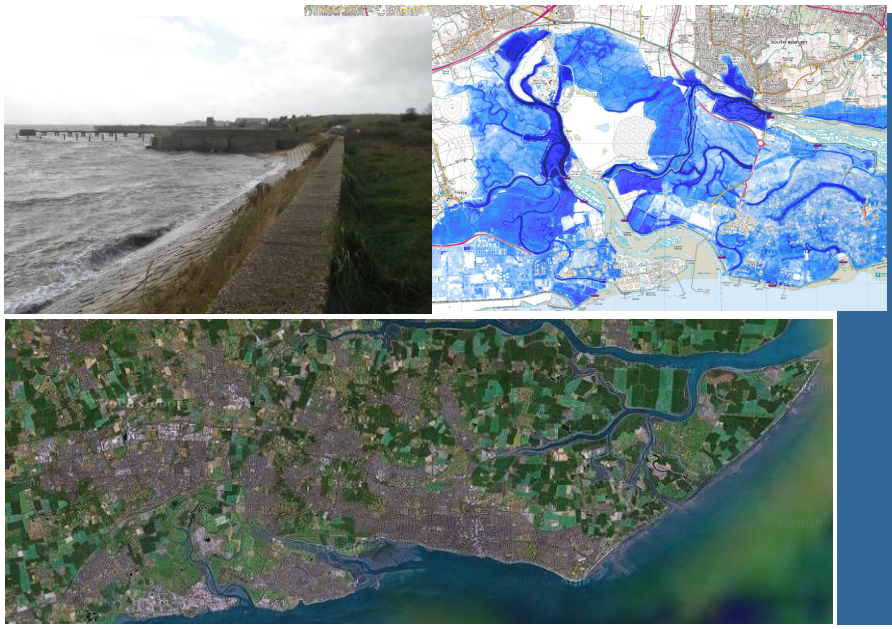
Thames Gateway South Essex

Strategic Flood Risk Assessment Review

Scoping Report

March 2009



Prepared for:

Basildon District Council
Rochford District Council
Southend-on-Sea Borough Council
Castle Point Borough Council
Essex County Council

Revision Schedule

Scoping Report and Brief for Level 1 and Level 2 SFRA

Rev	Date	Project Number	File Reference	Prepared by	Reviewed by	Approved by
01	January 2009	D122596	Draft, prior to EA comment	**Liz Williams** **Sarah Williams**	**Jon Robinson** Associate Director	**Jon Robinson** Associate Director
02	March 2009		Final including comments	**Liz Williams** Principal Consultant	**Jon Robinson** Associate Director	**Jon Robinson** Associate Director

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1 Introduction

1.1 Background

The Client Group consisting of: South Essex Strategic Planning Authorities of Essex County Council and Southend-on-Sea Borough Councils; and the Local Planning Authorities of Rochford District, Castle Point Borough and Basildon District Councils, require a Scoping Report, as a preliminary stage to achieving a South Essex Water Cycle Study (WCS) and a review of the Thames Gateway South Essex Strategic Flood Risk Assessment (SFRA) which was published in 2006.

Planning Policy Statement 25 (PPS25) Development and Flood Risk was published in December 2006 and highlights the need for Local Planning Authorities to take into account the potential impact of flooding throughout the spatial planning process.

The existing Strategic Flood Risk Assessment (SFRA) for the Thames Gateway South Essex area was published in November 2006. It was prepared by Scott Wilson Ltd to aid the South Essex Strategic Planning Authorities of Essex Country Council, Southend-on-Sea and Thurrock Borough Council and the Local Planning Authorities of Rochford District, Castle Point Borough and Basildon District Council in their planning and development control processes. The existing SFRA was prepared in full accordance with the prior flood risk management guidance, Planning Policy Guidance 25 (PPG25) Development and Flood Risk.

In light of the new guidance in PPS25, coupled with the publication of the East of England Regional Spatial Strategy in May 2008, which set targets for the scale and location of growth in the region, a review and update of the SFRA for Thames Gateway South Essex is required.

1.2 Study Area

The study area for the revision of the Thames Gateway South Essex SFRA is confined to the area within the boundaries of four local authorities which are part of Thames Gateway South Essex Partnership (TGSEP) , as shown in Figure 1, namely Basildon District Council, Rochford District Council, Southend-on-Sea Borough Council and Castle Point Borough Council. A large proportion of this area is relatively low lying land adjacent to the sea and the River Thames Estuary and is therefore at risk of tidal flooding.

Several river systems in the study area also introduce the risk of fluvial flooding to the more inland areas of Basildon District and Southend-on-Sea Borough.

It should be noted that due to differing timescales projected for the publication of its Local Development Framework, Thurrock Borough Council has commissioned a separate SFRA update for its borough and will therefore not be participating in the review of wider Thames Gateway South Essex SFRA for the Thurrock Borough Council area.

1.3 Level 1 and Level 2 SFRA

SFRA provide an assessment of the flood risk across a defined area, identifying land at risk and the degree of that risk from all sources of flooding. The requirements of an SFRA are set out in PPS25 and its

accompanying Practice Guide, which recommends a staged approach to allow application of the sequential approach and PPS25 Exception Test.

Level 1 involves a collation and review of all existing available information regarding flood risk across the study area to define the risk and degree of flooding from all sources at a strategic scale. The information should be sufficient for the partnership authorities to carry out the PPS25 Sequential Test when allocating sites for development.

Where there is pressure to develop in areas at medium or high flood risk, a Level 2 SFRA should be carried out to consider in more detail the nature of the flood risk and hazard and to allow application of the PPS25 Exception Test. This information will supplement the Level 1 SFRA to provide the partnership authorities with an evidence base sufficient to further inform and justify the allocation of development sites.

The existing SFRA predates this staged approach, although contains much of the information required for both a Level 1 and Level 2 SFRA, subject to updates.

1.4 Aims of Scoping Report

This aim of this report is to provide a brief for the production of a Level 1 and Level 2 SFRA for Thames Gateway South Essex, particularly given the changes in policy relating to flood risk and development since the production of the existing SFRA, which was completed in 2006. Details regarding deliverables and expected timescales have also been included.

Additionally, this report provides a review of any available data, summarised in a catalogue of datasets, studies and useful information required to complete the SFRA, along with their availability, completeness and source.

