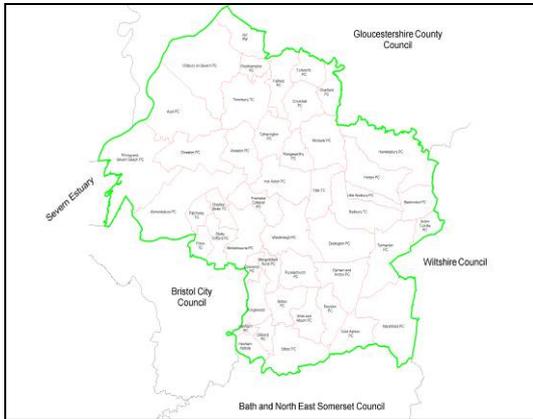
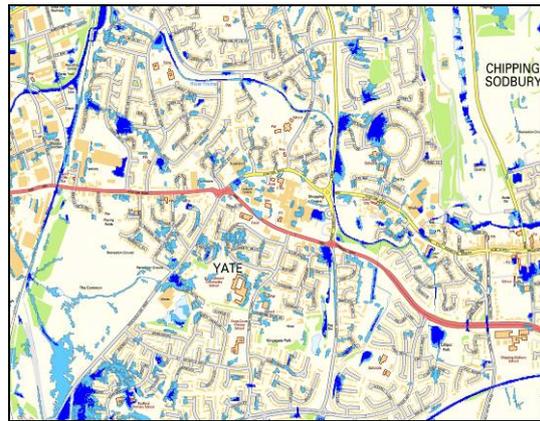


South Gloucestershire Council

Preliminary Flood Risk Assessment

Final Report V03 August 2011



Revision Schedule

Preliminary Flood Risk Assessment June 2011

Rev	Date	Details	Prepared by	Reviewed by	Approved
01	June 2011	Draft Report (for initial internal and external consultation)	<p>Nigel Hale Senior Engineer (Drainage), Street Care, SGC</p> <p>Ryan Perry Drainage Engineer, Street Care, SGC</p> <p>Robin Levenston Planning Assistant, Spatial Plans Team, SGC</p> <p>Barry Spaul GIS Officer Corporate IT,SGC</p>	<p>Paul King Technical Specialist Bristol Asset System Management Team, EA</p>	Comments and recommendations
02	June 2011	Draft Report (for final internal and external consultation)	<p>Nigel Hale Senior Engineer (Drainage), Street Care, SGC</p> <p>Ryan Perry Drainage Engineer, Street Care, SGC</p> <p>Robin Levenston Planning Assistant, Spatial Plans Team, SGC</p> <p>Barry Spaul GIS Officer Corporate IT,SGC</p>	<p>Mark King Head of Street Care, Community Service Directorate</p>	Internal Approval (Officer sign off)
03	August 2011	Final Report (SGC Executive Member approval)	<p>Nigel Hale Senior Engineer (Drainage), Street Care, SGC</p> <p>Ryan Perry Drainage Engineer, Street Care, SGC</p> <p>Robin Levenston Planning Assistant, Spatial Plans Team, SGC</p> <p>Barry Spaul GIS Officer Corporate IT,SGC</p>	<p>Cllr James Hunt Executive Member for Communities</p>	Internal Approval (SGC Executive Member)

Executive Summary

This report has been prepared to assist South Gloucestershire Council (SGC) meet its duty to manage local flood risk and deliver the requirements of the Flood Risk Regulations 2009. SGC, defined as a Lead Local Flood Authority (LLFA) under the Regulations, is a single tier authority supported by 39 parish and 7 town councils.

The report represents the first stage of the requirements of the Regulations and is to be completed and submitted to the Environment Agency for review by 22 June 2011. The aim of the Preliminary Flood Risk Assessment process is to provide a high level overview of flood risk, both past (historic) and future (potential), from local sources including surface water, groundwater, ordinary watercourses and canals, as necessary. The methodology for producing the PFRA is based on the Environment Agency's Preliminary Flood Risk Assessment Final Guidance and Defra's Guidance on Selecting and Reviewing Flood Risk Areas for Local Sources of Flooding, both published in December 2010.

The Environment Agency has used national criteria, set by Defra, to identify Flood Risk Areas across England. Ten indicative Flood Risk Areas have been identified nationally that have more than 30,000 people at risk of flooding based on the Flood Map for Surface Water dataset produced by the Environment Agency. From examination of the datasets provided by the EA it has been verified that South Gloucestershire Council does not have an indicative Flood Risk Area. However the adjoining authority, Bristol City Council, does have an indicative Flood Risk Area ranking it fifth highest cluster group of flooding within England. This indicative FRA overlaps into the southern boundary of this district.

In order to determine the historic flood risk within SGC this Council, further to initiating a partnership forum, compiled and analysed historic flood data obtained from within the authority and from external partners. This information revealed only a very few locally significant harmful consequence flood incident sites. Although these sites are recorded in the report all are known to have been the subject of flood alleviation measures, therefore none were considered to be eligible for inclusion in the report spreadsheet annex 1.

An assessment of the future flood risk to a number of defined receptors was undertaken using the Flood Map for Surface Water (FMfSW) as the locally agreed surface water information. This revealed local flood risk areas that will need to become the subject of further examination through the future local flood risk management strategy. In terms of residential property within this study area a detailed count has calculated approximately 17421 people are estimated to be at risk of flooding to a depth of 0.3 metres during a rainfall event with a 1:200 (0.5%) annual chance of occurrence (FMfSW 1:200 deep). This assessment is based on residential properties affected.

The report highlights that SGC has in place within its Adverse Weather Plan a Flood Specific Plan (FSP) to address known flooding hotspots. This FSP will be reviewed by reference to the locally agreed FMfSW dataset and modified, as necessary, further to local and partner consultation.

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Abbreviations

Abbreviation	Definition
ASStSWF	Areas Susceptible to Surface Water Flooding
ASStGWF	Areas Susceptible to Groundwater Flooding
Defra	Department for Environment, Food and Rural Affairs
CFMP	Catchment Flood Management Plan
CRS	Customer Response Systems
EA	Environment Agency
EC	European Commission
FRIS	Flood Reconnaissance Information System
FMfSW	Flood Map for Surface Water
FWMA	Flood and Water Management Act 2010
GIS	Geographical Information Systems
LSIDB	Lower Severn Internal Drainage Board
LLFA	Lead Local Flood Authority
LPA	Local Planning Authority
NRD	National Receptor Dataset
PPS25	Planning and Policy Statement 25: Development and Flood Risk
PFRA	Preliminary Flood Risk Assessment
RFDC	Regional Flood Defence Committee
SAB	SuDS Approving Body
SAC	Special Areas of Conservation
SFRA	Strategic Flood Risk Assessment
SGC	South Gloucestershire Council
SPA	Special Protection Areas
SSSI	Site of Special Scientific Interest
SuDS	Sustainable Drainage Systems
WAG	Welsh Assembly Government

1 INTRODUCTION

1.1 Preliminary Flood Risk Assessment

This report document has been compiled based on research by South Gloucestershire Council (SGC) towards the preparation of a Preliminary Flood Risk Assessment (PFRA) for its administrative area.

The chief drivers behind this research and preparation of the PFRA report are two sets of new legislation; the Flood Risk Regulations (The Regulations), which came into force on 10 December 2009 and the Flood and Water Management Act (FWMA) which gained Royal Assent on 8 April 2010. Under these pieces of legislation all unitary authorities, including South Gloucestershire Council, and all county councils are designated a Lead Local Flood Authority (LLFA) and have formally been allocated a number of key responsibilities with respect to local flood risk management. A full description of these responsibilities is provided within Section 2.

The purpose of the Regulations was to transpose the EC Floods (Directive 2007/60/EC) into domestic law in England and Wales and to implement its provisions. In particular it places duties on the Environment Agency and LLFAs to prepare a number of documents including:

- Preliminary Flood Risk Assessments;
- Flood Hazard and Flood Risk Maps;
- Flood Risk Management Plans.

Figure 1 is an excerpt from the Flood Risk Regulations 2009. This requires, under Part 2, 10(1), each LLFA to prepare a PFRA report in relation to flooding in its area.

Part 2
Preliminary Flood Risk Assessments

Duty to prepare preliminary assessment maps and reports: Environment Agency

9.—(1) The Environment Agency must prepare in relation to each river basin district—

- (a) a preliminary assessment map, and
- (b) a preliminary assessment report in relation to flooding from—
 - (i) the sea,
 - (ii) main rivers, and
 - (iii) reservoirs.

(2) This regulation is subject to regulations 31 and 32.

Duty to prepare preliminary assessment reports: lead local flood authorities

10.—(1) A lead local flood authority must prepare a preliminary assessment report in relation to flooding in its area.

(2) A lead local authority is not required to include in its report information about flooding from a source mentioned in regulation 9(1)(b) unless the authority thinks that it may affect flooding from another source.

(3) The Environment Agency—

- (a) must review a preliminary assessment report prepared under this regulation, and
- (b) may recommend modifications.

(4) Following a review, a lead local flood authority may revise its preliminary assessment report.

(5) The Agency's power to require information under regulation 36 includes power to require a lead local flood authority to provide a preliminary assessment report by a specified date.

(6) This regulation is subject to regulations 33 and 34.

Figure 1 - Excerpt from Flood Risk Regulations 2009 relating to the production of a PFRA.

Table 1 indicates the elements of work required to be undertaken by South Gloucestershire Council under the Flood Risk Regulations 2009, along with the timescales for their respective delivery. The first two elements are covered by the preparation of this PFRA report. The third and fourth elements of work will not be required to be undertaken by SGC as it has no Flood Risk Areas (FRAs) that meet the national criteria of 30,000 people at risk of flooding within a defined cluster area (further explanation in Section 6).

22 June 2011	Prepare Preliminary Assessment Report	<i>The PFRA should focus on local flood risk from surface water, ground water, ordinary watercourses and canals.</i>
22 June 2011	On the basis of the PFRA, identify and/or review Flood Risk Areas	<i>Flood risk areas are areas of significant risk identified on the basis of the findings of the PFRA, national criteria set by the UK Government Secretary of State and guidance provided by the Environment Agency.</i>
22 June 2013	Prepare Flood Hazard Maps and Flood Risk Maps for each Flood Risk Area	Used to identify the level of hazard and risk of flooding within each Flood Risk Area to inform flood Risk Management Plans
22 June 2015	Prepare Flood Risk Management Plans for each Flood Risk Area	Plans setting out risk management objectives and strategies for each Flood Risk Area

Table 1 - Elements of work required under the Flood Risk Regulations 2009

The data gathered by this PFRA report preparation, both for historic and potential flooding, will also feed into SGC's Local Flood Risk Management Strategy which is the next stage of legislation to progress. This is a separate FWMA requirement on LLFAs and should be progressed further to publication of the national Flood and Coastal Erosion Risk Management Strategy for England by the Environment Agency. (Consultation being published by April 2011).

1.2 Scope of PFRA Report

Under the Regulations (refer to Figure 1) the Environment Agency (EA) has a duty to assess flood risk from:

The Sea
Main Rivers
Reservoirs

LLFAs are responsible for preparing a PFRA report for other local sources of flooding. This is to include flood risk from:

Surface Run-Off: 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, drainage system or public sewer. Flooding from surface run-off is sometimes called pluvial flooding. The term surface water is used generically to refer to water on the surface.

Ordinary Watercourses: This is any river, stream, ditch, cut, sluice, dyke or non public sewer which is not a main river. This will also include rhine and culverted watercourse.

Groundwater: Water which is below the surface of the ground and in direct contact with the ground or subsoil. It is most likely to occur in areas underlain by permeable rocks, called aquifers. These can be extensive, regional aquifers, such as chalk or sandstone, or may be more local sand or river gravels in valley bottoms underlain by less permeable rocks.

Flood risk from canals is also to be considered by the LLFAs, though there are none within this study area.

Reference to Figure 1, the Regulations indicate that the LLFA is only to include in its report information about the sea, main rivers or reservoirs if this is believed to affect flooding from another source.

1.3 Aim and Objective

The aim of the PFRA is to:

- Undertake a high level screening exercise to gather and assess information on past (historic) and future (potential) floods.
- Identify areas of significant local flood risk within the PFRA study area (where there are locally significant harmful consequences).
- Allow the national surface water flood risk model, issued by the EA, to be verified and challenged if appropriate. National guidance issued by Defra sets national thresholds for defining areas where the flood is significant nationally.
- Provide an evidence base to support the future Local Flood Risk Management Strategy, to be prepared by each LLFA.

The objective will be achieved by completion of the 9 key tasks in the PFRA process as listed below:

1. Establish partnership with external agencies and organisations and information sharing.
2. Collect information on past flooding from partners and available internally.
3. Assess significant flood events for historic flooding based on agreed thresholds.
4. Collect information on future flooding. Local flood modelling or agree to use a national surface water flooding dataset.
5. Estimate consequences of flood events. Based on selected surface water flooding dataset, undertake a count on the number of receptors within a flood outline.
6. Review indicative Flood Risk Areas as determined by the EA for agreement or challenge if a national receptor threshold is exceeded.
7. Compile the Preliminary Assessment Report.
8. Compile the Preliminary Assessment Spreadsheet.
9. Submit to the Environment Agency for approval.

