Southern Staffordshire Surface Water Management Plan

Phase 1

Stafford Borough, Lichfield District, Tamworth Borough, South Staffordshire District and Cannock Chase District Councils

July 2010

Final Report

9V5955

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Document title	Southern Staffordshire Surface Water Management Plan Phase 1
Document short title	Southern Staffordshire SWMP Phase 1
Status	Final Report
Date	July 2010
Project name	Stafford, Lichfield, Tamworth, South Staffordshire and Cannock WCS and SWMP
Project number	9V5955
Client	Stafford Borough, Lichfield District, Tamworth Borough, South Staffordshire District and Cannock Chase District Councils
Reference	9V5955/R00003/303671/Soli

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Date/initials check		19/7/10
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Date/initials approval		19/7/10

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EXECUTIVE SUMMARY

This report has followed the requirements of Defra's draft Surface Water Management Plan (SWMP) guidance and the requirements of the Brief to produce a Phase 1 SWMP for the Local Authority areas of Stafford Borough, Lichfield District, Tamworth Borough, South Staffordshire District and Cannock Chase District. As such, this report completes the first step of Defra's four stage approach to surface water flood risk management.

As stated within Defra's guidance there are three main aims of a Phase 1 SWMP:

1. Establishing a partnership between the key consultees and stakeholders;
2. Collecting and collating existing information on surface water flooding; and
3. Selecting an approach to carry out further analysis (i.e. the scope for Phase 2).

The key objective and outcome of this study was the identification of the locations within the study area at greatest risk of surface water flooding. The aims of this are to assist the Councils with determining an appropriate approach to further stages of the SWMP process, and to aid their selection of potential development sites for progression within their Local Development Frameworks (LDFs).

The start of a partnership has been formed between the key consultees and stakeholders through the formation of an Engagement Plan. This plan identifies a three-tier approach with the Local Councils taking a central role. The Core Steering Group assumes the bulk of the responsibility for surface water management and data provision. Additional data is obtained from the second tier, whereas the third tier is affected by the decisions of a SWMP rather than playing a key role in its construction. This partnership approach is still at a fledgling stage and requires cultivation throughout the SWMP process.

A key aim of this Phase 1 SWMP was the collection and collation of as much existing information regarding both historic flood events and the potential for future surface water flooding occurrences as possible. Data sources have included the Level 1 SFRAs, Council owned flood event records and Severn Trent Water Limited's (STWL) register of surface water sewer flooding. Future flood risk has been determined through interrogation of the Environment Agency's surface water flood maps and Defra's comparative analysis of UK settlements. Further information was obtained from the River Severn Catchment Flood Management Plan (CFMP) and the West Midlands Regional Flood Risk Appraisal. Reference has been made throughout the report to the Water Cycle Study (WCS) carried out by Royal Haskoning in parallel to this study, which provides greater detail on the use of Sustainable Drainage Systems (SUDS) within the study area.

Key Recommendations

A number of general and specific recommendations have been drawn out from this report. The following key recommendations apply across the study area:

1. The causes of the repeating, overlapped or clustered flood events should be investigated further, either by the Councils as a further step towards mitigating

the source of surface water flooding problems, or by developers as part of a site specific FRA;

2. All results from this Phase 1 SWMP should be discussed with the Partners and Key Stakeholders to identify any inconsistencies, anomalies, gaps and/or duplications within the data collected. As above, this should either be carried out by the Councils with an aim to mitigate surface water flooding issues on a large scale, or by developers as part of a site specific FRA;
3. Lichfield, Cannock Chase and South Staffordshire District Councils should consult with STWL and the Lichfield and Hatherton Canal Restoration Trust regarding potential joint surface water management opportunities associated with the restoration of the Lichfield and Hatherton canals;
4. Where this study has identified development sites that are at high or medium risk of surface water flooding (highlighted as red or yellow within the summary sheets), site specific FRAs prepared by developers should confirm surface water flood risk and identify runoff mitigation measures to be implemented as part of site development;
5. The Councils and developers should ensure appropriate SUDS techniques are implemented into all new developments (as per the Floods and Water Management Act which places responsibility for installation upon the developers and adoption and maintenance upon the Local Authorities) and as far as possible retrofitted into existing settlements, especially where historic flood events have been identified. This will need to involve the new SUDS Approval Board (SAB), when it has been set up by Staffordshire County Council.
6. To assist in the mitigation of the surface water flood risk and the promotion of development sites, the Councils and developers should discuss with the appropriate Partners and Stakeholders whether any of the flood events are/have already been investigated and/or rectified;
7. The Councils (or appropriate owners) should ensure that the rural watercourses are adequately maintained and regularly cleared;
8. Where relevant, the Councils should review the agricultural and land management practices within the study area and encourage farmers to not leave land bare. Some funding may be available through Defra to undertake such initiatives via their "Farming Floodplains for the Future Scheme"[1];
9. Councils and developers should, as far as possible, implement the site specific recommendations listed in the summary sheets.
10. All the conclusions and information included in this Phase 1 SWMP require consideration by developers and should be investigated in further detail if a site is to be progressed;
11. Emphasis should be placed upon the responsibilities of individual authorities to reduce the risk of surface water flooding, but in a coordinated approach between all members of the partnership. Progression of a centralised recording system for surface water flood events, including identification of type, recurrence, asset owner (if flooding has resulted for asset failure) and location, will greatly assist the Lead Flood Authority (Staffordshire County Council) in identifying and mitigating the sources of such flooding. Such a recording system is currently being investigated by Staffordshire County Council, but will require support and contribution of data from all stakeholders and partners.

[1] http://www.defra.gov.uk/environment/flooding/risk/innovation/sld2314.htm

12. The Councils should further review the settlements classified within the analysis as having a high overall risk of surface water flooding (highlighted as red in the summary sheets), when considering the promotion of development sites within those areas. All development sites in these settlements should be reviewed by the Councils in consultation with partners and stakeholders to determine those most suitable for progression. This will require consideration of all the other Evidence Base studies collected as part of the LDF process. If sites are progressed, the information presented within this SWMP should also be reviewed by developers as part of site specific FRAs. The flood risk classifications for the individual development sites provided for review within this SWMP can be found in Appendices D - H.

    These 'high risk' settlements consist of:

Stafford
- Stafford;
- Eccleshall and Copmere End;
- Salt and Weston;
- Stone;
- Walton and Norton Bridge; and
- Yarnfield.

South Staffordshire
- Penkridge;
- Wombourne;
- Codsall;
- Great Wyrley;
- Cheslyn Hay; and
- Perton.

Lichfield
- Lichfield
- Armitage and the Longdons;
- Burntwood, Elford;
- Little Aston;
- Mile Oak and Fazeley; and
- Whittington.

Cannock Chase
- Cannock;
- Norton Canes; and
- Rugeley town.

Tamworth
- Tamworth

13. More specifically, the following five settlements have been noted as being at high risk of surface water flooding (based upon historic flooding occurrences, future flooding potential and severity of flooding) and are also identified as locations for a relatively high number of potential development sites. It is therefore recommended they are investigated further as part of a Phase 2 SWMP:

    - Stafford town;
    - Lichfield City;
    - Cannock town (Norton Canes will be included within the analysis);
    - Tamworth town; and
    - Penkridge (South Staffordshire).

14. For all proposed development sites outside of the above listed settlements the developer should, through the precautionary principle, ensure that water issues are sufficiently addressed and agreed with the Environment Agency, as part of a site specific FRA.

Local Authority specific recommendations are presented in Sections 4.3 (Stafford Borough), 5.3 (Lichfield District), 6.3 (Tamworth Borough), 7.3 (South Staffordshire District) and 8.3 (Cannock Chase District) of this report, with general recommendations presented in Section 9. For all the recommendations, the maintenance of the partnership approach and the cooperation and openness between partners and key stakeholders is paramount to the success of a sustainable surface water management strategy

Phase 2 SWMP

A number of settlements have been highlighted within this mapping exercise as 'red' with regards to overall surface water flooding. Ideally all of these areas should be investigated further within a Phase 2 SMWP. However, to undertake the modelling required for a robust SWMP the data requirements are high, especially for the topographical representation (the LiDAR data) and, as a result, so are the costs. To produce a robust, and therefore useful, representation of surface water flooding within an area, LiDAR of at least 2m resolution is required for the entire watershed in which a settlement falls. This ensures that all the water falling within the catchment of that urban area is routed appropriately across the topography and down the key drainage channels, such as roads, into the urban area in question. As such, prioritisation has been given to the procurement of LiDAR for the five key settlements listed above.

Once the LiDAR has been obtained (currently due by the end of July 2010), the Phase 2 SWMP for these five settlements will be progressed. The scope for the modelling will be agreed with the Councils and then progressed at the required level of detail, covering the area included within the watershed boundaries for each of the settlements. Dependent upon receipt of the LiDAR Phase 2 should be finalised by the end of 2010.

GLOSSARY

Antecedent Conditions	The pre-existing condition before a rain event (e.g. waterlogged soil)
Brownfield site	Any land or site that has been previously developed.
Catchment	The area contributing flow or *runoff* to a particular point on a watercourse.
Catchment Flood Management Plan	Environment Agency produced documents providing an overview of the flood risk across each river catchment and estuary and recommended ways of managing those risks now and over the next 50-100 years.
Climate change	Long-term variations in global temperature and weather patterns both natural and as a result of human activity, primarily greenhouse gas emissions.
Culvert	Covered channel or pipe that forms a *watercourse* below ground level, or through a raised embankment.
Defra	UK Government department responsible for policy and regulations on the environment, food and rural affairs.
Development	The carrying out of building, engineering, mining or other operations in, on, over or under land or the making of any material change in the use of any buildings or other land.
Enmained	Watercourse designated as a *Main River*
Environment Agency	Government Agency charged with the protection of the environment.
Flood defence	Flood defence infrastructure, such as flood walls and embankments, intended to protect an area against flooding, to a specified *standard of protection*.
Flood probability	The estimated likelihood of a flood of a given magnitude occurring or being exceeded in any specified time period.
Flood risk	An expression of the combination of the *flood probability* and the magnitude of the potential consequences of the *flood event*.
Flood risk assessment	A study to assess the risk of a site or area flooding, and to assess the impact that any changes or development in the site or area will have on *flood risk*.

Flood Zones	Flood Zones are defined in Table D.1 of Planning Policy Statement (PPS) 25: Development and Flood Risk. They indicate land at risk by referring to the probability of flooding from river and sea, ignoring the presence of defences.
Fluvial Water	Water contained or flowing within a river or stream.
Greenfield	Previously undeveloped land.
Groundwater	Water in the ground, usually referring to water in the saturated zone below the *water table*.
Groundwater flooding	Flooding caused by *groundwater* escaping from the ground when the *water table* rises to or above ground level.
Groundwater Vulnerability	A measure of the vulnerability of groundwater stores to contamination.
Growth Points	The New Growth Points initiative was designed to provide support to local communities who wish to pursue large scale and sustainable growth, including new housing, through partnership with the Government. 29 areas were named New Growth Points and will share £40m in 2007-8 for a first round of infrastructure projects and to support growth related studies, master planning and capacity-building.
LiDAR	Data set that provides a 3D image of the surface of the earth.
Local Development Documents	Documents that set out the spatial strategy for local planning authorities which comprise development plan documents.
Local Development Framework	Framework which forms part of the statutory development plan and supplementary planning documents which expand policies in a development plan document or provide additional detail.
Local Planning Authority	Body responsible for planning and controlling development, through the planning system.
Main River	A watercourse designated on a statutory map of Main rivers, maintained by the Environment Agency.
Mitigation measure	A generic term used in this guide to refer to an element of *development* design which may be used to manage some *risk* to the *development*, or to avoid an increase in *risk* elsewhere.
Ordinary watercourse	A watercourse which is not a private drain and is not designated a *Main river*.

Outfall Height	Level at which a sewer or drain discharges into a watercourse.
Riparian Owners	Land owners with land or property alongside a river or other watercourse
Runoff	Water flow over the ground surface to the drainage system.
Standard of protection	The estimated probability of an event occurring which is more severe than those against which an area is protected by flood defences.
Strategic Flood Risk Assessment (SFRA)	A study to examine flood risk issues on a sub-regional scale, typically for a river catchment or local authority area during the preparation of a development plan.
Source Protection Zone (SPZ)	Defined areas showing the risk of contamination to selected groundwater sources used for public drinking water supply, from any activities that might cause pollution in the area.
Surface Water	Water collected or flowing over the ground not contained within a watercourse. Usually results from heavy rainfall.
Sustainable Drainage Systems (SUDS)	A sequence of management practices and control structures, often referred to as SUDS, designed to drain surface water in a more sustainable manner. Typically, these techniques are used to attenuate rates of runoff from potential development sites.
Watercourse	Any natural or artificial channel that conveys surface water.
Water Cycle Strategy (WCS)	Provides a plan and programme of Water Services Infrastructure implementation. It is determined through an assessment of the environment and infrastructure capacity for: water supply; sewage disposal; flood risk management; and surface water drainage.
Watershed	Line depicting the area within which all surface water will drain into an area of interest, such as a town or village. For the assessment of surface water this boundary is defined from the topography.

ABBREVIATIONS

CFMP	Catchment Flood Management Plan
Defra	Department for Environment Flood and Rural Affairs
DQS	Data Quality Score
FRA	Flood Risk Assessment
GIS	Geographical Information System
GWA	Ground Water Availability
IDB	Internal Drainage Board
LDF	Local Development Framework
LiDAR	Light Detecting and Ranging
LPA	Local Planning Authority
MCM	Multi Coloured Manual
MSfW	Making Space for Water
NPD	National Property Dataset
OS	Ordnance Survey
PPS25	Planning Policy Statement 25 – Development and Flood Risk
RFRA	Regional Flood Risk Appraisal
SFRA	Strategic Flood Risk Assessment
SPZ	Source Protection Zone
SSSI	Sites of Special Scientific Interest
SSW	South Staffordshire Water
STWL	Severn Trent Water Limited
SUDS	Sustainable Drainage Systems
SWMP	Surface Water Management Plan
WCS	Water Cycle Study

WMRSS	West Midlands Regional Spatial Strategy

1 INTRODUCTION

1.1 General Overview

In November 2009 Royal Haskoning was appointed by Stafford Borough, Lichfield District, Tamworth Borough, South Staffordshire District and Cannock Chase District Councils (hereafter "the Councils") to produce a Phase 1 and Phase 2 Surface Water Management Plan (SWMP) and a Phase 1 and Phase 2: Scoping and Outline Stage Water Cycle Study (WCS). This report relates to the production of the Phase 1 SWMP and has been written to the specification of the Defra's draft Surface Water Management Plan guidance (version 1 - February 2009) and the requirements of the Brief.

1.2 Objectives of the SWMP

As shown in **Table 1.1** the Councils are at different stages in the process of preparing their Local Development Framework (LDF) submissions, as required by the Planning and Compulsory Purchase Act 2004. To inform and support their submissions, the Councils are required to present a portfolio of studies, forming an Evidence Base, of which this SWMP will form a part, along with the associated WCS.

Table 1.1 - Local Authority Development Plan Status (January 2010)

Local Authority	Commencement	Publication*	Submission*	Adoption*
Stafford Borough[2]				
Core Strategy	October 2007	June 2011	November 2011	May 2012
Site Specific Documents	October 2009	December 2010	April 2011	December 2011
Lichfield District[3]				
Core Strategy	March 2007	October 2009	January 2010	August 2010
Site Specific Documents	July 2009	November 2010	February 2011	November 2011
Tamworth Borough[4]				
Core Strategy	2007	October 2010	February 2011	January 2012
Site Specific Documents	October 2008	July 2010	October 2010	May 2011
South Staffordshire District[5]				
Core Strategy		November 2010	March 2011	November 2011
Site Specific Documents	July 2009	November 2011	March 2012	November 2012
Cannock Chase District[6]				
Core Strategy	September 2004	December 2009	March 2010	May 2010
Site Specific Documents	September 2009	September 2011	December 2011	February 2012

NB Shaded cells represent completed items

**Progression of all the Core Strategies is delayed due to RSS Phase 2 Review delays and guidance that is awaited following the formation of a new Government. All figures are correct at the time of print.*

[2] Stafford Borough Council Local Development Scheme, November 2008

[3] Lichfield District Council, Local Development Scheme, July 2009

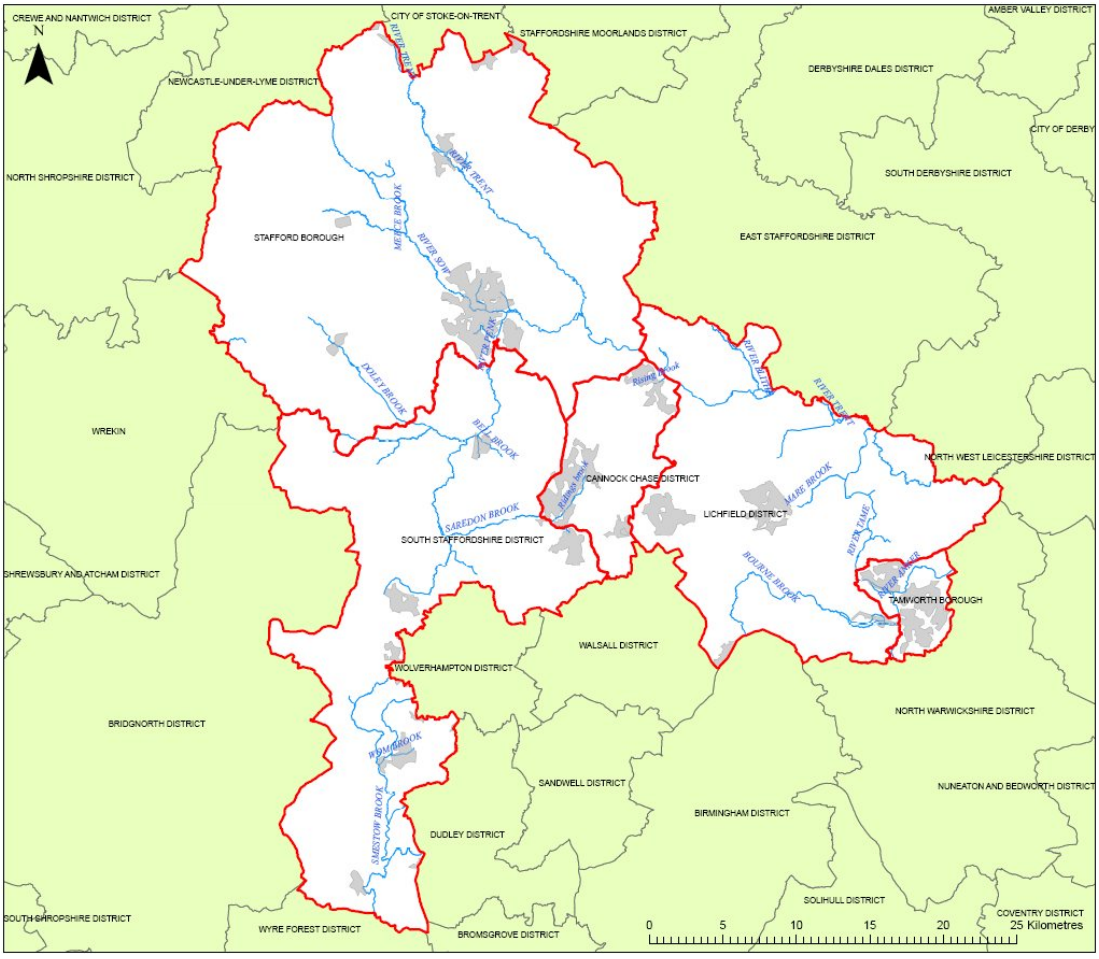
[4] Tamworth Borough Council, Local Development Scheme, September 2009

[5] South Staffordshire District Council, March 2007

[6] Cannock Chase District Council, April 2009. Please note, the Council is currently re-considering its timetable in light of delays primarily related to the potential impacts of development upon the Cannock Chase Special Area of Conservation. Further information on the most up to date timetable should be sought from the Council."

The study area for this project covers the administrative areas of Stafford Borough, Lichfield District, Tamworth Borough, South Staffordshire District and Cannock Chase District, totalling an area of just under 1,450km², as shown in **Figure 1.1**. Due to the cross boundary issues associated with the targeted growth (explained further in Section 3), it is important for this area to be studied as a whole. The locations identified for development should be selected carefully with due consideration of all the sources and types of surface water flooding, both within and beyond Local Authority boundaries. Consideration of the findings of this SWMP and the Phase 2 SWMP, when complete, alongside the conclusions of the other strategic studies undertaken for this study area (including the existing Level 1 SFRAs and the WCS) will enable the Councils to make informed decisions regarding the most sustainable locations for their planned developments.

Figure 1.1 - Study Area



One of the primary aims of the UK Government's strategy for flood and coastal erosion risk management, Making Space for Water (MSfW) is manage flood risk more effectively through the adoption of a holistic, joined-up and integrated approach. Highlighted within the Pitt Review following the summer 2007 floods, surface water flooding is a widespread problem across the country. During heavy rainfall events rainwater rapidly

exceeds the capacity of the existing drainage networks, causing widespread flooding and disruption. This is most notable within urban areas where the sewerage networks and culverted watercourses often cannot accommodate the rapid and extreme runoff from the impermeable surfaces. The main objective of this SWMP is therefore to inform the Councils as to the occurrence and cause of surface water flooding within their boundaries and the appropriate mitigation strategies to assist in managing this risk in a sustainable manner.

1.3 Scope of the SWMP

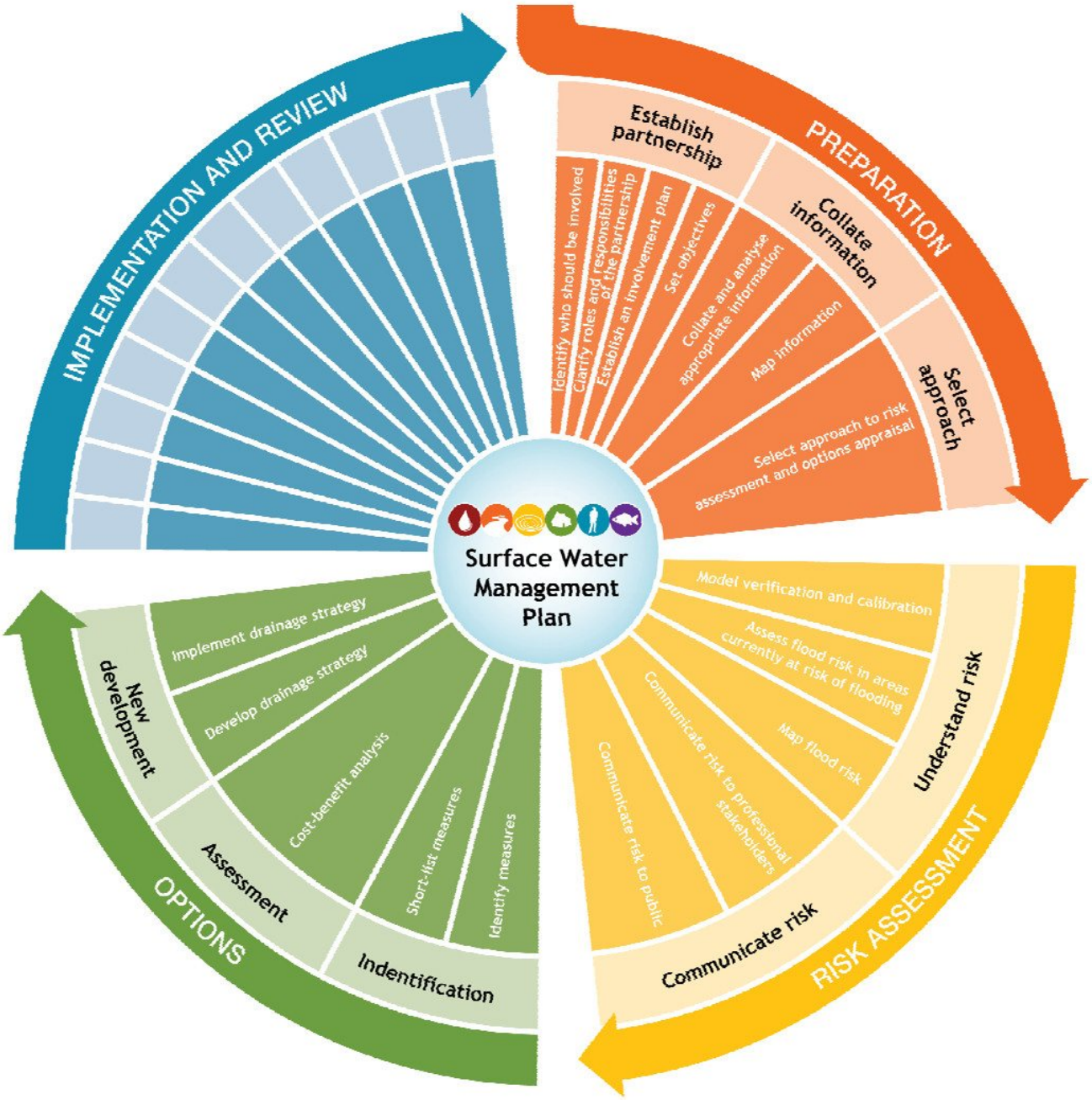
Defra's SWMP guidance states there are four main stages to producing a SWMP, as shown graphically in **Figure 1.2**:

- Phase 1 - Preparation;
- Phase 2 - Risk Assessment;
- Phase 3 - Options; and
- Phase 4 - Implementation and Review.

As shown in **Figure 1.2** these four phases are interlinked into a linear process that extends from the identification of a problem through to the implementation of actions to resolve the situation. Within each of these Phases there are a number of sub-tasks, around which the structure of this Phase 1 study has been based. This commission encompasses only the first two Phases of this process, namely the Preparation and Risk Assessment, with this report focussing solely upon Phase 1. The key objectives of these two Phases are discussed further in Sections 1.3.1 and 1.3.2 below.

***Please note**: As this commission was awarded in 2009, the scope is based upon the requirements of Defra's draft SWMP Technical guidance, published in February 2009 and not the requirements of the updated guidance, published in March 2010. However, the key Phases have remained the same and the overall approach is similar, although the subcategories and division of tasks within each phase has now been superseded. Despite these changes, the final outcomes from both methodologies are the same. As a result, it is not thought to be necessary to update this report to the new guidance document.*

Figure 1.2 - Key Elements of a SWMP



(Taken from draft SWMP Technical Guidance, Defra, February 2009: pp xxviii)

1.3.1 Phase 1 - Preparation

This phase focuses on preparing and scoping the requirements of the SWMP at a strategic level. The overall objective is to determine which locations within the study area require further analysis and the best method by which this analysis should be undertaken. There are three key aims to this stage:

1. Establishing a partnership between the key consultees and stakeholders;
2. Collecting and collating existing information on surface water flooding; and
3. Selecting an approach to carry out further analysis (i.e. the scope for Phase 2).

The first two of these stages have been addressed further within Sections 2 and 3 of this report, split into the subsections shown within **Figure 1.2.** Sections 4 to 8 present the mapping, analysis and conclusions for the five separate Local Authorities, with Section 9 presenting the summary conclusions and recommended approach for further stages of the SWMP. The approach to this SWMP has been devised and agreed in consultation with the Environment Agency. This includes approval of a technical note, dated 23rd February 2010, detailing the methodology for displaying the mapped information.

1.3.2 Phase 2 - Risk Assessment

The risk assessment approach to SWMPs involves the selection of an appropriate modelling technique to assist in determining the risk of particular areas from surface water flooding at a more local scale. The modelling approaches vary in detail from relatively simple 'Rolling Ball' models which analyse the topography of an area to determine flow pathways, to 'Detailed' combined models which include the drainage networks, such as sewers within an urban area. Further detail on the varying modelling techniques is provided within the updated SMWP guidance[7]. The appropriate area and scale of modelling to be considered by a Local Authority is guided by the analysis carried out as part of Phase 1 and therefore the conclusions of this report.

As all the modelling approaches for a SWMP rely upon an accurate representation of the topography of an area, a key data requirement to progress a SWMP beyond Phase 1 is access to topographic data of a fairly high resolution, namely LiDAR data with a resolution of ≥2m. At the start of this commission the available data was reviewed and it immediately became evident that insufficient LiDAR coverage was available for this study area. As a result Phase 2 of this commission was placed on hold until the appropriate LiDAR data was procured. To assist the Councils in the progression of their LDF documents, this Phase 1 report has been drafted as an intermediate step.

[7] Surface Water Management Plan Technical Guidance, March 2010.

2 ESTABLISHING A PARTNERSHIP

There are many causes and sources of surface water flooding, illustrated within Box 2 of the draft SWMP guidance:

Box 2 Surface water flooding

In this context, **surface water flooding** describes flooding from sewers, drains, small water courses and ditches that occurs during heavy rainfall in urban areas. It includes:

- Pluvial flooding; flooding as a result of high intensity rainfall when water is ponding or flowing over the ground surface (surface runoff) before it enters the underground drainage network or watercourse, or cannot enter it because the network is full to capacity.
- Sewer flooding; flooding which occurs when the capacity of underground systems is exceeded, resulting in flooding inside and outside of buildings. Normal discharge of sewers and drains through outfalls may be impeded by high water levels in receiving waters.
- Flooding from small open-channel and culverted urban watercourses which receive most of their flow from inside the urban area
- Overland flows from the urban/rural fringe entering the built-up area, including overland flows from groundwater springs.

(Taken from draft SWMP Technical Guidance, Defra, February 2009: pp xxiv)

A key starting point for a SWMP is therefore to identify all the appropriate partners and stakeholders involved with the management and maintenance of the drainage networks. Through this process the SWMP can be seen as a framework through which key local partners with responsibility for surface water and drainage work together to understand and agree the most sustainable and cost effective method for managing surface water flood risk. The aim of this method is to ensure that a strategic approach is applied across a region, rather than on a site by site basis.

2.1 Identification of Partners

The key partners to be involved in this SWMP were identified at the Initiation meeting for this study, which took place on 20th November 2009 and at which representatives from all the local Councils, the County Council, Severn Trent Water and Royal Haskoning were present.

Three main groups were identified, consisting of the following partners and stakeholders:

Core Steering Group (Partners)

- Local Councils (Stafford Borough, Lichfield District, Tamworth Borough, South Staffordshire District and Cannock Chase District);
- Staffordshire County Council
- Royal Haskoning;
- The Environment Agency; and

- Water Companies (Severn Trent Water Limited and South Staffordshire Water).

Additional Data Providers / Key Consultees (mix of Partners and Stakeholders)

- Natural England
- British Waterways
- Environmental Groups
- Internal Drainage Boards
- Public Flood Risk Forums
- Lichfield and Hatherton Canal Restoration Trust

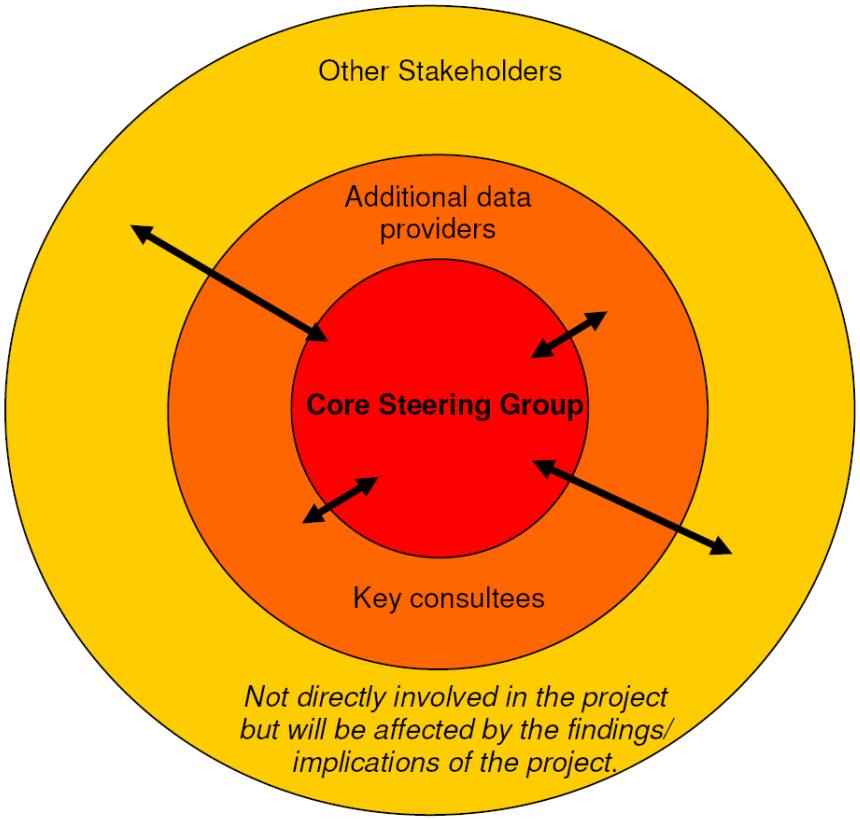
Other Stakeholders (Stakeholders)

- Public
- Riparian Owners
- Developers

N.B: Partners have a role to take responsibility for the decisions or actions, whereas stakeholders are affected by the problem or solution and, as such, hold an interest in the study.

The interconnections between these various partners and stakeholders are illustrated in the following relationship diagram:

Figure 2.1 - Partner Relationship Diagram



2.2 Roles and Responsibilities

The roles and responsibilities of these various stakeholders were also defined following the Initiation meeting. The roles of the *Core Steering Group* members are defined within **Table 2.1** below:

Table 2.1 - Roles and Responsibilities of Core Steering Group

Member	Engagement with….	Role/Method
Councils	Coordination of other Steering Group members	Throughout project life and beyond
	Additional data providers	Assisting RH with data collection
	Other Stakeholders	Meetings/Workshops/Presentations
		Day to day communication
		Implementation of development
Royal Haskoning	Rest of Steering Group	Data requests/queries Steering Group progress meetings Presentation
	Additional data providers	Telephone/Email/Meetings
	Other Stakeholders	Presentation to members - assisting the Council in disseminating the key messages from the SMWP.
Environment Agency	Steering Group	Provision of data
	Other Stakeholders	Either directly through day to day responsibilities or to assist the Council in dissemination of findings
Severn Trent Water	Steering Group	Provision of data
	Other Stakeholders	Either directly through day to day responsibilities or to assist the Council in dissemination of findings
South Staffordshire Water	Steering Group	Provision of data
	Other Stakeholders	Either directly through day to day responsibilities or to assist the Council in dissemination of findings

It was established that the Local Councils would be the main contact with the 'outside ring' of partners, including the public, riparian owners and developers, although they would be supported in this role by the other Steering Group members. To enable this approach to be successful all these members were identified to have a responsibility for openness and cooperation within the Core Steering Group, which was identified as being a key requirement.

The second tier of *Additional Data Providers and Key Consultees* was identified to have a role as providers of additional, but not key, data and information. As such they were identified to have a responsibility to correspond with the Steering Group when required (e.g. through the provision of data).

The third tier of *Other Stakeholders* was not identified as holding any data or information for the high level Phase 1 and possibly Phase 2 studies. However, as they would be affected by the implications of the SWMP, the key findings should be communicated to them, for example through presentations before any future Phases (3 and/or 4) were undertaken.

2.3 Engagement Plan

As a result of the discussions with the Steering Group at the start of the commission an Engagement Plan was drafted to summarise the key outcomes. This is included within **Appendix A**.

2.4 Objectives

The main objectives of this Phase 1 SWMP, as defined in the draft Defra SWMP guidance are to:

- Establish a partnership with the Steering Group and additional stakeholders;
- Clarify the roles and responsibilities of partners;
- Draw up an Engagement Plan;
- Determine and map the historic occurrences of surface water flooding across the Study Area;
- Define the areas at greatest risk of surface water flooding and therefore which areas require further investigation as part of Phase 2; and
- Advise the Councils as the 'next steps' for the SWMP.

3 COLLATE AND MAP INFORMATION

3.1 Data Collection and Quality

As the Phase 1 SWMP is a strategic study covering a large geographical area, a key focus has been placed upon the collection and analysis of existing information regarding historic and future surface water flooding. Data has been requested and received from all the partners and a vast majority of the stakeholders identified in Section 2 above. This has been undertaken through direct phonecalls and emails, in addition to the downloading of publically available information on the internet. A full data register of the information received is shown in **Appendix B** (it must be noted that this register includes the information obtained for use in both the SWMP and parallel WCS). Key consultees at this stage have included:

- Stafford Borough Council
- Lichfield District Council
- Tamworth Borough Council
- South Staffordshire District Council
- Cannock Chase District Council
- Staffordshire County Council
- Environment Agency
- Severn Trent Water
- Lichfield and Hatherton Canal Restoration Trust

Although as much information as possible has been collected during this Phase 1 study not all stakeholders and partners were able to provide data useful at a strategic scale. It will therefore be beneficial to use the conclusions of this Phase 1 study as a basis for further discussion with the consultees at the start of the Phase 2 stage. This will assist in the identification of more detailed surface water flood risk and, potentially, mitigation strategies that adopt a partnership approach. Two key consultees who were unable to provide information for this study but who may be able to assist within Phase 2 and to provide comment upon the conclusions of Phase 1 are British Waterways and the Sow and Penk IDB. This will be discussed further within the following Sections of this report.

The main aim of this Phase 1 SWMP is to identify which locations within the Study Area are at highest risk of surface water flooding, based upon available information. There are two main areas into which the collected data has been categorised:

1. The location of historic flooding events; and
2. The locations at highest risk of future flooding events.

The methodology for analysing this information was agreed by the Councils and Environment Agency in March 2010 following a technical note submitted by Royal Haskoning and is discussed in more detail in Sections 3.1.1 and 3.1.2 below. As the Councils are yet to finalise the locations of the proposed development, analysis within this report has focussed upon the main settlements within each of the Local Authority areas. The locations of these settlements are shown in **Figures A1 - A5** within **Appendix C** and match those assessed within the WCS.

Data Quality

As this SWMP is based upon the collection and assimilation of data, an important element was to assess the quality and confidence of the data received. This was undertaken using the data quality scale outlined within the Flood Hazard Research Centre's (FHRC) Multi Coloured Manual. This scale grades data quality based upon the confidence the user can have in its accuracy to give a Data Quality Score (DQS) as shown in **Table 3.1** below:

Table 3.1 - Multi Coloured Manual Data Quality Assessment

Data Quality Score (DQS)	Description	Explanation	Examples given in draft SWMP guidance
1	'Best of Breed'	No better available; unlikely to be improved on in near future	High resolution LiDAR River/sewer flow data Raingauge data
2	Data with deficiencies	To be replaced as soon as third parties re-issue	Typical sewer or river model that is a few years old
3	Gross assumptions	Not invented but deduced by the project team from experience or related literature/data sources	Location, extent and depth of much surface water flooding Operation of unmodelled highway drainage 'Future risk' inputs e.g. rainfall, population
4	Heroic assumptions	No data sources available or yet found; data based on educated guesses	Ground roughness for 2d models

This system has been used to grade the data collected and therefore assists in highlighting the potential shortfalls in the analysis. The background OS Mapping used in this Phase 1 study has been given a DQS of 1. The rest of the data used is discussed further and graded within the relevant sections below.

3.1.1 Historic Flood Event Data

Key Data Sources and Interpretation

The key starting point for this study was to collect as much information regarding the locations of historic flooding as possible. The key sources of this data consisted of the Local Authorities, Staffordshire County Council and Severn Trent Water Limited and the data collected, its source and the assigned DQS are listed in **Table 3.2** on the following page:

Table 3.2 - Historic Flooding Data

Data	Source	Information Included	Extent	DQS
SFRA Shapefiles	Stafford BC*, South Staffordshire DC and Cannock Chase DC	All sources of flooding available at time of SFRA publication.	All Boroughs/ Districts	3
"Historic Flooding Highways Hotspots"	Staffordshire County Council via Stafford Borough Council	Location of all sources of flooding.	Entire Study Area	3
Lichfield 'Hot Spots'	Lichfield DC	Unspecified flooding	Lichfield District	3
Floods2 Database	Severn Trent Water Limited	Sewer flooding (1991 - 2009)	Entire Study Area	3

*This data set covers Stafford Borough, Tamworth Borough and Lichfield District

As all this data has been deemed to be of an equivalent quality it has not been differentiated by source within the analysis. However, it must be appreciated that, due to the nature of this type of data, it is not comprehensive and cannot be quantified or checked in its accuracy. As such it only provides a guide to the areas vulnerable to surface water flooding.

To review the historic flood events they have been mapped, together with the potential development sites within each Local Authority area, shown in **Appendix C** (**Figures B1 - B5**). Many of the data sets have been made available in the form of GIS shapefiles and, as such, their locations accurately placed as points on the map. However, as the accuracy of these locations and the reports of flooding cannot be verified, the locations should not be considered definite and, to avoid the blighting of individual properties, the markers on the maps have been expanded in size with each covering a number of properties. Where there are overlaps between the different datasets, the points are overlaid. Care must be taken with these locations as they may refer to the same incident that has been recorded as originating form differing sources within the different data sets.

In addition to the location of the flood event, most of the data sets also state the type of flood event and the date on which the flooding occurred. This enables the events to be split in terms of 'source' and 'recurrence'. As many of the data sets include fluvial flooding as well as surface water, these fluvial events have firstly been removed. The rest relate to the causes of flooding listed on page 7 and have been differentiated on the analysis maps through use of the following symbols:

Figure 3.1 - Flood Event Key

The dates of flooding included within the datasets have been used to assess the recurrence, and therefore the persistence of the flood events. In many cases surface flooding occurs as a 'one-off' event that relates to a temporary blockage in a system and/or very unusual rainfall and/or antecedent conditions. Although these events indicate weak points within the system they could be isolated events and therefore may not warrant a full investigation unless associated with other more frequent recurring events. They should however be recognised, especially where they occur in an area associated with other flood events. The repeating flood events indicate problematic locations which require further investigation. These are discussed further in Sections 4 to 8. To illustrate this variation in recurrence the flood events located as points have been colour coded on **Figures B1** to **B5** using the methodology shown in **Table 3.3**.

Table 3.3 - Flood Event Regularity Key

Colour	Regularity	Data Classification	Data Source
Red Points	Repeat Occurrence	3+ records within the data set OR As stated	Floods2 SFRA point data Historic Flooding Highways Hotspots database
Orange Points	Occasional Occurrence	2 records within the data set OR As stated	Floods2 SFRA point data Historic Flooding Highways Hotspots database
Yellow Points	Rare Occurrence	1 record within the data set OR As stated	Floods2 SFRA point data Historic Flooding Highways Hotspots database
Blue Points	Exceptional Occurrence	As stated	Historic Flooding Highways Hotspots database

Postcode Area Sewer Flooding Records

One of the datasets of historic flooding, the sewer flooding records included within the SFRA reports could not be marked on the maps in the form of points. This information is only available in the form of postcode areas with an associated number of events. As there is likely to be overlap between this information and the Floods2 database, this dataset has not been included on the printed maps. It is, however, included in the interactive PDFs for reference. Table 3.4 below shows the colour key to the information shown.

Table 3.4 - Postcode Sewer Data Regularity Key

Colour	Regularity	Data Classification	Data Source
Light Red Shading	Repeat Occurrence	10 + records of flooding within postcode area	Postcode Polygons
Light Orange Shading	Occasional Occurrence	5 - 10 records of flooding within postcode area	Postcode Polygons
Light Yellow Shading	Rare Occurrence	1- 5 records of flooding within postcode area	Postcode Polygons
No fill	None	No records of flooding within postcode area	Postcode Polygons

Additional Data Sources

Other sources of historic flooding information have included the West Midlands Regional Flood Risk Appraisal (RFRA)[8]. This has identified some occurrences of surface water flooding within all five Local Authority areas, with particular review of Tamworth and Cannock towns. Although not mapped this information is discussed further within Sections 4 to 8. Unfortunately the River Trent Catchment Flood Management Plan (CFMP) has not yet been finalised so is unavailable for use in this study. The River Severn Catchment Flood Management Plan (CFMP), however, has been finalised and covers the western edge of the study area and the southern half of South Staffordshire District. Although it recognises that surface water is a flood issue within the catchment as a whole it does not identify any particular locations of relevance to this study.

3.1.2 Future Flood Risk Data

As this study relies upon the collection and collation of existing data there are three main sources of information relating to the predicted surface water flood risk that may occur in the future: the Environment Agency's surface water flood map; Defra's ranking of UK settlements; and the feasibility studies for the reconstruction of the Lichfield and Hatherton canals.

Surface Water Flood Map

The Environment Agency have recently commissioned the production of a surface water 'flood map' of the UK. This mapping utilised a fairly crude modelling technique whereby a single rainfall event was run over the topography of the land to determine where surface water may collect and pool. However it does not include underground sewerage and drainage systems, small over ground drainage systems or buildings. The terrain data used for this assessment was also 5m resolution, which is coarser than recommended for accurate surface water management analysis. This resolution, for example, does not identify important surface water flow routes such as roads. It therefore indicates the susceptibility of an area to surface water flooding and does not prescribe exact locations. As such this data set has been ascribed a DQS of 2.

[8] West Midlands Regional Assembly Regional Flood Risk Appraisal Update FINAL February 2009

For this Phase 1 assessment of available data this map has been used to assess, on a more comparative rather than accurate basis, locations at risk of possible future flooding. Three bands of flooding are defined in these flood maps, indicating 'less' to 'more' susceptibility to surface water flooding, shown in varying grades of purple. These extents for the study area are shown in **Figure C1**, **Appendix C**.

Due to the inaccuracies of this data at a small scale the flood zone outlines have not been used to assess individual development areas or settlements, or shown on a scale smaller than the study area. Instead, an alternative approach has been agreed with the Environment Agency to assist in interpretation of the data. This approach converts the flood risk posed to the key settlements[9] from a Flood Zone extent to a colour coded flag using the following methodology:

1. Determine the number of properties located within the largest surface water flood zone extent within the settlement in question by overlaying the National Property Dataset (NPD) with the surface water 'Less' susceptible extent. (Using this largest flood zone provides a worst case estimate of properties at risk);
2. Colour the flag dependent upon the number of properties at risk - see the colour banding shown in **Table 3.5.** The numbers of properties chosen to fall within each band have been selected as a representation of the variation across the study area in question. This is based upon our judgement of the study area and range of results - there is no set standard for each colour band, although the splits used in this study were agreed with the Environment Agency in advance. We believe this banding highlights the settlements at highest comparative risk as compared to the other settlements within the study.;
3. Attach a number to the flag indicating the number of properties at risk; and
4. Overlay these flags onto the surface water flood maps (**Figures B1 - B5**) with the historic flood event data.

Table 3.5 - Surface Water Flood Map Flag Classifications

Colour of Flag	Number of Properties at Risk
None	0
White	1 - 20
Purple	21 - 50
Blue	51 - 100
Yellow	101 - 350
Orange	351 - 999
Red	1000+

As this is a simple approach and the area selection for each of the settlements may include too many properties, including those surrounding the settlement in question, or not enough (the NPD is cropped to the study area and therefore the selections will not be accurate for those areas located on the boundaries). However, we believe it, in general, offers a conservative estimate and therefore a useful guide to compare different areas within the study region.

[9] Due to the extent of the study area it was not possible to analyse all the settlements within each Local Authority area. Instead, focus has been placed upon the key settlements, as shown on **Figures A1 - A5** in **Appendix C**.

Defra's Assessment

Following the completion of the Environment Agency's surface water flood map, and in order to assist with the prioritisation of funding, Defra analysed the EA's results. The output from this analysis was a national ranking of settlements in order of surface water flood risk. The analysis provided two key figures - the number of properties at risk within the settlement and the rank of the settlement within the country (with "1" indicating the settlement at highest risk of surface water flooding, out of a total of 4,350).

In addition to the flag system developed for use in this study, we have also included reference to Defra's analysis. However there are three main uncertainties with this data which results in differing conclusions to our own:

1. The numbers are rounded;
2. Defra split the entire UK into sections, which will cover different geographical areas to our settlement specific selections; and
3. It is not clear which of the surface water flood extents were used in Defra's analysis or the date of the NPD used.

To avoid confusion we have not mapped the numbers resulting from Defra's analysis amongst our own, although they are included, for reference, in Sections 4 to 8.

It must be noted that the housing figures provided from Defra's analysis are, in many cases significantly different to the number produced within our 'flag' analysis. This could be the result or combination of any of the three uncertainties listed above and highlights that the numbers associated with the flags and our analysis are worst case estimates. Rather than providing an empirical answer, they should be purely used to provide guidance as to which settlements should be assessed further with regards to surface water flood risk. For further information regarding the methodology used in Defra's analysis please see their website[10]

Canal Restoration

All development has the potential to exacerbate surface water flooding from both additional runoff and the blocking of existing drainage routes. However, there is an additional type of development planned across the southern areas of the study area which may also impact on the surface water flooding regime, namely the reconstruction of the Hatherton and Lichfield canals. This construction may assist in alleviating surface water flooding through acceptance and conveyance of surface water discharge which would also provide a source of water to top up canal water levels. Appropriate sizing of new culverts for existing watercourses could be used for attenuation of water course peak flow rate and source control.

Whilst the restored canals can provide positive benefits in any surface water management regime there are also risks which will need to be considered. These include overtopping of the canal in extreme rainfall events or flooding risk associated

[10] http://www.defra.gov.uk/environment/flooding/documents/manage/surfacewater/sw-methodology.pdf

with new culverts that have not been provided with suitable capacity at watercourse crossing points. Another potential issue raised by the Lichfield and Hatherton Canal trust is that there is a high probability that the surface water sewer draining all of southern Lichfield is currently located in the bed of the proposed Lichfield canal. To restore the canal this pipe will require removal and therefore cooperation and agreement between STWL, Lichfield District Council and the Canal Trust

It is therefore essential that the Canal Trust are considered within any surface water management regime. The associated risks and effects are outlined within the feasibility studies for the two canals, which are discussed further, where relevant, within Sections 4 to 8[11] .

3.2 Mapping and GIS

As part of a Phase 1 SWMP the draft SWMP guidance recommends the production of a number of maps of the study area, as discussed below and included within **Appendix C**. In addition, we have provided Summary Sheets highlighting the key sources of flood risk on a smaller scale and have included recommendations regarding any requirements for further assessment. These sheets focus upon the key settlements within each of the Local Authority areas, as shown in **Figures A1 - A5** within **Appendix C** and discussed within Section 3.1. All the datasets used within the following maps will also be provided with the final report in GIS format to enable the Councils to mix and match the various shapefiles to suit their requirements.

3.2.1 Surface Water Flooding

All the available information regarding both historic incidences of surface water flooding and future risk has been mapped and recorded within a GIS. The aim of this is to assist the Local Authorities and other Partners in developing their understanding of the existing surface water flood risk situation within the study area. Local Authority specific maps have been produced showing the following information:

- Locations of historic flood events, indicating type and recurrence of flooding;
- Flags indicating the vulnerability of each settlement to future flooding and the number of properties at risk, as located within the Environment Agency's 'Less' surface water flood extent;
- Locations of Main Rivers and Canals; and
- Potential development sites as provided by each of the Local Authorities.

The aim of these maps is to provide each Local Authority with a visual representation of their Borough or District which illustrates the areas that have experienced the highest density of historic surface water flooding events and the settlements which are most vulnerable to experiencing future surface water flood events, based upon the data available and the methodology outlined in Section 3.1.

[11] This can be viewed in more detail at http://www.lhcrt.org.uk

3.2.2 Flood Risk Assets

As stated within the draft SWMP guidance, one of the recommendations of the Pitt Review is that:

> *"Local Authorities should collate and map the main flood risk management and drainage assets (over and underground), including a record of their ownership and condition"*
>
> **Recommendation 16 of the Pitt Review**

As part of this SWMP, data has been collected regarding a number of flood risk management and drainage assets. To assist the Councils in meeting this recommendation we have mapped this data, highlighting which organisation owns each asset and is therefore responsible for maintenance, as shown in **Figure C2** (**Appendix C**). Within GIS this information can be plotted alongside the layers showing historic flooding and therefore may assist the Phase 2 analysis and by matching up flood events with assets. Unfortunately, due to the conditions of their confidentiality statement, we are unable to display the locations of STWL's sewers. We recommend the Councils look to obtain this information for their own reference.

3.2.3 SUDS Map

For all developments Sustainable Drainage Systems (SUDS) will be required to minimise surface runoff and therefore not increase flood risk elsewhere. As such the application of SUDS techniques is a key recommendation for all settlements and development sites. PPS25 recommends runoff from developed sites does not exceed Greenfield runoff. For the Local Authority areas in question the Environment Agency have the following current requirements for surface water run-off:

a) Greenfield developments – the rate of surface water run-off should not exceed the existing Greenfield run-off rate, the general accepted rate for annual run off is considered to be approximately 5/l/s/ha in this area (unless demonstrated otherwise).
b) Brownfield redevelopments – a minimum of 20% reduction in flows when compared to the historic run-off rates, although further betterment is strongly encouraged.
c) Redevelopment sites situated at an upstream point of a catchment subject to significant flood risk (site-specific locations) – run-off to be limited to less than Greenfield rates where possible in order to provide wider flood risk reduction downstream.

In addition, a result of the implementation of the Flood and Water Management Act, the right to connect surface water to a public sewer has been removed. As a result, STWL are no longer obliged to accept new surface water connections to their network (although they may consider applications on an individual basis). As such almost all surface water must be collected and managed on site through the implementation of SUDS storage and infiltration systems. The underlying geology of each site has implications for the types of SUDS techniques that will be appropriate at that site. In addition, the proximity of the site to any water supply aquifers and the susceptibility of

the underlying strata to pollution must be accounted for. The various techniques and applications are discussed in detail with the WCS report associated with this SWMP and should be that referenced for further information, which includes maps and a constraints matrix illustrating the restrictions on SUDS application for each of the key development sites within the study area, including discussion of Groundwater Vulnerability (GWV) and Source Protection Zones (SPZ). Please see Figures 5.8, 6.8, 7.8, 8.8 and 9.8 within the WCS report[12].

3.2.4 Summary Sheets

To assist the Local Authorities with their interpretation of these surface water flood risk maps, the information shown has been captured and summarised for each of the key settlements within settlement specific summary sheets, contained within **Appendix D - H**. These sheets outline the risk to both the settlement as a whole and to individual key development sites for historic, future and overall flood risk using the methodology outlined below. A traffic light colour code is provided for historic, future and overall flood risk to indicate the action that should be taken for the site, as shown in **Table 3.6**:

Table 3.6 - Surface Water Flood Risk Traffic Light Colour Code

Colour	Meaning
Red	Area should be investigated further as part of a Phase 2 SWMP or site specific study.
Yellow	Area would benefit from further investigation. Development should be reviewed with reference to the surface flood maps and causes of historic flooding should be investigated.
Green	Based on current data no detailed further analyses required, although the topography of individual sites should be reviewed before development and all new development should utilise SUDS methods.

An annotated example template of a summary sheet is shown in **Figure 3.2**. The tables to which the annotations refer follow the example figure.

[12] Southern Staffordshire Phase 2 Water Cycle Study Draft Report, Royal Haskoning, April 2010

Figure 3.2 - Summary Sheet Template

Snapshot of key settlement, taken from **Figures B1 - B5**.

Map key, taken from **Figures B1 - B5**.

Historic Flooding section details the occurrences of historic flooding shown within and around the settlement in question.

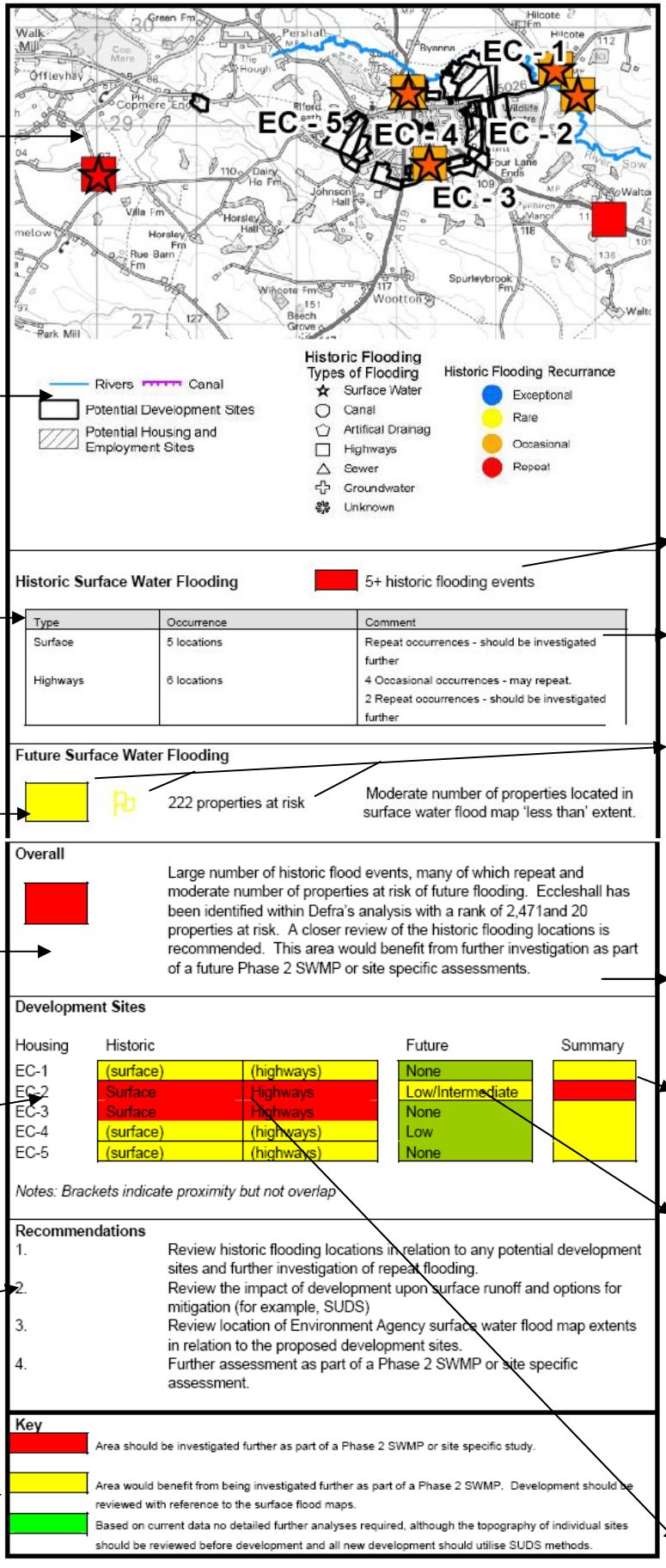
Future Flooding section outlines the results from the conversion of the Environment Agency's surface water flood map into a flagged system (see Section 3.1.2 for more detail)

Overall Flooding section summarises the combined results for the settlement, accounting for both historic and future flooding.

