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# Menstrie Burn Post Flood Study

Summary Report

May 2013

Clackmannanshire Council  
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**Clackmannanshire  
Council**

# 1 Introduction

On the 29 August 2012 the Menstrie Burn catchment and the surrounding area witnessed a particularly intense and localised rainfall event that caused flooding to the village of Menstrie. In the preceding months leading up to the event the Ochil Hills experienced exceptionally intense rainfall on a number of occasions.

## 1.1 Background to study

Clackmannanshire Council responded to the flood with assistance from emergency services. During the flood and the following day, Clackmannanshire Council staff gathered information on the extent and impact of flooding. This report was commissioned to review this and other evidence, the rarity of the flood event, the impacts and causes of the flood, and to recommend options to reduce future flood risk from the Menstrie Burn. This report summarises the full report's findings provided to Clackmannanshire Council for distribution to the public.

## 1.2 History of flooding

The Hillfoot burns have an intermittent history of flooding, the most infamous being the 1877 flood in Tillicoultry, although other floods in 1785 and 1846<sup>1</sup> also illustrate the risk and nature of flooding to communities located at the base of the Ochils. The only recorded previous flooding on the Menstrie Burn was in 2004:

*9 August 2004* - 30 properties in the vicinity of Burnside Road in Menstrie flooded. During the flood debris collected on the footbridge and washed the footbridge onto the vehicle access bridge downstream. The access bridge clogged with material and flood water backed up causing substantial flooding in the Burnside Road and Holly Grove area of Menstrie.

As a result of the 2004 flood the access bridge was removed and a new footbridge crossing was constructed upstream. In addition, a flood wall was provided to protect the properties in the vicinity of Burnside Road.



## 1.3 Current watercourse condition/findings

This section summarises the nature of the burn in its current condition and its response to flooding in August 2012.

- The watercourse is generally open and clear with relatively few channel restrictions that might contribute to flooding. The Menstrie Burn has relatively few burn crossings; those that are present are generally open with a low risk of blockage.
- Post flood, the channel is generally clear of large woody debris, presumably because most was washed through the watercourse by the high flows. Despite this, there are relatively few locations within the reach where debris could become trapped and block the watercourse.
- The exception to this is the reach adjacent to Brook Street which has, at one location, trees and shrubs encroaching on the banks that caught debris during the flood and obstructed flows. It should be noted that some of these trees are actually holding the old stone banks together, thus stabilising the banks and reducing the risk of bank erosion.
- The recent flood did not cause significant bed or bank erosion along the watercourse. Local evidence gathered by Clackmannanshire Council staff suggested that the movement of larger stones and boulders could be heard during the event<sup>2</sup> and damage to some walls was witnessed.

<sup>1</sup>Chronology of British Hydrological Events (<http://www.dundee.ac.uk/geography/cbhe/>)

<sup>2</sup>Pers. Comm. Stuart Cullen, Clackmannanshire Council.  
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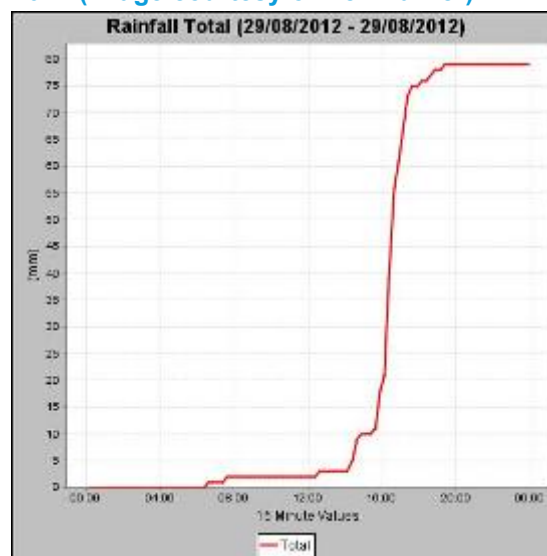
## 2 Prior conditions and rainfall

Investigations have confirmed that the summer conditions were exceptionally wet leading to a saturated ground within local catchments. Assessment of the rainfall for the latter half of August showed a number of rainfall events. Rainfall in the local Menstrie area on the day and on the days leading up to the event was not particularly significant and unlikely to have caused the flooding. However, a very intense and localised rainfall storm was recorded in Bridge of Allan (to the south west of the catchment).

Information on rainfall and flows was gathered from the Scottish Environment Protection Agency (SEPA) and other local sources. The following are key findings:

- Rainfall for the months of July and August were well above average, suggesting that the catchment was saturated prior to flooding.
- Locally gathered evidence suggests that the cause of the flood was a very localised, high intensity rainfall event, witnessed in the catchment and recorded in Bridge of Allan.
- Bridge of Allan experienced a high intensity rain storm on 29 of August. In just 2 hours 64mm of rain water fell. This has an estimated return period of 1,000+ years.
- It is assumed that the same storm which occurred over the Bridge of Allan also occurred and moved eastwards over the Ochils and into the Menstrie Burn catchment area.

