Flood and Water Management Act 2010

Section 19 Flood Investigation Report

Llanvihangel Gobion and Kemeys Commander

Storm Dennis February 2020

Version: FINAL





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Version Control

Title	Llanvihangel Gobion and Kemeys Commander, Storm Dennis February 2020		
Purpose	Section 19 Flood Investigation Report		
Owner	Highways and Flood Risk Management		
Approved by	M. Hand (Head of Placemaking, Housing, Highways and Flooding)		
Date	9 December 2021		
Version Number	V4.0		
Status	Final		
Review Frequency	Not applicable		
Next review date	Not applicable		
Consultation	Natural Resources Wales, Monmouthshire County Council		

Version	Prepared by	Reviewed by	Approved by	Date
Draft V1.0	JP	ER		May 2021
Draft V1.2	ER	JS		July 2021
Draft V2.0	ER	JS		3 September 2021
Draft V2.1	ER	JS		10 October 2021
Draft V3.0	ER	JS		22 November 2021
Final V4.0	ER	JS	MH	9 December 2021



1. Executive Summary

In accordance with Section 19 of the Flood and Water Management Act 2010 (FWMA), Monmouthshire County Council (MCC) has a duty as Lead Local Flood Authority (LLFA) to investigate flooding within its area, insofar as it considers it necessary and appropriate. This report meets the requirements of Section 19 of the Act and provides a factual account of the flood event that occurred on 15, 16 and 17 February 2020 in the flood investigation area, referred to in this report as Llanvihangel Gobion and Kemeys Commander, due to intense rainfall from Storm Dennis 15 and 16 February 2020.

February 2020 was the wettest February on record in Wales and the UK as well as the 5th wettest month ever recorded. Storm Dennis was the 4th named storm of the season and fell on ground that was already saturated from Storm Ciara 1 week prior, and an unnamed rainfall event on 12 and 13 February. Intense rainfall from Storm Dennis significantly impacted river flows and resulted in substantial flooding across South Wales.

From anecdotal reports the primary source of flooding in Llanvihangel Gobion and Kemeys Commander was fluvial from the main river Usk.

The Usk overtopped in multiple locations from The Bryn to Chainbridge, with flows extending across the floodplain, and flooded low lying property and roads.

Following the flood event officers from MCC visited the residents and properties affected in the flood investigation area to collect information on the event.

At the time of preparing this report there are anecdotal reports of 5 residential properties flooding in Llanvihangel Gobion, 4 in Kemeys Commander, and further properties in between.

Information has been shared between MCC, and Natural Resources Wales (NRW) as the Risk Management Authorities (RMA). Supporting information on weather patterns and rainfall at the time of the event has been gathered from the Met Office.

The report has identified recommendations and actions to avoid or minimise the impact of any future flood events. These recommendations and actions can be found in section 9.



2. Introduction

2.1 Purpose of the Section 19 Flood Investigation

On 15 and 16 February 2020, Monmouthshire was impacted by a significant weather event named Storm Dennis which resulted in heavy and prolonged rainfall in the northern parts of the county and upper catchments of many ordinary watercourses and main rivers, including the catchment of the River Usk.

As a result, many areas across Monmouthshire flooded particularly in the north.

This report will focus on flooding in the flood investigation area Llanvihangel Gobion and Kemeys Commander, Monmouthshire.

This report has been prepared by MCC in response to the duties of the LLFA in Section 19 of the FWMA, 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

The Llanvihangel Gobion and Kemeys Commander flood investigation area is in the central west of Monmouthshire. The area is populated by small villages and hamlets on the banks of the main river Usk.

Llanvihangel Gobion is located at National Grid Reference SO 34748 09617, between the A40 and the left bank of the Usk. The Bryn is approximately 1.2km to the west, Llanvair Kilgeddin is within 1km south, and Kemeys Commander and Chainbridge are approximately 3.8km south. See Figure 2-2 for a location plan.

The red line in Figure 2-1 shows the Flood Estimation Handbook catchment for the River Usk at Chainbridge which has an approximate area of 914km2. The catchment is predominately rural in nature and includes central areas of the Brecon Beacons National Park. Major tributaries of the Usk include Nant Bran, Afon Ysgir, Afon Tarell, River Honddu, Afon Cynrig, Afon Crawnon and the River Gavenny.

On 15, 16 and 17 February the flood investigation area suffered severe flooding. The River Usk overtopped in multiple locations from The Bryn to Chainbridge. There are anecdotal reports of internal property flooding at Llanvihangel Gobion, Llanvair Kilgeddin, Bettws Newydd and Chainbridge. The B4598 also flooded in Llanvihangel Gobion.









Figure 2-2. Flood Investigation Area location plan



The NRW Risk of Flooding from Rivers map is shown in Figure 2-3 and Figure 2-4, and shows The Bryn and Llanvihangel Gobion are at high risk of flooding from the Usk, as well as land to the southeast of Llanvihangel Gobion. The floodplain of the Usk is narrower south of Llanvair Kilgeddin.

The risk of flooding from surface water and ordinary watercourses within the flood investigation area is not extensive as shown in Figure 2-5 and Figure 2-6.







