NORTH YORKSHIRE COUNCIL

Flood Investigation Report

Knaresborough 6th May 2024

Acknowledgements

North Yorkshire Council Lead Local Flood Authority would like to thank the following for their cooperation and assistance in this investigation:

Chain Lane Community Hub

Knaresborough Town Council

North Yorkshire Councilors

Yorkshire Water Services Ltd

North Yorkshire Council Highways Department

North Yorkshire Council Resilience & Emergencies Team

The Environment Agency

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1.0 Executive summary

On the 6th of May 2024 over 50 homes and businesses were flooded during a severe localised weather event in Knaresborough. The local community banded together with the help of the Chain Lane Community Hub to act as community anchor for residents to receive aid and temporary housing arrangements, along with working the LLFA to feed information of their experience so that we were able to deliver this report accurately.

The report uses the best available data along with resident's accounts to inform our understanding of flood risk across Knaresborough. The assessment of risk identifies a strong correlation between the worst affected locations and areas of high and medium flood risk. It is concluded that our understanding of risk corroborates the magnitude of rainfall observed.

Approximately 54mm of rainfall fell within a 35 minute period. This exceeded the average May monthly rainfall total of 43mm in half an hour with an equivalent storm intensity return period of 516 years. In the context of current drainage design standards, drainage is designed for no above ground flooding in a 1 in 30 year event and no flooding to properties in the 1 in 100 year event. The rainfall intensity therefore far exceeded current design standards for drainage systems. The event exceeded all current reasonable worst case scenarios and was not something that could be effectively forecasted.

Significant concerns were raised by the community in relation to condition of the drainage networks and new housing developments, and the use of historical soakaway drainage. The report directly addresses each of these issues.

Knaresborough is served by a comprehensive and complex network of integrated highway and public surface water and foul sewers. As well as the considering the exceptional rainfall event, the report considers with best available data, the condition of the local drainage networks. Data relating to drainage assets has been obtained from North Yorkshire Council and Yorkshire Water to establish whether the reported concerns regarding gully maintenance and drainage system failures contributed to the extent of flooding.

This report makes several recommendations with the aim of improving preparedness, resilience and recovery of communities throughout Knaresborough, North Yorkshire. It is also recommended that every opportunity is taken to ensure that regular maintenance of existing infrastructure is undertaken to ensure that drainage systems are functioning to their full capacity and that any opportunity to explore collaborative working with Yorkshire Water on the reducing the amount of surface water entering the public sewer network is maximised. Given the event has highlighted the risk in the locations and climate change predictions indicating that these type of storm events will become more frequent; it is critical that communities also play an active role in helping themselves to be resilient to the increasingly prevalent risk of flooding.

1.1 Scope/purpose of report

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 Risk Management Authorities (RMAs) had relevant flood risk management functions during the flooding that occurred on 6th May 2024, 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.

The supporting data has been put together based on reports of flooding from a variety of sources. Whilst every effort has been made to verify the locations that were flooded, the nature of the data and the methods used to collate this information mean that it does not include every occurrence of flooding. Private individual properties which flooded are not identified in this report as it is not within the wider public interest for each individual property to be identified. This data only identifies general areas where flooding has been reported to the Lead Local Flood Authority (LLFA).

1.2 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.

1.3 Section 19 Investigation Requirement

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

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

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.

1.4 Trigger for Section 19 Report

The incident has been assessed in line with the criteria set out in Section 3 of the North Yorkshire Council Local Flood Risk Strategy (2023) and has been judged to warrant a formal Section19 investigation on the basis of:

a. The relationship with the functions of other Risk Management Authorities.

b. Number of properties internally flooded

c. The depth, area or velocity of flooding reported.

d. The nature and extent of critical infrastructure impacted by the flood.

2 Background

2.1 Location of this investigation

This section of the report presents an analysis of the location of the properties impacted by the flooding and provides a brief assessment of the current understanding of flood risk at these locations. The understanding of flood risk is based on the best currently available data. This data is publicly available, and links provided below.

Flooding incidents were recorded at 51 private residences and 4 businesses during the event on the 6th May 2024. A map is shown below (Figure 1) that highlights the areas that were affected to show the clear scale and distribution of the incident within Knaresborough.

In general, the recorded incidents are distributed across Knaresborough, with clear areas of clustered properties and business affected. There are also several isolated incidents where a single property has reported flooding. To avoid going into granular detail that would identify and risk publishing details of individual properties, this report will focus on areas where individual properties will be more difficult to identify. This is consistent with our flood risk management strategy response to investigating flood incidents. We will address the issues affecting individual properties on a case by case basis with the property owners. Based on the clustering of properties in Figure 1 and shared concerns raised at each location, the report will cover in more specific detail the areas of Park Avenue, Orchard Close and Halfpenny Lane, St Margaret's Gardens, Queen's Road, Dentdale Drive, Lundale Avenue and Cotterdale Close.

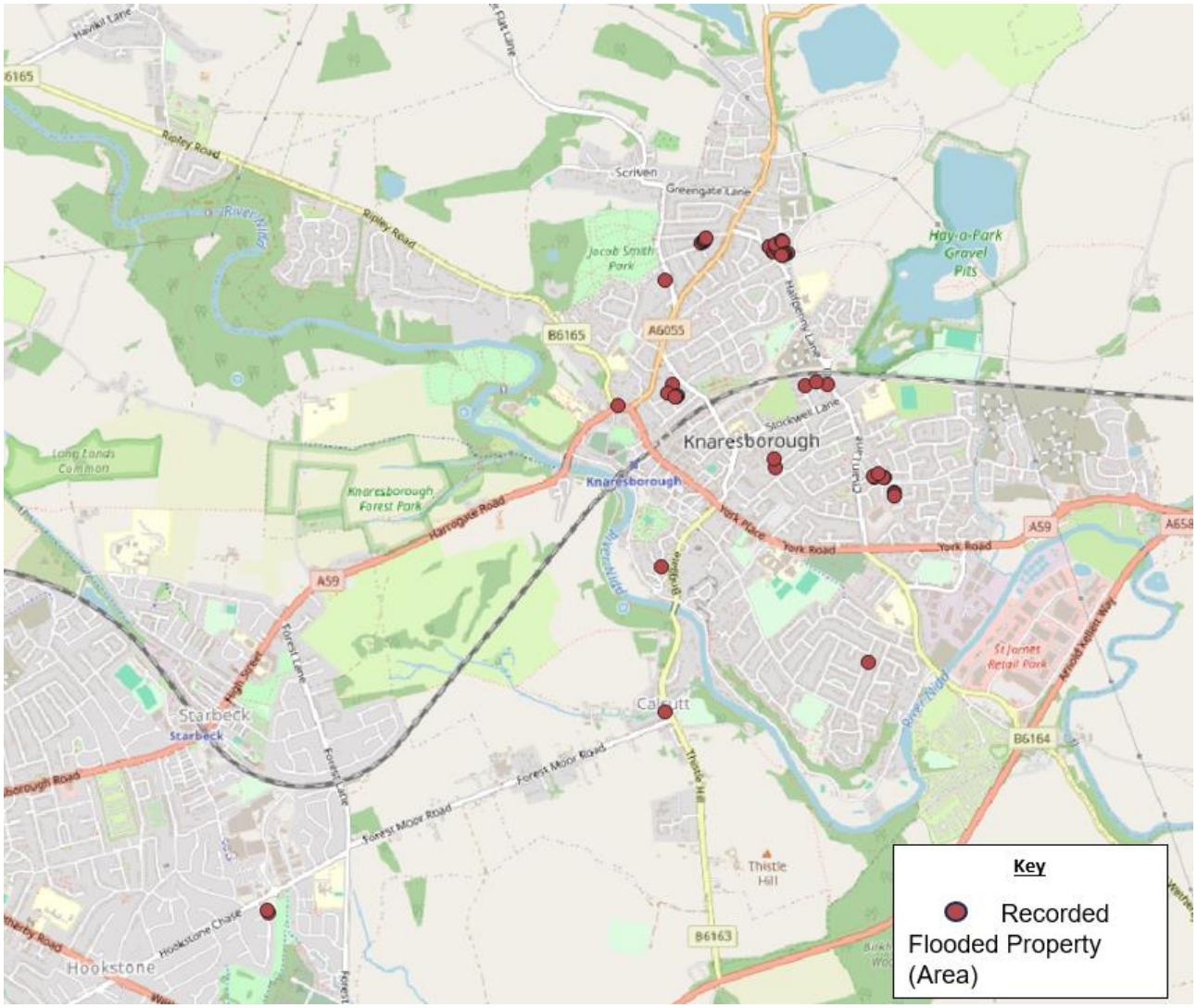


Figure 1: Recorded internal flooding locations

2.2 Understanding of Risk

This section aims to use the best available data to establish our current understanding of flood risk across Knaresborough, specifically around the area where internal flooding has been reported.

The flood map for planning, is a publicly available tool for reviewing flood risk from rivers and the sea. The flood map for planning is available to see online at https://flood-map-for-planning.service.gov.uk/

The flood map for planning provides the best available information on fluvial and tidal flooding. It is largely based on modelled data and the information it therefore provides is indicative of the expected flood extent. The information is not sufficiently detailed to demonstrate risk at individual property level, primarily because the Environment Agency do not hold details about properties and their door thresholds and floor levels. Properties with higher floor levels may not always face the same chance of flooding as the areas that surround them. The mapping is also limited to watercourses with a catchment area generally greater than 2km^2. This means that some of the smaller watercourses may not have an indicative flood extent recorded on the system.

It should also be noted that locations may also be at risk from other sources of flooding, such as overland (surface water) runoff from heavy rain, or failure of infrastructure such as sewers and storm drains.

Areas at risk of surface water flooding are harder to understand and demonstrate than areas at risk from tidal or fluvial flooding. Small changes such as raising or lowering a kerb can alter the way surface water flows through a town or village. Notwithstanding this, where smaller watercourses have not been included in the national generalised modelling on the flood map for planning, the risk of surface water flooding maps give an indication of flood risk based upon Lidar imaging.

Surface water risk and risk from reservoirs maps are available to see online at https://www.gov.uk/check-long-term-flood-risk

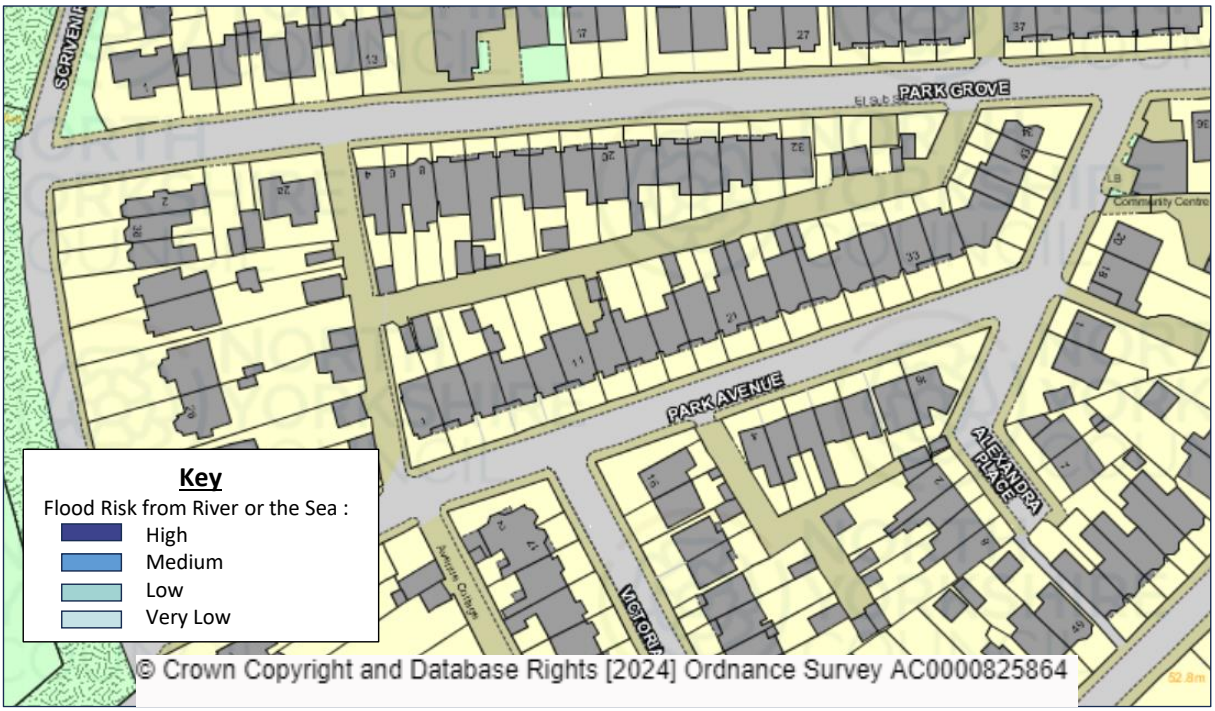
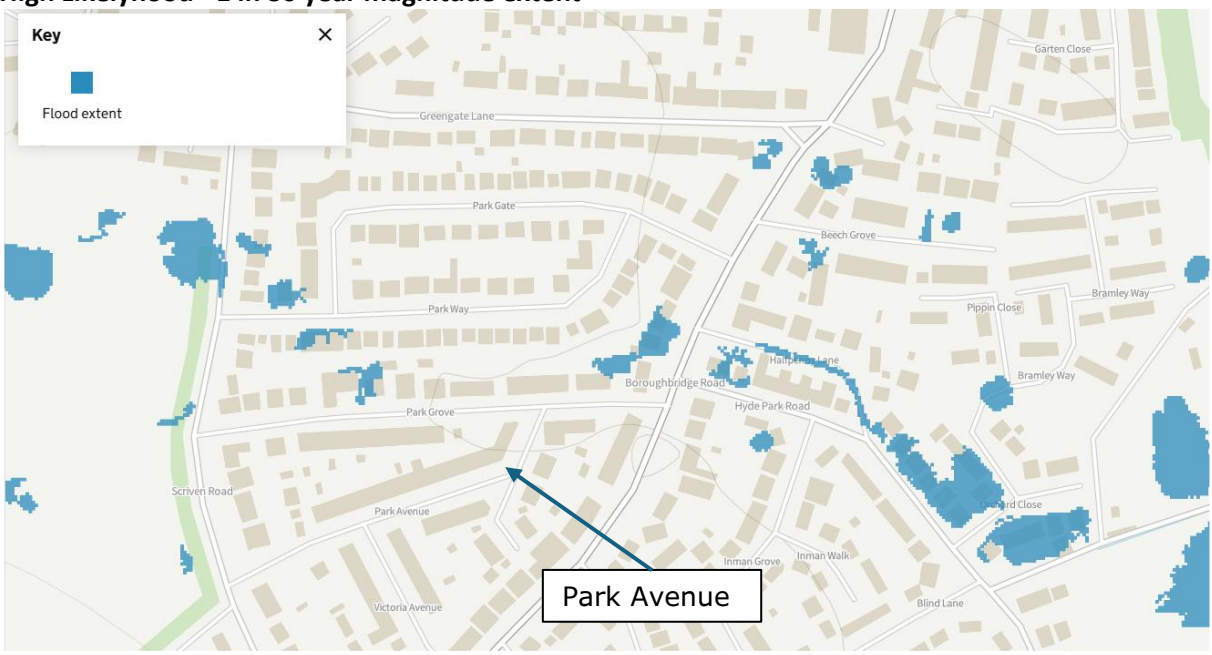
North Yorkshire Council commissioned and developed its own overland flow mapping which is based on ground levels to supplement publicly available data. The mapping was produced for the entire county and the level of detail provided is commensurate to a scale and needs of the whole county. As such the overland flow mapping does not consider the presence of drainage infrastructure and based purely on coarse ground level data. The mapping does not identify exact flow pathways but instead serves to inform of the catchment area that contributes and where flow of water may be concentrated.

Water held and flowing within permeable rocks and within the soil below the normal ground level is termed groundwater. Groundwater flooding occurs when the level of the water in the ground – sometimes referred to as the water table - rises above the ground level, or infiltrates underground structures which are designed to be dry. Groundwater flooding would typically occur when sustained periods of heavy rainfall over several months is experienced.

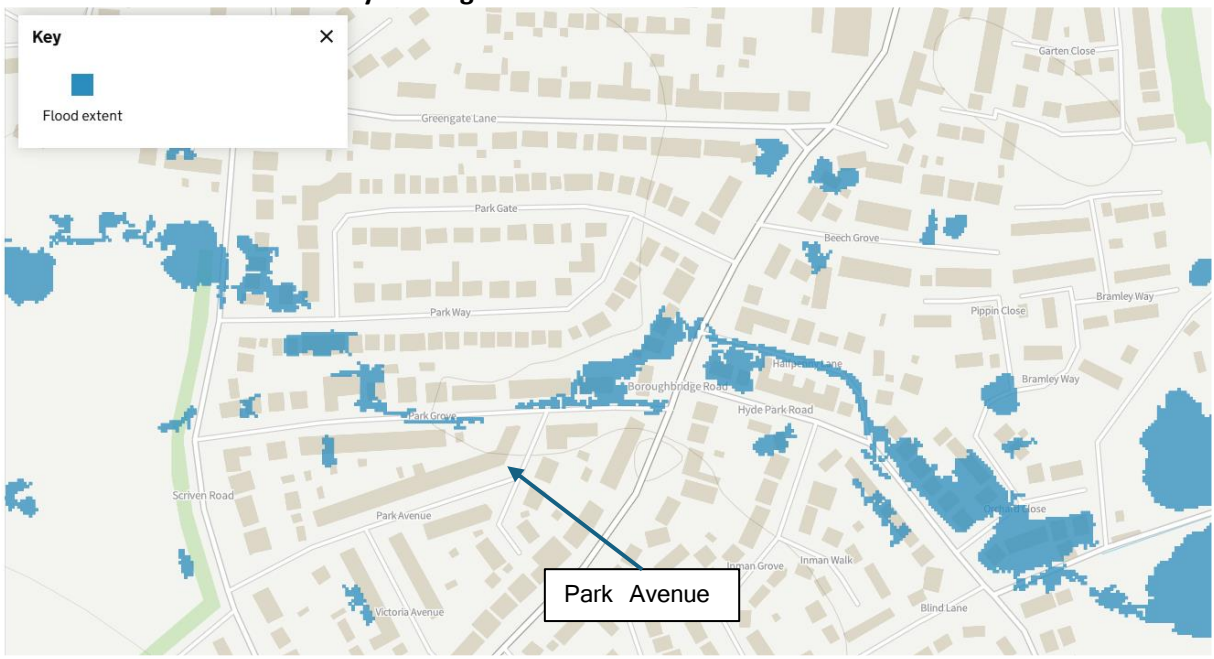
An assessment of risk for each of the locations identified above is presented below.