2 Data Collection and Review

2.1 Introduction

In order to gain an appropriate understanding of the flood risk across the study area, a considerable amount of data and an appreciation of local issues is necessary. A review of the existing data and information is presented below.

2.2 Digital Terrain Data

LiDAR

An accurate and up to date Digital Terrain Model (DTM) is required in order to produce high resolution flood risk mapping. Light Detection and Ranging (LiDAR) data is available for the majority of the study area. The Environment Agency has provided LiDAR collected between 1999 and 2007 with 2m resolution and +/- 300mm vertical accuracy. Figure 2 shows the available LiDAR tiles and coverage over the study area.

The coverage is in general very good. Southend has complete coverage. There is missing data in Rochford along the coastal part of Foulness Island and in the upstream reach of the River Roach, near Great Stambridge; and coverage in the northern part of the district is patchy. Canvey Island is well covered by the LiDAR data; however there is a small area of missing data in the northern part of Castle Point Borough. In Basildon there is missing data to the west of Basildon and north of Billericay. The missing areas are identified in Figure 02 Appendix B of this report. The general areas missing LiDAR are rural areas of low development density, generally in Flood Zone 1.

It is understood, through correspondence with the LiDAR supplier, that Local Authorities have access to NEXTMap SAR as part of the National Interest Mapping Services Agreement and therefore, if terrain data is required for areas where LiDAR is not available, the possibilities for acquiring SAR will need to be discussed with the relevant Local Authority.

2.3 Reports

A number of studies have been completed for the councils and the Environment Agency by various consultants. These reports will be of importance during the production of the revised SFRA to avoid duplicate work.

Thames Gateway South Essex SFRA, December 2006, Scott Wilson

In 2006 Scott Wilson published an SFRA for the Thames Gateway South Essex Partnership to assist with the development of LDFs by identifying flood risk areas and outlining principles for sustainable development policies, informing strategic land allocations and integrating flood risk management into the spatial planning of South Essex (http://floodrisk.tgessex.co.uk). As part of this assessment, the potential for tidal flooding as a result of a breach of flood defences was considered at strategic locations along the coastline within the study area. Flood depth, hazard maps and animations were provided for each of the breach scenarios to inform spatial planning and emergency planning across the study area.

Mid Essex Strategic Flood Risk Assessment, 2008 Scott Wilson

Scott Wilson completed a Level 1 and Level 2 SFRA for each of the Mid Essex authorities, including Chelmsford, Braintree, Colchester and Maldon local authorities. Flood zone maps were identified for present day and taking into account climate change. Additional fluvial modelling was commissioned as part of the study to provide hazard and depth map deliverables. The boundaries of Basildon and Rochford fall within the catchment areas of the River Wid and River Crouch, so this report should be used to ensure catchment issues are addressed across the study boundaries.

Water Levels, 2007, Environment Agency

The Environment Agency commissioned a study in 2007 as part of the Thames Estuary 2100 project to reassess extreme water levels along the Thames Estuary for a series of different annual probability events. These water levels present the most up to date information and will be required for mapping PPS25 flood zones across the study area and for inclusion in any revised hydraulic breach and overtopping models.

Roach and Crouch Flood Management Strategy, 2005, Environment Agency

This report provides an assessment of the current and future standard of protection of the existing flood defences within the Roach and Crouch study area using data regarding the existing defence parameters, water levels, and the type of flood defence.

South Essex Catchment Flood Management Plan, August 2008, Environment Agency

The Environment Agency has recently completed the Catchment Flood Management Plan (CFMP) for South Essex. This is due to be released in January 2009. The CFMP provides a detailed overview of flood risk issues within the area and sets policies for flood risk management at a catchment scale, taking into account the increased risk of flooding due to climate change. The CFMP presents the findings (including flood risk and flood depth maps, catchment maps and peak flow rates) of broad scale modelling of reaches of the following fluvial systems:

- River Mardyke
- Horndon Brook
- River Crouch to Wickford Gauging Station
- River Crouch to Tidal Limit
- North Benfleet Brook
- Prittle Brook
- Rettendon Brook
- River Roach
- Fenn Brook
- Mucking Hall Brook
- Great Hayes Brook
- Asheldham Brook

- Wrigley Ditch
- Raywick Redward Ditch
- Eastward Brook

North Essex Catchment Flood Management Plan (in development), Environment Agency

This document is currently in development for the catchment areas in north essex. If this document is available for the SFRA revision it should be referenced for the northern catchment areas in Basildon and Rochford to ensure all policy and management issues are incorporated into the revised reports.

Essex Shoreline Management Plan, 1997, Environment Agency.

The Shoreline Management Plan (SMP) for the stretch of coastline between Harwich and Canvey Island was initially published in April 1997. It is understood that a second generation SMP (SMP2) is currently under preparation for the shoreline between Languard Point to the River Mardyke. Draft options from the SMP2 are expected by the Summer of 2009.

Thames Estuary 2100, 2008, Environment Agency

The aim of the Thames Estuary 2100 project is to develop an understanding of the estuary and flood risk, in order to anticipate how flood risk may change in the future and how the increasing risk (due primarily to climate change and/or degeneration of existing flood defence infrastructure) can be managed. As part of this study water levels have been remodelled and, coupled with the impact of climate change, result in increased extreme water levels for fluvial and tidal events. This will have an impact on the determined overall level of protection provided by the existing defences in the Thames Gateway South Essex area.

Essex Estuarine Strategies, 2008, Environment Agency

The Environment Agency has commissioned a collection of long-term strategies for flood management in the Essex Estuaries; the Roach and Crouch, Blackwater and Colne, the Stour and Orwell, and Hamford Water. These strategies will encourage effective management of the potential impacts that rising sea levels will cause and enable a strategic view of the opportunities associated with these changes (the date of publication of these studies is not yet known).

Proposed Thames Gateway South Essex Water Cycle Study 2009/2010

The Water Cycle Study for the TGSE area will provide a plan and programme for the implementation of appropriate water services infrastructure in line with future development. The Water Cycle Study will be commissioned at the same time as the SFRA review and update and therefore it will be important to ensure that the outputs of the SFRA are reported clearly to the authors of the Water Cycle Study on an ongoing basis.