Figure 2-4. Extract from Natural Resources Wales, Risk of Flooding from Rivers (south)









Figure 2-6. Extract from Natural Resources Wales, Risk of Flooding from Surface Water (south)





2.3 Investigation Evidence and Data

To support the investigation the following list of qualitative and quantitative evidence has been gathered:

- Resident's photos, statements, written correspondence, and recorded verbal correspondence.
- Site inspections and photos.
- Met Office Data Storm report and weather warnings.
- Natural Resources Wales hydrometric data, report entitled *February 2020 Floods in Wales: Flood Event Data Summary*.
- Monmouthshire County Council hydrometric data, asset database, Flood Risk Management Plan, Preliminary Flood Risk Assessment.

2.4 Anecdotal Evidence

Table 2-1 presents anecdotal evidence collected after the flood event. The table provides a reference to address points of local individuals consulted; a full table with a list of references and addresses can be found in Appendix A, however the appendix will be redacted prior to report publication due to General Data Protection Regulations.

Table 2-1. Anecdotal evidence

Address reference	Notes
LK2020/01	Internal property flooding. Resident stated that during the Storm Dennis flood event water pooled in the road outside the property. The pooled water gets thrown over the property due to vehicles driving through it too fast Flooding at the far end of the garden reached 0.12m.
LK2020/02	No internal property flooding. Source of flooding appears to be the River Usk, which is separated from the property by a field. The separating field and some of the property's land were flooded during Storm Dennis, flood water comes within approximately 10m of the property. The grounds of the house flooded at approximately 13:00hrs on Saturday 15 February and had cleared by approximately 08:00hrs on 17 February 2020. Resident moved into the property in January 2018, since then they have experienced the field adjacent to the river flooding but not the house.
LK2020/03	Internal property flooding of 0.30m.
LK2020/04	Internal property flooding. Entire property and adjoining road and fields flooded to 1.22m depth. The flooding started with water from a drain backing up into our kitchen in the afternoon of 15th February 2020. Our neighbour pumped out the drain and we cleared the water from the kitchen at that time. The flooding began again in the kitchen at about 03:00hrs on the 16th February 2020 and the water rose through the outside drains and from under our floors until the river broke over its banks at approximately 06:00hrs. We were evacuated by the Fire Services at around 08:30hrs and have since been staying in alternative accommodation. Our neighbour informed us that our yard was clear of water at 08.30hrs on 17th February 2020 although at that stage there was still water in our kitchen, which is lower than the yard. The Fire Service came to pump out the remaining water in the kitchen the next day. The water in all other areas had cleared by then. We have lived at the property since January 2015 and during that time we have experienced one other minor flooding incident in or around October 2019 after a particularly wet and stormy period when an outside drain backed up into our yard and kitchen. The depth of water was approximately 0.05m. At the time we bought the property we understood that there had been one similar incident with water in the kitchen when an outside



	underground pump had inadvertently been switched off. Other than that, we were advised that the last major flood had occurred in 1979.
LK2020/05	Flood water did not enter either of the properties. Flood depth on land up to 2.44m. The peak of the flood was approximately 11:00hrs to 12:00hrs on 16 February 2020. It was the deepest flood residents have experience in 14 years of occupying the property. There is annual flooding of land. Highest floods have been on 26 October 2019 and 13 October 2018.
LK2020/06	Internal property flooding. Entire property was flooded after the River Usk overtopped its banks.
LK2020/07	No internal property flooding. The River Usk overtopped its banks nearby but flooding did not reach the property.
LK2020/08	Internal flooding to multiple properties. Flooding occurred between 07:00hrs on 16, and 01:00hrs on 17 February 2020. Entire area became inundated after the River Usk overtopped its banks. Flooding occurs once Llanfoist NRW river gauge measurements hit 5m. There are bunds around 2 properties. Flood depths within properties: 0.36m, 0.3m, 0.39m. The B4598 flooded to a depth of 0.6m. Land flooded to a depth of 1.8m.
LK2020/09	Internal residential property flooding on 15 and 16 February, possibly 17 February 2020. Property was accessible by 07:00hrs on 17 February. Downstairs had flooded to approximately 0.2m, utility room and garage flooded to approximately 0.25m. The garden, approximately 3 to 3.66m from the house has previously flooded in January/February 2015 and October 2019. The river is at the bottom of the garden, and there is usually a 3 to 3.66m drop down to the river. Residents asked other locals about the flooding and they said the house had not flooded in living memory. Figure 2-7 is a photo of the B4598 flooding during the flood event.

Table 2-2 provides timings of flood event milestones from anecdotal reports and MCC.

Table 2-2. Flood event milestones from anecdotal evidence

Milestone	Time and date
Onset of flooding	13:00hrs on 15 February 2020
Peak of the flood	11:00hrs to 12:00hrs on 16 February 2020
Floodplain extents drain away	08:00hrs 17 February



Figure 2-7. The B4598 flooding north of Pant-Y-Goitre Bridge, Storm Dennis flood event, photo taken at 17:00hrs 16 February 2020, from Steel Horse Café, Llanvihangel Gobion.





3. Flooding

3.1 Previous Flood Incidents

Table 3-1 provides dates of historical fluvial flooding from the River Usk to the flood investigation area gathered from anecdotal reports. There have been surface water and ordinary watercourse flood events to Llanvair Kilgeddin village in the past that are not included in the table.

Table 3-1. Recorded historic flood events

Flood date
26 October 2019
13 October 2018
1979

3.2 Flood Incident

Storm Dennis was the 4th named storm of the 2019/2020 season and brought heavy and persistent rain across South Wales. The Met Office issued a Red Warning for Storm Dennis across parts of South Wales and there was major and widespread flooding. See section Figure 3-8 for further details on the Met Office severe weather warning.