2.2.1 Park Avenue

Table 1: Park Avenue Understanding of Flood Risk

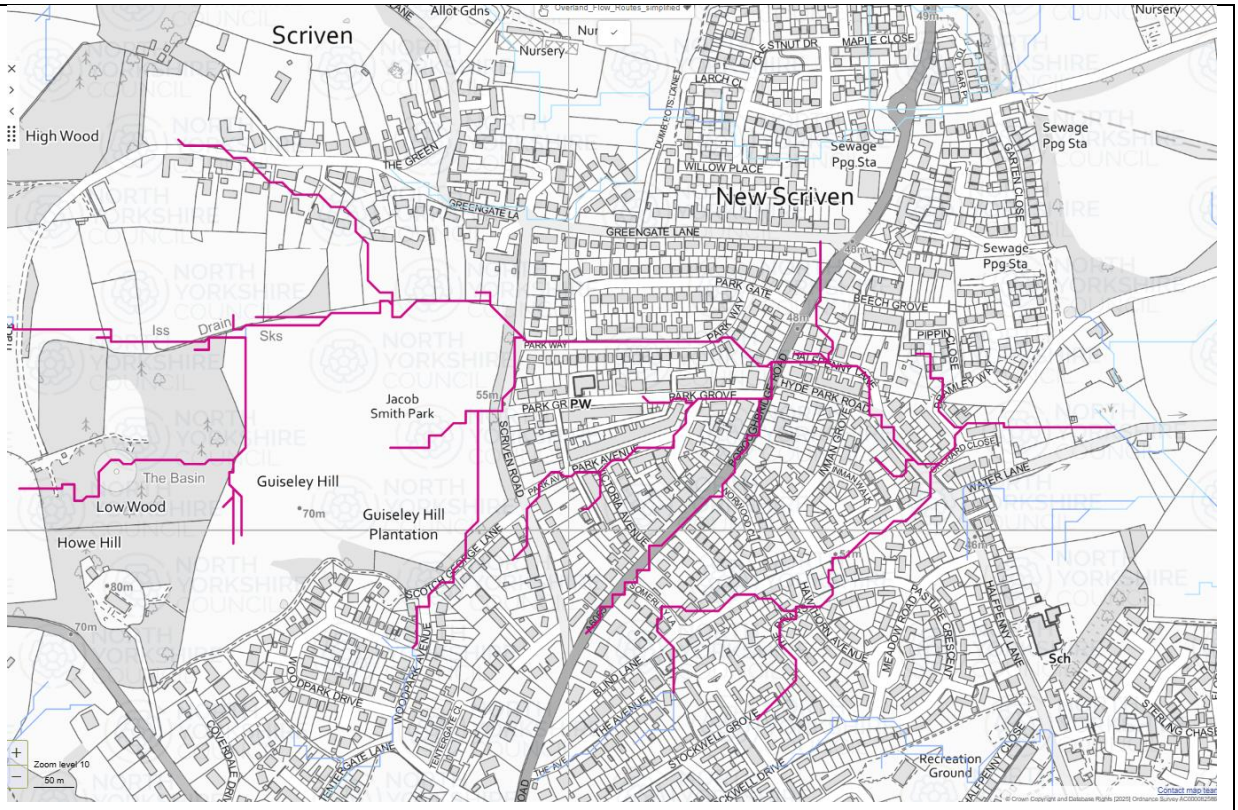
Source of Flooding	Understanding of Risk
Flood Risk from River or the Sea	 The properties at Park Avenue are not shown to be at risk from rivers or sea.
Pluvial Flood Risk (Surface Water)	**High Likelyhood - 1 in 30 year magnitude extent** 

Medium Likelihood - 1 in 100 year magnitude extent



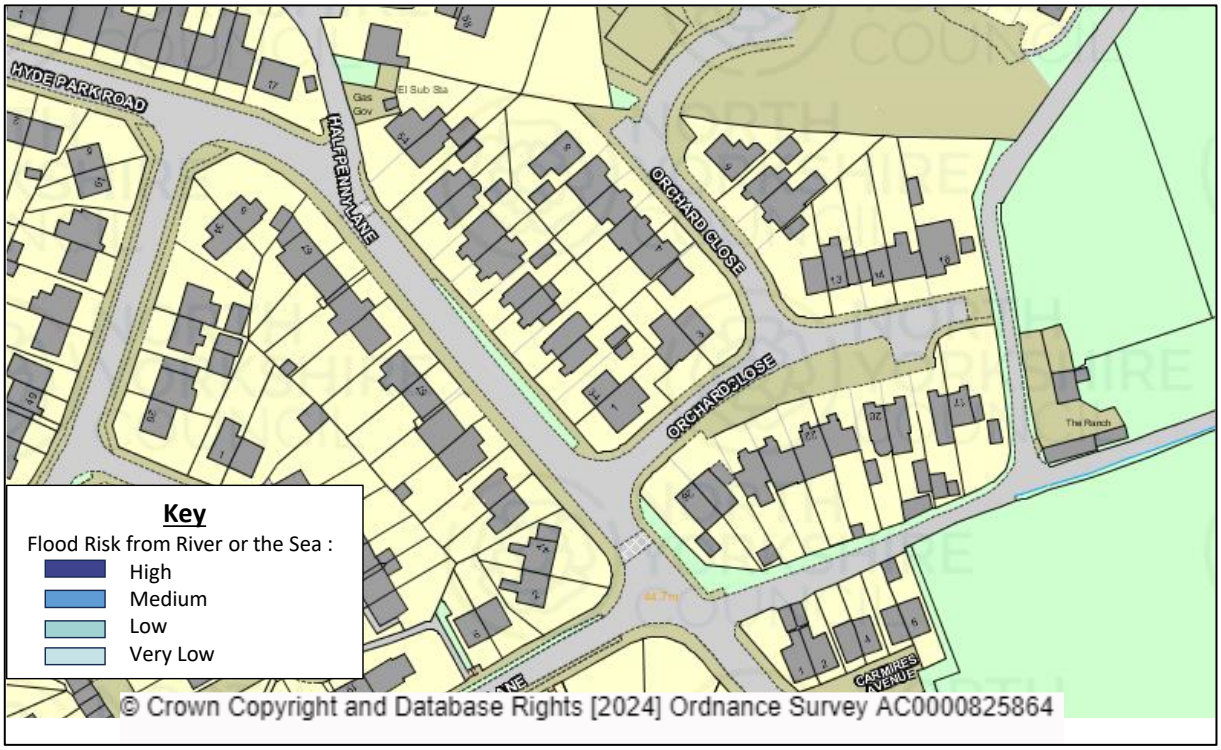
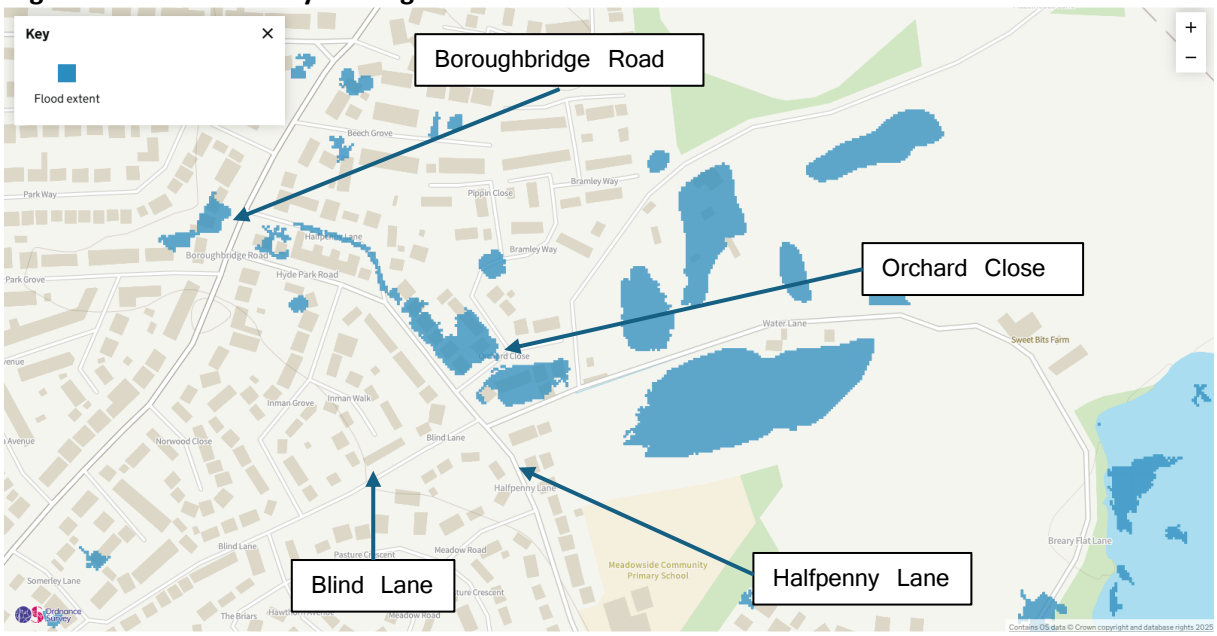
Low Likelihood - 1 in 1,000 year magnitude extent

The Risk of Flooding from Surface Water map indicates that there are some pockets of High risk of flooding (1 in 30 year event) associated with localised low spots along Park Grove but properties along Park Avenue are not show to be at risk. In the Medium and Lower likelihood scenarios, the flood extents expand, and flow paths emerge from Jacob Smith Park and flow along Park Grove, whilst some flood extent would be expected in the 1 in 1,000 year event on Park Avenue and significant flooding on Park Grove, the properties on Park Avenue that reported flooding continue to be indicted as being very Low risk.

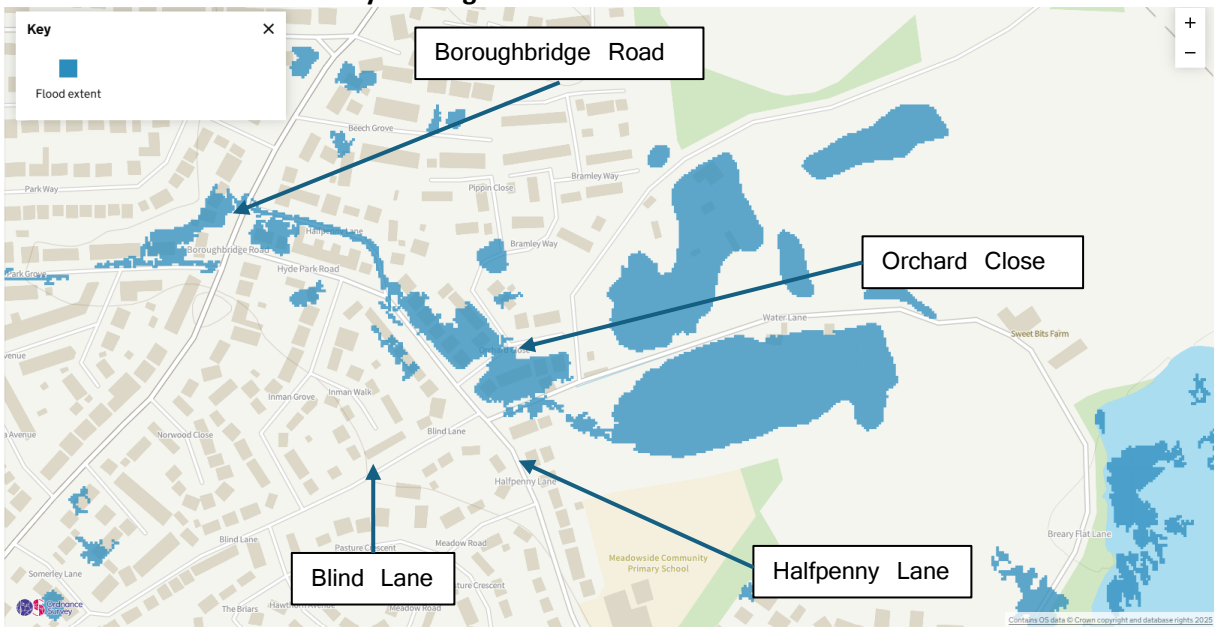
Overland Flow Pathways	 The overland flow pathways indicate a catchment extending beyond upstream from to Skriven Road to the south east. In an exceptional event runoff could be routed along this pathway.
Reservoir Flooding	Park Avenue is not shown to be at risk of flooding from reservoirs.
Flood Alert and Warning Areas	Park Avenue is not within any Flood Warning areas.
Current Flood Defences	There are no formal flood defences to protect Park Avenue from surface water flooding.
Conclusion	The predominant risk of flooding at Park Avenue is from Sewer and Surface Water flooding, the area is not at risk of flooding from any other source.

2.2.2 Orchard Close and Halfpenny Lane

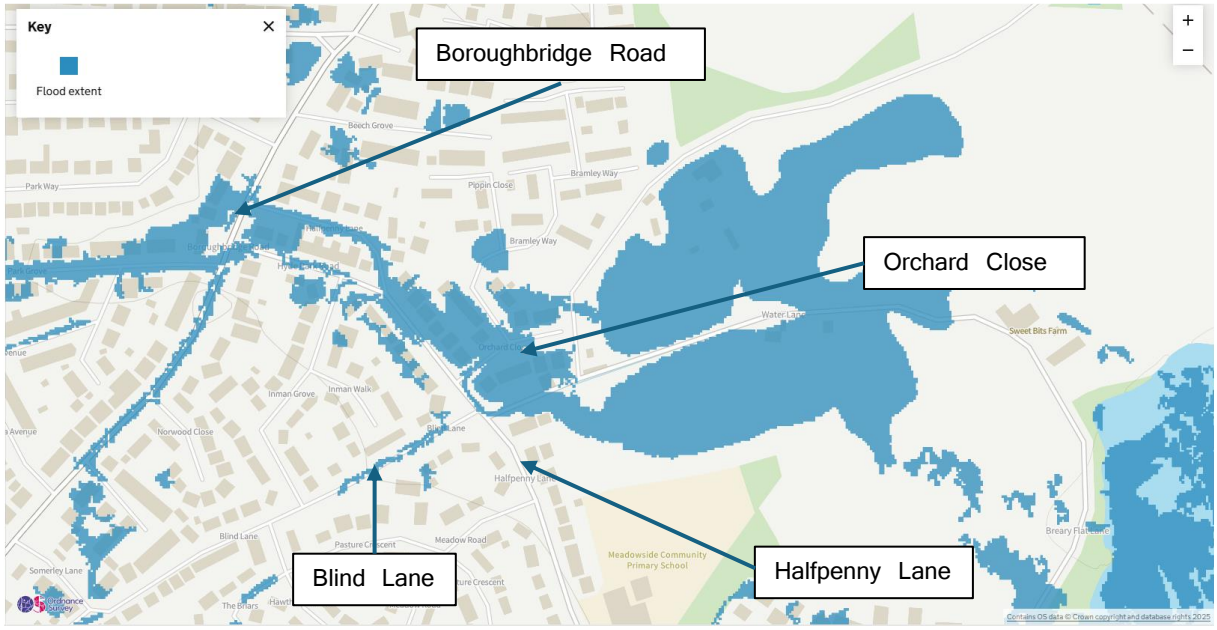
Table 2: Orchard Close and Halfpenny Lane Understanding of Flood Risk

Source of Flooding	Understanding of Risk
Flood Risk from River or the Sea	 Orchard Close & Halfpenny Lane are shown to not be at risk from rivers or sea.
Pluvial Flood Risk (Surface Water)	**High Likelihood - 1 in 30 year magnitude extent** 

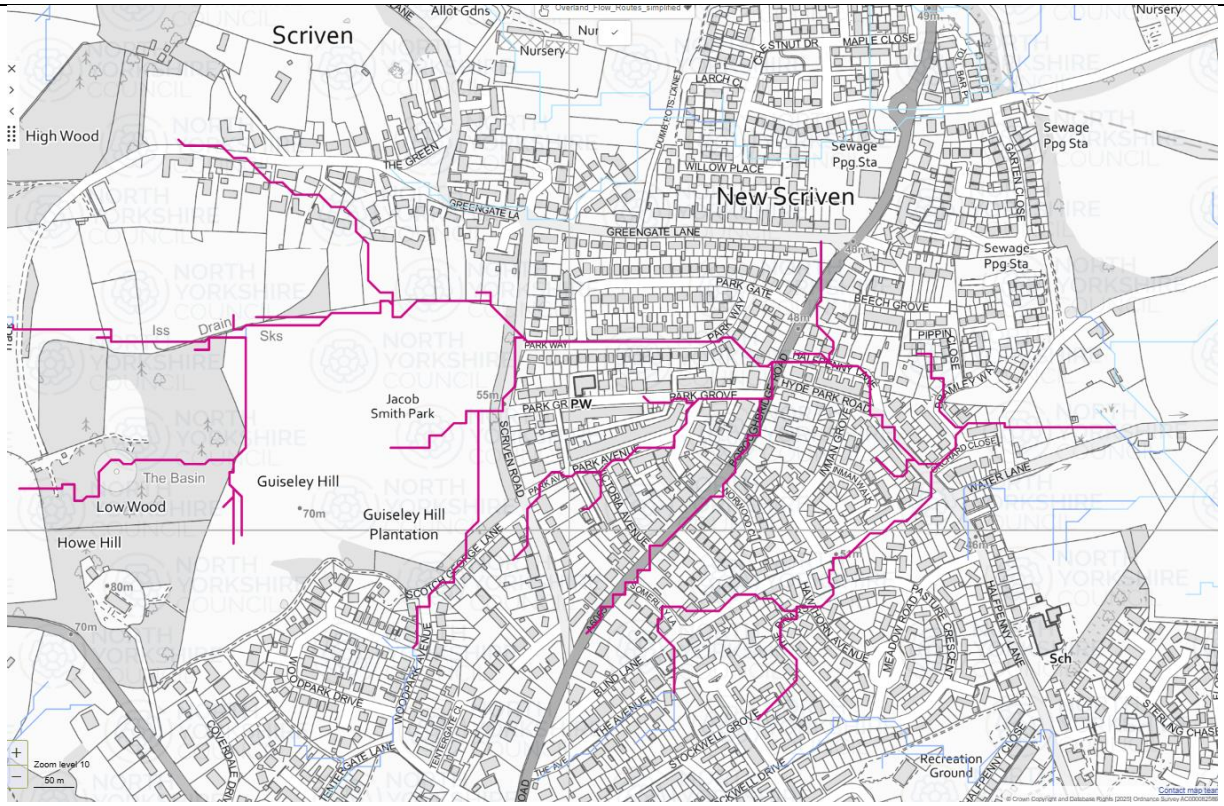
Medium Likelihood - 1 in 100 year magnitude extent