2.4 Models

Breach Modelling

The existing TGSE SFRA includes 21 breach models, excluding those undertaken within the Thurrock Borough Council boundary. These breach models were run in accordance with PPG25, using 6mm increases per year for 50 years of climate change up to 2055. However PPS25 requires that climate change is considered for the lifetime of the development, which, in the case of residential development, is 100 years. In addition PPS25 advocates an incremental increase in water level for climate change as set out in Table B.1 of PPS25. Therefore climate change would result in a water level increase of 1.02m over 100 years, which is significantly higher than the climate change water levels modelled in the existing SFRA. The current day extreme water level has itself also increased since the original breach modelling work was undertaken. The implication of these water level and climate change increases is that overtopping of flood defences at their current crest height is likely. Therefore as part of the SFRA revision overtopping will also need to be modelled for the entire frontage.

Based on recent advice from the Environment Agency Flood Risk Mapping team in the area (Ipswich office), it is recommended that four water level scenarios are run for each breach model for each extreme water level:

- 1 in 200 year present day;
- 1 in 1000 year present day;
- 1 in 200 year plus 100 years climate change;
- 1 in 1000 year plus 100 years climate change, to inform safe egress/access considerations and emergency planning. This information will be more detailed in a site-specific FRA, however the SFRA should provide a strategic overview for allocations (e.g. where access/egress could be a showstopper for part c) of the Exception Test).

Figures B1 and B2 show the existing breach locations in the TGSE study area, all of these will need to be re-run to take into consideration the revised water levels and climate change recommendations.

Overtopping

In the previous SFRA overtopping was not modelled as the defences were considered a higher standard than the PPG25 climate change allowances. Incorporating the PPS25 climate change recommendations and revised water levels, it is anticipated that some of the existing flood defences around the south essex coastline will be overtopped. Therefore each of the existing flood cells will need to be modelled for overtopping, which presents an actual flood risk. The overtopping results will need to be presented as depth and hazard maps to assist in part c) of the Exception Test. Overtopping models are only required for each flood cell for the climate change extreme water level scenarios:

- 1 in 200 year plus 100 years climate change;
- 1 in 1000 year plus 100 years climate change.

Hydraulic Modelling of Fluvial Systems

The South Essex CFMP was completed by the Environment Agency in April 2008, and includes hydraulic modelling and floodplain mapping for the main watercourses in South Essex. These include:

- River Crouch
- North Benfleet Brook

- River Roach
- Stanford Brook
- Nobblesgreen Ditch

The models were built using the software ISIS v2.3 and were used in combination with estimates of design flow to simulate flood events with return periods of 1 in 10, 20, 50, 75, 100 and 1,000 years, as well as the 1 in 100 year event plus climate change. Flood outlines were defined using the 1D modelling with refinement from 2D models to better assess flood extent on Hassen Brook, a tributary of Stanford Brook.

The River Wid affects the outer urban areas of Billericay. The lower reaches of this river have been modelled, therefore some hydraulic model outputs should be available for the upper reaches.

Depth mapping was included within the CFMP therefore it is anticipated depth grids will be made available for the SFRA study. Therefore additional fluvial modelling is not anticipated as part of the SFRA revision.

2.5 Flood Defences

National Flood and Coastal Defence Database

The National Flood and Coastal Defence Database (NFCDD), provides a centralised store of digital information about flood defences that is available to the Environment Agency. Datasets have been received for flood defences and structures within the study area. These datasets contain information on the defence location, type, length, height, design standard and authority in charge of maintenance. The information from the NFCDD can be used to construct accurate models that take into account existing defences. The NFCDD information is provided in GIS format.

Where information exists on the elevation of outlet pipes, consideration should be made to their ability to operate with increasing water levels and climate change.

Wallasea Island Managed Realignment

The Wallasea Project is being carried out by Royal Society for the Protection of Birds on behalf of DEFRA, and with advice from Natural England and the Environment Agency. The project involves the creation of new coastal habitat following the realignment of sea defences on low-lying land beside the Crouch Estuary. These modifications will also serve to enhance the level of flood protection provided to the land behind the new sea walls

2.6 GIS Layers

Environment Agency Flood Zones

The Environment Agency have mapped PPS25 Flood Zones 2 and 3, which identify areas at medium and high risk from fluvial and tidal flooding. These Flood Zones cover large parts of the study area, showing the vulnerability of low lying parts of South Essex to extreme flood events. These maps do not take into consideration the presence of flood defences and therefore present the worst case scenario. The actual occurrence of flooding may be reduced by the presence of flood defences.

TGSE SFRA Flood Zones and Hazard Zones

Mapping of tidal Flood Zones 2 and 3 (PPG25 definition) and tidal hazard zones (3 categories) are available from the existing TGSE SFRA. However, these are now out of date and are suitable only for comparative use against new outputs produced.

Main River Centrelines

Main River centrelines have been provided in a digitised GIS format. These will be required to identify the paths of rivers and to locate river channels within the LiDAR elevation data.

Geology

Where members of the client group hold geological maps in digital format from the British Geological Survey, these should be supplied for the consultants reference in relation to SuDS and drainage suitability.

NFCDD

A record of flood defences within the study area, including the location, height, length, authority in charge of maintenance, design standard and type of defence. This information will be important in order to carry out accurate assessment of flood risk following a breach or overtopping of the defences in specific locations.

Study area boundary

Shape files have been received which define the Local Authority boundaries. These will be used to locate and define the Thames Gateway South Essex study area boundary and immediate surroundings.

Ordnance Survey Maps

Mapping including OS Mastermap covering the Thames Gateway South Essex study area is available at scales 1:10,000, 1:25,000 and 1:50,000.

2.7 Data Gaps

Undertaking a revised SFRA for the Thames Gateway South Essex study area will require a large amount of data collection, some of which is dependant upon the willingness of third parties to supply. There is some data which is not available for review as part of this Scoping Study and will need to be requested from the relevant third party. The following data and gaps and further requirements have been identified:

- A number of gaps have been identified within the LiDAR coverage, however it is understood that Local Authorities have access to NextMap SAR data that can be used where necessary as infill;
- Flood Zones, updated with the most recent water levels at the time of the SFRA's review, will need to be obtained from the Environment Agency;
- Historic records for groundwater, surface and sewer flooding, available through the DG5 register and should be obtained as part of the WCS;
- Problem areas for surface water flooding, to be identified by local authority 'local knowledge';
- Problem areas for groundwater flooding, which should be made available from the Environment Agency;
- Problem areas for sewer flooding, which should be made available through the WCS;
- Thames Estuary 2100 Policy Options: these are currently undergoing final preparation and should be available for consideration during the SFRA Review from the Environment Agency.

