Flood and Water Management Act 2010

Storm Bert November 2024 - Overview Report

February 2025

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DOCUMENT VERIFICATION

Client	Director for Highways, Streetcare and Transportation Services
Project	Flood and Water Management Act 2010, Section 19
Document Title	Storm Bert November 2024 – Overview Report
Document Ref	FRM – Storm Bert – Overview Report
Project No	N/A

Revision Status	Final			
Publication Status	Publication Approved			
Date of Issue	10/01/2025			
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EXECUTIVE SUMMARY

This report provides an overview of the storm event that occurred on the 23 and 24th November 2024, including detailed rainfall, watercourse and river level analysis, a short summary of the impacts, primary flooding types and an overview of the roles and responsibilities of Risk Management Authorities in managing different sources of flooding. It does not identify any proposed specific causes, actions or works in relation to the storm event.

The flooding that affected Rhondda Cynon Taf (RCT) on 23 and 24th November 2024 was a result of an extreme rainfall event, named by the Met Office as 'Storm Bert'. The storm was preceded by one weather warning issued by the Met Office on 20th November 2024.

The impact of Storm Bert resulted in internal flooding to approximately 438 properties and extensive flooding of infrastructure including rail and highway networks, town centres, business parks and leisure facilities. These impacts were identified through inspections made by Rhondda Cynon Taf County Borough Council's (RCTCBC) Flood Risk Management Team during the days following the storm event, as well as information collated by residents, RCTCBC's Public Health, Protection and Community Service and Dŵr Cymru Welsh Water (DCWW).

Record-breaking rainfall and river levels exceeded the design standard of drainage infrastructure in RCT, resulting in severe flooding to homes, businesses and infrastructure.

Under Section 19 of the Flood and Water Management Act 2010, RCTCBC have a duty to investigate and publish reports on flood events that occur within its area to the extent that it considers it necessary or appropriate. Detailed assessments of the flooding mechanisms and impacts caused during the storm event have been produced

for individual areas across RCT. A total of 25 areas have been investigated across the county borough, 5 of which have met stipulated Welsh Government thresholds for the production of individual Section 19 Reports. These reports will be made available to the public and will compliment this overview report of Storm Bert.

ABBREVIATIONS

DCWW – Dŵr Cymru Welsh Water

FWMA – Flood and Water Management Act 2010

LFRMS – Local Flood Risk Management Strategy

LLFA – Lead Local Flood Authority

NRW – Natural Resources Wales

RCT - Rhondda Cynon Taf

RCTCBC – Rhondda Cynon Taf County Borough Council

RMA – Risk Management Authority

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1. INTRODUCTION

1.1. BACKGROUND

On the 23 and 24th November 2024, Rhondda Cynon Taf County Borough Council (RCTCBC) was impacted by a severe weather event which was designated by the Met Office as 'Storm Bert' on 20th November 2024.

Storm Bert brought extremely wet and windy weather across South Wales, with over 150mm falling in the wettest upland areas.

Communities within RCT were amongst the worst impacted by the storm with several hundred homes and businesses flooded. Intense rainfall in the catchment areas of RCT during the storm event caused rivers and watercourses to react quickly, reaching record levels for the Rhondda Fawr River at Tynewydd and Gelli and the River Cynon at Aberdare (according to Natural Resources Wales (NRW) river gauge data). A major incident was declared by RCTCBC following the serious disruption caused by the flooding.

Although every storm cannot be attributed to the effects of climate change, evidence suggests that extreme weather events, such as those of November 2024 and Storm Dennis in February 2020, will become more frequent in the future. Climate projections over UK land for the 21st century suggest that winters will become warmer and wetter, summers will be drier, and we will experience an increase in the frequency and intensity of extreme weather events.

As a society we must all learn to adapt to the changing climate, both in terms of raising awareness of flood risk, improving preparedness for flooding and also in terms of responding to major instances of flooding.

1.2. PURPOSE OF REPORT

The 23rd and 24th November saw a severe weather event impact RCT and resulted in widespread residential and commercial flooding across the authority. The purpose of this report is to provide an initial overview of the storm event, designated by the Met Office as ‘Storm Bert.

This wider overview report of Storm Bert provides a detailed analysis of rainfall during the event and the subsequent responses of local watercourses and Main Rivers flowing through the authority. It also includes a brief overview of the impacts experienced across RCT caused by a wide range of flood sources. This report will also set out how the authority intends to formalise the investigation process, as required under Section 19 of the FWMA, which has been underway since November 2024.

It is important to note that this overview report has been produced to compliment the specific flood investigations which will be published under Section 19 of the FWMA following this report.

2. Storm Bert

2.1. Forecasting and Prediction Timeline

Storm Bert was the second named storm of the 2024-25 European windstorm season and was named by the Met Office on 20th November 2024.

Storm Bert brough extreme weather changes to the United Kingdom (UK), with heavy snowfall and freezing temperatures in northern regions contrasting sharply with unseasonable warm and wet conditions in the south.

A yellow weather warning for rain, with low likelihood for medium impacts associated with Storm Bert, was issued by the Met Office for the majority of Wales, including RCT, at 11:07 on 20th November 2024. The warning was in place between 06:00 on Saturday 23rd November and 06:00 Sunday 24th November. Details of the weather warning and its extent is shown in Table 1 and Figure 1.

According to the weather warning, prolonged and heavy rainfall across large parts of the UK was expected during 23 and 24th November. Approximately 50-75mm of rain was predicted to fall widely, with 100-125mm of rain over higher ground, particurarly in south Wales. Up to 150mm was predicted to fall in some places, with strong southerly winds accompanying the heavy rain, locally exacerbating impacts in many areas.

No further weather warnings were issued by the Met Office for RCT during Storm Bert.

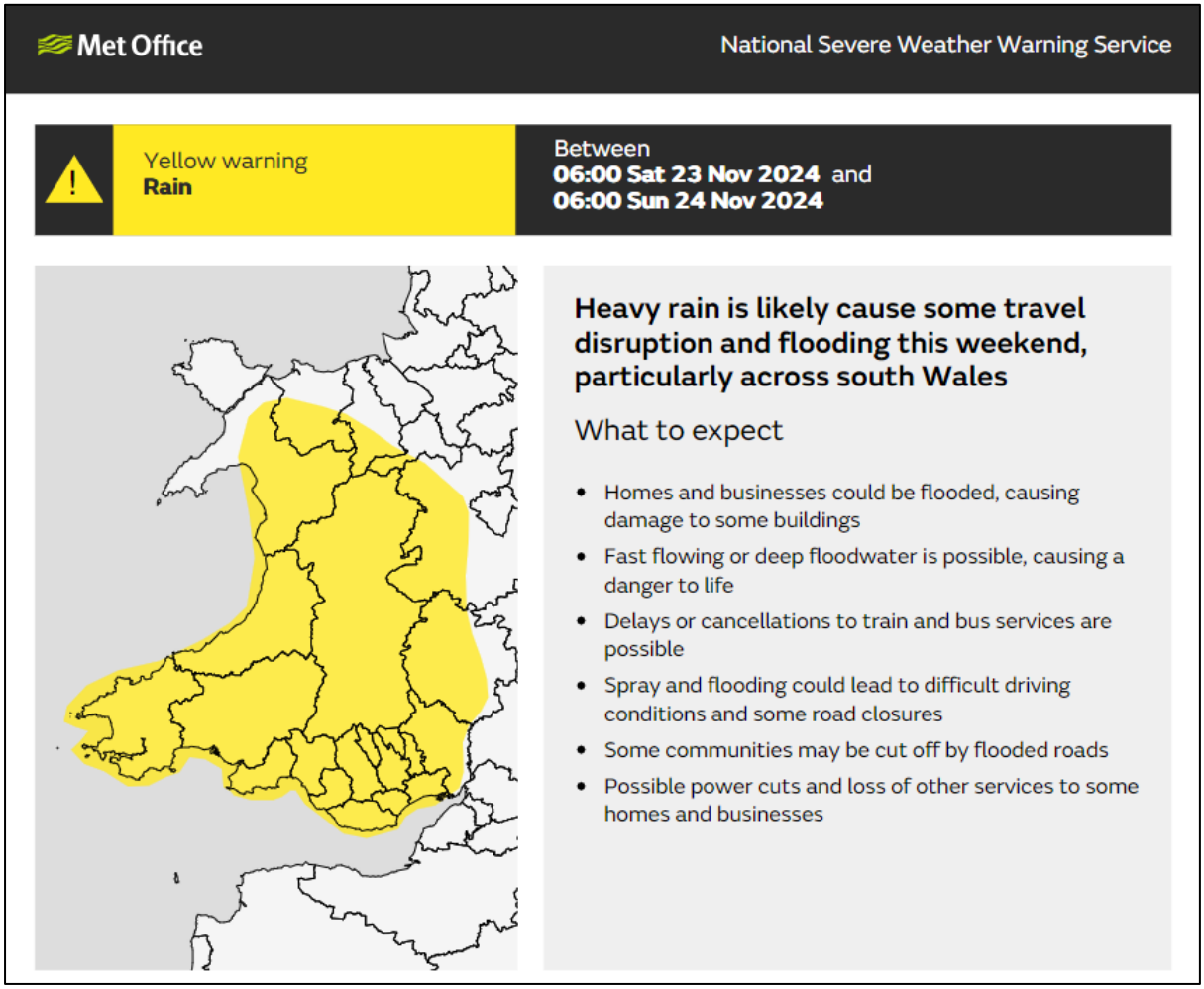
A full list of weather warnings issued by the Met Office for the UK during Storm Bert is available in the online National Severe Weather Warnings Archive[1].

[1] National Severe Weather Warnings Archive - Met Office

Weather Warning	Date of Issue	Start of Warning Period	End of Warning Period
Yellow Warning - Rain	11:01 Wed 20 Nov	06:00 Sat 23 Nov	06:00 Sun 24 Nov

Table 1: Weather Warning issued for RCT relating to Storm Bert

Figure 1: Weather warning issued by the Met Office's National Severe Weather Warning Service at 11:01 Wednesday 20th November 2024



2.2. RAINFALL ANALYSIS

The first half of November 2024 was mild and dry with Wales recording approximately no more than 10% of its average rainfall by mid-month, according to the Met Office[2]. In contrast, the latter half of the month brought storms, snow and heavy rainfall to the UK. Figure 2 shows the very dry start to November 2024, followed by heavy rain later in the month. Notably, Storm Bert is identified by the sharp increase in rainfall on 23rd and 24th November 2024 shown in the graph below.

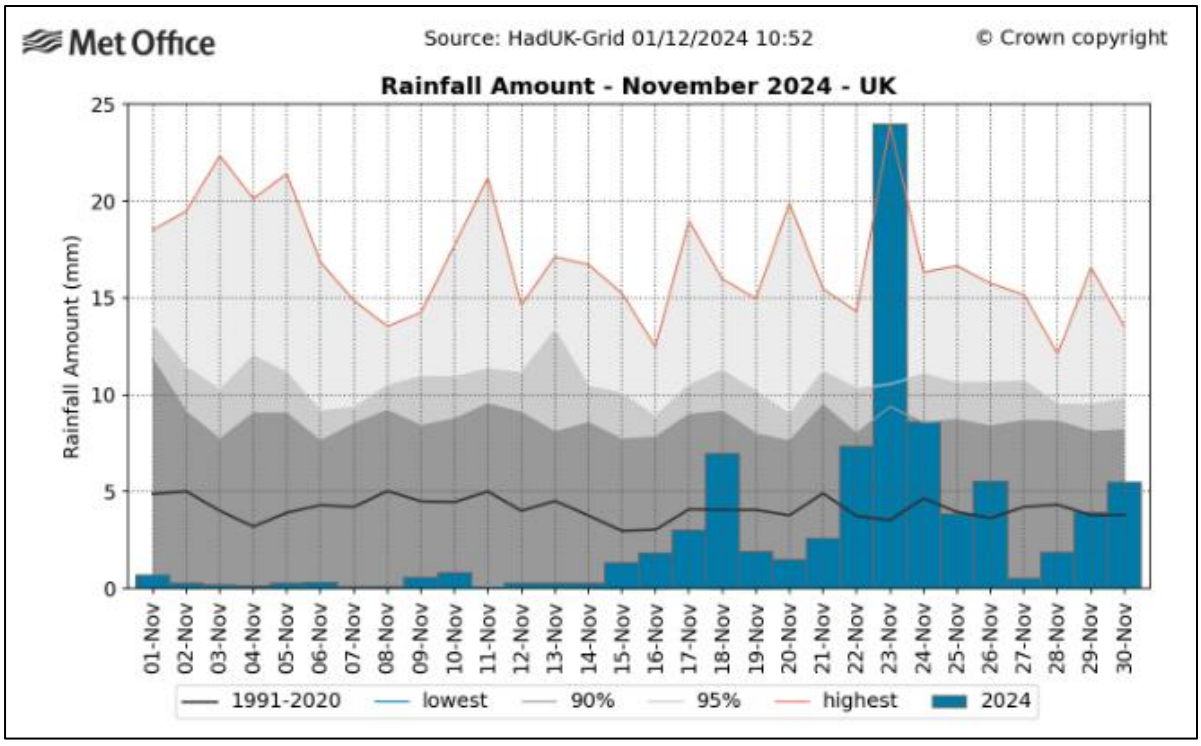


Figure 2: Average UK rainfall amounts in November 2024. Met Office.

Figure 3 taken from the Met Office's Storm Bert summary show[3], rainfall totals across the UK during Storm Bert (between 22nd and 24th November 2024). The map illustrates the intensity and persistence of the rainfall that occurred across parts of the South Wales. More than 150mm of rain fell across the hills of RCT, with lower lying areas

[2] November 2024: a month of two halves - Met Office
[3] Storm Bert, November 2024, Met Office

receiving between 50 – 100mm more widely. It is estimated that approximately three-quarters of the whole-month November average rainfall amount fell widely across the south-east of South Wales[3].

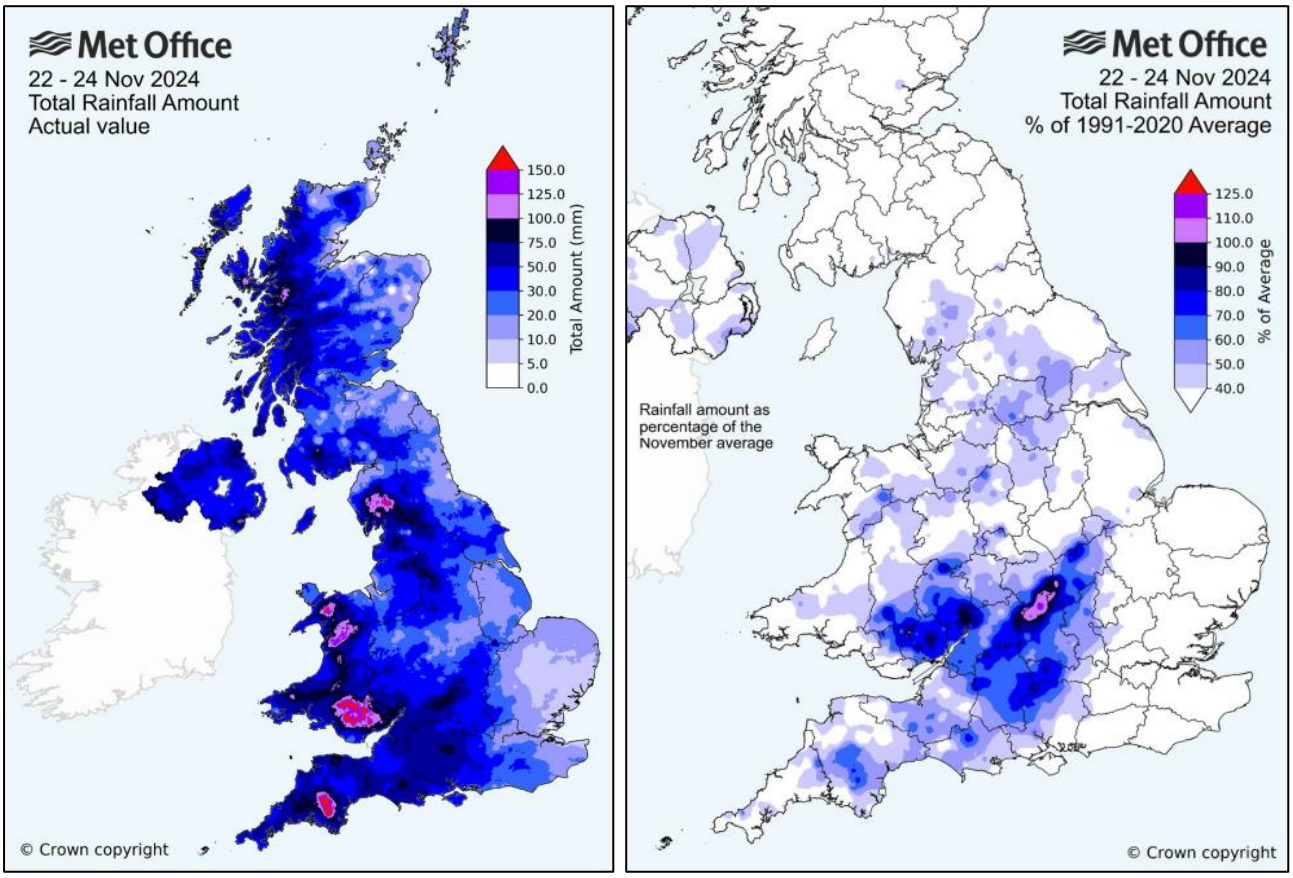


Figure 3: Total rainfall amount (actuals) and % of 1991-2020 November average rainfall during 22 – 24 November 2024. Met Office.