Bridge of Allan rainfall chart for 29-August 2012 (image courtesy of Ken Turner)



## 3 Flood flow estimates

Estimates of flood flows are important to help find out how rare the flood was and help assess how often it might occur. Flood flows are typically determined by recording the level of flood water at specific gauging stations. No gauging station exists on the Menstrie Burn, therefore the flood flow witnessed in the burn needed to be estimated by other means. These are recognised as appropriate to calculate flood flows, but they are, unavoidably, subject to a wide range of confidence and reliability.

A number of approaches have been made to estimate the size of the flood. Estimates suggest that the peak flow was in the region of 35 cubic meters per second ( $m^3/s$ ). This estimated flow is significant and could be greater than the 1 in 200 year flood flow (this flood has a 0.5% chance of occurring in any year). Importantly, this doesn't mean that this size of flood will not occur for the next 200 years, nor does it imply that a flood of the same size cannot reoccur this year.

In Scotland the accepted risk to plan for, or protect against in ideal situations, is the 1 in 200 year flood flow. The estimated flood flows for the August 2012 flood are estimated to have been above this level and what could feasibly have been designed against or considered by previous risk assessments.

## 4 The August 2012 flood event and impacts

Clackmannanshire Council was on site during the flood event and immediately after. A report and plan illustrating flood extent and effected properties was prepared. A summary of the Council's findings and additional information gathered is presented below:

- The Lossburn Reservoir in the upper catchment over topped its spillway at the time of the flood and continued to do so into the evening of the flood event. Any attenuation

impact from this Reservoir would have been absent. Scottish Water confirmed that there was no controlled release of water at the time of the flood.

- A number of works have been undertaken since the 2004 flood to mitigate flooding on Menstrie Burn. In particular, the wall along Burnside Road prevented more extensive and deeper flooding than that witnessed. The new footbridge was unaffected by blockage.
- Inspections and a prioritisation system have been implemented by Clackmannanshire Council to ensure regular inspections and maintenance of the burn through Menstrie. An inspection of the burn had in fact been undertaken on the morning of 29 August 2012. The watercourse was found to be clear with no build up of material on structures.
- During the flood a large build up of material was witnessed on Hazel Avenue culvert. This however did not contribute to the flooding that occurred.

## 4.1 Flood mechanisms

The land either side of Menstrie slopes away from the Menstrie Burn and as such once the water leaves the burn channel it is unable to return to the watercourse. The following are locations where water was found to have left the burn channel:

- The first exit point was on the **upstream face of the A91 Road Bridge**. The majority of water flooding onto the Main Street West from upstream of the road bridge travelled south west across Menstrie, following the road layout and impacting several properties; flooding gardens and premises. Flows entered Abercrombie Place, and probably also Windsor Street directly from Main Street. This water eventually ended up flooding Dumyat Road, Craigomus Crescent and Willow Grove, before following flow paths down towards Hazel Avenue.



- Some of the flow from the overtopping of A91 Road Bridge is thought to have flowed to the east and down Brook Street.
- Additional flood water overflowed the **right bank downstream face of the A91 Road Bridge** in and around the pub site. Flows entering the pub site were contained by the boundary wall and returned to the watercourse.



- Downstream of the pub, **water overflowed the bank and into the care home site**. A flow path developed onto The Charrier and combined with flows coming from Main Street West.
- Out of bank flows on the right bank were recorded along the block of houses at the end of **The Charrier (between houses 29 to 33)**. This water flooded properties in The Charrier and ended up on Burnside Road. Once on Burnside Road the water flowed into Craigomus Crescent and down Dumyat Road. Flood water also flowed south, crossing Burnside Road and through the properties into Pine Crescent, where it found its way into the surface water drainage network.



- Flood waters also escaped on the **left bank at the southern end of Brook Street** flooding Millbrook Place and continued south where it joined flood flows from the downstream side of the new foot bridge and onto Menstrie Mains Farm. Flood water flowed through the farm and ponded in a natural low point north of Birch Grove.
- Evidence of out of bank flows were also found at the southern end of Menstrie on the right bank flooding agricultural land. This may have been exacerbated by blockage on a fence within the channel immediately downstream.

## 4.2 Summary of flood impacts

- At least 21 properties were flooded with estimated monetary flood damage in the region of £600,000.
- The causes of flooding appear to be the overtopping of the A91 Road Bridge and the channel capacity exceedence on the right and left banks of the burn. This led to overland flows away from the burn.
- Blockage of structures does not appear to have been a significant cause of flooding despite the large volume of debris washed down from the upper catchment.
- The new wall constructed after the 2004 flood prevented greater spatial extents and deeper flood waters in the Burnside Road area of Menstrie.

