MetroWest

Portishead Branch Line (MetroWest Phase 1)

TR040011

Applicant: North Somerset District Council
5.6, Flood Risk Assessment, Part 4 of 17
Appendices C to J
The Infrastructure Planning (Applications: Prescribed Forms and Procedure) Regulations 2009, regulation 5(2)(e)
Planning Act 2008

Author: CH2M
Date: November 2019

Notice

Limitation: This document has been prepared on behalf of, and for the exclusive use of Jacobs' client, and is subject to, and issued in accordance with, the provisions of the contract between Jacobs and the client. Jacobs accepts no liability or responsibility whatsoever for, or in respect of, any use of, or reliance upon, this document by any third party.

Where any data supplied by the client or from other sources have been used, it has been assumed that the information is correct. No responsibility can be accepted by Jacobs for inaccuracies in the data supplied by any other party. The conclusions and recommendations in this report are based on the assumption that all relevant information has been supplied by those bodies from whom it was requested. Where field investigations have been carried out, these have been restricted to a level of detail required to achieve the stated objectives of the work. This work has been undertaken in accordance with the quality management system of Jacobs.

Document history

Project	Portishead Branch Line (MetroWest Phase 1) Development Consent Order Scheme
Planning Inspectorate Scheme Reference	TR040011
Volume and Application Document Reference	5, 5.6
Document title	Flood Risk Assessment, Part 4 of 17, Appendices C to J: Appendix C Catchment Flood Management Plan summaries Appendix D Environment Agency susceptibility to groundwater flood map Appendix E Environment Agency updated Flood Map for Surface Water Flooding Appendix F Flood risk information provided by NSDC and BCC Appendix G Severn Estuary Shoreline Management Plan 2 Policy Units Appendix H Severn Estuary Flood Risk Management Strategy summary information Appendix J Environment Agency flood defences information
Regulation Number	Regulation 5(2)(e)
Applicant	North Somerset District Council
Lead Author	RB at CH2M

Version	Date	Status of Version
Rev: 01	12/11/19	Application Issue

MetroWest

Portishead Branch Line (MetroWest Phase 1)

TR040011

Applicant: North Somerset District Council
5.6, Flood Risk Assessment,
Appendix C Catchment Flood Management Plan summaries
The Infrastructure Planning (Applications: Prescribed Forms and Procedure) Regulations 2009, regulation 5(2)(e)
Planning Act 2008

Author: CH2M
Date: November 2019

NetworkRail · West of England Local Enterprise Partnership · West of England Combined Authority · HM Government · Bath & North East Somerset Council · Bristol City Council · North Somerset Council · South Gloucestershire Council · travelwest

Environment Agency

Bristol Avon Catchment Flood Management Plan

Summary Report June 2012

We are the Environment Agency. It's our job to look after your environment and make it a better place – for you, and for future generations.

Your environment is the air you breathe, the water you drink and the ground you walk on. Working with business, Government and society as a whole, we are making your environment cleaner and healthier.

The Environment Agency. Out there, making your environment a better place.

Published by:

Environment Agency
Manley House
Kestrel Way
Exeter EX2 7LQ
Tel: 0870 8506506
Email: enquiries@environment-agency.gov.uk
www.environment-agency.gov.uk

June 2012

Introduction

I am pleased to introduce our summary of the Bristol Avon Catchment Flood Management Plan (CFMP). This CFMP gives an overview of the flood risk in the Bristol Avon catchment and sets out our preferred plan for sustainable flood risk management over the next 50 to 100 years.

The Bristol Avon CFMP is one of 77 CFMPs for England and Wales. Through the CFMPs, we have assessed inland flood risk across all of England and Wales for the first time. The CFMP considers all types of inland flooding, from rivers, ground water, surface water and tidal flooding, but not flooding directly from the sea (coastal flooding), which is covered by Shoreline Management Plans (SMPs). Our coverage of surface and ground water is however limited due to a lack of available information.

The role of CFMPs is to establish flood risk management policies which will deliver sustainable flood risk management for the long term. This is essential if we are to make the right investment decisions for the future and to help prepare ourselves effectively for the impact of climate change. We will use CFMPs to help us target our limited resources where the risks are greatest.

This CFMP identifies flood risk management policies to assist all key decision makers in the catchment. It was produced through a wide consultation and appraisal process, however it is only the first step towards an integrated approach to Flood Risk Management. As we all work together to achieve our objectives, we must monitor and listen to each others progress, discuss what has been achieved and consider where we may need to review parts of the CFMP.

The Bristol Avon catchment has a history of flood risk, and over the last 60 years numerous engineering schemes have been implemented to reduce flood risk in the catchment. At present 7,000 properties are at risk in the catchment in a 1% event. This is likely to increase to over 20,000 properties in the future.

We cannot reduce flood risk on our own, we will therefore work closely with all our partners to improve the co-ordination of flood risk activities and agree the most effective way to manage flood risk in the future. We have worked with others including: Bristol City Council, Natural England, Wessex Water and the National Farmers Union to develop this plan.

This is a summary of the main CFMP document, if you need to see the full document an electronic version can be obtained by emailing enquiries@environment-agency.gov.uk or alternatively paper copies can be viewed at any of our offices in South West Region.

Richard Cresswell
South West Regional Director

Contents

The purpose of a CFMP in managing flood risk		3
Catchment overview		4
Current and future flood risk		6
Future direction for flood risk management		10
Sub-areas		
1	Bristol sub-area	12
2	Bath sub-area	13
3	Upper Avon sub-area	14
4	Lower Avon sub-area	16
5	Upper Bristol Frome sub-area	17
6	Mendip slopes and Long Ashton sub-area	18
7	Wootton Bassett and Dauntsey sub-area	19
8	Wiltshire Towns sub-area	20
9	Bradford-on-Avon and Frome sub-area	21
10	Markham Brook and Avonmouth sub-area	22
Map of CFMP policies		23

The purpose of a CFMP in managing flood risk

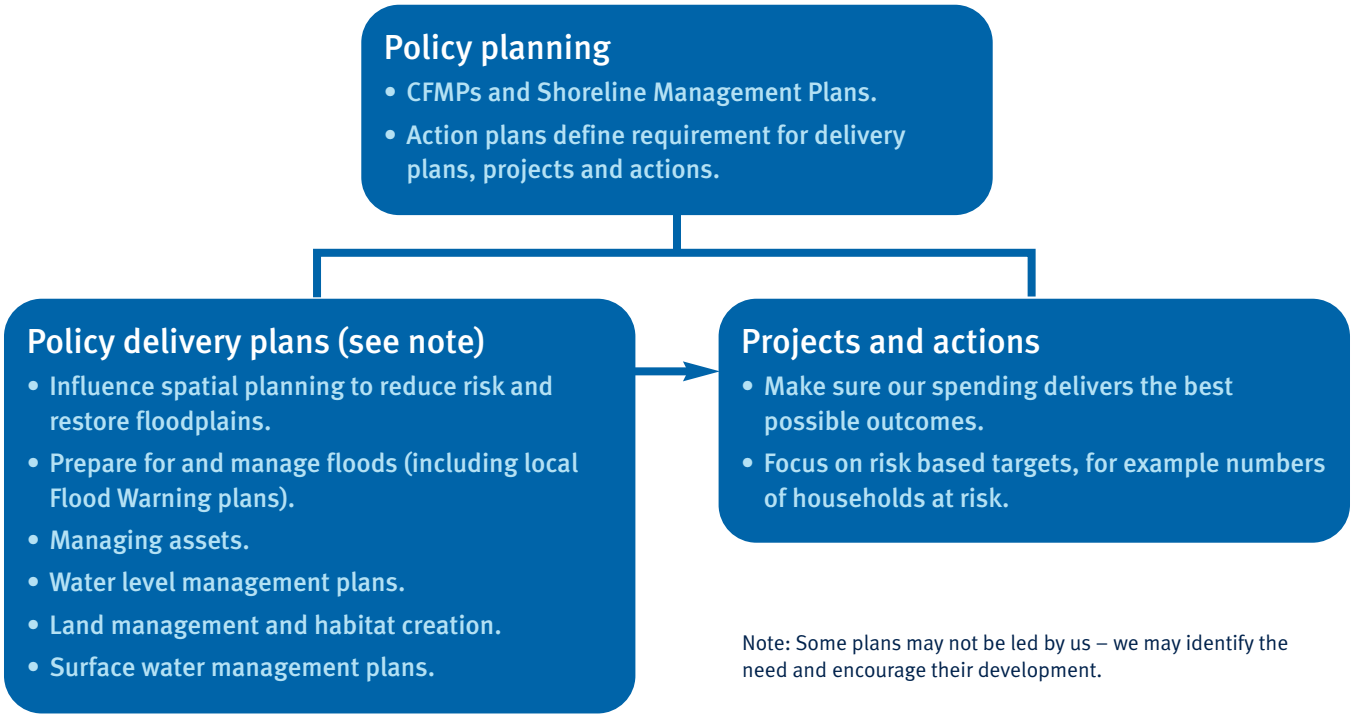
CFMPs help us to understand the scale and extent of flooding now and in the future, and set policies for managing flood risk within the catchment. CFMPs should be used to inform planning and decision making by key stakeholders such as:

- the Environment Agency, who will use the plan to guide decisions on investment in further plans, projects or actions;
- Regional Assemblies and local authorities who can use the plan to inform spatial planning activities and emergency planning;
- Internal Drainage Boards (IDB), water companies and other utilities to help plan their activities in the wider context of the catchment;
- transportation planners;
- land owners, farmers and land managers that manage and operate land for agriculture, conservation and amenity purposes;
- the public and businesses to enhance their understanding of flood risk and how it will be managed.

CFMPs aim to promote more sustainable approaches to managing flood risk. The policies identified in the CFMP will be delivered through a combination of different approaches. Together with our partners, we will implement these approaches through a range of delivery plans, projects and actions.

The relationship between the CFMP, delivery plans, strategies, projects and actions is shown in Figure 1.

Figure 1. The relationship between CFMPs, delivery plans, projects and actions



Note: Some plans may not be led by us – we may identify the need and encourage their development.

Catchment overview

The Bristol Avon catchment is located in the west of England. It drains parts of Gloucestershire, Wiltshire and Somerset and flows through the major cities of Bristol and Bath to the Severn Estuary at Avonmouth.

Map 1 shows the location and extent of the River Avon CFMP area. It includes the Somerset Frome and the Bristol Frome, plus a number of other tributaries including Semington Brook, the River Chew and Midford Brook. The downstream limit of the CFMP area overlaps with the upstream boundary of the Severn Estuary Shoreline Management Plan (SMP).

The Severn Estuary SMP deals with coastal flood management, while the CFMP considers tidal flood risk along the River Avon upstream of Netham Weir to the tidal limit at Keynsham.

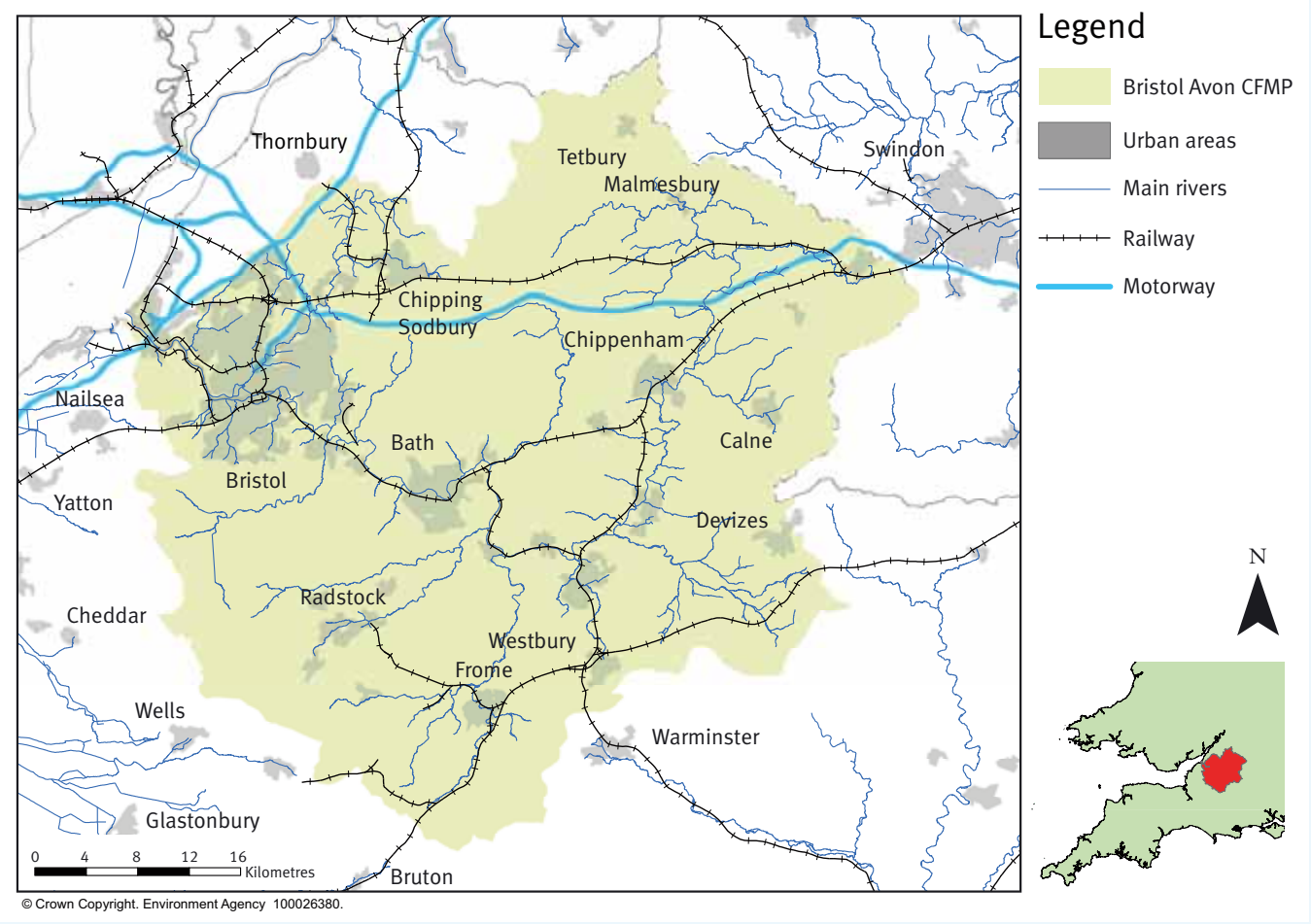
The overall catchment area is about 2,221 square kilometres, and has a population of around 1,050,000. Ten per cent of the catchment is urbanised. As well as Bristol and Bath, its main urban areas include Chippenham, Frome, Trowbridge, Devizes, Melksham, Malmesbury, Calne, Keynsham, Westbury, Midsomer Norton and Radstock, Yate and Chipping Sodbury, Bradford-on-Avon and Corsham.

The Bristol Avon catchment is delineated by the Mendip Hills to the south, the Cotswold Hills to the north, the Marlborough Downs and Salisbury Plain to the east and the Severn Estuary to the west. The River Avon's direction and path is dictated by the catchment's topography and results in the river following a crescent shape, initially flowing south from the Cotswolds before bending west through Bath and Bristol.

The main geological features of the catchment are the limestone Mendip Hills, the oolitic limestone Cotswolds and the chalk downs in the east, all of which are major aquifers affecting the hydrology of the catchment. Impermeable clays lie between the west-sloping strata of the limestone and the chalk, while sandstone and mudstone are exposed in the west of the catchment.

Within the River Avon catchment there are a number of sites designated for their environmental importance including Special Areas of Conservation (SAC), Special Protection Areas (SPA) and Ramsar sites. Important environmental sites in the catchment include four Areas of Outstanding Natural Beauty (AONB) including the Cotswolds and the Mendip Hills, five SACs, 23 SPAs, 98 Sites of Special Scientific Interest (SSSIs) and 299 Scheduled Monuments.

Map 1. Location and extent of the Bristol Avon CFMP area



↑ High water levels on the Avon at Old Bridge – since replaced by Churchill Bridge – in Bath in 1960

Current and future flood risk

Overview of the current flood risk

Flood risk has two components: the chance (probability) of a particular flood and the impact (or consequence) that the flood would have if it happened. The probability of a flood relates to the likelihood of a flood of that size occurring within a one year period. It is expressed as a percentage. For example, a 1% flood has a 1% chance or 0.01 probability of occurring in any one year, and a 0.5% flood has a 0.5% chance or 0.005 probability of occurring in any one year. The flood risks quoted in this report are those that take account of flood defences already in place.

This catchment has a long history of flooding, which resulted in many flood defence schemes being built, particularly in the period 1935 to 2000. Since then, high flows on the River Avon in 2000 and 2008 which would have caused widespread flooding resulted in little damage.

Currently the main sources of flood risk for people, property, infrastructure and the land are:

- river flooding from the River Avon and its tributaries, particularly in Bristol, Bath, Malmesbury, Chippenham, Chew Magna, Frome, Melksham, Bradford-on-Avon and Midsomer Norton;
- tidal flooding from the River Avon between Avonmouth and Bristol, where tidal water could result in tidelocking on tributaries draining to the river;
- surface water drainage and sewer flooding, which has occurred in parts of Bristol, Bath, Midsomer Norton, Chipping Sodbury and Corsham. Several other towns have the potential to be at risk from surface water flooding.

What is at risk?

At present there are around 17,000 people and 7,000 commercial and residential properties at risk in the whole catchment from a 1% annual probability river flood. This means that 1.6% of the total population living in the catchment are currently at risk from flooding.

It is difficult to assess the current impact of flooding to environmental features. Many designated sites at risk from flooding would not actually be damaged by the inundation.

43 Scheduled Monuments are at risk of flooding, but again, the actual risk of damage from flooding is limited.

Sluice gates built on the River Avon at Twerton as part of the Bath Flood Alleviation Scheme. They are vital for maintaining the river level in Bath and open automatically to let flood flows through. ➜

Map 2. Flood risk to property in a 1% annual probability river flood, taking into account current flood defences

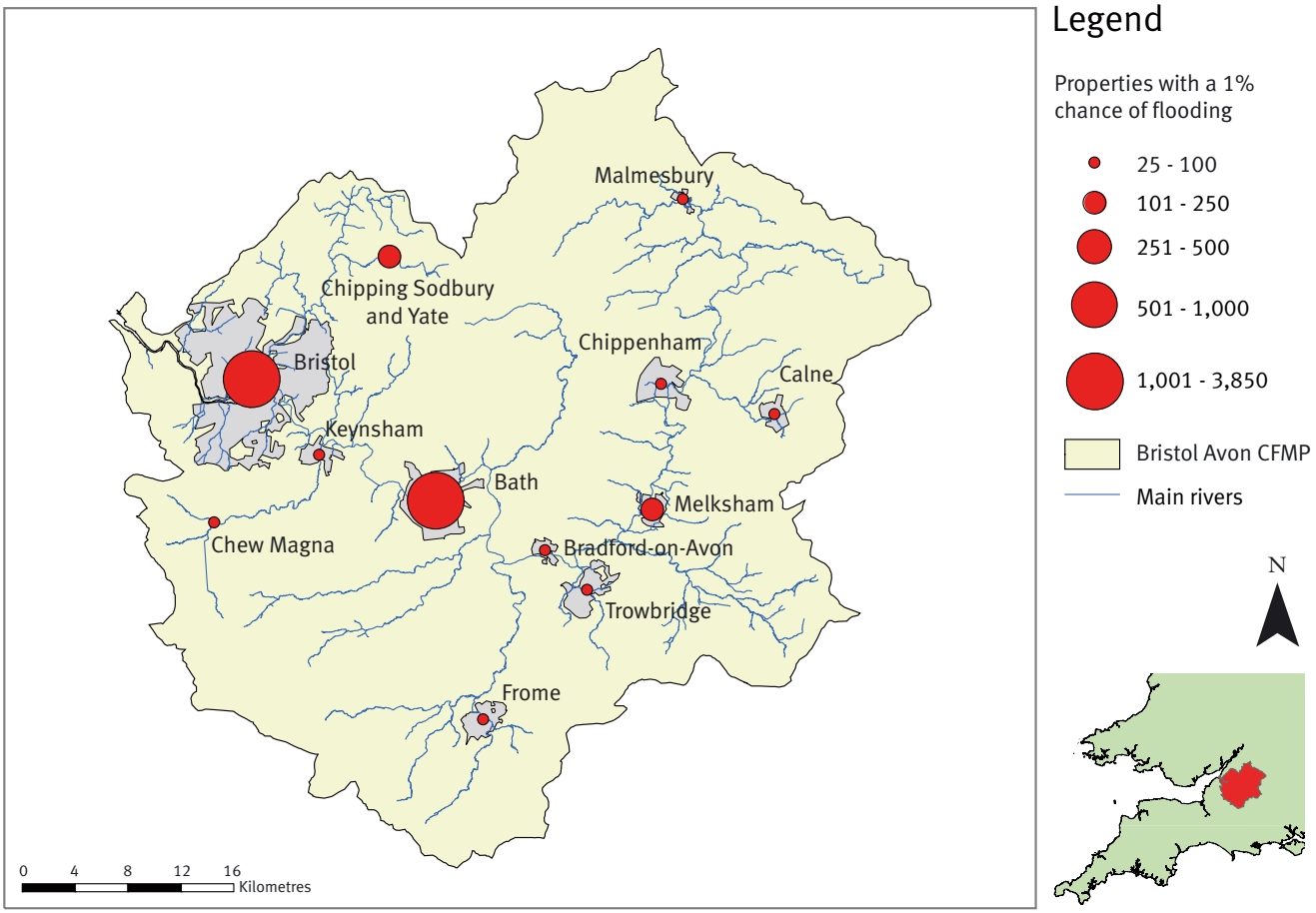


Table 1. Locations of towns and villages with 25 or more properties at risk in a 1% annual probability river flood

Number of properties at risk	Locations
›1,000	Bristol, Bath
500 to 1,000	None
100 to 500	Chipping Sodbury and Yate, Melksham
50 to 100	Trowbridge, Calne, Chew Magna, Keynsham, Bradford-on-Avon, Malmesbury
25 to 50	Chippenham, Frome

Table 2. Critical infrastructure at risk:

2 ambulance stations, 53 electricity sub-stations, 4 care homes

Where is the risk?

Around a third of the people and properties that are at risk within the catchment from a 1% annual probability river flood, are located in Bristol. A further 15% are located in Bath.

The distribution of properties at risk from a 1% annual probability river flood, is illustrated in Map 2. Table 1 summarises where there is flood risk to more than 25 properties. We recognise that there is also a potential risk from surface water and groundwater flooding. However, further studies following on from the CFMP are needed by us and our partners to quantify this potential risk.

How we currently manage the risk

The catchment has a history of flood risk, generally due to the high rainfall that can lead to extensive flooding of the river valleys.

Over 50 years at the end of the 20th Century, numerous engineering schemes were implemented to reduce flood risk in the catchment, including:

- widening and deepening of rivers and removal of obstructions in Bath, Chippenham, Frome, Trowbridge, Melksham, Malmesbury, Calne, Radstock, Keynsham, Castle Combe and Great Somerford. Protection varies from 4% annual probability in Malmesbury to 1% in Bath;
- building flood bypass tunnels: the bypass tunnel at Midsomer Norton which provides protection up to a 1% annual probability river flood, while at Ashton Vale in Bristol, this protection is reduced to 3% due to the risk of tidelocking of the tunnel outfall. The Northern Stormwater Interceptor at Eastville diverts flood flows from the centre of Bristol directly to the River Avon;
- constructing reservoirs. The flood storage reservoir at Iron Acton reduces flood risk downstream on the Bristol Frome through Frampton Cotterell to Eastville. Other reservoirs at Wootton Bassett and Emerson's Green have similar impacts on the Hancock's Water and Folly Brook respectively.

These measures have all reduced flood risk.

In addition to these engineering schemes other flood risk management activities are carried out in the catchment. These include activities which help to reduce the probability of flooding and those that address the consequences of flooding.

Activities that reduce the probability of flooding include:

- maintaining and improving existing flood defences and structures;
- maintaining river channels;
- maintenance of road drainage and sewers;
- working with local authorities to influence the location, layout and design of new and redeveloped property and ensuring that only appropriate development is allowed on the floodplain through the application of Planning Policy Statement 25 (PPS25).

Activities that reduce the consequences of flooding include:

- understanding where flooding is likely by using flood risk mapping;
- providing flood forecasting and warning services;
- promoting awareness of flooding so that organisations, communities and individuals are aware of the risk and are prepared in case they need to take action in time of flood;
- promoting resilience and resistance measures for those properties already in the floodplain.

The impact of climate change and future flood risk

In the future, flooding will be influenced by climate change, changes in land use (for example urban development) and rural land management. In the Bristol Avon catchment, climate change will have the greatest impact on flood risk, with urban development being a further impact on the Bristol Frome. The following future scenario for climate change was used in the CFMP:

- 20% increase in peak flow in all watercourses. This will increase the probability of large-scale flood events;
- a total sea level rise of 1,000 mm by the year 2100. This will increase the probability of tidal flooding on the lower reaches from Avonmouth to Keynsham and increase the length of time watercourses will be tide locked.

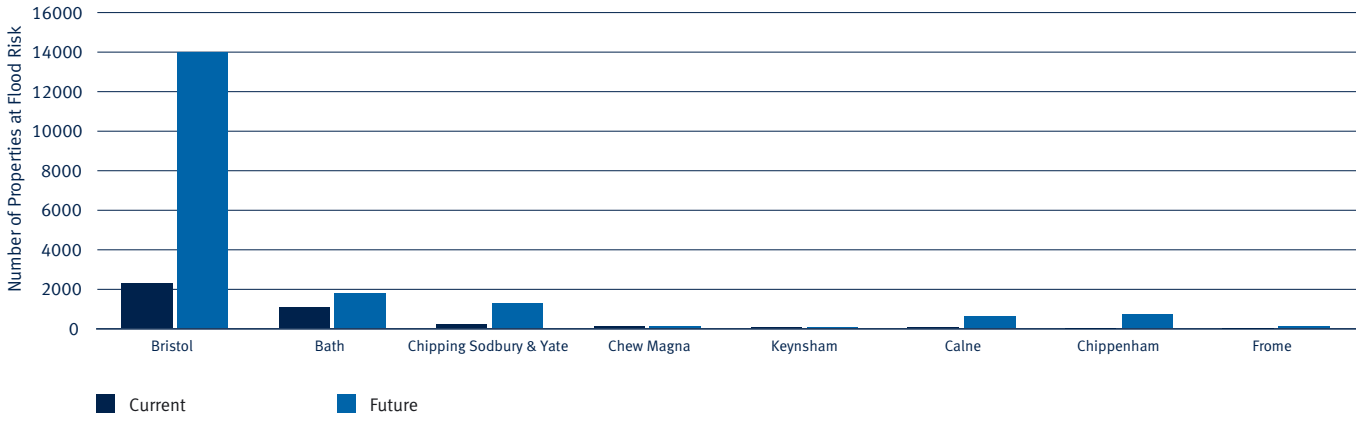
Using river models we estimate that by 2100, around 50,000 people and 20,000 properties across the catchment may be at risk from a 1% annual probability flood. Flood risk from rivers increases mainly in the Bristol and the Bristol Frome catchment, but significant increases also occur in the Wiltshire towns of Chippenham, Trowbridge and Calne.

The sensitivity testing undertaken has shown that the main drivers of change to flood risk in the Bristol Avon catchment to be climate change and in some locations, urban development.

Figure 2 shows the difference between current and future flood risks from a 1% annual probability river flood at key locations in the catchment. Following on from the CFMP, organisations need to work together to investigate flood risk from other sources (e.g. surface water and ground water flooding) in more detail.

In general, it is unlikely that the impact of flooding on environmental sites will change significantly in the future.

Figure 2. Current and future (2100) flood risk to property from a 1% annual probability river flood, taking into account current flood defences



Future direction for flood risk management

Approaches in each sub-area

We have divided the Bristol Avon catchment into nine distinct sub-areas which have similar physical characteristics, sources of flooding and level of risk. We have identified the most appropriate approach to managing flood risk for each of the sub-areas and allocated one of six generic flood risk management policies, shown in Table 3.

To select the most appropriate policy, the plan has considered how social, economic and environmental objectives are affected by flood risk management activities under each policy option.

↑ River Chew at the village of Pensford after floods of July 1968

Map 3. Bristol Avon sub-areas

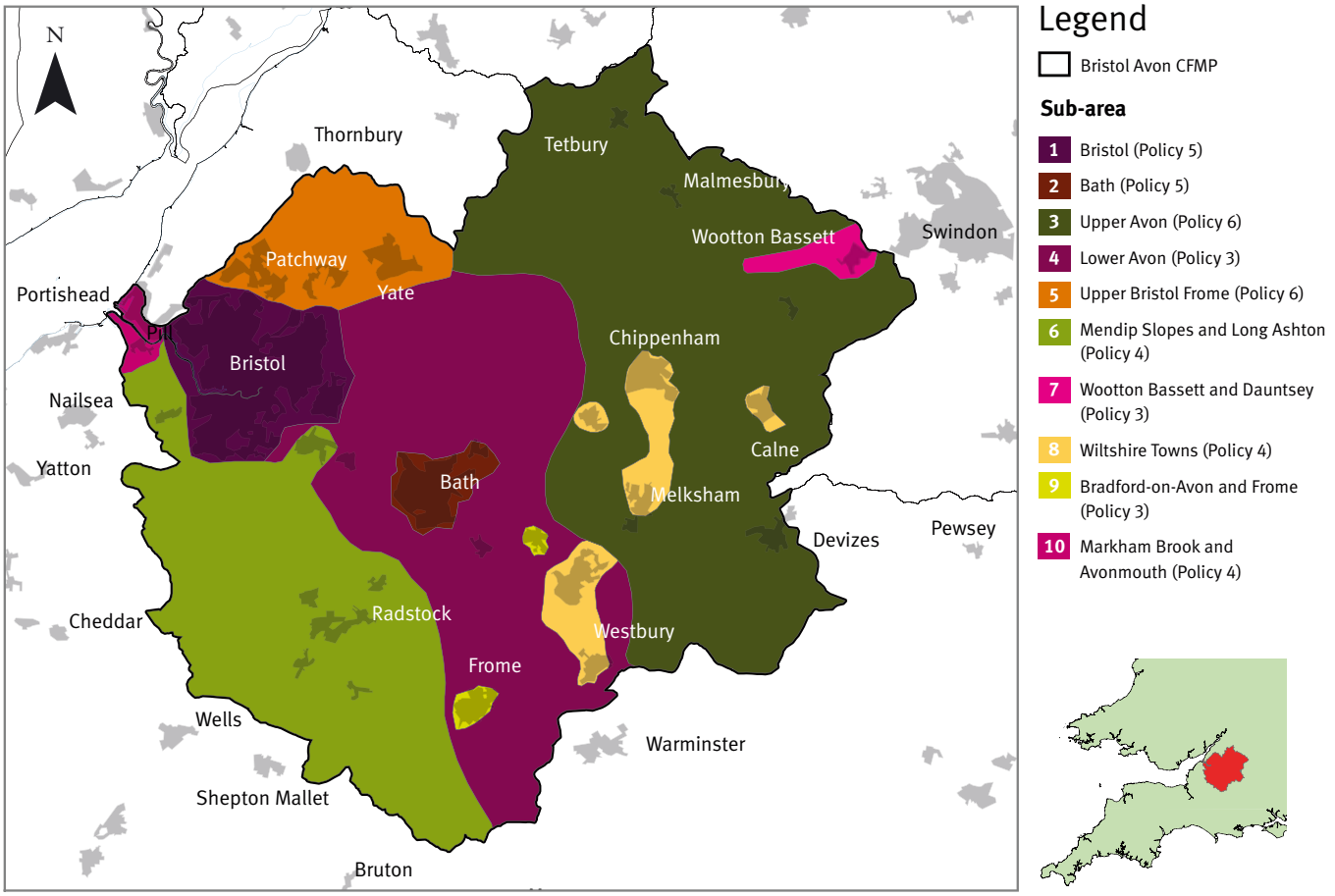


Table 3. Policy options

Policy 1

Areas of little or no flood risk where we will continue to monitor and advise

This policy will tend to be applied in those areas where there are very few properties at risk of flooding. It reflects a commitment to work with the natural flood processes as far as possible.

Policy 2

Areas of low to moderate flood risk where we can generally reduce existing flood risk management actions

This policy will tend to be applied where the overall level of risk to people and property is low to moderate. It may no longer be value for money to focus on continuing current levels of maintenance of existing defences if we can use resources to reduce risk where there are more people at higher risk. We would therefore review the flood risk management actions being taken so that they are proportionate to the level of risk.

Policy 3

Areas of low to moderate flood risk where we are generally managing existing flood risk effectively

This policy will tend to be applied where the risks are currently appropriately managed and where the risk of flooding is not expected to increase significantly in the future. However, we keep our approach under review, looking for improvements and responding to new challenges or information as they emerge. We may review our approach to managing flood defences and other flood risk management actions, to ensure that we are managing efficiently and taking the best approach to managing flood risk in the longer term.

Policy 4

Areas of low, moderate or high flood risk where we are already managing the flood risk effectively but where we may need to take further actions to keep pace with climate change

This policy will tend to be applied where the risks are currently deemed to be appropriately-managed, but where the risk of flooding is expected to significantly rise in the future. In this case we would need to do more in the future to contain what would otherwise be increasing risk. Taking further action to reduce risk will require further appraisal to assess whether there are socially and environmentally sustainable, technically viable and economically justified options.

Policy 5

Areas of moderate to high flood risk where we can generally take further action to reduce flood risk

This policy will tend to be applied to those areas where the case for further action to reduce flood risk is most compelling, for example where there are many people at high risk, or where changes in the environment have already increased risk. Taking further action to reduce risk will require additional appraisal to assess whether there are socially and environmentally sustainable, technically viable and economically justified options.

Policy 6

Areas of low to moderate flood risk where we will take action with others to store water or manage run-off in locations that provide overall flood risk reduction or environmental benefits

This policy will tend to be applied where there may be opportunities in some locations to reduce flood risk locally or more widely in a catchment by storing water or managing run-off. The policy has been applied to an area (where the potential to apply the policy exists), but would only be implemented in specific locations within the area, after more detailed appraisal and consultation.

Bristol

Our key partners are:

City of Bristol Unitary Authority

South Gloucestershire Unitary Authority

North Somerset Unitary Authority

Wessex Water

Met Office

The issues in this sub-area

This sub-area is a mostly urban area, covering the city of Bristol and its suburbs.

The defences through Bristol include the Northern Storm Water Interceptor (NSWI), diverting flood flows from the Bristol Frome away from the city into the tidal Avon. There are also smaller diversion channels on the Ashton, Longmoor and Colliters Brooks and the Brislington Brook. The Floating Harbour in the centre of the city has a vital role in protecting the city from combined tidal and fluvial flooding, effectively acting as a large storage area.

It is estimated that approximately 2,200 properties lie within the current 1% annual probability flood extent. Many of these properties are protected by defences. Within the future 1% annual probability flood extent the number of properties is expected to increase to 14,000.

There are a number of environmental designations at risk of flooding including the Horseshoe Bend (Shirehampton), Avon Gorge and three Scheduled Monuments.

Flooding affects a significant amount of critical infrastructure in Bristol. This includes hospitals, police stations, and fire stations. Numerous roads are at risk of flooding including the M4 and M32 motorways. The increase in future flood risk will mainly be driven by climate change.

Climate change and increasing development pressures have been identified as the main drivers for increase in flood risk.

The vision and preferred policy

Policy Option 5 - We can generally take further action to reduce flood risk.

Taking further action to reduce the flood risk will ensure that the standard of protection through Bristol is improved where required. This will ensure that the effects of increased flows as a result of climate change and future development do not result in an increase in the level of flood risk in vulnerable areas.

Proposed actions to implement the preferred policy

- We will carry out a study to determine the combined fluvial / tidal flood risk to Bristol from the tide, the River Avon and the Bristol Frome in order to reduce uncertainty relating to the level of risk this poses.
- This information will then be used to inform and further develop our flood risk management strategy for Bristol.
- We will identify if there are other specific areas where tide-locking of tributaries (for example the Malago Stream flowing into the River Avon from the South) are causing flooding problems, and look at ways of mitigating this risk.
- Carry out integrated urban drainage studies to identify current and future risks, and propose mitigation.
- We will investigate the benefits of improved flood forecasting and flood warning using improved meteorological technology.

Bath

Our key partners are:

Bath & North East Somerset Unitary Authority

The issues in this sub-area

This sub-area covers the urban area of Bath and includes a large number of designated sites. Bath is a World Heritage Site.

Approximately 1,100 properties are within the current 1% annual probability flood extent. This figure increases to an estimated 1,800 properties for the future 1% annual probability flood extent.

Although the majority of the properties and people are at risk of flooding from the River Avon, a significant number are at risk from tributaries, in particular those flowing into the River Avon from the north (right bank). Bath has a formal defence scheme to protect the city from the River Avon.

Flooding significantly affects critical infrastructure in Bath. Ambulance stations, health surgeries and a police station are at risk. Transport networks are also at risk.

Two Scheduled Monuments, including the Roman Baths and part of the World Heritage Site, are at risk of flooding.

The increase in future flood risk will mainly be driven by climate change, which is predicted to result in increases to peak river flows.

The vision and preferred policy

Policy Option 5 - We can generally take further action to reduce flood risk.

The current level of flood risk in Bath is considered unacceptable and under the chosen policy this risk would be reduced. Future increases in flood risk due to climate change could be balanced by reducing flows through increasing storage in the Upper Avon sub-area.

Proposed actions to implement the preferred policy

- Carry out improvements to existing assets through development opportunities on those lengths identified as below standard, and identify an overall strategy for the future protection of Bath and for its existing defences.
- We will increase awareness of risk and response to flood warnings, and discourage inappropriate development.

Flooded streets at Southgate in Bath in December 1960 ➜

Upper Avon

Our key partners are:

- Wiltshire Unitary Authority
- South Gloucester Unitary Authority
- Cotswold District Council
- Natural England
- Wessex Water
- National Farmers Union
- Farming and Wildlife Advisory Group
- Local farmers and landowners

The issues in this sub-area

This sub-area covers the predominantly rural area of the Upper Avon catchment and includes the Semington Brook. The main flood risk comes from the River Avon, though there is also a flood risk associated with the tributaries. Overall, there are no particularly large concentrations of people or properties at risk within the sub-area.

There are very few formal defences within the sub-area and most of the watercourses remain in a natural state. Malmesbury is the main settlement, but generally across the sub-area most properties at risk are isolated. There are a number of old river control structures that have been replaced with flood defence control structures on the River Avon and tributaries. Within the sub-area, approximately 400 properties are at risk of flooding during the current 1% annual probability flood event. These numbers increase to approximately 600 properties for the future 1% annual probability event. The floodplain of the River Avon covers a wide extent and flooding of the agricultural land is a significant factor.

An AONB, three SSSI and four Scheduled Monuments are at risk of flooding. A school, health centre, electricity sub-station, a sewage treatment works, a water treatment works and a fire and ambulance station are at risk. Railway lines and roads, including the M4 motorway, are also at risk. The increase in future flood risk will mainly be driven by climate change, with future land use changes and land management practices unlikely to have a major effect on future flood risk.

The vision and preferred policy

Policy Option 6 - We will take action with others to store water or manage run-off in locations that provide overall flood risk reduction or environmental benefits.

This policy offers the potential for considerable environmental benefits. The floodplain of the River Avon is quite wide for much of this sub-area, meaning that there is potential for significant floodplain storage. This will have the effect of attenuating flows and retaining floodwater, thereby reducing the flood risk to areas at risk downstream, and locally.

Proposed actions to implement the preferred policy

- We will carry out a detailed study to determine specific areas where storage of floodwater may be feasible. This is likely to include a detailed topographic study (e.g. upstream of Malmesbury), and will propose the implementation of feasible schemes. This work will also identify urban areas and smaller settlements within the sub-area at risk of flooding so that the risk to these would not be increased by adopting this policy.
- We will identify areas which could benefit from increased flooding, for example suitable areas in which to develop water meadows, wet woodland and other wetland habitat, or opportunities to convert arable land to permanent pasture that may also allow flooding. We will identify opportunities to create recreational public amenities or water resources benefits through such storage options. We will propose a schedule of schemes for suitable sites.
- We will carry out pilot studies on the Semington Brook, Brinkworth Brook and at Little Somerford into the benefits of planting wet woodlands in floodplain.
- We will monitor the effects of upland storage on flows through Bradford-on-Avon and Bath.

↑ The confluence of the River Avon and the Brinkworth Brook at Great Somerford during flooding

Lower Avon

Our key partners are:

Bath and North East Somerset Unitary Authority

South Gloucestershire Unitary Authority

Mendip District Council

The issues in this sub-area

This sub-area covers much of the rural area of the lower Bristol Avon catchment and includes the By Brook, River Boyd and the lower sections of the Somerset Frome and Midford Brook. This sub-area covers a large proportion of the Bristol Avon CFMP.

There are very few formal defences within the sub-area with mainly isolated properties at flood risk. A limited flood warning service is offered to the main areas at risk.

Approximately 200 properties are within the current 1% annual probability flood extent, most of which are well dispersed across the sub-area.

This figure is expected to increase to an estimated 340 properties within the future 1% annual probability flood extent.

Numerous features have designations, including 15 Sites of Special Scientific Interest, 11 Scheduled Monuments, two Areas of Outstanding Natural Beauty and the Salisbury Plain and Mells Valley Special Areas of Conservation.

Three electricity sub-stations and three water treatment works are at risk of flooding, along with railways and major roads, including the M4 and A36.

The increase in future flood risk will be driven mainly by climate change which is predicted to result in increases to fluvial flows. Neither land use or land management changes are expected to have a significant influence on future flood risk in the sub-area.

The vision and preferred policy

Policy Option 3 - We are generally managing existing flood risk effectively.

Flood risk is predicted to increase in the future through climate change but the effective decrease in the standard of protection that this will bring is not expected to have significant social or economic implications and this policy therefore represents the best balance of costs and benefits, socially, economically and environmentally.

The increased frequency of flooding will bring a limited opportunity to increase the area of water meadows, wetland and/or wet woodland, including around Bradford-on-Avon and Newton St Loe.

Proposed actions to implement the preferred policy

- Through the development of a System Asset Management Plan, study the cost-efficiency of existing asset maintenance in relation to flood risks at sites such as Bathford, Swineford, Batheaston etc and implement any recommended improvements.

Upper Bristol Frome

Our key partners are:

South Gloucestershire Unitary Authority

The issues in this sub-area

This sub-area covers the upper Bristol Frome catchment and includes the towns of Frampton Cotterell, Chipping Sodbury and Yate. The main flood risk comes from the Bristol Frome, although a few minor tributaries contribute to the flood risk.

The majority of properties at risk are in Chipping Sodbury and Yate, but isolated properties at Frampton Cotterell and on the Stockwell Watercourse, Bradley Brook and Folly Brook are also at risk. Tubbs Bottom detention dam was constructed to reduce the risk of flooding to areas downstream.

Around 300 properties are within the current 1% annual probability flood extent. This figure is expected to increase significantly to 1,600 properties in the future. An electricity sub-station, a care home, a fire station, schools and health centres are at risk from flooding. Part of the M4 motorway and the A432 road are also at risk.

The vision and preferred policy

Policy Option 6 - We will take action with others to store water or manage run-off in locations that provide overall flood risk reduction or environmental benefits.

Increasing storage through this approach, including increasing the efficiency of Tubbs Bottom detention reservoir, has the potential to reduce the flood risk in the urban areas of the sub-area through increased floodplain storage upstream. This would bring an associated reduction in the severity and frequency of flooding to people and properties. The flood risk to the health centres, school, care homes and the fire station will be reduced, as will the flood risk to the roads within the urban areas.

Proposed actions to implement the preferred policy

- We will carry out a detailed study to consider, firstly, the operation of Tubbs Bottom detention reservoir to further benefit downstream, and secondly, the opportunities for further floodplain storage on the Ladden Brook and tributaries.
- We will discourage inappropriate development in flood risk locations, especially critical infrastructure.

↑ Construction work at Tubbs Bottom

Mendip Slopes and Long Ashton

Our key partners are:

Mendip District Council

Bath and North East Somerset Unitary Authority

North Somerset Unitary Authority

Met Office

The issues in this sub-area

This sub-area covers the slopes of the Mendips and the upper reaches of the Midford Brook, Somerset Frome and River Chew. An area to the west of Bristol around Long Ashton is also included. It is a predominantly rural area, but does contain the towns of Midsomer Norton, Chew Magna, Keynsham and Radstock.

The flood risk mainly arises from the relatively fast response of the watercourses due to their location on the slopes of the Mendip Hills and from direct surface run-off. Notable areas at risk of flooding include Chew Stoke, Hallatrow, Nunney, Witham Friary, Mells, Pensford, Chilcompton, Compton Dando and Vobster. Approximately 580 properties (of which 470 are residential) are at risk of flooding currently, rising to 790 (600 residential) in the future.

Within the current 1% annual probability flood extent there are various environmental designations. These include nine SSSIs, two AONB, two SAC and 15 Scheduled Monuments.

Seven electricity sub-stations are also at risk along with health centres, schools, a sewage treatment works, railways and major roads.

The increase in future flood risk will mainly be driven by climate change with future changes in land use and land management practices unlikely to have much of an effect on future flood risk. The steeper nature of the watercourses combined with the increased flows predicted under climate change may lead to a larger increase in flood risk compared to some of the other sub-areas in the Bristol Avon CFMP.

The vision and preferred policy

Policy Option 4 - We are already managing the flood risk effectively but we may need to take further actions to keep pace with climate change.

This policy will require us to do more in the future to contain what would otherwise be increasing risk. There should be no increase in flood risk to the schools, health centres, sewage treatment works or industrial units currently at risk of flooding.

Proposed actions to implement the preferred policy

- We will review emergency contingency planning, especially in the light of climate change, increase awareness of risk and response to flood warnings, and discourage inappropriate development.
- We will investigate the benefits of improved flood forecasting and flood warning using improved meteorological technology.

Wootton Bassett and Dauntsey

Our key partners are:

Wiltshire Unitary Authority

Highways Agency

Network Rail

The issues in this sub-area

This sub-area includes the towns of Wootton Bassett and Dauntsey, both of which are located in the upper reaches of the catchment

Whilst this sub-area is predominantly rural, at Wootton Bassett significant development is predicted. The main flood risk is to 40 residential properties at Dauntsey, rising to 60 with climate change increases. There is a flood detention reservoir in Wootton Bassett. This was primarily installed to ensure that increased run-off from development upstream did not increase flooding to agricultural land.

There is one Scheduled Monument at risk of flooding within the current 1% annual probability flood extent. Also at risk are roads, including part of the M4 motorway and the railway line from Bristol to Swindon. A school in Dauntsey is also at risk.

The increase in future flood risk will mainly be driven by climate change, which is predicted to result in increases to river flows and surface run-off.

The vision and preferred policy

Policy Option 3 - We are generally managing existing flood risk effectively.

Although this approach may lead to a slight increase in the frequency of flooding in the future and to the level of disruption, this is not deemed significant enough to increase the level of flood risk management. Policy 3 represents the best balance of costs and benefits, socially, economically and environmentally.

Proposed actions to implement the preferred policy

- Undertake integrated urban drainage studies, in particular for main line railway and M4 motorway flood risks, and implement any recommended improvements.
- Through the development of a System Asset Management Plan, study the cost-efficiency of existing channel maintenance in relation to Dauntsey Green, and implement any recommended improvements.

Sub-area 8

Wiltshire Towns

Our key partners are:

Wiltshire Unitary Authority

Met Office

The issues in this sub-area

This sub-area covers the towns of Chippenham, Melksham, Corsham, Calne, Westbury and Trowbridge. The main flood risk to Chippenham comes from the River Avon, though several small tributaries flow through the town and increase the risk.

None of these towns have significant flood risk, and, except for Corsham, are protected to a reasonable level by past schemes. Development pressures affect all the towns and climate change will increase properties at risk dramatically. It is estimated that approximately 400 properties lie within the current 1% annual probability extent. Within the future 1% annual probability flood extent the number of properties is expected to increase to 2,600. Major infrastructure including main line rail, roads and an electricity sub station will be at increased risk.

The vision and preferred policy

Policy Option 4 - We are already managing the flood risk effectively but we may need to take further actions to keep pace with climate change.

Under this approach, further action will be taken to sustain the current level of flood risk into the future. The majority of the 2,600 properties at risk in the future would see the risk remain similar to that at present.

Proposed actions to implement the preferred policy

- We will develop a prioritised programme of strategies for maintaining the level of risk into the future. As well as benefiting from upstream storage, we would look to include the possible future modification of existing assets, including utilising development opportunities for the removal or replacement of sluice structures at Chippenham and Melksham. We would look at options to make channel improvements and undertake bank raising in Trowbridge and Westbury. We would also look at options to make improvements to channels, culverts and their screening, and storage in Corsham and Calne.
- Improve flood forecasting and flood warning using improved meteorological technology and improve response through raising awareness.
- Undertake integrated urban drainage studies, in particular for main line rail flood risks, and implement any recommended improvements at Corsham.
- Discourage inappropriate development in Corsham, Calne, Trowbridge and Westbury.
- Reinforce contingency planning and self-help in Corsham and Calne.

Bradford-on-Avon and Frome

Our key partners are:

Wiltshire Unitary Authority

Mendip District Council

The issues in this sub-area

This sub-area covers the towns of Bradford-on-Avon and Frome.

Both towns would be cut in half if major flooding takes place. Unlike Bradford-on-Avon, Frome already has some protection afforded by an earlier scheme. Both towns suffer from the impracticality of future improvements to channels and bridges in the town.

There are currently 75 properties with the current 1% annual probability flood extent and this is expected to rise to around 190 in the future.

Three Scheduled Monuments in Bradford-on-Avon are at risk of flooding. Also at risk in the town are an electricity sub-station, a fire station and a police station. The A363 road and the railway line through the town are also at risk.

There are no environmental designations at risk of flooding in Frome. The A361 and A362 roads, along with the railway, are also at risk. Flooding could also affect an electricity sub-station and two health centres in the town.

The vision and preferred policy

Policy Option 3 - We are generally managing existing flood risk effectively.

The overall increase in the level of flood risk is likely to be small.

Proposed actions to implement the preferred policy

- We will reinforce contingency planning and self-help, increase awareness of risk and response to flood warnings, and discourage inappropriate development.
- Through the development of the System Asset Management Plan, study the cost-efficiency of existing maintenance of the two town centre's bridges, channels and culverts and implement any recommended improvements.

Markham Brook and Avonmouth

Our key partners are:

City of Bristol Unitary Authority

North Somerset Unitary Authority

Port of Bristol Authority

Wessex Water

The issues in this sub-area

This sub-area covers both banks of the tidal River Avon below Shirehampton including the Markham Brook and Chapel Pill. This includes the urban areas of Shirehampton, Pill and Easton-in-Gordano and a small area of Avonmouth including Portbury and Avonmouth Docks. Most of Avonmouth is covered by the Severn Tidal Tributaries CFMP.

The over-riding flood risk in this sub-area is from tidal flooding and both banks of the Avon have raised tidal defences.

Behind the defences, the main risk of flooding is from surface water exacerbated by tide-locking.

Around 60 properties, mainly residential, are at risk of flooding from the current 1% annual probability flood event, though these are protected from flooding by the existing defences. The number of properties at risk during the future 1% event increases to an estimated 120.

The Severn Estuary Special Protection Area, and Ramsar are not affected by fluvial and surface water flooding in this sub-area.

An electricity substation, a fire station and 10 sheltered houses are at risk from the current 1% annual probability flood event. A main road is also at risk.

The vision and preferred policy

Policy Option 4 - we are already managing the flood risk effectively, but we may need to take further actions to keep pace with climate change.

Increased river flows, surface run-off and sea level rise as a result of climate change are likely to be the three main drivers of future flood risk within this sub-area.

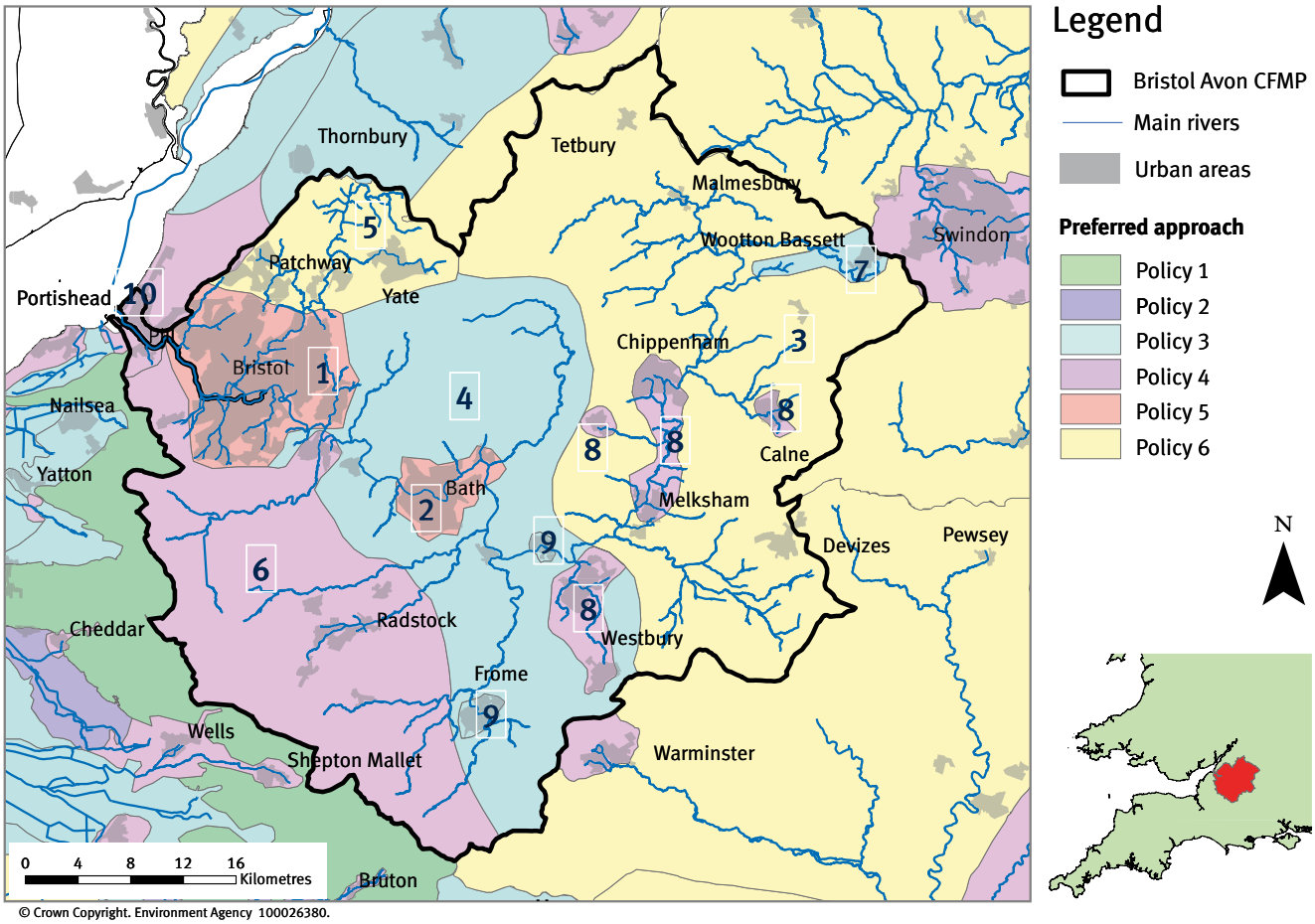
Under this approach, further action will be taken to sustain the current level of flood risk into the future. The estimated 120 properties at risk of flooding would see the risk remain similar to that at present.

Proposed actions to implement the preferred policy

- Review emergency contingency planning, especially in the light of climate change
- Increase awareness of risk and response to flood warnings.
- Discourage inappropriate development.
- Encourage the production of surface water management plans for Pill and Shirehampton
- Consider future improvements for the Pill pumping station.

Map of CFMP policies

Map of the policies in the Bristol Avon catchment



The sub-areas

1 Bristol
2 Bath
3 Upper Avon
4 Lower Avon
5 Upper Bristol Frome
6 Mendip Slopes and Long Ashton
7 Wootton Bassett and Dauntsey
8 Wiltshire Towns
9 Bradford-on-Avon and Frome
10 Markham Brook and Avonmouth

Would you like to find out more about us, or about your environment?

Then call us on

08708 506 506* (Mon-Fri 8-6)

email

enquiries@environment-agency.gov.uk

or visit our website

www.environment-agency.gov.uk

incident hotline 0800 80 70 60 (24hrs)
floodline 0845 988 1188

*** Approximate call costs: 8p plus 6p per minute (standard landline). Please note charges will vary across telephone providers.**

Environment first: Viewing this on-screen? Please consider the environment and only print if absolutely necessary.
If you're reading a paper copy, please don't forget to reuse and recycle.

GESW0612BWPY-E-E

Environment Agency

North and Mid Somerset Catchment Flood Management Plan

Summary Report June 2012

We are the Environment Agency. It's our job to look after your environment and make it a better place – for you, and for future generations.

Your environment is the air you breathe, the water you drink and the ground you walk on. Working with business, Government and society as a whole, we are making your environment cleaner and healthier.

The Environment Agency. Out there, making your environment a better place.

Published by:

Environment Agency
Manley House
Kestrel Way
Exeter EX2 7LQ
Tel: 0870 8506506
Email: enquiries@environment-agency.gov.uk
www.environment-agency.gov.uk

June 2012

Introduction

I am pleased to introduce our summary of the North and Mid Somerset Catchment Flood Management Plan (CFMP). This CFMP gives an overview of the flood risk in the North and Mid Somerset catchment and sets out our preferred plan for sustainable flood risk management over the next 50 to 100 years.

The North and Mid Somerset CFMP is one of 77 CFMPs for England and Wales. Through the CFMPs, we have assessed inland flood risk across all of England and Wales for the first time. The CFMP considers all types of inland flooding, from rivers, ground water, surface water and tidal flooding, but not flooding directly from the sea (coastal flooding), which is covered by Shoreline Management Plans (SMPs). Our coverage of surface and ground water is however limited due to a lack of available information.

The role of CFMPs is to establish flood risk management policies which will deliver sustainable flood risk management for the long term. This is essential if we are to make the right investment decisions for the future and to help prepare ourselves effectively for the impact of climate change. We will use CFMPs to help us target our limited resources where the risks are greatest.

This CFMP identifies flood risk management policies to assist all key decision makers in the catchment. It was produced through a wide consultation and appraisal process; however it is only the first step towards an integrated approach to Flood Risk Management. As we all work together to achieve our objectives, we must monitor and listen to each others progress, discuss what has been achieved and consider where we may need to review parts of the CFMP.

The North and Mid Somerset catchment has a history of flood risk. Over the last 50 years numerous engineering schemes have been implemented to reduce flood risk in the catchment. At present 2,300 properties are at risk in the catchment in a 1% event (taking into account flood defences). This will increase to over 4,200 properties in the future.

We cannot reduce flood risk on our own, we will therefore work closely with all our partners to improve the co-ordination of flood risk activities and agree the most effective way to manage flood risk in the future. We have worked with others including: Somerset County Council, Natural England, Wessex Water and the National Farmers Union to develop this plan.

This is a summary of the main CFMP document, if you need to see the full document an electronic version can be obtained by emailing enquiries@environment-agency.gov.uk or alternatively paper copies can be viewed at any of our offices in South West Region.

Richard Cresswell
South West Regional Director

Contents

The purpose of a CFMP in managing flood risk 3

Catchment overview 4

Current and future flood risk 6

Future direction for flood risk management 10

Sub-areas

1 Portbury sub-area 12

2 Congresbury and Bruton sub-area 14

3 Weston-super-Mare sub-area 15

4 River Axe and River Brue sub-area 16

5 Coastal Towns sub-area 17

6 North Somerset Moors sub-area 18

7 Levels and Moors Towns sub-area 20

8 Levels and Moors sub-area 22

9 Uplands sub-area 24

Map of CFMP policies 25

The purpose of a CFMP in managing flood risk

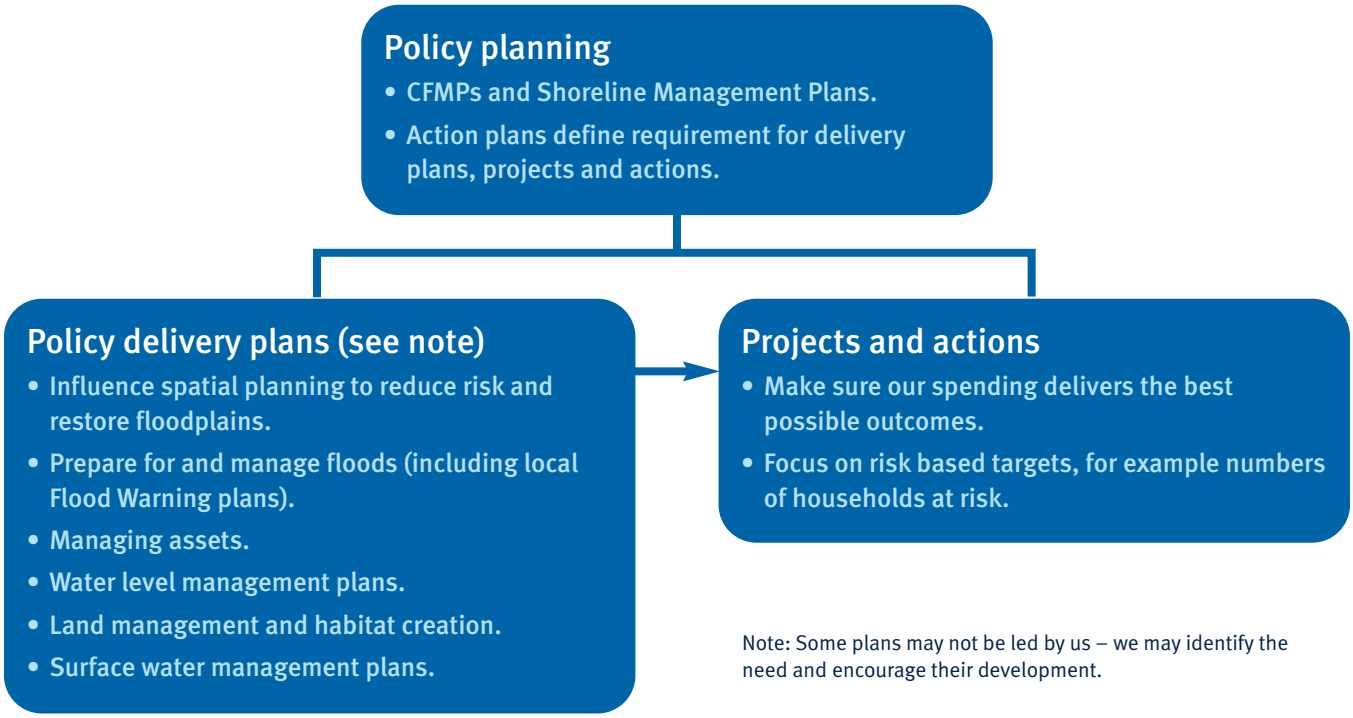
CFMPs help us to understand the scale and extent of flooding now and in the future, and set policies for managing flood risk within the catchment. CFMPs should be used to inform planning and decision making by key stakeholders such as:

- the Environment Agency, who will use the plan to guide decisions on investment in further plans, projects or actions;
- Regional Assemblies and local authorities who can use the plan to inform spatial planning activities and emergency planning;
- Internal Drainage Boards (IDB), water companies and other utilities to help plan their activities in the wider context of the catchment;
- transportation planners;
- land owners, farmers and land managers that manage and operate land for agriculture, conservation and amenity purposes;
- the public and businesses to enhance their understanding of flood risk and how it will be managed.

CFMPs aim to promote more sustainable approaches to managing flood risk. The policies identified in the CFMP will be delivered through a combination of different approaches. Together with our partners, we will implement these approaches through a range of delivery plans, projects and actions.

The relationship between the CFMP, delivery plans, strategies, projects and actions is shown in Figure 1.

Figure 1. The relationship between CFMPs, delivery plans, projects and actions



Note: Some plans may not be led by us – we may identify the need and encourage their development.

Catchment overview

The catchment of the rivers in the North and Mid Somerset CFMP are located in the south west of England. They drain from the Mendips, flowing via various channels through the low-lying coastal plain to the Severn Estuary.

Map 1 shows the location and extent of the North and Mid Somerset CFMP area. It includes the rivers Brue, Axe, Congresbury Yeo, Land Yeo, Banwell and Portbury Ditch. The downstream limits of the CFMP area meet with the upstream boundary of the North Devon and Somerset Shoreline Management Plan (SMP) boundary at tidal sluices on the Brue and Axe, and with the Severn Estuary SMP at tidal sluices on the rest.

North Devon and Somerset and Severn Estuary SMPs deal with coastal flood management, while the CFMP considers the flood risk from tide-locking.

The overall catchment area is about 1,100 square kilometres, and has a population of around 275,000. It's a rural catchment, with urban areas making up only five per cent of the total. Its main urban areas, mainly located on the coastal plain, include Weston-super-Mare, Burnham-on-Sea and Highbridge, Portishead and Clevedon, Nailsea, Congresbury, Cheddar, and Glastonbury and Street.

The rivers and streams flow from their source in the Mendips in the east of the catchment; they flow in a westerly direction through low-lying coastal plain, before flowing out into the Severn Estuary through tidal exclusion sluices.

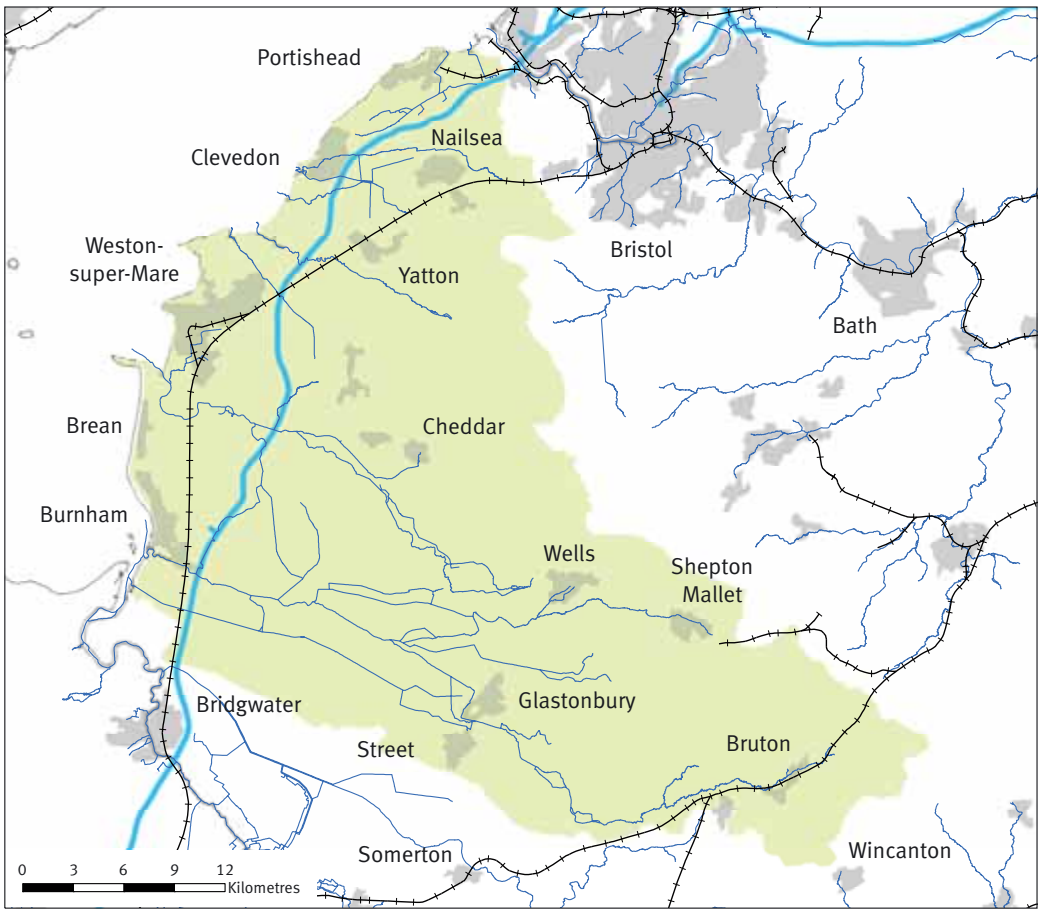
The rivers Brue and Axe flow through the Somerset Levels and Moors, where they are embanked and in some places perched above the surrounding floodplain. In the Somerset Levels and Moors, flooding is caused by long duration storms or a series of storms. The high-level embanked channels overflow and floodwater is stored in the moors before it can reach the estuary. The capacity of these channels can be significantly reduced by high tidal conditions. Internal Drainage Boards have an important role in managing land drainage within these low-lying moors.

The underlying rock has a significant influence on the catchment's response to rainfall, with high run-off from the impermeable uplands in the south east and water-logging of the clay lowlands. Permeable uplands in the north east results in many rivers' headwaters being limestone springs.

The catchment contains a number of designated sites of national and international importance. A significant part of the low-lying Somerset Moors are designated Special Protection Areas (SPA) and a Ramsar site, which depend upon flooding. The area is also rich in archaeological sites that depend on waterlogged conditions for their preservation.

Important environmental sites in the catchment include two Areas of Outstanding Natural Beauty, three Special Areas of Conservation, two Ramsar and two SPA (including the Severn Estuary), 74 Sites of Special Scientific Interest, nine National Nature Reserves and over 300 Schedule Monuments.

Map 1. Location and extent of the North and Mid-Somerset CFMP area



↑ Minor works undertaken on the River Brue near Glastonbury

Current and future flood risk

Overview of the current flood risk

Flood risk has two components: the chance (probability) of a particular flood and the impact (or consequence) that the flood would have if it happened. The probability of a flood relates to the likelihood of a flood of that size occurring within a one year period. It is expressed as a percentage. For example, a 1% flood has a 1% chance or 0.01 probability of occurring in any one year, and a 0.5% flood has a 0.5% chance or 0,005 probability of occurring in any one year. The flood risks quoted in this report are those that take account of flood defences already in place.

This catchment has a long history of flooding, with the most significant event in recent years having occurred in Shepton Mallet in May 2008 when for the second time in 18 months 30 properties were affected by surface water and river flooding after periods of heavy rainfall.

Currently the main sources of flood risk for people, property, infrastructure and the land are:

- river flooding from the River Brue, Axe, Cheddar Yeo, Congresbury Yeo particularly in Bruton, Cheddar and Congresbury;
- Tide lock flooding from the Blind Yeo in Clevedon, and the Uphill Great Rhyne in Uphill;
- breaching/failure of embankments, which could be a problem along the Brue and Axe system across the levels and moors of the catchment;
- surface water drainage flooding, which has occurred in Shepton Mallet and Cheddar. Other towns have the potential to be at risk from surface water flooding.

What is at risk?

At present there are around 7,000 people and 3,000 commercial and residential properties at risk in the whole catchment from a 1% annual probability river flood, taking into account current flood defences.

This means that 2.5% of the total population living in the catchment are currently at risk from flooding.

It is difficult to assess the current impact of flooding to environmental features. Many designated sites at risk would not actually be damaged by the inundation.

Three Scheduled Monuments are at risk of flooding, but again, the actual risk of damage from flooding is limited.

Map 2. Flood risk to property in a 1% annual probability river flood, taking into account current flood defences

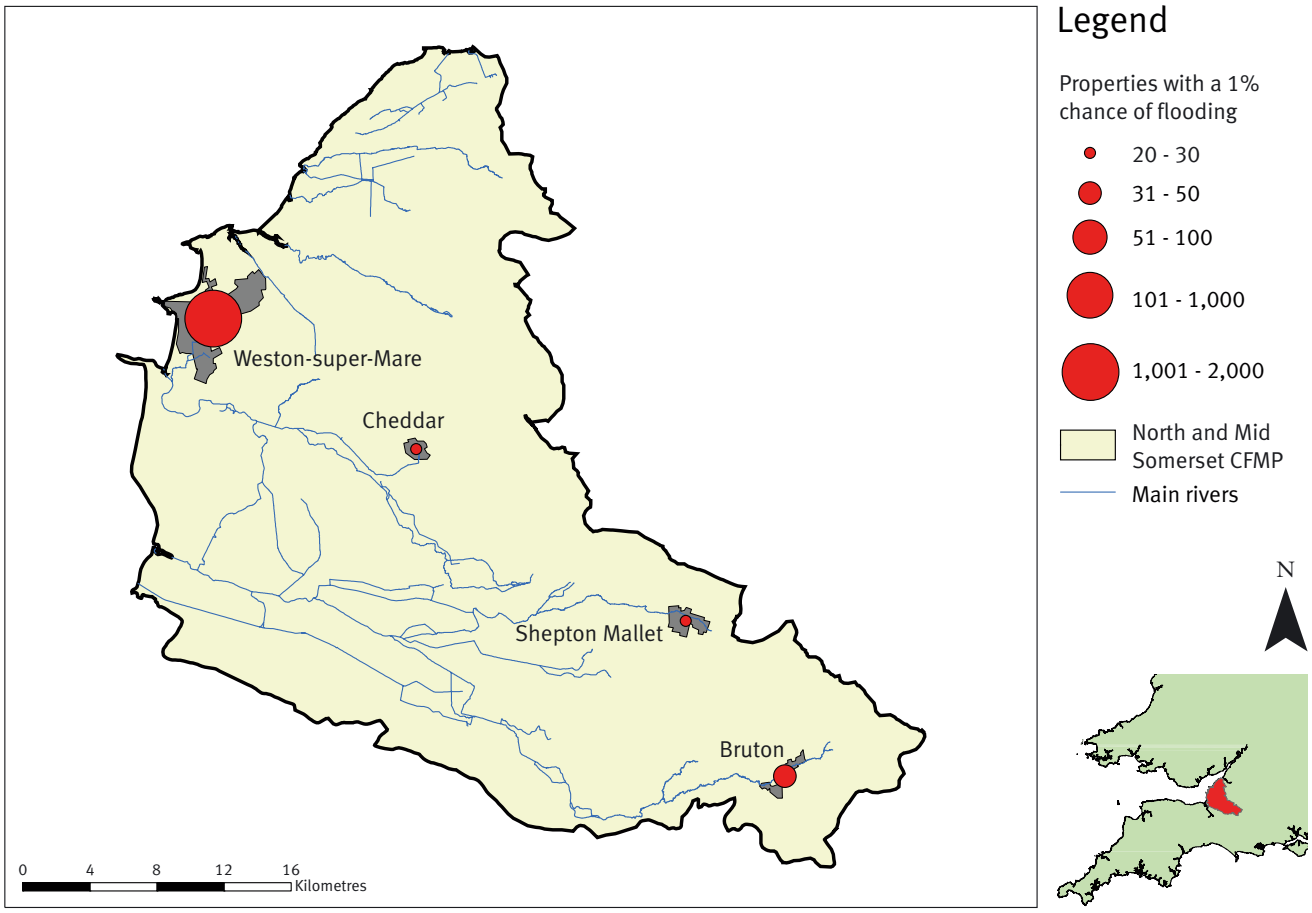


Table 1. Locations of towns and villages with 25 or more properties at risk in a 1% annual probability river flood

Number of properties at risk	Locations
›1,000	Weston-super-Mare
500 to 1,000	Levels and Moors
100 to 500	None
50 to 100	None
25 to 50	Bruton, Shepton Mallet, Congresbury

Table 2. Critical infrastructure at risk:

20 electricity substations, 2 police stations, 1 water treatment works, 3 waste management sites, 6 care homes, 12km of main roads, 2km of motorway, 8km of mainline railway, and 6 schools.

