East Staffordshire Strategic Flood Risk Assessment

Level 1 Report

East Staffordshire Borough Council

February 2008

Final Report

9S8995/R/Bham/02

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EXECUTIVE SUMMARY

Study Objectives

This Level 1 Strategic Flood Risk Assessment (SFRA) for the East Staffordshire Borough Council (the Council) has been undertaken to provide a robust assessment of the extent and nature of the risk of flooding and its implications for land use planning. In addition, the SFRA sets the criteria for the submission of planning applications in the future and for guiding subsequent development control decisions. The key objectives of the study are to:

- Provide a reference and policy document to inform preparation of the Local Development Framework (LDF) for the Borough;
- Ensure that the Council meets its obligations under the Department of Communities and Local Government's (DCLG's) Planning Policy Statement 25 "Development and Flood Risk"; and
- Provide a reference and policy document to advise and inform private and commercial developers of their obligations under PPS25.

An increased scope Level 2 SFRA as per paragraph E6 of PPS25 will be required to facilitate possible application of Exception Test and to address significant flood risk issues within the Borough, prior to the submission of emerging LDF documents. This more detailed SFRA should consider the detailed nature of the flood hazard by building upon the findings of this Level 1 SFRA and by fully taking account of the presence of flood management measures through further detailed hydraulic modeling.

Outputs

The principal output from the study is a set of maps, which categorises the Borough into Flood Zones according to PPS25. It depicts the presence of flood defences where they exist. These maps have been produced adopting a robust assessment to give the Council sufficient information so as to have an overall view of flood risk areas for strategic planning purposes.

The maps and this accompanying report and guidance will provide a sound framework enabling consistent and sustainable decisions to be made when making future planning decisions. Methods of assessment and limitations of the SFRA outputs, including further recommendations to address them, are also presented. The Level 1 SFRA evaluates the present-day (year 2007) situation and the situation after 80 years time (year 2087) with increased peak flood flows to allow for projected climate change.

Figures 1 and **2** present the study area and show the main watercourses within the Borough. The SFRA has considered all sources of flooding within the Borough, as explained in this report and related figures.

Data Sources

Appendix D documents the data that was made available for the study.

Co-operation

The SFRA was carried out for the Council with the co-operation and support of the Environment Agency, Severn Trent Water, Highways Agency and British Waterways.

GLOSSARY

Basin	A ground depression acting as a flow control or water treatment structure that normally is dry and has a proper outfall, but which is designed to detain storm water temporarily.
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 (CFMP)	A strategic planning tool through which the Environment Agency seeks to work with other key decision-makers within a river catchment to identify and agree policies for sustainable flood risk management.
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.
Design flood level	The maximum estimated water level during the *design event*.
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.
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 event	A flooding incident characterised by its level or *flow hydrograph.*
Flood probability	The estimated probability of a flood of given magnitude occurring or being exceeded in any specified time period. See also *annual flood probability*.
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 storage	The temporary storage of excess runoff or river flow in ponds, basins, reservoirs or on the *floodplain* during a flood event.
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 see, ignoring the presence of defences. The fluvial Flood Zones are usually derived using a two-dimensional hydraulic model called JFLOW, into which a national coarse Digital Terrain Model is fed. However, in some instances, more detailed modelling can be undertaken, using refined information.
Floodplain	Area of land that borders a watercourse, an estuary or the sea, over which water flows in time of flood, or would flow but for the presence of flood defences where they exist.
Functional floodplain	Land where water has to flow or be stored in times of flood. It includes the land which would flood with an annual probability of 1 in 20 (5%) or greater in any year or is designed to flood in an extreme (0.1%) flood, or at another probability to be agreed between the LPA and the Environment Agency, including water conveyance routes.
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.
Highway authority	A local authority with responsibility for the maintenance and drainage of highways maintainable at public expense.
Hydrograph	A graph that shows the variation with time of the level or discharge in a *watercourse*.
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 Department for Environment, Food and Rural Affairs (DEFRA).

Mitigation measure	A generic term used in this guide to refer to an element of *development* design which may be used to manage *flood risk* to the *development*, or to avoid an increase in *flood risk* elsewhere.
Ordinary watercourse	A watercourse which is not a private drain and is not designated a *Main river*.
Overland flow flooding	Flooding caused by surface water *runoff* when rainfall intensity exceeds the infiltration capacity of the ground, or when the soil is so saturated that it cannot accept any more water.
Pond	Permanently wet depression designed to retain storm water above the permanent pool and permit settlement of suspended solids and biological removal of pollutants.
Return period	A term sometimes used to express *flood probability*. It refers to the estimated average time gap between floods of a given magnitude, but as such floods are likely to occur very irregularly, an expression of the *annual flood probability* is to be preferred.
Runoff	Water flow over the ground surface to the drainage system. This occurs if the ground is impermeable or saturated, or if rainfall is particularly intense.
Sequential test	A risk-based approach to *flood risk assessment* in accordance with Planning Policy Statement 25, applied through the use of flood risk zoning, where the type of *development* that is acceptable in a given zone is dependent on the assessed *flood risk* of that zone and *flood vulnerability* of the proposed development.
Standard of protection	The estimated probability of a *design event* occurring, or being exceeded, in any year. Thus it is 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	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.
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 *development sites*.
Watercourse	Any natural or artificial channel that conveys surface water.

ABBREVIATIONS

CFMP	Catchment Flood Management Plan
DBFO	Design Build Finance Operate (*Roads built with private capital*)
DCLG	Department of Communities and Local Governments
DEFRA	Department for Environment, Food and Rural Affairs
EA	Environment Agency
FAS	Flood Alleviation Scheme
FRA	Flood Risk Assessment
FZ	Flood Zone
GIS	Geographical Information System
LDD	Local Development Documents
LDF	Local Development Framework
LiDAR	Light Detection And Ranging
LPA	Local Planning Authority
NFCDD	National Flood and Coastal Defence Database
Ofwat	Office of Water Services
OS	Ordnance Survey
PPS25	Planning Policy Statement 25 – Development and Flood Risk
RFRA	Regional Flood Risk Assessment
RSS	Regional Spatial Strategy
SFRA	Strategic Flood Risk Assessment
SUDS	Sustainable Drainage Systems

1 BACKGROUND

1.1 General Overview

In August 2007 Royal Haskoning was appointed by the East Staffordshire Borough Council (hereafter "the Council") to produce a Level 1 and Level 2 Strategic Flood Risk Assessment (SFRA). This report relates to the production of the Level 1 SFRA.

1.2 Scope

The scope for this SFRA is in accordance with PPS25 guidelines (Communities and Local Government, 2006, Planning Policy Statement 25: Development and Flood Risk), Development and Flood Risk a Practice Guide Companion to PPS25, "Living Draft", and Royal Haskoning's proposal dated 29th August 2007.

The Council is in the process of preparing its Local Development Framework (LDF) as required by the Planning and Compulsory Purchase Act 2004. East Staffordshire has been identified as a potential New Growth Point by Central Government and, as such, it has ambitions for growth, subject to the statutory regional and local planning process, including:

- An additional 5,000 high quality homes by 2016 and a further 7,000 by 2026.
- Redevelopment of 282 hectares of high quality premium employment land.
- Comprehensive Area Action Plans for Burton-upon-Trent Town Centre.
- Improvements to key gateways.
- Preserve the rural nature of the Borough through the enhancement of the natural environment, green spaces, canals and rivers.

The majority of the development will be focussed on Burton-upon-Trent, although Uttoxeter is also expected to grow further. Flood risk is a key consideration in the allocation of land for development especially with the current concerns over climate change. Therefore, to enable the developments to be sited in appropriate locations to minimise damage to property and threat to life the Council needs to be informed by the most accurate picture of flood risk possible.

The key aims of the Level 1 SFRA are to broadly assess all sources of flooding and the other key flood risk considerations expected by PPS25 across the entire Council's area.

Royal Haskoning produced this Level 1 report in close consultation with the Council and the Environment Agency. Input to the SFRA was also provided by Severn Trent Water, British Waterways and the Highways Agency.

1.3 Study Area

The Borough of East Staffordshire lies to the North East of the West Midlands conurbation. It covers an area of 150 square miles. In 2001 the population totaled 103,800 (2001 census) with 64,449 living in the principal town of Burton upon Trent (including the parishes of Branston, Outwoods and Stretton). The two main towns of Burton and Uttoxeter lie at opposite ends of the Borough, with Burton on the boundary in the South East corner and Uttoxeter to the North West. They are surrounded by a number of outlying villages and hamlets, the largest of which are concentrated along the Southern and Eastern borders.

The principal town of Burton is located along the River Trent, which flows through the main town centre, separating the Stapenhill and Winshill areas to the South of the river from the Branston, Shobnall, Horninglow and Stretton areas to the North. There are also a number of tributary streams and brooks, draining the surrounding fields and hills which flow through the areas mentioned above, discharging into the Trent in the centre of the town. The Trent and Mersey Canal follows a similar route to the River Trent through the Borough, lying roughly parallel to the A38. Consequently there are a number of developed areas that exist within the floodplain, giving rise to concern over flooding.

Uttoxeter, the second largest settlement with a population of 12,000 in 2001, is affected by a number of watercourses. Most notable is Picknall brook which flows through the Southern part of the town, joined by a network of streams draining the steep hillsides to the South and forming a confluence with Picknall Brook in the middle of its course through Uttoxeter. The River Dove, a tributary of the River Trent, flows to the east of the main town and the River Tean forms the Northern border of the urban extent, joining the Dove to the Northeast.

Both Uttoxeter and Burton have suffered from a number of flooding events, as have many of the villages and hamlets, the largest of which tend to be located along the boundary rivers and their tributary brooks and streams.

The Borough also contains a network of streams, pools and brooks all having the potential to cause flooding. There is a large water supply reservoir, Blithfield Reservoir located on the River Blithe to the West of the Borough, just upstream of its confluence with the River Trent. In addition, Branston Water Park is located just outside Burton next to the River Trent, consisting of a number of water-filled sand and gravel pits.

Figure 1 shows the East Staffordshire Borough boundary and includes key features such as main towns, villages, watercourses, roads and railways.

East Staffordshire is bounded by six planning authority areas:

- Lichfield Borough;
- Stafford Borough Council;
- Staffordshire Moorland Borough Council
- The Peak Borough National Park;
- Derbyshire Dales Borough Council; and
- South Derbyshire Borough Council

1.4 Data Used

The data used in the study derives from several sources, most notably the Environment Agency and the Council. A data register is provided in **Appendix D.**

The key types of data obtained include:

- OS background mapping;
- Topographic survey – LiDAR
- National Flood Zones and historic flooding records from all sources of flooding ;
- Flood defences, structures and flood alleviation measures;
- Flood risk studies and modelling reports;
- Catchment Flood Management Plan (CFMP);
- Flood warning and Flood watch areas; and
- Local plan and LDF documents and development proposals.

1.5 Limitations and Assumptions

The conclusions of this SFRA are based on information currently available. The areas of the proposed potential development sites are indicative only. The final sites will be subject to the outcome of ongoing studies commissioned by the Council that will provide the evidence base for the emerging Local Development Framework.

The Level 1 SFRA maps (1 in 10,000 scale) for the entire East Staffordshire Borough are based on the Environment Agency's latest released Flood Zone information, (September 2007).

2 CATCHMENT DESCRIPTION AND CAUSES OF FLOODING

2.1 Catchment Description

2.1.1 General

Figure 2 illustrates the river system within the East Staffordshire Borough which largely falls within the following three Main River catchments:

- River Trent
- River Dove; and
- River Blithe.

2.1.2 River Trent Catchment

River Trent

The River Trent flows in a Easterly direction, forming the South Eastern boundary of the Borough, and passes through the town of Burton upon Trent. The River Trent rises in the South Pennines on Biddulph Moor, North of Stoke on Trent and, by Burton, drains a catchment of over 3000 km^2. Through Burton it carries extreme flows of approximately 468m^3/s in a 1 in 100 year event, (Fluvial Trent Hydraulic and Economic Study: Burton Hydraulic Modelling Report). Burton has suffered on numerous occasions from fluvial flooding, both as a result of rainfall and snow melt. Due to the location of Burton, moderately high up in the catchment, there is a relatively quick response time between rainfall and the rise in river levels, making flood forecasting problematic and reducing the viability of temporary and demountable defences through the town. Following floods in 1947, defences were built through Burton town centre to a 1 in 100 year standard. After a review of the November 2000 floods, these defences were upgraded in 2006-7 and are now mostly at a 1 in 200 year standard (East Staffordshire Borough Council), protecting over 7000 properties (Environment Agency).

The tributaries of the River Trent within the East Staffordshire Borough are Dale Brook, Stapenhill Brook, Johnson's Brook, "Kitling Greaves Brook", "Bitham Lane Brook", Shobnall Brook, Tatenhill Brook, Barton Brook, the River Swarbourn and the River Dove. The confluence of the River Blithe with the River Trent is located just upstream, outside the boundary of the Borough.

Dale Brook

- Flows in a North-Westerly direction, forming the Northern border of the Winshill area of Burton and joins the River Trent just downstream of Meadow's Farm.
- The brook rises on the slopes between Bretby and Winshall.
- Natural channel that runs behind residential gardens.
- There is no history of flooding from the watercourse itself, but there have been issues regarding the routing of surface water flows into the brook through the residential gardens. Work was carried out to solve this problem in the late 1990s and there have been no reports of incidents since.

Stapenhill Brook

- Flows in a Westerly direction through the Stapenhill area of Burton and joins the River Trent just downstream of St Peter's Bridge.
- The brook initiates at the privately owned (although the owner is unidentified) balancing lake, which serves the Brislincote Valley estate, close to the Borough boundary next to Development Site 37 (previously the Model Dairy Farm).
- Just downstream of the balancing lake is a Council-maintained hydrobrake.
- Most of the channel is natural, with the exception of the last 500m which is culverted.
- In the early 1990s this culvert had to undergo repairs following an explosion caused by the wedging of a child's tricycle in the channel. It now has a grill covering the open end.

Johnson's Brook

- Small tributary flowing in a North-Westerly direction parallel to the rear of houses on Highlands Drive in the Winshill area of Burton.
- The Brook is in open form for most of its length, with a culverted section at the downstream end, where it feeds into the Trent.
- The culvert appears to be unstable, but, as it is in private ownership, no realignment has taken place.

'Kitling Greaves Brook'

- This watercourse flows in an Easterly direction through the ''Outwoods' area of Burton, before entering the Knightsbridge Way balancing lake, exiting into the Horninglow channel (an open channel built in the 1960s) which subsequently feeds the lower section of Shobnall Brook and then into the Trent at Wetmore Hall Farm.
- The brook has multiple culverted and open sections.
- Flooding occurred as the result of the blinding of the grill at the top end of the culvert in June 1999 which resulted in de-silting work being carried out.
- The top culvert is now under the control of the Highways Agency.
- There is a balancing pond between the new Forest Edge Way development and the brook downstream of the top culvert.
- The open section of the Brook next to De Ferrers School was reprofiled for aesthetic reasons in spring 2007.
- Alarms have been installed on the lower culverts, in addition to improved grill clearance and regular inspections following the blinding of the balancing lake grill, which resulted in flooding in November 2000.

