Mid Suffolk District Council
Strategic Flood Risk Assessment

March 2008




Prepared for:

Mid Suffolk District Council

Revision Schedule

Mid Suffolk
Strategic Flood Risk Assessment

Final Report

March 2008

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Abbreviations

Acronym	Definition
AOD	Above Ordnance Datum
AONB	Area of Outstanding Natural Beauty
CFMP	Catchment Flood Management Plan
DEM	Digital Elevation Model
DPD	Development Plan Documents
EA	Environment Agency
EP	English Partnerships
FRA	Flood Risk Assessment
GIS	Geographical Information Systems
IDB	Internal Drainage Board
LDDs	Local Development Documents
LDF	Local Development Framework
LDS	Local Development Scheme
LiDAR	Light Detection and Ranging
LPA	Local Planning Authority
MSDC	Mid Suffolk District Council
ODPM	Office of the Deputy Prime Minister
PCPA	Planning and Compulsory Purchase Act 2004
PPG25	Planning Policy Guidance Note 25: Development and Flood Risk
PPS25	Planning Policy Statement 25: Development and Flood Risk
RFRA	Regional Flood Risk Assessment
RPG	Regional Planning Guidance
RSS	Regional Spatial Strategy
SAR	Synthetic Aperture Radar
SA	Sustainability Assessment
SFRA	Strategic Flood Risk Assessment
SPG	Supplementary Planning Guidance
SSSI	Site of Special Scientific Interest
SuDS	Sustainable Drainage Systems
SW	Scott Wilson
WCS	Water Cycle Strategy

Glossary

Term	Definition
Aquifer	A source of groundwater comprising water-bearing rock, sand or gravel capable of yielding significant quantities of water.
Catchment Flood Management Plan	A high-level planning strategy through which the Environment Agency works with their key decision makers within a river catchment to identify and agree policies to secure the long-term sustainable management of flood risk.
Climate Change	Both natural and human actions causing long term variations in global temperature and weather patterns.
Culvert	A channel or pipe that carries water below the level of the ground.
DG5	Data collected by Water Companies regarding flooding from sewers. OFWAT use this data as a performance indicator.
Exception Test	Required where the vulnerability of a development type is not entirely compatible with the level of flood risk at a particular site, i.e., following application of the Sequential Test. In order to qualify for development, it must be demonstrated that the development passes all elements of the Exception Test.
Flood defence	Infrastructure used to protect an area against floods such as floodwalls and embankments; they are designed to a specific standard of protection (design standard).
Floodplain	Area adjacent to river, coast or estuary that is naturally susceptible to flooding.
Flood storage	A temporary area that stores excess runoff or river flow often ponds or reservoirs.
Flood Outline	The extent of the area that is determined to be at a potential risk of flooding during a flood event of a given magnitude.
Fluvial flooding	Flooding by a river or a watercourse.
Fluvial Reaches	A stretch of river that is not influenced by the tide.
Functional Floodplain	Land where water has to flow or be stored in times of flood. Specifically, this land would flood with an annual probability of 1 in 20 (5 %) or greater in any year and is designed to flood in an extreme (0.1 %) event. The functional floodplain includes water conveyance routes and flood storage areas. Developed areas are not generally considered to comprise functional floodplain.
GIS Layers	Data that is presented in a spatial manner. Normally, each dataset constitutes one GIS layer. A number of GIS layers can be presented on a single map.
Groundwater	Water that is in the ground, this is usually referring to water in the saturated zone below the water table.
Indicative floodplain map	A map that delineates the areas that have been predicted to be at risk of being flooded during an event of specified probability.

Internal Drainage Board	Independent bodies with responsibility of ordinary watercourses within a specified District.
Inundation	Flooding.
LiDAR	An airborne mapping technique that creates topographic data by using a laser device to measure the distance between the aircraft and the ground below.
Local Development Framework (LDF)	The core of the updated planning system (introduced by the Planning and Compulsory Purchase Act 2004). The LDF comprises the Local Development Documents, including the Development Plan Documents that expand on policies and provide greater detail. The development plan includes a core strategy, site allocations and a proposals map.
Local Planning Authority	Body that is responsible for controlling planning and development through the planning system.
Mitigation measure	An element of development design that may be used to manage flood risk or avoid an increase in flood risk elsewhere.
Risk	The probability or likelihood of an event occurring.
SAR	A high-resolution microwave imaging system.
Sequential Test	A risk-based approach to assess flood risk, which gives priority in ascending order of flood risk, i.e. lowest risk first.
Sewer flooding	Flooding caused by a blockage or overflowing in a sewer or urban drainage system.
Stakeholder	A person or organisation that has an interest in, or could be affected by the decisions made within a site.
Sustainability Appraisal	A process used to identify whether policies, strategies or plans promote sustainable development and also for improving policies. It is a requirement for Regional Spatial Strategies under the *Planning and Compulsory Purchase Act 2004.*
Sustainable Drainage Systems	Methods of management practices and control structures that are designed to drain surface water in a more sustainable manner than some conventional techniques.
Sustainable development	Development that meets the needs of the present without compromising the ability of future generations to meet their own needs.
Tidal Outline	The extent of the area that is determined to be at a potential risk of flooding during a tidal flood event of a given magnitude.
Tidal Reach	A stretch of river that is influenced by tidal cycles.
1 in 100 year event	An event that has a probability of occurring once every 100 years. Also expressed as an event, which has a 1% probability of occurring in any one year.
1 in 100 year design standard	Flood defence that is designed for an event, which has an annual probability of 1%. In events more severe than this the defence would be expected to fail or to allow flooding.

Executive Summary

Local Planning Authorities (LPAs) are required to produce Local Development Frameworks (LDFs), which are a portfolio of Local Development Documents (LDDs) that collectively deliver the spatial planning strategy for the authority area. The LDDs undergo a Sustainability Appraisal (SA) which assists Planning Authorities in ensuring their policies fulfil the principles of sustainability. Strategic Flood Risk Assessments (SFRAs) are one of the documents to be used as the evidence base for planning decisions and are a component of the SA process. Therefore, SFRAs should be used in the review or production of LDDs.

Planning Policy Statement 25: Development and Flood Risk (PPS25; Communities and Local Government, December 2006) and its Practice Guide Companion "Living Draft" (February 2007) recommends that SFRAs are completed in two consecutive stages. The Level 1 SFRA enables application of the Sequential Test, and the Level 2 SFRA increases the scope of an SFRA for development sites where the Exception Test is required. The Sequential Test is a simple decision-making tool designed to ensure that sites at little or no risk of flooding are developed in preference to areas at higher risk. Where it is not possible, due to wider sustainable development issues, to locate the development in a low flood risk area, a sequential approach within the Flood Zone is required and the Exception Test should be applied where necessary. This Executive Summary and the accompanying SFRA report constitute 'Stage 2' of the Mid Suffolk SFRA, which has been commissioned by Mid Suffolk District Council.

Flood related planning policy at national, regional and district levels was collated and tabulated. This serves to highlight the fact that flood risk is taken into account at every hierarchical level within the planning process and also helps to demonstrate how the SFRA will feed into the Council's LDF process. The Council has not yet identified specific strategic development locations and the SFRA is designed to inform this decision-making process.

The main source of flood risk policy and strategy within the sub-region are Catchment Flood Management Plans (CFMPs). The three relevant CFMPs shaping flood risk management, guidance and strategy covering the Mid Suffolk study area are:

- River Great Ouse CFMP, February 2007(draft stage)
- Broadland Rivers CFMP, June 2006 (draft stage)
- East Suffolk CFMP September 2006 (scoping stage).

As well as highlighting the flood risks within a catchment, CFMPs also outline policies for dealing with flood risk management at various locations within a catchment.

PPS25 requires that, as part of any SFRA, all sources of flooding are identified. In order to assess the risk of flooding, the Environment Agency (EA) has provided data and has been closely involved with the Mid Suffolk SFRA. In addition, other key stakeholders have been consulted and those that have provided data include Anglian Water, Suffolk County Council, and the Highways Agency. From historical flood records, and using other sources of flood risk information, five main sources of flood risk were identified: fluvial flooding, sewer flooding, surface water flooding, groundwater flooding and flooding from artificial sources.

The catchments of the River Waveney, River Dove, River Gipping, and River Deben are the main hydrological influences of the study area. None of their catchments within the study area are tidally influenced, although if tide locking occurs downstream, effects in Mid Suffolk can be made worse.

In order to present the best available flood information, SFRA Flood Zones were derived using a variety of existing sources of data. Where detailed numerical modelling of rivers has been undertaken and the flood outlines mapped, these have been used in preference to broad-scale modelled flood outlines. The result is a single map for each Flood Zone using a variety of data. Information regarding the relative confidence and source of the data accompanies the electronic versions of this data. All SFRA Flood Zones are based on information provided by the EA and prescribed methodologies in PPS25. The methodology for deriving each of the SFRA Flood Zones is described below.

Flood Zone 1 refers to all areas that are considered to be at low risk of fluvial or tidal flooding. Flood Zone 1 consists of everything that falls outside of areas shown to be within Flood Zones 2 and 3. Whilst fluvial and tidal flooding is not a concern in these areas, the risk of flooding from other sources, such as surface water, groundwater, sewers and artificial sources may still be an issue.

Flood Zone 2 is the extreme flood event outline. This is the flood outline for the 1 in 1000-year flood event and is entirely based upon a combination of broadscale modelling provided by the EA and detailed modelling of the Gipping, Waveney, Dove and Deben undertaken as part of this study.

Flood Zone 3a is the outline for the 1 in 100 year fluvial flood event and is the part of Flood Zone 3 that is outside Flood Zone 3b (the functional floodplain)

Flood Zone 3b is the area of land falling within the 1 in 20 year flood plain or land that is designed to flood within an extreme event and is termed functional floodplain (FFP). The 1 in 20 flood outline has been used to define the FFP where available. For reaches where this is not available, the 100-year flood outline (i.e.Flood Zone 3a) has been used as a proxy in line with the guidance contained within the PPS25 Practice Guide until such a time when more detailed information is available (i.e., an EA modelling study or hydraulic modelling undertaken for a site-specific flood risk assessment). This is not to say that the entire area used as a proxy is FFP, moreover that the boundary of the FFP falls somewhere within that area as recommended by the EA.

All Flood Zones have been calculated with an allowance for climate change to 2107. For fluvial reaches, this Flood Zone is calculated by adding a net increase of 20 % over and above peak flows to the 100-year flood event. Where modelled information is not available, the Flood Zone 2 outline has been used as a proxy until such a time when more detailed information is available (i.e., an EA modelling study or hydraulic modelling undertaken for a site-specific flood risk assessment). This is not to say that the entire area used as a proxy is Flood Zone 3 plus an allowance for climate change, moreover that the boundary of Flood Zone 3 plus an allowance for climate change falls somewhere within that area

In general, the fluvial flood risk across the study area is low. The SFRA Flood Zones show that the areas that are potentially at risk of flooding are relatively narrow strips of land immediately adjacent to the watercourses, which is due to the well-defined channels of the watercourses in the study area and their relatively small size. The at risk areas are largely rural and the populations potentially at risk are therefore minimal. Urban locations within the study area that are potentially affected by flooding include Stowmarket and Needham Market and historic flood records have shown flood events in Walsham–le-Willows. In addition, there are numerous other settlements in the study area that have smaller areas at risk of fluvial flooding.

Sewer flooding was identified using historical records from Anglian Water DG5 database detailing the total number of flood events that affected both internal and external property in a six-month period. The number of recorded sewer flooding events varies across the region and due to the rural nature of the study area and the format in which data was provided, it is difficult to pin-point specific

areas. The DG5 data supplied by Anglian Water and the East Suffolk CFMP highlight sewer flooding as an issue in Stowmarket.

No records of groundwater flooding were found during the course of the study. However, there are minor aquifers with more permeable superficial deposits overlying them within the study area. Following periods of sustained rainfall, there may be a potential for groundwater flooding to occur.

Due to the history of flooding in the study area, consultation with the EA has revealed that there are numerous structures and embankments (either purpose built or natural) that contribute to flood risk management, although these are not depicted graphically as NFCDD is in the process of being updated at the time of writing. The EA maintain and keep records of many of the defences in the district, though it should be noted that there are a great deal more “private” or “non-maintained” structures and embankments that provide a level of protection to areas. The standard of protection for defences within the study area varies markedly.

A number of studies in addition to the CFMPs have identified an increased level of flood risk to the district over the next 25 to 100 years as a result of climate change. Firstly, as a result of wetter and warmer winters, an increase in large fluvial flood events is likely to affect the larger rivers and watercourses in the study area. Secondly, extreme rainfall events are likely to become more frequent leading to a greater storm intensity and duration. This is likely to lead to a great deal more runoff causing surface water flooding and overwhelming of the urban sewer networks in particular. Revised guidance from UKCIP is due to be released shortly and is likely to update current figures of increases in flood risk

To attempt to counteract this increase in runoff in local areas, the use of Sustainable Drainage Systems (SuDS) is becoming more important. In addition to the more usual attenuation and infiltration systems, providing more ‘green’ spaces within the urban environment can also help to reduce runoff and also increase wildlife habitat. These areas can sometimes be most effective when placed alongside development in water corridors (e.g. along canals). Groundwater Vulnerability (GWV) data was collected for this study. GWV refers to the potential for contamination of groundwater, rather than groundwater flooding, and can be used to identify areas suitable for particular SuDS techniques.

Using information and analysis gathered during the planning policy and flood risk reviews, a strategic overview of the flood risk was carried out to identify potential conflicts between development pressures and flood risk now and in the future.

The draft Regional Spatial Strategy (RSS) outlines the housing provision targets for the Mid Suffolk Authorities and involves an increase (between 2003 and 2021) of 800 in the policy area of parishes adjoining Ipswich, 7500 for the remainder of Mid Suffolk, giving a total requirement of 8300 for Mid Suffolk as a whole. The draft RSS stipulates that at least 60 % of housing is located on previously developed (brownfield) land.

A focused settlement assessment was undertaken by ‘zooming in’ on each of the 3 towns and 12 Key Service Centres outlined in the Core Strategy. These focussed settlement assessments present all of the available flood risk information. The maps, statistics and main issues are presented on summary sheets for each of the settlements.

The purpose of the focused settlement assessment is to identify where future strategic level development sites could potentially be located. In addition, the maps can be used to identify the requirements for, and also inform, site-specific FRAs for future development. Guidance on undertaking site-specific FRAs is provided in the report.

This SFRA was completed using the PPS25 climate change recommendations, however during the lifetime of this document it is quite likely that climate change levels may alter. As a result future site-specific flood risk assessments may have to adapt to these changes in line with current guidance in response to continuing research into climate change.

The Mid Suffolk SFRA has been completed in accordance with PPS25 and the current guidance outlined in the draft Development and Flood Risk: A Practice Guide Companion to PPS25 'Living Draft' (Feb 2007). The SFRA has been developed by building heavily upon existing knowledge with respect to flood risk within the study area. These documents have an intended lifespan of 6-10 years. Therefore it should be noted that although up-to date at the time of production, the SFRA has a finite lifespan and should potentially be upgraded or revised as required by the local authorities. As a result, it is recommended that the SFRA be adopted as a "Living" document and should be reviewed regularly and, if necessary, updated with new flood risk or planning policy data.

1 Introduction

1.1 Background

The Planning and Compulsory Purchase Act 2004 (PCPA) (HMSO, 2004) requires Local Planning Authorities (LPAs) to produce Local Development Frameworks (LDFs) to replace the system of Local, Structure and Unitary Development Plans. LDFs are a portfolio of documents (Local Development Documents (LDDs) that collectively deliver the spatial planning strategy for the authority area. The PCPA 2004 requires LDDs to undergo a Sustainability Appraisal (SA) which assists LPAs in ensuring their policies fulfil the principles of sustainability. Strategic Flood Risk Assessments (SFRAs) are one of the documents to be used as the evidence base for planning decisions; they are also a component of the SA process and should be used in the production or review of LDDs.

The release of Planning Policy Guidance Note 25 (PPG25): Development and Flood Risk in July 2001 introduced the responsibility placed on Local Authorities to ensure that flood risk is understood and managed effectively using a risk-based approach as an integral part of the planning process.

PPG25 was superseded by Planning Policy Statement 25: Development and Flood Risk (PPS25) in December 2006. PPS25 re-emphasises the active role LPAs should have in ensuring flood risk is considered in strategic land use planning. PPS25 encourages LPAs to undertake SFRAs and to use their findings to inform land use planning. In February 2007, a "Living Draft" of the Practice Guidance for PPS25 was released for consultation. Although this is a consultation document, the approach to SFRAs that is suggested should be considered.

To assist LPAs in their strategic land use planning, SFRAs should present sufficient information to enable LPAs to apply the Sequential Test to their proposed development sites:

> "*Decision-makers should use the SFRA to inform their knowledge of flooding, refine the information on the flood map and determine the variations in flood risk from all sources of flooding across and from their area. These should form the basis for preparing appropriate policies for flood risk management for these areas."*
> *(PPS25, 2007:31*)"

In addition, where development sites cannot be located in accordance with the Sequential Test as set out in PPS25 (i.e., to steer development to low risk sites): there is a need to apply the Exception Test. In which case,

> *"…the scope of the SFRA will be widened to consider the impact of the flood risk management infrastructure..."*
> (PPS25, 2007:21)

In addition to forming a tool for use in strategic land use planning, an SFRA should also be accessible and provide guidance to aid the general planning process of a LPA.

A Stage 1 SFRA (pre PPS25) was carried out by Faber Maunsell (FM) and this SFRA builds upon the data collected as part of the FM stage 1scoping study.

1.2 The Mid Suffolk SFRA

The study area of Mid Suffolk District Council (MSDC) includes a small area in the south of the District which is situated within the Ipswich Policy Area of the Haven Gateway Partnership. The Partnership will deliver additional housing and create additional focus for growth in hi-tech, knowledge based employment, while protecting and enhancing its high quality natural assets by establishing a network of open spaces and green corridors across the sub-region

Within Mid Suffolk, the main urban centre is Stowmarket with the smaller towns of Needham Market and Eye among the other key urban centres within the District. The recent MSDC Core Strategy Submission Document (October 2007) states that regeneration of the District will continue through concentrating employment opportunities and residential growth where they are most accessible to the majority of the population, focussing on the towns and key service centres in the District, particularly Stowmarket. Once finalised, the Core Strategy will identify other areas of new development and an SFRA is intended to assist in identifying such development areas.

The spatial planning of any proposed development must be considered with regard to the current and future risk of flooding from a number of sources, including fluvial, tidal, surface water (storm water) and groundwater. It is therefore vitally important that flood risk is considered at a strategic scale to inform land allocations and future developments proposed by the emerging LDFs.

1.3 The SFRA Structure

The Practice Guide Companion to PPS25 recommends that SFRAs are completed in two consecutive stages; this follows the iterative approach encouraged by PPS25 and provides Local Planning Authorities with tools throughout the LDF and SFRA process sufficient to inform and update decisions regarding development sites. The two stages are:

Level 1 SFRA – Enables application of the Sequential Test,
Level 2 SFRA – Increases scope of SFRA for sites where the Exception Test is required.