Storm Dennis delivered heavy rainfall on 15 and 16 February 2020. The rain fell on already saturated ground due to Storm Ciara 1 week prior, and an unnamed rainfall event on 12 and 13 February 2020.

MCC has anecdotal reports that the primary source of flooding during this event was the River Usk.

From anecdotal reports flooding to the investigation area occurred between 13:00hrs on 15 February and 08:00hrs on 17 February, with the peak of the flood occurring between approximately 11:00hrs and 12:00hrs on 16 February 2020. Reported flood depths varied across the area, with maximum levels of 1.22m inside properties, 2.44m on land, and 1.22m on the B4598.

The River Usk overtopped in multiple locations along its course from The Bryn to Chainbridge. There are anecdotal reports of 5 residential properties flooding in Llanvihangel Gobion, 4 in Kemeys Commander, and further properties in between. The B4598 flooded in Llanvihangel Gobion.

Flood flow paths from anecdotal reports are shown in Figure 3-1.



Figure 3-1. Flood flow paths from anecdotal evidence









3.3 Gauging Stations

The location of nearby NRW and Environment Agency (EA) river, rain and tidal gauges are shown in Figure 3-3.

All gauges are operated by NRW except Vowchurch rain gauge, Ross on Wye river gauge, and Avonmouth Portbury tidal gauge which are operated by the EA. All the listed river and tidal gauges are telemetered. Rain gauges are a mixture of telemetered and logger.







3.4 Gauge Monitoring

Table 3-2 provides a list of the hydrometric data from NRW which has been assessed in the investigation. Gauges selected are telemetered as these have functionality to provide readings at consistent 15-minute time intervals during elevated river flows.

The assessment has been carried out for 2 comparable storms which caused flooding in South Wales, these were the Met Office named events Persistent Wet Weather 25 and 26 October 2019, and Storm Dennis 15 and 16 February 2020. The hydrographs later in the section are for the following 2 periods covering these storms:

- 15-day period 00:00 on 17 October 2019 to 23:45 on 31 October 2019.
- 15-day period 00:00 on 7 February 2020 to 23:45 on 21 February 2020.

¹ Contains Natural Resources Wales information © Natural Resources Wales and database right. All rights reserved.

² this uses Environment Agency rainfall data from the real-time data API (Beta).



Table 3-2. Hydrometric gauges included in the assessment

Data	Gauge name	Source
Rainfall	Tal Y Maes	NRW
Rainfall	Brecon	NRW
Rainfall	Crai Reservoir	NRW
Rainfall	Usk Reservoir No2	NRW
Rainfall	Upper Chapel No1	NRW
River stage and flow	Chainbridge	NRW
River stage	Llanfoist Bridge	NRW

Within the Usk's catchment upstream of Chainbridge there are 5 telemetered rain gauges. Thiesson Polygon analysis calculates the weighted percentage of the catchment assigned to these gauges as shown in Figure 3-4. The Thiesson Polygons are generated from points where the rain gauges are located: the area within each polygon is closer to its central rain gauge point than any of the other rain gauges. It is noted that some of the rainfall data had not been validated by NRW at the date of receipt; because of this NRW warned there may be some accuracy issues with the data and that it should be used with caution.





There is a river flow and stage gauge on the Usk at Chainbridge which is the catchment's discharge point. There is another river gauge at Llanfoist Bridge 15.15km upstream from Chainbridge.

The following hydrographs in Figure 3-5 to Figure 3-8 present river stage data for the Usk alongside Thiessen Polygon weighted rainfall data for Storm Dennis. There is a time lag



between rainfall on the catchment and the response in levels on the Usk, this is referred to as the time to peak.





Figure 3-6. Storm Dennis - Rainfall and river levels for the Usk at Llanfoist Bridge for the 15-day period 7 to 12 February 2020





Figure 3-7. Persistent Wet Weather October 2019 - Rainfall and river levels for the Usk at Chainbridge for the 15day period 17 to 31 October 2019



Figure 3-8. Storm Dennis - Rainfall and river levels for the Usk at Chainbridge for the 15-day period 7 to 21 February 2020





The peaks in the hydrographs on the Usk are used by flood risk authorities as triggers for flood warnings, and to action emergency flood responses. Lead times are important in emergency flood situations; the earlier the warning, the longer property owners have to evacuate and protect their property, and the longer emergency services have to respond.

Table 3-3 and Table 3-4 present river level peaks from the above graphs for flooding due to Persistent Wet Weather October 2019 and Storm Dennis.

Table 3-3. Hydrograph peaks for the period 17 to 31 October 2019, including Persistent Wet Weather October 2019.

River and gauge	Level (m)	Time (GMT), Date
Peak on the Usk at Llanfoist Bridge	5.175	19:00hrs 26 Oct, 2019
Peak on the Usk at Chainbridge	4.982 to 4.997	20:45hrs 26 Oct to 02:15hrs 27 Oct, 2019

Table 3-4	Hydrograph	neaks for the	neriod 7 Februar	v to 21 Febr	12n/ 2020 il	ncluding Storm	Dennis
1 abie 5-4.	пушоўгаріі	peaks ior life	penou i rebiuar	y lo 21 rebit	iary 2020, II	nciuuiny storm	Dennis.