'Bitham Lane Brook'

- Small watercourse draining the 'Outwoods' area of Burton between Horninglow and Stretton and feeds into the Northern end of the Knightsbridge Way balancing lake.
- Mostly open but culverted in the middle section.
- Alarms have been installed on the lower culverts, in addition to improved grill clearance and regular inspections following the blinding of the balancing lake grill and subsequent flooding in November 2000.

Shobnall Brook

- This watercourse flows in a South-Easterly direction through Shobnall, before adjusting course from its original channel to flow in a North-Easterly direction, partially as the Horninglow channel, entering the River Trent at Wetmore Hall Farm.
- The channel is partially culverted: along Forest Road; under the A38; and through the developed area as it is diverted towards the Northeast and enters the Horninglow channel.
- The Brook experienced severe flooding in July 1999 along its entire length.
- The field ditch which feeds into Shobnall Brook from Lordswell Road is culverted through the Lordswell Road cul-de-sac and had its entrance reprofiled, with the addition of a grill, following the 1999 floods.

Tatenhill Brook

- This watercourse flows in a Southerly direction through the village of Tatenhill and enters the River Trent upstream of Branston.
- The channel is mostly open, with small culverted sections through the Old Mill in Tatenhill, underneath the canal and under the A38.
- The culvert through the Old Mill was rebuilt after it became blinded by a tree trunk in July 1999 and collapsed.
- This Brook also caused flooding in Branston Water Park when it overflowed in November 2000.

Barton Brook

- This brook flows in an Easterly direction through Barton under Needwood and enters the River Trent at Walton-on-Trent.
- The channel is partially culverted in sections through Barton village and under the A38 and the railway.
- There have been problems associated with the blinding of the grill under the A38, resulting in the flooding of the road.
- This brook is now enmained.
- A new drainage system, constructed as part of a residential development around the village centre has produced an increase in peak discharge of storm water to Barton Brook[1]
- Flooding has occurred along the route of Barton Brook during severe rainfall events[1]
- Flooding has occurred upstream of the culvert entrances on Wales Lane, St James Road, Efflinch Lane and land upstream of the Trent and Mersey Canal as a result of inadequate capacity. This has resulted in the flooding of properties and gardens[1]
- The off take from the fishing pond at Efflinch Lane is via a control pipe and weir. In times of storm the control on the outlet causes the pond to overtop the bank flowing into the watercourse[1]
- Extensive flooding at the rear of gardens of properties along Meadow Rise adjacent to Barton Brook has occurred on a regular basis (at least once a year) and has extended to the cartilage of the nearest buildings[1]

[1] (*Barton under Needwood, Barton Brook Improvement Scheme, 1989)*.

- As a result of the flooding incidents listed above, it is also understood that the Barton Brook is unable to cater for major flood events, and that significant flooding could be expected on this watercourse.

River Swarbourn

- This river flows in a Southerly direction from the village of Newborough to the village of Yoxall before turning Southeast and joining the River Trent just upstream of Alrewas.
- The river drains an area of approximately 44km², much of which is rural.
- Due to the steepness of its catchment, the river has a rapid response to rainfall with peak flows being achieved within 7-8 hours after the start of an event (*River Swarbourn Flood Modelling and Alleviation Report, 2002*)
- There are no raised flood defences or culverts along the river, although there are a number of small weirs through Yoxall village.
- As a result of the steep catchment significant flooding occurs in Yoxall with flood waters rising fast and with very little warning, as occurred during the August 1987 and November 2000 events (*River Swarbourn Flood Modelling and Alleviation Report, 2002*).

River Dove

- Described in Section 2.1.3 below.

2.1.3 River Dove Catchment

Within East Staffordshire the River Dove passes close by the towns and villages of Mayfield, Rocester, Uttoxeter, Marchington, Tutbury, Rolleston on Dove and the Clay Mills end of Burton upon Trent, discharging into the River Trent slightly downstream of Burton at Newton Solney.

At the confluence with the River Trent the River Dove drains a catchment area of approximately 911km^2. At its downstream extent the 1 in 100 year return period flow is 343 m^3/s (CEH dataset). No flood alleviation schemes are in place along the Dove valley, although there are a few limited areas with raised defences (all designed to 1 in 100 year standard): along the Mill Fleam near Rolleston on Dove; around the bridge at Tutbury; and along the stretch of river from Coton on the Clay, past Aston Bridge to Marchington Prison.

The main tributaries of the River Dove, from the East Staffordshire side are Rolleston Brook, Tutbury Mill Fleam, Marchington Brook, Picknall Brook, The River Tean and the River Churnet.

Rolleston Brook

- Rolleston Brook drains the area to the North of Burton upon Trent.
- The watercourse flows in a North-Easterly direction and joins the Tutbury Mill Fleam just North of the village of Rolleston on Dove.
- Just upstream of the village of Rolleston, the river feeds a fishpond.
- There are no defences along the Brook, although the stretch of channel is maintained through the village by the Environment Agency.

Tutbury Mill Fleam

- The Mill Fleam leaves the River Dove just upstream of Tutbury and flows in a South-Easterly direction parallel to the Main River and rejoins the Dove just downstream of Rolleston on Dove.
- The section of channel downstream of Tutbury is maintained by the Environment Agency and the final section before it rejoins the River Dove is protected by flood defences of a 1 in 100 year standard.

Marchington Brook

- This brook drains the hills behind Marchington and flows in a North-Easterly direction, past the South-Eastern side of the village and joins the River Dove just downstream.
- The brook has two Environment Agency maintained culverts, underneath Green Lane and underneath Church Lane.

Picknall Brook

- Picknall Brook drains an area of just under 23km².
- Its headwaters are North-West of the village of Wirthington, where the watercourse is referred to as *Dagdale Brook*. It then flows East through the village of Dagdale and rural farmland until it reaches the Southern part of Uttoxeter, where its name changes to Picknall Brook. Beyond Uttoxeter the Brook adjusts to a South-Easterly course and joins the River Dove downstream of the town next to the village of Woodford.
- There are three formal flood defences on the Brook within Uttoxeter: an embankment, maintained by the Environment Agency, located upstream of Hockley Road bridge; a brick wall on either side of the channel along Station Road, also maintained by the Environment Agency; and a privately owned defence between the Brook and the JCB factory site.
- In addition, there are a couple of culverts – one under Hockley Road and the other along Station Road.
- The 1 in 100 year return period flow is 39.7 m^3/s (Picknall Brook SFRM).
- The Brook is also fed by an unnamed, mainly culverted, watercourse which flows almost due North through the Balance Hill area, in the South of Uttoxeter.

River Tean

- The River Tean forms the boundary of the Borough from Lower Tean to Fole and then flows in an Easterly direction parallel to the A50, next to the Northern boundary of Uttoxeter, before splitting into two channels and entering the River Dove from one channel beside the A50 Bridge and another approximately 1km upstream.
- The river is separated from the town of Uttoxeter by the A50, which appears to act as a flood barrier, and does not flow through any notable settlements within the Borough, although it does flow along the perimeter of the sewage works, a couple of kilometres North of Church Leigh.
- This river is fed by minor tributaries draining the surrounding hills within East Staffordshire.
- The 1 in 100 year return period flow is 30m^3/s (CEH dataset).

River Churnet

- The River Churnet enters the Borough a few kilometres downstream of Alton and then follows a Southerly course past the village of Denstone and merges with the River Dove downstream of Rocester.
- Between Denstone and its confluence with the Dove, much of the channel is privately maintained, as stated in the NFCDD database.
- For approximately 600m beside the village of Rolleston, the channel has privately maintained, 1 in 100 year standard, raised flood defences along its left bank.
- The 1 in 100 year return period flow is approximately 102m²/s (CEH dataset)
- The river has one major, unnamed tributary within the East Staffordshire boundary, which drains the Northern area of Wootton Park via a series of pools.
- There are also a number of pools between the main river and the JCB factory at Rocester
- In addition there is one minor tributary stream, Denstone Brook, which runs through the village of Denstone in an Easterly direction before turning North and joining the River Churnet upstream of Rocester

2.1.4 River Blithe

Within East Staffordshire the River Blithe does not pass through any towns or large villages. It flows in a mainly Southerly direction, entering the Borough at its North-Western corner, just upstream of Upper Leigh. It then continues South to Woodcock Heath, where it forms the Western border of the Borough for a couple of kilometres. Beyond Newton the river curves to the Southeast and forms the SSSI, Blithfield Reservoir. Upon exiting the reservoir, the River forms the South-Western boundary for another 3 km before leaving the Borough and merging with the River Trent upstream of King's Bromley. Just upstream of Blithfield reservoir, the Blithe has a 1 in 100 year return period flow of 31m³/s (CEH dataset).

Along its course through East Staffordshire, the River Blithe is joined by Tad Brook, Ash Brook and Pur Brook, as well as a number of other, unnamed, tributaries. Apart from a couple of hamlets, none of these watercourses flow through any major settlements. They also do not have a noted history of flooding and there are no developments planned along their lengths.

2.1.5 Trent and Mersey Canal

The Trent and Mersey Canal runs parallel with the A38 and River Trent across the South-Eastern corner of the Borough, from Clay Mills (the North-Eastern extent of Burton upon Trent) to Alrewas. At this Southern extent of the Borough, the Canal outfalls into the River Trent for a short stretch before resuming its own path into the Lichfield region of Staffordshire.

There are a number of lock structures, sluices and weirs along the course of the Canal through the Borough as listed below:

- Alrewas Weir (on the Trent next to the outfall of the canal)
- Weir 3, Weir 4 and Sluice 14 (Wychnor)
- Sluice 12, Sluice 13 and Wychnor Lock (Wychnor Business Park)

- Weir 3, Sluice 10 and Tatenhill Lock (Branston Water Park)
- Branston Lock (next to Branston Junction)
- Dallow Lane Lock (Shobnall)
- Weir 2 (Stretton)
- Sluice 8, on Culvert 102 (Stretton)
- Weir 1A (Clay Mills)

In addition to acting as navigational features, the lock structures also serve to regulate water levels. This is achieved through a series of fixed and manually operated sluices and weirs, which aim to maintain a freeboard of 300mm. Even during flood events, the Canal system deals well with flows derived from the small catchments and feeder streams draining directly to it. No problems have been observed regarding flooding from the Canal, although there is potential for them to occur, as discussed in Section 3.1.6.

2.2 Causes of Flooding

The possible causes of flooding within East Staffordshire include:

i. Overflow of watercourses and existing flood defences including water retention facilities such as flood storage reservoirs/washlands and storm water balancing ponds;
ii. Breaching of flood defences (including flood storage areas);
iii. Mechanical, structural or operational failure (including due to blockages) of hydraulic structures, pumps etc;
iv. Localised surface water flooding (including sewer flooding, highway drainage flooding and overland flooding);
v. Manmade waterways such as reservoirs and canals;
vi. Functional Floodplains or Washlands; and
vii. Groundwater flooding.

3 DATA COLLECTION AND REVIEW

3.1 Historic Flooding

3.1.1 General

Historical flood information from all sources of flooding has been collected from the Environment Agency, Council, Severn Trent Water, Highways Agency and British Waterways in addition to anecdotal and media reports.

Historically, the key source of flooding within the Borough was from the Environment Agency's Main River network shown in **Figure 1**, as a result of heavy rainfall, rapid snow thaw or a combination of both, as occurred in the spring of 1947. However, much of the flooding in recent years is attributable to the blinding or blocking of grills or culverts or the overloading of the drainage systems. This was especially notable in the summer of 1999 and the autumn of 2000 in Burton, Uttoxeter and many of the surrounding villages. Many of the waterways in which the problematic culverts were located have not been enmained.

Figure 2 indicates the locations that are known to have been affected from all forms of flooding within the Borough. The towns of Burton upon Trent and Uttoxeter are shown in greater detail in **Figures 3** and **4**, respectively. **Tables B1** to **B4** in **Appendix B** summarise the different historic flood events including an indication of causes of flooding (if known). For ease of reference, each event has a unique identification number ("ID") enabling cross reference with **Figure 2**.

Whereas a single incident of Main River flooding has the potential to cause disruption to a large number of properties, very heavy rainfall, or rapid snow melt, within the Borough has the potential to result in large numbers of individual local floods. Surface water run-off management in the entire Borough therefore remains an important issue for all developments which highlight the need for Sustainable Drainage Systems (SUDS) thereby maximising the use of source control measures.

3.1.2 Flooding from Watercourses

Appendix B indicates that the River Dove and River Trent have caused a long history of flooding within the Borough. The most severe flooding occurred in 1947 when harsh winter conditions rapidly thawed as a consequence of prolonged rainfall.

However, many events have affected Uttoxeter as a result of the overtopping of Picknall Brook. The most notable of these occurred in autumn 2000 when the water level reached a maximum of 81.34m AOD at Hockley Road (Picknall Brook SFRM). In addition, the events of summer 1999 and autumn 2000 caused flooding in Burton, even though the water in the Trent was held back by the flood defences, as a result of the overtopping of non-main river watercourses in the suburbs of the town. Many of these were the result of surcharging of culvert entrances.

Many of the other tributaries of the Dove and the Trent, namely the River Swarbourn, Tatenhill Brook, Barton Brook, Marchington Brook, Denstone Brook and Rolleston Brook have also caused occurrences of flooding in the surrounding villages.

3.1.3 Sewer flooding

Severn Trent Water was consulted and asked to provide information on previous sewer flooding and those areas deemed to be at potential risk.

There are a number of properties on Severn Trent Water's "At Risk Flooding Register", which Severn Trent Water uses to capture reported incidents of sewer flooding within their area. Those properties affected by sewer flooding are reported to the Office of Water Services (Ofwat) as part of Director General Performance Measure 5 (known as DG5).

DG5 is the performance measure that Ofwat judges water companies by for sewer flooding. It covers two measures:

- The number of properties at risk of internal flooding from sewers due to hydraulic overloading within the last ten years; and

- Properties which are internally flooded. Sewer flooding can be caused by temporary problems, such as blockages or sewer collapses, or because of hydraulic overloading.

The locations of previously flooded properties are covered by the Data Protection Act. For this reason Severn Trent Water was unable to supply a map indicating properties at risk of sewer flooding but they agreed to supply this information in an alternative less detailed format. This makes it possible to broadly identify the areas where sewer flooding has occurred.

Figure 2 includes the locations that have been subject to some localised surface sewer flooding according to the information released by Severn Trent Water. These locations are indicated by the black triangles.

