

North Somerset Council Preliminary Flood Risk Assessment



Preliminary Assessment Report

June 2011



Executive Summary

This Preliminary Flood Risk Assessment (PFRA) has been prepared to assist North Somerset Council (NSC) in meeting its duties as a Lead Local Flood Authority (LLFA) to manage local flood risk and deliver the requirements of the Flood Risk Regulations 2009.

North Somerset is located in the southwest of England and borders the local authority areas of Bristol, Sedgemoor, Mendip and Bath & North East Somerset. NSC is a unitary authority which is approximately 375km² in size. More than two thirds of the district is rural. The majority of residents live in Weston-super-Mare, Portishead, Clevedon and Nailsea. The population within the entire district is just over 200,000.

The PFRA process is aimed at providing a high level overview of flood risk which must be submitted to the Environment Agency for review by 22nd June 2011. The methodology used has been based on the Environment Agency's Final PFRA Guidance and Defra's Guidance on selecting Flood Risk Areas, both published in December 2010.

The PFRA is a high level screening exercise to locate and agree areas in which the risk of local flooding is significant and warrants further examination. The scope of the PFRA considers historic flooding and potential future flooding ostensibly from surface water, groundwater and ordinary watercourses. The PFRA scope does not include flooding from tidal and fluvial sources, however, the interaction between flood sources is highlighted and should be the subject of further work in the future.

The PFRA identifies priority flood risk areas within the LLFA's jurisdiction. This has been done by considering both past flooding and potential future flooding. The preparation of the PFRA is also the first step toward the development of North Somerset's local flood risk strategy, providing an evidence base and identification and prioritisation of local flood risk areas.

The Environment Agency has used a methodology to identify indicative Flood Risk Areas across England and Wales. Of the ten indicative Flood Risk Areas that have been identified in England, none are located within North Somerset Council's administrative area.

In order to develop a clear overall understanding of the flood risk across the North Somerset area flood risk data and records of historic flooding were collected from a number of sources including the councils land drainage and highways drainage departments, the Environment Agency, Wessex Water, Internal Drainage Boards, Town and Parish Councils, emergency services and other risk management authorities.

The historic flooding data and local knowledge has been used together with Environment Agency national flood maps to agree the local flood risk in the study area.

Specific information was available from the outputs of the Weston-s-Mare Surface Water Management Plan to gain a more detailed appreciation of the potential flood risks in the council's largest town.

Interaction with other flooding sources has been assessed where a combination of flood mechanisms would have significant consequences. This has been helped by the inclusion of outputs from both the SFRA and the Weston-s-Mare SWMP.

Potential future flooding and its consequences have been considered by using a combination of flood risk indicators set out by the Environment Agency and other local measures.

From the assembled information a prioritised list of flood locations has been produced based on a combination of the likelihood of flooding and the associated impacts on properties and assets.

Based on national surface water modelling a number of residential properties are estimated to be at risk from flooding to a depth of greater than 0.3m during a rainfall event with a 1 in 200 (0.5%) annual chance of occurring.

As a result of the assessment the highest risk areas are:

- Weston-super-Mare
- Wrington
- Nailsea

The PFRA sets out the next steps the Council will be taking to manage the risks identified.

Actions to date include:

1. Setting up of a Strategic Flood Board
2. Completing a SWMP for Weston-s-Mare
3. Works to mitigate flooding at Milton Hill, Worle
4. Liaison with Wessex Water about additional flood mitigation work at Milton Hill
5. Submitting a Flood Defence Grant in Aid (FDGiA) bid for a major flood mitigation scheme at Wrington

And further actions include:

6. Developing the council's Local Flood Risk Strategy (LFRS)
7. Discussing potential flood risk in the north east of the study areas with Bristol City Council including ways to identify specific risk locations in North Somerset and proposals to mitigate risks
8. Developing an action plan to address the top three flood risk locations in the study area (this may include capital expenditure and/or increased maintenance)
9. Developing an action plan based on the detailed outputs of the WsM SWMP
10. Assessing further the combined outputs of the SFRA, WsM SWMP and PFRA and assessing if specific FRMPs would be of benefit
11. Assessing the potential impacts of climate change
12. Further developing the council's database for recording flood events based on revised EA guidelines
13. Adopting the database for all future flood recoding and introduce new processes in the council to ensure data is captured and recorded
14. Agreeing a protocol with Wessex Water and North Somerset IDB to regularly update the database to include WW and IDB flood events
15. Adding further historical data from stakeholders that could not be acquired in time to complete the PFRA
16. Scheduling periodic reviews of SWMP and other modelling
17. Developing a communications plan to engage with wider stakeholders and the public

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Glossary

AStSWF	Areas Susceptible to Surface Water Flooding
Catchment	An area that serves a river with rainwater. Every part of land where the rainfall drains to a single watercourse is in the same catchment.
BCC	Bristol City Council
CFMP	Catchment Flood Management Plan
Defra	Department for Environment, Food and Rural Affairs
EA	Environment Agency
FCERM	Flood and coastal erosion risk management
Flood Risk Area	An area determined as having a significant risk of flooding in accordance with guidance published by Defra and WAG.
FRMP	Flood Risk Management Plan
FMfSW	Flood Map for Surface Water
IDB	Internal Drainage Board
Indicative Flood Risk Area	Areas determined by the Environment Agency as indicatively having a significant flood risk, based on guidance published by Defra and WAG and the use of certain national datasets. These indicative areas are intended to provide a starting point for the determination of Flood Risk Areas by LLFAs.
LLFA	Lead Local Flood Authority.
Main River	A watercourse shown as such on the Main River Map, and for which the Environment Agency has responsibilities and powers
NRD	National Receptor Dataset – a collection of risk receptors produced by the Environment Agency.
NSC	North Somerset Council
Ordinary Watercourse	All watercourses that are not designated Main River, and which are the responsibility of Local Authorities or,
PFRA	Preliminary Flood Risk Assessment
SFRA	Strategic Flood Risk Assessment
SWMP	Surface Water Management Plan
WSM	Weston-super-Mare
WW	Wessex Water

Introduction

This Preliminary Flood Risk Assessment (PFRA) has been prepared by North Somerset Council as a requirement of the Flood Risk Regulations which came into force on the 10th December 2009 and the Flood & Water Management Act 2010. The council has a responsibility as a Local Lead Flood Authority (LLFA) to complete the PFRA by 22nd June 2011.

Prepare Preliminary Assessment Report.	Preliminary Assessment Report for each LLFA	Deadline 22 nd June 2011
Identify Flood Risk Areas.	Where the risk of flooding is significant	Deadline 22 nd June 2011
Prepare Flood Hazard Maps and Flood Risk Maps	For Flood Risk Areas	Deadline 22 nd June 2013
Prepare Flood Risk Management Plans	For Flood Risk Areas	Deadline 22 nd June 2015

Table 1 - Stages of the Flood Risk Regulations

Scope of PFRA

The Preliminary Flood Risk Assessment (PFRA) has been compiled using Defra guidance. It is a high level screening exercise to identify locations where the risk of flooding is significant and requires further examination through the production of maps and management plans.

The scope of this PFRA is to consider past flooding and possible future flooding from the following local flood sources:

- Surface water
- Groundwater
- Ordinary Watercourses

In addition the PFRA looks at the interaction with other flood mechanisms. This is particularly relevant to North Somerset because of the significant flood risk associated with tidal and fluvial sources.

Flood risk has been assessed in terms of both national and local significance according to prescribed national threshold levels.

Objectives

The key aims of the assessment are twofold, firstly to provide an assessment of flood risk in the national context and secondly to support local flood risk management strategies.

The objectives of the PFRA are to:

- Establish a local partnership in order to share information and manage stakeholder engagement
- Collate historic flood data from a range of sources within the study area
- Use historic data and local knowledge to agree and confirm locally agreed surface water information
- Identify future flood risk areas
- Assess the potential harmful consequences of future flood events in flood risk areas
- Prioritise flood risk locations
- Produce a forward work plan based on the outputs of the PFRA

Study Area

North Somerset District is located in the southwest of England and borders the local authority areas of Bristol, Sedgemoor, Mendip and Bath & North East Somerset. NSC is a unitary authority which is approximately 375km² in size. More than two thirds of the district is rural. The majority of residents live in Weston-super-Mare, Portishead, Clevedon and Nailsea. The population within the entire district is just over 200,000.

This PFRA covers the entire NSC area excluding the island of Steep Holm. More than two thirds of the district is rural.

