

Flood Investigation Report

Sleights



Revision Schedule

Revision	Date	Details	Author	Checker
A		Version 1		
B		Version 2		
C		Version 3		

Reviewer Record

Revision	Date	Reviewer	Organisation	Sign off
A			NYCC	
B			NYCC	
C			NYCC	

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Records of the public sewer system included are a facsimile of the statutory record provided by Yorkshire Water Services Ltd. For the purposes of this report minor sewers and other non-relevant data have been omitted from the plans for clarity.

Purpose

This document has been prepared specifically for the purpose of meeting the requirements of Section 19 of the Flood and Water Management Act 2010.

The purpose of this report is to investigate which RMAs had relevant flood risk management functions during the flooding incident, and whether the relevant RMAs have exercised, or propose to exercise, their risk management functions (as per section 19(1) of the Flood and Water Management Act 2010). It does not address wider issues beyond that remit, nor include recommendations for future actions.

The supporting data has been put together based on records of internal property flooding and road closure information from a variety of sources. While every effort has been made to verify the locations of the Section 19s identified, the nature of the data and the methods used to collate this information mean that it does not include every occurrence of flooding. This data only identifies where flooding has been reported and is indicative only.

Acknowledgements

We would like to thank the following for their cooperation and assistance in this investigation:

North Yorkshire County Council Highways Department

The Environment Agency

Yorkshire Water

Scarborough Borough Council

Dates of Inspections

22nd of November 2016

15th of December 2016

11th July 2017

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1 Executive Summary

On the 21st of November 2016 widespread and substantial rainfall fell over North Yorkshire, with localised storm conditions persisting particularly in the east of the county during the evening. Whilst high rainfall was experienced, the volumes were not particularly remarkable compared to typical November records.

As a result of the rainfall, surface water originating from the moors above Sleights, conveyed down Blue Bank which lies above the village, and through the settlement. Approximately 8 homes were flooded. This is not something that has previously historically occurred or would be expected to happen given the volume of rainfall experienced.

The volume of water conveying down Blue Bank was sufficient to remove the content of the arrestor bed which runs parallel to the highway for much of the descent, and approximately 600 tonnes of material were consequently deposited on the Bank, causing deep channels of surface water, which made it impossible to safely remove those trapped in vehicles on the bank and left people stranded whilst the water subsided.

Thankfully, no one was hurt during the incident, but there was nevertheless a clear risk to the public during the event.

The A169, a primary arterial route into Whitby was closed for 5 days to permit the materials to be removed from site, to clear drains and to replace the content of the arrestor bed. It was also necessary for material to be cleared from private land and gardens.

The flooding mechanisms associated with the flood event are;

- Surface water from the moor could not pass under the highway above Blue Bank due to obstructed and damaged culverts along the A169
- The water then tracked down the A169 into Sleights, instead of entering Iburndale Beck towards the east of the village
- The force of the water caused the material in the arrestor bed to become mobile, which was swept through the village
- Arrestor bed material blocked highway gullies and land drains meaning water could not escape from the highway. This caused property flooding in the village.
- There was a reported surge of water in Iburndale Beck, which was perhaps attributable to surface water joining the beck further downstream with increased velocity, causing property flooding and damage to the watercourse in Iburndale and in the south of Sleights.

This report finds that the volume of water which conveyed down Blue Bank was as a direct result of damage and obstruction to a series of culverts along the moor above Blue Bank, resulting from inadequacies in utility work that had been undertaken in the months prior to the event.

The culverts are designed to take surface water run-off to Little Beck, on an overland route which crosses the moor and avoids the village. There have been no historic accounts of their failure to convey water on this path.

The utility company have agreed in principle to pay the clear-up costs incurred by the County Council and the damage to the series of culverts. The individual affected property owners have been invited by the company to claim for property damage and recovery.

The culverts will be added to the Flood Risk Asset Register, following the Section 19 investigation, due to their significant impact upon the flooding events in Sleights. The Local Highways Office has added the culverts to its inspection schedules, to ensure they remain well maintained in the future.

In addition, and as a precautionary measure, NYCC as highway authority has undertaken improvements to its kerb alignment, at strategic points on the A169 to permit the free flow of any excessive highway surface water away from Blue Bank, and intends to increase the capacity of the drainage crossing under the highway through the installation of two additional culverts.

As the flooding was an isolated incident with established causes which have been rectified, there is no further action identified by the report.

This report has identified the actions and responses of the Risk Management Authorities which have responsibilities during a flood event in the Sleights area. It is understood that all Risk Management Authorities have undertaken appropriate action.

2 Introduction

2.1 Flood and Water Management Act (2010)

In his review of the summer 2007 floods, Sir Michael Pitt recommended that local authorities should be given a duty to investigate flooding.

The Flood and Water Management Act 2010 (FWMA), defines the roles and responsibilities of 'Risk Management Authorities' and designates the unitary or upper tier authority for an area as Lead Local Flood Authority (LLFA).

The LLFA has responsibility for leading and co-ordinating local flood risk management. Local flood risk is defined as the risk of flooding from surface water runoff, groundwater and small ditches and watercourses (collectively known as ordinary watercourses). The responsibility to lead and co-ordinate the management of tidal and fluvial flood risk remains that of the Environment Agency (EA).

The Act also implements the recommendations made by Sir Michael Pitt that local authorities should have a duty to investigate flooding from all sources.

2.2 Section 19 Investigation Requirement

North Yorkshire County Council (NYCC), as LLFA, has a responsibility under Section 19 of the FWMA to investigate significant flood incidents in its area. Section 19 States:

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.*

Section 14 of the FWMA grants the LLFA power to request information associated with its functions. These powers have been exercised in the preparation of this report.

2.3 Trigger for Section 19 Report

The incident has been assessed in line with the criteria set out in Section 3 of the North Yorkshire County Council Local Flood Risk Strategy (2015) and has been judged to warrant a formal Section 19 investigation on the basis of:

- Number of properties internally flooded
- The depth, area or velocity of flooding reported
- The nature and extent of critical infrastructure impacted by the flood

2.4 Location

Sleights is situated in the Borough of Scarborough in North Yorkshire and is home to approximately 1,900 residents. Sleights contains residential and commercial properties as well as a Primary School.

Sleights rests between the River Esk, which meanders to the north of the village, and Iburndale Beck which joins the Esk to the north east of Sleights, in the smaller village of Briggswath.

Blue Bank is part of the A169 which runs between Whitby and Pickering, Sleights is located immediately north of Blue Bank, residential properties are situated at the bottom of the Bank, as its gradient shallows, SE 486590 506749.

Sleights moor at the crest of Blue Bank is drained by a series of land drains, which sit between the hill peak at the A169 junction with Fairhead and Blue Bank. The land drains outfall into Littlebeck, which meanders to the immediate east of Sleights, becoming Iburndale Beck, before it reaches the Esk. The water from the moorland is therefore designed to reach the River Esk without travelling through Sleights village.