There are relatively few occurrences of surface sewer water flooding within the Borough and all are located outside the Flood Zone boundaries. Occurrences are located in the villages of Rough Hay, Anslow, Tutbury, Denstone and Mayfield, in addition to the suburb of Stapenhill in Burton upon Trent.

3.1.4 Highway drainage and overland flooding

The Highways Agency were consulted and asked to provide information on highway flooding related incidents. The main route through the Borough which the Highways Agency is responsible for is the A38, which transgresses the Southeastern corner, through Burton upon Trent. The other main road in the Borough is the A50, which is currently under a DBFO contract. Records of flooding have been provided for the A38 covering the period 2002-2007. These are presented in **Table B4** in **Appendix B** and shown on **Figure 2**. There have apparently not been any occurrences of flooding on the A50 throughout its history.

Liaison with the Council's Drainage Engineer also identified a number of locations where flooding was attributable to problems associated with surface water flooding due to inadequate road drainage.

3.1.5 Groundwater flooding

The Environment Agency's groundwater team was consulted and confirmed that there have been very few recorded incidences of groundwater flooding within East Staffordshire. The only events that have occurred are as a result of the cessation of the quarrying of gravel and sand in the area and thus the abstraction of water from the pits. Once the abstraction machines were removed, the groundwater levels rose and filled some of the pits, hence the existence of the Branston Water Park. As a result of this, there has been one report regarding the occurrence of minor cellar flooding.

3.1.6 Canal Flooding

British Waterways were consulted in order to gain an understanding of the flood risk arising from the Trent and Mersey Canal. The canal system is effectively self-regulating, with water levels controlled through a system of sluices and weirs, aiming to maintain a freeboard of 300mm. In isolation, the canal system operates effectively, and is able to accommodate the flows that enter it from feeder streams and its own small catchment areas.

At the present time there have not been any occurrences of flooding from the canal. However, it has been recognised that problems may arise if the River Trent interacts with the canal system. Around the Branston area, South of Burton, there are locations where the canal is within Flood Zone 2 and, for a short stretch, Flood Zone 3. If the river levels in the Trent exceed the bank heights of the canal, any water entering the canal system will quickly use the storage afforded by the available freeboard. The canal will then act as a conduit to flood water and may exacerbate the flooding. This situation has not yet been observed, although it has been recognised by British Waterways that any increase in runoff close to the canal, for example, from a new development, or in the occurrence of an extreme flood, could result in such an event. In addition, it has also been recognised that a failure to remove sufficient water from the canal system at Wychnor may result in a backing up of the canal and therefore a potential flood risk for the surrounding area, including the A38.

3.1.7 Blithfield Reservoir

South Staffordshire Water's Blithfield Reservoir is located just over a kilometre Southwest of Abbots Bromley, on the River Blithe. It is a SSSI, used primarily as a water supply reservoir, but also as a recreational and educational facility. The water is retained by a clay cored dam structure. Dam failure would therefore result in the rapid release of a large volume of water down the River Blithe towards its confluence with the River Trent, 7km downstream at Kings Bromley. Although there are no significant settlements on the River Blithe, such an event could have significant consequences in terms of flood risk to properties downstream on the Trent, including the town of Burton.

However, it should be noted that the operation of reservoirs is strictly managed. Legislation has been in place since the 1930s when a dam failure resulted in the loss of life. This early legislation was updated by the Reservoirs Act 1975. Reservoir owners have ultimate responsibility for the safety of their reservoirs. The Environment Agency has the role of enforcing the Reservoirs Act 1975. The Reservoir Act 1975 places a demand on the reservoir owner to appoint a Panel Engineer to supervise and inspect the operation and management of the reservoir.

3.2 Topographical Data

The Environment Agency has provided filtered and unfiltered LiDAR (Light Detection And Ranging). The LiDAR data provides full coverage of the main watercourses within the Borough, with the exception of a few small patches. It is, however, restricted to these main watercourses and does not extend far beyond their courses. There are therefore gaps in the LiDAR for most of the centre and large parts of the East and North of the Borough. As there are only minor watercourses and headwaters within these regions and no large settlements or development proposals, the extent of the LiDAR should be sufficient for this SFRA.

The LiDAR spatial resolution in this area is 2m. Taken together with the generally accepted vertical accuracy of ±11cm to 25cm, this indicates that in the areas covered by the LiDAR data would provide a good representation of ground surface for the required flood risk mapping where modifications to the current Flood Zones are required. The LiDAR data therefore provides the topographic information necessary to produce flood outlines for different return period flood events, including the 1 in 1000 year (Flood Zones 2) and also to assess the impacts of climate change along the main watercourses. The LiDAR data coverage is also sufficient for use in conjunction with channel cross section surveys, to undertake any potential hydraulic modeling in the Level 2 SFRA.

Figure 5 shows the extent of LiDAR currently available within the Borough.

3.2.1 Existing Studies and Hydraulic Models

Appendix C summarises the hydraulic models that have been undertaken for watercourses within the Borough. The extents of the models are also presented in **Figure 6**.

3.3 Land at Flood Risk

The sources of flooding and historic flooding information are identified above. **Figure 7** shows the Environment Agency's Flood Zones and the proposed development sites within the Borough. Burton upon Trent and Uttoxeter are shown in greater detail in **Figures 8** and **9**, respectively. **Figures 7, 8** and **9** also show the Functional Floodplain (Flood Zone 3b) where defined as part of this SFRA. Further details on the definition of Flood Zone 3b is given in Section 4.3.2. The land at risk of flooding shown in this figure should also be considered in conjunction with historic flooding information given in **Figures 2, 3** and **4** and Section 3.1.

The land at risk is depicted in terms of the Flood Zones and the locations known to have experienced flooding problems in the past. This includes the floodplains of the Rivers Trent, Dove and Blithe in addition to their Main River tributaries. Table D.1 and Table D.2 of PPS25 define the Environment Agency's Flood Zones and provide flood risk vulnerability classification, including policy aims and Flood Risk Assessment (FRA) requirements.

3.4 Existing Flood Management Measures

3.4.1 General

Figure 10 identifies the key flood risk management structures within the Borough, which comprise raised flood embankments and flood walls.

The Environment Agency has the responsibility for looking after the formal defences that are owned by them. In addition to inspection and routine maintenance of their formal defences and other structures, the Environment Agency carries out the routine maintenance, such as bank clearance or in-channel work to remove weed growth and silt, and non-routine maintenance (e.g. removal of blockages) of the designated Main Rivers.

The maintenance and operation of all key hydraulic structures including flood defences has a significant impact upon flood risk management and it is therefore critical to identify the owners as well as the condition of such structures during a Level 2 SFRA.

A brief description of the existing flood risk management measures managed by various organisations is given below.

3.4.2 Environment Agency

River Trent

As can be seen from **Figure 10** Burton is protected a flood alleviation scheme. These flood defences were initially erected, and the Burton Weirs removed, in the 1960s following the 1947 floods. Although they have been updated and extended over the years, the last major improvement works were carried out in 2006-2007. The scheme comprises raised defences, mostly along the North bank of the river through Burton, and is now considered to be of 1 in 200 year standard throughout the whole town, with the exception of a short stretch adjacent to the Meadowside Centre.

The previous flood alleviation scheme was observed to operate effectively during the November 2000 flood event, although water did seep through the weaknesses in the structures (Burton upon Trent FRMP, 2005)

River Dove

There is not an extensive flood alleviation scheme in place along the Dove valley, although there are a few limited areas with raised defences (all designed to 1 in 100 year standard): along the Mill Fleam near Rolleston on Dove; around the bridge at Tutbury; and along the stretch of river from Coton on the Clay, past Aston Bridge to Marchington Prison.

3.4.3 Council

At present, the Council does not maintain any raised defences within the Borough other than fulfilling general drainage aspects of non-main river watercourses and associated surface water balancing features.

3.4.4 Private

There are a few short sections of privately maintained raised defences within the Borough: the Sudbury A515 Road Bridge at Aston Bridge, across the River Dove; the wall and earth bank beside the JCB factory along Picknall Brook in Uttoxeter; and a short section of defence just North of Rocester on the River Churnet.

All of these are reported by the Environment Agency as being designed to a 100 year standard, with the exception of the section outside the Riverside Hotel, which is recorded as being of a 200 year standard.

3.5 Flood Warning and Emergency Response

3.5.1 Flood Warning

Within the Borough of East Staffordshire, as elsewhere in England, the responsibility for flood warning rests primarily within the Environment Agency. It provides flood warnings for designated Flood Warning Areas that are based on risk categories, which take into account factors such as the likelihood and impact of flooding, and the resulting risk for each area. The Environment Agency has supplied the details of present flood warning arrangements for the Borough. However, the Environment Agency continuously updates its flood warning system and therefore the relevant Agency Area staff should be contacted for the latest information.

As shown in **Figure 10**, the current flood warning zone covers nearly all of the main rivers within the Borough, including the entire extent of the Rivers Trent, Dove, Blithe (with the exception of Blithfield Reservoir), Tean and Churnet, and the downstream sections of Picknall Brook (through Uttoxeter), River Swarbourn (through Yoxall), Rolleston Brook (through Rolleston on Dove) and a small section of Marchington brook (not extending through Marchington village itself).

3.5.2 Warning Dissemination

Flood Warnings are disseminated by the Environment Agency via a system known as Floodline Warning's Direct. The service is a free flood warning service that provides warnings direct to customers 24 hours a day by telephone, mobile, fax or pager. It replaces the older Automatic Voice Messaging System which was used to send out flood warnings direct to the public since 1996. The message details the level of warning issued for the area for which the warning is in force and advice on what action to take. As flood events develop the public is encouraged to phone Floodline for updates. This system requires residents of "at risk property" to register their telephone numbers with the Environment Agency. Concerned parties are able to obtain current flood warning information according to a particular river or Flood Warning Risk Area.

Other current methods of warning dissemination include:

- The media – warnings are issued through the media; they are broadcast on TV weather bulletins and on radio weather and travel reports. Flood warnings are also displayed on ITV Teletext regional weather pages (page 154) and on the BBC Ceefax (page 419).

- **Floodline 0845 988 1188** – offers callers the option to listen to recorded flood warning information 24 hours a day and speak to a trained operator for more advice.
- Internet – The EA's website **www.environment-agency.gov.uk/flood** contains live warning information.

If anyone has not currently registered their phone number but is at risk of flooding, they should consider contacting the Environment Agency.

The EA issues flood warnings using a set of four easily recognisable codes which include:

- **Flood Watch**, where flooding of low-lying land and roads is possible;
- **Flood Warning**, where flooding of homes, businesses and main roads is expected;
- **Severe Flood Warning**, where severe flooding is expected. Extreme danger to life and property; and
- **All Clear**, where flood watches or warnings are no longer in force.

A **Flood Watch** would be issued when water levels along the river are forecast to cause out-of-bank flooding of low-lying land and roads.

A **Flood Warning** is issued when the Environment Agency anticipate flooding to property. The trigger levels currently set for this are based on the levels of permanent dwellings.

The trigger for issue of a **Severe Flood Warning** is dependent on a number of factors, but is essentially used when there is thought to be extreme danger to life.

The Environment Agency generally aims to give a two-hour lead time for all of the above levels of warning prior to any properties being flooded. However in certain cases of severe or "flash flooding" this may not always be possible. The Environment Agency can not provide flood warnings for surface water, road drains, sewer flooding and burst drains. The information on these will come from the Highways Agency, Council, Severn Trent Water and the public. Certain areas may be at additional risk due to their location downstream of heavily urbanised areas and urban areas that have the potential for "flash flooding", surcharging the capacity of existing sewers and watercourses.

3.5.3 Emergency Response

Following the flooding during the summer of 2007, the Major Incident Flood Plans for Staffordshire were rendered neither strategic nor operational and, as far as we are aware, the re-evaluation process has not yet been completed. However, a copy of a previous Flood Action Plan, constructed by the Parish Council, for Rolleston on Dove has been obtained.

4 DEVELOPMENT AND FLOOD RISK ISSUES

4.1 Potential Development Sites

This Level 1 SFRA has been prepared mindful of the current potential development sites, both Brownfield and Greenfield, as provided by the Council. The locations of potential development sites are presented in **Figures 7, 8** and **9**. For ease of reference each development site has been given a unique identification number for cross-reference with these figures.

4.2 PPS25 Requirements

PPS25 is a new-style PPS reflecting the expectations of the Government's Planning Green Paper, *Planning: delivering a fundamental change*. It focuses on national policy and provides clarity on what is required at regional and local levels to ensure that decisions are made at the most appropriate level and in a timely fashion to deliver sustainable planning for development and flood risk.

Section 2.34 of Development and Flood Risk a Practice Guide Companion to PPS25, "Living Draft" states the key outputs from a Level 1 SFRA to be as follows:

- Plans showing the LPA area, Main Rivers, ordinary watercourses and flood zones, including the functional floodplain where appropriate, across the local authority area as defined in Table D1 of PPS25, as well as allocated development sites.
- An assessment of the implications of climate change for flood risk at allocated development sites over an appropriate time period, if this has not been factored into the plans above.
- Areas at risk of flooding from sources other than rivers and the sea.
- The location of any flood risk management measures, including both infrastructure and the coverage of flood warning systems.
- Locations where additional development may significantly increase flood risk elsewhere.
- Guidance on the preparation of FRAs for allocated development sites.
- Guidance on the likely applicability of different sustainable drainage systems (SUDS) techniques for managing surface water run-off at key development sites.

(Development and Flood Risk: A Practice Guide Companion to PPS25 "Living Draft, Communities and Local Government, February 2007)

The remainder of Section 4 highlights how these outputs have been addressed in the production of this Level 1 SFRA.

4.3 Mapping, Flood Zones and Development Areas

Plans showing the LPA area, Main Rivers, ordinary watercourses and flood zones, including the functional floodplain where appropriate, across the local authority area as defined in Table D1 of PPS25, as well as allocated development sites.

4.3.1 General

Figure 1 of this report shows the East Staffordshire Borough boundary, the Main Rivers and ordinary watercourses.

The Environment Agency's Flood Zones 2 and 3 (1000 and 100 year return periods respectively) are presented in **Figure 7, 8** and **9**, along with the current potential development sites.

4.3.2 Functional Floodplain

As defined in PPS25, the Functional Floodplain (i.e. Zone 3b) comprises land where water has to flow or be stored in times of flood. It includes the land which would flood with an annual probability of 1 in 20 (5%) or greater in any year or is designed to flood in an extreme (0.1%) flood, or at another probability to be agreed between the LPA and the Environment Agency, including planned water conveyance routes.

