Rutland County Council

Rutland SFRA

Final Report

29 May 2009

Entec UK Limited

Report for

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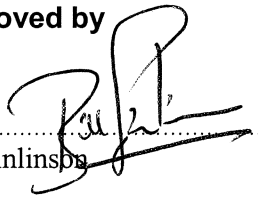

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Executive Summary

Purpose of this Report

This report has been produced for the purpose of providing a Level 1 and 2 Strategic Flood Risk Assessment (SFRA) for Rutland County Council. The SFRA has been produced by Entec in close consultation with Rutland County Council, the Environment Agency, and Anglian Water. The SFRA has been prepared in accordance with the requirements of Planning Policy Statement 25 *Development and Flood Risk* (PPS25).

The first part of the report is a Level 1 SFRA which has the primary focus of to allowing application of the PPS25 Sequential Test and to determine if application of the Exception Test is likely to be necessary. This is largely a desk based assessment in which information on flood risk across Rutland has been collected, collated and interpreted to allow an assessment of flood risk across the County. The Level 1 SFRA also includes an assessment of flood risk to minerals and waste sites within Rutland. The key outputs are a series of GIS based maps mapping all sources of identified flood risk which include an assessment of the implications of climate change on flood risk.

The second part of the report forms a Level 2 SFRA assessment which builds upon the findings from the Level 1 study to provide a more detailed flood risk assessment of two key areas identified during Level 1 - Oakham and Uppingham.

Guidance on the preparation of Flood Risk Assessments (FRAs) for allocated development sites is provided along with guidance on the likely applicability of different sustainable drainage systems (SuDS) techniques.

Level 1 SFRA

The Level 1 SFRA is largely a desk based study based on existing information. As a starting point, higher level strategic documents relating to flood risk were reviewed. Two principal documents of relevance were the East Midlands Regional Flood Risk Assessment (RFRA) and the River Welland Catchment Flood Management Plan (CFMP). Principal sources of data on flood risk were obtained from Rutland County Council, the Environment Agency and Anglian Water. All relevant information was then used to provide a strategic overview of flood risk across the County and is summarised in the following paragraphs.

Fluvial Flood Risk

Fluvial flood risks have been assessed in more detail in the SFRA because they represent the most significant hazard within the area and there exists the greatest amount of available data on these sources of flooding. The majority of the River Welland Catchment within Rutland has been modelled for the Environment Agency and the outputs from these models have been used to inform the assessment. In addition, further information on historical flooding and existing flood defences has been sourced and considered as part of the Level 1 assessment. The Environment Agency Flood Zones form the focus of the guidance presented in PPS25. As such these datasets along with the modeled output were used to form the main body of the assessment of flood risk as they enable each potential development site to be attributed with information compatible with PPS25 in order to inform the planning process.

Climate Change

The impacts of climate change on flooding are a serious issue recognized by National Government and this concern is reflected in PPS25. Where detailed river model results for climate change scenarios exist then these have been used for mapping areas at risk from climate change. In the absence of detailed river model output climate change has been addressed by conducting an indicative sensitivity analysis through a comparison of Flood Zone extents.

Other Sources of Flooding

Other sources of flooding have been considered within the SFRA. This includes the assessment of additional overland drainage paths and surface water flooding. This information was derived through a broadscale overland flow modelling exercise. Flood information from non-fluvial sources has also been obtained through consultation with Rutland County Council and water companies. The level of detail to which the other sources of flooding have been assessed is proportionate to the risks they pose.

Surface water and drainage related flooding tends to be very site specific. As a result the data available to the SFRA only allows for the broad issues to be highlighted (for example blocked culverts and drainage systems with insufficient capacity), along with specific examples of historic surface water flooding. It has been recommended that these sources of flood risk be considered in detail at the site specific Flood Risk Assessment stage.

Key Findings

The flood zone maps indicate that fluvial flood risk is of limited spatial extent within the County and that the majority of the higher risk flood zones (2 and 3) are located in rural areas away from the built environment. There are a few small settlements where the flood map shows properties at risk and these include Langham, Whissendine, Cottesmore, Ryhall, Ketton and parts of Oakham.

Proposed/existing minerals and waste sites within Rutland were all shown to fall within Flood Zone 1 except for Ketton which had a small proportion of its area in Zones 2 and 3.

It can be concluded that at present the need for application of the PPS25 Exception Test for planned development in Rutland is unlikely due to sufficient availability of land in Flood Zone 1.

Sustainable Drainage Systems (SuDS) should be used to reduce runoff from new development and they can in turn provide an attractive high-quality urban environment. In general the western part of Rutland has more clayey soils and infiltration SuDS are unlikely to be feasible. Other attenuation measures to control runoff such as long term storage are likely to be more appropriate in such areas. In the east of the County the soils are loamy in nature and contain some major aquifers. In such locations infiltration SuDS are likely to be feasible but this should be confirmed in site specific investigations as part of a Flood Risk Assessment.

The results of the Level 1 SFRA were then used as a basis to focus in greater detail on the towns of Oakham and Uppingham.

Level 2 SFRA

The Level 2 SFRA has reviewed flood risk in Oakham and Uppingham in greater detail.

In **Oakham**, the town and its surrounding area were divided into areas based on the drainage catchments of the numerous small watercourses that drain the town. Flood risk was considered within each catchment in relation to downstream receptors and the potential for new development to exacerbate flood risk was used as the basis by which to prioritise catchments for development potential. In catchments with existing flood risk that are likely to be subject to significant development pressure it is recommended that a Surface Water Management Plan be prepared to consider integrated nature of catchment drainage in more detail assessing factors such as the likely increase in surface water runoff from new development, the capacity and condition the watercourse and existing sewerage infrastructure, location of flooding 'hotspots' and consideration of strategic SuDS solutions such as storage areas on a catchment-wide basis.

Uppingham contains fewer watercourses and development zones have therefore been inversely prioritised based on their potential to increase flood risk to downstream areas through additional surface water runoff.

Residual risk from reservoir dam failure has been a considered within the SFRA. The SFRA advises against development downstream of raised reservoirs such as Rutland Water and Eyebrook Reservoir.

This SFRA identifies the process that should be followed for any windfall development proposals. All developments within Flood Zones 2 and 3 require a Flood Risk Assessment as will developments over 1 hectare in size in all Flood Zones. This SFRA presents a flow chart that should be followed to inform the type of assessment required.

Suggested wording has been supplied regarding SuDS for incorporation into LDF policies. This emphasises the need to identify responsibilities for long term adoption and maintenance of SuDS.

Glossary

Design Flood Event	Flood event that has a given probability of occurrence and is used to design flood defences or alleviation schemes, or produce flood risk maps.
Exception Test	The PPS 25 Exception Test is the process by which departures from the Sequential Test (see entry below) may be justified where it is necessary to meet the wider aims of sustainable development[1].
Flood Defence	Man made structure - embankment, bund, sluice gate, reservoir, barrier - designed to prevent flooding of areas adjacent to the defence.
Flood Resilience	Measures which ensure that a property situated on the floodplain is not damaged during a flood event. They are mainly related to preventing floodwater from entering the property or ensuring that if water was to enter the property, no damage would be caused. In the broader sense, flood resilience is the ability of society and whole communities to minimise the overall damage caused by flood events and to quickly recover after flood events.
Flood Resistance	Measures which reduce the amount of water entering a building during a flood. It is important that these measures are fallible as they may involve the insertion of protective barriers (in doorways) by occupiers; water pressure also limits the flood-depth in which they can be applied.
Floodplain	Topographic area adjacent the rivers, the coast or estuaries liable to flooding.
Hydraulic	Related to the flow of water.
Inundation	Overflowing of water onto land that is normally dry. In the case of Rutland, causes of inundation could include (but not necessarily be limited to) rivers, groundwater, overland flow, culvert blockages, structural failures, and sewer flooding.

[1] *PPS 25 Development and Flood Risk, Communities and Local Government*, December 2006.

Local Development Framework	The Local Development Framework (LDF) is at the heart of the new planning system introduced by the Planning and Compulsory Purchase Act 2004[2]. The LDF will comprise Local Development Documents (LDDs), including the Development Plan Documents (DPDs) (statutory planning documents) and supplementary planning documents which expand on policies or provide greater detail. The development plan documents may include a core strategy, site specific allocations and an adopted proposals map.
Main River	All watercourses shown as such on the statutory main river maps held by the Environment Agency and the Department of Environment, Food and Rural Affairs, and can include any structure or appliance for controlling or regulating the flow of water into, or out of the channel. The Environment Agency has permissive powers to carry out works of maintenance and improvement on these rivers.
Non-main River	See Ordinary Watercourse.
Ordinary Watercourse	Any natural watercourse not designated as main river.
Planning Obligations	Planning Obligations (or s106 agreements) are private agreements negotiated as part of planning applications between local planning authorities and developers which are intended to make acceptable development that would otherwise be unacceptable in planning terms[3].
Planning Policy Guidance and Statements for England	Planning Policy Guidance Notes (PPGs) and their replacements Planning Policy Statements (PPSs) are prepared by the government after public consultation to explain statutory provisions and provide guidance to local authorities and others on planning policy and the operation of the planning system. They also explain the relationship between planning policies and other policies which have an important bearing on issues of development and land use.Local authorities must take their contents into account in preparing their development plans. The guidance may also be relevant to decisions on individual planning applications and appeals.
Residual Risk	Flood risk associated with areas afforded protection from flood defences or alleviation schemes. The residual risk is the remaining risk of flooding due to exceedence of the design flood event (see entry above) or the failure of the scheme itself (structural or operational).

[2] *PPS 12 Local Development Frameworks*, Office of the Deputy Prime Minister, 2004.

[3] *Draft Revised Circular on Planning Obligations (Consultation Document)*, Office of the Deputy Prime Minister, November 2004.

Regional Spatial Strategy	Following the enactment of the Planning and Compulsory Purchase Act 2004, Regional Planning Guidance (RPG) has become part of the statutory development plan and has been re-named as a Regional Spatial Strategy (RSS). It covers the scale and distribution of new housing, priorities for the environment, transport, infrastructure, economic development, agriculture, minerals extraction, waste treatment and disposal.
Sequential Test	The PPS 25 Sequential Test refers to the process of determining the suitability of land for development in flood risk areas, central to the PPS 25 guidance, and to be applied to all levels of the planning process[4].
Supplementary Planning Document	Supplementary Planning Documents expand policies set out in a development plan document or provide additional detail on both thematic and site specific matters. They are not subject to independent examination and therefore do not form part of the statutory development plan, nor are they used to allocate land.
UK Climate Impacts Programme 02 Scenarios	UK climate change scenarios are often used to assess the potential impact of climate change in the UK based on different global emission scenarios. Four UKCIP02 scenarios have been derived from climate model runs at the Hadley Centre and are described in detail in the UKCIP02 Scientific Report. Each of the climate scenarios is based on a different global emissions scenario that was developed for the Intergovernmental Panel on Climate Change Special Report on Emissions Scenarios.

[4] *PPS 25 Development and Flood Risk, Communities and Local Government*, December 2006.

Abbreviations

ABI	Association of British Insurers
AEP	Annual Exceedance Probability
AOD	Above Ordnance Datum
BW	British Waterways
CFMP	Catchment Flood Management Plan
CIRIA	Construction Industry Research and Information Association
CLG	(Department for) Communities and Local Government
CSO	Combined Sewer Overflow
DEFRA	Department for the Environment, Food and Rural Affairs
DPD	Development Plan Documents
DTM	Digital Terrain Model
EA	Environment Agency
ESS	Environmental Stewardship Scheme
FEH	Flood Estimation Handbook
FRA	Flood Risk Assessment
GIS	Geographical Information System
IDB	Internal Drainage Board
ISIS	1-D hydraulic modelling software, commonly used in flood modelling
JFLOW	JFLOW (2D flood modelling software package)
LDD	Local Development Document
LDF	Local Development Framework
LDS	Local Development Scheme
LPA	Local Planning Authority
OW	Ordinary Watercourses
PAG 2	Project Appraisal Guidance 2
PPG	Planning Policy Guidance
PPS	Planning Policy Statement
RCC	Rutland County Council

RFRA	Regional Flood Risk Assessment
RPB	Regional Planning Bodies
RSS	Regional Spatial Strategy
SCP	Sustainable Communities Plan
SFRA	Strategic Flood Risk Assessment
STW	Severn Trent Water
SuDS	Sustainable Drainage Systems
UKCIP	United Kingdom Climate Impact Programme

Contents

1. Introduction and Context

1.1 Introduction

Rutland County Council appointed Entec UK in December 2007 to undertake a Strategic Flood Risk Assessment (SFRA) for their area. Preparation of the SFRA took place between January and July 2008. The work was overseen by a steering group consisting of Rutland County Council, the Environment Agency and Anglian Water. An interim report covering the first stage of the project was circulated to the steering group in February 2008. The SFRA has been carried out in accordance with PPS25 *Development and Flood Risk*[5] and its companion *Practice Guide*[6].

The purpose of the SFRA is to assess flood risk across Rutland, and in particular the flood risks associated with areas being considered for future development as part of the emerging Local Development Framework (LDF). The SFRA also includes an assessment of minerals and waste sites within the County in order to inform development of the Minerals and Waste Development Framework. Relevant national planning legislation and policy guidance has been considered throughout the SFRA.

Planning process is driven by legislation and guidance developed at a national, regional and local level. Flood risk is one of many factors to consider when making decisions relating to land use. The objective of the SFRA is to provide clear guidance for considering flood risk within future sustainable development planning. The 'Making Space for Water' report published by Defra (2005), identified the severe flooding experienced by mainland Europe in 2000 as being one of the catalysts for the Government to show an increased interest in flood risk management. Recent high-profile flood events across the United Kingdom in 2007 and the subsequent recommendations in the Pitt Review, have kept flood risk in the public eye and make the need for effective consideration of flood risk in the planning process even more important.

The SFRA is intended to provide Rutland County Council with a better understanding of:

- The different sources of flood risk county-wide and their significance;
- The delineation of the PPS25 flood risk zones; and
- The flood risk implications for potential development areas.

The *PPS25 Practice Guide* outlines two 'levels' of SFRA: an overview assessment (Level 1) and a more detailed investigation (Level 2). This SFRA has been undertaken in two stages in accordance with this approach.

[5] *PPS 25 Development and Flood Risk, Communities and Local Government*, December 2006.

[6] PPS 25 Development and Flood Risk Practice Guide, Communities and Local Government, June 2008.

An earlier draft report presented the results of the Level 1 Study. This final report presents the findings of both the Level 1 Study and the Level 2 Study.

The Level 1 Study focussed on identifying and mapping flood risks within Rutland at a County wide level. All available flood risk data was collated to develop a baseline dataset that the Council could use to inform future site allocations (using the Sequential Test) and to develop planning policies that take appropriate account of all sources of flooding. The Level 1 Study report was also used to scope the requirements for Level 2.

At the start of the study it was agreed through the steering group that the Level 2 Study should concentrate on the key settlements of Oakham and Uppingham and include any other potential development areas identified at Level 1 that may be inappropriate for development on flood risk grounds, or that may require an Exception Test.

Advice has been given to help formulate drainage policies for potential development sites. Where necessary, mitigation measures have been considered at a strategic level and recommendations made as to the appropriate development of these sites. Where further investigations have been deemed necessary, these have been identified and recommendations made about their scope and nature.

1.2 How to Use the SFRA

The SFRA report is a reference document, to be consulted when the Council are presented with questions or situations that require an appreciation of flood risk, either at county wide level or site level.

Developers will still have to carry out site specific FRAs for individual development applications. The SFRA provides developers with a source of information to help them undertake Flood Risk Assessments (FRAs) where they are required.

The Level 1 SFRA is largely a desk-based assessment of available data and information and provides an overview of flood risk within the County. Areas identified for further consideration at Level 1 have been assessed in the Level 2 SFRA and in these areas more detail has been presented on the nature and scale of flood risk.

It is intended that the SFRA report and the maps, presented in Appendix A, should be sufficient to provide supporting evidence to enable the Council to identify the level of flood risk at potential development sites across the County and to prioritise areas for development. All GIS data used in the mapping is provided electronically as a separate deliverable to accompany the final SFRA report.

1.3 Planning Policy Context

1.3.1 National Planning Policy

Preparation of this SFRA has taken place in a period during which planning authorities have been implementing the provisions of the Planning and Compulsory Purchase Act 2004 and accompanying planning guidance, including PPS1 (*Planning Policy Statement 1 - Delivering Sustainable Development*) and PPS 12 (*Planning Policy Statement - Local Development Frameworks*). These affect all tiers of the planning system and have necessitated major changes

at both the regional and local level which will impact on the way in which planned development is reflected in the regional strategy and delivered locally.

The Government has set in motion changes to the planning policy process, which will see the Local Plan replaced by a Local Development Framework (LDF). The LDF is comprised of a framework of documents including the Core Strategy, Development Plan Documents (DPDs), Site Specific Policies and Proposal Maps, statements of Community Involvement and Supplementary Planning Documents.

Planning Policy Statement 25: Development and Flood Risk

This SFRA has been undertaken in accordance with the guidance provided in Planning Policy Statement 25 - Development and Flood Risk (PPS25) and its accompanying Practice Guide (*Development and Flood Risk - A Practice Guide Companion to PPS25, June 2008*). Box 1 presents a summary of the guidance presented in PPS25.

This SFRA gives an overview of flood risk issues across the County of Rutland (Level 1 Assessment), and goes on to describe what land uses are appropriate for each site for which a potential flood risk is identified, based upon the vulnerability classification presented in Annex D of PPS25. A Level 2 Assessment is then undertaken which looks at key development areas in greater detail.

The most effective method of flood risk management is to avoid flood risk by locating development in lower risk flood zones. As such, sites in Flood Zone 1 must be prioritised for development ahead of Zones 2 and 3. Only where there are **no** alternative sites within Flood Zone 1 should development within the floodplain be considered. If this situation occurs then, in line with the Sequential Approach given in PPS25, Zone 2 should be prioritised ahead of Zone 3.

Box 1 Summary of Guidance in PPS25

PPS25 Objectives

Through PPS25, the Government has sought to provide clarity on what is required at a regional and local level to ensure that appropriate and timely decisions are made to deliver sustainable planning for development. The key planning objectives as stated in PPS25 are that:

"Regional Planning Bodies (RPBs) and LPAs should prepare and implement planning strategies that help to deliver sustainable development by:

- APPRAISING RISK

Identifying land at risk and the degree of risk of flooding from river, sea and other sources in their areas;

Preparing Regional Flood Risk Assessments (RFRAs) or Strategic Flood Risk Assessments (SFRAs) as appropriate, as freestanding assessments that contribute to the Sustainability Appraisal of their plans.

- MANAGING RISK

Framing policies for the location of development which avoid flood risk to people and property where possible, and manage any residual risk, taking account of the impacts of climate change;

Only permitting development in areas of flood risk when there are no reasonably available sites in areas of lower flood risk and benefits of the development outweigh the risks from flooding;

- REDUCING RISK

Safeguarding land from development that is required for current and future flood management e.g. conveyance and storage of flood water, and flood defences;

Reducing flood risk to and from new development through location, layout and design, incorporating sustainable drainage systems (SuDS);

Using opportunities offered by new development to reduce flood risk to reduce the causes and impacts of flooding e.g. surface water management plans; making the most of the benefits of green infrastructure for flood storage, conveyance and SuDS; re-creating functional floodplain; and setting back defences;

- A PARTNERSHIP APPROACH

Working effectively with the Environment Agency and other stakeholders to ensure that best use is made of their expertise and information so that decisions on planning applications can be delivered expeditiously; and Ensuring spatial planning supports flood risk management and emergency planning.

