



Flood Investigation Report

Section 19, Flood & Water Management Act (2010)

Upper Calder Valley – 29th July 2013 Flooding Incident

Control Sheet

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	Name	Signature	Date
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Checked	Howard Glenn		27.09.13
Approved	David Turner		
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Executive Summary

On the 29th July 2013, large storm cells brought heavy rainfall to the Pennine region. In Calderdale, the upper valley area was badly affected by flooding from a variety of sources. The communities and infrastructure worst affected by the flooding were principally those located in the Upper Calder Valley immediately adjacent to the Walsden Water and River Calder. The towns and villages impacted the most were Walsden, Todmorden and Hebden Bridge. The key infrastructure affected was Caldervale line at Walsden Station, a culvert on a subcatchment watercourse on the Walsden Water and highway and drainage infrastructure on the Rochdale (A6033) and Burnley Road (A646).

In response to the flood event this Section 19 - flood investigation report has been completed by Calderdale Metropolitan Borough Council (CMBC) as the Lead Local Flood Authority (LLFA), under the duties set out in Section 19 of the Flood & Water Management Act (2010). It was deemed necessary to complete an investigation as properties and infrastructure were badly affected during this storm event.

A large data collection exercise was undertaken between key stakeholders, CMBC and third parties to gain understanding of the flood mechanisms, extent of flooding, damage assessment and flooding response.

Approximately 151 properties have been directly affected by the flood event. The report has identified the key areas that were mainly affected and the mechanisms that caused the flooding in those areas.

The main flood mechanisms have been identified as;

- The two watercourses Fir Wood Clough and Fir Wood Drain located on the hillside above Kershaw Road, Walsden were unable to convey flood flows and suffered severe erosion, overloading and blocking the land drainage system,
- Excess surface water from the damaged culverts on Kershaw Road, Walsden spilled onto the Caldervale line at Walsden Station and onto Rochdale Road damaging infrastructure and flooding properties,
- Excess surface water from hillside runoff and sub-catchment watercourses causing damage along Bacup Road and flooded property and infrastructure along Rochdale Road,
- A partially blocked culvert on the Walsden Water, as the result of the collapse of temporary works during the flood event, flooded property and infrastructure on the Walsden Water,
- Overtopping of Birks Clough, Walsden flooding Rochdale Road,
- Excess runoff from sub-catchment watercourses and hillside runoff flooding properties along Burnley Road and adjacent streets,
- Rainfall and surface water overwhelmed the design capacity (1 in 30 year event) of the sewers and highway drainage (1 in 2 year event), although the sewerage infrastructure suffered little damage,

A hydrological analysis was undertaken by the Environment Agency (EA) for this storm event. This has identified the key hydrological evidence, which is included in this report.

This report has identified the relevant risk management authorities and their roles and responsibilities for flooding in accordance with the Flood & Water Management Act (2010).

The report summarises the activities risk management authorities have undertaken according to their roles and responsibilities.

The report recognises the roles of riparian and property owners which assign a certain level of responsibility to those owners to anticipate flooding where risk has been identified and to take appropriate measures. This is also recognised by Government through the partnership funding system and various acts of parliament.

For this flood event risk management authorities have responsibilities for ;

- EA – general overview of Flood Risk Management and partnership with other RMAs. Works taking place on the Walsden Water as part of Phase 3 of the Todmorden and Lower Walsden Flood Alleviation Scheme.
- LLFA (CMBC) - compliance with Flood and Water Management Act 2010 in particular preparing this report. Bringing forward FRM proposals to be included in the EA Medium Term Plan and reacting to urgent situations requiring capital solutions in partnership with other RMAs.
- Highway Authority (CMBC) – maintaining adequate highway drainage and acting as riparian owner of culverts crossing the highway.
- Yorkshire Water – maintaining the sewer network in serviceable condition and bringing forward improvement schemes as found necessary in partnership with other RMAs.
- Network Rail – ensuring integrity and serviceability of the railway network and working in partnership with other RMAs to reduce risk.
- Riparian owners – maintaining their assets to the standard required by the Land Drainage Act 1991 and cooperating with the LLFA as necessary to facilitate progress of revenue and capital proposals brought forward in the community interest.
- Property owners – making their property as resistant and resilient to flood risk as possible. Flood events provide the opportunity to introduce resilience measures in conjunction with their insurers who are now beginning to recognise the value of doing more than replacing like with like.
- Insurance companies – fulfilling the terms of their insured's policies.

It is the conclusion of this report that all these responsibilities have been or are in the process of being discharged to a greater or lesser extent.

All flood risk management authorities, strategic partners and community groups have undertaken activities to restore the Upper Calder Valley to a working order. All mitigation measures have been implemented. Capital works or investigations have been identified and are subject to the availability of resources.

This report shows the significant contribution each risk management authority, volunteer groups, community groups and local businesses has made during and post-flood event.

Sub-catchment watercourses, Main River and the sewer network have played a pivotal role in this flood event. The EA, CMBC and Network Rail are developing options to mitigate the flood risk in areas affected by the flooding identified in this report. Many of the areas of concern have been identified on the long term Calder

Valley Flood Investment Plan, which CMBC and partners are developing and implementing.

Acknowledgements

The Council would like to thank Yorkshire Water Services Ltd, the Environment Agency, Network Rail and the Canal & River Trust for their assistance in this investigation.

The Council would also like to thank members of the Calderdale community, businesses and community groups for their on-going assistance and support in the aftermath of the flooding on the 29th July.

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Table of Contents

- 1. Introduction 2
 - 1.1. Background..... 2
 - 1.2. Flooding Location 3
 - 1.3. History of Flooding..... 3
- 2. Flooding Incident..... 5
 - 2.1. Flood Warnings and Alerts..... 5
 - 2.2. Risk Management Authorities Immediate Response 6
 - 2.3. Data Collected 7
- 3. Areas Affected 9
 - 3.1. Walsden..... 9
 - 3.2. Todmorden 12
- 4. Rainfall Analysis..... 17
 - 4.1. River Levels and Flows 18
- 5. Roles, Responsibilities and Post Flood Event Activities 19
 - 5.1. Environment Agency..... 19
 - 5.2. Lead Local Flood Authority 20
 - 5.3. Water and Sewerage Company 21
 - 5.4. Riparian and Property Owners 22
 - 5.4.1. Network Rail..... 23
 - 5.4.2. Canal & River Trust 24
 - 5.4.3. Property Owners 24
- 6. Conclusions 25
- 7. References 27

1. Introduction

1.1. Background

An investigation into the flood event on the 29th July 2013 is required as approximately 151 properties were affected by the flooding in the Calderdale area. The main affected areas of the event were Walsden and Todmorden. There was significant disruption and damage to properties and key infrastructure including highway and drainage infrastructure and the Caldervale Line.

