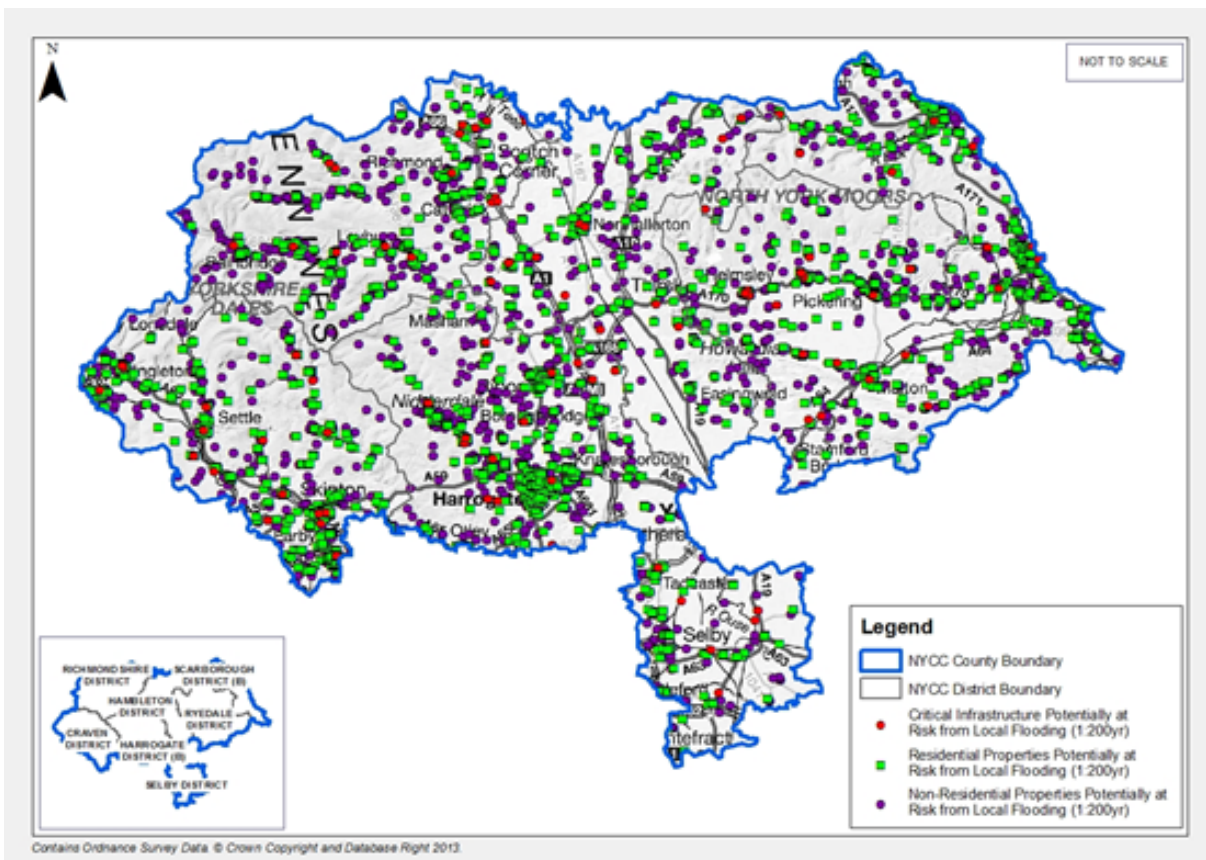


Local Flood Risk Strategy 2022-2027



Section 4: Flooding in North Yorkshire

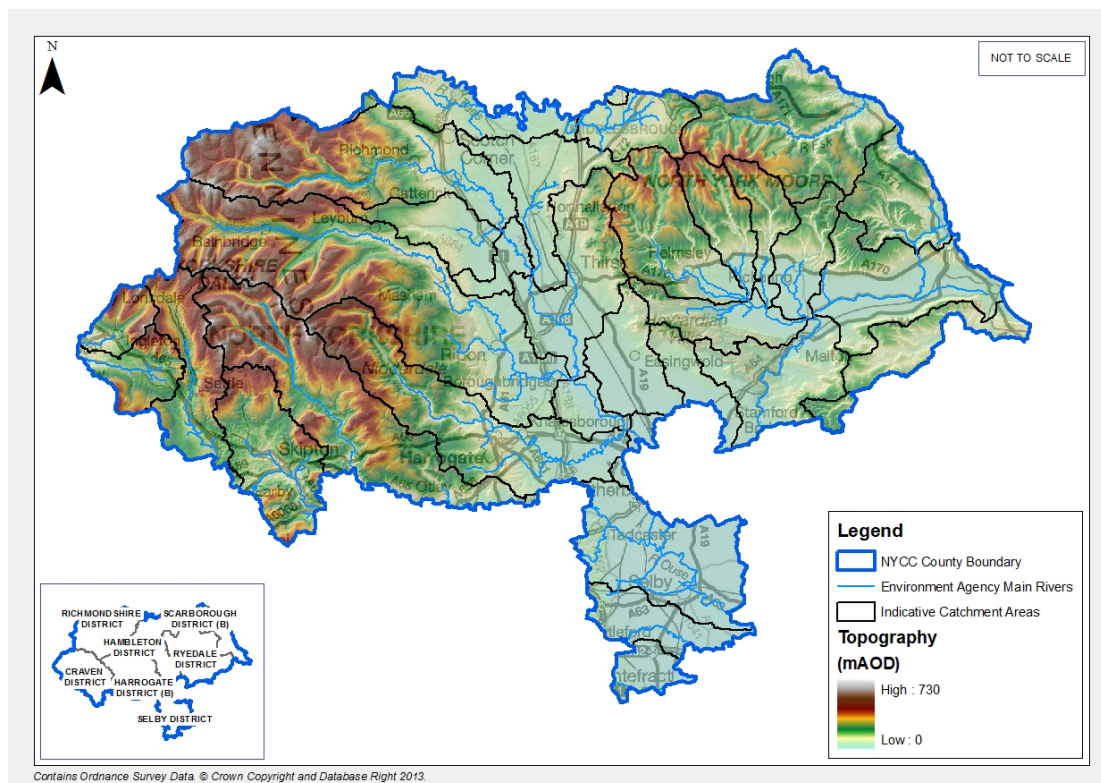
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4 Overview of the Authority Area

The County of North Yorkshire extends over 8,053 km² from the North Sea to Lancashire and from County Durham to Selby. The topography of the land varies from the high points of the Moors and Dales to the low lying Vales of Mowbray, York and Pickering.

The area is drained into the Humber Estuary to the south and directly into the North Sea to the east by over 1700km of main rivers and nearly 23,000km of ordinary water courses and land drainage.



