

Strategic Flood Risk Assessment

FOR NORTH LINCOLNSHIRE &
NORTH EAST LINCOLNSHIRE



Contents List

1. Introduction

2. Context

The study area

Factors affecting flood risk

PPG25; development and flood risk

The planning policy context

Guidance on the preparation of strategic flood risk assessments

Information for flood risk planning

3. Methodology

Sources of data

Identification of flood risk areas

Assessment of flood risk

Review arrangements

4. Flood risk in Stage 1 - Eastern Coastal Area

Description of area

Flood zones and flood compartments

Flood risk assessments; tidal flood compartments

- 1T1: Cleethorpes
- 1T2: Grimsby & Stallingborough
- 1T3: Immingham & North Killingholme
- 1T4: Goxhill
- 1T5: Barton upon Humber

Flood risk assessments; fluvial flood compartments

- 1F1: Waithe Beck
- 1F2: Buck Beck & Goosepaddle Drain
- 1F3: River Freshney & Laceby Beck
- 1F4: East Halton Beck/Skitter Beck

5. Flood risk in Stage 2 - Ancholme Valley Area

Description of area

Flood zones and flood compartments

Flood risk assessments; tidal flood compartments

- 2T1: South Ferriby (East)
- 2T2: South Ferriby (West)

- 2T3: Winterton

Flood risk assessments; fluvial flood compartments

- 2F1: Lower Ancholme Right Bank
- 2F2: Lower Ancholme Left Bank
- 2F3: Island Carr
- 2F4: Middle Ancholme Right Bank
- 2F5: Middle Ancholme Left Bank

6. Flood risk in Stage 3 - Trent Valley Area

Description of area

Flood zones and flood compartments

Flood risk assessments; tidal flood compartments

- 3T1: Alkborough
- 3T2: Flixborough
- 3T3: Gunness
- 3T4: Garthorpe & Keadby

Flood risk assessments; fluvial flood compartments

- 3F1: Upper Bottesford Beck
- 3F2: Messingham
- 3F3: Three Rivers
- 3F4: Isle of Axholme
- 3F5: River Idle

7 Managing future flood risk; development planning and control

Roles and responsibilities

Environment Agency standing advice

Process for deciding a planning application

Flood risk assessments accompanying planning applications

Approvals and refusals of planning applications

Tables

1. Flood risk zones for the sequential test (from PPG25, July 2001)
2. Flood risk zones adopted for the NE/NLC SFRA
3. Sub-zone definition criteria
4. Breach parameters (from EA Anglian Reg Guidance Note)
5. Width of high velocity sub-zone

Stage 1 – South Humberside

- 1.1 Water level, wave height combinations with 0.5% probability of occurring
- 1.2 Main river watercourses
- 1.3 Significant ordinary watercourses (SOWs)
- 1.4 Drainage pumping stations
- 1.5 Places with two or more recorded complaints
- 1.6 Flood compartments

Stage 2 – Ancholme Valley

- 2.1 Water level, wave height combinations with 0.5% probability of occurring
- 2.2 Main river watercourses
- 2.3 Significant ordinary watercourses (SOWs)
- 2.4 Drainage pumping stations
- 2.5 Places with two or more recorded complaints
- 2.6 Flood compartments

Stage 3 – Trent Valley

- 3.1 Water level, wave height combinations with 0.5% probability of occurring
- 3.2 Main river watercourses
- 3.3 Internal Drainage Boards in the Stage 3 Area
- 3.4 Drainage pumping stations
- 3.5 Places with two or more recorded complaints
- 3.6 Flood compartments
6. Internal Drainage Boards
7. Planning response matrix
8. Category comments in matrix

Figures

1. The study area
2. The indicative flood plain in the study area (Environment Agency 2002)
3. IDBs in the study area

Stage 1 - Eastern Coastal Area

- 1.1 The Eastern Coastal Area
- 1.2 The indicative flood plain, main river watercourses and COWs
- 1.3 IDB boundaries and drainage systems
- 1.4 Recorded complaints about flood problems
- 1.5 Flood risk zones

Stage 2 – Ancholme Valley Area

- 2.1 The Ancholme Valley area
- 2.2 The indicative flood plain, main river watercourses and COWs
- 2.3 IDB boundaries and drainage systems
- 2.4 Recorded complaints about flood problems
- 2.5 Flood risk zones

Stage 3 – Trent Valley Area

- 3.1 The Trent Valley area
- 3.2 The indicative flood plain and main river watercourses
- 3.3 IDB boundaries and drainage systems
- 3.4 Recorded complaints about flood problems
- 3.5 Flood risk zones

Appendices

- A Regional Planning Guidance for Yorkshire and Humberside (RPG12)
Policy R2; Development and flood risk
- B Local Plan Policies; Development and flood risk
- C Critical flood level tables
- D Organisations with drainage, flooding and flood risk responsibilities
Contact addresses
- E Environment Agency standing advice to local planning authorities for planning applications; Development and flood risk

Flood Risk Assessment Annexes

- 1. Stage 1 Flood Compartments – South Humberside
- 2. Stage 2 Flood Compartments – Ancholme Valley
- 3. Stage 3 Flood Compartments – Trent Valley

1. Introduction

- 1.1 The introduction of Planning Policy Guidance Note 25 (PPG25: Development and Flood Risk) has placed a responsibility on local planning authorities to make objective judgements about flooding when drawing up land allocations for development plans. These judgements should be made using a risk-based approach and adopting the sequential test set out in that document.
- 1.2 Some initial flood risk studies were carried out for the Humber Estuary Shoreline Management Plan (HESMP), which is developing a long-term strategy for managing the flood defences around the Humber Estuary. In view of this, North East Lincolnshire Council (NELC) invited RYE Consultancy to carry out a Strategic Flood Risk Assessment (SFRA) on their behalf. Following later discussions with North Lincolnshire Council (NLC) and Yorkshire Forward it was agreed that the work should be extended to cover both local authority areas (NELC and NLC) and that Yorkshire Forward would support the study. This allows the whole of the South Humber Bank Industrial Area (which spans both authorities) to be treated as a single unit.
- 1.3 The objectives of the study are as follows:-
- to identify the potential sources of flood risk within the study area;
 - to identify and map the flood zones (as defined by PPG25) associated with each potential source;
 - to produce a matrix showing how planning applications for development within each flood zone will be treated; and
 - to produce a report describing how the work was carried out and setting out the findings.
- 1.4 The study area is shown in Figure 1. The work has been carried out in three stages covering the following areas:-

Stage 1 Eastern Coastal Area; covering the southern shoreline of the Humber Estuary from Humberston Fitties to South Ferriby Cliff and extending inland to the eastern boundary of the River Ancholme catchment.

Stage 2 Ancholme Valley Area; covering the catchment of the River Ancholme including Brigg, most of Scunthorpe and the Humber Estuary shoreline between South Ferriby Cliff and Whitton.

Stage 3 Trent Valley Area; covering the remaining land including part of Scunthorpe, the River Trent and the Isle of Axholme.

This report covers all three areas. It will be reviewed at regular intervals with the first review being within one year of its initial publication.

- 1.5 PPG25 confirms that the Environment Agency has the lead role in providing advice on flood issues, at the strategic level and in relation to planning applications. The Environment Agency's Anglian Region is responsible for the areas covered by Stages 1 and 2 and is the first point of contact for such advice in the Stage 3 area, although subsequent contacts for this area are with the Midland Region. Both regions have been fully involved in the preparation of this report.

2. Context

The study area

- 2.1 The study area, shown in Figure 1, stretches from Cleethorpes in the east to Crowle and from Kirton in Lindsey in the south to the Humber Estuary. The total area of land covered by the two councils is 1080 km² containing some 310,000 people. The majority of these people live in urban areas including parts of Cleethorpes, Grimsby, Immingham, Brigg and Scunthorpe, large parts of which lie within flood risk areas shown on maps produced by the Environment Agency in 2005 and reproduced in Figure 2, and so are potentially at risk of being flooded.
- 2.2 As well as people and their houses, the same low-lying land contains considerable industrial and commercial property, including power stations, chemical plants and storage areas for a range of goods, together with large parts of the South Humber Bank Industrial Area that has been allocated for estuary-related commercial and industrial development. It also contains important infrastructure links including port facilities, roads, railway lines, power transmission lines and gas pipelines. A significant number of the businesses are chemical industries that have working practices and restrictions under the Health and Safety legislation.
- 2.3 The identification and management of flood risk within the study area is therefore important. The main sources of flood risk are the Humber Estuary and the rivers draining to it, particularly the Ancholme and the Trent but also a number of smaller ones including the Waithe Beck, Freshney, East Halton Beck, the Bottesford Beck and the various canals and drains east of the Trent by the Isle of Axholme. Flooding can also arise from smaller drains, however, and from blockages in quite small culverts, while elsewhere groundwater levels can rise following heavy rain leading to ponding if the water cannot get away.

Factors affecting flood risk

- 2.4 Flood risk involves both the statistical probability of a flood occurring and the scale of the potential consequences. In principle the main causes of flooding are either high sea levels, if the flooding is beside the coast or an estuary (coastal flooding), or heavy rainfall if the flooding is from a river or drain (fluvial flooding). The mechanism of flooding is different in the two cases and this can have an impact on how floods develop, how frequently they are likely to occur in the future and how they can be managed.

Coastal/tidal flooding

- 2.5 On the east coast of England high sea levels are generally caused by a combination of tidal conditions (caused by relative movements of the moon, earth and sun) and a surge (caused by the weather conditions, particularly the movement of low-pressure storm systems). As a result, unusually high sea levels tend to rise fairly rapidly, remain at their peak for one or two hours and then fall away equally rapidly. There will then be a further peak at the following high tide some 12½ hours later, which is generally lower than the first one but could be higher if the surge is particularly prolonged.
- 2.6 If the strip of low-lying land beside the coast (the coastal/tidal floodplain) is relatively narrow then there will normally be enough time for water from the sea to flood across it and rise to the same peak level that occurs just offshore. If the floodplain is broad, however, or if it lies towards the head of an estuary, then the flow of water from the sea to the area being flooded can be insufficient to fill it before the sea level begins to fall again. As a result the peak water level in the flooded area is less

than the peak sea level. This effect is particularly marked in the tidal reaches of the rivers draining to the estuary, where the flooding of a large area of land can lower the water levels in the river as well.

- 2.7 Historically, the normal response to coastal flooding has been to build flood defences and the whole of the south bank of the Humber is protected in this way (apart from a few points where high land comes to the water's edge). These defences would be high enough to keep out all but the most extreme events if there were no waves. The weather conditions causing large surges, however, often cause waves as well. The spray from these can lead to local flooding nearby and, more importantly, could undermine the defences causing them to breach and allow the sea to flow through.
- 2.8 The defences can breach for a number of other reasons, including structural failure and accidental damage. A similar effect can be caused by the failure of a floodgate or barrier to close, either because of a mechanical or electrical fault or through operator error. Whatever the cause, if there is a gap in the defences the sea will flow through it and flood low-lying land behind. The extent of flooding will depend on the topography of the area and the volume of water flowing through the defences, which in turn will depend on the peak sea level and the size, number and timing of the breaches.

Fluvial flooding

- 2.9 When rainfall occurs over land some of the water will be absorbed into the vegetation or other materials on the surface and some will infiltrate into the underlying ground. Surplus water collects on the surface and flows downhill until it enters a ditch or other drainage system. In time some of the infiltration water will also enter the drainage system and from there the water will flow to a river and, eventually, to the sea. This takes time, however, so rain falling in the upper catchment of a large UK river can take several days to arrive at the lower reaches. Rainfall on the lower catchment will reach the same place more quickly, with the effect that the flow from two storms can converge giving results that are more serious than either one alone.
- 2.10 In most UK rivers, the bank-full capacity of the natural channel is about the mean annual flood (the flow that occurs, on average, once a year). When the flow is greater than this the river comes out of its banks and spreads across the surrounding land (the fluvial floodplain). This increases the area of flow, allowing more water to pass downstream, and provides storage for surplus water until conditions downstream have improved sufficiently for it to flow away. If the river channel is constricted at some point downstream the flow function is limited and the storage function becomes more important. The depth of water on the floodplain will depend on the severity of the flood and the conditions downstream.
- 2.11 Man's activity in the catchment, particularly urbanisation and agriculture, can affect both the proportion of rainfall entering the drainage system and the rate at which it does so. Urbanisation (the construction of buildings, roads, car parks and their drainage systems) tends to reduce the volume of water infiltrating into the ground (since the surfaces are normally impervious), reduce the volume of water stored on the surface (since puddles are not normally acceptable) and increase the rate of discharge into the river (since water normally flows more rapidly through a designed drainage system than across natural ground). Agricultural practices, such as ploughing down rather than across a slope, can have similar effects. The result will generally be to increase the size and speed of flooding that occurs during small or medium rainfall events. The effect is normally less important

during extreme events since prolonged heavy rainfall causes the ground to become sodden and fills the available surface storage, so any subsequent rain runs off into the rivers more rapidly.

- 2.12 Man's activity on the floodplain can affect both its ability to allow water to flow downstream and its storage capacity. A road across a valley or a wall across a field can obstruct the flow and cause water to pond upstream, raising flood levels. A building raised above the surrounding ground will reduce the volume available for storing floodwater. The water that would have been stored there has to go somewhere else, again raising flood levels.
- 2.13 Generally the most significant impacts on floodplain function are caused by flood defences. These, until they are overtopped, cut off the floodplain from its river so the water that would have been stored there has to pass further downstream, raising water levels and possibly causing referred flooding if the channel capacity is inadequate. Once the defences are overtopped any surplus water will flow into the floodplain and will be trapped there until the flood has passed. If the defences are breached, either accidentally, due to structural failure or because they are washed out, the flow into the floodplain will increase and is likely to lower the water levels in the river. The extent of flooding will depend on the volume of water stored in the river and the capacity of the channel downstream as well as the size and duration of the flood event. If the system is pumped the extent will also be controlled by the pump capacity and will be seriously affected if the pumps fail to operate correctly.

Future changes

- 2.14 The assessment of flood risk is based on a statistical analysis of past events, either in the same catchment (or at the same point on the shore for coastal flooding) or in similar catchments elsewhere. These records are generally quite short (possibly 30 or 40 years or less) which introduces some uncertainty when predicting events that may happen on average once every 100 or 200 years. This uncertainty is increasing, as the world's climate appears to be changing. As a result of this, the UK is expected to experience more frequent winter storms (and less rainfall in summer), which is likely to mean that high river flows, and hence fluvial flooding, will also occur more frequently. The incidence of coastal flooding is also likely to increase, partly because the increased storminess will increase the frequency of waves and surges but also because sea levels are expected to rise.
- 2.15 The effect of these changes is difficult to estimate but Government guidance currently suggests that flood flows in rivers could increase by perhaps 20% across the country over the next 50 years while sea levels off the East Coast could rise by perhaps 0.3m (the equivalent of about one foot).

PPG25: Development and Flood Risk

- 2.16 PPG25 was published in July 2001 with the aim of strengthening the co-ordination between land use and development planning and the planning of flood and coastal defences. The document¹ states that the susceptibility of land to flooding must be taken into account in the planning process and sets out the role of the Environment Agency in providing advice on flood risk issues. Other key statements may be summarised as follows:-
- development plans should outline how flood issues will be taken into account;
 - planning authorities should adopt the precautionary principle when considering flood risk, using a sequential test to avoid such risk where possible and to manage it elsewhere;

1 Copies of which can be obtained from The Stationery Office, PO Box 29, Norwich NR3 1GN.

- developers should fund the provision and maintenance of flood defences and warning measures required because of their development;
- flood risk and its management needs to be considered on a whole-catchment basis, not just in floodplains.

The use of a risk-based sequential test to manage flood risk and the implications of considering the whole of the catchment are discussed further below.

The risk-based approach and the sequential test

2.17 The inherent uncertainty in estimating flood flows and flood extents make it important to act on a precautionary basis when considering the potential interaction between development and flood risk. PPG25 achieves this by defining three flood zones, as set out in Table 1, on the next page, and requiring planning authorities to give priority to these zones in descending order (i.e. from lowest to highest risk, taking the Zone 3 sub-divisions into account) when allocating land in development plans or deciding planning applications for development. When considering development allocations or applications at sites in a high flood risk zone, it is necessary to demonstrate that there are no reasonable options available in a lower-risk zone, consistent with other development objectives. Developers seeking sites for housing and other development are also expected to take this test into account. The table also gives details of the types of development considered suitable in each flood zone and contains a note to the effect that development should not be permitted where existing defences would not give an appropriate standard of safety over the lifetime of the development. Practical guidance on how to apply the sequential test is discussed later in this chapter (paragraphs 2.27).

**Table 1 - Flood risk zones for the sequential test
(from PPG25, July 2001)**

Flood Zone	Annual probability of flooding	
1. Little or no risk	River	<0.1%
	Tidal/coastal	<0.1%
2. Low to medium risk	River	0.1 to 1.0%
	Tidal/coastal	0.1 to 0.5%
3. High risk (a) Developed areas (b) Undeveloped and sparsely developed areas (c) Functional floodplains	River	1.0% or greater
	Tidal/coastal	0.5% or greater

2.18 The document also requires planning authorities to take the following issues into account when assessing flood risk:-

- the area liable to flooding;
- the probability of it occurring, both now and over time;
- the extent and standard of existing flood defences and their effectiveness over time;

- the likely depth of flooding
- the rates of flow likely to be involved;
- the likelihood of impacts to other areas, properties and habitats;
- the effects of climate change; and
- the nature and currently expected lifetime of the development proposed and the extent to which it is designed to deal with flood risk.

Applicants for planning permission are expected to prepare an assessment of the flood-risk and run-off implications of their proposals that is appropriate to the scale and nature of the development and the risks involved and submit this with their application. Guidance on what such a flood risk assessment should cover is given in Appendix E of the document.

- 2.19 The guidance in PPG25 is generic, in that it was developed for the circumstances that apply most commonly across the country, and may therefore need to be tailored to local circumstances. The document recognises this, advising for example, that the socio-economic needs of an area should be considered when evaluating flood risk and pointing out that in low-lying parts of the country (particularly in the East of England) alternative sites to those in areas of high flood risk may not be available. Issues appropriate for the area covered by the present study are discussed in Chapter 3.

The whole-catchment approach to assessing flood risk

- 2.20 Development outside the floodplain will generally affect flood risk by changing the way rainwater drains off the site, as discussed under **'Fluvial flooding'** above. The document addresses this by requiring planning authorities to work closely with the Environment Agency and others to encourage the use of sustainable drainage systems, particularly in large developments. These systems are designed to mimic the natural drainage patterns by making use of surface or sub-surface storage areas and flow limiting devices.

Flooding and the planning policy context

- 2.21 Although PPG25 does not specifically require planning authorities to prepare a strategic flood risk assessment, it does provide guidance requiring regional, structure and local plans to take account of the need to consider flood risk and the control of surface water drainage. Regional and structure plans should set out strategic policies to avoid or manage the threat of flooding, identify areas where flooding is likely to be a risk and set out requirements and restrictions on the type and form of development that will be appropriate. Local plans should show the areas of flood risk and review land allocations in the light of this risk. The principles of the sequential test should be applied when drawing up these plans and any reasons from departing from them (if this is considered justifiable) should be fully explained.

Development plan hierarchy

- 2.22 The development plan hierarchy for North and North East Lincolnshire is as follows:-

- Regional Spatial Strategy (revised) for Yorkshire and the Humber (December 2004)

- Humberside Structure Plan Replacement (1987) as amended by Alteration No 1 (1993)
- North Lincolnshire Local Plan (adopted May 2003)
- North East Lincolnshire Local Plan (adopted November 2003)

The components of the hierarchy are discussed separately below.

Regional Spatial Strategy (RSS) for Yorkshire and the Humber

- 2.23 Under the recent Planning and Compulsory Purchase Act (September 2004), the country's regional planning structure has been changed. The new structure requires the preparation of a 'Regional Spatial Strategy' (RSS) for each region, taking the place of 'Regional Planning Guidance' that had been produced earlier. These RSSs will cover a period of up to 20 years and set out broad policies for the region's future development, dealing with a wide range of issues including land use. A new RSS is currently being prepared for Yorkshire and the Humber but as an interim measure the previous Regional Planning Guidance (originally adopted as RPG12 in 2001) with its Selective Review (completed in 2004) was accepted as the 'revised RSS' for the region in December 2004. Policy R2 of the revised RSS covers the issue of development and flood risk, a copy of which is given in Appendix A..

The Humberside Structure Plan

- 2.24 The Humberside Structure Plan (1991 to 2006) is nominally still in force but will be superseded by the revised RSS once it expires. It does not include any policies concerning development in flood risk areas.

The North and North East Lincolnshire Local Plans

- 2.25 The North and North East Lincolnshire Local Plans set out more detailed policies to guide development including site-specific proposals and detailed land use policies. Flood risk issues are addressed in policies DS16 of the North Lincolnshire Local Plan and GEN1, GEN2 and GEN9 of the North East Lincolnshire Local Plan, copies of which are given in Appendix B. These are based on generic criteria, however, and more detailed guidance is required for development proposed in flood risk areas. It should be noted that the new planning act has replaced Local Plans with a different system named the "Local Development Framework" although the existing Local Plan policies will remain in force for a transitional period of at least 3 years.

Status of this SFRA

- 2.26 The detailed guidance in this SFRA expands on the generic policies in the North and North East Lincolnshire Local Plans, on the Regional Planning Guidance for Yorkshire and the Humber and on the national planning guidance given in PPG25. The information it contains will help inform future land allocations proposed in the new Local Development Frameworks and will help determine planning applications. The SFRA will be submitted to the North and North East Lincolnshire Councils for consideration and approval.

Guidance on the preparation of strategic flood risk assessments

- 2.27 The resolution of flood risk issues can be complex, particularly for planning authorities containing extensive areas of low-lying land or land that traditionally relies on pumped drainage and raised flood defences. In these circumstances the Environment Agency, in its role as the lead provider of advice on flood issues, supports planning authorities that wish to prepare a strategic flood risk

assessment and is currently producing, at national level, guidance on how such assessments should be carried out. The recommended approach involves:-

- (i) identifying potential flood sources, the corresponding flood compartments (the area where flooding from each source is likely to take place) and the presence of existing flood defences;
- (ii) assessing the flood risk within each compartment both with and without flood defences (taking into account the risk of breaching) and mapping the flood zones as defined in PPG25, with additional sub-divisions to improve the quantification of risk if appropriate;
- (iii) drawing up a matrix that sets out the types of development allowed in each flood zone and the conditions that will be placed on developers when they submit planning applications.

- 2.28 The Environment Agency has incorporated the matrix concept in the standing advice it has produced² to help local planning authorities make decisions on planning applications where flood risk is an issue. The aim of this advice is to enable decisions on applications where the flood risk is low to be made without consulting the Environment Agency and to identify those higher risk development situations where case-by-case consultation with the Environment Agency should continue.

Information for flood risk planning

- 2.29 In addition to providing guidance on preparing flood risk assessments, the Environment Agency provides information that will help in their preparation. Much of this is or will be produced in the form of a suite of maps covering the whole country. Copies of these Flood Maps are available from the Environment Agency's web site and are updated regularly, as discussed below.

Flood zone boundaries

- 2.30 Maps showing the Zone 2 (PPG25 low to medium risk) and Zone 3 (PPG25 high risk) boundaries are currently available for the whole country. They have been produced nationally to a consistent standard using topographic data obtained specifically for the project. The size of the task has meant that both the data and the modelling techniques used to determine the flood zones are relatively coarse, however, so that while the results give a good general picture of the flood zones across the country the detail is not always consistent with local experience. The maps are therefore updated and re-issued every quarter taking into account the results of any more detailed local modelling that have become available.

Flood defences, defended areas and washland areas

- 2.31 The flood zone boundary maps are intended to show the extent of the natural floodplain and so ignore the presence of any existing flood defences. Maps showing the line of all the defences owned or managed by the Environment Agency are currently being prepared. In due course they will be supplemented by maps identifying defences that protect to the PPG25 Zone 3 standard and the corresponding areas they defend. These maps will also identify areas that are currently used as washlands to store floodwater and so have a role in managing flood risk elsewhere in the system.

2 National Standing Advice to Local Planning Authorities for Planning Applications – Development and Flood Risk; Environment Agency, June 2003

Flood hazard and flood vulnerability

- 2.32 A national project to produce maps showing flood hazard is due to begin shortly. These maps will identify areas within the flood zones where, if a flood does occur, there is likely to be a significant risk to people and property either because flow velocities will be high or because the water will be deep. They will take the presence of the existing defences into account, assessing the standard they provide, the probability of them failing and the consequences of this failure. Again they will rely on fairly coarse data and modelling techniques and so are likely to be updated as the results of more detailed local modelling become available.
- 2.33 Once the flood hazard maps have been produced a further project identifying flood vulnerability is planned. The details of this are not yet fully defined but, in general terms, it is intended to use socio-economic data to identify areas where people are likely to be particularly vulnerable to flooding, for example because of their age or medical condition.
- 2.34 The Environment Agency has produced a map showing the combined maximum extent of all known and substantiated historic flood events. Additional information about the individual historic events that have been used to generate this map is also available.

Information about more detailed studies

- 2.35 The Environment Agency can provide details of areas where specific flood risk modelling has been carried out, or is planned, and for which it has detailed topographic information. The latter has generally been obtained using LIDAR, a remote sensing technique that generally provides reasonably accurate and consistent results although care is needed to interpret the information in built-up areas or areas (such as crop fields before harvest) where the vegetation cover is continuous and its height relatively consistent.

3. Methodology

- 3.1 The same approach was used to carry out the flood risk assessment for the area covered by each stage of the study. It is based on the approach pioneered by Boston Borough Council and is described in general terms in this chapter. The details of the assessments are discussed in Chapters 4 to 6 and the development control matrix in Chapter 7.

Sources of data

Ground levels

- 3.2 The standard Ordnance Survey mapping provides ground level contours at 10m intervals. While these give a general impression of the topography they do not give sufficient detail in broad, low-lying areas, where differences of 1 or 2m can have a significant impact on flood risk.
- 3.3 Although the Environment Agency has LIDAR data for much of the tidal flood plain beside the Humber Estuary the coverage is not complete. The Humber Estuary Shoreline Management Plan (HESMP) has therefore used Ordnance Survey (OS) Profile data for estimating the extent of flooding from the estuary. The Environment Agency has produced contours of the tidal flood plain at 1m intervals using the data and these have been made available for this project.
- 3.4 Contours have also been produced for the fluvial flood plains within the study area using the same data source. These give adequate detail where the flood plain is broad (beside the Trent and the Ancholme and near the Isle of Axholme) but where it is narrow the data are sparse and the results therefore less useful. In these areas the information has been supplemented by OS and other spot height data (including LIDAR), aerial photographs and site inspections.

Tidal flood conditions

- 3.5 A number of the studies carried out for the HESMP provide information about tidal flooding in the area. In particular, the Joint Probability Analysis³ gives details about the combinations of water levels and wave heights and periods that are likely to occur throughout the estuary, while the Existing Defences Review⁴ describes the type of defences and their condition from Donna Nook (east of Cleethorpes) to Keadby Bridge (on the Trent). The Long Term Programme⁵ assesses the standard of service these defences currently provide, makes a preliminary assessment of suitable target standards (based on the cost of maintaining them and the value of the assets in the flood plain) and describes the works needed over the next 50 years to achieve these targets. The results of these studies have been made available for this project.

Fluvial flood conditions

- 3.6 The Environment Agency has records of the defences beside the watercourses for they are responsible. These are termed '**main river**' watercourses and include the majority (but not all) of the significant rivers and channels in the study area. An overall summary of the defences and their condition has been provided together with copies of reports of flood studies and schemes that have been carried out.

3 Humber Tidal Database Joint Probability Analysis; Environment Agency, 1999

4 Humber Estuary Shoreline Management Plan, Existing Flood Defences; Binnie Black & Veatch, March 1999

5 Humber Estuary Shoreline Management - Stage 2, Long Term Programme; Black & Veatch, July 2004

Local drainage conditions

- 3.7 The drainage from most of the low-lying land beside the estuary and in the Trent and Ancholme valleys is administered by a number of Internal Drainage Boards (IDBs), as shown in Figure 3. They have provided information about the drainage arrangements (including watercourses, outfalls, pumping stations and design standards) for which they are responsible together with copies of reports relating to particular problems where they are available.
- 3.8 In the past the Environment Agency has identified a number of **'critical ordinary watercourses'** (COWs) within the study area. These watercourses were not classified as main river but are nevertheless potentially significant sources of flood risk because of their characteristics and the density of development nearby. Information about these watercourses has been obtained from the Environment Agency and from the organisations responsible for them (generally the IDB or the District Council).
- 3.9 Recently the classifications have been reviewed and in November 2004 those COWs with the most serious flood risk were en-mained and are now managed by the Environment Agency. All other watercourses are still potential sources of flood risk and will continue to be managed as before. Those that were COWs but have not been en-mained have, for the purposes of this report, been identified as **'significant ordinary watercourses'** (SOWs) and are subsequently referred to as such.
- 3.10 Not all flooding occurs in areas close to known important watercourses. It can occur in unexpected places and for unexpected reasons, such as a blocked culvert. Such events were identified by collecting details of all flood complaints received by the District Councils over the last 5 years and plotting these on a map to determine whether there are any places with a particular history of flooding problems. These were discussed with the District Council and with the Anglian Water Services, which is the organisation responsible for sewers and foul drainage in the study area (although the foul and surface water systems are generally separate they are combined in places).

Identification of flood risk areas

Tidal flood compartments

- 3.11 Tidal flood compartments are based largely on the flood zones shown on the Environment Agency's Flood Maps as re-issued in 2005. The Zone 2 boundary beside the estuary is based on the results of the national mapping project described in Chapter 2 but the Zone 3 boundary has been derived from the extreme water level and topographic data developed for the HESMP and discussed in the previous section. At each point the still water level (i.e. the water level with no wave activity) that has a 0.5% chance of happening each year was projected horizontally until it intersected with the ground level obtained from the OS Profile data. This simplified approach gives an indication of the high-risk flood zone (Zone 3) boundary but tends to over-estimate the extent of the flooding that will occur during such an event in practice, for the following reasons:-
- (i) The whole of the estuary shoreline is defended (except where there is high ground) and the existing defences are everywhere higher than the 0.5% annual probability still water level. The joint probability analysis shows, however, that water levels occurring with waves will always be lower than the still water level having the same annual probability of occurrence. Since the risk of the defences being breached by a combination of high water levels and

waves is significantly greater than by still water conditions alone, the water level during the critical event will almost certainly be lower than assumed.

- (ii) Flooding will only occur if the defences are breached and the volume of water flowing through the breach will be inadequate to flood the whole area before the tide falls away and the flow is stopped.

- 3.12 The tidal flood compartments were based primarily on local topography, the aim being to define compartments that take account of the local drainage patterns (so that any flooding within a compartment will tend to be confined there rather than flooding a neighbouring compartment). This was not always possible and some compartments have been sub-divided for other reasons, such as a change in the standard of protection provided by the defences. Generally the compartments follow those adopted for the HESMP.

Fluvial flood compartments

- 3.13 The fluvial flood compartments are also based primarily on the Environment Agency's Flood Maps as re-issued in 2005. These maps incorporate some minor adjustments to the Zone 3 boundary to take into account the results of more detailed local modelling but otherwise rely largely on the results of the national modelling project described in Chapter 2.

Local drainage issues

- 3.14 The SOW locations are based on the Environment Agency defined lengths of each watercourse. The width of the floodplain beside each SOW is not defined and so an arbitrary width of 100m on either side of the centre-line was adopted.
- 3.15 The local drainage problem areas were defined as places where at least two separate complaints about flooding have been logged within 750m of each other and on the same drainage system during the last five years. All recorded complaints were examined and discussed with the District Council and Anglian Water Services to confirm the nature of the problems causing the complaints.

Assessment of flood risk

- 3.16 The flood risk in each flood compartment was assessed using currently available information only; no detailed hydrology or hydraulic modelling work has been carried out to improve its quality. In view of the uncertainty attached to some of the information and the requirement in PPG25 to adopt the precautionary principle, a conservative approach has been taken when defining flood zone boundaries on the basis of this information. It is accepted that more detailed, site-specific studies may indicate that the boundaries should be amended and arrangements for doing this are discussed in Chapter 7.

Definition of flood risk zones

- 3.17 The flood risk zones defined in PPG25 are set out in Table 1 on page 6. These definitions are intended to apply across the country and PPG25 recognises that they may need to be tailored to local circumstances. Almost all the land covered by this study is currently defended, so local circumstances suggest that the standard and adequacy of these defences are of greater relevance when assessing flood risk than the level of development. Accordingly, the PPG25 flood risk zones were adapted for this study, as set out in Table 2

Table 2 - Flood risk zones adopted for the NE/NLC SFRA

Flood Zone	Annual probability of flooding	
1. Little or no risk	River	<0.1%
	Tidal/coastal	<0.1%
2. Low to medium risk	River	0.1 to 1.0%
	Tidal/coastal	0.1 to 0.5%
3. High risk	River	1.0% or greater
(i) Low vulnerability (with appropriate defences and not unacceptable flood risk)	Tidal/coastal	0.5% or greater
(ii) High vulnerability (without appropriate defences or unacceptable flood risk)		
(iii) Functional floodplains		

3.18 The main flood risk zone definitions (for Zones 1, 2 and 3) follow those given in PPG25. Within Zone 3, the following three sub-zones were identified:-

- **Zone 3(i) High risk, low vulnerability areas:** Areas that, on the basis of information supplied by the Environment Agency, are protected by defences currently providing at least the 'appropriate standard' of protection and where the consequences of these defences breaching during an extreme event are unlikely to be life-threatening (as described below);
- **Zone 3(ii) High risk, high vulnerability areas:** Areas where the defences do not provide the 'appropriate standard' of protection **or** where if the defences fail there is a potential threat to the lives of people nearby; and
- **Zone 3(iii):** Areas that have been identified as **functional floodplain**.

3.19 Defences providing the 'appropriate standard' are defined as being capable of protecting against a 1% (1 in 100 year) event for river flooding or a 0.5% (1 in 200 year) event for tidal/coastal flooding. Areas where there is a potential threat to life if the defences breach were taken to include:-

- areas (generally close to the defences) where the flow of water could be fast enough to threaten people attempting to wade through it ; and
- areas where any flood water is likely to collect and pond in sufficient depth to threaten people wading through it.

The criteria used to define these areas are given in Table 3. Finally, areas were taken to be functional floodplain if they were identified:-

- within Environment Agency reports (or by Environment Agency staff) as providing flood storage under defined conditions (i.e. during events with return periods greater than a given figure) and so forming part of the flood management system; or
- within publicly available Environment Agency documents as being considered in the Humber Estuary Shoreline Management Plan as potential managed retreat sites.

Table 3 - Sub-zone definition criteria

Higher risk sub-zone	Criterion
Flow velocity	Velocity (m/s) x depth (m) \geq 1.0
Water depth	Maximum depth of pond (m) \geq 0.5

Breach parameters

- 3.20 Guidance from the Environment Agency's Anglian Region recommends that the parameters given in Table 4 are adopted when assessing the extent of flooding that will occur if the defences breach, on the assumption that the breach extends to ground level at the landward toe of the defence. This was generally done, although the parameters differ from those used in the HESMP to assess flood damage resulting from breaches. In some places different (and generally more severe) criteria were used, for the reasons discussed in the relevant detailed assessment.

Table 4 - Breach parameters (from EA Anglian Reg Guidance Note)

Location	Defence type	Breach width (m)	Time to close (hrs)
Open coast	Earth bank	200	72
	Dunes	100	72
	Hard	50	36
	Sluice	Sluice width	24
Estuary	Earth bank	50	36
	Hard	20	18
Tidal river	Earth bank	50	36
	Hard	20	18
Fluvial river	Earth bank	40	30
	Hard	20	18

- 3.21 Using the flow velocity criterion from Table 3 and making some simple assumptions about how the flow through a breach will spread suggests that a reasonable width to allow for the high velocity sub-zone is as shown in Table 5. These widths have been used throughout the report.

Table 5 - Width of high velocity sub-zone

Height of water above ground level (m)	High velocity sub-zone width (m) for breach widths of			
	20m	40m	50m	100m
1.0	20	40	50	100
2.0	40	80	100	200
3.0	80	160	200	400
4.0	120	240	300	600

Climate change

- 3.22 Government guidance Defra states that as a result of climate change sea levels will rise by 0.3 m and fluvial flood flows increase by 20% over the next 50 years. Modelling carried out for the HESMP indicates that, as a first estimate, flood levels in tidal compartments will rise by the same amount as sea levels. No modelling of fluvial flood flows has been carried out for this study but it is not unreasonable to assume that flood levels in fluvial compartments will rise by the same amount. The topographic data available to the study is not sufficiently accurate to allow any resulting movement of the flood zone boundaries to be identified with confidence.

Review arrangements

- 3.24 This report and the accompanying flood risk maps and matrix will be reviewed at intervals not exceeding five years, with the first review occurring within one year of initial publication. These reviews will take note of any new information that is available at the time. The first review will, in particular, take into account the following:-
- new contours based on the most recent Lidar data available from the Environment Agency, which may lead to revisions of some of the flood zone boundaries, particularly between Zones 3(i) and 3(ii);
 - the results of the Environment Agency's Trent Tidal and Lower Trent Fluvial Strategies and the River Tome Modelling Study;
 - the results of a breach analysis currently being commissioned by the Environment Agency for the Eastern Coastal Area, which covers parts of flood compartments 1T2 and 1T3;
 - any policy modifications introduced by Planning Policy Statement (PPS) 25, which will replace PPG25 and is due to be published in July 2006.

4. Flood Risk In Stage 1 Eastern Coastal Area

Description of area

Location, extent and development potential

- 4.1 The Stage 1 Eastern Coastal Area stretches from Humberston Fitties, which is east of Cleethorpes, to the high ground outcropping at South Ferriby Cliff, west of Barton-upon Humber and the Humber Bridge, as shown in Figure 1.1. The shoreline of the Humber Estuary forms the northern and eastern boundaries while the council borders (NELC and NLC) form the southern boundary. The watershed dividing the River Ancholme catchment from the catchments draining east to the estuary acts as the western boundary.
- 4.2 The main centres of population in the area are Cleethorpes, Grimsby, Immingham and Barton-upon-Humber, all lying within 5km of the estuary. The area also contains the major ports of Grimsby and Immingham and wharfage facilities at North Killingholme and New Holland. There are major industrial and commercial facilities beside the coast between Grimsby and North Killingholme, including power stations, chemical works and storage areas. Many of these are either linked to the docks or are associated with the estuary in some other way. The remainder of the area is largely devoted to agriculture.
- 4.3 The coastal plain between Grimsby and East Halton Skitter (about 3 km along the coast from North Killingholme) has been allocated for estuary-related development in the local plans and is currently the subject of a detailed development study funded jointly by both councils with support from Yorkshire Forward. Between North Killingholme and Grimsby the development will consist primarily of infilling between existing facilities but further north the land is largely undeveloped and is currently used for agriculture. No other parts of the area are allocated for major development.

Main sources of flood risk

- 4.4 The main source of flood risk in the area is a combination of large waves and high water levels in the Humber Estuary. The Joint Probability Analysis quotes the combinations having a 0.5% probability of occurrence and a selected list of these combinations is given in Table 1.1. Combinations with water levels 0.2 to 0.4m higher are likely to have a 0.1% probability of occurrence. Current guidance suggests sea levels could rise by 0.3m and wave heights increase by 10% over the next 50 years.

Table 1.1 Water level and wave height combinations with a 0.5% probability of occurrence; South Humberside area

Humber Bridge		Immingham		Cleethorpes	
Water level (mOD)	Wave ht (m)	Water level (mOD)	Wave ht (m)	Water level (mOD)	Wave ht (m)
5.44	0.0	4.93	0.0	4.56	0.0
5.25	0.6	4.60	1.0	4.43	1.5
4.80	0.8	4.05	1.5	4.20	2.2
4.14	0.9	3.25	1.8	3.60	3.2

- 4.5 The tidal flood plain within the Stage 1 area is shown on Figure 1.2, taken from the Environment Agency's Flood Map, together with the fluvial flood plain, the main river watercourses and the

SOWs. There are nine main river watercourses, as listed in Table 1.2, including one (New Cut, Grimsby) that was en-mained in November 2004 as discussed in Chapter 3. Five of these lie wholly within the tidal flood plain and one (Stallingborough North Beck) has only a very short length (~300m) lying outside. The Environment Agency has carried out studies assessing the standard of defence beside four of the watercourses, as marked in the table.

Table 1.2 Main river watercourses - Stage 1 area

Name of watercourse	Wholly within tidal floodplain	Date of study report
Waithe Beck	—	May 2003
Buck Beck & Goosepaddle Drain	—	Aug 2000
River Freshney & Laceby Beck	—	Sep 2000
New Cut, Grimsby **	—	—
Oldfleet Drain	Yes	Jul 2000
Stallingborough North Beck	Mostly	Jul 2000
East Halton Beck & Brockelsby Beck	—	Jul 1995
Barrow Beck	Yes	—
Butts Beck & Tributary	Yes	—

** En-mained in November 2004

- 4.6 Figure 1.2 also shows the ten watercourses lying within the Stage 1 Area that, as discussed in Chapter 3, are classified as SOWs for the purposes of this report. They are listed in Table 1.3 with the organisation that is responsible for them. All but five lie within the tidal or fluvial floodplain, as currently defined and North East Lindsey IDB is responsible for all but two of them.

Table 1.3 Significant ordinary watercourses (SOWs) - Stage 1 area

Ref No (Fig 1.2)	Name of watercourse	Wholly within tidal floodplain	Managed by
1	Buck Beck, Waltham (a)	—	NELC
2	Buck Beck, Waltham (b)	—	NELIDB
3	Little Buck Beck	—	NELIDB
4	Gooseman's Drain	—	NELC
5	Mawmbridge Drains	Yes	NELIDB
6	Middle Drain, Stallingborough	Yes	NELIDB
7	Haborough Marsh Drains	Yes	NELIDB
8	South Killingholme Main Drain	Yes	NELIDB
9	New Holland Main Drain	Yes	NELIDB
10	Midby Drain, Barrow	—	NELIDB

Note:- NELC = North East Lincolnshire Council
NELIDB North East Lindsey Internal Drainage Board

- 4.7 The responsibility for draining all the low-lying land within the Stage 1 Area is shared by two IDBs, Lindsey Marsh (which deals with the Waithe Beck and the Humberston Fitties and surrounding area) and North East Lindsey (which deals with the remainder). The IDB boundaries and the main features of each drainage system (ordinary watercourses and pumping stations) are shown on Figure 1.3. The pumping stations are all operated by the North East Lindsey IDB and are listed in Table 1.4. The IDB has to approve the drainage arrangements of all significant new development within its boundaries or affecting its watercourses. In principle the site runoff characteristics should remain unchanged, although often the IDB will accept the receiving drainage system being improved so it can accept the increased discharge, at the developer's expense. It is understood that the design standard for these improvements is the event having a 1.0% annual probability of occurrence.

Table 1.4 Drainage pumping stations; Stage 1 area

Ref No (Fig 1.2)	Pumping Station
P1	Little Buck Beck
P2	Mawmbridge
P3	Middle Drain
P4	Immingham
P5	New Holland Estate
P6	New Holland Outfall

- 4.8 The location of all recorded complaints to the District Councils about flooding in the Eastern Coastal Area during the last five years are shown on Figure 1.4. There are two places where at least two separate complaints within 750m of each other and on the same watercourse have been made, as shown on the figure and listed in Table 1.5.

Table 1.5 Places with two or more complaints of flooding - Stage 1 area

Location	No of complaints
Goxhill	6
Barrow upon Humber	2

Flood zones and flood compartments

Flood zones

- 4.9 The NE/NLC SFRA flood zone definitions are given in Table 2, in Chapter 3. The high risk zone (Zone 3) is defined as the area where the annual risk of flooding (assuming there are no defences) is more than 1.0% from a fluvial source or 0.5% from a tidal source. These are shown on the Environment Agency's Flood Maps, which are based the results of the national mapping project mentioned in Chapter 2 but modified to take into account the findings of more detailed local modelling as discussed in Chapter 2.
- 4.10 The medium risk zone (Zone 2) is defined as the area where the annual risk of flooding is less than 0.1%, whether from a fluvial or a tidal source and again assuming there are no defences. This is also shown on the Environment Agency's Flood Maps. Again the boundary has been modified to take into account the findings of more detailed local modelling, in particular the HESMP study results indicating that the water level with 0.1% risk of occurring in the estuary is only about 0.3m higher than the water level with a 0.5% risk of occurring. As a result, the boundaries of the high risk zone beside the estuary and the adjacent medium risk zone are very close together.
- 4.11 The flood zones for the Stage 1 Area are shown on Figure 1.5.

Flood compartments

- 4.12 To allow more detailed assessment, the floodplain (defined as all land lying within the Zone 2 boundaries) has been divided into flood compartments taking into account the topography, type of defence, drainage arrangements, land use and administrative issues. These compartments are shown on Figure 1.5 and listed in Table 1.6 with the sources of flood risk they include.

Table 1.6 Flood compartments; Stage 1 area

Compartment reference	Compartment name	Sources of flood risk
1T1	Cleethorpes	Humber Estuary Lower Buck Beck Little Buck Beck
1T2	Grimsby & Stallingborough	Humber Estuary Lower River Freshney New Cut Mawmbridge Drains Oldfleet Drain Middle Drain, Stallingborough Stallingborough North Beck
1T3	Immingham & North Killingholme	Humber Estuary Stallingborough North Beck Habrough Marsh Drain South Killingholme Main Drain Lower East Halton Beck
1T4	Goxhill	Humber Estuary Lower East Halton Beck Goxhill complaints
1T5	Barton upon Humber	Humber Estuary New Holland Main Drain Barrow Beck Butts Beck Midby Drain, Barrow Barrow complaints
1F1	Waithe Beck	Waithe Beck
1F2	Buck Beck & Goosepaddle Drain	Buck Beck Buck Beck, Waltham (a & b)
1F3	River Freshney & Laceby Beck	River Freshney
1F4	East Halton Beck/Skitter Beck	East Halton Beck Brockelsby Beck

Note:- The reference prefix denotes the primary source of flood risk in the compartment;
T = Tidal; F = Fluvial; D = Drainage

- 4.13 Detailed flood risk assessments for each of the Stage 1 Area compartments are given in Annex 1. These include descriptions of the area, the sources of flood risk and the existing defences together with recommended development restrictions. The key features of each assessment are summarised below.

Flood risk assessments; tidal flood compartments

Compartment 1T1: Cleethorpes

- 4.14 This compartment runs from the northern end of the Cleethorpes Promenade to the NELC boundary at the southern end of Humberston Fitties. It is about 6 km long and varies in width from 30 m along the promenade to about 4 km along the Buck Beck and behind Humberston Fitties. Most of the land is open but there are some residential areas in Cleethorpes and Humberston.
- 4.15 The primary source of flood risk in this compartment is tidal, a combination of large waves and high water levels in the Humber Estuary. There are in addition three fluvial sources of risk; the Buck Beck (and its tributary the Goosepaddle Drain); the Little Buck Beck and a system of ditches managed by LMIDB and draining the area behind Humberston Fitties.
- 4.16 Cleethorpes is defended by the sea wall incorporated in its promenade while further south an earth embankment forms the defence as far as Humberston. Both provide an adequate standard of protection. South of Humberston the embankment is set back behind the Humberston Fitties Holiday Camp, which is defended by sand dunes reinforced by gabion boxes at the toe. The risk of flooding here is particularly high so a more detailed assessment covering this area alone has been undertaken. This is included in Annex 1. A combination of earth embankments and dwarf floodwalls provide protection against flooding from the Buck Beck and Goosepaddle Drain.

Assessment of flood risk

- 4.17 All land in the compartment lying within the Zone 3 boundary, as shown in Figure 1.5, is below the highest water levels with a 0.5% annual probability of occurring in the estuary. This area should therefore be classified as Zone 3 (High risk). This classification should also be applied to the land within the compartment behind the Cleethorpes Promenade. All land in the compartment lying outside these areas should be classified as Zone 2 (Medium risk).
- 4.18 Most of the land lying within Zone 3 is adequately protected against floods with a 0.5% (tidal) or 1.0% (fluvial) annual probability of flooding and therefore may be classified as NE/NLC SFRA Zone 3(i) (high risk, low vulnerability). There are a number of exceptions to this however, as follows:-
- (a) All land lying within 9m of any flood defences or of any watercourse managed by the Environment Agency or an Internal Drainage Board will be subject to restrictions laid down by the Environment Agency or the IDB.
 - (b) Although the estuary defences are currently in reasonable condition there is, nevertheless, a risk that they will fail, resulting in a breach (except behind the Cleethorpes Promenade, where the land is too high for a breach to form). If this happens at high tide, water will flow through the breach at high velocity posing a significant risk to people and property in the immediate vicinity. Between the end of the Promenade (i.e. at the Leisure Centre) and Humberston the peak water level in the estuary is about +4.5 mOD and the ground level immediately behind the defences is generally about +3.5 mOD, so Table 5 indicates that a 50m wide zone should be classified as NE/NLC SFRA Zone 3(ii) (high risk, high vulnerability). At Humberston Fitties the defence is provided by sand dunes so Table 5 indicates that in this section the width of the zone should be 100m.

- (c) If the estuary defences between the Leisure Centre and Humberston are breached during an event with a 0.5% annual probability, flooding up to about +4.0 mOD could occur on the land beside the Buck Beck. All land lying below +3.5 mOD in this area is therefore potentially at risk of being flooded to a depth of 0.5m. Table 3 indicates that such land should be classified as NE/NLC SFRA Zone 3(ii) (high risk, high vulnerability).
- (d) The sand dunes in front of Humberston Fitties provide a standard of protection significantly lower than the 0.5% annual probability required by PPG25. This area should be therefore classified as NE/NLC SFRA Zone 3(ii) (high risk, high vulnerability).
- (e) Although the land behind the secondary defences at Humberston Fitties is protected against a breach in the sand dunes during a 0.5% annual probability event in the estuary it is at risk of being flooded from a breach in the defences further south. If this occurs there is a risk that flooding up to +3.5 mOD could occur in this area. All land lying below +3.0 mOD in this area is therefore potentially at risk of being flooded to a depth of 0.5 m. Table 3 indicates that such land should be classified as NE/NLC SFRA Zone 3(ii) (high risk, high vulnerability).

Development restrictions

4.19 The process of deciding planning applications where flood risk is an issue, including the use of the NE/NLC SFRA matrix to determine whether an application is submitted to the Environment Agency, is set out in Chapter 7. It is recommended that in this flood compartment the following additional considerations are taken into account:-

- (a) Development on land within Zone 2 should be subject to confirmation that suitable arrangements for dealing with land drainage have been made with the appropriate IDB (NELIDB or LMIDB).
- (b) Development on land within NE/NLC SFRA Zone 3(i) should be subject to confirmation that suitable arrangements for dealing with land drainage have been made with the appropriate IDB.
- (c) Development on land within NE/NLC SFRA Zone 3(ii) or on land subject to Environment Agency, NELIDB or LMIDB bye-laws is unlikely to be supported by the Environment Agency.

Compartment 1T2: Grimsby & Stallingborough

4.20 This compartment runs from the right bank of the Stallingborough North Beck to high ground between Grimsby and Cleethorpes. It is about 10km long and varies between about 2 and 4 km in width except where it extends up the valley of the River Freshney. The eastern end includes the central district of Grimsby and is largely urban while the western end contains a number of major industrial facilities and has been designated in the NELC local plan for estuary-related industry. A development study for the area (the South Humber Bank Study) is currently being undertaken with joint funding from NELC, NLC and Yorkshire Forward.

4.21 Although the Humber Estuary is the primary source of flood risk to this compartment there are also six fluvial sources. These are the main river watercourses of Stallingborough North Beck, the Oldfleet Drain, the River Freshney and the New Cut together with two SOWs managed by NELIDB; the Middle Drain and the Mawmbridge Drain.

