

Staveley and Ings

Flood Investigation Report



Gowan Bridge, Staveley

Flood Event 5-6th December 2015

This Flood Investigation Report has been produced by Cumbria County Council as Lead Local Flood Authority under Section 19 of the Flood and Water Management Act 2010, in partnership with the Environment Agency as a key Risk Management Authority.

Version	Prepared by	Reviewed by	Approved by	Date
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Executive Summary

The flooding experienced in Staveley and Ings on Saturday 5th and into Sunday 6th December 2015 was the result of the effects of Storm Desmond. This storm caused a period of prolonged, intense rainfall across Northern England. This rainfall fell on catchments that were already saturated and resulted in high river levels and flooding throughout Cumbria and beyond. The flow in the River Kent through Bowston and Kendal on the 5th of December was the highest ever recorded.

In response to the flood event, this *Flood Investigation Report* has been completed by Cumbria County Council as the Lead Local Flood Authority, working in partnership with the Environment Agency as a key Risk Management Authority (RMA), under the duties as set out in Section 19 of the Flood and Water Management Act 2010. This report provides a summary of the flooding that occurred in Staveley and Ings, and to do so it has used a range of data collected from affected residents, professional partners, site visits, surveys and general observations, along with river and rainfall telemetry data recorded during the flood event. In this context, it should be acknowledged that much of the information used as the basis of the report was collected and provided by Staveley with Ings Parish Council. Their support is greatly appreciated. Whilst every effort has been made to ensure that any information is correct in understanding the full scope of the flooding that occurred, there may have been additional flooding mechanisms that were not observed within the data collected.

There are no formal flood defences that provide benefit to Staveley and Ings. There are, however, numerous man made works within or adjacent to the two main watercourses (River Kent and River Gowan) that may have influenced flooding. The flooding resulted in a risk to life throughout the area. An elderly man drowned having been washed into a stream feeding the River Kent, downstream of Staveley. He was reportedly attempting to prevent debris entering the watercourse and causing blockage. The flooding tended to be disparate in location and the source of risk. Approximately 40 properties were affected by flooding in Staveley, with a further 6 affected in Ings.

The main source of flooding during the flood event was from the River Gowan. A group of 11 properties on Main Street, Staveley, were affected by flooding, with the likely source being the high water levels in the Rivers Gowan and Kent, as well as groundwater. In addition, 7 properties were flooded in The Green and Silver Street area; Staveley with Ings Parish Council reported that this was caused by water 'backing up' from the River Gowan, though surface water/highway flooding will likely have been a significant factor. The River Kent also flooded the Kentmere Packaging business. River scour and sediment movement also caused significant problems. Two bridges suffered damage, one of which, Gowan Bridge (which provides the main access to the southern end of the village from the A591), was subsequently demolished ahead of replacement by Cumbria County Council, programmed for Spring 2017.

Various actions have been recommended in this report and these will require the involvement of a number of organisations and the local community. Details of these actions can be found in the Recommended Actions section on page 23.

A draft version of the Staveley and Ings Flood Investigation Report was published online in July 2016 for public consultation. Following the draft publication, a public meeting chaired by Cumbria County Council was held in Staveley on 20th July 2016, where the Environment Agency formally presented the report to the local community. Other Risk Management Authorities were also present at the meeting to answer any questions raised during a question and answer session following presentation of the report. Through the public meeting and local consultation with the community, including with Staveley with Ings Parish Council, a range of feedback has been provided on the reports. The Environment Agency and Cumbria County Council have reviewed this feedback and, where appropriate, updated the Final version of the report to reflect the required amendments.

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Introduction

Under Section 19 of the Flood and Water Management Act (2010) Cumbria County Council, as Lead Local Flood Authority (LLFA), has a statutory duty to produce Flood Investigation Reports for areas affected by flooding. Section 19 of the Flood and Water Management Act states:

- (1) *On becoming aware of a flood in its area, a lead local flood authority must, to the extent that it considers it necessary or appropriate, investigate:*
- (a) *which risk management authorities have relevant flood risk management functions, and*
 - (b) *whether each of those risk management authorities has exercised, or is proposing to exercise, those functions in response to the flood.*
- (2) *Where an authority carries out an investigation under subsection (1) it must:*
- (a) *publish the results of its investigation, and*
 - (b) *notify any relevant risk management authorities.*

This section of the Act leaves the determination of the extent of flood investigation to the LLFA. It is not practical or realistic for Cumbria County Council to carry out a detailed investigation into every flood incident that occurs in the County, but every incident, together with basic details will be recorded by the LLFA.

Only those with 5 or more properties/businesses involved will have investigations published. An investigation will be carried out, and a report prepared and published by the LLFA when the flooding impacts meet the following criteria:

- where there is ambiguity surrounding the source or responsibility of flood incident,
- internal flooding of one property that has been experienced on more than one occasion,
- internal flooding of five properties has been experienced during one single flood incident and
- there is a risk to life as a result of flooding.

As a flood Risk Management Authority (RMA), the Environment Agency have partnered with Cumbria County Council (CCC) to produce the 53 flood investigation reports across Cumbria.

Scope of this report

This Flood Investigation Report **is**:

- an investigation on the what, when, why, and how the flooding took place resulting from the 5th-6th December 2015 flooding event and
- a means of identifying potential recommendations for actions to minimise the risk or impact of future flooding.

This Flood Investigation Report **does not**:

- interpret observations and measurements resulting from this flooding event. Interpretation will be undertaken as part of the subsequent reports,
- provide a complete description of what happens next.

The Flood Investigation Report outlines recommendations and actions that various organisations and authorities can do to minimise flood risk in affected areas. Once agreed, the report can be used by communities and agencies as the basis for developing future plans to help make the area more resilient to flooding in the future.

For further information on the “Section 19” flood investigations being completed throughout Cumbria following the flooding in December 2015, including a timetable of Flood Forum events and associated documentation, please visit the County Council website at:

<http://www.cumbria.gov.uk/floods2015/floodforums.asp>

To provide feedback on the report please email LFRM@cumbria.gov.uk.

Flooding History

Staveley has a history of flooding, much of it being in common to the main historical flood events across Cumbria. The larger events on record are presented below, with river flow data mainly taken from the National River Flow Archive. The details are taken from the Kent and Leven Catchment Flood Management Plan and other Environment Agency records. Note that no river level / flow gauging data exists for the River Gowan, which is problematic given its importance in terms of local flood risk.

Flood Event	Details	Peak Flow in River Kent at Bowston (m ³ /s)*
November 1898	On the 2 November 1898 flood waters reportedly flowed down Main Street with houses submerged to a depth of 1 m. This is considered to be the most significant flood on record, at least prior to the December 2015 event.	-
1954	Significant event that affected Kendal and wider area. Reportedly the worst event since 1898.	-
December 1985	Reportedly a similar scale event to 1954, with flooding thought to have occurred in Staveley but no definitive records are available.	86*
February 2004	Flooding affected the village with 1 property suffering internal flooding. This event caused significant flooding downstream in Kendal.	109
January 2005	Flooding to properties on Main Street "due to the river and surface water".	122
November 2009	This flood event was reportedly focussed on the Kent, which affected the properties along Kendal Road and Main Street, in the vicinity of the confluence of the Gowan and Kent. Four properties on Main Street flooded, with ponding at the lowest point in the road and water backing up through drains reported to be the source. However, there are also reports of flooding issues related to the Gowan, particularly at Ings but no reports of internal property flooding.	119
June 2012	This event was caused by intense local rainfall. This appears to have caused direct surface water runoff-related flooding (affecting Staveley Primary School off Brow Lane) and also exceedance of the capacity of the local surface water drainage system. The main area affected was reported to be around the junction of Silver Street, School Lane and Back Lane. This is a topographically low area within the village, which backs on to the steep fell sides to the north west of the village.	N/A
Dec 2015	Detailed in this report.	177

Table 1: Recent flood events affecting Staveley and Ings

It should be noted that the gauge record at Bowston commenced in October 1999. Prior to this a gauge was used at Burneside. This gauge has a 5% greater catchment area size and suitable data is available

*Data from Burneside gauge

between 1981 and 2000. The Bowston data for 2005, 2009 and 2015 events all exceed any of the recorded flow data at Burneside. The highest flow recorded at Burneside was 89 m³/s in January 1982. The last 10 to 15 years has clearly been a significantly worse period with regard to sustained high rainfall and river flow events compared with the previous decades.

Event Background

The flood incident occurred in Staveley and Ings on the 5th and 6th December 2015. This section describes the location of the flood incident and identifies the properties that were affected by flooding.

Flooding Incident

Staveley is a village located 7km north-west of Kendal in South Cumbria, and is situated on the confluence of the River Kent and River Gowan. Ings is a smaller community located on the River Gowan, 2km west of Staveley. Both communities are located adjacent to the A591 between Kendal and Windermere. The two civil parishes covering the Staveley area have a population of approximately 1,150 (based on 2011 census data*).

At Staveley, the River Kent flows south and drains a mostly rural 40-41km² catchment in the south-eastern Lake District. The River Gowan is a smaller watercourse that joins the River Kent in Staveley, having flowed through the village of Ings approximately 2km upstream. The River Gowan drains a rural catchment of 15-16km². The River Kent is a designated 'main river', as is the River Gowan from downstream of the A591 at Ings. Also of note regarding a potential source of flood risk, there are steep fell sides immediately north-west of Staveley which drain towards the village.

The location of Staveley and Ings and associated major watercourses is shown in Figure 1.