## 5 Hydraulic Analysis

Hydraulic models are computer software tools that can help to predict flood levels for a particular flow of water. This can help recreate flood events that have occurred and determine what could be done to reduce the risk of future flooding.

An existing hydraulic model was amended to represent the conditions found during the August 2012 event. This model was then used to review the capacity of the watercourse to check for poor channel conveyance, channel bank low points and the possible need for additional flood defences. The results of this assessment confirmed the locations where flood flows escaped along the top of existing banks.

The modelling suggests that the structures and channel are largely capable of conveying a 1 in 200 year flood flow. However, this does not include a recognised factor of safety level which normally accounts for increases which might occur as a result of climate change. Analysis of identified low points along the burn suggests that the right bank adjacent to the care home and the left bank on Brook Street have a lower capacity; in the region of a 1 in 100 year to 1 in 200 year flood.

## 6 Works undertaken since August 2012 flooding

A number of works have been undertaken by Clackmannanshire Council since the flood event. The following works have been undertaken and are shown in the photographs below:

1. Fitting of flap valves to outfalls (to ensure that backing up of flows into the drainage system does not occur).
2. Wall repairs have been undertaken downstream of the Ochil Road Bridge and at the Burnside Footbridge.
3. Vegetation clearance on the burn was undertaken between September 2012 and March 2013 to clear some of the trees and shrubs in the middle reach of the watercourse between the A91 Road Bridge and the Burnside Road footbridge.
4. Regular inspections of the burn through Menstrie continue to be programmed by Clackmannanshire Council.

**1 - Flap Valve**



**2 - Wall Repair**



**3. Vegetation Clearance**



## 7 Recommendations

### 7.1 Homeowners responsibilities

Current legislation reinforces the point that it is a responsibility of homeowners and landlords to protect themselves, their family, properties or businesses from flooding. Homeowners and landlords being aware of the risk of flooding is an important first step to being prepared for flooding. SEPA recommends<sup>4</sup> that all home owners consider the following to reduce flood risk:

- Make sure your building is fully insured.
- Consider installing [flood protection products](#).
- Have a family or business flood plan in place to protect your property and belongings.
- Register to receive [free SEPA flood warning messages](#).

### 7.2 Recommendations for Clackmannanshire Council

A number of recommendations are made for Clackmannanshire Council to reduce flood risk.

#### 7.2.1 Short term generic measures

These aspects cover Menstrie Burn but could be extended to all burns in the area as they are generally good flood management practices for small watercourses.

- Secure access to structures and warning. Signage on high risk structures is recommended to inform the public to the risks and to help inform the Council of high water levels, blockages and overtopping of structures.
- Flow gauging (measuring flows). It is recommended that either Clackmannanshire Council or SEPA provide a flow gauge on either Menstrie Burn or one of the other Hillfoot burns. This, in addition to a rain gauge located within the catchment would help with future flood estimation for the Menstrie and adjacent burns.

#### 7.2.2 Medium term recommendations

More structural works have been proposed to raise low points on both banks to prevent out of bank flooding in the future up to the standard 1 in 200 year flood event. These are most likely to consist of new walls due to the restricted nature of the watercourse at these key locations.

If Clackmannanshire Council propose to undertake the suggested works, further analysis based on the land survey currently being undertaken is recommended. This is needed to inform the design of necessary works and to ensure that any works do not result in increased flood risk elsewhere.

#### 7.2.3 Longer term recommendations

There are a number of other works that would increase the capacity of the channel to provide a consistent level of protection greater than the 1 in 200 year flood to all properties in Menstrie from the Menstrie Burn. This would be over and above the current best practice guidance for flood protection in Scotland but would help to protect against floods of a similar magnitude to the August 29th 2012 flood. Such works would also help protect against the increase in flood flows that are predicted as a result of climate change.

On the current understanding of climate change the current 200 year return period flow would reduce to around a 100 year return period by 2080, suggesting careful review will be required as flooding is likely to become a more significant problem within a relatively short time frame.

We would recommend that this is based on updated flow modelling and flow / rainfall measuring in the catchment to help give a greater degree of accuracy to future assessments.

It should be noted that the economic viability of undertaking structural measures may not be justifiable as the burn through Menstrie currently affords a relatively high standard of protection. Further investigation would help to identify the economic effectiveness of any proposed works.

<sup>4</sup> [http://www.sepa.org.uk/flooding/be\\_flood\\_aware/who\\_does\\_what.aspx](http://www.sepa.org.uk/flooding/be_flood_aware/who_does_what.aspx)  
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