

Flood and Water Management Act 2010

Section 19 Flood Investigation Report

Storm Dennis –
Flood Investigation Area RCT20
(Ynyshir)

March 2022

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This report should be read in its entirety

This report has been prepared in accordance with the requirements of section 19 Flood and Water Management Act 2010. The Council assumes no responsibility or liability from any person in connection with its contents or findings.

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CONTENTS

EXECUTIVE SUMMARY	3
ABBREVIATIONS.....	6
TABLES AND FIGURES	7
1 INTRODUCTION.....	9
1.1. Purpose of Investigation.....	9
1.2. Site Location	10
1.3. Drainage System.....	12
1.4. Investigation Evidence	12
1.5. Public Engagement	13
2 FLOODING HISTORY	14
2.1. Previous Flood Incidents	14
2.2. Flood Incident.....	15
2.3. Rainfall Analysis.....	23
3. POSSIBLE CAUSES.....	24
3.1. Culvert Conditions.....	24
3.2. Ordinary Watercourse Conditions	27
3.3. Main River	30
3.3.1. Main River Levels and Flood Warnings	30
3.3.2. Main River Flood Risk.....	32
3.3.3. Main River Flood Defences.....	35
3.4. Highway Drainage Conditions	36
3.5. Dŵr Cymru Welsh Water Apparatus	38
3.6. Surface Water	39
3.7. Access Structures	42
3.8. System at Capacity	43
3.9. Summary of Possible Causes	44
4. RISK MANAGEMENT AUTHORITY ACTIONS.....	46
4.1. Lead Local Flood Authority	51
4.2. Natural Resources Wales	54

4.3. Water Company	56
4.4. Highway Authority	57
USEFUL LINKS/CONTACTS	58

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EXECUTIVE SUMMARY

This report has been produced through the duties placed upon Rhondda Cynon Taf County Borough Council under Section 19 of the Flood and Water Management Act 2010. The Act states, “On becoming aware of a flood in its area, a lead local flood authority 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”.

This Section 19 investigation provides a factual report of the storm event that occurred on the 15th and 16th of February 2020 within the Rhondda Cynon Taf County Borough Council area, focusing the investigation on the flooding that occurred within the impacted areas of Ynyshir in the Rhondda Fach valley (Flood Investigation Area RCT20, Figure 1).

This report was undertaken to identify the mechanisms of flooding, establish which Risk Management Authorities have relevant flood risk management functions under the Flood and Water Management Act 2010 and ascertain if those Risk Management Authorities have undertaken or are planning to undertake actions related to those functions to manage the risk of flooding.

The flooding that affected RCT on the 15 and 16th of February 2020 was a result of an extreme rainfall event, designated by the Met Office as ‘Storm Dennis’. The storm event resulted in internal flooding to 26 properties: including 24 residential properties and 2 non-residential properties. Significant flooding to the highway also occurred throughout the investigation area. These impacts were identified through inspections made by RCT’s Flood Risk Management Team during the days following the storm event, as well as information collated by residents, RCT’s Public Health team, RCT’s Highway and Streetcare Depot, Natural Resources Wales and Dŵr Cymru Welsh Water.

The evidence gathered within this report identifies two primary sources of internal flooding within the investigation area: the overtopping of the Rhondda Fach River and the surcharging of two culvert inlets located at Heath Terrace.

The overtopping of the Rhondda Fach River at RCT20 was caused by a fallen tree and other woody debris obstructing the flow of the main river at a highway bridge connecting Avon Terrace and Riverside Close, causing water to rise behind the

obstruction. The unprecedently high river levels within the Rhondda Fach are considered to have contributed to the severity of the overtopping, with NRW's Maerdy station approximately 7.5 kilometres upstream recording its second highest recorded peak during Storm Dennis (1.371 metres).

The surcharging of two culvert inlets at Heath Terrace was caused by a significant accumulation of debris on both culvert inlet's debris screens, with overland flows across the eastern valley catchment leading to excessive scouring of the hillside and debris material being deposited and transported by the unnamed ordinary watercourses flowing down the hillside towards the culvert inlets.

Surface water flooding was also noted as a source of flooding to one residential property on Standard Terrace following the accumulation of surface water at a localised low point in the highway

NRW has been determined as the relevant Risk Management Authority with permissive powers to manage the main river flooding that occurred during Storm Dennis. In response to the flooding at investigation area RCT20, NRW have;

- Carried out their own post event investigative analysis work to understand the mechanism of flooding from the Rhondda Fach River at Ynyshir;
- Commissioned a Rhondda Flood Modelling Project, the outcomes of which will include an initial assessment of the viability of potential flood risk management options; and
- Developed a series of recommendations and a detailed action plan to address areas of improvement for future storm events, including the performance and expansion of NRW's Flood Warning Service and incident management response.

RCT as the Lead Local Flood Authority, Land Drainage Authority and Highway Authority has been determined as the relevant Risk Management Authority responsible for managing the ordinary watercourse and surface water flooding that occurred during Storm Dennis. In response to the flooding at investigation area RCT20, the LLFA has undertaken 16 actions and have proposed to undertake a further 6. A summary of which include;

- Carried out survey, jetting and cleansing operations to highway drainage infrastructure.

- Led on the development of a central Control Room to compliment the Council's Contact Centre and CCTV Centre; and to provide a comprehensive and informed response to residents during storm events;
- Expanded its asset inspection and maintenance schedule to include the culvert inlet structures which surcharged during the storm event within its response to extreme weather event planning;
- Exercised its powers, under Section 13 of the Flood and Water Management Act 2010, to engage with NRW and DCWW in relation to their responsibilities as Risk Management Authorities; and
- Carried out significant upgrades to 'Culvert Inlet 2' and sections of ordinary watercourse at Heath Terrace to reduce the risk of scour and potential blockages.

The event that occurred on 15 and 16th February was extreme, and it is unlikely flooding from a similar event could be prevented entirely. It is concluded that Risk Management Authorities satisfactorily carried out their flood risk management functions in response to the flood event. All relevant RMAs have proposed further measures to improve preparedness and responses to future flood events.

ABBREVIATIONS & GLOSSARY

CaRR – Communities at Risk Register

DCWW – Welsh Water

FRMP – Flood Risk Management Plan

FWMA – Flood and Water Management Act 2010

LDA – Land Drainage Authority

LFRMS – Local Flood Risk Management Strategy

LLFA – Lead Local Flood Authority

NFD – Non-Flood Defence – A structure that provides a flood defence benefit, which is not designed or maintained as a Flood Defence Structure. Thereby the benefits derived from the structure cannot be depending upon to deliver a Flood Defence.

NRW – Natural Resources Wales

Q – Return Period (1 in X chance of an event occurring in any given year)

RCT - Rhondda Cynon Taff CBC

RCT20 – Flood Investigation Area RCT 20

RMA – Risk Management Authority

SAB – Sustainable Drainage Approval Body

SFRA – Strategic Flood Risk Assessment

SOC – Strategic Outline Business Case

SuDs – Sustainable Drainage Systems

TABLES AND FIGURES

Table 1: Investigative evidence gathered in preparation of the Storm Dennis Section 19 report	12
Table 2: Summary of the source(s), pathway(s) and receptor(s) affected during Storm Dennis within investigation area RCT 20.....	15
Table 3: Peak river levels at NRW's monitoring stations along the Rhondda Fawr and Fach Rivers during Storm Dennis	31
Table 4: Summary of the culvert capacity assessment results which indicate the current standard of protection of culverts on Heath Terrace in free flowing and blockage conditions.....	43
Table 5: Summary of source(s) and possible cause(s) of flooding in investigation area RCT20 during Storm Dennis	44
Table 6: Risk Management Authority with relevant functions to manage the risk for different flood types.....	46
Table 7: Recommendations provided by the LLFA to be considered by the relevant Risk Management Authority identified in response to the source(s) of flooding in RCT20 (as per Table 5)	47
Figure 1: Flood Investigation Area RCT20 Location Plan	10
Figure 2: Natural Resources Wales' Flood Risk Assessment Wales (FRAW) map for rivers and ordinary watercourse and surface water flood risk at investigation area RCT20. Contains Natural Resources Wales information © Natural Resources Wales and database right. All rights reserved. ..	11
Figure 3: Partial Cross Section of the Rhondda Fach Valley, based on LiDAR	17
Figure 4: Rainfall Topographic Watershed and sub-catchments above investigation area RCT20	17
Figure 5: Flow pathways and surcharged culvert inlets within investigation area RCT20 during Storm Dennis	18
Figure 6: Whirlpool above the fully submerged 'Culvert Inlet 2' during Storm Dennis (image provided by resident).....	19
Figure 7: Post storm event photograph of 'Culvert Inlet 1' depicting the displacement of material (Image captured by a RCT's Flood Risk Management team on 17 th February 2020)	20
Figure 8: Rhondda Fach River highway bridge connecting Riverside Close and Avon Terrace (Image captured by a RCT Structures officer on 17 th February 2020)	21
Figure 9: Image capturing accumulated woody debris on the embankment of the Rhondda Fach River behind the highway bridge following Storm Dennis (Image captured by a RCT Structures officer on 17 th February 2020).....	21
Figure 10: Surveyed culverted ordinary watercourse networks within investigation area RCT20	25
Figure 11: 'Culvert Inlet 2' being cleared of debris following Storm Dennis (image provided by resident and captured 16 th February 2020).....	26
Figure 12: Map of Ordinary Watercourses which feed into investigation area RCT20	27
Figure 13: Overland flow travelling across the hillside track towards the hillside upstream of 'Culvert Inlet 1' (captured by RCT's Flood Risk Management team on 19/02/2020)	28

Figure 14: Overland flow and deposition of material across the hillside track above RCT20 (captured by RCT's Flood Risk Management team on 19/02/2020)	28
Figure 15: Evidence of eroded embankments within the ordinary watercourse upstream of 'Culvert Inlet 1' (captured by RCT's Flood Risk Management team on 19/02/2020)	29
Figure 16: Significant deposition of scoured material along the hillside track above 'Culvert Inlet 2' post Storm Dennis (image provided by resident)	29
Figure 17: The Rhondda Fach River levels at Maerdy station between the 14 th and 17 th February 2020 (Natural Resources Wales)	30
Figure 18: NRW River Level Monitoring Stations along the Rhondda Fawr and Fach Rivers	31
Figure 19: NRW's FRAW map for River sources in RCT20. Contains Natural Resources Wales information © Natural Resources Wales and database right. All rights reserved.....	33
Figure 20: Debris accumulation along the channel bed of the Rhondda Fach River upstream of the footbridge between Standard View and Springfield Estate (image captured by RCTs Infrastructure team on 17 th February 2020).....	34
Figure 21: Drone image of Tylorstown landslip impacting the flow within the Rhondda Fach River (image captured by RCTs Infrastructure team on 18 th February 2020)	35
Figure 22: Mud, silt and debris deposited onto the highway at Heath Terrace following the clearance operation of 'Culvert Inlet 2' during Storm Dennis (image provided by resident)	36
Figure 23: NRW's FRAW map for surface water and ordinary watercourse sources within RCT20. Contains Natural Resources Wales information © Natural Resources Wales and database right. All rights reserved.	39
Figure 24: Overland flows conveying down the hillsides to the east of RCT20 following Storm Dennis (Image captured by a RCT Flood Risk officer on 19/02/2020)	40
Figure 25: Saturated ground along the hillside above RCT20 post storm event (Image captured by a RCT Flood Risk officer on 19/02/2020).....	40
Figure 26: Displaced material on bridleways along the hillsides east of RCT20 following minor landslips during Storm Dennis (Image captured by a RCT Flood Risk officer on 19/02/2020)	41

1 INTRODUCTION

1.1. PURPOSE OF INVESTIGATION

On the 15 and 16th of February 2020, RCT was impacted by an extreme weather event which was designated by the Met Office as ‘Storm Dennis’. Due to the extent and impact of the event, the LLFA opted to undertake a formal investigation.