3 PPS25 Implications for Study Area

Since the production of the TGSE SFRA, Planning Policy Statement 25: Development and Flood Risk (PPS25) has replaced the prior guidance Planning Policy Guidance Note 25: Development and Flood Risk (PPG25). Full consideration of the policy within PPS25 will need to be made during the review of the SFRA. This chapter provides an overview of the key aspects of PPS25 and a summary of the implications it will have for strategic planning within the study area.

3.1 Flood Zones

PPS25 Flood Zones subdivide the spatial variation of flood probability from rivers and the sea into 4 zones; the functional floodplain and the high, medium and low probability flood zones. The previous SFRA did not include mapping of the Flood Zone 3b, defined as the functional floodplain in PPS25.

Tables 3-1 and 3-2 show the probabilities used to define the flood zones.

Table 3-1: Tidal Flood Zone Definitions (as defined in PPS25, Table D.1)

Flood Zone	Definition	Probability of Flooding
Flood Zone 1	At risk from flood event greater than the 1 in 1000 year event (greater than 0.1% annual probability of flooding each year)	Low Probability
Flood Zone 2	At risk from flood event between the 1 in 200 and 1 in 1000 year event (between 0.5% and 0.1% annual probability of flooding each year)	Medium Probability
Flood Zone 3a	At risk from flood event less than or equal to the 1 in 200 year event (greater than 0.5% annual probability of flooding each year)	High Probability
Flood Zone 3b	This zone comprises land where water has to flow or be stored in times of flood. SFRAs should identify this Flood Zone (land which would flood with an annual probability of 1 in 20 (5%) or greater in any year or is designed to flood in an extreme (0.1%) flood, or at another probability to be agreed between the LPA and the Environment Agency, including water conveyance routes)	Functional Floodplain

Table 3-2: Fluvial Flood Zone Definitions (as defined in PPS25, Table D.1)

Flood Zone	Definition	Probability of Flooding
Flood Zone 1	At risk from flood event greater than the 1 in 1000 year event (greater than 0.1% annual probability of flooding each year)	Low Probability
Flood Zone 2	At risk from flood event between the 1 in 100 and 1 in 1000 year event (between 1% and 0.1% annual probability of	Medium Probability

	flooding each year)	
Flood Zone 3a	At risk from flood event less than or equal to the 1 in 100 year event (greater than 1% annual probability of flooding each year)	High Probability
Flood Zone 3b	This zone comprises land where water has to flow or be stored in times of flood. SFRAs should identify this Flood Zone (land which would flood with an annual probability of 1 in 20 (5%) or greater in any year or is designed to flood in an extreme (0.1%) flood, or at another probability to be agreed between the LPA and the Environment Agency, including water conveyance routes)	Functional Floodplain

3.2 Development Vulnerability Classifications

PPS25 classifies development according to their vulnerability. Five vulnerability classifications are defined;

- Essential Infrastructure;
- Highly Vulnerable;
- More Vulnerable;
- Less Vulnerable, and
- Water Compatible.

Full definitions are provided in Table D.2 of PPS25 including the types of development that fall under these classifications. PPS25 also stipulates where the differing types of vulnerable development may be appropriate based on flood risk. This is presented in Table D.3 of PPS25, which is reproduced below (Table 3-3).

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

✓ – Development is appropriate ✗ – Development should not be permitted

Table 3-3: PPS25 Table D3 Flood Risk Vulnerability and Flood Zone 'Compatibility' (DCLG, 2006)

3.3 Climate change

In accordance with recommendations from PPS25, the method by which climate change is taken into consideration has changed since the completion of the TGSE SFRA in 2006. PPS25 now requires climate change to be considered for the lifetime of the development, which is defined as 100 years for residential property. The climate change increases are suggested on an incremental basis, which translate into a 20% increase in fluvial discharge and 1.02m increase in tidal water levels over the next 100 years.

Climate change should be incorporated in line with any changes to PPS25 and/or the associated practice guide. Potential changes could be made in future when the new UKCIP climate change figures are published (expected in the near future).

3.4 Water levels

The Roach and Crouch Flood Management Strategy (2005) and the ongoing Thames Estuary 2100 (TE2100) project have re-modelled the predicted water levels for these water courses. These have resulted in increased water levels which will be needed for input into the tidal breach hydraulic models along with the updated climate change allowances. These two factors will result in the need to consider much greater water levels for hydraulic modelling. In some cases the existing defence height may be 'overtopped' by lower return periods when climate change is taken into consideration.

3.5 The Pitt Report & Surface Water Considerations

The Pitt Report was published following the flood events in the summer of 2007. It draws attention to the high proportion of surface water flooding that occurred during that period, and states that the impact of climate change means that the probability of events of a similar nature and scale happening in the future is increasing.

The report calls for improved modelling of all forms of flooding to enable better flood warning and planning and highlights the need for greater use of sustainable drainage systems (SUDs). The UK Government has recently endorsed the findings of this report. Therefore the revised SFRA will need to consider in more detail the potential for, and implications of, surface water flooding across the study area using local knowledge, including the need for Surface Water Management Plans (SWMP).

Any consideration of surface water flood risk, or critical drainage areas should be cross references with the TGSE Water Cycle Study (WCS) being carried out in parallel with the SFRA. Where the WCS shows capacity issues for infrastructure (or this isn't known and it must be assumed that there is no capacity) then the flood risk implications will need to be mapped. The main driver for all surface water concerns in future will be the SWMPs which will be led by the Local Authority.

3.6 Emergency Planning

Several documents have been published recently, including the Pitt Review (2008), National Flood Emergency Framework 2008 (as issued by DEFRA) and Review of the civil contingencies Act (ongoing through 2009), indicate increased areas of responsibility for Local Authorities and in particular, the Emergency Planning fraternity.

As a result of this, the SFRA revision should provide specific guidance for this group with respect to the use of the SFRA deliverables in relation to part c of the Exception Test. Emergency planners need

confidence in the SFRA process and how to use the deliverables as they are frequently asked to comment on linked FRA's in relation to part c of the Exception Test and flood response plans.