1.4 Study area of South Gloucestershire Council

The unitary authority of South Gloucestershire Council was formed under local government re-organisation in 1996. It merged a district council (Northavon District Council), a borough council (Kingswood Borough Council) and the northern sector of the former Avon County Council.

With a total land area of 497 sq km, South Gloucestershire is the largest unitary authority of the ten in the South West stretching from the Severn Estuary in the west to the Cotswolds Area of Outstanding Natural Beauty (AONB) in the east. Its southern boundary borders Bristol City Council, abuts the River Avon and extends almost to Bath and North East Somerset Council. Both the first and second crossing of the River Severn lie within South Gloucestershire and the area is well served by both motorway and rail links. The district has a rich, natural and cultural heritage and is an area of diversity and contrast with a variety of communities, characterised by the special relationship between town and country. Attractive and historic landscapes link unspoilt market towns, villages and established rural and urban communities with major new residential areas, industrial and commercial developments.

The population of South Gloucestershire is 256,516 (Office of National Statistics 2007 mid year estimate). Much of the population is concentrated in the expanding northern and eastern urban fringe areas of Bristol. Yate/Chipping Sodbury and Thornbury are the largest freestanding settlements with populations of 35,000 and 14,000 respectively. There are approximately 107,000 households in South Gloucestershire.

Four motorways, namely M32, M4, M5 and M48 are routed through South Gloucestershire. Also national railway networks traverse the district from east to west and north to south.

The local watercourse and catchment areas; tidal areas; topography and geology are all described in the Level 1 Strategic Flood Risk Assessment report prepared for South Gloucestershire dated February 2009.

The PFRA for SGC falls within the region of the Severn River Basin District. There are over 80km of main river within the study area.

Within South Gloucestershire are 39 parish and 7 town councils of varying size and operational base. These are indicated within Figure 2.

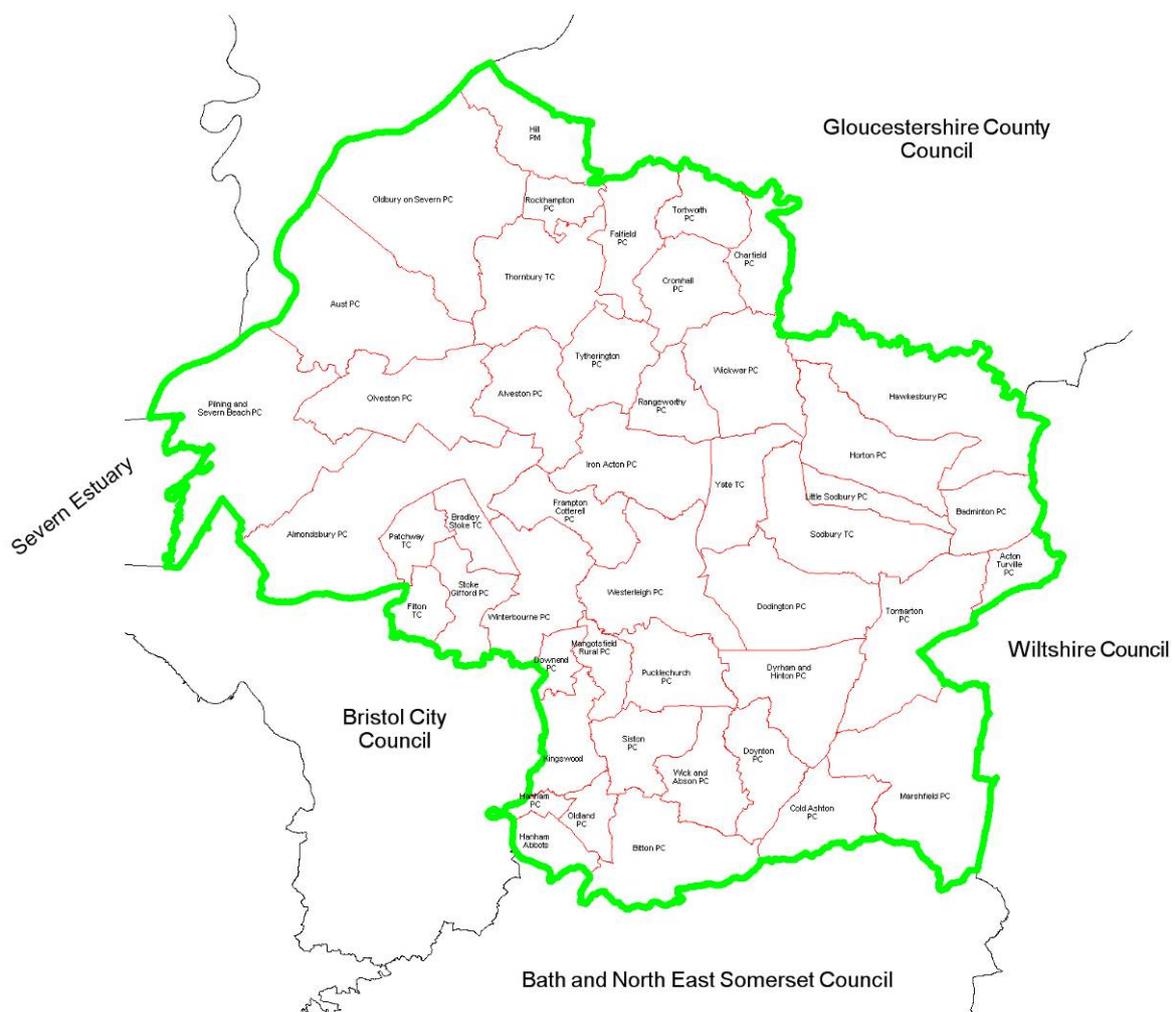
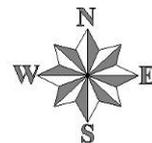


Figure 2

Legend

- █ South Gloucestershire Council Boundary
- █ Parish and Town Council Boundaries



Street Care
 PO Box 20, Castle Street, Thornbury
 South Gloucestershire. BS35 9BJ
 Telephone: 01454 86 3509

**South Gloucestershire Council
 Preliminary Flood Risk Assessment**

**Parish and Town Council
 Boundaries**

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The council has in place 5 area forums to consider decisions at a local level and to ensure public meeting involvement. These area forums cover groups of electoral wards and are as illustrated in Figure 3.

From a public highway and public open space management and maintenance perspective, SGC has split the district into 2 operational areas (north and south). This is also indicated within Figure 3.

The district of South Gloucestershire is served by a single sewerage company, namely Wessex Water PLC. Also, the Lower Severn Internal Drainage Board operates within the district to manage the rhine drainage system below the 10.0m AOD level.

The Environment Agency is the land drainage authority for main river activity. Whereas the LSIDB is the drainage authority within their area and South Gloucestershire Council is the land drainage authority for ordinary watercourses external to the IDB area. Refer to Figure 4.

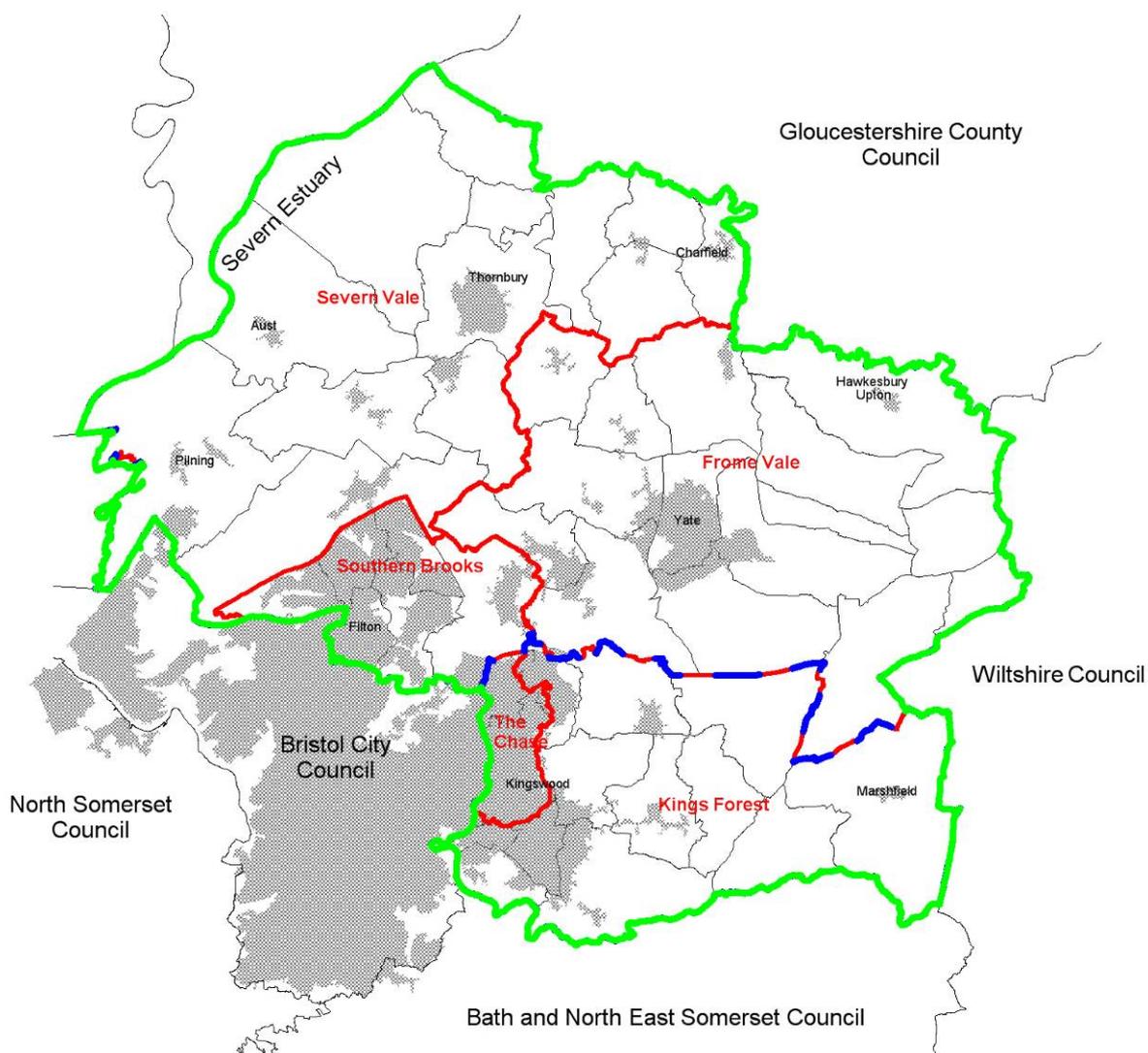
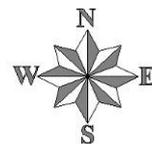


Figure 3

<p>Legend</p> <ul style="list-style-type: none"> — South Gloucestershire Council Boundary — Area Forum Consultation Boundaries — Operational Boundary 	 <p>Street Care PO Box 20, Castle Street, Thornbury South Gloucestershire, BS35 9BJ Telephone: 01454 86 3509</p>	<p>South Gloucestershire Council Preliminary Flood Risk Assessment</p> <p>Consultation Area Forums and StreetCare Maintenance Operation Boundary</p> <p><small>© Crown copyright and database rights [2011] Ordnance Survey [100023410]</small></p>
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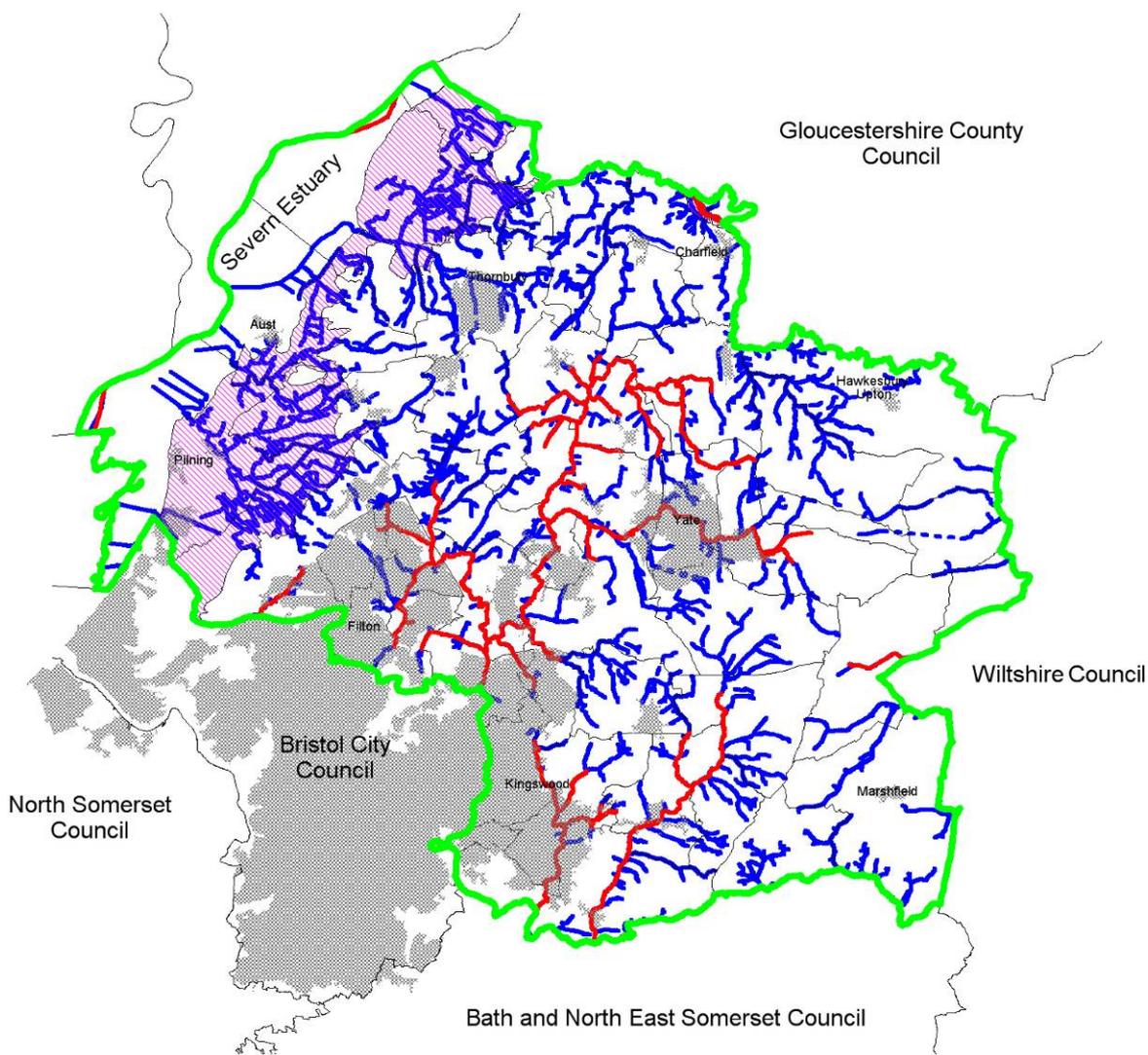
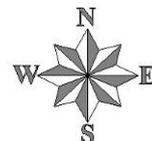