Calderdale Metropolitan Borough Council (CMBC) as the Lead Local Flood Authority (LLFA) has a responsibility to record and report flood incidents in accordance with Section 19 of the Flood and Water Management Act (2010):

- (1) On becoming aware of a flood in its area, a LLFA must, to the extent that it considers it necessary or appropriate, investigate -
 - (a) Which risk management authorities have relevant flood risk management functions, and
 - (b) Whether each of those risk management authorities has exercised, or is proposing to exercise, those functions in response to the flood.
- (2) Where an authority carries out an investigation under subsection (1) it must –
 - (a) Publish the results of its investigation, and
 - (b) Notify any relevant risk management authorities.

This report summarises the flood mechanisms, extent of flooding, damage assessment and flooding response in Walsden, Todmorden and outlying areas that were affected. This report outlines the basic responsibilities of the risk management authorities involved, outlines their response to the flood event and identifies any potential future actions.

1.2. Flooding Location

The communities and infrastructure worst affected by the flooding were principally those located in Walsden Shade and Salford areas of Todmorden adjacent to the Walsden Water (see Figure 1).

The key infrastructure affected was the culverted watercourses (Fir Wood Clough and Fir Wood Drain) at Kershaw and Clough Road in Walsden, Caldervale line at Walsden Station and highway drainage infrastructure on the Rochdale (A6033) and Burnley Road (A646).

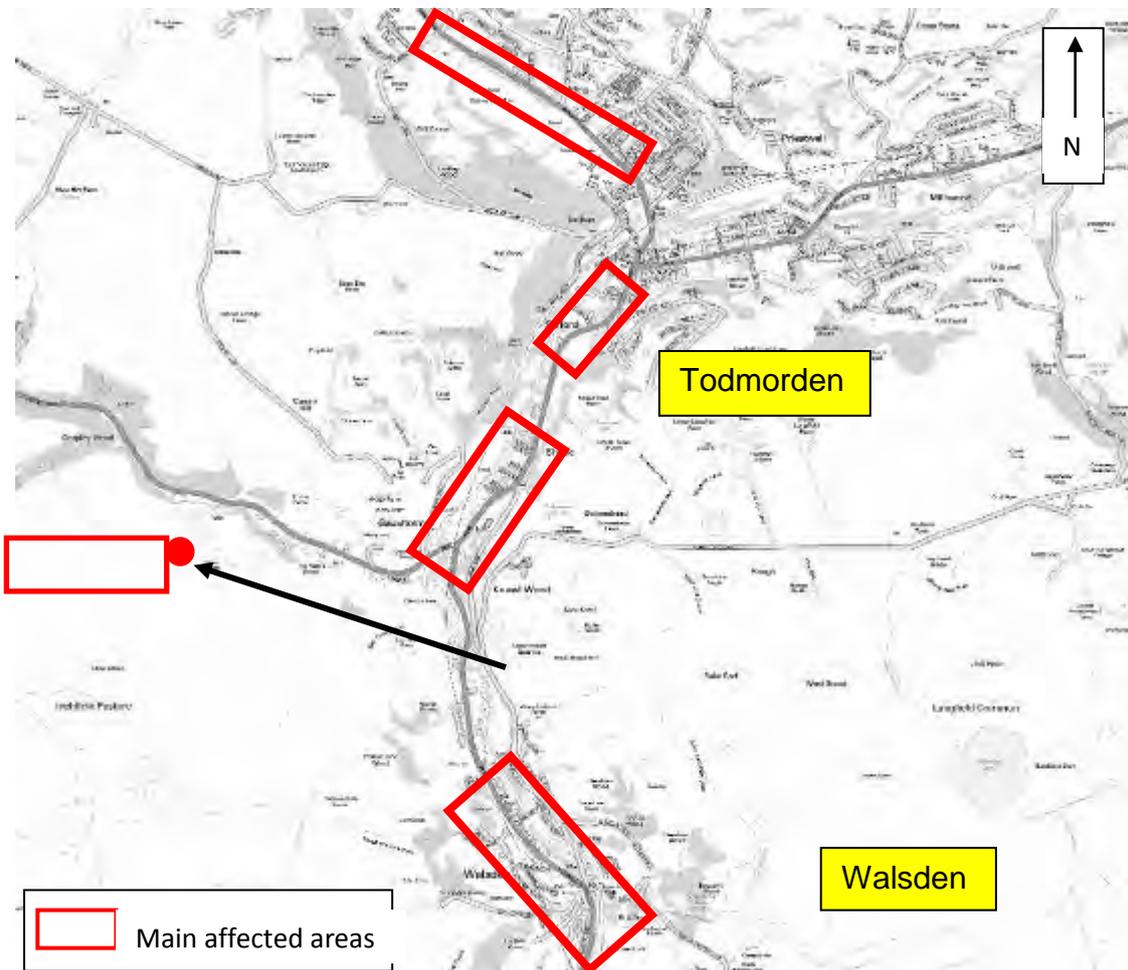


Figure 1 – Location of the communities affected by July flooding

1.3. History of Flooding

Calderdale has a long history of flooding from a variety of sources including surface water flooding (pluvial), river (fluvial) or a combination of these.

Significant fluvial and pluvial flooding has occurred in the recent past particularly

2000, 2006, 2007, 2009, 2011 and 2012. Due to the nature of the topography in the Upper Calder and Walsden Valleys, surface water collects quickly in the valley bottom because of steep valley sides and rapid runoff from thinly vegetated and impermeable surfaces.

The majority of the historical pluvial and fluvial flooding has occurred in the winter and has been the result of a period of prolonged heavy rainfall. However, more frequent annual surface water and fluvial flooding has occurred in the summer months as a result of short duration, high intensity storm events. The most recent example being the two flood events that occurred in the summer of 2012.