The storm resulted in widespread residential and commercial flooding within the Rhondda Cynon Taf County Borough Council area. This report will focus on Flood Investigation Area RCT20 (further referred to as RCT20) which covers the village of Ynyshir in the Rhondda Fach valley.

The reason behind RCT’s investigation is in response to the duties of the local authority in regard to Section 19; of the Flood and Water Management Act 2010, which states:

1. “on becoming Aware of a flood in its area, a lead local flood authority must, to the extent that it considers it necessary or appropriate, investigate:
 - a) “Which risk management authorities have relevant flood risk management functions and,
 - b) Whether each of those risk management authorities has exercised, or is proposing to exercise, those functions in the response to the flood.”
2. “When 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 authority”¹

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.

Specific details of Storm Dennis, such as rainfall analysis are covered within a separate overview report that covers the wider RCT area. The report is titled ‘Storm Dennis February 2020 – Overview Report’ and will be referred to as ‘FRM – Storm Dennis – Overview Report’².

¹ Flood and Water Management Act 2010 – Section 19 - <https://www.legislation.gov.uk/ukpga/2010/29/section/19>

² [Flood Investigation Reports | Rhondda Cynon Taf County Borough Council \(rctcbc.gov.uk\)](http://rctcbc.gov.uk)

1.2. SITE LOCATION

The area investigated within this report falls within the village of Ynyshir, specifically the area east of the A4233. The area falls within the electoral ward of Ynyshir and is situated approximately 1.5 kilometres north of Porth within the central region of the county borough.

Ynyshir is situated within the Rhondda Fach River catchment which meanders from the northwest of the investigation area and flows through the centre of RCT20 before continuing in a southwesterly direction down the Rhondda Fach valley.

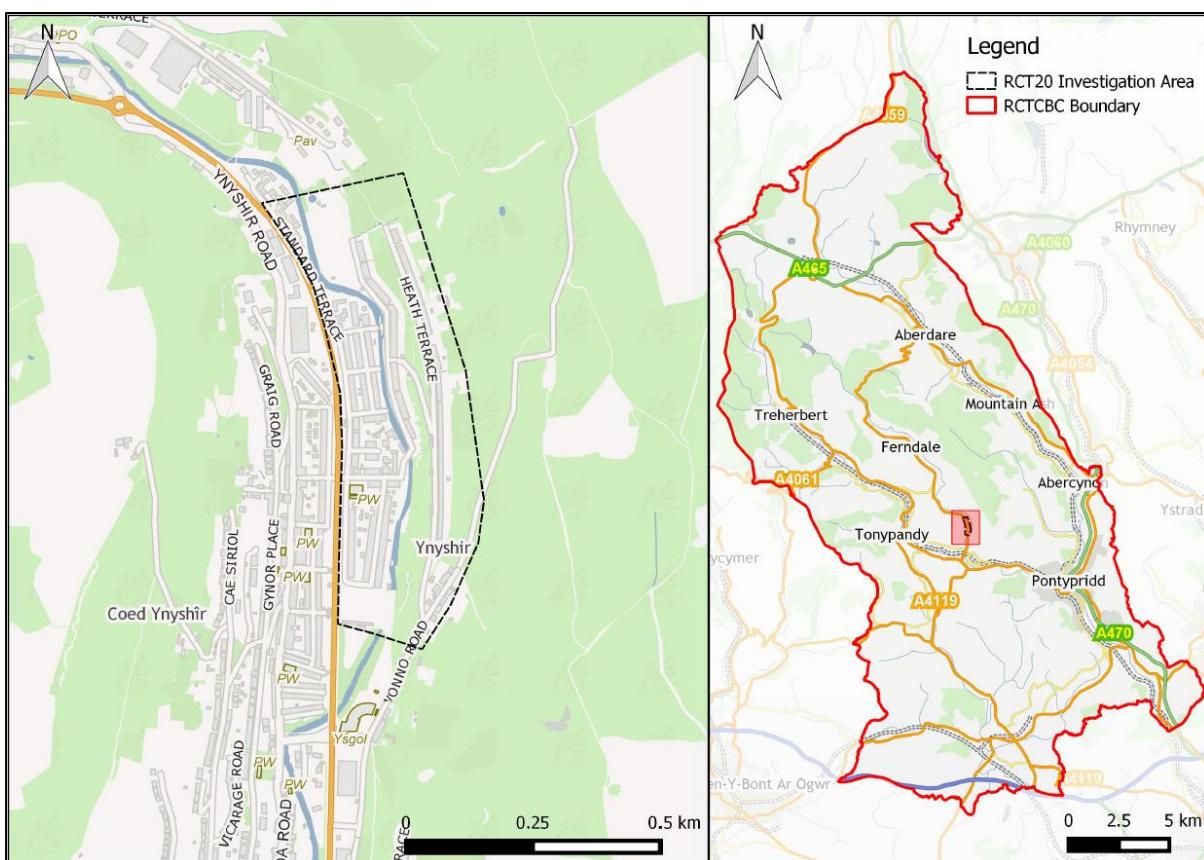


Figure 1: Flood Investigation Area RCT20 Location Plan

Ynyshir is located at the base of the Rhondda Fach valley, with steep hillsides rising to the east and the west. Whilst most of the village is located at the valley floor, some of the properties impacted during the storm event are positioned on streets which cling to the eastern hillsides, such as Heath Terrace.

Several minor unnamed watercourses drain the eastern highlands above RCT20 and are partially culverted beneath residential developments before discharging into Rhondda Fach River.

According to the Welsh Government's CaRR, Ynyshir is ranked 55th for surface water flood risk and 167th for main river flooding in Wales.

NRW's FRAW map (Figure 2) indicates that the highest risk posed to people and properties within investigation area RCT20 is broadly associated with the Rhondda Fach River, with a low to medium flood risk observed along the length of the watercourse. Figure 2 also denotes a high to low risk of surface water and ordinary watercourse flooding sourced by culvert inlets related to the network of unnamed watercourses draining the eastern hillsides. Flood risk throughout Ynyshir is further described within RCT's Flood Risk Management Plan (FRMP)³.

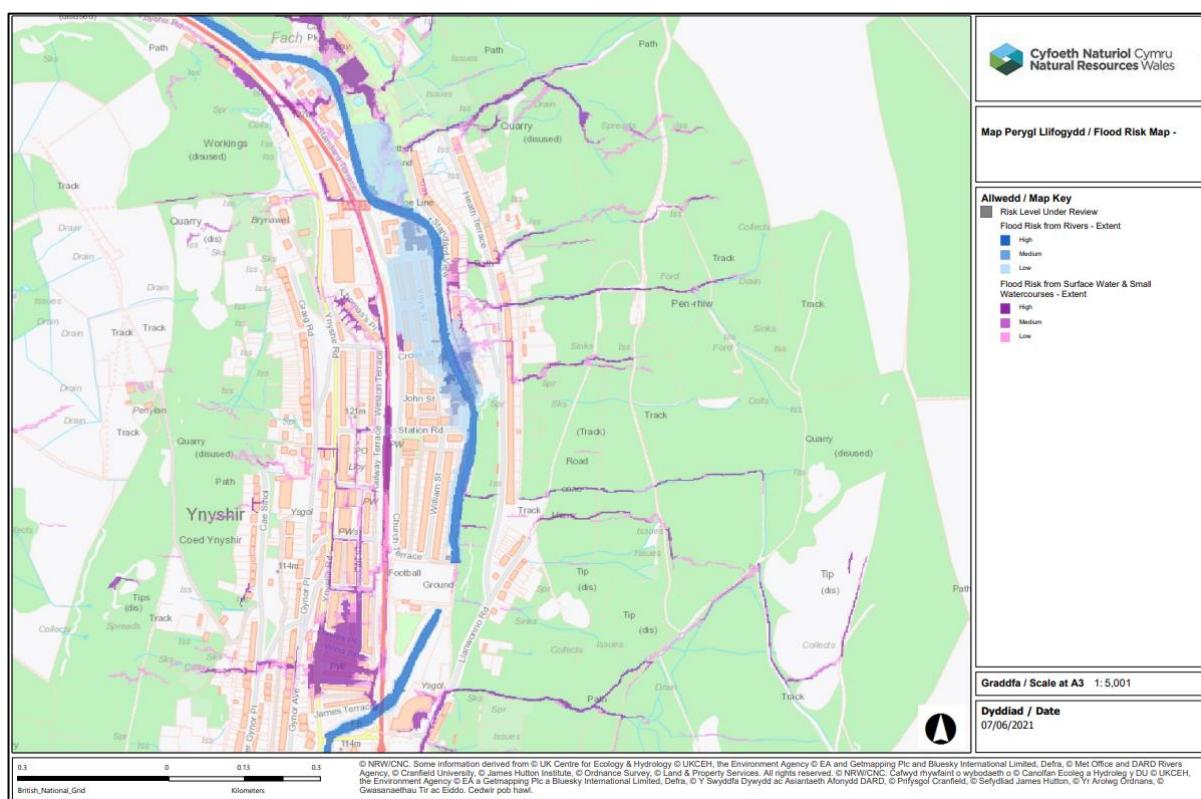


Figure 2: Natural Resources Wales' Flood Risk Assessment Wales (FRAW) map for rivers and ordinary watercourse and surface water flood risk at investigation area RCT20. Contains Natural Resources Wales information © Natural Resources Wales and database right. All rights reserved.

³ [RCT'S Flood Risk Management Plan \(rctcbc.gov.uk\)](http://rctcbc.gov.uk)

1.3. DRAINAGE SYSTEM

The surface water drainage system that serves investigation area RCT20 is that of the highway drainage network designed to manage the surface water within the highway and public surface water and combined sewer networks operated by Dŵr Cymru Welsh Water.

1.4. INVESTIGATION EVIDENCE

To support the investigation a range of qualitative and quantitative evidence has been gathered from numerous sources, the summary of which is listed in Table 1.

Table 1: Investigative evidence gathered in preparation of the Storm Dennis Section 19 report

Source	Data
Residents	Photos, videos, statements, email correspondence, public engagement survey responses
Responders' statements	Local responders' statements
CCTV Surveys	Internal surveys of the local drainage networks
Met Office Data	Weather Warning information (see FRM – Storm Dennis – Overview Report)
Rain Gauges	RCT and NRW operated gauge information (see FRM – Storm Dennis – Overview Report)
Natural Resources Wales	River Level and Flood Warning data
RCT Flood Risk Management Plan	Site specific information and data for each electoral ward in RCTCBC
Communities at Risk Register	Flood risk ranking and scores for all flood types based on community data in Wales
Flood Investigation Report (Redstart's FIR)	A summary of the source-pathway-receptors, culvert capacity assessment and hydraulic modelling work undertaken by Redstart. The Flood Investigation Report was commissioned by RCTCBC prior to writing the Section 19 report.

Evidence sourced from the 'Flood Investigation Report', commissioned by RCT, will be further referred to as 'Redstart's FIR' throughout this report.