Where is the risk?

More than half of the people and properties that are at risk within the catchment from a 1% annual probability river flood are located in Weston-super-Mare.

The distribution of properties at risk from a 1% annual probability river flood, is illustrated in Map 2. Table 1 summarises where there is flood risk to more than 25 properties. We recognise that there is also a potential risk from surface water and groundwater flooding. However, further studies following on from the CFMP are needed by us and our partners to quantify this potential risk.

How we currently manage the risk

The catchment has a history of flood risk, generally due to the high rainfall that can lead to extensive flooding of the river valleys. Over the last 70 years, numerous engineering schemes have been implemented to reduce flood risk in the catchment, including:

- Improving flood banks of the Congresbury Yeo through Congresbury to provide a 2% to 1% protection;
- Construction of a detention reservoir upstream of Bruton to provide a 2% to 1% protection on the Brue through Bruton.

These measures have all reduced flood risk.

In addition to these engineering schemes, other flood risk management activities are carried out in the catchment. These include activities which help to reduce the probability of flooding and those that address the consequences of flooding.

Activities that reduce the probability of flooding include:

- maintaining and improving existing flood defences and structures, especially raised banks of the Rivers Brue, Axe and Congresbury Yeo, tidal sluices on all river outfalls, and pumping stations for evacuation of floodplain storage;
- maintaining river channels; maintenance of drainage networks by Internal Drainage Boards (IDBs) and landowners;
- maintenance of road drainage and sewers.

Activities that reduce the consequences of flooding include:

- understanding where flooding is likely by using flood risk mapping;
- providing flood forecasting and warning services;
- promoting awareness of flooding so that organisations, communities and individuals are aware of the risk and are prepared in case they need to take action in time of flood;
- promoting resilience and resistance measures for those properties already in the floodplain.
- working with local authorities to influence the location, layout and design of new and redeveloped property and ensuring that only appropriate development is allowed on the floodplain through the application of Planning Policy Statement 25 (PPS25).

↑ Large tracts of low-lying land see extensive flooding during the winter months

The impact of climate change and future flood risk

In the future, flooding will be influenced by climate change, changes in land use (for example urban development) and rural land management. In the North and Mid Somerset catchment, climate change will have the greatest impact on flood risk. The following future scenario for climate change was used in the CFMP:

- 20% increase in peak flow in all watercourses. This will increase the probability of large-scale flood events;
- a total sea level rise of 500 mm by the year 2100. This will increase the length of time watercourses will be tide locked on the lower reaches of the Brue at Burnham-on-Sea, Highbridge and Huntspill, the Uphill Great Rhyne at Uphill, the Land Yeo at Clevedon and the Portbury Ditch at Portishead, and the length of time moors will have to store floodwater before evacuation.

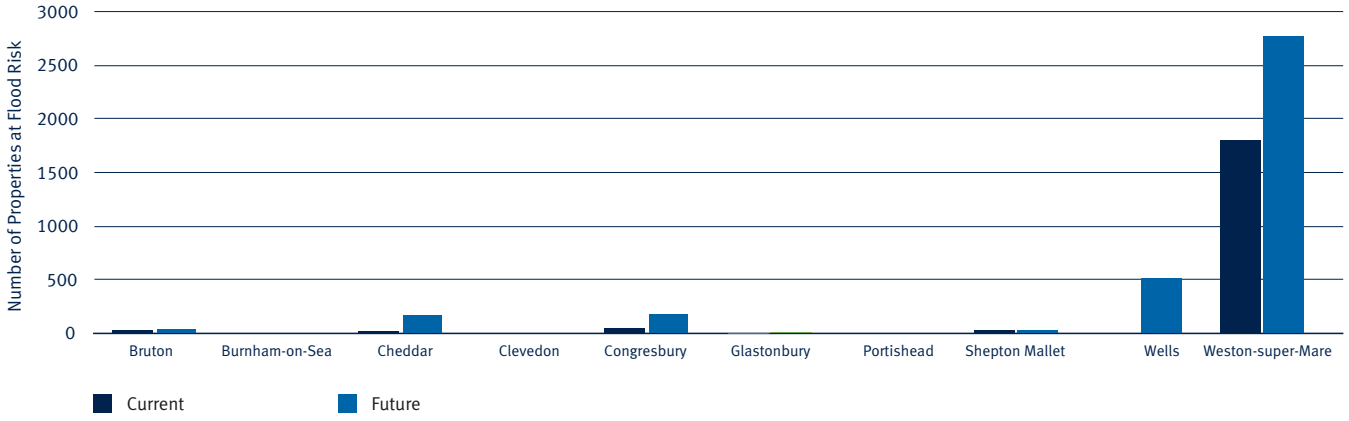
Using river models we estimate that by 2100, around 9,500 people and 4,200 properties across the catchment may be at risk from a 1% annual probability flood. Flood risk from rivers increases mainly in Congresbury, Wells and Weston-super-Mare.

The sensitivity testing undertaken showed that river flooding in the CFMP area is sensitive to climate change, as flood depths and extents increased over a wide area. The area is moderately sensitive to land use change over a wide area which leads to an increase in damages for both property and agricultural land. There is a limited pressure for development within the CFMP area, with the area most under pressure being the coastal strip. Development at the coast does not affect flooding on a catchment-wide scale.

Figure 2 shows the difference between current and future flood risks from a 1% annual probability river flood at key locations in the catchment. Following on from the CFMP, organisations need to work together to investigate flood risk from other sources (e.g. surface water and ground water flooding) in more detail.

In general, it is unlikely that the impact of flooding on environmental sites will change significantly in the future.

Figure 2. Current and future (2100) flood risk to property from a 1% annual probability river flood, taking into account current flood defences



Future direction for flood risk management

Approaches in each sub-area

We have divided the North and Mid Somerset catchment into nine distinct sub-areas which have similar physical characteristics, sources of flooding and level of risk. We have identified the most appropriate approach to managing flood risk for each of the sub-areas and allocated one of six generic flood risk management policies, shown in Table 3.

To select the most appropriate policy, the plan has considered how social, economic and environmental objectives are affected by flood risk management activities under each policy option.

↑ Church Bridge at Bruton

Map 3. North and Mid Somerset sub-areas

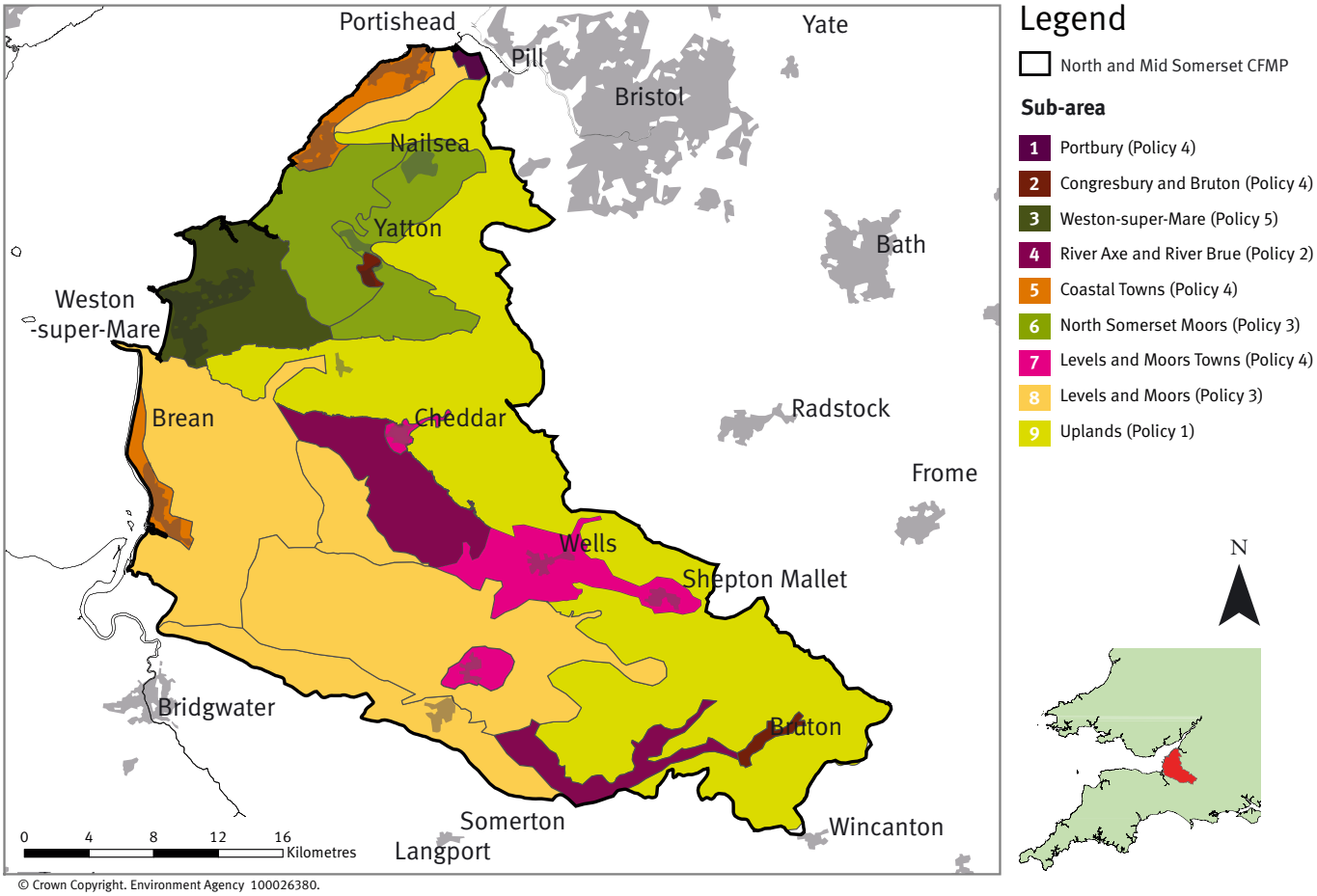


Table 3. Policy options

Policy 1

Areas of little or no flood risk where we will continue to monitor and advise

This policy will tend to be applied in those areas where there are very few properties at risk of flooding. It reflects a commitment to work with the natural flood processes as far as possible.

Policy 2

Areas of low to moderate flood risk where we can generally reduce existing flood risk management actions

This policy will tend to be applied where the overall level of risk to people and property is low to moderate. It may no longer be value for money to focus on continuing current levels of maintenance of existing defences if we can use resources to reduce risk where there are more people at higher risk. We would therefore review the flood risk management actions being taken so that they are proportionate to the level of risk.

Policy 3

Areas of low to moderate flood risk where we are generally managing existing flood risk effectively

This policy will tend to be applied where the risks are currently appropriately managed and where the risk of flooding is not expected to increase significantly in the future. However, we keep our approach under review, looking for improvements and responding to new challenges or information as they emerge. We may review our approach to managing flood defences and other flood risk management actions, to ensure that we are managing efficiently and taking the best approach to managing flood risk in the longer term.

Policy 4

Areas of low, moderate or high flood risk where we are already managing the flood risk effectively but where we may need to take further actions to keep pace with climate change

This policy will tend to be applied where the risks are currently deemed to be appropriately-managed, but where the risk of flooding is expected to significantly rise in the future. In this case we would need to do more in the future to contain what would otherwise be increasing risk. Taking further action to reduce risk will require further appraisal to assess whether there are socially and environmentally sustainable, technically viable and economically justified options.

Policy 5

Areas of moderate to high flood risk where we can generally take further action to reduce flood risk

This policy will tend to be applied to those areas where the case for further action to reduce flood risk is most compelling, for example where there are many people at high risk, or where changes in the environment have already increased risk. Taking further action to reduce risk will require additional appraisal to assess whether there are socially and environmentally sustainable, technically viable and economically justified options.

Policy 6

Areas of low to moderate flood risk where we will take action with others to store water or manage run-off in locations that provide overall flood risk reduction or environmental benefits

This policy will tend to be applied where there may be opportunities in some locations to reduce flood risk locally or more widely in a catchment by storing water or managing run-off. The policy has been applied to an area (where the potential to apply the policy exists), but would only be implemented in specific locations within the area, after more detailed appraisal and consultation.

Portbury

Our key partners are:

North Somerset Unitary Authority

Internal Drainage Boards

Port of Bristol Authority

Wessex Water

The issues in this sub-area

The main source of flood risk is tidal flooding, through overtopping or a breach of the coastal flood defence walls, embankments and outfall controls. Tidal flooding is addressed in the Severn Estuary Shoreline Management Plan.

Other risks are from surface water flooding as a result of tide-locked urban drainage networks, and tidally influenced river flood risk to localised areas in extreme conditions. As the primary source is surface water and sewer flooding, flooding is shallow, relatively slow moving and confined to the low-lying land.

The Royal Portbury Docks is a key transportation link for the South West of England. The industrial area surrounding the docks includes properties with a high probability of flooding.

The industrial area surrounding the docks is currently at risk of flooding from the combined 1% annual probability river flood event.

In the future the risk is expected to increase with more surface water flooding.

The vision and preferred policy

Policy Option 4 - we are already managing the flood risk effectively, but we may need to take further actions to keep pace with climate change.

The current level of flood risk is considered to be low and acceptable. Surface water flooding is considered more likely due to tide-locked urban drainage networks.

Climate change and the potential dock development are likely to increase future levels of flood risk from surface water flooding to unacceptable levels. The chosen policy sets a framework that prevents the level of flood risk increasing in the future as a result of climate change and/or increased urban growth and would limit further key infrastructure from becoming at risk of river or surface water flooding.

Proposed actions to implement the preferred policy

Liaise with key stakeholders to:

- understand and review existing flood risk management activities undertaken within the unit;
- develop and implement a system for monitoring, recording and sharing information on flooding from other sources (sewer/surface water) in order to establish baseline information and measure the impacts of climate change.

Using this baseline information, develop an integrated drainage plan (surface water /sewer/river flooding) for the Royal Portbury Docks which aims to maintain the same standard of protection into the future, allowing for potential increases in rainfall intensity and tide-locking due to climate change. Consider the impacts of the Shoreline Management Plan in the work.

Implement the integrated drainage plan as part of the dock development.

Whilst the integrated urban drainage plan is being developed, continue with existing flood risk management activities in the Royal Portbury Docks. This includes

- routine inspection and maintenance of river channels, flood walls/embankments and the urban sewer system;
- reactive maintenance such as dredging or unblocking when required;
- discouraging re-development and intensification of development in areas with a higher probability of flooding.

Encourage the use of Sustainable Drainage Systems (SuDS) on all new developments and redevelopments.

↑ The wildlife corridor within the heavily developed Portbury docks complex.

Congresbury and Bruton

Our key partners are:

North Somerset Unitary Authority

Somerset County Council

Internal Drainage Boards

Wessex Water

The issues in this sub-area

There will be greater pressure on the urban drainage system and watercourse within Congresbury to manage the increased rates and volumes of run-off expected due to climate change. The probability of sewer flooding is expected to increase. There will be increased overtopping of embankments in the reach of main river and increased probability of failure of embankments.

Flood flows into Bruton are managed by the retention dam, which is located in rural land upstream of the town. There is a residual risk associated with a breach of the dam. Bruton has experienced surface water flooding in the past. This has primarily been caused by under capacity of the land and urban drainage systems to manage direct run-off from the surrounding sleep slopes of the urban area.

The total number of properties in Congresbury and Bruton currently in the 1% annual probability flood extent is 180. This is expected to increase to 310 in the future flood extent.

The vision and preferred policy

Policy Option 4 - we are already managing the flood risk effectively, but we may need to take further actions to keep pace with climate change.

This policy would permit improvements to the existing schemes to ensure that the consequences of flooding in the future will remain the same as the current situation.

Proposed actions to implement the preferred policy

Undertake a feasibility study to assess the current and future standard of protection of the Congresbury flood alleviation scheme, with an allowance for the potential impacts of climate change. Investigate options for upgrading the scheme to maintain the same standard of protection into the future.

Undertake a supplementary study to the feasibility study (July 2007) to assess the future standard of protection of the Bruton Flood Alleviation Scheme, taking account the potential impacts of climate change. Revisit the options appraisal in light of the aim to maintain the current standard of protection into the future.

Prepare flood emergency plans for Congresbury and Bruton, taking account of the potential impacts of climate change and including scenarios of overtopping and breach of flood defence embankments.

Until the above investigations are completed, continue with existing flood risk management activities in the towns, including:

- routine inspection and maintenance of river channels, urban sewer system and flood alleviation schemes;
- reactive maintenance such as unblocking of structures when required;
- using the planning process to discourage re-development, encourage relocation and limit intensification of development in areas with a higher probability of flooding.

Encourage the use of Sustainable Drainage Systems on all new developments and redevelopments.

Weston-super-Mare

Our key partners are:

North Somerset Unitary Authority

Somerset County Council

Internal Drainage Boards

South West Regional Development Agency

Weston Vision

Wessex Water

The issues in this sub-area

Flooding from the Severn Estuary is the main source of flooding in this sub-area and this is covered in the North Devon and Somerset Shoreline Management Plan.

This is the most densely populated sub-area in the CFMP area and is under considerable pressure for development. Low lying areas of the sub-area are predominantly located on impermeable clay soil, which is particularly susceptible to drainage problems. The main non-tidal source of flooding is surface water and sewer flooding (including the impacts of tide-locking) with flooding being shallow, relatively slow moving and confined to the low-lying land. As such flooding is caused by intense rainfall there can be little warning.

As well as permanent residents, Weston-super-Mare attracts a large number of tourists each year over the summer, including those staying in one of the many camping grounds in the area. Around 2,050 properties are affected by sewer and river flooding currently and this may increase to 3,375 in the next 100 years.

The vision and preferred policy

Policy Option 5 - we can generally take further action to reduce flood risk.

Flood risk is considered high in Weston-super-Mare at present and this is expected to increase further in the future. Additional appraisal will be required to assess whether there are socially and environmentally sustainable, technically viable and economically justified options.

Proposed actions to implement the preferred policy

Liaise with key stakeholders to:

- understand and review existing flood risk management activities undertaken within the sub-area; and
- develop and implement a system for monitoring, recording and sharing information on flooding from other sources (sewer/surface water) in order to establish baseline information and measure the impacts of climate change.

Using this baseline information and the findings of the pre-feasibility studies of the Uphill Great Rhyne and River Banwell, develop an integrated urban drainage plan (surface water /sewer/river flooding) for Weston-super-Mare which aims to improve the current standard of protection, allowing for potential increases in rainfall intensity and tide-locking due to climate change. Consider the impacts of the Shoreline Management Plan in the strategy.

Implement the strategy as part of new development / redevelopment.

Until the flood management strategy is completed, continue with existing flood risk management activities in Weston-super-Mare, including:

- routine inspection and maintenance of river channels, masonry walls and embankments, and the urban sewer system;
- reactive maintenance such as unblocking of structures when required;
- using the planning process to discourage re-development, encourage relocation and limit intensification of development in areas with a higher probability of flooding.

Encourage the use of Sustainable Drainage Systems on all new developments and redevelopments.

River Axe and River Brue

Our key partners are:

Internal Drainage Boards

Natural England

Land managers

The issues in this sub-area

River flooding from the River Axe and Cheddar Yeo affects agricultural land, and some residential properties within small communities. River Flooding from the River Brue and River Alham affects isolated properties and properties in East Lydford, agricultural land, the A37, A371 and the railway line.

Some surface water run-off and urban drainage problems exist.

Currently in the sub-area, 43 properties are at risk of flooding in the 1% annual probability flood event, and this is expected to increase to 52 properties in the future event.

The vision and preferred policy

Policy Option 2 - we can generally reduce existing flood risk management actions.

The current level of flood risk is low and it is not expected to increase in the future, even with a reduction in maintenance.

The East Lydford Flood Alleviation Scheme is no longer active and there may be an opportunity to reduce maintenance of the scheme.

The current flood risk management activities carried out for the surface water flooding problems are considered appropriate and acceptable for the level of risk.

Proposed actions to implement the preferred policy

Through the development of System Asset Management Plans (SAMPs), identify the current annual costs of non-tidal flood risk management in the River Axe valley compared with the costs of other activities (such as water level management, legal over-rides and fisheries).

Undertake a pre-feasibility study for the decommissioning of the East Lydford Flood Allevation Scheme and implement findings.

Identify specific locations on the River Axe and devise schemes where watercourses and floodplains can be restored by reducing conveyance where appropriate, reducing incidents of tree clearance in the river corridor (where such features do not increase the flood risk) and removing or altering obstructions and implement findings.

Support implementation of water level management plans by:

- ensuring that responsible parties are identified and aware of their actions; and
- work with key stakeholders to seek improvements in the efficiency of water level management operations.

Consider the potential changes due to climate change, and the outcome of the SAMPs.

Whilst the SAMPs are being developed, continue with existing flood risk management activities. This includes:

- routine inspection and maintenance of river channels and flood defence embankments, including weed-cutting;
- operation of water level management structures in line with existing plans;
- reactive maintenance such as unblocking when required.
- in the River Brue area, discourage new development in areas more prone to flooding, encourage relocation to areas away from the floodplain and use of SuDS in all new developments and redevelopments.

Coastal Towns

Our key partners are:

North Somerset Council

Somerset County Council

Wessex Water

The issues in this sub-area

This sub-area includes the towns of Portishead, Clevedon, Burnham-on-Sea and Highbridge.

The main source of flood risk is tidal flooding, through overtopping or a breach of the coastal flood defence walls, embankments and outfall controls. Tidal flooding is addressed in the Severn Estuary and North Devon and Somerset Shoreline Management Plans.

Other risks are from surface water flooding as a result of tide-locked urban drainage networks and tidally influenced river flood risk to localised areas in extreme conditions.

Currently these towns have a total of 250 properties at risk in the 1% annual probability flood extent. This is expected to increase to 375 properties in the future extent.

The vision and preferred policy

Policy Option 4 - we are already managing the flood risk effectively, but we may need to take further actions to keep pace with climate change.

The current level of flood risk from river flooding is considered to be low and acceptable. This sub-area has a higher probability of surface water flooding than river flooding. Climate change and the potential urban development are likely to increase future levels of flood risk from surface water flooding to unacceptable levels. The chosen policy sets a framework that prevents the level of flood risk increasing in the future as a result of climate change and/or increased urban growth and would limit further key infrastructure from becoming at risk of river or surface water flooding.

Proposed actions to implement the preferred policy

Support the preparation of flood emergency plan for caravan parks, to manage the increased risk of surface water flooding in the future, taking account of the potential impacts of climate change. Make reference to the existing Coastal Flooding Loud Hailer Route in the area.

Liaise with key stakeholders to:

- understand and review existing flood risk management activities undertaken within the unit;
- develop and implement a system for monitoring, recording and sharing information on flooding from other sources (sewer/surface water) in order to establish baseline information and measure the impacts of climate change.

Using this information, develop and implement an integrated drainage plan (surface water /sewer/river flooding) for Clevedon, Portishead and Burnham which aims to maintain the same standard of protection into the future, allowing for potential increases in rainfall intensity and tide-locking due to climate change.

Whilst the integrated urban drainage plan is being developed, continue with existing flood risk management activities. This includes:

- routine inspection and maintenance of river channels, flood walls/embankments and the urban sewer system
- reactive maintenance such as dredging or unblocking when required
- discouraging re-development and intensification of development in areas with a higher probability of flooding

Encourage the use of Sustainable Drainage Systems on all new developments and redevelopments.

Sub-area 6

North Somerset Moors

Our key partners are:

- Natural England
- North Somerset Unitary Authority
- Somerset County Council
- Internal Drainage Boards
- Wessex Water
- Land managers

The issues in this sub-area

This sub-area includes the Gordano Valley and the communities of Puxton, Kenn, Tickenham, Nailsea, Yatton and Wrington.

The main risk is from tidally influenced river flooding during tide-locked conditions and overtopping of flood embankments on the main river channels, including risk of breach.

Communities and isolated properties are at risk from surface water run-off from the surrounding higher level land and as a result of tide-locked agricultural drainage networks.

Currently, this sub-area has 72 properties at risk in the 1% annual probability flood extent. This is expected to increase to 133 properties in the future extent. Flood risk from tidal flooding through overtopping or a breach of the coastal flood defence walls, embankments and outfall controls is addressed in the Severn Estuary Shoreline Management Plan.

The vision and preferred policy

Policy Option 3 - we are generally managing existing flood risk effectively.

The current flood risk management activities carried out for the flooding problems are considered appropriate and acceptable for the level of risk.

At the present time we cannot generally justify increasing actions to address climate change or reduce flood risks further. The scattered nature of the problems makes such investment unlikely to be economic or sustainable.

Flood flows due to breaches in embankments are considered hazardous to life and therefore continued embankment maintenance (especially of the Congresbury Yeo) in the future is necessary. This sub-area is rich in environmental designations. These designations are water-based. Some moors rely on frequent flood events for their water-based environmental designations to remain in a healthy state.

Proposed actions to implement the preferred policy

Continue with existing flood risk management activities in Nailsea, Yatton and Wrington, including:

- Routine inspection and maintenance of river channels, flood walls/embankments, and the urban sewer system;
- Reactive maintenance such as unblocking of structures when required;
- Using the planning process to discourage re-development, encourage relocation and limit intensification of development in areas with a higher probability of flooding;
- Encourage the use of SuDS on all new developments and redevelopments.

Develop System Asset Management Plans (SAMP). Where appropriate, separate flood risk management costs. In many cases the current annual costs of non-tidal flood risk management in Puxton, Kenn and Tickenham are associated with other activities (such as water level management, conservation objectives, legal over-rides and fisheries) and flood risk benefits from the activities.

Where work is carried out purely for FCRM, assess the level of this against annual average damages of flooding, including the impact of climate change and water level management activities. If appropriate, make recommendations for improving the efficiency of existing activities and implement

Continue to support the implementation of water level management plans in the Puxton, Kenn and Tickenham areas by:

- ensuring that those responsible parties are identified and aware of their actions; and
- working with key stakeholders to seek improvements in the efficiency of water level management operations.

↑ Looking across Weston Moor from Weston in Gordano

Levels and Moors Towns

Our key partners are:

- Sedgemoor District Council
- Mendip District Council
- Somerset County Council
- Emergency Services
- Wessex Water
- Land managers
- Department for Environment, Food and Rural Affairs

The issues in this sub-area

This sub-area includes the towns of Cheddar, Glastonbury, Wells and Shepton Mallet.

The main risks are from river flooding in Wells, from the Cheddar Yeo in Cheddar, the River Sheppey in Shepton Mallet and the Millstream in Glastonbury.

Risks also occur from surface water flooding from surrounding hill slopes and from an under capacity of the urban drainage network.

Currently, the towns have a total of 225 properties at risk in the 1% annual probability flood extent. This is expected to increase to 900 properties at risk in the future extent.

Groundwater resulting from springs emerging from the foot of permeable geology slopes can cause problems in Cheddar.

The vision and preferred policy

Policy Option 4 - we are already managing the flood risk effectively, but we may need to take further actions to keep pace with climate change.

The current level of river flood risk is low. However, flood depths and velocities are expected to increase. As a result there is the potential for hazard and risk to life to increase. The social consequences of river flooding are significant. A significant increase in surface water flooding is also expected.

Climate change (in increased flows) and urban drainage surface water incidents could significantly increase future levels of flood risk to an unacceptable level.

Proposed actions to implement the preferred policy

Liaise with key stakeholders to:

- understand and review existing flood risk management activities undertaken in Wells, Shepton Mallet and Glastonbury;
- develop and implement a system for monitoring, recording and sharing information on flooding from other sources (sewer/surface water) in order to establish baseline information and measure the impacts of climate change.
- Develop and implement a strategy to manage the potential impacts of climate change on combined surface water, sewer and river flooding in the urban and highway drainage systems in Cheddar and Glastonbury.
- revise options appraisal and recommendations for flood risk management in Cheddar paying particular attention to the 2006 and 2008 flood events and the potential impacts of climate change, in light of a policy to sustain the current scale of flood risk into the future. Implement recommendations.

Undertake a study to investigate the potential for flood warning service to be introduced in Cheddar, Shepton Mallet, Wells and surrounding villages. Consider the use of rainfall forecasting techniques in place of water level or flow gauge data for triggering flood warnings. Based on the outcomes of the study, implement a flood warning system.

Prepare a flood emergency plan for Cheddar, Wells and Shepton Mallet taking account of the potential impacts of climate change and including scenarios of sewer flooding and overtopping or a breach of sluice gates in the urban river system and include procedures for protecting the heritage sites in Wells.

Until strategy is completed, continue with existing flood risk management activities.

Encourage the use of Sustainable Drainage Systems on all new developments and redevelopments.Use the planning process to discourage re-development, encourage relocation and limit intensification of development in areas with a high risk of flooding.

↑ The Cheddar Yeo flowing through the town of Cheddar.

Levels and Moors

Our key partners are:

- South Somerset District Council
- Sedgemoor District Council
- Mendip District Council
- Somerset County Council
- Internal Drainage Boards
- Natural England
- The Royal Society for the Protection of Birds
- Wessex Water
- National Farmers Union
- Farming and Wildlife Advisory Group
- Land managers
- Department for Environment, Food and Rural Affairs

The issues in this sub-area

Numerous isolated properties, major roads, including the M5, and the Bristol to Exeter railway line are at risk from river flooding combined with surface water flooding and tidally influenced river flooding (caused by tide locking).

River flooding occurs when the capacity of the river and rhyne network is exceeded after long periods of rainfall. Flooding occurs relatively slowly, at a shallow depth, and over a wide area. Floodwaters remain for a considerable length of time due to the flat topography and slow drainage. Flooding also occurs if the embankments along the main river channels fail. This type of flooding is more hazardous to properties close to the breach as there is less warning, and flood flows and velocities are higher. Surface water run-off from the sloping topography and urban drainage surface water flooding from under capacity drainage networks are also issues.

Currently the sub-area has 165 properties at risk of flooding in the 1% annual probability flood event. This is expected to increase to 215 properties in the future extent.

The vision and preferred policy

Policy Option 3 - we are generally managing existing flood risk effectively.

The current level of flood risk is low, including very few isolated properties being affected and it is not expected to increase in the future.

The current flood risk management activities carried out for the surface water flooding problems are considered appropriate and acceptable for the level of risk.

Flood flows due to breaches in embankments are considered hazardous to life, and this is a major focus for maintenance now and in the future

Environmental designations affected are water-based and rely on frequent flood events to remain in a healthy state. Flooding is not expected to negatively affect these sites now or in the future and in most cases additional flooding would be beneficial.

Proposed actions to implement the preferred policy

Continue with existing flood risk management activities. This includes:

- Working with Local Council's to undertake routine inspection, maintenance and upgrade of urban/land drainage system in Wedmore and Polden HIlls;
- Routine inspection and maintenance of river channels, flood walls/embankments, and the urban sewer system in the Huntspill area;
- Reactive maintenance such as unblocking when required;
- Encourage the use of SuDS on all new developments and redevelopments;
- Continuing to promote catchment sensitive farming around Wedmore.

- Use the planning process to discourage re-development, encourage relocation and limit intensification of development in areas of high risk of flooding around Huntspill;

Undertake an investigation to identify opportunities to work with environmental organisations to integrate day to day flood management with environmental management.

Carry out a study to identify opportunities to link flood management with priority restoration/enhancement of Biodiversity Action Plan habitats, internationally/nationally designated environment sites and national nature reserves and produce 'opportunity maps'.

Work with farming related bodies to identify and promote adaptive farming techniques in floodplain areas.

Through the development of System Asset Management Plans (SAMPs), identify the current annual costs of non-tidal flood risk management in North, South Drain and River Brue, compared with the costs of other activities (such as water level management, legal over-rides and fisheries).

Improve the efficiency of existing flood risk management activities in line with the recommendations.

Support implementation of water level management plans by:

- ensuring that responsible parties are identified and aware of their actions; and
- work with key stakeholders to seek improvements in the efficiency of water level management operations.

Whilst the studies are being undertaken, continue with existing flood risk management activities in North, South Drain and River Brue areas. This includes:

- Routine inspection and maintenance of river channels and rhynes, including weed-cutting;
- Operation of water level management structures in line with existing plans, including operation of the large pumping stations at North Drain and Gold Corner;
- Routine inspection and maintenance of flood defence embankments on the main rivers and on small-scale private flood defence schemes;
- Flood warning service on the River Brue.

The River Brue near Clewer

Uplands

Our key partners are:

- South Somerset District Council
- Mendip District Council
- North Somerset Unitary Authority
- Bath and North East Somerset Unitary Authority
- Somerset County Council
- Internal Drainage Boards
- Natural England
- Wessex Water
- National Farmers Union
- Farming and Wildlife Advisory Group
- Land managers

The issues in this sub-area

This sub-area is essentially rural, featuring forestry and all grades of agricultural land. The sub-area is rich in environmental and landscape designations.

The main source of flooding is surface water and flooding from rivers which are small in nature. Being of permeable geology, the percentage run-off from land in the northern portion is generally low, although steep slopes in some areas can increase run-off rates locally. In the southern portion the less permeable geology can result in higher run-off rates and the steep topography can resist the extent of flood flows causing water levels to rise quickly, with little roaming. The catchments in this area are small, resulting in relatively small peak flows.

Currently 27 properties are at risk of flooding in the 1% annual probability flood extent. This is likely to increase to around 30 properties in the future extent.

The vision and preferred policy

Policy Option 1 - we will continue to monitor and advise.

We do not currently undertake any flood risk management in this sub-area. We are not aware of any other Stakeholders undertaking flood risk management in this sub-area although it is possible that very small scale activities are carried out and some areas to protect individual properties from surface water flooding. Given the generally permeable geology and sparse population, we do not expect a significant number of properties to be affected in the future.

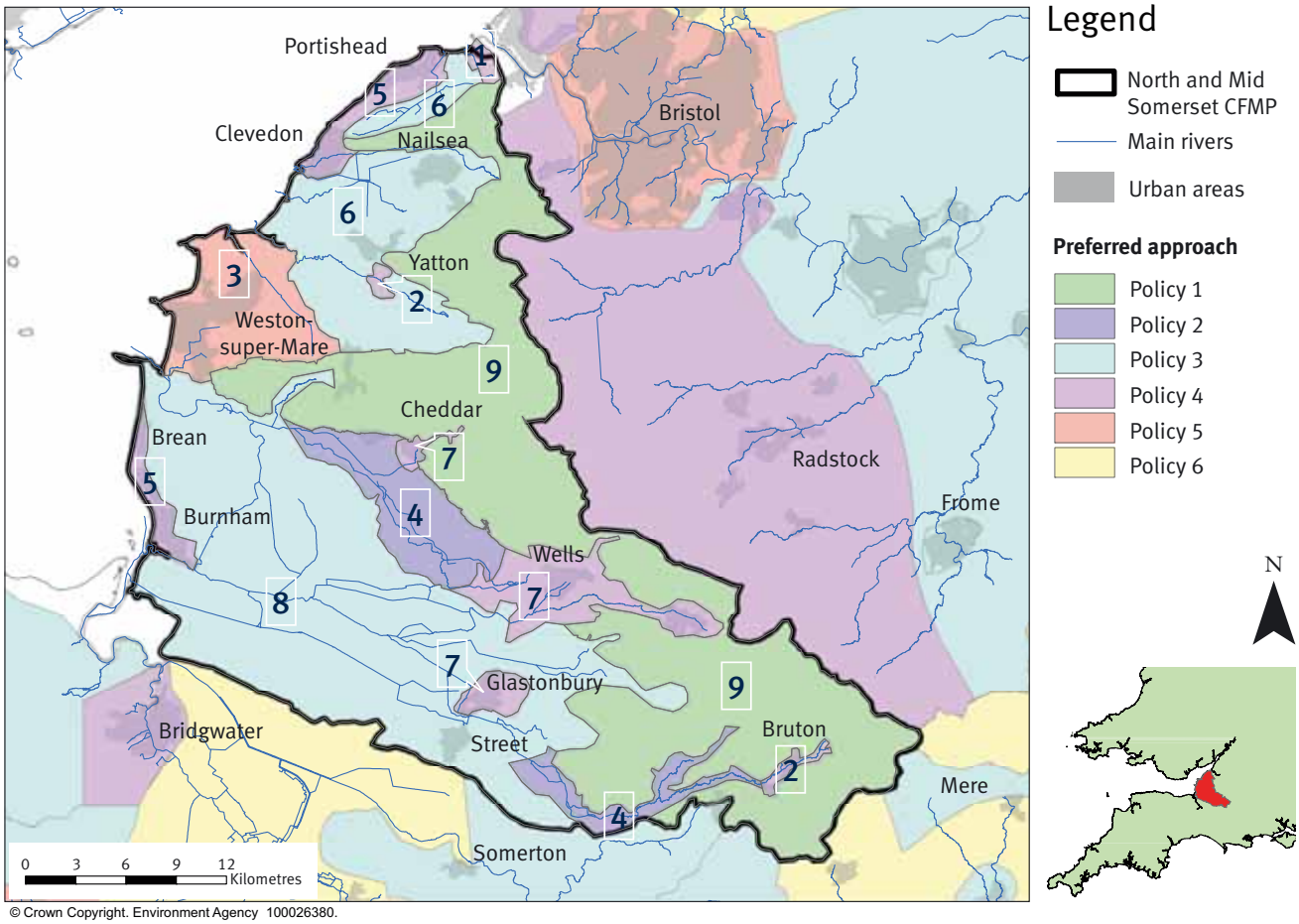
No critical infrastructure sites are expected to be affected during the 1% annual event probability flood, although there may be some localised flooding of roads.

Proposed actions to implement the preferred policy

No specific actions have been identified in this sub-area. We will continue to monitor and advise.

Map of CFMP policies

Map of the policies in the North and Mid Somerset catchment



The sub-areas

1 Portbury
2 Congresbury and Bruton
3 Weston-super-Mare
4 River Axe and River Brue
5. Coastal Towns
6. North Somerset Moors
7. Levels and Moors Towns
8. Levels and Moors
9. Uplands

Would you like to find out more about us, or about your environment?

Then call us on

08708 506 506* (Mon-Fri 8-6)

email

enquiries@environment-agency.gov.uk

or visit our website

www.environment-agency.gov.uk

incident hotline 0800 80 70 60 (24hrs)
floodline 0845 988 1188

*** Approximate call costs: 8p plus 6p per minute (standard landline). Please note charges will vary across telephone providers.**

Environment first: Viewing this on-screen? Please consider the environment and only print if absolutely necessary.
If you're reading a paper copy, please don't forget to reuse and recycle.

GESW0612BWPS-E-E

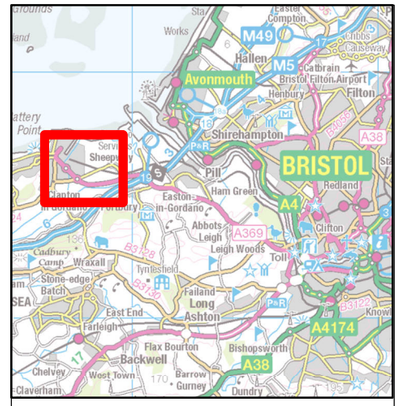
MetroWest

Portishead Branch Line (MetroWest Phase 1)

TR040011

Applicant: North Somerset District Council
5.6, Flood Risk Assessment,
Appendix D Environment Agency susceptibility to groundwater flood map
The Infrastructure Planning (Applications: Prescribed Forms and Procedure) Regulations 2009, regulation 5(2)(e)
Planning Act 2008

Author: CH2M
Date: November 2019



KEY

- Order Limits
- WFD - River Waterbody
- 18 tonne slew. Access to inland bund & vertical wall. Need to retain access

Portishead Branch Line

- The Nationally Significant Infrastructure Project (NSIP) Works

Areas Susceptiple to Ground Water Flooding

- < 25%
- >= 25% <50%
- >= 50% <75%

0 250 500
Metres

Rev	By	Chkd	Apprvd	Date	Description
ES-A	MPC	RB	CF	14/10/2019	First draft

Client

travelwest
Bath & North East Somerset, Bristol, North Somerset and South Gloucestershire Councils working together to improve your local transport

CH2M HILL
Geospatial
Burderop Park, Swindon, SN4 0QD
Tel: +44 (0)1793 812479 Fax: +44 (0)1793 812089
www.ch2m.com

Project :
Portishead Branch Line
(MetroWest Phase 1)

Drawing :
Appendix D Figure 1
Environment Agency Areas
Susceptible to Groundwater Flooding Data

Drawn By :	Martin Costello	Date: 14/10/2019
Checked By :	Rober Bird	Date: 14/10/2019
Approved By :	Carolyn Francis	Date: 14/10/2019

Drawing No. : 674946-005-005 - 1
Revision : ES-A

Drawing Scale : 1:10,000

Document Path: \\swin-fs-06\Consulting\we\Environmental_Assessment\Projects\MetroWest Phase 1\GIS\MXDs\Water\490327-004-001-A_DCO_Groundwater_Flood_Susceptibility_v2.mxd

KEY

- Order Limits
- WFD - River Waterbody

Portishead Branch Line

- The Nationally Significant Infrastructure Project (NSIP) Works
- The Associated Development Works

Existing Railway

- Existing Railway Line

Areas Susceptiple to Ground Water Flooding

- < 25%
- >= 25% <50%
- >= 50% <75%
- >= 75%

0 250 500
Metres

Rev	By	Chkd	Apprvd	Date	Description
ES-A	MPC	RB	CF	14/10/2019	First draft

Client

travelwest
Bath & North East Somerset, Bristol, North Somerset and South Gloucestershire Councils working together to improve your local transport

CH2M HILL
Geospatial
Burderop Park, Swindon, SN4 0QD
Tel: +44 (0)1793 812479 Fax: +44 (0)1793 812089
www.ch2m.com

Project :
Portishead Branch Line
(MetroWest Phase 1)

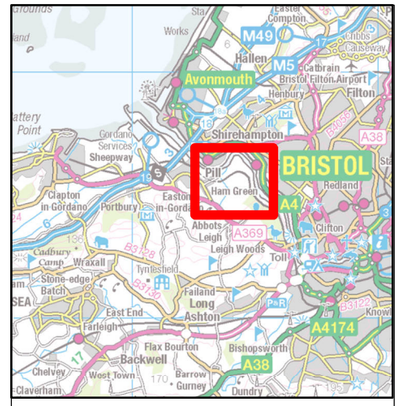
Drawing :
Appendix D Figure 1
Environment Agency Areas
Susceptible to Groundwater Flooding Data

Drawn By :	Martin Costello	Date: 14/10/2019
Checked By :	Rober Bird	Date: 14/10/2019
Approved By :	Carolyn Francis	Date: 14/10/2019

Drawing No. : 674946-005-005 - 2
Revision : ES-A

Drawing Scale : 1:10,000

Document Path: \\swin-fs-06\Consulting\we\Environmental_Assessment\Projects\MetroWest Phase 1\GIS\MXDs\Water\490327-004-001-A_DCO_Groundwater_Flood_Susceptibility_v2.mxd



KEY

- Order Limits
- WFD - River Waterbody

Portishead Branch Line

- The Nationally Significant Infrastructure Project (NSIP) Works
- The Associated Development Works
- Section in Tunnel

Existing Railway

- Existing Railway Line

Areas Susceptiple to Ground Water Flooding

- < 25%

0 250 500

Metres

Rev	By	Chkd	Apprvd	Date	Description
ES-A	MPC	RB	CF	14/10/2019	First draft

Client

travelwest

Bath & North East Somerset, Bristol, North Somerset and South Gloucestershire Councils working together to improve your local transport

CH2M HILL
Geospatial
Burderop Park, Swindon, SN4 0QD
Tel: +44 (0)1793 812479 Fax: +44 (0)1793 812089
www.ch2m.com

Project :

Portishead Branch Line
(MetroWest Phase 1)

Drawing :

Appendix D Figure 1
Environment Agency Areas
Susceptible to Groundwater Flooding Data

Drawn By :	Martin Costello	Date: 14/10/2019
Checked By :	Rober Bird	Date: 14/10/2019
Approved By :	Carolyn Francis	Date: 14/10/2019

Drawing No. :
674946-005-005 - 3

Revision
ES-A

Drawing Scale : 1:10,000

Document Path: \\swin-fs-06\Consulting\we\Environmental_Assessment\Projects\MetroWest Phase 1\GIS\MXDs\Water\490327-004-001-A_DCO_Groundwater_Flood_Susceptibility_v2.mxd

N

CUTLINE

CUTLINE

KEY

Order Limits

Portishead Branch Line

The Associated Development Works

Section in Tunnel

Existing Railway

Existing Railway Line

Areas Susceptiple to Ground Water Flooding

< 25%

0 250 500

Metres

Rev	By	Chkd	Apprvd	Date	Description
ES-A	MPC	RB	CF	14/10/2019	First draft

Client

travelwest

Bath & North East Somerset, Bristol, North Somerset and South Gloucestershire Councils working together to improve your local transport

CH2M HILL
Geospatial
Burderop Park, Swindon, SN4 0QD
Tel: +44 (0)1793 812479 Fax: +44 (0)1793 812089
www.ch2m.com

Project :

Portishead Branch Line
(MetroWest Phase 1)

Drawing :

Appendix D Figure 1
Environment Agency Areas
Susceptible to Groundwater Flooding Data

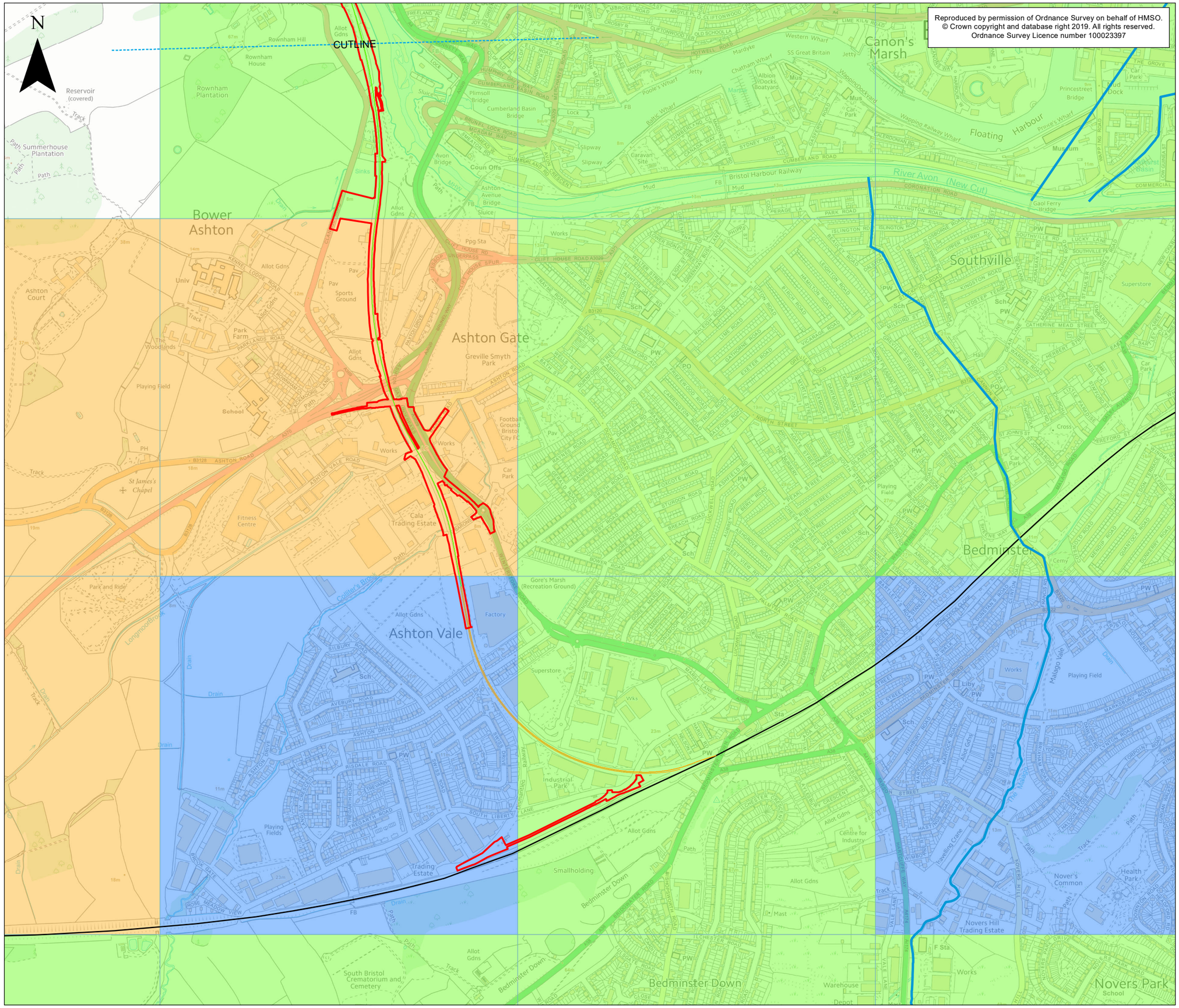
Drawn By :	Martin Costello	Date: 14/10/2019
Checked By :	Rober Bird	Date: 14/10/2019
Approved By :	Carolyn Francis	Date: 14/10/2019

Drawing No. : 674946-005-005 - 4

Revision ES-A

Drawing Scale : 1:10,000

Document Path: \\swin-fs-06\Consulting\we\Environmental_Assessment\Projects\MetroWest Phase 1\GIS\MXDs\Water\490327-004-001-A_DCO_Groundwater_Flood_Susceptibility_v2.mxd



KEY

Order Limits

WFD - River Waterbody

Portishead Branch Line

The Associated Development Works

Other Works

Network Rail Permitted Development Rights

Existing Railway

Existing Railway Line

Areas Susceptiple to Ground Water Flooding

< 25%

>= 25% <50%

>= 50% <75%

0 250 500

Metres

ES-A	MPC	RB	CF	14/10/2019	First draft
Rev	By	Chkd	Apprvd	Date	Description

Client

travelwest

Bath & North East Somerset, Bristol, North Somerset and South Gloucestershire Councils working together to improve your local transport

CH2M HILL
Geospatial
Burderop Park, Swindon, SN4 0QD
Tel: +44 (0)1793 812479 Fax: +44 (0)1793 812089
www.ch2m.com

Project :

Portishead Branch Line
(MetroWest Phase 1)

Drawing :

Appendix D Figure 1
Environment Agency Areas
Susceptible to Groundwater Flooding Data

Drawn By :	Martin Costello	Date: 14/10/2019
Checked By :	Rober Bird	Date: 14/10/2019
Approved By :	Carolyn Francis	Date: 14/10/2019

Drawing No. : 674946-005-005 - 5

Revision ES-A

Drawing Scale : 1:10,000

Document Path: \\swin-fs-06\Consulting\we\Environmental_Assessment\Projects\MetroWest Phase 1\GIS\MXDs\Water\490327-004-001-A_DCO_Groundwater_Flood_Susceptibility_v2.mxd

MetroWest

Portishead Branch Line (MetroWest Phase 1)

TR040011

Applicant: North Somerset District Council
5.6, Flood Risk Assessment,
Appendix E Environment Agency updated Flood Map for Surface Water Flooding
The Infrastructure Planning (Applications: Prescribed Forms and Procedure) Regulations 2009, regulation 5(2)(e)
Planning Act 2008

Author: CH2M
Date: November 2019

Updated Flood Map for Surface Water – Basic Package – Product Description

WHAT IS THE UPDATED FLOOD MAP FOR SURFACE WATER

A map of flood risk from surface water for England and Wales produced using updated national scale modelling, enhanced with compatible locally produced mapping where available.

Shows areas at risk of flooding from surface water, for three chances of flooding. It also includes:

- data on the models used to develop the maps
- information that describes the suitable uses of the data.

This Flood Map for Surface Water supersedes earlier EA national scale maps made available to local resilience forum and local planning authority partners. These were Areas Susceptible to Surface Water Flooding (2008/9) and Flood Map for Surface Water (2010).

HOW WAS IT PRODUCED

Method	The national scale model uses a detailed model of the ground to see where rain water flows and ponds, taking account of a range of storm durations, infiltration into the ground, hydraulics, and, in broad terms, subsurface drainage. Lead Local Flood Authorities (LLFAs) have provided compatible detailed surface water mapping where this is available and where it is more representative, and this replaces the national scale mapping in these locations. A suitability rating has been assigned based on the applicability of the model, the input data quality and, where available, an LLFA review of the maps against recorded or known flood risk. Find out more
Investment (£)	Including the underlying data, we have spent: • National scale surface water model development £1m + • Survey (not exclusively for uFMfSW) £20m + Data from 32 local models (for version 1 of uFMfSW) has also been included but not included in these costs.

DATA CONTENT

A File Geodatabase containing the following feature classes, based on a grid of 2m x 2m cells, for each of the **1 in 30 (3.3%)**, **1 in 100 (1%)** and **1 in 1000 (0.1%)** chances of flooding in any given year:

- **Flood extent** – the extent of land that could be affected by a flood of a given chance

Each cell has also been assigned a suitability rating to show what scale the data is generally appropriate to be used at to assess flood risk from surface water. Find out more.

A model details layer gives the properties of any underlying local models used to develop the local mapping – for example, the type of model software and model input data used.

Update Frequency	The map will be updated as more local mapping becomes available. Frequency of updates is likely to be confirmed in spring 2014.

USING uFMfSW

Strengths	• Model resolution of 2 metres • Three storm durations modelled for each of three flood probabilities • Infiltration rates take account of land use and soil type • High quality ground levels

	• Local mapping incorporated where it is compatible and available (32 locations for version 1) • Nationally consistent data for comparing risk from surface water flooding in different places • Local validation by Lead Local Flood Authorities where flood records were available
Limitations	A single drainage rate has been assumed for all urban areas within the national scale modelling. Large subsurface drainage elements such as flood relief culverts and flood storage are not included. These assumptions can affect the modelled extent and pattern of flooding. Limited recorded surface water flood data exists for LLFAs to perform validation, so in many places no validation has yet been carried out. As with many other flood models: • The input information, model performance and modelling that were used to create the uFMfSW vary for different areas; these affect the reliability of the mapped flood extents and, in turn, the suitability for different applications • uFMfSW does not take individual property threshold heights into account. • The flood extents show predicted patterns of flooding based on modelled rainfall. In reality, no two storms are the same, and so two floods of similar rarity may result in different patterns of flooding and consequently these maps cannot definitively show that an area of land or property is, or is not, at risk of flooding. Find out more
Companion Datasets	The following datasets relate primarily to flood risk from rivers and sea but may complement the uFMfSW: • Flood Map layers • Historic flood event outlines • NaFRA postcode dataset • NaFRA property dataset • Spatial flood defences
PUBLIC ACCESS TO THIS INFORMATION	
The public can view a simplified version of the Updated Flood Map for Surface Water (basic) data on the Environment Agency's website. It is a map called "Risk of Flooding from Surface Water".	
If you would like a sample of the uFMfSW basic package or to find out more please contact data.info@environment-agency.gov.uk.	

How the national scale model for uFMfSW (basic) is produced

1. A bare earth ground model is produced for all of England & Wales. This shows the height of the ground divided into 2m squares allowing small scale features that affect flood patterns, such as paths between buildings to be represented.

    a. The ground height is typically raised by around 0.3m to represent building footprints
    b. The ground model is edited to include flow paths through structures such as bridges and rail embankments.
    c. Road surfaces were lowered by the kerb height so they were better represented as flood flow paths.
    d. Ground roughness was varied to take into account different land use and its effect on flow.

2. Total rainfall depths are calculated for all of England & Wales divided into 5km squares using:

    a. Rainfall probabilities of 1 in30, 1 in 100 and 1 in 1000 chance of occurring in any year
    b. Storm durations of 1, 3 and 6 hours
    c. The 50% summer rainfall profile

    These are then adjusted to take into account infiltration (urban / rural area split) and drainage (single amount removed in all urban areas).

3. The effect of the remaining rainfall is modelled across the edited ground surface to see where it flows and ponds and therefore the extent of flooding. Buildings are represented in such a way that water can flow through them once the depth exceeds the 0.3m the footprints have been raised by.

4. We validated the results from the computer model using historical observations and local modelling data in 3 pilot areas.

Deciding whether to include local authority information

1. We set minimum standards which locally produced information should meet for it to be compatible with the updated flood map for surface water. These standards cover the same things as how the national model was produced, e.g. the local model needs to have taken account of drainage and buildings.
2. Lead Local Flood Authorities were asked to review the national scale mapping alongside historic flooding information and local knowledge before submitting their information for inclusion in the updated flood map for surface water.
3. As part of LLFA review they:
    a. Used local recorded flood data to identify areas that are known to flood, and to highlight unexpected patterns of flooding
    b. Identified how confident they are in the national mapping
    c. Compared locally produced information with the national scale mapping to determine which mapping is more representative for each area

How reliable are the surface water results?

The results should not be used to understand flood risk for individual properties. In some places the results should only be used for high level risk assessments – comparing risk between towns and counties – whilst in other places the results are more reliable and can be used to understand risk at street level. These different levels of reliability are assigned to 50m x 50m cells, and are set out in the table below.

How have we estimated how reliable the results are?

We considered each 50m x 50m impact cell using a nationally consistent method.

Using this method, a default 'suitability' value was assigned to reflect how confident we are that each impact cell has been assigned the correct likelihood category, broadly based on:

- how well we think the computer flood model performs in that location
- how good the input data, e.g. water levels, defence levels is for the location.

LLFAs were invited to review these 'suitability' default values, and had the opportunity to change them where they had appropriate evidence to do so.

Suitability: 'it's good enough for...'		Reliability: 'how good is it for...'		Typical Applications
Indicative suitable scale	Indicative suitable use	How reliable is this for a local area?	How reliable is this for an individual property?	
National to county - suitable for identifying which parts of countries or counties are at risk, or which countries or counties have the most risk.	Suitable for identifying areas with a natural vulnerability to flood first, deepest or most frequently.	Very unlikely to be reliable for a local area.	Extremely unlikely to be reliable for identifying individual properties at risk.	SWMP strategic level assessment prioritising areas for further modelling
County to town - suitable for identifying which parts of counties or towns are at risk, or which counties or towns have the most risk.	Suitable for identifying approximate extents, shallower and deeper areas.	Unlikely to be reliable for a local area.	Very unlikely to be reliable for identifying individual properties at risk.	National or regional scale property counts; identifying likelihood of flooding at multiple streets / parts of community scale; SWMP intermediate assessment
Town to street - suitable for identifying which parts of towns or streets are at risk, or which towns or streets have the most risk.	Suitable for identifying flood extents, approximate depth of flooding, and identifying streets at risk of flooding.	Likely to be reliable for a local area (and so the information is suitable for areas of land, not individual properties).	Unlikely to be reliable for identifying individual properties at risk (and so the information is suitable for areas of land, not individual properties).	Local property counts; SWMP intermediate assessment; identifying likelihood of flooding at street scale (i.e. which streets)
Street to parcels of land - suitable for identifying which parts of streets or parcels* of land are at risk, or which streets or parcels of land have the most risk.	Suitable for identifying flood extents, depths and approximate velocities.	Very likely to be reliable for a local area (and so the information is suitable for areas of land, not individual properties).	Likely to be reliable for identifying individual properties at risk (though not whether they flood internally, so the information is suitable for areas of land, not individual properties).	Identifying which parts of a street are at risk (but not individual properties); SWMP detailed assessment; drainage system design and evaluation
Property (including internal) - suitable for identifying which parts of a property are at risk (including internal / external distinction), or which properties have the most risk.	Suitable for identifying flood extents, depths, velocities, and distinguishing between street and property flooding.	Extremely likely to be reliable for a local area.	Likely to be very reliable at identifying individual properties at risk, including depths of flooding internally (this provides a genuine property level assessment).	Depth and velocity of flooding at property scale; SWMP detailed assessment; drainage system design and evaluation

uFMfSW Limitations

Flood estimation is not an exact science and any flood risk assessment needs to be understood and used in that context.

The data should only be used as a first step in assessing flood risk and we strongly recommend that it is used in conjunction with other flooding information and mapping products which may be available from other sources.

Each of our flood risk maps is an assessment of flood risk from one or two sources of flooding, and shows the likelihood of flooding from that source (or those sources).

A full picture of the likelihood of flooding at any location will need to take into consideration all sources of flooding at that site.

However the total overall likelihood of flooding cannot be calculated by simply adding the likelihood of flooding from different individual flood risk assessments or flood risk maps. This is because there are dependencies between the weather conditions which generate flooding from these different sources.

The Environment Agency is investigating ways to provide information on flooding from all sources in the future.

The results are not suitable for property level assessment. The uFMfSW can only provide an indication of the likelihood of flooding and further information is required to determine the actual impact on a specific property.

It only presents a current day scenario.

It does not show flooding that occurs from:

- Overflowing watercourses
- Drainage systems or public sewers
- River flow or
- Groundwater

It does not include:

- the presence or effect of pumping stations in catchments with pumped drainage
- any allowance for tide locking, high levels or fluvial levels where sewers cannot discharge

A single drainage rate has been assumed for all urban areas within the national scale modelling. Modelled flood extents are particularly sensitive to the drainage rate used. The omission of large subsurface drainage elements such as flood relief culverts and flood storage can also affect the modelled pattern of flooding.

Limited recorded surface water flood data exists for LLFAs to perform validation, so in many places no validation was carried out.

Suitability for different applications varies in areas due to the different input information, model performance and modelling that was used to create the uFMfSW.

uFMfSW Improvements / Update frequency

We intend to update the map as new information becomes available. However we have not yet agreed with Lead Local Flood Authorities and others how often an update will be made available. Users are therefore strongly advised to ensure they are referring to the most current information by checking with the relevant Lead local Flood Authority.

Data Specifications

The tables below contain the data specifications for the uFMfSW Basic Package. They describe the geometry, file format and also the attributes of the data.

Data Specification for uFMfSW Basic Package (ESRI File Geodatabase)

Dataset	Filename	Format	Geometry	Attributes*
1 in 1000 Flood Extent	uFMfSW_{OSREF}_EXTENT_1in1000_BV	Feature class	Polygon	PUB_DATE
1 in 100 Flood Extent	uFMfSW_{OSREF}_EXTENT_1in100_BV	Feature class	Polygon	PUB_DATE
1 in 30 Flood Extent	uFMfSW_{OSREF}_EXTENT_1in30_BV	Feature class	Polygon	PUB_DATE
Suitability (Merged Grid Cells)	uFMfSW_{OSREF}_Suitability_Merged	Feature class	Polygon	SUITABILITY, PUB_DATE
Model Details	uFMfSW_Model_Details	Feature class	Polygon	ID, Name, Data_own, Dom_ref, Mod_name, Descrip, Mod_date, Mod_type, Mod_soft, Hyd_type, DTM, DTM_res, Mod_grid, Stor_Dur, Sewer, Manning, Build, Debris, Confid, Comments

* See tables below for attribute specifications

Attribute Details for uFMfSW Datasets

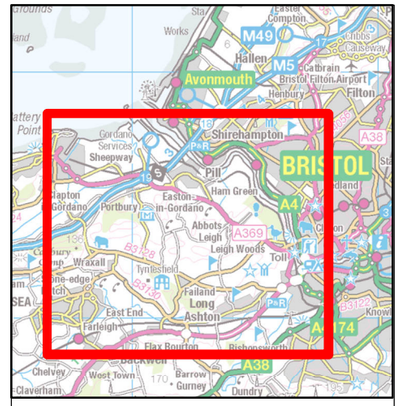
PUB_DATE	
Description	The date first published
Field Type	Date
VALUE	
Mar 2013 *[for v0 data]*	
Sept 2013 *[for v1 data]*	

SUITABILITY	
Description	Indication of the scale at which is it generally appropriate to use this information to assess flood risk.
Field Type	Text
VALUE	
National to County	
County to Town	
Town to Street	
Street to Parcels of land	
Property (inc. internal)	

Attribute Details for Model Details Dataset

Dataset Attribute	Attribute Name	Description	Format	Values
ID	ID (Auto-generated by review website)	Unique identifier for LLFA feedback record	Text	-
Name	LLFA name	Attribute containing full LLFA name who submitted locally produced modelling	Text	[LLFA Name]
Data_own	Data owner	Attribute containing data ownership details for locally produced modelling - LLFA name, or 3rd party name (if applicable)	Text	[Data owner]
Dom_ref	Model domain reference	Attribute containing a unique reference for the locally produced modelling	Text	[xxxxName_yyyy_mm] <8 letter locality of model>_<year of model completion>_<month of model completion>
Mod_name	Model name	Attribute containing the name of the local model including reference to location	Text	[Model name]
Descrip	Description	Attribute containing a description of the reason for creating the locally produced modelling	Text	[Description]
Mod_date	Model completion date	Attribute containing the model completion date (or the last update to the model) for the locally produced modelling	Text	[Model completion date]
Mod_type	Model type	Attribute containing type of model used for the locally produced modelling	Text	[Model type]
Mod_soft	Model software	Attribute containing the name of the modelling software used for the locally produced modelling	Text	[Model software]
Hyd_type	Hydrology type	Attribute containing the name/type of hydrology used for the locally produced modelling	Text	[Hydrology type]
DTM	Source digital terrain model	Attribute containing the source of digital terrain model used for the locally produced modelling	Text	"EA Composite DTM" "LIDAR EA" "LIDAR Other" "NextMap" "Other DTM"
DTM_res	Source DTM resolution	Attribute containing the grid resolution of the digital terrain model used for the locally produced modelling	Text	[Source DTM resolution]
Mod_grid	Model grid resolution	Attribute containing the resolution of the model grid for the locally produced modelling	Text	[Model grid resolution]
Stor_Dur	Storm duration	Attribute containing the rainfall storm durations used for the locally produced modelling	Text	[Storm duration]
Sewer	Representation of sub-surface drainage	Attribute containing information about how sub-surface drainage has been represented in the locally produced modelling	Text	[Representation of sub-surface drainage]
Manning	Surface roughness values	Attribute containing how the source of information on surface roughness was	Text	[Surface roughness values]

Dataset Attribute	Attribute Name	Description	Format	Values
		defined according to land use for the locally produced modelling		
Build	Representation of buildings	Attribute containing information on how the buildings in urban areas were represented in the locally produced modelling	Text	[Representation of buildings]
Debris	Debris factor	Attribute containing the debris factor(s) used in calculating hazard rating as defined in Defra R&D paper on risks to people (where Hazard rating = depth x (velocity + 0.5) + debris factor) for the locally produced modelling	Text	[Debris factor]
Confid	Confidence score	Attribute containing confidence score assigned to locally produced modelling	Text	"1" "2" "3" "4" "5"
Comments	Comments	Attribute containing other details about locally produced modelling	Text	[Comments]



KEY

Order Limits

Portishead Branch Line

The Nationally Significant Infrastructure Project (NSIP) Works

The Associated Development Works

Section in Tunnel

Other Works

Network Rail Permitted Development Rights

Existing Railway

Existing Railway Line

uFMfSW Suitability

County to Town

National to County

Street to Parcels of land

Town to Street

0 500 1,000

Metres

Rev	By	Chkd	Apprvd	Date	Description
ES-A	MPC	RB	CF	14/10/2019	First draft

Client

travelwest

Bath & North East Somerset, Bristol, North Somerset and South Gloucestershire Councils working together to improve your local transport

CH2M HILL
Geospatial
Burderop Park, Swindon, SN4 0QD
Tel: +44 (0)1793 812479 Fax: +44 (0)1793 812089
www.ch2m.com

Project :

Portishead Branch Line (MetroWest Phase 1)

Drawing :

Appendix E Figure 1
Environment Agency Updated Flood Map for Surface Water: Indicative Suitability Classification

Drawn By :	Martin Costello	Date: 14/10/2019
Checked By :	Rober Bird	Date: 14/10/2019
Approved By :	Carolyn Francis	Date: 14/10/2019

Drawing No. : 674946-005-100

Revision ES-A

Drawing Scale : 1:35,000

Document Path: \\swin-fs-06\Consulting\we\Environmental_Assessment\Projects\MetroWest Phase 1\GIS\MXDs\Water\674946-005-100-A_DCO_uFMfSW_Suitability_v1.mxd

MetroWest

Portishead Branch Line (MetroWest Phase 1)

TR040011

Applicant: North Somerset District Council
5.6, Flood Risk Assessment,
Appendix F Flood risk information provided by NSDC and BCC
The Infrastructure Planning (Applications: Prescribed Forms and Procedure) Regulations 2009, regulation 5(2)(e)
Planning Act 2008

Author: CH2M
Date: November 2019

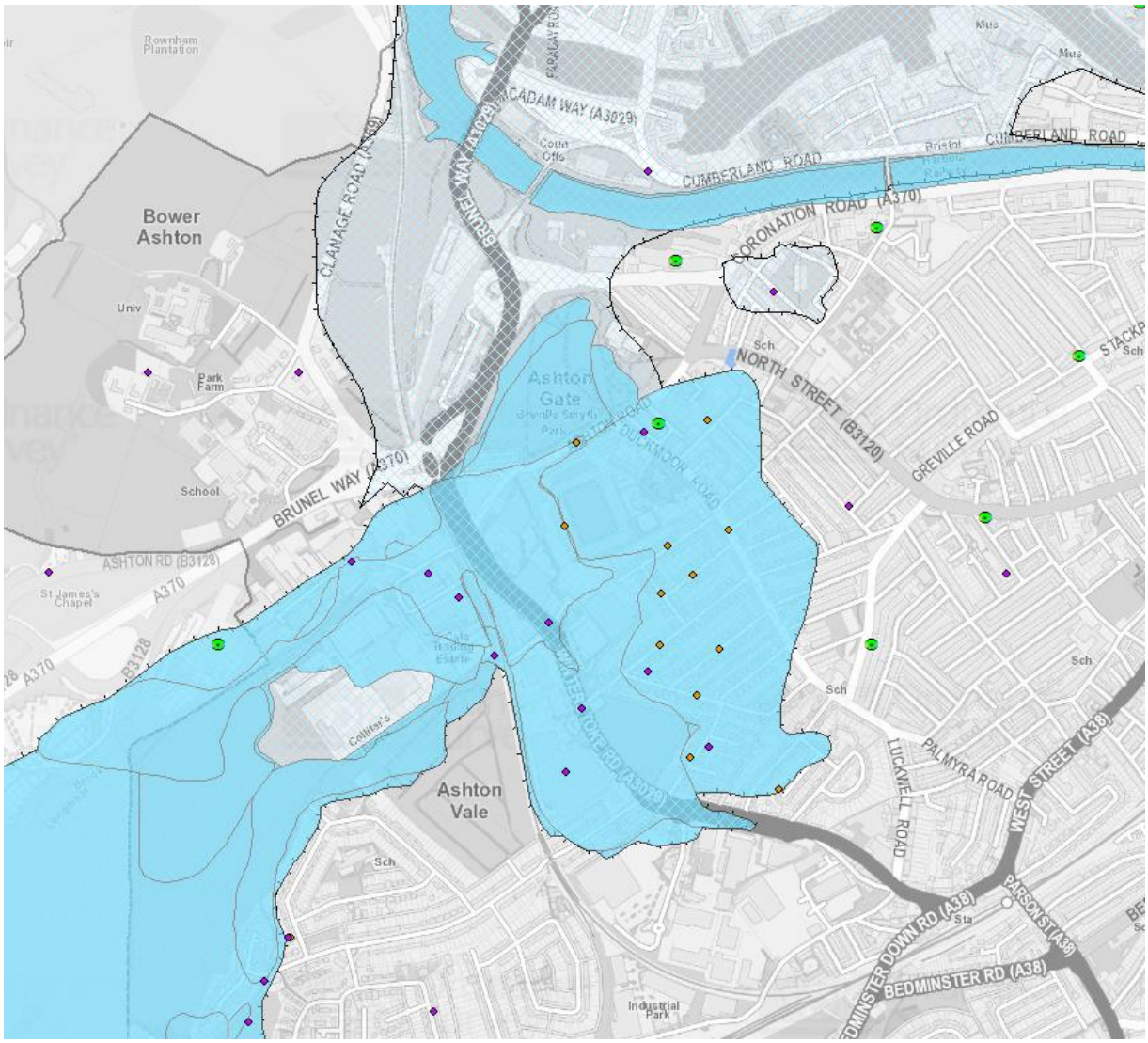
NetworkRail · West of England Local Enterprise Partnership · West of England Combined Authority · HM Government · Bath & North East Somerset Council · Bristol City Council · North Somerset Council · South Gloucestershire Council · travelwest

From: Thomas Meyrick [mailto:thomas.meyrick@bristol.gov.uk]
Sent: 07 April 2015 15:32
To: Bird, Robert/UKS <Robert.Bird@ch2m.com>
Subject: RE: MetroWest Phase 1 FRA: Local flood risk information

Robert,

We know the Ashton area has been highlighted as a high risk area from Surface Water and Tidal flooding identified in the SWMP and the CAFRA. Many of the flow routes identified would only provide benefit to park land or is located within the urban realm where extensive work will be required to further understand the flood mechanisms. Regrettably, we are not currently in a position to propose a solution which can be built into the design of the scheme . Even so we would still very much like to be included in the progression of this scheme and are willing to provide assistance where we can.