The main areas affected by flooding in this event have been affected by similar flooding in previous events. In 2006 Kershaw Road suffered a major rainfall event, which resulted in damage and subsequent significant repair to the Kershaw Road culvert in 2007. Walsden station and surrounding properties were greatly affected by fluvial and surface water flooding in the flood events during the summer of 2012. Birks Clough overtopped the river channel adjacent to the Rochdale Road on two occasions in the summer of 2012. Scott Street and adjoining streets have a history of flooding from hillside runoff. There is currently a land drainage system that is not sufficient to convey excess surface water runoff from the hillside in this location. The Shade and Salford areas of Todmorden have also been badly affected by severe flooding in the summer of 2012. Burnley Road has flooded on several occasions in the past and particularly in the locations identified in this report.

2. Flooding Incident

2.1. Flood Warnings and Alerts

A number of flood warning communications were received by CMBC and the local community prior to the 29th July flood event. The key communications are summarised below:

- **27th July 10:30hrs** – The Meteorological Office (MO) and EA (Flood Forecasting Centre) issued a Flood Guidance Statement (FGS) indicating “the overall river flood risk and surface water flood risk is Low for England. There is potential for intense, thundery downpours, which may move north overnight into Sunday 28th July”.
- **27th July 16:00hrs** – The MO and EA (Flood Forecasting Centre) issued a FGS indicating “an overall Medium flood risk for Durham, Tyne and Wear and Northumberland for surface water and river flooding. A Low flood risk remains for the rest of England and Wales”.
- **28th July 10:00hrs** - The MO and EA (Flood Forecasting Centre) issued a FGS indicating the overall flood risk was Low to Very Low for the whole country.
- **29th July 14:30hrs** – The MO and EA (Flood Forecasting Centre) issued a FGS indicating “there was an overall Low flood risk from river and surface water flooding. However, there is a Medium flood risk of river and surface water flooding in the Yorkshire region. Showers currently affecting England and Wales are locally heavier than expected and therefore expect some minor disruption”.
- **30th July 10:30hrs** – The MO and EA (Flood Forecasting Centre) issued a FGS indicating “there was a Medium risk of minor disruption due to surface water flooding in the Yorkshire region”.

The EA issued a Flood Alert for the Upper Calder at 17:44hrs on the 29th July. A flood warning was issued for the Walsden Water at Walsden. A Flood Warning was issued again at 18:31hrs for the Walsden Water and this triggered the flood warning sirens. A Flood Warning update was issued at 21:30hrs. The all clear was issued at 08:31hrs the following morning of the 30th July.

EA flood warnings are available on the Calderdale Website, please use the following link;

<http://www.calderdale.gov.uk/advice/emergencies/flooding/index.html>.

2.2. Risk Management Authorities Immediate Response

A summary of the activities risk management authorities undertook during and immediately after the 29th July Flood Event is given below:-

Calderdale Metropolitan Borough Council

On the advice of the Flood Forecasting Centre CMBC teams were on standby throughout the weekend prior to the flood event on the 29th July. CMBC implemented relevant emergency plans during and after the flood event. Representatives from all emergency services, Stakeholders and CMBC teams were present to coordinate a proactive response to the flooding. Additional Council resources were retained throughout the week to support the post clean up operation. The Calderdale Community Recovery Framework was activated immediately following the floods.

Drainage contractors were deployed across the borough during and immediately after the peak of the flood event to assist in the clean up operation. Following the flood event Council Services were dealing with an exceptionally high volume of flooding issues ranging from collapsed and blocked culverts to internal flooding to gully defects. Drainage gangs worked to unblock drainage infrastructure across the borough. However the main focus of activity was concentrated in the worst affected communities of Walsden and Todmorden.

Network Rail

The rail network was significantly disrupted by flood water between Summit Tunnel and Walsden Station. Train services were cancelled for the duration of the emergency works to the track. A replacement bus service was put into operation during the repair works.

Yorkshire Water

Yorkshire Water operational staff was on alert following the weather warnings throughout the weekend and on the 29th July. YW engineers implemented

appropriate measures in preparation for heavy, thundery showers. YW contractors worked to remove silt / debris from sewer systems and maintain sewer capacity.

Environment Agency

The main river network was mainly unaffected in the 29th July flood event. The EA provided support and resources to help coordinate the emergency response and recovery plan during and after the flood event. The EA provided immediate additional resources to support the other risk management authorities.

Note: Canal & Rivers Trust is not identified as a risk management authority under the Flood & Water Management Act (2010) but it is a significant stakeholder and an essential contributor to any multi-agency response. However, the canal network was unaffected by this rainfall event.

2.3. Data Collected

A data collection exercise was carried out after the flood event by the following partners:-

- The Environment Agency,
- CMBC,
- Emergency Services,
- Network Rail,
- Canal & River Trust,
- Yorkshire Water Services,
- The Meteorological Office Flood Forecasting Centre.

The data provided includes:

- Flood warning and guidance information,
- Hydrological data – including rainfall totals and river flows and levels,
- Reports from officers and operatives of what happened during the flood event,
- Reports logged at CMBC customer contact centre,

- Photographs and video footage from CMBC, network rail and the EA – including CCTV and footage from the internet,
- Surveyed data of the flood damage taken by the EA and CMBC,
- Online news reports,
- Flood extent outlines plotted from observed flood levels and local knowledge.

3. Areas Affected

A high intensity, localised storm fell on the 29th July in the Upper Calder Valley. The greatest impact was felt in Walsden at Walsden Station and the Shade and Salford areas of Todmorden. Approximately 151 residential and business properties were flooded, surface water overwhelmed drainage and sewerage systems, a major culvert collapsed in Walsden and excess surface water runoff and a significant blockage at a culvert entrance on the Walsden Water in Shade, caused flooding to parts of Todmorden. The impacts of the rainfall are examined in more detail below and illustrated in Appendix A for the Kershaw Road area in Walsden and Appendix B for Shade, Todmorden area.

3.1. Walsden

3.1.1 Kershaw, Clough Road and Walsden Station

High intensity, localised rainfall fell in the Upper Calder Valley between Walsden and Todmorden. Two rainfall events occurred during Monday 29th July at 10:15 to 11:20 and 16:00 to 17:00. The peak rainfall fell within a few minutes, which caused a surge of surface water runoff into the valley generating hillside runoff and overloading watercourses.

In Walsden, Walsden Station and residents on Kershaw Road and adjoining streets were greatly affected by the high intensity rainfall. Two watercourses Fir Wood Clough and Fir Wood Drain, take water directly from the upland moorland area of Oatley Hill and Burnt Hills above Walsden. The two watercourses flow into separate culverts, which converge to a single culvert under properties along Kershaw Road. The culvert then transports flows under Clough Road, through a short section of open channel, which then passes under the railway line and the A6033 into the Walsden Water. Refer to Appendix A for more details.