Rainfall during Storm Bert was recorded at seven weather stations maintained by RCT. An additional five monitoring stations owned and maintained by NRW in the RCT area have also been included in this review to account for rainfall across the upper valley catchments. The location of the monitoring stations within RCT are shown in Figure 4.

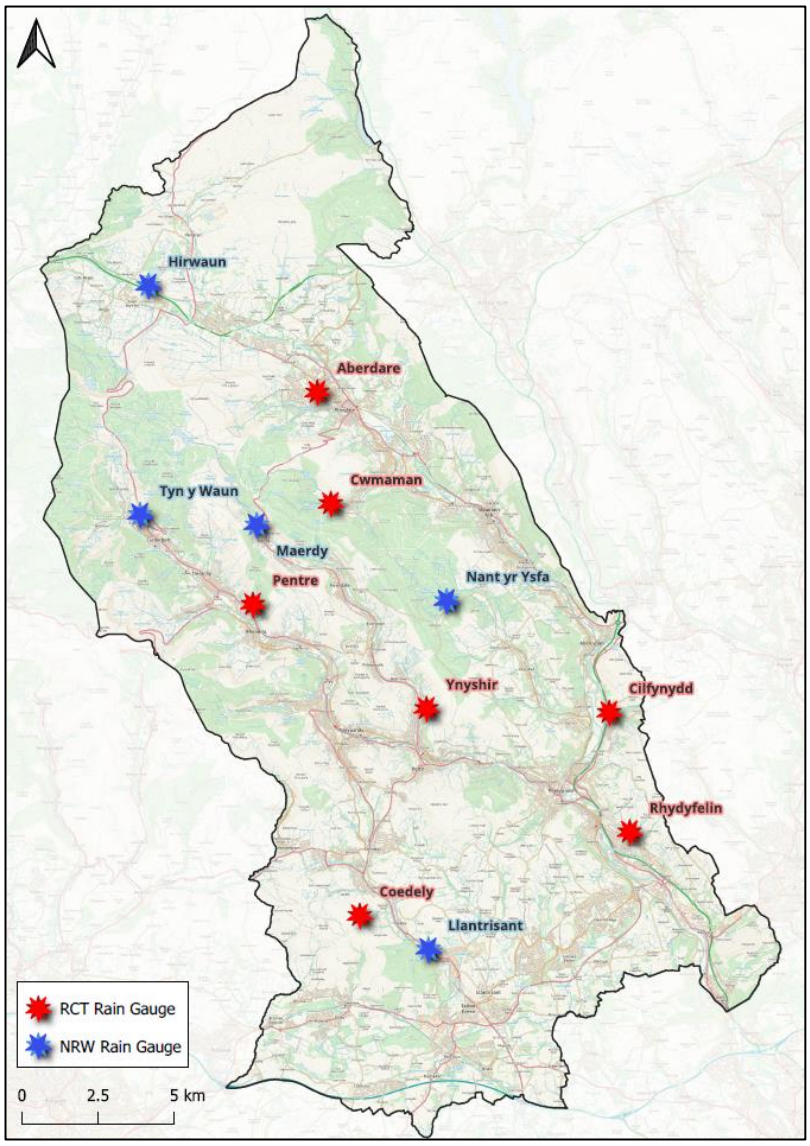


Figure 4: Location of RCT and NRW operated and maintained rain gauge monitoring stations in RCT

Geographically the RCT stations are situated within the lower-lying, urban catchments of Aberdare and Cwmaman in the Cynon valley, Cilfynydd and Rhydyfelin in south-eastern sector of RCT, Coedely in the lower Taf valley and Pentre and Ynyshir in the Rhondda Fawr and Fach valleys, respectively.

NRW's Tyn y Waun station is located to the north-west of RCT in the Rhondda Fawr valley while the Maerdy station lies within the Rhondda Fach valley. The Hirwaun

station is located to the north-east in the upper Cynon valley, Nant yr Ysfa is situated at St Gwynno Forest above the town of Ynysybwl and NRW's Llantrisant gauge located in the Ely catchment. All five of NRW's rain gauges are situated on higher ground compared with RCT's monitoring stations which reflect the higher rainfall totals and intensities captured within Table 2 for NRW stations due to the influence of the hills on increasing the rainfall (also known as 'orographic enhancement').

Table 2: Rainfall totals and peak hourly intensities recorded at RCT and NRW rain gauges during Storm Bert (23-24 November 2024). Contains Natural Resources Wales information © Natural Resources Wales and database right. All rights reserved.

Monitoring Station	Total Rainfall (mm) (23/11/24)	Total Rainfall (mm) (24/11/24)	Total Rainfall (mm)	Peak Hourly Intensity (mm/hour)	Date & Time of Peak
RCT Aberdare	51.4	41.4	92.8	10	24/11/2024 - 05:15 - 06:15
RCT Cwmaman	44.2	37.2	81.4	8.8	24/11/2024 - 05:30 - 06:30
RCT Cilfynydd	41.4	54.4	95.8	13.2	24/11/2024 - 06:45 - 07:45
RCT Rhydyfelin	20.6	39.4	60	11.6	24/11/2024 - 06:45 - 07:45
RCT Coedely	23.8	37.6	61.4	11.2	24/11/2024 - 06:45 - 07:45
RCT Pentre	35	25.2	60.2	5.8	24/11/2024 - 05:30 - 06:30
RCT Ynyshir	47.2	47.6	94.8	12	24/11/2024 - 06:45 - 07:45
NRW Tyn y Waun	81.2	90.4	171.6	22	24/11/2024 - 05:15 - 06:15
NRW Maerdy	76	78	154	18.2	24/11/2024 - 05:30 - 06:30
NRW Hirwaun	76.2	79.6	155.8	10	24/11/2024 - 06:30 - 07:30
NRW Nant yr Ysfa	80.2	87.6	167.8	15.6	24/11/2024 - 06:45 - 07:45
NRW Llantrisant	26	42.4	68.4	11.8	24/11/2024 - 06:45 - 07:45

Table 2 details the total rainfall and peak intensities recorded over the 2-day period of Storm Bert (23 – 24 November 2024) across all RCT and NRW rain gauge monitoring stations.

Storm Bert brought very heavy rainfall across the entirety of RCT. The heaviest rainfall totals were recorded in the upper catchments, particularly across the tops of the Rhondda Fawr valley, with **NRW's Treherbert** station recording a total of **171.6mm** of rainfall over the 2-day period. This rain gauge also recorded the highest peak intensity of **22 mm/hour** between 05:15 and 06:15 on 24th November, within which **6.4mm** of rain fell within 15 minutes. Nearby in the Rhondda Fach valley, **NRW's Maerdy** station also recorded a significant rainfall total of **154mm**, with a peak intensity of **18.2 mm/hour** during the same time period.

The lower Rhondda catchments experienced varied rainfall totals. At **RCT's Ynyshir** station, located in the lower Rhondda Fach, a total of **94.8mm** was recorded, with a peak intensity of **12mm/hour** between 06:45 and 07:45. In contrast, **RCT's Pentre** station in the lower Rhondda Fawr recorded a lower total of **60mm**, with a peak intensity of **5.8mm/hour** between 05:30 and 06:30. Following a review of the condition of RCT's Pentre rain gauge it was identified to have leaf debris within, which suggests that rainfall readings at this location were inaccurate and were likely higher than those recorded.

In the Cynon valley, **NRW's Hirwaun** station recorded a total rainfall of **155.8mm**, with a peak intensity of **10 mm/hour** between 06:30 and 07:30 on 24 November. Whilst RCT's rain gauges in the lower catchments of the Cynon valley recorded slightly lower values, rainfall totals and peak intensities were still high, with **RCT's Park Lane** rain gauge recording totals of **92.8 mm** (**10mm/hour**) and **RCT's Cwmaman** rain gauge recording **81.4mm** (**8.8mm/hour**).

In the eastern areas of RCT, **RCT's Cilfynydd** station recorded a notable total of **95.8mm**, with a peak intensity of **13.2mm/hour** between 06:45 and 07:45 – the highest peak intensity recorded across RCT owned rain gauges.

Rainfall totals were lowest across the lower Taf sector of RCT compared with the rest of the borough, with **RCT's Coedely** and **Rhydyfelin** rain gauges recording approximately **60mm** of rainfall over the 2-day period. Despite these lower totals, peak intensities at both stations were very high, with **over 11mm** of rainfall falling between 06:45 and 07:45.

Figure 5 shows the rainfall pattern during Storm Bert. Whilst rainfall was persistent over the 2-day period, two notable peaks occurred across RCT. The first peak in rainfall occurred at approximately 15:00 on Saturday 23rd, followed by a much greater peak in rainfall intensity between 05:00 and 08:00 on Sunday 24th November. Following this, rainfall began to ease throughout the day, with rainfall intensities ranging between 1-3mm, which is still considered moderate.

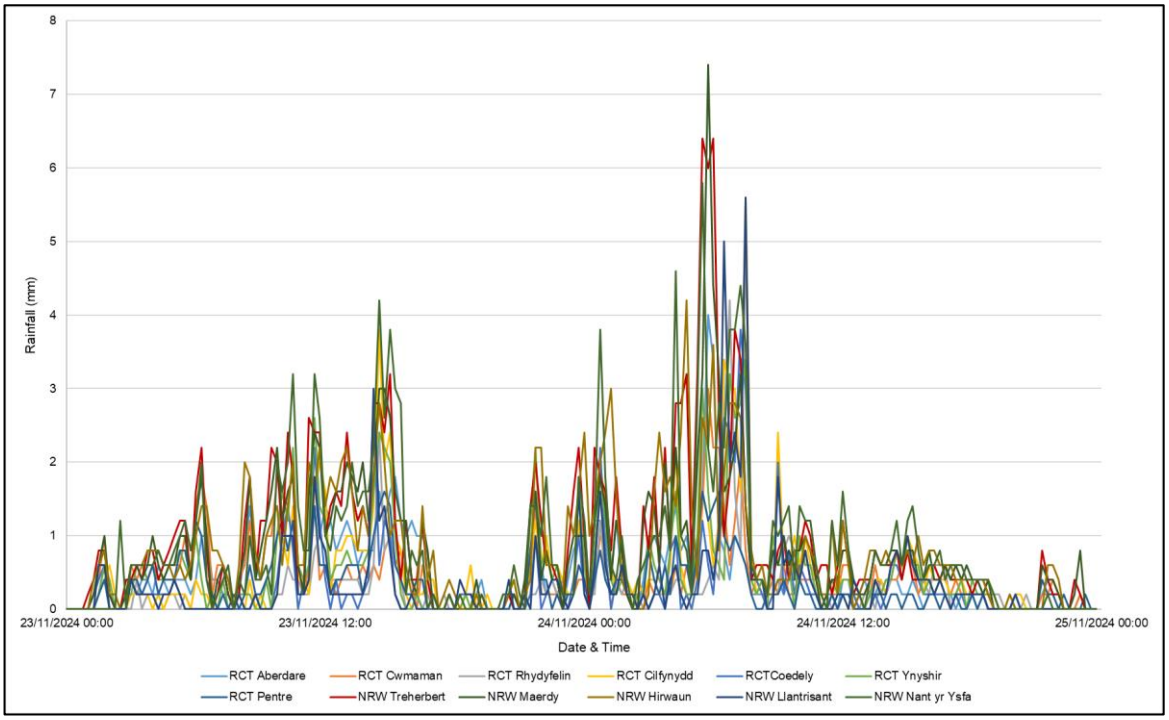


Figure 5: Rainfall recorded at RCT and NRW rain gauges between 23-24 November 2024

When comparing the rainfall recorded across RCT during Storm Bert against Storm Dennis (the most recent major storm event to impact RCT), the results are significant.

Storm Dennis occurred on the 15 and 16th February 2020 and was the fourth named storm of the 2019-2020 season. Storm Dennis was noted as one of the most intense extratropical cyclones ever recorded and resulted in a rare red weather warning for rain being issued by the Met Office for RCT on 16th February 2020. Further details of Storm Dennis are available within the 'Storm Dennis – Overview Report', published by the Council in July 2021[4].

Based on the data shown in Table 3 and Figure 6, it can be observed that the majority of RCT experienced higher rainfall totals and intensities during Storm Bert, compared with Storm Dennis, despite only a yellow weather warning for rain being issued by the Met Office.

NRW's Tyn y Waun rain gauge in Treherbert recorded 21.4mm more rainfall during Storm Bert compared with Storm Dennis, and a peak intensity of 10mm more within a one-hour period. NRW's Nant yr Ysfa and Hirwaun rain gauges also recorded almost 20% higher rainfall totals during Storm Bert, compared with Storm Dennis. Despite this, rainfall intensities during Storm Bert at NRW's Hirwaun was lower by 3.4mm/hour compared with Storm Dennis. This isn't observed elsewhere across the borough however, as peak intensities recorded during Storm Bert were often greater than those recorded during Storm Dennis, particularly at NRW's Maerdy station and RCT's Rhydyfelin and Cilfynydd stations.

