

Investigation Report into Flooding
Incident of 3rd September 2016
Cilmaengwyn Road, Cilmaengwyn and
Graig Road, Godre'r-graig



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Revision Schedule

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1. Introduction

An investigation has been undertaken by Neath Port Talbot Council as Lead Local Flood Authority in response to the flooding that occurred at Graig Road, Godre'r-graig and Cilmaengwyn Road, Cilmaengwyn on 3rd September 2016. This report is a summary of the investigation and includes relevant information required to meet the statutory requirements placed on the Authority by Section 19 of The Flood and Water Management Act 2010. Information regarding the duties and responsibilities placed on a Lead Local Flood Authority to investigate flooding can be found in Appendix A.

One of the requirements of Section 19 is that an investigation report must identify which Risk Management Authorities (RMA's) have relevant flood risk management functions. Appendix B provides a summary of the roles and responsibilities of the RMA's within Neath Port Talbot.

Through the investigation process, it was determined that the relevant RMA's for the flooding that occurred at Cilmaengwyn and Graig Road are:

- NPTCBC as Lead Local Flood Authority
- NPTCBC as Highway Authority

In addition, it was found that a number of land owners and those with riparian responsibilities for watercourses are also relevant in this instance.

The flooding of Cilmaengwyn and Graig Road occurred between 18:00hrs and 19:00hrs on Saturday 3rd September 2016 following a period of very intense localised rainfall, which fell on top of a 10 hour period of continuous rain.

Some actions have already been undertaken by NPTCBC to reduce the flood risk in the area, however there remain a number of recommended actions as set out in the report.

2. Flood Incident

2.1. Location of Flooding

Cilmaengwyn and Graig Road are located in the electoral ward of Godre'r-graig which is situated in the upper Swansea valley. The upper Swansea valley is located in the North West of Neath Port Talbot County Borough.

2.2. Rainfall Event

On Saturday 3rd September 2016, there was continuous rainfall across the County Borough between the hours of 08:00 and 21:00. The communities situated in the North West of the authority received the highest levels of rainfall throughout the day.

Between the hours of 08:00 and 18:00, the Authority's emergency out of hours contact centre received very few calls, with no real issues being reported. However at approximately 18:00hrs, intense rainfall fell across the North West of the County Borough causing numerous flooding incidents. Figure 1 below illustrates the levels of rainfall that fell on Godre'r-graig throughout the day on 3rd September 2016.

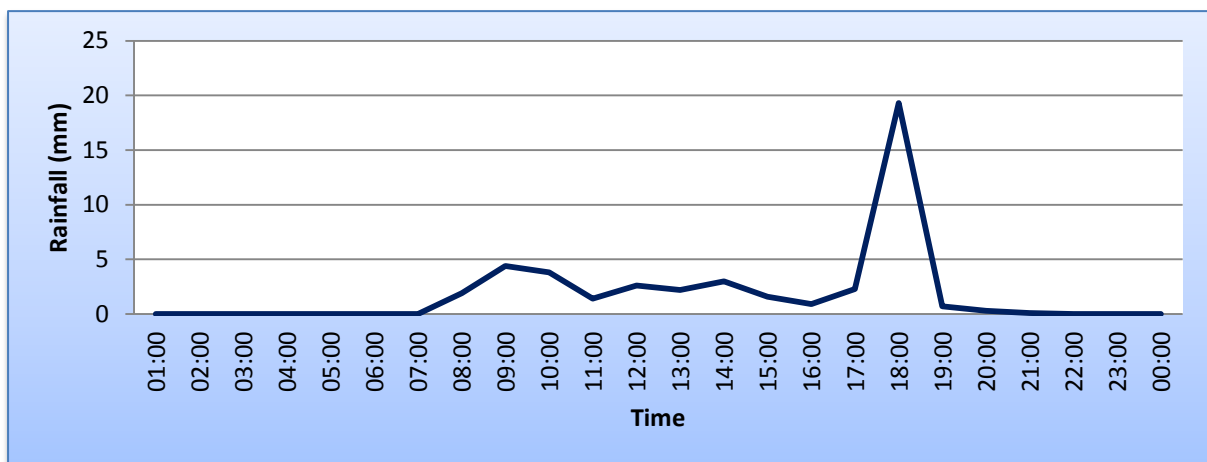


Figure 1, Rainfall in Godre'r-graig on 3rd September 2016 (Rainfall data provided by MetDesk Limited)

