

Oaklands Drive Carlisle

Flood Investigation Report



**Flood Event 22 November 2017
and 10 February 2018**

This flood investigation report has been produced by Cumbria County Council as a Lead Local Flood Authority under Section 19 of the Flood and Water Management Act 2010.

Version	Undertaken by	Reviewed by	Approved by	Date
Draft	Peter Allan	Helen Renyard	Doug Coyle	December 2017
Final	Peter Allan	Helen Renyard	Doug Coyle	March 2018

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Executive Summary

Cumbria County Council as Lead Local Flood Authority (LLFA) has prepared this report with the assistance of other Flood Risk Management Authorities as it considers necessary to do so under Section 19 of the Flood and Water Management Act 2010.

This report examines the flooding at Oaklands Drive, Carlisle on the 22 November 2017 and 10th February 2018, detailing flood routes near to the affected properties. The main cause of the flooding on the 22nd November 2017 appeared to be from blockages and the inability of the drainage infrastructure behind Oaklands Drive to accommodate surface water runoff from neighbouring fields causing internal flooding to 8 properties. It is also noted that flooding occurred again on the 10 / 11 February 2018 resulting in internal flooding to 3 properties.

Several actions have been identified in the report which would reduce the risk of future flooding. The recommendations range from installing property level protection, to longer term solutions that may require Flood and Coastal Erosion Risk Management Grant in Aid funding from Defra(FCERM GiA). Most of the actions will require partnership working from the Oaklands Drive community and Story Homes Ltd with clear guidance and support from Lead Local Flood Authority (LLFA) working with Making Space for Water officers.

Cumbria County Council's LLFA team has used information from a wide range of sources to compile this report. This includes details from individuals, other authorities, the Oaklands Drive community and on-site observations. Whilst best endeavours have been made to be factual, to understand the full scope of the flooding that occurred and the mechanisms influencing it, some information has been used from secondary sources. If this has resulted in incorrect reporting, please inform the LLFA on tel. 01228 221330 or email LFRM@cumbria.gov.uk stating Oaklands Drive in the title.

Event Background

This section describes the location of the flood incident and identifies the properties that were flooded.

Flooding Incident

Oaklands Drive is situated in the Upperby area on the south edge of Carlisle. The properties affected by the flooding include those backing on to fields and within the Oaklands Drive estate and are in a semi-rural setting close to Hammond's Pond.

Old maps suggest that there were brick works and a clay pit in the area. Indications from the old maps suggest that Hammond's Pond was likely to have been created to initially support the brick making industry before being used for leisure at a later date. This gives an indication that the soil types in the area were clay.

The fields behind slope towards Oaklands Drive, this is where a culvert has been installed to transfer surface water to Wire Mire Beck close to Hammond's Pond. It is understood that the culvert was installed at a similar time to the construction of the properties in the 1950s. However, it is not clear if the culvert was planned before the properties were constructed or if it was installed at a later date due to the volumes of surface water.

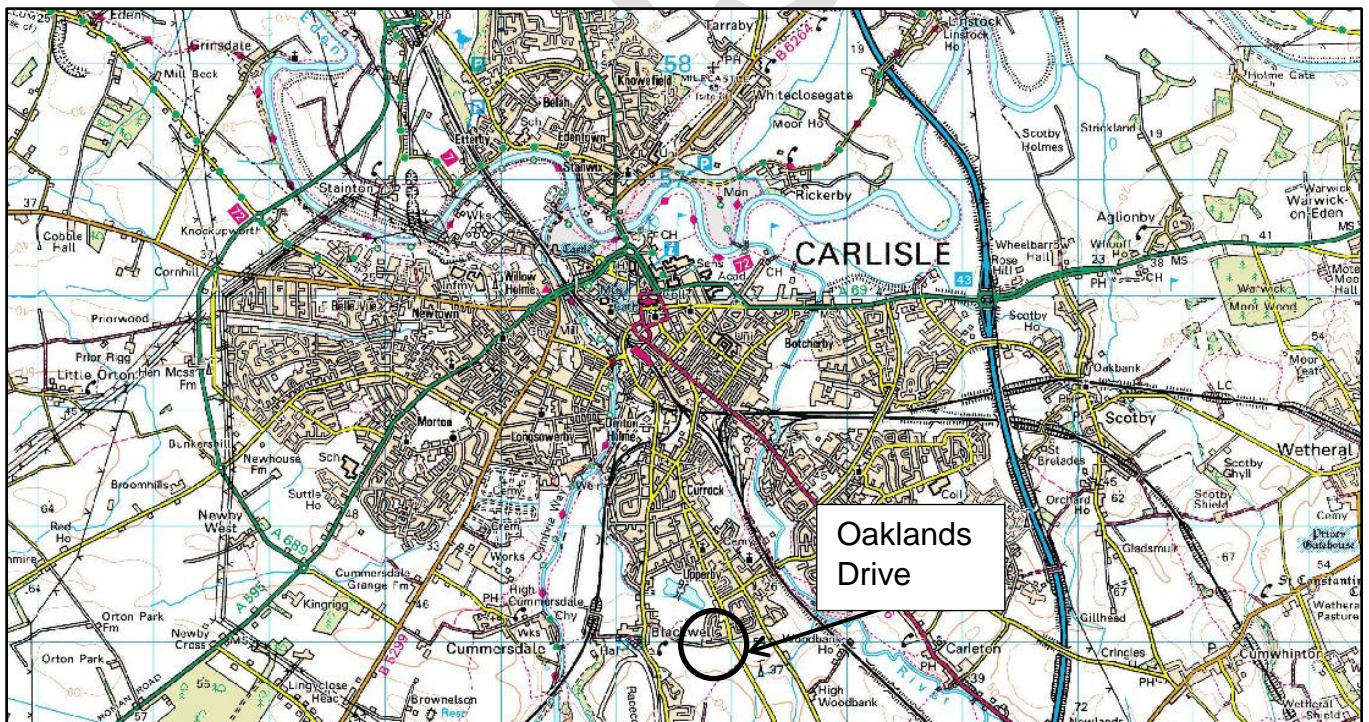


Figure 1: Location Plan

Nine properties were affected with eight being flooded internally by the flooding on 22nd November 2017. Three properties were again internally flooded on the 10 / 11 February 2018.

