

# Storm Desmond Flood

## December 2015

Image: Cumbria County Council



Image: Environment Agency



# What was Storm Desmond?

- Storm Desmond was the 4<sup>th</sup> named storm to affect the UK and Ireland during the winter of 2015/16.
- The storm brought a period of prolonged and intense rainfall to Northern England.
- Falling on already saturated ground, the storm resulted in widespread flooding across the region.

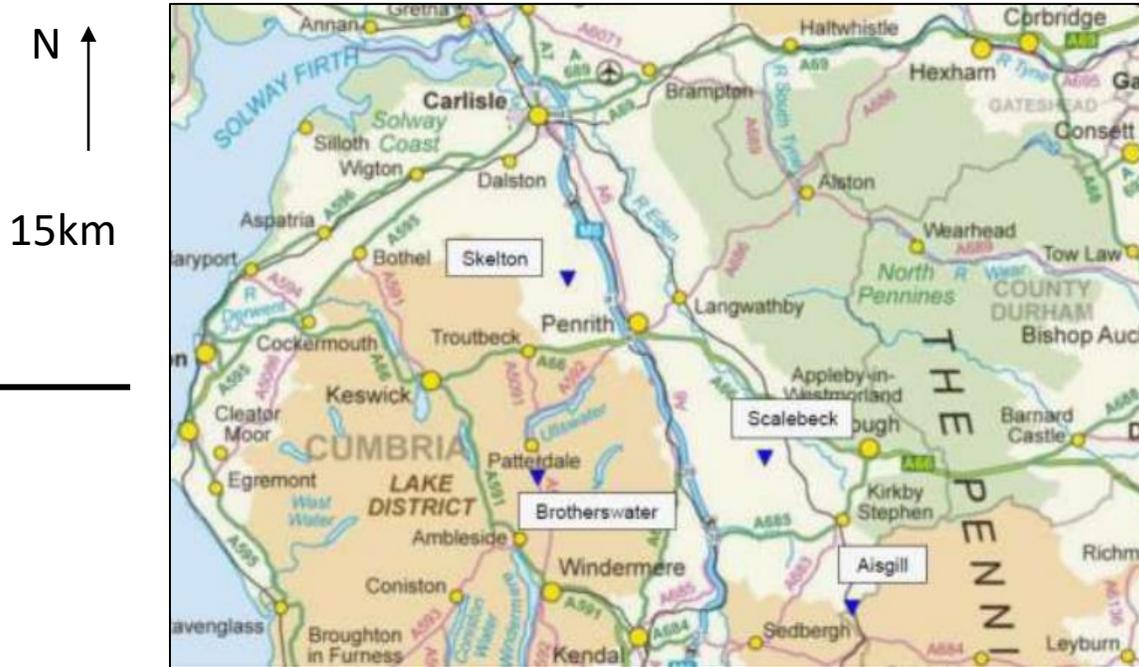


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Click the link to view a Met Office video showing the track of Storm Desmond

<https://www.metoffice.gov.uk/weather/warnings-and-advice/uk-storm-centre/storm-desmond>

# Broken rainfall records



- December 2015 was the wettest month on record in the UK. It followed a very wet November.
- Between the 4<sup>th</sup> and 7<sup>th</sup> December, Cumbria recorded record rainfall totals for both 24-hour and 48-hour periods.

	24 hour Rainfall during November 2009 Event		24 hour Rainfall during December 2015 Event	
	mm	mm	mm	Estimated AEP
Scalebeck	60.8	147.6	0.2% to 0.1%	
Skelton	42.2	137.8	<0.1%	
Brotherswater	200.8	293.4	<0.1%	
Aisgil	61.2	105.7	20% to 5%	

	Previous record November 2009		Current Record December 2015	
	Location	mm	Location	mm
24 hour rainfall	Seathwaite	316.4	Honister Pass	341.4
48 hour rainfall	Seathwaite	395.6	Thirlmere	405

Annual Exceedance Probability (AEP) – see next slide

Source: [Cumbria County Council](http://www.cumbria.gov.uk)

# Annual Exceedance Probability (AEP)

- The Annual Exceedance Probability (AEP) describes the likelihood of a specified flow of water being exceeded in a given year.
- An event likely to occur once every 10 years has an AEP of 0.1 (or 10%). A more serious event (once in 100 years) will have an AEP of 0.01 (1%).
- The 2015 event at Low Crosby was estimated to be an AEP of 0.006 (0.6%) . . . a magnitude of once in 167 years!