The graph identifies that between 18:00hrs and 19:00hrs the average rate of rainfall in Godre'r-graig was approximately 19.3mm/hr. However when studying the five minute rainfall radar over the same period, it was found that the peak rainfall intensity during that hour reached between 50-100mm/hr. A screenshot of the rainfall radar produced by NPTCBC's weather forecasters MetDesk Limited can be seen in Figure 2. The period where the rainfall

intensity peaked above 50mm/hr was the time that numerous communities throughout the North West of the County Borough began to suffer from surface water, ordinary watercourse and river flooding. After 19:00hrs the rainfall intensity significantly reduced until it stopped completely by 21:00hrs.

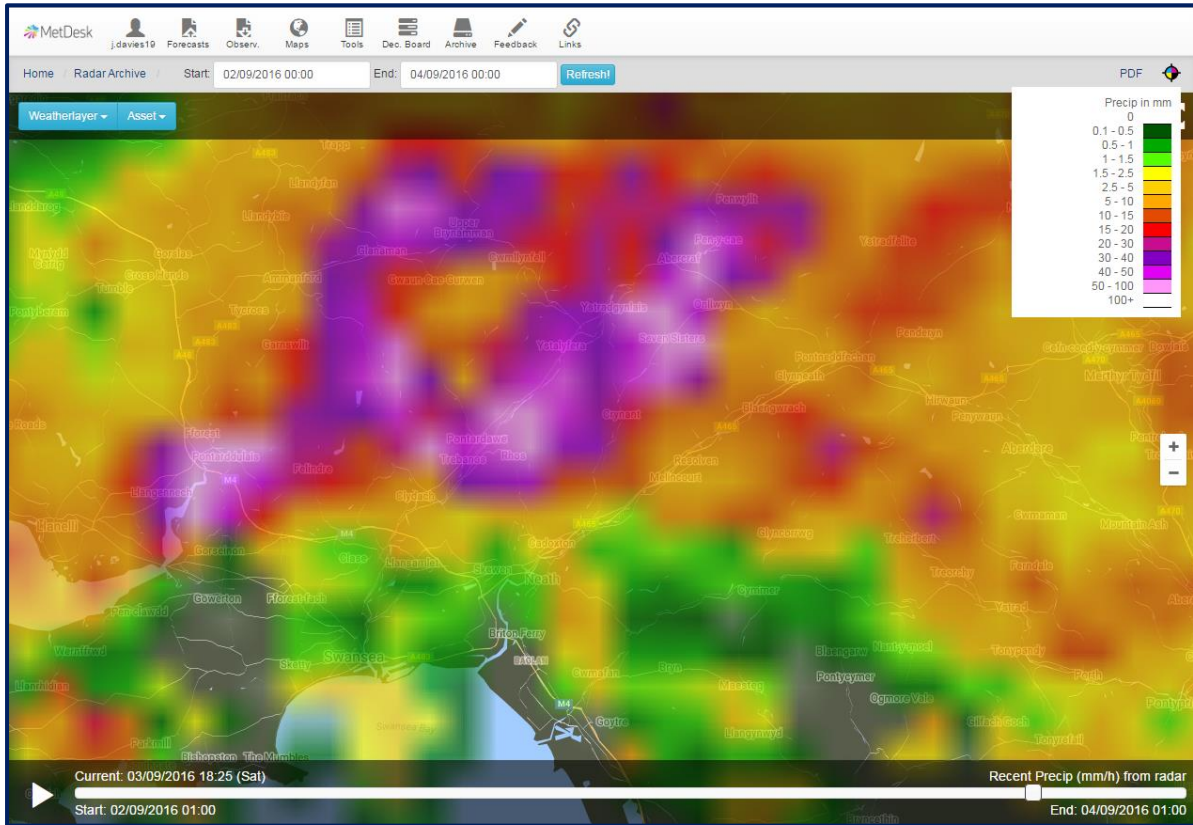


Figure 2, Screenshot of radar imagery showing precipitation levels at 18:25 on 3rd September 2016 (Provided by MetDesk Limited)

2.3. Flood Extent

A number of properties suffered internal flooding on 3rd September at Graig Road, with many more experiencing flooding and erosion of their gardens and driveways. Figure 3 illustrates the general location of the properties that were affected as a result of the flooding.