Planning Policy Statement 1: Delivering Sustainable Development

Published in February 2005, this document sets out the overarching planning policies for the delivery of sustainable development across the planning system. PPS1 explicitly states that development plan policies should take account of flooding. It proposes that the new development in areas at risk of flooding should be avoided. Planning authorities are also advised to ensure that developments are sustainable, durable and adaptable. This should be achieved through taking into account natural hazards such as flooding. A supplementary note to PPS1 issued in December 2007 entitled Planning and Climate Change states that when selecting land for development constraints such as flood risk must be considered and a precautionary approach should be adopted to allow for increases in risk as a result of likely changes to the climate

PPS1 also places an emphasis on *spatial planning* in contrast to the more rigid *land use planning* approach which it supersedes. LPAs will still produce site-specific allocations and a proposals map as part of Local Development Documents (LDDs). The Core Strategies will be more strategic and visionary in content and will take into account the desirability of achieving integrated and mixed use development, whilst considering a broader range of community needs than has historically been the case. It will be important for the Core Strategies and

accompanying supplementary planning documents, to recognise the contribution that non-structural measures can make to effective flood management.

1.3.2 Regional Planning Policy

The Draft East Midlands Regional Plan

The Draft East Midlands Plan revises the Regional Spatial Strategy for the East Midlands (RSS8) and maps out the future development up to 2026. It provides a spatial framework to inform the preparation of local development documents, local transport plans and regional and sub-regional strategies and programmes that have a bearing on land use activities and forms part of the key development plan for the purposes of determining planning applications and has a statutory force under the new Planning and Compulsory Purchase Act.

RSS8, the Regional Spatial Strategy for the East Midlands, was first published by the Secretary of State in March 2005 providing a broad development strategy for the East Midlands to 2021. Following a re-examination of the Plan it was published for consultation on 22 July 2008 with the Secretary of State's proposed changes. The consultation period will last until 17 October 2008. It divides the East Midlands region into five sub-areas which are then further divided into Housing Market Areas (HMAs).

Rutland is located within the sub-region of the East Midlands known as the Eastern area and falls within the Peterborough Partial HMA. A priority identified in the strategic sense that applies to housing in Rutland is to 'consolidate the local role of Oakham'.

Policy 13 of the report sets a target of 4 250 houses to be built in Rutland in the period 2001 to 2026. This target is divided up into annual build rates spread over 5 year periods.

The plan recognises the need for a regional approach to managing flood risk and land drainage, especially after the extensive flooding which occurred in 2000/01, which highlights its importance as a key future spatial planning issue. Policy 35 of the report states that the LDF should take account of the potential impact of climate change on flooding and land drainage which will be informed by this SFRA.

The SFRA has focussed on identifying constraints and opportunities that may influence the potential for the relevant towns and villages to fulfil their hierarchical function in order to assist Rutland County Council in the preparation of their Local Development Framework.

1.3.3 Local Planning Policy

Rutland Local Plan

The Rutland Local Plan was adopted by Rutland County Council on 23 July 2001 and provided land-use planning policies for the period 1991-2006 (excluding those relating to minerals and waste). Policies in the Plan were automatically saved for a three year period until 28 September 2007 under the provisions of the Planning and Compulsory Purchase Act 2004. Many of the policies were extended beyond that date by a Direction issued by the Secretary of State on 21 September 2007. These remain in force until replaced by new policies through the LDF process.

Minerals Local Plan

The Minerals Local Plan sets out land-use planning policies relating to the safeguarding and extraction of mineral deposits. Rutland is covered by the Leicestershire Minerals Local Plan Review, which was adopted by Leicestershire County Council in 1995, prior to Rutland becoming a unitary authority in 1997. A Direction released by the Secretary of State extended certain policies beyond 2007. Policies not listed in the Direction expired on 27 September 2007.

Waste Local Plan

The Leicestershire, Leicester and Rutland Waste Local Plan was adopted by Rutland County Council on 2 September 2002 and came into operation on 11 September 2002. The plan provides land-use planning policies for management and disposal of waste for the period 1995-2006. A Direction released by the Secretary of State extended all 20 policies beyond 2007.

The Emerging Local Development Framework

Local Plans will gradually be replaced by a portfolio of Local Development Documents (LDDs) as part of the Local Development Framework (LDF). The LDF will take the form of a portfolio of plans and documents. Some of them will have a statutory status (Development Plan Documents, DPDs) and others will be adopted as local guidance documents. The documents deal with different issues or areas, and may be prepared at different times, but when taken together they will set out the Council's policies for how it will assess development proposals and direct future growth.

The full Rutland LDF will eventually comprise:

- Development Plan Documents (DPDs);
- Supplementary Planning Documents (SPDs);
- A Statement of Community Involvement (SCI);
- An Annual Monitoring Report (AMR);
- A Local Development Scheme (LDS).

Rutland County council has identified LDDs to be prepared for the period to March 2010. The preparation of the *Core Strategy DPD* began in March 2008 and will identify the most suitable locations for development. It will also include policies for waste management. The *Minerals Core Strategy and Development Control Policies DPD* provides the overall vision for future minerals development in Rutland and will update and simplify the Development Control policies of the Leicestershire Minerals Local Plan Review.

1.4 PPS25 and Local Planning Authorities

PPS25 specifies that LPAs should adopt a risk-based approach to planned development through the application of a Sequential Test. This sequential process relates to the steering of new developments towards areas of lowest flood risk. PPS25 also sets out the need to consider other sources of flood risk (such as groundwater, overland flow, and sewer) in addition to the main

fluvial and tidal sources. The implications of climate change on flood risk are also required to be considered in the interest of sustainable development.

PPS25 introduces the Exception Test which allows some scope for departures from the sequential approach where it is necessary to meet the wider aims of sustainable development. The criteria for exception include where the development makes a positive contribution to sustainable communities or redevelopment of brownfield land. Exceptions can be permitted where it can be demonstrated that the residual flood risks are acceptable and satisfactorily managed.

The Town and County Planning (Flooding) (England) Direction 2006 has made the Environment Agency a Statutory Consultee on all applications for development in flood risk areas, including areas with critical drainage problems and for developments exceeding 1 hectare outside of flood risk areas. After discussion with the Agency LPAs are required to notify the Secretary of State if they remain minded to approve a planning application contrary to a sustained objection from the Environment Agency.

2. Methodology

2.1 Level 1 Study

2.1.1 Data Acquisition

Data on the location of all settlements, proposed development sites, mineral and waste sites were obtained from Rutland County Council. Information on flood risk was sourced from the Environment Agency, Rutland County Council, Anglian Water and Severn Trent Water. These data were provided in different electronic formats and through verbal and written consultation responses.

2.1.2 Data Review and Mapping

Flood Zone Mapping

The EA Flood Map identifies Zone 3 (high probability) and Zone 2 (medium probability), with all remaining land assumed to fall within Zone 1 (low probability). This provides an indication of fluvial flood risk for catchments greater than 3 km^2. The Flood Maps are updated every three months by the Environment Agency to reflect improved knowledge of the flood risk, particularly as a result of detailed modelling. For all main rivers within the Welland catchment the Flood Map is based on detailed model output from the Welland Catchment Strategic Model (August 2007). The model provides a better understanding of flood extents than the Flood Zone maps it replaces as it contains detailed information on hydraulic structures such as bridges and weirs as well as providing a better representation of channel geometry. Elsewhere, for non-main rivers the Flood Map data has been developed using broad scale techniques that may not accurately represent the flood risk at site specific level. Flood Maps do not include any flood defences that may be present.

Historic Flood Event Data

The EA provided flood event outlines that map the extent of flooding for historical events. Rutland County Council also provided descriptions of flood events that have occurred in the County. Historic information only identifies what flooding has previously occurred based on a particular set of circumstances; it does not give a full representation of flood risk present, but can be a useful indicator of the accuracy of flood mapping. This dataset does not capture all historical flood events, but where available has been used to identify locations that have experienced flooding that may not be included in the Flood Map. Most of the historical event data that has been mapped is on the River Welland. There is little historic information on flood levels available for its tributaries.

Functional Floodplain

PPS25 defines the functional floodplain as the "land where water has to flow or be stored in times of flood" and suggests that this is land which would flood with an Annual Exceedance Probability (AEP) of 5% (1 in 20 years). As part of the SFRA it was necessary to delineate this

sub-definition of Flood Zone 3, the so-called Flood Zone 3b, in order to identify these very high risk areas and enable them to be considered in the application of the Sequential Test.

The EA does not hold maps of the extent of Flood Zone 3b for the study area. However, it does have extensive mapping across the County from existing models that include the extent of the 4% AEP (1 in 25 year) event. In discussions the Environment Agency agreed that this extent could be used as the basis for defining the extent of the functional floodplain.

Other Sources of Flooding

Flood risk can also result from minor watercourses, groundwater, surface water and the urban drainage network. Information on historical flooding from these sources was identified through consultation with Rutland County Council, water companies, and the Environment Agency. The exact extent of the associated risk with other sources of flooding is unknown, particularly as much of the information is anecdotal. In many of Rutland's upland areas there is a risk of flooding from overland flow as water rapidly drains off impermeable soils. This runoff will eventually find its way into surface drainage channels before joining the main river network. The Environment Agency Flood Map only maps areas with a catchment of 3 km^2 or greater. As a result there is little or no mapping of risk areas in the small upland catchments. This study has conducted a broadscale modelling exercise to provide some indication of areas that may be at risk from overland flooding.

Areas potentially at risk from groundwater flooding have been identified by looking at aquifer and soil information across the County as well as through considering historic information.

Areas potentially at risk from sewer flooding have been identified through consultations with water companies.

Climate Change Assessment

Sustainable development requires a consideration of the likely impact of climate change as this has the potential to significantly change the level of flood risk over the next century. It is predicted that climate change will result in increased rainfall intensity and associated increases in peak flood flows. It is essential that long-term development planning considers the potential for the frequency of severe flood events to increase due to climate change.

An indicative assessment of the potential impact of climate change on flood extents has been undertaken by comparing the difference between the Flood Zone 2 and 3 extents. In addition, where detailed hydraulic model coverage exists a climate change scenario has been mapped whereby model inflows have been increased by 20%.

The impact of climate change on flooding from non-fluvial sources is more difficult to gauge and has been assessed in a qualitative way. It is likely that increased storm intensities and the frequency of such storms will place increasing demand upon surface water sewers and combined sewers which may increase the risk of sewer flooding and combined sewer overflows. Wetter winters may raise groundwater levels and increase the likelihood of flooding from groundwater.

2.2 Level 2 Detailed Assessment

2.2.1 Key Development Areas

Rutland County Council advised that the larger towns of Oakham and Uppingham will be subject to most of the development pressure in the County. While no specific development allocation boundaries were provided, the Council did specify a search area for potential future development around the perimeter of the two towns, based on a radius of 1.5 km and 1 km respectively, as measured from the town centre.

During the Level 2 Study the nature of flood risk within these areas has been examined in greater detail and where necessary the area has been sub-divided and a priority order given for development based on flood risk considerations alone.

2.2.2 Windfall Development

Guidance has been provided in Section 5.4 on appropriate development types in terms of flood risk for locations outside the key towns including villages. Key factors that site specific flood risk assessments may require have been addressed.

3. Overview of Flood Risk in Rutland

3.1 Introduction

Flood risk throughout the County has been characterised based on all available sources of information. This includes consideration of both primary (fluvial) flooding, as well as other secondary sources of flooding. Fluvial flood risk has largely been assessed using the Environment Agency's Flood Zones and detailed river model output.

As Rutland lies within the headwaters of tributaries for the Welland, Wreake and Witham, river systems can respond quite rapidly to rainfall and surface water runoff from relatively impermeable soils can lead to overland flooding of areas that do not appear on river flood maps. Therefore, as part of the preparation of the SFRA, an analysis was made of areas that may be potentially vulnerable to overland flooding through detailed mapping of drainage paths.

Rutland has two significant reservoirs, namely Rutland Water and Eye Brook Reservoir. Through well engineered design, risk of dam failure is minimal but a residual risk of flooding still remains.

Data on historical flooding from the Environment Agency, the Council and water companies has been captured in order to provide an indication of the varied nature of flood risk throughout Rutland.

3.2 Primary Sources of Flooding

3.2.1 Fluvial Flooding

Any watercourse poses a potential flood risk to both existing and future development. Floods may also be associated with obstructions to flow, such as constrictions at bridges or blockage of the channel and other structures by fallen trees or floating debris.

The majority of watercourses in Rutland drain into the River Welland which forms the southern boundary to the County. A small number of watercourses in the north west of the County drain into the River Wreake and an even smaller number in the northernmost part of the Country form the headwaters of the River Witham catchment. A history of flooding is well documented for the River Welland and for some of its key tributaries through Rutland. Table 3.1 summarises the main watercourses in the country along with the key flood risk issues associated with each watercourse.

Table 3.1 Fluvial Flood Risk in Rutland

Catchment	Principal Watercourses	Key Flood Issues
Main Welland	Welland	Extensive floodplain occupying largely agricultural land within Rutland. Large scale flooding occurred in 1947, 1975, 1998, 2000 and 2004.
Gwash	River Gwash, Barleythorpe Brook, North Brook.	Since 1975 Rutland Water has significantly reduced flooding on the Gwash. Localised problems remain on Barleythorpe Brook in Oakham due to culvert capacities. North Brook known to cause localised flooding in Greetham and Cottesmore. Ryhall is at risk of flooding from the Gwash.
Chater	River Chater, Mercott Brook	Settlements of Ketton and South Luffenham affected.
Eye Brook	Eye Brook	Caldecott at risk of flooding despite upstream Eyebrook reservoir. There are reports that this reservoir sometimes overtops.
West Glen	West Glen, River Tham, Holywell Brook	A combination of heavy rain and high groundwater levels can affect the village of Essendine.
Upper Wreake	Whissendine Brook, Langham Brook	Langham and Whissendine are prone to rapid flooding from their respective brooks.
Upper Witham	Fishpool Dyke	No recorded flooding.

Main River watercourses within Rutland are shown in Figure 3.1. In addition, there are many smaller watercourses some of which are not included in the Environment Agency's Flood Zones, illustrating the importance of considering smaller watercourses in site specific FRAs.

3.2.2 Fluvial Flood Risk

Flood Zones are defined within PPS25 and are datasets maintained by the EA and available to view online. Since their initial publication the Agency has worked with consultants to refine these maps through the commissioning of detailed hydraulic modelling projects The Flood Maps are updated every three months by the Environment Agency to reflect improved knowledge of the flood risk, particularly as a result of detailed modelling. For all main rivers within the Welland catchment the Flood Map is based on detailed model output from the Welland Catchment Strategic Model. Elsewhere, for non-main rivers the Flood Map data has been developed using broad scale techniques that may not accurately represent the flood risk at site specific level. Flood Maps do not include any flood defences that may be present.

Box 2 outlines the different Environment Agency Flood Zones.

Box 2 Introduction to the Environment Agency's Flood Zones

Flood Zone 1

This zone comprises land assessed as having a less than 1 in 1000 annual probability of river or sea flooding in any year (<0.1%).

Flood Zone 2

This zone comprises land assessed as having a 1 in 100 and 1 in 1000 annual probability of river flooding (1% 0.1) or between a 1 in 200 and 1 in 1000 annual probability of sea flooding (0.5% - 0.1%) in any year.

Flood Zone 3a

This zone comprises land assessed as having a 1 in 100 or greater annual probability of river flooding (>1%) or a 1 in 200 or greater annual probability of flooding from the sea (>0.5%) in any year.

Flood Zone 3b

This zone comprises land where water has to flow or be stored in times of flood. This Flood Zone is land which would flood with an annual probability of 1 in 20 (5%) or greater in any year.

Additional Information

- The Flood Zones are mapped using a 'no defences' scenario which has necessitated areas of floodplain know to be defended to be identified on the Flood Map as benefiting from defences.
- The Flood Zone extents, regardless of whether the area benefits from a defence, are used to determine when Flood Risk Assessments are required to support a planning application.

Figure 3.2 shows the extent of the various flood zones within Rutland. It should be noted that not all of these zones are derived from detailed model output. For non-main rivers the Flood Map data has been developed using broad scale techniques that may not accurately represent the flood risk at site specific level. As a default many of these unmodelled watercourses are based on the output of JFLOW modelling which is a two dimensional raster floodplain model that routes flows over a coarse underlying Digital Terrain Model (DTM). This modelling approach does not take into account structures in the floodplain such as bridges and culverts or contain any detail on channel geometry, all of which may have significant local effects on the extent and depth of flooding.

The JFLOW derived Flood Zones were produced as a national exercise and therefore provide a broad indication of fluvial flood risk within the above constraints. In areas where more detailed modelling is available the Flood Zones have been updated.

The Environment Agency Flood Zones do not provide any indication of flood risk due to minor watercourses (i.e. with catchments of less than 3 km^2) or other secondary sources of flooding including groundwater, overland flow and sewer flooding. These other flood risks have been characterised for Rutland as part of this SFRA. This includes additional mapping of areas potentially vulnerable to overland flow in upland areas, historic information on sewer flooding and identifying of areas that may be at risk from groundwater flooding.

Where development is proposed in or near the boundaries of the higher flood risk zones (i.e. Zones 2 and 3), more detailed modelling may be required as part of site-specific Flood Risk Assessments to determine the floodplain extent and design flood levels more accurately. Modelling also provides a means for investigating the effects of climate change on flood risk, an important aspect of the FRA for proposed development.

The Level 1 SFRA has identified the extent of Flood Zones in Rutland and they are presented as mapped output in Appendix A. For main rivers where a detailed hydraulic model is available, output from the model has been used to define the extent of Zone 3b (the functional floodplain) based on the 4% event (1 in 25 year return period). Modelled output has also been utilised to ascertain the increased risk of flooding resulting from the impacts of climate change.

3.3 Secondary Sources of Flooding

An analysis of overland flooding and the collation of historical flood records in Rutland have highlighted that in addition to fluvial flooding, other secondary sources of flooding can present significant flood risks to development. PPS25 also emphasises the need to consider these other sources of flooding both at the strategic and site level when planning development.

3.3.1 Groundwater

Raised groundwater levels caused by prolonged periods of rainfall can result in flooding. New springs may appear in locations previously thought to be safe. Groundwater may not be perceived to be a major factor contributing to flood risk, but over 1000 homes and businesses were affected in the UK in the winter of 2000/2001, mainly in the south of England and often associated with underlying chalk, a major water-bearing rock or 'aquifer'. Once groundwater flooding occurs, it may take a long time for groundwater levels to fall and flooding to abate.

Rutland contains significant groundwater flows in the east of the county corresponding to limestone and sandstone rock. This corresponds to a major aquifer area (Figure 3.3). If groundwater levels are high enough water from the ground may emerge as springs or and either flow overland or pond in depressions in the ground. However, such flooding is difficult to predict where and when it will occur as it depends on a number of different factors such as the local geology and topography. There are 11 groundwater monitoring boreholes in the east of the county with many of these located in close proximity to the West Glen as it cuts through the far east of the county near Essendine.

There are no records of groundwater flooding in the catchment and this is partly explained due to the difficulty in differentiating it from other types of flooding e.g. high groundwater levels can lead to a higher risk of overland flooding.

3.3.2 Sewer Flooding

Sewage and surface water drains pose a potential flood risk to development though a number of mechanisms. If stormwater flows exceed the capacity of the network water can pond or flow above ground rather than draining via sewers, potentially inundating property. Where sewage and surface water drains are not fitted with one way valves, there is also a risk of floodwater backing up through the drainage network potentially inundating properties. Blockages in the sewerage network can have the same effect, indeed sewer flooding can occur at any time, not only during meteorological flood events.

In addition to considering the risks of sewer flooding on planned development, the effects of the development and the resultant increase in sewage flows and surface water runoff must be considered. Inappropriately managed, increased flows could increase the flood risk both at the site and to downstream areas.