Figure 4

<p>Legend</p> <ul style="list-style-type: none"> — South Gloucestershire Council Boundary — Main Rivers — Ordinary Watercourses Lower Severn IDB area (< 10m AOD) 	 <p>Street Care PO Box 20, Castle Street, Thornbury South Gloucestershire. BS35 9BJ Telephone: 01454 86 3509</p>	<p>South Gloucestershire Council Preliminary Flood Risk Assessment</p> <p>Main Rivers and Ordinary Watercourses</p> <p><small>© Crown copyright and database rights [2011] Ordnance Survey [100023410]</small></p>
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2. LEAD LOCAL FLOOD AUTHORITY RESPONSIBILITIES

2.1 SGC Governance and Partnership Arrangements

SGC formed an internal officer Pitt Working Group in 2009. The lead officer appointed and notified to the Environment Agency was Mark King, Head of Street Care (Community Services Directorate).

Further to this a flood and drainage partnership inception meeting was convened by this authority in June 2010 to give notification of both the council's role under the Regulations and the anticipated sharing of flood related information.

Attendance at this meeting included representatives of the following organisations and groups:

Lower Severn Internal Drainage Board (LSIDB)
Highways Agency (HA)
Wessex Water PLC (WW)
Environment Agency (EA)
SGC Emergency Planning Unit
SGC Spatial Planning Team
SGC Street Care Unit

Prior to this new legislation, SGC has over recent years co-ordinated closely with the LSIDB, WW and the EA to progress surface water and land drainage issues. There has also been collaborative working with WW on a number of recent surface water drainage projects with SGC, as the highway authority, contributing financially towards 2 WW flood alleviation schemes to provide community safeguard.

SGC's Highway Asset Team has also recently commenced working in partnership with Wessex Water enabling the council's highway drainage asset records to be electronically digitised. Ancillary to this, WW have received additional private drainage network data. This mutually beneficial partnership is ongoing.

Figure 5 shows the current communication and liaison arrangements for South Gloucestershire Council and its partners relating to all aspects of drainage and flooding.

South Gloucestershire Council Drainage And Flood Management Structure



Figure 5 - SGC drainage and flood management structure

2.2 New Legislation

The production of a PFRA is the first of a number of new key responsibilities given to LLFAs under the new legislation. Other responsibilities that have arisen from the Regulations and the FWMA include:

- **Investigating flood incidents** – LLFAs have a duty to investigate and record details of significant flood events within their area. This duty includes identifying which authorities have flood risk management functions and what they have done or intend to do with respect to the incident, notifying risk management authorities where necessary and publishing the results of any investigations carried out.
- **Asset Register** – LLFAs also have a duty to maintain a register of structures or features which are considered to have an effect on flood risk, including details on ownership and condition as a minimum. The register must be available for inspection and the Secretary of State will be able to make regulations about the content of the register and records.
- **SuDS Approving Body** – LLFAs are designated the SuDS Approving Body (SAB) for any new drainage system, and therefore must approve, adopt and maintain any new sustainable drainage systems (SuDS) within their area.
- **Local Strategy for Flood Risk Management** – LLFAs are required to develop, maintain, apply and monitor a local strategy for flood risk management in its area. The local strategy will build upon information such as national risk assessments and will use consistent risk based approaches across different local authority areas and catchments.
- **Works powers** – LLFAs have powers to undertake works to manage flood risk from surface runoff and groundwater, consistent with the local flood risk management strategy for the area.
- **Designation powers** – LLFAs, as well as district councils and the Environment Agency have powers to designate structures and features that affect flooding or coastal erosion in order to safeguard assets that are relied upon for flood or coastal erosion risk management.
- **Consenting for ordinary watercourses** – LLFAs will take over this consenting role on ordinary watercourses from the Environment Agency. The EA will retain an overview role.

2.3 Communication with Partners and the Public

In order to gather historic flood data, communication has taken place with the following bodies:

Parish and town councils
Highways Agency
Lower Severn Internal Drainage Board
Wessex Water PLC
SGC Emergency Planning Unit
Environment Agency

Due to the high level of this report and the flood data previously gathered on behalf of this council (refer to Section 3 Methodology and Data Review), it was determined that the parish and town council consultation would suffice for public engagement. It is certainly anticipated that public engagement will occur when concluding SGC's future Local Flood Risk Management Strategy. The LFRMS will be advertised on the council's website and at the Area Forum meetings. Also parish and town councils will be further consulted.

Also, as consultation with both the Fire Brigade and Network Rail had taken place in order to draft SGC's Level 1 SFRA in 2009 a repeat data request was considered unwarranted.

3 METHODOLOGY AND DATA REVIEW

3.1 Introduction

The PFRA is a high-level screening exercise used to identify areas where the risk of flooding is considered to be significant and warrants further examination and management through the production of flood risk and flood hazard maps and flood risk management plans (Refer to Table 1).

The approach for producing the PFRA was based upon the Environment Agency's Preliminary Flood Risk Assessment Final Guidance (Report GEH01210BTGH-E-E), which was released in December 2010. The PFRA is based on readily available or derivable data and with this in mind the following methodology has been used to undertake this exercise.

3.2 Methodology - Data collection from Partner Organisations

3.2.1 Parish and Town Councils

Email correspondence was issued to all 46 parish and town councils to obtain historic flood data and details of any known flood risk sites. These bodies contributed freely to the data collection exercise. Although, as expected, many did not possess any evidence of historic flooding affecting properties due to the elevated topography and well draining terrain within these parishes.

To-date 43 responses have been received. Of these responses 27 state that no historic data flood was available. More significantly prior to this consultation there was only one outstanding flooding issue being investigated by this council in conjunction with a parish council.

Of the replies that indicated flood locations the majority were assessed to be either as a consequence of main river flooding or local highway flooding issues of a minor nature caused by debris obstructions within ditches or over gully gratings.

A database of these responses has been compiled for record purposes and further investigation as necessary. Only one of the sites reported could be classified as locally significant (refer to 4.4 and 4.5).

3.2.2 Highways Agency

As 4 motorways traverse the study area it was considered imperative to ensure all available flooding information pertaining to this network was obtained. Further to detailed research by the HA a set of motorway flooding incidents dating between 2006-2011 was provided.

Incidents of hard shoulder and lane closures were recorded, although no information was provided to indicate a complete motorway closure within the study area due to flooding. The details of the information provided were classified as confidential.

3.2.3 Internal Drainage Board

The Lower Severn Internal Drainage Board's initial response indicated that a database of flooding events was not held, although anecdotal evidence was being provided. This verified some of the flood incidents notified by parish councils (Aust, Olveston and Pilning and Severn Beach).

3.2.4 Water Company

Wessex Water PLC provided DG5 register database information at post code level only. The recorded internal property flooding was due to combined/foul sewers. Only 2 of the reported external flooding incidents related to public surface water drainage. This council was aware of both of these incident sites having attended consultation meetings with the water and sewerage company. Both surface water flooding sites were notified by WW as being current schemes to be progressed imminently.

3.2.5 Network Rail

A previous consultation exercise was undertaken with this organisation in 2009 by consultants, Scott Wilson, in the preparation of the Level 1 Strategic Flood Risk Assessment for South Gloucestershire Council.

Six track/rail tunnel locations were identified as flooding. One location was recognised as being groundwater, the others were source unknown. There was no indication within the data provided that the track was impassable. However, this has been investigated further and SGC is presently co-ordinating with NR to ensure that critical highway culverts that receive run-off flow from main railway lines do not restrict track surface water run-off.

3.2.6 Fire Brigade

Avon Fire and Rescue Service have also been consulted previously in connection with the Level 1 SFRA. A database of 32 incidents was provided for the period from 2005. This information has been interrogated for any significant incidents.

For record, a meeting is arranged with both the Avon Fire and Rescue Service and the Environment Agency to discuss future information sharing and vulnerable flood risk sites. It is likely that the outcomes from this meeting will input to this council's future Local Flood Risk Management Strategy.

3.2.7 SGC Highway Maintenance Unit (acting as the land drainage authority)

This new unitary authority, South Gloucestershire Council, was formed under local government reorganisation in 1996. It is apparent that only limited historic flooding data was retained upon this re-organisation. The available information was in the form of paper records within land drainage files covering each of the parish and town council areas as both the former authorities, Kingwood Borough Council and Northavon District Council, acted as the land drainage authority. These files have been examined for evidence of significant flooding incidents.

3.2.8 SGC Customer Response System

This council has operated a number of customer enquiry recording systems including Customer Relationship Management (CRM), Street Care Management and Mayrise. Where possible these systems were interrogated to extract information for the most severe rainfall events during the period 2000-2011. In the order of 94 incidents were collated.

The majority of these reports related to highway drainage and road flooding issues, of a minor nature, though there was some evidence of surface water flooding of land and properties. Only a few of these were internal flooding of properties.

The incidents collated were categorised as follows:

- Highway (carriageway flooding or blocked gully) 68
- Property flooding 8
- Surface water run-off from land 7
- Ordinary watercourse flooding 7
- Main river flooding 4

3.2.9 SGC Emergency Planning Unit

An enquiry to SGC's Emergency Planning Unit revealed that the Local Resilience Forum did not hold flooding data but the member organisations may hold information. Of the member organisations, Avon Fire and Rescue Service had previously provided information. The Police authority will notify this council, as the highway authority, when there is flooding that affects the highway network, therefore consultation with the Police for the purpose of obtaining historic flooding data is unwarranted.

3.2.10 Data Provided Through LLFA Partnership

Environment Agency Datasets	Remarks
<p>Areas Susceptible to Surface Water Flooding: First generation nationally modelled surface water outlines, three surface water flood depth bands.</p> <p>Flood Map for Surface Water: Second generation nationally modelled surface water maps having allowance for infiltration and sewer flow conveyance.</p> <p>Areas Susceptible to Groundwater Flooding: 1km grid squares indicating the proportion of each grid square as a percentage which is susceptible to groundwater flooding.</p> <p>Historic Flood Map: a flood extent map of flooding from rivers sea and groundwater only.</p> <p>Flood Map: Extent of flooding from the sea and river catchments over 3kmsq. Includes: Flood defences Flood storage areas Areas benefiting from flood defences Flood zones 2 and 3 extents, from rivers and the sea.</p> <p>Flood Reconnaissance Information System (FRIS): Data collected of flood events indicating properties affected and flooding extent.</p> <p>Detailed River Network: This identifies main rivers and ordinary watercourses.</p> <p>National Receptor Dataset (NRD): This is a national dataset of social economic, environmental and cultural receptors (i.e. residential properties; non-residential properties; Pollution Prevention and Control (PCC) sites, schools, electricity sub stations, hospitals, nationally listed buildings).</p> <p>Indicative Flood Risk Areas: Nationally identified flood risk areas based on the Defra definition of 'significant' flood risk.</p> <p>Bristol Avon Catchment Flood Management Plan: Considers all types of flooding within catchment and includes a list of assets at risk within settlements from a 1.0% and 0.1% annual probability event.</p> <p>Severn Tidal Tributaries Catchment Flood Management Plan: Considers all types of flooding within catchment and includes a list of assets at risk within sub-catchments from a 1.0% and a 0.1% annual probability event.</p>	<p>Refer to Table 5 for difference between AStSWF and FMfSW.</p> <p>Refer to Figure 11</p> <p>Refer to Figure 10</p> <p>Refer to Figure 4.</p>
Wessex Water PLC	
DG5 register for internal and external flooding plus scheme programme details.	DG5 records at post code level only
Lower Severn Internal Drainage Board	
Anecdotal information on historic flooding. Also maintained rhine network dataset.	
Parish and Town Councils	
Reports of historic and recent flood incidents. Limited photographic evidence.	