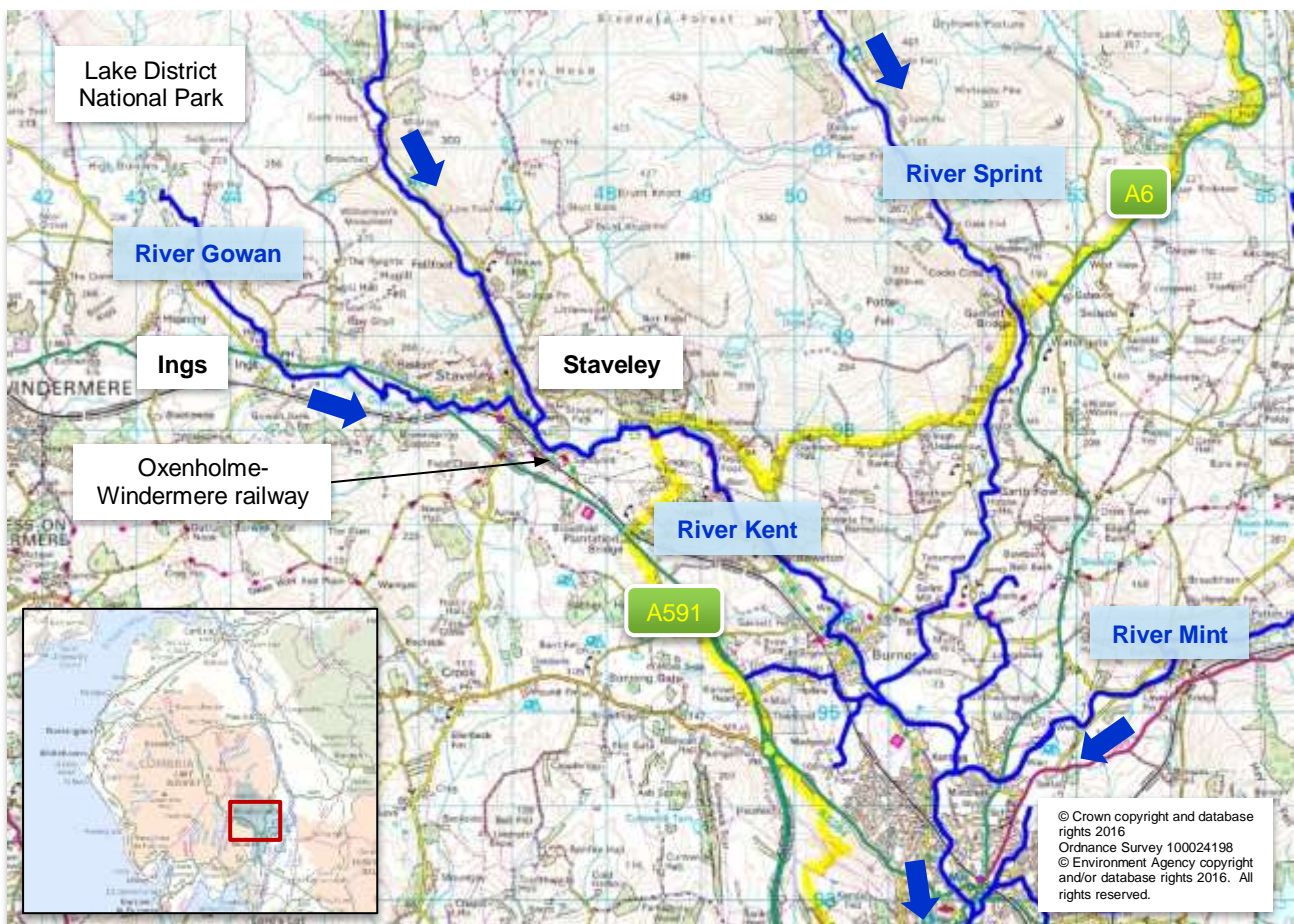


Figure 1: Location of Staveley, Ings and Watercourses

* https://en.wikipedia.org/wiki/Staveley,_Cumbria

Due to their positions within the floodplains of the River Kent and River Gowan, parts of Staveley and Ings lie within Flood Zone 3 (1% Annual Exceedance Probability or AEP) and are therefore at risk of fluvial flooding (see Figure 2). Staveley and Ings are also at risk from other sources of flooding, including surface water (see Figure 3).

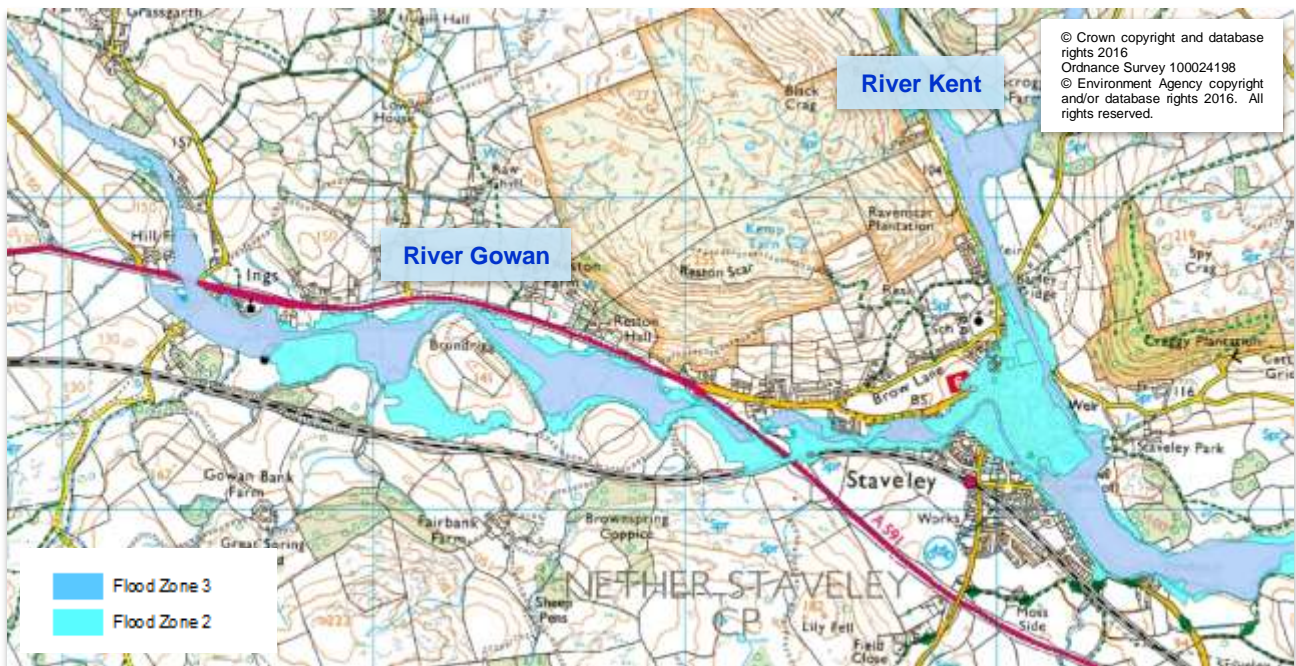


Figure 2: Indicative risk of flooding to Staveley and Ings from rivers (fluvial)

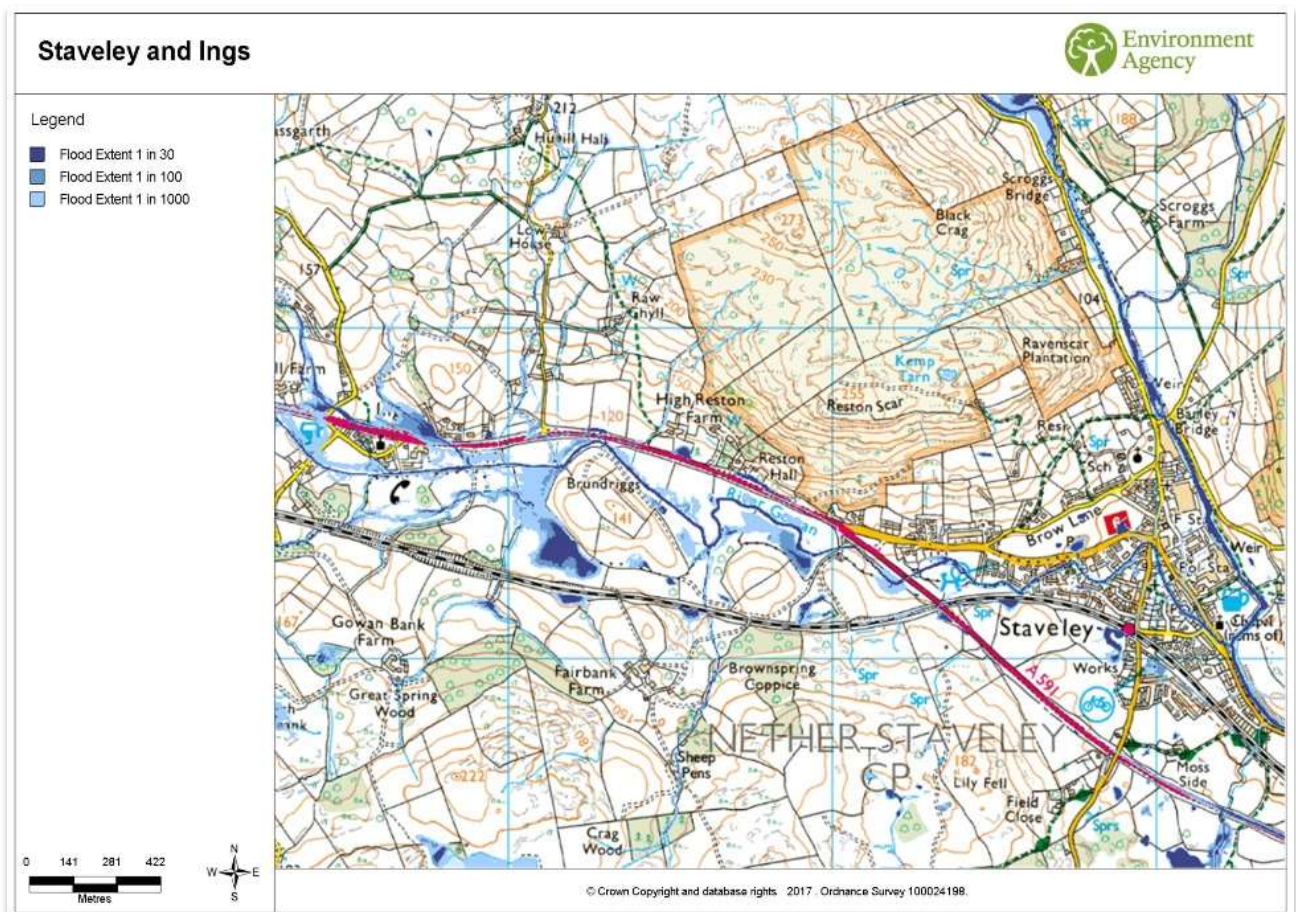


Figure 3: Areas in Staveley and Ings at risk of surface water flooding

Improved hydraulic modelling and flood risk mapping for the Rivers Gowan and Kent is currently being undertaken by the Environment Agency and is expected to be completed in Spring 2017.