- 4.22 Between its northern end and Pyewipe, near Grimsby the compartment is protected against flooding from the estuary by an earth embankment with revetment and wave wall. Further south (as far as the entrance to Grimsby Dock) a gabion wall and rubble mound provides the protection while the northern end of Cleethorpes is protected by a concrete revetment with wave and splash walls. There are earth embankments along parts of the Stallingborough North Beck and the Oldfleet Drain while the Environment Agency has recently completed a scheme raising the defences and creating flood storage areas along the lower reaches of the River Freshney.

Assessment of flood risk

- 4.23 All land in the compartment lying within the Zone 3 boundary, as shown in Figure 1.5, is below the highest water levels with a 0.5% annual probability of occurring in the estuary. This area should therefore be classified as Zone 3 (High risk). All land in the compartment lying outside this area should be classified as Zone 2 (Medium risk).
- 4.24 Most of the land lying within Zone 3 is adequately protected against floods with a 0.5% (tidal) or 1.0% (fluvial) annual probability of flooding and therefore may be classified as NE/NLC SFRA Zone 3(i) (high risk, low vulnerability). There are a number of exceptions to this however, as follows:-
- (a) All land lying within 9 m of any flood defences or of any watercourse managed by the Environment Agency or an Internal Drainage Board will be subject to restrictions laid down by the Environment Agency or the IDB.
 - (b) Although the estuary defences are currently in reasonable condition there is, nevertheless, a risk that they will fail, resulting in a breach. If this happens at high tide, water will flow through the breach at high velocity posing a significant risk to people and property in the immediate vicinity. Between the Stallingborough North Beck outfall and Pyewipe the peak water level in the estuary is about +5 mOD and the ground level immediately behind the defences is generally about +3 mOD, so Table 5 indicates that a 100 m wide zone should be classified as NE/NLC SFRA Zone 3(ii) (high risk, high vulnerability). Between Grimsby and Cleethorpes the ground level is generally about +4 mOD so Table 5 indicates that the width of this zone should be 50m.
 - (c) If the estuary defences are breached during an event with a 0.5% annual probability, flooding up to about +3.5 mOD could occur. All land lying below +3.0 mOD is therefore potentially at risk of being flooded to a depth of 0.5 m. Table 3 indicates that such land should be classified as NE/NLC SFRA Zone 3(ii) (high risk, high vulnerability).
 - (d) The Stallingborough North Beck and Oldfleet Drain model studies identify land adjacent to these watercourses that is likely to be flooded during a 1.0% probability event. This land should be classified as NE/NLC SFRA Zone 3(ii) (high risk, high vulnerability).
 - (e) The recently completed works beside the lower reaches of the River Freshney include flood storage areas at Town's Holt, Freshney Bog and Church Lane Meadows. These areas should be classified as NE/NLC SFRA Zone 3(iii) (functional floodplain).
 - (f) The annual probability of flooding from the New Cut Drain is currently unspecified, although the Environment Agency is planning to investigate this watercourse in the near future. As a precautionary measure, all land within 50 m of this watercourse that would otherwise be

classified as NE/NLC SFRA Zone 3(i) should be classified as NE/NLC SFRA Zone 3(ii) (high risk, high vulnerability) until these studies are completed.

- (g) The annual probability of flooding from the Middle Drain and Mawmbridge Drains may be less than 0.1%. As a precautionary measure, all land within 50 m of these watercourses that would otherwise be classified as NE/NLC SFRA Zone 3(i) should be classified as NE/NLC SFRA Zone 3(ii) (high risk, high vulnerability).

Development restrictions

4.25 The process of deciding planning applications where flood risk is an issue, including the use of the NE/NLC SFRA matrix to determine whether an application is submitted to the Environment Agency, is set out in Chapter 7. It is recommended that in this flood compartment the following additional considerations are taken into account:-

- (a) Development on land within Zone 2 should be subject to confirmation that suitable arrangements for dealing with land drainage have been made with NELIDB.
- (b) Development on land within NE/NLC SFRA Zone 3(i) should be subject to confirmation that suitable arrangements for dealing with land drainage have been made with NELIDB.
- (c) Development on land within NE/NLC SFRA Zone 3(ii) should be subject to early pre-application discussions with the Environment Agency to determine the appropriateness or otherwise of proposed development in these areas.
- (d) Development on land within NE/NLC SFRA Zone 3(iii) or subject to Environment Agency or NELIDB bye-laws should be wholly exceptional and is unlikely to be supported by the Environment Agency.

Compartment 1T3: Immingham and North Killingholme

4.26 This compartment extends from the right bank of the East Halton Beck to the left bank of the Stallingborough North Beck and is about 10 km long and up to 5 km wide. It contains major industrial developments and part of the village of Immingham. The whole area has been designated in the relevant local plans for estuary-related industry and a development study (the South Humber Bank Study) is currently being undertaken with joint funding from NELC, NLC and Yorkshire Forward.

4.27 The Humber Estuary is the primary source of flood risk but there are also four fluvial sources. These are the East Halton and Stallingborough North Becks and two SOWs managed by NELIDB, the Habrough Marsh Drains and the South Killingholme Main Drain.

4.28 Along most its frontage the compartment is protected against flooding from the estuary by an earth embankment with revetment and wave wall on the crest, although a combination of gabion walls, a lock structure and a stone embankment protect the Immingham Dock area. It is possible that the Environment Agency will choose not to maintain the defences protecting a relatively small, undeveloped area south of the East Halton Beck. There are earth embankments along part of the Stallingborough North Beck.

Assessment of flood risk

- 4.29 All land in the compartment lying within the Zone 3 boundary, as shown in Figure 1.5, is below the highest water levels with a 0.5% annual probability of occurring in the estuary. This area should therefore be classified as Zone 3 (High risk). All land in the compartment lying outside this area should be classified as Zone 2 (Medium risk).
- 4.30 Most of the land lying within Zone 3 is adequately protected against floods with a 0.5% (tidal) or 1.0% (fluvial) annual probability of flooding and therefore may be classified as NE/NLC SFRA Zone 3(i) (high risk, low vulnerability). There are a number of exceptions to this however, as follows:-
- (a) All land lying within 9m of any flood defences or of any watercourse managed by the Environment Agency or an Internal Drainage Board will be subject to restrictions laid down by the Environment Agency or the IDB.
 - (b) If the defences protecting the undeveloped area south of East Halton Beck are not maintained this area will no longer be adequately protected against floods with a 0.5% annual probability of flooding. Until the future of these defences is determined the area should be classified as NE/NLC SFRA Zone 3(ii) (high risk, high vulnerability).
 - (c) Although the estuary defences are currently in reasonable condition there is, nevertheless, a risk that they will fail, resulting in a breach. If this happens at high tide, water will flow through the breach at high velocity posing a significant risk to people and property in the immediate vicinity. Given that the peak water level in the estuary is about +5 mOD and the ground level immediately behind the defences is generally about +3 mOD, Table 5 indicates that a 100m wide zone should be classified as NE/NLC SFRA Zone 3(ii) (high risk, high vulnerability).
 - (d) If the estuary defences are breached during an event with a 0.5% annual probability, flooding up to about +3.5 mOD could occur. All land lying below +3.0 mOD is therefore potentially at risk of being flooded to a depth of 0.5 m. Table 3 indicates that such land should be classified as NE/NLC SFRA Zone 3(ii) (high risk, high vulnerability).
 - (e) The Stallingborough North Beck model study identifies land adjacent to this watercourse that is likely to be flooded during a 0.1% probability event. This land should be classified as NE/NLC SFRA Zone 3(ii) (high risk, high vulnerability).
 - (f) The East Halton Skitter model study suggests that the water level in this watercourse during a 0.1% probability event will be +3.21 mOD. Although the study omitted floodplain effects and so may have over-estimated flood levels, nevertheless it used an outdated approach that tends to under-estimate levels. Adopting a precautionary approach it is reasonable to assume that flooding to +3.5 mOD might occur. All land adjacent to the watercourse lying below this level should be classified as NE/NLC SFRA Zone 3(ii) (high risk, high vulnerability).

Development restrictions

- 4.31 The process of deciding planning applications where flood risk is an issue, including the use of the NE/NLC SFRA matrix to determine whether an application is submitted to the Environment Agency, is set out in Chapter 7. It is recommended that in this flood compartment the following additional considerations are taken into account:-

- (a) Development on land within Zone 2 should be subject to confirmation that suitable arrangements for dealing with land drainage have been made with NELIDB.
- (b) Development on land within NE/NLC SFRA Zone 3(i) should be subject to confirmation that suitable arrangements for dealing with land drainage have been made with NELIDB.
- (c) Development on land within NE/NLC SFRA Zone 3(ii) should be subject to early pre-application discussions with the Environment Agency to determine the appropriateness or otherwise of proposed development in these areas.
- (d) Development on land subject to Environment Agency or NELIDB bye-laws is unlikely to be supported by the Environment Agency.

Compartment 1T4 Goxhill

- 4.32 This flood compartment falls into two parts, one beside the Humber Estuary and one along the valley of the East Halton Beck. The part beside the estuary is bounded by the New Holland Main Drain and East Halton Beck and is about 6 km long and up to 3 km wide. The second part lies along the valley of the East Halton Beck and extends to the downstream railway bridge near Ulceby, taken as the limit of the tidal floodplain, and is also about 6 km long and up to about 2 km wide. The compartment is almost entirely devoted to agriculture but contains small pockets of housing at New Holland, Goxhill, South End, East Halton and Ulceby. A small area near East Halton Beck has been identified by the Environment Agency as a potential site for managed realignment.
- 4.33 The Humber estuary is the primary source of flood risk to this compartment but there are two fluvial sources as well, the East Halton Beck and the New Holland Main Drain. Six complaints of flooding in the Goxhill area have been received by NLC within the last five years.
- 4.34 An earth embankment provides protection against flooding from the estuary except at Barrow Haven, where there is a sheet-pile retaining wall, and the New Holland Dock, which is protected by a combination of dock other retaining walls. There are no significant fluvial flood defences in the compartment.

Assessment of flood risk

- 4.35 All land in the compartment lying within the Zone 3 boundary, as shown in Figure 1.5, is below the highest water levels with a 0.5% annual probability of occurring in the estuary. This area should therefore be classified as Zone 3 (High risk). All land in the compartment lying outside this area (including the land at Goxhill at risk of local flooding) should be classified as Zone 2 (Medium risk).
- 4.36 None of the land lying within Zone 3 is adequately protected against floods with a 0.5% (tidal) or 1.0% (fluvial) annual probability of flooding and therefore the whole area should be classified as NE/NLC SFRA Zone 3(ii) (high risk, high vulnerability). The following additional points should be noted:-
 - (a) All land lying within 9m of any flood defences or of any watercourse managed by the Environment Agency or an Internal Drainage Board will be subject to restrictions laid down by the Environment Agency or the IDB.

- (b) Although the estuary defences are currently in reasonable condition there is, nevertheless, a risk that they will fail, resulting in a breach. If this happens at high tide, water will flow through the breach at high velocity posing a significant risk to people and property in the immediate vicinity. Given that the peak water level in the estuary is about +5 mOD and the ground level immediately behind the defences is generally about +3 mOD, Table 5 indicates that this high-velocity sub-zone should be 100m wide.
- (c) If the estuary defences are breached during an event with a 0.5% annual probability, flooding up to about +4.5 mOD could occur. All land lying below +4.0 mOD is therefore potentially at risk of being flooded to a depth of 0.5 m. Table 3 indicates that such land should be classified as within the deep-flooding sub-zone.
- (d) The land identified by the Environment Agency as a potential site for managed realignment should be classified as NE/NLC SFRA Zone 3(iii) (functional floodplain)

Development restrictions

4.37 The process of deciding planning applications where flood risk is an issue, including the use of the NE/NLC SFRA matrix to determine whether an application is submitted to the Environment Agency, is set out in Chapter 7. It is recommended that in this flood compartment the following additional considerations are taken into account:-

- (a) Development on land within Zone 2 should be subject to confirmation that suitable arrangements for dealing with land drainage have been made with NELIDB, noting in particular that any development at Goxhill should take into account the risk of local flooding there.
- (b) Development on land within NE/NLC SFRA Zone 3(ii) is unlikely to be supported by the Environment Agency.
- (c) Development on land within NE/NLC SFRA Zone 3(iii) should be wholly exceptional and is unlikely to be supported by the Environment Agency.
- (d) Development on land subject to Environment Agency or NELIDB bye-laws is unlikely to be supported by the Environment Agency.

Compartment 1T5 Barton upon Humber

4.38 This compartment runs from high ground at South Ferriby Cliff in the west to the left bank of the New Holland Main Drain in the east. It is about 8 km long and up to 2 km wide except where it extends up the valley of the Barrow Beck. It contains the villages of New Holland and Barrow Haven together with the low-lying parts of Barton upon Humber (beside Barton Haven) and Barrow upon Humber. Except at Barton, the area immediately behind the estuary defences contains a number of large water-filled clay pits which have a high nature conservation value.

4.39 As well as the Humber Estuary, which is the primary source of flood risk, there are three fluvial sources, the Butts Drain and the Barrow Beck, both of which are main river and managed by the Environment Agency, and the New Holland Main Drain, which is a SOW managed by NELIDB. Two complaints of flooding in the Barrow upon Humber area have been received by NLC within the last five years.

- 4.40 Along most of its length the compartment is protected against flooding from the estuary by an earth embankment, which has a revetment in places. The Barrow Beck has some lengths of embankment and retaining wall that act as flood defences.

Assessment of flood risk

- 4.41 All land in the compartment lying within the Zone 3 boundary, as shown in Figure 1.5, is below the highest water levels with a 0.5% annual probability of occurring in the estuary. This area should therefore be classified as Zone 3 (High risk). All land in the compartment lying outside this area should be classified as Zone 2 (Medium risk).
- 4.42 None of the land lying within Zone 3 is adequately protected against floods with a 0.5% (tidal) or 1.0% (fluvial) annual probability of flooding and therefore the whole area should be classified as NE/NLC SFRA Zone 3(ii) (high risk, high vulnerability). The following additional points should be noted:-
- (a) All land lying within 9m of any flood defences or of any watercourse managed by the Environment Agency or an Internal Drainage Board will be subject to restrictions laid down by the Environment Agency or the IDB.
 - (b) Although the estuary defences are currently in reasonable condition there is, nevertheless, a risk that they will fail, resulting in a breach. If this happens at high tide, water will flow through the breach at high velocity posing a significant risk to people and property in the immediate vicinity. Given that the peak water level in the estuary is about +5.5 mOD and the ground level immediately behind the defences is generally about +3 mOD, Table 5 indicates that this high-velocity sub-zone should be 150 m wide.
 - (c) The ground levels beside the Barton and Barrow Havens are higher and the defences are generally hard, indicating that the high-velocity sub-zone adjacent to these defences should be 40 m wide.
 - (d) If the estuary defences are breached during an event with a 0.5% annual probability, flooding up to about +4.5 mOD could occur. All land lying below +4.0 mOD is therefore potentially at risk of being flooded to a depth of 0.5 m. Table 3 indicates that such land should be classified as within the deep-flooding sub-zone.

Development restrictions

- 4.43 The process of deciding planning applications where flood risk is an issue, including the use of the NE/NLC SFRA matrix to determine whether an application is submitted to the Environment Agency, is set out in Chapter 7. It is recommended that in this flood compartment the following additional considerations are taken into account:-
- (a) Development on land within Zone 2 should be subject to confirmation that suitable arrangements for dealing with land drainage have been made with NELIDB, noting in particular that any development at Barrow upon Humber should take into account the risk of local flooding there.
 - (b) Development on land within NE/NLC SFRA Zone 3(ii) is unlikely to be supported by the Environment Agency.

- (c) Development on land subject to Environment Agency or NELIDB bye-laws is unlikely to be supported by the Environment Agency.

Flood risk assessments; fluvial flood compartments

Compartment 1F1 Waithe Beck

- 4.44 The Waithe Beck drains a catchment of about 108 km² in the Lincolnshire Wolds between Ludford and Beelsby. About 10 km of its length lies within the NELC boundaries and its valley, which is well-defined here, forms the main part of this flood compartment. A secondary part is formed by a narrow tributary valley leading to the south. Most of the land is farmed although there is some residential property at Hatcliffe and Brigsley.
- 4.45 The Waithe Beck is the primary source of flood risk in this compartment. The only significant flood defences are at Hatcliffe and consist of some lengths of floodwall and retaining wall along both banks.

Assessment of flood risk

- 4.46 All land in the compartment lying within the Zone 3 boundary, as shown in Figure 1.5, is currently considered to be below the highest water levels with a 1.0% annual probability of occurring in the Waithe Beck (although further studies are planned and could lead to the boundary being amended). This area should therefore be classified as Zone 3 (High risk). All land in the compartment lying outside this area should be classified as Zone 2 (Medium risk).
- 4.47 None of the land lying within Zone 3 is adequately protected against floods with a 1.0% (fluvial) annual probability of flooding and therefore the whole area should be classified as NE/NLC SFRA Zone 3(ii) (high risk, high vulnerability). All land lying within 9m of any flood defences or of any watercourse managed by the Environment Agency or an Internal Drainage Board will be subject to restrictions laid down by the Environment Agency or the IDB.

Development restrictions

- 4.48 The process of deciding planning applications where flood risk is an issue, including the use of the NE/NLC SFRA matrix to determine whether an application is submitted to the Environment Agency, is set out in Chapter 7. It is recommended that in this flood compartment the following additional considerations are taken into account:-
 - (a) Development on land within Zone 2 should be subject to confirmation that suitable arrangements for dealing with land drainage have been made with LMIDB.
 - (b) Development on land within NE/NLC SFRA Zone 3(ii) is unlikely to be supported by the Environment Agency.
 - (c) Development on land subject to Environment Agency or LMIDB bye-laws is unlikely to be supported by the Environment Agency.

Compartment 1F2 Buck Beck and Goosepaddle Drain

- 4.49 The Buck Beck drains a catchment of about 21 km² to the south of Cleethorpes, including all of Waltham, Humberston and New Waltham. It is joined by the Goosepaddle Drain, which carries surface water from the southern part of Cleethorpes, about 2 km from its outfall. This flood

compartment runs from the Buck Beck's source to the point where the channel crosses the A1098. The area further downstream lies within the tidal flood compartment 1T1 (Cleethorpes).

- 4.50 The Buck Beck is the only identified source of flood risk in this compartment. Dwarf floodwalls were constructed along some of its banks and the channel was widened and deepened in the 1970's.

Assessment of flood risk

- 4.51 All land in the compartment lying within the Zone 3 boundary, as shown in Figure 1.5, is below the highest water levels with a 1.0% annual probability of occurring in the Buck Beck and should therefore be classified as Zone 3 (High risk). All land in the compartment lying outside this area should be classified as Zone 2 (Medium risk).
- 4.52 All the land lying within Zone 3 downstream of the A16 crossing is adequately protected against floods with a 1.0% (fluvial) annual probability of flooding and therefore may be classified as NE/NLC SFRA Zone 3(i) (high risk, low vulnerability). All the land within the remaining Zone 3 area (upstream of the A16 crossing) should be classified as NE/NLC SFRA Zone 3(ii) (high risk, high vulnerability). All land lying within 9m of any flood defences or of any watercourse managed by the Environment Agency or an Internal Drainage Board will be subject to restrictions laid down by the Environment Agency or the IDB.

Development restrictions

- 4.53 The process of deciding planning applications where flood risk is an issue, including the use of the NE/NLC SFRA matrix to determine whether an application is submitted to the Environment Agency, is set out in Chapter 7. It is recommended that in this flood compartment the following additional considerations are taken into account:-
- (a) Development on land within Zone 2 should be subject to confirmation that suitable arrangements for dealing with land drainage have been made with NELIDB.
 - (b) Development within NE/NLC SFRA Zone 3(i) should be subject to confirmation that suitable arrangements for dealing with land drainage have been made with NELIDB.
 - (c) Development on land within NE/NLC SFRA Zone 3(ii) is unlikely to be supported by the Environment Agency.
 - (d) Development on land subject to Environment Agency or NELIDB bye-laws is unlikely to be supported by the Environment Agency.

Compartment 1F3 River Freshney and Laceby Beck

- 4.54 The River Freshney, which becomes the Laceby Beck in its upper reaches and then becomes the Team Gate Drain, drains a catchment of about 50 km² to the south and west of Grimsby. The main section of the flood compartment runs from the river's source near Waltham to the limit of the tidal floodplain about 2 km downstream of the point where the channel crosses the A46. The area further downstream lies within the tidal flood compartment 1T2 (Grimsby and Stallingborough). A subsidiary section lies in the valley of a tributary stream that flows past Aylesby and joins the river just east of Laceby. The land in the compartment is largely devoted to agriculture, apart from a small built-up area through Laceby.

- 4.55 The River Freshney/Laceby Beck is the main source of flood risk in this compartment. There are no significant flood defences within the compartment.

Assessment of flood risk

- 4.56 All land in the compartment lying within the Zone 3 boundary, as shown in Figure 1.5, is below the highest water levels with a 1.0% annual probability of occurring in the River Freshney/Laceby Beck and its tributary and should therefore be classified as Zone 3 (High risk). All land in the compartment lying outside this area should be classified as Zone 2 (Medium risk).
- 4.57 None of the land lying within Zone 3 is protected against floods with a 1.0% (fluvial) annual probability of flooding. This land should therefore be classified as Zone 3(ii) (high risk, high vulnerability). All land lying within 9m of any flood defences or of any watercourse managed by the Environment Agency or an Internal Drainage Board will be subject to restrictions laid down by the Environment Agency or the IDB.

Development restrictions

- 4.58 The process of deciding planning applications where flood risk is an issue, including the use of the NE/NLC SFRA matrix to determine whether an application is submitted to the Environment Agency, is set out in Chapter 7. It is recommended that in this flood compartment the following additional considerations are taken into account:-
- (a) Development on land within Zone 2 should be subject to confirmation that suitable arrangements for dealing with land drainage have been made with NELIDB.
 - (b) Development on land within NE/NLC SFRA Zone 3(ii) is unlikely to be supported by the Environment Agency.
 - (c) Development on land subject to Environment Agency or NELIDB bye-laws is unlikely to be supported by the Environment Agency.

Compartment 1F4 East Halton Beck and Skitter Beck

- 4.59 The East Halton Beck, which becomes the Skitter Beck in its upper reaches, drains a catchment with a total area of about 124 km² to the south and west of Immingham. The flood compartment has two sections, containing the valleys of the Skitter Beck and its tributary, the Brocklesby beck respectively. The main sea action runs from the Skitter Becks's source near Keelby to the limit of the tidal floodplain at the downstream railway bridge near Ulceby, about 9 km from the outfall at East Halton Skitter. The area further downstream lies within the tidal flood compartment 1T3 (Immingham and North Killingholme). The land is devoted almost entirely to agriculture except for a small built-up area at Ulceby.
- 4.60 The East Halton Beck/Skitter Beck is the main source of flood risk in the compartment. There are no significant flood defences within the compartment.

Assessment of flood risk

- 4.61 All land in the compartment lying within the Zone 2 boundary, as shown in Figure 1.5, is below the highest water levels with a 1.0% annual probability of occurring in the East Halton Beck/Skitter Beck and should therefore be classified as Zone 3 (High risk). All land in the compartment lying outside this area should be classified as Zone 2 (Medium risk).

- 4.62 None of the land lying within Zone 3 is protected against floods with a 1.0% (fluvial) annual probability of flooding. This land should therefore be classified as NE/NLC SFRA Zone 3(ii) (high risk, high vulnerability). All land lying within 9m of any flood defences or of any watercourse managed by the Environment Agency or an Internal Drainage Board will be subject to restrictions laid down by the Environment Agency or the IDB.

Development restrictions

- 4.63 The process of deciding planning applications where flood risk is an issue, including the use of the NE/NLC SFRA matrix to determine whether an application is submitted to the Environment Agency, is set out in Chapter 7. It is recommended that in this flood compartment the following additional considerations are taken into account:-
- (a) Development on land within Zone 2 should be subject to confirmation that suitable arrangements for dealing with land drainage have been made with NELIDB.
 - (b) Development on land within NE/NLC SFRA Zone 3(ii) is unlikely to be supported by the Environment Agency.
 - (c) Development on land subject to Environment Agency or NELIDB bye-laws is unlikely to be supported by the Environment Agency.

5. Flood Risk In Stage 2 Area – Ancholme Valley

Description of area

Location, extent and development potential

- 5.1 The Stage 2 Ancholme Valley Area stretches from the high ground outcropping at South Ferriby Cliff, west of Barton-upon Humber, to the high ground at Whitton and south as far as Waddingham in the Ancholme Valley, as shown in Figure 2.1. The shoreline of the Humber Estuary forms the northern boundary while the NLC border forms the southern boundary. The watersheds dividing the River Ancholme catchment from the catchments draining east to the estuary and from the River Trent catchment act as the eastern and western boundaries respectively.
- 5.2 The main centres of population in the area are Winterton, Broughton and Brigg. Winterton and Broughton are both on high ground well above the floodplain but much of Brigg is in the bottom of the Ancholme Valley, about 14 km from its outfall at South Ferriby on the Humber. A number of villages (or parts of them) also lie within the floodplain, including Winteringham, South Ferriby, Wrawby and Hibaldstow. There are some industrial and commercial facilities at Brigg and a cement works at South Ferriby. The remainder of the area is largely devoted to agriculture.
- 5.3 The North Lincolnshire Council's Local Plan, published for consultation in September 2000, identified a number of potential sites for development in Brigg. The Environment Agency advised that it would object to any development in the floodplain and the Council therefore appointed WS Atkins Ltd to carry out a Strategic Flood Risk Assessment in preparation for the Local Plan Inquiry⁶. The Council modified its proposals in the light of this assessment and the Inspector accepted the revised proposals in his report dated January 2003⁷. No other parts of the area are allocated for major development.

Main sources of flood risk

- 5.4 There are two main sources of flood risk in the River Ancholme area, a combination of large waves and high water levels in the Humber Estuary and high river flows in the River Ancholme.
- 5.5 The HESMP Joint Probability Analysis quotes the water level and wave height combinations having a 0.5% probability of occurrence in the estuary and a selected list of these combinations is given in Table 2.1, on the next page. Combinations with water levels 0.2 to 0.4m higher are likely to have a 0.1% probability of occurrence. Current guidance suggests sea levels could rise by 0.3m and wave heights increase by 10% over the next 50 years.
- 5.6 The tidal flood plain within the River Ancholme area is shown on Figure 2.2, taken from the Environment Agency's Flood Maps, together with the fluvial flood plain, the main river watercourses and the SOWs. There are two sections of fluvial floodplain within the area, a relatively small one associated with the Winterton Beck that discharges to the estuary at Winteringham Haven, and the main one associated with the River Ancholme that has a gated outfall at South Ferriby. Both sections contain complex drainage systems that are managed by the Ancholme IDB.

⁶ North Lincolnshire District Council Local Plan Inquiry, Strategic Flood Risk Assessment for Brigg WS Atkins, November 2001
⁷ North Lincolnshire District Council Local Plan Inquiry, Inspector's Report, January 2003

Table 2.1 Water level and wave height combinations with a 0.5% probability of occurrence – Stage 2 area

Whitton		South Ferriby		Humber Bridge	
Water level (mOD)	Wave ht (m)	Water level (mOD)	Wave ht (m)	Water level (mOD)	Wave ht (m)
5.54	0.0	5.52	0.0	5.44	0.0
5.42	0.4	5.25	0.6	5.25	0.6
5.26	0.6	4.93	0.7	4.80	0.8
5.04	0.7	4.51	0.8	4.14	0.9

- 5.7 There are nineteen main river watercourses within the area, as listed in Table 2.2 on the next page. Throughout the study area the River Ancholme is embanked and acts as a highland carrier (carrying drainage flows from high ground further upstream at levels that are above the local ground level). Two separate main river watercourse systems (for the left and right bank respectively) drain the low-lying land beside the lower reaches of the river to the estuary, again discharging through gated outfalls at South Ferriby. Further upstream more highland carriers drain the uplands on either side of the Ancholme Valley, receiving gravity or pumped flows from the IDB drainage system and discharging them to the River Ancholme. They are all classified as main river watercourses. The Environment Agency has carried out a series of studies on the flood defences of the River Ancholme, with the aim of promoting a scheme to raise the standard of defence to Brigg and surrounding areas⁸, and is currently completing a study assessing the standard of defence at Hibaldstow⁹.
- 5.8 Figure 2.2 also shows the four watercourses lying within the River Ancholme Area that, as discussed in Chapter 3, are classified as SOWs for the purposes of this report. They are listed in Table 2.3, also on the next page. They all lie within the tidal or fluvial floodplain, as currently defined, and are managed by the Ancholme IDB.
- 5.9 The responsibility for draining all the low-lying land within the River Ancholme area lies with the Ancholme IDB. Its drainage system is complex and, except near the estuary, much of it is pumped. The areas near the estuary are currently drained by gravity but siltation at the outfalls is becoming a serious problem and the IDB considers in due course most of them will need to be pumped; it has already applied to DEFRA for support towards a new pumping station near Whitton Ness to prevent the drainage of the area between Whitton and Winteringham deteriorating. The IDB boundaries and its pumping stations are shown on Figure 2.3 and the pumping stations are listed in Table 2.4.

⁸ River Ancholme Improvements, Stage 2 Report, Posford DuVivier, May 2002 and subsequent reports to be produced by Posford Haskoning

⁹ Hibaldstow Standard of Protection Study, Atkins, April 2004

Table 2.2 Main river watercourses – Stage 2 area

Name of watercourse	Watercourse type	Discharging to
East Drain Lower Land Drain Bonby Catchwater Worlabby Catchwater Little Carr Drain Wrawby Catchwater	Highland carrier Highland carrier Highland carrier Highland carrier Floodplain drain Floodplain drain	Humber Estuary East Drain Lower Land Drain Land Drain Land Drain Land Drain
West Drain Appleby Mill Beck Ella & Moor Beck	Floodplain drain Floodplain drain Floodplain drain	Humber Estuary West Drain West Drain
New River Ancholme Spring Dyke Scawby Catchwater Hibaldstow Catchwater Hibaldstow North Drain Redbourne Old River Redbourne Catchwater Sallow Row Drain North Kelsey & Grasby Beck Froghall Drain Kettleby Beck	Highland carrier Highland carrier Highland carrier Highland carrier Floodplain drain Highland carrier Highland carrier Highland carrier Highland carrier Highland carrier Floodplain drain Highland carrier	Humber Estuary New River Ancholme New River Ancholme New River Ancholme Hibaldstow Catchwater New River Ancholme Redbourne Old River New River Ancholme New River Ancholme Kettleby Beck New River Ancholme
Winterton Beck	Floodplain drain	Humber Estuary

Table 2.3 Significant ordinary watercourses (SOWs) – Stage 2 area

Ref No (Fig 2.2)	Name of watercourse	Watercourse type	Discharging to
1	Fullseas & Marsh Drains	Gravity outfall	Humber Estuary
2	West Drain (IDB)	Pumped outfall	New River Ancholme
3	Island Carr North	Pumped outfall	New River Ancholme
4	Scawby Brook	Gravity outfall	New River Ancholme

Table 2.4 Drainage pumping stations – Stage 2 area

Ref No (Fig 2.3)	Pumping Station	Discharging to
P1	Appleby	New River Ancholme
P2	Broughton	New River Ancholme
P3	Hibaldstow	New River Ancholme
P4	Redbourne Hayes	New River Ancholme
P5	North Kelsey	New River Ancholme
P6	Thirty Foot	New River Ancholme
P7	Cadney	New River Ancholme
P8	Candleby	Froghall Drain
P9	Bently	New River Ancholme
P10	Island Carr	New River Ancholme
P11	Worlaby	New River Ancholme

- 5.10 The IDB aims to provide a standard of between 10% and 5% annual probability of occurrence (1:10 and 1:20 years return period) for agricultural land throughout the system but this includes a freeboard of at least 1m below local ground level (to prevent the land from being waterlogged). As a result the standard provided to property (which is not affected by flooding until the water level rises above local ground level) is generally in the range 2.0% and 1.0% annual probability (1:50 to 1:100 years return period). The IDB has to approve the drainage arrangements of all significant new development within its boundaries or affecting its watercourses. In principle the site runoff characteristics should remain unchanged, although the IDB may accept the receiving drainage system being improved so it can accept the increased discharge, at the developer's expense. It is understood that the design standard for these improvements is the event having a 1.0% annual probability of occurrence.
- 5.11 The location of all recorded complaints to the District Councils about flooding in the Stage 2 area during the last five years are shown on Figure 2.4. There is only one place where at least two separate complaints within 750m of each other, as shown on the figure and listed in Table 5.5. These do not appear to be on any identified watercourse.

Table 2.5 Places with two or more complaints of flooding – Stage 2 area

Location	No of complaints
Scawby	2

Flood zones and flood compartments

Flood zones

- 5.12 The NE/NLC SFRA flood zone definitions are given in Table 2, in Chapter 3. The high risk zone (Zone 3) is defined as the areas where the annual risk of flooding (assuming there are no defences) is more than 1.0% from a fluvial source or 0.5% from a tidal source. These are shown on the Environment Agency's Flood Maps, which are based on the results of the national mapping project mentioned in Chapter 2 but modified to take into account the findings of more detailed local modelling as discussed in Chapter 2.

- 5.13 At Brigg the strategic flood risk assessment carried out by W S Atkins noted that the peak water level through the town with a 1.0% annual risk of occurring is +2.8 mOD. Their report includes a map showing land below this level, plotted using Environment Agency data. This is used to define the Zone 3 boundary within Brigg.
- 5.14 The medium risk zone (Zone 2) is defined as the area where the annual risk of flooding is less than 0.1%, whether from a fluvial or a tidal source and again assuming there are no defences. This is also shown on the Environment Agency's Flood Maps. Again the boundary has been modified to take into account the findings of more detailed local modelling, in particular the HESMP studies results indicating that the water level with this risk of occurring in the estuary is only about 0.3m higher than the water level with a 0.5% risk of occurring. As a result, the boundaries of the high risk zone beside the estuary and the adjacent medium risk zone are very close together.
- 5.15 The flood zones for the Stage 2 Area are shown on Figure 2.5.

Flood compartments

- 5.16 To allow more detailed assessment, the floodplain (defined as all land within the Zone 2 boundaries) has been divided into flood compartments taking into account the topography, type of defence, drainage arrangements, land use and administrative issues. These compartments are shown on Figure 2.5 and listed in Table 2.6 with the sources of flood risk they include.

Table 2.6 Flood compartments – Stage 2 area

Compartment reference	Compartment name	Sources of flood risk
2T1	South Ferriby (East)	Humber Estuary New River Ancholme East Drain Lower Fulseas & Marsh Drains
2T2	South Ferriby (West)	Humber Estuary New River Ancholme West Drain
2T3	Winterton	Humber Estuary Winterton Beck
2F1	Lower Ancholme Right Bank	New River Ancholme Land Drain Bonby Catchwater Worlaby Catchwater Little Carr Drain Wrawby Catchwater Humber Estuary
2F2	Lower Ancholme Left Bank	New River Ancholme West Drain Appleby Mill Beck Ella & Moor Beck Spring Dyke West Drain (IDB) Humber Estuary

Compartment reference	Compartment name	Sources of flood risk
2F3	Island Carr	Island Carr North
2F4	Middle Ancholme Right Bank	New River Ancholme North Kelsey & Grasby Beck Froghall Drain Kettleby Beck
2F5	Middle Ancholme Left Bank	New River Ancholme Castlethorpe Drain Scawby Catchwater Hibaldstow Catchwater Hibaldstow North Drain Redbourne Old River Redbourne Catchwater Sallow Row drain Scawby Brook

- 5.17 The reference prefix denotes the primary source of flood risk in the compartment (T for tidal and F for fluvial) although it should be noted that all compartments north of Brigg are at risk from both tidal and fluvial flooding. Detailed flood risk assessments for each of the Stage 2 Ancholme Valley compartments are given in Annex 2. These include descriptions of the area, the sources of flood risk and the existing defences together with recommended development restrictions. The key features of each assessment are summarised below.

Flood risk assessments; tidal flood compartments

Compartment 2T1: South Ferriby (East)

- 5.18 This compartment extends from high ground at South Ferriby to the Ferriby Sluice and is about 2.5 km long and 1.5 km wide at its widest point. It contains low-lying properties in South Ferriby and a section of the A1077 but otherwise the land is devoted to agriculture.
- 5.19 The Humber Estuary is the primary source of flood risk but there are also three fluvial sources, the New River Ancholme, the East Drain Lower and the Fulseas & Marsh Drain (which is a SOW managed by the Ancholme IDB).
- 5.20 A combination of earth embankments and brick walls protects the compartment against flooding from the estuary. There are embankments along the New River Ancholme and the East Drain Lower.

Assessment of flood risk

- 5.21 All land in the compartment lying within the Zone 3 boundary, as shown in Figure 2.5, is below the highest water levels with a 0.5% annual probability of occurring in the estuary. This area should therefore be classified as Zone 3 (High risk). All land in the compartment lying outside this area should be classified as Zone 2 (Medium risk).
- 5.22 None of the land lying within Zone 3 is adequately protected against floods with a 0.5% annual probability of tidal flooding. This land should therefore be classified as NE/NLC SFRA Zone 3(ii)

(high risk, high vulnerability). All land lying within 9m of any flood defences or of any watercourse managed by the Environment Agency or an Internal Drainage Board will be subject to restrictions laid down by the Environment Agency or the IDB.

Development restrictions

5.23 The process of deciding planning applications where flood risk is an issue, including the use of the NE/NLC SFRA matrix to determine whether an application is submitted to the Environment Agency, is set out in Chapter 7. It is recommended that in this flood compartment the following additional considerations are taken into account:-

- (a) Development on land within Zone 2 should be subject to confirmation that suitable arrangements for dealing with land drainage have been made with the Ancholme IDB.
- (b) Development on land within NE/NLC SFRA Zone 3(ii) is unlikely to be supported by the Environment Agency.
- (c) Development on land subject to Environment Agency or Ancholme IDB bye-laws is unlikely to be supported by the Environment Agency.

Compartment 2T2: South Ferriby (West)

5.24 This compartment extends from the River Ancholme at Ferriby Sluice to the Winterton Beck at Winteringham Haven, a distance of about 5 km. From the estuary it extends south about 3 km along the Ancholme Valley a ridge of higher ground. It contains a cement works at Ferriby Sluice, some isolated farm buildings and a section of the A1077. The remaining land is devoted to agriculture.

5.25 The Humber Estuary is the primary source of flood risk to this compartment but there are also three fluvial sources, the New River Ancholme, the West Drain and the Winterton Beck.

5.26 The estuary flood defences consist of earth embankments with toe piling to counter significant erosion that has been taking place opposite the western end of Read's Island. There are embankments along some sections of the New River Ancholme.

Assessment of flood risk

5.27 All land in the compartment lying within the Zone 3 boundary, as shown in Figure 2.5, is below the highest water levels with a 0.5% annual probability of occurring in the estuary. This area should therefore be classified as Zone 3 (High risk). All land in the compartment lying outside this area should be classified as Zone 2 (Medium risk).

5.28 None of the land lying within Zone 3 is adequately protected against floods with a 0.5% annual probability of tidal flooding. This land should therefore be classified as NE/NLC SFRA Zone 3(ii) (high risk, high vulnerability). All land lying within 9m of any flood defences or of any watercourse managed by the Environment Agency or an Internal Drainage Board will be subject to restrictions laid down by the Environment Agency or the IDB.

Development restrictions

5.29 The process of deciding planning applications where flood risk is an issue, including the use of the NE/NLC SFRA matrix to determine whether an application is submitted to the Environment Agency,

is set out in Chapter 7. It is recommended that in this flood compartment the following additional considerations are taken into account:-

- (a) Development on land within Zone 2 should be subject to confirmation that suitable arrangements for dealing with land drainage have been made with the Ancholme IDB.
- (b) Development on land within NE/NLC SFRA Zone 3(ii) is unlikely to be supported by the Environment Agency.
- (c) Development on land subject to Environment Agency or Ancholme IDB bye-laws is unlikely to be supported by the Environment Agency.

Compartment 2T3: Winterton

- 5.30 The estuary frontage of this compartment runs from Winteringham Haven to Whitton and is about 4 km wide. The compartment extends up the valley of the Winterton Beck for a distance of about 7 km. A number of isolated farm buildings and parts of Whitton and Winteringham lie within the compartment. The remaining land is devoted to agriculture.
- 5.31 The primary source of flood risk to this compartment is the Humber Estuary but there is also a fluvial source, the Winterton Beck, which carries drainage flows from the north-eastern part of Scunthorpe.
- 5.32 The estuary flood defences consist of earth embankments. There are no fluvial flood defences.

Assessment of flood risk

- 5.33 All land in the compartment lying within the Zone 3 boundary, as shown in Figure 2.5, is below the highest water levels with a 0.5% annual probability of occurring in the estuary. This area should therefore be classified as Zone 3 (High risk). All land in the compartment lying outside these areas should be classified as Zone 2 (Medium risk).
- 5.34 None of the land lying within Zone 3 is adequately protected against floods with a 0.5% annual probability of tidal flooding. This land should therefore be classified as NE/NLC SFRA Zone 3(ii) (high risk, high vulnerability). All land lying within 9m of any flood defences or of any watercourse managed by the Environment Agency or an Internal Drainage Board will be subject to restrictions laid down by the Environment Agency or the IDB.

Development restrictions

- 5.35 The process of deciding planning applications where flood risk is an issue, including the use of the NE/NLC SFRA matrix to determine whether an application is submitted to the Environment Agency, is set out in Chapter 7. It is recommended that in this flood compartment the following additional considerations are taken into account:-
 - (a) Development on land within Zone 2 should be subject to confirmation that suitable arrangements for dealing with land drainage have been made with the Ancholme IDB.
 - (b) Development on land within NE/NLC SFRA Zone 3(ii) is unlikely to be supported by the Environment Agency.

- (c) Development on land subject to Environment Agency or Ancholme IDB bye-laws is unlikely to be supported by the Environment Agency.

Flood risk assessments; fluvial flood compartments

Compartment 2F1: Lower Ancholme Right Bank

- 5.36 This compartment extends from the landward boundary of Compartment 2T1 southwards as far as the town of Brigg, a distance of some 11.5 km. The New River Ancholme forms the western boundary while the eastern boundary is taken as the Zone 2 boundary shown on the Environment Agency's Flood Maps. The M180 motorway crosses the compartment north of Brigg and forms the northern limit of NLC's development boundary for the town. The majority of the land within the compartment south of this limit is either already developed or has been scheduled for development in the NLC Local Plan. Land north of the motorway contains isolated farm buildings and is devoted to agriculture.
- 5.37 The main sources of flood risk in this compartment are the New River Ancholme and the local drainage system on the right bank of the river, although there is also a risk of tidal flooding from the Humber Estuary. This system includes 5 lengths of main river, the Land Drain (which is the primary drain into which the others discharge) and the Bonby Catchwater, Worlaby Catchwater, Little Carr Drain and Wrawby Catchwater (each draining a sub-area of the compartment). The Land Drain and the Bonby and Worlaby Catchwaters are embanked over at least part of their length and act as high-level carriers.
- 5.38 Flood defences within the compartment include embankments along most of the New Ancholme River and along the Land Drain and the Bonby and Worlaby Catchwaters. The condition and standard of the defences within the compartment at Brigg (upstream of the motorway bridge) has been assessed by W S Atkins¹⁰ as part of their flood risk assessment for the NLC Local Plan Inquiry.

Assessment of flood risk

- 5.39 All land in the compartment lying within the Zone 3 boundary, as shown in Figure 2.5, is below the highest fluvial water levels with a 1.0% annual probability of occurring. This area should therefore be classified as Zone 3 (High risk). All land in the compartment lying outside these areas should be classified as Zone 2 (Medium risk).
- 5.40 The land within Zone 3 south of the M180 motorway bridge has been identified in the Inspector's Report¹⁰ as being of low vulnerability and is therefore classified as NE/NLC SFRA Zone 3(i) (high risk, low vulnerability). The land within Zone 3 north of the motorway bridge is not adequately protected to this standard and should therefore be classified as NE/NLC SFRA Zone 3(ii) (high risk, high vulnerability). All land lying within 9m of any flood defences or of any watercourse managed by the Environment Agency or an Internal Drainage Board will be subject to restrictions laid down by the Environment Agency or the IDB.

Development restrictions

- 5.41 The process of deciding planning applications where flood risk is an issue, including the use of the NE/NLC SFRA matrix to determine whether an application is submitted to the Environment Agency, is set out in Chapter 7. It is recommended that in this flood compartment the following additional considerations are taken into account:-

10 North Lincolnshire District Council Local Plan Inquiry, Strategic Flood Risk Assessment for Brigg WS Atkins, November 2001

- (a) Development on land within Zone 2 should be subject to confirmation that suitable arrangements for dealing with land drainage have been made with the Ancholme IDB.
- (b) Development on land within NE/NLC SFRA Zone 3(i) (located south of the M180 motorway bridge, in Brigg) should be in accordance with the NLC Local Plan, as modified following the Inspector's Report¹¹.
- (c) Development on land within NE/NLC SFRA Zone 3(ii) is unlikely to be supported by the Environment Agency.
- (d) Development on land subject to Environment Agency or Ancholme IDB bye-laws is unlikely to be supported by the Environment Agency.

Compartment 2F2: Lower Ancholme Left Bank

- 5.42 This compartment extends from the landward boundary of Compartment 2T2 southwards as far as the A18 road (Bridge Street) by the town of Brigg, a distance of some 11.5 km. The New River Ancholme forms the eastern boundary while the western boundary is taken as the Zone 2 boundary shown on the Environment Agency's Flood Maps. The M180 motorway crosses the compartment about 1 km north of the A18. The NLC Local Plan shows an area about 500 m by 150 m between the two roads, of which part has already been developed and the remainder is allocated for development. The rest of the compartment contains only isolated farm buildings and is devoted to agriculture.
- 5.43 The main sources of flood risk in this compartment are the New River Ancholme and the local drainage system on the left bank of the river, although there is also a risk of tidal flooding from the Humber Estuary. This system includes 3 lengths of main river, the West Drain (which is the primary watercourse into which the other two discharge), Appleby Mill Beck and Ella & Moor Beck. There is also a short length of main river, the Spring Dyke, lying between the M180 and the A18.
- 5.44 There are flood embankments along much of the New Ancholme River within the compartment. The other main river watercourses contain only short lengths of embankment. The condition and standard of the defences upstream of the motorway bridge has been assessed by W S Atkins as part of their flood risk assessment for the NLC Local Plan Inquiry.

Assessment of flood risk

- 5.45 All land in the compartment lying within the Zone 3 boundary, as shown in Figure 2.5, is below the highest fluvial water levels with a 1.0% annual probability of occurring. This area should therefore be classified as Zone 3 (High risk). All land in the compartment lying outside these areas should be classified as Zone 2 (Medium risk).
- 5.46 None of the land within Zone 3 is adequately protected against floods with a 1.0% annual probability of fluvial flooding. It should therefore all be classified as NE/NLC SFRA Zone 3(ii) (high risk, high vulnerability). All land lying within 9m of any flood defences or of any watercourse managed by the Environment Agency or an Internal Drainage Board will be subject to restrictions laid down by the Environment Agency or the IDB.

Development restrictions

5.47 The process of deciding planning applications where flood risk is an issue, including the use of the NE/NLC SFRA matrix to determine whether an application is submitted to the Environment Agency, is set out in Chapter 7. It is recommended that in this flood compartment the following additional considerations are taken into account:-

- (a) Development on land within Zone 2 should be subject to confirmation that suitable arrangements for dealing with land drainage have been made with the Ancholme IDB.
- (b) Development on land within NE/NLC SFRA Zone 3(ii) should be as set out in the NLC Local Plan, as modified following the Inspector's Report.
- (c) Development on land subject to Environment Agency or Ancholme IDB bye-laws is unlikely to be supported by the Environment Agency.

Compartment 2F3: Island Carr

5.48 This compartment is the island west of Brigg that lies between the channels of the New and the Old River Ancholme and is approximately 1 km long and 0.5 km wide at its widest point. Its northern part lies within the NLC's development boundary for Brigg and is already largely developed, mainly for industrial purposes but with a small area allocated for housing and a larger area for mixed use development in the Local Plan. The southern part of the compartment is devoted to agriculture.

5.49 The main sources of flood risk in this compartment are the two River Ancholme channels. Drainage from the compartment is difficult, the northern part is pumped to the Old River Ancholme but the southern part is drained by gravity.

5.50 There are multiple defences protecting the compartment and these defences are not consistent in either form or type. As a result the possibility of failure is higher than would be the case with a uniform defence system.

Assessment of flood risk

5.51 All land in the compartment lying below +2.8 mOD, as shown in Figure 2.5, is below the highest fluvial water levels with a 1.0% annual probability of occurring. This area should therefore be classified as Zone 3 (High risk). All land in the compartment lying outside these areas should be classified as Zone 2 (Medium risk).

5.52 Although the defences surrounding the compartment will protect land within Zone 3 against fluvial floods having a 1.0% annual probability of occurring, the multiplicity of the defences means that the risk of failure is higher than would normally be expected. The drainage difficulties add to the potential risk of flooding and, overall, indicate that the land is not suitable for unrestricted development. It should therefore all be classified as NE/NLC SFRA Zone 3(ii) (high risk, high vulnerability). All land lying within 9m of any flood defences or of any watercourse managed by the Environment Agency or an Internal Drainage Board will be subject to restrictions laid down by the Environment Agency or the IDB.

Development restrictions

5.53 The process of deciding planning applications where flood risk is an issue, including the use of the NE/NLC SFRA matrix to determine whether an application is submitted to the Environment Agency,

is set out in Chapter 7. It is recommended that in this flood compartment the following additional considerations are taken into account:-

- (a) Development on land within Zone 2 should be subject to confirmation that suitable arrangements for dealing with land drainage have been made with the Ancholme IDB.
- (b) Development on land within NE/NLC SFRA Zone 3(ii) should be as set out in the NLC Local Plan, as modified following the Inspector's Report.
- (c) Development on land subject to Environment Agency or Ancholme IDB bye-laws is unlikely to be supported by the Environment Agency.

Compartment 2F4: Middle Ancholme (Right Bank)

- 5.54 This compartment lies south of Brigg and east of the New River Ancholme and is limited partly by topography and partly by the NLC boundaries. As a result, although the compartment is hydraulically a single unit, a strip of land across it falls within West Lindsey District Council. This strip divides the area within the NLC boundaries into two parts, a small one on the town's outskirts and a considerably larger one further south. The smaller area is about 0.5 km by 1 km and is partly urbanised. The larger area is about 3 km by 6 km, is used for agriculture and contains isolated farm buildings.
- 5.55 The main sources of flood risk in this compartment are the New River Ancholme and the local drainage system. This includes two main river watercourse systems, the Kettleby Beck with its tributary the Froghall Drain, and the North Kelsey & Grasby Beck.
- 5.56 Flood defences within the compartment include embankments beside the New and Old Ancholme Rivers and the Kettleby and North Kelsey & Grasby Becks.

Assessment of flood risk

- 5.57 All land in the northern part of the compartment (i.e. by Brigg) lying below +2.8 mOD, as shown in Figure 2.5, is below the highest fluvial water levels with a 1.0% annual probability of occurring and should therefore be classified as Zone 3 (High risk). Similarly, all land in the southern part of the compartment lying within the Zone 3 boundary is below the highest water levels with a 1.0% annual probability of occurring in the estuary and should also be classified as Zone 3 (High risk). All land in the compartment lying outside these areas should be classified as Zone 2 (Medium risk).
- 5.58 None of the land lying within Zone 3 is adequately protected against floods with a 1.0% annual probability of tidal flooding. This land should therefore be classified as NE/NLC SFRA Zone 3(ii) (high risk, high vulnerability). All land lying within 9m of any flood defences or of any watercourse managed by the Environment Agency or an Internal Drainage Board will be subject to restrictions laid down by the Environment Agency or the IDB.

Development restrictions

- 5.59 The process of deciding planning applications where flood risk is an issue, including the use of the NE/NLC SFRA matrix to determine whether an application is submitted to the Environment Agency, is set out in Chapter 7. It is recommended that in this flood compartment the following additional considerations are taken into account:-

- (a) Development on land within Zone 2 should be subject to confirmation that suitable arrangements for dealing with land drainage have been made with the Ancholme IDB.
- (b) Development on land within NE/NLC SFRA Zone 3(ii) is unlikely to be supported by the Environment Agency.
- (c) Development on land subject to Environment Agency or Ancholme IDB bye-laws is unlikely to be supported by the Environment Agency.