Historical information indicates there have been numerous flooding incidents within the area, see below. The majority of the incidents stem from fluvial flooding in ’68, but there are a few incidents of surface water flooding from 1995. Apart from the some dates we have limited information.



On another note, have you managed to get the CAFRA data you required and whether you can send the data back?

Thanks,
Tom

Thomas Meyrick
Flood Risk Officer
T: 01173 525 497
E: thomas.meyrick@bristol.gov.uk

Flood Maps

Flood Zones (defences not taken into account)

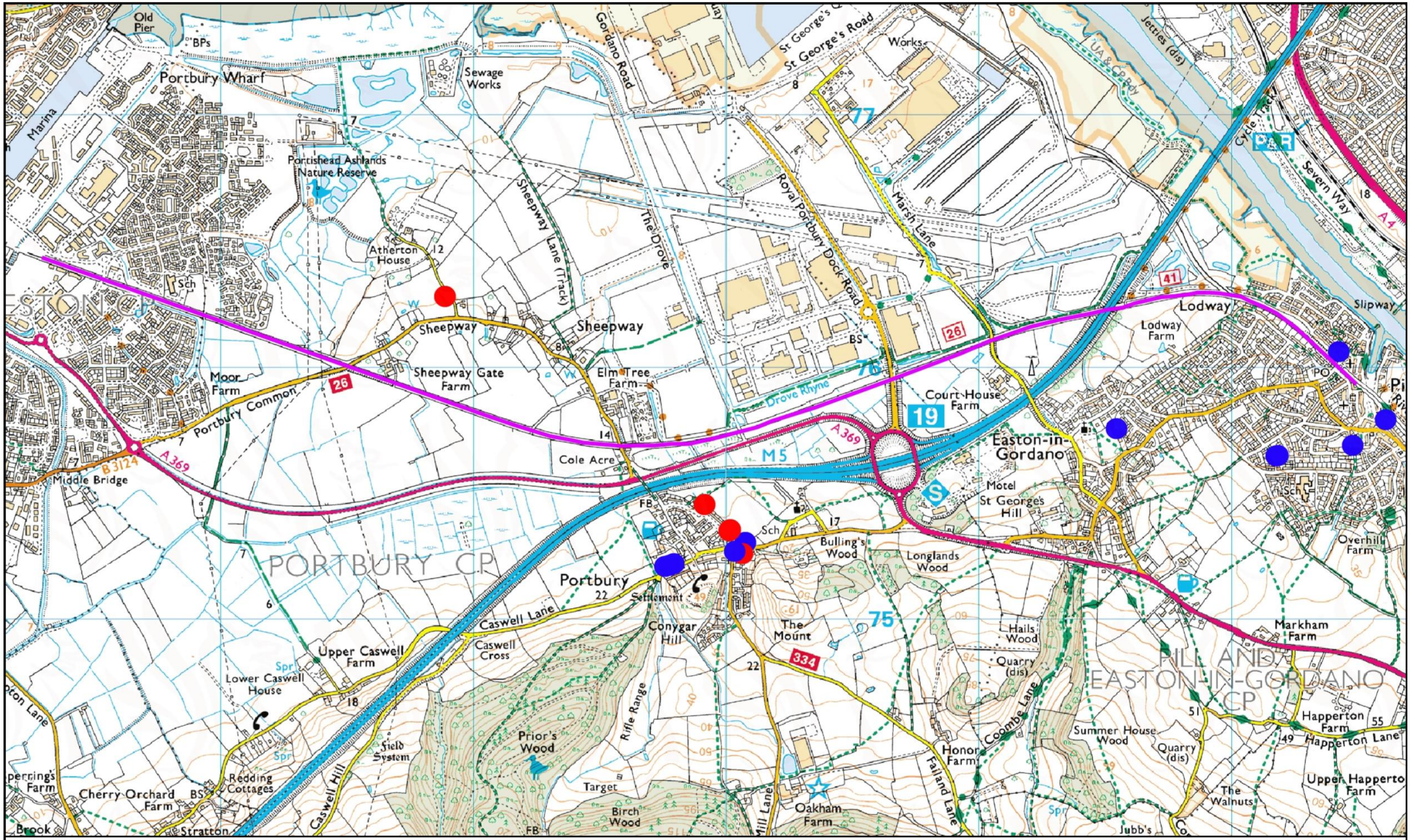
Over 50% of the 6km route from Portishead to Pill is within Flood Zone 2 or Flood Zone 3.

Updated Flood Map for Surface Water

Looking at the thresholds for 1:30 and 1:1000, the mapping shows that there are many isolated “patches” of flood risk along the route, with particular risk on the track parallel with Monmouth Road, Pill. Adjacent to the track areas such as Sheepway Gate Farm, east of Portbury Dock Road and between Marsh Lane and the Motorway show areas of flooding.

Risk of Flooding from Rivers and Sea (defences taken into account)

25% of the 6km route from Portishead to Pill is at low risk of flooding. Approximately a further 25% is at high risk of flooding, mainly adjacent to the east and west of Royal Portbury Dock Road.

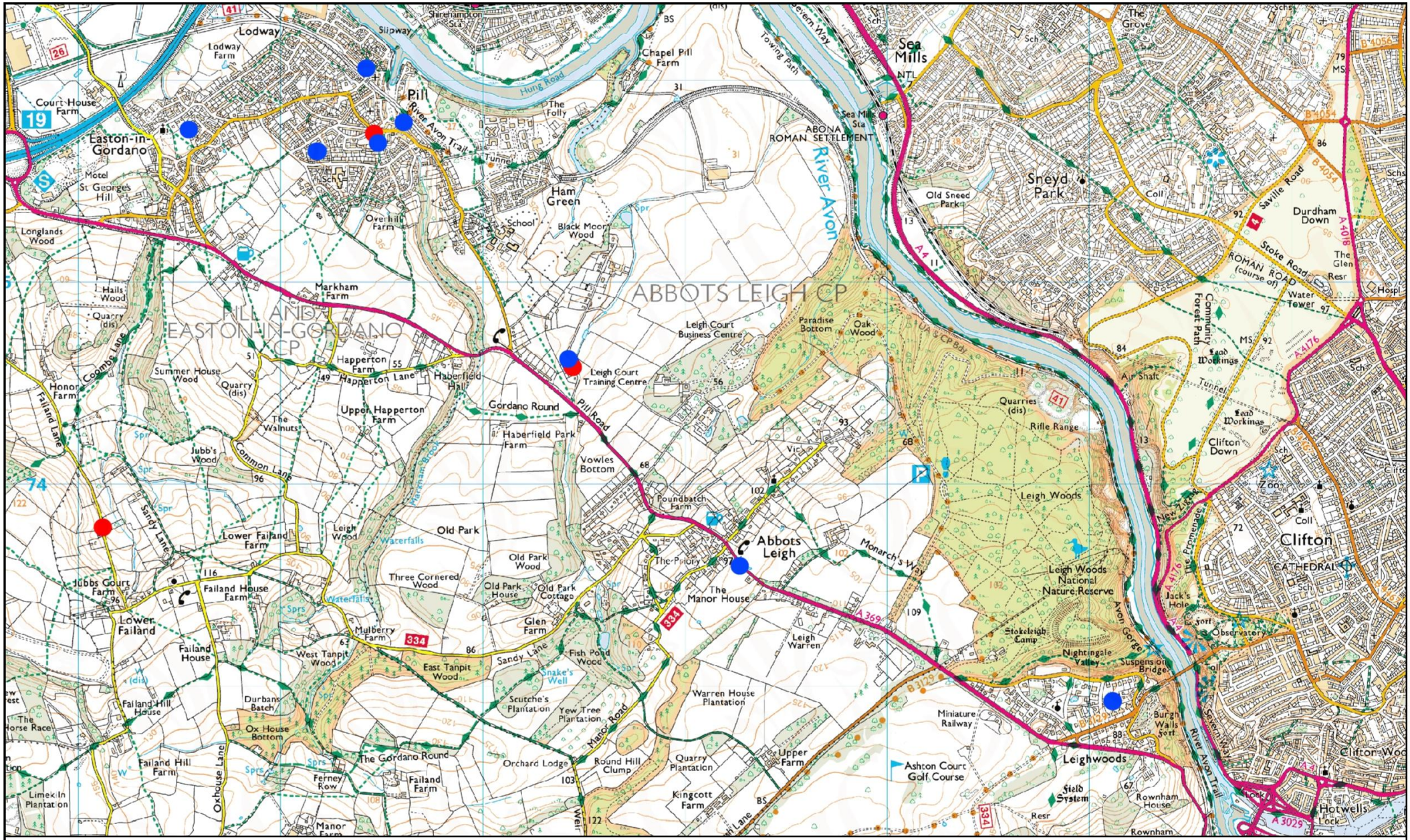


Flooded Properties Register

Red = External Blue = Internal

Scale: 1:20000
Drawn by: Jason Reading
Date: 06 March 2014
Time: 15:53:52

N



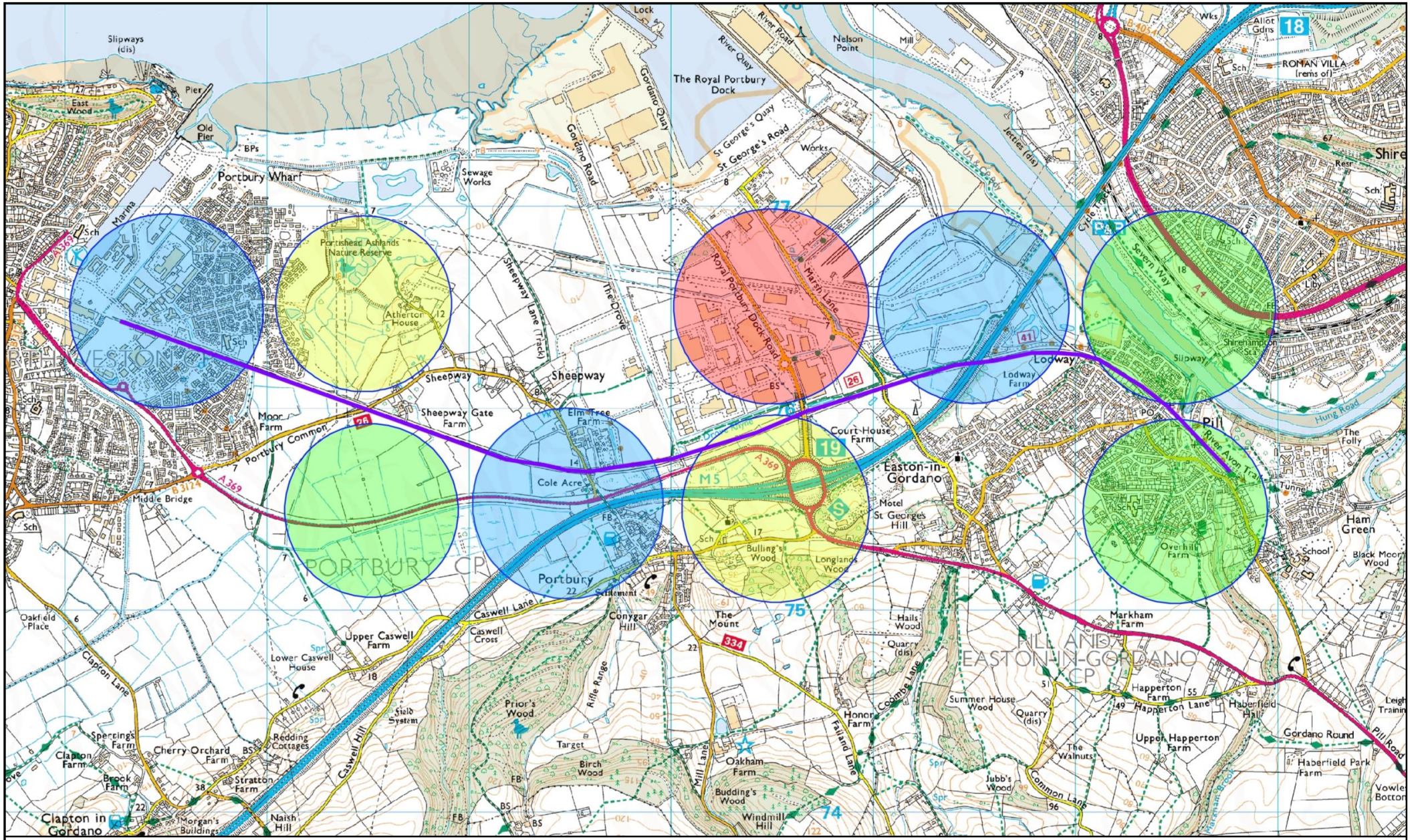
FLOODED PROPERTY REGISTER

Red = External Blue = Internal

Flood Risk Management Team
Castlewood, Tickenham Road, Clevedon, BS21 6FW

Scale: 1:25000
Drawn by: Ann-Marie Wood
Date: 16 March 2015
Time: 11:22:28

N

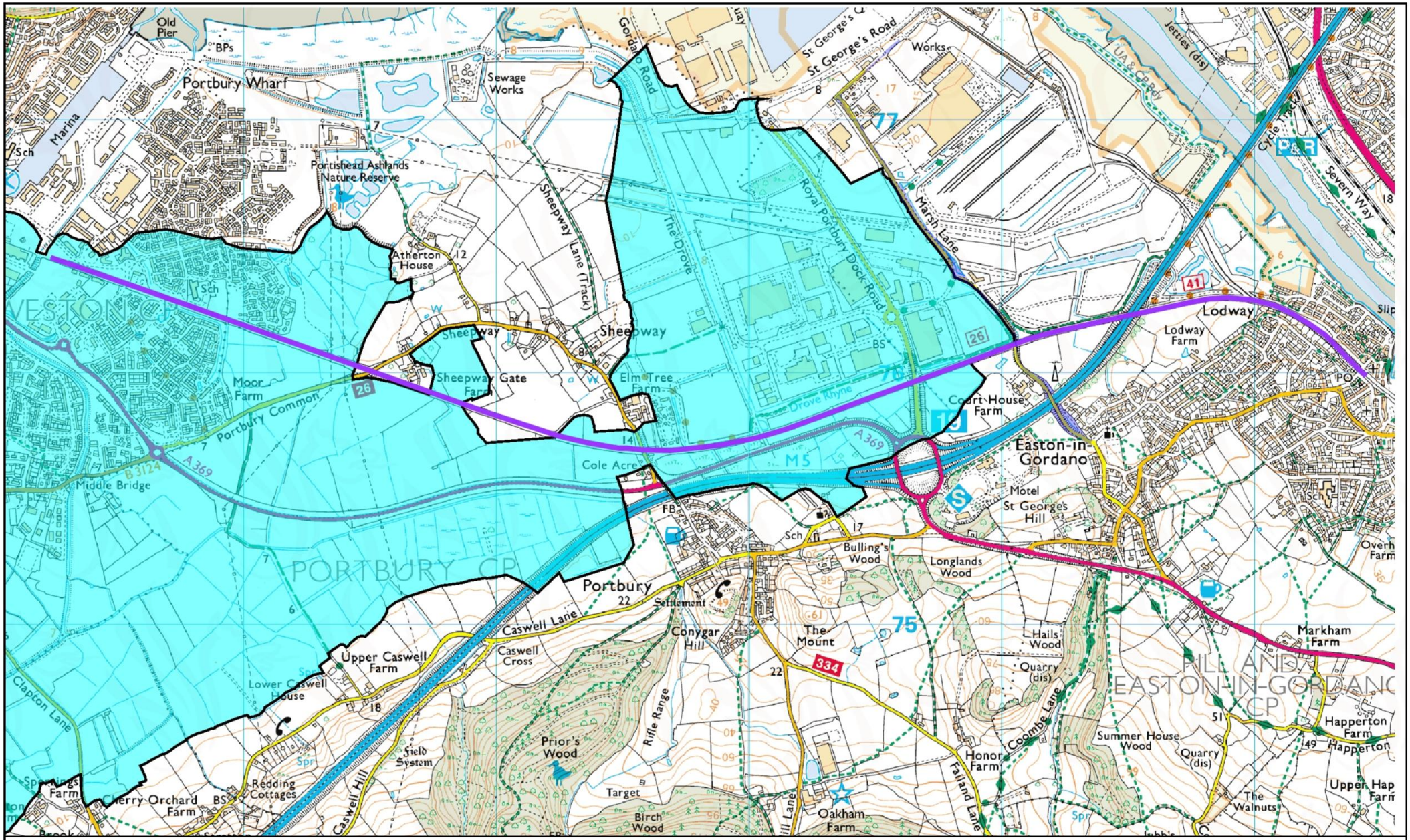


Groundwater susceptibility

Green = Very Low Yellow = Low Blue = Medium Red = High

Scale: 1:25000
Drawn by: Jason Reading
Date: 06 March 2014
Time: 13:44:37

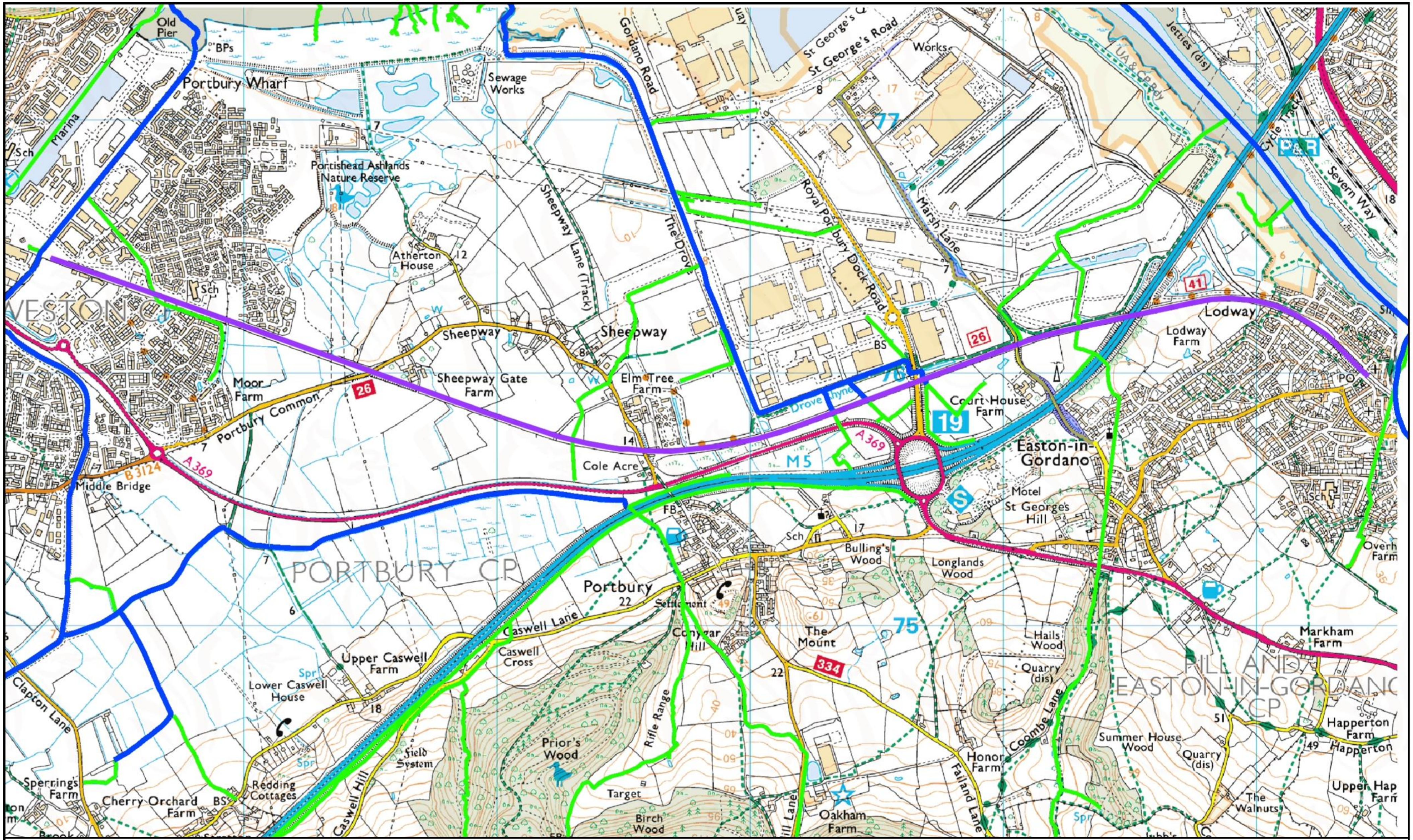
N



North Somerset Council

Scale: 1:20000
Drawn by: Jason Reading
Date: 05 March 2014
Time: 14:13:19

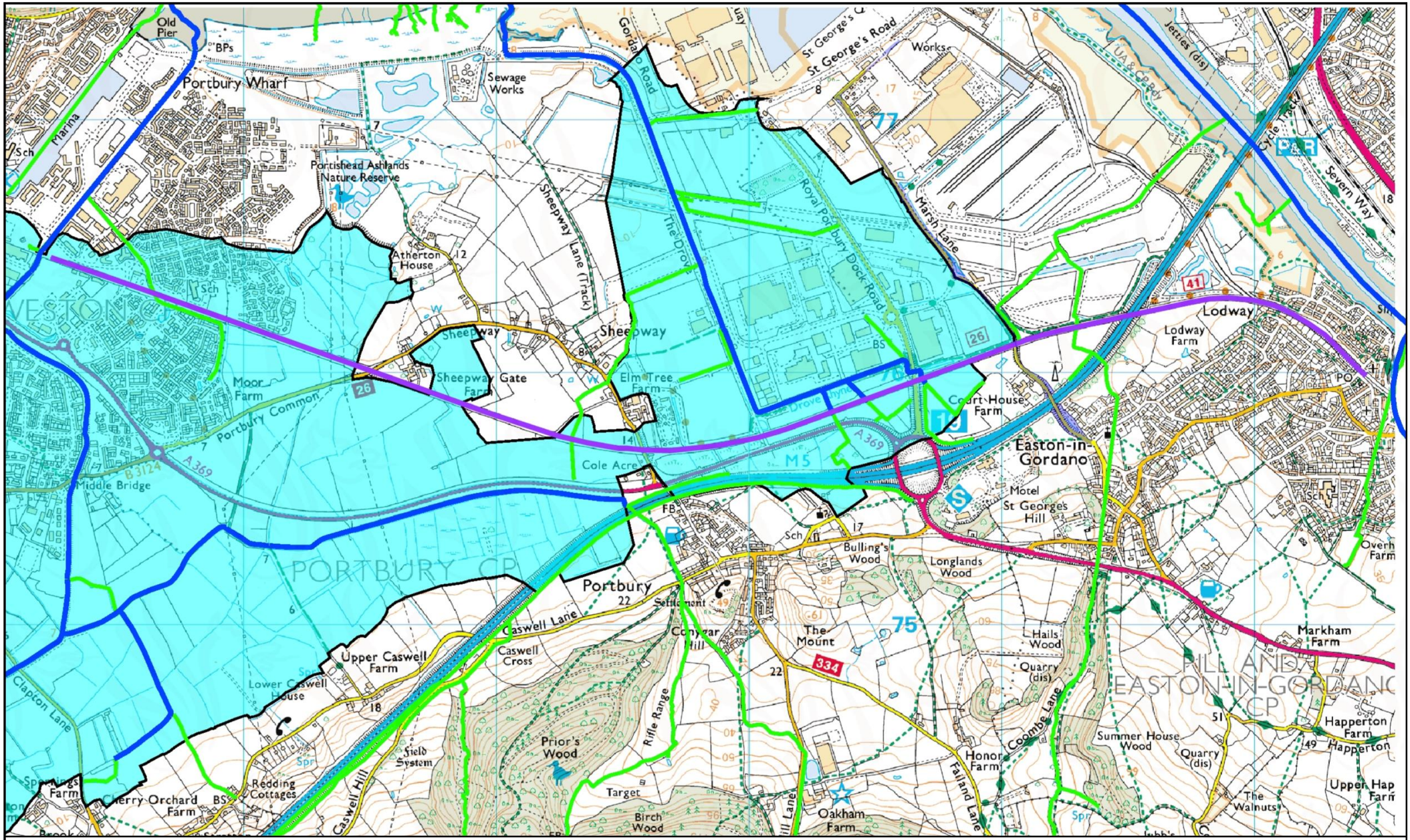
N



Purple = Railway   Blue = Main River (EA)   Green = Ordinary watercourse

Scale: 1:20000
Drawn by: Jason Reading
Date: 05 March 2014
Time: 14:16:47

N



North Somerset Council

Purple = Railway watercourse

Blue = Main River (EA)

Green = Ordinary

Scale: 1:20000
Drawn by: Jason Reading
Date: 05 March 2014
Time: 14:17:43

N

North Somerset - 2012 Flood Investigations

North Somerset COUNCIL

Table of Contents

Table of Contents i
1 Introduction 1
2 Key Responsibilities 3
3 Rainfall in 2012 6
4 Flood Incident Extent and Impact 16
5 Abbots Leigh and Pill & Easton-in-Gordano 19
6 Backwell 21
7 Banwell 23
8 Blagdon 26
9 Churchill and Langford 29
10 Claverham and Yatton 34
11 Clevedon 40
12 Congresbury 43
13 Dundry and Winford 48
14 Hutton 51
15 Locking 53
16 Nailsea 57
17 Portbury 62
18 Portishead 67
19 Weston-super-Mare 70
20 Winscombe & Sandford 76
21 Wraxall & Failand 79
22 Wrington 81
23 Remaining Investigations 87
24 Summary - Risk Management Authorities 92
Glossary 93

1 Introduction

In 2012, unprecedented levels of rainfall were experienced throughout England causing wide spread flooding. The Met Office reported that 2012 was the wettest year on record in England and the second wettest in the UK since records began. Furthermore North Somerset experienced more rainfall than the national average. The most severe storm events that occurred in North Somerset were in August, September and November impacting both residential properties and businesses alike.

All Risk Management Authorities (RMAs) have responsibilities for flooding from different sources (Table 2). Historically it had not been easy to identify which RMA had a duty to investigate flood incidents and carry out their flood risk management functions. This is because there is often a multitude of flood sources, some of which are not easily identifiable once the water has dissipated. Under new legislation[1] North Somerset Council has a responsibility to investigate flood incidents where it is considered appropriate. The purpose of this report is to investigate the flooding that occurred across North Somerset in 2012, identifying what the main causes of flooding were and which RMAs have appropriate risk management functions. This does not necessarily mean that any RMA will be undertaking physical works, but will ensure there is a clear understanding of which RMAs have risk management responsibilities in relation to any flood incident.

Intelligence was gathered from residents, professional partners, Parish / Town Councils, local community groups as well as others to inform our investigation. This information was compiled to make a list of flooded properties and investigate the cause of the flooding. One of the difficulties experienced during investigation was obtaining useable information and it was quickly recognised that local residents were often the best source of intelligence and capturing their knowledge was an important process. This information gathering exercise included Local Community Flood Surgeries, flood report forms and site visits amongst other activities.

To ensure the full extent of the flooding is appreciated and recorded it has been decided that this report will include all locations, brought to our attention, which experienced any internal property flooding and also other areas of particular concern.

[1] Flood and Water Management Act 2010

1.1 Flood and Water Management Act 2010

The Flood and Water Management Act 2010 (the Act) was established in April 2010 and defined unitary authorities and county councils as Lead Local Flood Authorities (LLFAs). Section 19 of the Act commenced in April 2011 and gives LLFAs the duty to investigate flooding when considered appropriate and publish the results.

Flood and Water Management Act 2010 Section 19 – Local authorities: investigations

This flood investigation report has been produced by North Somerset Council (NSC) as a Lead Local Flood Authority under Section 19 of the Flood and Water Management

Act 2010:

1) On becoming aware of a flood in its area, a lead local flood authority must, to the extent that it considers it necessary or appropriate, investigate -

a) which risk management authorities have relevant flood risk management functions, and

b) whether each of those risk management authorities has exercised, or is proposing to exercise, those functions in response to the flood.

2) Where an authority carries out an investigation under subsection (1) it must -

a) publish the results of its investigation, and

b) notify any relevant risk management authorities.

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

A '*Risk Management Authority' (RMA)* means:

(a) the Environment Agency,

(b) a lead local flood authority,

(c) a district council for an area for which there is no unitary authority,

(d) an internal drainage board,

(e) a water company, and

(f) a highway authority.

When considering if it is necessary or appropriate to investigate a flood incident NSC will review the severity such as the number of properties affected and the frequency of such an occurrence. Currently NSC is working to the following thresholds:

- five or more residential properties flooded internally;
- two or more non-residential properties flooded internally;
- one or more critical service (e.g. hospital) flooded, and/or;
- a key transport link is totally impassable for a significant period.

As no flood incident is the same, it is not feasible to cover all possible thresholds; therefore there may be circumstances where North Somerset Council may choose to carry out an investigation where the above is not met.

2 Key Responsibilities

2.1 Recording Flood Incidents

For the LLFA to carry out a flood investigation efficiently, it is necessary to record the flood incidents that occur across North Somerset. To help gather intelligence effectively and consistently, a Flood Report Form was created. Information is shared between RMAs to ensure a more representative picture is captured. Table 1 summarises the type of information collected from the report form.

The following information will be recorded on a flood incident database, supporting NSC carry out its flood investigation duties from December 2011	
Start date	
Duration	
Main source	Fluvial (watercourse); Surface water runoff; Drainage structure defect; Tidal; or Groundwater
Main characteristics	Natural flood; Flash flood; or Debris flow Clear; Muddy; or Polluted
Extent	Internal / External property flooding; Depth; & Highway impact
Historic flooding	

Table 1: Information the LLFA now records

2.2 Risk Management Authority Responsibilities

There are various other Risk Management Authorities in addition to North Somerset Council, all who have their roles and responsibilities. Table 2 specifies the functions of each Risk Management Authority and the different sources of flooding for which they have a risk management function.

Flood Source	Lead Local Flood Authority	Environment Agency	Highways Authority	Wessex Water	Internal Drainage Board
The Sea		✓			
Main River [2]		✓			
Ordinary Watercourse [3]	✓				✓ (if located in IDB area)
Surface Water	✓				
Surface Water highway flooding			✓		
Groundwater	✓				
Sewer Flooding				✓	
Reservoir		✓			

Table 2: The different RMA's responsibilities for managing flood risk from different sources and enforcement

North Somerset Council as the Lead Local Flood Authority is responsible for managing the flood risk from Ordinary Watercourses, groundwater and surface water runoff. They are also responsible for consenting to works on Ordinary Watercourses. As the LLFA they have an overarching managing role across North Somerset.

North Somerset Council as the Highway Authority is responsible for surface water on the highway and maintaining gullies and culverts to ensure effective highway drainage.

The Environment Agency is responsible for managing flood risk from the sea, Main Rivers and reservoirs and has a strategic overview role for all flood risk management. The EA also provides a flood warning service throughout England and Wales in areas at risk of flooding from rivers or the sea.

[2] A Main River is a river that has been designated as such by the Environment Agency. These tend to be the larger arterial watercourses that are considered to pose a significant flood risk.

[3] Ordinary watercourses include all rivers and streams not designated as a Main River and all ditches, drains, cuts, culverts, dikes, sluices, sewers (other than public sewers) and passages, through which water flows.

Wessex Water is responsible for managing, maintaining and improving the sewer network. This includes surface water (from property roofs and driveways etc).

The Internal Drainage Board is responsible for Ordinary Watercourses that fall within the IDB area. This is determined by water catchment areas and is typically in low lying areas and farm land. They have permissive powers to undertake work to secure clean water drainage and water level management.

2.3 Riparian responsibilities

Land/Property Owners that have a watercourse in or adjacent to their land have riparian rights and responsibilities[4] on that watercourse. This means the landowner must:

- Let water flow through their land without any obstruction, pollution or diversion which affects the rights of others.
- Accept flood flows through their land, even if these are caused by inadequate capacity downstream.
- Keep the banks clear of anything that could cause an obstruction and increase flood risk, either on their land or downstream if it is washed away.
- Maintain the bed and banks of the watercourse and the trees and shrubs growing on the banks and should also clear any litter or debris from the channel and banks, even if it did not come from their land.
- Keep any structures, such as culverts, trash screens, weirs and mill gates, clear of debris.

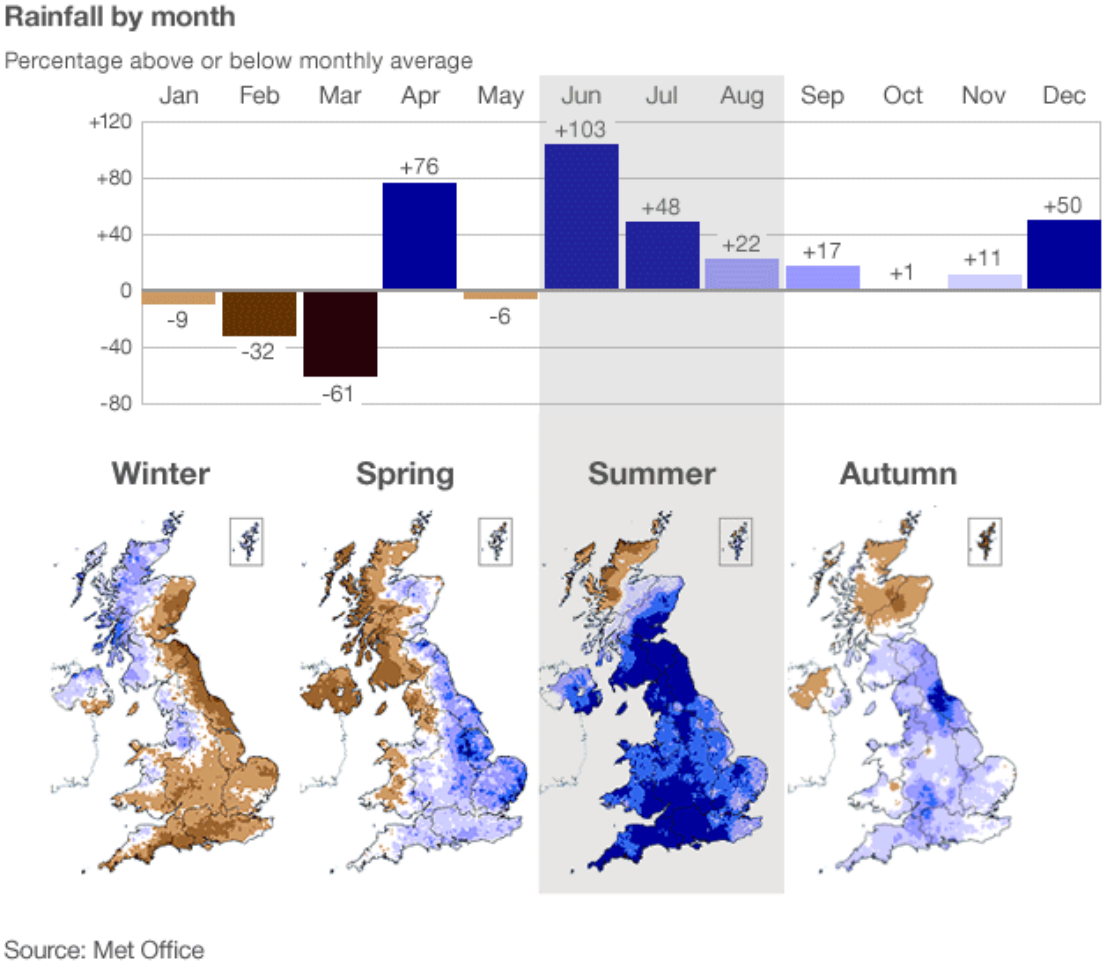
[4] The Environment Agency has produced a guide outlining the rights and responsibilities of riparian owners. The "Living on the edge" guide can be found on the EA website at http://www.environment-agency.gov.uk/homeandleisure/floods/31626.aspx

3 Rainfall in 2012

3.1 A National Context

The Met Office reported that 2012 was the wettest year on record in England and the second wettest in the UK since records began. The year started with concerns about drought and between the months of January and March the UK had below average rainfall. However, *the situation was then transformed by the wettest April and June in England and Wales from 1766, while summer (June, July and August) was the wettest since 1912. Rainfall totals for autumn and December remained well above average, and a succession of storm events in late November and late December contributed to extensive disruption from flooding* – ***Met Office.***

The graph and diagram below show the pattern of average rainfall experienced in the UK during 2012.



Source: Met Office

Figure 1: Rainfall by month – Percentage above or below monthly average

3.2 Rainfall in North Somerset

Research shows that the average rainfall in North Somerset is lower than the average rainfall in the UK for all months of the year. The average annual rainfall in North Somerset for the four years prior to 2012 was a little over 750mm. In 2012 the annual rainfall was 1450mm.

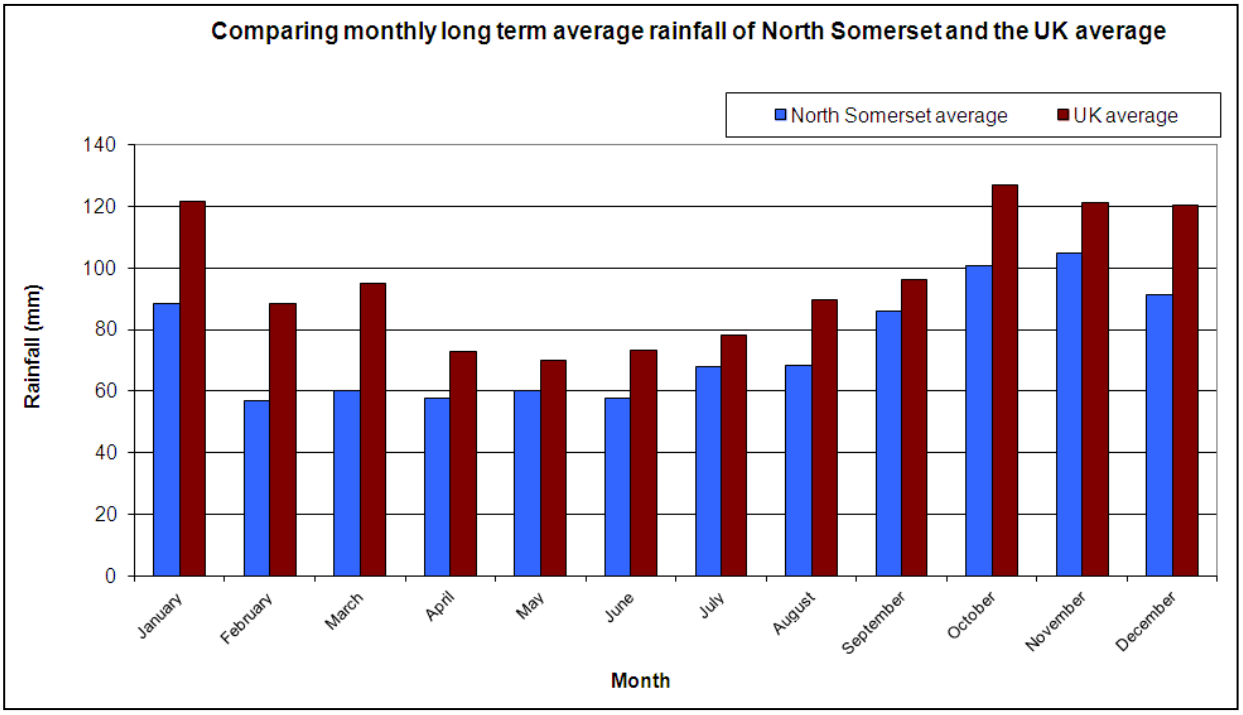


Figure 2: Comparing the average rainfall in North Somerset to the average rainfall in the UK. Data sourced from the Met Office / North Somerset data based on rainfall data collected at Weston-super-Mare (data from 1981-2010)

North Somerset was impacted significantly by flooding in 2012, the majority of which occurred in the latter part of the year, particularly in August, September and November. More localised flood incidents occurred in July and December. There were over 450 internal flooding incidents and over 350 external incidents reported.

Figure 3 shows the amount of rainfall in 2012 for North Somerset compared to the national average. North Somerset experienced less rainfall for 8 out of the 12 months with April, June, August and November exceeding the UK average. Within the context of the elevated national levels, North Somerset's rainfall in these four months is particularly significant

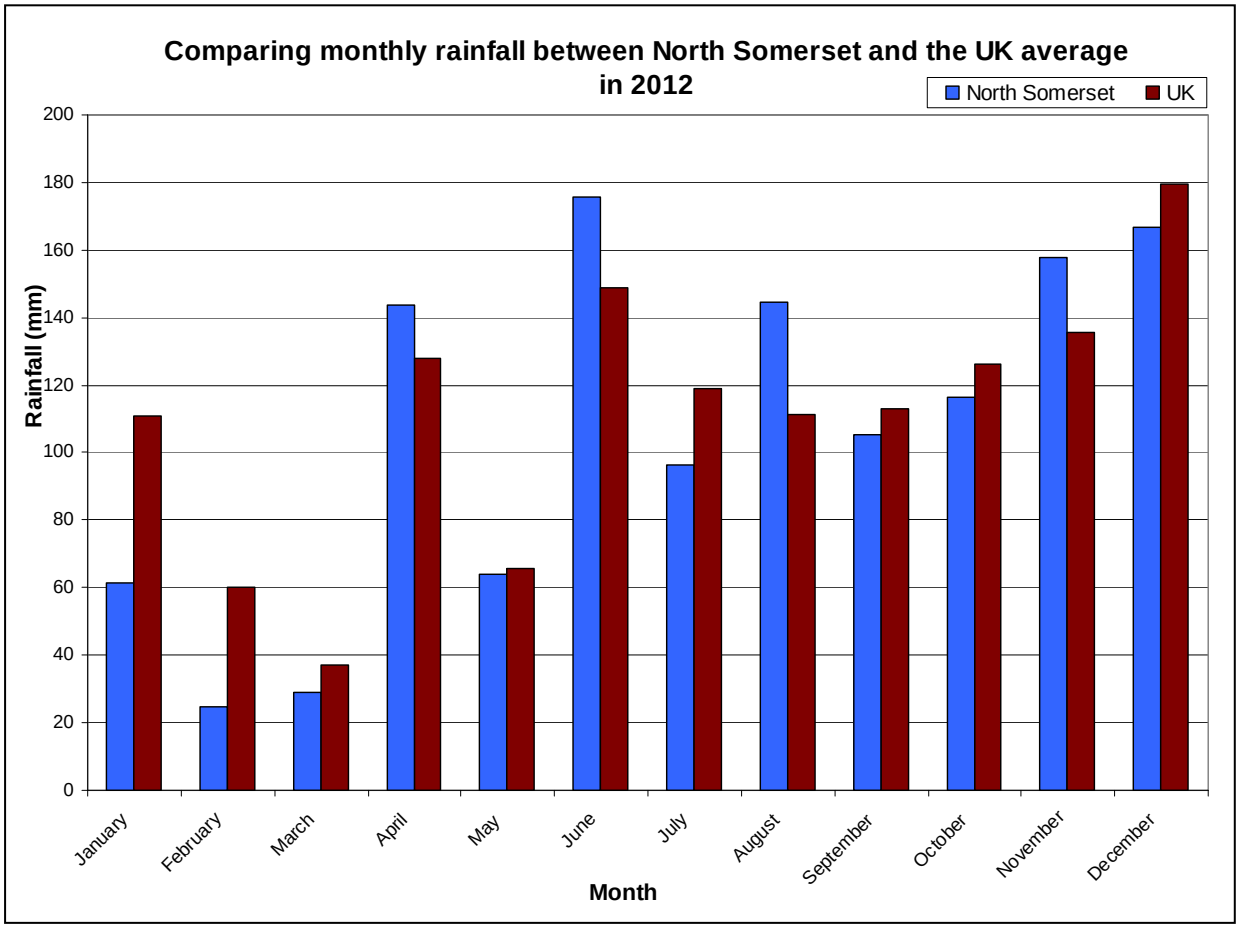


Figure 3: Comparing rainfall in North Somerset to the rest of the UK for 2012. UK rainfall data from Met Office / North Somerset data based on rainfall data collected at Wraxall and supplied by EA

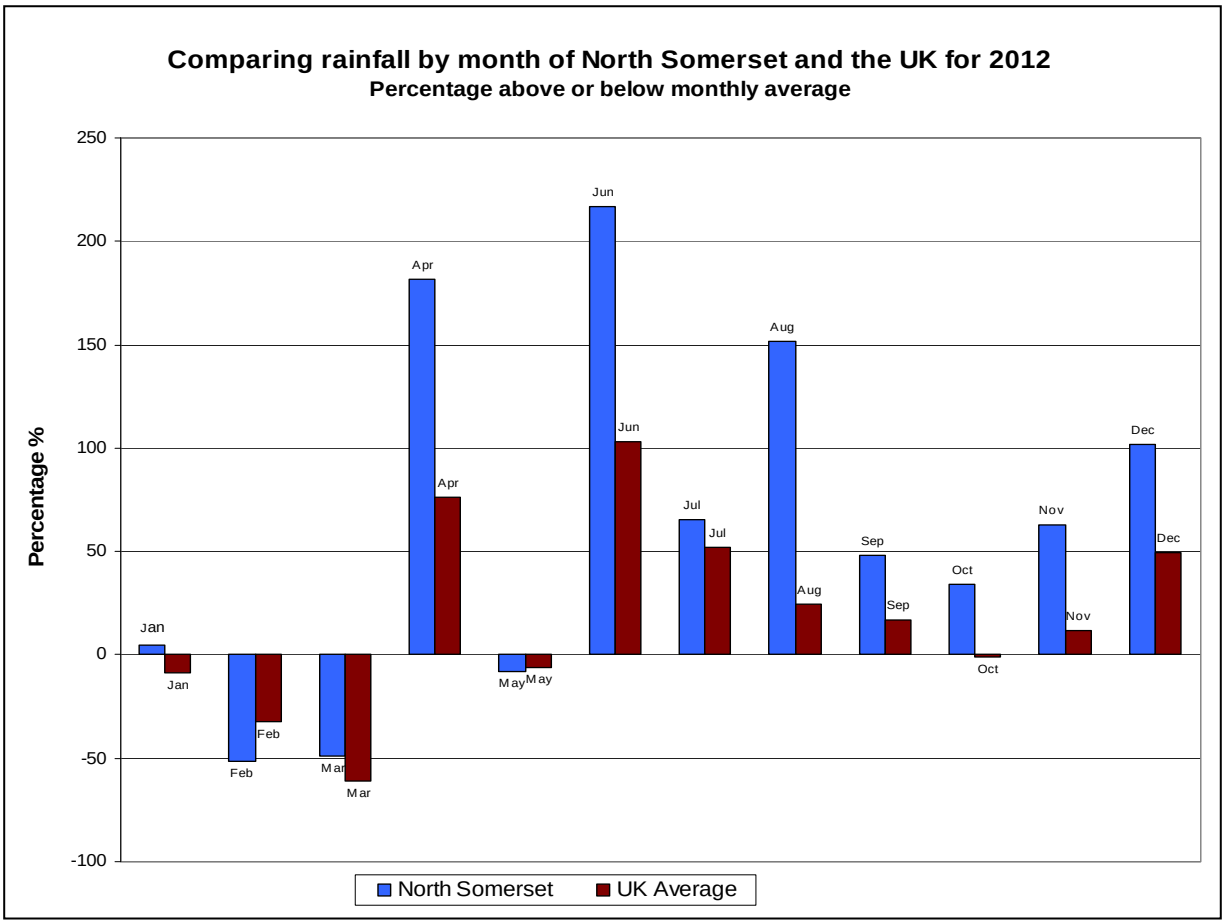


Figure 4: Graph comparing rainfall in North Somerset to the rest of the UK for 2012. UK rainfall data from Met Office / North Somerset data based on rainfall data collected at Wraxall and supplied by EA

Figure 4 shows which months experienced above or below average rainfall. The graph compares the rainfall as a percentage above and below the monthly average for North Somerset with the rest of the UK.

It can be seen that from June onwards North Somerset consistantly experienced higher rainfall totals in comparison to long term averages than other areas in the Country. Overall North Somerset experienced more than 1.5 times its average annual rainfall (based on data collected between 1981-2010), which is significantly more than the rest of the UK.

Although there was significant rainfall in April and June, the ground was exceptionally dry and therefore could absorb much of the water. After a significantly wet summer, the ground was completely saturated and even moderate winter rainfalls were causing flooding issues.

Rainfall in July

Flooding occurred in Weston-super-Mare on 29 and 30 July. Rainfall data for this month has been obtained from a private rain gauge (Figure 5). Seven of the eight properties that flooded in July occurred on 29 and 30, which as shown by the graph was an intense period of rainfall.

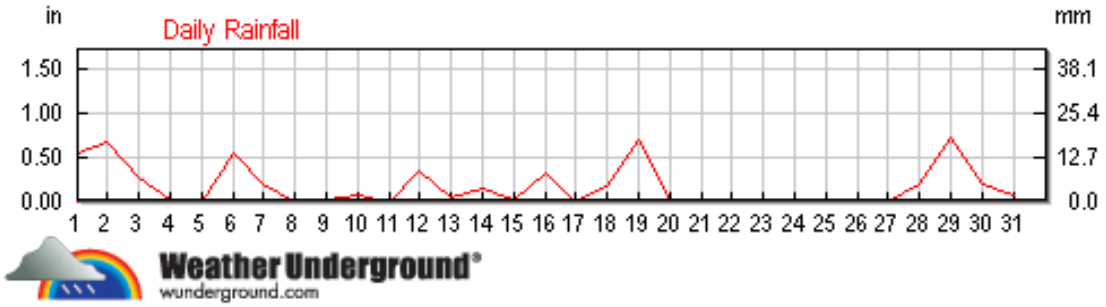


Figure 5: Rainfall data for Weston-super-Mare in July sourced from Wunderground.com

Rainfall in August

Major flooding occurred on 4 August in Nailsea. Rainfall data was provided by the Environment Agency which can be seen in Table 3.

Location	Rainfall	Source
Clevedon	14.6mm	EA
Wraxall	63mm	EA
Sand Bay	27.9mm	EA
Blagdon	3.6mm	Private

Table 3: Total rainfall collected at different weather stations in North Somerset on 4 August 2012

Table 3 shows the rainfall that fell around the North Somerset region was highly variable on 4 August. There is approximately 4.5 miles between Clevedon and Wraxall but the amount of rainfall collected at each weather station on 4 August was significantly different. Nailsea and Portbury were greatly impacted by flooding on this date and with Wraxall being the closest geographically, it can be seen that approximately 1 month's worth of rainfall fell over Nailsea on that day. A private rain gauge (Wunderground.com) in Blagdon recorded a little over 3mm on 4 August, further demonstrating the localised nature of the storm event. The rainfall radar image (Figure 6) reinforces these findings and shows how localised the rainfall was over Nailsea.

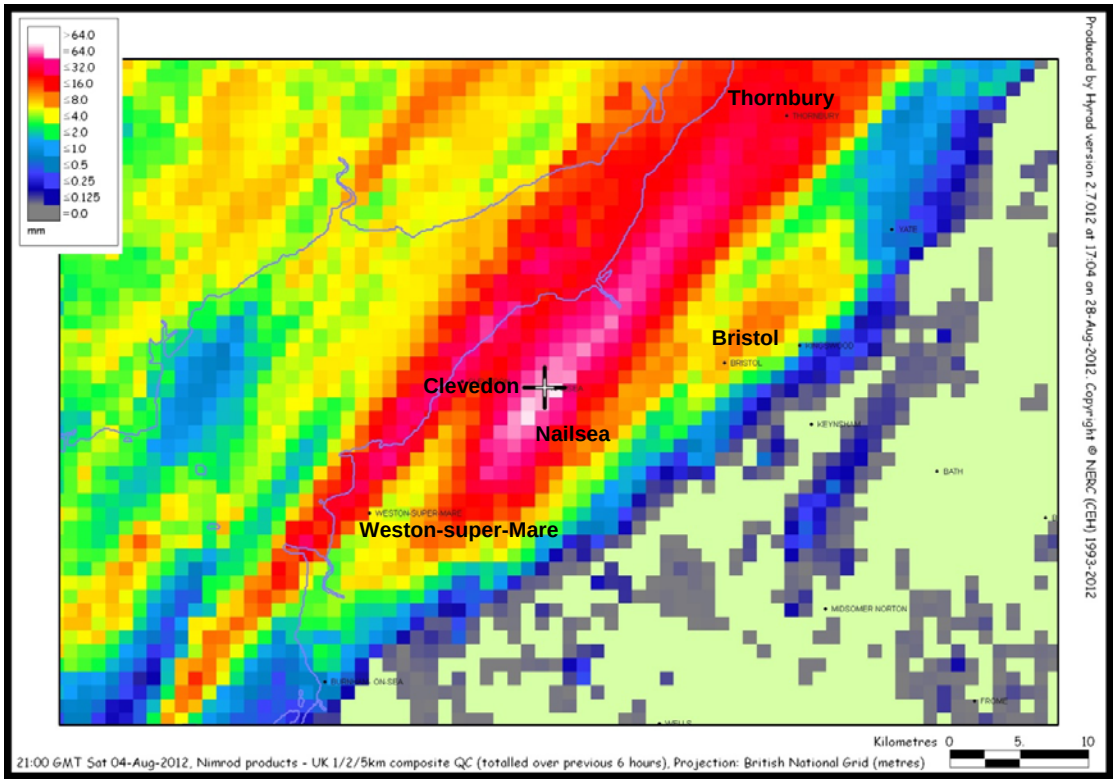


Figure 6: Radar data – total rainfall accumulation over 6 hours on 4 August

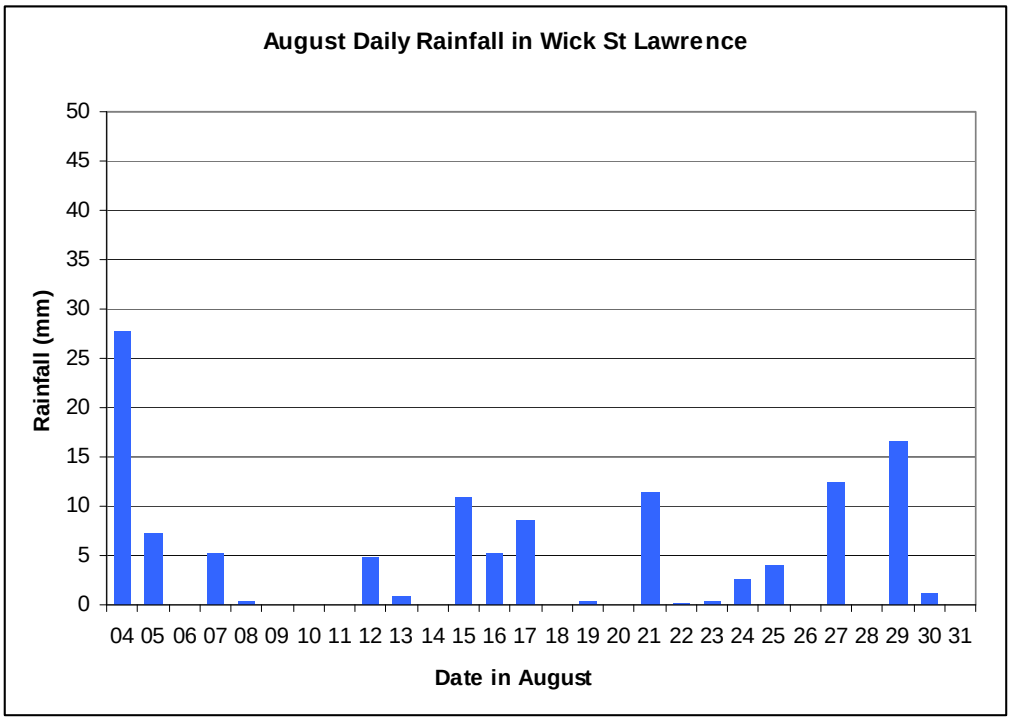


Figure 7: Rainfall totals in August 2012

The significant rainfall event on 4 August is shown in Figure 7. Despite heavy rainfall later in the month, few properties were impacted by flooding.

Rainfall in September, November and December 2012

North Somerset experienced wide scale flooding during September and November, with more localised flooding in December.

Graphs showing daily rainfall totals for the months of September, November and December are shown in Figure 8, Figure 9 and Figure 10 respectively. Over this period rainfall across the district appeared to be more spatially uniform.

On 24 September numerous houses were flooded across North Somerset and this can be seen in the figure below as a large peak in rainfall.

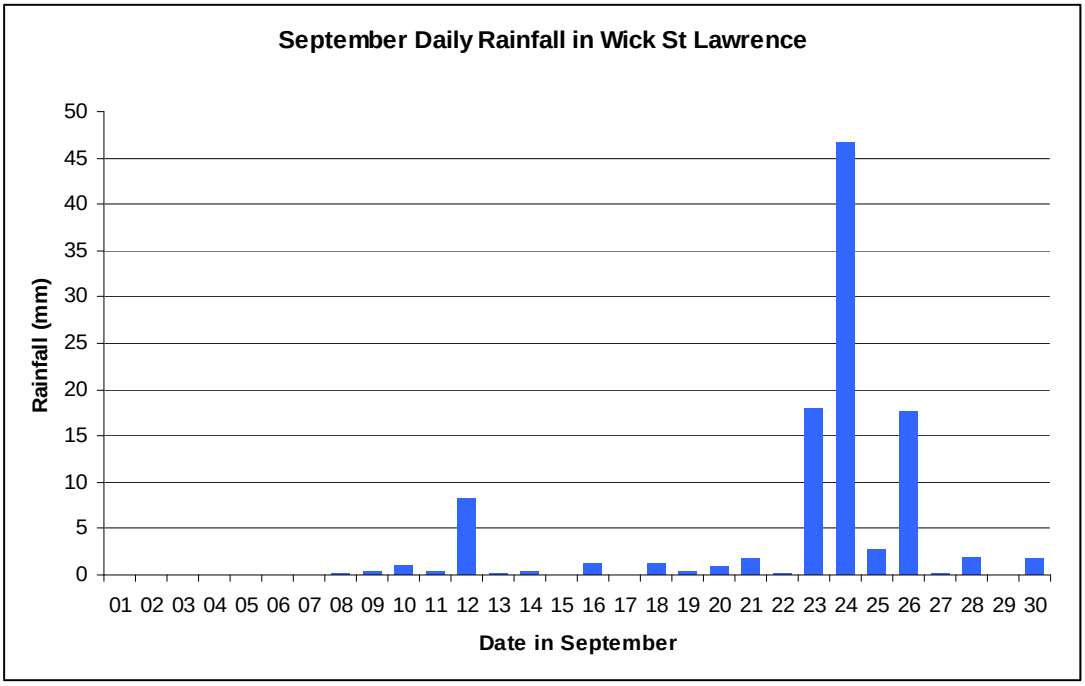


Figure 8: Rainfall totals in September 2012

On 4 November and between 21 and 25 November further widespread floods were experienced across North Somerset.

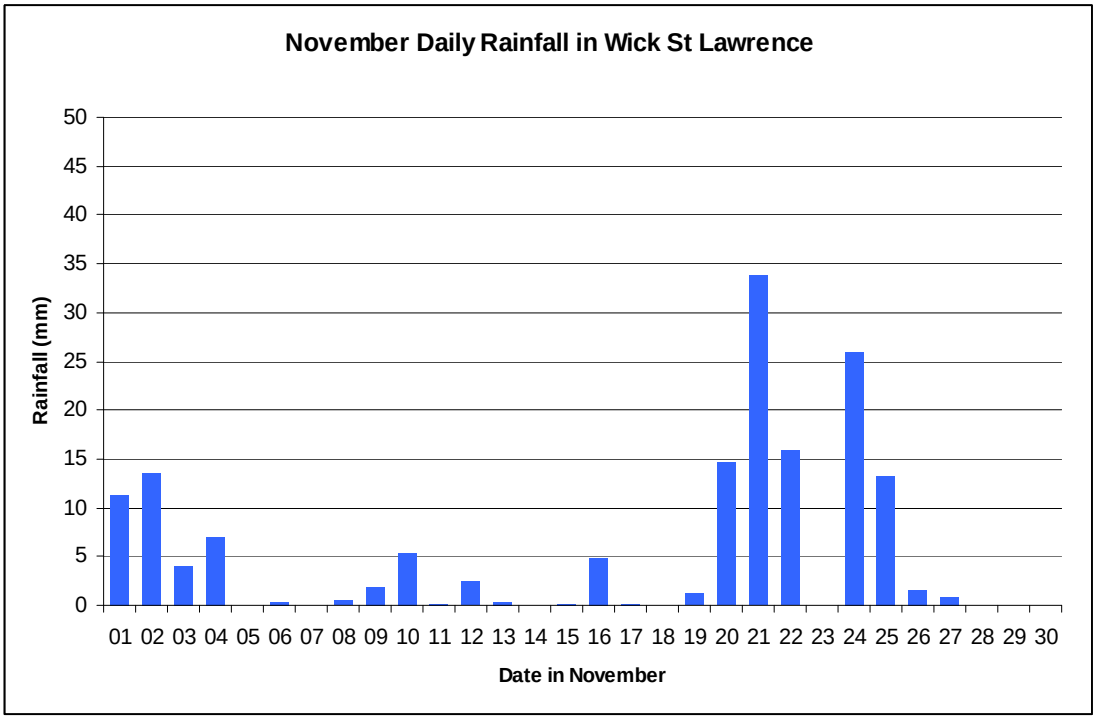


Figure 9: Rainfall totals for November 2012

Rainfall totals exceeded those in November and experienced similar peaks of daily rainfall, however the impacts of flooding were generally less throughout December.

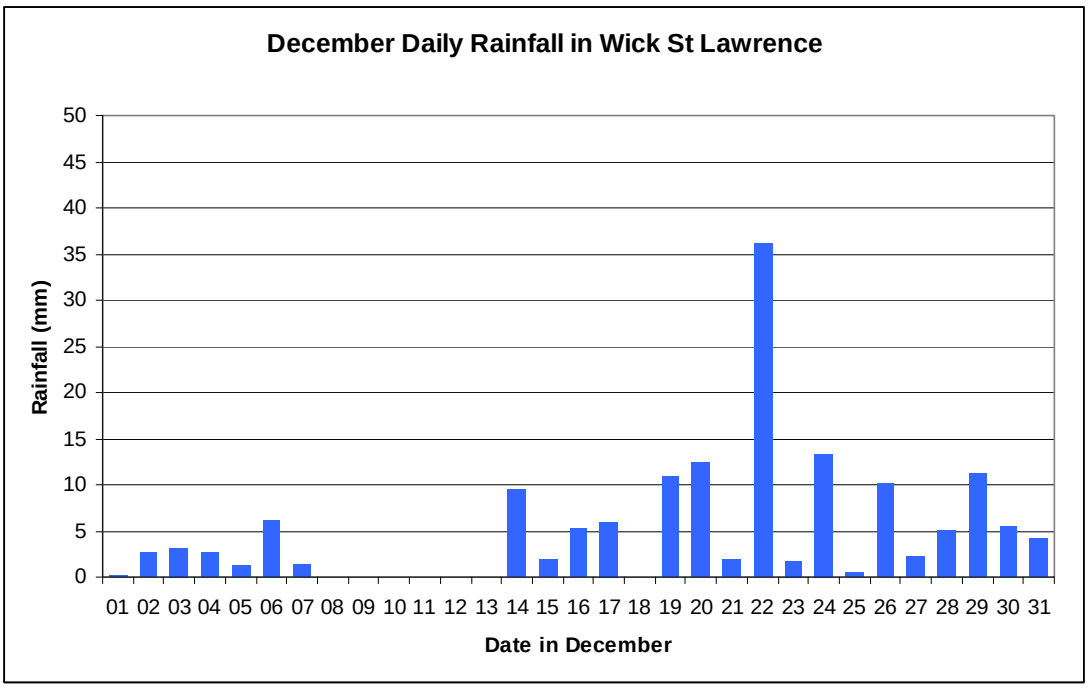


Figure 10: Rainfall totals for December 2012

To highlight how widespread the impacts were for the most significant rainfall events for 2012, three rain gauges have been selected across North Somerset to show the variation in rainfall across the area. These locations are Wraxall (EA), Blagdon (wunderground.com) and Wick St Lawrence (EA) (Figure 11).

Figure 11: A map showing the three rain gauge locations

The flood incidents typically happened over a number of days during each month. Figure 12 highlights the variation in rainfall at each location for the most significant rainfall event in August, September, November and December.

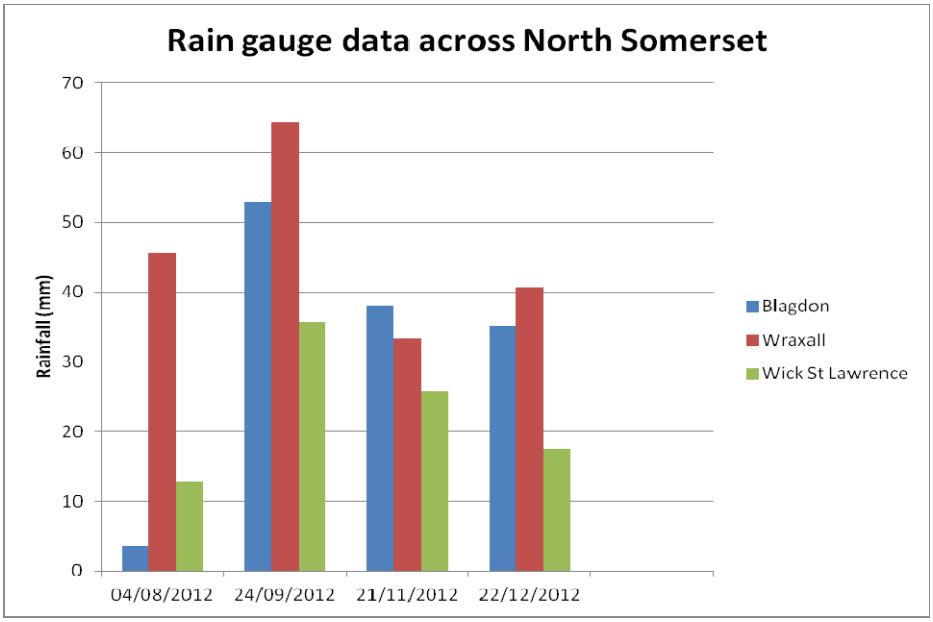


Figure 12: Rainfall data for significant storm events

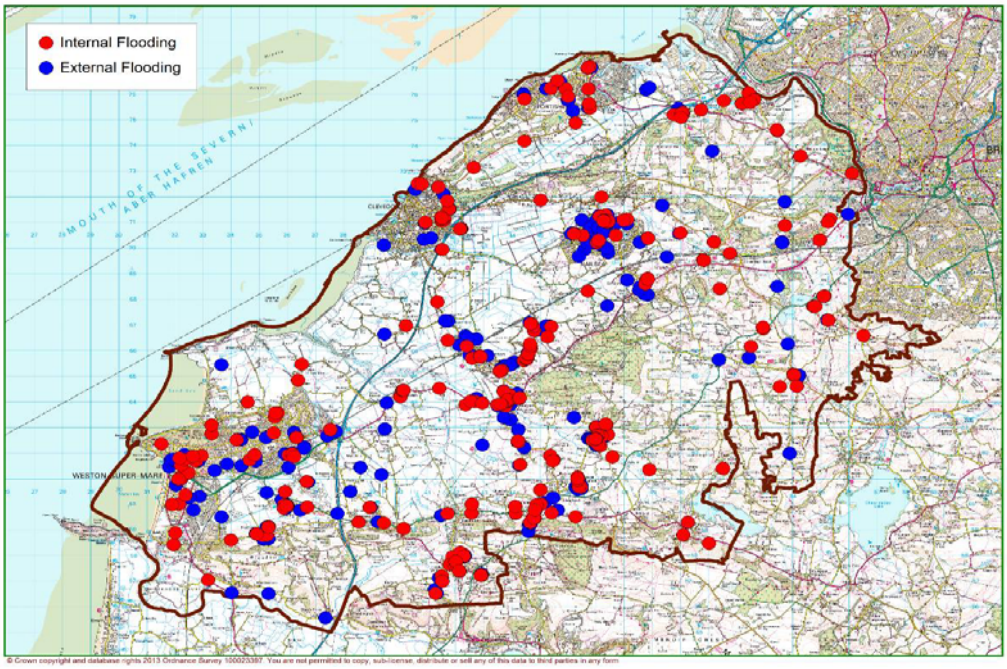


Figure 13: The internal and external property flooding across North Somerset in 2012

Figure 13 shows the locations of internal and external flood incidents. Figure 14 colates these flood incidents for each urban area and states the number of flooded properties. For more detail see
Table 4.

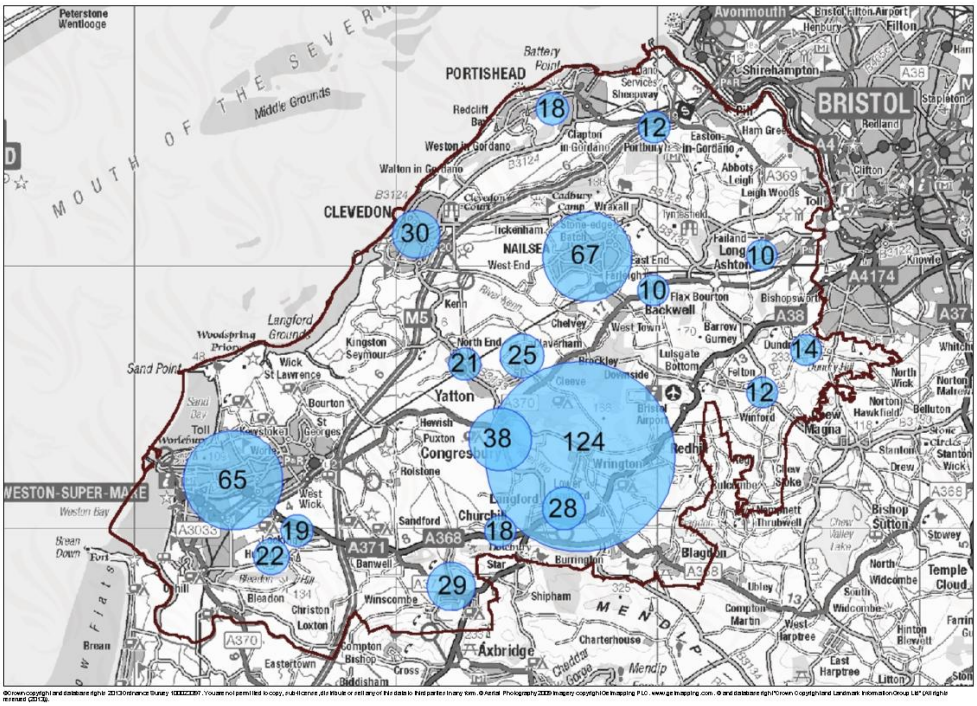


Figure 14: Number of properties which flooded internally and externally (minimum of 10) in urban areas

4 Flood Incident Extent and Impact

4.1 Summary

North Somerset experienced intense rainfall during 2012 on 24 September, 21 November and 24 November. There was more localised intense rainfall on 4 August which fell over Nailsea, Portishead and Portbury. More moderate rainfalls fell between 24 September into the New Year contributing to over 700 residential and commercial properties impacted by flooding. The table below lists the locations that experienced flooding during 2012

The report has predominantly been split into chapters where each chapter covers a parish, but it is worth noting that some parishes have been grouped together where issues have spanned across the border. The chapters throughout the report have been listed in alphabetical order and not in any order of priority.

Location	No. of properties internally flooded	No. of properties externally flooded	Total no. of properties flooded	Occurrences of internal property flooding	Occurrences of external property flooding	Total no. of flooding incidents
Abbots Leigh	4	0	**4**	4	0	**4**
Backwell	6	8	**14**	10	8	**18**
Banwell	6	5	**11**	7	5	**11**
Barrow Gurney	3	1	**4**	3	1	**4**
Blagdon	6	0	**6**	6	0	**6**
Bleadon	1	2	**3**	1	2	**3**
Brockley	1	1	**2**	1	1	**2**
Burrington	0	1	**1**	0	1	**1**
Butcombe	1	0	**1**	3	0	**3**
Churchill	9	8	**17**	12	9	**21**
Claverham	14	12	**26**	20	12	**32**
Clevedon	24	6	**30**	26	8	**34**
Congresbury	25	13	**38**	48	14	**62**
Dundry	13	1	**14**	13	1	**14**

North Somerset – 2012 Flood Investigations

Location	No. of properties internally flooded	No. of properties externally flooded	Total no. of properties flooded	Occurrences of internal property flooding	Occurrences of external property flooding	Total no. of flooding incidents
Flax Bourton	2	1	**3**	3	1	**4**
Hutton	16	6	**22**	17	6	**23**
Kenn	2	1	**3**	2	1	**3**
Kewstoke	1	1	**2**	1	1	**2**
Kingston Seymour	2	1	**3**	2	1	**3**
Langford	17	11	**28**	22	14	**36**
Locking	11	8	**19**	15	10	**25**
Long Ashton	7	3	**10**	6	3	**11**
Loxton	0	1	**1**	0	1	**1**
Nailsea	19	48	**67**	20	48	**68**
Pill & Easton-in-Gordano	6	1	**7**	6	1	**7**
Portbury	7	5	**12**	8	6	**14**
Portishead	12	6	**18**	12	8	**20**
Puxton	6	2	**8**	6	2	**8**
St Georges	1	2	**3**	1	2	**3**
Tickenham	2	0	**2**	2	0	**2**
Walton-in-Gordano	1	0	**1**	1	0	**1**
Weston-in-Gordano	1	0	**1**	4	0	**4**
Weston-super-Mare	33	29	**65**	33	30	**63**
Wick St Lawrence	2	0	**2**	2	0	**2**

North Somerset – 2012 Flood Investigations

Location	No. of properties internally flooded	No. of properties externally flooded	Total no. of properties flooded	Occurrences of internal property flooding	Occurrences of external property flooding	Total no. of flooding incidents
Winford	7	5	**12**	8	8	**16**
Winscombe & Sandford	22	7	**29**	27	9	**36**
Wraxall & Failand	2	3	**5**	3	3	**6**
Wrington	40	84	**124**	109	145	**254**
Yatton	8	13	**21**	8	14	**22**
Totals	**340**	**296**	**639**	**472**	**376**	**849**

Table 4: Flood data for locations across North Somerset

5 Abbots Leigh and Pill & Easton-in-Gordano

5.1 Flood incident extent and impact

The parish of Pill & Easton-in-Gordano is located to the north of North Somerset and borders the tidal River Avon. Abbots Leigh is situated adjacent to the east. Both parishes have similar topography, of hilly terrain.