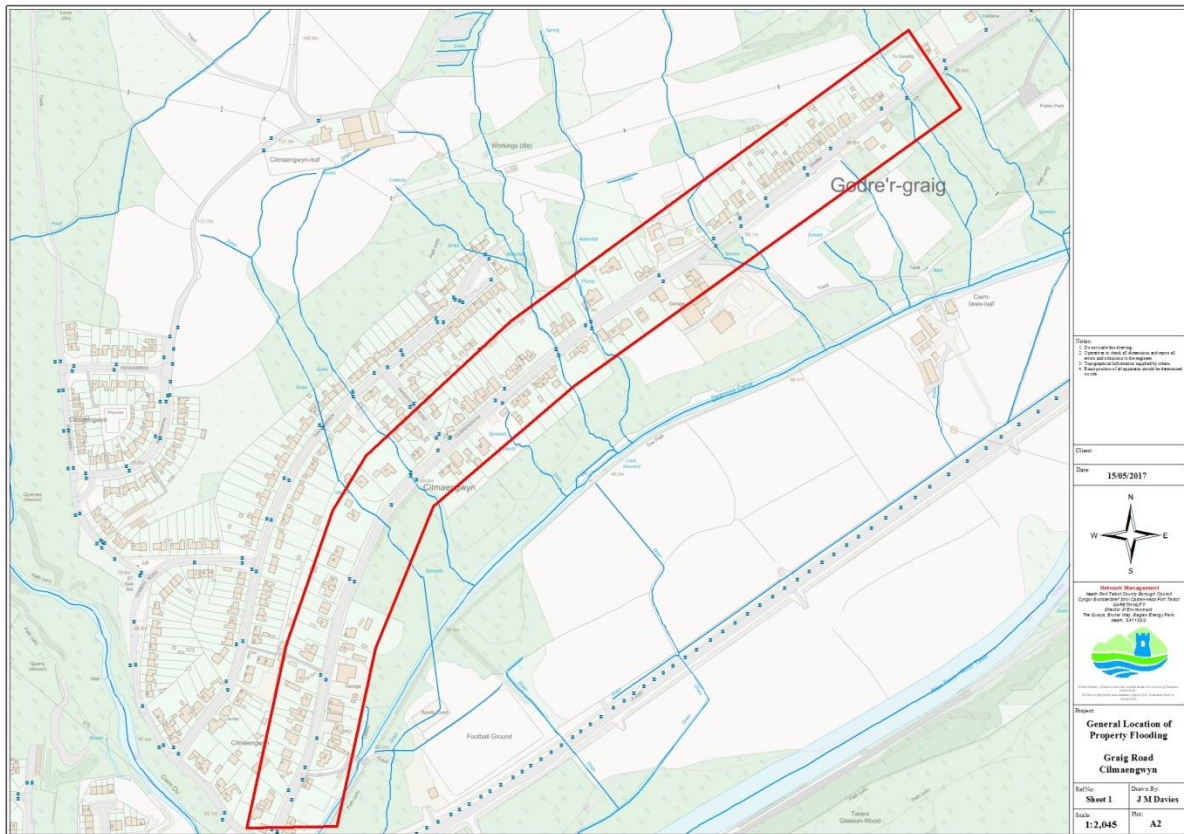


Figure 3, General Location of Properties affected by the flood event on 3rd September 2016

2.4. Site Characteristics

The Properties on Cilmaengwyn and Graig Road are located on the south east face of Mynydd Allt-y-grug which lies at the centre of the Swansea Valley in Cilmaengwyn. The sub catchment of Ystalyfera which forms part of the large Twrch and Tawe fluvial catchment is approximately 466 ha in size and encompasses the study area which is to west of the sub catchment.