AEP (as percent)	AEP (as probability)
50%	0.5
20%	0.2
10%	0.1
4%	0.04
2%	0.02
1%	0.01
0.1%	0.001

Source: [Cumbria County Council](#)

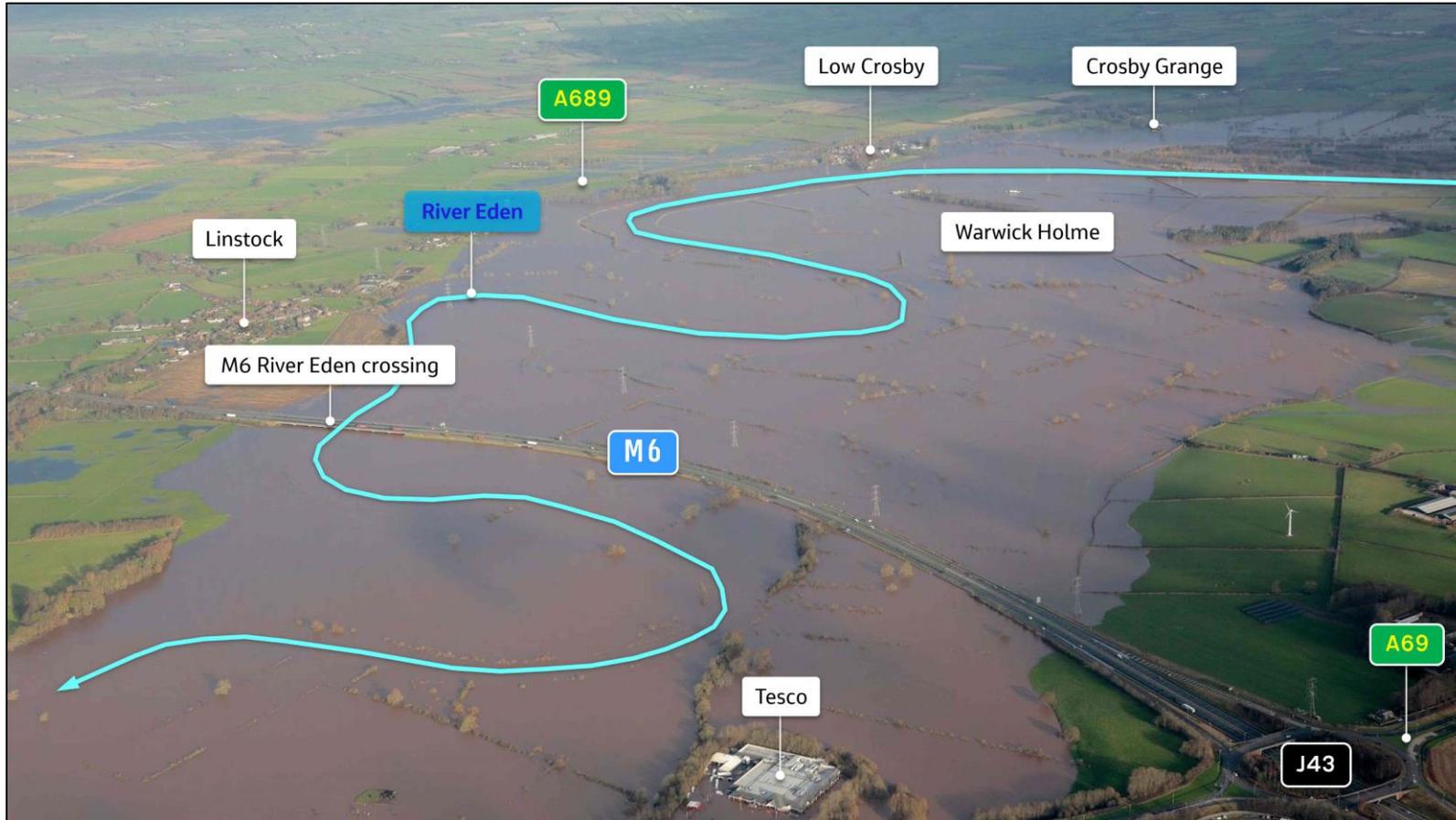
# What were the impacts of Storm Desmond?