The study area is illustrated below:

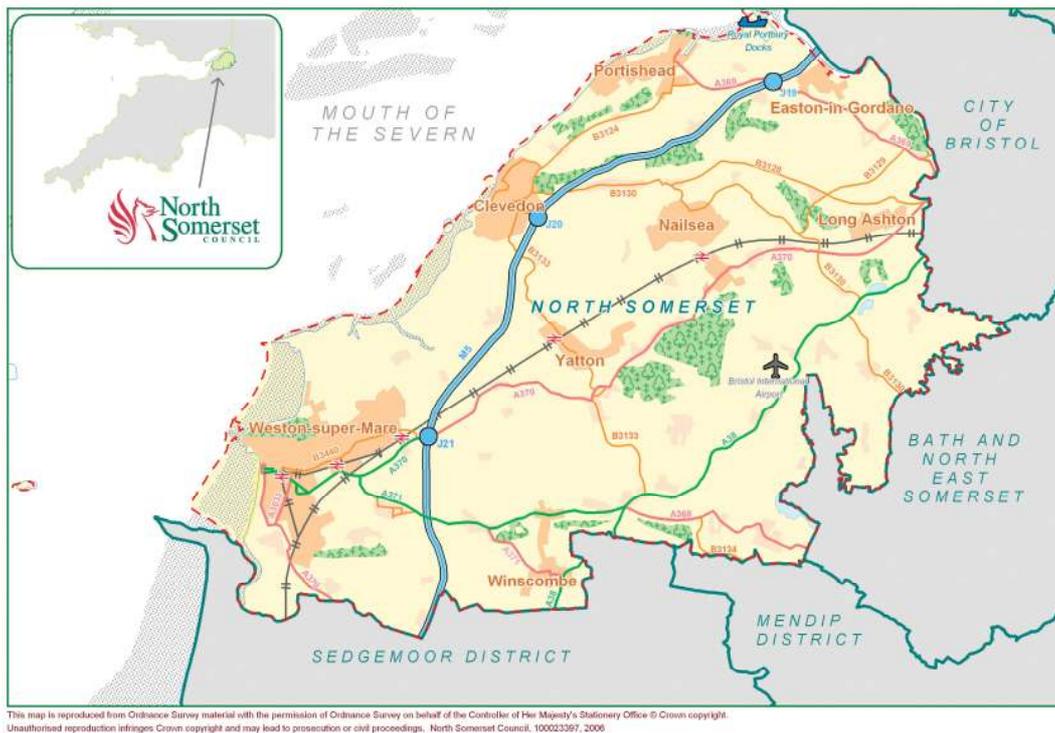


Figure 1 – PFRA Study Area

Lead Local Authority Responsibilities

The Flood & Water Management Act enhances the role of local authorities by giving them responsibility for leading the co-ordination of flood risk management.

The Act defines the lead local flood authority (LLFA) for an area as the unitary authority or the county council and enables lead local authorities to delegate flood or coastal erosion functions to another risk management authority by agreement.

Local Partnerships

The lead local flood authority should bring together all relevant bodies (district councils, internal drainage boards, highways authorities and water companies) to help manage local flood risk.

Flood Risk Management Strategies

The Act also requires a lead local flood authority to develop, maintain, apply and monitor a strategy for local flood risk management in its area.

Duty to Act Consistently with Local and National Strategies

The Act will require local flood risk management strategies to be consistent with the national strategy. The local strategies will build on information such as national risk assessments and will use consistent risk based approaches across different local authority areas and catchments.

Duty to Investigate and to Maintain a Register

To ensure greater co-ordination of information and avoid situations where bodies do not accept responsibility, the lead local flood authority will:

- Investigate flooding incidents, publish the results of any investigation, and notify any relevant authorities.
- Maintain a register of structures or features which they consider have a significant effect on flood risk in their area.

Ensuring Progress

The Act does not require routine reporting on performance, but allows information to be requested where necessary.

In addition, the Act will enable overview and scrutiny committees in lead local flood authorities to hold all the risk management authorities to account. In this way, the public can be actively involved in ensuring authorities perform.

Works Powers

The Act provides the lead local flood authority with powers to do works to manage flood risk from surface runoff and groundwater.

Designation of Third Party Assets

The Act provides lead local flood authorities with powers to designate structures and features that affect flooding or coastal erosion.

Sustainable Drainage Systems (SUDS)

The Act establishes a SUDS Approving Body (the "SAB") at county or unitary local authority levels. The SAB would have responsibility for the approval of proposed drainage systems in new developments and redevelopments, subject to exemptions and thresholds.

Other Powers

Local authorities will be able to use all their normal powers (in planning, regeneration, local investment, highways and to provide information and guidance) to support their new roles under the Act. They will take over the Environment Agency's role in deciding whether to allow works by third parties that may affect water flows to take place.

Sustainable Development Duty and Environmental Works

The Act includes a duty for local authorities, highways authorities, and internal drainage boards to contribute to sustainable development in discharging their flood and coastal erosion risk management (FCERM) functions. This is similar, to the existing duty that the Environment Agency already has.

Governance

North Somerset Council has developed a core working partnership with the following organisations:

- Wessex Water
- West Mendip IDB
- North Somerset IDB

This partnership was established primarily for the development of the Weston-s-Mare Surface Water Management Plan and has latterly been integrated into a Strategic Flood Management Board which meets quarterly to develop flood management strategies, share information and discuss progress with on-going work.

The Strategic Board is also attended by representatives of the Environment Agency and an Executive elected member.

Specific information about historic local flooding has been provided by Wessex Water and the two IDBs and additional information was sought from other sources including Town and Parish Councils, Network Rail, Highways Agency, Fire Service and Association of British Insurers.

Upon completion of the PFRA it is intended to share the outputs and findings with a wider range of stakeholders and to develop and agree a forward work plan that focuses on priority areas. Further work is likely to take the form of specific detailed studies to better understand the flood risk, capital scheme investment, asset maintenance work and contingency planning.

A communication strategy will be developed detailing how the outputs of the PFRA and any subsequent work will be shared with stakeholders and the public.

The PFRA was presented and approved at an Executive Briefing on 7th June 2011. The PFRA will also be presented to the Planning and Economic Development Policy & Scrutiny Panel on 27th June 2011.

Methodology & Data Review

Methodology

Data held by North Somerset Council was viewed as the starting point for the assessment. Prior to the review this data was held in a variety of places and in different formats.

Information was gathered from both land drainage and highways drainage departments and a single dataset was created. The historic flood data derived from North Somerset Council records was supplemented by additional data from Wessex Water and the two Internal Drainage Boards. The council data required significant checking and cleansing to eliminate duplication.

Since 2008 the council has carried out two additional studies that provide more detailed historic and predicted flood risk information.

- Strategic Flood Risk Assessment (SFRA1 & 2)
- Weston-s-Mare Surface Water Management Plan (WsM SWMP).

Whereas the SFRA covers the entire council area it is primarily concerned with the significant risk posed by tidal and fluvial flooding rather than surface water and flooding from ordinary watercourses.

The WsM SWMP is more appropriate for use with the PFRA because it focuses on surface water flooding risk but only covers the town of Weston-s-Mare. Outputs from the SWMP have been based on scenarios where surface water is affected by tide locked drainage and a saturated catchment and therefore provides a greater level of detail for the assessment in Weston-s-Mare.

The above data sources have been combined to arrive at an agreed historical flood record which incorporates a wide variety of inputs and is supported by the council and its partners.

Additional historic reported flood data was requested from the following:

- Parish and Town Councils
- The Fire Service
- Highways Agency
- Network Rail
- The Association of British Insurers

Data Review

This PFRA is based on data obtained from the following sources:

- Historical flood records
- North Somerset Council flooding database
- Information gathered from strategic partners about flood risk in North Somerset
- North Somerset Councils Strategic Flood Risk Assessments (SFRA 1 & 2)
- Weston-s-Mare Surface Water Management Plan (SWMP)
- Information gathered from external sources
- Environment Agency flood risk maps

Historic data was combined into a new single database (Excel format) which will be used to record fresh flooding incidents going forward. Within the spreadsheet the source of the data has been provided to differentiate between different data sets. Cleansed historic flood data has also been added to the councils MapInfo GIS system which provides a graphical representation of the same information.

The historic flood data contained in both the SFRA and the Weston-s-Mare SWMP was largely based on council records, so although this data has been considered, it is unlikely to be either new or more accurate than the records held by the council.

The majority of the historic flood records did not include sufficient detailed information to establish the severity of the corresponding rainfall that caused the flood event. However, the data from Wessex Water and the IDBs had been recorded in more detail and did therefore give some indication of the intensity of the rainfall.

Much of the flood data obtained from other external sources was even harder to assess in terms of severity and was not available at an early enough stage in the assessment to follow up with the providers of the data. For this reason one of the recommendations for further work coming out of the PFRA will be to assess this additional information and where appropriate incorporate it into the single data repository.

Going forward the recording of future flood events will need to be better managed to provide more accurate historic records for the next assessment.

Flood Maps

Flood maps were provided by the Environment Agency for use in the PFRA. A large amount of data was made available and in order to simplify the process of assessment a limited amount of this data was selected which was considered to be the most relevant for North Somerset.

The maps were shared with the council's partners to check their accuracy and validity.

Table 2 below shows the available maps and highlights those used for the assessment.

Map Source	Map Description	For PFRA Use
EA Flood Risk Regs CD	Indicative flood risk areas (national risk)	Yes
EA Flood Risk Regs CD	Places above flood risk thresholds	Yes
EA Flood Risk Regs CD	Supporting information for clusters	Yes
EA Flood Risk Regs CD	Listed buildings	If appropriate
EA Flood Risk Regs CD	Scheduled monuments	If appropriate
Geostore	Flood Map – Flood defences	If appropriate
Geostore	Flood Map – Flood storage areas	If appropriate
Geostore	Flood Map – Areas benefiting from flood defences	If appropriate
Geostore	Flood Map – Flood zones 2 and 3	If appropriate
Geostore	Main Rivers	If appropriate
Geostore	Historic Flood Map	Yes
Geostore	Areas Susceptible to SW Flooding – more /intermediate/less	Yes
Geostore	Areas susceptible to GW Flooding	Yes
Geostore	Detailed River Network	If appropriate
Geostore	Historic Landfill	If appropriate
Geostore	National Receptor Database – property points	If appropriate
Geostore	National Receptor Database – social/cultural/environmental (1&2)	If appropriate
Geostore	Flood Map for SW 1:30 year – depth > 0.3m	Yes
Geostore	Flood Map for SW 1:30 year – depth > 0.1m	Yes
Geostore	Flood Map for SW 1:200 year – depth > 0.3m	Yes
Geostore	Flood Map for SW 1:200 year – depth > 0.1m	Yes

Table 2 – Flood Maps for use with PFRA

Past Flood Risk

Information on past floods has been compiled using the Environment Agency Flood Reconnaissance Information System (FRIS) database, supplemented with the Council's own Highways Flood Record database.