The area has a history of mining activity due to its underlying geology and there are many springs and small un-named watercourses that originate from the hillside which can dry up in the summer months but can also quickly reappear particularly during heavy rainfall. The land above Cilmaengwyn and Graig Road is made up of exposed moorland and grazing land that is covered in loamy/peaty soils, this then changes to further freely draining soils covered in vegetation and trees which lies directly on top of bed rock as you move down the mountain side.

The surface water drainage network in the area consists of a large number of small highway culvert crossings over a short stretch of road into which highway systems are randomly connected. The culverted watercourses convey a number

of ordinary watercourses and tributaries that drain the land above Cilmaengwyn and Graig Road down to the Swansea Canal. The foul sewers for the study location are positioned to the rear of the properties and drain out into the main trunk sewer that runs down the centre of the highway.

2.5. Drainage Networks and Paths

On 3rd September 2016, the hydraulic capacity of four of the culverts which convey ordinary watercourses from Mynydd Allt-y-grug underneath Cilmaengwyn and Graig Road was exceeded. This resulted in the ordinary watercourses spilling over onto the highway, causing water to flow down the road which travelled at a high velocity due to the roads gradient. The majority of the properties situated on the left hand side (when travelling down Cilmaengwyn and Graig road) are at a lower level than the road surface and this situation allowed flood water to enter private properties where solid boundary walls were not present to channel the water along the road.