The majority of Rutland falls within the operating area of Anglian Water while a small part of the north west of the county lying within the operating area of Severn Trent Water. Both water companies have been consulted to identify areas at risk of sewer flooding in the county. Registers of flood incidents associated with the sewerage network are held by the water companies and have been obtained for this SFRA. Appendix B contains a list of incidents by street as at January 2008 and these are shown by location on Figure 3.4. This register is not a definitive picture of sewer flood risk in Rutland as it only records reported incidents and many go unreported. It is also subject to periodic updating as repair works and upgrades are carried out. In addition there may be other areas at risk under different meteorological conditions which have yet to flood, and new areas may be at risk from the effects of future urbanisation and/or climate change.

Nevertheless the database does give a useful indication of existing problem areas and highlights the importance of considering all sources of flooding when planning new development. Early consultation with the relevant water company is recommended so that potential risks to the development or issues associated with the additional load on the sewerage infrastructure can be identified at an early stage, and sewer flood risk appropriately managed.

3.3.3 Overland Flow

Overland flow is defined as water flowing over the ground surface that has not entered a natural drainage channel or artificial drainage system. Overland flow flooding is sometimes also referred to as pluvial flooding (i.e. derived direct from rainfall) or flooding from surface water runoff.

When the infiltration capacity of land is exceeded, excess rainwater flows overland; this water will collect in topographic depressions and at obstructions, and can adversely affect development downslope from it. Severe rainfall events, soils, geology and land management all contribute to and affect the severity of overland flow.

Rutland contains many upland areas that form the head of tributaries for the Welland, the Wreake and the Witham river systems. The west of Rutland in particular contains relatively steep topography overlain by clayey soils (Figure 3.5) which combines to promote catchments that are very quick responding to rainfall events (i.e. the rainfall tends to runoff as overland flow rather than infiltrating into the ground. Such overland flow can occur initially as sheet flow from areas such as fields before finding its way into local low points of watercourses.

New development on greenfield land can exacerbate the problem as areas that once allowed infiltration to the ground will infiltrate less once they have been built upon. Unless development is properly planned for and surface water runoff is controlled at source then the combined effect of many new developments can significantly alter the natural drainage pattern of a catchment through increased and more rapid runoff. PPS25 provides a mechanism for ensuring such effects are mitigated (e.g. through the use of measures such as SuDS) by requiring that when planning new developments, there must be consideration not only of the flood risks to the development itself but also the risks that the development poses to sites elsewhere.

A mapping exercise has been undertaken in this SFRA to identify potential areas that may be subject to overland flooding. A general conclusion is that this type of flooding is more prevalent in the west of the catchment (west of Rutland Water) due to the steeper topography

and clayey soils. However, overland flooding can occur almost anywhere within the catchment resulting from a heavy storm event with little or no warning time given.

The analysis is based on modelling exceedance flow (i.e. that flow that is in excess of the capacity of the piped surface water drainage network). It has been achieved by simulating an extreme rainfall event over upland catchments and allowing to water to flow over a digital terrain model. Full details are provided in Appendix C. The output is in the form of a map which shows potential overland flow routes in the manner of a river network. However, in addition to river channels the output also contains potential flow routes that are usually dry and indicates where local low points lie in the terrain that may be subject to ponding. An overview map showing potential overland flow routes on a county wide scale is shown in Figure 3.6. This map has been used to help inform the Level 2 SFRA.

3.3.4 Residual Risk from Reservoirs

The County of Rutland contains two significant reservoirs namely Rutland Water and Eye Brook Reservoir. On 1 October 2004 the Environment Agency took over responsibilities for enforcement of the Reservoirs Act 1975. This Act applies to raised reservoirs holding over 25 000 cubic metres of water above natural ground level. Generally risk of dam failure is considered extremely low but failure could have major consequences, including loss of life. Under the Water Act 2003 there is a requirement for reservoir undertakers to prepare reservoir flood plans which will need to include a map identifying the extent and severity of flooding resulting from an uncontrolled release of water. This is likely to become a legal requirement in 2009. Such maps are currently not available within the public domain although this situation is likely to change.

Rutland Water was constructed in 1975 and is a water supply reservoir managed by Anglian Water under the Reservoirs Act. Since its construction its large storage capacity has been shown to significantly attenuate flood flows. This has had the beneficial effect of reducing flood risk downstream of the dam along the lower Gwash. There remains a very small probability of downstream flooding due to overtopping of the dam or a dam breach. Should such a breach occur the consequence could be very high hence the risk (as defined by probability x consequence) could be significant.

Anglian Water has produced inundation maps for Rutland Water in the event of a dam breach but in line with security guidance these are not currently available to the public. It does however approximately show a 0.5-1.0 km wide swath of flood water centred on the River Gwash which propagates downstream and may also back up the North Brook.

Eyebrook reservoir was built during the 1930's to supply water to steel works at Corby. It has a surface area of 1.6 square kilometres and average depth of 5 metres with a maximum depth of 14 metres. It is currently owned by Tata Steel (formally Corus) and is underutilised therefore providing little spare capacity for attenuating flood flows downstream. There are plans to use the reservoir for water supply which will result in lower reservoir levels and greater scope for flood attenuation.

Residual risk from reservoirs is considered further as part of the Level 2 SFRA.

3.3.5 Blockage of Artificial Drainage Systems

Where watercourses have been piped or culverted there is risk of blockage as well as a risk that the capacity may be insufficient to convey peak flows. Flooding can occur due to backing up of culverts so that the water overflows the channel and follows the lowest topography overland. Culvert collapses, fallen trees, cars and skips are common causes of blockage. Lack of an appropriate trash screen at the culvert entrance exacerbates the risk of flooding. Where a specific problem exists, there may be scope to reduce the risk by increasing the capacity to convey peak design event flood flows. Regular maintenance also minimises the potential for blockages to occur. Urbanised watercourses where these risks are high have been identified in Section 5.2 and shown on figures in Appendix A. Measures and policies to mitigate, manage and reduce the risk are also included in Section 5.2.

3.4 Climate Change

3.4.1 General Guidance

Over time, climate change could have a significant effect on flood risk, as it is expected to cause winters to become wetter and summers to become drier. The insurance industry has warned that premiums could rise as flood prone properties become more difficult to protect, and some properties may be unable to obtain insurance against flood altogether. Climate change effects could mean that extreme weather events such as droughts, floods and storms could become more common. For the East Midlands, the UK Climate Impacts Programme (UKCIP) model predicts:

- By 2050, there could be up to a 13% increase in winter rainfall;
- By 2050, there could be up to an 18% decrease in summer rainfall.

For extreme rainfall events, precipitation could increase by 40% in winter months and, whilst overall summer rainfall is expected to decrease, there could be an increased likelihood of more intense summer storms. This could potentially be exacerbated by urban heat island effects. Due to wetter winters, groundwater levels could increase in winter months, potentially exacerbating groundwater flooding problems in prone areas. PPS 25 (Paragraph B9) recommends that there be an allowance for up to a 20% increase in peak river flows by 2050, and up to 30% by 2110 to account for the potential effects of climate change based on current guidance.

Increased storminess and higher peak rainfall values will also cause increases in runoff. Water companies have indicated that, under such scenarios, the current design standard for surface water drainage sewers will need to take climate change into account. PPS 25 (Paragraph B10) recommends that there be an allowance for up to a 10% increase in rainfall intensities by 2050, and up to 15% by 2110 to account for the potential effects of climate change based on current guidance.

3.4.2 Climate Change and Development Planning

PPS 25 requires that flood risk and its mitigation are assessed for the lifetime of any proposed development. The Sequential Test guides new development to areas of low flood risk, i.e. Zone 1. However, where development is proposed for the higher risk flood zones, the climate change guidance provided in PPS 25 should be used to assess the effect of climate

change on flood risk posed to new development, and to ensure the robustness of any mitigation measures.

Within well defined flood plains such as along the main River Welland climate change has the potential to greatly increase flood extents. The generally flat nature of the land means that a small increase in water levels can result in flooding over a large area. In upland areas where watercourses are generally located in well defined narrow valleys between steep slopes any increase in rainfall as a result of climate change is likely to increase depths and velocities of floodwater rather than resulting in any significant change in extents. One way of mapping areas where climate change might cause the most lateral expansion of inundation is to compare Flood Zones 2 and 3 to see how rarer, more extreme flows affect the floodplain extents. This comparison is shown in Figure 3.7.

Mapping this increased risk in upland areas is not so easy, especially if no hydraulic modelling exists. Indicative upland drainage paths have been mapped as part of this SFRA. The likelihood and severity of flood events occurring on these paths is increased due to an increase in extreme storms as a result of climate change. Where required, an assessment of the potential effect of climate change on runoff and associated flood risk, and testing of mitigation measures for robustness, should be dealt with in a site specific FRA based on the guidance provided in PPS 25.

3.5 Land Use

Land use and land use change may have a more immediate effect on the hydrology of a catchment, where step-changes in land use effect changes in the catchment's responsiveness to rainfall events. The frequent location of development and urban areas in valley bottoms near major rivers often leaves them vulnerable to the effects of land use change in the upper catchment. The implications will depend on the extent of the land use change and the type of catchment (i.e. its geology, topography and the hydraulic connectivity of its watercourses, which largely affects catchment response. The flow data and flood records available for Rutland indicate that water levels in its watercourses rise quickly in response to rainfall events. Broadly speaking, land use change can be divided into two categories:

1. Change in agricultural land use or agricultural practices;

2. Conversion from rural to urban land use.

Because a large proportion land in Rutland is used for agricultural purposes, small changes in agricultural land use practices could have a significant effect on the proportion of rainfall that is intercepted by vegetation, infiltrated into the soil (and underlying aquifer), or runs off as overland flow to watercourses. Where runoff presents local flooding problems, there may be potential for various mitigation measures and practices to be put in place in agreement with farmers and land owners to reduce peak runoff rates.

In the case of increasing urbanisation, SuDS systems have been developed as a way to manage drainage to mimic the natural (greenfield) runoff regime. The implementation of SuDS systems in new developments is instrumental in ensuring that flood risk is not adversely affected by the planned development. This should be enforced at the development planning stage through PPS 25.

Flood mitigation measures are discussed further in Section 4.

480000
490000
500000
310000
300000
N
Whissendine
Ashwell
Cottesmore
Greetham
Exton
Langham
Ryhall
NORTH BROOK
RIVER WEST GLEN
Barleythorpe Brook
RIVER GWASH NORTH ARM
RIVER GWASH
Oakham
Empingham
Great Casterton
Braunston
RIVER CHATER
Edith Weston
Manton
Ketton
RIVER CHATER
Wing
MORCOTT BROOK
Belton-in-Rutland
Morcott
Uppingham
BISBROOKE BROOK
EYE BROOK
Caldecott

Key:

Rutland Boundary

Main River

Elevation

High : 214m AOD

Low : 10m AOD

0 0.5 1 2 3 4 Kilometres

Scale: 1:100,000 @ A3

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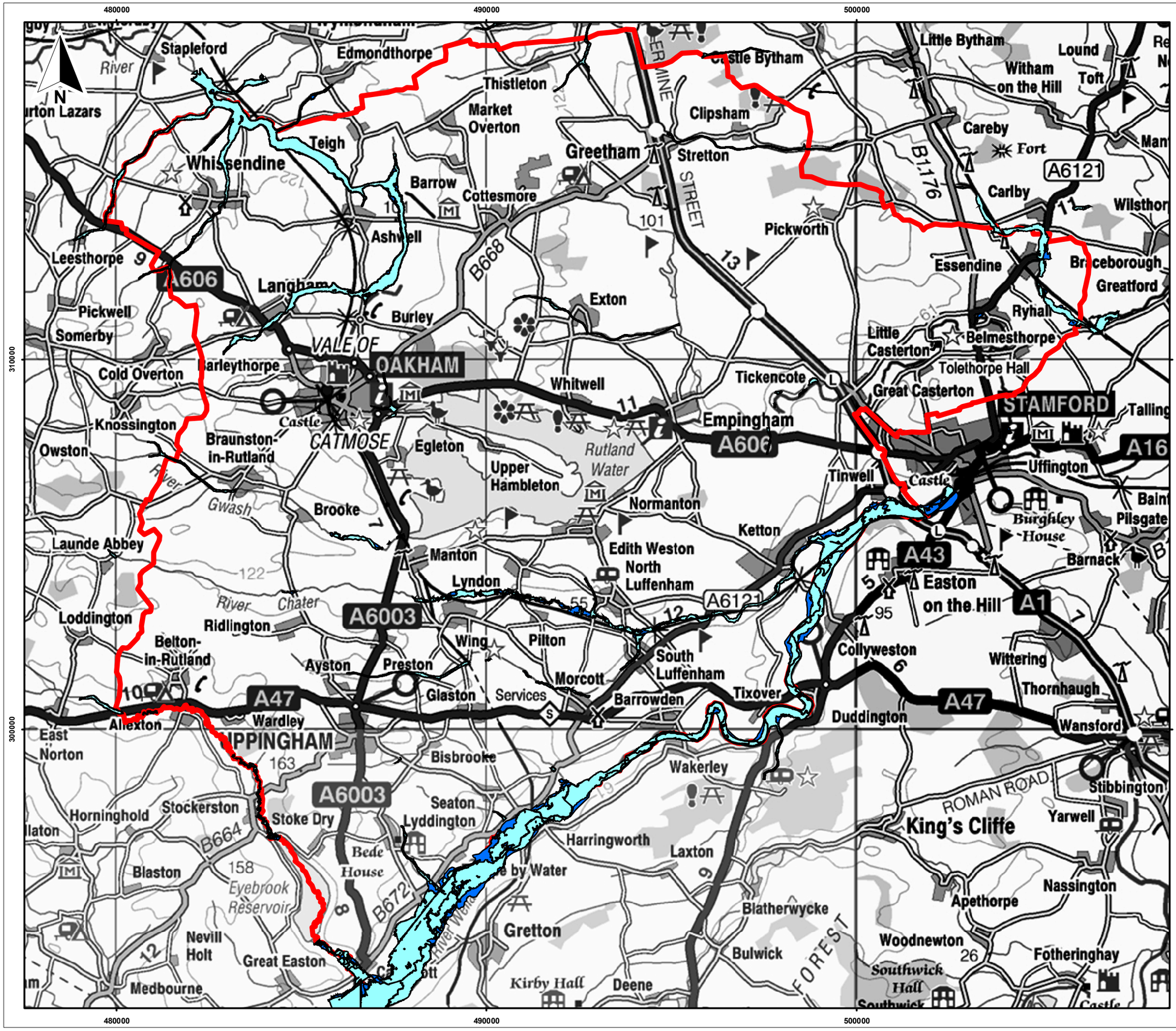
Fig_3.1_Main_Rivers.mxd

Rutland SFRA

Figure 3.1
Main River/Topography

March 2008
22153-S17 rodgb

Entec



Key:

- Rutland Boundary
- Flood Zone 3
- Flood Zone 2

Scale: 1:100,000 @ A3

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Rutland SFRA

Figure 3.2
Flood Zones

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Entec

480000 490000 500000

310000

300000

N

Whissendine
Ashwell
Greetham
Cottesmore
Essendine
Exton
Langham
Ryhall
Oakham
Great Casterton
Empingham
Braunston
Edith Weston
Manton
Ketton
Wing
Belton-in-Rutland
Morcott
Uppingham
Caldecott

Key:

Rutland Boundary

Aquifer Type/Leaching Potential

- Major - High
- Major - Intermediate
- Major - Low
- Minor - High
- Minor - Intermediate
- Minor - Low

0 0.5 1 2 3 4 Kilometres

Scale: 1:100,000 @ A3

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Fig_3.3_Groundwater.mxd

Rutland SFRA

Figure 3.3
Groundwater

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480000 490000 500000

310000 300000

N

Whissendine Brook
Whissendine
Various

Main Street

Greetham

Whissendine

Ashwell

Cottesmore

Langham Brook
Langham
08/2007; 01/2008

Barleythorpe Brook
Schofield Road
January 2008

Essendine

Exton

Langham

Ryhall

Main Street,
Lower Farm Close

Spey Drive

Great Casterton

Empingham

Oakham

Main Road

Braunston

STAMFORD

Rutland Water

Edith Weston

Manton

Ketton

Wing

River Chater
Ketton
11/2000

Belton-in-Rutland

North Street East

Morcott

Uppingham

Seaton Road

Station Road

Newtown
Road

Caldecott

480000 490000 500000

Based upon the Ordnance Survey Map with the permission of the Controller of Her Majesty's Stationery Office. © Crown Copyright. AL100018056

Key:

- Rutland Boundary
- Easter 1998 Flood on River Welland
- DG5 Sewer Flooding Records
- Known historical flood locations

0 0.5 1 2 3 4 Kilometres

Scale: 1:100,000 @ A3

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Fig_3.4_Historical.mxd

Rutland SFRA

Figure 3.4
Historical Flooding

March 2008
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480000
490000
500000
310000
300000
N
Whissendine
Ashwell
Cottesmore
Greetham
North Brook
Essendine
West Glen
Exton
Langham
Ryhall
Barleythorpe Brook
Oakham
North Gwash
Empingham
Great Casterton
R Gwash
Braunston
South Gwash
Edith Weston
Manton
Ketton
R Chater
Wing
Belton-in-Rutland
Morcott Brook
Morcott
R Welland
Uppingham
Bisbrooke Brook
Seaton Brook
Eye Brook
Caldecott
Key:
Rutland Boundary
Main River
Water
Loamy Soils
Clayey Soils
0 0.5 1 2 3 4 Kilometres
Scale: 1:100,000 @ A3
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Rutland SFRA
Figure 3.5
Soils
March 2008
22153-S21 rodgb
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480000
490000
500000
310000
300000
N
Whissendine
Ashwell
Greetham
Cottesmore
Essendine
Exton
Langham
Ryhall
Oakham
Great Casterton
Empingham
Braunston
Edith Weston
Manton
Drainage Paths not derived for lowland catchment area as drainage routes are well established by watercourses.
Wing
Belton-in-Rutland
Morcott
Uppingham
Caldecott

Key:

Main River

Indicative Drainage Path Definition

Low

Medium

High

0 0.5 1 2 3 4 Kilometres

Scale: 1:100,000 @ A3

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Fig_3.6_Drainage Paths.mxd

Rutland SFRA

Figure 3.6
Indicative Upland Drainage Paths

March 2008
22153-S22 rodgb

Entec

480000 490000 500000

310000 300000

N

Typical increase in levels of 0.02m

Typical increase in levels of 0.26m

Typical increase in levels of 0.08m

Typical increase in levels of 0.04m

Typical increase in levels of 0.16m

Typical increase in levels of 0.1m

No predicted increase

Typical increase in levels of 0.06m

Typical increase in levels of 0.12m

Typical increase in levels of 0.09m

Typical increase in levels of 0.09m

Typical increase in levels of 0.27m

Typical increase in levels of 0.02m

Typical increase in levels of 0.06m

Whissendine
Ashwell
reetham
Cottesmore
Essendine
Exton
Langham
Ryhall
Oakham
Empingham
Great Casterton
Braunston
Edith Weston
Manton
Ketton
Wing
Belton-in-Rutland
Morcott
Uppingham
Caldecott

This map highlights areas potentially vulnerable to increased frequency of flooding from climate change. Areas shown in purple are currently not deemed to lie within the 1 in 100 year flood extent but may flood with greater frequency as a result of climate change.
Indicative changes in 100 year flood levels with and without climate change are given for selective modelled locations.

Key:

- Rutland Boundary
- Flood Zone 3
- With Climate Change

0 0.5 1 2 3 4 Kilometres

Scale: 1:100,000 @ A3

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Rutland SFRA

Figure 3.7
Climate Change
Areas at Increased Flood Risk

March 2008
22153-S23 rodgb

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4. Flood Risk Mitigation

4.1 Introduction

The Level 2 SFRA applies the PPS 25 Sequential Test to areas of search to assess their suitability for development with respect to flood risk. It is likely that the majority of land marked for potential development lies outside of the floodplain in Zone 1 (i.e. low probability of flooding from rivers).