Compartment 2F5: Middle Ancholme (Left Bank)

5.60 This compartment lies south of Brigg and west of the New River Ancholme. Its northern boundary is the A18 road (Bridge Street) by Brigg and its southern boundary is the NLC's southern border, which here follows the Sallow Row Drain. It is about 8.5 km long and 3.5 km wide at its widest point. The Gainsborough to Grimsby railway line marks the southern limit of the NLC's development boundary for Brigg, although no sites are allocated for development in this area (which already includes some industry and housing). Further south the land is used for agriculture and, apart from the village of Hibaldstow, contains only isolated farm buildings.

5.61 The main sources of flood risk in this compartment are the New River Ancholme and the local drainage system. This includes four main river watercourse systems, the Scawby Catchwater, the Hibaldstow Catchwater and its tributary the Hibaldstow North Drain, the Redbourne Old River and its tributary the Redbourne Catchwater, and the Sallow Row Drain. There is also a SOW managed by the Ancholme IDB, the Scawby Brook.

5.62 The New and Old Ancholme Rivers are flanked by flood embankments, as are the main river sections of the local drainage systems.

Assessment of flood risk

5.63 All land north of the railway line (i.e. by Brigg) lying below +2.8 mOD, as shown in Figure 2.5, is below the highest fluvial water levels with a 1.0% annual probability of occurring and should therefore be classified as Zone 3 (High risk). Similarly, all land south of the compartment lying within the Zone 3 boundary is below the highest water levels with a 1.0% annual probability of occurring in the estuary and should also be classified as Zone 3 (High risk). All land in the compartment lying outside these areas should be classified as Zone 2 (Medium risk).

5.64 None of the land lying within Zone 3 is adequately protected against floods with a 1.0% annual probability of tidal flooding. This land should therefore be classified as NE/NLC SFRA Zone 3(ii) (high risk, high vulnerability). All land lying within 9m of any flood defences or of any watercourse managed by the Environment Agency or an Internal Drainage Board will be subject to restrictions laid down by the Environment Agency or the IDB.

Development restrictions

5.65 The process of deciding planning applications where flood risk is an issue, including the use of the NE/NLC SFRA matrix to determine whether an application is submitted to the Environment Agency, is set out in Chapter 7. It is recommended that in this flood compartment the following additional considerations are taken into account:-

- (a) Development on land within Zone 2 should be subject to confirmation that suitable arrangements for dealing with land drainage have been made with the Ancholme IDB.
- (b) Development on land within NE/NLC SFRA Zone 3(ii) is unlikely to be supported by the Environment Agency.
- (c) Development on land subject to Environment Agency or Ancholme IDB bye-laws is unlikely to be supported by the Environment Agency.

6. Flood Risk In Stage 3 Area – Trent Valley

Description of area

Location, extent and development potential

- 6.1 The Stage 3 Trent Valley area extends from Whitton Ness on the Humber in the north to the NLC border about 4 km south of Haxey, a total distance of some 30 km, as shown on Figure 3.1. The watershed along the Lincolnshire Edge dividing the River Ancholme and River Trent catchments forms the eastern boundary while the NLC border forms the northern and western boundary except for a short section between Whitton Ness and Trent Falls, where the boundary is the estuary shoreline.
- 6.2 The main centre of population in the area is the heavily industrialised town of Scunthorpe. Much of this is on relatively high ground but it extends east as far as the low-lying ground that forms the River Trent floodplain. There are a number of villages, wharves and industrial areas along the river, notably at Burton upon Stather, Flixborough, Gunness, Keadby, Althorpe East and West Butterwick and Owston Ferry. Further west, the flat, low-lying floodplain extends well beyond the NLC border. Originally marshland, this area was reclaimed in the 16th and 17th Centuries and is very fertile but relies on an extremely complex drainage system, almost entirely pumped, to maintain water levels low enough for arable agriculture to take place. There are a number of villages and small towns within the marsh, generally located on local high spots. The Isle of Axholme is particularly significant in this respect, reaching an elevation of 35 mOD and supporting the towns of Belton, Epworth, Haxey and Upperthorpe. Further north, Crowle stands on a noticeable high point but the small villages of Eastoft, Garthorpe and Adlingfleet are only a few metres above the surrounding marsh level.
- 6.3 Major development is planned for Scunthorpe but, except for a few areas to the west of the town, this is mostly on relatively high ground above the floodplain. There is likely to be some pressure for development along the banks of the River Trent as the wharves and industrial facilities there expand. No other parts of the area are allocated for major development.

Main sources of flood risk

- 6.4 There are two main sources of flood risk in the Stage 3 area, high water levels in the River Trent and failure of the network of watercourses and pumping stations that together drain the marshland surrounding the river.
- 6.5 Water levels in the lower section of the River Trent (north of Keadby) are dominated by tidal conditions and so are related to water levels in the Humber Estuary. Work carried out for the HESMP indicates that the water levels with given probabilities of occurrence in the river are as shown in Table 3.1, on the next page. Current guidance suggests sea levels could rise by 0.3m over the next 50 years.
- 6.6 Further upstream water levels during extreme events are due to a combination of tidal and fluvial conditions. An extensive study of the Trent flood defences was carried out during the 1960s and 1970s and included a detailed assessment of extreme water levels. The river defences were then raised to provide a consistent standard of 1:100 years, equivalent to a 1% annual probability of flooding and have since been maintained to these levels. The Environment Agency is undertaking a Flood Defence Strategy Study of the Tidal Trent (from Trent Falls to the tidal limit at Cromwell Weir) that will review the extreme water levels and flood risk throughout the system.

Table 3.1 Water levels for different probabilities of occurrence in the tidal River Trent - Stage 3 area

Location	Water level (mOD) for given annual probability		
	1.0%	0.5%	0.2%
Trent Falls	5.61	5.65	5.79
Keadby	5.79	5.82	5.83

- 6.7 The flood plain beside the River Trent is shown on Figure 3.2, taken from the Environment Agency's Flood Maps, together with the main river watercourses (SOWs are not shown as there are none within the Stage 3 area). There are two other sections of fluvial floodplain within the area, beside the Bottesford Beck and the River Eau respectively. The Bottesford Beck collects water from much of the eastern part of Scunthorpe, flowing initially south and then turning west to discharge to the Trent by gravity. The River Eau drains high land further south and much of its indicative floodplain lies outside the NLC border. Both the Bottesford Beck and the River Eau are embanked where they cross the Trent floodplain and so act as highland carriers.
- 6.8 The main river watercourses within the area are listed in Table 3.2 on the next page. Those on the right bank of the Trent are discussed above. On the left bank there are four principal watercourse groups connected to the Trent. The most northerly of these is the Stainforth & Keadby Canal, which is managed by British Waterways. This connects the River Don with the River Trent and is separated from the river at either end by a set of locks. There is no flow in the canal but it is embanked for part of its length and there is consequently a potential risk of flooding if the embankment fails since the water it contains will drain out. The two Soak Drains (one on either side of the canal) are both main river watercourses.
- 6.9 South of the canal three main river watercourses (the Hatfield Waste Drain, the River Torne and the South Level Waste Drain, each of which has some lengths of tributary watercourses which are also designated as main river) come together and run parallel with each other to the Keadby pumping station, where the flow is pumped to the River Trent. A number of pumping stations, some operated by the Environment Agency and some by the adjacent IDB, pump water into these watercourses.
- 6.10 South of the Isle of Axholme is the Warping Drain, which is about 9 km in length but now only collects the discharge from one small pumping station so has a very low flow. It is embanked in places, however, so there is a potential risk of flooding if an embankment fails, and the flow is pumped to the River Trent. Further south again is the River Idle, most of which is outside the study area except for a short section where it forms the NLC border. This is an embanked watercourse draining high ground to the south and west of the study area as well as collecting local drainage flows from Environment Agency and IDB pumping stations. The River Idle flows to West Stockwith where it is pumped to the River Trent.

Table 3.2 Main river watercourses – Stage 3 area

Name of watercourse	Watercourse type	Discharging to
River Trent	Tidal river	Humber Estuary
Bottesford Beck	Highland carrier	River Trent
River Eau	Highland carrier	River Trent
North Soak Drain	Pumped drain	River Trent
South Soak Drain	Pumped drain	River Trent
North Level Engine Drain	Pumped drain	Hatfield Waste Drain
Hatfield Waste Drain	Pumped drain	River Trent
River Torne	Pumped drain	River Trent
South Level Engine Drain	Pumped drain	River Trent
Warping Drain	Pumped drain	River Trent
River Idle	Pumped drain	River Trent

- 6.11 The responsibility for draining the low-lying land within the Stage 3 area, and managing the extremely complex drainage system that does this, is shared by the 12 IDBs listed in Table 3.3. They can be collected together into two groups, as shown on the table, one (the Shire Group) of IDBs managed by Grantham Brundell & Farran (GBF, part of JBA Consulting) and one (the Isle of Axholme Group) of those managed by the Lindsey Marsh Drainage Board (LMDB). The boundaries of the IDBs are shown on Figure 3.3.

Table 3.3 Internal Drainage Boards (IDBs) - Stage 3 area

Name of IDB	Location
Managed by GBF	
Messingham	Right bank
Scunthorpe	Right bank
Gainsborough	Right bank
Finningley	Left bank
Garthorpe	Left bank
Hatfield Chase	Left bank
Tween Bridge	Left bank
Managed by LMDB	
Adlingfleet & Whitgift	Left bank
Althorpe	Left bank
Crowle	Left bank
South Axholme	Left bank
West Axholme	Left bank
West Butterwick	Left bank

- 6.12 Figure 3.3 also shows the main river watercourses and the pumping stations that discharge to them, distinguishing between those operated by the Environment Agency and those operated by the relevant IDB. The pumping stations are listed together with operating authority and the receiving watercourse in Table 3.4 (on the next page). Only pumping stations within the study area are included, others operated by the same authorities lie just outside the area but are not included in the list.
- 6.13 The HESMP indicates that the River Trent's tidal flood defences provide a standard of protection that is currently better than 0.5% annual probability of occurrence while its fluvial defences are designed to provide a standard of 1.0% annual probability against fluvial events. The standards provided by the internal drainage system are not as good as this, however. The Environment Agency indicates that the Bottesford Beck and River Eau offer a standard of about 3.0% annual probability (a return period of 30 years) while the River Idle provides a standard of about 2.0% annual probability (return period of 1 in 50 years). The watercourses of the Three Rivers system generally give a standard of about 10% (return period of 1 in 10 years) although this rises to about 3.0% for the River Torne and the South Level Engine drain if freeboard is taken into account.
- 6.14 The IDBs aim to provide a standard of between 10% and 5% annual probability of occurrence (1:10 and 1:20 years return period) for agricultural land throughout the system but this includes a freeboard of at least 1m below local ground level (to prevent the land from being waterlogged). As a result the standard provided to property (which is not affected by flooding until the water level rises above local ground level) is generally in the range 2.0% and 1.0% annual probability (1:50 to 1:100 years return period). The IDBs have to approve the drainage arrangements of all significant new development within their boundaries or affecting their watercourses. In principle the site runoff characteristics should remain unchanged, although the IDB may accept the receiving drainage system being improved so it can accept the increased discharge, at the developer's expense.
- 6.15 The location of all recorded complaints to the District Councils about flooding in the Stage 1 area during the last five years are shown on Figure 3.4. There is no apparent clumping of complaints on a particular watercourse.
- 6.16 The above discussion concentrates on sources of flood risk within the Stage 3 area. The part north of the Stainforth & Keadby Canal is, however, also potentially at risk of flooding from two sources outside the area, the River Ouse and the River Don. The implications of this are discussed under the assessment for compartment 3T4.

Table 3.4 Drainage pumping stations - Stage 3 area

Operating authority	Pumping Station	Discharging to
Environment Agency	Belton Grange	Hatfield Waste Drain
	Bull Hassocks	South Level Engine Drain
	Candy Farm (North)	River Torne
	Candy Farm (South)	River Torne
	Dirtness	South Level Engine Drain
	Goodcop	Hatfield Waste Drain
	Keadby	River Trent
	Low Bank	River Trent
	New Zealand	North Soak Drain
	Snow Sewer Drainhead	River Trent
	Tunnel Pits (North)	River Torne
	Tunnel Pits (South)	River Torne
	West Stockwith	River Trent
	Woodcarr	Hatfield Waste Drain
Adlingfleet & Whitgift IDB	Cow Lane	Adlingfleet Drain
Althorpe IDB	Althorpe	Three Rivers
Crowle IDB	Grange Farm	(River Trent)
	Common Carrs	Paupers Drain
	Goodnow	North Soak Drain
	Paupers Drain	River Trent
	Bewcarrs	(River Trent)
Finningley IDB	Snow Sewer	Warping Drain
Hatfield Chase IDB	Blaxton Quarry	River Torne
	Cadmans	(South Level Engine Drain)
	Franklins	(South Level Engine Drain)
	South Thorne Bank	(South Level Engine Drain)
Messingham IDB	East Butterwick	River Trent
	Black Bank	River Trent
Scunthorpe IDB	Burringham	River Trent
	Flixborough	River Trent
	Lysaghts	River Trent
South Axholme IDB	South Street	River Trent
	Heckdyke	River Trent
	Three Bridges	Warping Drain
	Four Bridges	Warping Drain
Tween Bridge	North Soak Drain	North Soak Drain
West Axholme IDB	Greenham	South Level Engine Drain
	Derrythorpe	River Trent
	Kelfield	River Trent
West Butterwick	Blackdyke	River Trent
	Rushcarrs	Rushcarr Drain
	Trentside	River Trent
	Southfields	River Trent

Flood zones and flood compartments

Flood zones

- 6.17 The NE/NLC SFRA flood zone definitions are given in Table 2, in Chapter 3. The high risk zone (Zone 3) is defined as the area where the annual risk of flooding (assuming there are no defences) is more than 1.0% from a fluvial source or 0.5% from a tidal source. These are shown on the Environment Agency's Flood Maps, which are based on the results of the national mapping project mentioned in Chapter 2 but modified to take into account the findings of more detailed local modelling as discussed in Chapter 2.
- 6.18 The medium risk zone (Zone 2) is defined as the area where the annual risk of flooding is less than 0.1%, whether from a fluvial or a tidal source and again assuming there are no defences. This is also shown on the Environment Agency's Flood Maps. Again the boundary has been modified to take into account the findings of more detailed local modelling, in particular the HESMP studies indicating that the water level with this risk of occurring in the estuary is only about 0.3m higher than the water level with a 0.5% risk of occurring. As a result, the boundaries of the high risk zone beside the estuary and the adjacent medium risk zone are very close together.
- 6.19 The flood zones for the Stage 3 area are shown on Figure 3.5.

Flood compartments

- 6.20 To allow more detailed assessment, each flood risk zone has been divided into flood compartments taking into account the topography, type of defence, drainage arrangements, land use and administrative issues. These compartments are shown on Figure 3.5 and listed in Table 3.5 (on the next page) with the sources of flood risk they include.
- 6.21 Detailed flood risk assessments for each of the Trent Valley compartments are given in Annex 3. These include descriptions of the area, the sources of flood risk and the existing defences together with recommended development restrictions. The key features of each assessment are summarised below.

Table 3.5 Flood compartments - Stage 3 area

Compartment reference	Compartment name	Sources of flood risk
3T1	Alkborough	Humber Estuary
3T2	Flixborough	River Trent Scunthorpe IDB
3T3	Gunness	River Trent Bottesford Beck Scunthorpe IDB
3T4	Garthorpe & Keadby	River Trent (River Ouse) (River Don) Stainforth & Keadby Canal North Soak Drain Garthorpe IDB Adlingfleet & Whitgift IDB Tween Bridge IDB Crowle IDB
3F1	Upper Bottesford Beck	Bottesford Beck
3F2	Messingham	River Trent Bottesford Beck River Eau
3F3	Upper River Eau	River Eau Gainsborough IDB
3F4	Three Rivers	River Trent Stainforth & Keadby Canal South Soak Drain North Level Engine Drain Hatfield Waste Drain River Torne Hatfield Chase IDB
3F5	Isle of Axholme	River Trent River Torne South Level Engine Drain Warping Drain Althorpe IDB West Butterwick IDB South Axholme IDB West Axholme IDB Hatfield Chase IDB
3F6	River Idle	River Trent Warping Drain South Ancholme IDB Finningley IDB

Note:- The reference prefix denotes the primary source of flood risk in the compartment;
T = Tidal, F = Fluvial

Flood risk assessments; tidal flood compartments

Compartment 3T1: Alkborough

- 6.22 This compartment is a triangular area of land at the mouth of the Trent on its right bank. It is about 4 km long and 2 km wide at its widest point and is currently used for agriculture. It has been identified as suitable for managed realignment and a group including the Environment Agency, English Nature and NLC has recently purchased the land and is intending to develop the site for inter-tidal habitat and flood storage.
- 6.23 The Humber Estuary is the main source of flood risk to this compartment. There are no significant fluvial watercourses flowing through the area.
- 6.24 The compartment is defended from flooding by warth embankments along the estuary frontage.

Assessment of flood risk

- 6.25 All land in the compartment lying within the Zone 3 boundary, as shown in Figure 3.5, is below the highest water levels with a 0.5% annual probability of occurring in the estuary. This area should therefore be classified as Zone 3 (High risk). All land in the compartment lying outside these areas should be classified as Zone 2 (Medium risk).
- 6.26 Although at present the land lying within Zone 3 is adequately protected against floods with a 0.5% annual probability of tidal flooding, the whole area has been identified by the Environment Agency as suitable for managed retreat. The land should therefore be classified as NE/NLC SFRA Zone 3(iii) (functional floodplain). All land lying within 9m of any flood defences or of any watercourse managed by the Environment Agency or an Internal Drainage Board will be subject to restrictions laid down by the Environment Agency or the IDB.

Development restrictions

- 6.27 The process of deciding planning applications where flood risk is an issue, including the use of the NE/NLC SFRA matrix to determine whether an application is submitted to the Environment Agency, is set out in Chapter 7. It is recommended that in this flood compartment the following additional considerations are taken into account:-
- (a) Development on land within Zone 2 should be subject to confirmation that suitable arrangements for dealing with land drainage have been made with Scunthorpe IDB and agreed with the Environment Agency.
 - (b) Development on land within NE/NLC SFRA Zone 3(iii) (functional floodplain) should be wholly exceptional and is unlikely to be supported by the Environment Agency.
 - (c) Development on land subject to Environment Agency or Scunthorpe IDB bye-laws is unlikely to be supported by the Environment Agency.

Compartment 3T2: Flixborough

- 6.28 This compartment is on the right bank of the River Trent and extends from high ground north of Burton Stather to the minor road running between Flixborough Stather and Flixborough village. It is about 4 km long and 1.2 km wide at its widest point. It contains some industrial development at its two ends (at Burton Stather in the north and Flixborough Industrial Estate in the south). The area

between the two developed areas is currently used for agriculture but has been identified by the Environment Agency as potentially suitable for managed realignment to create flood storage.

- 6.29 The primary source of flood risk to this compartment is high water levels in the Humber Estuary leading to high water levels in the River Trent. There are no other significant watercourses flowing through the area.
- 6.30 The flood defences are generally earth embankments along the bank of the River Trent except at Burton Stather and the Flixborough Industrial Estate, where the defences are incorporated with the quay structures.

Assessment of flood risk

- 6.31 All land in the compartment lying within the Zone 3 boundary, as shown in Figure 3.5, is below the highest water levels with a 0.5% annual probability of occurring in the estuary. This area should therefore be classified as Zone 3 (High risk). All land in the compartment lying outside these areas should be classified as Zone 2 (Medium risk).
- 6.32 In principle, most of the land lying within Zone 3 is adequately protected against floods with a 0.5% (tidal) or 1.0% (fluvial) annual probability of occurring and therefore may be classified as NE/NLC SFRA Zone 3(i) (high risk, low vulnerability). There are a number of exceptions to this however, as follows:-
- (a) All land lying within 9m of any flood defences or of any watercourse managed by the Environment Agency or an Internal Drainage Board will be subject to restrictions laid down by the Environment Agency or the IDB.
 - (b) Although the Trent's defences are currently in reasonable condition there is, nevertheless, a risk that they will fail, resulting in a breach. If this happens at high tide, water will flow through the breach at high velocity posing a significant risk to people and property in the immediate vicinity. Given that the peak water level in the river is about +5.8 mOD and the ground level immediately behind the defences is generally about +3.0 mOD or less, Table 5 indicates that a 200m wide zone should be classified as NE/NLC SFRA Zone 3(ii) (high risk, high vulnerability).
 - (c) If the Trent's defences are breached during an event with a 0.5% annual probability, flooding up to about +3.5 mOD could occur. All land lying below +3.0 mOD is therefore potentially at risk of being flooded to a depth of 0.5m. Table 3 indicates that such land should be classified as NE/NLC SFRA Zone 3(ii) (high risk, high vulnerability).
 - (d) Much of the remaining area has been identified by the Environment Agency as suitable for managed retreat and should be classified as NE/NLC SFRA Zone 3(iii) (functional floodplain).

Development restrictions

- 6.33 The process of deciding planning applications where flood risk is an issue, including the use of the NE/NLC SFRA matrix to determine whether an application is submitted to the Environment Agency, is set out in Chapter 7. It is recommended that in this flood compartment the following additional considerations are taken into account:-

- (a) Development on land within Zone 2 should be subject to confirmation that suitable arrangements for dealing with land drainage have been made with Scunthorpe IDB and agreed with the Environment Agency.
- (b) Development on land within NE/NLC SFRA Zone 3(i) should be subject to confirmation that suitable arrangements for dealing with land drainage have been made with Scunthorpe IDB and agreed with the Environment Agency.
- (c) Development on land within NE/NLC SFRA Zone 3(iii) (functional floodplain) should be wholly exceptional and is unlikely to be supported by the Environment Agency.
- (d) Development on land subject to Environment Agency or Scunthorpe IDB bye-laws is unlikely to be supported by the Environment Agency.

Compartment 3T3: Gunness

- 6.34 This compartment is on the right bank of the River Trent, extends from Flixborough Stather to the Bottesford Beck and is about 8.5 km long and 4 km wide at its widest point. It contains some industrial development, particularly at Grove Wharf and Gunness, together with the A18 and A1077, the M180 and the Scunthorpe to Doncaster railway line. It also includes the western fringe of Scunthorpe, where there is both housing and industry. The remainder of the area is used for agriculture.
- 6.35 The primary source of flood risk to this compartment is high water levels in the River Trent. The Environment Agency's indicative flood plain map shows the area north of the M180 motorway as being subject to tidal flooding (i.e. due to high water levels in the Humber Estuary) and the area further south as subject to either tidal or fluvial flooding (i.e. due to high flows in the River Trent). There is one source of fluvial flooding, the Bottesford Beck (an embanked high-level conveyor draining the eastern and southern parts of Scunthorpe). The local drainage system is managed by Scunthorpe IDB.
- 6.36 The River Trent flood defences consist largely of earth embankments with short sections of quay wall in the wharf areas. The Bottesford Beck defences consist entirely of earth embankments.

Assessment of flood risk

- 6.37 All land in the compartment lying within the Zone 3 boundary, as shown in Figure 3.5, is below the highest water levels with a 0.5% annual probability of occurring in the estuary. This area should therefore be classified as Zone 3 (High risk). All land in the compartment lying outside these areas should be classified as Zone 2 (Medium risk).
- 6.38 In principle, most of the land lying within Zone 3 is adequately protected against floods with a 0.5% (tidal) or 1.0% (fluvial) annual probability of occurring and therefore may be classified as NE/NLC SFRA Zone 3(i) (high risk, low vulnerability). There are a number of exceptions to this however, as follows:-
 - (a) All land lying within 9m of any flood defences or of any watercourse managed by the Environment Agency or an Internal Drainage Board will be subject to restrictions laid down by the Environment Agency or the IDB.

- (b) Although the Trent's defences are currently in reasonable condition there is, nevertheless, a risk that they will fail, resulting in a breach. If this happens at high tide, water will flow through the breach at high velocity posing a significant risk to people and property in the immediate vicinity. Given that the peak water level in the river is about +5.8 mOD and the ground level immediately behind the defences is generally about +3.0 mOD or less, Table 5 indicates that a 200m wide zone should be classified as NE/NLC SFRA Zone 3(ii) (high risk, high vulnerability).
- (c) If the Trent's defences are breached during an event with a 0.5% annual probability, flooding up to about +3.5 mOD could occur. All land lying below +3.0 mOD is therefore potentially at risk of being flooded to a depth of 0.5 m. Table 3 indicates that such land should be classified as NE/NLC SFRA Zone 3(ii) (high risk, high vulnerability).
- (d) The M181/A1077 road system is raised above the surrounding land and could protect the land to the east from flooding if the Trent's defences are breached provided measures are taken to prevent reverse flows through the culverts and other openings in the embankments. The land east of these roads could then be classified as NE/NLC SFRA Zone 3(i) (high risk, low vulnerability).
- (e) The Bottesford Beck's defences do not provide protection against a 0.1% probability event. Should such an event occur and the defences are overwhelmed the M180 motorway, which is raised above the surrounding land, will prevent overland flow and so limit flooding further north. Floodwater will flow through the IDB drainage system however, and will pool in low-lying land near the Burringham pumping station. Land south of the motorway and near the pumping station should therefore be classified as NE/NLC SFRA Zone 3(ii) (high risk, high vulnerability).

Development restrictions

6.39 The process of deciding planning applications where flood risk is an issue, including the use of the NE/NLC SFRA matrix to determine whether an application is submitted to the Environment Agency, is set out in Chapter 7. It is recommended that in this flood compartment the following additional considerations are taken into account:-

- (a) Development on land within Zone 2 should be subject to confirmation that suitable arrangements for dealing with land drainage have been made with Scunthorpe IDB and agreed with the Environment Agency.
- (b) Development on land within NE/NLC SFRA Zone 3(i) should be subject to confirmation that suitable arrangements for dealing with land drainage have been made with Scunthorpe IDB and agreed with the Environment Agency.
- (c) Development on land within NE/NLC SFRA Zone 3(ii) is unlikely to be supported by the Environment Agency. Exceptions may be made for developments east of the M181/A1077 road system provided adequate measures are taken to prevent reverse flows through openings in the road embankments.
- (d) Development on land subject to Environment Agency or Scunthorpe IDB bye-laws is unlikely to be supported by the Environment Agency.

Compartment 3T4: Garthorpe & Keadby

- 6.40 This compartment is on the left bank of the River Trent and extends from the NLC border to the Stainforth & Keadby Canal. It is about 8 km from north to south and 12 km east to west at its widest point. The flat, low-lying land that forms the Trent floodplain extends well beyond the NLC border. This area is very fertile but relies on an extremely complex drainage system, almost entirely pumped, to maintain water levels low enough for arable agriculture to take place. There are a number of villages within the marsh, generally located on local high spots. Crowle stands on a noticeable high point but Eastoft, Garthorpe, Luddington and Adlingfleet are only a few metres above the surrounding marsh level. Apart from a major power station at Keadby the area is devoted largely to agriculture.
- 6.41 In principle this compartment is surrounded by four watercourses (the Trent, Ouse and Don Rivers and the Stainforth & Keadby Canal) and is therefore at risk of flooding from them all. In practice the Canal poses only a limited risk since it carries no flow. The River Don could affect the western part of the compartment (beyond Crowle) and the River Ouse the northern part. The primary sources of flood risk, however, are the River Trent and the local drainage system. This includes the North Soak Drain, classified as main river, and the systems managed by the four IDBs listed in Table 3.5.
- 6.42 The River Trent and River Ouse flood defences consist largely of earth embankments although there are some lengths of sheet-pile and other walls.

Assessment of flood risk

- 6.43 All land in the compartment lying within the Zone 3 boundary, as shown in Figure 3.5, is below the highest water levels with a 0.5% annual probability of occurring in the estuary. This area should therefore be classified as Zone 3 (High risk). All land in the compartment lying outside these areas should be classified as Zone 2 (Medium risk).
- 6.44 If the defences beside the Ouse or the Trent are breached during an event with a 0.5% (tidal) or 1.0% (fluvial) probability of occurring, or if the Stainforth & Keadby Canal's bank is breached, flooding could occur up to levels of between about +2.0 and +2.5 mOD. This would affect the low-lying areas north of Eastoft and east and west of Crowle. In principle, therefore, the remaining land within Zone 3 is adequately protected against flooding. Nevertheless, the very flat and low-lying nature of the land, the complexity of the drainage system and the heavy reliance on pumping mean that, in practice, if the defences fail flooding could be widespread and in locations that are difficult to predict. Under these circumstances only those places where the ground level is more than 0.5 m higher than the average ground level in the surrounding area (taken as +3.0 mOD) should be considered as being safe from flooding. As a result, only land above +3.5 mOD is classified as NE/NLC SFRA Zone 3(i) (high risk, low vulnerability). There are two further issues to be considered, as follows:-
- (a) All land lying within 9m of any flood defences or of any watercourse managed by the Environment Agency or an Internal Drainage Board will be subject to restrictions laid down by the Environment Agency or the IDB.
 - (b) Although the Trent's defences are currently in reasonable condition there is, nevertheless, a risk that they will fail, resulting in a breach. If this happens at high tide, water will flow through the breach at high velocity posing a significant risk to people and property in the immediate vicinity. Given that the peak water level in the river is about +5.8 mOD and the ground

level immediately behind the defences is generally about +3.5 mOD, Table 5 indicates that a 100m wide zone could be affected.

Development restrictions

6.45 The process of deciding planning applications where flood risk is an issue, including the use of the NE/NLC SFRA matrix to determine whether an application is submitted to the Environment Agency, is set out in Chapter 7. It is recommended that in this flood compartment the following additional considerations are taken into account:-

- (a) Development on land within Zone 2 should be subject to confirmation that suitable arrangements for dealing with land drainage have been made with the appropriate IDB and agreed with the Environment Agency.
- (b) Development on land within NE/NLC SFRA Zone 3(i) should be subject to confirmation that suitable arrangements for dealing with land drainage have been made with the appropriate IDB and agreed with the Environment Agency.
- (c) Development on land within NE/NLC SFRA Zone 3(ii) is unlikely to be supported by the Environment Agency.
- (d) Development on land subject to Environment Agency or IDB bye-laws is unlikely to be supported by the Environment Agency.

Flood risk assessments; fluvial flood compartments

Compartment 3F1: Upper Bottesford Beck

6.46 The Bottesford Beck drains the southern and eastern parts of Scunthorpe. Its lower reaches are embanked to carry the drainage flows across the floodplain to the River Trent. This compartment begins at the limit of compartment 3T3 and its other boundaries are taken as the limit of the Environment Agency's indicative fluvial floodplain. They will be reviewed once the results of the Environment Agency's model studies to determine the extent of the medium flood risk area (discussed in Chapter 2) are available. The lower part of the compartment includes some properties on the edge of existing developments and a significant part of its upper reaches is heavily industrialised, including part of Scunthorpe Steelworks.

6.47 The Bottesford Beck is the only source of flood risk in the compartment. A major source of concern is the sensitivity of the flood risk to future development in the catchment. The outflow from the upper part of the compartment is likely to be constricted, causing flood levels to respond more strongly to changes in flow rate than catchments where the outflow is less constrained. As a result any development within this catchment that increases the rate of runoff will have a greater impact on flood risk than a development in a less sensitive catchment.

6.48 There are no flood defences within this compartment.

Assessment of flood risk

6.49 All land in the compartment lying within the Zone 3 boundary, as shown in Figure 3.5, is below the highest water levels with a 1.0% annual probability of occurring in the Bottesford Beck. This area should therefore be classified as Zone 3 (High risk). None of this land is adequately protected

against flooding and it should therefore all be classified as NE/NLC SFRA Zone 3(ii) (high risk, high vulnerability). There are two further issues to be considered, as follows:-

- (a) All land lying within 9m of any flood defences or of any watercourse managed by the Environment Agency be subject to restrictions laid down by the Environment Agency.
- (b) In view of the sensitivity of the flooding in this compartment to changes in runoff rates the Environment Agency's requirement for new developments within the catchment to install on-site storage and other measures to minimise the impact on drainage discharge rates should be rigorously enforced.

Development restrictions

6.50 The process of deciding planning applications where flood risk is an issue, including the use of the NE/NLC SFRA matrix to determine whether an application is submitted to the Environment Agency, is set out in Chapter 7. It is recommended that in this flood compartment the following additional considerations are taken into account:-

- (a) Development on land within NE/NLC SFRA Zone 3(ii) is unlikely to be supported by the Environment Agency.
- (b) Development on land subject to Environment Agency or IDB bye-laws is unlikely to be supported by the Environment Agency.
- (c) The Environment Agency's requirement for the impact of any new development within the catchment on drainage flow rates to be minimised should be rigorously enforced.

Compartment 3F2: Messingham

6.51 This compartment is on the right bank of the River Trent and extends from the Bottesford Beck to the River Eau, which also marks the NLC border. It is about 3 km from north to south and 4.5 km from east to west and is largely devoted to agriculture.

6.52 The primary source of flood risk to this compartment is high water levels in the River Trent, which are influenced by tidal conditions as well as by rainfall and catchment characteristics, in particular floodplain storage further upstream. There are in addition two other main river watercourses that could affect the compartment, the Bottesford Beck and the River Eau.

6.53 The River Trent flood defences consist largely of earth embankments, as do the Bottesford Beck and River Eau defences. There is a flood storage area upstream of the embanked section on the left bank of the River Eau (and therefore outside the NLC border and so outside the compartment).

Assessment of flood risk

6.54 All land in the compartment lying within the Zone 3 boundary, as shown in Figure 3.5, is below the highest water levels with a 0.5% annual probability of occurring in the River Trent. This area should therefore be classified as Zone 3 (High risk). All land in the compartment lying outside these areas should be classified as Zone 2 (Medium risk).

6.55 Although much of the land lying within Zone 3 is adequately protected against floods with a 0.5% tidal or 1.0% fluvial annual probability of occurring in the River Trent, it is not protected against

floods with a 1.0% probability of happening in Bottesford Beck or the River Eau and should therefore be classified as NE/NLC SFRA Zone 3(ii) (high risk, high vulnerability). There are two further issues to be considered, as follows:-

- (a) All land lying within 9m of any flood defences or of any watercourse managed by the Environment Agency or an Internal Drainage Board will be subject to restrictions laid down by the Environment Agency or the IDB.
- (b) Although the Trent's defences are currently in reasonable condition there is, nevertheless, a risk that they will fail, resulting in a breach. If this happens at high tide, water will flow through the breach at high velocity posing a significant risk to people and property in the immediate vicinity. Given that the peak water level in the river is greater than +5.8 mOD and the ground level immediately behind the defences is generally about +3.5 mOD, Table 5 indicates that a 150m wide zone could be affected.

Development restrictions

6.56 The process of deciding planning applications where flood risk is an issue, including the use of the NE/NLC SFRA matrix to determine whether an application is submitted to the Environment Agency, is set out in Chapter 7. It is recommended that in this flood compartment the following additional considerations are taken into account:-

- (a) Development on land within Zone 2 should be subject to confirmation that suitable arrangements for dealing with land drainage have been made with Messingham IDB and agreed with the Environment Agency.
- (b) Development on land within NE/NLC SFRA Zone 3(ii) is unlikely to be supported by the Environment Agency.
- (c) Development on land subject to Environment Agency or Messingham IDB bye-laws is unlikely to be supported by the Environment Agency.

Compartment 3F3: Upper River Eau

6.57 Although the NLC border and the River Eau diverge upstream of compartment 3F2, the border then turns south and crosses the river again further upstream. As a result there is a small area of land at risk of flooding west of Kirton in Lindsey, which is this compartment. It is about 5 km long and 2 km wide at its widest point.

6.58 The River Eau is the only source of flood risk in the compartment. Gainsborough IDB manages the local drainage.

6.59 There are no flood defences within this compartment.

Assessment of flood risk

6.60 All land in the compartment lying within the Zone 3 boundary, as shown in Figure 3.5, is below the highest water levels with a 1.0% annual probability of occurring in the River Eau. This area should therefore be classified as Zone 3 (High risk). All land in the compartment lying outside this area should be classified as Zone 2 (Medium risk).

- 6.61 None of the land within Zone 3 is adequately protected against flooding and it should therefore all be classified as NE/NLC SFRA Zone 3(ii) (high risk, high vulnerability). All land lying within 9m of any flood defences or of any watercourse managed by the Environment Agency or an IDB will be subject to restrictions laid down by the Environment Agency or the IDB.

Development restrictions

- 6.62 The process of deciding planning applications where flood risk is an issue, including the use of the NE/NLC SFRA matrix to determine whether an application is submitted to the Environment Agency, is set out in Chapter 7. It is recommended that in this flood compartment the following additional considerations are taken into account:-

- (a) Development on land within NE/NLC SFRA Zone 3(ii) is unlikely to be supported by the Environment Agency.
- (b) Development on land subject to Environment Agency or Gainsborough IDB bye-laws is unlikely to be supported by the Environment Agency.

Compartment 3F4: Three Rivers

- 6.63 This compartment is on the left bank of the River Trent and lies between the Stainforth & Keadby Canal and the River Torne, which is one of the watercourses that are together known as the Three Rivers. It is about 10 km from east to west and 9 km north to south at its widest point. It lies in the Trent floodplain and, like the rest of the area, relies on a complex drainage system, almost entirely pumped, to maintain water levels low enough for arable agriculture to take place. It contains small villages and isolated farms, is extremely flat and very fertile, is devoted largely to agriculture and is crossed by the M180, the A18 and A161 and a number of minor roads.
- 6.64 The main sources of flood risk to this compartment are high water levels in the River Trent (which are influenced by tidal conditions as well as by rainfall and catchment characteristics, in particular floodplain storage further upstream and four main river watercourses, the South Soak Drain, the Hatfield Waste Drain, the North Level Engine Drain (which runs beside the Hatfield Waste Drain for much of its length and eventually joins it) and the River Torne. The Stainforth & Keadby Canal poses only a limited risk since it carries no flow.
- 6.65 There are defences along the very short length of the River Trent beside the compartment and the River Torne is embanked over part of its. There are no other significant formal flood defences.

Assessment of flood risk

- 6.66 All land in the compartment, as shown in Figure 3.5, is below the water levels that would occur with a 0.5% annual probability of occurring in the River Trent. This area should therefore be classified as Zone 3 (High risk).
- 6.67 Although much of the land lying within Zone 3 is apparently adequately protected against water levels with a 0.5% (tidal) or 1.0% (fluvial) annual probability of occurring in the Trent, nevertheless the very flat and low-lying nature of the land, the complexity of the drainage system, the low standard of protection it affords and the heavy reliance on pumping mean that during an extreme event flooding could be widespread and in locations that are difficult to predict. Under these circumstances only those places where the ground level is more than 0.5 m higher than the average ground level in the surrounding area (taken as +3.0 mOD) should be considered as being safe from flooding.

As a result, only land above +3.5 mOD is classified as NE/NLC SFRA Zone 3(i) (high risk, low vulnerability). There are two further issues to be considered, as follows:-

- (a) All land lying within 9m of any flood defences or of any watercourse managed by the Environment Agency or an Internal Drainage Board will be subject to restrictions laid down by the Environment Agency or the Hatfield Chase IDB.
- (b) Although the Trent's defences are currently in reasonable condition there is, nevertheless, a risk that they will fail, resulting in a breach. If this happens at high tide, water will flow through the breach at high velocity posing a significant risk to people and property in the immediate vicinity. Given that the peak water level in the river is about +5.8 mOD and the ground level immediately behind the defences is generally about +3.5 mOD, Table 5 indicates that a 100m wide zone should therefore be classified as NE/NLC SFRA Zone 3(ii) (high risk, high vulnerability).

Development restrictions

6.68 The process of deciding planning applications where flood risk is an issue, including the use of the NE/NLC SFRA matrix to determine whether an application is submitted to the Environment Agency, is set out in Chapter 7. It is recommended that in this flood compartment the following additional considerations are taken into account:-

- (a) Development on land within NE/NLC SFRA Zone 3(i) should be subject to confirmation that suitable arrangements for dealing with land drainage have been made with the appropriate IDB and agreed with the Environment Agency.
- (b) Development on land within Zone 3(ii) is unlikely to be supported by the Environment Agency.
- (c) Development on land subject to Environment Agency or the Hatfield Chase IDB bye-laws is unlikely to be supported by the Environment Agency.

Compartment 3F5: Isle of Axholme

6.69 This compartment is on the left bank of the River Trent and lies between the River Torne and the Warping Drain. Its overall compartment dimensions are about 13 km from east to west and the same distance from north to south but it contains a large area of land (the Isle of Axholme) that is above the general floodplain level and is therefore excluded from the assessment. It is flat, very fertile, devoted largely to agriculture and, like the rest of the Trent floodplain, relies on a complex drainage system, almost entirely pumped, to maintain water levels low enough for arable agriculture to take place. Parts of some villages lie within it and the M180 motorway, the A18, A161 and a number of minor roads cross it.

6.70 The main source of flood risk to this compartment is high water levels in the River Trent. The Environment Agency's indicative flood plain map shows the area north of the M180 motorway as being subject to tidal flooding (i.e. due to high water levels in the Humber Estuary) and the area further south as subject to either tidal or fluvial flooding (i.e. due to high flows in the River Trent). The other sources are the other three main river watercourses (River Torne, South Level Engine Drain and Warping Drain) and the local IDB systems (managed by Althorpe, West Butterwick, West Axholme, South Axholme and Hatfield Chase IDBs).

- 6.71 The River Trent flood defences consist largely of earth embankments. The River Torne and the Warping Drain are also embanked over part of their length.

Assessment of flood risk

- 6.72 All land in the compartment lying within the Zone 3 boundary, as shown in Figure 3.5, is below the highest water levels with a 0.5% annual probability of occurring in the River Trent. This area should therefore be classified as Zone 3 (High risk). All land in the compartment lying outside these areas should be classified as Zone 2 (Medium risk).

- 6.73 Although much of the land lying within Zone 3 is apparently adequately protected against water levels with a 0.5% (tidal) or 1.0% (fluvial) annual probability of occurring in the Trent, nevertheless the very flat and low-lying nature of the land, the complexity of the drainage system, the low standard of protection it affords and the heavy reliance on pumping mean that during an extreme event flooding could be widespread and in locations that are difficult to predict. Under these circumstances only those places where the ground level is more than 0.5 m higher than the average ground level in the surrounding area (taken as +3.0 mOD) should be considered as being safe from flooding. As a result, only land above +3.5 mOD is classified as NE/NLC SFRA Zone 3(i) (high risk, low vulnerability). There are two further issues to be considered, as follows:-

- (a) All land lying within 9m of any flood defences or of any watercourse managed by the Environment Agency or an Internal Drainage Board will be subject to restrictions laid down by the Environment Agency or the appropriate IDB.
- (b) Although the Trent's defences are currently in reasonable condition there is, nevertheless, a risk that they will fail, resulting in a breach. If this happens at high tide, water will flow through the breach at high velocity posing a significant risk to people and property in the immediate vicinity. Given that the peak water level in the river is about +5.8 mOD and the ground level immediately behind the defences is generally about +3.5 mOD, Table 5 indicates that a 100m wide zone should therefore be classified as NE/NLC SFRA Zone 3(ii) (high risk, high vulnerability).

Development restrictions

- 6.74 The process of deciding planning applications where flood risk is an issue, including the use of the NE/NLC SFRA matrix to determine whether an application is submitted to the Environment Agency, is set out in Chapter 7. It is recommended that in this flood compartment the following additional considerations are taken into account:-

- (a) Development on land within Zone 2 should be subject to confirmation that suitable arrangements for dealing with land drainage have been made with the appropriate IDB and agreed with the Environment Agency.
- (b) Development on land within NE/NLC SFRA Zone 3(i) should be subject to confirmation that suitable arrangements for dealing with land drainage have been made with the appropriate IDB and agreed with the Environment Agency.
- (c) Development on land within NE/NLC SFRA Zone 3(ii) is unlikely to be supported by the Environment Agency.

- (d) Development on land subject to Environment Agency or IDB bye-laws is unlikely to be supported by the Environment Agency.

Compartment 3F6: River Idle

- 6.75 This compartment is on the left bank of the River Trent and lies between the Warping Drain and the southern NLC border (which runs along the River Idle for part of its length. It is 9 km from east to west and 4 km from north to south at its widest part. The land is flat, very fertile, devoted largely to agriculture, contains no significant villages and, like the rest of the Trent floodplain, relies on a complex drainage system, almost entirely pumped, to maintain water levels low enough for arable agriculture to take place. The A161 main road crosses it.
- 6.76 The main source of flood risk to this compartment is high water levels in the River Trent, which are influenced by tidal conditions as well as by rainfall and catchment characteristics, in particular floodplain storage further upstream. The other sources are the other two main river watercourses (Warping Drain and River Idle) and the local IDB systems (managed by Finningley and South Axholme IDBs).
- 6.77 The River Trent flood defences consist largely of earth embankments. The River Idle and the Warping Drain are also embanked

Assessment of flood risk

- 6.78 All the land in the compartment lies within the Zone 3 boundary, as shown in Figure 3.5, and is therefore below the highest water levels with a 0.5% annual probability of occurring in the River Trent. The whole area should therefore be classified as Zone 3 (High risk).
- 6.79 Although much of the land lying within Zone 3 is apparently adequately protected against water levels with a 0.5% (tidal) or 1.0% (fluvial) annual probability of occurring in the Trent, nevertheless the very flat and low-lying nature of the land, the complexity of the drainage system, the low standard of protection it affords and the heavy reliance on pumping mean that during an extreme event flooding could be widespread and in locations that are difficult to predict. Under these circumstances only those places where the ground level is more than 0.5 m higher than the average ground level in the surrounding area (taken as +3.0 mOD) should be considered as being safe from flooding. As a result, only land above +3.5 mOD is classified as NE/NLC SFRA Zone 3(i) (high risk, low vulnerability). There are two further issues to be considered, as follows:-
 - (a) All land lying within 9m of any flood defences or of any watercourse managed by the Environment Agency or an Internal Drainage Board will be subject to restrictions laid down by the Environment Agency or the IDB.
 - (b) Although the Trent's defences are currently in reasonable condition there is, nevertheless, a risk that they will fail, resulting in a breach. If this happens at high tide, water will flow through the breach at high velocity posing a significant risk to people and property in the immediate vicinity. Given that the peak water level in the river is about +5.8 mOD and the ground level immediately behind the defences is generally about +3.5 mOD, Table 5 indicates that a 100m wide zone could be affected.

Development restrictions

6.80 The process of deciding planning applications where flood risk is an issue, including the use of the NE/NLC SFRA matrix to determine whether an application is submitted to the Environment Agency, is set out in Chapter 7. It is recommended that in this flood compartment the following additional considerations are taken into account:-

- (a) Development on land within NE/NLC SFRA Zone 3(i) should be subject to confirmation that suitable arrangements for dealing with land drainage have been made with the appropriate IDB and agreed with the Environment Agency.
- (b) Development on land within NE/NLC SFRA Zone 3(ii) is unlikely to be supported by the Environment Agency.
- (c) Development on land subject to Environment Agency or IDB bye-laws is unlikely to be supported by the Environment Agency.

7. Managing Future Flood Risk - Development Planning And Control

- 7.1 The previous chapters identify the flood risk areas and classify them in accordance with the flood risk zones set out in PPG25 and as modified for this study in Chapter 3. This chapter addresses the actions to be taken in each of these zones.

Roles and responsibilities

- 7.2 Both North and North East Lincolnshire Council are the local planning authority in their area and are therefore responsible for deciding all planning applications for development in that area. PPG25, however, requires local planning authorities to address the problems which flooding can cause when making these decisions by, among other things, taking the susceptibility of land to flooding into account and by applying the precautionary principle (using a risk-based search sequence) so that risk is avoided where possible and avoided elsewhere. It also requires them to consult the Environment Agency, which has the lead role in providing advice to on flood issues, and other relevant organisations.
- 7.3 The Environment Agency has a duty to 'exercise a general supervision over all matters relating to flood defence' but has limited direct powers to control activities affecting flood risk. It therefore depends upon an effective planning system to prevent future problems arising as a result of development in areas at risk of flooding. It is a statutory consultee for all forward planning policy documents, for environmental assessment and for certain categories of development. The Lincoln Office of the Environment Agency's Anglian Region is the first point of contact for flood risk issues in the North and North East Lincolnshire Council areas, although it passes detailed issues relating to the River Trent on to the Midland Region. Contact addresses are given in Appendix D.
- 7.4 Internal Drainage Boards have powers to carry out measures to alleviate flooding in districts with special drainage needs, other than on those watercourses managed directly by the Environment Agency. The drainage boards with responsibilities within the North and North East Lincolnshire Council areas are listed in Table 6 (on the next page) and the areas they administer are shown on Figure 3. The names of boards that employ an external organisation to act as Engineer are followed by the initials of that relevant organisation, either GBF (Grantham Brundell and Farran) or LMIDB (Lindsey Marsh IDB). The Councils themselves have powers to maintain or improve watercourses (other than those managed by the Environment Agency) except in internal drainage districts. As highway authorities, they are responsible for draining highways. Anglian Water Services Ltd, is the water company responsible for managing the sewerage systems within the Council areas. Together, these are the 'other relevant organisations' referred to in PPG25 with regard to consultations about flood risk issues. Contact addresses are again given in Appendix D

Table 6 Internal Drainage Boards

Stage and Area	Internal Drainage Board
Stage 1 – Eastern Coastal Area	Lindsey Marsh North East Lindsey
Stage 2 – River Ancholme Area	Ancholme (GBF)
Stage 3 – River Trent Area	Adlingfleet and Whitgift (LMIDB) Althorpe (LMIDB) Crowle (LMIDB) Garthorpe (GBF) Finningley (GBF) Hatfield Chase (GBF) Messingham (GBF) Scunthorpe (GBF) South Axholme (LMIDB) Tween Bridge (GBF) West Axholme (LMIDB) West Butterwick (LMIDB)

Environment Agency standing advice

- 7.5 To simplify the process of deciding planning applications where flood risk is an issue, the Environment Agency¹² has produced standing advice to local planning authorities. This identifies situations where the flood risk and vulnerability to flooding is sufficiently low to allow the planning authority to make the decision without consulting the Environment Agency. It also identifies those higher risk situations where case-by-case consultation with the Environment Agency should continue. A copy of the standing advice is attached as Appendix E
- 7.6 The standing advice is accompanied by a Flood Risk Response Matrix, which describes the actions that should be taken for developments located in the three main flood risk zones described in PPG25. This matrix has been amended for the circumstances found in the NE/NLC areas by extending it to cover all the flood risk zones discussed in Chapter 2 and listed in Table 2 together with a list of critical flood levels for each flood compartment (attached as Appendix C). A copy of the amended matrix is enclosed on the CD. Further copies can be obtained from the council offices (see Appendix D for contact address). Both the standing advice and the NE/NLC matrix refer to flood risk areas, which are the areas shown on the flood risk maps accompanying this document.
- 7.7 While the general principles set out in the standing advice continue to apply to the NE/NLC matrix, the amendments have introduced the flexibility needed to take account of local circumstances. As a result the advice needs to be read in the context of the description of the matrix and how it should be used set out in the following paragraphs.
- 7.8 The NE/NLC response matrix identifies 8 categories of development and 5 possible locations for each category. A copy of the matrix as it appears is given in Table 7. The matrix has comments attached, giving more information about the headings (A to G) describing the issues raised and actions to be taken concerning applications that are covered by the matrix (3 to 10). These comments can be seen within the matrix on the CD by placing the cursor over the relevant part of the matrix but are

not visible in the table. In addition, the comments attached to the matrix are listed in Table 8. The response matrix can also be accessed on the North Lincolnshire Councils web site.