On the 5th December 2015, approximately 40 properties in Staveley and six in Ings were affected by flooding as a result of Storm Desmond. In addition, many more residents and local businesses were adversely affected by the flooding as a result of local impacts such as damaged road bridges, eroded banksides, flooding to gardens and blocked access roads. Gowan Bridge, which provides access from the A591 to the south of the village, including to the Main Street, suffered significant structural damage which led to its closure and subsequent demolition. In addition, the parapet of Scroggs Bridge, located on the River Kent a mile upstream of Staveley on the road to Kentmere, having already suffered vehicle damage, was totally destroyed by water from the River Kent overflowing on to the road. However, the most significant local impact was that of a man dying, with his body recovered downstream of Staveley.

The flooding experienced was from various sources and this is described in the "Investigation" section of this report.

This storm caused record breaking rainfall over Cumbria and other parts of North West England. The storm led to widespread river and surface water flooding across Cumbria, with significant flood events occurring on the Eden, Derwent and Kent catchments.

*<http://www.itv.com/news/border/update/2015-12-07/man-found-dead-in-river-died-trying-to-prevent-flooding-in-staveley/>

Existing Flood Defences

There are no Environment Agency maintained formal flood defences within Staveley or Ings. Staveley does, however, benefit from a 'conveyance scheme' constructed in the 1970's, designed to convey flood flows through the village on the River Gowan. The conveyance scheme consists of retaining walls, strengthened wall footings, and bed-check weirs to manage the channel gradient on the River Gowan through the village. Gravel and vegetation management on both the River Gowan and River Kent watercourses is undertaken when required by the Environment Agency. There are also lengths of informal flood defences, such as raised walls, along the Rivers Gowan and Kent that may have an effect on flooding and overland flow paths.

At the time of the flood incident, there was an embankment located on the left bank of the River Kent, immediately downstream of the confluence with the River Gowan. The embankment was not a formal flood defence, however it may have afforded the agricultural land behind it some protection. South Cumbria Rivers Trust, in partnership with the Environment Agency and Natural England, removed the embankment in September 2016 in order to reconnect the river with its natural floodplain.

There are no formal measures in place to manage surface water run off or flooding from the local drainage system.

Property level protection and resilience measures have been taken up by some local residents.

Investigation

This section provides details of the rainfall event, the likely causes of flooding and the history of flooding in the area.

This investigation was carried out by the Environment Agency through surveys of the area and data collected from the communities affected with help from Cumbria County Council, South Lakeland District Council and Staveley with Ings Parish Council. This report has compiled this data to provide details of the flooding within Staveley and Ings.

Rainfall and Fluvial Events

December 2015 was the wettest calendar month on record with much of the northern UK receiving double the average December rainfall. This also followed a particularly wet November and as such, much of the soil within the Cumbria catchments was already saturated.

From the 4th to the 7th of December there was a period of prolonged, intense rainfall caused by Storm Desmond. Over this period, new 24 hour and 48 hour rainfall records were set for the UK. Both of these were within Cumbria and broke the previous records, also within Cumbria, set during the November 2009 flood event, which saw widespread devastation in the towns of Keswick, Cockermouth and Workington. The record-breaking total rainfall values are presented in Table 2.

Rainfall Period	Storm Desmond			Previous Record		
	Date	Location	Total rainfall (mm)	Date	Location	Total rainfall (mm)
24 hour rainfall	December 2015	Honister Pass	341	November 2009	Seathwaite	316
48 hour rainfall	December 2015	Thirlmere	405	November 2009	Seathwaite	396

Table 2: UK Rainfall Records

Within the Kent catchment, Kentmere Hallow Bank rain gauge recorded a total of 225.8mm of rain between 19:00 on 04/12/2015 and 07:45 on 06/12/2015. This is the rainfall associated with Storm Desmond and this followed a series of smaller rainfall events in the preceding days, which contributed to the already saturated ground conditions in the catchment. Within Staveley, Seed Howe rain gauge recorded a total of 101.2mm of rain over 24 hours on the 5th December, with a 48 hour total of 158.7mm. Both the 24 and 48-hour recordings are the highest ever recorded at this gauge since it started recording rainfall in 1984. The location of the local catchment rain gauges is shown in Figure 4.

Five principal flow gauging stations are located within the catchment of the River Kent* (see Figure 4). All five of the stations are downstream of Staveley and the closest station on the River Kent is at Bowston, which replaced Burneside gauging station (now closed) in 1999. Further downstream on the River Kent, Victoria Bridge gauging station is located in the centre of Kendal, while Sedgwick gauging station is located approximately 6km downstream of Kendal town centre. In addition to these, Sprint Mill and Mint Bridge gauging stations record flows in the River Sprint and River Mint respectively, which both join the River Kent downstream of Staveley. Together, these stations recorded the fluvial event caused by Storm Desmond, and the recorded data is presented in Table 3, Figure 5 and Figure 6. There are currently no river flow gauges on the River Gowan.

* Flow gauging station data obtained from Environment Agency records and the National River Flow Archive (www.nrfa.ceh.ac.uk)

At Bowston gauging station, the level of the River Kent peaked at 60.0m AOD at 18:15 on Saturday 5th December. This was the highest river level ever recorded, and exceeded the previous record level of 59.6m AOD (January 2005).

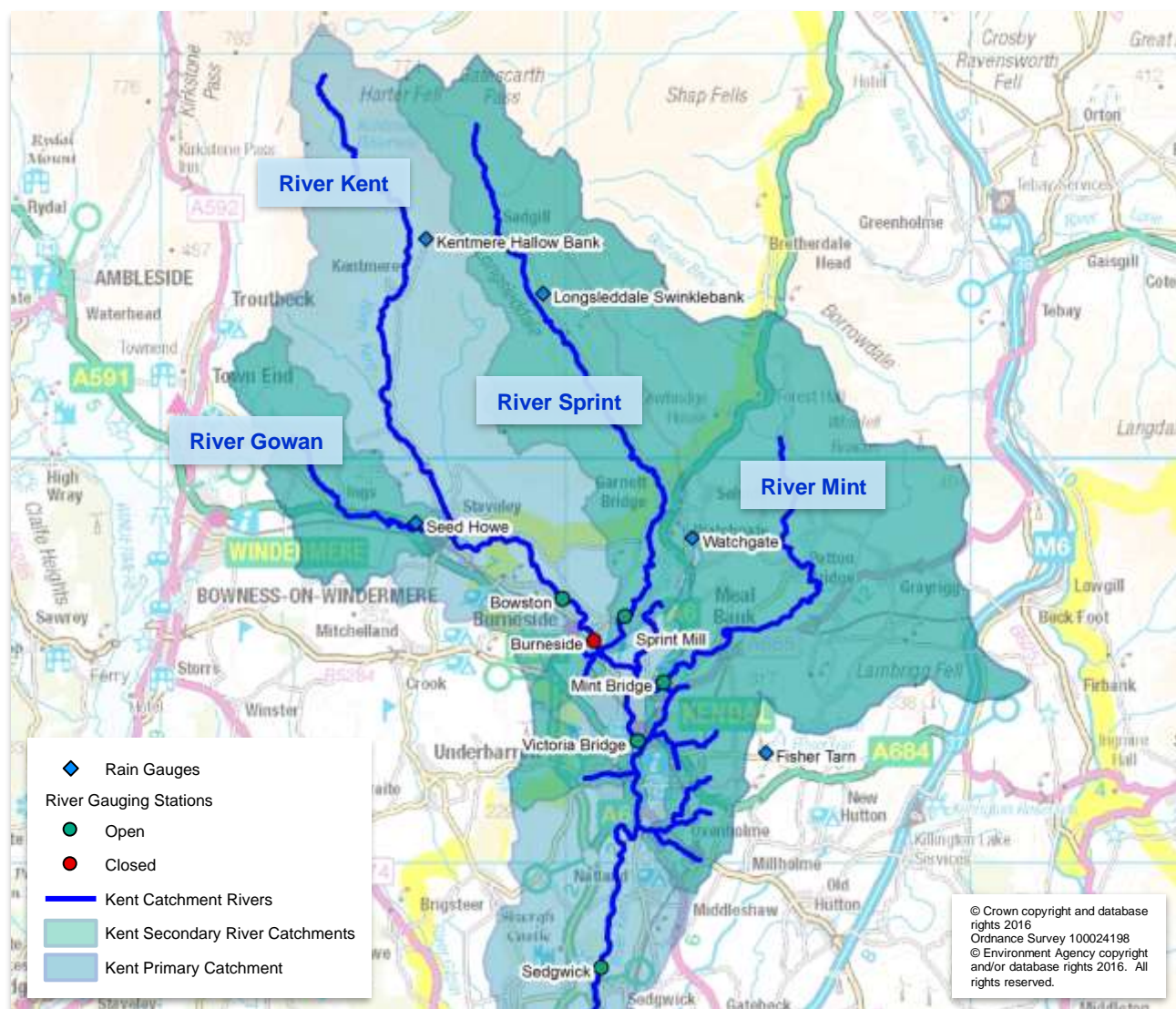


Figure 4: Location of rain gauges and river gauging stations in the River Kent catchment

Gauging Station	River	Peak flow (m ³ /s)		
		Dec 2015	Jan 2005	Dec 1985
Bowston	Kent	177	122	-
Burneside	Kent	-	-	86
Victoria Bridge	Kent	403	286	234

Table 3: Recorded peak river flows in the River Kent Catchment*

* Source: Flow gauging station data obtained from Environment Agency records and the National Flow Archive (www.nrfa.ceh.ac.uk)