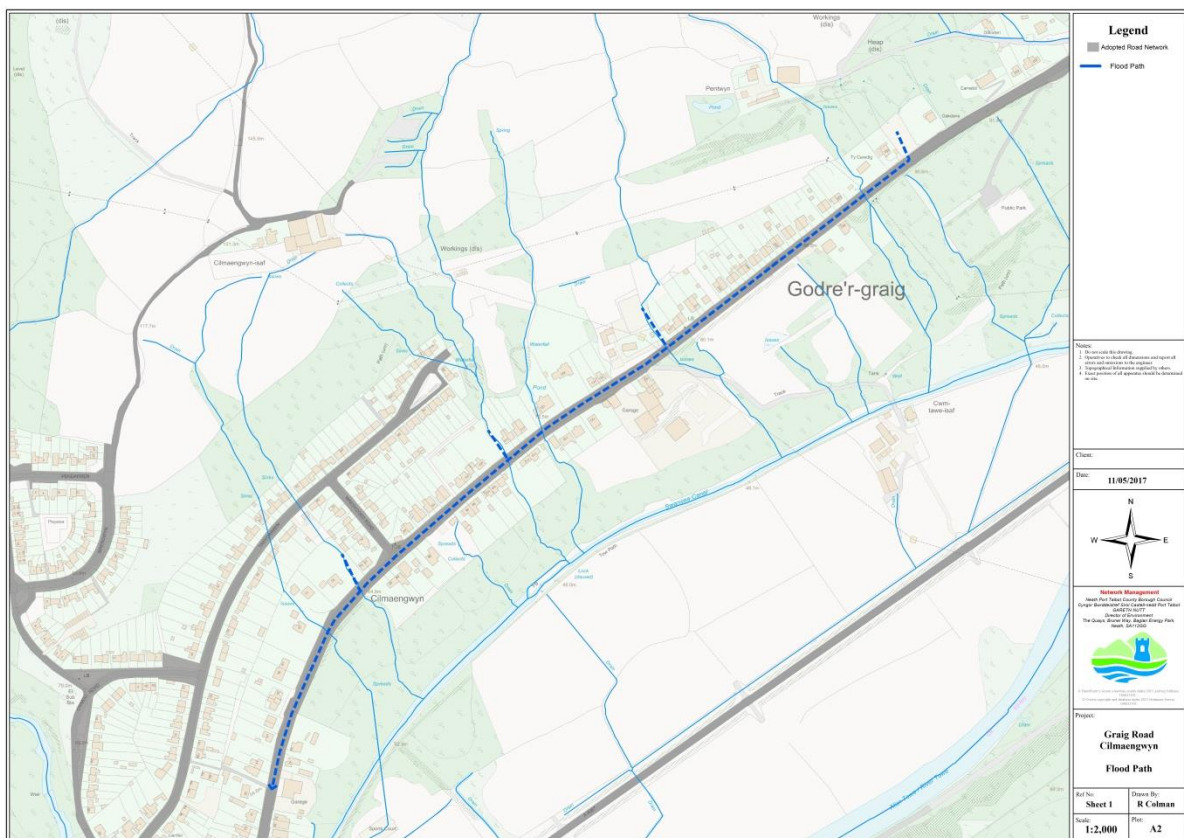


Figure 4, Map showing the flow route of flood water affecting Cilmaengwyn and Graig Road

2.6. Detailed Investigation Findings

There have been a number of isolated drainage and flooding issues associated with Cilmaengwyn and Graig Road in previous years; however none have caused the impact that was experienced during September 2016.

Investigations have determined that the flood water that affected the Roads emanated from four separate watercourses that convey water from Mynydd Allt-y-grug. Figure 5 identifies the location of the four watercourses where they pass under the highway. The four culverts indicated by the green, blue, yellow and red points on Figure 5 surcharged on 3rd September 2016.