In relation to emergency planning roles in evacuation plans, it is important that the SFRA should consider the speed at which water recedes following inundation. These rates will relate directly to tidal fluctuations and mechanical pumping capacities. The length of time areas are surround/submerged by water directly affects the response EP and blue lights will provide regarding a stay put policy or a evacuation policy pre-event or their ability to rescue.

The emergency planning and blue light community should be consulted throughout the SFRA review process. This consultation is supported by PPS25 which refers to the objectives of the SFRA in determining the acceptability of flood risk in relation to emergency planning capability.

3.7 Flood Zone 3b Considerations

Mapping of Flood Zone 3b, the functional floodplain, was not undertaken as part of the previous SFRA. However, under the revised PPS25, Flood Zone 3 is divided into 3a and 3b based on the probability of flooding alone, as shown in Tables 3-1 and 3-2.

The functional floodplain is defined as *land where water has to flow or be stored in times of flood*. This includes water conveyance routes and areas of floodwater storage. These areas are clearly highly valuable for providing space for floodwaters during flooding and therefore areas of functional floodplain need to be identified when considering spatial planning. In general, non-water compatible development should be directed away from these areas; Table 3-3 identifies the type of development considered appropriate for these zones and when the PPS25 Exception Test will need to be satisfied in order for development to be permissible.

Areas that would be classified as functional floodplain, but are protected by existing defences or buildings, will not usually be defined as functional floodplain, but would be defined as Flood Zone 3a. PPS25 does not differentiate between developed and undeveloped areas since some developed areas may still provide storage and conveyance, for example a car park designed to flood may serve to retain flood storage volumes.

It is possible, given the increased water levels and climate change considerations, that extreme water levels during a higher probability event such as a 1 in 20 year recurrence may overtop existing defences for both tidal and fluvial systems. In accordance with PPS25 these areas would be identified as Flood Zone 3b.

3.8 Key Implications

Below is a summary of the key flood management issues for which prevailing policy or available data has been changed or updated since the finalisation of the original TGSE SFRA in 2006. These aspects will need to be taken into consideration as part of the revised and updated SFRA.

- Increased water levels, and greater allowances for climate change, could result in larger extents of Flood Zones 2 and 3a across the study area from tidal and fluvial sources, which will subsequently impact the type of development considered appropriate at different locations within the study area;

- An introduction of Flood Zone 3b is likely along the fluvial floodplains. Flood Zone 3b may also now exist in tidal marshland areas along the edge of the River Thames where overtopping could occur. In accordance with PPS25 most types of development are considered inappropriate for these areas;
- Areas with an identified residual risk, e.g. from a breach in flood defences, are likely to experience increased flood depths and higher flood hazard classifications. Robust policy implementation and support from emergency planning teams will be required to ensure safe access and egress can be addressed adequately in defended areas. Failure to do so could result in developments being unable to demonstrate part c) of the PPS25 Exception Test.
- Flood defences that could overtop will need to be identified for future improvements to protect existing development from tidal and fluvial flooding, taking into account climate change allowances;
- A greater awareness and understanding is required in the revised SFRA of those areas with surface water flooding issues, and how appropriate Sustainable Drainage Systems (SUDs) can be implemented to mitigate surface water flooding for existing and future development; and
- Greater emphasis will be required on emergency planning and the location of emergency services and refuge areas outside of the floodplain to assist individual developments formulate emergency plans to submit for part c) of the PPS25 Exception Test. Critical infrastructure should be identified within the focus areas in relation to flood risks;
- It should be noted that the emerging TE2100 plan is placing more emphasis on appropriate floodplain management and the SFRA will play a key role in this.

In light of these implications, further, more specific, requirements for each of the five client authorities undertaking the SFRA review and update have been summarised in Section 4.

4 Detailed Level 1 and Level 2 SFRA Brief

4.1 Introduction

The client authorities of Basildon District, Castle Point Borough, Rochford District, Southend on Sea Borough and Essex County Councils require a review and update of the existing Thames Gateway South Essex Strategic Flood Risk Assessment (SFRA) to inform strategic spatial planning in their areas. The following provides a detailed brief of those aspects that will need to be considered as part of the SFRA Review.

4.2 Objectives

The requirements for carrying out a SFRA are set out in PPS25 and its accompanying Practice Guide. A staged approach is recommended, as follows:

Level 1

The objective of the Level 1 SFRA is to collate and review all existing available information on flood risk for the study area. Information is sourced from a variety of stakeholders including the Environment Agency, sewerage undertaker, highways authorities and local authorities.

The deliverables from the Level 1 SFRA should be used to complete the Sequential Test. Where the Sequential Test identifies the potential need to apply the Exception Test, further data collection and/or analysis may need to be carried out in a Level 2 report.

The Level 1 report will also need to include specific reference to Minerals and Waste sites for each local authority to inform Essex County Council's Minerals and Waste policy development. The specific requirements relating to this are outlined later in this chapter.

Level 2

The Level 2 SFRA uses information obtained in the Level 1 SFRA where suitable, and additional works where necessary, to generate sufficient information for the application of the Exception Test to those sites which cannot be located in lower flood risk zones through application of the Sequential Test. In some cases the residual flood risk mapping presented in the Level 2 SFRA may also be used to apply the sequential approach within the Flood Zones.

The Exception Test is the application of a three part test, as set out in PPS25. The test considers the wider sustainability benefits of the development, whether the site is where possible located on previously developed land, and the flood risks to the development to ensure it is safe and does not increase flood risk elsewhere.

This information will supplement the Level 1 SFRA to provide each of the partnership authorities with an evidence base sufficient to inform the strategic planning of each of their local authority areas. The Level 2 report should also include detailed FRA guidance, information regarding appropriate sustainable drainage systems (SUDs), and recommendations for policy and development control purposes.

4.3 Deliverables

The deliverables for the SFRA should include the following:

Overall

- A single Executive Summary providing an overview of the sub-regional issues, and how flood risk may impact on the spatial planning of South Essex to inform the Regional Spatial Strategy Review to 2031 and Local Development Frameworks.

Level 1

Four Individual **Level 1 Reports** for each local authority area, which each provide an assessment of the local flood risks from all sources of flooding. Each report will need to contain a specific chapter on Minerals and Waste sites within their LPA boundary.