Even though PPS 25 directs planned development towards Zone 1, there will be occasions where planning permission is sought for development in the higher risk flood zones, for example with respect to redevelopment of brownfield sites in line with sustainability objectives. Furthermore, development in Zone 1 must still consider other flood risks, particularly secondary sources of flooding and the potential impact that the development's drainage and surface water runoff may have on flood risk elsewhere.

When planning development, flood mitigation measures should be considered as early as possible in the development process to reduce and manage the flood risks associated with development.

4.2 Catchment Policy

The River Welland Catchment Flood Management Plan (CFMP) identifies Policy Units to which generalised flood risk management polices are attributed. The County of Rutland is covered by three Policy Units:

- Policy Unit 1 - Upper Tributaries;
- Policy Unit 2 - Welland and Glens;
- Policy Unit 5 - Oakham.

The flood risk management policies attributed to these Policy Units are to 'Reduce existing flood risk management actions' for Policy Units 1 and 2 and to 'Continue existing actions' for Policy Unit 5.

Whilst these are generalised policies applied at a strategic level any flood mitigation works considered should take into account these policies and review if such mitigation works are sustainable in the long term.

4.3 Drainage

All planned development, whether in the floodplain or not, must consider the implications for its drainage on flood risk. In particular, this applies to development of greenfield sites, for which the significant increase in impermeable area can considerably increase runoff volumes and rates from the site. A strategic approach to the drainage of new urban areas is likely to increase the

effectiveness and efficiency of the drainage and flood risk management proposals, and reduce the flood risks associated with new development.

The Environment Agency require that for all new developments surface water is limited to Greenfield rates and this applies for all events up to the 1 in 100 year inclusive of climate change on site. For brownfield sites the Environment Agency seek to obtain a betterment of 20% from the existing situation.

4.3.1 Integrated Drainage Strategy

Opportunities for developing an Integrated Water or Drainage Management Strategy such as a Surface Water Management Plan across development site boundaries is recommended, and ideally a catchment-led approach should be adopted. This has been recognized in the recent consultation paper by DEFRA, *Making Space for Water*. Experience shows that integrated approaches often lead to a much more efficient and reliable surface water management system at a comparatively lower cost because it enables a wider variety of potential flood mitigation options to be used, and a better overall design can be achieved. Integrated management of surface water has potential benefits in addition to flood risk, and can include improved water quality through the use of SuDS (see next section) and reduce water demand through grey water recycling/rain water harvesting. In Rutland, once the preferred area(s) of search have been selected, consideration should be given at an early stage to the best way to manage drainage to maximise benefits.

4.3.2 Sustainable Drainage Systems (SuDS)

PPS 25 requires that new development does not exacerbate flood risks elsewhere, resulting in a need to control drainage and runoff to ensure there are no increases in overland flow as a result of the development. SuDS are designed to prevent new developments generating additional runoff. When considered at the planning stage, they can be implemented to reduce flood risk to downstream areas.

> *"The philosophy of SuDS is to replicate as closely as possible the natural drainage from a site before development… so reducing the impact on receiving watercourses. This requires a reduction in the rate and volume of runoff from developments..."*[7]

The ability to appropriately manage surface water from a development site should be demonstrated in any FRA. Specifically, CIRIA guidance on SuDS states these potential benefits[8]:

- *"Lowering peak flows to watercourses or sewers, thereby reducing the risk of flooding downstream;*
- *Reducing volumes and frequency of water flowing directly from developed sites to watercourses or sewers, to replicate natural land drainage and reduce flood risk;*

[7] *Sustainable Drainage Systems,* CIRIA Report C609, 2004.

[8] *Sustainable Drainage Systems,* CIRIA Report C609, 2004.

- *Improving water quality over conventional surface water sewers by removing pollutants from sources such as cleaning activities (vehicles, windows), wear from tyres, oil leaks from vehicles or atmospheric fallout from combustion (in rural areas this can include runoff from fields where fertilisers and biocides are used);*
- *Improving amenity through the provision of features such as wildlife habitat;*
- *Reducing the number of times that combined sewer overflows (CSOs) operate and discharge polluted water to watercourses;*
- *Replicating natural drainage patterns so that changes to base flows are minimised;*
- *Finally, by increasing base flow to watercourses (through slow release of water).”*

SuDS techniques have been successfully used in the UK and abroad for over 20 years, with techniques that can be used in both impervious and pervious catchments. A detailed description of individual techniques is given in the CIRIA guidance.

To maximise benefits and minimise costs, SuDS should be incorporated at the feasibility stage of a planned development, rather than being inserted later on as an afterthought. SuDS incorporated into developments can provide an attractive high-quality urban environment, with no increase in off-site runoff above greenfield levels.

Figures 3.3 and 3.5 (Groundwater and soils) can be used to gain an understanding as to the likely applicability of SuDS. These figures show that for the western half of the County there are minimal groundwater reserves due in large part to the clayey soils present in these upland areas. In such locations the use of infiltration is unlikely to be a viable option and other attenuation measures to control runoff such as long term storage are likely to be more appropriate. In the eastern half of the County the soils are loamy in nature and contain some major aquifers. In such locations infiltration SuDS are likely to be feasible but site specific investigations should be carried out to ensure that there is adequate depth of soil between the base of an infiltration device and the groundwater table. Such investigations should also consider the risk for contamination of groundwater from brownfield sites.

Retrofitting of SuDS to existing developments can be considered as a flood alleviation measure in certain particular problem areas. SuDS will not, however, protect an area from flooding due to upstream causes (such as overland flow from an upstream catchment or runoff from upslope developments).

As with all drainage systems, SuDS systems will only perform as well as they are designed and maintained. ‘Whole life costs’ associated with SuDS (i.e. taking into account their environmental benefit and runoff management) compare favourably with conventional urban drainage systems[9].

It is particularly important to define a suitable management and maintenance regime - with responsibilities clearly defined - for SuDS schemes throughout the design life of the development.

[9] *Sustainable Drainage Systems*, CIRIA Report C609, 2004.

4.4 Agricultural Runoff

Most of the countryside in Rutland is used for agriculture. Upstream catchments can generate significant overland flows that pose a flood risk to development downslope. Where this is the case, measures can be implemented to manage runoff and reduce risks. At a strategic level, this can occur through the identification of and incorporation of agricultural land into schemes such as DEFRA's Environmental Stewardship Scheme (ESS) allowing surface runoff to be reduced through improved management practices. Examples of these practices include:

- Buffer strips;
- Counter ploughing;
- Reduced stocking levels;
- Detain excess flows in throttled depressions;
- Reduced autumn sowing of grain crops;
- Improvements to hedgerows, ditches and gate locations.

These methods can all reduce the volume of agricultural runoff reaching watercourses, or flowing overland into developed areas. In areas such as western Rutland with large areas of impermeable geology this approach could contribute significantly to a reduction in flood risk.

4.5 Flood Resistance and Resilience

Where buildings must be located in areas with medium to high levels of flood risk, the incorporation of flood resistance and resilience at the design stage can reduce the impacts should inundation occur. Standard measures include the provision of a minimum freeboard above ground or predicted flood level, and the use of resilient fixtures and fittings within. CIRIA and the Association of British Insurers (ABI) produce guidance on suitable measures of flood protection. Flood resistance measures include:

- Buildings constructed with extra freeboard to be above the flood level;
- Fitting one way valves to sewage pipes, or the use of temporary bungs;
- Sump and pump systems to remove water from buildings faster than it enters;
- Temporary door or air vent flood boards to stop the entry of flood water.

Flood resilience measures include:

- Use of concrete floors rather than timber;
- Design of buildings such as townhouses with lower floors occupied by garages and utility areas, minimising the damage caused when flooded;
- Location of boilers, and electrics above the possible flood level;
- No chipboard or MDF, instead using plastic and metal alternatives;
- Lime plaster with a cement render rather than conventional gypsum based plasters.

Retrofitting flooded properties during the repair procedure with these is common practice. These measures are not necessarily more expensive than conventional techniques, but will significantly reduce the damage, cost and time to repair if properties are flooded.

4.6 Flood Warnings

The Environment Agency provides flood warnings in Rutland for fluvial flooding on the following watercourses:

- Rivers Chater, Gwash and their tributaries including Ketton;
- River Welland and its tributaries between Market Harborough and Stamford.

In addition, the Environment Agency issues a more generalised warning of flood risk for the River Welland.. This warning may give some notice of a risk of flooding for watercourses across the County.

The Environment Agency flood warnings cannot provide advance notice for all forms of flooding. Warnings do not give advance notice of flooding from small watercourses, overland flow, groundwater or flooding due to structural failures or culvert blockages. Intense rainfall events may also generate localised and severe rapid onset floods that are very difficult to predict.

The Agency's flood warnings are provided for existing developments at risk from flooding. They should not be considered as a mitigation measure for new and planned developments.

4.7 Dry Access

Any flood risk assessment must consider the need for suitable dry access/evacuation routes from a site. This should be above the level of the 1 in 100 year flood inclusive of climate change.

4.8 Future Proofing

It is important that new developments, particularly in the higher risk flood zones, are designed in a precautionary manner, given the possible range of potential climate change impacts that may occur. Proposed flood mitigation measures should be reviewed at the detailed FRA stage, paying particular attention to the potential implications of future changes in climate and land use. The application of the precautionary principle and the provision of freeboard and flood resistance and resilience in buildings can mitigate future increases in flood risk at relatively low cost at the design and construction stage.

4.9 Other Measures

Measures to mitigate the risks of flooding both to and from development are not necessarily limited to those above. Depending on the specific risks relating to a site, the following investigations/options may need further consideration at the detailed FRA stage of development planning:

- Flood resistance/resilience measures specific to the potential for groundwater flooding;
- Management of surface 'run-on' (i.e. overland flow and runoff entering the site from upslope areas) as part of the development's drainage strategy;

Maintenance/improvement of watercourses, culverts, drains and sewerage networks to reduce associated flood risks.

5. Level 2 SFRA

5.1 Introduction

The Level 1 SFRA was a desk based study considering flood risk on a county wide scale across Rutland. All sources of flood risk were considered and the key output is a series of maps delineating zones of flood risk which form the basis of aiding the application of the Sequential Test.

Although the SFRA has shown that there is the potential for quite extensive flooding along the main River Welland this does not constitute a major risk to existing development as there are minimal receptors in the floodplain. Much of Rutland is located in upland areas with many small watercourses in well defined channels. As such, Flood Zones are limited in extent and it is likely that there is sufficient room for new development to be located outside of higher risk Flood Zones.

The principal purpose of a Level 2 SFRA is to facilitate the application of the Exception Test. Although it is thought unlikely that this test will need to be applied on a large scale, a more detailed study of flood risk will be undertaken in key potential development areas. It is possible that the Exception Test may be required for occasional development applications within Zones 2 and 3 such as windfall sites.

The two key development areas are Oakham and Uppingham and were identified in the project brief. Development allocations are to be informed by the results of this SFRA and potential areas based on circular search areas of 1.5 km and 1 km radius have been specified around Oakham and Uppingham respectively. Within these areas flood risk will be looked at in greater detail. In addition general guidance has been provided on development in smaller villages outside of the search radii.

Further work has also been carried out with respect to residual risk in the event of failure of flood defences or other infrastructure such as dams. This assessment will focus on areas proposed for new development.

5.2 Flood Risk in Oakham

Oakham is the principal town in the County of Rutland and a number of small watercourses flow through and close to the town before entering Rutland Water reservoir. The upstream catchment areas of these watercourses are relatively small and as a result peak flows generated from extreme storms are unlikely to be large. However, flooding can result from the blockage of culverts or be exacerbated by increased runoff from large developments. In addition, the geology underlying Oakham consists largely of Jurassic Lias Clays and Marlstones. Clays are present particularly in areas upstream of Oakham. The relatively impermeable nature of the geology gives rise to rapid runoff following heavy rain. This means that little, if any, advance warning can be given for potential flood events in Oakham.

The adopted approach has been to sub-divide the town by drainage catchment area and then assess the level of risk on a catchment-by-catchment basis. Development can then be considered and prioritised according to the level of risk. In total six zones have been defined for Oakham, namely

- North Oakham (4.6 km^2);
- Barleythorpe (3.4 km^2);
- Oakham Central (1.1 km^2);
- Oakham South Upstream (4.3 km^2);
- Oakham South Downstream (1.1 km^2);
- Egleton (3.7 km^2).

The catchment areas are shown in Figure 5.1 and are assessed in turn in the following sections.

5.2.1 North Oakham

Description

The north Oakham boundary is based on the catchment area of a small unnamed rural watercourse that drains largely agricultural land to the north of the town before joining Barleythorpe Brook and eventually flowing into Rutland Water. The catchment area down to the confluence with Barleythorpe Brook is estimated at 4.6 km^2 and most of this land is relatively flat with underlying Marlstone bedrock. Soils consist of slowly permeable, seasonally waterlogged clays and fine loams. Remnants of the disused Oakham canal which once connected Oakham with Melton Mowbray lie within the catchment although parts of it are currently infilled. Other than a relatively small out of town retail park located close to the watercourse alongside Burley Road there is little other development in the catchment area.

Development Pressure

The southern boundary of the catchment is located in close proximity to the Oakham Bypass and due to advantageous transport links the area may be subject to moderate development pressure.

Constraints

Flows in the unnamed watercourse are unlikely to be large due to the small upstream area and flat nature of the catchment. The overland flow analysis indicates that there are unlikely to be any significant problems with overland flooding in the area although some isolated areas may be subject to ponding and will require robust surface water drainage strategies if they are to undergo development. The unnamed watercourse flows under two main roads into Oakham but the capacity of these bridges is not thought to be a limiting factor. In line with good practice any developments should limit runoff to greenfield rates but it is thought that issues of flood risk are not a limiting factor to development in this zone.

As for all new developments the masterplanning should allow space for accommodating runoff in excess of the design capacity of the drainage network, whether derived from the development itself or from overland flow running onto the development. SuDS should be used to attenuate

additional runoff generated from increasing the impermeable area on development sites. Infiltration techniques are unlikely to be feasible due to the clayey nature of the underlying soils. However SuDS features such as wet ponds, detention basins and wetlands may be used to achieve attenuation to greenfield rates. Section 4 contains some generic advice on SuDS and further information can be found in CIRIA C697 - The SuDS Handbook.

5.2.2 Barleythorpe Brook

Description

Named after the watercourse that drains this catchment, the Barleythorpe Brook boundary contains a catchment area of some 3.4 km^2 which drains largely agricultural land upstream with relatively impermeable clayey soils and an urban portion of Oakham at its downstream end. The middle of the catchment drains a significant developed area consisting of large industrial units with further development planned at Hawksmead through the LDF process. The watercourse is constrained by embankments as it runs through the north east of Oakham and it passes through numerous culverts before passing under the A606 Burley Park Way and joining the unnamed watercourse draining land to the north (North Oakham Catchment). The watercourse is subject to numerous surface water inflows from the newly built housing estates that flank its lower reaches. There is a small attenuation basin for excess floodwater on land adjacent to Schofield Road which is designed to come into operation if the culvert under Schofield Road blocks and the water level backs up. The effectiveness of this attenuation basin is questionable as it was reported that in January 2008 a flood event on this watercourse resulted in high levels in the channel but the attenuation basin did not function. It is believed that maintenance of this attenuation basin currently lies with a private developer and failure of this basin to operate should be investigated further and should be considered as part of any Surface Water Management Plan for the area. There are other offline attenuation storage measures in place to deal with surface water runoff from the large units centred around Lands End Road. The watercourse has been hydraulically modelled as part of the Welland Catchment Improvements Strategy. The modelling showed no flooding for the 100 year plus climate change model run in Oakham. However this was modelled assuming all culverts were free from blockage.

Development Pressure

This is an area subject to considerable development pressure especially in the middle reaches of the watercourse between the railway line and Main Road. Recent development has occurred on land in the east of the Barleythorpe catchment which was allocated for employment in the Rutland Local Plan. Approximately 1 000 new dwellings are proposed for the Hawksmead area which are being promoted through the LDF process. The recently constructed Oakham Bypass is likely to add to this pressure with potential for business parks.

Constraints

The capacity of existing culverts and issues of culvert blockage are critical factors in assessing flood risk in this catchment. The culvert under Schofield Road appears particularly vulnerable despite the small attenuation basin alongside the southern bank of the watercourse. Blockage of this culvert is likely to result in flooding of properties along Schofield Road. Responsibility for the maintenance of this culvert currently lies with a private developer as at the time of writing the road has not yet been adopted by the Council. If and when the road becomes adopted responsibility for ongoing maintenance should be clearly agreed between the developer, the

Council and the Environment Agency. The upstream catchments ability to naturally attenuate flows through methods such as infiltration and surface storage is being reduced through on-going development in the area. Uncontrolled runoff from large impermeable areas is likely to significantly exacerbate flood risk in the downstream residential part of the catchment. Even if peak runoff rates are limited to greenfield rates it is likely that an increased volume of water will end up in the watercourse as attenuation ponds continue to discharge the water after the storm has receded. This will result in an artificially increased baseflow during the period following heavy rainfall events which in turn will reduce the capacity of the channel to convey flood flows in the event of further heavy rainfall. In the case of culvert blockages the volume of water becomes critical as room then has to be found for it on developed floodplains where there is no space.

The clayey nature of the soils in the catchment precludes the use of infiltration techniques to manage surface water runoff. Whilst discharge of surface water to open watercourses remains preferable to discharges into sewers, strict limits on flows discharged to Barleythorpe Brook will need to be set if more development is planned for this catchment. This could be achieved through the use of various other source control methods such as rainwater tanks, grassed swales, detention basins and constructed wetlands. As a minimum both peak flows and volumes should be attenuated to greenfield rates and ideally a reduction from greenfield rates should be sought to help compensate for existing runoff to the watercourse from impermeable areas elsewhere. Section 4 contains some generic advice on SuDS and further information can be found in CIRIA C697 - The SuDS Handbook.

As for all new developments the masterplanning should allow space for accommodating runoff in excess of the design capacity of the drainage network, whether derived from the development itself or from overland flow running onto the development.

Plate 5.1 a) Schofield Road Culvert and b) Attenuation Basin

5.2.3 Oakham Central

Description

This small catchment drains the central portion of Oakham. A watercourse is only visible towards the downstream end of this catchment and it is thought that most of the surface water in the upstream part of the catchment finds its way into the piped urban drainage network. The catchment has an area of 1.1 km^2 and has been delineated to a point just beyond the sewage treatment works where the small watercourse joins Barleythorpe Brook. The majority of the catchment is urbanised. The sewage treatment works discharges treated effluent into this watercourse at the downstream end. There is an existing attenuation basin in a field near to the downstream end of this watercourse. It is assumed that this is for the purpose of attenuating surface water runoff from the adjacent housing estate.

Development Pressure

The catchment is already considerably developed and is unlikely to be subject to further development other than a small degree of infill and changes of use. It is possible that some development may occur at the upstream end of the catchment where there is a greater proportion of open space.

Constraints

There are potential drainage constraints to development in this catchment set by the high percentage of existing urban development. The main challenge will be in finding ways to deal appropriately with excess runoff to satisfy the requirements of PPS25. The watercourse is only present in the downstream part of the catchment making it difficult to connect directly to it from the upstream end. It is likely that the sewer network is at or near capacity meaning that surface water runoff may need to be retained on site in engineered storage ponds or other such devices allowing infiltration to slowly drain the water away. Flood related constraints will largely be based around managing runoff from any potential developments and ensuring that this does not run-on to nearby properties. The capacity of the downstream watercourse is not thought to be an issue provided that flows are attenuated to greenfield rates. This is due to the presence of open land alongside the channel and only two structures crossing the channel, Tolethorpe Close road bridge and Burley Park Way road bridge both of which are unlikely to have capacity issues at high flows.

The broad-scale overland flow assessment has revealed no significant problems in this catchment with the exception of some isolated areas that may be subject to surface water ponding. They are located in existing fields and if they are ever to be developed a flood risk assessment will need to assess the risk of ponding.

