North West Leicestershire SFRA

SFRA Report (2015 update)

North West Leicestershire District Council

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Glossary

Term	Definition
AIMS	Asset Information Management System
BGS	British Geological Society
CFMP	Catchment Flood Management Plan
CIL	Community Infrastructure Levy
CLG	Communities and Local Government
D	Depth
DF	Debris factor
FCERM	Flood and Coastal Erosion Risk Management
FDGiA	Flood Defence Grant in Aid
FRA	Flood Risk Assessment
FRMP	Flood Risk Management Plan
FWMA	Flood and Water Management Act
GIS	Geographical Information System
HCA	Homes and Communities Agency
LAA	Local Area Agreement

Term	Definition
LEP	Local Enterprise Partnership
LFRMS	Local Flood Risk Management Strategy
LLFA	Local Lead Flood Authority
LPA	Local Planning Authority
MTP	Medium Term Plan
NPPF	National Planning Policy Framework
PFRA	Preliminary Flood Risk Assessment
PPS25	Planning Policy Statement 25
SAB	SuDS Approving Body
SFRA	Strategic Flood Risk Assessment
SoP	Standard of Protection
SuDS	Sustainable Drainage Systems
uFMfSW	Updated Flood Maps for Surface Water
v	Velocity
WCS	Water Cycle Study
WFD	Water Framework Directive

Executive summary

This Strategic Flood Risk Assessment (SFRA) provides an update to the previous SFRA completed in 2008 and is required to inform the draft Local Plan for North West Leicestershire currently being reviewed for implementation. This SFRA provides an overview of the planning context in relation to flood risk and development within North West Leicestershire. The report outlines the roles and responsibilities of parties involved with future development, incorporating the recent (April 2015) changes to statutory consultees for planning applications. SFRAs are considered live documents and should be revised periodically when updated information becomes available, following policy changes or when it is required to inform Local Plans.

The information assessed within this SFRA identifies that the main source of flood risk in the district is fluvial (river flooding) although areas are also at risk from surface water, sewer, canal or groundwater flooding.

15 potential sites for residential development and 19 sites for non residential development have been assessed in relation to flood risk. The results of this assessment have identified that 26 of the potential sites are at low risk of flooding and therefore considered sequentially acceptable in relation to flood risk. North West Leicestershire planners are required to take into account this determined flood risk as part of the Sequential Test, which is one of many factors taken into consideration when allocating potential sites for development in the Local Plan. Not all sites assessed in this SFRA will be allocated in the Local Plan. Sites not assessed within this SFRA could still be considered for development, although they would be treated as windfall applications. This SFRA provides a windfall site review flow chart to be used by planners in determining the appropriateness of individual windfall applications in relation to the Sequential Test.

As well as assessing flood risk at potential development sites and guidance for reviewing windfall sites this SFRA also provides guidance on surface water management for new development. This is owing to surface water flood risk becoming more of a focus in the assessment of planning applications due to the increased knowledge and understanding associated with this source of risk, and specifically the potential flood risk impacts of insufficient surface water management.

Given the driver of this SFRA update is to inform the emerging Local Plan for North West Leicestershire, the recommendations of this report should be considered when setting the Local Plan Policies. The recommendations for the Local Plan Policies are:

- The flood risk to, and impact of, new development should be promoted through careful planning and where possible locating new development in the lowest flood risk areas, from all sources;
- Where development cannot be proposed in the lowest flood risk area, but where development would provide benefits that outweigh flood risk, suitable mitigation must be provided. This will ensure an acceptable level of risk to the new development whilst not increasing risk elsewhere. This would normally be demonstrated through the application of the Exception Test and must be agreed with relevant statutory consultees;
- There is an increased focus on surface water management and new development must ensure the drainage system serves to reduce runoff to agreed standards over the life time of the development. It also necessary that the design of new surface water drainage systems follow the Sustainable Drainage Systems (SuDS) hierarchy. The runoff rate is normally the pre development rate for greenfield sites or as recommended in the Leicestershire County Council SuDS emerging guidance for brownfield sites. Where possible a strategic approach to surface water management should also be considered; and
- Where possible redundant watercourse crossings and culverted reaches are removed to provide flood risk and ecological benefits. However the downstream impacts should be carefully considered to prevent an increased flood risk elsewhere.

The other recommendations from this SFRA are that:

- This SFRA should support the completion of site specific Flood Risk Assessments (FRAs). FRAs are required for all proposed development that goes through the planning system located within areas at risk from fluvial flooding and those covering sites greater than 1 hectare;
- The Sequential Test should be carried out for all proposed windfall development and the flow chart provided in this SFRA should be used to aid planners with this process. It is recommended that the flow

chart is updated, if necessary, following its use in assessing proposed development and following changes in policy or flood risk information; and

- It is recommended that this SFRA is considered as a live document, which is based on current understanding and available data. As further flooding occurs, as policy changes and as there are advances in flood risk studies this SFRA should be reviewed and updated as appropriate.

1. Introduction

1.1. Overview

North West Leicestershire is a largely rural area with population concentrated in the principal settlements of Coalville and Ashby de la Zouch and a number of villages including Castle Donington, Kegworth, Ibstock and Measham. Flooding is one of the most widespread and frequently occurring of natural hazards and, therefore flood risk is one of main factors that influences the spatial planning process. All forms of flooding and their impact on the natural and built environment are material planning considerations.

North West Leicestershire District Council lies wholly within the catchment of the River Trent. There is a watershed within the District at Coalville where watercourses either flow approximately north or south. The north of the District drains to the Lower River Trent either directly or via the River Soar, whilst the south of the District flows via the River Mease or the River Sence to the Upper River Trent. The Lower River Trent is considered to be the catchment contributing to the River Trent downstream of the confluence with the River Dove in Derbyshire.

It is also important to recognise that the District of North West Leicestershire is situated immediately upstream of the Boroughs of Erewash and Rushcliffe to the north and Hinckley and Bosworth, South Derbyshire and North Warwickshire Districts to the south and west. North West Leicestershire District is adjacent to Charnwood through which the River Soar flows before entering North West Leicestershire. There are a large number of properties within the adjoining Boroughs that are susceptible to flooding from the River Trent and the River Soar, and future development within North West Leicestershire District must be carefully managed to ensure that this risk of flooding is not exacerbated.

Under existing planning law, most applications for proposed development should be assessed in accordance with the development plan. North West Leicestershire District Council are currently in the process of updating their Local Plan to inform future development within this area, and this Local Plan will take into account the National Planning Policy Framework (NPPF). The NPPF states that '*inappropriate development in areas at risk of flooding should be avoided by directing development away from areas at highest risk, but where development is necessary, making it safe without increasing flood risk elsewhere*'. The NPPF also requires that the Local Plan is supported by a Strategic Flood Risk Assessment (SFRA). In 2007 North West Leicestershire District Council commissioned Atkins to complete a SFRA for North West Leicestershire. Since the completion of the SFRA (Atkins, 2008), there have been updates to national policy (specifically the enactment of the NPPF), further flooding events and updates to flood risk mapping. It was therefore considered by North West Leicestershire District Council and the Environment Agency that the 2008 SFRA required revisions to make use of the available updated information.

1.2. Future development within North West Leicestershire District

North West Leicestershire District has a long history of mineral extraction, with coal, brick clay, gravel and granite amongst the products. All the deep coal mines are now closed, but opencast extraction continues. The District has undergone a transformation in recent years from the old employment base of deep mining to new jobs within the industrial and service sectors. The North West Leicestershire District has good transport links through the M1, A42, A50 and A511 which can assist in further economic regeneration of the area through employment growth and new housing areas.

At the time of writing, North West Leicestershire District Council are currently preparing a new Local Plan for the District that will set out the locations at which development should take place up to 2031. The Local Plan will guide future development and will look at various issues such as housing and economic needs, as well as measures to protect the environment and the effects of climate change.

This SFRA will be used to inform the Local Plan and will form part of the evidence base. This SFRA has only included sites for the application of the Sequential Test which North West Leicestershire District Council (NWLDC) are considering allocating, all other sites would need to be treated as windfall.

1.3. Objectives

The objectives of this SFRA are:

- To provide sufficient data and information to enable North West Leicestershire District Council to apply the Sequential Test for potential land allocations, and where necessary the Exception Test. The SFRA has only included sites which NWLDC are considering allocating, all other sites would need to be treated as windfall;
- To enable North West Leicestershire District Council to prepare appropriate policies for the management of flood risk within the Local Plan;
- To identify the level of detail required for site specific Flood Risk Assessments (FRAs); and
- Enable North West Leicestershire District Council to determine whether the flood risk is acceptable in relation to emergency planning capability.

1.4. Scope of this document

This SFRA report has been prepared in accordance with the NPPF to summarise the findings of the data collection phase and to provide a basis for the application of the Sequential Test in respect to potential development areas/sites identified so far through the planning process.

The SFRA report builds upon the previous SFRA (Atkins, 2008), updating information that has now been superseded or was not previously available. This includes updating reference to flood risk policy, reviewing recent flood events and updating flood risk mapping. Where alterations were not necessary for the SFRA update the text has been taken directly from the previous SFRA (Atkins, 2008). This updated SFRA can then be used to refresh the Sequential Test and complete new Sequential testing for land allocations as appropriate.

This report provides an overview of the planning context in relation to flood risk and development within North West Leicestershire (Section 2). A summary of the data collected and a review of this data is provided (Section 3) which then forms a basis for the assessment of flood risk in North West Leicestershire (Section 4). The Sequential Test is outlined for the potential sites for development (Section 5). Sustainable flood risk management is discussed for future development in North West Leicestershire (Section 6) and an assessment of potential mitigation has been provided (Section 7).

2. Review of planning policy

This section provides an overview of the planning context in relation to flood risk and development within North West Leicestershire.

2.1. National planning policy

National planning policy plays a key role in shaping the direction in which Local Planning Authorities prepare their Local Plans for development.

The NPPF sets outs the Government's national policies on different aspects of land use planning in England. The NPPF includes policy relating to development and flood risk. The NPPF and its technical guidance were published in 2012 which revoked the previous Planning Policy Statements (PPS), and specifically PPS25 that related to development and flood risk, although the principles remain the same. The NPPF technical guidance was updated in 2014.

The aims of the NPPF are to ensure that flood risk is taken into account at all stages in the planning process to avoid inappropriate development in areas at risk from flooding and to direct development away from areas at highest risk. By exception, where new development is, necessary in high risk areas, policy aims to make it safe without increasing flood risk elsewhere and where possible, reducing flood risk overall.

As with PPS25, Sequential testing, and in some cases Exception testing, is required for new development and land use. As outlined within the technical guidance "*the aim of the Sequential Test is to steer new*

development to areas with the lowest probability of flooding. The flood zones [see Section 3.3] *are the starting point for this sequential approach*".

Whilst the overall aim of the Sequential Test is to steer new development to the lowest area at risk there are likely to be instances where development cannot be located in the lowest risk area and as such the Exception Test would be required (for Essential Infrastructure, Highly Vulnerable and More Vulnerable development classifications as shown in Appendix A).

The Flood and Water Management Act received Royal Assent in 2010 and aims to provide a more comprehensive management of flood risk for people, homes and businesses, whilst safeguarding community groups from unaffordable rises in surface water drainage charges. This Act included the introduction the concept of flood risk management rather than simply flood defence and provides a framework to deliver flood risk management though national and local strategies.

2.2. Regional planning policy

Since the completion of the original SFRA (2008) regional planning policy has been abolished. The abolition of the regional strategies for growth reinforces the importance of Local Plans, which are created through consultation with local communities. Therefore there is currently no regional policy for development within North West Leicestershire and development in this area is steered by planning policy on a national and local scale.

2.3. Local planning policy

The local planning authorities that are responsible for planning on a district scale, such as North West Leicestershire District Council, are required to prepare and maintain an up to date Local Plan for their respective area.

To ensure that the Local Plan remains effective it must be kept up to date and will generally require either full or partial update every five years, with reviews proportionate to reasons for the update. In line with the online Planning Practice Guidance[1] "*the National Planning Policy Framework makes clear that relevant policies for the supply of housing should not be considered up to date if the authority cannot demonstrate a five years supply of deliverable housing sites*".

The Local Plan is required to clearly set out the strategic priorities for the District and the policies outlined within the plan must address these priorities. Further detail in regards to the creation of the Local Plan are provided within the Planning Practice Guidance.

To support the Local Plan for North West Leicestershire District Council there is a wide range of documents being considered. These cover numerous topics, and those which address flood risk specifically are the SFRA and the Water Cycle Study (WCS). Therefore this SFRA forms part of the evidence based for the Local Plan and should be read in conjunction with the Scoping and Outline WCS (Entec, 2010) and the Detailed WCS (Amec, 2012),as well as the other relevant documents forming the evidence base provided on the North West Leicestershire District Council website[2].

3. Data collection and review

3.1. Introduction

The purpose of the data collection and review phase of the SFRA is to identify and obtain information regarding flood risk. It is during this phase that existing knowledge is collated with regards to the sources and extent of flood risk; existing flood management measures; and the land use and development opportunities within the North West Leicestershire area.

[1] http://planningguidance.planningportal.gov.uk/blog/guidance/local-plans/preparing-a-local-plan/
[2] http://www.nwleics.gov.uk/pages/evidence_base_documents

Consultation has been undertaken with North West Leicestershire District Council, Leicestershire County Council, the Environment Agency and Severn Trent Water. The information gathered during this phase has been used to assess the potential extent and frequency of flood risk, the implications of this flood risk for development opportunities and the opportunities for flood management practices which may help mitigate or reduce future flood risk.

3.2. Overview of the district area

North West Leicestershire District covers an area of approximately 280km^2 and is situated within the River Trent catchment. Within any catchment the hydrology is intrinsically linked to the geology and topography. The geology of the District is dominated by Triassic Mercia Mudstone which is relatively soft and has been eroded over thousands of years to form the wide flat valleys of the River Trent and the River Soar which bound the north and east of the district.

Carboniferous Coal Measures underlie much of the south of North West Leicestershire and forms part of the Leicestershire and South Derbyshire Coalfield. The Coalfield consists of a northern section where the Lower, Middle and Upper Carboniferous Coal Measures are exposed, and a southern section where they are beneath Mercia Mudstone and Sherwood Sandstone which, in turn, are overlain by glacial till.

The Coalfield landform is one of gentle ridges and shallow valleys. The undulations become particularly shallow towards the south where there are locally thick deposits of glacial till which form the Mease/Sence Lowlands and the Leicestershire Vales. To the north the land falls away, often quite steeply, to the River Trent. The Coalfield forms part of the watershed between the Mease and Sence to the south and the River Soar to the east, with numerous brooks draining the generally undulating land.

Geology has a very strong influence on a catchments response to rainfall. The degree to which water can percolate through rock, (described as permeability), influences the extent of overland flow and therefore the response of a watercourse to a rainfall event. The Mercia Mudstone has a high clay content and is relatively impermeable resulting in rapid surface runoff. The Sherwood Sandstone and Coal Measures, whilst more permeable, can promote rapid surface runoff where they form steep slopes.

Historically, the watercourses in North West Leicestershire have experienced many man-made changes, particularly where mining has been carried out. This has disturbed the natural processes of erosion and accretion and increased sediment movement, resulting in localised flooding from culvert, sluice gates and channel blockages. Farming practices and land use affect soil structure and vegetation cover and can impact on run-off rates and soil erosion. From the elevated area around Coalville a number of small fast flowing streams transfer sediment into the relatively flat River Soar. This river requires regular silt removal, carried out by Canal and River Trust, to maintain the channel capacity and allow navigation.

3.3. Flood Zone definition

3.3.1. The NPPF Flood Zones

The NPPF makes use of four separate Flood Zones that should be considered when determining if proposed development is at an acceptable level of flood risk through the Sequential Test based on the land use vulnerability classification (see Appendix A). These Flood Zones represent flooding without flood defences in place and are defined as follows:

- **Flood Zone 1** is defined as having a ‘Low Probability’ of flooding and incorporates areas where the annual probability of flooding is lower than 1 in 1,000 (0.1%). The NPPF imposes no constraints upon the type of development within this Flood Zone.
- **Flood Zone 2** is defined as having a ‘Medium Probability’ with an annual probability of flooding between 1 in 1,000 and 1 in 100 (0.1% and 1%) for fluvial flooding and between 1 in 1,000 and 1 in 200 (0.1% and 0.5%) for tidal flooding. The NPPF recommends that this area is acceptable for most types of development with the exception of Highly Vulnerable land uses, as listed within Table 2: Flood Risk Vulnerability Classification taken from the NPPF flood risk planning practice guidance and included within Appendix A of this SFRA update.
- **Flood Zone 3** is defined as having a ‘High Probability’ of flooding and incorporated areas with an annual probability of flooding of 1 in 100 (1%) or more frequent for fluvial flooding or 1 in 200 (0.5%) or more frequent for tidal flooding. The NPPF also splits this category of risk into two sub categories of Flood

Zone 3a and 3b. Flood Zone 3a is 'High Probability' and Flood Zone 3b is 'functional floodplain' where water has to be stored during times of flooding. There are greater constraints associated with development in these areas, as described in Appendix A of this SFRA update.

3.3.2. The Environment Agency flood maps

The Environment Agency's flood maps, that identify the Flood Zones outlined in Section 3.3.1, were made available for this study. These flood maps are the Environment Agency's best estimate (as of November 2014) of the areas at risk from fluvial flooding (not taking into account the presence of flood defences) for the 1 in 100 annual probability (1%) and 1 in 1,000 annual probability (0.1%) events. The flood map is updated on a quarterly basis as the Environment Agency's knowledge of flooding is improved through detailed modelling studies, recent flood events and data from river level and flow monitoring stations.

The Environment Agency's flood map outlines are based on a combination of specific detailed hydraulic modelling and generalised river modelling and mapping method carried out nationally, to provide an indication of flood risk. The flood map outlines produced through generalised river modelling are the result of the macro modelling techniques, and whilst they are generally accurate on a large scale, they are not provided for specific sites or land where the catchment of the watercourse is less than 3km^2.

For the above reasons the flood map is not deemed sufficiently accurate to resolve the details of possible flooding for individual properties or sites. To provide site specific flood risk information, or in catchment areas smaller than the 3km^2 cut-off, a more precise local assessment of flood risk is required.

Furthermore, because the Flood Zone outlines are not definitive and do not include all minor watercourse flood plains, they should not be assumed to be correct where a minor watercourse (ditch, brook, drain, dyke, etc.) is shown with no flood outlines, within or adjacent to a site.

The detailed hydraulic modelling makes use of more accurate catchment and channel topography to provide flood extents and depths with a greater degree of confidence. It is normal to use the detailed hydraulic modelling flood extents in preference to those estimated through generalised river modelling.

The flood map outlines provided for this SFRA have been derived using a combination of a generalised model derived as part of the Flood Zone Project (a high level national mapping programme), more detailed hydraulic modelling and historical flooding outlines. The Flood Map outlines, therefore, have a varying degree of accuracy dependent on the quality of the inputs and, in particular, the availability of detailed hydraulic modelling.

The Flood Map presents flood risk in accordance with the NPPF Flood Zones 1, 2 and 3a. Appendix B Figure Set C displays the existing Environment Agency Flood Maps for Zones 2 and 3. Whilst this Flood Map should be used as a starting point for allocating land for development, any sites that contain watercourses, or where a watercourse is adjacent to the site boundary, further detailed assessment would be required by the applicant to confirm flood risk.

3.4. Hydraulic modelling

A number of flood risk mapping studies have been carried out by the Environment Agency across North West Leicestershire District. These studies have involved the development of detailed hydraulic models, providing a more robust understanding of the local flooding mechanisms and flow paths. The flood extent outputs from the following models have been provided for this SFRA:

- Black Brook Strategic Flood Risk Management study, Capita Symonds 2006;
- Lower River Soar and tributaries, JBA 2012;
- Trent Fluvial Strategy, B&V 2004; and
- The Gilwiskaw Brook hydraulic model updated in 2012 and currently being further updated as commissioned by the Environment Agency.

These models cover the River Trent, the River Soar, Grace Dieu Brook, Black Brook, River Mease, Gilwiskaw Brook and Hooborough Brook. The extent of these models are illustrated in Appendix B Figure Set C.

The hydraulic modelling is based on detailed cross sectional survey and hydrological assessment and the mapping of the flood levels is based on a detailed Digital Terrain Model. Therefore, the flood extents derived

from the detailed hydraulic modelling are considered to be more accurate than the flood map which is derived from the generalised model (outlined in Section 3.3.2) which cannot fully represent complexities in flood flow routes.