This zone takes into account the effect of existing flood risk management measures and other infrastructure in accordance with the guidance given in the 'Living Draft' Practice Guide. Functional Floodplain has been determined for all watercourses for which modelled flood levels are currently available. Functional Floodplain is also presented in **Figures 7, 8** and **9**. It should be noted that flood levels were only provided for the 1 in 25 year flood for many of the Main Rivers within the Borough: the River Dove, River Trent, River Churnet, Picknall Brook and Rolleston Brook. Only the small section of the River Tean is modelled to the 1 in 20 year standard (however the report is currently missing the cross section and flood outline figures). Therefore the Functional Floodplain has been based on the results of the 25 year return period models where available. Functional Floodplain has not been determined for the section of the River Trent upstream of Burton upon Trent, due to the omission of the cross section extents within the Fluvial Trent Strategy Report. As there are no proposed development sites along this reach it is not considered essential to define Functional Floodplain for this reach. Further details describing the current availability of hydraulic modelling within the Borough is given in Section 3.3 of this report.

Additional hydraulic modelling is beyond the scope of the Level 1 SFRA and therefore the Functional Floodplain has still to be identified for the following watercourses, either as part of a future Level 2 SFRA or a site specific FRA:

- River Dove (upstream of Rocester);
- Picknall Brook (upstream of Loxley Lane and downstream of the racecourse to its confluence with the River Dove);
- River Tean (downstream of Beamhurst to confluence with the River Dove – the upstream end should be available if the missing sections of the report are recovered);
- River Blithe (entire extent);
- Shobnall Brook;
- River Swarbourn;

- Tatenhill Brook;
- Stapenhill Brook;
- Dale Brook;
- 'Kitling Greaves Brook';
- 'Bitham Lane Brook';

Until a Level 2 SFRA has been produced or appropriate site specific FRAs show this zone for the above watercourses to the satisfaction of the Environment Agency, it is recommended that all areas within the Flood Zone 3a should be considered as the Functional Floodplain.

4.3.3 Assessment of Fluvial Flood Risk to Proposed Development Areas

Table 1 indicates the details of the potential development sites within the Borough and whether they are located within Flood Zones 2 and 3. All planning applications for development proposals of 1 hectare or greater in Flood Zone 1 and all proposals for new development located in Flood Zones 2 and 3 should be accompanied by a FRA to satisfy the requirements of PPS25.

Table 1a: Potential Development Sites: Identified by White, Young and Green Consultants

Unique ID[1]	Location	Total Area (ha)	Within Flood Zone 2	Within Flood Zone 3a	Within Flood Zone 3b	Current Status
D1	Forest Edge Way, Burton Upon Trent	0.82	No *(But adjacent watercourse not modelled)*	No	No	Scrub Land, not previously developed
D2	Rolleston Road, Burton Upon Trent	0.28	No	No	No	Potential redevelopment of a workshop
D3	Horninglow Road North, Burton upon Trent	0.16	No	No	No	Potential Redevelopment of a pub garden
D4	Wetmore, Burton upon Trent	3.20	**Yes**	No	No	Vacant/derelict industrial site
D5	Wetmore Road, Burton upon Trent	0.79	**Yes**	**Yes**	No	Open land not previously developed
D6	Arthur Street, Burton Upon Trent	1.90	No	No	No	Potential redevelopment of an industrial estate
D7	Dallow Street, Burton Upon Trent	2.63	No	No	No	Potential redevelopment of a workshop
D8	Victoria Crescent, Burton Upon Trent	2.26	No	No	No	Potential redevelopment of a transport depot
D9	Horninglow Road, Burton Upon Trent	3.68	**Partially**	No	No	Vacant/derelict factory and land
D10	Dallow Street/Victoria Road, Burton Upon Trent	0.46	No	No	No	Potential redevelopment of an employment site
D11	Derby Street, Burton Upon Trent	2.87	**Yes**	No	No	Potential Redevelopment of an Industrial Premises

D12	Horninglow Street Middle Yard, Burton Upon Trent	1.49	**Yes**	**Yes**	No	Potential redevelopment of a derelict warehouse, car hire etc
D13	Station Street, Burton Upon Trent	0.90	**Yes**	**Partially**	No	Potential conversion into a commercial building from offices
D14	Curzon Street, Burton Upon Trent	1.85	**Yes**	**Yes**	No	Vacant/derelict transport depot and warehouse
D15	Shobnall Road (Waste Site)	0.97	**Yes**	**Yes**	No	Potential redevelopment of waste station
D16	Shobnall Road, Burton Upon Trent	1.52	**Yes**	**Yes**	No (Haswell Report)	Potential redevelopment of Industrial and B1 site
D17	Shobnall Road, Burton Upon Trent	0.83	**Yes**	**Yes**	No (Haswell Report)	Potential redevelopment of Industrial and B1 site
D18	Crown Industrial Estate, Burton Upon Trent	6.34	**Yes**	**Yes**	No	Potential conversion into a commercial building from various employment use
D19	Fleet Street, Burton Upon Trent	0.52	**Yes**	**Yes**	No	Potential redevelopment of a retail warehouse
D20	Bond Street, Burton Upon Trent	0.73	**Yes**	**Yes**	No	Potential redevelopment of offices
D21	Bond Street/Green Street, Burton Upon Trent	0.27	**Yes**	**Yes**	No	Potential redevelopment of an employment site
D22	Horninglow Street, Burton Upon Trent	0.17`	**Yes**	**Yes**	No	Vacant/derelict former PFS site
D23	Watson Street, Burton Upon Trent	1.79	**Yes**	**Yes**	No	Potential redevelopment of Modern B2
D24	Queen Street, Burton Upon Trent	1.12	**Yes**	**Yes**	No	Potential redevelopment of warehouse premises
D25	Broadway Street, Burton Upon Trent	0.24	**Yes**	**Yes**	No	Potential redevelopment of car repairs garage
D26	Blackpool Street, Burton Upon Trent	0.26	**Yes**	**Yes**	No	Potential redevelopment of outbuildings
D27	All Saints Road, Burton Upon Trent	0.31	**Yes**	**Yes**	No	Potential redevelopment of employment site
D28	Branston Depot, Burton Upon Trent	25.21	**Yes**	**Yes**	No	Potential redevelopment of warehouse
D29	Lynwood Road, Burton Upon Trent	0.73	**Yes**	**Yes**	No	Open space, not previously developed
D30	Bridgford Avenue, Burton Upon Trent	0.20	**Yes**	**Yes**	No	Open space, not previously developed
D31	Manor Farm, Burton Upon Trent	2.30	**Yes**	**Yes**	No	Grazing land, not previously developed
D32	Lichfield Lane, Burton upon Trent	3.74	**Yes**	**Yes**	No	Container storage, not previously developed

D33	Hollyhock Lane, Burton upon Trent	15.59	**Yes**	**Yes***	No, but in proximity	Grazing land, not previously developed
D34	Stanton Road, Burton upon Trent	0.26	No	No	No	Potential redevelopment of smallhold/grazing land
D35	Model Dairy Farm, Burton upon Trent	3.80	No	No	No	Potential Redevelopment of farm buildings and open storage
D36	Scalpcliffe Close	0.35	No	No	No	Vacant/derelict workshop
D37	Scalpcliffe Road	0.20	**Partially**	No	No	Vacant/derelict Ex PFS, now car sales
D38	Vancouver Drive, Burton upon Trent	0.66	No	No	No	Open space, previously undeveloped
D39	Berryhedge Youth Centre, Burton upon Trent	0.22	No	No	No	Potential redevelopment of a youth centre
D40	Roslison Road, Burton upon Trent	0.13	No	No	No	Potential redevelopment of a car repairs and sales centre
D41	Tatenhill Lane, Burton upon Trent	2.44	**Yes**	**Yes**	No	Open land, previously undeveloped
D42	Brookside Road, Uttoxeter	6.62	**Yes**	**Yes**	**Yes**	Potential redevelopment of employment site
D43	JCB Sites, Uttoxeter	6.79	**Partially**	**Partially**	**Partially**	Potential redevelopment of industrial and open storage
D44	Stafford Road, Uttoxeter	1.09	**Partially**	No, but very close	No	Potential redevelopment of highways depot
D45	Eastfields Road, Uttoxeter	1.36	**Yes**	**Yes**	No	Potential redevelopment of employment site

* *NB a review of the LiDAR contradicts the Environment Agency flood zones in this location and indicates this development site should not to be in Flood Zone 3. This will be investigated further in the Level 2 SFRA.*

Table 1b: Potential Development Sites: Greenfield Sites

Unique ID[1]	**Location**	**Total Area (ha)**	**Within Flood Zone 2**	**Within Flood Zone 3a**	**Within Flood Zone 3b**	**Current Status**
GF1	Beam Hill, Burton upon Trent	45.44	No	No	No	Previously undeveloped Greenfield – town perimeter
GF2	Harehedge Lane, Burton Upon Trent	19.05	No	No	No	Previously undeveloped Greenfield – town perimeter
GF3	Outwoods Lane (North), Burton upon Trent	81.23	No *(But adjacent watercourse not modelled)*	No	No	Previously undeveloped Greenfield – town perimeter
GF4	Outwoods Lane (Southeast), Burton upon Trent	14.16	No	No	No	Previously undeveloped Greenfield – outside town

GF5	Outwoods Lane (Southwest), Burton upon Trent	27.95	No	No	No	Previously undeveloped Greenfield – outside town
GF6	Lower Outwoods, Burton upon Trent	1.12	No	No	No	Previously undeveloped Greenfield – town perimeter
GF7	Henhurst Hill, Rough Hay	3.17	No	No	No	Previously undeveloped Greenfield – village perimeter
GF8	Postern Road, Rough Hay	14.28	No	No	No	Previously undeveloped Greenfield – village perimeter
GF9	Forest Road, Burton upon Trent	17.23	No	No	No	Previously undeveloped Greenfield – town perimeter
GF10	Henhurst Hill, Rough Hay	0.34	No	No	No	Previously undeveloped Greenfield – village perimeter
GF11	Forest Road, Burton upon Trent	4.76	**Partially**	**Partially**	No	Previously undeveloped Greenfield – town perimeter
GF12	Belvoir Road, Burton upon Trent	0.18	No	No	No	Previously undeveloped Greenfield – within town
GF13	A38, Burton upon Trent	165.15 (Island = 0.69)	**Partially**	**Partially**	No	Previously undeveloped Greenfield – town perimeter
GF14	Tatenhill Lane, Burton upon Trent	2.46	**Yes**	**Yes**	No	Previously undeveloped Greenfield – town perimeter
GF15	Manor Farm, Branston, Burton upon Trent	0.60	**Yes**	**Yes**	No	Previously undeveloped Greenfield – town perimeter
GF16	Uxbridge Street, Burton upon Trent	0.09	**Yes**	**Yes**	No	Previously undeveloped Greenfield – within town
GF17	Lichfield Street, Burton upon Trent	0.17	**Yes**	**Yes**	No	Previously undeveloped Greenfield – within town
GF18	Bond Street, Burton upon Trent	0.28	**Yes**	**Yes**	No	Previously undeveloped Greenfield – within town
GF19	Green Street, Burton upon Trent	0.14	**Yes**	**Yes**	No	Previously undeveloped Greenfield – within town
GF20	Horninglow Street/Hawkins Lane, Little Burton, Burton upon Trent	4.21	**Yes**	**Yes**	No	Previously undeveloped Greenfield – within town
GF21	Model Dairy Farm, Woods Lane, Burton upon Trent	3.46	No	No	No	Previously undeveloped Greenfield – town perimeter
GF22	St Mary's Drive, Burton upon Trent	1.29	No	No	No	Previously undeveloped Greenfield – town perimeter
GF23	Dovecliff Road, Burton upon Trent	2.28	**Partially**	**Partially**	No	Previously undeveloped Greenfield – town perimeter
GF24	Walford Road (Sports Field), Rolleston on Dove	6.03	No	No	No	Previously undeveloped Greenfield – village perimeter
GF25	Craythorne Road, Rolleston on Dove	1.24	No	No	No	Previously undeveloped Greenfield – village perimeter

GF26	Green Lane, Tutbury	15.27	No	No	No	Previously undeveloped Greenfield – village perimeter
GF27	Redhill Lane, Tutbury	8.55	No	No	No	Previously undeveloped Greenfield – village perimeter
GF28	Station Road, Barton under Needwood	20.68	**Partially**	No	No	Previously undeveloped Greenfield – outside village
GF29	Mill Bridge, Barton under Needwood	18.94	**Partially**	**Partially**	No	Previously undeveloped Greenfield – village perimeter
GF30	Barton Green, Barton under Needwood	5.15	No	No	No	Previously undeveloped Greenfield – village perimeter
GF31	Thorny Lanes, Hoar Cross	0.42	No	No	No	Previously undeveloped Greenfield – outside village
GF32	Knightsfield Road, Hanbury Woodend	0.41	No	No	No	Previously undeveloped Greenfield – outside village
GF33	Jacks Lane, Marchington	1.62	No	No	No	Previously undeveloped Greenfield – village perimeter
GF34	Demontfort Way, Uttoxeter	4.12	No	No	No	Previously undeveloped Greenfield – town perimeter
GF35	Timber Lane (Track), Uttoxeter	3.16	No	No	No	Previously undeveloped Greenfield – town perimeter
GF36	B5013 – Timber Lane, Uttoxeter	16.58	No	No	No	Previously undeveloped Greenfield – town perimeter
GF37	Brookside Road, Uttoxeter	2.14	**Yes**	**Yes**	**Yes**	Previously undeveloped Greenfield – town perimeter
GF38	Eastfield Road, Uttoxeter	0.26	**Yes**	**Yes**	No	Previously undeveloped Greenfield – town perimeter
GF39	Spath Cottage Farm, Uttoxeter	6.47	**Partially**	**Partially**	No	Previously undeveloped Greenfield – town perimeter
GF40	A50, Uttoxeter	64.76	No	No	No	Previously undeveloped Greenfield – town perimeter
GF41	Bramshall Road, Uttoxeter	6.09	No	No	No	Previously undeveloped Greenfield – town perimeter
GF42	Northfield Avenue, Rocester	2.26	No	No	No	Previously undeveloped Greenfield – village perimeter

Notes:

1 - For Cross Reference with Figures 7, 8 and 9.

As can be seen from the Tables 1a and 1b, there are number of sites that are within Flood Zones 3a which will require passing the Exception Test following the application of Sequential Test under PPS25 guidance. The Council will need to clarify with the Environment Agency how to handle these sites when determining planning permission. Also, sites D42, D43 and GF37 are within the Functional Floodplain, (Flood Zone 3b) and no development should be permitted within this zone. Additional analysis should be undertaken to determine whether sites D16 and D17 are within the Functional Floodplain.

4.4 Impacts of Climate Change

An assessment of the implications of climate change for flood risk at allocated development sites over an appropriate time period, if this has not been factored into the plans above.

PPS25 clearly emphasises the need for addressing climate change impacts to deal with the increased and new risks of flooding within the lifetime of planned development. Also, Planning Policy Statement 1: Delivering Sustainable Development and its supplementary draft Planning Statement on Planning and Climate Change (consultation completed in March 2007) provide further guidance on how to address the new thereat of climate change within the planning system.