[4] StormDennisOverviewReport.pdf

Table 3: Rainfall totals and peak intensities recorded during Storm Bert (23-24 Nov 2024) and Storm Dennis (15-16 Feb 2020)

Monitoring Station	Total Rainfall (mm) (Storm Bert)	Total Rainfall (mm) (Storm Dennis)	Variance +/- (mm)	Peak Hourly Intensity (mm/hour) (Storm Bert)	Peak Hourly Intensity (mm/hour) (Storm Dennis)	Variance +/- (mm)
RCT Aberdare	92.8	N/A	N/A	10	N/A	N/A
RCT Cwmaman	81.4	94	-12.6	8.8	7.4	+1.4
RCT Cilfynydd	95.8	88.6	+7.2	13.2	10.2	+3
RCT Rhydyfelin	60	53.4	+6.6	11.6	8.8	+2.8
RCT Coedely	61.4	58.8	+2.6	11.2	11.2	0
RCT Pentre	60.2	N/A	N/A	5.8	N/A	N/A
RCT Ynyshir	94.8	N/A	N/A	12	N/A	N/A
NRW Tyn y Waun	171.6	150.2	+21.4	22	12	+10
NRW Maerdy	154	157	-3	18.2	14.8	+3.4
NRW Hirwaun	155.8	129.2	+26.6	10	13.4	-3.4
NRW Nant yr Ysfa	167.8	145.4	+22.4	15.6	14	+1.6
NRW Llantrisant	68.4	N/A	N/A	11.8	N/A	N/A

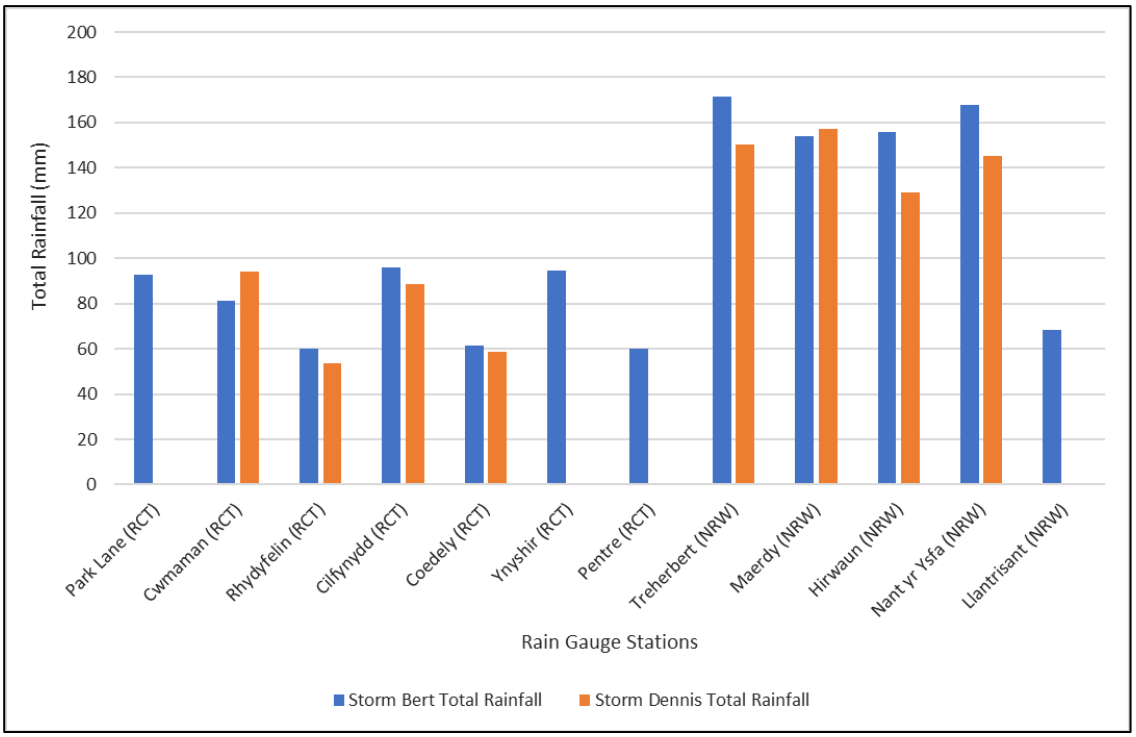


Figure 6: Rainfall totals recorded at RCT and NRW rain gauge stations during Storm Bert (23-24 Nov 2024) and Storm Dennis (15-16 Feb 2020)

2.3. Ordinary Watercourse Response

The catchments of the South-east Wales Valleys within RCT; the Rhondda, Cynon, Taff and Ely, are all characterised by steep sides, which are susceptible to intense rainfall and associated flash flooding. The combination of topographic, geological and geographical factors causes the catchments within RCT to have an almost immediate response to rainfall with events often subsiding in hours, rather than days (FRMP, 2015[7]).

RCTCBC have established a network of telemetry monitoring stations across the borough to both monitor water levels at RCT's highest risk watercourses and attenuation basins and provide early warnings of potential blockages to drainage infrastructure such as culvert inlets. This enables RCTCBC to mobilise resources rapidly and effectively to reduce the risk of flooding caused by blockages.

Across RCT's network of telemetry monitoring stations, 15 early-warning alarms were triggered across RCT during Storm Bert. Of the 15 stations which triggered early-warning alarms, 4 stations surcharged (flood) during the storm event between approximately 05:00 and 07:00 on 24th November 2024. An additional 11 monitoring stations which are monitored via CCTV only also showed evidence of surcharging (flood) during this time. The location of the monitoring stations which showed evidence of surcharging (flood) during the storm event are shown in Figure 7. Please note, this is not the confirmed list of surcharged assets during Storm Bert. The below contains data on RCT monitoring stations only.

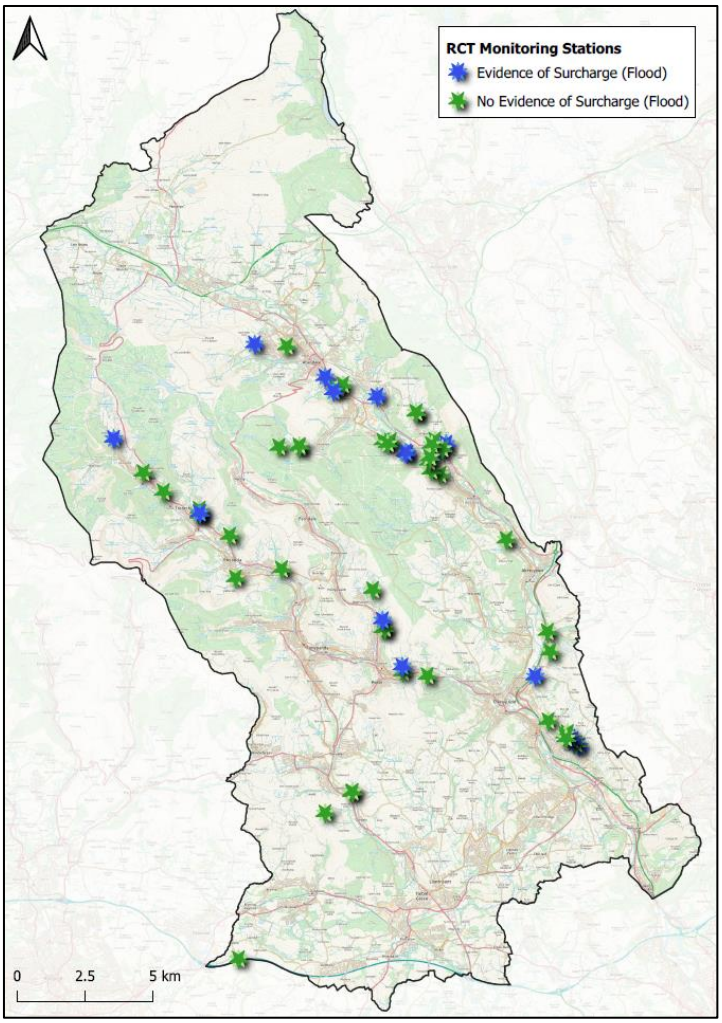


Figure 7: Map of RCT's network of telemetry monitoring stations showing those that showed evidence of surcharging (flood) during Storm Bert in blue.

Examples of the rapid rise and subsequent fall in watercourse levels in response to rainfall is illustrated below within the hydrographs and supported by CCTV footage which show the response of two high-risk ordinary watercourses situated at Cilfynydd (Figure 8) and Rhydyfelin (Figure 9) during the storm event. Both watercourses rose rapidly over a short amount of time, with a lag time of approximately 15 to 30-minutes following peak rainfall. This exceptionally short lag time between peak rainfall and peak discharge was experienced across several of RCT's watercourses, causing them to become overwhelmed during the storm event, causing flooding downstream.

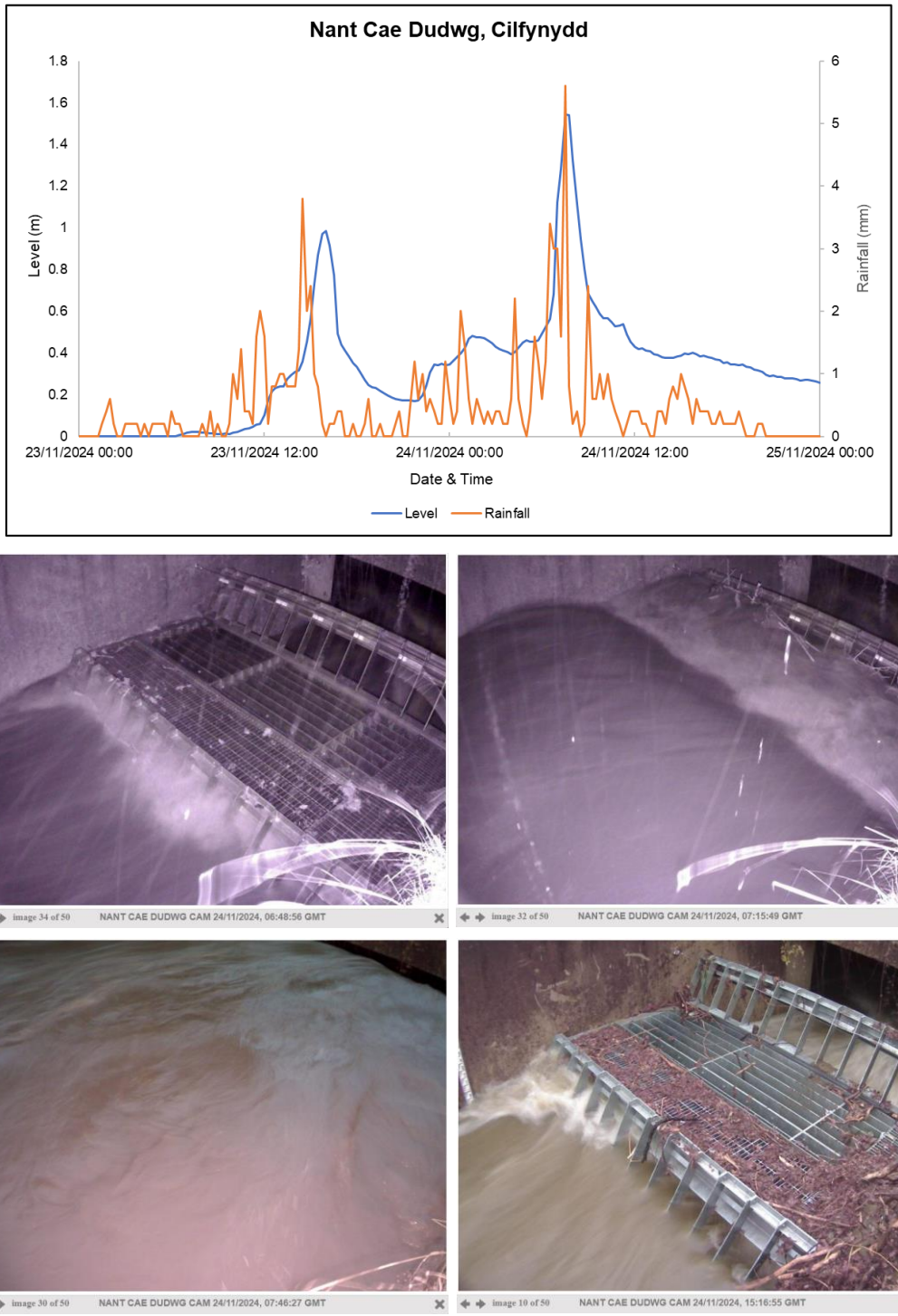
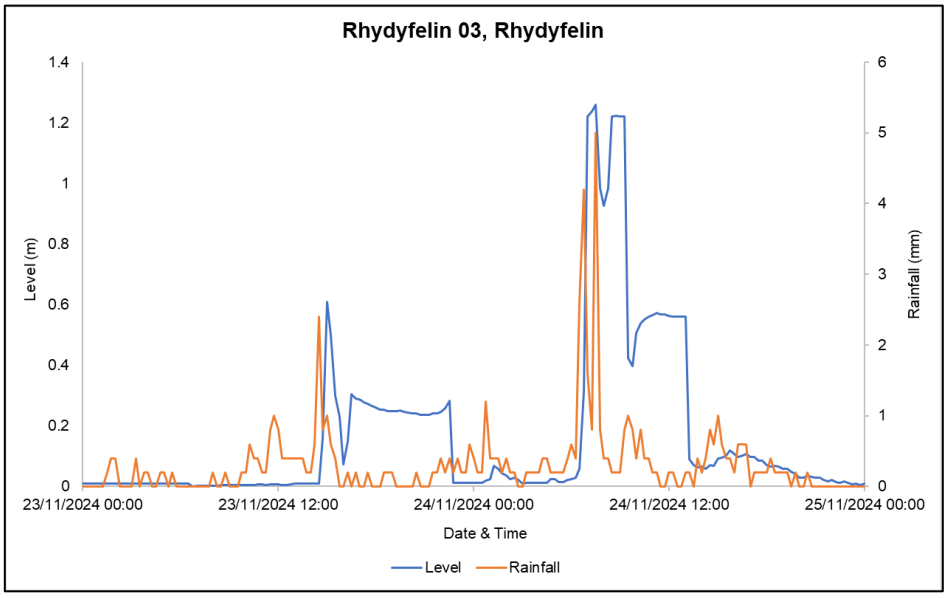


Figure 8: Level and rainfall data (hydrograph) and images of the Nant Cae Dudwg inlet captured at RCT's monitoring station on 24th November 2024 (06:48 (top left), 07:15 (top right), 07:48 (bottom left), 15:16 (bottom right)).



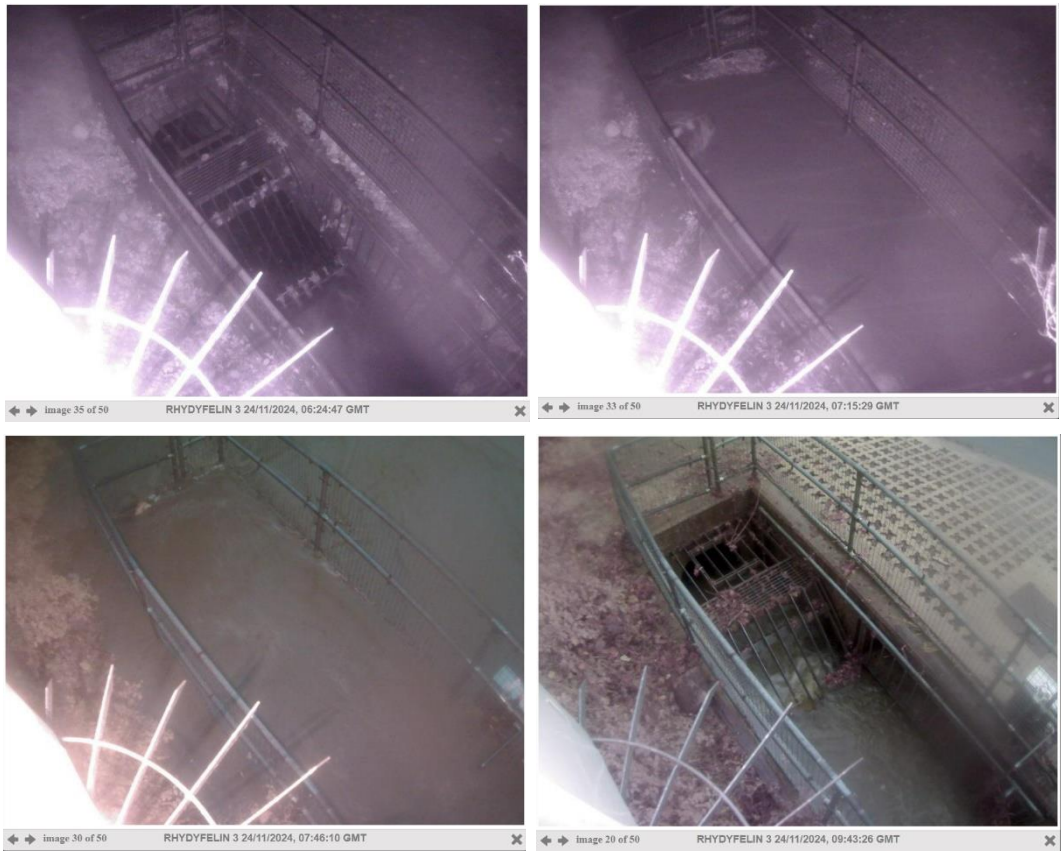


Figure 9: Level and rainfall data (hydrograph) and images of the Rhydyfelin 03 inlet captured at RCT's monitoring station on 24th November 2024 (06:24 (top left), 07:15 (top right), 07:48 (bottom left), 09:43 (bottom right)).

In addition to the rapid rise and fall in watercourse levels in response to rainfall across RCT, the mobilisation of debris from the upper catchments occurs frequently and quickly during storm events due to the character of the landscape. Debris mobilisation from the hillsides increases the risk of blockages to infrastructure downstream, particularly culvert inlets and networks. Evidence of this rapid debris mobilisation in response to rainfall during Storm Bert is shown below in Figure 10, captured at Heath Terrace Central inlet in Ynyshir.

Within the space of an hour the culvert inlet became overwhelmed with debris and overtopped at approximately 07:55. An estimated 40 tonnes of debris was removed from the culvert inlet structure at Heath Terrace Central by RCTCBC operatives during the storm event.

The images captured by RCT's monitoring stations demonstrate the watercourses' rapid response to rainfall which was replicated across the Authority at a number of ordinary watercourses.