North Yorkshire topography Main Rivers and catchment boundaries are also shown

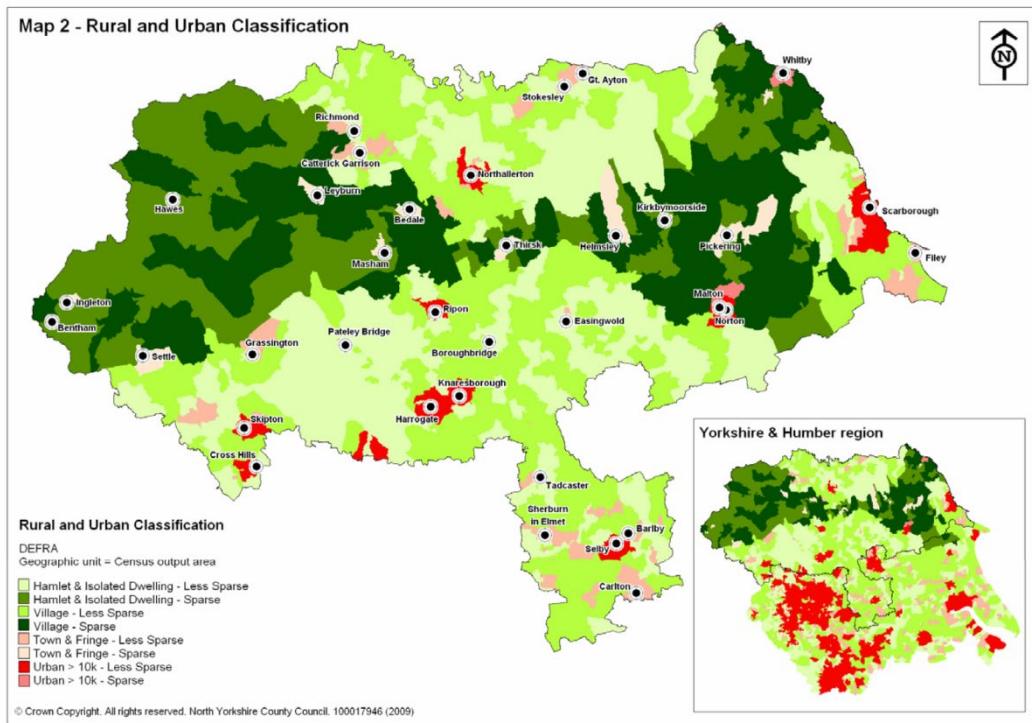
In the upper catchments the higher elevation and steeper terrain can lead to more rapid run off from the surrounding land, and a faster rise in the levels of local water courses. The flood risk tends to be from small watercourses and/or surface water occurring as a result of localised rainfall events and when specific local triggers within the catchment are reached. The duration of flooding that is experienced can range from a few hours to 1 or 2 days depending exactly where it occurs in the catchment. Particular challenges are associated with managing flood risk in upland catchments, where flooding incidents carrying a high level of hazard to the community can occur with very limited warning, and where the limited transport network, and isolated and dispersed nature of the population, can make emergency response difficult.

In the middle and lower parts of the catchments, the terrain becomes less steep and this is where several larger watercourses exist. The types of flooding that are experienced can be much more varied with complex interactions between different flood sources. Some of the larger watercourses can have high water levels for several days after rain has fallen on the upper parts of their catchments. These levels are monitored by a network of [EA gauges](#) throughout the county.

The longer response times of the middle and lower parts of the catchments enable earlier and more accurate forecasting of flood risk from the river system in these parts of the county. However, the high river levels over these longer durations can lead to a complex array of other flooding issues in surrounding local drainage systems. These areas also tend to be more populous, and the extended duration of raised water levels tends to lead to much greater levels of loss and damage to property.

4.1 Land use and population

North Yorkshire has a population of 604,900 (ONS Figures 2016) spread across a predominantly rural area. The 2004 Defra ‘rural definition’ study show North Yorkshire to be one of the most rural and sparsely populated counties in England with agricultural land, moorland and national parks making up approximately 77% of NYCCs administrative area.



Rural and urban classification in North Yorkshire

Within North Yorkshire the boroughs of Harrogate and Scarborough are home to 44% of this population between them; there are 38 market towns and larger settlements

that have a population of over 2,750 and the remainder of the population live in small villages and hamlets. The county's size and the disparate nature of its population is a key challenge in terms of providing local government functions, including the provision of flood risk management services.

4.2 Economy

Due to the natural geography and history of the County, tourism and agriculture form a key part of the economy and are dominant in the market towns and coastal areas. Employment is also provided by manufacturing and the public sector and the Ministry of Defence also have number of their bases within the County, though these are still generally consistent with the picture of a highly dispersed population.

Since funding for flood risk mitigation typically favours areas where the concentration of risk is high, and is also weighted in favour of areas where indicators of poverty and deprivation are similarly concentrated, our County faces a particularly significant challenge in terms of attracting funding for flood risk management. The funding system also anticipates contributions from the beneficiaries of flood defence initiatives, and in particular significant business interests, which again are difficult to secure when the direct risks and benefits are so widely distributed.

4.3 Understanding flood risk across the county area

Many areas across the county have been impacted by flood events in the past. Records of many incidents have been captured and collated, though it is not a complete record. In particular, records from more localised events, involving smaller water courses, surface runoff and groundwater have not always been captured.