There are therefore a series of approximately 22 culverts under the A169 running perpendicular to the highway, at the point where the land drains cross beneath the carriageway.

In addition there is a large highway drain which runs adjacent to the A169 on the western side, which allows highway surface water to access these culverts.

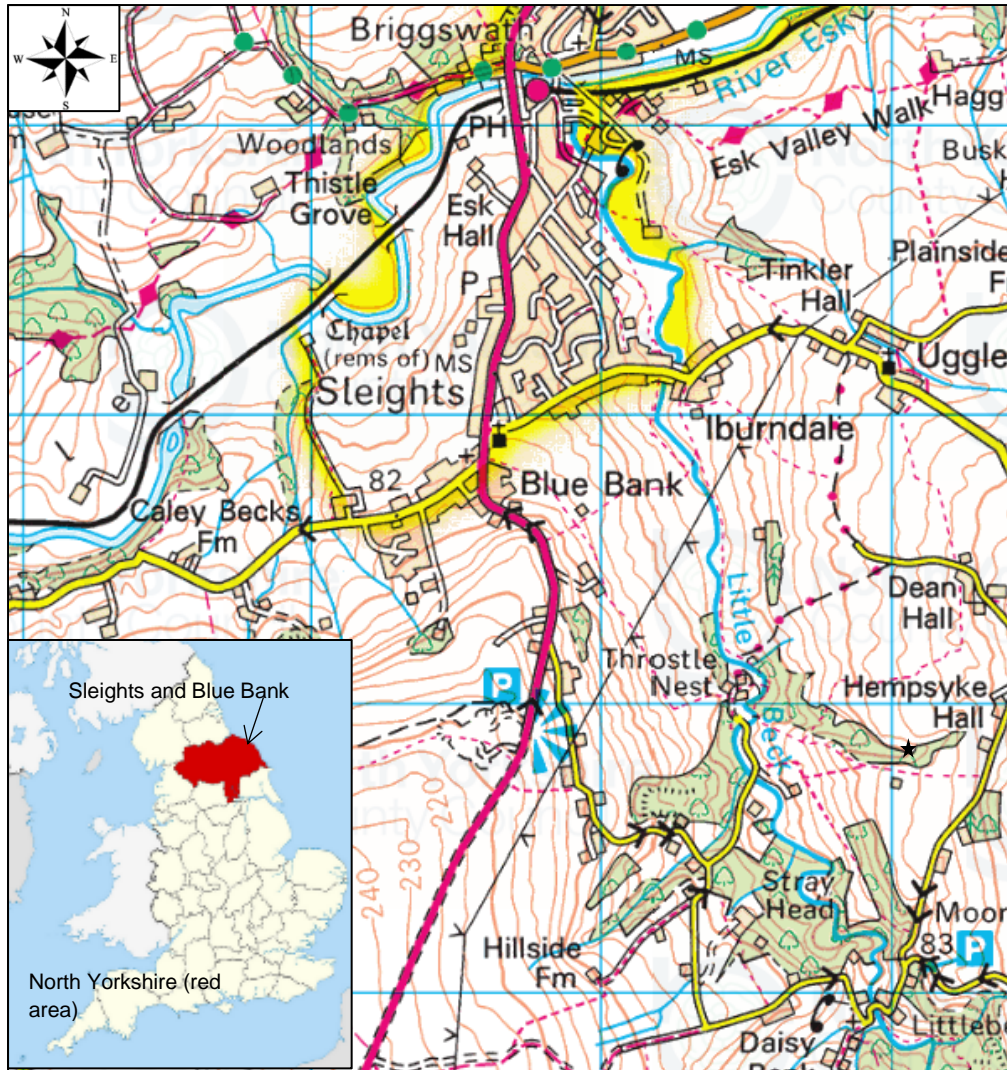


Figure 2.1 Sleights and Blue Bank Location Map (Source: NYCC)

The Study Area of this report is displayed in the figure below

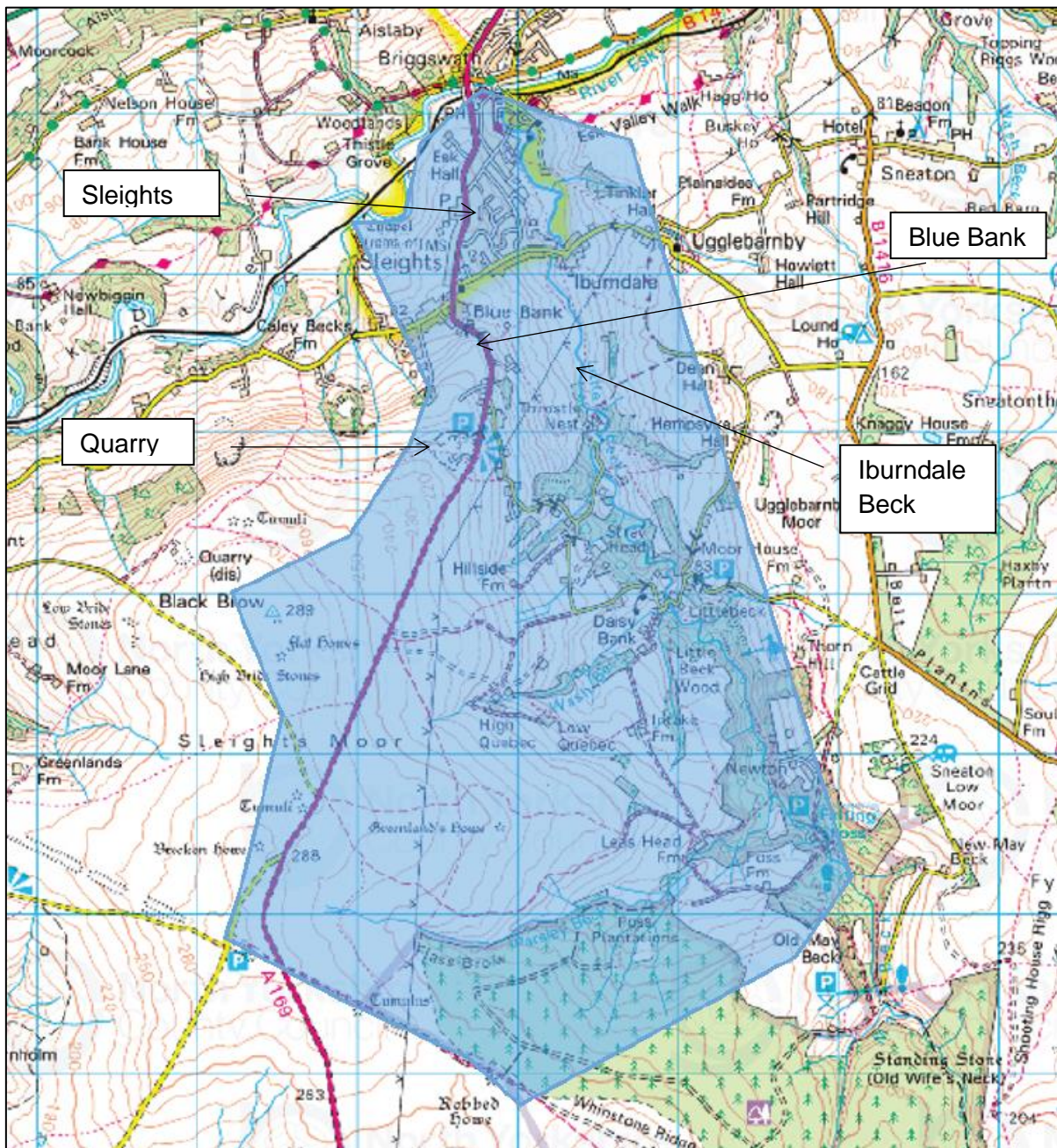


Figure 2.2 Sleights and Blue Bank Study Area (Source: NYCC)