Investigation

This section provides details of the existing flood risk, an analysis of flow routes and details of likely causes of flooding. Also included are details of the rainfall event and any previous flooding history in the area.

Existing flood risk

This section provides information on areas of flood risk from the Environment Agency mapping that is available. The following information is publically available and can be viewed at the following website - <https://flood-warning-information.service.gov.uk/long-term-flood-risk/map>. As can be viewed from the extract below the properties that were affected were already identified as being in a flood risk area.

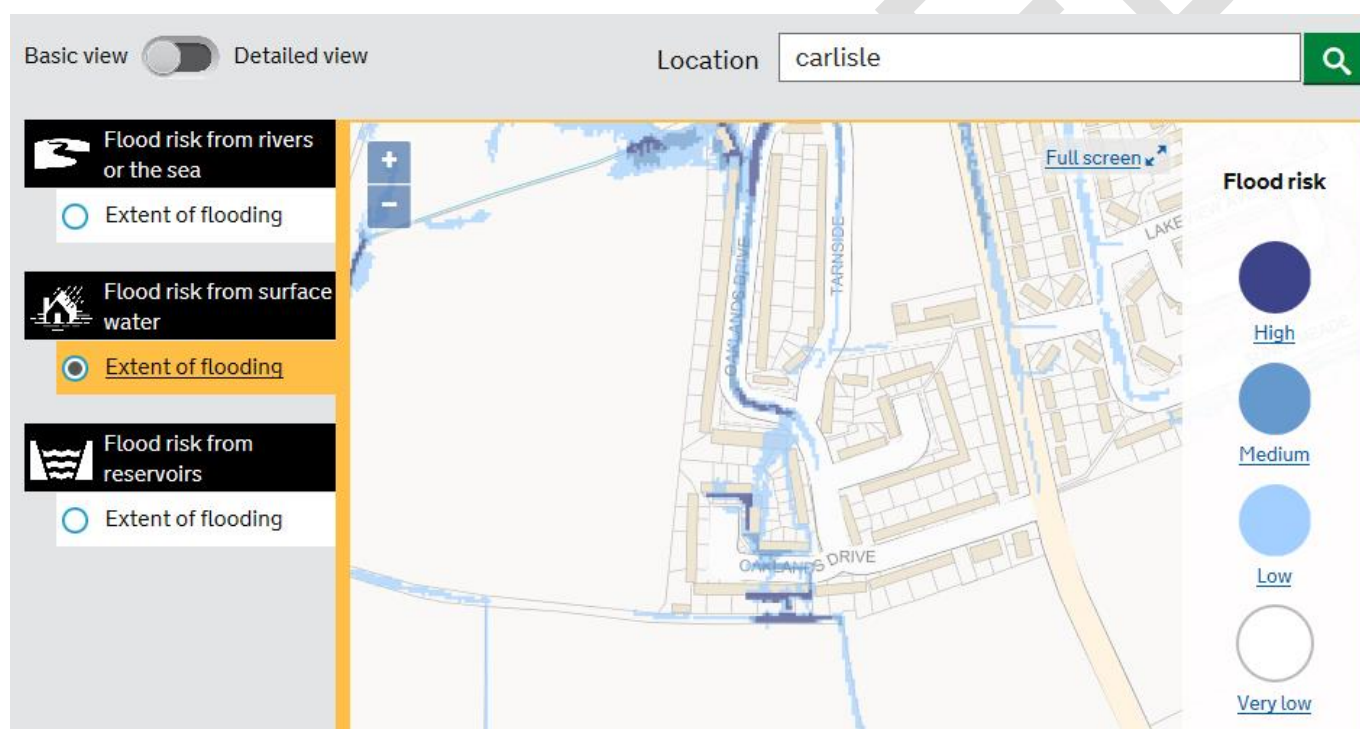


Figure 2: Surface water flood risk map

As it will be seen within this report the flooding that occurred did follow the predicted flow routes from the mapping.

Rainfall Event

The following details provide information on the rainfall event that occurred on the 22nd November 2017. Also provided is a comparison of previous rainfall events on 7th January 2005, 5th December 2015, this event on 22nd November 2017 and the following event on 10 / 11 February 2018..

The following diagrams provide an indication of the event that crossed Cumbria on 22nd of November 2017 and 10th February 2018.