1.5. PUBLIC ENGAGEMENT

Following the initial flooding event that occurred on the 15 and 16th of February during Storm Dennis, flood risk officers from RCT's Flood Risk Management department were deployed to areas across the borough to investigate reports of internal flooding by residents. Residents engaged with the Flood Risk Management team to help determine the initial impacts caused by the flooding event and to investigate the potential source(s) and pathway(s) of flood water. Due to the volume of calls received by RCT's Out of Hours department, visits were prioritised to those areas experiencing significant internal flooding to residential properties.

To support the flood investigations, a public engagement exercise was undertaken between the 4th and 25th of January 2021 by Redstart, on behalf of RCT. The aim of this exercise was to engage with local residents who were affected by the flood event to capture details on how they were impacted, the source and movement of flood water within the area, how receptors were impacted as well as drawing on local knowledge to query how local conditions could have exacerbated the event. This data is useful to help the LLFA better understand and validate our assessment of the flood event to support the investigation under Section 19 of the FWMA.

2 FLOODING HISTORY

2.1. PREVIOUS FLOOD INCIDENTS

Historical flood information and residents accounts captured by RCT's Flood Risk Management officers following Storm Dennis indicate that very little internal flooding has occurred across RCT20 prior to February 2020, with recent records identifying one property on Cross Street as reporting internal flooding in 2014.

Anecdotal information supplied by long-term residents of Heath Terrace highlighted the demolition of 8 properties on the street during the 1950s as a result of recurrent flood incidents; however, no reports of internal flooding have been recorded subsequent to the demolition works.

External flooding has been recorded on several occasions throughout RCT20 in relation to intense rainfall events and overland flows originating from the steep hillsides to the east. Streets particularly impacted by overland flows include Heath Terrace and Llanwonno Road.

2.2. FLOOD INCIDENT

The flooding that occurred on the 15th and 16th February 2020 was a result of an extreme rainfall event, designated by the Met Office as 'Storm Dennis' which affected the majority of RCT and caused widespread flooding to communities.

Specific details of Storm Dennis, such as rainfall and river level analysis are covered within a separate overview report that covers the wider RCT area, referenced 'FRM – Storm Dennis – Overview Report'².

The post event inspections undertaken on the days following the storm event by RCT's Flood Risk Management Team and Public Health Wales identified 24 residential properties and 2 commercial properties as internally flooded.

A summary of the source(s) and pathway(s) of flooding within investigation area RCT20 during Storm Dennis have been outlined in the Table 2 and further described throughout this section.

Table 2: Summary of the source(s), pathway(s) and receptor(s) affected during Storm Dennis within investigation area RCT 20

Source	Pathway	Receptor
The Rhondda Fach River overtopping its eastern and western banks due to a blockage at the bridge adjacent to Avon Terrace.	Main river flood water from the Rhondda Fach River conveyed eastwards across Avon Terrace and Standard View and westwards towards Cross Street, Station Road and Riverside Close.	17 residential properties and 2 non-residential properties were flooded across streets adjacent to the main river.
Intense rainfall running off the steep hillsides to the east of RCT20 draining to lower ground via several unnamed ordinary watercourses	Flood water conveyed from the two surcharging culvert inlets down towards properties on Heath Terrace and onwards to the rear of properties on Standard View.	Internal flooding to at least 4 residential properties at the southern end of Heath Terrace. Internal flooding to 2 residential properties on Standard View.

Intense rainfall and surface water accumulation.	Surface water runoff from the A4233 Porth Relief Road, which is situated at a higher elevation than Standard Terrace, flowed towards the low points in the road and exceeded the capacity of the local highway drainage network.	Internal flooding of a single residential property on Standard Terrace.
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On review of Table 2, there are two primary sources of flooding within the investigation area. Impacted areas situated on the valley hillside were primarily impacted by significant overland runoff from the steep highlands to the east of the investigation area, whilst areas of Ynyshir at the valley floor were primarily impacted by the overtopping of the main river, the Rhondda Fach.

In areas flooded by pluvial flows from the surrounding hillsides, the runoff was routed by the eastern topographic catchment via a network of unnamed ordinary watercourses which drain the hillside, before being culverted beneath residential development in RCT20 and ultimately discharging into the Rhondda Fach River.

On review of the area of land that would expect to drain towards the flood investigation area, LIDAR based assessments produced by Redstart's FIR (Figure 3) show the eastern valley side of Ynyshir to be steeply inclined and absent of any ridge-like features that may divert surface water flows. These steep slopes above the investigation area largely contribute to the rapid surface water and ordinary watercourse flows travelling down the hillside during heavy rainfall.

Figure 4 depicts the topographic watershed of the Rhondda Fach and Cynon River valleys (bold pink line), with rainfall to the west of the watershed draining to the Rhondda Fach catchment. The catchment above investigation area RCT20 can be sub-divided into further sub-catchments to illustrate the area of land that would expect to drain towards the investigation area (hatched areas in Figure 4).

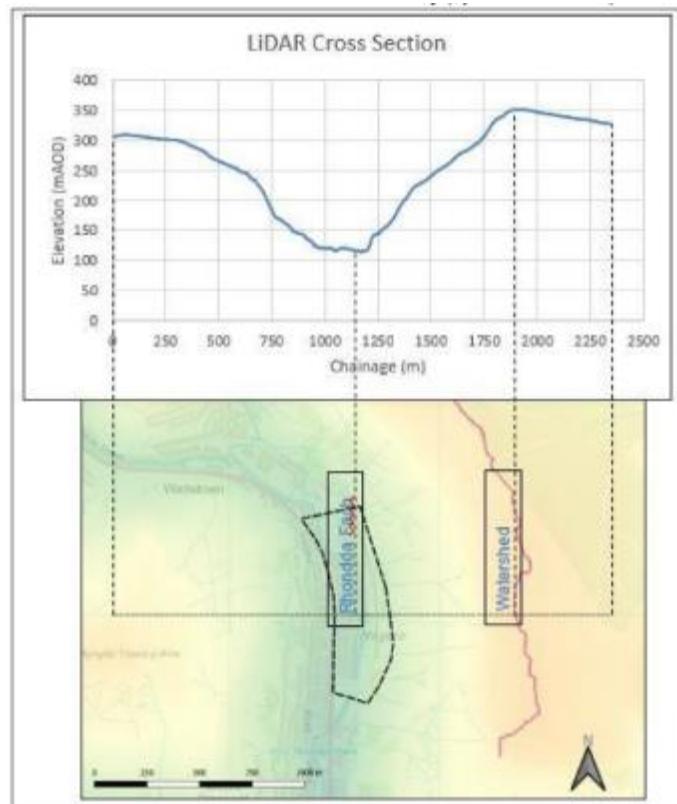


Figure 3: Partial Cross Section of the Rhondda Fach Valley, based on LiDAR

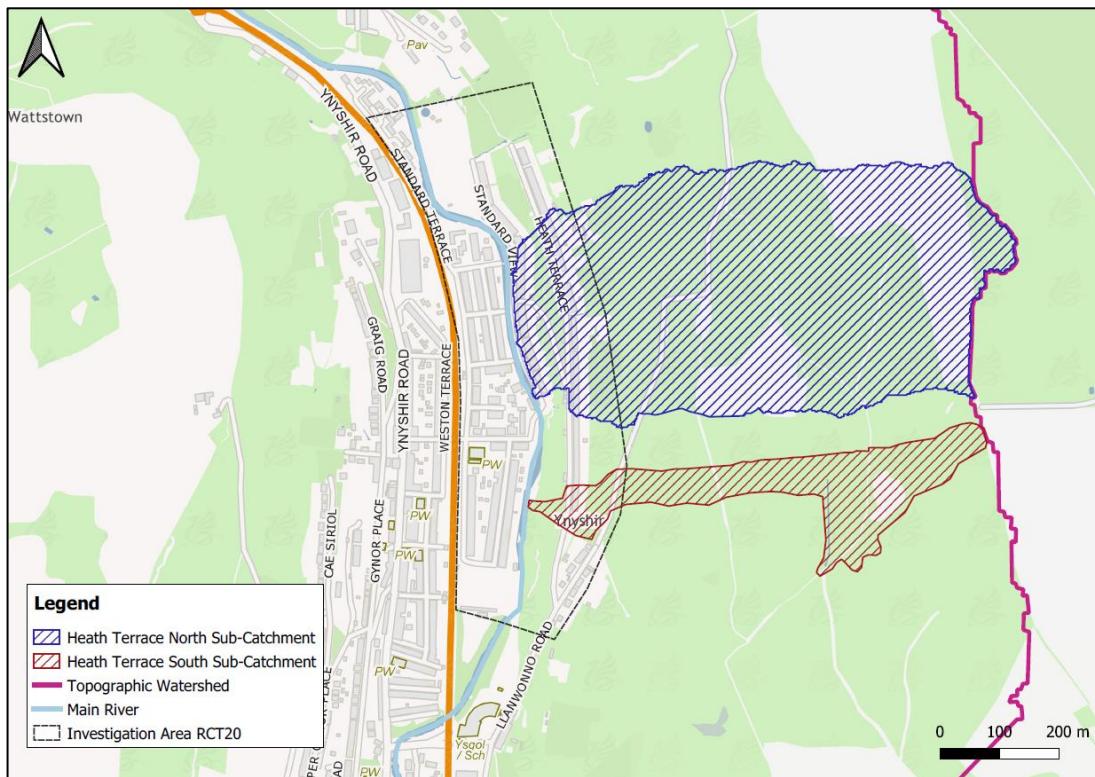


Figure 4: Rainfall Topographic Watershed and sub-catchments above investigation area RCT20

As depicted in Figure 5, surface water flows originating from the steep eastern hillsides and conveying via a series of unnamed ordinary watercourses contributed to the surcharging of two culvert inlets within RCT20, labelled 'Culvert Inlet 1' within the Heath Terrace North sub-catchment and 'Culvert Inlet 2' within the Heath Terrace South sub-catchment. A further culvert inlet to the south of the investigation area, labelled 'Culvert Inlet 3', also surcharged during the storm event however, no flooding to properties was reported as a result.

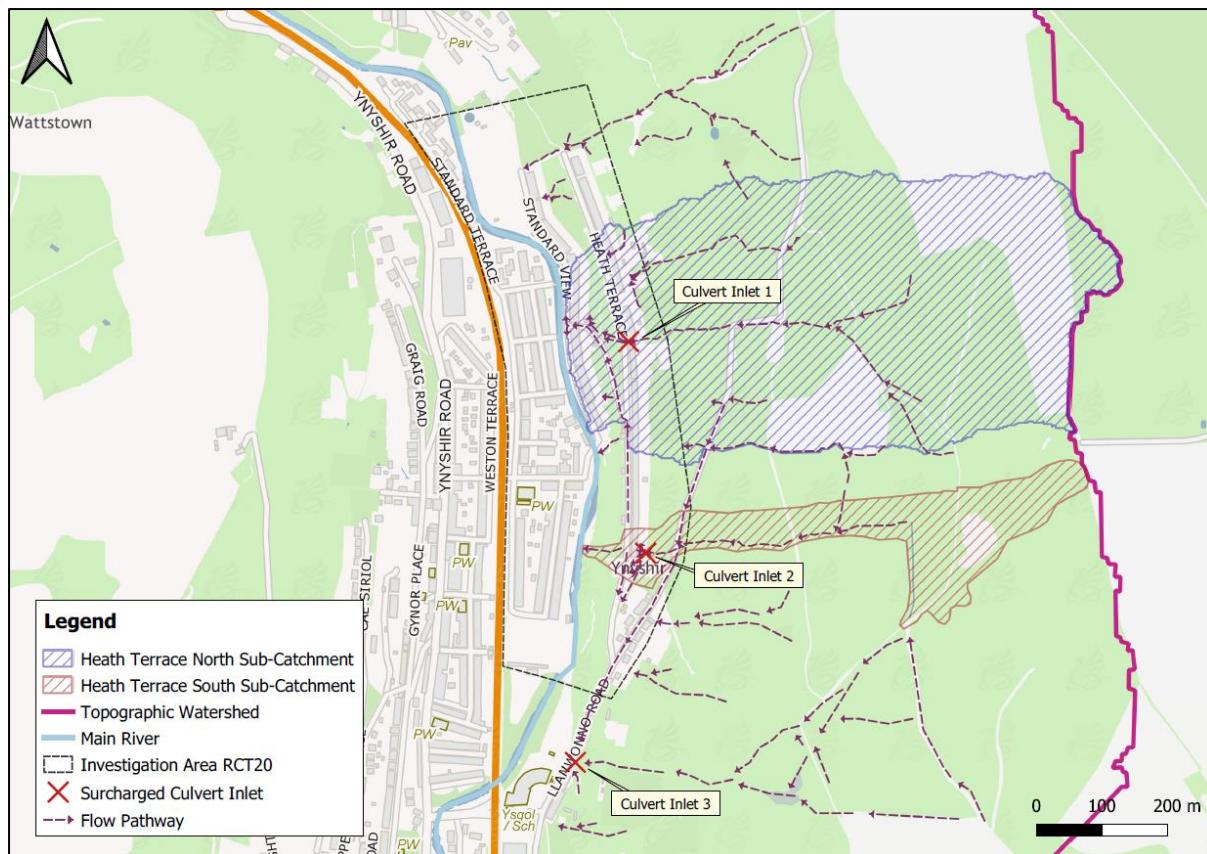


Figure 5: Flow pathways and surcharged culvert inlets within investigation area RCT20 during Storm Dennis