2.5 Topography

Sleights is on the steep sided valley of the Esk catchment. The mudstone based landscape has been shaped by glacier, river and stream activities over thousands of years.

The A169 enters Sleights from Sleights Moor, descending down Blue Bank, which has a gradient of 1 in 4 (25%). The A169 runs from south to north, along high moorland before descending down Blue Bank into the village of Sleights. The road continues to descend, and eventually crosses the River Esk at the northern extremity of the village.

Whilst the gradient of the hill progressively shallows as the road continues north from Blue Bank, Sleights is nevertheless built on a sharp decline towards the River Esk, with the

majority of properties being built on the eastern side of the A169, on a decline towards Iburndale Beck.

The gradient of the bank has historically caused vehicle break failure, and consequently the bank contains an arrestor bed, associated with the highway which is filled with Lytag, small round man-made spherical pellets, made from fly ash generated in power stations. The arrestor bed holds approximately 600 tonnes of Lytag, one of the main characteristics of the product is that it is 50% lighter than natural aggregate.

2.6 Public sewers

Records from YWSL show that Sleights is predominantly served by a combined sewer system, as shown in Figure 2.3.

The sewer system is the responsibility of Yorkshire Water Services Ltd (YWSL). The LLFA is aware of no reports received in relation to flooding from the public sewer network associated with this event.

The highway surface water system is only connected to the YWSL sewer system at a point approximately quarter of a mile from the bottom of Blue Bank, and beyond the point that the Lytag was carried to, so it is reasonable to assume the system was not impacted by the event, given that the rainfall was not particularly remarkable for the time of year.

Further North in the village, approximately quarter of a mile from Blue Bank the highway gullies are connected to the YWSL combined sewer near Lowdale Lane. Beyond this point, the highway system outfalls directly into the River Esk.

Highways gullies in the south of the village were blocked quickly by the large volume of material from the arrestor bed which caused additional water to continue its run off down the roads in Sleights.

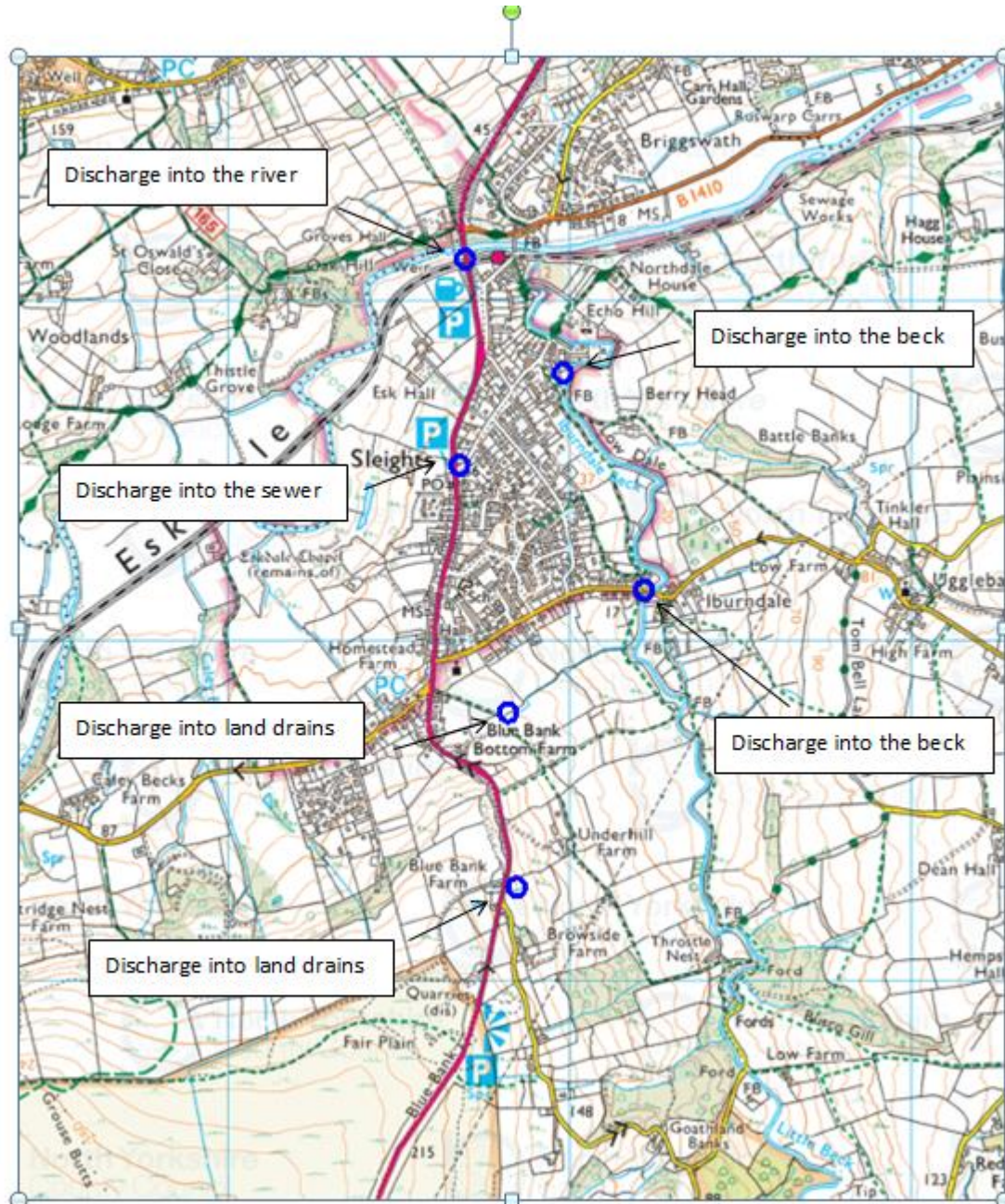


Figure 2.4 Approximate position of highway surface water drainage discharge points.