Highways Agency	
Summary of drainage and flooding issues on motorway networks.	Restriction to publishing data
Data held by South Gloucestershire Council	
<p>South Gloucestershire Level 1 Strategic Flood Risk Assessment: Containing historic flooding information from the Environment Agency, Fire Brigade, Network Rail and Wessex Water.</p> <p>Archived land drainage correspondence files: Record of flooding incidents and maintenance/improvement actions.</p> <p>Highway flooding reports: Information extracted from Customer Response Systems.</p> <p>Avonmouth and Severnside Flood Risk Assessment: Recent study by consultants Capita Symonds.</p> <p>Highway structures database includes bridge and culvert details.</p> <p>Street Care Adverse Weather Incident Response Plan incorporating Flooding Specific Plan: Response plan for known flood risk sites</p> <p>Highway trash screens and grills maintenance schedule manual.</p>	

Table 2 – Data provided through LLFA partnership

3.3 Systems to Store and Share Information

Flood incident data provided by partner organisations is held within the Council's GIS data repository within a secure dedicated PFRA folder.

Sharing of some of the information supplied is subject to the authorisation of the provider and owner.

3.4 Quality Assurance, Security, Data Licensing and Restrictions

The INSPIRE Directive (2007/2/EC) is implemented in the UK by the INSPIRE Regulations 2009. Its main aim is to improve the quality, consistency and accessibility of spatial datasets and services for environmental data to ensure they can be shared and integrated seamlessly into applications with minimal manual intervention. The general principles of INSPIRE have been, where possible, adhered to within this PFRA.

A single backup of the datasets are held in a secure storage area dedicated to GIS data. A read only copy of the data is accessible to all council staff with access to the corporate mapping server unless data sensitivity dictates a secure folder with limited access to staff.

Ordnance survey map data: This Council only shares data with fellow members of the Public Sector Mapping Agreement (PSMA), contractors or end users (partners) working with or on behalf of the Council.

EA data: In most cases we only have a single site licence to view the data supplied by the EA within the Council for the work being undertaken. We adhere to the licensing restrictions applied by the EA and do not allow access to others.

This PFRA report will be placed in Street Care's Highway Asset data storage module. Updates/revisions will require to be authorised/approved at Head of Service level.

Data provided by SGC's partners for the purpose of this report will be treated as sensitive.

Data production for this report is in accordance with Annex 5 of the PFRA Guidance.

4. PAST FLOOD RISK

4.1 Summary of Past Flooding Incidents

From interrogation of SGC's customer enquiry recording system a considerable number of customer requests have been for attendance to deal with highway flooding or blocked gullies. Although it has not been possible to determine whether these incidents were caused by blockages within a positive drainage system or a system capacity issue.

Many of the recurring highway flooding problems will have been investigated by this council as the highway authority. A full time drainage investigation crew (with jetting unit) and a dedicated drainage repair gang is engaged to examine and rectify blockages or collapses found within highway drainage systems.

This council is proactive in reducing, where possible, past flood risk incidents. This is managed in the following way:

- Local flood risk management by following the procedures as set out in the council's Adverse Weather Incident Response Plan. Within this document is a Flooding Specific Plan. This plan includes a number of hotspots within areas susceptible to flooding. The sites are graded high, medium or low risk and response instructions are documented for each site.
- Programmed inspection and maintenance of trash screens and grills fitted to highway culverts and culverted watercourses within the adopted highway and public realm limits.
- Execution of an annual capital programme of drainage improvement schemes to both ensure safe use of the highway network and to provide increased local flood protection of residential and non-residential premises. These schemes are priority rated based on:
 - number of premises affected
 - severity of flooding
 - frequency of flooding
 - source of flooding.

4.2 Adverse Weather Incident Response Plan

The Flooding Specific Plan within the SGC response document includes a number of sites deemed at risk of flooding under extreme rainfall conditions. Effectively this plan is SGC's present local flood risk management strategy.

The locations recorded within this document are:

Location	Cause
Swineford Village	Flooding of River Avon
Riverside Cottages and the Chequers Inn, Hanham	Flooding of River Avon
New Street, Charfield	Flooding of River Little Avon
Severn Beach Village	Severn Estuary high tide spray overtopping
Church Road/Mill Lane, Frampton Cotterell	Flooding of River Frome
St Johns Way, Chipping Sodbury	Flooding of River Frome
Celestine Road, Yate	Flooding of River Frome
Westons Hill Drive, Emersons Green	Surface Water accumulation linked to high Flow in Folly Brook (main river)
Marsh Common, Pilning	Estuary tide locking rhine flooding
Grasmere Gardens, North Common	Flooding of North Common watercourse/culverted watercourse restriction
Aust Village	Culverted watercourse/rhine flooding

Table 3 – Flooding Specific Plan incident sites

It should be noted that all of these locations are at flood risk due to the effects of main river flooding with the exception Marsh Common and Aust Village.

4.3 Past Flooding Data

The following maps represent the flood incident data collected from partners or available to this council. This data has been interrogated to determine whether past flood events were considered to have significant harmful consequences to human health, the economy, the environment or cultural heritage (refer to section 4.4 for 'significant harmful consequence' definition).

- Figure 6: SGC Customer Response Systems data
- Figure 7: EA Flood Reconnaissance Information System and Avon Fire and Rescue Services Data
- Figure 8: Highways Agency and Network Rail incidents
- Figure 9: Wessex Water sewer flooding data (DG5)

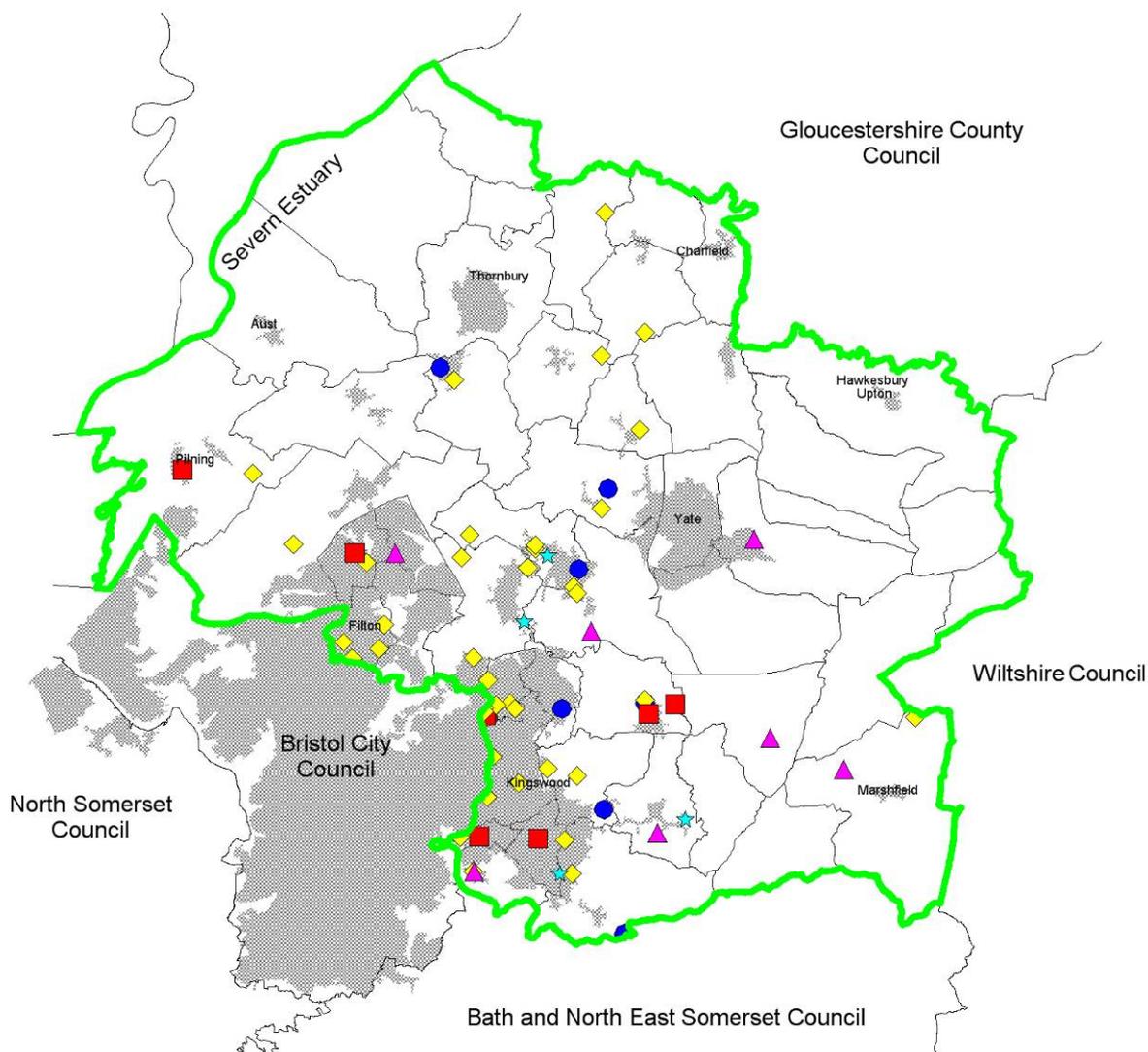
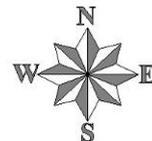


Figure 6

Legend

- South Gloucestershire Council Boundary
- ◆ Highway Flood
- Surface Water Flood
- Property Flood
- ★ River Flood
- ▲ Ordinary Watercourse Flood



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South Gloucestershire Council
 Preliminary Flood Risk Assessment

South Gloucestershire Council
 Customer Response Systems
 Data

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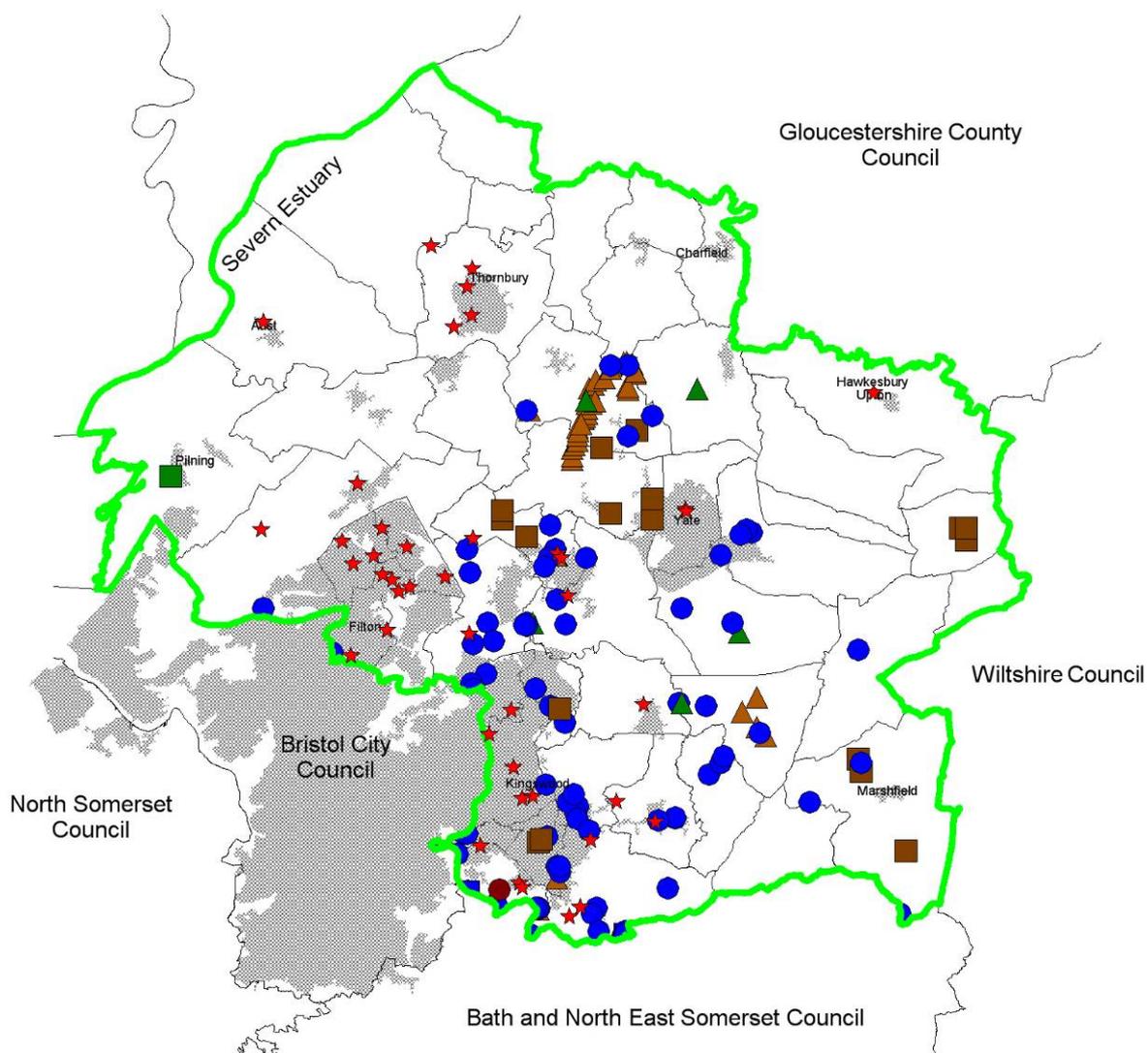
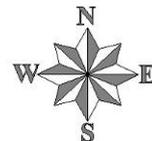