Low Likelihood - 1 in 1,000 year magnitude extent

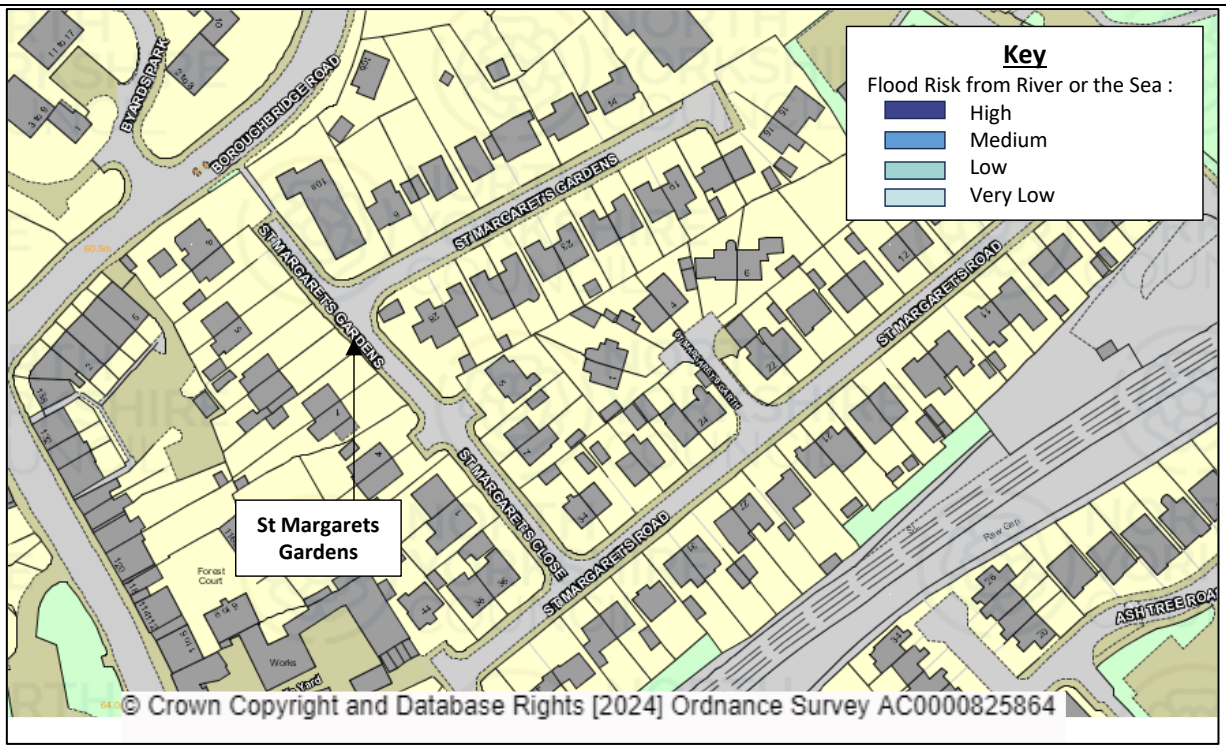


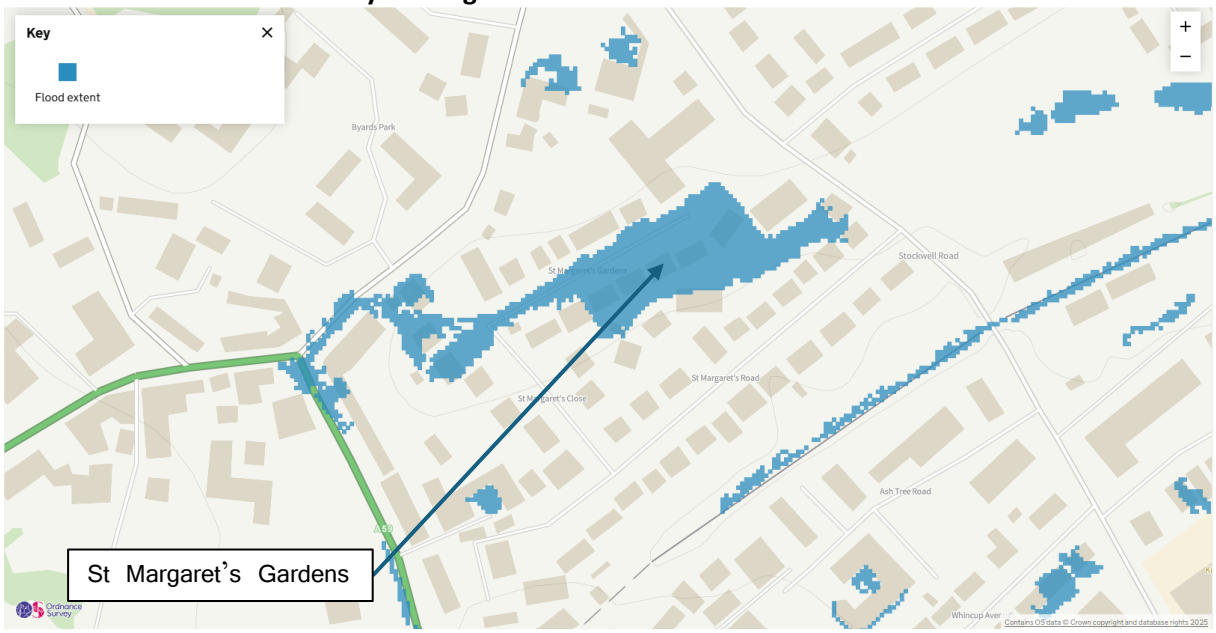
The maps identify a large number of properties within the High and Medium risk area from surface water flooding. Initially in the High risk scenarios the flooding is isolated to ponding within low spots. As the intensity increases it appears that the highways become conduits for surface water. There is a strong correlation of runoff along Park Grove, Boroughbridge Road and Blind Lane converging on Halfpenny Lane and the Orchard.

Overland Flow Pathways	 As discussed in the surface water risk section, flood pathways are shown to emerge from beyond Boroughbridge Road and Blind Lane and converge around the area of Orchard Close. The catchment that contributes runoff to the properties on Halfpenny Lane and Orchard Close is extensive. Pathways have been identified. The sewer records indicate a surface water sewer originating from Jacob Smith Park and emerging around Water Lane before flowing into the gravel pit. This is likely to follow the course of a historical watercourse.
Reservoir Flooding	Orchard Close/Halfpenny Lane are not shown to be at risk of flooding from reservoirs.
Flood Alert and Warning Areas	The area around Orchard Close and Halfpenny Lane is not included within a flood warning area.
Current Flood Defences	There are no formal flood defences to protect Orchard Close/Halfpenny Lane from surface water flooding.
Conclusion	The primary risks of flooding to Orchard Close and Halfpenny Lane is surface water runoff or sewer flooding due to the sewer system being overwhelmed by the volume of water.

2.2.3 St Margaret's Gardens

Table 3: St Margaret's Gardenss: Understanding of Risk

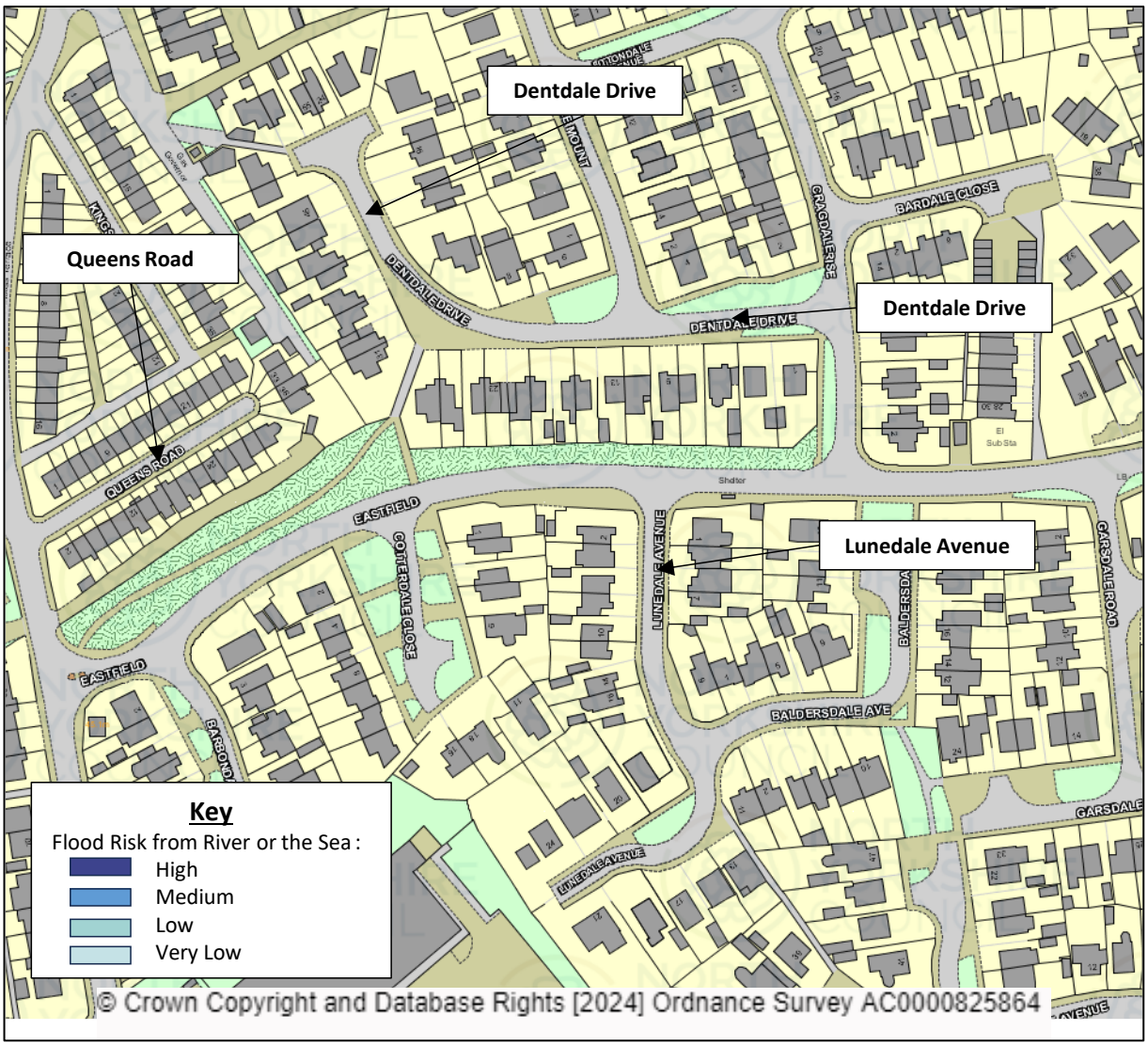
Source of Flooding	Understanding of Risk
Flood Risk from Rivers and Sea	 The properties at St Margaret's Gardens is shown to not be at risk from Rivers or the sea.
Pluvial Flood Risk (Surface Water)	**High Likelihood - 1 in 30 year magnitude extent** 

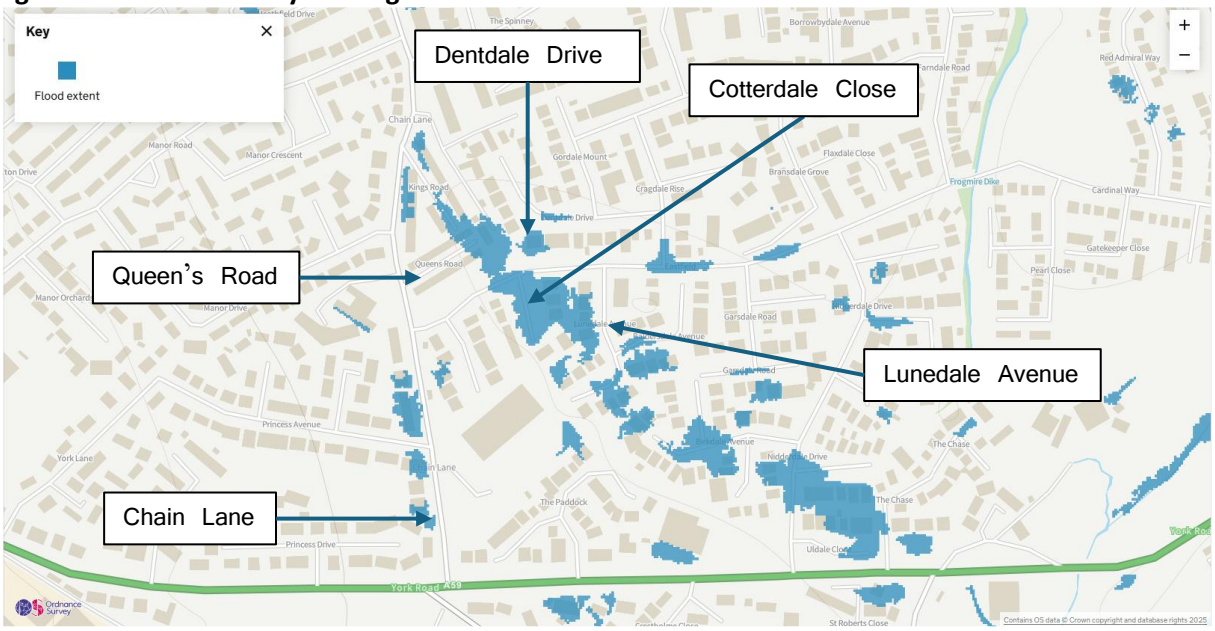
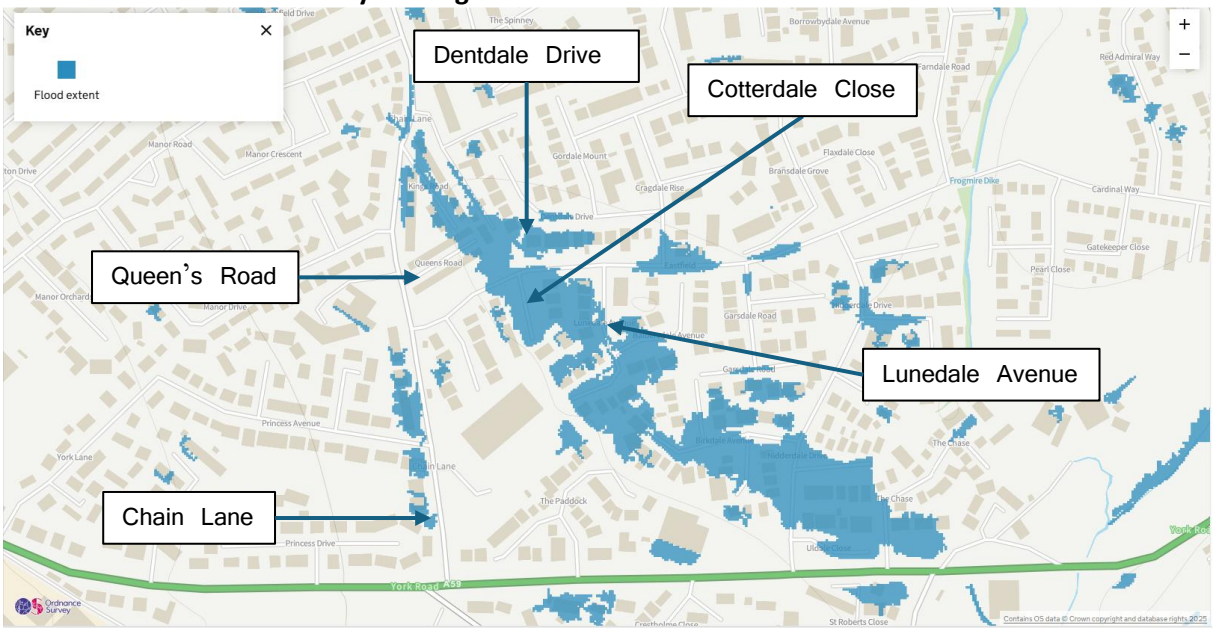
	Medium Likelihood - 1 in 100 year magnitude extent  **Low Likelihood - 1 in 1,000 year magnitude extent**  It is noted the map above shows the surface water flood risk for St Margaret's Gardens. The data presents a large area of properties that are within the High and Medium risk area from surface water flooding. The mapping in this location shows a higher number of properties at risk of flooding than reported flooding during event. It could be considered that the above flood extent and risk is conservative.
Reservoir Flooding	St Margaret's Gardens is not shown to be at risk of flooding from reservoirs.
Flood Alert and Warning Areas	St Margaret's Gardens is not located within a flood warning area.
Current Flood Defences	There are no formal flood defences to protect Orchard Close/Halfpenny Lane from surface water flooding.

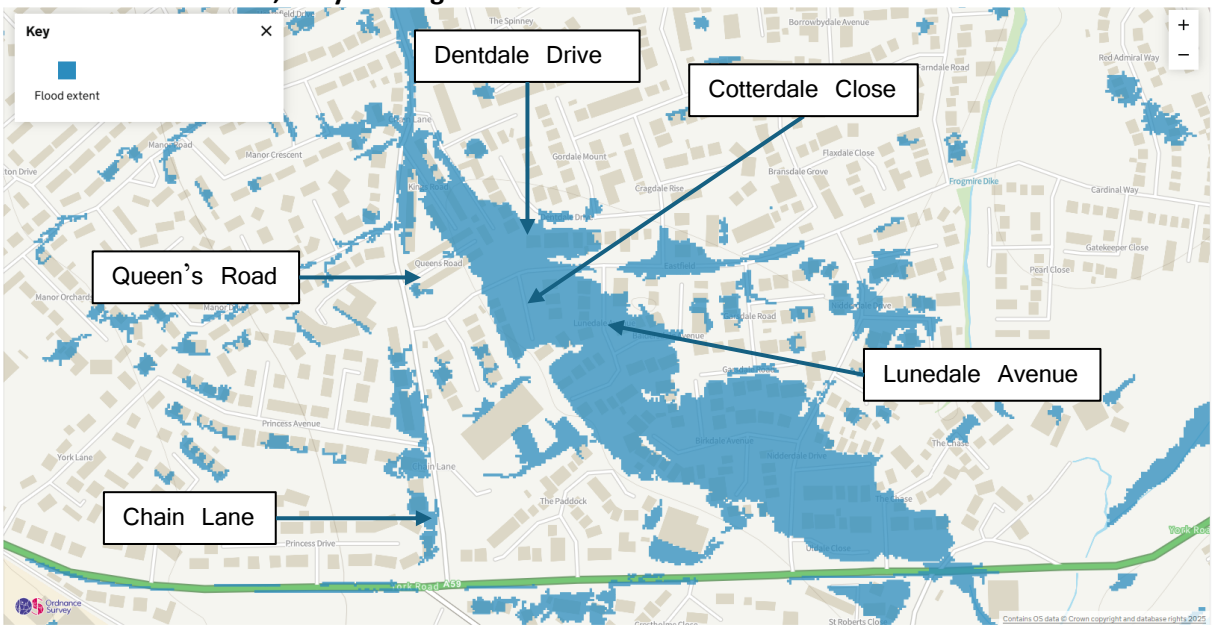
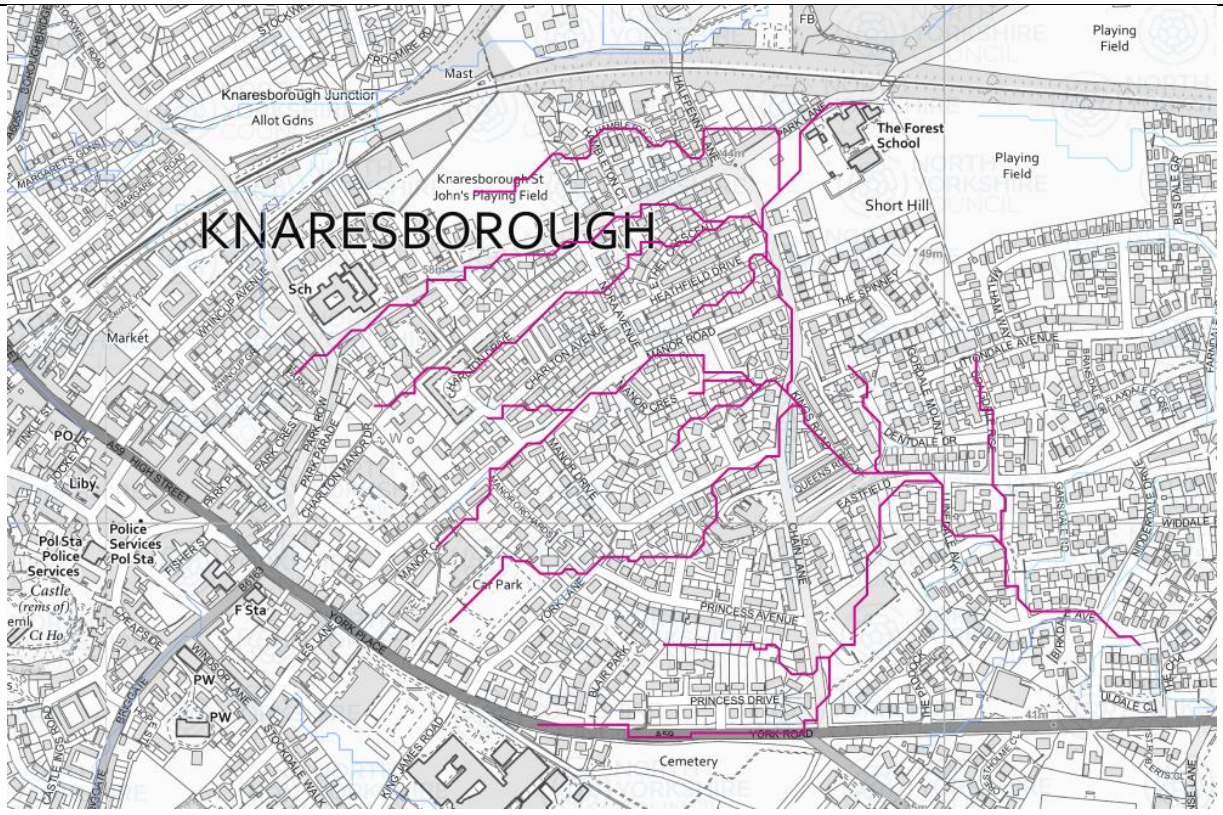
Conclusion	The primary risks of flooding to St Margeret's Close is surface water runoff or sewer flooding due to the sewer system being overwhelmed by the volume of water.

