

Executive Summary

Introduction

Norfolk Local Planning Authorities (LPAs) have a long track record of cooperation and are working together on strategic cross-boundary planning issues, through the emerging Norfolk Strategic Framework. One of the aims of the emerging framework is to inform the preparation of future Local Plans, through shared objectives and strategic priorities.

Strategic Flood Risk Assessments (SFRAs) form part of the evidence base of the Local Plan and can be used to inform the Sustainability Appraisal. The requirement for the preparation of SFRAs is detailed in paragraph 100 of the **National Planning Policy Framework (NPPF)**.

A consortium of Norfolk LPAs, comprising Broadland District Council, Great Yarmouth Borough Council, the Borough Council of King's Lynn and West Norfolk, North Norfolk District Council, Norwich City Council, South Norfolk Council and the Broads Authority, have commissioned new Level 1 SFRAs to inform strategic planning decisions, the preparation of Local Plans and to inform development management decisions. These councils are local planning authorities for their respective administrative areas, with the exception of the Broads Executive Area, where the Broads Authority is the Local Planning Authority.

The 2017 Level 1 SFRAs comprise the following four reports:

- 2017 Greater Norwich Area SFRA, covering the Norwich City Council, Broadland District Council, South Norfolk Council and parts of the Broads Authority administrative areas
- 2017 North Norfolk SFRA covering the North Norfolk District Council and parts of the Broads Authority administrative areas
- 2017 Great Yarmouth SFRA covering the Great Yarmouth Borough Council and parts of the Broads Authority administrative areas
- 2017 King's Lynn and West Norfolk SFRA covering the Borough Council of King's Lynn and West Norfolk

Within this 2017 SFRA report, when reference is made to the 'combined study area', this is the whole area covered by the four reports listed above.

This 2017 SFRA document is one of a series of SFRAs that will replace the previous joint North Norfolk District Council, Broadland District Council, the Broads Authority, Norwich City Council and South Norfolk Council SFRA, originally published in 2008. The main purpose of the SFRA is to inform the selection of options for the Local Plan allocations and support determination of planning applications for North Norfolk District Council. The Broads Authority also covers parts of North Norfolk.

SFRA objectives

The key objectives of the 2017 Strategic Flood Risk Assessment are:

- To provide up to date information and guidance on flood risk for North Norfolk district, taking into account the latest flood risk information and the current state of national planning policy;
- To determine the variations in risk from all sources of flooding in North Norfolk district, taking into account climate change;
- To identify the requirements for site-specific flood risk assessments;
- To consider opportunities to reduce flood risk to existing communities and developments;
- To enable local authorities in North Norfolk district to apply the Sequential Test;
- To aid authorities in identifying when the Exception Test is required and when a more detailed Level 2 SFRA will be required, when determining strategic site allocations; and,
- To inform the Sustainability Appraisal of the authorities' Local Plans, so that flood risk is taken into account when considering strategic site allocations.

SFRA outputs

This report fulfils Level One SFRA requirements.

To meet the objectives, the following outputs have been prepared:

- Assessment of all potential sources of flooding (see Section 5 and 6)
- Assessment of the potential impact of climate change on flood risk (see Sections 4 and 5)
- Mapping of all potential sources of flooding including climate change (see Appendix A)
- Mapping of location and extent of functional floodplain (see Appendix A)
- Mapping of “dry islands” (see Appendix A)
- A high-level overview of existing flood risk management infrastructure (see Section 7)
- Mapping of areas covered by Environment Agency Flood Warnings (see Section 6.11.3 and Appendix C)
- Review of opportunities to reduce flood risk to existing communities and development (see Section 10)
- Guidance for developers including requirements for site-specific flood risk assessments and general advice on the requirements and issues associated with Sustainable Drainage Systems (SuDS) (see Sections 8 and 9)
- Recommendations of the criteria that should be used to assess future development proposals and the development of a Sequential Test and sequential approach to flood risk (see Section 3).