Figure 10: Images of the Heath Terrace Central culvert inlet captured at RCT's monitoring station on 24th November 2024 (06:55 (top left), 07:55 (top right), 10:54 (bottom left), 13:54 (bottom right)).

2.4. Attenuation Basin Volume Storage

Attenuation basins, also known as attenuation ponds, are engineered structures designed to manage and control excess rainwater and help to reduce the risk of flooding during storm events. These basins or ponds act as temporary reservoirs, strategically placed to collect and store storm water, before gradually releasing the water, ensuring a controlled and measured discharge.

There are currently four attenuation basins across RCT which are monitored by RCTCBC's telemetry network: Park Lane in Aberdare, Upper Bronallt Terrace in Aberaman, Cwmaman and Rhydyfelin. Further information relating to these flood alleviation schemes are available on the Council's dedicated 'Flood Alleviation Scheme' webpage[5]. Table 4 displays the maximum volume of storm water that the monitored attenuation basin flood alleviation schemes within RCT stored during Storm Bert.

Attenuation Basin	Peak Level (m)	Date & Time of Peak	Volume Stored (m^3) during storm event	% Storage Utilised
Park Lane, Aberdare	2.2989	24/11/2024 07:30	5013.41	73.50%
Upper Bronallt Terrace, Aberaman	1.6749	24/11/2024 07:45	729.89	59.34%
Cwmaman	1.1865	24/11/2024 07:30	1696.5	29.79%
Rhydyfelin	1.10195	24/11/2024 08:00	432.21	36.66%

Table 4: Storage volume utilised within RCT's monitored attenuation basins during Storm Bert

Based on telemetry data, RCT's Park Lane attenuation basin reached a peak level of 2.3m, storing over 5,000 m^3 of water during the peak of the storm event (approximately

[5] Flood Alleviation Schemes | Rhondda Cynon Taf County Borough Council

73.5% of available capacity). RCT's Upper Bronallt Terrace basin also attenuated a significant amount of water, attenuating approximately 730m^3 of water (almost 60% of the available capacity). RCT's Cwmaman and Rhydyfelin attenuation basins attenuated less water during the peak of the storm. It is important to note that no flooding was reported from the attenuation basins during Storm Bert. The basins operated well during Storm Bert, attenuating a significant volume of storm water which otherwise would have entered the drainage systems within the urban areas, overwhelming them and leading to an increased risk of flooding downstream.

Figure 11 displays RCT's Park Lane attenuation basin before and during Storm Bert, demonstrating the peak storage utilised based on CCTV footage. The basins achieved peak storage capacity between 07:00 and 08:00 on Sunday 24th November, with a lag time of approximately one hour after peak rainfall which again illustrates the rapid response of RCT's catchments to rainfall.

Figure 11: RCT's Park Lane attenuation basin captured by CCTV before (top) Storm Bert at 07:50 23rd November 2024, and during (bottom) Storm Bert at 07:45 24th November 2024 (it's peak level)

2.5. Main River Response

This section of the report will provide an overview of the main river response within RCT. Main rivers are usually larger streams and rivers and in Wales, main rivers are legally designated by NRW. There are four primary main rivers which flow through RCT: the River Cynon, Taff, Ely, and the Rhondda Rivers.

NRW are also responsible for issuing flood warnings and alerts for main rivers in their role as the relevant Risk Management Authority. There are three tiers of flood warnings and alerts issued by NRW.

- **Flood Alert** – Flooding is possible – be prepared
- **Flood Warning** – Flooding is expected – immediate action required
- **Severe Flood Warning** – Severe Flooding – danger to life

As shown in Table 5, NRW issued Flood Alerts for the River Cynon, Taf and Rhondda ahead of the onset of the storm on Saturday 23rd November 2024. An alert was issued for the River Ely during the storm event in the early hours of Sunday 24th November 2024. All 4 flood alerts were removed at approximately 07:30 on Monday 25th November 2024.

Table 5: Flood Alerts issued by NRW for RCT during Storm Bert

Station Name	Date & Time - Start	Date & Time - End
River Cynon	23/11/2024 10:01	25/11/2024 07:28
River Taf	23/11/2024 10:01	25/11/2024 07:29
Rhondda Rivers	23/11/2024 15:10	25/11/2024 07:28
River Ely	24/11/2024 07:41	25/11/2024 07:28

15 Flood Warnings were also issued by NRW during Storm Bert along the Rivers Cynon, Taf and Rhondda in RCT. A full list of the flood warnings is shown in Table 6

and a map illustrating the extent of the flood warnings issued by NRW for RCT during Storm Bert is shown below in Figure 12.

All Flood Warnings were issued between 05:30 and 08:15 on Sunday 24th November and remained in place across the Authority until between 19:40 on Sunday 24th November and 07:00 Monday 25th November 2024.

No Severe Flood Warnings were issued by NRW for RCT during Storm Bert.

Table 6: Flood Warnings issued by NRW for RCT during Storm Bert

Station Name	Date & Time - Start	Date & Time - End
River Cynon at Hirwaun	24/11/2024 05:31	24/11/2024 19:41
River Cynon at Aberdare	24/11/2024 05:32	24/11/2024 19:42
River Cynon at Mountain Ash	24/11/2024 05:36	24/11/2024 19:44
Rhondda Fawr at Treherbert	24/11/2024 06:19	24/11/2024 21:06
Rhondda Fawr at Gelli	24/11/2024 06:20	24/11/2024 21:06
River Cynon at Aberaman	24/11/2024 06:28	24/11/2024 19:43
Rhondda Fawr at Pentre	24/11/2024 06:30	24/11/2024 21:06
River Taff at Upper Boat	24/11/2024 06:52	25/11/2024 07:02
River Rhondda at Porth	24/11/2024 07:14	24/11/2024 21:07
River Cynon at Abercynon	24/11/2024 07:30	24/11/2024 19:44
Rhondda Fach at Ynyshir	24/11/2024 07:37	24/11/2024 21:07
River Taff at Pontypridd	24/11/2024 07:41	25/11/2024 07:02
River Taff at Hawthorn and Rhydyfelin	24/11/2024 08:13	25/11/2024 07:02
River Taff at Nantgarw	24/11/2024 08:14	25/11/2024 07:03
River Taff at Taffs Well and Industrial Areas of Gwaelod y Garth	24/11/2024 08:14	25/11/2024 07:03

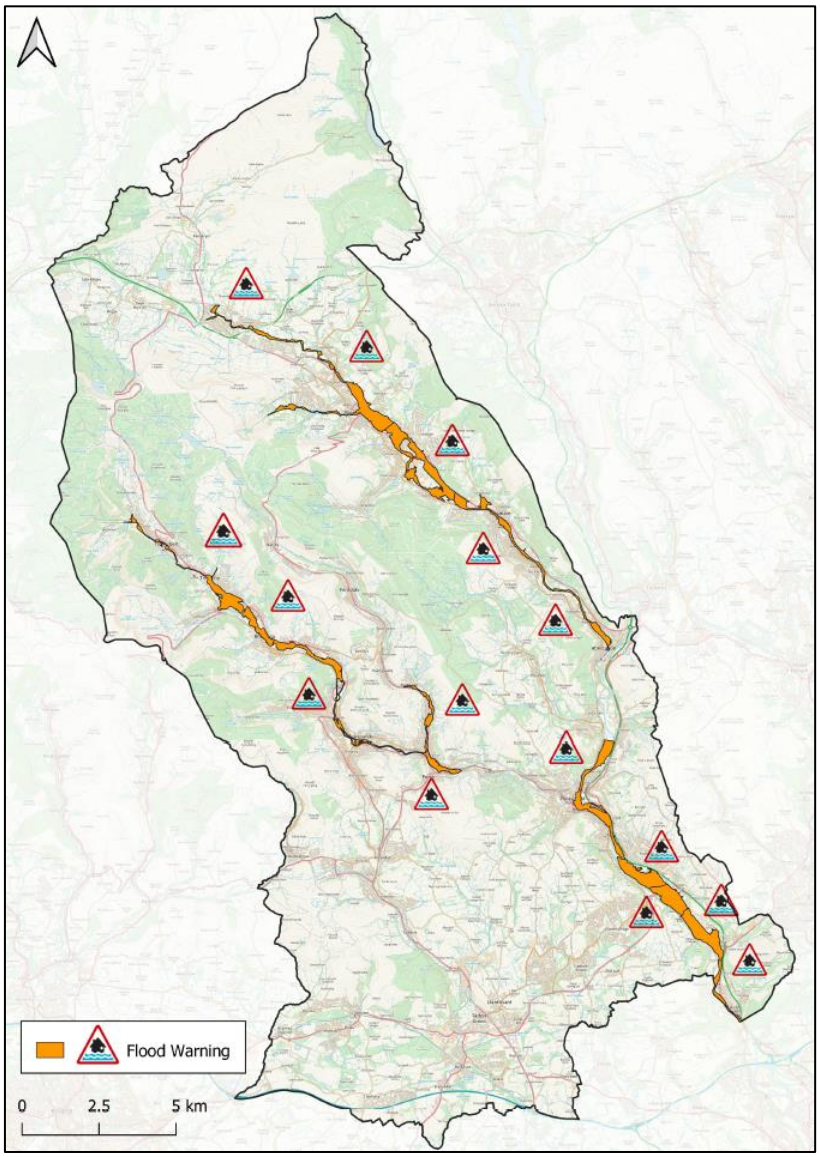


Figure 12: Flood Warnings in placed across RCT during Storm Bert. Contains Natural Resources Wales information © Natural Resources Wales and database right. All rights reserved.

Rivers in the South Wales area are relatively steep and flow through narrow valleys that are underlain by impermeable geology. Consequently, runoff from headwaters and ordinary watercourses rapidly reach the Main Rivers and levels respond quickly following intense rainfall.

The steep sided catchments of RCT's valleys paired with intense rainfall meant that river levels rose suddenly and in a matter of hours during Storm Bert. Examples of the rapid rise and subsequent fall in main river levels in response to rainfall is illustrated below within the hydrographs which show the response of the Cynon at Aberdare (Figure 13), Rhondda at Gelli (Figure 14) and the Taf at Pontypridd (Figure 15) in response to rainfall captured at the nearest weather station.

All main rivers rose rapidly over a short amount of time, with a lag time of approximately 1-2 hours following peak rainfall for the Rhondda, Cynon and Taf Rivers, before falling quickly. These exceptionally short lag time between peak rainfall and peak river levels reflects a similar response to that of the ordinary watercourses (discussed in Section 3.3), causing rivers to become overwhelmed during the storm event and causing flooding to several communities.

As shown in Figure 13, a Flood Warning (indicating flooding is expected) for the River Rhondda at Gelli was issued by NRW at 06:20 on 24th November 2024, at which point the river level was approximately 2.17m in height. The river reached its peak level of 2.593m at 07:30 on 24th November, approximately 2 hours following peak rainfall (recorded at NRW's Tynewydd rain gauge) and just over 1 hour following NRW's Flood Warning. A further 4 Flood Warnings were issued by NRW at locations along the Rhondda Rivers during Storm Bert (listed in Table 6).

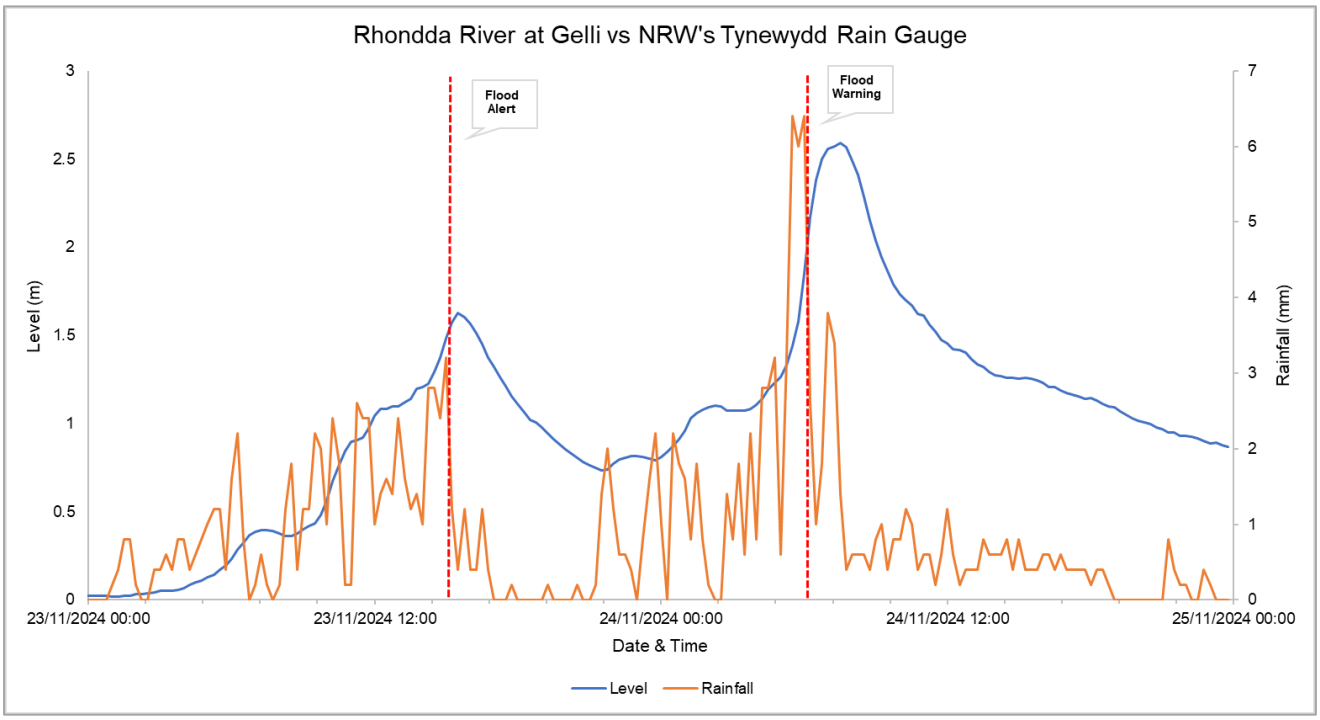


Figure 13: Level data at NRW's River Rhondda at Gelli station compared with the total rainfall captured at NRW's Tynewydd rain gauge station during Storm Bert. Date and time of NRW's Flood Alert and Flood Warning issue also included.

The River Cynon typically runs through the town of Aberdare between 0.1 and 0.5 metres. At its peak during Storm Bert, levels reached 2.148m at 07:15 on 24th November 2024, breaking the previous record set in Storm Dennis. The peak level at Aberdare occurred just over 2 hours following the peak in rainfall intensity at NRW's Hirwaun rain gauge, and approximately 1 hour 45 minutes following NRW's Flood Warning which was issued at 05:32 for the Cynon at Aberdare (illustrated in Figure 14). A further 4 Flood Warnings were issued by NRW at locations along the River Cynon during Storm Bert (listed in Table 6).