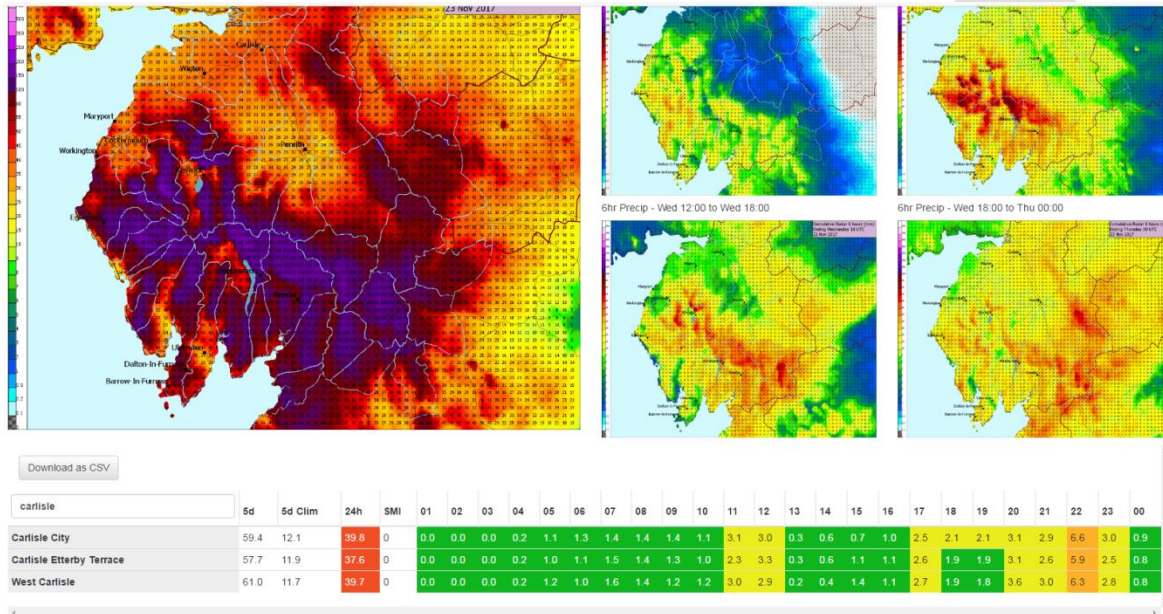


Figure 3: Details of rainfall event across Cumbria on 22nd November 2017

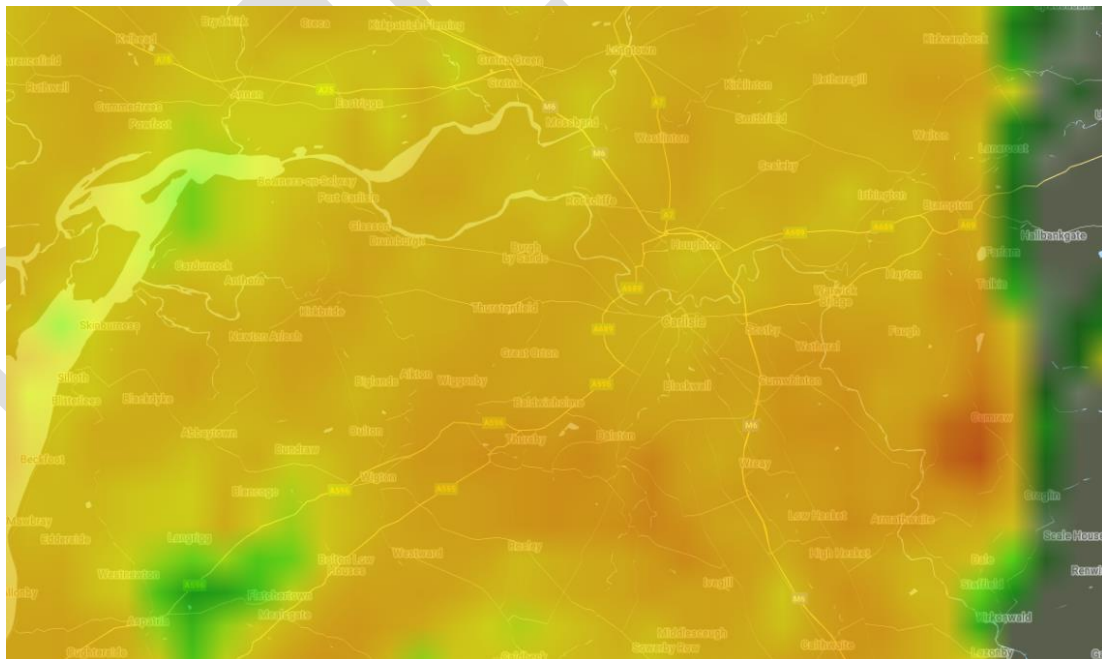


Figure 4: Graphic of rainfall event on 10th February 2018 at 23:00

Rainfall intensity on the 22nd November at Oaklands Drive is shown below. The rainfall totals on the 22nd November 2017 were 39mm in 24 hours and 50mm for 36 hours from 22nd into 23rd of November.

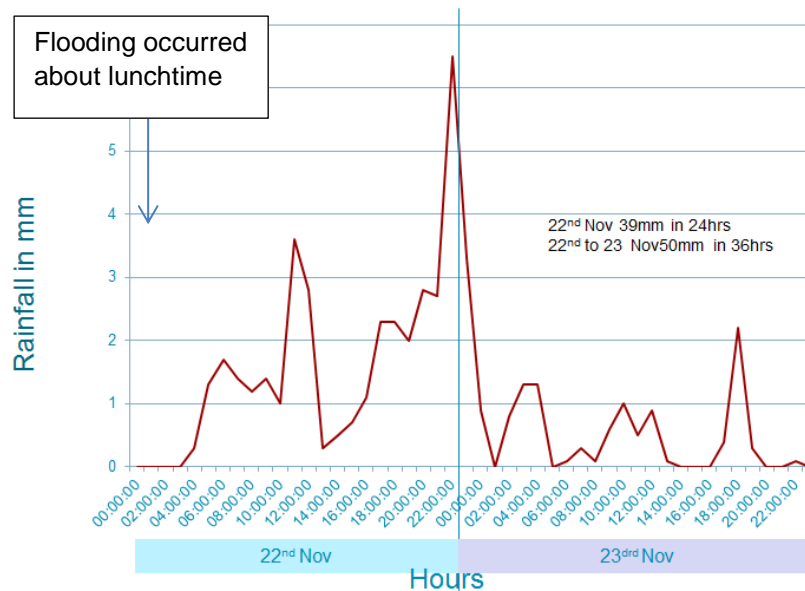


Figure 5: Rainfall totals 22nd to 23rd November 2017

In comparing the rainfall over the 24hr period with then average rainfall for the Carlisle area in November it would appear that over half a **month's** rainfall fell in **24 hours**.

