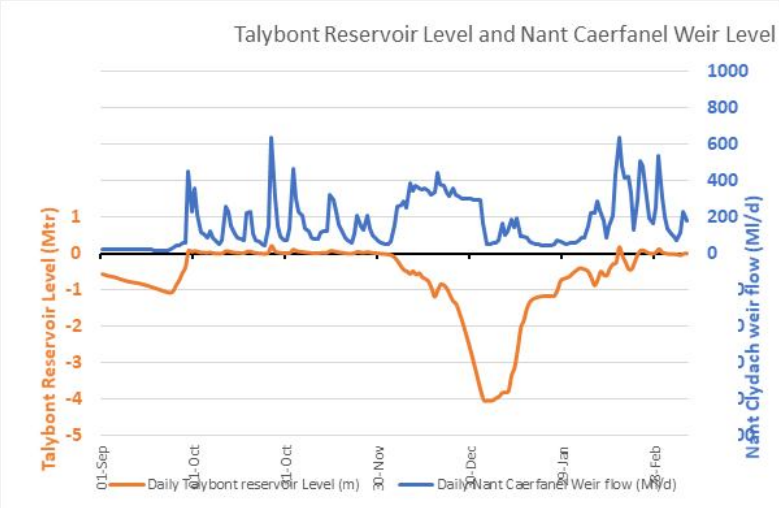
Date: 15th October 2020

Dear James

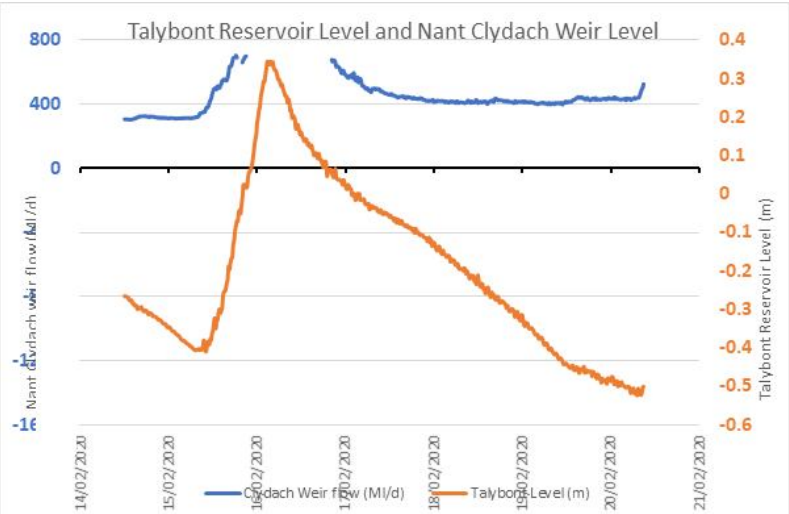
Many thanks for your enquiry regarding '*Flooding Event Saturday 15th February to 16th February 2020 at Llanwenarth, Abergavenny*' Investigation Report - Section 19 Flood and Water Management Act 2010.

1. **Please provide a record of water levels at the Talybont Reservoir throughout the period 1st to 28th February 2020.**

Please see graphs below;
Graph 1 – Dates of flows and level of Talybont reservoir over 6 months Sept 19 to Feb 20



Graph 2 Dates of flows and level of Talybont reservoir during Storm Dennis Feb 20



Dŵr Cymru
Welsh Water

Linea
Fortran Road
St Mellons
Cardiff
CF3 0LT

Tel: +44 (0)800 052 0145
Web site: www.dwrcymru.com

Linea
Heol Fortran
Llaneirwg
Caerdydd
CF3 0LT

Ffôn: +44 (0)800 052 0145
Safle gwe: www.dwrcymru.com

The flow data for Talybont reservoir is recorded at the Nant Clydach weir, which records all flows through the compensation pipework, excess water that flows down the spillway plus flows from the Nant Clydach river within the catchment. The Nant Clydach river responds to rainfall and water run off much quicker than the reservoir, which is why the graph show increased flows before the reservoir level is >0m (when the reservoir is full).

It is worth noting that the discharge capability from our reservoirs are extremely small in comparison to the rates of spill and flows within the river Usk in response to Storm Dennis. To put this into context, NRW reported a preliminary flow rate of over 60,000Ml/d 1km downstream of the Talybont reservoir on the River Usk (Llandetty gauge) whereas the capacity of the discharge valve at Talybont is around 380Ml/d, which would have been only 0.6% of the flow if valves were fully open. Also, in the graphs the reservoirs are on spill when the level is >0m and this is the point we have no control over the water entering the rivers as this is the safety mechanism built into all Dams to protect the integrity of the Dam itself. Excess water in the reservoir then travels down the spillway rather than overtopping the Dam and eroding the structure.

Our normal flows from Talybont reservoir for February are 25Ml/d. These are classed as compensation releases legally controlled through abstraction licenses issued by NRW and specify the discharges that must be made. At the time of Storm Dennis we also had a discharge consent in place with NRW to release up to 400Ml/d.

2. **Please provide a record of any actions or occurrences at Talybont Reservoir during the period 1st to 28th February 2020 which may have had an impact on Llanwenarth (which is situated on the River Usk to the west of Abergavenny).**

There were no actions that would have impacted Llanwenarth. As stated above the capacity of the discharge valve at Talybont is around 380Ml/d.

3. **Please outline what role, if any, the Talybont Reservoir plays in reducing flood risk to Llanwenarth**

Talybont reservoir doesn't play any part in reducing flood risk at Llanwerarth. During the winter months the reservoir is usually full and on spill.

I hope this answers your query but if you require any further information please don't hesitate to contact me and I will respond as soon as I can.

Kind Regards

Rebecca Hiscock
Flooding Performance Coordinator
Dŵr Cymru Welsh Water