The results of the SFRA will enable MSDC to review the current potential major development sites and to inform the scope of the Sustainability Appraisal (SA).

This report comprises the Level 1 Mid Suffolk SFRA and part of a level 2 SFRA for the towns of Eye, Needham Market and Stowmarket.

1.3.1 Level 1 SFRA

The Level 1 SFRA should present sufficient information to enable the LPA to apply the Sequential Test to potential development sites and to assist in identifying whether the application of the Exception Test will be necessary.

The objective of the Level 1 SFRA is to collate and review available information on flood risk for the study area. Information has been sought from a variety of stakeholders including the Faber Maunsell (FM) brief, Environment Agency (EA), MSDC, Suffolk County Council (SCC), the Highways Agency (HA) and Anglian Water (AW). In addition to the review of data and consultation with local stakeholders, Level 1 also considers any available data needed to meet the requirements of a Level 2 SFRA. Where necessary the report identifies works beyond the critical scope that may benefit the assessment.

The information presented in a Level 1 SFRA should not be considered as an exhaustive list of all available flood-related data for the study area. The Level 1 SFRA report is a presentation of flood sources and risk, which is based on data collected following consultation with and input from the partner LPA and relevant agencies, within the timeframe available. The Level 2 SFRA will enable the contacts and relationships with key stakeholders developed in Level 1 to continue to assist in providing data and information for the SFRA.

The Level 1 SFRA should be used by the LPA, together with other evidential documents and the draft SA, to undertake the Sequential Test. This will help to identify where sites can be located in Flood Zone 1 and may require further investigation through a Level 2 SFRA.

1.3.2 Level 2 SFRA

The Level 2 SFRA will provide sufficient information to facilitate the application of the Exception Test, where required. This will be based on information collected for the Level 1 SFRA and additional works where necessary.

1.4 The SFRA Aims & Purpose

The original Mid Suffolk SFRA stage 2 brief was created prior to the release of PPS25 and the Practice Guide Companion. An agreement was reached with MSDC to continue following the aims outlined in the original brief but to follow the layout recommended by PPS25 and the Practice Guide Companion to ensure that the SFRA is sound and undertaken in accordance with current guidance. Figure 1-1 shows the work that has been undertaken to produce this SFRA.

The aims and purpose of the Mid Suffolk SFRA as set out in the brief dated July 2007 are: -

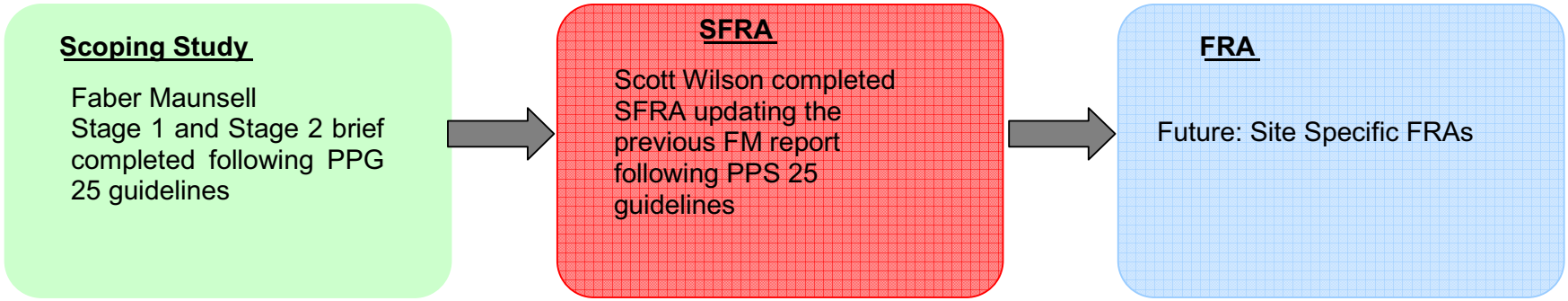
1. To identify areas that are at risk of flooding for all Flood Zones now, in 25 years and in 50 years given the known projections on climate change and development proposals, however in agreement with MSDC and the EA, all climate change increases in this SFRA are considered at the 20-year, 100-year and 1000-year event in 2107.

2. To identify variations in the actual flood risk in a given area, including the effect of any defences, within Flood Zone 3, as identified by the EA Flood Zone Maps, now, in 25 years and 50 years given the known projections on climate change and development proposals,

3. To identify the effect of the increase in surface water run off from proposed developments, for all zones identified in PPS25, and any areas where the receiving system is known to be inadequate, now, in 25 years and in 50 years given the known projections on climate change and development proposals.

This SFRA Report addresses point 1 and parts of point 2 and point 3. This SFRA and other planning policy requirements will be used to identify future development sites. Any additional sites that require further investigation, following this SFRA, may need to be considered with site specific FRAs.

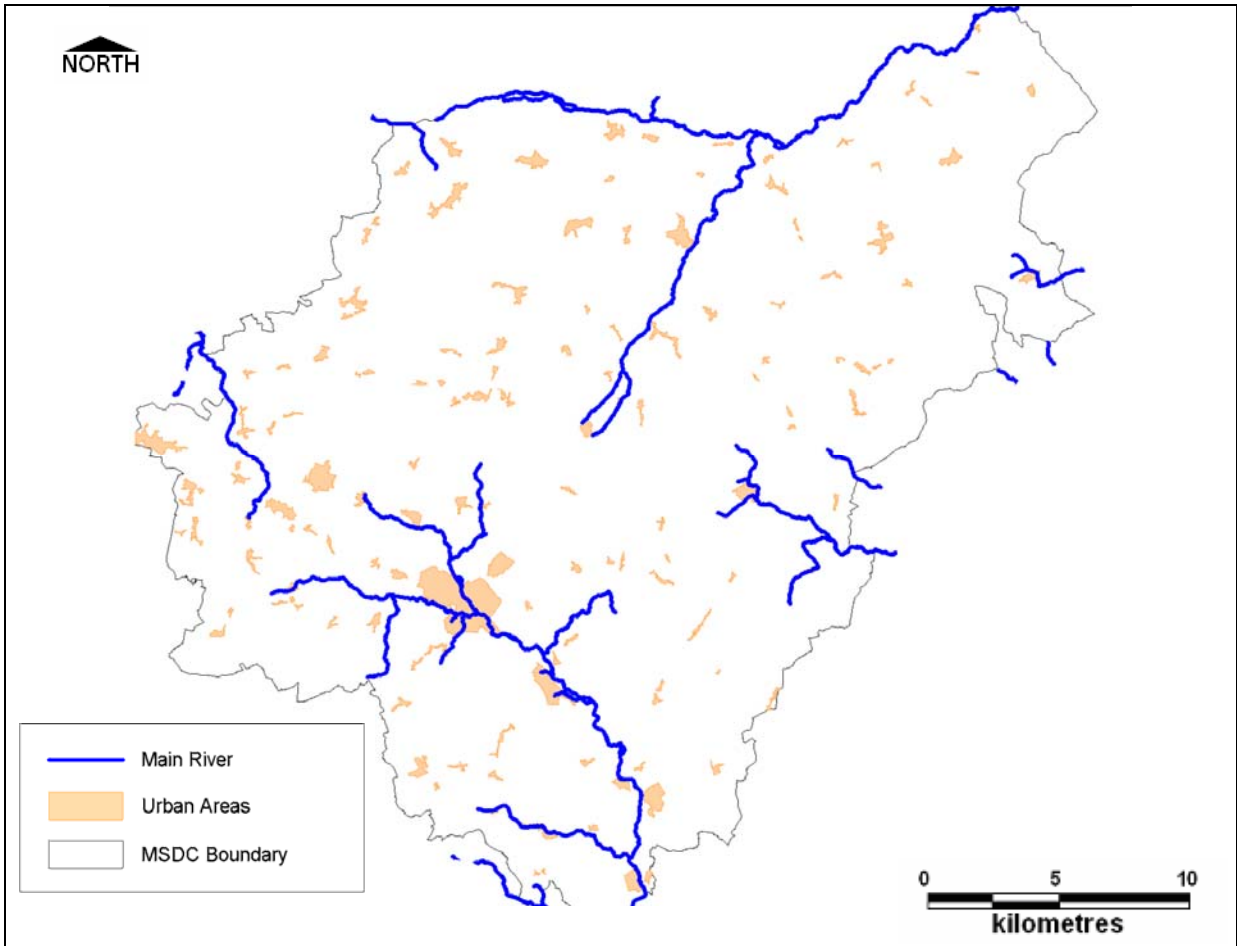
Figure 1-1: SFRA History and Process



2 Study Area

The study area comprises the administrative area of MSDC and covers a total area of 829 km². The Mid Suffolk administrative area is predominantly rural, with the major town being the market town of Stowmarket. Smaller urban centres within Mid Suffolk include, Debenham, Eye, Needham Market and Walsham le Willows. The study area is covered by three Internal Drainage Boards (IDBs), Waveney Valley IDB, Deben Upper IDB and the Gipping IDB.

Figure 2-1: Study Area



2.1 Historical Flooding

There have been numerous historical flood events in the Mid Suffolk study area. These events are summarised by catchment in Table 2-1 with the causes and effects presented where available. The EA were contacted regarding historic flood events and few were recorded for the study area. Similarly the Council held no records of historical flooding, although it is believed that Norfolk Property Services may hold records on surface water and sewer flooding. This should be investigated further when the SFRA is updated. . EA data, including CFMPs and British Hydrological Society Chronology of British Hydrological Events (BHS CBHE) database[1]. Information was used to produce Table 2-1 Flooding from other sources is also important, with stakeholder responses from Anglian Water indicating sporadic flooding hotspots across the study area. Table 2-1 below shows recorded historic flood events.

Table 2-1: Historical Flooding

Year	Month	Location	Source of Flooding	Impact
1875	November	Waveney Valley	Fluvial (rain and snowmelt)	Waveney Valley flooded for 5 weeks
1875	November	Upper Ouse catchment	Fluvial	Flooding in Walsham-le-Willows
1875	July	Gipping- Blakenham and Claydon	Fluvial	Crops flooded in Gipping Valley
1877	January	Waveney Valley	Fluvial	Prolonged flooding
1887	July	Framsden, Deben	Fluvial	Flooded agricultural land
1889	October	Deben Valley	Fluvial	Prolonged flooding
1896	September	Claydon	Surface water and drainage flooding	Intense rainfall
1910	December	Needham Market, Gipping	Fluvial	Severe flooding including property flooding
1968	September	Waveney Valley	Fluvial	Land and property flooded
1987	August	Stowmarket, Needham Market-Gipping,	Fluvial	Properties and land flooded
1988	January	Gipping, Stowmarket, Needham market	Fluvial	Properties flooded
1993	October	Gipping- Stowmarket, Great Finborough, Combs Ford, Needham Market, Combs, Pips Ford.	Fluvial 1 in 5yr event and surface water	Property flooding
1993	October	Deben- Debenham	Fluvial 1 in 25 year event and surface water flooding	Properties flooded
2001		Thurston, railway station	Groundwater following prolonged rainfall	Localised flooding and minor transport disruption
2004	May	Rattlesden River, Gipping Valley	Fluvial	Roads flooded

[11]British Hydrological Society, Chronology of British Hydrological Events, Online Database, University of Dundee. http://www.dundee.ac.uk/geography/cbhe/[1]

2.2 Flood Sources and Flood Defences

2.2.1 Fluvial

The main watercourses within the study area are:

- River Deben,
- River Dove,
- River Gipping,
- River Waveney.

The majority of the south of the District is drained by the River Gipping and its tributaries. The northern part of the District is drained by the River Waveney and its tributaries including the River Dove. A small area to the middle east of the District is drained by the River Deben.

These watercourses and their catchments are small and due to their underlying geology, they are consequently flashy in nature and respond quickly to rainfall, particularly if the catchment is saturated or baked hard following prolonged dry periods.

River Deben
The catchment of the River Deben covers the middle-eastern part of the study area and is covered by the East Suffolk Catchment Flood Management Plan (EA, 2007) The River Deben has a catchment area of 184km^2. Its source lies just to the west of Debenham.

The underlying geology of the River Deben catchment consists of the Chillisford Crags and clays, river terrace deposits and alluvium and underlain by a minor aquifer in the north west of the catchment, and a narrow strip of major aquifer downstream of Debenham. This suggests that underlying strata are not very permeable.

The catchment of the River Deben is rural in nature with the village of Debenham being the largest settlement within the catchment in the study area. The East Suffolk CFMP estimates that in Debenham 248 properties are at risk of fluvial flooding. The East Suffolk CFMP gives Debenham a Standard of Protection (SoP) of 1 in 5 years.

River Dove
The River Dove is a major tributary of the River Waveney and joins the Waveney just downstream of Hoxne. The majority of the Dove catchment is rural, with small settlements including Braiseworth, and the small town of Eye fringing its floodplain. The entire catchment of the River Dove covers an area of 200km^2 and is 17km in length.

The underlying geology of the River Dove catchment consists of folded chalk overlain by drift deposits of boulder clay, sand and gravel and the entire catchment is underlain by a minor aquifer of high, intermediate and low vulnerability.

River Gipping
The catchment of the River Gipping covers the southern part of the study area. According to the East Suffolk CFMP, the River Gipping drains a total catchment area of approximately 313km^2 and outfalls to the Orwell estuary. The main tributaries of the River Gipping are the Rattlesden River, Earl Stonham watercourse and Somersham watercourse. Due to the number of tributaries and presence of urban areas, hydrometric records show that the River Gipping responds quickly to rainfall events as occurred in October

1993. The River Gipping flows in a general northwest to south-easterly direction. The majority of the catchment is rural and there are pockets of urbanisation along the entire reach of the River Gipping including the major town in the study area, Stowmarket, and the smaller town of Needham Market. .

The geology of the River Gipping consists of chalk deposits including red chalk, sands and gravel and river terrace deposits and the majority of the catchment is underlain by a minor aquifer, with a thin strip of major aquifer adjacent to the river channel downstream of Stowmarket.

The East Suffolk CFMP estimates that 302 properties are at risk of flooding in Stowmarket from the River Gipping and tributaries, 594 properties in Needham Market and 32 properties in Rattlesden. Needham Market and Stowmarket are defended to a standard of 1 in 25 years, whilst the rest of the Gipping Valley has a Standard of Protection of approximately 1 in 5 years.

River Waveney

The catchment of the fluvial River Waveney covers the northern part of the study area. The fluvial reach is approximately 32km in length. The fluvial Waveney drains a total catchment area of approximately 673 km^2

The River Waveney flows in a general west to east direction from its source at Redgrave Fen to the tidal limit at Ellingham Mill. The river has a shallow gradient and consequently has a gentle profile with an associated low carrying capacity, and limited ability to alter its course during a flooding event. As areas surrounding the River Waveney are fairly flat, the river will spread into an extensive flood plain during times of high flow when the river overtops its banks. This floodplain area will subsequently drain slowly, due to low gradients, and may be boggy and marshy. The catchment landscape is rural and relatively flat with floodplains drained by a network of drainage channels flanking the river. The primary land uses in the catchment are agriculture and touristic uses. There are numerous sluices found along the non-tidal reaches of the river to regulate river levels during low flow conditions, and to assist in land drainage and to supply a limited amount of flood storage to the system (The River Waveney Flood Risk Study, March 2006).

Similar to the River Dove, the underlying geology of the Waveney consists of folded chalk overlain by drift deposits of boulder clay, sand and gravel. The east and west of the catchment are underlain by major aquifers, whilst the centre of the catchment is underlain by a minor aquifer.

2.2.2 Groundwater

The geology of the study area is varied. Large tracts of the study area are underlain by chalk and the Norwich and Chillisford crags which are then overlain by sands and gravels of varying thickness. Large parts of the study area can therefore be considered a minor aquifer, which according to the East Suffolk CAMS (2007) is of local importance. There are however significant pockets major aquifer, particularly in the east and west of the Waveney catchment, and in the west of the study area near Walsham le Willows and the Great Ouse catchment. The geology of the River Gipping consists of chalk deposits of the Lowestoft formation, sands and gravel and river terrace deposits. The underlying geology of the River Waveney and River Dove consists of folded chalk overlain by drift deposits of boulder clay, sand and gravel. The underlying geology of the River Deben catchment consists of marine crags and Chillisford Clays river terrace deposits and alluvium

There are few reported occurrences of groundwater flooding from hard rock aquifers or superficial deposits in the study area. The Great Ouse CFMP identifies an instance of groundwater flooding in 2001 near the railway station in Thurston which caused some traffic disruption. The East Suffolk CFMP studied the Defra Strategy for Flood and Coastal Erosion Risk Management study and summarised that groundwater flooding is not a significant risk in East Anglia. However, the chalk overlain by sands and gravels forms a

minor aquifer, with pockets of major aquifer in places, therefore the potential for groundwater flooding could exist.

2.2.3 Tidal Influences

None of the watercourses within the study area are tidally influenced; however tide-locking is an issue in the Broadlands to the northeast, just outside the study area. In an extreme event there is a potential risk that tide locking could cause backing up of waters in the River Waveney. Failure of Ellingham sluice could potentially see tidal influences extend further upstream. Discussion with the EA have revealed that during tidal events, it is not uncommon for flood watches to remain on fluvial stretches of the Broadlands for several tidal cycles due to the tide looking effect.

2.2.4 Sewers and drainage

The majority of sewers built in the last 30 years are built to the guidelines within "Sewers for Adoption" (WRC, 2006). These sewers have a design standard to the 1 in 30 year rainfall event and therefore it is likely that the majority of sewer systems will surcharge during rainstorm events with a return period greater than 30 years (e.g. 100 years). Many sewers are however much older and date back to the Victorian era and are of an unknown capacity and condition. Anglian Water has provided DG5 data for the region, which is presented as a series of points in GIS format. It is also worth noting that the Mid Suffolk CFMP states that sewer flooding is a particular risk in Stowmarket, and the data provided by Anglian Water also appears to indicate this. Sewer flooding is thought to be the most common cause of flooding in the UK and yet there is limited information available on the issue. The Interim findings of the Pitt Report (December 2007) also highlights sewer and drainage flooding as a key issue requiring further investigation. It is recommended that the issue is discussed further with both Anglian Water Services and Norfolk Property Services who have dealt with sewer flooding in the District. Norfolk Property Services were contacted following a meeting held with MSDC but data was not available to be incorporated at the time of writing. Any relevant data should be incorporated into the SFRA when it is updated.

2.2.5 Pluvial and overland

During periods of prolonged rainfall events and sudden intense downpours, overland flow from adjacent higher ground may 'pond' in low-lying areas of land without draining into watercourses, surface water drainage systems or the ground. Much of the flooding experienced in October 1993 in the River Gipping and River Deben catchments can be attributed to pluvial and surface water flooding following prolonged intense rainstorms. One of the main issues with pluvial flooding is that in areas with no history, relatively small changes to hard surfacing and surface gradients can cause flooding (garden loss and reuse of brownfield sites for example). As a result, continuing development could mean that pluvial and surface water flooding can become more frequent and, although not on the same scale as fluvial flooding, it can still cause significant disruption.