In Pill and Easton-in-Gordano, 6 properties flooded internally in 2012 but all on separate occasions. Two properties flooded in August and a further property for each of the remaining months of the year. The A369 was significantly flooded, which flowed down onto Blackmoor Road contributing to three properties flooding internally.

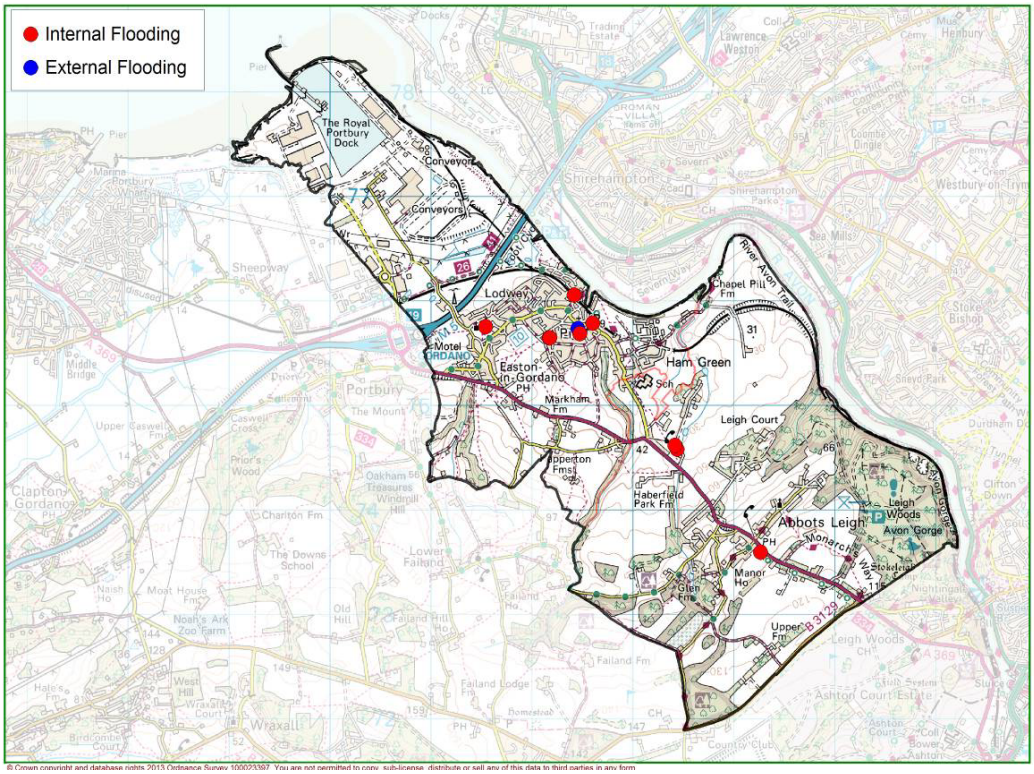


Figure 15: Flood locations in Abbots Leigh, Pill and Easton-in-Gordano

Abbots Leigh and Pill & Easton-in-Gordano Flood Source					
The Sea	Fluvial	Surface Water	Surface Water highway	Groundwater	Sewer Flooding
		✓	✓		

Table 5: Sources of flooding in Abbots Leigh and Pill & Easton-in-Gordano

5.2 Historic Flooding

Roads known to have flooded are:

- Avon Road
- Cross Lane
- Abbots Leigh Road

5.3 Evidence Collected

5.3.1 Local knowledge & site investigation

Pill & Easton-in-Gordano

Two properties flooded in North Grove in August from highway runoff, where water flowed down the cul-de-sac, over the kerb and down the driveways.

Further properties that flooded were on Watery Lane, Crusty Lane and Mount Pleasant however the source of the flooding has not been determined. The Church Hall on Priory road which is situated at the end of a long car park also flooded. The Hall is below the level of the road and depends on a soakaway as the source of drainage.

Abbots Leigh

Two properties were flooded internally on Blackmoor Road in September and another in November. Surface runoff from both the highway and surrounding hillside contributed to the flooding. The A369 is the main road from Portishead to the city of Bristol and passes Pill and Abbots Leigh. This important transport link was flooded at Abbots Leigh to a depth of 600 mm in locations causing significant disruption.

5.4 Likely Cause of Flood Incident

Many of the flood incidents can be attributed to highway runoff. Due to the substantial rainfall, the catchment was saturated creating additional runoff from the surrounding fields that would normally have been absorbed into the subsurface. This field runoff often flowed onto the highway where it was transported to localised low points.

5.5 Risk Management Authorities

	Risk Management Authorities				
	LLFA	EA	WW	IDB	HA
Involvement required	✓				✓

Table 6: The RMA's which have flood risk management responsibilities in Abbots Leigh and Pill & Easton-in-Gordano as a result of the 2012 flooding

6 Backwell

6.1 Flood incident extent and impact

There were 9 properties that flooded internally in Backwell, the majority of which occurred in November. These incidents were split between Backwell Bow and Farleigh Road.

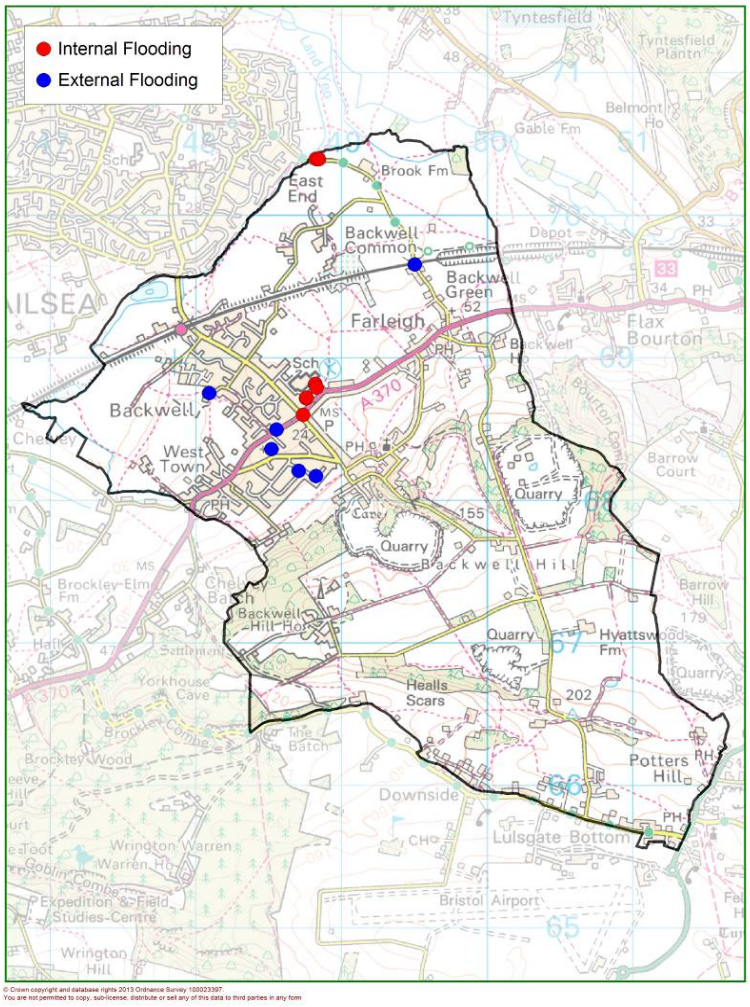


Figure 16: Flood locations in Backwell

Backwell Flood Source					
The Sea	Fluvial	Surface Water	Surface Water highway	Groundwater	Sewer Flooding
	✓		✓		

Table 7: Sources of flooding in Backwell

6.2 Historic Flooding

Roads known to have flooded are:

- West Town Road
- Farleigh Road
- Chapel Hill
- Station Road
- Oatsfield Estate

6.3 Evidence Collected

6.3.1 Local knowledge & site investigation

A ditch that runs along Backwell Bow overtopped in both September and November, flooding two properties in each month.

There were five internal flood incidents in Farleigh Road with flooding from the highway. Backwell Leisure Centre also flooded and a pump was required to discharge the water from the building.

It was also reported that the Land Yeo overflowed it's banks near Backwell Bow. Water escaped at the low points in the banks and was the main cause for flooding in this area.

6.4 Likely Cause of Flood Incident

In regards to the ditch at Backwell Bow, overtopping would have been due to the rainfall rate exceeding the capacity of the ditch.

There have been issues with the Highway drain along Farleigh Road where the water has not been able to drain away efficiently. Reports of blocked gullies would also have contributed to the problem.

6.5 Risk Management Authorities

	Risk Management Authorities				
	LLFA	EA	WW	IDB	HA
Involvement required	✓	✓		✓	✓

Table 8: The RMA's which have flood risk management responsibilities in Backwell as a result of the 2012 flooding

7 Banwell

7.1 Flood incident extent and impact

The Parish of Banwell is positioned to the south west of North Somerset, adjacent to Weston-super-Mare. The village sits at the foot of Banwell Hill, nearly 100 metres below the summit. With the exception of Woolvershill Batch, the remainder of Banwell Parish is relatively flat and is surrounded by a vast network of rhynes and ditches to drain the land.

Five properties flooded internally and four properties externally, the majority of which occurred in September.

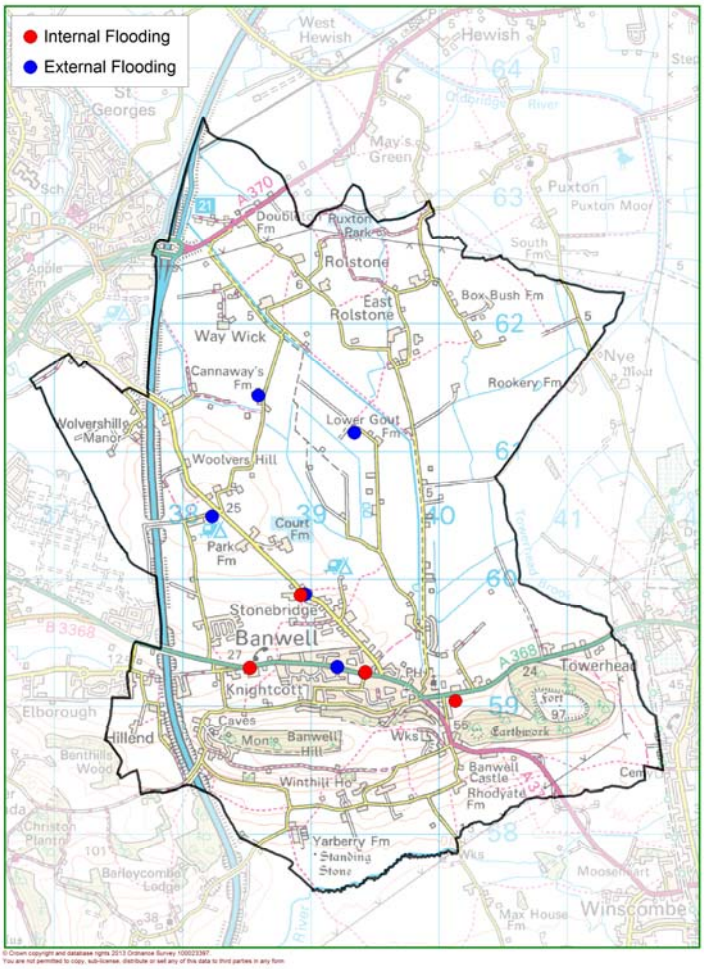


Figure 17 Flood locations in Banwell

Banwell Flood Source					
The Sea	Fluvial	Surface Water	Surface Water highway	Groundwater	Sewer Flooding
	✓	✓	✓		✓

Table 9: Sources of flooding in Banwell

7.2 Historic Flooding

Roads known to have flooded are:

- Summer Lane
- West Street
- Woolvershill Road

7.3 Evidence Collected

7.3.1 Local knowledge & site investigation

The flooding impacts were fairly isolated and spread around the parish. The River Banwell was reported to overtop its banks, suggesting the discharge from neighbouring drainage into the River Banwell would have been limited due to "locking" (this is when water is unable to flow away due to a high tide inhibiting the outfall, or in low lying and flat areas water cannot flow and remains 'locked ' in one location).

Table 10 highlights roads where properties experienced flooding:

Road name	Impact
West Street	Basement and garden flooded due to the sewer surcharging. Water from Westfield Road also contributed.
Summer Lane	Highway flooded with cars creating bow waves onto surrounding properties.
Silver Moor Lane	Highway flooded at a number of locations.
Moor Road	Highway runoff and field runoff contributed to a properties garden flooding.
Knightcott Road (1)	September 24, runoff from surrounding fields was pooling on the highway. Due to the drop kerb, water quickly made its way into the property.
Knightcott Road (2)	Water from Westfield Road and Woolvershill Road contributed.
East Street	Water from the adjacent field flowed down into the property, via the air vents of the property. A pond in the corner of the field was at maximum capacity.

Woolvershill Road (1)	Water pools on the highway and then flowed down the drop kerb contributing to the flooding of both properties
Woolvershill Road (2)	Water overtopped the road as the water was throttled back due to the limited capacity of the ditch

Table 10: Impacts on roads in Banwell

7.4 Likely Cause of Flood Incident

Due to the River Banwell being at maximum capacity for several days the public sewers and highway drainage would have struggled to take water off the land and highways, to discharge into the watercourse. Furthermore, silt and debris carried off from fields and onto the highway may have blocked the road side gullies, contributing to the flooding on the highway. The capacity of road side ditches were unable to cope with the volume of rainfall, overtopping onto the road. Water can then drain through the surface water manholes causing surcharging down stream.

7.5 Risk Management Authorities

	Risk Management Authorities				
	LLFA	EA	WW	IDB	HA
Involvement required	✓	✓	✓	✓	✓

Table 11: The RMA's which have flood risk management responsibilities in Banwell as a result of the 2012 flooding

8 Blagdon

8.1 Flood incident extent and impact

Blagdon Parish is located centrally to the South of North Somerset and shares a border with Somerset County Council. It is primarily rural and has a population a little over 1,000. Blagdon forms part of the Mendip Hills and is therefore relatively hilly. A large section of Blagdon Lake also falls within the parish.

Seven properties flooded in 2012, however over half were within April and May which is uncharacteristic of flooding in other areas of North Somerset.

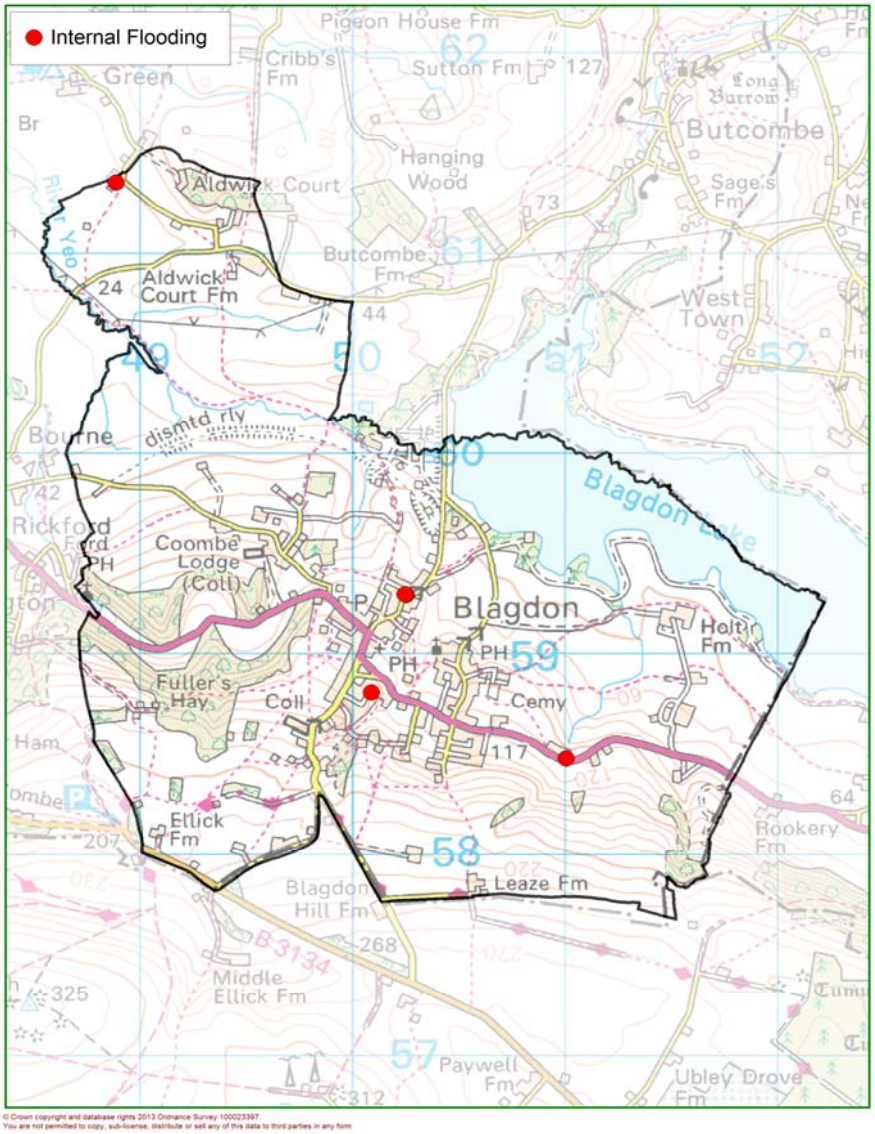


Figure 18: Flood locations in Blagdon

Blagdon Flood Source					
The Sea	Fluvial	Surface Water	Surface Water highway	Groundwater	Sewer Flooding
		✓	✓	✓	

Table 12: Sources of flooding in Blagdon

8.2 Historic Flooding

Roads known to have flooded are:

- Station Road

8.3 Evidence Collected

8.3.1 Local knowledge & site investigation

The first property of the year to flood in Blagdon was in Fallowfield. Topographically, Fallowfield is on the edge of a natural valley feature and there is a 15 metres difference in height from each end of the road. The water here tracked the downward slope to the end of the cul-de-sac and exceeded the height of the footway. Due to the property being below the level of the road, water flowed down the driveway to this natural low point.

On 1 May, blocked gullies at the junction of Garston Lane and Station Road, near the Fire Station reportedly caused flooding to two properties down the hill in Garston Lane. On 8 May, a repeat of heavy rainfall caused flooding to the same properties. These properties are below the level of the road.

Flooding occurred outside the Primary School and Public House on Bath Road throughout November and December due to blocked drains, posing difficulties for children to cross.

A property flooded on Dipland Grove, and at a low point on Bath Road. Water came from both easterly and westerly directions along the road, as well as from the field to the south. The gullies located to the west are prone to get blocked, as tractors use this route, depositing mud onto the roads which wash down into the gullies. The grip (a small drainage channel) that takes water from the road into the field located to the east was likely overwhelmed during the heavy storms. This water congregates around the property and floods down the driveway.

Two properties near West Aldwick Farm flooded. The area varies in height, with higher ground located to the north and east. Water from the direction of Aldwick Lodge and Aldwick Court flowed down Aldwick Lane and over the dropped kerbs into the properties. There are also a number of Springs located in the area that in times of heavy rainfall, would have contributed further to the flood waters.

8.4 Likely Cause of Flood Incident

Debris and silt from the fields would have contributed to the blocking of highway gullies, increasing the amount of highway runoff. This silt etc would have been taken from the fields by surface water and groundwater. Groundwater levels would likely be high because of the proximity with Blagdon Lake.

8.5 Risk Management Authorities

	Risk Management Authorities				
	LLFA	EA	WW	IDB	HA
Involvement required	✓				✓

Table 13: The RMA's which have flood risk management responsibilities in Blagdon as a result of the 2012 flooding

9 Churchill and Langford

9.1 Flood incident extent and impact

The villages of Langford and Churchill are located to the south of North Somerset, near the boundary with Somerset. There were 11 internal flooding incidents in Churchill, split evenly between September and November. In Langford, 22 internal flooding incidents occurred, the majority in September and November, but with approximately 20% taking place in the summer months. Churchill and Langford make nearly 7% of all internal and external flooding incidents in 2012.

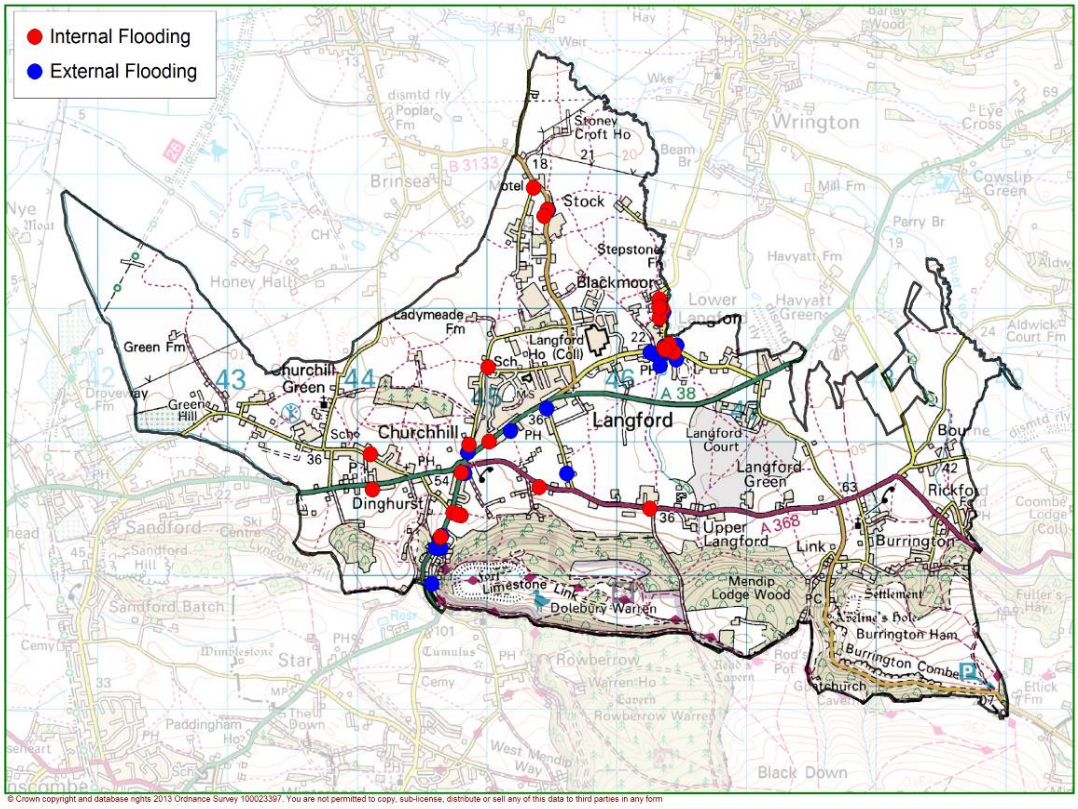


Figure 19: Flood locations in Churchill and Langford

Churchill and Langford Flood Source					
The Sea	Fluvial	Surface Water	Surface Water highway	Groundwater	Sewer Flooding
	✓	✓	✓	✓	✓

Table 14: Sources of flooding in Churchill and Langford

Churchill

During September, November and December surface water runoff caused isolated flooding incidents across the area. There was little impact to the west side of Churchill where no property flooding was reported. The main areas impacted were Doleberrow up to the Churchill traffic lights. As a result of the significant rainfall events, the road in Doleberrow flooded, restricting resident's in the use of their vehicles. Due to the amount of rainfall, water flowed from Doleberrow onto the A38 and along to the Churchill traffic lights, flooding four properties internally. A culvert downstream of the ditch system through Doleberrow overflowed, flooding two properties internally.

Langford

Langford Brook (an ordinary water course) starts in Upper Langford, runs through Lower Langford and discharges into the Congresbury Yeo. The significant rainfall event on 24 September and 4 & 21 November caused the Brook to overtop the banks south of Grove Nurseries at the 90 degree bend in the channel, flowing over fields onto Langford Road and Blackmoor, flooding two properties internally, before re-entering the watercourse. A number of properties flooded due to water from the highway throughout Langford. One property on the A368 Bath Road has flooded from the highway 9 times (4 times internally and 5 times externally).

9.2 Historic Flooding

Churchill

There has been a history of regular flooding in Doleberrow dating back to 1990. Flooding is limited to the highway, which becomes impassable for vehicles.

New Road has been reported to flood up to 20 times a year and is very vulnerable to heavy rainfall.

Langford

One property has flooded more than 5 times internally in the previous 10 years..

Roads known to have flooded are:

- Blackmoor
- Bath Road

9.3 Evidence Collected

9.3.1 Local knowledge, site investigation & flood surgeries

Information gained from a site walkover and a flood surgery held on 27 March 2013 has been used to piece together the turn of events and the impacts of the flooding.

Churchill

The contours show Doleberrow to be typically 75 metres above mean sea level. There are a number of steep hills located within a kilometer to the south ranging from

100 – 200 meters above mean sea level which generate rapid surface runoff. During a site walkover on 16 March it was visible how steep the sides of Doleberrow estate were (typically 1:1.3) and how the topography funnels the surface water from the surrounding area down Doleberrow. This water can reach up to 600 mm deep, but is mostly kept within the highway due to the houses being built above the level of the road. It was recorded that the flow is very fast and vehicles driving through the flood water sustained damage. Water pools at the bottom of Doleberrow and can spill over onto the A38 and along to the Churchill traffic lights where one property flood. This was exacerbated by a surcharging manhole on the pavement near Enderleigh Gardens, contributing to the volume of water onto the highway.

A culvert taking water from Doleberrow overflowed flooding two properties internally. It was reported that the flooding was 600mm deep in the gardens where the water struggled to dissipate. Downstream of the culvert, it was reported that the ditch near Jews Lane was unable to take the volume of water coming off the fields, resulting in one property flooding externally.

Residents have mentioned - *that the pipe network has blocked more frequently recently and think the amount of debris coming from the hills has increased since the Forestry Commission have carried out felling upstream.*

A pond on Dinghurst Farm overflowed during the intense periods of rainfall. This tracked towards Dinghurst Road, contributing to the flooding of several properties externally and one internally.

Generally speaking, it has been noted by the residents that a number of incidents occur in times of flooding.

- *The manhole junction with Enderleigh Gardens surcharges*
- *The ditch (150m+ of Enderleigh Gardens) overtops, flooding the fields to the east and the adjacent A38 to the west.*
- *A manhole surcharges in the gardens of the terrace houses on New Road.*

Langford

High levels in the Langford Brook resulted in significant out of bank flows. The majority of internal flooding in Langford was due to the overtopping of Langford Brook. Langford Brook flows under the A38 and meanders towards Grove Nurseries. Approximately 200 metres from Langford Road the channel has a ford followed by a 90 degree bend to the east where water overtops the bank, flowing towards Langford road and down Blackmoor Road. Properties affected went as far as Greenwell Lane but it is not clear if this is due to the overtopping of the banks near Grove Nurseries or if water spills over the banks at another location.

Water flowed overland near Maysmead Place down towards Blackmoor flooding one property internally. Surface runoff from the land was not a significant contributor to the number of properties that flooded in the Langford area.

Three properties have been recorded as flooding on Stock Lane, near Duck Lane. It is not clear as to the source of flooding to two of the properties, but there are ponds and ditches located nearby that may have overtopped. One property flooded due to

a combination of surface runoff from land near Mushroom Farm and highway flooding.

Water struggled to discharge via the ditch adjacent to Kitland Lane, backing up and spilling onto the road. Water then tracked north entering a nearby ditch flowing under Stock Lane and eventually into the Congresbury Yeo.

9.3.2 Highways information

There were a number of roads that flooded during the significant rainfall events in the latter part of 2012.

Churchill

The Churchill traffic lights are at a low point and therefore much of the highway runoff contributed to the flooding at this location. As mentioned, a significant amount of water flows from Doleberrow onto New Road towards the lights, as well as from Skinners Lane and Enderleigh Gardens. It was reported that *New Road was like a torrent, which flowed past the lights and onto Bristol Road*, which residents say *they have hardly ever seen before*.

The west side of Bath Road struggled to cope with the amount of rain water, which was exacerbated by some of the gullies being blocked. This and the combination of the ditch (between Jews Land and New Road) also at capacity led to one property flooding externally. It was noted at the flood surgery that overland flow tracks from the fields between properties near the nursery, to the ditch and also onto Jews Lane.

Langford

On the A38 outside the Beeches, water flowed down towards Yew Tree Close at which point, it escapes from the road due to a drop curb, flooding properties externally on and adjacent to Yew Tree Close.

Residents raised concerns *that there are no gullies on Saxon Street*. *This contributed to the resulting external flooding.* It was also reported that surface runoff from Yew Tree Close flowed onto Saxon Street, making the existing problem worse.

Several properties flooded internally and externally due to highway runoff and these seem to be isolated incidents across the area. These included: Says Lane; Stock Lane; Ladymead Lane; Pudding Pie Lane; and Langford Road.

Groundwater has a limited impact on flooding at this location. However water did percolate up through the ground in the fields and flows towards Says Lane.

9.4 Likely Cause of Flood Incident

Churchill

The main issue stems from Doleberrow, which had a number of problems with the drainage system, adjacent to Dolebury End, outside Ankerhus and down by The White House. Doleberrow is located alongside a pre-existing river. The lay of the land naturally funnels the water down this path and in times of excessive rainfall, the drainage systems are unable to cope. Surface water picks up leaf litter and silt depositing in the ditches and against the trash screens, reducing the efficiency of the assets.

There is a pond upstream of Doleberrow which has allegedly been neglected, possibly contributing to the issues.

There is a right angled bend in the surface water drainage pipe near Enderleigh Gardens on New Road, which slows the flow and increases the pressure, eventually surcharging the manhole. It is believed the highways drainage pipe goes from a 300 mm pipe into a 225 mm pipe. Review of the Wessex Water plans doesn't show any diameters regarding the pipe.

There were reports of blocked gullies throughout the area, particularly by the Churchill Lights, likely blocked from silt and debris picked up from the surrounding fields.

Reportedly *there is little road drainage on New Road between Skinners Lane and the Churchill lights. During excessive rainfall, the road becomes inundated.*

Langford

The likely causes of the flood incident appear to be the out of banks flow of the Langford Brook. The primary reason for the overtopping was because of the ford and the sharp turn in the channel where slowed down and backed up, raising the water level. The highways drainage was overwhelmed by the severe storm events however in many areas the highway drainage systems were reported as being blocked, contributing to the problem. There were issues regarding surface runoff from some fields but these were isolated incidents.

There were concerns regarding the foul sewer system backing up around Yew Tree Close. The public sewer is a combined sewer which is designed to take sewerage and a certain amount of roof water from several old properties.

9.5 Risk Management Authorities

	Risk Management Authorities				
	LLFA	EA	WW	IDB	HA
Involvement required	✓		✓		✓

Table 15: The RMA's which have flood risk management responsibilities in Churchill and Langford as a result of the 2012 flooding

10 Claverham and Yatton

10.1 Flood incident extent and impact

The parish of Yatton is situated at the centre of North Somerset and is relatively flat. There is a vast system of ditches and rhynes outside the urban areas draining the land. Yatton is approximately four times the size of Claverham, but experienced less flooding, the majority of which was on Claverham Road, equating to one third of all flooding in the parish.

Several roads leading in and out of Yatton were flooded and had to be closed during the severe storm events in late 2012, at times bringing the town to a standstill. Eight properties flooded internally and 13 properties flooded externally. The break down as to when these properties flooded is unknown except that flooding occurred between September and December 2012. There were 20 internal flood occurrences in Claverham with 9 being on Claverham Road. One property on the High Street flooded 3 times between September and November.

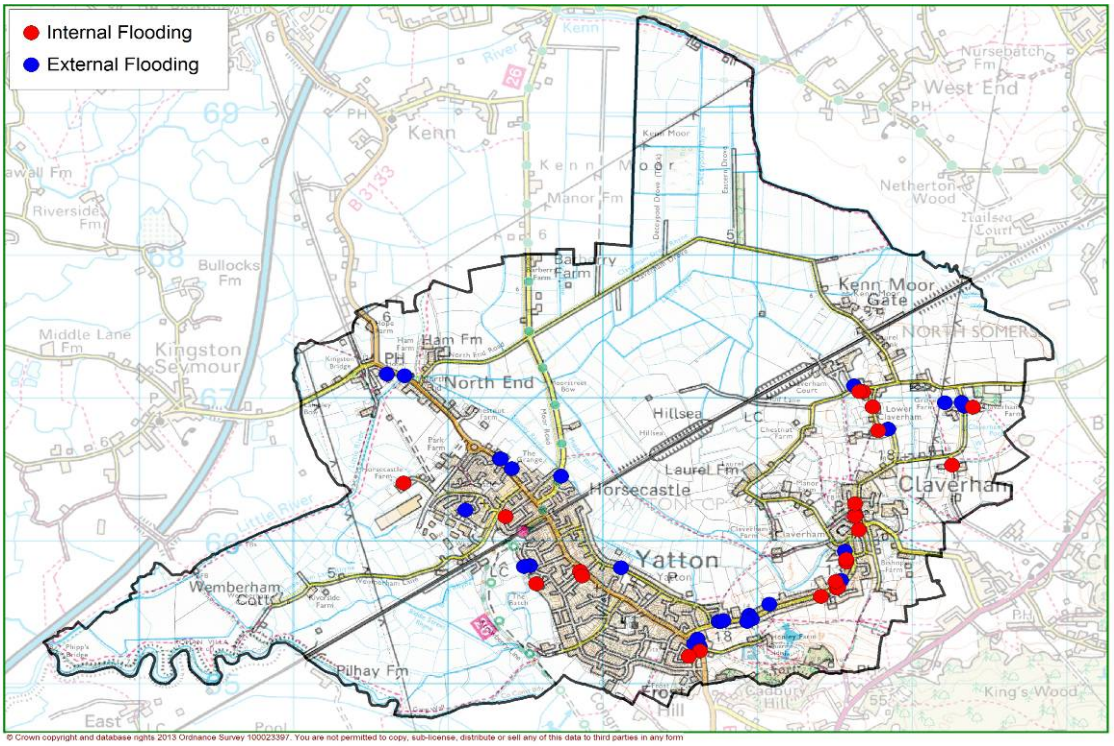


Figure 20: Flood locations in Claverham and Yatton

Claverham and Yatton Flood Source					
The Sea	Fluvial	Surface Water	Surface Water highway	Groundwater	Sewer Flooding
	✓	✓	✓	✓	✓

Table 16: Sources of flooding in Claverham and Yatton

10.2 Historic Flooding

North End Road and the High Street in Yatton has been the only significant case of flooding historically, occasionally spilling onto the side roads but mostly being contained within the highway. These roads are:

- North End Road
- High Street (Yatton)
- High Street (Claverham)
- Derham Park

10.3 Evidence Collected

10.3.1 Local knowledge & site investigation

Much of the information North Somerset Council has collected was provided by the Yatton PACT community group. The majority of the flooding seemed to be highway runoff however the flooding on Claverham Road points to runoff from Cadbury Hill. There were many reports where there was a concern of sewage in the water.

8 areas were identified by the residents as “risk areas”	
North Yatton	North End, Wemberham Lane, Rugby Club, Bridge Inn
North West Yatton	Horsecastle Close, Horsecastle Farm Road, Wakedean Gardens
West Yatton	Mendip Road, Grace Close
Central Yatton	Yatton High Street, properties/offices around the newsagent, The Eagles to Railway Bridge
East Yatton	Stowey Road – 3 properties
South East Yatton	Top-Scaur, Henley Lodge & Henley Lane
West Claverham	Areas on Claverham Road, contributed by springs near RC Church
North Claverham	Brockley Way, Green Farm & Grove Farm

Table 17: Flood risk areas identified by local residents

Yatton

There was significant flooding to Yatton High Street and North End Road for substantial periods during the latter months of 2012. The key issues were primarily highway flooding with vehicle spray greatly exacerbating the impact to properties and passing pedestrians.

Despite no internal flooding on North End Road, there was still a great disruption to the use of the highway, which stretched from The Bridge Inn down to the Rugby ground. Residents reported the water to be above the kerb, spilling onto the footpath making it impassable for pedestrians, and forcing vehicles to pass on the wrong side of the road. This was particularly hazardous adjacent to the Rugby ground for cars accessing and leaving their driveways.

The surface water sewers in the Horsecastle development became drowned by the water level in Wemberham Lane Rhyne down stream reducing the rate of dissipation. Horsecastle Close was subject to some severe highway flooding and flood levels were reaching the front doors of many properties. One property flooded internally and externally (on separate occasions) with depths in the garden at around 460 mm.

There were reports of foul sewage contaminating the flood waters throughout Yatton. Wakedean Gardens flooded causing damage to vehicles and properties. Pools would form, lasting for days at a time, with residents reporting a smell of sewage. One property on Stowey Road flooded externally on multiple occasions due to a surcharging foul sewer manhole on the driveway. There were flooding issues on Mendip Road around the junction with The Ridge, reportedly containing foul sewage. The ditches on the farm land were blocked with debris and overtopped, contributing to the flooding. One property owner has lived on Grace Close for over 11 years and 24 September was the first time water had entered their property. The ground was saturated and the resident was getting ingress of flood water from neighbouring gardens. The foul sewer manhole lifted in the back garden due to the water pressure in the system.

Two properties flooded internally on Yatton High Street, both due to vehicle spray from passing vehicles.

There was flooding at Top-Scaur, a local term used to describe the area around Frost Hill junction with Mendip Road and Tripps Corner. Runoff from Cadbury Hill and surrounding fields flowed onto Top-Scaur on numerous occasions taking 2 weeks for the water to dissipate in some circumstances. One property was flooded internally in Henley Park and a further two externally. Water came from both the front and back of the house, and dissipated after 4 hours.

Claverham

Between September and December 2012, there was a recurring problem at the bottom of Meetinghouse Lane and Brockley Way. Every time there was significant rainfall, Brockley Way flooded as water struggled to drain away, backing up onto Meeting House Lane. Passing cars and cyclists were forced onto the wrong side of the road and one property flooded internally multiple times up to a depth of 75 mm.

Flood water on the highway was reported to be 450mm deep and around 50 metres in length in some areas. Two properties flooded internally from groundwater and highway runoff, where flood waters rapidly rose and fell.

Claverham Road

Claverham Road was flooded at multiple locations along its length on a number of occasions between September and December 2012. There were differing durations

as to how long it took the water to dissipate; some as long as two weeks. It was reported that around 75% of the road width was flooded between Hollowmead and Streamcross (400m) with depths of up to 150mm. Water from the road also flowed along driveways of adjacent properties. Eight properties flooded internally with many other gardens flooding, leaving debris behind after the waters receded. It was reported that the gullies on Hollowmead Close were blocked and unable to cope with the volume of water. This overtopped the kerb height and flowed via the back gardens into properties on Claverham Road.

Runoff was flowing off Cadbury Hill on to the road. Springs near the Roman Catholic Church contributed to the volume of water flooding gardens and garages. It took over two weeks for the water level around the Church to reduce.

There were several occurrences of the sewers backing up along Claverham Road, reportedly due to blockages.

Other Areas

A property on Streamcross near Mud Lane flooded due to the local water courses overflowing. The entrance track to Grove Farm off Brockley Way flooded. This was believed to be due to the culvert that runs under the track being blocked or not having a sufficient capacity to cope with the volume of water present. It is believed that a similar issue caused the flooding of a property on Jasmine Lane. The Public Sewer system was also backing up causing flooding issues on Brockley Way.

10.3.2 Highways information

Many highways were impacted by the flooding in Yatton presenting difficulties for the residents. Many of these impacts have been mentioned above. There were reports of blocked gullies throughout the villages of Yatton and Claverham contributing to the pooling water.

Town	Road	Road closure
Claverham	Claverham Road	✓
	Lower Claverham Road	
	Jasmine Lane	
	Claverham High Street	
	Hollowmead Close	
	Brockley Way	
	Claverham Drove Road	
	Meetinghouse Lane	
	High Street	
Yatton	Grace Close	

	Horsecastle Close	
	North End Road	✓
	High Street	
	Kenn Moor	
	Wemberham Lane	
	Elborough Avenue	
	Henley Lane	✓
	Mendip Road	
	Grassmere	
	Henley Park	
	Henley Lodge	
	Stowey Road	
	Wakedean Gardens	
	Horsecastle Farm Road	
	Frost Hill	✓

Table 18: Roads impacted by flooding in Yatton Parish in 2012

10.4 Likely Cause of Flood Incident

Yatton

It is suspected that a drainage pipe along parts of the B3133 throughout Yatton has collapsed which would limit the rate of drainage. The ditches taking water away from Yatton were also reported as being at capacity contributing to the build up of water on many roads. The limited capacity of the drainage assets contributed to the flooding of localised low points throughout Yatton. Furthermore, the excessive rainfall flooded the foul sewer causing it to surcharge.

Claverham

Excessive rainfall saturated the land, raising groundwater levels. Springs were a contributing factor for both property and highway flooding. There was a significant volume of runoff from fields onto Claverham Road, bringing with it silt which blocked many gullies along the road. Blocked gullies were also an issue throughout the area.

10.5 Risk Management Authorities

	Risk Management Authorities				
	LLFA	EA	WW	IDB	HA
Involvement required	✓		✓	✓	✓

Table 19: The RMA's which have flood risk management responsibilities in Claverham and Yatton as a result of the 2012 flooding

11 Clevedon

11.1 Flood incident extent and impact

There were a total of 24 different properties affected by internal flooding within Clevedon in 2012. However some of these properties were affected on more than one occasion.

Clevedon is split into 7 wards and the majority of these flooding incidents (26 out of the 34) happened within the ward boundary of Clevedon East. The flood incident that affected the largest number of properties in Clevedon was on 24 September when 19 properties were flooded internally.

There are three areas in Clevedon where a number of properties can be grouped together into individual flood incidents. 12 properties were flooded internally on Kingston Avenue and Clover Close. Five properties were flooded internally on Court Lane and three properties were flooded internally on Tickenham Road. The remaining three properties were flooded on different days in different locations.

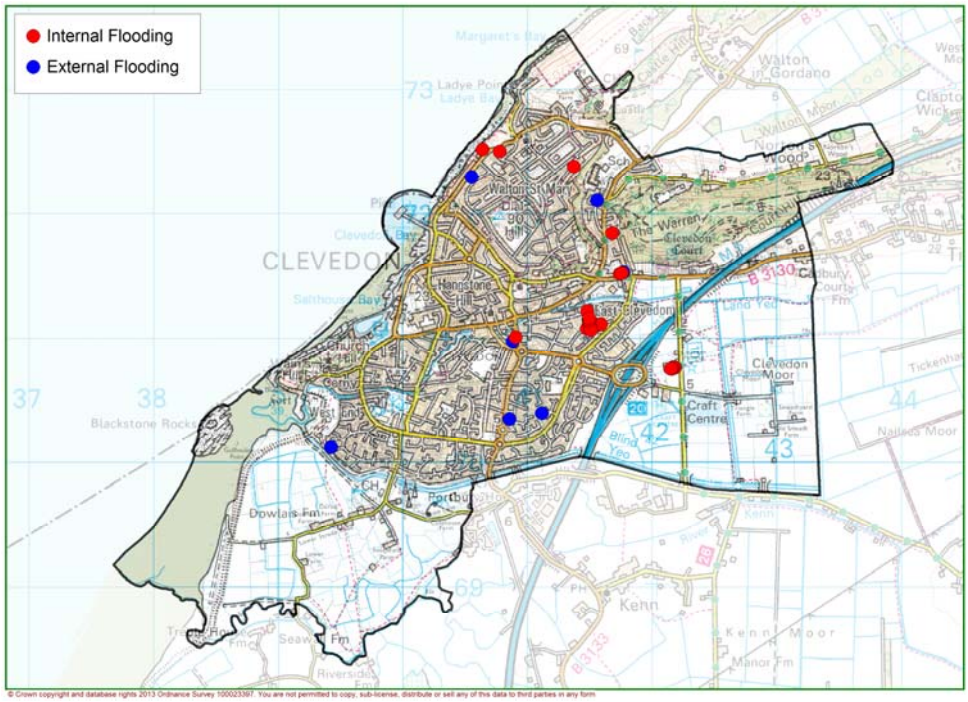


Figure 21: Flood locations in Clevedon

Clevedon Flood Source					
The Sea	Fluvial	Surface Water	Surface Water highway	Groundwater	Sewer Flooding
		✓	✓	✓	✓

Table 20: Sources of flooding in Clevedon

11.2 Historic Flooding

Roads known to have flooded are:

- Kenn Road
- Old Church Road
- Cherry Avenue
- Chapel Hill
- Tickenham Road
- Lower Stode Road
- Court Lane

11.3 Evidence collected

11.3.1 Local Knowledge & site investigation

Kingston Avenue & Clover Close

Ten different houses have been flooded internally with some of these properties reporting multiple flooding incidents. The most significant incident was on 24 September when all 10 of these properties flooded.

NSC was informed by residents that a variety of sources were contributing to flooding in the area. Drains were reported as being blocked on Clover Close as water was unable to drain away. Water was recorded as coming up through the floorboards due to suspected groundwater. A letter from one resident *suggests that the problem is not only surface water but water from foul sewers, due to the toilets backing up.* Some reports suggested that the flooding came from the nearby rhynes or drainage ditches.

Properties on Kingston Avenue and Clover Close were also affected by external flooding as the below excerpts from the media suggest.

> *"20 homes in Clover Close in Clevedon affected by floodwater*," the fire and rescue service spokesman added. **- BBC NEWS website, 24 September 2012**

> *"In Clevedon, eight to 10 homes in Kingston Avenue had their gardens flooded, with the water also running under floorboards, causing the electrics to cut out in some homes. Residents used buckets and wheelie bins to take water away from their properties before fire crews turned up to help pump it away."*
> **- Weston Mercury**

Court Lane

On 24 September there were five houses that flooded internally on Court Lane. It can be seen from maps and aerial photography that this area is covered in a network of drainage ditches, a number of which are located near to properties. Reports that gullies were blocked or overwhelmed and that drainage ditches were overflowing were received from local residents. Runoff from the M5 motorway was a major contributor.

Tickenham Road

Three houses flooded internally on Tickenham Road and a fourth flooded externally. Anecdotal evidence suggests that there is a regular occurrence of highway flooding at this location. A number of gullies were blocked.

Other flooded areas in Clevedon

Individual properties were also affected by flooding at Wellington Terrace, Edward Road South and Halswell Road. All of these flood incidents relate to excessive surface water on the highway. Gullies at these locations were unable to cope with the volume and intensity of rainfall.

11.4 Likely Cause of Flood Incident

A private rain gauge in Clevedon showed that 45mm of rain fell within 24 hrs (24 September). The average monthly rainfall for September over the last three years was 38mm. This highlights the intensity of rainfall fell and how the highway drainage would have been completely overwhelmed as it is not designed to take such volumes. Further to this, the consistent rainfall in the months leading up to this would have saturated the ground and surface water from land again would have exceeded the capacity of the drainage ditches.

11.5 Risk Management Authorities

	Risk Management Authorities				
	LLFA	EA	WW	IDB	HA
Involvement required	✓		✓	✓	✓

Table 21: The RMA's which have flood risk management responsibilities in Clevedon as a result of the 2012 flooding

12 Congresbury

12.1 Flood incident extent and impact

Congresbury is situated centrally within North Somerset. The Congresbury Yeo, one of North Somerset's largest Main Rivers, flows through the village from east to west starting upstream of Blagdon Lake and discharging into the Severn Estuary. Millennium Green is designed to take excess flows from the Congresbury Yeo during periods of high flows, which it did in September and December. No properties were flooded directly from the watercourse. Surface water runoff appeared to be the main issue. There were 48 internal flood occurrences between September and December, and a further 13 external occurrences. Rainfall radar shows approximately 40mm of rainfall fell over Congresbury between 21:00 23 September and 09:00 24 September equating to 60% of a month's rainfall in just 12 hours. In November the Iwood gauging station confirmed record flows of 12.9m^3/s, approximately 12 times more than average and the river level rose to a record high of 1.47 meters (gauge datum).

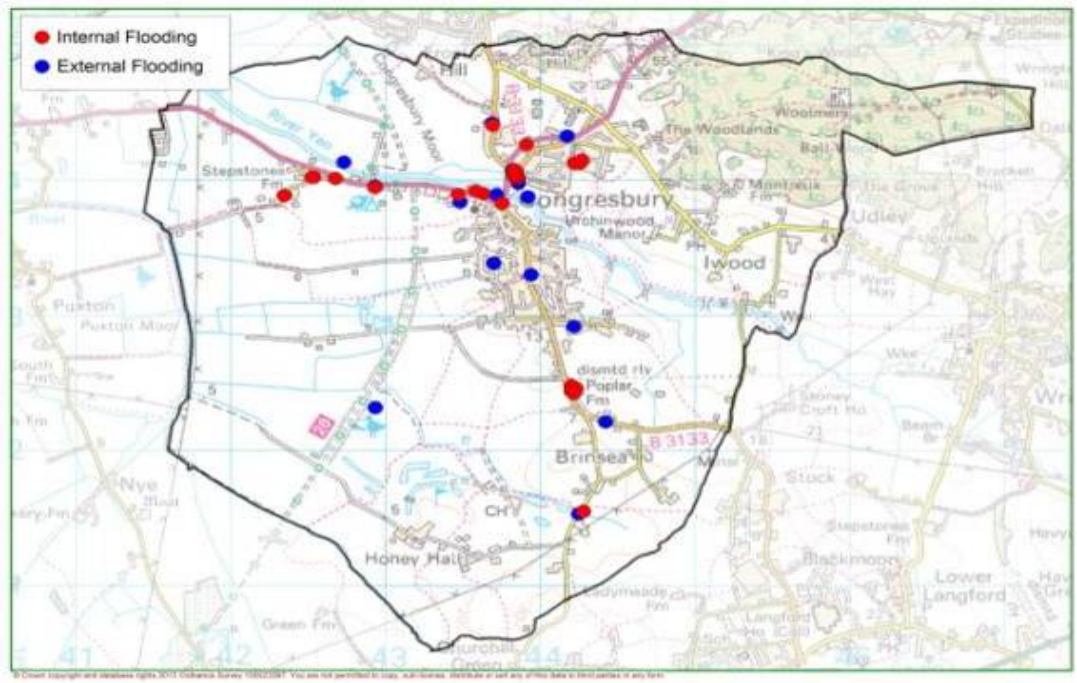


Figure 22: Flood locations in Congresbury

Congresbury Flood Source					
The Sea	Fluvial	Surface Water	Surface Water highway	Groundwater	Sewer Flooding
		✓	✓	✓	✓

Table 22: Sources of flooding in Congresbury

The table below highlights the different mechanisms that contributed to the flooding across Congresbury.

Road name	No. of properties flooded (internal & external)	Source				
		Fluvial	Highway runoff	Field runoff	Blocked ditch / culvert	Groundwater
Brinsea Batch	1		✓	✓	✓	✓
Brinsea Road	6		✓	✓	✓	✓
Bristol Road	2		✓			
Gooseham Mead	1		✓			
High Street	1					✓
Kent Road	5		✓		✓	✓
Nomis Park Road	1					
Old Weston Road	3				✓	
Smallway	2		✓			✓
Station Road	4		✓		✓	✓
Stonewell Drive	2		✓			
Verlands	1		✓			
Weetwood Road	2		✓			
Weston Road	1				✓	

Table 23: List of flooded roads, with number of impacted properties and source by which they flooded

12.2 Historic Flooding

There has been a history of flooding in Congresbury, with records dating back as far as 1703. The most notable incident was in 1968 where 125 properties were flooded, some to a depth of 2 meters. This resulted in major improvement works in the area to manage the risk of flooding from the river and the Millennium Green storage area was created. This has been seen to function in recent years when the area has flooded, preventing property flooding.

12.3 Evidence Collected

12.3.1 Local knowledge & site investigation

Various sources of information were used during the investigation, including the EA Reconnaissance Report and the Congresbury Community Resilience Flood Team reports including information gained from local residents. The majority of flooding occurred in September and November, with some more localised flooding occurring in December. Flooding was observed in the low lying areas of the village. This was not directly caused by the river, but more a multitude of flooding sources, including blocked ditches & culverts, highway runoff and groundwater. It is important to note that the high levels in the Congresbury Yeo and Gooseham Rhyne would have resulted in the drowning of outfalls and the backing up of surface water drainage. This caused a number of manholes to surcharge in Gooseham Mead, Kent Road and Well Park. It was also noted that a number of properties at these locations were affected by backflows through foul sewer systems. There were further reports of foul sewer flooding at St Andrews School due to the toilets backing up.

Flooding was also reported to happen due to rising groundwater levels as a result of the catchment being saturated. The Ship and Castle Public House on the High Street flooded internally due to rising groundwater. Although the flooding was not substantial, it happened repeatedly. Other locations where groundwater contributed to property flooding included Kent Road, Smallway and Station Road.

In September, properties on Old Weston Road flooded due to surface water not dissipating into the rhynes. The rhynes were also blocked with debris further reducing the rate of drainage. The depth of water on the road at the entrance to Dolemoor Lane was so significant that only farm vehicles and 4x4's could get through, causing disruption in the area.

In November, there was internal flooding on Brinsea Batch from multiple sources. There are a number of ponds located to the east that drain west, passing under Brinsea Batch north of Brinsea Road Farm. It was reported that the culvert was blocked or under capacity for the experienced flows, causing out of bank flow and contributing to the flooding.

Six properties flooded on Brinsea Road, many on multiple occasions. A local ditch was blocked preventing water discharge from the area. It was reported that there was a history of property flooding at this location, but never to the depth of 250mm reported in 2012. Flooding was potentially exacerbated as the culvert underneath Brinsea Road appeared to restrict flow into the ditch on the opposite side of the road.

The east side of Wrington Lane is a single lane road with no drainage, bordered by vegetation. During times of heavy rainfall mud and gravel are collected by the flow of water and carried west where the road becomes kerbed and gullies are present. The water slows here depositing the debris which contributes to the blocking of drains further down hill, exacerbating the situation. Water from Wrington Lane flows onto Weetwood Road and the Verlands via the highway and gardens.

December saw further sustained rainfall, which saw water being stored in Millennium Green again. Properties in Kent Road were flooded because water was not able to drain away.

Figure 23: Congresbury Yeo at capacity, over flowing into Millennium Green, taken from Ship and Castle Car Park in November

12.3.2 Highways information

Surface water flooding occurred throughout the village in November and surrounding areas with roads becoming impassable, as follows:

- Kent Road
- A370 on the southbound lane just after the Smallway junction
- The lane that serves the allotment
- On the bend of Frost Hill near Cadbury House Hotel
- Brinsea Road

There was extensive surface water flooding on the A370 which caused disruption to transport as well as potentially causing flooding to some adjacent gardens and properties.

It was reported that the outlet pipes connecting ditches were buried, particularly impacting Kent Road.

12.4 Likely Cause of Flood Incident

There was no single source that can be labelled as causing the flooding in Congresbury. Although it can be said with confidence that no flooding came from the main watercourse through the village, the high water levels did have an indirect impact. Submerged outfalls caused the surface water drainage system to become temporarily overwhelmed, causing flooding of properties and the highway. High river levels would also raise the localised groundwater level which was reported as flooding a number of river side properties.

12.5 Risk Management Authorities

	Risk Management Authorities				
	LLFA	EA	WW	IDB	HA
Involvement required	✓		✓	✓	✓

Table 24: The RMA's which have flood risk management responsibilities in Congresbury as a result of the 2012 flooding

13 Dundry and Winford

13.1 Flood incident extent and impact

Ten properties flooded in Dundry Parish, the majority on Winford Terrace and Dundry Lane. Four properties flooded internally within the hilly parish of Winford, all of which were on the High Street. There was also significant flooding at Airport Tavern, Lulsgate Bottom where the road flooded multiple times and pumping equipment was required to make this busy road safe.

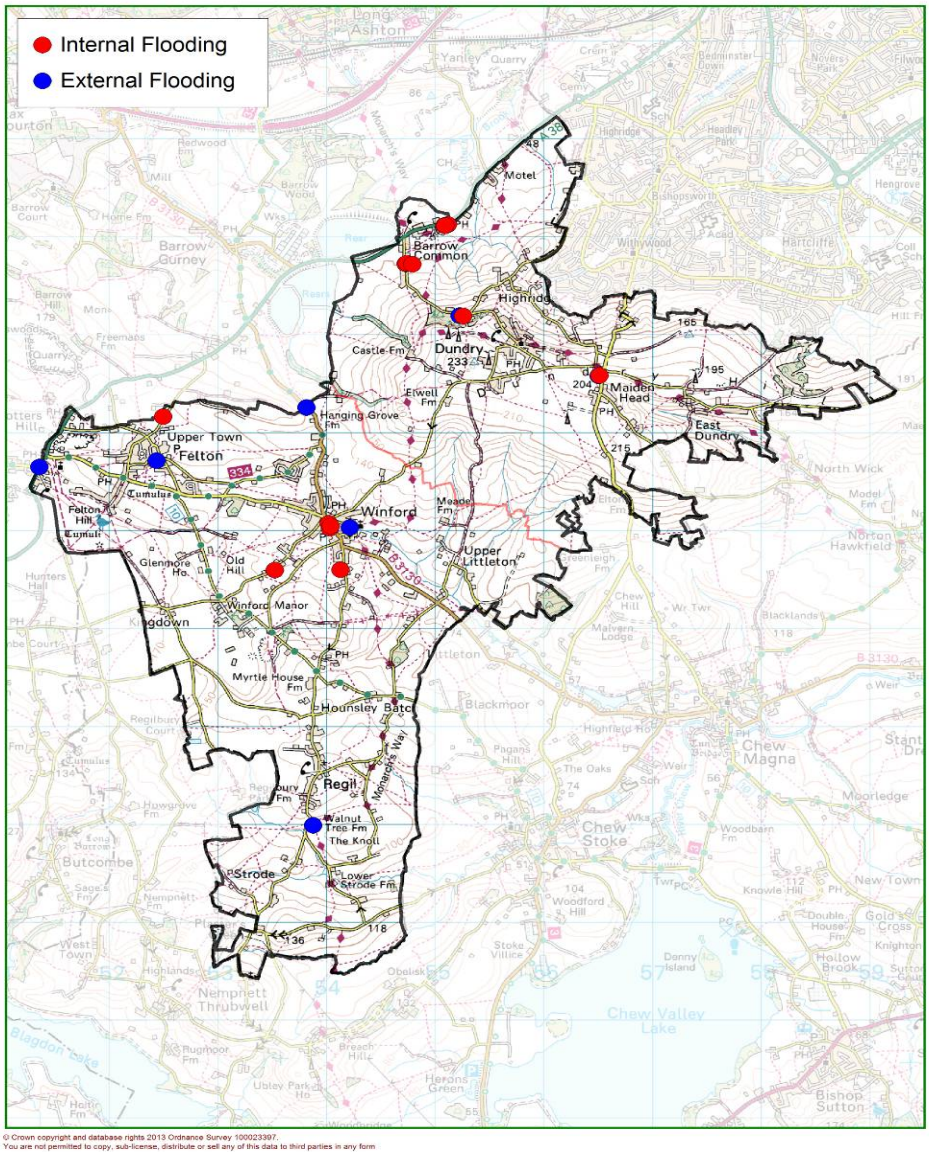


Figure 24: Flood locations in Dundry and Winford

Dundry and Winford Flood Source					
The Sea	Fluvial	Surface Water	Surface Water highway	Groundwater	Sewer Flooding
	✓	✓	✓	✓	✓

Table 25: Sources of flooding in Dundry and Winford

13.2 Historic Flooding

Roads known to have flooded are:

- Highridge Road
- Wells Road
- Broadoak Hill
- Kingsdown Road
- Bristol Road

13.3 Evidence Collected

13.3.1 Local knowledge & site investigation

Dundry

Seven properties flooded internally in Winford Terrace during the significant rainfall event on 24 September. A resident had lived in the premises for 25 years and never experienced anything like what happened that day. Water was flowing down Bridgwater Road over dropped kerbs directly into homes and on into the Winford Arms. The volume of water was such that the two gullies less than 40 meters up the road could not cope. A further gully located on the walkway was also not capturing enough surface water to prevent the properties from flooding.

Winford

Flooding on Winford High Street was a particular issue in September where four properties were reported as flooding internally. There were a number of blocked gullies along the High Street, contributing to flooding of the highway.

Following the heavy rainfall on 24 September, all the drains on both sides of the road of the High Street in Winford Village were reported as being totally blocked with stones and mud. Water made its way down the slope and into a village shop causing damage and some stock loss, despite sandbags being placed along the road.

Properties on the High Street that sit below the level of the road flooded when water on the highway exceeded the level of the kerbs resulting in flooding to several properties.

There was flooding on Parsonage Lane outside Winford C of E Primary School. Although no water entered the school, this section of the highway is frequently used and was reported as a potential hazard for vehicle users due to the depth of water.

Lulsgate Bottom

The A38 at Lulsgate bottom is the main route to access Bristol International Airport from the north. There is a low point on the road outside Airport Tavern with the road sloping up 1.4km to the south and 0.4km to the north with higher ground also to the west from Downside Road. Water collected at this low point flooding the highway on numerous occasions. Highway safety was highlighted with 2 of the 3 lanes underwater and depths reaching in excess of 450mm. The pipe draining this section of the highway had collapsed under the retaining wall and with the land owner's permission pumping equipment was used, discharging water into the adjacent field west. Had the pipe not collapsed, the manhole in the field would have surcharged still flooding the area. The drainage system also suffered from substantial silt deposits, blocking / restricting the pipe.

During the summer of 2012, Barrow Lane suffered flooding due to blocked gullies. The grips that are designed to take water from the road and into a ditch were blocked with overgrown vegetation. This would likely have contributed to the deep water on the road.

Church Road flooded due to the overtopping of the ditch and ponds that run adjacent to the road, externally flooding a property opposite.

A gully blocked on The Street. This road slopes down to the south and surface water would flow down the hill via the highway. The water was flowing fast enough to cause damage to the road. Walnut Tree Farm suffered flooding partly due to a blocked culvert / ditch, which overtopped at Spring Field and ran down the hill in combination with the highway runoff. After speaking with local farmers they believe *there is a 225 mm pipe at this location that needed to be jetted*.

13.4 Likely Cause of Flood Incident

The primary sources of flooding appear to be surface runoff from fields or highway runoff. In some circumstances, the ditches that drain the land overtopped and flowed onto the highway, which then guided the water down the hill and into properties. Water from surrounding land flowed onto the highway depositing silt blocking gullies reducing the efficiency of the drainage. The heavy rainfall contributed to the saturation of the ground with water discharging from springs.

13.5 Risk Management Authorities

	Risk Management Authorities				
	LLFA	EA	WW	IDB	HA
Involvement required	✓				✓

Table 26: The RMA's which have flood risk management responsibilities in Dundry and Winford as a result of the 2012 flooding

14 Hutton

14.1 Flood incident extent and impact

Hutton is a small village east of Weston-super-Mare and located at the foot of Hutton Hill. 17 flood incidents were reported in 2012 with over half located on Moorcroft Road. To the north of Hutton is an array of ditches and rhynes to drain the land.

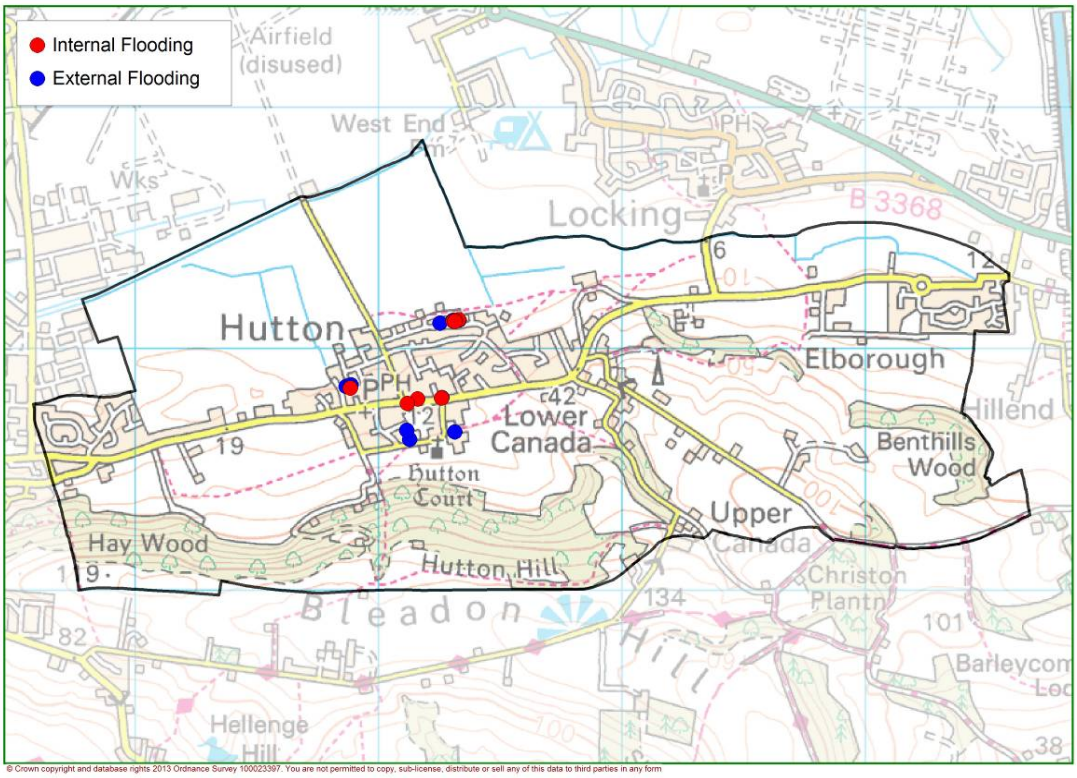


Figure 25: Flood locations in Hutton

Hutton Flood Source					
The Sea	Fluvial	Surface Water	Surface Water highway	Groundwater	Sewer Flooding
	✓	✓	✓	✓	✓

Table 27: Sources of flooding in Hutton

14.2 Historic Flooding

Roads known to have flooded are:

- Main Road
- Robin Drive
- Farm Road

14.3 Evidence Collected

14.3.1 Local knowledge & site investigation

Four properties flooded on Moorcroft Road in September and again in November. On 21 November properties were flooded from groundwater and highway runoff, with reports that the gullies were surcharging. Flooding lasted approximately 6 hours and water levels peaked at 11:00am, 3 hours after flooding commenced. Flooding depths were recorded at over 100mm in one garden. The foul sewer system was at full capacity due to the addition of surface water accessing the system, and in some locations the foul sewer manholes were surcharging. Water entered the air bricks in one property and caused the loss of electricity for over 5 hours.

Main Road flooded in September and November from multiple sources. In November it was reported that water came down Hutton Hill, down Church Lane East and down from Canada Coombe via the fields and the ditch adjoining the Village Hall car park. Furthermore, water was surcharging from the roadside gullies and flowing over drop kerbs into a resident's house.

Outbuildings flooded at two properties on Church Lane. On the east side, ditches on private land have been replaced with pipes, which were overwhelmed during the incident. On the south side, water collects on Church Lane from surrounding land and then spills from the highway, through residents' gardens onto Robin Drive bringing with it mud and debris.

14.4 Likely Cause of Flood Incident

Many properties flooded due to water flowing from the highway over the drop kerbs and down onto properties that were built lower than the level of the road. Due to the volume of water that fell, the catchment was saturated leading to runoff from the hills, groundwater levels to rise, the overtopping of ditches and the flooding of the foul sewer drainage. Blocked gullies would have contributed to the flooding.

Much of the drainage in the village discharges into Cross Rhyne. High water levels in Cross Rhyne would essentially "rhyne lock" the drainage system and therefore reduce the rate of dissipation.

14.5 Risk Management Authorities

	Risk Management Authorities				
	LLFA	EA	WW	IDB	HA
Involvement required	✓		✓		✓

Table 28: The RMA's which have flood risk management responsibilities in Hutton as a result of the 2012 flooding

15 Locking

15.1 Flood incident extent and impact

The comparatively small parish of Locking is located to the east of Weston-super-Mare. A total of 13 internal flooding incidents and nine external incidents were reported. Elm Tree Road accounted for nearly 70% of the flood incidents within the parish with some properties flooding four times within nine weeks.

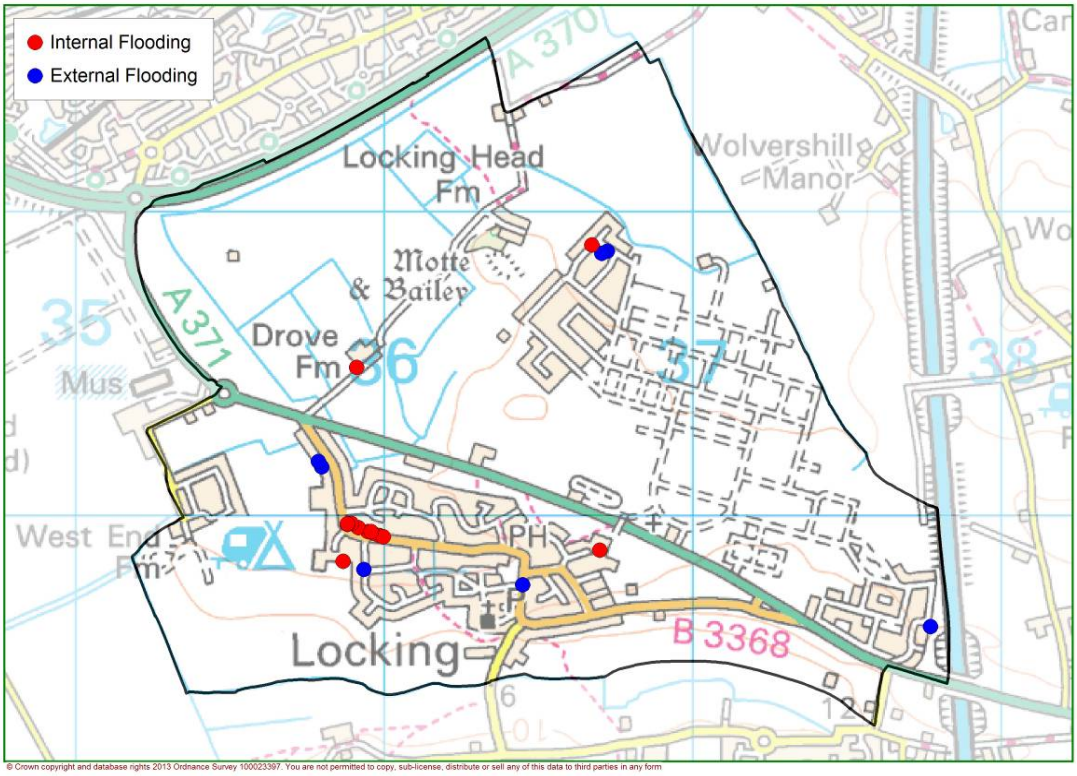


Figure 26: Flood locations in Locking

Locking Flood Flood Source					
The Sea	Fluvial	Surface Water	Surface Water highway	Groundwater	Sewer Flooding
	✓	✓	✓	✓	✓

Table 29: Sources of flooding in Locking

15.2 Historic Flooding

The village of Locking is located 4km east of the sea and has not seen a significant flood since 1968 and in the following year (1969) North Somerset Council carried out improvement works to the drainage system. There have been a few minor flooding incidents since then.

Roads known to have flooded are:

- Elm Tree Road

15.3 Evidence Collected

15.3.1 Local knowledge & site investigation

Locking is particularly flat and the gravity fed drainage system can take time to take water away from the area.

On 24 September two properties on Trenchard Road flooded. It was reported that the lay of the land slopes towards these properties and overland flow from the fields to the east entered the gardens, flooding the garages and sheds. The gardens are tiered and have flooded three times in the past eight years, with flood water in some instances reaching the properties.

On 26 September, properties on Woolvers Way were reported to have flooded. Originally, calls from residents were stating *that the flooding was limited to the gardens and highway only*. Later it was logged that some drivers passing through the flood water were creating bow waves resulting in flood water entering homes.

Classrooms at Locking Primary School flooded and the fire brigade had to pump water out to the play ground where it struggled to drain away, due to the saturated ground. The source of water has not been confirmed, but considering there is slightly higher ground to the east and given the groundwater levels, it is likely to be overland flow.

Elm Tree Road

Background

Elm Tree Road experienced severe flooding during the storm incidents in September and November. North Somerset Council obtained much of the information provided by a resident from Elm Tree Road, who experienced some of the worst flooding.

The flooding in Elm Tree Road first occurred in the early hours of 24 September. Water from highway runoff caused internal flooding to eight properties. Water was witnessed to flow down South Lawn, Byron Road and through gardens in Rydal Avenue down onto Elm Tree Road.

Elm Tree Road flooded again on 26 September, although not all the same properties were flooded on this occasion, those that weren't still had gardens submerged plus sheds and garages.

Again there was flooding on 21 November as heavy rainfall caused surface runoff to run down Elm Tree Road. Many of the gullies on Elm Tree Road were identified as running freely but at 3am the gully opposite No. 90 and the junction with, South Lawn blocked and then the system started to back up very quickly. Some of the same properties were again flooded. Sandbags and other 'defences' were installed by residents to protect their properties. Due to the frequency of rainfall at this time and potential consequence, residents took precautions and permanently left 'defences' in

place by the access ways to their properties. It was noted that the volume of water in Elm Tree Road itself was higher than on previous occasions.