To provide a more consistent basis for our future flood risk management activities, we have undertaken a County wide assessment to identify areas at greatest risk of flooding and to identify the different sources of flooding. We have used those historic flooding records that do exist, provided by flood risk partners and impacted communities, together with predicted flood risk from modelling carried out by the Environment Agency for rivers, surface water and coastal flooding. In addition to this mapping, we also undertook a further modelling exercise to identify the most likely flow routes for surface water during and after extreme rainfall events.

The results of this exercise have provided us with an initial high level assessment of the risk, scale and characteristics of flooding that could occur at any location in the County, from which we have identified a prioritised list of further detailed studies and a series of interventions and projects in specific locations.

The exercise has highlighted a significant level of risk to property and critical infrastructure, including:

- Approximately 13,800 residential properties;
- Approximately 6,500 non residential properties;
- Many parts of the highways and rail network;
- Approximately 50 items of critical infrastructure (hospitals, emergency service facilities, national power, energy and water/sewerage infrastructure, government offices, schools and nurseries)

4.4 Flood Source Descriptions

4.4.1 Ordinary Watercourses

An Ordinary Watercourse is every river, stream, ditch, drain, cut, dyke, sluice, sewer (other than a public sewer) and feature through which water flows, which does not form part of a Main River.

4.4.2 Surface Water

Surface water is essentially the water that cannot infiltrate into the ground or find its way to a watercourse or drainage system. It is normally observed flowing across the land surface towards natural low points, or, ponding in such low points.

4.4.3 Groundwater

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 structure which is designed to be dry.

Groundwater flooding won't typically occur unless sustained periods of heavy rainfall over several months is experienced.

4.4.4 Local Flooding

A term given specific meaning by the FWMA being flooding from either one, or any combination of, Ordinary Watercourses, surface water and groundwater. NYCC as Lead Local Flood Authority has powers and duties for the management of the risk of flooding from these sources.

4.4.5 Main Rivers

Main rivers are the larger rivers and other critical watercourses, designated as such and managed by the Environment Agency. Main Rivers can also include any structure that controls or regulates the flow of water in, into or out of the channel.

4.4.6 Sewer Flooding

Flooding from any part of a sewerage system caused either wholly or partly by an increase in the volume of rainwater entering or otherwise affecting the system.

4.5 Ordinary Watercourse Flooding

North Yorkshire is drained by an extensive network of ordinary watercourses that are not classified as main rivers. They generally follow natural and historic drainage routes and range from being well-known and named becks, to underground networks of culverts and pipes which may have evolved over centuries, and for which there may be little or no record.

Landowners, be they individuals or organisations, are responsible for the upkeep of all watercourses and for maintaining the flow in them, as riparian owner (see Section 4.13). However, as many watercourses have been culverted or piped in the past, landowners may not be aware of their existence until a problem occurs. Lack of maintenance leading to blockages and collapse can pose a significant flood risk resulting in surcharge, overland flow and surface collapse.

Identifying these networks is a huge task that presents significant practical challenges and significant potential costs. Nonetheless, 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 local flood risk incidents and the development of the Asset Register (see section 5.3).

4.6 Surface Water Flooding

Surface water flooding is typically the result of high intensity, localised rainfall on either impermeable or saturated surfaces. The sheer volume of water over a short time period can surpass the rate at which the ground can absorb it and outstrip the capacity of the immediate drainage networks and watercourses.

The storm water will find and flow along the easier flow routes, often the road network and ponds in low points in the topography. Historically this kind of flooding has been associated more with urban areas where there are greater areas of impermeable surface. However, investigations into recent flooding events in the county have shown that surface water runoff is an increasing issue in rural areas.

This was particularly evident in 2012 and more recently in 2019 in the Dales , when high rainfall, month on month from late spring and throughout the winter months meant that the ground became saturated such that, in places, even modest rainfall could not soak in, forming overland flow and causing property and highway flooding. In some areas this water carried high levels of silt and debris into highway and private drainage systems causing blockages which restricted the performance of a system already under great strain.