3 Flood Event

3.1 Rainfall data

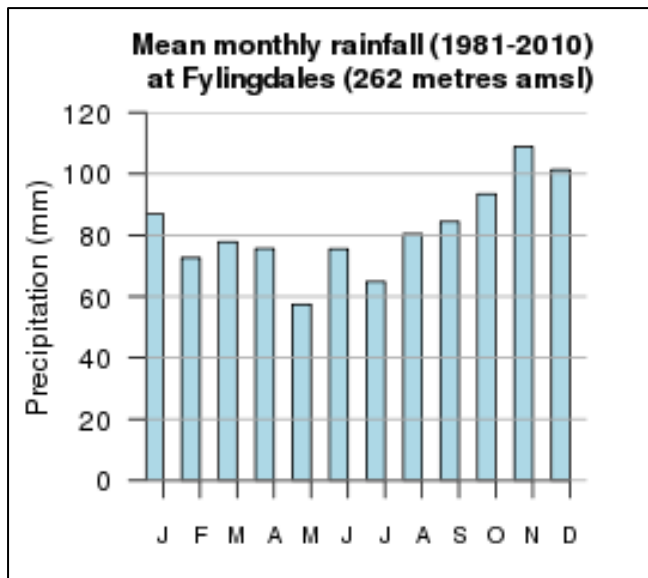


Figure 3.1 Mean Monthly Rainfalls for Fylingdales (Source: Met Office Data)

The mean monthly rainfall data for Fylingdales demonstrates that the average November rainfall is close to 110 mm.

During the event in November 2016, 26mm of water fell in the most intense 6 hours of the storm.

3.1.1 Meteorological Conditions

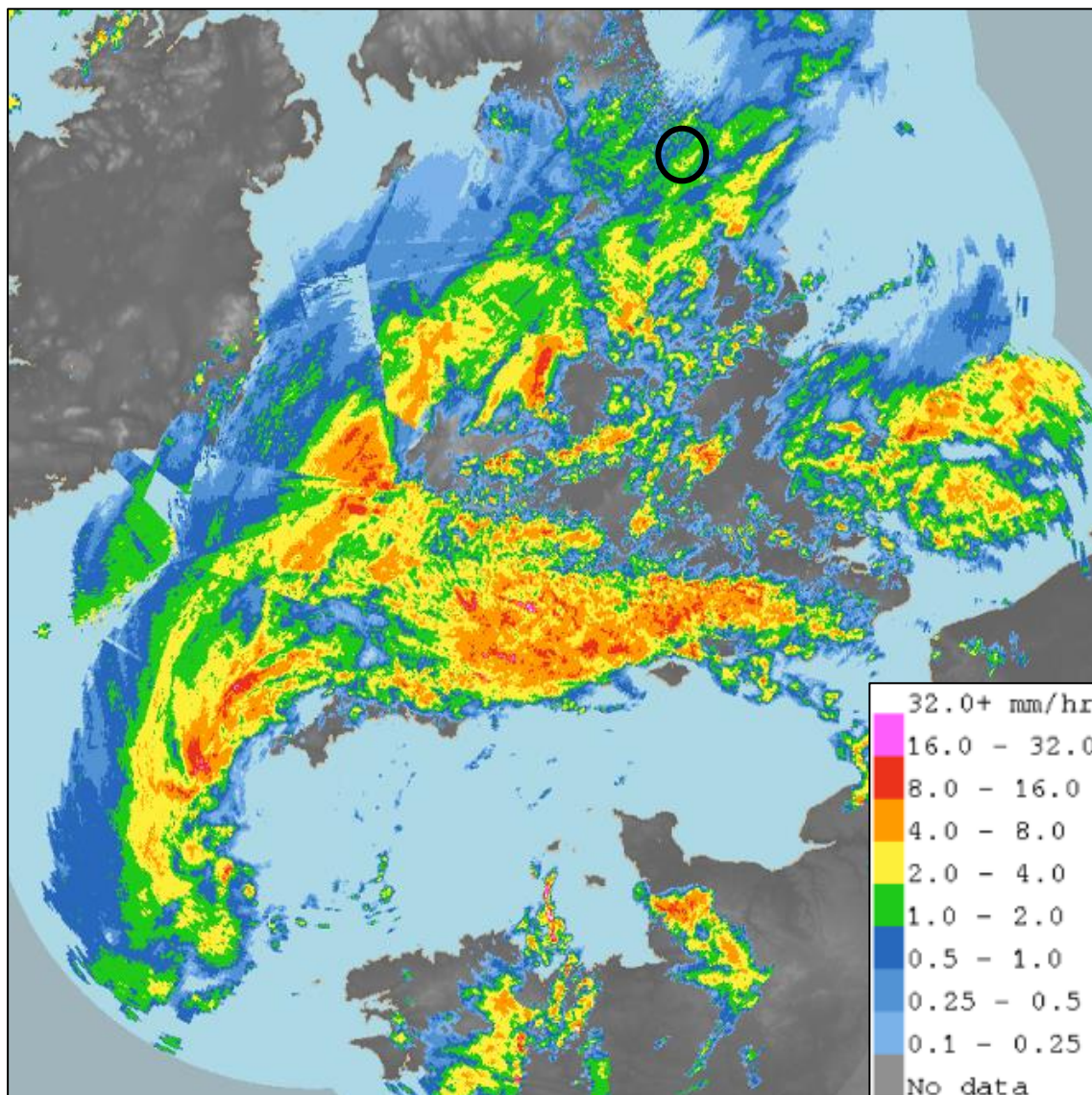


Figure 3.3 Rainfall radar map of the Storm (Source: Met Office Data)

The black circle on figure 3.3 demonstrates the study area around Sleights. This radar data shows that the storm around Sleights was patchy and not as intense as in other parts of the county, which did not experience flooding events.