The fire brigade was called on several occasions to pump water out of properties that were internally flooded. They also attended and pumped water from the Elm Tree Road - South Lawn junction to a functioning manhole outside 102 Elm Tree Road.

The section of open rhyne outside No. 75 overflowed in both September and November, causing flooding to gardens, garages and outbuildings. In September it took five days to subside however in November it drained within a day.

Although the surface water and foul sewer systems are largely separate, large quantities of overland flow and floodwater entered the foul sewer system causing it to surcharge and contaminate the flood waters.

15.4 Likely Cause of Flood Incident

Elm Tree Road

These drains are part of the Elm Tree and South Lawn system indicating there was a blockage or a restriction in the main line. During times of highway flooding, many drivers sped through the water creating bow waves, causing additional damage as the flood water flowed into properties.

Blockages

Gullies were reportedly blocked on South Lawn, Byron Road, Grenville Avenue, Rydal Avenue and on Elm Tree Road, east of the junction with South Lawn.

Inspections of the drains along Elm Tree Road identified that some gullies were blocked with silt and detritus and stagnant water was visible whereas other gullies were running freely. Leaves were seen to cover some drains restricting the discharge of water from the highway. During one inspection a lump of concrete was found and removed from one of the manholes.

Restrictions

There is a confluence in the drainage system outside number 102 Elm Tree Road where the Fire Brigade pumped the water. If the pressure within the system was greater at the north end, this would have restricted the discharge rate of the south pipe and therefore water from Elm Tree Road.

The highway drainage discharges into Cross Rhyne via a culvert to the west of the village. High water levels in Cross Rhyne would essentially “rhyne lock” the drainage system and therefore reduce the rate of dissipation.

Capacity

The sewer system takes both highways and surface water, and was at capacity during the storm events. Even if the drains were fully functional, they could not have coped with the volume of rainfall that occurred in September and November.

15.5 Risk Management Authorities

	Risk Management Authorities				
	LLFA	EA	WW	IDB	HA
Involvement required	✓		✓	✓	✓

Table 30: The RMA's which have flood risk management responsibilities in Locking as a result of the 2012 flooding

16 Nailsea

16.1 Flood incident extent and impact

On 4 August, parts of North Somerset were subject to heavy rainfall. The most intense rainfall fell over Nailsea, with isolated pockets of flooding across the town. 63mm fell over a 5 hours period causing surface water flooding, mainly in Heathfield Road, Greenfield Crescent, Mizzymead Rise and Moorend Spout. In total 20 properties flooded internally in 2012.

The number of properties flooded on 4 August were 16 internally and 43 properties externally. The main source of flooding was from surface runoff from the highway and other impermeable surfaces. On 30 August, NSC with the EA and WW held a flood surgery for the residents of Nailsea.

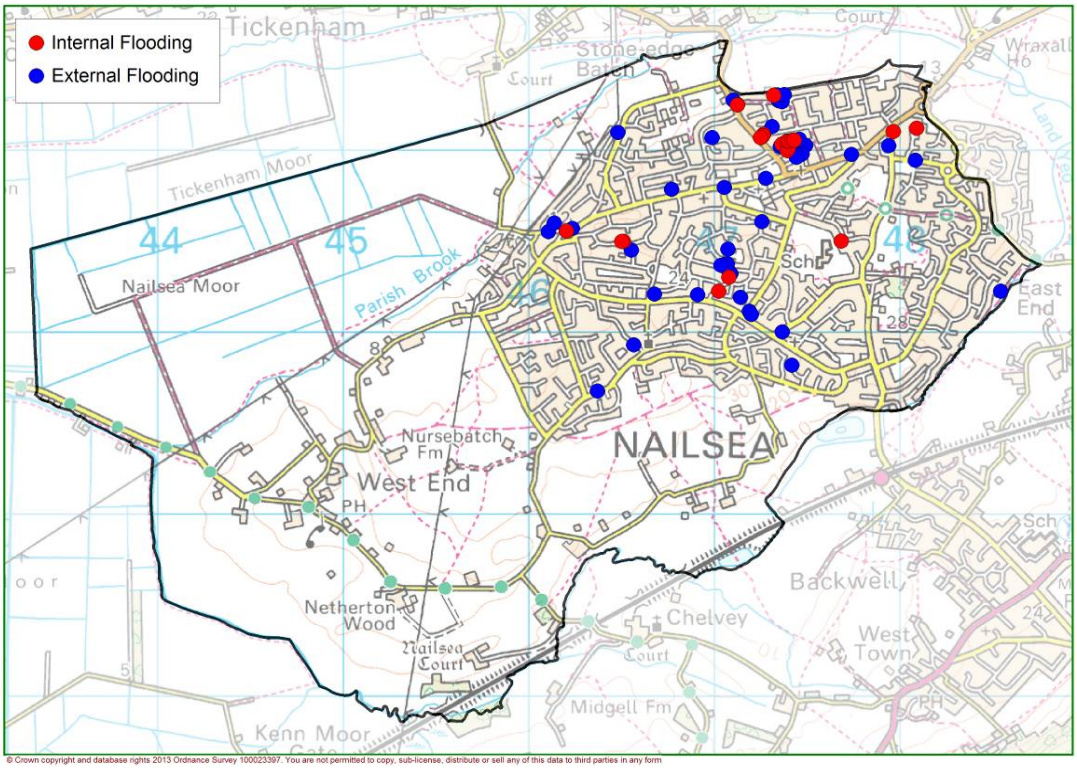


Figure 27: Flood locations in Nailsea

Nailsea Flood Source					
The Sea	Fluvial	Surface Water	Surface Water highway	Groundwater	Sewer Flooding
		✓	✓		✓

Table 31: Sources of flooding in Nailsea

16.2 Historic flooding

Prior to 2012, records showed that historically there has been no significant flooding in Nailsea. However, the North Somerset Preliminary Flood Risk Assessment did highlight that Nailsea was at significant risk of flooding and was identified as the 3rd highest risk area in North Somerset for surface water flooding. Speaking to residents at the flood surgery, it became apparent that there were flooding issues that NSC was unaware of.

- Residents explained how Greenfield Crescent is very susceptible to flooding when there is heavy rain fall and can happen several times a year.
- Further information provided by a resident explained how their back garden in Valley Way Road floods during times of very heavy rain.
- A few properties on Southfield Road have a history of flooding.
- Heathfield Road experienced severe flooding in 2009 after heavy rainfall, with blocked drains contributing.
- Properties on Cherry Road and Orchard Road both experienced flooding in 2007.
- Further properties and roads include Southfield Road, Clarken Close, Mizzymead Rise, Pound Lane and Station Road were flooded

Roads known to have flooded:

- Stockway North Subway
- Bucklands Batch
- Coombe Road
- Worcester Gardens
- Watery Lane

16.3 Evidence collected

16.3.1 Local knowledge & site investigation

The emergency services received about 80 calls for assistance and ten separate crews were called to pump flood water out of properties and drains in Heathfield Road, Southfield Road and Greenfield Crescent between 6pm on 4 August and 12.30am on 5 August after the rainfall became too much for the drains to cope with.

Further information was gathered from the NSC Area Officer who was on duty and Avon Fire and Rescue Service. News articles were also collected and reviewed.

NSC, the Environment Agency and Wessex Water held a flood drop-in session for the residents of Nailsea at Nailsea School. This provided an opportunity for residents to come and share their concerns, as well as engage with the information the authorities had to offer.

Recreation Centre, Mizzymead Rise and Clarken Close

The Recreation Centre is located in central Nailsea and flooded externally. The complex consists of buildings spanning 190 square metres, tennis courts, a bowling green and a car park. The drainage was not sufficient to cope with the volume of water, which was flowing off the site through the rear gardens on Mizzymead Rise and also onto Clarken Close. Water from Hillcrest Road contributed to the flooding on Clarken Close, which pooled at the low point of the cul-de-sac.

Station Road

One property on Station Road flooded internally from surface water on the highway. The property is located at the lowest point of the road. There is one gully in the dip and it did not have the capacity to cope with the amount of surface water runoff produced by the heavy rainfall. The water rose to about 300mm against the wall, where the gully had surcharged flooding the road. The pooling water continued to increase in depth before exceeding the height of the kerb and flowing down the driveway towards the resident's property, which is situated approximately half a meter below road level. The water rose to about 250mm against the property before entering the property through doors, flooding the ground floor to a depth of 50mm.

North Nailsea

A number of gullies were reported as being blocked throughout Nailsea, including Stock Way North and the High Street. Water flowed from Stock Way North down Heathfield Way (impacting 3 properties externally) and onto Heathfield Road where the water pooled flooding 7 properties internally and 7 externally.

Water collected on Southfield Road where the gullies could not cope with the volume of runoff and water flowed down Valley Way Road, Greenfield Crescent and Clevedon Road, settling at the low point in Greenfield Crescent flooding one property internally and eight externally.

Cherry Road and Orchard Road

Water flowed from the south of Cherry Road down onto Orchard Road where two properties flooded internally.

The whole width of Cherry Road flooded and was in excess of 10 meters in length. The water pooled at the lowest point in the road and overtopped the kerb, flowing down a driveway flooding the garden and garage. It was estimated that the depth in the garden was 300mm. The resident had put up make-shift flood boards in the doorways to stop any water coming into the house. There are two foul sewer manholes to the rear of the property that surcharged, flooding the garden and greenhouse. There is higher ground south of the property and the resident believes *that surface water came from adjacent properties into the back garden, exacerbating the situation.*

In Orchard Road two properties are below the level of the road and once the level of water exceeded the height of the kerb, it flowed down the driveway and into the houses. The water was recorded as being 230 mm deep in the gardens. The foul

drain in a driveway also surcharged. The sewer manholes in Cherry Road and Orchard Road are connected and clearly the system was overwhelmed.

Other areas within Nailsea

Other roads experiencing flooding throughout Nailsea included:

- Watery Lane
- Kings Hill & Union Street
- Church Lane
- Coombe Road
- Porlock Gardens
- Four Acres
- Downland Close

There was significant flow down Church Lane external flooding on Downland Close. Moorend Spout, Union Street flooded due to a surcharging manhole cover. The pressure was so great in the system that the tarmac lifted, resulting in the road needing to be closed.

16.4 Likely cause of flood incident

Evidence indicates that following the intense storm event on 4 August 2012 flooding was mainly due to excess surface water on the roads and insufficient drainage capacity to cope with the heavy rainfall. The reported rainfall event was estimated to be between a 1 in 50 to a 1 in 75 year rainfall event in Nailsea. Highway drainage is typically only designed to manage a 1 in 5 to a 1 in 20 year event, and therefore couldn't manage the volume of water.

Blocked gullies were reported to have contributed to the flooding. Many of the gullies in the worst affected areas had been cleaned on 3 August during routine maintenance. The heavy rainfall could have washed silt and debris from roads leading to blockages.

Weather station data for locations near & around North Somerset: 4 August 2012			
Location	**Rainfall data**	**Location**	**Rainfall data**
Nailsea	63 mm	Weston-super-Mare	10.9 mm
Wraxall	45.7 mm	Blagdon	3.6 mm
Portishead	40.4 mm	Bristol, Redhill	2.3 mm
Clevedon	18 mm	Bristol Airport	0 mm
Clifton	13.7 mm	-	-

Table 32: Weather station data for 4 August

Table 32 above highlights how localised the flooding was and how intense the rainfall was over Nailsea.

16.5 Risk Management Authorities

	Risk Management Authorities				
	LLFA	EA	WW	IDB	HA
Involvement required	✓		✓		✓

Table 33: The RMA's which have flood risk management responsibilities in Nailsea as a result of the 2012 flooding

17 Portbury

17.1 Flood incident extent and impact

The parish of Portbury is located to the north of North Somerset and is particularly rural. Properties predominantly lie in the village of Portbury or along Sheepway that runs along the boundary of Portishead. Seven properties flooded internally between August and December (note location not known for all properties - Figure 28). The flooding issues can be almost wholly categorised as surface runoff from the land.

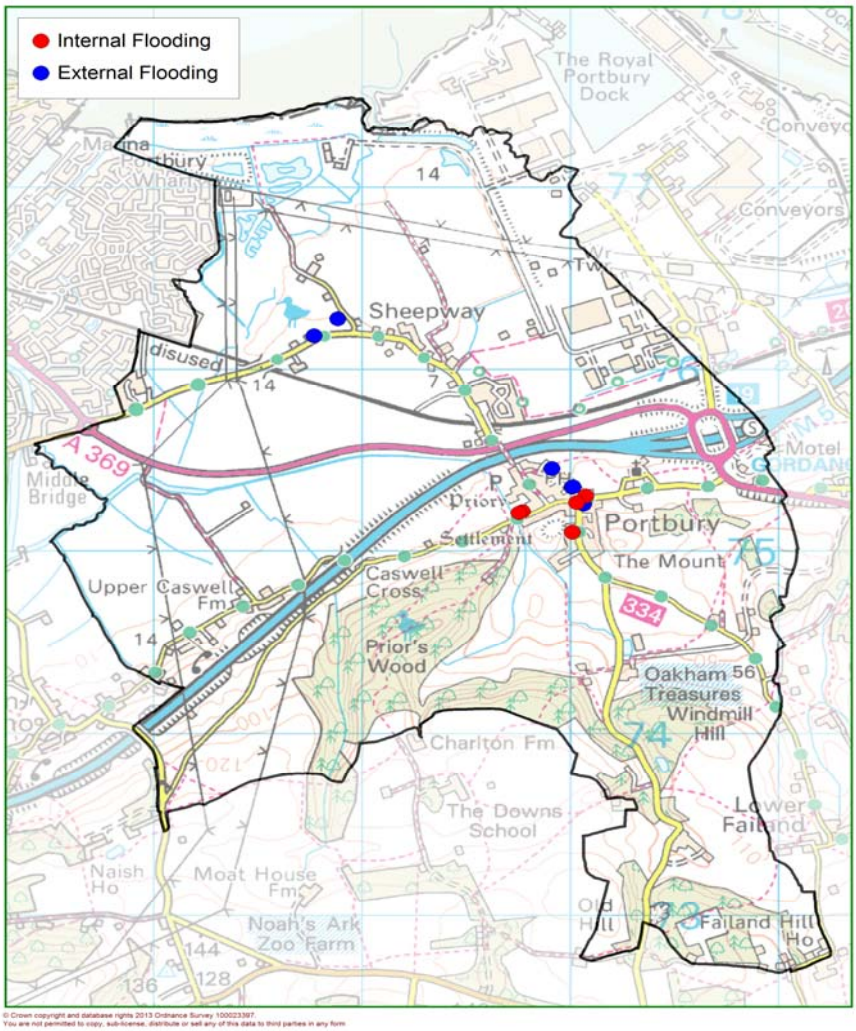


Figure 28: Flood locations in Portbury

Portbury Flood source					
The Sea	Fluvial	Surface Water	Surface Water highway	Groundwater	Sewer Flooding
		✓	✓		✓

Table 34: Sources of flooding in Portbury

A site inspection was undertaken on 21 November 2012 during the height of the flooding. There was a considerable volume of water flowing down Mill Lane (up to 300mm deep and fast flowing) into the village, however only two properties flooded. Roads were closed by the police due to vehicles getting stranded in the deep flood water. These roads were Portbury High Street, Mill Lane and Sheepway.

17.2 Historic Flooding

The Village Hall on Portbury High Street flooded 6/7 years ago and damaged the skittle alley.

Roads known to have flooded are:

- Portbury Lane into Mill Lane
- Portbury High Street
- Caswell Lane
- Failand Lane
- Sheepway
- Wharf Lane

17.3 Evidence Collected

17.3.1 Local knowledge & site investigation

Portbury Village is located at the bottom of surrounding hills. Runoff from surrounding areas is directed into the village. Runoff flows into the village along Failand Lane and Mill Lane. The roads into Portbury, namely Portbury Lane (into Mill Lane), Failand Lane and Caswell Lane are all typically lower than surrounding land. Due to the steepness of the hills, the flow of water was very fast, carrying a lot of sediment.

August

The first floods in 2012 were on 4 August which was estimated to be a 1:50 year storm (a rainfall event that has a 2% chance of happening each year). There were many sources of discharging water onto Mill Lane in August, contributing to the overall flooding at the bottom of the village.

- There were also several pipes discharging large amounts of water onto the highway along Portbury Lane.
- A ditch near Cooper Beach Farm had overtopped, freely discharging water onto the highway.

- Water was flowing from a field via the access gate and over the verge on to Mill Close and subsequently onto Mill Lane.
- A manhole drain located on the pavement adjacent to Brittan Place on the south side was surcharging.
- Several gullies on the roads were surcharging.

Water from Mill Lane flowed onto the High Street, flooding gardens. It was reported that two properties on Mill Lane, both on the east side above where the road narrows, flooded internally. Much of the flood water entering Portbury pooled outside the Village Hall, a low point in the village, causing minor flood damage to the building. During the August flood incident a land slip occurred in Failand Lane.

September

Garages on the high street were flooded again, due to the substantial amount of runoff from Mill Lane. An additional garage was flooded in Priory Road. Again minor damage was sustained to the Village Hall. Although there was greater rainfall in September than August, residents were a little more prepared and able to take some measures to protect their properties.

November

The same garages flooded at the junction of the High Street with Mill Lane and on Priory Road. Again there was minor flooding to the Village Hall. A property in Mill Lane suffered minor internal flooding due to groundwater. Water flowed between the properties on the High Street and into the adjacent back gardens on Priory Road, with one property coming very close to flooding internally.

December

Many of the residents were well prepared for the flooding that arose in December and had devised various means of diverting water away from their properties to great effect using sandbags and flood boards. Despite this, two properties still flooded internally; on Caswell Lane and Mill Lane.

Caswell Lane was flooded due to the culvert under the road becoming blocked and the water trying to bypass the obstruction via the road. Underneath the motorway bridge, there was a significant amount of pooling water on Caswell Lane, which was too deep for cars to pass.

17.3.2 Highways information

The majority of highways affected by surface water runoff have been discussed above. It was reported that many of the gullies in Portbury village were blocked during the flooding incidents.

Wharf Lane off Sheepway was flooded during the November and December storms. This area of the parish is low lying and generally flat, which makes draining water off the land slow. There is a dip in the road at the entrance to Wharf Lane, which slopes slightly up hill. Wharf Lane also appears to be set below the surrounding land which directs water to the low point at the entrance. During 24 November, the entrance to

Wharf Lane flooded for a number of days to a depth of about 350mm and 9 meters in length. The same occurred in December. The gullies to the west of Wharf Lane were running clear but on Wharf Lane and to the east on Sheepway, the drains were blocked. There was further flooding on Sheepway near Rose Cottage, due to a grip not discharging quickly into the field.

17.4 Likely Cause of Flood Incident

From the site inspection it seems that the main cause of flooding was surface runoff from the surrounding fields with the local highways acting as flow paths. Because the catchment is large, low lying and flat, it takes time for the water to flow away.

One of the greatest concerns and impacts were vehicles being driven too quickly through the water creating bow waves, flooding or increasing the flooding to properties.

Figure 29: Location of pooling water and the conveyance route

17.5 Management Authorities

	Risk Management Authorities				
	LLFA	EA	WW	IDB	HA
Involvement required	✓		✓	✓	✓

Table 35: The RMA's which have flood risk management responsibilities in Portbury as a result of the 2012 flooding

18 Portishead

18.1 Flood incident extent and impact

Portishead is located on the Severn Estuary to the north of the district. Eight properties flooded internally between September and December and a further two properties flooded earlier in the year, one of the properties flooding twice. The incidents were primarily issues regarding highway runoff with a few incidents relating to field runoff. Flooding on Valley Road was particularly severe, with water surcharging out the gullies and running down the hill at a significant speed and depth, taking debris from the verge and depositing it at the bottom of the hill.

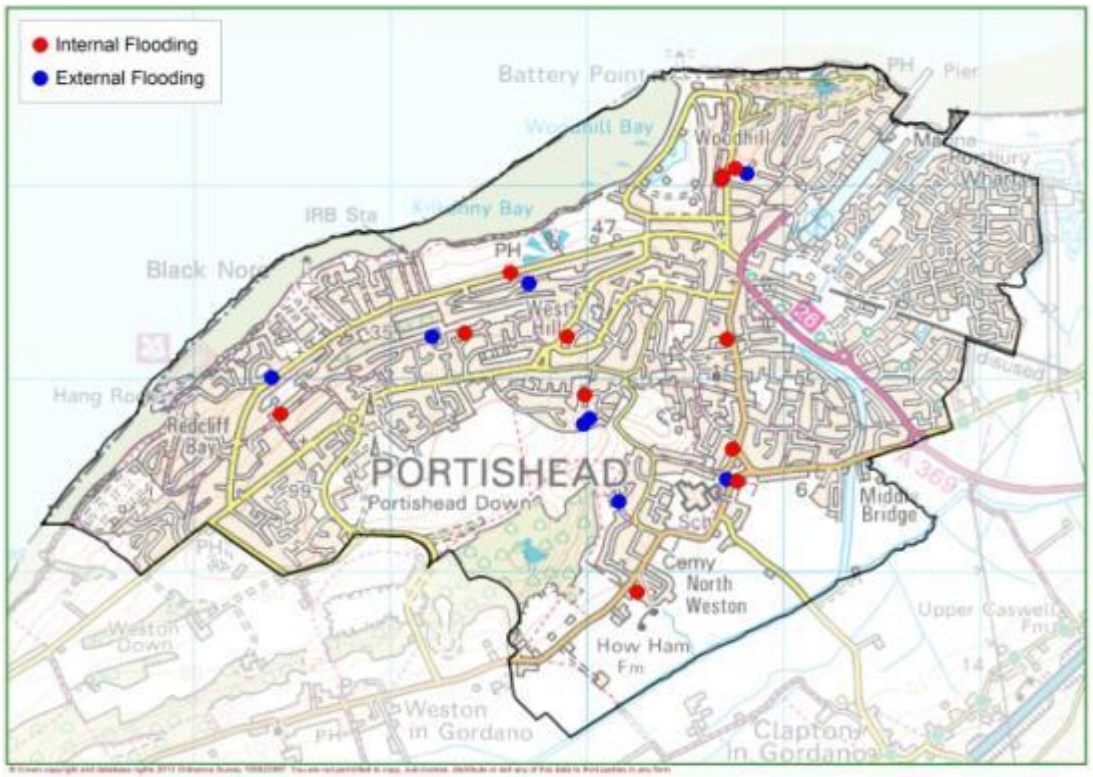


Figure 30: Flood locations in Portishead

Portishead Flood Source					
The Sea	Fluvial	Surface Water	Surface Water highway	Groundwater	Sewer Flooding
		✓	✓	✓	✓

Table 36: Sources of flooding in Portishead

18.2 Historic Flooding

A number of properties flooded in the High Street due to the capacity of the highways drainage system being overwhelmed in 2009.

18.3 Evidence Collected

18.3.1 Local knowledge & site investigation

Reconnaissance information was largely gathered by the Area Officer for Portishead during the multiple rainfall events.

There is an 800m long hill which starts at High Down School and slopes down to Gordano School. There is an 80m difference in height between the two locations which are separated by fields. After the significant rainfall in September, the ground was saturated and generated a significant amount of surface runoff. Some of this flow is channeled to a spring and naturally formed ditch, in the field north west of Gordano School. Under normal conditions, the flow from the ditch sinks into the ground; however the ditch overtopped and flowed down into Weston Wood Road. The houses here are above the height of the road and therefore did not suffer any flooding. Cedar Way is about 500m from, and 40m below, High Down School where again a significant amount of surface runoff led to the garages of several properties being flooded. St Mary's Road, just to the east of Cedar Way constantly had water running down it, even after days of no rain and the water was fast flowing during the storm events. This is likely because of a nearby spring. This water then pooled at the gates of Gordano School.

The Lake Grounds was completely saturated with pooling water spread across the site. There are no highway gullies on the road between the Cricket Pavilion and the Café and therefore water took some time to drain away through the ground.

There were problems in the foul sewer system on Bristol Road, with the toilets backing up at St Joseph's Primary School.

18.3.2 Highways information

The majority of flooding across Portishead was due to highway runoff and standing water struggling to disperse and flowing over kerbs into properties.

Two properties flooded internally, one on Fircliff Park in November, and externally earlier in the year on 4 August, and another on Bredon Road. Both of these properties are situated at the bottom of a slope and below the level of the road. Other properties impacted by the flooding are on: the High Street, which was receiving water from Church Road South; Clifton Street; Raleigh Rise; Channel View Crescent and The Rowens.

A property on Woodhill Road flooded internally twice in the months prior to September, however it did not flood during the significant rainfall events that occurred after this. It was reported that the flooding was due to a highway defect, which was corrected and evidently resolved the issue.

Other roads impacted by flooding were:

Impacted Roads		
Avon Way	Denny View	Nore Road
Brendon Road	Down Road	Pier Road
Bristol Road	Fircliff Park	Raleigh Rise
Cedar Way	Hawthorn Close	St Mary's Road
Channel View Crescent	High Street	The Rowens
Church Road South	Hill Crest	Valley Road
Clifton Street	Lake Road	Weston Wood Road
Clevedon Road B3124	Lipgate Place	Woodhill Road

Table 37: List of roads impacted by the flooding in 2012

18.4 Likely Cause of Flood Incident

From the evidence collected it seems that the main causes of flooding in Portishead were from highway runoff and surface runoff from the surrounding fields. Highway gullies and drainage pipes were reported to be blocked which may have been a contributing factor in certain areas; in addition to the systems being overwhelmed by intense rainfall. Groundwater discharging from springs around Clapton Lane was a contributor for the local area.

The likely cause of the toilets backing up at St Joseph's Primary School would be a block in the foul sewer line or rain water being discharged into the line, surcharging the system.

18.5 Risk Management Authorities

	Risk Management Authorities				
	LLFA	EA	WW	IDB	HA
Involvement required	✓		✓		✓

Table 38: The RMA's which have flood risk management responsibilities in Portishead as a result of the 2012 flooding

19 Weston-super-Mare

19.1 Flood incident extent and impact

Weston-super-Mare is the largest town in North Somerset. 20 properties flooded internally in 2012, the third most behind Wrington and Congresbury. Flooding was wide spread across the town, with a combination of both minor and more significant incidents. The majority of properties impacted by the floods, 28 in total, occurred in September (15 internal + 13 external). Unusually there was also a lot of flooding prior to September during the summer months, impacting 16 properties (4 internal + 12 external).

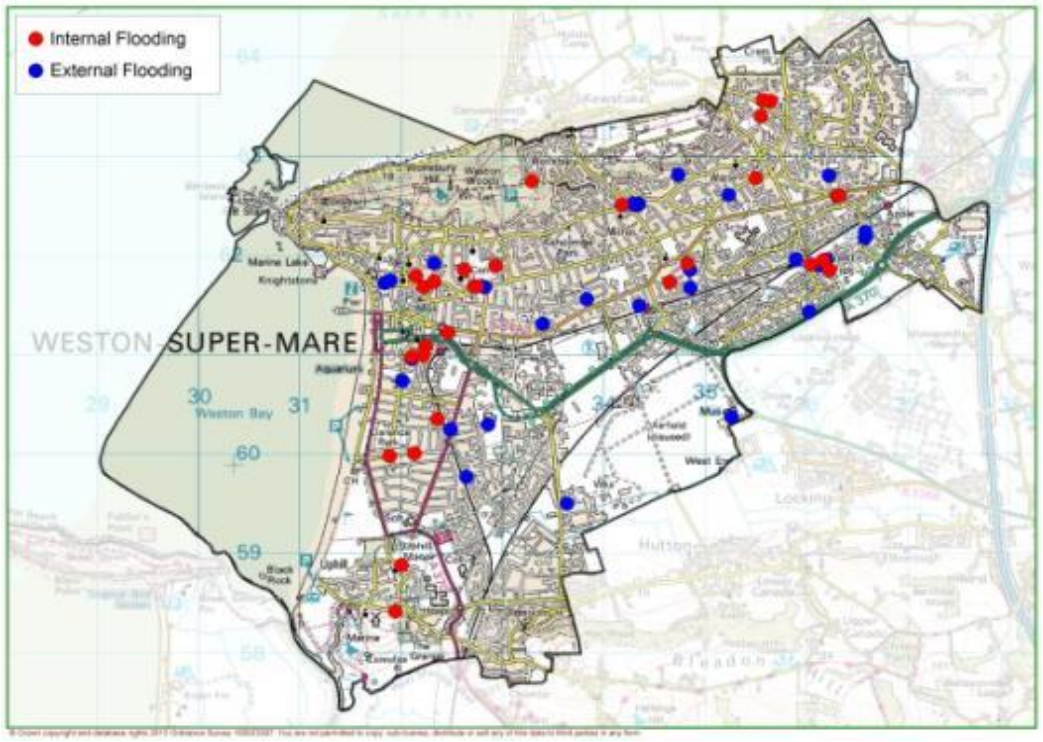


Figure 31: Flood locations in Weston-super-Mare

Weston-super-Mare Flood source					
The Sea	Fluvial	Surface Water	Surface Water highway	Groundwater	Sewer Flooding
✓	✓		✓	✓	

Table 39: Sources of flooding in Weston-super-Mare

19.2 Historic Flooding

Heavy rainfall in 2011 caused flooding to 9 properties in Milton Hill.

Road name	No. impacted properties	Impact
Spring Valley	2	Internal
Spring Hill	4	Unknown
Upper Bristol Road	3	Unknown

Table 40: Historic flooding in Milton Hill, Weston-super-Mare

Other locations where properties have been known to flood:

Road name	Date flooded	Impact
Victoria Square	15/06/2011	External
Cliff Road	08/08/2011	Internal
South Road	24/10/2011	Internal
Meadow Street	03/11/2011	Internal
Ellenborough Park South	13/12/2011	External
Polden Road	29/12/2011	Internal

Table 41: Historic flooding in wider Weston-super-Mare

19.3 Evidence Collected

19.3.1 Local knowledge & site investigation

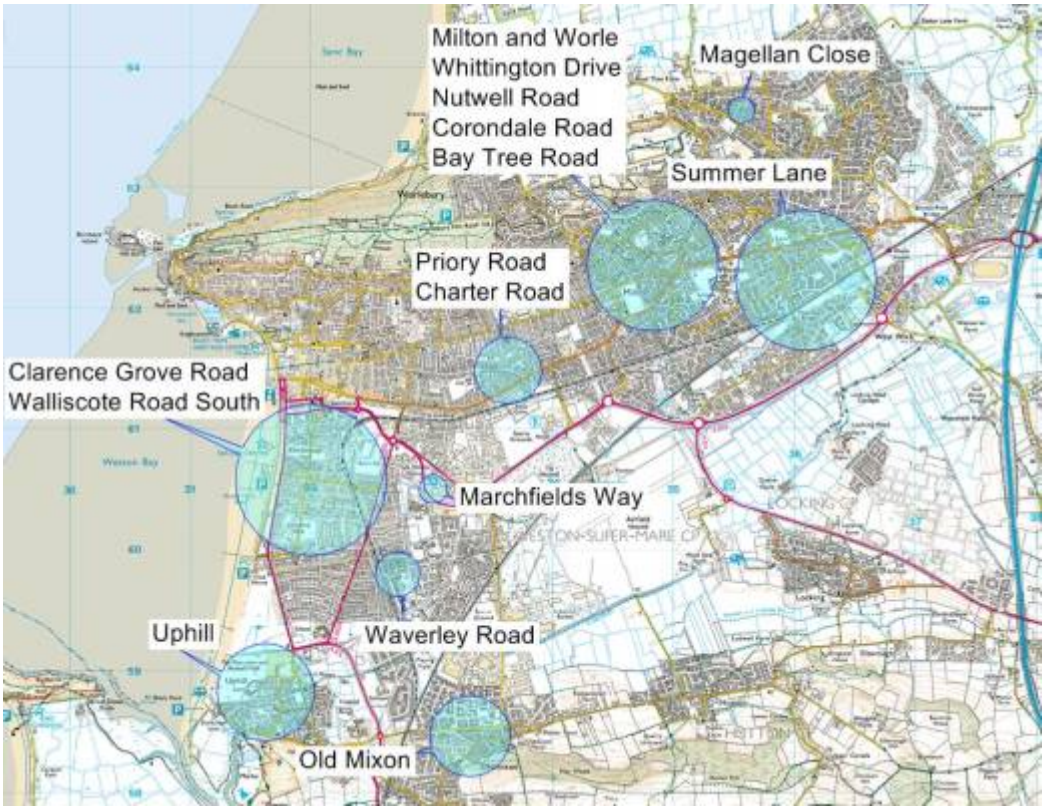


Figure 32: Areas of flooding in Weston-super-Mare

Prior to September 2012

There were other recorded incidents of flooding prior to September as follows.

Polden Road	30/07/2012	Internal
Trewartha Park	30/07/2012	Internal
Neva Road	04/08/2012	External
Worlebury Hill Road	04/08/2012	Internal
Ellenborough Park South	07/06/2012	External
Instow	21/06/2012	External
High Street	28/06/2012	External
West Street	05/07/2012	External
Spring Vally	29/07/2012	External (x4)
Landemann Path	30/07/2012	External

Table 42: Recorded flood incidents between January and August 2012

September 2012

Summer Lane
The Summer Lane Ponds are located in Worle. They are designed to take surface water and highways drainage from the surrounding area. In times of excessive rainfall, the permanent pond is designed to spill over into an overflow pond to the west.

Residents stated that the overflow pond had rarely been used within the last 20 years. Water overtopped the normally dry pond and flooded the open space area to the west up to Moor Lane. As the ponds were at capacity, the gullies were struggling to discharge water from the highway, leading to many roads becoming flooded.

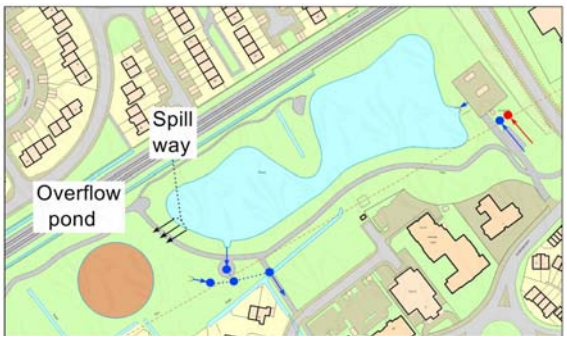


Figure 35: Summer Lane Ponds & Overflow Pond


Figure 36: Flooding extent of green open space from the Summer Lane Ponds overtopping

Numerous properties were impacted by the Summer Lane Ponds flooding. Largely this was external flooding to garages and gardens, but one property in Shrewsbury Bow flooded internally. Diamond Batch and Elmham Way flooded, raising particular concerns for the adjacent Nursing Homes and the risk posed to the residents.

The ponds at Summer Lane and Moor Lane discharge through a network of ditches, one of which runs adjacent to Somerset Avenue. It was reported that the water levels were very high and overtopped near Boundary Road.

Wessex Water, Weston Power, the Environment Agency, the Emergency Services and North Somerset Council all contributed to management of flooding on this site including the pumping of water away from site via a temporary pipeline.

Wider Weston-super-Mare – Highway runoff
Elsewhere in Weston, highway runoff contributed to the internal flooding of properties on Clarence Grove Road and Walliscote Road South causing flooding in a basement flat.
In the Milton Hill area water entered three properties on Corondale Road and Baytree Road due to the highway being inundated and over spilling.

Around Worle, highway runoff flooded five properties internally on New Bristol Road and Worle High Street.

A property on Magellan Close was reported as flooding. The driveway is slightly lower than the kerb and water came from the public footpath. Groundwater contributed to the flooding which reached depths of 180mm externally, entering the

garage and shed. Water seeped into the property through the air bricks and through the walls.

Further properties that were flooded externally due to highway runoff were on Charter Road, Nutwell Road, Whittington Drive, Waverley Road, Priory Road and Marchfields Way where gardens and driveways were impacted.

Wider Weston-super-Mare – Overland flow
Surface water flows from the Cemetery on Bristol Road Lower, onto Milton Road. A suspected blocked / broken pipe was causing water to bubble up through the pavement and also out of the air vents of a property. The garage at the same property was reported as flooding around eight times in 2012.

Wider Weston-super-Mare – Groundwater
A property on Uphill Road South suffered from groundwater flooding where water came through the floor to a depth of 75mm. The ground floor of the property is below the level of the road. The neighbouring cricket pitch has been reported as often being water logged due to poor drainage / high water table.

Wider Weston-super-Mare – Other sources of flooding
A pipe taking water from a drainage ditch on Oldmixon Road was reported as being blocked by gravel, restricting the rate of drainage. This overtopped contributing to the flooding of a property.

October 2012
The only case of flooding from the sea was on 16 October. At around 7:30am spray from the sea was such that it began to flood the road running adjacent to the shoreline. Vehicles continued to use the road with depths estimated to 300mm.

November 2012
Summer Lane Ponds again overtopped in November with similar flood impacts. Further properties on Uphill Way, Weston High Street, Copperfield Drive and Garsdale Road were impacted from flooding. It was also reported that surface water was making its way into the foul sewer on Coronation Road.

December 2012
Another property on Corondale Road flooded externally from highway runoff.

19.4 Likely Cause of Flood Incident

Parts of Weston-super-Mare are low-lying. Watercourses in the area are often tide-locked during periods of high tide. Due to the ground and watercourses having little gradient, the drainage is particularly slow with many of the ditches having very little flow of water. During the Summer Lane ponds incidents, a significant factor would have been the volume of rainfall over the catchment and the limitations for water to drain away. Much of the east side of Weston drains into the River Banwell. This was at maximum capacity for long periods of time, “locking” many of the drainage outfalls in the area. Furthermore, due to the catchment being so saturated, no water was able to percolate into the ground, adding to the stress on the rhyne network.

Restrictions in the highway drainage system were a common theme in Weston. These restrictions could be blockages from debris or a broken / collapsed pipe.

The information gathered during this report will be fed into the Surface Water Management Plan for Weston-super-Mare.

19.5 Risk Management Authorities

	Risk Management Authorities				
	LLFA	EA	WW	IDB	HA
Involvement required	✓	✓	✓	✓	✓

Table 43: The RMA's which have flood risk management responsibilities in W-s-M as a result of the 2012 flooding

20 Winscombe & Sandford

20.1 Flood incident extent and impact

There were 27 incidents of internal flooding in Winscombe and Sandford in 2012; 24 incidents occurred in Winscombe and three in Sandford. Out of those there were 14 internal flood incidents that occurred on 24 September. Flooded properties were located on Church Road, Oakridge Lane, Moorham Road, Knapps Drive, Nippors Way, The Lynch and Winscombe Hill.

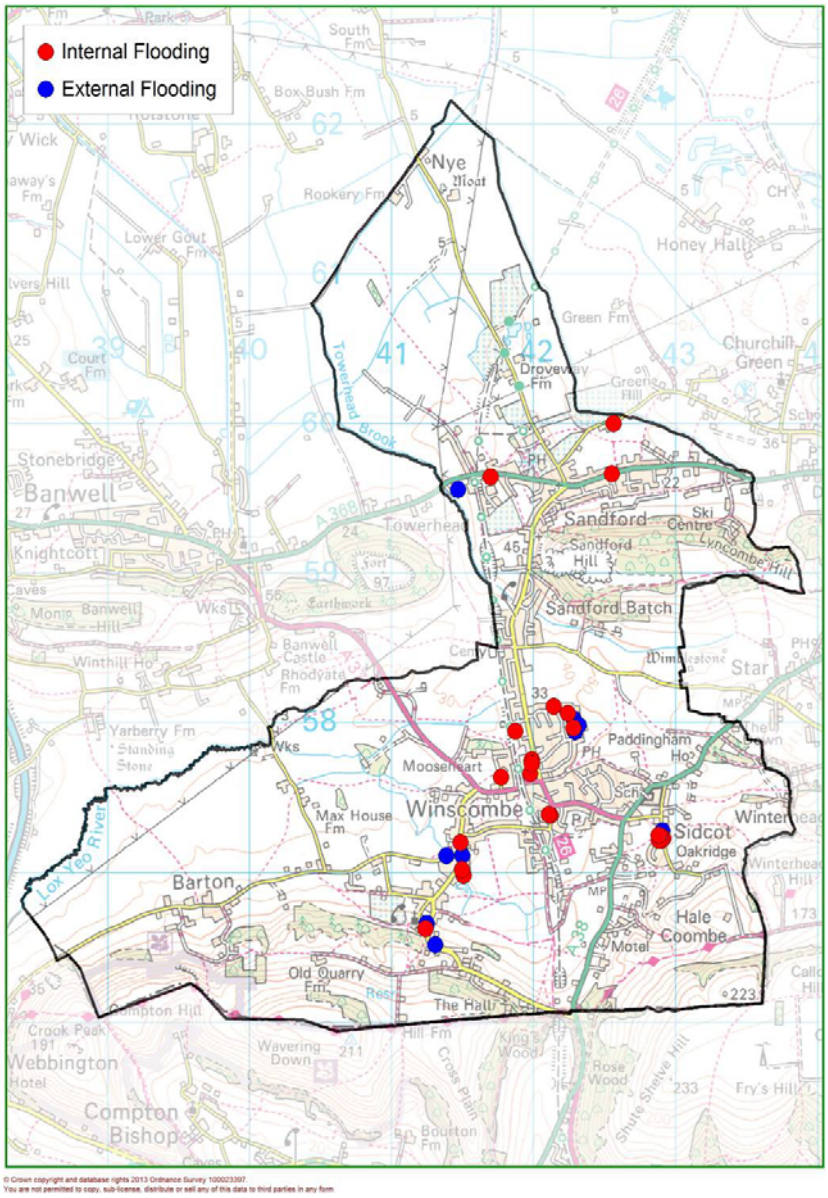


Figure 37: Flood locations in Winscombe and Sandford

Winscombe & Sandford Flood source					
The Sea	Fluvial	Surface Water	Surface Water highway	Groundwater	Sewer Flooding
	✓		✓	✓	

Table 44: Sources of flooding in Winscombe & Sandford

20.2 Historic Flooding

Roads known to have flooded are:

- Church Road
- Woodborough Primary School on Moorham road experienced external flooding due to an overgrown ditch
- Well Close
- The Lynch
- Winscombe Hill

20.3 Evidence Collected

20.3.1 Local knowledge & site investigation

Reconnaissance information was gathered by the Area Officer and direct correspondence from residents via means of the call centre, flood report forms, emails and letters.

The following are the key points:

- On 24 September the stream at the side of Church Road overtopped and flood water and debris went onto the road. Drains were also reported to be blocked on Church Road.
- A large quantity of silt was reported to be blocking gullies on Church Road.
- On 12 October it was reported that there was an inspection cover in Church Road from which water was pouring even though no rain was falling.
- Work to unblock the gullies on Church Road in December was undertaken, but residents believe the blockage was actually due to a broken pipe not the gully being blocked.
- Drains were blocked on Oakridge Lane. These were cleared by NSC highway drainage engineers but a problem with the outlet was discovered. Flooding was also being influenced by works at Sidcot School.
- The field drainage system for the land at the top of Well Close was overwhelmed and flooded four times over the course of 2012.
- On 24 September it was reported that gullies needed clearing on Well Close.
- It was reported that a number of gullies were full with mud on The Lynch, Winscombe. The gullies could not cope with the volume of rainfall and large pools of water were formed on the road.

20.4 Likely Cause of Flood Incident

The flooding in Sandford and Winscombe was mostly as a result of surface water being unable to get away quickly enough. This may partly have been down to blocked gullies or drainage ditches but will also have been down to capacity exceedance of both. The overtopping of the stream to the east of Winscombe Woodborough Primary School caused significant flooding issues on Moorham Road. The volume of rainfall would also have raised groundwater levels.

20.5 Risk Management Authorities

	Risk Management Authorities				
	LLFA	EA	WW	IDB	HA
Involvement required	✓				✓

Table 45: The RMA's which have flood risk management responsibilities in Winscombe & Sandford as a result of the 2012 flooding

21 Wraxall & Failand

21.1 Flood incident extent and impact

Two properties flooded internally during 2012, one of which flooded twice. Six of the seven reported flood incidents occurred on Bristol Road, Wraxall.

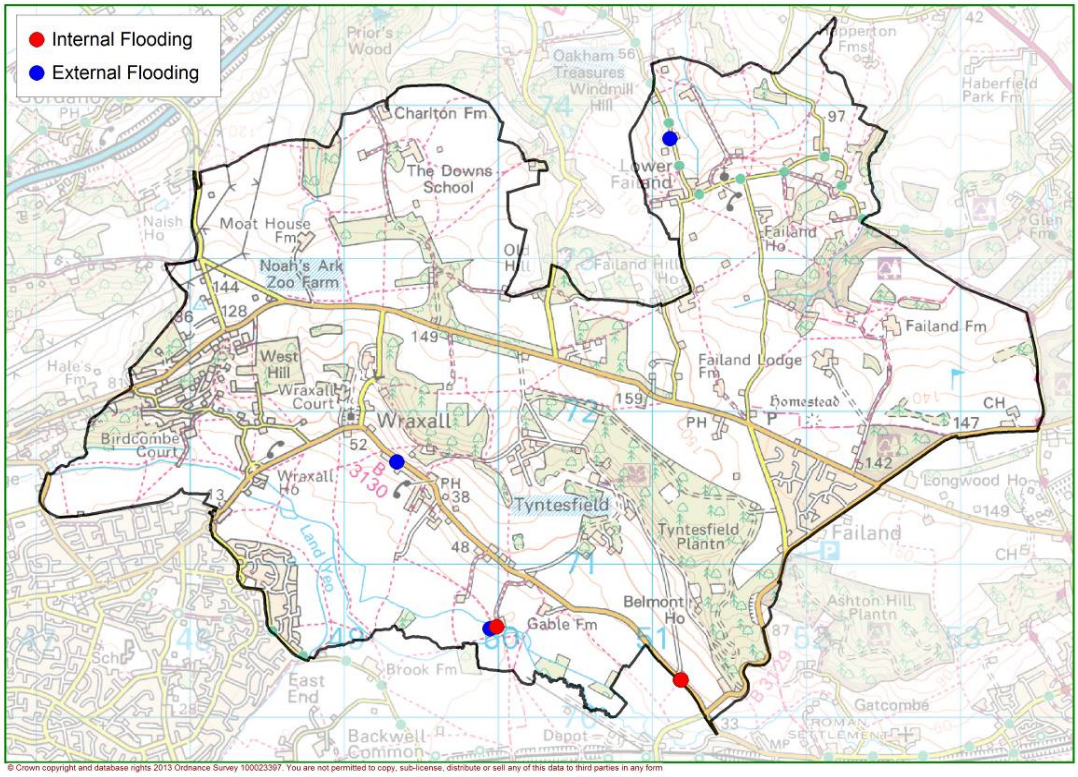


Figure 38: Flood locations in Wraxall and Failand

Wraxall & Failand Flood source					
The Sea	Fluvial	Surface Water	Surface Water highway	Groundwater	Sewer Flooding
	✓		✓	✓	

Table 46: Sources of flooding in Wraxall & Failand

21.2 Historic Flooding

Roads known to have flooded are:

- Tower House Lane
- Bristol Road – flooding lasts between 6-12 hrs
- Clevedon Road

21.3 Evidence Collected

21.3.1 Local knowledge & site investigation

A property on Bristol Road flooded to a depth of 50mm in the porch during September and November from highway runoff. The road is unkerbed and water flowed off the road and down the sloped driveway. A further property on Bristol Road was flooded as a result of highway runoff flowing down the driveway in September. The driveway entrance is flush with the road level and then slopes downwards.

The garage of a property on Failand Lane flooded because of the same circumstances to those mentioned above.

21.4 Likely Cause of Flood Incident

Evidence collected suggests…

- Blocked gullies
- Properties set below the level of the road

21.5 Risk Management Authorities

	Risk Management Authorities				
	LLFA	EA	WW	IDB	HA
Involvement required	✓				✓

Table 47: The RMA's which have flood risk management responsibilities in Wraxall and Failand as a result of the 2012 flooding

22 Wrington

22.1 Flood incident extent and impact

The village of Wrington has a long history of flooding. A notable flood occurred in 1968, with further flood incidents in 1999, 2007 and 2008. The village is surrounded by steep hills, particularly to the north and east. The Brook flows through the village from the east to the south and was an open watercourse until a portion was culverted to allow for the development of The Glebe in 1994.

There were 109 internal flood occurrences impacting 40 properties during September and November. The primary source is fluvial flooding from the Brook which flows through the village of Wrington. A flood surgery was held at the Memorial Hall where representatives from North Somerset Council, the Environment Agency and Wessex Water were present.

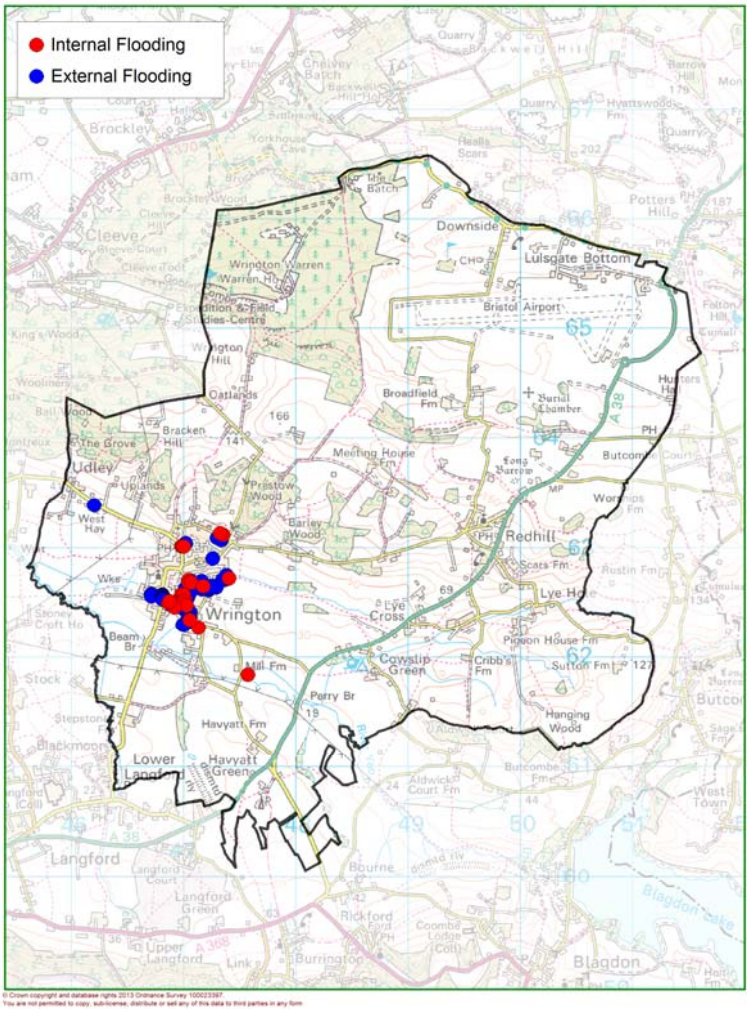


Figure 39: Flood locations in Wrington

Wrington Flood source					
The Sea	Fluvial	Surface Water	Surface Water highway	Groundwater	Sewer Flooding
	✓	✓	✓		✓

Table 48: Sources of flooding in Wrington

22.2 Historic Flooding

Roads known to have flooded are:

- Rickyard Road
- Silver Street
- Garstons Close
- The Glebe
- Garstons Orchard
- Ropers Lane

22.3 Evidence Collected

22.3.1 Local knowledge & site investigation

The Brook responds very quickly to the rainfall with the peak flow occurring approximately an hour after levels begin to rise. Similarly, it tends to fall back to normal level within an hour once the flooding begins to dissipate. Depending on the localised antecedent catchment conditions, flooding can occur much more rapidly than this. The lane between Garstons Close and The Glebe can flood to two feet within 20 minutes and dissipate just as quickly.

There were four main flood incidents where people suffered internal flooding. These were 24 September and 21, 22 and 24 November. The flooding impacts for the November incident were similar. The evidence collected came from residents within the Wrington Community, the Parish Council, the Environment Agency and Wessex Water.

Properties are impacted by both surface water and fluvial flooding. The sources of flooding are from both The Brook and overland flow. Properties in Garstons Close, The Glebe, Garstons Orchard and Silver Street are predominantly impacted from flood water exceeding the capacity of the Brook. Properties on Ropers Lane and Yeomans Orchard are impacted from surface runoff.

The most impacted properties were in:

- The Glebe - with recorded internal flood depths of 0.6m.
- Garstons Close - with recorded internal flood depths of 0.3m.
- Silver Street - with recorded internal flood depths of 0.3m.

Fluvial flooding

Rickyard Road

The main source of flooding for residents in Rickyard Road is from the Brook to the east. Water is prone to overtopping and typically flows adjacent to the Brook into Rickyard Road via the access gate to the field. This water flows from the gate along the road and tracks left, down the hill towards Silver Street. Residents reported that The Brook level was a lot higher in November than in September. Water that has overtopped from The brook also flows into the storage pond. The pond is only designed to take surface water from the new development on Rickyard Road. Under extreme rainfall, the pond overtops and flows between the properties and onto the road.

Silver Street

It was reported that flood water on Silver Street is from a variety of sources with:

- runoff from Rickyard Road (originally from the Brook overtopping to the east)
- surface water runoff from the High Street (possibly originating from the hills to the north of Wrington)
- surcharging drains
- ground water flooding

It was reported that the foul sewer man holes on Silver Street were surcharging.

The Glebe

19 properties flooded internally in The Glebe, many on multiple occasions and to a depth of 0.6m.

The culvert located in the back garden of 60 The Glebe does not have sufficient capacity to cope during extreme rainfall. The water backs up and overflows into the gardens and round the sides of the properties both onto the road and to adjacent gardens.

The water flows south towards the car park and into the lane connecting The Glebe to Garstons Close. Residents call this point the “Wrington Dam” as the water pools at this location. As the water cannot discharge away fast enough, it starts to back up and floods properties in The Glebe and Garstons Close.

Six properties flooded internally in Garstons Close, however these properties flooded on multiple occasions (29 in total between them). There is a local understanding of conditions that suggest flooding within The Glebe and Garstons Close is imminent. There are two thresholds observed by residents as to when flooding will occur:

- When flood water east of Wrington, flows down Rickyard Road and onto Silver Street. If water stays on the top part of Rickyard Road, the system normally manages the volume of water.
- The weir wall adjacent south to Silver Street overtops.

Garstons Orchard

There were 27 external flood incidents and three internal incidents. Water entered Garstons Orchard at various locations. The build up of pooling water was causing damage to fence panels in Garstons Orchard. The flood water then makes its way back into the Brook that runs adjacent.

Water from The Glebe flooded properties on Old Station Close and Butts Batch internally in late November with fast flowing waters 100mm deep. The rear gardens of The Cottages were also flooded.

Surface runoff

There are three main areas where overland flow enters Wrington, from the north onto Ropers Lane, from the north-east onto South Meadows and from the south-east onto Cox's Green.

Ropers Lane

There are steep hills to the north of Ropers Lane. Water comes from the fields as well as Wrington Hill Road and Simms Lane. The drainage on Wrington Hill was not able to capture the fast flowing water. This was exacerbated by leaves choking the gully grills, further restricting the drainage. This water on Ropers Lane then flowed south down both School Road and Yeomans Orchard, the latter being the most significant. Water flows down Yeomans Orchard and flows between the properties onto the High Street.

Cox's Green

Overland flow north and south of Cox's Green flows west into the Burnett Industrial Estate (this may have also been contributed to by water from Silver Street). This water then flows into Garstons Orchard.

South Meadows

Surface water from the field drains from the rear of 9 - 12 South Meadows into the back garden of 56 South Meadows and then into The Brook. Water can stand in the back garden for 3 - 4 hours before draining away as The Brook cannot cope with additional water during peak times.

Roads impacted by the flooding are listed in Table 49.

Roads that were significantly impacted			
Butts Batch	Garstons Orchard	Old Station Close	Silver Street
Cox's Green	Havyat Road	Rickyard Road	The Glebe
Garstons	High Street	Ropers Lane	Wrington Hill
Garstons Close	Nates Lane	School Road	Yeomans Orchard

Table 49: Roads impacted in Wrington

The roads impacted by the storm events in September and November can be seen in Figure 40.

Figure 40: Map of impacted roads in Wrington

22.4 Likely Cause of Flood Incident

There are many causes that contributed to the flooding in Wrington and we do not fully understand all of the mechanisms. Within the wider topography, Wrington is located at a low point and water flows off the fields towards the village. The Brook overtopping east of Rickyard Road flows out of bank into the new Rickyard development pond and the adjacent highways. The Brook also overtops at The Glebe due to the size of the culvert flooding properties in this area. The culvert takes water from The Brook and also a large amount of surface water from the village. The highway drains were blocked by silt from The Brook reducing the efficiency of taking water off the highway.

22.5 Risk Management Authorities

	Risk Management Authorities				
	LLFA	EA	WW	IDB	HA
Involvement required	✓		✓		✓

Table 50: The RMA's which have flood risk management responsibilities in Wrington as a result of the 2012 flooding

23 Remaining Investigations

23.1 Flood incident extent and impact

There was also further flooding throughout North Somerset but in these areas, fewer properties were impacted.

These flood incidents have been highlighted in the table below and consider both internal and external incidents.

Parish	Road name	No. of flood incidents	Date	Source	Risk Management Authorities Involvement required				
					LLFA	EA	WW	IDB	HA
Barrow Gurney	Naish Lane	1	31/08/2013	Highway runoff					✓
	Barrow Court	1	24/09/2012	Unknown	✓				
	Bridgwater Road A38	1	21/11/2012	Highway runoff					✓
	Wild Country Lane	1	21/11/2012	Unknown	✓				
Bleadon	Bridgwater Road A370	1	25/06/2012	Highway runoff					✓
	Shiplate Road	1	21/11/2012	Groundwater runoff	✓				✓
	Bridge Road	1	23/11/2012	Highway runoff					✓

North Somerset – 2012 Flood Investigations

Parish	Road name	No. of flood incidents	Date	Source	Risk Management Authorities Involvement required				
					LLFA	EA	WW	IDB	HA
Brockley	Chelvey Road	1	24/09/2012	Unknown	✓				
	Chelvey Lane	1	25/11/2012	Unknown	✓				
Burrington	Lower Langford	1	24/09/2012	Unknown	✓				
Butcombe	Green Lane	3	Unknown	Unknown	✓				✓
Flax Bourton	Church Lane	2	24/09/2012 21/11/2012	Fluvial Highway runoff	✓		✓		✓
	Church Lane End	2	21/11/2012 24/11/2012	Unknown	✓				
Kenn	Davis Lane	2	24/09/2012 21/11/2012	Unknown	✓				
	Kenn Road	1	24/09/2012	Unknown	✓				

North Somerset – 2012 Flood Investigations

Parish	Road name	No. of flood incidents	Date	Source	Risk Management Authorities Involvement required				
					LLFA	EA	WW	IDB	HA
Kewstoke	Beach Road	1	24/09/2012	Foul Sewer	✓		✓	✓	
	Lower Norton Lane	1	21/11/2012	Unknown	✓				
Kingston Seymour	Ham Lane	1	24/09/2012	Unknown	✓				
	Middle Lane	2	24/09/2012	Unknown	✓				
Long Ashton	Yanley Lane	1	24/09/2012	Fluvial	✓				
	Bannerleigh Lane	2	27/04/2012 24/09/2012	Highway runoff					✓
	Rayens Cross Road	1	21/11/2012	Groundwater	✓				
	Ashton Road	1	29/12/2012	Unknown	✓				
	Gatcombe Mill Lane	-	-	Overland flow	✓				
Loxton	Sevier Road	1	02/07/2012	Highway runoff					✓

North Somerset – 2012 Flood Investigations

Parish	Road name	No. of flood incidents	Date	Source	Risk Management Authorities Involvement required				
					LLFA	EA	WW	IDB	HA
Puxton	Palmers Elms	1	24/09/2012	Highway runoff					✓
	Bristol Road	6	24/09/2012	Unknown	✓				
	Cowslip Lane	1	24/09/2012	Unknown	✓				
St Georges	Goosey Lane	1	24/09/2012	Fluvial	✓				
	Station Road	1	24/09/2012	Unknown	✓				
	The Copse	1	24/09/2012	Fluvial	✓				
Tickenham	Clevedon Road	1	27/11/2012	Groundwater	✓				
	Tickenham Hill	1	04/08/2012	Highway runoff					✓
Walton-in-Gordano	Moor Lane	1	24/09/2012	Unknown	✓				
Weston-in-	Clevedon Road	4	14/09/2012	Field runoff	✓				✓

North Somerset – 2012 Flood Investigations

Parish	Road name	No. of flood incidents	Date	Source	Risk Management Authorities Involvement required				
					LLFA	EA	WW	IDB	HA
Gordano	B3124		24/09/2012 08/10/2012 12/11/2012	Highway runoff					
Wick St Lawrence	Duck Lane	1	24/09/2012	Unknown	✓				
	Wick Road	1	24/09/2012	Highway runoff					✓

Table 51: Summary of lesser impacted areas

24 Summary - Risk Management Authorities

As there are different sources of flooding in parishes across North Somerset, the following table states which RMA has duties to undertake in each parish covered within the main document.

Location	Risk Management Authorities Involvement required				
	LLFA	EA	WW	IDB	HA
Abbots Leigh and Pill & Easton-in-Gordano	✓				✓
Backwell	✓	✓		✓	✓
Banwell	✓	✓	✓	✓	✓
Blagdon	✓				✓
Churchill and Langford	✓		✓		✓
Claverham and Yatton	✓		✓	✓	✓
Clevedon	✓		✓	✓	✓
Congresbury	✓		✓	✓	✓
Dundry and Windford	✓				✓
Hutton	✓		✓		✓
Locking	✓		✓	✓	✓
Nailsea	✓		✓		✓
Portbury	✓		✓	✓	✓
Portishead	✓		✓		✓
Weston-super-Mare	✓	✓	✓	✓	✓
Winscombe & Sandford	✓				✓
Wraxall & Failand	✓				✓
Wrington	✓		✓		✓

Table 52: The RMA's which have flood risk management responsibilities in parishes across North Somerset as a result of the 2012 flooding

Glossary

Catchment	The extent or an area of land where surface water from rain (or other precipitation) converges to a single point at a lower elevation, usually the exit of the basin, where the waters join another water body, such as a river or sea.
Community Flood Resilience Team	A group of local residents who take actions to reduce the flood risk within their area and become more resilient to flooding.
Conveyance	A flow route.
Culvert	A closed conduit (typically a pipe) used for the conveyance of surface drainage water under a roadway, railroad, canal, or other impediment.
Design standard	Structures such as the drainage system are now designed to cope with a certain degree of rainfall e.g. a 1 in 5 year storm (see Return Period).
Environment Agency	A Public Body responsible to the Secretary of State for environment, Food and Rural Affairs (Defra) and an Assembly Sponsored Public Body responsible to the National Assembly for Wales. The Environment Agency's principal aims are to protect and improve the environment, and to promote sustainable development. They play a central role in delivering the environmental priorities of central government and the Welsh Assembly Government through our functions and roles.
Exceedance	The surcharging of capacity in a given structure e.g. the overflowing of a full ditch.
Externally flooded	The flooding of a property where water does not enter the living spaces e.g. garden or garage. This also includes flooding of the cavity walls.
Flood	A flood is an overflow of an expanse of water that submerges land. Both the Flood and Water Management Act (2010) and the Flood Risk Regulations (2009) state that it doesn't matter whether a flood is caused by: heavy rainfall; a river overflowing its banks; a dam overflowing; tidal waters; groundwater; or anything else including a combination of factors. However, both state that a 'flood' does not include: a flood caused from any part of a sewerage system, unless wholly or partly caused by an increase in the volume of rainwater (and other precipitation) entering or affecting the system; or a flood caused by a burst water main.

Flood and Water Management Act (2010)	The Act brings together the recommendations of the Pitt report and previous policies, to improve the management of water resources and create a more comprehensive and risk based regime for managing the risk of flooding from all sources. The Act states that its purpose is to "make provision about water, including provision about the management of risks in connection with flooding and coastal erosion."
Flood incident	Where flood water impacts a property.
Flood Risk	Flood risk is a combination of two components: the chance (or probability) of a particular flood event and the impact (or consequence) that the event would cause if it occurred.
Fluvial	The processes associated with rivers and streams and the deposits and landforms created by them.
Groundwater	Water located beneath the ground surface, either in soil pore spaces or fractures in rock.
IDB	Internal Drainage Board.
Internally flooded	Where water enters the living spaces of a property e.g. kitchen / dining area.
LLFA	Lead Local Flood Authority.
Main River	All watercourses shown on the statutory main river maps held by the Environment Agency and the Department for Environment, Food and Rural Affairs. This can include any structure or appliance for controlling or regulating the flow of water into, in or out of the channel. The Environment Agency has permissive power to carry out works of maintenance and improvement on these rivers.
Ordinary Watercourse	Any section of watercourse not designated as a Main River.
Positive drainage	A designed feature or structure with the function to drain water from a site.
Reservoir	Artificial lake used to store water. Reservoirs may be created in river valleys by the construction of a dam or may be built by excavation in the ground or by conventional construction techniques such a brickwork or cast concrete. Reservoirs greater than 10,000m3 are governed by the Reservoirs Act.
Return Period (Rainfall event)	An estimate of the likelihood of an event. The probability of a rainfall event of a given magnitude occurring within any one year e.g. a 1 in 100 year event has a probability of occurring once in 100 years, or a 1% chance in any one year. However a 1 in 100 year event could occur twice or more within 100 years, or not at all.

Riparian Owner	All landowners whose property is adjoining to a body of water have the right to make reasonable use of it and suitably maintain it.
Risk Management Authority	Defined in the Flood and Water Management Act, they all have some responsibility for managing flood risk.
Surface runoff	Rainwater that is on the surface of the ground (whether or not it is moving); and has not entered a watercourse, draining system or public sewer. Typically it flows off an impermeable surface e.g. paved areas (driveways) or even saturated fields.
Sewer flooding	The consequence of sewer systems exceeding their capacity during a rainfall event. This includes foul sewage and surface water (roof top water).
Tidal Flood Risk	The flood risk that arises as a consequence of high tides or tidal surges.
Topography	The arrangement of the natural and artificial physical features of an area.

North Somerset Local Flood Risk Management Strategy

North Somerset COUNCIL

Executive Summary

Flooding can threaten lives and cause substantial negative social and economic effects to people, property, infrastructure and agricultural land. Historical flooding within North Somerset has demonstrated these devastating effects. In addition to the Great Flood of 1607 which killed 2,000 people there have been a number of significant flooding incidents in North Somerset in 1968, 1981, 1989-90, 2007, 2008, and more recently in 2012 which was the second wettest year on record in the UK. Indeed, during 2012 it is estimated that approximately 340 properties flooded internally across North Somerset. Flooding in North Somerset arises from watercourses, the sea, surface runoff, exceedance from urban drainage networks, reservoirs, and groundwater.

Under legislation from 2010[1] North Somerset Council has new responsibilities for managing flooding from surface runoff, ordinary watercourses and groundwater, in addition to the responsibility we already have to manage flooding and drainage from our highway network. This type of flooding is becoming an increasingly recognised issue, although until the 2010 legislation there has been little understanding of these sources of flooding, or actions to manage the risk.

One of our primary responsibilities under the legislation is to produce a strategy, known as a 'local flood risk management strategy', which sets objectives and outlines how we, in partnership with a range of other organisations and the public, will seek to manage flooding from surface runoff, ordinary watercourses and groundwater.

The strategy focuses on managing the risk of flooding to people and property due to surface runoff, ordinary watercourses and groundwater, in line with our responsibilities. However, we recognise that for those who suffer from flooding it matters little what type of flooding is causing the problem. So we are taking a leadership and coordinating role across North Somerset. This does not mean that we will act as the lead organisation on all types of flooding, but rather we will work with others to identify the most appropriate organisation to lead in any given location where flood risk is an issue.

We have developed this strategy to identify actions we need to take to reduce flood risk. The strategy identifies the top 15 communities in North Somerset which are considered to be most vulnerable to flooding from surface runoff, ordinary watercourses and groundwater. It identifies the measures we propose to take in these communities to reduce flood risk, subject to sufficient funding and resource availability.

The measures are designed to complement works undertaken by North Somerset highways which provide local improvements. The strategy identifies where additional investment will be required beyond that currently programmed by the highways

[1] Flood and Water Management Act, 2010, available at: http://www.legislation.gov.uk/ukpga/2010/29/contents

authority. It also complements the work undertaken by emergency management to plan for emergencies and work with local communities to increase resilience against flooding.

The list of top 15 communities identified are outlined in the table below in alphabetical order.

Community	
Backwell	Long Ashton
Churchill	Nailsea
Claverham	Pill
Clevedon (East)	Portbury
Congresbury	Winscombe
Hutton	Wrington
Langford	Weston-super-Mare*

* It should be noted that Weston-super-Mare (WsM) has been considered as a single community for the strategy to align with the Surface Water Management Plan carried out for the town. However, the strategy has identified two specific parts of WsM which are most vulnerable: 1) Milton Hill and Worle, and 2) Central and West WsM.

The strategy also identifies broader actions we will take across our area. These include actions such as ensuring runoff from new developments is appropriately managed and ensuring communities are more resilient and able to respond in the event of future flooding.

Before we finalise the strategy we are seeking the views of organisations and the public about whether we have correctly identified the risk of flooding to communities in North Somerset, and whether our planned actions are appropriate. The consultation will be live for a period of 10 weeks, commencing on 9th December 2013.

Table of Contents

Executive Summary i
Table of Contents iii
Table of Figures vi
Table of Tables vi
1 Introduction 1
1.1 Context 1
1.2 What is a Local Flood Risk Management Strategy? 2
1.3 Structure of LFRMS 3
1.4 Links to other plans, policies, legislation and regulation 5
2 Key principles and objectives of the LFRMS 6
2.1 Key principles 6
2.1.1 Partnership working 6
2.1.2 Prioritising investment 7
2.1.3 Promoting and supporting personal responsibility 7
2.1.4 Sustainability 7
2.2 Objectives 7
3 Understanding current and future flood risk 13
3.1 Historic flooding in the North Somerset administrative area 13
3.2 Current flood risk in North Somerset 14
3.2.1 Flood risk from surface runoff and ordinary watercourses 15
3.2.2 Flooding from groundwater 16
3.2.3 Flood risk from Main Rivers and the Sea 16
3.2.4 Flooding due to tide and fluvial 'locking' 17
3.2.5 Flooding from sewerage systems 17
3.3 How flood risk may change over time 18
3.3.1 Climate change 18
3.3.2 New Development 21
3.3.3 Asset deterioration 22
3.4 Identifying communities most vulnerable to local flooding 22
3.4.1 Methodology 23
3.4.2 Summary of most vulnerable communities 24

4 Managing local flood risk 28
4.1 Overview of approach 28
4.2 Measures in place to manage local flood risk 29
4.3 Measures we will take to manage local flood risk 32
4.4 Measures we will take in communities most vulnerable to flooding 35
5 Funding Strategy 38
5.1 Introduction 38
5.2 Strategic funding approach 39
5.3 Individual project funding 39
5.4 Review 40
6 Action Plan 42
6.1 Action plan for over-arching measures 42
6.1.1 Establish Asset Register Plus 47
6.1.2 Develop protocol for investigating flooding incidents 47
6.1.3 Develop protocol for designating structures 47
6.1.4 Collate historic flood data from parish councils 48
6.1.5 Work with community resilience groups to raise awareness of flood risks 48
6.1.6 Develop protocol for consenting and enforcement on ordinary watercourses 48
6.1.7 Develop two-yearly implementation plan 48
6.1.8 Continue working with RMAs through the SFMB 49
6.1.9 Manage stretch of coastline near Weston-super-Mare and Clevedon 49
6.1.10 Develop risk-based approach for maintaining assets 49
6.1.11 Encourage and promote investment in flood risk management activities which have multiple benefits 50
6.1.12 Develop SUDS Approval Body role 50
6.1.13 Improve linkages with development management services 50
6.1.14 Improve understanding of future flood risk due to climate change 50
6.1.15 Publish up to date surface water mapping 51
6.1.16 Develop information brochure to raise awareness of flooding 51
6.2 Action plan for measures in the most vulnerable communities 51
6.2.1 Wrington 52
6.2.2 Weston-super-Mare 53
6.2.3 Nailsea 54
6.2.4 Winscombe 56

6.2.5 Claverham 58
6.2.6 Congresbury 59
6.2.7 Long Ashton....60
6.2.8 Backwell....61
6.2.9 Churchill....62
6.2.10 Langford....63
6.2.11 Pill....64
6.2.12 Hutton 65
6.2.13 Portbury 65
6.2.14 Clevedon East 66
6.3 Monitoring and Review 67
6.3.1 Monitoring 67
6.3.2 Review and Update 67
Appendix A Relevant legislation, regulations, plans and policies.... 69
Appendix B Maps 70
Appendix C Working together to deliver local flood risk management.... 71
Appendix D Potential funding sources.... 72
Appendix E Summary of action plans 73
Appendix F Glossary 74

Table of Figures

Figure 1-1: Structure of LFRMS and linkages between LFRMS and the implementation plan 4
Figure 1-2: Overview of flood & coastal erosion risk management policy & strategy (NFCERM Strategy) 5
Figure 5-1: Funding sources and beneficiaries 41
Figure 6-1: Summary of over-arching measures we will take across North Somerset 43

Table of Tables

Table 2-1: LFRMS Objectives 9
Table 3-1: Key flooded locations in 2012 14
Table 3-2: Mitigation measures for adapting to climate change 20
Table 3-3: Matrix for risk assessment 24
Table 3-4: Summary of most vulnerable communities (* = one of top 5 communities) 26
Table 4-1: Measures already in place to manage local flood risk 29
Table 4-2: Measures we will take to manage local flood risk 32
Table 4-3: Types of measures that can be taken to manage flood risk in vulnerable communities 36
Table 6-1: Overview of how measures will be funded, assessed and who is responsible for delivery 44
Table 6-2: Timeline for review and update of LFRMS and associated documents 68

1 Introduction

1.1 Context

North Somerset is located in the southwest of England and borders the local authority areas of Bristol, Sedgemoor, Mendip and Bath & North East Somerset. North Somerset Council (NSC) is a unitary authority which is approximately 375km^2 in size, and more than two thirds of the district is rural. The majority of residents live in the main urban centres of Weston-super-Mare, Portishead, Clevedon and Nailsea. The population within the entire district is just over 200,000.