This Level 1 SFRA has assessed the impacts of climate change eighty years hence (2087) by assessing the impact on the existing Flood Zone 3, taking into account the impact of climate change on river flows. In accordance with PPS25 this process has only been undertaken in the vicinity of potential development sites.

Where 100 year water levels and flows were available from hydraulic models the approximate increase in flood level was determined by adding 20% to the flows.

For unmodelled watercourses and as a conservative approach, it was considered that this outline should be the same as the present-day Flood Zone 2, until demonstrated otherwise in a Level 2 SFRA or a detailed site specific FRA.

Using this approach, the currently allocated sites can be broadly assessed against the potential risk from climate change, as shown in **Tables 2a** and **2b**. However, they will need further assessment as per the guidance in Annex B of PPS25 by fully taking into account the presence of existing flood defences through an updated Level 2 SFRA or site-specific FRAs.

Table 2a: Impacts of Climate Change on Potential Development Sites: Identified by White, Young and Green Consultants

Unique ID[1]	Location	Impact of Climate Change
D1	Forest Edge Way, Burton Upon Trent	The adjacent watercourse has not been modelled. It is recommended that the existing main river Flood Zone 2 be used to represent Flood Zone 3 with climate change until the watercourse has been assessed in greater detail. As it is outside Flood Zone 2 (1 in 1000 year) risk of flooding is not directly affected by climate change. However, the consequences of the development in terms of additional runoff and increased flood risk elsewhere due to climate change should be considered.
D2	Rolleston Road, Burton Upon Trent	Outside Flood Zone 2 (1 in 1000 year) and therefore risk of flooding not directly affected by climate change. However, the consequences of the development in terms of additional runoff and increased flood risk elsewhere due to climate change should be considered.
D3	Horninglow Road North, Burton upon Trent	Outside Flood Zone 2 (1 in 1000 year) and therefore risk of flooding not directly affected by climate change. However, the consequences of the development in terms of additional runoff and increased flood risk elsewhere due to climate change should be considered.

D4	Wetmore, Burton upon Trent	Approximate increase in the 1 in 100 year flood level of 0.38m* (Burton Economic Model).
D5	Wetmore Road, Burton upon Trent	Approximate increase in the 1 in 100 year flood level of 0.38m* (Burton Economic Model).
D6	Arthur Street, Burton Upon Trent	Outside Flood Zone 2 (1 in 1000 year) and therefore risk of flooding not directly affected by climate change. However, the consequences of the development in terms of additional runoff and increased flood risk elsewhere due to climate change should be considered.
D7	Dallow Street, Burton Upon Trent	Outside Flood Zone 2 (1 in 1000 year) and therefore risk of flooding not directly affected by climate change. However, the consequences of the development in terms of additional runoff and increased flood risk elsewhere due to climate change should be considered.
D8	Victoria Crescent, Burton Upon Trent	Outside Flood Zone 2 (1 in 1000 year) and therefore risk of flooding not directly affected by climate change. However, the consequences of the development in terms of additional runoff and increased flood risk elsewhere due to climate change should be considered.
D9	Horninglow Road, Burton Upon Trent	Very small segment inside Flood Zone 2 (1 in 1000 year) and therefore risk of flooding not directly affected by climate change. However, the consequences of the development in terms of additional runoff and increased flood risk elsewhere due to climate change should be considered.
D10	Dallow Street/Victoria Road, Burton Upon Trent	Outside Flood Zone 2 (1 in 1000 year) and therefore risk of flooding not directly affected by climate change. However, the consequences of the development in terms of additional runoff and increased flood risk elsewhere due to climate change should be considered.
D11	Derby Street, Burton Upon Trent	Outside the current Flood Zone 3 (1 in 100 year). Therefore an increase in flood height cannot be given. However, a prediction of a Peak Water Level of 45.55m AOD (Burton Economic Study) suggests that the development will be partially affected when compared with the LiDAR.*
D12	Horninglow Street Middle Yard, Burton Upon Trent	Approximate increase in the 1 in 100 year flood level of 0.38m* (Burton Economic Model).
D13	Station Street, Burton Upon Trent	Approximate increase in the 1 in 100 year flood level of 0.38m* (Burton Economic Model).
D14	Curzon Street, Burton Upon Trent	The current Flood Zone 3 (1 in 100 year) is not given in the model, therefore approximate increase cannot be calculated. However, a prediction of a Peak Water Level with climate change of 45.55m AOD (Burton Economic Study) suggests that the development should not be affected by the River Trent when compared with the LiDAR, although this does not account for potential flooding from Shobnall Brook, for which level data is not available*.
D15	Shobnall Road (Waste Site)	As flood level data is not available for Shobnall Brook and the difference in flood extent between Flood Zones 2 and 3 is minimal, it is recommended that the existing main river Flood Zone 2 be used to represent Flood Zone 3 with climate change until the watercourse has been assessed in greater detail. A comparison between the predicted climate change flood reservoir level from the Burton Economic study with the LiDAR suggests that this location will not be affected by the River Trent*.
D16	Shobnall Road, Burton Upon Trent	As flood level data is not available for Shobnall Brook and the difference in flood extent between Flood Zones 2 and 3 is minimal, it is recommended that the existing main river Flood Zone 2 be used to represent Flood Zone 3 with climate change until the watercourse has been assessed in greater detail

D17	Shobnall Road, Burton Upon Trent	As flood level data is not available for Shobnall Brook and the difference in flood extent between Flood Zones 2 and 3 is minimal, it is recommended that the existing main river Flood Zone 2 be used to represent Flood Zone 3 with climate change until the watercourse has been assessed in greater detail.
D18	Crown Industrial Estate, Burton Upon Trent	The current water level for Flood Zone 3 (1 in 100 year) is not provided in the model, therefore approximate increase cannot be calculated. However, a prediction of a Peak Water Level of 45.89m AOD (Burton Economic Study) for that reservoir has been provided and, as the development is already located in Flood Zone 3, it will be significantly affected by this increase*.
D19	Fleet Street, Burton Upon Trent	Approximate increase in the 1 in 100 year flood level of 0.38m* (Burton Economic Model).
D20	Bond Street, Burton Upon Trent	Approximate increase in the 1 in 100 year flood level of 0.38m* (Burton Economic Model).
D21	Bond Street/Green Street, Burton Upon Trent	Approximate increase in the 1 in 100 year flood level of 0.38m* (Burton Economic Model).
D22	Horninglow Street, Burton Upon Trent	Approximate increase in the 1 in 100 year flood level of 0.38m* (Burton Economic Model).
D23	Watson Street, Burton Upon Trent	The current water level for Flood Zone 3 (1 in 100 year) is not provided for the reservoir, therefore approximate increase cannot be calculated. However, a prediction of a Peak Water Level of 45.89m AOD (Burton Economic Study) for that reservoir has been provided and, as the development is already located in Flood Zone 3, it will be significantly affected by this increase*.
D24	Queen Street, Burton Upon Trent	The current water level for Flood Zone 3 (1 in 100 year) is not provided for the reservoir, therefore approximate increase cannot be calculated. However, a prediction of a Peak Water Level of 45.89m AOD (Burton Economic Study) for that reservoir has been provided and, as the development is already located in Flood Zone 3, it will be significantly affected by this increase*.
D25	Broadway Street, Burton Upon Trent	The current water level for Flood Zone 3 (1 in 100 year) is not provided for the reservoir, therefore approximate increase cannot be calculated. However, a prediction of a Peak Water Level of 45.89m AOD (Burton Economic Study) for that reservoir has been provided and, as the development is already located in Flood Zone 3, it will be significantly affected by this increase*.
D26	Blackpool Street, Burton Upon Trent	The current water level for Flood Zone 3 (1 in 100 year) is not provided for the reservoir, therefore approximate increase cannot be calculated. However, a prediction of a Peak Water Level of 45.89m AOD (Burton Economic Study) for that reservoir has been provided and, as the development is already located in Flood Zone 3, it will be significantly affected by this increase*.
D27	All Saints Road, Burton Upon Trent	The current water level for Flood Zone 3 (1 in 100 year) is not provided for the reservoir, therefore approximate increase cannot be calculated. However, a prediction of a Peak Water Level of 45.89m AOD (Burton Economic Study) for that reservoir has been provided and, as the development is already located in Flood Zone 3, it will be significantly affected by this increase*.
D28	Branston Depot, Burton Upon Trent	Approximate increase in the 1 in 100 year flood level of 1.5m* (Burton Economic Model). This significant increase should be examined in greater detail in the Level 2 SFRA or a site specific FRA.

D29	Lynwood Road, Burton Upon Trent	The current water level for Flood Zone 3 (1 in 100 year) is not provided for the reservoir, therefore approximate increase cannot be calculated. However, a prediction of a Peak Water Level of 46.62m AOD (Burton Economic Study) for that reservoir has been provided and, as the development is already located in Flood Zone 3, it will be significantly affected by this increase*.
D30	Bridgford Avenue, Burton Upon Trent	The current water level for Flood Zone 3 (1 in 100 year) is not provided for the reservoir, therefore approximate increase cannot be calculated. However, a prediction of a Peak Water Level of 46.62m AOD (Burton Economic Study) for that reservoir has been provided and, as the development is already located in Flood Zone 3, it will be significantly affected by this increase*.
D31	Manor Farm, Burton Upon Trent	The current water level for Flood Zone 3 (1 in 100 year) is not provided for the reservoir, therefore approximate increase cannot be calculated. However, a prediction of a Peak Water Level of 46.62m AOD (Burton Economic Study) for that reservoir has been provided and, as the development is already located in Flood Zone 3, it will be significantly affected by this increase*.
D32	Lichfield Lane, Burton upon Trent	It is likely that the flooding in this area originates from Branston Water Park or Tatenhill Brook, neither of which have been modelled, other than by JFLOW. It is recommended that the existing main river Flood Zone 2 be used to represent Flood Zone 3 with climate change until the watercourse has been assessed in greater detail.
D33	Hollyhock Lane, Burton upon Trent	Approximate increase in the 1 in 100 year flood level of 0.38m* (Burton Economic Model).
D34	Stanton Road, Burton upon Trent	Outside Flood Zone 2 (1 in 1000 year) and therefore risk of flooding not directly affected by climate change. However, the consequences of the development in terms of additional runoff and increased flood risk elsewhere due to climate change should be considered.
D35	Model Dairy Farm, Burton upon Trent	The adjacent watercourse has not been modelled. It is recommended that the existing Flood Zone 2 be used to represent Flood Zone 3 with climate change until the watercourse has been assessed in greater detail. The development is located outside Flood Zone 2 (1 in 1000 year) and therefore risk of flooding not directly affected by climate change. However, the consequences of the development in terms of additional runoff and increased flood risk elsewhere due to climate change should be considered.
D36	Scalpcliffe Close, Burton upon Trent	Outside Flood Zone 2 (1 in 1000 year) and therefore risk of flooding not directly affected by climate change. However, the consequences of the development in terms of additional runoff and increased flood risk elsewhere due to climate change should be considered.
D37	Scalpcliffe Road, Burton upon Trent	Outside Flood Zone 2 (1 in 1000 year) and therefore risk of flooding not directly affected by climate change. However, the consequences of the development in terms of additional runoff and increased flood risk elsewhere due to climate change should be considered.
D38	Vancouver Drive, Burton upon Trent	Outside Flood Zone 2 (1 in 1000 year) and therefore risk of flooding not directly affected by climate change. However, the consequences of the development in terms of additional runoff and increased flood risk elsewhere due to climate change should be considered.
D39	Berryhedge Youth Centre, Burton upon Trent	Outside Flood Zone 2 (1 in 1000 year) and therefore risk of flooding not directly affected by climate change. However, the consequences of the development in terms of additional runoff and increased flood risk elsewhere due to climate change should be considered.

D40	Roslison Road, Burton upon Trent	Outside Flood Zone 2 (1 in 1000 year) and therefore risk of flooding not directly affected by climate change. However, the consequences of the development in terms of additional runoff and increased flood risk elsewhere due to climate change should be considered.
D41	Tatenhill Lane, Burton upon Trent	It is likely that the flooding in this area originates from Branston Water Park or Tatenhill Brook, neither of which have been modelled, other than by JFLOW. It is recommended that the existing main river Flood Zone 2 be used to represent Flood Zone 3 with climate change until the watercourse has been assessed in greater detail.
D42	Brookside Road, Uttoxeter	Approximate increase in the 1 in 100 year flood level of 0.26m* (Picknall Brook Model).
D43	JCB Sites, Uttoxeter	Approximate increase in the 1 in 100 year flood level of 0.23m* (Picknall Brook Model).
D44	Stafford Road, Uttoxeter	Outside Flood Zone 2 (1 in 1000 year) and therefore risk of flooding not directly affected by climate change. However, the consequences of the development in terms of additional runoff and increased flood risk elsewhere due to climate change should be considered.
D45	Eastfields Road, Uttoxeter	Approximate increase in the 1 in 100 year flood level of 0.04m* (River Dove Strategy Model)

Notes:

1 - For Cross Reference with Figures 7, 8 and 9.

* - Increases in the 100year flood levels due to climate change do not take into account the effect of breaching or overtopping of the flood defences. This needs to be considered in Level 2 through additional modelling.

Table 2b: Impacts of Climate Change on Potential Development Sites: Greenfield Sites

Unique ID[1]	**Location**	**Impact of Climate Change**
GF1	Beam Hill, Burton upon Trent	Outside Flood Zone 2 (1 in 1000 year) and therefore risk of flooding not directly affected by climate change. However, the consequences of the development in terms of additional runoff and increased flood risk elsewhere due to climate change should be considered.
GF2	Harehedge Lane, Burton Upon Trent	Outside Flood Zone 2 (1 in 1000 year) and therefore risk of flooding not directly affected by climate change. However, the consequences of the development in terms of additional runoff and increased flood risk elsewhere due to climate change should be considered.
GF3	Outwoods Lane (North), Burton upon Trent	The adjacent watercourse has not been modelled. It is recommended that the existing main river Flood Zone 2 be used to represent Flood Zone 3 with climate change until the watercourse has been assessed in greater detail. As it is outside Flood Zone 2 (1 in 1000 year) risk of flooding is not directly affected by climate change. However, the consequences of the development in terms of additional runoff and increased flood risk elsewhere due to climate change should be considered.
GF4	Outwoods Lane (Southeast), Burton upon Trent	Outside Flood Zone 2 (1 in 1000 year) and therefore risk of flooding not directly affected by climate change. However, the consequences of the development in terms of additional runoff and increased flood risk elsewhere due to climate change should be considered.