Types of Flooding

Surface Water

Surface water is rainfall that has fallen on to the ground or roofs but has not yet entered a natural or man made drainage system. Surface water flooding occurs when rainfall exceeds the capacity of the local drainage network and water flows overland.

Flooding from surface water can be caused by a lack of drainage capacity, inadequate drainage capacity or by blockages and malfunctions of the drainage network.

Tidal and Fluvial Flood Risk

In the North Somerset area there is regular flooding of land without risk to property and in parts of the low lying North Somerset levels controlled flooding of agricultural land forms part of the catchment management processes. There are however areas within the NSC boundary that are at a greater risk of fluvial and coastal flooding. The majority of the EA Flood Zones 2 and 3 within the NSC area are on the west side of the district, reflecting the underlying topography and low lying areas of coastline.

The NSC area has approximately 58 km of coastline and therefore the risk of coastal flooding is extensive. Flood Zone 3 – ‘tidal flooding’, covers around 25% of the total NSC district area which is significant. There are three vulnerable stretches of coast which are susceptible to overtopping of coastal defences; from Portishead south westerly inland to the North East of Clevedon; along the coast from the Land Yeo, south to Congresbury Yeo; and at Weston super Mare south to Uphill Sluice. The latter two areas of tidal flooding join to flood a large parcel of flooded land.

Specific areas at risk of tidal flooding include Kingston Seymour and Wick St Lawrence, Sand Bay and Weston Bay. Where high tides, especially Spring tides combine with strong onshore winds the associated waves and spray can overtop or breach defences causing coastal flooding and in some cases structural damage caused by the water itself or by debris within it.

Without defences in place a quarter of the area of the North Somerset area is at risk of flooding. Due to the rapid onset of flooding the consequences and impacts of flooding from the sea and tidal waters are more severe than flooding from rivers. The severity of coastal flooding depends on a number of parameters including weather systems, wind and wave conditions, underlying topography, effectiveness of drainage systems and the condition of flood defences.

There have been a number of fluvial flooding issues in the past, with the main areas affected being land and properties adjacent to the Congresbury Yeo at Congresbury, low lying areas within Weston-super-Mare and more recently fluvial flooding from the Winford Brook has flooded properties in Winford.

Sewer flooding

In urban areas, rainwater frequently drains into surface water sewers, or sewers containing both surface and waste water, known as combined sewers. These sewers can be overwhelmed by heavy rainfall, become blocked, or be of inadequate capacity, resulting in flooding of the surrounding area until the water can drain away. This is particularly a problem when a combined sewer is involved because there is then a high risk of contaminated water flooding a property internally.

Wessex Water has provided locations of sewer flooding risk as recorded for Ofwat, as shown in Figure 4. The water industry regulator, Ofwat, records properties that have flooded from sewers and are at risk of flooding again. There are separate registers for internal and external flooding and each register is split showing the risk of flooding twice in ten years (2:10), once in ten years (1:10) and once in twenty years (1:20).

The majority of this flooding is located in Weston-super-Mare. The information provided is only representative of the situation as of May 2008.

Ground Water Flooding

Groundwater flooding occurs as a result of water rising up from the underlying aquifer or from water flowing from ephemeral springs. This tends to occur after long periods of sustained rainfall, and the areas most at risk are often low-lying where the water table is more likely to be at shallow depth. Groundwater flooding is known to occur in areas underlain by major aquifers, although it is also being associated with more localised floodplain alluvial deposits.

Ordinary Watercourses

An Ordinary Watercourse is defined as any river, stream, ditch, cut, sluice, dyke or non-public sewer which is not a Main River. The Act devolved consenting powers for works on Ordinary Watercourses from the EA to the LLFA. Therefore flooding from an ordinary watercourse is similar to fluvial flooding with the difference being a matter of responsibility and degree of risk.

Combined Flood Risk

Following the extreme flooding events of 2007 the Environment Agency published an assessment of national flood risk and North Somerset was ranked second of ten local authorities with the highest number of properties in areas with a significant chance of flooding.

Although this PFRA is primarily concerned with the risk of flooding from surface water, ground water and reservoir breach by far the most significant risk to North Somerset Council is the risk of tidal flooding.

Sea levels generally are a contributory factor in surface water flooding as much of the North Somerset area relies on land draining into the sea. High tides can create tide locked conditions which if combined with heavy rainfall can result in flooding from modest rainfall events.

Modern sewerage systems are designed to cope with rainfall events of up to 1:30 years, however, many sewers were built to the standards of protection that prevailed at the time and have significantly less capacity.

Tidal flooding and rainfall events such as those modelled by the Environment Agency (FMfSW) and those used in the Weston-s-Mare SWMP are far greater than the sewerage network can manage. For these types of flooding event it is therefore likely that the public sewerage network would be overwhelmed and with this would come the risk of contamination and pollution from foul sewers on top of the general disruption from excess water.

Historic Flood Risk

Significant recorded historic flood events are listed and described in detail in Appendix A.

The Environment Agency Historic Flood Map records events across England and Wales. This Historic Flood Map dataset has recently been updated and is shown in Figure 2 below.

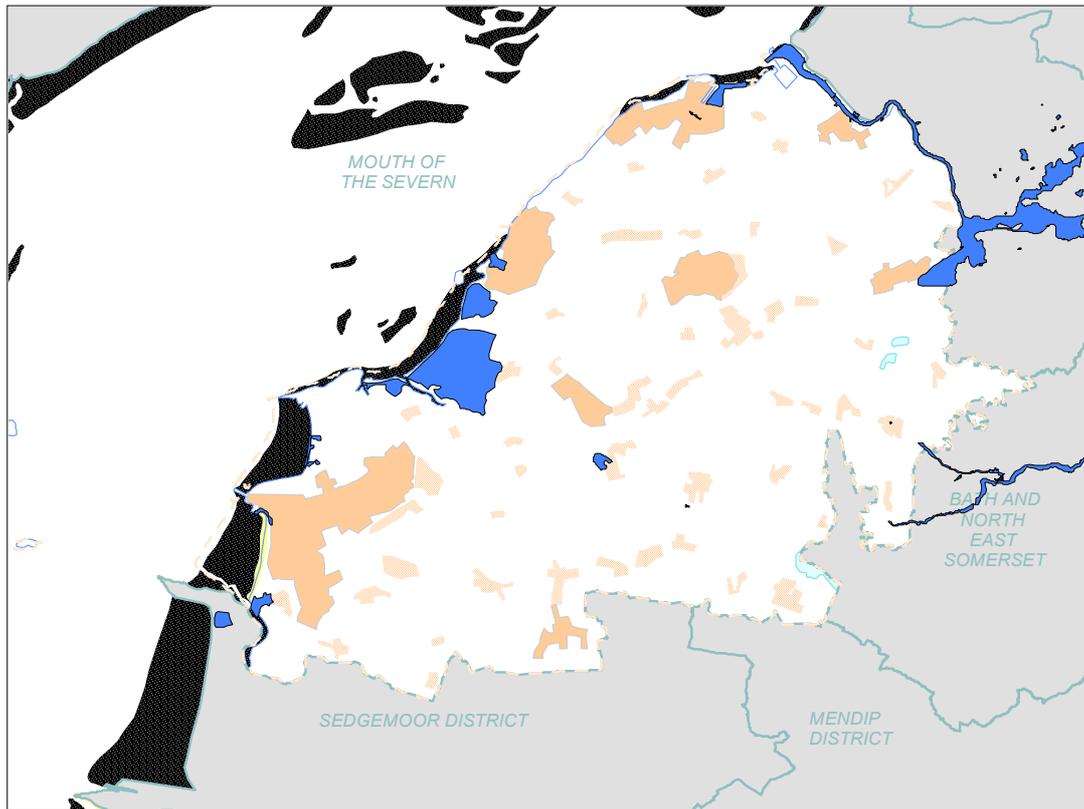


Figure 2 – Environment Agency Historic Flood Map (EA)

The Strategic Flood Risk Assessment (SFRA 1) identified various sources of reported historic flooding which are shown in Figure 3. This map includes all sources of flooding.