2.2.4 Queen's Road, Dentdale Drive and Lundale Avenue

Table 4: Queen's Road, Dentdale Drive and Lunedale Avenue: Understanding of Risk

Source of Flooding	Understanding of Risk
Flood Risk from Rivers and Sea	 The properties at Queen's Road/Dentdale Drive/Lundale Avenue are shown to not be at risk from Rivers or the sea.

Pluvial Flood Risk (Surface Water)	**High Likelihood - 1 in 30 year magnitude extent**  **Medium Likelihood - 1 in 100 year magnitude extent** 

	Low Likelihood - 1 in 1,000 year magnitude extent  It is noted the map above shows the surface water flood risk for Queen's Road, Dentdale Drive, Lundale Avenue and Cotterdale Close. The data presents a large area of properties that are within the High and Medium risk area from surface water flooding. The Highway is primarily within a Medium/Low risk area with some areas of the Highway being partially within a High risk area.
Overland Flow Maps	 The overland flow maps demonstrate a signficant catchment that contribites runoff towards the Eastield, Cotterdale Close and Lundedale Avenue from York Road to the South to the railway line to the North. The catchment is aslo particlarly steep generating high velocities of runoff.
Reservoir Flooding	Queen's Road, Dentdale Drive, Lundale Avenue and Cotterdale Close are not shown to be at risk of flooding from reservoirs.

Flood Alert and Warning Areas	The area of Queen's Road, Dentdale Drive, Lundale Avenue and Cotterdale Close is not included in a flood warning area.
Current Flood Defences	There are no formal flood defences in the vicinity of Queen's Road, Dentdale Drive, Lundale Avenue and Cotterdale Close.
Conclusion	The primary risks of flooding to Queen's Road, Dentdale Drive, Lundale Avenue and Cotterdale Close is surface water runoff or sewer flooding due to the sewer system being overwhelmed by the volume of water.

3 Investigation

3.1 Rainfall event – location, depth & duration

3.1.1 Environment Agency Data

Information below provided by the Environment Agency was supplied in response to the LLFA's Section 14 of the Flood and Water Management Act 2010 request for data.

The radar image below shows the 3-hour accumulation from 5pm to 8pm BST; the heaviest rain is shown as white, the lightest rain is the blue and grey. The rainfall was very localised and focused on an area from Leeds and Bradford to the south and stretching North through Harewood, Spofforth, Knaresborough and close to Boroughbridge in just to the north of Knaresborough.

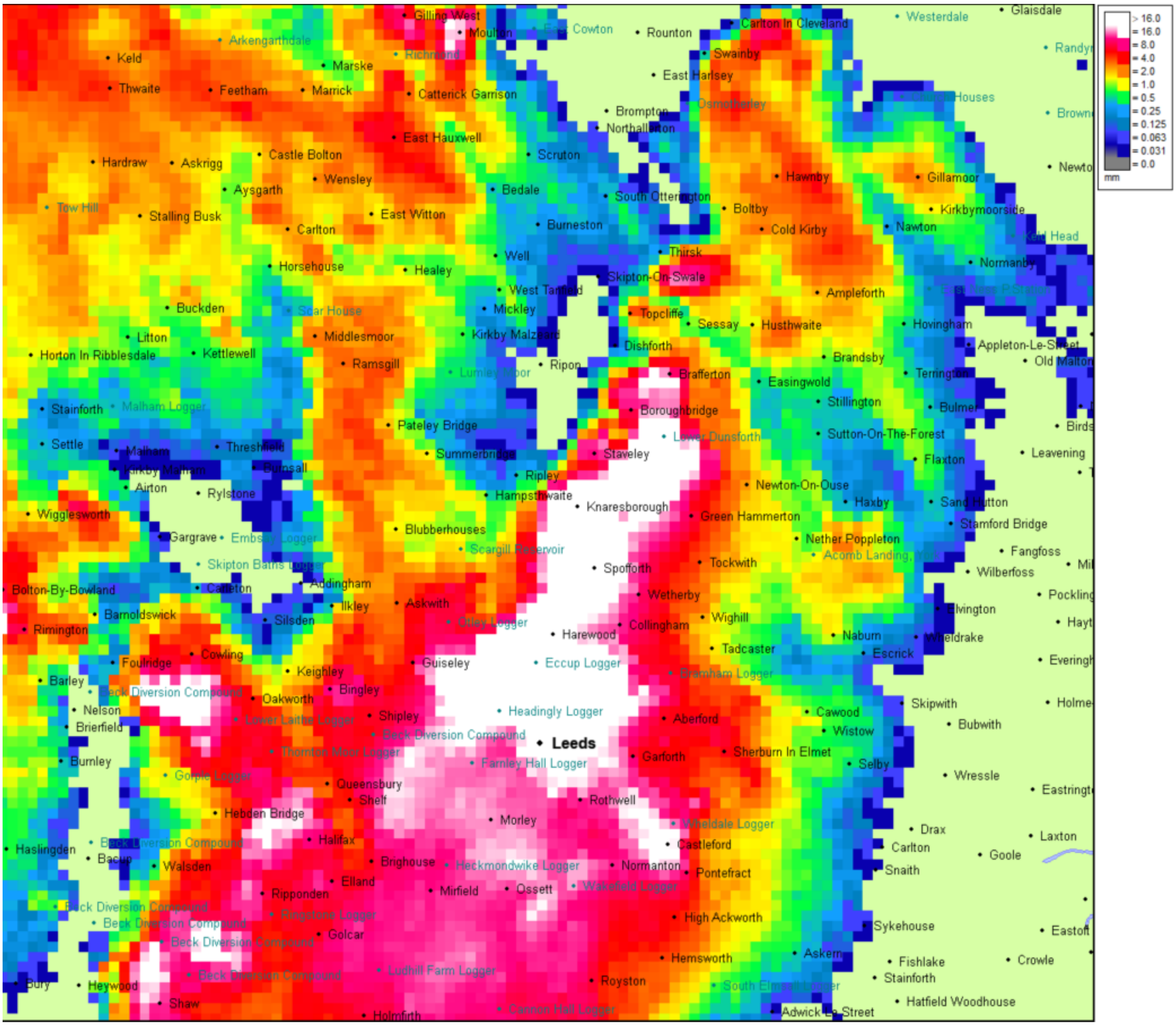


Figure 2: Yorkshire Water Rainfall Radar 6th May 2024

In addition to Kanresborough, flooding was also reported within the media in Leeds and Bradford. This was therefore a significant event and not isolated to Knaresborough.

Leeds: Flash flooding hits roads and railways during storm

7 May 2024

Downpours led to rainwater flooding the tracks at Horsforth railway station

Heavy rain during a thunderstorm led to flash flooding on Bank Holiday Monday in Leeds, as drivers abandoned cars and several roads were closed.

A section of Low Lane in Horsforth between King George Road and St James Drive has shut "until further notice" due to a sink hole, the council said.

https://www.bbc.co.uk/news/uk-england-leeds-68970025

Flooding a 'one in 150-year event', says council

The M606 was closed on Monday because of the downpours

8 May 2024

Flash floods which hit Bradford over the bank holiday were a "one in 150-year storm event", the city council has said.

The M606 motorway was closed on Monday following a sudden downpour, while parts of the city centre were also badly affected.

Killinghall Primary School was closed on Tuesday because of the previous day's flooding.

Bradford Council said its drainage systems had been "overwhelmed".

https://www.bbc.co.uk/news/articles/cl5k0vk34gzo

Flash flooding causes widespread disruption across Bradford

6TH MAY 2024 EMERGENCY WEATHER BRADFORD

Flash flooding battered Bradford this afternoon. These pictures show Vicar Lane in the city centre and the M606 when floodwaters forced it to be blocked off. *(Image: UGC)*

By Daryl Ames
Reporter

https://www.thetelegraphandargus.co.uk/news/24301960.flash-flooding-forces-broadway-car-park-roads-close/

The Environment Agency have reported to the LLFA that on the 6th of May 2024 there were no flood alerts or warnings issued in regard to the River Nidd in Knaresborough .

3.1.2 Yorkshire Water rainfall analysis

For analysis and risk estimation purposes, the magnitude of rainfall is often expressed as return periods. A return period is derived from historical data and is the average time between events. For example, a rainfall event can be

described as a 1 in 100 year rainfall event which means there is a 1% chance of that rainfall occurring in any given year. The lower the chance, the greater size of the flood.

Data provided to the LLFA from Yorkshire Water for the afternoon of 6th May 2024 recorded a peak rainfall intensity of 1 in 516 years. The rainfall event also lasted approx. 35 minutes and peaked at 54mm of rainfall. New modern drainage systems, both Highway drainage and public sewer networks are typically designed to contain a 1 in 30 year below ground and guide anything up to a 1 in 100 to a designated area for storage. Elsewhere and in the case of Knaresborough where there are historic networks the 1 in 100 is not catered for. Nevertheless, the Highway drainage is designed to cope with rain which falls on the highway only and is typically designed to still cope with rainfall events up to the 1 in 30 year scale. Similarly, the public sewer network is designed to contain up to the 1 in 30 year level of rainfall event. Household drainage systems often have a capacity of less than 1 in 10 year.

Rainfall in excess of this will inevitably overwhelm the system, and with rainfall at a rate close to a 1 in 516 year event the capacity of the drainage network was greatly exceeded. This overwhelmed all drainage systems and networks due to the amount of water that affected the area.

3.2 Flooding consequences & Investigation

The Areas that were affected by the flooding are dispersed around the Knaresborough area in clusters and correlate very closely to the areas indicated to be at high and medium flood risk in accordance with the Risk of Flooding from Surface Water (RoFSW) mapping. In this section, we review witness accounts in addition to information gathered from North Yorkshire Highways, and Yorkshire Water.

Section 14 of the Flood and Water Management Act 2010 requires all risk management authorities to co-operate and share information for the purpose of investigating flooding issues. The investigation to each locality below is informed by

- Witness Reports
- Overland flow mapping
- Kaarbontech Gully Cleansing Data from North Yorkshire Council -Kaarbontech
- North Yorkshire Council Highways jetting and drainage CCTV surveys
- Yorkshire Water work order records and CCTV survey results

3.2.1 Park Avenue

Flooding to a number of properties was reported on Park Avenue, mainly confined to basements, and particularly where bathrooms and toilets have been installed below ground level. As noted within the understanding risk section, whilst Park Grove is indicated to be at medium to high risk of flooding (between 1 in 30 and 1 in 100 year event). Flooding above ground level would therefore be expected in 1 in 516 year event.

The area is served by a network of public foul and surface water sewers in Figure 3. It is noted however that a number of the properties area indicated to have a single combined foul and surface water drain (denoted red) connecting to the foul only sewer (brown lines) . This suggests that surface water is being discharge d into a system that was historically designated for foul waste water only. The public sewers are maintained and regulated by Yorkshire Water. The location of NYC highway drainage is presented in Figure 4.

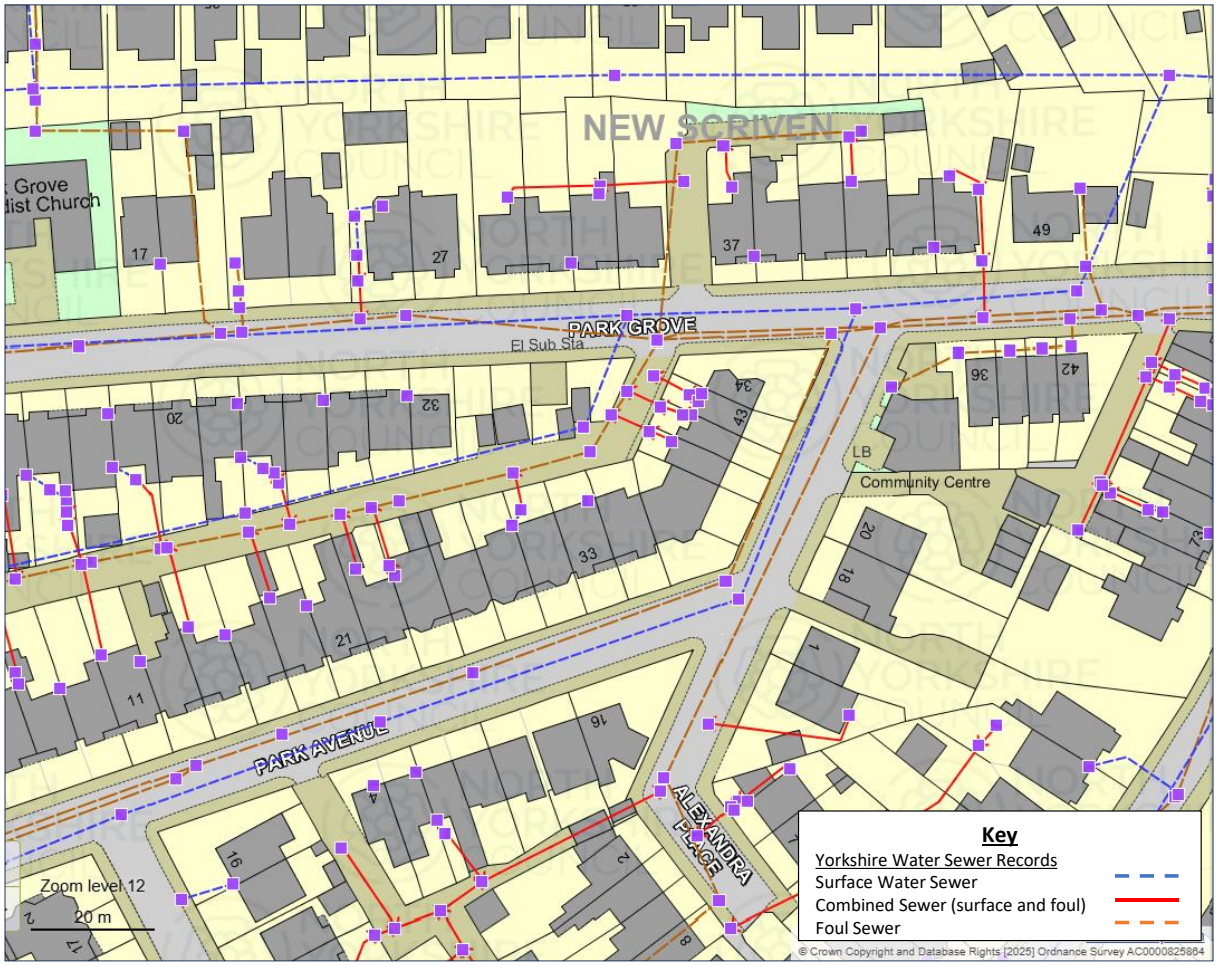


Figure 3: Park Avenue Public Sewer Records

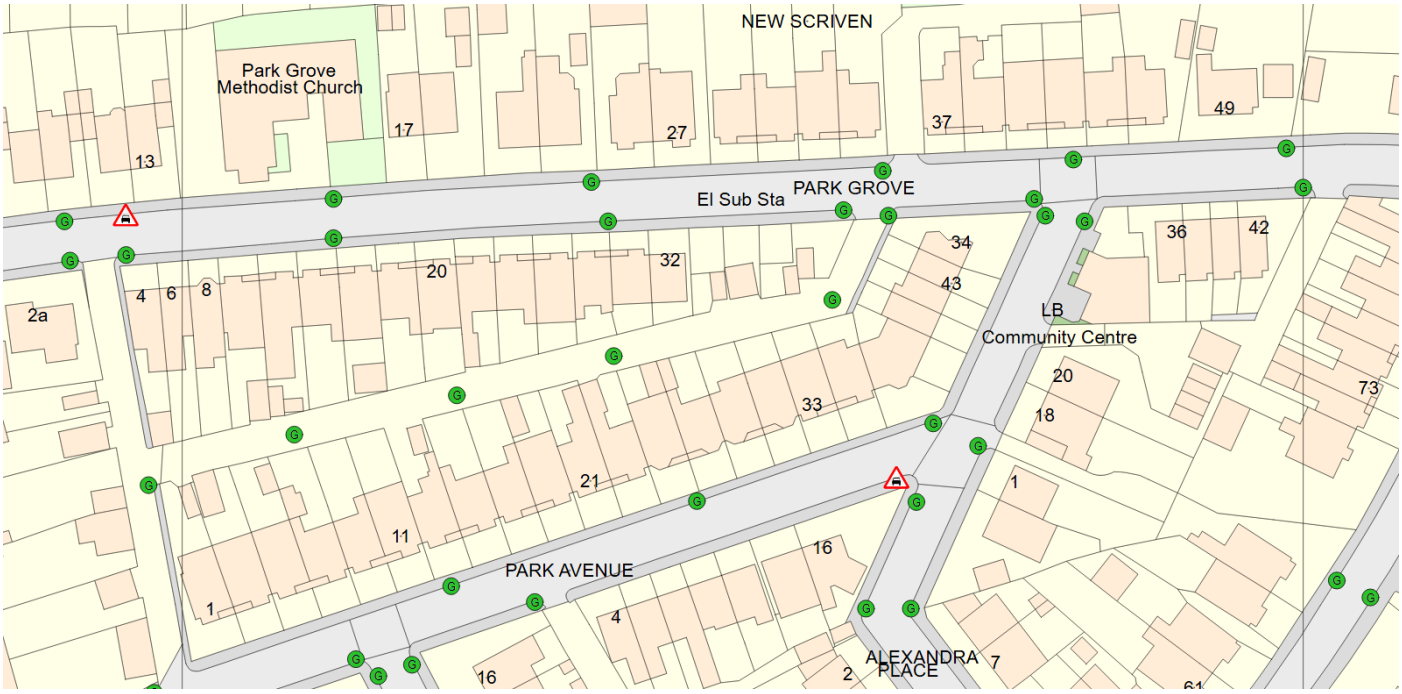


Figure 4: Park Avenue Highway Gully locations

For demonstration purposes the gullies within Figure 4 are shown as presented on the Council's routine gully cleansing schedule programme. The system provides insights on the status of each individual gully on the network. Other than parked cars located over two gullies, one of Park Grove and the other on Park Avenue, the green G

symbols confirm there are no known issues with the gullies in this location. The gullies on Park Grove were checked and cleared on 21st May 2024 and Park Avenue on 23 August 2024 in response to the event and no issues were reported with the gullies immediately after the event.