River and gauge	Level (m)	Time (GMT), Date
Peak on the Usk at Llanfoist Bridge	5.673	09:30hrs 16 Feb, 2020
Peak on the Usk at Chainbridge	5.899	12:30hrs 16 Feb, 2020

The following observations have been made on the hydrographs included in the assessment and the 2 tables above:

- Anecdotal reports in section 2.4 state that for Storm Dennis the peak of the flood occurred between approximately 11:00hrs to 12:00hrs on 16 February 2020. This is almost consistent with the data in the hydrographs.
- During Storm Dennis it took 3 hours for the peak at Llanfoist Bridge to travel to Chainbridge. It is not possible to ascertain with certainty the time it takes for the peak to do the same journey during Persistent Wet Weather October 2019 as there is a long flat peak in the hydrograph on the Usk at Chainbridge between 20:45hrs on 26 October 2019 and 02:15hrs on 27 October.
- In the Storm Dennis flood event, the peak at Llanfoist Bridge is 0.498m higher, and the peak at Chainbridge is 0.902m higher, than in Persistent Wet Weather October 2019.
- River levels at Llanfoist Bridge and Chainbridge were higher at the onset of Storm Dennis. Tal Y Maes is the rain gauge assigned the greatest Thiessen Polygon weighting of 39%. Based on Tal Y Maes rainfall, at the onset of Persistent Wet Weather October 2019 the level at Llanfoist Bridge was 0.883m, at the onset of Storm Dennis it was 1.783. At the onset of Persistent Wet Weather October 2019, the level at Chainbridge was 0.904m, at the onset of Storm Dennis it was 1.775. For Storm Dennis the level at Llanfoist Bridge was 0.9m greater, and the level at Chainbridge was 0.871m greater, than for Persistent Wet Weather October 2019.
- For Storm Dennis the peak level at Llanfoist Bridge was a new record high. This is recorded in Table 5 of the NRW report entitled *February 2020 Floods in Wales: Flood Event Data Summary.*

The graphs in Figure 3-9 and Figure 3-10 show cumulative rainfall totals for the 4-day period with the storms beginning on day 2 for Thiessen Polygon weighted rainfall of the 5 gauges included in the assessment. The individual cumulative rainfall graphs for the 5 gauges can be found in Appendix B. The cumulative totals are presented in Table 3-5:



Table 3-5. Cumulative rainfall totals.

Rainfall gauge	Persistent Wet Weather October 2019 (mm)	Storm Dennis (mm)
Thiessen Polygon weighted	93.4	97.5
Tal Y Maes	82.4	72.2
Brecon	104.8	106.6
Upper Chapel No1	81.0	80.2
Crai Reservoir	137.4	176.6
Usk Reservoir No2	74.8	112.8



Figure 3-9. Persistent Wet Weather October 2019 - Rainfall totals (mm/15mins) and cumulative rainfall (mm) for the 4-day period 24 to 27 October 2019



Figure 3-10. Storm Dennis - Rainfall totals (mm/15mins) and cumulative rainfall (mm) for the 4-day period 14 to 17 February 2020





3.5 Return Period

3.5.1 Rainfall

The Met office document *Wales: Climate, Updated 10 October 2016* reported that most parts of Wales experience daily totals of 50mm or greater at least once every 2 years.

In the NRW document *February 2020 Floods in Wales: Flood Event Data Summary*, NRW reported that Storm Dennis resulted in substantial and intense rainfall with significant impacts on river flows, river levels and flooding in South Wales. Nant yr Ysfa rain gauge, situated between the Cynon and Rhondda Fach catchments, received 130.4mm of rainfall in 24 hours, equivalent to 72% of an entire month's rainfall in a single day. At the top of the Rhondda Fawr catchment, Tyn Y Waun rain gauge received 132.4mm of rainfall in 24 hours, this equates to 62% of a month's rainfall in a single day.

In Pontypridd, the River Taff reached its highest level since records began in 1968. Peak flow passing through Pontypridd was estimated at 805m³/s, enough to fill an Olympic sized swimming pool in just over three seconds. This river level is 78cm higher than the previous record-level set during the 1979 floods.

The rainfall return period is the average interval a storm of at least a specified magnitude will occur on a catchment. The higher the return period the greater the storm.

The rainfall return period has been calculated for the Usk's catchment at Chainbridge using the Flood Estimation Handbook (FEH), at point 334600, 205550, see Table 3-7. Thiessen Polygon weighted rainfall and average duration was used for the 5 rain gauges assessed in the catchment. The rain gauge depth and duration data used is presented in Table 3-6, and shows how rainfall varied over the catchment during the storms.

Rain Gauge	Storm	Period	Duration (hrs)	Rainfall Depth (mm)
Tal Y Maes	Persistent Wet Weather Oct 2019	09:30hrs 25 Oct to 13:00hrs 26 Oct	27.5	79.6
Tal Y Maes	Storm Dennis	06:45hrs 15 Feb to 06:30hrs 16 Feb	23.75	63.0
Brecon	Persistent Wet Weather Oct 2019	08:15hrs 25 Oct to 13:00hrs 26 Oct	28.75	102.2
Brecon	Storm Dennis	06:15hrs 15 Feb to 06:15 16 Feb	24	93.0
Upper Chapel No1	Persistent Wet Weather Oct 2019	07:30hrs 25 Oct to 12:30hrs 26 Oct	29	80.2
Upper Chapel No1	Storm Dennis	06:15hrs 15 Feb to 06:15hrs 16 Feb	24	57
Crai Reservoir	Persistent Wet Weather Oct 2019	07:45hrs 25 Oct to 12:45hrs 26 Oct	29	129.2
Crai Reservoir	Storm Dennis	03:45hrs 15 Feb to 06:15hrs 16 Feb	27	139.4

Table 3-6. Rainfall depth and duration data.