Large boulder material blocked the culvert under Kershaw Road resulted in the culvert surcharging immediately behind 1 and 3 Melbourne Road. This resulted in a collapse of the main culvert in Kershaw Road adjacent to 1 Calf Hey Terrace. Excess surface water and debris from the collapsed structures overflowed onto Clough Road and adjoining streets, causing significant damage to the highway and nearby properties.



Figure 2 – Debris from the collapsed culverts onto adjacent property



Figure 3 – Kershaw and Clough Road, road surface severely damaged as a result of the excess surface water on Clough Road.

At the lower end of Clough Road the excess surface water could not flow back into the watercourse and therefore spilled onto the railway track, flooding the rail

track at Walsden Station. Similar to the summer 2012 events the excess surface water spilled onto Rochdale Road and flooded the highway and adjacent properties.

The track at Walsden station suffered significant damage. Several properties were flooded and Rochdale Road was closed temporarily until the following morning, while the authorities made safe the area and cleaned the highway. The sewer and gullies along Rochdale Road were cleaned immediately after the event.

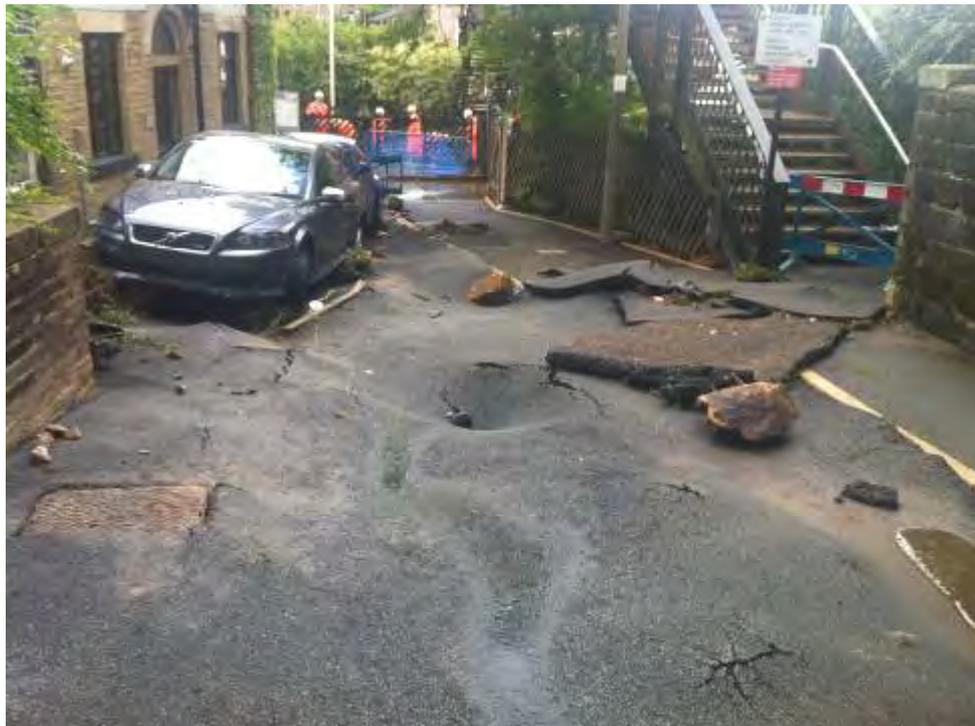


Figure 4 – View looking down slope on Clough Road towards the railway line.

It is thought that the high water levels scoured the riverbanks on Fir Clough Drain and Fir Clough Culvert, which resulted in debris being transported into the culverts and causing the blockages. A culvert repair had been undertaken in 2007 on Kershaw Road, this remained unaffected by this rainfall event.

3.1.2 Scott Street

Properties and highways around Spruce Walk, Cedar Street, Fir Street and Scott Street were flooded during the heavy rainfall between 16:00 and 17:00. Excess surface water flowed down the hillside, transporting mud and debris and overwhelmed an existing surface water drainage system behind Spruce Walk.

Excess surface water spilled out of the open channel and flooded several properties and the highway.

Immediately downstream of Scott Street on the Walsden Water a river wall collapsed into the river channel.

3.1.3 Birks Clough

Severe erosion from Birks Clough during the summer 2012 flood events has exposed riverbanks to further hydraulic scour. High water levels eroded the riverbanks further and deposited debris in an open channel section adjacent to Rochdale Road, reducing its capacity. The flood waters were unable to discharge into the Walsden Water due to high flows and spilled onto Rochdale Road flooding the highways and blocking the surface water drainage systems.

It is reported that Inchfield Road was also conveying large amounts of hillside runoff onto Rochdale Road.

3.2. Todmorden

3.2.1 Bacup Road

Culverts carrying watercourses off the hillside surcharged adjacent to Stoneswood Mill, causing damage to the road and spilling debris onto the highway which in turn blocked surface water drainage systems. Hillslope runoff also caused mud slides to the rear of newly built properties along Bacup Road. Refer to Appendix A for more details.

As in previous rainfall events Bacup Road acted as a conduit for surface water from surcharged watercourses and hillside runoff, channelling flows down Bacup Road. It is reported that some of the surface water flowed into the Rochdale Canal where Bacup Road passes over.

The majority of the surface water continued to flow down Bacup Road until the junction with Rochdale Road where it seems to have mixed with flow escaping from Walsden Water prior to collapse of the bridge parapet. These waters then flowed along Rochdale Road and ponded in the residential streets adjacent to the main road. The residential streets affected included Lock Street, Shade Street, Littleholme Street, High Street, Cannon Street, Market Street, Bar Street and Weir Street.

In some of these streets flood waters were up to 0.5m deep in places. Properties on these streets were mainly affected by water entering the cellars via external entrances.

3.2.2 Shade/Salford

After the peak rainfall, Walsden Water's river level in the Shade area (with significant contribution from Midgelden Brook) rose significantly over a short duration. Flood defences are currently being constructed just north of the junction between Bacup Road and Rochdale Road on the Walsden Water, as part of the third phase of the Todmorden Flood Alleviation Scheme. On the 29th July the flood defence wall above and adjacent to the culvert immediately next to Shade Chapel was being constructed. Temporary works partially constricted the river channel while the work was being undertaken (see figure 5). The Environment Agency had also removed a section of riverside wall to allow access to the river for plant and materials. Temporary defences were in place to maintain the standard of flood protection (see figure 6).