Further investigation after the event by NYC confirms that Park Avenue and Park Grove are served by separate surface water and foul sewer systems and the highway drainage from Park Avenue is connected to the surface water network on Park Grove. Inspection of the main surface water sewer identified a slight build-up of silt reducing the capacity by about 10%. NYC therefore requested Yorkshire Water cleansed the system.

Whilst the foul sewer was running fine during the investigation the flow rapidly increased during a 5-minute rain shower observed. It is noted that Yorkshire Water have already removed an interceptor trap to try and improve the flow out of one of the properties.

It is noted from the resident's witness account that this is not the first instance of flooding from this source, with flooding reported in 2006, 2021 and 2024. Whilst the event of 6th of May was unprecedented the issue on Park Avenue does not appear to be isolated and points to a long-term issue with miss-connections of surface water into the foul drain. The foul drain is designed to accommodate the foul water only from the properties and surface water should not be connected to the foul drains, as such, the drain does not have any capacity for surface water runoff resulting in flooding.

A recommendation is made that YW continues to monitor and explore means of resolution to the internal flooding on Park Avenue. Residents should also check where possible whether their drainage is combined or separate and make enquiries with Yorkshire Water as to how the miss-connections could be resolved or their impacts reduced by slowing the flow through sustainable drainage methods such as water butts or raingardens.

3.2.2 Orchard Close/Halfpenny Lane

The area around Orchard Close and Halfpenny Lane was significantly affected with 22 reports of internal flooding received. As noted in the understanding risk section, the properties on Halfpenny Lane and Orchard Close are indicated to be at high risk of surface water flooding.

Whilst there are a network of surface water and foul water sewers on Halfpenny Lane and Orchard close, discussion with property owners in the vicinity of Halfpenny Lane and Orchard close confirms that the properties currently drain to private soakaways. These soakaways were installed to drain the roof water of the properties, and the soakaways are located within the gardens of the properties. The information provided by a resident indicates that these are pits filled with granular material, which can be difficult to identify and maintain. However, they are included within the plans provided within the property deeds. The soakaways have been operational since the development was constructed in the 1960s. The responsibility for these soakaways rest with the property owners. Some of the soakaways are in shared ownership and there may be nuances as the to the maintenance of these written within the deeds. If there is nothing written within the deeds the responsibility defaults to the landowner. We recommend that residents seek their own independent legal advice on this matter.

If the private soakaways are adequately maintained and regularly inspected, there is no reason why they cannot operate for over a 100 years. Inevitably the soakaways will need replacing when silt levels have built up over time. The timing of when this is required depends on the how frequent the soakaways have been maintained throughout its operational life. A typical soakaway maintenance regime is provided in below.

Table 4: Typical Soakaway Maintenance Regime (Ciria SuDS Manual)

Maintenance schedule	Required action	Typical frequency
Regular maintenance	Inspect for sediment and debris in pre-treatment components and floor of inspection tube or chamber and inside of concrete manhole rings	Annually
	Cleaning of gutters and any filters on downpipes	Annually (or as required based on inspections)
	Trimming any roots that may be causing blockages	Annually (or as required)
Occasional maintenance	Remove sediment and debris from pre-treatment components and floor of inspection tube or chamber and inside of concrete manhole rings	As required, based on inspections
Remedial actions	Reconstruct soakaway and/or replace or clean void fill, if performance deteriorates or failure occurs	As required
	Replacement of clogged geotextile (will require reconstruction of soakaway)	As required
Monitoring	Inspect silt traps and note rate of sediment accumulation	Monthly in the first year and then annually
	Check soakaway to ensure emptying is occurring	Annually

Given the granular pit type soakaway systems, and from anecdotal evidence, it is likely that some soakaways may be reaching the end of their operational life and may not be as effective and disposing of surface water as intended and will need replacement. Notwithstanding this the recorded rainfall event of a 1 in 516 year event would far exceed the 1 in 10 year building regulation standard for domestic soakaways. This reaffirms the high surface water flood risk of the area, and that the performance of the soakaways is unlikely to be the initiation of any flood event.

As mentioned above, there are also foul and surface water sewer networks in the vicinity of Halfpenny Lane and Orchard Close, these are maintained and regulated by Yorkshire Water. A map of their location is provided in Figure 5. There is also highway drainage on Orchard Close and Halfpenny Lane, the highway drainage drains directly into the Yorkshire Water Surface water sewer. As a consequence, the capacity of the highway drainage network is limited to the capacity of the Yorkshire Water network.

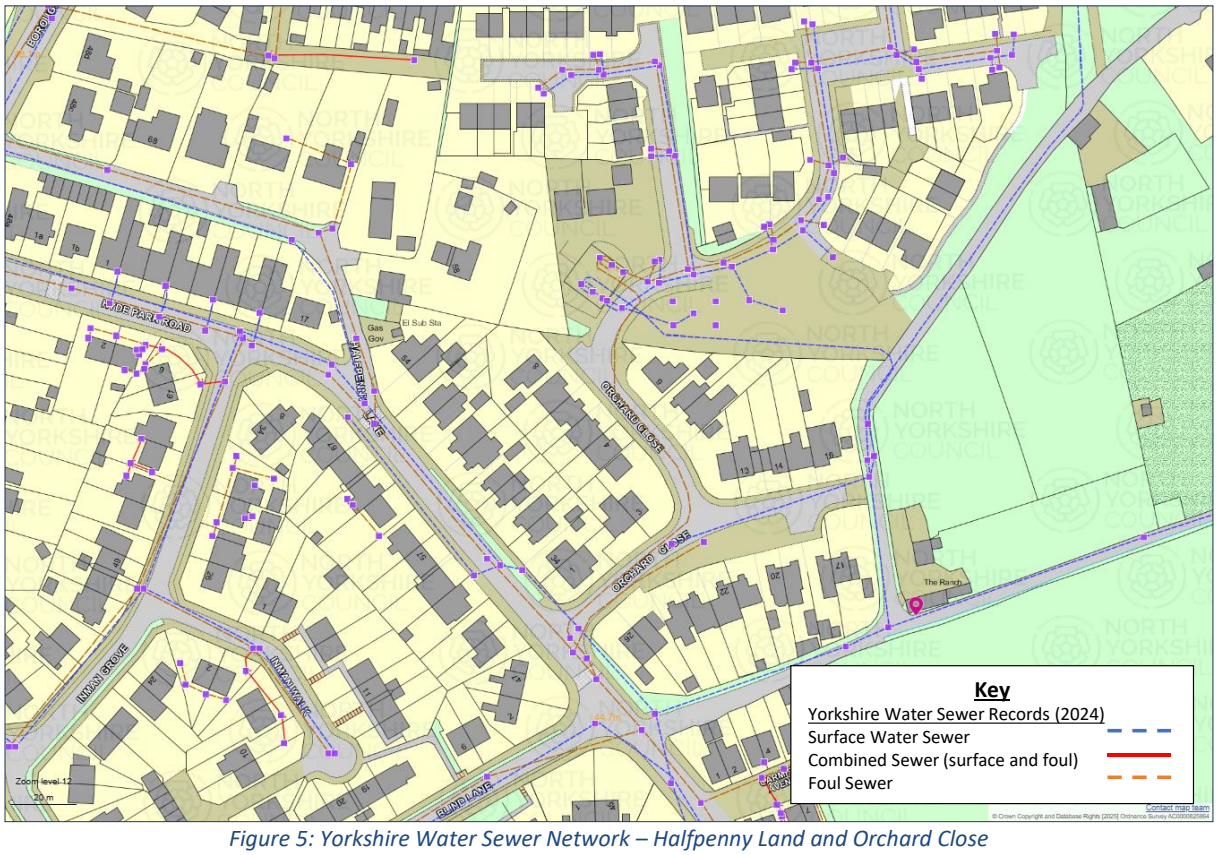


Figure 5: Yorkshire Water Sewer Network – Halfpenny Land and Orchard Close

Residents have raised concerns in relation to the condition of the highways drainage networks. An analysis of the drainage networks is provided below.

Figure 6 below shows the current layout of highway gullies within the vicinity of Halfpenny Lane and Orchard Close and the wider catchment beyond this area based on the overland flows presented in Table 2.

Figure 6: Kaarbontech Data for Park Avenue, Halfpenny Lane and Orchard Close

For demonstration purposes the gullies within Figure 7 have been numbered to give reference for a table that will be provided below. This will showcase data that was collected from Highways to highlight the maintenance and routine cleaning of these gullies.

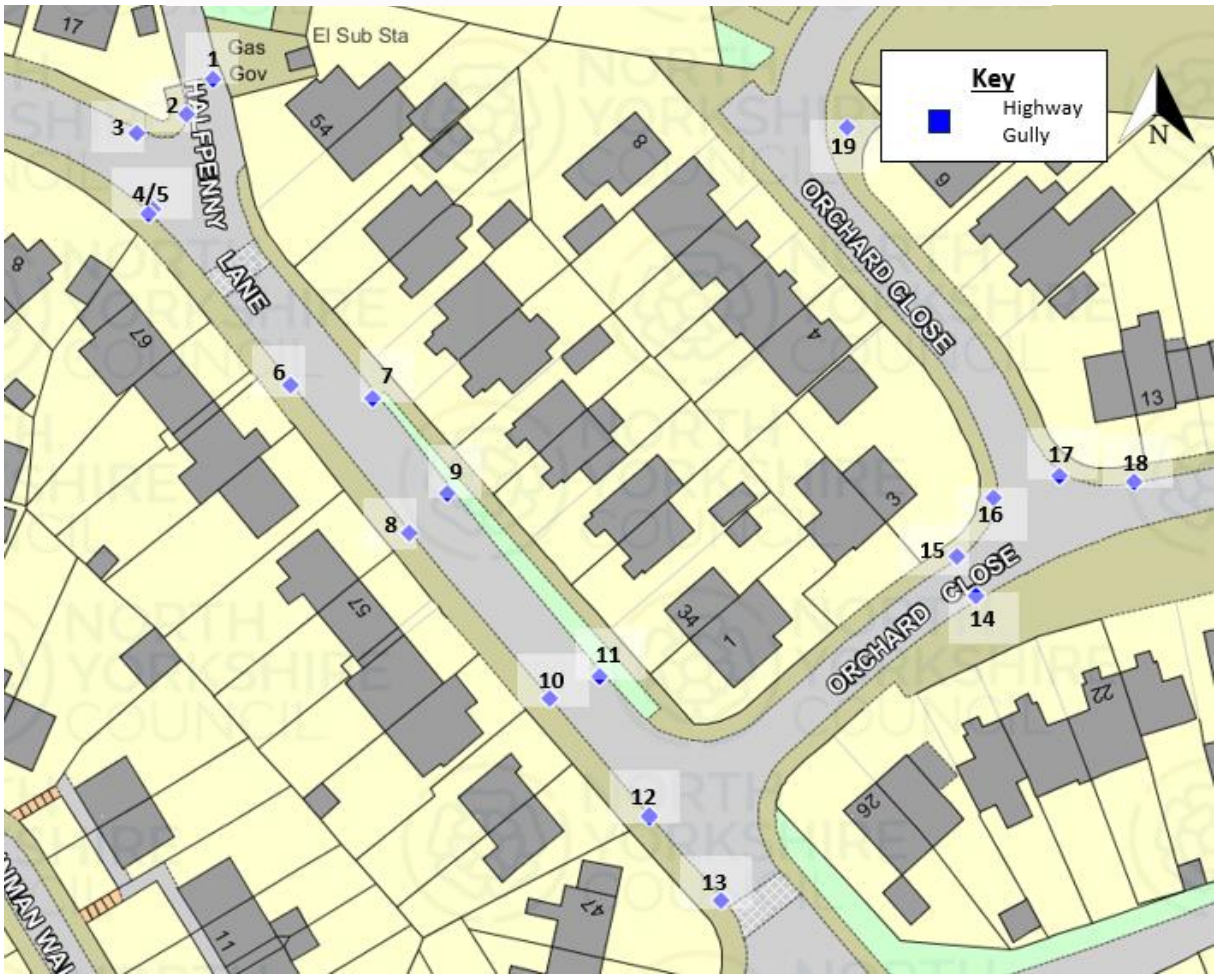


Figure 7: Halfpenny Lane and Orchard Close Highway Gully Schedule

Table 5: Kaarbontech Gully Maintenance Data Pre and Post Event 6th May 2024

Gully Number	Latest Inspection Pre 6th May 2024 event	Latest Inspection Post 2024 Flood event	Operational during Flood Event? Yes/No
1	31st May 2023 – Silt Level 50% Operational on arrival. Operational on leaving.	22nd August 2024 – Silt Level 25% - Operational on arrival. Operational on leaving.	Yes
2	31st May 2023 – Silt Level 50% - Operational on arrival. Operational on leaving.	22nd August 2024 – Silt Level 50% - Operational on arrival. Operational on leaving.	Yes
3	31st May 2023 – Silt Level 50% - Operational on arrival. Operational on leaving.	22nd August 2024 – Silt Level 50% - Operational on arrival. Operational on leaving.	Yes
4	30th May 2023 – Silt Level 50% - Operational on arrival. Operational on leaving.	22nd August 2024 – Silt Level 25% - Operational on arrival. Operational on leaving.	Yes
5	30th May 2023 – Silt Level 50% - Operational	22nd August 2024 – Silt Level 50% - Operational	Yes

	on arrival. Operational on leaving.	on arrival. Operational on leaving.	
6	30th May 2023 – Silt Level 50% - Operational on Arrival. Operational on leaving.	22nd August 2024 – Silt Level 25% - Operational on arrival. Operational on leaving.	Yes
7	31st May 2023 – Silt Level 75% - Slow running on arrival. Operational on leaving.	22nd August 2024 – Silt Level 25% - Operational on arrival. Operational on leaving.	Yes
8	30th May 2023 – Silt Level 75% - Operational on Arrival. Operational on leaving.	22nd August 2024 – Silt Level 25% - Operational on arrival. Operational on leaving.	Yes
9	31st May 2023 – Silt Level 75% - Slow running on arrival. Operational on leaving.	22nd August 2024 – Silt Level 50% - Operational on arrival. Operational on leaving.	Yes
10	30th May 2023 – Silt Level 50% - Operational on Arrival. Operational on leaving.	22nd August 2024 – Silt Level 50% - Operational on arrival. Operational on leaving.	Yes
11	31st May 2023 – Silt Level 100% - Not operational on arrival. Not operational on leaving.	22nd August 2024 – Silt Level 100% - Not operational on arrival. Not operational on leaving.	No
12	30th May 2023 – Silt Level 75% - Operational on Arrival. Data not available for status when left.	22nd August 2024 – Silt Level 25% - Slow running on arrival. Slow running on leaving.	No
13	30th May 2023 – Silt Level 50% - Operational on Arrival. Operational on leaving.	22nd August 2024 – Silt Level 50% - Operational on arrival. Operational on leaving.	Yes
14	7th September 2022 - Silt Level 50% - Operational on Arrival. Operational on leaving.	22nd August 2024 – Silt Level 50% - Operational on arrival. Operational on leaving.	Yes
15	7th September 2022 - Silt Level 50% - Operational on Arrival. Operational on leaving.	22nd August 2024 – Silt Level 50% - Operational on arrival. Operational on leaving.	Yes
16	7th September 2022 – Silt Level 75% - Slow running on Arrival. Operational on leaving.	22nd August 2024 – Silt Level 50% - Operational on arrival. Operational on leaving.	Yes
17	7th September 2022 - Silt Level 75% - Operational on Arrival. Operational on leaving.	22nd August 2024 – Silt Level 50% - Operational on arrival. Operational on leaving.	Yes
18	7th September 2022 - Silt Level 50% - Operational	22nd August 2024 – Silt Level 50% - Operational	Yes

	on Arrival. Operational on leaving.	on arrival. Operational on leaving.	
19	Gully replace by new development		

In conclusion, 16 Gully's have been deemed to of been operational when the May 2024 flooding occurred. This is due to their inspection data before the event and how the Gully's were left after the inspection, in addition to the gully's status upon arrival after the event. Gully 19 has insufficient data to suggest that it was functional during the event, the gully location also appears to be an anomaly hence no data. Gully 11 however, was not operational during the event. Inspections immediately after the event confirmed the gully was indeed blocked (Figure 8). Data from the Kaarbontech system suggest that this gully had not been operational since 2023. Gully 12 was also identified as a slow running indicating a reduction in performance.

Further gullies on Blind Lane were also identified by residents as being ineffective during the event. Photographs of the two gullies are presented in Figure 9 and Figure 10 below. The gully in Figure 9 is blinded with debris. It cannot be proven when this occurred, but a significant amount of debris would have been washed onto the gully grate during the event. The gully chamber and outlet were not full and blocked. Likewise, the gully in Figure 10 does have vegetation growing out of the grate, but the gully chambers itself was clear with the outlet functional. This indicates that the two particular gullies whilst blinded are emptied at an appropriate frequency. It does highlight however a requirement for further sweeping and inspections.

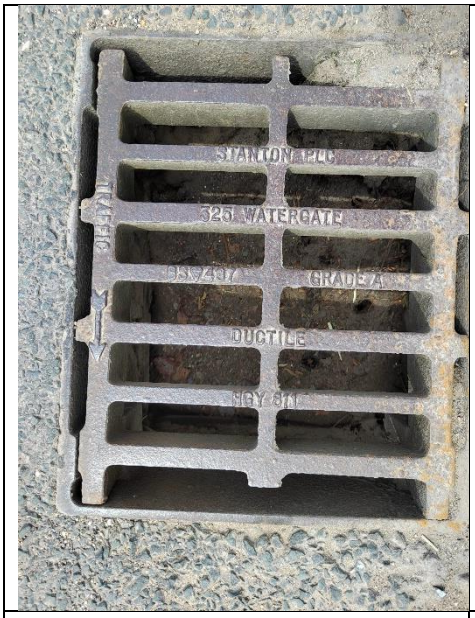


Figure 8: Gully Halfpenny Lane

Figure 9: "Blinded" Gully on Blind Lane

Figure 10: Gully on Blind Lane

As discussed in the understanding risk section, the catchment upstream of Orchard Close is extensive with surface water contributing from as far Jacob Smith Park via Park Grove, and Boroughbridge Road. Resident's witness accounts report water flowing down Blind Lane "like a river". This would corroborate the flood mapping and flow pathways identified within the understanding risk section and the understanding of the contributing area. Evidence of surface water issues have been reported all over the catchment as presented in Figure 1, which indicates that the whole catchment was saturated. It is acknowledged from the Kaarbontech data (Figure 6) that gullies may not have been operational and indicates 4 gullies on Boroughbridge road, 2 on Scriven Road and 4 on Halfpenny as requiring further investigation. Whilst some gullies were clearly not operational, there is evidence that the drainage

networks were already at capacity with water overflowing from manholes in the roads. This indicates that there was no spare capacity it the drainage system, even if the gullies were operational. Due to the significant volume of rainfall and the comparisons drawn to the 1999 flooding, which would have occurred under a very different gully cleansing regime, the gullies alone would not have resulted in the flooding.