Figure 7

Legend

- Coastal
- Tidal
- Fluvial Tidal
- ▲ Fluvial Surface Water
- Fluvial
- Surface Water
- ▲ Groundwater
- Sewer
- ▲ Unknown
- ★ Avon Fire Service Flood Incidents



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**EA Flood Reconnaissance
 Information System and
 Avon Fire and Rescue
 Services Data**

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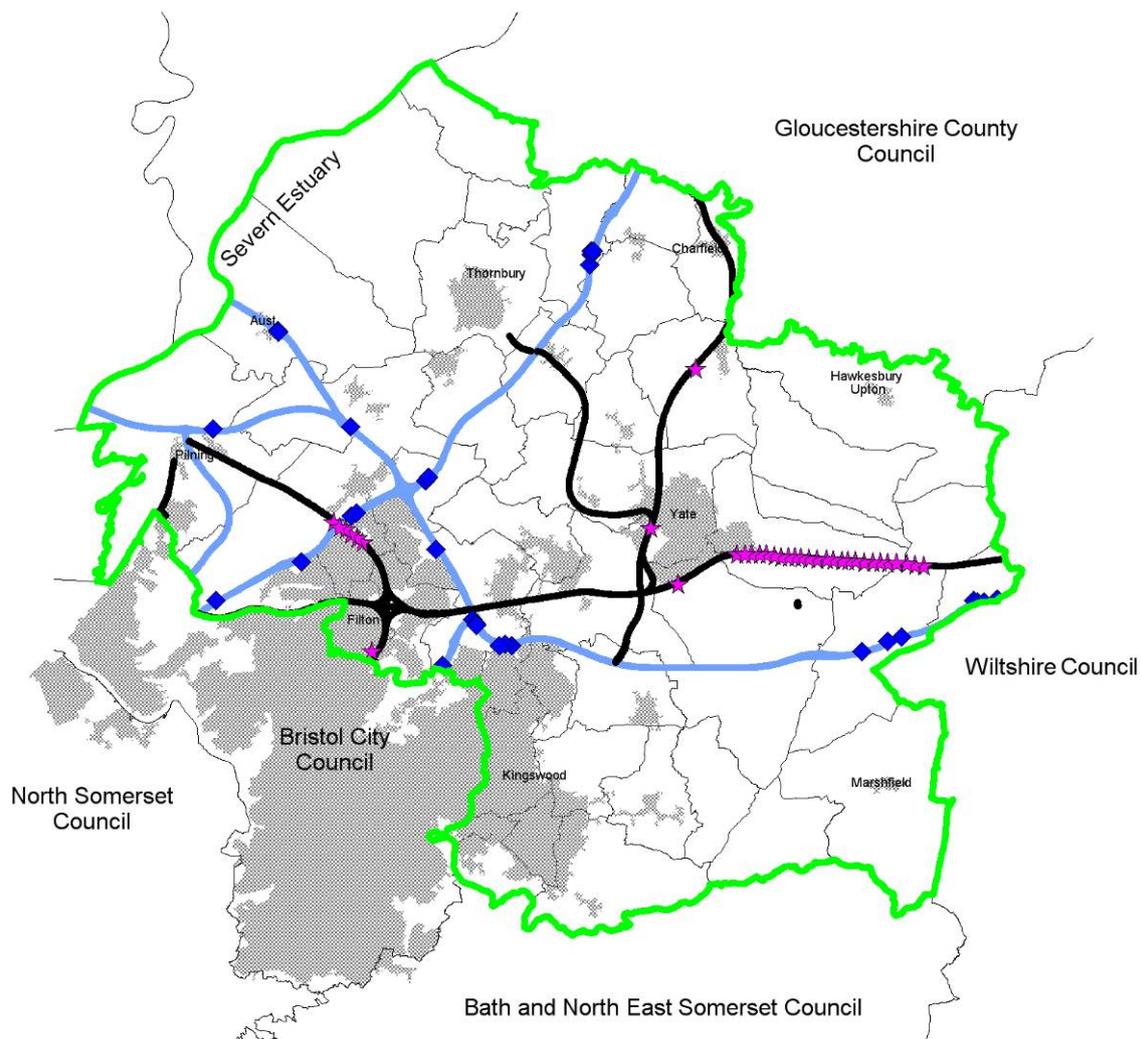
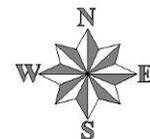


Figure 8

<p>Legend</p> <ul style="list-style-type: none"> — South Gloucestershire Council Boundary ★ Network Rail Flood incidents ◆ Highways Agency Flood incidents 	 <p>Street Care PO Box 20, Castle Street, Thornbury South Gloucestershire. BS35 9BJ Telephone: 01454 86 3509</p>	<p>South Gloucestershire Council Preliminary Flood Risk Assessment</p> <p>Highways Agency and Network Rail incidents</p> <p><small>© Crown copyright and database rights [2011] Ordnance Survey [100023410]</small></p>
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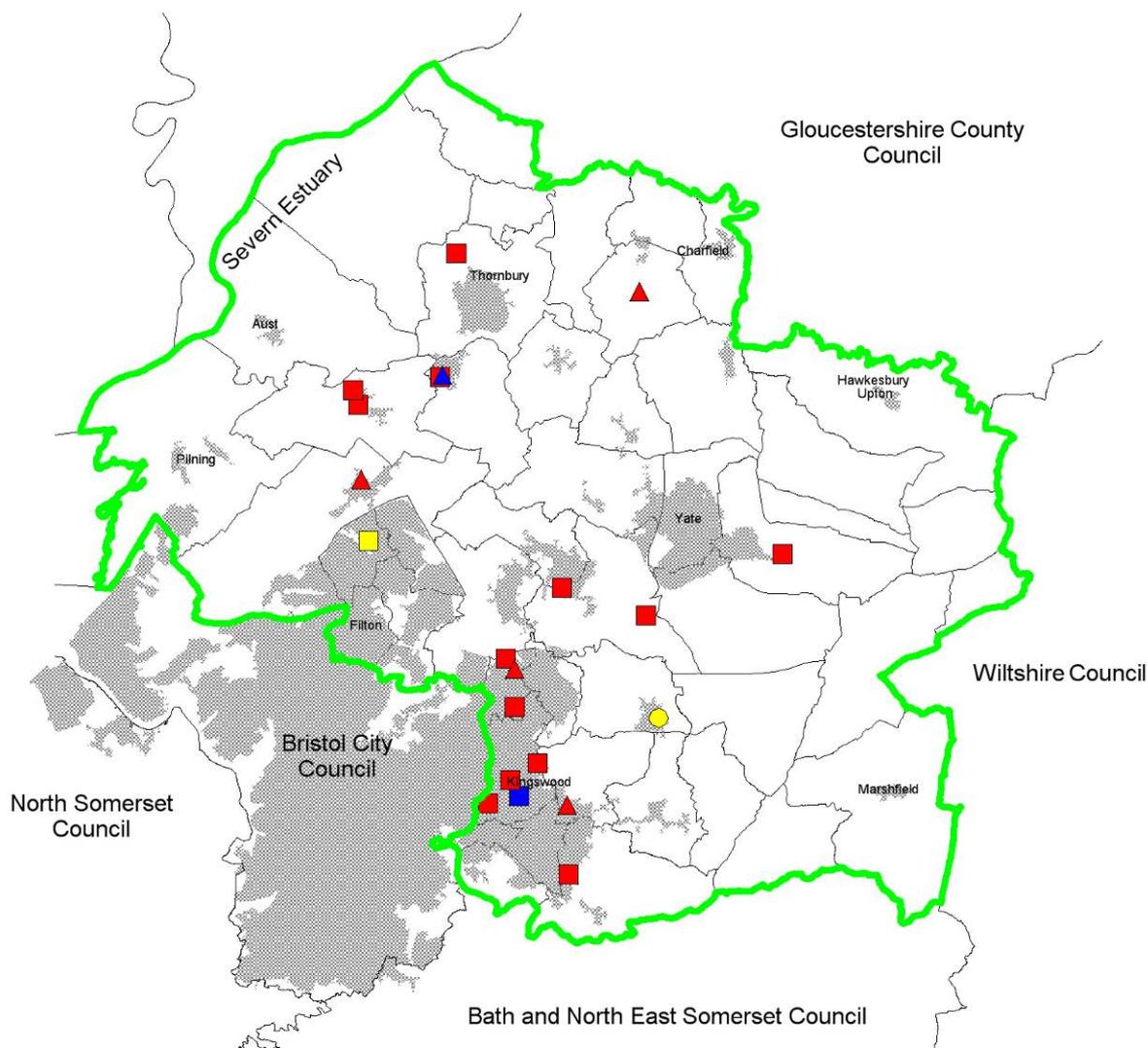
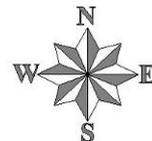


Figure 9

Note:

- DG5 EA - At risk of flooding externally twice in 10 years
- DG5 EB - At risk of flooding externally once in 10 years
- DG5 EC - At risk of flooding externally once in 20 years
- DG5 IA - At risk of flooding internally twice in 10 years
- DG5 IC - At risk of flooding internally once in 20 years

Legend

- South Gloucestershire Council Boundary
- DG5 EA - Foul/Combined
- ▲ DG5 EB - Foul/Combined
- DG5 EA - Surface Water
- ▲ DG5 EB - Surface Water
- DG5 IA - Foul/Combined
- ◆ DG5 IC - Foul/Combined

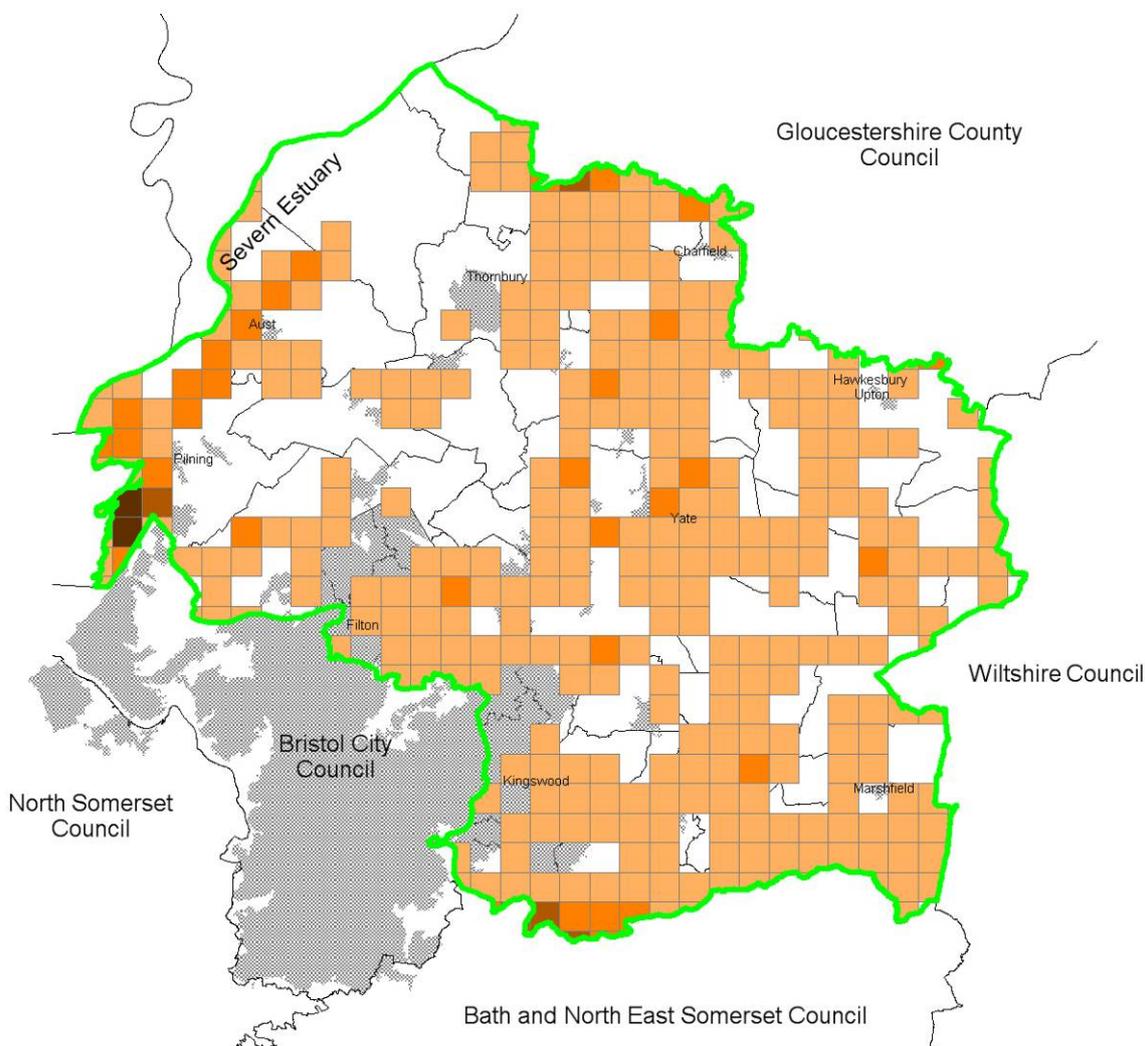
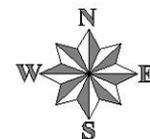


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**Wessex Water Sewer
 Flooding Data (DG5)**

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Note:

1km grid squares indicating the proportion of each grid square as a percentage which is susceptible to groundwater flooding.