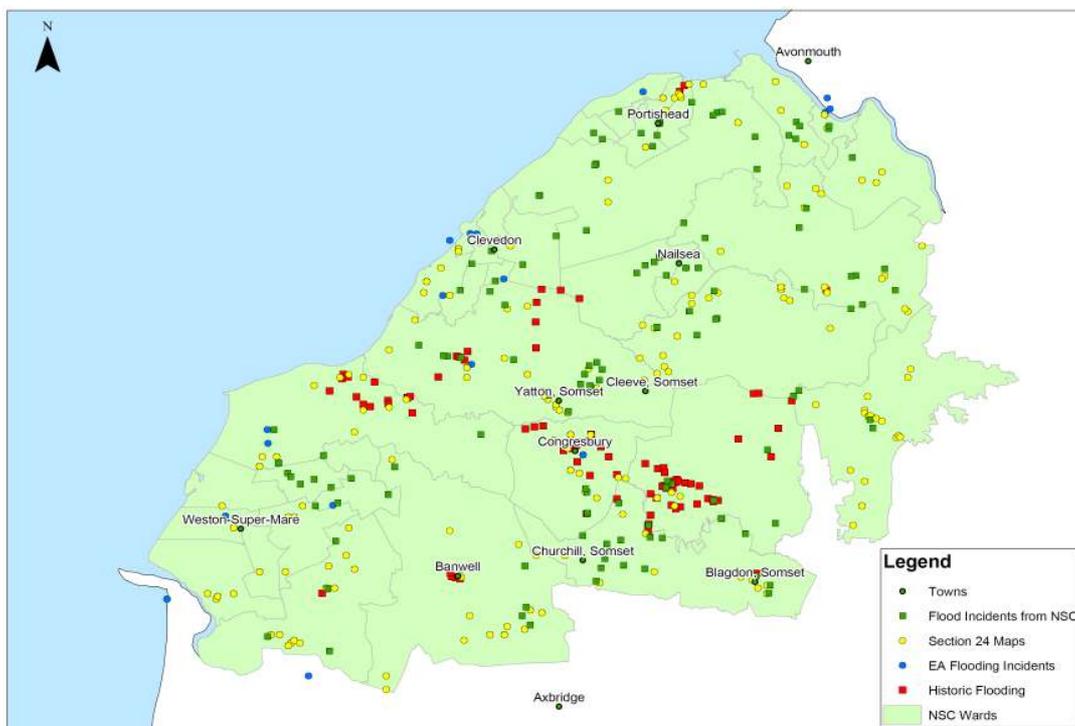


Figure 3 – Historic Flood Incidents (Royal Haskoning SFRA1)

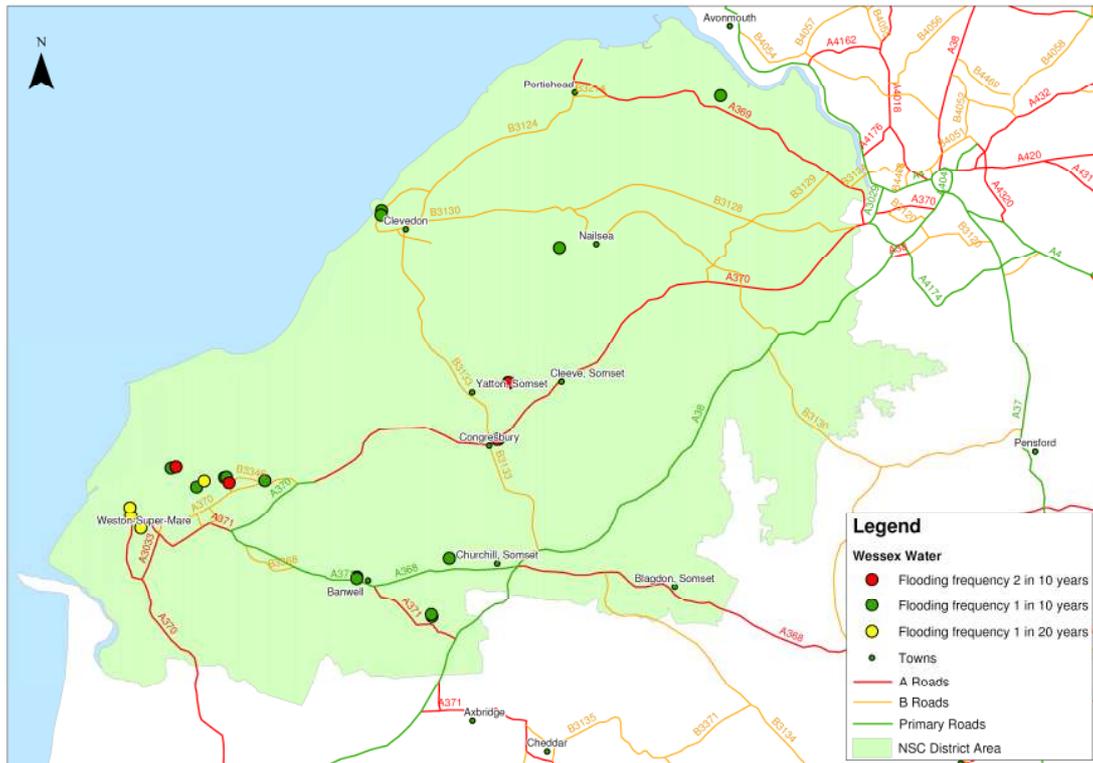


Figure 4 – Sewer Flooding Reported by Wessex Water (Royal Haskoning SFRA1)

Further records of historic flooding were obtained from the recently completed Weston-super-Mare Surface Water Management Plan (SWMP). Figure 4 includes flooding from all sources.

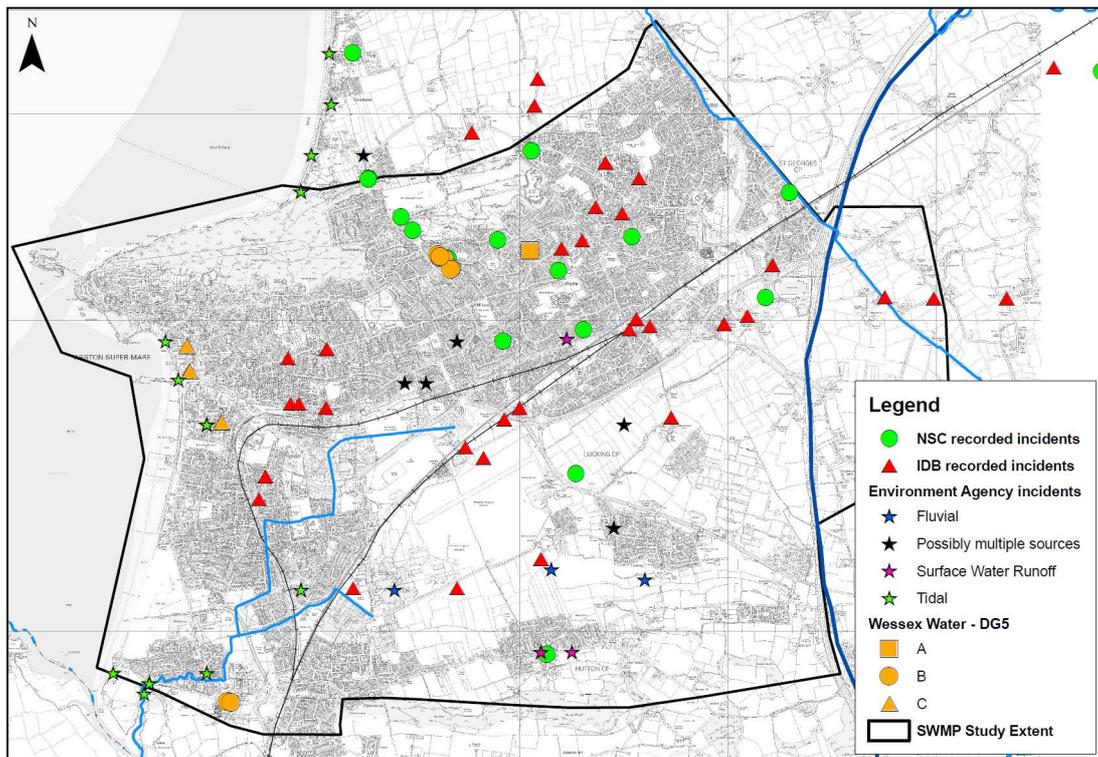


Figure 5 – Historic Flood Incidents in Weston-s-Mare (Royal Haskoning WsM SWMP)

Past Flood Risk Summary

Historic flood records provide a useful contribution to forecasting locations that are currently at risk of flooding or may be at risk of flooding in the future. However, the exact cause of historical flooding and the associated rainfall intensity may not be known, so an element of caution is required in using past flood events to forecast future flood risk.

There is a requirement for the PFRA to consider if any historic flood events should be considered as having significant harmful consequences. The definition of significant harmful consequences in the context of local flooding has been considered and greater than 300 properties at risk was deemed a sensible threshold being marginally higher than the threshold used by the Environment Agency in determining future flood risk (Places above Flood Risk Thresholds).

EA Flood Zones only consider fluvial and tidal sources of flooding. To measure the effect of other sources historic flooding information was considered in the council's SFRA1. The number of properties within a specified distance of a historic location of flooding was estimated to provide an indication of the flood risk. No location exceeded the 300 threshold.

Defra has indicated that it does not expect a long list of significant past floods and only those events that would register at a national level of consequence i.e. events that might be reportable to the EU should be included. For this reason North Somerset Council does not consider there to be any historical flooding that falls into the category of significant and has not therefore completed Annex 1 of the PFRA submission.

Future Flood Risk

In late 2010 / early 2011 the Environment Agency published a suite of flood maps specifically for use in developing the PFRA. A list of these maps is included in Table 2 earlier in this report.