Flooding can threaten lives and cause substantial negative social and economic effects to people, property, infrastructure and agricultural land. Historical flooding within North Somerset has demonstrated these devastating effects. In addition to the Great Flood of 1607 which killed 2,000 people there have been a number of significant flooding incidents in North Somerset in 1968, 1981, 1989-90, 2007, 2008, and more recently in 2012 which was the second wettest year on record in the UK. Indeed, during 2012 it is estimated that approximately 340 properties flooded internally across North Somerset. Flooding in North Somerset arises from rivers, the sea, surface water runoff, exceedance from urban drainage networks, reservoirs, and groundwater. Flooding from the sea presents the most significant source of flood risk in North Somerset, although this is well managed by the presence of raised and natural sea defences along the majority of the coastline[2]. A future increase in precipitation and sea level due to climate change is likely to cause further increases in flood risk for North Somerset, although the nature and extent of this increase remains uncertain.

Given the scale of existing risk, and the predicted increase in future flood risk it is vital that key stakeholder organisations and local communities work together to better understand the flood risk issues in North Somerset. We must seek to identify measures which will help reduce the risk to people and property wherever it is economically, technically, socially and environmentally feasible to do so.

It is important to recognise that flooding is a natural process which provides numerous benefits including the recharge of groundwater, improvement of soil fertility, maintenance of ecosystems in river corridors, and floodplain biodiversity. Flooding cannot be wholly prevented. The risk it poses through its interaction with people and property can be reduced, however, and its negative impacts can be mitigated through good planning and management, and by maximising the effectiveness of available resources.

[2] A draft copy of the Severn Estuary Flood Risk Management Strategy, which considers how flood risk along the Severn Estuary will be managed over the next 100 years, is available at: http://www.severnestuary.net/frms/

1.2 What is a Local Flood Risk Management Strategy?

Under the Flood and Water Management Act 2010[3] NSC is now a Lead Local Flood Authority (LLFA) with new statutory powers and responsibilities for the management of flooding from **surface water, ordinary watercourses and groundwater**, in partnership with other organisations within North Somerset. This is referred to as 'local flood risk' in the Flood and Water Management Act.

One of our overarching responsibilities as a LLFA is to develop, maintain, apply and monitor a strategy for local flood risk management in our area (a 'local flood risk management strategy')[4]. The Local Flood Risk Management Strategy (LFRMS) will set out our high level vision for local flood risk management, and provide the framework for identifying and prioritising the specific measures which should be undertaken. The LFRMS will also identify how NSC will work together with its fellow Risk Management Authorities[5], other stakeholders, and local communities to manage local flood risk.

Furthermore, the LFRMS will provide the evidence base to target future capital and operational investment to manage flood risk in North Somerset. It is important to note that the LFRMS focuses on managing flood risk to people and property due to surface runoff, ordinary watercourses and groundwater, in accordance with our statutory duties and responsibilities. The measures identified in the strategy are designed to complement the works undertaken by North Somerset highways which provide local improvements. The strategy identifies where additional investment will be required to manage flood risk beyond that currently programmed by the highways authority. In addition, the measures in the strategy complement the work being undertaken by emergency management who have a plan in place for dealing with emergencies such as flooding. During flood incidents emergency management will provide leadership in response and recovery to the incidents. The LFRMS will be used to pro-actively plan and implement measures in communities to reduce the probability or consequence of flood risk.

However, we recognise that by far the most significant risk to North Somerset is that of tidal flooding. Whilst it is not a direct requirement of the LFRMS to address tidal flooding, which remains the responsibility of the Environment Agency, sea levels are a contributory factor in surface water flooding across our low lying coastal areas which rely on managed land drainage. High tides can create tide locked conditions which if combined with heavy rainfall can significantly exacerbate flooding. Because of the flood risk associated with tidal and fluvial sources across North Somerset it is also important that we consider the interaction of local flood risk sources with other flood mechanisms.

[3] http://www.legislation.gov.uk/ukpga/2010/29/contents

[4] Section 9 of the Flood and Water Management Act defines what the Local Flood Risk Management Strategy must include

[5] Risk Management Authorities are defined in the Flood and Water Management Act as the LLFA, district/borough councils (where present) the Environment Agency, water and sewerage companies, the highways authority and Internal Drainage Boards.

As a coastal authority, we also have responsibilities in relation to coastal erosion which, although not specifically required by the Flood and Water Management Act (FWMA), we have chosen to include within the Strategy so that all the information pertaining to our strategy for flood risk and coastal erosion is together in one document.

1.3 Structure of LFRMS

The structure of the LFRMS is illustrated in Figure 1-1. As part of the development of the LFRMS we have developed an action plan which considers the types of measures, timescales and responsibility for implementation to enable us to manage flood risk in North Somerset over the next 10 years. The action plans consider broad measures we will take across North Somerset to manage local flood risk, but also consider measures within the communities identified as being most vulnerable to local flood risk. It is important to recognise that whilst the action plans set the framework for how we will manage local flood risk over the next 10 years there will inevitably be legislative, regulatory and financial changes over this period which could affect how we manage local flood risk.

Therefore, we will need to maintain some flexibility during the delivery period of the LFRMS to allow for such changes. To reflect future uncertainty and maintain flexibility during the delivery period of the LFRMS, we will develop and maintain a ‘rolling’ two-year implementation plan, which will be reviewed, updated and published on an annual basis. The implementation plan will provide more specific details on: progress against the LFRMS objectives; any material changes which impact on delivery of the LFRMS (e.g. funding opportunity or regulatory changes), and; the priorities and actions for the next two year period. It is worth noting that consideration of suitable funding sources to deliver mitigation measures will be considered within the implementation plan.

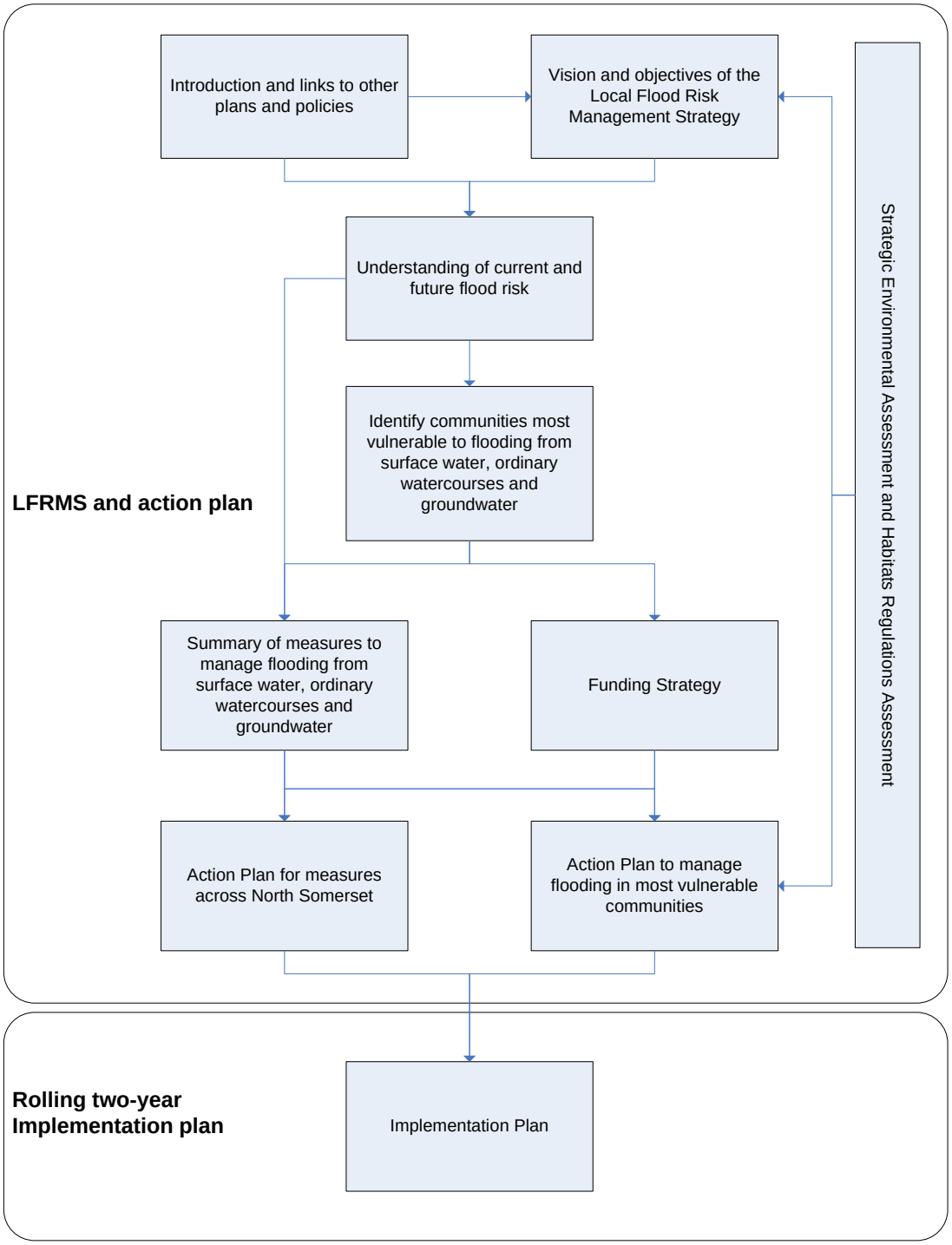


Figure 1-1: Structure of LFRMS and linkages between LFRMS and the implementation plan

1.4 Links to other plans, policies, legislation and regulation

The LFRMS influences and is influenced by a range of other plans, policies and legislation. The linkages between other plans, policies and legislation must be considered to ensure consistency whilst avoiding duplication.

Figure 1-2 shows where the LFRMS sits in relation to other relevant plans, policies and legislation. A more detailed overview of other relevant plans and policies is provided in Appendix A.

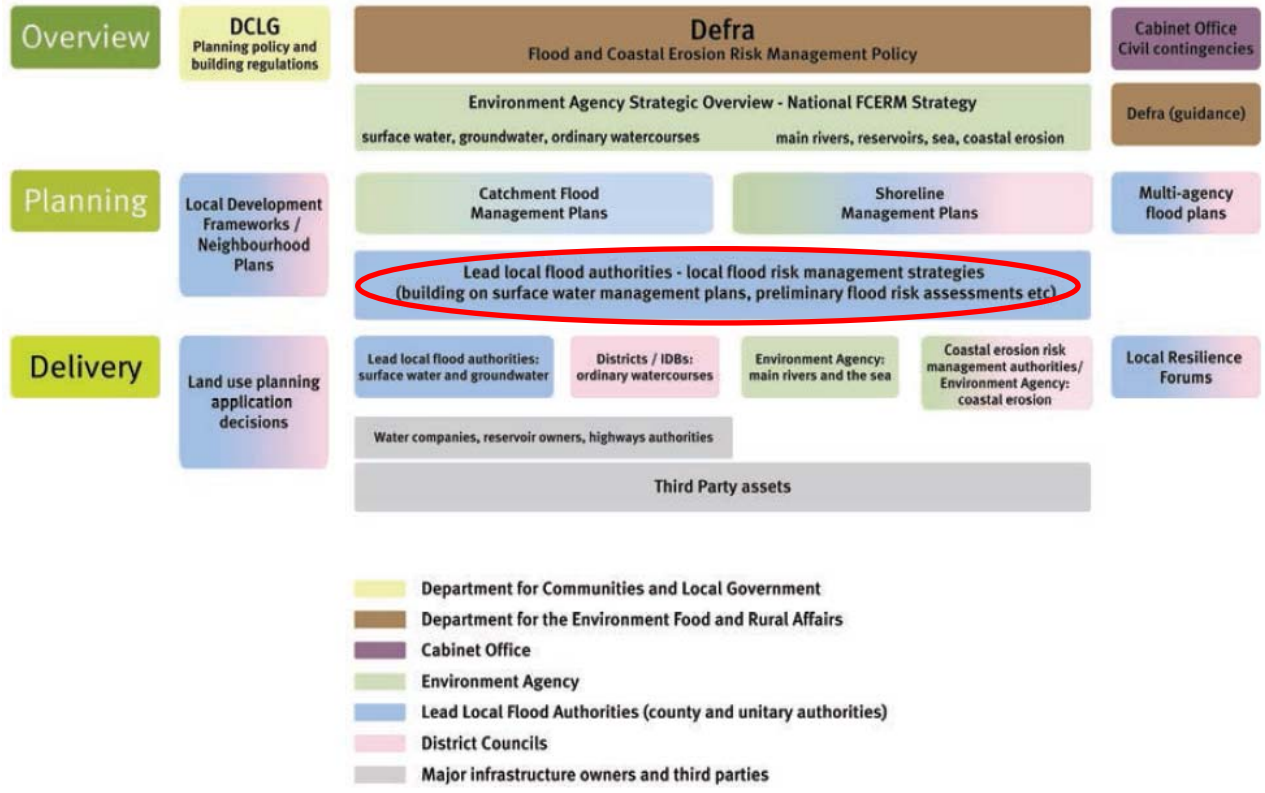


Figure 1-2: Overview of flood & coastal erosion risk management policy & strategy (NFCERM Strategy)

2 Key principles and objectives of the LFRMS

2.1 Key principles

2.1.1 Partnership working

As a LLFA we are responsible for providing leadership for flood risk from surface runoff, ordinary watercourses and groundwater, which is referred to as 'local flood risk', in accordance with our statutory duties and responsibilities. However, we cannot do this alone by simply improving the highways and public realm infrastructure over which we have direct responsibility. The integrated nature of flooding in North Somerset means that we will need to work in partnership with Risk Management Authorities, local communities and other stakeholders who have relevant responsibilities and/or assets in order to deliver effective improvements. It is also important that the 'professional' stakeholders, in particular Risk Management Authorities, work together to help local communities understand the risks they face and to support and promote appropriate local action. The LFRMS has been developed in partnership with our Risk Management Authorities, and in consultation with other stakeholders.

Maintaining this partnership approach will be essential to fulfilling our commitments under the LFRMS to deliver local flood risk management. Appendix C of this Strategy provides further details on roles and responsibilities of Risk Management Authorities, and provides more information on how we will communicate our plans effectively to other flood risk management stakeholders. We have established a core partnership with our fellow local Risk Management Authorities. This Strategic Flood Management Board (SFMB) meets quarterly to share information on flood risks, and to update each other on progress and future plans. We are also committed to working with our internal partners to manage flood risk. It should be noted that we are also working closely with our neighbouring local authorities to share information on cross-boundary issues as well as pooling experience and best practice. With all these partners we will continue to seek opportunities to deliver more for less through collaboration. The SFMB includes representatives from:

- North Somerset Council;
- Environment Agency;
- Wessex Water
- North Somerset Levels Internal Drainage Board, and;
- Axe Brue Internal Drainage Board;

The Terms of Reference for the SFMB are provided in Appendix C.

In addition, North Somerset Council has formed an Operational Group, which has a stronger focus on operational and 'on the ground' issues. The Operational Group focuses on: local priorities for flood risk; monitoring the operation of critical infrastructure and maintenance; raising relevant items for the SFMB to discuss, and; assisting the SFMB in the development and implementation of strategies.

2.1.2 Prioritising investment

We appreciate that flood risk is a concern for many of our residents, and we aim to mitigate flood risk wherever practicable. A key principle of the LFRMS is that investment will be prioritised in areas at greatest risk from local flooding. Prioritisation will be based on the most up to date available information and will ensure that resources are directed to those areas with the highest demonstrable level of local flood risk. This prioritisation will be revisited and adjusted accordingly as our understanding of local flood risk improves over time and as new information becomes available.

2.1.3 Promoting and supporting personal responsibility

Stakeholders at all levels have a role to play in managing flood risk. Risk Management Authorities have legal duties and powers to manage watercourses and drainage but individuals, communities and businesses can also play a key role in a number of ways. For example, by: reducing drain blockages by disposing of fats and oils responsibly, taking action to protect themselves and their properties, and getting involved in local flood risk management activities. Additionally, riparian owners have a responsibility to maintain a proper flow of water in any watercourse running through their land. The LFRMS aims to promote personal responsibility by raising awareness of flood risk and supporting community-based actions. Within North Somerset the Community Resilience network will be the primary mechanism for engaging with local communities[6].

2.1.4 Sustainability

In developing and delivering our LFRMS we will be guided by the North Somerset vision of 'Sustainable, inclusive, safe, healthy, prosperous communities thriving in a quality environment'[7]. Flood risk management offers many opportunities to contribute to sustainable development and sustainable communities, and we will seek to maximise these to deliver multiple benefits to communities and the environment wherever possible. This will help to ensure that we deliver best value for our investment in flood risk. A Strategic Environmental Assessment (SEA) of the LFRMS has been undertaken concurrently, to guide the development of a sustainable LFRMS and associated action plan which has due regard to the environment and identifies potential enhancement opportunities when delivering flood risk management schemes.

2.2 Objectives

We have identified a set of high level objectives to guide the development of the LFRMS for North Somerset. These have been derived from the objectives of the Environment Agency's

[6] http://www.communityresilience-ns.org.uk/

[7] North Somerset Sustainable Community Strategy 2008 – 2026, http://www.northsomersetpartnership.co.uk/usefulinformation/sustainable+community+strategy+2008-20261.asp

National Flood and Coastal Erosion Risk Management (FCERM) Strategy[8], with which we are required to act consistently, and interpreted to make them locally relevant and specific.

The six strategic objectives for the LFRMS, which have been agreed by the SFMB, are:

- improve our understanding of flood and coastal erosion risks in North Somerset;
- develop plans and policies to manage these risks sustainably;
- work in partnership with other flood Risk Management Authorities and lead by example;
- maintain and improve flood and coastal erosion risk management infrastructure and systems to reduce risk;
- avoid inappropriate development in areas of flood and coastal erosion risk, and ensure that development does not increase risks elsewhere, and;
- increase public awareness of flooding and promote individual and community level flood resilience.

Under each of these strategic objectives we have set out specific goals and anticipated outcomes to help interpret them into actions.

[8] http://www.environment-agency.gov.uk/research/policy/130073.aspx

Table 2-1: LFRMS Objectives

Detailed components	Anticipated outcomes
1. Improve our understanding of flood and coastal erosion risks in North Somerset	
Review and collate existing information on flood risk and identify data gaps.	Establish an understanding of flood risk and mechanisms of flooding based on best available information, and identify where additional information is needed.
Identify and prioritise areas of locally significant flood risk.	Using the existing evidence base a prioritised list of target areas can be produced using a fair and transparent process.
Establish and maintain a register of structures or features (assets) which are likely to have a significant effect on flood risk.	Identify assets which could have a significant impact on where and how flooding occurs, to improve prioritisation of investment.
Record, map and investigate flooding incidents to a proportionate level.	Improved historical flooding records leading to better informed prioritisation of capital and operational investment.
2. Develop plans and policies to manage these risks sustainably	
Ensure that flood risk management proposals are consistent with other relevant high level plans, policies and strategies.	LFRMS will comply with legislation and be consistent with other relevant plans, helping to deliver against common objectives.
Develop an implementation plan to drive investment in local flood risk management in North Somerset, reviewed annually and/or in response to defined triggers.	A clear plan for investment in flood risk management over the short, medium and long term, to direct appropriate use of resources and support fundraising opportunities.
Ensure that flood risk management measures seek to deliver wider benefits for local communities wherever practicable.	Flood risk management measures which offer additional benefits such as education, recreation or cultural heritage will be promoted, leading to social and economic benefits for local communities. Flood risk management activities will seek to improve the built environment.
Ensure that flood risk management	Flood risk management measures are delivered

measures work with natural processes and contribute to achieving specific environmental objectives wherever practicable.	without detriment to existing natural processes, and wherever possible offer environmental enhancements. Wherever possible, flood risk management measures contribute to achieving environmental objectives.
Ensure that flood risk management measures incorporate actions to tackle climate change and adapt to the changes it brings wherever practicable.	Adaptable and flexible flood defences with greater resilience to extreme weather events and the projected impacts of climate change[9].
Develop a monitoring and review cycle for the LFRMS, including procedure, review period, stakeholders involved, defined triggers for interim review.	Progress will be regularly reviewed, difficulties will be identified and addressed, and the LFRMS will be kept up to date.
3. Work in partnership with other flood risk management authorities and lead by example	
Ensure the roles and responsibilities of all RMAs in North Somerset are clearly defined and that common objectives, as well as potential differences, are appreciated.	Risk management activities will be well coordinated. RMAs will understand how and when to work together to achieve common objectives, and appreciate where different drivers may make this difficult.
Engage all local RMAs in development and review of flood risk management plans and policies, and promote partnership working.	Plans will take into account the actions and intentions of other RMAs to avoid duplication and achieve synergies. RMAs will co-ordinate their activities to deliver the most appropriate and cost beneficial solutions.
Establish and develop mechanisms to facilitate sharing of information between risk management authorities.	Relevant information will be shared promptly between risk management authorities to assist in local flood risk management, wherever possible.
Engage with other RMAs on a regular basis to monitor and review progress against flood risk management objectives, share information and discuss any issues arising.	Progress will be monitored and plans reviewed if circumstances change or new information becomes available. A forum for relationship building and information sharing between RMAs will be maintained.
4. Maintain and improve flood and coastal erosion risk management	

infrastructure and systems	
Improve operational maintenance planning and data capture to develop a positive maintenance regime for flood risk assets.	More targeted maintenance regime focusing investment on infrastructure in highest priority areas.
Improve flood incident reporting and response systems.	More effective use of resources in the event of flooding, leading to: shorter response times, increased availability of support to the public and more effective interaction with other risk management authorities and responders.
5. Avoid inappropriate development in areas of flood and coastal erosion risk, and ensure that development does not increase risks elsewhere	
Engage with spatial planning and development management services during the development of flood risk management plans and policies.	Flood risk management objectives will be effectively supported by appropriate spatial planning and enforcement.
Ensure planning authority service uses the 'Locally Agreed Surface Water Information' to support spatial planning.	Spatial planning will be informed by the best available information on local flood risk.
Ensure that drainage proposals for new development are appropriately reviewed for compliance with relevant national and local standards.	New development and redevelopment will manage surface water effectively and not increase the risk of flooding elsewhere.
Engage with developers as early as possible in the planning process to ensure that they are aware of drainage requirements and build these into their proposals from the outset.	Development will take into account space for water from the outset, making it more likely that site drainage will be managed sustainably.
6. Increase public awareness of flooding and promote individual and community level flood resilience	
Establish and promote links with local communities through which information about local flood risk	Communities will be aware of their vulnerability to flooding and better equipped to appropriately prepare and respond to flood incidents. We will be able to use local intelligence to help develop

can be shared.	and prioritise flood risk management strategy.
Support local communities to raise awareness of individual and community-led measures that they could implement to increase their resilience to flood risk.	Communities will be better informed of measures available to them, and empowered to put in place mitigation measures to reduce their vulnerability to flooding.
Encourage local communities and individuals to sign up to flood warning systems, where available.	Local communities and individuals will have access to early information about potential flooding incidents, which will improve their ability to respond, recover more quickly and reduce the potential impact of a flood incident.
Provide support to communities and individuals both in the event of flooding and throughout the aftermath.	Local communities will have access to the information and services they need to help them recover more quickly in the event of flooding.

3 Understanding current and future flood risk

3.1 Historic flooding in the North Somerset administrative area

North Somerset has a long history of flooding, with records dating back to the infamous 'Great Flood' in 1607 which killed 2,000 people across Somerset. Within the last 30-40 years there have also been a number of significant flooding incidents in North Somerset. Appendix A of the Preliminary Flood Risk Assessment provides a summary of the most significant flooding incidents in North Somerset up to 2010, including:

- July 1968 – flooding to Banwell Moor, St Georges Village, Wrington, Congresbury, Weston-super-Mare and Clevedon due to a combination of fluvial and surface water flooding;
- 1981 – tidal flooding affected Uphill, Clevedon, Wick St Lawrence and Kingston Seymour;
- 1989-90 – tidal inundation on a lesser scale in Weston-super-Mare, Kingston Seymour, Wick St Lawrence and Clevedon;
- Summer 2007 – flooding was experienced in Wrington due to surface water runoff and overtopping of the ordinary watercourse;
- January 2008 – there were over 200 incidents recorded by the Avon Fire and Rescue Service in one afternoon, and within North Somerset properties were affected in Winford, St Georges Hill and Wrington, and;
- February 2008 – Station Road (A370) at Flax Bourton became impassable and the railway line was temporarily closed with trains cancelled.

More recently, there was significant flooding across the North Somerset administrative boundary in August, September and November 2012. Records from North Somerset Council indicate that approximately 340 properties suffered internal flooding in North Somerset over this period. A summary of the key flooded locations where more than 10 properties suffered internal flooding is provided in Table 3-1. A map of historic flooding incidents is provided in Appendix B.

Table 3-1: Key flooded locations in 2012

Location	Estimated no. internal flooding incidents in 2012	Estimated no. external flooding incidents in 2012
Congresbury	10-20	10-20
Clevedon	20-30	5-10
Langford	10-20	10-20
Locking	10-20	5-10
Nailsea	20-30	40-50
Weston-super-Mare	20-30	20-30
Winscombe	20-30	10-20
Wrington	80-90	140-150

Whilst historic flooding locations may not be indicative of all areas which may be at risk in the future, it is evident that flooding remains a big issue in North Somerset. The available historic data does not record the source of flooding, although it is known that flooding in North Somerset is caused by overtopping of watercourses (fluvial flooding), overtopping of tidal defences whether natural or man-made, flooding from surface water runoff, flooding from drainage networks (highway and sewerage drainage systems), and groundwater

3.2 Current flood risk in North Somerset

In addition to collating anecdotal evidence of flooding there are tools and methods available to assess the risk of future flooding from a range of sources. In this situation, risk equates to the likelihood of flooding occurring multiplied by the consequence of flooding to people, property and the environment. The following sources of flood risk are considered in the LFRMS:

- flooding from surface runoff (part of local flood risk);
- flooding from ordinary watercourses (part of local flood risk);
- flooding from groundwater (part of local flood risk);
- flooding from Main Rivers and the Sea (responsibility of the Environment Agency);
- flooding due to tidal or fluvial ‘locking’ which prevents free discharge of drainage networks to rivers and the sea, and;
- flooding from sewerage systems (responsibility of water and sewerage companies).

3.2.1 Flood risk from surface runoff and ordinary watercourses

Since the summer floods of 2007 much work has been undertaken to better understand flood risk from surface runoff and ordinary watercourses both nationally by the Environment Agency and locally such as Weston-super-Mare Surface Water Management Plan. As part of the Preliminary Flood Risk Assessment (PFRA) in 2010 we analysed the available mapping to determine which sources of mapping were most representative of flood risk in North Somerset. This is known as the 'Locally Agreed Surface Water Information'[10]. As the 'Locally Agreed Surface Water Information' represents the best available information on areas vulnerable to surface water flooding this should be used as the primary dataset when understanding whether an area is vulnerable to surface water flooding. A map of the flood risk from surface water is provided in Appendix B

Based on the 'Locally Agreed Surface Water Information' nearly 2,000 residential and non-residential properties are predicted to be at risk of surface water flooding during a rainfall event with a probability of occurring once every 30 years[11]. During a rainfall event with a probability of occurring once every 200 years nearly 6,000 residential and non-residential properties could be at risk of surface water flooding. Key surface water flood risk areas for a rainfall event with a probability of occurring once every 30 years, are:

- Backwell - >75 properties predicted to be at risk (NB: limited recorded flooding in this location);
- Claverham - >100 properties predicted to be at risk (NB: limited recorded flooding in this location);
- Clevedon - >50 properties predicted to be at risk
- Long Ashton - >125 properties predicted to be at risk (NB: limited recorded flooding in this location);
- Nailsea - >100 properties predicted to be at risk;
- Portishead – nearly 70 properties predicted to be at risk;
- Weston-super-Mare - >200 properties predicted to be at risk;
- Winford - >50 properties predicted to be at risk, and;
- Wrington – 125-150 properties predicted to be at risk.

Locally Agreed Surface Water Information

The Environment Agency is currently in the process of updating their national surface water flood map ('updated Flood Map for Surface Water'). It is anticipated that this updated map will provide a more robust prediction of areas vulnerable to surface water flooding due to improvements in the hydrology, representations of the urban drainage network and the Digital Terrain Model (DTM). The maps will be published by December 2013. Once the updated Flood Map for Surface Water is available NSC will work with Risk Management Authorities to assess whether the 'Locally Agreed Surface Water Information' should be updated to reflect this new mapping.

3.2.2 Flooding from groundwater

Current understanding of groundwater flooding is very limited due to the complexities of representing the flow and emergence of groundwater. Existing approaches have tended to focus on the **susceptibility** of areas to groundwater flooding.

The Environment Agency has produced a groundwater susceptibility map (see Appendix B), known as the 'Areas Susceptible to Groundwater Flooding map', which identifies vulnerability to groundwater flooding on a 1km square grid. It must be noted that this map should only be used to identify broad areas, rather than individual properties, which are vulnerable to groundwater flooding and hence may need further investigation. Based on this analysis locations which may be vulnerable to groundwater flooding include:

- Claverham;
- Langford and Lower Langford;
- North of Junction 19 (M5) near Portbury Royal Docks;
- Portishead east of the A369, and;
- Winscombe.

Due to the uncertainties in groundwater mapping it is recommended that the mapping only be used in conjunction with anecdotal evidence of groundwater flooding.

3.2.3 Flood risk from Main Rivers and the Sea

Flooding from Main Rivers and the Sea is managed by the Environment Agency using its permissive powers under the Environment Act 1995. The 'undefended' Environment Agency flood maps indicate large areas of North Somerset being at risk due to flooding from Main Rivers and the Sea. Indeed the PFRA noted that 25% of the total NSC administrative area was considered to be at risk of tidal flooding based on Flood Zone 3[12].

With respect to Main Rivers and the Sea, the communities outlined below are at risk of flooding. In all cases there is likely to be more than one flood source, and close partnership working will be needed.

- Clevedon – large parts of South and Central Clevedon are located within the combined fluvial/tidal Flood Zone 3 due to flood risk from the Land Yeo and Blind Yeo, although there are flood defences on both banks of these rivers according to the Environment Agency's asset database.
- Congresbury – the town suffered severe flooding in 1968 due to overtopping of the Congresbury Yeo, and there is now a flood defence along the left bank to manage the risk of overtopping of the river.
- Pill – properties adjacent to the Markham Brook are located within Flood Zone 3.
- Portishead – parts of East Portishead are located within the combined fluvial/tidal Flood Zone 3.
- Winford - it should be noted that the Winford Brook becomes a Main River on Church Road and upstream of this it is an ordinary watercourse.

With respect to flooding from the sea, there is an extensive network of tidal defences along the North Somerset coast, which are built to offer protection up to either a 100 year (1%

chance of occurring in any given year) or 200 year (0.5% chance of occurring in any given year). Therefore, there is a high current standard of protection along many parts of the coastline. The Environment Agency's draft Severn Estuary Flood Risk Management Strategy[13] provides an overview of the current and future investment needs and proposals for the Severn Estuary.

The Strategy notes several areas where flood risk from the Estuary may affect people, property, infrastructure or agricultural land either now or in the future due to sea level rise associated with climate change. Between Clevedon and Middle Hope the probability of tidal flooding to properties in Kingston Seymour, Wick St. Lawrence, Weston-super-Mare and west Clevedon is currently 1 in 50 years, and some agricultural land can flood on an annual basis. Between Middle Hope and Brean Down some agricultural areas to the north of Weston-super-Mare have a 1 in 20 chance of flooding in any year, and there is a risk of flooding east of Sand Bay due to the transient nature of sand dunes in the area.

3.2.4 Flooding due to tide and fluvial 'locking'

Fluvial or tidal 'locking' occurs when high tides or high river levels prevent the free flow discharge from urban drainage systems or cause river systems to back up. This occurs particularly in low-lying areas such as North Somerset and can cause or exacerbate flooding. Indeed in September and November 2012 some parts of North Somerset were more severely affected as a result of urban drainage systems being prevented from discharging due to elevated levels in rivers and rhynes.

The Mid and North Somerset Catchment Flood Management Plan[14] specifically identifies tide locking causing potential flood risk in:

- Clevedon from the Blind Yeo tide locking of urban drainage networks;
- Portbury from tide locking of urban drainage networks;
- Portishead from tide locking of urban drainage networks;
- Uphill from the Uphill Great Rhyne, and;
- Weston-super-Mare from tide locking of urban drainage networks.

Furthermore, there is anecdotal evidence of tidal/fluvial locking exacerbating flood risk in the 2012 flooding in Congresbury, Nailsea and Weston-super-Mare.

Implementing mitigation measures to alleviate tidal and fluvial locking will need to be considered on a case by case basis, considering the hydrological regimes and impacts of different components of the drainage network (e.g. tidal, fluvial or urban drainage). Close partnership working between NSC, the IDBs and the Environment Agency will be required to ensure river levels are managed appropriately during rainfall events.

3.2.5 Flooding from sewerage systems

Flooding from sewerage systems occurs when the capacity of the drainage network is exceeded. This can be due to blockage, failure of equipment or overloading of sewers due to rainfall. Water and sewerage companies are responsible for managing sewerage networks under the Water Industry Act 1991. All water and sewerage companies maintain a register of properties/areas which have experienced flooding from the sewerage system due to lack of

capacity in their network; this is known as the DG5 Register[15]. This includes flooding from foul sewers, combined sewers and surface water sewers.

For the LFRMS Wessex Water provided their DG5 Register (correct as of January 2013). This has been used to identify areas where flooding from the sewerage systems is an existing issue. Where local flood risk corresponds to properties on the DG5 Register we can identify potential opportunities for joint working and funding to manage flood risk. The majority of properties on the DG5 Register are in Weston-super-Mare.

3.3 How flood risk may change over time

3.3.1 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 the 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, which is defined as more than 25mm in a day. It is plausible that the amount of rain in extreme storms (those 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 the majority of North Somerset falls within the Severn River Basin District projections for this River Basin District have been used for the LFRMS.

Key projections for 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.

The adaptation sub-committee's progress report[16] identified four key adaptation measures to manage long-term flood risk in a changing climate:

- location and design of new development;
- actions to protect existing properties from flooding;
- measures for managing surface water flows in developed areas [NB: surface water flows will also need to be effectively managed in rural areas to protect properties in rural areas and in downstream developed areas], and;
- emergency planning and response

Table 3-2 identifies example mitigation measures which could be taken for each of the four categories. Example mitigation and adaptation measures have been identified from our Climate Change Adaptation Plan[17].

Table 3-2: Mitigation measures for adapting to climate change

Category	Example mitigation / adaptation measures
Location and design of new development	• Follow guidelines of National Planning Policy Framework to ensure all sources of flood risk are considered when assessing development sites, and that downstream properties are protected from an increase in flood risk due to development [NB: this is part of policy CS3 of the adopted Core Strategy] • Use climate change maps in determining suitable locations for development [NB: this is part of policy CS3 of the Core Strategy] • Ensure sustainable drainage systems (SUDS) are implemented in new development, using the SUDS Approval Body as the delivery mechanism when established [NB: this is part of policy CS2 of the adopted Core Strategy and we are currently developing local SUDS guidance to support implementation of the SuDS Approval Body]
Actions to protect existing properties from flooding Measures for managing surface water flows in urban [and rural] areas	• Review maintenance regimes for clearance of gullies and amend as necessary • Design green infrastructure provision to reduce surface water runoff [NB: this is part of policy CS9 of the adopted Core Strategy] • Adjust arable farming practices to restrict the rate of surface water runoff (e.g. changing direction of ploughing) • Ensure existing buildings are more resilient (e.g. raising plug sockets) • Ensure critical infrastructure have plans in place to deal with flooding if they are at risk [NB: these have been identified during the LFRMS] • Maintain and seek to enhance existing watercourses and overland flow corridors • Minimise future culverting of watercourses and seek to 'daylight' culverts where possible • Identify opportunities to educate individuals and communities about flood risk and to promote

	personal response
Emergency planning and response	• Encourage uptake of Environment Agency flood warnings • Identify a range of rest centres to house people in the short-term, although due to the unpredictable nature of flooding the accessibility of any rest centre will need to be determined during a flooding incident • Develop and assess flood evacuation and shelter plans and implement measures to response. Early warning and community-led response will be key prior to and during a flooding incident • Raise community awareness of flood risks and actions to take in the event of a flood • Target vulnerable groups and individuals to encourage action [NB: project already underway with community resilience teams] • Ensure that emergency services have access to the latest flood risk mapping to know vulnerable locations

3.3.2 New Development

Without effective planning policy there is a risk that the increase in hard standing and impermeable surfaces associated with development will increase surface water runoff and hence the risk of flooding. It is imperative that surface runoff and flood risk are fully assessed as part of the development of local planning documents and in determining planning applications to mitigate this risk.

Adopted in April 2012, the Core Strategy[18] is the main planning document for North Somerset. It sets out the objectives and strategic planning policies for North Somerset up to 2026.

The Core Strategy outlines the mitigation measures required to offset the potential impacts of new development. The key policy relating to flood risk management within the Core Strategy is CS3: Environmental impacts and flood risk assessment. This outlines that development which would lead to environmental pollution or harm amenity, health or safety will only be permitted if potentially negative effects would be mitigated to an acceptable level. It states that development will not be permitted in flood zones 2 and 3 of the Environment Agency Flood map unless it complies with the sequential test, and where necessary the exception test as outlined in the National Planning Policy Framework. The policy also refers to the use of the 'climate change additional extents' map produced as part of the North Somerset Strategic Flood Risk Assessment for use in long term planning.

Other policies within the Core Strategy which relate to flood risk management include:

- CS1: Addressing climate change and carbon reduction which includes the principle that "areas will be enhanced to be resilient to the impacts of climate change including flood defence and public realm enhancements"
- CS2: Delivering sustainable design and construction states that when considering proposals for developments the council will "require the application of best practice in Sustainable Drainage Systems to reduce the impact of additional surface water runoff from new developments."
- CS9: Green infrastructure: which seeks to safeguard, improve, enhance the existing network of green infrastructure by 'further provision, linking in to existing provision where appropriate, ensuring it is a multi-functional, accessible network which promotes healthy lifestyles, maintains and improves biodiversity and landscape character and contributes to climate change objectives'.

3.3.3 Asset deterioration

Assets (e.g. culverts, trash screens, gullies) which are not adequately maintained may not function appropriately during times of rainfall and could therefore exacerbate the consequences of flooding. In addition over time the performance of assets may be reduced due to deterioration of such assets.

The Environment Agency, using their permissive powers under the Environment Act (1995)[19], maintain flood defence assets associated with Main Rivers and the Sea using a risk-based approach and depending on availability of funding. The Environment Agency uses an asset management system (AIMS [Asset Information Management System]) to manage the maintenance and condition of assets related to Main Rivers and the Sea. In addition, Wessex Water has an asset management system for their public sewerage network.

There is significantly less knowledge about the location, ownership and condition of assets which affect local flood risk. Typically, these might be include culverts on ordinary watercourses or local drainage ditches. Section 21 of the Flood and Water Management Act has created a duty for us to maintain a register of assets which records the condition, location and ownership of assets with a significant effect on a flood risk. Our approach to better understanding assets which have a significant effect on a flood risk is provided in the action plan of the LFRMS, which is outlined in Section 6.

3.4 Identifying communities most vulnerable to local flooding

Under objective 1 of the LFRMS one of the key activities is to "identify and prioritise areas of locally significant flood risk." This will ensure that we can inform future investigations and investment on the basis of the priority areas across North Somerset and that the limited resources are targeted to the areas of greatest flood risk. In the highest risk communities it is likely that more significant capital investment will be required to manage flood risk, and these highest risk communities will remain our priority.

However, it is important to note that just because a location is classified as lower risk it does not mean we will not consider actions in these areas to mitigate risk. In areas of lower risk

smaller scale operational improvements (e.g. highway improvements) and community resilience measures will be preferred measures to manage flood risk. In all locations collaborative approaches with partners and the community will be essential.

3.4.1 Methodology

To identify and prioritise the communities most vulnerable to local flood risk we have defined a methodology which uses the best available historic and predictive data on local flooding. The methodology is based on identifying communities most vulnerable from surface water and ordinary watercourses, although subsequent analysis has been undertaken to assess potential interactions between local flood risk and other sources of flooding, including Main Rivers, the Sea and the urban drainage network. It should be noted that the methodology seeks to identify the locations where the greatest number of properties are at risk of flooding, recognising that internal property flooding will cause the biggest social and economic effects to local communities.

We recognise that flooding of infrastructure will also cause adverse social and economic impacts, and we have considered the risks of flooding to critical infrastructure as part of the LFRMS. Information on roads and other critical infrastructure (e.g. schools) have been passed onto internal partners within NSC, and we are committed to working with internal partners to manage flood risk to people, property and infrastructure.

The methodology to identify the most vulnerable communities is briefly outlined below.

i. Divide the North Somerset administrative area into a 1km grid as the basis for the assessment. We recognise that flooding does not respect such boundaries, but the purpose of splitting the area into a grid is to provide a consistent scale for the analysis at a sufficiently detailed resolution. We explored a number of different spatial scales for this analysis, including parish and ward boundaries. However, the best granularity and resolution was achieved through a 1km grid approach.
ii. Collate and map historic flooding incidents from North Somerset Council, which includes geo-referenced information dating back as far as 1994, although it should be noted there is greater confidence in more recent data due to more accurate reporting methods.
iii. Count the number of known internal flooding incidents from North Somerset Council within each 1km grid square.
iv. Count the number of 'other'[20] flooding incidents from North Somerset Council within each 1km grid square.
v. Count the number of residential and non-residential properties predicted to be at risk using the 'Locally Agreed Surface Water Information' for a rainfall event with a probability of occurring once every 30 years.
vi. Using the matrix outlined in Table 3-3 calculate a 'risk score' for each 1km grid cell. It should be noted that the matrix has applied a higher weighting to predictive surface water data because at the time of writing the LFRMS we have relatively low confidence in historic data (with the exception of 2012 data). We are continuing to improve the capture of flood incident data and therefore will have improved confidence as we gather data in the event of future flood incidents. In future revisions

of the risk assessment methodology this will mean we can apply a higher weighting to recorded flooding incidents. The current weighting applied has been tested to understand the sensitivity of the weighting to the outputs from the risk assessment. It was found that the highest risk communities did not change with different weightings applied.

vii. Identify areas where there may be interactions between local flood risk, and fluvial/tidal/sewerage flooding.

The output from the analysis provides a 'risk score' for each 1km grid cell. Adjacent grid cells which have a high risk score have been clustered together; these will form the communities most vulnerable to local flood risk. For the communities most vulnerable to local flood risk specific action plans have been developed to identify the next steps and actions to mitigate local flooding. The list of communities most vulnerable to local flood risk will be updated as mitigation measures are implemented to manage risk in these locations.

Table 3-3: Matrix for risk assessment

Criteria	Weighting	Score				
		1	2	3	4	5
Known internal flooded properties	35%	<2	2-5	5-15	15-25	>25
'Other' historic flooding incidents	15%	<2	2-5	5-15	15-25	>25
No. residential and non-residential properties at risk from SW flooding during 1:30 year rainfall event	50%	<5	5-10	10-25	25-50	>50

3.4.2 Summary of most vulnerable communities

Table 3-4 indicates the communities most vulnerable to local flood risk is based on the methodology described in Section 3.4.1. A map of these communities is available in Appendix B. The table summarises the numbers of properties which have experienced flooding based on the our historic flood database and the numbers of properties predicted to be at risk based on surface water mapping, alongside a summary of the key sources of flooding within these communities.

It should be noted that Weston-super-Mare (WsM) has been considered as a single community for the LFRMS to align with the SWMP undertaken for the town. However, the

LFRMS has identified two specific parts of WsM which are most vulnerable to local flood risk: 1) Milton Hill and Worle, and 2) Central and West WsM.

Table 3-4: Summary of most vulnerable communities (= one of top 5 communities)*

Location	Known internal flooded properties	Other historic flooding incidents	No. residential and non-residential properties at risk from SW flooding during 1:30 year rainfall event	Surface runoff	Fluvial	Ground water	Highway	Sewerage	Fluvial / tide locking	Other
Backwell	0-5	5-10	80-90	☐			☐			
Churchill	5-10	5-10	40-50	☐	☐	☐	☐	☐		Blockages
Claverham*	10-20	10-20	60-70	☐		☐	☐	☐		
Clevedon East	10-20	5-10	10-20			☐	☐	☐	☐	
Congresbury	20-30	5-10	10-20	☐	☐	☐	☐		☐	Blockages
Hutton	5-10	5-10	10-20		☐	☐		☐		
Langford	15-20	15-20	20-30		☐	☐	☐	☐		
Long Ashton	0-5	10-15	110-120		☐		☐	☐		
Nailsea*	10-20	50-60	100-110	☐		☐	☐	☐	☐	Blockages
Pill	0-5	0-5	60-70	☐	☐		☐	☐		
Portbury	0-5	0-5	30-40	☐	☐		☐		☐	
Winscombe*	10-20	5-10	60-70	☐	☐	☐	☐			Blockages

Wrington*	80-90	140-150	120-130		□		□			
WSM*	20-30	70-80	210-220	□		□	□	□	□	

4 Managing local flood risk

4.1 Overview of approach

There are a range of measures which can be taken to manage local flood risk. The purpose of this section is to provide a broad overview of the measures we will take to manage local flood risk.

Table 4-1 outlines the range of measures and actions we have taken since we became a LLFA under the Flood and Water Management Act 2010. Table 4-2 considers the measures we will take across the North Somerset administrative area through the LFRMS to achieve the objectives set out in Section 2.2.

In addition Table 4-3 summarises the types of measures which can be taken in the communities most vulnerable to local flood risk.

It is important to note that the delivery of the proposed measures will be dependent upon the availability of funding, and will be undertaken over the long term rather than immediately. A phased approach will be required, particularly with respect to capital investment measures. The LFRMS action plan in Section 6 provides further consideration of the timetable, responsibilities and funding to deliver these measures.

4.2 Measures in place to manage local flood risk

Table 4-1: Measures already in place to manage local flood risk

Strategic objective	Type of measure	Description of measures already in place
Strategic objective 1: Improve our understanding of flood and coastal erosion risks in North Somerset	Capital	We have undertaken a risk assessment to identify the 15 communities most vulnerable to local flood risk in North Somerset
	Capital	We have developed a prioritisation matrix for highways schemes to manage drainage and flooding from highways. This will be used to drive investment in highways
	Operational	We have developed an asset register to record the location, condition and ownership of key assets in North Somerset, and will be further developing this asset register ('asset register plus')
Strategic objective 2: Develop plans and policies to manage these risks sustainably	Capital	For the most vulnerable communities we have developed action plans to identify what actions should be taken to manage local flood risk (see Section 6). Furthermore we have developed a Surface Water Management Plan for Weston-super-Mare
	Capital	We have developed a clear action plan to identify all actions we will take across North Somerset to manage local flood risk (see Section 6)
	Capital	We have developed a funding strategy and funding guidance that identifies the primary sources of local flood risk management funding. The strategy also identifies how to maximise other non-flood related outputs to secure

		contributions from other secondary sources of funding (see Section 5)
	Policy	We have developed a Strategic Environmental Assessment which considers the environmental benefits associated with actions in the LFRMS and identifies environmental enhancement opportunities
	Policy	We have ensured that the LFRMS is consistent with the National Flood and Coastal Erosion Risk Management Strategy
Strategic objective 3. Work in partnership with other flood risk management authorities and lead by example	Policy	We have established a Strategic Flood Management Board and North Somerset Operational Group which include representatives from all Risk Management Authorities
	Policy	We have established mechanisms to share data between Risk Management Authorities which will be enhanced through the development of the 'asset register plus'
	Policy	We are engaging with neighbouring risk management authorities through the West of England partnership and South West Flood Risk Managers Group
	Policy	We have been working closely with our internal partners to share information, establish common investment needs and manage flood risk more effectively
	Operational	We have improved our procedures for capturing recorded flood incident data
Strategic objective 5: Avoid inappropriate development in areas of flood and coastal erosion risk,	Operational	We have engaged with development management services during the development of the LFRMS to ensure consistency with spatial planning and transfer of information

and ensure that development does not increase risks elsewhere	Operational	We have provided up to date surface water mapping information to assist development management services in ‘plan-making’ and ‘decision-taking’
Strategic objective 6: Increase public awareness of flooding and promote individual and community level flood resilience	Capital	We have undertaken a community resilience pilot in Congresbury, which has now been extended across North Somerset’s administrative area
	Operational	We have improved the flood content on our website which enables communities to better access information about flood risk management

4.3 Measures we will take to manage local flood risk

Table 4-2: Measures we will take to manage local flood risk

Strategic objective	Type of measure	Description of measure/s	Consideration in LFRMS
Strategic objective 1: Improve our understanding of flood and coastal erosion risks in North Somerset	Operational	We will establish an enhanced asset register ('asset register plus') to improve our understanding and management of assets which have a significant impact on local flood risk	Section 6.1.1
	Operational	We will develop protocols for the reporting and investigation of flooding incidents and will ensure that flood incidents are investigated in accordance with our statutory duties	Section 6.1.2
	Operational	We will develop protocols for designating structures or features and propose to designate key structures or features	Section 6.1.3
	Operational	We will work closely with parish councils to collate historic flood incident data, which will be used to update the vulnerable communities' assessment. We will establish a mechanism to enable improved transfer of information from parish councils to NSC in the event of future flooding incidents	Section 6.1.4
	Operational	We will work with Community Resilience groups across North Somerset to build communities which can be more resilient to flooding. Recognising that resources are limited we will prioritise community resilience to flooding in those	Section 6.1.5

		communities which are identified in this Strategy as being most vulnerable to flood risk.	
	Operational	We will develop protocols for the consenting and enforcement of ordinary watercourses	Section 6.1.6
Strategic objective 2: Develop plans and policies to manage these risks sustainably	Operational	We will develop an two-yearly implementation plan which sets out progress against the objectives of the LFRMS and the works programmed over the next two year period	Section 6.1.7
Strategic objective 3. Work in partnership with other flood risk management authorities and lead by example	Policy	We will continue to work in partnership with Risk Management Authorities through the SFMB and Operational Group	Appendix C and Section 6.1.8
Strategic objective 4: Maintain and improve flood and coastal erosion risk management infrastructure and systems	Operational	We will operate and maintain the tidal flood defences where we are the operating authority, in partnership with the Environment Agency.	Section 6.1.9
	Operational	We will develop a risk-based approach to the maintenance of our assets in the highest risk locations, using our 'asset register plus' as the platform to accomplish this	Section 6.1.10
	Policy	We will encourage and promote investment in drainage and flood risk management infrastructure which achieves multiple benefits (e.g. green infrastructure)	Section 6.1.11
Strategic objective 5: Avoid inappropriate development in areas	Operational	We will develop our SUDS Approval Body protocols in time	Section 6.1.12

of flood and coastal erosion risk, and ensure that development does not increase flood risk elsewhere		for commencement of Schedule 3 of the FWMA	
	Policy	We will develop local SUDS guidance to set out our vision to the design of SUDS in North Somerset	
	Operational	We will continue to improve linkages with development management services to inform decisions on planning applications	Section 6.1.13
Strategic objective 6: Increase public awareness of flooding and promote individual and community level flood resilience	Operational	We will publish up to date surface water mapping to raise awareness of surface water flood risk, working closely with the Environment Agency	Section 6.1.14
	Operational	We will develop an information brochure to raise awareness for residents on how to prepare for a flood and what to do in the event of a flood in consultation with all partners	Section 6.1.16

4.4 Measures we will take in communities most vulnerable to flooding

Table 4-3 summarises the types of measures that can be taken to mitigate flood risk in local areas. The measures are broken down into broad themes:

- **Investigations** aim to better understand the cause of flooding to improve the confidence in decision-making
- **Source control measures** for surface water flooding normally aim to reduce flooding by increasing storage of flood water, reducing the rate of runoff or increasing the volume of water which soaks into the ground. Sustainable Drainage Systems (SUDS) are often an effective means to implement source control. SUDS encompass a variety of measures such as permeable paving which allows more water to soak into the ground than traditional impermeable road and path surfaces. Other SUDS measures may include introducing ponds and wetlands that can hold flood water, or swales and detention basins which slow the movement of water and reduce the volume of runoff. Source control measures can also integrate with re-use of water through grey-water recycling or rainwater harvesting.
- **Pathway measures** aim to manage the movement of flood water through both natural and manmade drainage systems. Measures may be structural, for example involving the development of new drainage systems, or separating foul and surface water sewers, or may be non-structural for example encouraging land management practices which reduce runoff. We recognise that maintenance of our existing drainage infrastructure will be an important aspect to managing flooding; it can reduce flood risk with minimal capital investment, freeing up funds for measures elsewhere.
- **Receptor-level measures** aim to reduce the likelihood but more often the impact of flooding on people, property and environment. We will work with our partners to increase awareness of flood risk so that individuals and communities understand the flood risks they face and the ways in which they can help to manage that risk. We will help people to understand how they can become more resilient to flooding. This will better equip people to take measures to prevent flood water entering their properties, and recover if they are affected by flooding.

The Action Plan in Section 6 considers which of these measures will be applicable in each of the communities most vulnerable to local flooding.

Table 4-3: Types of measures that can be taken to manage flood risk in vulnerable communities

Theme	ID	Capital / Operational / Policy	Type of measure
Investigation	I-1	Capital	Study (e.g. SWMP) or investigation (e.g. site walkover)
Investigation	I-2	Capital	Survey / Modelling
Source	S-1	Capital	Retrofit SUDS measures / Green Infrastructure / Rainwater Harvesting
Source	S-2	Capital	Land management practices
Source	S-3	Capital	Intercept and divert pluvial runoff
Pathway	P-1	Capital	Storage above or below ground
Pathway	P-2	Capital	Manage exceedance flows (e.g. re-profiling road)
Pathway	P-3	Capital	Increase capacity of urban drainage network (sewer or highway drainage)
Pathway	P-4	Capital	Increase capacity of drains/watercourses
Pathway	P-5	Capital	Raise/create flood defences
Pathway	P-6	Capital	Daylight culverted watercourses
Pathway	P-7	Operational	Enhance maintenance of gullies / drainage network

Pathway	P-8	Operational	Enhance maintenance of watercourses/culverts
Pathway	P-9	Capital	Separate foul and surface water sewer systems
Receptor	R-1	Capital	Individual property level protection
Receptor	R-2	Policy	Improve flood warning
Receptor	R-3	Policy	Planning policies to influence development
Receptor	R-4	Policy	Raise awareness and education
Receptor	R-5	Capital / Operational	Community level resilience

5 Funding Strategy

5.1 Introduction

Successful delivery of local flood risk management measures will require innovative ways of working and funding, based on teamwork and trust. Collaborative working and joint funding across partner organisations will be key to maximising the return on investment in flood risk management. Defra's introduction in 2011 of the partnership funding approach means that the ability of LLFAs to leverage both financial and in kind contributions from local partners could make the difference between locally important projects going ahead or not. Successful fundraising is dependent on relationships, timing and effort. Understanding what types of outputs and outcomes are needed to qualify for various funding sources is critical in order to persuade potential funders to commit to a project. The qualifying benefits for dedicated flood risk funding sources are typically well understood, but it may also be possible, with slight modifications or additions to a flood risk project or even just a different way of 'selling' the benefits, to meet the requirements of funders outside the flood risk industry and access additional funding in this way.

Whilst it may be possible to fully fund some projects using only the mainstream dedicated flood risk funding sources such as Flood and Coastal Erosion Risk Management Grant in Aid (FCRM GiA), the majority are likely to require supplementary funding from a range of sources to make up the total sum needed. Some projects may attract only limited funding of any kind and it is important that fundraising opportunities are maximised for more 'attractive' projects.

Appendix D of this document contains an overview of the funding sources considered most likely to be suitable for local flood risk management measures. In addition, Defra has published a guide to "Partnership funding and collaborative delivery of local flood risk management"[21], intended to promote successful collaboration and partnership funding. There are a wide range of potential alternative sources of funding, and the suitability of these for individual projects will depend on a number of factors:

- Total sum required (funding gap)
- Total fund available
- Effort / investment required (number of applications, match funding, etc)
- Qualifying benefits (outputs/outcomes) required
- Frequency of availability (e.g. annual)
- Longevity
- Level of competition

It is important to strike a balance between spreading the fundraising risk over a range of funders and fund types without burdening individual projects with numerous

funders all requiring updates and reports, i.e. proportionality of investment versus return.

5.2 Strategic funding approach

For measures proposed under North Somerset Council's LFRMS we anticipate that the majority of funding will come from dedicated flood risk management sources and other local authority based funding sources, supplemented by contributions from appropriate alternative sources wherever sufficient qualifying outputs/outcomes are identified.

It is likely that the most appropriate funding mix for most local flood risk projects will take in a cross section of the funding sources outlined in Appendix D. However, at a time of significant austerity across the whole of the public sector, expectations as to the level of available funding need to be carefully managed.

We will seek to secure dedicated flood risk funding first from FCRM GiA and Local Levy, supplemented by LLFA, local authority and/or development-related sources depending on local circumstances. We will use Defra's Partnership Funding Calculator to estimate in advance the amount of FCRM GiA a project may qualify for, and thus determine the likely size of the funding gap. Since one of the factors affecting FCRM GiA eligibility is the amount of other contributions obtained, we will engage as early as possible with the local community in the development of flood risk management proposals in order to establish an understanding of the likely availability of local contributions. Once the funding gap left by the main dedicated flood risk funding sources has been established, projects will be individually assessed according to how they meet a range of funders' requirements and this assessment will be used to determine the best approach for making up the shortfall. As individual schemes are progressed fundraising should be considered as an integral part of project development, assuming a need for some form of third party funding has been identified.

5.3 Individual project funding

There are many contributing factors that will lead to the delivery of successful fundraising action plans for flood risk management projects, but the three main areas are:

- partnership working, to identify opportunities and to share knowledge;
- early planning to ensure that deadlines are not missed and that projects are designed with the funder's requirements in mind; and,
- the development of a sound business case for support, including benefits to local businesses and communities that go beyond those specific to flood risk management.

As proposed measures are developed in detail we will work with our partners on the SFMB and Operational Group and with the project-specific delivery teams as

appropriate to explore the costs and benefits and determine how they can best be packaged up to attract the necessary financial support.

The matrix of funding sources and benefits in Figure 5-1 is designed to help with the initial identification of those funding sources most likely to be suitable based on the anticipated outcomes and outputs of a measure. The top section focuses on the primary benefit of flood risk management measures (i.e. to reduce the risk of flooding to various types of receptor), whilst the bottom section focuses on opportunities to create, promote or enhance 'other' benefits**.** To use the matrix select the receptor(s) that will benefit from a reduction in flood risk as a result of the measure under consideration and read along the row to identify the funding sources with the highest potential. Next, read down the funding source column to identify other outputs and outcomes which could increase the likelihood of accessing this funding source. For example, it is unlikely that European Union funding could be secured for a flood risk scheme in isolation. However if there was a flood risk scheme which was fully integrated with regeneration and community education, for example, these additional benefits could be brought to the fore to maximise the likelihood of securing European Union funding.

To secure funding from sources which are not primarily dedicated to flood risk management will require Risk Management Authorities to consider 'other' benefits early on in the development of a scheme to ensure they are fully integrated. It will also require Risk Management Authorities to appropriately demonstrate these 'other' benefits when submitting funding applications

The matrix in Figure 5-1is intended as an initial guide to help direct fundraising efforts. If project or area specific knowledge suggests a funding source may have greater or lesser potential than is suggested by this matrix then such evidence should take precedence.

5.4 Review

This funding strategy will be realigned against the LFRMS objectives and action plan during the development of the two-yearly implementation plan, and the suggested funding mix is not set in stone. The funding strategy is likely to need adjusting over time to take advantage of new opportunities; building on strong/successful areas and or to re-evaluate in light of changes to the availability of different funding sources. We must be flexible to enable us to respond to funding opportunities which may arise over the next 10 years.

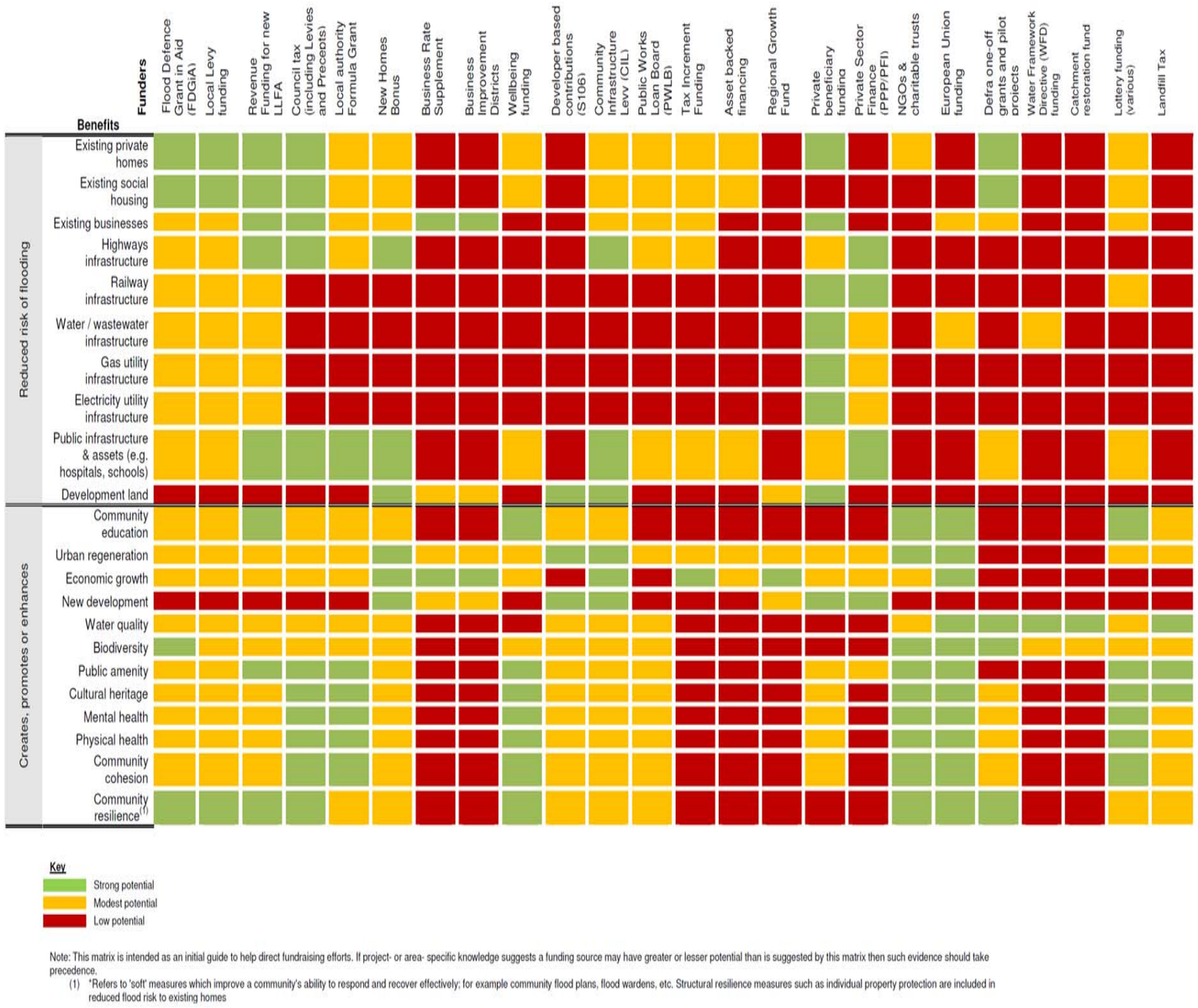


Figure 5-1: Funding sources and beneficiaries

6 Action Plan

The purpose of the action plan is to set the timescales and responsibility for the suite of measures identified that we propose to take across North Somerset and in specific communities to manage the risk of flooding. It should be recognised that whilst the action plan sets the framework for how we will manage local flood risk over the next 10 years there will inevitably be legislative, regulatory and financial changes over this period which could affect how we manage local flood risk. Therefore, we will need to maintain some flexibility during the delivery period of the LFRMS to allow for such changes. To this end we will develop a 'rolling' two-yearly implementation plan which is reviewed on an annual basis, which will:

- assess progress against the LFRMS objectives;
- identify whether measures have been delivered in accordance with the action plan;
- assess whether there have been any material changes which impact upon the LFRMS (e.g. funding opportunity or regulatory changes) and in particular the risk prioritisation, and;
- set the priorities and measures for the next two year period.

6.1 Action plan for over-arching measures

Table 6-1 illustrates the measures we will take across North Somerset over the next 10 years to manage local flood risk.

More detail on each of these measures is presented in Sections 6.1.1 to 6.1.16.

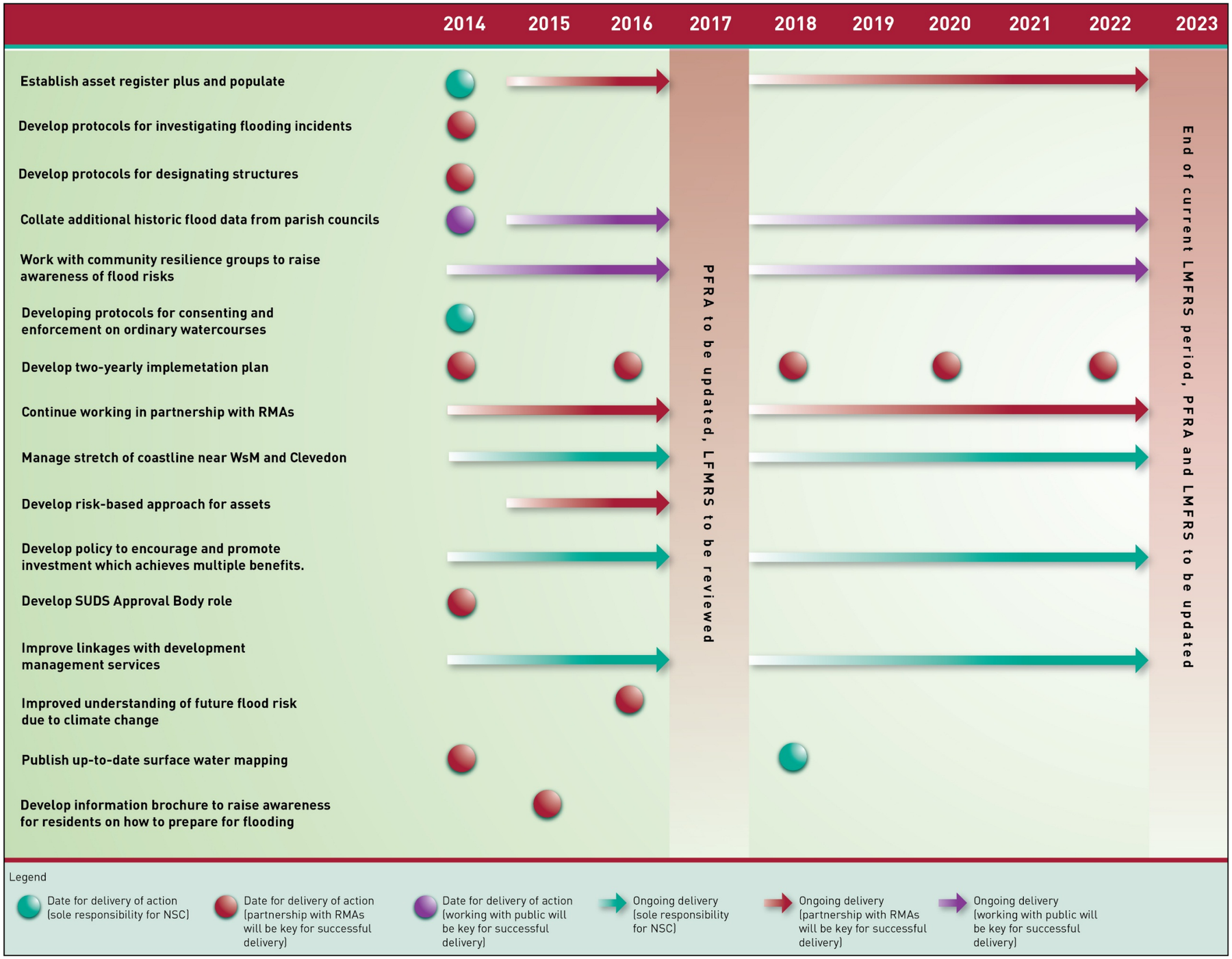


Figure 6-1: Summary of over-arching measures we will take across North Somerset

Table 6-1: Overview of how measures will be funded, assessed and who is responsible for delivery

Section No.	Measure	Who is responsible for delivery	How will the measures be paid for	When will the measures be implemented	How and when will we measure success
6.1.1	Establish Asset Register Plus	North Somerset Council, in partnership with Risk Management Authorities	Through NSC officer time, currently funded through Revenue funding from Defra	The asset register plus will be in place by December 2014. Populating the Asset Register Plus with additional data will be undertaken on an ongoing basis using a risk-based approach.	Development of 'Asset Register Plus' by December 2014, with evidence of additional data being incorporated year on year.
6.1.2	Develop protocol for investigating flooding incidents	North Somerset Council, in partnership with Risk Management Authorities	Through NSC officer time, currently funded through Revenue funding from Defra	The protocol will be produced in 2014, ready for publication by December 2014.	Development of the protocol by December 2014, and an ongoing assessment of whether the protocol is followed by Risk Management Authorities.
6.1.3	Develop protocol for designating structures	North Somerset Council, in partnership with the Environment Agency and Internal Drainage Boards	Through NSC officer time, currently funded through Revenue funding from Defra	The protocol will be produced in 2014, ready for publication by April 2014 when the SUDS Approval Body role is anticipated to commence.	Development of the protocol by April 2014, and an ongoing assessment of whether the protocol is followed by designating authorities
6.1.4	Collate historic flood data from parish councils	North Somerset Council, in partnership with parish councils	Through NSC officer time, currently funded through Revenue funding from Defra	Initial work with the parish councils to collate existing flood information will be undertaken during 2014, after which we will need to continue to work closely with parish councils on an ongoing basis	Additional data collated from parish councils by December 2014 and ongoing data sharing in the event of future flooding incidents.
6.1.5	Work with community resilience groups to raise awareness of flood risk	North Somerset Council, in partnership with local community resilience groups	Through NSC officer time, currently funded through Revenue funding from Defra	Community resilience groups have been, and continue to be established. The flood risk management team will provide ongoing advice to community resilience groups, focusing on those communities which are most vulnerable to flood risk	Increased awareness and community led planning of how to prepare for, and respond during, a flood. Success will be measured by the Emergency Management Unit within NSC who are leading on this work
6.1.6	Develop protocol for consenting and enforcement on ordinary watercourses	North Somerset Council	Through NSC officer time, currently funded through Revenue funding from Defra	The protocol will be developed and in place by April 2014	Protocol in place by April 2014..
6.1.7	Develop two-yearly implementation plan	North Somerset Council	Through NSC officer time, currently funded through Revenue funding from Defra	On a two-yearly basis, with the first implementation plan to be published in 2014.	Publication of an implementation plan on a two-yearly basis
6.1.8	Continue working with RMAs through SFMB and Operational Group	North Somerset Council, in partnership with Risk Management Authorities	Through NSC officer time, currently funded through Revenue funding from Defra	The measure will need to be implemented on an ongoing basis	Continuation of the SFMB and Operational Group. The frequency of meetings will be reviewed on a two-yearly basis in conjunction with the update of the

					implementation plan.
6.1.9	Manage stretch of coastline near Weston-super-Mare and Clevedon	North Somerset Council	Operation and maintenance of tide gates, walls and associated drains/interceptors as well as beach levels forming the sea defence are currently funded through Development and Environment revenue funding, although an EA grant has been sought for beach management.	The measure will need to be implemented on an ongoing basis	Ongoing maintenance and operation of the sea defences within NSC's responsibility
6.1.10	Develop risk-based approach for maintaining assets	North Somerset Council	The development of the risk-based approach will be funded through NSC officer time, currently funded through Revenue funding from Defra. Funding for ongoing maintenance has yet to be confirmed.	The risk-based approach will be developed during 2015 and 2016, once the Asset Register Plus is in place.	Development of a risk-based approach by end 2016.
6.1.11	Encourage and promote investment in flood risk management and activities which have multiple benefits'	North Somerset Council	Through NSC officer time, currently funded through Revenue funding from Defra	The measure will need to be implemented on an ongoing basis	Ongoing analysis to identify whether drainage and flood risk management infrastructure is being designed to achieve multiple benefits
6.1.12	Develop SUDS Approval Body role	North Somerset Council, in partnership with Risk Management Authorities and West of England Partnership	Initial work will be paid for through NSC officer time, currently funded through Revenue funding from Defra. Government has stated that the ongoing costs of the SUDS Approval Body role (once implemented) will be cost neutral	We will deliver the measures in readiness for the commencement date of the SUDS Approval Body role, which is anticipated to commence in April 2014	Procedures, processes, local guidance and resources in place in a timely manner for the commencement of the SUDS Approval Body role.
6.1.13	Improve linkages with development management services	North Somerset Council	Through NSC (flood manager) officer time, currently funded through Revenue funding from Defra and D&E revenue for DM staff	This is an ongoing measure, and we will continue to work in collaboration with development management services	Ongoing analysis to assess flood risk information being included in planning conditions
6.1.14	Improve understanding of future flood risk due to climate change	North Somerset Council in partnership with the Environment Agency	Through NSC officer time, currently funded through Revenue funding from Defra	The work will be undertaken in 2016 to inform an update of the LFRMS and PFRA in 2017	Improved understanding of how future increases in precipitation may affect surface water, groundwater and ordinary watercourse flood risk to communities
6.1.15	Publish up to date surface water mapping	North Somerset Council in partnership with the	Through NSC officer time, currently funded through	Surface water mapping to be published online by December 2014 at the latest	Publication of surface water mapping online by December 2014, with an update

		Environment Agency	Revenue funding from Defra		programmed in December 2018 should improved data become available (e.g. through additional surface water mapping studies).
6.1.16	Develop information brochure to raise awareness of flooding	North Somerset Council	Through NSC officer time, currently funded through Revenue funding from Defra	Information brochure to be published by December 2015.	Publication of a web-based and hard copy information brochure by December 2015.