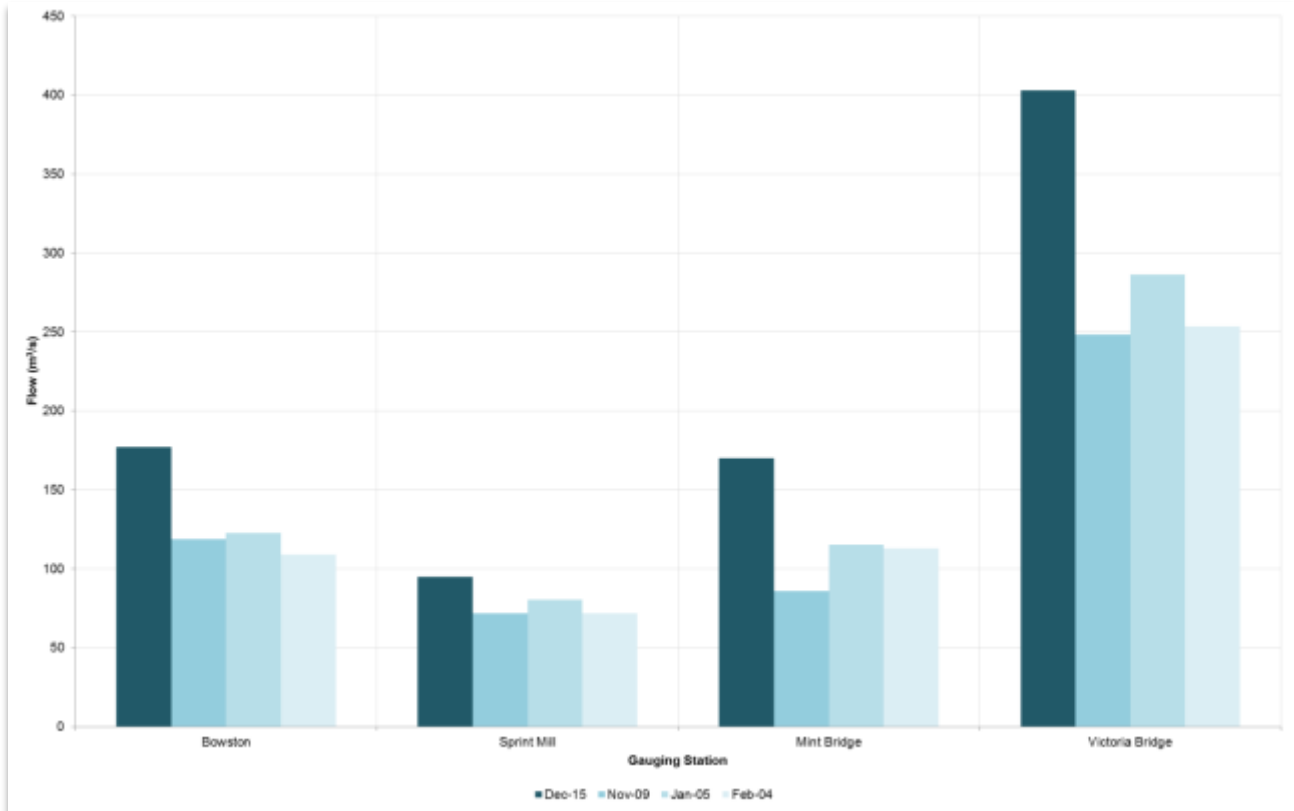


Figure 5: Recorded peak river flows in the River Kent catchment for recent flood events

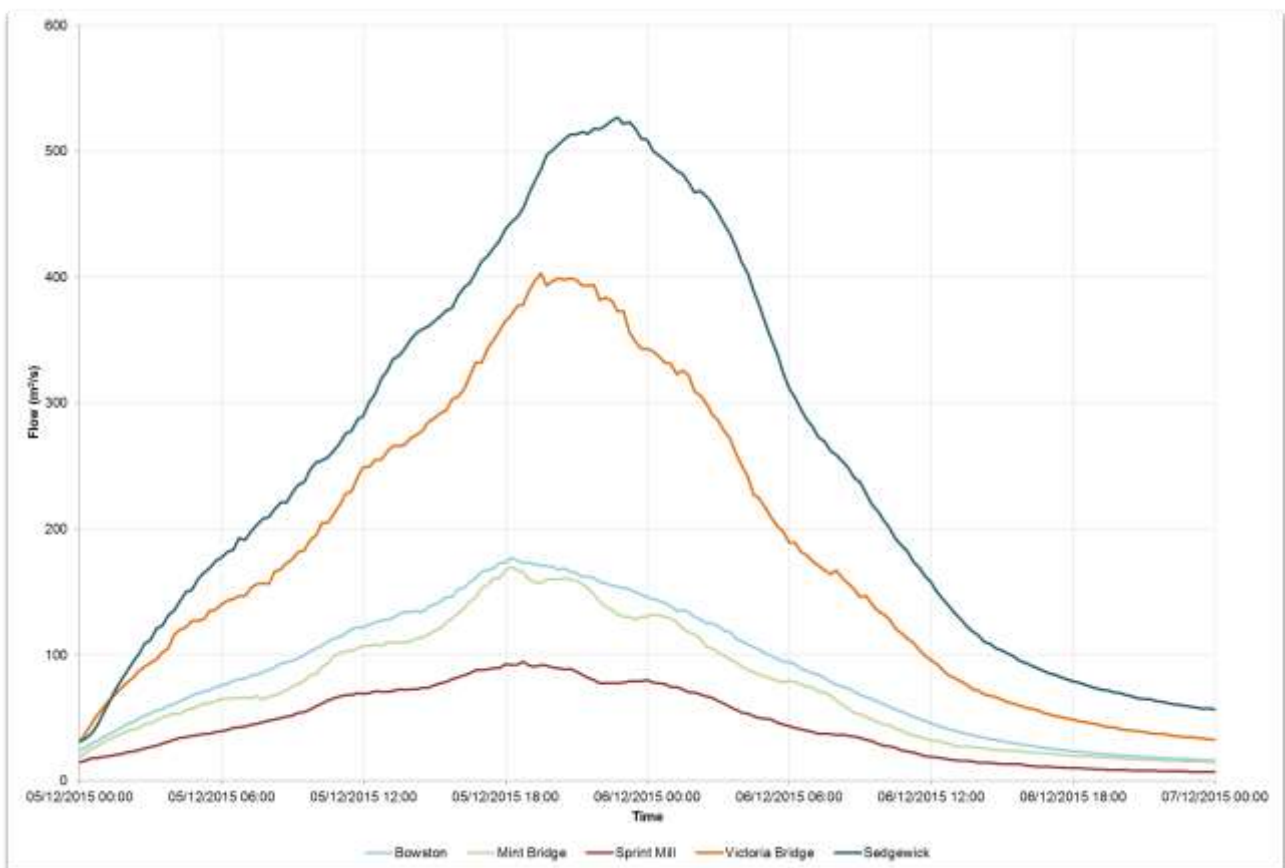


Figure 6: Gauged river flows in the Kent catchment during the December 5th and 6th flood event

The recorded peak flow at Bowston gauging station is greater than any flow previously recorded at this location on the River Kent and initial analysis of this data suggests that the December 5th event had a 0.4% probability of occurring in any given year (0.4% Annual Exceedance Probability or AEP). However, it should be noted that this assessment is based on recorded data at a river level gauge approximately 4km downstream of Staveley, and provides only a limited guide to the severity of local rainfall and river flows in and around Staveley and Ings.

Sources of Flooding, Flow Routes and Event Timeline

There were several discrete flood flow routes during the event. Detailed information regarding the flow routes into these areas, the likely causes, and the recorded impacts are discussed in the 'Flooding Incident' and 'Likely Causes of Flooding' sections.

Table 4 below provides a summary timeline of the key events during the 5th December flood incident in Staveley and Ings.


4 th December 2015	Event
15:22	 Flood Alert issued (Kent and Bela catchments)
19:00	First rainfall associated with Storm Desmond recorded at Kentmere Hallow Bank rain gauge.
5 th December 2015	Event
10:00	Flooding reported at Almshouses in Ings.
10:30	Water started to enter Kentmere Packaging Ltd from the River Kent upstream of Barley Bridge and potentially from surface water runoff down Hall Lane.
15:00	Flooding to properties on Main Street, Staveley commences.
16:00	Water levels reported locally to have peaked on the River Kent. Flooding to properties in the centre of the village (The Green and Silver Street).
18:15	River Kent peak at Bowston gauging station: 60.0m AOD/177m ³ /s.

Table 4: Summary timeline of key events during the flooding at Staveley and Ings

Likely Causes of Flooding: Staveley

In Staveley, the main source of flooding was from the rivers, and could broadly be split between that originating from the River Kent, River Gowan, and that from local surface water flow paths. There were also localised reports of flooding from the foul water sewer system, with manholes observed to be surcharging and contaminated water visible at various locations in the village.

Just upstream of Staveley Village on the River Kent, Scroggs Farm was reportedly affected by surface water runoff from adjacent high ground. Heywood, located on Kentmere Road, was affected by surface water runoff from an adjacent field and water backing up from highway drains.

The parapet at Scroggs Bridge was demolished by river water from the River Kent overflowing through a gap caused by a previous vehicle collision. The access road from Scroggs Bridge to Scroggs Cottages and New Mill Cottage was badly damaged, however action taken by residents prevented flooding to properties.

The River Kent burst its banks at Barley Bridge (Location 1 on Figure 8), near the site of Kentmere Packaging (Hall Lane), which was flooded to a depth of up to 0.5-0.8m. Flooding in the same area also affected the highway and gardens on Kent Drive.

Local residents reported highway flooding on Windermere Road, with water originating from the steep fellsides to the north west of the village and flowing down Brow Lane (Location 2 on Figure 8). Two properties on Brow Lane were reportedly affected by surface water runoff from the adjacent steep fellsides. Residents of the terraced properties on Danes Road, situated at the foot of Brow Lane, reported that flooding affected gardens of their properties. Residents along Windermere Road took action to protect their properties from flooding by placing makeshift flow deflection barriers at the road junctions and property boundaries along Windermere Road, which prevented flow down the road affecting more properties in this area. Water flowing down Windermere Road did however impact properties at Gatefoot Mill. Residents reported that bow waves from passing vehicles exacerbated flooding issues.

Seven properties were affected by flooding in The Green and Silver Street area (Location 3 on Figure 8). The Parish Council reported that this was caused by water 'backing up' from the River Gowan, though surface water/highway flooding will likely have been a significant factor.