Source: Environment Agency

- The flooding at Low Crosby on the 5<sup>th</sup> and 6<sup>th</sup> December 2015 as a result of Storm Desmond, was unprecedented.
- The flow of the River Eden towards Carlisle on the 6<sup>th</sup> December was the highest ever.
- Flood levels reached 0.6m higher than the previous record set in January 2005.

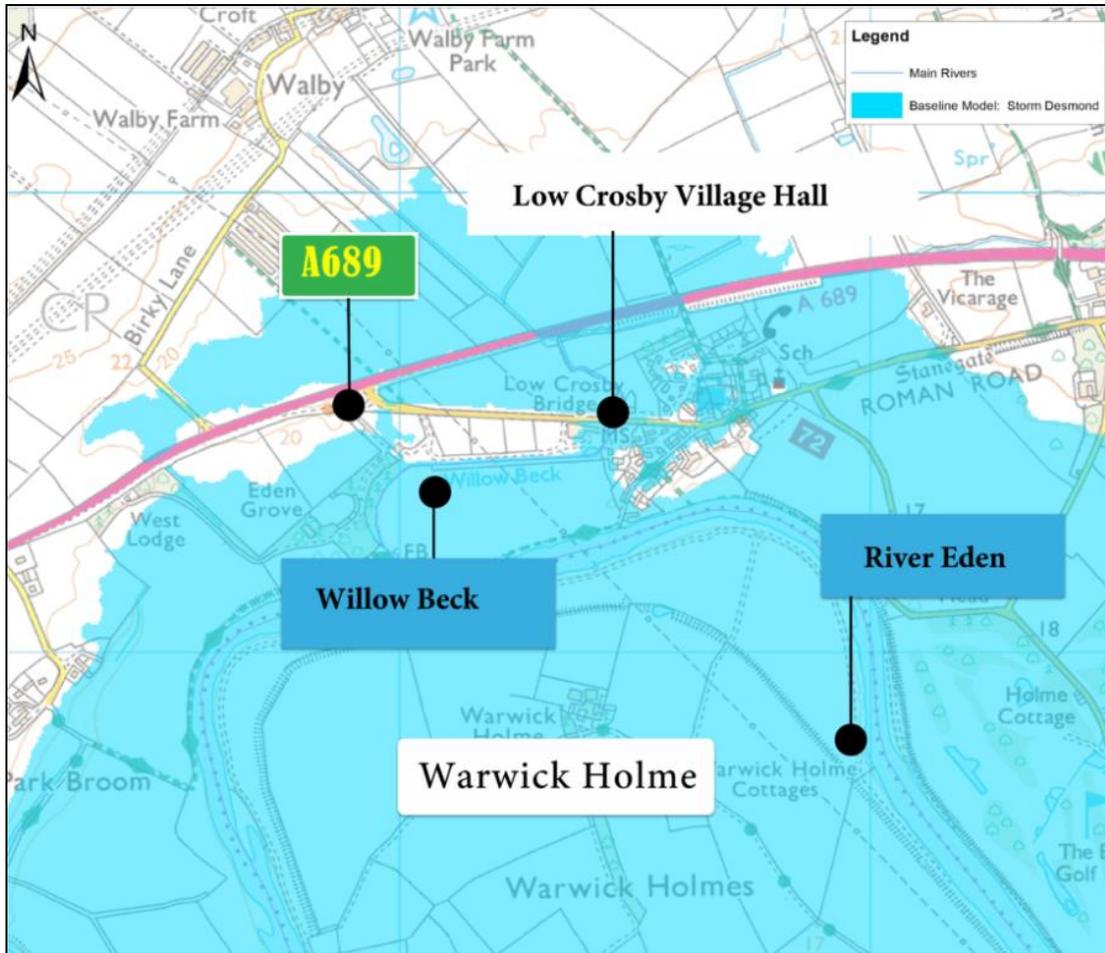
# Flooding of the Eden Valley, 2015



Source: Environment Agency

This aerial photo shows the extensive flooding of the River Eden valley. The blue line shows the normal course of the river. Locate Low Crosby – notice that it is surrounded by water.

# Flood extent at Low Crosby, 2015



- This map shows the maximum extent of flooding at Low Crosby in 2015.
- Locate the course of the River Eden and Willow Beck.
- As the River Eden rose, it flowed up the course of the Willow Beck entering the western side of the village.
- Additionally, the Willow Beck was unable to discharge water into the River Eden.