Summary of key **development sites** shown within the settlement.

Recommendations are provided for the settlement as a whole.

Key refers to the implications of each of the box colours.



Number of historic flooding occurrences marked as points on the map snapshot shown above. Colour code is explained in **Table 3.7**

Further explanation of all historic flooding events within and around the key settlement.

Box colour explained in **Table 3.8**.
Flag colour explained in **Table 3.5**
Number of properties taken from comparison of EA surface water flood map and NPD (RH analysis)

Box colour is explained in **Table 3.9**
Text summarises the conclusions shown above, plus the results of Defra's analysis for the settlement.

Summary box colour is explained in Table 3.9 as a combination of Historic and Future

Future box colour refers to the EA surface water flood map extent in which the development site is either wholly or partially located:
Green - overlap with 'Less' flood extent or no overlap
Yellow - overlap with 'Intermediate' flood extent.
Red - overlap with 'more' flood extent.

Historic box colour explained in **Table 3.7**

Both the settlements (as a whole) and individual key development sites are assigned an historic flood risk traffic light colour using the methodology outlined in **Table 3.7.** In addition, a tabulated commentary is provided which summarises the type, recurrence and implication of each of the historic flood events within a settlement.

Table 3.7 - Assessment of Historic Surface Water Flood Events

Colour	Settlement Analysis[1]	Development Site Analysis
Red	Settlement contains 5+ historic flooding events	Overlaps with 1+ historical flooding events[2]
Yellow	Settlement contains 1-5 historic flooding events	Located in proximity to a historic flooding event
Green	Settlement contains no records of historic surface water flood events, or contains 1 rare surface water flood event.	No historic flooding events in proximity.

NOTES:

1 - As the exact locations of SFRA sewer flooding events are not recorded at a scale smaller than a postcode area, this data is not utilised within this analysis. It is, however, included within the commentary of historic flood risk to the settlement.

2 - Due to the required size of the markers used for historic flooding on the area maps, an event overlapping with the edge of a development site may not indicate historic flooding has occurred within the site boundaries.

Future surface water flood risk is shown on the maps in the form of the coloured flags. The summary sheet identifies the colour of this flag and number of properties at risk. To bring the classification in line with the historic flooding, a three tier traffic light colour code is assigned based on the classifications shown in **Table 3.8**, condensing the full range of flag colours referenced in **Table 3.5**.

Table 3.8 - Assessment of Future Surface Water Flood Risk

Colour	Reason
Red	351+ properties at risk (Orange and Red flags)
Yellow	20 - 350 properties at risk (Purple, Blue and Yellow flags)
Green	<20 properties at risk (no or white flag).

An overall colour code is assigned to each of the settlements and key development sites using the following matrix:

Table 3.9 - Overall Surface Water Flood Risk Classification

		Historic Flooding Classification		
		Green	Yellow	Red
Future Flooding Classification	Green	G	Y	Y
	Yellow	Y	Y	R
	Red	Y	R	R

4 STAFFORD BOROUGH

4.1 Surface Water Flood Risk

The development sites and settlements assessed within the Borough are shown on **Figure A1**.

Historic Flooding

Figure B1 illustrates a fairly large number of historic surface water flood occurrences across the Borough, including sewers, highways and surface water, although one isolated incidence of canal overtopping on the Shropshire Union has also been identified. A high proportion of these flood events are listed as occasional or repeat occurrences and/or show overlaps between different flood events (although these overlaps may indicate duplications between different data sets). A number of the flood events are scattered across the rural areas of the Borough but clusters are evident within the main settlements, with Stafford town, Stone and Eccleshall being the most prominent (identified with 25, 9 and 9 incidences of surface water flooding respectively). The classification of the postcode areas with regards to sewer flooding also indicates a prominence of flood events within the urban areas and a fairly high occurrence of sewer flooding across the Borough as a whole.

Future Flooding

The surface water flood map, **Figure C1**, indicates areas in which surface water flooding is potentially a high risk, with the areas surrounding Gnosall, Eccleshall, Stafford and Weston being the most prominent. Away from the main river valleys this illustration highlights the low lying historically marshy areas of ground across the middle swathe of the Borough, which does roughly correlate with the historic flooding records.

The comparative analysis of the surface water flood map and NPD points, shown on **Figure B1**, identifies Stafford town and Stone as being the areas of highest risk with over 4,000 properties in Stafford being located within the Environment Agency's "Less" flood extent (including most of the adjoining villages of Brocton and Derrington). Defra's analysis ranks Stafford as 220 and Stone as 606[13]. For further information regarding the derivation of these numbers, please see Section 3.1.2. Beyond these two main towns, a further seven settlements have been highlighted with yellow flags indicating a 'moderate' flood risk of between 100 and 350 houses within the flood extent, including Eccleshall, Yarnfield, the Bridgeford Area, Salt and Weston, Gnosall, Hixon and Stowe and Haywood.

[13] The lower the rank number, the higher the flood risk.

Overall

The surface water Summary Sheets for Stafford Borough are included within **Appendix D**.

Overall the following six settlements have been identified as being at a high risk of surface water flooding (indicated by a red traffic light colour code) and therefore would benefit from further investigation:

- Stafford;
- Eccleshall and Copmere End;
- Salt and Weston;
- Stone;
- Walton and Norton Bridge; and
- Yarnfield.

The reason for their classification varies between the settlements, with most suffering from both historical and the potential for future flooding. However, for the more rural areas, such as Walton and Norton Bridge, the flooding is fairly dispersed around an area much larger than the settlements. In these locations it may be more beneficial for the Council to analyse the occurrences on an individual basis and when/if a development site is progressed.

A large proportion of the development sites have been classified as 'yellow' and would therefore benefit from some further investigation, possibly as part of a site specific FRA, funded by the developer and approved by the Environment Agency prior to site progression (please see the summary sheets in Appendix D for individual site references). However, there are also a number of development site classified as 'red', either due to an overlap with historic flood events and/or overlap with areas of the Environment Agency's flood map classified as 'More' susceptible to surface water flooding (namely sites SF-12, SF-f, EC-2, GH-1, HI-1, HI-3, HA-a, HA-b, HA-c and SN-3). It is recommended these sites are reviewed individually before progression, especially where they are identified as overlapping with a recurring historic flood event. For all sites which are developed it will be important to reduce the Greenfield runoff rate from the site so the flood risk beyond the developed area is not increased and, if possible, reduced.

4.2 Surface Water Management

The high number of sewer flooding incidences within the Borough indicates a general exceedence of capacity within the sewerage network. It is recommended that discussion is held with STWL to identify whether these locations are already being addressed within their current strategy. The capacity of the sewerage network in general with regards to the proposed development sites is discussed further within the WCS report, although STWL have stated that no new connections of surface water will be permitted.

SUDS are therefore an essential inclusion within all new developments and, as far as possible, the retrofitting of existing developments. Although it will be necessary to secure the necessary developer contributions ahead of granting planning permissions to

ensure that the correct SUDS policies and drainage improvements are incorporated, the Flood and Water Management Bill states that is it the responsibility of Local Authorities for adopting and maintaining SUDS schemes that serve multiple properties and the responsibility of the highways authority to maintain SUDS schemes on roads.

A large majority of the flood occurrences within the towns are identified as highways flooding. This may be a result of blocked highways drains, which falls under the responsibility of the highways authority, or the overflow of ordinary watercourses or drains within the town, which are the responsibility of the owner, although Local Authorities are empowered to undertake maintenance works if necessary (for Main Rivers, shown on **Figure C2**, these powers lie with the Environment Agency). It is recommended the repeat occurrences are investigated further to determine their source and therefore assist in rectifying the problem. More detail would be provided as part of a Phase 2 modelled SWMP.

Incidences of canal overtopping are the responsibility of British Waterways (in conjunction with other authorities dependent upon the cause of the overtopping). Following the completion of this Phase 1 SWMP it is recommended that discussion is held with British Waterways to determine whether the highlighted event is a single occurrence or whether any improvements to surface water management practices within the Borough would reduce the risk of a repeat event in the future.

4.3 Recommendations

Following the analysis within this Phase 1 SWMP, the following recommendations are concluded for Stafford Borough. Please note that these recommendations are based upon the most recent data and all will require review following completion of the Phase 2 SWMP study. All recommendations relating to the determination of the locations most desirable for development (i.e. development of preferred options/areas) are the responsibility of the Local Authority. All recommendations relating to the progression of individual development sites are the responsibility of the developer. As a result of the Floods and Water Management Act Staffordshire County Council, as Lead Local Authority, has responsibility for monitoring and managing surface water flood risk.

1. The causes of the repeating, overlapped or clustered flood events should be investigated further, either by the Council as a further step towards mitigating the source of surface water flooding problems, or by developers as part of a site specific FRA;
2. All results from this Phase 1 SWMP should be discussed with the Partners and Key Stakeholders to identify any inconsistencies, anomalies, gaps and/or duplications within the data collected. As above, this should either be carried out by the Council with an aim to mitigate surface water flooding issues on a large scale, or by developers as part of a site specific FRA;
3. Further investigation into surface water flood risk and runoff mitigation should be carried out for the development sites identified as being at a high or medium overall risk of surface water flooding from this analysis (highlighted as red or yellow within the summary sheets), within site specific FRAs undertaken by the developer. The sites classified as red consist of: SF-12, SF-f, EC-2, GH-1, HI-1, HI-3, HA-a, HA-b, HA-c and SN-3;

4. The Council should undertake Phase 2 SWMP modelling for the town of Stafford (this is particularly important due to the identification of the town as a Growth Point and the resulting high number of development proposals);
5. The Council should consider undertaking a Phase 2 SWMP in the future for the town of Stone. The necessity for this is dependent upon the level and location of final development planned for the town and the availability of the necessary data;
6. The Council and developers should review the six settlements - *Stafford, Eccleshall and Copmere End, Salt and Weston, Stone, Walton and Norton Bridge and Yarnfield* - identified as being classified as having a high overall risk of surface water flooding within the analysis (highlighted as red in the summary sheets) when considering the promotion of development sites within those areas;
7. All development sites in the settlements specified above should be reviewed by the Council in consultation with partners and stakeholders to determine those most suitable for progression. This will require consideration of all the other Evidence Base studies collected as part of the LDF process. If sites are progressed, the information presented within this SWMP should also be reviewed by developers as part of site specific FRAs.
8. For the settlements not included in the more detailed, Phase 2 SWMP, the developer should ensure that surface water management issues are sufficiently addressed and agreed with the Environment Agency, within a site specific FRA.
9. The Council and developers should ensure appropriate SUDS techniques are implemented into all new developments (as per the Floods and Water Management Act) and as far as possible retrofitted into existing settlements, especially where historic flood events have been identified;
10. The Council should review the agricultural and land management practices within the District and encourage farmers to not leave land bare. Some funding may be available through Defra to undertake such initiatives via their "Farming Floodplains for the Future Scheme"[14];
11. To assist in the mitigation of the surface water flood risk and the promotion of development sites, the Council and developers should discuss with the appropriate Partners and Stakeholders whether any of the flood events are/have already been investigated and/or rectified;
12. Councils and developers should, as far as possible, implement the site specific recommendations listed in the summary sheets.
13. All the conclusions and information included in this Phase 1 SWMP require consideration by developers and should be investigated in further detail if a site is to be progressed.

[14] http://www.defra.gov.uk/environment/flooding/risk/innovation/sld2314.htm

5 LICHFIELD DISTRICT

5.1 Surface Water Flood Risk

The development sites and settlements assessed within the District are shown on **Figure A2.**

Historic Flooding

Figure B2 illustrates a fairly large number of historic surface water flood occurrences across the District, the majority of which relate to highways, surface or unknown flooding. A high number of these events have been listed at rare occurrences, especially in and around Lichfield City. As this area was badly affecting during the summer 2007 rainfall event (to which many of these records relate), this indicates that the surface water drainage network cannot cope with extreme events. The recording of such incidences is likely to have increased following this event, thereby leading to a relatively high number of individual occurrences. In addition to the flooding events mentioned above, some areas of the District have also been affected by sewer flooding and canal overtopping. Sewer flooding in particular is prominent to the northwest of the District, around the Armitage area. Canal overtopping has occurred in a couple of locations on the Birmingham and Fazeley canal, close to the border with Tamworth Borough.

A number of the flood events are scattered across the rural areas of the District but clusters are evident within the main settlements, with Lichfield City and Burntwood being the most prominent (reporting 12 and 15 incidences of surface water flooding respectively). Other areas experiencing high numbers of historic flooding incidences include Armitage and the Longdons, Elford, Mile Oak and Fazeley and Whittington.

Future Flooding

The surface water flood map, **Figure C2**, indicates areas in which surface water flooding is potentially a high risk, with a swathe of northern and eastern Lichfield District, from Rugeley past Alrewas towards Tamworth being the most prominent. Away from this area Burntwood and Lichfield City are also identified as being in particularly susceptible areas.

The comparative analysis of the surface water flood map and NPD points, shown on **Figure B2**, identifies Lichfield City as the area of highest risk with over 2,000 properties being located within the Environment Agency's "Less" flood extent. Defra's analysis ranks 'Lichfield' as 329[15] (it is unclear whether any of the District, beyond Lichfield City, is included within Defra's analysis). Burntwood, Mile Oak and Fazeley, Fradley and Armitage and the Longdons have been identified as having between 350 and 1,000 properties at risk each (illustrated by the orange flags). For further information regarding the derivation of these numbers, please see Section 3.1.2.

[15] The lower the rank number, the higher the flood risk.

Overall

The surface water Summary Sheets for Lichfield District are included within **Appendix E**.

Overall, the following seven settlements have been identified as being at a high risk of surface water flooding (indicated by a red traffic light colour code) and therefore would benefit from further investigation:

- Lichfield City;
- Armitage and the Longdons;
- Burntwood;
- Elford;
- Little Aston;
- Mile Oak and Fazeley; and
- Whittington

The reason for their classification varies between the settlements, although most suffer from both historical and the potential for future flooding.

A number of the development sites have been classified as 'yellow' and would therefore benefit from some further investigation, possibly as part of a site specific FRA, funded by the developer and approved by the Environment Agency prior to site progression (please see Appendix E for individual site references). However, some of the development sites are classified as 'red', either due to an overlap with historic flood events and/or overlap with areas of the Environment Agency's flood map classified as 'More' susceptible to surface water flooding (namely 125, 1, 109, 102, 69, 426 and 96). It is recommended these sites are reviewed individually before progression, especially where they are identified as overlapping with a recurring historic flood event. For all sites which are developed it will be important to reduce the Greenfield runoff rate from the site so the flood risk beyond the developed area is not increased and, if where possible, reduced.

5.2 Surface Water Management

A large majority of the flood occurrences are identified as highways flooding. This may be a result of blocked highways drains, which falls under the responsibility of the highways authority, or the overflow of ordinary watercourses or drains within the town, which are the responsibility of the owner, although Local Authorities are empowered to undertake maintenance works if necessary (for Main Rivers, shown on **Figure C2**, these powers lie with the Environment Agency). In storm situations, such as the summer 2007 event, a number of highways flooding incidences may have resulted from the backing up of surface water drains when the water level within the watercourses has risen above the outfall height. It is recommended that the repeat occurrences and those grouped together within the urban areas are investigated further to determine their source and therefore rectify the problem. More detail would be provided as part of a Phase 2 modelled SWMP.

The high number of sewer flooding incidences to the northwest and west of Burntwood indicate a general exceedence of capacity within the network. It is recommended that

discussion is held with STWL to identify whether these locations are already being addressed within their current strategy. The capacity of the sewerage network in general with regards to the proposed development sites is discussed further within the WCS report, although no new connections of surface water will be permitted.

SUDS are therefore an essential inclusion within all new developments and, as far as possible, the retrofitting of existing developments. Although it will be necessary to secure the necessary developer contributions ahead of granting planning permissions to ensure that the correct SUDS policies and drainage improvements are incorporated, the Flood and Water Management Bill states that is it the responsibility of Local Authorities for adopting and maintaining SUDS schemes that serve multiple properties and the responsibility of the highways authority to maintain SUDS schemes on roads.

Incidences of canal overtopping are the responsibility of British Waterways (in conjunction with other authorities dependent upon the cause of the overtopping). Following the completion of this Phase 1 SWMP it is recommended that discussion is held with British Waterways to determine whether the highlighted event is a single occurrence or whether any improvements to surface water management practices within the District would reduce the risk of a repeat event in the future.

5.2.1 Canal Restoration

The Lichfield and Hatherton Canal Restoration Trust are currently looking to restore the Lichfield canal from Huddlesford Junction on the Coventry Canal to the Ogley Junction on the Birmingham Canal Navigations, a distance of 7 miles, as shown in **Figure 5.1**. The feasibility study for the restoration, completed in July 2009, identifies minimal flood risk resulting from the scheme. However there are four watercourse crossings within the currently plans - two across the Darnford Brook near Huddlesford, one over the Pipehill Brook near Pipehill pumping station and one on the Crane Brook, just south of the A5. The study states that there are no planned combined canal and watercourse, flood channels and/or tunnels in the scheme.

Wherever a new crossing is made over an existing watercourse a culvert must be emplaced that does not impede drainage down the watercourse during a flood event. As these minor watercourses are likely to play an important role in transporting surface water runoff the impact of the canal construction must be considered. As stated within the feasibility report, a Level 2 FRA is recommended for the scheme to ensure flood risk is not increased elsewhere. The canal was historically considered to be part of the surface water drainage network. The 1954 Act of Parliament which permitted its abandonment as a navigation required its retention for land drainage purposes. Culverting was permitted subject to approval of the then Trent River Authority (now the Environment Agency). It is not known whether at this time there were facilities to allow excess water to discharge from the canal to the Darnford Brook.

The whole length of former canal within Lichfield downstream of Chesterfield Road has been culverted to a point adjacent to the Tamworth Road next to the A38 trunk road. At this point the culvert follows a different route, discharging to the Darnford Brook. The public surface water sewer and highway drainage systems, which drain the whole of the southern portion of Lichfield, discharge via this culvert. STWL has undertaken hydraulic modelling of whole drainage system to the point of discharge into the Darnford Brook,

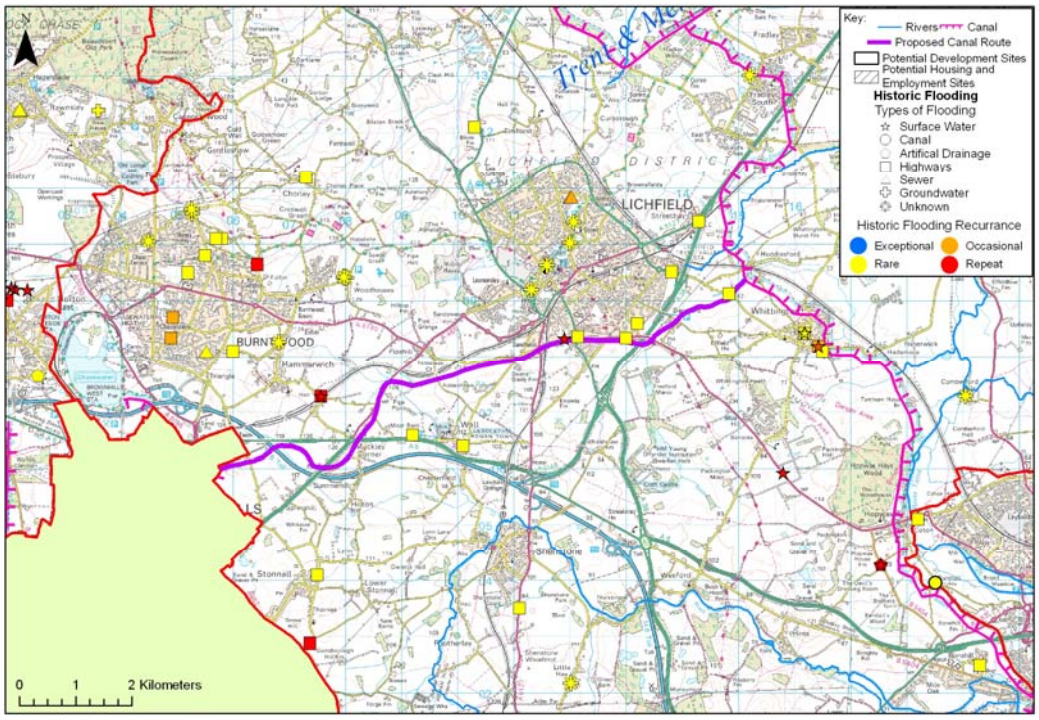
which predicts that the culvert has capacity to convey run off from a 1 in 30 year rainfall event without flooding. The Lichfield and Hatherton Canal Trust intend to use these flow rates to size the canal flow control structures.

The replacement of the culvert with the canal provides a potential opportunity to alleviate flood risk at historic flood locations in the south of Lichfield. If Lichfield is modelled within a Phase 2 SWMP, further detail may be provided both on local flooding within southern Lichfield and interlinkages between the current culvert, future canal and the Darnford Brook.

The Coventry canal is located in very close proximity to the Whittington flood events and a number of canal overtopping events have occurred to the south of Huddlesford junction to the south as shown in **Figure 5.1**. The potential impact of flows from the canal restoration on the Coventry canal should be assessed.

Given the interaction between canal and surface water sewers and watercourses it is recommended that the Lichfield and Hatherton Canal Restoration Trust is consulted following the submission of this Phase 1 study to explore the potential joint management options. Consultation through this stage of the study indicates that they are very keen to be involved in the process.

Figure 5.1 - Historic Flood Events in Proximity to the Proposed Route of the Lichfield Canal



N.B, the route shown has been taken from the satellite image on the Lichfield and Hatherton Canal website[16]

[16] This can be found at http://www.lhcrt.org.uk/lich.htm

5.3 Recommendations

Following the analysis within this Phase 1 SWMP the following recommendations are concluded for Lichfield District. Please note that these recommendations are based upon the most recent data and all will require review following completion of the Phase 2 SWMP study. All recommendations relating to the determination of the locations most desirable for development (i.e. development of preferred options/areas) are the responsibility of the Local Authority. All recommendations relating to the progression of individual development sites are the responsibility of the developer. As a result of the Floods and Water Management Act Staffordshire County Council, as Lead Local Authority, has responsibility for monitoring and managing surface water flood risk.

1. All results from this Phase 1 SWMP should be discussed with the Partners and Key Stakeholders to identify any inconsistencies, anomalies, gaps and/or duplications within the data collected. This should either be carried out by the Council with an aim to mitigate surface water flooding issues on a large scale, or by developers as part of a site specific FRA;
2. Consultation should be held between the Council, STWL and the Lichfield and Hatherton Canal Restoration Trust to investigate potential joint surface water mitigation methods;
3. The causes of the repeating, overlapped or clustered flood events should be investigated further, either by the Council as a further step towards mitigating the source of surface water flooding problems, or by developers as part of a site specific FRA;
4. Further investigation into surface water flood risk and runoff mitigation should be carried out for the development sites identified as being at a high or medium overall risk of surface water flooding from this analysis (highlighted as red or yellow within the summary sheets), within site specific FRAs undertaken by the developer. The sites classified as red consist of: 125, 1, 109, 102, 69, 426 and 96;
5. The Council should undertake Phase 2 SWMP modelling for the city of Lichfield (due to the high risk of surface water flooding, the impact of the summer 2007 floods and requirement for new growth);
6. The Council and developers should review the seven settlements - *Lichfield City, Armitage and the Longdons, Burntwood, Elford, Little Aston, Mile Oak and Fazeley and Whittington* - identified as being classified as having a high overall risk of surface water flooding within the analysis (highlighted as red in the summary sheets);
7. All development sites in the settlements specified above should be reviewed by the Council in consultation with partners and stakeholders to determine those most suitable for progression. This will require consideration of all the other Evidence Base studies collected as part of the LDF process. If sites are progressed, the information presented within this SWMP should also be reviewed by developers as part of site specific FRAs;
8. For the settlements not included in more detailed, Phase 2 SWMP the developer should ensure that surface water management issues are sufficiently addressed and agreed with the Environment Agency, within a site specific FRA;
9. The Council and developers should ensure appropriate SUDS techniques are implemented into all new developments (as per the Floods and Water

Management Act) and as far as possible retrofitted into existing settlements, especially where historic flood events have been identified;

10. The Council should review the agricultural and land management practices within the District and encourage farmers to not leave land bare. Some funding may be available through Defra to undertake such initiatives via their "Farming Floodplains for the Future Scheme"[17];
11. To assist in the mitigation of the surface water flood risk and the promotion of development sites, the Council and developers should discuss with the appropriate Partners and Stakeholders whether any of the flood events are/have already been investigated and/or rectified;
12. Councils and developers should, as far as possible, implement the site specific recommendations listed in the summary sheets;
13. All the conclusions and information included in this Phase 1 SWMP require consideration by developers and should be investigated in further detail if a site is to be progressed.

[17] http://www.defra.gov.uk/environment/flooding/risk/innovation/sld2314.htm

6 TAMWORTH BOROUGH

6.1 Surface Water Flood Risk

The development sites and settlements assessed within the Borough are shown on **Figure A3**.

Historic Flooding

Figure B3 illustrates a relatively low number of historic surface water flood occurrences across the Borough, as compared to the rest of the study area. Many of the events that have occurred relate to the exceedance of sewer capacity, although some incidences of highways flooding and canal overtopping have also been included. However, Tamworth is dissected by a number of large watercourses and, as such, incidences of surface water flooding may have incorrectly been identified as fluvial flooding. In addition high flows of surface water runoff may result in fluvial flooding with complex interactions between the urban drains and the watercourses. Due to Tamworth's location downstream of other Local Authorities, the impact of surface water runoff from those areas must also be considered. The area of Fazeley is one such location where there are numerous surface water flood events located upstream and very close to the border of Tamworth.

Future Flooding

The surface water flood map indicates large areas in which surface water flooding is potentially a high risk within Tamworth, with nearly 3,500 properties at risk. Tamworth has been given a rank of 330 within Defra's analysis[18]. For further information regarding the derivation of these numbers, please see Section 3.1.2. These results relate to the downstream location of the town within the catchments and therefore extensive low lying land. This is illustrated in **Figure C1,** with the downstream northwesterly corner of the Borough being most prominent, in addition to the northeasterly section.

Tamworth has been identified within the West Midlands RFRA as being at Medium probability of surface water flooding and medium consequence, although its probability of fluvial flooding is considered much higher.

Overall

The surface water Summary Sheets for Tamworth Borough are included within **Appendix F**. Unlike the other Local Authority areas Tamworth could not be split into separate settlements. To increase the detail of the assessment, the Borough was therefore split into five main sections within the Summary Sheets.

The south west and central sections of the Borough have been identified as being at highest risk of surface water flooding (indicated by a red traffic light colour code) and therefore would benefit from further investigation. Due to the interlinkages between all the drainage networks within this highly urban area and the location of large

[18] The lower the rank number, the higher the flood risk.

development sites on the periphery and upstream edge of the Borough, it is highly recommended that the whole town is modelled further as part of the Phase 2 SWMP.

Some of the development sites have been classified as either 'yellow' or 'red' and would therefore benefit from some further investigation, possibly as part of a site specific FRAs, although further modelling of the Borough would clarify a number of these issues. These sites consist of:

Housing/Additional: 1, 12, 13, 15, 25
Employment: 1, 3, 5, 6, 16, 17 and 18

For these sites, site specific FRAs should be funded by the developer and approved by the Environment Agency prior to site progression. It is recommended that all sites are reviewed individually before progression, especially where they are identified as overlapping with a recurring historic flood event. For all sites which are developed it will be important to reduce the Greenfield runoff rate from the site so the flood risk beyond the developed area is not increased and, if where possible, reduced.

6.2 Surface Water Management

The relatively high number of sewer flooding incidences within the Borough (both individually marked on the maps and shown by the postcode shading) indicates a general exceedence of capacity of the sewerage network. It is recommended that discussion is held with STWL to identify whether these locations are already being addressed within their current strategy. The capacity of the sewerage network in general with regards to the proposed development sites is discussed further within the WCS report, although no new connections of surface water will be permitted.

SUDS are therefore an essential inclusion within all new developments and, as far as possible, the retrofitting of existing developments (by the owner). Although it will be necessary to secure the necessary developer contributions ahead of granting planning permissions to ensure that the correct SUDS policies and drainage improvements are incorporated, the Flood and Water Management Bill states that is it the responsibility of Local Authorities for adopting and maintaining SUDS schemes that serve multiple properties and the responsibility of the highways authority to maintain SUDS schemes on roads.

A number of other flood occurrences within the towns are identified as highways flooding. This may be a result of blocked highways drains, which falls under the responsibility of the highways authority, or the overflow of ordinary watercourses or drains within the town, which are the responsibility of the owner, although Local Authorities are empowered to undertake maintenance works if necessary (for Main Rivers, shown on **Figure C2**, these powers lie with the Environment Agency). It is recommended the repeat occurrences are investigated further to determine their source and therefore rectify the problem. More detail would be provided as part of a Phase 2 modelled SWMP.

Incidences of canal overtopping are the responsibility of British Waterways (in conjunction with other authorities dependent upon the cause of the overtopping). Following the completion of this Phase 1 SWMP it is recommended that discussion is

held with British Waterways to determine whether the highlighted events are single occurrences or whether any improvements to surface water management practices within the Borough would reduce the risk of a repeat event in the future.

6.3 Recommendations

Following the analysis within this Phase 1 SWMP the following recommendations are concluded for Tamworth Borough. Please note that these recommendations are based upon the most recent data and all will require review following completion of the Phase 2 SWMP study. All recommendations relating to the determination of the locations most desirable for development (i.e. development of preferred options/areas) are the responsibility of the Local Authority. All recommendations relating to the progression of individual development sites are the responsibility of the developer. As a result of the Floods and Water Management Act Staffordshire County Council, as Lead Local Authority, has responsibility for monitoring and managing surface water flood risk.

1. The Council should undertake Phase 2 SWMP modelling for the town of Tamworth (to improve understanding as to the interactions between the surface water and fluvial flows);
2. All development sites in the settlements within Tamworth should be reviewed by the Council in consultation with partners and stakeholders to determine those most suitable for progression. This will require consideration of all the other Evidence Base studies collected as part of the LDF process. If sites are progressed, the information presented within this SWMP should also be reviewed by developers as part of site specific FRAs.
3. All results from this Phase 1 SWMP should be discussed with the Partners and Key Stakeholders to identify any inconsistencies, anomalies, gaps and/or duplications within the data collected. As above, this should either be carried out by the Council with an aim to mitigate surface water flooding issues on a large scale, or by developers as part of a site specific FRA;
4. Further investigation into surface water flood risk and runoff mitigation should be carried out for the development sites identified as being at a high or medium overall risk of surface water flooding from this analysis (highlighted as red or yellow within the summary sheets), within site specific FRAs undertaken by the developer. The sites in question are: 1, 12, 13, 15, 25 (Housing/Additional) and 1, 3, 5, 6, 16, 17 and 18 (Employment);
5. As part of site specific FRAs, developers should consider the flood events located upstream of and close to the Borough boundaries when reviewing potential flood risk to individual development sites. The Council should consider such risks when promoting areas of the town for development;
6. The Council and developers should ensure appropriate SUDS techniques are implemented into all new developments (as per the Floods and Water Management Act) and as far as possible retrofitted into existing settlements, especially where historic flood events have been identified;
7. For all development sites not included in the more detailed, Phase 2 SWMP, the developer should ensure that surface water management issues are sufficiently addressed and agreed with the Environment Agency, within a site specific FRA.
8. To assist in the mitigation of the surface water flood risk and the promotion of development sites, the Council and developers should discuss with the

appropriate Partners and Stakeholders whether any of the flood events are/have already been investigated and/or rectified;

9. Councils and developers should, as far as possible, implement the site specific recommendations listed in the summary sheets.
10. All the conclusions and information included in this Phase 1 SWMP require consideration by developers and should be investigated in further detail if a site is to be progressed.

7 SOUTH STAFFORDSHIRE DISTRICT

7.1 Surface Water Flood Risk

The development sites and settlements assessed within the District are shown on **Figure A4**.

Historic Flooding

Figure B4 illustrates a fairly high number of historic surface water flood occurrences across the District, including a high incidence of surface water and highways flooding events, although a number of unknown events are also included. A high proportion of these flood events are listed as occasional or repeat occurrences and/or show overlaps between different flood events (although these overlaps may indicate duplications between different data sets). A number of the flood events are scattered across the rural areas of the District but clusters are evident within and around most of the main settlements, with Penkridge, Wombourne, Codsall and Perton being the most prominent, (recorded as hosting 12, 18, 17 and 13 incidences of surface water flooding respectively). The classification of the postcode areas with regards to sewer flooding also indicates a prominence of flood events within the central swathe of the District.

Future Flooding

The surface water flood map, **Figure C4**, indicates areas in which surface water flooding is potentially a high risk, with the areas to the north and centre, corresponding to the locations identified above being the most prominent. Away from the main river valleys this illustration highlights the low lying historically marshy areas of ground to the northern area of the District around Penkridge and Gailey.

The comparative analysis of the surface water flood map and NPD points, shown on **Figure B4**, identifies Perton, Codsall, Wombourne, Penkridge and Great Wyrley and Cheslyn Hay as being the areas of highest risk with over 1,100 properties in Perton, over 350 in Codsall, over 600 in Wombourne, nearly 400 in Penkridge and nearly 1,000 being located within the Environment Agency's "Less" flood extent. Defra's analysis in particular identifies Wombourne with a rank of 637 and Great Wyrley as 538[19]. Beyond these main settlements, a further four villages have been highlighted with yellow flags indicating a 'moderate' flood risk of between 100 and 350 houses within the flood extent, including Brewood, Coven and Four Ashes, the area around Featherstone, Brinsford and Coven Heath and Kinver. For further information regarding the derivation of these numbers, please see Section 3.1.2.

Overall

The surface water Summary Sheets for South Staffordshire District are included within **Appendix G**.

[19] The lower the rank number, the higher the flood risk.

Overall the following five settlements have been identified as being at a high risk of surface water flooding (indicated by a red traffic light colour code) and therefore would benefit from further investigation:

- Codsall;
- Great Wyrley and Cheslyn Hay;
- Penkridge;
- Perton; and
- Wombourne.

All of these settlements suffer from both historical flooding and the potential for future flooding.

A large proportion of the development sites have been classified as 'yellow' and would therefore benefit from some further investigation, possibly as part of a site specific FRA funded by the developer and approved by the Environment Agency prior to site progression. However, there are a couple of development sites classified as 'red' (6:0004:001 and 44055 in Coven and Four Ashes; 6:0013:001 and 6:0013:002 in Featherstone, Brinsford and Coven Heath; 041 and 6:0002:001 in Great Wyrley and Cheslyn Heath; and 151 in Wombourne), either due to an overlap with historic flood events and/or overlap with areas of the Environment Agency's flood map classified as 'More' susceptible to surface water flooding. It is recommended these sites are reviewed individually before progression, especially where they are identified as overlapping with a recurring historic flood event. For all sites which are developed it will be important to reduce the Greenfield runoff rate from the site so the flood risk beyond the developed area is not increased and, if where possible, reduced.

7.2 Surface Water Management

A large majority of the flood occurrences are identified as highways flooding. This may be a result of blocked highways drains, which falls under the responsibility of the highways authority, or the overflow of ordinary watercourses or drains within the settlement, which are the responsibility of the owner, although Local Authorities are empowered to undertake maintenance works if necessary (for Main Rivers, shown on **Figure C2**, these powers lie with the Environment Agency). It is recommended the repeat occurrences are investigated further to determine their source and therefore rectify the problem. More detail would be provided as part of any modelling carried out within a Phase 2 SWMP.

Another key occurrence of flooding is simply listed as 'surface water'. The exact cause of this is unknown and may be linked to any of the routes of surface water drainage. However, given the agricultural nature of this District it may be linked to direct surface runoff from the land. If so, this may be controlled through the use of appropriate agricultural practices.

Where sewer flooding incidences have been identified within the District, there is an indication of general exceedence of capacity within the network. It is recommended that discussion is held with STWL to identify whether these locations are already being addressed within their current strategy. The capacity of the sewerage network in

general with regards to the proposed development sites is discussed further within the WCS report, although no new connections of surface water will be permitted.

SUDS are therefore an essential inclusion within all new developments and, as far as possible, the retrofitting of existing developments. Although it will be necessary to secure the required developer contributions ahead of granting planning permissions to ensure that the correct SUDS policies and drainage improvements are incorporated. The Flood and Water Management Bill states that is it the responsibility of Local Authorities for adopting and maintaining SUDS schemes that serve multiple properties and the responsibility of the highways authority to maintain SUDS schemes on roads.

7.2.1 Canal Restoration

The Lichfield and Hatherton Canal Restoration Trust are currently looking to restore the Hatherton canal from the Hatherton Junction at Calf's Heath on the Staffordshire and Worcestershire Canal to the Wyrley and Essington Canal at the currently disused Lord Hay Branch. This route, which passes through both South Staffordshire and Cannock Chase Districts is shown on **Figure 7.1**

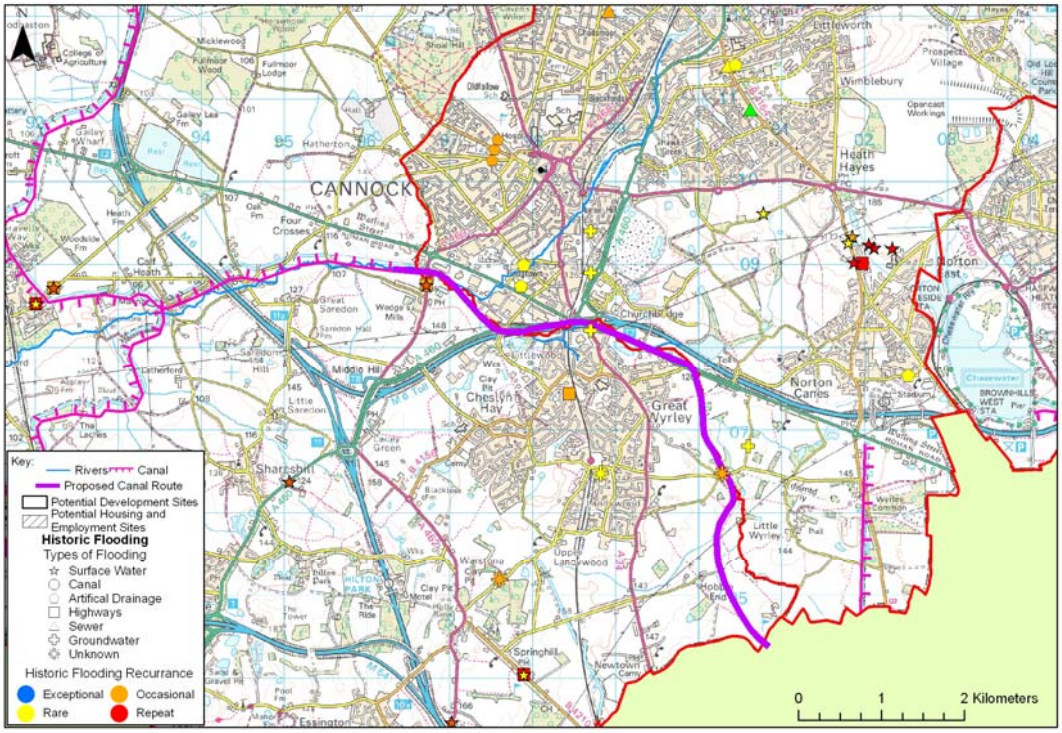
The original route, which would have connected to the Cannock Extension Canal, has been changed due to ecological concerns. A supplementary study for restoration (completed in 2009) confirmed the feasibility of an alternative route with connection to the currently disused Lords Hay branch. The study identified a number of locations where the route of the canal will be in proximity to local watercourses, in addition to a requirement for it to cross over the Wash Brook. The design of the canal must therefore ensure that flood water from the Brook cannot enter the canal and vice versa. In addition, where the canal is required to cross over a watercourse a culvert must be emplaced that does not impede drainage down the watercourse during a flood event. As these minor watercourses are likely to play an important role in transporting surface water runoff the impact of the canal construction must be considered. Any unintended interaction between watercourses and canals can have potentially devastating consequences, and may result in the canal breaching its banks. Such an event can have far reaching effects downstream both within and beside the existing canal network. It is therefore important to ensure that there is no unplanned interaction between the canal and the watercourses. The culvert provided to drain the Wash Brook under the canal will need careful sizing to ensure adequate capacity.

The length of canal from Hatherton Junction to the south of Cannock remains in use for land drainage purposes and provides a supply of water to the Staffordshire and Worcester Canal. The proposed route which extends to the south and east of Cannock clashed with the Birmingham Northern Relief Toll Road Motorway. At the time of motorway construction, culverts were provided to enable the future canal to pass under the motorway. It is therefore recommended that the impact of canal restoration upon the surface water drainage within the area is reviewed prior to construction. As the proposed canal route is located in close proximity to a number of historic flood events around the south of Cannock and the boundary of South Staffordshire District, it will be important to ensure that no unplanned additional surface water can enter the canal (either from overland flow or watercourse flooding).

It is recommended that the impact of the scheme upon the surface water drainage within the area is reviewed prior to construction. As the proposed canal route is located in proximity to a number of historical flood events around the south of Cannock and the boundary of South Staffordshire District, as shown in **Figure 7.1**, it will be important to ensure that a repeat of any of these events will not enter the canal. Due to the proximity of the proposed canal to the existing urban area of Cannock and Great Wyrley and a number of potential development sites it must be ensured that no additional surface water can enter the canal (either from overland flow or watercourse overtopping) as this may cause the canal to breach. If Cannock is modelled within a Phase 2 SWMP, further detail may be provided on the flooding within this area and the interlinkages between the surface water drainage and minor watercourses. This should be reviewed with reference to the potential impacts within South Staffordshire District.

However, canals can be a useful destination for surface water runoff if it is planned and factored into the design from the start. Due to the general shortage of water supply within the area (see the WCS), surface water drainage may assist in feeding the new canal system. It is therefore recommended that the Lichfield and Hatherton Canal Restoration Trust is consulted following the submission of this Phase 1 study to explore the potential joint management options. Consultation through this stage of the study indicates that they are very keen to be involved in the process.

Figure 7.1 - Historic Flood Events in Proximity to the Proposed Route of the Hatherton Canal



NB, the route shown has been taken from the satellite image on the Lichfield and Hatherton Canal website[20]

[20] This can be found at http://www.lhcrt.org.uk/hatherton.htm

7.3 Recommendations

Following the analysis within this Phase 1 SWMP the following recommendations are concluded for South Staffordshire District. Please note that these recommendations are based upon the most recent data and all will require review following completion of the Phase 2 SWMP study. All recommendations relating to the determination of the locations most desirable for development (i.e. development of preferred options/areas) are the responsibility of the Local Authority. All recommendations relating to the progression of individual development sites are the responsibility of the developer. . As a result of the Floods and Water Management Act Staffordshire County Council, as Lead Local Authority, has responsibility for monitoring and managing surface water flood risk.

1. The causes of the repeating, overlapped or clustered flood events should be investigated further, either by the Council as a further step towards mitigating the source of surface water flooding problems, or by developers as part of a site specific FRA;
2. All results from this Phase 1 SWMP should be discussed with the Partners and Key Stakeholders to identify any inconsistencies, anomalies, gaps and/or duplications within the data collected. As above, this should either be carried out by the Council with an aim to mitigate surface water flooding issues on a large scale, or by developers as part of a site specific FRA
3. Further investigation into surface water flood risk and runoff mitigation should be carried out for the development sites identified as being at a high or medium overall risk of surface water flooding from this analysis (highlighted as red or yellow within the summary sheets), within site specific FRAs undertaken by the developer. The sites highlighted in red consist of: (6:0004:001 and 44055 in Coven and Four Ashes; 6:0013:001 and 6:0013:002 in Featherstone, Brinsford and Coven Heath; 041 and 6:0002:001 in Great Wyrley and Cheslyn Heath; and 151 in Wombourne);
4. The Council should review the surface water flooding situation within Penkridge and Wombourne, with reference to the location of development sites to be progressed. If necessary, further analysis of the settlements as a whole should be undertaken and funded by the Council or by developers on a site specific basis, as appropriate;
5. All development sites in the settlements highlighted within this report (Penkridge, Wombourne, Codsall, Great Wyrley. Cheslyn Hay and Perton) should be reviewed by the Council in consultation with partners and stakeholders to determine those most suitable for progression. This will require consideration of all the other Evidence Base studies collected as part of the LDF process. If sites are progressed, the information presented within this SWMP should also be reviewed by developers as part of site specific FRAs.
6. For the settlements not included in a more detailed, Phase 2 SWMP, the developer should ensure that surface water management issues are sufficiently addressed and agreed with the Environment Agency, within a site specific FRA.
7. The Council should review the agricultural and land management practices within the District and encourage farmers to not leave land bare. Some funding

may be available through Defra to undertake such initiatives via their "Farming Floodplains for the Future Scheme"[21];

8. The Council (or appropriate owner) should ensure that the rural watercourses are adequately maintained and regularly cleared;
9. The Council should consult with STWL and the Lichfield and Hatherton Canal Restoration Trust regarding potential joint surface water management opportunities;
10. The Council and developers should ensure appropriate SUDS techniques are implemented into all new developments (as per the Floods and Water Management Act) and as far as possible retrofitted into existing settlements, especially where historic flood events have been identified;
11. To assist in the mitigation of the surface water flood risk and the promotion of development sites, the Council and developers should discuss with the appropriate Partners and Stakeholders whether any of the flood events are/have already been investigated and/or rectified;
12. Councils and developers should, as far as possible, implement the site specific recommendations listed in the summary sheets.
13. All the conclusions and information included in this Phase 1 SWMP require consideration by developers and should be investigated in further detail if a site is to be progressed.

[21] http://www.defra.gov.uk/environment/flooding/risk/innovation/sld2314.htm

8 CANNOCK CHASE DISTRICT

8.1 Surface Water Flood Risk

The development sites and settlements assessed within the District are shown on **Figure A5**.

Historic Flooding

Figure B5 illustrates a fairly large number of historic surface water flood occurrences across the District, with high concentrations within and around Cannock, Norton Canes and Rugeley. This flooding mainly consists of sewer and artificial drainage, with a number of events being highlighted as repeat occurrences and occurring in clusters. This is especially evident to the north of Norton Canes and south of Rugeley.

Sewer flooding is especially prominent within the District with the classification of the postcode areas highlighting these events within the urban areas. This is a clear indication that the sewer network within the area is operating under pressure. The artificial drainage flooding is most likely to relate to culverted watercourses and drainage ditches running through the urban areas which have perhaps become blocked or do not have sufficient capacity for heavy rainfall events.

Also present, especially to the south of the District, are a number of groundwater flooding incidences, relating to the disused mines within the area. Although not strictly surface water flooding incidences, this water can overflow from where it has pooled, especially during periods of heavy rainfall and infiltration and create surface water flooding problems.

Cannock has been identified within the analysis as having 17 occurrences of historic flooding, Norton Canes as having 9 and Rugeley as 11.

Future Flooding

The surface water flood map, **Figure C5**, indicates areas in which surface water flooding is potentially a high risk, with the areas to the south around Cannock, Norton Canes and the disused mines being the most prominent.

The comparative analysis of the surface water flood map and NPD points, shown on **Figure B5**, identifies Cannock and Rugeley as being the areas of highest risk of future flooding with nearly 2,500 properties in Cannock and over 2,200 in Rugeley being located within the Environment Agency's "Less" flood extent. Defra's analysis ranks Cannock as 263 and Rugeley as 305, whereas Norton Canes only scores a rank of 639[22]. Beyond these main settlements, there are relatively few occurrences of surface water flooding recorded or predicted. The area including Prospect Village and Cannock Wood has a very low 20 houses identified as being located within the flood extent. For further information regarding the derivation of these numbers, please see Section 3.1.2.

[22] The lower the rank number, the higher the flood risk.

Cannock town has also been identified within the West Midlands RFRA as being at a low probability of surface water flooding overall but a medium consequence. The greatest risks are identified in Cannock and Rugeley. The canal network in particular was identified to have a medium consequence of flooding. This reiterates the message that surface water drainage must not interact with the canal network.

Overall

The surface water Summary Sheets for Cannock Chase District are included within **Appendix H**.

Overall Cannock, Rugeley and Norton Canes have been identified as being at a high risk of surface water flooding (indicated by a red traffic light colour code) and therefore would benefit from further investigation. All of these settlements suffer from both historical flooding and the potential for future flooding.

A large proportion of the development sites have been classified as 'yellow' and would therefore benefit from some further investigation, possibly as part of a site specific FRA, funded by the developer and approved by the Environment Agency prior to site progression (please see Appendix H for individual site classifications). Cannock Chase District is unusual in that no development sites have been classified as 'red'. However it is recommended that, given the classifications of the settlements as a whole, all potential development sites are reviewed individually before progression, especially where they are identified as overlapping with a recurring historic flood event. For all sites which are developed it will be important to reduce the Greenfield runoff rate from the site so the flood risk beyond the developed area is not increased and, if where possible, reduced.

8.2 Surface Water Management

Where sewer flooding incidences have been identified within the District, there is an indication of general exceedence of capacity within the network. It is recommended that discussion is held with STWL to identify whether these locations are already being addressed within their current strategy. The capacity of the sewerage network in general with regards to the proposed development sites is discussed further within the WCS report, although no new connections of surface water will be permitted.

As such, SUDS are an essential inclusion within all new developments and, as far as possible, the retrofitting of existing developments. Although it will be necessary to secure the necessary developer contributions ahead of granting planning permissions to ensure that the correct SUDS policies and drainage improvements are incorporated, the Flood and Water Management Bill states that is it the responsibility of Local Authorities for adopting and maintaining SUDS schemes that serve multiple properties and the responsibility of the highways authority to maintain SUDS schemes on roads.

A number of flood incidences relate to artificial drainage. As shown in **Figure C2**, these watercourses are, generally, the responsibility of the Local Authority. It is recommended that the causes of the flooding incidences recorded are investigated and the watercourses checked for blockages.

Another key occurrence of flooding is simply listed as 'surface water'. The exact cause of this is unknown and may be linked to any of the routes of surface water drainage, including the artificial drainage listed above. In the more rural areas of the District, or on the edge of the developed area it may be linked to direct surface runoff from the land. If so, this may be maintained through the use of appropriate land management practices. This is especially important on the steeper slopes within the District.

Where flood occurrences are identified as highways flooding, this may be a result of blocked highways drains, which falls under the responsibility of the highways authority, or the overflow of ordinary watercourses or drains within the town, which are the responsibility of the owner, although Local Authorities are empowered to undertake maintenance works if necessary (for Main Rivers, shown on **Figure C2**, these powers lie with the Environment Agency). It is recommended the repeat occurrences are investigated further to determine their source and therefore rectify the problem. More detail would be provided as part of a Phase 2 modelled SWMP.

8.2.1 Canal Restoration

The Lichfield and Hatherton Canal Restoration Trust are currently looking to restore the Hatherton canal from the Hatherton Junction at Calf's Heath on the Staffordshire and Worcestershire Canal to the Wyrley and Essington Canal at the currently disused Lord Hay Branch. This route, which passes through both South Staffordshire and Cannock Chase Districts is shown on **Figure 8.1.**

The original route, which would have connected to the Cannock Extension Canal, has been changed due to ecological concerns. A supplementary study for restoration (completed in 2009) confirmed the feasibility of an alternative route with connection to the currently disused Lords Hay branch. The study identified a number of locations where the route of the canal will be in proximity to local watercourses, in addition to a requirement for it to cross over the Wash Brook. The design of the canal must therefore ensure that flood water from the Brook cannot enter the canal and vice versa. In addition, where the canal is required to cross over a watercourse a culvert must be emplaced that does not impede drainage down the watercourse during a flood event. As these minor watercourses are likely to play an important role in transporting surface water runoff the impact of the canal construction must be considered. Any unintended interaction between watercourses and canals can have potentially devastating consequences, and may result in the canal breaching its banks. Such an event can have far reaching effects downstream both within and beside the existing canal network. It is therefore important to ensure that there is no unplanned interaction between the canal and the watercourses. The culvert provided to drain the Wash Brook under the canal will need careful sizing to ensure adequate capacity.

The length of canal from Hatherton Junction to the south of Cannock remains in use for land drainage purposes and provides a supply of water to the Staffordshire and Worcester Canal. The proposed route which extends to the south and east of Cannock clashed with the Birmingham Northern Relief Toll Road Motorway. At the time of motorway construction, culverts were provided to enable the future canal to pass under the motorway. It is therefore recommended that the impact of canal restoration upon the surface water drainage within the area is reviewed prior to construction. As the proposed canal route is located in close proximity to a number of historic flood events

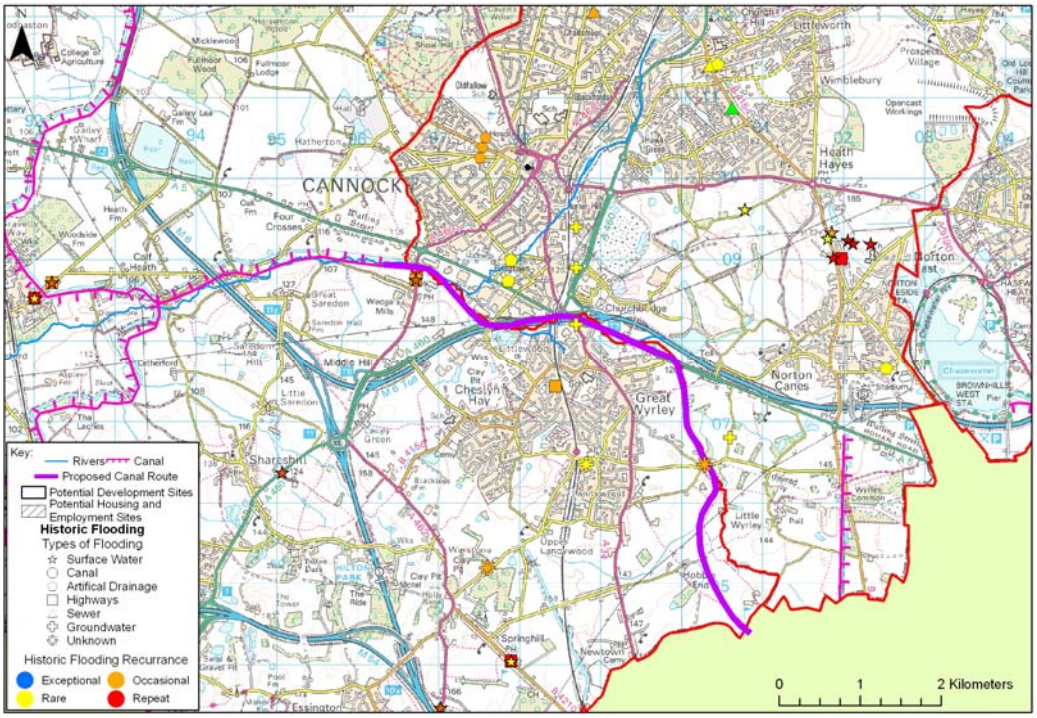
around the south of Cannock and the boundary of South Staffordshire District, it will be important to ensure that no unplanned additional surface water can enter the canal (either from overland flow or watercourse flooding).

It is recommended that the impact of the scheme upon the surface water drainage within the area is reviewed prior to construction. As the proposed canal route is located in proximity to a number of historical flood events around the south of Cannock and the boundary of South Staffordshire District, as shown in **Figure 8.1**, it will be important to ensure that a repeat of any of these events will not enter the canal. Due to the proximity of the proposed canal to the existing urban area of Cannock and Great Wyrley and a number of potential development sites it must be ensured that no additional surface water can enter the canal (either from overland flow or watercourse overtopping) as this may cause the canal to breach. If Cannock is modelled within a Phase 2 SWMP, further detail may be provided on the flooding within this area and the interlinkages between the surface water drainage and minor watercourses.

However, canals can be a useful destination for surface water runoff if it is planned and factored into the design from the start. Due to the general shortage of water supply within the area (see the WCS), surface water drainage may assist in feeding the new canal system. It is therefore recommended that the Lichfield and Hatherton Canal Restoration Trust is consulted following the submission of this Phase 1 study to explore the potential joint management options. Consultation through this stage of the study indicates that they are very keen to be involved in the process.

Figure 8.1 - Historic Flood Events in Proximity to the Proposed Route of the Hatherton Canal

NB, the route shown has been taken from the satellite image on the Lichfield and Hatherton Canal website[23]



8.3 Recommendations

Following the analysis within this Phase 1 SWMP the following recommendations are concluded for Cannock Chase District. Please note that these recommendations are based upon the most recent data and all will require review following completion of the Phase 2 SWMP study. All recommendations relating to the determination of the locations most desirable for development (i.e. development of preferred options/areas) are the responsibility of the Local Authority. All recommendations relating to the progression of individual development sites are the responsibility of the developer. As a result of the Floods and Water Management Act Staffordshire County Council, as Lead Local Authority, has responsibility for monitoring and managing surface water flood risk.