Process for deciding a planning application

7.9

The standing advice sets out the procedure to be followed when a planning application is received. In principle this is as follows:-

- (i) Check the flood risk maps to determine whether the proposed development is located:-
 - On land within 9m of the bank top of a 'main river' (a watercourse managed by the Environment Agency) or a coastal defence, where Environment Agency byelaws apply. Environment Agency consent is required for all such developments and is likely to be refused on the basis that an access strip is needed for maintenance purposes.
 - Within a high flood risk area defined as functional floodplain (NE/NLC SFRA Zone 3(iii) - shaded purple on the flood risk maps)
 - Within a high flood risk area where the standard of defence is not appropriate or the flood risk unacceptable (NE/NLC SFRA Zone 3 (ii) - shaded in red on the flood risk maps).
 - Within a high flood risk area where the standard of defence is appropriate and the flood risk acceptable (NE/NLC SFRA Zone 3 (i) - shaded in pink on the flood risk maps).
 - Outside the high flood risk area (i.e. within Zones 1 and 2).

This will determine into which column of the matrix the development will fall.

Note that if a proposed development is located within 5m of an ordinary watercourse (a watercourse that is not 'main river') then consent may also be required under the Land Drainage Act 1991. This applies to all categories of development and all flood risk areas. Similarly, any proposed development located on land administered by an Internal Drainage Board (all the Zone 3 areas and the areas shown in blue on the flood risk maps) will require consent from that Board.

- (ii) Determine the development type against the categories set out on the vertical axis of the matrix. This will into which row of the matrix the development will fall.
- (iii) Determine into which box of the matrix the proposed development falls. Note that if a proposed development falls into more than one development type or flood risk zone then the higher risk response should be adopted. As an example, a 0.9 ha hospital development within a flood risk area where the standard of defence is adequate should be considered under the 'Civil emergency infrastructure' category (red box) rather than the 'Operational development less than 1.0 ha' category (green box).
- (iv) Interpret the information within the relevant cell of the matrix. Note that if the proposal falls into a **red** box the application can go straight to the Environment Agency for consultation. If it falls into a **green** box the Environment Agency's response will be as set out in the matrix

and the application should go to the Local Planning Authority, which will decide it accordingly. If it falls within a **grey** box the application is outside the scope of this standing advice and will be decided by the Local Planning Authority without reference to the Environment Agency.

To help developers, some guidance on basic surface water drainage issues has been provided for larger developments within this category.

Note that although development falling within the **green** or **grey** boxes can be decided without reference to the Environment Agency on **flood risk** grounds, consultation may still be required in relation to **other environmental issues**. The Environment Agency's standing advice relating to such other issues should therefore always be checked.

Flood risk assessments accompanying planning applications

7.10 The standing advice points out that PPG25 requires every planning application to be accompanied by a FRA, irrespective of the flood risk zone in which the proposed development is located. For proposals falling within high flood risk areas (i.e. columns 2, 3 and 4 in the matrix) the FRA will need to address both:-

- the risk to the development itself, from whatever cause; and
- the risk to others due to surface water from the development.

Proposals within medium and low flood risk areas (i.e. columns 5 and 6 of the matrix) will only need to address the latter issue. The FRA will need to show that the organisations affected by surface water draining from the development (the Internal Drainage Board, Anglian Water Services or the Council) have been consulted on and agree with the proposals. **Applications not complying with these requirements will be refused.**

7.11 FRAs accompanying proposed developments falling into one of the green cells in the matrix will be assessed by the planning authority rather than the Environment Agency. Detailed guidance on the scope and content of a FRA is given in Appendix F of PPG25 but the standing advice gives some supplementary guidance on this, pointing out in particular that the FRA should be appropriate to the scale and nature of the development and that, as a result, not all the possible factors set out in that appendix will apply in every case. It also points out that the responsibility for ensuring a FRA is carried out competently lies with the developer, not with the Environment Agency or the planning authority.

7.12 To speed up the application process, the standing advice encourages pre-application discussions between developers and the Environment Agency about FRAs for proposals falling into any of the red cells in the matrix and for developments between 1.0ha and 5.0ha falling into a green cell. The procedure is described in detail in Annex 2 of the standing advice included in Appendix E and may be summarised as follows:-

- (a) Pre-application
 - (i) Initial enquiry for information on flood risk to Environment Agency;
 - (ii) Submission of draft FRA to Environment Agency Development Control Team;

- (iii) Comments by Environment Agency Development Control Team (following site visits, meetings if appropriate);
 - (iv) Submission of final FRA to Environment Agency;
 - (v) Environment Agency provides Letter of Compliance to developer.
- (b) Application
- (c) Submission of planning application with FRA and Letter of Compliance to planning authority;
- (i) Planning authority consults with Environment Agency;
 - (ii) Environment Agency considers all relevant issues, including flood risk, and responds within timetable.

Provided this process is adhered to the Environment Agency will respond within the agreed time limit of 21 days from the date when all the relevant documents have been received from the planning authority.

Approvals and refusals of planning applications

7.13 The standing advice makes it clear that planning authorities are expected to approve **the flood risk aspects** of any planning applications falling within the green cells of the matrix, provided they comply with the advice given in the comments attached to the relevant cell. They are also expected to refuse any applications that do not comply with this advice. The Environment Agency confirms that it will support such decisions to the full. **It should be noted that if a development proposal is satisfactory with regard to flood risk aspects it may still be unacceptable to the Environment Agency with regard to other material considerations.**

7.14 If the planning authority is considering granting planning permission contrary to the standing advice, the Environment Agency will be advised of the grounds for doing this and given an opportunity to make further representations.

NE/NLC SFRA FLOOD RISK MATRIX - INITIAL PLANNING RESPONSE v1.6

Table 7 Planning response matrix

	A	B	C	D	E	F	G
		Within 9 metres of Main River or Sea Defence		PPG25 Zone 3 High flood risk	NE/NLC SFRA Zone 3(ii) - Low Vulnerability Area (Defences to appropriate standard and flood risk not unacceptably high)	PPG25 Zone 2 Medium/low flood risk	PPG25 Zone 1 Little/no flood risk
1	Development category	Main Rivers and Sea Defences as shown on Flood Risk maps	NE/NLC SFRA Zone 3(iii) Functional Floodplain	NE/NLC SFRA Zone 3(ii) - High Vulnerability Area (Defences not to appropriate standard and/or flood risk unacceptably high)	NE/NLC SFRA Zone 3(i) - Low Vulnerability Area (Defences to appropriate standard and flood risk not unacceptably high)	NE/NLC SFRA Zone 2 Medium/low flood risk	NE/NLC SFRA Zone 1 Little/no flood risk
2	Domestic extensions	Consult EA	Consult EA	Standard response	Standard response	Standard response	No comment on flood risk (but see comment on Ordinary Watercourses)
3	Industrial/Commercial extensions less than 250m ²	Consult EA	Consult EA	Standard response	Standard response	Standard response	No comment on flood risk (but see comment on Ordinary Watercourses)
4	Change of use to a more 'flood risk sensitive' use	Consult EA	Consult EA	Consult EA	Consult EA	Consult EA	No comment on flood risk (but see comment on Ordinary Watercourses)
5	Operational development (i.e. no change of use) less than 1ha	Consult EA	Consult EA	Consult EA	Consult EA	Consult EA	No comment on flood risk (but see comment on Ordinary Watercourses)
6	Camping & Caravan Sites	Consult EA	Consult EA	Consult EA	Consult EA	Consult EA	No comment on flood risk (but see comment on Ordinary Watercourses)
7	Operational development (i.e. no change of use) between 1ha and 5ha	Consult EA	Consult EA	Consult EA	Consult EA	Consult EA	No comment on flood risk (but see comment on Ordinary Watercourses)
8	Civil Emergency Infrastructure	Consult EA	Consult EA	Consult EA	Consult EA	Consult EA	Standard response
9	Operational development (i.e. no change of use) greater than 5.0ha	Consult EA	Consult EA	Consult EA	Consult EA	Consult EA	Standard response
10		Consult EA	Consult EA	Consult EA	Consult EA	Consult EA	Consult EA

NB This Flood Risk Matrix must be looked at in accordance with the accompanying General Guidance Note and the Environment Agency's Technical Guidance Notes on flood risk assessment.

Procedure key -Development and Flood Risk Standing Advice

11	Consult EA
12	Standard response
13	General surface water drainage information

Consult Environment Agency. Environment Agency to see FRA before commenting.

LPAs need not refer planning application to Agency. Standard response applies. FRA required.

LPA need not refer to Environment Agency. Outside scope of standing advice.

Ordinary Watercourses - Land Drainage Act consent

Consent information applicable to development adjacent to Ordinary Watercourses in all locations.

Table 8 Category comments in matrix

A3 Domestic extensions

A4 Industrial / Commercial extensions less than 250m²

This size threshold of 250m² relates to the size of the footprint increase of the building itself rather than the overall site size.

A5 Change of use to a more 'flood risk sensitive' use

The category of 'flood risk-sensitive changes of use' relates to the need to identify changes of use within high flood risk areas (i.e. within PPG25 Zone 3) which may increase flood risks to occupants and ensure that any resulting additional risks are properly assessed and managed. For example, a change of use from office to any residential use especially at ground floor level would fall into this category. The vulnerability of potential occupants to flood risk is also a key factor. Those occupants considered most vulnerable would be people who by virtue of their age or infirmity would be at particular risk during a flood event. A proposed school would therefore be classified as a 'sensitive' development. The risks to vulnerable occupants are likely to be increased if the proposed development is intended to be residential in nature. Examples would include residential care homes and hospices.

Under the Use Classes Order 1987 relevant changes of use would include:

FROM

A1 (Shops); A2 (Financial and Professional Services); A3 (Food and Drink); B1 (Business); and B2 (General Industrial)

TO

any Part C use i.e. C1 (Hotels), C2 (Residential Institutions) and C3 (Dwelling Houses); part D1 (Non-Residential Institutions) with vulnerable occupants i.e. D1 (a) (non-residential medical facilities), D1 (b) (e.g. creches, day nurseries and day centres); and class D2 (Assembly and Leisure) uses.

A6 Operational development (i.e. no change of use) less than 1ha

This broad category covers any development which involves building, mining or engineering operations i.e. anything other than material change of use

A7 Camping & Caravan Sites

Camping and caravan sites may give rise to particular problems in relation to flood risk. See paragraph 70 and appendix G of PPG25.

A8 Operational development (i.e. no change of use) between 1ha and 5ha

This broad category covers any development which involves building, mining or engineering operations i.e. anything other than material change of use.

A9 Civil Emergency Infrastructure

Civil emergency infrastructure includes installations such as hospitals, police stations and emergency vehicle depots. These need to be operational and maintain access in all circumstances (see paragraph 34 of PPG25).

A10 Operational development (i.e. no change of use) greater than 5.0ha

This broad category covers any development which involves building, mining or engineering operations i.e. anything other than material change of use.

- B1 Within 9 metres of Main River or Sea Defence**
This is defined as any land within 9 metres of the bank top of Main Rivers and Sea Defences as shown on Environment Agency maps. Environment Agency bye-laws will apply to development within this zone.
- B2 Main Rivers and Flood Defences as shown on Flood Risk maps.**
Main Rivers and Sea Defences are shown on Environment Agency maps and on the Flood Risk maps accompanying this SFRA. The Flood Risk map information was correct at the time of publication but does not include any subsequent amendments.
- B3 River or Sea Defence**
Environment Agency byelaw consent required and likely to be refused. Agency objection to grant of planning permission likely. Early contact with Environment Agency at pre-application stage is strongly advised.
- B4 Industrial/Commercial extensions less than 250m² within bye-law distance (9 metres) of a Main River or Sea Defence**
Environment Agency byelaw consent required and likely to be refused. Agency objection to grant of planning permission likely. Early contact with Environment Agency at pre-application stage is strongly advised.
- B5 Change of use to a more 'flood risk sensitive' use within bye-law distance (9 metres) of a Main River or Sea Defence**
Environment Agency byelaw consent required and likely to be refused. Agency objection to grant of planning permission likely. Early contact with Environment Agency at pre-application stage is strongly advised.
- B6 Operational development (i.e. no change of use) less than 1ha within bye-law distance (9 metres) of a Main River or Sea Defence**
Environment Agency byelaw consent required and likely to be refused. Agency objection to grant of planning permission likely. Early contact with Environment Agency at pre-application stage is strongly advised.
- B7 Camping & caravan sites within bye-law distance (9 metres) of Main River or Sea Defence**
Environment Agency byelaw consent required and likely to be refused. Agency objection to grant of planning permission likely. Early contact with Environment Agency at pre-application stage is strongly advised.
- B8 Operational development (i.e. no change of use) between 1ha and 5ha within bye-law distance (9 metres) of a Main River or Sea Defence**
Environment Agency byelaw consent required and likely to be refused. Agency objection to grant of planning permission likely. Early contact with Environment Agency at pre-application stage is strongly advised.
- B9 Civil Emergency Infrastructure within bye-law distance (9 metres) of Main River or Sea Defence**
Environment Agency byelaw consent required and likely to be refused. Agency objection to grant of planning permission likely. Early contact with Environment Agency at pre-application stage is strongly advised.

- B10 Operational development (i.e. no change of use) greater than 5.0 ha within byelaw distance (9 metres) of Main River or Sea Defence**
Environment Agency byelaw consent required and likely to be refused. Agency objection to grant of planning permission likely. Early contact with Environment Agency at pre-application stage is strongly advised.
- C1 PPG25 Zone 3 - High flood risk area**
Zone 3 is the high flood risk zone as defined in Table 1, paragraph 30 of PPG25.
Zone 3 is shown on Environment Agency maps and on the Flood Risk maps accompanying this SFRA. It covers land with an estimated annual probability of river flooding greater than 1.0% (i.e. at risk from a less than 1 in 100 year event) or of tidal & coastal flooding greater than 0.5% (i.e. at risk from a less than 1 in 200 year event).
- C2 NE/NLC SFRA Zone 3(iii) - functional floodplain**
Zone 3 is the high risk zone as defined in Table 1, paragraph 30 of PPG25.
In this SFRA, Zone 3(iii) refers to areas within Zone 3 which have been identified as functional floodplain. This includes areas identified:-
- (a) within Environment Agency reports (or by Environment Agency staff) as providing flood storage under defined conditions (i.e. during events with return periods greater than a given figure) and so forming part of the flood management system; and
 - (b) within publicly available Environment Agency documents as being considered in the Humber Estuary Shoreline Management Plan as potential managed retreat sites.
- C3 Domestic extensions within NE/NLC SFRA Zone 3(iii) - functional floodplain**
Environment Agency objection to grant of planning permission likely. Early contact with Environment Agency at pre-application stage is strongly advised.
- C4 Industrial/Commercial extensions less than 250m² within NE/NLC SFRA Zone 3(iii) - functional floodplain**
Environment Agency objection to grant of planning permission likely. Early contact with Environment Agency at pre-application stage is strongly advised.
- C5 Change of use to a more 'flood risk sensitive' use within NE/NLC SFRA Zone 3(iii) - functional floodplain**
Environment Agency objection to grant of planning permission likely. Early contact with Environment Agency at pre-application stage is strongly advised.
- C6 NE/NLC Zone 3(iii) - functional floodplain**
Environment Agency objection to grant of planning permission likely. Early contact with Environment Agency at pre-application stage is strongly advised.
- C7 Camping & caravan sites within NE/NLC SFRA Zone 3(iii) - functional floodplain**
Environment Agency objection to grant of planning permission likely. Early contact with Environment Agency at pre-application stage is strongly advised.
- C8 Operational development (i.e. no change of use) between 1ha and 5ha within NE/NLC SFRA Zone 3(iii) - functional floodplain**
Environment Agency objection to grant of planning permission likely. Early contact with Environment Agency at pre-application stage is strongly advised.

C9 Civil Emergency Infrastructure within NE/NLC SFRA Zone 3(iii) - functional floodplain

Environment Agency objection to grant of planning permission likely. Early contact with Environment Agency at pre-application stage is strongly advised.

C10 Operational development (i.e. no change of use) greater than 5.0 ha within NE/NLC SFRA Zone 3(iii) - functional floodplain

Environment Agency objection to grant of planning permission likely. Early contact with Environment Agency at pre-application stage is strongly advised.

D1 PPG25 Zone 3 - High flood risk area

Zone 3 is the high flood risk zone as defined in Table 1, paragraph 30 of PPG25.

Zone 3 is shown on Environment Agency maps and on the Flood Risk maps accompanying this SFRA. It covers land with an estimated annual probability of river flooding greater than 1.0% (i.e. at risk from a less than 1 in 100 year event) or of tidal & coastal flooding greater than 0.5% (i.e. at risk from a less than 1 in 200 year event).

D2 NE/NLC SFRA Zone 3(ii) - High Vulnerability Area

(Defences not to appropriate standard and/or defences and/or flood risk unacceptably high) Zone 3 is the high risk zone as defined in Table 1, paragraph 30 of PPG25.

In this SFRA, Zone 3(ii) refers to areas within Zone 3 which have been identified as being at a **greater** risk of flooding compared to other areas of Zone 3 because:-

- (a) They have defences that, on the basis of information supplied by the Environment Agency or others, **do not** currently provide the 'appropriate standard' of protection. Defences providing the 'appropriate standard' are defined as being capable of protecting against a 1% (1 in 100 year) event for river flooding or a 0.5% (1 in 200 year) event for tidal/coastal flooding; **or**
- (b) If the defences do provide the 'appropriate standard' of protection, then if they should breach during such an event the flow velocity and depth of flooding estimated as described in Chapter 3 of the SFRA, will be **greater** than the limiting criteria set out in Table 2 of that chapter (i.e. flow velocity > 1.0 m/s or depth of flooding > 0.5 m).

D3 Domestic extensions within NE/NLC SFRA Zone 3(ii) - High Risk; High Vulnerability (Defences not to appropriate standard and/or flood risk unacceptably high)

In this SFRA Zone 3(ii) refers to those areas within PPG25 Zone 3 which have been identified EITHER as having no defences or being protected by defences that do not provide the 'appropriate standard' of protection OR where if the defences fail there is a potential threat to life because of fast flowing or deep water. The 'appropriate standard' is defined as the 1 in 100 year (1% annual probability) river flood event or the 1 in 200 year (0.5% annual probability) tidal and coastal flood event.

FRA minimum requirements

Planning applications must be accompanied by a Flood Risk Assessment (FRA) produced by or for the applicant. Where a FRA is not submitted with the application or the FRA is not accepted by the LPA the Environment Agency OBJECTS to the application and requests that the LPA either defers the application or refuses planning permission.

To be acceptable the FRA should confirm in writing as a minimum that:-

EITHER

1. Floor levels within the proposed development will be set no lower than existing levels.

AND

2. Flood proofing of the proposed development has been considered by the applicant and incorporated where appropriate.

OR

3. Floor levels within the extension will be set 300 mm above the critical flood levels set out in Appendix C of the NELC/NLC SFRA Report and repeated in the tables attached to this matrix. This must be demonstrated by a plan to Ordnance Datum/GPS showing finished floor levels relative to the flood level.

Process

A simple FRA confirming, as a minimum, the criteria set out above must accompany planning applications submitted to the Local Planning Authority (LPA). The LPA should determine the adequacy of the FRA. If the applicant does not provide a FRA meeting these minimum requirements the Agency recommends the application be refused.

Background

For proposed domestic extensions within NE/NLC SFRA Zone 3 (ii), the main aspect of flood risk to consider is that the development itself may be at risk of flooding. The most effective means of addressing this risk is through the submission of a simple flood risk assessment (FRA) This should identify the flood risk and set out the proposed measures to mitigate that risk. For most developments within this Zone submission of a site plan showing floor levels related to Ordnance Datum/GPS should confirm that the site is above flood level. Where such a plan indicates otherwise or is not provided, mitigation measures will need to focus on controlling floor levels and incorporating flood proofing into the design of the extension. Further guidance on what may be included within the FRA including an assessment of residual risks is contained in the Environment Agency's guidance note FRA 3.

Floor levels

From a flood risk point of view, the ideal mitigation in terms of floor levels is to ensure that these are set above the known or modelled 1 in 100 year ((1% annual probability) river flood level or 1 in 200 year (0.5% annual probability) tidal and coastal flood level at that location. However, in the case of an extension it will often not be practical to raise floor levels given the potential effects on other issues such as access (including that for disabled users), usability and visual amenity. Any proposals to raise floor levels must therefore be discussed and agreed with the LPA at the earliest possible stage.

Flood proofing

The Environment Agency recommends that in areas at risk of flooding consideration be given to the incorporation of flood proofing measures into the design and construction of the development. These include removable barriers on building apertures such as doors and air bricks and bringing electrical services into the building at a high level so that plugs are located above possible flood levels. Additional guidance, including information on kite marked flood protection products, can be found on the Environment Agency web site www.environment-agency.gov.uk

Residual risks

It should be noted that if the building is in a 'low spot' the measures adopted above will not necessarily eliminate risks during a flood event. Applicants should be asked to check ground levels if in doubt about this. Even where it is possible to ensure floor levels are set above the known or modelled 1 in 100 year (1% annual probability) river and 1 in 200 year (0.5% annual probability) tidal and coastal flood level, flood risks will remain for an event that exceeds this magnitude.

Note

Development which involves a culvert or an obstruction to flow on an Ordinary Watercourse will require Environment Agency consent under the Land Drainage Act 1991.

An Ordinary Watercourse is defined as any watercourse not identified as a Main River held on maps by the Environment Agency and DEFRA. For further information see the comment in cell B26 (Ordinary Watercourses - Land Drainage Act consent) under the 'Procedure Key' heading.

D4 Industrial/Commercial Extensions less than 250m² within NE/NLC SFRA Zone 3(ii) - High Risk; High Vulnerability (Defences not to appropriate standard and/or flood risk unacceptably high)

In this SFRA Zone 3(ii) refers to those areas within PPG25 Zone 3 which have been identified EITHER as having no defences or being protected by defences that do not provide the 'appropriate standard' of protection OR where if the defences fail there is a potential threat to life because of fast flowing or deep water. The 'appropriate standard' is defined as the 1 in 100 year (annual probability 1% chance) river flood event or the 1 in 200 year (annual probability 0.5% chance) tidal and coastal flood event.

FRA minimum requirements

Planning applications must be accompanied by a Flood Risk Assessment (FRA) produced by or for the applicant. Where a FRA is not submitted with the application or the FRA is not accepted by the LPA the Environment Agency OBJECTS to the application and requests that the LPA either defers the application or refuses planning permission.

To be acceptable the FRA should confirm in writing as a minimum that:-

EITHER

1. Floor levels within the proposed development will be set no lower than existing levels.

AND

2. Flood proofing of the proposed development has been considered by the applicant and incorporated where appropriate.

OR

3. Floor levels within the extension will be set 300 mm above the critical flood levels set out in Appendix C of the NELC/NLC SFRA Report and repeated in the tables attached to this matrix. This must be demonstrated by a plan to Ordnance Datum/GPS showing finished floor levels relative to the flood level.

Process

A simple FRA confirming, as a minimum, the criteria set out above must accompany planning applications submitted to the Local Planning Authority (LPA). The LPA should determine the adequacy of the FRA. If the applicant does not provide a FRA meeting these minimum requirements the Agency recommends the application be refused.

Background

For proposed minor industrial/commercial extensions within NE/NLC SFRA Zone 3 (ii), the main aspect of flood risk to consider is that the development itself may be at risk of flooding. The most effective means of addressing this risk is through the submission of a simple flood risk assessment (FRA) This should identify the flood risk and set out the proposed measures to mitigate that risk. For most developments within this Zone submission of a site plan showing floor levels related to Ordnance Datum/GPS should confirm that the site is above flood level. Where such a plan indicates otherwise or is not provided, mitigation measures will need to focus on controlling floor levels and incorporating flood proofing into the design of the extension. Further guidance on what may be included within the FRA including an assessment of residual risks is contained in the Environment Agency's guidance note FRA 3.

Floor levels

From a flood risk point of view, the ideal mitigation in terms of floor levels is to ensure that these are set above the known or modelled 1 in 100 year (1% chance each year) river flood level or 1 in 200 year (0.5% chance each year) tidal and coastal flood level at that location. However, in the case of an extension it will often not be practical to raise floor levels given the potential effects on other issues such as access (including that for disabled users), usability and visual amenity. Any proposals to raise floor levels must therefore be discussed and agreed with the LPA at the earliest possible stage.

Flood proofing

The Environment Agency recommends that in areas at risk of flooding consideration be given to the incorporation of flood proofing measures into the design and construction of the development. These include removable barriers on building apertures such as doors and air bricks and bringing electrical services into the building at a high level so that plugs are located above possible flood levels. Additional guidance, including information on kite marked flood protection products, can be found on the Environment Agency web site www.environment-agency.gov.uk

Residual risks

It should be noted that if the building is in a 'low spot' the measures adopted above will not necessarily eliminate risks during a flood event. Applicants should be asked to check ground levels if in doubt about this. Even where it is possible to ensure floor levels are set above the known or modelled 1 in 100 year (1% chance) river and 1 in 200 year (0.5% chance) tidal and coastal flood level, flood risks will remain for an event that exceeds this magnitude.

Note

Development which involves a culvert or an obstruction to flow on an Ordinary Watercourse will require Environment Agency consent under the Land Drainage Act 1991.

An Ordinary Watercourse is defined as any watercourse not identified as a Main River held on maps by the Environment Agency and DEFRA. For further information see the comment in cell B26 (Ordinary Watercourses - Land Drainage Act consent) under the 'Procedure Key' heading.

D5 Change of use to a more 'flood risk sensitive' use within NE/NLC SFRA Zone 3(ii) - High Risk; High Vulnerability (Defences not to appropriate standard and/or flood risk unacceptably high)

Planning applications will need to be accompanied by a Flood Risk Assessment (FRA). The Environment Agency should be consulted at an early stage, before any planning application or accompanying FRA is prepared.

Note

Development which involves a culvert or an obstruction to flow on an Ordinary Watercourse will require Environment Agency consent under the Land Drainage Act 1991. An Ordinary Watercourse is defined as any watercourse not identified as a Main River held on maps by the Environment Agency and DEFRA. For further information see the comment in cell B26 (Ordinary Watercourses - Land Drainage Act consent) under the 'Procedure Key' heading.

D6 Operational development (i.e. no change of use) less than 1ha within NE/NLC SFRA Zone 3(ii) - High Risk; High Vulnerability (Defences not to appropriate standard and/or flood risk unacceptably high)

Planning applications will need to be accompanied by a Flood Risk Assessment (FRA). The Environment Agency should be consulted at an early stage, before any planning application or accompanying FRA is prepared.

Note

Development which involves a culvert or an obstruction to flow on an Ordinary Watercourse will require Environment Agency consent under the Land Drainage Act 1991. An Ordinary Watercourse is defined as any watercourse not identified as a Main River held on maps by the Environment Agency and DEFRA. For further information see the comment in cell B26 (Ordinary Watercourses - Land Drainage Act consent) under the 'Procedure Key' heading.

D7 Camping & caravan sites within NE/NLC SFRA Zone 3(ii) - High Risk; High Vulnerability (Defences not to appropriate standard and/or flood risk unacceptably high)

Planning applications will need to be accompanied by a Flood Risk Assessment (FRA). The Environment Agency should be consulted at an early stage, before any planning application or accompanying FRA is prepared.

Note

Development which involves a culvert or an obstruction to flow on an Ordinary Watercourse will require Environment Agency consent under the Land Drainage Act 1991. An Ordinary Watercourse is defined as any watercourse not identified as a Main River held on maps by the Environment Agency and DEFRA. For further information see the comment in cell B26 (Ordinary Watercourses - Land Drainage Act consent) under the 'Procedure Key' heading, as any watercourse not identified as a Main River held on maps by the Environment Agency and DEFRA. For further information see the comment in cell B26 (Ordinary Watercourses - Land Drainage Act consent) under the 'Procedure Key' heading.

D8 Operational development (i.e. no change of use) between 1ha and 5ha within NE/NLC SFRA Zone 3(ii) - High Risk; High Vulnerability (Defences not to appropriate standard and/or flood risk unacceptably high)

Planning applications will need to be accompanied by a Flood Risk Assessment (FRA). The Environment Agency should be consulted at an early stage, before any planning application or accompanying FRA is prepared.

Note

Development which involves a culvert or an obstruction to flow on an Ordinary Watercourse will require Environment Agency consent under the Land Drainage Act 1991. An Ordinary Watercourse is defined as any watercourse not identified as a Main River held on maps by the Environment Agency and DEFRA. For further information see the comment in cell B26 (Ordinary Watercourses - Land Drainage Act consent) under the 'Procedure Key' heading.

D9 Civil emergency infrastructure within NE/NLC SFRA Zone 3(ii) - High Risk; High Vulnerability (Defences not to appropriate standard and/or flood risk unacceptably high)

Planning applications will need to be accompanied by a Flood Risk Assessment (FRA). The Environment Agency should be consulted at an early stage, before any planning application or accompanying FRA is prepared.

Note

Development which involves a culvert or an obstruction to flow on an Ordinary Watercourse will require Environment Agency consent under the Land Drainage Act 1991. An Ordinary Watercourse is defined as any watercourse not identified as a Main River held on maps by the Environment Agency and DEFRA. For further information see the comment in cell B26 (Ordinary Watercourses - Land Drainage Act consent) under the 'Procedure Key' heading.

D10 Operational development (i.e. no change of use) greater than 5.0ha within NE/NLC SFRA Zone 3(ii) - High Risk; High Vulnerability (Defences not to appropriate standard and/or flood risk unacceptably high)

Planning applications will need to be accompanied by a Flood Risk Assessment (FRA). The Environment Agency should be consulted at an early stage, before any planning application or accompanying FRA is prepared.

Note

Development which involves a culvert or an obstruction to flow on an Ordinary Watercourse will require Environment Agency consent under the Land Drainage Act 1991. An Ordinary Watercourse is defined as any watercourse not identified as a Main River held on maps by the Environment Agency and DEFRA. For further information see the comment in cell B26 (Ordinary Watercourses - Land Drainage Act consent) under the 'Procedure Key' heading.

E1 PPG25 Zone 3 - High flood risk area

Zone 3 is the high flood risk zone as defined in Table 1, paragraph 30 of PPG25.

Zone 3 is shown on Environment Agency maps and on the Flood Risk maps accompanying this SFRA. It covers land with an estimated annual probability of river flooding greater than 1.0% (i.e. at risk from a less than 1 in 100 year event) or of tidal & coastal flooding greater than 0.5% (i.e. at risk from a less than 1 in 200 year event).

E2 NE/NLC SFRA Zone 3(i) - Low Vulnerability Area

(Defences to appropriate standard and flood risk not unacceptably high) Zone 3 is the high risk zone as defined in Table 1, paragraph 30 of PPG25.

In this SFRA, Zone 3(i) refers to areas within Zone 3 which have been identified as being at a **reduced** risk of flooding compared to other areas of Zone 3 because:-

- (a) They have defences that, on the basis of information supplied by the Environment Agency or others, **do** currently provide the 'appropriate standard' of protection. Defences providing the 'appropriate standard' are defined as being capable of protecting against a 1% (1 in 100 year) event for river flooding or a 0.5% (1 in 200 year) event for tidal/coastal flooding; **and**
- (b) If the defences should breach during such an event the flow velocity and depth of flooding estimated as described in Chapter 3 of the SFRA, will be less than the limiting criteria set out in Table 2 of that chapter (i.e. flow velocity < 1.0 m/s and depth of flooding < 0.5 m).

E3 Domestic extensions within NE/NLC SFRA Zone 3(i) - High Risk; Low Vulnerability (Defences to appropriate standard and flood risk not unacceptably high)

In this SFRA, Zone 3(i) refers to those areas within PPG25 Zone 3 which have been identified as being at a reduced risk of flooding compared to other areas of Zone 3 because they are protected by defences providing the 'appropriate standard' of defence AND where if the defences fail during an event of this magnitude there is unlikely to be a threat to life due to fast flowing or deep water. The 'appropriate standard' is defined as the 1 in 100 year (1% annual probability) river flood event or the 1 in 200 year (0.5% annual probability) tidal and coastal flood event.

It should be noted that this does NOT mean these areas are free from the risk of flooding. Development within these areas may still be flooded by an event of a greater magnitude than that considered in the SFRA or which exceeds the design standard of the defences leading to overtopping. There is also always a risk, however small, that defences will fail even on a flood event which falls within the design standard for that defence.

FRA minimum requirements

Planning applications must be accompanied by a simple Flood Risk Assessment (FRA) produced by or for the applicant. Where a FRA is not submitted with the application or the FRA is not accepted by the LPA the Environment Agency OBJECTS to the application and requests that the LPA either defers the application or refuses planning permission.

To be acceptable the FRA should confirm in writing as a minimum that:-

EITHER

1. Floor levels within the proposed development will be set no lower than existing levels.

AND

2. Flood proofing of the proposed development has been considered by the applicant and incorporated where appropriate.

OR

3. Floor levels within the extension will be set 300 mm above the critical flood levels set out in Appendix C of the NELC/NLC SFRA Report and repeated in the tables attached to this matrix. This must be demonstrated by a plan to Ordnance Datum/GPS showing finished floor levels relative to the flood level.

Process

A simple FRA confirming, as a minimum, the criteria set out above must accompany planning applications submitted to the Local Planning Authority (LPA). The LPA should determine the adequacy of the FRA. If the applicant does not provide a FRA meeting these minimum requirements the Agency recommends the application be refused.

Background

For proposed domestic extensions within NE/NLC SFRA Zone 3 (i), the main aspect of flood risk to consider is that the development itself may be at risk of flooding. The most effective means of addressing this risk is through the submission of a simple flood risk assessment (FRA) This should identify the flood risk and set out the proposed measures to mitigate that risk. For most developments within this Zone submission of a site plan showing floor levels related to Ordnance Datum/GPS should confirm that the site is above flood level. Where such a plan indicates otherwise or is not provided, mitigation measures will need to focus on controlling floor levels and incorporating flood proofing into the design of the extension. Further guidance on what may be included within the FRA including an assessment of residual risks is contained in the Environment Agency's guidance note FRA 3.

Floor levels

From a flood risk point of view, the ideal mitigation in terms of floor levels is to ensure that these are set above the known or modelled 1 in 100 year ((1% annual probability) river flood level or 1 in 200 year (0.5% annual probability) tidal and coastal flood level at that location. However, in the case of an extension it will often not be practical to raise floor levels given the potential effects on other issues such as access (including that for disabled users), usability and visual amenity. Any proposals to raise floor levels must therefore be discussed and agreed with the LPA at the earliest possible stage.

Flood proofing

The Environment Agency recommends that in areas at risk of flooding consideration be given to the incorporation of flood proofing measures into the design and construction of the development. These include removable barriers on building apertures such as doors and air bricks and bringing electrical services into the building at a high level so that plugs are located above possible flood

levels. Additional guidance, including information on kite marked flood protection products, can be found on the Environment Agency web site www.environment-agency.gov.uk

Residual risks

It should be noted that if the building is in a 'low spot' the measures adopted above will not necessarily eliminate risks during a flood event. Applicants should be asked to check ground levels if in doubt about this. Even where it is possible to ensure floor levels are set above the known or modelled 1 in 100 year (1% annual probability) river and 1 in 200 year (0.5% annual probability) tidal and coastal flood level, flood risks will remain for an event that exceeds this magnitude.

Note

Development which involves a culvert or an obstruction to flow on an Ordinary Watercourse will require Environment Agency consent under the Land Drainage Act 1991.

An Ordinary Watercourse is defined as any watercourse not identified as a Main River held on maps by the Environment Agency and DEFRA. For further information see the comment in cell B26 (Ordinary Watercourses - Land Drainage Act consent) under the 'Procedure Key' heading.

E4 Industrial/Commercial Extensions less than 250m² within NE/NLC SFRA Zone 3(i) - High Risk; Low Vulnerability (Defences to appropriate standard and flood risk not unacceptably high)

In this SFRA, Zone 3(i) refers to those areas within PPG25 Zone 3 which have been identified as being at a reduced risk of flooding compared to other areas of Zone 3 because they are protected by defences providing the 'appropriate standard' of defence AND where if the defences fail during an event of this magnitude there is unlikely to be a threat to life due to fast flowing or deep water. The 'appropriate standard' is defined as the 1 in 100 year (1% annual probability) river flood event or the 1 in 200 year (0.5% annual probability) tidal and coastal flood event.

It should be noted that this does NOT mean these areas are free from the risk of flooding. Development within these areas may still be flooded by an event of a greater magnitude than that considered in the SFRA or which exceeds the design standard of the defences leading to overtopping. There is also always a risk, however small, that defences will fail even on a flood event which falls within the design standard for that defence.

FRA minimum requirements

Planning applications must be accompanied by a Flood Risk Assessment (FRA) produced by or for the applicant. Where a FRA is not submitted with the application or the FRA is not accepted by the LPA the Environment Agency OBJECTS to the application and requests that the LPA either defers the application or refuses planning permission.

To be acceptable the FRA should confirm in writing as a minimum that:-

EITHER

1. Floor levels within the proposed development will be set no lower than existing levels.

AND

2. Flood proofing of the proposed development has been considered by the applicant and incorporated where appropriate.

OR

3. Floor levels within the extension will be set 300 mm above the critical flood levels set out in Appendix C of the NELC/NLC SFRA Report and repeated in the tables attached to this matrix. This must be demonstrated by a plan to Ordnance Datum/GPS showing finished floor levels relative to the flood level.

Process

A simple FRA confirming, as a minimum, the criteria set out above must accompany planning applications submitted to the Local Planning Authority (LPA). The LPA should determine the adequacy of the FRA. If the applicant does not provide a FRA meeting these minimum requirements the Agency recommends the application be refused.

Background

For proposed minor industrial/commercial extensions within NE/NLC SFRA Zone 3 (i), the main aspect of flood risk to consider is that the development itself may be at risk of flooding. The most effective means of addressing this risk is through the submission of a simple flood risk assessment (FRA) This should identify the flood risk and set out the proposed measures to mitigate that risk. For most developments within this Zone submission of a site plan showing floor levels related to Ordnance Datum/GPS should confirm that the site is above flood level. Where such a plan indicates otherwise or is not provided, mitigation measures will need to focus on controlling floor levels and incorporating flood proofing into the design of the extension. Further guidance on what may be included within the FRA including an assessment of residual risks is contained in the Environment Agency's guidance note FRA 3.

Floor levels

From a flood risk point of view, the ideal mitigation in terms of floor levels is to ensure that these are set above the known or modelled 1 in 100 year (1% annual probability) river flood level or 1 in 200 year (0.5% annual probability) tidal and coastal flood level at that location. However, in the case of an extension it will often not be practical to raise floor levels given the potential effects on other issues such as access (including that for disabled users), usability and visual amenity. Any proposals to raise floor levels must therefore be discussed and agreed with the LPA at the earliest possible stage.

Flood proofing

The Environment Agency recommends that in areas at risk of flooding consideration be given to the incorporation of flood proofing measures into the design and construction of the development. These include removable barriers on building apertures such as doors and air bricks and bringing electrical services into the building at a high level so that plugs are located above possible flood levels. Additional guidance, including information on kite marked flood protection products, can be found on the Environment Agency web site www.environment-agency.gov.uk

Residual risks

It should be noted that if the building is in a 'low spot' the measures adopted above will not necessarily eliminate risks during a flood event. Applicants should be asked to check ground levels if in doubt about this. Even where it is possible to ensure floor levels are set above the known or modelled 1 in 100 year (1% annual probability) river and 1 in 200 year (0.5% annual probability) tidal and coastal flood level, flood risks will remain for an event that exceeds this magnitude.

Note

Development which involves a culvert or an obstruction to flow on an Ordinary Watercourse will require Environment Agency consent under the Land Drainage Act 1991.

An Ordinary Watercourse is defined as any watercourse not identified as a Main River held on maps by the Environment Agency and DEFRA. For further information see the comment in cell B26 (Ordinary Watercourses - Land Drainage Act consent) under the 'Procedure Key' heading.

E5 Change of use to a more 'flood risk sensitive' use within NE/NLC SFRA Zone 3(i) - High Risk; Low Vulnerability (Defences to appropriate standard and flood risk not unacceptably high)

In this SFRA, Zone 3(i) refers to those areas within PPG25 Zone 3 which have been identified as being at a reduced risk of flooding compared to other areas of Zone 3 because they are protected by defences providing the 'appropriate standard' of defence AND where if the defences fail during

an event of this magnitude there is unlikely to be a threat to life due to fast flowing or deep water. The 'appropriate standard' is defined as the 1 in 100 year (i.e. 1% annual probability) river flood event or the 1 in 200 year (0.5% annual probability) tidal and coastal flood event.

It should be noted that this does NOT mean these areas are free from the risk of flooding. Development within these areas may still be flooded by an event of a greater magnitude than that considered in the SFRA or which exceeds the design standard of the defences leading to overtopping. There is also always a risk, however small, that defences will fail even on a flood event which falls within the design standard for that defence.

FRA minimum requirements

Planning applications must be accompanied by a Flood Risk Assessment (FRA) produced by or for the applicant. Where a FRA is not submitted with the application or the FRA is not accepted by the LPA the Environment Agency OBJECTS to the application and requests that the LPA either defers the application or refuses planning permission.

To be acceptable the FRA must confirm in writing:-

1. That an assessment has been made of the flood risks accruing from the proposed change of use. This should include a level survey to Ordnance Datum/GPS showing the critical flood levels set out in Appendix C of the NELC/NLC SFRA Report and repeated in the tables attached to this matrix relative to proposed site levels. It should also include an assessment of whether or not the proposed development site lies within an area with a documented flooding history.

AND

2. What mitigation is proposed to deal with any identified risks e.g. ensuring bedrooms are located upstairs, warning or evacuation plans, flood proofing etc.

Process

A FRA confirming the two elements set out above must accompany planning applications submitted to the Local Planning Authority (LPA). The LPA should determine the adequacy of the FRA. If the applicant does not provide a FRA meeting these minimum requirements the Environment Agency recommends the application be refused.

Where a FRA is provided that indicates that the site lies within a documented historic flooding area, the Environment Agency should be consulted for a bespoke response unless the LPA considers that this issue has been dealt with through a Letter of Compliance issued to the applicant by the Environment Agency and attached to the FRA.

Background

In most cases, changes of use within NELC/NLC SFRA Zone 3(i) will pose little or no increase in flood risk. For changes of use qualifying as 'flood risk sensitive uses', however, the risks may be higher and need to be assessed and dealt with. For example, a proposed change of use from residential accommodation to a care home may bring a significantly increased number of vulnerable users into a high flood risk area.

For proposed developments falling within an area with a previous history of flooding, the Environment Agency needs to continue to have a technical input to the FRA process. This will be achieved either through input at the pre-application stage culminating in the issue of a Letter of Compliance and/or through bespoke consultation at the planning application stage when a FRA indicates that the site has previously flooded.

Note

Development which involves a culvert or an obstruction to flow on an Ordinary Watercourse will require Environment Agency consent under the Land Drainage Act 1991. An Ordinary Watercourse

is defined as any watercourse not identified as a Main River held on maps by the Environment Agency and DEFRA. For further information see the comment in cell B26 (Ordinary Watercourses - Land Drainage Act consent) under the 'Procedure Key' heading.

E6 Operational development (i.e. no change of use) less than 1ha within NE/NLC SFRA Zone 3(i) - High Risk; Low Vulnerability (Defences to appropriate standard and flood risk not unacceptably high)

In this SFRA, Zone 3(i) refers to those areas within PPG25 Zone 3 which have been identified as being at a reduced risk of flooding compared to other areas of Zone 3 because they are protected by defences providing the 'appropriate standard' of defence AND where if the defences fail during an event of this magnitude there is unlikely to be a threat to life due to fast flowing or deep water. The 'appropriate standard' is defined as the 1 in 100 year (1% annual probability) river flood event or the 1 in 200 year (0.5% annual probability) tidal and coastal flood event.

It should be noted that this does NOT mean these areas are free from the risk of flooding. Development within these areas may still be flooded by an event of a greater magnitude than that considered in the SFRA or which exceeds the design standard of the defences leading to overtopping. There is also always a risk, however small, that defences will fail even on a flood event which falls within the design standard for that defence.

FRA minimum requirements

Planning applications must be accompanied by a Flood Risk Assessment (FRA) produced by or for the applicant. Where a FRA is not submitted with the application or the FRA is not accepted by the LPA the Environment Agency OBJECTS to the application and requests that the LPA either defers the application or refuses planning permission.

To be acceptable the FRA must include the following as a minimum:-

1. A level survey to Ordnance Datum/GPS showing the critical flood levels set out in Appendix C of the NELC/NLC SFRA Report and repeated in the table attached to this matrix relative to proposed site levels.
2. An assessment of the risks posed to the site including that based on any documented historic flooding and risks associated with any increase in surface water run-off from the site.
3. Proposed mitigation measures to control those risks e.g. setting appropriate floor levels, providing flood proofing, providing suitable means of surface water disposal.

Specific FRA requirements relating to surface water run-off for given sizes of development are set out in the text below.

Process

A FRA must accompany planning applications submitted to the Local Planning Authority (LPA). The LPA should determine the adequacy of the FRA. If the applicant does not provide a FRA meeting these minimum requirements the Agency recommends the application be refused.

Where a FRA is provided that indicates that the site lies within a documented historic flooding area, the Environment Agency should be consulted for a bespoke response unless the LPA considers that this issue has been dealt with through a Letter of Compliance issued to the applicant by the Environment Agency and attached to the FRA.

Background

Within NELC/NLC SFRA Zone 3(i) there are two main flood risk considerations:-

1. The flood risk to the site resulting from an extreme flood event (i.e. a flood that is greater than the 1% annual probability river or 0.5% annual probability tidal and coastal events) or from an event in which the defences fail.
2. The flood risk resulting from the change of use of greenfield land to developed land which will reduce the natural drainage permeability of that land leading to increased flood risk elsewhere.

For proposed developments falling within an area with a previous history of flooding, the Environment Agency needs to continue to have a technical input to the FRA process. This will be achieved either through input at the pre-application stage culminating in the issue of a Letter of Compliance and/or through bespoke consultation at the planning application stage when a FRA indicates that the site has previously flooded.

Flood risk to the development site

Any development within NE/NLC SFRA Zone 3 (i) may itself be at risk of flooding. The most effective means of addressing this risk is through the submission of a flood risk assessment (FRA). This should use available historic information, surveys and local knowledge to establish the flood risk and set out the proposed measures to mitigate that risk.

It is possible that flooding may occur from a source other than those identified within this SFRA, such as local drainage constraints, groundwater and surface water run-off problems in the area. The FRA will need to investigate the cause and effect of such local flooding as well as identifying appropriate mitigation.

Flood risk from the development site

The second matter for consideration is the risk posed to others by the development of a site increasing surface water runoff. This will depend mainly on the size and nature of the development proposal. Development towards the larger end of the 1 ha category can generate a significant increase in the surface water discharge rate. The impacts and risks posed by this will vary according to the characteristics of the development itself i.e. the scale of the impermeable surfacing and of the catchment concerned e.g. catchment size, distance from watercourse, gradient, soil type etc.

The risk posed should be reduced if the Environment Agency has been consulted and agreed the surface water disposal at the development plan/development brief stage. Proposed developments will also present a lower risk if a FRA has previously been developed in consultation with the Environment Agency for inclusion with that planning application.

PPG25 at paragraph 60 notes that the requirement to assess the flood risks posed by a development includes an assessment of the run-off implications of the development appropriate to the nature and scale of that development. In some cases the risks will be small and the assessment will be correspondingly simple, in others the assessment will need to be more detailed reflecting greater risks.

Specific requirements for flood risk due to surface water run-off from operational development up to 0.5 ha in size

The FRA must:-

- assess the run-off likely to be generated from the proposed development; and
- assess surface water measures already in place, their condition and their performance.

Where it is apparent that increased flooding would occur, then the FRA must identify measures to mitigate/manage these effects. These can be either:-

1. Sustainable drainage systems (SUDS).

2. On-site surface water management measures to restrict surface water discharge before it leaves the site. Water may then only discharge either at a rate capable of being conveyed by the receiving system or at a rate equivalent to the greenfield run-off rate for the site.
3. Maintenance to the receiving watercourse to allow additional rates of flow to be accommodated.
4. Local modifications to the watercourse such that the increased volume is stored and accommodated at, or adjacent to, the site.

Specific requirements for flood risk due to surface water run-off from operational development 0.5 ha to 1.0 ha in size

At this scale development is likely to have an impact on the water surface drainage system to which its surface water will discharge, especially where the proposal is for industrial/commercial development with large impermeable areas. In addition to the requirements in the previous section, the FRA should include an assessment of the likelihood of additional flooding elsewhere and the associated impacts. This should identify flood management measures, which should in the first instance look at the inclusion of SUDS.

Note

Development which involves a culvert or an obstruction to flow on an Ordinary Watercourse will require Environment Agency consent under the Land Drainage Act 1991. An Ordinary Watercourse is defined as any watercourse not identified as a Main River held on maps by the Environment Agency and DEFRA. For further information see the comment in cell B26 (Ordinary Watercourses - Land Drainage Act consent) under the 'Procedure Key' heading.

E7 Camping and caravan sites within NE/NLC SFRA Zone 3(i) - High Risk; Low Vulnerability (Defences to appropriate standard and flood risk not unacceptably high)

Planning applications will need to be accompanied by a Flood Risk Assessment (FRA). The Environment Agency should be consulted at an early stage, before any planning application or accompanying FRA is prepared.

Note

Development which involves a culvert or an obstruction to flow on an Ordinary Watercourse will require Environment Agency consent under the Land Drainage Act 1991. An Ordinary Watercourse is defined as any watercourse not identified as a Main River held on maps by the Environment Agency and DEFRA. For further information see the comment in cell B26 (Ordinary Watercourses - Land Drainage Act consent) under the 'Procedure Key' heading.

E8 Operational development (i.e. no change of use) between 1ha and 5ha within NE/NLC SFRA Zone 3(i) - High Risk; Low Vulnerability (Defences to appropriate standard and flood risk not unacceptably high)

Planning applications will need to be accompanied by a Flood Risk Assessment (FRA). The Environment Agency should be consulted at an early stage, before any planning application or accompanying FRA is prepared.

Note

Development which involves a culvert or an obstruction to flow on an Ordinary Watercourse will require Environment Agency consent under the Land Drainage Act 1991. An Ordinary Watercourse is defined as any watercourse not identified as a Main River held on maps by the Environment Agency and DEFRA. For further information see the comment in cell B26 (Ordinary Watercourses - Land Drainage Act consent) under the 'Procedure Key' heading.

E9 Civil emergency infrastructure within NE/NLC SFRA Zone 3(i) - High Risk; Low Vulnerability (Defences to appropriate standard and flood risk not unacceptably high)

Planning applications will need to be accompanied by a Flood Risk Assessment (FRA). The Environment Agency should be consulted at an early stage, before any planning application or accompanying FRA is prepared.

Note

Development which involves a culvert or an obstruction to flow on an Ordinary Watercourse will require Environment Agency consent under the Land Drainage Act 1991. An Ordinary Watercourse is defined as any watercourse not identified as a Main River held on maps by the Environment Agency and DEFRA. For further information see the comment in cell B26 (Ordinary Watercourses - Land Drainage Act consent) under the 'Procedure Key' heading.

E10 Operational development (i.e. no change of use) greater than 5.0ha within NE/NLC SFRA Zone 3(i) - High Risk; Low Vulnerability (Defences to appropriate standard and flood risk not unacceptably high)

Planning applications will need to be accompanied by a Flood Risk Assessment (FRA). The Environment Agency should be consulted at an early stage, before any planning application or accompanying FRA is prepared.

Note

Development which involves a culvert or an obstruction to flow on an Ordinary Watercourse will require Environment Agency consent under the Land Drainage Act 1991. An Ordinary Watercourse is defined as any watercourse not identified as a Main River held on maps by the Environment Agency and DEFRA. For further information see the comment in cell B26 (Ordinary Watercourses - Land Drainage Act consent) under the 'Procedure Key' heading.

F1 PPG25 Zone 2 - Medium to low flood risk area

Zone 2 is the low to medium flood risk zone as defined in Table 1, paragraph 30 of PPG25.

Zone 2 is shown on Environment Agency maps and on the Flood Risk maps accompanying this SFRA. It covers land where the annual probability of either river or tidal & coastal flooding is greater than 0.1% (i.e. at risk from a less than 1 in 1000 year event) but less than 1.0% from river flooding and 0.5% from tidal & coastal flooding (i.e. not at risk from less than 1 in 100 year river or 1 in 200 year tidal & coastal events).