The hydraulic model outlines for the 1 in 100 annual probability (1%) and 1 in 1000 annual probability (0.1%) events have been compared with the Flood Map for this SFRA to derive definitive flood outlines for Zone 2 and Zone 3a which are used as the basis of the Sequential Test.

In the absence of site-specific information to the contrary, functional floodplain is assumed to be land which would flood with an annual probability of 1 in 20 or greater in any one year (5%) or land which is set aside for flood storage. The Black Brook and the River Trent fluvial strategy hydraulic models have not been run for the 1 in 20 annual probability (5%) event; however, there are flood outlines available for the 1 in 25 annual probability (4%) event. The 1 in 25 annual probability flood outline has been used to represent the functional floodplain as this is considered to be the best available information.

3.5. Historical flood events

Information on historical flood events can supplement the understanding of flooding mechanisms and flood extents determined through hydraulic modelling.

3.5.1. Fluvial flood history

Significant flood events affecting the whole of the River Trent basin occurred in 1932, 1947, 1960, 1998 and 2000. Individual catchments have also experienced severe flooding at other times.

River Trent / River Soar

The 1947 event was caused by snowmelt following prolonged rainfall and affected many locations in England and Wales. The event was notable for its prolonged duration and significant flood volumes. This event remains the highest recorded at several locations on the River Soar and Lower River Trent. In recent years, the largest events on the Lower River Trent were in Autumn 1998 and October/November 2000. However, the Easter 1998 event was significant on the River Soar.

In the Autumn 1998 event flooding on the lower River Soar overtopped the defences at Kegworth that offer protection during the 1 in 10 annual probability (10%) flood event. However, the defences at Ratcliffe on Soar, which offer protection during the 1 in 100 annual probability (1%) event were not breached or overtopped.

The October/November 2000 floods had a widespread impact throughout the River Trent catchment with an approximate annual probability of between 1 in 25 (4%) and 1 in 50 (2%). The worst affected areas were the lower reaches of the River Soar and the middle reaches of the River Trent from upstream of Nottingham to Newark, both affecting property within North West Leicestershire. Environment Agency defences failed or were overtopped along the River Soar. No properties flooded between Kegworth and the River Trent confluence from the River Soar; however there were a significant number of properties flooded within North West Leicestershire, including:

- Burton to Castle Donington – 18 properties flooded from the River Trent and received a severe flood warning.
- Castle Donington to Long Eaton – 6 properties flooded from the River Trent and received a severe flood warning.
- Cotes to Kegworth – 15 properties flooded from the River Soar and received a flood warning; 13 properties not flooded but received a flood warning.

The River Soar suffered severe flooding in 1932 and 1954 which led to the construction of flood management schemes in the 1960s mainly through Leicester. However, there are still considerable areas at risk of flooding from the River Soar and a strategy study has been undertaken recently for future flood risk management of the reach from Sharnford to the River Trent confluence.

Grace Dieu Brook

There has been significant flooding of roads and properties from Grace Dieu Brook, including in Thringstone and Belton in 1987 and in the village of Osgathorpe during 1955.

The most significant recent event was in July 2002 when 105mm of precipitation was recorded at Mount St. Bernards raingauge over a 9 hour period. This rainfall is 91% more than the monthly average for July and equates to about one seventh of the average annual precipitation recorded at the gauge. The rainfall resulted in an extreme event on Black Brook and Grace Dieu Brook and there was significant flooding with the residents of 58 properties requesting assistance from North West Leicestershire District Council to remove flood damaged household items. There was also significant flooding of roads which resulted in major disruption to residents of Whitwick. Many other properties along the course of the Brook suffered damage to their gardens.

Gilwiskaw Brook

Significant flooding of roads has occurred in Packington and Ashby de la Zouch from Gilwiskaw Brook. 1 property and 5 gardens were flooded following heavy rainfall in July 2001. The flooding of Mill Street during the July 2001 event caused disruption to the residents of Packinton. Several other heavy rainfall events have resulted in flooding of roads and gardens in Packington with the most recent events in June 2007.

Minor Watercourses

Flooding occurs frequently in Hemington Village from Hemington Brook. In February 1977, 9 houses, a post office, 2 public houses and a road were flooded. The cause of flooding is considered to be the inadequate capacity of brook, culverts and access bridges. Hemington Brook is also affected by backing up from the River Soar and River Trent.

Flooding of roads and properties has been reported in Lockington caused by the inadequate capacity of Lockington Brook and the culvert in the centre of the village.

Other reported flooding includes houses and the road in Hallgate and Ladygate in Diseworth from Diseworth Brook and Hall Brook which carry runoff from Nottingham East Midlands Airport and flooding of an access road from B5401 in Long Whatton from Long Whatton Brook. However, these are thought to be the result of local issues regarding channel maintenance.

Flooding has been reported in Appleby Magna and at three separate locations, Church Street, Black Horse Hill and A444/Bowleys Lane. It is reported that the flooding has occurred from overtopping from the ordinary watercourse and culverted reaches, as well as from surface water.

3.5.2. Recent flood investigation

As the Local Lead Flood Authority (LLFA), Leicestershire County Council are responsible for investigating flood incidents, from any source, under Section 19 of the Flood and Water Management Act (FWMA 2010) that fall under their specific criteria. As part of this responsibility flood incident reports have been completed in North West Leicestershire. One such report is currently available, which is associated with the flood event that occurred on 28th June 2012 along Bardon Road, Coalville. The cause of this flooding is reported as surface water flooding, as there was not sufficient capacity in the existing system to collect all runoff during the associated high intensity rainfall event.

Five further reports are proposed, although these were not available at the time of writing this SFRA. The locations at which the investigations are proposed identify areas that have flooded, although further details such as date or source of flooding has not been provided. Potential sources of flooding have been identified through internet searches, although this would need to be confirmed following the publication of the flood investigation reports. The five locations for which flood investigation reports are proposed by the LLFA are:

- Bath Lane, Moira (fluvial flooding);
- A444, Appleby Magna (fluvial or surface water flooding);
- Drome Close, Coalville (surface water flooding);
- Crawshaw Close, Long Whatton (fluvial flooding); and
- Ashby Road, Measham (fluvial flooding).

In addition to the flood incident reports, Leicestershire County Council commissioned a flood study in relation to previous flood events that occurred in the villages of Diseworth and Long Whatton. The previous flood events occurred in November 2000 and November 2012. The report concluded that inundation to properties during November 2012 was the result of fluvial flooding from Hall Brook, Diseworth Brook and the small watercourse upstream of Main Street in Long Whatton. High level potential solutions such as channel

improvements and flood storage were proposed within the report, although discussions between the LLFA and stakeholders are required prior to selecting the preferred option.

The locations outlined within this section have been included within the historical flood mapping provided in Appendix B Figure Set B.

3.5.3. Historical flood outlines

Historical digital spatial flood data was made available for this study from the Environment Agency for the Black Brook, the River Soar, the River Trent and Cosby Brook. The historical flood outlines are shown in Appendix B Figure Set B. It can be seen that flooding is known to occur in the lower reaches of the Black Brook from downstream of its confluence with Grace Dieu Brook (possibly due to backing up from the River Soar). The historical flood extents also show that flooding is known to have occurred along the wide floodplain of the River Soar and the River Trent.

The LLFA provided flood mapping indicating flood events additional to those outlined within the above sections. These flood events have occurred from a range of sources including from watercourse, surface water runoff, highways, blocked structures or unknown sources. This flood incidents are shown in Appendix B Figure Set B.

3.6. Recent studies on flood risk

A number of studies have been completed within North West Leicestershire in relation to flood risk and flood risk management.

Leicestershire County Council has completed a draft Local Flood Risk Management Strategy (LFRMS) to fulfil their duties under the Flood and Water Management Act 2010. This strategy is out for consultation until mid January 2015 and therefore the final report is not available within the timescales of this SFRA. Therefore the draft LFRMS has been used to inform this SFRA. The Strategic Environmental Assessment (SEA) (LUC, 2014a) was completed to assess the potential environmental effects of implementing the LFRMS and has been used to inform this SFRA.

Following consultation with Leicestershire County Council on 12th November 2014, it was confirmed that there are currently no Surface Water Management Plans (which outline preferred strategies for surface water management) for North West Leicestershire, and during this consultation there were no plans to complete one. Therefore, there are no SWMPs that can be used to inform this SFRA.

In October 2014 the Environment Agency issued draft updates to the River Basin Management Plan for the Humber River Basin District (Environment Agency, 2014a). The reason for this update was owing to improvements and updates to water company assets and plans; a new programme of flood and coastal risk investments; more recent monitoring and investigation; and updated policy. This updated river basin management plan is proposed for publication in December 2015 and will cover the period 2015 to 2021.

These policies are outlined within the Humber River Basin District draft Flood Risk Management Plan (FRMP) (Environment Agency, 2014b), with the aim to issue the final FRMP by December 2015. The aim of the FRMP is to "*help deliver the requirements of the National Flood and Coastal Erosion Risk Management Strategy in England by setting out the measures to manage flood risk now and in the future*". The draft FRMP recognises that maintaining hard defences will become uneconomical in many cases and therefore not sustainable in the future. The approach outlined within the draft FRMP is a move towards systems that work with nature and through a catchment based approach. The catchment that covers the North West Leicestershire is the River Soar. The draft FRMP outlines the current and proposed measures to manage risk in the River Soar and Trent catchment which includes catchment wide measures such as preparedness through investigating flood resilience to site specific measures along discrete watercourses to provide flood risk benefits to a set number of properties.

The River Soar Management Catchment summary (Environment Agency, 2014c) of the wider Humber River Basin District draft FRMP outlines that 29 actions have been proposed, although detail in relation to these actions is not provided. The Environment Agency has put together a six year plan for proposed future flood risk management ambitions. These ambitions attempt to look beyond traditional flood defence schemes and to identify environmental enhancements and WFD improvements that reduce flood risk in Leicester and Leicestershire.

3.7. Existing flood risk management

3.7.1. Definition of flood risk management

Information on existing flood risk management is required to indicate areas where there is protection from fluvial flood risk, the level of protection provided and predicted life of the flood risk management option. Flood risk management is normally in the form of either formalised flood defences or other approaches such as flood storage or flood resilience.

Flood defences

Flood defences are raised structures that prevent floodwater from flooding surrounding areas by altering the natural flood flow paths from a watercourse or retaining flood water. Flood defences are categorised as 'formal' defences or 'informal' defences. A 'formal' defence is a structure that was built separately to defend land or property from flooding and is maintained for this purpose by the Environment Agency, Local Authority or riparian landowner. An 'informal' defence is a structure that has not been specifically built to retain flood water and is not maintained for this specific purpose but may afford some protection against flooding. 'Informal' defences include boundary walls, industrial buildings and railway and road embankments.

The extent, condition and standard of protection of the defences owned and maintained by the Environment Agency are recorded within the Asset Information Management System (AIMS). To determine the standard of protection provided by the defence, the following information is essential:

- Location of the defence; and
- Defence crest level.

Where available the following information is also collated:

- Condition of the defence (based on the AIMS scale of 1 to 5, good to poor);
- Residual life; and
- Type of defence.

Other flood risk management

Other flood risk management solutions may involve schemes to increase flood water storage in upstream areas, with gradual release. This will reduce the chance of river channel overtopping and hence flooding in the downstream protected areas. This can be achieved either though the construction of formalised flood storage reservoirs, or providing increased "natural" floodplain storage through reduced bank levels. Additional flood storage could be provided by deculverting areas and creating new floodplain, especially where redevelopment is being proposed. This would have the potential added benefit of restoring the channel for amenity and wildlife as well as enhanced water quality (Water Framework Directive).

The removal of other in channel structures (such as watercourse crossings) may provide some additional flood risk benefit to upstream areas as it could improve flow conveyance. This may also improve ecology including fish and eel migration. However downstream flood risk impacts would need to be considered carefully for this type of flood risk management.

Sewer separation, i.e. separating surface water and foul water within sewer systems could also reduce flood risk, as well as limiting associated pollution incidents.

As outlined within the Habitats Regulations Assessment report (LUC, 2014b) the construction and operation of flood risk management options, particularly flood defences, have the potential to cause adverse impacts on habitat sites such as through the removal of habitat, damage (including through dredging), non-physical disturbance such as noise or vibration and through pollution. It is therefore necessary to carefully consider these potential environmental impacts when assessing flood risk management.

3.7.2. Location and description of flood defences

The severe flood event in 1947 acted as a catalyst for the construction of the existing flood defences through the River Trent catchment. Flood defence embankments are in place along the River Trent and the River Soar where the rivers form the northern and eastern parts of the North West Leicestershire District boundary.

The flood defences were constructed in the 1960s and early 1970s and at the time provided protection from flooding with an annual probability of up to 1 in 100 (1%).

The main areas for flood defences along the River Trent are Cavendish Bridge, a large stretch of the eastern side of the M1 and Trentlock, at the confluence with the River Soar.

The River Soar has two sets of embankments. The first are small raised earth embankments set close to the river (within 10 metres), to protect farmland against frequent flooding. The second much larger embankments are designed to protect inhabited areas and are generally set much further away from the river. This arrangement provides extensive areas of flood storage on the floodplain, whilst protecting the many villages and towns in the area.

There are formal defences along Hemington Brook, Lockington Brook and Grace Dieu Brook providing a standard of protection that ranges from the 1 in 10 annual probability (10%) to 1 in 50 annual probability (2%).

It is understood that there is formalised flood storage provided along Gilwiskaw Brook to protect downstream areas during flooding. However the details of this potential flood storage reservoir are unknown and its location is not shown in the flood defence details provided by the Environment Agency or as available on the Environment Agency website.

Appendix B Figure Set C shows the location of flood defences as provided by the Environment Agency. Details of these flood defences, including standard of protection are provided in Table 3-1.

Table 3-1 Flood defence details

Watercourse	Location	Type of Raised Defence	Design SoP	Comments	Approx. Grid Reference
Grace Dieu Brook	Abbott's Oak Drive/Meadow Lane, Coalville	Wall	Tbc	Wall is currently inspected and maintained by the Environment Agency.	SK 44842 14552 to SK 44817 14583
River Soar	The Osiers, Kegworth	Wall	10 year	Environment Agency does not have access to this wall. It is privately maintained	SK 49112 26867 to SK 49212 26866
River Soar	Bridge Fields, Kegworth	Embankment	100 year	Currently inspected and maintained by the Environment Agency	SK 49106 27074 to SK 49193 27134
River Soar	New Street, Kegworth	Wall	100 year	Currently inspected and maintained by the Environment Agency	SK 49202 27148
River Soar	Bridge Farm, Kegworth to Trent confluence downstream of Ratcliffe on Soar	Minor Embankments	10 year	Currently inspected and maintained by the Environment Agency	SK49348 27321 to SK49211 30811
River Trent	Railway to upstream of Soar confluence, Ratcliffe on Soar	Minor Embankments	10 year	Currently inspected and maintained by the Environment Agency	SK47809 60386 to SK49179 30956
River Trent	Railway to Back Lane, Cavendish Bridge	Minor Embankments	5 - 10 year	Currently Environment Agency inspected but privately maintained	SK 43047 28444 to SK 44537 29870

3.8. Flood warning

In addition to flood defences to reduce the probability of flooding, flood warning has been in operation in the River Trent catchment for a number of years as a means of reducing the impacts of flooding. A range of systems have been in operation in various parts of the catchment operated by the Environment Agency and their predecessors, the National River Authority, the Water Authority and even as far back as the River Boards during the early 1960s. Although flooding in the upper parts of the catchment is difficult to predict because of the rapid response of the smaller urbanised catchments, the lower reaches of the River Trent benefit from relatively accurate forecasts with good lead-times based on upstream water levels.

There are several flood warning services currently provided for areas at risk of flooding within North West Leicestershire, these are:

- Grace Dieu Brook at Whitwick and Thringstone located to the north of Coalville;
- River Trent at Castle Donington including Hemington and Lockington;
- River Trent at Castle Donington Kings Mill Areal;
- River Trent at Hemington Ponds, Hole and Fields area;
- River Trent at Cavendish Bridge;
- River Trent at Sawley Marina, including Sawley Lock;
- River Soar at Kegworth;
- Gilwiskaw Brook at Packington; and
- River Mease at Measham and Netherseal.

The above Flood Warning Areas are based on a combination of the Flood Zone 2 outline and the historic flood extent. This is because some known historic flooding has occurred outside of Flood Zone 2.

In addition to the above Flood Warning Areas, North West Leicestershire is covered by general early alerts to possible flooding, known as Flood Alerts, for the following areas:

- River Trent in Nottinghamshire from Castle Donington to Cromwell Weir
- River Trent and tributaries in Derbyshire from Newton Solney to Castle Donington;
- Lower River Soar in Leicestershire including tributaries from Cossington to Redhill at the River Trent;
- River Anker and River Sence, low lying land and roads between Nuneaton and Tamworth on the River Anker and between Temple Mill and Ratcliffe Culey on the River Sence;
- River Mease, low lying land and roads between Ashby and Croxall; and
- Loughborough urban watercourses, specifically Black Brook, Wood Brook, Burleigh Brook, Grace Dieu Brook and other urban watercourses in Loughborough.

3.9. Land allocations

The new Local Plan will identify sites for development. A number of potential sites have already been identified for both housing and employment and these potential sites have been assessed as part of this SFRA. The Council has identified a number of potential housing sites in its published Strategic Housing Land Availability Assessment (SHLAA) and in a similar assessment for potential employment sites. The SHLAA contains many more sites than will be required so only the most significant sites in the larger settlements have been assessed as part of this study. Any sites not listed within the Local Plan, irrespective of whether they are listed within the SHLAA will be treated as windfall sites.

The potential land allocations that have been assessed within this SFRA are provided in Table 3-2. The location of all these potential development sites is shown on Appendix B Figure Set C. Not all sites that have been assessed in this SFRA will definitely be allocated for development, as this SFRA will be used to identify those site that are preferable for allocation based on flood risk considerations alone (i.e. those located in Flood Zone 1).

Table 3-2 Potential land allocations

Site type	Site reference	Name
Commercial	E1	South of Pegasus Business Park, East Midlands Airport
Commercial	E2	Land at Sawley Crossroads, Castle Donington
Commercial	E3	Land at Beveridge Lane, Bardon, Coalville
Commercial	E4	Donington Park Race Circuit, Castle Donington
Commercial	E5	Land south of Packington Nook, Measham Road, Ashby de la Zouch
Commercial	E6a	Land North of Pretoria Road, Whitehill Road, Ellistown
Commercial	E6b	Land South of Pretoria Road, Whitehill Road, Ellistown
Commercial	E8	Little Battleflat Farm, Beveridge Lane, Ellistown
Commercial	E9	Land at Ryecroft Road, Hemington
Commercial	E10	Stephenson College, Thornborough Road, Coalville
Commercial	E11	TNT Premises, Lount
Commercial	E12	Land at Bardon Road, Coalville
Commercial	E13	Land off Gracedieu Road, Whitwick
Commercial	E14	Land South of Sawley Marina, Tamworth Road, Long Eaton
Commercial	E15	Land rear of Enterprise House, Coalville
Commercial	E16	TNT Premises, Lount
Commercial	E17	Money Hill Site, North of Ashby
Commercial	E18	Swains Park, Occupation Road, Albert Village
Commercial	E19	North of Derby Road, Kegworth
Residential	A5	Land at Money Hill, North of Ashby de la Zouch, same location as E17
Residential	A7	Land South East of Ashby de la Zouch (Packington Nook)
Residential	C18	Land Rear of Thornborough Road, Thornborough/New Swannington
Residential	C19	Land at Stephenson Green, Coalville
Residential	C23	Land rear of Bardon Road (South), Coalville
Residential	C46	Land at Broomleys Farm, Coalville
Residential	C48	South of Church Lane, Swannington
Residential	IB7	Land off Ravenstone Road/Melbourne Road, Ibstock
Residential	IB18	Land off Leicester Road, Ibstock
Residential	K5	Land at Station Road/Long Lane, Kegworth
Residential	K10	Slack and Parr, Long Lane, Kegworth
Residential	K11	South of Derby Road (north west of the Data Centre), Kegworth
Residential	M6	Land adjacent to Atherstone Road, Measham
Residential	M11	Land at Leicester Road/Grassy Lane, Measham
Residential	M12	Land off Ashby Road, Measham

4. Flood risk in North West Leicestershire

4.1. Sources of flooding

4.1.1. Fluvial

Overview

Fluvial flooding occurs when the flow within a watercourse exceeds the channel capacity causing out of bank flow.