2.2.6 Artificial Sources

The Broadlands of Norfolk and Suffolk lie to the immediate north of the study area, and Needham Lake lies to the south of Needham Market. The Broads originated in the Middles Ages, during the 9th to 13th centuries, as shallow pits from which generations of Norfolk people dug peat for heating and cooking purposes. During the 14th century the sea level rose, the area flooded, forming the Broadlands as we know them today. Forty-one shallow lakes that are fed and interconnected by the rivers Bure, Yare and Waveney and their tributaries the Ant, Thurne and Chet, make up the 200-kilometre lock free waterway.

2.2.7 Flood Defences

NFCCD data is currently being updated, and the data obtained as part of the SFRA shows only one small section of raised flood defence in Mid-Suffolk, in Needham Market. Discussion with the EA suggests that it is however likely that various formal and informal flood defence structures exist, particularly in urban areas such as Stowmarket. Consultation with the EA should be maintained to ensure all flood defences are correctly identified.

2.2.8 Flood Warnings

The Civil Contingencies Bill requires that the Environment Agency 'maintain arrangements to warn the public of emergencies'. The Environment Agency are responsible for issuing flood warnings to the public based on 24 hour monitoring of rainfall, river levels and sea state. This data is combined with weather data and tidal reports from the Met Office, including the use of radar to track storms and rainfall intensity, and data from the national tide gauge network. The warnings are issued by local radio, supplemented by direct dial telephone systems, (Floodline Warnings Direct), on www.environment-agency.gov.uk/floodwarnings which is updated every 15 minutes, and other local systems as appropriate. The Environment Agency also endeavors to raise awareness of flooding in areas prone to flooding and suggest that people living in vulnerable areas make preparations in advance.

The Environment Agency has general supervisory and other statutory duties for flood defence and flood warnings in Mid Suffolk. The work carried out to meet these duties includes:

- Maintaining main river channels and flood defence structures
- Providing and operating a flood warning service

The existing warning service provided by the Environment Agency applies only to flooding from rivers and the sea. Some parts of the country provide a nominal groundwater flood warning service. There is no obligation on Water Companies to provide warnings of flooding from sewers or drains.

The degree of advance warning that can be provided is critical to the amount of action that can be taken to prevent damage. A minimum of 2 hours advance warning is the standard currently used in England and Wales for river flooding. The ability to provide this depends on the geography of an area, the intensity of the rainfall and the type of weather systems causing the rain as these variables can act together to produce an unlikely and therefore unpredictable event. In the case of flooding from the sea an entirely different set of natural parameters needs to be measured and assimilated into forecasting systems, such as tidal levels and storm surges in order to provide predictions of sea level and wave height.

When conditions require, e.g. forecast high tide with high winds, the EA provide local forecasts on the possibility of flooding and determine which defences to operate and when, closing moveable defence features if necessary.

The role of flood warnings in flood risk and residual risk reduction can be either a standalone measure or in combination with built defences. Flood warning as a stand-alone measure can reduce the consequences of flooding to properties by enabling reactive action to protect life and reduce the effect of flooding on property. Flood warning in combination with built defences can protect life and reduce damage in the event of the defence level being exceeded by the severity of the flood.

The need for flood warnings in highly populated areas, such as Stowmarket is particularly important, as the consequence of flooding in areas where people's perception of flood risk is low can be significant. In such cases flood warning needs to work closely with local authority emergency planning to allocate potential evacuation routes and contingency plans following a flood event. The difficulties of issuing effective warnings of possible defence failure poses a significant challenge and in some cases it will not be practical to provide a reliable or timely flood warning service to an area because of the rapidity or unpredictable nature of flooding.

There are a number of flood warning areas in Mid Suffolk, which aim to provide two hours lead time for flood warnings issued by the Environment Agency. However, the flashy nature of many of the catchments in the area to winter rainfall and high intensity summer thunderstorms make issuing warnings difficult. In the future Flood Warning Areas and Flood Watch Areas, targeted at a community level will see an increase in flood warnings in the area so that only communities at risk from individual events will be notified.

2.2.9 Flooding Mechanisms

Overtopping

Overtopping occurs when water passes over a flood defence. When flow exceeds the capacity of the conveying channel, the water level will rise in that channel until its banks are overtopped. Water will then spill over the channel banks and onto adjoining land. With an upland river the adjoining land is its natural floodplain, which will generally be of limited extent and fairly well defined. In a downstream river where the gradient flattens the floodplain can be much wider Flood defences and urban development can significantly alter natural flow paths within the floodplain area and affect the dispersion of floodwater.

Flood defences are usually designed with a degree of 'freeboard', the height by which the crest level of the defence exceeds the design flood level. Main river and tidal embankments are designed to have a constant freeboard above their design level so, in theory, when they are overtopped the overflow should be small in volume and of uniform depth along the full length of the defence embankment, occurring during the highest water levels at the peak of the tide/flood. In reality the freeboard varies from point to point due to the natural subsidence of defences over time, and water heights can be exacerbated by wave action. Even so, the embankment acts like a weir limiting the rate of flow and volume over the embankment and limiting flooding velocities and volume to the immediate area.

Breaching

Breaching of flood embankments is one of the main causes of major flooding in lowland areas. Breaches can occur in any situation where there is a defence which has a crest raised above adjacent land levels. An earth embankment may be breached as a result of overtopping, which weakens the structure through erosion, eventually creating a breach in the defences. Breaches in embankments are more likely during high water level events including extreme tides or periods of high river flow. A fluvial breach in an embankment will result in the dispersal of floodwater from the channel resulting in a lowering of the water levels and flow through the breach.

The time taken for a breach to be sealed can have a major effect on the extent and depth of flooding. In addition to the flood risk associated with a breach event, there is an implied flood hazard. The highest hazard exists in the period immediately following a breach, and usually, but not necessarily, in the areas closest to the breach. Floodwater flowing through a breach will be of high velocity and volume, dissipating rapidly across large low-lying areas, and possibly affecting evacuation routes. Flooding as a result of a breach in defences, either from fluvial or tidal sources, can be life threatening with far reaching consequences.

Mechanical or Structural Failure

Flooding may result from the failure of engineering installations such as tidal barriers, land drainage pumps, sluice gates and floodgates. Hard defences may fail through the slow deterioration of structural components such as the rusting of sheet piling, erosion of concrete reinforcement and toe protection or the failure of ground anchors. Such deterioration is often difficult to detect, so that failure when it occurs is often sudden and unexpected. Failure is more likely when the structure is under maximum stress, such as extreme fluvial events when pressures on the structure are at its most extreme.

2.3 Administrative Bodies

2.3.1 Mid Suffolk District Council

MSDC have provided information on their emerging LDF including information on policies relating to flood risk.

2.3.2 Environment Agency

The study area falls within the Environment Agency's Anglian Region – Eastern and Central Areas. The Environment Agency's Anglian Region has discretionary powers under the Water Resources Act (1991) for all Main Rivers and their associated flood defences within the study area.

2.3.3 Water Companies

Anglian Water, together with Essex and Suffolk Water (who supply Eye) are responsible for storm and foul water management across the Mid Suffolk study area. In addition, private individuals may be responsible for drainage systems that operate prior to discharge either into a watercourse or into a public sewer.

2.3.4 Suffolk County Council

Suffolk County Council were contacted as part of this SFRA and provided details of the county structure plan. Their highways team were also contacted for any highways drainage information.

2.3.5 Internal Drainage Boards

Mid Suffolk's administrative areas includes some watercourses that are administered by the River Gipping, River Deben and River Waveney IDB's.

2.4 Potential Development Pressures

MSDC have supplied outlines of the 400 land bid sites from their Site Allocations Issues and Options paper (November 2007). More exact development locations will only be possible after the sequential testing process has been undertaken. Development pressures vary somewhat across Mid Suffolk, with most development being focussed in Stowmarket. The most significant pressure for MSDC, as it is for many authorities across the country, comes from identifying land for new housing, particularly brownfield land.

The Panel Report for the Examination in Public of the draft RSS for the East of England outlines the following housing provision targets for the Mid Suffolk Authorities.

Table 2-2: Housing targets to 2021 according to East of England RSS

Houses Required 2001-2021 according to draft East of England RSS	
Mid Suffolk Parishes Adjoining Ipswich	800
Remainder of Mid Suffolk	7,500
Total 2001-2021	8,300
Houses required 2021-2025 (estimate based on draft East of England RSS)	
Total 2021-2025 (415x4 = 1,660)	1,660

Table 2-2 above shows the small Mid Suffolk parishes adjoining Ipswich as a separate entity within Mid Suffolk. This small area consists of Great Blakenham, Whitton, Claydon, Ackenham, and Barham. These settlements form part of the Ipswich Policy area of the Haven Gateway Partnership sub-region. This area is planned to be developed as a centre of Hi-Tech, knowledge based industry. Employment growth is, according to the Core Strategy, likely to be concentrated in the six towns and key service centres situated along the two main trunk roads in the study area (A14 and A140). These service centres are: Great Blakenham, Needham Market, Stowmarket, Woolpit, Eye and Mendlesham and are shown in Figure 2-2.

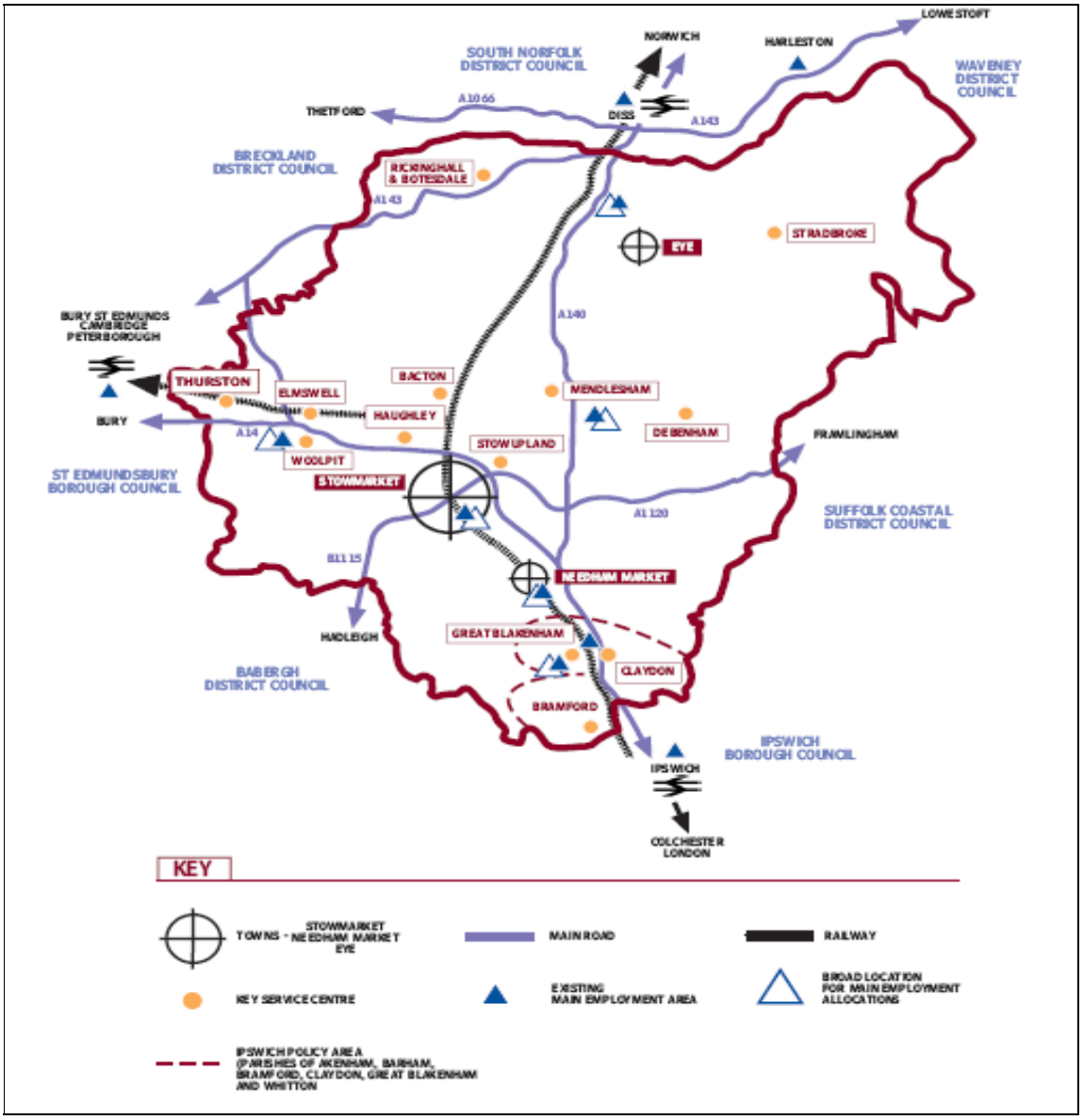


Figure 2-2: MSDC Core Strategy 2007 Existing and Potential Employment Sites

In addition, MSDC have designated three key potential growth areas: Stowmarket, Needham Market and Eye. These three towns together with other key services centres of Bacton, Bramford, Claydon, Debenham, Elmswell, Mendlesham, Rickinghall with Botesdale, Stowupland, Stradbroke, Thurston and Woolpit, form the main areas where future urban development is likely to be concentrated.

Table 2-3 is taken from MSDC's Core Strategy Submission October 2007, and shows the distribution of housing supply over the next 15 years and further breaks the supply down into those built on greenfield land (GF) and previously developed land (PDL).

Table 2-3: 15 Year Housing Supply from MSDC Core Strategy Submission

Years	2010-2015		2015-2020		2020-2025		Total 2010-2025	
	PDL	GF	PDL	GF	PDL	GF	PDL	GF
Stowmarket	300	300	100	400	0	340	400	1040
Needham Market	180	0	180	0	0	150	360	150
Eye	80	0	0	100	0	100	80	200
Ipswich Policy Unit	600	0	100	0	100	0	800	0
Key Service Centres	50	100	0	150	0	200	50	450
Primary Villages	0	100	0	100	0	100	0	300
Secondary Villages	0	0	0	0	0	0	0	0
Mid Suffolk Total	1210	500	380	750	100	890	1690	2140

Draft RSS policy SS11 lists remote rural Norfolk and Suffolk as priority areas for regeneration. Parts of Mid Suffolk fall into this category.

Parts of the Mid Suffolk study area also fall within the EU Objective 5b area and the Objective 2 core area. These areas are designated to receive economic regeneration through business support measures, development of key clusters, sectors and locations and community economic regeneration.

It is also worth highlighting that the large-scale 'Snoasis' development is proposed for Great Blakenham, which, if approved, could provide 600 houses and supporting services. The development would require an upgrade to the Alton water treatment works as part of the AMP5 2010-2015 works. The development is currently subject to a public enquiry (MSDC Core Strategy Submission October 2007).

2.5 Climate Change and Future Flood Risk (25, 50 and 100 Year Horizons)

PPS25 updates the approach to estimating the impacts of climate change on flooding by using newer scenarios predicted by the UKCIP02 (UK Climate Impacts Programme – Scenario 2). In addition to increasing the peak flow of larger watercourses (by up to 20%), PPS25 now also includes an increase in the peak rainfall intensity of up to 30%. This will seriously affect smaller urban catchments, leading to rapid runoff to watercourses and surface water flooding, surcharging of gullies and drains and sewer flooding.

The CFMP's have also considered flood risk for the next 50-100 years and have taken into account the flood risk drivers of climate change, urban development and changes in land use. Catchment models and the Modelling and Decision Support Framework (MDSF) software were used in the CFMP to test sensitivity to the flood risk drivers across the catchments in the study area.

To account for climate change in Mid Suffolk, additional modelling was carried out to obtain fluvial Flood Zone 2, 3a and 3b modelled outlines including the effects of climate change. Where there are no modelled climate change results, an estimate of the impacts of climate change on flood outlines is required. To this

end, the Flood Zone 2 outlines were used as a proxy. This is not to say that the 100 year flood outline will necessarily increase to the 1000 year outline, but rather that one would expect the depth and extents of flooding to increase to somewhere between the 100 year and 1000 year outlines. This is a conservative approach designed to help strategic planners identify where increased detail and resolution in the flood outlines is needed at either the Level 2 SFRA or Site Specific FRAs.

Sewer and surface water flooding are likely to become more frequent and widespread under urbanisation and climate change scenarios as the amount of impermeable surfaces and runoff increase, highlighting the importance of SuDS.

The location of future urban developments and flood defences within a catchment can heavily influence flood risk in the area and has the potential to further increase flood risk at sites downstream of such developments. Impacts include the lowering of the standard of protection offered by flood defences and the carrying capacity of culverts, drains, sewers and watercourse channels. This potentially leads to areas being at risk of flooding that were previously not at risk and highlights the increasing conflicts and pressures that are emerging between climate change scenarios and future development aspirations.

The draft PPS 1 Supplement sets out important objectives in order to tackle climate change, sea level rise and avoid flood risk. The purpose of design policies should be to ensure that developments are sustainable, durable and adaptable to natural hazards such as flooding. Following this guidance, it should be possible to mitigate against increased flood risk through incorporating 'flood proofing' measures such as raised finished floor levels into the development design, and/or development of compensatory storage and flood storage basins.

The ASCCUE (Adaptation Strategies for Climate Change in the Urban Environment) project is a study undertaken collaboratively by the University of Manchester, The University of Cardiff, The University of Southampton and Oxford Brooks University.

The project aimed to further the understanding of the impacts and risks of climate change on towns and cities through three 'exposure units' of human comfort, urban green space and the built environment. One of the aspects examined was surface water runoff during extreme rainfall events. With an increase in development, there comes an increase in the amount of impermeable areas thus leading to increased runoff during storm events. In one of the worst-case modelled scenarios in Manchester, an increase in rainfall of 56% by 2080, led to an increase in runoff of 82%. This highlights the increasing conflict and pressures that are emerging between climate change scenarios and future development aspirations.

2.5.1 Fluvial Flood Risk

Scott Wilson have been provided with a number of detailed hydraulic models for watercourses within the study area. There is a potential for increased peak river flow as a result of climate change, as identified in Table 2-4, and an increase in peak flow results in a greater floodplain envelope. The hydraulic models provided have an outline of Flood Zone 3a, 3b and 2 plus an allowance for climate change and therefore takes account of the 20year, 100year and 1000-year fluvial flood event plus a 20 % increase in peak river flows.

For watercourses where no detailed hydraulic model was available, the approach was taken to use the Flood Zone 2 and 3 outline where appropriate as a substitute until such a time that modelled data is available. The methodology is explained further in section 4.5.

2.5.2 Surface Water and Sewer Flooding

The potential increase in peak rainfall intensity (Table 2-4) is likely to lead to an increase in surface water flooding, surcharging of gullies and drains and sewer flooding. This is very difficult to identify and should be considered in site-specific FRAs.