Pluvial flows from the wider valley catchment caused significant scour of the hillside, subsequently resulting in the transportation of debris within the hillside's ordinary watercourses. As the watercourses conveyed into the investigation area, debris was deposited at several culvert inlet trash screens, leading to blockage and the surcharging of two culvert inlets at Heath Terrace and a further culvert inlet at Llanwonno Road.

The surcharging of a 'Culvert Inlet 2' associated to the Heath Terrace South sub-catchment (Figure 5) was reported by residents on the 16th February 2020. Figure 6,

captured by a resident on the 16th February 2020, shows the culvert inlet as fully submerged. The surcharging resulted in the internal flooding of at least four properties, with flood water conveying along the rear access road and entering properties via their rear gardens. Beyond Heath Terrace, flood water carrying mobilised debris conveyed down the adjacent hillside and onto the highway.



Figure 6: Whirlpool above the fully submerged 'Culvert Inlet 2' during Storm Dennis (image provided by resident)

'Culvert Inlet 1' associated with the Heath Terrace North sub-catchment (Figure 5) also surcharged at Heath Terrace during Storm Dennis and contributed to the internal flooding of properties below along Standard View. 'Culvert Inlet 1' is situated adjacent to the front of terraced houses along Heath Terrace, allowing surcharged flows to convey downhill in accordance with local topography towards the rear of Standard View, resulting in internal flooding to two residential properties.

'Culvert Inlet 1' was identified as heavily silted during a site inspection undertaken by RCT's Flood Risk Management team on 17th February 2020, indicating significant mobilisation of scour material occurred during the storm event (Figure 7).



Figure 7: Post storm event photograph of 'Culvert Inlet 1' depicting the displacement of material
(Image captured by a RCT's Flood Risk Management team on 17th February 2020)

Flooding from the main River Rhondda Fach overtopping its banks was also reported as a primary source of flooding by residents situated on streets adjacent to the main river channel during Storm Dennis. It was reported by residents that during the storm event a fallen tree and other woody debris, mobilised by the fast-flowing water, caused an impediment of flow at the highway bridge between Avon Terrace and Riverside Close, resulting in water levels within the Rhondda Fach River rising quickly behind the obstruction and overtopping onto the adjacent highways. Sections of the retaining wall at Cross Street (classified as a Non-Flood Defence (NFD) Structure) were also identified as damaged during post event inspections.

The primary flow paths observed during the event saw fluvial flood water convey onto Avon Terrace, Riverside Close, Station Road and Cross Street, where 17 residential properties were internally impacted by main river flooding during Storm Dennis, including 8 to the east of the main river channel and 10 to the west. 2 non-residential properties to the west of the river channel also experienced internal flooding during the storm event. Accounts from residents impacted by main river flooding indicate that

internal flood depths of up to 1 metre were experienced at properties adjacent to the point of surcharging.



Figure 8: Rhondda Fach River highway bridge connecting Riverside Close and Avon Terrace (Image captured by a RCT Structures officer on 17th February 2020)

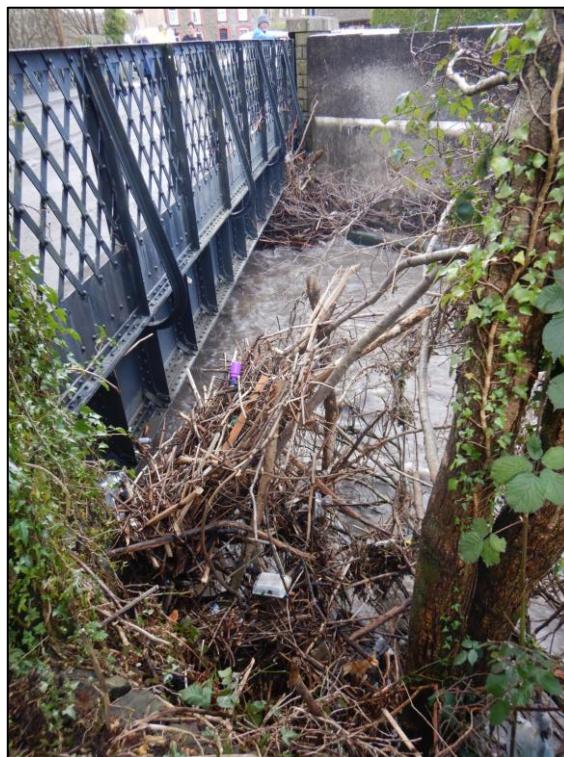


Figure 9: Image capturing accumulated woody debris on the embankment of the Rhondda Fach River behind the highway bridge following Storm Dennis (Image captured by a RCT Structures officer on 17th February 2020)

Surface water ponding at a localised low point was also identified as a source of flooding to one residential property at Standard Terrace, with pluvial flows conveying from the surrounding highway network.

2.3. RAINFALL ANALYSIS

See RCT's 'Overview Report' of Storm Dennis, reference 'FRM – Storm Dennis – Overview Report'², for a detailed analysis of the rainfall and ordinary watercourse response.

3. POSSIBLE CAUSES

3.1. CULVERT CONDITIONS

There are several unnamed watercourses that drain the eastern hillsides above Ynyshir and discharge into the Rhondda Fach River. Many of these watercourses are partially culverted beneath the residential area of RCT20.

Two culverted ordinary watercourse networks associated to the two culvert inlets identified as sources of flooding within RCT20, 'Culvert Inlet 1 and 2', were inspected by RCT's Flood Risk Management team and the Council's Highways and Streetcare Depot following the flood event to assess their condition. CCTV survey inspections of both culvert network were also undertaken to ascertain both the operational condition of the network, and its structural integrity along sections of network. Both networks are depicted in Figure 10.

It should be noted that all surveys reported in this section were undertaken post flood event. It's not possible to say what debris identified in the survey was mobilised and deposited as a result of the storm event and what had been deposited by previous events. As such, the following should be considered to be reflective of the asset condition at the end of the storm event and may not necessarily be reflective of the condition of the assets prior to the onset of the storm event.

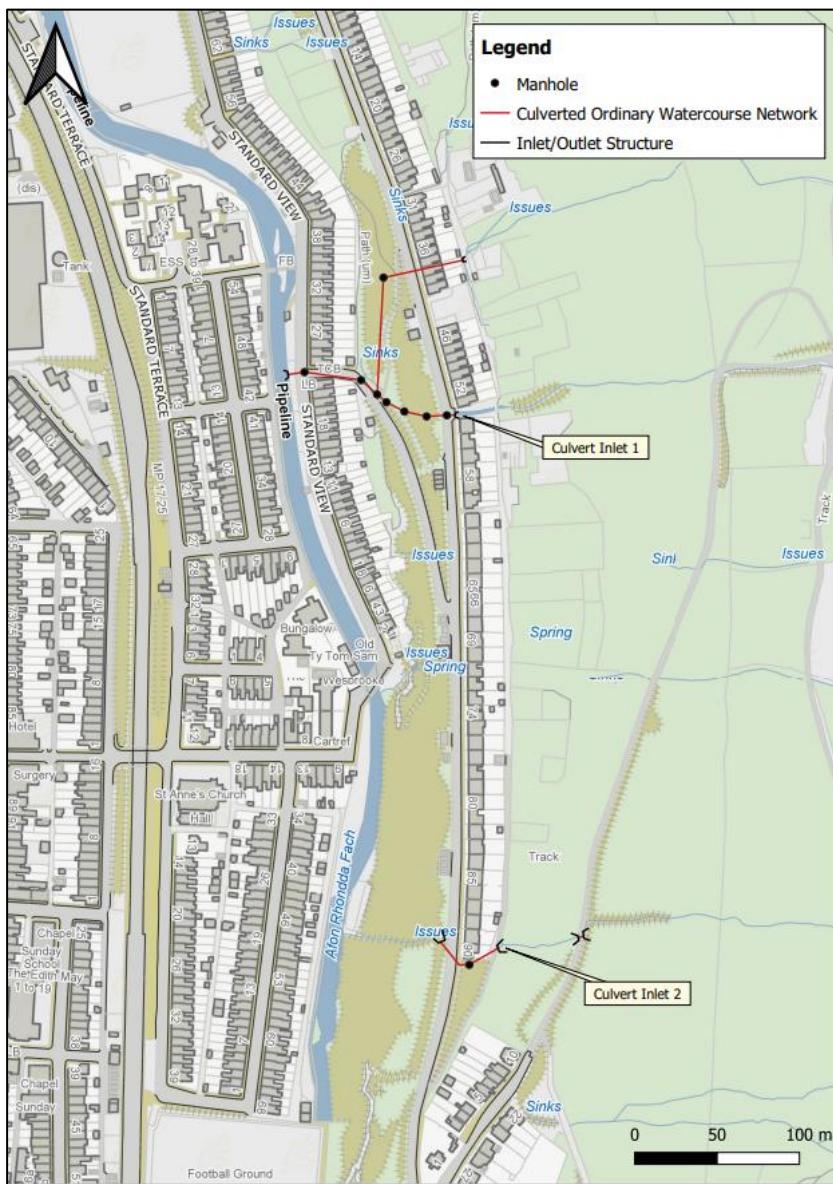


Figure 10: Surveyed culverted ordinary watercourse networks within investigation area RCT20

Upon an inspection of 'Culvert Inlet 1' post storm event, the structure was identified as heavily silted with significant scour material deposited around the inlet structure, indicating that the inlet had surcharged due to blockage during the storm event (see Figure 7).

'Culvert Inlet 2' was also identified by first responders as being blocked with a significant volume of debris which mainly consisted of stonewash material mobilised from the hillside. Figure 11 shows emergency clearance works to the culvert inlet carried out by local residents on the 16th February 2020.



Figure 11: 'Culvert Inlet 2' being cleared of debris following Storm Dennis (image provided by resident and captured 16th February 2020)

'Culvert Inlet 1' is identified as the responsibility of the Council as the Highway Authority. 'Culvert Inlet 2' is identified as a privately owned asset.