The primary source of flood risk in North West Leicestershire is fluvial flooding. The north and east of the district is vulnerable from the River Trent and the River Soar, both independently and, in wider flood events, concurrently. The south and west of the district is at risk of fluvial flooding from the River Mease, a tributary of the Upper River Trent, the River Sence and a tributary of the River Soar.

Throughout North West Leicestershire there are several other tributaries of the River Trent and the River Soar which present a flood risk, most notably Gilwiskaw Brook and Grace Dieu Brook. Appendix B Figure Set C shows the outlines for each of the Flood Zones based on a combination of the Environment Agency Flood Map outlines and flood extents from hydraulic modelling and historical events.

The currently available flood extents for the Gilwiskaw Brook have been presented in this SFRA, however the associated modelling is in the process of being updated. The revised flood extents along Gilwiskaw Brook will be published by the Environment Agency in the near future (date unknown) and therefore these updated flood maps, when available, should be used in preference to the mapping in this SFRA for proposed development applications in this area.

The figure shows the main urban areas at risk of flooding are:

- Castle Donington from the River Trent and Castle Donington Brook
- Hemington from the River Trent and Hemington Brook
- Lockington from the River Trent and Lockington Brook
- Kegworth from the River Soar
- Diseworth from Long Whatton Brook
- Osgathorpe from Westmeadow Brook
- Belton from Westmeadow Brook
- Thringstone from Grace Dieu Brook
- Whitwick from Grace Dieu Brook
- Ashby de la Zouch from Gilwiskaw Brook
- Packington from Gilwiskaw Brook
- Measham from the River Mease
- Appleby Magna from a minor ordinary watercourse

As outlined within Section 3.3 areas at risk from fluvial flooding are categorised into Flood Zone 1 (low probability), Flood Zone 2 (medium probability), Flood Zone 3a (high probability) and Flood Zone 3b (functional floodplain). For the purposes of the SFRA, functional floodplain represents land where the flow of water is not prevented by flood defences and is subject to flooding during the 1 in 20 annual probability (5%) event. It also includes areas of land which are designed for flood storage, e.g. washlands. However hydraulic model outputs are not provided for this event for the Black Brook or the River Trent and therefore the 1 in 25 annual probability (4%) extents have been used to represent the functional floodplain along these watercourses. Elsewhere hydraulic modelling is not available and therefore as a conservative approach the Environment Agency Flood Zone 3 should be used to represent the functional floodplain.

4.1.2. Surface water

Surface water flooding occurs when rainfall intensities exceed the infiltration capacity such that water collects on the ground surface and has the potential to cause significant urban flood risk through rapid runoff rates. Developed land, specifically with large areas of impermeable surfacing, can be vulnerable to surface water flooding where an adequate drainage system is not present. Surface water flooding can also result from run-off associated with various agricultural practices. Certain arable farming practices in particular are likely to increase this risk of surface water flooding and excessive loss of top soil; however this is considered to be a minor problem within the district.

In recent years surface water flooding has become more problematic within North West Leicestershire. Flood investigation reports have been completed by Leicestershire County Council that have identified high intensity rainfall has exceeded drainage system capacities causing surface water flooding along Bardon Road in Coalville.

Information in relation to known locations of surface water flooding has identified areas at risk from surface water flooding (although potentially in combination with other sources) include:

- Coalville;
- Measham;
- Blackfordby;
- Appleby Magna;
- Peggs Green; and
- Castle Donington.

The information provided from the Environment Agency for this SFRA included the updated Flood Maps for Surface Water (uFMfSW). These indicate areas at risk from surface water flooding during three events; the 1 in 30 annual probability (3.3%), the 1 in 100 annual probability (1%) and the 1 in 1000 annual probability (0.1%) event. This flood mapping shown in Appendix B Figure Set D. This mapping has been used to inform the Sequential Test assessment, the results of which are included within Table 5-1.

4.1.3. Groundwater

Groundwater flooding normally occurs where the water table meets the ground surface in low lying areas which are underlain by permeable rock known as aquifers. This tends to follow long periods of sustained rainfall, but can also be caused as a result of local obstructions to groundwater flow (e.g. following the placement of engineering structures or buildings with foundations) or by the rebound of groundwater levels after a decrease in abstraction or dewatering.

It is important to recognise that the risk of groundwater flooding is typically highly variable and heavily dependent on local geological, topographical and weather conditions. Groundwater flooding is hard to predict and challenging to mitigate.

The majority of North West Leicestershire is underlain by Triassic Mercia mudstone consisting of a series of red clays and marls occasionally interbedded with sandstone. Superficial deposits consist of alluvium deposits in the floodplain interspersed with areas of sand and gravel. Where groundwater exists it flows through strata very slowly and in limited quantities.

The risk of groundwater flooding is considered to be relatively low within North West Leicestershire but can contribute to flooding from other sources.

Parts of North West Leicestershire are susceptible to rising groundwater due to the large-scale closure of the coal mines within the Leicestershire and South Derbyshire coalfield. The closure of a mine and the cessation of water pumping results in the resaturation of the mine void by water. The residual body of the Coal Board, the Coal Authority is responsible for monitoring rising groundwater and the Environment Agency reviews the results through a formal dialogue with the Authority. Groundwater level monitoring undertaken by the Coal Authority across the Coalfield indicates that the minewater is still rising and rebound is incomplete. Discussion with the LLFA (pers. comms. 09/12/14) identified that Leicestershire County Council are aware of the associated risks with the Coalfield minewater rising, specifically within Oakthorpe and Donnisthorpe (approximate location E432320, N313550 and as shown in Appendix B Figure Set E) although have not received any reports of associated flooding. Whilst potential sites should not be ruled out for development in

this area, the potential risk from this source should be considered during the design phases of associated development proposals.

The Environment Agency hold mapping that indicates areas susceptible to groundwater flooding which has been created at a strategic scale and is based on a 1km grid. The Environment Agency outline that the mapping has been created through the use of "*the top two susceptibility bands of the British Geological Society (BGS) 1:50,000 groundwater susceptibility map and thus covers consolidated aquifers and superficial deposits. It does not take into account the chance of flooding from groundwater rebound. It shows the proportion of each 1km grid square where geological and hydrogeological conditions show that groundwater may emerge*".

Whilst this data shows the proportion of each 1km grid square that is susceptible to groundwater flooding the data should not be used to identify areas where flooding is likely to occur resulting from flow or ponding. The purpose of the data is to identify areas where further assessment and groundwater studies would be considered particularly useful. Whilst this dataset is presented in the summary of the assessment of flood risks for the Sequential Test (Table 5-1), a site located within an area with high susceptibility would not be considered sequentially unacceptable based on this source of risk alone. Rather, the site could be considered sequentially acceptable, although the potential risk of groundwater emergence should be specifically considered during the development design.

4.1.4. Sewers

The sewerage infrastructure of North West Leicestershire is largely based on Victorian sewers and there is a risk of localised flooding associated with the existing drainage and sewer system.

Flooding from sewers can occur when the artificial drainage system is overwhelmed hydraulically, becomes blocked or suffers structural failure or pump failure. Blockage and structural failure incidents tend to be isolated and unpredictable. Severn Trent Water is responsible for the management of the urban drainage system throughout North West Leicestershire including surface water and foul sewerage. Severn Trent Water has procedures in place to respond to and rectify such incidents, which are also recorded on databases to inform maintenance and improvement plans.

A review of areas where the sewer system has been overwhelmed can potentially identify parts of the system that are under capacity. Severn Trent Water maintains an extensive database of flood events from sewers. This is a strategic level problem and is addressed by Severn Trent Water through their ongoing asset management procedures, supported by a programme of detailed network modelling. Severn Trent Water has the following target levels of protection against sewer flooding of properties:

- Foul and combined systems: 1 in 10 to 1 in 50 annual probability (depending on property type).
- Surface water system: 1 in 10 to 1 in 30 annual probability (depending on property type).

Wherever possible, Severn Trent Water seeks to promote the highest specified standard. However, this is dependent on the cost-benefit analysis of the improvement scheme. It is therefore not appropriate for the SFRA to recommend strategic options for managing sewer flooding where levels of protection to properties are inadequate as this is a fundamental part of Severn Trent Water's existing asset management procedures.

However, Severn Trent Water has made the database of sewer flood events available and this can form a useful dataset for informing the spatial planning process with regard to flood risk. Appendix B Figure Set B shows the location of foul and surface water sewer incidents. Within the context of strategic planning, identification of these hotspots will inform North West Leicestershire District Council of areas where increased levels of investment may be required by developers to improve the hydraulic capacity of the existing sewer system. It is essential to ensure that future development does not exacerbate known existing problems and conditions should be placed upon future development to ensure that these capacity issues are rectified before development is permitted. It is important, however, to consider that all hydraulic improvements to the systems, required due to new development, are subject to approval in line with the strategies and policies of Severn Trent Water.

Pipe leakage is a common and widespread problem throughout the UK and can contribute to basement flooding and more widespread surface water flooding in some areas. Pipe leakage within North West

Leicestershire is managed by Severn Trent Water as a fundamental part of their asset management procedures.

Pipe bursts tend to be isolated and unpredictable incidents. Severn Trent Water has procedures in place to respond to and rectify such incidents.

Severn Trent Water provided information associated with the sewer flooding schemes currently under investigation, specifically those proposed to address sewer flooding (i.e. not capital works such as rehabilitation schemes). A potential scheme is being reviewed for Appleby Magna and is currently in the feasibility stage for completion under AMP6 (2015-2020). A scheme at this location will only be taken forward if identified to be economically and technically viable. There are no other sewer schemes currently proposed (correct as of November 2014) within the North West Leicestershire District.

4.1.5. Canal Infrastructure

The Ashby Canal is about 22 miles long from Marston Junction on the Coventry Canal near Bedworth, through largely rural and remote countryside to its present terminus at Snareston. Constructed mainly to carry coal, the canal opened in 1804 and was taken over by the Midland Railway company in 1846. Its railway owners did not invest sufficient money in the canal to maintain it properly and in 1918 a major breach caused by mining subsidence caused the last few miles of the canal near Ashby to be abandoned. Since this time a stretch of the canal near Moira has been restored and re-filled with water with further restoration planned. The Ashby Canal is owned and maintained by the Canal and River Trust. The Canal and River Trust have not reported any flooding incidents from the canal.

Part of the River Trent and River Soar are maintained as navigable sections by the Canal and River Trust. The River Trent is navigable from Shardlow to Trent Lock where it forms part of the boundary of North West Leicestershire.

Northwards from Leicester, the Grand Union Canal utilises the River Soar to provide a through route to the Trent Navigation. The route includes a number of artificial canals, canalised river sections and river navigations. The Canal and River Trust state that for this section of the River Soar "*flooding is comparatively common in winter*". In July 2007 flooding was experienced at several locks along the River Soar, including Kegworth.

There are no connections between the Grand Union Canal and the River Soar in the form of overflows so the risk of flooding from the canal is only localised to the canal network. Flood risk to development (and potential development sites) is considered to be minor from canal infrastructure.

4.1.6. Reservoirs

There are two reservoirs within North West Leicestershire, Blackbrook Reservoir and Staunton Harold Reservoir. Black Brook Reservoir is a large body of water near Whitwick and was constructed in 1796 to feed the Charnwood Forest canal, which has long since become redundant. The first earth embankment dam failed in 1799 and was subsequently repaired in 1801. The present gravity dam was constructed in 1906. Black Brook is rarely used by its operators, Severn Trent Water, as a water supply source, and as such is maintained at, or close to, full capacity. With the exception of particularly dry periods, the reservoir continuously spills over six equal length weirs into a stilling pool which flows into the Black Brook. The reservoir spans across North West Leicestershire District and Charnwood Borough.

Staunton Harold Reservoir was created in 1964 to provide communities and businesses in Leicester and the East Midlands with drinking water and is currently owned and maintained by Severn Trent Water. The Reservoir spans across North West Leicestershire and South Derbyshire Districts with the majority of it being in South Derbyshire.

Flooding from reservoirs can occur when water retaining structures fail. All large reservoirs are covered by the Reservoirs Act and are subject, by law, to regular safety inspections. A very low residual risk of flooding from these reservoirs remains if they were to fail unexpectedly.

4.1.7. Failure or blockage of critical assets

Flooding can result from the failure or blockage of critical assets, for example culverts or bridges. When trash screens become blocked due to the build up of debris, or where blockages occur at the inlet to culverts,

there is potential for localised flooding to result. The floodwater backs up and can flood nearby land or low-lying areas as it finds an alternative route around the culvert or structure.

The City of Dan culvert along Grace Dieu Brook through Whitwick is known to be susceptible to blockage. Water quickly accumulates upstream of the culvert and this has historically led to overtopping of the structure and flooding along Castle Street. There is also a trash screen on Gilwiskaw Brook at Hood Park which may be susceptible to blockage, therefore leading to overtopping along this watercourse.

The risk of failure or blockage of critical assets is associated with ineffective maintenance. Therefore proposed development (specifically design and layout) should be planned to ensure the provision of necessary access to the watercourse for maintenance and hence to reduce the risk of flooding associated with failure or blockage of critical water assets.

4.2. Flood defences

Where there are flood defences with a standard of protection to prevent flooding during the 1 in 100 annual probability (1%) event, the area benefiting from these defences has been assessed. Appendix B Figure Set C shows the areas benefiting from flood defences for a 1 in 100 annual probability (1%) event. The main areas benefiting from flood defences along the River Trent are Castle Donington with approximately 250 properties protected; Hemington with approximately 150 properties protected; and Lockington with approximately 50 properties protected.

In addition, there are defences along the River Soar, which protect a small number (<20) of properties within Kegworth.

Within North West Leicestershire there is also a considerable length of flood defences that would not provide protection during the 1 in 100 annual probability (1%) event. Whilst these defences offer protection to properties for flood events up to their design standard, for the 1 in 100 annual probability (1%) event the defences offer little protection and are overtopped.

The Environment Agency provided data indicating areas that will benefit from new and reconditioned flood schemes under the Medium Term Plan (2014/15 to 2019/2020). The identified schemes are those that the Environment Agency will commence alongside the local authorities from the financial year 2014/15 and within the next six years. This information identified that there is a proposed scheme for flood protection in Long Whatton and Diseworth with construction due to start between 2018 and 2021. The proposed scheme will provide protection to 30 properties. There are currently no other proposed flood defence schemes within the North West Leicestershire District.

4.3. Flood risk sensitivity

The flood risk sensitivity analysis for North West Leicestershire was undertaken in 2008 to identify potential changes in risk that will be caused by climate change and the variability associated with urban development and land management practices. In addition, the impact of overtopping and breaching of flood defences on flood risk has been considered.

4.3.1. Flood sensitivity to climate change

The River Trent CFMP (current at the time of the original SFRA) identified that climate change is expected to have a major influence on future flood risk. The expectations are that winter floods will happen more often and in urban areas flooding from thunderstorms will be more regular and more severe.

The guidance from Defra (Defra, 2006) on assessing climate change sensitivity was used for this assessment completed in 2008, which recommended assuming a 10% increase in fluvial flow up to 2025 and then an increase of 20% thereafter. Subsequent guidance in relation to the increases in flood risk associated with climate change, specifically the Environment Agency's adapting to climate change report (Environment Agency, 2011) has since been published. The adapting to climate change report suggests a change factor of 10% for the 2020s, 15% for the 2050s and 20% for the 2080 for river flows in the Humber River Basin District. This is similar to the change factors used for the flood risk sensitivity assessment completed in 2008 and an associated update to the assessment is not considered necessary.

Hydraulic modelling of the River Trent and Grace Dieu Brook has considered the potential impact of climate change over the next 100 years, assuming a 20% increase in the 1 in 100 annual probability (1%) flow and outlines are available from previous studies undertaken for the Environment Agency.

For Gilwiskaw Brook, Hooborough Brook, River Mease and parts of the River Soar a 20% increase in the 1 in 100 annual probability (1%) flow has not been modelled. For these watercourses the Flood Zone 2 outline (1 in 1000 annual probability (0.1%)) has been used to represent the possible impact of climate change.

The assessment indicated that there would be a small increase in the number of properties at risk of flooding in the future compared with the existing 1 in 100 annual probability (1%) outline. The impact of climate change for each of the main watercourses in North West Leicestershire are discussed further below.

River Trent

There would be no difference in the flood extent for the River Trent and no increase in the number of properties at risk; however the Fluvial Trent Strategy report suggests an average increase in water levels of 350mm as a result of climate change.

River Soar

There is no significant difference in the flood extent for the River Soar except for at Kegworth where there are up to 100 further properties and a sewage treatment works at risk with climate change. However, this flood outline is based on the 1 in 1000 annual probability (0.1%) event so the actual risk from climate change will be lower.

Grace Dieu Brook

There would be approximately 15 properties at risk from Grace Dieu Brook within Whitwick particularly around Cademan Street and Vicarage Street due to flow out of bank at the Leicester Road culvert. Flood depths within this part of Whitwick are predicted to have a maximum increase of 280 mm as a result of climate change.

Along the rest of Grace Dieu Brook there are similar increases in flood depths and flood extents; however there are no further properties or roads at risk from climate change.

Gilwiskaw Brook

The effect of climate change on Gilwiskaw Brook is anticipated to increase the extent of flooding in Ashby de la Zouch town centre and the southern parts of the town around Western Park. The modelling along Gilwiskaw Brook is currently being updated and therefore the flood depth impact climate change will have on flooding in this area is unknown.

River Mease

Climate change would also increase flood risk in Measham with an additional property at risk on Westminster Industrial Estate. There is no increase in residential property at risk but Birds Hill Road and a small part of Wordsworth Way will be at risk of flooding from climate change.

Summary

The anticipated changes in climate have the potential to not only increase the risk of fluvial flooding but also, by increasing the frequency and intensity of localised storms, increase the occurrence of flash flooding in small catchments. This may exacerbate localised drainage problems and so any site-based detailed Flood Risk Assessment and the Drainage Impact Assessment prepared by a developer at the planning application stage should take due consideration of climate change.

Impacts of climate change on specific potential development sites are discussed later within this document.

4.3.2. Flood sensitivity to increase urban development

The effects of flooding due to increases in urbanisation have been tested on a number of different catchments within the Trent CFMP, (current in 2008). The findings show that storm run-off from impervious surfaces, if controlled and routed rapidly by artificial drainage networks, can increase flood peaks in watercourses downstream of new urbanised areas. There is also an increased risk of localised “flash

flooding" in intense rainstorms. Urban growth will, therefore, increase surface water run-off rates and volumes with the potential for increasing flood risk unless new development is properly controlled.

Through new developments there is an opportunity to reduce surface water flood risk through the installation of drainage systems that limit runoff from a site.

Some of the new development is likely to be located on brownfield sites. These sites may already have connections to the drainage network. Therefore, unless the land use significantly increases the impermeable surface area, new development is unlikely to increase surface water flood risk. An exception to this would be where low density residential areas of large houses, with extensive gardens, are replaced by high density developments of flats or smaller houses. However, with the use of Sustainable urban Drainage Schemes (SuDs) any potential adverse effects can be avoided.

For certain greenfield allocations, surface water and/or discharges from new developments into watercourses would be reviewed by the LLFA to ensure existing greenfield runoff rates are maintained post development.

Design criteria should conform to the Sustainable Drainage Systems 'Non-statutory technical standards for sustainable drainage systems National Standards' (Defra, 2015). Also Leicestershire County Council will be publishing a SuDS design guide, which it is anticipated to have a minimum target for reduction in surface water run-off from "brownfield" redevelopment. This design guide will also specify design criteria for development sites.

Developers must approach Severn Trent Water to determine if they have the capacity to allow a new development to connect to the existing adopted drainage system. Severn Trent Water will either allow connection if they have capacity or inform the developer that an increase in capacity is required and that the developer would have to cover the cost before connection is permitted. However, connecting new developments into the Severn Trent Water drainage system is not sustainable as surface water sewers discharge into the watercourses. Effort should be made to attenuate surface water runoff on the site so it does not put pressure on the existing drainage system or increase runoff into watercourses via the sewer network.

Clever design, situation and location of future development can, therefore, all contribute to reducing the risk of flooding, including:

- Steering developments outside of the floodplain;
- Application of property and location specific flood protection measures;
- Improving property resilience to flood damage;
- Identifying river corridors and the natural floodplain to provide potential riverside storage and urban river corridors in built up areas; and
- Application of sustainable urban drainage techniques for new developments.

4.3.3. Flood sensitivity to land management practices

The volumes and rate of runoff from land into watercourses and rivers can be greatly affected by agricultural practices, such as the removal of hedgerows and woodland areas, reshaping landform and the provision of positive land drainage. Such practices can result in an increase in the flood risk from these watercourses to areas downstream.