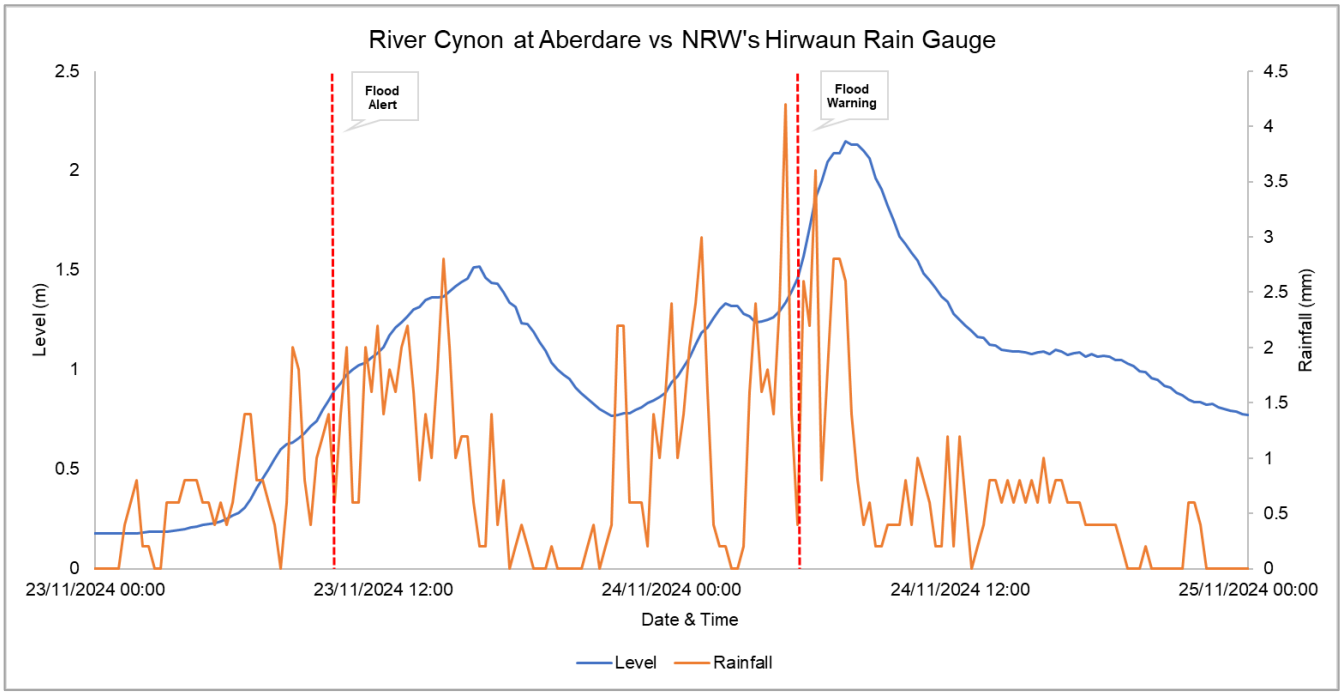


Figure 14: Level data at NRW's River Cynon at Aberdare station compared with the total rainfall captured at NRW's Hirwaun rain gauge station during Storm Bert. Date and time of NRW's Flood Alert and Flood Warning issue also included.

The River Taf at Pontypridd reached a peak level of 4.427m at 09:15 on 24th November 2024, approximately 1 hour 45 minutes following the peak rainfall intensity recorded at the nearest rain gauge (RCT's Cilfynydd station). According to NRW, the River Taf rose 300mm every 15 minutes at the height of the rainfall[6]. As shown in Figure 15, a Flood Warning for the River Taf at Pontypridd was issued by NRW at 07:41 on 24th November 2024, shortly after the spike in rainfall, however it was reported by residents that the River Taf at Sion Street and Berw Road in Pontypridd overtopped prior to the Flood Warning, at approximately 06:00 on 24th November.

The River Taf at Pontypridd reached its peak level approximately 1 hour 30 minutes following NRW's Flood Warning. A further 4 Flood Warnings were issued by NRW at locations along the River Taf during Storm Bert (listed in Table 6).

[6] Natural Resources Wales / Storm Bert

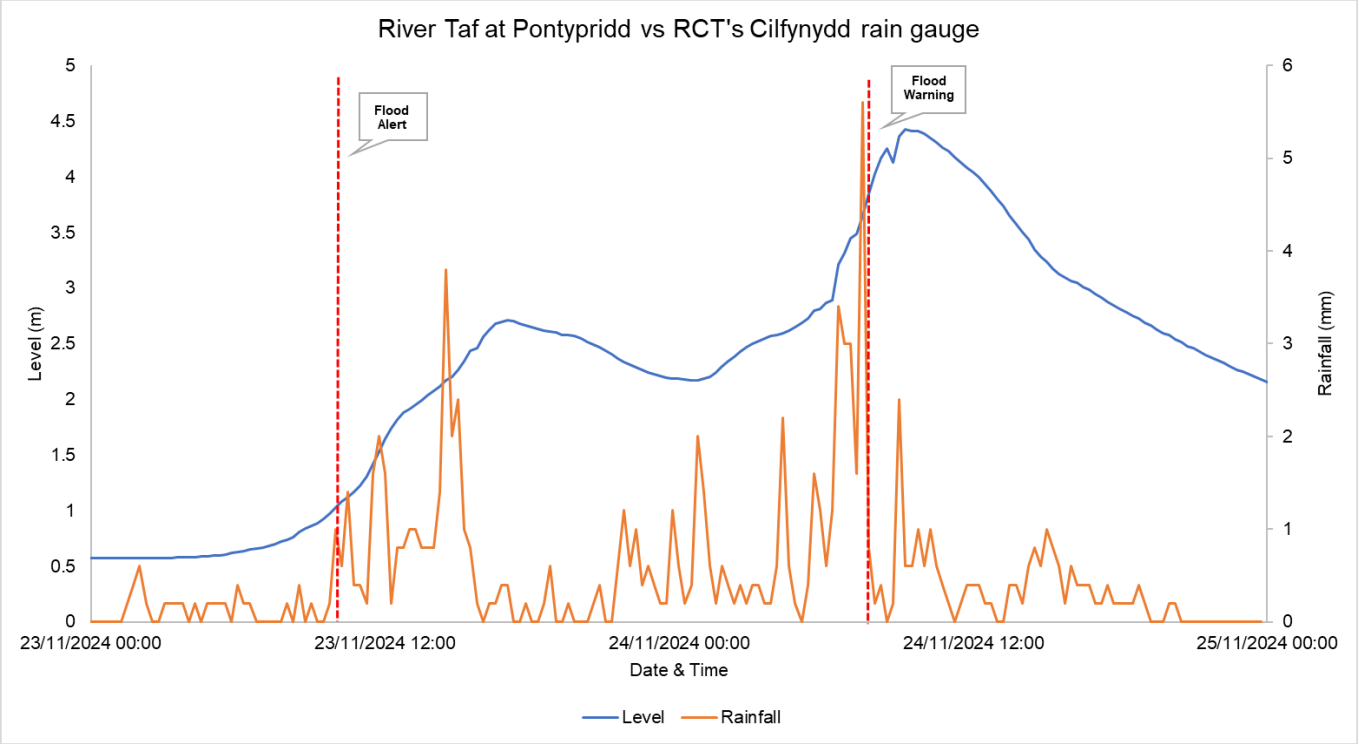


Figure 15: Level data at NRW's River Taf at Pontypridd station compared with the total rainfall captured at RCT's Cilfynydd rain gauge station during Storm Bert. Date and time of NRW's Flood Alert and Flood Warning issue also included.

All main rivers in RCT reached almost record-breaking levels during Storm Bert, with many incidences of main river overtopping and flooding to properties and highway infrastructure reported to the Authority.

Data from NRW's river level gauges show that the main rivers in RCT reached almost record-breaking levels during Storm Bert, with many incidences of main river overtopping and flooding to properties and highway infrastructure reported to the Authority. Whilst the River Cynon, Taf and Ely remained below their highest recorded levels, which were recorded during Storm Dennis on 16th February 2020, the Rhondda Fawr River at Treherbert and Gelli and the River Cynon at Aberdare broke Storm Dennis records. Figure 16 illustrates how close several river gauge stations in RCT were to reaching their highest recorded levels.

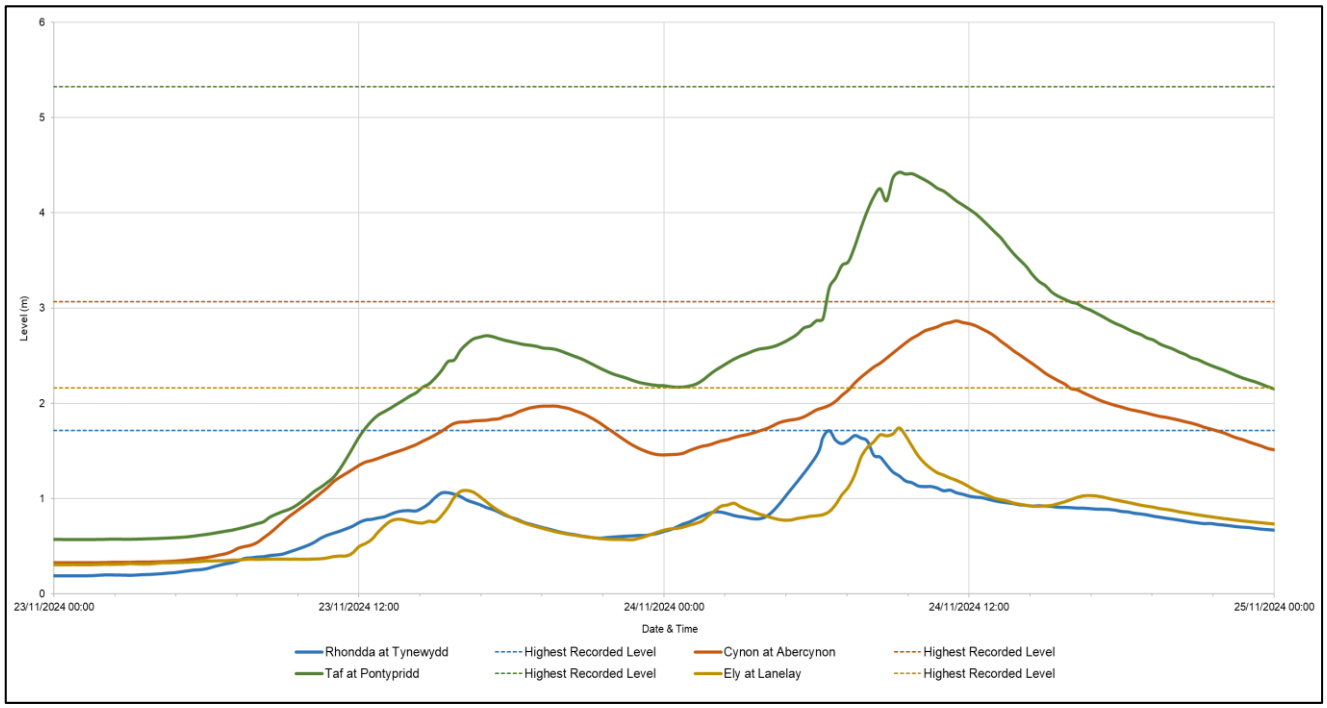


Figure 16: River levels at Rhondda at Tynewydd, Cynon at Abercynon, Taf at Pontypridd and Ely at Lanelay during Storm Bert (23-24 November 2024), along with the highest river level recorded at each station. Contains Natural Resources Wales information © Natural Resources Wales and database right. All rights reserved.

Table 7 shows the peak levels recorded at each of NRW's river gauge stations during Strom Bert compared with Storm Dennis.

Table 7: Peak river level recorded at NRW's river level gauge stations during Storm Bert and Storm Dennis

Station Name	Storm Bert Peak Level (m)	Date & Time of Peak	Storm Dennis Peak Level (m)	Variance +/- (m)
River Cynon at Hirwaun	1.323	24/11/2024 06:30	1.333	-0.010
River Cynon at Aberdare	2.148	24/11/2024 07:15	2.125	+0.023
River Cynon at Mountain Ash	3.133	24/11/2024 10:15	3.500	-0.367
River Cynon at Abercynon	2.866	24/11/2024 11:30	3.067	-0.201
Rhondda Fawr River at Tynewydd	1.714	24/11/2024 06:30	1.624	+0.090

Station Name	Storm Bert Peak Level (m)	Date & Time of Peak	Storm Dennis Peak Level (m)	Variance +/- (m)
Rhondda Fawr River at Gelli	2.593	24/11/2024 07:30	1.998	+0.595
Rhondda River at Trehafod	3.619	24/11/2024 08:15	3.977	-0.358
Rhondda Fach River at Maerdy	1.171	24/11/2024 06:30	1.371	-0.200
River Taff at Ponytpridd	4.427	24/11/2024 09:15	5.324	-0.897
River Taff at Upper Boat	5.070	24/11/2024 09:30	5.489	-0.419
River Ely at Lanelay	1.744	24/11/2024 09:15	2.163	-0.419

It is unsurprising that river levels across RCT reached levels similar or greater to those recorded in Storm Dennis as rainfall totals and intensities across parts of RCT during Storm Bert also broke Storm Dennis records.

2.6. WIND DATA

Despite heavy rainfall being the primary impact of Storm Bert, the storm event also brough relatively strong winds to RCT over the weekend of 23-24th November 2024. Wind summaries for Storm Bert are shown in Tables 8 and 9, captured by the Met Desk.

South-westerly winds brought gusts of up to 66mph on higher ground, and up to 52 mph on lower ground. Winds speeds were also notable, although not exceptional for this time of year.

Table 8: 24-hour Wind Summary for RCT on 23rd November 2024 (Met Desk)

RCT Above 200m	23/11/2024 00:00 – 06:00	23/11/2024 06:00 – 12:00	23/11/2024 12:00 – 18:00	23/11/2024 18:00 – 00:00
Direction	SW	SW	SW	SW
Speed (mph)	19-31	17-28	17-28	14-23
Gust (mph)	48-66	44-60	47-65	41-54
RCT Below 200m	**23/11/2024 00:00 – 06:00**	**23/11/2024 06:00 – 12:00**	**23/11/2024 12:00 – 18:00**	**23/11/2024 18:00 – 00:00**
Direction	SW	SW	SW	SW
Speed (mph)	17-23	17-22	17-24	12-21
Gust (mph)	48-52	44-47	47-50	41-45

Table 9: 24-hour Wind Summary for RCT on 24th November 2024 (Met Desk)

RCT Above 200m	24/11/2024 00:00 – 06:00	24/11/2024 06:00 – 12:00	24/11/2024 12:00 – 18:00	24/11/2024 18:00 – 00:00
Direction	SW	SW	SW	W
Speed (mph)	15-22	17-23	11-23	11-19
Gust (mph)	35-43	36-49	35-48	34-43
RCT Below 200m	**24/11/2024 00:00 – 06:00**	**24/11/2024 06:00 – 12:00**	**24/11/2024 12:00 – 18:00**	**24/11/2024 18:00 – 00:00**
Direction	SW	SW	SW	W
Speed (mph)	14-17	15-19	11-18	11-18
Gust (mph)	29-37	31-39	32-36	34

3. IMPACTS

Storm Bert saw an exceptional amount of rain fall in a short amount of time, which caused rapid increase in river and watercourse levels and led to severe flooding to communities across RCT. Very few communities within RCT escaped the impacts of Storm Bert.

It was noted that RCT recorded over 600 calls from residents reporting issues of flooding within the borough during Storm Bert and the days following the event.

Provisional data following the investigations undertaken by RCTCBC's Flood Risk Management team and Public Health department, estimate that approximately 334 residential properties and 104 non-residential premises were internally flooded during Storm Bert. The number of properties that suffered external flooding is expected to be much higher.

The map below shows the extent of the flooding impacts to receptors during Storm Bert per electoral ward within RCT (Figure 17). Notably, the impacts of flooding were widespread, with Treherbert, Porth, Aberdare, Pontypridd and Nantgarw worst affected. Areas to the southwest of the borough were least affected during Storm Bert.