Refer To Legend

Dataset provided by the Environment Agency

Figure 10

<p style="text-align: center;"><u>Legend</u></p> <ul style="list-style-type: none"> — South Gloucestershire Council Boundary Less Than 25% 25% to 50% 50% to 75% More than 75% 	 <p>Street Care PO Box 20, Castle Street, Thornbury South Gloucestershire. BS35 9BJ Telephone: 01454 86 3509</p>	<p>South Gloucestershire Council Preliminary Flood Risk Assessment</p> <p>Areas Susceptible to Groundwater Flooding</p> <p><small>© Crown copyright and database rights [2011] Ordnance Survey [100023410]</small></p>
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4.4 Locally Significant Harmful Consequence of Flooding

Although no guidance has been given by Defra for defining locally significant harmful consequences of flooding, the Environment Agency has recommended that the threshold should be an order of magnitude below the 'significant' criteria for defining Flood Risk Areas (refer to Section 6). The EA also recommends that, as a minimum, it should involve flooding of a number of properties on more than one occasion.

The local authority flood forum, the South West Flood Risk Managers Group have agreed the following criteria for the purpose of reporting past floods. A flood is deemed to be significant if it:

- Caused internal flooding to five or more residential properties, or
- Flooded two or more business premises, or
- Flooded one or more items of critical infrastructure, or
- Caused a transport link to be totally impassable for a significant period

The definition of 'significant period' is dependant on the transport link affected as follows (highway categories are as set out in Table 1 of the UKRLG Code of Practice for Highway Maintenance).

- Category 1 highways (motorways) and major rail links – 2 hours or more
- Category 2 and 3a highways and other railway links – 4 hours or more
- Category 3b and 4a highways – 10 hours or more
- Category 4b highways – 24 hours or more.

This definition has been adopted by South Gloucestershire Council for the purpose of reporting significant past (historic) floods.

4.5 Assessment of Historic Flooding

This assessment has been undertaken for all events recorded by SGC from 2000 or advised by one of the partner organisations.

Where the primary flooding cause has been due to the Severn Estuary or main river these events have not been included.

Assessment of the event data has in the majority of cases provided insufficient facts to determine whether any of the criteria (refer to 4.4) has been met or exceeded. The author, though, has been employed as a drainage engineer within the authority since 1996 and previously with Northavon District Council from 1974 and has a good knowledge of the majority of surface water and watercourse flood incidents during this period.

Upon conclusion it has been considered appropriate to record 3 locations as follows within this report that meet the locally significant harmful consequence of flooding criteria. Although as remedial works were executed subsequent to the flood incidents these sites are not to be recorded in annex 1. These locations met the criteria of 5 or more residential properties flooded on more than one occasion.

Location	Cause of Flooding	Remedial Actions
Emersons Green Area A North	Surface water infrastructure (attention pond) restricted discharge. Properties set low.	Flow control device removed and outfall pipeline upsized and relief overflow pipeline installed
Aust Village	Surface water run-off and restricted rhine flow	Main rhine highway and field culverts upgraded. Rhine bank raised.
Station Road, Little Stoke	Ordinary Watercourse obstructed by fly tipping and lack of maintenance	Although there is private ownership responsibility for this stretch of watercourse, this council has taken a lead to ensure regular inspection and maintain of the watercourse channel is undertaken. WW have also undertaken a capital scheme to provide a relief surface water sewer to ensure an additional property safeguard.

Table 4 - Significant Past (historic) Floods

Although there were a significant number of properties flooded within Severn Beach village in the 1970's a Ministry of Agriculture Food and Fisheries (MAFF) emergency grant enabled a flood relief scheme to be undertaken by the then district council. Although there is still a tidal flood threat to properties within this village due to estuary high tide spray being blown over the tidal defence, this location has been excluded from the list as the source of flooding is from the Severn Estuary.

5 Future Flood Risk

5.1 Introduction

Historic flood events may be useful in assessing local future flood risk. Although even if there has not been flooding in the past an area should not be discounted from future flood risk.

Within SGC due to the lack of significant past local surface water flooding predictive hydraulic modelling that simulate flood events have not been produced. Furthermore, as would be expected due to the lack of major flooding incidents, this council has not produced a Surface Water Management Plan to assess floor risk for any part of its area.

As previously mentioned in Section 1.4 and 2.3, a Level 1 SFRA has been produced for this district.

A Level 2 SFRA has recently been commissioned by this authority and this is programmed for completion in August 2011. This study is to review main river modelling, undertaken primarily on behalf of the EA but also for developers who have an interest in future large scale development. It will examine in detail the surface water flood risk pertaining to the development areas under consideration within the council's draft Core Strategy. Where land under consideration is at known risk of ordinary watercourse flooding the extent of this threat is to be quantified by detailed modelling.

This authority has also, in partnership with Bristol City Council and the LSIDB, commissioned a Flood Risk Assessment (FRA) for Avonmouth and Severnside mainly for planning control purposes. This study models a range of fluvial events coincidental with estuary tidal defence breaches and will, once approved, supersede the EA tidal flood zone mapping. The extent of this study area is from Avonmouth to the Old Severn Bridge at Aust.

Future flood risk should consider the effect of surface water run-off and accumulation, fluvial flooding from ordinary watercourses and groundwater flood effect. Canals are to be considered also, although none exist within this study area. Reference to the EA's PFRA Final Guidance, there is also a duty on LLFAs to include in its report information about flooding from the sea, main rivers or reservoirs if it thinks this source of flooding may affect flooding from a source being considered. Within SGC the effect of the Severn Estuary tide locking conditions can affect both main river and rhine discharge. Although the coincidence of tide locking and fluvial flooding is not analysed the consequence of this due to climate change will exacerbate the flood risk.

5.2 Locally Agreed Surface Water Information

As previously mentioned there is no surface water modelling pertaining to local future flooding held by this authority. Therefore an assessment of the two national surface water flooding outline datasets, produced and provided by the EA, was undertaken to determine which best represents local conditions. It is considered necessary to record within this section of the report the differences between these two datasets; Areas Susceptible to Surface Water Flooding (ASStSWF) and Flood Map for Surface Water (FMfSW), for future reference. This comparison is indicated in Table 5 below:

Properties	ASStSWF	FMfSW	Difference
Annual Probability rainfall modelled	1 in 200 chance (0.5% event)	1 in 30 (3.3% event) and 1 in 200 (0.5% event) chance	ASStSWF produced in 2009 and the second generation FMfSW produced in 2010. The 1 in 30 chance added to the FMfSW outputs to allow a better understanding of lower consequence more frequent events
Storm Duration Modelled	6.5 hours	1.1 hour	1.1 hour produced on average higher results than other durations piloted.
Rainfall profile	50% summer	50% summer	Recommended profile from the Flood Estimation Handbook
Reduction to rainfall amount to represent infiltration	None	Reduction to 39% in rural areas and 70% in urban areas	ASStSWF did not consider infiltration (rate of surface water soakage into the ground)
Reduction to rainfall amount to represent sewer flow.	None	Reduction to 0mm/hr rural areas, 12mm/hr urban areas.	ASStSWF did not consider the effect of sewers conveying flow.
Manning's 'n'	0.1	0.1 rural, 0.03 urban	Urban value reduces now as buildings are included in Digital Terrain Model. Previously n was increased to account for lack of building representation.
Digital Terrain Model (DTM)	Infoterra bare earth LIDAR and GeoPerspectives	EA 2010 Composite (SAR, EA LIDAR and PGA2 LIDAR) with OS 2009 Mastermap Buildings (DTM raised by 5m).	Access to EA LIDAR available for FMfSW
Model Resolution	5m	5m	Modelling at smaller resolution was impractical at a national scale with the model used due to processing demands.
Model Domain Size	5 x 5km	5 x 5km	5km provides a reasonable balance between high intensity local storms and larger less intense events
Buildings	Not represented	Represented in the DTM using the 2009 OS Mastermap Buildings layer	Earlier work identified the presence of buildings improved the routing of flow in urban areas. Use high buildings based upon the DTM plus 5m. Building outlines are best represented by OS Mastermap polygons
Threshold bands (flood depths model output)	0.1 to 0.3m 0.3 to 1.0m Greater than 1.0m	Greater than 0.1m. Greater than 0.3m.	Consultation with partners resulted in 2 bands rather than 3 bands.

Table 5 – Differences between FMfSW and ASStSWF

A comparison between the FMfSW and AStSWF flood outlines for the same event (1:200 chance annual probability rainfall) is illustrated in Figure 12. Reference to Table 5, within this urban area (Chipping Sodbury/Yate border) the FMfSW includes a rainfall reduction to represent ground infiltration (70%) and a rainfall reduction (12mm/hr) to represent sewer flow. The AStSWF dataset makes no allowance for this and this is reflected in a larger flood outline.

The review of these datasets for the study area by the author has included examination of historic flooding incident locations as well as sites where known surface water/land drainage schemes have or are to be undertaken by either this council or the water and sewerage company, Wessex Water.

Further to analysis of the data and consultation with the Environment Agency it has been agreed that the Flood Map for Surface Water generally provides an indication of future surface water flood risk within the study area. Specifically, the FMfSW 1:200 deep (greater than 0.3m) will be used in this Council's assessment as the locally agreed surface water information. Figure 11 illustrates this locally agreed information for surface water flooding.

It should be noted that this dataset has been used by the EA for this area to undertake its assessment to determine indicative Flood Risk Areas.

It should, however, be recorded that for certain areas neither dataset may be an accurate representation of flood risk due to:

- Tide locking conditions
- Main river flood plain effect
- The beneficial effect of culvert crossings below highway and railway embankments to convey run-off and prevent accumulation of surface water to the extent and level modelled
- Flood alleviation schemes previously undertaken

Reference to the EA Final Guidance (3.5.5 Interactions with Other Sources of Flooding). The interaction between more than one source of flooding is complex and no information is available nationally. To understand reactions will require a detailed local study including joint probability of the different sources of flooding.

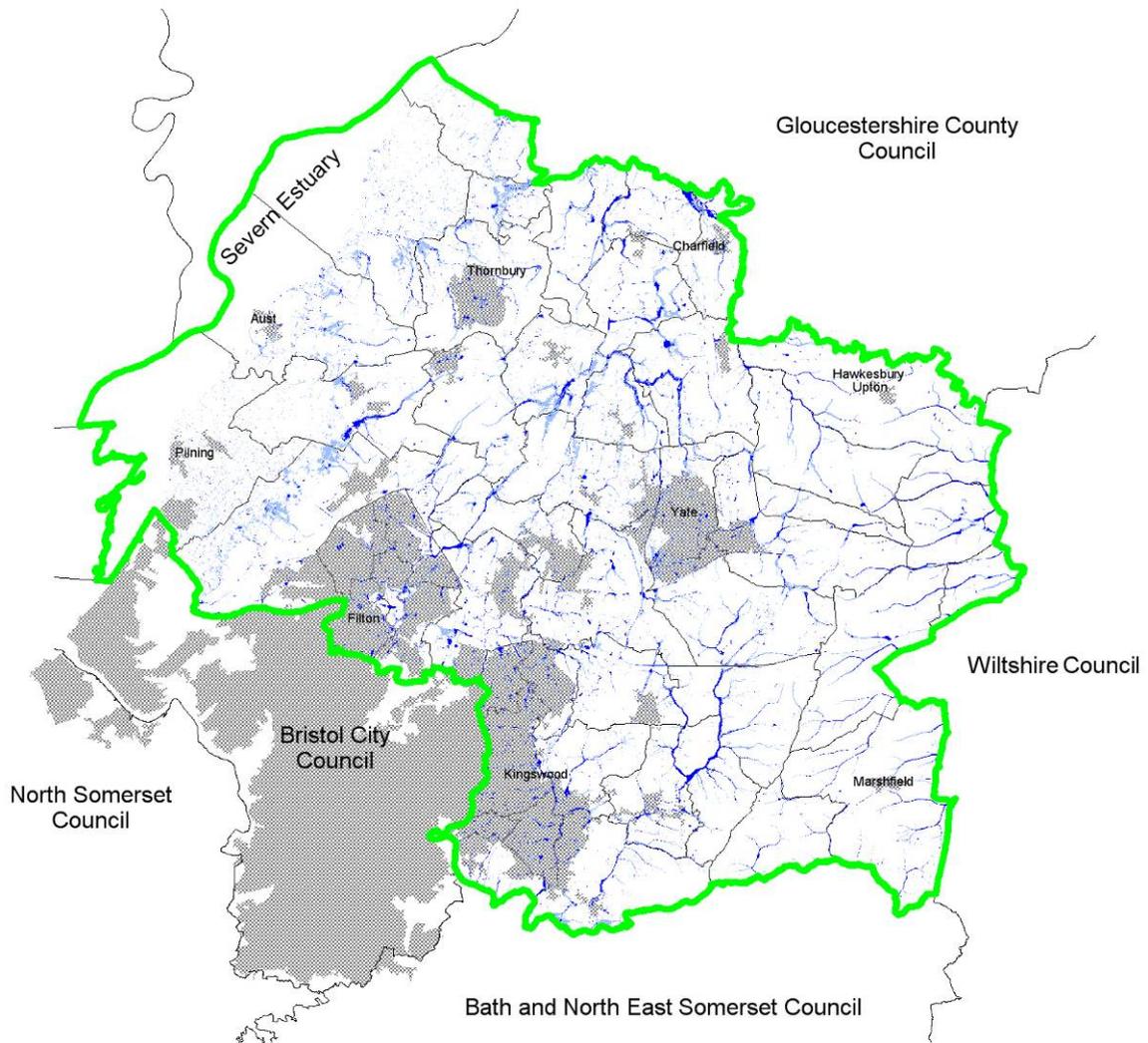
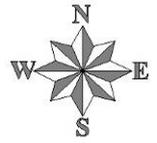