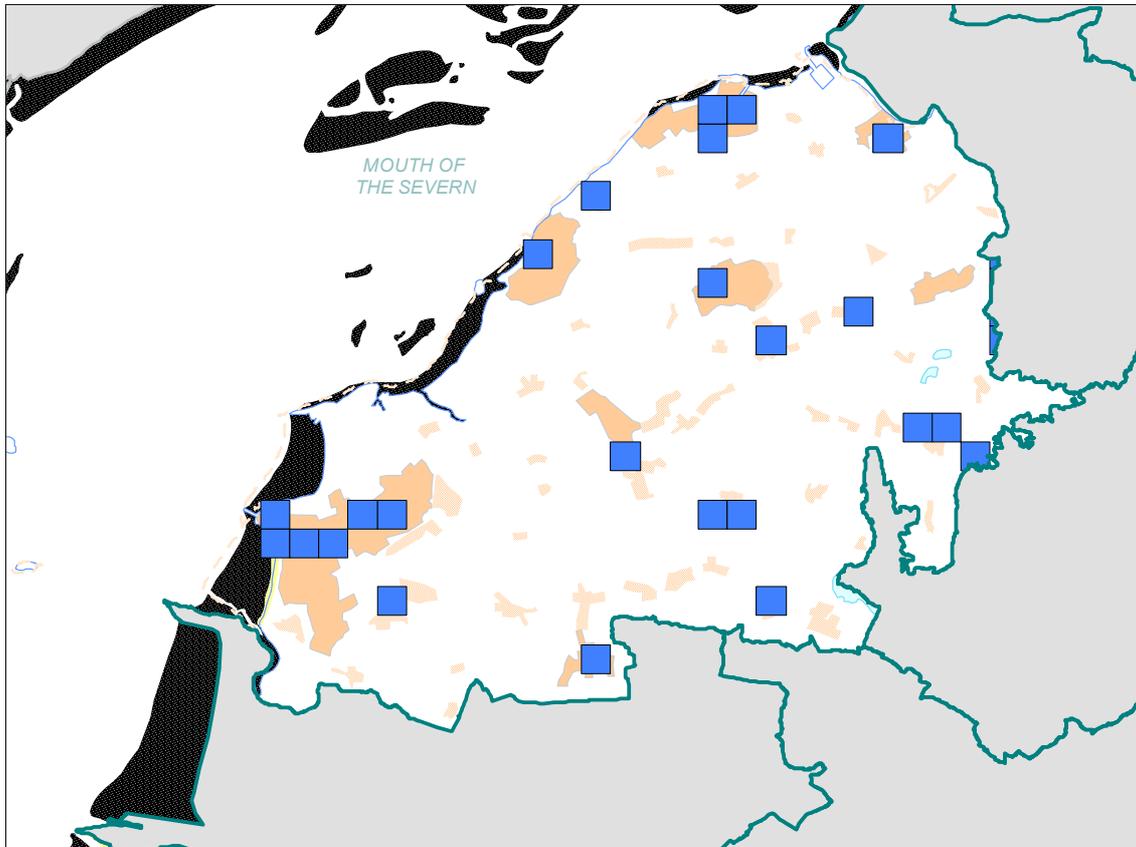


Figure 6 – Places above Flood Risk Threshold (EA)

Flood Risk Areas have been identified in Figure 6 above (Places above Flood Risk Threshold). These are shown as individual 1km blue squares where there is one or more of the following:

- Greater than 200 people at risk
- Greater than one critical services at risk
- Greater than 20 non-residential properties at risk

Within the North Somerset boundary there are 24 Places above Flood Risk Thresholds (1km blue squares). The threshold identifying national Indicative Flood Risk Areas is where more than 30,000 people are at risk of surface water flooding inside 5 or more touching 1km squares within a 3km by 3km area. There are 10 Indicative Flood Risk Areas across England and none of these are located in the North Somerset Council area.

Notwithstanding the above the north east corner of the study area borders a part of Bristol City Council's study area that does contain an Indicative Flood Risk Area and there is therefore a potential risk that needs to be explored in more detail. It is understood that Bristol City Council will be considering this risk within their PFRA and a recommendation of this PFRA will therefore be to engage in detailed discussions with Bristol City Council about the potential flood risk along this boundary.

The methodology adopted to assess future flood risk in this PFRA has been based on an assessment of the flood maps highlighted in Table 2.

The first map (Areas Susceptible to SW Flooding) is a first generation surface water flood map and does not make an allowance for the performance of the drainage network. It is possible therefore that this map overestimates the volume of surface water. A second generation map (Flood Map for Surface Water) has recently been released which does include an allowance for loss into the drainage network. Therefore in theory the second generation maps should be the more accurate of the two.

The Environment Agency has advised that the following versions of the old and new surface water flood maps are roughly comparable and have therefore been used in the assessment

- Areas Susceptible to Surface Water Flooding (Intermediate 0.3m-1.0m)
- Flood Maps for Surface Water (Depth >0.3)

Historic flood locations were added as a GIS layer and for each of the 24 blue squares a detailed assessment was made within each square to assess the accuracy of the flood prediction based on combining the AStSWF and FMfSW locations and actual reported flooding. This process was extended in slightly less detail for areas outside of the blue squares. In Weston-s-Mare the outputs of the SWMP were also used.

Locally Agreed Surface Water Information

The conclusion from the verification process is that the second generation flood maps compare more closely to the historical flood locations and therefore most accurately predict surface water flooding in the North Somerset area.

Wessex Water and the two Internal Drainage Boards were consulted about the choice of flood maps to be adopted for the PFRA. Based on the methodology used above the Locally Agreed Surface Water Information has been based on the FMfSW 1:200 year maps. The locally agreed surface water summary map is shown below in Figure 7.

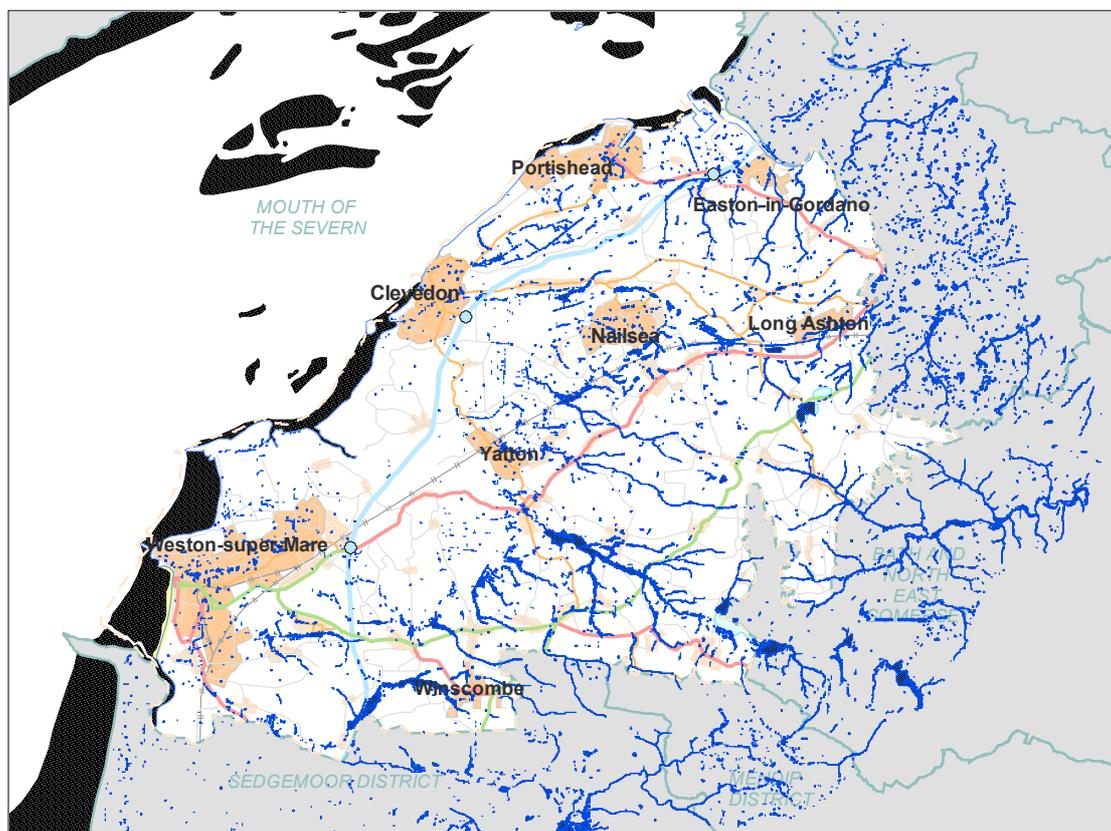


Figure 7 - FMfSW 1:200 years (Depth > 0.3m)

Groundwater flood risk has been very difficult to assess. The map provided by the Environment Agency shows significant areas that may be susceptible to ground water flooding in the North Somerset area but these could not be verified with any degree of certainty and for that reason the effects of groundwater have been ignored.

SFRA Outputs

In 2008 the council commissioned Royal Haskoning to produce a Level 1 Strategic Flood Risk Assessment (SFRA). This work, principally concerned with the risk of flooding in connection with future development, identified flood risk locations from all sources in the North Somerset Council area.

In 2009 this work was augmented by the Level 2 SFRA which focused on specific locations identified in the Level 1 study. The majority of the flood risk identified in the SFRA is from tidal and fluvial flooding sources, principally due to the large area of low lying ground in North Somerset.

Other sources of flooding were somewhat insignificant in comparison with the relative enormity of the tidal and fluvial flood risk; however, surface water flooding risk at the following locations was recognised.

- Wrington
- Congresbury
- Hutton High Street

Although there is very little risk associated with Surface Water arising from the SFRA the significant tidal and fluvial risk cannot be ignored in the PFRA.

Approximately 30% of the NSC area is covered by EA Flood Zones. This means that roughly 33% of the population of NSC area are currently at high risk of fluvial or tidal flooding i.e. within EA Flood Zone 3, with an additional 5% within EA Flood Zone 2. The main areas (as wards) at risk from EA Flood Zone 3 are Clevedon South, Clevedon Yeo, Weston-super-Mare South Worle, Portishead East and Clevedon West. All of these locations have over 90% of their population within the boundary of the flood zone. Weston-super-Mare East and South also have a high percentage of their population within the boundary of EA Flood Zone 2.