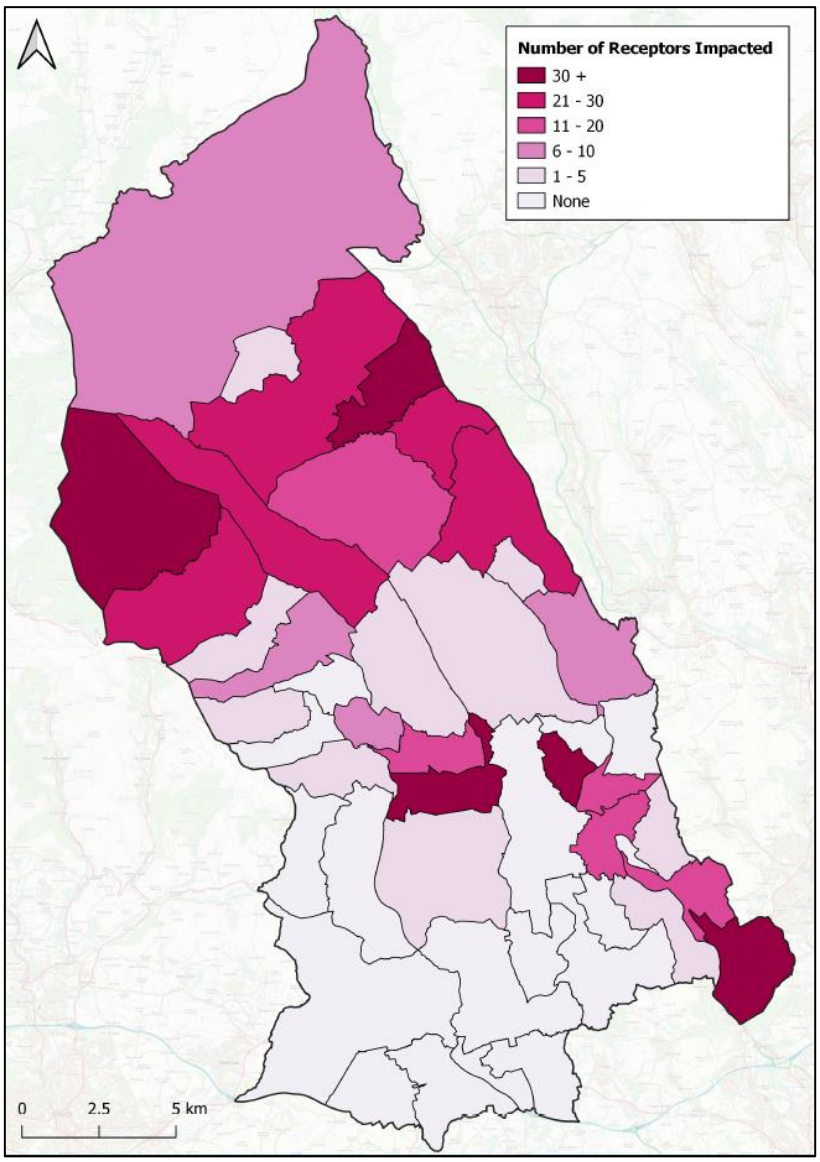


Figure 17: Number of Receptors flooded per electoral ward in RCT during Storm Bert

The primary causes of flooding to properties across RCT was due to local sources (surface water, ordinary watercourses, and groundwater). Approximately 219 receptors were internally flooded due to local flood sources, of which 190 (87%) were residential properties. Fluvial flooding from the Main Rivers was also a dominant flood source during Storm Bert, causing approximately 103 receptors to flood internally, of which 69 (67%) were residential properties.

Figure 18 shows the total percentage of flooded receptors which were impacted by the various types of flooding during Storm Bert. These flood types have been further described in Section 3.1.

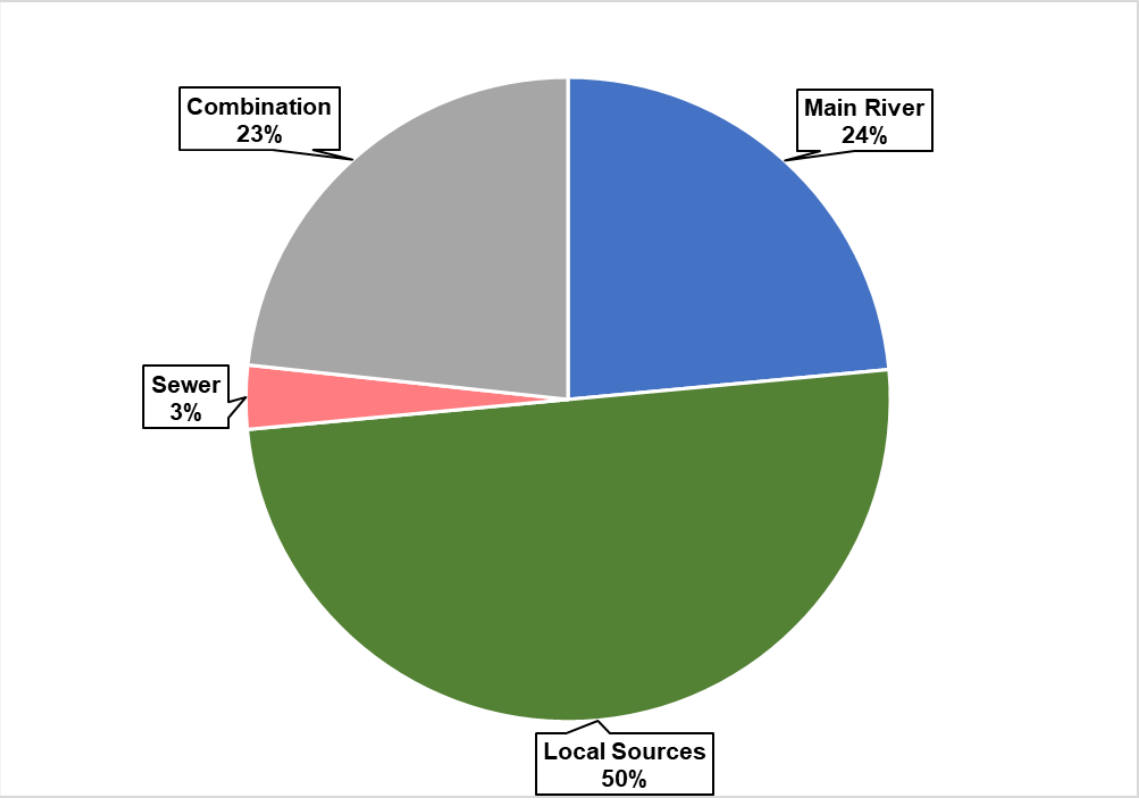


Figure 18: Percentage of the total number of flooded receptors impacted by primary flood type during Storm Bert

As noted within Figure 18, several properties were impacted by a combination of flood types, primarily a combination of main river and local sources (67%). This combination of flood types was commonplace across RCT during Storm Bert, owing to the elevated river levels which is considered to have influences the discharge of water from open and culverted ordinary watercourses, highway drainage and combined sewer infrastructure, contributing to the observed flooding in many areas. A full breakdown of the combination of flood types which impacted properties in RCT during Storm Bert is provided in Figure 19.

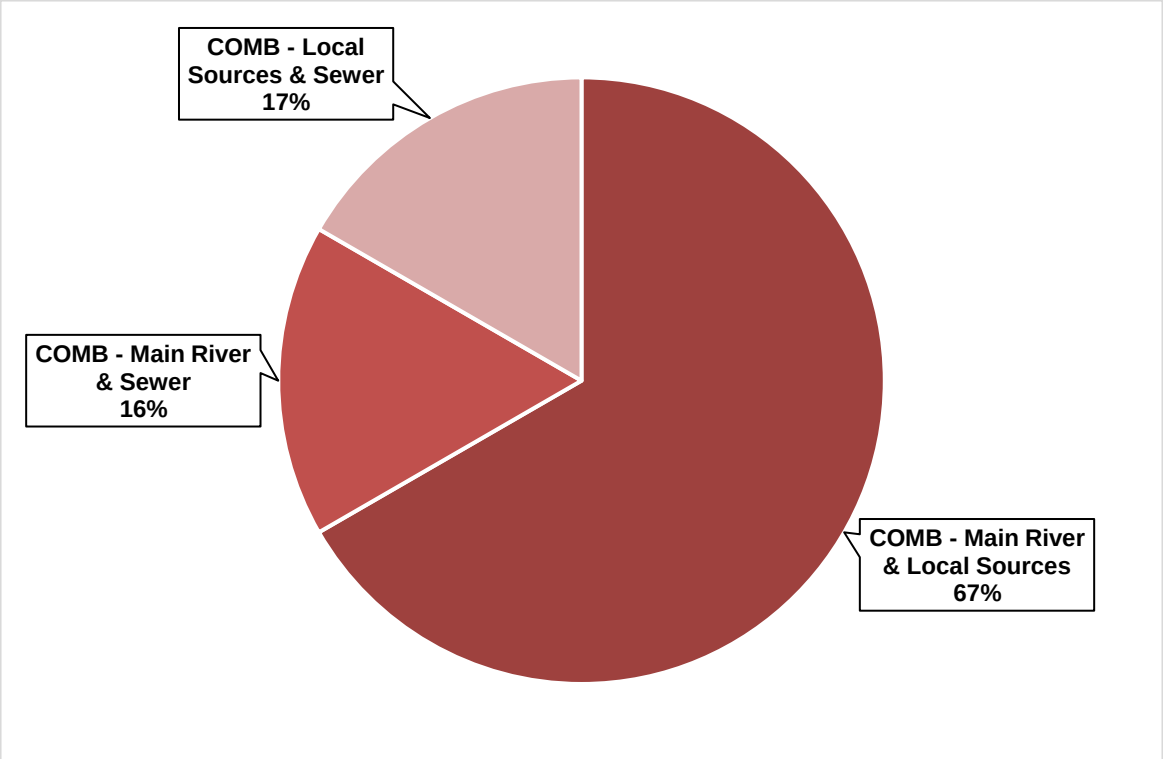


Figure 19: Percentage of the flooded receptors during Storm Bert which were impacted by a combination of flood types

3.1. Impacts – Types of Flooding

This section identifies the key sources of flooding and describes the mechanisms of each type of flooding that occurred during Storm Bert. It is not intended to cover every incidence of flooding across the county borough, but to provide an overview of the primary flood sources. An overview of the flooding impacts to infrastructure and assets during Storm Bert has also been described within section 3.2.

3.1.1. Local Sources of Flooding – Ordinary Watercourse

Local flood risk is defined as the risk from ordinary watercourse, surface water and groundwater sources.

An ordinary watercourse is defined as a watercourse that does not form part of a Main River. This includes streams, drains, culverts, dikes, ditches and passages through which water flows. Ordinary watercourse flooding is the most common cause of flooding within RCTCBC due to the area's steep hillsides and concentrated urban development and occurs when the capacity of a local drainage channel is exceeded and/or culvert inlets and trash screens are blocked with debris (FRMP, 2015)[7].

Storm Bert was an extreme storm event which led to many parts of RCT, but particularly below the steep valley hillsides, being affected by ordinary watercourse flooding as a result of culvert networks becoming over capacitated resulting in hydraulic overload/surcharging, as well as large stonewash and debris being transported downstream causing damage and blockages to culvert inlets and debris screens (Figures 20, 21 and 22). It is estimated that 57% of all residential flooding during Storm Bert was primarily caused by local sources (ordinary watercourse,

[7] RCT's Flood Risk Management Plan 2015 - https://www.rctcbc.gov.uk/EN/Resident/ParkingRoadsandTravel/Roadspavementsandpaths/FloodAlleviation/RelatedDocuments/FloodRiskManagementPlanFinal.pdf

surface water and groundwater), and of this percentage, 48% has been attributed to culvert inlets as the primary source of flooding.

Areas worst affected by ordinary watercourse flooding were widespread and mainly affected residential properties. These areas include Treherbert, Treorchy, Ferndale, Aberdare, Ynysboeth and Nantgarw, among others.

Figure 20: Image of a private culvert inlet in Treorchy pre (left), during (middle) and post Storm Bert (right) showing evidence of overtopping during the event and mobilised debris obstructing the trash screen immediately following the event.

Figure 21: Image of an RCT maintained culvert inlet at Dynea Road, Rhydyfelin pre (left), during (middle) and during clearance works (left) following Storm Bert showing evidence of overtopping during the event and mobilised debris obstructing the trash screen immediately following the event.

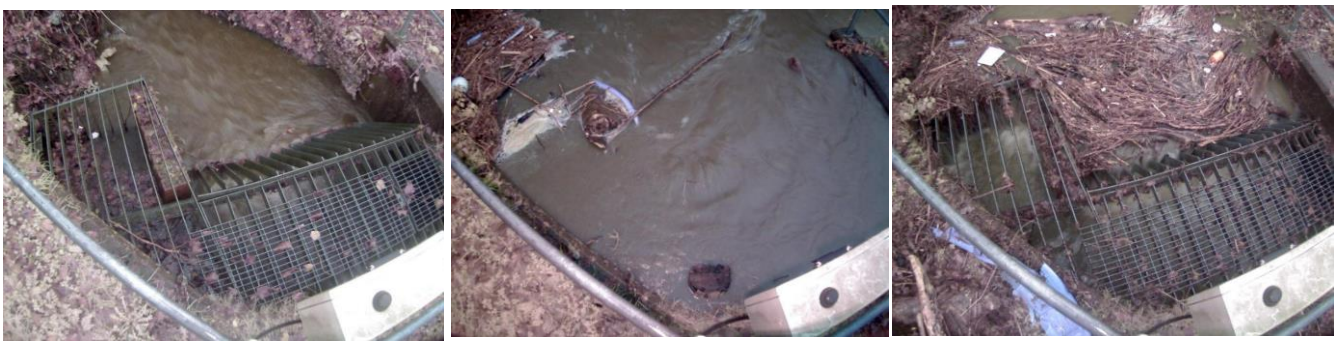


Figure 22: Image of a RCT maintained culvert inlet adjacent to the A4059 in Aberaman pre (left), during (middle) and post Storm Bert (right), showing evidence of high water levels during the event and mobilised debris obstructing the trash screen immediately following the event.

Evidence of scour in the upper catchments of RCT indicate the power of the flows within the watercourses which mobilised and transported large amounts of debris and stonewash downstream towards culvert inlets and carrier lines during the storm event (illustrated in Figures 23). Minor landslips and fallen trees were also identified during post event inspections (Figure 24), increasing the risk of obstruction to infrastructure downstream.

Figure 23: Evidence of scour to the banking of the unnamed ordinary watercourse (left) and the subsequent deposition of material downstream at the Heath Terrace Central culvert inlet in Ynyshir (right) during Storm Bert.

Figure 24: Evidence of a minor landslip and fallen tree (left) which contributed to the deposition of material downstream which caused an obstruction to a private culvert inlet in Treorchy (right) during Storm Bert.

The role of geomorphological processes as a significant contributor to flood risk in many areas of RCT has been highlighted by the events of Storm Bert. The degree of morphological instability and potential sediment supply varies from catchment to catchment, however both historical and present-day anthropogenic landscape changes at the catchment scale have been identified as key influences on ordinary watercourse behaviours and local flood risk.

3.1.2. Local Sources of Flooding – Surface Water

Surface runoff occurs when rainwater which is on the surface of the ground and has not yet entered a watercourse, drainage system or public sewer (FRMP, 2015)[7]. As a result of RCT's catchment geomorphology, climate and concentrated urban development, surface water flooding is common and particularly prominent following a prolonged period of rainfall when the catchment is saturated, or after an intense storm and drainage systems become overwhelmed.

Surface water flooding was experienced across the majority of RCT and was exacerbated in some locations by the impacts from ordinary watercourse, main river and sewer network flooding.

Notable areas of surface water flooding include parts of Aberdare, Cwmbach and Mountain Ash. An example of surface water flooding at Trem y Dyffryn, Mountain Ash is included in Figure 25.

Figure 25: Surface water flooding at Trem y Dyffryn, Mountain Ash during Storm Bert

3.1.3. Local Sources of Flooding – Groundwater

Flooding from groundwater occurs as a result of water rising from the underlying aquifer or from water flowing through normal springs. This tends to occur after sustained high rainfall, and the areas at most risk are often low-lying where the water table is more likely to be at shallow depth.

Historic mining activities within RCT have disrupted the 'natural' groundwater regime within the coal measures and it is likely that the interconnection between many of the collieries has resulted in cross catchment 'groundwater flow' in certain parts of RCT. Although the carboniferous limestone is recognised as a major aquifer, and the coal measures and Triassic strata are minor aquifers with local importance, the contribution of groundwater to even low flows is modest.

Although the risk posed by groundwater flooding is generally low, the periods of abnormally high rainfall that we are experiencing due to factors including climate change are resulting in the more frequent emergence of groundwater at the ground surface, causing damage to property and infrastructure[8].

[8] Groundwater extremes, climate change and resilience - British Geological Survey

3.1.4. Fluvial Flooding – Main River

Fluvial flooding (flooding from the main river) can be caused by river levels 'overtopping' their banks and/or 'breaching' of the defence structures. 'Main Rivers' are usually larger streams and rivers and include certain structures that control or regulate the flow of water in, into or out of a main river. In Wales, main rivers are legally designated by NRW and under the Flood and Water Management Act 2010, NRW are responsible for flood risk management activities on main rivers.

The River Taf, Cynon and Rhondda (Fawr and Fach) and Ely are the primary main rivers running through RCT. The Rivers Cynon, Rhondda and Taf overtopped their banks at various locations across the borough, with the most notable flooding impacts occurring along the River Taf which is fed by both the Cynon and Rhondda rivers and caused flooding to multiple receptors situated within the urban and industrial floodplains of the Taff.

Areas worst affected by main river flooding include Pontypridd, Nantgarw, Porth and Taffs Well. Images of flooding from the main rivers across RCT during Storm Bert are included in Figures 26 and 27.