Eleven properties on Main Street were also affected by flooding. Water flooded the Main Street area from the River Kent and Gowan, whilst there were also reports of water coming from the rear of the properties, through the floors and through the walls of neighbouring properties. Passing traffic through floodwater on Main Street was reported to have exacerbated flooding issues. Foul water from surcharging manholes was also observed in the Main Street area.

Water from the River Gowan over-spilled into Beck Nook, flooding several garages and gardens. At the south-eastern end of Beck Nook, there were reported issues relating to the railway embankment. Water gathering to the south of the railway embankment was observed to be flowing through the railway embankment in a northerly direction towards properties on Beck Nook. Residents took action and dug a trench to divert water away from properties, which prevented any properties from flooding.

Two properties were affected by flooding on Station Road (Location 4 on Figure 8); one at the junction with Beck Nook, with floodwater entering the porch, and another suffering flooding of a cellar.

River bank erosion was also experienced at 1 Rock Cottage, where a riverside retaining wall collapsed due to undermining, also affecting a pedestrian access bridge. There was also erosion damage on the left bank of the River Gowan at Gowan Close, located opposite 1 Rock Cottage.

Significant redistribution of sediment also occurred on the River Gowan, notably causing a gravel bank immediately upstream of Abbey Bridge (Location 5 on Figure 8). A riverside retaining wall collapsed as a result of undermining on the left bank of the River Gowan immediately downstream of Abbey Bridge.

Surface water flooding occurred within Gowan Crescent (Location 6 on Figure 8), but this did not result in any internal flooding of property. According to a local resident, the flow route into Gowan Crescent was from the footpath connecting it with Station Road.

The highway in front of Gowan Terrace (opposite Main Street on the right bank of the River Gowan), was also flooded due to high river levels. Foul water was observed to be surcharging from manholes by the footbridge, resulting in contaminated water also affecting the area. Water was reportedly within an inch of the threshold of the lowest properties at the downstream end of Gowan Terrace.

There were several aspects to flood damage that occurred at the confluence of the Rivers Kent and Gowan (Location 7 on Figure 8).

The recreational area near the Eagle and Child Inn flooded from the River Kent and Gowan. Flooding in this area also extended up to the front door of the Eagle and Child Inn and its cellar was flooded.

Gowan Bridge, spanning across the River Gowan near the Eagle and Child Inn, suffered major damage, including displacement of the central pier (illustrated in Figure 7). The damaged bridge was subsequently demolished, with a new structure due to be constructed in Spring 2017.

Foul water pollution also occurred from roadway manhole covers at Caldrigg Fold, Gowan Terrace and Main Street. The Parish Council reported that several properties, including St James's Church where the cellar was flooded, were affected by the high level of the water table.

Culvert damage also occurred at the entrance to Caldrigg Fold, which is situated adjacent to the River Kent on Kendal Road (Location 8 on Figure 8). The culvert serves a small tributary to the River Kent which flows from the south west of the village.



Figure 7: Structural damage to Gowan Bridge

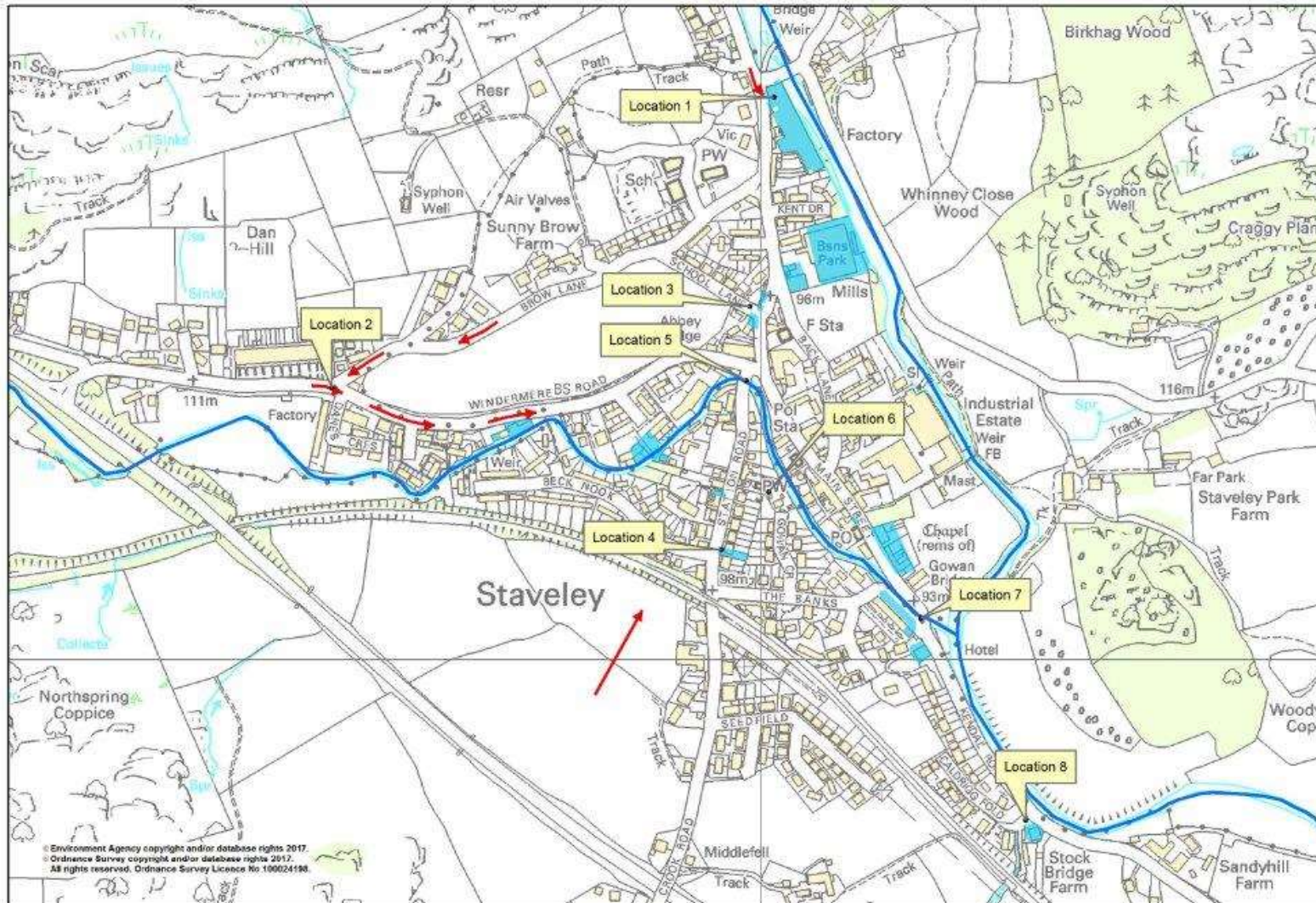


Figure 8: Locations affected by flooding and flow routes in Staveley

Likely Causes of Flooding: Ings

The following information relating to flooding impacts and mechanisms in Ings has been compiled using information provided by local residents during a site visit on 11th March 2016, as well as further subsequent information provided by Ings residents and Staveley with Ings Parish Council.

It should be noted that several tributaries combine upstream of Ings to form the River Gowan. One tributary, which flows past Ings Hall Caravan Park to the south west of the village, joins the River Gowan to the south of the Village Hall in the centre of the village, and appears to have been one source of flooding. Water from this tributary filled the floodplain to the west of Ings, perhaps due to impeded channel capacity at the culvert under the road adjacent to Ings Hall Caravan Park. This flood water then spilled onto Church Lane, and followed local topography and the route of least resistance along Church Lane.

Local residents reported that the predominant source of flooding in Ings was the 'main' River Gowan, which flows from the north west to the south east through Ings. The River Gowan reportedly flowed onto, and across, the A591 near Grassgarth Lane in the north west of the village, where the watercourse passes under a bridge over Grassgarth Lane and then goes into culvert under the A591. It is possible that the constraint caused by the bridge and culvert resulted in water flowing out of bank and across the A591 towards Ings. Water flowing across the A591 then merged with flows from the western tributary, flowing along Church Lane and impacting properties in the village. Through Ings, several dry stone walls were demolished, both by the force of the flood water and local residents who were attempting to divert water into adjacent fields and away from properties.

The Watermill Inn pub, situated on Church Lane, suffered flooding in the kitchen and bar areas on the ground floor, with a reported flood depth of up to 300mm. This resulted in the business requiring refurbishment, closing for several months.

As the flood water passed over the Church Lane road bridge crossing the River Gowan, some flood water escaped back into the grazed area to the south. However, most of the floodwater continued at speed along Church Lane past the Village Hall and Church View terrace. Local residents commented that the floodwater was approximately 200-300mm deep at this location and hazardous to stand in. They also commented that the floodplain to the south did not appear to be full and that better use of this land could be made during flood events. Despite low thresholds, local residents at Church View met on 11th March 2016 reported that they were not flooded. This was due to action taken by homeowners to protect their property.

The flood water then continued to flow in an easterly direction towards the area of the Almshouses (also known as Meadowcroft Cottages) and Meadowcroft Country Guest House. Water entered the car park of the Almshouses and surrounded the properties. Foul water from the sewer system was observed in this area. Four Almshouses were flooded internally, as was the Meadowcroft Country Guest House. The communal entrance and store area for other Almshouses was also flooded. The Guest House was flooded up to a depth of approximately 200mm, and subsequently required refurbishment. The flood water from around the Almshouses dispersed through a wooden fence to the rear of the properties, before passing through a Garage forecourt and returning to the River Gowan downstream. Local residents reported that at all times through the flood incident the River Gowan channel through Ings appeared to have sufficient capacity to convey additional flows.

To the east of the village, flooding was reported on the A591 near the petrol station. This was reportedly due to a small ordinary watercourse culverted under the A591 exceeding the culvert capacity, and the highway drainage system not being able to cope with the volume of water on the highway. Flooding to the A591 was also reported at the start of the 40mph speed limit near Vicarage Lane. An ordinary watercourse which flows in a southerly direction from Kings Garth and is culverted under the A591 was reported to have flooded the gardens of Rose Bank and Fair Wood, which are situated upstream of the A591 culvert inlet. Residents reported that the cause of this flooding was a lack of channel capacity, a lack of culvert capacity under the A591 (possibly due to blockage), and blocked highway drainage.