GF5	Outwoods Lane (Southwest), Burton upon Trent	Outside Flood Zone 2 (1 in 1000 year) and therefore risk of flooding not directly affected by climate change. However, the consequences of the development in terms of additional runoff and increased flood risk elsewhere due to climate change should be considered.
GF6	Lower Outwoods, Burton upon Trent	Outside Flood Zone 2 (1 in 1000 year) and therefore risk of flooding not directly affected by climate change. However, the consequences of the development in terms of additional runoff and increased flood risk elsewhere due to climate change should be considered.
GF7	Henhurst Hill, Rough Hay	Outside Flood Zone 2 (1 in 1000 year) and therefore risk of flooding not directly affected by climate change. However, the consequences of the development in terms of additional runoff and increased flood risk elsewhere due to climate change should be considered.
GF8	Postern Road, Rough Hay	Outside Flood Zone 2 (1 in 1000 year) and therefore risk of flooding not directly affected by climate change. However, the consequences of the development in terms of additional runoff and increased flood risk elsewhere due to climate change should be considered.
GF9	Forest Road, Burton upon Trent	The adjacent watercourse has not been modelled. It is recommended that the existing main river Flood Zone 2 be used to represent Flood Zone 3 with climate change until the watercourse has been assessed in greater detail. As it is outside Flood Zone 2 (1 in 1000 year) risk of flooding is not directly affected by climate change. However, the consequences of the development in terms of additional runoff and increased flood risk elsewhere due to climate change should be considered.
GF10	Henhurst Hill, Rough Hay	Outside Flood Zone 2 (1 in 1000 year) and therefore risk of flooding not directly affected by climate change. However, the consequences of the development in terms of additional runoff and increased flood risk elsewhere due to climate change should be considered.
GF11	Forest Road, Burton upon Trent	The adjacent watercourse has not been modelled. It is recommended that the existing main river Flood Zone 2 be used to represent Flood Zone 3 with climate change until the watercourse has been assessed in greater detail. As it is outside Flood Zone 2 (1 in 1000 year) risk of flooding is not directly affected by climate change. However, the consequences of the development in terms of additional runoff and increased flood risk elsewhere due to climate change should be considered.
GF12	Belvoir Road, Burton upon Trent	Outside Flood Zone 2 (1 in 1000 year) and therefore risk of flooding not directly affected by climate change. However, the consequences of the development in terms of additional runoff and increased flood risk elsewhere due to climate change should be considered.
GF13	A38, Burton upon Trent	No modelled levels have been given. This site will need addressing in greater detail in the Level 2 SFRA or a site specific FRA. The consequences of the development in terms of additional runoff and increased flood risk elsewhere due to climate change should also be considered.
GF14	Tatenhill Lane, Burton upon Trent	It is likely that the flooding in this area originates from Branston Water Park or Tatenhill Brook, neither of which have been modelled, other than by JFLOW. It is recommended that the existing main river Flood Zone 2 be used to represent Flood Zone 3 with climate change until the watercourse has been assessed in greater detail.

GF15	Manor Farm, Branston, Burton upon Trent	The current water level for Flood Zone 3 (1 in 100 year) is not provided for the reservoir, therefore approximate increase cannot be calculated. However, a prediction of a Peak Water Level of 46.62m AOD (Burton Economic Study) for that reservoir has been provided and, as the development is already located in Flood Zone 3, it will be significantly affected by this increase*.
GF16	Uxbridge Street, Burton upon Trent	Approximate increase in the 1 in 100 year flood level of 0.38m* (Burton Economic Model)..
GF17	Lichfield Street, Burton upon Trent	Approximate increase in the 1 in 100 year flood level of 0.38m* (Burton Economic Model)..
GF18	Bond Street, Burton upon Trent	Approximate increase in the 1 in 100 year flood level of 0.38m* (Burton Economic Model)..
GF19	Green Street, Burton upon Trent	Approximate increase in the 1 in 100 year flood level of 0.38m* (Burton Economic Model)..
GF20	Horninglow Street/Hawkins Lane, Little Burton, Burton upon Trent	Approximate increase in the 1 in 100 year flood level of 0.38m* (Burton Economic Model)..
GF21	Model Dairy Farm, Woods Lane, Burton upon Trent	The adjacent watercourse has not been modelled. It is recommended that the existing Flood Zone 2 be used to represent Flood Zone 3 with climate change until the watercourse has been assessed in greater detail. The development is located outside Flood Zone 2 (1 in 1000 year) and therefore risk of flooding not directly affected by climate change. However, the consequences of the development in terms of additional runoff and increased flood risk elsewhere due to climate change should be considered.
GF22	St Mary's Drive, Burton upon Trent	Outside Flood Zone 2 (1 in 1000 year) and therefore risk of flooding not directly affected by climate change. However, the consequences of the development in terms of additional runoff and increased flood risk elsewhere due to climate change should be considered.
GF23	Dovecliff Road, Burton upon Trent	Approximate increase in the 1 in 100 year flood level of 0.18m* (River Dove Strategy Model)
GF24	Walford Road (Sports Field), Rolleston on Dove	Outside Flood Zone 2 (1 in 1000 year) and therefore risk of flooding not directly affected by climate change. However, the consequences of the development in terms of additional runoff and increased flood risk elsewhere due to climate change should be considered.
GF25	Craythorne Road, Rolleston on Dove	Outside Flood Zone 2 (1 in 1000 year) and therefore risk of flooding not directly affected by climate change. However, the consequences of the development in terms of additional runoff and increased flood risk elsewhere due to climate change should be considered.
GF26	Green Lane, Tutbury	Outside Flood Zone 2 (1 in 1000 year) and therefore risk of flooding not directly affected by climate change. However, the consequences of the development in terms of additional runoff and increased flood risk elsewhere due to climate change should be considered.
GF27	Redhill Lane, Tutbury	Outside Flood Zone 2 (1 in 1000 year) and therefore risk of flooding not directly affected by climate change. However, the consequences of the development in terms of additional runoff and increased flood risk elsewhere due to climate change should be considered.
GF28	Station Road, Barton under Needwood	Outside Flood Zone 2 (1 in 1000 year) and therefore risk of flooding not directly affected by climate change. However, the consequences of the development in terms of additional runoff and increased flood risk elsewhere due to climate change should be considered.

GF29	Mill Bridge, Barton under Needwood	It is likely that the flooding in this area originates from Branston Water Park or Tatenhill Brook, neither of which have been modelled, other than by JFLOW. It is recommended that the existing main river Flood Zone 2 be used to represent Flood Zone 3 with climate change until the watercourse has been assessed in greater detail.
GF30	Barton Green, Barton under Needwood	Outside Flood Zone 2 (1 in 1000 year) and therefore risk of flooding not directly affected by climate change. However, the consequences of the development in terms of additional runoff and increased flood risk elsewhere due to climate change should be considered.
GF31	Thorny Lanes, Hoar Cross	Outside Flood Zone 2 (1 in 1000 year) and therefore risk of flooding not directly affected by climate change. However, the consequences of the development in terms of additional runoff and increased flood risk elsewhere due to climate change should be considered.
GF32	Knightsfield Road, Hanbury Woodend	Outside Flood Zone 2 (1 in 1000 year) and therefore risk of flooding not directly affected by climate change. However, the consequences of the development in terms of additional runoff and increased flood risk elsewhere due to climate change should be considered.
GF33	Jacks Lane, Marchington	Outside Flood Zone 2 (1 in 1000 year) and therefore risk of flooding not directly affected by climate change. However, the consequences of the development in terms of additional runoff and increased flood risk elsewhere due to climate change should be considered.
GF34	Demontfort Way, Uttoxeter	Outside Flood Zone 2 (1 in 1000 year) and therefore risk of flooding not directly affected by climate change. However, the consequences of the development in terms of additional runoff and increased flood risk elsewhere due to climate change should be considered.
GF35	Timber Lane (Track), Uttoxeter	Outside Flood Zone 2 (1 in 1000 year) and therefore risk of flooding not directly affected by climate change. However, the consequences of the development in terms of additional runoff and increased flood risk elsewhere due to climate change should be considered.
GF36	B5013 – Timber Lane, Uttoxeter	Outside Flood Zone 2 (1 in 1000 year) and therefore risk of flooding not directly affected by climate change. However, the consequences of the development in terms of additional runoff and increased flood risk elsewhere due to climate change should be considered.
GF37	Brookside Road, Uttoxeter	Approximate increase in the 1 in 100 year flood level of 0.26m* (Picknall Brook Model).
GF38	Eastfield Road, Uttoxeter	Approximate increase in the 1 in 100 year flood level of 0.04m* (River Dove Strategy Model)
GF39	Spath Cottage Farm, Uttoxeter	The adjacent watercourse has not been modelled. It is recommended that the existing main river Flood Zone 2 be used to represent Flood Zone 3 with climate change until the watercourse has been assessed in greater detail
GF40	A50, Uttoxeter	Outside Flood Zone 2 (1 in 1000 year) and therefore risk of flooding not directly affected by climate change. However, the consequences of the development in terms of additional runoff and increased flood risk elsewhere due to climate change should be considered.
GF41	Bramshall Road, Uttoxeter	Outside Flood Zone 2 (1 in 1000 year) and therefore risk of flooding not directly affected by climate change. However, the consequences of the development in terms of additional runoff and increased flood risk elsewhere due to climate change should be considered.

GF42	Northfield Avenue, Rocester	Outside Flood Zone 2 (1 in 1000 year) and therefore risk of flooding not directly affected by climate change. However, the consequences of the development in terms of additional runoff and increased flood risk elsewhere due to climate change should be considered.

Notes:

1 - For Cross Reference with Figures 7, 8 and 9.

* - Increases in the 100year flood levels due to climate change do not take into account the effect of breaching or overtopping of the flood defences. This needs to be considered in Level 2 through additional modelling.

4.5 Flood Risk from Sources other than Rivers and the Sea

Areas at risk of flooding from sources other than rivers and the sea.

Figures 2, 3 and **4** shows the location of all sources of historic flooding including:

- Main River flooding;
- Non-Main River flooding;
- Sewer flooding;
- Surface water flooding; and
- Groundwater flooding.

4.6 Flood Risk Management Infrastructure and Flood Warning

The location of any flood risk management measures, including both infrastructure and the coverage of flood warning systems.

Section 3.5 of this report describes the existing flood risk management infrastructure within the Borough. This information is also presented graphically in **Figure 10**. The current Flood Warning procedures are documented in Section 3.6. **Table 3a** and **3b** identifies whether the potential development areas are protected by existing flood alleviation measures or flood warning systems. For such areas the future safety of the site from flooding will be dependent upon the future maintenance and operation of the flood defence.

Table 3a – Influence of Existing Flood Risk Management and Flood Warning Systems: Identified by White, Young and Green Consultants

Unique ID[1]	Location	Current Status	Protected by Flood Defence?	Covered by Flood Warning?
D1	Forest Edge Way, Burton Upon Trent	Scrub Land, not previously developed	Outside Flood Zone 2, therefore defence not needed (although is located next to unmodelled watercourse)	No
D2	Rolleston Road, Burton Upon Trent	Potential redevelopment of a workshop	Outside Flood Zone 2, therefore defence not needed	Not Required
D3	Horninglow Road North, Burton upon Trent	Potential Redevelopment of a pub garden	Outside Flood Zone 2, therefore defence not needed	Not Required

D4	Wetmore, Burton upon Trent	Vacant/derelict industrial site	Defended by Burton FAS	Yes
D5	Wetmore Road, Burton upon Trent	Open land not previously developed	Defended by Burton FAS	Yes
D6	Arthur Street, Burton Upon Trent	Potential redevelopment of an industrial estate	Outside Flood Zone 2, therefore defence not needed	Not Required
D7	Dallow Street, Burton Upon Trent	Potential redevelopment of a workshop	Outside Flood Zone 2, therefore defence not needed	Not Required
D8	Victoria Crescent, Burton Upon Trent	Potential redevelopment of a transport depot	Outside Flood Zone 2, therefore defence not needed	Not Required
D9	Horninglow Road, Burton Upon Trent	Vacant/derelict factory and land	No	Not Required
D10	Dallow Street/Victoria Road, Burton Upon Trent	Potential redevelopment of an employment site	Outside Flood Zone 2, therefore defence not needed	Not Required
D11	Derby Street, Burton Upon Trent	Potential Redevelopment of an Industrial Premises	Defended by Burton FAS	Yes
D12	Horninglow Street Middle Yard, Burton Upon Trent	Potential redevelopment of a derelict warehouse, car hire etc	Defended by Burton FAS	Yes
D13	Station Street, Burton Upon Trent	Potential conversion into a commercial building from offices	Defended by Burton FAS	Yes
D14	Curzon Street, Burton Upon Trent	Vacant/derelict transport depot and warehouse	Defended by Burton FAS	Yes
D15	Shobnall Road (Waste Site)	Potential redevelopment of waste station	No	No
D16	Shobnall Road, Burton Upon Trent	Potential redevelopment of Industrial and B1 site	No	No
D17	Shobnall Road, Burton Upon Trent	Potential redevelopment of Industrial and B1 site	No	No
D18	Crown Industrial Estate, Burton Upon Trent	Potential conversion into a commercial building from various employment use	Defended by Burton FAS	Yes
D19	Fleet Street, Burton Upon Trent	Potential redevelopment of a retail warehouse	Defended by Burton FAS	Yes
D20	Bond Street, Burton Upon Trent	Potential redevelopment of offices	Defended by Burton FAS	Yes

D21	Bond Street/Green Street, Burton Upon Trent	Potential redevelopment of an employment site	Defended by Burton FAS	Yes
D22	Horninglow Street, Burton Upon Trent	Vacant/derelict former PFS site	Defended by Burton FAS	Yes
D23	Watson Street, Burton Upon Trent	Potential redevelopment of Modern B2	Defended by Burton FAS	Yes
D24	Queen Street, Burton Upon Trent	Potential redevelopment of warehouse premises	Defended by Burton FAS	Yes
D25	Broadway Street, Burton Upon Trent	Potential redevelopment of car repairs garage	Defended by Burton FAS	Yes
D26	Blackpool Street, Burton Upon Trent	Potential redevelopment of outbuildings	Defended by Burton FAS	Yes
D27	All Saints Road, Burton Upon Trent	Potential redevelopment of employment site	Defended by Burton FAS	Yes
D28	Branston Depot, Burton Upon Trent	Potential redevelopment of warehouse	Defended by Burton FAS	Yes
D29	Lynwood Road, Burton Upon Trent	Open space, not previously developed	No	No
D30	Bridgford Avenue, Burton Upon Trent	Open space, not previously developed	Defended by Burton FAS	Yes
D31	Manor Farm, Burton Upon Trent	Grazing land, not previously developed	No	No
D32	Lichfield Lane, Burton upon Trent	Container storage, not previously developed	No	No
D33	Hollyhock Lane, Burton upon Trent	Grazing land, not previously developed	No	No
D34	Stanton Road, Burton upon Trent	Potential redevelopment of smallhold/grazing land	Outside Flood Zone 2, therefore defence not needed	Not Required
D35	Model Dairy Farm, Burton upon Trent	Potential Redevelopment of farm buildings and open storage	Outside Flood Zone 2, therefore defence not needed (although is located next to unmodelled watercourse)	No
D36	Scalpcliffe Close	Vacant/derelict workshop	Outside Flood Zone 2, therefore defence not needed	Not Required
D37	Scalpcliffe Road	Vacant/derelict Ex PFS, now car sales	Outside Flood Zone 2, therefore defence not needed	Not Required

D38	Vancouver Drive, Burton upon Trent	Open space, previously undeveloped	Outside Flood Zone 2, therefore defence not needed	Not Required
D39	Berryhedge Youth Centre, Burton upon Trent	Potential redevelopment of a youth centre	Outside Flood Zone 2, therefore defence not needed	Not Required
D40	Roslison Road, Burton upon Trent	Potential redevelopment of a car repairs and sales centre	Outside Flood Zone 2, therefore defence not needed	Not Required
D41	Tatenhill Lane, Burton upon Trent	Open land, previously undeveloped	No	No
D42	Brookside Road, Uttoxeter	Potential redevelopment of employment site	No	No
D43	JCB Sites, Uttoxeter	Potential redevelopment of industrial and open storage	Partially – JCB defences	No
D44	Stafford Road, Uttoxeter	Potential redevelopment of highways depot	No	No
D45	Eastfields Road, Uttoxeter	Potential redevelopment of employment site	No	Partially

Notes:

1 - For Cross Reference with Figures 7, 8 and 9.