Summary of the SFRA

Appraisal of flood risk

- There have been a number of recorded flood incidents across North Norfolk district, from a combination of sources. Prominent sources of flooding are from tidal surges. The most significant flooding in recent years was caused by a tidal surge on the 5th/ 6th December 2013 with damage caused to both sea defences and property. Under Section 19 of the Flood and Water Management Act, Norfolk County Council in their role as LLFA, have published two Section 19 reports covering settlements in North Norfolk district. Communities in Tunstead and Happisburgh have experienced surface water flooding due to heavily rainfall events and low capacity systems to be exceeded. Section 19 reports are available to download from Norfolk County Council's [website](#). Historic flood risk is discussed further in Section 6.1.
- Tidal flooding is the most significant flood risk in the district as North Norfolk is bounded to the north and east by the North Sea and many of its watercourses are tidally influenced. The Broads river network is dominated by a tidal influence which typically causes flooding to be gradual and relatively predictable. Rivers not being able to flow freely at high tide (called tide-locking) is also an issue within North Norfolk. Tide-locking affects the lower reaches of the River Glaven and River Stiffkey as well as the settlements of Hoveton and Horning along the River Bure. Tidal flood risk is discussed further in Section 6.5.
- Coastal erosion is a predominant process along much of the North Norfolk coastline. Coastal erosion threatens some settlements and poses an additional threat to coastal defences. If these defences are compromised, there could be an additional risk of inundation to properties behind them. Coastal flood risk is discussed further in Section 6.6.
- Fluvial flood risk within North Norfolk district is primarily associated with the Rivers Wensum, Bure, Stiffkey, Glaven, Ant and Thurne and their tributaries. However, flooding across the district is predominantly from a combination of fluvial and tidal flooding, particularly in the Broads river system. Fluvial flooding can be exacerbated in the upper reaches of the Broadlands catchment, due to mill structures restricting the flow (i.e. in Fakenham). Another contributing factor could be the failure or the overwhelming of pumping stations that may result in localised flooding (i.e. at Fakenham and North Walsham). Fluvial flood risk is identified in several settlements including Wells-next-the-Sea, Eccles on sea, Lessingham, Ingham Corner, Sea Palling, Hickling, Hickling Green and Hickling Heath, Potter Heigham, Horning, Hoveton, Fakenham and Mundesley. Fluvial flood risk is discussed further in Section 6.4.
- Watercourses in Internal Drainage Board (IDB) districts are managed for water level and flood risk management. North Norfolk district is partially covered by the Water Management Alliance. The Water Management Alliance covers five IDBs; those in the North Norfolk district include the Broads IDB and the Norfolk Rivers IDB. The IDB coverage is mapped

in Appendix B. The IDB policy statements on flood protection and water level management have been used to determine the general standard of flood protection provided to each IDB District. The Broads IDB **policy statement** and the Norfolk Rivers IDB **policy statement** states that the Boards will seek to maintain a general standard of protection against flooding of 1 in 10-years with 600mm of freeboard to agricultural land and 1 in 100-year with 300mm freeboard to developed areas. The policy statement acknowledges that the standards cannot be taken literally and that some over-spilling from the systems may occur during these events.

- The Risk of Flooding from Surface Water (RoFfSW) dataset shows that surface water predominantly follows topographical flow paths of existing watercourses or dry valleys with some isolated ponding located in low-lying areas. Surface water flood risk is identified in a number of settlements including Wells-next-the-Sea, Eccles on Sea, Lessingham, Ingham Corner, Sea Palling, Hickling, Hickling Green and Hickling Heath, Potter Heigham, Horning, Hoveton, Fakenham, Mundesley, North Walsham, Cromer, Sheringham, Walcott, Bacton, Witton and Ridlington. A **Surface Water Management Plan** is being produced for North Norfolk district; Stage 1 was completed in May 2013. Stage 2 is currently being undertaken for the settlements of Cromer, Sheringham and North Walsham areas. Surface water flood risk is discussed further in Section 6.7.
- Groundwater plays a role in coastal erosion, as water within the rock strata can create instabilities within coastal cliffs. The AStGWf (Areas Susceptible to Groundwater flooding) dataset shows that areas more susceptible to groundwater flooding are generally associated with the valleys of watercourses and along coastline areas. number of settlements have been identified to be susceptible to groundwater flooding. Areas of Witton and Ridlington and Wells-next-the-Sea have a $\geq 25\%$ and $< 75\%$ susceptibility to groundwater flooding. Although limited data is available in relation to groundwater flooding is it believed the pumping infrastructure operated by IDBs maintains a low water table reducing the probability of groundwater flooding. Within the Broadlands area it is believed pumping from the Internal Drainage Board (IDB) maintain the water table at a relatively lower level reducing the risk of groundwater flooding. Groundwater flooding is discussed further in Section 6.8 and the AStGWf dataset is shown in Appendix A.
- Historical incidents of flooding are detailed by Anglian Water in their DG5 register. This database records incidents of flooding relating to public foul, combined or surface water sewers and identifies which properties suffered flooding. A total 109 recorded flood incidents have been identified in the North Norfolk district. Flood risk from sewers is discussed further in Section 6.10.1.
- There is one canal in North Norfolk district; the North Walsham and Dilham Canal which runs from Antingham Ponds to the River Ant. The canal is in private ownership and is currently being restored by the **North Walsham and Dilham Canal Trust**. The interaction of this canal with surrounding watercourses is unknown. Canals rarely pose a direct flood risk as they are a regulated waterbody. The residual risk from canals tends to be associated with lower probability events such as overtopping and embankment failure (breach and sudden escape of the water retained in the canal channel). Canal flood risk is discussed further in Section 6.9.
- There are no records of flooding from reservoirs impacting properties inside the study area. Flooding from reservoirs is discussed further in Section 6.10.2.
- Currently there are 11 Flood Alert Areas and 20 Flood Warning Areas (FWAs) covering the study area. Flood warning and emergency planning is discussed in Section 6.11 and mapping showing the coverage of the Flood Alert Areas and FWAs is provided in Appendix A.
- A high-level review was undertaken to identify the main settlements where flood risks / extents are more prominent; this is shown in Table 6-4. If a settlement is not listed in this table this does not mean that the settlement is not at flood risk. The mapping provided in Appendix A can be used as a high-level screening exercise, to identify whether a location or site has a potential risk of flooding.
- The mapping of all potential sources of flooding including climate change is provided in Appendix A.