1. The causes of the repeating, overlapped or clustered flood events should be investigated further, either by the Council as a further step towards mitigating the source of surface water flooding problems, or by developers as part of a site specific FRA;
2. All results from this Phase 1 SWMP should be discussed with the Partners and Key Stakeholders to identify any inconsistencies, anomalies, gaps and/or duplications within the data collected. As above, this should either be carried out by the Council with an aim to mitigate surface water flooding issues on a large scale, or by developers as part of a site specific FRA;
3. Further investigation into surface water flood risk and runoff mitigation should be carried out for the development sites identified as being at a high or medium overall risk of surface water flooding from this analysis (highlighted as red or yellow within the summary sheets), within site specific FRAs undertaken by the developer
4. The Council should undertake Phase 2 SWMP modelling for the town of Cannock. All urban areas would benefit from modelling, but due to the number of development proposals within the area, Cannock would be the most beneficial. Due to the extent of the watershed, modelling for Cannock will also incorporate the urban area of Norton Canes;
5. The Council should review the development sites in Rugeley through detailed review of the historic flood events and in consultation with the partners and stakeholders to determine the most beneficial for progression. This will require consideration of all the other Evidence Base studies collected as part of the LDF process. If sites are progressed, the information presented within this SWMP should also be reviewed by developers as part of site specific FRAs;
6. For the settlements not included in a more detailed, Phase 2 SWMP, the developer should ensure that surface water management issues are sufficiently addressed and agreed with the Environment Agency, within a site specific FRA.
7. The Council should review the agricultural and land management practices within the District and encourage farmers to not leave land bare. Some funding may be available through Defra to undertake such initiatives via their “Farming Floodplains for the Future Scheme”[24];
8. The Council (or other owner) should ensure that the rural watercourses are adequately maintained and regularly cleared;

[23] This can be found at http://www.lhcrt.org.uk/hatherton.htm

[24] http://www.defra.gov.uk/environment/flooding/risk/innovation/sld2314.htm

9. The Council should consult with STWL and the Lichfield and Hatherton Canal Restoration Trust regarding potential joint surface water management opportunities;
10. The Council and developers should ensure appropriate SUDS techniques are implemented into all new developments (as per the Floods and Water Management Act) and as far as possible retrofitted into existing settlements, especially where historic flood events have been identified;
11. All development sites in the settlements specified above should be reviewed by the Council in consultation with partners and stakeholders to determine those most suitable for progression. This will require consideration of all the other Evidence Base studies collected as part of the LDF process. If sites are progressed, the information presented within this SWMP should also be reviewed by developers as part of site specific FRAs.
12. Councils and developers should, as far as possible, implement the site specific recommendations listed in the summary sheets.
13. All the conclusions and information included in this Phase 1 SWMP require consideration by developers and should be investigated in further detail if a site is to be progressed.

9 SELECTION OF AN APPROACH FOR FURTHER ANALYSIS

9.1 Key Conclusions and Recommendations

Through the review of the data collected and assimilated as part of this Phase 1 SWMP, a number of common conclusions for the study area have emerged. Although informative and extremely useful for this analysis, the records of historic flood data must be viewed with some caution regarding their viability, comprehensively and singularity. An initial recommendation for the study area would therefore be to promote the recording of surface water flooding information, perhaps in the form of a single incident spreadsheet. This would require cooperation between the varying authorities, but would provide a very useful tool to assist in the targeting of future surface water management initiatives. Such a scheme has already been initiated by Staffordshire County Council and should be encouraged and set up to include event location, type, recurrence, time and date, severity of the rainstorm and the authority responsible for the failed/exceeded drainage asset. If such a dataset was stored in GIS then the results of this Phase 1 SWMP could be constantly updated and improved.

A second key conclusion of this SWMP regards the importance of data sharing between the different authorities, further neighbouring Councils, the key Partners and Stakeholders. The analysis of settlements located on the boundary of the study area has been limited due to the restriction of available data to the study area in question. The Councils may find it useful to review the conclusion of SWMPs carried out in the neighbouring Boroughs/Districts when and if they are undertaken. Such an approach is vital to achieving the goal of strategic and sustainable development.

Discussions with stakeholders and partners and sharing of the mapping following the publication of this Phase 1 SWMP is vital to incorporate additional knowledge, fill in any gaps in the data and verify the flood events that have been recorded. We recommend such a discussion takes place as soon as possible, before the Phase 2 SWMP is undertaken. The most important consultees who may be able to provide additional information include British Waterways, the Sow and Penk IDB, the Hatherton and Lichfield Restoration Trust and STWL.

A number of settlements and potential development locations across the study area have been identified as being at risk of surface water flooding - either due to the occurrence of historic flooding events or recognised possibility of surface water flooding occurring in that location in the future. Such settlements and sites should be investigated further to determine whether any improvements can be made to the management techniques to reduce the risk in the future, as detailed within Sections 4-8. In many cases this will relate to increased maintenance of existing drainage channels. In other areas additional surface water drainage capacity may be required for significant storm events. The best way to identify the cause of the flooding and therefore the most appropriate management strategy is to undertake site specific assessment of the areas in question or, where feasible, undertake further modelling of the surface water drainage network. Such an approach will identify which parts of the drainage network are failing to cope with severe rainfall events and within which organisation’s responsibility the maintenance falls.

The key organisations responsible for the maintenance of surface water assets within the study area have been shown in **Figure C2**. For the repeating events plotted within **Figures B1** to **B5**, the Councils should work closely with all these organisations to promote the partnership approach to tackling surface water flooding. In many locations flooding is occurring due to the combination of a number of flooding sources and, for such locations, a strategic management strategy will be vital.

For all locations the implementation of SUDS practices is paramount. This should become standard practice in all new developments and as far as possible retrofitted into existing developments. The existing combined sewer networks do not have the capacity to transmit both foul and surface water and, as such, there is an important need to accommodate surface water discharges on site, although the Councils must understand where their responsibilities lie with regards to such practices. The Floods and Water Management Bill requires developers to incorporate SUDS into their designs and the Local Authority responsibility for approving, adopting and maintaining new SUDS where they affect more than one property. More information regarding appropriate SUDS techniques for different parts of the study area is included within the associated WCS.

This document should be used as part of the Evidence Base of Local Development Documents to support the Council in their LDF submissions.

9.2 Phase 2 SWMP

A number of settlements have been highlighted within this mapping exercise as 'red' with regards to overall surface water flooding. Ideally all of these areas should be investigated further within a Phase 2 SMWP. However, to undertake the modelling required for a robust SWMP the data requirements are high, especially for the topographical representation (the LiDAR data) and, as a result, so are the costs. To produce a robust, and therefore useful, representation of surface water flooding within an area, LiDAR of at least 2m resolution is required for the entire watershed in which a settlement falls. This ensures that all the water falling within the catchment of that urban area is routed appropriately across the topography and down the key drainage channels, such as roads, into the urban area in question.

The watersheds and LiDAR availability for the following five key settlements are shown in **Figure 9.1**:

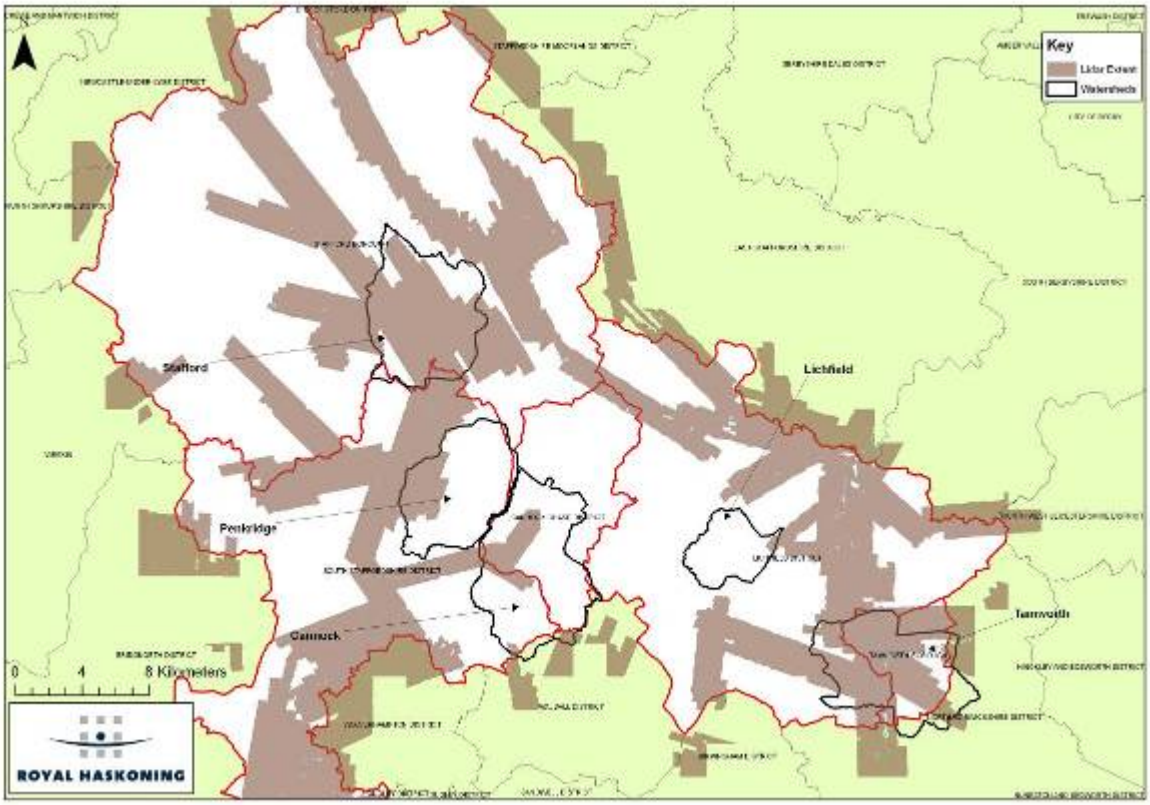
- Stafford town;
- Cannock town;
- Lichfield City;
- Tamworth town; and
- Penkridge.

These settlements have been chosen for progression as part of the Level 2 SWMP based upon historic flooding occurrences, future flooding potential, severity of flooding and the development plans/potential of the settlement:

The gaps and insufficiencies in the LiDAR data are immediately evident. As such the modelling cannot be progressed until sufficient data is received. Before the modelling commences, the most appropriate modelling technique must also be discussed with the

Councils. Due to the range of flood sources (including the combination of sewer and surface drainage), a more detailed combined approach would be the most comprehensive. If data is available a simpler review of the surface topography and potential flow routes/pooling locations in the additional 'at risk' settlements and individual development sites may be more appropriate.

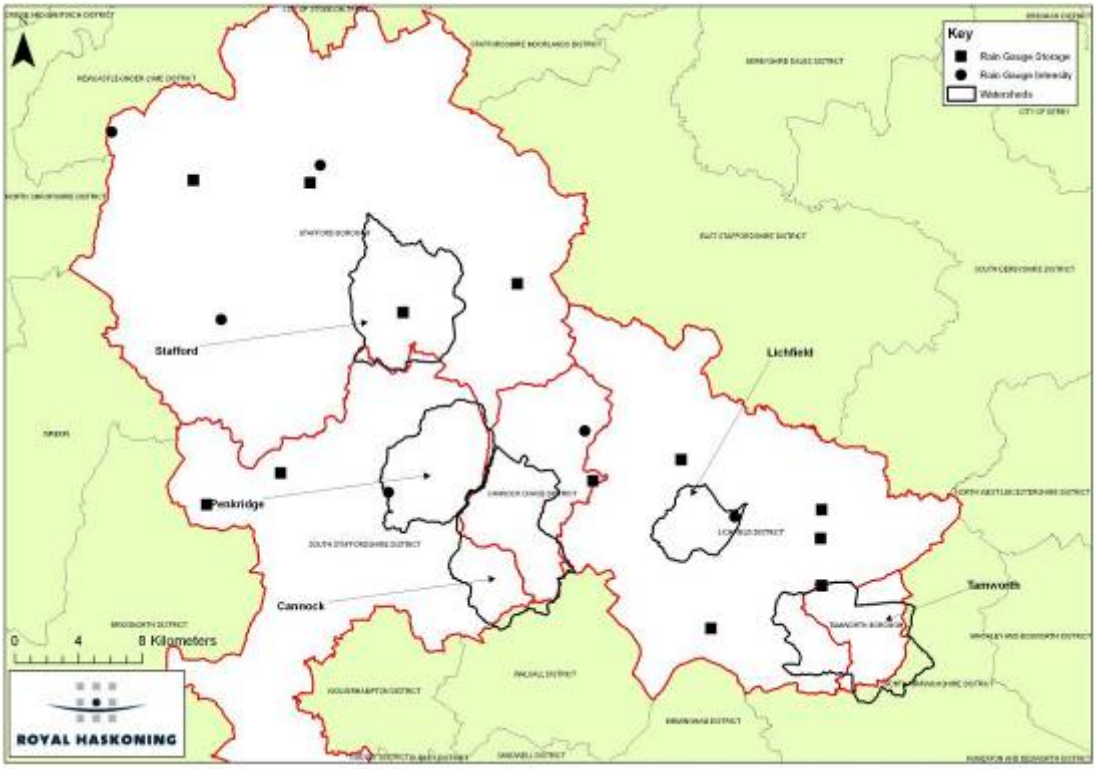
Figure 9.1 - Watershed Location and LiDAR Coverage



The other key settlements identified within the analysis as also being at high risk of surface water flooding, include Wombourne, Stone, Burntwood and Rugeley. These require further review, but, for the time being, this is best pursued through further interrogation of the existing data and discussion with the partners/stakeholders and maintenance organisations. If feasible, they may benefit from further modelling at a later date.

In addition to the LiDAR another key data requirement is rainfall information. **Figure 9.2** shows the location of rain gauges within the study area, as provided by the Environment Agency. The coverage is fairly extensive and, provided all the gauges have a consistent record of information, there should be sufficient data to carry out the analysis. Further details will be discussed with the Councils prior to the initiation of Phase 2 once the modelling areas and approach have been confirmed.

Figure 9.2 - Rain Gauge Locations Within the Study Area



The next steps for this SWMP for the Councils to follow are:

1. Discuss the findings of the SWMP with the relevant partners/stakeholders, updating and extending the information where necessary;
2. Identify the locations to be modelled as part of the Phase 2 SWMP;
3. Agree the scope of the required modelling;
4. Undertake any site specific analysis/further review of settlements and/or sites not assessed within the Phase 2 SMWP before progression; and
5. Confirm management roles, responsibilities and requirements of all the surface water asset maintainers.

9.3 Summary

In summary, this Phase 1 SWMP has achieved all the objectives set at the start:

- ✓ A partnership has been established with the Steering Group and additional stakeholders;
- ✓ The roles and responsibilities of partners have been established;
- ✓ An Engagement Plan has been drawn up for use during the res of the study
- ✓ The historic occurrences of surface water flooding have been determined and mapped across the study area;
- ✓ The areas at greatest risk of surface water flooding and therefore areas which require further investigation as part of Phase 2 have been defined; and
- ✓ The Councils have been advised as the ‘next steps for the SWMP.

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Appendix A
Engagement Plan

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Note

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COASTAL & RIVERS

To	:	Stafford, Lichfield, Tamworth, South Staffs and Cannock Chase WCS / SWMP Steering Group members
From	:	G Davies
Date	:	20 November 2009
Copy	:	
Our reference	:	9V5955/N00001/303671/Soli
Subject	**:**	**SWMP Engagement Plan DRAFT**

Context

Defra's guidance on Surface Water Management Plans[1] (SWMPs) lays down current 'best practice' for the preparation of such plans. One of the early stages of the SWMP process requires the project team to establish an Engagement Plan. The aims of the plan are:

- to ensure that all project partners (Steering Group) are fully engaged with the SWMP process;
- to identify the level of engagement required with other stakeholders; and
- to identify processes by which other stakeholders will be engaged.

Approach to engagement

Annex C of the SWMP Technical Guidance identifies different levels of engagement, from Type A decisions (low conflict, low controversy, low uncertainty) to Type C decisions (high conflict, high controversy, high uncertainty). The Annex also outlines questions that can be used to guide practitioners in determining the most appropriate level of engagement for a particular SWMP.

The current project for five District Councils in Staffordshire is for completion of the SWMP to Stage 2 only (up to and including completion of risk assessment, but not including options identification and appraisal). At this early stage in the SWMP, there do not appear to be any particular areas of major conflict or potential controversy, and therefore a 'Type A' approach is proposed. This approach should be reviewed at intervals through the project to confirm that it is still the most applicable approach. Appropriate points for reviewing the approach could include:

- On completion of the initial high level flood risk mapping stage, depending on the conclusions from that work.
- On completion of the SWMP, Stage 2, when areas of risk have been fully identified.

At this moment, therefore, the engagement plan covers only the main issues of engagement of the main project partners with the SWMP process. The Engagement Plan is a living document, and it is anticipated that the Plan will develop through the SWMP project.

It is noted in particular that the draft SWMP Technical Guidance document does not include any guidance on how the results from SWMPs should be communicated to the general public. Section 5.6 of the guidance states that 'guidance on communicating risk to the public will be developed during the living draft phase'.

[1] Surface Water Management Plan Technical Guidance, Living draft version 1, Defra, February 2009

As the updated SWMP guidance is likely to be published during the course of this project, this engagement plan may need to be updated to reflect any new guidance on communicating risk to the public that may become available. It is worth stressing at this stage, however, that the communication of risk to the public is likely to be a process that requires a considered and sensitive approach. For example, the publication of maps showing areas of surface water flood risk has the potential to blight particular properties, and so the way in which such information is made public must be carefully planned.

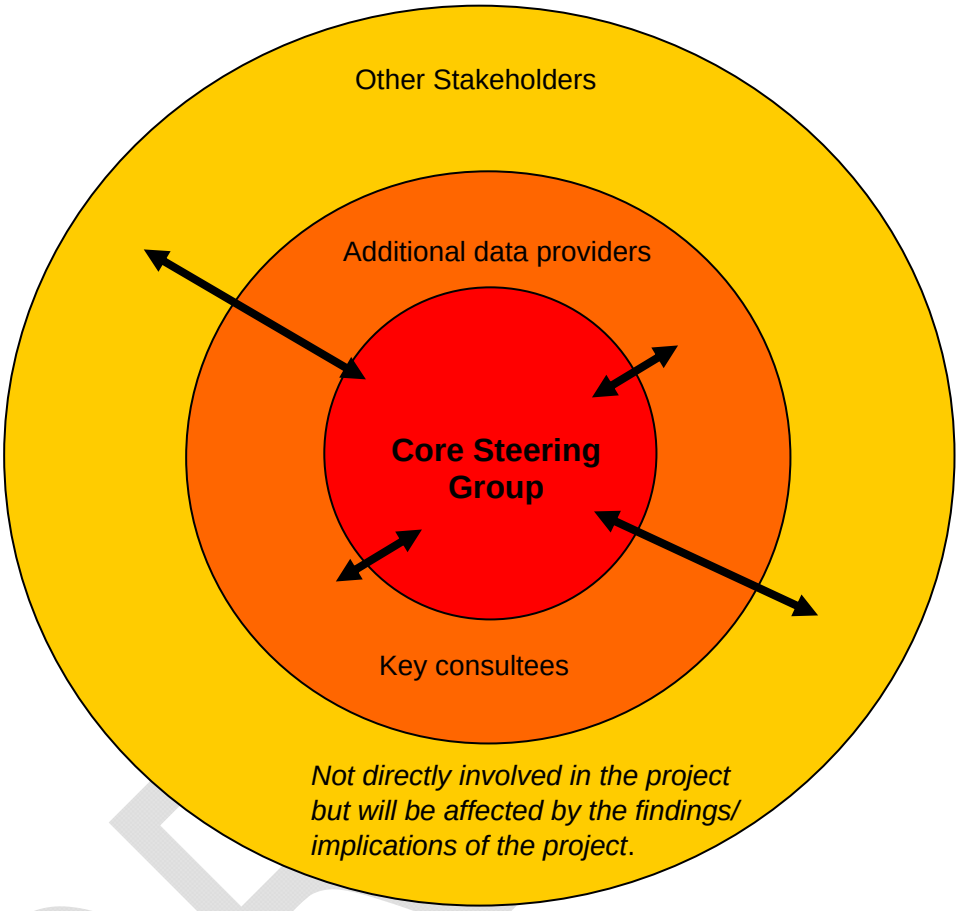
Contents

This Engagement Plan comprises the following elements:

1. Identification of Core Steering Group members, key consultees and other project stakeholders, including relationship between those groups.
2. Extract from SWMP Technical Guidance identifying roles and responsibilities of primary stakeholders (Steering Group members and key consultees).
3. Project Directory, giving contact details for Steering Group members.

1. STEERING GROUP, KEY CONSULTEEES AND OTHER STAKEHOLDERS

Relationship diagram



Core Steering Group (*Councils, EA, RH, STW, SSW)*

Member	Engagement with….	Role/Method
Councils	Coordination of other Steering Group members	Throughout project life and beyond
	Additional data providers	Assisting RH with data collection
	Other Stakeholders	Meetings/Workshops/Presentations
		Day to day communication
		Implementation of development
Royal Haskoning	Rest of Steering Group	Data requests/queries Steering Group progress meetings Presentation
	Additional data providers	Telephone/Email/Meetings
	Other Stakeholders	Presentation to members - assisting the Council in disseminating the key messages from the SMWP.
Environment Agency	Steering Group	Provision of data
	Other Stakeholders	Either directly through day to day responsibilities or to assist the Council in dissemination of findings
Severn Trent Water	Steering Group	Provision of data

Member	Engagement with….	Role/Method
	Other Stakeholders	Either directly through day to day responsibilities or to assist the Council in dissemination of findings
South Staffordshire Water	Steering Group	Provision of data
	Other Stakeholders	Either directly through day to day responsibilities or to assist the Council in dissemination of findings

- Councils would be main contact with outside 'ring' of public, riparian owners, developers etc
- Councils would be supported in this role by other Steering Group members
- Royal Haskoning would only contact this outside group through the Council, e.g. at the presentation of final reports
- Requirement of openness and partnership approach with Core Steering Group

Additional Data Providers / Key Consultees (*Natural England, British Waterways, Environmental Groups, Public Flood Risk Forums etc)*

- Providers of additional, but not key, data and information
- Correspondence with Steering Group when required (e.g. to provide information).
- Although not at all the progress meetings, it is envisaged this group would be invited to the project group presentation.
- This group may benefit from progress reports throughout the project life (e.g. from the Council) to feel involved/ have the ability to provide additional information/comment

Other Stakeholders (*Public, Riparian Owners, Developers)*

- This group would not hold any data or information for these high level studies
- They would be affected by the implications of the plans so should be communicated with after finalisation of the project (e.g. through the Presentation to Members)
- The main direct contact with this group would be through the Council
- They may be able to provide more specific information necessary for the latter Phases of the study, if commissioned, so it is important to get their buy-in at an early stage.

2. ROLES AND RESPONSIBILITIES

Reproduced from Section 1 of the SWMP Technical Guidance.

Partner or Stakeholder	Role in SWMP
Local authority	**Lead partner** for the SWMP responsible for ensuring that objectives are set and met and that a partnership approach is adopted. Responsible for sharing information about or making available: • land-use planning and urban development, • highways drainage (Highways Agency for major routes) • urban green space • Sustainable drainage systems in their control • ordinary watercourses in their control • Strategic Flood Risk Assessment (PPS25) • Reported flooding incidents • costs and practicalities of re-engineering streets and green space as flow routes or storage • Operations and maintenance regimes • Property values and damage due to flooding SWMP will inform how they: • Prepare for emergencies (together with others in Local Resilience Forums[26]) • Allocate land-use and adopt surface water management policies • Control drainage for new development through planning controls • Use opportunities arising from development and redevelopment to work in partnership with developers to implement the SWMP • Communicate with residents about surface water flooding • Refurbish and improve the urban environment • Plan operations and maintenance regimes • Invest in local flood risk management, in particular highways drainage and ordinary watercourses
Environment Agency	**Essential partner** for the SWMP responsible for main river and coastal flooding. Responsible for sharing information about or making available: • River flows, levels and flooding • River flow models • Catchment flood management plans

Partner or Stakeholder	Role in SWMP
	• Reported flooding incidents • DEM data (e.g. LiDAR) • Interactions between rivers or the sea and drainage systems • Operation and maintenance regimes • Long term investment plans SWMP will inform how they: • Prepare for emergencies • Communicate with residents about all sources of flooding • Invest in flood risk management (especially for smaller urban 'main' watercourses) • Plan operations and maintenance regimes
Water Company (sewerage provider)	**Essential partner** for the SWMP responsible for public sewer systems and the reduction of sewer flooding. Responsible for 'effectually draining'[27] their area. Responsible for sharing information about or making available: • Sewer network capacity and performance • Reported flooding incidents • Sewer network models • Costs and practicalities of sewer rehabilitation • Drainage Area Plans and Sewerage Management Plans • Long term investment plans • Sustainable drainage systems in their control SWMP will inform how they: • Prepare for emergencies • Communicate with residents about sewer flooding • Undertake Drainage Area and Sewerage Management Plans • Plan their investment in sewerage systems • Respond to climate and population change • Work with developers to adopt some drainage infrastructure for new developments
Internal Drainage Board	**Potential Partner** for the SWMP if responsible for land drainage and surface water management in or near to

Partner or Stakeholder	Role in SWMP
	urban areas. Responsible for sharing information about or making available: • Sustainable drainage systems in their control • River/channel flows, levels and flooding • River/channel flow models SWMP will inform how they: • Plan their investments in drainage facilities • Plan operations and maintenance regimes • Respond to climate and population change • Plan operation and maintenance regimes
Riparian Owners	**Potential Partner** or **stakeholder** for the SWMP if responsible for improvement to open channel or culverted watercourses essential to surface water drainage. Responsible for sharing information about or making available: • Flooding incidents SWMP will inform how they: • Deliver channel improvements and maintenance to reduce flood risk
Householders, businesses and landowners (the community)	**Potential partner** or **stakeholder** for the SWMP. A valuable source of information about historical flood occurrences and preferences for flow exceedance routes and/or storage. They can also be involved in the development of solutions. SWMP will inform how they: • Understand and respond to local flood risks • Take steps to manage runoff from their business premises or land • Take steps to protect their property from surface water flooding
Developers	**Key stakeholder** or **potential partner** for the SWMP especially where large areas of new development are planned and there are opportunities for a strategic approach to surface water drainage. If developers are involved in the SWMP they can share information about development proposals as early as possible, thus ensuring any surface water issues are fully

Partner or Stakeholder	Role in SWMP
	integrated into the SWMP SWMP will inform how they: • Provide strategic surface water drainage infrastructure such as SUDS. • Provide drainage from and around buildings • Respond to climate and population change
Highways Agency	**Potential partner** for the SWMP where main or trunk roads form a key part of the drainage or flood risk SWMP will inform how they: • Design road drainage to minimise surface water runoff • Plan exceedance routes
Navigation authorities	**Potential Partner** for the SWMP where navigation channels (e.g. canals) present an urban flood risk and/or conveyance or storage for excess surface water.

3. PROJECT CONTACTS DIRECTORY

Stafford Borough Council		
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	info@shiregroup-idbs.gov.uk	

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Appendix B
Data Register

Southern Staffordshire WCS and SWMP Data Register

Reference Number	Data Type	Date Received	Source
9V595501_001	Ancient Woodland, Biodiversity Action Plan species both 100m and 1km, Biodiversity Alert Site, Conservation Areas, Habitat data, Local Nature Reserves, National Nature Reserves, Protected Open Space, Protected Species 1km and 100m, Ramsar Sites, Regionally Important Geological Sites, Sites of Biological Interest 1 and 2, Special Area of Conservation, SSSI, Tree Preservation Order, Woodland	20 Nov 09	Stafford BC Naomi Perry
9V595501_002	Bank Top, Copy of National floodzone, Definitive footpaths, Flood Areas 05, 06, 07, 08 and 2009, Centrelines, Water, Flood Defence	20 Nov 09	Stafford BC Naomi Perry
9V595501_003	Listed Buildings, Retail and warehouse parks, SHLAA	20 Nov 09	Stafford BC Naomi Perry
9V595501_004	Town Centre Boundary, Wards	20 Nov 09	Stafford BC Naomi Perry
9V595501_005	Green Network, Green Belt, Land classification, Landfill sites	20 Nov 09	Stafford BC Naomi Perry
9V595501_006	Stafford Borough Local Plan 2001	20 Nov 09	Stafford BC Naomi Perry
9V595501_007	Core Strategy issues and options for housing and employment,	20 Nov 09	Stafford BC Naomi Perry
9V5955_01_008	MasterMap	20 Nov 09	Stafford BC Naomi Perry
9V5955_01_009	Aston Chase EA Flood Alleviation Scheme, Core Strategy, Severn Trent Water , Infrastructure, Mapped Flood Plains, SFRA Level 1, EA Level 2 SFRA advice, Green Infrastructure, Biodiversity, Photos,	20 Nov 09	Stafford BC Naomi Perry
9V5955-01_010	Historic Flooding - Highways Hotspots	27 Nov 09	Stafford CC - Shona Frost

Reference Number	Data Type	Date Received	Source
9V5955_01_011	Bridges over Watercourses (xls)	27 Nov 09	Stafford CC - Shona Frost
9V5955_01_012	OS Mapping	10 Dec 09	Stafford BC - Gareth Thomas
9V5955_01_013	LDF Documents	16 Dec 09	Stafford BC Website
9V5955_01_009	Infrastructure Study	21 Dec 09	Stafford BC Website
9V5955_01_014	SFRA Shapefiles (Litchfield, Stafford, and Tamworth)	10 Feb 09	Stafford BC - Naomi Perry
9V595502_001	Core Strategy	20 Nov 09	Litchfield DC Website Neil Cox
9V595502_002	Development Sites - pdf and Ward completions	20 Nov 09	Litchfield DC Neil Cox
9V595502_003	SFRA - pdf	20 Nov 09	Litchfield DC Website Neil Cox
9V595502_004	Strategy Reports - Tamworth Future Development and Infrastructure Study - Canal Feasibility	20 Nov 09	Litchfield DC Website Neil Cox
9V595502_005	Water Quality Report - pdf River Quality 2003 - xls EA Quality Grades - xls Threatened River Species - xls	20 Nov 09	Litchfield DC Neil Cox
9V5955_02_006	OS Mapping 10K (50K in S Staffs and Stafford)	10 Dec 09	Litchfield DC Gareth Thomas
9V5955_02_007	Flood Data - shp	10 Dec 09	Litchfield DC Gareth Thomas
9V5955_02_008	Mastermap	10 Dec 09	Litchfield DC Gareth Thomas
9V5955_02_009	Canals - shp	10 Dec 09	Litchfield DC Gareth Thomas

Reference Number	Data Type	Date Received	Source
9V5955_02_010	Contours - shp	10 Dec 09	Litchfield DC Gareth Thomas
9V5955_02_011	Wards - shp	10 Dec 09	Litchfield DC Gareth Thomas
9V5955_02_012	Development Shapefiles - SHLAA and Strategic Sites	10 Dec 09	Litchfield DC Gareth Thomas
9V5955_02_013	AMRs	17 Dec 09	Litchfield DC Website
9V595503_001	Historic Flooding (EA)	4 Dec 09	Tamworth DC Jane Parry
9V595503_002	OS Map Data 10K Mastemap	4 Dec 09	Tamworth DC Jane Parry
9V595503_003	SFRA - Jan 2008	4 Dec 09	Tamworth DC Jane Parry
9V595503_004	Updated SFRA - September 2009	4 Dec 09	Tamworth DC Jane Parry
9V595503_005	Flood Zones (2, 3, 3b) - shp	4 Dec 09	Tamworth DC Jane Parry
9V5955_03_006	Development Site shapefiles Updated files	4 Dec 09 13 Jan 10	Tamworth DC Jane Parry Thomas James
9V5955_03_007	Documents - Residential Land Availability and SHLAA	4 Dec 09	Tamworth DC Jane Parry
9V5955__03_008	WCS Data - GIS Sites	5 Jan 10	Tamworth DC Thomas James
9V5955_03_009	NextMap	25 Jan 10	Tamworth DC Thomas James

Reference Number	Data Type	Date Received	Source
9V595504_001	Mapping 10K 50K Mastermap	7 Dec 09	South Staffs Kelly Harris
9V595504_002	SFRA shapefiles	7 Dec 09	South Staffs Kelly Harris
9V595504_003	Development Sites - shp	7 Dec 09	South Staffs Kelly Harris
9V595504_004	Employment Sites - shp	7 Dec 09	South Staffs Kelly Harris
9V595504_005	Settlement Hierarchy - primary, secondary, tertiary, main villages	7 Dec 09	South Staffs Kelly Harris
9V595504_006	Documents Core policy housing numbers Preferred spatial strategy Development plan	7 Dec 09	South Staffs Kelly Harris
9V5955_04_007	LDF_Documents	16 Dec 09	South Staffs website
9V5955_04_003	Development Site Updated Information	4 Jan 10	South Staffs Kelly Harris
9V5955_04_004	Employment Site Updated Information	6 Jan 10	South Staffs Debbie Hall
9V595505_001	Ancient Woodlands - shp, tab	9 Dec 09	Magic Website
9V595505_002	National Nature Reserves - shp, tab	9 Dec 09	Magic Website
9V595505_003	RAMSAR - shp, tab	9 Dec 09	Magic Website
9V595505_004	SAC - shp, tab	9 Dec 09	Magic Website
9V595505_005	SPA - shp, tab	9 Dec 09	Magic Website
9V595505_006	SSSIs - shp, tab	9 Dec 09	Magic Website

Reference Number	Data Type	Date Received	Source
9V595506_001	LiDAR	11 Dec 09	Geomatics - Mike Plant (CD)
9V5955_06_002	Data Response List	14 Dec 09	EA - Diane Edwards (CD)
9V5955_06_003	Flow, Level, Rainfall Locations - xls	14 Dec 09	EA - Diane Edwards (Email)
9V5955_06_004	Flood Watch/Warning - Staffordshire LFWP and Amendment request form	15 Dec 09	EA - Diane Edwards (CD)
9V5955_06_005	West Midlands Regional Flood Risk Appraisal 2009	15 Dec 09	wmra.gov.uk
9V5955_06_006	CAMS - Trent Corridor and Staffordshire Trent Valley	15 Dec 09	EA website
9V5955_06_007	GWV, SPZ and GQA shapefiles	16 Dec 09	Diane Edwards (email)
9V5955_06_008	FRM Data (Admin Boundaries, Critical Infrastructure, Defence and Structure, Flood zones, Historic Flood Outlines, LiDAR Extents, Modeled and Historic Levels, Rainfall and Flow Gauges, River Centre Lines, Surface Water Flood Map	16 Dec 09	Mike Adams (CD)
9V5955_06_009	National Property Dataset	4 Jan 10	Diane Edwards (CD) (Password received separately by email - .txt)
9V5955_06_008	Cannock and South Staffs FRM Data (ABDs, Critical Infrastructure, Flood Zones, Gauges, Historic Levels, Modeled Levels, NFCDD, River Centre Lines, Surface Water Flood Map	11 Jan 10	Mike Adams (CD)
9V5955_06_010	SW flood map document LiDAR extents Staffs County	11 Feb 10	Phil Edwards (Email)
9V595507_001	Sow and Penk IDB Byelaws	09 Dec 09	Website
9V595508_001	STWL_ WwTW - shp	10 Dec 09	Steve Southern
9V5955_08_002	STWL - waterlines - shp	10 Dec 09	Steve Southern

Reference Number	Data Type	Date Received	Source
9V5955_08_003	STWL - sewer lines - shp	10 Dec 09	Steve Southern
9V5955 08_004	WwTW DAP Catchments	15 Dec 09	Tim Smith
9V5955 08_005	Floods2 Database	9 Feb 09	Tim Smith
9V5955 08_006	Analysis	17 - 23 Feb 10	Tim Smith
9V595509_001	Hatherton Canal Feasibility Study	14 Dec 09	www.lhcrt.org.uk (via Derek Lord)
9V5955_09_002	Hatherton Canal Feasibility Study Supplement	14 Dec 09	www.lhcrt.org.uk (via Derek Lord)
9V5955_09_003	Litchfield Canal Feasibility Study	14 Dec 09	www.lhcrt.org.uk (via Derek Lord)
9V5955_09_004	Sharkey Environmental Report	14 Dec 09	www.lhcrt.org.uk (via Derek Lord)
9V595510_001	SSW supply boundary - sbf	14 Dec 09	Dave Martin
9V5955_10_002	Site Specific Analysis - Results	12 Feb 10	Dave Martin
9V595511_001	OS Mapping - 10K, 25K, 50K and Mastermap	08 Jan 10	Cannock Chase DC (Sarah Pritchard)
9V5955_11_002	SFRA	08 Jan 10	Cannock Chase DC (Sarah Jones)
9V5955_11_003	LDF Documents	08 Jan 10	Cannock Chase DC (Sarah Jones)
	Updated Development Sites	13 Jan 10	(Sarah Jones)
9V5955_11_004	Rugeley SFRA	08 Jan 10	Cannock Chase DC (Sarah Jones)
9V5955_11_005	Critical Infrastructure	08 Jan 10	Cannock Chase DC (Sarah Jones)
9V5955_11_006	Flood Risk Assessments	08 Jan 10	Cannock Chase DC (Sarah Jones)
9V5955_11_007	Strategic Studies	08 Jan 10	Cannock Chase DC (Sarah Jones)

Reference Number	Data Type	Date Received	Source
9V5955_11_008	Asset Database	08 Jan 10	Cannock Chase DC (Sarah Jones)
9V595512_001	Surface Water Flooding Spreadsheet (Defra properties and occurrences)	11 Feb 10	Staffs County Council (Matt Bulzacchelli)
9V5955_12_002	Defra Surface Water Flooding Guidance	22 Feb 10	Staffs County Council (Matt Bulzacchelli)

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Appendix C
Figures

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Appendix D
Stafford Borough Summary Sheets

Summary Sheet Explanation

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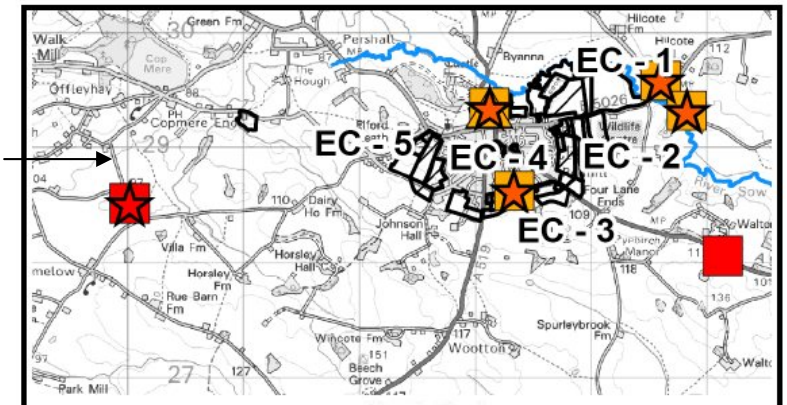
Snapshot of key settlement, taken from **Figures B1 - B5**.



Map key, taken from **Figures B1 - B5**.

Rivers
Canal
Potential Development Sites
Potential Housing and Employment Sites

Historic Flooding Types of Flooding
- Surface Water
- Canal
- Artifical Drainag
- Highways
- Sewer
- Groundwater
- Unknown

Historic Flooding Recurrance
- Exceptional
- Rare
- Occasional
- Repeat

Number of historic flooding occurrences marked as points on the map snapshot shown above. Colour code is explained in **Table 3.7**

Historic Flooding section details the occurrences of historic flooding shown within and around the settlement in question.

Historic Surface Water Flooding — 5+ historic flooding events

Type	Occurrence	Comment
Surface	5 locations	Repeat occurrences - should be investigated further
Highways	6 locations	4 Occasional occurrences - may repeat. 2 Repeat occurrences - should be investigated further

Further explanation of all historic flooding events within and around the key settlement.

Future Flooding section outlines the results from the conversion of the Environment Agency's surface water flood map into a flagged system (see Section 3.1.2 for more detail)

Future Surface Water Flooding

222 properties at risk

Moderate number of properties located in surface water flood map 'less than' extent.

Box colour is explained in **Table 3.8**. Flag colour is explained in **Table 3.5** Number of properties taken from comparison of EA surface water flood map and NPD (RH analysis)

Overall Flooding section summarises the combined results for the settlement, accounting for both historic and future flooding.

Overall

Large number of historic flood events, many of which repeat and moderate number of properties at risk of future flooding. Eccleshall has been identified within Defra's analysis with a rank of 2,471and 20 properties at risk. A closer review of the historic flooding locations is recommended. This area would benefit from further investigation as part of a future Phase 2 SWMP or site specific assessments.

Box colour is explained in **Table 3.9** Text summarises the conclusions shown above, plus the results of Defra's analysis for the settlement.

Summary of key **development sites** shown within the settlement.

Development Sites

Housing	Historic		Future	Summary
EC-1	(surface)	(highways)	None	
EC-2	Surface	Highways	Low/Intermediate	
EC-3	Surface	Highways	None	
EC-4	(surface)	(highways)	Low	
EC-5	(surface)	(highways)	None	

Notes: Brackets indicate proximity but not overlap

Summary box colour is explained in **Table 3.9** as a combination of Historic and Future

Future box colour refers to the EA surface water flood map extent in which the development site is either wholly or partially located:
Green - overlap with 'Less' flood extent or no overlap
Yellow - overlap with 'Intermediate' flood extent.
Red - overlap with 'more' flood extent.

Historic box colour explained in **Table 3.7**

Recommendations are provided for the settlement as a whole.

Recommendations

1. Review historic flooding locations in relation to any potential development sites and further investigation of repeat flooding.
2. Review the impact of development upon surface runoff and options for mitigation (for example, SUDS)
3. Review location of Environment Agency surface water flood map extents in relation to the proposed development sites.
4. Further assessment as part of a Phase 2 SWMP or site specific assessment.

Key

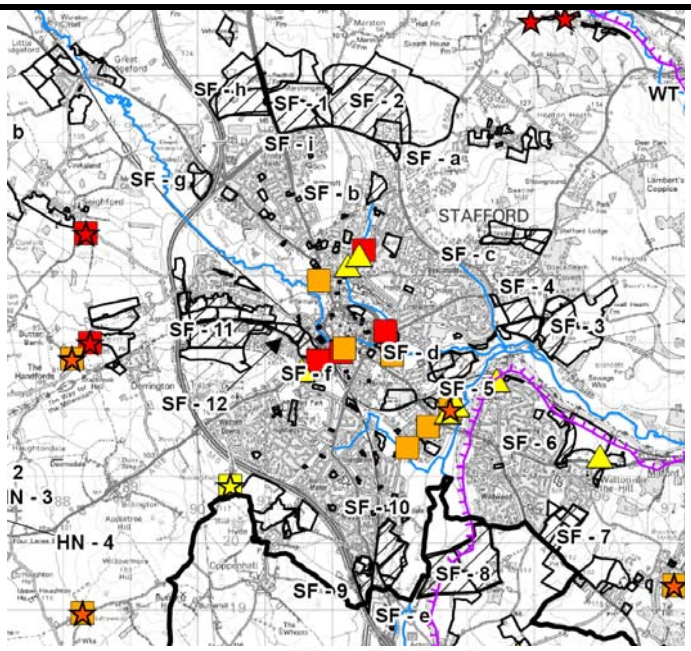
Area should be investigated further as part of a Phase 2 SWMP or site specific study.

Area would benefit from being investigated further as part of a Phase 2 SWMP. Development should be reviewed with reference to the surface flood maps.

Based on current data no detailed further analyses required, although the topography of individual sites should be reviewed before development and all new development should utilise SUDS methods.

Key refers to the implications of each of the box colours.

Stafford Borough - Stafford (in and around)



Rivers
Canal
Potential Development Sites
Potential Housing and Employment Sites

Historic Flooding
Types of Flooding
Surface Water
Canal
Artifical Drainag
Highways
Sewer
Groundwater
Unknown

Historic Flooding Recurrance
Exceptional
Rare
Occasional
Repeat

Historic Surface Water Flooding 5+ historic flooding events

Type	Occurrence	Comment
Surface	5 locations	Rare, Occasional and Repeat occurrences -Rare may only occur during extreme events -Occasional occurrence - may repeat -Repeat require further investigation
Highways	13 locations	Rare, Occasional and Repeat occurrences -Rare may only occur during extreme events -Occasional occurrence - may repeat -Repeat require further investigation
Unknown	1 locations (east)	Rare occurrences - may only occur during extreme events
Sewer	6 locations	Rare may only occur during extreme events

Future Surface Water Flooding

4,175 properties at risk

High number of properties located in surface water flood map 'less than' extent.

Overall

Large number of historic flood events and high number of properties at risk of future flooding. Stafford has been identified within Defra's analysis with a rank of 220 and 1,600 properties at risk. Brocton has been identified within Defra's analysis with a rank of 2,805 and 10 properties at risk. Derrington has been identified within Defra's analysis with a rank of 2,493 and 20 properties at risk. Further analysis of surface water flooding in this area is recommended.

Development Sites

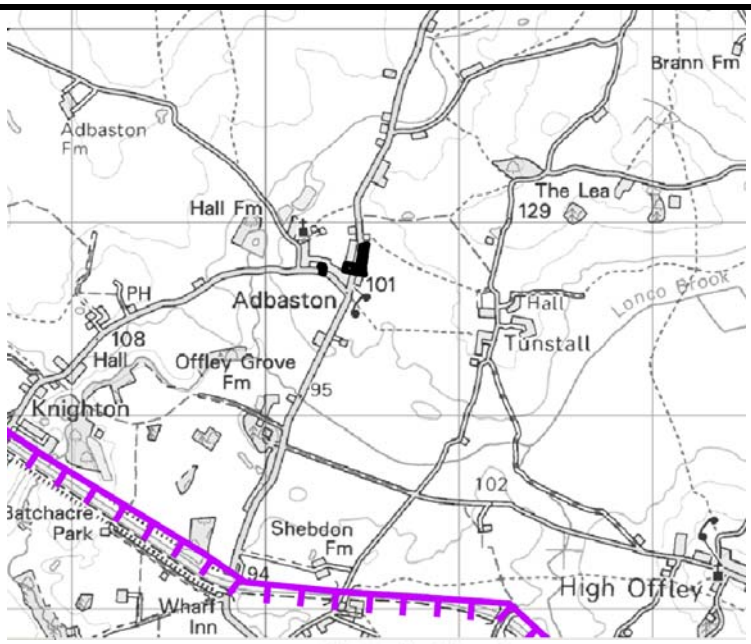
Housing	Historic			Future	Summary
SF - 1	None			Low/Intermediate	
SF - 2	None			Low/Intermediate	
SF - 3	None			Low	
SF - 4	None			Low	
SF - 5	(sewer)	(Highways)	(surface)	Intermediate	
SF - 6	(sewer)			Low	
SF - 7	None			None	
SF - 8	None			More	
SF - 9	None			More	
SF -10	None			More	
SF - 11	None			More	
SF - 12	(Highways)	(sewer)		Intermediate/ More	
Employment					
SF - a	None			Low/Intermediate	
SF - b	None			Intermediate	
SF - c	None			Intermediate	
SF - d	(sewer)	(Highways)	(surface)	Low	
SF - e	None			More	
SF - f	Highways	(sewer)		More	
SF - g	None			Intermediate	
SF - h	None			Intermediate/More	
SF - i	None			Low/Intermediate	

Notes: Brackets indicate proximity but not overlap

Recommendations	
1.	Review the repeating flood events and areas affected
2.	Review the impact of development upon surface runoff and options for mitigation (for example, SUDS)
3.	Review location of Environment Agency surface water flood map extents in relation to the proposed development sites.
4.	Further analysis as part of a Phase 2 SWMP.

Key	
	Area should be investigated further as part of a Phase 2 SWMP or site specific study.
	Area would benefit from being investigated further as part of a Phase 2 SWMP. Development should be reviewed with reference to the surface flood maps.
	Based on current data no detailed further analyses required, although the topography of individual sites should be reviewed before development and all new development should utilise SUDS methods.

Stafford Borough - Adbaston



Historic Surface Water Flooding — No historic flooding events (points)

Type	Occurrence	Comment
None		

Future Surface Water Flooding

29 properties at risk

Low number of properties located in surface water flood map 'less than' extent.

Overall

No historic flood events and low number of properties at risk of future flooding. This are has not been identified within Defra's. It is recommended that a review of measures to mitigate surface runoff from new development sites is carried out prior to development.

Development Sites

No Key Sites

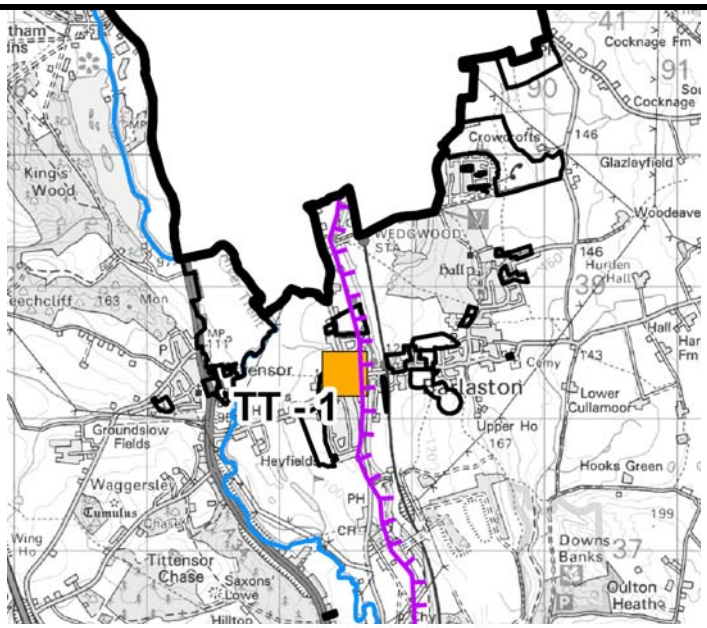
Recommendations

1. Review the impact of development upon surface runoff and options for mitigation (for example, SUDS)
2. Review location of Environment Agency surface water flood map extents in relation to any proposed development sites.

Key

	Area should be investigated further as part of a Phase 2 SWMP or site specific study.
	Area would benefit from being investigated further as part of a Phase 2 SWMP. Development should be reviewed with reference to the surface flood maps.
	Based on current data no detailed further analyses required, although the topography of individual sites should be reviewed before development and all new development should utilise SUDS methods.

Stafford Borough - Barlaston



Rivers
Canal
Potential Development Sites
Potential Housing and Employment Sites

Historic Flooding

Types of Flooding
- Surface Water
- Canal
- Artifical Drainag
- Highways
- Sewer
- Groundwater
- Unknown

Historic Flooding Recurrance
- Exceptional
- Rare
- Occasional
- Repeat

Historic Surface Water Flooding — 1 historic flooding event

Type	Occurrence	Comment
Highways	1 locations	Occasional occurrence - may repeat.

Future Surface Water Flooding

192 properties at risk

Moderate number of properties located in surface water flood map 'less than' extent.

Overall

Few historic flood events and low number of properties at risk of future flooding. Barlaston has been identified within Defra's analysis with a rank of 1,906 and 50 properties at risk. Tittensor has also been identified within Defra's analysis with a rank of 4,046 and 0 properties at risk. Further analysis is recommended for sites located within the surface water flood extents and/or close to the location of historic flooding.

Development Sites

Housing	Historic	Future	Summary
TT-1	None	None	

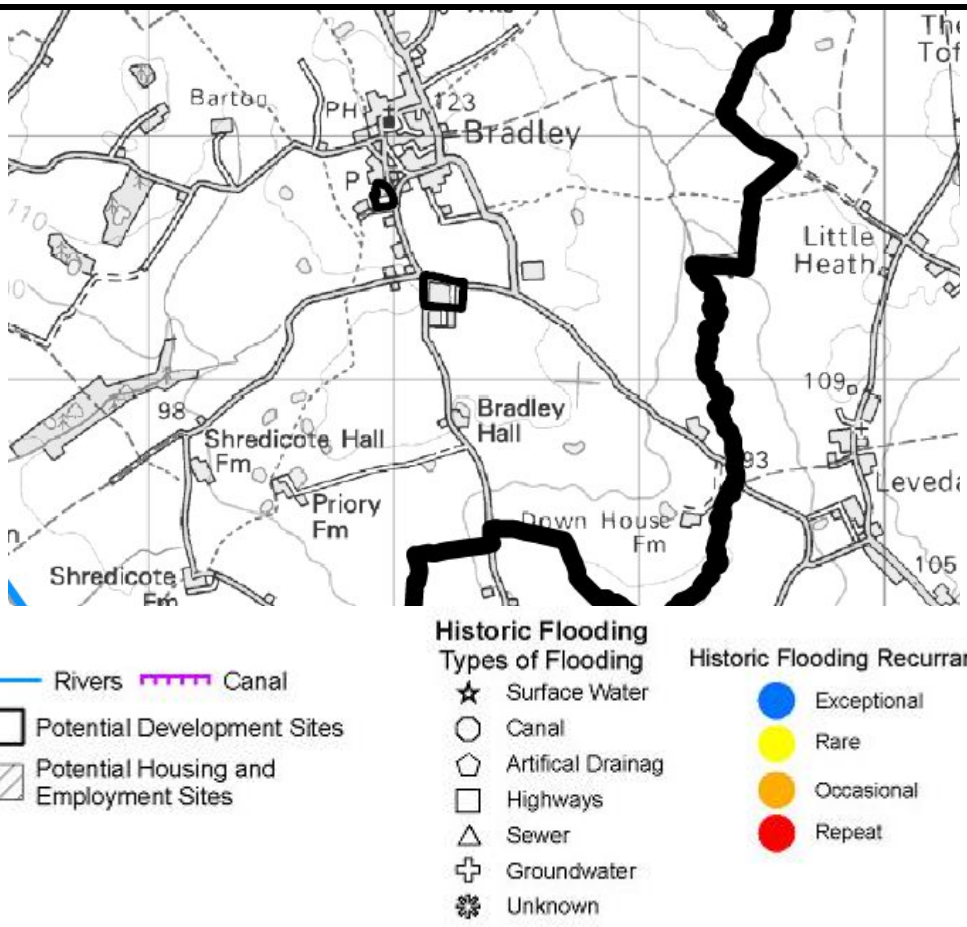
Recommendations

1. Review the impact of development upon surface runoff and options for mitigation (for example, SUDS)
2. Review location of Environment Agency surface water flood map extents in relation to the proposed development sites.

Key

	Area should be investigated further as part of a Phase 2 SWMP or site specific study.
	Area would benefit from being investigated further as part of a Phase 2 SWMP. Development should be reviewed with reference to the surface flood maps.
	Based on current data no detailed further analyses required, although the topography of individual sites should be reviewed before development and all new development should utilise SUDS methods.

Stafford Borough - Bradley



Historic Surface Water Flooding — No historic flooding events (points)

Type	Occurrence	Comment
None		.

Future Surface Water Flooding

13 properties at risk

Very low number of properties located in surface water flood map 'less than' extent.

Overall

No historic flood events but very low number of properties at risk of future flooding. This area has not been identified within Defra's analysis. A closer review of methods to mitigate surface water runoff from any potential development is recommended.

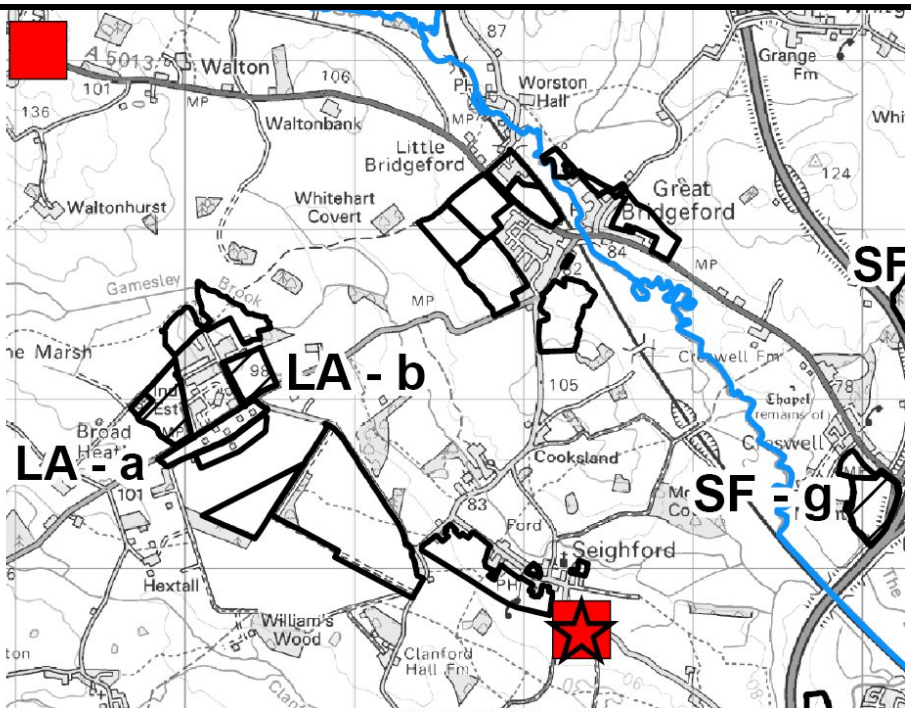
Development Sites

No Key Sites

Recommendations	
1.	Review the impact of development upon surface runoff and options for mitigation (for example, SUDS)
2.	Review location of Environment Agency surface water flood map extents in relation to any proposed development sites.

Key	
	Area should be investigated further as part of a Phase 2 SWMP or site specific study.
	Area would benefit from being investigated further as part of a Phase 2 SWMP. Development should be reviewed with reference to the surface flood maps.
	Based on current data no detailed further analyses required, although the topography of individual sites should be reviewed before development and all new development should utilise SUDS methods.

Stafford Borough - Bridgeford Area



Historic Surface Water Flooding — 2 historic flooding events

Type	Occurrence	Comment
Surface	1 location	Repeat occurrence - should be investigated further
Highways	1 location	Repeat occurrence - should be investigated further

Future Surface Water Flooding

125 properties at risk

Moderate number of properties located in surface water flood map 'less than' extent.