The localised nature of this type of flooding makes it difficult to predict with certainty. However the Flood Forecasting Centre, established following the 2007 floods, does

provide extreme rainfall event forecasting and is now supporting partner agencies in planning emergency responses for such events.

4.7 Groundwater Flooding

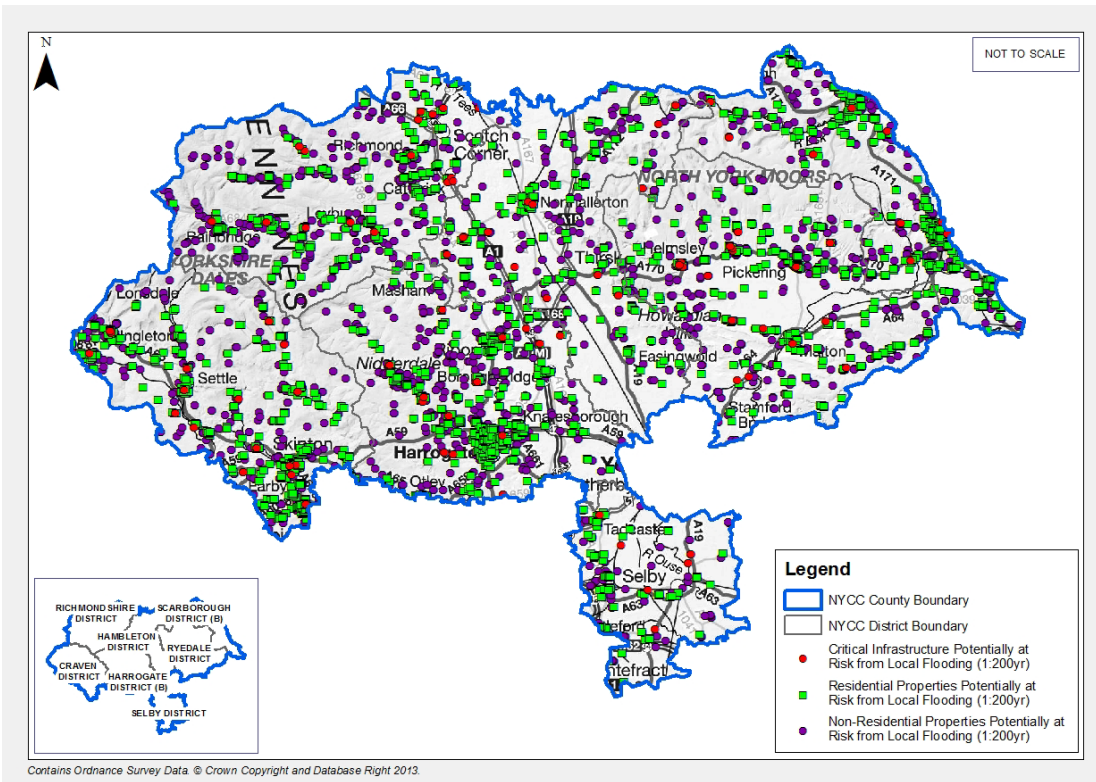
Groundwater flooding is less common in our County than other forms of flooding, but where it does occur the impact upon homes and businesses can be very significant. Groundwater flooding is often very difficult to address, and also tends to last for much longer than other types of flooding.

In North Yorkshire, groundwater flooding has occurred on the southern flank of the North Yorkshire Moors, where water levels in the underlying rock can lead to the activation of springs. Groundwater flooding has also been experienced adjacent to some of the larger rivers in the county.