Table 3 highlights the main urban areas within NSC area where properties are located within EA Flood Zones. The table indicates the approximate number of properties at risk; the primary source of flooding is tidal and fluvial.

	Number of Properties			Percentage	
	Total	In FZ3	In FZ2	In FZ3	In FZ2
Weston-s-Mare	38039	!Table Index Cannot be Zero	!Table Index Cannot be Zero	49.80	60.39
Clevedon	13015	0	0	64.64	65.53
Portishead	3703	0	0	20.91	21.54
Banwell & Winscombe	2740	1361	1379	29.4	29.8
Kewstoke	1628	725	903	53.9	67.1
Yatton	1530	732	798	19.0	20.7
Congresbury	530	262	268	17.5	17.9
Hutton & Locking	488	198	290	6.9	10.1
Pill	324	156	168	9.8	10.5
Wrington	213	101	112	7.1	7.8
Winford	79	39	40	3.2	3.2
Gordano	79	39	40	3.3	3.4
Easton-in-Gordano	51	17	34	1.3	2.6
Blagdon & Churchill	34	15	19	0.9	1.2
Wraxall & Long Ashton	24	4	20	0.1	0.7
Backwell	18	9	9	0.4	0.4
Nailsea	12	3658	4080	0.03	0.07

Table 3 - Number of Properties by Town at Risk of Fluvial or Tidal Flooding Within EA Flood Zones

Weston-s-Mare Surface Water Management Plan Outputs

In 2010 the council received Defra funding to undertake a Surface Water Management Plan (SWMP) for Weston-s-Mare. The SWMP provides more accurate information about the specific surface water flood risk in Weston-s-Mare; however it did not provide detailed information for the remainder of the North Somerset area.

The SWMP for Weston-s-Mare incorporated an independent assessment of flood risk using more detailed modelling than that used by the EA to create the national flood maps. The outputs of the SWMP supported the general conclusion that the second generation EA flood maps (FMfSW) are more accurate; at least for the Weston-s-Mare study area.

Both maps assume that all drainage systems are operating as designed but the two maps are not entirely compatible as the national map predicts the 1:200 year chance of flooding whilst the SWMP map predicts the 1:100 year chance of flooding. However, there is a reasonable match between the two maps in respect of the locations at risk and the variance is largely consistent with the difference in rainfall return period.

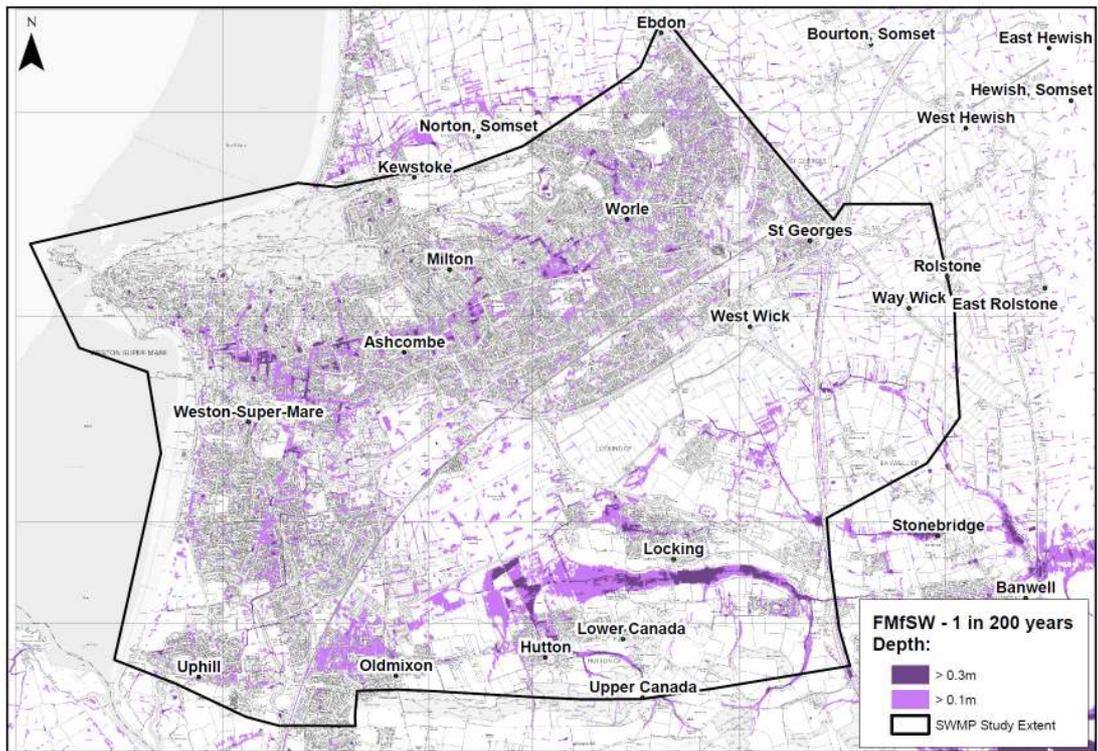


Figure 8 - 1 in 200 year FMfSW Map W-s-M (EA)

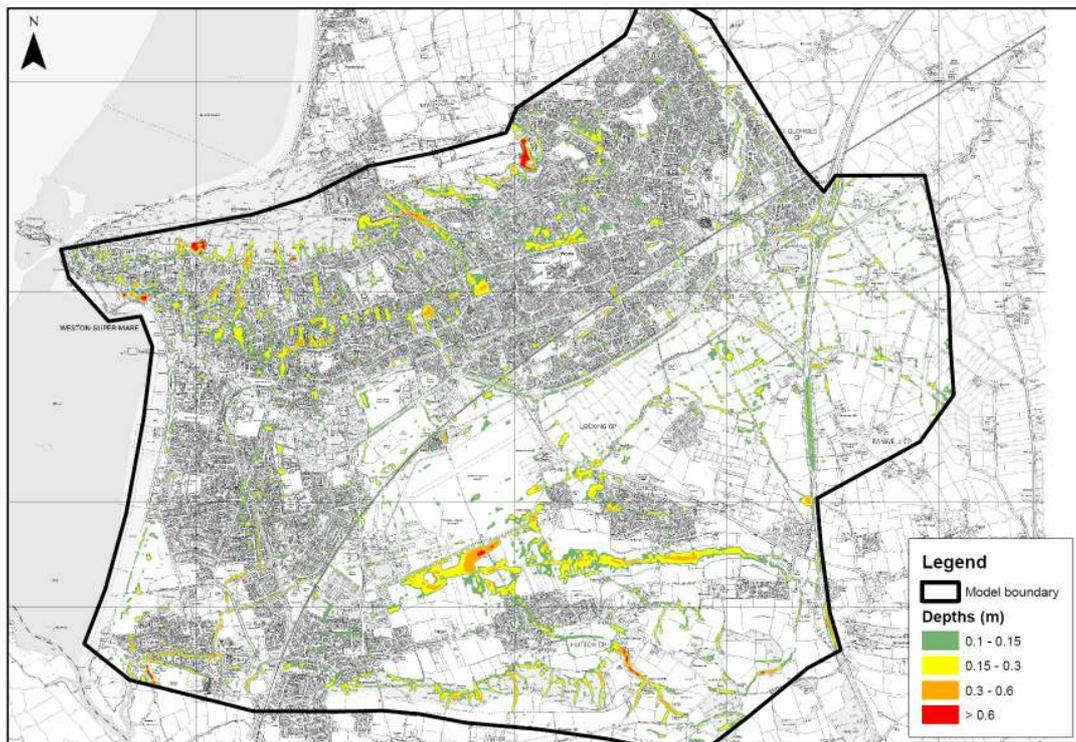


Figure 9 - 1 in 100 year SWMP Map W-s-M (Royal Haskoning)

The outputs focus on flooding over 300mm deep. This is based on the general threshold level that is assumed for properties and therefore represents where there is a risk of internal flooding. The results are based on a saturated and hence very much a worst case scenario.

The mapping has highlighted that there are definite areas of ponding and across the study area there are a large number of properties affected, resulting in a relatively high damage value for the study area

However, the properties at risk are not generally in clusters, instead there are just a few isolated properties affected in each at risk area. This makes it very difficult to flag up "areas of risk" and potential engineering solutions as there will not be the grouped benefits to support capital expenditure. Individual property protection is therefore one of the most likely options for most of these properties.

The only real area that does stand out is Milton Hill and there is already work being carried out here by both Wessex Water and the council.

There are a number of properties in the North West corner of the study area, particularly along Birnbeck Road and Knightstone Road. Options could be investigated regarding linking to the new drainage installed as part of the coastal protection works.

Generally the recommendations of the SWMP are to ensure maintenance is undertaken particularly when heavy rainfall is predicted, that the pumping station is monitored to ensure it is operating as designed, and that individual property protection is considered in some places. It may also be worth some kind of education of residents on the potential impacts of flooding and how to deal with the risks.

Climate Change

Over the past century around the UK we have seen sea level rise and more of our winter rain falling in intense wet spells. Seasonal rainfall is highly variable. It seems to have decreased in summer and increased in winter, although winter amounts changed little in the last 50 years. Some of the changes might reflect natural variation; however the broad trends are in line with projections from climate models.