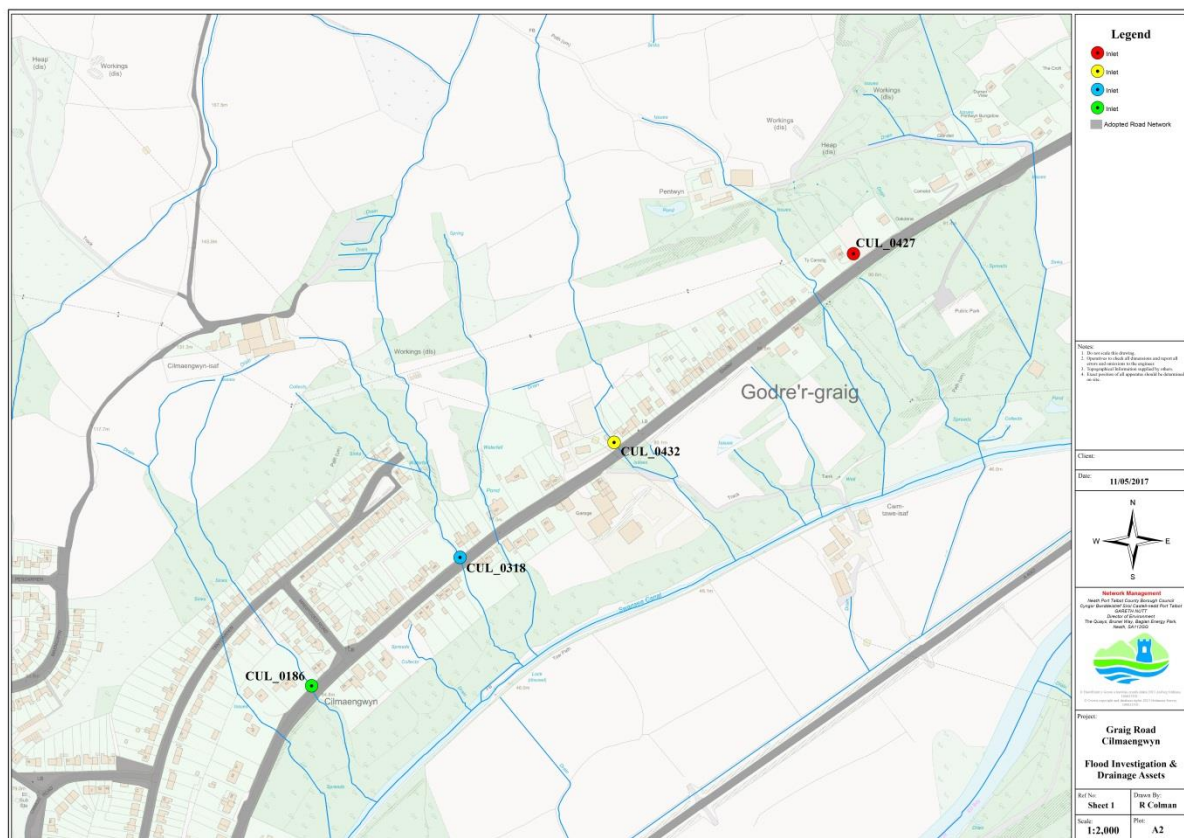


Figure 5, Key assets along Cilmaengwyn and Graig Road

Culvert (ID: CUL_0186) is indicated by the green point on Figure 5. The culvert is 300mm in diameter and as can be seen in Figure 6 has a concrete block headwall and an overflow system to convey flows should the intake structure become impeded. The high levels of flow in the watercourse caused a large amount of debris to be washed down to the culvert intake, partially blocking the pipe and limiting its hydraulic capacity. This, in combination with the general level of flow caused by the heavy rainfall, resulted in the

watercourse surcharging onto Cilmaengwyn Road.



Figure 6, Culvert intake structure (ID: CUL_0186)

Culvert (ID: CUL_0318) is indicated by the blue point on Figure 5. The culvert consists of two 600mm diameter circular pipes, a head wall and wing walls and a trash screen which can be seen in Figure 7.

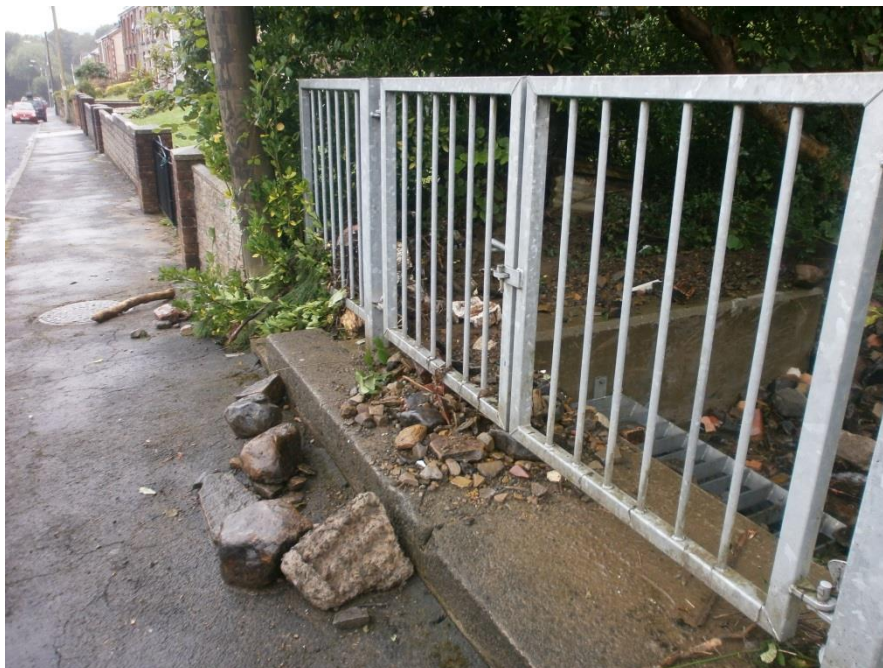


Figure 7, Culvert intake structure (ID: CUL_0318)

This watercourse surcharged onto Cilmaengwyn Road as the culverts capacity was exceeded in a similar way to culvert (ID: CUL_0186). However the ordinary watercourse conveyed by this culvert is much larger, contributing to a greater amount of flood water. The photograph taken after the flood event (Figure 7) shows some of the stone that was washed down to the intake structure by the flood water.