# What were the effects of flooding at Low Crosby?



Source: [Cumbria County Council](#)

- Approximately 60 properties experienced internal flooding.
- Nearby rural properties were also flooded (e.g. Warwick Holmes and Newby Grange).
- Large areas of agricultural land were flooded, for example, at Warwick Holmes.
- Sections of road became impassable including the A689.

# What were the existing flood defences?

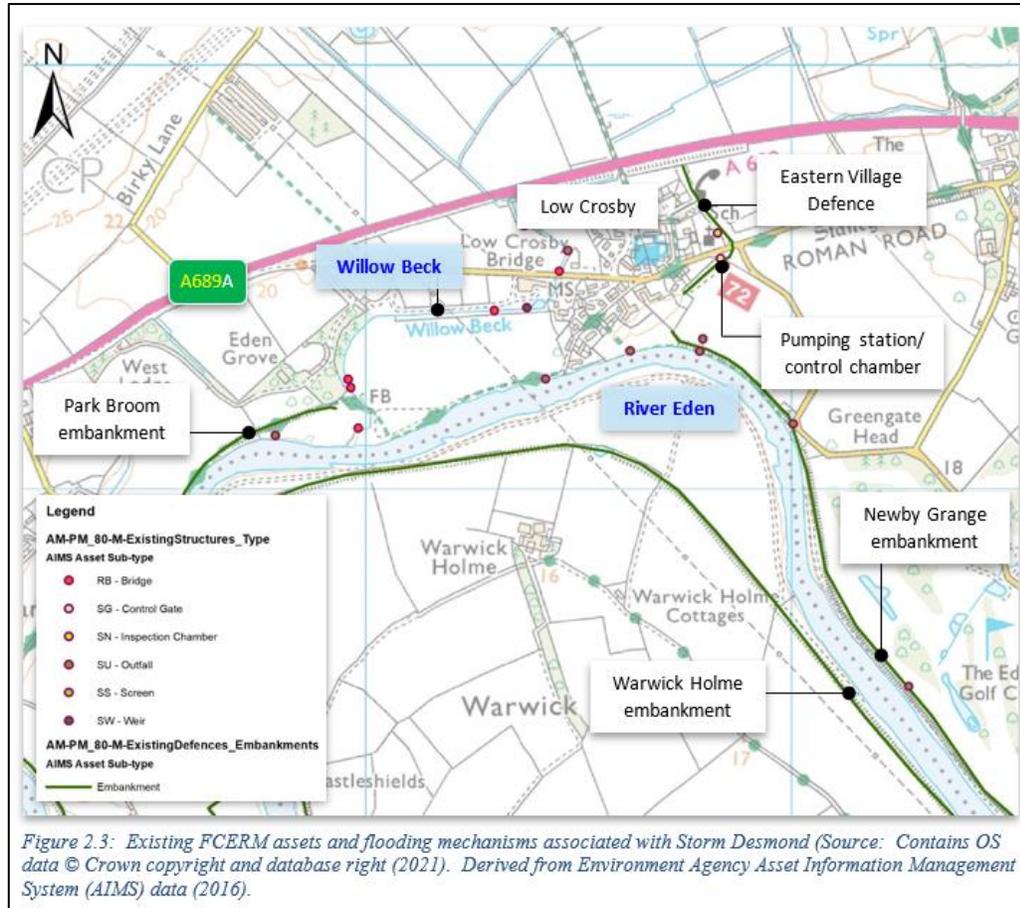


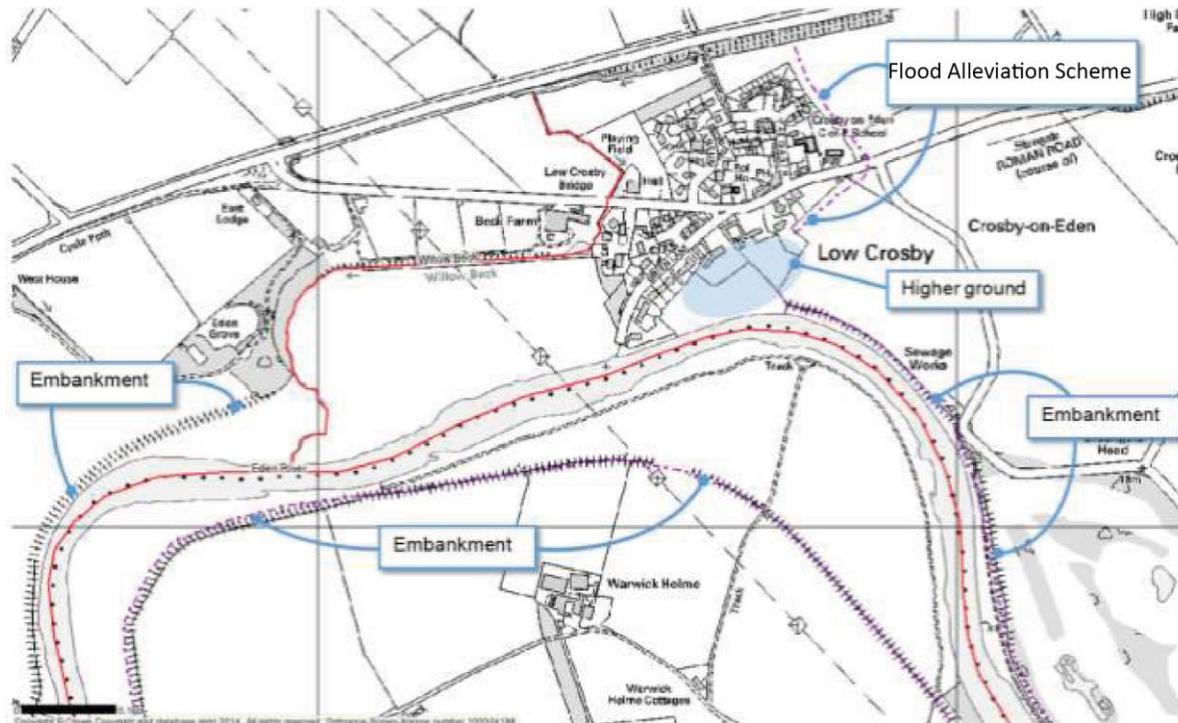
Figure 2.3: Existing FCERM assets and flooding mechanisms associated with Storm Desmond (Source: Contains OS data © Crown copyright and database right (2021). Derived from Environment Agency Asset Information Management System (AIMS) data (2016).

Source: Environment Agency

1 km

- In 2009-11, the Eastern village defence embankment was completed. This was in response to the flooding in 2005. The cost of the embankment was around £830,000.
- At the time, a cost-benefit analysis did not favour additional defences for the village.
- Elsewhere, long standing embankments at Park Broom, Warwick Holme and Newby Grange offered some protection.