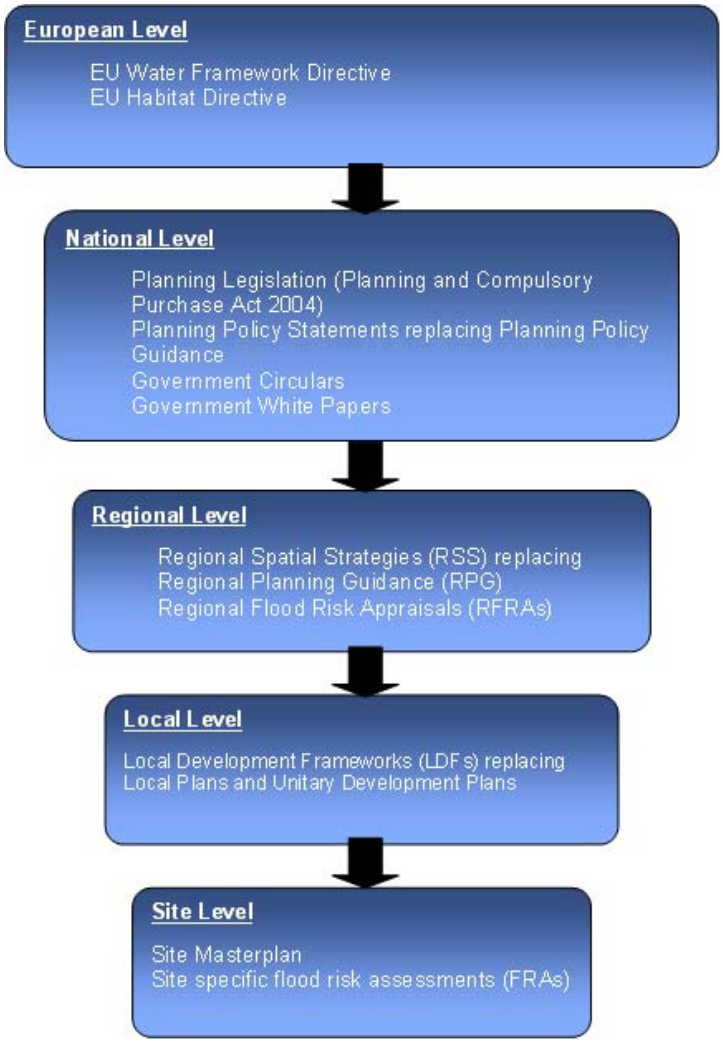
Table 2-4: Recommended national precautionary sensitivity ranges for peak rainfall intensities and peak river flows (PPS25 Table B.2)

Parameter	1900 to 2025	2025 to 2055	2055 to 2085	2085 to 2115
Peak rainfall intensity	+5%	+10%	+20%	+30%
Peak river flow	+10%	+20%		

3 Policy Review

National and local policies have been reviewed against the local flood risk issues and objectives identified by the EA in the Broadland Rivers, East Suffolk Rivers and River Great Ouse CFMPs. From these policies the following catchment-wide and specific area strategies have been developed under the headings Flood Risk, SuDS and the Water Environment. Integration of these suggested policy considerations into LDF / LDD should ensure that the objectives and aspirations of the EA and national policy are met whilst strengthening the position of the LPA with regard to flood risk.

Figure 3-1: Flow chart showing structure of the planning system



3.1 Planning Policy

The planning policy review collates and summarises all planning policy and guidance, relevant to flood risk in the Mid Suffolk Sub-Region. Firstly, PPS25 was reviewed as the key flood risk and development policy at a national level, followed by draft Regional Spatial Strategy (RSS) for the East Of England (December 2004) and the subsequent Secretary of States Proposed Changes to the Draft Revision of the RSS for the East of England and Statement of Reasons (December 2006).

The policy review covered policies pertaining to flood risk and development in flood risk areas and so also expanded to review key strategic development pressures, such as targets for housing provision, as set out by the draft RSS and the Secretary of State Report, as these need to be taken into consideration when assessing flood risk.

3.2 European Policy

Water Framework Directive (December 2000)

The Water Framework Directive (WFD) is a substantial piece of EC legislation and the largest directive related to water to date. The directive came into force on 22nd December 2000, and establishes a new, integrated approach to the protection, improvement and sustainable use of Europe's rivers, lakes, estuaries, coastal waters and groundwater. The directive requires that all member states manage their inland and coastal water bodies so that a "good status" is achieved by 2015. This aims to provide substantial long-term benefits for sustainable management of water.
The Directive introduces two key changes to the way the water environment must be managed across the European Community:

1. Environmental & Ecological Objectives. The WFD provides for Protected Areas and Priority Substances to safeguard uses of the water environment from the effects of pollution and dangerous chemicals. In addition, important ecological goals to protect, enhance and restore aquatic ecosystems are set out
2. River Basin Management Plans (RBMPs). RBMPs are the key mechanism to ensure that the integrated management of rivers, canals, lakes, reservoirs and groundwater is successful and sustainable. RBMPs aim to provide a framework in which costs and benefits can be properly taken into account when setting environmental and water management objectives.

Each RBMP must apply to a "River Basin District" (RBD) (a geographical area which is defined based on hydrology – see Annex 1, DEFRA & WAG River Basin Planning Guidance (RBPG), August 2006). The RBD that is relevant to Mid Suffolk is the Anglian RBD (equivalent to the EA Anglian Region). The river basin planning process involves setting environmental objectives for all groundwater and surface water (including estuaries and coastal waters) within the RBD, and designing steps and timetables to meet the objectives. The EA is responsible for implementing the WFD in England and Wales and aim to have completed draft RBMPs by 2009.

According to the DEFRA and WAG River Basin Planning Guidance (August 2006), a RBMP should be a strategic plan that gives all stakeholders within a RBD some confidence about future water management in their district. It should also set the policy framework within which future regulatory decisions affecting the water environment will be made.

Although RBMPs specifically address sustainable water management issues, the WFD also requires that other environmental considerations and socio-economic issues are taken into account. This ensures that

the policy priorities between different stakeholders are balanced to ensure that sustainable development within RBDs is achieved.

As a result of the strategic nature of RBMPs, they are inherently linked to and can both influence and be influenced by planning policy within their areas. The following sections are extracted from the DEFRA and WAG River Basin Planning Guidance (August 2006).

Spatial Plans Influencing RBMPs

Emerging development plans will be an important source of information on future water management pressures that can inform the EA and refine its understanding of the current status of water bodies, and how this might change if no action was taken. The RBPG stresses the importance of taking into account the continuation of sustainable human development (including ports, recreational uses, water storage and flood risk management schemes) within RBDs and the setting of water management frameworks.

The EA's Catchment Flood Management Plans (CFMPs) and Catchment Abstraction Management Strategies (CAMS) are examples of such high-level planning tools that can inform development of RBMPs. Using CFMPs, the Regional Flood Risk Assessments (RFRA) and Strategic Flood Risk Assessments (SFRAs) will build upon existing flood risk and planning information to present current and potential future development within RBDs in relation to flood risk. In addition, policies that emerge from these studies (for example SuDS, Flood Risk Management procedures and mitigation options) will inform the development of the water management frameworks in RBMPs. The Mid Suffolk SFRA should play an important role in informing the water management framework in the emerging Anglian RBMP.

RBMPs Influencing Spatial Plans

As well as being informed by various spatial and catchment wide plans and strategies, RBMPs should produce strategic, regional policy information that is necessary to feed into the spatial planning process such as Local Development Frameworks. For example, where RBMPs have a direct affect on the use and development of land they will have to be material considerations in the preparation of statutory development plans for the areas they cover. It will also be necessary for planning authorities to consider WFD objectives at the detailed development control stage (not least to consider the requirements of Article 4(7) of the WFD in relation to new physical modifications).

To allow local authorities to incorporate WFD objectives into their various statutory development plans, the Environment Agency will provide local authorities with information such as CFMPs, CAMS and other catchment-wide guidance and strategies, to enable effective integration of the water management framework within statutory development plans. In order to address the fact that these plans have different planning cycles and are at different stages in their development, RBMP policies that affect the development and use of land must be considered in the monitoring and review of statutory spatial plans.
In addition, some of the measures necessary to achieve WFD objectives will be delivered through land use planning mechanisms. For example spatial planners can make major contributions to WFD objectives by including appropriate planning conditions and planning obligations in relevant planning permissions for new developments, or by restricting some forms of development. Delivery of these measures is more likely to take place if they are included in Local Development Frameworks/Plans by land use planners. As stated above, the Mid Suffolk SFRA should inform the RBMPs and, as a result, the LDF being prepared by the MSDC should already include policies and recommendations relating to flood risk management and development within catchments.

3.3 National Planning Policy

3.3.1 Planning Policy Statement 25: Development and Flood Risk (December 2006)

The relevant Planning Policy Statement in terms of managing flood risk that pertains to development is PPS25. PPS25 requires local authorities to take a risk-based approach to flooding in relation to the preparation of local development documents or plans.

This document aims to ensure that flood risk is taken into account at all stages in the planning process from the inception of regional and local policy through to individual development control decisions.

The document seeks to avoid inappropriate development in areas at risk of flooding, and to direct development away from areas of high risk through the application of the Sequential Test and the precautionary principle. It is acknowledged that, in some exceptional circumstances, it might not be possible to deliver available sites in lower risk zones through the sequential approach. Here, policy will aim to ensure that the development will be safe, without increasing flood risk elsewhere and, where possible, reducing flood risk overall.

Key Planning Objectives

PPS25 identifies means by which Regional Planning Bodies (RPBs) and Local Planning Authorities (LPAs) should prepare and implement strategies that help to deliver sustainable development. These include:

- Appraising risk
- Identifying land at risk and the degree of risk of flooding from river, sea and other sources in the area;
- Preparing Regional Flood Risk Assessments (RFRAs) or Strategic Flood Risk Assessments (SFRAs) as appropriate;
- Managing risk
- Framing policies for the location of development which avoid flood risk to people and property where possible, and manage any residual risk and accounting for 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 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; recreating functional floodplain; and setting back defences;
- A partnership approach
- Ensuring spatial planning supports flood risk management policies and plans, River Basin Management Plans and emergency planning.

A Risk-based Approach

PPS25 presents a three-tier approach to flood risk assessment at the regional, strategic and site-specific levels. At the regional level this will be in the form of a Regional Flood Risk Assessment (RFRA) and at the local level a Strategic Flood Risk Assessment (SFRA). Policies and proposals should be established on the basis of flood risk assessments.

PPS25 indicates that the Regional Planning Body should take flood risk into consideration when determining strategic planning considerations in the Regional Spatial Strategy (RSS). The RSS, guided by the RFRA, should identify broad locations and establish locational criteria for development in the region. This in turn will inform Strategic Flood Risk Assessments and consequently Local Development Documents at the local level.

Key requirements for SFRAs:

- Strategic Flood Risk Assessments (SFRAs) will refine information on the probability of flooding, taking into account all sources of flooding and the impacts of climate change. SFRAs should have regard to catchment-wide flooding issues that affect that area.
- The SFRA should provide the foundation from which to apply the Sequential and Exception Test in the development allocation and development control process (see Flood Zones 1-3b).
- SFRAs should be prepared in consultation with the Environment Agency, emergency response and drainage authority functions of the LPA and where appropriate Internal Drainage Boards.
- Development should not add to flood risk and should, where possible, reduce it.

SFRAs should identify the four key Flood Zones:

Table 3-1 Flood Zones as defined in Table D1, Annex D of PPS25 (full description provided in Appendix D of PPS25).

	Definition		Probability of Flooding
	Fluvial	Tidal	
Flood Zone 1	< 1 in 1000 year (< 0.1%)	< 1 in 1000 year (< 0.1%)	Low Probability
Flood Zone 2	Between 1 in 1000 year (< 0.1%) and 1 in 100 year (1%)	Between 1 in 1000 year (< 0.1%) and 1 in 200 year (0.5%)	Medium Probability
Flood Zone 3a	> 1 in 100 year (> 1%)	> 1 in 200 year (> 0.5%)	High Probability
Flood Zone 3b	Either > 1 in 20 (5%) or as agreed by between the EA and LPA	Either > 1 in 20 (5%) or as agreed by between the EA and LPA	Functional Floodplain

Percentages refer to the annual probability of a flood event occurring in any year

Minimum requirements (set out in Annex E) for flood risk assessments are that they should:

- Be proportionate to risk and appropriate to the scale, nature and location of the development.
- Consider risk of flooding to the development and risk arising from the development.
- Consider the impacts of climate change.
- Be undertaken early, by competent people.
- Consider adverse and beneficial effects of flood management infrastructure and consequences of failure.
- Consider vulnerability of those occupying the development, taking account of the Sequential and Exception Tests, the vulnerability classification and safe access arrangements.
- Ensure that assessments are fit for purpose by ensuring that different types of flooding are considered and quantified. Flooding should be considered from natural and human sources and joint cumulative effects should also be considered. Flood Risk reduction measures should be identified.

- The effects of flooding events (including extreme events) on people, property, the natural and historic environment and river and coastal processes should be considered.
- The remaining residual risk reduction measures should be included. It should be demonstrated that this is acceptable for the particular development/land use.
- The ability of water to soak into the ground may change with development and this should be considered, as should how the proposed layout of the development may affect drainage systems.
- Assessments should be supported by appropriate data and information including historical data on previous events.

PPS 25 in Context
It is important to see Planning Policy Statement 25 Development and Flood Risk (PPS25) as part of a wider integrated approach to spatial planning. Flood risk should be considered alongside other spatial planning concerns such as the delivery of housing, economic growth, management of natural resources, regeneration and the management of other natural hazards. There are clear links to other Planning Policy Statements that may not be explicit in PPS 25, but which are necessary to achieve its objectives. The most obvious link is with the draft supplement to PPS1 "Climate Change and Sustainable Development".

Development and Flood Risk: A Practice Guide Companion to PPS25 'Living Draft'

This draft Practice guide provides advice on the practical implication of PPS25. It is however a 'living' document and is likely to change in content as new flood risk policy and legislation evolves. Consultation has now finished on the document however, and it is currently being reviewed.

Draft PPS1 Supplement "Climate Change and Sustainable Development"

PPS1 is the Government's overarching statement on the purpose of the planning system. Paragraph 3 of the PPS makes clear that 'sustainable development is the core principle underpinning planning'. The PPS 1 Supplement (December 2007) sets out important objectives in order to tackle climate change, sea level rise and avoid flood risk. The purpose of design policies should be to ensure that developments are sustainable, durable and adaptable to natural hazards such as flooding.

PPS 25 is clearly a key part of the Government's programme of responses to the challenge of climate change. If climate change is not stabilised (mitigated) then this will have two impacts on flood risk. Projected sea level rises would suggest that the risk of flood defence levels being overtopped would increase. Second, climate change is likely to create higher rainfall in winter, and consequently to increase the risk of flooding along river catchments. An increased frequency of intense rainfall events is also likely to increase the numbers of urban and flash floods, and could also mean increases in the extent of flooding from rising groundwater.

PPS3 Housing

PPS3 Housing sets out the Government's broad policy objectives for planning for housing and those policies it considers will help to realise those objectives, including the efficient use of land, variety of household types and supply, affordability and designing for quality. Via the consideration of climate change and flood risk, PPS3 aims to deliver housing policies that seek to minimise environmental impact.

PPS25 strongly supports the strategy for housing set out in PPS3. In meeting the objective of increasing housing supply the assessment of flood risk is crucial. Via the incorporation of local flood mitigation measures such as Sustainable Urban Drainage Systems and good quality design and site layout, it is possible to build safely and to manage flood risk.

PPS7 Sustainable Development in Rural Areas

PPS7 sets out the Government's planning policies for rural areas, with the protection and enhancement of the natural and historic environment, the quality and character of the countryside and existing communities all of crucial importance. The PPS states that any development in rural areas should consider flood risk at all stages of the planning process in order to reduce future damage.

PPS9 Biodiversity and Geological Conservation

The Government's planning policies on the protection of biodiversity and geological conservation via the planning system are outlined in PPS9. Crucially, many protected sites fall within Flood Zones and there is also an imperative to consider the impact of removing woodland on carbon sinks and on flooding.
There is also a grave risk that if land is used for development because its value in respects other than productive capacity is limited, the pressure on less productive land for production may increase in the future. In the case of increased flood risk, any adverse affects arising from the development of land should be avoided rather than minimised.

PPS 11 Regional Spatial Strategies

PPS11 sets out the Government's policy on the preparation of Regional Spatial Strategies - what they should cover and how they should be prepared and revised. The RSS should articulate a spatial vision of what the region would look like by the end date of the strategy, and how it will contribute to achieving sustainable development objectives. The RSS must, importantly for flood risk, address regional or sub-regional issues that cross local authority boundaries, working in consultation with LPAs and other stakeholders to identify the circumstances in which a sub-regional approach should be applied. Annex 4 of PPS11 sets out the policies and guidance that should be considered and covered by the RSS, including climate change, water, and the requirements of PPS25.

PPS12 Local Development Frameworks

PPS12 sets out the Government's policy on the preparation of local development documents, which together comprise the Local Development Framework. Key issues include the consideration of climate change and the need to identify local areas at risk from flooding and to highlight the geographical location of such areas on the adopted proposals map. The preparation of all local development documents must be informed by a Sustainability Appraisal. Gathering information on flood risk is an important element of assembling the baseline information for these assessments.

A Core Output Indicator which must be reported on in the Annual Monitoring Report is the number of planning permissions granted contrary to the advice of the Environment Agency.

3.4 Non-Statutory National Planning Documents

3.4.1 Making Space for Water

During 2004, the Department for Food and Rural Affairs (DEFRA) undertook a consultation exercise, the object of which was to engage a wide range of stakeholders in the debate regarding the future direction of flooding strategy. The consultation document 'Making Space for Water' is part of the Governments overall approach to managing future flood risks and sets out the following aim:

'To manage the risks from flooding and coastal erosion by employing an integrated portfolio of approaches which reflect both national and local priorities, so as to:

- *Reduce the threat to people and their property; and*
- *Deliver the greatest environmental, social and economic benefit, consistent with the Government's sustainable development principles'* (p1)

Thus, the aim of the strategy is to balance the main pillars of sustainable development, namely social, economic and environmental factors.

Making Space for Water examines the impact of climate change on flood levels. Experts consider that the primary impacts on flood risk will be from changes in precipitation, extreme sea levels and coastal storms. DEFRA and the Environment Agency will produce revised guidance for use by those implementing flood and coastal erosion risk management measures. The revised guidance, yet to be published, will ensure that adaptability to climate change through robust and resilient solutions becomes an integral part of all flood and coastal erosion management decisions.

Making Space for Water emphasises the Government's commitment to ensure that a pragmatic approach to reduce flood risk is adopted. However, the paper notes that 10 per cent of England is already within mapped areas of flood risk. Contained within these areas are brownfield sites, which policy has identified as a priority for future development. The document asserts that over the past five years 11 per cent of new houses were built in flood risk areas.

The plan advocates the use of European Union (EU) funding streams, such as INTERREG IIIB, to enable local authorities to undertake trans-national projects aimed at advancing knowledge and good practice in flood risk management. The document also encourages integration with water management initiatives, in particular Catchment Flood Management Plans. The document proposes that RSSs and LDFs should take full account of strategic flood risk assessment and incorporates the sequential approach as set out in PPS25.