Greenhouse gas (GHG) levels in the atmosphere are likely to cause higher winter rainfall in future. Past GHG emissions mean some climate change is inevitable in the next 20-30 years. Lower emissions could reduce the amount of climate change further into the future, but changes are still projected at least as far ahead as the 2080s.

We have enough confidence in large scale climate models to say that we must plan for change. There is more uncertainty at a local scale but model results can still help us plan to adapt. For example we understand rain storms may become more intense, even if we can't be sure about exactly where or when. By the 2080s, the latest UK climate projections (UKCP09) are that there could be around three times as many days in winter with heavy rainfall (defined as more than 25mm in a day). It is plausible that the amount of rain in extreme storms (with a 1 in 5 annual chance or rarer) could increase locally by 40%.

North Somerset is located in two River Basin Districts, Severn River and South West. As 99.9% of North Somerset falls within the Severn River Basin District projections for this River Basin District have been used in this report.

Key Projections for the Severn River Basin District

If emissions follow a medium future scenario, UKCP09 projected changes by the 2050s relative to the recent past are:

- Winter precipitation increases of around 12% (very likely to be between 2 and 26%)
- Precipitation on the wettest day in winter up by around 9% (very unlikely to be more than 22%)
- Relative sea level at Bristol very likely to be up between 10 and 40cm from 1990 levels (not including extra potential rises from polar ice sheet loss)
- Peak river flows in a typical catchment likely to increase between 9 and 18%

Increases in rain are projected to be greater at the coast and in the south of the district.

In North Somerset, increased precipitation will increase the risk of inland surface water flooding, which may be exacerbated by blockages in culverts, gutters and drains (sometimes due to inadequate maintenance).

Implications for Flood Risk

Climate changes can affect local flood risk in several ways. Impacts will depend on local conditions and vulnerability.

Wetter winters and more of this rain falling in wet spells may increase river flooding along the Severn and its tributaries. More intense rainfall causes more surface runoff, increasing localised flooding and erosion. In turn, this may increase pressure on drains, sewers and water quality. Storm intensity in summer could increase even in drier summers, so we need to be prepared for the unexpected.

Rising sea or river levels may also increase local flood risk inland or away from major rivers because of interactions with drains, sewers and smaller watercourses.

Where appropriate local studies will be required to understand climate impacts in detail, including effects from other factors like land use.

Review of Indicative Flood Risk Areas

The national Indicative Flood Risk Areas are based on an assessment of the consequences of flooding as shown on the Flood Map for Surface Water associated with a rainfall event with a 1:200 chance of occurring in any year.

The threshold to identify national Indicative Flood Risk Areas is where more than 30,000 people are at risk of surface water flooding contained within a cluster of 5 or more touching 3km squares. There are 10 Indicative Flood Risk Areas across England and none of these are in the North Somerset Council area.

Only Weston-s-Mare with a population of 72,000 exceeds the threshold 30,000. The outputs of the Surface Water Management Plan for Weston-s-Mare indicate that flooding from a rainfall event in the order of 1:200 would affect less than the 30,000 population threshold.

Looking at the above criteria and the available data in terms of both historical and predicted flooding there is therefore no evidence to suggest creating any new Indicative Flood Risk Areas in North Somerset. An entry in Annex 2 of the PFRA will therefore not be made.

Identification of Flood Risk Areas

Nationally Significant Flood Risk Areas

In assessing future flood risk a high degree of confidence can be attached to the assessment for Weston-s-Mare afforded by the SWMP. Elsewhere the assessment has relied on a combination of historical flood data and the Environment Agency national flood maps.

North Somerset Council does not consider that the verification of the risks identified justify the creation of new flood risk areas. However, at a local level it is important for the council to identify all flood risk and to identify areas at risk in terms of the likelihood and the consequences of flooding. To this end the council will consider individual flood sources both within and outside of the scope of the PFRA and the interaction of these flood sources as a practical, on-going development of the PFRA.

Locally Significant Flood Risk

The table below summarises data gathered using a GIS assessment for the whole of the North Somerset Council area for each of the flood maps available for the PFRA. Extracts of this data are also available in Annex 2 of the Preliminary Assessment Report spreadsheet.

	AStSWF Less	AStSWF Intermediate	AStSWF More	FMfSW 1:30	FMfSW 1:30 Deep	FMfSW 1:200	FMfSW 1:200 Deep	AStGWF	Flood Zone 2	Flood Zone 3
Residential Properties	20928	7093	255	2125	548	7575	1610	55643	31664	36247
Average Population	92083	31209	1122	9350	2411	33330	7084	244829	139322	159487
Non Residential Properties	1796	594	51	143	34	485	94	4731	2686	3071
Total Properties	22724	7687	306	2268	582	8060	1704	60374	34350	39318
Critical Services	6	3	0	2	0	3	0	14	6	7
Listed Buildings	122	44	7	558	188	1086	339	863	169	188
Scheduled Ancient Monuments	19	7	2	41	12	68	24	62	21	20
Schools	19	9	0	5	1	11	3	45	27	28
Hospitals	1	1	0	0	0	0	0	2	3	3
Care Homes & Prisons	27	11	2	1	1	9	1	163	31	39
Police Station	1	1	0	1	0	1	0	3	0	0
Fire & Ambulance Stations	4	1	0	1	0	2	0	9	3	4
Sewage Treatment Plants	0	0	0	0	0	1	0	3	2	4
Electricity Installations	304	113	11	71	14	206	55	1194	349	437

Table 4 –Flood Risk Indicators

The assessment above generated some large property and asset counts which may suggest that there are significant flood risks. However, confidence in the data is relatively low with the AStSWF and AStGWF maps.

Locally Significant Flood Risk Areas (Main Population Centres)

The assessment below identifies local flood risk in a variety of locations. The table below summarises these locations in priority order based on the degree of risk.

Within each of the 24 blue squares (areas above flood risk thresholds) an assessment was made of the number of flood risk indicators falling within the FMfSW flood zones. The summary of this assessment is given below in Table 4.

Square	Location	Residential Properties	Number of People	Non Residential Properties	Listed Buildings	Scheduled Ancient Monuments	Schools	Hospitals	Care Homes & Prisons	Police Stations	Fire & Ambulance Stations	Sewage Treatment Works	Electricity Installations
1	Portishead	17	68	4	2	0	0	0	0	0	0	0	0
2	Portishead	3	12	0	0	0	0	0	0	0	0	0	1
3	Portishead	7	28	0	0	0	0	0	0	0	0	0	0
4	Pill	25	100	1	0	0	0	0	0	0	0	0	0
5	Walton in Gordano	5	20	1	11	0	0	0	0	0	0	0	0
6	Clevedon	37	148	8	2	0	0	0	0	0	0	0	0
7	Nailsea	66	264	0	0	0	0	0	0	0	0	0	1
8	Flax Bourton	2	8	5	1	0	0	0	0	0	0	0	0
9	Backwell	51	204	1	1	0	0	0	0	0	0	0	0
10	Winford	18	72	1	0	0	0	0	0	0	0	0	0
11	Winford	20	80	0	4	0	0	0	0	0	0	0	1
12	Congresbury	1	4	1	3	0	0	0	0	0	0	0	1
13	Upper Littleton	2	8	0	5	0	0	0	0	0	0	0	0
14	Weston-s-Mare	11	44	0	0	0	0	0	0	0	0	0	0
15	Weston-s-Mare	61	244	2	0	0	0	0	0	0	0	0	0
16	Weston-s-Mare	30	120	1	0	0	0	0	0	0	0	0	0
17	Wrington	76	304	5	0	0	0	0	0	0	0	0	0
18	Wrington	48	192	1	2	0	0	0	0	0	0	0	0
19	Weston-s-Mare	20	80	0	0	1	0	0	0	0	0	0	0
20	Weston-s-Mare	172	688	23	1	0	0	0	0	0	0	0	2
21	Weston-s-Mare	43	172	2	0	0	0	0	0	0	0	0	1
22	Hutton	13	52	1	0	0	0	0	0	0	0	0	1
23	Rickford	9	36	1	2	0	0	0	1	0	0	0	0
24	Winscombe	23	92	0	1	0	0	0	0	0	0	0	0

Table 5 –Flood Risk Indicators in Each Blue Square

The main population centres within Table 4 have been grouped and the corresponding indicators added to provide a ranked list of local flood risk locations.

Location	Residential Properties	Number of People	Non Residential Properties	Listed Buildings	Scheduled Ancient Monuments	Schools	Hospitals	Care Homes & Prisons	Police Stations	Fire & Ambulance Stations	Sewage Treatment Works	Electricity Installations
Weston-s-Mare	337	1348	28	1	1	0	0	0	0	0	0	3
Wroughton	124	496	6	2	0	0	0	0	0	0	0	0
Nailsea	66	264	0	0	0	0	0	0	0	0	0	1
Backwell	51	204	1	1	0	0	0	0	0	0	0	0
Clevedon	37	148	8	2	0	0	0	0	0	0	0	0
Winford	38	152	1	4	0	0	0	0	0	0	0	1
Portishead	27	108	4	2	0	0	0	0	0	0	0	1
Pill	25	100	1	0	0	0	0	0	0	0	0	0
Winscombe	23	92	0	1	0	0	0	0	0	0	0	0
Hutton	13	52	1	0	0	0	0	0	0	0	0	1
Rickford	9	36	1	2	0	0	0	1	0	0	0	0
Walton in Gordano	5	20	1	11	0	0	0	0	0	0	0	0
Flax Bourton	2	8	5	1	0	0	0	0	0	0	0	0
Upper Littleton	2	8	0	5	0	0	0	0	0	0	0	0
Congresbury	1	4	1	3	0	0	0	0	0	0	0	1

Table 6 – Flood Risk Indicators Summary by Location

In addition to the above an assessment in each of the locations in Table 6 below was carried out as a cross-check on the relative severity of risk based on matches against historical and predicted flood locations.