6.1.1 Establish Asset Register Plus

We have currently developed an asset register which meets the statutory duty under Section 21 of the Flood and Water Management Act. However, the asset register in its present form is an interim step towards a more comprehensive interactive system under development at present ('Asset Register Plus'). It is our intention that the more comprehensive system will be available to partners, stakeholders and the public to view via our website in due course. Once in place, we will work with Risk Management Authorities to gather additional data on assets. Additional data will be gathered using a risk-based approach, focusing on the most vulnerable communities identified in the LFRMS. In addition, during routine maintenance activities operatives will be instructed to gather further asset information on structures so as to continually improve and expand the asset register.

6.1.2 Develop protocol for investigating flooding incidents

Section 19 of the Flood and Water Management Act places a statutory duty for us as a LLFA to take a lead role in ensuring that flooding incidents are investigated and reported by the relevant Risk Management Authority "to the extent it considers it necessary or appropriate". Under our leadership role we will develop a protocol in partnership with the relevant Risk Management Authorities which will clearly outline how we propose to approach investigating flood incidents. The purpose of the protocol will be to ensure clarity and consistency for NSC and Risk Management Authorities following flooding incidents. The protocol will consider:

- the circumstances and process for determining whether a Section 19 Investigation will be undertaken;
- how investigations should be undertaken, including engagement with Risk Management Authorities and affected communities;
- who will be responsible for undertaking investigations, depending on which organisation has relevant risk management functions;
- how information will be shared and communicated between Risk Management Authorities following a flooding incident, and;
- the programme for completing and publishing investigations.

6.1.3 Develop protocol for designating structures

Schedule 1 of the Flood and Water Management Act gives NSC, the Environment Agency and Internal Drainage Boards the power to designate structures or features which have an effect on flood risk. The effect of a designation is that the relevant structure or feature cannot be altered, removed or replaced without the consent of the 'designating authority'. To ensure a consistent approach is adopted across North Somerset we will develop a collaborative protocol with the Environment Agency and Internal Drainage Boards. The protocol will set out how designating authorities should identify structures or features to be designated, and the process to designate a structure or feature.

6.1.4 Collate historic flood data from parish councils

During the development of the Preliminary Flood Risk Assessment (PFRA) and following the 2012 flooding event across North Somerset, we collected a wealth of information on flooded locations in partnership with parish councils. We recognise that there may still be data gaps and it is vital to ensure that the information we hold on historic flooding is as comprehensive as possible. Therefore, we will continue to liaise with parish councils and Community Resilience groups to identify any additional flood incident data from 2012 and preceding flooding incidents. Furthermore, we will also work with parish councils to establish mechanisms to facilitate data sharing in the event of future flooding.

6.1.5 Work with community resilience groups to raise awareness of flood risks

The community resilience network in North Somerset aims to build strong resilient communities, prepared to deal with any emergency using local resources and trained volunteers. This includes making local communities more resilient to flooding incidents, through:

- awareness and information sharing – establish and promote links with local communities through which information about local flood risk can be shared;
- education and training – encourage individuals and local communities to sign up to flood warning systems where available, and;
- community resilience and Integrated Emergency Management (IEM) – support communities to become more resilient and self-sufficient to the risks of flooding

We will work with Community Resilience groups across North Somerset to build communities which can be more resilient to flooding. Recognising that resources are limited we will prioritise community resilience to flooding in those communities which are identified in this Strategy as being most vulnerable to flood risk.

6.1.6 Develop protocol for consenting and enforcement on ordinary watercourses

Under Schedule 2 of the Flood and Water Management Act 2010 we have a duty to consent works and a power to undertake enforcement on ordinary watercourses under changes to the Land Drainage Act 1991 (sections 23, 24 and 25). The duty to consent enables us to approve or reject applications to do works on ordinary watercourses depending on the impact of the proposed works on flood risk. We will develop a protocol for consenting and enforcement works on ordinary watercourses to ensure consistency and transparency.

6.1.7 Develop two-yearly implementation plan

The LFRMS seeks to set the vision and framework for managing local flooding in North Somerset over the next ten years. It sets the strategic priorities and measures we will take in partnership with others. However, it is recognised that we need to maintain some flexibility in the delivery of local flood risk management to respond to legislative, financial or environmental changes, for example. Therefore, we will develop a rolling two-yearly implementation plan which will be reviewed and updated on an annual basis. The implementation plan will assess progress made to date against the measures outlined in the

LFRMS, and the measures to be taken in the forthcoming two year period. It will also identify specific funding changes/opportunities. The implementation plan will be subject to internal scrutiny, and will be the primary mechanism for ensuring we are delivering the objectives and measures in the LFRMS.

6.1.8 Continue working with RMAs through the SFMB

We have formed a core working partnership with Risk Management Authorities which also includes the Executive Elected Member with responsibility for flood and coastal erosion risk. This partnership was established primarily for the development of the Weston-super-Mare Surface Water Management Plan, but has since been more formally designated as North Somerset's Strategic Flood Management Board (SFMB). The SFMB meets quarterly as a minimum to develop flood management strategies, share information and discuss progress with on-going flood risk management activities.

In addition, we have formed an Operational Group, which has a stronger focus on operational and 'on the ground' issues. The Operational Group focuses on: local priorities for flood risk; monitoring the operation of critical infrastructure and maintenance; raising relevant items for the SFMB to discuss, and; assisting the SFMB in the development and implementation of strategies. We will continue to work with Risk Management Authorities through the SFMB and Operational Group to ensure a coordinated approach is adopted across North Somerset.

6.1.9 Manage stretch of coastline near Weston-super-Mare and Clevedon

We act as the operating authority for managing a limited stretch of tidal flood defences. This includes tidal flood defence assets at Weston-super-Mare and Clevedon. We will operate and maintain the tidal flood defences where we are the operating authority, in partnership with the Environment Agency.

In addition, as a maritime authority we have responsibility to manage the risk of coastal erosion along the stretch of shoreline within our area. To ensure that this is done in a coordinated way we work closely with the Environment Agency, who have the national overview through their Coastal Monitoring programme. The Environment Agency also produces Shoreline Management Plans.

6.1.10 Develop risk-based approach for maintaining assets

We will use the Asset Register Plus, once implemented, to develop a risk-based approach for maintaining assets which have a critical effect on local flood risk. The risk-based approach will seek to identify the assets whose performance will most significantly affect flood risk (e.g. where blockages to a culvert would cause property flooding). We will need to prioritise our maintenance programme for assets due to the availability of funding. Furthermore, because many assets are on third party land we will need to work with landowners to ensure they maintain their assets appropriately. The output of this work will be a prioritised list of assets and a proposed maintenance schedule.

6.1.11 Encourage and promote investment in flood risk management activities which have multiple benefits

Historically, drainage and flood risk management infrastructure have been designed and implemented with limited focus on potential amenity, biodiversity or water quality benefits. Working with our highways, public open spaces, and leisure teams internally, as well as with Risk Management Authorities through the Operational Group, we will encourage and promote investment in drainage and flood risk management which integrates multiple benefits into design and implementation. For example, through implementation of green infrastructure in developed areas which capture surface water at source, thereby reducing flood risk, but which also provide significant opportunities to improve amenity, and to create habitat and biodiversity within developed areas.

6.1.12 Develop SUDS Approval Body role

Under Schedule 3 of the Flood and Water Management Act we will become a SUDS Approval Body, which means we will become responsible for approving, adopting and maintaining sustainable drainage systems (SUDS) for new and re-development. We have already developed a draft approvals procedure and process for the SUDS Approval Body role, but in preparation for the commencement of the role we will:

- finalise the approvals procedure and process document;
- develop local SUDS guidance in collaboration with our partners[22], which will complement the national SUDS standards, are more bespoke to North Somerset and will consider how green infrastructure is considered as part of SUDS infrastructure, and;
- identify and secure sufficient resources to deliver the SUDS Approval Body role.

6.1.13 Improve linkages with development management services

We recognise that good planning of new development will ensure that the development itself is not at risk of flooding and there is no increase in downstream flood risk. We are already working with the development management services in NSC to provide drainage and flood risk comments on planning applications. However, as part of the implementation of the LFRMS we are proposing to provide enhanced comments on planning applications, providing greater input in the most vulnerable communities. We will also seek earlier engagement with developers through the development management services to maximise the opportunities to influence the location and design of drainage in new development.

6.1.14 Improve understanding of future flood risk due to climate change

We recognise that future predicted climate change could lead to increased precipitation and sea level rise, which would result in increased flood risk to communities in North Somerset. Whilst there is understanding of how future sea level risk could affect tidal flood risk to communities which is outlined in the Severn Estuary Flood Risk Management Strategy, we have limited understanding of how future precipitation changes could affect flood risk from surface water, ordinary watercourses and groundwater. Therefore, working with the

Environment Agency, we will assess the future implications of precipitation changes on flood risk from surface water, ordinary watercourses and groundwater. This will be undertaken by 2016, and the evidence base will be used to inform an update of the LFRMS in 2017.

6.1.15 Publish up to date surface water mapping

We will publish the most up to date surface water mapping to allow local residents to identify whether they are at risk from surface water flooding. This will be published alongside appropriate guidance on how to interpret and use this information. It should be noted that the Environment Agency is currently consulting on whether it will publish their updated national surface water mapping in December 2013. Therefore, we will progress this action in collaboration with the Environment Agency.

6.1.16 Develop information brochure to raise awareness of flooding

We believe there is significant merit in producing a single information brochure for local residents in order to raise awareness about how to prepare for a flood, what to do in the event of a flood, and how to recover following a flood. We will produce an information brochure in collaboration with the community resilience team and will distribute it online and via parish councils. It should be noted that the Emergency Management Unit is developing an Emergencies Handbook and App. The information brochure will support and work alongside the Emergencies Handbook and App.

6.2 Action plan for measures in the most vulnerable communities

Sections 6.2.1 to 6.2.14 outline the action plans for the most vulnerable communities identified based on the methodology discussed in Section 3.4.1. The action plans consider the types of measures, and their timescales for delivery. The timescales for delivery are split into short-term (approximately 0-2 years), medium-term (approximately 2-5 years) and long-term (approximately 5-10 years). It should be noted that potential funding sources for the measures will be considered in the development of the rolling two-year implementation plan.

An environmental appraisal of the measures has been undertaken and is reported in the Strategic Environmental Assessment report. However, the environmental enhancement opportunities from the SEA are presented in the action plans. This will help to ensure that environmental opportunities are identified as early as possible so they can be integrated into flood risk management.

It is important to note that in many locations the action plans recommend further investigation or survey in the first instance. This is necessary to fully understand flooding mechanisms and impacts prior to the development of flood mitigation schemes. As the actions identified in the subsequent sections are completed, and further measures identified, the action plans will need to be updated. The action plans will be updated during the review of the LFRMS in 2017 and 2023.

The top five most vulnerable communities in North Somerset are: Wrington; Weston-super-Mare; Nailsea; Winscombe, and; Claverham. The action plans for these communities are considered first in the sections below, followed by the remaining communities most vulnerable to local flood risk.

6.2.1 Wrington

No.	ID	Type of measure	Description	Environmental enhancement opportunities	Programme
1	I-1a & I-2	Study and survey / modelling	The ordinary watercourse through Wrington is under capacity, and there are complex riparian ownership issues. NSC is currently undertaking a study to investigate the most feasible options to mitigate flooding from the watercourse, and is undertaking hydraulic modelling to support the development of the business case. Several options are being investigated to alleviate flooding from the watercourse including: • P-1 – storage upstream of Wrington, and; • P-4 - upsizing of the watercourse at critical points.	There are traditional orchard and deciduous woodland BAP priority habitats in the 'Alburys'/High Street area in the north of Wrington. There are also larger areas of both these BAP habitats to the north of the developed area. Wrington contains examples of 'ancient and/or species-rich hedgerows', which are listed in the North Somerset BAP as being good examples of 'boundary and linear features' priority habitat. Wrington is close to a Strategic Nature Area with woodland priority habitat and secondary habitats of calcareous grassland and lowland heath. NSC has recognised that Wrington currently has an insufficient supply of neighbourhood open space, woodland, conservation sites and formal parks or public gardens. Any opportunities to improve this provision or enhance the LNR or BAP priority habitat should be explored with Natural England and Avon Wildlife Trust. If it is decided that upstream storage options will be constructed, it may be possible to provide biodiversity or amenity enhancements, for example through landscaping or planting.	Short-term - completion of study Medium term – implementation of measures (subject to funding)
2	I-1b	Study	Surface water mapping predicts further significant flooding in the north of Wrington to properties on School Road and Broad Street due to surface runoff. There is limited anecdotal evidence of flooding to properties on these roads, although evidence from properties on Yeomans Orchard indicates surface runoff from Wrington Hill bypasses gullies during high intensity storms and ponds at the low spot. There is further predicted and anecdotal evidence of flooding on Roper's Lane. NSC will undertake a localised investigation which will involve the following tasks: • investigating the route of any watercourses or ditches to the north of Wrington; • confirming the capacity and condition of watercourses, ditches and culverts; • liaising with local residents to confirm the flooding mechanism predicted on School Road, Broad Street and Roper's Lane, and; • investigating the sufficiency of highway and sewer networks to drain surface runoff.		Short-term – completion of investigation and recommendations for future work
3	I-1c	Study			

6.2.2 Weston-super-Mare

No.	ID	Type of measure	Description	Environmental enhancement opportunities	Programme
1	I-1	Study	A Surface Water Management Plan is ongoing for the urbanised town centre of Weston-super-Mare as well as the 'Weston Development Area'. The SWMP is undertaking detailed hydraulic modelling of the town and will recommend specific capital, operational and policy measures to mitigate surface water flood risk in the town. The LFRMS has identified two specific areas in Weston-super-Mare at highest risk of surface water flooding: 1) Milton Hill and Worle, 2) Central and West area. Following the completion of the SWMP specific measures will be identified and programmed into the implementation plan	The Weston Woods Local Nature Reserve lies to the north of the urban area. Ellenborough Park West SSSI is close to the seafront in central Weston and Uphill Cliff SSSI/ LNR, Purn Hill and Bleadon Hill SSSIs all lie to the south of the urban area. The SWMP will be able to identify if there are likely to be any flood risk measures required in the vicinity of these schemes and, if so, whether any mitigation or enhancement is required. Weston is also within the project area of the North Somerset Wetland Programme so there may be opportunities to improve wetland habitats in the Weston area.	Short-term – Completion of SWMP and recommendations for future work
2	R-4	Raise awareness	Surface water mapping predicts several critical infrastructure at risk of flooding to depths >0.3m during a 1 in 30 year rainfall event. NSC will work with the infrastructure owners to raise their awareness of potential flood risk.		Short-term – raising awareness of flood risk

6.2.3 Nailsea

No.	ID	Type of measure	Description	Environmental enhancement opportunities	Programme
1	P-7	Improved maintenance of gullies	Anecdotal evidence in Nailsea indicates that blocked highway gullies were a contributory factor in the flooding which occurred during 2012. Therefore, further investigation is required to understand the current maintenance of highway gullies in Nailsea and whether an enhanced maintenance regime is required. The outputs from the investigation will be linked to the asset register plus to ensure that the maintenance regime is appropriately captured in our asset management system.	Consultation with North Somerset Council has shown there are several locations in the district that would benefit from improved pollution control. This includes Tickenham Causeway, as the ditch which conveys the majority of surface water from Nailsea to Tickenham, Nailsea and Kenn Moors SSSI (ST 444705) has high levels of phosphates and organic pollutants; any improvement to the quality of this surface water through LFRMS schemes is likely to lead to biodiversity benefits for the SSSI, particularly for invertebrate species. Other SSSIs in the vicinity of Nailsea include West End Meadows (ST 458691), Fields along Youngwood Lane (ST 467695), Batch Farm Meadow (ST 450692) and Nursebatch Farm Fields (ST 453691). Nailsea is close to the Strategic Nature Area of Nailsea Moor, a priority habitat of Coastal and Floodplain Grazing Marsh. NSC has recognised that the developed area of Nailsea currently has an insufficient supply of woodland and conservation sites. Any opportunities to improve this provision or enhance designated sites or other habitats should be explored.	Short-term – improved maintenance of highway network
2	I-1	Study	Flood risk is an issue across different parts of Nailsea. As a result a Surface Water Management Plan would the ideal approach to enable NSC and its flood risk management partners to better understand the flooding mechanisms, and to identify feasible and cost-effective mitigation measures. The SWMP will include: • establishing a steering group which includes NSC, Wessex Water, North Somerset Levels Internal Drainage Board and the Environment Agency; • gathering further data from local residents on historic flooding; • gathering additional information on existing drainage infrastructure in Nailsea (including culverted watercourses [see I-2] and the public sewer network); • undertaking integrated hydraulic modelling of the developed area to confirm flooding mechanisms and properties at risk; • identifying and appraising mitigation measures, and; • preparing the evidence to support a business case for FDGiA funding. It should be noted that local residents have reported that the drainage network was constructed in 1959 and is no longer sufficient given recent development. In addition, residents have noted that part of the flooding on Mizzymead Rise, Clarken Close and Coombe Road was due to surface runoff. The SWMP will consider these issues.		Short-term – completion of SWMP and recommendations for future work
3	I-2	Survey	There appear to be historic watercourses through Nailsea, which have been culverted as the town developed over time. In order to establish their effect on flood risk a data gathering exercise is required to establish what data currently exists and to scope the need for further survey. It is likely that a walkover and possibly a CCTV survey will be needed to establish the route, connectivity and location of these historic watercourses. Liaison with the Town Council and Wessex Water will be key in gathering data		Short-term – completion of investigation into historic watercourses

4	R-4	Raise awareness	Surface water mapping predicts an electricity sub-station at risk of flooding to depths >0.3m during a 1 in 30 year rainfall event. NSC will work with the infrastructure owners to raise their awareness of potential flood risk.		Short-term – raising awareness of flood risk

6.2.4 Winscombe

No.	ID	Type of measure	Description	Environmental enhancement opportunities	Programme
1	I-1a	Study	There is significant predicted flooding in Winscombe. The majority of predicted flooding is due to water flowing on the surface where there are culverted sections of watercourses. This is because the mapping does not represent the culverted watercourse. NSC will undertake a culvert capacity assessment of the culverted watercourses to establish their current capacity against expected peak flows from the catchment being drained. The culverts to be assessed are: • to the rear of properties on Wimblestone Road; • Sandford Road near Sloughpit Farm; • south of Woodborough Primary School; • culverts under Oakridge Lane (near Oakridge Close) and The Lynch, and; • south of the junction of Church Road / Barton Road Should the culverts be under-sized capital works will be required to increase their capacity	Cheddar Valley Railway Walk is a linear Local Nature Reserve lying to the west of Winscombe. The Mendip Hills AONB and some deciduous woodland BAP priority habitat also lie to the west, east and south of the developed area The LNR is in close proximity to 'The Lynch and The Green', areas where there are known highway drainage issues. NSC has recognised that Winscombe currently has an insufficient supply of neighbourhood open space. Opportunities to enhance the LNR, BAP priority habitat or neighbourhood open space should be explored with Natural England and Avon Wildlife Trust.	Short-term – assessment of capacity of culverts Medium-term – upsizing of culverts (if required and subject to funding)
2	I-2	Survey	CCTV of the culverts listed above will also be undertaken to confirm the route and condition of the culverts. Should the culverts require maintenance this will be programmed.		Short-term – completion of CCTV survey
3	I-1b	Study	According to the Environment Agency's flood defence database (NFCDD) there is a natural flood defence on the left and right bank of the watercourse which flows near the junction of Church Road / Barton Road. Further investigation will be undertaken to establish the standard of protection of these flood defences, and whether the presence of the flood defences is sufficient to protect properties in this location from flooding		Short to medium-term – investigation into flood defence near Church Road / Barton Road
4	I-1c	Study	There is significant predicted flooding to the east of the railway embankment, but this could be caused because existing mapping does not represent the location of culverts under the railway. NSC will investigate the presence and location of existing culverts under the railway to ensure surface water will drain rather than backing up against the railway embankment causing flooding to a significant number of properties		Short to medium-term – investigation into predicted flooding near railway embankment
5	P-3 / P-7	Improve drainage network or enhance	Based on information from the highways team there are three locations in Winscombe which are on the highways prioritisation list for future schemes. The flood risk management and highways teams will work together to identify the cause of flooding in these locations and the mitigation measures required.		Short-term – investigation (and enhancements if required) into highway

		maintenance	Anecdotal evidence indicates that blocked gullies at the top of Well Close and near the primary school contribute to flooding to properties on Moorham Close. Any requirements to enhance the maintenance regime of highway drainage will be recorded in asset register plus to ensure that the maintenance regime is appropriately captured in our asset management system.		drainage network

6.2.5 Claverham

No.	ID	Type of measure	Description	Environmental enhancement opportunities	Programme
1	I-1	Study	A Surface Water Management Plan would be the ideal approach to enable NSC and its flood risk management partners to better understand the flooding mechanisms, and to identify feasible and cost-effective mitigation measures. The SWMP will include: • establishing a steering group which includes NSC, Wessex Water, North Somerset Levels Internal Drainage Board and the Environment Agency; • gathering further data from local residents on historic flooding; • gathering additional information on existing drainage infrastructure in Claverham (including culverted watercourses and the public sewer network); • understand the condition and capacity of the existing ditch and watercourse network in Claverham; • undertaking surface water modelling to confirm flooding mechanisms and properties at risk (NB: hydraulic modelling should include the upstream area of Cleeve to ensure that the hydrological catchment is included); • identifying and appraising mitigation measures, and; • preparing the evidence to support a business case for FDGiA funding.	If it is decided that attenuation basins will be constructed, it may be possible to provide biodiversity or amenity enhancements, for example through landscaping or planting. Similarly, the construction of new ditches to the south of Claverham Road and/or new culverts under Claverham Road could also offer small-scale biodiversity enhancement opportunities.	Short to medium-term – completion of SWMP Medium-term – funding application should business case be applicable
2	R-1	Property level protection	To the north of Claverham there are several properties that have suffered historic flooding in 2012 or are predicted to be at risk of flooding. NSC will work with these property owners to investigate whether property-level protection measures can be implemented. Wessex Water has fitted non-return valves on some flooded properties due to backing up of water into properties and some work has been undertaken to improve the capacity of the culvert under the road.		Medium-term – implementation of property-level protection (subject to funding)
3	R-4	Raise awareness	Surface water mapping predicts an electricity sub-station and factory at risk of flooding to depths >0.3m during a 1 in 30 year rainfall event. NSC will work with the infrastructure owners to raise their awareness of potential flood risk.		Short-term – raising awareness of flood risk

6.2.6 Congresbury

No.	ID	Type of measure	Description	Environmental enhancement opportunities	Programme
1	P-3 / P-7 / P-8	Enhance existing maintenance and improve network	Anecdotal evidence indicates that flooding on Kent Road is caused by backing up of the urban drainage and rhyne/watercourse network. This is likely to be due to elevated levels in the rhyne network which meant outfalls into the river backed up causing flooding. NSC flood risk management and highways teams will assess the current performance and maintenance of the drainage network and will enhance the network where needed. Partnership working with Wessex Water will be important. Any requirements to enhance the maintenance regime of highway drainage will be recorded in asset register plus to ensure that the maintenance regime is appropriately captured in our asset management system.	There is an area of coastal and floodplain grazing marsh BAP priority habitat to the east and west of Congresbury. This settlement is also within the project area of the North Somerset Wetland Programme and in close vicinity to two Strategic Nature Areas of Coastal and Floodplain Grazing Marsh. There are three SSSIs in the vicinity of Congresbury; rhynes south of Dolemoor Lane (ST 419635) and Congresbury Yeo, adjacent land and rhynes (ST 4286407). King's Wood and Urchin Wood SSSI, part of the North Somerset and Mendip Bats SAC also lies to the east and north of Congresbury. Opportunities to enhance the extent or quality of these habitats should be explored with Natural England and Avon Wildlife Trust. It is important to protect or enhance this ancient broad-leaved woodland.	Medium-term – investigation of performance of sewer network Medium-term – implementation of improvements (subject to funding)
2	P-8	Enhance maintenance of watercourses	Flooding at St Andrews Primary School is likely to be caused by a lack of maintenance of the rhyne running adjacent to the school and backing up of the foul sewer network. NSC will work with the IDB and Wessex Water to ensure the rhyne network is adequately maintained to drain flood water		Medium-term – implementation of mitigation measures
3	I-1a	Investigation	NSC will investigate the cause of flooding to properties on the High Street and Station Road before recommending mitigation measures		Medium-term – implementation of mitigation measures
4	I-1b	Investigation	NSC will investigate the cause of flooding to properties near Verlands before recommending mitigation measures		Medium-term – implementation of mitigation measures
5	R-4	Raise awareness	Anecdotal evidence indicates that part of the flooding to properties was due to bow waves caused by cars driving through flood water. NSC will undertake an education programme in the area through the community resilience group to encourage road users to take additional precautions when driving through flood water to avoid causing flooding to properties. In addition, NSC will continue to raise awareness through the community resilience teams about actions local residents should take before, during and after a flood to mitigate the impacts of flooding		Short-term – raising awareness of flood risk

6.2.7 Long Ashton

No.	ID	Type of measure	Description	Environmental enhancement opportunities	Programme
1	I-1	Study	Bristol City Council will be producing a Flood Risk Management Plan for the Bristol 'Flood Risk Area' under the Flood Risk Regulations, which includes parts of Long Ashton. NSC will form part of the steering group to influence the development of a plan to manage flood risk in Long Ashton. This will need to fully assess the risk of flooding from the Long Ashton Brook, as the Brook is predicted to present a significant flood risk to properties, even though there has been little anecdotal evidence of flooding. Anecdotal evidence from 2012 indicates flooding on Yanley Lane is due to localised blockage of the drain into the Long Ashton Brook which causes backing up and flooding. This will need to be assessed as part of the study of the Long Ashton Brook	Long Ashton is within a Strategic Nature Area with primary woodland habitat and secondary habitats of calcareous and neutral grassland.	Short-term – completion of Flood Risk Management Plan in accordance with legislative deadline (December 2015)
2	P-7	Enhance maintenance of drainage network	Historic flooding in Long Ashton appears to be due to inadequate maintenance of highway drainage. NSC will investigate the performance of the highway drainage network in Rayens Cross Road and Providence Lane and enhance maintenance/undertake improvements where necessary. Any requirements to enhance the maintenance regime of highway drainage will be recorded in asset register plus to ensure that the maintenance regime is appropriately captured in our asset management system.		Medium-term – investigation into flooding issues and recommendations for future work
3	R-3	Planning policy	Long Ashton Parish Council is currently producing a Neighbourhood Plan. NSC will work with the parish to ensure flood risk issues are considered and incorporated into the plan		Short to medium-term – depending on progress of neighbourhood plan
4	R-4	Raise awareness	Surface water mapping predicts flood risk to Northleaze Primary School. NSC will work with the school to raise awareness of potential flood risk, identify feasible mitigation measures and ensure a flood emergency plan is in place		Short -term – raising awareness of flood risk

6.2.8 Backwell

No.	ID	Type of measure	Description	Environmental enhancement opportunities	Programme
1	I-1a	Investigation	One of the dominant predicted flow pathways is surface water flowing on Farleigh Road and into Backwell. The source is likely to be pluvial runoff south of Farleigh Road but NSC will investigate the source of runoff and identify mitigation measures.	In the south of Backwell (Hillside Road) and north (Station Road) of the developed area there are traditional orchard BAP priority habitats. To the south-east of the developed area there is some deciduous woodland BAP priority habitat. Backwell is also close to a Strategic Nature Area of priority woodland habitat with secondary habitats of calcareous grassland and lowland heath.	Medium-term – completion of investigation and recommendation for future work
2	I-1b	Investigation	The majority of historic and predicted flooding in Backwell is through the centre of the town, including the A370. Further investigation is required to understand the cause of flooding in order to identify mitigation measures		Medium-term – completion of investigation and recommendation for future work
3	R-3	Planning policy	Backwell Parish Council is currently producing a Neighbourhood Plan. NSC will work with the parish to ensure flood risk issues are considered and incorporated into the plan	The Bucklands Pool/ Backwell Lake Local Nature Reserve is situated between the developed areas of Nailsea and Backwell. Backwell Lake is also an example of North Somerset BAP 'open water' priority habitat. Opportunities to enhance these sites, particularly the surface water conveyance to Backwell Lake, should be explored with Natural England and Avon Wildlife Trust.	Short-term – depending on progress of neighbourhood plan
4	R-4	Raise awareness	Surface water mapping predicts a school and hospice are at risk of flooding to depths >0.3m during a 1 in 30 year rainfall event. NSC will work with the infrastructure owners to raise their awareness of potential flood risk.		Short-term – raising awareness of flood risk
5	P-3	Increase capacity of drainage network	Flooding of the A370 was observed during 2012 and the network is on the highways prioritised list for future schemes. The flood risk management and highways teams will work together to identify the cause of flooding and the mitigation measures required. Any requirements to enhance the maintenance regime of highway drainage will be recorded in asset register plus to ensure that the maintenance regime is appropriately captured in our asset management system.		Short to medium-term – depending on highways prioritisation
6	I-1c	Investigation	There is significant flooding predicted to properties in the north of Backwell due to surface water runoff backing up against the railway embankment. Whilst there is no anecdotal evidence of this area flooding it needs to be investigated to identify whether this risk could materialise because of the depth of flooding and number of properties potentially at risk		Medium-term – completion of investigation

6.2.9 Churchill

No.	ID	Type of measure	Description	Environmental enhancement opportunities	Programme
1	I-2 / P-3	Survey and increase capacity of watercourses	There is uncertainty about the route of the watercourse in places, and a walkover / watercourse survey will be undertaken of the entire watercourse, including culverts. Anecdotal evidence indicates there are broken culverts within the area. Should these be located during survey NSC will undertake to repair these	No specific opportunities identified.	Medium-term – completion of investigation and remedial works to watercourse
2	P-7 / P-8	Enhance maintenance of drainage and watercourses	Anecdotal evidence indicates that some parts of the drainage and watercourse network require enhanced maintenance. A site walkover with officers from NSC and local residents will be undertaken to discuss future maintenance requirements. Evidence from local residents from 2012 indicates that there is a collapsed culvert underneath the road (Doleberrow), and that there were blocked drains and gullies which contributed to flooding on Doleberrow and further downstream at Jews Lane / New Road. Any requirements to enhance the maintenance regime of highway drainage or watercourses will be recorded in asset register plus to ensure that the maintenance regime is appropriately captured in our asset management system.		Short to medium-term – depending on highways prioritisation
3	I-1	Investigation	Following on from survey and review of the existing maintenance NSC will undertake an investigation to identify whether there is a capacity issue associated with the watercourse and/or culverts within the area. This may involve simplified hydrological / hydraulic assessment or a detailed 1D-2D hydraulic model if necessary to support a business case for FDGiA funding.		Medium to long-term – investigation completed following remedial works to the watercourse

6.2.10 Langford

No.	ID	Type of measure	Description	Environmental enhancement opportunities	Programme
1	I-1a	Study	There is evidence of overtopping of the Langford Brook, so a study will be undertaken to investigate the hydraulic capacity of the watercourse and the existing natural flood defences on the right and left bank. Evidence from the 2012 flooding suggests there is a gap in the flood defence wall due to a footbridge and that flood water escaped at this gap causing property flooding. Properties flooded on Langford Road are also at risk of flooding due to overtopping of the Brook.	No specific opportunities identified.	Medium-term – completion of investigation and recommendation of mitigation measures
2	I-1b	Investigation	There is historic and predicted evidence of surface water flowing on Langford Road east of Langford Inn. An investigation is required to assess whether the existing highway drainage network could be improved to drain water off the highway or whether runoff could be managed at source		Short to medium-term – depending on highways prioritisation
3	P-7	Enhance maintenance of drainage network	Reports of flooding from 2012 indicate that the highway gullies seem to be blocked or inefficient. Therefore, NSC will investigate the existing condition of the highway drainage network and evaluate any improvements to the maintenance regime required. Any requirements to enhance the maintenance regime of highway drainage will be recorded in asset register plus to ensure that the maintenance regime is appropriately captured in our asset management system.		Short to medium-term – depending on highways prioritisation programme

6.2.11 Pill

No.	ID	Type of measure	Description	Environmental enhancement opportunities	Programme
1	I-1a	Investigation	The Environment Agency constructed a pumping station in Pill to enable surface water to be pumped into the River Avon during high tide. Given the flooding which occurred in Pill in 2012 the operation of this pump will be assessed by the Environment Agency and NSC	Priory Farm and Pill Paddock Local Nature Reserves are both close to Pill. NSC has recognised that Pill currently has an insufficient supply of woodland, formal park and public garden and conservation sites. Any opportunities to improve this provision should be explored. Pill lies within a strategic area of coastal habitat shown on the Strategic Nature Area map of the south west. Opportunities to enhance the biodiversity, wildlife corridors, amenity or access to the Local Nature Reserves or other habitats should be explored.	Long-term – completion of investigation
2	P-7	Enhance maintenance of drainage network	Evidence from local residents indicates that flooding on North Grove was caused by blocked highway gullies which resulted in water flowing down the cul-de-sac and into properties. Therefore, NSC will investigate the existing condition of the highway drainage network and evaluate any improvements to the maintenance regime required. Any requirements to enhance the maintenance regime of highway drainage will be recorded in asset register plus to ensure that the maintenance regime is appropriately captured in our asset management system.		Short to medium-term – depending on highways prioritisation programme
3	I-2	Survey	There is an ordinary watercourse which runs through Pill. The watercourse is open until just north of Brookside where it is mostly culverted until its confluence with the Markham Brook near the River Avon. A CCTV survey of the culverted watercourse should be undertaken to establish the condition and capacity of the watercourse.		Long-term – completion of survey and recommendations for future work if required

6.2.12 Hutton

No.	ID	Type of measure	Description	Environmental enhancement opportunities	Programme
1	P-3	Increase capacity of urban drainage network	Flooding to the north of Hutton (Moorcroft Road) appears to be the result of localised capacity issues in the highway drainage and/or sewer network, but there is also evidence of high groundwater levels causing flooding in this area. Any requirements to enhance the maintenance regime of highway drainage will be recorded in asset register plus to ensure that the maintenance regime is appropriately captured in our asset management system.	NSC has recognised that Hutton currently has an insufficient supply of neighbourhood open space, formal park and public garden, woodland and conservation sites. Any opportunities to improve this provision should be explored. Hutton is also close to a Strategic Nature Area of woodland priority habitat, which lies to the south.	Medium to long-term – investigation depending on alignment with investigations by Wessex Water
2	I-2	Survey	There is a culverted watercourse which runs through Hutton although the route is unclear. Flooding on Main Road is likely to be caused by overtopping of this watercourse, possibly at the culvert entrance near Main Road. A CCTV survey should be undertaken to establish the route, capacity and condition of the watercourse. If it is under capacity further mitigation measures may be required such as culvert upsizing or upstream storage. The Main Road is Hutton is on the highways prioritisation list for future schemes. The flood risk management and highways teams will work together to identify the cause of flooding and the mitigation measures required		Long-term – completion of investigation into watercourse

6.2.13 Portbury

No.	ID	Type of measure	Description	Environmental enhancement opportunities	Programme
1	I-2	Survey	NSC will undertake a walkover / watercourse survey of the watercourse and ponds which run along the west of Portbury Lane to establish their capacity and condition	Portbury Wharf, Prior's Wood and Priory Farm Local Nature Reserves are all close to Portbury. There are also various SSSIs locally, listed in the Environmental Report. Portbury is within a Strategic Nature Area, with primary woodland habitat and secondary habitats of calcareous and neutral grassland. Opportunities to enhance the biodiversity, wildlife corridors, amenity or access to the Local Nature Reserves or SSSIs should be explored.	Medium-term – completion of survey and recommendations for future work
2	S-3	Intercept and divert pluvial runoff	Flooding in Portbury is caused by pluvial runoff from the south flowing on Failand Lane and Mill Lane, before arriving in the village and causing property flooding. Options to intercept and divert pluvial runoff will be investigated		Long-term – implementation of mitigation (subject to funding)

6.2.14 Clevedon East

No.	ID	Type of measure	Description	Environmental enhancement opportunities	Programme
1	I-1a	Study	There is anecdotal evidence and predicted flooding in Valley Road, Carey's Close and Tickenham Road, which lie in a natural valley between Fir Wood and Court Wood. Therefore this area is natural susceptible to surface water flooding. Further work will be undertaken to establish the drainage within this area and the cause of flooding, which will result in a recommendation for mitigation measures. Tickenham Road is on the highways prioritisation list for future schemes. The flood risk management and highways teams will work together to identify the cause of flooding and the mitigation measures required	There are potential landscape or biodiversity enhancement opportunities on the southern boundaries of Fir Wood and Court Wood. If there are any surface water pathways that reach Tickenham, Nailsea and Kenn Moors SSSI originating from the Clevedon east developed area, there may also be opportunities to filter out surface water contaminants through the use of SUDS.	Medium-term – investigation into highways flooding depending on highways prioritisation programme Long-term – wider investigation of flooding in natural valley
2	I-1b	Investigation	There was recorded flooding in Kingston Avenue in 2012, but the cause of this flooding is uncertain. Working with local communities NSC will investigate the cause of flooding and recommend suitable mitigation measures. There is some anecdotal evidence of flooding due to elevated groundwater levels		Long-term – completion of investigation and recommendations for future work

6.3 Monitoring and Review

Ensuring public accountability, engaging with local people and taking informed and transparent decisions are among the key principles upon which NSC's code of corporate governance is based. We will follow this code when exercising our role as a LLFA, providing the LFRMS, and seeking the best use of resources and value for money.

The Act ensures that we consult with the public and its partner organisations on the content of the LFRMS. The process for continued accountability is already in place with the Act providing for close working co-operation between the Risk Management Authorities and a continuing exchange of information. This legislative framework of governance includes arrangements for Overview and Scrutiny Committees (OSC) to review and scrutinise the exercise by Risk Management Authorities of their flood risk management functions. The authorities must comply with any request by OSC for information or a response to a report.

6.3.1 Monitoring

We will monitor the progress of the LFRMS through the development of a 'rolling' two year implementation plan which will be presented to the Strategic Flood Management Board and scrutiny committee, and will be reviewed and updated annually. The implementation plan will also be published on our website. The implementation plan will ensure that the Strategy remains relevant by:

- assessing progress against the LFRMS objectives;
- identifying whether measures have been delivered that mitigate risk;
- assessing whether there have been any material changes which impact upon the Strategy and in particular the risk prioritisation, and;
- setting the priorities and measures for the next two year period.

6.3.2 Review and Update

The LFRMS (including the action plans) will remain live until 2023 after which it will be reviewed and updated as necessary. In addition an update of the LFRMS is planned for 2017 at the same time as the PFRA is being updated. A timeline illustrating the programme for reviewing and updating the LFRMS, SEA, implementation plan and PFRA is illustrated in Table 6-2. In the interim period the LFRMS will remain live and will only be updated if:

- the implementation identifies this as necessary (for example if the LFRMS is not meeting its objectives);
- significant flooding occurs that challenges the conclusion of the risk assessment;
- significant changes are made to any of the datasets upon which the risk assessment is based;

- there are significant policy changes that amend the roles and responsibilities of those responsible for flood risk management, and;
- there is a change in funding available which has a significant effect on the actions proposed in the LFRMS.

Table 6-2: Timeline for review and update of LFRMS and associated documents

Activity	Year									
	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023
LFRMS	●			◆						●
SEA	●									●
Implementation Plan	●	◆	~	◆	~	◆	~	◆	~	●
PFRA				●						●

● = Publish / Re-write of document/s, ◆ = Update of document/s to reflect progress, ~ = Report on progress

Appendix A Relevant legislation, regulations, plans and policies

(Available as separate document)

Appendix B Maps

(Available as separate maps)

Appendix C Working together to deliver local flood risk management

(Available as separate document)

Appendix D Potential funding sources

(Available as separate document)

Appendix E Summary of action plans

(Available as separate document)

Appendix F Glossary

CFMP – Catchment Flood Management Plan - A CFMP is a high-level strategic plan through which the Environment Agency seeks to work with other key-decision makers within a river catchment to identify and agree long-term policies for sustainable flood risk management.

Civil Contingencies Act (2004) - Legislation that aims to deliver a single framework for civil protection in the UK and sets out the actions that need to be taken in the event of a flood

Climate Change – A long-term change in the statistical distribution of weather patterns over periods of time that range from decades to millions of years. It may be a change in the average weather conditions or a change in the distribution of weather events with respect to an average, for example, greater or fewer extreme weather events. Climate change may be limited to a specific region, or may occur across the whole Earth.

Climate Change Act (2008) – An Act that requires a UK-wide climate change risk assessment every five years, accompanied by a national adaptation programme that is also reviewed every five years. It also requires public bodies and statutory organisations such as water companies to report on how they are adapting to climate change.

Coastal Erosion - The wearing away of land or the removal of beach or dune sediments by wave action, tidal currents, wave currents, or drainage. Waves, generated by storms, wind, or fast moving motor craft, cause coastal erosion, which may take the form of long-term losses of sediment and rocks, or merely the temporary redistribution of coastal sediments; erosion in one location may result in accretion nearby.

Commencement Order – An instruction that brings a defined aspect of legislation into force

Community Resilience – The ability of a community to keep functioning during an emergency, being collectively prepared to respond and recover, and being able to provide assistance to vulnerable residents

Conservation of Habitats and Species Regulations (2010) - An Act which transposed the Habitats Directive into UK law. The regulations aim to help maintain and enhance biodiversity throughout the EU, by conserving natural habitats, flora and fauna. The main way it does this is by establishing a coherent network of protected areas and strict protection measures for particularly rare and threatened species.

Critical Infrastructure - a term used to describe the assets that are essential for the functioning of a society and economy. Most commonly associated with the term are facilities for: electricity generation, transmission and distribution; gas production,

transport and distribution; oil and oil products production, transport and distribution; telecommunication; water supply (drinking water, waste water/sewage, stemming of surface water (e.g. dikes and sluices)); agriculture, food production and distribution; heating (e.g. natural gas, fuel oil, district heating); public health (hospitals, ambulances); transportation systems (fuel supply, railway network, airports, harbours, inland shipping); financial services (banking, clearing); and security services (police, military).

Culvert - A closed conduit used for the conveyance of surface drainage water under a roadway, railroad, canal, or other impediment

Defence (Flood Defence) – A structure that alters the natural flow of water or flood water for the purposes of flood defence, thereby reducing the risk of flooding. A defence may be formal' (a structure built and maintained specifically for flood defence purposes) or 'informal'/'defacto' (a structure that provides a flood defence function but has not been built and/or maintained for this purpose).

Defra - Department of Environment, Food and Rural Affairs

EC Floods Directive – A European Directive that has been transposed to UK law through the Flood Risk Regulations (2009).

Environment Agency – An Executive Non-departmental Public Body responsible to the Secretary of State for environment, Food and Rural Affairs and an Assembly Sponsored Public Body responsible to the National Assembly for Wales. The Environment Agency's principal aims are to protect and improve the environment, and to promote sustainable development. They play a central role in delivering the environmental priorities of central government and the Welsh Assembly Government through our functions and roles.

Flood - A flood is an overflow of an expanse of water that submerges land. Both the Flood and Water Management Act (2010) and the Flood Risk Regulations (2009) state that it doesn't matter whether a flood is caused by: heavy rainfall; a river overflowing its banks of being breached; a dam overflowing or being breached; tidal waters; groundwater; or anything else including a combination of factors. However, both state that a 'flood' does not include: a flood caused from any part of a sewerage system, unless wholly or partly caused by an increase in the volume of rainwater (including snow and other precipitation) entering or otherwise affecting the system; or a flood caused by a burst water main.

Flood and Water Management Act (2010) - The Act brings together the recommendations of the Pitt report and previous policies, to improve the management of water resources and create a more comprehensive and risk based regime for managing the risk of flooding from all sources. The Act states that its purpose is to "make provision about water, including provision about the management of risks in connection with flooding and coastal erosion."

Flood Map for Surface Water – National surface water mapping produced by the Environment Agency to facilitate analysis of areas naturally vulnerable to surface water flooding

Flood Hazard Map – A map that defines flood risk areas and shows: the likely extent (including water level or depth) of possible floods; the likely direction and speed of flow of possible floods; and whether the probability of each possible flood occurring is low, medium or high (in the opinion of the person preparing the map).

Flood Resistance – Actions taken to prevent to ingress of flood water to a property. Flood Resistance measures may include flood barriers placed over doorways.

Flood Resilience – Actions taken which allow the ingress of flood water through a property, but enable swift recovery after the flood event. Flood resilience measures may include (among others) flood-resistant construction materials, raised electricity sockets and water-resistant flooring.

Flood Risk – Flood risk is a combination of two components: the chance (or probability) of a particular flood event and the impact (or consequence) that the event would cause if it occurred

Flood Risk Area – a term defined for the Flood Risk Regulations, and represents an area of significant flood risk. It is calculated by identifying a cluster where at least 30,000 people are at risk from surface water flooding. There are 10 'Flood Risk Areas' in England.

Flood Risk Map – A map showing: the number of people living in the area who are likely to be affected in the event of flooding; the type of economic activity likely to be affected in the event of flooding; any industrial activities in the area that may increase the risk of pollution in the event of flooding; any relevant protected areas that may be affected in the event of flooding; any areas of water subject to specified measures or protection for the purpose of maintaining the water quality that may be affected in the event of flooding; and any other effect on human health, economic activity or the environment (including cultural heritage).

Flood Risk Management Plan – A plan for the management of a significant flood risk. The plan must include details of: objectives set by the person preparing the plan for the purpose of managing the flood risk; and the proposed measures for achieving those objectives (including measures required by any provision of an Act or subordinate legislation).

Fluvial - The processes associated with rivers and streams and the deposits and landforms created by them.

Flood Risk Regulations (2009) - Transposes the EC Floods Directive (Directive 2007/60/EC on the assessment and management of flood risks) into domestic law and implements its provisions. The regulations outline the roles and responsibilities of the various authorities consistent with the Flood and Water Management Act 2010 and provide for the delivery of the outputs required by the directive. The Directive

requires Member States to develop and update a series of tools for managing all sources of flood risk.

Flood Zones - Nationally consistent delineation of 'high' and 'medium' flood risk, published on a quarterly basis by the Environment Agency.

Functional Floodplain Zone 3b - Defined as areas at risk of flooding in the 5% AEP (1 in 20 year) design event. In any one year the chance of a 5% AEP (1 in 20 year) event occurring is 5%.

Groundwater - Water located beneath the ground surface, either in soil pore spaces or fractures in rock.

IDB – Internal Drainage Board

LLFA – Lead Local Flood Authority

Local Flood Risk – defined in the Flood and Water Management Act as flooding from surface runoff, ordinary watercourses and groundwater

Low Probability Zone 1 – The area outside Zone 2. Defined as an area with less that 0.1% AEP (1 in 1000 year) chance of flooding. In any one year the chance of a 1% AEP (1 in 100 year) event occurring is less than 0.1%.

Main River – All watercourses shown on the statutory main river maps held by the Environment Agency and the Department for Environment, Food and Rural Affairs. This can include any structure or appliance for controlling or regulating the flow of water into, in or out of the channel. The Environment Agency has permissive power to carry out works of maintenance and improvement on these rivers.

MSfW - Making Space for Water (Defra 2004). The Government's new evolving strategy to manage the risks from flooding and coastal erosion by employing an integrated portfolio of approaches, so as: a) to reduce the threat to people and their property; b) to deliver the greatest environmental, social and economic benefit, consistent with the Government's sustainable development principles, c) to secure efficient and reliable funding mechanisms that deliver the levels of investment required.

Medium probability Zone 2 - Defined as an area at risk of flooding from flood events that are greater than the 1% AEP(1 in 100 year), and less than the 0.1% AEP (1 in 1000 year) design event. The probability of flooding occurring in this area in any one year is between 1% and 0.1%.

NRD – National Receptor Dataset

Ordinary Watercourse – Any section of watercourse not designated as a Main River.

PFRA – Preliminary Flood Risk Assessment

Pluvial – Direct runoff, which occurs when the intensity or amount of rainfall landing on a surface exceeds the natural or artificial capacity of the surface to drain the water away, resulting in runoff over land

Precipitation – Describes rain, sleet, hail, snow and other forms of water falling from the sky.

PPS 25 - Planning Policy Statement 25: Development and Flood Risk. Government policy on development and flood risk. Its aims are to ensure that flood risk is taken into account at all stages in the planning process, to avoid inappropriate development in areas at risk of flooding and to direct development away from areas of highest risk. Where new development is, exceptionally, necessary in such areas, policy aims to make it safe without increasing flood risk elsewhere and where possible, reducing flood risk overall.

RBD – River Basin District.

RFCC – Regional Flood and Coastal Committee

RFRA – Regional Flood Risk Assessment

Reservoir - artificial lake used to store water. Reservoirs may be created in river valleys by the construction of a dam or may be built by excavation in the ground or by conventional construction techniques such a brickwork or cast concrete. Reservoirs greater than 10,000m3 are governed by the Reservoirs Act.

Residual Risk - The risk which remains after all risk avoidance, reduction and mitigation measures have been implemented.

Return Period – The probability of a flood of a given magnitude occurring within any one year e.g. a 1% AEP (1 in 100 year) event has a probability of occurring once in 100 years, or a 1% chance in any one year. However, a 1% AEP (1 in 100 year) event could occur twice or more within 100 years, or not at all.

Riparian Owner - All landowners whose property is adjoining to a body of water have the right to make reasonable use of it and suitably maintain it.

Risk Management Authority – defined in the Flood and Water Management Act, they all have some responsibility for managing flood risk

Sequential Test - Informed by a SFRA, a planning authority applies the Sequential Test to demonstrate that there are no reasonably available sites in areas with less risk of flooding that would be appropriate to the type of development or land use proposed.

Sewer flooding – The consequence of sewer systems exceeding their capacity during a rainfall event.

SFRA (Strategic Flood Risk Assessment) - An SFRA is used as a tool by a planning authority to assess flood risk for spatial planning, producing development briefs, setting constraints, informing sustainability appraisals and identifying locations of emergency planning measures and requirements for flood risk assessments.

SUDS – Sustainable Drainage Systems. SuDS are drainage systems which are designed to reduce the impact of urbanisation on the hydrology of a river system.

SWMP – Surface Water Management Plan

Surface Runoff – Rainwater (including snow and other precipitation) which: is on the surface of the ground (whether or not it is moving); and has not entered a watercourse, draining system or public sewer.

Sustainable Development – "Development that meets the needs of the present without compromising the ability of future generations to meet their own needs" (The World Commission on Environment and Development, 1987)

Tidal Flood Risk – The flood risk that arises as a consequence of high tides or tidal surges.

Unitary Authority – A type of local authority that has a single tier and is responsible for all local government functions within its area or performs additional functions which elsewhere in the relevant country are usually performed by national government or a higher level of sub-national government.

WaSC – Water and Sewerage Company

WFD - Water Framework Directive

Structures

Note not all structure locations are confirmed. They have been identified from Earthlight, NSC's GIS package.

Structure - Highway crossing
GR - 347535.401, 176346.149
Notes – Unadopted highway

Structure – Culvert x2
GR - 347930.896, 176204.521 & 347940.650, 176200.999
Notes – Private (within IDB area)

Structure – Culvert
GR - 348294.218, 176074.818
Notes – Private (within IDB area)

Structure – Portbury Common Railway Bridge
GR - 348501.211, 176001.118
Notes – NSC owned, structure number 47017

Structure – Culvert
GR - 348768.758, 175907.176
Notes – Private (within IDB area)

Structure – Culvert
GR - 349295.249, 175732.018
Notes – Private (within IDB area)

Structure – Portbury Station Railway Bridge
GR - 349581.761, 175687.993
Notes – NSC owned, structure number 47002

Structure – Culvert
GR - 349970.347, 175725.585
Notes – Private (within IDB area)

Structure – Culvert
GR - 350459.856, 175887.948
Notes – Private (within IDB area)

Structure – Royal Portbury Dock Road Bridge (West Dock Road Bridge)
GR - 350662.378, 175963.809
Notes – NSC owned, structure number 57263

Structure – Marsh Lane Railway Bridge
GR - 351053.877, 176108.497
Notes – NSC owned, structure number 57055

Structure – Motorway Bridge
GR - 351508.232, 176222.695
Notes – Highways Agency

Structure – Lodway Close Railway Bridge
GR - 352100.357, 176248.840
Notes – NSC owned, structure number 57392

Useful documents

Strategic Flood Risk Assessment level 1

< http://www.n-somerset.gov.uk/Environment/Planning_policy_and-research/researchandmonitoring/Documents/Level%201%20study%20of%20North%20Somerset%20(pdf).pdf>

Strategic Flood Risk Assessment level 2

<http://www.n-somerset.gov.uk/Environment/Planning_policy_and-research/researchandmonitoring/Documents/Level%202%20study%20of%20Clevedon,%20Nailsea,%20Portishead%20%20and%20larger%20villages%20(pdf).pdf>

Historic Borehole Records

<http://mapapps.bgs.ac.uk/boreholescans/boreholescans.html>

MetroWest

Portishead Branch Line (MetroWest Phase 1)

TR040011

Applicant: North Somerset District Council
5.6, Flood Risk Assessment,
Appendix G Severn Estuary Shoreline Management Plan 2 Policy Units
The Infrastructure Planning (Applications: Prescribed Forms and Procedure) Regulations 2009, regulation 5(2)(e)
Planning Act 2008

Author: CH2M
Date: November 2019

NetworkRail · West of England Local Enterprise Partnership · West of England Combined Authority · HM Government · Bath & North East Somerset Council · Bristol City Council · North Somerset Council · South Gloucestershire Council · travelwest

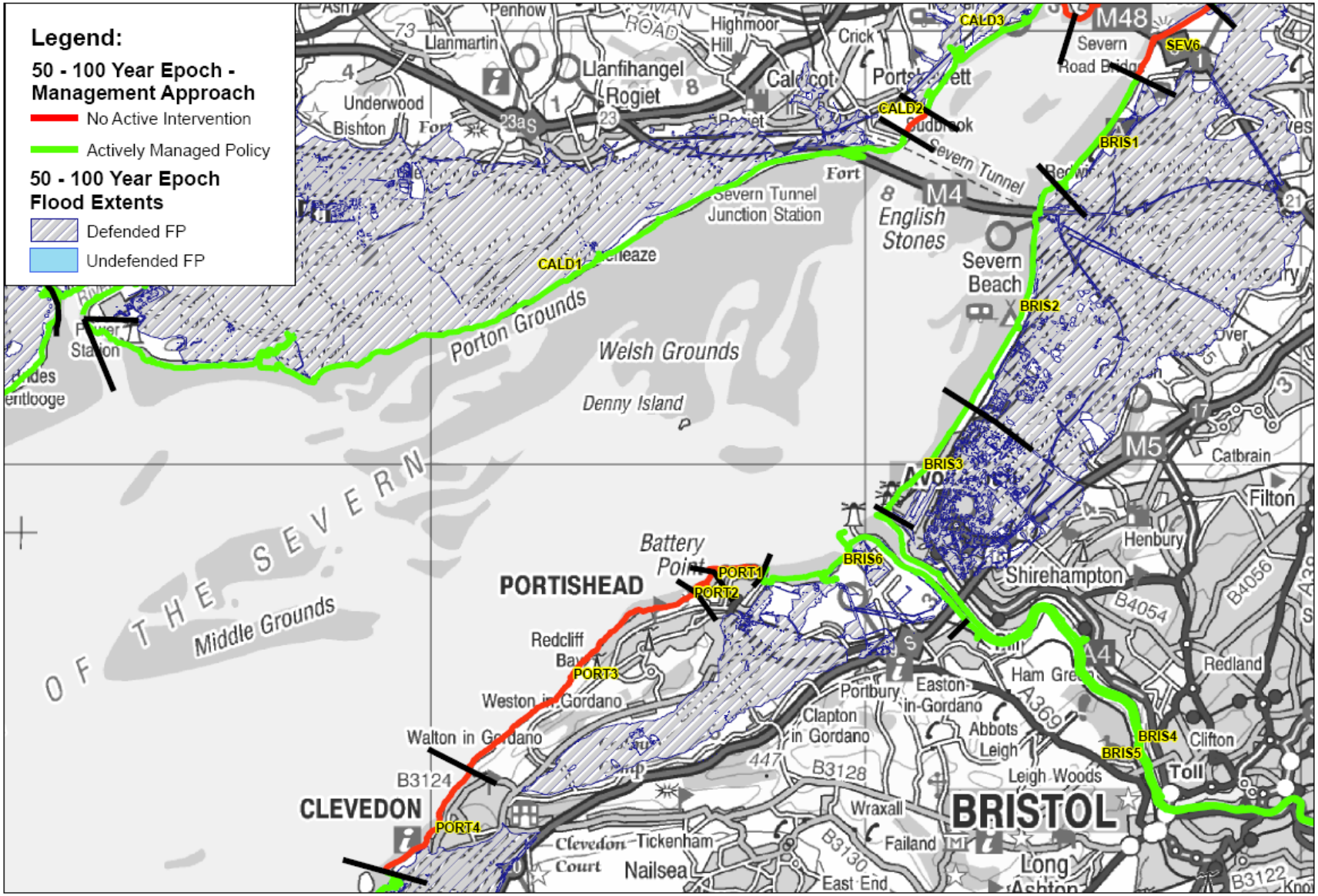


Figure 3.8 - WPM implications –Upper Severn (NB: Actively Managed Policy may include HTL, MR or ATL).

MetroWest

Portishead Branch Line (MetroWest Phase 1)

TR040011

Applicant: North Somerset District Council
5.6, Flood Risk Assessment,
Appendix H Severn Estuary Flood Risk Management Strategy summary information
The Infrastructure Planning (Applications: Prescribed Forms and Procedure) Regulations 2009, regulation 5(2)(e)
Planning Act 2008

Author: CH2M
Date: November 2019

Portbury to Clevedon

Existing defences and probability of flooding

Properties currently have less than 1 in 200 chance of tidal flooding in any year.

Several listed buildings and 4 scheduled monuments will benefit from a sustained level of protection.

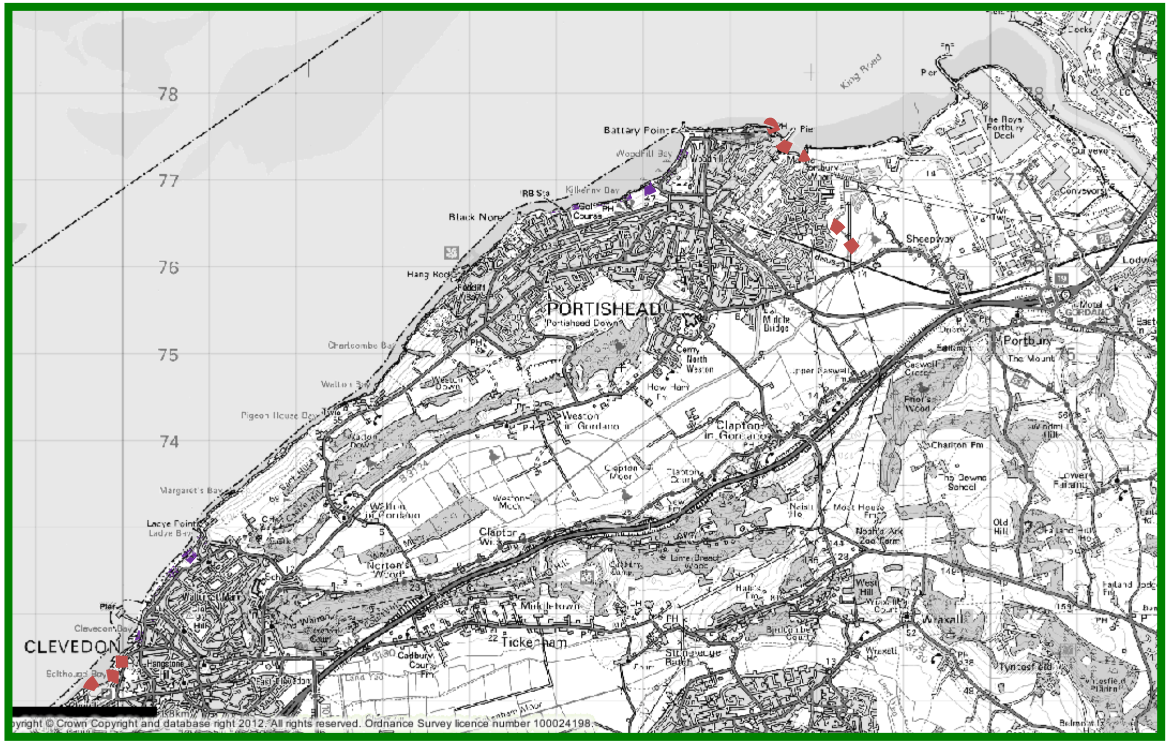
In the future, as sea levels and storminess increase, the level of flood risk will increase.

Continued maintenance by the Environment Agency, landowners and other authorities is required to ensure defences continue to be effective.

Sea level rise note

The UKCP09 medium emissions scenario projects about 0.1m of sea level rise by 2030, about 0.3m by 2060, and about 0.7m by 2110.

Currently sea level is rising at about 2 to 2.5mm a year. If this rate were to continue, sea level rise would be less than what is projected by the UKCP09 medium emissions scenario.



How these options were reached

The seaward defence between Portishead and Portbury Docks will not be maintained into the future (not shown on map). The inland defence provides a more effective and higher defence standard (marked in red on the map).

At Portishead, the Environment Agency intends to maintain the defences into the medium to long term future (as funds allow).

At Woodhill Bay, the frontage is not maintained as a defence because there are no properties or critical infrastructure at risk of flooding. For this reason, the site is a very low priority for funding (for improvement or maintenance).

What can be done?

Raised defences which are maintained by the Environment Agency have a remaining life of at least 50 years.

Flood defences between Portishead and Portbury Docks will be provided by the inland defences (marked in red on the map).

At Portbury Docks, the existing high ground will continue to provide defence.

At Portishead the defences will be maintained, as funds allow. After 2030 the defences or ground levels could be raised to keep pace with climate change. This will protect approximately 3600 properties and infrastructure.

At Woodhill Bay, the frontage will not be maintained as a flood defence because there are no homes or critical infrastructure in the floodplain, and there are alternative routes to the coastal road. The structures will still provide a defence to adjacent land.

At Clevedon, Marshalls Bank provides protection for flooding greater than 1:200 year event.

Landowners can help to maximise the life of defences by ensuring their activities do not cause unnecessary damage.

Key

Defences maintained by the EA

Other defences

MetroWest

Portishead Branch Line (MetroWest Phase 1)

TR040011

Applicant: North Somerset District Council
5.6, Flood Risk Assessment,
Appendix J Environment Agency flood defences information
The Infrastructure Planning (Applications: Prescribed Forms and Procedure) Regulations 2009, regulation 5(2)(e)
Planning Act 2008

Author: CH2M
Date: November 2019

NetworkRail · West of England Local Enterprise Partnership · West of England Combined Authority · HM Government · Bath & North East Somerset Council · Bristol City Council · North Somerset Council · South Gloucestershire Council · travelwest

Product 4 - AIMS Information **SW/6775** **Date:** 06/06/2014

Map Ref	Asset ID	Asset Type	Asset Description	Approx Length (m)	Left or Right Bank	Actual fluvial downstream crest level (mAOD)	Actual fluvial downstream crest level accuracy	Actual fluvial upstream crest level (mAOD)	Actual fluvial upstream crest level accuracy	Actual coastal crest level (mAOD)	Actual coastal crest level accuracy	NGR	Most Recent Inspection	Overall Condition*
1	81996	high_ground	High ground	1036.98	coastal	DNR	DNR	DNR	DNR	DNR	DNR	ST5024877000	27/03/2008	3
3	54425	high_ground	Natural channel	315.32	right	4.72	+/->75cm	5.94	+/->75cm	DNR	DNR	ST4935077250	03/03/2014	3
4	7910	high_ground	Tipped High Ground	295.75	coastal	DNR	DNR	DNR	DNR	DNR	DNR	ST4937677284	19/03/2012	3
5	56322	embankment	EARTH BANK	342.23	coastal	DNR	DNR	DNR	DNR	8.00	+/- 1 to 5cm	ST4937677284	09/04/2014	3
6	2912	high_ground	Channel Outfall	1033.09	left	DNR	DNR	6.78	+/->75cm	DNR	DNR	ST4902977296	03/03/2014	3
7	41649	high_ground	Channel Outfall	1030.75	right	DNR	DNR	6.78	+/->75cm	DNR	DNR	ST4903577297	03/03/2014	3
8	23249	embankment	Embankment	769.07	coastal	DNR	DNR	DNR	DNR	DNR	DNR	ST4916777425	23/03/2011	3
9	2369	high_ground	REGRADED BANK	587.37	left	9.25	+/->75cm	8.32	+/->75cm	DNR	DNR	ST5114377432	28/03/2014	3
10	40724	embankment	COMPLEX REVETMENT	114.38	right	9.96	+/->5 to 15cm	10.26	+/->5 to 15cm	DNR	DNR	ST5143177614	28/03/2014	4
11	2371	embankment	COMPLEX REVETMENT	199.23	right	10.16	+/->5 to 15cm	9.95	+/->5 to 15cm	DNR	DNR	ST5133377673	28/03/2014	4
12	2370	wall	CONCRETE WALL	55.70	right	10.14	+/->5 to 15cm	10.16	+/->5 to 15cm	DNR	DNR	ST5115177754	28/03/2014	4
13	23348	high_ground	Old Banks and Tipped High Ground	1416.91	coastal	DNR	DNR	DNR	DNR	DNR	DNR	ST4960378110	15/01/2013	3
14	40607	embankment	COMPLEX REVETMENT	55.69	right	10.94	+/->5 to 15cm	10.94	+/->5 to 15cm	DNR	DNR	ST5110477784	28/03/2014	4
15	178814	embankment	Bristol Port private defence	1229.08	coastal	DNR	DNR	DNR	DNR	10.50	+/->75cm	ST5105177801	28/03/2014	4
16	23347	wall	Seawall	1218.09	coastal	DNR	DNR	DNR	DNR	DNR	DNR	ST4965277993	28/04/2010	3
17	2915	high_ground	Natural Bank	2185.58	left	4.97	+/->75cm	6.40	+/->75cm	DNR	DNR	ST5060676039	03/03/2014	3
18	1302	high_ground	Natural Bank	968.86	right	6.72	+/->75cm	5.94	+/->75cm	DNR	DNR	ST5060276050	03/03/2014	3
19	167493	high_ground	Maintained Channel	111.85	left	DNR	DNR	DNR	DNR	DNR	DNR	ST5060776039	03/03/2014	3
20	167494	high_ground	Natural channel	118.69	right	DNR	DNR	DNR	DNR	DNR	DNR	ST5060276050	03/03/2014	3
21	148802	high_ground	Natural Channel	129.56	left	DNR	DNR	DNR	DNR	DNR	DNR	ST5068376003	04/03/2014	3
22	150195	high_ground	Natural Channel	140.51	right	DNR	DNR	DNR	DNR	DNR	DNR	ST5068376007	04/03/2014	3
23	173924	embankment	Sea Defence	530.14	coastal	DNR	DNR	DNR	DNR	9.70	+/- 1 to 5cm	ST4849676026	24/03/2014	3
24	125375	high_ground	High Ground	1680.44	coastal	DNR	DNR	DNR	DNR	DNR	DNR	ST4846076115	23/03/2011	3
25	172580	high_ground	Natural channel	1234.80	right	6.02	+/->75cm	6.72	+/->75cm	DNR	DNR	ST4989776183	03/03/2014	3
27	57160	high_ground	OLD REDUNDANT FLOOD EMBANKMEI	1760.68	left	8.32	+/->75cm	8.19	+/->75cm	DNR	DNR	ST5205676314	28/03/2014	4
30	173923	wall	Seawall	36.97	coastal	DNR	DNR	DNR	DNR	9.31	+/- 1 to 5cm	ST4821676456	24/03/2014	3
31	160071	high_ground	Bank protection	594.59	coastal	DNR	DNR	DNR	DNR	DNR	DNR	ST4820376490	23/03/2011	3
33	108040	wall	Seawall	129.26	coastal	DNR	DNR	DNR	DNR	10.11	+/- 1 to 5cm	ST5015376911	24/03/2014	3
34	47164	embankment	Embankment	106.46	coastal	DNR	DNR	DNR	DNR	10.11	+/- 1 to 5cm	ST5007876953	24/03/2014	3
35	47163	wall	Seawall	111.24	coastal	DNR	DNR	DNR	DNR	10.11	+/- 1 to 5cm	ST4998576969	24/03/2014	3
36	47162	embankment	Embankment	73.15	coastal	DNR	DNR	DNR	DNR	10.06	+/- 1 to 5cm	ST4994777016	24/03/2014	3
37	172886	high_ground	High ground	676.36	coastal	DNR	DNR	DNR	DNR	DNR	DNR	ST4783877200	23/03/2011	3
39	170948	embankment	Seawall	50.45	coastal	DNR	DNR	DNR	DNR	10.17	+/- 1 to 5cm	ST4989777007	24/03/2014	3
40	143259	embankment	Embankment	85.89	coastal	DNR	DNR	DNR	DNR	10.37	+/- 1 to 5cm	ST4963177020	24/03/2014	3
41	77993	embankment	Embankment	124.00	coastal	DNR	DNR	DNR	DNR	9.94	+/- 1 to 5cm	ST4982477028	24/03/2014	3
42	5456	embankment	EARTH BANKS	405.97	coastal	DNR	DNR	8.00	+/->75cm	9.76	+/- 1 to 5cm	ST4963177020	10/04/2014	3
43	171819	wall	Seawall	108.59	coastal	DNR	DNR	DNR	DNR	10.11	+/- 1 to 5cm	ST4971677020	24/03/2014	3
45	80412	embankment	Embankment with metalised road on crest	111.46	coastal	DNR	DNR	DNR	DNR	9.97	+/- 1 to 5cm	ST4939577288	24/03/2014	3

46	128792	embankment	EARTH BANK	1258.86	coastal	DNR	DNR	DNR	DNR	5.48	+/- 1 to 5cm	ST4903477287	24/03/2014	3
48	117325	high_ground	Natural Bank	335.87	left	4.72	+/->75cm	4.98	+/->75cm	DNR	DNR	ST4935077246	03/03/2014	3
7	2914	simple_culvert	PCC Culvert	39.69		DNR	DNR	DNR	DNR	DNR	DNR	ST4938977243	10/04/2014	3
10	2913	simple_culvert	Fastings Gout Culvert	37.89		DNR	DNR	DNR	DNR	DNR	DNR	ST4903677260	03/03/2014	3

Notes

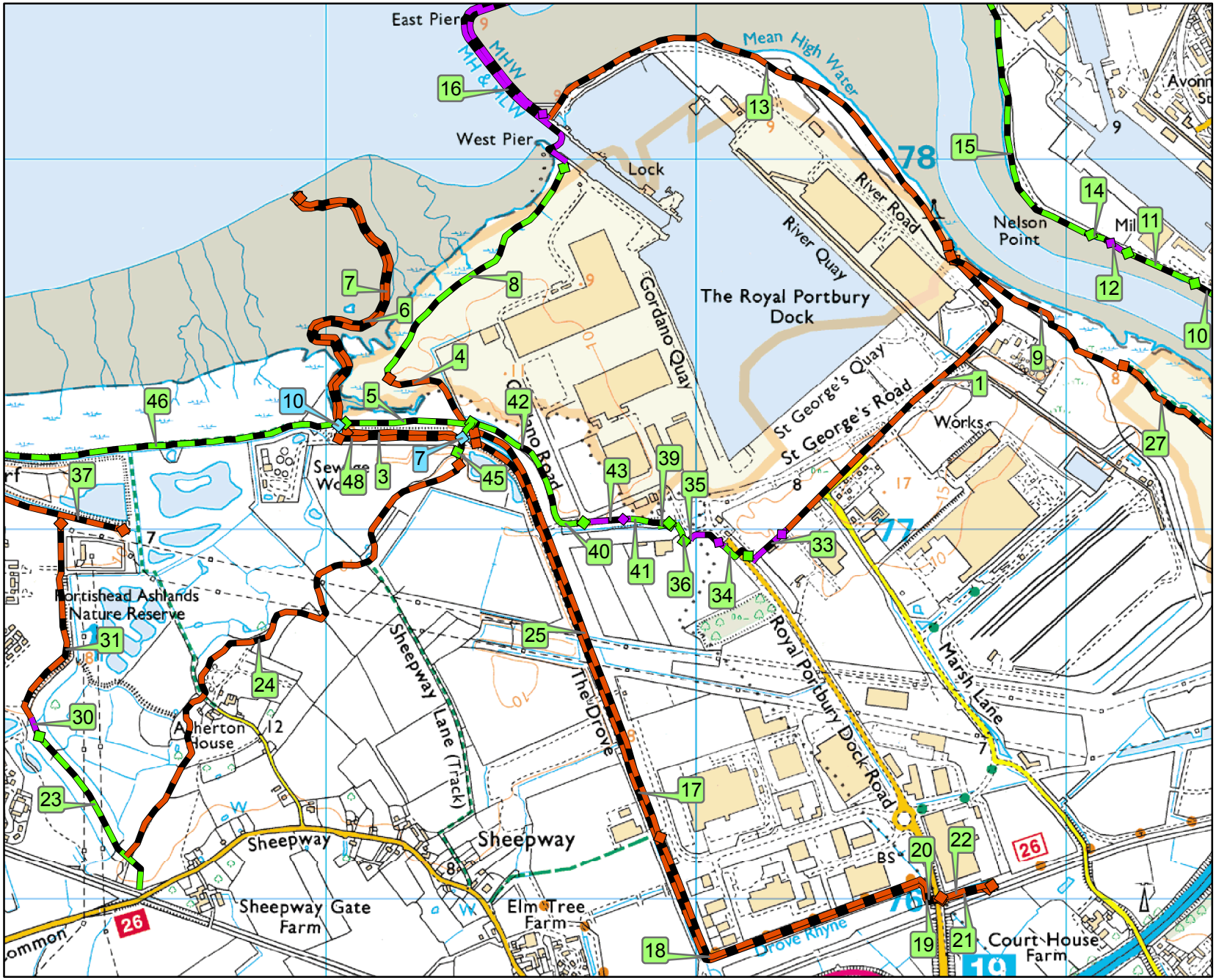
*** Overall Condition has been taken from the most recent inspection**

*** Inspections are of a purely visual nature and do not necessarily reflect the true condition of the asset**

*** Condition 1 = very good, condition 2 = good, condition 3 = fair, condition 4 = poor, condition 5 = very poor**

DNR = data not recorded

Current Flood Defences centred on ST 50484 75950, created 06/06/2014 Ref: SW/6775



Environment Agency

Scale: 1:15,000

N W E S

Legend

Channels_6775

ASSET_TYPE

- open_channel
- simple_culvert

Defences_6775

ASSET_TYPE

- bridge_abutment
- barrier_beach
- cliff
- demountable
- embankment
- flood_gate
- high_ground
- promenade
- quay
- wall
- beach
- dunes

This data has been extracted from the Asset Information Management System (AIMS) which was created to draw various data sources into one database and has been populated with information of varying quality.