At the development control level, the document encourages local planning authorities to follow the existing guidance to require site-specific FRAs. In addition, the use of FRAs as supporting documents to planning applications in areas of flood risk is encouraged. The document proposes that if mitigating measures are shown to be required, they should be fully funded as part of the development.

3.4.2 Sustainable Communities Plan

The Sustainable Communities Plan (SCP, ODPM, 2003a) was launched by the ODPM in February 2003. The plans main aims include improving the overall quality of housing in England, a step change in housing supply to meet demand, encouraging new growth areas while maintaining and protecting the Green Belt. These objectives are to be achieved with sustainability at the centre to ensure a legacy of improved, livable communities.

The challenge is to reconcile the SCP's requirement to identify sufficient land for large volumes of new homes whilst ensuring that the sites allocated satisfy sustainability criteria specifically with regard to the avoidance of flood risk.

'*Sustainable Communities in the East of England: Building for the Future*' is the document that covers the districts commissioning this SFRA and will be discussed further in the Regional Planning Policy and Guidance Section.

3.5 Regional Planning Policies

Regional Spatial Strategies (RSS)

The Regional Spatial Strategy (RSS) for the East of England will, when adopted, replace Regional Planning Guidance for the South East (RPG9). Revisions to the East of England Plan are described in

The Secretary of State's Proposed Changes to the Draft Revision to the Regional Spatial Strategy for the East of England (December 2006). The detailed distribution of development is to be left to local Councils to decide. Below are summaries of the draft RSS policies that are relevent to this SFRA:

Policy SS14: Development and Flood Risk

Local development documents will:

- Promote the use of SFRAs to guide development away from high flood risk areas both current areas of risk and future areas at risk, through the use of flood risk mapping based on historical and modelled data, including an allowance for the impacts of climate change.
- Require that all developments do not increase flood risk elsewhere and aim to reduce flood risk pressure by the use of SUDS techniques where appropriate
- Only permit development in areas of higher flood risk or that may increase flood risk pressure where no alternative land is available, where there is an overriding need for development and where the risk can be fully mitigated against by design or engineering measures

Policy SS1: Achieving Sustainable Development

This policy aims to achieve a sustainable relationship between jobs, homes and services at the strategic and local level. It requires a sequential approach to the location of major development as a core component of sustainable development. It will require most development to be focussed on major urban areas, primarily on previously developed land and where there are strong transport links, decreasing the need for long distance commuting.

Policy WAT4: Flood Risk Management

This policy prioritises the defence of existing properties from flooding and encourages the location of new development to areas that have little or no risk from flooding. The policy also requires that SFRAs take into account the impact of climate change.

Suffolk Structure Plan

The Structure Plan is a statement of strategic policies for the protection of the environment and the control of development over the next 15 years. It provides a basis for investment decisions by local authorities, businesses and individuals, and for the plans and programmes of other organisations. However, as with RPG6 this document and all its policies will be abolished and have no affect once the East of England Plan is adopted and the Local Development Frameworks are in place for the respective Local Authorities.

Additionally, policies relevant to flood risk in the Suffolk Structure Plan were deleted on 27th September 2007 in accordance with the Planning and Compulsory Purchase Act 2004 and therefore have no weight.

3.5.1 Regional Flood Risk Appraisal (RFRA)

Discussion with the regional planning officer for the East of England has revealed that there is currently no RFRA for the East of England but that discussions with the EA on its production are ongoing.

3.6 Local Planning Policy

3.6.1 Local Development Framework (LDF)

Work is underway on the new LDF, a suite of planning documents that will set out MDSC's future planning policies and eventually replace the adopted September 1998 Local Plan

3.6.2 Local Development Documents (LDD)

The LDF will comprise Local Development Documents (LDDs), which will be of two types:

- Development Plan Documents (DPDs), which can deal with different issues or geographical areas, will be subject to independent testing and have the weight of development plan status; and
- Supplementary Planning Documents (SPDs), which will not be subject to independent testing and will not therefore have development plan status. SPDs will however be subject to rigorous procedures of community involvement and sustainability appraisals, and can be a material consideration in the determination of planning applications.

3.6.3 Development Plan Documents (DPDs)

MSDC are in the process of producing eight DPDs as part of the LDF. Four of the main DPDs are:

Core Strategy

This document sets out the strategic vision, objectives and spatial strategy for the area until 2021. Contains core strategic policies, e.g. green belt boundaries. It includes housing allocation numbers derived from the emerging RSS. MSDC has recently submitted its Core strategy for consultation (October 2007). The spatial strategy states that economic and residential growth will be focused in the key service centres and towns along the A14/A140 corridor, primarily Stowmarket. Policies relating to flood risk are included which incorporate PPS25 guidance and states that developments proposed in Flood Zone 1, but which are entirely surrounded by Flood Zones 2 or 3, will be treated as if they were in Flood Zone 2 or 3. No allocations will be permitted in Flood Zones 2 and 3 with the exception of Stowmarket.

Site Allocations

This document identifies site-specific allocations for a range of land uses such as Housing, Employment, Retail, Leisure, Community uses, Urban Open Spaces, Cemeteries, Education, as appropriate. It provides the policy framework for the delivery of both identified and windfall sites not otherwise dealt with in the Core Strategy or Development Control DPD. It will cover at least a ten-year period. MSDC recently published its Issues and Options Paper on Site Allocations (November 2007). The public consultation period ended January 2008. The document has identified 3 towns and 12 key service centres (Bacton, Bramford, Claydon, Debenham, Haugley, Elmswell, Eye, Mendlesham, Needham Market, Rickinghall with Botesdale, Stowmarket, Stowupland, Stradbroke, Thurston, Woolpit) in which development will be concentrated. There are approximately 400 potential land bid sites identified in the issues and options paper. In addition six key potential employment sites have been identified in Mid Suffolk. These are Great Blakenham, Needham Market, Stowmarket, Woolpit, Mendlesham and Eye

Development Control Policies DPD

A suite of generic development control policies, not covered by other DPDs setting out the criteria against which applications for the development and use of land and buildings will be considered.

Stowmarket Area Action Plan

This document will set out how development in Stowmarket will be progressed to meet the needs of the Core Strategy

3.6.4 Supplementary Planning Documents (SPD)

Supplementary Planning Documents (SPDs) are part of the Local Development Framework. SPDs give further guidance and information on how the District council will implement policies in the Local Development Framework.

3.7 Catchment Flood Management Plans

A CFMP is a high-level strategic plan which is used to identify and agree long-term policies for sustainable flood risk management within individual river catchments. CFMPs undertake an assessment of flood risk to identify the causes, size and location of flood risk throughout the catchment and the various influences that can affect the probability and consequences of flooding. This enables the effect of potential changes in the catchment on flood risk to be identified. Each potential source of change can be influenced by land use planning policy, such as a changing policy approach towards greenbelt protection or the allocation of large greenfield sites for housing development. Potential changes may include, for example:

- Development and land use change, such as new development or significant changes in the developed environment;
- Changes in the rural landscape, including large scale changes in land management;
- Loss of, or potential threat to, wildlife habitats or biodiversity;
- Climate change.

Flood risk management looks at the probability of a flood occurring and the potential resultant impacts. A spatial planning element also exists in flood risk management since it involves decisions on when, where and how to store or convey flood waters to minimise the risks to people, property and the environment.

CFMPs identify broad, long term (50-100 years) policies for sustainable flood risk management in the context of a particular catchment. The planning period is therefore considerably longer than the period typically considered to be “long-term” in land-use planning policy terms, which is usually 10 to 15 years. This potential conflict in planning timeframes should be taken into consideration, as a change to land-use policy can occur in a much shorter period of time than the CFMP may account for. There is also a potential conflict in that catchment boundaries do not necessarily relate to local planning authority boundaries and land use policy approaches may vary between authorities, increasing the complexity for flood risk management decisions across the catchment.

CFMPs aim, amongst other objectives, to inform and support planning policies, statutory land use plans and implementation of the Water Framework Directive, so that future development in the catchment is sustainable in terms of flood risk. Awareness of the role of CFMPs among land-use planners is in its infancy as these plans, along with SFRAs, are a relatively new requirement.

Preparing CFMP’s involves carrying out a strategic assessment of current and future flood risk from all sources (not just fluvial or coastal), understanding both the likelihood and impact of the risk and the effect

of current measures to reduce that risk. The scale of risk is broadly measured in economic, social and environmental terms. The Plans identify opportunities and constraints within the catchment to reduce flood risk through strategic changes or responses, such as changes in climate, urban development, land use, land management practices and/or the flood defence infrastructure and waterways.

CFMP policies (Table 3-2), which are identiifed for each individual "policy unit" (a policy unit relates to a specific geographical area), establish whether action should be taken to increase, decrease or maintain the current scale of flood risk. The CFMP does not identify specific ways of managing flood risk, which are the subject of subsequent, more detailed studies. A single policy is applied to each policy unit. Six policy options exist and may be applied:

Table 3-2: Generic CFMP Policy Options

Policy Option	Policy
1	No active intervention (including flood warning and maintenance), continue to monitor and advise.
2	Reduce existing flood risk management actions (accepting that flood risk will increase with time)
3	Continue with existing or alternative actions to manage flood risk at the current level (accepting that flood risk will increase over time from this baseline)
4	Take further action to sustain the current scale of flood risk into the future (responding to the potential increases in flood risk from urban development, land use change, and climate change)
5	Take further action to reduce flood risk (now and/or in the future)
6	Take action to increase the frequency of flooding (where appropriate) to deliver benefits locally or elsewhere, (which may constitute an overall flood risk reduction, e.g. for habitat inundation)

In order to achieve the specified policy approach, a number of actions may be identified for each policy unit. It is expected that CFMPs will be used by regional and local government authorities to inform their spatial planning activities, sustainability appraisal/SEAs and emergency planning.

There are three CFMPs in the study area, the Broadland Rivers, East Suffolk Rivers and River Great Ouse CFMPs. These are in varying stages of draft preparation and have been prepared very recently. Consequently, it is unlikely that their implications have been fully taken into account in current development plan documents. The importance of CFMPs for land-use planning and particularly sites allocations planning, is an important message that needs to be conveyed to those responsible for preparing Local Development Frameworks.

Currently the draft Broadland CFMP for the Upper Yare and Waveney (of which some the northern part of the study area falls) currently recommends policy 3. The Draft Great Ouse CFMP which covers a small area in the west of the catchment including Walsham-Le-Willows, curently recommends a combination of policies 2, 3 and 6. The East Suffolk CFMP does not as yet have any draft recommendations for policy units.

3.8 Flood Risk

3.8.1 Regional / National

1. In accordance with PPS25, all sites should be allocated in accordance with the Sequential Test to reduce the flood risk and ensure that the vulnerability classification of the proposed development is appropriate to the Flood Zone classification;
2. FRAs should be undertaken for all developments within Flood Zones 2 and 3 and sites with identified flooding sources (according to PPS25 Annex E) to assess the risk of flooding to the development and identify options to mitigate the flood risk to the development, site users and surrounding area;
3. FRAs are required for all major developments in Flood Zone 1 (according to PPS25 Annex E). These are residential developments consisting of sites greater than 0.5 ha or greater than 10 dwellings and commercial developments that are greater than 1 ha or have a floor area greater than 1000 m^2;
4. Flood Risk to development should be assessed for all forms of flooding (in accordance with PPS25 Annex E);
5. According to PPS25, it is recommended that where floodplain storage is removed, the development should provide compensatory storage on a level for level and volume for volume basis to ensure that there is no loss in flood storage capacity.

3.8.2 Sub-Regional / Local

1. As stated in PPS25, Surface water flooding should be investigated in detail as part of site specific FRAs for developments and early liaison with the EA and the relevant LPA for appropriate management techniques should be undertaken.
2. As stated in PPS25, Groundwater flooding should be investigated in more detail as part of site specific FRAs.

Through integration of these suggestions, the emerging LDF will comply with PPS25 and the aspirations and policies represented in following:

- The Broadland Rivers, East Suffolk Rivers and River Great Ouse CFMP;
- Biodiversity Action Plan for Suffolk;
- Broadland Rivers and East Suffolk Catchment Abstraction Management Strategies (CAMS).

3.9 Sustainable Drainage Systems

A guide to Sustainable Drainage Systems (SuDS) is provided in Appendix F. Sustainable Drainage Policies should address the following issues:

3.9.1 Regional / National

1. Sustainable Drainage Systems should be included in new developments unless it is demonstrably not possible to manage surface water using these techniques;

2. PPS25 requires the use of SuDS as an opportunity of managing flood risk, improving water quality and increasing amenity and biodiversity
3. SuDS are a requirement of the new Buildings Regulations
4. Flood Risk Assessments are required for all major developments in Flood Zone 1 (according to PPS25 Annex E). These are residential developments consisting of sites greater than 0.5 ha or greater than 10 dwellings and commercial developments that are greater than 1 ha or have a floor area greater than 1000 m^2;
5. As stated in PPS25, runoff rates from new developments should not be such that the volumes and peak flow rates of surface water leaving a developed site are no greater than the rates prior to the proposed development, unless specific off-site arrangements are made and result in the same net effect;
6. It is recommended that runoff and/or discharge rates should be restricted to greenfield runoff rates in areas known to have a history of sewer and/or surface water flooding.

3.9.2 Sub-Regional / Local

At the site-specific FRA level, the suitability of Sustainable Drainage Systems should be investigated for each development.

A list of each site highlighting the underlying geology and soil, together with site-specific recommendations for SuDS and FRAs is presented in the Broad Scale Assessment of SuDS at the end of Appendix F.

Through integration of these suggestions, the emerging LDF will comply with PPS25 and the aspirations and policies represented in following:

- Regional policy for the East of England of which Policy EM5 (Integrated Water Management) is relevant to the management of flood risk;
- Broadland Rivers and East Suffolk Catchment Abstraction Management Strategies (CAMS).
- Biodiversity Action Plan for Suffolk;
- The Broadland Rivers, East Suffolk Rivers and River Great Ouse Catchment Flood Management Plans;

3.10 Water Environment

3.10.1 Regional / National

1. Development should not have a detrimental impact on the water environment through changes to water chemistry or resource;
2. Developments should look to incorporate water reuse and minimisation technology;
3. Any development should not be located within the 9 metre Byelaw distance of the riverbank to ensure access for maintenance but amongst other things should ensure a riparian corridor for improvement of the riverine environment.

Through integration of these suggestions, the emerging LDF will comply with PPS25 and the aspirations and policies represented in following:

- The Water Framework Directive (summarised in section 6.2);
- Regional policy for the East of England of which Policy EM5 (Integrated Water Management) is relevant to the management of flood risk;
- The Broadland Rivers, East Suffolk Rivers and River Great Ouse Catchment Flood Management Plans;
- Biodiversity Action Plan for Suffolk;
- Broadland Rivers and East Suffolk Catchment Abstraction Management Strategies (CAMS).

Flood Risk Management Policies contained within the Catchment Flood Management Plans have been set out by the Environment Agency and assigned to different zones within the SFRA area. The strategies suggested above interlink with these aspirations and if integrated will help to strengthen the position of the Local Planning Authority.

4 SFRA – Methodology

4.1 Objective

As outlined in Sections 1.3 and 1.4, the objective of the Level 1 SFRA is to collate and review the information available relating to flooding in the study area as gathered by Faber Maunsell during Stage 1 of the study. Once reviewed and any data gaps have been resolved, the information is then presented in a format to enable MSDC to apply the Sequential Test to their growth areas and to identify potential development sites in Flood Zone 2 and Flood Zone 3, which would require the application of the Exception Test through a Level 2 SFRA. Gaps in the data / information have also been identified in order to ascertain additional requirements needed to meet the objectives of a Level 2 SFRA, where required.

4.2 Tasks

The sequence of tasks undertaken in the preparation of the SFRA was, in chronological order:

- Inception meeting with MSDC and EA on 9th October 2007,
- Established the local stakeholders,
- Contacted stakeholders requesting data/information,
- Collated and reviewed data and populated data register,
- Presentation of available relevant information on flood sources and flood risk,
- Reviewed received data against the SFRA objectives,
- Identified gaps in data.

The above tasks were completed between October 2007 and February 2008.

4.3 Stakeholders

The stakeholders that were contacted to provide the data / information for the SFRA were:

- Suffolk County Council,
- Mid Suffolk District Council,
- Anglian Water,
- Environment Agency,
- Highways Agency.

4.3.1 Local Authorities

MSDC was contacted to provide information, advice and data on flood risk and planning issues across their administrative area and how their LDF programme is emerging. In addition to their planning and development aspirations, the council was asked if they held any records of previous flooding issues within their administrative areas. The council was able to provide some detail of flooding within their boundary and several site-specific flood risk assessments were provided to add resolution and detail to existing flood risk data.

4.3.2 Environment Agency

The Environment Agency (EA) is the principal holder of flood risk data in the UK. The EA has discretionary powers under the Water Resource Act (1991) to manage flood risk and, as a result, are the holders of the majority of flood risk data available in the study area. Mid Suffolk falls within the Anglian region of the EA and is administered by the Eastern and Central Area offices.

A meeting was held with the EA to determine what information could be made available for the SFRA and to discuss how to best use the data. A full list of the data provided by the EA can be found in Appendix H but can be summarised as:

- Catchment Flood Management Plans (CFMP) for the East Suffolk Rivers (Draft), Broadland Rivers (Draft), and Great Ouse catchments;
- Strategic Flood Risk Mapping (SFRM) outlines and supporting data;
- Details and locations of historical flood events;
- LiDAR Digital Terrain Model and other survey;
- Details and locations of flood defence assets and flood warning procedures;

The EA have also assisted with advice on the Water Framework Directive (WFD) as well as internal strategic projects being carried out at a national and regional level. Similarly, the EA have assisted in the production of the SFRA by providing expert advice and comment.

4.3.3 Anglian Water

Anglian Water (AW) and Essex and Suffolk Water (ESW) provide potable water distribution and wastewater collection for the Mid Suffolk administrative area. AW have provided a register of flood events that have affected properties (internal) and outside areas such as roads (external) to a particular postcode. This information is provided to the regulatory body OFWAT (Office of Water Services) and is used to help define their capital programme. The register is also known as the DG5 register, and contains commercially sensitive information as well as information covered by the Data Protection Act (1998). As a result, a detailed analysis of the scale, consequences and risks of sewer flooding has not been possible at this stage of the SFRA.

The principal contacts and their associated details for these stakeholders are presented in Appendix I.

4.4 Data / Information Collected

Information / data was requested from the stakeholders. The data was integrated with SW's GIS system where possible to facilitate a review. The information/data requested from the identified stakeholders was based on the following categories: -

- Terrain Information e.g. LiDAR, SAR, river cross-sections,
- Hydrology e.g. the main and ordinary watercourses,
- Hydrogeology e.g. groundwater emergence zones and vulnerability maps,
- Flood Defence e.g. flood banks, sluices,
- Environment Agency Modelled Flood Levels,
- Environment Agency Flood Zone Maps,
- Local Authority Information e.g. Local Development Schemes and allocation sites,
- Historical flooding,
- Sewer flooding problems.