The influences for change in land use and land management were explored in the River Trent CFMP (current in 2008 when this sensitivity assessment was completed). The agricultural land within North West Leicestershire is mainly classified as Grade 3 and is characterised by mixed land use. There are small areas of Grade 2 land along the River Trent and there is intensive agricultural use of the floodplain. In many places the floodplain is no longer naturally linked to the river due to engineered flood defences and river channels which protect this agricultural land from flooding.

There is a strong link between land use and land management practices and runoff generation at a plot or individual field scale. However, research into the potential impact of rural land use and land management practice on flood generation at a catchment scale was still underway at the time of the original SFRA (2008). Ongoing research funded by Defra (Defra / Environment Agency, 2004) and the Environment Agency is evaluating the impacts of rural land use and land management on run-off and flood generation. It was

concluded that impacts are evident at the local scale (individual fields and very small stream catchments). Further research is required to identify and understand impacts for larger catchments. The assessment identified that land management effects are most notable for small to medium flood events. In extreme floods the overall volume of rainfall is the controlling factor for flood magnitude.

In conclusion it is very difficult to predict future changes in agricultural land use and management within North West Leicestershire; however at this time it is thought that any changes in land management practices are not going to significantly affect runoff and, therefore, flood risk at a catchment wide scale.

4.3.4. Flood sensitivity to breach and overtopping of flood defences

Overview

Areas behind flood defences are at risk due to the potential overtopping or breach of flood defences resulting in the rapid onset of fast-flowing and deep water flooding with little or no warning. Local Planning Authorities and developers need to consider these residual risk issues relating to a development.

The level of residual risk behind flood defences is dependent on the distance from and the relative elevation of the land in relation to the water source. Figure 4-1 illustrates the various risk zones behind a river flood defence.

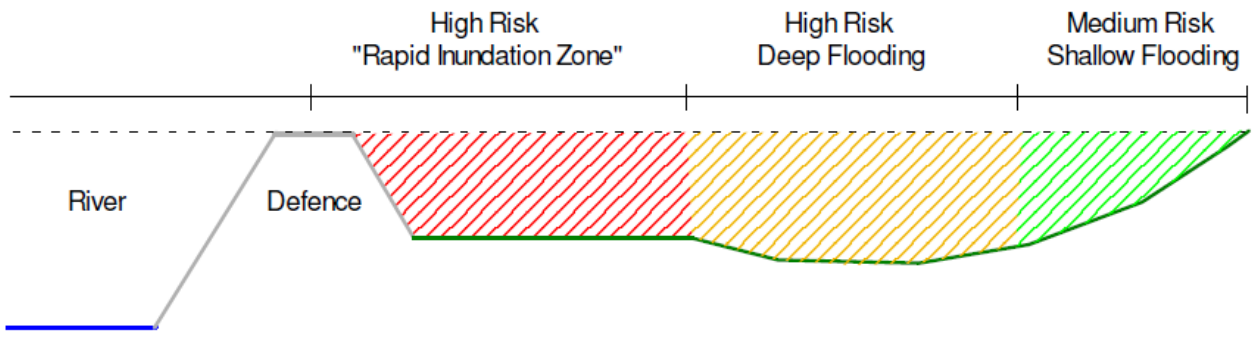

Figure 4-1 Risk zones behind flood defences

A Rapid Inundation Zone is an area which is at risk of rapid flooding should a flood defence structure be breached or overtopped. The zone at highest risk from rapid inundation is the area located close behind a flood defence.

Breach of defences

The breaching of a flood defence is a worst-case scenario for a flood event. During a breach event, a section of the flood defence fails, allowing large quantities of flood water to pass through the opening in the defence. The likelihood and scale of a breach is dependent on many factors, in particular, the material composition and condition of the defence.

Flood hazard describes the physical risk that floodwater presents to people (and to vehicles and property). It is a function of water depth (D), velocity (v) and a debris factor (DF). The flood hazard classification (Defra, 2005) is summarised in Table 4-1.

Table 4-1 Flood hazard classification (risks to people)

Flood hazard rating (D x (v+0.5) + DF	Degree of flood hazard	Description
<0.75	Low	Caution – flood zone with shallow flowing water or deep standing water.
0.75-1.25	Moderate	Dangerous for some (i.e. children): Danger – flood zone with deep or fast flowing water.

Flood hazard rating (D x (v+0.5) + DF	Degree of flood hazard	Description
1.25-2.5	Significant	Dangerous for most people: Danger – flood zone with deep fast flowing water.
>2.5	Extreme	Dangerous for all: Extreme danger – flood zone with very deep fast flowing water.

Proposed development within areas at risk from breaching, specifically those with a hazard rating greater than 0.75, are subject to additional flood mitigation requirements, as outlined by the Environment Agency standing advice. This includes raising finished floor levels and the provision of safe havens, to ensure that people are not put at an unacceptable risk. Therefore developers of potential sites within areas where there is a moderate to high flood hazard following breaching must take these requirements into consideration at the early stages of development design.

Breach analysis has been undertaken for the flood defences along the River Trent which protect properties in Castle Donington, Hemington and Lockington.

Atkins has developed in-house look up tables for breach analysis to determine the depths, velocities and hazard ratings associated with a breach. Table 4-2 summarises the range of values expected for a breach of the flood defences on the River Trent. The assumptions undertaken for the breach analysis is that the breach of the defence is 50m wide and the depth of water behind the flood defence prior to the breach is 2-3m for a 1 in 100 annual probability (1%) event. A 1 in 100 annual probability (1%) event has been used for the breach analysis as this is the current standard of protection offered by the flood defences near Castle Donington.

Table 4-2 Breach analysis of flood defences on the River Trent near Castle Donington

Distance from breach (m)	Depth of flooding (m)	Velocity of flood water (m/s)	Flood hazard rating
100	0.6-0.8	1.1-1.8	1.6-2.8
200	0.4-0.6	0.6-0.8	0.8-1.5
500	0.2-0.4	0.3-0.4	0.4-0.7
1000	0.1-0.2	0.1-0.2	0.2-0.3

*based on colour coding provided in Table 4-1

Breach analysis has also been undertaken of the flood defences along the River Soar which protect Bridge Farm and properties in Kegworth. Table 4-3 summarises the range of values expected for a breach of the flood defences on the River Trent. The assumptions undertaken for the breach analysis is that the breach of the defence is 50m wide and the depth of water behind the flood defence prior to the breach is 1-2m for a 1 in 100 annual probability (1%) event. A 1 in 100 annual probability (1%) event has been used for the breach analysis as this is the current standard of protection offered by the flood defences near Kegworth.

Table 4-3 Breach analysis of flood defences on the River Soar neat Kegworth

Distance from breach (m)	Depth of flooding (m)	Velocity of flood water (m/s)	Flood hazard rating
100	0.3-0.6	0.5-1.1	0.7-1.6
200	0.2-0.4	0.3-0.6	0.4-0.8
500	0.1-0.2	0.1-0.3	0.2-0.4
1000	0.0-0.1	0.0-0.1	0.1-0.2

*based on colour coding provided in Table 4-1

Overtopping of defences

The majority of the flood defences within North West Leicestershire have a standard of protection of less than the 1 in 50 annual probability (2%) event with some only having a standard of protection of 1 in 10 annual probability (10%) event. Where the existing defences have a standard of protection less than 1 in 100 annual probability (1%) event they will be easily overtopped and even submerged during a 1 in 100 annual probability (1%) flood event (see Figure 4-2). Out of bank flow will occur in a manner almost as if no defences existed. In these circumstances flood depths, velocities and extent can be expected to be similar to the undefended situation.

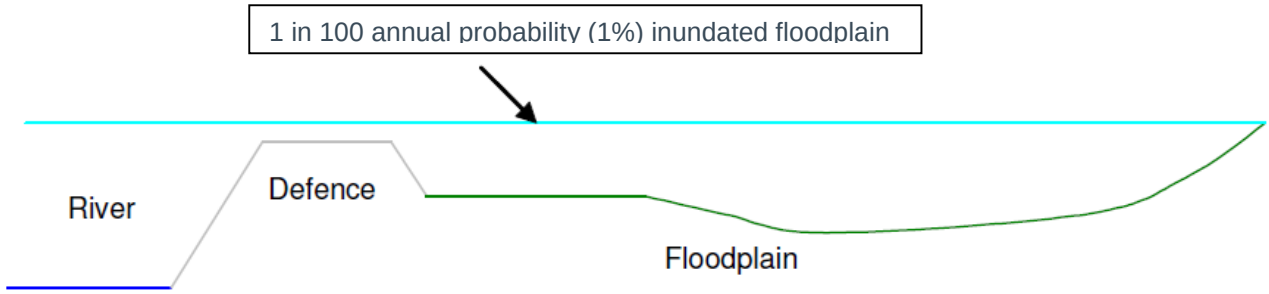

Figure 4-2 Overtopping of defences

The flood defences along the River Trent and the River Soar which currently offer a standard of protection of 1 in 100 annual probability (1%) event would be overtopped by more severe events, e.g. 1 in 1000 annual probability (0.1%) but also by increased water levels as a result of climate change. The impact of climate change was assessed as part of the Fluvial Trent Strategy. For the location of the flood defences near to Castle Donington (with asset name d/s Trent / A6 crossing) an increase in water levels of 0.5m is predicted. The result of overtopping of the flood defences is likely to result in a moderate level of risk in close proximity to the defences (100-200m) due to depths of water of >0.5m. However, at a greater distance (>500m) from the defences, the depth of flooding will be less as will the level of risk.

5. NPPF and the Sequential Test

5.1. Background

The Government requires Local Planning Authorities (LPAs) to apply a risk-based approach to the preparation of development plans and their decisions on development control. The NPPF encourages LPAs to steer development away from areas affected by flood risk and recommends the application of a 'Sequential Test' that splits a local planning district into zones of high, medium or low risk. The NPPF is the key guidance for planners managing flood risk as it clearly defines the appropriateness of the development type for each of the defined flood risk zones.

As stated above, the Sequential Test splits the planning district into three distinct flood risk zones, furthermore, the high flood risk zone is split further into areas of functional floodplain and High Probability Floodplain as shown in Figure 5-1.

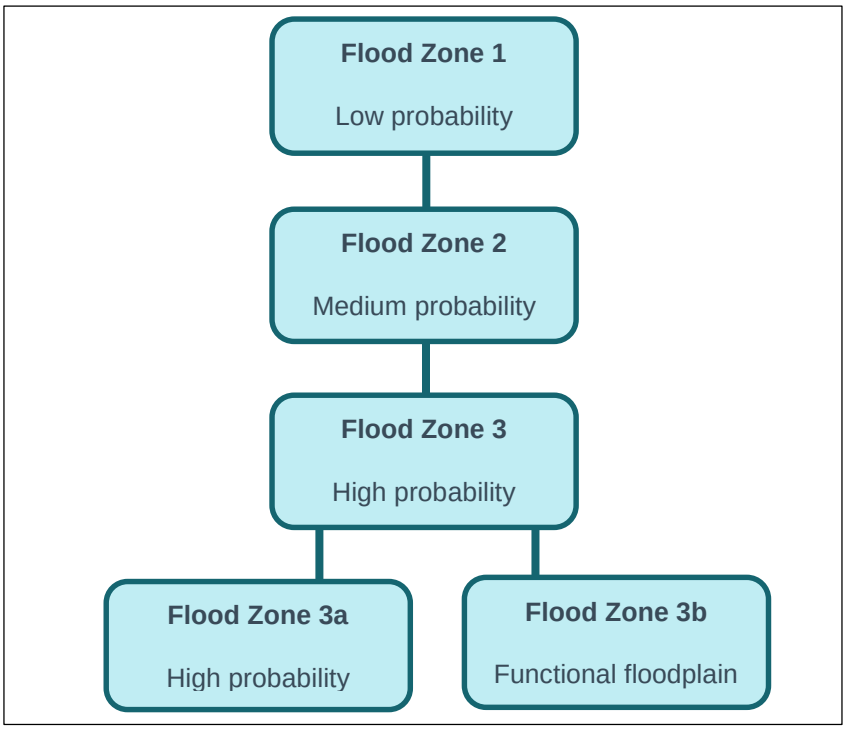

Figure 5-1 Flood Zones

5.2. Sequential Test

Planning needs to be at the forefront of managing flood risk in a sustainable manner by steering development away from areas that are susceptible to flooding. The NPPF advocates a sequential approach that will guide the planning decision making process (i.e. the allocation of sites). The aim of the Sequential Test is to:

"*Steer new development to areas within the lowest probability of flooding. The flood zones* [see Figure 5-1] *are the starting point for this sequential approach. The flood zones refer to the probability of sea and river flooding only, ignoring the presence of existing flood defences*."

Therefore in the first instance development should be located within Flood Zone 1. In circumstances when there are no reasonable sites available within Flood Zone 1 the development may be permitted within Flood Zone 2 depending on the land use vulnerability classification and applying the Exception Test if required. Only in circumstances when there are not suitable sites within Flood Zone 1 or 2 should development within Flood Zone 3 be considered. The acceptability of development within Flood Zone 3 will be dependent on land use vulnerability and evidence to meet the requirements of the Exception Test may be required. Where a site is located within a range of Flood Zones a sequential approach should be applied within the site boundary. This would help ensure that the most vulnerable areas of the development are located within the lowest areas risk as possible.

The early stages of a Sequential Test approach has been undertaken for this SFRA on the potential land allocations for the draft Local Plan. This Sequential Test assessment identifies:

- Those sites that are considered sequentially acceptable;
- Those for which further information is required to determine whether the Sequential Test could be considered passed; and
- Those for which a passed Sequential Test is unlikely to be demonstrated.

5.3. Assessing flood risk using the Sequential Test

The methodology adopted to undertake the Sequential Test for this SFRA has been provided in Figure 5-2. Flood risk is just one consideration of many in the planning remit that needs to be considered when the site is

ultimately allocated within the local plan. The planners need to take on all considerations, of which flood risk is just one.

In considering flood risk, Figure 5-2 identifies the steps undertaken to identify the Flood Zones that each of the proposed development sites reside within. These steps are outlined as follows:

1. Obtain the latest editions of the Environment Agency Flood Map and overlay within a Geographic Information System (GIS) for review.
2. Based upon catchment flood knowledge, historical flooding and hydraulic modelling update Flood Zones 2 and 3 if appropriate.
3. Identify Functional Floodplain using hydraulic model data where available. Assign this area as Flood Zone 3b.
4. Identify potential development site to be incorporated into the Local Plan;
5. Incorporate the potential development sites and the flood risk maps (flood risk from all sources) within GIS.
6. Determine which Flood Zone each of the potential development sites are located and tabulate the results.
7. Identify a hierarchy of preferred sites based on flood risk using a traffic light colour coding system (i.e. green go, red no go, as outlined within section 5.4).

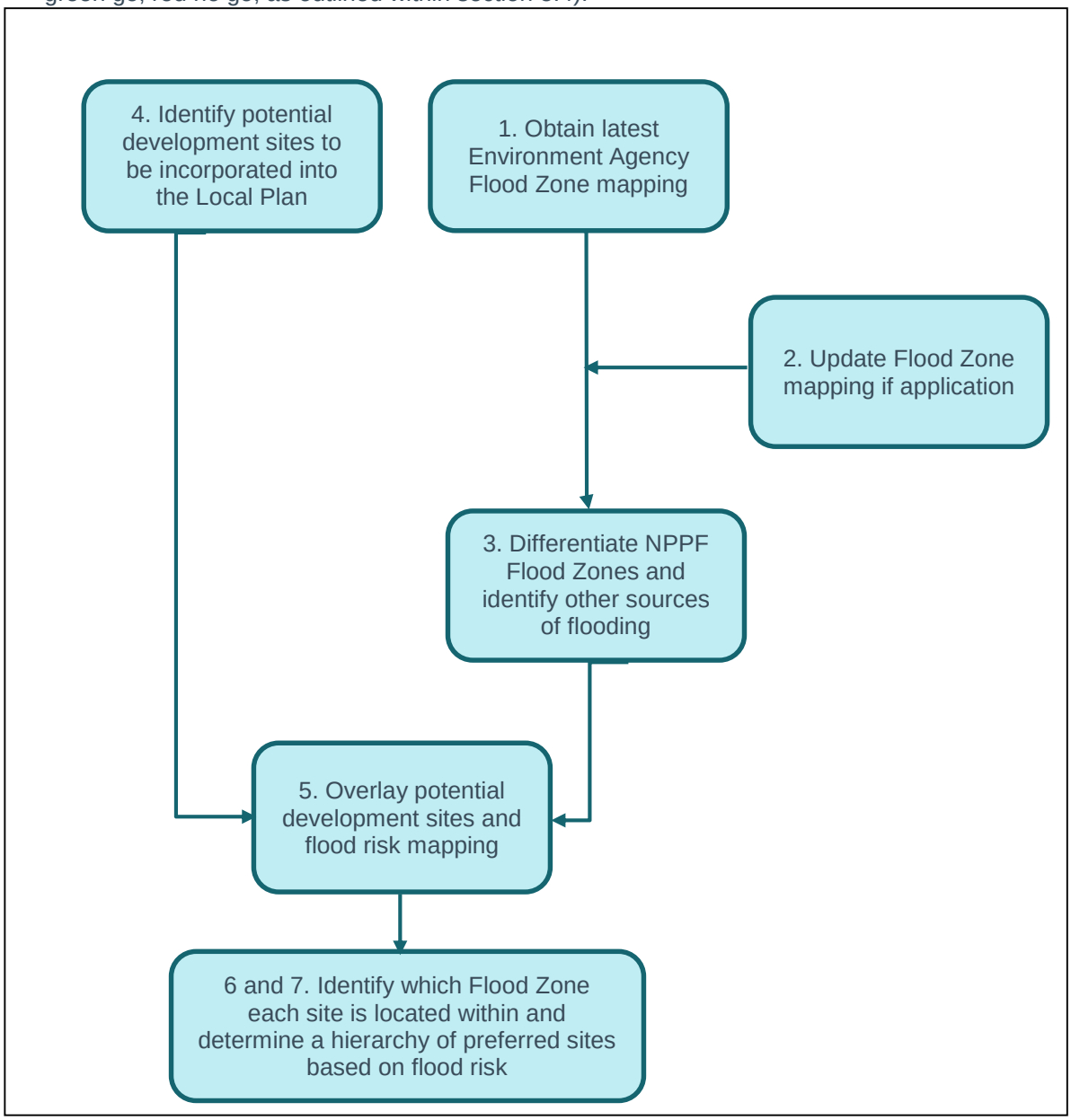

Figure 5-2 Flow diagram of Sequential Test methodology

5.4. Results of the Sequential Test on potential land allocations

The results of the Sequential Test for proposed land allocations are provided in Table 5-1. The location of these sites, together with the traffic light colour coding of the results are shown in Appendix B Figure Set C.

North West Leicestershire District Council have identified the most likely land uses for each of the potential development sites assessed within the SFRA. The application of the Sequential Test to each of these sites and the intended land uses has resulted in 3 groupings:

1. Sites where proposed land use is appropriate (highlighted green in Table 5-1);
2. Sites which require application of the Exception Test, or where the sequential approach should be applied for planning the layout of the site (highlighted amber in Table 5-1); and
3. Sites where the intended land use is not considered appropriate at this stage and further justification as to why the development of the site would have benefits that outweigh the flood risk (highlighted red in Table 5-1).

5.4.1. Site specific results

The following section outlines the individual sites assessed for the Sequential Test, the associated results of the Sequential Test and an indication of flood risk considerations that should be made through the planning process. Fluvial flood risk is considered the main factor in determining whether a site is considered sequentially acceptable, although surface water flooding and groundwater flooding have been used as other flood risk considerations that should be taken into account during development design and through the planning process.

E1 – South of Pegasus Business Park, East Midlands Airport

This site is proposed for commercial development.

The site is located within Flood Zone 1 and therefore considered sequentially acceptable.

There is one small area identified to be at risk from surface water flooding within this site, however this area at risk is associated with a pond. Therefore in general the site is currently considered to be at a very low risk from surface water flooding.

The site is also within an area considered to have a low susceptibility to groundwater flooding. Whilst development below the existing ground level should consider the potential for groundwater ingress, the overall risk from this source of flooding is considered relatively low.

E2 – Land at Sawley Crossroads, Castle Donington

This site is proposed for commercial development.

The site is fully located within Flood Zones 2 and 3a and over 20% of the site is located within Flood Zone 3b. Therefore the site is within an area at high risk from fluvial flooding and not sequentially acceptable. Further justification would be required if the site is to be taken forward for development. This justification needs to demonstrate that there are wider benefits that outweigh flood risk, and the development design would need to demonstrate no adverse impact on flood risk, both on site and elsewhere, as a result of the development.