F2 NE/NLC SFRA Zone 2 - Medium to low flood risk area

The definition of this zone is the same as the definition for Zone 2 given in Table 1 paragraph 30 of PPG 25.

This column covers land where the annual probability of either river or tidal & coastal flooding is greater than 0.1% (i.e. at risk from a less than 1 in 1000 year event) but less than 1.0% from river flooding and 0.5% from tidal & coastal flooding (i.e. not at risk from less than 1 in 100 year river or 1 in 200 year tidal & coastal events).

F3 Domestic extensions within NE/NLC SFRA Zone 2 - medium to low flood risk

In this SFRA, Zone 2 refers to those areas shown on the Environment Agency's Flood Maps as having a medium to low flood risk as defined for PPG25 Zone 2. Flooding is unlikely to occur during events smaller than the 1 in 100 year (1% annual probability) river or the 1 in 200 year (0.5% annual probability) tidal and coastal events but the whole area is likely to be flooded during the 1 in 1000 years (0.1% annual probability) river or tidal and coastal event.

FRA minimum requirements

Planning applications must be accompanied by a Flood Risk Assessment (FRA) produced by or for the applicant. Where a FRA is not submitted with the application or the FRA is not accepted by the

LPA the Environment Agency OBJECTS to the application and requests that the LPA either defers the application or refuses planning permission.

To be acceptable the FRA should confirm in writing as a minimum that:-

EITHER

1. Floor levels within the proposed development will be set no lower than existing levels.

AND

2. Flood proofing of the proposed development has been considered by the applicant and incorporated where appropriate.

OR

3. Floor levels within the extension will be set 300 mm above the critical flood levels set out in Appendix C of the NELC/NLC SFRA Report and repeated in the tables attached to this matrix. This must be demonstrated by a plan to Ordnance Datum/GPS showing finished floor levels relative to the flood level. Flood levels should be obtained from the Environment Agency, noting that a charge may be made for this service.

Process

A simple FRA confirming, as a minimum, the criteria set out above must accompany planning applications submitted to the Local Planning Authority (LPA). The LPA should determine the adequacy of the FRA. If the applicant does not provide a FRA meeting these minimum requirements the Agency recommends the application be refused.

Background

For proposed domestic extensions within NE/NLC SFRA Zone 2, the main aspect of flood risk to consider is that the development itself may be at risk of flooding. The most effective means of addressing this risk is through the submission of a simple flood risk assessment (FRA) This should identify the flood risk and set out the proposed measures to mitigate that risk. For most developments within this Zone submission of a site plan showing floor levels related to Ordnance Datum/GPS should confirm that the site is above flood level. Where such a plan indicates otherwise or is not provided, mitigation measures will need to focus on controlling floor levels and incorporating flood proofing into the design of the extension. Further guidance on what may be included within the FRA including an assessment of residual risks is contained in the Environment Agency's guidance note FRA 3.

Floor levels

From a flood risk point of view, the ideal mitigation in terms of floor levels is to ensure that these are set above the known or modelled 1 in 100 year ((1% annual probability) river flood level or 1 in 200 year (0.5% annual probability) tidal and coastal flood level at that location. However, in the case of an extension it will often not be practical to raise floor levels given the potential effects on other issues such as access (including that for disabled users), usability and visual amenity. Any proposals to raise floor levels must therefore be discussed and agreed with the LPA at the earliest possible stage.

Flood proofing

The Environment Agency recommends that in areas at risk of flooding consideration be given to the incorporation of flood proofing measures into the design and construction of the development. These include removable barriers on building apertures such as doors and air bricks and bringing electrical services into the building at a high level so that plugs are located above possible flood levels. Additional guidance, including information on kite marked flood protection products, can be

found on the Environment Agency web site www.environment-agency.gov.uk

Residual risks

It should be noted that if the building is in a 'low spot' the measures adopted above will not necessarily eliminate risks during a flood event. Applicants should be asked to check ground levels if in doubt about this. Even where it is possible to ensure floor levels are set above the known or modelled 1 in 100 year (1% annual probability) river and 1 in 200 year (0.5% annual probability) tidal and coastal flood level, flood risks will remain for an event that exceeds this magnitude.

Note

Development which involves a culvert or an obstruction to flow on an Ordinary Watercourse will require Agency consent under the Land Drainage Act 1991.

An Ordinary Watercourse is defined as any watercourse not identified as a Main River held on maps by the Environment Agency and DEFRA. For further information see the comment in cell B26 (Ordinary Watercourses - Land Drainage Act consent) under the 'Procedure Key' heading.

F4 Industrial/Commercial Extensions less than 250m² within NE/NLC SFRA Zone 2 - medium to low flood risk

In this SFRA, Zone 2 refers to those areas shown on the Environment Agency's Flood Maps as having a medium to low flood risk as defined for PPG25 Zone 2. Flooding is unlikely to occur during events smaller than the 1 in 100 year (1% annual probability) river or the 1 in 200 year (0.5% annual probability) tidal and coastal events but the whole area is likely to be flooded during the 1 in 1000 years (0.1% annual probability) river or tidal and coastal event.

FRA minimum requirements

Planning applications must be accompanied by a Flood Risk Assessment (FRA) produced by or for the applicant. Where a FRA is not submitted with the application or the FRA is not accepted by the LPA the Environment Agency OBJECTS to the application and requests that the LPA either defers the application or refuses planning permission.

To be acceptable the FRA should confirm in writing as a minimum that:-

EITHER

1. Floor levels within the proposed development will be set no lower than existing levels.

AND

2. Flood proofing of the proposed development has been considered by the applicant and incorporated where appropriate.

OR

3. Floor levels within the extension will be set 300 mm above the critical flood levels set out in Appendix C of the NELC/NLC SFRA Report and repeated in the tables attached to this matrix. This must be demonstrated by a plan to Ordnance Datum/GPS showing finished floor levels relative to the flood level.

Process

A simple FRA confirming, as a minimum, the criteria set out above must accompany planning applications submitted to the Local Planning Authority (LPA). The LPA should determine the adequacy of the FRA. If the applicant does not provide a FRA meeting these minimum requirements the Agency recommends the application be refused.

Background

For proposed minor industrial/commercial extensions within NE/NLC SFRA Zone 2, the main aspect of flood risk to consider is that the development itself may be at risk of flooding. The most effective means of addressing this risk is through the submission of a simple flood risk assessment (FRA) This should identify the flood risk and set out the proposed measures to mitigate that risk. For most developments within this Zone submission of a site plan showing floor levels related to Ordnance Datum/GPS should confirm that the site is above flood level. Where such a plan indicates otherwise or is not provided, mitigation measures will need to focus on controlling floor levels and incorporating flood proofing into the design of the extension. Further guidance on what may be included within the FRA including an assessment of residual risks is contained in the Environment Agency's guidance note FRA 3.

Floor levels

From a flood risk point of view, the ideal mitigation in terms of floor levels is to ensure that these are set above the known or modelled 1 in 100 year ((1% annual probability) river flood level or 1 in 200 year (0.5% annual probability) tidal and coastal flood level at that location. However, in the case of an extension it will often not be practical to raise floor levels given the potential effects on other issues such as access (including that for disabled users), usability and visual amenity. Any proposals to raise floor levels must therefore be discussed and agreed with the LPA at the earliest possible stage.

Flood proofing

The Environment Agency recommends that in areas at risk of flooding consideration be given to the incorporation of flood proofing measures into the design and construction of the development. These include removable barriers on building apertures such as doors and air bricks and bringing electrical services into the building at a high level so that plugs are located above possible flood levels. Additional guidance, including information on kite marked flood protection products, can be found on the Environment Agency web site www.environment-agency.gov.uk

Residual risks

It should be noted that if the building is in a 'low spot' the measures adopted above will not necessarily eliminate risks during a flood event. Applicants should be asked to check ground levels if in doubt about this. Even where it is possible to ensure floor levels are set above the known or modelled 1 in 100 year (1% annual probability) river and 1 in 200 year (0.5% annual probability) tidal and coastal flood level, flood risks will remain for an event that exceeds this magnitude.

Note

Development which involves a culvert or an obstruction to flow on an Ordinary Watercourse will require Agency consent under the Land Drainage Act 1991.

An Ordinary Watercourse is defined as any watercourse not identified as a Main River held on maps by the Environment Agency and DEFRA. For further information see the comment in cell B26 (Ordinary Watercourses - Land Drainage Act consent) under the 'Procedure Key' heading.

F5 Change of use to a more 'flood risk sensitive' use within NE/NLC SFRA Zone 2 - medium to low flood risk

In this SFRA, Zone 2 refers to those areas shown on the Environment Agency's Flood Maps as having a medium to low flood risk as defined for PPG25 Zone 2. Flooding is unlikely to occur during events smaller than the 1 in 100 year (1% annual probability) river or the 1 in 200 year (0.5% annual probability) tidal and coastal events but the whole area is likely to be flooded during the 1 in 1000 years (0.1% annual probability) river or tidal and coastal event.

FRA minimum requirements

Planning applications must be accompanied by a Flood Risk Assessment (FRA) produced by or for the applicant. Where a FRA is not submitted with the application or the FRA is not accepted by the LPA the Environment Agency OBJECTS to the application and requests that the LPA either defers the

application or refuses planning permission.

To be acceptable the FRA must confirm in writing:-

1. That an assessment has been made of the flood risks accruing from the proposed change of use. This should include a level survey to Ordnance Datum/GPS showing the critical flood levels set out in Appendix C of the NELC/NLC SFRA Report and repeated in the table attached to this matrix relative to proposed site levels. It should also include an assessment of whether or not the proposed development site lies within an area with a documented flooding history.

AND

2. What mitigation is proposed to deal with any identified risks e.g. ensuring bedrooms are located upstairs, warning or evacuation plans, flood proofing etc.

Process

A FRA confirming the two elements set out above must accompany planning applications submitted to the Local Planning Authority (LPA). The LPA should determine the adequacy of the FRA. If the applicant does not provide a FRA meeting these minimum requirements the Agency recommends the application be refused.

Where a FRA is provided that indicates that the site lies within a documented historic flooding area, the Agency should be consulted for a bespoke response unless the LPA considers that this issue has been dealt with through a Letter of Compliance issued to the applicant by the Agency and attached to the FRA.

Background

In most cases, changes of use within NELC/NLC SFRA Zone 2 will pose little or no increase in flood risk. For changes of use qualifying as 'flood risk sensitive uses', however, the risks may be higher and need to be assessed and dealt with. For example, a proposed change of use from residential accommodation to a care home may bring a significantly increased number of vulnerable users into a high flood risk area.

For proposed developments falling within an area with a previous history of flooding, the Agency needs to continue to have a technical input to the FRA process. This will be achieved either through input at the pre-application stage culminating in the issue of a Letter of Compliance and/or through bespoke consultation at the planning application stage when a FRA indicates that the site has previously flooded.

Note

Development which involves a culvert or an obstruction to flow on an Ordinary Watercourse will require Agency consent under the Land Drainage Act 1991. An Ordinary Watercourse is defined as any watercourse not identified as a Main River held on maps by the Environment Agency and DEFRA. For further information see the comment in cell B26 (Ordinary Watercourses - Land Drainage Act consent) under the 'Procedure Key' heading.

F6 Operational development (i.e. no change of use) less than 1ha within NE/NLC SFRA Zone 2 - medium to low flood risk

In this SFRA, Zone 2 refers to those areas shown on the Environment Agency's Flood Maps as having a medium to low flood risk as defined for PPG25 Zone 2. Flooding is unlikely to occur during events smaller than the 1 in 100 year (1% annual probability) river or the 1 in 200 year (0.5% annual probability) tidal and coastal events but the whole area is likely to be flooded during the 1 in 1000 years (0.1% annual probability) river or tidal and coastal event.

FRA minimum requirements

Planning applications must be accompanied by a Flood Risk Assessment (FRA) produced by or for the applicant. Where a FRA is not submitted with the application or the FRA is not accepted by the Local Planning Authority (LPA) the Agency OBJECTS to the application and requests that the LPA either defers the application or refuses planning permission.

To be acceptable the FRA must include the following as a minimum:-

1. A level survey to Ordnance Datum/GPS showing the critical flood levels set out in Appendix C of the NELC/NLC SFRA Report and repeated in the tables attached to this matrix relative to proposed site levels.
2. An assessment of the risks posed to the site including that based on any documented historic flooding and risks associated with any increase in surface water run-off from the site.
3. Proposed mitigation measures to control those risks e.g. setting appropriate floor levels, providing flood proofing, providing suitable means of surface water disposal.

Specific FRA requirements relating to surface water run-off for given sizes of development are set out in the text below.

Process

A FRA must accompany planning applications submitted to the Local Planning Authority (LPA). The LPA should determine the adequacy of the FRA. If the applicant does not provide a FRA meeting these minimum requirements the Agency recommends the application be refused.

Where a FRA is provided that indicates that the site lies within a documented historic flooding area, the Agency should be consulted for a bespoke response unless the LPA considers that this issue has been dealt with through a Letter of Compliance issued to the applicant by the Agency and attached to the FRA.

Background

Within NELC/NLC SFRA Zone 2 there are two main flood risk considerations:-

1. The flood risk to the site resulting from an extreme flood event (i.e. a flood that is greater than the 1% annual probability river or 0.5% annual probability tidal and coastal events).
2. The flood risk resulting from the change of use of greenfield land to developed land which will reduce the natural drainage permeability of that land leading to increased flood risk elsewhere.

For proposed developments falling within an area with a previous history of flooding, the Agency needs to continue to have a technical input to the FRA process. This will be achieved either through input at the pre-application stage culminating in the issue of a Letter of Compliance and/or through bespoke consultation at the planning application stage when a FRA indicates that the site has previously flooded.

Flood risk to the development site

Flooding of any site within NE/NLC SFRA Zone 2 will only take place in either an extreme flood event or as a result of local catchment drainage flooding.. This zone is therefore suitable for most types of development, however PPG25 paragraph 30 states that the LPA should request a flood risk assessment (FRA) to assist in their decision making. This may be particularly where protection from an extreme flood is required or where a site has recently been known to flood. The FRA should use available historic information, surveys and local knowledge to establish what the impact of flooding

would have been. This can then be used to establish any mitigation measures necessary to protect the development from future extreme events..

It is possible that flooding may occur from a source other than those identified within this SFRA, such as local drainage constraints, groundwater and surface water run-off problems in the area. The FRA will need to investigate the cause and effect of such local flooding as well as identifying appropriate mitigation.

Flood risk from the development site

The second matter for consideration is the risk posed to others by the development of a site increasing surface water runoff. This will depend mainly on the size and nature of the development proposal. Development towards the larger end of the 1 ha category can generate a significant increase in the surface water discharge rate. The impacts and risks posed by this will vary according to the characteristics of the development itself i.e. the scale of the impermeable surfacing and of the catchment concerned e.g. catchment size, distance from watercourse, gradient, soil type etc.

The risk posed should be reduced if the Agency has been consulted and agreed the surface water disposal at the development plan/development brief stage. Proposed developments will also present a lower risk if a FRA has previously been developed in consultation with the Agency for inclusion with that planning application.

PPG25 at paragraph 60 notes that the requirement to assess the flood risks posed by a development includes an assessment of the run-off implications of the development appropriate to the nature and scale of that development. In some cases the risks will be small and the assessment will be correspondingly simple, in others the assessment will need to be more detailed reflecting greater risks.

Specific requirements for flood risk due to surface water run-off from operational development up to 0.5 ha in size

The FRA must:-

- assess the run-off likely to be generated from the proposed development; and
- assess surface water measures already in place, their condition and their performance.

Where it is apparent that increased flooding would occur, then the FRA must identify measures to mitigate/manage these effects. These can be either:-

1. Sustainable drainage systems (SUDS).
2. On-site surface water management measures to restrict surface water discharge before it leaves the site. Water may then only discharge either at a rate capable of being conveyed by the receiving system or at a rate equivalent to the greenfield run-off rate for the site.
3. Maintenance to the receiving watercourse to allow additional rates of flow to be accommodated.
4. Local modifications to the watercourse such that the increased volume is stored and accommodated at, or adjacent to, the site.

Specific requirements for flood risk due to surface water run-off from operational development 0.5 ha to 1.0 ha in size

At this scale development is likely to have an impact on the water surface drainage system to which its surface water will discharge, especially where the proposal is for industrial/commercial development with large impermeable areas. In addition to the requirements in the previous section, the FRA

should include an assessment of the likelihood of additional flooding elsewhere and the associated impacts. This should identify flood management measures, which should in the first instance look at the inclusion of SUDS.

Note

Development which involves a culvert or an obstruction to flow on an Ordinary Watercourse will require Agency consent under the Land Drainage Act 1991. An Ordinary Watercourse is defined as any watercourse not identified as a Main River held on maps by the Environment Agency and DEFRA. For further information see the comment in cell B26 (Ordinary Watercourses - Land Drainage Act consent) under the 'Procedure Key' heading.

F7 Camping & caravan sites within NE/NLC Zone 2 - medium to low flood risk

In this SFRA, Zone 2 refers to those areas shown on the Environment Agency's Flood Maps as having a medium to low flood risk as defined for PPG25 Zone 2. Flooding is unlikely to occur during events smaller than the 1 in 100 year (1% annual probability) river or the 1 in 200 year (0.5% annual probability) tidal and coastal events but the whole area is likely to be flooded during the 1 in 1000 years (0.1% annual probability) river or tidal and coastal event.

FRA minimum requirements

Planning applications must be accompanied by a Flood Risk Assessment (FRA) produced by or for the applicant. Where a FRA is not submitted with the application or the FRA is not accepted by the LPA the Environment Agency OBJECTS to the application and requests that the LPA either defers the application or refuses planning permission.

To be acceptable the FRA must include the following as a minimum:-

1. A level survey to Ordnance Datum/GPS showing the critical flood levels set out in Appendix C of the NELC/NLC SFRA Report and repeated in the tables attached to this matrix relative to proposed site levels.
2. An assessment of the risks posed to the camping and caravan site including that based on any documented historic flooding and risks associated with any increase in surface water run-off from the site.
3. Proposed mitigation measures to control those risks e.g. ensuring the proposed pitches for camping and caravan users are situated as high as possible within the site, providing a warning/evacuation system.

Process

In all cases a FRA that addresses both the risk to the camping/caravan site itself and the control of surface water run-off will need to accompany the planning application submitted to the Local Planning Authority (LPA). The LPA should determine the adequacy of the FRA. If the applicant does not provide a FRA meeting these minimum requirements the Agency recommends the application be refused.

Where a FRA is provided that indicates that the site lies within a documented historic flooding area, the Agency should be consulted for a bespoke response unless the LPA considers that this issue has been dealt with through a Letter of Compliance issued to the applicant by the Agency and attached to the FRA.

Background

Camping and caravan sites are especially vulnerable to flooding, as is recognised in paragraph 70 of PPG25 and further guidance is given in Appendix G thereto.

For proposed developments falling within an area with a previous history of flooding, the Agency

needs to continue to have a technical input to the FRA process. This will be achieved either through input at the pre-application stage culminating in the issue of a Letter of Compliance and/or through bespoke consultation at the planning application stage when a FRA indicates that the site has previously flooded.

Note

Development which involves a culvert or an obstruction to flow on an Ordinary Watercourse will require Agency consent under the Land Drainage Act 1991. An Ordinary Watercourse is defined as any watercourse not identified as a Main River held on maps by the Environment Agency and DEFRA. For further information see the comment in cell B26 (Ordinary Watercourses - Land Drainage Act consent) under the 'Procedure Key' heading.

F8 Operational development (i.e. no change of use) between 1ha and 5ha within NE/NLC SFRA Zone 2 - medium to low flood risk

Planning applications will need to be accompanied by a Flood Risk Assessment (FRA). The Environment Agency should be consulted at an early stage, before any planning application or accompanying FRA is prepared.

Note

Development which involves a culvert or an obstruction to flow on an Ordinary Watercourse will require Environment Agency consent under the Land Drainage Act 1991. An Ordinary Watercourse is defined as any watercourse not identified as a Main River held on maps by the Environment Agency and DEFRA. For further information see the comment in cell B26 (Ordinary Watercourses - Land Drainage Act consent) under the 'Procedure Key' heading.

F9 Civil emergency infrastructure within NE/NLC SFRA Zone 2 - medium to low flood risk

Planning applications will need to be accompanied by a Flood Risk Assessment (FRA). The Environment Agency should be consulted at an early stage, before any planning application or accompanying FRA is prepared.

Note

Development which involves a culvert or an obstruction to flow on an Ordinary Watercourse will require Environment Agency consent under the Land Drainage Act 1991. An Ordinary Watercourse is defined as any watercourse not identified as a Main River held on maps by the Environment Agency and DEFRA. For further information see the comment in cell B26 (Ordinary Watercourses - Land Drainage Act consent) under the 'Procedure Key' heading.

F10 Operational development (i.e. no change of use) greater than 5.0ha within NE/NLC SFRA Zone 2 - medium to low flood risk

Planning applications will need to be accompanied by a Flood Risk Assessment (FRA). The Environment Agency should be consulted at an early stage, before any planning application or accompanying FRA is prepared.

Note

Development which involves a culvert or an obstruction to flow on an Ordinary Watercourse will require Environment Agency consent under the Land Drainage Act 1991. An Ordinary Watercourse is defined as any watercourse not identified as a Main River held on maps by the Environment Agency and DEFRA. For further information see the comment in cell B26 (Ordinary Watercourses - Land Drainage Act consent) under the 'Procedure Key' heading.

G1 PPG25 Zone 1 - Little or no flood risk area

Zone 1 is the little or no flood risk zone as defined in Table 1, paragraph 30 of PPG25.

Zone 1 is the area outside Zones 2 and 3 shown on Environment Agency maps and on the Flood Risk maps accompanying this SFRA. It covers land where the annual probability of either river or

tidal & coastal flooding is less than 0.1% (i.e. the land is not at risk from a less than 1 in 1000 year event).

G2 NE/NLC SFRA Zone 1 - Little or no flood risk area

The definition of this zone is the same as the definition for Zone 1 given in Table 1 paragraph 30 of PPG 25.

This column covers land where the annual probability of either river or tidal & coastal flooding is less than 0.1% (i.e. the land is not at risk from a less than 1 in 1000 year event).

G3 Ordinary Watercourses

Note

Development which involves a culvert or an obstruction to flow on an Ordinary Watercourse will require Environment Agency consent under the Land Drainage Act 1991. An Ordinary Watercourse is defined as any watercourse not identified as a Main River held on maps by the Environment Agency and DEFRA. For further information see the comment in cell B26 (Ordinary Watercourses - Land Drainage Act consent) under the 'Procedure Key' heading.

G4 Ordinary Watercourses

Note

Development which involves a culvert or an obstruction to flow on an Ordinary Watercourse will require Environment Agency consent under the Land Drainage Act 1991. An Ordinary Watercourse is defined as any watercourse not identified as a Main River held on maps by the Environment Agency and DEFRA. For further information see the comment in cell B26 (Ordinary Watercourses - Land Drainage Act consent) under the 'Procedure Key' heading.

G5 Ordinary Watercourses

Note

Development which involves a culvert or an obstruction to flow on an Ordinary Watercourse will require Environment Agency consent under the Land Drainage Act 1991. An Ordinary Watercourse is defined as any watercourse not identified as a Main River held on maps by the Environment Agency and DEFRA. For further information see the comment in cell B26 (Ordinary Watercourses - Land Drainage Act consent) under the 'Procedure Key' heading.

G6 Ordinary Watercourses

Note

Development which involves a culvert or an obstruction to flow on an Ordinary Watercourse will require Environment Agency consent under the Land Drainage Act 1991. An Ordinary Watercourse is defined as any watercourse not identified as a Main River held on maps by the Environment Agency and DEFRA. For further information see the comment in cell B26 (Ordinary Watercourses - Land Drainage Act consent) under the 'Procedure Key' heading.

G7 General surface water drainage information for areas within NE/NLC SFRA Zone 1

Developments on this scale in these lower risk locations within NE/NLC SFRA Zone 1 fall outside the scope of formal standing advice. The following is offered to aid developers in managing the surface water runoff issues for information purposes only as a pointer towards best practice for surface water disposal.

Surface water run-off should be controlled as near to its source as possible through a sustainable drainage approach to surface water management. This approach involves using a range of techniques including soakaways, infiltration trenches, permeable pavements, grassed swales, ponds and wetlands to reduce flood risk by attenuating the rate and quantity of surface water run-off from a site. This approach can also offer other benefits in terms of promoting groundwater

recharge, water quality improvement and amenity enhancements. Approved Document Part H of the Building Regulations 2000 sets out a hierarchy for surface water disposal which encourages a SUDs approach.

- In accordance with Approved Document Part H of the Building Regulations 2000, the first option for surface water disposal should be the use of sustainable drainage methods (SUDS) which limit flows through infiltration e.g. soakaways or infiltration trenches, subject to establishing that these are feasible, can be adopted and properly maintained and would not lead to any other environmental problems. For example, using soakaways or other infiltration methods on contaminated land carries ground water pollution risks and may not work in areas with a high water table. Where the intention is to dispose to soakaway, these should be shown to work through an appropriate assessment carried out under BRE Digest 365.
- Flow balancing SUDS methods which involve the retention and controlled release of surface water from a site may be an option for some developments at this scale providing balanced surface water flows exceed the minimum feasible discharge rate (approx. 5 litres/second/hectare). Flow balancing should seek to achieve water quality and amenity benefits as well as managing flood risk.
- Further information on SUDS can be found in PPG25 paragraphs 40-42, PPG25 appendix E, in the CIRIA C522 document Sustainable Urban Drainage Systems-design manual for England and Wales and the Interim Code of Practice for Sustainable Drainage Systems. The Interim Code of Practice will be made available electronically on both the Environment Agency's web site at www.environment-agency.gov.uk and CIRIA's web site at: www.ciria.org.uk.
- Where it is intended that disposal be made to public sewer, the Water Company or its agents should confirm that there is adequate spare capacity in the existing system taking future development requirements into account.

Note

Development which involves a culvert or an obstruction to flow on an Ordinary Watercourse will require Environment Agency consent under the Land Drainage Act 1991. An Ordinary Watercourse is defined as any watercourse not identified as a Main River held on maps by the Environment Agency and DEFRA. For further information see the comment in cell B26 (Ordinary Watercourses - Land Drainage Act consent) under the 'Procedure Key' heading.

G8 Operational development (i.e. no change of use) between 1ha and 5ha within NE/NLC SFRA Zone 1 - little or no flood risk

FRA minimum requirements

Planning applications must be accompanied by a flood risk assessment produced by or for the applicant. Where a FRA is not submitted with the application or the FRA is not accepted by the Local Planning Authority (LPA) the Environment Agency OBJECTS to the application and requests that the LPA either defers the application or refuses planning permission. The applicant should then be advised to contact the Environment Agency with a view to obtaining pre-application technical advice and securing a Letter of Compliance before progressing their planning application any further. Where the LPA is minded to refuse the application, the following standard paragraphs may be applicable.

Failure to submit a FRA - Environment Agency objection

The Environment Agency OBJECTS to the proposed development on the grounds that the application may present a significant flood risk from the generation of surface water run-off but is not accompanied by a flood risk assessment as required by PPG25.

Inadequate FRA - Environment Agency objection

The flood risk information submitted in support of the application is not acceptable to the Environment Agency for the following reasons:-

[add omissions / areas for clarification / more detail etc as appropriate].

The Environment Agency therefore OBJECTS to the proposed development on the grounds that a proper assessment of flood risk has not been undertaken as required by PPG25.

FRA - requirements for operational development of 1 to 5 ha in NE/NLC SFRA Zone 1

In order to demonstrate that the development is of low flood risk the FRA should show:-

1. That it will be feasible to balance surface water run-off to the greenfield run-off rate for all events up to the 1 in 100 year storm (including climate change) and set out how this will be achieved.
2. How sustainable drainage techniques (SUDS) will be used with any obstacles to their use clearly justified.

Process

A FRA must accompany planning applications submitted to the LPA. The FRA will focus on the control of surface water runoff generated by the development and the ability of any receiving watercourse to deal with it. The LPA should determine the adequacy of the FRA.

Background

Within NE/NLC SFRA Zone 1 the primary flood risk issue generated by most new development is the risk posed to others by surface water runoff. Development within this category can generate significant volumes of water. The impact and risks posed by this will vary according to the characteristics of the development itself i.e. the scale of impermeable surfacing and of the catchment concerned i.e. catchment size, distance from local watercourses, capacity of local watercourses, gradient, soil type etc.

PPG25 at paragraph 60 notes that the requirement to assess the flood risks posed by development includes an assessment of the run-off implications of development appropriate to the nature and scale of that development. In some cases the risk will be small and the assessment will be correspondingly simple, in others the assessment will need to be more detailed reflecting greater risks. Even at the outline application stage the applicant needs to be able to demonstrate that surface water balancing can be achieved.

Applicants are strongly advised to contact the Environment Agency at a pre-application stage to discuss the scope of the FRA.

Letter of Compliance

The risk posed should be reduced if the Environment Agency has been consulted and agreed the surface water disposal at the development plan/development brief stage. Proposed developments will also present a lower risk if a Letter of Compliance issued by the Environment Agency after pre-application negotiations with the developer accompanies the flood risk assessment (FRA).

SUDS

Further information on SUDS can be found in PPG25 paragraphs 40-42, PPG25 appendix E, in the CIRIA C522 document Sustainable Urban Drainage Systems-design manual for England and Wales and the Interim Code of Practice for Sustainable Drainage Systems. This Interim Code of

Practice provides advice on design, adoption and maintenance issues and a good overview of other technical guidance on SUDS. The Interim Code of Practice will be made available electronically on both the Environment Agency's web site at www.environment-agency.gov.uk and CIRIA's web site at: www.ciria.org.uk.

Note that whilst the focus within the FRA must be on flood risk management, any SUDS should also seek to maximise opportunities for water quality and amenity benefits.

Note

Development which involves a culvert or an obstruction to flow on an Ordinary Watercourse will require Environment Agency consent under the Land Drainage Act 1991. An Ordinary Watercourse is defined as any watercourse not identified as a Main River held on maps by the Environment Agency and DEFRA. For further information see the comment in cell B26 (Ordinary Watercourses - Land Drainage Act consent) under the 'Procedure Key' heading.

G9 Civil emergency infrastructure less than 5.0 ha within NE/NLC SFRA Zone 1 - little or no flood risk

Within NE/NLC SFRA Zone 1 the primary flood risk issue generated by most new development is the risk posed to others by surface water runoff. Development within this category can generate significant volumes of water. The impact and risks posed by this will vary according to the characteristics of the development itself i.e. the scale of impermeable surfacing and of the catchment concerned i.e. catchment size, distance from local watercourses, capacity of local watercourses, gradient, soil type etc.

For Civil Emergency Infrastructure which can range in scale from a small fire station to a major hospital, the response required to a proposed development in flood risk terms will depend on the scale of the proposed development as set out below. Please note that where these developments are proposed on 'dry islands' then any flood risk assessment should include consideration of how access will be provided during flood events.

1. Up to 1.0 ha - Grey cell response for 'Operational development less than 1ha' applies.

Do not consult the Agency, response falls outside the scope of formal Standing Advice.

2. 1.0 ha to 5.0 ha - Green cell response for 'Operational development between 1ha and 5ha' applies.

This is subject to Standing Advice at the planning application stage but the Agency wishes to have a pre-application technical input.

Note

Development which involves a culvert or an obstruction to flow on an Ordinary Watercourse will require Environment Agency consent under the Land Drainage Act 1991. An Ordinary Watercourse is defined as any watercourse not identified as a Main River held on maps by the Environment Agency and DEFRA. For further information see the comment in cell B26 (Ordinary Watercourses - Land Drainage Act consent) under the 'Procedure Key' heading.

G10 Operational development (i.e. no change of use) greater than 5.0ha within NE/NLC SFRA Zone 1 - little or no flood risk

Planning applications will need to be accompanied by a Flood Risk Assessment (FRA). The Environment Agency should be consulted at an early stage, before any planning application or accompanying FRA is prepared.

Note

Development which involves a culvert or an obstruction to flow on an Ordinary Watercourse will require Environment Agency consent under the Land Drainage Act 1991. An Ordinary Watercourse

is defined as any watercourse not identified as a Main River held on maps by the Environment Agency and DEFRA. For further information see the comment in cell B26 (Ordinary Watercourses - Land Drainage Act consent) under the 'Procedure Key' heading.

A11 Environment Agency National Standing Advice to Local Planning Authorities on Development and Flood Risk

General advice on development within the RED boxes

Status

The Environment Agency will comment on planning applications and flood risk assessments where the proposed development and the site location are as described within the RED boxes. These represent high flood risk combinations of development type and/or location where the Environment Agency needs to continue to provide a bespoke response at the pre-application, application and post-application stages.

Process

Developments falling within the red boxes will need a Flood Risk Assessment (FRA) before the Environment Agency can comment on the planning consultation. The need for an appropriate assessment of flood risk is set out at paragraphs 20 and 57-60 of PPG25. General advice on the range of factors to consider in FRAs is contained in Appendix F of PPG25. The Environment Agency has produced a series of four guidance documents to aid those involved in the development process identifying which factors need to be considered in which circumstances.

The following process is advised to enable a 'fast track' consideration of FRAs at the planning application stage.

1. The Local Planning Authorities (LPA) should advise applicants to contact the Environment Agency for pre-planning discussions to scope the specific requirements of their flood risk assessment.
2. Applicants should then submit a preliminary FRA to the Environment Agency.
3. If necessary, the Environment Agency will then contact the applicant to discuss any final amendments required to the FRA.
4. Where the FRA is acceptable to the Environment Agency, the Environment Agency will issue a Letter of Compliance to the applicant.
5. At the planning application stage, the applicant submits the Letter of Compliance to the LPA together with planning application and FRA who will forward it on to the Environment Agency.

Further information on the Letter of Compliance procedure is given in the General Guidance Note on Development and Flood Risk standing advice that accompanies this matrix.

Outcome

If a FRA has not been submitted to the LPA with the planning application then the Environment Agency will OBJECT to the proposal. The FRA submitted must demonstrate to the Environment Agency's satisfaction that the development can proceed without creating an unacceptable flood risk either to future occupants or elsewhere. If it cannot do this then the Environment Agency will maintain its objection.

Where the FRA is acceptable the Environment Agency will advise on Flood Risk conditions at the Outline, Full or Reserved Matters stage or make such other recommendations as appropriate.

Note

Where an LPA is considering granting planning permission contrary to Environment Agency advice for development within the RED boxes, as per paragraph 65 of PPG25, the Environment Agency should be re-consulted, informed of the grounds for the intended grant of planning permission and given an opportunity to make further representations.

A12 Standard Response

Environment Agency National Standing Advice to Local Planning Authorities on Development and Flood Risk

General advice on development within the GREEN boxes

Status

The Environment Agency will not provide a bespoke comment on individual planning applications or pre-planning consultations and any accompanying flood risk assessment where the combination of the development type/scale and the site location falls within the GREEN boxes that indicate lower flood risk.

There is an exception to this general rule which applies to development between 1.0 and 5.0 hectares within PPG25 Zone 1 (cell H12) in relation to pre-planning consultations. For this limited category of development, the Environment Agency wishes to continue to have a technical input at pre-application stage only to ensure that surface water issues are adequately addressed. A procedure to help ensure this is set out below (Letter of Compliance procedure).

Process - general

The Local Planning Authority (LPA) should process planning applications according to development plan policies, the information in any Flood Risk Assessment (FRA), any relevant Strategic Flood Risk Assessment and the standing advice in the relevant cell of the matrix.

Process - Letter of Compliance for proposed development between 1.0 and 5.0 hectares within PPG25 Zone 1 (cell H12) only

As for 'Process - general' set out above but, in addition, the following Letter of Compliance Procedure will apply.

1. LPAs should advise applicants to contact their local Environment Agency office in the first instance for pre-planning discussions to scope the specific requirements of their flood risk assessment.
2. Applicants should then submit a preliminary FRA to the Environment Agency.
3. If necessary, the Environment Agency will then contact the applicant to discuss any final amendments required to the FRA.
4. Where the FRA is acceptable to the Environment Agency, the Environment Agency will issue a Letter of Compliance to the applicant.
5. At the planning application stage, the applicant submits the Letter of Compliance to the LPA together with planning application.

Outcome

If an appropriate FRA is not provided where the standing advice advises that this is necessary then LPAs should refuse or defer the application pending receipt of further information and direct the applicant to commence pre-application discussions with the Environment Agency.

FRAs - the obligation to assess risk - general advice

The need for an appropriate assessment of flood risk is set out at paragraphs 20 and 57-60 of PPG25. Further guidance on the scope of issues a FRA might cover is provided at appendix F of PPG25. In addition the Environment Agency has produced a series of four guidance note for LPAs and developers designed to indicate as far as possible which FRA issues should be addressed in which circumstances. PPG25 specifically acknowledges that failure to provide an assessment of flood risk that is appropriate to the scale and nature of the development and risks involved can constitute a reason for refusal (paragraph 60).

A13 Environment Agency General Surface Water Drainage Information General advice on development within the GREY boxes

The Environment Agency will not comment on individual planning applications or pre-planning consultations and any accompanying flood risk assessment where the proposed development and the site location fall within the GREY boxes that indicate the lowest scale of flood risk. Developments within these boxes falls outside the scope of standing advice. The Environment Agency's response is either 'no comment' because no significant surface water runoff issues are raised or 'General surface water drainage information' which sets out a few basic land drainage principles for information purposes only.

The attention of the Local Planning Authority (LPA) is drawn to paragraph 60 of PPG25 which states that a Flood Risk Assessment (FRA) appropriate to the nature and scale of the development should be carried out. Advice on what this should contain is given in FRA guidance note 1. The FRA does not need to be submitted to the Environment Agency for these developments in these locations.

Ordinary Watercourses - Land Drainage Act consent

The requirement for consent under the Land Drainage Act 1991

Under the terms of the Land Drainage Act 1991, the prior written consent of the Environment Agency is required for any mill dam, weir or like obstruction or for any culvert (or alteration to a culvert) likely to affect the flow in an Ordinary Watercourse. An Ordinary Watercourse is any watercourse not identified as a Main River held on maps by the Environment Agency and DEFRA.

Some Local Authorities have their own bye-laws and planning policy restrictions and Internal Drainage Boards will have their own bye-law consenting arrangements, otherwise in general the Agency makes the following comments:

Culverting

The Environment Agency has a policy on culverting which strongly discourages the creation of new culverts or extensions to existing culverts except where required for essential access purposes. From a flood risk viewpoint, culverting increases the risk of flooding by restricting the capacity of the channel to cope with increased flows during flood events and presents significant maintenance problems over the longer term with an on-going risk of blockage. The culvert may also need to be repaired or replaced in the future to maintain or increase its capacity. In addition to the flood risks, culverting may damage the ecology of a watercourse, restricting the scope for water-based fauna and flora to survive and inhibiting the movement of fish. Applicants considering culverting are advised to contact the Environment Agency at the earliest possible stage to discuss the feasibility of the proposals and the likelihood of gaining Land Drainage Act consent.

Any diversion should maintain the original watercourse in cross section, long section and in plan. Such works will require the prior consent of the Environment Agency under the Land Drainage Act 1991.

Whilst Environment Agency consent is not required for building over an existing culvert on an Ordinary Watercourse, the Environment Agency strongly advises against the practice. The reason is that building over culverts will obstruct any overland flow route, increasing the likelihood of flooding to the development and its neighbours.

Recommendations for ensuring access for maintenance

It is important to ensure that access for maintenance purposes is provided in relation to all watercourses whether culverted or not. For Ordinary Watercourses the Environment Agency makes the following recommendations:

For watercourses with a top width LESS THAN 2.0 metres wide and culverts LESS THAN 1.0 metre wide or 1.0 metre diameter

The Environment Agency recommends that a minimum easement of 3 metres from bank top or culvert edge, on both banks, is left clear to allow access for maintenance works. A 4 metre wide strip to gain access to each bank should be provided.

For watercourses GREATER THAN 2 metres wide and culverts GREATER THAN 1.0 metre wide or 1.0 metre diameter

The Environment Agency recommends that a minimum easement of 5 metres from bank top or culvert edge, on both banks, is left clear to allow access for maintenance works. A 4 metre wide strip to gain access to each bank should be provided.

Figures

Appendix A

Regional Planning Guidance – Policy Relating to Flood Risk

(Relevant Extracts)

Development and Flood Risk – Introduction

10.9 Map 9 shows the Environment Agency's indicative flood plain map (2000). This indicates areas that would be at risk from coastal, estuarine or fluvial flooding without some form of protection i.e. the map does not differentiate between defended and undefended areas. Nor does it take account of the likelihood that food risk will be increased by climate changes. As can be seen from map 9, such areas include large parts of the region, including extensive areas within many existing towns and cities. Many of the built up areas are and will continue to be protected in the context of Policy R1. Map 9 should not therefore be interpreted as indicating areas where development should not necessarily be located. However, the regional spatial pattern of development needs to minimise the risk of new buildings being subject to flooding and ensure that development does not increase the likelihood of flooding. Policy R2 below sets out the strategic approach to ensure this is the case. The issue of sustainable drainage systems, which can help to reduce flood risk, is dealt with in Policy R3.

Development and Flood Risk Policy Policy R2 Development and Flood Risk

Development Plans should adopt a sequential risk-based approach to development and flooding as defined in PPG25. To enable the risk from flooding to be appropriately managed in the region:

- a) In functional floodplains* and washlands**, and in undeveloped floodplain areas where the risk from tidal and fluvial flooding is high, development should be avoided.**
- b) In previously developed areas, and areas of undeveloped floodplain where the risk from flooding is lower, development should be of an appropriate type and design and will require the availability or provision of an appropriate standard of flood defence and the incorporation of flood mitigation and /or flood warning measures.**
- c) Following application of the sequential approach, where other considerations in favour of the development, (for example the significant need for economic and social regeneration and the need to recycle previously developed land) outweigh the flooding issues in identified flood risk areas, development will only be permitted where it has been established, following consultation with the Environment Agency and other relevant organisations, that any necessary protection or management measures can and will be provided and are consistent with the emerging Catchment Flood Management Plans**

(CFMPs) and, where relevant, the Humber Estuary Shoreline Management Plan (SMP).

- d) In liaison with the Environment Agency, local authorities should adopt a strategic approach to assessing the risk of flooding and the potential implications of development for flooding elsewhere.**
- e) Those proposing development in flood risk areas should carry out Flood Risk Assessments (FRAs). Where local authorities propose to allocate for development in the floodplain they will need to undertake FRA. The Environment Agency and other bodies should provide information and advice to assist in the preparation of these FRAs.**
- f) Local Authorities and the Environment Agency should take into account the latest information available from each other to ensure that their policies consistently deal with managing the risk from:-**
 - i) Tidal flooding around the Humber Estuary and along the coast;**
 - ii) Fluvial flooding along river corridors and other significant watercourses resulting from catchments within and beyond the region.**

[*functional floodplains are the unobstructed or active areas where water regularly flows in time of flood. **washlands are areas of flood plain where water is stored in time of flood]

Justification to Policy R2 Development and Flood Risk

- 10.10 Local planning authorities will need to liaise closely with the Environment Agency to ensure that different types of development are located in appropriate locations with regard to flood risk in accordance with Policy R2. This will entail a sequential approach, looking first at sites at lower risk of flooding which also fit with the overall regional spatial strategy including the locational criteria in Policy P1. This will need to be informed by the numerical assessments in use by DEFRA and the Environment Agency.
- 10.11 Local authorities will need to adopt a strategic approach based on river catchment areas rather than administrative boundaries. Many of the region's rivers cross local authority boundaries. Taking account of circumstances within entire catchments, development plans should identify opportunities to control and manage floodwater.

Development plans should pay particular attention to identifying the extent of functional floodplains, the potential for the extension of managed washlands and the possibilities for multi-functional uses of such land. Co-ordinated management mechanisms should be established by the Environment Agency and local authorities to inform development plans and gain effective integrated management of areas at risk from tidal or fluvial flooding. Internal Drainage Boards should be involved in this process where appropriate.

Appendix B

North Lincolnshire Local Plan – Policy Relating to Flood Risk

(Relevant Extracts)

Flood Risk – Introduction

- 17.44 Two major rivers, the Trent and the Humber, and the smaller River Ancholme fall within North Lincolnshire. The Isle of Axholme in particular is protected by a sophisticated network of flood defence works and drainage measures. The method by which the flood plains of these rivers is protected, especially the Humber Estuary, is important.

Policy Relating to Flood Risk

DS16 - Flood Risk

Development will not be permitted within floodplains where it would:

- i) increase the number of people or buildings at risk; or**
- ii) impede the flow of floodwater; or**
- iii) impede access for the future maintenance of watercourses; or**
- iv) reduce the storage capacity of the floodplain; or**
- v) increase the risk of flooding elsewhere; or**
- vi) undermine the integrity of existing flood defences unless adequate protection or mitigation measures are undertaken.**

Justification to Policy DS16

- 17.45 New development should not be at risk from flooding. Flood plains and areas of low-lying land adjacent to a watercourse are by their very nature liable to flood under certain conditions. Flood plains also provide for the storage of floodwater, so development can reduce this storage capacity and hence increase the risk of flooding elsewhere. The local planning authority will publish, as supplementary planning guidance, the area of flood risk where policy DS16 is to be applied.
- 17.46 Government Circular 30/92 states that development plans should take into account flood risk when allocating land for development. The Environment Agency will be consulted in evaluating the nature of any flood risk and the adequacy of any works proposed to contain that risk. The Environment Agency has published the Humber Shoreline Management Plan which gives guidance on the need for flood defence. In some cases a planning obligation will be imposed to provide suitable mitigating measures, and also guarantees of future access to watercourses will be required.

North East Lincolnshire Local Plan- Policies Relating to Flood Risk (Relevant Extracts)

Policy GEN1 (vi) – Development Areas and Flood Risk

Policy GEN1: Development Areas. Proposals requiring planning permission for new development, conversion or alteration of existing buildings or the change of use of land or buildings within the defined Development Areas shown on the Inset Maps will be permitted subject to the suitability of proposals in relation to:-

- (i) their size, scale, density and impact on the character and appearance of the area and the relationship to existing land uses;**
- (ii) access and vehicle generation levels;**
- (iii) provision for services;**
- (iv) impact upon neighbouring land uses by reason of noise, disturbance or visual intrusion;**
- (v) advice from the Health and Safety Executive;**
- (vi) flood risk;**
- (vii) impact upon areas of natural and historical heritage;**
- (viii) the requirements of other appropriate policies in the development plan.**

Justification of Policy GEN1 (vi) –Relating to Flood Risk

- 3.7 Development proposals will be assessed using the sequential test stated in Table 1 of PPG25: Development and Flood Risk and should meet the criteria set therein. Development proposals will need to be supported by a flood risk assessment appropriate to the type of development proposal and its proposed location, and the necessary mitigation measures put in place prior to the development to ensure flood risks are properly managed. Mitigation measures funded by the developer may be necessary to effectively manage flood risk and to ensure that development remains safe throughout its lifetime. These measures will complement or improve existing defences where appropriate. Where there will be an unacceptable risk of flooding to the proposed development or itself would unacceptably increase the risk to others such development will not be permitted. Development should not prejudice any long term requirement for the construction of sustainable flood protection and defences along the coastline.
- 3.8 The Local Authority will seek to bring about an overall reduction in flood risk through development and all proposals will incorporate sustainable drainage systems and solutions and their maintenance according to the type of development and location proposed. The Council is also in the process of preparing Supplementary Planning Guidance on 'Flood Risk' and undertaking additional work on flood risk assessment in association with this guidance.
- 3.10 There are many development types and opportunities that may be permitted under Policy GEN1. However, there are also many considerations and constraints to development relating to the particular nature of the development and characteristics of the individual site which will need to be considered.

Therefore, it is likely that the requirements of other policies in the Development Plan will need to be satisfied for proposals to be considered acceptable.

Policy GEN2 (xiv) – Development in the Open Countryside and Flood Risk

Policy GEN2: Development in the Open Countryside. Proposals requiring planning permission on areas outside the defined development boundaries under Policy GEN1 will be permitted provided:-

- (i) it is essential to the needs of agriculture, horticulture, forestry, mineral extraction, waste disposal or other land use which requires a countryside location; or
- (ii) it consists of the use of a rural building or buildings; or
- (iii) it consists of development to meet a local employment need; or
- (iv) it is for leisure and tourism purposes requiring an open countryside location, or
- (v) it consists of the rebuilding, alteration or extension of an existing dwelling where the residential use of the property is not considered to have been abandoned; or
- (vi) it consists of affordable housing for local needs, or
- (vii) it consists of proposals to generate energy from sources of renewable energy; or
- (viii) it consists of telecommunications development. The suitability of proposals will be assessed in relation to:-
 - (ix) the size, scale, density and impact on the character and appearance of the area and the relationship to existing land uses;
 - (x) access and vehicle generation levels;
 - (xi) provision for services;
 - (xii) impact upon neighbouring land uses by reason of noise, disturbance or visual intrusion;
 - (xiii) advice from the Health and Safety Executive;
 - (xiv) flood risk
 - (xv) impact upon areas of natural and historical heritage;
 - (xvi) the requirements of other appropriate policies in the development plan.

Justification of Policy GEN2 (xiv) – Relating to Flood Risk

See above justification paragraphs.

Policy GEN9 - Coastal Defences and Flood Protection

Policy GEN9: Coastal Defences and Flood Protection. Planning permission for works involving the improvement or provision of flood protection and sea defences will be granted where proposals accord with the strategic shoreline management option identified in the Shoreline Management Plans. Developments that would adversely affect the integrity of coast defences, fluvial defences or identified defence proposals will be resisted. In view of the SPA/Ramsar status of the intertidal mudflats, any encroachment onto them by coastal or flood defences can only be justified by urgent national interest and must be compensated for by replacement provision.

Justification of Policy GEN9 –Coastal Defences and Flood Risk

- 3.35 It is important that a balance must be achieved between the effects of coastal and flood defences on natural processes/conservation and their socio-economic benefits. A range of options are available for the provision of effective defences, ranging from enhancement of natural processes using managed realignment to construction of hard defences.
- 3.36 The Humber Estuary Coastal Authorities Group initiated work on a strategy to guide future coastal defence decision making. The work was taken up by the Humber Estuary Shoreline Management Plan. One of the primary aims is to achieve a strategic overview of the coastal processes. Against this background decisions on sustainable coastal defence can be made which ensure localised defence works won't have adverse impacts elsewhere.
- 3.37 Shoreline Management Plans (SMPs) are being promoted by MAFF. Whilst coastal protection is the responsibility of maritime local authorities under the provisions of the Coastal Protection Act 1949, and flood protection falls to the Environment Agency under the Water Resources Act 1991 and Land Drainage Act 1991, MAFF is the government body through which public sector expenditure on coastal defences is channelled.
- 3.38 The SMP takes into account the natural processes and other environmental influences and needs. Through a process of consultation, data collection and review the plan has proceeded to evaluate a series of coastal defence options.
- 3.39 With respect to the North East Lincolnshire coastline the current preferred strategic coastal defence policy option over the three identified coastal stretches is to 'hold the line'. This involves taking action, as and when necessary, to maintain the 1997 defence line. This reflects the economic importance of the land uses along the estuary frontage on which the local economy of the area depends. It is intended as with the development plan that the SMP will be a 'living document' subject to periodic review in light of future monitoring and research.
- 3.40 Substantial research is currently in progress into the geomorphology and natural environment of the Humber Estuary by the Environment Agency in order to produce a second Shoreline Management Plan to cover the flood defences around the Humber Estuary. This project is intended to take account of rising sea levels and ensure the requirements of the habitats directives are satisfied in the management of flood defence.