As for all new developments the masterplanning should allow space for accommodating runoff in excess of the design capacity of the drainage network, whether derived from the development itself or from overland flow running onto the development. SuDS should be used to attenuate additional runoff generated from increasing the impermeable area on development sites. Infiltration techniques are unlikely to be feasible due to the clayey nature of the underlying soils. However SuDS features such as wet ponds, detention basins and wetlands may be used to achieve attenuation to greenfield rates. Section 4 contains some generic advice on SuDS and further information can be found in CIRIA C697 - The SuDS Handbook.

Plate 5.2 Unnamed Watercourse Draining Part of Oakham Central

5.2.4 Oakham South Upstream

Description

This catchment drains into the north arm of the River Gwash and has been delineated as far downstream as the bridge under Uppingham Road. The catchment area is estimated at 4.3 km^2 and includes much of the town of Oakham as well as agricultural land bordering the town. There are a number of culverts conveying flow beneath roads as the watercourse runs through Oakham. There are also numerous surface water discharges into the watercourse in Oakham.

Development Pressure

There may be some development pressure on the outskirts of Oakham but this is likely to be remote from this part of the town so it can be located closer to the bypass.

Constraints

It is likely that any potential development in the area will be on the periphery of the town and as a result any surface runoff into nearby watercourses would then have to be conveyed through the town through an already constrained channel.

Whilst discharge of surface water to open watercourses remains preferable to discharges into sewers strict limits on flows discharged to the North Gwash are to be recommended if more

development is to occur in this catchment. As a minimum both peak flows and volumes should be attenuated to greenfield rates and ideally a reduction from greenfield rates should be sought to help compensate for existing runoff to the watercourse from impermeable areas elsewhere.

The analysis of overland flow suggests the presence of overland flow pathways in locations where development could be located. Whilst this high level assessment should not be used to rule development out it should be used as a tool to guide further investigations into the nature of overland flood routes.

Sewer records show that there is one property 'at risk' to external flooding from sewers. On its own this is unlikely to form any constraint to development but this does emphasise the importance of preferentially discharging any runoff from developed sites to surface watercourses rather than the sewer network to avoid exacerbating existing sewer flooding problems.

As for all new developments the masterplanning should allow space for accommodating runoff in excess of the design capacity of the drainage network, whether derived from the development itself or from overland flow running onto the development. SuDS should be used to attenuate additional runoff generated from increasing the impermeable area on development sites. Infiltration techniques are unlikely to be feasible due to the clayey nature of the underlying soils. However SuDS features such as wet ponds, detention basins and wetlands may be used to achieve attenuation to greenfield rates. Section 4 contains some generic advice on SuDS and further information can be found in CIRIA C697 - The SuDS Handbook.

5.2.5 Oakham South Downstream

Description

This catchment consists of the area draining the lower North Gwash. It has been distinguished from the upstream catchment as here the watercourse flows through largely rural land with few constricting features such as culverts. The catchment area is 1.1 km^2 and extends downstream to Rutland Water.

Development Pressure

Due to the presence of the nearby Oakham Bypass the area may be subject to considerable development pressure.

Constraints

As this part of the catchment is downstream of residential development and discharges into Rutland Water any development is likely to have minimal impact on flood risk elsewhere. It would still nevertheless be advisable to limit any runoff flows to greenfield rates. Care should also be taken to ensure that an adequate standoff from the watercourse is achieved in order to minimise the risk of flooding to developments should levels in Rutland Water rise and cause backing-up in the channel.

As for all new developments the masterplanning should allow space for accommodating runoff in excess of the design capacity of the drainage network, whether derived from the development itself or from overland flow running onto the development. SuDS should be used to attenuate additional runoff generated from increasing the impermeable area on development sites. Infiltration techniques are unlikely to be feasible due to the clayey nature of the underlying soils. However SuDS features such as wet ponds, detention basins and wetlands may be used to

achieve attenuation to greenfield rates. Section 4 contains some generic advice on SuDS and further information can be found in CIRIA C697 - The SuDS Handbook.

5.2.6 Egleton Catchment

Description

This catchment drains an area of largely agricultural land to the south of Oakham. The watercourse into which it drains passes through the small settlement of Egleton before discharging into the southern part of Rutland Water. There are numerous drainage ditches crossing the catchment which generally converge into the main watercourse that flows through Egleton. The catchment area is estimated at 3.7 km^2.

Development Pressure

There may be development pressure associated with Oakham Bypass passing through part of the catchment. Development around Egleton itself may be limited due to the nearby presence of a nature reserve.

Constraints

Most potential development sites will likely require discharge of surface water to nearby drainage ditches or watercourses. As most watercourses converge on a channel through Egleton and due to the presence of culverts strict measures should be applied to any development to reduce both peak runoff rates and volumes to mimic greenfield conditions as closely as possible.

The overland flow analysis indicates the presence of areas that may be subject to surface water ponding. Adequate drainage strategies should be put in place should development be located in such areas.

As for all new developments the masterplanning should allow space for accommodating runoff in excess of the design capacity of the drainage network, whether derived from the development itself or from overland flow running onto the development. SuDS should be used to attenuate additional runoff generated from increasing the impermeable area on development sites. Infiltration techniques are unlikely to be feasible due to the clayey nature of the underlying soils. However SuDS features such as wet ponds, detention basins and wetlands may be used to achieve attenuation to greenfield rates. Section 4 contains some generic advice on SuDS and further information can be found in CIRIA C697 - The SuDS Handbook.

5.2.7 Prioritisation of Sites

Based on the PPS25 Sequential Test, potential development should be prioritised in Zone 1 (low risk of flooding from major watercourses). Within Oakham the vast majority of land falls within Zone 1 and a sustainable approach to zoning within Zone 1 has been suggested as part of this Level 2 SFRA whereby development locations are prioritised on the basis of their potential to exacerbate flooding problems downstream. The sub catchment areas identified for Oakham in the above sections can largely be grouped into two main classes: Those which are upstream of existing development and; those with minimal downstream development. The latter of these categories includes development that is located in urbanised catchments but is downstream of the existing development and development that is located in rural catchments. In this assessment priority has been recommended to sites with minimal downstream risk of flooding. The six

catchments have been ranked in order of priority (priority 1 is preferred) and are shown in descending order in Table 5.1.

Table 5.1 Oakham Prioritisation

Priority Ranking	Catchment	Description
1	North Oakham/Oakham South Downstream	Minimal downstream flood risk
2	Egleton/Oakham Central	Possible risk to downstream locations
3	Oakham South Upstream	Potential to exacerbate risk downstream
4	Barleythorpe Brook	Potential to exacerbate risk downstream - known issues

North Oakham and Oakham South Downstream both have little in the way of downstream development and have been placed first in the order of development preference. Egleton and Oakham Central catchments both have issues whereby development may have a detrimental impact on flood risk. For the Egleton catchment there is the downstream risk to the village of Egleton itself whilst for Oakham Central the issue is one of discharging surface water to a suitable outlet. Both these catchments have been placed in equal second position in the order of preferential development. Oakham South Upstream and Barleythorpe Brook catchments are the final two catchments in the list. Both catchments have locations for potentially significant development at the upstream end whilst having residential receptors at the downstream end. Barleythorpe Brook was ranked as the least preferable catchment in which to put development as this catchment has a known flood history that is likely to be exacerbated by increased upstream development.

It is recognised however that the final selection of site(s) for future development will depend on a wider range of planning considerations. This prioritisation does not preclude the need for a more detailed assessment (in the form of an FRA) of the sites selected for future development. Whilst the primary and secondary sources of flooding have been assessed in this SFRA, these sources remain to be assessed in detail at the site specific FRA stage, where the site specific focus will allow a more detailed appraisal of any potential flood risk issues to be undertaken. The FRA should demonstrate that the development meets the Sequential Test (and Exception Test if required), is adequately protected from flooding over the lifetime of the development (taking into account climate change), provides for surface water management with SuDS and adequately manages any residual flood risks. The FRA should demonstrate that flood Risk to third parties is not increased, and where appropriate flood risk should be reduced.

5.2.8 Climate Change in Oakham

Differences in mapped flood extents in Oakham between Flood Zone 3 (1 in 100 year) and Flood Zone 2 (1 in 1000 year) are minor indicating that a potential increase in flows as a result of climate change will have minimum impact on flood extents for extreme flood events. The detailed modelling study undertaken on behalf of the Environment Agency has mapped flood extents in Oakham from 1 in 100 year flows with an allowance for future climate change (an

increase in flows of 20%). Again, this indicates that there is minimal increase in flood extents as a result of climate change.

This minimal change in flood extent is largely a result of watercourses with well defined channels and limited functional floodplain. Although extents do not change significantly with climate change, depths and velocities are likely to increase as overall the volume of flow will increase. As can be seen from Figure 3.7, typical increases in depth resulting from climate change for the 100 year event are 0.16 m for Barleythorpe Brook and 0.1 m for the unnamed watercourse in the southern portion of Oakham. In addition the frequency of extreme events may increase putting increasing pressure on culvert capacity and the capacity of combined sewer systems making the need to control runoff from upstream development an important consideration.

5.3 Flood Risk in Uppingham

Description

Uppingham is a town that forms the headwaters of two small watercourses, namely Bisbrooke Brook and Seaton Brook (Figure 5.2). Environment Agency Flood Zones do not extend as far upstream as Uppingham but site observations and the overland flow analysis conducted as part of this SFRA show that watercourses are largely well confined and would pose little flood risk taking into account the small upstream catchment areas.

Development Pressure

Uppingham along with Oakham has been identified as an area of Rutland that may be subject to significant development pressure. A 1 km search radius was defined in the brief to this project in which to identify potential flood risk constraints to development.

Constraints

In general existing flood risk in Uppingham can be considered minimal and will have little constraint on the siting of potential developments. However a key consideration is the effect of development on flood risk. Anglian Waters DG5 sewer records indicate that there are localised problems with sewer capacity in Uppingham and as a result any future development may exacerbate such problems. Any surface water discharged from developments should therefore be discharged to open watercourses where possible and attenuated to greenfield rates. If these open watercourses are upstream of existing properties then even with attenuation there is the potential to increase downstream flood risk to properties due to increase runoff volumes and the potential for attenuation measures to fail. It is preferable therefore to discharge to areas downstream of vulnerable areas. In the case of Uppingham when siting any potential development the north east of the town and the south of the town are favourable for the above reasons. Whilst development in other areas should not be ruled out, preference should be given to these two locations.

As for all new developments the masterplanning should allow space for accommodating runoff in excess of the design capacity of the drainage network, whether derived from the development itself or from overland flow running onto the development. SuDS should be used to attenuate additional runoff generated from increasing the impermeable area on development sites. Infiltration techniques are unlikely to be feasible due to the clayey nature of the underlying soils. However SuDS features such as wet ponds, detention basins and wetlands may be used to

achieve attenuation to greenfield rates. Section 4 contains some generic advice on SuDS and further information can be found in CIRIA C697 - The SuDS Handbook.

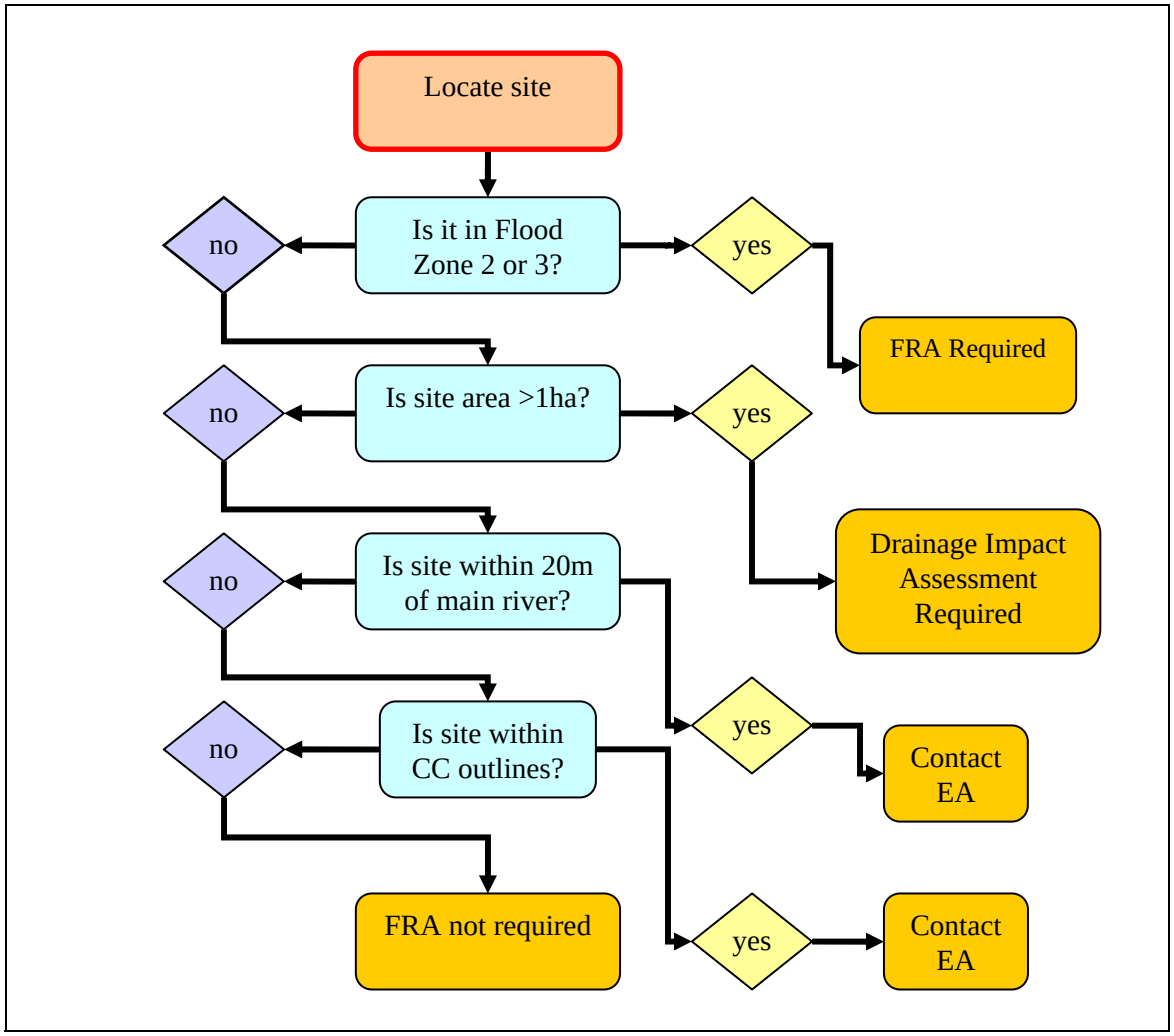
5.3.1 Climate Change in Uppingham

As for Oakham the impact of climate change on flood extents in Uppingham is minimal as the watercourses are well confined and the small upstream area means that significant flows are not generated. The increase in frequency of extreme events as a result of climate change should be a planning consideration to ensure that runoff from new development does not place additional strain on channel capacities.

5.4 Other Locations (Windfall Development)

For areas outside of Oakham and Uppingham such as villages that may be subject to windfall development the SFRA should be used to identify within which Flood Zone the proposed development falls. All developments within Flood Zones 2 and 3 require a Flood Risk Assessment as will developments over 1 hectare in size in all Flood Zones. Any developments within 20 m of a main river may require a flood risk assessment and the EA should be contacted. The flow diagram below illustrates the process that should be applied to windfall sites. The SFRA should be used as a starting point to understand the level of risk posed at other locations and developers should follow the general guidance laid out in Table D1 of PPS25.

Plate 5.3 Windfall Sites Flow Diagram



5.4.1 Rutland Water

There is a residual risk of a breach or overtopping of the dam that impounds Rutland Water. A breach may cause considerable damage to property and infrastructure as well as risk to life.

The general extent of flooding in the event of a breach of Rutland Water has been mapped by Anglian Water. Broadly-speaking the area affected would be the downstream valley which is generally confined to a river corridor of between 0.5 and 1 km width. Settlements that would be affected by a breach include the southern part of Empingham, Tickencote, Great Casterton and Ryhall. Flood depths and velocities would be very high in these locations and pose a threat to life. While the consequences of failure are high it should be emphasised that the Rutland Water dam is regularly inspected and that the probability of a breach occurring is minimal.

For reasons of national security the mapped output cannot at present be made public. This situation may change if recommendations within the recent Pitt Review are accepted and implemented by Government. The Pitt Review recommends that information relating to dam

failure or overtopping should be provided to Local Resilience Forums for contingency planning purposes and that outline maps should be made available to the public online as part of wider flood risk information.

5.4.2 Eyebrook Reservoir

In a similar way to Rutland Water there remains a residual risk of flooding resulting from a breach or overtopping of the dam at Eyebrook Reservoir. The village of Caldecott would be the principal settlement at risk but the large increase in flow to the River Welland would pose an increased flood risk along the main Welland valley.

No flood mapping has been located for this reservoir.

5.5 General Guidance

A FRA will be required for all sites greater than 1ha located in Flood Zone 1 to ensure that flood risk is not increased by increases in surface water runoff from new hardstanding.

Surface water management procedures will need to ensure there are adequate pollution controls and discharge consents may be required to control both quality and quantity of discharge.

Any proposed works affecting ordinary watercourses, statutory main river, within the indicative floodplain or within the bylaw distance (9 metres) requires the prior written consent of the Environment Agency under the relevant statutory legislation and current land drainage bylaws. It should not be assumed that such consent will automatically be forthcoming, and the applicant should consult with the Environment Agency at the earliest opportunity in order to determine and secure formal flood defence consent for the proposed works as appropriate.

Where de-watering is to occur in support of minerals extraction an assessment of the hydro(geo)logical impact will be required, to ensure that nearby water resources are not detrimentally impacted.

5.5.1 SuDS and the LDF

One of the key issues which must be resolved before SUDS are implemented is the responsibility for long-term maintenance, as SUDS require ongoing maintenance over their lifetime (e.g. grass cutting, desilting) if they are to remain effective. The issue of responsibility makes it difficult to enforce the use of SuDS in policy documents. However a strong recommendation should be made for their use, and where SuDS are not being used on new developments then a justification should be made clear.