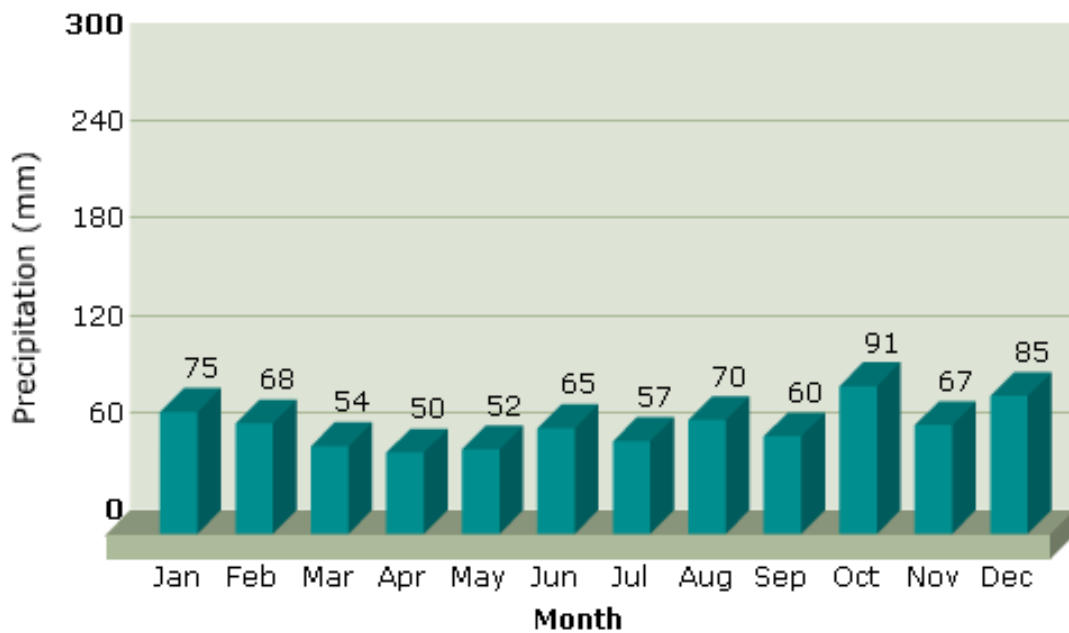


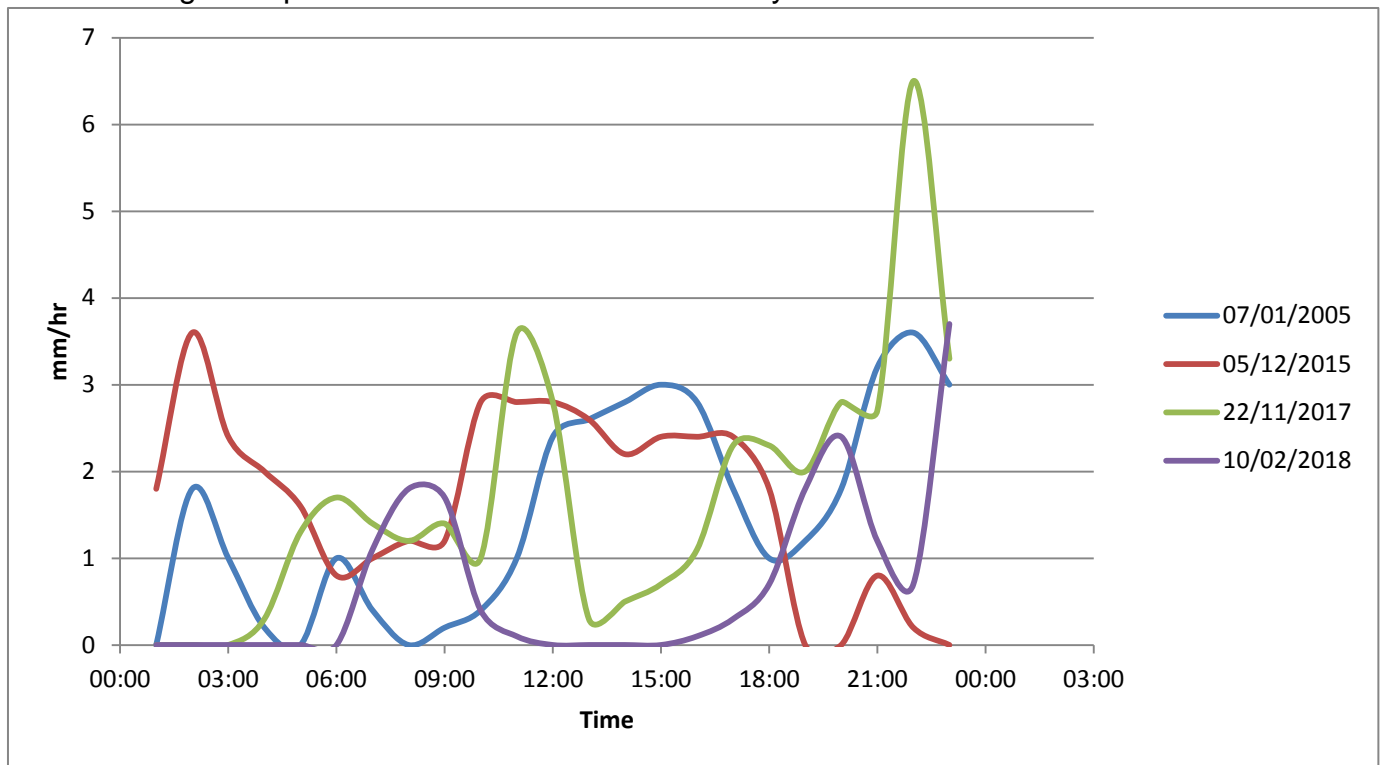
Figure 6: Average annual rainfall for the Carlisle area

This rainfall event was then compared with previous heavy rainfall events of 7th January 2005, 5th December 2015 and the event that occurred on 10 February 2018. It can be seen that similar peak rainfall was recorded for all of the events except for the 6.5mm peak which occurred late on the 22nd November 2017 but much later than the flooding occurred.