In addition to the highway drainage issues, concerns have also been raised in relation to the new development to the north of Orchard Close. As part of the planning process, local and national planning policies required developers and house builders to ensure flood risk is not increased elsewhere as a result of the development. In the case of this development, this was achieved by the developer installing storm water attenuation tanks. The detail of which are publicly available on North Yorkshire Council planning website. The Drainage Layout Plan in Appendix 8.2. The surface drainage for the site connects to the Yorkshire Water surface water drainage network at a discharge rate lower than pre-development as calculated by industry standard. The connection point is on Hazelheads Lane, which then subsequently discharged to the sewer on Water Lane and does not flow through Orchard Close and has no significant bearing on the capacity of the drainage on Orchard Close.

As part of the planning application process, the applicants were required to demonstrate that in the event of drainage failure or a rainfall event that exceeded the 1 in 100 year event with an additional allowance for climate change would be managed without increasing risk elsewhere. To this end the applicants produced an exceedance flow plan. The exceedance flow plan is included in Appendix 8.3. Ground levels have been designed such that the majority of exceedance flow toward Hazelheads Lane as per the existing pre-development scenario. Figure 11 illustrates the cross fall down towards the now constructed basin with the predominant fall towards Hazelheads Lane. The southern and western part of the site were designated to flow to an attenuation basin on the southern boundary. It is noted that this location was at the time of the event, the site compound, with raised kerbs along carriageway preventing water from reaching the proposed basin.

Figure 11:Carriageway Crossfall Bramley Way

In the context of the wider catchment that has been identified in the understanding risk section, the area that contributes runoff to Orchard Close from the Bramley Way site is very small and alone would not have contributed significantly to the flooding.

As discussed above, residents have confirmed that this is not the first occasion that properties on Halfpenny Lane and Orchard Close have flooded. The last recorded event was in 1999. This would again strengthen the understanding of flood risk, and that the area is at high risk of surface water flooding given its topography and that

the influence of new development and a small number of blocked or slow running gullies is limited. The properties on Halfpenny Lane and Orchard close are below the level of the highway, which as discussed above acts as a conduit for surface water during extreme events, making the properties extremely vulnerable to flooding.

3.2.3 St Margaret Gardens

Four properties were recorded to be flooded on St Margaret Gardens. The area is served by a network of public foul and surface water sewers as illustrated in Figure 12. The extract shows a 600mm diameter surface water sewer along the rear gardens of properties on St Margaret's Gardens with a 225mm diameter pipe within the highway, which then "dog legs" through private gardens into the 600 diameter pipe.

Yorkshire Water were again requested as part of the request for information to confirm the status of their network in the St Margaret's Garden area. It is noted from their response that a blockage on St Margaret's Gardens was identified in their post event investigation.

Within the Section 14 data request the status of the sewer is recorded as a sewer that has recently transferred to Yorkshire Water's jurisdiction. The latest tranche of transferring private sewers to Yorkshire Water occurred in 2011. The Transfer of Sewers Act outlines the process for transferring private sewers and drainage systems to water and sewerage companies. It involves identifying private sewers and drains, notifying affected property owners, and completing the transfer ownership. It is noted that the blockage identified is within a property curtilage. The pipe would have historically been privately maintained by the property owners. Upon being notified of the issue Yorkshire Water duly exercised their risk management functions and duties and cleared the blockage.

Such a blockage would likely have accelerated the onset of flooding, but given the magnitude of the event and the high risk of surface water flooding indicated in Table 3, and the suggestion from anecdotal evidence from residents that "drains for the street and the surrounding roads were inadequate to cope", some flooding would have been expected in the area.

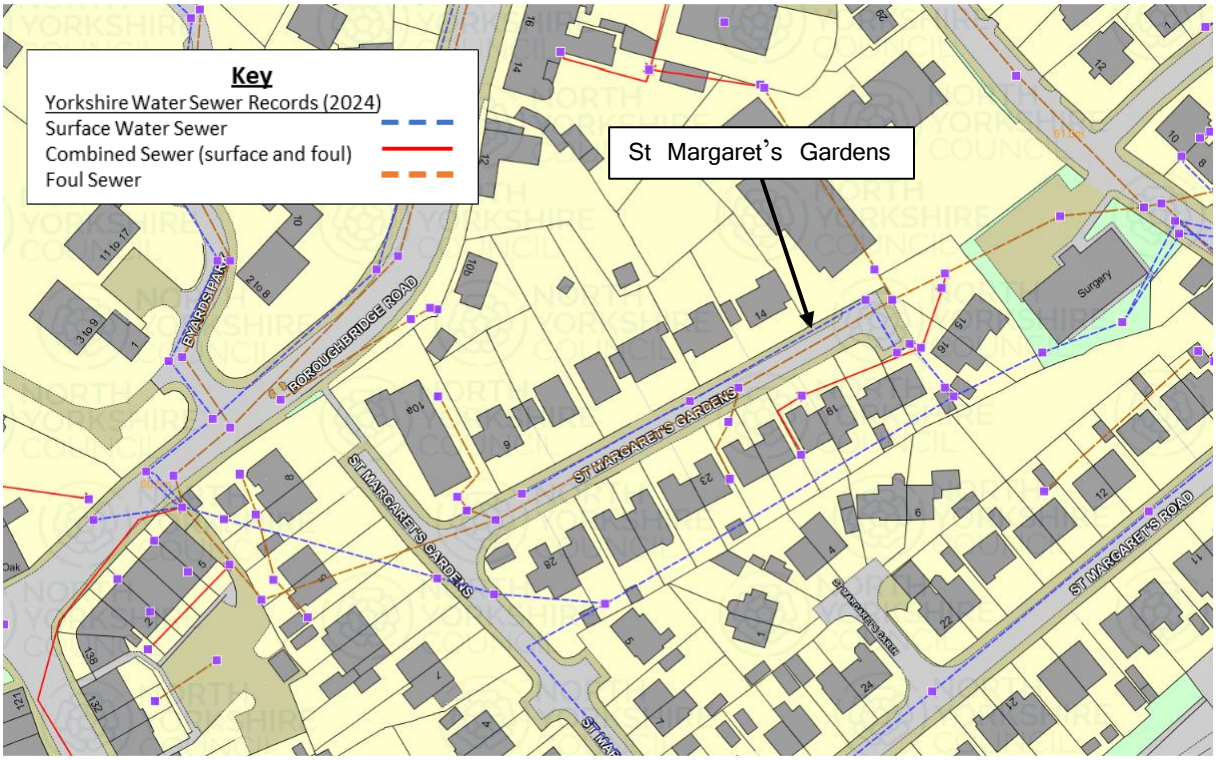


Figure 12: Yorkshire Water Public Sewer Network St Margaret's Gardens

3.2.4 Queen's Road, Dentdale Drive, Lundale Avenue and Cotterdale Close

Around 9 properties were affected in this area. As discussed within the understanding risk section the area has been identified as high surface water flood risk. Flooding would therefore be expected in an event of this magnitude.

Anecdotal reports have been provided by residents relating to the flooding mechanism and the actions of the RMAs after the event.

One local resident noted that “the main drain that straddles number 36 Queens Road has not been cleared in 30 years and was compacted to the top of the manhole cover. This was confirmed by a Yorkshire Water Engineer as he removed the lid of the manhole. Due to this being blocked, naturally the water had nowhere to go except into my house and by my neighbours. I would like this to be specifically reviewed as part of the investigation, as I believe that the flood could have been avoided if the drains were effectively cleared.”

The local area is served by a network of surface water sewers within Yorkshire Water’s jurisdiction, in particular an 850mm diameter surface water sewer that runs in a south easterly direction from the Mayfield Grove direction toward Cotterdale Close, bisecting Queen’s Road and Dentdale Drive. This is a substantial surface water sewer serving a large catchment area. There is also a surface water sewer that flows down Queens Drive and connects to the larger diameter sewer. For the avoidance of doubt, the sewer referred to by the resident is the smaller diameter sewer not the 850mm drain. Some root ingress was identified within the 850mm diameter pipe, but due to the significant size of the pipe, the roots were not considered to have a significant bearing on the capacity of the pipe.

Yorkshire Water were requested as part of the Section 14 request for information to confirm the status of their network in the area. The on-site mark-up provided by Yorkshire Water following their investigation into the sewer blockage in Figure 13. As per the resident’s testimony, Yorkshire Water have confirmed a blockage on the surface water sewer at the location stated.

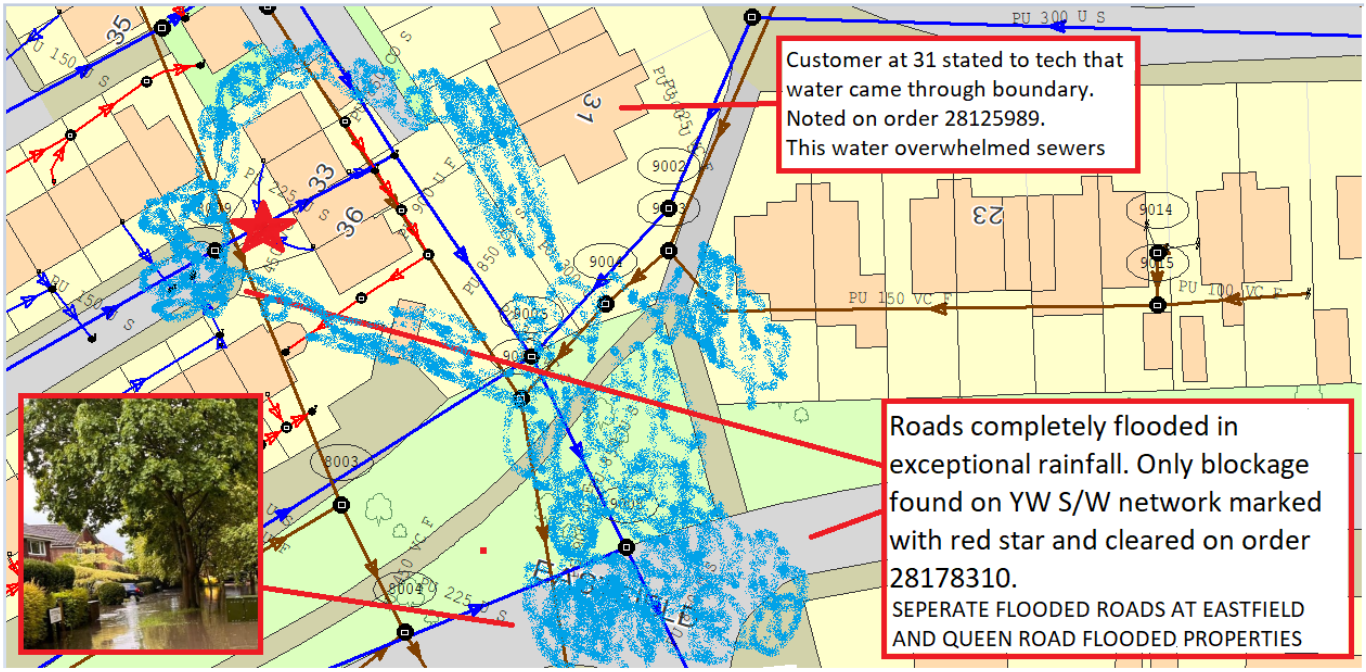


Figure 13: Yorkshire Water Annotated Plan Queen's Road

Within the Section 14 data request the status of the sewer is recorded as in the case of St Margaret’s Gardens a sewer that has recently transferred to Yorkshire Water’s jurisdiction. Yorkshire Water mapping prior to the event did not have the sewer mapped which confirms that as a private sewer they were not aware of its existence until the problem was highlighted to them on the 6th of May 2024. Upon being notified Yorkshire Water duly exercised their risk management functions and duties and cleared the blockage.

The highway gullies on Queen’s Drive were cleaned on the 15th of April 2024, one month before the event. All gullies were noted to be operational. Similarly, the gullies on Dentdale Avenue were also cleaned in April 2024. One gully on Dentdale Drive required further attention (see Figure 14).

Yorkshire water note in their response that the flooding on the Eastfield, Cotterdale Close and to an extent Dentdale Drive and Queens Drive was not attributed to the blocked sewer issue. Evidence has been provided on the 850mm being surcharged on Eastfield. Surcharging of the sewer means that the sewer cannot accept more water as is overflowing due to exceeding it's capacity. As previously discussed within the report, this is to be expected in a 1 in 516 year event. It is also noted that this is not the first instance of this area being affected from flooding. Anecdotal evidence suggests this area also flooded "20 years" ago, which we have assumed to correlated with the 1999 event that affected Orchard Close.

It may be true that the sewer blockage accelerated the onset of flooding, but given the magnitude of the event, it is unlikely to have had any material affect on the overall extent and depth of flooding as the sewer itself would been prevented from discharging into the main sewer due to hydraulic locking.

Based on the catchment areas identified for the Dentdale Drive, Cotterdale Close, Lunedale Avenue are, a review of the gully statuses has been undertaken, supported by the feedback from the reactive cleaning of the highway gillies. The shaded area highlight the areas that contributes runoff to the flooded area. It is a vast area, which has been split into north and south. In total 16 gullies are identified as needing further investigation as they were not operational on arrival. Five gullies are located on Chain Lane, three on the Spinney, two on Manor Drive, two on Manor Crescent, one on Manor Orchards and one on Dentdale Drive. Other than the drains on Chain Lane, the Spinney and Dentdale Drive, the which are along the flood flow path, other are somewhat disperse across the catchment. It is also important to put the 12 gullies into the context of the 600+ gullies in this area of Knaresborough alone.

It should also be noted that following a site inspection the gullies on the southern side of York Road, opposite Chain Lane to the North are unlikely to contribute any runoff to the Eastfield area, rather it is expected that the road levels would direct runoff down York Road to the east. Further runoff from Chain Lane would also likely be directed toward the Lidl site.

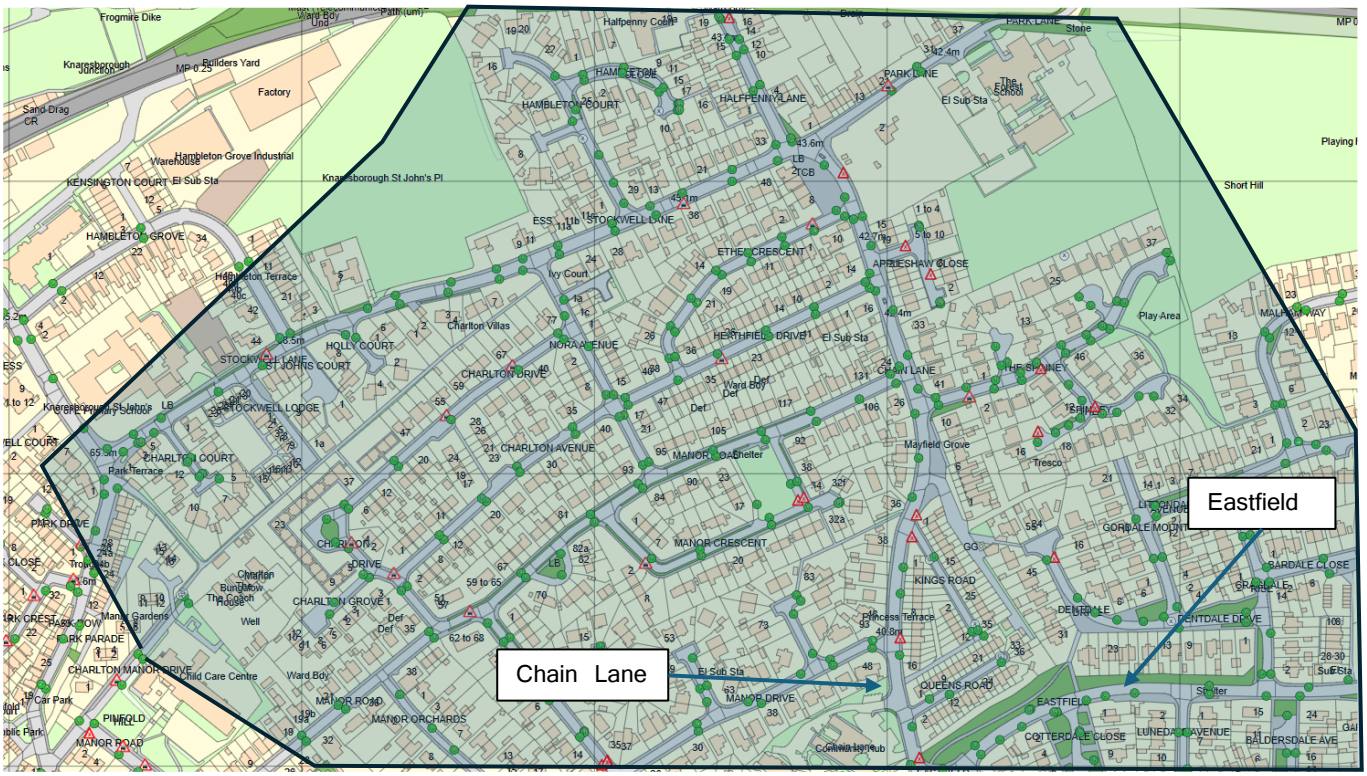


Figure 14: Kaarbontech data north of Eastfield

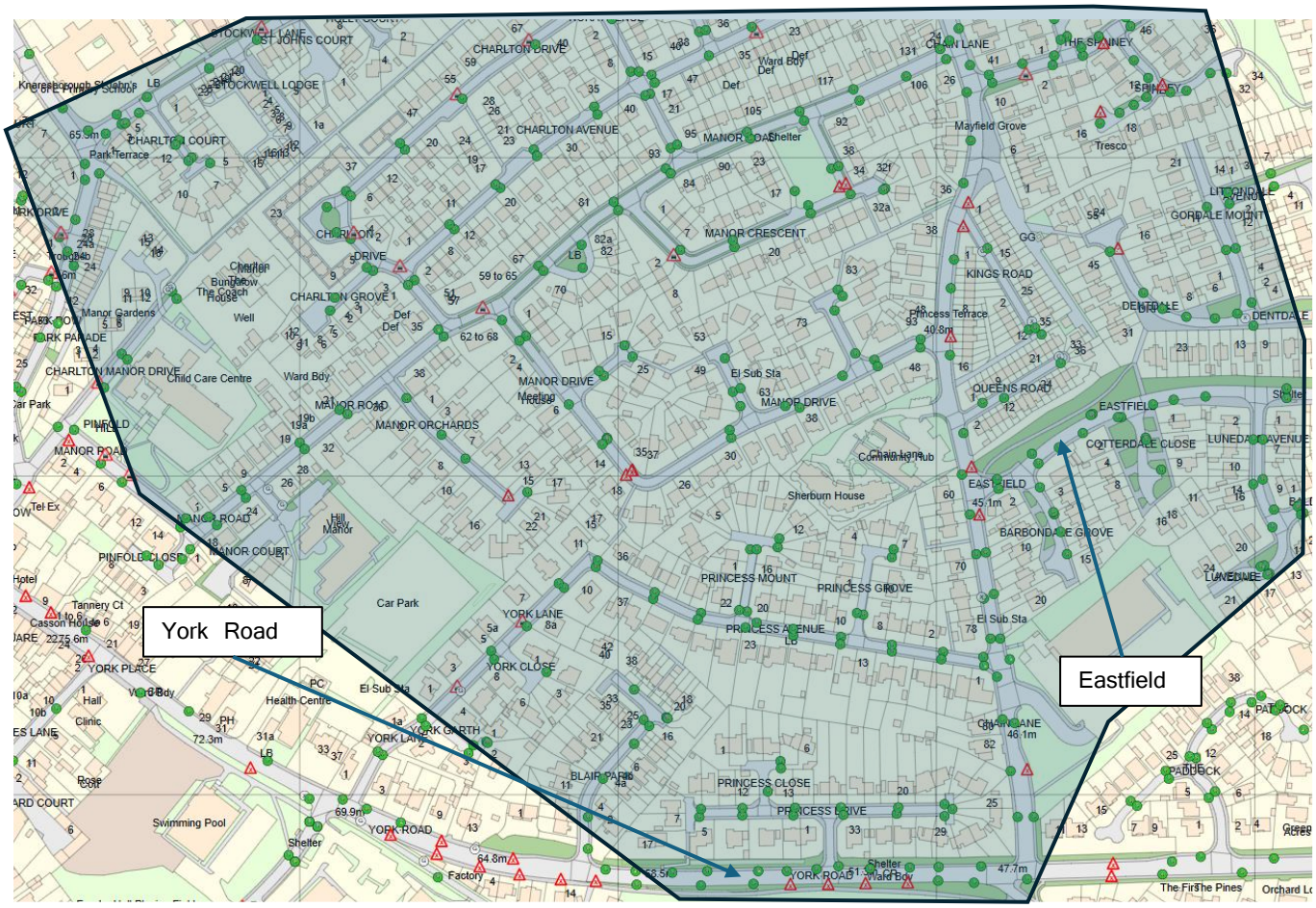


Figure 15: Kaarbontech data south west of Eastfield

3.3 Flood risk management functions undertaken

The response to any flooding incident is initially conducted by the Emergency Services under the Civil Contingencies Act 2004. Other than the Environment Agency, which has duties under both acts, the other Risk Management Authorities, have a reactive duties and powers bestowed under the Flood and Water Management Act (FWMA) 2010. **The immediate response to the incident by emergency services, Environment Agency, North Yorkshire Highways and NYC Emergencies and Resilience team is reviewed separately to this Section 19 report.**