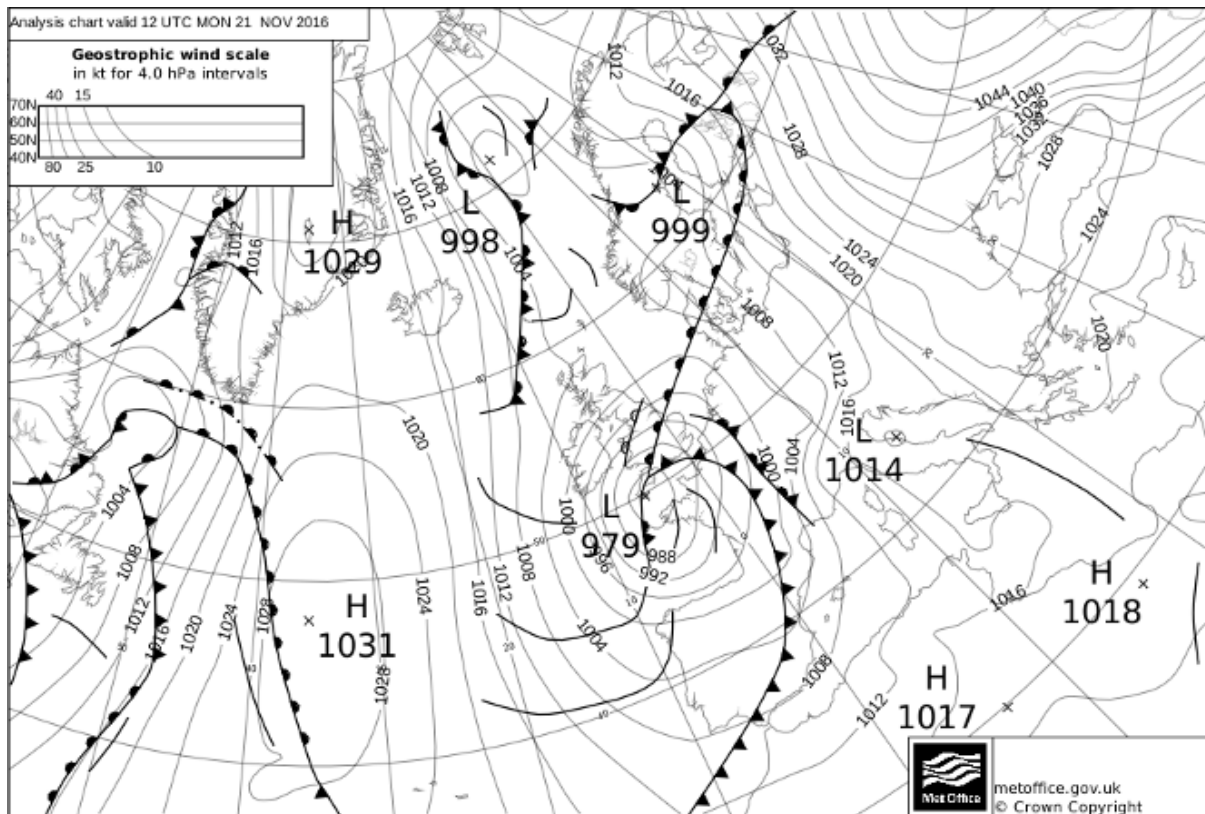


Figure 3.4 Wind map showing the low pressure system that caused the storm. (Source: Met Office Data)

3.1.2 Antecedent conditions

Before the storm the weather had been within tolerance of the average values expected for November. It had been overcast and rainy since Monday the 14th November, the week before the event.

The volume of water already held in the ground prior to the event would therefore have limited the amount of water that it was possible for the soil to absorb during the storm.

3.1.3 Site Rainfall Event

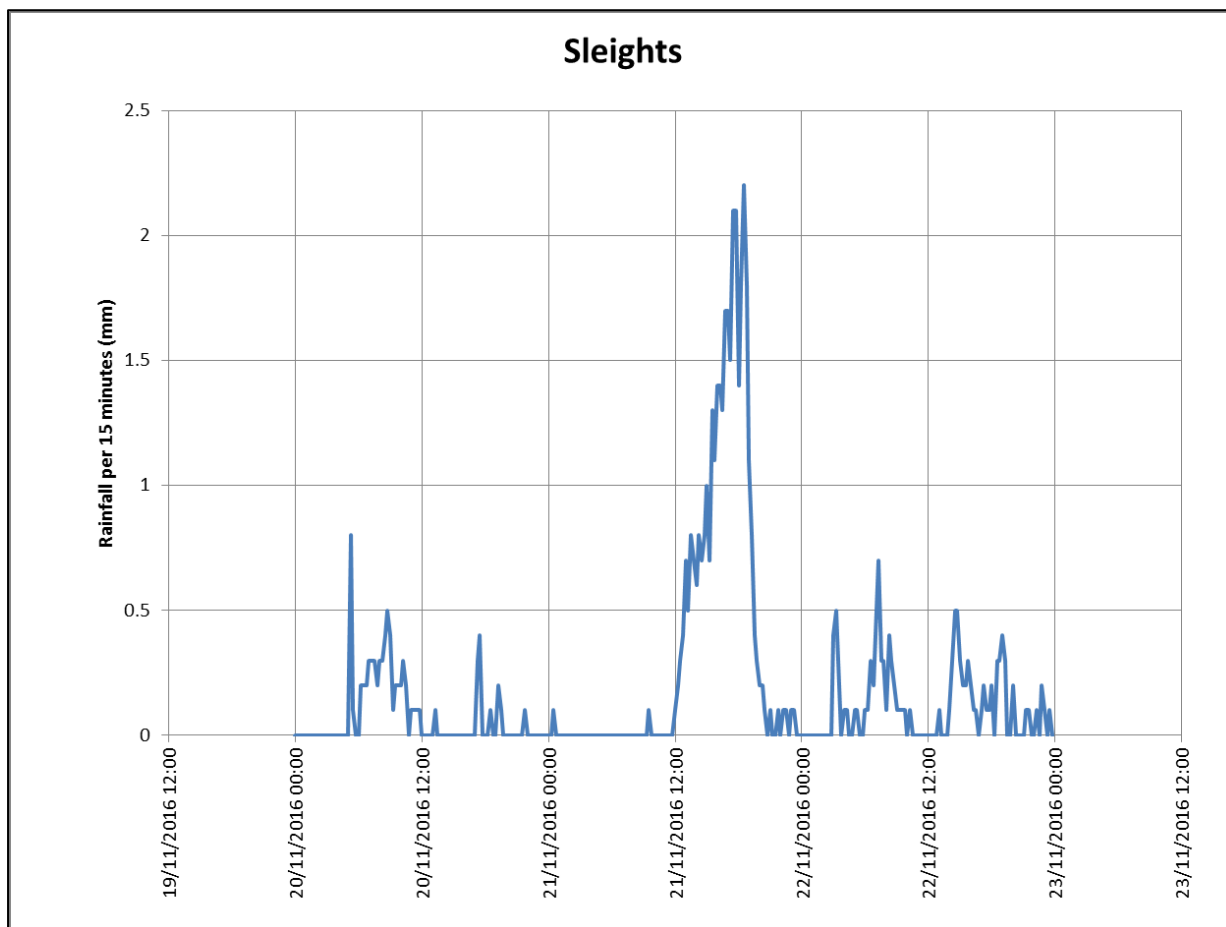


Figure 3.5 Sleights Rainfall Event (Source: EA Data)

3.2 Description of Events

Figure 3.5 clearly demonstrates a significant peak in the rainfall, between midday, continuing through to approximately 10pm on the 21st November 2016. This peak tallies with the events unfolding in Sleights. 26mm of water fell in the most intense 6 hours of the storm.

The volume of water fell at an estimated 1 in 5 year return period, (which is essentially a 20% chance of a similar occurrence in any given year), during the most intense part of the storm. This is not normally enough to affect the village of Sleights or its road network.

In Sleights, the rain had been falling for the majority of the day. Surface water began running off the moors into Sleights at approximately 5:30pm. From this point until approximately 7pm, around 600 tonnes of Lytag was washed out of the arrestor bed (escape road) which runs adjacent to the carriageway on Blue Bank.