On the 10 February 2018 the rainfall peaked at 3.7mm at 23:00 which coincided with the timing of the internal flooding occurring. The overall volume of rainfall was considerably less than the previous 3 flood events in comparison by a minimum of 14mm over the 24 hour period. It is likely that due to the cold weather preceding the event that the soils were still frozen. This resulted in little percolation into the soil strata and the vast volumes of runoff which flooded 3 dwellings. The following graph indicates these events.

Figure 7: Comparison of rainfall events

The following table provides rainfall totals for these days in table 1



Rainfall event	Total rainfall
5/12/2005	30.8mm
5/12/2015	38.8mm
22/11/2017	39.2mm
10/02/2018	16mm

Table1: Comparison of rainfall totals

Map of Flow Routes

The following diagram shows the route of the surface water towards the land drainage system at the rear of Oaklands Drive.

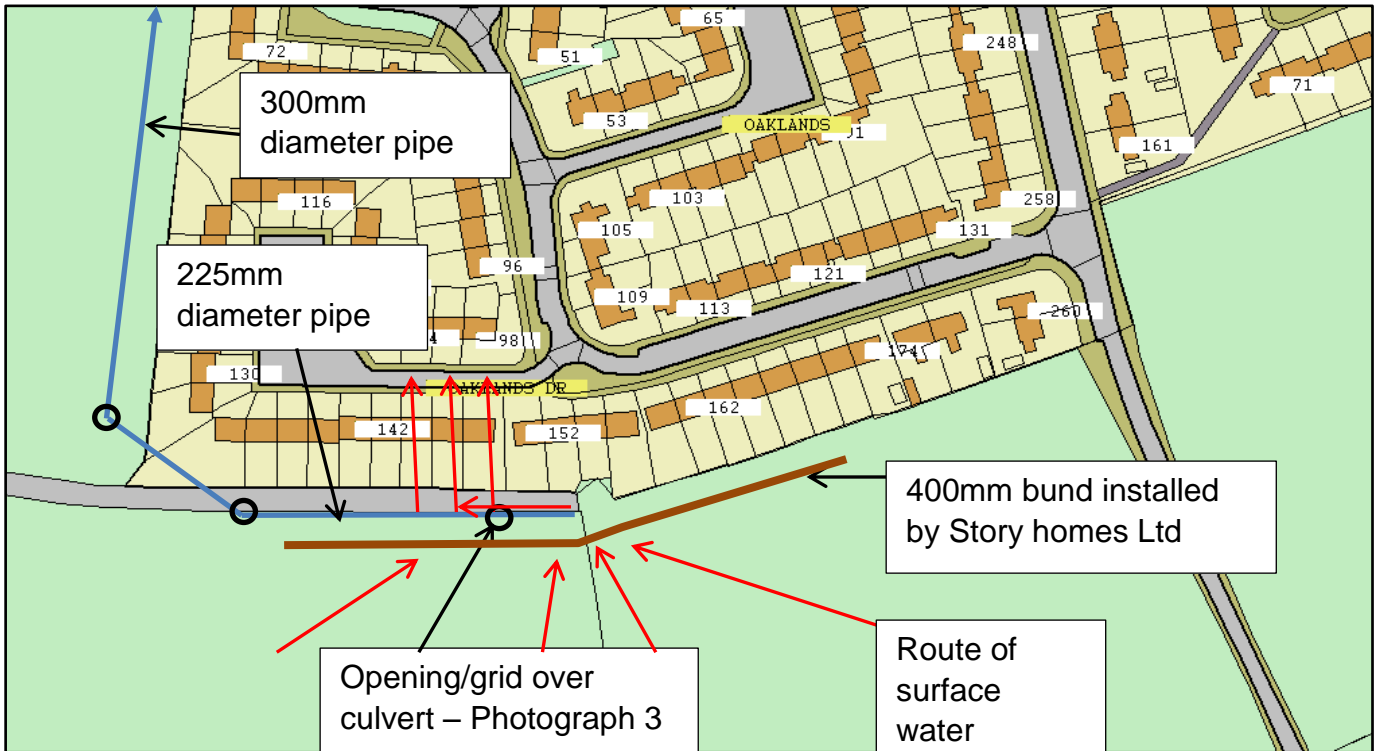


Figure 8: Plan indicating flow routes

The following photographs indicate the area above where the flooding occurred.



Photograph 1: Surface water flowing from field behind houses



Photograph 2: Land Drainage route from fields above

Investigations including CCTV surveys of the land drainage system has identified that the drainage system consists of a series of 225mm, 300mm and 450mm diameter pipes which make up the system. The land drainage system is located along the back of 134-150 Oaklands Drive and then runs through the gardens of 132 & 134 Oaklands Drive before being located in the field behind 130 Oaklands Drive where it then travels to discharge into Wire Mire Beck as shown in figure 8.

As well as the above land drainage system there is also a small overflow from the low area at the rear of the flooded properties which connects into the public surface water sewer within the Oaklands Drive estate. Figure 9 indicates the public sewer within the estate.