The culvert networks downstream of 'Culvert Inlet 1 and 2' were surveyed in July 2020 following Storm Dennis. Both networks were identified as being in acceptable condition with limited structural defects and settled deposits, indicating that blockages to both inlet structures caused by debris was the primary cause of surcharge during Storm Dennis.

Based on the above, the culvert conditions are not considered to have significantly contributed to the recorded flooding of properties in RCT20 during Storm Dennis as the present obstruction was associated with the culvert inlet, rather than the culvert network itself.

3.2. ORDINARY WATERCOURSE CONDITIONS

Several sections of natural ditches and unnamed ordinary watercourses which drain the steep catchment above Ynyshir are identified to flow through the investigation area and into the culvert networks discussed in Section 3.1. The unnamed ordinary watercourses have been illustrated in Figure 12.

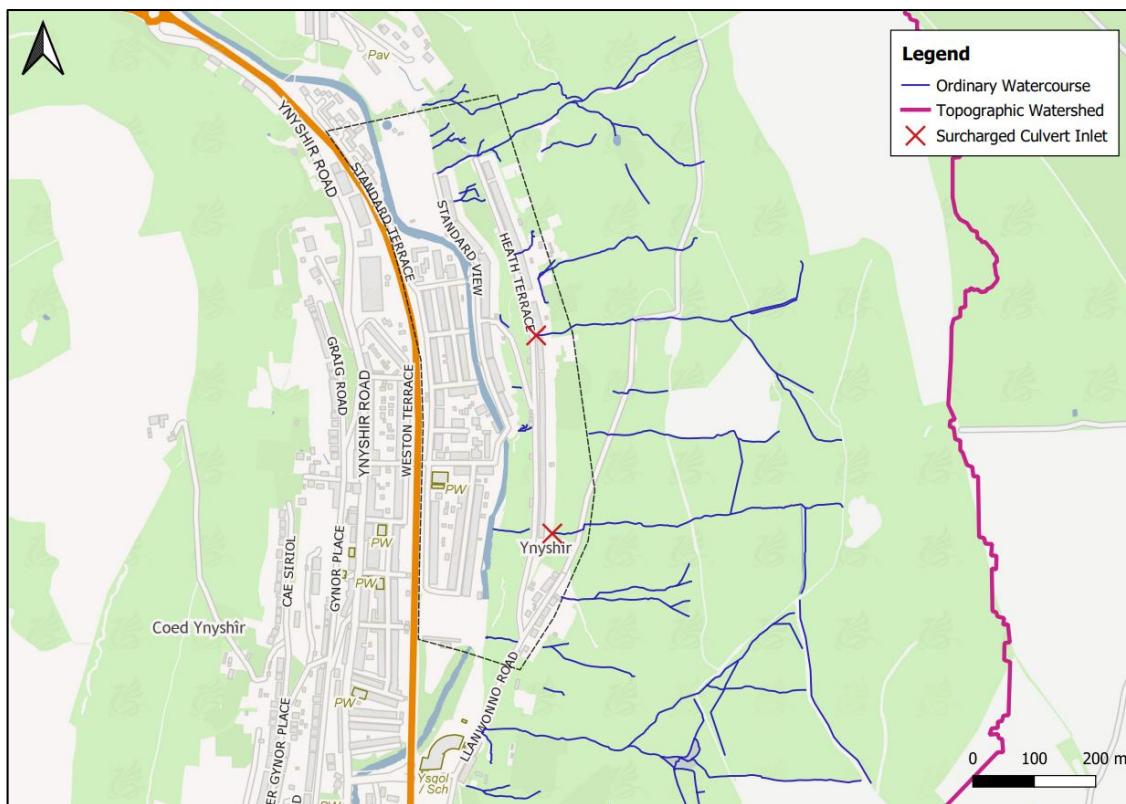


Figure 12: Map of Ordinary Watercourses which feed into investigation area RCT20

Following the storm event, RCT Flood Risk Management officers carried out a site walk-over assessment of the ordinary watercourses upstream of the culvert inlets identified as sources of flooding to assess the condition of the watercourses for any signs of overtopping, evidence of scour and any land movement of the hillsides.

On review of the unnamed ordinary watercourses above the investigation area, several indications of scour across the hillside were observed. The evidence suggests that intense rainfall and resultant surface water and ordinary watercourse flows caused severe erosion of the natural channels, leading to a significant displacement of debris, and sediment transportation within the watercourse itself, which conveyed towards 'Culvert Inlet 1 and 2' during the storm event.

The ordinary watercourses upstream of 'Culvert 1 and 2' are partially culverted beneath the track that runs up the hillside above RCT20 (Llanwonno Road). It was observed upon inspection that the culverted sections had become overwhelmed during the storm event, resulting in ordinary watercourse flows flowing overland and leading to increased erosive forces along the track and hillside. The figures below show evidence of debris deposition across the track, out-of-bank flows and eroded embankments, indicative of the significant flows travelling down the hillside towards the investigation area during the storm event.



Figure 13: Overland flow travelling across the hillside track towards the hillside upstream of 'Culvert Inlet 1' (captured by RCT's Flood Risk Management team on 19/02/2020)



Figure 14: Overland flow and deposition of material across the hillside track above RCT20 (captured by RCT's Flood Risk Management team on 19/02/2020)



Figure 15: Evidence of eroded embankments within the ordinary watercourse upstream of 'Culvert Inlet 1' (captured by RCT's Flood Risk Management team on 19/02/2020)



Figure 16: Significant deposition of scoured material along the hillside track above 'Culvert Inlet 2' post Storm Dennis (image provided by resident)

The displacement of debris from the hillsides to the rear of Heath Terrace is considered to have led to the subsequent obstruction of 'Culvert Inlet 1 and 2' and resultant surcharge due to a reduction in the hydraulic capacity of both culverts to manage the flow of water from the hillside during the storm event.

3.3. MAIN RIVER

The designated main River Rhondda Fach flows from the northwest of the investigation area towards the centre of RCT20, before continuing in a southwesterly direction towards the town of Porth (Figure 4). Areas on both the western and eastern embankments of the main river were impacted during Storm Dennis.

3.3.1. MAIN RIVER LEVELS AND FLOOD WARNINGS

The hydrograph in Figure 17 illustrates the rapid rise in levels of the Rhondda Fach River in response to rainfall, with the Rhondda Fach River at NRW's Maerdy station reaching its second highest recorded peak of 1.371 metres at 02:30am (16th February).

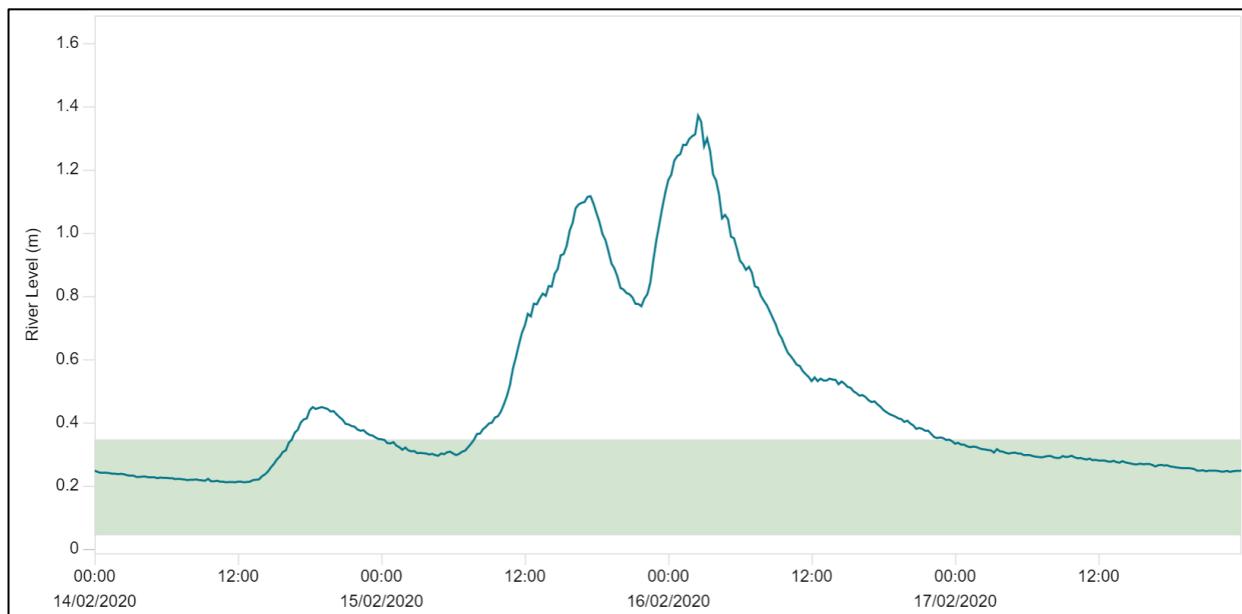


Figure 17: The Rhondda Fach River levels at Maerdy station between the 14th and 17th February 2020 (Natural Resources Wales)

Whilst NRW's Maerdy station is approximately 7.5 kilometres northwest of the investigation area, it is the only main river station in operation along the Rhondda Fach River. The nearest station downstream of the investigation area is beyond the main river's confluence with the Rhondda Fawr at Trehafod (Figure 18).

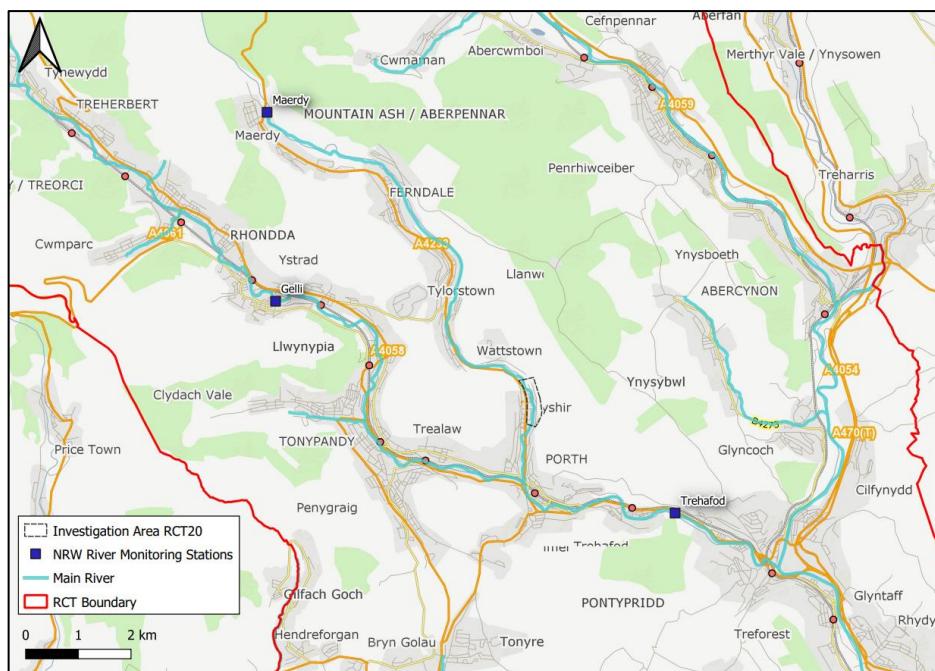


Figure 18: NRW River Level Monitoring Stations along the Rhondda Fawr and Fach Rivers

The green bar displayed on the hydrograph (Figure 17) shows the typical level of the Rhondda Fach River at Maerdy station, ranging between 0.05 and 0.35 meters. At its peak, the Rhondda Fach River was over a meter higher than its average level, stressing the extreme and unprecedented levels that RCT's rivers rose to during the storm's peak intensity.