Figure 11

Note:

Dataset provided by the Environment Agency

Legend

- South Gloucestershire Council Boundary
- 1 in 200yr >0.1m (shallow)
- 1 in 200 yr > 0.3m (deep)



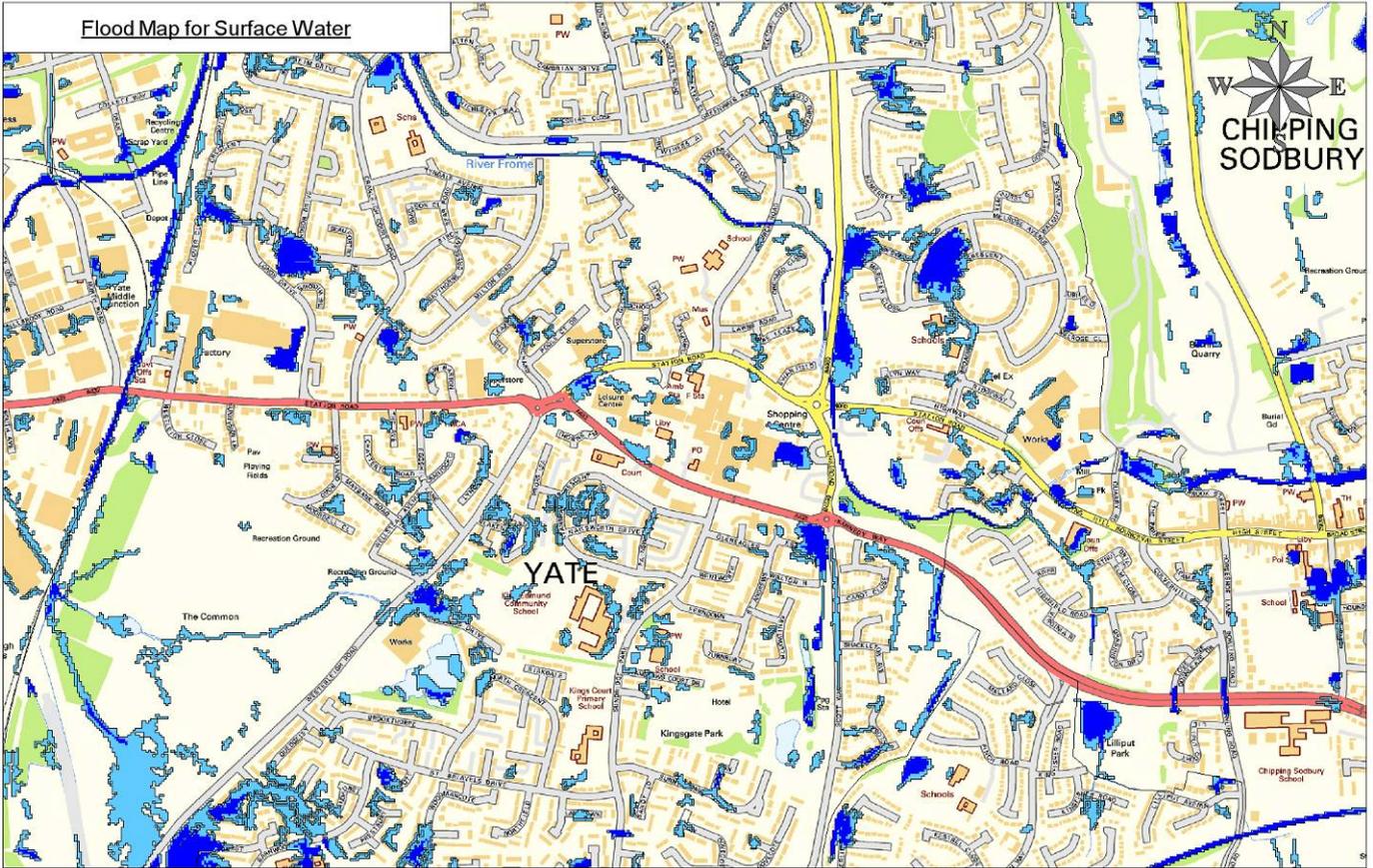
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**South Gloucestershire Council
 Preliminary Flood Risk Assessment**

**Locally Agreed Surface Water
 Information (FMfSW 200yr)**

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Flood Map for Surface Water



Areas Susceptible to Surface Water Flooding

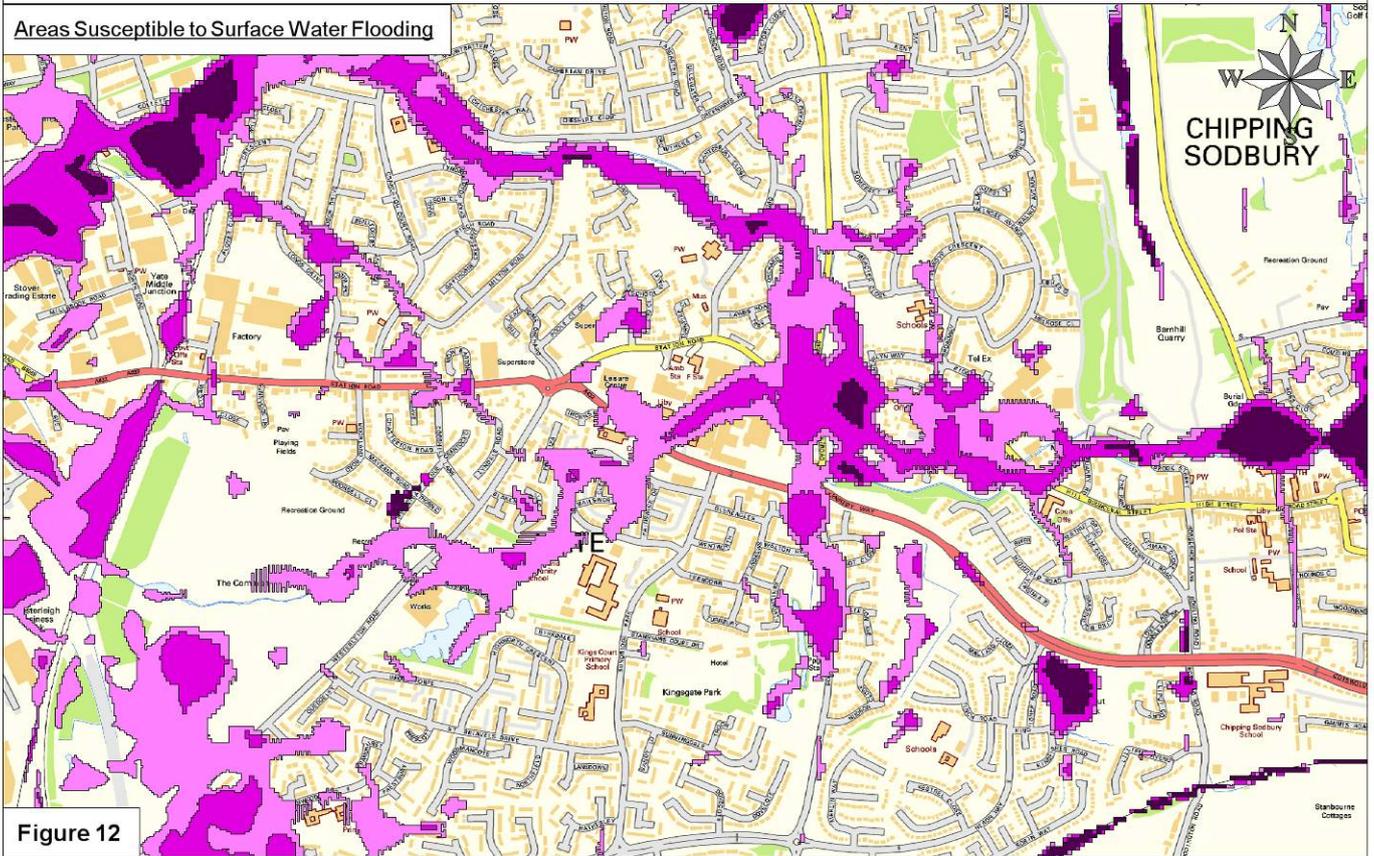


Figure 12

Legend

- FMfSW - 1 in 200yr > 0.1m (shallow)
- FMfSW - 1 in 200yr > 0.3m (deep)
- ASfSWF - Less (< 0.3m)
- ASfSWF - Intermediate (between 0.3m and 1.0m)
- ASfSWF - More (< 1.0m)



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Comparison of EA
 Surface Water Datasets

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5.3 Potential Consequences of Future Flooding

The regulations require that each LLFA considers the possible harmful effect of floods on:

- Human Health
- Economic Activity
- Environment (including cultural heritage)

In order for LLFAs to undertake this assessment the EA have provided the National Receptor Dataset (NRD), a collection of risk receptors available online via [DataShare](#).

Below is a fuller explanation of these key flood risk indicators, for future reference.

5.3.1 Human Health

Two indicators can be used to identify the consequence of flooding on human health. These are:

- Number of people affected by flooding (based on property numbers x 2.34 people). This indicator is calculated by a count of residential properties within the FMfSW flood outline.
- Number of critical services. This is defined as school; hospital; nursing/care/retirement homes and other institutions including prisons; police stations; fire and ambulance stations; sewerage treatment works and electricity installations. Similarly an assessment of these premises and sites is undertaken by reference to the FMfSW flood outline.

5.3.2 Economic Activity

Three factors can be used to identify the consequences of flooding on economic activity:

- The number of non-residential properties
- Infrastructure network. This is the length of roads and rail affected by flooding. The importance of the route (national, regional or local) and whether there is an alternative route will determine whether this is a significant consequence.
- Area of agricultural land. The assessment of this is to determine the area in hectares of each grade of agricultural land flooded based on agricultural land classification.

5.3.3 Environment

Three factors need to be used to identify the consequences of flooding on the environment:

- The consequence of pollution. In particular flooding of Pollution Prevention and Control (PPC) and Control of Major Accident Hazard (COMAH) sites is to be considered. The EA have identified where these sites lie within the FMfSW areas.
- The impact on internationally and nationally designated environmental sites including Special Areas of Conservation (SAC); Special Protection Areas (SPA); Ramsar sites and Sites of Special Scientific Interest (SSSI).
- The impact on internationally and nationally designated heritage assets. This includes world heritage sites; scheduled monuments; listed buildings and registered parks and gardens.

Summary of Flood Risks

Tables 6 and 7 below summarise the results of applying the GIS analysis to identify the numbers and types of properties and critical services within the FMfSW flood outline - 1:200 year (deep). This is compared with the AStSWF 1:200 (intermediate). The **detailed GIS** method is used to estimate the consequences of this flood event.

Receptor	FMfSW	AStSWF
	1 in 200 year Deep	1 in 200 year Intermediate
Residential Properties	7445	6436
No of people	17421	15060
Non-Residential Properties	908	799
Critical Services	137	155
Listed Buildings	62	68
Scheduled Ancient Monuments	29	9
Total Properties (residential + non-residential)	8353	7235

Table 6 - Property receptors within the surface water flood zones across South Gloucestershire

Receptor	FMfSW	AStSWF
	1 in 200 year Deep	1 in 200 year Intermediate
Schools	26	21
Hospitals	0	0
Nursing/Care Homes	6	4
Police Stations	1	0
Fire and Ambulance Stations	1	0
Sewage Treatment Works	37	44
Electricity Installations	66	86
Total	137	155

Table 7 – Breakdown of critical services receptors within surface water flood zones across South Gloucestershire

5.4 The Impacts of Climate Change

5.4.1 The Evidence

There is clear scientific evidence that global climate change is happening now. It cannot be ignored.

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

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

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

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.

5.4.2 Implications for Flood Risk

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

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

Drainage systems in the district have been modified to manage water levels and could help in adapting locally to some impacts of future climate on flooding, but may also need to be managed differently. Rising sea or river levels may also increase local flood risk inland or away from major rivers because of interactions with drains, sewers and smaller watercourses.

Where appropriate, we need local studies to understand climate impacts in detail, including effects from other factors like land use. Sustainable development and drainage will help us adapt to climate change and manage the risk of damaging floods in future

5.4.3 Adapting to Change

Past emission means some climate change is inevitable. It is essential we respond by planning ahead. We can prepare by understanding our current and future vulnerability to flooding, developing plans for increased resilience and building the capacity to adapt. Regular review and adherence to these plans is key to achieving long-term, sustainable benefits.

Although the broad climate change picture is clear, we have to make local decisions uncertainty. We will therefore consider a range of measures and retain flexibility to adapt. This approach, embodied within flood risk appraisal guidance, will help to ensure that we do not increase our vulnerability to flooding.