Usk Reservoir	Persistent Wet	08:30hrs 25 Oct	27.5	73.0
No2	Weather Oct 2019	to		
		12:00hrs 26 Oct		
Usk Reservoir	Storm Dennis	06:30hrs 15 Feb	23.5	87.4
No2		to		
		06:00 16 Feb		

Table 3-7. FEH return period in years.

Storm	Duration (hrs)	Rainfall Depth (mm)	Return Period in Years
Persistent Wet Weather October 2019	28.35	90.41	27
Storm Dennis	24.45	80.62	18

Storm Dennis has a lower FEH return period than Persistent Wet Weather October 2019. The difference in return period between the 2 storms is primarily due to Persistent Wet Weather 2019 having a 10mm, or 11% greater rainfall depth. Persistent Wet Weather October 2019 also had a longer storm duration by 4 hours or 14%.

The Depth Duration Frequency curves in Figure 3-11 show the relationship between rainfall depth and storm duration for set return periods for the Usk's catchment at point 334600, 205550. Between 0 and approximately 48-hours, rainfall depths increase at a decreasing rate, and for storms of approximately 48-hour duration and greater, the relationship between storm duration and rainfall depth is linear.

Whilst Storm Dennis has the lower return period, river levels were already high at Chainbridge at the onset of Storm Dennis, and the catchment was already saturated due to Storm Ciara and an unnamed rainfall event on 12 and 13 February 2020 generating very fast runoff to the rivers and a high peak in the hydrograph; these were major contributing factors to the flooding. See section 3.4 for further details on antecedent conditions and factors contributing to flooding.



Figure 3-11. FEH Depth Duration Frequency, Usk Catchment, point 334600, 205550.



3.5.2 River Flow

The Chainbridge river gauge has a long and largely complete record of flow data for the Usk's catchment since 1957, therefore the gauge is suitable for enhanced single site (ESS) analysis to determine the river flow return period of Storm Dennis.

Using WINFAP software, and peak flow data at Chainbridge from the National River Flow Archive (NRFA), the flood growth curve was calculated indicating the river flow return period.

For ESS the index flood is QMED, this is the median flow, and is derived from a long historical record of annual maximum (AMAX) flood data. The growth curve is generated by multiplying observed flows by QMED, and provides a scale for higher and lower return period events. AMAX for the water year 2019/2020 was reached during the Storm Dennis flood event with the Usk discharging at 718m³/s, at 13:30hrs on 16 February 2020. Using the flood frequency curve this puts the river flow return period at around a 1 in 40-year event, see Figure 3-12.



Figure 3-12. Flood frequency curve for the Usk at Chainbridge

The NRFA records show that the greatest flow event in the gauge's history was 819.6³/s on 27 December 1979, see Figure 3-13, Storm Dennis is the last bar in the graph and has the second greatest flow since 1957.







3.5.3 Tidal

This section is not applicable to this report, it is retained for consistency with other FWMA Section 19 reports.

There is no tidal influence on the Usk within the flood investigation area.



3.6 Storm Dennis Across South Wales

South Wales has an oceanic climate and experiences low pressure weather systems moving eastwards from the Atlantic with the polar jet stream. It is also characterised by mountainous terrain. Rivers drain radially from the Brecon Beacons to the coast via main rivers.

Orographic uplift rainfall occurs when air is forced from a low elevation to a higher elevation as it moves across rising terrain. The combination of weather systems arriving from the Atlantic and the orographic lift over the extensive mountainous ranges in South Wales leads to notable storm events.

A Met Office review of the persistent heavy rainfall across Wales and England on 15 and 16 February 2020 (see section 10) reported that Storm Dennis brought 100 to 150mm or more rain across high ground of the Brecon Beacons and South Wales valleys. Storm Ciara one week earlier brought 100mm of rain across high ground of Snowdonia, and high rainfall in South Wales. For the 9-day period from 8 to 16 February 2020, most of the UK received the February whole month average rainfall, East Wales received 150%, and parts of Herefordshire received 200%, see Figure 3-14 and Figure 3-15.





Rainfall (mm	/ hour)							
0.01 - 0.5	0.5 - 1	1-2	2-4	4-8	8-16	16-32	»32]



Figure 3-15. Rainfall totals at individual rain gauges for Storms Ciara and Dennis combined as % of 1981-2010 February long term average.



The chart below in Figure 3-16 shows the UK areal-average rainfall totals for each day of winter between 1 December 2019 and 18 February 2020, with the exceptionally wet days of 8 and 15 February associated with storms Ciara and Dennis. The red line shows the maximum rainfall for these days between 1981 and 2010, both storms Ciara and Dennis are above the maximum rainfall for any day within this period between 1981 and 2010.



Figure 3-16. UK areal-average daily rainfall totals for 1 December 2019 to 18 February 2020.



3.7 Met Office Weather and Flood Warning

The NRW report *February 2020 Floods in Wales: Flood Event Data Summary* reported that February 2020 became the busiest month on record for issuing Flood Warnings in Wales; 243 Flood Alerts, 181 Flood Warnings and 6 Severe Flood Warnings were issued. These warnings reached 55,784 individuals, helping people to prepare and take action to save themselves and protect their property. However, due to the intense nature of events, a small number of flood warnings were issued late, or not at all.