Figure 8 is a photograph that was taken by a resident during the flood event, showing overland flows coming off the steep sloping mountain side above the properties on Graig Road that were eventually conveyed to culvert CUL_0432 which is indicated by the yellow point on Figure 5. There is a ditch present at the top of the field (Figure 9), which collects an ordinary watercourse and surface water run-off from Mynydd Allt-y-grug. The ditch conveys water to two separate pipes, which in turn convey the flows to two culverts that cross underneath Graig Road, one of which being the culvert mentioned above, the other did not contribute to the flood water.



Figure 8, Culvert intake structure (ID: CUL_0432) during flood event

The intake structure of CUL_0432 consists of a 350mm diameter pipe and a concrete headwall which has an overflow system built into it. As can be seen in Figure 9, the capacity of the culvert and the overflow system was far exceeded on 3rd September 2016, causing high levels of flood water to spill over onto Graig Road.



Figure 8, Overland flows that were conveyed to culvert (ID: CUL_0432)

Culvert (ID: CUL_0427) is indicated by the red point on Figure 5. The culvert is 400mm in diameter and includes a concrete headwall and trash screen.



Figure 9, Photograph of the location of culvert (ID: CUL_0427) post flood event

Figure 10 is a photograph taken after the flood event showing the culvert intake. As can be seen from the photograph, the excavation and earth moving works that has been undertaken on the adjacent private land has caused the culvert to block and form a small pond. Any water that arrived at this culvert on 3rd September 2016 was unable to enter the culvert and consequently spilled over onto Graig Road.

2.7. Summary of Investigation Findings

The conclusion of the Authority's investigation is that the steep sloping mountainside situated above Cilmaengwyn and Graig Road was saturated as a result of the high levels of rainfall that fell between the hours of 08:00 and 18:00. The severe intensity of rainfall that then fell between the hours of 18:00 and 19:00 moved at a high velocity both via ordinary watercourses and as surface water down the hillside to the culvert crossings at Cilmaengwyn and Graig Road. The hydraulic capacity of the culverts was far exceeded by the volume of water that arrived at them during this time, causing large volumes of water to spill over onto the highway. The capacity of the four culverts that surcharged onto the highway was exceeded due to the following:

- The extraordinary level of rainfall received between the hours of 18:00 and 19:00.
- Partial blockages caused by the wash down of debris such as stone, silts and vegetation.
- Blockages as a result of excavation and earth moving works at Culvert CUL_0427.

3. Recommended Actions

The actions contained within Table 1 are recommended actions to be taken forward by the relevant RMA or property/landowner.

Table 1, Recommended actions

No.	Action by	Action	How it will be achieved
1.	Land Owners	Remove any obstructions within a watercourse if found.	<ul style="list-style-type: none"> Consider the rights and responsibilities placed upon a landowner under common law in relation to riparian ownership of a watercourse.
2.	NPTCBC as Highway Authority	Maintain highway culverts to maximise hydraulic capacity.	<ul style="list-style-type: none"> Cyclic inspections, maintenance and clearance of any debris that has washed down to the intake structures highlighted in this report.
3.	NPTCBC as Highway Authority	Consider improvements to highway culverts.	<ul style="list-style-type: none"> Officers to investigate options for upgrading highway culverts where required. A new trash screen has already been constructed on Culvert (ID: CUL_0318).
4.	NPTCBC as LLFA	Land Drainage enforcement.	<ul style="list-style-type: none"> Should there be a requirement the LLFA will implement its powers under common law to remove any obstructions in a watercourse. Monitor the work being undertaken on the land adjacent to the Culvert (ID: CUL_0427).
5.	Property Owners	Consider flood risk to own properties.	<ul style="list-style-type: none"> To install property level protection where necessary in liaison with the appropriate RMA's.

The recommended actions that have been identified to be undertaken by RMA's and landowners will be monitored for progress by NPTCBC as the LLFA.

4. Appendices

4.1. Appendix A - Duty to Investigate

The Flood Risk Regulations 2009 and the Flood and Water Management Act 2010 identify NPTCBC as the Lead Local Flood Authority (LLFA) for the area. This has placed a number of flood risk management duties and responsibilities on the Council. In particular, Section 19 of the Flood and Water Management Act 2010 places a duty upon NPTCBC to undertake investigations into flood events to the extent that it considers necessary.