Also located in the lane behind Oaklands Drive is an 'overflow' drain which discharges to the public sewer (surface water) in Oaklands Drive. It is unclear when this structure was constructed, whether this was before or after the culvert but unfortunately it flows to the 150mm diameter sewer which during a heavy rainfall event may already be close to its capacity. It is understood that the surface water that flowed through the small overflow in this event overwhelmed the public sewer system that in turn caused surcharging from the public sewer system in other parts of the estate. The overflow is indicated in figure 9 and shown in photograph 3.



Figure 9: Plan of public sewers in Oaklands Drive



Photograph 3: Overflow drain to public sewer

It has been known that the surface water sometimes runs around the first stretch of culvert and falls into the next section through an opening covered by a grid as shown in photograph 4. In normal circumstances this is sufficient to accommodate the surface water flows. However, there are several large trees in the area which can create debris to build up on the grid causing it to block. It is understood that residents do monitor the grid and remove debris as and when required. However, since the start of the new development and construction of the temporary access this has been difficult as the grid has been enclosed within the site barriers



Photograph 4: Grid over culvert

It was observed by some of the residents that the preceding days to the rainfall event of 22nd of November 2017 had been windy and had resulted in heavy leaf fall from the trees in the area.

It is understood that during the event on 22nd November that the large volume of leaf fall was a contributing factor to the blockage of the grid.

During the flood event on 24th September 2012 residents have confirmed that a member of the public had entered the flood water and removed the grid which allowed the flood water to flow away from the area.

A CCTV survey of the land drainage system was undertaken by Cumbria County Council on the 14th December 2017 and the results of this indicated that some sections of the drain are in poor condition. These will need to be appropriately addressed either by repairing them or diverting the culvert.

Image of the flooding

The following photograph shows the flood water flowing from the front door of the property. The flood water had entered at the rear of the property.



Photograph 5: Image of flooding shared on social media

New Housing Development/Planning Permission

In 2012 Story Homes applied for planning permission (Application reference 12/0793) to construct 318 dwellings on the land bounded by Hammonds Pond, Oaklands Drive and Durdar Road with permission being granted subject to various conditions. The development also proposes to include properties being constructed at the rear of some of the flooded properties, however, the construction of these houses have not yet been started.

Due to the size of the development the construction is phased to be carried out over several years with construction starting in 2016 and the final phase 3 section starting in the latter part of 2018.

A further application for a temporary access under planning permission 17/0400 was granted planning permission in August 2017. This was to provide a temporary access to the site from Scalegate Road and runs along the rear boundary of some of the flooded properties.

Proposed New School

It is also known that it is proposed that the site for the new Newman School is to be located on land above Oaklands Drive as indicated within the following plan.



Figure 10: Location of proposed new school site

It is anticipated that the drainage design for the new school will also help to reduce the risk of flooding as attenuation of rainfall and surface water can be incorporated on the site.

Likely Causes of Flooding

22nd November 2017

During the investigations following the event on 22nd November 2017 it was identified that a restriction was located within the culvert that runs through some of the gardens. This restriction was caused due to a previous repair on the land drain. However, comparing the rainfall data from the December 2015 event and the November 2017 event it is unclear if this restriction was the cause of the flooding. However, further information has been provided which suggests that the pipe upstream of the restriction is starting to cause subsidence in the gardens.

It was, however, identified that a section of the culvert at the upstream end was heavily silted and during the cleaning works on the 14th December 2017 a soft toy was removed from the drainage system. However, this had been partially blocked in previous years and any excess surface water by passed this section of culvert and flowed into an open grid downstream as demonstrated in the following diagram.