A total of 3,130 properties were flooded during February 2020 in Wales. These included 224 properties flooded during Storm Ciara, 2,765 properties during Storm Dennis, and 141 During Storm Jorge. Of these an estimated 2,527 were households, with an average claims data from the insurance industry valuing around £81 million of flood damage.

Due to Storm Dennis many rivers reached historically high levels, exceeding the 1979 levels which caused extensive flooding and damage across South Wales. However, although significant flooding still occurred, it is estimated that NRW defences across South Wales protected over 19,000 properties.

On 11 February 2020 the Met Office issued a Yellow weather warning for disruption to travel in Wales and England due to very strong winds from Storm Dennis on 15 and 16 February 2020. On 13 February 2020 in addition to disruption to travel the Yellow weather warning predicted very heavy rain from Storm Dennis. At 06.10 on 16 February 2020 a Red weather warning was issued for Monmouthshire, in this Storm Dennis was predicted to bring further heavy rain on the morning of 16 February 2020, with it there was a warning of danger to life and high impacts as shown in Figure 3-17.



Figure 3-17. Met Office weather warning for South Wales issued 06:10 Sunday 16 February 2020





Storm Dennis is expected to bring further heavy rain for a time on Sunday morning, increasing the likelihood of high impacts.

What to expect

- · Danger to life from fast flowing or deep floodwater
- · Extensive flooding to homes and businesses is likely
- Collapsed or damaged buildings or bridges
- Road closures and bus and train service delays and cancellations
- Dangerous driving conditions because of spray and flooded roads
- Loss of power and other essential services, such as gas, water, mobile phone service
- Communities could be completely cut off by floodwater, perhaps for several days

Further details

Prolonged, heavy rain will continue until mid-morning, easing slowly into the middle of the day. This rain will bring event totals to between 100 and 140mm over higher ground in south Wales.



All regions & authorities affected

Wales

Blaenau Gwent Bridgend Caerphilly Cardiff Merthyr Tydfil Monmouthshire Neath Port Talbot Rhondda Cynon Taf Torfaen



4. Sources of Flooding

4.1 Fluvial Flooding

MCC has anecdotal reports that the primary source of flooding to the investigation area on 15, 16 and 17 February 2020 was the main river Usk. There are also records that the B4598 flooded due to the Usk and an ordinary watercourse coming out of bank in Llanvihangel Gobion.

Flooding in the investigation area occurred between 13:00hrs on 15 February and 08:00hrs on 17 February, with the peak of the flood occurring at approximately 11:00 to 12:00hrs on 16 February 2020. Maximum flood depths varied across the area, with approximately 1.22m internal to property, 2.44m on land, and 1.22m on the B4598.

The River Usk overtopped in multiple locations along its course from The Bryn to Chainbridge, and flood water extended across the Usk's floodplain. Figure 4-1 shows the course of the river Usk and its floodplain in blue, and ordinary watercourses in red. There are anecdotal reports of 5 residential properties flooding in Llanvihangel Gobion, 4 in Kemeys Commander, and further properties in between. Some properties in the flood investigation area are surrounded by earth bunds, one of the residents of these properties reported that during the flood event one of the bunds leaked.

There is an ordinary watercourse which flows in an easterly direction from land to the west of the B4598 near Pant-Y-Goitre Bridge. Once the watercourse reaches the B4598 it turns 90 degrees and is culverted under the road to the east side, it then flows northwards adjacent to the B4598 before culverting under the road called The Cottages. An image of The Cottages inlet and outlet is shown in Figure 4-2, there were stones and debris at the outlet at the time of the site visit in April 2021. From the culvert the watercourse continues to flow north along the B4598, approximately 185m south of the Usk the watercourse turns 90 degrees to flow eastwards again and around the perimeter of the Church of St Mary (see Figure 4-7), it then turns south-easterly and discharges to the Usk. The Church of St Mary flooded to a depth of 0.3m due to Storm Dennis.

There is a further ordinary watercourse in Llanvihangel Gobion which is culverted under the B4598, and discharges to the Usk via Church Lane. The area is very flat and the culvert under the B4598 does not have capacity to convey out of bank flows from the River Usk and was completely submerged during the Storm Dennis flood event. Figure 4-3 shows images of the watercourse near Saint Michael's Church, and the culvert under the B4598, these photos were taken on a site visit in April 2021. The photo in Figure 2-7 shows flooding of this section of the B4598 due to Storm Dennis. In times of flood, cars become marooned on this section of road where on one side the road is flooded directly from the Usk, and the other side the road is flooded from the ordinary watercourse.

An economically viable option to manage the risk to life posed by flooding of the B4598 in Llanvihangel Gobion, would be road closure gates which completely block off the road to drivers, signage, and traffic diversion routes. There are suitable diversion routes for individuals driving through the area and for locals travelling home. This option would also be far quicker to implement than any hard engineered solutions. Currently in times of flood MCC put out traffic cones and signage to warn drivers of the flood risk, however it is not enough to deter people from driving through the flood water and becoming marooned.

Photos of the River Usk in the flood investigation area are shown in Figure 4-4, Figure 4-5 and Figure 4-6.



Figure 4-1. Path of the River Usk and ordinary watercourses in Llanvihangel Gobion and south of Pant-Y-Goitre Bridge.



Figure 4-2. Ordinary watercourse near Pant-Y-Goitre Bridge south of the Usk, culvert under The Cottages, left the inlet, right the outlet, site visit April 2021.





Figure 4-3. Ordinary watercourse in Llanvihangel Gobion, left near St Michael's Church, centre and right the inlet and outlet of the culvert under the B4598, site visit April 2021



Figure 4-4. The River Usk and floodplain at The Bryn, site visit April 2021.