Figure 5 – View looking downstream at the temporary construction works on the culvert on the Walsden Water.



Figure 6 – Damaged caused by flood waters on the new unfinished flood wall being constructed. During the flood event a section of the temporary works collapsed, reducing the capacity of the channel. The constriction at the culvert caused an increase in the level of flood waters upstream of the culvert. Approximately 50 metres upstream is a small, privately owned, masonry vehicle access bridge which suffered structural damage resulting in the collapse of the bridge parapet and masonry facing.



Figure 7 – Damage to the bridge and parapet walls after the flood event on an access bridge on the Walsden Water.

The collapse of the bridge parapet walls allowed the flood waters to spill onto Rochdale Road (as shown in Figure 8). The flood waters combined with the surface water flooding, flowed towards the resident and commercial areas of Shade and Salford. This exacerbated the flooding which had already taken place.



Figure 8 – Flood waters spilling onto Rochdale Road during the flood event.

Dobroyd Clough is reported to have overtopped the river channel in Hall Wood and spilled surface water and debris onto network rail track on the 29th July.

3.2.3 730-724 Halifax Road

Heavy rainfall in the upper valley and in this location overloaded the local sewer system, which overflowed and spilled onto Halifax Road into adjacent property gardens. Some properties in this location have been fitted with a Property Level Protection scheme, which prevented property flooding.

3.2.4 Burnley Road

The Hare and Hound Pub and nine properties were flooded along Ashenhurst Road and Burnley Road as a result of excess surface water overwhelming drainage systems. Properties and businesses were also flooded at the junction between Blind Lane, Burnley Road and West Street. It has been reported that a manhole cover surcharged on Major Clough at the top of Victoria Road adding to the excess surface water on Burnley Road.

4. Rainfall Analysis

The 29th July storm was a significant rainfall event that resulted in intense, localised surface water flooding. High intensity showers were produced by a frontal system that tracked across the region from the southeast heading in a north-westerly direction. The Yorkshire and Northumberland coast also was greatly affected by localised intense rainfall.

Significant rainfall fell on Monday 29th July within the Walsden Water branch catchment of the River Calder. Table 1 below illustrates the rainfall intensities record at the rain gauge at Gorpley reservoir, located approximately 500m south of Bacup Road (A681) on the moorland area.

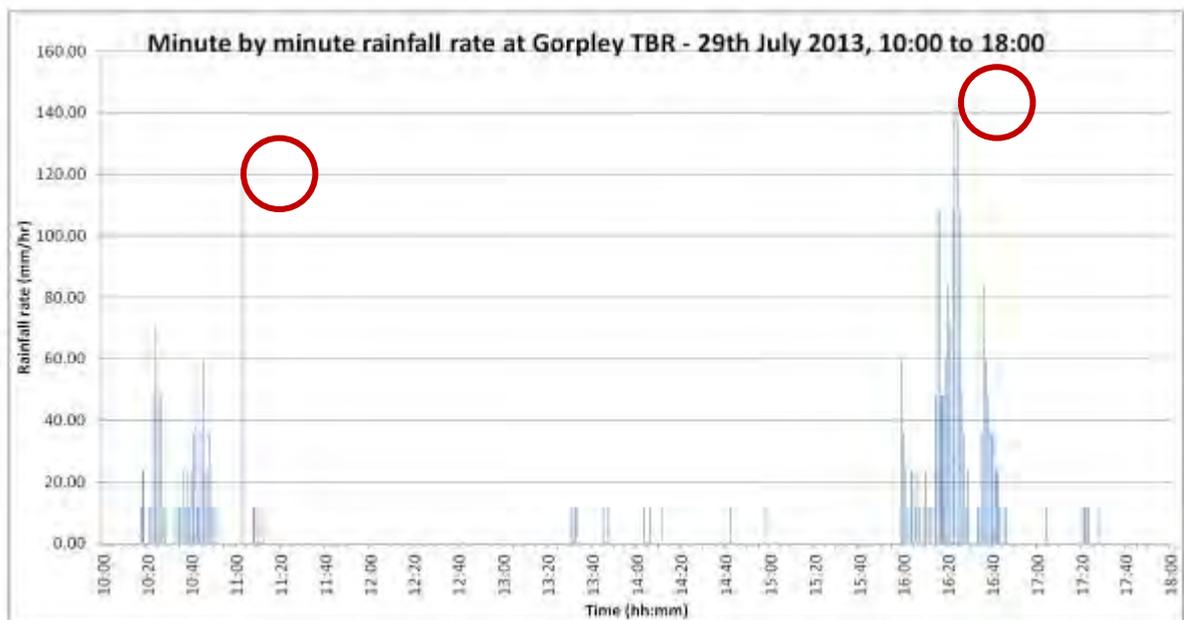


Table 1 – Rainfall intensities for Monday 29th July at Gorpley Reservoir.

The table shows that there were two distinct high intensity rainfall events. The largest event occurred between 16:00 and 16:40 GMT (5:00pm to 5:40pm BST), falling on an already saturated area. The most intense period of rain in this event equates to 140mm per hour and lasted approximately 2 minutes. The second largest rainfall event occurred at approximately 11:10 equating to 120mm over two minutes. Further bursts of intense rainfall throughout the day equated to approximately 60mm per hour. The data shows that the majority of the rainfall (calculated as being a 1 in 20 year return event) fell in just two or three minutes.

A more detailed assessment of rainfall intensities for the 29th July flood event can be found in the Yorkshire & North East Region Flood Hydrology Facts Sheet 11¹.

4.1. River Levels and Flows

The localised nature of the storms resulted in a localised effect on river levels in the borough. The river levels in the Walsden Water upstream of Midgelden Brook were not as high as the river levels seen in the Summer 2012 storm events. However, in Salford and Millwood river levels were recorded as being the second highest river levels ever recorded at these locations. This is thought to be as a result of significant flows from the Midgelden Brook. This shows the unique, localised nature of this particular rainfall event in the Walsden catchment.

River levels in the River Calder were relatively low compared with previous rainfall events on the 29th July. Peak river levels between Todmorden and Hebden Bridge were significantly lower than in the Walsden Water, indicating that the volume of runoff was not large enough to influence river levels significantly.

¹ Fact Sheet 11: The events of July 27th to 29th July 2013. Yorkshire & North East Region Hydrology, Environment Agency.