Overall

A couple of historic flood events and moderate number of properties at risk of future flooding. This area has not been identified within Defra's analysis. It is recommended development sites are reviewed on an individual basis before being progressed.

Development Sites

Employment	Historic	Future	Summary
LA - a	None	Less/Intermediate	
LA - b	None	More	

Notes: Brackets indicate proximity but not overlap

Recommendations

1. Review the impact of development upon surface runoff and options for mitigation (for example, SUDS)
2. Review location of Environment Agency surface water flood map extents in relation to the proposed development sites.
3. Investigate the repeat historical flood events further

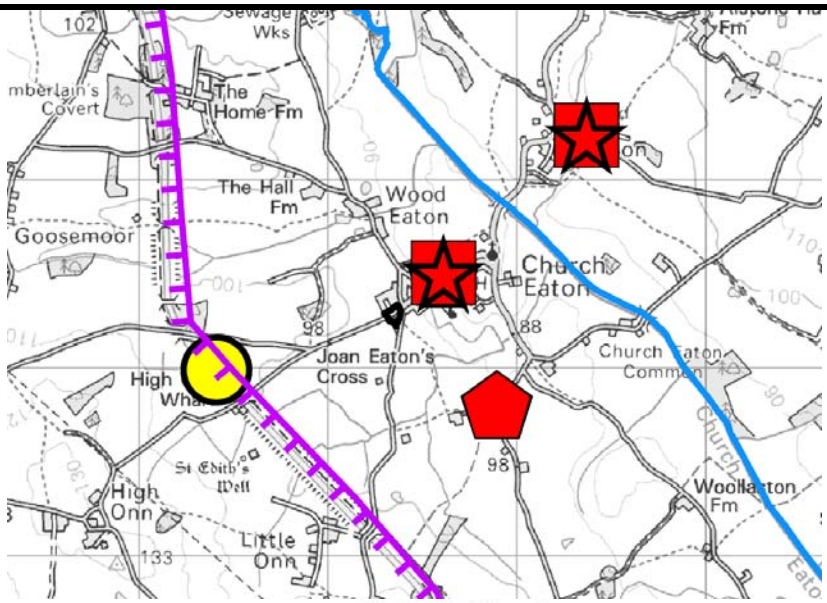
Key

Area should be investigated further as part of a Phase 2 SWMP or site specific study.

Area would benefit from being investigated further as part of a Phase 2 SWMP. Development should be reviewed with reference to the surface flood maps.

Based on current data no detailed further analyses required, although the topography of individual sites should be reviewed before development and all new development should utilise SUDS methods.

Stafford Borough - Church Eaton



Rivers
Canal
Potential Development Sites
Potential Housing and Employment Sites

Historic Flooding
Types of Flooding
- Surface Water
- Canal
- Artifical Drainag
- Highways
- Sewer
- Groundwater
- Unknown

Historic Flooding Recurrance
- Exceptional
- Rare
- Occasional
- Repeat

Historic Surface Water Flooding — 4 historic flooding events

Type	Occurrence	Comment
Surface	1 location	Repeat occurrences - requires further investigation.
Artificial Drainage	1 location	Repeat occurrences - requires further investigation.
Highways	1 location	Repeat occurrences - requires further investigation.
Canal	1 location	Rare occurrence - may only occur during extreme events

Future Surface Water Flooding

46 properties at risk

Low number of properties located in surface water flood map 'less than' extent.

Overall

Few historic flood events but high number of repeating occurrences and low number of properties at risk of future flooding. Church Eaton has not been identified within Defra's analysis. A closer review of the historic flooding locations and mitigation of surface water runoff from potential development sites is recommended.

Development Sites

No Key Sites

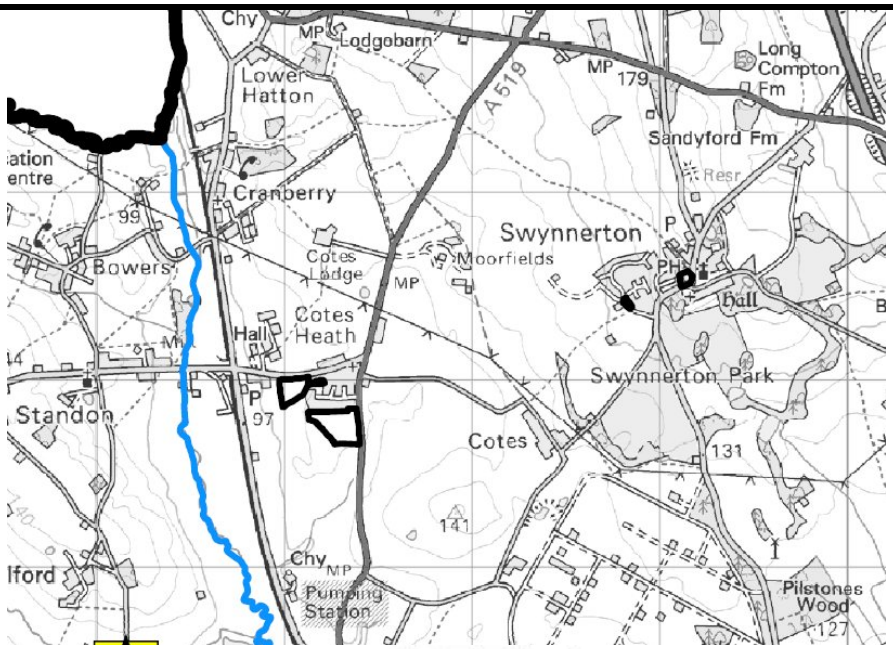
Recommendations

1. Review historic flooding locations in relation to any potential development sites and investigate repeat events further.
2. Review the impact of development upon surface runoff and options for mitigation (for example, SUDS)
3. Review location of Environment Agency surface water flood map extents in relation to the proposed development sites.

Key

	Area should be investigated further as part of a Phase 2 SWMP or site specific study.
	Area would benefit from being investigated further as part of a Phase 2 SWMP. Development should be reviewed with reference to the surface flood maps.
	Based on current data no detailed further analyses required, although the topography of individual sites should be reviewed before development and all new development should utilise SUDS methods.

Stafford Borough - Cotes Heath and Swynnerton



Rivers
Canal
Potential Development Sites
Potential Housing and Employment Sites

Historic Flooding

Types of Flooding
- Surface Water
- Canal
- Artifical Drainag
- Highways
- Sewer
- Groundwater
- Unknown

Historic Flooding Recurrance
- Exceptional
- Rare
- Occasional
- Repeat

Historic Surface Water Flooding

No historic flooding events (points)

Type	Occurrence	Comment
None		

Future Surface Water Flooding

39 properties at risk

Moderate number of properties located in surface water flood map 'less than' extent.

Overall

No historic flood events and a moderate number of properties at risk of future flooding. This area has not been identified within Defra's analysis. A closer review of measures to mitigate surface water runoff from potential development sites is recommended.

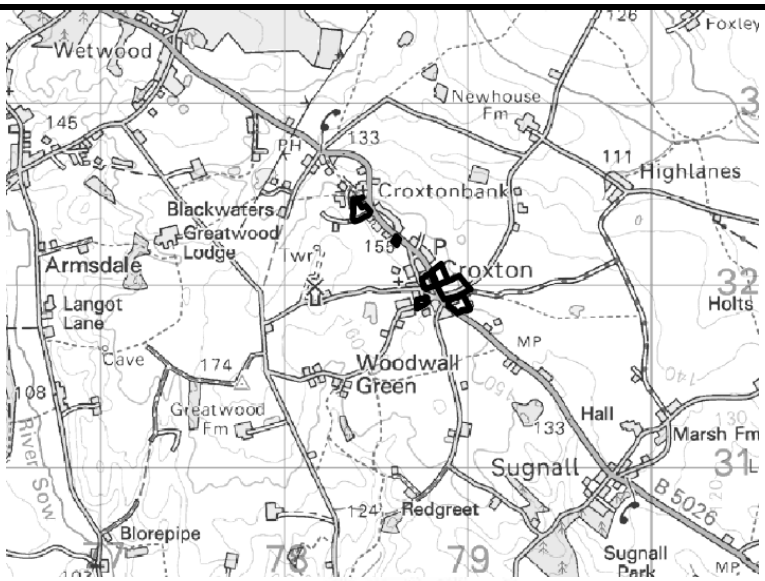
Development Sites

No Key Sites

Recommendations	
1.	Review the impact of development upon surface runoff and options for mitigation (for example, SUDS)
2.	Review location of Environment Agency surface water flood map extents in relation to any proposed development sites.

Key	
	Area should be investigated further as part of a Phase 2 SWMP or site specific study.
	Area would benefit from being investigated further as part of a Phase 2 SWMP. Development should be reviewed with reference to the surface flood maps.
	Based on current data no detailed further analyses required, although the topography of individual sites should be reviewed before development and all new development should utilise SUDS methods.

Stafford Borough - Croxton



Rivers Canal
Potential Development Sites
Potential Housing and Employment Sites

Historic Flooding
Types of Flooding
- Surface Water
- Canal
- Artifical Drainag
- Highways
- Sewer
- Groundwater
- Unknown

Historic Flooding Recurrance
- Exceptional
- Rare
- Occasional
- Repeat

Historic Surface Water Flooding

No historic flooding events (points)

Type	Occurrence	Comment
None		

Future Surface Water Flooding

18 properties at risk

Very low number of properties located in surface water flood map 'less than' extent.

Overall

No historic flooding events and very low number of properties at risk of surface flooding. This area has not been identified within Defra's analysis. However, a closer review of measures to mitigate surface water runoff from potential development sites is recommended.

Development Sites

No Key Sites

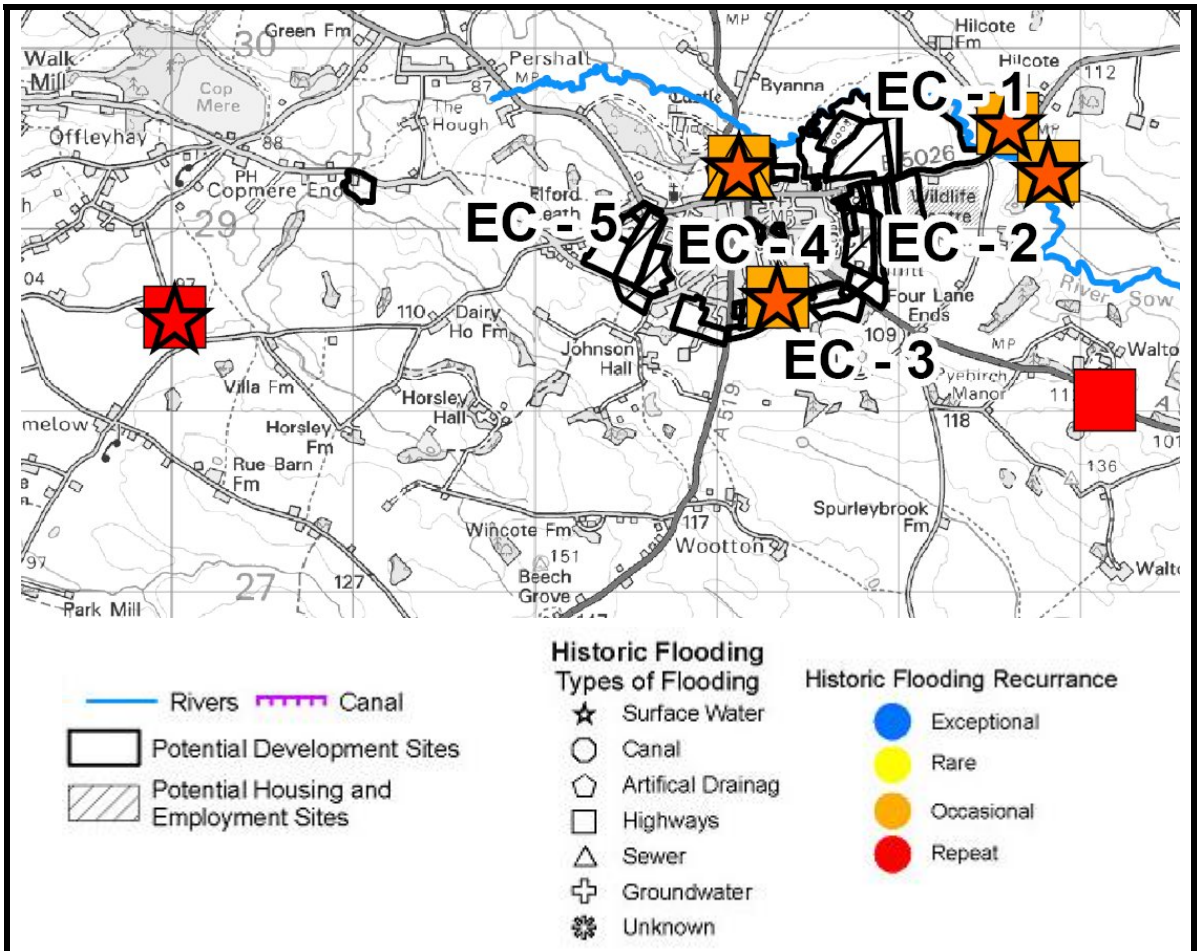
Recommendations

1. Review the impact of development upon surface runoff and options for mitigation (for example, SUDS)
2. Review location of Environment Agency surface water flood map extents in relation to any proposed development sites.

Key

	Area should be investigated further as part of a Phase 2 SWMP or site specific study.
	Area would benefit from being investigated further as part of a Phase 2 SWMP. Development should be reviewed with reference to the surface flood maps.
	Based on current data no detailed further analyses required, although the topography of individual sites should be reviewed before development and all new development should utilise SUDS methods.

Stafford Borough - Eccleshall and Copmere End



Historic Surface Water Flooding — 5+ historic flooding events

Type	Occurrence	Comment
Surface	5 locations	Repeat occurrences - should be investigated further
Highways	6 locations	4 Occasional occurrences - may repeat. 2 Repeat occurrences - should be investigated further

Future Surface Water Flooding

222 properties at risk

Moderate number of properties located in surface water flood map 'less than' extent.

Overall

Large number of historic flood events, many of which repeat and moderate number of properties at risk of future flooding. Eccleshall has been identified within Defra's analysis with a rank of 2,471and 20 properties at risk. A closer review of the historic flooding locations is recommended. This area would benefit from further investigation as part of a future Phase 2 SWMP or site specific assessments.

Development Sites

Housing	Historic		Future	Summary
EC-1	(surface)	(highways)	None	
EC-2	Surface	Highways	Low/Intermediate	
EC-3	Surface	Highways	None	
EC-4	(surface)	(highways)	Low	
EC-5	(surface)	(highways)	None	

Notes: Brackets indicate proximity but not overlap

Recommendations

1. Review historic flooding locations in relation to any potential development sites and further investigation of repeat flooding.
2. Review the impact of development upon surface runoff and options for mitigation (for example, SUDS)
3. Review location of Environment Agency surface water flood map extents in relation to the proposed development sites.
4. Further assessment as part of a Phase 2 SWMP or site specific assessment.

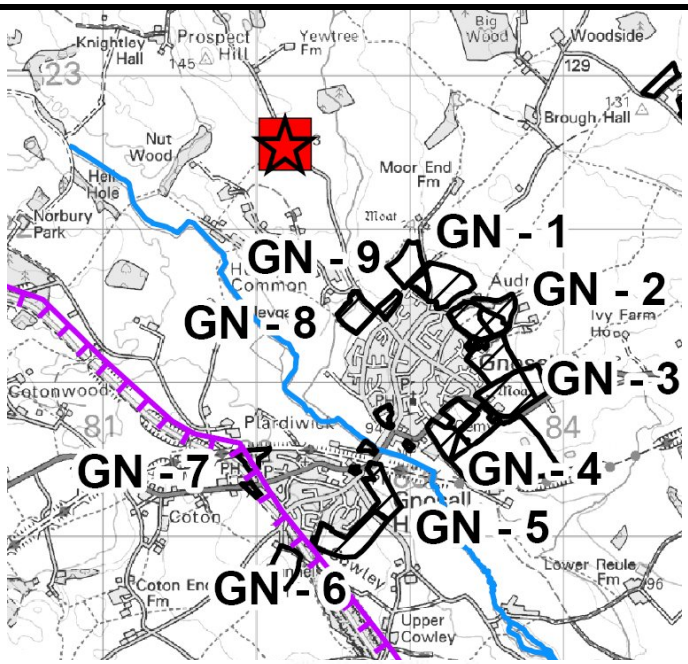
Key

Area should be investigated further as part of a Phase 2 SWMP or site specific study.

Area would benefit from being investigated further as part of a Phase 2 SWMP. Development should be reviewed with reference to the surface flood maps.

Based on current data no detailed further analyses required, although the topography of individual sites should be reviewed before development and all new development should utilise SUDS methods.

Stafford Borough - Gnosall



Historic Surface Water Flooding — 2 historic flooding events

Type	Occurrence	Comment
Surface	1 locations	Repeat occurrence - should be investigated further
Highways	1 location	Repeat occurrence - should be investigated further

Future Surface Water Flooding

244 properties at risk

Moderate number of properties located in surface water flood map 'less than' extent.

Overall

Moderate number of historic flood events and moderate number of properties at risk of future flooding. Gnosall has been identified within Defra's analysis as having a rank of 1,344 and 110 properties at risk. A closer review of the historic flooding events and EA surface water flood map extents is recommended. This area would benefit from further from site specific assessments.

Development Sites

Housing	Historic		Future	Summary
GN - 1	(surface)	(highways)	Low	
GN - 2	None		Low	
GN - 3	None		Low	
GN - 4	None		Low/None	
GN - 5	None		Low/Intermediate	
GN - 6	None		None	
GN - 7	None		Intermediate/More	
GN - 8	(surface)	(highways)	Intermediate	
GN - 9	(surface)	(highways)	None	

Notes: Brackets indicate proximity but not overlap

Recommendations

1. Review the repeating flood events and areas affected
2. Review the impact of development upon surface runoff and options for mitigation (for example, SUDS)
3. Review location of Environment Agency surface water flood map extents in relation to the proposed development sites.

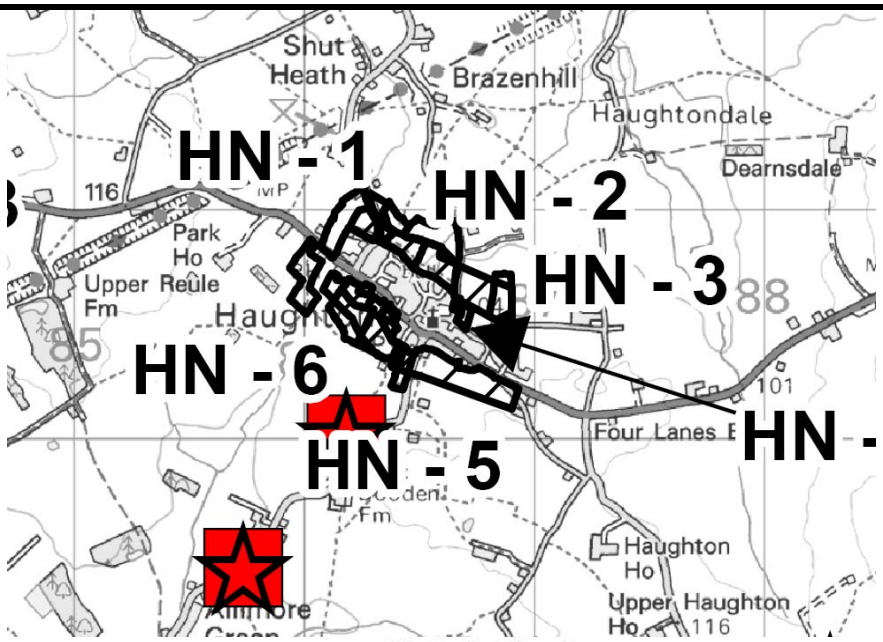
Key

Area should be investigated further as part of a Phase 2 SWMP or site specific study.

Area would benefit from being investigated further as part of a Phase 2 SWMP. Development should be reviewed with reference to the surface flood maps.

Based on current data no detailed further analyses required, although the topography of individual sites should be reviewed before development and all new development should utilise SUDS methods.

Stafford Borough - Haughton



Historic Surface Water Flooding — 4 historic flooding events

Type	Occurrence	Comment
Surface	2 locations	Repeat occurrence - should be investigated further
Highways	2 locations	Repeat occurrence - should be investigated further

Future Surface Water Flooding

43 properties at risk

Moderate number of properties located in surface water flood map 'less than' extent.

Overall

Moderate number of historic flood events (all repeating) and moderate properties at risk of future flooding. This area has not been identified within Defra's analysis. A closer review of the repeat historic flooding locations and mitigation of surface water runoff from potential development sites is recommended.

Development Sites

Housing	Historic		Future	Summary
HN-1	None		Low/None	
HN-2	None		Low/Intermediate	
HN-3	None		Low	
HN-4	None		None	
HN-5	(surface)	(highways)	Low/None	
HN-6	(surface)	(highways)	Low	

Notes: Brackets indicate proximity but not overlap

Recommendations

1. Further assessment of repeat flooding events, especially with reference to any potential development sites.
2. Review the impact of development upon surface runoff and options for mitigation (for example, SUDS)
3. Review location of Environment Agency surface water flood map extents in relation to the proposed development sites.

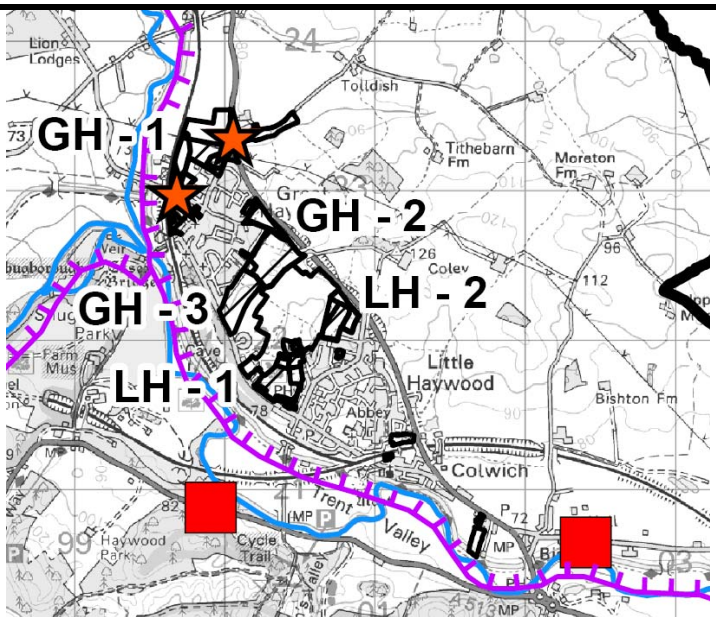
Key

Area should be investigated further as part of a Phase 2 SWMP or site specific study.

Area would benefit from being investigated further as part of a Phase 2 SWMP. Development should be reviewed with reference to the surface flood maps.

Based on current data no detailed further analyses required, although the topography of individual sites should be reviewed before development and all new development should utilise SUDS methods.

Stafford Borough - Haywood



Rivers
Canal
Potential Development Sites
Potential Housing and Employment Sites

Historic Flooding
Types of Flooding
- Surface Water
- Canal
- Artifical Drainag
- Highways
- Sewer
- Groundwater
- Unknown

Historic Flooding Recurrance
- Exceptional
- Rare
- Occasional
- Repeat

Historic Surface Water Flooding — 4 historic flooding events

Type	Occurrence	Comment
Surface	2 locations	Occasional occurrences - may repeat.
Highways	2 locations	Repeat occurrence - should be investigated further

Future Surface Water Flooding

232 properties at risk

Moderate number of properties located in surface water flood map 'less than' extent.

Overall

Moderate number of historic flood events, many of which repeat and moderate number of properties at risk of future flooding. Little Haywood and Colwich have been identified within Defra's analysis as having a rank of 2,021 and 40 properties at risk and Great Haywood having a rank of 1,875 and 50 properties at risk. A review of the historic flooding events and extent of the Environment Agency's surface water flood zones is recommended.

Development Sites

Housing	Historic	Future	Summary
GH-1	Surface	More	
GH-2	(surface)	None	
GH-3	(surface)	None	
LH-1	None	None	
LH-2	None	None	

Recommendations

1. Review historic flooding locations in relation to any potential development sites and investigate repeat events further.
2. Undertake site specific analysis of the sites highlighted in red or yellow above.
3. Review the impact of development upon surface runoff and options for mitigation (for example, SUDS)
4. Review location of Environment Agency surface water flood map extents in relation to the proposed development sites.

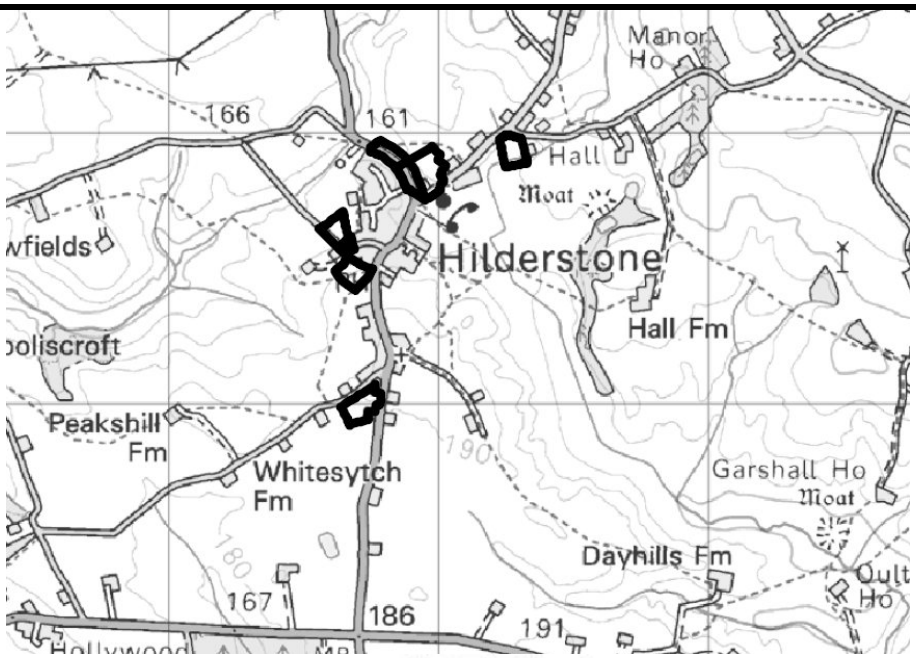
Key

Area should be investigated further as part of a Phase 2 SWMP or site specific study.

Area would benefit from being investigated further as part of a Phase 2 SWMP. Development should be reviewed with reference to the surface flood maps.

Based on current data no detailed further analyses required, although the topography of individual sites should be reviewed before development and all new development should utilise SUDS methods.

Stafford Borough - Hilderstone



Historic Surface Water Flooding — No historic flooding events (points)

Type	Occurrence	Comment
None		

Future Surface Water Flooding

10 properties at risk

Low number of properties located in surface water flood map 'less than' extent.

Overall

Low number of historic flood events and properties at risk of future flooding. This area has not been identified within Defra's analysis. A review of method to mitigate surface water runoff from potential development sites is recommended.

Development Sites

No Key Sites

Notes: Brackets indicate proximity but not overlap

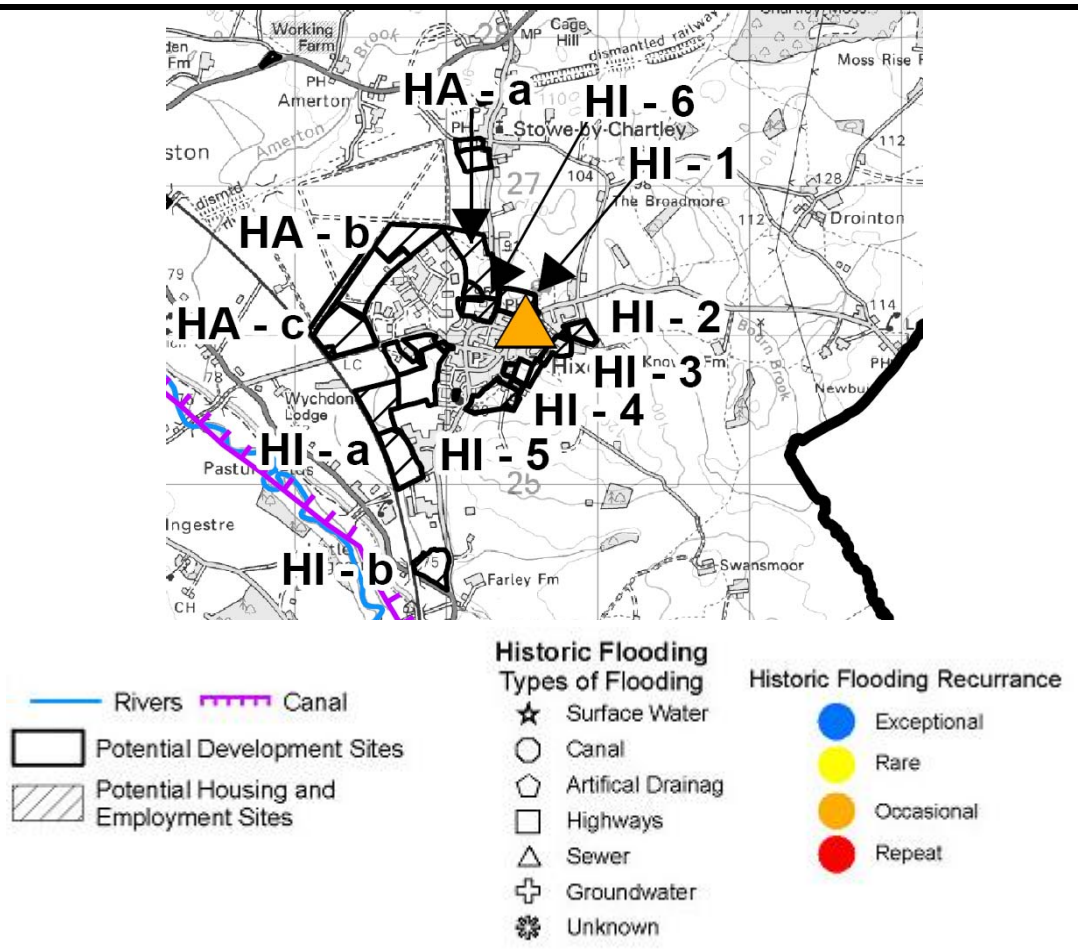
Recommendations

1. Review the impact of development upon surface runoff and options for mitigation (for example, SUDS)
2. Review location of Environment Agency surface water flood map extents in relation to the proposed development sites.

Key

	Area should be investigated further as part of a Phase 2 SWMP or site specific study.
	Area would benefit from being investigated further as part of a Phase 2 SWMP. Development should be reviewed with reference to the surface flood maps.
	Based on current data no detailed further analyses required, although the topography of individual sites should be reviewed before development and all new development should utilise SUDS methods.

Stafford Borough - Hixon and Stowe



Historic Surface Water Flooding — 1 historic flooding event

Type	Occurrence	Comment
Sewer	1 location	Occasional occurrence - may repeat

Future Surface Water Flooding

183 properties at risk

Moderate number of properties located in surface water flood map 'less than' extent.

Overall

Low number of historic flood events but moderate number of properties at risk of future flooding. Hixon has been identified within Defra's analysis as having a rank of 2,251 and 30 properties at risk of flooding. It is recommended that all potential development sites are reviewed with reference to the location and cause of the historic flooding event and the Environment Agency's surface water flood zone extents.

Development Sites

Housing	Historic	Future	Summary
HI-1	Sewer	Intermediate	
HI-2	(sewer)	None	
HI-3	Sewer	Intermediate	
HI-4	(sewer)	None	
HI-5	(sewer)	Low/Intermediate	
HI-6	(sewer)	Low	

Employment			Summary
HA-a	(sewer)	Low	
HA-b	(sewer)	Low/None	
HA-c	(sewer)	More	
HI-a	(sewer)	More	
HI-b	(sewer)	Intermediate/More	

Notes: Brackets indicate proximity but not overlap

Recommendations

1. Further assessment of flooding event and site specific analysis.
2. Review the impact of development upon surface runoff and options for mitigation (for example, SUDS)
3. Review location of Environment Agency surface water flood map extents in relation to the proposed development sites.

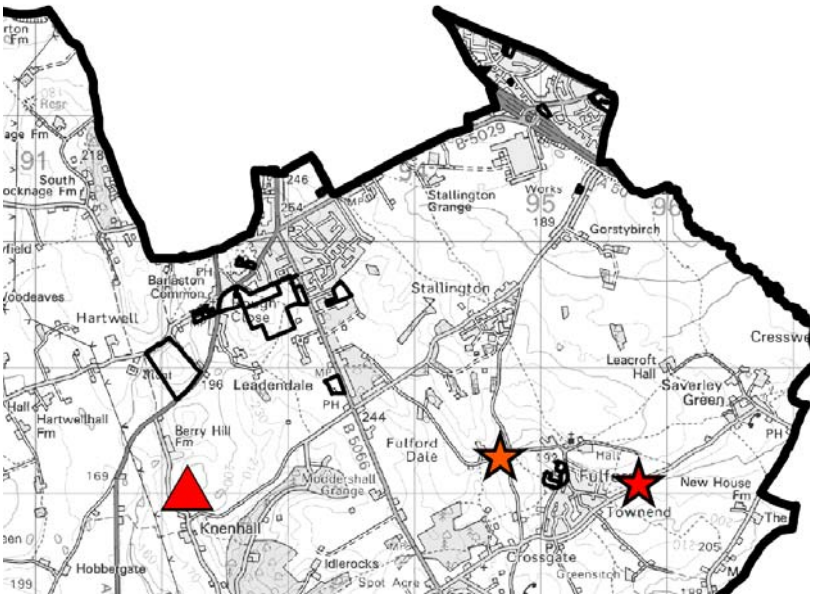
Key

Area should be investigated further as part of a Phase 2 SWMP or site specific study.

Area would benefit from being investigated further as part of a Phase 2 SWMP. Development should be reviewed with reference to the surface flood maps.

Based on current data no detailed further analyses required, although the topography of individual sites should be reviewed before development and all new development should utilise SUDS methods.

Stafford Borough - Leadendale, Blythe Bridge and Fulford



Historic Surface Water Flooding 3 historic flooding events

Type	Occurrence	Comment
Surface	2 locations	Occasional occurrence - may repeat. Repeat occurrence - should be investigated further
Sewer	1 location	Repeat occurrence - should be investigated further

Future Surface Water Flooding

85 properties at risk

Low/Moderate number of properties located in surface water flood map 'less than' extent.

Overall

A few number of historic flood events, many of which repeat and low/moderate number of properties at risk of future flooding. Fulford has been identified within Defra's analysis as having a rank of 2,891 and 10 properties at risk of flooding. It is recommended that all potential development sites are reviewed with reference to the location and cause of the historic flooding events and the Environment Agency's surface water flood zone extents.

Development Sites

No Key Sites

Recommendations

1. Further assessment of flooding event and site specific analysis where properties are affected.
2. Review the impact of development upon surface runoff and options for mitigation (for example, SUDS)
3. Review location of Environment Agency surface water flood map extents in relation to the proposed development sites.

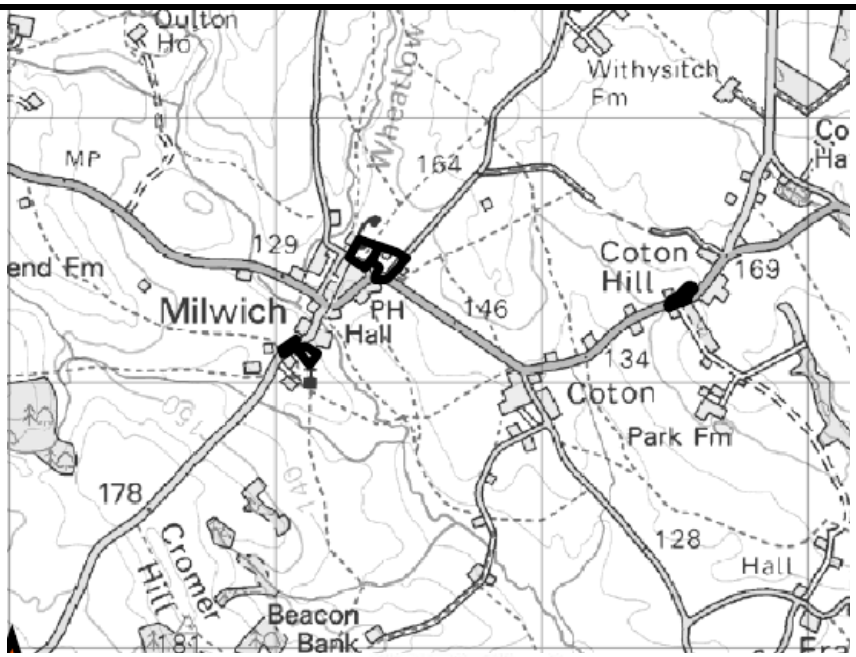
Key

Area should be investigated further as part of a Phase 2 SWMP or site specific study.

Area would benefit from being investigated further as part of a Phase 2 SWMP. Development should be reviewed with reference to the surface flood maps.

Based on current data no detailed further analyses required, although the topography of individual sites should be reviewed before development and all new development should utilise SUDS methods.

Stafford Borough - Milwich



Rivers
Canal
Potential Development Sites
Potential Housing and Employment Sites

Historic Flooding
Types of Flooding
- Surface Water
- Canal
- Artifical Drainag
- Highways
- Sewer
- Groundwater
- Unknown

Historic Flooding Recurrance
- Exceptional
- Rare
- Occasional
- Repeat

Historic Surface Water Flooding

No historic flooding events (points)

Type	Occurrence	Comment
Sewer	1-5 locations within postcode area	Few occurrences in a large postcode area - this area is unlikely to be affected.
	10+ locations within postcode area (northwest)	High number of occurrences but postcode area fairly large - this area may not be affected

Future Surface Water Flooding

41 properties at risk

Low number of properties located in surface water flood map 'less than' extent.

Overall

No historic flood events an low number of properties at risk of future flooding. Milwich has not been identified within Defra's analysis. It is recommended that all potential development sites are reviewed with reference to the Environment Agency's surface water flood zone extents and potential methods to mitigate surface runoff.

Development Sites

No Key Sites

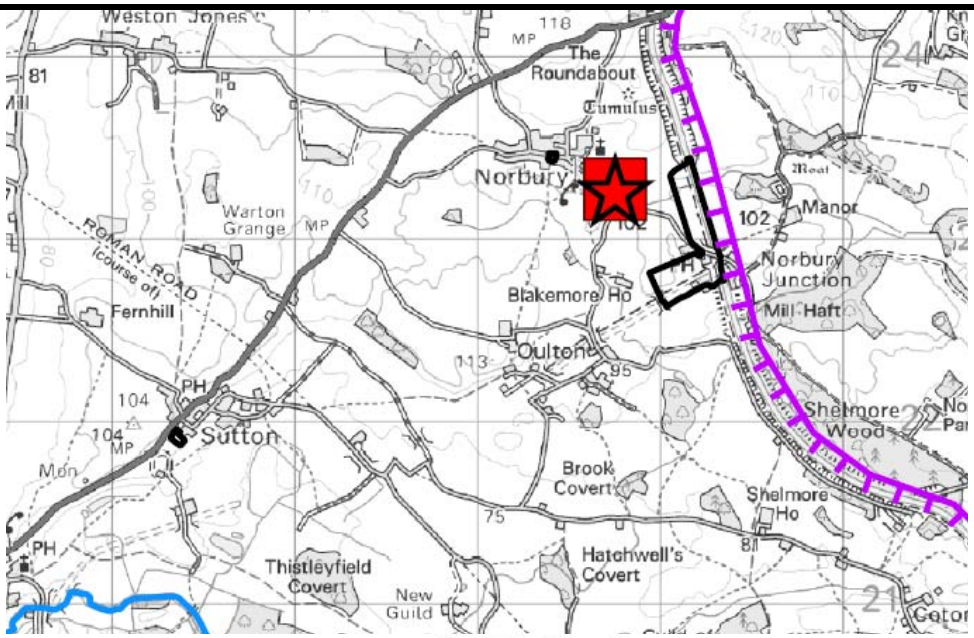
Recommendations

1. Further assessment of flooding event and site specific analysis.
2. Review the impact of development upon surface runoff and options for mitigation (for example, SUDS)
3. Review location of Environment Agency surface water flood map extents in relation to the proposed development sites.

Key

	Area should be investigated further as part of a Phase 2 SWMP or site specific study.
	Area would benefit from being investigated further as part of a Phase 2 SWMP. Development should be reviewed with reference to the surface flood maps.
	Based on current data no detailed further analyses required, although the topography of individual sites should be reviewed before development and all new development should utilise SUDS methods.

Stafford Borough - Norbury and Sutton



Historic Surface Water Flooding — 2 historic flooding events

Type	Occurrence	Comment
Surface	1 location	Repeat occurrence - should be investigated further
Highways	1 location	Repeat occurrence - should be investigated further

Future Surface Water Flooding

45 properties at risk

Low number of properties located in surface water flood map 'less than' extent.

Overall

Low number of historic flood events and low number of properties at risk of future flooding. This are has not been identified within Defra's analysis. It is recommended that all potential development sites are reviewed with reference to the Environment Agency's surface water flood zone extents and potential methods to mitigate surface runoff.

Development Sites

No Key Sites

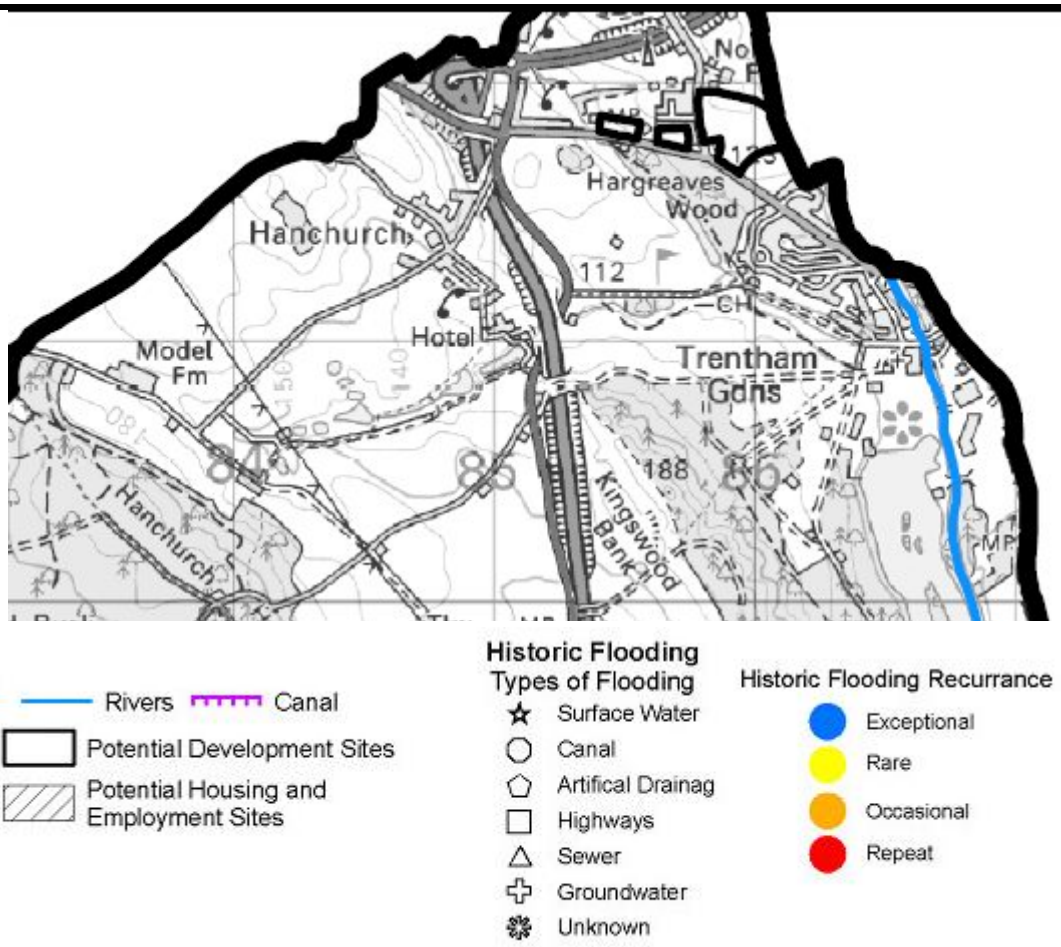
Recommendations

1. Review the impact of development upon surface runoff and options for mitigation (for example, SUDS)
2. Review location of Environment Agency surface water flood map extents in relation to the proposed development sites.

Key

	Area should be investigated further as part of a Phase 2 SWMP or site specific study.
	Area would benefit from being investigated further as part of a Phase 2 SWMP. Development should be reviewed with reference to the surface flood maps.
	Based on current data no detailed further analyses required, although the topography of individual sites should be reviewed before development and all new development should utilise SUDS methods.

Stafford Borough - Northwood



Historic Surface Water Flooding — No historic flooding events (points)

Type	Occurrence	Comment
None		

Future Surface Water Flooding

7 properties at risk

Very low number of properties located in surface water flood map 'less than' extent.

Overall

No historic flood events and very low number of properties at risk of future flooding. This area has not been identified within Defra's analysis. It is recommended that all potential development sites are reviewed with reference to the location and cause of the historic flooding event and the Environment Agency's surface water flood zone extents. Due to its location on the edge of the study area, this area may be affected by events beyond the boundaries.

Development Sites

No Key Sites

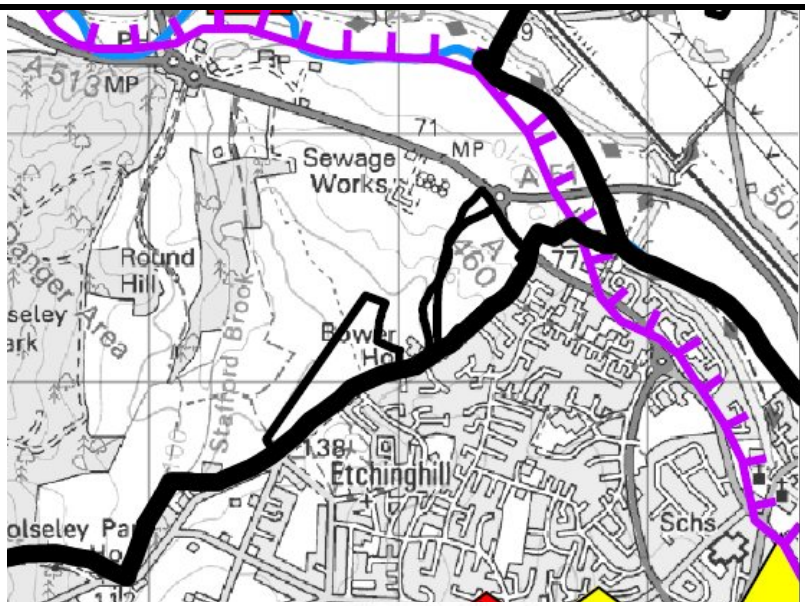
Recommendations

1. Review the impact of development upon surface runoff and options for mitigation (for example, SUDS)
2. Review location of Environment Agency surface water flood map extents in relation to the proposed development sites.

Key

	Area should be investigated further as part of a Phase 2 SWMP or site specific study.
	Area would benefit from being investigated further as part of a Phase 2 SWMP. Development should be reviewed with reference to the surface flood maps.
	Based on current data no detailed further analyses required, although the topography of individual sites should be reviewed before development and all new development should utilise SUDS methods.

Stafford Borough - North of Cannock



Historic Surface Water Flooding — No historic flooding events (points)

Type	Occurrence	Comment
None		

Future Surface Water Flooding

563 properties at risk

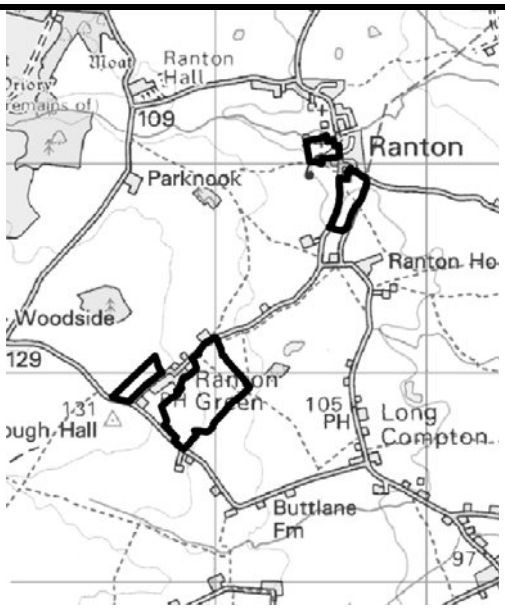
Moderate/High number of properties located in surface water flood map 'less than' extent.

Overall

No historic flood events but moderate/high number of properties at risk of future flooding. This area has not been individually identified within Defra's analysis. It is recommended that all potential development sites are reviewed with reference to the Environment Agency's surface water flood zone extents and methods to mitigate surface water runoff. The high number of properties at risk results from the density of development beyond the Borough boundaries.

Development Sites	
No Key Sites	
Recommendations	
1.	Review the impact of development upon surface runoff and options for mitigation (for example, SUDS)
2.	Review location of Environment Agency surface water flood map extents in relation to the proposed development sites.
Key	
	Area should be investigated further as part of a Phase 2 SWMP or site specific study.
	Area would benefit from being investigated further as part of a Phase 2 SWMP. Development should be reviewed with reference to the surface flood maps.
	Based on current data no detailed further analyses required, although the topography of individual sites should be reviewed before development and all new development should utilise SUDS methods.

Stafford Borough - Ranton



Rivers
Canal
Potential Development Sites
Potential Housing and Employment Sites

Historic Flooding

Types of Flooding
- Surface Water
- Canal
- Artifical Drainag
- Highways
- Sewer
- Groundwater
- Unknown

Historic Flooding Recurrance
- Exceptional
- Rare
- Occasional
- Repeat

Historic Surface Water Flooding

No historic flooding events (points)

Type	Occurrence	Comment
None		

Future Surface Water Flooding

54 properties at risk

Low/Moderate number of properties located in surface water flood map 'less than' extent.

Overall

No historic flood events but low/moderate number of properties at risk of future flooding. This area has been identified within Defra's analysis. It is recommended that all potential development sites are reviewed with reference to the Environment Agency's surface water flood zone extents and methods to mitigate surface water runoff.

Development Sites

No Key Sites

Recommendations

1. Review the impact of development upon surface runoff and options for mitigation (for example, SUDS)
2. Review location of Environment Agency surface water flood map extents in relation to the proposed development sites.

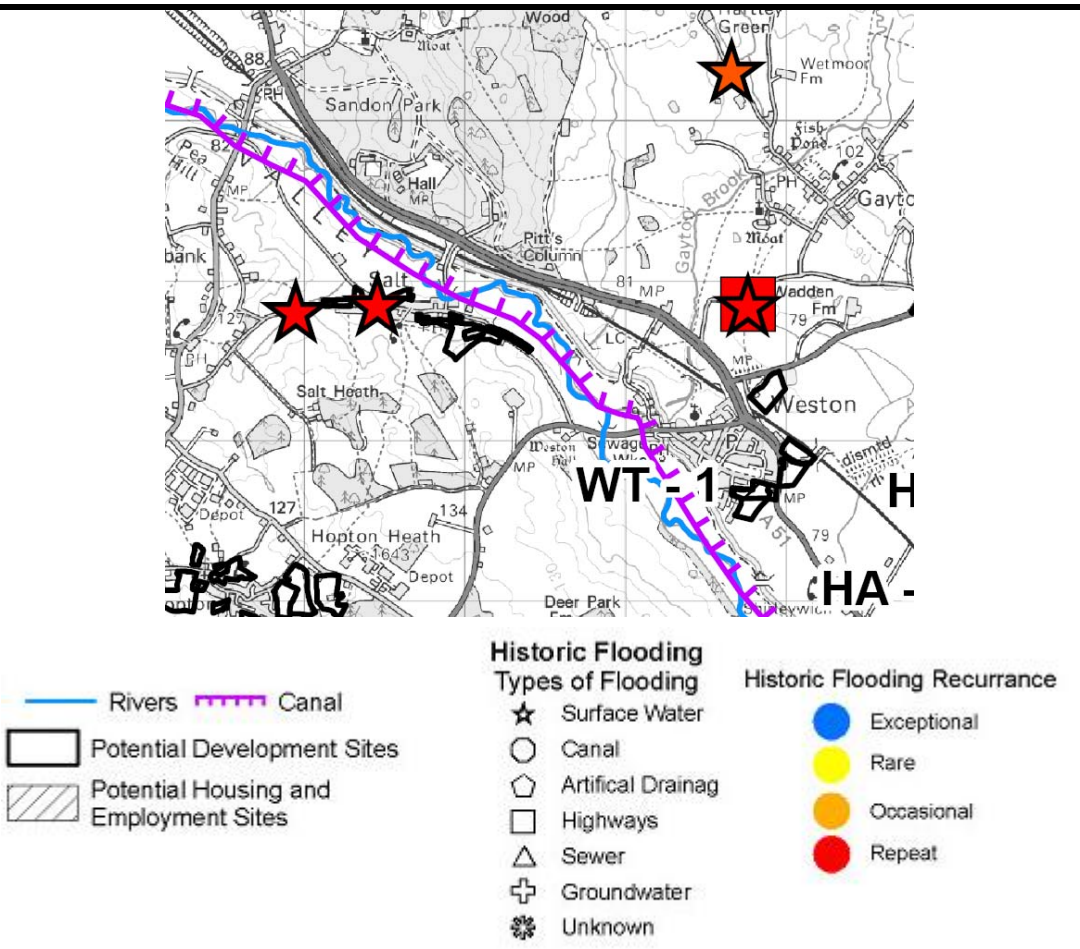
Key

Area should be investigated further as part of a Phase 2 SWMP or site specific study.

Area would benefit from being investigated further as part of a Phase 2 SWMP. Development should be reviewed with reference to the surface flood maps.

Based on current data no detailed further analyses required, although the topography of individual sites should be reviewed before development and all new development should utilise SUDS methods.

Stafford Borough - Salt and Weston



Historic Surface Water Flooding — 5+ historic flooding event

Type	Occurrence	Comment
Surface	4 locations	1 Occasional occurrence - may repeat 3 Repeat occurrences - should be investigated further
Highways	1 location	Repeat occurrence - should be investigated further

Future Surface Water Flooding

125 properties at risk

Moderate number of properties located in surface water flood map 'less than' extent.

Overall

High number of historic flood events and moderate number of properties at risk of future flooding. Weston has been identified within Defra's analysis as having a rank of 2,287 and 30 properties at risk of flooding. It is recommended that all potential development sites are reviewed with reference to the location and cause of the historic flooding events and the Environment Agency's surface water flood zone extents.

Development Sites

Housing	Historic		Future	Summary
WT-1	(surface)	(highways)	Low	

Notes: Brackets indicate proximity but not overlap

Recommendations

1. Review historic flooding locations in relation to any potential development sites and investigate repeat events further.
2. Review the impact of development upon surface runoff and options for mitigation (for example, SUDS)
3. Review location of Environment Agency surface water flood map extents in relation to the proposed development sites.
4. Further analysis as part site specific investigations

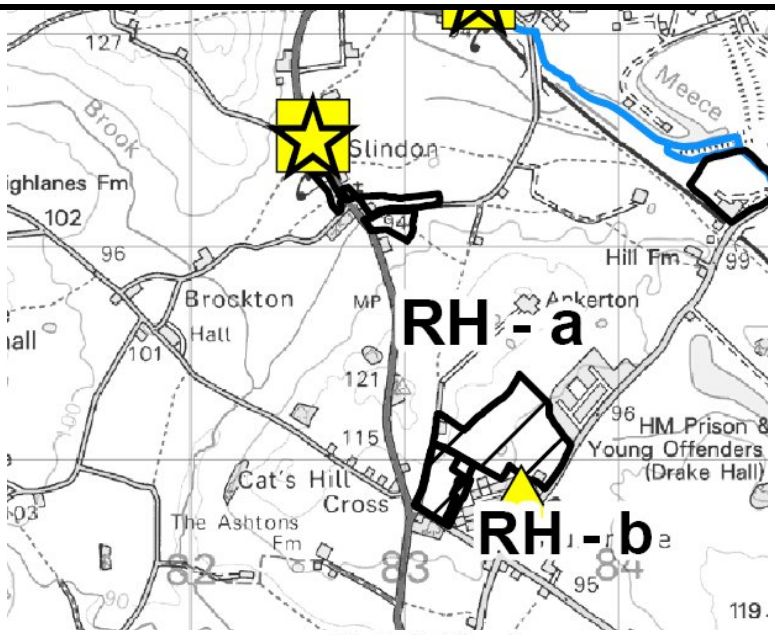
Key

Area should be investigated further as part of a Phase 2 SWMP or site specific study.

Area would benefit from being investigated further as part of a Phase 2 SWMP. Development should be reviewed with reference to the surface flood maps.

Based on current data no detailed further analyses required, although the topography of individual sites should be reviewed before development and all new development should utilise SUDS methods.

Stafford Borough - Slindon and Sturbridge



Historic Surface Water Flooding — 3 historic flooding events

Type	Occurrence	Comment
Surface	1 location	Rare occurrence - may only occur during extreme events
Highways	1 location	Rare occurrence - may only occur during extreme events
Sewer	1 location	Rare occurrence - may only occur during extreme events

Future Surface Water Flooding

21 properties at risk

Low number of properties located in surface water flood map 'less than' extent.

Overall

A few historic flood events and low number of properties at risk of future flooding. This area has not been identified within Defra's analysis. It is recommended that all potential development sites are reviewed with reference to the location and cause of the historic flooding events and the Environment Agency's surface water flood zone extents.