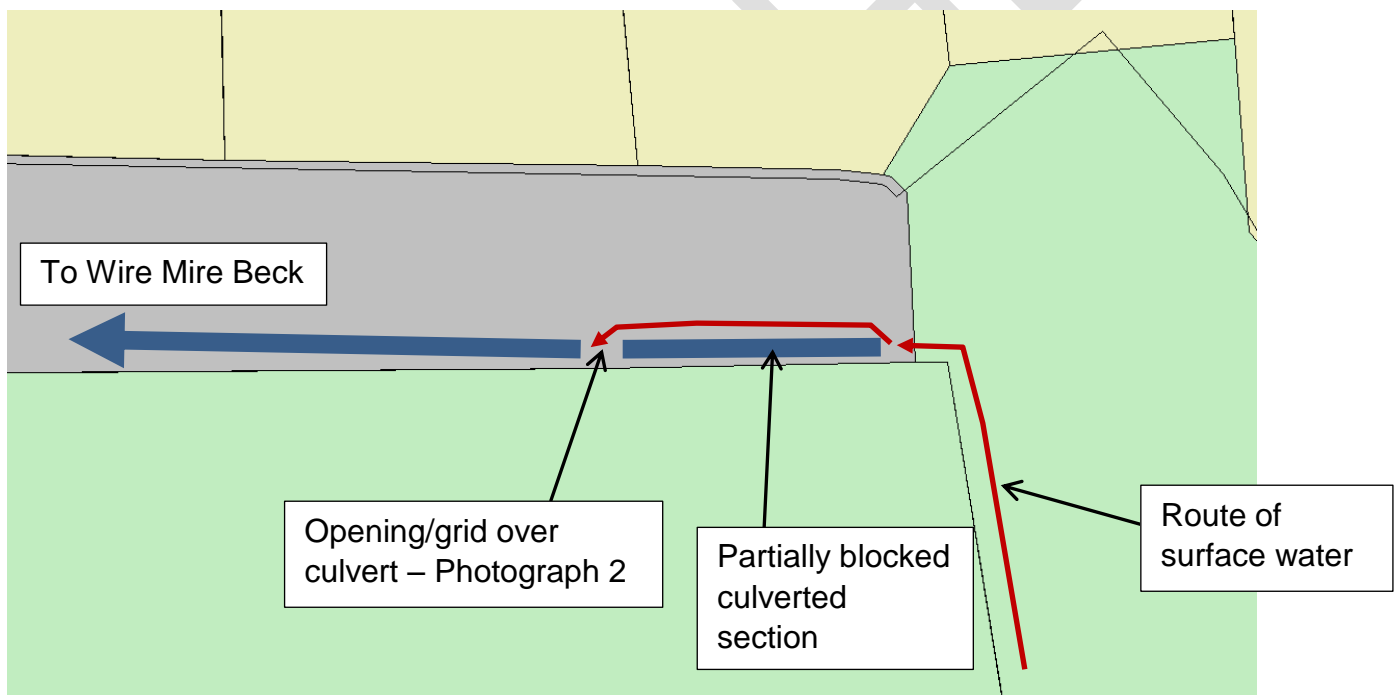


Figure 11: Plan indicating how culvert blockage is affecting flow

When clear it appears that the drainage system is sufficient to carry surface water away from the site, under normal rainfall conditions, however, when blocked it has been known to cause drainage problems and on occasion flood properties. It has been a long standing concern that the ownership of this culvert has been unknown and therefore clearance of the grid was generally carried out by the affected residents. However, with the start of the new housing development the area around the grid was fenced off and the residents were unable to clear the grid.

From the investigations carried out it is concluded that the cause of the flooding was that surface water was unable to enter the culvert due to partial blockage of the culvert inlet and

recent leaf fall and vegetation blocking the grid combined with insufficient capacity of the drainage network also a contributory factor in all flood events.

10th February 2018

The flooding which occurred on 10th February 2018 was following the CCTV survey by Cumbria County Council (14/12/17) when blockages from the soft toy and leaves had been removed. Improvement works had also been carried out to the bund along the temporary access track. Observations during and shortly after the event suggested that surface water has gathered behind the bund but had then breached and overtopped the bund. This had then overwhelmed the existing drainage system (drainage system indicated in figures 8 & 11). The breach appeared to have occurred where a section of the bund had been stoned up to allow slow seepage of flow from the bunded area. The following photographs were taken on the 14th February 2018.



Photograph 6: Bund along new access track



Photographs 7 & 8: Runoff of surface water from the bund in the grid on the drainage system

Flooding History

Flooding events have occurred in this location previously as follows:

- 8 January 2005 (no internal flooding – lane and gardens) flooding caused by a collapse on the culvert downstream. Collapse repaired by owner.
- 11 October 2005 – anecdotal evidence that 2 properties were flooded internally from surface water runoff from the rear of their properties.
- 7 December 2006 – flooding of nearby properties occurred understood to be caused by surface water from the culvert which was exacerbated by a blockage on the public surface water sewer.
- 24 September 2012 – three properties flooded internally which is understood to be caused by a blockage within the drainage culvert behind Oaklands Drive. Again this was from surface water runoff being unable to enter the culvert behind the properties.

Recommended Actions

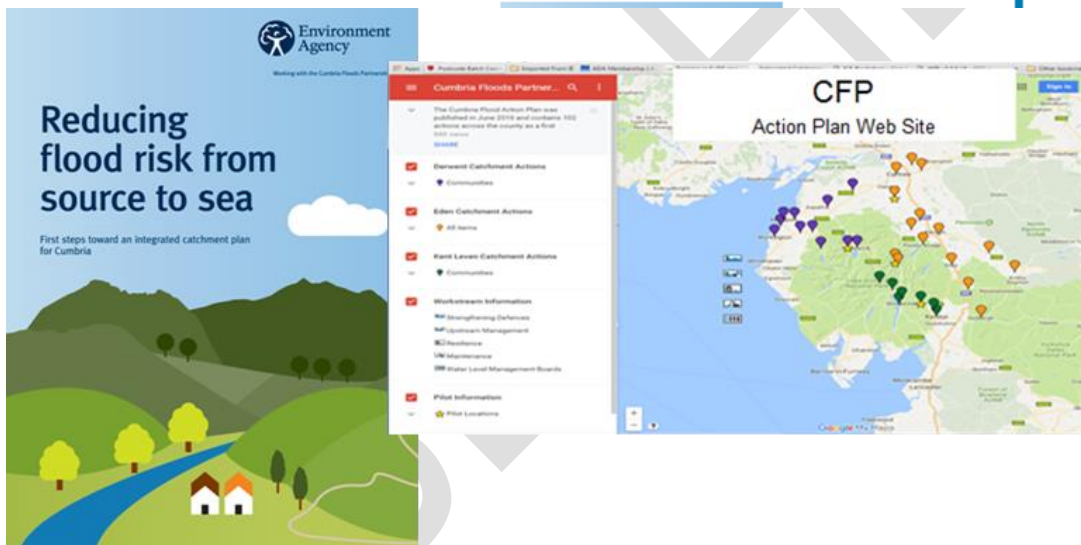
Cumbria Flood Partnership Themes:	Action by:	Recommended Action:	Timescale:
Community resilience	Developer (short term)	Ensure works are carried out by Story Homes that reduce the risk of flooding during the development work (bundling and monitoring)	Completed bund in December 2017 and monitoring ongoing
	Residents (short term)	Report any flooding incidents to Cumbria County Council	Ongoing
	CCC LLFA / LPA (short term)	Ensure developers (Story Homes and Newman School) in the area manage surface water on site so that flood risk to neighbouring properties is not increased as a result of the development.	Ongoing
	Residents / Riverside Housing (short term)	Consider Installation of property level protection	Timescale to suit individual residents
	Riverside / UU (short term / long term)	Drain to be repaired outside of 100 / 102 Oaklands Drive to improve conveyance of surface water – long term maintenance by UU.	Repair completed by Riverside February 2018.
	Story Homes (short term)	Pump on site which is to be used to prevent surface water building up behind Oaklands Drive	Until the permanent solution to flooding issues on site are completed
Upstream Management	LLFA/Story Homes/ LPA/UU (medium term)	Installation of a scheme to reduce surface water flows from fields to the south of Oaklands Drive with runoff attenuation features, such as cut-off ditches, and associated drainage.	Ongoing – preliminary design complete. Installation as soon as detailed design agreed and proposal consented – planned for 2018.
Maintenance	Residents / Developer (short term)	Check screen regularly	Ongoing
	Developer (medium term)	Remove trees behind properties at Oaklands Drive	Before Autumn 2018