Figure 4-5. Pant Y Goitre Bridge carrying the B4598 over the River Usk, south bank, site visit April 2021.





Figure 4-6. Photo showing flood extent to land adjacent to the Usk, Storm Dennis February 2020



Figure 4-7. Ordinary watercourse flowing around the Church of St Mary, site visit April 2021



4.2 Groundwater

This section is not applicable to this report, it is retained for consistency with other FWMA Section 19 reports.



4.3 Tidal

This section is not applicable to this report, it is retained for consistency with other FWMA Section 19 reports.

There is no tidal influence on the River Usk in the flood investigation area.

4.4 Land Drainage

There are land drainage arches in Llanvihangel Gobion on the banks of the River Usk under the B4598, as shown in Figure 4-8.

Figure 4-8. Land drainage under the B4598 on the banks of the River Usk. Pant Y Goitre Bridge can be seen in the right photo, Llanvihangel Gobion, site visit April 2021



Additionally, there are ordinary watercourses in Llanvihangel Gobion and south of Pant-Y-Goitre Bridge as described in section 4.1 and shown in Figure 4-1.

4.5 Surface Water Drainage

Residents of a property near Chainbridge reported internal flooding on 15 and 16 February 2020 commencing with water rising from outside drains which had surcharged due to high levels on the Usk. Later the Usk came out of bank and submerged the property and the drainage system.



5. Rights and Responsibilities of Risk Management Authorities

5.1 Lead Local Flood Authority

Under the FWMA 2010, MCC has been established as the Lead Local Flood Risk Authority (LLFA) for its administrative area.

In its role as LLFA, MCC visited the residents affected by flooding due to Storm Dennis shortly after the event.

As defined in the Act, 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 take the lead in dealing with surface water flooding incidents prior to the changes contained within the Act.

The Act places 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.
- 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 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.
- The ability to cause flooding or coastal erosion under certain conditions.

LLFA's in Wales have also taken on the role of the Sustainable Drainage Systems (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 where applicable 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 the flood investigation area included a range of Response and Recovery functions:

- Officers investigated the flooding and have produced this report in line with Section 19 of the FWMA 2010.
- Officers contacted residents affected by flooding to offer support and advice to assist in the recovery following the event.
- Officers coordinated the response to the flooding with Emergency Services.



• Asset information collected during the flood event has been incorporated into the LLFA Asset Register.

5.2 Natural Resources Wales

Under the Flood and Water Management Act 2010 and The Water Resources Act 1991, NRW have discretionary powers to manage the risk of flooding from main rivers, reservoirs and the sea. They are also recognised as a coastal erosion risk management authority under the Coast Protection Act 1949.

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 in areas where there is a special need for drainage, including flooding. The Llanvihangel Gobion and Kemeys Commander flood investigation area is not in an IDD.

NRW as the Risk Management Authority can use its permissive powers to carry out work in several ways:

- By building new flood defences and other structures such as sluices and pumping stations.
- By maintaining defences and structures once built, keeping them in good condition subsequently, and repairing or improving them if and when required.
- By maintaining main river watercourses, removing obstructions, vegetation and silt or gravel, to keep water flowing and remove significant flooding risks.

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 levels, prevent overloading of the sewer systems, and maintaining and repairing 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.

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 Highways Authority

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

MCC 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 FWMA 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.

5.6 Riparian Landowners

A riparian owner is anyone who owns a property where there is a watercourse within or adjacent to the boundaries of their property. A riparian owner possesses rights over and responsibilities for the stretch of a watercourse within or adjacent to 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 it 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 RMA, LLFA, or NRW.

Landowners are responsible for ditches and land drainage assets upon their land. NRW has permissive powers to maintain watercourses which are designated as main rivers and MCC has permissive powers to maintain the ordinary watercourses respectively.

This investigation has not identified any defects with watercourses (main river or ordinary watercourse) under riparian ownership which would have contributed to the flooding.

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 Schemes / Drainage Improvements

No previous flood alleviation and drainage improvement schemes have been identified in the Section 19 flood investigation area.



8. Conclusion

The NRW report *February Floods in Wales: Flood Event Data Summary* states that the consensus from climate change scientists is that extreme weather events, such as Storm Dennis and other storms that hit Wales in February 2020, are becoming more frequent. Climate change is increasingly impacting the way we live and work around rivers, catchments and the coast, and the way we manage water. Therefore, we need to understand how to adapt the way we live and work in these locations.

This FWMA Section 19 flood investigation into flooding which occurred in the Llanvihangel Gobion and Kemeys Commander flood investigation area between 13:00hrs on 15 February 2020 and 08:00hrs on 17 February 2020, has determined that the flooding was due to heavy and persistent rain during Storm Dennis which fell on ground that was already saturated from Storm Ciara and an unnamed rainfall event on 12 and 13 February 2020. The rain fell across the Usk's catchment resulting in a rapid rise in levels on the river and its tributaries.

The Usk overtopped in multiple locations from The Bryn to Chainbridge. There are anecdotal reports of 5 residential properties flooding in Llanvihangel Gobion, 4 in Kemeys Commander, and further properties in between. North of Pant-Y-Goitre Bridge in Llanvihangel Gobion the B4598 flooded; several vehicles drove through one section of flooding on the carriageway to become marooned on an island of carriageway with fast flowing water either side; this flood risk is severe as it poses risk to life.