Development Sites

Employment	Historic	Future	Summary
RH-a	Sewer	Low	
RH-b	(sewer)	None	

Notes: Brackets indicate proximity but not overlap

Recommendations

1. Further assessment of flooding events and site specific analysis.
2. Review the impact of development upon surface runoff and options for mitigation (for example, SUDS)
3. Review location of Environment Agency surface water flood map extents in relation to the proposed development sites.

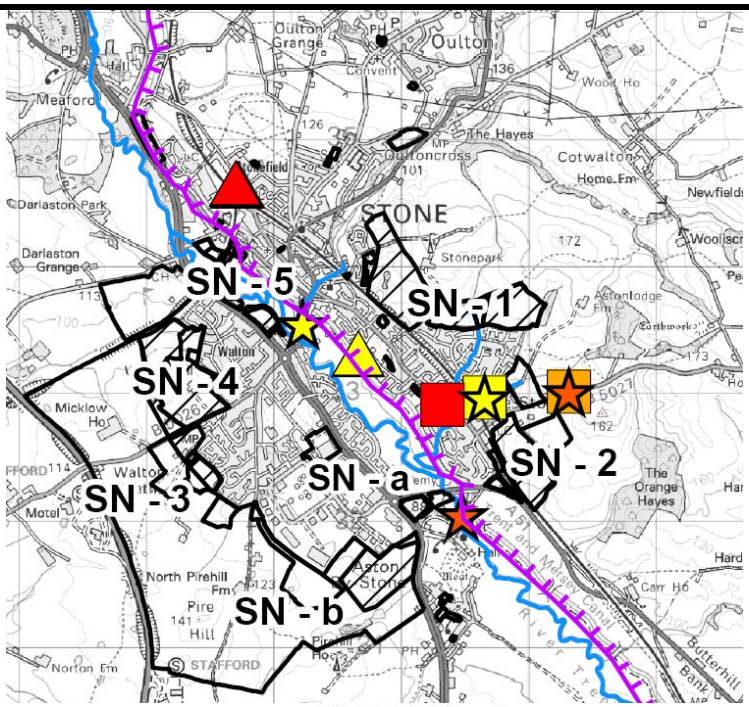
Key

Area should be investigated further as part of a Phase 2 SWMP or site specific study.

Area would benefit from being investigated further as part of a Phase 2 SWMP. Development should be reviewed with reference to the surface flood maps.

Based on current data no detailed further analyses required, although the topography of individual sites should be reviewed before development and all new development should utilise SUDS methods.

Stafford Borough - Stone



Rivers
Canal
Potential Development Sites
Potential Housing and Employment Sites

Historic Flooding
Types of Flooding
- Surface Water
- Canal
- Artifical Drainag
- Highways
- Sewer
- Groundwater
- Unknown

Historic Flooding Recurrance
- Exceptional
- Rare
- Occasional
- Repeat

Historic Surface Water Flooding — 5+ historic flooding events

Type	Occurrence	Comment
Surface	4 locations	2 Rare occurrences - may only occur during extreme events 2 Occasional occurrences - may repeat.
Highways	3 locations	Rare occurrence - may only occur during extreme events Occasional occurrence - may repeat. Repeat occurrence - should be investigated further
Sewer	2 locations	1 Rare occurrence - may only occur during extreme events 1 Repeat occurrence - should be investigated further

Future Surface Water Flooding

1,316 properties at risk

High number of properties located in surface water flood map 'less than' extent.

Overall

High number of historic flood events and high number of properties at risk of future flooding. Stone has been identified within Defra's analysis as having a rank of 606 and 440 properties at risk of flooding. It is recommended that all potential development sites are reviewed with reference to the location and cause of the historic flooding event and the Environment Agency's surface water flood zone extents. Further modelling may be beneficial.

Development Sites

Housing	Historic			Future	Summary
SN-1	(sewer)	(highways)	(surface)	Low	
SN-2	Highways	Surface		Low	
SN-3	None			Low	
SN-4	(surface)			Intermediate/More	
SN-5	Surface	(sewer)		Low	

Employment			Summary
SN-a	Surface	None	
SN-b	(surface)	Low/Intermediate	

Notes: Brackets indicate proximity but not overlap

Recommendations

1. Review historic flooding locations in relation to any potential development sites and investigate repeat events further.
2. Review the impact of development upon surface runoff and options for mitigation (for example, SUDS)
3. Review location of Environment Agency surface water flood map extents in relation to the proposed development sites.
4. Further analysis as part of a future Phase 2 SWMP or site specific investigations

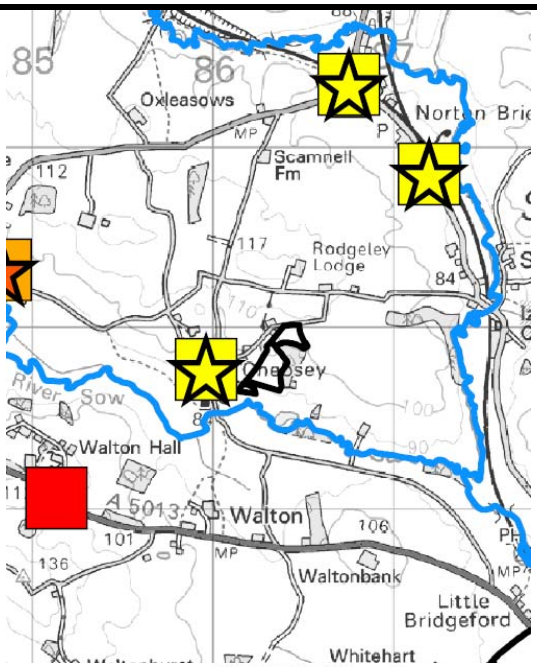
Key

Area should be investigated further as part of a Phase 2 SWMP or site specific study.

Area would benefit from being investigated further as part of a Phase 2 SWMP. Development should be reviewed with reference to the surface flood maps.

Based on current data no detailed further analyses required, although the topography of individual sites should be reviewed before development and all new development should utilise SUDS methods.

Stafford Borough - Walton and Norton Bridge



Rivers
Canal
Potential Development Sites
Potential Housing and Employment Sites

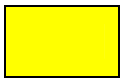
Historic Flooding
Types of Flooding
- Surface Water
- Canal
- Artifical Drainag
- Highways
- Sewer
- Groundwater
- Unknown

Historic Flooding Recurrance
- Exceptional
- Rare
- Occasional
- Repeat

Historic Surface Water Flooding — 5+ historic flooding event

Type	Occurrence	Comment
Surface	4 locations	3 Rare occurrence - may only occur during extreme events 1 Repeat occurrence - should be investigated further
Highways	5 locations	3 Rare occurrence - may only occur during extreme events 1 Occasional occurrence - may repeat. 1 Repeat occurrence - should be investigated further

Future Surface Water Flooding



64 properties at risk

Low/Moderate number of properties located in surface water flood map 'less than' extent.

Overall

High number of historic flood events but low/moderate number of properties at risk of future flooding. This area has not been identified within Defra's analysis. It is recommended that all potential development sites are reviewed with reference to the location and cause of the historic flooding event and the Environment Agency's surface water flood zone extents.

Development Sites

No Key Sites

Recommendations

1. Further assessment of flooding events and site specific analysis.
2. Review the impact of development upon surface runoff and options for mitigation (for example, SUDS)
3. Review location of Environment Agency surface water flood map extents in relation to the proposed development sites.

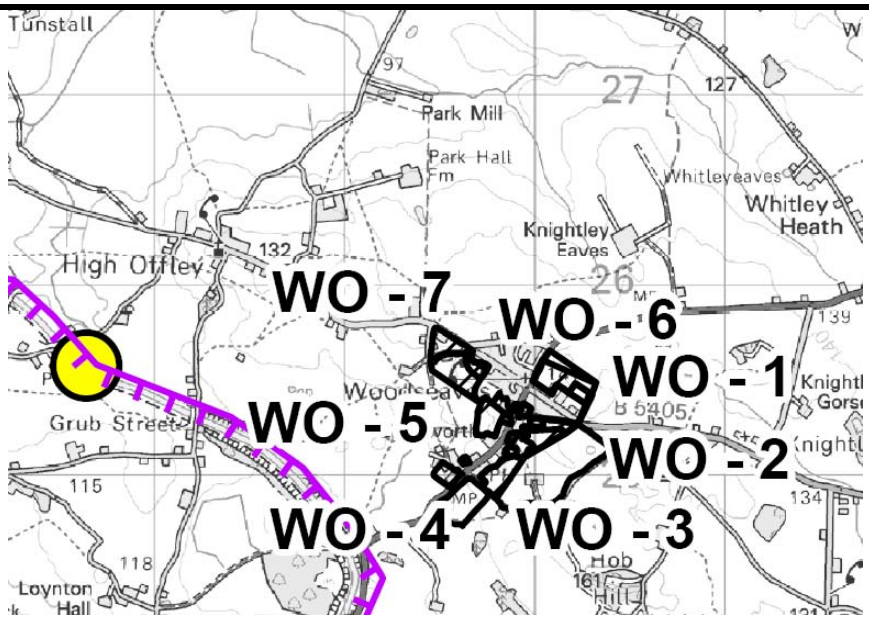
Key

Area should be investigated further as part of a Phase 2 SWMP or site specific study.

Area would benefit from being investigated further as part of a Phase 2 SWMP. Development should be reviewed with reference to the surface flood maps.

Based on current data no detailed further analyses required, although the topography of individual sites should be reviewed before development and all new development should utilise SUDS methods.

Stafford Borough - Woodseaves



Rivers
Canal
Potential Development Sites
Potential Housing and Employment Sites

Historic Flooding
Types of Flooding
- Surface Water
- Canal
- Artifical Drainag
- Highways
- Sewer
- Groundwater
- Unknown

Historic Flooding Recurrance
- Exceptional
- Rare
- Occasional
- Repeat

Historic Surface Water Flooding — 1 rare historic flooding event (points)

Type	Occurrence	Comment
Canal	1 location	Rare occurrence - may only occur during extreme events

Future Surface Water Flooding

23 properties at risk

Low number of properties located in surface water flood map 'less than' extent.

Overall

Almost no historic flood events and low number of properties at risk of future flooding. This area has been identified within Defra's analysis as having a rank of 2,251 and 30 properties at risk of flooding. It is recommended that all potential development sites are reviewed with reference to the Environment Agency's surface water flood zone extents and methods to mitigate surface water runoff.

Development Sites

Housing	Historic	Future	Summary
WO-1	None	Low/Intermediate	
WO-2	None	Low/Intermediate	
WO-3	None	More	
WO-4	None	None	
WO-5	None	None	
WO-6	None	Low/Intermediate	
WO-7	None	Low/Intermediate	

Notes: Brackets indicate proximity but not overlap

Recommendations

1. Review the impact of development upon surface runoff and options for mitigation (for example, SUDS)
2. Review location of Environment Agency surface water flood map extents in relation to the proposed development sites.

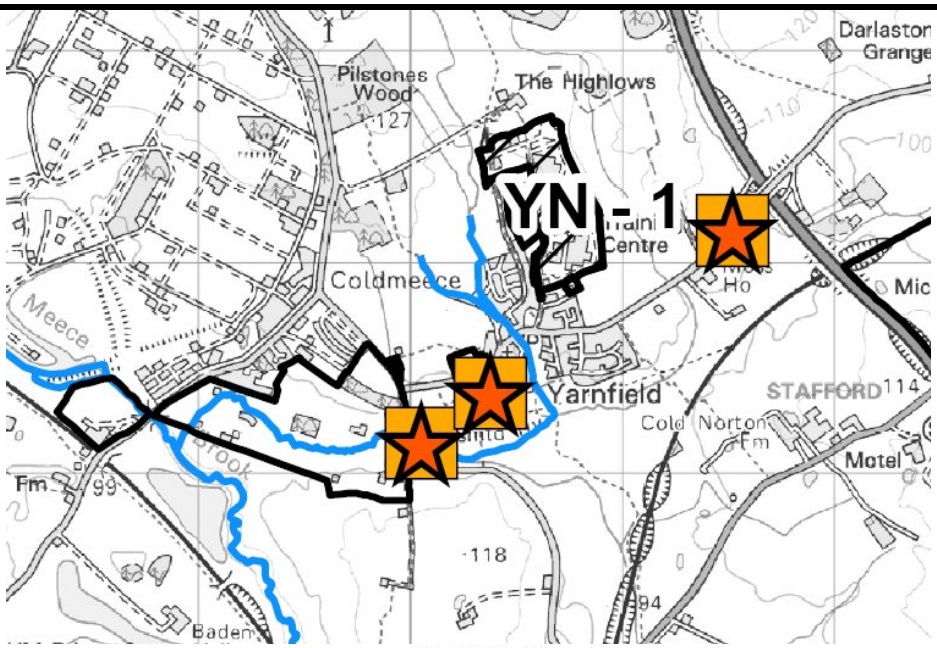
Key

Area should be investigated further as part of a Phase 2 SWMP or site specific study.

Area would benefit from being investigated further as part of a Phase 2 SWMP. Development should be reviewed with reference to the surface flood maps.

Based on current data no detailed further analyses required, although the topography of individual sites should be reviewed before development and all new development should utilise SUDS methods.

Stafford Borough - Yarnfield



Rivers Canal
Potential Development Sites
Potential Housing and Employment Sites

Historic Flooding
Types of Flooding
- Surface Water
- Canal
- Artifical Drainag
- Highways
- Sewer
- Groundwater
- Unknown

Historic Flooding Recurrance
- Exceptional
- Rare
- Occasional
- Repeat

Historic Surface Water Flooding — 5+ historic flooding events

Type	Occurrence	Comment
Surface	3 locations	Repeat occurrences - should be investigated further
Highways	3 locations	Occasional occurrences - may repeat

Future Surface Water Flooding

173 properties at risk

Moderate number of properties located in surface water flood map 'less than' extent.

Overall

High number of historic flood events, many of which repeat but moderate number of properties at risk of future flooding. Yarnfield has been identified within Defra's analysis as having a rank of 1,906 and 50 properties at risk of flooding. It is recommended that all potential development sites are reviewed with reference to the location and cause of the historic flooding events and the Environment Agency's surface water flood zone extents.

Development Sites

Housing	Historic		Future	Summary
YN-1	(surface)	(highways)	Low/Intermediate	

Notes: Brackets indicate proximity but not overlap

Recommendations

1. Further assessment of flooding events and potentially site specific analysis.
2. Review the impact of development upon surface runoff and options for mitigation (for example, SUDS)
3. Review location of Environment Agency surface water flood map extents in relation to the proposed development sites.

Key

	Area should be investigated further as part of a Phase 2 SWMP or site specific study.
	Area would benefit from being investigated further as part of a Phase 2 SWMP. Development should be reviewed with reference to the surface flood maps.
	Based on current data no detailed further analyses required, although the topography of individual sites should be reviewed before development and all new development should utilise SUDS methods.

A COMPANY OF

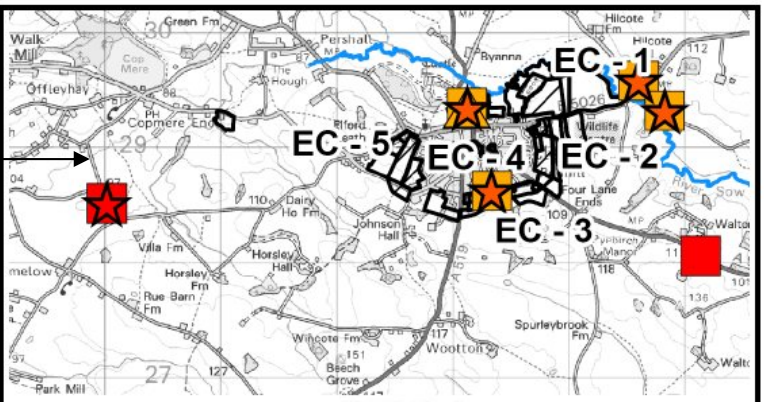
ROYAL HASKONING

Appendix E
Lichfield District Summary Sheets

Summary Sheet Explanation

ROYAL HASKONING

Snapshot of key settlement, taken from **Figures B1 - B5**.



Map key, taken from **Figures B1 - B5**.

Rivers
Canal
Potential Development Sites
Potential Housing and Employment Sites

Historic Flooding Types of Flooding
- Surface Water
- Canal
- Artifical Drainag
- Highways
- Sewer
- Groundwater
- Unknown

Historic Flooding Recurrance
- Exceptional
- Rare
- Occasional
- Repeat

Number of historic flooding occurrences marked as points on the map snapshot shown above. Colour code is explained in **Table 3.7**

Historic Flooding section details the occurrences of historic flooding shown within and around the settlement in question.

Historic Surface Water Flooding — 5+ historic flooding events

Type	Occurrence	Comment
Surface	5 locations	Repeat occurrences - should be investigated further
Highways	6 locations	4 Occasional occurrences - may repeat. 2 Repeat occurrences - should be investigated further

Further explanation of all historic flooding events within and around the key settlement.

Future Flooding section outlines the results from the conversion of the Environment Agency's surface water flood map into a flagged system (see Section 3.1.2 for more detail)

Future Surface Water Flooding

222 properties at risk

Moderate number of properties located in surface water flood map 'less than' extent.

Box colour is explained in **Table 3.8**. Flag colour is explained in **Table 3.5** Number of properties taken from comparison of EA surface water flood map and NPD (RH analysis)

Overall Flooding section summarises the combined results for the settlement, accounting for both historic and future flooding.

Overall

Large number of historic flood events, many of which repeat and moderate number of properties at risk of future flooding. Eccleshall has been identified within Defra's analysis with a rank of 2,471and 20 properties at risk. A closer review of the historic flooding locations is recommended. This area would benefit from further investigation as part of a future Phase 2 SWMP or site specific assessments.

Box colour is explained in **Table 3.9** Text summarises the conclusions shown above, plus the results of Defra's analysis for the settlement.

Summary of key **development sites** shown within the settlement.

Development Sites

Housing	Historic		Future	Summary
EC-1	(surface)	(highways)	None	
EC-2	Surface	Highways	Low/Intermediate	
EC-3	Surface	Highways	None	
EC-4	(surface)	(highways)	Low	
EC-5	(surface)	(highways)	None	

Notes: Brackets indicate proximity but not overlap

Summary box colour is explained in **Table 3.9** as a combination of Historic and Future

Future box colour refers to the EA surface water flood map extent in which the development site is either wholly or partially located:
Green - overlap with 'Less' flood extent or no overlap
Yellow - overlap with 'Intermediate' flood extent.
Red - overlap with 'more' flood extent.

Historic box colour explained in **Table 3.7**

Recommendations are provided for the settlement as a whole.

Recommendations

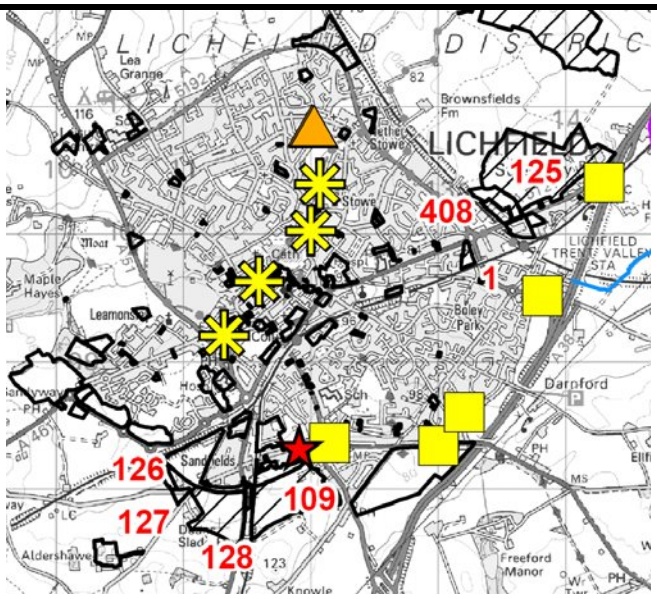
1. Review historic flooding locations in relation to any potential development sites and further investigation of repeat flooding.
2. Review the impact of development upon surface runoff and options for mitigation (for example, SUDS)
3. Review location of Environment Agency surface water flood map extents in relation to the proposed development sites.
4. Further assessment as part of a Phase 2 SWMP or site specific assessment.

Key

- Area should be investigated further as part of a Phase 2 SWMP or site specific study.
- Area would benefit from being investigated further as part of a Phase 2 SWMP. Development should be reviewed with reference to the surface flood maps.
- Based on current data no detailed further analyses required, although the topography of individual sites should be reviewed before development and all new development should utilise SUDS methods.

Key refers to the implications of each of the box colours.

Lichfield District - Lichfield



Historic Surface Water Flooding

5+ historic flooding events - area should be investigated further

Type	Occurrence	Comment
Surface Water	1 location (south)	Repeat occurrence - requires further investigation
Sewer	2 locations (north)	Few occurrences this area is unlikely to be affected.
Highways	5 locations (east)	Rare - may only occur in extreme circumstances
Unknown	4 locations (central)	Rare - may only occur in extreme circumstances

Future Surface Water Flooding

2,096 properties at risk

High number of properties located in surface water flood map 'less than' extent.

Overall

Numerous historic events and high number of properties at risk of future flooding. Lichfield has been identified within Defra's analysis with a rank of 329 and 1000 properties at risk. More detailed analysis of surface water flooding is required in addition to potential mitigation.

Development Sites

Housing/ Employment	Historic		Future	Summary
125	Highways		Intermediate	
408	None		Intermediate	
1	(Highways)		More	
109	Surface	Highways	Intermediate	
128	(Surface)		Intermediate	
127	None		Intermediate	
126	None		Intermediate	

Notes: Brackets indicate proximity but not overlap

Recommendations

1. Investigate causes of historic surface water flood events
2. Model Lichfield as part of Phase 2 SWMP
3. Review any potential development sites on individual basis before progression
4. Review the impact of development upon surface runoff and options for mitigation (for example, SUDS)

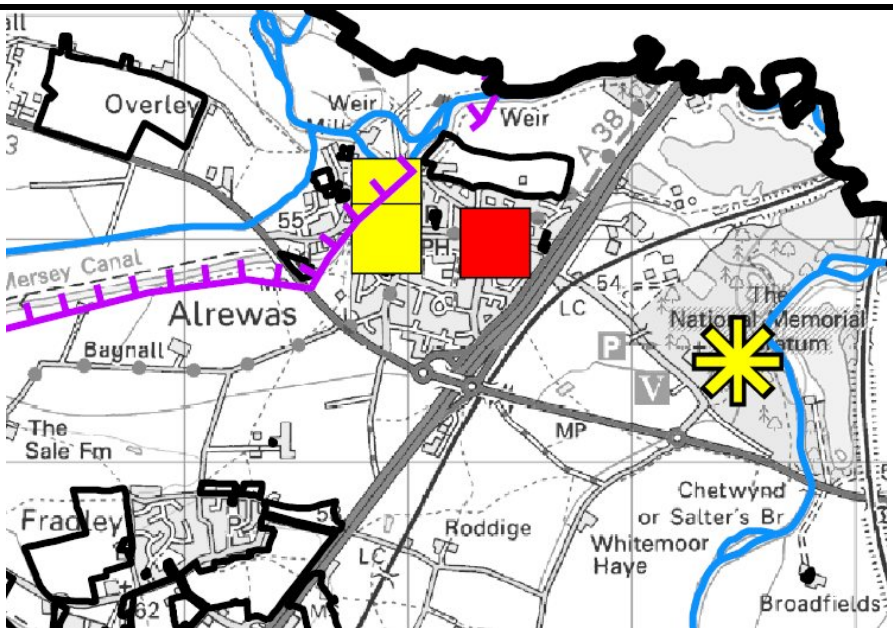
Key

Area should be investigated further as part of a Phase 2 SWMP or site specific study.

Area would benefit from being investigated further as part of a Phase 2 SWMP. Development should be reviewed with reference to the surface flood maps.

Based on current data no detailed further analyses required, although the topography of individual sites should be reviewed before development and all new development should utilise SUDS methods.

Lichfield District - Alrewas



Rivers
Canal
Potential Development Sites
Potential Housing and Employment Sites

Historic Flooding
Types of Flooding
- Surface Water
- Canal
- Artifical Drainag
- Highways
- Sewer
- Groundwater
- Unknown

Historic Flooding Recurrance
- Exceptional
- Rare
- Occasional
- Repeat

Historic Surface Water Flooding

4 historic flooding events - further investigation would be beneficial.

Type	Occurrence	Comment
Highways	3 locations (central)	2 Rare - may only occur in extreme events 1 Repeat occurrence - should be investigated further
Unknown	1 locations (east)	Rare occurrence - may only occur during extreme events

Future Surface Water Flooding

240 properties at risk

Moderate number of properties located in surface water flood map 'less than' extent.

Overall

Number of historic events and moderate number of properties at risk of future flooding. Lichfield has been identified within Defra's analysis with a rank of 2035 and 40 properties at risk. More detailed analysis of surface water flooding is required for individual development sites, especially in proximity to the repeat flooding event.

Development Sites

No key sites

Recommendations

1. Investigate causes of repeat historic surface water flood event
2. Review locations of sewer flooding in relation to development sites
3. Review any potential development sites on individual basis before progression
4. Review the impact of development upon surface runoff and options for mitigation (for example, SUDS)

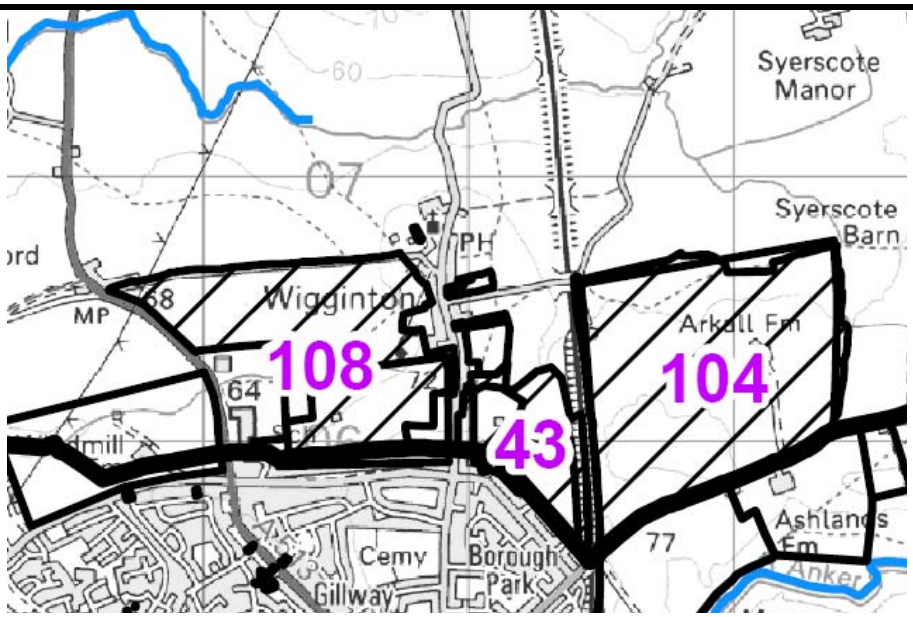
Key

Area should be investigated further as part of a Phase 2 SWMP or site specific study.

Area would benefit from being investigated further as part of a Phase 2 SWMP. Development should be reviewed with reference to the surface flood maps.

Based on current data no detailed further analyses required, although the topography of individual sites should be reviewed before development and all new development should utilise SUDS methods.

Lichfield District - Anker Valley



Rivers Canal
Potential Development Sites
Potential Housing and Employment Sites

Historic Flooding
Types of Flooding
- Surface Water
- Canal
- Artifical Drainag
- Highways
- Sewer
- Groundwater
- Unknown

Historic Flooding Recurrance
- Exceptional
- Rare
- Occasional
- Repeat

Historic Surface Water Flooding — No Historic Flood Events (points)

Type	Occurrence	Comment
None		

Future Surface Water Flooding

9 properties at risk

Very low number of properties located in surface water flood map 'less than' extent.

Overall

No historic events and very low number of properties at risk of future flooding. This area has not been identified within Defra's analysis. Site specific investigation is still recommended, especially with regards to surface run off from the development.

Development Sites

Additional Alternative	Historic	Future	Summary
108	None	More	
104	None	Less	
43	None	Intermediate	

Notes: Brackets indicate proximity but not overlap

Recommendations

1. Review location of Environment Agency surface water flood map extents in relation to the proposed development sites.
2. Review any potential development sites individually with regards to surface water runoff, including adoption of SUDS.

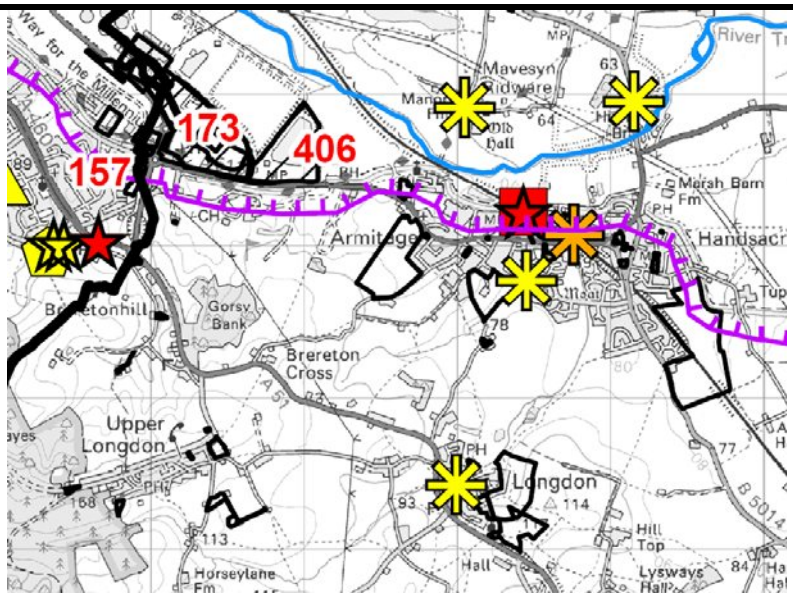
Key

Area should be investigated further as part of a Phase 2 SWMP or site specific study.

Area would benefit from being investigated further as part of a Phase 2 SWMP. Development should be reviewed with reference to the surface flood maps.

Based on current data no detailed further analyses required, although the topography of individual sites should be reviewed before development and all new development should utilise SUDS methods.

Lichfield District - Armitage and The Longdons



Historic Surface Water Flooding

5+ historic flooding events - area should be investigated further

Type	Occurrence	Comment
Surface Water	1 location (Armitage)	Repeat occurrence - should be investigated further
Highways	1 location (Armitage)	Repeat occurrence - should be investigated further
Unknown	5 locations (Armitage, Handsacre and Longdon)	Rare to Occasional - may only occur in extreme circumstances / irregularly

Future Surface Water Flooding

375 properties at risk

Moderate/high number of properties located in surface water flood map 'less than' extent.

Overall

Numerous historic events and moderate/high number of properties at risk of future flooding. Armitage has been identified within Defra's analysis with a rank of 982 and 200 properties at risk. More detailed analysis of surface water flooding is before development proceeds, either as site specific studies or through more detailed modelling.

Development Sites

Potential Development Sites	Historic	Future	Summary
157	None	More	
173	None	Intermediate/Less	
406	None	More	

Recommendations

1. Investigate causes of historic surface water flood events
2. Carry out site specific analysis, especially for sites close to historic flooding events.
3. Review any potential development sites on individual basis before progression
4. Review location of Environment Agency surface water flood map extents in relation to the proposed development sites.
5. Further analysis as part of a future Phase 2 SWMP or site specific investigations

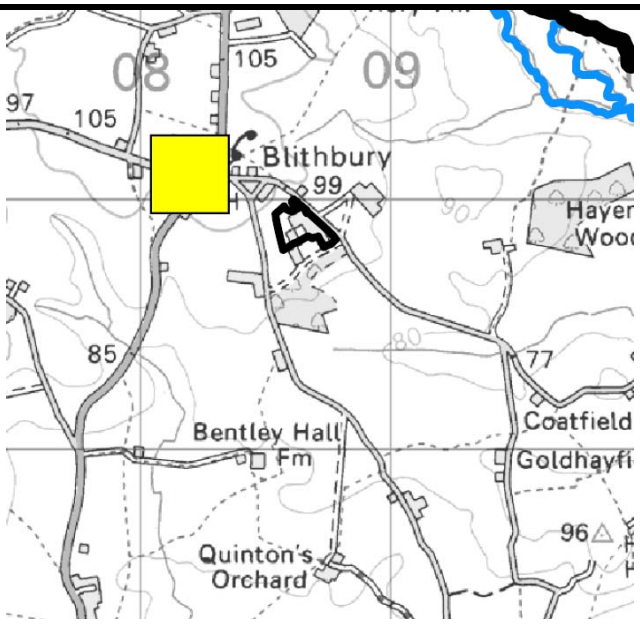
Key

Area should be investigated further as part of a Phase 2 SWMP or site specific study.

Area would benefit from being investigated further as part of a Phase 2 SWMP. Development should be reviewed with reference to the surface flood maps.

Based on current data no detailed further analyses required, although the topography of individual sites should be reviewed before development and all new development should utilise SUDS methods.

Lichfield District - Blithbury



Rivers
Canal
Potential Development Sites
Potential Housing and Employment Sites

Historic Flooding
Types of Flooding
- Surface Water
- Canal
- Artifical Drainag
- Highways
- Sewer
- Groundwater
- Unknown

Historic Flooding Recurrance
- Exceptional
- Rare
- Occasional
- Repeat

Historic Surface Water Flooding

1 historic flooding event, but rare occurrence (points)

Type	Occurrence	Comment
Highways	1 location (west)	Rare occurrence - may only occur during extreme events

Future Surface Water Flooding

8 properties at risk

Very low number of properties located in surface water flood map 'less than' extent.

Overall

No historic events and very low number of properties at risk of future flooding. This area has not been identified within Defra's analysis. Site specific investigation is still recommended, especially with regards to surface run off from the development.

Development Sites

No key sites

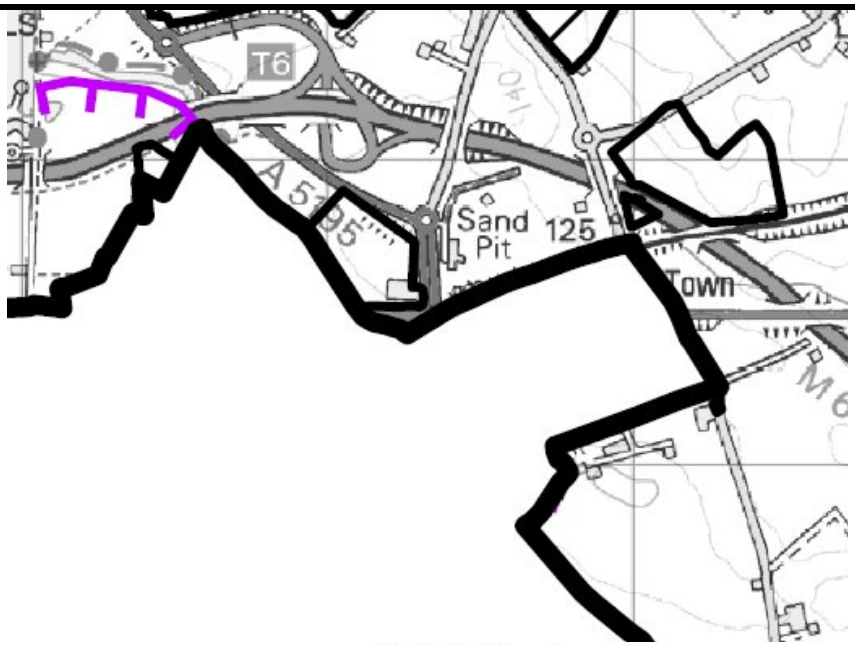
Recommendations

1. Review any potential development sites individually to determine potential for surface water flooding
2. Review any potential development sites individually with regards to surface water runoff, including adoption of SUDS.

Key

	Area should be investigated further as part of a Phase 2 SWMP or site specific study.
	Area would benefit from being investigated further as part of a Phase 2 SWMP. Development should be reviewed with reference to the surface flood maps.
	Based on current data no detailed further analyses required, although the topography of individual sites should be reviewed before development and all new development should utilise SUDS methods.

Lichfield District - Brownhills



Rivers
Canal
Potential Development Sites
Potential Housing and Employment Sites

Historic Flooding

Types of Flooding
- Surface Water
- Canal
- Artifical Drainag
- Highways
- Sewer
- Groundwater
- Unknown

Historic Flooding Recurrance
- Exceptional
- Rare
- Occasional
- Repeat

Historic Surface Water Flooding — None (points)

Type	Occurrence	Comment
None		

Future Surface Water Flooding

71 properties at risk

Low/Moderate number of properties located in surface water flood map 'less than' extent.

Overall

Low historic events but low/moderate number of properties at risk of future flooding. This area has not been identified within Defra's analysis. However, site specific investigation is recommended, especially with regards to surface run off from the development and with reference to future flooding.

Development Sites

No key sites

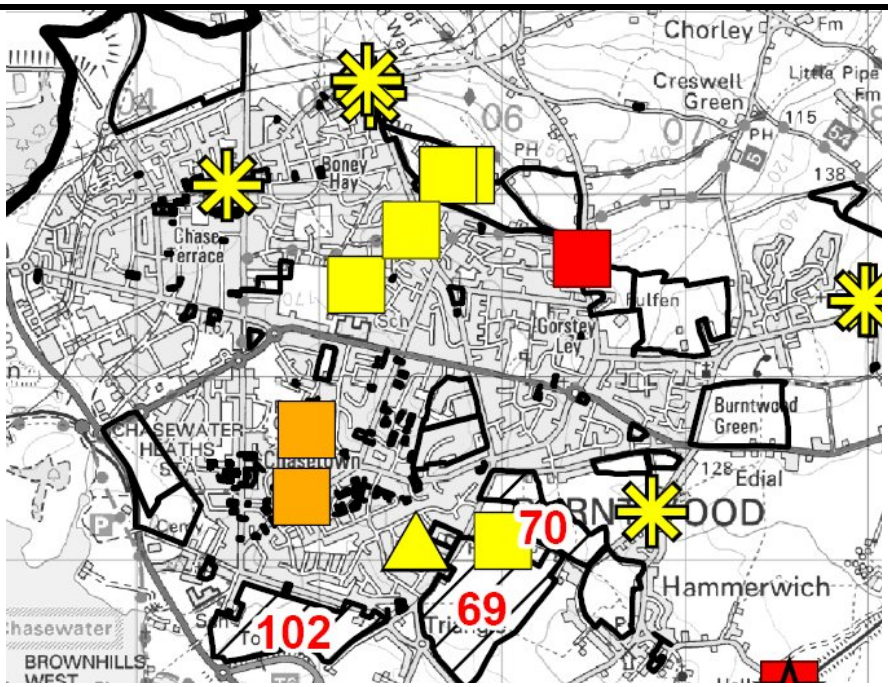
Recommendations

1. Review location of Environment Agency surface water flood map extents in relation to the proposed development sites.
2. Review the impact of development upon surface runoff and options for mitigation (for example, SUDS)

Key

	Area should be investigated further as part of a Phase 2 SWMP or site specific study.
	Area would benefit from being investigated further as part of a Phase 2 SWMP. Development should be reviewed with reference to the surface flood maps.
	Based on current data no detailed further analyses required, although the topography of individual sites should be reviewed before development and all new development should utilise SUDS methods.

Lichfield District - Burntwood (in and around)



Rivers
Canal
Potential Development Sites
Potential Housing and Employment Sites

Historic Flooding
Types of Flooding
- Surface Water
- Canal
- Artifical Drainag
- Highways
- Sewer
- Groundwater
- Unknown

Historic Flooding Recurrance
- Exceptional
- Rare
- Occasional
- Repeat

Historic Surface Water Flooding

5+ historic flooding events - area should be investigated further

Type	Occurrence	Comment
Sewer	1 location (south)	Rare occurrence - may only occur during extreme events
Highways	8 locations (north, central, south)	Rare to repeat
Unknown	6 locations (northwest and east)	Rare - may only occur in extreme circumstances

Future Surface Water Flooding

704 properties at risk

Moderate/high number of properties located in surface water flood map 'less than' extent.

Overall

Numerous historic events and high number of properties at risk of future flooding. Burntwood has been identified within Defra's analysis with a rank of 851 and 260 properties at risk. More detailed analysis of surface water flooding is required in addition to potential mitigation.

Development Sites

Potential Development Sites	Historic			Future	Summary
102	(Sewer)			Intermediate/More	
69	Sewer	Highways		Intermediate	
70	(Sewer)	Highways	(Unknown)	Less	

Notes: Brackets indicate proximity but not overlap

Recommendations

1. Investigate causes of historic surface water flood events
2. Further analysis as part of a future Phase 2 SWMP or site specific investigations
3. Review any potential development sites on individual basis before progression
4. Review the impact of development upon surface runoff and options for mitigation (for example, SUDS)

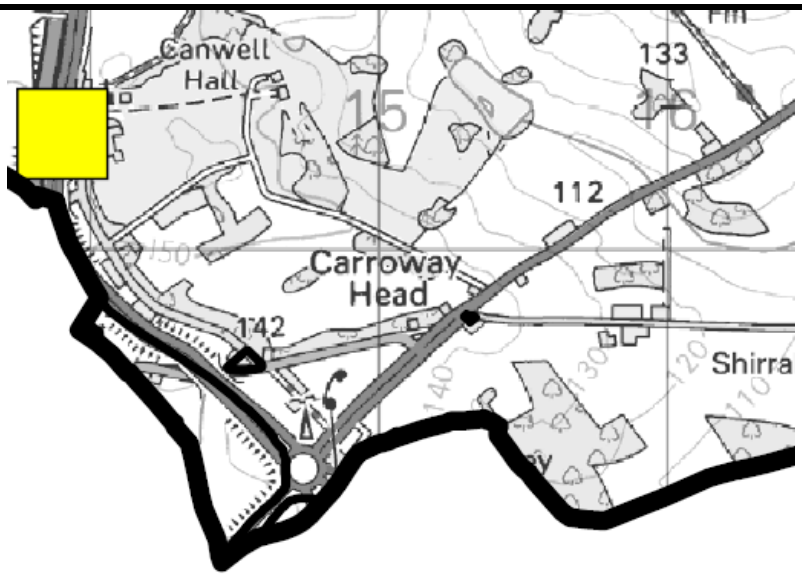
Key

Area should be investigated further as part of a Phase 2 SWMP or site specific study.

Area would benefit from being investigated further as part of a Phase 2 SWMP. Development should be reviewed with reference to the surface flood maps.

Based on current data no detailed further analyses required, although the topography of individual sites should be reviewed before development and all new development should utilise SUDS methods.

Lichfield District - Carroway Head



Rivers
Canal
Potential Development Sites
Potential Housing and Employment Sites

Historic Flooding
Types of Flooding
- Surface Water
- Canal
- Artifical Drainag
- Highways
- Sewer
- Groundwater
- Unknown

Historic Flooding Recurrance
- Exceptional
- Rare
- Occasional
- Repeat

Historic Surface Water Flooding

1 historic flooding event - rare occurrence on edge of area (points)

Type	Occurrence	Comment
Highways	1 location (northwest)	Rare - may only occur in extreme events

Future Surface Water Flooding

7 properties at risk

Very low number of properties located in surface water flood map 'less than' extent.

Overall

One rare historic event and very low number of properties at risk of future flooding. This area has not been identified within Defra's analysis. Site specific investigation is still recommended, especially with regards to surface run off from any development.

Development Sites

No key sites

Recommendations

1. Review location of Environment Agency surface water flood map extents in relation to the proposed development sites
2. Review the impact of development upon surface runoff and options for mitigation (for example, SUDS)

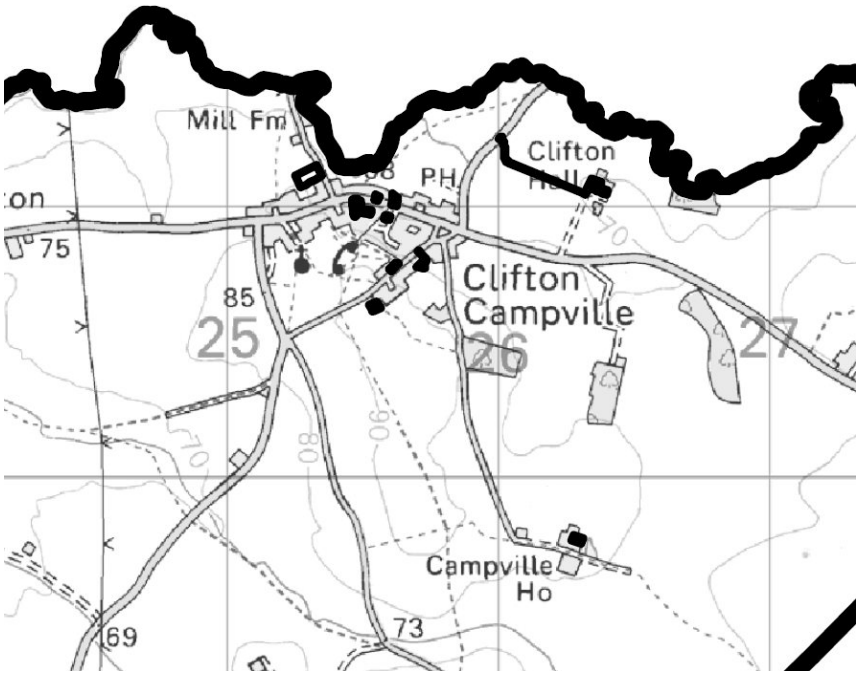
Key

Area should be investigated further as part of a Phase 2 SWMP or site specific study.

Area would benefit from being investigated further as part of a Phase 2 SWMP. Development should be reviewed with reference to the surface flood maps.

Based on current data no detailed further analyses required, although the topography of individual sites should be reviewed before development and all new development should utilise SUDS methods.

Lichfield District - Clifton Campville



Rivers Canal
Potential Development Sites
Potential Housing and Employment Sites

Historic Flooding
Types of Flooding
Surface Water
Canal
Artifical Drainag
Highways
Sewer
Groundwater
Unknown

Historic Flooding Recurrance
Exceptional
Rare
Occasional
Repeat

Historic Surface Water Flooding — No Historic Flood Events (points)

Type	Occurrence	Comment
None		

Future Surface Water Flooding

10 properties at risk

Very low number of properties located in surface water flood map 'less than' extent.

Overall

No historic events and very low number of properties at risk of future flooding. This area has not been identified within Defra's analysis. Site specific investigation is still recommended, especially with regards to surface run off from any development.

Development Sites

No key sites

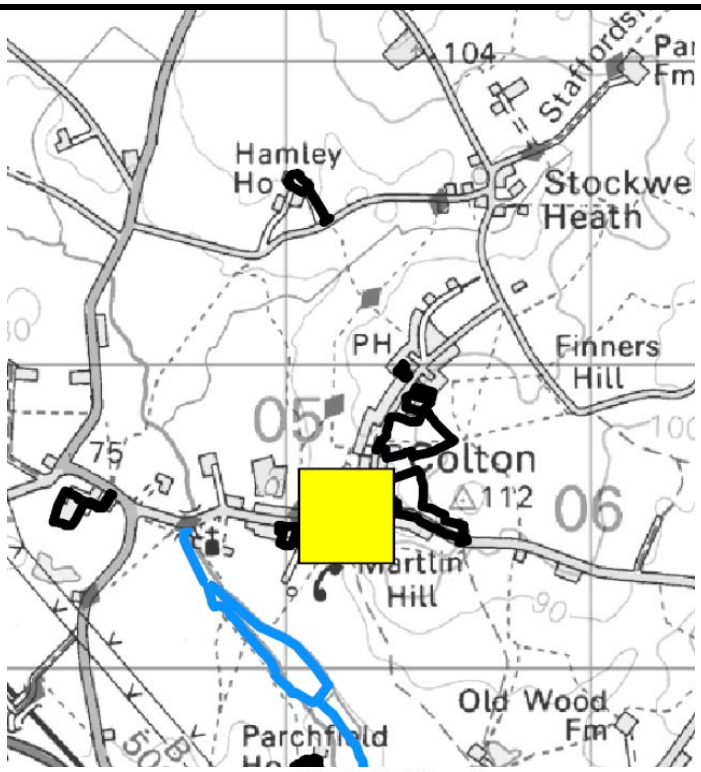
Recommendations

1. Review location of Environment Agency surface water flood map extents in relation to the proposed development sites
2. Review the impact of development upon surface runoff and options for mitigation (for example, SUDS)

Key

	Area should be investigated further as part of a Phase 2 SWMP or site specific study.
	Area would benefit from being investigated further as part of a Phase 2 SWMP. Development should be reviewed with reference to the surface flood maps.
	Based on current data no detailed further analyses required, although the topography of individual sites should be reviewed before development and all new development should utilise SUDS methods.

Lichfield District - Colton



Rivers Canal
Potential Development Sites
Potential Housing and Employment Sites

Historic Flooding
Types of Flooding
Surface Water
Canal
Artifical Drainag
Highways
Sewer
Groundwater
Unknown

Historic Flooding Recurrance
Exceptional
Rare
Occasional
Repeat

Historic Surface Water Flooding — 1 historic flooding event - rare occurrence

Type	Occurrence	Comment
Highways	1 location (central)	Rare - may only occur in extreme events

Future Surface Water Flooding

38 properties at risk

Low number of properties located in surface water flood map 'less than' extent.

Overall

One rare historic event and low number of properties at risk of future flooding. This area has not been identified within Defra's analysis. Site specific investigation is still recommended, especially with regards to surface run off from any development.

Development Sites

No key sites

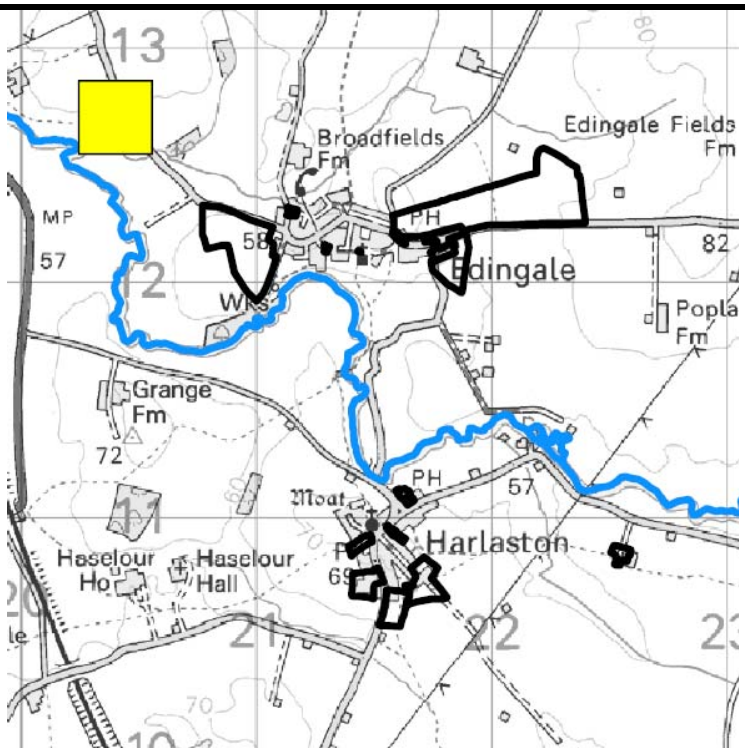
Recommendations

1. Review location of Environment Agency surface water flood map extents in relation to the proposed development sites
2. Review the impact of development upon surface runoff and options for mitigation (for example, SUDS)

Key

	Area should be investigated further as part of a Phase 2 SWMP or site specific study.
	Area would benefit from being investigated further as part of a Phase 2 SWMP. Development should be reviewed with reference to the surface flood maps.
	Based on current data no detailed further analyses required, although the topography of individual sites should be reviewed before development and all new development should utilise SUDS methods.

Lichfield District - Edingale and Harlaston



Rivers
Canal
Potential Development Sites
Potential Housing and Employment Sites

Historic Flooding

Types of Flooding
- Surface Water
- Canal
- Artifical Drainag
- Highways
- Sewer
- Groundwater
- Unknown

Historic Flooding Recurrance
- Exceptional
- Rare
- Occasional
- Repeat

Historic Surface Water Flooding

1 historic flooding event - rare occurrence to edge of area

Type	Occurrence	Comment
Highways	1 location (northwest)	Rare - may only occur in extreme circumstances

Future Surface Water Flooding

39 properties at risk

Low number of properties located in surface water flood map 'less than' extent.

Overall

One rare historic event and low number of properties at risk of future flooding. This area has not been identified within Defra's analysis. Site specific investigation is still recommended, especially with regards to surface run off from any development.

Development Sites

No key sites

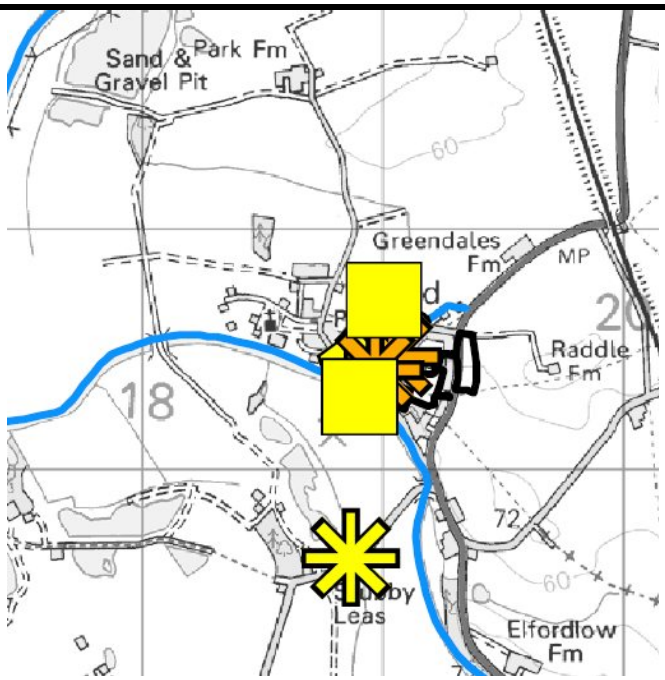
Recommendations

1. Review location of Environment Agency surface water flood map extents in relation to the proposed development sites
2. Review the impact of development upon surface runoff and options for mitigation (for example, SUDS)

Key

	Area should be investigated further as part of a Phase 2 SWMP or site specific study.
	Area would benefit from being investigated further as part of a Phase 2 SWMP. Development should be reviewed with reference to the surface flood maps.
	Based on current data no detailed further analyses required, although the topography of individual sites should be reviewed before development and all new development should utilise SUDS methods.

Lichfield District - Elford



Rivers
Canal
Potential Development Sites
Potential Housing and Employment Sites

Historic Flooding
Types of Flooding
- Surface Water
- Canal
- Artifical Drainag
- Highways
- Sewer
- Groundwater
- Unknown

Historic Flooding Recurrance
- Exceptional
- Rare
- Occasional
- Repeat

Historic Surface Water Flooding — 5+ historic flooding events

Type	Occurrence	Comment
Highways	2 locations (central)	Rare - may only occur in extreme events
Unknown	3 locations (central and south)	Rare to occasional occurrences: - rare may only occur during extreme events - occasional may repeat

Future Surface Water Flooding

68 properties at risk

Low/Moderate number of properties located in surface water flood map 'less than' extent.

Overall

Numerous historic events and low/moderate number of properties at risk of future flooding. This area has not been identified within Defra's analysis. More detailed analysis of surface water flooding is required in addition to potential mitigation.

Development Sites

No key sites

Recommendations

1. Investigate causes of historic surface water flood events
2. Review location of Environment Agency surface water flood map extents in relation to the proposed development sites.
3. Review the impact of development upon surface runoff and options for mitigation (for example, SUDS)

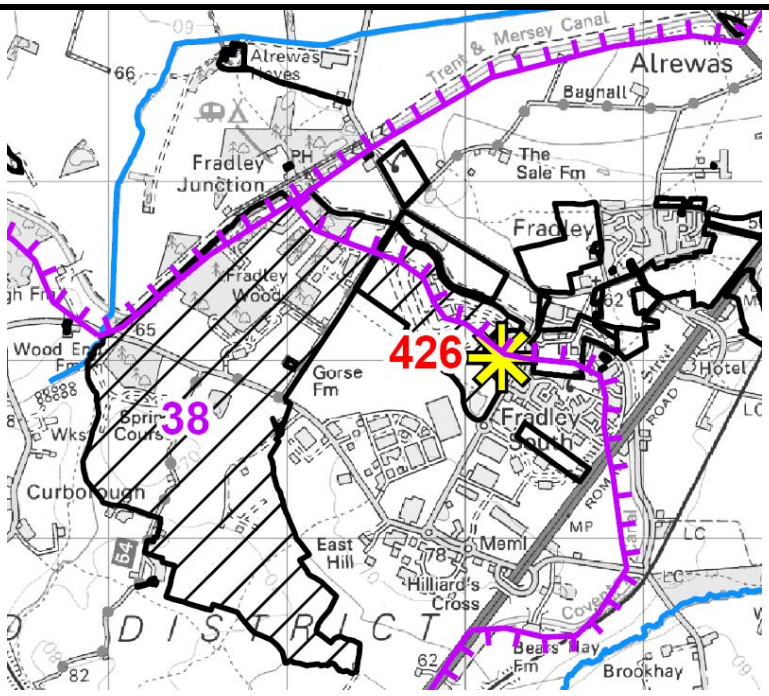
Key

Area should be investigated further as part of a Phase 2 SWMP or site specific study.

Area would benefit from being investigated further as part of a Phase 2 SWMP. Development should be reviewed with reference to the surface flood maps.

Based on current data no detailed further analyses required, although the topography of individual sites should be reviewed before development and all new development should utilise SUDS methods.

Lichfield District - Fradley



Historic Surface Water Flooding — 1 historic flooding event but rare

Type	Occurrence	Comment
Unknown	1 location (west)	Rare occurrence - may only occur during extreme events

Future Surface Water Flooding

412 properties at risk

Moderate/High number of properties located in surface water flood map 'less than' extent.