Suggested wording for incorporation into LDF policies is:

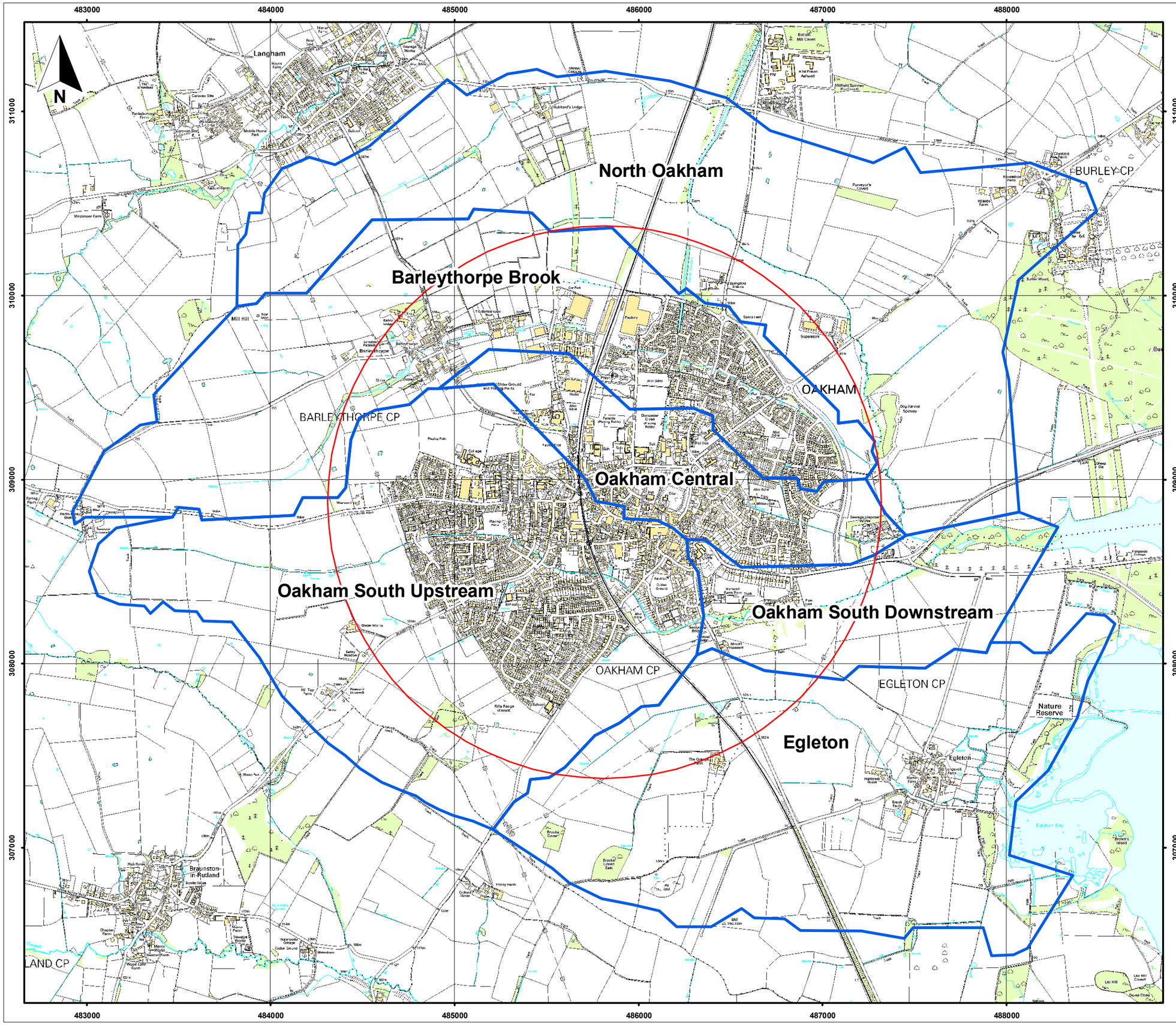
"Development proposals will be required to incorporate Sustainable Drainage Systems (SuDS) for the disposal of surface waters. Where this is not practicable it must be demonstrated that an acceptable alternative means of surface water disposal is incorporated.

A need to identify responsibilities for long term adoption and maintenance of SuDS should be a consideration from the early planning stages of any SuDS scheme. This should be clearly demonstrated in planning applications."

5.6 Future Hydraulic Modelling

Flood risk in the villages of Langham and Whissendine in the north west of Rutland is currently poorly represented on existing Environment Agency Flood Maps. It is believed that mapped flood extents are derived from JFLOW runs that formed the basis of the original flood zones. At present no hydraulic models exist for the watercourses in these villages. There are also limited topographic data available for these villages.

It is recommended that any further significant development in and around the Flood Zones in these villages or elsewhere should be supported by hydraulic modelling as part of a Flood Risk Assessment. As part of any modelling study a topographic survey may need to be conducted of the floodplain in order to map the outputs from the hydraulic models.



Key:

- 1.5km search radius
- Catchments

0 125 250 500 750 1,000 Metres

Scale: 1:20,000 @ A3

H:\Projects\HM-255\22153 Rutland SFRA\Drawings\
Stage 2 Oakham.mxd

Rutland SFRA

Figure 5.1
Oakham Catchments

July 2008
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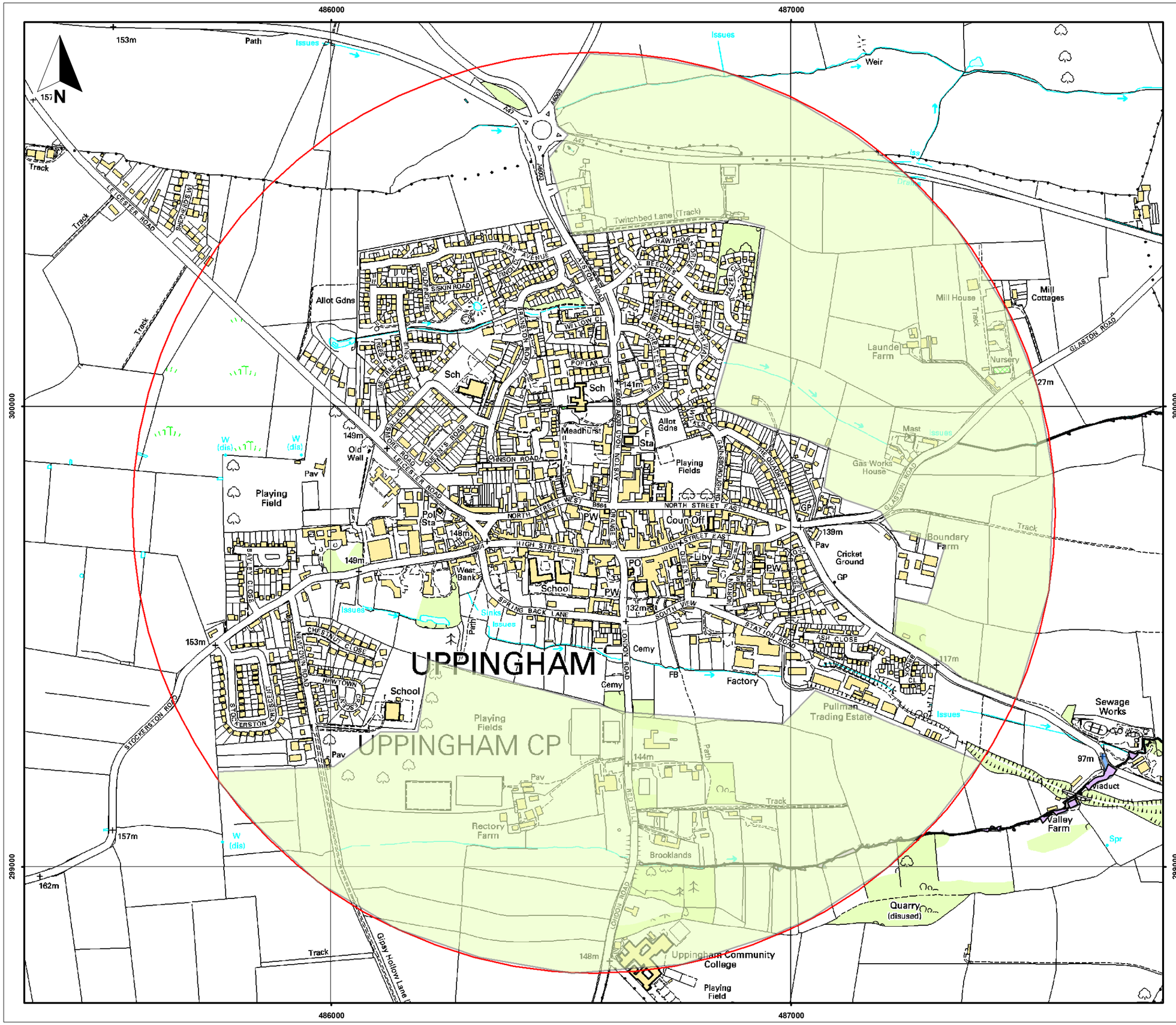

Key:

1km search radius

Preferred Development Zone

0 40 80 160 240 320 Metres

Scale: 1:8,000 @ A3

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Stage 2 Uppingham.mxd

Rutland SFRA

Figure 5.2
Uppingham Zoning

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6. Minerals and Waste

6.1 Purpose

Rutland County Council is producing a Minerals Core Strategy DPD which will set out a strategy for minerals planning in Rutland and forms part of the LDF. The existing Waste Local Plan covers Leicestershire and Rutland and the Secretary of State has issued a Direction that extends all the policies of the Plan beyond 27 September 2007. The policies will remain in force until replaced by new policies though the LDF process.

In accordance with good practice and advice from the Department of Communities and Local Government (CLG) the SFRA has considered the flood risk implications of mineral extraction and waste management development. This has included having regard to potential sites for minerals and waste development within the Rutland County boundary. The consideration of the flood risk implications of these sites is part of the evidence gathering required by the plan making process.

6.2 Flood Risk Appraisal of Waste and Minerals Sites

Table 6.1 lists the Waste and Minerals sites in Rutland and these are shown graphically in Figure 6.1. There are two civic amenity sites and six active quarrying operations in the County. Mineral resources are concentrated almost exclusively in the eastern half of the County and consist mainly of limestone and clay. The largest minerals operation in County is the cement works at Ketton (one of the largest in the Country). An extensive area of search for Ketton has been provided for consideration in this study. With the exception of Ketton Quarry none of the mineral or waste sites are located in an area of fluvial flood risk according to the EA Floodzones. Part of the consented extraction area Ketton Quarry lies within Flood Zone 3. This narrow Flood Zone is associated with the presence of a small watercourse draining northwards into the River Gwash. Any quarry works that occur close to a watercourse or modify it in any way are likely to require Environment Agency consent and the EA should be engaged at the earliest opportunity.

The Sequential Test aims, as far as possible, to allocate all development to the available sites with the lowest flood risk. PPS25 (Table D.2) classifies minerals working and processing (except for sand and gravel) as Less Vulnerable, and sand and gravel workings as Water Compatible.

Landfill and waste facilities fall into two flood vulnerability categories:

- More Vulnerable - Landfill and sites used for waste management facilities for hazardous waste; and
- Less Vulnerable - Waste treatment (except landfill and hazardous waste facilities).

Sand and gravel processing (Water Compatible development) is considered compatible development (PPS25 Table D.3) in all Flood Zones. For More Vulnerable waste uses, PPS25

Table D.3 considers these uses compatible with Flood Zones 1 and 2, and if the Exception test is passed Flood Zone 3a. For Less Vulnerable waste uses, PPS25 Table D.3 considers these uses compatible with Flood Zones 1 and 2, and 3a. Waste uses are not compatible with Flood Zone 3b.

Table 6.1 Minerals and Waste Sites

Potential Site	Use	Flood Zone
Waste		
North Luffenham Civic Amenity site	Waste disposal site	Flood Zone 1
Cottesmore Civic Amenity site	Waste disposal site	Flood Zone 1
Minerals		
Clipsham Quarry	Limestone extraction	Flood Zone 1
Greetham Quarry	Limestone extraction	Flood Zone 1
Ketton Quarry	Castle Cement Works	Largely Flood Zone 1 (minor Flood Zone 3)
Little Casterton Quarry	Clay extraction	Flood Zone 1
Stretton Quarry	Limestone extraction	Flood Zone 1
Thistleton Quarry	Limestone extraction permitted but not yet in use	Flood Zone 1
Woolfox Quarry	Limestone extraction	Flood Zone 1

All minerals and waste sites considered in this SFRA appear to be in appropriate locations with regards to flood risk. It should however be noted that all new development over 1 hectare in size will be subject to a flood risk assessment (see Section 6.3 below).

6.3 General Guidance

A FRA will be required for all sites greater than 1 ha located in Flood Zone 1 to ensure that flood risk is not increased by increases in surface water runoff from new hardstanding or changes in land use management.

Surface water management procedures will need to ensure there are adequate pollution controls and discharge consents may be required to control both quality and quantity of discharge.

Any proposed works affecting ordinary watercourses, statutory main river, within the indicative floodplain or within the bylaw distance (9 metres) requires the prior written consent of the Environment Agency under the relevant statutory legislation and current land drainage bylaws. It should not be assumed that such consent will automatically be forthcoming, and the applicant should consult with the Environment Agency at the earliest opportunity in order to determine and secure formal flood defence consent for the proposed works as appropriate.

A distance of 30 metres is required from top of bank of main river to any minerals extraction to ensure that the stability of the bank is maintained and that the extraction does not increase the flood risk.

Where de-watering is to occur in support of minerals extraction an assessment of the hydro(geo)logical impact will be required, to ensure that nearby water resources are not detrimentally impacted.

480000 490000 500000

310000 300000

N

Thistleton
Stretton
Clipsham
Greetham
Woolfox
Cottesmore
Little Casterton
Ketton
Luffenham

Rutland Water

OAKHAM
UPPINGHAM
STAMFORD

Key:

- Quarries
- Waste sites
- Ketton Area of Search
- Flood Zone 3
- Flood Zone 2
- Rutland Boundary

0 0.5 1 2 3 4 Kilometres

Scale: 1:100,000 @ A3

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Fig_6.1_Minerals_Waste.mxd

Rutland SFRA

Figure 6.1
Minerals and Waste Sites

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7. Conclusions and Recommendations

7.1 Level 1

Flood risk has been characterised throughout the County based on a range of information sources. The risks associated with primary fluvial flooding have been predominantly based on the Environment Agency's flood zones, supplemented where appropriate with data from hydraulic modelling and historical sources. These data sources were further supplemented by carrying out a broadscale pluvial analysis using readily available topographic data for upland areas of the catchments to identify potential overland drainage routes not covered by the flood zones.

The flood zone maps indicate that fluvial flood risk is of limited spatial extent within the county and that the majority of the area covered by flood zones 2 and 3 is largely rural. There are a few small settlements where the flood map shows properties at risk and these include Langham, Whissendine, Cottesmore, Ryhall, Ketton and parts of Oakham.

Under the climate change scenario used (a 20% increase in peak flows), hydraulic modelling has indicated that there will be a limited (but locally important) increase in the extent and depth flood water in Flood Zone 3a along the main Welland valley. Along Barleythorpe Brook in Oakham this scenario mainly indicates an increase in the depth of flood water rather than its extent, particularly upstream of in-channel structures such as bridges. This is due to the relatively steep embankments which the floodplain and constrain flow within a corridor. Planners should be aware of the potential for increase in flood depth as well as extent due to climate change as indicated on the maps. FRAs should consider the potential increases in risk due to climate change.

A set of maps showing the extent of the Flood Zones in Rutland along with the digital GIS extents have been supplied to Rutland County Council for use by their Planning and Development Control teams. These maps show the extent of Flood Zone 2, Flood Zone 3 and where available Flood Zone 3b (Functional Floodplain).

7.2 Level 2

The flood risk associated with two broad potential development areas in Rutland has been assessed, with a view to prioritising locations with the lowest associated flood risk. This information can now be used in the application of the PPS25 Sequential Test in order to allocate development as part of the LDF process. This should be used by the Council's planners to preferentially place development in areas of lowest flood risk and to, as far as practicable, avoid areas of flood risk. The information should also be used to help reduce flood risk on existing development. The key conclusions arising from this process are as follows:

7.2.1 Oakham

Oakham was subdivided into 6 areas based on the catchment areas of numerous small watercourses that drain the town and its surrounds. There are only a few very minor areas lying within flood zones 2 or 3 in the town (associated with the Gwash North Arm watercourse). Therefore it is unlikely that any major allocations will require preferential relocation to Zone 1 through the PPS25 sequential test.

However the absence of Flood Zone 2 or 3 areas within the town does not mean that there is no associated flood risk. Uncontrolled development in any flood zone has the potential to exercabate downstream flood risk through increased surface water runoff. The Oakham subcatchments have therefore been prioritised on the basis of their potential for development to increase flood risk to downstream receptors. Preference has been given to areas that have little or no downstream development or flooding problems/drainage restrictions downstream. The order of preference is:

- North Oakham/Oakham South Downstream;
- Egleton/Oakham Central;
- Oakham South Upstream;
- Barleythorpe Brook.

These areas are shown in Figure 5.1.

If development is planned for the lower priority catchments (Barleythorpe Brook and Oakham South Upstream) then it is recommended that in line with emerging best practice a ***Surface Water Management Plan*** should be completed for each sub-catchment. This plan would look at the integrated nature of catchment drainage in more detail assessing factors such as the likely increase in surface water runoff from new development, the capacity and condition the watercourse and existing sewerage infrastructure, location of flooding 'hotspots' and consideration of strategic SuDS solutions such as storage areas on a catchment-wide basis. A further advantage of developing a SWMP is that it will enable advance planning of drainage infrastructure to avoid future flooding problems such as gradual loss of capacity in culverts due to increased volume of flow or increased likelihood of blockage due to debris.

7.2.2 Uppingham

As with Oakham there are no areas within Flood Zone 2 or 3. There are, however, watercourses that drain the town and these will have some element of flood risk associated with them. Increasing the amount of water entering these watercourses upstream of existing development will increase the risk to that development. It is therefore recommended that locations downstream of existing development should be given priority when considering new development allocations in Uppingham.

7.2.3 Residual Risk of Dam Failure

Residual risk of dam failure should be a consideration when allocating development sites in areas downstream of raised reservoirs. Preference should be given to areas elsewhere and if this is not possible then a flood risk assessment should be prepared which would include items such as flood evacuation procedures.

7.3 Application of the Sequential Test to Brownfield and Infill Development

For brownfield and infill development within Rutland, particularly in some of the key villages the Council should follow the sequential approach and prioritise sites in Flood Zone 1 for development, followed by sites in Flood Zone 2, and finally Flood Zone 3a.

If no suitable location can be found in Flood Zone 1 then the Environment Agency's Sequential Test Guidance should be followed. A copy of this guidance is provided in Appendix D.

In all instances of infill or brownfield development in the floodplain, an FRA must show that any development is safe for the residents or users of the facility.

7.4 Recommendations for Future Work

7.4.1 Updates to the SFRA

The results of the SFRA should be used to inform the Local Development Framework. Provisions should be made for updating the SFRA map outputs if significant changes in flood extent are predicted by revised hydraulic models of watercourses.

7.4.2 Surface Water Management Plans

It is strongly recommended that Surface Water Management Plans are developed for all major areas of allocated urban development in line with Defra's policy and emerging advice on Integrated Urban Drainage (IUD), the pilot studies for which were concluded earlier this year. Surface Water Management Plans are intended to provide a holistic plan for managing urban drainage and would include masterplanning e.g. strategic areas set aside for flood attenuation or excess flow conveyance allied to green space provision as well as other issues such as funding and adoption for operation and maintenance. Recommendations for taking these forward are likely to emerge over the next 12 months.

7.4.3 Knowledge Management

The way information about past flood events is recorded, disseminated and used is material to the development of flood risk knowledge and the development of solutions to risk avoidance and reduction. The Environment Agency maintains records of past flood events and these are used in the preparation of the flood risk maps which are regularly revised and publicly available on the internet. Record keeping by the local authority of the occurrence and type of flooding can provide a key input into characterising flood risk. The water companies also keep records of sewage and surface water flooding arising from surcharging of drains and sewers within its responsibility which will provide essential information in reducing the risks to new development associated with sewer flooding.

Without proper management, this invaluable information on past flood events can be lost, particularly where knowledge resides with officers of longstanding employment who can recall past flood events, their causes, effects and any remedial measures from memory. This SFRA has attempted to collate multiple sources of local information. It is highly recommended that this database of knowledge is expanded and updated as new information arises, ideally through

the identification of a single officer, responsible for the codification of information about flood risk in the County and for improving communication between departments.

There may be concern that organising data in this way may give rise to blighting of properties (similar to the concerns raised over the Register of Contaminated Land). This could be a real issue in the context of the Freedom of Information Act and needs legal investigation before proceeding.

It is essential to build up the operational and organisational capacity of local authorities for dealing with this issue. There is a need to improve and maximise liaison between Rutland County Council, the Environment Agency, Anglian Water and Severn Trent Water on flood risk matters and, in this respect, there may be considerable value in meetings on a regular basis after the SFRA itself is complete.

7.4.4 Guidance for Developers

To complement the findings and recommendations of the Rutland SFRA with respect to development and flood risk in Rutland, it is recommended that a set of guidance notes are produced setting out the requirements for both private and commercial developers. This could comprise documentation, leaflets and flow charts covering the correct procedure(s) for the various types of application in relation to flood risk, including:

- Production of preliminary or Stage 1 FRAs;
- Production of detailed or Stage 2 FRAs;
- Assessment of surface water runoff from large and small developments;
- Use of SuDS and long term maintenances;
- Assessment of historic flows off brownfield sites;
- Monitoring of post development runoff;
- Strategic solutions to flood risk;
- Culverting policy and environmental gain.