# Eastern village defence embankment

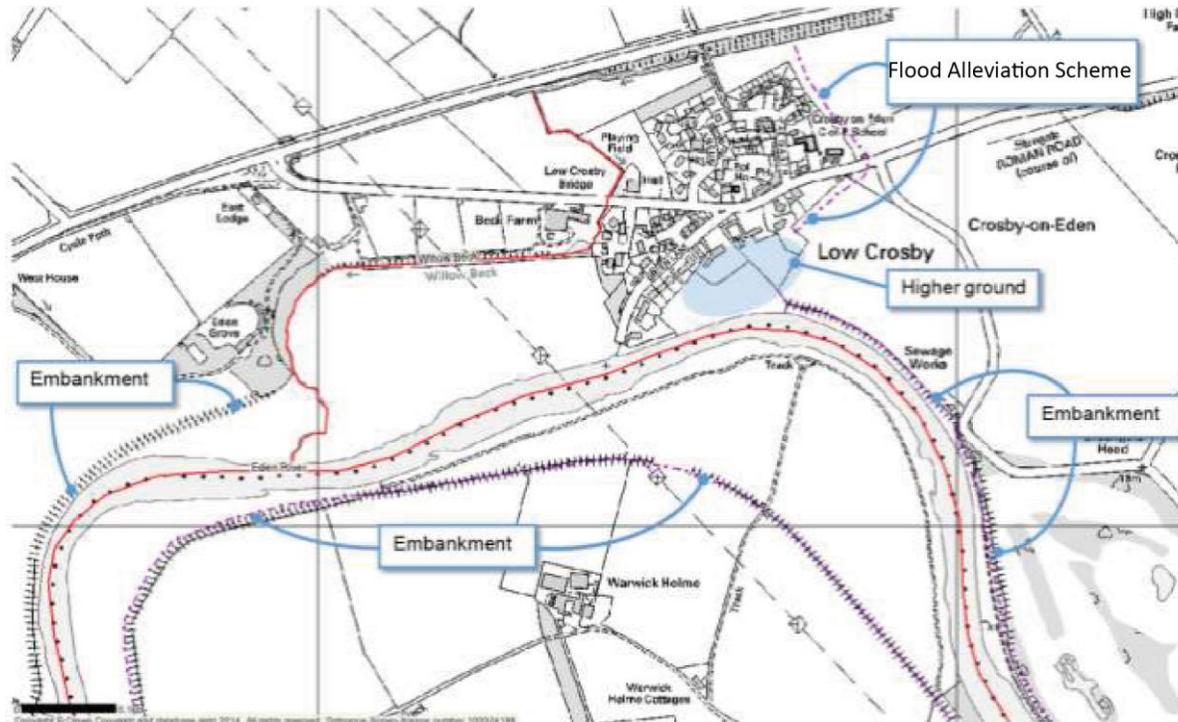


Source: Environment Agency

1 km

- The flood embankment to the east of Low Crosby was constructed in 2009-11. The 380m raised embankment is typically 1.5m high.
- The defence includes an area of raised road and a chamber to accommodate a water pump.
- The scheme ties in with raised ground to the south (see map) and the A689 road embankment to the north.
- The scheme was designed to provide protection from a flood event up to 1% AEP (1 in 100 year event).

# Additional defence embankments



Source: Environment Agency

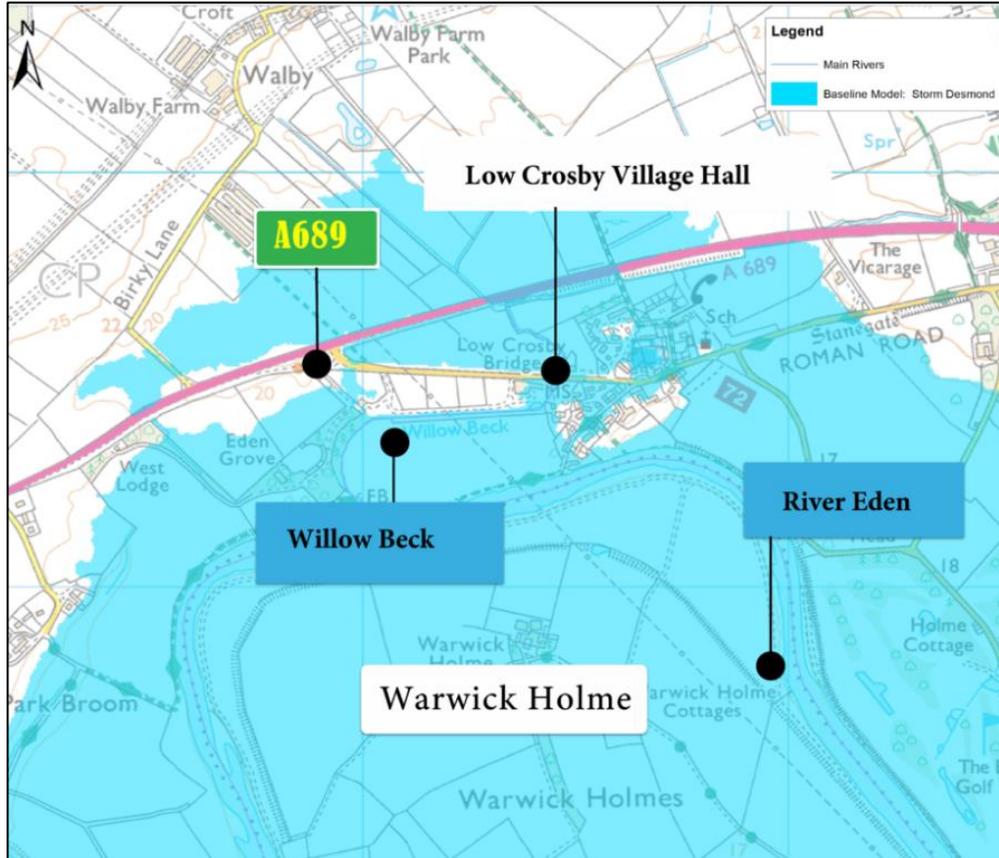
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There are three lengths of long standing embankments:

1. North-bank embankment upstream of Low Crosby offers some protection to a golf course and scattered houses (10% AEP).
2. South-bank Warwick Holmes embankment helps to protect farmland and some farm properties.
3. North-bank embankment downstream of Low Crosby provides low level protection to Hadrian's Wall Footpath.