5.4.4 Long Term Developments

It is possible that long term developments might affect the occurrence and significance of flooding. However current planning policy aims to prevent new development from increasing flood risk.

In England, Planning Policy Statement 25 (PPS25) on development and flood risk aims 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 at 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."

Adherence to Government policy ensures that new development does not increase local flood risk. However, in exceptional circumstances the Local Planning Authority may accept that flood risk can be increased contrary to Government policy, usually because of the wider benefits of a new or proposed major development. Any exceptions would not be expected to increase risk to levels which are "significant" (in terms of the Government's criteria).

6. Identifying Flood Risk Areas

6.1 Overview and Methodology

In order to ensure a consistent national approach, Defra have identified significance criteria and thresholds to be used for defining Flood Risk Areas (FRAs). Guidance on applying these thresholds is provided within Defra's document *Selecting and Reviewing Flood Risk Areas for Local Sources of Flooding – Guidance to Lead Local Authorities*, December 2010.

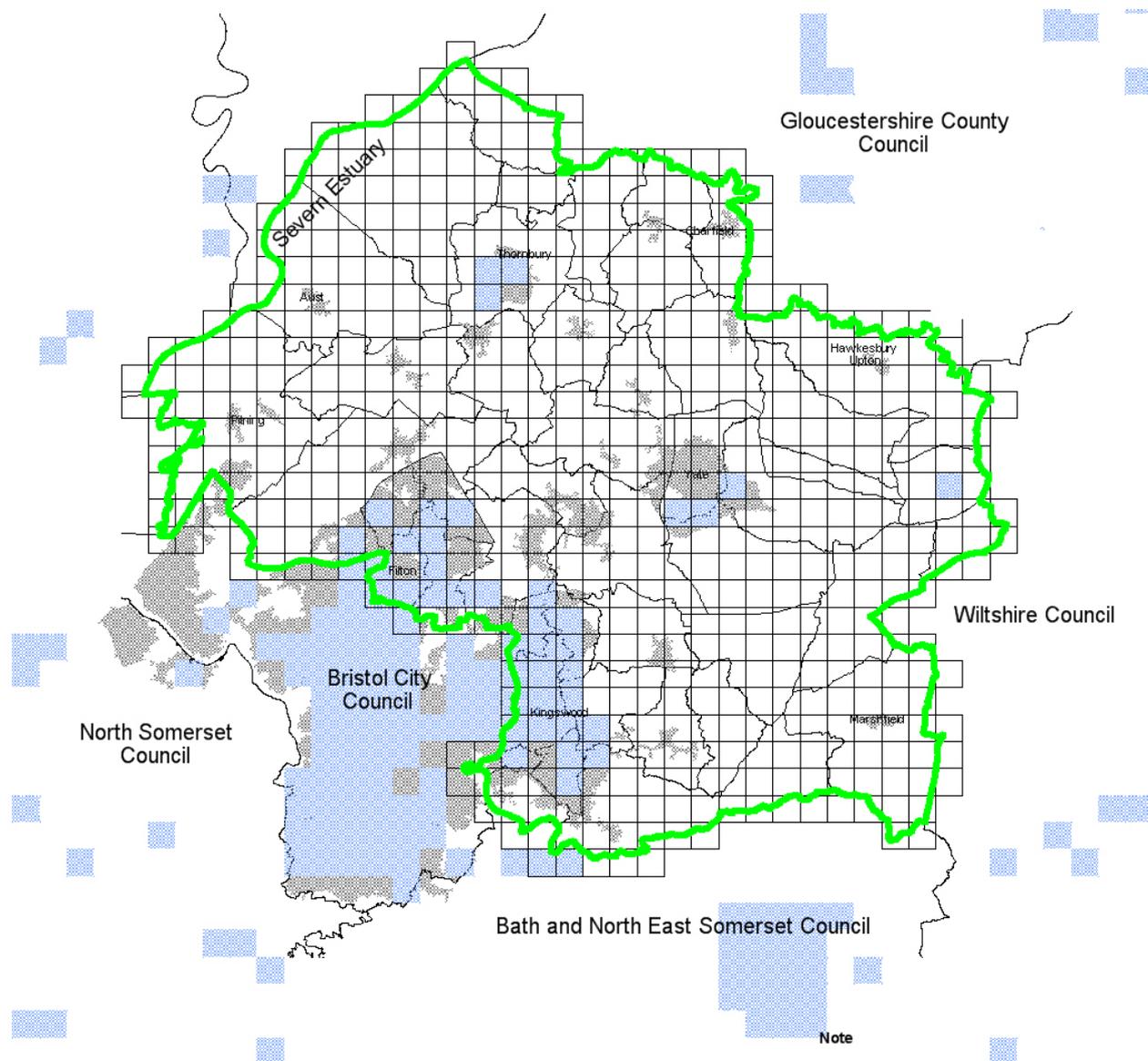
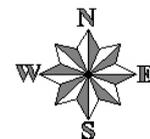
The national key risk indicator and threshold values for determining a Flood Risk Area is as follows, either:

- Number of people – greater than 200 (based on residential property x 2.34), or
- Critical services – greater than 1, or
- Number of non-residential properties – greater than 20

This assessment is undertaken for a 1km grid square where one of the indicators must be above its flood risk threshold. Within this study area the grid squares assessed by the EA to be above the flood risk threshold are indicated on Figure 13.

Where there are 5 or more adjacent 1km grid squares within a 3km x 3km grid then this is defined as a cluster area, revealing where the flooding is concentrated.

The clusters assessed for South Gloucestershire are also indicated in Figure 13. It is important to record that the FRAs are only based on surface water flooding. For the majority of the country, including this study area, this assessment was carried out using the FMfSW 1:200 annual chance rainfall event (greater than 0.3m flood depth) outlines.



Note

Places above the Flood Risk Thresholds are 1km grid squares where at least one of the following flood risk indicators is above the threshold given below:

1. Number of People > 200
2. Critical Services > 1
3. Number of Non-Residential Properties > 20

Indicators calculated using the Environment Agency's detailed method of counting (based on property outlines) for the new Flood Map for Surface Water (deep - for 1 in 200 annual probability rainfall).

Figure 13

<p>Legend</p> <p> South Gloucestershire Council Boundary</p> <p> Places above Flood Risk Thresholds 1km grids (Refer to Note)</p>	 <p>Street Care PO Box 20, Castle Street, Thornbury South Gloucestershire. BS35 9BJ Telephone: 01454 86 3509</p>	<p>South Gloucestershire Council Preliminary Flood Risk Assessment</p> <p>EA Defined Areas Above the Flood Risk Thresholds</p> <p><small>© Crown copyright and database rights [2011] Ordnance Survey [100023410]</small></p>
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6.2 Indicative Flood Risk Areas

Defra have defined a cluster area that identifies more than 30,000 people as risk of flooding as being an Indicative Flood Risk Area (WAG apply the figure of 5000 people). Based on this minimum number of people there have been identified 10 indicative Flood Risk Areas across England. The adjoining LLFA, Bristol City Council, has been identified with the number of 36,681 people calculated (based on residential properties x 2.34). A small area of Bristol City Council's indicative Flood Risk Area overlaps into this administrative boundary. BCC will review this within their report assessment. Following on from this there is set to be programmed consultation with BCC and the Environment Agency regarding this impact particularly regarding flood risk management.

6.3 Identification of Flood Risk Areas

The 1KM grids and cluster areas identified by the EA (Figure 13 refers) have been analysed using the most recent version 1.1 national receptor dataset (NRD). This has not led to the identification of further 1km grids where one of the national key risk indicators is above the threshold level, or any other contributing circumstance. The information gathered will, however, assist in the future local flood risk management strategy to be undertaken by this council.

7 Scrutiny and Review Procedures

The scrutiny and review procedures that must be adopted when producing a PFRA are set out by the European Commission (EC). Meeting quality standards is important in order to ensure that the appropriate sources of information have been used to understand flood risk and the most significant flood risk areas are identified for attention in the next stages.

Another important aspect of the review procedure is to ensure that the guidance is applied consistently to determine the Flood Risk Areas, although this should not involve amending the significance criteria, set by Defra for England.

7.1 Local Authority Review

The internal review procedure will be approval of the draft report by the Head of Street Care to ensure it meets the required quality standards. Further to this the PFRA report will be presented to the Director of Community Services/ Acting Director of Planning Transportation and Strategic Environment and the portfolio Executive Members for their consideration and approval (programmed 13 July 2011).

7.2 Environment Agency Review

Under the Flood Risk Regulations 2009 the Environment Agency has a duty to review, collate and publish all of the PFRAs once submitted (by 22 June 2011).

Local Environment Agency staff will review the preliminary assessment report to ensure it meets the minimum standards required by the European Commission. A checklist has been provided to ensure consistency in the report production process. This is to be submitted also together with template spreadsheets.

The EA national review will focus on the Flood Risk Areas and in particular where indicative areas have been amended. It will check that any changes are justified and nationally consistent.

The national review panel will make recommendations to the Regional Flood Defence Committee for endorsement. Subsequently the EA regional director will sign off the PFRA. Finally it will be collated published and submitted to the European Commission.

The first review cycle of the PFRA will be initiated by South Gloucestershire Council and must be submitted to the Environment Agency by the 22 June 2017. The EA will submit it to the European Commission by 22 December 2017 using the same review procedure as described above.

Subsequent reviews will be undertaken at intervals of no more than 6 years.

8 Next Steps

8.1 Local Flood Risk Management Strategy

As mentioned in Section 4.2 this council has produced a Flood Specific Plan for a number of locations to enable a co-ordinated response in the event of a severe rainfall event. This Plan will be reviewed using the Flood Map for Surface Water as a guidance tool and further to consultation with partners there will be further sites classified for inclusion within this Plan. The revised Flood Specific Plan will be publicised at Area Forums and notified to the parish and town councils, as necessary.

In addressing flood risk management there will be consultation with neighbouring authorities, in particular Bristol City Council.

Based on the council's Flood Specific Plan the greatest perceived flood threat to property is from main river sources. Therefore it is essential to communicate to the Environment Agency and the emergency services the Council's capabilities in advance of an incident. This will be undertaken by the Emergency Planning Unit via the Local Resilience Forum.

8.2 Reviewing and Updating Flood Data and Modelling

Presently this council does not possess model information appertaining to surface water flooding. Only one location was known to be subject to a modelling assessment, Emersons Green Area A North, and the model was retained by the drainage consultant appointed by the council for this investigation.

The water company, Wessex Water, will hold modelling for some surface water sewer networks within urban locations. Access to the results of these models will be investigated by this council in future partnership discussions. Information obtained will be registered on the Street Care GIS based data repository.

8.3 Post Flood Event Data Collection

The FWMA requires that LLFAs investigate and record details of significant flood events within their area. Examination of the authority's Customer Response System and external Out of Hours Call Centre will be undertaken to ensure that pertinent incident details are being recorded.

Further consultation will also be held with both the Fire Service and Highways Agency to ensure incident reports are concise to enable this authority to perform its duty.

8.4 Maintaining an Asset Register

The EA have provided LLFAs with a set of templates to enable this duty to be performed.

Although this council holds condition and maintenance schedules regarding assets such as bridge and culvert structures, grills and trash screens, flow control chambers and devices, this data is not retained within a single database. As part of Street Care's Asset Management Project this information will be centralised within the GIS based data repository.

8.5 Development and Planning

The outputs and conclusions from the Level 2 Strategic Flood Risk Assessment, to be published later this year, will require consideration and consultation for input to the local flood risk management strategy.

As mentioned previously, this authority already has in place a SuDS approval team. The creation of a SuDS Approval Body (SAB) is a requirement of the FWMA. It is accepted that the present set-up will be strengthened to accommodate the increased workload of adoption and maintenance of numerous SuDs features envisaged to be constructed under the new compulsory legislation.

References

Avonmouth – Severnside Strategic Flood Risk assessment: Level 2 Report March 2011

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

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European Commission (2007) EU Floods Directive [online]

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European Commission (2007) EU INSPIRE Directive [online]

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Flood and Water Management Act (2010)

The Flood Risk Regulations (2009)

South Gloucestershire Council Core Strategy – Proposed changes version
December 2010

South Gloucestershire Council – Strategic Flood Risk Assessment: Level 1 report:
February 2009

Annex 1: Records of past floods and their significant consequences (Preliminary Assessment Report Spreadsheet)

Reference to Annex 1 of the Preliminary Assessment Report Spreadsheet attached with this report. As discussed within Section 4, there are no known flooding incidents that meet the criteria for determining locally significant harmful consequences of flooding therefore none have been recorded within this annex.

Annex 2: Records of future floods and their significant consequences (Preliminary Assessment Report Spreadsheet)

Reference to Annex 2 of the Preliminary Assessment Report Spreadsheet attached with this report. This includes a record of the future flood risk information for South Gloucestershire including details of the potential consequences of flooding to key risk receptors within the district recorded in Section 5.

Annex 3: Records of Flood Risk Areas and their rationale (Preliminary Assessment Report Spreadsheet)

Reference to Annex 3 of the Preliminary Assessment Report Spreadsheet attached with this report. Section 6 of the report refers. There have been no indicative Flood Risk Areas identified for South Gloucestershire therefore none have been recorded within this annex.

Annex 4: Preliminary Flood Risk Assessment Checklist

Reference to annex 4 attached to this report which contains the Preliminary Flood Risk Assessment Checklist, provided by the EA for the purpose of reviewing PFRA submissions.