Contact Us: National Customer Contact Centre, PO Box 544, Rotherham, S60 1BY. Tel: 08708 506 506 (Mon-Fri 8-6). Email: enquiries@environment-agency.gov.uk

Product 4 - AIMS Information **SW/8936** **Date:** ########

Map Ref	Asset ID	Asset Type	Asset Description	Approx Length (m)	Left or Right Bank	Actual fluvial downstream crest level (mAOD)	Actual fluvial downstream crest level accuracy	Actual fluvial upstream crest level (mAOD)	Actual fluvial upstream crest level accuracy	Actual coastal crest level (mAOD)	Actual coastal crest level accuracy	NGR	Actual Standard of Protection	Most Recent Inspection	Overall Condition*
1	40726	high_ground	NATURAL BANK	213.66	right	8.20	+/->75cm	9.02	+/->75cm	DNR	DNR	ST5259476322	100	30/06/2014	3
2	40677	wall	Masonry Wall	202.65	left	9.12	+/- 1 to 5cm	9.56	+/- 1 to 5cm	DNR	DNR	ST5254675967	100	05/03/2014	3
3	40748	embankment	EMBANKMENT	54.08	left	9.36	+/- 1 to 5cm	9.31	+/- 1 to 5cm	DNR	DNR	ST5256775945	100	05/03/2014	3
4	115899	high_ground	Walled Bank	167.26	right	8.19	+/->75cm	7.61	+/->75cm	DNR	DNR	ST5254675967	2	05/03/2014	3
5	329339	flood_gate	FLOOD GATE	5.00	DNR	DNR	DNR	DNR	DNR	DNR	DNR	ST5254876148	DNR	30/06/2014	2
6	329338	flood_gate	FLOOD GATE	5.00	DNR	DNR	DNR	DNR	DNR	DNR	DNR	ST5254976102	DNR	05/03/2014	2
7	2185	embankment	RAMP IN ROAD	17.57	right	9.35	+/- 1 to 5cm	10.05	+/- 1 to 5cm	DNR	DNR	ST5258575944	200	05/03/2014	3
8	58489	embankment	EMBANKMENT	91.08	right	8.85	+/- 1 to 5cm	9.33	+/- 1 to 5cm	DNR	DNR	ST5266076288	100	30/06/2014	3
9	2308	high_ground	MASONRY WALL	91.26	left	6.97	+/->75cm	6.28	+/->75cm	DNR	DNR	ST5268076040	2	30/06/2014	3
10	2309	wall	MASONRY FLOOD WALL (Private Defence	49.79	left	9.35	+/- 1 to 5cm	9.35	+/- 1 to 5cm	DNR	DNR	ST5262676053	2	30/06/2014	3
11	329651	flood_gate	FLOOD GATE (PILL TD)	5.00	DNR	DNR	DNR	DNR	DNR	DNR	DNR	ST5262276042	DNR	30/06/2014	3
12	328139	flood_gate	FLOOD GATE (PILL TD)	5.00	DNR	DNR	DNR	DNR	DNR	DNR	DNR	ST5262376052	DNR	30/06/2014	3
13	328186	flood_gate	FLOOD GATE (PILL TD)	5.00	DNR	DNR	DNR	DNR	DNR	DNR	DNR	ST5262576042	DNR	30/06/2014	3
14	328137	flood_gate	FLOOD GATE (PILL TD)	5.00	DNR	DNR	DNR	DNR	DNR	DNR	DNR	ST5262876039	DNR	30/06/2014	3
15	328138	flood_gate	FLOOD GATE (PILL TD)	5.00	DNR	DNR	DNR	DNR	DNR	DNR	DNR	ST5263476050	DNR	30/06/2014	3
16	329340	flood_gate	FLOOD GATE	3.32	DNR	DNR	DNR	DNR	DNR	DNR	DNR	ST5266076288	DNR	30/06/2014	2
17	103652	wall	MASONRY FLOOD WALL	56.32	right	9.25	+/- 1 to 5cm	9.27	+/- 1 to 5cm	DNR	DNR	ST5269776260	100	30/06/2014	3
18	77157	high_ground	Natural Bank	1142.08	left	11.37	+/->75cm	25.85	+/->75cm	DNR	DNR	ST5297874652	2	05/03/2014	3
19	40729	high_ground	NATURAL BANK	68.31	left	6.28	+/->75cm	6.51	+/->75cm	DNR	DNR	ST5273375997	2	30/06/2014	3
20	77187	high_ground	Natural Bank	1143.46	right	11.03	+/->75cm	25.19	+/->75cm	DNR	DNR	ST5298574652	2	05/03/2014	3
21	77156	high_ground	REGRADED BANK	1461.80	right	9.30	+/->75cm	14.37	+/->75cm	DNR	DNR	ST5376576474	100	30/06/2014	3
22	329341	flood_gate	FLOOD GATE	3.60	DNR	DNR	DNR	DNR	DNR	DNR	DNR	ST5269776260	0	30/06/2014	2
23	40728	embankment	EMBANKMENT	31.06	right	9.20	+/- 1 to 5cm	9.14	+/- 1 to 5cm	DNR	DNR	ST5272176236	100	30/06/2014	3
24	77155	high_ground	NATURAL BANK	1670.74	left	6.51	+/->75cm	8.24	+/->75cm	DNR	DNR	ST5387876325	2	30/06/2014	3
26	2915	high_ground	Natural Bank	2185.59	left	4.97	+/->75cm	6.40	+/->75cm	DNR	DNR	ST5060676039	100	03/03/2014	3
27	172580	high_ground	Natural channel	1234.81	right	6.02	+/->75cm	6.72	+/->75cm	DNR	DNR	ST4989776183	100	03/03/2014	3
28	38719	high_ground	Concrete Lined Ditch	34.32	right	7.97	+/->75cm	8.26	+/->75cm	DNR	DNR	ST4952075470	2	14/07/2009	2
32	1302	high_ground	Natural Bank	968.86	right	6.72	+/->75cm	5.94	+/->75cm	DNR	DNR	ST5060276050	2	03/03/2014	3
39	167494	high_ground	Natural channel	118.70	right	DNR	DNR	DNR	DNR	DNR	DNR	ST5060276050	2	20/08/2014	3
40	167493	high_ground	Maintained Channel	111.86	left	DNR	DNR	DNR	DNR	DNR	DNR	ST5060776039	2	20/08/2014	3
41	150195	high_ground	Natural Channel	140.51	right	DNR	DNR	DNR	DNR	DNR	DNR	ST5068376007	2	20/08/2014	3
42	148802	high_ground	Natural Channel	129.56	left	DNR	DNR	DNR	DNR	DNR	DNR	ST5068376003	2	20/08/2014	3
43	2369	high_ground	REGRADED BANK	587.38	left	9.25	+/->75cm	8.32	+/->75cm	DNR	DNR	ST5114377432	2	30/06/2014	3
44	57160	high_ground	OLD REDUNDANT FLOOD EMBANKMENT	1760.69	left	8.32	+/->75cm	8.19	+/->75cm	DNR	DNR	ST5205676314	2	30/06/2014	4
45	2372	embankment	REGRADED BANK	641.36	right	10.26	+/- 1 to 5cm	10.89	+/->75cm	DNR	DNR	ST5185777199	2	30/06/2014	4
46	40725	wall	MASONRY WALL	58.67	right	9.85	+/->75cm	9.85	+/->75cm	DNR	DNR	ST5189477153	2	30/06/2014	3
47	2494	embankment	REGRADED BANK	223.80	right	9.74	+/- 1 to 5cm	8.66	+/- 1 to 5cm	DNR	DNR	ST5205076997	2	30/06/2014	3
49	165794	embankment	FLOOD EMBANKMENT	470.22	left	9.93	+/- 1 to 5cm	9.61	+/- 1 to 5cm	DNR	DNR	ST5239676258	100	30/06/2014	3
50	2495	high_ground	STEEL SHEET PILING	278.54	right	9.12	+/->75cm	9.35	+/->75cm	DNR	DNR	ST5244776477	100	30/06/2014	3
51	40727	wall	MASONRY FLOOD WALL	268.61	left	9.32	+/- 1 to 5cm	9.32	+/- 1 to 5cm	DNR	DNR	ST5255176098	100	30/06/2014	3
54	1659	high_ground	Natural Bank	153.04	left	6.08	+/->75cm	5.40	+/->75cm	DNR	DNR	ST4826375298	10	14/07/2009	2
58	38840	high_ground	Abutment Wall	12.77	right	5.40	+/->75cm	5.40	+/->75cm	DNR	DNR	ST4826175313	2	14/07/2009	2
59	1405	high_ground	Natural Bank	170.34	right	5.40	+/->75cm	6.04	+/->75cm	DNR	DNR	ST4841775375	2	14/07/2009	2
60	38842	high_ground	Bridge Abutment	7.56	left	5.40	+/->75cm	5.40	+/->75cm	DNR	DNR	ST4827075300	2	14/07/2009	2
61	1660	high_ground	Natural Bank	92.91	left	6.13	+/->75cm	6.48	+/->75cm	DNR	DNR	ST4835475340	2	14/07/2009	2
62	89591	high_ground	Natural Bank	679.16	left	6.13	+/->75cm	5.71	+/->75cm	DNR	DNR	ST4900975512	2	14/07/2009	2
63	38841	high_ground	Natural Bank	911.67	right	6.07	+/->75cm	6.70	+/->75cm	DNR	DNR	ST4930875517	2	14/07/2009	2
67	1662	high_ground	Natural Bank	302.16	left	5.71	+/->75cm	7.42	+/->75cm	DNR	DNR	ST4930975503	2	14/07/2009	2
73	1661	high_ground	Natural Bank	199.91	right	6.70	+/->75cm	7.97	+/->75cm	DNR	DNR	ST4950675500	2	14/07/2009	2
74	38720	high_ground	Natural Bank	173.13	left	7.42	+/->75cm	8.33	+/->75cm	DNR	DNR	ST4948075490	2	14/07/2009	2
76	1663	high_ground	Natural Bank	19.22	left	8.33	+/->75cm	7.84	+/->75cm	DNR	DNR	ST4949975491	2	14/07/2009	2
77	1600	high_ground	Lined Ditch	28.50	left	7.84	+/->75cm	7.79	+/->75cm	DNR	DNR	ST4950875465	2	14/07/2009	2
78	58524	high_ground	Natural Bank	248.68	left	6.50	+/->75cm	6.00	+/->75cm	DNR	DNR	ST4727274976	25	27/03/2014	3
79	38839	high_ground	Natural Bank	574.48	right	6.24	+/->75cm	5.30	+/->75cm	DNR	DNR	ST4793075385	2	14/07/2009	2
80	38838	high_ground	Natural Bank	180.78	left	6.81	+/->75cm	6.74	+/->75cm	DNR	DNR	ST4768475138	2	14/07/2009	2
81	1401	high_ground	Natural Bank	149.90	left	6.74	+/->75cm	6.90	+/->75cm	DNR	DNR	ST4777875242	10	14/07/2009	2
82	1497	high_ground	Natural Bank	395.19	right	6.65	+/->75cm	6.18	+/->75cm	DNR	DNR	ST4730575179	25	27/03/2014	3
84	1402	high_ground	Natural Bank	205.18	left	6.91	+/->75cm	8.00	+/->75cm	DNR	DNR	ST4792875373	10	14/07/2009	2
85	1467	high_ground	Natural Bank	201.75	left	5.85	+/->75cm	6.08	+/->75cm	DNR	DNR	ST4811075300	10	14/07/2009	2
87	1404	high_ground	Natural Bank	331.31	right	5.30	+/->75cm	5.40	+/->75cm	DNR	DNR	ST4824875314	10	14/07/2009	2
88	1403	high_ground	Culvert Wall	4.73	right	5.30	+/->75cm	5.30	+/->75cm	DNR	DNR	ST4793475382	2	14/11/1995	3
89	1496	high_ground	Retaining Wall, Gabion, Part of Garden	58.24	left	6.86	+/->75cm	6.50	+/->75cm	DNR	DNR	ST4729875516	2	27/03/2014	3
90	117725	high_ground	Natural Bank	783.69	right	5.80	+/->75cm	6.66	+/->75cm	DNR	DNR	ST4733075570	2	27/03/2014	3
91	153833	high_ground	Natural Bank	740.23	left	6.00	+/->75cm	6.86	+/->75cm	DNR	DNR	ST4732075570	2	27/03/2014	3
92	1571	high_ground	Natural Bank	143.10	left	7.07	+/->75cm	6.00	+/->75cm	DNR	DNR	ST4706076150	2	27/03/2014	3
93	1572	high_ground	Natural Bank	124.51	right	6.20	+/->75cm	5.80	+/->75cm	DNR	DNR	ST4706776164	2	27/03/2014	3
94	1570	high_ground	Natural Bank	208.31	right	DNR	DNR	DNR	DNR	DNR	DNR	ST4701676252	2	27/03/2014	3
95	1569	high_ground	Natural Bank	208.38	left	DNR	DNR	DNR	DNR	DNR	DNR	ST4700576258	2	27/03/2014	3
96	1568	high_ground	Natural Bank	1035.56	right	3.96	+/->75cm	DNR	DNR	DNR	DNR	ST4716476398	2	27/03/2014	3
97	117724	high_ground	Natural Bank	1036.43	left	DNR	DNR	DNR	DNR	DNR	DNR	ST4715476404	5	27/03/2014	3
108	114782	high_ground	Earth Bank Farm Land	856.20	left	5.77	+/->75cm	5.45	+/->75cm	DNR	DNR	ST4606573638	2	01/05/2009	2
109	57617	high_ground	Farm Land	228.65	right	5.95	+/->75cm	5.48	+/->75cm	DNR	DNR	ST4607673648	2	01/05/2009	2
110	1698	high_ground	Earth Bank Farm Land	628.68	right	5.95	+/->75cm	6.09	+/->75cm	DNR	DNR	ST4620073820	2	01/05/2009	2
111	1535	high_ground	Natural Bank	374.43	right	6.10	+/->75cm	5.65	+/->75cm	DNR	DNR	ST4569073960	2	27/03/2014	3
112	1534	high_ground	Natural bank	593.29	left	6.30	+/->75cm	5.35	+/->75cm	DNR	DNR	ST4567673982	2	27/03/2014	3
113	41363	high_ground	Natural Bank	202.44	right	6.40	+/->75cm	6.10	+/->75cm	DNR	DNR	ST4600074170	2	27/03/2014	3
114	80246	high_ground	Natural bank	1060.71	right	6.91	+/->75cm	6.54	+/->75cm	DNR	DNR	ST4619174297	2	27/03/2014	3
115	54743	high_ground	Natural channel	1083.67	left	7.20	+/->75cm	6.30	+/->75cm	DNR	DNR	ST4615774320	2	27/03/2014	3
116	1672	high_ground	Natural Bank	176.66	right	6.16	+/->75cm	6.36	+/->75cm	DNR	DNR	ST4749374460	2	04/09/2009	3
117	1673	high_ground	Natural Bank	284.15	left	6.31	+/->75cm	6.81	+/->75cm	DNR	DNR	ST4748574467	2	03/09/2009	3
118	1670	high_ground	Natural Bank	249.03	right	6.33	+/->75cm	6.94	+/->75cm	DNR	DNR	ST4763774561	2	04/09/2009	3
119	1671	high_ground	Natural Bank	412.20	left	6.00	+/->75cm	6.31	+/->75cm	DNR	DNR	ST4770574644	2	04/09/2009	2
120	1626	high_ground	Natural Bank	322.25	right	5.91	+/->75cm	6.23	+/->75cm	DNR	DNR	ST4766674763	2	04/09/2009	2
121	41362	high_ground	Bridge Abutment	6.42	right	6.46	+/- 1 to 5cm	6.53	+/- 1 to 5cm	DNR	DNR	ST4710274822	2	27/03/2014	3
122	1532	high_ground	Natural bank with spoil banks from channel v	239.58	right	6.46	+/- 1 to 5cm	6.40	+/- 1 to 5cm	DNR	DNR	ST4710774826	2	27/03/2014	3
123	1533	high_ground	Bridge abutment	7.24	left	6.40	+/- 1 to 5cm	7.13	+/- 1 to 5cm	DNR	DNR	ST4709874829	2	27/03/2014	3
124	1406	high_ground	Natural channel with spoil banks from chann	230.54	left	6.36	+/- 1 to 5cm	6.26	+/- 1 to 5cm	DNR	DNR	ST4710374834	2	27/03/2014	3
125	1434	high_ground	Natural Bank	25.65	left	6.10	+/->75cm	7.03	+/->75cm	DNR	DNR	ST4731874958	2	14/07/2009	2
126	38837	high_ground	Wall associated with lifting weir	17.58	left	5.33	+/->75cm	5.33	+/->75cm	DNR	DNR	ST4733374962	2	14/07/2009	2
127	1398	high_ground	Natural Bank	196.18	left	7.00	+/->75cm	6.81	+/->75cm	DNR	DNR	ST4751175040	10	14/07/2009	2
128	1399	high_ground	Wall At Lifting Weir	24.29	right	6.24	+/->75cm	5.35	+/->75cm	DNR	DNR	ST4731574976	2	14/07/2009	2
129	89761	high_ground	Natural Bank	16.14	right	6.98	+/->75cm	6.24	+/->75cm	DNR	DNR	ST4731574976	10	14/07/2009	2
130	54426	high_ground	Natural channel with spoil banks from chann	213.69	right	6.59	+/- 1 to 5cm	7.07	+/- 1 to 5cm	DNR	DNR	ST4730074971	25	27/03/2014	3
131	1400	high_ground	Earth Bank In Farmland	179.88	right	5.35	+/->75cm	6.24	+/->75cm	DNR	DNR	ST4749375052	10	14/07/2009	2
132	1601	high_ground	Abutment Wall Of Farm Access	30.42	left	6.09	+/- 1 to 5cm	6.22	+/- 1 to 5cm	DNR	DNR	ST4751175040	2	04/09/2009	3
1	2259	simple_culvert	Culvert	387.42	DNR	DNR	DNR	DNR	DNR	DNR	DNR	ST5268275624	DNR	05/03/2014	3
16	2914	simple_culvert	PCC Culvert	39.69	DNR	DNR	DNR	DNR	DNR	DNR	DNR	ST4938977243	DNR	10/04/2014	3

Notes

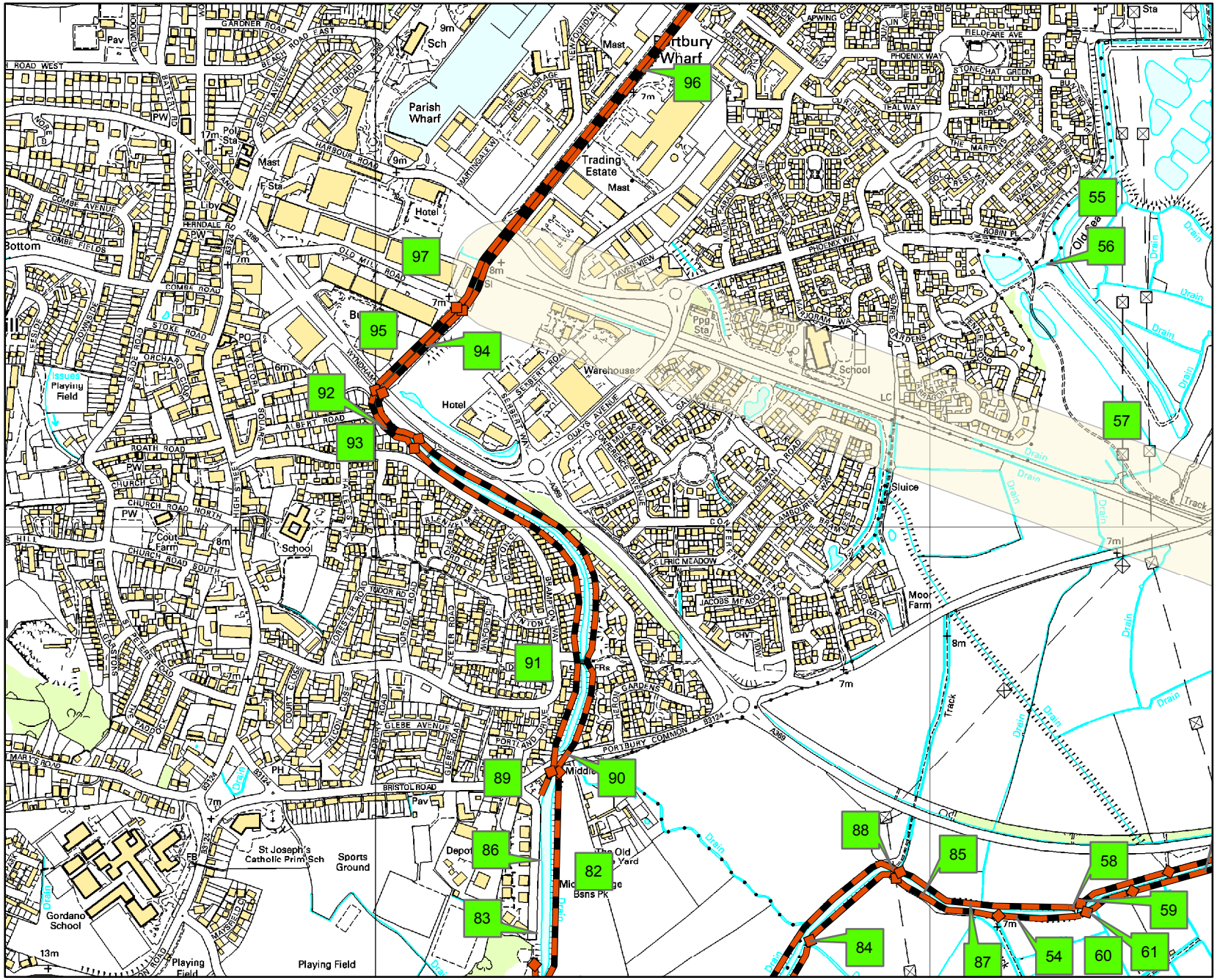
*** Overall Condition has been taken from the most recent inspection**

*** Inspections are of a purely visual nature and do not necessarily reflect the true condition of the asset**

*** Condition 1 = very good, condition 2 = good, condition 3 = fair, condition 4 = poor, condition 5 = very poor**

DNR = data not recorded

Current Flood Defences centred on Portishead to Pill, created 02/12/2014 Ref: SW/8936



Environment Agency

Scale: 1:10,000

N W E S

Legend

Channels_Expo

Asset Type

- open_channel
- simple_culvert

defences_Expo

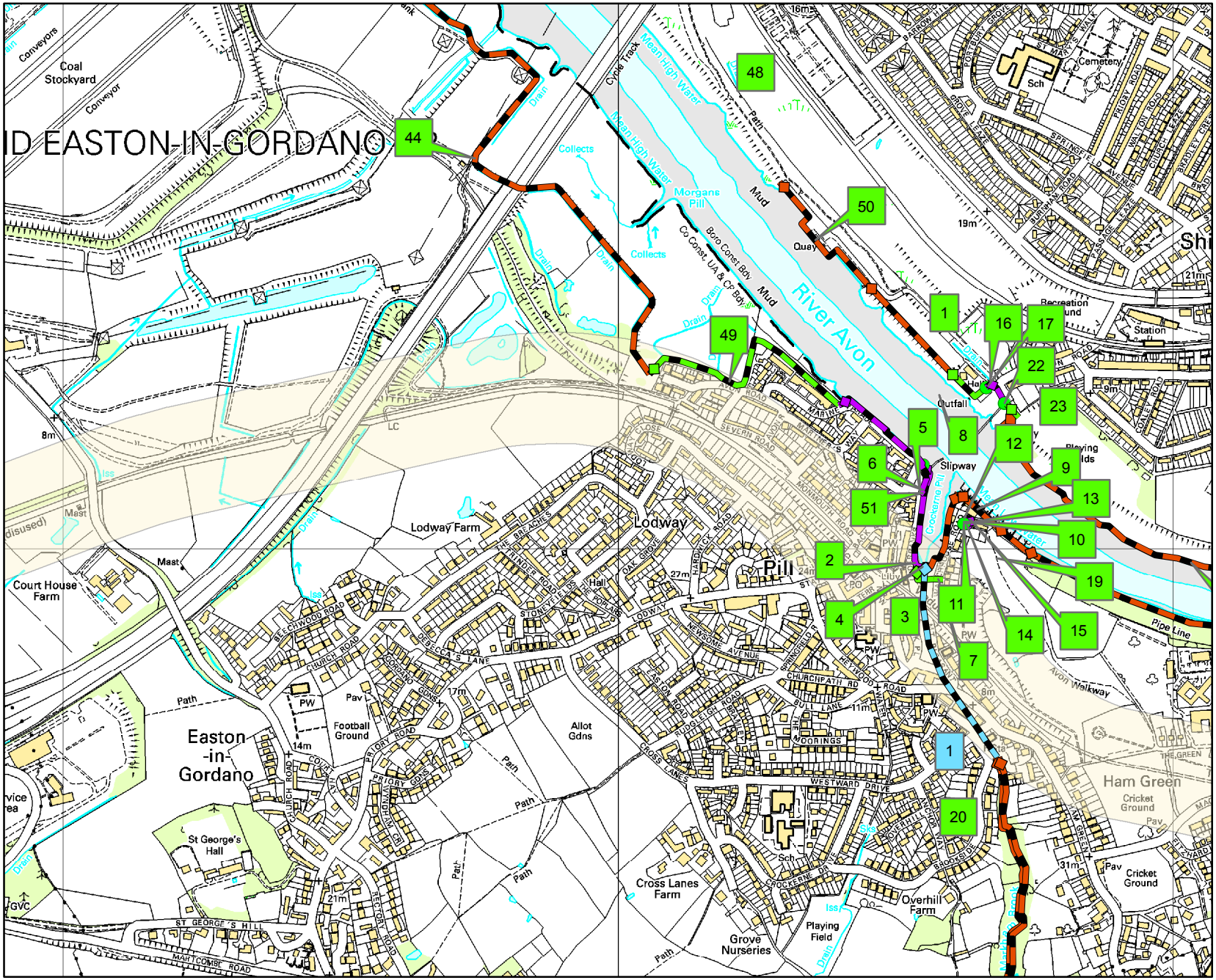
Asset Type

- bridge_abutment
- barrier_beach
- cliff
- demountable
- embankment
- flood_gate
- high_ground
- promenade
- quay
- wall
- beach
- dunes
- Radius_100m

This data has been extracted from the Asset Information Management System (AIMS) which was created to draw various data sources into one database and has been populated with information of varying quality.

Contact Us: National Customer Contact Centre, PO Box 544, Rotherham, S60 1BY. Tel: 08708 506 506 (Mon-Fri 8-6). Email: enquiries@environment-agency.gov.uk

Current Flood Defences centred on Portishead to Pill, created 02/12/2014 Ref: SW/8936



Environment Agency

Scale: 1:10,000

N W E S

Legend

Channels_Expo

Asset Type

- open_channel
- simple_culvert

defences_Expo

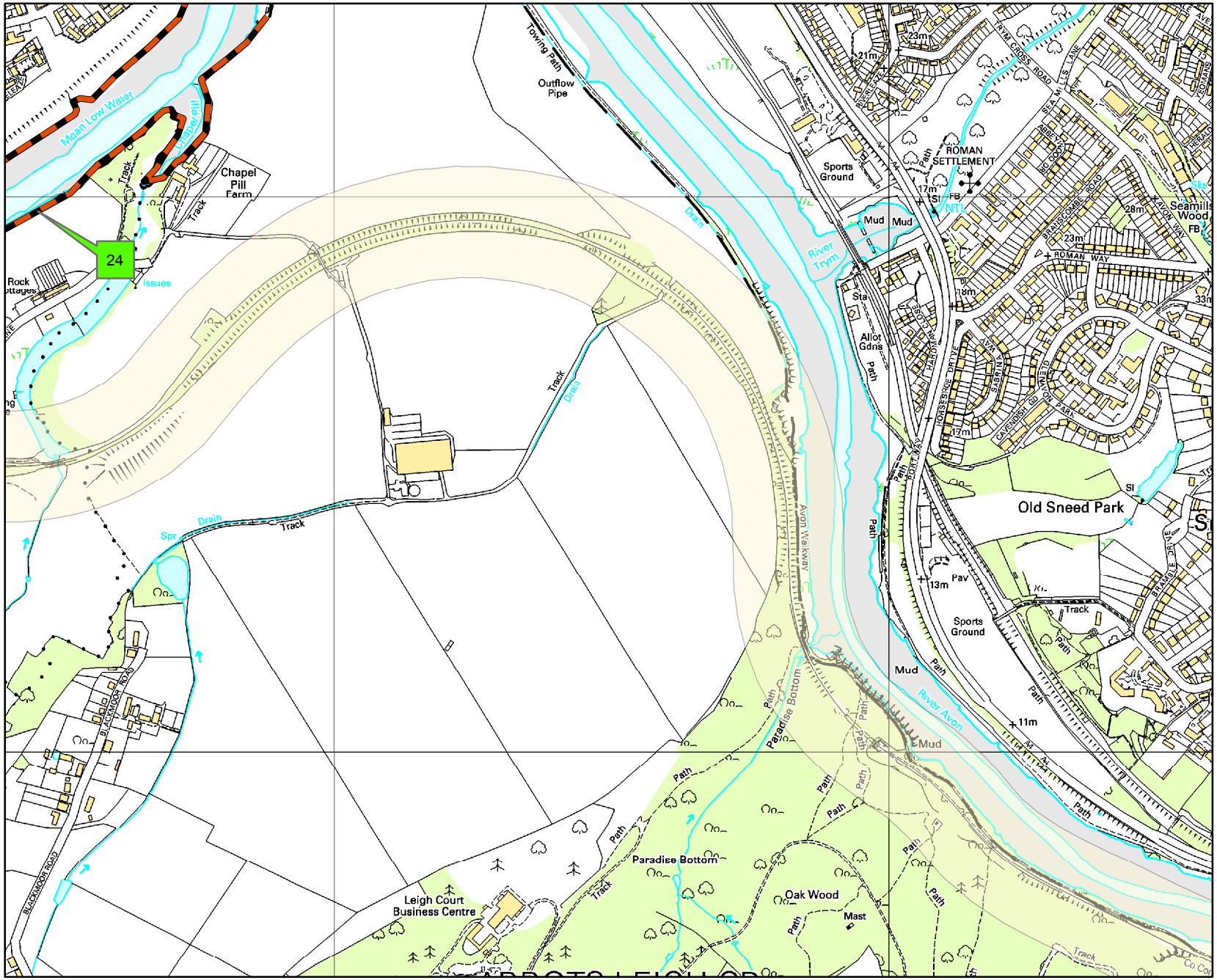
Asset Type

- bridge_abutment
- barrier_beach
- cliff
- demountable
- embankment
- flood_gate
- high_ground
- promenade
- quay
- wall
- beach
- dunes
- Radius_100m

This data has been extracted from the Asset Information Management System (AIMS) which was created to draw various data sources into one database and has been populated with information of varying quality.

Contact Us: National Customer Contact Centre, PO Box 544, Rotherham, S60 1BY. Tel: 08708 506 506 (Mon-Fri 8-6). Email: enquiries@environment-agency.gov.uk

Current Flood Defences centred on Portishead to Pill, created 02/12/2014 Ref: SW/8936



Environment Agency

Scale: 1:10,000

N W E S

Legend

Channels_Expo

Asset Type

- open_channel
- simple_culvert

defences_Expo

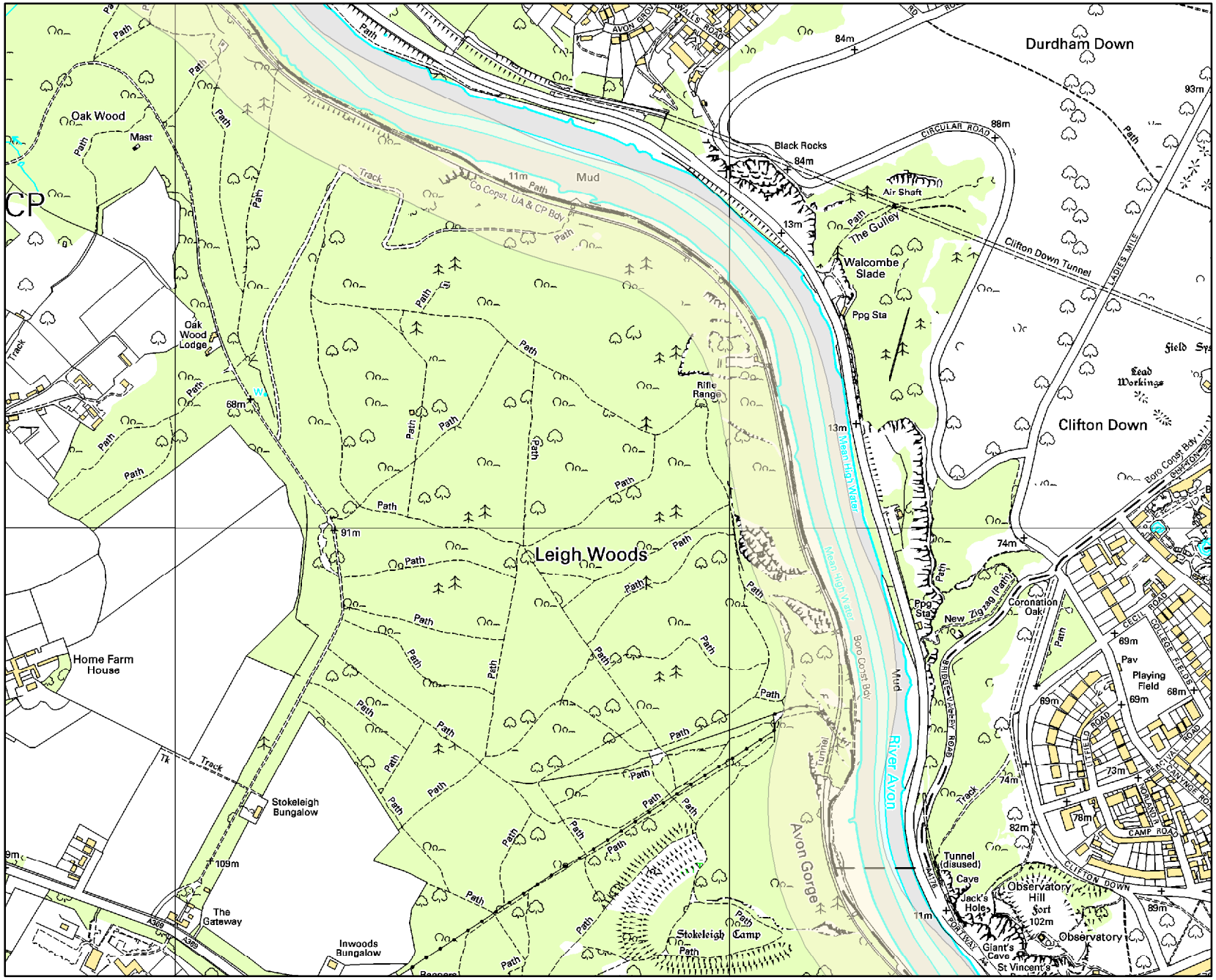
Asset Type

- bridge_abutment
- barrier_beach
- cliff
- demountable
- embankment
- flood_gate
- high_ground
- promenade
- quay
- wall
- beach
- dunes
- Radius_100m

This data has been extracted from the Asset Information Management System (AIMS) which was created to draw various data sources into one database and has been populated with information of varying quality.

Contact Us: National Customer Contact Centre, PO Box 544, Rotherham, S60 1BY. Tel: 08708 506 506 (Mon-Fri 8-6). Email: enquiries@environment-agency.gov.uk

Current Flood Defences centred on Portishead to Pill, created 02/12/2014 Ref: SW/8936



Environment Agency

Scale: 1:10,000

N W E S

Legend

Channels_Expo

Asset Type

- open_channel
- simple_culvert

defences_Expo

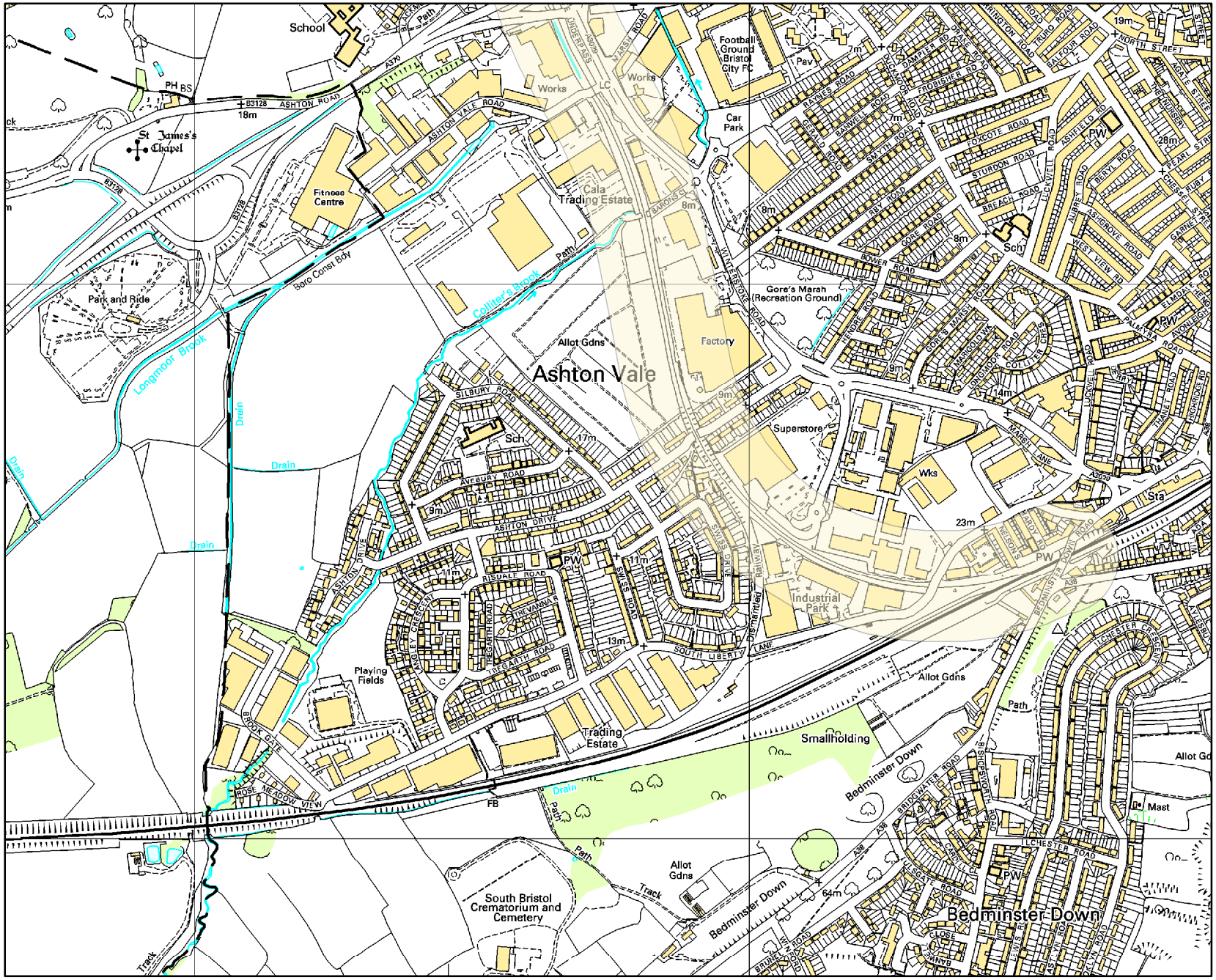
Asset Type

- bridge_abutment
- barrier_beach
- cliff
- demountable
- embankment
- flood_gate
- high_ground
- promenade
- quay
- wall
- beach
- dunes
- Radius_100m

This data has been extracted from the Asset Information Management System (AIMS) which was created to draw various data sources into one database and has been populated with information of varying quality.

Contact Us: National Customer Contact Centre, PO Box 544, Rotherham, S60 1BY. Tel: 08708 506 506 (Mon-Fri 8-6). Email: enquiries@environment-agency.gov.uk

Current Flood Defences centred on Portishead to Pill, created 02/12/2014 Ref: SW/8936



Environment Agency

Scale: 1:10,000

N W E S

Legend

Channels_Expo

Asset Type

- open_channel
- simple_culvert

defences_Expo

Asset Type

- bridge_abutment
- barrier_beach
- cliff
- demountable
- embankment
- flood_gate
- high_ground
- promenade
- quay
- wall
- beach
- dunes
- Radius_100m

This data has been extracted from the Asset Information Management System (AIMS) which was created to draw various data sources into one database and has been populated with information of varying quality.

Contact Us: National Customer Contact Centre, PO Box 544, Rotherham, S60 1BY. Tel: 08708 506 506 (Mon-Fri 8-6). Email: enquiries@environment-agency.gov.uk

Product 4 - AIMS Information **WW/0411** **Date:** 02/03/2015

Map Ref	Asset ID	Asset Type	Asset Description	Approx Length (m)	Left or Right Bank	Actual fluvial downstream crest level (mAOD)	Actual fluvial downstream crest level accuracy	Actual fluvial upstream crest level (mAOD)	Actual fluvial upstream crest level accuracy	Actual coastal crest level (mAOD)	Actual coastal crest level accuracy	NGR	Most Recent Inspection	Overall Condition*
31	81602	high_ground	Canal wall	107.69	right	DNR	DNR	DNR	DNR	DNR	DNR	ST5996372510	03/11/2014	3
32	97331	high_ground	Sheet piling wall	146.62	left	DNR	DNR	DNR	DNR	DNR	DNR	ST5985072570	03/11/2014	3
33	81601	high_ground	Brickwork harbour wall	246.37	right	DNR	DNR	DNR	DNR	DNR	DNR	ST5977372664	03/11/2014	3
34	97330	high_ground	Gabion wall and waste ground	137.39	left	DNR	DNR	DNR	DNR	DNR	DNR	ST5973672645	03/11/2014	3
35	98903	high_ground	Sheet piling wall with footpath above	271.78	left	DNR	DNR	DNR	DNR	DNR	DNR	ST5951572788	03/11/2014	3
36	81338	high_ground	Harbour wall	292.83	right	DNR	DNR	DNR	DNR	DNR	DNR	ST5977372664	03/11/2014	3
37	81598	high_ground	Harbour wall and footpath	128.96	left	DNR	DNR	DNR	DNR	DNR	DNR	ST5951572788	03/11/2014	3
38	81337	high_ground	Harbour wall with footpath and buildings above	114.03	right	DNR	DNR	DNR	DNR	DNR	DNR	ST5942672877	03/11/2014	3
39	146252	high_ground	Natural channel	1064.67	left	DNR	DNR	DNR	DNR	DNR	DNR	ST5850768387	14/03/2014	3
40	144986	high_ground	Natural channel	1060.16	right	DNR	DNR	DNR	DNR	DNR	DNR	ST5851068389	14/03/2014	3
41	155134	high_ground	Natural channel	750.75	left	DNR	DNR	DNR	DNR	DNR	DNR	ST5819469139	14/03/2014	3
42	153733	high_ground	Open channel with weirs and Malago diversion chamber	727.44	right	DNR	DNR	DNR	DNR	DNR	DNR	ST5820369135	14/03/2014	3
43	153548	high_ground	Open channel	742.58	right	DNR	DNR	DNR	DNR	DNR	DNR	ST5810669876	14/03/2014	3
44	155132	high_ground	Channel	731.74	left	DNR	DNR	DNR	DNR	DNR	DNR	ST5810269876	14/03/2014	3
45	82924	high_ground	Natural	53.91	right	DNR	DNR	DNR	DNR	DNR	DNR	ST5802369802	18/03/2014	3
46	156025	high_ground	Natural	51.88	left	DNR	DNR	DNR	DNR	DNR	DNR	ST5801869808	18/03/2014	3
47	128314	high_ground	Natural	50.09	right	DNR	DNR	DNR	DNR	DNR	DNR	ST5807569850	18/03/2014	3
48	156023	high_ground	Walled bank	42.83	left	DNR	DNR	DNR	DNR	DNR	DNR	ST5806969854	18/03/2014	3
49	129835	high_ground	Natural	1239.27	right	DNR	DNR	DNR	DNR	DNR	DNR	ST5849370947	18/03/2014	3
50	154724	high_ground	Natural Channel	1272.64	left	DNR	DNR	DNR	DNR	DNR	DNR	ST5848370986	18/03/2014	3
51	129834	high_ground	Walled channel	42.71	right	DNR	DNR	DNR	DNR	DNR	DNR	ST5848870987	18/03/2014	3
52	154722	high_ground	Road bridge and penstock upstream	26.86	left	DNR	DNR	DNR	DNR	DNR	DNR	ST5848271065	18/03/2014	3
53	129667	high_ground	roadbridge and penstock upstream	17.71	right	DNR	DNR	DNR	DNR	DNR	DNR	ST5848871060	18/03/2014	3
54	129666	high_ground	Natural	231.22	right	DNR	DNR	DNR	DNR	DNR	DNR	ST5862871240	18/03/2014	3
55	129348	high_ground	Walled bank	74.50	left	DNR	DNR	DNR	DNR	DNR	DNR	ST5853271119	18/03/2014	3
56	130715	high_ground	Natural channel with cantilevered walkway	118.74	left	DNR	DNR	DNR	DNR	DNR	DNR	ST5860271213	18/03/2014	3
57	130714	high_ground	Natural	102.22	left	DNR	DNR	DNR	DNR	DNR	DNR	ST5865071300	18/03/2014	3
58	129665	high_ground	Walled bank	75.79	right	DNR	DNR	DNR	DNR	DNR	DNR	ST5865471305	18/03/2014	3
59	130712	high_ground	Natural channel wiuth wall at downstream end	94.33	left	DNR	DNR	DNR	DNR	DNR	DNR	ST5868971387	12/06/2013	3
60	127165	high_ground	Railway Embankment	84.44	right	DNR	DNR	DNR	DNR	DNR	DNR	ST5869471383	12/06/2013	3
61	127164	high_ground	Walled channel with high wall against road	48.96	right	DNR	DNR	DNR	DNR	DNR	DNR	ST5878371592	18/03/2014	3
62	130711	high_ground	Walled channel	47.75	left	DNR	DNR	DNR	DNR	DNR	DNR	ST5877971591	18/03/2014	3
63	127163	high_ground	Walled channel	98.03	right	DNR	DNR	DNR	DNR	DNR	DNR	ST5870971636	18/03/2014	3
64	130709	high_ground	Walled channel	89.94	left	DNR	DNR	DNR	DNR	DNR	DNR	ST5869971629	18/03/2014	3
65	133146	high_ground	MASONRY WALL	562.73	left	DNR	DNR	DNR	DNR	DNR	DNR	ST5968872216	08/09/2014	3
66	2064	high_ground	MASONRY REVETMENT	178.80	left	DNR	DNR	DNR	DNR	DNR	DNR	ST5922071931	08/09/2014	3
67	2063	high_ground	MASONRY WALL	500.09	left	DNR	DNR	DNR	DNR	DNR	DNR	ST5904971980	08/09/2014	3
68	1817	high_ground	MASONRY WALL	402.78	right	DNR	DNR	DNR	DNR	DNR	DNR	ST5955972160	08/09/2014	3
69	2066	high_ground	MASONRY WALL	343.27	right	DNR	DNR	DNR	DNR	DNR	DNR	ST5921071986	08/09/2014	3
70	40600	high_ground	MASONRY WALL	134.67	left	DNR	DNR	DNR	DNR	DNR	DNR	ST5856372001	08/09/2014	3
71	2062	high_ground	REGRADED ROCK BANK	500.92	left	DNR	DNR	DNR	DNR	DNR	DNR	ST5843072020	08/09/2014	3
72	40626	high_ground	REGRADED BANK	203.75	right	DNR	DNR	DNR	DNR	DNR	DNR	ST5888072078	08/09/2014	3
73	2061	high_ground	MASONRY WALL	1092.50	right	DNR	DNR	DNR	DNR	DNR	DNR	ST5868172067	08/09/2014	3
74	73911	high_ground	Walled channel	969.83	left	DNR	DNR	DNR	DNR	DNR	DNR	ST5777172449	03/11/2014	3
75	134970	high_ground	Walled channel	118.24	right	DNR	DNR	DNR	DNR	DNR	DNR	ST5808272356	03/11/2014	3
76	134971	high_ground	Walled channel	322.70	right	DNR	DNR	DNR	DNR	DNR	DNR	ST5818372309	03/11/2014	3
77	155914	high_ground	harbour wall	433.06	right	DNR	DNR	DNR	DNR	DNR	DNR	ST5847172342	03/11/2014	3
78	155913	high_ground	Masonry harbour wall with cobbled hardstanding above	360.07	left	DNR	DNR	DNR	DNR	DNR	DNR	ST5858172748	03/11/2014	3
79	154447	high_ground	Harbour wall	247.25	right	DNR	DNR	DNR	DNR	DNR	DNR	ST5855272389	03/11/2014	3
80	155912	high_ground	Stepped embankment with wooden quay	51.64	left	DNR	DNR	DNR	DNR	DNR	DNR	ST5856172749	03/11/2014	3
81	155710	high_ground	Harbour wall	281.32	left	DNR	DNR	DNR	DNR	DNR	DNR	ST5861572335	03/11/2014	3
82	154293	high_ground	Weir/Lock entrance	10.66	left	DNR	DNR	DNR	DNR	DNR	DNR	ST5864772101	03/11/2014	3
83	155711	high_ground	Harbour wall	185.20	left	DNR	DNR	DNR	DNR	DNR	DNR	ST5877572233	03/11/2014	3
84	154294	high_ground	Harbour wall	360.78	left	DNR	DNR	DNR	DNR	DNR	DNR	ST5865372093	03/11/2014	3
85	155726	high_ground	Harbour wall and carpark	627.01	right	DNR	DNR	DNR	DNR	DNR	DNR	ST5870072415	03/11/2014	3

86	154295	high_ground	Slipway and walls	22.73	left	DNR	DNR	DNR	DNR	DNR	DNR	ST5881972319	03/11/2014	3
87	154296	high_ground	Harbour wall	235.39	left	DNR	DNR	DNR	DNR	DNR	DNR	ST5882572319	03/11/2014	3
88	155727	high_ground	mooring	26.68	right	DNR	DNR	DNR	DNR	DNR	DNR	ST5893272745	03/11/2014	3
89	155728	high_ground	Harbour wall	169.12	right	DNR	DNR	DNR	DNR	DNR	DNR	ST5893372772	03/11/2014	3
100	41400	high_ground	REGRADED BANK	143.31	right	7.83	+/->75cm	9.01	+/->75cm	DNR	DNR	ST5675772225	06/03/2014	3
101	77159	high_ground	REGRADED BANK	608.12	left	6.91	+/->75cm	8.45	+/->75cm	DNR	DNR	ST5728072019	08/09/2014	3
102	77160	high_ground	REGRADED BANK	414.12	right	9.01	+/->75cm	8.57	+/->75cm	DNR	DNR	ST5710772054	08/09/2014	3
103	129473	high_ground	Walled channel	383.29	left	DNR	DNR	DNR	DNR	DNR	DNR	ST5680072329	03/11/2014	3
104	2237	high_ground	Natural Bank	75.44	right	8.25	+/->75cm	8.42	+/->75cm	DNR	DNR	ST5686771427	21/03/2014	3
105	129474	high_ground	Walled channel	397.35	left	0.00	No Data	0.00	No Data	DNR	DNR	ST5707672291	03/11/2014	3
106	73914	high_ground	Walled channel	151.22	right	0.00	No Data	0.00	No Data	DNR	DNR	ST5707772311	03/11/2014	3
107	41402	high_ground	MASONRY WALL	216.12	right	8.57	+/->75cm	8.57	+/->75cm	DNR	DNR	ST5731972092	08/09/2014	3
108	73688	high_ground	Patent Slipway and walled channel	69.65	left	0.00	No Data	0.00	No Data	DNR	DNR	ST5716672163	03/11/2014	3
109	73689	high_ground	Walled channel	91.35	left	0.00	No Data	0.00	No Data	DNR	DNR	ST5716272147	03/11/2014	3
110	73687	high_ground	Walled channel	52.85	left	0.00	No Data	0.00	No Data	DNR	DNR	ST5716972206	03/11/2014	3
111	73709	high_ground	Walled channel	39.56	left	0.00	No Data	0.00	No Data	DNR	DNR	ST5724472141	03/11/2014	3
112	73710	high_ground	Walled channel	68.50	left	0.00	No Data	0.00	No Data	DNR	DNR	ST5726572167	03/11/2014	3
113	1949	high_ground	MASONRY WALL	181.93	left	8.45	+/->75cm	7.96	+/->75cm	DNR	DNR	ST5745872045	08/09/2014	3
114	73711	high_ground	Walled channel	301.18	left	0.00	No Data	0.00	No Data	DNR	DNR	ST5731772215	03/11/2014	3
115	119950	high_ground	MASONRY WALL	225.14	right	8.57	+/->75cm	8.63	+/->75cm	DNR	DNR	ST5754172125	08/09/2014	3
116	41401	high_ground	GABION WALL (COMPLEX)	104.02	left	7.96	+/->75cm	8.03	+/->75cm	DNR	DNR	ST5756172055	08/09/2014	3
117	40550	high_ground	MASONRY WALL	120.25	right	8.63	+/->75cm	8.62	+/->75cm	DNR	DNR	ST5766172138	08/09/2014	3
118	2060	high_ground	MASONRY WALL	385.65	left	8.03	+/->75cm	8.27	+/->75cm	DNR	DNR	ST5794472103	08/09/2014	3
119	56794	high_ground	Natural Bank	392.32	left	9.47	+/->75cm	10.22	+/->75cm	DNR	DNR	ST5615271004	11/02/2015	3
120	56851	high_ground	Natural Bank	1254.92	left	8.70	+/->75cm	12.11	+/->75cm	DNR	DNR	ST5615670210	21/03/2014	3
121	182329	high_ground	Tipped high ground	206.46	right	0.00	No Data	0.00	No Data	DNR	DNR	ST5633371104	11/02/2015	3
122	57184	high_ground	Natural Bank	1250.15	right	8.70	+/->75cm	13.59	+/->75cm	DNR	DNR	ST5616070208	21/03/2014	3
123	40239	wall	Flood Wall	190.42	right	8.52	+/- 1 to 5cm	8.56	+/- 1 to 5cm	DNR	DNR	ST5633371104	11/02/2015	3
124	5046	high_ground	Sheet Piling	92.75	left	9.47	+/->75cm	9.47	+/->75cm	DNR	DNR	ST5647571224	11/02/2015	3
125	5119	high_ground	Sheet Piling	100.29	right	9.47	+/->75cm	9.65	+/->75cm	DNR	DNR	ST5647971220	11/02/2015	3
126	2186	high_ground	Masonry Wall	205.88	left	8.25	+/->75cm	8.42	+/->75cm	DNR	DNR	ST5691671310	21/03/2014	3
127	40503	high_ground	Natural Bank	256.41	right	8.42	+/->75cm	8.54	+/->75cm	DNR	DNR	ST5690871197	21/03/2014	3
128	40750	high_ground	Natural Bank	125.49	left	8.42	+/->75cm	8.54	+/->75cm	DNR	DNR	ST5690571200	21/03/2014	3
131	125829	high_ground	Natural	809.47	left	0.00	No Data	0.00	No Data	DNR	DNR	ST5774169557	18/03/2014	3
132	82925	high_ground	Natural	816.70	right	0.00	No Data	0.00	No Data	DNR	DNR	ST5775469551	18/03/2014	3
141	1915	high_ground	Natural Bank	80.78	right	14.64	+/->75cm	14.49	+/->75cm	DNR	DNR	ST5554670416	11/02/2015	3
143	78046	high_ground	Natural Bank	1129.13	left	15.51	+/->75cm	28.55	+/->75cm	DNR	DNR	ST5602170007	21/03/2014	3
144	78379	high_ground	Natural Bank	1174.21	right	15.78	+/->75cm	27.50	+/->75cm	DNR	DNR	ST5602770007	21/03/2014	3
145	40240	high_ground	Embankment	322.18	right	11.32	+/->75cm	12.03	+/->75cm	DNR	DNR	ST5605270945	11/02/2015	3
146	57186	high_ground	Natural Bank	190.96	left	13.02	+/->75cm	15.41	+/->75cm	DNR	DNR	ST5601870041	21/03/2014	3
147	1953	high_ground	Natural Bank	188.96	right	13.02	+/->75cm	15.41	+/->75cm	DNR	DNR	ST5602570042	21/03/2014	3
148	1796	high_ground	Natural Bank	108.06	right	0.00	No Data	0.00	No Data	DNR	DNR	ST5614970994	11/02/2015	3
149	1997	high_ground	Concrete Lined Bank	117.53	left	8.89	+/->75cm	9.56	+/->75cm	DNR	DNR	ST5605370404	11/03/2014	3
151	40505	high_ground	Natural Bank	499.66	left	7.68	+/->75cm	8.89	+/->75cm	DNR	DNR	ST5606270521	11/03/2014	3
152	57185	high_ground	Natural Bank	503.70	right	8.44	+/->75cm	8.90	+/->75cm	DNR	DNR	ST5606770521	11/03/2014	3
153	131638	high_ground	REGRADED BANK	418.35	left	9.18	+/->75cm	7.34	+/->75cm	DNR	DNR	ST5672772157	06/03/2014	3
154	73714	high_ground	Drydock	350.57	left	0.00	No Data	0.00	No Data	DNR	DNR	ST5771872438	03/11/2014	3
155	73713	high_ground	Sheet piling walled channel	283.83	left	0.00	No Data	0.00	No Data	DNR	DNR	ST5760972321	03/11/2014	3
156	73645	high_ground	Walled channel	353.87	right	0.00	No Data	0.00	No Data	DNR	DNR	ST5722972319	03/11/2014	3
157	73912	high_ground	Walled channel	402.15	right	0.00	No Data	0.00	No Data	DNR	DNR	ST5673372478	03/11/2014	3
158	73712	high_ground	Harbour wall and slipway	83.38	left	0.00	No Data	0.00	No Data	DNR	DNR	ST5756972376	03/11/2014	3
159	134972	high_ground	Sheet pile wall	19.78	right	0.00	No Data	0.00	No Data	DNR	DNR	ST5721072320	03/11/2014	3
160	1948	high_ground	MASONRY WALL	467.68	right	7.53	+/->75cm	7.83	+/->75cm	DNR	DNR	ST5673172333	06/03/2014	3
161	73913	high_ground	Walled channel	67.96	right	0.00	No Data	0.00	No Data	DNR	DNR	ST5680172346	03/11/2014	3
162	129472	high_ground	Walled channel	194.34	left	0.00	No Data	0.00	No Data	DNR	DNR	ST5672072463	03/11/2014	3
163	144601	high_ground	Walled channel	132.21	right	0.00	No Data	0.00	No Data	DNR	DNR	ST5733772352	03/11/2014	3
164	134969	high_ground	Walled channel/bund	250.85	right	0.00	No Data	0.00	No Data	DNR	DNR	ST5788472508	03/11/2014	3
165	73910	high_ground	Walled channel and Drydock	271.53	left	0.00	No Data	0.00	No Data	DNR	DNR	ST5771872438	03/11/2014	3
166	144602	high_ground	Harbour wall	39.29	right	0.00	No Data	0.00	No Data	DNR	DNR	ST5745572406	03/11/2014	3
167	134807	high_ground	Walled channel	251.08	right	0.00	No Data	0.00	No Data	DNR	DNR	ST5748972426	03/11/2014	3

168	134808	high_ground	Walled channel	169.17	right	0.00	No Data	0.00	No Data	DNR	DNR	ST5772272519	03/11/2014	3
169	1947	high_ground	MASONRY WALL	463.70	left	8.80	+/->75cm	9.18	+/->75cm	DNR	DNR	ST5660072518	06/03/2014	3
170	2184	high_ground	COMPLEX WALL (MASONRY/CONCRETE)	1030.16	right	11.58	+/->75cm	7.96	+/->75cm	DNR	DNR	ST5666072561	06/03/2014	3
4	10451	simple_culvert	Culverted Channel	305.74		DNR	DNR	DNR	DNR	DNR	DNR	ST5821768119	14/03/2014	3
5	10235	simple_culvert	Culverted Channel	10.48		DNR	DNR	DNR	DNR	DNR	DNR	ST5850968386	14/03/2014	3
6	147516	simple_culvert	Culverted Channel	298.19		DNR	DNR	DNR	DNR	DNR	DNR	ST5850168391	14/03/2014	3
7	147515	simple_culvert	Short length under Hengrove Way	50.09		DNR	DNR	DNR	DNR	DNR	DNR	ST5827668418	14/03/2014	3
8	147514	simple_culvert	Culverted Channel	16.00		DNR	DNR	DNR	DNR	DNR	DNR	ST5827968468	14/03/2014	3
10	155133	simple_culvert	Culvert	59.66		DNR	DNR	DNR	DNR	DNR	DNR	ST5819869135	14/03/2014	3
12	154721	simple_culvert	Culverted Channel	43.77		DNR	DNR	DNR	DNR	DNR	DNR	ST5807269851	18/03/2014	3
14	154723	simple_culvert	Culverted Channel	63.67		DNR	DNR	DNR	DNR	DNR	DNR	ST5848770986	18/03/2014	3
16	153734	simple_culvert	Culvert	1247.65		DNR	DNR	DNR	DNR	DNR	DNR	ST5847171053	14/03/2014	3
17	130713	simple_culvert	Twin culvert under railway	34.37		DNR	DNR	DNR	DNR	DNR	DNR	ST5865271301	18/03/2014	3
19	130708	simple_culvert	Culverted Channel	188.26		DNR	DNR	DNR	DNR	DNR	DNR	ST5869171383	18/03/2014	3
21	130710	simple_culvert	Culvert	14.50		DNR	DNR	DNR	DNR	DNR	DNR	ST5878171591	18/03/2014	3
23	130707	simple_culvert	Culverted Channel	528.04		DNR	DNR	DNR	DNR	DNR	DNR	ST5871471627	18/03/2014	3
30	39915	simple_culvert	Culvert	1053.08		DNR	DNR	DNR	DNR	DNR	DNR	ST5915373210	15/05/2012	3
31	57219	simple_culvert	Ashton Vale Relief Culvert	933.00		DNR	DNR	DNR	DNR	DNR	DNR	ST5653771292	11/02/2015	3
33	40749	simple_culvert	Culvert	547.80		DNR	DNR	DNR	DNR	DNR	DNR	ST5683571494	21/03/2014	3
42	2236	simple_culvert	Culvert	129.58		DNR	DNR	DNR	DNR	DNR	DNR	ST5679271128	21/03/2014	3
44	117561	simple_culvert	Culverted channel	266.54		DNR	DNR	DNR	DNR	DNR	DNR	ST5714768383	18/03/2014	3
46	117558	simple_culvert	Culverted channel	61.52		DNR	DNR	DNR	DNR	DNR	DNR	ST5723769009	18/03/2014	3
48	117560	simple_culvert	Culverted channel	56.06		DNR	DNR	DNR	DNR	DNR	DNR	ST5734768553	12/06/2013	3
49	127019	simple_culvert	Culvert	324.23		DNR	DNR	DNR	DNR	DNR	DNR	ST5774569552	18/03/2014	3
51	156024	simple_culvert	Culverted Channel	26.66		DNR	DNR	DNR	DNR	DNR	DNR	ST5802069805	18/03/2014	3
54	5267	simple_culvert	Culvert	65.75		DNR	DNR	DNR	DNR	DNR	DNR	ST5518570414	26/01/2015	3

Notes

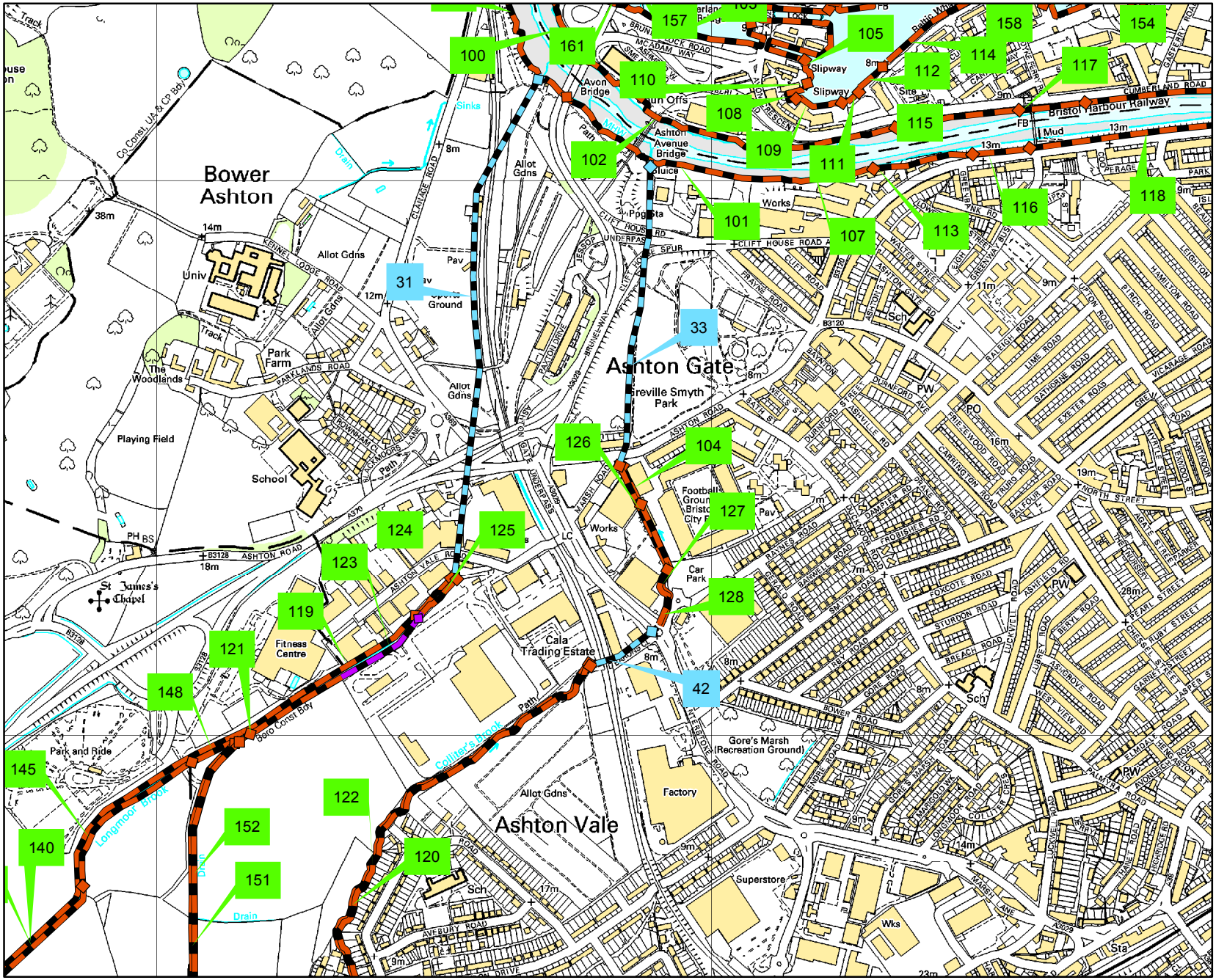
*** Overall Condition has been taken from the most recent inspection**

*** Inspections are of a purely visual nature and do not necessarily reflect the true condition of the asset**

*** Condition 1 = very good, condition 2 = good, condition 3 = fair, condition 4 = poor, condition 5 = very poor**

DNR = data not recorded

Current flood defences centred on the Bristol Metro site, created 02/03/2015 REF; WX/0411 Map one



Environment Agency

Scale: 1:10,000

N W E S

Legend

Channels

ASSET_TYPE

- open_channel
- simple_culvert

Defences

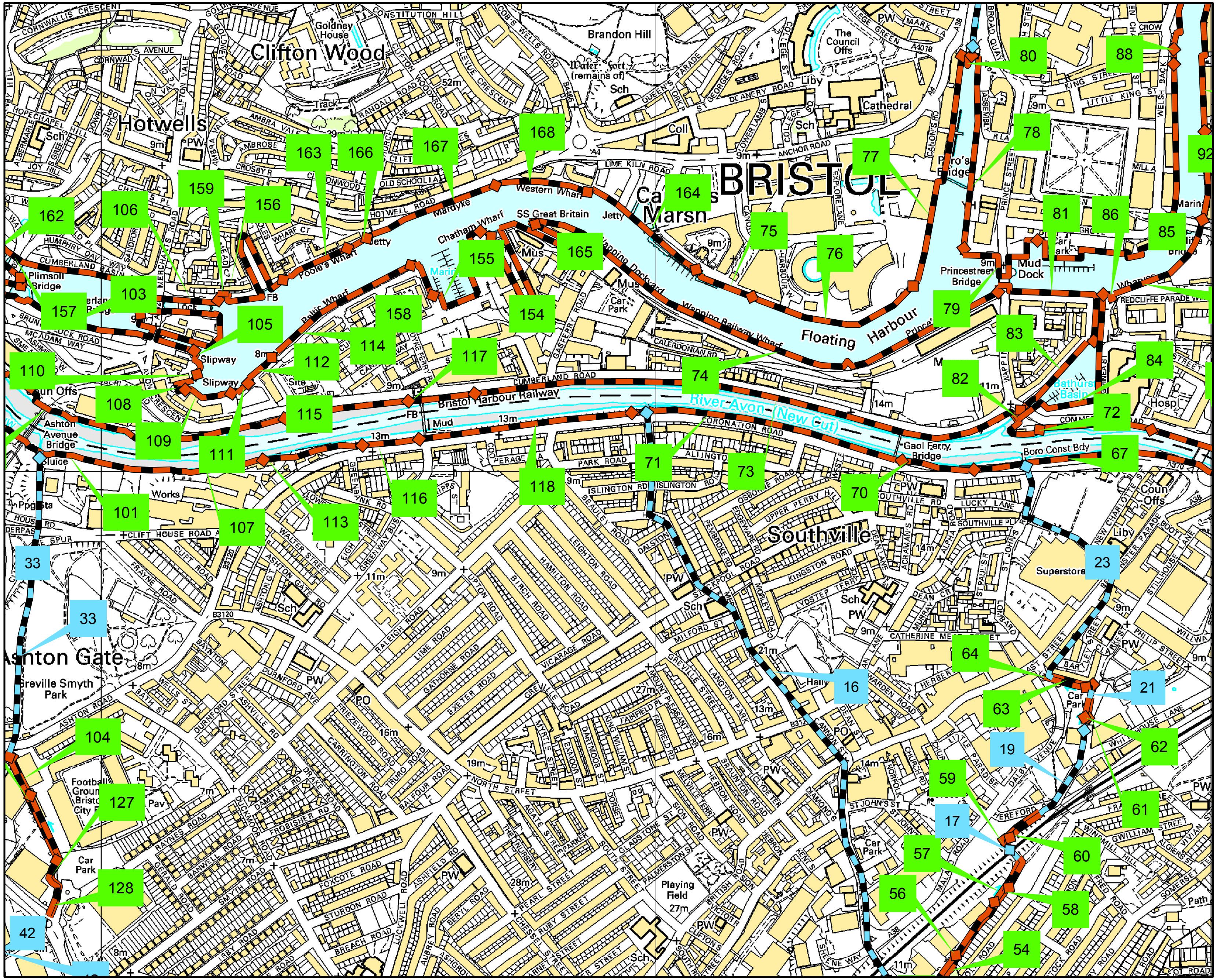
ASSET_TYPE

- bridge_abutment
- barrier_beach
- cliff
- demountable
- embankment
- flood_gate
- high_ground
- promenade
- quay
- wall
- beach
- dunes

This data has been extracted from the Asset Information Management System (AIMS) which was created to draw various data sources into one database and has been populated with information of varying quality.

Contact Us: National Customer Contact Centre, PO Box 544, Rotherham, S60 1BY. Tel: 08708 506 506 (Mon-Fri 8-6). Email: enquiries@environment-agency.gov.uk

Current flood defences centred on the Bristol Metro site, created 02/03/2015 REF; WX/0411 Map two



Scale: 1:10,000

N
W E
S

Legend

Channels

ASSET_TYPE

- open_channel
- simple_culvert

Defences

ASSET_TYPE

- bridge_abutment
- barrier_beach
- cliff
- demountable
- embankment
- flood_gate
- high_ground
- promenade
- quay
- wall
- beach
- dunes

This data has been extracted from the Asset Information Management System (AIMS) which was created to draw various data sources into one database and has been populated with information of varying quality.

Contact Us: National Customer Contact Centre, PO Box 544, Rotherham, S60 1BY. Tel: 08708 506 506 (Mon-Fri 8-6). Email: enquiries@environment-agency.gov.uk