Overall

One rare historic event but moderate/high number of properties at risk of future flooding. Fradley has been identified within Defra's analysis with a rank of 2274 and 30 properties at risk. Site specific analysis is recommended.

Development Sites

Housing/ Employment	Historic	Future	Summary
426	Unknown	More (small area)	
38	(Unknown)	Intermediate/More	

Recommendations

1. Review location of Environment Agency surface water flood map extents in relation to the proposed development sites.
2. Review the impact of development upon surface runoff and options for mitigation (for example, SUDS)

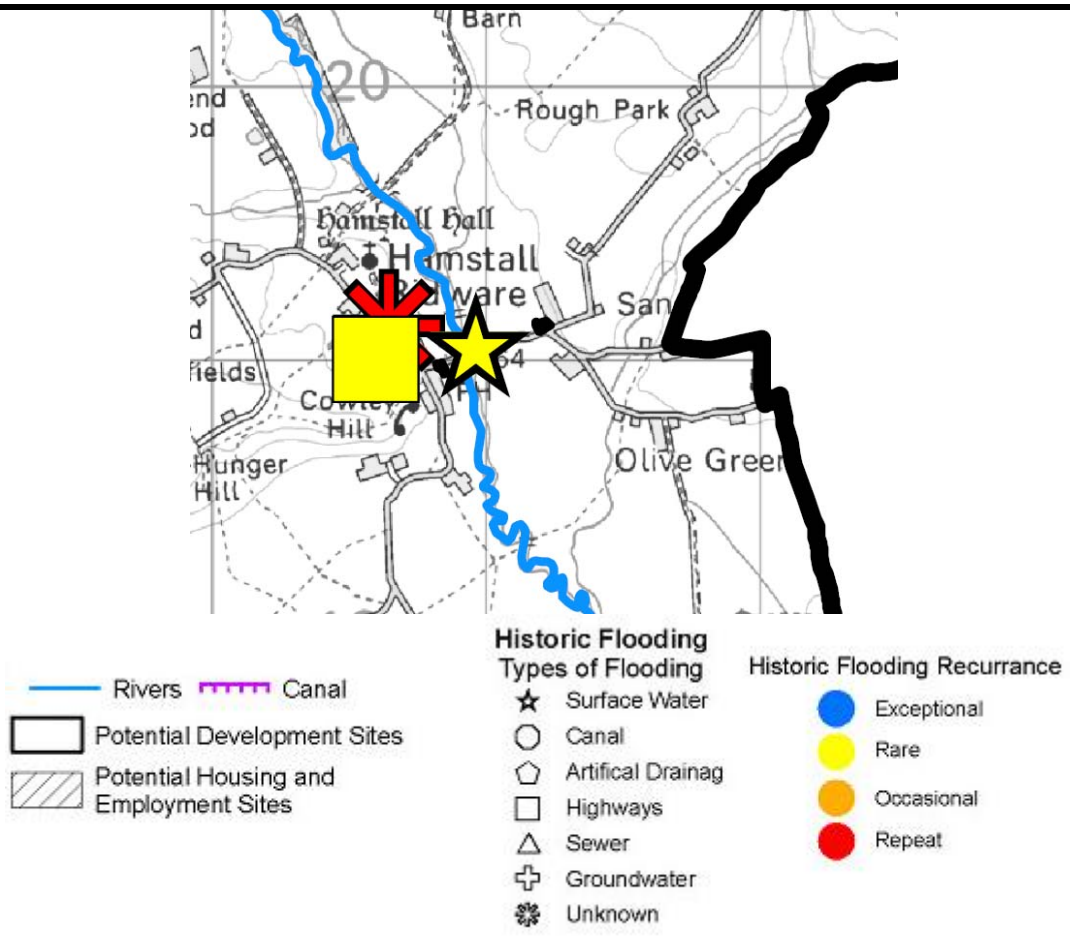
Key

Area should be investigated further as part of a Phase 2 SWMP or site specific study.

Area would benefit from being investigated further as part of a Phase 2 SWMP. Development should be reviewed with reference to the surface flood maps.

Based on current data no detailed further analyses required, although the topography of individual sites should be reviewed before development and all new development should utilise SUDS methods.

Lichfield District - Hamstall Ridware



Historic Surface Water Flooding — 3 historic flooding events

Type	Occurrence	Comment
Surface	1 location	Rare occurrence - may only occur during extreme events
Unknown	1 location	Occasional occurrence - may repeat
Highways	1 location	Rare occurrence - may only occur during extreme events

Future Surface Water Flooding

31 properties at risk

Low number of properties located in surface water flood map 'less than' extent.

Overall

A few rare-occasional historic events and low number of properties at risk of future flooding. Hamstall Ridware has not been identified within Defra's. Site specific analysis is recommended, especially where development sites are located in proximity to the historic flooding events.

Development Sites

No key sites

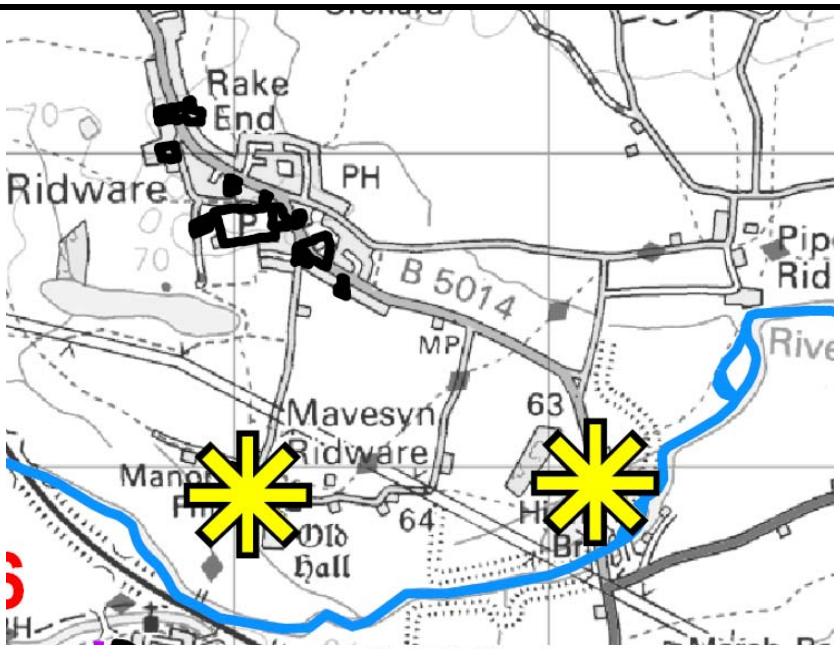
Recommendations

1. Review location of Environment Agency surface water flood map extents in relation to the proposed development sites.
2. Review the impact of development upon surface runoff and options for mitigation (for example, SUDS)

Key

	Area should be investigated further as part of a Phase 2 SWMP or site specific study.
	Area would benefit from being investigated further as part of a Phase 2 SWMP. Development should be reviewed with reference to the surface flood maps.
	Based on current data no detailed further analyses required, although the topography of individual sites should be reviewed before development and all new development should utilise SUDS methods.

Lichfield District - Hill Ridware



Historic Surface Water Flooding — No historic flooding events (points)

Type	Occurrence	Comment
Unknown	2 locations (central)	Rare occurrence - may only occur during extreme events

Future Surface Water Flooding

61 properties at risk

Low/moderate number of properties located in surface water flood map 'less than' extent.

Overall

No historic events and low/moderate number of properties at risk of future flooding. Hill Ridware has been identified within Defra's analysis with a rank of 3116 and less than 10 properties at risk. Site specific analysis is recommended, with further analysis identifying the location of potential future surface water flooding.

Development Sites

No key sites

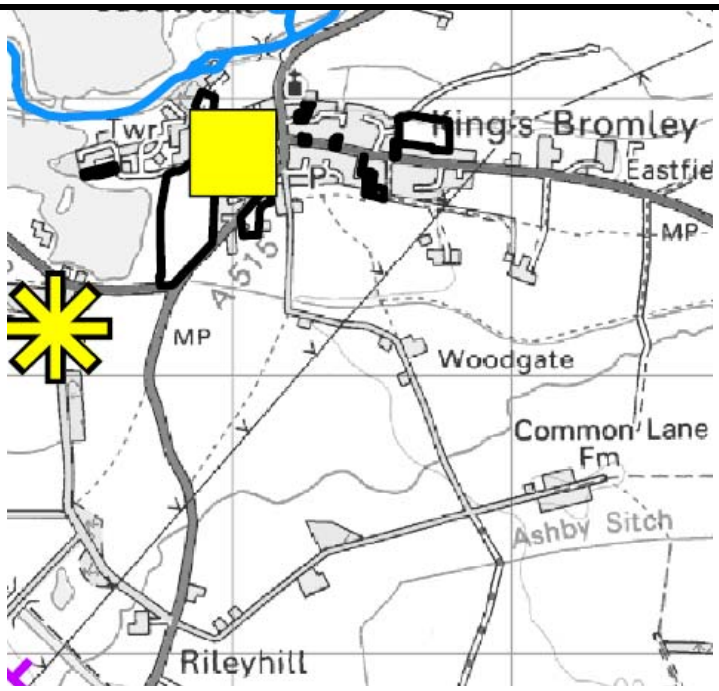
Recommendations

1. Review location of Environment Agency surface water flood map extents in relation to the proposed development sites.
2. Review the impact of development upon surface runoff and options for mitigation (for example, SUDS)

Key

	Area should be investigated further as part of a Phase 2 SWMP or site specific study.
	Area would benefit from being investigated further as part of a Phase 2 SWMP. Development should be reviewed with reference to the surface flood maps.
	Based on current data no detailed further analyses required, although the topography of individual sites should be reviewed before development and all new development should utilise SUDS methods.

Lichfield District - Kings Bromley



Rivers
Canal
Potential Development Sites
Potential Housing and Employment Sites

Historic Flooding
Types of Flooding
- Surface Water
- Canal
- Artifical Drainag
- Highways
- Sewer
- Groundwater
- Unknown

Historic Flooding Recurrance
- Exceptional
- Rare
- Occasional
- Repeat

Historic Surface Water Flooding — 2 historic flooding events

Type	Occurrence	Comment
Highways	1 location (central)	Rare occurrence - may only occur during extreme events
Unknown	1 location (southwest)	Rare occurrence - may only occur during extreme events

Future Surface Water Flooding

91 properties at risk

Low/moderate number of properties located in surface water flood map 'less than' extent.

Overall

Few historic events and low/moderate number of properties at risk of future flooding. Kings Bromley has been identified within Defra's analysis with a rank of 2137 and less than 30 properties at risk. Site specific analysis is recommended, with further analysis identifying the location of potential future surface water flooding.

Development Sites

No key sites

Recommendations

1. Review location of Environment Agency surface water flood map extents in relation to the proposed development sites.
2. Review the impact of development upon surface runoff and options for mitigation (for example, SUDS)

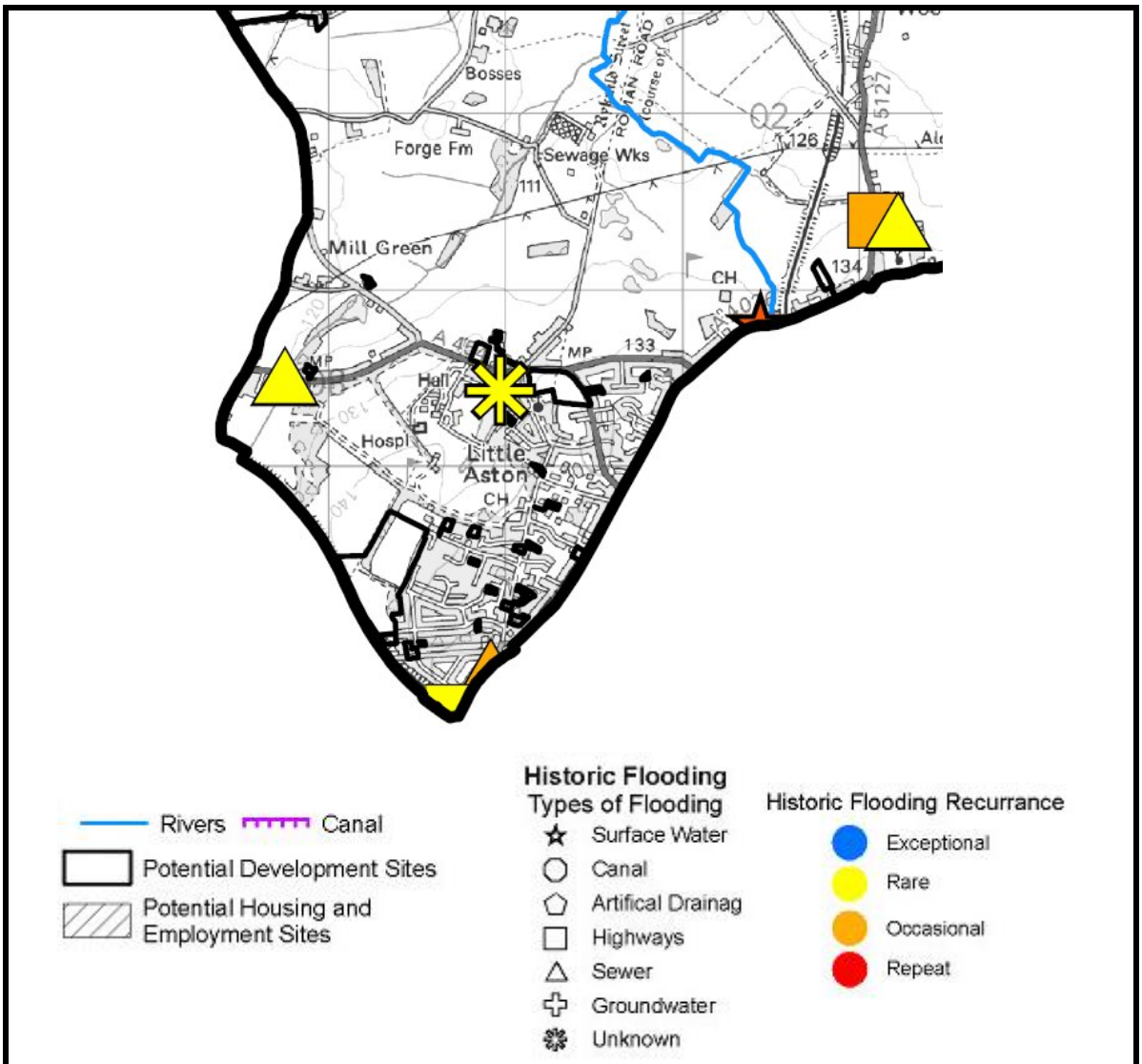
Key

Area should be investigated further as part of a Phase 2 SWMP or site specific study.

Area would benefit from being investigated further as part of a Phase 2 SWMP. Development should be reviewed with reference to the surface flood maps.

Based on current data no detailed further analyses required, although the topography of individual sites should be reviewed before development and all new development should utilise SUDS methods.

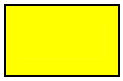
Lichfield District - Little Aston



Historic Surface Water Flooding 5+ historic flooding events

Type	Occurrence	Comment
Surface	1 location (northeast)	Repeat occurrence - should be investigated further
Highways	2 locations (south and northeast)	Rare occurrence - may only occur during extreme events (south) Occasional occurrence - may repeat.(northeast)
Sewers	3 locations (west, south and northeast)	Rare occurrence - may only occur during extreme events (west and northeast) Occasional occurrence - may repeat (south
Unknown	1 location (central)	Rare occurrence - may only occur during extreme events

Future Surface Water Flooding



106 properties at risk

Moderate number of properties located in surface water flood map 'less than' extent.

Overall

Multiple historic events and moderate number of properties at risk of future flooding. This area was not identified within Defra's analysis. Site specific analysis is recommended, with further analysis identifying the location of potential future surface water flooding. Investigation into historic flooding occurrences (especially the occasional and repeat locations) is recommended.

Development Sites

No key sites

Recommendations

1. Review any potential development sites individually to determine potential for surface water flooding.
2. Review any potential development sites individually with regards to surface water runoff, including adoption of SUDS.
3. Further investigation into historic flood events noted for repeat or occasional occurrences.

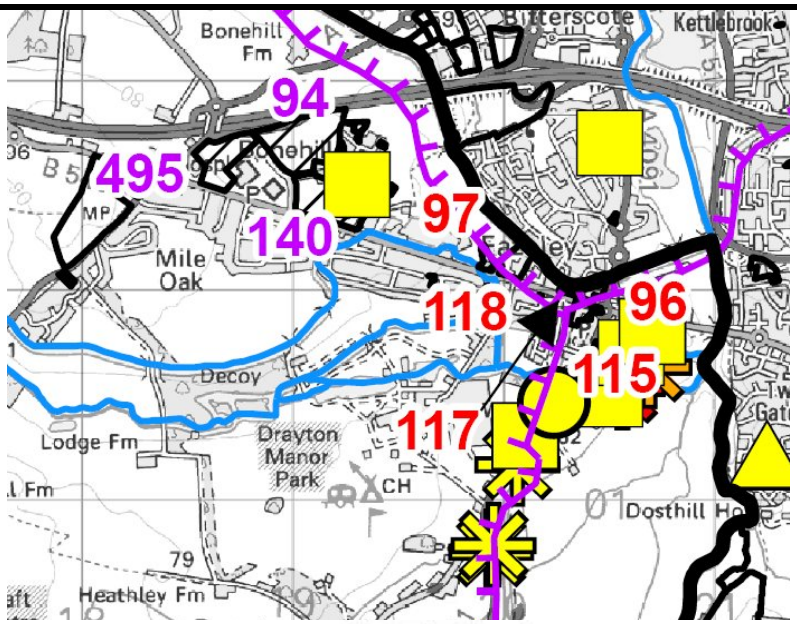
Key

Area should be investigated further as part of a Phase 2 SWMP or site specific study.

Area would benefit from being investigated further as part of a Phase 2 SWMP. Development should be reviewed with reference to the surface flood maps.

Based on current data no detailed further analyses required, although the topography of individual sites should be reviewed before development and all new development should utilise SUDS methods.

Lichfield District - Mile Oak/Fazeley



Rivers
Canal
Potential Development Sites
Potential Housing and Employment Sites

Historic Flooding
Types of Flooding
- Surface Water
- Canal
- Artifical Drainag
- Highways
- Sewer
- Groundwater
- Unknown

Historic Flooding Recurrance
- Exceptional
- Rare
- Occasional
- Repeat

Historic Surface Water Flooding — 5+ historic flooding events

Type	Occurrence	Comment
Highways	6 locations	Rare occurrence - may only occur during extreme events
Canal	1 location	Rare occurrence - may only occur during extreme events
Unknown	5 locations (southeast)	Rare - repeat occurrences - some areas require further investigation.

Future Surface Water Flooding

895 properties at risk

Moderate/High number of properties located in surface water flood map 'less than' extent.

Overall

Multiple historic events and moderate number of properties at risk of future flooding. Fazeley has been identified within Defra's analysis with a rank of 621 and 430 properties at risk. Investigation into historic flooding occurrences (especially the occasional and repeat locations) is recommended, in addition to further investigation into potential locations for future surface water flooding.

Development Sites

Potential Development Sites	Historic			Future	Summary
97	None			Less	
118	None			None	
96	Highways	Unknown		Intermediate	
115	Highways	Unknown	(Canal)	Less	
117	Highways	(Unknown)	(Canal)	Less	
Additional/Alternative					
94	Highways			Less	
495	(Highways)			Less	
140	Highways			Less	
95	Highways			Less	

Recommendations

1. Review any potential development sites individually to determine potential for surface water flooding.
2. Review the impact of development upon surface runoff and options for mitigation (for example, SUDS)
3. Further investigation into historic flood events noted for repeat or occasional occurrences.
4. Further analysis as part of a future Phase 2 SWMP or site specific investigations

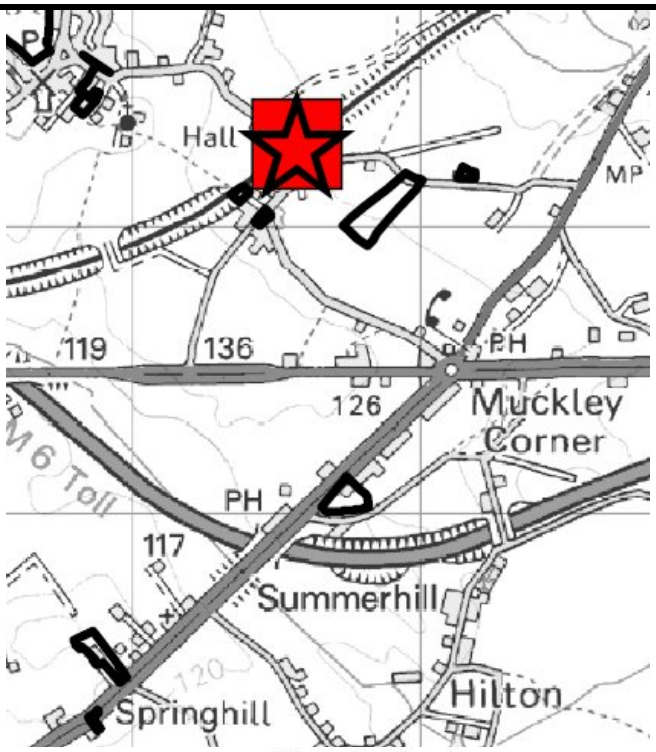
Key

Area should be investigated further as part of a Phase 2 SWMP or site specific study.

Area would benefit from being investigated further as part of a Phase 2 SWMP. Development should be reviewed with reference to the surface flood maps.

Based on current data no detailed further analyses required, although the topography of individual sites should be reviewed before development and all new development should utilise SUDS methods.

Lichfield District - Muckley Corner, Summerhill and Springhill



Rivers
Canal
Potential Development Sites
Potential Housing and Employment Sites

Historic Flooding
Types of Flooding
- Surface Water
- Canal
- Artifical Drainag
- Highways
- Sewer
- Groundwater
- Unknown

Historic Flooding Recurrance
- Exceptional
- Rare
- Occasional
- Repeat

Historic Surface Water Flooding — 2 historic flooding events

Type	Occurrence	Comment
Surface	1 occurrence (north)	Repeat event - may need further investigation
Highways	1 occurrence (north)	Repeat event - may need further investigation

Future Surface Water Flooding

19 properties at risk

Very low number of properties located in surface water flood map 'less than' extent.

Overall

One area with records of repeat historic events but a very low number of properties at risk of future flooding. This area has not been identified within Defra's analysis. Site specific investigation is still recommended, especially close to the repeating flood event locations.

Development Sites

No key sites

Recommendations

1. Review any potential development sites individually to determine potential for surface water flooding
2. Review the impact of development upon surface runoff and options for mitigation (for example, SUDS)
3. Investigate the repeat historical flood events further.

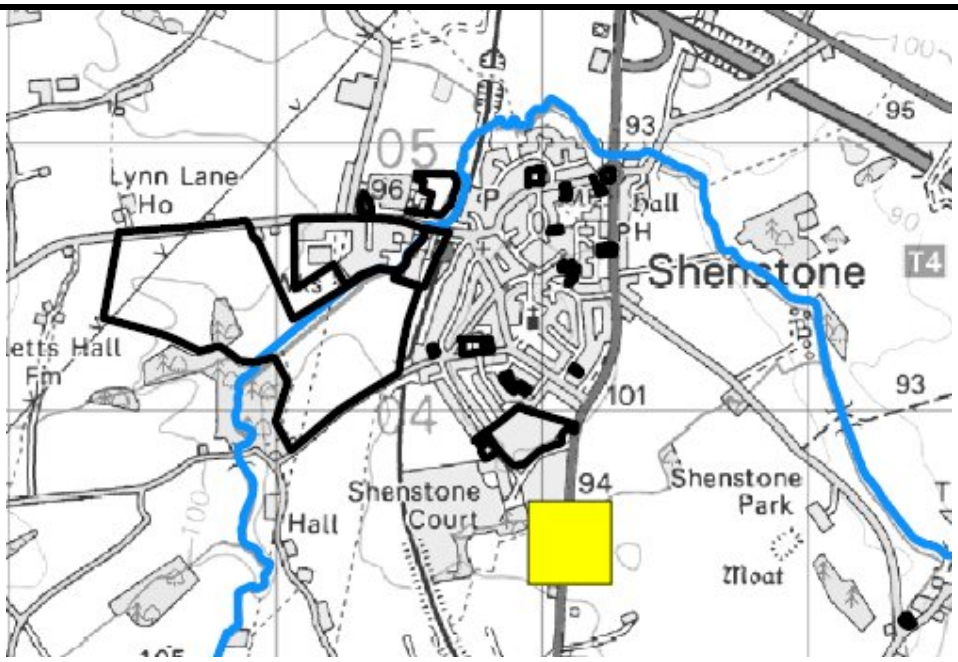
Key

Area should be investigated further as part of a Phase 2 SWMP or site specific study.

Area would benefit from being investigated further as part of a Phase 2 SWMP. Development should be reviewed with reference to the surface flood maps.

Based on current data no detailed further analyses required, although the topography of individual sites should be reviewed before development and all new development should utilise SUDS methods.

Lichfield District - Shenstone



Rivers
Canal
Potential Development Sites
Potential Housing and Employment Sites

Historic Flooding
Types of Flooding
- Surface Water
- Canal
- Artifical Drainag
- Highways
- Sewer
- Groundwater
- Unknown

Historic Flooding Recurrance
- Exceptional
- Rare
- Occasional
- Repeat

Historic Surface Water Flooding — 1 historic flooding event, but rare (points)

Type	Occurrence	Comment
Highways	1 occurrence (south)	Rare occurrence - may only occur during extreme events

Future Surface Water Flooding

121 properties at risk

Moderate number of properties located in surface water flood map 'less than' extent.

Overall

One area with record of rare historic event but a moderate number of properties at risk of future flooding. Shenstone has been identified within Defra's analysis with a rank of 1886 and 50 properties at risk. Site specific investigation is still recommended, especially where sites are identified within the Environment Agency's surface water flood extents.

Development Sites

No key sites

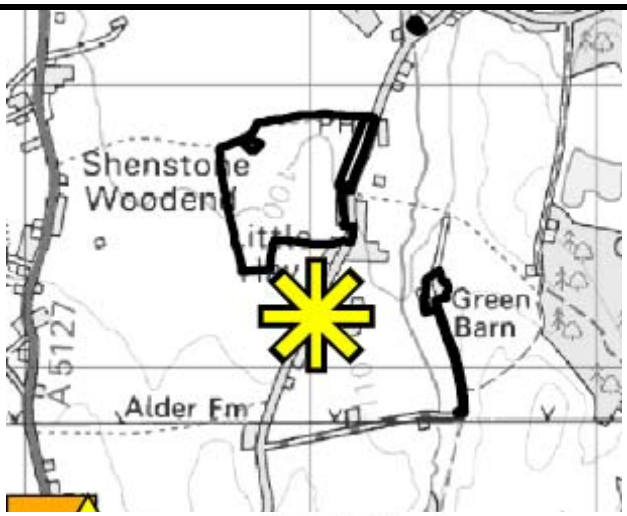
Recommendations

1. Review any potential development sites individually to determine potential for surface water flooding, especially where they overlap with the Environment Agency's surface water flood extents.
2. Review the impact of development upon surface runoff and options for mitigation (for example, SUDS)

Key

	Area should be investigated further as part of a Phase 2 SWMP or site specific study.
	Area would benefit from being investigated further as part of a Phase 2 SWMP. Development should be reviewed with reference to the surface flood maps.
	Based on current data no detailed further analyses required, although the topography of individual sites should be reviewed before development and all new development should utilise SUDS methods.

Lichfield District - Shenstone Woodend



Rivers
Canal
Potential Development Sites
Potential Housing and Employment Sites

Historic Flooding
Types of Flooding
- Surface Water
- Canal
- Artifical Drainag
- Highways
- Sewer
- Groundwater
- Unknown

Historic Flooding Recurrance
- Exceptional
- Rare
- Occasional
- Repeat

Historic Surface Water Flooding — 1 historic flooding event, but rare (points)

Type	Occurrence	Comment
Unknown	1 occurrence (south)	Rare occurrence - may only occur during extreme events

Future Surface Water Flooding

18 properties at risk

Very low number of properties located in surface water flood map 'less than' extent.

Overall

One area with record of rare historic event and very low number of properties at risk of future flooding. Shenstone Woodend has not been identified within Defra's analysis (although it may have been included within their analysis of Shenstone). Surface water flooding is unlikely to limit development in this area although consideration should be given to the mitigation of surface water runoff from any new development, for example through the implementation of SUDS.

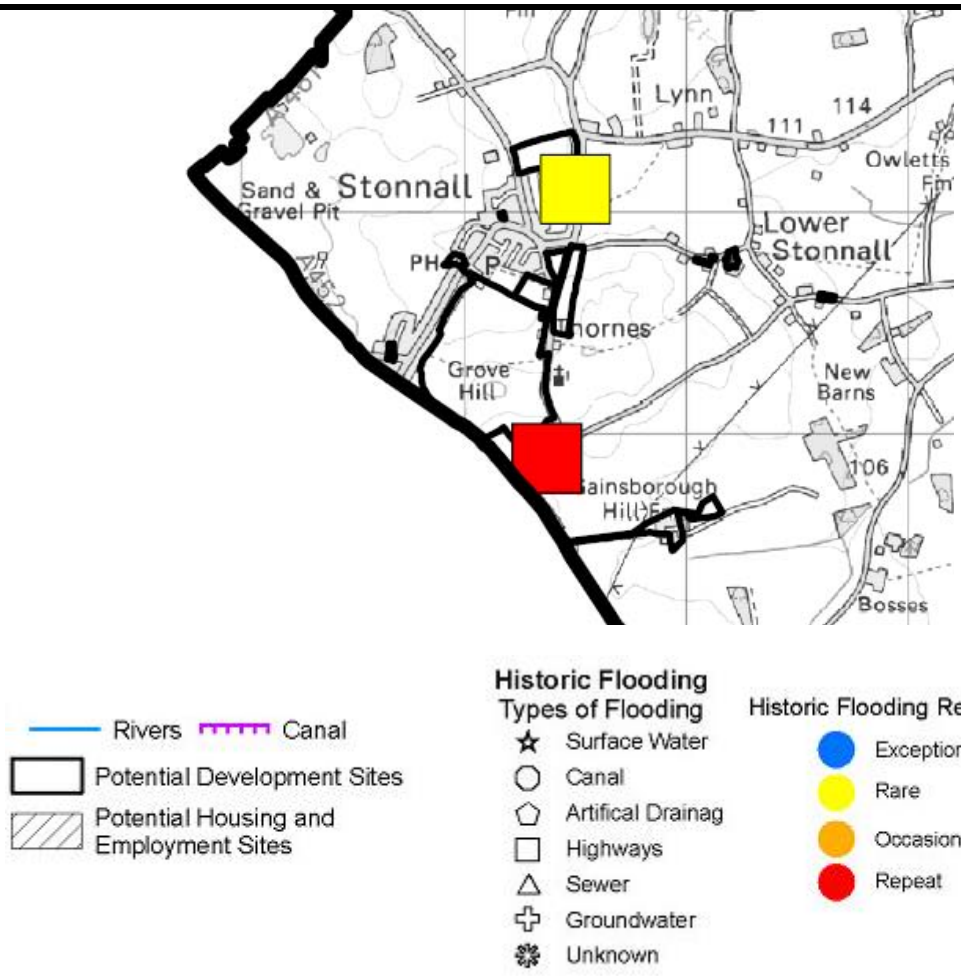
Development Sites

No key sites

Recommendations	
1.	Review the impact of development upon surface runoff and options for mitigation (for example, SUDS)
2.	Review location of Environment Agency surface water flood map extents in relation to the proposed development sites.

Key	
	Area should be investigated further as part of a Phase 2 SWMP or site specific study.
	Area would benefit from being investigated further as part of a Phase 2 SWMP. Development should be reviewed with reference to the surface flood maps.
	Based on current data no detailed further analyses required, although the topography of individual sites should be reviewed before development and all new development should utilise SUDS methods.

Lichfield District - Stonnall



Historic Surface Water Flooding — 2 historic flooding events

Type	Occurrence	Comment
Highways	2 occurrence (central and south)	1 Rare occurrence - may only occur during extreme events 1 Repeat occurrence - should be investigated further

Future Surface Water Flooding

135 properties at risk

Moderate number of properties located in surface water flood map 'less than' extent.

Overall

Records of rare historic events, one of which is a repeat occurrence and moderate number of properties at risk of future flooding. Shenstone has been identified within Defra's analysis with a rank of 2352 and 30 properties at risk. Further consideration should be given to the location of development sites with reference to these flood events and the Environment Agency's surface water flood extents.

Development Sites

No key sites

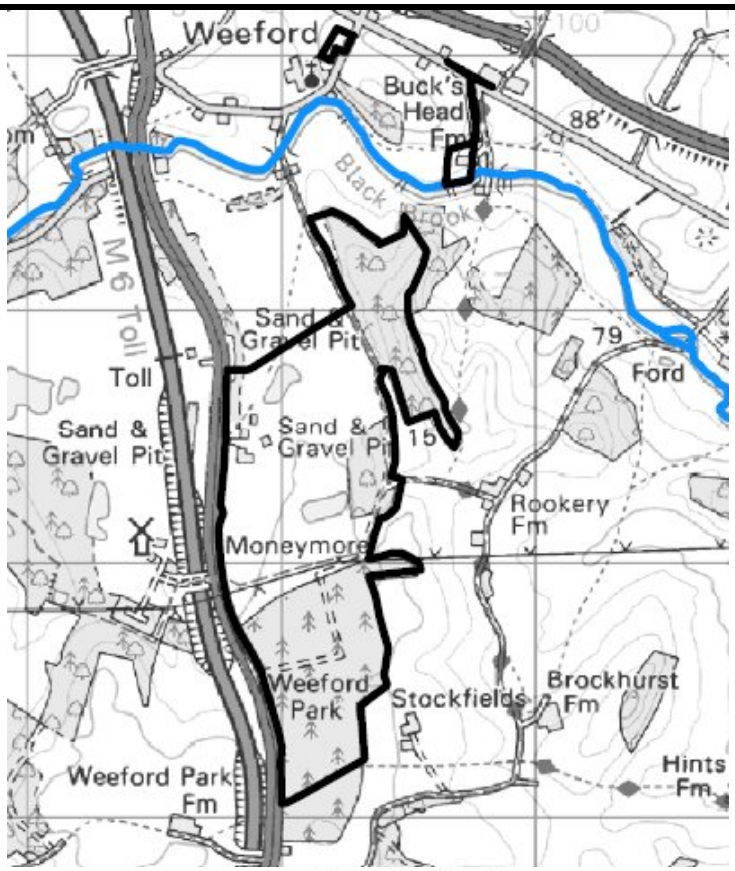
Recommendations

1. Further investigation of the repeat surface water flood event.
2. Review the impact of development upon surface runoff and options for mitigation (for example, SUDS)
3. Review location of Environment Agency surface water flood map extents in relation to the proposed development sites.

Key

	Area should be investigated further as part of a Phase 2 SWMP or site specific study.
	Area would benefit from being investigated further as part of a Phase 2 SWMP. Development should be reviewed with reference to the surface flood maps.
	Based on current data no detailed further analyses required, although the topography of individual sites should be reviewed before development and all new development should utilise SUDS methods.

Lichfield District - Weeford



Historic Surface Water Flooding — No historic flooding events (points)

Type	Occurrence	Comment
None		

Future Surface Water Flooding

135 properties at risk

Low number of properties located in surface water flood map 'less than' extent.

Overall

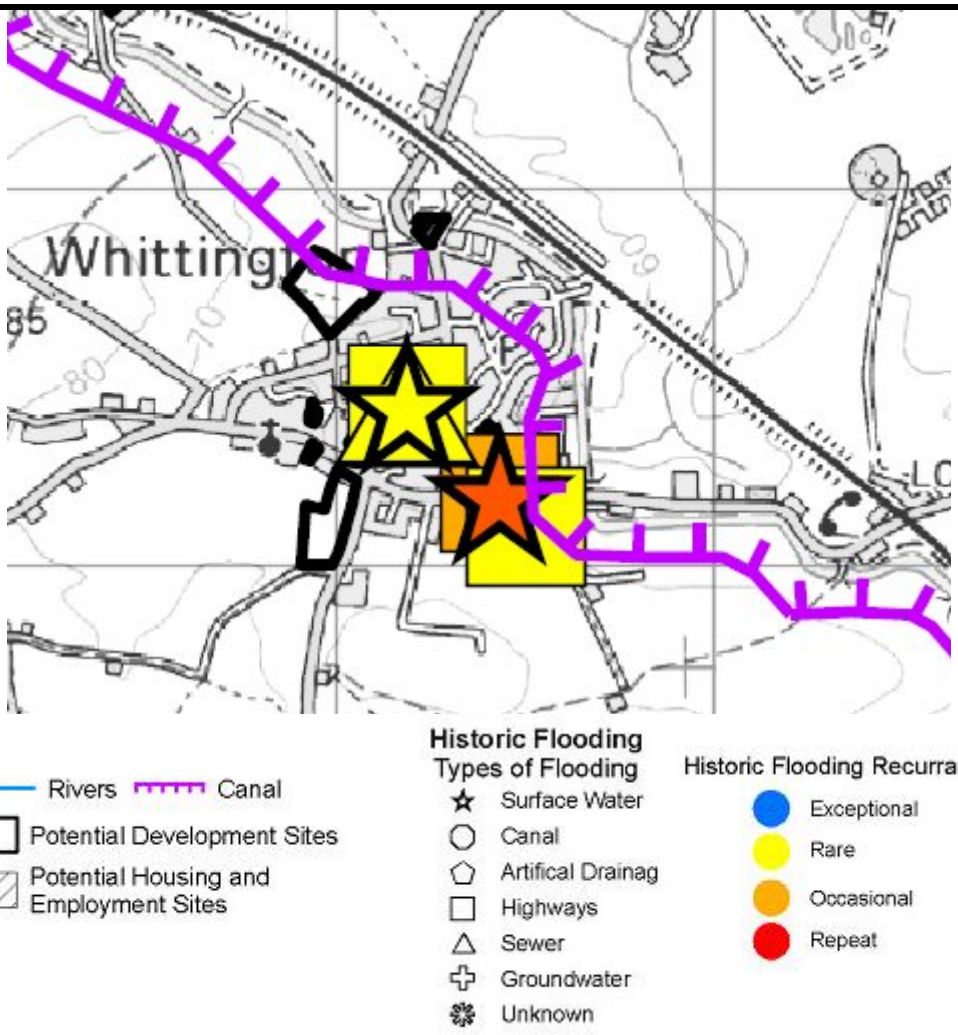
No records of historic flood events and low number of properties at risk of future flooding. This area has not been identified within Defra's analysis. Consideration should be given to the location of development sites with

	reference to the Environment Agency's surface water flood extents and the potential for mitigating surface water runoff from any development sites.
Development Sites	
No key sites	
Recommendations	
1.	Review the impact of development upon surface runoff and options for mitigation (for example, SUDS)
2.	Review location of Environment Agency surface water flood map extents in relation to the proposed development sites.

Key

	Area should be investigated further as part of a Phase 2 SWMP or site specific study.
	Area would benefit from being investigated further as part of a Phase 2 SWMP. Development should be reviewed with reference to the surface flood maps.
	Based on current data no detailed further analyses required, although the topography of individual sites should be reviewed before development and all new development should utilise SUDS methods.

Lichfield District - Whittington



Historic Surface Water Flooding 5+ historic flooding events

Type	Occurrence	Comment
Surface	2 locations (central)	1 Rare occurrence - may only occur during extreme events 1 Repeat occurrence - should be investigated further
Highways	3 locations (central and south)	2 Rare occurrence - may only occur during extreme events 1 Occasional occurrence - may repeat.
Sewers	1 rare event (central)	Rare occurrence - may only occur during extreme events

Future Surface Water Flooding

115 properties at risk	Moderate number of properties located in surface water flood map 'less than' extent.

Overall

Numerous records of historic flood events and moderate number of properties at risk of future flooding. Whittington has been identified within Defra's analysis with a rank of 1656 and 70 properties at risk. Consideration should be given to the location of development sites with reference to the Environment Agency's surface water flood extents and the potential for mitigating surface water runoff from any development sites. The repeat flood events should be investigated further.

Development Sites

No key sites

Recommendations

1. Investigate causes of historic surface water flood events
2. Review the impact of development upon surface runoff and options for mitigation (for example, SUDS)
3. Review location of Environment Agency surface water flood map extents in relation to the proposed development sites.
4. Further analysis as part of a future Phase 2 SWMP or site specific investigations

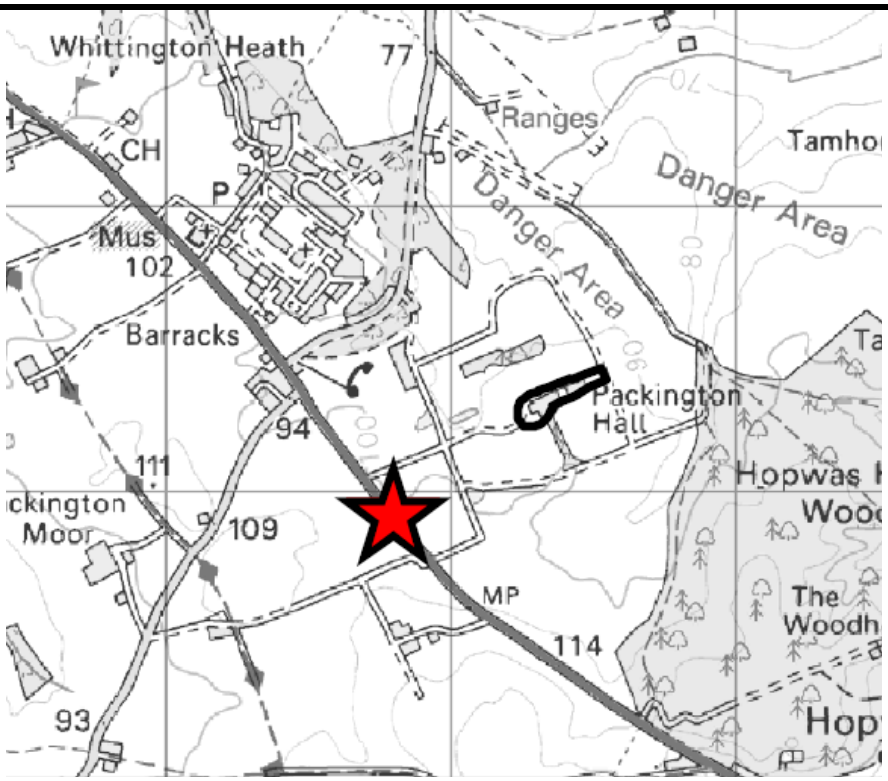
Key

Area should be investigated further as part of a Phase 2 SWMP or site specific study.

Area would benefit from being investigated further as part of a Phase 2 SWMP. Development should be reviewed with reference to the surface flood maps.

Based on current data no detailed further analyses required, although the topography of individual sites should be reviewed before development and all new development should utilise SUDS methods.

Lichfield District - Whittington Heath



Historic Surface Water Flooding 1 historic flooding event

Type	Occurrence	Comment
Surface	1 locations	Repeat occurrence - should be investigated further

Future Surface Water Flooding

11 properties at risk

Very low number of properties located in surface water flood map 'less than' extent.

Overall

Only one record of historic flood events, although it is a repeat occurrence, and a very low number of properties at risk of future flooding. Whittington Heath has not been identified within Defra's analysis, although may be included within their analysis of Whittington. Consideration should be given to the location of development sites with reference to the Environment Agency's surface water flood extents and the potential for mitigating surface water runoff from any development sites. The repeat flood event should be investigated further.

Development Sites

No key sites

Recommendations

1. Investigate causes of repeat historic surface water flood event.
2. Review the impact of development upon surface runoff and options for mitigation (for example, SUDS)
3. Review location of Environment Agency surface water flood map extents in relation to the proposed development sites.

Key

Area should be investigated further as part of a Phase 2 SWMP or site specific study.

Area would benefit from being investigated further as part of a Phase 2 SWMP. Development should be reviewed with reference to the surface flood maps.

Based on current data no detailed further analyses required, although the topography of individual sites should be reviewed before development and all new development should utilise SUDS methods.

A COMPANY OF

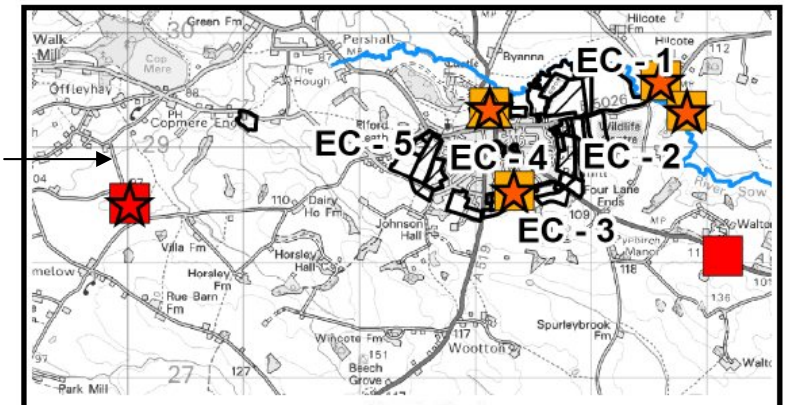
ROYAL HASKONING

Appendix F
Tamworth Borough Summary Sheets

Summary Sheet Explanation

ROYAL HASKONING

Snapshot of key settlement, taken from **Figures B1 - B5**.



Map key, taken from **Figures B1 - B5**.

Rivers
Canal
Potential Development Sites
Potential Housing and Employment Sites

Historic Flooding Types of Flooding
- Surface Water
- Canal
- Artifical Drainag
- Highways
- Sewer
- Groundwater
- Unknown

Historic Flooding Recurrance
- Exceptional
- Rare
- Occasional
- Repeat

Number of historic flooding occurrences marked as points on the map snapshot shown above. Colour code is explained in **Table 3.7**

Historic Flooding section details the occurrences of historic flooding shown within and around the settlement in question.

Historic Surface Water Flooding — 5+ historic flooding events

Type	Occurrence	Comment
Surface	5 locations	Repeat occurrences - should be investigated further
Highways	6 locations	4 Occasional occurrences - may repeat. 2 Repeat occurrences - should be investigated further

Further explanation of all historic flooding events within and around the key settlement.

Future Flooding section outlines the results from the conversion of the Environment Agency's surface water flood map into a flagged system (see Section 3.1.2 for more detail)

Future Surface Water Flooding

222 properties at risk

Moderate number of properties located in surface water flood map 'less than' extent.

Box colour is explained in **Table 3.8**. Flag colour is explained in **Table 3.5** Number of properties taken from comparison of EA surface water flood map and NPD (RH analysis)

Overall Flooding section summarises the combined results for the settlement, accounting for both historic and future flooding.

Overall

Large number of historic flood events, many of which repeat and moderate number of properties at risk of future flooding. Eccleshall has been identified within Defra's analysis with a rank of 2,471and 20 properties at risk. A closer review of the historic flooding locations is recommended. This area would benefit from further investigation as part of a future Phase 2 SWMP or site specific assessments.

Box colour is explained in **Table 3.9** Text summarises the conclusions shown above, plus the results of Defra's analysis for the settlement.

Development Sites

Housing	Historic		Future	Summary
EC-1	(surface)	(highways)	None	
EC-2	Surface	Highways	Low/Intermediate	
EC-3	Surface	Highways	None	
EC-4	(surface)	(highways)	Low	
EC-5	(surface)	(highways)	None	

Notes: Brackets indicate proximity but not overlap

Summary of key **development sites** shown within the settlement.

Summary box colour is explained in **Table 3.9** as a combination of Historic and Future

Future box colour refers to the EA surface water flood map extent in which the development site is either wholly or partially located:
Green - overlap with 'Less' flood extent or no overlap
Yellow - overlap with 'Intermediate' flood extent.
Red - overlap with 'more' flood extent.

Recommendations

1. Review historic flooding locations in relation to any potential development sites and further investigation of repeat flooding.
2. Review the impact of development upon surface runoff and options for mitigation (for example, SUDS)
3. Review location of Environment Agency surface water flood map extents in relation to the proposed development sites.
4. Further assessment as part of a Phase 2 SWMP or site specific assessment.

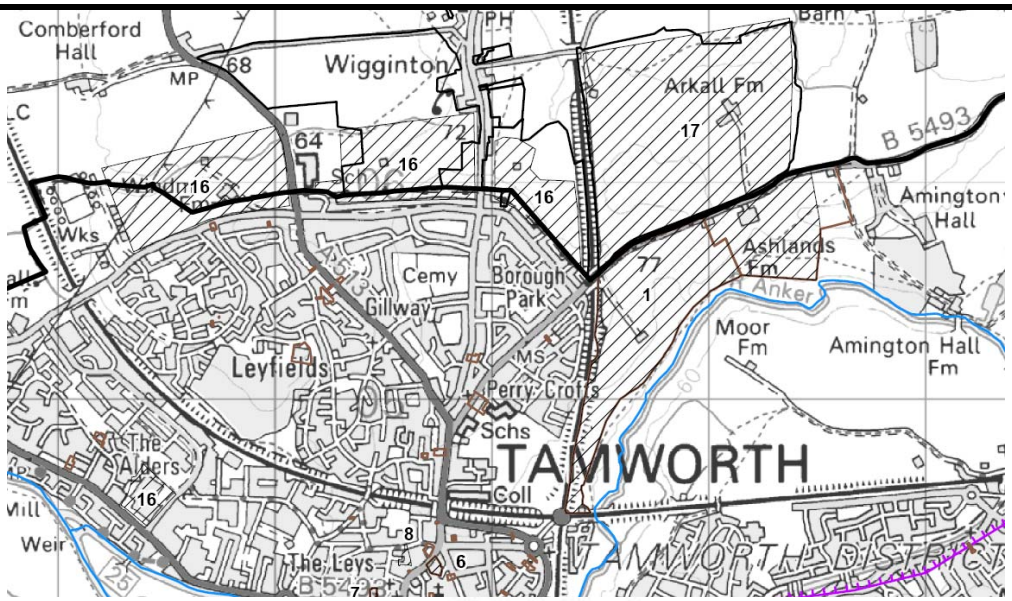
Recommendations are provided for the settlement as a whole.

Key
- Area should be investigated further as part of a Phase 2 SWMP or site specific study.
- Area would benefit from being investigated further as part of a Phase 2 SWMP. Development should be reviewed with reference to the surface flood maps.
- Based on current data no detailed further analyses required, although the topography of individual sites should be reviewed before development and all new development should utilise SUDS methods.

Historic box colour explained in **Table 3.7**

Key refers to the implications of each of the box colours.

Tamworth Borough - Tamworth North



Historic Surface Water Flooding — No specific historic flooding events (points)

Type	Occurrence	Comment
None		

Future Surface Water Flooding

3,426 properties at risk (whole of Tamworth)

High number of properties located in surface water flood map 'less than' extent.

Overall

No specific historic events, although fairly high potential that historic DG5 sewer floods have occurred within this area. Also high number of properties at risk of future flooding. Tamworth (as a whole) has been identified within Defra's analysis with a rank of 330 and 1000 properties at risk. It has also been identified within the Regional Flood Risk Appraisal as being at risk of surface water flooding. More detailed analysis of surface water flooding is required in addition to potential mitigation.

Development Sites

Housing	Historic	Future	Summary
1	None	Less/Intermediate	
Additional Sites			
16	None	Intermediate/More	
17	None	Less	

Notes: Brackets indicate proximity but not overlap

Recommendations

1. Review any potential development sites on individual basis before progression
2. Review the impact of development upon surface runoff and options for mitigation (for example, SUDS)
3. Review location of Environment Agency surface water flood map extents in relation to the proposed development sites.
4. Undertake Phase 2 SWMP modelling for the whole of Tamworth

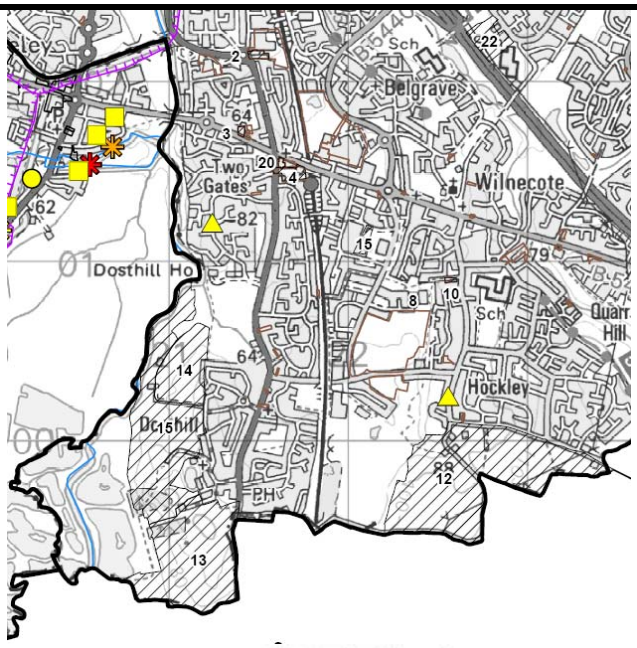
Key

Area should be investigated further as part of a Phase 2 SWMP or site specific study.

Area would benefit from being investigated further as part of a Phase 2 SWMP. Development should be reviewed with reference to the surface flood maps.

Based on current data no detailed further analyses required, although the topography of individual sites should be reviewed before development and all new development should utilise SUDS methods.

Tamworth Borough - Tamworth South



Historic Surface Water Flooding

5+ historic flooding events (some beyond Borough boundary)

Type	Occurrence	Comment
Highways	4 locations (west, Lichfield District)	Rare occurrence - may only occur during extreme events
Canal	1 location (west, Lichfield District)	Rare occurrence - may only occur during extreme events
Unknown	2 locations (west, Lichfield District)	Occasional - repeat occurrences - some areas require further investigation.
Sewer	2 locations (central and southeast)	Rare occurrence - may only occur during extreme events

Future Surface Water Flooding

3,426 properties at risk (whole of Tamworth)

High number of properties located in surface water flood map 'less than' extent.

Overall

Multiple historic flooding events and high number of properties at risk of future flooding. Tamworth (as a whole) has been identified within Defra's analysis with a rank of 330 and 1000 properties at risk. It has also been identified within the Regional Flood Risk Appraisal as being at risk of surface water flooding. More detailed analysis of surface water flooding is required in addition to potential mitigation.

Development Sites

Housing	Historic	Future	Summary
2	None	None	
3	None	None	
4	None	None	
10	None	None	
12	(sewers)	Less/Intermediate	
13	None	Less/Intermediate	
14	None	None	
15	None	Less/Intermediate	
20	None	None	
Employment			
8	None	None	
15	None	None	
22	None	None	

Notes: Brackets indicate proximity but not overlap

Recommendations

1. Review any potential development sites on individual basis before progression
2. Review the impact of development upon surface runoff and options for mitigation (for example, SUDS)
3. Review location of Environment Agency surface water flood map extents in relation to the proposed development sites.
4. Undertake Phase 2 SWMP modelling for the whole of Tamworth

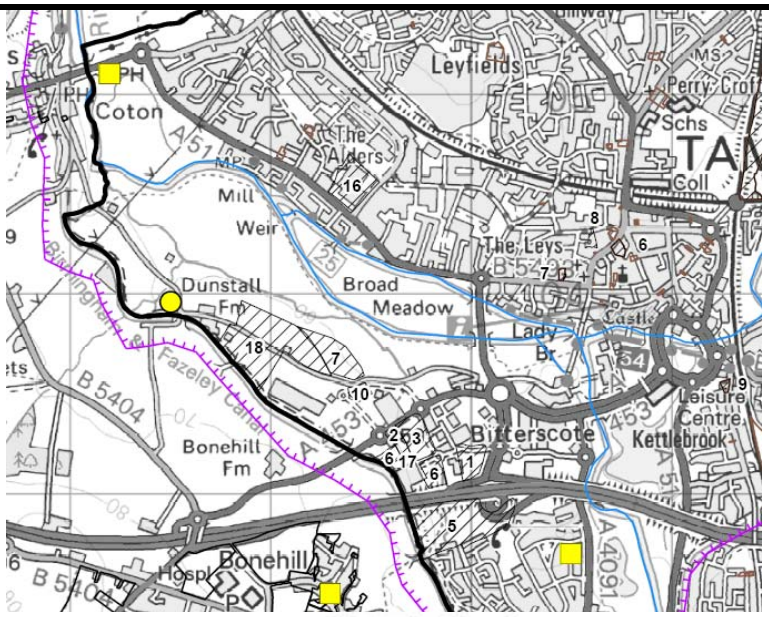
Key

Area should be investigated further as part of a Phase 2 SWMP or site specific study.

Area would benefit from being investigated further as part of a Phase 2 SWMP. Development should be reviewed with reference to the surface flood maps.

Based on current data no detailed further analyses required, although the topography of individual sites should be reviewed before development and all new development should utilise SUDS methods.

Tamworth Borough - Tamworth West



Historic Surface Water Flooding

4 historic flood events (one beyond Borough boundary)

Type	Occurrence	Comment
Highways	3 locations (northwest, southwest and south)	All rare occurrences - may not repeat
Canal	1 location (west)	Rare occurrence - may not repeat

Future Surface Water Flooding

3,426 properties at risk (whole of Tamworth)

High number of properties located in surface water flood map 'less than' extent.

Overall

A number of specific historic events, although all 'rare' in occurrence they may repeat in extreme events. Also high number of properties at risk of future flooding. Tamworth (as a whole) has been identified within Defra's analysis with a rank of 330 and 1000 properties at risk. It has also been identified within the Regional Flood Risk Appraisal as being at risk of surface water flooding. More detailed analysis of surface water flooding is required in addition to potential mitigation.