Small isolated areas are identified to be at risk from surface water flooding. These isolated areas are likely to represent small depressions in the topography, where surface water may collect following storm events. The potential for this source of flooding should be considered within the design of the development, although this risk would not render the site inappropriate for development or result in the site being considered sequentially unacceptable.

The site is located within an area at high susceptibility to groundwater flooding. The potential risk associated with this classification is not considered to impact on the Sequential Test and a high susceptibility classification does not necessarily identify a high risk from this source. However this classification does highlight where further assessment in relation to groundwater is considered necessary to determine the implications for development design.

E3 – Land at Beveridge Lane, Bardon, Coalville

This site is proposed for commercial development.

The site is located within Flood Zone 1 and therefore considered sequentially acceptable.

There is a relatively large area in the south western area of the site that is at a low risk from surface water flooding. The potential for this source of flooding should be considered within the design of the development, although this risk would not render the site inappropriate for development or result in the site being considered sequentially unacceptable.

The site is also within an area considered to have a medium susceptibility to groundwater flooding. Whilst development below the existing ground level should consider the potential for groundwater ingress, the overall risk from this source of flooding is considered medium. However it may be prudent to undertake a groundwater assessment to inform the development design.

E4 – Donington Park Race Circuit, Castle Donington

This site is proposed for commercial development.

The site is located within Flood Zone 1 and therefore considered sequentially acceptable.

There are areas at risk from surface water flooding, which are predominately categorised as low risk, although there are also areas at high risk. These areas at low to high risk appear to follow a flow path before discharging into Ramsley Brook, although are not covered by Flood Zones 2 or 3. The potential for this source of flooding should be considered within the design of the development, although this risk would not render the site inappropriate for development or result in the site being considered sequentially unacceptable.

The site is also within an area considered to have a low susceptibility to groundwater flooding, with approximately 5% of the site within a medium risk area. Whilst development below the existing ground level should consider the potential for groundwater ingress, the overall risk from this source of flooding is considered relatively low.

E5 – Land south of Packington Nook, Measham Road, Ashby de la Zouch

This site is proposed for commercial development.

The site is located within Flood Zone 1 and therefore considered sequentially acceptable.

There is an area at low risk from surface water flooding in the southern area of the site. This area at risk appears to follow a flow path to a tributary of Gilwiskaw Brook, although this flow path is not covered by Flood Zones 2 or 3. The potential for this source of flooding should be considered within the design of the development, although this risk would not render the site inappropriate for development or result in the site being considered sequentially unacceptable.

The site is also within areas considered to have a low and medium susceptibility to groundwater flooding. Whilst development below the existing ground level should consider the potential for groundwater ingress, the overall risk from this source of flooding is considered medium. However it may be prudent to undertake a groundwater assessment to inform the development design.

E6a – Land north of Pretoria Road, Whitehill Road, Ellistown

This site is proposed for commercial development.

The site is located within Flood Zone 1 and therefore considered sequentially acceptable.

There are areas at risk from surface water flooding, which are predominately categorised as low risk, although there are also areas at high risk. These areas at low to high risk appear to follow various flow paths although are not covered by Flood Zones 2 or 3. The potential for this source of flooding should be considered within the design of the development, although this risk would not render the site inappropriate for development or result in the site being considered sequentially unacceptable.

The site is also within an area considered to have a low susceptibility to groundwater flooding. Whilst development below the existing ground level should consider the potential for groundwater ingress, the overall risk from this source of flooding is considered relatively low.

E6b – Land south of Pretoria Road, Whitehill Road, Ellistown

This site is proposed for commercial development.

The site is located within Flood Zone 1 and therefore considered sequentially acceptable.

There is an area at low risk from surface water flooding, which appears to follow a flow path although is not covered by Flood Zones 2 or 3. The potential for this source of flooding should be considered within the design of the development, although this risk would not render the site inappropriate for development or result in the site being considered sequentially unacceptable.

The site is also within an area considered to have a low susceptibility to groundwater flooding. Whilst development below the existing ground level should consider the potential for groundwater ingress, the overall risk from this source of flooding is considered relatively low.

E8 – Little Battleflat Farm, Beveridge Lane, Ellistown

This site is proposed for commercial development.

The site is located within Flood Zone 1 and therefore considered sequentially acceptable.

Two small isolated areas (one of which is at the location of a pond) and a relatively large isolated area are at risk from surface water flooding. These isolated areas are likely to represent depressions in the topography, where surface water may collect following storm events. The potential for this source of flooding should be considered within the design of the development, although this risk would not render the site inappropriate for development or result in the site being considered sequentially unacceptable.

The site is located within an area at low, medium and high susceptibility to groundwater flooding. The potential risk associated with this classification is not considered to impact on the Sequential test and a high susceptibility classification does not necessarily identify a high risk from this source. However this classification does highlight where further assessment in relation to groundwater is considered necessary to determine the implications for development design.

E9 – Land at Ryecroft Road, Hemington

This site is proposed for commercial development.

The site is fully located within Flood Zone 2 and 3a, and almost fully within Flood Zone 3b and therefore within the highest fluvial flood risk area. This indicates that the site is not sequentially acceptable. Further justification, such as development type, would be required if the site is to be taken forward for development. This justification needs to demonstrate that there are wider benefits that outweigh flood risk, and the development design would need to demonstrate no adverse impact on flood risk, both on site and elsewhere, as a result of the development.

Small isolated areas are identified to be at a low risk from surface water flooding. These isolated areas are likely to represent small depressions in the topography, where surface water may collect following storm events. The potential for this source of flooding should be considered within the design of the development, although this risk would not render the site inappropriate for development or result in the site being considered sequentially unacceptable.

The site is located within an area at high susceptibility to groundwater flooding. The potential risk associated with this classification is not considered to impact on the Sequential test and a high susceptibility classification does not necessarily identify a high risk from this source. However this classification does highlight where further assessment in relation to groundwater is considered necessary to determine the implications for development design.

E10 – Stephenson College, Thornborough Road, Coalville

This site is proposed for commercial development.

The site is located within Flood Zone 1 and therefore considered sequentially acceptable.

Small isolated areas are identified to be at risk from surface water flooding. These isolated areas are likely to represent small depressions in the topography, where surface water may collect following storm events. The potential for this source of flooding should be considered within the design of the development, although this risk would not render the site inappropriate for development or result in the site being considered sequentially unacceptable.

The site is also within an area considered to have a low susceptibility to groundwater flooding. Whilst development below the existing ground level should consider the potential for groundwater ingress, the overall risk from this source of flooding is considered relatively low.

E11 – TNT Presmises, Lount

This site is proposed for commercial development.

The site is located within Flood Zone 1 and therefore considered sequentially acceptable.

Small isolated areas are identified to be at risk from surface water flooding. These isolated areas are likely to represent small depressions in the topography, where surface water may collect following storm events. The potential for this source of flooding should be considered within the design of the development, although this risk would not render the site inappropriate for development or result in the site being considered sequentially unacceptable.

The site is also within an area considered to have a low susceptibility to groundwater flooding. Whilst development below the existing ground level should consider the potential for groundwater ingress, the overall risk from this source of flooding is considered relatively low

E12 – Land at Bardon Road, Coalville

This site is proposed for commercial development.

The site is located within Flood Zone 1 and therefore considered sequentially acceptable.

The northern boundary of the site is identified to be at a low and medium risk from surface water flooding. This risk is associated with a tributary of the River Sence, although this reach is not covered by Flood Zones 2 or 3. The potential for this source of flooding should be considered within the design of the development, although this risk would not render the site inappropriate for development or result in the site being considered sequentially unacceptable.

The site is also within an area considered to have a medium susceptibility to groundwater flooding. Whilst development below the existing ground level should consider the potential for groundwater ingress, the overall risk from this source of flooding is considered medium. However it may be prudent to undertake a groundwater assessment to inform the development design.

E13 – Land off Gracedieu Road, Whitwick

This site is proposed for commercial development.

The site is located within Flood Zone 1 and therefore considered sequentially acceptable.

The site is currently considered to be within an area at very low risk from surface water flooding.

The site is also within an area considered to have a low susceptibility to groundwater flooding. Whilst development below the existing ground level should consider the potential for groundwater ingress, the overall risk from this source of flooding is considered relatively low.

E14 – Land south of Sawley Marina, Tamworth Road, Long Eaton

This site is proposed for commercial development.

The site is fully located within Flood Zone 3, and almost fully within Flood Zone 3b and therefore within the highest fluvial flood risk area. This indicates that the site is not sequentially acceptable. Further justification, such as development type, would be required if the site is to be taken forward for development. This justification needs to demonstrate that there are wider benefits that outweigh flood risk, and the development design would need to demonstrate no adverse impact on flood risk, both on site and elsewhere, as a result of the development.

Small isolated areas are identified to be at a low risk from surface water flooding. These isolated areas are likely to represent small depressions in the topography, where surface water may collect following storm events. The potential for this source of flooding should be considered within the design of the development, although this risk would not render the site inappropriate for development or result in the site being considered sequentially unacceptable.

The site is located within an area at high susceptibility to groundwater flooding. The potential risk associated with this classification is not considered to impact on the Sequential Test and a high susceptibility classification does not necessarily identify a high risk from this source. However this classification does highlight where further assessment in relation to groundwater is considered necessary to determine the implications for development design.

E15 – Land rear of Enterprise House, Coalville

This site is proposed for commercial development.

The site is located within Flood Zone 1 and therefore considered sequentially acceptable.

Small isolated areas are identified to be at a low risk from surface water flooding. These isolated areas are likely to represent small depressions in the topography, where surface water may collect following storm events. The potential for this source of flooding should be considered within the design of the development, although this risk would not render the site inappropriate for development or result in the site being considered sequentially unacceptable.

The site is also within an area considered to have a medium susceptibility to groundwater flooding. Whilst development below the existing ground level should consider the potential for groundwater ingress, the overall risk from this source of flooding is considered medium. However it may be prudent to undertake a groundwater assessment to inform the development design.

E16 – TNT Premises, Lount

This site is proposed for commercial development.

The site is located within Flood Zone 1 and therefore considered sequentially acceptable.

The site is currently considered to be within an area at very low risk from surface water flooding.

The site is also within an area considered to have a low susceptibility to groundwater flooding. Whilst development below the existing ground level should consider the potential for groundwater ingress, the overall risk from this source of flooding is considered relatively low.

E17 – Money Hill Site, north of Ashby

This site is proposed for commercial development.

The site is located within Flood Zone 1 and therefore considered sequentially acceptable.

There are areas at risk from surface water flooding, which are predominately categorised as low risk, although there are also areas at high risk. These areas at low to high risk appear to follow various flow paths although are not covered by Flood Zones 2 or 3. The potential for this source of flooding should be considered within the design of the development, although this risk would not render the site inappropriate for development or result in the site being considered sequentially unacceptable.

The site is also within an area considered to have a low susceptibility to groundwater flooding. Whilst development below the existing ground level should consider the potential for groundwater ingress, the overall risk from this source of flooding is considered relatively low

E18 – Swains Park, Occupation Road, Albert Village

This site is proposed for commercial development.

The site is located within Flood Zone 1 and therefore considered sequentially acceptable.

There is a low risk from surface water flooding in the southern area of the site. This area at risk appears to follow a flow path to Hooborough Brook, although this flow path is not covered by Flood Zones 2 or 3. The potential for this source of flooding should be considered within the design of the development, although this risk would not render the site inappropriate for development or result in the site being considered sequentially unacceptable.

The site is also within an area considered to have a medium susceptibility to groundwater flooding. Whilst development below the existing ground level should consider the potential for groundwater ingress, the overall risk from this source of flooding is considered medium. However it may be prudent to undertake a groundwater assessment to inform the development design.

E19 – North of Derby Road, Kegworth

This site is proposed for commercial development.

The site is located within Flood Zone 1 and therefore considered sequentially acceptable.

There is a small area at low risk from surface water flooding along the eastern boundary of the site. This small isolated area is likely to represent small depressions in the topography, where surface water may collect following storm events. The potential for this source of flooding should be considered within the design of the development, although this risk would not render the site inappropriate for development or result in the site being considered sequentially unacceptable.

The site is located within an area at high susceptibility to groundwater flooding. The potential risk associated with this classification is not considered to impact on the Sequential Test and a high susceptibility classification does not necessarily identify a high risk from this source. However this classification does highlight where further assessment in relation to groundwater is considered necessary to determine the implications for development design.

A5 – Ashby de la Zouch

This site covers a similar area to E17

This site is proposed for residential development.

The site is located within Flood Zone 1 and therefore considered sequentially acceptable.

There are areas at risk from surface water flooding, which are predominately categorised as low risk, although there are also areas at high risk. These areas at low to high risk appear to follow various flow paths although are not covered by Flood Zones 2 or 3. The potential for this source of flooding should be considered within the design of the development, although this risk would not render the site inappropriate for development or result in the site being considered sequentially unacceptable.

The site is also within an area considered to have a low susceptibility to groundwater flooding. Whilst development below the existing ground level should consider the potential for groundwater ingress, the overall risk from this source of flooding is considered relatively low.

A7 – Ashby de la Zouch

This site is proposed for residential development.

The majority of the site is located within Flood Zone 1, with most of the rest of the site located within Flood Zone 2 and 3a associated with the Gilwiskaw Brook. Only a very small proportion of the site is located within

Flood Zone 3b. It is not considered that the site has passed the Sequential Test, as a proportion of the site is within an area at risk from fluvial flooding, although it is not considered appropriate to rule out the site for development at this stage. Alternatively it is considered necessary for a sequential approach to be applied within the site boundary, locating vulnerable development within Flood Zone 1. It would be necessary for the applicant to further assess fluvial flood risk in order to confirm the areas on site where development should be avoided.

There is an area at risk of surface water flooding in the eastern area of the site. This area at risk appears to follow the Gilwiskaw Brook and flow paths to this watercourse. The majority of this area at risk is also covered by Flood Zones 2 and 3 and therefore consideration of fluvial flood risk for the development is likely to incorporate surface water flood risk in this area.

The site is also within an area considered to have a low susceptibility to groundwater flooding. Whilst development below the existing ground level should consider the potential for groundwater ingress, the overall risk from this source of flooding is considered relatively low.

C18 – Coalville

This site is proposed for residential development.

The majority of the site is located within Flood Zone 1, with a small area in the eastern area of the site located within Flood Zone 2 and 3a (the site is not located within Flood Zone 3b). It is not considered that the site has passed the Sequential Test, as a proportion of the site is within an area at risk from fluvial flooding, although it is not considered appropriate to rule out the site for development at this stage. Alternatively it is considered necessary for a sequential approach to be applied within the site boundary, locating vulnerable development within Flood Zone 1. It would be necessary for the applicant to further assess fluvial flood risk in order to confirm the areas on site where development should be avoided.

Small isolated areas are identified to be at risk from surface water flooding. These isolated areas are likely to represent small depressions in the topography, where surface water may collect following storm events. The potential for this source of flooding should be considered within the design of the development, although this risk would not render the site inappropriate for development or result in the site being considered sequentially unacceptable.

The site is also within an area considered to have a low susceptibility to groundwater flooding, with approximately 5% of the site within a medium risk area. Whilst development below the existing ground level should consider the potential for groundwater ingress, the overall risk from this source of flooding is considered relatively low.

C19 – Coalville

This site is proposed for residential development.

The site is located within Flood Zone 1 and therefore considered sequentially acceptable.

There are areas at risk from surface water flooding, which are predominately categorised as low risk, although there are also areas at high risk. These areas at low to high risk appear to follow various flow paths although are not covered by Flood Zones 2 or 3. The potential for this source of flooding should be considered within the design of the development, although this risk would not render the site inappropriate for development or result in the site being considered sequentially unacceptable.

The site is located within an area at low, medium and high susceptibility to groundwater flooding. The potential risk associated with this classification is not considered to impact on the Sequential Test and a high susceptibility classification does not necessarily identify a high risk from this source. However this classification does highlight where further assessment in relation to groundwater is considered necessary to determine the implications for development design.

C23 – Coalville

This site is proposed for residential development.

The majority of the site is located within Flood Zone 1, although the River Sence and one of its tributaries flow through the centre of the site. Areas of Flood Zone 2 and 3a are attributed to these watercourses which

cover a relatively small proportion of the site. It is not considered that the site has passed the Sequential Test, as a proportion of the site is within an area at risk from fluvial flooding, although it is not considered appropriate to rule out the site for development at this stage. Alternatively it is considered necessary for a sequential approach to be applied within the site boundary, locating vulnerable development within Flood Zone 1. It would be necessary for the applicant to further assess fluvial flood risk in order to confirm the areas on site where development should be avoided.

This is a large site that is covered by areas at high, medium and low risk of surface water flooding. The surface water flood risk areas generally follow distinct flow paths that are associated with the River Sence and its tributaries. Some of these flow paths are also covered by Flood Zones 2 and 3.

Whilst the site does contain areas at risk from fluvial and surface water flooding, there are also relatively large areas within the site boundary that would be at a low risk. Therefore the design of the site, and specifically the site layout, must take into consideration these risk areas. Therefore a sequential approach should be considered for the site layout, and this must be clearly demonstrated within the site specific FRA that would be required for the proposed development.

The site is located within an area at low, medium and high susceptibility to groundwater flooding. The potential risk associated with this classification is not considered to impact on the Sequential Test and a high susceptibility classification does not necessarily identify a high risk from this source. However this classification does highlight where further assessment in relation to groundwater is considered necessary to determine the implications for development design.

C46 – Coalville

This site is proposed for residential development.

The site is located within Flood Zone 1 and therefore considered sequentially acceptable.

There are areas at risk from surface water flooding, which are predominately categorised as low risk, although there are also areas at high risk. These areas at low to high risk appear to follow various flow paths although are not covered by Flood Zones 2 or 3. The potential for this source of flooding should be considered within the design of the development, although this risk would not render the site inappropriate for development or result in the site being considered sequentially unacceptable.

The site is located within an area at low, medium and high susceptibility to groundwater flooding. The potential risk associated with this classification is not considered to impact on the Sequential Test and a high susceptibility classification does not necessarily identify a high risk from this source. However this classification does highlight where further assessment in relation to groundwater is considered necessary to determine the implications for development design.

C48 – Coalville

This site is proposed for residential development.

The site is located within Flood Zone 1 and therefore considered sequentially acceptable.

Small isolated areas are identified to be at risk from surface water flooding. These isolated areas are likely to represent small depressions in the topography, where surface water may collect following storm events. The potential for this source of flooding should be considered within the design of the development, although this risk would not render the site inappropriate for development or result in the site being considered sequentially unacceptable.

The site is also within an area considered to have a low susceptibility to groundwater flooding. Whilst development below the existing ground level should consider the potential for groundwater ingress, the overall risk from this source of flooding is considered relatively low.

IB7 – Ibstock

This site is proposed for residential development.

The site is located within Flood Zone 1 and therefore considered sequentially acceptable.

The site is currently considered to be within an area at very low risk from surface water flooding.

The site is also within an area considered to have a low susceptibility to groundwater flooding. Whilst development below the existing ground level should consider the potential for groundwater ingress, the overall risk from this source of flooding is considered relatively low.

IB18 – Ibstock

This site is proposed for residential development.

The site is located within Flood Zone 1 and therefore considered sequentially acceptable.

There are areas at risk from surface water flooding, which are predominately categorised as low risk, although there are also areas at high risk. These areas at low to high risk appear to follow a distinct flow path before discharging to the River Sence although are not covered by Flood Zones 2 or 3. The potential for this source of flooding should be considered within the design of the development, although this risk would not render the site inappropriate for development or result in the site being considered sequentially unacceptable.

The site is also within an area considered to have a low susceptibility to groundwater flooding. Whilst development below the existing ground level should consider the potential for groundwater ingress, the overall risk from this source of flooding is considered relatively low.

K5 – Kegworth

This site is proposed for residential development.

The majority of the site is located within Flood Zones 2 or 3a, with a small proportion of the site located within Flood Zone 3b. Therefore the site is within an area at high risk from fluvial flooding and not sequentially acceptable. Further justification would be required if the site is to be taken forward for development. This justification needs to demonstrate that there are wider benefits that outweigh flood risk, and the development design would need to demonstrate no adverse impact on flood risk, both on site and elsewhere, as a result of the development.