Table 3b – Influence of Existing Flood Risk Management and Flood Warning Systems: Greenfield Sites

Unique ID[1]	Location	Current Status	Protected by Flood Defence?	Covered by Flood Warning?
GF1	Beam Hill, Burton upon Trent	Previously undeveloped Greenfield – town perimeter	Outside Flood Zone 2, therefore defence not needed	Not Required
GF2	Harehedge Lane, Burton Upon Trent	Previously undeveloped Greenfield – town perimeter	Outside Flood Zone 2, therefore defence not needed	Not Required
GF3	Outwoods Lane (North), Burton upon Trent	Previously undeveloped Greenfield – town perimeter	Outside Flood Zone 2, therefore defence not needed (although is located next to unmodelled watercourse)	No
GF4	Outwoods Lane (Southeast), Burton upon Trent	Previously undeveloped Greenfield – outside town	Outside Flood Zone 2, therefore defence not needed	Not Required
GF5	Outwoods Lane (Southwest), Burton upon Trent	Previously undeveloped Greenfield – outside town	Outside Flood Zone 2, therefore defence not needed	Not Required
GF6	Lower Outwoods, Burton upon Trent	Previously undeveloped Greenfield – town perimeter	Outside Flood Zone 2, therefore defence not needed	Not Required
GF7	Henhurst Hill, Rough Hay	Previously undeveloped Greenfield – village perimeter	Outside Flood Zone 2, therefore defence not needed	Not Required
GF8	Postern Road, Rough Hay	Previously undeveloped Greenfield – village perimeter	Outside Flood Zone 2, therefore defence not needed	Not Required
GF9	Forest Road, Burton upon Trent	Previously undeveloped Greenfield – town perimeter	Outside Flood Zone 2, therefore defence not needed (although is located next to unmodelled watercourse)	No
GF10	Henhurst Hill, Rough Hay	Previously undeveloped Greenfield – village perimeter	Outside Flood Zone 2, therefore defence not needed	Not Required

GF11	Forest Road, Burton upon Trent	Previously undeveloped Greenfield – town perimeter	Outside Flood Zone 2, therefore defence not needed (although is located next to unmodelled watercourse)	No
GF12	Belvoir Road, Burton upon Trent	Previously undeveloped Greenfield – within town	Outside Flood Zone 2, therefore defence not needed	Not Required
GF13	A38, Burton upon Trent	Previously undeveloped Greenfield – town perimeter	No	No
GF14	Tatenhill Lane, Burton upon Trent	Previously undeveloped Greenfield – town perimeter	No	No
GF15	Manor Farm, Branston, Burton upon Trent	Previously undeveloped Greenfield – town perimeter	No	No
GF16	Uxbridge Street, Burton upon Trent	Previously undeveloped Greenfield – within town	Defended by Burton FAS	Yes
GF17	Lichfield Street, Burton upon Trent	Previously undeveloped Greenfield – within town	Defended by Burton FAS	Yes
GF18	Bond Street, Burton upon Trent	Previously undeveloped Greenfield – within town	Defended by Burton FAS	Yes
GF19	Green Street, Burton upon Trent	Previously undeveloped Greenfield – within town	Defended by Burton FAS	Yes
GF20	Horninglow Street/Hawkins Lane, Little Burton, Burton upon Trent	Previously undeveloped Greenfield – within town	Defended by Burton FAS	Partially
GF21	Model Dairy Farm, Woods Lane, Burton upon Trent	Previously undeveloped Greenfield – town perimeter	Outside Flood Zone 2, therefore defence not needed (although is located next to unmodelled watercourse)	No

GF22	St Mary's Drive, Burton upon Trent	Previously undeveloped Greenfield – town perimeter	Outside Flood Zone 2, therefore defence not needed	Not Required
GF23	Dovecliff Road, Burton upon Trent	Previously undeveloped Greenfield – town perimeter	No (although mostly outside Flood Zone 2)	No
GF24	Walford Road (Sports Field), Rolleston on Dove	Previously undeveloped Greenfield – village perimeter	Outside Flood Zone 2, therefore defence not needed	Not Required
GF25	Craythorne Road, Rolleston on Dove	Previously undeveloped Greenfield – village perimeter	Outside Flood Zone 2, therefore defence not needed	Not Required
GF26	Green Lane, Tutbury	Previously undeveloped Greenfield – village perimeter	Outside Flood Zone 2, therefore defence not needed	Not Required
GF27	Redhill Lane, Tutbury	Previously undeveloped Greenfield – village perimeter	Outside Flood Zone 2, therefore defence not needed	Not Required
GF28	Station Road, Barton under Needwood	Previously undeveloped Greenfield – outside village	No (although mostly outside Flood Zone 2)	No
GF29	Mill Bridge, Barton under Needwood	Previously undeveloped Greenfield – village perimeter	No	No
GF30	Barton Green, Barton under Needwood	Previously undeveloped Greenfield – village perimeter	No	No
GF31	Thorny Lanes, Hoar Cross	Previously undeveloped Greenfield – outside village	Outside Flood Zone 2, therefore defence not needed	Not Required
GF32	Knightsfield Road, Hanbury Woodend	Previously undeveloped Greenfield – outside village	Outside Flood Zone 2, therefore defence not needed	Not Required
GF33	Jacks Lane, Marchington	Previously undeveloped Greenfield – village perimeter	Outside Flood Zone 2, therefore defence not needed	Not Required

GF34	Demontfort Way, Uttoxeter	Previously undeveloped Greenfield – town perimeter	Outside Flood Zone 2, therefore defence not needed	Not Required
GF35	Timber Lane (Track), Uttoxeter	Previously undeveloped Greenfield – town perimeter	Outside Flood Zone 2, therefore defence not needed (although is located next to unmodelled watercourse)	No
GF36	B5013 – Timber Lane, Uttoxeter	Previously undeveloped Greenfield – town perimeter	Outside Flood Zone 2, therefore defence not needed (although is located next to unmodelled watercourse)	No
GF37	Brookside Road, Uttoxeter	Previously undeveloped Greenfield – town perimeter	No	No
GF38	Eastfield Road, Uttoxeter	Previously undeveloped Greenfield – town perimeter	No	No
GF39	Spath Cottage Farm, Uttoxeter	Previously undeveloped Greenfield – town perimeter	No	No
GF40	A50, Uttoxeter	Previously undeveloped Greenfield – town perimeter	Outside Flood Zone 2, therefore defence not needed	Not Required
GF41	Bramshall Road, Uttoxeter	Previously undeveloped Greenfield – town perimeter	Outside Flood Zone 2, therefore defence not needed	Not Required
GF42	Northfield Avenue, Rocester	Previously undeveloped Greenfield – village perimeter	Outside Flood Zone 2, therefore defence not needed	Not Required

Notes:

1 - For Cross Reference with Figures 7, 8 and 9.

4.7 Flood Risk from Developments

Locations where additional development may significantly increase flood risk elsewhere.

4.7.1 General

The impact of each of the proposed development sites has been assessed in respect to the following:

- potential increase in surface water runoff; and
- loss of floodplain storage area.

4.7.2 Surface Water Drainage

Many of the currently proposed development allocations are on Brownfield sites and will therefore be unlikely to contribute additional runoff. However, there are also a number of potential sites proposed on currently undeveloped areas (Greenfield sites) as listed in the tables above.

If these sites are chosen for development then it will be necessary to pay closer attention to the disposal of surface water in order to ensure that the development does not contribute additional runoff to receiving watercourses and thereby increase the risk of flooding to other areas.

However, it is anticipated that current awareness of sustainable drainage techniques (SUDS), which will be required as a prerequisite of any future development, will actually reduce the rate of runoff from the proposed sites. The provision of SUDS is a Borough Council Policy and is the first method of disposal to be considered for surface water.

4.7.3 Loss of Floodplain Storage

As shown in **Table 1**, there are a number of potential developments which fall within Flood Zones 2 and 3. Such proposals have the potential to:

- reduce floodplain storage;
- impede water flows; and
- increase flood risk elsewhere

All proposals in Flood Zones 2 and 3 should be subjected to the Sequential Test, the Exception Test (if required), and accompanied by a FRA. See Annex E, PPS25 for minimum requirements.

In Flood Zone 2 only water-compatible, less vulnerable and more vulnerable uses of land and essential infrastructure are appropriate. In Flood Zone 3 only water-compatible and less vulnerable uses of land are appropriate, highly vulnerable uses should not be permitted in this zone. More vulnerable and essential infrastructure uses should only be permitted in zone 3 if the Exception Test is passed. Any development permitted in line with PPS25 should be designed and constructed to remain operational and safe for users in times of flood.

The Environment Agency will object to any development which does not accord with guidance contained within PPS25.

4.8 Guidance

Guidance on the preparation of FRAs for allocated development sites.
Guidance on the likely applicability of different sustainable drainage systems (SUDS) techniques for managing surface water run-off at key development sites.

4.8.1 General

Guidance on the preparation of site specific FRAs is provided in Chapter 2 of Development and Flood Risk a Practice Guide Companion to PPS25, "Living Draft", (Communities and Local Government, February 2007). Guidance on the use of SUDS is provided in Section 4.

It is recommended that before any of the potential development sites are taken forward a site specific FRA should be undertaken, addressing the specific issues identified in Section 4 of this Level 1 SFRA.

Additional guidance for specific elements is given below.

4.8.2 Application of the Sequential Test

The policies in PPS25 require that all stages of the development planning process should take account of both the nature and spatial distribution of flood risk and the degree of vulnerability of different types of development. Reinforcing the philosophy of managing flood risk through avoidance/prevention, PPS25 requires that planners and developers do not simply match land use types to areas or zones with an 'acceptable' degree of flood risk. Rather, a sequential approach to location of new development is required, by application of the Sequential Test as defined in paragraphs 16 and 17 and paragraphs D1 to D8 of Annex D of PPS25.

The application of the Sequential Test requires the identification of Flood Zones as defined in Table D.1 of PPS25. Also, it will require LPAs to demonstrate that there are no reasonable available sites in areas with a lower probability of flooding that would be appropriate to the type of development or land use proposed, by considering all forms of flooding based on a Level 1 SFRA (i.e. as reported in this report and accompanying maps).

It is the responsibility of the decision-maker (i.e. the Local Planning Authority) to undertake the Sequential Test (Paragraph 3.2, PPS25 Practice Guide). However, where there is no sequentially tested LDD policies the responsibility to provide the evidence for the Local Planning Authority to carry out the Sequential Test lies with the developer (Paragraph 3.4, PPS25 Practice Guide)

4.8.3 Flood Risk Assessment

Properly prepared assessments of flood risk will inform the decision-making process at all stages of development planning. Annex E of PPS25 stipulates requirements for three levels of flood risk assessment:

- Regional Flood Risk Assessments (RFRA);

- Strategic Flood risk Assessments (SFRAs); and
- Site-specific Flood Risk Assessments (FRAs).

The responsibility for preparing RFRAs will remain with Regional Planning Bodies and Local Planning Authorities are responsible for preparing SFRAs.

In order to provide relevant information and to steer the planning-process in the right direction, the minimum requirements for flood risk assessments are that they should:

- be proportionate to the risk and appropriate to the scale, nature and location of the development;
- consider the risk of flooding arising from the development in addition to the risk of flooding to the development;
- take the impacts of climate change into account as per Annex B of PPS25;
- be undertaken by competent people, as early as possible in the particular planning process, to avoid misplaced effort and raising landowner expectations where land is unsuitable for development;
- consider both the potential adverse and beneficial effects of flood risk management infrastructure including raised defences, flow channels, flood storage areas and other artificial features together with the consequences of their failure;
- consider the vulnerability of those that could occupy and use the development, taking account of the Sequential and Exception Tests and the vulnerability classification as per Annex D of PPS25, including arrangements for safe access;
- consider and quantify the different types of flooding (whether from natural and human sources and including joint and cumulative effects) and identify flood risk reduction measures, so that assessments are fit for the purpose of the decisions being made;
- consider the effects of a range of flooding events including extreme events on people, property, the natural and historic environment and river and coastal processes;
- include the assessment of the residual risk after risk reduction measures have been taken into account and demonstrate that this is acceptable for the particular development or land use;
- consider how the development will modify run-off and promote the use of Sustainable Drainage Systems (SUDS) to mitigate that impact; and
- be supported by appropriate data and information, including historical information on previous events.

At the planning application stage, an appropriate site-specific FRA should be carried out to demonstrate how flood risk from all sources of flooding to the development itself and flood risk to others would be managed by fully taking into account climate change impacts. Table D.1 of PPS25 defines the requirements for carrying out FRAs for development sites depending on their location within each type of Flood Zone.

Therefore, planning applications for development proposals of 1 hectare or greater in Flood Zone 1 and all proposals for new development located in Flood Zones 2 and 3 should be accompanied by an FRA, which satisfies the above minimum requirements.

4.8.4 Surface Water Management

Historically, surface water drainage systems have been designed to remove surface water from a site as quickly as possible by means of underground piped systems. This has the potential to increase flooding problems downstream and does not contribute to the natural recharge of groundwater levels. Such systems contribute to the transport of pollutants from urban areas to watercourses and groundwater. In addition, to cater for climate change, a 20% reduction in flows leaving the site is required.

With concerns surrounding the impacts of climate change and the requirements of the PPS25 and Water Framework Directive, a more sustainable approach to drainage is required to reduce flood risk, manage water quality and provide integrated amenity benefits. The effective disposal of surface water from development is a material planning consideration in determining proposals for the development and use of land. It will always be much more effective to manage surface water flooding at and from new development early in the land acquisition and design process rather than to resolve problems after development.