The Rhondda Fawr River also reached unprecedentedly high levels at both the Gelli and Trehafod monitoring stations (both operated by NRW), highlighting that both the Rhondda Fach and Fawr catchments experienced significant rainfall and subsequent record-breaking river levels during Storm Dennis (Table 3).

Table 3: Peak river levels at NRW's monitoring stations along the Rhondda Fawr and Fach Rivers during Storm Dennis

NRW Monitoring Station	Location	Peak River Level (m)	Date & Time of Peak Level
Maerdy	River Rhondda Fach	1.371	02:30 16/02/2020
Gelli	River Rhondda Fawr	1.998	03:15 16/02/2020
Trehafod	River Rhondda Fawr	3.977	04:00 16/02/2020

No flood warnings were issued for the Rhondda Fach at Ynyshir during Storm Dennis as RCT20 does not fall within a NRW Flood Warning Area. There are no Flood Warning Areas currently in place for the Rhondda Fach River.

Improvements to NRW's flood forecasting and warning services are being internally investigated by NRW and where feasible, implemented to deliver the recommendations outlined within their Flood Incident Response Review⁴.

3.3.2. MAIN RIVER FLOOD RISK

Figure 19 is an excerpt from NRW's Flood Risk Assessment Wales (FRAW) mapping exercise which depicts the main river flood extents for the 'Defended' scenario, i.e., with the presence of flood defence infrastructure. The darker shading identifies areas at higher risk of flooding (more frequent/less extreme rainfall events) and lighter shading showing the lower risk areas (less frequent/more extreme rainfall events).

The flooding that occurred within RCT20 during Storm Dennis is largely consistent with the modelled outputs of NRW's FRAW map (Figure 19), with the majority of the impacted areas within RCT20 falling within an area of medium and low risk of fluvial flooding. A small area of high main river flood risk is also present along the western embankment at Riverside Close.

A high risk of flooding means that an area has a chance of flooding of greater than 1 in 30 (3.3%) each year; a medium risk of flooding signifies a yearly chance of flooding between 1 in 100 (1%) and 1 in 30 (3.3%); meanwhile a low risk of flooding means that an area has a chance of flooding of between 1 in 1000 (0.1%) and 1 in 100 (1%) each year. Considering Storm Dennis has been estimated as a 1 in 200 annual probability (Q200) flood event, the area of flooding aligns with those depicted by the medium main river flood risk extent (Figure 19).

⁴ [February 2020 Floods in Wales: Flood Incident Management Review \(cyfoethnaturiol.cymru\)](http://cyfoethnaturiol.cymru)

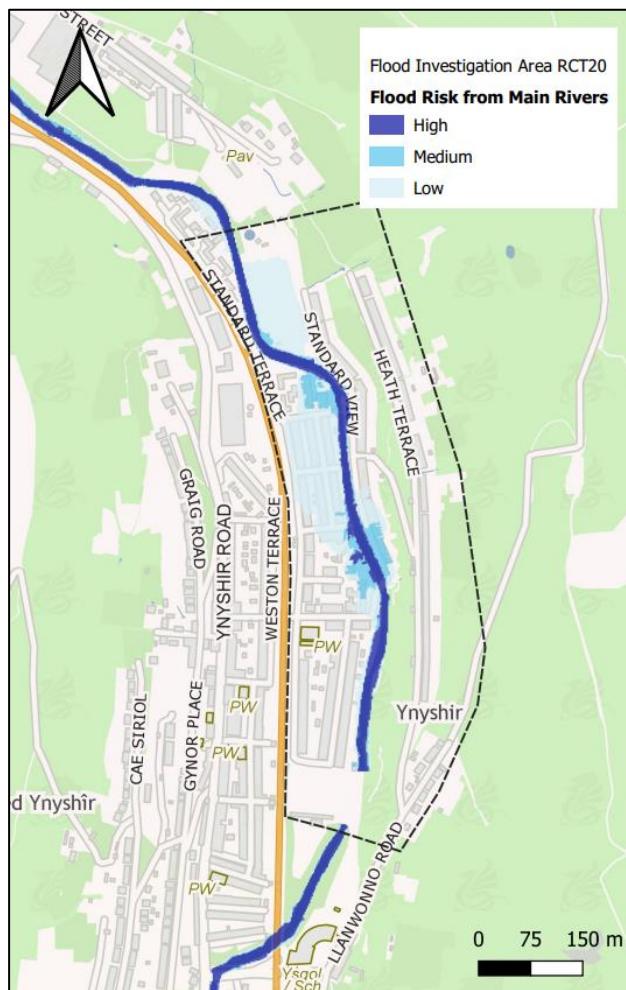


Figure 19: NRW's FRAW map for River sources in RCT20. Contains Natural Resources Wales information © Natural Resources Wales and database right. All rights reserved.

Flooding up to 1 metre was observed across the worst affected streets at RCT20, including at Riverside Close and Avon Terrace. It is however notable that areas of medium main river flood risk upstream of the worst affected streets did not experience internal flooding during Storm Dennis, such as adjacent to the footbridge between Standard View and Springfield Estate.

This suggests that, whilst unprecedented river levels were recorded in the Rhondda Fach River during Storm Dennis, the primary cause of the overtopping at RCT20 was the obstruction of the river flow caused by woody debris at the highway bridge connecting Avon Terrace and Station Road. This obstruction created a damming effect which resulted in the River Rhondda Fach overtopping its bank upstream.

It should also be noted that a significant volume of deposited debris was identified along the riverbed following the fall in water levels within the Rhondda Fach River post

Storm Dennis. Figure 20 identifies deposition of material along the channel bed, inclusive of large stones and smaller sediments, captured during post event inspections of the footbridge upstream of the highway bridge at Avon Terrace. This material is considered to have been influenced by the Tylorstown landslip which occurred during the storm event approximately 3 kilometres upstream of the investigation area and contributed 60,000 tonnes of material towards the valley floor.



Figure 20: Debris accumulation along the channel bed of the Rhondda Fach River upstream of the footbridge between Standard View and Springfield Estate (image captured by RCTs Infrastructure team on 17th February 2020)

The movement of material at Tylorstown tip was observed to have significantly altered the flow of the Rhondda Fach River. Figure 21 shows how the landslip pushed the flow within the main river to the left, in addition to supplying material into the channel.

It is reasonable to assume that the material identified across the Rhondda Fach riverbed in Figure 20 originated from the landslip however, it is unclear what the condition of the channel bed was pre-Storm Dennis. Although the observed shoaling is not considered to have caused the flooding at RCT20, the entrainment and deposition of debris downstream is indicative of the powerful flows within the Rhondda Fach River during Storm Dennis and is considered to have influenced the water level within the channel, however there is limited evidence to outline this interaction.

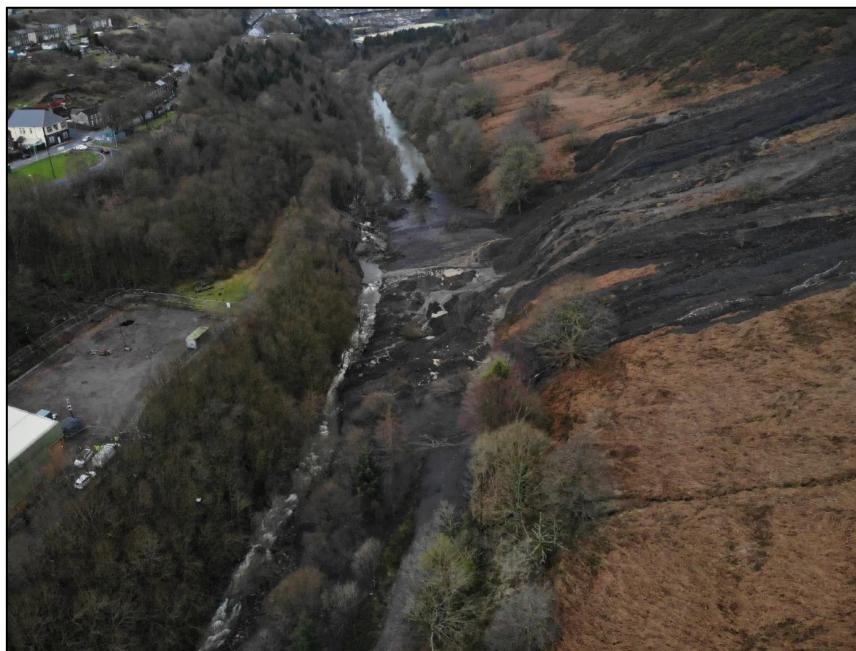


Figure 21: Drone image of Tylorstown landslip impacting the flow within the Rhondda Fach River
(image captured by RCTs Infrastructure team on 18th February 2020)

3.3.3. MAIN RIVER FLOOD DEFENCES

The properties impacted by the River Rhondda Fach at RCT20 are currently 'Undefended', i.e., there are no formally designated flood defence infrastructure under the operation and maintenance of NRW in place along the River Rhondda Fach at Ynyshir.

3.4. HIGHWAY DRAINAGE CONDITIONS

Several properties within the vicinity of the highway bridge connecting Station Road and Avon Terrace were internally flooded by the overtopping of the Rhondda Fach River during Storm Dennis. These fluvial flows deposited mud, silt and debris across the adjacent streets which are assumed to have entered the highway drainage system, leading to blockages and a reduction in the hydraulic capacity of the surface water network.

Furthermore, ordinary watercourse and surface water runoff originating from the hillsides to the east of RCT20 conveyed onto Heath Terrace and overwhelmed the street's highway drainage system. Detritus being transported by the overland flows also reduced the capacity of the drainage infrastructure to intercept the flows within the investigation area, exacerbating the surface water flows conveying towards the lower reaches of RCT20. Figure 22 depicts the volume of mud and silt that was removed from the surcharged culvert inlets at Heath Terrace.



Figure 22: Mud, silt and debris deposited onto the highway at Heath Terrace following the clearance operation of 'Culvert Inlet 2' during Storm Dennis (image provided by resident)

The condition of the highway drainage on Heath Terrace is not considered to have contributed to the internal flooding of the street's properties due to their relative position above the highway on the eastern hillside. The reduced performance of highway drainage assets on streets adjacent to the Rhondda Fach River is considered

to have exacerbated the internal flooding that occurred, with drainage becoming overwhelmed and unable to accommodate the fluvial flows.

Highway drainage is not designed to manage overland flows from private areas, parks or open space, nor is it designed to accommodate fluvial flows that may arise during storm events. In this instance, the capacity of the highway drainage in RCT20 was exceeded as a result of both main river and surface water flows entering the network at different locations across the investigation area. The maintenance condition of the highway drainage infrastructure is not considered to have significantly impacted the flooding experienced during Storm Dennis.

3.5. DŴR CYMRU WELSH WATER APPARATUS

There is no evidence from this investigation that DCWW apparatus contributed to the flooding that occurred during Storm Dennis within investigation area RCT20.

DCWW reported no issues within RCT20 during Storm Dennis and it is not believed that any DCWW infrastructure was damaged during the storm event. Whilst DCWW have concluded that their assets performed well during Storm Dennis, the majority of drainage infrastructure within the investigation area is comprised of combined sewer networks which are likely to have become overwhelmed during the storm event for the reasons outlined in Section 3.4.

3.6. SURFACE WATER

Surface water flows generated by intense rainfall across the hillside to the east of the investigation area and conveying via local topography and the highway network is considered to be a contributing source of flooding to properties within the lower reaches of Ynyshir, particularly along Standard View and Avon Terrace, where water naturally accumulates.