A 'Risk Management Authority' (RMA) means:

Flood and Water Management Act: Section 19 - Local authorities: investigations

(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.

Flood and Water Management Act (2010), S.19, c.29, London: HMSO

- A. Natural Resources Wales (NRW)
- 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.

When considering if it is necessary or appropriate to investigate a flood event within its area, NPTCBC will review the severity of the incident along with the

number of properties affected and the frequency of such an occurrence. The Council's Local Flood Risk Management Strategy sets out the criteria to be used when considering a Flood Investigation Report.

4.2. Appendix B - Risk Management Authorities Responsibilities

RMA's in Neath Port Talbot have responsibilities in relation to flood risk management. Table 2 below identifies numerous sources of flooding and the RMA that has responsibility and flood risk management functions relating to a particular source of flooding.

Table 2, Responsibilities of Risk Management Authorities

Flood Source	Natural Resources Wales	Lead Local Flood Authority	Water Company	Highway Authority
Main River	✓			
Ordinary Watercourse		✓		
Surface Water		✓		
Surface Water Originating on the Highway				✓
Sewer Flooding			✓	
The Sea	✓			
Ground Water		✓		

The general responsibilities placed upon RMA's in relation to flood risk management are outlined below.

Natural Resources Wales

Natural Resources Wales (NRW) is responsible for managing the risk of flooding from main rivers and the sea. NPTCBC works closely with NRW, especially when managing flood risk from combined sources and in the event of a large flood incident. NRW also provide a flood warning service throughout Wales in areas at risk of flooding from rivers or the sea.

Neath Port Talbot County Borough Council as LLFA

NPTCBC is responsible for managing the flood risk related to ordinary watercourses, groundwater and surface water. NPTCBC has produced a Flood Risk Management Plan in line with the Flood Risk Regulations 2009 which sets out how the authority proposes to undertake this function. In addition to this and as previously stated, the Authority also has a Local Flood Risk Management

Strategy which was produced to meet the requirements of the Flood and Water Management Act 2010. There are a number of duties and responsibilities placed upon the Authority as the LLFA for the area by these two legislative documents. The Authority is also responsible for consenting works on ordinary watercourses and enforcing the removal of any unlawful structure or obstruction within the watercourse.

Neath Port Talbot County Borough Council as Highway Authority

The Authority undertakes routine maintenance on the water conveyance infrastructure contained within the highway including culvert and gully cleansing operations. These operations, together with visual inspections of the condition of such assets are undertaken to reduce the risk of flooding on the adopted highway network and adjacent land.

Dwr Cymru Welsh Water

Dwr Cymru Welsh Water (DCWW) is responsible for the supply of drinking water and for taking away, treating and properly disposing the wastewater that is produced throughout Wales. Any flooding that occurs from the overload of public sewers or burst water mains is the responsibility of DCWW.

South Wales Trunk Road Agency

The South Wales Trunk Roads Agency (SWTRA) is responsible for maintaining and managing the trunk road network throughout South Wales, including any associated drainage and flood risk assets.

Land/Property Owners

Under common law, land or property owners have rights and responsibilities relating to any watercourse that passes through or adjacent to the boundaries of their land. This means that the landowner must:

- Pass on flow without obstruction, pollution or diversion affecting the rights of others.
- Accept natural flood flows through their land, even if caused by inadequate capacity downstream, as there is no common law duty to improve a watercourse.
- Maintain the bed and banks of the watercourse (including trees and shrubs growing on the banks) and clear any debris, natural or otherwise,

including litter and animal carcasses, even if it did not originate from their land.

- Not cause any obstructions to the free passage of fish.
- Keep the bed and banks clear from any matter that could cause an obstruction either on their land, or by being washed away by high flow to obstruct a structure downstream.
- Take responsibility for protecting their property from seepage through natural or constructed banks.
- Keep clear any structure that they own such as culverts, trash screens, weirs etc.

Under the FWMA 2010, a landowner needs consent from the Council if they want to construct a culvert or flood relief control structure on any ordinary watercourse.