The requirement of the section 19 report is to reflect on the responsibilities of each Risk Management Authority and assesses whether each authority has undertaken the statutory duties leading up to the event, during and after, in accordance with the Flood and Water Management Act 2010 (see Appendix 6.1). In accordance with Section 19 of the FMWA, the LLFA has identified the following as Risk Management Authorities with actions and responsibilities in relation to the flooding on 6th May 2024:

- Environment Agency (overarching role)
- North Yorkshire Council as Lead Local Flood Authority and Local Highway Authority
- Yorkshire Water
- Property Owners

3.3.1 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 must produce a National Flood and Coastal Erosion Risk Management Strategy for England – The latest strategy was published in July 2020. 'The strategy sets out a vision of a nation ready for, and resilient to, flooding and coastal

change – today, tomorrow and to the year 2100.' The strategy has 3 long-term ambitions, underpinned by evidence about future risk and investment needs. They are:

- Climate resilient places: working with partners to bolster resilience to flooding and coastal change across the nation, both now and in the face of climate change
- Today's growth and infrastructure resilient in tomorrow's climate: making the right investment and planning decisions to secure sustainable growth and environmental improvements, as well as infrastructure resilient to flooding and coastal change
- A nation ready to respond and adapt to flooding and coastal change: ensuring local people understand their risk to flooding and coastal change, and know their responsibilities and how to take action

The Section 19 report concludes that the EA did not have any functions to exercise in relation to Main Rivers before, during or after the event.

3.3.2 North Yorkshire Council

The Development Management Team which undertakes the LLFA function for the council is not a category responder and instead provides the strategic view on flood risk management activities within the county. The flood risk management functions set out in the FWMA 2010 include (but are not limited to);

- Provision of a Local Flood Risk Management Strategy (LFRMS).

The Local Flood Risk Management Strategy was published in 2015. The strategy sets out how the authority will manage local sources of flood risk within its administrative boundary. This plan focuses on the development of action to meet the six North Yorkshire Flood Risk Management priority objectives:

1. Promoting a greater role for communities in managing flood risk
2. Improved knowledge and understanding of flood risk and management responsibilities for all stakeholders, communities and the media
3. Sustainable and appropriate development
4. Improved knowledge of watercourse networks and drainage infrastructure
5. Flood risk management measures that deliver social, economic and environmental benefits
6. Best use of all potential funding opportunities to deliver flood risk management measures

In addition to the duties and the responsibilities in the FWMA 2010, the conclusions and recommendations of this report will be based upon the local Flood Risk Management Strategy objectives.

- Designation and maintenance of a register of structures or features that have a significant effect on flood risk.

It is recognised in NYCCs strategy that identifying these features and drainage networks is a huge task that presents significant practical challenges and significant potential costs. Nevertheless, in areas where the flood risk is significant, the location and mapping of critical assets has a great potential for assisting in the management of flood risk by highlighting those risks and facilitating preventative actions. NYCC as LLFA intend to take a systematic, risk-based approach to this task, identifying those areas of greatest risk and working with riparian owners and local communities to manage that risk. This will be supported by the gathering of information on the recent flooding event in February and the continual development of the Asset Register (see section 5.3).

- 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 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 Highways Authority has a duty under the Highways Act 1980 to maintain highways that are 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.

The council operates a cyclical gully cleansing schedule across the county, with a reactive service also in operation for when additional cleansing is required. Inevitably gullies are designed to a finite capacity to take highway surface water. In periods of significant rainfall like those experienced in May, Highway gullies struggled to cope with the amount of surface water that was present in such a short period of time. The road gullies are not designed to take this volume of water, and this is not indication that additional cleansing is required. These circumstances inevitably result in a build-up of detritus in the drains, which is why the reactive service is critical in this location to ensure their function following high rainfall events.

Gullies on the following streets were cleaned prior to, and in the aftermath of the storm. All the streets cleaned after the event were because of enquiries/complaints following the storm.

- Boroughbridge Road – 18/04/24
- Greengate Lane – 18/04/24
- Boroughbridge Road – Roundabout to Calm Water Bay – 19/04/24
- Boroughbridge Road – Hyde Park Road to Greengate Lane
- Park Row – 25/04/24
- High Bond End – 25/04/24
- Chain Lane – 09/05/24 – 17/05/24
- Queens Road – 09/05/24
- Blair Park – 09/05/24
- Waterside/Castle Mills – 09/05/24 – 13/05/24
- Kirkgate – 10/05/24
- Gracious Street – 10/05/24
- Market Place – 10/05/24
- Harrogate Road from Waterside – 10/05/24 – 14/05/24 – 25/05/24
- Halfpenny lane – 11/05/24
- Blind Lane – 11/05/24
- Orchard Close – 13/05/24
- Lunedale Avenue – 14/05/24
- Nidderdale Drive – 20/05/24
- Eastfield – 20/05/24
- Park Grove – 21/05/24
- Scriven Road – 21/05/24
- Forest Moor Road – 21/05/24
- Stockwell Lane – 23/05/24
- St Margarets Gardens - 25/07/24
- Park Avenue - 23/08/2024

Following the reactive cleansing the following data was provided to the LLFA for review. The data shows that out of the above 43 gullies required further attention in the form of jetting or additional cleansing out of a total of 422.

Road Name	Date	Number of Gullies Checked	Number of Gully Issues
Boroughbridge Road	18/04/2024	3	2
Green Gate Lane	18/04/2024	13	3
Boroughbridge Road (Roundabout to Calm Water Bay)	19/04/2024	5	0
Boroughbridge Road (Hyde Park Road to Greengate Lane)	19/04/2024	12	2
Park Row - Nr Lamp Column 9	25/04/2024	1	0
High Bond End	25/04/2024	11	3
Chain Lane	09/05/2024	18	4
Queens Road	09/05/2024	4	0
Blair Park	09/05/2024	10	2
Waterside / Castle Mills	09/05/2024	5	6
O/S 17 Kirkgate	10/05/2024	2	2
Gracious Street Nr Fire Station	10/05/2024	3	0
Market Place O/S Blind Jacks	10/05/2024	3	0
Harrogate Road from Mobility Scooter Shop to Stevensons Place	10/05/2024	10	2
Harrogate Road from Waterside	10/05/2024	15	0
Harrogate Road O/S Heath Cote House	14/05/2024	38	2
Halfpenny Lane	11/05/2024	52	7
Blind Lane	11/05/2024	21	1
Orchard Close	13/05/2024	7	7
Waterside	13/05/2024	5	0
Lunedale Avenue	14/05/2024	2	0
Chain Lane	17/05/2024	18	0
Nidderdale Drive	20/05/2024	24	0
Eastfield	20/05/2024	31	0
Scriven Road	21/05/2024	28	0
Park Grove	21/05/2024	15	0
Stockwell Road	22/05/2024	18	0
Forest Moor Road	22/05/2024	21	0
Stockwell Lane	23/05/2024	14	0
Waterside – Briggate to Car Park	24/05/2024	13	0
Total		422	43

3.3.3 Yorkshire Water

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.

Yorkshire Water is responsible for managing and maintaining the network of public sewers throughout the investigation area. Public sewer networks are either combined systems, where foul and surface water drain through the same pipes to the local wastewater treatment works, or are separate systems where foul water is conveyed to the sewage works and surface water is conveyed either to a local watercourse or other receiving body of water, or to a point at which it joins the combined sewer network. The upper dales are mostly served by combined and Foul Sewer systems.

Upon being made aware of the issues at Queen's Road and St Margaret's Garden, Yorkshire water duly acted on their duties.

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.

3.3.4 Responsibilities of Riparian Land Owners and Individual Property Owners

It is critically important that the extent and nature of each organisation's role in flood risk management is understood and appreciated by the communities and individual residents affected by flooding. It is equally important that we set out the roles that others, including riparian owners, are required to play.

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

A landowner can be an individual e.g. homeowner or farmer, private business or an organisation e.g. the district council as park owner, on school grounds the 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 (this includes flap vales and sluices).
- 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 outlined in the Environment Agency publication 'Living on the edge', available at:

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

Property owners also have a responsibility for their own drainage systems within the curtilage of their property unless it is a designated public sewer. Property owners should ensure that guttering, downpipes and yard gullies are kept clear and free of detritus, with any silt traps or inspection chamber checked regularly and cleansed as required.

4 Investigation findings and Conclusions

Over 50 properties and businesses were affected by the flooding event in Knaresborough in May 2024. The flooding event highlighted key areas at high risk of surface water flooding. The areas identified at risk are predominately due to localised topography directing surface water exceedance flow along what is assumed to be historical watercourse floodplains. The storm return period is estimated to be in the region of 1 in 516 years, and evidence is provided in the form of photographs and videos that the drainage networks could not handle the exceptional amount of surface water in such a short time span.

Residents raised concerns regarding the gullies across the town being non-operational. The council operates a cyclical gully cleansing schedule across the county, with a reactive service also in operation for when additional cleansing is required. Gullies are designed to a finite capacity to take highway surface water only. In periods of significant rainfall like those experienced in May, the entire catchment including non-highway areas contributes water on to the highway. This includes water from roof gutters that may be overflowing, garden patio's driveways and even underperforming soakaways. As a result, the highway gullies struggled to cope with the amount of surface water that was present in such a short period of time. The road gullies are not designed to take this volume of water, and this is not an indication that additional cleansing is required. These circumstances inevitably result in a build-up of detritus in the drains, which is why the reactive service is critical in this location to ensure their function following high rainfall events.

It is undeniable that a small number of gullies are noted to have been blocked for a significant period of time, however these are isolated cases. Site visits were undertaken post flooding incident to inspect gullies in the area to which Highways reported that only a small number of gullies were underperforming due to blockages – these gullies were cleaned and jetted by Highways after the flooding. The highways authority responded to 422 gullies in the immediate aftermath of the event with 43 requiring additional follow up investigation. In flash flood conditions gullies can become subject to being 'blinded', which is a term used to describe gullies when debris has laid on the top of gullies which subsequently does not allow surface water to enter the system. Blinded gullies were found in the flooded areas as evidenced on Blind Lane, near Orchard Close and were cleared by Highways shortly after. Given the drainage networks were already beyond capacity and were not allowing any further surface water to enter their systems, the apportionment of blame on the non-operational gullies is likely to be less than expected and cannot be ruled as a clear reason for the flooding or that the flooding was amplified due to these non-functional gullies, in such an extreme event. Had the event been of a lesser magnitude and closer to the design standard of the local drainage networks then a more in-depth investigation as to the impact of the non-functional gullies would be entirely justified. It would be prudent to review the street cleansing rota to better align with High risk surface water catchments to prevent such prominent blinding issues.

Likewise in relation to the blockages and capacity of the Yorkshire Water sewerage network. As noted above, blockages were limited on the public sewer network to two small diameter sewers in St Margaret's Gardens and Queens Road. No other blockages or structural failures of the drainage system were reported. The drainage system failed to convey water away quickly enough to avert the flooding as it is simply not designed with the capacity to cope with the amount of water which was present, and as such no further capacity assessments are necessary as a result of the 1 in 516 year event. Yorkshire Water are however continually developing their Development and Wastewater Management Plans for Knaresborough and are implementing a Combined Sewer Overflow Reduction Plan, this may include opportunities to better understand any headroom or opportunities that could be developed to reduce flood risk through use of SuDS and rainwater attenuation at source.

Climate change predictions are for more intense, short duration, summer storms. Upgrading Knaresborough's drainage system so that it has sufficient capacity to cope with these types of events would require changes in national policy and legislation, and huge levels of investment, along with major on-going disruption while the work

was undertaken. It is not realistic at this time to expect drainage infrastructure to be upgraded to a capacity sufficient to cope with this level of event.

The community responded with resilience and bravery as multiple residents were relocated due the severity of the flooding. The LLFA believe that this report will serve as a critical reference point for what is to come regarding flood management strategies to better protect Knaresborough residents from future flooding incidents.

7 Recommendations

The following recommendations are made because of the conclusions of this report:

1. Subject to funding eligibility, the LLFA to assess the potential for property level resilience in areas where multiple properties (including Businesses) are at risk from repeated events.

2. All risk management authorities to continue responsive service within the Knaresborough area.

3. Yorkshire Water to consider and implement appropriate options to manage the frequency and impact of surcharging of foul drainage on Park Avenue.

4. Yorkshire Water to continue the development of their Development and Wastewater Management Plans (DWMP)

5. Where opportunities are identified either through the DWMP, or Combined Sewer Overflow Reduction plans and where funding sources are identified, YW and NYC to work collaboratively to maximise opportunities to separate surface water and foul drainage by promoting the use of Sustainable Drainage Systems (SuDS) to reduce the impacts on flooding in the High risk areas.

6. All risk management authorities to work with the communities to encourage and promote improved level of resilience. With the impacts of climate change becoming ever more clear, it is critical that communities play an active role in helping themselves to be resilient to the increasingly prevalent risk of flooding.

8 Appendices

8.1 Useful contacts & links

Flood Forecasting Centre

The Flood Forecasting Centre (FFC) is a partnership between the Environment Agency and the Met Office, combining our meteorology and hydrology expertise into a specialised hydrometeorology service. The centre forecasts for all natural forms of flooding - river, surface water, tidal/coastal and groundwater.

Flood Forecasting Centre - GOV.UK

Online Flood Risk Mapping

This service uses computer models to assess an area's long term flood risk from rivers, the sea, surface water and some groundwater.

https://flood-warning-information.service.gov.uk/long-term-flood-risk/map

National Flood Forum

A charity to help, support and represent people at risk of flooding.

https://nationalfloodforum.org.uk/

North Yorkshire Local Resilience Forum

NYLRF is a partnership of local agencies working together to prepare for, respond to and recover from potential major incidents and emergencies via the duties stated in the Civil Contingencies Act 2004 (CCA).

http://www.emergencynorthyorks.gov.uk/

NYC Resilience & Emergencies Unit

The resilience and emergencies unit is responsible for planning for a wide variety of potential incidents and emergencies that could affect the population of North Yorkshire.

https://www.northyorks.gov.uk/resilience-and-emergencies-unit

NYC Flood & Water Management

As lead local flood authority, we investigate and assess flood risks, including flooding from surface water, groundwater and existing watercourses. We work with partners involved in flood and water management to protect communities from the impact of flooding.

https://www.northyorks.gov.uk/flood-and-water-management

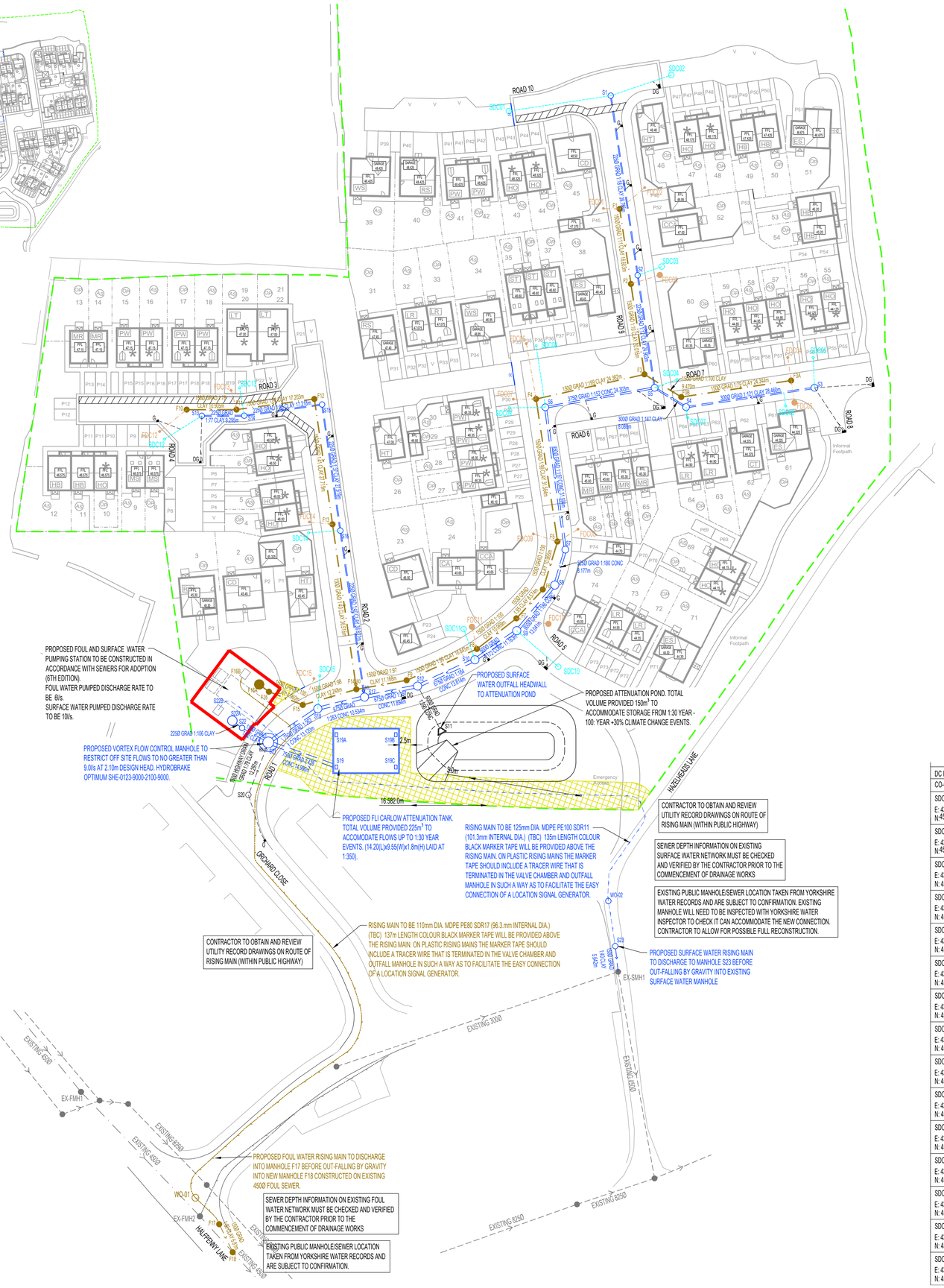
8.2 Development North of Orchard Close - Drainage Layout Plan