- Each Level 1 Report will contain specific maps illustrating tidal and fluvial flood zone based on Environment Agency PPS25 Flood Zones, and taking account of future flood risk. PPS25 Flood Zones play a dominant role in the Sequential Test process and will therefore need to reflect flood extents accounting for climate change, as well as identifying functional floodplain for the Thames Estuary/North Sea and main rivers. Based on recent advice from the Environment Agency, two scenarios are required to inform the Sequential Test approach in Flood Zone 3a:
  - 1 in 200 year present day breach models;
  - 1 in 1000 year present day breach models;

  Maps illustrating the **flood hazard** resulting from each breach scenario model for present day water levels, based on the two water level scenarios above. These maps should be of a local authority scale as a composite hazard map- using the maximum identified hazard to inform the sequential test for sites proposed in Flood Zone 3a. Flood Hazard categories should be derived using the index of flood water depth and velocity, as advocated by DEFRA Report FD2320 (Defra and The Environment Agency (2005) Flood Risk Assessment Guidance for New Development, Phase 2, Framework and guidance for assessing and managing flood risk for new development - full document and tools, R&D Technical Report FD2320/TR2).
- The Level 1 Report should also contain maps illustrating the **flood risk from other sources**, including surface water, groundwater and sewer flooding, based on records of previous events. This should be supported by an appreciation of the wider geology of the study area as well.
- An assessment of **surface water flood risk** should be included at this stage, including an appreciation of the spatial variation and suitability for the application of SuDS across each of the local authority areas.
- Each individual Level 1 Report should **provide a summary of the flood risk issues** specific to each local authority area. The Flood Zone and flood sources maps should be sufficient to enable each of the local authorities to apply the Sequential Test to their proposed site allocations as part of their LDF's.
- All mapping deliverables should be provided in a standard GIS format (compatible with MapInfo and/or ArcGIS).
- Each authority will require 2 hard copies and a digital Adobe Acrobat PDF copy of the Level 1 report and associated mapping.
- A hard copy and a digital Adobe Acrobat PDF copy will also be required for each of the Technical Advisors

Level 2

- Four individual **Level 2 Reports** specific to each of the four local authority areas, which provide a greater level of information for potential site allocations and development locations that may require the application of the Exception Test. A separate chapter may be required on Minerals and Waste sites where relevant to each local authority.
- Based on recent guidance from the Environment Agency two scenarios are required for each breach location, to include overtopping modelling and breach modelling assuming the existing defence standards:
    - 1 in 200 year plus 100 years climate change;
    - 1 in 1000 year plus 100 years climate change, to inform safe egress/access considerations and emergency planning.

Maps illustrating the **flood hazard** resulting from each breach and/or overtopping scenario model (see list below), based on the two water level scenarios above. These maps should be of a sufficient scale (e.g. 1:25,000) to inform the suitability of development in parts of the study area highlighted as being at risk during Level 1. Flood Hazard categories should be derived using the index of flood water depth and velocity, as advocated by DEFRA Report FD2320 (Defra and The Environment Agency (2005) Flood Risk Assessment Guidance for New Development, Phase 2, Framework and guidance for assessing and managing flood risk for new development - full document and tools, R&D Technical Report FD2320/TR2)

- Maps illustrating the **flood depth** resulting from each breach and/or overtopping scenario model. These maps should be of a sufficient scale (e.g. 1:25,000) to inform the suitability of development in parts of the study area highlighted as being at risk during Level 1.
- One **animation** (*.avi file) for each and/or overtopping scenario model is to be supplied. This must show spatial flood risk against an ordnance survey background, from beginning to end of the model simulation. Time of inundation at each timestep must be clearly shown to inform part c) of the Exception Test.
- Each Level 2 Report shouldmust contain a section on emergency planning in relation to application of part c of the Exception Test and a suggested draft Emergency Flood Management Plan (headings and type of data to be included, with suggested focus action points) should also be included.
- All mapping deliverables should be provided in a standard GIS format (compatible with MapInfo and/or ArcGIS).
- Each authority will require 2 hard copies and a digital Adobe Acrobat PDF copy of the Level 2 report and associated mapping.
- A hard copy and a digital Adobe Acrobat PDF copy will also be required for each of the Technical Advisors.

4.4 Minerals and Waste Sites

It is understood that Essex County Council (ECC) has appointed consultants to undertake SFRA work to inform Minerals and Waste policy development. Although the existing TGSE SFRA provides

evidence for the emerging Local Development Framework for Minerals and Waste, the revised SFRA will provide information in line with current planning policy for flood risk (PPS25).

The Minerals Development Document and Waste Development Documents require explicit information on flood risk for current and potential uses for the following:

- Mineral extraction sites;
- Minerals processing and transhipment sites;
- Waste handling, treatment and disposal sites.

SFRAs identify flood risk from sources including tidal, fluvial, groundwater, surface water and artificial sources (e.g. reservoirs, canals) for the present day and provide allowances for the potential effects of climate change.

The following stages are recommended as a separate stand alone chapter in the revised Level 1 SFRA's to provide ECC with the required information for Minerals and Waste decision making processes.

- Identify existing and potential waste handling/treatment and disposal sites, mineral extraction, processing and transhipment sites within TGSE area.
- Provide a chapter on Minerals and Waste in the Level 1 SFRA report in the context of PPS25 and a synopsis of flood risk vulnerability classification for the different minerals and waste uses.
- Provide a broad scale assessment for each site for existing and future flood risk using a tick box approach (this can also be assessed using a traffic light system) and comment on access/egress issues. This will use the GIS mapping produced for the wider study.
- Provide general recommendations relating to minerals and waste sites.

The Level 1 SFRA should provide the flood risk baseline information required for the Waste and Minerals Plan; but as with the LPA's sites, any Waste and Minerals sites that fall into a flood zone will need to be tackled in the Level 2 SFRA;

4.5 Additional Requirements

Southend Borough Council

The southern boundary of the Southend-on-Sea Borough forms the north bank of the tidal River Thames. The main urban development in the Borough has grown up along the sea front along with associated tourism-related and recreational industries (and fishing industry still active in Leigh on Sea). Reduction in this industry over time along the riverfront area has led to increased 'brownfield' land available for development along the River Thames frontage. Regeneration in Southend is a recognised requirement in the Regional Spatial Strategy and is supported by other regeneration drives such as the Thames Gateway initiative. Much of the areas identified for regeneration in the adopted Copre Strategy DPD, including the Seafront, are currently classified as Flood Zone 3a under Planning Policy Statement 25: Development and Flood Risk (PPS25).