5. Roles, Responsibilities and Post Flood Event Activities

Local flood risk in Calderdale is managed by the Risk Management Authorities (RMAs) as defined in the Flood and Water Management Act (2010). Each RMA has specific responsibilities in relation to flood risk management and should co-ordinate their activities with each other. The RMAs have been contacted as part of the ongoing flood investigation and will contact relevant stakeholders and third parties depending on the identified source of the flooding.

The Risk Management Authorities are:-

- Environment Agency
- Calderdale Metropolitan Borough Council
- Yorkshire Water

The roles and responsibilities of the RMA's are identified and discussed below. Canal & River Trust is a Navigation Authority, Network Rail is a Significant Transport Authority and they have both been included in this section as they have an important role in helping to manage flood risk and are both members of the multi-agency project group formed to respond to these events.

5.1. Environment Agency

The EA is responsible for managing flood risk from Main Rivers, the sea and reservoirs including coastal erosion risk management. The EA has permissive powers to maintain Main Rivers, strategic overview of all forms of flooding and development of a National Flood Risk Strategy.

The EA will encourage third party asset owners to maintain their property in an appropriate condition and take enforcement action where it is appropriate. The EA may undertake maintenance or repair of third party assets only where it can be considered justified in the interests of public safety and there is no alternative option.

According to the roles and responsibilities identified above the EA has undertaken activities post flood event in response to the flood event. As well as the response to the fluvial flooding the EA has provided a support role for

stakeholders, landowners and third parties to help speed up the post flood recovery.

5.2. Lead Local Flood Authority

The Council is the LLFA and has flood risk management duties and permissive powers to manage flood risk within its boundary from ordinary watercourses, groundwater and surface water run-off. CMBC are also responsible for development of the Local Flood Risk Management Strategy, Asset Register and Investigations.

CMBC has undertaken the following activities in response to the flood events:-

In the 29th July flood event CMBC received and responded to approximately 153 calls through the customer contact centre from members of the public. The logged telephone calls ranged from blocked gullies to cellar flooding to landslips. The logged telephone calls were prioritised based on high, medium and low risk to life, damage to infrastructure and potential disruption and dealt with accordingly.

The Highways Service undertook condition assessments of the carriageways and bridges as necessary throughout the borough and prioritised any emergency works accordingly. Several minor roads suffered surfacing damage during the flooding and minor works were undertaken in these locations to address the damaged areas.

Sandbags were deployed at locations in the borough including, but not limited to, Blind Lane, Dineley Avenue, Wellington Road, Rochdale Road between Walsden and Todmorden and Crown Street in Hebden Bridge.

Kershaw and Clough Road

Immediately after the rainfall event the Council committed to tidying up the site in an attempt to get water back below ground and repair the collapse culvert in Kershaw Road. This required a gas main diversion. All the damaged surfacing was removed and the top taken off the masonry culvert which is largely in private land. A temporary running surface was created in Kershaw/Clough Roads. The remaining piece of culvert under Kershaw Road was cleared of debris without removing the top to preserve access for residents and contractors. The

remaining sections of the culvert are thought to be in reasonable condition under Kershaw Road. A temporary steel plate was laid over it to protect it from traffic loadings following removal of surfacing. This has since been removed and resurfacing work has been completed.

The section of culvert under the property gardens along Clough Road has been cleaned of debris and a temporary surface has been constructed to Walsden Station.

Further investigation is being undertaken to determine the capacity of the culvert system into the Walsden Water. Ongoing discussions are being held with residents, CMBC, Environment Agency and other partners to resolve the situation.

It is also reported that land management practises upstream may have accelerated runoff into the watercourses. This is being investigated.

Shade/Salford area and Scott Street

Immediately after the event CMBC officers assisted residents in the clean up operation. Highway and gullies were cleaned of mud and debris by the Council's contractor Amey LG. CMBC Community teams supported those residents affected by the flooding.

The Fire Service pumped water away from properties in the streets affected by flood waters. Silt and debris started to drop out of the standing water, blocking drainage systems along highways and adjoining roads.

5.3. Water and Sewerage Company

Yorkshire Water Services is the statutory sewerage undertaker for Calderdale with a duty to effectively drain sewers in accordance with the Water Industry Act (1991) and the Flood and Water Management Act (2010). Yorkshire Water undertook the following activities;

- Jetting and de-silting has taken place in all relevant areas. The sewer in Rochdale Road was mostly clear after the flood event,
- CCTV camera work was undertaken on Hollins Road to check the condition of the sewer. Damage to the network was identified and further investigation has been carried out,

- CCTV camera work was undertaken for a significant length of sewer along Rochdale Road between Walsden Station to Cannon Street,
- Location and clearing of a penstock in the sewer on Rochdale Road.

According to the roles and responsibilities identified above Yorkshire Water has undertaken activities post flood event in response to the flood event.

5.4. Riparian and Property Owners

Riparian landowners are those who own land adjoining a watercourse. They have rights and responsibilities as detailed within the EA document 'Living on the Edge'. A riparian owner's basic responsibility is to maintain the free flow of the contents of the watercourse. This could involve all or any of the following:-

- Maintain the bed and banks of the watercourse, and also the trees and shrubs growing on the banks;
- Clear any debris, even if they did not originate from their land. These debris maybe natural or man-made;
- Keep any structures that they own clear of debris. These structures include culverts, trash screens, weirs and mill gates;
- If they do not carry out their responsibilities, they could face legal action under the 1991 Land Drainage Act and other legislation;
- Riparian landowners must understand and act upon these responsibilities.
- Riparian Landowners are not expected to provide an emergency response to a flood event. However, in keeping with their Land Drainage Act duties they should co-operate with the LLFA to reduce flood risk wherever possible. In extreme circumstances the LLFA might use its powers to require action by riparian owners
- It is the property owner's responsibility to take steps to reduce the potential impact flood waters can have on their property, household items and personal belongings.

Kershaw and Clough Road

It is the responsibility of the landowners to restore culverted watercourses under private land in conjunction with their insurance companies. However CMBC is

engaged in on-going discussions in an attempt to progress a more appropriate partnership response to the situation.

The submission of claims against the Authority by insurers is hampering progress in this regard at the time of drafting this report.

Shade/Salford area

The flooded streets in the Shade area stand below the level of Rochdale Road and water which gathers there is prevented from flowing onwards by the canal embankment. Residents should therefore be encouraged to work with CMBC , the EA and other agencies to develop solutions to mitigate against future flooding in this location. Landowners are responsible for providing their own property protection against flooding. CMBC have provided residents with a range of services to assist, where possible, in this regard.