The Lytag was carried some distance down the steep gradients, and eventually deposited on the highway and in gardens and land adjacent to the highway from Blue Bank Farm for about 200 metres.

The Lytag filled drains and trapped travelling cars on the bank, creating channels on the carriageway which resulted in areas of deep surface water tracking down the bank.

Approximately 8 Cars were stranded on the bank, as they were left surrounded by Lytag and deep surface water.

The occupants of a number of vehicles were assisted in exiting by NYCC Highway Officers and North Yorkshire Fire and Rescue (NYFRS). As the Lytag continued to deposit, the situation became increasingly dangerous, as quick flowing surface water rose above knee height between the vehicles and the Lytag deposits. Attempts to rescue passengers became too dangerous and the decision was taken by NYFRS for individuals to remain in their vehicles until the water subsided.

No one was seriously hurt in the incident, although a pregnant woman was trapped in a vehicle and required a hospital examination following the incident.

Highway drains and connecting land drains were all found to be blocked with Lytag following the event, the presence of which would have further exacerbated the volume of water continuing down the bank and through the village.

From the evening of the 21st a team of 14 highway operatives worked around the clock to clear the road, with two excavators, two HYMAC tracked vehicles, two sweeper lorries, one gully cleaner and one jetting wagon working on site.

The arrestor bed had to be refilled with about 600 tonnes of new material which required 15 wagons to transport it from Drax Power Station.

Iburndale Beck was also reported as having high flows during the storm and debris and silt was deposited against the bridge in Iburndale and required removal following the event. Additionally a property downstream of the bridge along Iburndale Beck experienced internal flooding from the river over-topping. It is considered that surface water tracking down the A169 may have still made its way into Iburndale Beck, joining at a lower point and with more velocity, causing the flooding problems in locations with no historic flood records.





The photographs above show the arrestor bed material in the street.

3.2.1 Culverts

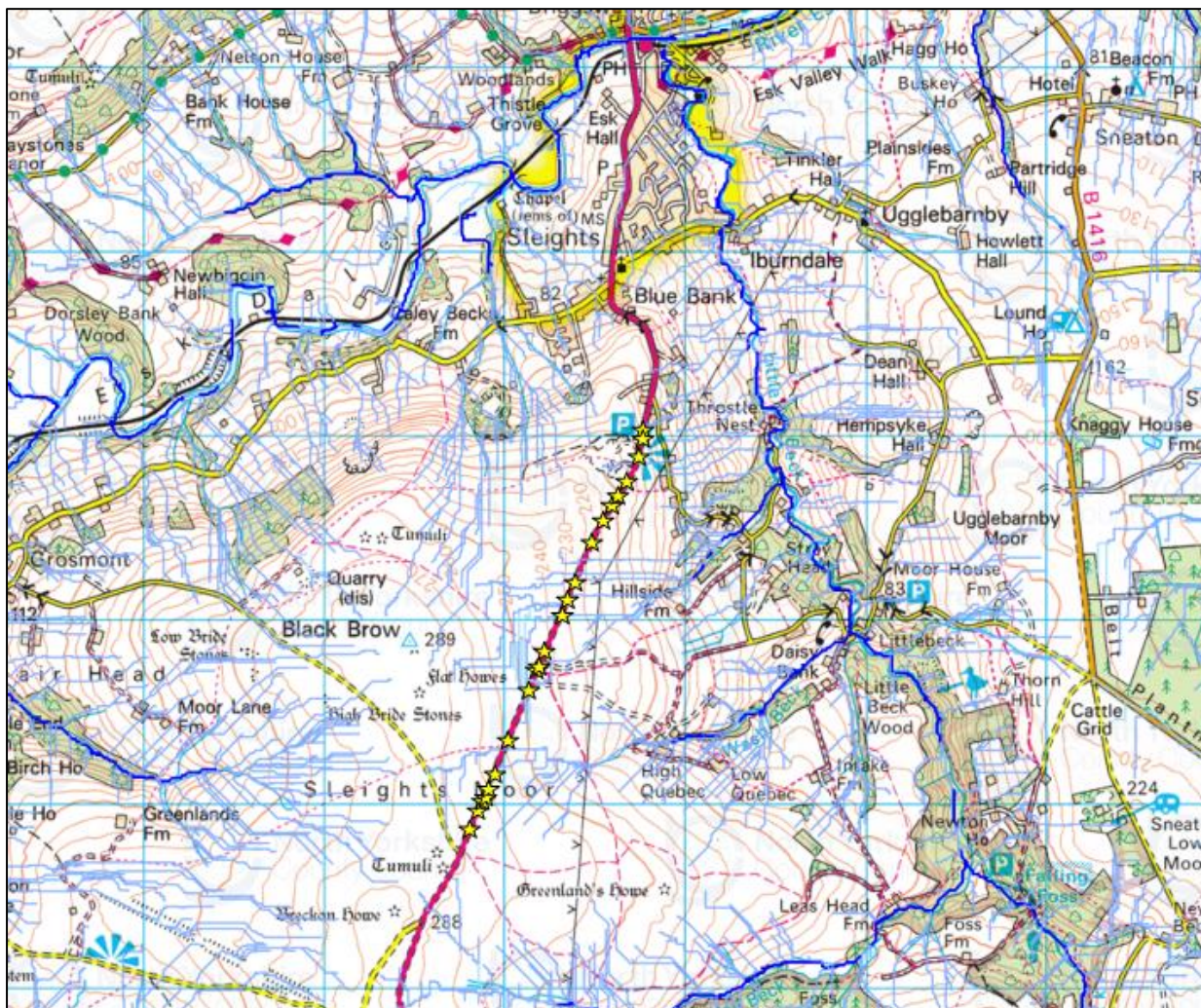


Figure 3.6 Approximate Locations of Damaged and Blocked Culverts and “rolling ball” flow path analysis (Source: NYCC)

The obstruction of culverts on Sleights Moor, between the A169 Fairhead junction and Blue Bank demonstrated on the map above are considered to have been the most significant contributor to the flood.

The blue lines on the document above represent the rolling ball flow paths across the moor. Rolling ball analysis uses the Environment Agency LIDAR Digital Terrain Model and simulates the path of water across the terrain, identifying where it is most likely to flow as a result of topography (the flow-paths).

Though the rainfall event was more intense than an average storm it is not considered that it was over the capacity of the drainage systems in Sleights given that the rainfall, whilst significant, was not particularly remarkable for November and that systems have historically coped with such events.

During the summer of 2016 utility works had been undertaken on the moors; whilst not associated with drainage, the works caused unintended damage and

obstruction to many culverts that pass under the A169 between Pickering and Sleights.

It is not considered that obstruction to one individual culvert would cause significant flooding but the accumulation of the series of obstructions to the intended flowpaths caused a significant flood to be directed down the A169 instead of traveling on its designed route towards Littlebeck and Iburndale beck.