Development Sites

Housing	Historic	Future	Summary
6	None	None	
7	None	None	
8	None	None	
9	None	None	
Employment			
1	None	Intermediate	
2	None	Less	
3	None	Intermediate	
5	(Highways)	Intermediate/More	
6	None	Intermediate	
7	None	Less	
10	None	Less	
16	None	None	
17	None	Less/Intermediate	
18	(Canal)	Less/Intermediate	

Notes: Brackets indicate proximity but not overlap

Recommendations

1. Review any potential development sites on individual basis before progression.
2. Review the impact of development upon surface runoff and options for mitigation (for example, SUDS).
3. Review location of Environment Agency surface water flood map extents in relation to the proposed development sites.
4. Undertake Phase 2 SWMP modelling for the whole of Tamworth.

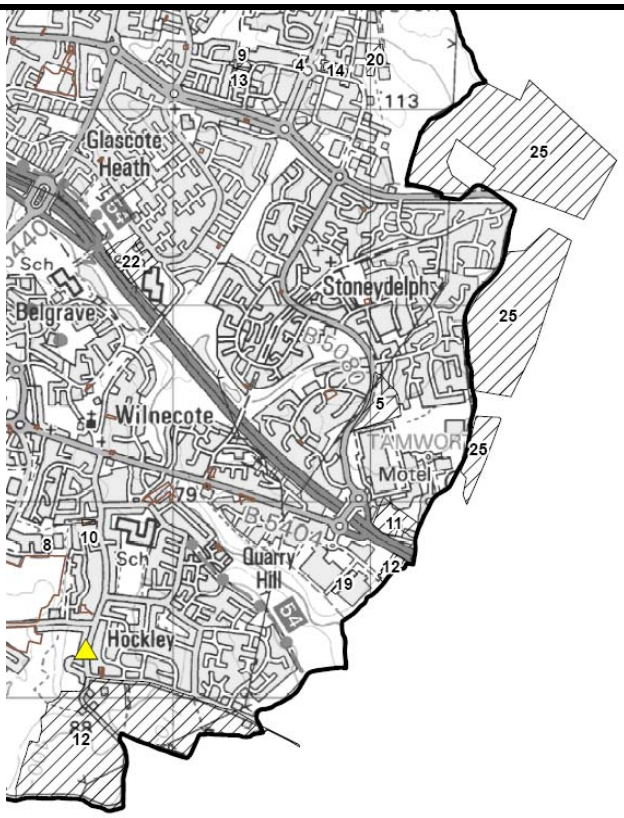
Key

Area should be investigated further as part of a Phase 2 SWMP or site specific study.

Area would benefit from being investigated further as part of a Phase 2 SWMP. Development should be reviewed with reference to the surface flood maps.

Based on current data no detailed further analyses required, although the topography of individual sites should be reviewed before development and all new development should utilise SUDS methods.

Tamworth Borough - Tamworth East



Rivers
Canal
Potential Development Sites
Potential Housing and Employment Sites

Historic Flooding
Types of Flooding
- Surface Water
- Canal
- Artifical Drainag
- Highways
- Sewer
- Groundwater
- Unknown

Historic Flooding Recurrance
- Exceptional
- Rare
- Occasional
- Repeat

Historic Surface Water Flooding

No historic flood events (points)

Type	Occurrence	Comment
Sewer	1 On map???	

Future Surface Water Flooding

3,426 properties at risk (whole of Tamworth)

High number of properties located in surface water flood map 'less than' extent.

Overall

No specific historic flooding events but high number of properties at risk of future flooding. Tamworth (as a whole) has been identified within Defra's analysis with a rank of 330 and 1000 properties at risk. It has also been identified within the Regional Flood Risk Appraisal as being at risk of surface water flooding. More detailed analysis of surface water flooding is required in addition to potential mitigation.

Development Sites

Housing	Historic	Future	Summary
5	None	None	
12	(sewer)	Less/Intermediate	
Additional			
25	None	Less/Intermediate	
Employment			
4	None	None	
9	None	None	
11	None	More	
12	None	None	
13	None	None	
14	None	None	
19	None	Less	
20	None	None	
22	None	None	
21	None	None	

Notes: Brackets indicate proximity but not overlap

Recommendations

1. Review any potential development sites on individual basis before progression.
2. Review the impact of development upon surface runoff and options for mitigation (for example, SUDS).
3. Review location of Environment Agency surface water flood map extents in relation to the proposed development sites.
4. Undertake Phase 2 SWMP modelling for the whole of Tamworth.

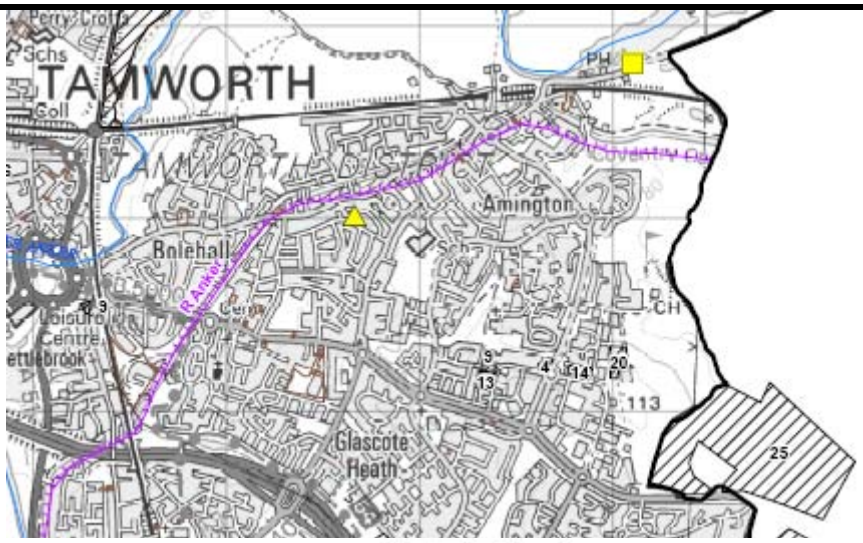
Key

Area should be investigated further as part of a Phase 2 SWMP or site specific study.

Area would benefit from being investigated further as part of a Phase 2 SWMP. Development should be reviewed with reference to the surface flood maps.

Based on current data no detailed further analyses required, although the topography of individual sites should be reviewed before development and all new development should utilise SUDS methods.

Tamworth Borough - Tamworth Central



Historic Surface Water Flooding — 2 historic flood events

Type	Occurrence	Comment
Highways	2 locations (central and northeast)	Rare occurrence - may only occur during extreme events
Sewer	1 on map????	

Future Surface Water Flooding

3,426 properties at risk (whole of Tamworth)

High number of properties located in surface water flood map 'less than' extent.

Overall

Relatively minor specific historic flooding events but high number of properties at risk of future flooding. Tamworth (as a whole) has been identified within Defra's analysis with a rank of 330 and 1000 properties at risk. It has also been identified within the Regional Flood Risk Appraisal as being at risk of surface water flooding. More detailed analysis of surface water flooding is required in addition to potential mitigation.

Development Sites

Housing	Historic	Future	Summary
1	None	Less/Intermediate	
Additional			
25	None	Less/Intermediate	
Employment			
4	None	None	
9	None	None	
13	None	None	
14	None	None	
20	None	None	
22	None	None	

Notes: Brackets indicate proximity but not overlap

Recommendations

1. Review any potential development sites on individual basis before progression.
2. Review the impact of development upon surface runoff and options for mitigation (for example, SUDS).
3. Review location of Environment Agency surface water flood map extents in relation to the proposed development sites.
4. Undertake Phase 2 SWMP modelling for the whole of Tamworth.

Key

Area should be investigated further as part of a Phase 2 SWMP or site specific study.

Area would benefit from being investigated further as part of a Phase 2 SWMP. Development should be reviewed with reference to the surface flood maps.

Based on current data no detailed further analyses required, although the topography of individual sites should be reviewed before development and all new development should utilise SUDS methods.

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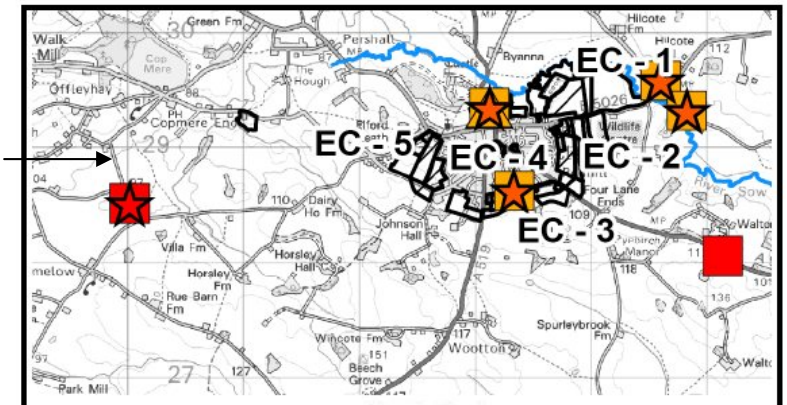
ROYAL HASKONING

Appendix G
South Staffordshire District Summary Sheets

Summary Sheet Explanation

ROYAL HASKONING

Snapshot of key settlement, taken from **Figures B1 - B5**.



Map key, taken from **Figures B1 - B5**.

Rivers
Canal
Potential Development Sites
Potential Housing and Employment Sites

Historic Flooding Types of Flooding
- Surface Water
- Canal
- Artifical Drainag
- Highways
- Sewer
- Groundwater
- Unknown

Historic Flooding Recurrance
- Exceptional
- Rare
- Occasional
- Repeat

Number of historic flooding occurrences marked as points on the map snapshot shown above. Colour code is explained in **Table 3.7**

Historic Flooding section details the occurrences of historic flooding shown within and around the settlement in question.

Historic Surface Water Flooding — 5+ historic flooding events

Type	Occurrence	Comment
Surface	5 locations	Repeat occurrences - should be investigated further
Highways	6 locations	4 Occasional occurrences - may repeat. 2 Repeat occurrences - should be investigated further

Further explanation of all historic flooding events within and around the key settlement.

Future Flooding section outlines the results from the conversion of the Environment Agency's surface water flood map into a flagged system (see Section 3.1.2 for more detail)

Future Surface Water Flooding

222 properties at risk

Moderate number of properties located in surface water flood map 'less than' extent.

Box colour is explained in **Table 3.8**. Flag colour is explained in **Table 3.5** Number of properties taken from comparison of EA surface water flood map and NPD (RH analysis)

Overall Flooding section summarises the combined results for the settlement, accounting for both historic and future flooding.

Overall

Large number of historic flood events, many of which repeat and moderate number of properties at risk of future flooding. Eccleshall has been identified within Defra's analysis with a rank of 2,471and 20 properties at risk. A closer review of the historic flooding locations is recommended. This area would benefit from further investigation as part of a future Phase 2 SWMP or site specific assessments.

Box colour is explained in **Table 3.9** Text summarises the conclusions shown above, plus the results of Defra's analysis for the settlement.

Development Sites

Housing	Historic		Future	Summary
EC-1	(surface)	(highways)	None	
EC-2	Surface	Highways	Low/Intermediate	
EC-3	Surface	Highways	None	
EC-4	(surface)	(highways)	Low	
EC-5	(surface)	(highways)	None	

Notes: Brackets indicate proximity but not overlap

Summary of key **development sites** shown within the settlement.

Summary box colour is explained in **Table 3.9** as a combination of Historic and Future

Future box colour refers to the EA surface water flood map extent in which the development site is either wholly or partially located:
Green - overlap with 'Less' flood extent or no overlap
Yellow - overlap with 'Intermediate' flood extent.
Red - overlap with 'more' flood extent.

Recommendations

1. Review historic flooding locations in relation to any potential development sites and further investigation of repeat flooding.
2. Review the impact of development upon surface runoff and options for mitigation (for example, SUDS)
3. Review location of Environment Agency surface water flood map extents in relation to the proposed development sites.
4. Further assessment as part of a Phase 2 SWMP or site specific assessment.

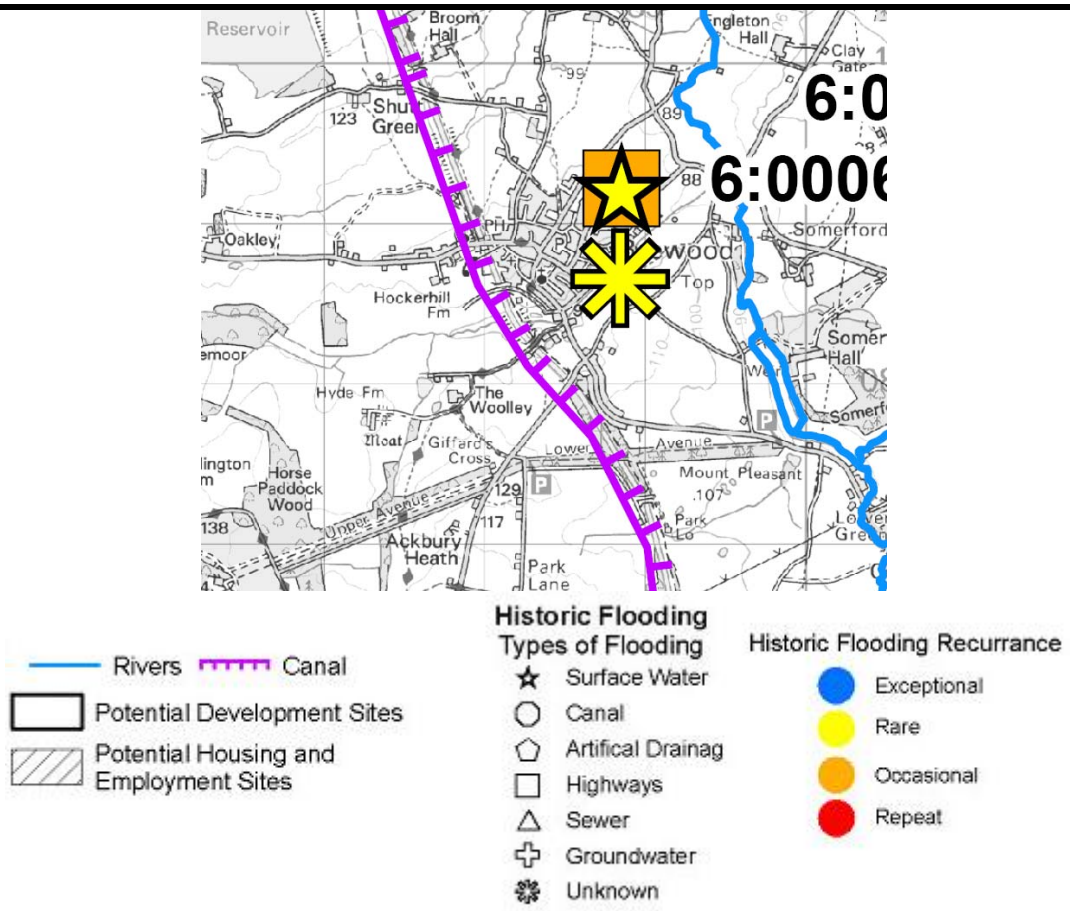
Recommendations are provided for the settlement as a whole.

Key
- Area should be investigated further as part of a Phase 2 SWMP or site specific study.
- Area would benefit from being investigated further as part of a Phase 2 SWMP. Development should be reviewed with reference to the surface flood maps.
- Based on current data no detailed further analyses required, although the topography of individual sites should be reviewed before development and all new development should utilise SUDS methods.

Historic box colour explained in **Table 3.7**

Key refers to the implications of each of the box colours.

South Staffordshire District - Brewood



Historic Surface Water Flooding — 3 historic flooding events

Type	Occurrence	Comment
Surface	1 locations (northeast)	Rare occurrence - may only occur during extreme events
Highways	1 location (northeast)	Occasional occurrence - may repeat
Unknown	1 locations (east)	Rare occurrences - may only occur during extreme events

Future Surface Water Flooding

147 properties at risk

Moderate number of properties located in surface water flood map 'less than' extent.

Overall

A few historic flood events located in a similar area and a moderate number of properties at risk of future flooding. Brewood has been identified within Defra's analysis with a rank of 1,655 and 70 properties at risk. A closer review of historic and potential flooding and mitigation of surface water runoff from potential development sites is recommended.

Development Sites

No Key Sites

Recommendations

1. Review the area affected by the historical flood events
2. Review the impact of development upon surface runoff and options for mitigation (for example, SUDS)
3. Review location of Environment Agency surface water flood map extents in relation to the proposed development sites.

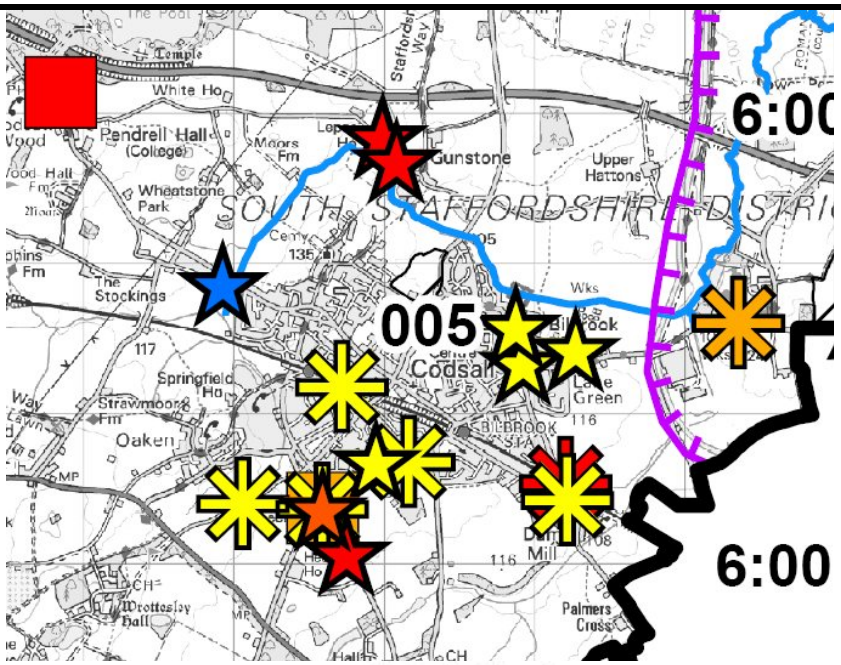
Key

Area should be investigated further as part of a Phase 2 SWMP or site specific study.

Area would benefit from being investigated further as part of a Phase 2 SWMP. Development should be reviewed with reference to the surface flood maps.

Based on current data no detailed further analyses required, although the topography of individual sites should be reviewed before development and all new development should utilise SUDS methods.

South Staffordshire District - Codsall



Historic Surface Water Flooding 5+ historic flooding events

Type	Occurrence	Comment
Surface	9 locations	Exceptional to repeat occurrences - areas experiencing multiple events or repeat occurrences should be investigated further
Highways	2 locations (south and northwest)	Occasional occurrence - may repeat (south) Repeat occurrence - should be investigated further (north)
Unknown	6 locations	Rare to Occasional occurrences - areas affected should be reviewed although flooding may only occur during extreme events.

Future Surface Water Flooding

	359 properties at risk	Moderate to High number of properties located in surface water flood map 'less than' extent.

Overall

High number of historic flood events and moderate/high number of properties at risk of future flooding. Codsall has been identified within Defra's analysis with a rank of 1,316 and 120 properties at risk. A closer review of historic and potential flooding and mitigation of surface water runoff from potential development sites is recommended.

Development Sites

Housing	Historic		Future	Summary
005	(Surface)	(Unknown)	Low/Intermediate	

Notes: Brackets indicate proximity but not overlap

Recommendations

1. Review the area affected by the historical flood events
2. Review the impact of development upon surface runoff and options for mitigation (for example, SUDS)
3. Review location of Environment Agency surface water flood map extents in relation to the proposed development sites.
4. Investigate the repeat historical flood events further
5. Review this area within a future Phase 2 SWMP

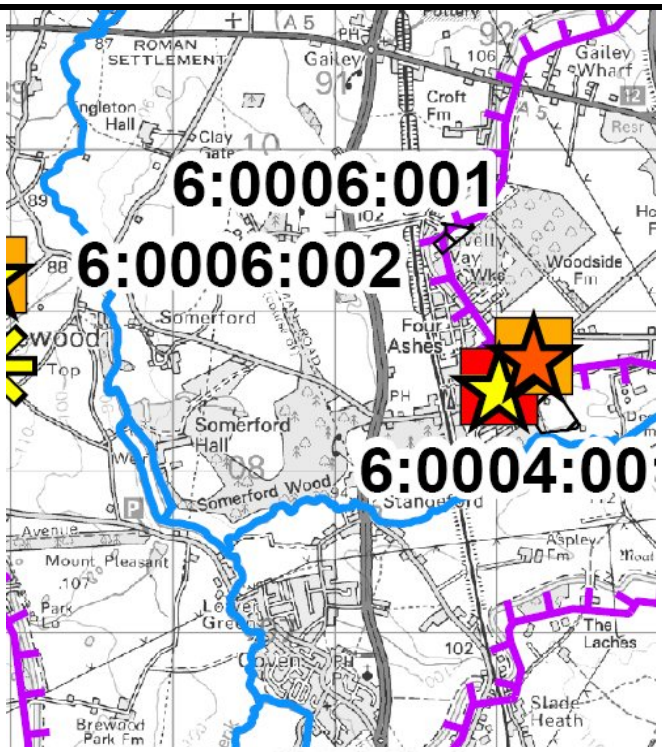
Key

Area should be investigated further as part of a Phase 2 SWMP or site specific study.

Area would benefit from being investigated further as part of a Phase 2 SWMP. Development should be reviewed with reference to the surface flood maps.

Based on current data no detailed further analyses required, although the topography of individual sites should be reviewed before development and all new development should utilise SUDS methods.

South Staffordshire District - Coven and Four Ashes



Historic Surface Water Flooding — 4 historic flooding events

Type	Occurrence	Comment
Surface	2 locations	Rare and Repeat occurrences - rare occurrences may only occur during extreme events, repeat occurrences should be investigated further
Highways	2 locations	Occasional to Repeat occurrences - occasional may repeat, repeat occurrences should be investigated further.

Future Surface Water Flooding

313 properties at risk

Moderate number of properties located in surface water flood map 'less than' extent.

Overall

A number of historic flood events and moderate number of properties at risk of future flooding. Coven has been identified within Defra's analysis with a rank of 1,933 and 50 properties at risk. A closer review of historic and potential flooding and mitigation of surface water runoff from potential development sites is recommended. As all the historic flooding events occur in proximity to each other a review of this area is recommended.

Development Sites

Employment	Historic		Future	Summary
6:0004:001	Surface	Highways	Intermediate	
6:0006:002	None		None	
6:0006:001	None		Low	
44055	Surface	Highways	Intermediate	
44056	Highways	(surface)	Low	

Recommendations

1. Review the area affected by the historical flood events
2. Review the impact of development upon surface runoff and options for mitigation (for example, SUDS)
3. Review location of Environment Agency surface water flood map extents in relation to the proposed development sites.
4. Investigate the repeat historical flood events further

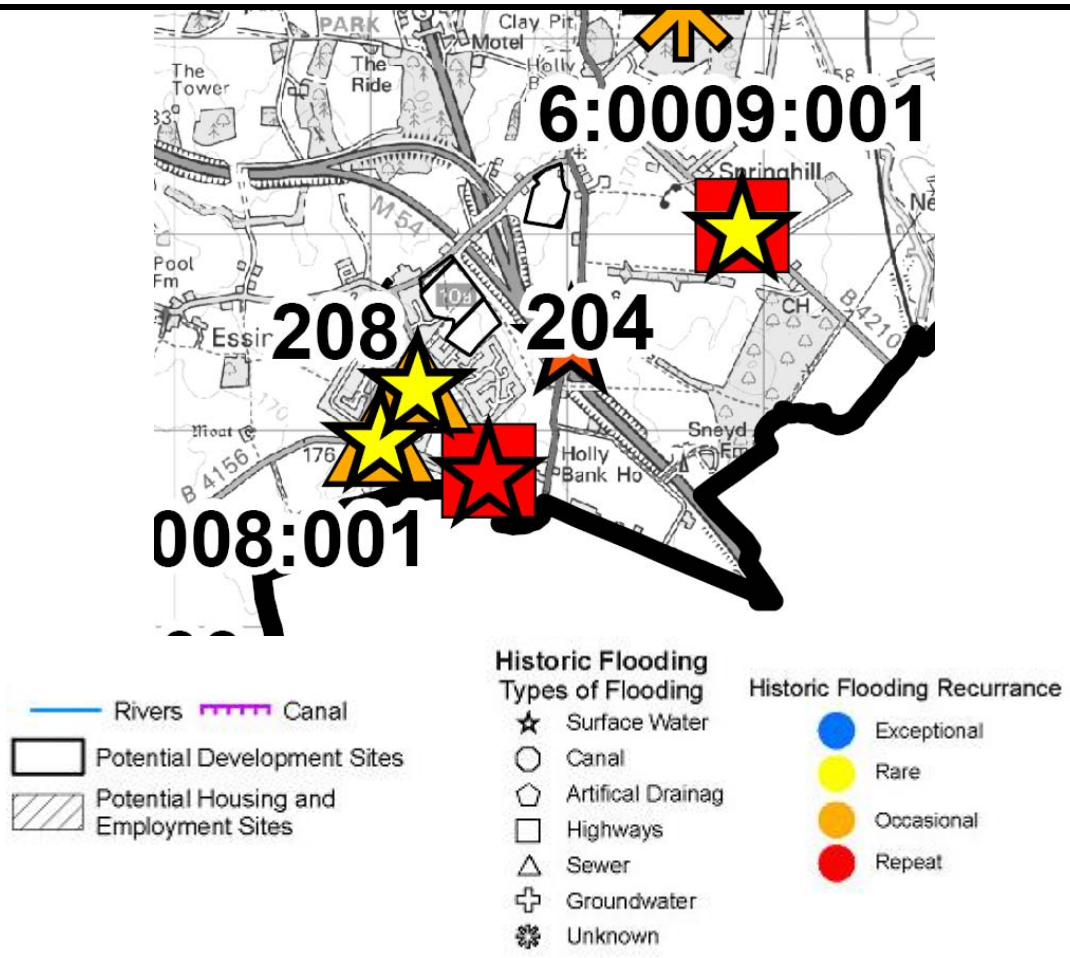
Key

Area should be investigated further as part of a Phase 2 SWMP or site specific study.

Area would benefit from being investigated further as part of a Phase 2 SWMP. Development should be reviewed with reference to the surface flood maps.

Based on current data no detailed further analyses required, although the topography of individual sites should be reviewed before development and all new development should utilise SUDS methods.

South Staffordshire District - Essington



Historic Surface Water Flooding — 5+ historic flooding events

Type	Occurrence	Comment
Surface	5 locations	Rare and Repeat occurrences - rare occurrences may not repeat, repeat occurrences should be investigated further
Highways	2 locations	Repeat occurrences - should be investigated further.
Unknown	1 location	Occasional occurrences - may repeat
Sewer	2 locations	Occasional occurrences - may repeat

Future Surface Water Flooding

20 properties at risk

Very low number of properties located in surface water flood map 'less than' extent.

Overall

A high number of historic flood events but very low number of properties at risk of future flooding. This are has not been identified within Defra's analysis. A closer review of the historic flooding locations and mitigation of surface water runoff from potential development sites is recommended.

Development Sites

Housing	Historic		Future	Summary
204	(surface)	(sewer)	None	
208	(surface)	(sewer)	None	
Employment 6:0009:001	(surface)		Intermediate	

Notes: Brackets indicate proximity but not overlap

Recommendations

1. Review the area affected by the historical flood events
2. Review the impact of development upon surface runoff and options for mitigation (for example, SUDS)
3. Review location of Environment Agency surface water flood map extents in relation to the proposed development sites.
4. Investigate the repeat historical flood events further

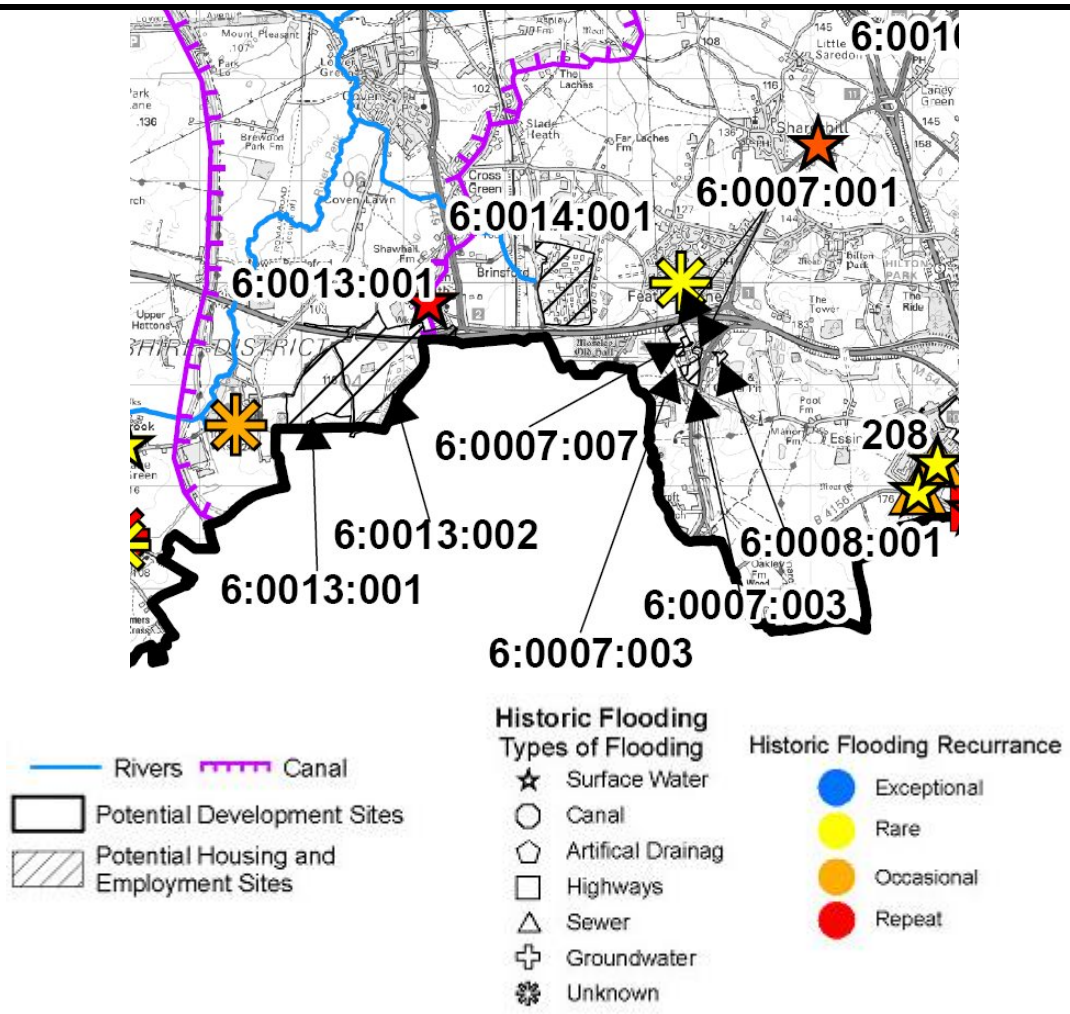
Key

Area should be investigated further as part of a Phase 2 SWMP or site specific study.

Area would benefit from being investigated further as part of a Phase 2 SWMP. Development should be reviewed with reference to the surface flood maps.

Based on current data no detailed further analyses required, although the topography of individual sites should be reviewed before development and all new development should utilise SUDS methods.

South Staffordshire District - Featherstone, Brinsford and Coven Heath



Historic Surface Water Flooding — 4 historic flooding events

Type	Occurrence	Comment
Surface	2 locations	Repeat occurrences - should be investigated further
Unknown	2 locations	Rare occurrence - may only occur during extreme events (east) Occasional occurrence - may repeat (west)

Future Surface Water Flooding

287 properties at risk

Moderate number of properties located in surface water flood map 'less than' extent.

Overall

A couple of historic flood events and moderate number of properties at risk of future flooding. Featherstone has been identified within Defra's analysis with a rank of 2,856 and 10 properties at risk. Featherstone prison has also been identified with a rank of 2,598 and 20 houses at risk. A closer review of the historic flooding locations and mitigation of surface water runoff from potential development sites is recommended.

Development Sites

Employment	Historic	Future	Summary
6:0007:001	(unknown)	Intermediate	
6:00014:001	None	Intermediate/More	
6:0013:001	(unknown)	More	
6:0013:002	(surface)	More	
6:0007:006	(unknown)	Low	
6:0007:007	(unknown)	None	
6:0007:003	(unknown)	None	
6:0008:001	(unknown)	Low	

Notes: Brackets indicate proximity but not overlap

Recommendations

1. Review the impact of development upon surface runoff and options for mitigation (for example, SUDS)
2. Review location of Environment Agency surface water flood map extents in relation to the proposed development sites.
3. Investigate the repeat historical flood event further

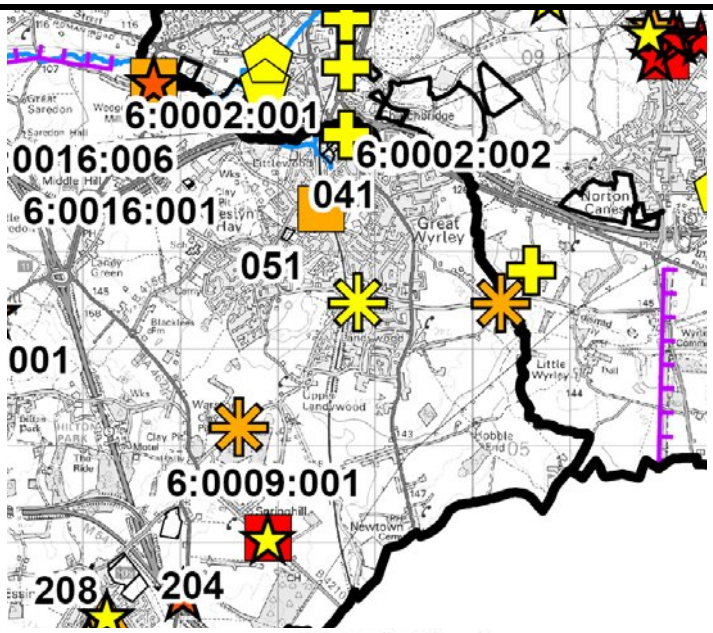
Key

Area should be investigated further as part of a Phase 2 SWMP or site specific study.

Area would benefit from being investigated further as part of a Phase 2 SWMP. Development should be reviewed with reference to the surface flood maps.

Based on current data no detailed further analyses required, although the topography of individual sites should be reviewed before development and all new development should utilise SUDS methods.

South Staffordshire District - Great Wyrley and Cheslyn Heath



Rivers
Canal
Potential Development Sites
Potential Housing and Employment Sites

Historic Flooding
Types of Flooding
- Surface Water
- Canal
- Artifical Drainag
- Highways
- Sewer
- Groundwater
- Unknown

Historic Flooding Recurrance
- Exceptional
- Rare
- Occasional
- Repeat

Historic Surface Water Flooding — 5+ historic flooding events

Type	Occurrence	Comment
Surface	4 locations	Rare and Repeat occurrences - rare may only occur in extreme events, repeat require further investigation.
Artificial Drainage	2 locations (north)	Rare occurrences - may only occur during extreme events
Highways	3 location	Occasional and Repeat occurrences - occasional may repeat, repeat should be investigated further
Groundwater	3 locations	Rare occurrences - may only occur during extreme events
Unknown	3 locations	Rare occurrences - may only occur during extreme events Occasional occurrences - may repeat

Future Surface Water Flooding

940 properties at risk

Moderate/High number of properties located in surface water flood map 'less than' extent.

Overall

Large number of historic flood events and moderate to high number of properties at risk of future flooding. Great Wyrley has been identified within Defra's analysis with a rank of 583 and 470 properties at risk. A closer review of the historic flooding locations and mitigation of surface water runoff from potential development sites is recommended. This area may benefit from further investigation as part of a future Phase 2 SWMP.

Development Sites

Housing	Historic		Future	Summary
040	Highways		Low	
041	Groundwater	(Highways)	More	
051	(Highways)		None	

Employment	Historic		Future	Summary
6:0002:001	Groundwater	(Highways)	More	
6:0002:002	Groundwater	(Highways)	Low	
6:0016:001	None		None	
6:0016:006	None		None	

Notes: Brackets indicate proximity but not overlap

Recommendations

1. Review historic flooding locations in relation to any potential development sites
2. Review the impact of development upon surface runoff and options for mitigation (for example, SUDS)
3. Review location of Environment Agency surface water flood map extents in relation to the proposed development sites.
4. Further assessment as part of a Phase 2 SWMP or site specific assessments may assist in locating development.

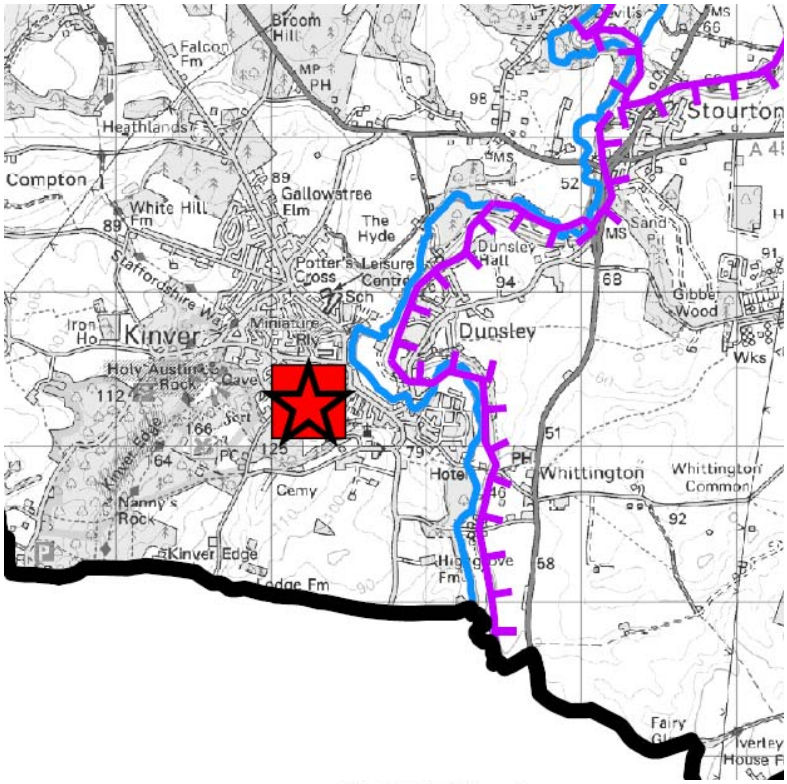
Key

Area should be investigated further as part of a Phase 2 SWMP or site specific study.

Area would benefit from being investigated further as part of a Phase 2 SWMP. Development should be reviewed with reference to the surface flood maps.

Based on current data no detailed further analyses required, although the topography of individual sites should be reviewed before development and all new development should utilise SUDS methods.

South Staffordshire District - Kinver



Historic Surface Water Flooding — 2 historic flooding events

Type	Occurrence	Comment
Surface Water	1 location	Repeat occurrence - requires further investigation
Highways	1 location	Repeat occurrence - requires further investigation

Future Surface Water Flooding

331 properties at risk

Moderate number of properties located in surface water flood map 'less than' extent.

Overall

Few historic flood events but one location in particular is affected by repeat events from multiple sources. Moderate number of properties at risk of future flooding. Kinver has been identified within Defra's analysis with a rank of 1,143 and 160 properties at risk. A closer review of the historic flooding locations and mitigation of surface water runoff from potential development sites is recommended.

Development Sites

No Key Sites

Recommendations

1. Investigate historic flooding sources further.
2. Review the impact of development upon surface runoff and options for mitigation (for example, SUDS)
3. Review location of Environment Agency surface water flood map extents in relation to the proposed development sites.

Key

Area should be investigated further as part of a Phase 2 SWMP or site specific study.

Area would benefit from being investigated further as part of a Phase 2 SWMP. Development should be reviewed with reference to the surface flood maps.

Based on current data no detailed further analyses required, although the topography of individual sites should be reviewed before development and all new development should utilise SUDS methods.

South Staffordshire District - Pattingham

Historic Surface Water Flooding — 3 historic flooding events

Type	Occurrence	Comment
Surface	1 locations	Rare occurrence - may only occur during extreme events
Highways	1 location	Repeat occurrence - requires further investigation
Sewer	1 location	Repeat occurrence - requires further investigation

Future Surface Water Flooding

18 properties at risk

Very low number of properties located in surface water flood map 'less than' extent.

Overall

Low number of historic flooding events but all located in the same place with some registered as repeating occurrences. This area should be investigated further. Very low number of properties at risk of future flooding from surface water flood map extents. Great Wyrley has been identified within Defra's analysis with a rank of 3,790 and 0 properties at risk. A closer review of the historic flooding locations and mitigation of surface water runoff from potential development sites is recommended.

Development Sites

No Key Sites

Recommendations

1. Investigate historic flooding events further.
2. Review the impact of development upon surface runoff and options for mitigation (for example, SUDS)
3. Review location of Environment Agency surface water flood map extents in relation to the proposed development sites.

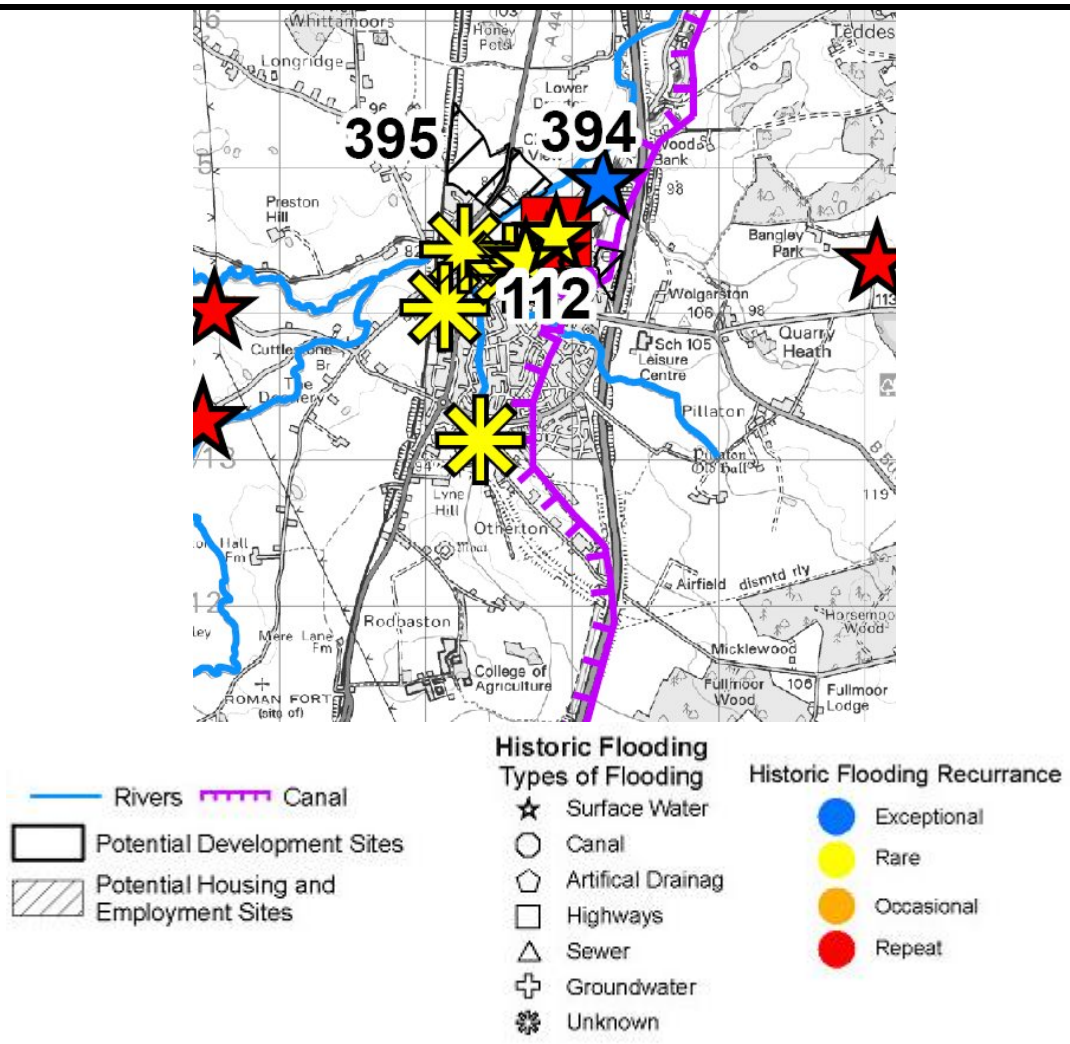
Key

Area should be investigated further as part of a Phase 2 SWMP or site specific study.

Area would benefit from being investigated further as part of a Phase 2 SWMP. Development should be reviewed with reference to the surface flood maps.

Based on current data no detailed further analyses required, although the topography of individual sites should be reviewed before development and all new development should utilise SUDS methods.

South Staffordshire District - Penkridge



Historic Surface Water Flooding — 5+ historic flooding events

Type	Occurrence	Comment
Surface	7 locations	Exception to repeat occurrences - repeat events should be investigated further
Highways	1 location	Repeat occurrence - should be investigated further
Unknown	4 locations	Rare occurrence - may not repeat or only occur in extreme events

Future Surface Water Flooding

377 properties at risk

Moderate/High number of properties located in surface water flood map 'less than' extent.

Overall

Large number of historic flood events and moderate to high number of properties at risk of future flooding. Penkridge has been identified within Defra's analysis with a rank of 1,211 and 140 properties at risk. A closer review of the historic flooding locations and mitigation of surface water runoff from potential development sites is recommended. This area would benefit from further investigation as part of a future Phase 2 SWMP.

Development Sites

Housing	Historic			Future	Summary
395	(surface)	(unknown)	(highways)	Low/Intermediate	
394	(surface)	(unknown)	(highways)	Low/Intermediate	
112	(surface)	(unknown)	(highways)	Low	

Notes: Brackets indicate proximity but not overlap

Recommendations

1. Review historic flooding locations in relation to any potential development sites
2. Review the impact of development upon surface runoff and options for mitigation (for example, SUDS)
3. Review location of Environment Agency surface water flood map extents in relation to the proposed development sites.
4. Further assessment as part of a Phase 2 SWMP

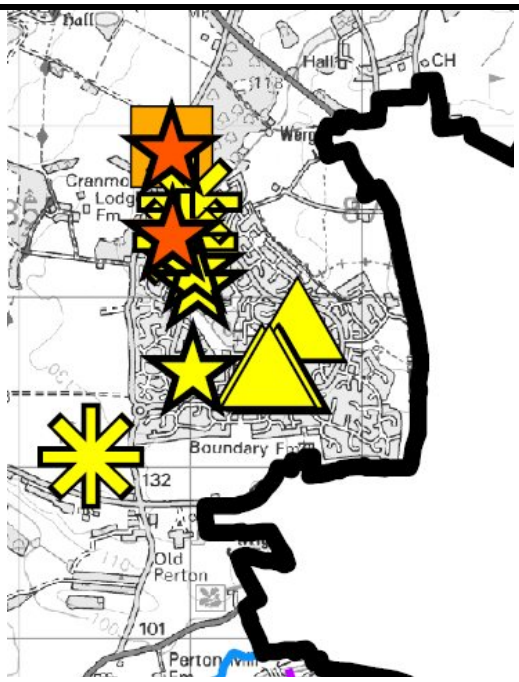
Key

Area should be investigated further as part of a Phase 2 SWMP or site specific study.

Area would benefit from being investigated further as part of a Phase 2 SWMP. Development should be reviewed with reference to the surface flood maps.

Based on current data no detailed further analyses required, although the topography of individual sites should be reviewed before development and all new development should utilise SUDS methods.

South Staffordshire District - Perton



Rivers
Canal
Potential Development Sites
Potential Housing and Employment Sites

Historic Flooding
Types of Flooding
- Surface Water
- Canal
- Artifical Drainag
- Highways
- Sewer
- Groundwater
- Unknown

Historic Flooding Recurrance
- Exceptional
- Rare
- Occasional
- Repeat

Historic Surface Water Flooding — 5+ historic flooding events

Type	Occurrence	Comment
Surface	5 locations	Rare to repeat occurrences - rare events may only occur in extreme events, repeat events should be investigated further
Highways	1 location	Occasional occurrence - may repeat
Unknown	3 locations	Rare occurrence - may only occur in extreme events
Sewer	4 locations	Rare occurrence but multiple events in small area - may require further investigation

Future Surface Water Flooding

1,160 properties at risk

High number of properties located in surface water flood map 'less than' extent.

Overall

Large number of historic flood events and high number of properties at risk of future flooding. Perton has not been identified within Defra's analysis. A closer review of the historic flooding locations and mitigation of surface water runoff from any potential development sites is recommended. This area would benefit from further investigation as part of a future Phase 2 SWMP or site specific assessments.

Development Sites

No Key Sites

Recommendations

1. Review historic flooding locations in relation to any potential development sites
2. Review the impact of development upon surface runoff and options for mitigation (for example, SUDS)
3. Review location of Environment Agency surface water flood map extents in relation to the proposed development sites.
4. Further assessment as part of a Phase 2 SWMP or site specific assessments

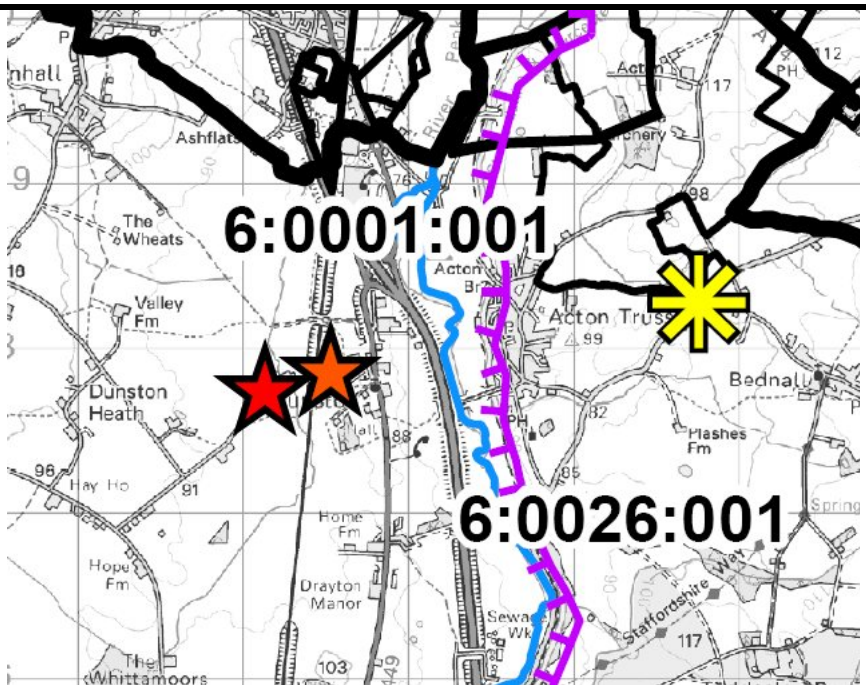
Key

Area should be investigated further as part of a Phase 2 SWMP or site specific study.

Area would benefit from being investigated further as part of a Phase 2 SWMP. Development should be reviewed with reference to the surface flood maps.

Based on current data no detailed further analyses required, although the topography of individual sites should be reviewed before development and all new development should utilise SUDS methods.

South Staffordshire District - South of Stafford



Historic Surface Water Flooding — 3 historic flooding events

Type	Occurrence	Comment
Surface	2 locations	Occasional and Repeat occurrences within a small geographical area - these may be linked and should be investigated further.
Unknown	1 locations	Rare occurrence - may not repeat or only occur in extreme events

Future Surface Water Flooding

57 properties at risk

High number of properties located in surface water flood map 'less than' extent.

Overall

Low number of historic flood events and properties at risk of future flooding. Acton Trussell has been identified within Defra's analysis as having a rank of 3,269 and fewer than 10 properties at risk. A closer review of the repeat historic flooding locations and mitigation of surface water runoff from potential development sites is recommended.

Development Sites

Employment	Historic	Future	Summary
6:0001:001	(surface)	Intermediate	
6:0026:001	None	None	

Notes: Brackets indicate proximity but not overlap

Recommendations

1. Further assessment of repeat flooding event
2. Review historic flooding locations in relation to any potential development sites
3. Review the impact of development upon surface runoff and options for mitigation (for example, SUDS)
4. Review location of Environment Agency surface water flood map extents in relation to the proposed development sites.

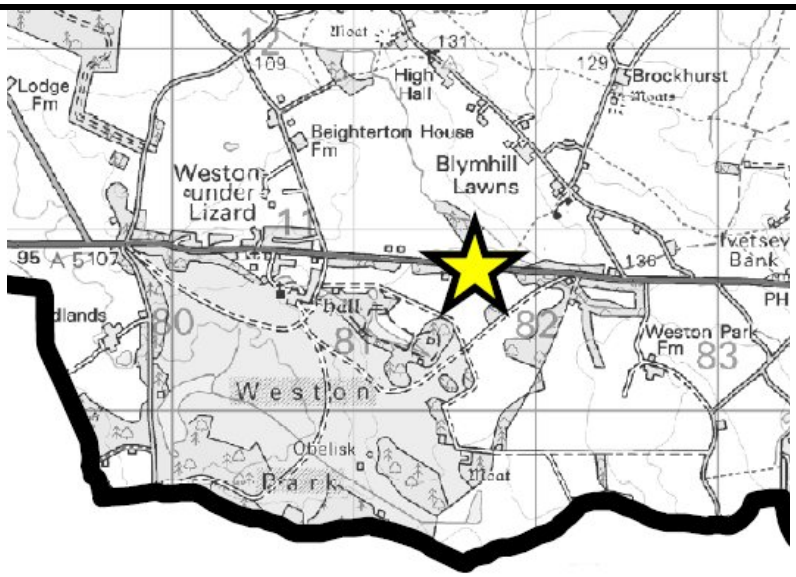
Key

Area should be investigated further as part of a Phase 2 SWMP or site specific study.

Area would benefit from being investigated further as part of a Phase 2 SWMP. Development should be reviewed with reference to the surface flood maps.

Based on current data no detailed further analyses required, although the topography of individual sites should be reviewed before development and all new development should utilise SUDS methods.

South Staffordshire District - Weston



Rivers
Canal
Potential Development Sites
Potential Housing and Employment Sites

Historic Flooding
Types of Flooding
- Surface Water
- Canal
- Artifical Drainag
- Highways
- Sewer
- Groundwater
- Unknown

Historic Flooding Recurrance
- Exceptional
- Rare
- Occasional
- Repeat

Historic Surface Water Flooding — 1 rare historic flooding event

Type	Occurrence	Comment
Surface	1 locations	Rare occurrence - may not repeat or only occur in extreme events

Future Surface Water Flooding

31 properties at risk

Low number of properties located in surface water flood map 'less than' extent.

Overall

Low number of historic flood events and properties at risk of future flooding. This area has not been identified within Defra's analysis. A review of method to mitigate surface water runoff from potential development sites is recommended.

Development Sites

No Key Sites

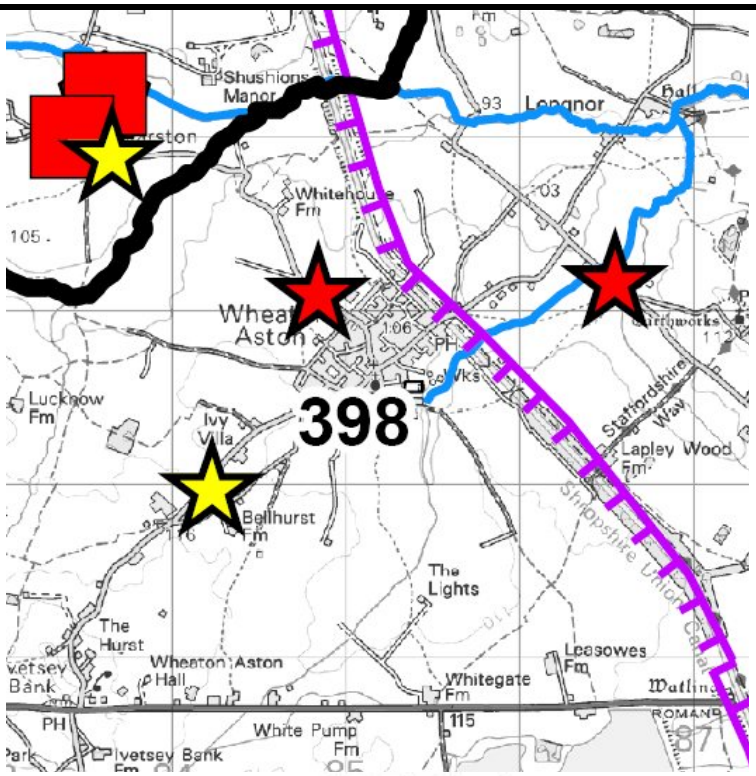
Recommendations

1. Review the impact of development upon surface runoff and options for mitigation (for example, SUDS)
2. Review location of Environment Agency surface water flood map extents in relation to the proposed development sites.

Key

	Area should be investigated further as part of a Phase 2 SWMP or site specific study.
	Area would benefit from being investigated further as part of a Phase 2 SWMP. Development should be reviewed with reference to the surface flood maps.
	Based on current data no detailed further analyses required, although the topography of individual sites should be reviewed before development and all new development should utilise SUDS methods.

South Staffordshire District - Wheaton Aston



Rivers
Canal
Potential Development Sites
Potential Housing and Employment Sites

Historic Flooding

Types of Flooding
- Surface Water
- Canal
- Artifical Drainag
- Highways
- Sewer
- Groundwater
- Unknown

Historic Flooding Recurrance
- Exceptional
- Rare
- Occasional
- Repeat

Historic Surface Water Flooding — 3 historic flooding events

Type	Occurrence	Comment
Surface	3 locations	Rare to Repeat occurrences - rare events may not repeat or only occur in extreme events, repeat events should be investigated further.