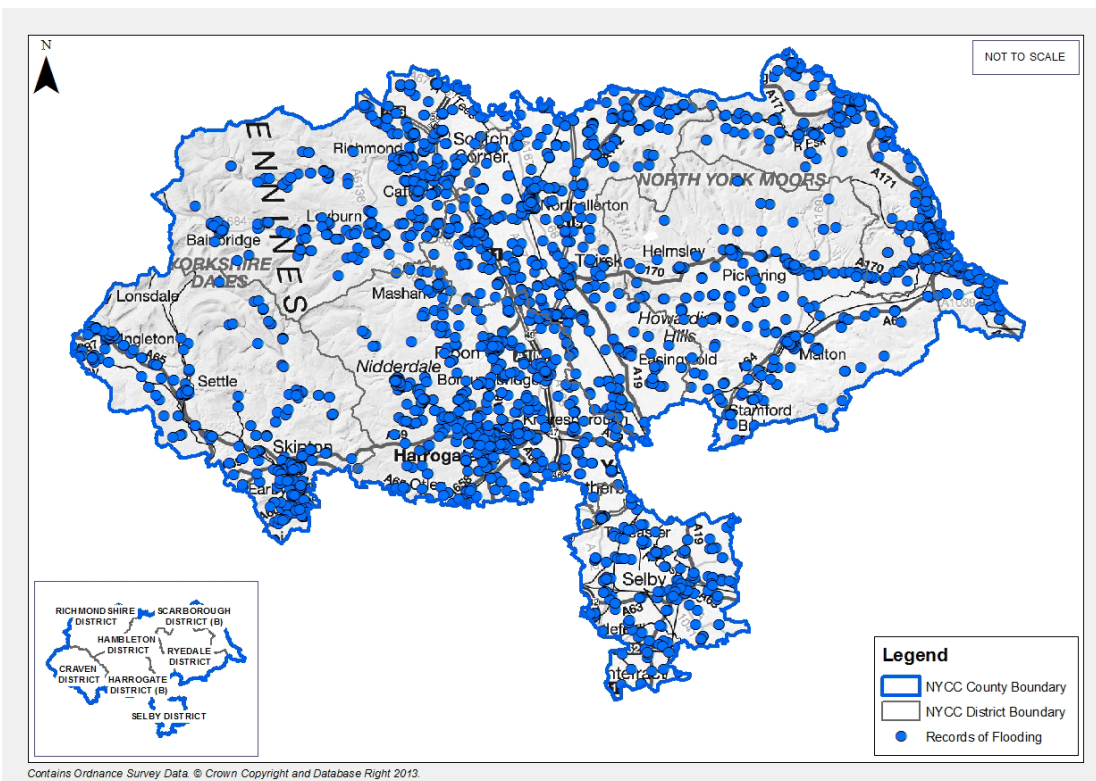
Locations where groundwater flooding occurs are often also at risk from other sources of flooding, and groundwater flooding problems can sometimes be masked by flooding from rivers and surface water.

4.8 Local Flooding

The scale and nature of local flood risk across North Yorkshire is significant and affects almost all parts of the County. We have carried out a series of hydraulic modelling exercises and surveys to help us to understand the risks, and we continue to build on this.



The map above shows the widespread distribution of flood risk across the County



The pattern of recorded flooding closely correlates with the flooding predicted by our modelling

4.9 Main River Flooding in North Yorkshire

North Yorkshire has experienced significant river or fluvial flooding events in its history, including several in years such as those experienced in 1999, 2000, 2004, 2007, 2012, 2015, 2019 and 2020. The Environment Agency manages the flood risk from the county's main rivers. The principle river systems in North Yorkshire are:

The Swale, Ure and Nidd – these rivers pass through the Yorkshire Dales and down through Vale of Mowbray to the Vale of York to become the **River Ouse**.

South of York, the **Ouse** is joined by the **Rivers Wharfe and Aire**, draining from the West, and the **River Derwent** from the East, before broadening into the upper reaches of the Humber Estuary at Goole.

In addition the Environment Agency publish flood risk maps, derived by using hydrological modelling techniques to establish the fluvial flood risk zones

4.10 Sewer Flooding

In England and Wales, the term 'public sewer' is specifically used to refer to the pipes and assets owned and operated by the local water company in their capacity as sewerage undertaker. Public sewers can be intended to carry foul flow, surface water or a combination of both.

However, it is important to note that the public sewer system exists alongside other drainage systems in most locations across North Yorkshire, the ownership of which is often private or can be the responsibility of the highway authority. These networks are often interconnected as a result of many different historical factors, meaning that it is rarely straightforward to establish a complete picture of the roles and responsibilities that each organisation or owner holds.