NRW own and maintain approximately 15.5km of flood defences within RCT. That's equivalent to 10.1% of the total length of main rivers that flow through RCT. Whilst NRW flood defences did overtop in a number of locations, some privately owned defences and highway retaining walls were also overtopped and some were breached and damaged during the storm event.

Figure 26: Flooding from the River Rhondda at Britannia Street, Porth during Storm Bert

Figure 27: Flooding from the River Taf at Berw Rad, Pontypridd during Storm Bert

3.1.5. Sewer Network

Sewer flooding is often caused by excess surface water entering the drainage network and exceeding the capacity of the sewer. When this happens, sewage can overflow from manholes and gullies and cause flooding to land and properties.

Dŵr Cymru Welsh Water have primary responsibility for flooding from water and sewerage systems (foul, surface-water and/or combined). Many areas have separate sewer systems to take foul water and rainwater (surface-water), but most sewers are combined, meaning that they are designed to simultaneously collect surface runoff and sewage water in a shared system.

Flooding arises from combined sewers when excess rainwater entering the system exceeds the capacity of the sewer. Due to the exceptional and unprecedented amounts of rainfall during Storm Bert, the sewer network in many parts of the borough become overwhelmed. An example of the combined sewer network at Mill Street in Pontypridd surcharging during Storm Bert is provided in Figure 28.

Notable areas of flooding from the sewer network include parts of Aberdare, Mountain Ash, Ferndale and Pontypridd.

Figure 28: Two combined sewer manholes showing evidence of surcharge at Mill Street, Pontypridd during Storm Bert

3.2. IMPACTS – ASSETS & INFRASTRUCTURE

Although no formal identification as to Storm Bert's exceedance probability has been confirmed by the relevant organisations (NRW / Met Office), it is likely given the record-breaking rainfall and river levels recorded during Storm Bert, that the storm event exceeded all current design standards for flood risk assets outlined in Table 10 below.

Table 10: Current design standards for flood risk assets

Asset Type	Design Standard	Guidance Document
Highway Drainage	Q30 (1 in 30 year flood event)	Statutory standards for sustainable drainage systems - designing, constructing, operating, and maintaining surface water drainage system[9]
Sewers	Q30 (1 in 30 year flood event)	Sewers for Adoption 7th Edition[10]
Ordinary Watercourse (i.e., Culverts)	Q100 (1 in 100 year flood event) plus climate change allowance	Culvert, screen and outfall manual CIRIA C786F[11]
Main River	Q100 (1 in 100 year flood event) plus climate change allowance	Flood and Coastal Erosion Business Case Guidance[12]

It should be of note that the design standards are applicable to infrastructure constructed in modern time. Significant extents of the assets & infrastructure within RCT were constructed during the age of industrialisation and urbanisation in the late

[9] statutory-national-standards-for-sustainable-drainage-systems.pdf
[10] WRC., 2012. Sewers for Adoption: 7th edition
[11] CIRIA Culvert, Screen and Outfall Manual (C786F)
[12] flood-and-coastal-erosion-risk-management-fcerm-business-case-guidance_0.pdf

19th and early 20th century indicating that a growing number of assets are expected to reach or exceed their design life within the next 30 years[13].

Despite Storm Bert incurring similar rainfall intensities to Storm Dennis, the impact to assets and infrastructure across RCT was less impactful.

RCTCBC have invested over £100 million on improvements to repair, upgrade and improve culverts and other assets since Storm Dennis in February 2020. As a result, the majority of this newly installed and upgraded infrastructure operated well and succeeded in reducing the risk to an estimated 2269 properties which would have otherwise been impacted during Storm Bert given its severity.

Initial investigations into the impact of flooding to Council-owned assets that have had investment since Storm Dennis identified that approximately 15% of these assets were impacted during Storm Bert, and only 9% caused internal flooding to properties. The impact from these assets accounted for approximately 5% of the total number of impacted receptors.

Examples of how two of RCTCBC's flood risk assets, which have received investment since Storm Dennis, responded during Storm Bert is shown in Figures 29 and 30. The Upper Bronallt Terrace Attenuation Basin in Abercwmboi is estimated to have reduced the risk of flooding to 38 properties, while the Pentre Road culvert inlet improvements in Pentre is estimated to have reduced the risk of flooding to 227 properties.

[13] Welsh Water 2050 Consultation Document

Figure 29: The response of the Upper Bronallt Terrace Attenuation Basin Flood Alleviation Scheme in Abercwmboi during the peak of Storm Bert

Figure 30: The response of the Pentre Road culvert inlet improvements in Pentre during the peak of Storm Bert

Further funding has been secured from the Welsh Government to continue works to repair and upgrade other culverts which were impacted during Storm Bert and remain at a high risk of flooding.

Notably however, the impact to properties from privately owned culvert inlets, which are the responsibility of the relevant riparian landowners (discussed in Section 4.2.2),

was significant. Based on initial investigations, it is estimated that of the total number of known culvert assets which were impacted during Storm Bert, 64% were privately owned and accounted for approximately 20% of the total number of impacted receptors.

The below sections are intended to provide a short overview of the damages caused to infrastructure across the borough, including bridges, culverts, sewers, retaining walls and highway infrastructure.

3.2.1. Structural Infrastructure & Colliery Spoil Tips

Prior to and over the week following Storm Bert, an additional 50 inspections on disused colliery spoil tips were carried out in addition to routine inspections. Some partial blockages to trash screens on culvert inlets and road gullies were identified as a result of Storm Bert however no colliery spoil tip slips were identified following the storm event.

Two minor landslips occurred in both the Rhondda Fach (Figure 31 left) and Fawr valleys, the latter of which resulted in an emergency closure of a right of way. No receptors were impacted by either landslip.

Collapses to various retaining walls in parts of Aberdare due to significant water pressure (Figure 31 right) and in Mountain Ash, Abercynon and Porth as a result of main river scouring and water pressure occurred during the storm event.

Figure 31: Landslip at Tylorstown in the Rhondda Fach (left) and collapsed retaining wall at Aberdare Park (right) captured following Storm Bert

Debris was identified as caught underneath bridges at twelve locations across RCT, in addition to ongoing construction works to replace Feeder Pipe Footbridge in Abercynon which were washed away during Storm Bert. Images showing the construction works at Feeder Pipe Footbridge before and after Storm Bert are shown in Figure 32.

Figure 32: Feeder Pipe Footbridge, Abercynon before and after Storm Bert

Current estimation on the cost of damages to civil infrastructure is in the millions, however further specialist inspections are being procured by RCTCBC to quantify the total damage for repair.

3.2.2. Highway Infrastructure

Flooding to the highway network across RCT was widespread. Highway drainage infrastructure in several locations became overwhelmed by the sheer volume of surface water entering the drainage network, resulting in surface water ponding which led to parts of the highway network becoming impassible.

Damages to highway infrastructure, rural lanes and carriageway surfacing was also commonplace during Storm Bert (Figure 33 left). Debris and stonewash mobilised from the upper catchments above residential settlements and carried downstream via watercourses resulted in blockages to the highway drainage network which not only caused significant damages but also exacerbated the flooding to the highway. Figure 33 (right) depicts evidence of silt and stonewash deposited onto the highway at Wordsworth Gardens in Rhydyfelin following the overtopping of watercourses upstream.

Figure 33: Scour damage to the highway in Beddau (left) and silt and debris deposited along the highway at Rhydyfelin following Storm Bert

4. Roles and Responsibilities of Risk Management Authorities

4.1. Risk Management Authorities and their Functions

The term 'Risk Management Authority' refers to the organisation(s) that have legislative powers concerning flood risk management. Risk Management Authorities (RMA) across Wales include NRW, the 22 Local Authorities as Lead Local Flood Authority (LLFA) and highway authority, water companies, and the Welsh Government as highway authority for trunk roads. Each RMA is required to fulfil a number of statutory duties, as defined under the FWMA. In addition to these statutory duties, the Act sets out a range of permissive powers for RMAs, enabling them to undertake defined activities if they so wish.

RCTCBC work in partnership with those organisations to investigate and manage flood risk. Whilst RCTCBC as the LLFA has a duty to investigate flood incidents in its area, it may be the responsibility of another RMA, or land/property owner, to take actions to resolve an issue.

Table 11 summarises which RMAs are primarily responsible for managing flood risk dependent on the type of flooding.

Further information pertaining to the roles and responsibilities of each individual RMA to manage flood risk is described in Section 5 of RCT's Local Flood Risk Management Strategy and Action Plan.

Table 11: Risk Management Authorities responsible for managing different types of flooding in RCT

Source of Flooding	Lead Local Flood Authority	Natural Resources Wales	Water Company	Highway Authority	South Wales Trunk Road Agency (Trunk Roads & Motorway)
Main River		✓			
Surface Water	✓			✓ (on or coming from the Highway)	✓ (on or coming from the Highway (Trunk Roads & Motorway)
Ordinary Watercourse	✓				
Groundwater	✓				
Sewer Flooding			✓		
Reservoirs		✓			

4.2. Role of Other Stakeholders

Whilst not designated flood risk management authorities, stakeholders such as infrastructure providers, riparian landowners and residents have responsibilities to maintain their assets for the purposes of managing flood risk. These have been discussed in detail below.

4.2.1. Network Rail & Transport for Wales

Whilst legislation does not impose an official role on Network Rail/Transport for Wales, they have an operational responsibility for flooding as a land and asset owner and are required to undertake regular maintenance of all drainage infrastructure and assets that pose a risk to flooding.

4.2.2. RIPARIAN LANDOWNERS

If you own land or property located adjacent to or abutting a waterway (watercourse, stream, ditch) then in legal terms you are a Riparian Owner and have certain common law rights and responsibilities.

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[14]. 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 must first be passed through the relevant RMA, LLFA or NRW.

Under common law, Riparian Owners have rights and responsibilities relating to any watercourse that passes through or adjacent to the boundaries of their land. The means that the landowner must:

- Pass on flow without obstruction, pollution or diversion affecting the rights of others;
- Accept natural flood flows through their land, even if caused by inadequate capacity downstream, as there is no common law duty to improve a watercourse;
- Maintain the bed and banks of the watercourse (including trees and shrubs growing on the banks) and clear any debris, natural or otherwise;

[14] Natural Resources Wales – Riverside Property Owners - https://naturalresources.wales/flooding/managing-flood-risk/riverside-property-owners-know-your-rights-and-responsibilities/?lang=en

- Not cause any obstruction to the free passage of fish;
- Keep the bed and banks clear from any matter that could cause an obstruction either on their land, or by being washed away by high flow to obstruct a structure downstream;
- Take responsibility for protecting their property from seepage through natural or constructed banks, and;
- Keep clear any structure that they own such as culvert, trash screen, weirs and mill gates.

Under the FWMA, a landowner needs consent from the Land Drainage Authority if they want to construct a culvert or flood relief control structure on any ordinary watercourse.

4.2.3. Residents, Property & Business Owners

Residents, property and business owners are responsible for the protection of their own properties against flooding as well as maintaining private surface water drainage infrastructure such as guttering and soakaways. Residents have the right to defend their property as long as they do not subsequently increase the risk of flooding to other properties.

Residents are advised to review their personal flood resilience to ensure that they are as prepared as possible for any future flooding events. For more information on property flood products and services to help reduce the risk of flooding to homes and/or businesses, see The Blue Pages webpage[15].

[15] Blue Pages, Flood Directory - http://bluepages.org.uk/

5. Section 19 Investigation & Reporting

The Section 19 report is a statutory requirement of the FWMA, which primarily focuses on the statutory responsibilities and duties of flood risk management authorities in response to a flood event.

The purpose of the investigation is to determine which RMAs have relevant flood risk management functions and which functions have been exercised in response to a flood. Specifically, Section 19 of the FWMA 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 the response to the flood."
2. "When an authority carries out an investigation under subsection (1) it must publish the results of its investigation, and notify any relevant risk management authority"[16]

Current Welsh Government guidance outlined within the National Strategy for Flood and Coastal Erosion Risk Management stipulates that Section 19 reports should be produced for flooding incidents where twenty or more properties experience internal flooding following a storm event[17].

Due to the widespread and extensive flooding impacts of Storm Bert across RCT, localised areas which experienced internal flooding of more than five properties have been clustered into 25 Flood Investigation Areas (FIA). These FIAs are shown in Figure 34 and are also listed in Table 12.

[16] Flood and Water Management Act 2010 – Section 19 - https://www.legislation.gov.uk/ukpga/2010/29/section/19
[17] National Strategy for Flood and Coastal Erosion Risk Management in Wales | GOV.WALES

Individual Flood Investigation Reports (FIR) will be produced for each FIA identifying the causes and mechanisms of flooding within each area, 5 of which will be progressed into Section 19 reporting following the thresholds set out by the Welsh Government. Those Flood Investigation Areas that require a Section 19 Report have been highlighted within Table 12.

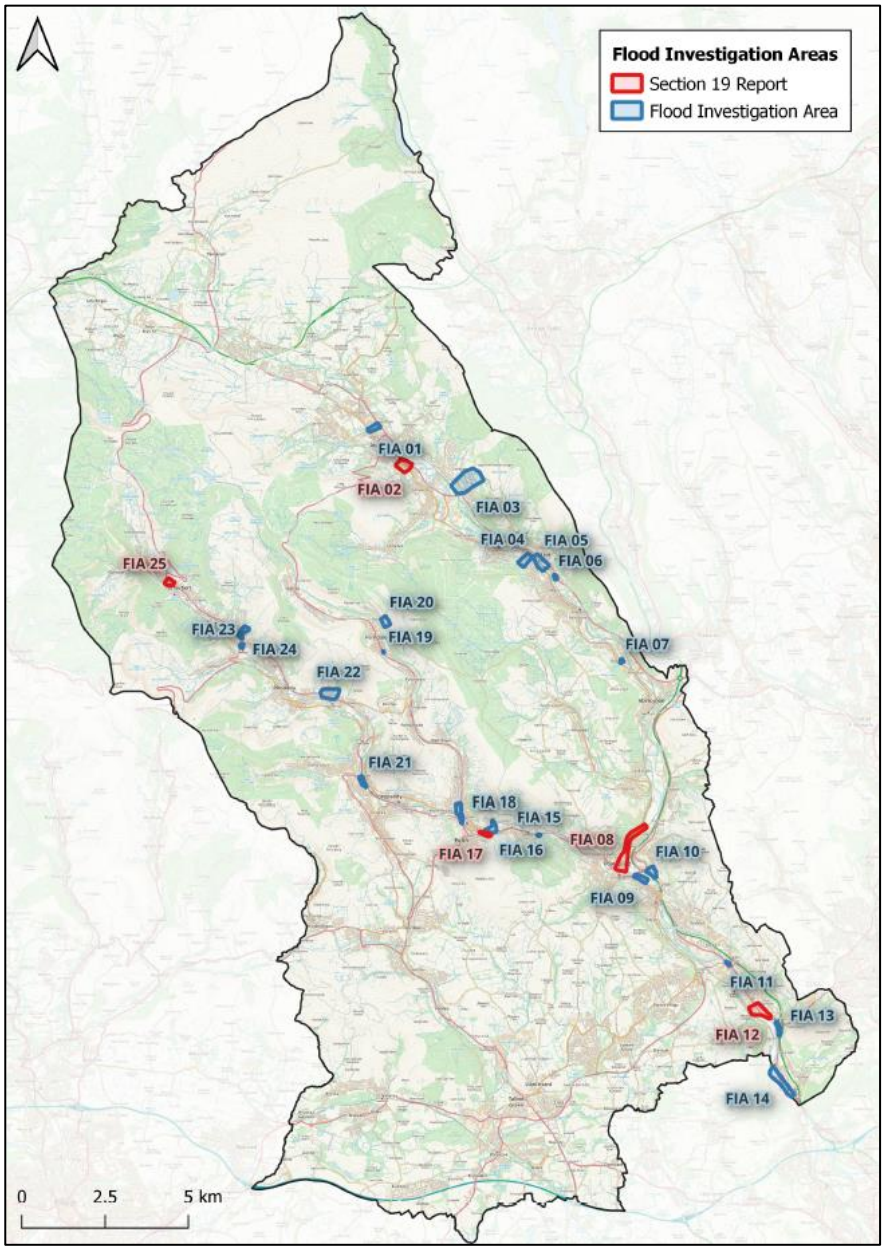


Figure 34: Flood Investigation Areas and those which meet the thresholds for the production of Section 19 reports in RCT following Storm Bert

Table 12: List of all 25 Flood Investigation Areas, the number of receptors affected and whether a Section 19 report is required.