There is an area at low and medium risk of surface water flooding along the western boundary of the site. These areas at risk appear to follow a flow path before discharging into the River Soar. This area at low to medium risk is also covered by Flood Zones 2 and 3 and therefore consideration of fluvial flood risk for the development is likely to incorporate surface water flood risk in this area. There is also a small area at low risk from surface water flooding located in the eastern area of the site. This is an isolated area likely to represent a small depression in the topography, where surface water may collect following storm events.

The potential for surface water flooding should be considered within the design of the development, although this risk would not render the site inappropriate for development or result in the site being considered sequentially unacceptable.

The site is located within an area at high susceptibility to groundwater flooding. The potential risk associated with this classification is not considered to impact on the Sequential Test and a high susceptibility classification does not necessarily identify a high risk from this source. However this classification does highlight where further assessment in relation to groundwater is considered necessary to determine the implications for development design.

K10 – Kegworth

This site is proposed for residential development.

Approximately half the site is located within Flood Zone 1, with the majority of the rest of the site located within Flood Zone 2. Only a very small proportion of the site is located within Flood Zone 3a and 3b. It is not considered that the site has passed the Sequential Test, as a proportion of the site is within an area at risk from fluvial flooding, although it is not considered appropriate to rule out the site for development at this stage. Alternatively it is considered necessary for a sequential approach to be applied within the site boundary, locating vulnerable development within Flood Zone 1. It would be necessary for the applicant to further assess fluvial flood risk in order to confirm the areas on site where development should be avoided.

Small isolated areas are identified to be at risk from surface water flooding. These isolated areas are likely to represent small depressions in the topography, where surface water may collect following storm events. The potential for this source of flooding should be considered within the design of the development, although this risk would not render the site inappropriate for development or result in the site being considered sequentially unacceptable.

The site is located within an area at high susceptibility to groundwater flooding. The potential risk associated with this classification is not considered to impact on the Sequential Test and a high susceptibility classification does not necessarily identify a high risk from this source. However this classification does highlight where further assessment in relation to groundwater is considered necessary to determine the implications for development design.

K11 – Kegworth

This site is proposed for residential development.

The site is located within Flood Zone 1 and therefore considered sequentially acceptable.

Two small isolated areas are identified to be at a risk from surface water flooding along the north eastern boundary of the site. These isolated areas are likely to represent small depressions in the topography, where surface water may collect following storm events. The potential for this source of flooding should be considered within the design of the development, although this risk would not render the site inappropriate for development or result in the site being considered sequentially unacceptable.

The site is located within an area at high susceptibility to groundwater flooding. The potential risk associated with this classification is not considered to impact on the Sequential Test and a high susceptibility classification does not necessarily identify a high risk from this source. However this classification does highlight where further assessment in relation to groundwater is considered necessary to determine the implications for development design.

M6 – Measham

This site is proposed for residential development.

The site is located within Flood Zone 1 and therefore considered sequentially acceptable.

Small isolated areas are identified to be at risk from surface water flooding. These isolated areas are likely to represent small depressions in the topography, where surface water may collect following storm events. The potential for this source of flooding should be considered within the design of the development, although this risk would not render the site inappropriate for development or result in the site being considered sequentially unacceptable.

The site is also within areas considered to have a low and medium susceptibility to groundwater flooding. Whilst development below the existing ground level should consider the potential for groundwater ingress, the overall risk from this source of flooding is considered medium. However it may be prudent to undertake a groundwater assessment to inform the development design.

M11 – Measham

This site is proposed for residential development.

The site is located within Flood Zone 1 and therefore considered sequentially acceptable.

Although there are small isolated areas at low risk of surface water flooding, the vast majority of the site is currently considered to be within an area at very low risk from surface water flooding.

The site is also within an area considered to have a low susceptibility to groundwater flooding. Whilst development below the existing ground level should consider the potential for groundwater ingress, the overall risk from this source of flooding is considered relatively low

M12 – Measham

This site is proposed for residential development.

The site is located within Flood Zone 1 and therefore considered sequentially acceptable.

There is a small isolated area identified to be at risk from surface water flooding. This isolated area is likely to represent a depression in the topography, where surface water may collect following storm events. The potential for this source of flooding should be considered within the design of the development, although this risk would not render the site inappropriate for development or result in the site being considered sequentially unacceptable.

The site is also within an area considered to have a low susceptibility to groundwater flooding. Whilst development below the existing ground level should consider the potential for groundwater ingress, the overall risk from this source of flooding is considered relatively low.

Table 5-1 Results of the Sequential Test

Site type	Site reference	% site coverage in Flood Zone 2	% site coverage in Flood Zone 3a	% site coverage in Flood Zone 3b	% site coverage in uFMfSW 1 in 30	% site coverage in uFMfSW 1 in 100	% site coverage in uFMfSW 1 in 1000	% site coverage at low risk from groundwater flooding*	% site coverage at medium risk from groundwater flooding*	% site coverage at high risk from groundwater flooding*	Past flooding on site	Result of Sequential Test**
Commercial	E1	0	0	0	0	1	1	100	0	0	-	
Commercial	E2	100	100	22	<1%	1	5	0	0	100	Fluvial flooding including in 1947 and 2012.	
Commercial	E10	0	0	0	<1%	1	2	100	0	0	A surface water flooding event occurred in close proximity to the site between 1996-2006	
Commercial	E11	0	0	0	1	1	3	100	0	0	-	
Commercial	E12	0	0	0	0	1	6	0	100	0	Surface water flooding June 2012.	
Commercial	E13	0	0	0	0	0	0	100	0	0	-	
Commercial	E14	100	100	95	0	0	4	0	0	100	Fluvial flooding including during 1932, 1947, 1977, 200 and 2012.	
Commercial	E15	0	0	0	6	10	26	0	100	0	A foul water flooding event occurred in close proximity to the site between 1996-2006	
Commercial	E16	0	0	0	0	0	0	100	0	0	-	
Commercial	E17	0	0	0	1	2	6	100	0	0	-	
Commercial	E18	0	0	0	0	0	2	0	100	0	-	
Commercial	E19	0	0	0	0	0	2	0	0	100	-	
Commercial	E3	0	0	0	0	0	20	0	100	0	-	
Commercial	E4	0	0	0	1	2	9	96	4	0	-	

Site type	Site reference	% site coverage in Flood Zone 2	% site coverage in Flood Zone 3a	% site coverage in Flood Zone 3b	% site coverage in uFMfSW 1 in 30	% site coverage in uFMfSW 1 in 100	% site coverage in uFMfSW 1 in 1000	% site coverage at low risk from groundwater flooding*	% site coverage at medium risk from groundwater flooding*	% site coverage at high risk from groundwater flooding*	Past flooding on site	Result of Sequential Test**
Commercial	E5	0	0	0	1	2	7	75	25	0	-	
Commercial	E6a	0	0	0	2	4	9	100	0	0	-	
Commercial	E6b	0	0	0	0	0	17	100	0	0	-	
Commercial	E8	0	0	0	4	5	11	4	74	22	-	
Commercial	E9	100	100	97	0	0	3	0	0	100	Fluvial flooding including in 1932 and 1947.	
Residential	A5	0	0	0	2	2	7	100	0	0	-	
Residential	A7	11	7	5	2	4	13	100	0	0	Foul water flooding has occurred in close proximity to the site between 1996-2006	
Residential	C48	0	0	0	3	3	6	100	0	0	A surface water flooding event occurred in close proximity to the site between 1996-2006	
Residential	C18	3	3	0	1	1	3	95	5	0	A surface water flooding event occurred in close proximity to the site between 1996-2006	
Residential	C19	0	0	0	2	3	9	1	53	46	-	
Residential	C46	0	0	0	2	4	12	0	10	90	-	

Site type	Site reference	% site coverage in Flood Zone 2	% site coverage in Flood Zone 3a	% site coverage in Flood Zone 3b	% site coverage in uFMfSW 1 in 30	% site coverage in uFMfSW 1 in 100	% site coverage in uFMfSW 1 in 1000	% site coverage at low risk from groundwater flooding*	% site coverage at medium risk from groundwater flooding*	% site coverage at high risk from groundwater flooding*	Past flooding on site	Result of Sequential Test**
Residential	C23	5	5	0	4	6	14	3	77	20	Surface water flooding June 2012 in close proximity to the site. Foul water and surface water flooding has occurred in close proximity to the site between 1996-2006	
Residential	IB7	0	0	0	0	0	0	100	0	0	-	
Residential	IB18	0	0	0	0	3	11	100	0	0	-	
Residential	K11	0	0	0	1	2	4	1	0	99	-	
Residential	K10	48	8	0	0	3	16	0	0	100	-	
Residential	K5	77	41	10	0	2	11	0	0	100	Eastern area of the site flooded in 1977.	
Residential	M11	0	0	0	0	0	1	100	0	0	A flood incident recorded in close proximity to the site although the source and date is unknown.	
Residential	M12	0	0	0	2	2	8	100	0	0	A flood incident recorded although the source and date is unknown.	
Residential	M6	0	0	0	1	2	10	67	33	0	A surface water flooding event occurred in close proximity to the site between 1996-2006	

*Low groundwater risk is <25% of a 1km grid square at risk, medium groundwater risk is 25-75% of a 1km grid square at risk and a high groundwater risk is >75% of a 1km grid square at risk.
**Colour coding as outlined within the bulleted list at the start of section 5.4.

5.5. Windfall sites

Not all proposed development will fall within areas allocated for development within the forthcoming Local Plan and therefore a Sequential Test should also be applied to windfall sites. To assist the LPA development control team a flow chart identifying how the Sequential Test should be applied to windfall sites has been created for this SFRA and is included in Appendix C. Developers should supply sufficient information to the LPA to be able to apply the process outlined within Appendix C. It is recommended that this flow chart is a 'live' document and is updated and evolves as feedback is received from development control officers and flood risk management policy changes such as the potential for Critical Drainage Areas to be established.

Although the proposal for a change of use to development is not subject to the Sequential Test it will still require a passed Exception Test if located in areas at risk from flooding. The Exception Test would be required to demonstrate that the development is at an acceptable risk of flooding, would not increase flood risk elsewhere, and/or wider development requirement outweigh flood risk. It is therefore recommended that the flow chart provided in Appendix C is also utilised for change of use development proposals.

6. Sustainable flood risk management

6.1. Overview

Flood and coastal erosion risk management is clearly embedded across a range of Government policies, including planning, urban and rural development, agriculture, transport, nature conservation and conservation of the historic environment.

Recent flood events have showed the devastating impact that flooding can have on lives, homes and businesses. A considerable number of people live and work in areas susceptible to flooding, and the ideal scenario would be to relocate this development into areas not susceptible to flooding. However, it is recognised that this is not a practicable solution so measures should be put in place to minimise the risk to property and life posed by flooding. The NPPF requires flood risk mitigation measures to ensure that that new development is safe throughout the lifetime of any development.

In 2010 the Flood and Water Management Act was enacted, which implements the recommendations of the Pitt review, to promote a more consistent and co-ordinated approach to flood risk management.

The Environment Agency adopts a tiered approach to flood management with the large-scale plans, such as CFMPs at the highest level. CFMPs will deliver a broad-brush assessment of the risks, opportunities and constraints, including areas of uncertainty, associated with flood management policy. Following on from CFMPs, are the strategic studies, such as SFRAs. Strategic studies would normally be prepared for an entire river within the catchment. They would take forward the preferred policies identified from the CFMP and apply these for part of the catchment. The preferred approach is, therefore, to prepare a CFMP in advance of a strategy. However, the need to assess the current flood risk within the Trent Valley meant that this strategy commenced ahead of the CFMP.

This section outlines which organisations are responsible for flood risk management, the current strategic approach to flood risk management within North West Leicestershire and the currently proposed mitigation measures.

6.2. Responsibility for flood risk management

An overview of the key responsibilities with respect to the management of flood risk is provided below.

6.2.1. Local Authority

The Local Planning Authority, which is part of the Local Authority, is responsible for carrying out a SFRA to inform the allocation of land for future development, development control policies and sustainability appraisal. Local Planning Authorities have a responsibility to consult with the appropriate statutory consultees when making planning decisions. The specific consultees will vary based on development type

and have changed following April 2015, as outlined within the statutory consultee consultation document (Department for Communities and Local Government, 2014) and as summarised within sections 6.2.2 and 6.2.3 . The results of the consultation process are not available within the timescales of this SFRA.

The Local Planning Authority has the responsibility to work with LLFAs, where appropriate to ensure that proposals for flood risk management in their area would effectively manage flood risks.

Local Authorities have certain permissive powers to undertake flood defence works under the Land Drainage Act 1991 on watercourses which have not been designated as Main Rivers and which are not within Internal Drainage Board areas. Local Authorities can control the culverting of watercourses under S263 of the Public Health Act 1936.

The Local Planning Authority have a responsibility for setting the maintenance regime for SuDS systems and to ensure long term maintenance in perpetuity. The LPA also provides promotion of SuDS within proposed developments where suitable and should consult with the LLFA in relation to major development that incorporate SuDS.

6.2.2. Lead Local Flood Authorities

The LLFA covering North West Leicestershire is Leicestershire County Council.

LLFAs are responsible for managing flood risk from surface water, groundwater and ordinary watercourses through developing, maintaining and applying a strategy for local flood risk management in their area.

The changes to statutory consultees have seen the LLFA become a statutory consultee on major developments that incorporate SuDS from April 2015. The LLFA has also become a statutory consultee for potential development sites that are subject to potential groundwater flooding, those in close proximity to ordinary watercourses and those where there are other known local flood risk issues.

The LLFA is also responsible for maintaining a register of flood risk assets in their area and undertaking flood investigations that fall within their locally defined criteria under Section 19 of the Flood and Water Management Act 2010.

6.2.3. Environment Agency

The Environment Agency has a statutory responsibility for flood management and flood defence in England. The Environment Agency supports the planning system through the provision of information and flood risk advice. At a strategic level, it provides the LLFA and the Local Planning Authority with advice on the preparation of SFRAs.

The Environment Agency is consulted by Local Planning Authorities on certain applications for development in flood risk areas and contributed to their consideration by providing advice. There is guidance for LPAs as to when to consult the Environment Agency at https://www.gov.uk/flood-risk-assessment-local-planning-authorities.

Under the Water Resources Act 1991, the Environment Agency has permissive powers for the management of flood risk arising from designated Main Rivers and the sea. The Environment Agency is also responsible for flood forecasting and flood warning dissemination, and for exercising a general supervision over matters relating to flood defence.

For planning purposes, the North West Leicestershire district falls within the Environment Agency area of Derbyshire, Nottinghamshire and Leicestershire, which is based at the Trentside offices located within Nottingham.

6.2.4. The Canal and River Trust

The Canal and River Trust is responsible for maintaining critical infrastructure on the River Soar and ensuring structures such as locks operate during flood events. The Canal and River Trust is also responsible for the Ashby Canal.

6.2.5. Water companies

Severn Trent Water is the sewerage undertaker for North West Leicestershire and is generally responsible for surface water drainage from development where this is through adopted sewers. Severn Trent Water is responsible for ensuring the maintenance of drainage infrastructure through removal of blockages and undertaking improvement works to ensure flooding does not result from capacity problems. This includes ensuring that their systems incorporate an appropriate level of resilience to flooding and that they are able to maintain essential services during emergencies.

Water companies also have a responsibility to work with the LLFA to identify how their systems integrate with other local sources of flood risk, and to work with the LLFA, developers and landowners to understand the risk and manage the volume and rates of surface water entering the surface water sewer.

In areas that have suffered frequent or severe sewer flooding, the water companies have a responsibility to address these risks through their capital investment plans that are regulated by Ofwat.

6.2.6. Landowners and Developers

Landowners have the primary responsibility for safeguarding their land and other property against flooding. Riparian owners have the responsibility of maintenance of any watercourse which are within and/or bounds their property. Individual property owners and users are also responsible for managing the drainage of their land so that they do not adversely impact neighbouring land. Those proposing development are responsible for providing a site specific FRA for submission with the planning application if the development is at risk from fluvial flooding or covers a site greater than 1 hectare.

6.3. Strategic flood risk management

Development along river corridors during the industrial age has resulted in large urban areas at risk of flooding. Historically, the management of flood risk was undertaken in a somewhat reactive manner, addressing problems on an ‘as needed’ basis in response to a flooding event through the construction of flood defence walls or embankments. It was recognised by Government that this approach was generally not a particularly cost effective solution and often failed to consider individual problem areas within the ‘bigger picture’ of the wider river system. The Environment Agency is now moving towards a more sustainable management of flood risk by steering away from the construction of raised defences and favouring solutions which work with natural processes.

The Environment Agency also endeavours to take a strategic approach to managing flood risk by considering flood risk on a catchment wide basis. Within the context of effective flood risk management therefore, the importance of influencing both the strategic planning process and development control as an outcome of these strategies is widely recognised as a key Environment Agency objective. For this reason, it is vital that the recommendations of the SFRA are consistent with the long term strategy(s) for flood risk management within the district (catchment).

A number of flood risk management strategies have been undertaken of the River Trent catchment encompassing North West Leicestershire District.

6.3.1. Catchment flood management plan

The Environment Agency have published CFMPs for England and Wales from 2009 to 2011 and are plans that enable flood risk management measures to be planned on a long term basis across a catchment.

In December 2010 the Environment Agency formally approved the River Trent CFMP, which provides an overview of flood risk within the River Trent catchment and identifies the preferred plan for sustainable flood risk management for now and over the next 50 to 100 years.

The plan was informed by a steering group of the Environment Agency and third parties such as local planning authorities, the community and environmental groups.

The River Trent CFMP summary report (Environment Agency, 2010) splits the River Trent catchment into eight policy areas. The vast majority of the North West Leicestershire District falls within the Rural Leicestershire sub area, with small areas along the eastern boundary within the Upper Soar and Upper Anker sub area.

The CFMP outlines that in general the flood risk in this area is low and will not significantly increase in the future. Flooding is outlined to "*generally impact farmland and isolated properties*". The CFMP preferred flood risk management policy for this area is Option 6 "*areas of low to moderate flood risk where we will take action with others to store water or manage runoff in locations that provide overall flood risk reduction or environmental benefits*". The long term vision for this sub area is "*to set a framework to deliver a sustainable approach to flood risk management that considers the natural function of the river and reduces long term dependence on raised flood defences*".

The CFMP outlines that the Upper Soar and Upper Anker sub area suffers from flooding associated with lack of capacity within watercourse due to reduced infiltration rates and rapid runoff, and from surface water flooding within developed areas. The CFMP outlines that there is a medium risk of flooding within this sub area, although some areas (outside the study area of this SFRA) are at a high risk. The CFMP preferred flood risk management policy for this area is option 4 "*areas of low, moderate and high flood risk where we are already managing the flood risk effectively, but where we may need to take further actions to keep pace with climate change*".

The policies outlined within the CFMP should be considered when planning development at the allocated and windfall sites.

6.3.2. Fluvial Trent Strategy

The principal aim of the Fluvial Trent Strategy (Environment Agency, 2005) was to identify the preferred approach and potential solutions to sustainably manage flood risk along the River Trent corridor over the next 50 years (as of 2005).

A number of potential options have been considered including channel improvements, flood storage, removal of floodplain obstructions, flow diversion, raised defences, land management and control structures, e.g. sluices and weirs. None of the preferred options taken forward were within the North West Leicestershire District; however, measures upstream may reduce the level of flood risk within the district.

National funding for flood defence is limited and the case for securing funding for flood alleviation schemes dependant on many factors. Therefore, it is essential that planning decisions are made on the basis of the current (unmitigated) flooding regime, which assumes flood defences are not in place.

6.4. Planning and development control

The NPPF creates a policy framework for North West Leicestershire District Council, Leicestershire County Council and the Environment Agency to contribute to a more sustainable approach to managing flood risk through the planning process. Opportunities for sustainable flood risk management that exist within the planning and development control process include:

- Considering flood risk at the early stages of the spatial planning process
- Ensuring planning decisions consider the implications of climate change
- Providing greater clarity to developers regarding which sites are suitable for developments of different types
- Developing local authority, developer and community-led initiatives for reducing flood risk and providing enhancement to the environment
- Ensuring direct and cumulative impacts of development on flood risk are considered and mitigated appropriately
- Considering flood risk and development on a catchment wide basis
- Developing integrated and sustainable developments which can deliver multiple benefits

In addition, certain conditions are imposed on planning applications which contribute to sustainable flood risk management, for example limiting surface water runoff from the site to greenfield runoff rates.

6.5. Development control

North West Leicestershire District Council have staff dedicated to the control of development within North West Leicestershire.