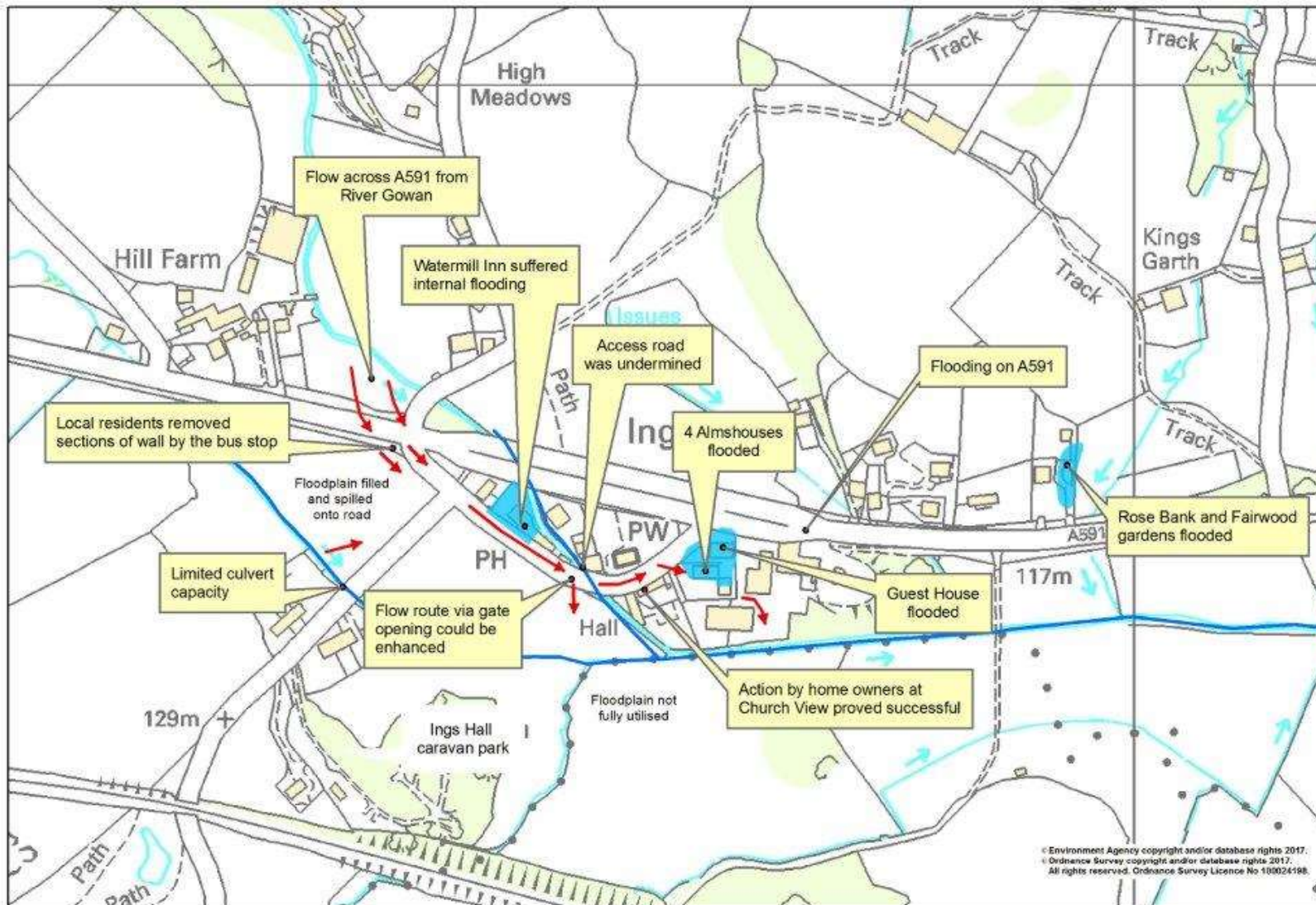


Figure 9: Locations affected by flooding and flow routes in Ings

Environment Agency Flood Incident Response

Pre-event Warning and Preparation

A Flood Alert for the River Kent catchment was issued on 4th December at 15:22 by the Environment Agency. A Flood Alert provides advance notice of possible flooding to low lying land and roads, and also acts as an early notification that river levels are expected to rise and that the Environment Agency are monitoring the situation closely. There are currently no Flood Warning Areas for Staveley and Ings, so during the December flood incident the Environment Agency updated the Flood Alert daily with relevant information.

Staveley and Ings do not currently have any operational assets that require operation by the Environment Agency prior to a flood event. Therefore no Environment Agency staff attended site during the flood event.

Due to the nature of the river environment in Staveley, gravel deposition occurs on both the Rivers Kent and Gowan. This can reduce channel capacity, which can have an impact on flood risk. Regular monitoring of gravel accumulation forms part of the Environment Agency's maintenance programme in Staveley – key gravel monitoring locations are surveyed on the River Gowan upstream and downstream of Abbey Bridge, and on the River Kent upstream and downstream of Barley Bridge Weir. If gravel builds up to a level where flood risk is increased, then the Environment Agency undertakes gravel removal to maintain channel capacity and flood flow conveyance through the village.

Post-event Repairs and Maintenance

Personnel from the Corps of Royal Engineers attended Staveley after the flood event (timing unknown) and closed both Gowan Bridge and Abbey Bridge.

Following the flood incident, the Environment Agency undertook an assessment of the gravel accumulation on the River Kent and River Gowan in Staveley. As a result of this assessment, the Environment Agency removed accumulated gravel on the River Gowan upstream and downstream of Abbey Bridge.

The Environment Agency completed inspections of the river walls along the River Gowan and River Kent to assess their condition, and determine the scope of repairs required. The Environment Agency subsequently secured funding through their Asset Recovery Programme, and in 2016 undertook repairs to damaged sections of riverside walls on the River Gowan that form part of the existing conveyance scheme.

Discussions and planning has taken place between Staveley with Ings Parish Council and the Environment Agency regarding the installation of a river level gauge on the River Gowan in Staveley village centre and a rain gauge in the River Gowan catchment upstream of Staveley. It is hoped that this new telemetry will be installed in Spring 2017. Information recorded from this new telemetry, in conjunction with existing rainfall and river level data from the River Kent catchment and outputs from the River Kent catchment hydraulic modelling study, will be used to establish new Flood Warning Areas for Staveley and Ings.

On-going Maintenance Activities

The Environment Agency maintains flood risk management structures and sections of river channel where maintenance actively reduces the risk of flooding to people and property. Local activities undertaken are summarised below:

-
- Targeted maintenance on river channels where the activity is beneficial to the reduction in flood risk. This could include:
 - Weed control
 - Grass control
 - Vegetation management
 - Invasive non-native species control
 - Gravel removal, when justified through investigation and survey

Recommended Actions

The following table details recommended actions for various organisations and members of the public to consider using the Cumbria Floods Partnership's 5 Themes: Resilience, Upstream Management, Strengthening Defences, Maintenance and Water Level Management Boards (WLMB's). Some of these recommendations may have already been carried out or are ongoing.

Cumbria Flood Partnership Theme	Action by	Recommended Action	Timescale
Resilience	Cumbria Local Resilience Forum ⁶	Review and update plans to enable homes & business to be better prepared for flooding & reduce the impacts of flooding. For example, review of evacuation procedures / emergency response.	2016
	Environment Agency	Continue to work closely with and support Staveley with Ings Parish Council to plan and prepare for future flood events, and to understand the various flooding mechanisms observed locally during the December flood event.	Ongoing
	Environment Agency	Review modelling data to ensure that hydraulic models for the River Kent catchment reflect real conditions as accurately as possible and replicate the 5 th -6 th December 2015 flood event to ensure the flooding mechanisms identified are reflected in the modelling output. Update the models where required and use this information to make any improvements to the flood forecasting and warning service.	Updated model due for completion Spring 2017.
	Environment Agency	Investigate options to provide an improved flood warning service for the Staveley and Ings area. This could include the installation of new river gauges on the River Gowan.	New telemetry due for installation Spring 2017.
	Residents & South Lakeland District Council	Implement flood resilience measures within flooded properties to reduce the impacts of future flooding. South Lakeland District Council is administering the Flood Recovery and Resilience Grants of up to £5000 per property to help people better protect their homes. A further £2000 top up grant can also be applied for from the Cumbria Flood Recovery Fund.	Closing date for grant applications is end of March 2017.
	Lake District National Park Authority, South Lakeland District Council, Cumbria County Council and Environment Agency	Review Local Development Plans and Strategic Flood Risk Assessment to reflect current understanding of flooding.	2016-2017

⁶ The Cumbria Local Resilience Forum includes emergency services, local authorities, Cumbria County Council, Environment Agency, Maritime Coastguard Agency and health agencies along with voluntary and private agencies. Under the Civil Contingencies Act (2004) every part of the United Kingdom is required to establish a resilience forum.