Previous flood events occurred at this location in 1979, 2018 and 2019, and it is reported that the land in the floodplain of the Usk floods annually.

The FEH rainfall return period analysis has calculated that Storm Dennis had a lower return period than Persistent Wet Weather October 2019. The WINFAP river flow return period analysis showed that Storm Dennis was the second biggest river flood event since records began on the Usk at Chainbridge, and that the biggest was the December 1979 flood.

Whilst Storm Dennis has the lower rainfall return period, river levels were already high at Chainbridge at the onset of Storm Dennis, and the catchment was already saturated due to Storm Ciara and an unnamed rainfall event on 12 and 13 February 2020 generating very fast runoff to the rivers and a high peak in the hydrograph.

Due to the element of risk to life posed by flooding to the highway, it is recommended that an economically viable flood risk management option which can be quickly implemented is considered in conjunction with trigger level responses. It is also recommended that Property Flood Resilience (PFR) measures are considered.



9. Recommendations

In accordance with Section 19 of the FWMA 2010, as LLFA, MCC has investigated this flood event and identified which RMAs 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 in Table 9-1 have been made.

	Table 9-1.	Recommendation	s from the	Section	19 Flood	Investigation
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Reference	Recommendation	Responsible Risk Management Authority(ies)
LG01 (Flood risk)	Undertake an initial assessment of options to manage the risk of main river flooding.	NRW
	The assessment(s) should include consideration of all areas covered by this report and the local factors specific to those areas.	
LG02 (Flood assets and land drainage features)	Record detail, ownership and maintenance responsibility of all flood assets and land drainage features and ensure such features are maintained to the required standards.	MCC/NRW
LG03	Record detail, ownership and maintenance	MCC
(Surface water)	drainage features and ensure such features are maintained to the required standards.	
LG04 (Community flood plan)	Consider the requirement for a Community Flood Plan to inform and aid the emergency response to future flood events. This should include community engagement, awareness raising and training to enable the community to monitor, interpret, act and respond to river trigger levels on the Usk. This will give the community more ownership of the flood plan. The plan should also include details of assistance and support available to the community including what financial support might be available following flood events.	MCC/NRW
LG05 (Flood warning service)	Raise awareness and understanding of the flood warning service "Floodline" and review take up within the area covered by this investigation.	NRW
LG06 (Highway B4598)	A review of the flood response arrangements for flooding along the B4598 should be undertaken with particular consideration given to trigger levels and emergency road closure arrangements.	MCC



10. Useful Links and Contacts

- Monmouthshire County Council Flood Pages: <u>www.monmouthshire.gov.uk/flood-risk-management</u>
- Natural Resources Wales: <u>www.naturalresources.wales/flooding</u>
- Welsh Government: <u>www.gov.wales/flooding-coastal-erosion</u>
- Blue Pages
 <u>www.bluepages.org.uk</u>
- Flood Re (Insurance): <u>www.floodre.co.uk</u>



11. Table of Acronyms

Table 11-1 is a list of acronyms used in the report.

Table 11-1. Table of acronyms

Full text	Acronym
Enhanced Single Site	ESS
Environment Agency	EA
Flood and Coastal Erosion Risk Management	FCERM
Flood and Water Management Act 2010	FWMA 2010
Flood Estimation Handbook	FEH
Internal Drainage District	IDD
Lead Local Flood Authority	LLFA
Monmouthshire County Council	MCC
Natural Flood Management	NFM
Natural Resources Wales	NRW
Property Flood Resilience	PFR
Risk Management Authority	RMA



Appendix A – Anecdotal evidence

This appendix has been redacted.



Appendix B - Rainfall graphs

Table 0-1. Persistent Wet Weather October 2019 - Rainfall totals Tal Y Maes (mm/15mins), and cumulative rainfall (mm) for the 4-day period 24 to 27 October 2019



Table 0-2. Storm Dennis - Rainfall totals Tal Y Maes (mm/15mins), and cumulative rainfall (mm) for the 4-day period 14 to 17 February 2020





Table 0-3. Persistent Wet Weather October 2019 - Rainfall totals Brecon (mm/15mins), and cumulative rainfall (mm) for the 4-day period 24 to 27 October 2019



Table 0-4. Storm Dennis - Rainfall totals Brecon (mm/15mins), and cumulative rainfall (mm) for the 4-day period 14 to 17 February 2020





Table 0-5. Persistent Wet Weather October 2019 - Rainfall totals Upper Chapel No1 (mm/15mins), and cumulative rainfall (mm) for the 4-day period 24 to 27 October 2019



Table 0-6. Storm Dennis - Rainfall totals Upper Chapel No1 (mm/15mins), and cumulative rainfall (mm) for the 4day period 14 to 17 February 2020





Table 0-7. Persistent Wet Weather October 2019 - Rainfall totals Crai Reservoir (mm/15mins), and cumulative rainfall (mm) for the 4-day period 24 to 27 October 2019



Table 0-8. Storm Dennis - Rainfall totals Crai Reservoir (mm/15mins), and cumulative rainfall (mm) for the 4-day period 14 to 17 February 2020





Table 0-9. Persistent Wet Weather October 2019 - Rainfall totals Usk Reservoir No2 (mm/15mins), and cumulative rainfall (mm) for the 4-day period 24 to 27 October 2019



Table 0-10. Storm Dennis - Rainfall totals Usk Reservoir No2 (mm/15mins), and cumulative rainfall (mm) for the 4-day period 14 to 17 February 2020