All data was registered on receipt and its accuracy and relevance reviewed to assess confidence levels for contribution to the SFRA. Details of all the data collected at the time of production are presented in Appendix H.

Table 4-1: Method for qualitative confidence ranking of data received

		RELEVANCE		
		1 - VERY RELEVANT	2 - PARTLY RELEVANT	3 - NOT RELEVANT
ACCURACY	1 - EXCELLENT	**VERY GOOD**	GOOD	GOOD
	2 - GOOD	GOOD	GOOD	FAIR
	3 - FAIR	GOOD	FAIR	FAIR
	4 - POOR	FAIR	FAIR	POOR
	5 - VERY POOR	FAIR	POOR	**VERY POOR**

4.5 GIS, Flood Mapping and Application

Using the data collected a series of GIS layers were collated to visually assist MSDC in their site allocation decisions and Development Control activities.

Broadly, the layers can be classified into planning policy, informative and flood risk categories. Table 4-2 summarises the main GIS layers used in the SFRA. Appendix G includes a more detailed table highlighting the GIS layers that have been used and their limitations.

4.5.1 GIS Data Gaps & Assumptions

Some data that is necessary to satisfactorily complete an SFRA is either not available at all, or is not available in GIS format. In order to present complete Flood Zones with the best available information for the Mid Suffolk study area, it has been necessary to make certain assumptions, in agreement with the LPA and the EA, so that gaps in data could be filled; these assumptions have been outlined in the proceeding sections and Appendix G.

Table 4-2: GIS Layers used in SFRA

Planning Policy	Informative	Flood Risk
MSDC Administrative Boundary	Main River Network	Flood Zone Maps (EA FZ 2 and 3, hydraulic modelled outlines for Gipping, Dove, Waveney Great Ouse and Deben)
Urban Areas (including Key Service Centres)	Critical Ordinary Watercourse Network	Historic Flood Events
Potential Land Bid Sites	OS Mapping	Flood Warning Areas
		Groundwater Vulnerability Maps
		Anglian Water DG 5
		Depth Grids

4.5.2 Flood Risk GIS Layers

The following section is intended for use in conjunction with the Flood Zone and depth hazard zone mapping presented in the Appendices of this study. Planning guidance indicating what type of development is likely to be appropriate in certain Flood Zones is presented in Tables D.2 and D.3 of PPS25 (Communities and Local Government, 2006). These tables can then be viewed in conjunction with the hazard zone mapping for specific areas to inform planning decisions and enable the LPA to apply the sequential approach within a Flood Zone, as well as between the Flood Zones.

Detailed Modelled Flood Outlines
The current Flood Zones (2007) were mapped for the main settlement and growth areas for each of the Local Authority areas. These maps present the Flood Zones 1, 2, 3a and 3b in relation to current levels of flood risk (2007). In addition these areas were also mapped to take into account the climate change recommended by PPS25 for residential development at 100 years (2107). These figures are included in each of the Appendices and should enable the local authorities to undertake the Sequential Test as part of the SFRA'. The flood outlines can be seen in Appendix C, maps C1-C34 for years 2007 and 2107.

In order to present the most up-to-date and relevant flooding information available, the Flood Zone maps (for both fluvial and tidal) have been created using a variety of existing sources of data. Where detailed hydraulic modelling has been undertaken and flood outlines mapped, these have been used in preference to broad-scale modelled flood outlines. This results in a single map for each Flood Zone generated using a combination of data. For each fluvial reach, information on the data has been provided detailing the source of the data used to create the Flood Zone and the relative confidence in the data.

For example, the flood outlines (fluvial FZ3a, FZ3b and FZ3 + Climate Change) for the River Waveney, River Gipping, River Dove and River Deben have been derived from hydraulic modelling studies. Some watercourses in the study area do not have Flood Zones associated with them or do not have all Flood Zones defined. This is not to suggest these watercourses do not flood, moreover that modelled data is not currently available.

Functional Floodplain
Functional floodplains have the highest probability of flooding of all the Flood Zones defined within Table D.1 of PPS25 (see *Table 5-1*, Chapter 5). As outlined by Table 5-1, there are only two appropriate land uses that should be permitted in this zone – water compatible land uses and essential infrastructure. Any planning applications for proposed appropriate development must be accompanied by a site-specific Flood Risk Assessment that proves that the proposed development will not impede flood flows, will not increase flood risk elsewhere and will remain operational in times of flood. In light of the above, it is important that functional floodplain is illustrated by the SFRA in order for the LPAs to consider its location when preparing LDF documents and other strategic documents.

A functional floodplain is defined by Table D.1 in PPS25 as an area of land where water has to flow or be stored at times of flood (Communities and Local Government, 2006). The functional floodplain has an annual probability of flooding of 5% (i.e. from a 1 in 20 year return period event). Table D.1 of PPS25 also classifies functional floodplains as being Flood Zone 3b. PPS25 states that functional floodplain should be determined considering the effects of defences and other flood risk management infrastructure.

Functional flood plains have been created for relevant locations within the SFRA study area. For the watercourses within the study area, the 5% flood outline has been modelled. Where the 1 in 20 year flood outline is not available it was agreed that the whole of Flood Zone 3 should be assumed to be functional until such a time that more detailed information is available, such as the Level 2 SFRA, an EA Strategic Flood Risk Mapping (SFRM) study or a site-specific FRA, as recommended by PPS 25 guidance.

The Effects of Climate Change
To ensure sustainable development now and in the future, PPS25 requires that the effects of climate change should be taken into account in an SFRA and that flood outlines delineating climate change should be presented. Where possible, modelled outlines for Flood Zone 3a, 3b and 2 including the effects of climate change to 2107 have been presented.

For fluvial reaches, climate change has been added to the 1 in 20 year, 1 in 100 year and 1 in 1000-year flood event using a net increase of 20% over and above peak flows. In areas where climate change has not been modelled or mapped, an increase in the depth and extents of the existing Flood Zones is likely. In order to take this into account, it has been agreed with MSDC and the EA that Flood Zone 2 should be used as a surrogate for Flood Zone 3 plus climate change until such time that more detailed information is available, such as the Level 2 SFRA, an EA Strategic Flood Risk Mapping (SFRM) study or a site-specific FRA.

Where modelled outlines do not exist for the Flood Zone 2 2107 outline (possible 1-in-1000 year event in 2107), it must be assumed that the extent of flood event would be greater than the 2007 outlines. As there are limitations, and extensive uncertainties, in deriving the floodplain for such an extreme event, it is not practical to use a proxy dataset or make assumptions to produce a 2107 Flood Zone 2 outline. It is therefore suggested that any proposed development adjacent to the existing 2007 Flood Zone 2 carries out a detailed FRA which examines the location and extent of the future 2107 Flood Zone 2.

Historical Flood Mapping
Historic flood events have been plotted as a series of points in approximate areas that have flooded in the past. It should be noted that the majority of these flood events have not been linked to return periods. Much of the information used to create the points is based on historic flood events primarily from the BHS CBHE database[2] and Anglian Water DG5 data and some inaccuracies may exist. In addition, historical flooding records do not always differentiate between flooding caused by fluvial sources and flooding as a result of other sources such as overwhelmed drainage or waterlogged rural land. However, the layer

[2]British Hydrological Society, Chronology of British Hydrological Events, Online Database, University of Dundee. http://www.dundee.ac.uk/geography/cbhe/[2]

serves a useful purpose to highlight to MSDC that there are areas, some of which may be shown to be outside the Flood Zones, which have experienced flooding in the past.

Sewer and Storm Water Flooding
Limited information regarding incidents of sewer flooding have been provided by Anglian Water in the form of DG5 data. The locations of incidences of sewer flooding have been presented as a series of points in a GIS layer. This layer will help to highlight to MSDC that there are certain areas where the drainage network can be overwhelmed during periods of high intensity rainfall and therefore new development in these areas must take account of this. Following discussion with MSDC, Norfolk Property Services were contacted but no data was available to us at this stage but when it becomes available it should be incorporated into the SFRA update.

Flood Defences
The national EA GIS layer of flood defences and the NFCDD do not show any raised flood defences within the administrative area of MSDC. However, the East Suffolk CFMP have identified that Stowmarket and Needham Market have a SoP of 1 in 25 years and the rest of the Gipping Valley 1 in 5 years. It also identifies that Debenham has a SoP of 1 in 5 years.

NFCDD data does give a description of channel embankments which can be considered informal defences. NFCDD is constantly being updated and new information on the location, standard of protection and condition of raised flood defences should be available from the EA in the near future.

Flood Warning Layers
Areas benefiting from an EA flood warning have been shown as a separate GIS layer. Emergency Planning Officers can use the flood warning layers in conjunction with the Flood Zone maps and flood defence information to assist in developing emergency plans for areas at risk of flooding within the Mid Suffolk study area. Flood warning areas are shown on Maps C1- C34 in Appendix C,

Groundwater Vulnerability Mapping
The EA's groundwater vulnerability maps have been presented in a thematic map to highlight areas that overlie aquifers with a high vulnerability. Major Aquifers with a high vulnerability tend to have a more permeable surface geology. Groundwater vulnerability relates to the potential for contamination to groundwater and thus is a useful tool to determine the suitability of sustainable drainage (SuDS) techniques. The Groundwater Vulnerability Maps are shown as a thematic map E-1 in Appendix E.

British Geological Survey Geology Mapping
BGS mapping was studied. This data can be used to ascertain the suitability of various sustainable drainage (SuDS) techniques for proposed developments.

4.5.3 Planning Policy GIS Layers

Urban Areas & Potential Allocation Sites

MSDC have provided a list of strategic development areas as shown in Table 4-3. The 400 land bid sites have also been supplied and displayed in GIS. In addition, a GIS layer depicting boundaries for the 400 land bid sites which came from the Issues and Options consultation paper was also supplied. These sites are shown in Appendix C in maps C1-C-34.

Table 4-3: Towns and Key Service Centres

Towns and Key Service Centres	
Bacton	Needham Market
Bramford	Rickinghall with Botesdale
Claydon	Stowmarket
Debenham	Stowupland
Elmswell	Stradbroke
Eye	Thurston
Mendlesham	Woolpit
Haughley	

4.6 Hazard Zones and Depth Mapping

In order to aid the spatial planning process of each district, a detailed assessment of flood risk in the MSDC authority area was required. This included refined depth hazard mapping for Flood Zones 2, 3a and 3b.

4.6.1 Fluvial Hazard Mapping

The fluvial hazard maps have been created for urban areas at risk from river flooding where revised modelling has been completed as part of this study. The settlements mapped are Stowmarket, Needham Market, Eye and Debenham. The fluvial depth hazard maps can be seen in Appendix D

Key (depth of flooding in metres assuming a 0 m/s velocity*):	
0.30-0.50	Danger for Some
0.50-1.50	Danger for Most
1.50 +	Danger for All

*Taken from Table 13.1 Defra/ EA Flood and Coastal Defence R&D Programme FD2320.

Figure 4-3: Key to Depth Hazard

4.6.2 Rapid Inundation Zone

The draft "Practice Guide Companion to PPS25 'Living Draft'" identifies a rapid inundation zone as an area at risk from rapid flooding should a flood defence structure be breached or overtopped (Communities and Local Government, 2007). Unsurprisingly, these areas tend to be located close behind the flood defences. In general, the zone of rapid inundation suggests that development should be avoided within the first few hundred metres of the defences because there is a risk to all people exposed to floodwater (Environment Agency Flood and Coastal Defence R&D Programme, 2005). There is an inherent risk to properties in this area from the potential high floodwater velocities following a potential breach event. Although the local topography and existing defences would need to be considered, the definition of this area for a particular site or Masterplan should be identified in a site specific flood risk assessment.

4.6.3 Using the Depth Hazard Maps

PPS25 requires local planning authorities to review flood risk across their districts, steering all development towards areas of lowest risk. Development is only permissible in areas at risk of flooding in exceptional circumstances where it can be demonstrated that there are no reasonably available sites in areas of lower risk, and the benefits of that development outweigh the risks from flooding. Such development is required to include mitigation/management measures to minimise risk to life and property should flooding occur.

It will be necessary for the Local Planning Authority to demonstrate that the Sequential Test has been passed. In certain circumstances where it cannot be passed, the LPA will then have to demonstrate that all 3 elements of the Exception Test have been satisfied.

It is intended that the hazard maps will provide the Local Planning Authority with an appreciation of the actual and residual flood risks faced in their areas taking into consideration the presence of flood defences.

The hazard maps will inform policies and practices required to ensure development satisfies the requirements of the Exception Test through the detailed consideration of flood hazard.

A number of further considerations in addition to flood hazard should be taken into account when allocating specific areas for development or placing one area ahead of another in terms of suitability for development. Potential evacuation routes, flood warning times and the time to peak flood hazard are some of the additional factors that should be taken into account.

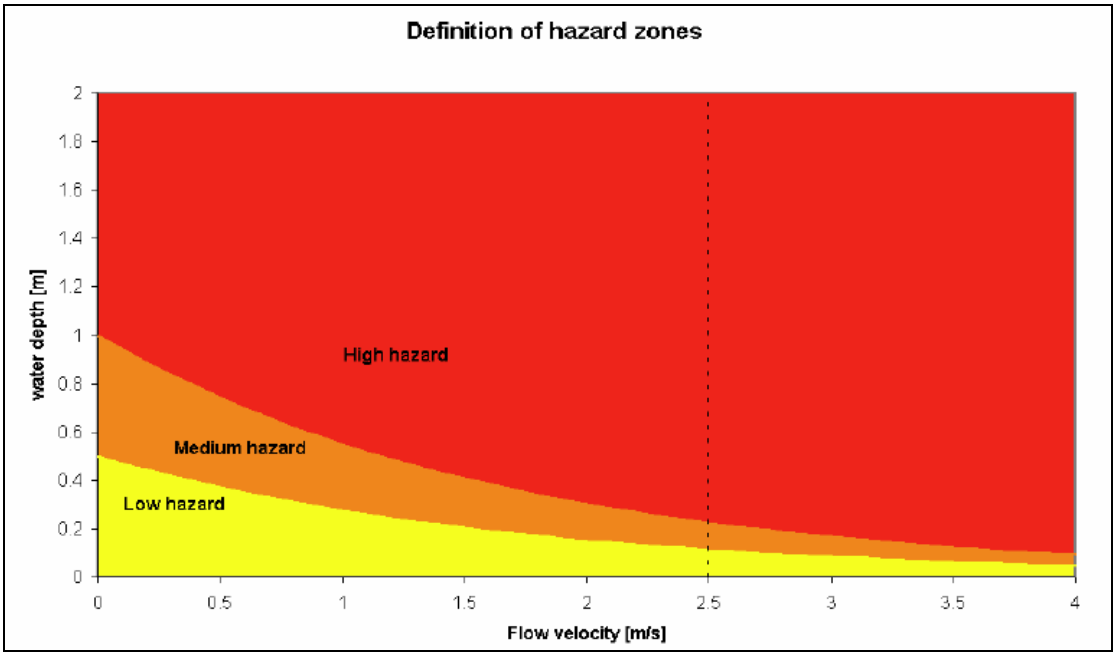


Figure 4-2: Definitions Of Hazard Zone

4.7 SFRA – Flood Risk Review Summary

4.7.1 Summary

In line with PPS25, the Sequential Test should be applied at all stages of planning. The aim of this is to direct new development towards areas that have a low probability of flooding. The information provided in Appendix A and B indicates the geographical extent of Flood Zone 2 and Flood Zone 3 for the Mid Suffolk study area.

The study area for MSDC is 867.6 km². The broad-scale and settlement-level assessments clearly show that, whilst flood risk exists in areas of the District, it does not pose a widespread and significant issue for the allocation of development sites. Where potential development sites are at risk from flooding, the LPA must determine their suitability based on the Sequential Test and vulnerability classifications presented in Tables D1 and D2 of PPS25. Wherever possible the LPAs should seek to direct development to low probability Flood Zones (Flood Zone 1). Where this is not possible, development should preferably be located in Flood Zone 2 and where this is not possible, sites in Flood Zone 3 can be considered.

Dependent on the vulnerability of the proposed development (as classified in PPS25 – table D2), some development sites that are either wholly or partly situated in Flood Zone 2 or 3 may require the application of the Exception Test. Those development areas requiring application of the Exception Test will require further assessment in a Level 2 SFRA. Information on the application of the Sequential Test, guidance on strategies for managing flood risk, guidance on the potential use of Sustainable Drainage Systems (SuDS) and guidance on site-specific FRAs are provided in Section 5.2, Chapter 6, and Appendix F

5 The Sequential Test

5.1 The Sequential Approach

The sequential approach is a simple decision-making tool designed to ensure that sites at little or no risk of flooding are developed in preference to areas at higher risk. It can be applied at all levels and scales of the planning process, both between and within Flood Zones. All opportunities to locate new developments (except water-compatible) in reasonably available areas of little or no flood risk should be explored, prior to any decision to locate them in areas of higher risk.

The Sequential Test refers to the application of the sequential approach by LPAs. This allows the determination of site allocations based on flood risk and vulnerability (see Table 5-1 and Table 5-2). Development should be directed to Flood Zone 1 wherever possible, and then sequentially to Flood Zones 2 and 3, and to the areas of least flood risk within Flood Zone 2 and then Flood Zone 3, as identified within this SFRA. A flow diagram for application of the Sequential Test from the Practice Guide Companion to PPS25 is provided (Figure 5-1).

The application of the sequential approach aims to manage the risk from flooding by avoidance. This will help prevent the promotion of sites that are inappropriate on flood risk grounds. The application of the Exception Test through a Level 2 SFRA will ensure that new developments in flood risk areas will only occur where flood risk is clearly outweighed by other sustainability drivers.

The LPA must demonstrate that it has considered a range of possible sites in conjunction with the Flood Zone information from the SFRA and applied the Sequential Test and where necessary the Exception Test (see Appendix D of PPS25) in the site allocation process. In cases where development cannot be fully met through the provision of site allocations, LPAs are expected to make a realistic allowance for windfall development based on past trends.

PPS25 acknowledges that some areas will be at risk of flooding from flood sources other than fluvial or tidal systems. All sources of flooding must be considered when looking to locate new development. Other sources of flooding that require consideration when situating new development allocations include:

- Surface Water;
- Groundwater;
- Sewers; and
- Artificial Sources.

As highlighted in 2.2 these flood sources are typically less understood than tidal and fluvial sources. Data primarily exists as point source data or through interpretation of local conditions. In addition, there is no guidance on suitable return periods to associate with floods arising from these sources. For example modern storm water drainage systems are constructed to a 1 in 30 year standard. Any storm event in excess of the 30-year return period storm would be expected to cause flooding. Contact with Anglian Water needs to be maintained as part of the SFRA updating process to ensure that any sewer models or data on sewer flooding incidents is incorporated into the SFRA. PPS 25 recommends that site specific FRAs should undertake detailed drainage and surface water investigation. It is recommended that such findings are collated on an ongoing basis to ensure the full extent of such issues is highlighted to the district.