Scott Street

CMBC as Highway Authority is looking for a solution to a highway drainage problem and is talking to property owners to develop a satisfactory partnership response to the risks from land drainage infrastructure.

5.4.1. Network Rail

Network Rail is the riparian landowner for a number of third party assets on ordinary watercourses and land drainage systems. According to the roles and responsibilities identified above Network Rail has undertaken the following activities, which are detailed below.

During the flood event, track engineers were on site investigating flooding reports and alleviating flooding on the track where possible. Track engineers walked over the network post-flood event to survey defects / damage along the line. Maintenance and bridge inspections have been undertaken on culverts and bridges along the network where appropriate.

The stretch of rail track at Walsden Station has been badly affected by the flooding from the culvert collapse along Kershaw Road. Network Rail in conjunction with the EA, CMBC and consultants are currently undertaking drainage and flooding assessments of the area to examine the flooding mechanism (s) and to identify solutions.



Figure 9 – Network Rail repair teams removing large volumes of debris and reinforcing rail track immediately after the flood event.

5.4.2. Canal & River Trust

Canal & River Trust (CRT) is the riparian landowner and a Navigation Authority for a number of third party assets on ordinary watercourses and land drainage systems. In addition, they are responsible for maintenance and management of the Rochdale Canal. On the 29th July the canal network remained unaffected during the high intensity rainfall event; no additional activities from their normal duties were undertaken.

5.4.3. Property Owners

CMBC as LLFA is beginning to promote the principle of self-help amongst at-risk property owners. Work is on-going on a number of fronts which include a Defra Pathfinder project, setting up local flood groups, providing assistance to residents to assess their property's suitability for resistance and resilience measures and general awareness within the Community of on-going risk.

6. Conclusions

1. The flooding on the 29th July significantly affected the key communities of Walsden and Todmorden. Historic flooding and flood risk mapping show that these communities are at significant risk of flooding from a variety of sources.
2. The flood event on the 29th July was as a result of a high intensity, short duration storm cell centred on Walsden that moved towards Todmorden. The rainfall on the 29th July fell on a saturated catchment and caused significant damage to property and infrastructure.
3. Repeated and severe flooding has occurred in the areas of Walsden and Todmorden in the last two years. In these areas historic flood events have been affected by several flood mechanisms, however in the majority of the events the surface water flow pathways have been similar. This indicates that the communities, in these locations identified in this report, are at significant risk from regular pluvial flooding.
4. The borough was on alert for heavy rainfall prior to and on the 29th July; however the intensity of the rainfall was greater than expected.
5. CMBC and partners collated a large amount of data for this event to help improve future flood risk in the borough.
6. The main flood mechanisms were;
 - Two watercourses (Fir Wood Drain and Fir Wood Clough) on the hillside above Kershaw Road, Walsden unable to convey flood flows and suffered severe erosion, overloading and blocking culverts,
 - Excess surface water from the culverts on Kershaw and Clough Road, Walsden spilled onto rail track at Walsden Station and onto Rochdale Road damaging infrastructure and flooding properties,
 - Excess surface water from hillside runoff and sub-catchment watercourses causing damage along Bacup Road and flooded property and infrastructure along Rochdale Road,

- A partially blocked culvert on the Walsden Water, as a result of the collapse of temporary works during the flood event, exacerbated flooding of property and infrastructure along Rochdale Road,
 - Overtopping of Birks Clough, Walsden flooding the highway,
 - Excess runoff from surface water runoff flooding properties along Burnley Road and adjacent streets,
 - Rainfall and surface water overwhelming the design capacity (1 in 30 year event) of the sewers and highway drainage (1 in 2 year event), although the sewerage infrastructure suffered little damage.
7. All risk management authorities and other strategic partner organisations and stakeholders have provided useful information to help identify the flood extents, mechanisms and damage caused. Cooperative working should continue to address outstanding works yet to be completed.
 8. All risk management authorities and strategic partners are collaborating to identify required investment to return watercourses, property and infrastructure to their condition prior to the flood event and go forward to reduce flood risk generally in the valley. A significant amount of post-event work has been undertaken by CMBC help to restore the areas worst affected.
 9. New works identified will be added to proposals of Calder Valley Flood Investment Plan, which CMBC and partners are progressing.
 10. It is essential that riparian owners are identified and flood risk assets in the Upper Valley are suitably maintained, to reduce flood risk in future significant rainfall events.