Appendix C - Critical Flood Level Tables

Stage 1 Flood Compartments

Flood compartment	Critical flood level (mOD)
Tidal compartments	
1T1 Cleethorpes	+ 4.0
1T2 Grimsby & Stallingborough	+ 3.5
1T3 Immingham & North Killingholme	+ 3.5
1T4 Goxhill	+ 4.5
1T5 Barton upon Humber	+ 4.5
Fluvial compartments	
1F1 Waithe Beck	See Note 1
1F2 Buck Beck & Goosepaddle Drain	
1F3 River Freshney & Laceby Beck	
1F4 East Halton Beck & Skitter Beck	

Stage 2 Flood Compartments

Flood compartment	Critical flood level (mOD)
Tidal compartments	
2T1 South Ferriby (East)	+ 5.0
2T2 South Ferriby (West)	+ 5.0
2T3 Winterton	+ 5.0
Fluvial compartments	
2F1 Lower Ancholme (Right Bank)	See Note 1
2F2 Lower Ancholme (Left Bank)	
2F3 Island Carr	+ 2.8
2F4 Middle Ancholme (Right Bank)	+ 2.8
2F5 Middle Ancholme (Left Bank)	+ 2.8

Stage 3 Flood Compartments

Flood compartment	Critical flood level (mOD)
Tidal compartments	
3T1 Alkborough	See Note 2
3T2 Flixborough	
3T3 Gunness	+ 3.5
3T4 Garthorpe & Keadby	+ 3.5
Fluvial compartments	
3F1 Upper Bottesford Beck	See Note 1
3F2 Messingham	+ 3.0
3F3 Upper River Eau	See Note 1
3F4 Three Rivers	+ 3.0
3F5 Isle of Axholme	+ 3.5
3F6 River Idle	+ 3.5

Notes

1. In these compartments the flood level varies along the course of the river. The critical level at a particular point should be obtained from the Environment Agency, noting that a charge may be made for this service.
2. These compartments are largely designated as Zone 3(iii) (Functional floodplain). Contact the Environment Agency about development proposals here.
3. Critical flood levels are based on the information available in February 2006. The information will be reviewed regularly and may be amended if appropriate.

Appendix D - Organisations With Drainage, Flooding And Flood Risk Responsibilities

Contact Addresses

Environment Agency
Anglian Region
Waterside House
Waterside North
Lincoln LN2 5HA
Tel: 08708 506506

Internal Drainage Boards

Lindsey Marsh Drainage Board
Wellington House
Manby Park
Manby
Louth
Lincolnshire LN11 8UU
Tel: 01507 328095

North East Lindsey Drainage Board
High Street
Ulceby
North Lincolnshire
DN39 6TG
Tel: 01469 588991

Grantham Brundell and Farrer
Denison House
Hexthorpe Road
Doncaster DN4 0BF
Tel: 01302 342055

Council Works Departments

North Lincolnshire Council
Church Square House
PO Box 42
Scunthorpe
Louth
North Lincolnshire
DN15 6XQ
Tel: 01724 296685

North East Lincolnshire Council
Civic Offices
Knoll Street
Cleethorpes
North East Lincolnshire
DN35 8LN

Water Companies

Anglian Water Services Ltd
Developer Services
PO Box 495
Ermine Business Park
Huntingdon
PE29 6YY
Tel: 0845 6066087

Margaret Burrup
Sewer Flooding Manager
Severn Trent Water Limited
Asset Protection Waste Water
Leicester Water Centre
Gorse Hill
Anstey
Leicester
LE7 7GU
Tel: 0116 234 3034

Appendix E - Environment Agency National Standing Advice to Local Planning Authorities for Planning Applications

**Development and Flood Risk England
User Guidance Note
Implementation date: 27th October 2003
Review date: 1st April 2004
Expiry date:**

Version 8.1 October 2003

National Standing Advice to Local Planning Authorities for Planning Applications - Development and Flood Risk England

1.0 Introduction

The Environment Agency (the Agency) has produced this standing advice to enable local planning authorities (LPAs) to make decisions on low risk planning applications where flood risk is an issue without directly consulting the Agency for an individual response. It also identifies those higher risk development situations where case by case consultation with the Agency should continue. This standing advice should be treated as if it were advice provided by the Agency via a direct consultation response. It should be treated as a material planning consideration in determining the application. As with any consultation reply, it is a matter for the LPA what weight it decides to attach to this standing advice having regard to this and all the other material considerations involved.

To accompany this guidance note, the Agency has provided LPAs with the following:

- Maps showing the location and extent of flood risk areas
- A flood risk response matrix (the 'matrix')
- A series of four technical guidance notes on flood risk assessment for different types of development in different locations.

2.0 Which geographical areas does this standing advice apply to?

This standing advice applies throughout England. The Government's policy framework on flood risk in Wales is governed by Planning Policy Wales and Technical Advice Note 15 rather than PPG25. We will issue separate standing advice which reflects this. Common principles will apply to both sets of standing advice.

3.0 What types of development are covered by this standing advice?

This standing advice is aimed at the planning application, pre-planning and post application stages. It is not intended for use in relation to development plan consultations.

4.0 Who in addition to LPAs should be aware of this standing advice?

Although the standing advice is aimed principally at LPAs it is also intended for use by developers and members of the public. It is intended to provide a guide to all parties in the development process on the Agency's approach to development and flood risk for any given type of development in any given location.

5.0 Process for Local Planning Authorities to follow when making a decision.

On receipt of a planning application, the LPA should:

5.1 Check the relevant flood risk constraint mapping provided by the Agency

Does the proposed development site fall within:

- Byelaw distance of a Main River?
- Within the Indicative Floodplain (i.e. zone 3)?
- Outside the Indicative Floodplain (i.e. zone 1 and 2)?

The answer to these questions determines where on the horizontal axis of the matrices the development will fall, i.e. into which flood risk zone.

The two principal constraints i.e. Main Rivers and the Indicative Floodplain should already be available to LPAs in a GIS format via the Flood Explorer CDs. These are updated annually. Currently, the location of Main Rivers is shown as a red centre line only on the Flood Explorer GIS rather than as a polygon based on the precise bye-law distance that applies locally. Local Area Planning teams will inform their LPAs as to the bye-law distance which applies locally. Application of the bye-law constraint will require a judgement from the LPA as to whether or not development falls within the local bye-law distance. If in doubt, the LPA should apply a pre-cautionary approach and consult the Agency.

In addition to planning considerations, the matrix also indicates situations when a consent may be needed from the Agency. Proposed developments falling into any of the cells in the matrix may also fall within 5.0 metres of an Ordinary Watercourse (defined as any watercourse not identified as a Main River held on maps by the Agency or DEFRA). In these cases in addition to planning permission, consent from the Agency under the Land Drainage Act 1991 may be required.

5.2 Determine the development type against the categories set out in the matrix

The vertical axis of the matrices sets out the development type. Determining the development type should be straightforward in most cases. Where the definition of the development is open to question, a brief definition of the development type is contained within the relevant cell.

5.3 Determine which cell of the matrix the proposal falls into.

Applying steps 5.1 and 5.2 above should indicate clearly what cell within the matrix a particular development falls into. However, where a proposed development falls within more than one possible

development type or flood risk zone, following the precautionary approach, the consultation response should always be based on the higher risk response.

E.g. A proposed 6.0 hectares hospital development falls outside PPG25 zone 3. This should be treated as falling within the 'Operational development greater than 5.0 hectares' category i.e. a RED cell response and referred to the Agency, rather than falling within the 'Civil Emergency Infrastructure' category which i.e. a GREEN cell response –LPA determine without reference to the Agency.

5.4 Interpret the information within the relevant cell of the matrix

Having established which cell the proposal falls into this information can be related to the instructions in the matrix.

- If the proposal falls into a RED cell that represents the highest risk development type/location combination, the application can go straight to the Agency for consultation together with any Flood Risk Assessment (FRA) provided by the applicant.
- If it falls into a GREEN cell, which represents a lower risk development type/location combination the proposal will need to go to the LPA for consideration and application of a standard response in place of a direct response from the Agency. The LPA will need to ensure that a FRA appropriate to the nature and scale of the development is provided by the applicant. This will need to be assessed by the LPA without reference to the Agency.
- If a development proposal falls into a GREY cell, which represents generally the lowest risk development type/location combination, the proposal will need to go to the LPA development control case officer for consideration without reference to the Agency. Development in this category falls outside the scope of formal standing advice but as an information aid to developers and LPAs, some basic surface water drainage guidance has been provided for larger development within this category. For development without significant surface water implications the response is 'no comment' as indicated in the matrix.

NOTE : Where development falls within the GREEN or GREY cells and can be dealt with without reference to the Agency on flood risk grounds, individual consultation with the Agency may still be required in relation to other environmental issues-check the other Agency Standing Advice. Where an application raises multiple issues some of which are lower risk and can be covered by a standard response and some which are higher risk and not covered in this way, please consult the Agency. The Agency will weave in the standard response into the overall response as required.

5.5 Provision of a FRA and refusal of planning permission

For development proposals falling within the RED and GREEN cells if a FRA is not provided where the standing advice indicates that this is required, then planning permission should be **refused**. Important as provision of a FRA is in these cases, it should be stressed that the fact that a FRA has been provided will not of itself necessarily make that development acceptable in flood risk terms. Where a FRA is submitted to the Agency for consideration, the Agency will still object in cases where it considers that the FRA does not or cannot adequately address the flood risk issues.

6.0 Flood Risk Assessments - what is the Agency expecting of LPAs?

PPG25 makes clear that in preparing their proposals, developers will be expected to provide an assessment of flood risk including run off implications which is appropriate to the nature and scale of the development and the risks involved. This should be submitted to the LPA with the planning application (paragraph 60). This 'appropriateness' requirement means that FRAs will vary in their complexity and not all the possible factors set out in appendix F of PPG25 will apply in every case.

For development within the GREEN boxes, the Agency will expect LPAs to assess FRAs submitted to them with the planning application using the standing advice without direct consultation with the Agency. To assist LPAs in making the transition towards taking on this responsibility the Agency has taken the following measures:

- The Agency has provided four technical guidance notes on FRA which give guidance on what a FRA should seek to cover in a range of different circumstances, two of which are applicable to lower risk development situations.
- The Agency will continue to respond to **pre-planning** consultations for development between 1.0 and 5.0 hectares outside zone 3 within the GREEN cells of the matrix where a continued technical input on surface water issues is required.

Addressing planning issues at the pre-application stage has long been recognised as good practice. It enables consideration of complex technical issues outside the constraints of the statutory planning time-frame. An approach to encourage pre-application discussion with the Agency on flood risk matters is the Letter of Compliance procedure referred to in more detail at annex 2 of this guidance note. This procedure is relevant to all development falling within the RED cells of the matrix and development between 1.0 and 5.0 hectares falling within the GREEN cells. The Letter of Compliance is intended to speed up consideration of the proposal at planning application stage by flagging up to the LPA and the Agency that flood risk issues have already been considered at the pre-application stage. The Letter of Compliance is NOT intended in any way as a general sign off of the acceptability of the proposal from the Agency. In many cases issues other than flood risk will be involved.

7.0 Local flood risk issues

It is recognised that there are local flood risk issues which need to be addressed as part of this standing advice e.g. defended areas within the indicative floodplain where flood risk is modified and areas with local surface water runoff issues. The Agency will address these issues through mapping and issuing additional standing advice as this becomes progressively available. A suitable vehicle for securing agreement on how the standing advice can reflect local issues is the Planning Protocol. This is an annex to the umbrella **Working Better Together** document jointly produced by the Environment Agency and the Local Government Association.

8.0 Appeals

Where the LPA considers flood risk to be a material consideration, and having referred to this standing advice has refused planning permission as recommended by the Agency, the Agency will support its position, at any subsequent appeal.

9.0 Development Plan Policies

Local Authorities should adopt flood risk policies in their local development plans. This will reduce the number of applications for development in flood risk areas. The Agency will also expect LPAs to

undertake Strategic Flood Risk Assessments when reviewing their Local Development Plans to aid application of the sequential test.

Annex 1 Case Studies

Note – Some scenarios amended for NE/NLC circumstances

Scenario 1 : Domestic Extension

Location: Within Main River bye-law distance

Outcome: Falls within RED cell. Refer to Agency for individual consultation response. FRA required. Agency minded to object. Agency bye-law consent required and likely to be refused.

Scenario 2 : Commercial extension –footprint increase 500m²

Location: Within NE/NLC SFRA Zone 3(ii)

Outcome: Greater than commercial/industrial extension size threshold for standard GREEN cell response in Zone 3(ii). Treat as operational development less than 1 hectare – i.e. RED cell response. Refer to Agency for comment with the FRA. Agency recommends LPA refuse planning permission if no FRA provided.

Scenario 3 : Change of use from office to residential

Location : Within NE/NLC SFRA Zone 3(i)

Outcome : This is a change of use to a more flood risk-sensitive development type. Falls within GREEN cell. LPA to determine application on basis of standard response. If no FRA provided or FRA inadequate in judgment of LPA, planning application should be refused pending re-submission of the application with a FRA following technical input from the Agency.

Scenario 4: Residential development 0.75 ha site size

Location : Within NE/NLC SFRA Zone 3(i)

Outcome: Standard GREEN cell response applies at planning application stage. FRA needed. LPA to determine application on basis of standard response. If no FRA provided or FRA inadequate in judgment of LPA, planning application should be refused pending re-submission of the application with a FRA following technical input from the Agency.

Scenario 5: Mixed use development including residential element- 7.0 ha site size

Location : Outside Zone 3

Outcome: Treat as operational development greater than 5.0ha outside zone 3 -RED cell response. Refer to Agency for individual consultation response. FRA required. Refer to Agency for comment with the FRA. Agency recommends LPA refuse planning permission if no FRA provided.

Scenario 5: Change of use from office use to 0.75ha hospice

Location: Outside Zone 3

Outcome: Falls within GREY cell. Outside floodplain and change of use only therefore no significant surface water runoff implications. Standard response applies –‘no comment’.

**Scenario 6: Camping site – total area including hard standing
0.5ha**

Location : Outside Zone 3. Ordinary Watercourse passes through the site. Greenfield site with reception building, small car park and shower block.

Outcome : Falls within GREEN cell. LPA to determine using standard response provided. FRA required. Main consideration - addressing flood risk to site from Ordinary Watercourse. Surface water issues are covered by advice in drainage information applicable to sites less than 1.0ha. (GREY cell response).

Annex 2 : Letter of Compliance procedure for Flood Risk Assessment of development

(1) PROCESS – Proposed development within RED cells of matrix

Pre-Application Initial enquiry for information on flood risk from developer to Agency.

- Submission of draft Flood Risk Assessment to Agency Planning Liaison Team.
- Comments by Agency. Site visit and meetings if appropriate.
- Submission of final FRA to Agency Planning Liaison Team.
- Agency provides Letter of Compliance to developer.

Application Submission of FRA with Letter of Compliance to LPA with planning application.

- LPA consult with Agency.
- Agency consider all relevant issues, including flood risk and responds within timetable.

(2) PROCESS – Proposed development 1.0 –5.0 hectares within GREEN cells of matrix

Pre-application As above for high risk development.

Application Submission of FRA with Letter of Compliance to LPA with planning application.

- LPA determine application on basis of FRA and Letter of Compliance and Agency standard response without consulting the Agency. If the LPA are not satisfied that the flood risk issues in terms of surface water run off posed by the development have been addressed satisfactorily or a FRA is not submitted, the LPA should refuse planning permission. The applicant should be advised to commence pre-application discussion with the Agency prior to submission of a fresh application for planning permission with a Letter of Compliance.

Flood Risk Assessment Annexes

- 1. Stage 1 Eastern Coastal
Flood Compartments**
- 2. Stage 2 Ancholme Valley
Flood Compartments**
- 3. Stage 3 Trent Valley
Flood Compartments**

Annexe 1 - Stage 1 Eastern Coastal Flood Compartments

Tidal Flood Compartments

Compartment 1T1: Cleethorpes

1T1.1 - Description of site

The estuary frontage of this compartment runs from the northern end of the Cleethorpes Promenade to the NELC boundary at the southern end of Humberston Fitties. In practice the compartment extends further south but the land there lies outside the Study Area and so is not covered by this SFRA. If the land floods, however, this flooding could extend into the Study Area and this possibility is considered in the assessment. The landward boundary of the compartment is taken as the Zone 2 boundary as shown on the Environment Agency's Flood Maps. Along Cleethorpes Promenade the boundary defines the area that could be subject to significant wave washover during a severe event and is taken as 30 m from the seawall.

The compartment is about 6 km long and varies in width from 30 m along the promenade to about 4 km along the Buck Beck and behind Humberston Fitties. Ground levels in the area indicate that most of the land is above +3.0 mOD except behind Humberston Fitties.

Most of the area is open and devoted either to agriculture or to recreational activities, the latter including the Discovery Centre and Theme Park on the front. There are some residential areas, however, in Cleethorpes and Humberston along the edges of the Buck Beck valley. The Thorpe Park Caravan Park is close to the beach at Humberston and abuts the Humberston Fitties Holiday Camp, which lies to the south. This contains a large number of single-storey holiday chalets, mainly of wooden construction but with an air of permanence. Ground levels in the Fitties area generally vary between +3.5 and +3.9 mOD and occupancy restrictions are placed on the chalets because of the high flood risk there. In view of this a separate and more detailed assessment covering this area alone has been undertaken and is attached as Appendix S.

1T1.2 - Sources of flood risk

The primary source of flood risk to this compartment is a combination of large waves and high water levels in the Humber Estuary. Table 1.1 lists selected combinations having a 0.5% annual probability of occurrence and shows the highest water level at Cleethorpes as +4.56 mOD. Current guidance suggests sea levels could rise by 0.3m and wave heights increase by 10% over the next 50 years.

In addition to this tidal source there are three fluvial sources of flood risk, the Buck Beck (and its tributary the Goosepaddle Drain), which discharges to the estuary through a gravity sluice between Cleethorpes and Humberston) and the Little Buck Beck which is pumped into the Buck Beck. The Buck Beck and Goosepaddle Drain are designated as main river and managed by the Environment Agency while the Little Buck Beck is managed by NELIDB. The third source is a system of ditches managed by LMIDB and draining the area behind Humberston Fitties through a gravity discharge to the Louth Canal seaward of Tetney Lock.

A hydraulic model of the Buck Beck and Goosepaddle Drain system was carried out in 2000. This indicates that during a 1.0% annual probability event the water level in the Buck Beck varies

from +3.6 mOD at the outfall to + 4.1 mOD at the compartment boundary. The level in the Goosepaddle Drain varies from +4.0 mOD at the junction with the Buck Beck to +4.2 mOD at its head. A further study is planned to examine the effect of a recent rise in beach levels as this may have reduced the outlet discharge capacity.

The two IDB drainage systems are understood to be capable of accommodating the 1.0% annual probability event if the additional storage provided by the freeboard allowance included in the design is taken into account.

1T1.3 - Existing defences

The Cleethorpes Promenade is fronted by a seawall with a crest level that varies between +5.8 and +6.3 mOD and is in good condition (Grade 2). This will provide adequate protection against wave overwash during a 1.0% annual return period event for the next 50 years (including the effects of sea level rise) provided beach levels remain as high as they are at present. Between the end of the promenade and Humberston an earth embankment with crest level varying between +6.6 and +8.3 mOD forms the defence. The condition is generally Grade 2 (good) with some sections being Grade 3 (fair) and the defence will protect the area behind against events with a 0.5% annual probability for the next 50 years.

South of Humberston the embankment is set back from the shore and acts as a secondary line of defence behind the Humberston Fitties. The main defence to the Fitties is formed by sand dunes reinforced by gabion boxes at the toe and rated as generally in good condition (Grade 2) with some elements in fair condition (Grade 3). The top of the boxes is about +4.7 mOD while the top of the sand dunes varies between +6.4 and +6.9 mOD except at points where they have been lowered locally to provide access to the beach. As a result of these low points the standard of protection is significantly less than the 0.5% annual probability requirement set out in PPG25.

A combination of earth embankments and dwarf floodwalls provide protection against flooding from the Buck Beck and Goosepaddle Drain. They are generally in good condition (Grade 2) with some sections in fair condition (Grade 3). The model studies indicate that they currently provide protection against a 1.0% annual probability event throughout this system.

1T1.4 - Assessment of flood risk

All land in the compartment lying within the Zone 3 boundary, as shown in Figure 1.5, is below the highest water levels with a 0.5% annual probability of occurring in the estuary. This area should therefore be classified as Zone 3 (High risk). This classification should also be applied to the land within the compartment behind the Cleethorpes Promenade. All land in the compartment lying outside these areas should be classified as Zone 2 (Medium risk).

Most of the land lying within Zone 3 is adequately protected against floods with a 0.5% (tidal) or 1.0% (fluvial) annual probability of flooding and therefore may be classified as NE/NLC SFRA Zone 3(i) (high risk, low vulnerability). There are a number of exceptions to this however, as follows:-

- (a) All land lying within 9m of any flood defences or of any watercourse managed by the Environment Agency or an Internal Drainage Board will be subject to restrictions laid down by the Environment Agency or the IDB.

- (b) Although the estuary defences are currently in reasonable condition there is, nevertheless, a risk that they will fail, resulting in a breach (except behind the Cleethorpes Promenade, where the land is too high for a breach to form). If this happens at high tide, water will flow through the breach at high velocity posing a significant risk to people and property in the immediate vicinity. Between the end of the Promenade (i.e. at the Leisure Centre) and Humberston the peak water level in the estuary is about +4.5 mOD and the ground level immediately behind the defences is generally about +3.5 mOD, so Table 5 indicates that a 50m wide zone should be classified as NE/NLC SFRA Zone 3(ii) (high risk, high vulnerability). At Humberston Fitties the defence is provided by sand dunes so Table 5 indicates that in this section the width of the zone should be 100m.
- (c) If the estuary defences between the Leisure Centre and Humberston are breached during an event with a 0.5% annual probability, flooding up to about +4.0 mOD could occur on the land beside the Buck Beck. All land lying below +3.5 mOD in this area is therefore potentially at risk of being flooded to a depth of 0.5 m. Table 3 indicates that such land should be classified as NE/NLC SFRA Zone 3(ii) (high risk, high vulnerability).
- (d) The sand dunes in front of Humberston Fitties provide a standard of protection significantly lower than the 0.5% annual probability required by PPG25. This area should be therefore classified as NE/NLC SFRA Zone 3(ii) (high risk, high vulnerability).
- (e) Although the land behind the secondary defences at Humberston Fitties is protected against a breach in the sand dunes during a 0.5% annual probability event in the estuary it is at risk of being flooded from a breach in the defences further south. If this occurs there is a risk that flooding up to +3.5 mOD could occur in this area. All land lying below +3.0 mOD in this area is therefore potentially at risk of being flooded to a depth of 0.5 m. Table 3.2 indicates that such land should be classified as NE/NLC SFRA Zone 3(ii) (high risk, high vulnerability).

1T1.5 - Development restrictions

The process of deciding planning applications where flood risk is an issue, including the use of the NE/NLC SFRA matrix to determine whether an application is submitted to the Environment Agency, is set out in Chapter 7. It is recommended that in this flood compartment the following additional considerations are taken into account:-

- (a) Development on land within Zone 2 should be subject to confirmation that suitable arrangements for dealing with land drainage have been made with the appropriate IDB (NELIDB or LMIDB).
- (b) Development on land within NE/NLC SFRA Zone 3(i) should be subject to confirmation that suitable arrangements for dealing with land drainage have been made with the appropriate IDB.
- (c) Development on land within NE/NLC SFRA Zone 3(ii) or on land subject to Environment Agency, NELIDB or LMIDB bye-laws is unlikely to be supported by the Environment Agency.

Compartment 1T2: Grimsby & Stallingborough

1T2.1 - Description of site

This flood compartment runs from the right bank of the Stallingborough North Beck to high ground between Grimsby and Cleethorpes. The north-east boundary is formed by the flood defences beside the Humber Estuary while the south-west boundary is taken as the Zone 2 boundary on the Environment Agency's Flood Maps. The compartment is about 10km long and varies between about 2 and 4 km in width except where it extends up the valley of the River Freshney. Ground levels indicate that much of the area lying between Stallingborough and the coast is lower than + 3.0 mOD, as is much of Grimsby.

The compartment contains a number of major industrial facilities at its western end, some of which are sited close to the estuary while others are set back. Undeveloped land between these sites is generally devoted to agriculture. The eastern end, covering about 50% of the whole area, is largely urbanised and contains industrial, commercial and residential property, including the central district of Grimsby. The A180 trunk road connecting Grimsby and Cleethorpes to the M180 and points west passes through it as does the main railway line.

The western part of the compartment (outside Grimsby) has been designated in the NELC local plan for estuary-related industry. A development study for the area (the South Humber Bank Study) is currently being undertaken with joint funding from NELC, NLC and Yorkshire Forward.

1T2.2 - Sources of flood risk

The primary source of flood risk to this compartment is a combination of large waves and high water levels in the Humber Estuary. Table 1.1 lists selected combinations having a 0.5% annual probability of occurrence and shows the highest water level at Cleethorpes as +4.56 mOD. Water levels rise up the estuary and the Joint Probability Analysis gives the highest level at Immingham as +4.93 mOD. Current guidance suggests sea levels could rise by 0.3m and wave heights increase by 10% over the next 50 years.

In addition to this tidal source there are six fluvial sources of flood risk. These are the main river watercourses of Stallingborough North Beck at the north end of the compartment, the Oldfleet Drain near the centre, the River Freshney (which discharges by gravity to the Docks at Grimsby) and the New Cut which runs beside the River Freshney for much of its course but flows direct to the estuary at its outfall, together with two SOWs managed by NELIDB. These are the Middle Drain and the Mawmbridge Drain, both of which are pumped to the estuary..

Studies of the lower reaches of the River Freshney, carried out in 1982 and 1996, indicated that flood flows from the river spilled into the New Cut Drain during events with a 10% annual probability of occurrence or greater. Under these conditions the capacity of the New Cut Drain is limited to the 10% annual probability flood flows, so flooding would occur during a more severe event. A further study, completed in 2000 (and listed in Table 1.2), indicates that the flood level during a 1.0% annual probability event varies between +4.41 mOD at the upstream end of Town's Holt to +3.60 mOD at New Haven Terrace.

Hydraulic model studies have also been carried out for the Stallingborough North Beck and the Oldfleet Drain. The Stallingborough North Beck study indicates that the water level having a 1.0% annual probability of occurrence varies from +4.12 mOD at the outfall to +4.28 mOD

at the upstream end of the model (some 300m upstream of the A1173). The flood risk from this watercourse is discussed further in relation to compartment T3 (Immingham and North Killingholme). The Oldfleet Drain study indicates that the water level with the same probability of occurrence in this watercourse varies from +2.74 mOD at the outfall to +2.98 mOD upstream of the A180 road bridge.

The NELIDB have examined conditions in the Middle Drain and Mawmbridge Drains in the past, generally to assess the drainage implications of large industrial developments in the area. These studies indicate that the existing systems were mostly designed to cater for events with a 1.0% probability of occurrence but that the design was generally based on the Flood Studies Report (FSR) approach used until 2000 and so may give lower water levels than would be found using the Flood Estimation Handbook (FEH) approach introduced in that year. Although the systems generally include a reasonable freeboard allowance (between the peak water level and the surrounding ground level), this may not always provide sufficient storage to accommodate the more onerous FEH requirements, indicating that some flooding above the local ground level may occur during a 1% annual probability event. The extent of this flooding is not currently known.

Many of the proposed developments in the compartment (or discharging to watercourses passing through it) would increase the runoff during an extreme event significantly and hence reduce the standard of protection to the surrounding area. One approach in these circumstances is to provide additional on-site storage, so the additional water can be kept until the flood is past. This can require relatively large areas of land, however, and it is often cheaper (and more effective) to improve the drainage system so it can accommodate the increased flows. The NELIDB is keen to support such an approach where it is suitable.

1T2.3 - Existing defences

From the Stallingborough North Beck outfall to Pyewipe (near Grimsby) the compartment is protected against flooding from the estuary by an earth embankment with a revetment on the front face and a wave wall on the crest. The crest level is +6.3 mOD and the condition is generally Grade 2 (Good) or 3 (Fair) although along some lengths the toe is at risk because foreshore levels are falling. The Environment Agency is aware of this and it will be addressed in the long-term programme of works being prepared for the HESMP. Work carried out for the HESMP indicates that, ignoring freeboard, these defences will protect the area behind against events with a 0.2% annual probability of occurring or better. The standard will remain above the 0.5% annual probability requirement set out in PPG25 for the next 50 years, taking the effect of sea level rise into account.

Between Pyewipe and the entrance to Grimsby Dock protection is provided by a gabion wall and rubble mound, in condition Grade 2 (Good) and 3 (Fair) respectively and with a crest level of +4.9 mOD. The HESMP studies indicate that severe overtopping due to wave activity could occur during a 0.2% annual probability event but that this would be unlikely to cause significant flooding outside the dock area and its approaches. East of the dock entrance a seawall formed of gabion baskets with a revetted slope provides the protection. The crest level is +7.0 mOD, which is considered to provide an adequate standard of protection during the 0.2% annual probability event, but its condition is currently graded as 3 (Fair) with some sections as 4 (Poor). One section is graded as 5 (Very poor) but failure here will not result in flooding as the defence is backed by high ground. The Agency's long-term plan includes an allowance for improvement works.

Further to the east, the northern end of Cleethorpes is protected by a concrete revetment with a wave return wall and a splash wall behind. The crest levels of the two walls are +7.0 mOD and +8.0 mOD respectively. The defence condition is generally good and the standard of protection will remain above the 0.5% annual probability requirement set out in PPG25 for the next 50 years, taking the effect of sea level rise into account.

Earth embankments provide protection against flooding from the Stallingborough North Beck between the outfall and the A1173 road bridge. They are generally in good condition (Grade 2) although there are short lengths of Grade 3 (Fair). The model studies indicate that they currently provide protection against a 1.0% annual probability event downstream of the railway bridge but that significant flooding would occur between this point and the A1173 road bridge. A small amount of flooding would also occur upstream of the road bridge. There are some lengths of earth embankment acting as flood defences along the Oldfleet Drain, mostly of condition Grade 2 (Good) with some of 3 (Fair). The standard of protection provided by these defences is variable. Some places will be flooded during an event with 20% annual probability of occurring while elsewhere flooding will not occur during events with more than 2% annual probability. The standard of protection is nowhere better than the 1.0% annual probability requirement set out in PPG25 for fluvial flooding.

The Environment Agency has recently completed a scheme along the lower reaches of the River Freshney to provide protection against events with a 1.0% annual probability of occurrence. This has involved raising flood defences and creating flood storage areas at Town's Holt, Freshney Bog and Church Lane Meadows. All the defences on this river and its tributary the Laceby Beck are classified as condition Grade 3 (Fair) or better.

The New Cut Drain lies close to but outside the River Freshney defences. It has no separate defences of its own and the standard of protection it provides is currently unknown, although the Environment Agency is planning to carry out the studies needed to determine this standard. The two SOW drainage systems managed by the NELIDB (Middle Drain and Mawmbridge Drains) are understood to have been designed to accommodate events with 0.1% annual probability by a combination of storage and pumping, without flooding the surrounding area. The designs were undertaken some years ago, however, and may not be able to deal with the more stringent standards currently applied. The Board is understood to adopt the current approach to define the 1.0% annual probability event used as the standard when assessing the works needed to deal with the drainage implications of new developments.

1T2.4 - Assessment of flood risk

All land in the compartment lying within the Zone 3 boundary, as shown in Figure 1.3, is below the highest water levels with a 0.5% annual probability of occurring in the estuary. This area should therefore be classified as Zone 3 (High risk). All land in the compartment lying outside this area should be classified as Zone 2 (Medium risk).

Most of the land lying within Zone 3 is adequately protected against floods with a 0.5% (tidal) or 1.0% (fluvial) annual probability of flooding and therefore may be classified as NE/NLC SFRA Zone 3(i) (high risk, low vulnerability). There are a number of exceptions to this however, as follows:-

- (a) All land lying within 9 m of any flood defences or of any watercourse managed by the Environment Agency or an Internal Drainage Board will be subject to restrictions laid down by the Environment Agency or the IDB.

- (b) Although the estuary defences are currently in reasonable condition there is, nevertheless, a risk that they will fail, resulting in a breach. If this happens at high tide, water will flow through the breach at high velocity posing a significant risk to people and property in the immediate vicinity. Between the Stallingborough North Beck outfall and Pyewipe the peak water level in the estuary is about +5 mOD and the ground level immediately behind the defences is generally about +3 mOD, so Table 5 indicates that a 100 m wide zone should be classified as NE/NLC SFRA Zone 3(ii) (high risk, high vulnerability). Between Grimsby and Cleethorpes the ground level is generally about +4 mOD so Table 5 indicates that the width of this zone should be 50m.
- (c) If the estuary defences are breached during an event with a 0.5% annual probability, flooding up to about +3.5 mOD could occur. All land lying below +3.0 mOD is therefore potentially at risk of being flooded to a depth of 0.5 m. Table 3 indicates that such land should be classified as NE/NLC SFRA Zone 3(ii) (high risk, high vulnerability).
- (d) The Stallingborough North Beck and Oldfleet Drain model studies identify land adjacent to these watercourses that is likely to be flooded during a 1.0% probability event. This land should be classified as NE/NLC SFRA Zone 3(ii) (high risk, high vulnerability).
- (e) The recently completed works beside the lower reaches of the River Freshney include flood storage areas at Town's Holt, Freshney Bog and Church Lane Meadows. These areas should be classified as NE/NLC SFRA Zone 3(iii) (functional floodplain).
- (f) The annual probability of flooding from the New Cut Drain is currently unspecified, although the Environment Agency is planning to investigate this watercourse in the near future. As a precautionary measure, all land within 50 m of this watercourse that would otherwise be classified as NE/NLC SFRA Zone 3(i) should be classified as NE/NLC SFRA Zone 3(ii) (high risk, high vulnerability) until these studies are completed.
- (g) The annual probability of flooding from the Middle Drain and Mawmbridge Drains may be less than 0.1%. As a precautionary measure, all land within 50 m of these watercourses that would otherwise be classified as NE/NLC SFRA Zone 3(i) should be classified as NE/NLC SFRA Zone 3(ii) (high risk, high vulnerability).

1T2.5 - Development restrictions

The process of deciding planning applications where flood risk is an issue, including the use of the NE/NLC SFRA matrix to determine whether an application is submitted to the Environment Agency, is set out in Chapter 7. It is recommended that in this flood compartment the following additional considerations are taken into account:-

- (a) Development on land within Zone 2 should be subject to confirmation that suitable arrangements for dealing with land drainage have been made with NELIDB.
- (b) Development on land within NE/NLC SFRA Zone 3(i) should be subject to confirmation that suitable arrangements for dealing with land drainage have been made with NELIDB.

- (c) Development on land within NE/NLC SFRA Zone 3(ii) should be subject to early pre-application discussions with the Environment Agency to determine the appropriateness or otherwise of proposed development in these areas.
- (d) Development on land within NE/NLC SFRA Zone 3(iii) or subject to Environment Agency or NELIDB bye-laws should be wholly exceptional and is unlikely to be supported by the Environment Agency.

1T3: Immingham and North Killingholme

1T3.1 - Description of site

The south-east boundary of this flood compartment is formed by the left bank of the Stallingborough North Beck and the north-west boundary initially by the right bank of the East Halton Beck but connected back to high ground near The Grange (north of East Halton). Both watercourses are main river and therefore operated by the Environment Agency. The flood defences beside the Humber Estuary form the north-east boundary while the south-west boundary is taken as the Zone 2 boundary on the Environment Agency's Flood Maps. The compartment is about 10 km long and up to 5 km wide. Ground levels in the area indicate that most of the site is above +4.0 mOD but there are areas, particularly near South Killingholme Haven and near Immingham, where the levels are lower. There is a significant low point in the south-east corner, where the ground level falls below +1.0 mOD.

The compartment contains major industrial developments including the port areas of Immingham, South Killingholme Haven and North Killingholme Haven with their associated storage capabilities and petro-chemical and related facilities, together covering about 50% of the total area. It also includes part of the village of Immingham. The remaining land is currently devoted primarily to agriculture.

The whole area has been designated in the relevant local plans for estuary-related industry. A development study for the area (the South Humber Bank Study) is currently being undertaken with joint funding from NELC, NLC and Yorkshire Forward.

1T3.2 - Sources of flood risk

The primary source of flood risk to this compartment is a combination of large waves and high water levels in the Humber Estuary. Table 1.1 lists selected combinations having a 0.5% annual probability of occurrence and shows the highest water level at Immingham as +4.93 mOD. Water levels rise up the estuary and the Joint Probability Analysis gives the highest level near East Halton Beck as +5.11 mOD. Current guidance suggests sea levels could rise by 0.3m and wave heights increase by 10% over the next 50 years.

In addition to this tidal source there are four fluvial sources of flood risk. These are the main river watercourses at the north and south ends of the compartment (East Halton Beck and Stallingborough North Beck) and two SOWs managed by NELIDB, the Habrough Marsh Drains which discharge partly to the estuary and partly to the Stallingborough North Beck through the Immingham Pumping Station and the South Killingholme Main Drain which discharges to the estuary at South Killingholme.

Hydraulic model studies have been carried out for the two main river watercourses, as listed in Table 1.2. The Stallingborough North Beck discharges by gravity to the estuary through a gated sluice and was modelled in 2000 using an approach based on the Flood Estimation Handbook (FEH) published that year. The model extended from the outfall about 3 km upstream to a point some 300 m upstream of the A1173 road crossing. The results indicate that the water level having a 1.0% annual probability of occurring varies from +4.12 mOD at the outfall to +4.28 mOD at the upstream end of the model. The East Halton Beck, which also discharges by gravity, was modelled in 1995 using an approach based on the Flood Studies Report (FSR, superseded by the FEH) that is likely to underestimate the critical conditions. The model extended from the outfall to the road bridge carrying the B1210 between Brocklesby and Habrough. The results indicate that during

severe events the water ponds in the lower 3.5 km reach of the Beck, reaching a level of +3.21 mOD during an event with a 1.0% annual probability of occurring.

The studies demonstrate that critical conditions in the lower reaches of both watercourses are strongly influenced by the assumed tidal conditions, with the floodwater ponding there while the outfall is tide-locked. In these circumstances the water level is controlled by volume of storage available. The East Halton Beck study assumed a nominal flood plain width of 100 m on each side of the river. The peak water level will be higher if this is reduced and, conversely, will be lower if it is enlarged. The difference in peak water levels that occur during the 1.0% and 10.0% probability events is less than 300 mm, which is the quoted error margin in the model.

The NELIDB have examined conditions in the watercourses they manage on a number of occasions in the recent past, generally to assess the drainage implications of large industrial developments in the area. These studies indicate that the existing systems were mostly designed to cater for events with a 1.0% probability of occurrence but that the design was generally based on the FSR approach and so may give lower levels than would be found using the FEH approach. The designs generally include a freeboard of between 300 mm and 450 mm between the peak water level and the surrounding ground level. If this additional storage is taken into account the studies suggest that the drainage systems will accommodate the 1% annual probability flood from the area in its undeveloped state without water levels rising above the local ground level.

Many of the proposed developments in the compartment (or discharging to watercourses passing through it) would increase the runoff during an extreme event significantly and hence reduce the standard of protection to the surrounding area. One approach in these circumstances is to provide additional on-site storage, so the additional water can be kept until the flood is past. This can require relatively large areas of land, however, and it is often cheaper (and more effective) to improve the drainage system so it can accommodate the increased flows. The NELIDB is keen to support such an approach where it is suitable.

1T3.3 - Existing defences

Along most its frontage the compartment is protected against flooding from the estuary by an earth embankment with a revetment on the front face and a wave wall on the crest. The crest level is generally +6.3 mOD although there are sections where it is slightly lower at +6.2 mOD. The condition is generally Grade 2 (Good) or 3 (Fair) although along some lengths the toe is at risk because foreshore levels are falling. The Environment Agency is aware of this and, except as discussed in the next paragraph, it will be addressed in the long-term programme of works being prepared for the HESMP. Work carried out for the HESMP indicates that, ignoring freeboard, these defences will protect the area behind against events with a 0.2% annual probability of occurring or better. The standard will remain above the 0.5% annual probability requirement set out in PPG25 for the next 50 years, taking the effect of sea level rise into account.

A relatively small area at the north end of the compartment, just south of East Halton Beck, is currently undeveloped and it is possible that the Environment Agency will choose to build a cross-bank to protect the developed land further south rather than maintain the existing defences along this reach. If this happens the condition of these defences will continue to deteriorate and the standard they provide will fall below the 0.5% annual probability requirement set out in PPG25.

The Immingham Dock area is protected by a combination of gabion walls, a lock structure and a stone embankment, generally in fair condition (Grade 3). The crest level here is about +5.5 mOD, which will also protect against events with a 0.5% annual probability of occurrence for the next 50 years but there is likely to be significant overtopping due to wave run-up. This could cause local flooding within the dock area but is unlikely to damage the defences sufficiently to cause a breach and so threaten the rest of the compartment.

Earth embankments provide protection against flooding from the Stallingborough North Beck between the outfall and the A1173 road bridge. They are generally in good condition (Grade 2) although there are short lengths of Grade 3 (Fair). The model studies indicate that they currently provide protection against a 1.0% annual probability event downstream of the railway bridge but that significant flooding would occur between this point and the A1173 road bridge. A small amount of flooding would also occur upstream of the road bridge.

There are no significant flood defences along the East Halton Beck. The surrounding area therefore begins to flood when water levels rise above bank level, which varies between +2.2 and +3.6 mOD within the compartment. Flooding is likely to occur during events with a 30% to 20% annual probability of occurrence (i.e. every 3 to 5 years on average).

The drainage systems managed by the NELIDB are understood to be able to accommodate events with 0.1% annual probability by a combination of storage and pumping, without flooding the surrounding area. The Board are understood to adopt this standard when assessing the works needed to deal with the drainage implications of new developments.

1T3.4 - Assessment of flood risk

All land in the compartment lying within Zone 3, as shown in Figure 1.5, is below the highest water levels with a 0.5% annual probability of occurring in the estuary. This area should therefore be classified as Zone 3 (High risk). All land in the compartment lying outside this area should be classified as Zone 2 (Medium risk).

Most of the land lying within Zone 3 is adequately protected against floods with a 0.5% (tidal) or 1.0% (fluvial) annual probability of flooding and therefore may be classified as NE/NLC SFRA Zone 3(i) (high risk, low vulnerability). There are a number of exceptions to this however, as follows:-

- (a) All land lying within 9m of any flood defences or of any watercourse managed by the Environment Agency or an Internal Drainage Board will be subject to restrictions laid down by the Environment Agency or the IDB.
- (b) If the defences protecting the undeveloped area south of East Halton Beck are not maintained this area will no longer be adequately protected against floods with a 0.5% annual probability of flooding. Until the future of these defences is determined the area should be classified as NE/NLC SFRA Zone 3(ii) (high risk, high vulnerability).
- (c) Although the estuary defences are currently in reasonable condition there is, nevertheless, a risk that they will fail, resulting in a breach. If this happens at high tide, water will flow through the breach at high velocity posing a significant risk to people and property in the immediate vicinity. Given that the peak water level in the estuary is about +5 mOD and the ground level

immediately behind the defences is generally about +3 mOD, Table 5 indicates that a 100m wide zone should be classified as NE/NLC SFRA Zone 3(ii) (high risk, high vulnerability).

- (d) If the estuary defences are breached during an event with a 0.5% annual probability, flooding up to about +3.5 mOD could occur. All land lying below +3.0 mOD is therefore potentially at risk of being flooded to a depth of 0.5 m. Table 3 indicates that such land should be classified as NE/NLC SFRA Zone 3(ii) (high risk, high vulnerability).
- (e) The Stallingborough North Beck model study identifies land adjacent to this watercourse that is likely to be flooded during a 0.1% probability event. This land should be classified as NE/NLC SFRA Zone 3(ii) (high risk, high vulnerability).
- (f) The East Halton Skitter model study suggests that the water level in this watercourse during a 0.1% probability event will be +3.21 mOD. Although the study omitted floodplain effects and so may have over-estimated flood levels, nevertheless it used an outdated approach that tends to under-estimate levels. Adopting a precautionary approach it is reasonable to assume that flooding to +3.5 mOD might occur. All land adjacent to the watercourse lying below this level should be classified as NE/NLC SFRA Zone 3(ii) (high risk, high vulnerability).

1T3.5 - Development restrictions

The process of deciding planning applications where flood risk is an issue, including the use of the NE/NLC SFRA matrix to determine whether an application is submitted to the Environment Agency, is set out in Chapter 7. It is recommended that in this flood compartment the following additional considerations are taken into account:-

- (a) Development on land within Zone 2 should be subject to confirmation that suitable arrangements for dealing with land drainage have been made with NELIDB.
- (b) Development on land within NE/NLC SFRA Zone 3(i) should be subject to confirmation that suitable arrangements for dealing with land drainage have been made with NELIDB.
- (c) Development on land within NE/NLC SFRA Zone 3(ii) should be subject to early pre-application discussions with the Environment Agency to determine the appropriateness or otherwise of proposed development in these areas.
- (d) Development on land subject to Environment Agency or NELIDB bye-laws is unlikely to be supported by the Environment Agency.

1T4 Goxhill

1T4.1 - Description of site

This flood compartment falls into two parts, one beside the Humber Estuary and one along the valley of the East Halton Beck. The western boundary of the part beside the estuary is formed by the right bank of the New Holland Main Drain and the south-eastern boundary initially by the left bank of the East Halton Beck but is connected back to high ground near The Grange, north of East Halton. The flood defences beside the Humber Estuary form the northern and eastern boundary while the landward limit is defined by the Zone 2 boundary on the Environment Agency's Flood Maps, except at Goxhill where it is extended to include land at risk of local flooding (as discussed in the next section). This part of the compartment is about 6 km long and up to 3 km wide. The second part of the compartment lies along the valley of the East Halton Beck and extends as far as the limit of the tidal floodplain, which is taken as the more downstream of the two railway bridges north of Ulceby Railway Station. This is about 9 km from the tidal outfall, measured along the channel. This part of the compartment is also about 6 km long and is up to about 2 km wide. Ground levels in the area indicate that most of the part beside the estuary is below +4.0 mOD and that there is a significant area at the eastern end (near the East Halton Beck) which is below +2.0 mOD.

The compartment is almost entirely devoted to agriculture except for a small area of dock-related development by New Holland, at its western end. It contains small pockets of residential housing at New Holland, at the northern and southern ends of Goxhill and at South End, East Halton and Ulceby.

A relatively small part of the compartment has been identified by the Environment Agency as a potential site for managed realignment. The suitability of this site is currently being examined further as part of the HESMP studies.

1T4.2 - Sources of flood risk

The primary source of flood risk to this compartment is a combination of large waves and high water levels in the Humber Estuary. Table 1.1 lists selected combinations having a 0.5% annual probability of occurrence and shows the highest water level at Immingham as +4.93 mOD. Water levels rise up the estuary and the Joint Probability Analysis gives the highest level as +5.11 mOD near East Halton Skitter and +5.35 mOD near New Holland. Current guidance suggests sea levels could rise by 0.3m and wave heights increase by 10% over the next 50 years.

In addition to this tidal source there are two fluvial sources of flood risk, the East Halton Beck at the eastern end of the compartment and the New Holland Main Drain at the western end. The East Halton Beck is a main river watercourse (and therefore managed by the Environment Agency) and discharges to the estuary by gravity at East Halton Skitter. The New Holland Main Drain is a SOW, managed by the NELIDB, and is pumped to the estuary at the New Holland Outfall. NELIDB also manages a system of drains that discharge to the estuary through a gravity outfall at Goxhill Haven and a drainage system at New Holland that is understood to have been sized to accommodate industrial expansion (although this hasn't taken place). This system is partly piped and discharges to the New Holland Drain through the New Holland Estate pumping station.

A hydraulic model study was carried out in 1995 for the East Halton Beck, using an approach based on the Flood Studies Report (FSR, superseded by the Flood Estimation Handbook, FEH) that is likely to underestimate the critical conditions. The model extended from the outfall to the road

bridge carrying the B1210 between Brocklesby and Habrough. The study demonstrates that critical conditions in the lower reaches of the Beck are strongly influenced by the assumed tidal conditions, with the floodwater ponding there while the outfall is tide-locked. In these circumstances the water level is controlled by the volume of storage available. The study assumed a nominal flood plain width of 100 m on each side of the watercourse and found that during severe events the water will pond in the lower 3.5 km, reaching a level of +3.21 mOD during an event with a 1.0% annual probability of occurring. This will be higher if the floodplain width is reduced and, conversely, will be lower if it is enlarged. Further upstream the water level during such an event will rise at roughly the same slope as the river bank.

Six complaints of flooding in the Goxhill area have been received by NLC within the last five years. It is understood that these are due primarily to problems with undersized culverts that are exacerbated when the Goxhill Haven outfall is tide-locked.

1T4.3 - Existing defences

Along most of its length the compartment is protected against flooding from the estuary by an earth embankment, some lengths of which have a revetment on the front face. Upstream of the Humber Bridge some lengths have a short wave wall. The crest level varies between +5.4 mOD and +6.1 mOD and the condition is generally Grade 2 (Good) or 3 (Fair). Work carried out for the HESMP indicates that in some places unacceptably high rates of overtopping due to wave run-up are likely to occur during events with a 5% annual probability of occurring (i.e. every 20 years on average) while elsewhere the annual probability of this occurring is lower, reaching about 1% (i.e. every 50 years on average) at best. This is significantly less than the 0.5% annual probability requirement set out in PPG25. The standard will reduce further in the future as sea levels rise.

The New Holland Dock area is protected by a combination of dock walls and other retaining walls, generally in poor condition (Grade 4). The crest level is about +5.6 mOD, which will protect against events with a 0.5% annual probability of occurrence for the next 50 years provided significant overtopping due to wave run-up can be tolerated. This could cause local flooding within the dock area but is unlikely to damage the defences sufficiently to cause a breach and so threaten the rest of the compartment.

Barrow Haven is protected by a sheet-pile retaining wall and revetted bank, with crest levels of +5.6 mOD. The condition is Poor (Grade 4) to Fair (Grade 3) but failure would not directly lead to flooding. Earth embankments, also with a crest level of +5.6 mOD, protect Barton Haven. Their condition is Good (Grade 2) but the crest is narrow and they are prone to seepage. Repairs are planned for 2004, when the crest level will be raised to +6.0 mOD.

There are no significant flood defences along the East Halton Beck. The surrounding area therefore begins to flood when water levels rise above bank level, which varies between +2.2 and +6.4 mOD within the compartment. Flooding is likely to occur during events with a 30% to 20% annual probability of occurrence (i.e. every 3 to 5 years on average).

The drainage systems managed by the NELIDB are understood to be able to accommodate events with 0.1% annual probability by a combination of storage and pumping, without flooding the surrounding area. The Board are understood to adopt this standard when assessing the works needed to deal with the drainage implications of new developments.

1T4.4 - Assessment of flood risk

All land in the compartment lying within the Zone 3 boundary, as shown in Figure 1.5, is below the highest water levels with a 0.5% annual probability of occurring in the estuary. This area should therefore be classified as Zone 3 (High risk). All land in the compartment lying outside this area (including the land at Goxhill at risk of local flooding) should be classified as Zone 2 (Medium risk).

None of the land lying within Zone 3 is adequately protected against floods with a 0.5% (tidal) or 1.0% (fluvial) annual probability of flooding and therefore the whole area should be classified as NE/NLC SFRA Zone 3(ii) (high risk, high vulnerability). The following additional points should be noted:-

- (a) All land lying within 9m of any flood defences or of any watercourse managed by the Environment Agency or an Internal Drainage Board will be subject to restrictions laid down by the Environment Agency or the IDB.
- (b) Although the estuary defences are currently in reasonable condition there is, nevertheless, a risk that they will fail, resulting in a breach. If this happens at high tide, water will flow through the breach at high velocity posing a significant risk to people and property in the immediate vicinity. Given that the peak water level in the estuary is about +5 mOD and the ground level immediately behind the defences is generally about +3 mOD, Table 5 indicates that this high-velocity sub-zone should be 100m wide.
- (c) If the estuary defences are breached during an event with a 0.5% annual probability, flooding up to about +4.5 mOD could occur. All land lying below +4.0 mOD is therefore potentially at risk of being flooded to a depth of 0.5 m. Table 3 indicates that such land should be classified as within the deep-flooding sub-zone.