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 help demonstrate how the two partnerships have now come together:

Cumbria Flood Partnership



NEW Cumbria Strategic Flood Partnership



Defra 25 Year Environment Plan Cumbria Flood Action Plan Local Flood Risk Management Strategy

<p>2016 – Cumbria Pioneer</p> <p>DEFRA 25 Year Environment Plan and vision New and innovative ways of working Making best use of resources Working at Catchment scale through engagement and commitment Place based decision making within DEFRA vision Lead – Jez Westgarth, Environment Agency</p>	<p>January 2016 - Cumbria Flood Partnership</p> <p>Created following December 2015 floods Local knowledge and expertise Integrated catchment management Community focus 25 year Cumbria Flood Action Plan Lead– Rory Stewart MP, Environment Agency and 3 Catchment Directors</p>	<p>2013 – LLFA Cumbria Strategic Partnership</p> <p>Flood and Water Management Act (2010) Professional partnership providing strategic leadership for flood risk management Reporting to RFCC Coordination and cooperation between Risk Management Authorities (RMA's) Lead – CCC as LLFA</p>
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Communities



Communities working together across Cumbria

Appendices

Appendix 1: Glossary

Acronyms

EA	Environment Agency
CCC	Cumbria County Council
UU	United Utilities
LLFA	Lead Local Flood Authority
LFRM	Local Flood Risk Management
MSfWG	Making Space for Water Group
FAG	Flood Action Group
FWMA	Flood and Water Management Act 2010
LDA	Land Drainage Act 1991
WRA	Water Resources Act 1991

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

The Flood Risk Regulations 1999 and the Flood and Water Management Act 2010 (the Act) have established Cumbria County Council (CCC) as the Lead Local Flood Authority (LLFA) for Cumbria. This has placed various responsibilities on CCC including Section 19 of the Act which states:

Section 19

- (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.

A 'Risk Management Authority' (RMA) means:

- (a) the Environment Agency,
- (b) a lead local flood authority,
- (c) a district council for an area for which there is no unitary authority,
- (d) an internal drainage board,
- (e) a water company, and
- (f) a highway authority.

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					
The 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 Cumbria County Council's work relating to flood risk.

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

Lead Local Flood Authorities (LLFAs) – 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 risk management authority 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 risk management authorities 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.

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 responsible for a larger number of sewers than prior to the regulation.

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.

Flood risk in Cumbria is managed through the Making Space for Water process which involves the cooperation 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 MSfWGs meet approximately 4 times per year to cooperate and work together to improve the flood risk in the vulnerable areas identified in this report by completing the recommended actions. CCC as LLFA 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 or a partners own capital investment process.

Flood Action Groups are usually formed by local residents who wish to work together to resolve flooding in their area. The FAGs are often supported by either CCC or the EA and provide a useful mechanism for residents to forward information to the MSfWG.

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Appendix 3: Useful contacts and links

Cumbria County Council (Local Flood Risk Management):
lfrm@cumbria.gov.uk, www.cumbria.gov.uk, tel: 01228 221330

Cumbria County Council (Highways):
highways@cumbria.gov.uk, www.cumbria.gov.uk, tel: 03003032992
Out of hours emergencies should be reported via the Police on 101

Insert Neighbourhood forum contact details

United Utilities: www.unitedutilities.com, tel: 0345 672 3723

Carlisle City Council: tel: 01228 817000

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>

Highways Act 1980:
<http://www.legislation.gov.uk/all?title=highways%20act>

EA – ‘Living on the Edge’ a guide to the rights and responsibilities of riverside occupation:
<http://www.environment-agency.gov.uk/homeandleisure/floods/31626.aspx>

EA – ‘Prepare your property for flooding’ how to reduce flood damage including flood protection products and services:
<http://www.environment-agency.gov.uk/homeandleisure/floods/31644.aspx>

Appendix 4: Summary of comments received following issue of draft report

Comments made	LLFA Response
Residents stated that due to the windy weather the day before the flooding the leaf fall from the trees at the rear of the properties had fallen onto the grid and caused a blockage of the grid.	These details have been updated within the report. Action included in the report to remove the trees.
The draft report mentions culvert blocked by leaves and restrictions in drainage system but there are no clear actions in the report	Actions now included within the report to address the leaf fall and restrictions.
The draft report states that a previous repair to the culvert, with a pipe diameter less than the existing pipe, is not a contributory cause, as there was no flooding in 2015, yet since then residents will tell you that the ground in the adjacent garden has sunk, indicating a problem caused by water backing up at the restricted junction.	The LLFA have reconsidered this information and amended the report accordingly.
With regard to the second event on 10 th February 2018 it was observed by residents that the bund erected by Story Homes was breeched as well as overtopped.	The report has been amended to reflect this.
It had been observed that the breach in the bund erected by Story Homes had been filled with stones to try to control the flow but when the second event occurred the stones were washed out and water then discharged into the gardens causing flooding.	The report has been amended to reflect this.
The pump that was in place over Christmas holidays should be reinstalled until a permanent solution is in place.	This has been considered as an action.

Translation services

If you require this document in another format (e.g. CD, audio cassette, Braille or large type) or in another language, please telephone 01228 606060.

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