Figure 3.7 Photographs demonstrating damage to the culverts under the A169. (Source: NYCC)

As the content of the arrestor bed was carried down the carriageway, and filled many land drains further down Blue Bank, this quickly caused additional obstruction to the drainage systems and meant water also could not convey along land drains further down Blue Bank.

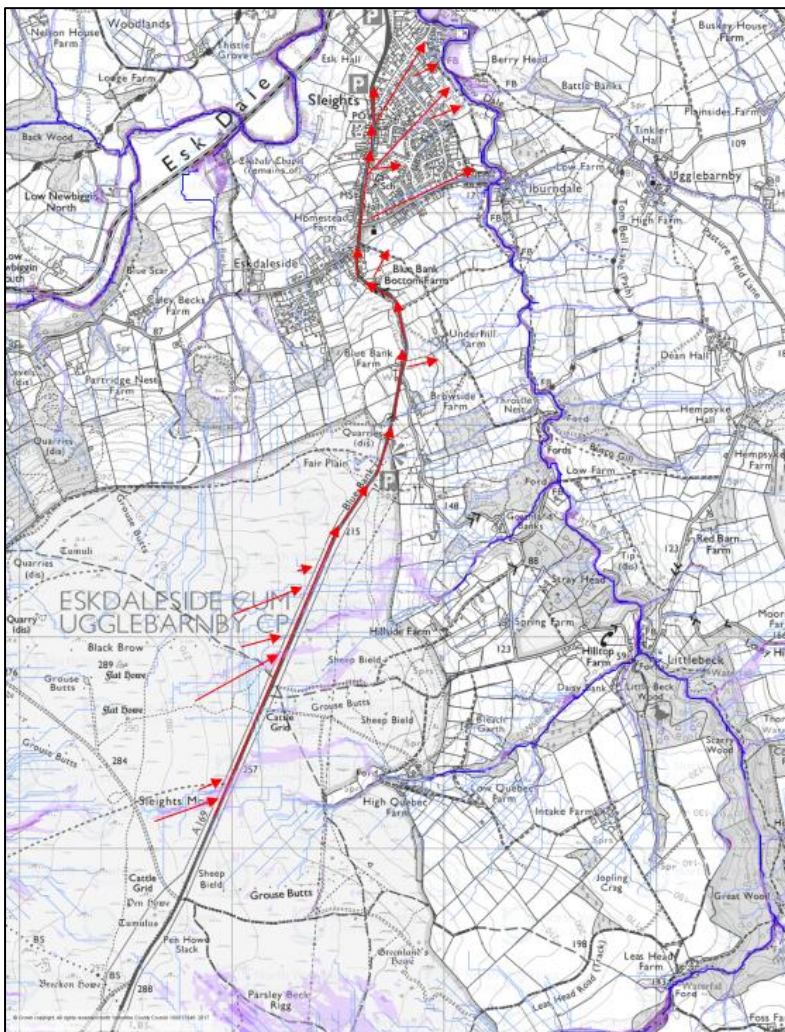


Figure 3.8 Approximate Flow Paths during the Event (Source: NYCC)

3.2.2 Quarry

At the crest of Blue Bank there is a disused quarry, which has an access road that joins the A169. The contribution that surface water run-off from the access may have made was investigated and though there would have been an amount of run-off originating from the site, it isn't considered that it would have significantly contributed to property flooding.

4 Risk Management Roles, Responsibilities and Actions

4.1 RMA Responsibilities

4.1.1 Environment Agency

Under the FWMA the Environment Agency (EA) has a strategic overview role for all sources of flooding as well as an operational role in managing flood risk from Main Rivers, reservoirs and the sea. As part of this role the EA have developed a National Flood and Coastal Erosion Risk Management Strategy for England – ‘Understanding the Risks, Empowering Communities, Building Resilience.’

This national strategy outlines the EA’s strategic functions as:

- Ensuring that flood risk management plans (FRMPs) are in place and are monitored to assess progress. The plans will set out high-level current and future risk management measures across the catchment
- Publishing and regularly updating its programme for implementing new risk management schemes and maintaining existing assets
- Supporting risk management authorities’ understanding of local flood risk by commissioning studies and sharing information and data
- Supporting the development of local plans and ensuring their consistency with strategic plans
- Managing and supporting Regional Flood and Coastal Committees and allocating funding

The EA’s operational functions are/include:

- Risk-based management of flooding from main rivers including permissive powers to do works including building flood defences
- Regulation of works in main rivers through the consenting process
- Regulation of reservoirs with a capacity exceeding 10,000m³
- Working with the Met Office to provide severe weather warnings – available to Risk Management Authorities
- Provide warning of flooding on main rivers
- The maintenance and operational management of main river assets including flood defences
- Statutory consultee to the development planning process
- The power to serve notice on any person or body requiring them to carry out necessary works to maintain the flow in main rivers

‘Main Rivers’ are defined through an agreed map which is updated annually. These tend to be the larger rivers in the country, though some smaller watercourses in sensitive locations are also defined as ‘Main Rivers’.

The EA are also category 1 responders regarding flood risk (Civil Contingencies Act 2004). They are required to warn and inform of flood risk.

4.1.2 Water Company

Water companies in England and Wales are named as a Risk Management Authority under the Flood and Water Management Act 2010 and must have regard to the Local Strategy of the LLFA. They are required to manage risks associated with assets or processes that may cause or be affected by flooding, and must share relevant data with other flood risk authorities.

They also have flood risk management functions under the Water Resources Act (1991). Relevant actions of water companies include: the inspection, maintenance, repair and any works to their drainage assets which may include watercourses, pipes, ditches or other infrastructure such as pumping stations.

The Civil Contingencies Act 2004 (CCA) also designates water and wastewater undertakers as statutory category 2 responders to national disasters and emergencies, placing on them duties to share assured information with other responders in an appropriate manner.

4.1.3 North Yorkshire County Council (NYCC)

NYCC, as Lead Local Flood Authority, has flood risk management functions which include (but are not limited to);

- Provision of a Local Flood Risk Management Strategy (LFRMS),
- Designation and maintenance of a register of structures or features that have a significant effect on flood risk,
- Consenting and enforcement works on Ordinary Watercourses,
- Responding to statutory consultations on drainage proposals in planning applications
- Undertaking Section 19 investigations.

NYCC also has responsibilities as a Highways Authority and as an Emergency Responder (under the Land Drainage Act 1991 and the S19 Flood Investigation Report Civil Contingencies Act 2004 respectively) which may relate to flooding.

Highway Authorities are responsible for providing and managing highway drainage which may include provision of roadside drains and ditches, and must ensure that road projects do not increase flood risk.

The Highway Authority has a duty under the Highways Act 1980 to maintain highway that is maintainable at public expense. This includes a duty to maintain existing highways drainage. Highway drainage systems are designed to take highway

surface water. Highway drainage systems are not designed as “storm drains”, and do not have the capacity for the level of rainfall from an extreme flash flood. The Highway Authority has powers to improve drainage systems but no duty to do so.