The land identified by the Environment Agency as a potential site for managed realignment should be classified as NE/NLC SFRA Zone 3(iii) (functional floodplain)

1T4.5 - Development restrictions

The process of deciding planning applications where flood risk is an issue, including the use of the NE/NLC SFRA matrix to determine whether an application is submitted to the Environment Agency, is set out in Chapter 7. It is recommended that in this flood compartment the following additional considerations are taken into account:-

- (a) Development on land within Zone 2 should be subject to confirmation that suitable arrangements for dealing with land drainage have been made with NELIDB, noting in particular that any development at Goxhill should take into account the risk of local flooding there.
- (b) Development on land within NE/NLC SFRA Zone 3(ii) is unlikely to be supported by the Environment Agency.
- (c) Development on land within NE/NLC SFRA Zone 3(iii) should be wholly exceptional and is unlikely to be supported by the Environment Agency.

- (d) Development on land subject to Environment Agency or NELIDB bye-laws is unlikely to be supported by the Environment Agency.

1T5 Barton upon Humber

1T5.1 - Description of site

This compartment runs from high ground at South Ferriby Cliff in the west to the left bank of the New Holland Main Drain in the east. The flood defences beside the Humber Estuary form the northern boundary while the southern boundary is formed by the Zone 2 boundary on the Environment Agency's Flood Maps. The compartment is about 8 km long and up to 2 km wide except where it extends up the valley of the Barrow Beck. Ground levels indicate that most of the area is higher than +3.0 mOD.

The compartment contains the villages of New Holland and Barrow Haven with the largely dock-related industry near them and the low-lying parts of Barton upon Humber (beside Barton Haven) and Barrow upon Humber. A branch railway line connecting Barton upon Humber to New Holland and then to Grimsby passes through it, as does the A15 trunk road from the Humber Bridge to the M180 (although this section of the road is elevated above the flood levels).

Except at Barton upon Humber, the area immediately behind the estuary defences contains a number of large water-filled clay pits. These have a high nature conservation value due to the wide range of wetland birds and habitats they support and at the end of 2003 were designated under the Birds Directive as part of the Humber Flats, Marshes and Coast Phase 2 potential Special Protection Area (pSPA).

1T5.2 - Sources of flood risk

The primary source of flood risk to this compartment is a combination of large waves and high water levels in the Humber Estuary. Table 1.1 lists selected combinations having a 0.5% annual probability of occurrence and shows the highest water level at the Humber Bridge as +5.44 mOD. Current guidance suggests sea levels could rise by 0.3m and wave heights increase by 10% over the next 50 years.

There are also three fluvial sources of flood risk, the Butts Drain and the Barrow Beck, both of which are main river and so managed by the Environment Agency, and the New Holland Main Drain, which is a SOW managed by NELIDB. The Barrow Beck has a tributary, the Midby Drain, which is also a SOW managed by NELIDB. Butts Drain and Barrow Beck both discharge by gravity to the estuary, via Barton Haven and Barrow Haven respectively. The New Holland Main Drain is pumped to the estuary at the New Holland Outfall.

The flood risk from the two main river watercourses has not been assessed recently, although the Environment Agency is currently undertaking a hydraulic model study of the Barrow Beck and Midby Drain system. The drainage system leading to the New Holland Main Drain is understood to have been sized to accommodate industrial expansion (although this hasn't taken place). It is assumed that this was designed to protect against flooding from an event with 0.1% annual probability of occurring after allowing for additional run-off from developable areas so it is likely that this standard is currently exceeded.

Two complaints of flooding in the Barrow upon Humber area have been received by NLC within the last five years. The reasons for these may be clarified by the hydraulic model study currently in progress.

1T5.3 - Existing defences

Along most of its length the compartment is protected against flooding from the estuary by an earth embankment, some lengths of which have a revetment on the front face. The crest level varies between +5.5 mOD and +5.8 mOD and the condition is generally although there are sections where it is slightly lower at +6.2 mOD. The condition is generally Grade 2 (Good) or 3 (Fair). Work carried out for the HESMP indicates that in some places unacceptably high rates of overtopping due to wave run-up are likely to occur during events with a 5% annual probability of occurring (i.e. every 20 years on average) while elsewhere the annual probability of this occurring is about 2% (i.e. every 50 years on average). This is significantly less than the 0.5% annual probability requirement set out in PPG25. The standard will reduce further in the future as sea levels rise.

The New Holland Dock area is protected by a combination of dock walls and other retaining walls, generally in Poor condition (Grade 4). The crest level is about +5.6 mOD, which will protect against events with a 0.5% annual probability of occurrence for the next 50 years provided significant overtopping due to wave run-up can be tolerated. This could cause local flooding within the dock area but is unlikely to damage the defences sufficiently to cause a breach and so threaten the rest of the compartment.

The Barrow Beck has some lengths of embankment and retaining wall that act as flood defences. These are generally in Fair condition (Grade 3) with some lengths in Good condition (Grade 2). There are no significant flood defences along the Butts Drain.

The drainage systems managed by the NELIDB are understood to be able to accommodate events with 0.1% annual probability by a combination of storage and pumping, without flooding the surrounding area. The Board are understood to adopt this standard when assessing the works needed to deal with the drainage implications of new developments.

1T5.4 - Assessment of flood risk

All land in the compartment lying within the Zone 3 boundary, as shown in Figure 1.5, is below the highest water levels with a 0.5% annual probability of occurring in the estuary. This area should therefore be classified as Zone 3 (High risk). All land in the compartment lying outside this area should be classified as Zone 2 (Medium risk).

None of the land lying within Zone 3 is adequately protected against floods with a 0.5% (tidal) or 1.0% (fluvial) annual probability of flooding and therefore the whole area should be classified as NE/NLC SFRA Zone 3(ii) (high risk, high vulnerability). The following additional points should be noted:-

- (a) All land lying within 9m of any flood defences or of any watercourse managed by the Environment Agency or an Internal Drainage Board will be subject to restrictions laid down by the Environment Agency or the IDB.
- (b) Although the estuary defences are currently in reasonable condition there is, nevertheless, a risk that they will fail, resulting in a breach. If this happens at high tide, water will flow through the breach at high velocity posing a significant risk to people and property in the immediate vicinity. Given that the peak water level in the estuary is about +5.5 mOD and the ground level immediately behind the defences is generally about +3 mOD, Table 5 indicates that this high-velocity sub-zone should be 150 m wide.

- (c) The ground levels beside the Barton and Barrow Havens are higher and the defences are generally hard, indicating that the high-velocity sub-zone adjacent to these defences should be 40 m wide.
- (d) If the estuary defences are breached during an event with a 0.5% annual probability, flooding up to about +4.5 mOD could occur. All land lying below +4.0 mOD is therefore potentially at risk of being flooded to a depth of 0.5 m. Table 3 indicates that such land should be classified as within the deep-flooding sub-zone.

1T5.5 - Development restrictions

The process of deciding planning applications where flood risk is an issue, including the use of the NE/NLC SFRA matrix to determine whether an application is submitted to the Environment Agency, is set out in Chapter 7. It is recommended that in this flood compartment the following additional considerations are taken into account:-

- (a) Development on land within Zone 2 should be subject to confirmation that suitable arrangements for dealing with land drainage have been made with NELIDB, noting in particular that any development at Barrow upon Humber should take into account the risk of local flooding there.
- (b) Development on land within NE/NLC SFRA Zone 3(ii) is unlikely to be supported by the Environment Agency.
- (c) Development on land subject to Environment Agency or NELIDB bye-laws is unlikely to be supported by the Environment Agency.

Fluvial Flood Compartments

1F1 Waithe Beck

1F1.1 - Description of site

The Waithe Beck drains a catchment of about 108 km² in the Lincolnshire Wolds between Ludford and Beelsby. It enters the NELC area just west of Hatcliffe, flows north-east for a distance of some 5 km until it crosses the A18 trunk road, then swings to just south of east, passes Brigsley and leaves the NELC area shortly before it crosses the A16 trunk road. From here it flows east past Tetney and meets the Louth Canal at Tetney Lock and then discharges to the estuary through Tetney Haven. Although the Beck is main river (and therefore managed by the Environment Agency) its lower reaches are within the LMIDB drainage area.

About 10 km of the Waithe Beck lies within the NELC boundaries and its valley, which along all this length is well-defined, contains the main part of this flood compartment. A second section lies within a narrow tributary valley leading from the Waithe Beck to the south through the villages of West Ravendale, East Ravendale and Wold Newton. The compartment boundary is formed by the Zone 2 boundary on the Environment Agency's Flood Maps. Most of the land within the compartment is farmed although there is some woodland in the upper reaches and some residential property at Hatcliffe and Brigsley. As well as crossing the A18, the Waithe Beck section of the compartment also crosses the B1203 at Brigsley and two minor roads, at Hatcliffe and where it leaves the NELC area. The tributary section runs along the B1203 within East Ravendale and along the minor road connecting West Ravendale to Wold Newton.

1F1.2 - Sources of flood risk

The Waithe Beck is the main source of flood risk in this compartment with the tributary valley being a secondary source. A pre-feasibility study of the Waithe Beck was carried out in 2003, indicating that Brigsley is protected against flooding from events with a 1.0% annual probability of occurring whereas Hartcliffe is at risk of being flooded from an event with an annual probability of about 8% (i.e. every 12 years on average).

1F1.3 - Existing defences

The only significant flood defences along the Waithe Beck within this flood compartment are at Hatcliffe and consist of some lengths of floodwall and retaining wall along both banks. The hydraulic model studies carried out in 2003 indicate that these defences do not provide the 1.0% annual probability requirement set out in PPG25.

1F1.4 - Assessment of flood risk

All land in the compartment lying within the Zone 3 boundary, as shown in Figure 1.5, is currently considered to be below the highest water levels with a 1.0% annual probability of occurring in the Waithe Beck (although it is worth noting that further studies are planned and could lead to the boundary being amended). This area should therefore be classified as Zone 3 (High risk). All land in the compartment lying outside the indicative flood plain should be classified as Zone 2 (Medium risk).

None of the land lying within Zone 3 is adequately protected against floods with a 1.0% (fluvial) annual probability of flooding and therefore the whole area should be classified as NE/NLC SFRA Zone 3(ii) (high risk, high vulnerability). All land lying within 9m of any flood defences or of any

watercourse managed by the Environment Agency or an Internal Drainage Board will be subject to restrictions laid down by the Environment Agency or the IDB.

1F1.5 - Development restrictions

The process of deciding planning applications where flood risk is an issue, including the use of the NE/NLC SFRA matrix to determine whether an application is submitted to the Environment Agency, is set out in Chapter 7. It is recommended that in this flood compartment the following additional considerations are taken into account:-

- (a) Development on land within Zone 2 should be subject to confirmation that suitable arrangements for dealing with land drainage have been made with LMIDB.
- (b) Development on land within NE/NLC SFRA Zone 3(ii) is unlikely to be supported by the Environment Agency.
- (c) Development on land subject to Environment Agency or LMIDB bye-laws is unlikely to be supported by the Environment Agency.

1F2 - Buck Beck and Goosepaddle Drain

1F2.1 - Description of site

The Buck Beck drains a catchment of about 21 km² to the south of Cleethorpes, including all of Waltham, Humberston and New Waltham. From its source near Waltham the Buck Beck crosses the B1203 within the town then flows through fields and crosses the B1219 and then the A16 northwest of New Waltham. It then crosses the A1098 and the A1031 before flowing through Cleethorpes golf course and past a Theme Park to a gated outfall discharging to the estuary. About 2 km from the outfall it is joined by the Goosepaddle Drain, which carries surface water from the southern part of Cleethorpes. Drainage flows from Humberston are pumped into the channel by the NELIDB's Little Buck Beck pumping station.

This flood compartment runs from the Buck Beck's source near Waltham to the point where the channel crosses the A1098. The area further downstream lies within the tidal flood compartment 1T1 (Cleethorpes). The boundary of the fluvial compartment is formed by the Zone 2 boundary on the Environment Agency's Flood Maps.

The Buck Beck is main river (and therefore managed by the Environment Agency) downstream of the point where it crosses the A16. Between the A16 and the B1219 and further upstream towards the built-up area of Waltham it is designated as a SOW, the downstream reach being managed by NELIDB and the upstream one by NELC.

1F2.2 - Sources of flood risk

The Buck Beck is the only identified source of flood risk in this compartment. A hydraulic model study of the main river reaches was carried out in 2000, indicating that all these reaches are protected against flooding from events with a 1.0% annual probability of occurring. The SOW reaches have not been studied but there is concern that the standard provided is significantly less than is available downstream and may not achieve the 1.0% annual probability requirement set out in PPG25.

1F2.3 - Existing defences

A flood defence scheme was implemented along the main river sections of the Buck Beck in the 1970's. This mostly involved widening and deepening the channel and bridge structures and constructing dwarf walls along some of the banks. The condition of these defences is generally classed as Good (Grade 2) with a small proportion classed as Fair (Grade 3). The hydraulic model studies carried out in 2000 indicate that these defences do provide the 1.0% annual probability requirement set out in PPG25. There are no significant defences further upstream.

1F2.4 - Assessment of flood risk

All land in the compartment lying within the Zone 3 boundary, as shown in Figure 1.5, is below the highest water levels with a 1.0% annual probability of occurring in the Buck Beck and should therefore be classified as Zone 3 (High risk). All land in the compartment lying outside this area should be classified as Zone 2 (Medium risk).

All the land lying within Zone 3 downstream of the A16 crossing is adequately protected against floods with a 1.0% (fluvial) annual probability of flooding and therefore may be classified as NE/NLC SFRA Zone 3(i) (high risk, low vulnerability). All the land within the remaining Zone 3 area (upstream of the A16 crossing) should be classified as NE/NLC SFRA Zone 3(ii) (high risk, high vulnerability). All land lying within 9m of any flood defences or of any watercourse managed by the

Environment Agency or an Internal Drainage Board will be subject to restrictions laid down by the Environment Agency or the IDB.

1F2.5 - Development restrictions

The process of deciding planning applications where flood risk is an issue, including the use of the NE/NLC SFRA matrix to determine whether an application is submitted to the Environment Agency, is set out in Chapter 7. It is recommended that in this flood compartment the following additional considerations are taken into account:-

- (a) Development on land within NE/NLC SFRA Zone 2 should be subject to confirmation that suitable arrangements for dealing with land drainage have been made with NELIDB.
- (b) Development on land within NE/NLC SFRA Zone 3(i) should be subject to confirmation that suitable arrangements for dealing with land drainage have been made with NELIDB.
- (c) Development on land within NE/NLC SFRA Zone 3(ii) is unlikely to be supported by the Environment Agency.
- (d) Development on land subject to Environment Agency or NELIDB bye-laws is unlikely to be supported by the Environment Agency.

1F3 River Freshney and Laceby Beck

1F3.1 - Description of site

The River Freshney, which becomes the Laceby Beck in its upper reaches and then becomes the Team Gate Drain, drains a catchment of about 50 km² to the south and west of Grimsby. From its source near Waltham the stream flows in a generally northwest direction to the outskirts of Laceby, where it crosses the A46 and turns to flow to the northeast, discharging to the estuary at Grimsby.

The main part of this flood compartment runs from the River Freshney's source near Waltham to the limit of the tidal indicative floodplain about 2 km downstream of the point where the channel crosses the A46. The area further downstream lies within the tidal flood compartment 1T2 (Grimsby and Stallingborough). A subsidiary section lies in the valley of a tributary stream that flows past Aylesby and joins the river just east of Laceby. The boundary of the fluvial compartment is formed by the Zone 2 boundary shown on the Environment Agency's Flood Maps. The land in the compartment is largely devoted to agriculture, part from a small built-up area through Laceby.

The River Freshney/Laceby Beck is main river (and therefore managed by the Environment Agency) downstream of the point southeast of Laceby where it becomes the Team Gate Drain. Further upstream it is an ordinary watercourse and is managed by NELIDB.

1F3.2 - Sources of flood risk

The River Freshney/Laceby Beck is the main source of flood risk in this compartment. A series of hydraulic model studies have been carried out but these have focused on conditions in the lower reaches through Grimsby, i.e. within tidal compartment 1T2. There is no record of conditions within this fluvial compartment having been modelled within the last 20 years. As a result the only information about flood risk within the compartment is that provided by the Environment Agency's Flood Maps.

1F3.3 - Existing defences

There are no significant flood defences beside the River Freshney/Laceby Beck within this compartment.

1F3.4 - Assessment of flood risk

All land in the compartment lying within the Zone 3 boundary, as shown in Figure 1.5, is below the highest water levels with a 1.0% annual probability of occurring in the River Freshney/Laceby Beck or its tributary and should therefore be classified as Zone 3 (High risk). All land in the compartment lying outside this area should be classified as Zone 2 (Medium risk).

None of the land lying within Zone 3 is protected against floods with a 1.0% (fluvial) annual probability of flooding. This land should therefore be classified as NE/NLC SFRA Zone 3(ii) (high risk, high vulnerability). All land lying within 9m of any flood defences or of any watercourse managed by the Environment Agency or an Internal Drainage Board will be subject to restrictions laid down by the Environment Agency or the IDB.

1F3.5 - Development restrictions

The process of deciding planning applications where flood risk is an issue, including the use of the NE/NLC SFRA matrix to determine whether an application is submitted to the Environment Agency,

is set out in Chapter 7. It is recommended that in this flood compartment the following additional considerations are taken into account:-

- (a) Development on land within Zone 2 should be subject to confirmation that suitable arrangements for dealing with land drainage have been made with NELIDB.
- (b) Development on land within NE/NLC SFRA Zone 3(ii) is unlikely to be supported by the Environment Agency.
- (c) Development on land subject to Environment Agency or NELIDB bye-laws is unlikely to be supported by the Environment Agency.

1F4 East Halton Beck and Skitter Beck

1F4.1 - Description of site

The East Halton Beck, which becomes the Skitter Beck in its upper reaches, drains a catchment with a total area of about 124 km² to the south and west of Immingham. From its source near Keelby it flows in a generally northwest direction for about 6 km to Ulceby where it is joined by the Brocklesby Beck, turns north and then gently bends to the northeast to discharge to the estuary through a gated outfall some 10 km downstream at East Halton Skitter.

This flood compartment has two sections, containing the Skitter Beck and the Brocklesby Beck respectively. The main section runs from the Skitter Beck's source near Keelby to the limit of the tidal floodplain at the downstream of the two railway bridges north of Ulceby Railway Station. This is about 9 km from the outfall at East Halton Skitter. The area further downstream lies within the tidal flood compartment T3 (Immingham and North Killingholme). The subsidiary section follows the Brocklesby Beck from Ulceby to the east. The boundary of the fluvial compartment is formed by the Zone 2 boundary shown on the Environment Agency's Flood Maps, except that it is curtailed where it falls outside the NELC/NLC boundary.

Within the compartment the East Halton Beck crosses the A180 trunk road, the A1077, the branch railway line between Grimsby and Barton upon Humber and a sub-branch to the Immingham and North Killingholme industrial areas. The Brocklesby Beck also crosses the A180 and in addition the main Scunthorpe to Grimsby railway line and the B1211 (both twice). The land is devoted almost entirely to agriculture except for a small built-up area at Ulceby.

The East Halton Beck/Skitter Beck is main river (and therefore managed by the Environment Agency) from its source to its outfall, as is the lower 2 km of the Brocklesby Beck. There are a large number of tributary drains that are managed by NELIDB.

1F4.2 - Sources of flood risk

The East Halton Beck/Skitter Beck is the main source of flood risk in this compartment. A feasibility study of options for improving the standard of the defences was carried out in 1995. This included hydraulic modelling of the current standard of protection and concluded that flooding is likely during an event with a 20% or greater annual probability of occurring (i.e. once every 5 years or less on average). It also concluded that improving the standard could not be justified economically.

1F4.3 - Existing defences

There are no significant flood defences beside the East Halton Beck/Skitter Beck or its tributaries within this compartment.

1F4.4 - Assessment of flood risk

All land in the compartment lying within the Zone 2 boundary, as shown in Figure 1.5, is below the highest water levels with a 1.0% annual probability of occurring in the East Halton Beck/Skitter Beck or its tributaries and should therefore be classified as Zone 3 (High risk). All land in the compartment lying outside this area should be classified as Zone 2 (Medium risk).

None of the land lying within Zone 3 is protected against floods with a 1.0% (fluvial) annual probability of flooding. This land should therefore be classified as NE/NLC SFRA Zone 3(ii) (high risk, high vulnerability). All land lying within 9m of any flood defences or of any watercourse managed by the

Environment Agency or an Internal Drainage Board will be subject to restrictions laid down by the Environment Agency or the IDB.

1F4.5 - Development restrictions

The process of deciding planning applications where flood risk is an issue, including the use of the NE/NLC SFRA matrix to determine whether an application is submitted to the Environment Agency, is set out in Chapter 7. It is recommended that in this flood compartment the following additional considerations are taken into account:-

- (a) Development on land within Zone 2 should be subject to confirmation that suitable arrangements for dealing with land drainage have been made with NELIDB.
- (b) Development on land within NE/NLC SFRA Zone 3(ii) is unlikely to be supported by the Environment Agency.
- (c) Development on land subject to Environment Agency or NELIDB bye-laws is unlikely to be supported by the Environment Agency.

Appendix S - Humberston Fitties

Flood Risk Assessment

1. Description of site

The area covered by this flood risk assessment is at Humberston Fitties Holiday Camp, south of Cleethorpes. It is bounded by the shoreline of the Humber estuary to the north-east and by the Environment Agency's flood defence embankment to the south-west. The northern boundary is a line drawn perpendicular to the coast at the car park separating the Holiday Camp from the Thorpe Park Caravan Park while the southern boundary is just beyond the Humber Mouth Yacht Club. The site is roughly rectangular, approximately 1km long by 200m wide and has a total area of about 0.2 km².

The site is fully developed, containing a large number of holiday chalets, generally of timber construction but most nevertheless having an air of permanence, together with access roads and services. Ground levels within the site generally vary between +3.5 and +3.9 mOD and most of the chalets appear to be founded between these levels although a few at the southern end are located on higher ground, up to +5.0 mOD.

The site is bounded by higher ground on all sides. To seaward there is a line of dunes, reinforced by gabion boxes at their base and rising to between +6.4 and +6.9 mOD, except at selected points where the dunes have been lowered locally to provide access to the beach. The crest of the Environment Agency's embankment varies between +4.4 and +5.0 mOD while the high ground to the south varies between +4.7 and +5.7 mOD. The car park at the northern boundary is at about +6.0 mOD. The site therefore acts, in effect, as a basin, with any water entering being prevented from leaving (except by infiltration or through the local drainage system) until the level has risen enough to allow the embankment along the south-west boundary to overflow.

2. Sources of flood risk

The main source of flood risk to the site is a combination of large waves and high water levels in the Humber Estuary. Work carried out for the Humber Estuary Shoreline Management Plan (Humber Tidal Database Joint Probability Analysis; Environment Agency; 1999) quotes the combinations having a 0.5% probability of occurrence (i.e. the most severe combination will occur on average once every 200 years). A selected list of these combinations is given in Table 1 on the next page. Note that current guidance suggests sea level could rise by 0.3m and wave heights increase by 10% over the next 50 years.

Two other potential sources of flood risk exist, the Buck Beck to the north and a local drainage channel on the other side of the Environment Agency embankment. The Buck Beck discharges to the estuary about 800m north of the site, through a flapped outfall which also carries the main discharge from the Grimsby/Cleethorpes drainage system. If the outfall is blocked during an extreme rainstorm flooding will ensue but this will be restricted to low-lying areas of the Golf Course and Country Park further inland to the west. The risk of this flooding extending to the Fitties is very remote, significantly less than 0.5%. The drainage channel on the other side of the Environment Agency embankment discharges to the outfall channel below Tetney Lock and could suffer from backing up when water levels in the estuary are high (or if the defences south of the Fitties are breached). The land further

inland is low-lying, however, and any flooding would take place there as the Fitties site would be protected by the embankment. These sources are therefore not considered further.

Table 1 - Wave height and water level combinations near Cleethorpes with a 0.5% probability of occurrence.

Wave height (m)	Water level (mOD)
3.78	3.0
3.44	3.3
3.20	3.6
2.79	3.9
2.22	4.2
1.5	4.43
0.0	4.56

3. Existing flood defences

The site is protected against flooding from the estuary by a row of sand dunes along its north-eastern edge. The crest of these dunes is generally between +6.4 and +6.9 mOD (except as discussed below) and they are reinforced at the toe by a line of gabions consisting of a framework of concrete piles lined with wire mesh and filled with stone. These gabions are about 1.5m high and their crest level is about +4.7 mOD.

The width of the dune line varies but is generally between 20m and 30m. The rear face slopes gradually back to the chalets and is generally grassed. The crest of the dunes is lowered, by up 1.5m (i.e. to just above the top of the gabions), at a number of points to provide access to the beach for pedestrians. The sand at these access points and the paths leading to them is generally loose and without grass.

The standard of protection provided by these defences is difficult to determine. The crest of the gabions is slightly above the 0.5% probability still water level at present and is likely to be slightly below it in 50 years time. This is not the key issue, however, since the critical event is likely to be one with a combination of a high water level (say +4.2 mOD) and large waves (say 2.2m). During such an event large volumes of water will wash over the reinforcing gabions and could erode the loose and unprotected sand at the top of the dunes. The backwash could also undermine the gabions themselves, leading to their collapse and exposing more of the dune face to erosion. In these circumstances the security of the defence will depend on whether the erosion hole can extend through the full width of the dunes (allowing a continuous flow of sea water through rather than just wave overwash) in the 3 to 4 hours that the tide is at its highest. The probability of this happening is very difficult to predict with confidence, nevertheless caution suggests there is a significant risk that failure could occur during an event having a 0.5% probability of occurrence.

4. Assessment of flood risk

The highest water level in the estuary (with no waves) having a 0.5% probability of occurrence is +4.56 mOD but water levels of +4.2 mOD and above together with waves higher than 2.0m are equally likely to occur. All these water levels are above the ground level in the site (+3.5 to +3.9 mOD), which therefore lies within Flood Zone 3 (High Risk) as defined in PPG25.

Although the area is protected from flooding by the reinforced sand dunes, there appears to be a significant (but difficult to define) risk that a failure could occur. The extent and depth of flooding that would occur during such an event have been determined using a simple spreadsheet breach-flooding model. The model shows that the depth of flooding will depend on assumptions about the peak water level in the estuary, the width of the breach and the time at which it occurs relative to the time of the peak water level. Selected results are given in Table 2 below.

Table 2 - Flood levels in compartment for range of possible conditions

Peak estuary level (mOD)	Breach width (m)	Water level (mOD) if breach occurs at time of		
		PL – 1 hr	Peak level, PL	PL + 1 hr
4.56	30	4.11	3.98	3.88
	100	4.34	4.24	4.08
	300	4.46	4.38	4.17
4.20	30	3.82	3.75	3.72
	100	3.99	3.92	3.87
	300	4.10	4.04	3.95

These results indicate that the greatest depth of flooding in the area is likely to be between 0.2m and 0.6m, possibly increasing to 0.9m in 50 years time (when the peak estuary levels are 0.3m higher) or if a breach occurs during an event that is water level rather than wave height dominated. Note that once water depths exceed the latter figure the Environment Agency embankment will begin to overflow, limiting any further increase in level.

Annexe 2 - Stage 2 Ancholme Valley Flood Compartments

Tidal Flood Compartments

Compartment 2T1: South Ferriby (East)

2T1.1 - Description of site

This compartment is about 2.5 km long and 1.5 km wide at its widest point. Its estuary frontage runs from high ground at South Ferriby Cliff to the outfall of the River Ancholme at Ferriby Sluice. From the estuary it extends south to a low ridge of land that LIDAR maps produced by the Environment Agency show running east-west between the New Ancholme River, which forms the western boundary, and high ground to the east. It is assumed that this ridge would limit flooding from the estuary extending further south. The eastern boundary is taken as the Zone 2 boundary shown on the Environment Agency's Flood Maps. Ground levels in the area indicate that some of the land is below +2.0 mOD.

The compartment contains low-lying properties in South Ferriby and a section of the A1077, connecting Scunthorpe and Barton-upon Humber. Otherwise, the land is devoted to agriculture.

2T1.2 - Sources of flood risk

The primary source of flood risk to this compartment is a combination of large waves and high water levels in the Humber Estuary. Table 2.1 lists selected combinations having a 0.5% annual probability of occurrence and shows the highest water level at South Ferriby as +5.52 mOD. Current guidance suggests sea levels could rise by 0.3m and wave heights increase by 10% over the next 50 years.

In addition to this tidal source there are three fluvial sources of flood risk, the New River Ancholme itself, the East Drain Lower and the Fulseas & Marsh Drain (which is a SOW managed by the Ancholme IDB). The New River Ancholme is embanked along part of its length within the compartment, carries water draining from land south of Brigg and discharges by gravity through Ferriby Sluice. The East Drain Lower is also embanked and drains the low-lying land north of Brigg. It also receives drainage flows from the escarpment edge. In this compartment it runs beside the River Ancholme and discharges through a tidal sluice beside Ferriby Sluice. The Fulseas & Marsh Drain carries water from land within the compartment and discharges to the estuary by gravity through a sluice at South Ferriby, the outfall channel of which currently suffers from siltation.

The Environment Agency's studies of the River Ancholme system have concentrated on conditions at Brigg and further upstream, where they suggest that the existing defences provide a standard of between 1:10 years and 1:20 years (i.e. 10% to 5% annual probability of flooding). The standard provided below Brigg is difficult to assess since it will depend on what happens above the town; if the upstream defences fail the land there will flood reducing the risk further downstream. If they do not fail, however, the flooding will be transferred downstream. Overall, the annual probability of flooding downstream of Brigg probably lies between 10% and 2.0%, which is significantly below the 1.0% limit required by PPG25. No assessment of the risk from the East Drain Lower has been carried out recently.

The Fulseas & Marsh Drain is understood to be capable of accommodating the 2.0% annual probability event if the additional storage provided by the freeboard allowance included in the design is taken into account.

2T1.3 - Existing defences

The estuary flood defences consist of a combination of earth embankments and brick walls with crest levels varying between +5.3 and +6.3 mOD. They are generally in good condition (Grade 2) although some relatively short lengths are in fair or poor condition (Grades 3 and 4 respectively). Parts of the defence are sufficiently high to prevent overtopping during events with a 0.5% annual probability, as required by PPG25, but significant lengths are not and in places overtopping could occur during an event with less than 10% annual probability of occurring.

The New River Ancholme provides a standard of protection that is well below the 1.0% annual probability of occurring required by PPG25. The banks are generally revetted and about 25% of the revetment is in good condition (Grade 2) but the remainder is poor (Grade 4) or worse. The East Drain Lower embankments are in fair condition (Grade 3) or better.

2T1.4 - Assessment of flood risk

All land in the compartment lying within the Zone 3 boundary, as shown in Figure 2.6, is below the highest water levels with a 0.5% annual probability of occurring in the estuary. This area should therefore be classified as Zone 3 (High risk). All land in the compartment lying outside these areas should be classified as Zone 2 (Medium risk).

None of the land lying within Zone 3 is adequately protected against floods with a 0.5% annual probability of tidal flooding. This land should therefore be classified as NE/NLC SFRA Zone 3(ii) (high risk, high vulnerability). All land lying within 9m of any flood defences or of any watercourse managed by the Environment Agency or an Internal Drainage Board will be subject to restrictions laid down by the Environment Agency or the IDB.

2T1.5 - Development restrictions

The process of deciding planning applications where flood risk is an issue, including the use of the NE/NLC SFRA matrix to determine whether an application is submitted to the Environment Agency, is set out in Chapter 7. It is recommended that in this flood compartment the following additional considerations are taken into account:-

- (a) Development on land within Zone 2 should be subject to confirmation that suitable arrangements for dealing with land drainage have been made with the Ancholme IDB.
- (b) Development on land within NE/NLC SFRA Zone 3(ii) is unlikely to be supported by the Environment Agency.
- (c) Development on land subject to Environment Agency or Ancholme IDB bye-laws is unlikely to be supported by the Environment Agency.

Compartment 2T2: South Ferriby (West)

2T2.1 - Description of site

The estuary frontage of this compartment extends from the outfall of the River Ancholme at Ferriby Sluice to the outfall of the Winterton Beck at Winteringham Haven, a distance of about 5 km. From the estuary it extends south about 3 km along the Ancholme Valley to the ridge of higher ground running from Maltby Farm to the New Ancholme River, which forms the compartment's eastern boundary. This ridge is assumed to limit flooding from the estuary extending further south. The western boundary is taken as the Zone 2 boundary shown on the Environment Agency's Flood Maps. Ground levels in the area indicate that some of the land is below +2.0 mOD.

The compartment contains a cement works at Ferriby Sluice and some isolated farm buildings together with a section of the A1077, connecting Scunthorpe and Barton-upon Humber. The remaining land is devoted to agriculture.

2T2.2 - Sources of flood risk

The primary source of flood risk to this compartment is a combination of large waves and high water levels in the Humber Estuary. Table 2.1 lists selected combinations having a 0.5% annual probability of occurrence and shows the highest water level at South Ferriby as +5.52 mOD. Current guidance suggests sea levels could rise by 0.3m and wave heights increase by 10% over the next 50 years.

In addition to this tidal source there are three fluvial sources of flood risk, the New River Ancholme itself, the West Drain and the Winterton Beck. The New River Ancholme is embanked along part of its length within the compartment, carries water draining from land south of Brigg and discharges by gravity through Ferriby Sluice. The West Drain carries drainage flows from low-lying land west of the River Ancholme and north of Brigg. It discharges through a tidal sluice beside Ferriby Sluice. The Winterton Beck carries drainage flows from the Winterton Valley, which extends south as far as the north-eastern part of Scunthorpe.

The Environment Agency's studies of the River Ancholme system have concentrated on conditions at Brigg and further upstream, where they suggest that the existing defences provide a standard of between 1:10 years and 1:20 years (i.e. 10% to 5% annual probability of flooding). The standard provided below Brigg is difficult to assess since it will depend on what happens above the town; if the upstream defences fail the land there will flood reducing the risk further downstream. If they do not fail, however, the flooding will be transferred downstream. Overall, the annual probability of flooding downstream of Brigg probably lies between 10% and 2.0%, which is significantly below the 1.0% limit required by PPG25. No assessment of the risk from either the West Drain or the Winterton Beck has been made recently.

The Ancholme IDB drainage system currently discharges by gravity, either to the West Drain or directly to the estuary. The system is understood to be capable of accommodating the 2.0% annual probability event if the additional storage provided by the freeboard allowance included in the design is taken into account.

2T2.3 - Existing defences

The estuary flood defences consist of earth embankments with crest levels varying between +5.5 and +6.2 mOD. The embankments are generally in fair to good condition (Grade 3 to 2) but there has been significant erosion at the toe opposite the western end of Read's Island. Toe piling has been

installed but is being undermined and further measures will be required in the near future. Parts of the defence are sufficiently high to prevent overtopping during events with a 0.5% annual probability, as required by PPG25, but significant lengths are not and in places overtopping could occur during an event with less than 10% annual probability of occurring.

The New River Ancholme provides a standard of protection that is well below the 1.0% annual probability of occurring required by PPG25. The banks are generally revetted and about 25% of the revetment is in good condition (Grade 2) but the remainder is poor (Grade 4) or worse.

2T2.4 - Assessment of flood risk

All land in the compartment lying within the Zone 3 boundary, as shown in Figure 2.5, is below the highest water levels with a 0.5% annual probability of occurring in the estuary. This area should therefore be classified as Zone 3 (High risk). All land in the compartment lying outside these areas should be classified as Zone 2 (Medium risk).

None of the land lying within Zone 3 is adequately protected against floods with a 0.5% annual probability of tidal flooding. This land should therefore be classified as NE/NLC SFRA Zone 3(ii) (high risk, high vulnerability). All land lying within 9m of any flood defences or of any watercourse managed by the Environment Agency or an Internal Drainage Board will be subject to restrictions laid down by the Environment Agency or the IDB.

2T2.5 - Development restrictions

The process of deciding planning applications where flood risk is an issue, including the use of the NE/NLC SFRA matrix to determine whether an application is submitted to the Environment Agency, is set out in Chapter 7. It is recommended that in this flood compartment the following additional considerations are taken into account:-

- (a) Development on land within Zone 2 should be subject to confirmation that suitable arrangements for dealing with land drainage have been made with the Ancholme IDB.
- (b) Development on land within NE/NLC SFRA Zone 3(ii) is unlikely to be supported by the Environment Agency.
- (c) Development on land subject to Environment Agency or Ancholme IDB bye-laws is unlikely to be supported by the Environment Agency.

Compartment 2T3: Winterton

2T3.1 - Description of site

This compartment is about 4 km wide and extends up the valley of the Winterton Beck for a distance of about 7 km. Its estuary frontage runs from Winteringham Haven to Whitton, where high ground reaches the shoreline. The landward boundary is taken as the Zone 2 boundary shown on the Environment Agency's Flood Maps. Ground levels in the area indicate that the land is generally at about +4.0 mOD.

The lower parts of the villages of Whitton and Winteringham lie within the compartment, as do a number of isolated farm buildings. The remaining land is devoted to agriculture.

2T3.2 - Sources of flood risk

The primary source of flood risk to this compartment is a combination of large waves and high water levels in the Humber Estuary. Table 2.1 lists selected combinations having a 0.5% annual probability of occurrence and shows the highest water level at Whitton as +5.54 mOD. Current guidance suggests sea levels could rise by 0.3m and wave heights increase by 10% over the next 50 years.

There is in addition one fluvial source of flood risk, the Winterton Beck, which carries drainage flows from the north-eastern part of Scunthorpe. There has been major landscaping work in this area, making it difficult to identify the watershed between the valleys of the Winterton Beck and the Bottesford Beck, which drains to the River Trent. For the purposes of this study the watershed has been taken as the A1077.

The Environment Agency has not assessed the flood risk from the Winterton Beck recently. The Ancholme IDB drainage system currently discharges by gravity, either to the Winterton Beck or directly to the estuary near Whitton Ness. The IDB has applied for grant aid to build a pumping station at the Whitton outfall. The system is understood to be capable of accommodating the 2.0% annual probability event if the additional storage provided by the freeboard allowance included in the design is taken into account.

2T3.3 - Existing defences

The estuary flood defences consist of earth embankments with crest levels varying between +6.1 and +6.9 mOD. The embankments are generally in good condition (Grade 2). Although most of the defences are sufficiently high to prevent overtopping during events with a 1.0% annual probability of occurrence they do not achieve the 0.5% annual probability required by PPG25 for tidal defences.

2T3.4 - Assessment of flood risk

All land in the compartment lying within the Zone 3 boundary, as shown in Figure 2.5, is below the highest water levels with a 0.5% annual probability of occurring in the estuary. This area should therefore be classified as Zone 3 (High risk). All land in the compartment lying outside these areas should be classified as Zone 2 (Medium risk).

None of the land lying within Zone 3 is adequately protected against floods with a 0.5% annual probability of tidal flooding. This land should therefore be classified as NE/NLC SFRA Zone 3ii) (high risk, high vulnerability). All land lying within 9m of any flood defences or of any watercourse managed by the Environment Agency or an Internal Drainage Board will be subject to restrictions laid down by the Environment Agency or the IDB.

2T3.5 - Development restrictions

The process of deciding planning applications where flood risk is an issue, including the use of the NE/NLC SFRA matrix to determine whether an application is submitted to the Environment Agency, is set out in Chapter 7. It is recommended that in this flood compartment the following additional considerations are taken into account:-

- (a) Development on land within Zone 2 should be subject to confirmation that suitable arrangements for dealing with land drainage have been made with the Ancholme IDB.
- (b) Development on land within NE/NLC SFRA Zone 3(ii) is unlikely to be supported by the Environment Agency.
- (c) Development on land subject to Environment Agency or Ancholme IDB bye-laws is unlikely to be supported by the Environment Agency.

Fluvial Flood Compartments

Compartment 2F1: Lower Ancholme Right Bank

2F1.1 - Description of site

This compartment extends from the landward boundary of Compartment 2T1 southwards as far as the town of Brigg, a distance of some 11.5 km. The New River Ancholme forms the western boundary while the eastern boundary is taken as the Zone 2 boundary shown on the Environment Agency's Flood Maps. Ground levels in the area indicate that in places the land is below +1.0 mOD.

The M180 motorway crosses the compartment north of Brigg and forms the northern limit of NLC's development boundary for the town. The majority of the land within the compartment south of this limit is either already developed or has been scheduled for development in the NLC Local Plan. Land north of the motorway contains isolated farm buildings and is devoted to agriculture.

2F1.2 - Sources of flood risk

The main sources of flood risk in this compartment are the New River Ancholme, which carries water draining from land south of Brigg, and the local drainage system on the right bank of the river, although there is also a risk of tidal flooding from the Humber Estuary. This system includes 5 lengths of main river, the Land Drain (which is the primary drain, into which the others discharge, and carries the flow to the estuary at South Ferriby) and the Bonby Catchwater, Worlaby Catchwater, Little Carr Drain and Wrawby Catchwater (each draining a sub-area of the compartment). The Land Drain and the Bonby and Worlaby Catchwaters are embanked over at least part of their length and act as high-level carriers.

The Environment Agency's studies of the River Ancholme system have concentrated on conditions at Brigg and further upstream, where they suggest that the existing defences provide a standard of between 1:10 years and 1:20 years (i.e. 10% to 5% annual probability of flooding). The studies also indicate that the 1:100 years peak water level (1.0% annual probability of flooding) through Brigg is +2.8 mOD. The standard provided below Brigg is difficult to assess since it will depend on what happens above the town; if the upstream defences fail the land there will flood reducing the risk further downstream. If they do not fail, however, the flooding will be transferred downstream. Overall, the annual probability of flooding downstream of Brigg probably lies between 10% and 2.0%, which is significantly below the 1.0% limit required by PPG25. No assessment of the risk from the Land Drain and its tributaries has been made recently.

Some of the Ancholme IDB drainage system discharges to the Land Drain (or a tributary) by gravity but much of it is pumped to the New River Ancholme. The system is understood to be capable of accommodating the 2.0% annual probability event if the additional storage provided by the freeboard allowance included in the design is taken into account.

2F1.3 - Existing defences

Downstream of the M180 motorway bridge the New Ancholme River is partly embanked and these embankments are generally in good condition (Grade 2). The embankments to the Land Drain and

the Bonby and Worlabby Catchwaters are also generally in good condition, with some lengths in fair condition (Grade 3).

The condition and standard of the defences within the compartment at Brigg (upstream of the motorway bridge) has been assessed by W S Atkins¹³ as part of their flood risk assessment for the NLC Local Plan Inquiry. They determined that the defences along the New Ancholme River are in good to fair condition (Grades 2 and 3) and will contain a water level of +2.8 mOD in the river with adequate freeboard. They also undertook a breach analysis of the land south of the motorway bridge and confirmed that the depth of flooding will not exceed 0.23m and the peak flow velocity will not exceed 0.26 m/s.

2F1.4 - Assessment of flood risk

All land in the compartment lying within the Zone 3 boundary, as shown in Figure 2.5, is below the highest fluvial water levels with a 1.0% annual probability of occurring. This area should therefore be classified as Zone 3 (High risk). All land in the compartment lying outside these areas should be classified as Zone 2 (Medium risk).

The land within Zone 3 south of the M180 motorway bridge has been identified in the Inspector's Report¹¹ as being of low vulnerability and is therefore classified as NE/NLC SFRA Zone 3(i) (high risk, low vulnerability). The land within Zone 3 north of the motorway bridge is not adequately protected to this standard and should therefore be classified as NE/NLC SFRA Zone 3(ii) (high risk, high vulnerability). All land lying within 9m of any flood defences or of any watercourse managed by the Environment Agency or an Internal Drainage Board will be subject to restrictions laid down by the Environment Agency or the IDB.

2F1.5 - Development restrictions

The process of deciding planning applications where flood risk is an issue, including the use of the NE/NLC SFRA matrix to determine whether an application is submitted to the Environment Agency, is set out in Chapter 7. It is recommended that in this flood compartment the following additional considerations are taken into account:-

- (a) Development on land within Zone 2 should be subject to confirmation that suitable arrangements for dealing with land drainage have been made with the Ancholme IDB.
- (b) Development within NE/NLC SFRA Zone 3(i) (located south of the M180 motorway bridge, in Brigg) should be in accordance with the NLC Local Plan, as modified following the Inspector's Report¹⁴.
- (c) Development on land within NE/NLC SFRA Zone 3(ii) is unlikely to be supported by the Environment Agency.
- (d) Development on land subject to Environment Agency or Ancholme IDB bye-laws is unlikely to be supported by the Environment Agency.

13 North Lincolnshire District Council Local Plan Inquiry, Strategic Flood Risk Assessment for Brigg WS Atkins, November 2001
14 North Lincolnshire District Council Local Plan Inquiry, Inspector's Report, January 2003

Compartment 2F2: Lower Ancholme Left Bank

2F2.1 - Description of site

This compartment extends from the landward boundary of Compartment 2T2 southwards as far as the A18 road (Bridge Street) by the town of Brigg, a distance of some 11.5 km. The New River Ancholme forms the eastern boundary while the western boundary is taken as the Zone 2 boundary shown on the Environment Agency's Flood Maps. Ground levels in the area indicate that in places the land is below +1.0 mOD.

The M180 motorway crosses the compartment about 1 km north of the A18. The NLC Local Plan shows an area about 500 m by 150 m between the two roads, of which part has already been developed and the remainder is allocated for development. The rest of the compartment contains only isolated farm buildings and is devoted to agriculture.

2F2.2 - Sources of flood risk

The main sources of flood risk in this compartment are the New River Ancholme, which carries water draining from land south of Brigg, and the local drainage system on the left bank of the river, although there is also a risk of tidal flooding from the Humber Estuary. This system includes 3 lengths of main river, the West Drain, Appleby Mill Beck and Ella & Moor Beck. The West Drain is the primary watercourse and carries the flow to the estuary at South Ferriby. The other two watercourses discharge to the West Drain. There is also a short length of main river, the Spring Dyke, which lies between the M180 and the A18 and drains to the New Ancholme River by gravity.

The Environment Agency's studies of the River Ancholme system have concentrated on conditions at Brigg and further upstream, where they suggest that the existing defences provide a standard of between 1:10 years and 1:20 years (i.e. 10% to 5% annual probability of occurrence). The studies also indicate that the 1:100 years peak water level (1.0% annual probability of flooding) through Brigg is +2.8 mOD. The standard provided below Brigg is difficult to assess since it will depend on what happens above the town; if the upstream defences fail the land there will flood reducing the risk further downstream. If they do not fail, however, the flooding will be transferred downstream. Overall, the annual probability of flooding downstream of Brigg probably lies between 10% and 2.0%, which is significantly above the 1.0% limit required by PPG25. No assessment of the risk of flooding from the West Drain and its tributaries has been made recently.

Some of the Ancholme IDB drainage system discharges to the Land Drain (or a tributary) by gravity but much of it is pumped to the New River Ancholme, through either the Broughton or the Appleby Pumping Stations. The system is understood to be capable of accommodating the 2.0% annual probability event if the additional storage provided by the freeboard allowance included in the design is taken into account.

2F2.3 - Existing defences

Downstream of the M180 motorway bridge the New Ancholme River is partly embanked and these embankments are generally in good condition (Grade 2). The other main river watercourses contain only short lengths of embankment, most of which are in fair condition (Grade 3).

The condition and standard of the defences within the compartment upstream of the motorway bridge has been assessed by W S Atkins as part of their flood risk assessment for the NLC Local Plan Inquiry. They determined that the defences along the New Ancholme River are in good to fair

condition (Grades 2 and 3) but do not consistently meet the 1.0% annual probability flood level in the river of +2.8 mOD with adequate freeboard.

2F2.4 - Assessment of flood risk

All land in the compartment lying within the Zone 3 boundary, as shown in Figure 2.5, is below the highest fluvial water levels with a 1.0% annual probability of occurring. This area should therefore be classified as Zone 3 (High risk). All land in the compartment lying outside these areas should be classified as Zone 2 (Medium risk).

None of the land within Zone 3 is adequately protected against floods with a 1.0% annual probability of fluvial flooding. It should therefore all be classified as NE/NLC SFRA Zone 3(ii) (high risk, high vulnerability). All land lying within 9m of any flood defences or of any watercourse managed by the Environment Agency or an Internal Drainage Board will be subject to restrictions laid down by the Environment Agency or the IDB.

2F2.5 - Development restrictions

The process of deciding planning applications where flood risk is an issue, including the use of the NE/NLC SFRA matrix to determine whether an application is submitted to the Environment Agency, is set out in Chapter 7. It is recommended that in this flood compartment the following additional considerations are taken into account:-

- (a) Development on land within Zone 2 should be subject to confirmation that suitable arrangements for dealing with land drainage have been made with the Ancholme IDB.
- (b) Development on land within NE/NLC SFRA Zone 3(ii) should be as set out in the NLC Local Plan, as modified following the Inspector's Report.
- (c) Development on land subject to Environment Agency or Ancholme IDB bye-laws is unlikely to be supported by the Environment Agency.

Compartment 2F3: Island Carr

2F3.1 - Description of site

This compartment is the island on the western side of Brigg that lies between the channels of the New and the Old River Ancholme. It is approximately 1 km long and 0.5 km wide at its widest point. Ground levels in the area indicate that in places the land is below +2.0 mOD.

The northern part of the compartment lies within the NLC's development boundary for Brigg. Much of this area is already developed, mainly for industrial purposes, and the NLC Local Plan shows a relatively small area close to the A18 allocated for housing and a larger area allocated for mixed use development. The southern part of the compartment (which is crossed by the Gainsborough to Grimsby railway line) is devoted to agriculture.

2F3.2 - Sources of flood risk

The main sources of flood risk in this compartment are the two River Ancholme channels. The Environment Agency's studies indicate that the 1:100 years peak water level (1.0% annual probability of occurrence) through Brigg is +2.8 mOD.

Drainage from the compartment is difficult. The northern part is pumped to the Old River Ancholme through the Ancholme IDB's Island Carr pumping station but the southern part of the site relies on drainage by gravity.

2F3.3 - Existing defences

The condition and standard of the compartment's defences has been assessed by W S Atkins as part of their flood risk assessment for the NLC Local Plan Inquiry. They determined that the defences along the New Ancholme River are in good to fair condition (Grades 2 and 3) and do consistently meet the 1.0% annual probability flood level in the river of +2.8 mOD with adequate freeboard. There are multiple defences protecting the compartment, however, and these defences are not consistent in either form or type. As a result the possibility of failure is higher than would be the case with a uniform defence system.

2F3.4 - Assessment of flood risk

All land in the compartment lying below +2.8 mOD, as shown in Figure 2.5, is below the highest fluvial water levels with a 1.0% annual probability of occurring. This area should therefore be classified as Zone 3 (High risk). All land in the compartment lying outside these areas should be classified as Zone 2 (Medium risk).

Although the defences surrounding the compartment will protect land within Zone 3 against fluvial floods having a 1.0% annual probability of occurring, the multiplicity of the defences means that the risk of failure is higher than would normally be expected. The drainage difficulties add to the potential risk of flooding and, overall, indicate that the land is not suitable for unrestricted development. It should therefore all be classified as NE/NLC SFRA Zone 3(ii) (high risk, high vulnerability). All land lying within 9m of any flood defences or of any watercourse managed by the Environment Agency or an Internal Drainage Board will be subject to restrictions laid down by the Environment Agency or the IDB.

2F3.5 - Development restrictions

The process of deciding planning applications where flood risk is an issue, including the use of the NE/NLC SFRA matrix to determine whether an application is submitted to the Environment Agency, is set out in Chapter 7. It is recommended that in this flood compartment the following additional considerations are taken into account:-

- (a) Development on land within Zone 2 should be subject to confirmation that suitable arrangements for dealing with land drainage have been made with the Ancholme IDB.
- (b) Development on land within NE/NLC SFRA Zone 3(ii) should be as set out in the NLC Local Plan, as modified following the Inspector's Report.
- (c) Development on land subject to Environment Agency or Ancholme IDB bye-laws is unlikely to be supported by the Environment Agency.

Compartment 2F4: Middle Ancholme (Right Bank)

2F4.1 - Description of site

This compartment lies south of Brigg and east of the New River Ancholme and is limited partly by topography and partly by the NLC boundaries. As a result, although the compartment is hydraulically a single unit, a strip of land across it falls within Lindsey District Council. This strip divides the area within the NLC boundaries into two parts, a small one on the town's outskirts and a considerably larger one further south.