Flood Investigation Area	Location	Nr of Receptors Impacted	Section 19 Report
FIA 01	Gadlys, Aberdare	8	No
FIA 02	Cardiff Road, Aberaman	25	**Yes**
FIA 03	Cwmbach Industrial Estate, Cwmbach	13	No
FIA 04	Woodland Street, Mountain Ash	5	No
FIA 05	Mountain Ash Town Centre, Mountain Ash	7	No
FIA 06	Cardiff Road, Mountain Ash	7	No
FIA 07	Nant y Fedw, Abercynon	8	No
FIA 08	Pontypridd Town Centre, Pontypridd	62	**Yes**
FIA 09	Egypt & Nile Street, Treforest	6	No
FIA 10	Pentrebach Road, Pontypridd	5	No
FIA 11	Upper Boat	5	No
FIA 12	Oxford Street, Nantgarw	21	**Yes**
FIA 13	Cardiff Road, Nantgarw	11	No
FIA 14	Taffs Well	5	No
FIA 15	Trehafod	9	No
FIA 16	Llwyncelyn, Porth	6	No
FIA 17	Britannia, Porth	24	**Yes**
FIA 18	Rheola Road, Porth	6	No
FIA 19	New Street, Ferndale	10	No
FIA 20	Blaenllechau	5	No
FIA 21	Foundry Road, Tonypandy	7	No
FIA 22	William Street, Ystrad	10	No
FIA 23	Dyfodwg Street, Treorchy	12	No
FIA 24	Glyncoli Close & Dumfries Street, Treorchy	5	No
FIA 25	Abertonllwyd, Dunraven & Hill Street, Treherbert	39	**Yes**

The initial results, based on available evidence, of the flooding mechanisms and impacts which occurred during Storm Bert within those Flood Investigation Areas that fall below the threshold stipulating the production of a Section 19 report, have been provided within Table 13 in Appendix 1 of this report. Appendix 1 will be reviewed following completion of the Flood Investigation Reports.

Approximately a further 117 properties, in addition to those outlined in Table 12, have been confirmed as experiencing internal flooding during Storm Bert. Those additional properties fall outside the boundaries of the 25 FIAs. For that reason, neither Flood Investigation Reports nor Section 19 Reports have been produced for those properties, however, RCTCBC's Flood Risk Management Team have undertaken initial investigations and will continue to manage the flood risk associated to each location on a prioritised basis.

As part of producing the Section 19 Reports, RCTCBC as the LLFA have engaged and will continue to collaborate with the local community and those affected to draw upon detailed local knowledge. The LLFA will also be engaging and consulting the relevant Risk Management Authorities to investigate whether their relevant flood risk management functions have been actioned or are proposed to be actioned to appropriately and proactively manage the risk of flooding to individual communities.

The primary outcome for each Flood Investigation Report is to gain a better, more comprehensive understanding of local flood risk across RCT, especially in relation to local sources of flood risk. Ultimately the production of Section 19 investigation reports will support future targeted investment in reducing flood risk, allow the development of recommendations for proposed solutions and will feed into the continued development of RCT's Flood Action Plan which sets out the Council's actions for managing local flood risk in the short, medium and long term, ensuring delivery against the objectives and measures within RCT's Local Flood Risk Management Strategy.

CONCLUSION

This overview report has been produced to provide a factual account of the events that occurred during Storm Bert (23-24th November 2024) and is not meant as a detailed investigation into the individual flooding mechanisms that impacted many communities.

Record-breaking rainfall and river levels were recorded across many parts of RCT, resulting in severe flooding to approximately 438 homes and businesses, in addition to infrastructure including bridges, rail and highway networks.

While the figures suggest that the flooding events experienced in November 2024 and February 2020 (Storm Dennis) were exceptional, climate science suggest that they might not be quite so exceptional in the years to come. It is evident that storms are becoming more frequent and severe across Wales and the UK. The need to enhance community resilience, build preparedness and improve our ability to adapt to the challenges facing society now and in the future is paramount.

APPENDIX 1

Table 13: The initial results, based on available evidence, of the flooding mechanisms and impacts observed during Storm Bert within the Flood Investigation Areas that do not stipulate a Section 19 report.

Flood Investigation Area	Nr of Receptors Impacted	Initial Results of Flood Mechanisms and Impacts
FIA 01	8	Flood Investigation Area 01 is located within the area of Gadlys in Aberdare, situated north of the confluence of the Dare and Cynon Rivers. The primary sources of flooding at FIA 01 were identified as a combination of surface water and ordinary watercourse flows originating from Aberdare Park. Aberdare Pond overtopped during the storm event, resulting in surface water flows conveying towards Gadlys Road and onwards to impacted properties along Hirwaun Road, Railway Street and Tudor Terrace. Evidence also indicated that a culvert inlet conveying from Aberdare Park, beneath the highway and onwards towards the River Cynon, overtopped during the event, contributing to the surface water flows discharging from the open park space.
FIA 03	13	Flood Investigation Area 03 lies within the lower reaches of the village of Cwmbach, south of Aberdare in the Cynon valley. FIA 03 was impacted by a combination of flood sources. In the upper reaches of Cwmbach, a culvert inlet situated adjacent to Cefnpennar Road overtopped during the storm event following heavy rainfall. This resulted in water flowing down the highway network towards Bro Deg, Bron Haul and Canal Road, impacting properties on its course of flow. A second culvert inlet at Tirfounder Road also overtopped during the event, contributing flows towards the lower reaches of FIA 03.

Flood Investigation Area	Nr of Receptors Impacted	Initial Results of Flood Mechanisms and Impacts
		Several commercial premises were also impacted at Cwmbach Industrial Estate. The primary source of flooding originated from two surcharging manholes within the industrial area, primarily due to a blockage within the culverted watercourse network. High levels within the River Cynon and Cwmbach Canal are also considered to have influenced the discharge of water, contributing to the observed surcharging manholes. Evidence of a surcharged manhole connected to the combined sewer network within the industrial estate was also identified as a contributing factor.
FIA 04	5	Flood Investigation Area 04 lies within the town of Mountain Ash in the Cynon Valley, specifically north of Darranlas in Mountain Ash West. The primary source of flooding at FIA 04 was identified as surface water flows originating from Victoria Pleasure Grounds to the southwest of the investigation area. Overland flows from the open area flowed downhill along the highway networks at Lyle Street and Woodland Terrace, onwards towards streets including Woodland Road, Woodland Street and Fountain Street, impacting residential properties on its course of flow before discharging into the highway drainage in the lower reaches. A manhole located at Lyle Street was also identified as surcharging during the event, contributing additional surface water flows downstream.
FIA 05	7	Flood Investigation Area 05 is situated within the town centre of Mountain Ash in the Cynon valley and encompasses the river embankments of Mountain Ash East and West. FIA 05 was impacted by a combination of flood sources during the storm event. Ordinary watercourse and surface

Flood Investigation Area	Nr of Receptors Impacted	Initial Results of Flood Mechanisms and Impacts
		water flows originating from the upper reaches of Mountain Ash East resulted in water flowing towards Ffrwd Crescent and Cardiff Road which lies adjacent to the River Cynon. Surface water flows originating from Fforest Road and Troed-y-rhiw Road entered Cardiff Road from the east whilst a culvert inlet located at Campbell Terrace contributed flows from the west. The culvert inlet surcharged during the storm event after becoming obstructed with debris. A manhole located on the embankment of the River Cynon was also identified as surcharging during the event, contributing to the flooding of a commercial unit at Cardiff Road. This has been attributed to high river levels in the Cynon influencing the discharge of water. On the western embankment of the River Cynon, the river overtopped, causing internal flooding to commercial premises along Oxford Street.
FIA 06	7	Flood Investigation Area 06 is located in the Newtown region of Mountain Ash East in the Cynon valley. The primary source of flooding at FIA 06 originated from the combined sewer network within the housing estate adjacent to the A4059 New Road and Cardiff Road. Several manholes associated with the combined sewer network in the area surcharged during the event, causing flooding to residential properties at Usk Villas. Private drainage in the gardens of some properties were also identified as surcharging during the event after becoming overwhelmed with the volume of surface water, contributing to the sewer flooding.
FIA 07	8	Flood Investigation Area 07 lies within the community area of Ynysboeth located in the River Cynon catchment, north of Abercynon.

Flood Investigation Area	Nr of Receptors Impacted	Initial Results of Flood Mechanisms and Impacts
		The source of flooding at Ynysboeth originated primarily from a surcharging manhole associated to the Nant y Fedw culverted ordinary watercourse network within the Nant y Fedw estate. The surcharging manhole caused water to enter several residential properties on its course of flow.
FIA 09	6	Flood Investigation Area 09 is located on the western embankment of the River Taf in Treforest. The source of flooding in this area was associated to the highway drainage infrastructure along the streets of Egypt Street, Niagara Street and Nile Street becoming overwhelmed with the volume of surface water entering the systems. The high river levels in the Taf are considered to have influenced the discharge of water from the highway drainage network. Water accumulated at the low points in the streets, entering several properties.
FIA 10	5	Flood Investigation Area 10 is located within the electoral ward of Trallwng. The area is bounded to the north by the A4054 Pentrebach Road and to the south by the River Taf and the A470. The primary source of flooding in FIA 10 originated from a twin pipe culvert which conveys water beneath footpath to the rear of Pentrebach Road. The culvert became blocked with debris from the upper catchment, causing water to overtop and convey towards the rear of several properties along Pentrebach Road.
FIA 11	5	Flood Investigation Area 11 is located along the eastern embankment of the River Taf in Upper Boat. The source of flooding in this area originated from the River Taf overtopping its banks and entering several properties at Williams Place which is a localised low point.

Flood Investigation Area	Nr of Receptors Impacted	Initial Results of Flood Mechanisms and Impacts
FIA 13	11	Flood Investigation Area 13 is located in the village of Nantgarw on the eastern embankment of the River Taf. The source of flooding in this area originated initially from a culvert outlet associated to the Nant Garw ordinary watercourse, followed by the upstream culvert inlet. The culvert network conveys beneath the A4054 Cardiff Road and the railway network before discharging into the River Taf to the west. The culvert outlet is considered to have surcharged primarily due to the influence of the elevated levels in the River Taf influencing the discharge of water from the Nant Garw watercourse. Several residential and commercial premises were impacted due to the surcharging flows from the culvert network. Surcharging highway drainage infrastructure was also noted as contributing to the flooding observed in this area.
FIA 14	5	Flood Investigation Area 14 is located along the eastern embankment of the River Taf in the village of Taffs Well. The primary source of flooding at FIA 14 was associated to the River Taf which overtopped at several locations along the eastern embankment. The River Taf was also identified to have breached its formal defences at a location to the rear of properties along Cardiff Road, entering the rear gardens of properties. Surface water flows conveying towards properties along Cardiff Road is also considered to have contributed to the main river flooding, particurarly from highway drainage infrastructure which was became overwhelmed during the event.
FIA 15	9	Flood Investigation Area 15 lies within the village of Trehafod between the towns of Pontypridd and Porth in the Rhondda valley.

Flood Investigation Area	Nr of Receptors Impacted	Initial Results of Flood Mechanisms and Impacts
		The primary source of flooding in FIA 15 has been attributed to a surcharging manhole on the A4058 Gyfeillion Road, associated to an unnamed ordinary watercourse conveying from the hillsides to the rear of the railway network. Flood water from the manhole entered the village of Trehafod which is set lower than the road, conveying towards Fountain Street and Trehafod Road, impacting several residential properties. Flooding was exacerbated by blockages to the highway drainage infrastructure in the lane adjacent to Fountain Street, caused as a result of the ordinary watercourse flows carrying debris, which restricted the ability of the drainage network to manage surface water flows.
FIA 16	6	Flood Investigation Area 16 is located within the region of Llwyncelyn in the town of Porth in the Rhondda valley. The primary source of flooding in this area was determined to have originated from a culverted ordinary watercourse network to the rear of Llwyncelyn Industrial Estate which became blocked and/or collapsed, causing water to escape the culvert system and flow towards several commercial premises. A localised landslip was identified as a result of these flows. A culvert inlet associated to the Nant Llyncelyn ordinary watercourse was also identified to have overtopped during the storm event, causing flooding to a residential property and contributing flows downstream towards the industrial estate. Blockages to highway gullies along North Road and Llwyncelyn Road which restricted the ability of the surface water drainage network to manage the exceedance ordinary watercourse flows was also identified as a contributing factor to the flooding experienced in this area.

Flood Investigation Area	Nr of Receptors Impacted	Initial Results of Flood Mechanisms and Impacts
FIA 18	6	Flood Investigation Area 18 is situated at the confluence of the Rhondda Fach and Fawr river, within the town of Porth. The primary source of flooding in this area has been attributed to the Rhondda Rivers overtopping their embankments at various locations, impacting properties located adjacent to the main river at Rheola Industrial Estate, Rheola Road and Porth Street. It was also identified that the Rhondda Fach River breached a private retaining wall to the rear of properties along Rheola Road, causing flooding to properties.
FIA 19	10	Flood Investigation Area 19 is located within the community area of Ferndale, specifically adjacent to the A4233 Dyffryn Street, within the Rhondda Fach valley. Flooding within FIA 19 has been attributed to a combination of sewer flooding due to a blockage within the combined sewer network, and groundwater ingress to the rear of several residential properties. A combined sewer manhole was identified as surcharging at New Street, in addition to reports of drainage systems in the rear of several properties also surcharging during the storm event, resulting in internal flooding to properties. The cause of surcharge is unclear at this time.
FIA 20	5	Flood Investigation Area 20 is located in the village of Blaenllechau, adjacent to the town of Ferndale in the Rhondda Fach valley. The primary source of flooding in FIA 20 has been identified as surface water conveying overland from the steep hillsides and roads north of Blaenllechau, and entering properties situated at lower elevations along Commercial Street and Wind Street.

Flood Investigation Area	Nr of Receptors Impacted	Initial Results of Flood Mechanisms and Impacts
		Blockages to highway drainage infrastructure restricting the ability to manage exceedance flows was also identified as a contributing factor to the observed flooding.
FIA 21	7	Flood Investigation Area 21 is located within the town of Tonypandy in the Rhondda River catchment. The source of flooding at FIA 21 in this incident originated from the Rhondda Fawr River which overtopped a retaining wall on the western embankment and entered Foundry Road Industrial Estate. The boundary walls of the industrial estate contained much of the main river water, resulting in water accumulating and conveying towards several commercial premises located north of the overtopping location.
FIA 22	10	Flood Investigation Area 22 is located within the community area of Ystrad in the Rhondda River catchment. The primary source of flooding in this area has been attributed to ordinary watercourse and surface water flows entering William Street from the upper reaches of Ystrad. Two private culvert inlets were identified as the primary sources of flooding to several properties along Victoria Street and William Street. Both inlets became blocked with debris from the upper catchments, resulting in exceedance flows overtopping both structures and conveying downhill. Flooding was exacerbated by blockages to the highway drainage infrastructure within the lower reaches of FIA 22, caused as a result of the ordinary watercourse flows carrying debris, which restricted the ability of the drainage network to manage surface water flows.
FIA 23	12	Flood Investigation Area 23 is located within the town of Treorchy in the Rhondda valley.

Flood Investigation Area	Nr of Receptors Impacted	Initial Results of Flood Mechanisms and Impacts
		The primary source of flooding at FIA 23 originated from the Nant Cwm-Parc main river which overtopped near to the highway culvert which conveys beneath Station Road towards the Rhondda River approximately 80m to the northeast. The river overtopped at a low point within the embankment retaining wall, resulting in internal flooding to several residential and commercial premises.
FIA 24	5	Flood Investigation Area 24 lies to the north of Treorchy in the Rhondda River catchment. FIA 24 was primarily impacted by ordinary watercourse flooding caused as a result of an unnamed ordinary watercourse surcharging at two private culvert inlets. Both culvert inlets are associated to the same unnamed ordinary watercourse which drains the steep hillsides above Treorchy. Both inlets became blocked with debris which was mobilised from the upper catchments. Significant scouring and a minor landslip was observed in the upper catchment, which is considered to have contributed material to both inlets. Exceedance flows from the culvert inlets conveyed downhill towards the lower reaches of Treorchy, causing flooding to residential properties along Glyncoli Close and Dumfries Street.