Future Surface Water Flooding

28 properties at risk

Low number of properties located in surface water flood map 'less than' extent.

Overall

Relatively low number of historic flood events and properties at risk of future flooding. However repeat flood events should be investigated further before development takes place. This area has been identified within Defra's analysis as having a rank of 3,772 and 0 properties at risk of flooding. A review of method to mitigate surface water runoff from potential development sites is recommended.

Development Sites

Housing	Historic	Future	Summary
398	(surface)	None	

Notes: Brackets indicate proximity but not overlap

Recommendations

1. Review the impact of development upon surface runoff and options for mitigation (for example, SUDS)
2. Review location of Environment Agency surface water flood map extents in relation to the proposed development sites.

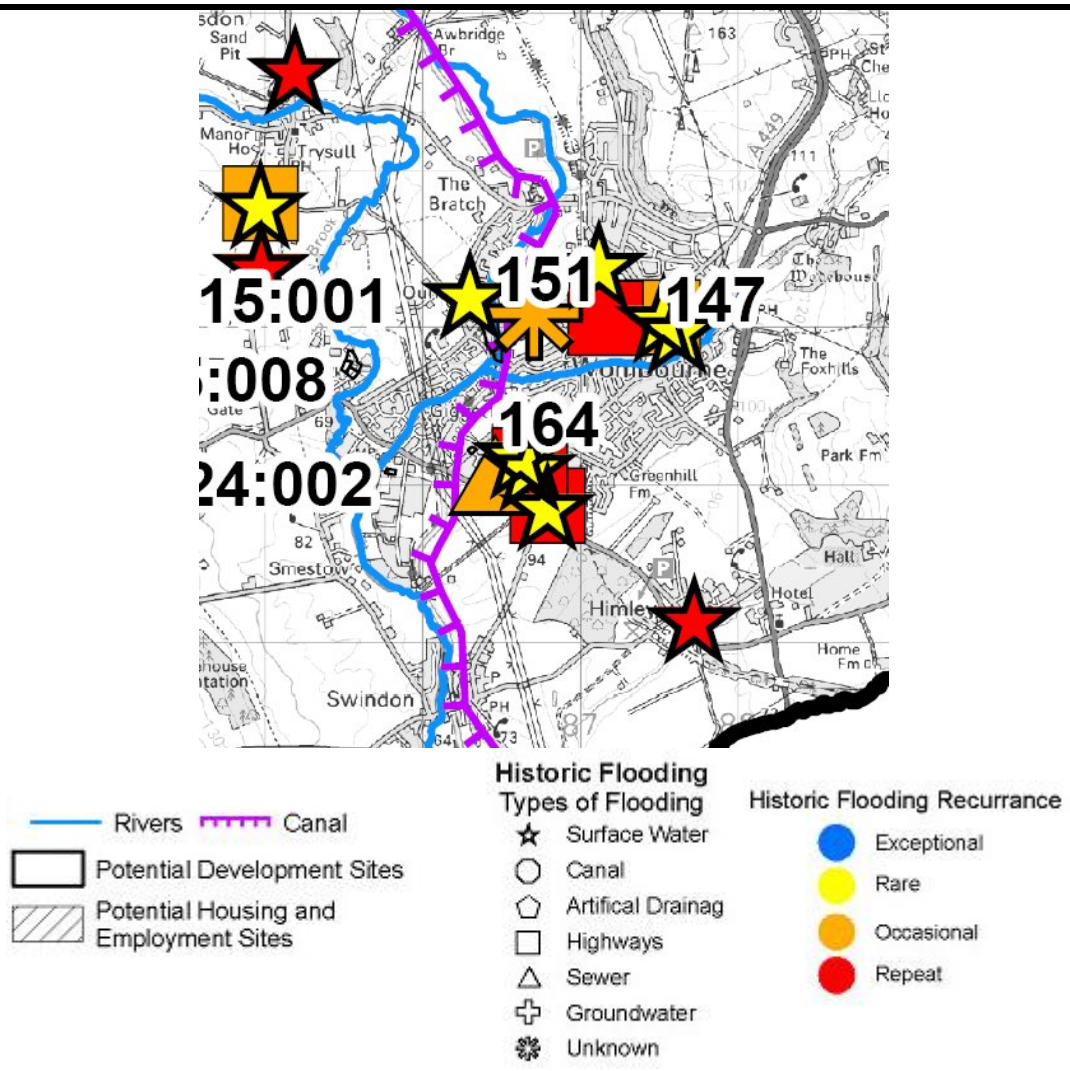
Key

Area should be investigated further as part of a Phase 2 SWMP or site specific study.

Area would benefit from being investigated further as part of a Phase 2 SWMP. Development should be reviewed with reference to the surface flood maps.

Based on current data no detailed further analyses required, although the topography of individual sites should be reviewed before development and all new development should utilise SUDS methods.

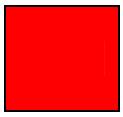
South Staffordshire District - Wombourne



Historic Surface Water Flooding 5+ historic flooding events

Type	Occurrence	Comment
Surface	11 locations	Rare to Repeat occurrences - rare events may not repeat or only occur in extreme events, repeat events should be investigated further.
Highways	5 locations	Occasional to Repeat occurrences - occasional events may repeat, repeat events should be investigated further.
Unknown	1 locations	Occasional occurrence - may repeat
Sewer	1 locations	Occasional occurrence - may repeat

Future Surface Water Flooding



609 properties at risk

Moderate to High number of properties located in surface water flood map 'less than' extent.

Overall

High number of historic flood events and high number of properties at risk of future flooding. This area has been identified within Defra's analysis as having a rank of 637 and 400 properties at risk of flooding. This area would benefit from further investigation either on a site by site basis or as part of a future Phase 2 SWMP.

Development Sites

Housing	Historic			Future	Summary
151	Surface	Unknown	(Highways)	Intermediate	
147	Multiple			None	
164	Multiple			None	
165	Multiple			None	

Employment	Historic	Future	Summary
6:0015:001	None	None	
6:0015:008	None	None	
6:0015:010	None	None	
6:0024:002	None	None	

Notes: Brackets indicate proximity but not overlap

Recommendations

1. Further assessment of repeat flooding event
2. Review historic flooding locations in relation to any potential development sites
3. Review the impact of development upon surface runoff and options for mitigation (for example, SUDS)
4. Review location of Environment Agency surface water flood map extents in relation to the proposed development sites.
5. Inclusion of Wombourne within a future Phase 2 SWMP or site specific assessments.

Key

Area should be investigated further as part of a Phase 2 SWMP or site specific study.

Area would benefit from being investigated further as part of a Phase 2 SWMP. Development should be reviewed with reference to the surface flood maps.

Based on current data no detailed further analyses required, although the topography of individual sites should be reviewed before development and all new development should utilise SUDS methods.

A COMPANY OF

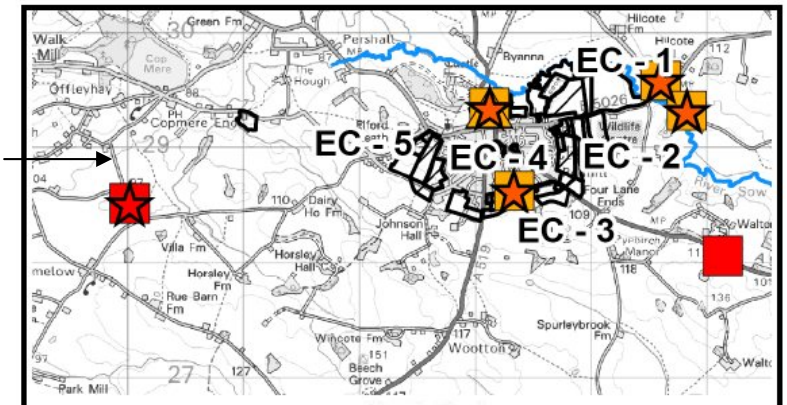
ROYAL HASKONING

Appendix H
Cannock Chase District Summary Sheets

Summary Sheet Explanation

ROYAL HASKONING

Snapshot of key settlement, taken from **Figures B1 - B5**.



Map key, taken from **Figures B1 - B5**.

Rivers
Canal
Potential Development Sites
Potential Housing and Employment Sites

Historic Flooding Types of Flooding
- Surface Water
- Canal
- Artifical Drainag
- Highways
- Sewer
- Groundwater
- Unknown

Historic Flooding Recurrance
- Exceptional
- Rare
- Occasional
- Repeat

Number of historic flooding occurrences marked as points on the map snapshot shown above. Colour code is explained in **Table 3.7**

Historic Flooding section details the occurrences of historic flooding shown within and around the settlement in question.

Historic Surface Water Flooding — 5+ historic flooding events

Type	Occurrence	Comment
Surface	5 locations	Repeat occurrences - should be investigated further
Highways	6 locations	4 Occasional occurrences - may repeat. 2 Repeat occurrences - should be investigated further

Further explanation of all historic flooding events within and around the key settlement.

Future Flooding section outlines the results from the conversion of the Environment Agency's surface water flood map into a flagged system (see Section 3.1.2 for more detail)

Future Surface Water Flooding

222 properties at risk

Moderate number of properties located in surface water flood map 'less than' extent.

Box colour is explained in **Table 3.8**. Flag colour is explained in **Table 3.5** Number of properties taken from comparison of EA surface water flood map and NPD (RH analysis)

Overall Flooding section summarises the combined results for the settlement, accounting for both historic and future flooding.

Overall

Large number of historic flood events, many of which repeat and moderate number of properties at risk of future flooding. Eccleshall has been identified within Defra's analysis with a rank of 2,471and 20 properties at risk. A closer review of the historic flooding locations is recommended. This area would benefit from further investigation as part of a future Phase 2 SWMP or site specific assessments.

Box colour is explained in **Table 3.9** Text summarises the conclusions shown above, plus the results of Defra's analysis for the settlement.

Summary of key **development sites** shown within the settlement.

Development Sites

Housing	Historic		Future	Summary
EC-1	(surface)	(highways)	None	
EC-2	Surface	Highways	Low/Intermediate	
EC-3	Surface	Highways	None	
EC-4	(surface)	(highways)	Low	
EC-5	(surface)	(highways)	None	

Notes: Brackets indicate proximity but not overlap

Summary box colour is explained in **Table 3.9** as a combination of Historic and Future

Future box colour refers to the EA surface water flood map extent in which the development site is either wholly or partially located:
Green - overlap with 'Less' flood extent or no overlap
Yellow - overlap with 'Intermediate' flood extent.
Red - overlap with 'more' flood extent.

Historic box colour explained in **Table 3.7**

Recommendations are provided for the settlement as a whole.

Recommendations

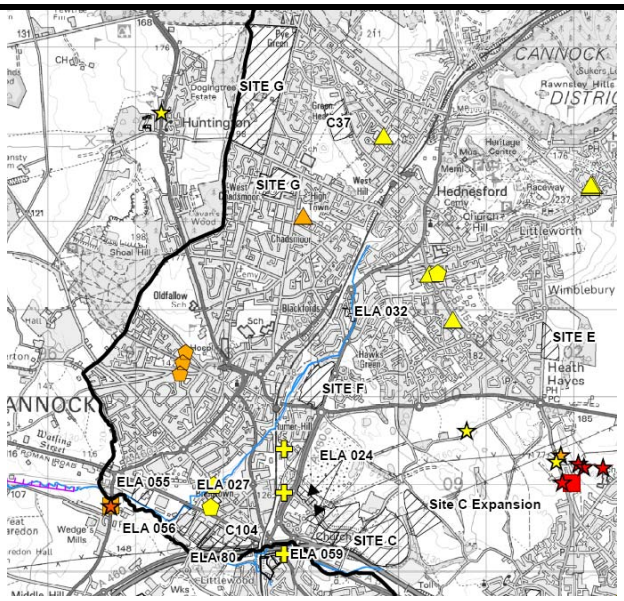
1. Review historic flooding locations in relation to any potential development sites and further investigation of repeat flooding.
2. Review the impact of development upon surface runoff and options for mitigation (for example, SUDS)
3. Review location of Environment Agency surface water flood map extents in relation to the proposed development sites.
4. Further assessment as part of a Phase 2 SWMP or site specific assessment.

Key

- Area should be investigated further as part of a Phase 2 SWMP or site specific study.
- Area would benefit from being investigated further as part of a Phase 2 SWMP. Development should be reviewed with reference to the surface flood maps.
- Based on current data no detailed further analyses required, although the topography of individual sites should be reviewed before development and all new development should utilise SUDS methods.

Key refers to the implications of each of the box colours.

Cannock Chase District - Cannock



Historic Surface Water Flooding 5+ historic flooding events

Type	Occurrence	Comment
Surface	3 locations (northwest, southwest and east)	Rare occurrence - may only occur during extreme events (northwest and east) Repeat occurrence - requires further investigation (southwest)
Highways	1 location (southwest)	Occasional occurrence - may repeat
Artificial Drainage	6 locations (east, central and south)	3 rare occurrences may only occur during extreme events (east and south) 3 occasional occurrences - may repeat (west)
Groundwater	3 locations (south)	Rare occurrences - may only occur during extreme events
Sewer	4 locations (northeast and east)	Rare to occasional occurrences - may repeat

Future Surface Water Flooding

	2,472 properties at risk	High number of properties located in surface water flood map 'less than' extent.

Overall

Multiple historic flood events from numerous sources, also high number of properties at risk of future flooding. Cannock (as a whole) has been identified within Defra's analysis with a rank of 263 and 1300 properties at risk. More detailed analysis of surface water flooding is required in addition to potential mitigation.

Development Sites

Housing	Historic		Future	Summary
Site G (a)	None		Less	
Site G (b)	(Sewer)		None	
C37	(Sewer)		None	
C104	(Artificial drainage)		None	
Site E	None		Low	
Employment				
ELA 032	None		None	
Site F	None		None	
ELA 024	(Groundwater)		None	
Site C	(Groundwater)		None	
Site C Expansion	None		None	
ELA 059	(Groundwater)		None	
ELA 027	Artificial drainage		Less	
ELA 055	(Surface)	(Highways)	None	
ELA 056	(Artificial drainage)		Less	
ELA 80	(Artificial drainage)		None	
ELA 81	(Artificial drainage)		Low	

Recommendations

1. Review any potential development sites on individual basis before progression
2. Review the impact of development upon surface runoff and options for mitigation (for example, SUDS)
3. Review location of Environment Agency surface water flood map extents in relation to the proposed development sites.
4. Undertake Phase 2 SWMP modelling

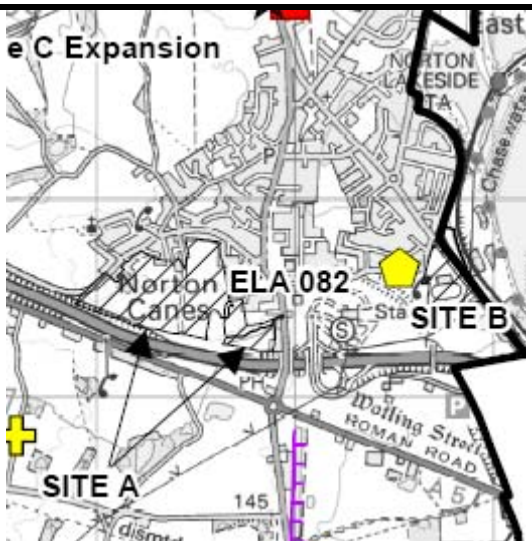
Key

Area should be investigated further as part of a Phase 2 SWMP or site specific study.

Area would benefit from being investigated further as part of a Phase 2 SWMP. Development should be reviewed with reference to the surface flood maps.

Based on current data no detailed further analyses required, although the topography of individual sites should be reviewed before development and all new development should utilise SUDS methods.

Cannock Chase District - Norton Canes



Historic Surface Water Flooding — 5+ historic flooding events

Type	Occurrence	Comment
Surface	6 locations (north)	Rare to repeat occurrence - some require further investigation
Highways	1 location (north)	Repeat occurrence - requires further investigation
Artificial Drainage	1 location (west)	Rare occurrence - may not repeat
Groundwater	1 location (southwest)	Rare occurrence - may not repeat

Future Surface Water Flooding

628 properties at risk

Moderate/High number of properties located in surface water flood map 'less than' extent.

Overall

High number of historic flooding events, many with repeat occurrence, plus a moderate to high number of properties at risk of future flooding. Norton Canes has been identified within Defra's analysis with a rank of 639 and 400 properties at risk. More detailed analysis of surface water flooding is required in addition to potential mitigation.

Development Sites

Housing	Historic	Future	Summary
Site B	(Artificial Drainage)	Intermediate	
Site A	None	None	
Employment			
ELA 082	None	None	
Site A	None	Intermediate	

Notes: Brackets indicate proximity but not overlap

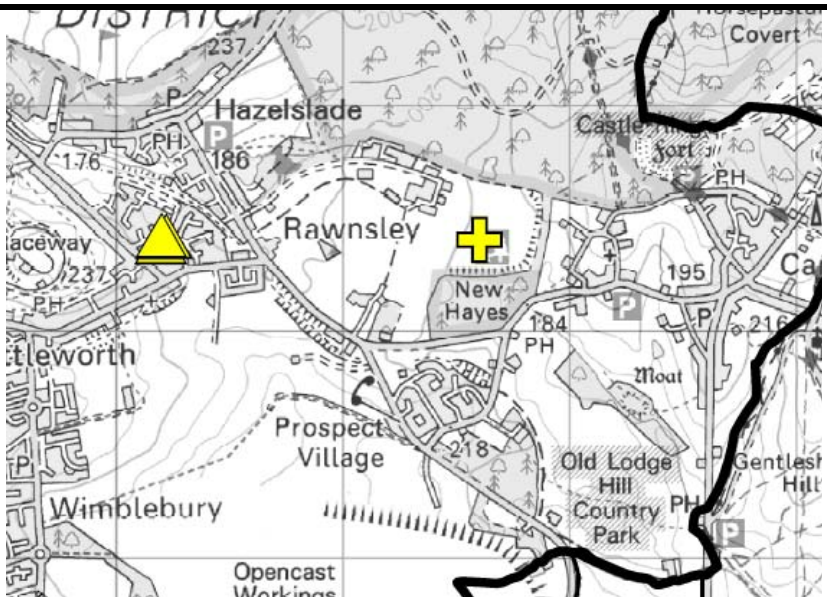
Recommendations

1. Review any potential development sites on individual basis before progression.
2. Review the impact of development upon surface runoff and options for mitigation (for example, SUDS).
3. Review location of Environment Agency surface water flood map extents in relation to the proposed development sites.

Key

	Area should be investigated further as part of a Phase 2 SWMP or site specific study.
	Area would benefit from being investigated further as part of a Phase 2 SWMP. Development should be reviewed with reference to the surface flood maps.
	Based on current data no detailed further analyses required, although the topography of individual sites should be reviewed before development and all new development should utilise SUDS methods.

Cannock Chase District - Prospect Village and Cannock Wood



Rivers
Canal
Potential Development Sites
Potential Housing and Employment Sites

Historic Flooding
Types of Flooding
- Surface Water
- Canal
- Artifical Drainag
- Highways
- Sewer
- Groundwater
- Unknown

Historic Flooding Recurrance
- Exceptional
- Rare
- Occasional
- Repeat

Historic Surface Water Flooding — 4 historic flooding events

Type	Occurrence	Comment
Groundwater	1 location (central)	Rare occurrence - may not repeat
Sewer	3 occurrences in close proximity	Rare occurrence - may not repeat although proximity of the three locations implies that this may be one event that is repeating. Further investigation is recommended.

Future Surface Water Flooding

20 properties at risk

Very low number of properties located in surface water flood map 'less than' extent.

Overall

A few historic flooding events, one of which may have a repeat occurrence and a low number of properties at risk of future flooding. Cannock Wood has been identified within Defra's analysis with a rank of 3985 and 0 properties at risk. Risk of surface water flooding is overall relatively low for this area although a review of individual development sites against the historical flood events is recommended.

Development Sites

No key sites

Recommendations

1. Review any potential development sites on individual basis before progression against Environment Agency surface water flood map extents and historical flooding.
2. Review the multiple-event sewer flooding location.
3. Review the impact of development upon surface runoff and options for mitigation (for example, SUDS).

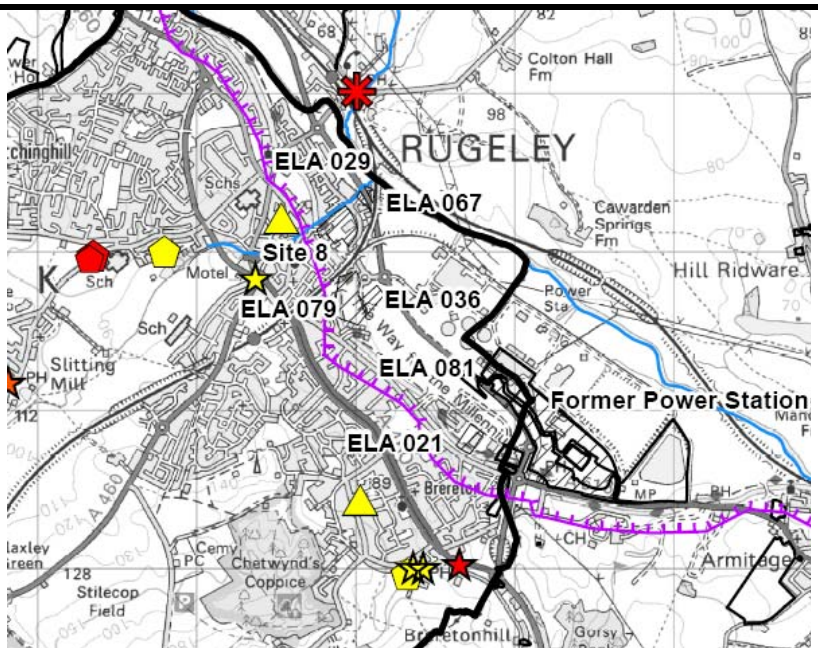
Key

Area should be investigated further as part of a Phase 2 SWMP or site specific study.

Area would benefit from being investigated further as part of a Phase 2 SWMP. Development should be reviewed with reference to the surface flood maps.

Based on current data no detailed further analyses required, although the topography of individual sites should be reviewed before development and all new development should utilise SUDS methods.

Cannock Chase District - Rugeley



Rivers Canal
Potential Development Sites
Potential Housing and Employment Sites

Historic Flooding
Types of Flooding
- Surface Water
- Canal
- Artifical Drainag
- Highways
- Sewer
- Groundwater
- Unknown

Historic Flooding Recurrance
- Exceptional
- Rare
- Occasional
- Repeat

Historic Surface Water Flooding — 5+ historic flooding events

Type	Occurrence	Comment
Surface	4 locations (central and south)	3 rare occurrences - may not repeat 1 repeat occurrence (south) - requires further investigation
Artificial Drainage	4 locations (west and south)	2 rare occurrences - may not repeat 2 repeat occurrences (west) - require further investigation
Unknown	1 location	1 repeat occurrence (north) - required further investigation
Sewer	2 locations (central and south)	Rare occurrence - may not repeat

Future Surface Water Flooding

2,218 properties at risk

High number of properties located in surface water flood map 'less than' extent.

Overall

A number of historic flood events, some of which have a repeat occurrence and a high number of properties at risk of future flooding. Rugeley has been identified within Defra's analysis with a rank of 305 and 1,100 properties at risk. Further investigation, possible as part of a Phase 2 SWMP is recommended.

Development Sites

Housing	Historic	Future	Summary
Former Power Station	None (but within small sewer flood postcode)	Low/Intermediate	
Employment			
ELA 029	None	Low	
ELA 067	None	None	
Site 8	(sewer)	Intermediate	
ELA 079	None	None	
ELA 036	None	Low	
ELA 081	None	Low/Intermediate	
ELA 021	None	High	

Recommendations

1. Review any potential development sites on individual basis before progression against Environment Agency surface water flood map extents and historical flooding.
2. Review the repeat occurrence flood events.
3. Review the impact of development upon surface runoff and options for mitigation (for example, SUDS).

Key

Area should be investigated further as part of a Phase 2 SWMP or site specific study.

Area would benefit from being investigated further as part of a Phase 2 SWMP. Development should be reviewed with reference to the surface flood maps.

Based on current data no detailed further analyses required, although the topography of individual sites should be reviewed before development and all new development should utilise SUDS methods.

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Appendix I
Response to Comments

Surface Water Management Plan - Comments Received on Draft Report

Environment Agency Comments

ID	Comments	RH Action
1.	Section 3.2.3 states that the Environment Agency are currently looking to go further than PPS25's requirements for ensuring that surface run-off is no more than that of the undeveloped site to 'less than greenfield', and this occurs throughout the document. This is not strictly true, however we have requested and achieved this in some specific localities (e.g. top of the Sandyford Brook catchment in Stafford, where there are significant flooding problems downstream). The Environment Agency's current requirements for surface run-off for the districts in question are as follows: a) Greenfield developments – the rate of surface water run-off should not exceed the existing Greenfield run-off rate, the general accepted rate for annual run off is considered to be approximately 5/l/s/ha in this area (unless demonstrated otherwise). b) Brownfield redevelopments – a minimum of 20% reduction in flows when compared to the historic run-off rates, although further betterment is strongly encouraged. c) Redevelopment sites situated at an upstream point of a catchment subject to significant flood risk (site-specific locations) – run-off to be limited beyond Greenfield rates where possible in order to provide wider flood risk reduction downstream.	Section 3.2.3 adjusted to read: *"For all developments Sustainable Drainage Systems (SUDS) will be required to minimise surface runoff and therefore not increase flood risk elsewhere. As such the application of SUDS techniques is a key recommendation for all settlements and development sites. PPS25 recommends runoff from developed sites does not exceed Greenfield runoff. For the Local Authority areas in question the Environment Agency have the following current requirements for surface water run-off:* *a) Greenfield developments – the rate of surface water run-off should not exceed the existing Greenfield run-off rate, the general accepted rate for annual run off is considered to be approximately 5/l/s/ha in this area (unless demonstrated otherwise).* *b) Brownfield redevelopments – a minimum of 20% reduction in flows when compared to the historic run-off rates, although further betterment is strongly encouraged.* *c) Redevelopment sites situated at an upstream point of a catchment subject to significant flood risk (site-specific locations) – run-off to be limited to less than Greenfield rates where possible in order to provide wider flood risk reduction downstream.* *In addition, a result of the implementation of the Flood and Water Management Act, the right to connect surface water to a*

		public sewer has been removed. As a result, STWL are no longer obliged to accept new surface water connections to their network (although they may consider applications on an individual basis). As such almost all surface water must be collected and managed on site through the implementation of SUDS storage and infiltration systems. The underlying geology of each site has implications for the types of SUDS techniques that will be appropriate at that site. In addition, the proximity of the site to any water supply aquifers and the susceptibility of the underlying strata to pollution must be accounted for. The various techniques and applications are discussed in detail with the WCS report associated with this SWMP and should be that referenced for further information, which includes maps and a constraints matrix illustrating the restrictions on SUDS application for each of the key development sites within the study area, including discussion of Groundwater Vulnerability (GWV) and Source Protection Zones (SPZ). Please see Figures 5.8, 6.8, 7.8, 8.8 and 9.8 within the WCS report." Referrals to less than Greenfield rates are caveated throughout the document to refer to these requirements.
2.	The document as submitted does not include amongst other appendices and figures, Figures A1-A5 which detail potential development sites therefore we have been unable to cross-reference this information with the proposals.	This has been re-sent and received.
3.	**The Environment Agency concurs with the recommendations for each district and the overall conclusions of the report.** However we would like to see that (where possible) it is made clear what work should be undertaken prior to the Adoption of the Core Strategies and Site Allocations, and which work would be	Thank you. The recommendations and conclusions have been refined to identify at what stage of the planning process the different elements should be undertaken and by whom.

	possible to be undertaken at planning application and site-specific FRA stage. Table 1.1 shows the projected timescales for Core Strategy and Site Allocation adoption, however it is unclear when the anticipated Level 2 SWMP will be completed and if it will be possible to take the conclusions of this work into consideration in the formulation of policies and/or allocations. As stated in our previous letter, the Environment Agency main concerns with regards to this work is its implementation within the planning process, given the tight projected timescales.	Until the LiDAR is received, comment can not be given on the end date for the Phase 2 - it will however be before the end of the year.

Other Comments - General

ID	Comments	RH Response
1.	It is highlighted that the work has been produced inline with the draft guidance. Can you advise on the main differences between the approach and the one advised in the final guidance? How much additional work would this involve?	Highlighted box in Section 1.3 adjusted to read: ***Please note**: As this commission was awarded in 2009, the scope is based upon the requirements of Defra's draft SWMP Technical guidance, published in February 2009 and not the requirements of the updated guidance, published in March 2010. However, the key Phases have remained the same and the overall approach is similar, although the subcategories and division of tasks within each phase has now been superseded. Despite these changes, the final outcomes from both methodologies are the same. As a result, it is not thought to be necessary to update this report to the new guidance document.*
2.	The images on the front page are quite negative. Alternatives attached (Suds scheme in Lichfield)	Picture changed to SuDS scheme #48 
3.	The executive summary doesn't flag up key issues. Not necessarily the ones for each settlement (it could reference that detailed locationally specific conclusions/findings can be find in sections X-X). The approach to the SWMP phase 2 should be highlighted in the summary.	Executive summary will be re-written. The approach to Phase 2 will be added.
4.	Greater caveats needed on some recommendations etc – mainly that these are based on the most recent data and that they will be	The following caveat has been added to the start of each L.A. specific Recommendation' section:

	developed further in line with phase 2 work. Rather sweeping statements made considering lack of evidence at this stage? Need to make proportionate conclusions? Use precautionary principle?	*"Please note that these recommendations are based upon the most recent data and all will require review following completion of the Phase 2 SWMP study."* Conclusions and executive summary have been tightened up/caveated.
5.	State that developers need to consider these findings and look at issues in more detail if promoting sites etc	Following point added to the recommendations for each L.A.: *"All the conclusions and information included in this Phase 1 SWMP require consideration by developers and should be investigated in further detail if a site is to be progressed."*
6.	Main issue is the colour and layering of the maps and that it is currently very difficult to understand and draw out key issues. Are the colours nationally recognised from other studies? Some colours should be changed and there needs to be clearer narration. The template layout is more understandable but the individual summaries do not correlate. Would it be possible to take the flag off as the figures are listed in the information below and this would help make the map less busy/confusing. Would separate maps be possible if changing the colours does not get over the issue?	Background postcode areas have been removed from all the printed maps. They will be left as a layer on the interactive pdf maps for reference. Part of section 3.1.1 adjusted to read: *"One of the datasets of historic flooding, the sewer flooding records included within the SFRA reports could not be marked on the maps in the form of points. This information is only available in the form of postcode areas with an associated number of events. As there is likely to be overlap between this information and the Floods2 database, this dataset has not been included on the printed maps. It is, however, included in the interactive PDFs for reference. Table [X] below shows the colour key to the information shown."* Development sites just shown as black outlines on all

		maps except A1-5. Flags removed from summary sheet maps. They have been left on Figures B1 - B5 Flags will remain as a layer in the interactive PDFs and can therefore be turned off. Template and summary sheet keys have been adjusted to match.
7.	When modelling takes place will this be done on a watershed basis or settlement basis?	Modelling will take place over the entire watershed in which the settlement is located as there is a need to model the area over which the surface water draining to a settlement would be collected.
8.	Make sure that headings/sub heading formats are consistent throughout the document.	Headings changed in Section 4.1, 5.1, 6.1, 7.1 and 8.1
9.	Can web links be changed to hyperlinks and put as footnotes	Adjusted in section 3.1.2

Tabulated General Comments

ID	Reference	Comments	RH Response
1.	Glossary	There are some terms in the list of abbreviations that would benefit from being in the glossary as well, including • Riparian Owners • 'outfall height' • CFMP	Added
2.	Abbreviations	Some not included: • IDB • CFMP	IDB added. CFMP already present.
3.	Page iii	River Severn CFMP- CFMP not defined	Defined in Executive Summary and 3.1.1
4.	Page iii	The last paragraph is quite shocking – remove 'surprisingly high'. In addition it would be useful to include more detail how the settlements were chosen, mainly from a combination of results in the SFRA and broad level/direction of growth options. "Expensive data requirements.." can this be further explained to say that therefore through the precautionary principle the onus would be on developers promoting sites in the settlements outlined should take on board the studies and do appropriate survey work???	The Executive Summary has been rewritten to meet all these requirements
5.	Page iv-	7th line should read "development sites" Para 2 – 'centralise recording' – who should be responsible? Para 2 last sentence – 'development site**s**'	Adjusted Comment has been added. Adjusted
6.	Page 1 Table 1.1	Need to alter timetables? Cannock Chase Council has 2009 information (footnote 5). Same	Cannock - the following change has been made to the footnote:

		issue as for the WCS table. For Stafford, whilst the dates are those in the LDS, we have not yet reached publication stage. Also it may be worth adding a small note underneath to say why the stages identified have not been reached – due to delay in the adoption of the RSS Phase II.	*"Cannock Chase District Council, April 2009. Please note, the Council is currently re-considering its timetable in light of delays primarily related to the potential impacts of development upon the Cannock Chase Special Area of Conservation. Further information on the most up to date timetable should be sought from the Council."* Following comments from Lichfield and S Staffs, the following comment is added beneath the table: *"*Progression of all the Core Strategies is delayed due to RSS Phase 2 Review delays and guidance that is awaited following the formation of a new government. All figures are correct at the time of print.".* S Staffs -dates changed as required Stafford - Core Strategy dates changed as requested Tamworth - Core Strategy dates changed as requested.
7.	Page 3	Some issues with the clarity of the diagram, useful to have it in but can it be higher resolution or redrawn – issue reading the text in the yellow area.	We have manually increased the resolution of this image - hopefully it is clearer now. The basic problem is that the image quality within the original SWMP guidance is poor.
8.	Page 4- 'Please Note'	Get EA advice on approach.	Changed as per 'Other Comments' #1
9.	Page 4 Paragraph 1.3.1	Bullet point numbering wrong 4, 5, 6 instead of 1, 2, 3.	Changed
10.	Page 5	Perhaps add extra explanation to say how this has been approached i.e. scoping note agreed with EA and what the next steps are	Following sentence added to Section 1.3.1: "*The approach to this SWMP has been devised and agreed in consultation with the Environment Agency. This includes approval of a technical note, dated 23rd February 2010,*

			detailing the methodology for displaying the mapped information."
11.	Page 5	"became evident that **in**sufficient LiDAR coverage was ~~un~~available…."	Changed
12.	Page 7 Core Steering Group	Staffordshire County Council are missing from the list	Added
13.	Page 8 Additional Data Providers	Remove *'etc'*	Done
14.	Page 10 Paragraph 2.4	How have these objectives been identified- via scoping note with EA or from DEFRA draft guidance?	Changed to: *"The main objectives of this Phase 1 SWMP, as defined in the draft Defra SWMP guidance are to"*
15.	Page 12 Table 3.1.	Future should have capital 'f'	Changed
16.	Page 13 Table 3.2	Did all authorities provide SFRA shape files? Only 3 listed. Also can Lichfield Hot Spots be defined as 'Lichfield District Hot Spots'.	Note added stating: *"*This data set covers Stafford Borough, Tamworth Borough and Lichfield District"*
17.	Page 14	What does *antecedent conditions* mean? Should this be in the glossary?	Added to state: *"The pre-existing condition before a rain event (e.g. waterlogged soil)"*
18.	Page 14- final paragraph	Delete gap between "shown in" and "Table 3.4"	Adjusted with some of the changes to the paragraph shown above.
19.	Page 16 bullet point '1'	Perhaps replace word 'conservative' with 'worst case' in line with yellow box on page 17 to be clear	Done
20.	Table 3.5	Would be useful if the Defra data was caveated – i.e how it is calculated and the different reasons why properties are 'at risk'. Also, does the study take into account the data	This is explained within the 'Defra' section below and the yellow box. Reference to the Defra website and a hyperlink to the relevant page has been added.

		provided by the authorities? A brief discussion in the report of this would be useful.	 All the relevant data supplied has been included. Discussion of all the data used is included within Section 3.1.
21.	Page 17- first paragraph	What number rank is the settlement at lowest risk if 1 is highest? E.g out of how many	"*out of a total of 4,350*" has been added.
22.	Page 19 paragraph 3.2.3	Does PPS25 recommend this?	The EA have provided the required changes. This has been altered.
23.		Regarding the statement about STWL not allowing surface water connections - query if this is correct.	This has been adjusted, as outlined above.
24.		"as such all surface water must be collected and managed…etc…" this sentence seems too sweeping given the limitations to the evidence in the report. It must be proportionate the development size etc.	Adjusted as outlined above.
25.	Page 21 Table 3.8	Why is the classification threshold for 'red' 400+ properties here and 1000+ properties in Table 3.5? What is the basis for 400? Brief summary how this has been arrived would be useful, along with the others – more than 20 and less than 20.	The following points note has been added to bullet 2 in Section 3.1.2: *"The numbers of properties chosen to fall within each band have been selected as a representation of the variation across the study area in question. This is based upon our judgement of the study area and range of results - there is no set standard for each colour band, although the splits used in this study were agreed with the Environment Agency in advance. We believe this banding highlights the settlements at highest comparative risk as compared to the other settlements within the study."* Paragraph above Table 3.8 altered to read:

			"Future surface water flood risk is shown on the maps in the form of the coloured flags. The summary sheet identifies the colour of this flag and number of properties at risk. To bring the classification in line with the historic flooding, a three tier traffic light colour code is assigned based on the classifications shown in Table 3.8, condensing the full range of flag colours referenced in Table 3.5." Numbers within Table 3.8 changed to read <20, 20-350 and 351+, in line with the splits shown in Table 3.5 (this was a typo)
26.	Page 28 paragraph 5.2	Need to explain 'outfall height'?	This is now defined in the glossary
27.	Page 29 Paragraph 5.2.1	Needs full stop between 'Figure 5.1' and 'The'.	Done
28.	Page 37, page 39, 41 and page 45	Great **Wyrley** spelt incorrectly	Done and checked throughout the document.
29.	Page 38 para 3	"part of site specific FRAs…" stronger onus on developers needs to come through.	Sentence changed to read: "*A large proportion of the development sites have been classified as 'yellow' and would therefore benefit from some further investigation, possibly as part of a site specific FRA, funded by the developer and approved by the Environment Agency prior to site progression."* This has been altered in all Local Authority specific sections.
30.	Page 38 para 3	"there are a couple of development site**s**…" which settlements??	References will be made to development sites for all Local Authorities.
31.	Page 38 7.2 para 1	"or the overflow of ordinary watercourses or drain within the town which are the responsibility of the LA…" – factually incorrect. The responsibility is the owner. The LA has various powers – not	Altered to read *"…or the overflow of ordinary watercourses or drains within the town, which are the responsibility of the owner, although Local Authorities are empowered to undertake*

		duties – under the Land Drainage Act, essentially to require the owners to maintain flows. "repeat occurrences ~~of~~ **are** investigated…"	*maintenance works if necessary (for Main Rivers these powers lie with the Environment Agency, shown on **Figure C2**)"* in all Local Authority sections.
32.	Page 41	Recommendation 7 – would this also apply to other districts where there is a lot of agricultural land? How and who would carry out?	Recommendation adjusted to read: *Review the agricultural management practices within the District and encourage farmers to not leave land bare. Some funding may be available through Defra to undertake such initiatives via their "Farming Floodplains for the Future Scheme"* Hyperlink added in footnote to refer to Defra initiative. Recommendation added to all Local Authority sections.

		Take out detailed recommendations for further SWMP and put in general 'review settlements'	For South Staffs recommendations 4 and 5 combined to read: *"Review the surface water flooding situation within Penkridge and Wombourne, with reference to the location of development sites to be progressed. If necessary, further analysis of the settlements as a whole should be undertaken and funded by the Council or by developers on a site specific basis, as appropriate"* For all other Local Authorities the reference to secondary Level 2 SWMPs (beyond those actually being undertaken) adjusted to read: *"If feasible, undertake Phase 2 SWMP modelling for the town of XXX, dependent upon the level and location of final development planned for the town"* Reference to Phase 2 for numerous settlements removed for all Local Authority sections. The recommendation for these areas is now to simply 'review'.

		Generally a recommendation should be to put onus on developer through precautionary principle to ensure that water issues are sufficiently addressed in settlements not modelled	Additional recommendation: *"For the settlements not included in more detailed, Phase 2 SWMP, modelling, the developer should ensure that surface water management issues are sufficiently addressed and agreed with the Environment Agency, within a site specific FRA."* Added to all Local Authority sections.
33.	Page 43, penultimate paragraph	Slightly concerned at the number of properties being identified at risk i.e. over 2,000 in Cannock and Rugeley. Could it please be clarified within the report how such numbers are arrived at because the reality on the ground conveys a different picture i.e. the Council has investigated known flooding sites that put specific properties at risk in conjunction with the Environment Agency (details of such sites provided to RH in data return). Concerned that level of risk being highly overestimated.	The following reference has been added to each 'Future Flooding' section within Sections 4 - 8: *"For further information regarding the derivation and restrictions of these numbers, please see Section 3.1.2."*
34.	Page 43- final sentence	Should refer to Cannock Chase District?	No, Cannock town - 'town' added.
35.	Page 44, 4th paragraph	Refers to reviewing all individual sites before progression- does this mean small scale ones not considered as part of the site-specific assessments?	All sites provided have been assessed. Refers to further site specific assessment as part of FRAs etc. No change made to text.
36.	Page 45, 2nd paragraph	First sentence has full stop in middle which needs to be deleted "Where flood occurrences…."	Full stop removed.
37.	Page 45, 4th paragraph	Replace "visa versa" with "vice versa"	Changed throughout document.
38.	Page 46 Figure 8.1	Doesn't show Cannock Chase Extension Canal	The Extension Canal has been added.
39.	Page 47, 3rd bullet point	What further investigations would be needed e.g.	Adjusted to read in all Local Authority sections:

		Flood Risk Assessments?	*"Further investigation into surface water flood risk and runoff mitigation should be carried out for the development sites identified as being at a high or medium overall risk of surface water flooding from this analysis (highlighted as red or yellow within the summary sheets), within site specific FRAs undertaken by the developer"*
40.	Page 47, 4th bullet point	Cannock (and Norton Canes as this is within the Cannock watershed) also has a higher level of risk as per DEFRA ranking etc? Explain that given the nature of the watershed this modelling will also take in Norton Canes?	Recommendations 4 and 5 adjusted to read: 4.Undertake Phase 2 SWMP modelling for the town of Cannock. All urban areas would benefit from modelling, but due to the number of development proposals within the area, Cannock would be the most beneficial. Due to the extent of the watershed, modelling for Cannock will also incorporate the urban area of Rugeley; 5.Review of Rugeley through detailed review of the historic flood events and in consultation with the partners and stakeholders;
41.	Page 47, 5th bullet point	Won't Norton Canes be covered by the Phase 2 SWMP as it's within the Cannock watershed? Rugeley Town Centre already has a Level 2 SFRA- is this referring to the wider Rugeley urban area and if so we have not been advised of the need for this by the EA. What is meant by 'review' i.e. by who, how, when?	Wording adjusted as above. Following discussion in the progress meeting at which Cannock Chase DC explained they have not been advised by the EA to undertake any further Level 2 SFRAs. As such reference to the Level 2 SFRA for Rugeley has been removed. Recommendation 5 adjusted to read:

			"Review of development sites in Rugeley by the Council, through detailed review of the historic flood events and in consultation with the partners and stakeholders to determine those most suitable for progression. This will require consideration of all the other Evidence Base studies collected as part of the LDF process. If sites are progressed, the information presented within this SWMP should also be reviewed by developers as part of site specific FRAs" Similar recommendation added to the other relevant Local Authority sections.
		In general reaching strong conclusions with big implications for us based upon data that has been acknowledged to be 'indicative' rather than 'conclusive'?	Yes, this study is indicative. It is very difficult to be 'conclusive' about surface water flood risk, due to the influence that small scale factors (such as locations of drop kerbs) have on overland flood flow routing. As identified within the report, the purpose of the study is to identify areas that may be at significant risk of flooding from surface water, so that further more detailed appraisals can be focused on areas of greatest risk. The Phase 2 study will include some more detailed appraisal, to help inform the LDF process, but where significant developments are planned the onus should be on the developer to demonstrate that his development will not increase flood risk.
42.	Page 47, general	Who should undertake review of flood events? In general, who is responsible for each of the recommendations?	Following sentence added to the start of each 'recommendations section': *"All recommendations relating to the determination of the locations most desirable for development (i.e. development of preferred*

			options/areas) are the responsibility of the Local Authority. All recommendations relating to the progression of individual development sites are the responsibility of the developer. As a result of the Floods and Water Management Act Staffordshire County Council, as Lead Local Authority, has responsibility for monitoring and managing surface water flood risk."
43.	Page 49 final paragraph	Concerns over the word 'high' number of settlements (which ones?), remove 'high'. Also with regard to development change this to potential development locations. Confusing paragraph as refers to historic flooding which has affected settlements in the past and also how settlements are also at risk now or in the future of surface water flooding. Final sentence 'reasonability' rather than responsibility. 3rd paragraph – Environment Agency not listed in list of stakeholders/consultees	Removed Changed Adjusted to read: "*A number of settlements and potential development locations across the study area have been identified as being at risk of surface water flooding - either due to the occurrence of historic flooding events or recognised possibility of surface water flooding occurring in that location in the future.*" Changed EA have already provided information - those listed 'may' have additional information. No change made.

44.	Page 50 second paragraph	Any recommendations/clear messages on how this would be done?	Following paragraph added: *"The Floods and Water Management Bill requires developers to incorporate SUDS into their designs and the Local Authority responsibility for approving, adopting and maintaining new SUDS where they affect more than one property. More information regarding appropriate SUDS techniques for different parts of the study area is included within the associated WCS."*
45.		The paragraph relating to lack of Lidar should go before the list of Lidar data that is currently being gathered.	Whole section has been reworded and adjusted.
46.	Page 52 bullet 1	• "findings of the **Phase 1** ~~SMWP~~ **SWMP**…"	Changed
47.	Figures	Cannock Extension Canal not shown on maps and Hatherton Branch alignment appears incorrect – please check the route	This has been added. The location has been taken from the Lichfield and Hatherton canal trust web page. http://www.lhcrt.org.uk/hatherton.htm. Hyperlinks have now been added in the footnotes beneath the maps.
48.	Appendix C	Stafford Map – would be possible to amend on the map 'Audmore' to 'Gnosall' which is the main settlement, Walton & Norton Bridge just read as Norton Bridge and North Cannock to read as North Rugeley. Same issue for all maps.	Changed
49.	Appendix H, page a	Summary box for Development Sites label contains 'Error'	Changed
50.	Appendix H	Confusion over whether or not Norton Canes will be included in the Phase 2 SWMP as part of the Cannock watershed	Yes, Norton Canes will be included - this has been changed in the main body of the text, as listed above.
51.	Appendix H	Should Prospect Village/Cannock Wood be rated 'green'? Seems to fit better with	No - there are historic flooding events. No development sites identified so no specific

		recommendations	recommendations. Yellow requires further review on a site specific basis. No changes made.
52.	Appendix H	Some spelling errors e.g. occurrence, location in Rugeley summary- please check	Corrected
53.	Appendix H	Colour coding of key needs further consideration- maps difficult to interpret	The postcode area colours have been removed, as have the development site colours. The maps are much clearer now.

Tamworth Borough specific response

ID	Reference	Comment	RH Response
1.	6.1	South west and central sections identified as being at highest risk. State that this area should be modelled as part of phase 2 SWMP. Would it be just this are or the whole catchment that LiDAR has been collected for?	Changed to read *"…it is highly recommended that the whole town is modelled further as part of the Phase 2 SWMP."*
2.	6.1	How would RH recommend that retrofitting of existing developments is undertaken? Who would pay?	*(by the owner)* added. e.g. private owners, developers if managed development or Council if public.
3.	Appendix F	Tamworth South – sites 12, 13, 14 & 15 should be purple; site 22 question green as not employment (leisure centre) Tamworth North – site to east of Anker Valley should be shown as purple	Sites 12-15 have been changed to purple in Appendix C. Appendix F all sites are now hashed, as agreed at the progress meeting. Leisure centres are included in employment sites. Key/description in text has been updated accordingly.
4.	Appendix C	Mapping error - Coventry Canal shown as purple castellated line labelled River Anker by mistake.	This is a result of the label spacing within ArcGIS. It has been manually corrected.
5.	Site 1, Anker Valley	Site 1, Anker Valley is shown in the Phase 1 SWMP as having no historic flood incidences and for the future as being less/intermediate flood risk. However, under the Flood Risk section of the WCS table 7.12 shows its classification as red. Explanation required.	The Phase 1 SWMP classifies the surface water flood risk only, whereas the WCS accounts for both surface and fluvial flood risk. The SWMP concludes that the site has no evidence of historic surface water flooding, but parts of it are located within the EA's surface water flood map outlines. As such, the SWMP allocates a summary *surface water* flood risk for the site of 'yellow'. However, the site is located next to the River Anker and, as such, parts of the site are located within the *fluvial* Flood Zones, including the high risk Flood Zone 3. The combination of high fluvial flood risk and intermediate surface water flood risk gives the site an overall flood risk classification within the WCS of 'red'.

Lichfield District specific response

ID	Reference	Comment	RH Response
1.	5.1 (first para)	'District' not Borough	Changed
2.	5.1 (second para)	.in and around Lichfield 'City?'	Changed
3.		Canal overtopping – can these couple of locations be defined?	Sentence adjusted: *"Canal overtopping has occurred in a couple of locations on the Birmingham and Fazeley canal, close to the border with Tamworth Borough."*
4.	5.1 (third para)	Lichfield 'city' not 'town'	Changed throughout
5.	5.1 (fourth para)	Refers to eastern Lichfield District and then refers to Rugeley (which is in the west)	Adjusted: *"The surface water flood map, **Figure C2**, indicates areas in which surface water flooding is potentially a high risk, with a swathe of northern and eastern Lichfield District, from Rugeley past Alrewas towards Tamworth being the most prominent."*
6.		Buntwood and Lichfield 'City.'	Changed
7.	5.1 (fifth para)	Lichfield 'City'	Changed
8.		Does Defra ranking relate to Lichfield District or City?	Following sentence added: *"…(it is unclear whether any of the District, beyond Lichfield City, is included within Defra's analysis)"*
9.	5.1 (Page 28)	Remove reference to North Streetly	Removed
10.	5.21 (first para)	Second sentence requires space adding	Changed
11.	Fig 5.1	Map and key do not correspond	Key has been updated.
12.	Recommendation 5	Lichfield 'city'	Changed
13.	Recommendation 6	Is this not already covered by (more generic) recommendation 7?	Recommendation 6 removed.

South Staffordshire comments

ID	Reference	Comment	RH Response
1.	Page iii final para	The decision to model the settlements was based on the findings of SFRAs level 1, not just an uninformed guess.	Clarification added.
2.	Page iv para 2	"centralise recording…" – who should be responsible??	Adjusted
3.	Page iv para 2 last sentence	"development site**s**…"	Changed
4.	Page 1 Table 1.1	Core Strategy: Publication = November 2010 Submission = March 2011 Adoption = November 2011 Site Allocations: Commencement = July 2009 Publication = November 2011 Submission = March 2012 Adoption = November 2012	Adjusted
5.	Page 37 7.1 para 1	South Staffordshire is a District not a Borough	Changed
6.	Page 37 para 2	South Staffordshire is a District not a Borough	Changed
7.	Page 37 para 2	Why isn't Kinver mentioned considering it is one of the two key EA flood warning locations in South Staffs? Other being Penkridge.	This paragraph refers to surface water flooding not fluvial. Kinver doesn't rate highly on the historic surface water flooding map. No change.
8.	Page 40 figure 7.1	Where have you got this map from? It doesn't correlate to the route we know of. It needs checking and referencing.	The Lichfield and Hatherton canal trust web page. http://www.lhcrt.org.uk/hatherton.htm Hyperlink added.
9.	Page 41 bullet 3	Does this refer to the flags on b4, if yes say so and consider listing them	No it does not refer to the flags. It refers to the overall summary classifications shown in the settlement specific sheets. List of development sites shown red added - yellow list too long.
10.	Page 41 bullet 4	We have no towns in South Staffs, all are villages	Changed to 'settlement'
11.	Page 41 bullet 5	Delete	Deleted. Following recommendation adjusted to read:

			"All development sites in the settlements highlighted within this report (Penkridge, Wombourne, Codsall, Great Wyrley. Cheslyn Hay and Perton) should be reviewed by the Council in consultation with partners and stakeholders to determine those most suitable for progression. This will require consideration of all the other Evidence Base studies collected as part of the LDF process. If sites are progressed, the information presented within this SWMP should also be reviewed by developers as part of site specific FRAs."

Lichfield and Hatherton Canal Trust Comments

ID	Comments	RH Response
1.	. In the case of the Lichfield section I think that it is fundamental that the pipe laid in the bed of the canal which must be removed in order to restore the canal is in fact the surface water outfall for all of southern Lichfield. This needs to be emphasised.	Following paragraph added to Section 3.1.2: *"Another potential issue raised by the Lichfield and Hatherton Canal trust is that there is a high probability that the surface water sewer draining all of southern Lichfield is currently located in the bed of the canal. To restore the canal this pipe will require removal and therefore cooperation and agreement between STWL, Lichfield District Council and the Canal Trust."*
2.	In the case of the Hatherton the sections for South Staffordshire and Cannock are essentially repeats and this gives a potential for confusion. My suggested amendments separate out the 2 and removes text which is not correct for the council area	Due to the cross boundary issues we feel the recommendations should essentially be repeated for the two LAs. This has been agreed with the Councils. No adjustment necessary.
3.	Page 17 Canal Restoration Suggested amendment This construction may assist in alleviating surface water flooding through acceptance and conveyance of surface water discharge which would also provide a source of water to top up canal water levels. Appropriate sizing of new culverts for existing watercourses could be used for attenuation of water course peak flow rate and source control. Whilst the restored canals can provide positive benefits in any surface water management regime there are also risks which will need to be considered. These include overtopping of the canal in extreme rainfall events or flooding risk associated with new culverts that have not been provided with suitable capacity at watercourse crossing points. It is therefore essential ……	Changed.
4.	Page 29 Canal Restoration - Lichfield	

	1st para no change 2nd para sentences 1 & 2 no change Delete “The Darnford Brook in particular ……” with suggested amendment The canal was historically considered to be part of the surface water drainage network.. The 1954 Act of Parliament which permitted its abandonment as a navigation required its retention for land drainage purposes. Culverting was permitted subject to approval of the then Trent River Authority (now the Environment Agency). It is not know whether at this time there were facilities to allow excess water to discharge from the canal to the Darnford Brook. The whole length of former canal within Lichfield downstream of Chesterfield Road has been culverted to a point adjacent to the Tamworth Road next to the A38 trunk road. At this point the culvert follows a different route discharging to the Darnford Brook. The public surface water sewer and highway drainage systems which drain the whole of the southern portion of Lichfield discharge via the culvert. STWL has undertaken hydraulic modelling of whole drainage system to the point of discharge into the Darnford Brook. This modelling predicts that the culvert has capacity to convey run off from a 1 in 30 year rainfall event without flooding. LHCRT intend to use the flow rates in sizing for canal flow control structures. In early stages of canal restoration before completion to Ogley junction, LHCRT require the inflow from pipes connected to the culvert in order to avoid water supply shortage. The replacement of the culvert with the canal provides a potential opportunity to alleviate flood risk at historic flood locations in the south of Lichfield. If Lichfield is modelled within a Phase 2	Information added.

	SWMP, further detail may be provided both on local flooding within southern Lichfield and interlinkages between the current culvert, future canal and the Darnford Brook. The Coventry canal is located in very close proximity to the Whittington flood events and a number of canal overtopping events have occurred to the south of Huddlesford junction to the south as shown in **Figure 5.**1. The potential impact of flows from the restored canal on the Coventry canal should be assessed. Given the interaction between canal and surface water sewers and watercourses it is recommended that ….. back to para 3 sentence 3	
5.	Page 39 Canal Restoration South Staffordshire 1st para 2nd sentence. This route which passes through both South Staffordshire and Cannock District Council areas is shown in **Figure 7.1** The length of canal from Hatherton Junction to the south of Cannock remains in use for land drainage purposes and provides a supply of water to the Staffordshire and Worcester Canal. The proposed route which extends to the south and east of Cannock clashed with the Birmingham Northern Relief Toll Road Motorway. At the time of motorway construction, culverts were provided to enable the future canal to pass under the motorway. It is recommended that the impact of canal restoration upon the surface water drainage within the area is reviewed prior to construction. As the proposed canal route is located in close proximity to a number of historic flood events around the south of Cannock and the boundary of South Staffordshire District as shown in **Figure 7.1,** it will be important to ensure that no	This information, together with the information in point 6 below have been incorporated into the text in both Sections 7 and 8.

	unplanned additional surface water can enter the canal (either from overland flow or watercourse flooding). Insert para 4 then para 3 last 2 sentences	
6.	Page 45 Canal Restoration South Staffordshire 1st para 2nd sentence. This route which passes through both South Staffordshire and Cannock District Council areas is shown in **Figure 8.1** The original route which would have connected to the Cannock Extension Canal has been changed due to ecological concerns. A supplementary study for restoration completed in 2009 confirmed the feasibility of an alternative route with connection to the currently disused Lords Hay branch. The study identified a number of locations where the route of the canal will be in proximity to local watercourses and a need to cross over the Wash Brook. It is important to ensure that there is no unplanned interaction between the canal and the watercourses. The culvert provided to drain the wash Brook under the canal will need careful sizing to ensure adequate capacity. Insert para 4	See above.