The boundaries of the small area by the town are the Old River Ancholme, the NLC boundary and either the Environment Agency's indicative fluvial floodplain boundary or the Ancholme IDB boundary, whichever lies furthest from the river. The northern boundary of the larger area further south is the Kettleby Beck, its eastern boundary is the Kettleby Beck and the Searby & Howsham Drain (operated by the Ancholme IDB) and its southern boundary is the North Kelsey Beck. Its western boundary is the New River Ancholme. There is, however, a significant area of high ground within these boundaries that is not at risk of flooding (i.e. lies within PPG25 Zone 1) and is therefore excluded from the assessment. This area is defined by the Zone 2 boundary shown on the Environment Agency's Flood Maps.

The smaller area is about 0.5 km by 1 km and is partly urbanised. Although some of it lies within the NLC's development boundary for Brigg the Local Plan shows no sites allocated for development within it. The larger area is about 3 km by 6 km, is used for agriculture and contains isolated farm buildings. Ground levels in the area indicate that in places close to the River Ancholme the land is below +2.0 mOD.

2F4.2 - Sources of flood risk

The main sources of flood risk in this compartment are the New River Ancholme, which is embanked and carries water from further south, and the local drainage system. This includes two main river watercourse systems, the Kettleby Beck with its tributary the Froghall Drain, and the North Kelsey & Grasby Beck. Both of these systems are embanked in their lower reaches and act as high-level carriers, discharging to the New River Ancholme by gravity.

The Environment Agency's studies of the River Ancholme system suggest that the 1:100 years peak water level (1.0% annual probability of flooding) through Brigg is +2.8 mOD. The studies also indicate that upstream of Brigg the existing defences provide a standard of between 1:10 years and 1:20 years (i.e. 10% to 5% annual probability of occurrence). No assessments of the risk of flooding from the Kettleby or North Kelsey & Grasby Becks have been made recently.

Some of the Ancholme IDB drainage system discharges by gravity to the upper reaches of the two becks but the remainder is pumped, either to the Kettleby Beck or to the New River Ancholme. The system is understood to be capable of accommodating the 2.0% annual probability event if the additional storage provided by the freeboard allowance included in the design is taken into account.

2F4.3 - Existing defences

The New and Old Ancholme river defences within the compartment and standard of the compartment's defences are generally in good to fair condition (Grades 2 and 3), although some toe boarding is noted as being in poor condition (Grade 4). The defences to the Kettleby and North Kelsey & Grasby

Becks are generally in mixed condition, with some lengths good (Grade 2) and some fair (Grade 3).

2F4.4 - Assessment of flood risk

All land in the northern part of the compartment (i.e. by Brigg) lying below +2.8 mOD, as shown in Figure 2.5, is below the highest fluvial water levels with a 1.0% annual probability of occurring and should therefore be classified as Zone 3 (High risk). Similarly, all land in the southern part of the compartment lying within the Zone 3 boundary is below the highest water levels with a 1.0% annual probability of occurring in the estuary and should also be classified as Zone 3 (High risk). All land in the compartment lying outside these areas should be classified as Zone 2 (Medium risk).

None of the land lying within Zone 3 is adequately protected against floods with a 1.0% annual probability of tidal flooding. This land should therefore be classified as NE/NLC SFRA Zone 3(ii) (high risk, high vulnerability). All land lying within 9m of any flood defences or of any watercourse managed by the Environment Agency or an Internal Drainage Board will be subject to restrictions laid down by the Environment Agency or the IDB.

2F4.5 - Development restrictions

The process of deciding planning applications where flood risk is an issue, including the use of the NE/NLC SFRA matrix to determine whether an application is submitted to the Environment Agency, is set out in Chapter 7. It is recommended that in this flood compartment the following additional considerations are taken into account:-

- (a) Development on land within Zone 2 should be subject to confirmation that suitable arrangements for dealing with land drainage have been made with the Ancholme IDB.
- (b) Development on land within NE/NLC SFRA Zone 3(ii) is unlikely to be supported by the Environment Agency.
- (c) Development on land subject to Environment Agency or Ancholme IDB bye-laws is unlikely to be supported by the Environment Agency.

Compartment 2F5: Middle Ancholme (Left Bank)

2F5.1 - Description of site

This compartment lies south of Brigg and west of the New River Ancholme. Its northern boundary is the A18 road (Bridge Street) by Brigg and its southern boundary is the NLC's southern border, which here follows the Sallow Row Drain. Hydraulically, its eastern boundary is the New River Ancholme but for convenience it is taken as the Old River Ancholme south of the North Kelsey Beck outfall, since this is also the NLC boundary there. The western boundary is the Zone 2 boundary shown on the Environment Agency's Flood Maps. The compartment is about 8.5 km long and 3.5 km wide at its widest point.

The Gainsborough to Grimsby railway line crosses the compartment about 1 km south of its northern end. This marks the southern limit of the NLC's development boundary for Brigg, although the Local Plan shows no sites allocated for development in this area (which already includes some industry and housing). Further south the land is used for agriculture and, apart from the village of Hibaldstow, contains only isolated farm buildings. Ground levels in the area indicate that much of the land close to the River Ancholme is below +2.0 mOD.

2F5.2 - Sources of flood risk

The main sources of flood risk in this compartment are the New River Ancholme, which is embanked and carries water from further south, and the local drainage system. This includes four main river watercourse systems, the Scawby Catchwater, the Hibaldstow Catchwater and its tributary the Hibaldstow North Drain, the Redbourne Old River and its tributary the Redbourne Catchwater, and the Sallow Row Drain. These systems are all embanked in their lower reaches and act as high level carriers, discharging to the New River Ancholme by gravity. The Scawby Brook, a SOW managed by the Ancholme IDB, also discharges to the New River Ancholme by gravity.

The Environment Agency's studies of the River Ancholme system suggest that the 1:100 years peak water level (1.0% annual probability of flooding) through Brigg is +2.8 mOD. The studies also indicate that upstream of Brigg the existing defences provide a standard of between 1:10 years and 1:20 years (i.e. 10% to 5% annual probability of occurrence). Environment Agency data shows that the lowest ground level in Hibaldstow is above +5.0 mOD, so the village is not at risk of flooding from the River Ancholme. The risk from the Hibaldstow Catchwater and North Drain has recently been assessed, leading to the conclusion that, contrary to earlier belief, it is less than 1.0% annual probability. No assessments of the risk of flooding from the Scawby Catchwater, Redbourne or Sallow Row drainage systems have been made recently.

Apart from the Scawby Brook, most of the Ancholme IDB drainage system is pumped to the New River Ancholme. The system is understood to be capable of accommodating the 2.0% annual probability event if the additional storage provided by the freeboard allowance included in the design is taken into account.

2F5.3 - Existing defences

The New and Old Ancholme river defences within the compartment and standard of the compartment's defences are generally in good to fair condition (Grades 2 and 3), although some toe boarding is noted as being in poor condition (Grade 4). The defences to the main river sections of the local drainage systems are also in mixed condition, with some lengths good (Grade 2) and some fair (Grade 3).

2F5.4 - Assessment of flood risk

All land north of the railway line (i.e. by Brigg) lying below +2.8 mOD, as shown in Figure 2.5, is below the highest fluvial water levels with a 1.0% annual probability of occurring and should therefore be classified as Zone 3 (High risk). Similarly, all land south of the compartment lying within the Zone 3 boundary is below the highest water levels with a 1.0% annual probability of occurring in the estuary and should also be classified as Zone 3 (High risk). All land in the compartment lying outside these areas should be classified as Zone 2 (Medium risk).

None of the land lying within Zone 3 is adequately protected against floods with a 1.0% annual probability of tidal flooding. This land should therefore be classified as NE/NLC SFRA Zone 3ii (high risk, high vulnerability). All land lying within 9m of any flood defences or of any watercourse managed by the Environment Agency or an Internal Drainage Board will be subject to restrictions laid down by the Environment Agency or the IDB.

2F5.5 - Development restrictions

The process of deciding planning applications where flood risk is an issue, including the use of the NE/NLC SFRA matrix to determine whether an application is submitted to the Environment Agency, is set out in Chapter 7. It is recommended that in this flood compartment the following additional considerations are taken into account:-

- (a) Development on land within Zone 2 should be subject to confirmation that suitable arrangements for dealing with land drainage have been made with the Ancholme IDB.
- (b) Development on land within NE/NLC SFRA Zone 3(ii) is unlikely to be supported by the Environment Agency.
- (c) Development on land subject to Environment Agency or Ancholme IDB bye-laws is unlikely to be supported by the Environment Agency.

Annexe 3 - Stage 3 Trent Valley Flood Compartments

Tidal Flood Compartments

Compartment 3T1: Alkborough

3T1.1 - Description of site

This compartment is a triangular area of land about 4 km long and 2 km wide at its widest point and located at the mouth of the Trent on its right bank. It is backed by a high and steep escarpment, which reaches the estuary shore at Whitton and the Trent bank north of Burton Stather. The northern and western boundaries are formed by the Environment Agency's defence lines and the south-east boundary by the Zone 2 boundary shown on the Environment Agency's Flood Maps. Ground levels in the area indicate that some of the land is below +2.0 mOD.

The compartment is currently used for agriculture but has been identified as suitable for managed realignment with the aim of creating new inter-tidal habitat and flood storage. A group, including the Environment Agency, English Nature and NLC, has recently purchased the land and is intending to develop the area as a managed realignment site.

3T1.2 - Sources of flood risk

The primary source of flood risk to this compartment is high water levels at Trent Falls, the junction between the River Trent and the Humber Estuary. Table 3.1 shows the water level with a 0.5% annual probability of occurrence there to be +5.65 mOD. Current guidance suggests sea levels could rise by 0.3m over the next 50 years.

There are no significant fluvial watercourses flowing through the area. Scunthorpe IDB manage the drainage, which discharges to the estuary by gravity.

3T1.3 - Existing defences

The estuary flood defences consist of earth embankments with crest levels of about +6.1 mOD. They are generally in good condition (Grade 2) although some lengths are fair (Grade 3). The defences are sufficiently high to prevent overtopping during events with a 0.5% annual probability, as required by PPG25.

3T1.4 - Assessment of flood risk

All land in the compartment lying within the Zone 3 boundary, as shown in Figure 3.5, is below the highest water levels with a 0.5% annual probability of occurring in the estuary. This area should therefore be classified as Zone 3 (High risk). All land in the compartment lying outside these areas should be classified as Zone 2 (Medium risk).

Although at present the land lying within Zone 3 is adequately protected against floods with a 0.5% annual probability of tidal flooding, the whole area has been identified by the Environment Agency as suitable for managed retreat. The land should therefore be classified as NE/NLC SFRA Zone 3(iii) (functional floodplain). All land lying within 9m of any flood defences or of any watercourse managed by the Environment Agency or an Internal Drainage Board will be subject to restrictions laid down by the Environment Agency or the IDB.

3T1.5 - Development restrictions

The process of deciding planning applications where flood risk is an issue, including the use of the NE/NLC SFRA matrix to determine whether an application is submitted to the Environment Agency, is set out in Chapter 7. It is recommended that in this flood compartment the following additional considerations are taken into account:-

- (a) Development on land within Zone 2 should be subject to confirmation that suitable arrangements for dealing with land drainage have been made with Scunthorpe IDB and agreed with the Environment Agency.
- (b) Development on land within NE/NLC SFRA Zone 3(iii) (functional floodplain) should be wholly exceptional and is unlikely to be supported by the Environment Agency.
- (c) Development on land subject to Environment Agency or Scunthorpe IDB bye-laws is unlikely to be supported by the Environment Agency.

Compartment 3T2: Flixborough

3T2.1 - Description of site

This compartment is on the right bank of the River Trent and extends from high ground just north of Burton Stather to the minor road running between Flixborough Stather and Flixborough village. The Trent's defences form its western boundary while its eastern boundary is formed by the Zone 2 boundary shown on the Environment Agency's Flood Maps. It is about 4 km long and 1.2 km wide at its widest point. Ground levels in the area indicate that some of the land is below +2.0 mOD.

The compartment contains some industrial development at its two ends (at Burton Stather in the north and Flixborough Industrial Estate in the south). The industrial estate is almost separated from the rest of the compartment by a railway embankment. The area between the two developed areas is currently used for agriculture but has been identified by the Environment Agency as potentially suitable for managed realignment with the aim of creating flood storage.

3T2.2 - Sources of flood risk

The primary source of flood risk to this compartment is high water levels in the River Trent. Table 3.1 shows the water level with a 0.5% annual probability of occurrence there to be between +5.65 mOD and +5.82 mOD. Current guidance suggests sea levels could rise by 0.3m over the next 50 years.

There are no significant fluvial watercourses flowing through the area. Scunthorpe IDB manage the drainage, most of which discharges to the estuary by gravity apart from the Flixborough Industrial Estate, which is pumped. The system is understood to be capable of accommodating the 2.0% annual probability event if the additional storage provided by the freeboard allowance included in the design is taken into account.

3T2.3 - Existing defences

The estuary flood defences consist of earth embankments with crest levels of between +6.1 and +6.3 mOD. They are generally in good to fair condition (Grades 2 and 3) and are sufficiently high to prevent overtopping during events with a 0.5% annual probability, as required by PPG25.

3T2.4 - Assessment of flood risk

All land in the compartment lying within the Zone 3 boundary, as shown in Figure 3.5, is below the highest water levels with a 0.5% annual probability of occurring in the estuary. This area should therefore be classified as Zone 3 (High risk). All land in the compartment lying outside these areas should be classified as Zone 2 (Medium risk).

In principle, most of the land lying within Zone 3 is adequately protected against floods with a 0.5% (tidal) or 1.0% (fluvial) annual probability of occurring and therefore may be classified as NE/NLC SFRA Zone 3(i) (high risk, low vulnerability). There are a number of exceptions to this however, as follows:-

- (e) All land lying within 9m of any flood defences or of any watercourse managed by the Environment Agency or an Internal Drainage Board will be subject to restrictions laid down by the Environment Agency or the IDB.

- (f) Although the Trent's defences are currently in reasonable condition there is, nevertheless, a risk that they will fail, resulting in a breach. If this happens at high tide, water will flow through the breach at high velocity posing a significant risk to people and property in the immediate vicinity. Given that the peak water level in the river is about +5.8 mOD and the ground level immediately behind the defences is generally about +3.0 mOD or less, Table 5 indicates that a 200m wide zone should be classified as NE/NLC SFRA Zone 3(ii) (high risk, high vulnerability).
- (g) If the Trent's defences are breached during an event with a 0.5% annual probability, flooding up to about +3.5 mOD could occur. All land lying below +3.0 mOD is therefore potentially at risk of being flooded to a depth of 0.5m. Table 3 indicates that such land should be classified as NE/NLC SFRA Zone 3(ii) (high risk, high vulnerability).
- (h) Much of the remaining area has been identified by the Environment Agency as suitable for managed retreat and should be classified as NE/NLC SFRA Zone 3(iii) (functional floodplain).

3T2.5 - Development restrictions

The process of deciding planning applications where flood risk is an issue, including the use of the NE/NLC SFRA matrix to determine whether an application is submitted to the Environment Agency, is set out in Chapter 7. It is recommended that in this flood compartment the following additional considerations are taken into account:-

- (a) Development on land within Zone 2 should be subject to confirmation that suitable arrangements for dealing with land drainage have been made with Scunthorpe IDB and agreed with the Environment Agency.
- (b) Development on land within NE/NLC SFRA Zone 3(i) should be subject to confirmation that suitable arrangements for dealing with land drainage have been made with Scunthorpe IDB and agreed with the Environment Agency.
- (c) Development on land within NE/NLC SFRA Zone 3(ii) is unlikely to be supported by the Environment Agency
- (d) Development on land within NE/NLC SFRA Zone 3(iii) (functional floodplain) should be wholly exceptional and is unlikely to be supported by the Environment Agency.
- (e) Development on land subject to Environment Agency or Scunthorpe IDB bye-laws is unlikely to be supported by the Environment Agency.

Compartment 3T3: Gunness

3T3.1 - Description of site

This compartment is on the right bank of the River Trent and extends from the minor road running between Flixborough Stather and Flixborough village to the Bottesford Beck. The Trent and Bottesford Beck defences form its western and southern boundaries respectively while its eastern boundary is formed by the Zone 2 boundary shown on the Environment Agency's Flood Maps. The compartment is about 8.5 km long and 4 km wide at its widest point. Ground levels in the area indicate that some of the land is below +1.0 mOD.

The compartment contains some industrial development beside the River, particularly at Grove Wharf and Gunness, together with a number of important communication links including the A18 and A1077 main roads, the M180 motorway and the Scunthorpe to Doncaster railway line. It also includes the western fringe of Scunthorpe, where there is both housing and industry. The remainder of the area is used for agriculture.

3T3.2 - Sources of flood risk

The primary source of flood risk to this compartment is high water levels in the River Trent. The Environment Agency's indicative flood plain map shows the area north of the M180 motorway as being subject to tidal flooding and the area further south as subject to either tidal or fluvial flooding. Table 3.1 shows the tidal water level at Keadby Bridge with a 0.5% annual probability of occurrence to be +5.82 mOD. Current guidance suggests sea levels could rise by 0.3m over the next 50 years. Fluvial flood levels are influenced by tidal conditions as well as by rainfall and catchment characteristics, in particular floodplain storage further upstream. Design levels were produced for the Trent Tidal Reach Improvement Scheme, which was implemented over the period 1960 – 1980 with the aim of providing protection against flooding with a 1.0% annual probability of occurrence. This is the currently quoted standard of defence but it will be reviewed as a strategy study that has recently been commissioned is undertaken.

There is only one other main river watercourse that could affect the compartment, the Bottesford Beck. This is an embanked high-level conveyor draining the eastern and southern parts of Scunthorpe and discharging to the River Trent by gravity. The local drainage system is managed by Scunthorpe IDB. Although there are some gravity outfalls most of the flow is pumped to the River Trent through the Lysaghts and Burringham pumping stations. The system is understood to be capable of accommodating the 2.0% annual probability event if the additional storage provided by the freeboard allowance included in the design is taken into account.

3T3.3 - Existing defences

The River Trent flood defences consist largely of earth embankments with short sections of quay wall in the wharf areas. The crest level varies between +6.1 and +6.3 mOD are sufficiently high to prevent overtopping during events with a 0.5% annual probability, as required by PPG25. The defences are generally in good to fair condition (Grades 2 and 3), although some of the quay walls are classified as poor (Grade 4). These walls are generally backed by wide paved areas, however, so the risk of progressive failure leading to widespread flooding during an extreme event is low.

The Bottesford Beck defences consist entirely of earth embankments, generally in good to fair condition (Grades 2 and 3). They provide a 1:30 years standard of protection (3.0% annual probability of flooding) to the surrounding area.

3T3.4 - Assessment of flood risk

All land in the compartment lying within the Zone 3 boundary, as shown in Figure 3.5, is below the highest water levels with a 0.5% annual probability of occurring in the estuary. This area should therefore be classified as Zone 3 (High risk). All land in the compartment lying outside these areas should be classified as Zone 2 (Medium risk).

In principle, most of the land lying within Zone 3 is adequately protected against floods with a 0.5% (tidal) or 1.0% (fluvial) annual probability of occurring and therefore may be classified as NE/NLC SFRA Zone 3(i) (high risk, low vulnerability). There are a number of exceptions to this however, as follows:-

- (i) All land lying within 9m of any flood defences or of any watercourse managed by the Environment Agency or an Internal Drainage Board will be subject to restrictions laid down by the Environment Agency or the IDB.
- (j) Although the Trent's defences are currently in reasonable condition there is, nevertheless, a risk that they will fail, resulting in a breach. If this happens at high tide, water will flow through the breach at high velocity posing a significant risk to people and property in the immediate vicinity. Given that the peak water level in the river is about +5.8 mOD and the ground level immediately behind the defences is generally about +3.0 mOD or less, Table 5 indicates that a 200m wide zone should be classified as NE/NLC SFRA Zone 3(ii) (high risk, high vulnerability).
- (k) If the Trent's defences are breached during an event with a 0.5% annual probability, flooding up to about +3.5 mOD could occur. All land lying below +3.0 mOD is therefore potentially at risk of being flooded to a depth of 0.5m. Table 3 indicates that such land should be classified as NE/NLC SFRA Zone 3(ii) (high risk, high vulnerability).
- (l) The M181/A1077 road system is raised above the surrounding land and could protect the land to the east from flooding if the Trent's defences are breached provided measures are taken to prevent reverse flows through the culverts and other openings in the embankments. The land east of these roads could then be classified as NE/NLC SFRA Zone 3(i) (high risk, low vulnerability).
- (m) The Bottesford Beck's defences do not provide protection against a 0.1% probability event. Should such an event occur and the defences are overwhelmed the M180 motorway, which is raised above the surrounding land, will prevent overland flow and so limit flooding further north. Floodwater will flow through the IDB drainage system however, and will pool in low-lying land near the Burringham pumping station. Land south of the motorway and near the pumping station should therefore be classified as NE/NLC SFRA Zone 3(ii) (high risk, high vulnerability).

3T3.5 - Development restrictions

The process of deciding planning applications where flood risk is an issue, including the use of the NE/NLC SFRA matrix to determine whether an application is submitted to the Environment Agency, is set out in Chapter 7. It is recommended that in this flood compartment the following additional considerations are taken into account:-

- (a) Development on land within Zone 2 should be subject to confirmation that suitable arrangements for dealing with land drainage have been made with Scunthorpe IDB and agreed with the Environment Agency.
- (b) Development on land within NE/NLC SFRA Zone 3(i) should be subject to confirmation that suitable arrangements for dealing with land drainage have been made with Scunthorpe IDB and agreed with the Environment Agency.
- (c) Development on land within NE/NLC SFRA Zone 3(ii) is unlikely to be supported by the Environment Agency. Exceptions may be made for developments east of the M181/A1077 road system provided adequate measures are taken to prevent reverse flows through openings in the road embankments.
- (d) Development on land subject to Environment Agency or Scunthorpe IDB bye-laws is unlikely to be supported by the Environment Agency.

Compartment 3T4: Garthorpe & Keadby

3T4.1 - Description of site

This compartment is on the left bank of the River Trent and extends from the NLC border to the Stainforth & Keadby Canal. The Trent and the Canal form its eastern and southern boundaries respectively while the NLC border forms its remaining boundary. The compartment is about 8 km from north to south and 12 km east to west at its widest point. Ground levels in the area indicate that much of the land is below +2.0 mOD.

The flat, low-lying land that forms the Trent floodplain extends well beyond the NLC border. Originally marshland, this area was reclaimed in the 16th and 17th Centuries and is very fertile but relies on an extremely complex drainage system, almost entirely pumped, to maintain water levels low enough for arable agriculture to take place. There are a number of villages within the marsh, generally located on local high spots. Crowle, for example, stands on a noticeable high point but the small villages of Eastoft, Garthorpe, Luddington and Adlingfleet are only a few metres above the surrounding marsh level. There is a major power station at Keadby but apart from this the area is devoted largely to agriculture.

3T4.2 - Sources of flood risk

In principle this compartment is part of a floodplain that is surrounded by four watercourses (the Trent, Ouse and Don Rivers and the Stainforth & Keadby Canal, which connects the Don and Trent) and is therefore at risk of flooding from them all. In practice the Canal poses only a limited risk since it carries no flow (if it breaches the water stored in the canal would drain out but gates at either end would prevent more water entering the channel). The River Don could affect the western part of the compartment (beyond Crowle) and the River Ouse the northern part. The primary sources of flood risk, however, are the River Trent and the local drainage system.

Table 3.1 shows the tidal water level in the River Trent with a 0.5% annual probability of occurrence to be between +5.65 and +5.82 mOD. Current guidance suggests sea levels could rise by 0.3m over the next 50 years. During such an event the tidal water level in the River Ouse will be similar or slightly higher while levels in the Don will be higher still and may also be influenced by fluvial conditions. The Environment Agency has recently commissioned a strategy study of the River Don that will examine the likely flood risks there and will contribute to an overall review of risk within this area of the floodplain to be carried out as part of the HESMP studies.

The only main river watercourse in the area is the North Soak drain, which runs beside the Stainforth & Keadby Canal and collects local drainage flows and pumped discharges from Crowle and Tween Bridge IDBs. These two IDBs, with Garthorpe and Adlingfleet & Whitgift, manage the local drainage within the compartment. Flows from the Garthorpe system are discharged to the River Trent by gravity but the remaining flows are largely pumped, either directly or indirectly, to the Trent or (for some of the Adlingfleet & Whitgift area) to the Ouse. The systems are understood to be capable of accommodating the 2.0% annual probability event if the additional storage provided by the freeboard allowance included in the design is taken into account.

3T4.3 - Existing defences

The River Trent flood defences consist largely of earth embankments although there are some short lengths of wall near Keadby. The crest level varies between +6.0 and +6.3 mOD so the embankments

are sufficiently high to prevent overtopping during events with a 0.5% annual probability. The defences are generally in good to fair condition (Grades 2 and 3).

The River Ouse flood defences also consist largely of earth embankments although there are some lengths of sheet-pile and other walls. They are sufficiently high to prevent overtopping during events with a 0.5% annual probability except near Reedness, where the standard is currently estimated to be lower than 2.0% annual probability. The Environment Agency is studying a scheme to improve the standard here. The defences are generally in good to fair condition (Grades 2 and 3).

3T4.4 - Assessment of flood risk

All land in the compartment lying within the Zone 3 boundary, as shown in Figure 3.5, is below the highest water levels with a 0.5% annual probability of occurring in the estuary. This area should therefore be classified as Zone 3 (High risk). All land in the compartment lying outside these areas should be classified as Zone 2 (Medium risk).

If the defences beside the Ouse or the Trent are breached during an event with a 0.5% (tidal) or 1.0% (fluvial) probability of occurring, or if the Stainforth & Keadby Canal's bank is breached, flooding could occur up to levels of between about +2.0 and +2.5 mOD. This would affect the low-lying areas north of Eastoft and east and west of Crowle. In principle, therefore, the remaining land within Zone 3 is adequately protected against flooding. Nevertheless, the very flat and low-lying nature of the land, the complexity of the drainage system and the heavy reliance on pumping mean that, in practice, if the defences fail flooding could be widespread and in locations that are difficult to predict. Under these circumstances only those places where the ground level is more than 0.5 m higher than the average ground level in the surrounding area (taken as +3.0 mOD) should be considered as being safe from flooding. As a result, only land above +3.5 mOD is classified as NE/NLC SFRA Zone 3(i) (high risk, low vulnerability). There are two further issues to be considered, as follows:-

- (a) All land lying within 9m of any flood defences or of any watercourse managed by the Environment Agency or an Internal Drainage Board will be subject to restrictions laid down by the Environment Agency or the IDB.
- (b) Although the Trent's defences are currently in reasonable condition there is, nevertheless, a risk that they will fail, resulting in a breach. If this happens at high tide, water will flow through the breach at high velocity posing a significant risk to people and property in the immediate vicinity. Given that the peak water level in the river is about +5.8 mOD and the ground level immediately behind the defences is generally about +3.5 mOD, Table 5 indicates that a 100m wide zone could be affected.

3T4.5 - Development restrictions

The process of deciding planning applications where flood risk is an issue, including the use of the NE/NLC SFRA matrix to determine whether an application is submitted to the Environment Agency, is set out in Chapter 7. It is recommended that in this flood compartment the following additional considerations are taken into account:-

- (a) Development on land within Zone 2 should be subject to confirmation that suitable arrangements for dealing with land drainage have been made with the appropriate IDB and agreed with the Environment Agency.

- (b) Development on land within NE/NLC SFRA Zone 3(i) should be subject to confirmation that suitable arrangements for dealing with land drainage have been made with the appropriate IDB and agreed with the Environment Agency.
- (c) Development on land within NE/NLC SFRA Zone 3(ii) is unlikely to be supported by the Environment Agency.
- (d) Development on land subject to Environment Agency or IDB bye-laws is unlikely to be supported by the Environment Agency.

Fluvial Flood Compartments

Compartment 3F1: Upper Bottesford Beck

3F1.1 - Description of site

The Bottesford Beck drains the southern and eastern parts of Scunthorpe. Its lower reaches are embanked and act as a high-level conveyor, carrying the drainage flows across the floodplain to the River Trent. This compartment begins at the limit of compartment 3T3, which covers the River Trent floodplain and its boundary is taken as the Zone 2 boundary shown on the Environment Agency's Flood Maps. The compartment is thus relatively narrow where the watercourse flows down the steep valley across the escarpment before it meets compartment 3T3 but broadens out further upstream where the ground slopes more gently.

The lower, narrow, part of the compartment includes some properties on the edge of existing developments. Some of the upper part is open ground (where, for example, a golf course is located) but a significant proportion is heavily industrialised, including part of Scunthorpe Steelworks.

3F1.2 - Sources of flood risk

The Bottesford Beck is the only source of flood risk in the compartment. Downstream (in compartment 3T3) the embankments flanking the watercourse provide a 1:30 years standard of protection (about 3% annual probability of occurrence) across the Trent floodplain. The channel within this compartment was improved in the 1980s to accommodate the extra discharge from a major development in the catchment but nevertheless the return period of the event causing the flow to come out of bank (i.e. the onset of flooding) is believed to be quite low, although no model studies to confirm this have been carried out.

A major source of concern is the sensitivity of the flood risk to future development in the catchment. The outflow from the upper part of the compartment is likely to be constricted, causing flood levels to respond more strongly to changes in flow rate than catchments where the outflow is less constrained. As a result any development within this catchment that increases the rate of runoff will have a greater impact on flood risk than a development in a less sensitive catchment.

The extent of the Bottesford Beck catchment is shown in Figure 3.5. There has been major landscaping work to the north-east of Scunthorpe, making it difficult to identify the watershed between the valleys of the Bottesford Beck and the Winterton Beck, which drains to the Humber Estuary. For the purposes of this study the watershed has been taken as the A1077.

3F1.3 - Existing defences

There are no flood defences (embankments, walls or formal storage areas) within this compartment.

3F1.4 - Assessment of flood risk

All land in the compartment lying within the Zone 3 boundary, as shown in Figure 3.5, is below the highest water levels with a 1.0% annual probability of occurring in the Bottesford Beck. This area should therefore be classified as Zone 3 (High risk). None of this land is adequately protected against flooding and it should therefore all be classified as NE/NLC SFRA Zone 3(ii) (high risk, high vulnerability). There are two further issues to be considered, as follows:-

- (a) All land lying within 9m of any flood defences or of any watercourse managed by the Environment Agency be subject to restrictions laid down by the Environment Agency.
- (b) In view of the sensitivity of the flooding in this compartment to changes in runoff rates the Environment Agency's requirement for new developments within the catchment to install on-site storage and other measures to minimise the impact on drainage discharge rates should be rigorously enforced.

3F1.5 - Development restrictions

The process of deciding planning applications where flood risk is an issue, including the use of the NE/NLC SFRA matrix to determine whether an application is submitted to the Environment Agency, is set out in Chapter 7. It is recommended that in this flood compartment the following additional considerations are taken into account:-

- (a) Development on land within NE/NLC SFRA Zone 3(ii) is unlikely to be supported by the Environment Agency.
- (b) Development on land subject to Environment Agency or IDB bye-laws is unlikely to be supported by the Environment Agency.
- (c) The Environment Agency's requirement for the impact of any new development within the catchment on drainage flow rates to be minimised should be rigorously enforced.

Compartment 3F2: Messingham

3F2.1 - Description of site

This compartment is on the right bank of the River Trent and extends from the Bottesford Beck (opposite West Butterwick) to the River Eau (which also marks the NLC border). These two watercourses form its northern and southern boundaries respectively while the Trent forms its western boundary. The eastern boundary is formed by the Zone 2 boundary shown on the Environment Agency's Flood Maps. The compartment is about 3 km from north to south and 4.5 km from east to west. Ground levels in the area indicate that much of the land is below +2.0 mOD.

The compartment is largely devoted to agriculture and contains a number of farms, most of which are relatively isolated.

3F2.2 - Sources of flood risk

The primary source of flood risk to this compartment is high water levels in the River Trent. These levels are influenced by tidal conditions as well as by rainfall and catchment characteristics, in particular floodplain storage further upstream. Design levels were produced for the Trent Tidal Reach Improvement Scheme, which was implemented over the period 1960 – 1980 with the aim of providing protection against flooding with a 1.0% annual probability of occurrence. This is the currently quoted standard of defence but it will be reviewed as a strategy study that has recently been commissioned is completed.

The two other main river watercourses that could affect the compartment are the Bottesford Beck and the River Eau. These are both embanked high-level conveyors draining land to the east and discharging to the River Trent by gravity. The flow from the local drainage system, which is managed by Messingham IDB, is pumped to the River Trent through the East Butterwick and Black Bank pumping stations. The system is understood to be capable of accommodating the 2.0% annual probability event if the additional storage provided by the freeboard allowance included in the design is taken into account.

3F2.3 - Existing defences

The River Trent flood defences consist largely of earth embankments that are sufficiently high to prevent overtopping during events with a 1.0% annual probability. The defences are generally in good to fair condition (Grades 2 and 3). The Bottesford Beck and River Eau defences consist entirely of earth embankments, generally in good to fair condition (Grades 2 and 3). They provide a 1:30 years standard of protection (3.0% annual probability of flooding) to the surrounding area.

There is a flood storage area upstream of the embanked section on the left bank of the River Eau (and therefore outside the NLC border and so outside the compartment). This is capable of taking the flow during events of up to 1:30 years return period (and providing this standard of protection to the village of Scotter, further upstream). More severe events will overtop the banks and, by restricting backing up, limit the threat to the village.

3F2.4 - Assessment of flood risk

All land in the compartment lying within the Zone 3 boundary, as shown in Figure 3.5, is below the highest water levels with a 0.5% annual probability of occurring in the River Trent. This area should therefore be classified as Zone 3 (High risk). All land in the compartment lying outside these areas should be classified as Zone 2 (Medium risk).

Although much of the land lying within Zone 3 is adequately protected against floods with a 0.5% annual probability of occurring in the River Trent, it is not protected against floods with a 1.0% probability of happening in Bottesford Beck or the River Eau and should therefore be classified as NE/NLC SFRA Zone 3(ii) (high risk, high vulnerability). There are two further issues to be considered, as follows:-

- (a) All land lying within 9m of any flood defences or of any watercourse managed by the Environment Agency or an Internal Drainage Board will be subject to restrictions laid down by the Environment Agency or the IDB.
- (b) Although the Trent's defences are currently in reasonable condition there is, nevertheless, a risk that they will fail, resulting in a breach. If this happens at high tide, water will flow through the breach at high velocity posing a significant risk to people and property in the immediate vicinity. Given that the peak water level in the river is greater than +5.8 mOD and the ground level immediately behind the defences is generally about +3.5 mOD, Table 5 indicates that a 150m wide zone could be affected.

3F2.5 - Development restrictions

The process of deciding planning applications where flood risk is an issue, including the use of the NE/NLC SFRA matrix to determine whether an application is submitted to the Environment Agency, is set out in Chapter 7. It is recommended that in this flood compartment the following additional considerations are taken into account:-

- (a) Development on land within Zone 2 should be subject to confirmation that suitable arrangements for dealing with land drainage have been made with Messingham IDB and agreed with the Environment Agency.
- (b) Development on land within NE/NLC SFRA Zone 3(ii) is unlikely to be supported by the Environment Agency.
- (c) Development on land subject to Environment Agency or Messingham IDB bye-laws is unlikely to be supported by the Environment Agency.

Compartment 3F3: Upper River Eau

3F3.1 - Description of site

Although the NLC border and the River Eau diverge upstream of compartment 3F2, the border then turns south and crosses the river again further upstream. As a result there is a small area of land at risk of flooding west of Kirton in Lindsey, which is this compartment. The NLC border forms its western boundary and the other boundary is the Environment Agency's indicative fluvial floodplain or the Gainsborough IDB boundary, whichever lies furthest from the river. The compartment is about 5 km long and 2 km wide at its widest point.

3F3.2 - Sources of flood risk

The River Eau is the only source of flood risk in the compartment. The return period of the event causing the flow to come out of bank (i.e. the onset of flooding) is believed to be less than 1:30 years (3% annual probability), although no model studies to confirm this have been carried out. Gainsborough IDB manages the local drainage.

3F3.3 - Existing defences

There are no flood defences (embankments, walls or formal storage areas) within this compartment.

3F3.4 - Assessment of flood risk

All land in the compartment lying within the Zone 3 boundary, as shown in Figure 3.5, is below the highest water levels with a 1.0% annual probability of occurring in the River Eau. This area should therefore be classified as Zone 3 (High risk). All land in the compartment lying outside this area should be classified as Zone 2 (Medium risk).

None of the land within Zone 3 is adequately protected against flooding and it should therefore all be classified as NE/NLC SFRA Zone 3(ii) (high risk, high vulnerability). All land lying within 9m of any flood defences or of any watercourse managed by the Environment Agency or an IDB will be subject to restrictions laid down by the Environment Agency or the IDB.

3F3.5 - Development restrictions

The process of deciding planning applications where flood risk is an issue, including the use of the NE/NLC SFRA matrix to determine whether an application is submitted to the Environment Agency, is set out in Chapter 7. It is recommended that in this flood compartment the following additional considerations are taken into account:-

- (a) Development on land within NE/NLC SFRA Zone 3(ii) is unlikely to be supported by the Environment Agency.
- (b) Development on land subject to Environment Agency or Gainsborough IDB bye-laws is unlikely to be supported by the Environment Agency.

Compartment 3F4: Three Rivers

3F4.1 - Description of site

This compartment is on the left bank of the River Trent and lies between the Stainforth & Keadby Canal and the River Torne, which is one of the watercourses that are together known as the Three Rivers. The River Torne forms the compartment's southern boundary to the point where it reaches the NLC border. The compartment is about 10 km from east to west and 9 km north to south at its widest point. Ground levels in the area indicate that much of the land is below +2.0 mOD.

The compartment is within the Trent floodplain and, like the rest of the area, relies on a complex drainage system, almost entirely pumped, to maintain water levels low enough for arable agriculture to take place. The area contains small villages and isolated farms, is extremely flat and very fertile and is devoted largely to agriculture. The M180 motorway, the A18 and A161 main roads and a number of minor roads cross the compartment.

3F4.2 - Sources of flood risk

In principle the main sources of flood risk are the River Trent, the Stainforth & Keadby Canal, which connects the Don and Trent, and four main river watercourses, the South Soak Drain (which flanks the Canal), the North Level Engine Drain, the Hatfield Waste Drain and the River Torne. In practice the Canal poses only a limited risk since it carries no flow (if it breaches the water stored in the canal would drain out but gates at either end would prevent more water entering the channel). The North Level Engine Drain runs beside the Hatfield Waste Drain for much of its length and eventually joins it.

High water levels in the River Trent are influenced by tidal conditions as well as by rainfall and catchment characteristics, in particular floodplain storage further upstream. The existing defences are intended to provide protection against fluvial flooding with a 1.0% annual probability of occurrence (and are likely to protect against a 0.5% annual probability of tidal flooding). The River Torne is a highland carrier receiving water from the Doncaster area and carrying it across the Trent floodplain to the Keadby pumping station, which discharges to the River Trent. The three other main river watercourses collect local drainage flows discharged or pumped to them from Hatfield Chase IDB drainage system, which is responsible for drainage from the land east of a point close to Belton Grange pumping station, and convey them to Keadby pumping station also.

The main river watercourses provide a nominal 1:10 years (10% annual probability) standard of protection to the surrounding area, although the River Torne's standard rises to 1:30 years (3% annual probability) if freeboard is taken into account. The IDB's system is understood to be capable of accommodating the 2.0% annual probability event if the additional storage provided by the freeboard allowance included in the design is taken into account.

3F4.3 - Existing defences

The defences along the very short length of the River Trent beside the compartment are in good condition (Grade 2). The River Torne is embanked over part of its length and these defences are generally in good to fair condition (Grades 2 and 3). There are no other significant formal flood defences within the compartment.

3F4.4 - Assessment of flood risk

All land in the compartment, as shown in Figure 3.5, is below the water levels that would occur with a 0.5% annual probability of occurring in the River Trent. This area should therefore be classified as Zone 3 (High risk).

Although much of the land lying within Zone 3 is apparently adequately protected against water levels with a 0.5% (tidal) or 1.0% (fluvial) annual probability of occurring in the Trent, nevertheless the very flat and low-lying nature of the land, the complexity of the drainage system, the low standard of protection it affords and the heavy reliance on pumping mean that during an extreme event flooding could be widespread and in locations that are difficult to predict. Under these circumstances only those places where the ground level is more than 0.5 m higher than the average ground level in the surrounding area (taken as +3.0 mOD) should be considered as being safe from flooding. As a result, only land above +3.5 mOD is classified as NE/NLC SFRA Zone 3(i) (high risk, low vulnerability). There are two further issues to be considered, as follows:-

- (a) All land lying within 9m of any flood defences or of any watercourse managed by the Environment Agency or an Internal Drainage Board will be subject to restrictions laid down by the Environment Agency or the Hatfield Chase IDB.
- (b) Although the Trent's defences are currently in reasonable condition there is, nevertheless, a risk that they will fail, resulting in a breach. If this happens at high tide, water will flow through the breach at high velocity posing a significant risk to people and property in the immediate vicinity. Given that the peak water level in the river is about +5.8 mOD and the ground level immediately behind the defences is generally about +3.5 mOD, Table 5 indicates that a 100m wide zone should therefore be classified as NE/NLC SFRA Zone 3(ii) (high risk, high vulnerability).

3F4.5 - Development restrictions

The process of deciding planning applications where flood risk is an issue, including the use of the NE/NLC SFRA matrix to determine whether an application is submitted to the Environment Agency, is set out in Chapter 7. It is recommended that in this flood compartment the following additional considerations are taken into account:-

- (a) Development on land within NE/NLC SFRA Zone 3(i) should be subject to confirmation that suitable arrangements for dealing with land drainage have been made with the appropriate IDB and agreed with the Environment Agency.
- (b) Development on land within NE/NLC SFRA Zone 3(ii) is unlikely to be supported by the Environment Agency.
- (c) Development on land subject to Environment Agency or the Hatfield Chase IDB bye-laws is unlikely to be supported by the Environment Agency.

Compartment 3F5: Isle of Axholme

3F5.1 - Description of site

This compartment is on the left bank of the River Trent and lies between the River Torne, which is one of the watercourses that are together known as the Three Rivers, and the Warping Drain. The River Torne forms the compartment's southern and most of its western boundaries while the River Trent and the Warping Drain form its eastern and southern boundaries respectively. The NLC border forms the rest of the external boundary. The compartment contains a large area of land (the Isle of Axholme) that is above the general floodplain level and is therefore excluded from this assessment. The limit of this area (the internal boundary) is defined by the Zone 2 boundary shown on the Environment Agency's Flood Maps. The overall compartment dimensions are about 13 km from east to west and the same distance from north to south. Ground levels in the area indicate that much of the land is below +2.0 mOD.

The compartment is within the Trent floodplain and, like the rest of the area, relies on a complex drainage system, almost entirely pumped, to maintain water levels low enough for arable agriculture to take place. Most of the larger villages (e.g. Epworth, Haxey) are located on high ground out of the floodplain but parts of some of them (e.g. Westwoodside, Westgate) have spread onto lower-lying land and some (e.g. Owston Ferry, West Butterwick) are almost entirely on the floodplain. The floodplain itself is flat, very fertile and devoted largely to agriculture. The M180 motorway, the A18 and A161 main roads and a number of minor roads cross the compartment.

3F5.2 - Sources of flood risk

The main source of flood risk to the compartment is the River Trent. North of the M180 motorway crossing the flood risk from the Trent is tidal while to the south it is both tidal and fluvial, indicating that high water levels are influenced by tidal conditions and by rainfall and catchment characteristics, in particular floodplain storage further upstream. The existing defences provide protection against tidal flooding with a 0.5% annual probability of occurrence (and are intended to protect against a 1.0% annual probability of fluvial flooding).

The other sources of flood risk are the other three main river watercourses (River Torne, South Level Engine Drain and Warping Drain) and the local IDB systems (managed by Althorpe, West Butterwick, West Axholme, South Axholme and Hatfield Chase IDBs). The River Torne is a highland carrier receiving water from the Doncaster area and conveying it across the Trent floodplain to the Keadby pumping station, which discharges to the River Trent. The South Level Engine Drain collects local drainage flows discharged or pumped to it from the Althorpe, West Axholme and Hatfield Chase IDB drainage systems and also conveys them to Keadby pumping station. The Warping Drain collects flows pumped to it from the South Axholme IDB (and the Finningley IDB, outside the compartment) and conveys them to the Snow Sewer Drainhead pumping station, which discharges to the River Trent.

The main river watercourses provide a nominal 1:10 years (10% annual probability) standard of protection to the surrounding area, although the River Torne's standard rises to 1:30 years (3% annual probability) if freeboard is taken into account and flows in the Warping Drain are very low indicating that in practice the flood risk is relatively low. The IDBs' systems are understood to be capable of accommodating the 2.0% annual probability event if the additional storage provided by the freeboard allowance included in the design is taken into account.

3F5.3 - Existing defences

The River Trent flood defences consist largely of earth embankments that are sufficiently high to prevent overtopping during events with a 0.5% (tidal) and 1.0% (fluvial) annual probability of occurrence. The defences are generally in good to fair condition (Grades 2 and 3). The River Torne and the Warping Drain are embanked over part of their length and these defences are also in good to fair condition (Grades 2 and 3), providing protection against flooding from events with a 3% annual probability (possibly better in the case of the Warping Drain).

3F5.4 - Assessment of flood risk

All land in the compartment lying within the Zone 3 boundary, as shown in Figure 3.5, is below the highest water levels with a 0.5% annual probability of occurring in the River Trent. This area should therefore be classified as Zone 3 (High risk). All land in the compartment lying outside these areas should be classified as Zone 2 (Medium risk).

Although much of the land lying within Zone 3 is apparently adequately protected against water levels with a 0.5% (tidal) or 1.0% (fluvial) annual probability of occurring in the Trent, nevertheless the very flat and low-lying nature of the land, the complexity of the drainage system, the low standard of protection it affords and the heavy reliance on pumping mean that during an extreme event flooding could be widespread and in locations that are difficult to predict. Under these circumstances only those places where the ground level is more than 0.5 m higher than the average ground level in the surrounding area (taken as +3.0 mOD) should be considered as being safe from flooding. As a result, only land above +3.5 mOD is classified as NE/NLC SFRA Zone 3(i) (high risk, low vulnerability). There are two further issues to be considered, as follows:-

- (a) All land lying within 9m of any flood defences or of any watercourse managed by the Environment Agency or an Internal Drainage Board will be subject to restrictions laid down by the Environment Agency or the appropriate IDB.
- (b) Although the Trent's defences are currently in reasonable condition there is, nevertheless, a risk that they will fail, resulting in a breach. If this happens at high tide, water will flow through the breach at high velocity posing a significant risk to people and property in the immediate vicinity. Given that the peak water level in the river is about +5.8 mOD and the ground level immediately behind the defences is generally about +3.5 mOD, Table 5 indicates that a 100m wide zone should therefore be classified as NE/NLC SFRA Zone 3(ii) (high risk, high vulnerability).

3F5.5 - Development restrictions

The process of deciding planning applications where flood risk is an issue, including the use of the NE/NLC SFRA matrix to determine whether an application is submitted to the Environment Agency, is set out in Chapter 7. It is recommended that in this flood compartment the following additional considerations are taken into account:-

- (a) Development on land within Zone 2 should be subject to confirmation that suitable arrangements for dealing with land drainage have been made with the appropriate IDB and agreed with the Environment Agency.

- (b) Development on land within NE/NLC SFRA Zone 3(i) should be subject to confirmation that suitable arrangements for dealing with land drainage have been made with the appropriate IDB and agreed with the Environment Agency.
- (c) Development on land within NE/NLC SFRA Zone 3(ii) is unlikely to be supported by the Environment Agency.
- (d) Development on land subject to Environment Agency or IDB bye-laws is unlikely to be supported by the Environment Agency.

3F6: River Idle

3F6.1 - Description of site

This compartment is on the left bank of the River Trent and lies between the Warping Drain and the southern NLC border (which runs along the River Idle for part of its length). The River Trent and the Warping Drain form its eastern boundary. The compartment is 9 km from east to west and 4 km from north to south at its widest part. Ground levels in the area indicate that much of the land is below +2.0 mOD.

The compartment is within the Trent floodplain and, like the rest of the area, relies on a complex drainage system, almost entirely pumped, to maintain water levels low enough for arable agriculture to take place. The land is flat, very fertile, devoted largely to agriculture and contains no significant villages. The A161 main road crosses it.

3F6.2 - Sources of flood risk

The main source of flood risk to the compartment is the River Trent. High water levels in the Trent at this point are influenced by tidal conditions and by rainfall and catchment characteristics, in particular floodplain storage further upstream. The existing defences provide protection against tidal flooding with a 0.5% annual probability of occurrence and are intended to protect against a 1.0% annual probability of fluvial flooding.

The other sources of flood risk are the other two main river watercourses (Warping Drain and River Idle) and the local IDB systems (managed by Finningley and South Axholme IDBs). The Warping Drain collects flows pumped to it from the IDBs and conveys them to the Snow Sewer Drainhead pumping station, which discharges to the River Trent. The River Idle is a highland carrier draining the greater part of North Nottinghamshire together with parts of Derbyshire and South Yorkshire. It conveys the flow to the West Stockwith Pumping Station, which discharges to the River Trent.

The IDBs' systems are understood to be capable of accommodating the 2.0% annual probability event if the additional storage provided by the freeboard allowance included in the design is taken into account.

3F6.3 - Existing defences

The River Trent flood defences consist largely of earth embankments that are sufficiently high to prevent overtopping during events with a 0.5% (tidal) and 1.0% (fluvial) annual probability of occurrence. The defences are generally in good to fair condition (Grades 2 and 3). The River Idle is embanked and these defences are also in good to fair condition (Grades 2 and 3). They work in conjunction with flood storage areas further upstream (outside the compartment) to provide protection against flooding from events with a 2% annual probability. The Warping Drain is also embanked and its defences are again in good to fair condition (Grades 2 and 3).

3F6.4 - Assessment of flood risk

All the land in the compartment lies within the Zone 3 boundary, as shown in Figure 3.5, and is therefore below the highest water levels with a 0.5% annual probability of occurring in the River Trent. The whole area should therefore be classified as Zone 3 (High risk).

Although much of the land lying within Zone 3 is apparently adequately protected against water levels with a 0.5% (tidal) or 1.0% (fluvial) annual probability of occurring in the Trent, nevertheless the

very flat and low-lying nature of the land, the complexity of the drainage system, the low standard of protection it affords and the heavy reliance on pumping mean that during an extreme event flooding could be widespread and in locations that are difficult to predict. Under these circumstances only those places where the ground level is more than 0.5 m higher than the average ground level in the surrounding area (taken as +3.0 mOD) should be considered as being safe from flooding. As a result, only land above +3.5 mOD is classified as NE/NLC SFRA Zone 3(i) (high risk, low vulnerability). There are two further issues to be considered, as follows:-

- (a) All land lying within 9m of any flood defences or of any watercourse managed by the Environment Agency or an Internal Drainage Board will be subject to restrictions laid down by the Environment Agency or the IDB.
- (b) Although the Trent's defences are currently in reasonable condition there is, nevertheless, a risk that they will fail, resulting in a breach. If this happens at high tide, water will flow through the breach at high velocity posing a significant risk to people and property in the immediate vicinity. Given that the peak water level in the river is about +5.8 mOD and the ground level immediately behind the defences is generally about +3.5 mOD, Table 5 indicates that a 100m wide zone could be affected.

3F6.5 - Development restrictions

The process of deciding planning applications where flood risk is an issue, including the use of the NE/NLC SFRA matrix to determine whether an application is submitted to the Environment Agency, is set out in Chapter 7. It is recommended that in this flood compartment the following additional considerations are taken into account:-

- (a) Development on land within NE/NLC SFRA Zone 3(i) should be subject to confirmation that suitable arrangements for dealing with land drainage have been made with the appropriate IDB and agreed with the Environment Agency.
- (b) Development on land within NE/NLC SFRA Zone 3(ii) is unlikely to be supported by the Environment Agency.
- (c) Development on land subject to Environment Agency or IDB bye-laws is unlikely to be supported by the Environment Agency.