Production of such guidance notes should be undertaken in consultation with the Environment Agency.

Appendix A
Map Output

9 Pages

480000 490000 500000

310000 300000

N

1

Whissendine

Ashwell

Langham

2

Cottesmore

North Brook

Greetham

Exton

Empingham

3

Essendine

West Glen

Ryhall

Great Casterton

7

Barleythorpe Brook

Oakham

North Gwash

Gwash

4

Braunston

South Gwash

Manton

R Chater

Wing

Belton-in-Rutland

5

Edith Weston

Ketton

Morcott

Morcott Brook

R Welland

8

Uppingham

Bisbrooke Brook

Seaton Brook

Eye Brook

6

Caldecott

480000 490000 500000

Key:

Rutland Boundary

Modelled River

0 0.5 1 2 3 4 Kilometres

Scale: 1:100,000 @ A3

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01_Overview_A3.mxd

Rutland SFRA

Figure 01
Overview Map

March 2008
22153-S01 rodgb

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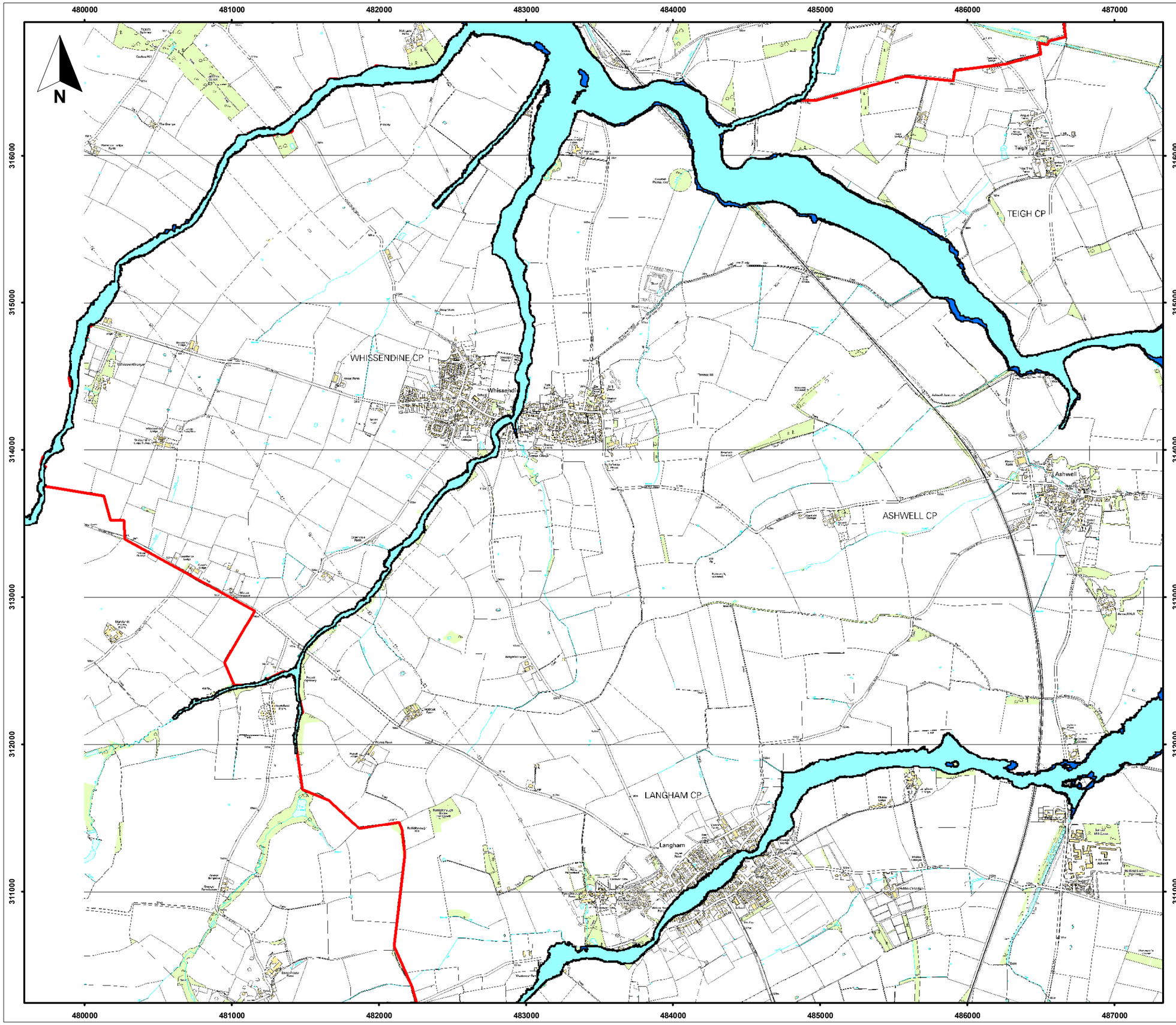

Key:

- Rutland Boundary
- Flood Zone 3
- Flood Zone 2

Note: Map of functional floodplain not available for this area

Kilometres
0 0.125 0.25 0.5 0.75 1

Scale: 1:25,000 @ A3

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02_Insert_1_zones.mxd

Rutland SFRA

Insert 1
Flood Zones

March 2008
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Key:

- Rutland Boundary
- Functional Floodplain
- Flood Zone 3
- Flood Zone 2

0 0.125 0.25 0.5 0.75 1 Kilometres

Scale: 1:25,000 @ A3

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03_Insert_2a_zones.mxd

Rutland SFRA

Insert 2
Flood Zones

March 2008
22153-S03 rodgb

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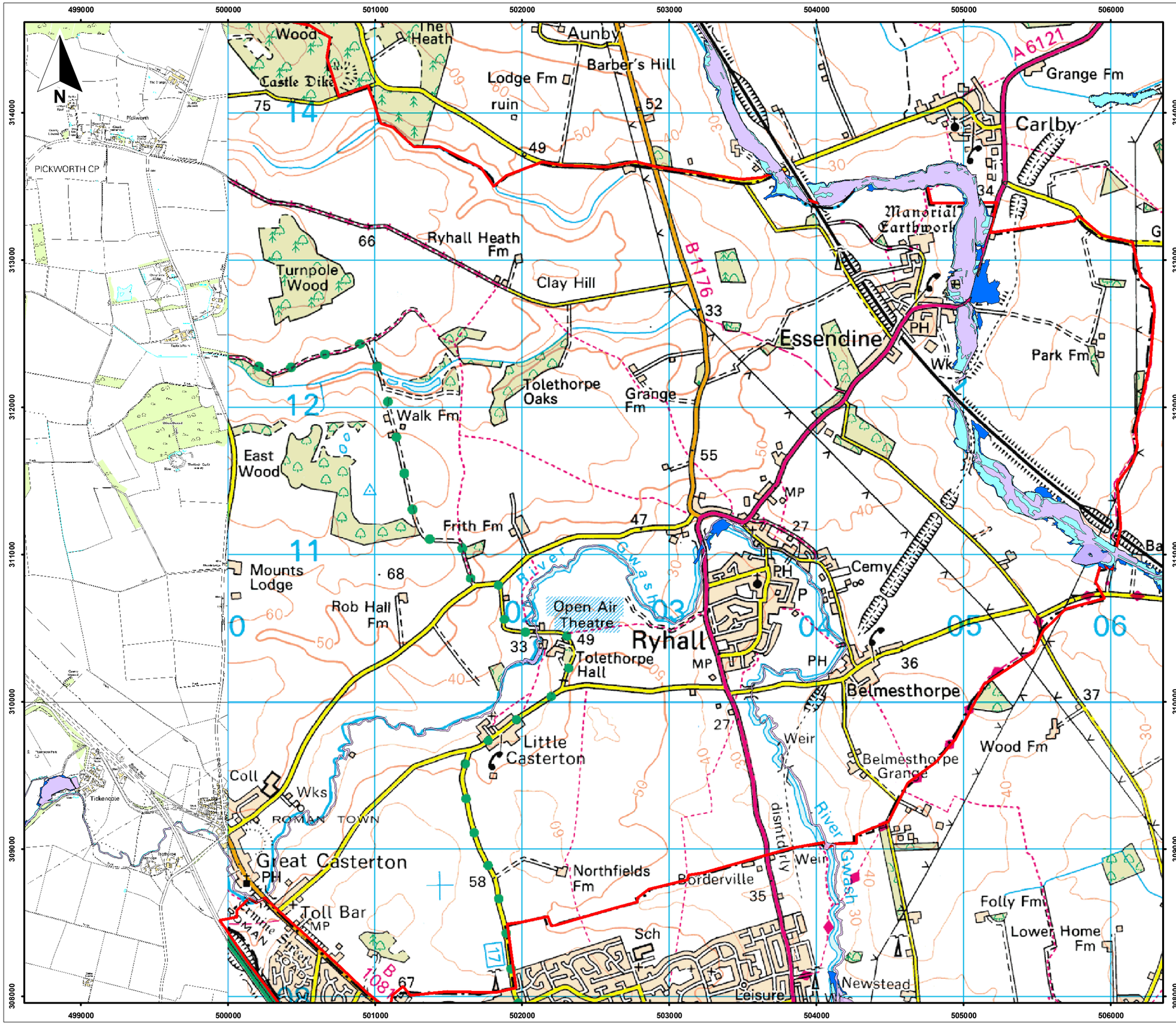

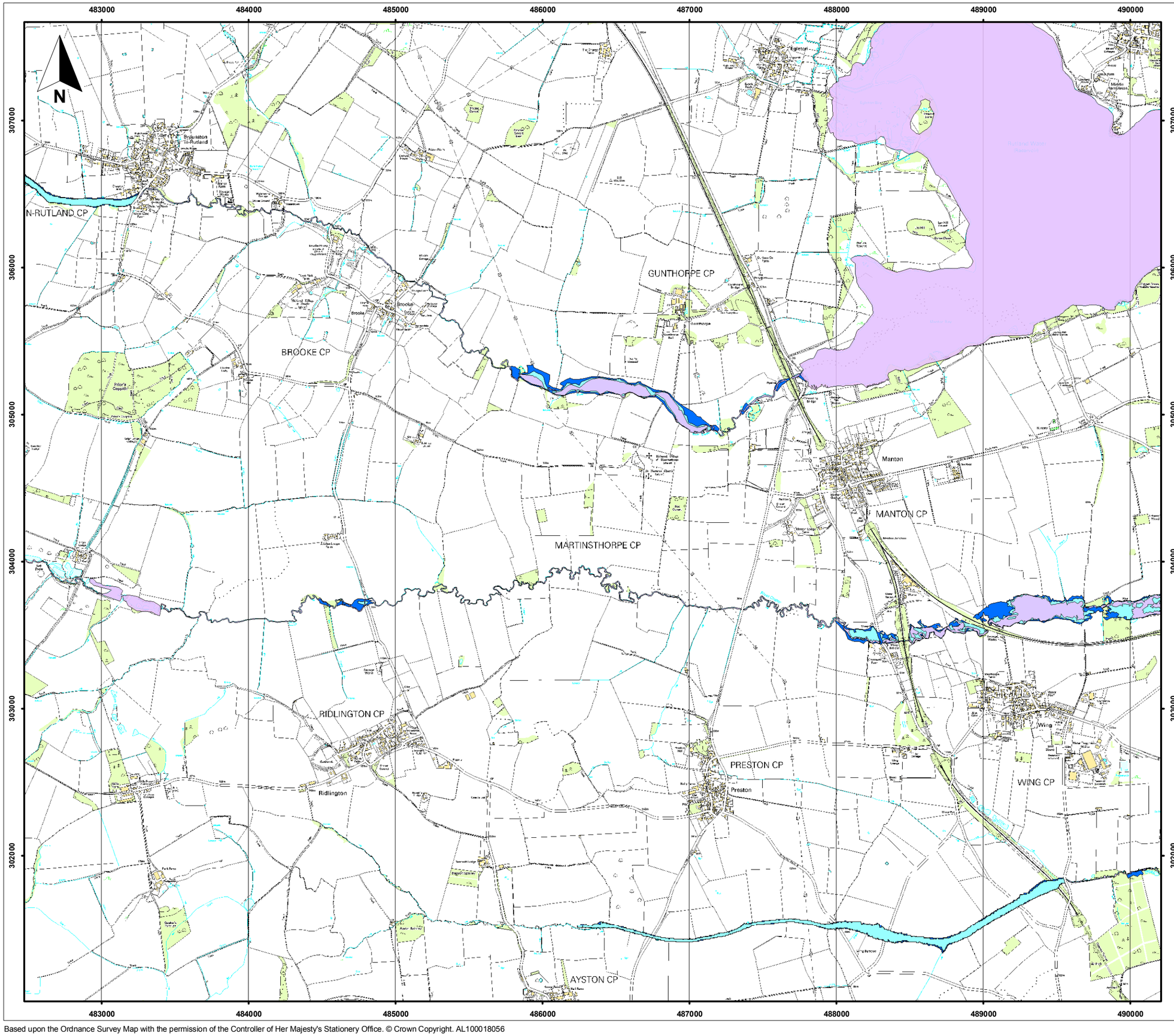

Key:

- Rutland Boundary
- Functional Floodplain
- Flood Zone 3
- Flood Zone 2

0 0.125 0.25 0.5 0.75 1 Kilometres

Scale: 1:25,000 @ A3

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07_Insert_4a_zones.mxd

Rutland SFRA

Insert 4
Flood Zones

March 2008
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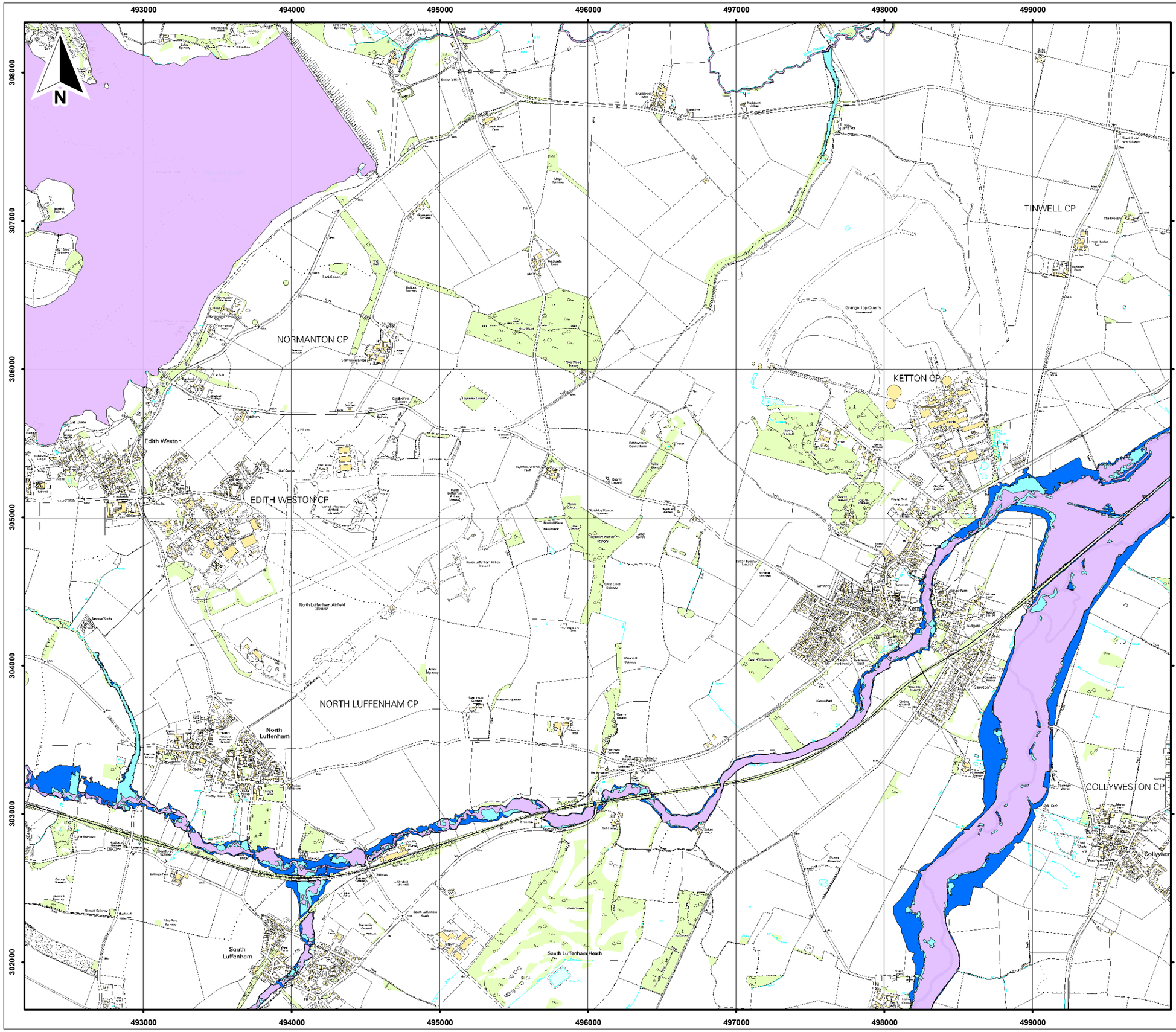

Key:

- Rutland Boundary
- Functional Floodplain
- Flood Zone 3
- Flood Zone 2

0 0.125 0.25 0.5 0.75 1 Kilometres

Scale: 1:25,000 @ A3

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Rutland SFRA

Insert 5
Flood Zones

March 2008
22153-S09 rodgb

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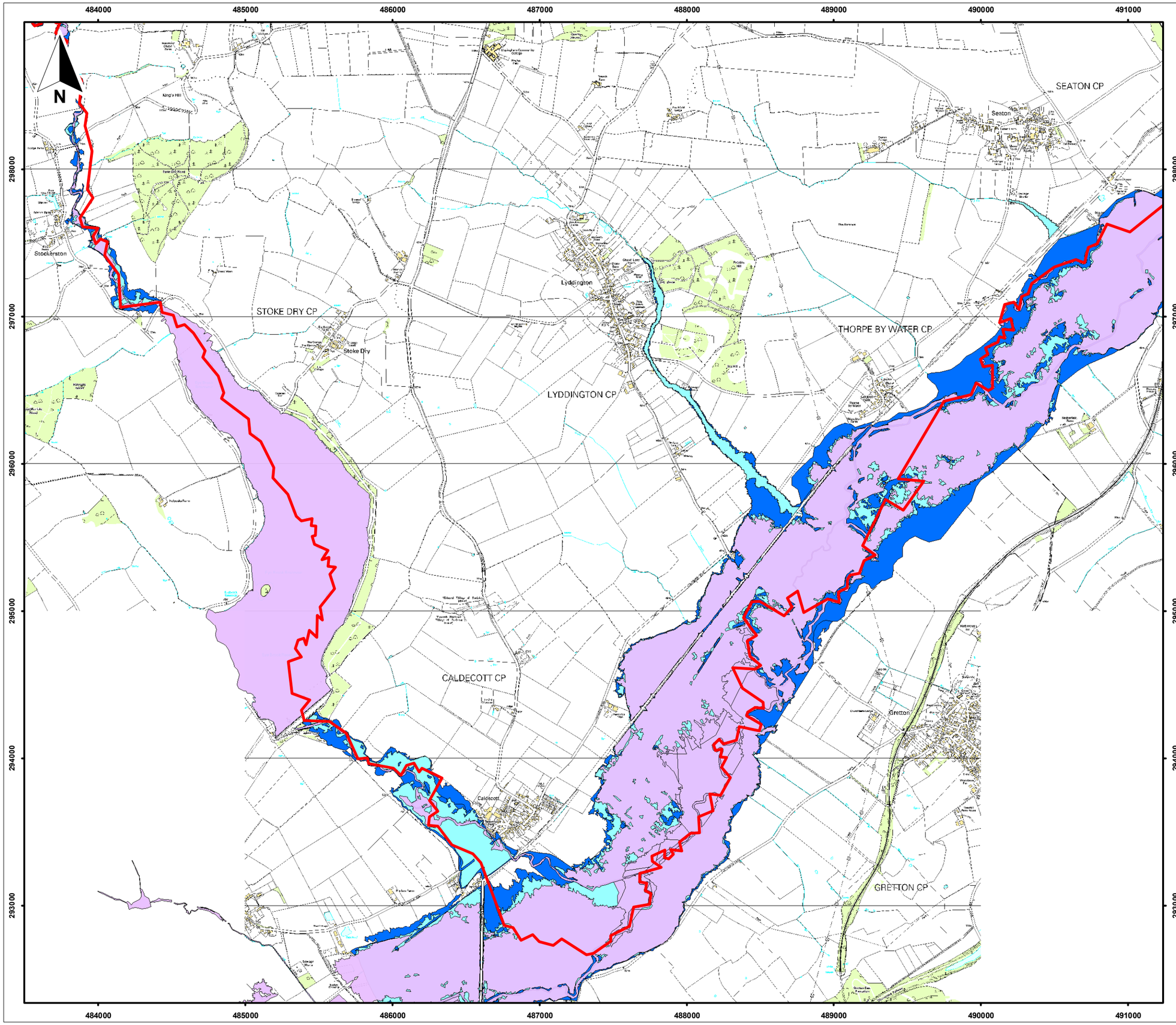