If a location is recorded as having experienced repeated flooding from the same source this should be acknowledged within the Sequential Test.

5.2 Using the SFRA to Apply the Sequential Test

The Sequential Test should be undertaken by the LPA and accurately documented to ensure decision processes are consistent and transparent. The Sequential Test should be carried out on potential development sites, with a view to balancing the flood probability and development vulnerability of sites throughout the LPA area.

The recommended steps required in undertaking the Sequential Test are detailed in section 5 The recommendations are based on the Flood Zone and Flood Risk Vulnerability and is summarised in Table 5-3. The use of the SFRA maps, data and GIS Layers in the application of the Sequential Test is detailed in sections 5.2, 5.3, and 5.4

Table 5-1 Flood Zones as defined in Table D1, Annex D of PPS25 (full description provided in Appendix D of PPS25).

	Definition		Probability of Flooding
	Fluvial	Tidal	
Flood Zone 1	< 1 in 1000 year (< 0.1%)	< 1 in 1000 year (< 0.1%)	Low Probability
Flood Zone 2	Between 1 in 1000 year (< 0.1%) and 1 in 100 year (1%)	Between 1 in 1000 year (< 0.1%) and 1 in 200 year (0.5%)	Medium Probability
Flood Zone 3a	> 1 in 100 year (> 1%)	> 1 in 200 year (> 0.5%)	High Probability
Flood Zone 3b	Either > 1 in 20 (5%) or as agreed by between the EA and LPA	Either > 1 in 20 (5%) or as agreed by between the EA and LPA	Functional Floodplain

Percentages refer to the annual probability of a flood event occurring in any year

Table 5-2 Flood Risk Vulnerability Classification (from PPS25, Appendix D, Table D2)

Essential Infrastructure	• Essential transport infrastructure (including mass evacuation routes), which has to cross the area at risk, and strategic utility infrastructure, including electricity generating power stations and grid and primary substations.
Highly Vulnerable	• Police stations, Ambulance stations and Fire stations and Command Centres and telecommunications installations required to be operational during flooding. • Emergency dispersal points. • Basement dwellings. • Caravans, mobile homes and park homes intended for permanent residential use. • Installations requiring hazardous substances consent.
More Vulnerable	• Hospitals. • Residential institutions such as residential care homes, children's homes, social services homes, prisons and hostels. • Buildings used for: dwelling houses; student halls of residence; drinking establishments; nightclubs; and hotels. • Non–residential uses for health services, nurseries and educational establishments. • Landfill and sites used for waste management facilities for hazardous waste. • Sites used for holiday or short-let caravans and camping, subject to a specific warning and evacuation plan.
Less Vulnerable	• Buildings used for: shops; financial, professional and other services; restaurants and cafes; hot food takeaways; offices; general industry; storage and distribution; non–residential institutions not included in 'more vulnerable' and assembly and leisure. • Land and buildings used for agriculture and forestry. • Waste treatment (except landfill and hazardous waste facilities). • Minerals working and processing (except for sand and gravel working). • Water treatment plants. • Sewage treatment plants (if adequate pollution control measures are in place).
Water-compatible Development	• Flood control infrastructure. • Water transmission infrastructure and pumping stations. • Sewage transmission infrastructure and pumping stations. • Sand and gravel workings. • Docks, marinas and wharves. • Navigation facilities. • MOD defence installations. • Ship building, repairing and dismantling, dockside fish processing and refrigeration and compatible activities requiring a waterside location. • Water-based recreation (excluding sleeping accommodation). • Lifeguard and coastguard stations. • Amenity open space, nature conservation and biodiversity, outdoor sports and recreation and essential facilities such as changing rooms. • Essential ancillary sleeping or residential accommodation for staff required by uses in this category, subject to a specific warning and evacuation plan.

Table 5-3 Flood Risk Vulnerability and Flood Zone 'Compatibility' from PPS25, Appendix D, Table D.3 (✓- Development is appropriate, × - Development should not be permitted)

	Flood Risk Vulnerability Classification				
	Essential Infrastructure	**Water Compatible**	**Highly Vulnerable**	**More Vulnerable**	**Less Vulnerable**
Flood Zone 1	✓	✓	✓	✓	✓
Flood Zone 2	✓	✓	Exception Test Required	✓	✓
Flood Zone 3a	Exception Test Required	✓	×	Exception Test Required	✓
Flood Zone 3b	Exception Test Required	✓	×	×	×

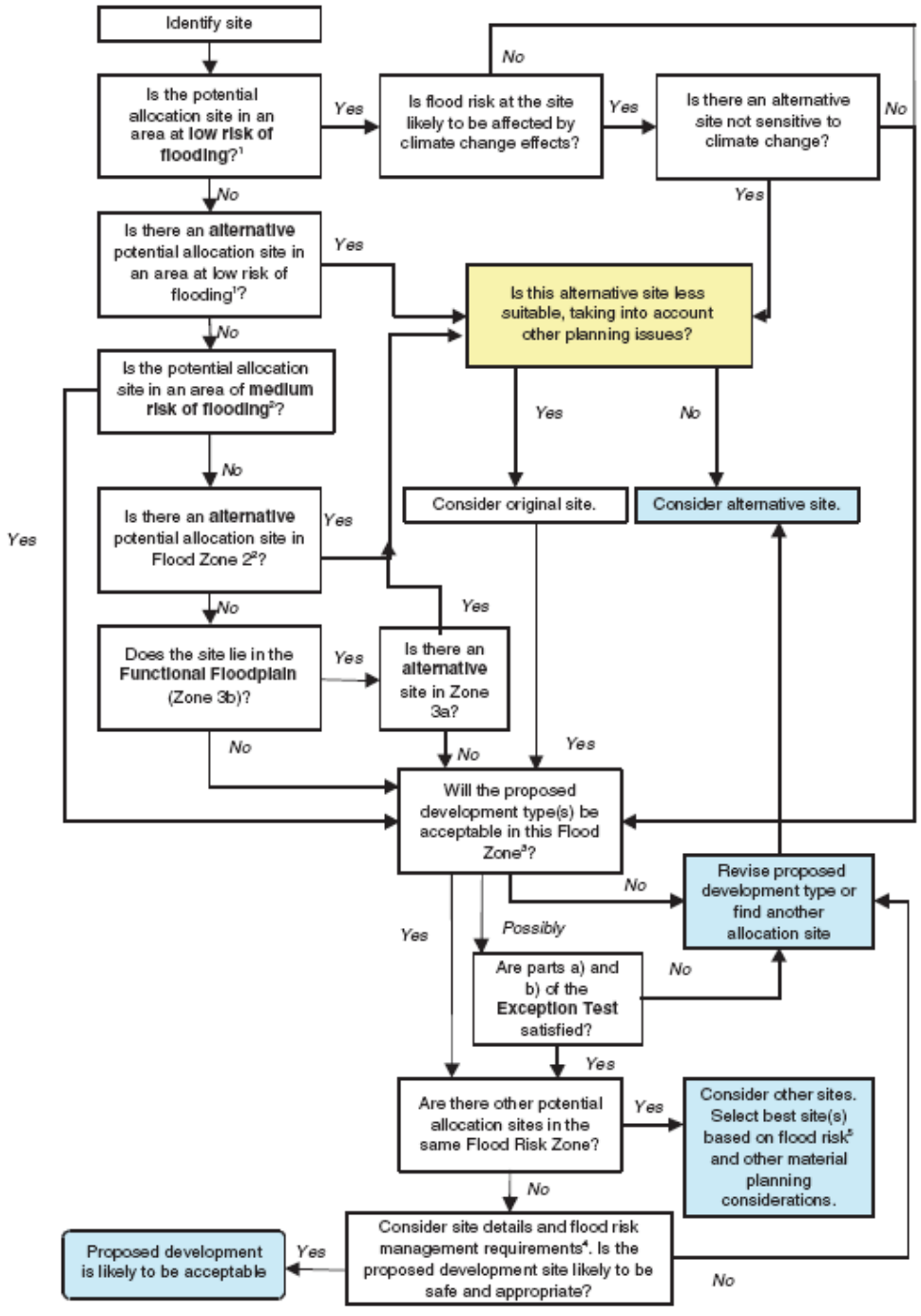


Figure 5-1 Flow diagram illustrating the application of the Sequential Test(from PPS25 Practice Guidance – April 2007)

Table 5-4 Sequential Test Key - A Guide to using the GIS Layers

Category	GIS Layer	Example Questions
Flood Zone Classification	SFRA combined fluvial & tidal FZ2, FZ3a & FZ3b layers. Also examine historical floodplain and take into consideration climate change outlines.	**Question 1** – Through consultation of the SFRA flood zone maps, is the development site located in Flood Zone 1?
		Question 2 - Through consultation of the SFRA flood zone maps, is the development site located in Flood Zone 2?
		Question 3 - Can the development be located in Flood Zone 1?
		Question 4 - Through consultation of the SFRA flood zone maps, is the development site located in Flood Zone 3a?
		Question 5 - Can the development be located in Flood Zone 1 or 2?
		Question 6 - Through consultation of SFRA flood zone maps, is the development site located in Flood Zone 3b?
		Question 7 **- Can the development be located in Flood Zone 1, 2 or 3a?**
	CEH watercourse network & EA main river maps.	**Question 8 -** Is the site located within 9m of a watercourse?

Table 5-4 Sequential Test Key - A Guide to using the GIS Layers (continued)

Category	GIS Layer	Example Questions
Development Vulnerability if located in Flood Zone 2, 3a or 3b	Not applicable refer to Table D2 in PPS25	**Question 9** – Is the proposed development defined as 'highly vulnerable' according to Table D2 in Planning Policy Statement 25?
		Question 10 - Is the proposed development defined as 'more vulnerable' according to Table D2 in Planning Policy Statement 25?
		Question 11 - Is the proposed development defined as 'less vulnerable' according to Table D2 in Planning Policy Statement 25?
		Question 12 - Is the proposed development defined as 'essential infrastructure according to Table D2 in Planning Policy Statement 25?
		Question 13 - Is the proposed development defined as 'water compatible development' according to Table D2 in Planning Policy Statement 25?
Other Flood Sources	SFRA combined fluvial and tidal FZ3 & FZ2 outlines plus climate change	**Question 14 –** Is the site impacted by the effects of climate change
	Sewer Flood Layer & Historical Flood Outlines	**Question 15** - Is the site in an area potentially at risk from sewer flooding?
	Historical Flood Outlines, Parish Council data, GEZ, CEH stream network (BFI) and groundwater vulnerability maps	**Question 16** - Is the site in an area potentially at risk from overland flow flooding?
		Question 17 - Is the site located in an area of rising groundwater levels?
		Question 18 - Does the site have a history of flooding from any other source?

Category	GIS Layer	Example Questions
Flood Risk Management	Flood Defence Layer (NFCDD), Flood Warning Layer, Areas Benefiting from Flood Defences Layer, Parish Council data	**Question 19** - Does the site benefit from flood risk management measures?
		Question 20 - Can the development be relocated to an area benefiting from flood risk management measures or of lower flood risk?

Table 5-5 Flood Risk Vulnerability and Flood Zone Compatibility

To be read in conjunction with Table D.1 and Table D.2 in PPS25. Table 5-5 seeks to highlight what development is appropriate in flood zones and where FRAs are required.

Use Category	Development	FLOOD ZONE			
		1	2	3a	3b
		FRA[1]	FRA	FRA	FRA
Essential Infrastructure	Essential Transport Infrastructure, Strategic Utility Infrastructure, Electricity Generating Power Stations	A	S ⇩ A	S ⇩ E ⇩ A	S ⇩ E ⇩ A
Highly Vulnerable	Police Stations, Ambulance Stations, Fire Stations, Command Centres and telecoms installations required to be operational during flooding, Emergency dispersal points, Basement dwellings, Caravans, mobile homes and park homes intended for permanent residential use, Installations requiring hazardous substances consent	A	S ⇩ E ⇩ A	N	N
More Vulnerable	Hospitals, Residential institutions (care homes, children's homes, social services homes, prisons and hostels), Dwelling houses, Student halls of residence, Drinking establishments, Nightclubs, Hotels, Non-residential health services, Nurseries, Educational establishments, Landfill sites, Sites used for waste management facilities for hazardous waste, Sites used for holiday or short-let caravans and camping (subject to a specific warning and evacuation plan)	A	S ⇩ A	S ⇩ E ⇩ A	N
Less Vulnerable	Shops, Buildings used for financial, professional and other services, Restaurants and cafes, Hot food takeaways, Offices, General Industry, Storage and distribution, Non-residential institutions (unless identified as more vulnerable), Assembly and Leisure, Land and buildings used for agriculture and forestry, Waste treatment (except landfill and hazardous waste), Minerals working and processing (except for sand and gravel workings), Water treatment plants, Sewage treatment plants (if adequate pollution control measures are in place)	A	S ⇩ A	S ⇩ A	N
Water Compatible Development	Flood control infrastructure, Water transmission infrastructure and pumping stations, Sewage transmission infrastructure and pumping stations, Sand and gravel workings, Docks, marinas and wharves, Navigation facilities, MOD defence installations, Ship building, repairing and dismantling, Dockside fish processing and refrigeration, Activities requiring a waterside location, Water based recreation (excluding sleeping accommodation), Lifeguard and coastguard stations, Amenity open space, Nature conservation and biodiversity, Outdoor sports and recreation, Essential facilities such as changing rooms, Essential ancillary sleeping or residential accommodation for staff required for water compatible development (subject to a specific warning and evacuation plan)	A	A	A	A

TABLE 5-5 - KEY

A: *Appropriate use*
N: *Use should not be permitted*
S: *Use only appropriate if it passes the sequential test*
E: *Use only appropriate if it passes the exception test*
⇩**:** *If passed proceed*

FRA[1]*: Flood risk assessment should be carried out for sites of 1 hectare or more in FZ 1, to consider the vulnerability of flooding from sources other than river and sea flooding, and the potential to increase flood risk elsewhere through the addition of hard surfaces and the effect of the new development on surface water run-off.*

FRA: *Flood risk assessment required for all developments.*

Note; Even where development is found to be acceptable through the application of the Sequential and Exception Tests further flood resistance/resilience may be required in the design and construction of specific developments. Such a test should be based on the SFRA.

Sequential Test: Development should be steered first towards the lowest risk areas. Only where there are no reasonably available sites should development on suitable available sites in higher risk areas be considered taking into account flood risk vulnerability and applying the Exception Test where required.

Exception Test: Exceptionally, development whose benefits outweigh the risk from flooding may be acceptable. For this test to be passed, the development should demonstrably provide wider sustainable benefits to the community, should be on developable previously-developed land (unless there are no reasonably available sites on developable previously-developed land), and should be demonstrably safe without increasing flood risk elsewhere and where possible reducing flood risk overall.

5.3 Recommended stages for LPA application of the Sequential Test

The information required to address many of these steps is provided in the accompanying GIS layers and maps presented in Appendices A, B and C. The recommended stages for the application of the Sequential Test by the Council are as follows:

1. Assign potential developments with a vulnerability classification (Table G-2). Where development is mixed, this should be moved to the higher classification.
2. The location and identification of potential development should be recorded.
3. The Flood Zone classification of potential development sites should be determined based on a review of the Environment Agency Flood Zones and the Flood Zones presented in this SFRA for fluvial and tidal sources. Where these span more than one Flood Zone, all zones should be noted.
4. The design life of the development should be considered with respect to climate change:
5. 60 years – up to 2072 for commercial / industrial developments; and
6. 100 years – up to 2112 for residential developments

7. It should be noted that for the purposes of the Sequential Test, Flood Zones with no consideration of defences should be used i.e. the SFRA flood zones.
8. Highly vulnerable developments should be located in those sites identified as being within Flood Zone 1. It should be noted at this stage that Flood Zone 1 represents any area that is not determined as Zone 2 or Zone 3. If these cannot be located in Flood Zone 1 because the identified sites are unsuitable or there are insufficient sites in Flood Zone 1, sites in Flood Zone 2 can then be considered. If sites in Flood Zone 2 are inadequate then the LPA may have to identify additional sites in Flood Zones 1 or 2 to accommodate development or seek opportunities to locate the development outside their administrative area.
9. Once all highly vulnerable developments have been allocated to a development site, the LPA can consider those development types defined as more vulnerable. In the first instance more vulnerable development should be located in any unallocated sites in Flood Zone 1. Where these sites are unsuitable or there are insufficient sites remaining, sites in Flood Zone 2 can be considered. If there are insufficient sites in Flood Zone 1 or 2 to accommodate more vulnerable development, sites in Flood Zone 3a can be considered. More vulnerable developments in Flood Zone 3a will require application of the Exception Test. More vulnerable development types are not appropriate in Flood Zone 3b – Functional Floodplain
10. Once all more vulnerable developments have been allocated to a development site, the LPA can consider those development types defined as less vulnerable. In the first instance less vulnerable development should be located in any remaining unallocated sites in Flood Zone 1, continuing sequentially with Flood Zone 2, then 3a. Less vulnerable development types are not appropriate in Flood Zone 3b – Functional Floodplain.
11. Essential infrastructure should be preferentially located in the lowest flood risk zones, however this type of development may be located in Flood Zones 3a and 3b, provided the Exception Test is fulfilled.
12. Water compatible development has the least constraints with respect to flood risk and it is considered appropriate to allocate these sites last. They do not require the application of the Exception Test.
13. On completion of the sequential test, the LPA may have to consider the risks posed to a site within a Flood Zone in more detail in a Level 2 Assessment. By undertaking the Exception Test, this more detailed study should consider the detailed nature of flood hazard to allow a sequential approach to site allocation within a Flood Zone. Consideration of flood hazard within a Flood Zone would include:
    - Flood risk management measures,
    - The rate of flooding,
    - Flood water depth and or,
    - Flood water velocity.

Where the development type is highly vulnerable, more vulnerable, less vulnerable or essential infrastructure and a site is found to be impacted by a recurrent flood source (other than tidal or fluvial), the site and flood sources should be investigated further regardless of any requirement for the Exception Test. This should be discussed with the Environment Agency to establish the appropriate time for the assessment to be undertaken, (i.e. Exception Test through a Level 2 SFRA or assess through a site specific flood risk assessment).

The maps presented in Appendices A, B and C are designed to assist MSDC in determining the flood risk classification for each site and in completing the Sequential Test. This will aid the determination of the most suitable type of development for each site based on development vulnerability and flood risk. Certain sites have been identified as lying within Flood Zones 2 and 3 and, if the sites cannot be relocated, it will be necessary to undertake an Exception Test.

5.4 Using the SFRA Maps, Data and GIS Layers

Table 5-4 highlights which GIS layers and SFRA data should be used in carrying out the sequential test. The table poses some example questions that are not exhaustive, but should provide some guidance for a user of the SFRA.

Appendix J summarises the steps required to maintain and update the SFRA together with a revision schedule. This should be checked to prior to the SFRA being used at a strategic land allocation scale or on a Development Control level to ensure the most current and up-to-date version of the SFRA is being used. In addition, close consultation with some of the key stakeholders, in particular the EA, may highlight updated flood risk information that may reduce uncertainty and ensure the Sequential Test is as robust as it can be.