Cumbria Flood Partnership Theme	Action by	Recommended Action	Timescale
Resilience	Cumbria County Council, United Utilities, Environment Agency and Electricity North West.	Review the resilience of critical transport, utility and power supply infrastructure in relation to flood risk.	2016-2017
Upstream Management	Cumbria Floods Partnership (CFP)	The CFP Action Plan will be published in summer 2016, and will consider natural flood management options to reduce flood risk across the catchment. This may include land use changes and/or flood storage.	CFP Action Plan was published June 2016.
	Cumbria Strategic Flood Partnership (CSFP), Farmers, Landowners, Community Groups, Trusts.	Explore opportunities for natural flood management solutions to be used upstream of Staveley in order to 'slow the flow' and manage peak river levels.	Medium term (over next 5 years)
Maintenance	Environment Agency, United Utilities and Cumbria County Council	Carry out inspections and repairs to assets which may have been damaged during the flood event.	Environment Agency inspections & asset repairs completed 2016.
	Environment Agency	Review the gravel and channel maintenance programme within the catchment in response to the flooding event of 2015.	2017
	Environment Agency	A new Environment Agency system is being developed to make it easier for communities to understand what maintenance work is being carried out in their area. Improvements will show exactly when, where and what maintenance is being planned each year. Make sure that communities understand how they can access information on planned maintenance at: https://www.gov.uk/government/publications/river-andcoastal-maintenance-programme	2017
Strengthening Defences	Cumbria County Council, South Lakeland District Council and United Utilities	Review the performance of the existing drainage and sewerage systems during the event to better understand where improvements are required.	2016-2017
	Cumbria County Council in partnership with the Environment	Conduct a detailed assessment for Staveley (including Kendal and Burneside) under the Surface Water Management Plan process and identify solutions to mitigate surface water flood risk in high risk areas that will integrate with fluvial flood risk mitigation options as part of a joined up approach.	2016-2017

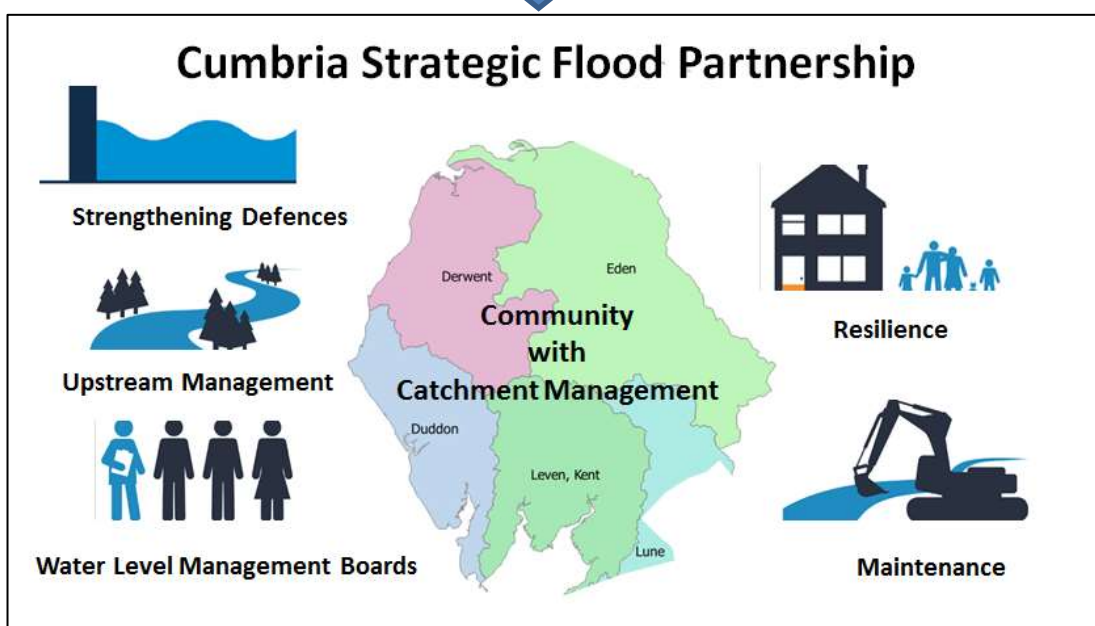
Cumbria Flood Partnership Theme	Action by	Recommended Action	Timescale
	Agency and United Utilities		
Strengthening Defences	Environment Agency in partnership with Cumbria County Council and South Lakeland District Council	Develop options to improve the existing Standard of Protection in Staveley and Ings as part of a wider appraisal of flood risk management improvements in the Kent catchment (including Kendal and Burneside). Defence options to be appraised are likely to include upstream storage, improvements to flood channel conveyance, raised flood defences and natural flood management.	2016-2017
	Cumbria County Council & Environment Agency	Assess the impact of the road bridges and footbridges in Staveley on flood flows, and investigate options to increase their flood capacity, taking into account the potential effects on flood risk downstream.	2016-2017
	Cumbria County Council	Complete works to replace Gowan Bridge near the Eagle and Child public house. The replacement structure should be designed taking into account possible effects on flood risk.	Replacement Gowan Bridge due Spring 2017
	Environment Agency in partnership with Cumbria County Council and Network Rail	Work with Network Rail to understand the interaction of the Windermere branch line with the rivers and watercourses in and around Staveley and Ings, their effect on flooding and their vulnerability during a flood.	2016-2017

Table 5: Recommended actions for consideration

Next Steps – Community & Catchment Action Plan

The Cumbria Floods Partnership has brought together a wide range of community representatives and stakeholders from a variety of sectors to plan and take action to reduce flood risk. The Cumbria Floods Partnership, led by the Environment Agency, is producing a 25 year flood action plan for the Cumbrian catchments worst affected by the December 2015 flooding, including Carlisle. The plan will consider options to reduce flood risk across the whole length of a river catchment including upstream land management, strengthening flood defences, reviewing maintenance of banks and channels, considering water level management boards and increasing property resilience. The Cumbria Floods Partnership structure below details how these 5 themes are being delivered in the Flood Action plans which will be completed in July.

The diagrams below helps demonstrate how the two partnerships have now come together:





Cumbria Strategic Flood Partnership



Community

RFCC

Cumbria Strategic Partnership Board

Catchment Management Group
Eden

Catchment Management Group
Derwent

Catchment Management Group
Kent and Leven

Steering Groups
(Various per Catchment)
MSFWG

'Farmers, environmental charities, landowners, private companies, councils and government agencies have joined together with a common goal.

To look at the evidence and potential funding sources to find flood solutions for defences, resilience, maintenance, upstream management and water level management boards, so they can work together to help communities at risk of flooding.'

In an dynamic move the Cumbria Strategic Flood Partnership have created three groups whose aim is to look at all options for how flood risk can be reduced in Cumbria.

This group the first of its kind in the country brings together the expertise of all those whose water and land management experience to look at what can be done to protect communities both residential and farming.

They will then discuss their findings to the communities at risk and plan a way forward.

This landmark move will ensure that fully integrated solutions for land and water management are utilised to protect people and the environment in which they live and rely on.

Appendices

Appendix 1: Acronyms and Glossary

Acronym	Definition
EA	Environment Agency
CCC	Cumbria County Council
SLDC	South Lakeland District Council
LLFA	Lead Local Flood Authority
FLAG	Flood Action Group
LFRMT	Local Flood Risk Management Team
FWMA	Flood and Water Management Act 2010
LDA	Land Drainage Act 1991
WRA	Water Resources Act 1991
UU	United Utilities

Term	Definition
Aquifer	A source of groundwater comprising water-bearing rock, sand or gravel capable of yielding significant quantities of water.
Attenuation	In the context of this report - the storing of water to reduce peak discharge of water.
Catchment Flood Management Plan	A high-level planning strategy through which the EA works with their key decision makers within a river catchment to identify and agree policies to secure the long-term sustainable management of flood risk.
Culvert	A channel or pipe that carries water below the level of the ground.

Term	Definition
De Facto Flood Defence	A feature or structure that may provide an informal flood defence benefit but is not otherwise designed or maintained by the Environment Agency
Flood Defence	Infrastructure used to protect an area against floods as floodwalls and embankments; they are designed to a specific standard of protection (design standard).
Floodplain	Area adjacent to river, coast or estuary that is naturally susceptible to flooding.
Flood Resilience	Measures that minimise water ingress and promotes fast drying and easy cleaning, to prevent any permanent damage.
Flood Risk	The level of flood risk is the product of the frequency or likelihood of the flood events and their consequences (such as loss, damage, harm, distress and disruption)
Flood Risk Regulations	Transposition of the EU Floods Directive into UK law. The EU Floods Directive is a piece of European Community (EC) legislation to specifically address flood risk by prescribing a common framework for its measurement and management.
Flood and Water Management Act	Part of the UK Government's response to Sir Michael Pitt's Report on the Summer 2007 floods, the aim of which is to clarify the legislative framework for managing surface water flood risk in England.
Flood Storage	A temporary area that stores excess runoff or river flow often ponds or reservoirs.
Flood Zone	Flood Zones are defined in the NPPF Technical Guidance based on the probability of river and sea flooding, ignoring the presence of existing defences.
Flood Zone 1	Low probability of fluvial flooding. Probability of fluvial flooding is < 0.1%
Flood Zone 2	Medium probability of fluvial flooding. Probability of fluvial flooding is 0.1 – 1%. Probability of tidal flooding is 0.1 – 0.5 %
Flood Zone 3a	High probability of fluvial flooding. Probability of fluvial flooding is 1% (1 in 100 years) or greater. Probability of tidal flooding is 0.5%(1 in 200 years)
Flood Zone 3b	Functional floodplain. High probability of fluvial flooding. Probability of fluvial flooding is >5%
Fluvial	Relating to the actions, processes and behaviour of a water course (river or stream)

Term	Definition
Fluvial flooding	Flooding by a river or a watercourse.
Freeboard	Height of flood defence crest level (or building level) above designed water level
Functional Floodplain	Land where water has to flow or be stored in times of flood.
Groundwater	Water that is in the ground, this is usually referring to water in the saturated zone below the water table.
Inundation	Flooding.
Lead Local Flood Authority	As defined by the FWMA, in relation to an area in England, this means the unitary authority or where there is no unitary authority, the county council for the area, in this case Cumbria County Council.
Main River	Watercourse defined on a 'Main River Map' designated by DEFRA. The EA has permissive powers to carry out flood defence works, maintenance and operational activities for Main Rivers only.
Mitigation measure	An element of development design which may be used to manage flood risk or avoid an increase in flood risk elsewhere.
Overland Flow	Flooding caused when intense rainfall exceeds the capacity of the drainage systems or when, during prolonged periods of wet weather, the soil is so saturated such that it cannot accept any more water.
Residual Flood Risk	The remaining flood risk after risk reduction measures have been taken into account.
Return Period	The average time period between rainfall or flood events with the same intensity and effect.
River Catchment	The areas drained by a river.
Sewer flooding	Flooding caused by a blockage or overflowing in a sewer or urban drainage system.
Sustainability	To preserve /maintain a state or process for future generations
Sustainable drainage system	Methods of management practices and control structures that are designed to drain surface water in a more sustainable manner than some conventional techniques.