Regional planning bodies and local authorities are encouraged to promote the use of SUDS for the management of run-off. SUDS aim to mimic natural drainage processes and remove pollutants from urban run-off at source. They comprise a wide range of techniques, including green roofs, permeable paving, rainwater harvesting, swales, detention basins, ponds and wetlands. To realize the greatest improvement in water quality and flood risk management these components can be used in combination. The surface water drainage arrangements for any development site should be such that the volumes and peak flow rates of surface water leaving a developed site are no greater than the rates prior to the proposed development, unless specific off-site arrangements are made and result in the same net effect.

Successful implementation of SUDS will require the early consideration of a wide range of issues surrounding their management, long-term adoption and maintenance. The design team and stakeholders should take every opportunity for early discussion about SUDS and should consider them at the feasibility stage of a development, to realize the optimum contribution.

All growth sites can increase flood risk on the receiving watercourses unless the additional runoff from the future development is adequately managed.

4.8.5 Flood Warning and Emergency Planning

New developments should consider the role of flood warning.

The Environment Agency operates a national flood warning system for a large number of existing properties currently at risk of flooding in order to enable householders to protect life or take early action to manage the effect of flooding on property. New developments should consider the role of flood warning in managing residual risks although they should not rely solely on them. Section 4.6 discussed the present availability of flood warning and emergency response arrangements within the Borough.

Developments which include areas likely to flood will need to provide appropriate flood warning and formulate appropriate emergency plans to ensure their safe occupancy in

the future. As a minimum, where any such development takes place in flood risk areas it is important that there is adequate passive flood warning in place, with signs highlighting the susceptibility to flooding and clearly signed evacuation routes where necessary.

4.8.6 Residual Risk Management

Flood risk to people and property associated with new developments can be managed but it can never be completely removed; a residual risk will always remain after flood management or mitigation measures have been put in place. Residual risk can be defined as the risk remaining after applying the sequential approach and taking mitigating actions.

Local Planning Authorities and developers should always consider residual flood risk issues relating to a development. The potential sources of this residual risk will need to be identified in the FRA, along with their potential impacts, and the most significant will have to be mitigated through flood risk management measures. The costs of such measures may be low compared to the damages they avoid and may enhance the value of the development.

As with all aspects of development and flood risk, it is best to consider residual flood risk early in the planning process, as measures to manage it may impact on site layout and the extent of developable land.

Although flooding cannot be wholly prevented, its impacts can be reduced through good planning and management. Thus it is vital to make the most of opportunities to reduce existing flood risk to communities. For instance, opportunities to re-create and safeguard functional flood plain and washlands and to design more liveable developments combining sustainable defences, green/recreational space and increased flood storage should be investigated as early as possible when planning new developments.

Residual flood risk management needs to be coordinated with emergency procedures.

5 CONCLUSIONS AND RECOMMENDATIONS

5.1 Conclusions

Flooding is a key issue in the Borough and one that should be considered in all stages of the planning process. Historically, the key sources of flooding were from the River Trent and River Dove. The recent construction of flood alleviation measures for the town of Burton upon Trent has reduced the risk from the River Trent. However, more recent events have resulted in flooding from more minor watercourses and from surface water run-off.

The information and knowledge gathered through this Level 1 SFRA will inform the emerging LDF and future flood risk management needs of the Borough. It will also provide a sound basis for a future Level 2 SFRA. This Level 1 SFRA considers all sources of flooding within the Borough based on a desktop study and consultation carried out with the Environment Agency, the Council, Severn Trent Water, British Waterways and the Highways Agency. It broadly satisfies the requirements for SFRAs and more specifically the amplified guidance given in paragraphs 2.32 to 2.35 of PPS25 Practice Guide Companion for preparing Level 1 SFRAs.

The findings of the Level 1 SFRA are given in the form of this report and the accompanying 1 in 10,000 scale SFRA Flood Zone maps (as per Table D.1 of PPS25) covering the entire Borough. These maps provide the basis for the application of Sequential Test. If the Exception Test is to be applied when identifying the Preferred Options and allocating development sites then the Council will have to carry out a Level 2 SFRA to fully consider the effectiveness and standard of protection provided by the existing flood defences.

5.2 Recommendations

A sequential test must be undertaken by the Council for all development sites and other sites in accordance with this report finding when preparing the emerging LDF documents for the Borough. An update of the existing SFRA (including a review of developer guidance) will be needed to bring it more inline with PPS25 Level 2 SFRA standard incorporating the latest guidance and studies. This will include a more detailed assessment of the risk and consequence of overtopping of the Burton upon Trent flood alleviation scheme and the defences in Uttoxeter. The Functional Floodplain for some main, and minor, rivers and watercourses will need mapping during this update.

Management of surface runoff from the proposed sites should use a combination of site specific and strategic SUDS measures encouraging ‘source control’ where possible. These measures should be developed with a strategic approach to flood management in mind.

6 REFERENCES

1. River Dove Hydrology and Hydraulic Modelling Report, Halcrow Group Limited, April 2006

2. MD676 Picknall Brook SFRM 2006-06, Capita Symonds, June 2006

3. Shobnall Brook Hydraulic Investigation: Appraisal Report, Haswell, May 2002

4. Tatenhill Brook Hydraulic Investigation: Appraisal Report, Haswell, April 2002

5. River Swarbourn, Yoxall: Flood Modelling and Alleviation Executive Summary. JMP Consultants Ltd, December 2002

6. River Swarbourn, Yoxall: Flood Modelling and Alleviation Report. JMP Consultants Ltd, December 2002

7. Water Resources Plan: Overview 2005-2010, Severn Trent Water, April 2004

8. East Staffordshire Local Plan, East Staffordshire Borough Council, July 2006

9. West Midlands Regional Spatial Strategy (RSS 11): The Impact of Housing Growth on Public Water Supplies, June 2007-12-20

10. West Midlands Regional Flood Risk Appraisal: Final Report, West Midlands Regional Assembly, October 2007-12-20 Fluvial Trent Strategy: Final Strategic Appraisal Report, Environment Agency, March 2005

11. River Churnet Section 105 Flood Mapping: Report Addendum 01, Black and Veatch, March 2007-12-20

12. Investigation of new main rivers in the Trent Catchment: The River Tean, NRA and WS Atkins, January 1991

13. Fluvial Trent Hydraulic and Economic Study, Burton Hydraulic Modelling Report, Black and Veatch June 2005

ROYAL HASKONING

ROYAL HASKONING

APPENDICES

ROYAL HASKONING

Appendix A
Figures

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Appendix B
Historic Flooding Tables

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Appendix C
Hydraulic Models

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Table C1: Existing studies within East Staffordshire Borough

Watercourse	Reach covered	Data source	Type of data	Comments
River Dove	Upstream of Rocester (*SK 117 407)* to confluence with Trent (*SK 280 261)*, including tributaries of Foston Brook, Hilton Brook, Rolleston Brook and Egginton Brook	Supplied by the Environment Agency	iSIS for River Dove, (Foston Brook) and (Hilton Brook) 2D Tuflow for Rolleston Brook and (Egginton Brook)	Stage values only for 2, 5, 10, 25, 50, 75, 100 and 200 years, excluding Rolleston and (Egginton) Brooks. No levels provided. Flooding regime and predicted performance of existing defences during a 100yr event Flood outlines provided for 75, 100 and 200 yr events for all watercourses
Picknall Brook	Confluence downstream of Loxley Lane (*SK066 326)* to Uttoxeter racecourse (*SK 097 332)*	Supplied by the Environment Agency	HEC-RAS	Level and Flow data for 25, 50, 75, 100, 200 and 1000 years 100 yr plus climate change is also modelled Shapefiles with cross sections showing the levels for each return period included. ABDs included Descriptive comparison of 100 and 1000 year flood extents

River Churnet	From boundary of Borough to Dove confluence	Supplied by the Environment Agency	iSIS	Levels and Flow data for 5, 10, 25, 75, 150, 200 and 1000 years Level 1 maps showing 1 in 100 year floodplain, existing flood defences in Leek and ABDs in 1 in 100 year flood. Level 2 maps show the floodplains at other return periods
River Trent	Entire extent through Borough	Supplied by the Environment Agency	iSIS	Level and flow data for 2, 5, 10, 25, 50, 75, 100, 150 and 200 year Climate change was incorporated into the models Includes suggestions for decreasing the flood risk Cross section extents missing for section of River Trent upstream of Burton upon Trent.
River Trent (Burton)	Walton Bridge (421410E 318230N) to Downstream of Treatment Works (427320E 325750N)	Supplied by the Environment Agency	iSIS	Peak water levels only for 5, 10, 25, 50, 75, 100 and 200 years Gives peak water levels for 3 scenarios (current/do minimum, do-nothing and 'with scheme'). Water levels with 20% increase on the 100 year flow included as well as reservoirs and breach scenarios for defences.

River Tean	Upstream from boundary of Borough (downstream of Lower Tean) to A522 road bridge at Beamhurst	Supplied by the Environment Agency	MIKE11	Levels given for just one location at Beamhurst for 2(5), 5(10), 20, and 100 years Cross sections taken at 100m intervals. Cross section maps and flood outlines missing form the report – EA cannot find them.
Shobnall Brook	Shobnall 220m upstream of Forest Road Bridge to 15m downstream of Shobnall Road culvert outfall	Supplied by the East Staffordshire Borough Council	HEC-RAS	One flow value provided per return period for 100, 200, 400 and 1000 year Flood outlines not included in report No cross sections included Only includes short description of the results Model not provided
River Swarbourn	Section through Yoxall from Woodlane Bridge and the Severn Trent Sewage Works	Supplied by the East Staffordshire Borough Council	HEC-RAS	Only for 100 year return period. Flows provided for river stations rather than cross sections and locations not provided. No outline maps in report Options proposed Model not provided

Tatenhill Brook	Through Tatenhill – 120m upstream of School Bridge to 60m downstream of Yews Bridge.	Supplied by the East Staffordshire Borough Council	HEC-RAS	Only water levels for each return period, 100, 200, 400 and 1000 year, at 4 different locations No outline maps included. Model not provided

ROYAL HASKONING

Appendix D
Data Register

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Appendix D – Data Register

Description	Media	Source	When Received
GIS File - Flood Zones 2&3 - Main Rivers - Area Benefiting from Defence - Historic Flood Outlines - Modelled Flood Outlines	1 x CD	EA (provided by Phil Edwards)	22/10/2007
Hydraulic Model Reports - Picknall Brook SFRM 2005-2006 - River Blithe SFRM 2006 - River Churnet Section 105 Flood Risk Mapping - Dove Strategy Report & Model 2006 - River Trent Strategy	5 x CD (including Digital Reports)	EA (provided by Phil Edwards)	22/10/2007
Raster Maps	1 x CD	East Staffordshire Borough Council	25/10/2007
River Trent Strategy Summary Report	Hard Copy report	EA (website)	29/10/2007
Burton upon Trent Flood Risk Management Project – Draft Environmental Report (November 2005)	Hard Copy report	EA (website)	29/10/2007
Managing Flood Risk in Burton – Upon – Trent, Flood Alleviation Works (2006)	Hard Copy report	EA (website)	29/10/2007
Trent Corridor Catchment Abstraction Management Strategy (December 2003)	Hard Copy report	EA (website)	30/10/2007
The Staffordshire Trent Valley Catchment Abstraction Management Strategy (July 2007)	Hard Copy report	EA (website)	30/10/2007
Dove Catchment Abstraction Management Strategy (CAMS)	Hard Copy report	EA (website)	30/10/2007
West Midlands Regional Spatial Strategy (RSS 11) The Impact of Housing Growth on Water Quality and Waste Water Infrastructure, June 2007	Hard Copy report	West Midlands Regional Assembly website	30/10/2007
West Midlands Regional Spatial Strategy (RSS 11) The Impact of Housing Growth on Public Water Supplies, June 2007	Hard Copy report	West Midlands Regional Assembly (website)	30/10/2007
West Midlands Regional Flood Risk Appraisal Final Report, October 2007	Hard Copy report	West Midlands Regional Assembly (website)	30/10/2007
River Trent Catchment Flood Management Plan – Consultation Scoping Report, November 2006	Hard Copy report	EA (website)	30/10/2007
Update of the Dove Strategy Report – Appendix H2_1	Email Attachment	EA (Phil Edwards)	05/11/2007

Development Plans for East Staffordshire (including White Young Green and Greenfield sites) – ESRI files	Email Attachment	East Staffordshire Borough Council (Amanda Dawson)	05/11/2007
East Staffordshire Local Plan July 2006	Hard Copy Report	East Staffordshire Borough Council Website	05/11/2007
LiDAR Data	CD	EA (Mike Plant) [01225 487 658]	14/11/2007
Tatenhill Brook Hydraulic Investigation Appraisal Report, 2002 Haswell Consulting Engineers	Hard Copy Report	East Staffs Council (Emma Roberts)	16/11/2007
Shobnall Brook Hydraulic Investigation, 2002, Haswell Consulting Engineers	Hard Copy Report	East Staffs Council (Emma Roberts)	16/11/2007
River Swarbourn Yoxall Flood Modelling and Alleviation Report, JMP Consultants LTD, 2002	Hard Copy Report	East Staffs Council (Emma Roberts)	16/11/2007
River Swarbourn Yoxall Flood Modelling and Alleviation Executive Summary, JMP Consultants LTD, 2002	Hard Copy Report	East Staffs Council (Emma Roberts)	16/11/2007
Rolleston on Dove drainage and flooding records	Hard Copy Folder	East Staffs Council (Emma Roberts)	16/11/2007
Node Data for NFCDD, including historic flood levels	Email Attachment	EA (Phil Edwards)	23/11/2007
Strategic Flood Risk Scoping Study	Email Attachment	Council (Philip Somerfield)	23/11/2007
Burton Economic Model Report 2005	CD	EA (Phil Edwards)	26/11/2007
River Churnet Section 105 Flood Mapping, November 2007	CD	EA (Phil Edwards)	26/11/2007
Rolleston on Dove Flood Action Plan	Internet	www.rolleston-on-dove.freeserve.co.uk	29/11/2007
Flood Plan Information	Email	East Staffs Council (Emma Roberts)	29/11/2007
Flood Watch and Flood Warning Areas	Shapefiles	EA (Phil Edwards)	30/11/2007
4 Digit Postcode Flooding Records	Excel Spreadsheet	Severn Trent (Martin Young)	04/12/2007
Canal Maps	Hard Copy – maps	British Waterways	05/12/2007
River Tean Model	Hard Copy Report	Environment Agency (Mandeep Bhullar)	06/12/2007
A38 Flooding Records	Excel Spreadsheet	Highways Agency (Richard Hancox)	07/12/2007
Barton under Needwood, Barton Brook Improvement Scheme	Hardcopy report	Environment Agency (Neil Lote)	03/03/2008