Location	Number of km blue squares	In EA Historic Flood Zone?	Match with AStSWF & FMfSW	Reported NSC Flood Incidents	Reported WW Flood Incidents	Reported IDB Flood Incidents
Weston-s-Mare (incl. Worle)	6	No	High/High	19	10	10
Wroughton	2	No	High/High	11	1	1
Nailsea	1	No	Med/Low	13	2	0
Portishead	3	Yes	Low/Low	9	1	0
Clevedon	1	No	Med/Low	8	1	0
Backwell	1	No	Low/Med	7	1	0
Congresbury	1	No	High/Low	6	1	0
Winscome	1	No	Med/Low	11	0	0
Winford	2	No	Med/Med	5	0	0
Burrington	1	No	High/High	2	0	0
Locking	1	No	Med/Med	3	0	0
Flax Bourton	1	No	Med/Med	2	0	0
Walton in Gordano	1	No	Med/Med	2	0	0
Pill	1	No	Med/Med	0	0	0
Upper Littleton	1	No	Med/Med	0	0	0

Table 7 – Key Flood Risk Indicators Cross Check

Flood Risk Summary

Although risks that would be considered significant at a national level have not been identified there are still risks that have local significance and which the council needs to be aware of address in terms of potential mitigation and emergency planning.

The top 10 flood risk locations from the PFRA are:

- Weston-s-Mare (including Worle)
- Wroughton
- Nailsea
- Backwell
- Clevedon
- Winford
- Portishead
- Pill
- Winscombe
- Hutton

The following locations that appear in the above list have also been identified as at risk of tidal and/or fluvial flooding within the SFRA.

- Weston-s-Mare
- Clevedon
- Portishead
- Banwell & Winscombe
- Hutton & Locking
- Pill
- Wroughton

Additional work is therefore required beyond the scope of this PFRA to look in more detail at the individual locations and the interaction of all flood sources as there are clearly locations that are at risk from multiple sources.

Next Steps

The PFRA has identified the highest priority flood risk areas within North Somerset. The PFRA and supporting plans will enable the council to deliver North Somerset's Local Flood Risk Strategy (LFRS). This strategy will focus on community based solutions and actions to direct resources to manage local flood risks.

The PFRA process forms part of an on-going six year cycle for Lead Local Flood Authorities under The Flood Risk Regulations. However, as North Somerset has no indicative flood risk areas within the present cycle, there is no immediate statutory requirement to produce flood hazard risk maps or Flood Risk Management Plans (FRMPs). North Somerset Council will however, be required to review and prepare a revised PFRA report, to be completed before June 2017. This review process must thereafter be carried out at intervals of no more than 6 years.

Notwithstanding the above the council may decide that a further assessment of the combined risk of surface water and tidal / fluvial flooding in certain high risk locations merits the preparation of a number of specific Flood Risk Management Plans.

The following list of further work is recommended:

- Developing the council's Local Flood Risk Strategy (LFRS)
- Discussing potential flood risk in the north east of the study areas with Bristol City Council including ways to identify specific risk locations in North Somerset and proposals to mitigate risks
- Developing an action plan to address the top three flood risk locations in the study area (this may include capital expenditure and/or increased maintenance)
- Developing an action plan based on the detailed outputs of the WsM SWMP
- Assessing further the combined outputs of the SFRA, WsM SWMP and PFRA and assessing if specific FRMPs would be of benefit
- Assessing the potential impacts of climate change
- Further developing the council's database for recording flood events based on revised EA guidelines
- Adopting the database for all future flood recording and introduce new processes in the council to ensure data is captured and recorded
- Agreeing a protocol with Wessex Water and North Somerset IDB to regularly update the database to include WW and IDB flood events
- Adding further historical data from stakeholders that could not be acquired in time to complete the PFRA
- Scheduling periodic reviews of SWMP and other modelling
- Developing a communications plan to engage with wider stakeholders and the public

References

Defra (2008). The Pitt Review - Learning lessons from the 2007 floods. Cabinet Office, June 2008.

Defra / WAG (2010) Selecting and reviewing Flood Risk Areas for local sources of flooding – Guidance to Lead Local Flood Authorities.

Available from <http://www.defra.gov.uk/environment/flooding/documents/research/flood-risk-method.pdf>

Environment Agency (2010a). Preliminary flood risk assessments. “Living Draft” Guidance for Lead Local Flood Authorities. Report GE00410BSLS-E-E. May 2010.

Environment Agency (2010b). Flood Risk Regulations – Information for LLFAs. December 2010, on CD.

Environment Agency (2010c). Preliminary Flood Risk Assessment - Final Guidance (Report – GEHO1210BTGH-E-E).

Available from <http://publications.environment-agency.gov.uk/pdf/GEHO1210BTGH-e-e.pdf>

Environment Agency (2010d). Flood Map for Surface Water - Property Count Method. November 2010.

Environment Agency (2011). Preliminary Flood Risk Assessment – Annexes to the Final Guidance (Report – GEHO1210BTHF-E-E). (Updated 2 March 2011).

Available from <http://publications.environment-agency.gov.uk/pdf/GEHO1210BTHFe-e.pdf>

Appendix A

Significant Recorded Historic Flood Events

30th January 1607 - TIDAL

This was known as the 'Great Flood' which killed 2,000 people across Somerset and has been described as one of the worst natural disasters to hit Britain. There is no accurate record it was estimated that the tide level at Kingston Seymour was 8.9mOD. It is estimated that water covered 520 km² of land.

1885 - TIDAL

In Wick St. Lawrence there was a breach at 'Isleton Farm' which caused 2-3 feet of flooding.

July 1968 – FLUVIAL / SURFACE WATER & ORDINARY WATERCOURSE

A low pressure event caused severe flooding throughout the South West after 5 inches of rain fell within 24 hours, including a major storm over the Mendip Hills.

The flooded areas included Banwell Moor to the north of Banwell Village, part of St. Georges Village and an area between St. Georges and West Wick. It is known that the River Banwell continued to rise for approximately six days after the storm had passed. It is important to note however that the catchment and water courses themselves were considerably different at that time in both alignment and cross-section to the current situation. Furthermore, St. Georges had experienced very little development prior to 1968 and the M5 Motorway had yet to be built.

In Wrington there were several reports of flooding in the 1968 event. Silver Street was flooded, caused by surface water from Clements Field and Riding Farm. The Congresbury Yeo burst its banks flooding 125 properties in Main Street, with flood depths of up to 2 metres and extensive damage to the A370 road bridge recorded. Parts of Weston-super-Mare were cut off due to flooding and landslides and areas of Clevedon were under 0.6m of water.

1981 - TIDAL

The failure of the old Uphill tidal sluice during a storm led to tidal inundation and extensive flooding in Uphill village. At the same time, sea defences were also breached in Uphill. However, the inner flood banks held which prevented further flooding.

In Clevedon, large waves broke over the sea wall and parts of the crest slabs and grouted stone rear facing were ripped off resulting in flooding to 12 properties. At Wick St. Lawrence there was a breach in the defences on the seaward side at Woodspring Bay with other sections of the defences affected and water levels reaching the top of the inner embankment. Properties were evacuated and at Kingston Seymour water collected in Middle Lane with flooding extended to Laurel Farm.

1989-90 - TIDAL

Tidal inundation on a lesser scale to 1981 occurred in Weston-super-Mare, Kingston Seymour, Wick Ste Lawrence and Clevedon following a storm event.

Summer 2007 – SURFACE WATER AND ORDINARY WATERCOURSE

Evidence suggests surface water runoff from surrounding fields was the cause of garage and gardens flooding in South Meadow, Wrington. The Glebe and Garstons Close also flooded in 2007 and anecdotal evidence suggests properties experienced internal flooding for two hours before waters receded. As well as fluvial flooding Wrington was affected by the local springs which exacerbated the surface water problem.

11th January 2008 - SURFACE WATER AND ORDINARY WATERCOURSE

The Avon Fire and Rescue service recorded more than 200 incidents in one afternoon. Within the NSC boundary there were two call outs. In Winford they rescued three people from a car trapped in flood water. At St. Georges Hill two pumps were used to remove flood water in properties. In Wrington roads were flooded and cars had to be abandoned.

February 2008 - SURFACE WATER AND ORDINARY WATERCOURSE

Station Road (A370) at Flax Bourton became impassable and the railway line was temporarily closed with trains cancelled.

Other recorded surface water events include:

- In 1970, 1999, July 2000 and 2007- Rickyard Road, Wrington experienced surface water flooding where the water level reached the top of the curb.
- 2005- Congresbury is subject to surface water flooding in times of heavy rain with water standing for many hours before disbursing. Highway flooding has been experienced. Water flows from Ball and Dressnells Wood flooding highways. Within an 8 year period properties in Weetwood Road have experienced water levels up to 18 inches deep.
- Garston Lane, Blagdon floods annually. Blocked gullies are the cause of flooding and water collects at the lowest point of the village.
- Hutton High Street- surface water drains through the village due to inadequate drainage, causing damage to properties and blocking access to the school and village hall.
- Nates Lane, Wrington- becomes impassable during high rainfall events.