The previous SFRA identified the flood zones across the Borough, and assessed the implications of a potential failure in the flood defences at four strategic sites along the river frontage for the 1 in 200 and 1 in 1000 year events including an allowance for 50 years of climate change. These will need to be remodelled using updated water levels and considerations for climate change.

As part of the upcoming SFRA Review, Southend Borough Council particularly requires advice for three Key Growth and Regeneration Areas; the Seafront, Town Centre, Shoeburyness and Airport. The four Area Action Plans for these areas detail the development sites within these broader areas. For each of these development areas, a review of the flood risk and advice regarding appropriate mitigation measures are required. This should be included within both the Level 1 and 2 reports. The Southend Airport is proposed as an Area Action Plan and should also be looked at with respect to pluvial flooding.

Additionally, fluvial flooding issues have been identified at Prittle Brook and Eastward Brook, notably following a flooding event at Temple Farm Industrial estate; these will need to be investigated further as part of the SFRA review within the Level 1 Report. The South Essex CFMP presents present and climate change flood zones for these river systems, which should be made available for the SFRA revision.

Castle Point Borough Council

Castle Point Borough Council covers two distinct areas of land; Canvey Island, which forms an entire flood cell surrounded by tidal watercourses; and the inland area of Thundersley and South Benfleet. The dominant flood risk is that of tidal flooding affecting the built up area of Canvey Island. The main source of fluvial flood risk is the Benfleet Hall Sewer that affects the southern area of South Benfleet. The sparsely developed area of Hadleigh Marsh which borders Benfleet Creek is also at risk of tidal flooding.

Seven sites have been identified as Strategic Housing Land Availability Sites for development on Canvey Island; each site requires an appraisal with respect to flood risk to and from the site:

- Castle View School
- East of Canvey Road
- West of Canvey Road
- Town Centre
- Seafront Regeneration Area
- Industrial Estate, South of Charfleet Road
- EEDA Site, South of Northwick Site

Two development sites have been identified for particular assessment of surface water flooding:

- North of Kiln Road
- Manor Trading Estate

All these potential development sites should be appraised with respect to flood risk issues, and advice should be provided regarding the development types considered appropriate, requirements for mitigation and an appreciation of the residual risk. Issues requiring consideration will include finished floor levels, provision of safe egress and access and incorporation of sustainable drainage systems into the developments.

Castle Point also requires an assessment of their scoring system for Green Belt locations with respect to surface water flooding carried out East of Rayleigh Road.

As part of the previous SFRA, implications of a potential failure in the flood defences was assessed at 9 strategic sites along the tidal frontages for the 1 in 200 and 1 in 1000 year events including an allowance for 50 years of climate change. These will need to be remodelled using updated water levels and considerations for climate change.

The previous SFRA included an assessment of probability of defence failure. The SFRA revision should assess whether the probability of failure is likely to increase as a result of increased water levels with climate change.

Rochford District Council

The entire northern and eastern boundary of the Rochford district is formed by tidally influenced watercourses, including the River Crouch, River Roach and North Sea. The western and southern boundaries are land locked with Southend Borough Council and Castle Point Borough Council to the south and Basildon District Council to the west.

The main settlement areas of Rochford and Rayleigh are predominantly located in areas of low flood risk. Small narrow fluvial floodplains associated with the Eastwood Brook and upper reaches of the River Roach affect localised areas of existing development. The extensive tidal floodplains along the estuarine extents of the River Roach and Crouch and North Sea effect only sparsely populated rural areas.

As part of the previous SFRA, implications of a potential failure in the flood defences was assessed at 7 strategic sites along the tidal frontages for the 1 in 200 and 1 in 1000 year events including an allowance for 50 years of climate change. These will need to be remodelled using updated water levels and considerations for climate change.

The following eleven locations have been identified as sites for potential residential development within Rochford:

- North of London Road, Rayleigh
- South West Rayleigh
- West Rochford
- West Hockley
- South Hawkwell
- East Ashingdon
- South East Ashingdon
- South West Hullbridge
- South West Great Wakering
- West Great Wakering
- South Canewdon

In addition to the preferred locations identified above for Green Belt release to accommodate residential development, it should be recognised that 1301 dwellings are expected to be developed within existing residential areas up to 2021.

In light of the dominance of Flood Zone 1 in this district, future development should where possible be steered to areas of lower flood risk using a sequential approach. These sites should be appraised with respect to flood risk issues, and advice should be provided regarding the development types considered appropriate, requirements for mitigation and an appreciation of the residual risk as well as the suitability for the application of SuDS.

Basildon District Council

Basildon District has a tidal boundary in the south of the district along Vange Creek and the Vange and Pitsea Marshes. These areas are currently greenbelt, with only a few residential and industrial properties,

scattered around the marsh. The area is occupied by waste management sites, Country Park, Port of London Authority Marina and RSPB Reserve. The north eastern boundary of the district at Wickford lies on the fluvial reaches of the River Crouch. The outer areas of Billericay are also at risk of fluvial flooding from the tributaries of the River Chelmer (River Wid). Therefore the district is at risk of both fluvial and tidal flooding.

Basildon itself is characterised by an interlinked system of stormwater drainage detention ponds (washlands). General capacity issues for the Basildon New Town washlands were investigated and reported in the existing SFRA, however, further analysis (including an assessment of condition and identification of responsibility and ownership) is required on the washlands in Wickford and Billericay of their ability to integrate with sustainable drainage principles for intended development. A 2D model of an extreme rainfall event routed using LiDAR data may provide a useful tool to demonstrate the long term viability of the system in relation to proposed development inputs.

The original TGSE SFRA identified flood zones across the district and assessed the implications of a potential failure in the flood defences at the Fobbing Marsh Barrier for the 1 in 200 and 1 in 1000 year events including an allowance for 50 years of climate change. The Fobbing Marsh Barrier failure will need to be remodelled using updated water levels and considerations for climate change.