# How did the existing defences cope in 2015?

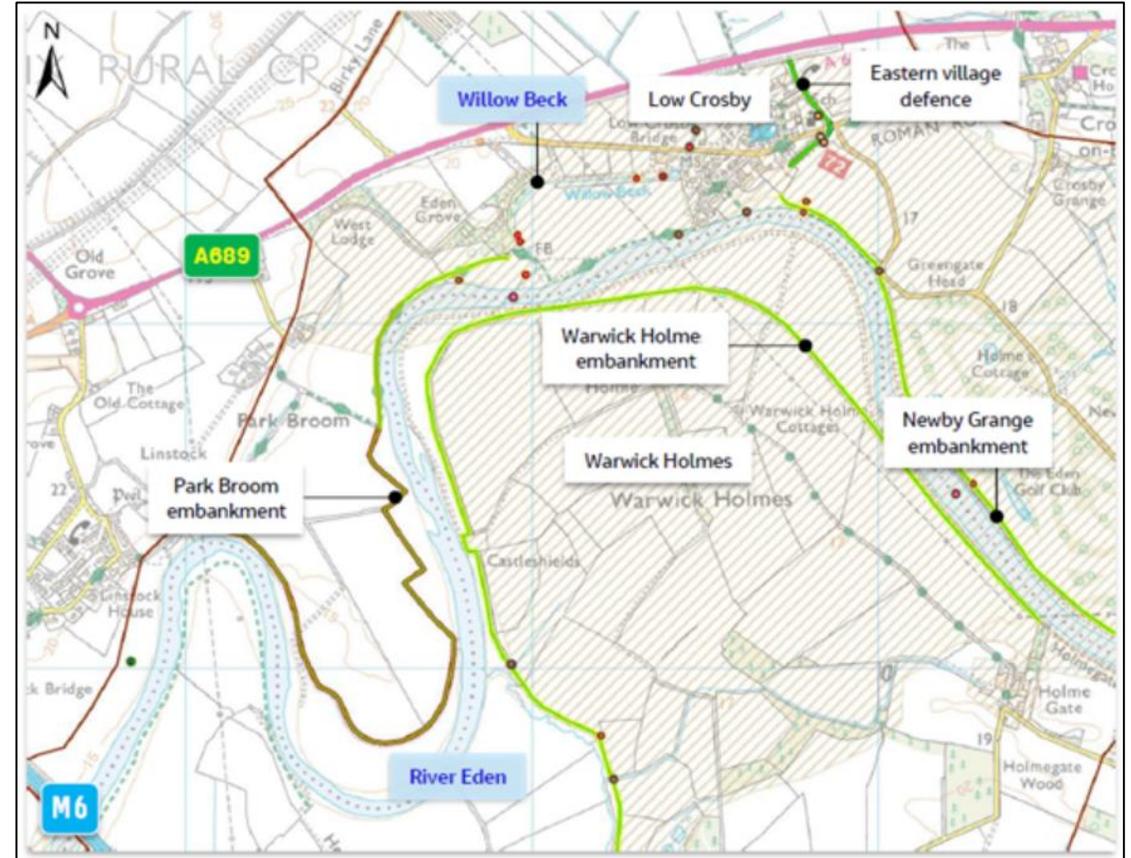
## Extent of flooding (2015)



Source: Environment Agency

1 km

## Existing flood defences



Source: Environment Agency

1 km

# Did the flood defences fail?



Source: Environment Agency

- The existing flood embankments were overtopped by the 2015 flood.
- The 2009-11 Eastern village defence was constructed to protect against a 1% AEP event. The 2015 was a rarer (0.6%) event of higher magnitude.
- The lack of western defences exposed the weakness of the existing flood defences, with water entering the village from the west via Willow Beck.
- Existing defences did not ‘fail’; they were not constructed to protect against such a rare event.

# What lessons were learnt?



Source: Environment Agency

- The level of flood protection of 1% AEP (1 in 100 years) may not be enough in some locations as climate change causes more extreme weather events.
- Alternative measures of flood defence – such as flood storage and natural flood management – may need to be considered alongside hard engineering options such as embankments.