The Town and Country Planning System is designed to regulate the development and use of land in the public interest. It is the means by which the environment can be enhanced and protected whilst enabling development to take place which is necessary for economic and social well-being. North West Leicestershire District Council's Development Control seeks to ensure the aims of the Town and Country Planning Act are achieved through the submission and determination of applications for planning permission for development.

The North West Leicestershire Local Plan will, once adopted, set out the vision, strategic objectives and spatial strategy for future developments within North West Leicestershire. Development Control Policies are a suite of criteria-based policies which are required to ensure that all development within the areas meets the spatial vision and spatial objectives set out in the Local Plan. These Development Control Policies include policies for development within floodplains and will be incorporated into the Local Plan.

The Environment Agency has a role in advising the Town and Country planning process and will object to inappropriate development within areas at risk of flooding as identified within the Flood Zone mapping. If planners are minded to go against Environment Agency advice and approve proposed development, they are required to refer the proposal to the Secretary of State[3]. This only applies to 'major developments' which are defined as a development where the number of dwellings to be constructed is 10 or more and/or the site area is greater than 0.5 hectares. For all other uses, a major development is one where the floor space to be built is 1,000 square metres or more, or where the site area is 1 hectare or more.

The Environment Agency has direct control over activities that may affect main river watercourses and the floodplain. According to the Water Resources Act 1991 and local byelaws, anyone wishing to carry out work in, over, under or within 8 metres from the top of bank of a main river needs consent from the Environment Agency.

Under the Land Drainage Act 1991 any proposal to construct works within any other watercourse also need Environment Agency consent if they relate to culverting or structures that resemble a mill, dam, weir or other like obstruction. However in 2012 this responsibility transferred to the LLFA (i.e. Leicestershire County Council for the study area) under the Flood and Water Management Act 2010.

The Environment Agency's Partnerships and Strategic Overview teams support the planning system through the provision of advice and information on fluvial flood risk to planning authorities and developers to enable full compliance with the NPPF. In April 2015 the Environment Agency's role in relation to comment on planning applications changed such that the Environment Agency will remain the statutory consultee for developments:

- *"In an area with flood zone 2 or flood zone 3;*
- *In an area within flood zone 1 identified as having critical drainage problems; and*
- *In the bed of, or within 20 metres of the top bank of, a main river which has been notified to the local planning authority by the Environment Agency".*

The Environment Agency will no longer be consulted on certain proposed developments including those that are over one hectare in size (without any other qualifying criteria as listed above) or development involving the culverting or control of flow of any river or stream (without any other quantifying criteria as listed above).

This change has led to the flood risk support in relation to surface water management being required from elsewhere. The LLFA is now a statutory consultee on planning application associated with major development with surface water flood risk. The LLFA may also be required to comment on development with groundwater management implications, those in proximity to ordinary watercourses and those with any other local flood risk issues, depending on the size of the proposed development.

[3] Town and Country Planning (Flooding) England Direction, 2007.

6.6. Mitigation measures

6.6.1. Overview

In the first instance, the primary aim of Strategic Flood Risk Management is to avoid new development in areas of flood risk. The mapping outputs of this SFRA will help North West Leicestershire District Council achieve this aim when planning for the future of new development within their authority.

The sequential approach should be applied within development sites to locate the most vulnerable elements of a development in the lowest risk areas. However, avoidance of flood risk areas may not always be achievable or a policy of avoidance may prevent the economic and social regeneration of existing developments. In such instances, to meet the wider aims of sustainable development, it may be necessary to locate some development in areas at risk of flooding. In these circumstances careful consideration needs to be given to incorporating appropriate mitigation measures for managing and reducing the risk of flooding to the development. Approval of developments which include such measures should only be accepted providing the development passes the Sequential and Exception Tests (when required depending on development type) and is consistent with the sustainability policies of North West Leicestershire District Council.

6.6.2. Objectives of flood risk mitigation

As outlined within the 2008 SFRA, the general objectives of flood risk mitigation measures are to:

- Reduce the probability of flooding to a development and consequently reduce the associated hazard to people occupying the development.
- Minimise the impact and damage that flood water may cause to a development and thus enable a faster recovery following a flood event.
- Ensure no adverse impacts resulting in increased flood risk to neighbouring sites.
- Wherever possible seek to provide an overall benefit in reducing flood risk for neighbouring sites.
- Be adaptable to future climate change scenarios.

6.6.3. Sources of Information on Flood Risk Mitigation

There are several sources of information on potential mitigation measures, as follows:

- Flood Risk Assessment Guidance for New Development, Environment Agency R&D (FD2320).
- Development and Flood Risk – Guidance for the Construction Industry, CIRIA 624.
- Flood resilient and resistant construction – guidance for new build, Department for Communities and Local Government (2007).
- Preparing for Floods, ODPM, 2003.
- The SuDS Manual, CIRIA (C697).
- Code of Practice for Surface water management for development sites (BS8582:2013).
- The SuDS National Standards (anticipated to be published later in 2015).

6.6.4. Mitigation Measure Options

The Environment Agency R&D Guidance on Flood Risk Assessments for new development suggests that mitigation measures can be split into three types:

- Measures that reduce the physical hazard, e.g. through raised defences or flood storage.
- Measures that reduce the exposure to the hazard, e.g. raise properties above flood levels.
- Measures that reduce the vulnerability to the hazard, e.g. flood warning or emergency planning.

Consideration of mitigation measures can take place at a number of stages of the development process, these include:

- The Master Planning Stage.
- The Outline Design Stage.
- The Detailed and Internal Design Stage.
- Retrofitting after the development is already in place.

The selection of appropriate mitigation measures depends on the requirements of the development and its sensitivity to flooding. Any mitigation measure selected should be sustainable in the future by taking into consideration the impact of climate change on flood risk. The residual risk of developing an area vulnerable to flooding with mitigation measures in place should also be considered.

Table 6-1summarises the types of mitigation measures, their limitations and the stage of the development process when they should be considered. If the whole of the development site cannot be located away from areas of flood risk, a sequential approach within the site boundary should always be considered as the first mitigation measure. Only if a sequential approach for the site layout cannot fully mitigate the risk of flooding, should the remaining mitigation measures be considered. SuDS however, should always be considered for every new development site.

It is important to note that mitigation measures are only effective up to the magnitude of the flood event for which they are designed. If the design flood event is exceeded, then mitigation measures may not be effective and the mitigation measures must not increase flood risk during events that exceed the design event. Exceedance of the design flood is an important consideration when employing mitigation measures for new development sites. Therefore, in some instances a combination of mitigation measures may need to be considered for a site. For example, flood resilience options should normally be included for all developments where significant mitigation measures have been included. This will provide the added benefit of ensuring a building can be quickly returned to use after an extreme flood event.

Table 6-1 Summary of mitigation measures

The information has been taken from the Planning Policy Statement 25 Practice Guide (and from the 2008 SFRA). Although this planning policy has been revoked following publication the NPPF, the mitigation measures outlined within this table remain suitable.

Mitigation option	Description	Examples	Development stage	Limitations
Site Zoning / Layout	The sequential approach can be applied within development site boundaries to locate the most vulnerable elements of the development in the areas of lowest risk.	Locating flood-compatible development, such as areas of open space and car parking in areas at higher risk and reserving lower risk areas for more vulnerable land use types such as housing.	Master Planning Stage	The spatial planning of developments sites may not always be achievable in line with a sequential approach for urban brownfield sites where the location of existing development and access routes can prevent zoning of development land use in line with flood risk probability.
Modification of Ground Levels	The probability of flooding can be mitigated through the modification of ground levels to raise developments above the flood level or at least reduce the depth of predicted flood water.	Land raising parts of a development site using material, either from other parts of the site or imported to the site from other locations.	Master Planning and Outline Design Stage	Raising ground levels may not be viable if existing buildings or access routes at ground level need to be maintained. Care is needed to avoid the formation of islands which would become isolated in flood conditions and to ensure there is safe access. Land raising must be accompanied by level-for-level compensatory provision of flood storage either on- or off-site. This option can prove costly if large volumes of material need to be moved or if fill material needs to be imported to the site from other locations.
Flood Walls & Embankments	Construction of engineered defences to prevent flood water entering a development site	Sheet pile walls, earth embankments, sea walls with wave return, revetments.	Master Planning and Outline Design Stage	New defences for developments should only be considered if fully funded and maintained by the developer and if the residual risk behind the development is appropriate to the land use proposed. Compensatory flood storage should be provided if new flood defences have been provided to allow development. Flood defence mitigation options can be costly and will require ongoing investment for maintenance. Developers proposing defences should also ensure that the defences can adapt to future climate change scenarios to maintain the minimum standard of protection required by PPS25 for the life time of the development. New defences must not increase flood risk to offsite third parties, and must be clearly demonstrated.

Mitigation option	Description	Examples	Development stage	Limitations
Flood Storage	The provision of upstream flood storage, either on or off the line of a river or watercourse, may be an effective measure to manage water levels at and downstream of a development site.	Flood storage reservoirs, controlled washlands, flood storage wetlands. Such options can also provide ecological and habitat benefits.	Master Planning and Outline Design Stage	Such options can involve significant land take which will need to be secured by the developer. If operational controls are required for such options consideration needs to be given to how this will be managed over the lifetime of the development. The longer term maintenance of the flood storage options will also need to be addressed from both a funding and operational perspective.
Building Design	Buildings can be designed such that the ground floor comprises flood compatible uses which are resilient to flood water and the associated damage caused. Residential and other people intensive uses are then located on the first floor upwards. Single-storey residential development and basements should not be considered in flood risk areas as such developments are generally more vulnerable to flood damage and occupants do not have the opportunity to retreat to higher floor levels.	Water compatible uses for the ground floor can include open plan public spaces, car parking and or utility areas. Provision of private garages or other enclosed private spaces should be avoided due to possible vehicle damage, pollution from stored material and a reduction in flow conveyance.	Detailed Design Stage	Where developments incorporate open space beneath the occupied level, measures such as legal agreements need to be in place to prevent inappropriate use or alteration of the ground floor that would impede flood conveyance or reduce flood storage. Safe access to higher ground, above the flood level, should be made available for people to evacuate all buildings where the habitable level is raised above the flood level. In areas of high flood flow velocity buildings should be structurally designed to withstand the expected water pressures, potential debris impacts and erosion which may occur during a flood event.
Temporary, Demountable or Operational Defences	Flood defences which require human intervention to ensure successful operation during a flood event.	Flood barriers and gates	Detailed Design Stage	These measures are unlikely to be suitable as the only mitigation measure as it is not usually appropriate to design a new development to rely on demountable or temporary flood defences to manage flood risk, unless such measures are proposed solely to manage residual flood risk to individual properties. For water-compatible and less vulnerable land uses, such measures may be appropriate where temporary disruption is acceptable and appropriate flood warning to activate the defences is provided.

Mitigation option	Description	Examples	Development stage	Limitations
Flood Resilience	External and internal building design, fixtures and fittings which ensure that the building can be quickly returned to use after a flood.	Raising electrical sockets above the predicted flood level. Wet proofing wall and floor furnishings using materials such as tiles and paint.	Detailed and Internal Design Stage	Such measures are unlikely to be suitable as the only mitigation measure to manage flood risk, but they may be suitable where: • disruption to water-compatible and less vulnerable uses is acceptable and appropriate flood warning is provided. • there are instances where the use of an existing building is to be changed and it can be demonstrated that no other measure is practicable.
SuDS	A sequence of management practices and control structures, designed to drain water in a more sustainable manner than some conventional techniques. Typically these are used to attenuate run-off from development sites.	There are a number of engineered and landscape vegetated types of SuDS options.	Outline and Detailed Design Stage	Issues which require early consideration when proposing SuDS include: • Land Take: is there sufficient land available for the options proposed? • Adoption and Maintenance: Who will fund, own and maintain the systems once installed, for the operational lifetime? This issue can often be secured through a planning condition for simple schemes or through a Section 106 agreement.

*the information has been taken from the Planning Policy Statement 25 Practice Guide. Although this planning policy has been revoked following publication the NPPF, the mitigation measures outlined within this table remain suitable.

6.6.5. Emergency planning

Planning for emergencies will promote an effective response to situations that threaten human welfare, the environment or the security of a community.

The Leicester, Leicestershire and Rutland Local Resilience Forum is responsible for developing emergency plans and does so in close liaison with its partner agencies.

A community risk register (Leicester, Leicestershire and Rutland Local Resilience Forum, 2014) has been compiled by members of the Local Resilience Forum to identify the hazards, risks and threats which may be present. Its aim is to deliver a risk awareness framework which will improve the ability to prevent and plan for emergencies. The current version of the Community Risk Register (2014) outlines the top 10 priorities for risk, those of relevance to this SFRA are:

- **Local/urban flooding (pluvial or surface water runoff)**, whereby the risk is “major flooding from surface water runoff overwhelming drainage systems, resulting in homeless people, damage to properties and widespread disruption to infrastructure”;
- **Significant local fluvial flooding (rivers and streams)**, whereby the risk is “sustained period of heavy rainfall extending over two weeks that would have a sub-regional impact, and is a real threat to lives. Localised economic damage and need between 6 and 18 months recovery before business as usual conditions are restored”; and
- **Flooding: Severe inland flooding affecting more than two UK regions**, whereby the risk is “a single massive fluvial event or multiple concurrent regional events following a sustained period of heavy rainfall extending over two weeks (perhaps combined with snow melt). The event would include major fluvial flooding affecting a large, single urban area. Closure of primary transport routes. Some infrastructure collapse. Sediment movement and contamination of water supplies. Loss of essential services (gas, electricity and telecons), significant numbers of people needing assistance with sheltering, significant economic damage”.

The purpose of the community risk register is:

- To ensure that local responders have an accurate understanding of the risks that they face and to provide a sound foundation for emergency planning;
- To provide a rational basis for the prioritisation of objectives, work programmes and allocation of resources;
- To enable local responders to assess the adequacy of their plans and identify any gaps;
- To facilitate joined up emergency planning, based on consistent assumptions;
- To provide an accessible overview of the emergency planning context for the public and officials; and
- To inform and reflect on national and regional risk assessments that support emergency planning and capability development at those levels.

Partner agencies are either Category 1 or Category 2 responders. For a major flood event in North West Leicestershire the Category 1 responder is anybody in the UK that has specific duties as determined under the Civil Contingencies Act (2004) and includes:

- Local Authority – North West Leicestershire District
- Government Agency – Environment Agency
- Emergency Services - Leicestershire Constabulary, Leicestershire Fire & Rescue Service, East Midlands Ambulance Service NHS Trust
- Health Bodies - Health Protection Agency, Leicestershire Partnership NHS Trust

For a major flood event in North West Leicestershire the Category 2 responders are those who have a role in supporting Category 1 responders in their duties under the Civil Contingencies Act (2004) and include:

- Utilities – Electricity, Gas, Water and sewerage, public communications providers (landlines and mobiles)
- Transport - Network Rail, Train Operating Companies, Airports, Highways Agency
- Government - Health and Safety Executive
- Health Sector - Strategic Health Authority

Emergency planning for extreme flood events is a key consideration for new developments located in areas at risk from flooding that have passed the Sequential Test. When preparing planning applications for such developments, developers should consult with the Environment Agency, emergency services and local resilience forums when developing emergency and evacuation plans. This consultation should feed into the submitted supporting information i.e. Flood Risk Assessment and evidence for the Exception Test to determine whether the site users are at an acceptable level of risk. The outputs of the SFRA will provide a useful information base from which to initially consider viable routes for safe evacuation during flood events. At the site specific level, a more detailed appraisal of proposed evacuation routes may be required to confirm that the route is safe for the lifetime of the development.

A key part of emergency planning also involves raising public awareness to the potential risks and providing comprehensive information regarding flood warning and evacuation routes for members of the public to follow during extreme flood events. Both developers and North West Leicestershire District Council should give particular consideration to communication of flood warnings and advice to people with impaired hearing and/or sight and with restricted mobility.

North West Leicestershire District Council can also use the outputs from this SFRA to facilitate the development of emergency planning policies for existing developments at risk within their local authority by considering the feasibility and sustainability of key access routes within their administrative boundary and across boundaries into neighbouring authorities.

6.6.6. Flood warning

Although North West Leicestershire District Council is responsible for developing emergency plans for their individual authority, the work undertaken by the Environment Agency in relation to flood warning is a key element which should be integrated into the process of developing such plans.

The Environment Agency's National Flood Warning Centre is currently responsible for co-ordinating and issuing flood warnings via 'Floodline'. The Environment Agency has developed a range of integrated catchment flood forecasting models for catchments which contain Flood Warning Areas. The main objective of this modelling is to improve the prediction of water levels at designated forecasting points and to assist in the process of issuing flood warnings. Consideration should be given to the estimated lead times which can be provided when developing strategies for emergency evacuation and response to flood events.

6.7. Surface water management

The planning system can act as an effective means of ensuring that all new developments manage surface water in a sustainable manner. Conventional surface water drainage systems have traditionally used underground pipe networks to efficiently convey water away from sites. In the past this has led to problems of downstream flooding, reductions in groundwater recharge and waste pollution incidents associated with surface water overwhelming combined sewers. Both 'Making Space for Water' and the Water Framework Directive have highlighted the need for an improved understanding and better management of how our urban environments are drained. The Flood and Water Management Act encourages the uptake of SuDS. Major development must consider the use of SuDS systems through applying the SuDS hierarchy:

1. Infiltration systems and soakaways;
2. Discharge to watercourse.
3. Discharge to sewers.

The hierarchy approach requires that infiltration and soakaway systems are considered in the first instance. Only if these SuDS approaches are not considered appropriate at the site then discharge to watercourses can be considered. If neither these options are possible, in the final instance discharge to sewers would be assessed.

The NPPF promotes Local Plans to consider climate change in respect to flood risk management and develop local planning policies that facilitate the requirement of SuDS in new developments.

The Delivering Sustainable Drainage Systems document (Defra, 2014) outlines the Governments approach to deliver effective sustainable drainage systems that will be maintained for the lifetime of the development they serve.

The NPPF requires that a site-specific flood risk assessment is undertaken for all sites including those in Flood Zone 1 with an area greater than one hectare to ensure that downstream flooding problems are not made worse by surface water runoff from the development.

Surface water drainage systems for a development should ensure that there is little or no residual risk of flooding for events in excess of the storm event for which the sewer system on the site is designed.

For previously undeveloped sites the rate of runoff from the development sites should be no greater than the existing (greenfield) rate of runoff from the site. For developments on previously developed (brownfield) sites the rate of runoff should not exceed the runoff of the site in its previously developed condition. However, developers are encouraged to manage runoff from these developments to targets set out in the forthcoming LCC SuDS guide wherever practicable and accommodate climate change.

As the upper part of several catchments are within North West Leicestershire, e.g. River Mease, River Sence and Grace Dieu Brook the District Council has responsibility to ensure development does not increase flows downstream in neighbouring authorities.

SuDS aim to mimic the natural drainage processes whilst also removing pollutants from urban runoff at the source before entering a watercourse. There are a wide range of SuDS techniques, including green roofs, permeable paving, swales, detention basins, ponds and wetlands. The different types of SuDS and where they can be used appropriately within North West Leicestershire are discussed in Section 7.3.

7. Flood risk management for North West Leicestershire

7.1. Funding of flood defence works

Where proposed developments include the provision of new flood mitigation measures, these should generally be funded wholly by the developer. Developers proposing new mitigation measures which solely benefit new development should not call on public resources as a means of funding. It should be noted that the construction of new flood defences to enable a development to proceed are not normally favoured or acceptable to the Environment Agency.

North West Leicestershire District Council may wish to consider entering into an agreement under Section 106 of the Town and Country Planning Act 1990 to ensure that the developer carries out the necessary works and that future maintenance commitments are met. They may also apply planning conditions which would require completion of the necessary works before the rest of the development can proceed. Section 106 of the Town and Country Planning Act 1990 allows a local planning authority to enter into an agreement with a landowner or developer in association with the granting of planning permission. A Section 106 agreement is used to address issues that are necessary to make a development acceptable, such as supporting the provision of services and infrastructure. One of the recommendations of ‘Making Space for Water’ was that local planning authorities should make more use of Section 106 agreements to ensure that there is a strong planning policy to manage flood risk. This means that any flood risk which is caused by, or increased by new development should be resolved and funded by the developer.

Where the mitigation measures proposed provide benefit to the wider community, or where the proposed works include upgrade or replacement of existing defences or flood alleviation schemes, it may be reasonable for the developer to contribute a proportion of the funding in partnership with the operating authority responsible for the existing works. Potential sources of funding that could be explored for such schemes are:

1. Flood & Coastal Erosion Risk Management or Flood Defence Grant in Aid (FDGiA)
2. Local community contributions

3. Community Infrastructure Levy (CIL)
4. Local Enterprise Partnership (LEP)
5. Council revenue and capital budgets
6. European Union grants
7. Regeneration grants

Capital works can seek funding through the FDGiA funding stream. To qualify for funding through this source it is necessary to demonstrate that the proposed scheme is cost beneficial which should be determined in accordance with the Flood and Coastal Erosion Risk Management (FCERM) guidance.