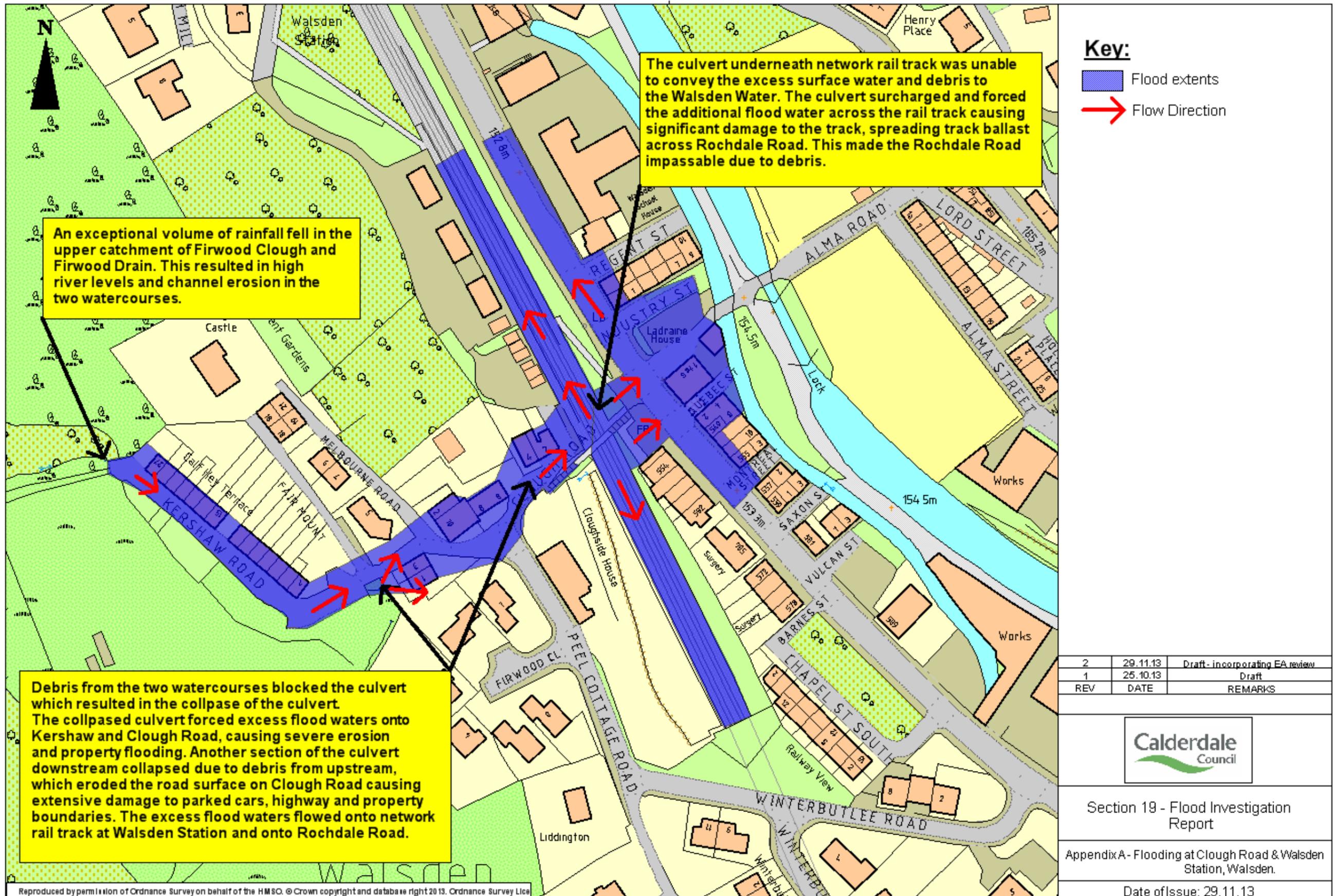
Property owners should continue to be made aware of the flood resistance and resilience measures available. The LLFA and EA should provide support and advice to the community on property level protection, where appropriate.
 11. It is the conclusion of this report that all the stakeholder responsibilities have been or are in the process of being discharged to a greater or lesser extent and within the limits of available data.

7. References

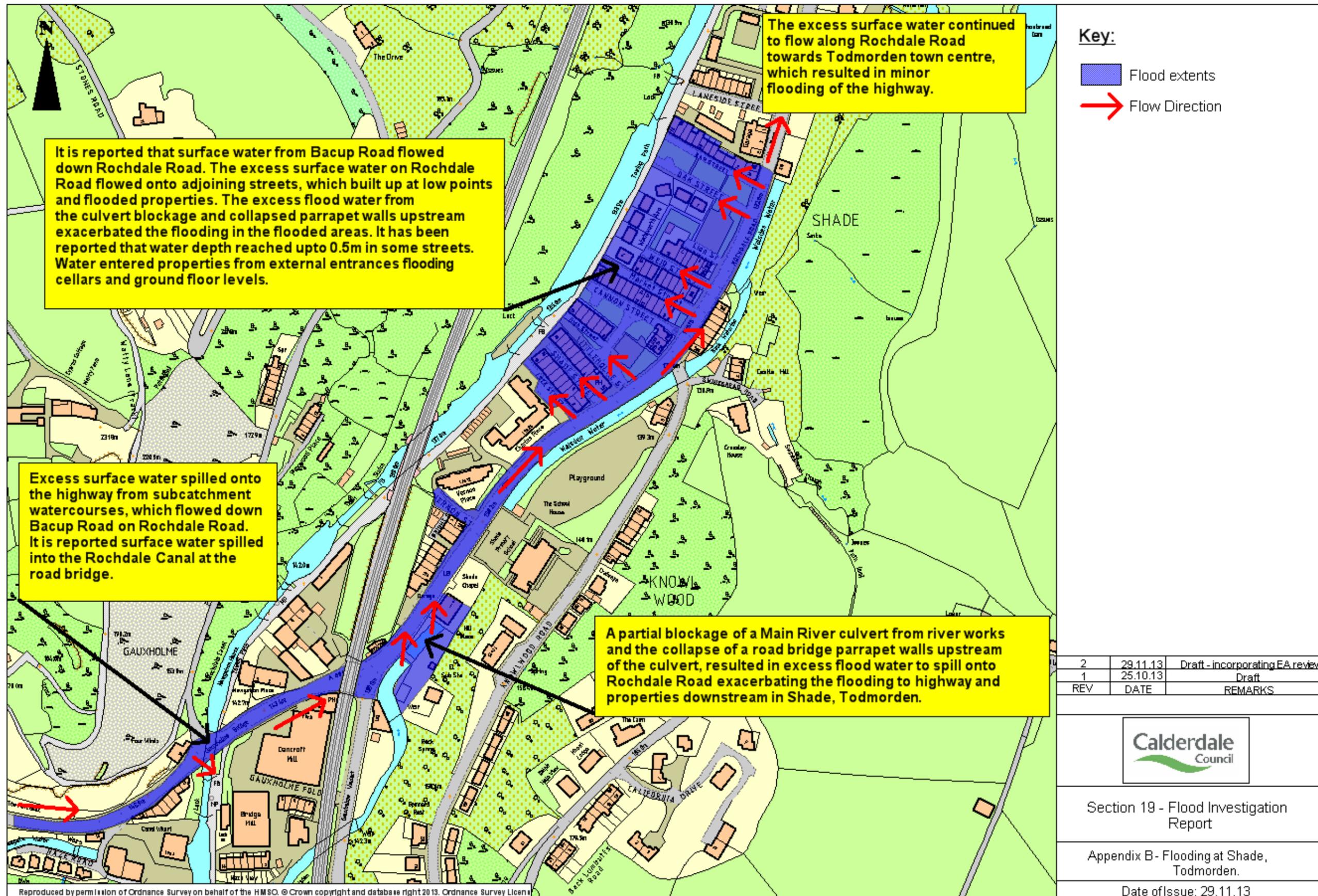
- 1 Fact Sheet 11: The events of July 27th to 29th July 2013. Yorkshire & North East Region Hydrology, Environment Agency.

Appendices

Appendix A: Walsden Flood Extent Map



Appendix B: Shade, Todmorden Flood Extent Map





Sustainable Environment Group

Planning and Highways

Huddersfield Road

Elland

HX5 9JR

Telephone: 01422 392929

Fax: 01422 377600

Email: highwaysandengineering@calderdale.gov.uk



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