Key:

- Rutland Boundary
- Functional Floodplain
- Flood Zone 3
- Flood Zone 2

0 0.125 0.25 0.5 0.75 1 Kilometres

Scale: 1:25,000 @ A3

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11_Insert_6a_zones.mxd

Rutland SFRA

Insert 6
Flood Zones

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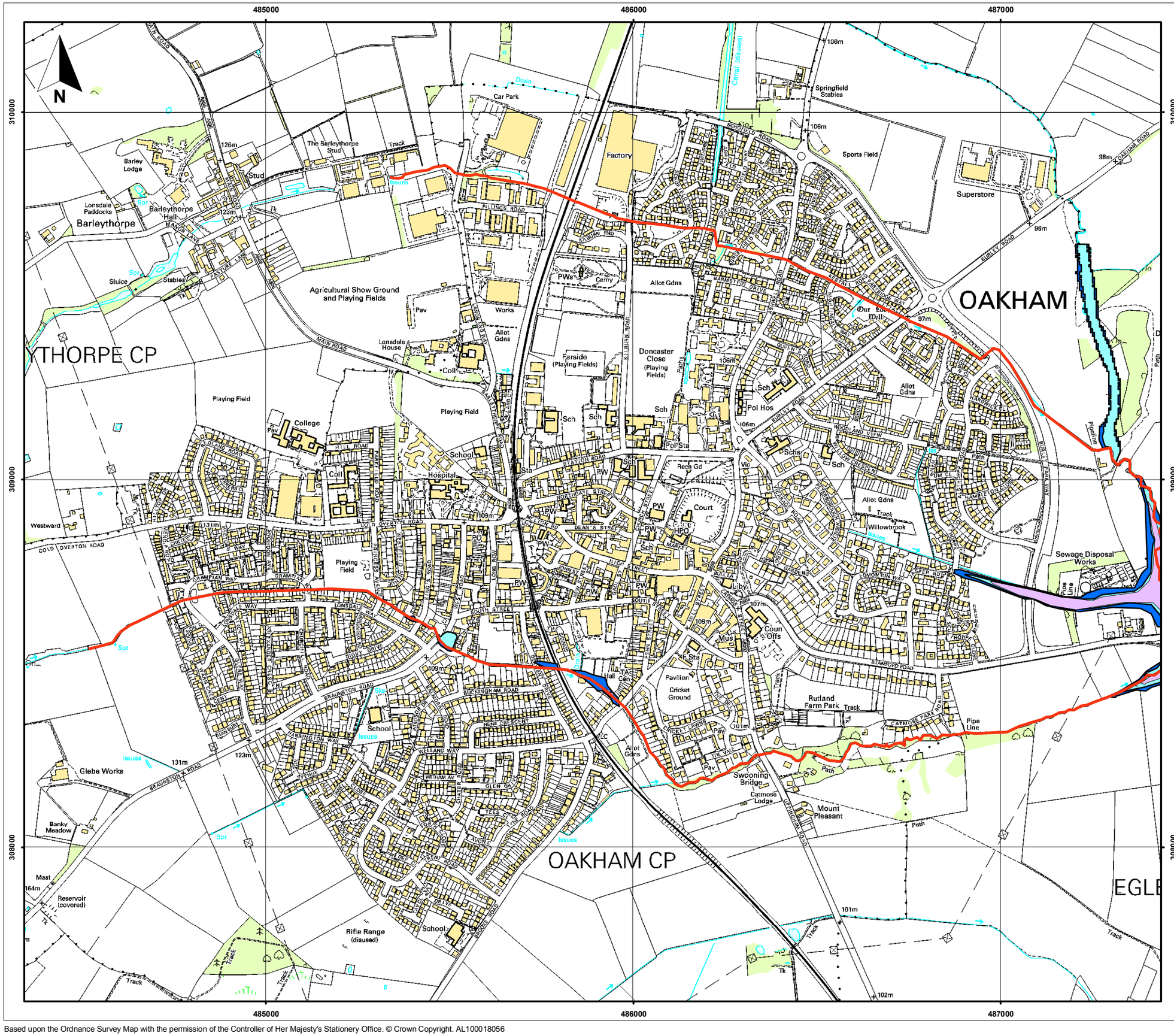

Key:

- Main River
- Functional Floodplain
- Flood Zone 3
- Flood Zone 2

0 55 110 220 330 440 Metres

Scale: 1:10,000 @ A3

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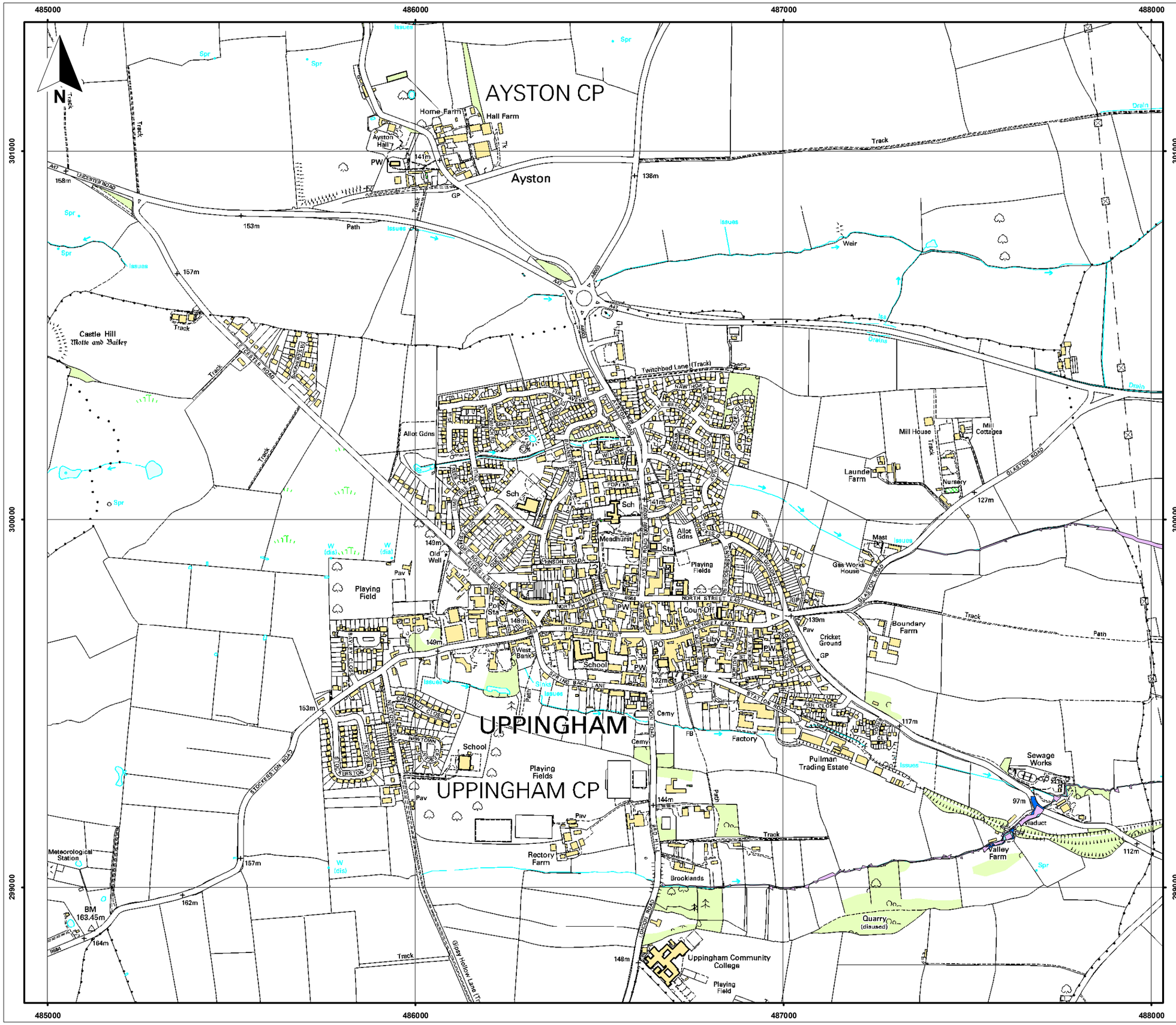
Rutland SFRA

Insert 7
Flood Zones

March 2008
22153-S13 rodgb

Entec



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Rutland SFRA

Insert 8
Flood Zones
Uppingham

March 2008
22153-S15 rodgb

Entec

Appendix B
DG5 Register

1 Page

Water companies are required to report to Ofwat, the water industry regulator, on its performance against levels of service criteria. There are eight levels of service indicators, known as DG2 to DG9. The Level of Service Indicator DG5 is concerned with Flooding from Sewers. Any previous flooding of properties resulting from public sewers is recorded on the DG5 Risk Register list and returned to Ofwat.

The majority of Rutland falls within the operating area of Anglian Water with a small portion in the north west of the county falling under Severn Trent Waters operating area. Both water companies have been consulted as part of this SFRA and the resulting DG5 register for Rutland is shown in Table B1. It should be noted that following any improvement works properties on the list are removed so the list presented in Table B1 is a snapshot of the present situation.

Table B1 DG5 Risk Register

Street/Road	Parish	Internal/External	Frequency
Main Street	Greetham	External	1 in 20
Main Street	Greetham	Internal	1 in 20
Lower Farm Close	Empingham	Internal	1 in 20
Main Street	Empingham	External	1 in 20
Main Street	Empingham	External	1 in 20
Main Road	Whitwell	External	1 in 20
Spey Drive	Oakham	External	1 in 20
Seaton Road	Glaston	External	1 in 20
Newtown Road	Uppingham	Internal	1 in 10
Newtown Road	Uppingham	Internal	1 in 10
North Street East	Uppingham	Internal	1 in 20
Station Road	Uppingham	External	1 in 20

Appendix C
Drainage Path Modelling

2 Pages

In order to further understand overland flow paths within Rutland an analysis on identifying potential drainage paths was conducted as part of this SFRA. This analysis focused on upland areas of the County where information on flooding from Environment Agency Flood Zones was limited - typically Flood Zones are only available for catchments greater than 3 km^2.

The analysis was undertaken by using existing topographic information in the form of a Digital Terrain Model (DTM) and simulating a heavy rainfall event over areas marked for analysis. Rainfall that became runoff drained to local low points in the topography and flow gradually accumulated along increasingly defined flow paths.

The only topographic data available for much of the upland areas of Rutland was NextMap data which is supplied at a 5 m resolution. The vertical resolution of such data is not as accurate as LiDAR data but it has the advantage of having complete nationwide coverage.

A 100 year design rainfall depth with a duration of 1 hour (M100-1h) was derived using FEH software. This rainfall depth was then attributed the FEH summer storm profile to give a design hyetograph and this was than increased by a further 30% as an allowance for future climate change. The FEH percentage runoff losses model was then used to convert the total rainfall into a net rainfall which was a generalised way of accounting for how much rainfall became runoff.

In order to make an allowance for how much flow the piped drainage network could take it was assumed that this could take up to the peak 1 in 30 year rate and this design net hyetograph was deducted from the 1 in 100 year climate change one.

TUFLOW 2D modelling software was used to simulate the rainfall over the terrain and the resulting output is provided in the main report. The model output indicates potential flow routes in upland areas that may not necessarily correspond to perennial streams. Following an extreme storm it may be that previously unknown flow routes, upon which development may now be placed, become utilised causing a potential flood risk. The modelling is broadscale in nature and uses relatively coarse topographic data along with many simplifying assumptions making it unsuitable for use in studies such as detailed urban flood path modelling. However it does provide a useful indication of flow paths in upland areas and is another dataset to draw on in Stage 2 of the SFRA, particularly if there is a lack of more detailed information.

Key Assumptions/Limitations

The main key assumptions associated with this broadscale method of modelling are outlined below.

- Topographic data is NextMap which is not as accurate in the vertical or horizontal domains as LiDAR data;
- Runoff parameters are purely based on catchment descriptors provided on the FEH CD-ROM. Runoff parameters are kept constant across Rutland;
- A universal surface roughness representing ‘natural grassland’ is applied across the modelled catchments;
- Large mass-balance errors resulting in part from supercritical flow across steep parts of the catchment mean that any depths/volumes/flows output by the model can only be treated as being purely indicative.

It is thought that any effort made to improve the rainfall-runoff component of the model e.g. through varying percentage runoff parameters or specifying surface roughness by land use, would be largely made redundant due to the mass-balance errors within the model. Nevertheless, the current modelling generates an extremely useful indicative set of data which, provided it is not taken out of its broadscale context, provides an indication of drainage routes across the upland areas of the county.

Appendix D
Guidance on Using Flood Zones

3 Pages

The Environment Agency categorise land into one of three Flood Zones.

- Flood Zone 1 is land outside the which falls outside the 0.1% floodplain (with a chance of flooding of less than 0.1% chance in any given year);
- Flood Zone 2 is land that falls between the 1 in 100 year extent and the 1 in 1000 year extent (a chance of flooding between 1% and 0.1% in any given year);
- Flood Zone 3 is land which falls within the 1 in 100 year flood extent (has a 1% chance of a flood occurring in any given year).

At present the Flood Zones in Rutland only indicate flooding from rivers. A site located in Flood Zone 1 may still be at risk from flooding from other sources such as groundwater and possibly from smaller unmapped watercourses.

Data used to create these maps have been derived from a number of sources. Initially a national map of flood zones was created for all catchments greater than 3 km^2 using a 'JFlow' model which involved routing water over a relatively coarse digital terrain model. In many places detailed modelling of rivers has been undertaken by the Environment Agency and this has allowed for the production of flood extents with a greater resolution and accuracy. This modelling has involved topographic survey of river channels which are input into detailed hydraulic models. In places where these studies have been carried out the JFlow derived flood zones have been replaced with results from the modelling studies.

In Rutland the River Welland and its main tributaries have been modelled in detail using the Welland Catchment Strategic Model. Tributaries of the River Wreake in the North West of the County have not been modelled in this way and so the boundaries of the Flood Zones in settlements such as Langham and Whissendine are less accurate. In cases where potential development sites are located within or immediately adjacent to Flood Zones 2 or 3 and the Flood Zones are not an accurate representation then the onus is on the developer to undertake a site specific Flood Risk Assessment to establish the nature of the flood risk.

Planning Policy Statement 25 further subdivides Flood Zone 3 into 3a and 3b. Floodzone 3b is termed 'Functional Floodplain' and is defined as land where water has to flow or be stored in times of flood. Flood Zone 3a is remaining land in Flood Zone 3. Subdivision of Zone 3 into 3a and 3b is only possible where detailed modelling exists and so has not been undertaken for areas in the North West of the County where only JFlow derived outlines are available.

It is possible to view Flood Zones 2 and 3 on the Environment Agency website and maps showing the flood zones (including the functional floodplain where detailed modelling exists) have been provided as part of the SFRA.

Climate Change Maps

Where detailed modelling exists a more extreme flood outline has been provided representing the current 1 in 100 year event with an additional allowance for future climate change and this is shown in Figure 3.7 of the main report. Whilst use of this outline in the Sequential and Exception Tests is not explicitly stated it should be used to inform flood risk assessments where they are required as well as potential future development areas within the LDF.

Use of Maps in the Sequential and Exception Tests

The Sequential Test is defined in Annex D of PPS25 with the principal aim of steering new development to areas of the lowest probability of flooding (Flood Zone 1). Where there are no reasonably available sites in Flood Zone 1 then decision makers should first consider Zone 2 and then Zone 3 taking into account the flood risk vulnerability of land uses as categorised in Table D2 of PPS25.

All development is permitted in Zone 1. Development in Zones 2 and 3 is restricted based on Table D3 of PPS 25 replicated below.

Table D.3[22]: Flood Risk Vulnerability and Flood Zone 'Compatibility'

Flood Risk Vulnerability classification (see Table D2)		Essential Infrastructure	Water compatible	Highly Vulnerable	More Vulnerable	Less Vulnerable
Flood Zone (see Table D.1)	Zone 1	✔	✔	✔	✔	✔
	Zone 2	✔	✔	Exception Test required	✔	✔
	Zone 3a	Exception Test required	✔	✗	Exception Test required	✔
	Zone 3b 'Functional Floodplain'	Exception Test required	✔	✗	✗	✗

Key:

✔ Development is appropriate

✗ Development should not be permitted

The large majority of land within Rutland falls within Flood Zone 1. However, if due to other planning considerations certain development cannot be avoided in higher flood risk zones then the Exception Test may be required.

Requirements for application of the Exception Test are given in PPS25 and they include the need for a Flood Risk Assessment to demonstrate that the development will be safe without increasing flood risk elsewhere, and, where possible to reduce flood risk overall.

Supplied Data for Applying the Tests

Flood Zones are mapped in Appendix A of the report as A3 size maps with both an overview map of the County and as eight 'Insert' maps which give a greater resolution. Flood Zones are also provided as digital GIS files on the CD accompanying the report (located at Digital_Data_Deliverables\Flood Zones) in both Mapinfo and ArcGIS formats are the files are detailed below:

- Flood Zone 2 GIS File - 'nat_floodzone2_v3_8';

- Flood Zone 3 GIS File - ‘nat_floodzone3_v3_8’.
- Functional Floodplain (3b) - Zone_3b_Functional_Floodplain.

Appendix E
Environment Agency Letter

1 Page

COPY

Mr B Rodgers
Entec UK Ltd
Canon Court North Abbey Lawn
Shrewsbury
Shropshire
SY2 5DE

Our ref: AN/2009/107047/01-L01
Your ref: RutSFRA

Date: 31 March 2009

Dear Mr Rodgers

RUTLAND SFRA LEVEL 2

Thank you for referring the Rutland Level 2 SFRA undertaken by Entec UK on behalf of Rutland County Council.

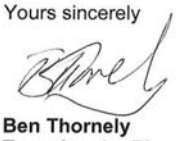
Having reviewed the document we would like to make the following comments.

The SFRA appears to have taken account of all our comments contained within our letter dated 22 January 2009 relating to the draft SFRA.

The Environment Agency can confirm that the Rutland Level 2 SFRA has been completed in line with the guidance contained in and compliant with Planning Policy Statement 25 – Development and Flood Risk (PPS25). Accordingly, we are satisfied that this document can be used as a background document to support the preparation of the individual documents of the Local Development Framework.

If you have any further queries, please do not hesitate to contact me.

Yours sincerely



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Appendix F
Digital Data

1 CD