NRW's surface water and ordinary watercourse flood map (Figure 23) depicts the higher risk of flooding from pluvial sources within those lower reaches. Despite main river flooding being identified as the primary cause of flooding to properties within the lower reaches of RCT20, surcharging flows from 'Culvert Inlet 1 and 2' above Heath Terrace are considered to have contributed to the surface water accumulation along these streets, which was unable to drain away via surface water drainage systems during the storm event.

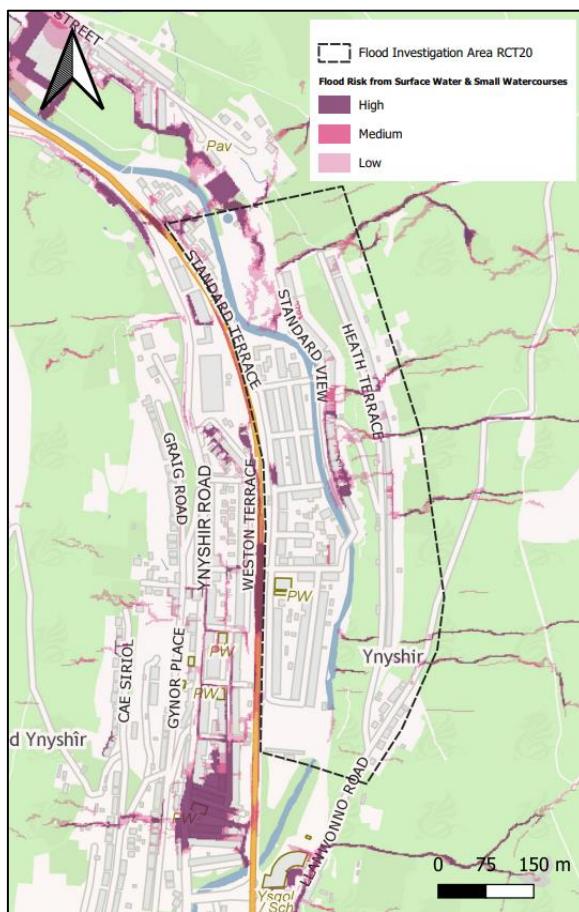


Figure 23: NRW's FRAW map for surface water and ordinary watercourse sources within RCT20.
Contains Natural Resources Wales information © Natural Resources Wales and database right. All rights reserved.

Out-of-bank flows and saturated ground were observed along the hillside in the days following the storm event (Figure 24 and 25). It was evident that in addition to the ordinary watercourse flows conveying down the hillsides above RCT20 during Storm Dennis, significant overland flows had also led to the displacement of natural debris and scour material. This material entered the ordinary watercourse networks across the hillside and was transported downstream towards the culvert inlets above Heath Terrace, contributing to the surcharge of 'Culvert Inlet 1 and 2'.



Figure 24: Overland flows conveying down the hillsides to the east of RCT20 following Storm Dennis
(Image captured by a RCT Flood Risk officer on 19/02/2020)



Figure 25: Saturated ground along the hillside above RCT20 post storm event (Image captured by a RCT Flood Risk officer on 19/02/2020)

The conveyance of surface water and associated mobilisation of natural debris on bridleways within land above RCT20 was also observed to have caused minor, localised landslips, resulting in further displacement of material (Figure 26).



Figure 26: Displaced material on bridleways along the hillsides east of RCT20 following minor landslips during Storm Dennis (Image captured by a RCT Flood Risk officer on 19/02/2020)

As outlined in Section 3.2, the displacement of hillside material and its resultant obstruction of ordinary watercourse culvert inlets was the primary cause of flooding to 4 properties on Heath Terrace and contributed to the flooding of two properties at Standard View.

Elsewhere within RCT20, the accumulation of surface water along the highway is considered to have resulted in the internal flooding of one residential property on Standard Terrace. Situated at a localised low point, intense rainfall is considered to have resulted in surface water flows from the surrounding highways conveying towards the front of the property before eventually entering the property. The surface water drainage at the front of the property reportedly became overwhelmed during the storm event, exacerbating surface water accumulation along the highway.

3.7. ACCESS STRUCTURES

No access structures were identified during the asset investigations within the area, as such 'access structures' have not been considered within this report.

3.8. SYSTEM AT CAPACITY

As outlined in Section 3.1, the condition of the culvert networks within RCT20 is not believed to have been the primary cause of flooding during Storm Dennis. The obstructions caused by debris to ‘Culvert Inlet 1 and 2’ largely prevented the ordinary watercourse flows from entering the culvert systems, resulting in surcharge.

Despite this, the LLFA undertook post event surveys of the culvert networks within the investigation area, the results of which fed into a review of the hydraulic capacity of the networks and culvert inlet structures that surcharged to ascertain their current standard of protection. The results of the culvert capacity assessments are summarised in Table 4.

Table 4: Summary of the culvert capacity assessment results which indicate the current standard of protection of culverts on Heath Terrace in free flowing and blockage conditions

Culvert Network	Standard of Protection (SOP) – Free Flowing	Standard of Protection (SOP) – Blockage Condition
Culvert Inlet 1	Q100 (10% AEP)	<Q2 (50% AEP)
Culvert Inlet 2	>Q1000 (0.1% AEP)	Q20 (5% AEP)

The assessment infers that both culvert inlets have an acceptable standard of protection in accordance with current design standards, as defined by CIRIA C789, assuming free-flowing conditions.

On review of the condition of both culvert inlets post Storm Dennis, a sensitivity analysis was undertaken to review the impact of flooding during both free-flowing and ‘medium’ (67%) blockage conditions⁵. In ‘medium’ blockage conditions the hydraulic capacity of both culvert inlets is reduced significantly to below design standards. It can be concluded that the blockages to both culvert inlets’ debris screens which reduced the networks capacity to manage the flow of water from the hillside was the primary cause of flooding to properties at Heath Terrace and contributed to the flooding within the lower reaches of RCT20.

⁵ Natural Resources Wales Guidance Note (Ref No GN43)

3.9. SUMMARY OF POSSIBLE CAUSES

The above sections have identified and described the possible causes of flooding within investigation area RCT20 during Storm Dennis (15-16th February 2020). A summary of the identified source(s) and possible cause(s) of flooding (issue) has been outlined below in Table 5.

Table 5: Summary of source(s) and possible cause(s) of flooding in investigation area RCT20 during Storm Dennis

Ref No	Asset (Source)	Issue	Asset Owner	Type of Flooding
1	Rhondda Fach River	The obstruction of the Rhondda Fach River channel by mobilised woody debris, combined with unprecedently high river levels, resulted in the main river overtopping its banks upstream of the obstruction and conveying into several properties.	Mixed Ownership	Main River
2	Culvert Inlet 1	Significant overland flows resulted in the displacement of debris from the surrounding hillside, leading to the obstruction and subsequent surcharging of Culvert Inlet 1 at Heath Terrace. Exceedance flows conveyed down the highway and hillside towards Standard View.	RCT Highway Authority	Ordinary Watercourse
3	Culvert Inlet 2	Significant overland flows resulted in the displacement of debris from the surrounding hillside, leading to the obstruction and subsequent surcharging of Culvert Inlet 2 at Heath Terrace. Exceedance flows conveyed towards the rear of properties at the southern end of Heath Terrace and onwards to impact the highway.	Private Landowner / Unregistered	Ordinary Watercourse

4	Surface water drainage network across RCT20	Intense rainfall across RCT combined with the overtopping of the River Taf and exceedance flows from the blocked ordinary watercourse infrastructure, severely overwhelmed highway drainage infrastructure, resulting in the accumulation of surface water on several streets throughout the investigation area.	RCT Highway Authority	Surface Water
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4. RISK MANAGEMENT AUTHORITY ACTIONS

A Welsh Risk Management Authority is defined in Section 6 of the Flood and Water Management Act 2010 as NRW; a LLFA, a district council for an area where there is no unitary authority, or a highway authority wholly in Wales; an internal drainage board for an internal drainage district that is wholly or mainly in Wales; a water company that exercises functions in relation to an area in Wales. As the LLFA, RCT has the responsibility to coordinate the management of flood risk and the interaction of Risk Management Authorities across Rhondda Cynon Taf.

An overview of the relevant Risk Management Authority in relation to flood type is provided in Table 6. For further details of the roles and responsibilities of individual Risk Management Authorities in managing flooding, refer to Welsh Government's National Strategy for Flood and Coastal Erosion Risk Management, Section 4 'Roles and Responsibilities'⁶, and RCT's 'FRM – Storm Dennis - Overview Report'².

Table 6: Risk Management Authority with relevant functions to manage the risk for different flood types

Type of Flooding	Risk Management Authority
Flooding from Main River, reservoirs and the sea (including coastal erosion).	Natural Resources Wales
Flooding from ordinary watercourses, surface water and groundwater	Lead Local Flood Authority
Flooding from water and sewage systems	Water Companies (Dŵr Cymru Welsh Water)
Flooding from the highway	Highway Authority
Flooding from the highway (motorways and major trunk roads)	Welsh Government Trunk Road Agency

Risk Management Authorities have direct flood risk management functions under the Flood and Water Management Act 2010, as well as the Water Resources Act 1991, Land Drainage Act 1991 and the Highways Act 1980. Through analysis of the flooding that impacted investigation area RCT20, the flood risk management functions exercised or proposed to be exercised by relevant RMAs were recorded pursuant to Section 19 of the Flood and Water Management Act 2010, which states;

⁶ [National Strategy for Flood and Coastal Erosion Risk Management in Wales \(English\) \(gov.wales\)](https://gov.wales/national-strategy-flood-and-coastal-erosion-risk-management-wales)

"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."

Through the investigation process, the source(s) and possible cause(s) of flooding in RCT20 during Storm Dennis have been previously identified and summarised within Table 5. The Risk Management Authorities responsible for managing that flooding have been listed in Table 7 below, along with a series of recommendations presented by the LLFA.

Table 7: Recommendations provided by the LLFA to be considered by the relevant Risk Management Authority identified in response to the source(s) of flooding in RCT20 (as per Table 5)

Ref No	Asset (Source)	Asset Owner	Type of Flooding	Relevant Risk Management Authority	Recommendations	
1	Rhondda Fach River	Mixed Ownership	Main River	National Resources Wales	R1A	NRW to "complete detailed investigative analysis work to understand the mechanisms of flooding in areas known to have flooded from main rivers", including the Rhondda Fach River at Ynyshir. Aligns with recommendation 'Action FD2' within NRW's Flood Incident Management Review.