8.3 Development North of Orchard Close – Exceedance Flow Plan

YORKSHIRE WATER REF
H-3-264-196

SITE LAYOUT

SCALE 1:2000



KEY:

- DEVELOPMENT BOUNDARY
- EXISTING PUBLIC FOUL WATER SEWER
- EXISTING PUBLIC FOUL WATER RISING MAIN
- EXISTING PUBLIC SURFACE WATER SEWER
- PROPOSED FOUL WATER SEWER / MANHOLE (S104)
- PROPOSED SURFACE WATER SEWER / MANHOLE (S104)
- PROPOSED SURFACE WATER & FOUL WATER BACKDROPS
- PROPOSED FOUL WATER RISING MAIN (S104)
- PROPOSED SURFACE WATER RISING MAIN (S104)
- PROPOSED FOUL WATER LATERAL / DEMARCATION CHAMBER
- PROPOSED SURFACE WATER LATERAL / DEMARCATION CHAMBER
- PROPOSED HIGHWAY DRAIN (S38)
- ROAD/HIGHWAY GULLY (DG DENOTES DOUBLE GULLY)
- DRAINAGE EASEMENT
- PROPOSED 1.5m WIDE SERVICE MARGIN
- PROPOSED SURFACE WATER PUMPING STATION. RED LINE INDICATES EXTENT OF LAND TRANSFER

YORKSHIRE WATER NOTES:

(THESE NOTE APPLY TO ALL ADOPTABLE DRAINAGE WORKS)

ALL ADOPTABLE SEWER WORKS AND MATERIAL TO BE IN ACCORDANCE WITH "SEWERS FOR ADOPTION" 6TH EDITION, THE RELEVANT BRITISH/EUROPEAN AND YORKSHIRE WATER'S STANDARDS/REQUIREMENTS/ADDENDUM TO THE MECHANICAL AND ELECTRICAL SPECIFICATION AND KITEMARKED.

MANHOLE COVERS SHALL/MUST HAVE A CLEAR OPENING OF 600MM AND SHALL BE CLASS D400 TO BS EN 124 WITH 150MM DEEP FRAMES IN HIGHWAYS.

FILLED GROUND MUST BE FILLED AND CONSOLIDATED UNDER THE SUPERVISION AND TO THE SATISFACTION OF YORKSHIRE WATER BEFORE ANY SEWER WORKS ARE CARRIED OUT.

YORKSHIRE WATER IS NOT OBLIGED TO ACCEPT FILTER DRAIN/LAND DRAINAGE RUN-OFF INTO THE PUBLIC SEWER NETWORK OR ADOPTABLE DRAINAGE SYSTEM (DIRECTLY OR IN-DIRECTLY). AN ALTERNATIVE METHOD OF DISPOSAL OF THE LAND DRAINAGE RUN-OFF WILL THEREFORE BE REQUIRED AND YOU WILL HAVE TO LIAISE WITH THE LOCAL AUTHORITY, LAND DRAINAGE SECTION WITH REGARD TO THE DISPOSAL OF THE FILTER DRAIN/LAND DRAINAGE RUN-OFF.

COVER SLABS MUST CARRY THE BSI KITEMARK OR WILL BE REJECTED BY YORKSHIRE WATER INSPECTOR. WHERE THE CLEAR OPENING OF THE KITEMARKED PRODUCT IS DIFFERENT TO THAT OF THE COVER AND FRAME, A LOADING BEARING SLAB SHOULD BE FITTED ABOVE THE COVER SLAB TO BRING THE SIZE DOWN TO 600MM X 600MM FOR THE YORKSHIRE WATER SPECIFIED COVER SIZE. PLEASE REFER TO CONCRETE PIPE SYSTEMS ASSOCIATION (CPSA), "TECHNICAL BULLETIN' ISSUED AUTUMN 2004 FOR KITEMARKED COVER SLAB OPENING SIZES.

SULPHATE RESISTANT CEMENT (C20-DC2) AND PRECAST CONCRETE PRODUCTS MUST BE USED OR A LABORATORY REPORT PROVIDED PROVING THAT SUCH PRECAUTIONS ARE NOT NECESSARY.

THE ADOPTABLE SEWERS SHOULD BE A MINIMUM OF 1M AND MANHOLES 0.5M FROM KERB FACES AND SERVICE MARGINS.

"SEWERS MUST HAVE 5 METRES CLEARANCE FROM TREES AND HEDGES (PLEASE ALSO REFER TO FIGURE 2.3 ON PAGE 33 IN "SEWERS FOR ADOPTION" 6TH EDITION FOR RESTRICTIONS ON TREE PLANTING ADJACENT TO SEWERS)".

SEWERS TO BE LAID IN CLASS "S" BEDDING (150MM GRANULAR BED AND SURROUND), WHERE DEPTH OF COVER TO TOP OF THE SEWER IS LESS THAN 1.2M IN HIGHWAYS AND VERGES (OR LESS THAN 900MM IN NONE VEHICULAR ACCESS AREAS) THEN A CONCRETE SLAB SHOULD BE PROVIDED ABOVE GRANULAR BED AND SURROUND.

BEDDING AND BACKFILL MATERIAL TO CONFORM TO THE REQUIREMENT OF WATER INDUSTRY SPECIFICATION 4-08-02 (TABLE A2).

THE CHAMBER SIZE OF MANHOLES WITH MORE THAN ONE CONNECTION IN THEM MAY NEED TO BE INCREASED AN INCREMENT TO ACCOMMODATE THE CONNECTIONS AND BENDS.

YORKSHIRE WATER POLICY IS NOT TO ACCEPT TYPE "C" BRICK MANHOLES AND 1050MM DIA MANHOLE RINGS. INSTEAD IT IS PREFERRED THAT YOU USE A TYPE "B" MANHOLE WITH 1200MM DIA OR 1500MM DIA RINGS, WITH THE OPENING SITED OVER THE CHANNEL WHERE DEPTH OF COVER TO PIPE SOFFIT IS 1-1.5M.

ADOPTABLE PLASTIC SEWER PIPES TO BE BSI KITEMARKED (CERTIFIED TO WIS 4-35-01 AND BS EN 13476). ADOPTABLE PLASTIC SEWER PIPES TO BE LAID IN MAXIMUM 3 METRE LENGTHS UNLESS THERE IS A SPECIFIC OPERATIONAL NEED TO LAY LONGER LENGTHS. PLASTIC CHANNEL SECTIONS IN MANHOLES ARE NOT ACCEPTABLE AND YORKSHIRE WATER WOULD PREFER CLAYWARE CHANNEL IN MANHOLES. WE HAVE FOUND THAT PLASTIC CHANNELS ARE DIFFICULT TO SET IN CONCRETE BECAUSE THEY FLOAT AND A SATISFACTORY FINNISH CANNOT BE OBTAINED ON THE BENCHING.

THE MINIMUM CRUSHING STRENGTH FOR CLAY PIPES SHOULD BE AS FOLLOWS: 100MM DIA 40KN/m, 150MM DIA 40KN/m, 225MM DIA 45KN/m AND 300MM DIA 72KN/m. THE MINIMUM CRUSHING STRENGTH FOR CONCRETE PIPES SHOULD BE - (CLASS 120 TO EN 1916/BS5911-1 2002). PLASTIC PIPES SHOULD CONFORM TO WIS 4-35-01 AND BS EN 13476.

WHERE B125 COVER AND FRAMES HAVE BEEN APPROVED, THIS MUST NOT BE COATED IN PLASTIC AND MUST HAVE LIFTING EYES SUITABLY SIZED TO ACCOMMODATE STANDARD LIFTING KEYS. SCREW DOWN COVERS ARE NOT ACCEPTABLE.

THE CLEARANCE OF THE CROSSOVER POINTS (MIN 300MM) BETWEEN THE SURFACE WATER SEWERS, FOUL WATERS SEWERS, RISING MAINS AND OTHER SERVICES SHOULD BE SUFFICIENT CLEARANCE TO PROVIDE 150MM GRANULAR BED AND SURROUND AROUND BOTH PIPES.

NOTES:

1. THIS DRAWING IS BASED ON PERSIMMON HOMES YORKSHIRE PROPOSED RM SITE LAYOUT DRAWING 693_101-G AND LATITUDE SURVEYS DETAILED TOPOGRAPHICAL SURVEY DRAWING PS1016-001 DATED 28/11/2012.
2. ALL DRAINAGE WORKS SHALL BE CARRIED OUT IN ACCORDANCE WITH "SEWERS FOR ADOPTION 6TH EDITION" AND YORKSHIRE WATER SPECIFICATIONS/SPECIAL REQUIREMENTS.
3. ALL BUILDING DRAINAGE WORKS SHALL BE CARRIED OUT IN ACCORDANCE WITH BSEN752:2008 BUILDING REGULATIONS AND THE LOCAL AUTHORITY BUILDING CONTROL SPECIFICATIONS AND REGULATIONS.
4. THE CONTRACTOR SHALL ALLOW FOR THE PROTECTION, TEMPORARY AND PERMANENT SUPPORT & DIVERSION WORKS AS NECESSARY TO ALL EXISTING SERVICES TO THE SATISFACTION OF THE PUBLIC UTILITY COMPANIES.
5. ALL LEVELS AND DIMENSIONS SHALL BE VERIFIED ON SITE PRIOR TO THE COMMENCEMENT OF ANY WORKS. DISCREPANCIES SHALL IMMEDIATELY BE BROUGHT TO THE ATTENTION OF THE ENGINEER.
6. THE CONTRACTOR SHALL ALLOW FOR OBTAINING ALL RELEVANT APPROVALS FROM THE RELEVANT AUTHORITIES WHEN WORKING IN THE PUBLIC HIGHWAY AND ON SEWERAGE SYSTEMS.
7. UPON COMPLETION OF THE WORKS, THE CONTRACTOR SHALL CLEAN ALL DRAINAGE BY JETTING, REMOVING ALL DEBRIS FROM SITE. NO DEBRIS SHALL BE PERMITTED TO ENTER THE PUBLIC DRAINAGE OR WATERCOURSE SYSTEM. ALL DRAINS SHALL BE CCTV SURVEYED WITH THE CD PASSED TO THE CLIENT FOR REVIEW.
8. EXISTING DOWNSTREAM ACCEPTING FOUL AND SURFACE WATER NETWORK SYSTEMS TO BE VERIFIED (COVER LEVEL AND INVERT OF MANHOLES EX-FMH1, EX-FMH2 AND EX-SMH1).

DC REF CO-ORDINATES	PIPE LENGTH	PIPE DIA	PIPE CLAY GRADIENT	PIPE MATERIAL
SDC01 E: 435510.566 N:458304.583	22.585	150	1 IN 42	VITRIFIED CLAY
SDC02 E: 435546.184 N:458312.452	14.029	150	1 IN 22	VITRIFIED CLAY
SDC03 E: 435544.053 N: 458270.515	5.581	150	1 IN 16	VITRIFIED CLAY
SDC04 E: 435547.407 N: 458245.781	5.221	150	1 IN 80	VITRIFIED CLAY
SDC05 E: 435577.242 N: 458250.634	6.664	150	1 IN 15	VITRIFIED CLAY
SDC06 E: 435571.227 N: 458239.992	2.996	150	1 IN 15	VITRIFIED CLAY
SDC07 E: 435549.745 N: 458237.420	2.355	150	1 IN 79	VITRIFIED CLAY
SDC08 E: 435516.561 N: 458253.167	13.625	150	1 IN 26	VITRIFIED CLAY
SDC09 E: 435510.688 N: 458239.589	7.896	150	1 IN 21	VITRIFIED CLAY
SDC10 E: 435521.412 N: 458162.693	12.051	150	1 IN 80	VITRIFIED CLAY
SDC11 E: 435500.681 N: 458191.152	7.164	150	1 IN 14	VITRIFIED CLAY
SDC12 E: 435435.136 N: 458232.733	9.643	150	1 IN 19	VITRIFIED CLAY
SDC13 E: 435451.580 N: 458243.980	6.218	150	1 IN 12	VITRIFIED CLAY
SDC14 E: 435466.726 N: 458212.225	6.947	150	1 IN 11	VITRIFIED CLAY
SDC15 E: 435469.173 N: 458180.951	7.256	150	1 IN 18	VITRIFIED CLAY

DC REF CO-ORDINATES	PIPE LENGTH	PIPE DIA	PIPE CLAY GRADIENT	PIPE MATERIAL
FDC01 E: 435531.301 N: 458283.243	3.556	100	1 IN 20	VITRIFIED CLAY
FDC02 E: 435540.334 N: 458287.810	7.200	100	1 IN 20	VITRIFIED CLAY
FDC03 E: 435543.661 N: 458266.668	6.633	100	1 IN 78	VITRIFIED CLAY
FDC04 E: 435571.673 N: 458250.604	5.091	100	1 IN 11	VITRIFIED CLAY
FDC05 E: 435573.159 N: 458240.719	4.779	100	1 IN 80	VITRIFIED CLAY
FDC06 E: 435514.405 N: 458253.657	12.326	100	1 IN 56	VITRIFIED CLAY
FDC07 E: 435511.549 N: 458241.483	4.992	100	1 IN 77	VITRIFIED CLAY
FDC08 E: 435525.730 N: 458213.014	5.255	100	1 IN 40	VITRIFIED CLAY
FDC09 E: 435515.955 N: 458211.972	5.531	100	1 IN 15	VITRIFIED CLAY
FDC10 E: 435519.259 N: 458192.287	7.132	100	1 IN 80	VITRIFIED CLAY
FDC11 E: 435502.492 N: 458191.652	4.989	100	1 IN 29	VITRIFIED CLAY
FDC12 E: 435434.060 N: 458234.409	7.608	100	1 IN 13	VITRIFIED CLAY
FDC13 E: 435449.715 N: 458243.418	4.384	100	1 IN 76	VITRIFIED CLAY
FDC14 E: 435466.896 N: 458214.579	5.066	100	1 IN 78	VITRIFIED CLAY
FDC15 E: 435467.879 N: 458180.318	6.294	100	1 IN 60	VITRIFIED CLAY

DRAWING SUBJECT TO THE APPROVAL OF YORKSHIRE WATER

DRAWING SUBJECT TO THE APPROVAL OF LOCAL AUTHORITY

Rev	Date	Amendments	By
C	31.05.19	Amended to suit Yorkshire Water comments received on 16/04/2019.	RD
B	03.04.19	Amended to suit Yorkshire Water comments received on 04/02/2019.	RD
A	08.01.19	Minor amendments.	RD

Drawing Status.

TENDER PACK

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Client

PERSIMMON HOMES YORKSHIRE

Project

ORCHARD CLOSE,
KNARESBOROUGH

Drawing Title.

SECTION 104 LAYOUT

Drawn: RD
Checked: ADC

Scale: 1:500 @ A1
Date: DEC 2018

Drawing No.

1043 - 102

Rev.

C

KEY:

- DEVELOPMENT BOUNDARY
- PROPOSED FOUL WATER SEWER / MANHOLE (S104)
- PROPOSED SURFACE WATER SEWER / MANHOLE (S104)
- PROPOSED SURFACE WATER & FOUL WATER BACKDROPS
- PROPOSED FOUL WATER LATERAL / DEMARCATION CHAMBER
- PROPOSED SURFACE WATER LATERAL / DEMARCATION CHAMBER
- PROPOSED HIGHWAY DRAIN (S38)
- PRIMARY CONTOURS (200mm INTERVALS)
- SECONDARY CONTOURS (50mm INTERVALS)
- FLOW ROUTE MAPPING

YORKSHIRE WATER REF
H-3-264-196

EXCEEDANCE FLOW ROUTING NOTES

THE PROPOSED SURFACE WATER DRAINAGE SYSTEM HAS BEEN DESIGNED TO ENSURE NO FLOODING UP TO AND INCLUDING 1 IN 100 YEAR + 30% CLIMATE CHANGE ALLOWANCE.

BEYOND THIS EXTREME EVENT, ANY FLOODING WOULD ONLY OCCUR FROM CONTROLLED LOCATIONS AND GENERALLY ONLY IN THE VICINITY OF THE ROAD GULLY AT THE LOW POINT OF ROAD 7 WITH OVERLAND FLOWS AWAY FROM RESIDENTIAL DWELLINGS ONTO HAZELHEADS LANE. THIS WOULD POSE NO RISK TO THE EXISTING OR PROPOSED DWELLINGS.

N

NOTES:

1. THIS DRAWING IS BASED ON PERSIMMON HOMES YORKSHIRE PROPOSED RM SITE LAYOUT DRAWING 693_101-G AND LATITUDE SURVEYS DETAILED TOPOGRAPHICAL SURVEY DRAWING PS1016-001 DATED 28/11/2012.

2. THIS DRAWING PROVIDES AN OVERVIEW OF THE DEVELOPMENT DRAINAGE NETWORK AND PROPOSED TOPOGRAPHY IN RELATION TO EXCEEDNACE EVENTS ARISING FROM EXTREME RAINFALL OR NETWORK BLOCK / FAILURE. THE FLOW ROUTES THROUGH THE DEVELOPMENT ARE CONSIDERED AND MAPPED TO ENSURE NO BUILDINGS WOULD BE SUBJECT TO FLOODING.

DRAWING SUBJECT TO THE APPROVAL OF LOCAL AUTHORITY

Rev	Date	Amendments	By
B	31.05.19	Site layout revised.	RD
A	03.04.19	Amended to suit Yorkshire Water comments received on 04/02/2019.	RD

Drawing Status.
TENDER PACK

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Client
PERSIMMON HOMES YORKSHIRE

Project
ORCHARD CLOSE, KNARESBOROUGH

Drawing Title.
EXCEEDANCE FLOW ROUTING

Drawn: RD
Checked: ADC
Scale: 1:500 @ A2
Date: DEC 2018

Drawing No.
1043 - 114
Rev.
B

C:\Users\ricky\OneDrive\FORTEM RICK\1043 - Orchard Close, Knaresborough\2. Drawings\1. FORTEM\2. Drawings\1. Current\1043 - 114 Exceedance Flow Routing.dwg 31 May, 2019 - 7:59pm