As identified in Section 2, some watercourses in the study area do not have Flood Zones associated with them or do not have all Flood Zones defined. This is not to suggest these watercourses do not flood, moreover that modelled data is not currently available. Therefore, allocations adjacent to un-modelled watercourses or watercourses where all Flood Zones have not been defined cannot be assessed against all aspects of the Sequential Test using the existing data.

To overcome this gap in the data and to enable MSDC to proceed with the application of the Sequential Test the following criteria should be considered:

- **For watercourses where no Flood Zones have been defined –** If a site is within 8m of a watercourse and promoted for development further investigation should be undertaken to determine the suitability of the site for the proposed development. For application of the Sequential Test the site should be considered as lying within Flood Zone 3a until proven otherwise. If following further investigation the site is found to lie within Flood Zone 3b the development may not be appropriate against the polices presented in PPS25.

- **For watercourses where Flood Zone 3b (functional floodplain) has not been defined –** If a proposed development site is located in Flood Zone 3, there is a possibility it may also fall within Flood Zone 3b. Further investigation should be undertaken to define Flood Zone 3b for the local water course(s). According to the PPS25 Practice Guide Companion when applying the Sequential Test the site should be considered as lying within Flood Zone 3b until proven otherwise. If following further investigation the site is found to lie within Flood Zone 3b the development may not be appropriate against the polices presented in PPS25.

- **For watercourses where the effect of climate change on Flood Zones has not been defined –** For any development located in or adjacent to a Flood Zone boundary, there is a possibility that when considering the effects of climate change the site may be at flood risk. For example if a site is clearly identified to be in Flood Zone 3a (and not within 3b), when the effects of climate change are considered the site may be found to lie within Flood Zone 3b. For application of the Sequential test, for sites located in Flood Zone 3 or at the boundary of Flood Zone 2 and 3, where the effects of climate change are not defined, the sites can be considered to lie within the current Flood Zone, however the effects of climate change should be investigated further. If following further investigation the site is found to lie within a different

Flood Zone the Sequential Test should be reapplied to determine if the proposed development is appropriate.

It should be noted that adopting this approach requires the LPAs to accept an element of risk when reviewing and allocating their development sites. For example, should the LPAs identify a site in Flood Zone 2 as acceptable for more vulnerable development, when considering the effects of climate change on Flood Zone definition the site may be found to be located in Flood Zone 3 and therefore require application of the Exception Test. Similarly location of more vulnerable development in Flood Zone 3a may be inappropriate if further work identifies those parts of 3a to be redefined as 3b with consideration of climate change.

As part of the SFRA update process, new modelled watercourse outlines should be incorporated into the SFRA mapping. New modelled outlines may become available as part of a site specific FRA or as part of ongoing EA updated modelling.

6 Site Specific Flood Risk Assessment Guidance

6.1 Introduction

The assessment of flood risk is a fundamental consideration for new development or redevelopment regardless of its scale or end-use. Understanding the flood risk posed to and by a development is key to managing the risk to people and property thereby reducing the risk of injury, property damage or even death. The effects of climate change may exacerbate future flood risk. Current predictions indicate that milder, wetter winters and hotter, drier summers will be experienced in the future and there will be a continued rise in sea levels. These changes will potentially lead to changes to the magnitude, frequency and intensity of flood events. Some areas currently defended from flooding may be at greater risk in the future due to the effects of climate change or as the defence condition deteriorates with age.

Opportunities to manage flood risk posed to and by development exist through understanding and mitigating against the risk. The location, layout and design of developments should be considered to enable the management of flood risk through positive planning. This positive planning approach must consider the risks to a development from local flood sources and the consequences a development may have on increasing flood risk to the surrounding areas. Early identification of flood risk constraints can ensure developments are sustainable whilst maximising development potential.

A Level 1 SFRA should present sufficient information to assist Local Planning Authorities to apply the Sequential Test and identify where the Exception Test may be required. These documents are predominately based on existing data. The scale of assessment undertaken for an SFRA is typically inadequate to accurately assess the risks at individual sites within the study area as, for example, the EA and SFRA Flood Zone Mapping do not account for all watercourses within the study area and may show a specific site to be within Flood Zone 1 when it may be adjacent to a watercourse. Therefore individual applications will be required to submit individual FRA's

Site-specific flood risk assessments (FRAs) are required to assess the flood risk posed to and by proposed developments and to ensure that, where necessary, appropriate mitigation measures are included in the development.

The guidance presented in the following sections has been based on:

- The recommendations presented in PPS25 and the consultation draft of the Practice Guide Companion;
- The information contained within this SFRA report.

At the time of writing this document no site-specific allocations had been finalised, therefore pending the finalisation of the other participating LPA allocations, the development areas were used to identify the flood risks to potential growth and development areas. If on completion of the preferred options there are any allocations that fall outside these growth areas, then the Sequential Test and potential exception test for these sites will need to be explored at that time. The following recommendations are made by way of an indication of how to proceed with the SFRA process once the preferred options allocations are finalised:

- The LPAs should apply the Sequential Test to the potential development sites and identify those sites they consider will be necessary to apply the Exception Test,
- If sites require the Exception Test the LPAs should provide responses to parts ‘a' and ‘b’ of the Exception Test for each of the allocation sites.

- Following completion of the Sequential Test and parts 'a' and 'b' of the Exception Test the Environment Agency should be consulted to confirm their acceptance of the LPAs arguments and justification for progressing with sites that require the Exception test. The LPA should then refer future developers to complete an FRA to meet the requirements of part c) of the Exception Test in line with recommendations set out in PPS25.

6.1.1 When is a Flood Risk Assessment required?

When informing developers of the requirements of an FRA for a development site, consideration should be given to the position of the development relative to flood sources, the vulnerability of the proposed development and its scale.

In the following situations a Flood Risk Assessment should always be provided with a planning application:

- Development sites located in Flood Zone 2 or 3;
- Proposed development that is classed as a major development and located in Flood Zone 1. These are residential developments consisting of sites greater than 0.5 ha or greater than 10 dwellings and commercial developments that are greater than 1 ha or have a floor area greater than 1000 m^2. Since the risk of fluvial or tidal flooding is minimal such FRAs should focus on the management of surface water;
- Development sites located in an area known to have experienced flooding problems from any flood source;
- Development sites located within 9m (water environment) of any watercourse regardless of Flood Zone classification.

6.1.2 What does a Flood Risk Assessment require?

Annex E of PPS25 presents the minimum requirements for FRAs. These include:

- The consideration of the risk of flooding arising from the development in addition to the risk of flooding to the development;
- Identify and quantify the vulnerability of the development to flooding from different sources and identify potential flood risk reduction measures;
- Assessment of the remaining 'residual' risk after risk reduction measures have been taken into account and demonstrate that this is acceptable for the particular development;
- The vulnerability of people that could occupy and use the development, taking account of the Sequential and Exception Tests and the vulnerability classification, including arrangements for safe access and egress;
- Consideration of the ability of water to soak into the ground, which could change with development, along with how the proposed layout of development may affect drainage systems;
- Fully account for current climate change scenarios and their effect on flood zoning and risk.

The Practice Guide Companion to PPS25 (consultation document) advocates a staged approach to site-specific FRAs with the findings from each stage informing the next and site master plans, iteratively throughout the development process.

The staged approach comprises of three stages outlined below.

6.1.3 Level 1 - Screening Study

A Level 1 Screening Study is intended to identify if a development site has any flood risk issues that warrant further investigation. This should be based on existing information such as that presented in the Level 1 SFRA. Therefore this type of study can be undertaken by a Development Control Officer in response to the developer query or by a developer where the Level 1 SFRA is available. Using the information presented in the Level 1 SFRA and associated GIS layers a Development Control Officer could advise a developer of any flooding issues affecting the site. A developer can use this information to further their understanding of how flood risk could affect a development.

6.1.4 Level 2 - Scoping Study

A Level 2 Scoping Study is predominately a qualitative assessment designed to further understanding of how the flood sources affect the site and the options available for mitigation. The Level 2 FRA should be based on existing available information where this is available and use this information to further a developers understanding of the flood risk and how they affect the development. This type of assessment should also be used to inform master plans of the site raising a developer's awareness of the additional elements the proposed development may need to consider.

6.1.5 Level 3 – Detailed Study

Where the quality and/or quantity of information for any of the flood sources affecting a site is insufficient to enable a robust assessment of the flood risks, further investigation will be required. For example it is generally considered inappropriate to base a flood risk assessment for a residential care home at risk of flooding from fluvial sources on Flood Zone maps alone. In such cases the results of hydraulic modelling are preferable to ensure details of flood flow velocity, onset of flooding and depth of floodwater is fully understood and that the proposed development incorporates appropriate mitigation measures.

At all stages, the Local Planning Authority, and where necessary the Environment Agency and/or the Statutory Water Undertaker should be consulted to ensure the Flood Risk Assessment provides the necessary information to fulfil the requirements for Planning Applications.

6.1.6 Site-Specific Guidance

The LPAs should consider the consequences of including SuDS on development sites and the impact these can have on the developable area. In all cases the LPA should assess allocation sites in relation to geology and local issues to enable completion of the Sustainable Drainage Systems summary in Appendix F; National and local policies should be reviewed against local flood risk issues and objectives identified by the Environment Agency. Through completion of these recommendations the LPA will be able to transparently manage flood risk and ensure risk to their development sites and communities, now and in the future are mitigated.

National Flood Risk Guidance

PPS 25 Methodology must be followed as detailed above
EA guidance on sequential testing must be followed as detailed above

Local Flood Risk Policy

Allocations within Flood Zones 2 and 3 will only be permitted in Stowmarket.
Where development is to be situated within a Flood Zone the following policies should be observed:

- The development should seek to reduce flood risk overall;
- Flood Proofing/Flood resilience measures should be incorporated into the design e.g. bungalows should have velux windows, sockets located high up on walls;
- Access and Egress routes must be at the 1000yr plus climate change or above level;
- Emergency Planning;
- EA Flood Warning Procedure should be adhered to;
- Flood action plans should be developed- these would consider Escape routes, a refuge room, adequate supplies of bottled water and food;
- Using Section 3.9 and Appendix F, site specific SFRAs should ensure appropriate SuDS techniques are investigated according to local geology

6.1.7 Dry Islands

In some instances there may be areas of Flood Zone 1 on higher ground, which are effectively 'dry islands', that are completely surrounded by Flood Zone 2 and 3. During a flood event such islands would become marooned leading to access and egress implications and be unsustainable. Therefore developments proposed on dry islands will be treated the same way as developments in flood zone 2 or 3 for the purposes of the sequential test in line with Core Strategy policy CS4.

The town of Eye in Mid Suffolk is entirely surrounded by flood zone 2 but in discussions with the Environment Agency it is agreed that it should not be classified as a 'dry island'. The SFRA maps show that access/egress from Eye could be possible along Lambseth Street in a flood event. In addition, in the event of a 1000yr flood, Eye town centre is large enough to sustain the population within the dry centre for a short period, if access/egress is not possible.

6.2 . Residual Risk Management

Residual risk in a generic sense can be defined as being the remaining risk following the implementation of all reasonable risk avoidance, reduction and mitigation measures (Communities and Local Government, 2007). In a flood risk context, this residual risk pertains to the flood risk that remains after flood avoidance and alleviation measures have been put in place. Examples of such residual risks include overtopping or breaching of flood walls or embankments.

Residual risk management therefore aims to prevent or mitigate the consequences of flooding that can occur despite the presence of flood alleviation measures.

Application of the Sequential Test as part of PPS25 aims to preferentially develop or relocate potential development sites into areas with low flood risk. Where this is not realistically possible, some development sites may be located in higher flood risk areas, such as PPS25 defined Flood Zones 2 and 3. As a result, such developments will require residual risk management to minimise the consequences of potential flooding, e.g. following a breach or overtopping of local defences.

Ensuring properties are defended to an appropriate design standard reduces flood risk. However, further options are also available should the residual risk to a development prove unacceptable. This chapter presents some of the information and options available to understand and manage residual risk.

6.2.1 Potential Evacuation and Rescue Routes

In the event of a flood incident, it is essential that the evacuation and rescue routes to and from any proposed development remain safe. The Environment Agency deem evacuation routes safe if they fall

within the white cells of Table 13.1 of the Defra/EA document FD2320 for a 1 in 100/200 year design event as a minimum, and the Environment Agency inform the LPA of the risk posed during the extreme event (1 in 1000 year). This allows the LPA to consult with the emergency services over the suitability of the access route. If potential evacuation routes are likely to become inundated so that safe access/egress would not be possible, then the proposed development should be relocated. This may also be the case should the possible evacuation routes be particularly long or across difficult terrain.

A key consideration in relation to the presence and use of evacuation routes is the vulnerability and mobility of those in danger of being inundated. Development for vulnerable users e.g. disabled or the elderly, should, be located away from high-risk areas. The Sequential Test does not however differentiate between the vulnerability of the end users of the site, only the vulnerability of the intended use of the site. A proposed residential development for highly vulnerable end users, (elderly, physically impaired etc) will still fall under the 'More Vulnerable' classification in Table D.2 of PPS25 and the Sequential and Exception Tests will apply accordingly. Where development for highly vulnerable end users cannot be avoided, safe and easy evacuation routes are essential.

6.2.2 Time to Peak of Flood Hazard

The time to the peak of the flood hazard relates to the amount of time it takes for a flood event to reach its maximum level, flow or height. The greater the time to peak, the greater the time available for evacuation. The time to peak can, for residual flooding, be very short. Should a defence structure breach then inundation can be rapid, resulting in a short time to peak for the areas local to the breach. Typically, areas immediately adjacent to a breach location will have a shorter time to peak than areas setback from the flood defence.

6.2.3 Methods of Managing Residual Flood Risk

The following sub-sections outline various methods available for the management of residual flood risk. The methods outlined will not be appropriate for all development types or all geographical areas. Therefore, they should be considered on a site-by-site basis. In addition, it is important that the use of such techniques do not exacerbate flooding elsewhere within the flood cell.

Recreation, Amenity and Ecology
There are many different ways in which recreation, amenity and ecological improvements can be used to mitigate the residual risk of flooding either by substituting less vulnerable land uses or by attenuating flows or both. They range from the development of parks and open spaces through to river restoration schemes. In addition, they have wider ecological biodiversity and sustainability benefits.

The basic function of these techniques is increased flood storage and the storage or conveyance of rainwater. Typical measures include various guises of pools, ponds, and ditches. These all can have the added benefit of improving the ecological and amenity value of an area. These features can provide a haven for local wildlife. In addition, they can contribute to a sites amenity value both aesthetically and for recreation by providing attractive areas available for activities such as walking, cycling, water sports or wildlife watching.

Secondary Defences
Secondary defences are those that exist on the dry side of primary defences. Typically, their main function is to reduce the risk of residual flooding following a failure or overtopping of the primary defences.

Secondary defences can relocate floodwaters away from certain areas or reduce the rate of flood inundation following a residual event. Examples of secondary defences include embankments or raised areas behind flood defence walls, raised infrastructure e.g. railways or roads and on a strategic level,

canals, river and drainage networks. The latter are a form of secondary defence as they are able to convey or re-direct water away from flood prone areas even if this is not their primary function.

Land Raising
Land raising can have mixed results when used as a secondary flood alleviation measure. It can be an effective method of reducing flood inundation on certain areas or developments by raising the finished levels above the predicted flood level. However, it can result in the reduction in flood storage volume within the flood cell. As a result, floodwater levels within the remainder of the cell can be increased and flooding can be exacerbated elsewhere within the flood cell. Level for Level compensation storage would be required where any loss of floodplain storage had occurred as a result of land raising or development within the floodplain.

Partial land raising can be considered in larger, particularly low-lying areas such as marshlands. It may be possible to build up the land in areas adjacent to flood defences in order to provide secondary defences. However, again the developer should pay due regard to the cumulative effects of flooding such as increasing flood risk elsewhere.

Finished Floor Levels
Where developing in flood risk areas is unavoidable, the most common method of mitigating flood risk is to ensure habitable floor levels are raised above the maximum flood water level. The Environment Agency require 300mm freeboard for precisely computated flood levels, and 600mm for less precisely computated levels in addition to modelled flood levels when setting finished floor levels. It is also necessary to ensure that roads levels are such that emergency access and evacuation routes are maintained. This can significantly reduce the risk of the proposed development becoming inundated by flooding. As with the land raising option, it is imperative that any assessment takes into consideration the volume of floodwater potentially displaced by such raising.

In areas where significant depths of floodwater are predicted to inundate the site, development design can incorporate the use of non-habitable uses on the ground floor. These can include garage areas, utility or storage spaces. This method can be somewhat contentious as it can be difficult to ensure that the ground floor remains uninhabited for the lifetime of the development and emergency access can be difficult.

Flood Resilience
The Association of British Insurers in cooperation with the National Flood Forum has produced published guidance on how homeowners can improve the flood resilience of their properties (ABI, 2004). These measures can not only improve properties against flood risk, by reducing the residual risk, but can also improve the insurability of homes in flood risk areas. The guidance identifies the key flood resistant measures as being:

- Replace timber floors with concrete and cover with tiles,
- Replace chipboard/MDF kitchen and bathroom units with plastic equivalents,
- Replace gypsum plaster with more water-resistant material, such as lime plaster or cement render,
- Move service meters, boiler, and electrical points well above likely flood level, and,
- Put one-way valves into drainage pipes to prevent sewage backing up into the house.

Advice on flood mitigation for homes and businesses is also given in the ODPM's 2003 report, 'Preparing for Floods' (ODPM, 2003b).

Flood Warning and Emergency Procedures
Flood warning and emergency procedures are typically higher-level management strategies. Such procedures typically include information such as warning, evacuation and repair procedures. Documents providing guidance on how to use flood resistance and resilience measures to limit damage caused by

flooding, such as 'Improving the Flood Performance of New Buildings, (Department for Communities and local Government, May 2007), can also offer important guidance and should be referred to.

When undertaking flood risk assessments for developments within flood risk areas, the local flood warning and emergency response plans should be referred to as a flood damage mitigation method.

Where these procedures already exist they should be updated to include the information generated by this SFRA. Emergency planning maps are provided in each of the supporting appendices and should be consulted in order to identify places of refuge within the District. This will ensure that emergency plans are appropriate to the conditions expected during a flood event and that local authorities and emergency services are fully aware of the likely conditions and how this may affect their ability to safeguard the local population.

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Appendix A: Flood Risk in Mid Suffolk: 2007

Appendix B: Flood Risk in Mid Suffolk: 2107

Appendix C: Flood Risk in Towns and Key Service Centres 2007 and 2107

Appendix D: Depth Hazard Mapping

Appendix E: Groundwater Vulnerability Map of Mid Suffolk:

Appendix F: Geology and SuDS Review

Appendix G: GIS Layers

Appendix H: Data

Appendix I- List of Contacts

Appendix J: SFRA Maintenance and Updates

Appendix K: SFRA Version Register