					R1B	NRW to work with asset owners to assess and review the risk of flooding from the Rhondda Fach River at RCT20 to identify the viability of risk management options.
					R1C	NRW to review its flood warning service provision, especially for extreme events. This will form part of NRW's Flood Warning Service Review Implementation Programme and aligns with the recommendations set out in their 'Flood Incidence Management Review'.
2	Culvert Inlet 1	RCT Highway Authority	Ordinary Watercourse	Lead Local Flood Authority and Land Drainage Authority	R2A	The LLFA and LDA to identify drainage asset ownership and responsibility.
					R2B	The LLFA and LDA to investigate the standard of protection and the condition of the culvert structure and network as a whole.
					R2C	The LLFA to jet and cleanse the ordinary watercourse network.
					R2D	The LLFA and LDA to exercise their permissive powers under Section 64 of the Land Drainage Act to inspect and investigate the area of hillside which falls under private ownership to assess the

							surface water drainage arrangements and its impact on flooding.
					R2E		The LLFA and LDA to engage and work with the riparian landowner to regulate the ordinary watercourse infrastructure to ensure the infrastructure is free flowing and unobstructed.
3	Culvert Inlet 2	Private Landowner / Unregistered	Ordinary Watercourse	Lead Local Flood Authority and Land Drainage Authority	R3A		The LLFA and LDA to identify drainage asset ownership and responsibility.
					R3B		The LLFA and LDA to investigate the standard of protection and the condition of the culvert structure and network as a whole.
					R3C		The LLFA to jet and cleanse the ordinary watercourse network.
					R3D		The LLFA and LDA to exercise their permissive powers under Section 64 of the Land Drainage Act to inspect and investigate the area of hillside which falls under private ownership to assess the surface water drainage arrangements and its impact on flooding.
					R3E		The LLFA and LDA to engage and work with the riparian landowner to regulate the ordinary watercourse infrastructure to ensure the

							infrastructure is free flowing and unobstructed.
					R3F	The LLFA to install remote telemetry monitoring at Culvert Inlet 2 to monitor the risk of blockage.	
					R3G	The LLFA to upgrade the culvert inlet structure and upstream ordinary watercourse channel following the damages caused during Storm Dennis.	
4	Surface water drainage network across RCT20	RCT Highway Authority	Surface Water	Highway Authority and Lead Local Flood Authority	R4A	The Highways Authority to jet and cleanse the highway drainage network and action repairs accordingly.	
					R4B	The LLFA and Highway Authority to evaluate surface water management options to alleviate pluvial flooding at locations across the investigation area.	

4.1. LEAD LOCAL FLOOD AUTHORITY

In review of Ref 2 and 3 in Table 7, the LLFA has been determined as the relevant Risk Management Authority in relation to the ordinary watercourse flooding which occurred at investigation area RCT20 during Storm Dennis.

The LLFA exercised the following functions in response to the flooding at investigation area RCT20:

- Officers investigated the initial flooding and have produced this report in line with Section 19 of the Flood and Water Management Act 2010.
- Officers contacted residents affected by flooding to offer support and advice to assist in the recovery following the event.
- A public engagement exercise carried out by Redstart, on behalf of RCT as the LLFA, was undertaken in order to gain further local insight and anecdotal evidence to support the flood investigation.
- The LLFA and LDA have exercised their permissive powers under Section 64 of the Land Drainage Act 1991 to investigate the culvert structures and network conditions and its impact on the flooding within the investigation area. **(R2B, R3B)**
- The LLFA and LDA have exercised their permissive powers under Section 64 of the Land Drainage Act 1991 to investigate the area of privately owned hillside identified as a contributor to flooding during Storm Dennis **(R2D, R3D)**
- The LLFA and LDA have undertaken clearance works to the culvert inlet structures which fall under the responsibility of the Authority. **(R2C, R3C)**
- The LLFA have expanded their asset inspection and maintenance schedule to include the impacted culvert inlets within the investigation area in its response to extreme weather event planning.
- An estimated 510 metres of culvert network length within RCT20 has been surveyed following the event to ascertain both the operational condition of the network, and its structural integrity along sections of the network. **(R2B, R2C, R3B, R3D)**
- An estimated 18 tonnes of material and debris was removed from the culvert networks within RCT20 during jetting and cleansing operations. **(R2C, R3C)**

- The LLFA commissioned Redstart to investigate the standard of protection of the existing culvert networks in RCT20 to determine their hydraulic capacity following the identification of several structural and operational defects within sections of the network. **(R2B, R3B)**
- The LLFA has exercised its powers, under Section 13 of the FWMA, to request information and co-operation from the relevant risk management authorities (NRW and DCWW) in relation to their responsibilities as RMAs in response to Storm Dennis.
- The LLFA has set up a central Control Room to compliment the Council's Contact Centre and CCTV centre, which is based at the Council's offices, to provide a comprehensive and informed response to the residents of RCT as appropriate during storm events.
- The LLFA have initiated an interim Property Flood Resistance project offering expandable flood gates to those properties deemed at high risk of flooding from local sources.
- The LLFA, working in partnership with NRW, have expanded their interim Property Flood Resistance project offering expandable flood gates to those properties deemed at high risk of flooding from the main river, as per NRW's determination.
- The LLFA and LDA have initiated engagement with riparian landowners to ensure the ordinary watercourse infrastructure is free flowing and unobstructed. **(R2E, R3E)**
- The LLFA have installed remote telemetry monitoring devices at key culvert structures, including 'Culvert Inlet 2', to enable operators to ensure the drainage systems in Ynyshir are operating effectively. **(R3F)**
- The LLFA have commenced works to upgrade 'Culvert Inlet 2' in addition to replacing the upstream natural ordinary watercourse channel with a concrete line channel to alleviate the risk of scour within the watercourse and to reduce the risk of blockages caused by debris to the inlet structure. The works are expected to be completed by March 2022. **(R3G)**

The LLFA propose to exercise the following functions in response to the flooding at investigation area RCT20;

- Following the surveying of culvert networks in RCT20, the LLFA propose to input and update all relevant asset data. **(R2A, R3A)**

- The LLFA and LDA intend to clarify drainage asset owners and management responsibilities to make them aware of their personal risk. To ensure landowners manage the risk in compliance with the relevant legislation, a team of Flood Enforcement Officers including legal support is to be appointed. (**R2A, R2D, R3A, R3D**)
- The LLFA and LDA will work with landowners and property owners to manage their personal flood risk through local measures, such as property resilience and resistance measures.
- As part of RCT's comprehensive review of the County Borough's most at risk communities, the LLFA are proposing to undertake a formal SFRA of the Rhondda Fach catchment area to better understand the overall risk from ordinary watercourse and surface water flooding in order to target investment to areas of highest risk. The SFRA also aim to encourage whole catchment measures, including working with natural processes, to alleviate flood risk in those areas of highest risk. (**R2D, R3D, R4B**)
- The LLFA will cooperate and collaborate with NRW to ensure a detailed study of the investigation area is completed and that appropriate actions to mitigate the impacts of river flooding are undertaken in accordance with NRW's Flood Incident Management Review.

4.2. NATURAL RESOURCES WALES

In review of Ref 1 in Table 7, NRW has been identified as the relevant Risk Management Authority in relation to the main river flooding from the River Rhondda Fach during Storm Dennis.

NRW have exercised the following functions in response to the flooding at RCT20:

- NRW have carried out post event data collection including an assessment of the properties impacted by main river flooding and a survey of wrack marks, i.e., the marked high-water level.
- Following Storm Dennis NRW undertook an inspection of the Rhondda Fach River at Ynyshir and undertook clearance works to remove debris and vegetation from the river channel.
- NRW has introduced improved digital services to provide comprehensive flood risk, river level and rainfall information to households, businesses and communities across Wales. The improved service was launched in September 2020 on the NRW website and will improve how live flood warning and water level data is shared before and during flood events. **(R1C)**
- Following the flooding events of February 2020, NRW published a review of its incident response to Storm Ciara and Dennis in October 2020⁷. This review contains several recommendations for improvements to their ways of working and services which NRW are in the process of implementing through an internal delivery programme.
- NRW have developed a detailed Implementation Programme to address the areas of improvement work required to deliver the recommendations of the Flood Warning Service Review carried out by NRW in 2018, including the creation of a Flood Warning Area for the Rhondda Fach at Ynyshir. Several of the recommendations directly link to the recommendations set out by NRW within their Flood Incident Management Review **(R1C)**.
- NRW have commissioned a Rhondda flood modelling project for completion in Spring 2022. **(R1A)**

⁷ [Natural Resources Wales / Our response to Storm Ciara and Storm Dennis](#)

NRW propose to exercise the following actions in response to the flooding at investigation area RCT20:

- Following the completion of NRW's Rhondda flood modelling project, NRW propose to undertake an initial assessment of the viability of potential flood risk management options. Consideration should be given to areas at high risk of flooding from rivers on a prioritised basis. **(R1A, R1B)**
- Following the completion of NRW's Rhondda Flood Modelling Project, NRW propose further threshold work and flood warning area amendments. **(R1A, R1C)**
- NRW will undertake a review of the modelled outputs and adopt changes to their maintenance program within the investigation area if required. **(R1A)**

4.3. WATER COMPANY

DCWW were not identified as a relevant authority in relation to the flooding at investigation area RCT20 during Storm Dennis. DCWW do not propose to undertake any actions in relation to the event within the investigation area.

4.4. HIGHWAY AUTHORITY

During the investigation into the flooding at investigation area RCT20 during Storm Dennis, the Highway was identified as flooding from a combination of sources at different locations, most notably as a result of surface water runoff and main river flooding from the Rhondda Fach River.

Ref 4 of Table 7 identified the Highway Authority as a relevant Risk Management Authority in relation to the surface water flooding that occurred along the highway across RCT20.

RCT as the Highway Authority have exercised the following functions in response to the flooding within investigation area RCT20:

- The Highway Authority assisted with the emergency response during the event by supplying equipment and sandbags, some to individual properties and using sandbags to redirect flood water away from properties.
- The Highway Authority exercised their functions under Section 100 of the Highways Act 1980, to arrange for all gullies and open drains in the highway to be inspected and cleansed following the influx of fluvial flood water to ensure the safety of the highway post event. (**R4A**)
- The Highway Authority has undertaken emergency clearance works to the culvert inlets identified as sources of flooding. (**R2C, R3C**)
- The Highway Authority have increased their resource capacity by establishing a dedicated ‘Pluvial Drainage Team’ to focus entirely on the refurbishment and maintenance of RCT’s existing and enhanced highway drainage infrastructure.
- In response to the damages caused by the River Rhondda Fach to the highway retaining wall (NFD Structure) at Cross Street during Storm Dennis, the Highway Authority have undertaken repair works to upgrade its structural integrity and have upgraded the outfall structures within the retaining wall to reduce the likelihood of main river surcharging.

RCT as the Highway Authority do not propose to undertake any further functions in relation to the storm event at RCT20.

USEFUL LINKS/CONTACTS

Blue Pages – property Resilience - <http://bluepages.org.uk/>

Flood Re – Flooded Property Insurance Scheme - <https://www.floodre.co.uk/>

Natural Resources Wales – Check Flood Warnings -
<https://naturalresources.wales/flooding/check-flood-warnings/?lang=en>

Natural Resources Wales – Long Term Flood Risk -
<https://naturalresources.wales/evidence-and-data/maps/long-term-flood-risk/?lang=en>

Rhondda Cynon Taf CBC – Local Flood Risk Management Plan -
<https://www.rctcbc.gov.uk/EN/Resident/ParkingRoadsandTravel/Roadspavementsandpaths/FloodAlleviation/Floodriskregulations2009.aspx>

Rhondda Cynon Taf CBC – Local Flood Risk Management Strategy -
<https://www.rctcbc.gov.uk/EN/Resident/ParkingRoadsandTravel/Roadspavementsandpaths/FloodAlleviation/LocalFloodRiskManagementStrategy.aspx>

Rhondda Cynon Taf CBC – Sustainable Drainage -
<https://www.rctcbc.gov.uk/EN/Resident/ParkingRoadsandTravel/Roadspavementsandpaths/SustainableDrainage/SustainableDrainage.aspx>

Welsh Government – National Strategy for Flood and Coastal Erosion Risk Management - <https://gov.wales/sites/default/files/publications/2019-03/national-strategy-for-flood-and-coastal-erosion-risk-management-in-wales.pdf>

Welsh Water – How to Contact Us – <https://www.welshwater.com/en/Contact-Us.aspx>