Fluvial flooding poses the greatest flood risk to future development in the areas of Wickford, Basildon and Billericay. Tidal flooding in the Basildon District has less of an impact on existing and future development, affecting rural areas of marshland to the south of the District.

Basildon District Council has identified 36 Areas of Potential Development Search, all but four of which are within its administrative area. These areas should be appraised with respect to flood risk issues, and advice should be provided regarding the development types considered appropriate taking into account known flood risk, requirements for mitigation (should development be explored) and an appreciation of the residual risk posed. Issues requiring consideration will include finished floor levels, provision of safe egress and access and incorporation of sustainable drainage systems into the developments.

Potash Road	Kennel Lane	Nevendon Road
Norsey East	Little Burstead North	Cranfield Park Road East
Snails Farm	Billericay South West	Shotgate North East
Outwood Common Road	Billericay North West	Wickford North West
Crouch Valley	Little Burstead South	Wickford North
Ramsden Bellhouse –Church Rd	Little Burstead West	North Benfleet East
Grebe House – Ramsden Bellhouse	Lower Dunton Road	Pitsea East
Crays Hill	Dry Street South	Bowers Hall
Barleylands	Vange West	Downham*
Noak Bridge East	Vange Ridge	Runwell North*
Watch House Farm	Crays Hill East	Runwell East*
Great Burstead South	Great Bromfords	Runwell North East*

* These areas of potential development are located outside the LPA area, the Mid Essex SFRA should be used to inform the flood risk issues with these areas and provide an overview on any related impacts on Basildon.

4.6 Breach/Overtopping Locations

The current version of the TGSE SFRA includes modelling of a breach in the flood defences at 21 locations, (excluding those breach models within the Thurrock area which are not required as part of this study). These are shown in Table 4-1. With the addition of new climate change allowances, it is possible that flood defences could be overtopped by still water levels in some areas. The hydraulic modelling method used should allow representation of this mechanism.

Table 4-1 Breach Locations, TGSE SFRA, 2006

BREACH NAME	BREACH LOCATION	EASTING	NORTHING
CAS01	Canvey Island 1	575200	183400
CAS02	Canvey Island 2	577100	182600
CAS03	Canvey Island 3	578100	182000
CAS04	Canvey Island 4	579500	182500
CAS05	Canvey Island 5	581600	182700
CAS06	Canvey Island 6	580900	184300
CAS07	Canvey Island 7	579000	185000
CAS08	Barrier Benfleet Creek	579100	185500
CAS09	Barrier Vange Creek	574000	184300
SOU01	Sh'ness Old Ranges	593700	184200
SOU02	Sh'ness New Ranges	595500	186000
SOU03	Sh'ness East Beach	594700	185300
SOU04	Southchurch Park	590100	184800
SOU05	Old Leigh	584200	185600
ROC01	Wallasea Island	594700	195000
ROC02	South Fambridge	585500	196200
ROC03	Paglesham	594800	192200
ROC04	Wakering Stairs	596900	187100
ROC05	Morrins Points	596300	186700
ROC06	Oxenham farm	595700	188700
ROC07	Paglesham creek	592300	193800

The breach models should be revised using up-to-date LiDAR data, water levels and climate change considerations for the following four water level scenarios:

- 1 in 200 year present day;
- 1 in 1000 year present day;
- 1 in 200 year plus 100 years of climate change,
- 1 in 1000 year plus 100 years of climate change.

Overtopping models will also be required for each identified flood cell in Figure 04 in Appendix B. The overtopping results will identify areas of 'actual risk'. Defences are generally considered to be of a high enough standard to protect against present day water levels, therefore these scenarios will need to be run for the climate change extreme water levels:

- 1 in 200 year plus 100 years climate change;

- 1 in 1000 year plus 100 years climate change.

The following deliverables are required for the Level 1 and Level 2 SFRA reports from the breach and overtopping models:

- Depth maps
- Hazard maps using FD2320 and taking debris factors into consideration
- Time to inundation mapping
- Where possible animations in 2D to inform emergency planning services.

Following the completion of the Level 1 SFRA for each of the local authority areas and the completion of the individual Sequential Tests, further breach assessments may be required for Level 2 for specific development sites in order to inform part c) of the Exception Test. A fee quotation for any additional breaches that may be required should also therefore be provided as a separate item in the proposal.

4.7 Surface Water and SUDs

PPS25 and its Practice Guide identify the need for SFRAs to consider all sources of flooding. This includes those parts of the study area which are susceptible to surface water flooding or those areas that are critical for drainage. Some initial outputs from the Water Cycle Study should be available to inform this section of the report.

Additionally, it will be necessary to identify SUDs techniques that will be appropriate for these areas in accordance with geology and other ground conditions.

4.8 Reporting

Drafts for the Executive Summary, Level 1 and Level 2 Reports should be supplied for comment in electronic format.

Final copies of these reports should be provided in hard copy and electronic format, suitable for publication on the internet. The Executive Summary should be written in a non-technical format to provide an overview of the issues on a sub-regional scale. Each client authority and Technical Advisor will require 2 hard copies and a digital copy in Adobe Acrobat PDF format.

All mapping including flood extents, depth, hazard and animations should be presented at a suitable scale (1:25,000 is suggested).

4.9 Timescales

The suggested timescale for undertaking the SFRA revision post commission are as follows:

Level 1 SFRA: This should take between 2-3 months to complete drafts of all 4 local authorities, including chapters on Minerals and Waste sites. For local authorities such as Castle Point and Southend-on Sea where development and regeneration is likely to be proposed in Flood Zone 3, present day hazard mapping will be required, and the necessary hydraulic modelling will need to be completed to produce these deliverables.

Level 2 SFRA: Following completion of the Level 1 SFRA, and identification of areas of focus for the Level 2 mapping deliverables by each local authority and Essex County Council, this stage should take between 2-3 months to complete. The length of time for completion will reflect the amount of Level 2 deliverables required for each specific area.

Consultation: From previous experience with SFRA's an allowance of 3-4 weeks should be allowed for each report to be commented on and signed off by the Environment Agency. This can be carried out for the Level 1 while the Level 2 reports are being drafted concurrently.

Therefore an overall programme of 7 months should be allowed following commission of the study for all four Level 1 and Level 2 SFRA reports to be completed.

Appendix A: Data Catalogue

Appendix B: Figures