The Environment Agency has developed a six year capital programme (2015/16 to 2020/21). This Medium Term Plan (MTP) and the projects which are currently approved to receive FDGiA funding were announced in December 2014. The announced list of projects includes the Long Whatton and Diseworth scheme with an estimated construction start between 2018 and 2021. This scheme is proposed to protect 30 properties. In order to submit any further North West Leicestershire schemes for inclusion in the MTP significant benefits must be demonstrated, and a high partnership funding score identified. Therefore unless proposed flood risk mitigation schemes are considered very highly beneficial, protecting a significant number of properties, gaining full funding through this programme is unlikely. In addition to contributions from developers, another important funding mechanism will come from local fundraising from the local communities and businesses who benefit from the proposed flood defence schemes. Where FDGiA, local levy, developer contributions and the promoting authority's own funds are insufficient to fund flood risk management work, contributions may be sought from the local community.

Through resident engagement within areas that have suffered ongoing flooding problems, it may be possible to create a resident group that would help contribute to ongoing works.

The potential for Section 106 agreements have been discussed above, however, after 2014, the regulations restrict the local use of planning obligations for pooled contributions towards items that may be funded via the CIL. The CIL is the government's preferred vehicle for the collection of pooled contributions.

The CIL is a levy that local authorities in England and Wales can choose to charge on new developments in their area. The money can be used to support development by funding infrastructure that the council, local community or neighbourhoods want – for example, a new flood defence or surface water management scheme. The system is very simple. It applies to most new developments and charges are based on the size and type of the new development. Local authorities should consider introduction of the levy because it delivers additional funding for them to carry out a wide range of infrastructure projects that support growth and benefit the local community, which are anticipated for inclusion within the Local Plan. This funding stream gives local authorities the flexibility and freedom to set their own priorities for what the money should be spent on. However it may be difficult to obtain funding through this stream if flood risk management is not a significant concern within the local authority area. It is also considered that this is a predictable funding stream that allows local authorities to plan ahead more effectively and provides developers with much more certainty 'up front' about how much money they will be expected to contribute. This 'up front' certainty for developers encourages greater confidence and higher levels of inward investment which promotes greater transparency for local people. This is because local people will be able to understand how new development is contributing to their community and enables local authorities to allocate a share of the levy raised in a neighbourhood to deliver infrastructure the neighbourhood wants.

There is also a potential to secure funding through the LEP for North West Leicestershire District Council which is the Leicester and Leicestershire Enterprise Partnership. In July 2014 the LLEP was awarded £80million with a further £20.3 million awarded in January 2015 for schemes which will directly promote growth.

There are other potential funding mechanisms available such as through North West Leicestershire District Council Revenue and Capital Budgets, European Union grants such as those which are related to the regeneration of urban, rural or ecological locations and those related to innovation or the development of best-practices. There are also regeneration grants from Communities and Local Government (CLG) for growth areas, growth points and housing market renewal pathfinders, grants linked to new housing through the Homes and Communities Agency (HCA) and funding for local area agreements (LAAs).

7.2. Raising flood defences and improving standard of protection

In order to identify locations where shortfalls in defence standards exist, appropriate defence standards would need to be determined. NPPF states that the minimum acceptable standard of protection for new developments should be to the 1 in 100 annual probability (1%) for fluvial flooding.

The Environment Agency Unit Cost Database was originally developed in 2001 based on historic information on capital projects completed within England and Wales. Since 2001 it has been updated with more recently completed projects and this information is provided in a Flood Risk Management Estimating Guide[4]. This guidance should be used when determining the costs associated with raising flood defences and improving the associated standard of protection.

Raising the height of minor embankments (1 in 10 annual probability (10%) standard of protection) is not a sustainable option and would result in large volumes of lost floodplain. Therefore, it is standard that only defences with a standard of protection greater than or equal to the 1 in 25 annual probability (4%) would be considered for raising.

7.3. Sustainable drainage systems

Local Authorities should prepare and implement planning strategies that help to deliver sustainable development, by using opportunities offered by new development to reduce the causes and impacts of surface water flooding. By implementing policies to encourage developers to incorporate SuDS wherever possible, Local Authorities can help to mitigate the impacts that development has on surface water runoff rates and volumes.

Figure 7-1 provides information relating to the spatial variation of permeability across North West Leicestershire. This information can be used as a first estimate of the suitability of different types of SuDS within North West Leicestershire as shown in Table 7-1.

[4] Flood Risk Management Estimating Guide – Unit Cost Database 2007, Environment Agency, October 2007

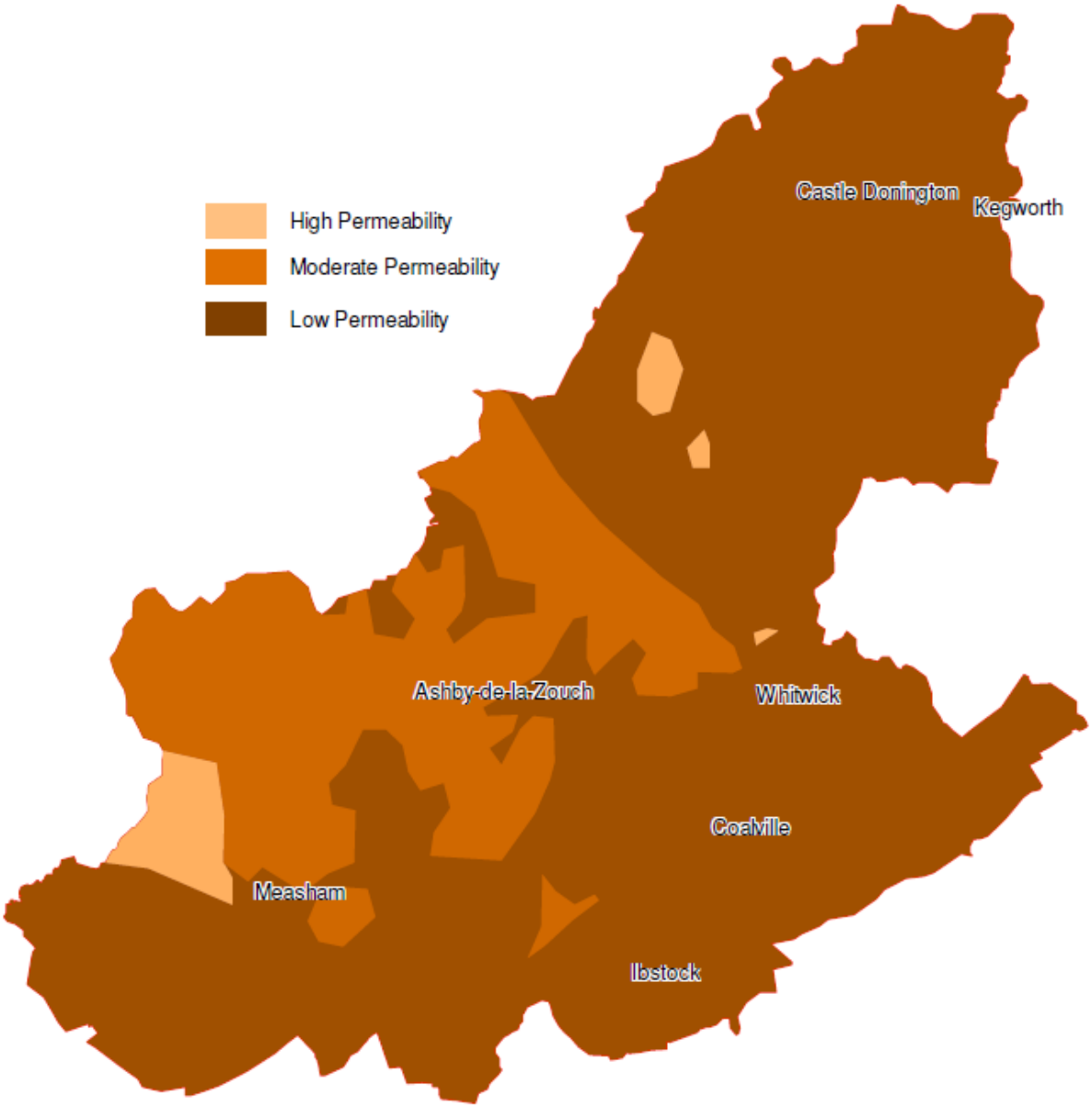

Figure 7-1 Permeability across North West Leicestershire

The general soil type within North West Leicestershire is 'loamy'. This soil type is moderately well drained, but it can be seasonally waterlogged. The catchment run-off can, therefore, be quite variable, and when waterlogged will result in a rapid response with high run-off rates.

It is important to note that the above assessment of the spatial suitability of SuDS is an indicative estimate and should be confirmed at the site specific level, using ground investigation data.

Table 7-1 Suitability of SuDS

Permeability	Indicative suitability of SuDS techniques
High permeability	Infiltration and combined systems
Moderate permeability	Infiltration and combined systems
Low permeability	Attenuation systems

7.3.1. Infiltration Systems

Infiltration systems allow surface water to discharge directly into the ground. These systems are only appropriate where site conditions meet the following criteria:

1. Ground which has a suitable water acceptance potential and
2. Locations where groundwater recharge will not adversely affect drinking water aquifers as identified by the Environment Agency's source protection zones, available on their website http://www.environmentagency.gov.uk.

Such systems may include:

- Permeable surfaces
  - Gravel
  - Permeable Paving
  - Block Paving with voids
  - Grassed areas

- Sub Surface Infiltration
  - Filter Drains
  - Geocellular Systems
  - Soakaways

7.3.2. Attenuation Systems

If ground conditions cannot support infiltration systems, surface water may need to be attenuated using measures to store surface water. Attenuation systems, if designed at ground level, have the potential to take up large areas of development sites. Early consideration of such constraints is therefore essential to ensure that sufficient land is allocated to accommodate SuDS systems. Attenuation systems may include:

- Landscaped
  - Detention Basins
  - Balancing Ponds
  - Retention Ponds
  - Wetlands
  - Lagoons

- Engineered
  - Underground Tanks
  - Ornate Water Features
  - Green Roofs
  - Oversized Pipes

Rainwater harvesting is another approach that can be considered to help attenuate surface water runoff, however this system cannot be considered as a formal attenuation system for planning purposes. This is because the system is likely to be already storing water during storm events, and the capacity of a rainwater harvesting system cannot be guaranteed during potential flood events.

7.3.3. Combined Systems

SuDS designs for most sites can include a combination of infiltration and attenuation systems and they have been categorised above according to the dominant process. Other forms of SuDS which can provide more balanced benefits of infiltration and attenuation include swales and filter strips.

7.3.4. SuDS Guidance

Developers should refer to the most current version of the Water Cycle Study which at present is dated 2010 (Entec, 2010) when considering designing, implementing and maintaining SuDS systems however it should be noted that Schedule 3 of the Flood and Water Management Act 2010 is yet to be implemented. As at January 2015 it is anticipated that the LPA will be responsible for approving SuDS systems with the LLFA being a statutory consultee on planning applications containing SuDS proposals.

The forthcoming SuDS guidance from Leicestershire County Council should be consulted when designing surface water management for proposed development within North West Leicestershire. The information provided by the applicant must include information for the ongoing maintenance of a drainage system.

7.4. Development control

Advice notes for developers for undertaking site specific FRAs within North West Leicestershire is provided within the Government's online environmental management guidance[5]. This guidance outlines when a site specific FRA is required and the scope of the study that needs to be included within the FRA. Potential developers should consult this guidance early on in the development planning process to determine the flood risk implications.

8. Conclusions and recommendations

8.1. Conclusions

The conclusions that have been made from this SFRA are:

This SFRA report provides an overview of the planning context in relation to flood risk and development within North West Leicestershire.

The data provided has been collated through consultation with North West Leicestershire District Council. Leicestershire County Council, the Environment Agency and Severn Trent Water. The information provided also builds upon the original SFRA completed in 2008.

The primary source of flood risk in North West Leicestershire is fluvial flooding arising from the River Trent, the River Soar, the River Mease, the River Sence and their tributaries. Other sources of flood risk in the district are surface water, sewers, canal infrastructure and groundwater arising from former coal mining areas.

There are existing flood risk management schemes in place, including formalised flood defences and flood storage areas. These flood risk management schemes fall under a range of responsibilities including the Environment Agency and private land owners, and provide varying levels of protection.

Climate change is predicted to cause an increase in flood risk in the future and therefore needs to be considered when designing flood risk mitigation and surface water management systems for new development.

A Sequential Test has been undertaken on potential sites for allocation, as provided by North West Leicestershire District Council. Of the 34 sites assessed, 26 sites are fully located within Flood Zone 1 and therefore within the lowest areas at risk from fluvial flooding. Of the remaining sites five are partially located within Flood Zones 2 and 3, and three are located fully within Flood Zone 3 and therefore at a high risk from fluvial flooding.

Windfall sites are potential development sites that have not been allocated through the Local Plan and have not been individually sequentially tested for this SFRA. The Sequential Test will need to be applied to these sites, which can be informed by the Sequential Test flowchart provided in this SFRA. If necessary evidence to meet the requirements of the Exception Test at the planning application stage would also be required.

8.2. Recommendations

The recommendations from this SFRA update are as follows. It is recommended that the list is considered when completing the Local Plan for North West Leicestershire.

1. This SFRA should support the completion of site specific FRAs. FRAs are required for submission with the associated planning application for all development located within areas at risk from flooding as

[5] https://www.gov.uk/planning-applications-assessing-flood-risk

defined in the fluvial flood mapping provided in the Appendices to this report (and as shown on the Environment Agency's website) and those classed as major development.

2. The risk to and impact of new development should be minimised through careful planning considerations in relation to flood risk. This would be achieved through promoting development to be located within the lowest areas of flood risk, from all sources.
3. The Sequential Test will need to be carried out for windfall sites and applicants should provide sufficient information to the Local Planning Authority to be able to assess it. It is recommended that the flow chart provided in this SFRA for assessing windfall sites is a 'live' document. As a live document is should be updated and evolved as feedback is received from development control officers and flood risk management policy changes such as the potential for Critical Drainage Areas to be established.
4. All sources of flood risk need to be considered when assessing the risk to new and proposed development. These sources of flood risk include fluvial, surface water, sewers, canal infrastructure and groundwater, such as through rising from former coal mining measures.
5. It is recognised that not all development could be located in areas at lowest risk from flooding, as in some cases the need for the proposed development will outweigh the risks of flooding. Where development is required in areas at risk from flooding it is necessary that new development will incorporate flood risk mitigation measures to ensure that both the site is at an acceptable level of risk, whilst preventing an increase in risk elsewhere. This would need to be demonstrated through the application of the Exception Test.
6. Where flood risk mitigation measures are required to ensure an acceptable level of flood risk associated with new development, these mitigation measures need to be agreed with the LPA (and potentially other statutory consultees) as appropriate to the level and nature of the flood risk. Furthermore the measures need to be satisfactorily implemented and maintained.
7. There is increased focus on suitable surface water management in new development, through the use of SuDS to prevent increased flood risk both on site and elsewhere. For development on greenfield sites surface water runoff from the site must be attenuated to the pre development rate. For development on brownfield sites, surface water runoff should be reduced as recommended by the Leicestershire County Council SuDS guide.
8. SuDS must be selected following the SuDS hierarchical approach and in accordance with national and local standards. The exception would only be if it can be clearly demonstrated that SuDS would not be technically, economically or operationally viable but other forms of surface water management would be possible, or in locations where SuDS would present health and safety concerns that could not be suitability addressed.
9. It is recommended that where appropriate, especially for strategic sites, SuDS should also be planned at a strategic scale and linked to wider sustainability benefits to enhance green infrastructure, improve water quality and provide wildlife and ecosystem benefits.
10. Development proposing SuDS needs to have a clear maintenance schedule outlining responsibilities for the management of the SuDS over the lifetime of the development to ensure the surface water drainage remains effective.
11. Where possible it is recommended that redundant watercourse crossings and culvert structures are removed to provide flood risk and ecological benefits. When proposing the removal of such structures, that have the potential to act as a constriction to flow, the downstream implications should be determined, and mitigation provided, to avoid detrimental downstream impacts.
12. It is recommended that this SFRA is considered to be a live document, which has been based on current understanding of flood risk and existing and available flood risk information. In the future as further flood events occur, as flood risk policy advances and as studies are completed to improve flood risk understanding, information in this SFRA will become outdated. To address these potential future changes, it is recommended that this SFRA is reviewed and updated as appropriate.

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Appendices

Appendix A. Flood risk vulnerability and compatibility tables

A.1. Flood risk vulnerability classification – taken from Table 2 in the NPPF flood risk planning practice guidance

Essential Infrastructure

- Essential transport infrastructure (including mass evacuation routes) which has to cross the area at risk.
- Essential utility infrastructure which has to be located in a flood risk area for operational reasons, including electricity generating power stations and grid and primary substations; and water treatment works that need to remain operational in times of flood.
- Wind turbines.

Highly Vulnerable

- Police and ambulance stations; fire stations and command centres; telecommunications installations required to be operational during flooding.
- Emergency dispersal points.
- Basement dwellings.
- Caravans, mobile homes and park homes intended for permanent residential use.
- Installations requiring hazardous substances consent. (Where there is a demonstrable need to locate such installations for bulk storage of materials with port or other similar facilities, or such installations with energy infrastructure or carbon capture and storage installations, that require coastal or water-side locations, or need to be located in other high flood risk areas, in these instances the facilities should be classified as 'Essential Infrastructure').

More Vulnerable

- Hospitals
- Residential institutions such as residential care homes, children's homes, social services homes, prisons and hostels.
- Buildings used for dwelling houses, student halls of residence, drinking establishments, nightclubs and hotels.
- Non–residential uses for health services, nurseries and educational establishments.
- Landfill* and sites used for waste management facilities for hazardous waste.
- Sites used for holiday or short-let caravans and camping, subject to a specific warning and evacuation plan.

Less Vulnerable

- Police, ambulance and fire stations which are not required to be operational during flooding.
- Buildings used for shops; financial, professional and other services; restaurants, cafes and hot food takeaways; offices; general industry, storage and distribution; non-residential institutions not included in the 'More Vulnerable' class; and assembly and leisure.
- Land and buildings used for agriculture and forestry.
- Waste treatment (except landfill* and hazardous waste facilities).
- Minerals working and processing (except for sand and gravel working).
- Water treatment works which do not need to remain operational during times of flood.
- Sewage treatment works, if adequate measures to control pollution and manage sewage during flooding events are in place.

Water-Compatible Development

- Flood control infrastructure.
- Water transmission infrastructure and pumping stations.
- Sewage transmission infrastructure and pumping stations.
- Sand and gravel working.
- Docks, marinas and wharves.
- Navigation facilities.
- Ministry of Defence defence installations.
- Ship building, repairing and dismantling, dockside fish processing and refrigeration and compatible activities requiring a waterside location.
- Water-based recreation (excluding sleeping accommodation).
- Lifeguard and coastguard stations.
- Amenity open space, nature conservation and biodiversity, outdoor sports and recreation and essential facilities such as changing rooms.
- Essential ancillary sleeping or residential accommodation for staff required by uses in this category, subject to a specific warning and evacuation plan.

A.2. Flood risk vulnerability and Flood Zone 'compatibility' – taken from Table 2 in the NPPF flood risk planning practice guidance

Flood Zones	Flood Risk Vulnerability Classification				
	Essential infrastructure	Highly vulnerable	More vulnerable	Less vulnerable	Water compatible
Flood Zone 1	✓	✓	✓	✓	✓
Flood Zone 2	✓	Exception Test required	✓	✓	✓
Flood Zone 3a†	Exception Test required†	X	Exception Test required	✓	✓
Flood Zone 3b*	Exception Test required*	X	X	X	✓*

Key

✓ Development is appropriate
X Development is not appropriate

†In Flood Zone 3a essential infrastructure should be designed and constructed to remain operational and safe in times of flood.

*In Flood Zone 3b (functional floodplain) essential infrastructure must demonstrate a passed Exception Test. Water compatible development should be designed and constructed to remain operational and safe for users in times of flood; result in no net loss of floodplain storage; and not impede water flows and not increase flood risk elsewhere.

Appendix B. Mapping

Appendix C. Windfall site flow chart

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