Term	Definition
Sustainable development	Development that meets the needs of the present without compromising the ability of future generations meeting their own needs.
Sustainable Flood Risk Management	Sustainable Flood Risk Management promotes a catchment wide approach to flooding that uses natural processes and systems (such as floodplains and wetlands) to slow down and store water.
Topographic survey	A survey of ground levels.
Tributary	A body of water, flowing into a larger body of water, such as a smaller stream joining a larger stream.
Watercourse	All rivers, streams, drainage ditches (i.e. ditches with outfalls and capacity to convey flow), drains, cuts, culverts and dykes that carry water.
Wrack Marks	An accumulation of debris usually marking the high water line.
1 in 100 year event	Event that on average will occur once every 100 years. Also expressed as an event, which has a 1% probability of occurring in any one year.
1 in 100 year design standard	Flood defence that is designed for an event, which has an annual probability of 1%. In events more severe than this the defence would be expected to fail or to allow flooding.

Appendix 2: Summary of Relevant Legislation and Flood Risk Management Authorities

The table below summarises the relevant Risk Management Authority and details the various local source of flooding that they will take a lead on.

Flood Source	Environment Agency	Lead Local Flood Authority	District Council	Water Company	Highway Authority
Rivers					
Main river					
Ordinary watercourse					
Surface Runoff					
Surface water					
Surface water on the highway					
Other					
Sewer flooding					
Sea					
Groundwater					
Reservoirs					

The following information provides a summary of each Risk Management Authority's roles and responsibilities in relation to flood reporting and investigation.

Government: DEFRA develop national policies to form the basis of the Environment Agency's and the LLFA's work relating to flood risk.

Environment Agency: Strategic overview of all sources of flooding and coastal erosion as defined in the Flood and Water Management Act (2010). As part of its role concerning flood investigations, this requires providing evidence and advice to support other RMAs. The Environment Agency also collates and reviews assessments, maps and plans for local flood risk management (normally undertaken by LLFA).

Lead Local Flood Authorities: Cumbria County Council is the LLFA for Cumbria. Part of their role requires them to investigate significant local flooding incidents and publish the results of such investigations. LLFAs have a duty to determine which RMA has relevant powers to investigate flood incidents to help understand how they happened, and whether those authorities have, or intend to, exercise their powers. LLFAs work in partnership with communities and flood RMAs to maximise knowledge of flood risk to all involved. This function is carried out at CCC by the Local Flood Risk Management Team.

District and Borough Councils: These organisations perform a significant amount of work relating to flood risk management, including providing advice to communities and gathering information on flooding. These organisations are classed as RMA's.

Water and Sewerage Companies: Manage the risk of flooding to water supply and sewerage facilities and the risk to others from the failure of their infrastructure. They make sure their systems have the appropriate level of resilience to flooding and where frequent and severe flooding occurs they are required to address this through their capital investment plans. It should also be noted that following the Transfer of Private Sewers Regulations 2011, water and sewerage companies are now responsible for a larger number of sewerage than prior to the regulation. These organisations are classed as RMAs.

Highway Authorities: Highway authorities have the lead responsibility for providing and managing highway drainage and certain roadside ditches that they have created under the Highways Act 1980. The owners of land adjoining a highway also have a common-law duty to maintain ditches to prevent them causing a nuisance to road users. These organisations are classed as RMAs.

Flood risk in Cumbria is managed through the Making Space for Water (MSfW) process, which involves the co-operation and regular meeting of the Environment Agency, United Utilities, District/Borough Councils and CCC's Highway and LFRM Teams to develop processes and schemes to minimise flood risk. The MSfW Groups will meet approximately 4 times per year to co-ordinate operations and work together to mitigate flood risk in the vulnerable areas identified in this report by completing the recommended actions. As LLFA, CCC has a responsibility to oversee the delivery of these actions.

Where minor works or 'quick win' schemes can be identified, these will be prioritised and, subject to available funding and resources, will be carried out as soon as possible. Any major works requiring capital investment will be considered through the Environment Agency's Medium Term Plan process or a partner's own capital investment process.

Flood Action Groups are usually formed by local residents who wish to work together to help reduce flood risk in their area. The FAGs are often supported by either CCC or the Environment Agency and provide a useful mechanism for residents to forward information to the MSfW Group.

Appendix 3: Gowan Bridge Concept Details




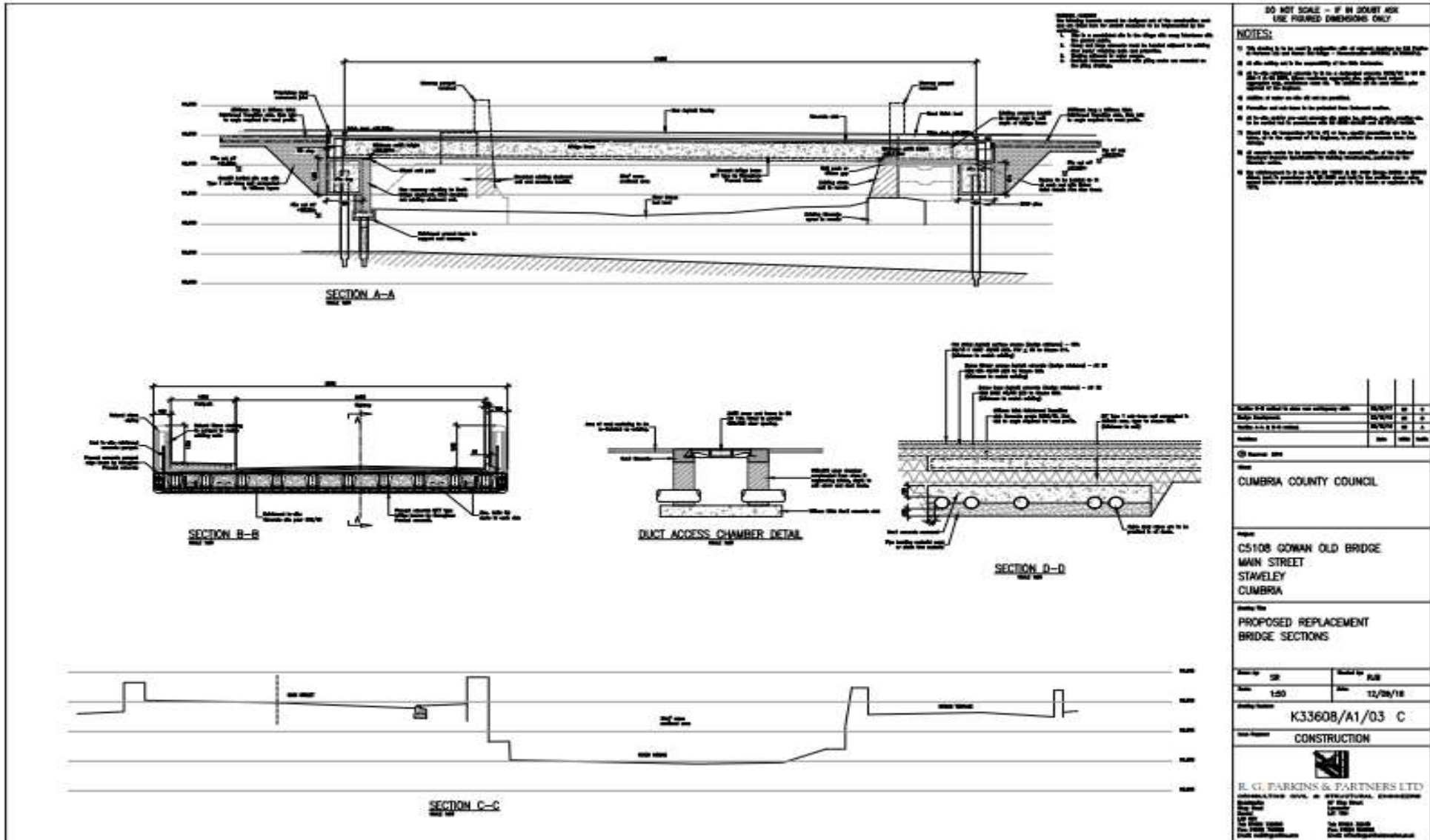
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Drawing Number: K33606/A1/05			
View Name: SCHEMATIC			
			
R. G. PARKINS & PARTNERS LTD CONSULTING CIVIL & STRUCTURAL ENGINEERS Head Office: 17 City Road Lancaster LA1 1UR Tel: 01524 373733 Fax: 01524 373734 E: info@rgparkins.co.uk Website: www.rgparkins.co.uk			



Appendix 4: Links to Other Information on Flooding

Sign up for Flood Warnings

<https://www.gov.uk/sign-up-for-flood-warnings>

Environment Agency – Prepare your property for flooding; a guide for householders and small businesses to prepare for floods

<https://www.gov.uk/government/publications/prepare-your-property-for-flooding>

Environment Agency – What to do before, during and after a flood: Practical advice on what to do to protect you and your property

<https://www.gov.uk/government/publications/flooding-what-to-do-before-during-and-after-a-flood>

Environment Agency – Living on the Edge: A guide to the rights and responsibilities of riverside occupiers

<https://www.gov.uk/government/publications/riverside-ownership-rights-and-responsibilities>

Flood and Water Management Act 2010:

<http://www.legislation.gov.uk/ukpga/2010/29/contents>

Water Resources Act 1991:

<http://www.legislation.gov.uk/all?title=water%20resources%20act>

Land Drainage Act:

<http://www.legislation.gov.uk/all?title=land%20drainage%20act>

Appendix 5: Flood Warnings and Alerts

Staveley and Ings is covered by the River Kent & Bela Flood Alert.

Flood Alerts:

011WAFKB - Rivers Kent and Bela

Alert issued on Friday 04/12/2015 at 15:22.

Alert removed on Thursday 10/12/2015 at 16:18.

Customers in Flood Alert area registered on FWD: 227

Contacts (landline, mobile, email etc) in Flood Alert area registered on FWD: 609

Successful contacts: 531

Unsuccessful contacts: 78

Alert Message:

A Flood Alert has been issued by the Environment Agency for the Rivers Kent and Bela. Flooding is possible for Rivers Kent and Bela. Low lying land and roads will be affected first. Be prepared to protect yourself, family, pets and property.

Heavy and persistent rainfall, along with strong South-Westerly winds, are forecast to continue this evening through until Sunday 06/12/2015. With the ground already saturated the river levels are expected to rise further and we may see some significant impacts. The forecast is likely to result in Flood Warnings being issued on Saturday. We advise that you keep an eye on the situation by listening to weather forecasts, checking our web pages or calling Floodline. We are continuing to monitor the situation and have workers on site operating defences and clearing blockages where required.