Roadside gullies are subject to routine maintenance in accordance with the NYCC Highway Asset Management Plan. The frequency of cleaning is dependent on an evidence based categorisation of risk, determined by factors relating to the consequence of failure and a range of other operational factors.

4.1.4 District or Borough Council

District and Borough Councils are named as Risk Management Authorities within the Flood and Water Management Act 2010, and are required to comply with the LLFA Local Strategy. Through the planning processes, they control development in their area, ensuring that flood risks are effectively managed.

In addition, in relation to the Civil Contingency Act (2004), the District and Borough Council:

- Are a Category 1 Responder. On a priority basis, they will provide sandbags to residents and businesses where property is at risk of flooding.
- Support the Emergency Services on request by providing Incident Liaison Officers
- Provide emergency accommodation – i.e. set up rest centre as required and other welfare provision
- Assist with arranging transport or evacuating areas.
- Participate in vulnerable people searches
- Assist with co-ordination of recovery

The NYCC Emergency Planning Unit provides support to the District Council

4.1.5 Internal Drainage Board

Internal Drainage Boards (IDB's) are local operating authorities established in areas of special drainage need (typically low lying areas) in England and Wales.

IDBs have permissive powers to undertake works to secure clean water drainage and water level management in designated drainage districts. In managing water levels IDBs have an important role in reducing flood risk in areas beyond their administrative boundary.

There is no IDB in the vicinity of Blue Bank.

4.1.6 All Risk Management Authorities

All RMAs under the Flood and Water Management Act (2010) have a responsibility to cooperate and coordinate with regards to their flood risk management functions, including raising awareness of flood risk and the sharing of information.

4.1.7 Riparian Owners

Landowners whose land is adjacent to a watercourse are known as 'riparian owners'.

A landowner can be an individual e.g. home owner or farmer, private business or an organisation e.g. the district council as park owner, on school grounds the county council as property owner.

A watercourse is defined as every river, stream, ditch, drain, cut, dyke, sluice, sewer (other than a public sewer) and feature through which water flows, but which does not form part of a Main River.

Riparian owners have legal duties, rights and responsibilities under common law and the Land Drainage Act 1991 for watercourses passing through or adjoining their land. These responsibilities are to:

- Pass on the flow of water without obstruction, pollution or diversion affecting the rights of others
- Accept flood flows through their land, even if these are caused by inadequate capacity downstream.
- Maintain the banks and bed of the watercourse and keep structures maintained
- Keep the bed and banks free from any artificial obstructions that may affect the flow of water including clearing litter, heavy siltation or excessive vegetation.

Guidance on the rights and responsibilities of riparian ownership are outline in the Environment Agency publication 'Living on the edge', available at

<http://www.environment-agency.gov.uk/homeandleisure/floods/31626.aspx>

4.2 Actions and Responses to December Floods

4.2.1 North Yorkshire County Council as Lead Local Flood Authority

The Flood Risk Management (FRM) Team provides an overarching view on flood risk management activities within the county. The FRM team has undertaken the following specific activities;

- Contacted the relevant risk management authorities.
- Conducted a section 19 report investigation.

- Contacted the custodian of the moorland above Sleights to investigate catchment sensitive opportunities.
- Supported the work of the local NYCC highways team.

4.2.2 North Yorkshire County Council as Highway Authority

The Highway Authority carries out regular maintenance of the highway drainage system. NYCC in its capacity as highway authority has undertaken the following specific activities;

- Assisted in the emergency response to the event.
- Undertaken maintenance activities such as jetting and repair of gully pots post flood event.
- Ensured the replacement and reinstatement of damaged culverts along Blue Bank.
- Undertaken kerb realignment on the A169 to direct the flow of highway surface water away from Blue Bank
- Proposes to install two additional culverts under the A169 to increase the overall capacity of the drainage system

4.2.3 The Environment Agency

The EA will continue with its programme of inspections. There are no proposals to undertake any works around Sleights

The EA flood alert for the River Esk also covers Iburndale Beck, Sleights is located upon the confluence of the two watercourses. Four properties are signed up to the EA flood alert at Sleights (122WAF935). The alert was issued at 18:31 on 21/11/2016. It was sent to 86 customers on the Esk.

4.2.4 Yorkshire Water Services Ltd

YWSL has undertaken the following post flood event activities:

- Asset inspections of the sewer system to identify any defects.

No other defects have been reported on the sewer system and to the Depot Pumping Station.

4.2.5 Scarborough Borough Council

Scarborough Borough Council has undertaken the following post flood event activities:

- SDC officers were involved with the recovery following the flood event.

5.0 Conclusions

Whilst the storm event on the 21st November involved heavier rainfall than is normally experienced, and flood alerts were issued prior to the event, the rainfall was not extraordinary for the time of year.

There is no record of surface water previously running towards Sleights from the moor via Blue Bank, and there are no recorded historic flooding issues in the village as a result of this mechanism.

The drainage of Sleights Moor is designed to take surface water flows to Littlebeck, which runs approximately parallel to the A169 at the bottom of the valley. The majority of the water from the moor by design thereby avoids the conurbation of Sleights.

A series of culverts between the Fairhead Junction with the A169 and Blue Bank are vital to enable this conveyance under the highway.

Utility work had been conducted in the months prior to the event and fault has been accepted by the company for unintended obstruction to the series of culverts between Blue Bank and the Fairhead Junction with the A169.

It is therefore considered that this was an isolated incident, occurring as a direct result of the utility works.

Works have now been undertaken to rectify the damage caused and return the system to its designed operation. The utility company has agreed in principle to paying the costs. The County Council Highways Service will conduct routine annual inspections of the culverts to ensure they are adequately maintained.

There is no question raised over the suitability of the present capacity of the drainage system as a result of this report. NYCC, as highway authority, has nevertheless undertaken subsequent precautionary works on the A169 above Blue Bank to afford an overall improvement to its drainage, given the projections for rainfall associated with climate change and the predicted increased frequency of high intensity rainfall events.

There have been alterations made to highway and kerb alignment on the A169 to permit surface water gathering on the carriageway to convey on its designed flow path away from the road to the east of the carriageway, thereby avoiding Blue Bank.

There have been talks with local landowners with regards to slowing the flow and improving natural flow paths on the moor above the A169.

The installation of 2 additional culvert crossings is being considered by NYCC Highways to increase the volume of water able to convey under the A169 in future.

This report has identified the actions and responses of the Risk Management Authorities (RMAs) who have responsibilities for the management of flood risk in the Scarborough Borough of which Sleights is part. It is understood that all Risk

Management Authorities have undertaken appropriate activities in response to the flood event, in line with their duties and responsibilities under the Flood & Water Management (2010) Act.

6.0 Recommendations

As a result of the findings of this investigation it is recommended that:

The series of culverts between the Fairhead Junction and Blue Bank be placed on the NYCC flood risk asset register, because of their implication on a significant flood event

NYCC in its capacity as highway authority, undertakes appropriate routine inspection of the culverts to ensure they are adequately maintained.