Climate change

The NPPF and accompanying Planning Practice Guidance set out how the planning system should help minimise vulnerability and provide resilience to the impacts of climate change. The Environment Agency published **updated climate change guidance** on 19 February 2016 (further updated on 3 February 2017), which supports the NPPF and must now be considered in all new developments and planning applications. The Environment Agency has also published guidance to LPAs in the application of appropriate climate change allowances when considering climate change effects (updated April 2016 **Adapting to Climate Change: Advice for Flood and Coastal Erosion Risk Management Authorities**).

When defining the scope of this commission, the climate change allowances were agreed by the Environment Agency and LLFA and are intended to assist with future planning across the combined study area. The climate change allowances used in the Strategic Flood Risk Assessment are detailed in Sections 4 and 5. Climate change modelling for watercourses and coastal areas across the combined study area was undertaken where detailed models exist, were available and supplied at the time of preparing this SFRA. Where existing detailed models were not re-run and mapped for climate change, this is documented in Appendix D. It should be noted that in North Norfolk district, the updated 2017 Wells-next-the-Sea coastal modelling was not available at the time of preparing this SFRA. Further details and guidance for developers is contained in Section 4 and 8. The mapping of all potential sources of flooding including climate change is provided in Appendix A.

Flood defences

There are a number of assets throughout North Norfolk. The assets comprise a combination of embankments, quays, bridge abutments, demountable defences, flood gates and walls. The condition of these assets varies. The flood risk analysis in Section 6 indicates that many coastline areas are heavily dependent on flood defences to protect settlements from flooding, notably at Eccles-on-Sea.

North Norfolk lies within the Broadland Flood Alleviation Project (BFAP). A critical aspect of the project is to protect and enhance the sensitive wetland areas that are rich in biodiversity, while providing an improved service level in flood defence protection through strengthening and restoring embankments, while making allowances for climate change and settlements of banks.

There are a number of local authority owned and maintained assets, primarily along the coastline. These assets have a role in coastal erosion and flood risk management.

Further information on flood defences and schemes in the district is provided in Section 7.

Development and flood risk

The Sequential and Exception Test procedures for both Local Plans and Flood Risk Assessments (FRAs) are documented in Section 3, along with guidance for planners and developers throughout the report. Links are provided to various relevant guidance documents and policies published by other Risk Management Authorities, such as the LLFA and the Environment Agency.

Dry Islands

In this SFRA, dry islands are defined as an area of 0.5 hectares or greater in size, identified as being in Flood Zone 1 and completely surrounded by land which falls within Flood Zone 2 (i.e. the extreme 1 in 1,000-year extent). The 0.5 hectares threshold was selected as this reflects one of the criteria used to define "major development" (see Section 2.5). Flood Zone 2 was selected as under the NPPG, developers are sometimes required to consider the safety of the site during the extreme flood event including the potential for an evacuation before the extreme flood event.

Dry islands can present specific hazards, primarily the provision of safe access and egress during a flood event.

The results show that there are 38 dry islands in North Norfolk district. The identified dry islands are scattered across the district and affect predominantly rural communities.

Dry islands are discussed in Section 6.11.4; this section expands further on the assumptions used to map dry islands and further considerations. Dry islands are mapped in Appendix A.

Relevant studies

There are many relevant regional and local key studies which complement the SFRA and have been considered, such as the Catchment Flood Management Plan, River Basin Management Plan, the Preliminary Flood Risk Assessment, Local Flood Risk Management Strategies and Shoreline Management Plans. Other policy considerations have also been incorporated, such as sustainable development principles, climate change and flood risk management. Relevant policy is discussed in Section 2 and policy considerations have been referenced throughout the report.

Policy Recommendations

The following policy recommendations are to be considered by local planning authorities in the North Norfolk district in the development of the Local Plans.

Development and planning considerations

Sequential approach to development

It is recommended that the sequential approach is adopted for all future developments within the North Norfolk district.

New development and re-development of land should wherever possible seek opportunities to reduce overall level of flood risk at the site.

Sequential and Exception tests

The SFRA has identified that areas of North Norfolk are at high risk of flooding from tidal, fluvial and surface water sources. Therefore, proposed development sites will be required to pass the Sequential and, where necessary, Exception Tests in accordance with the NPPF. North Norfolk District Council and the Broads Authority will use the information in this 2017 SFRA when deciding which development sites to take forward in their Local Plan.

The Broads Authority administrative area extends beyond North Norfolk district. As such, the Broads Authority should also use the information contained in the 2017 Great Yarmouth SFRA, the 2017 Greater Norwich Area SFRA and any SFRA's produced for Waveney District Council, when deciding which development sites to take forward in their Local Plan.

Site-specific Flood Risk Assessments

Developers should, where required, undertake more detailed hydrological and hydraulic assessments of the watercourses to verify flood extent (including latest climate change allowances), to inform development zoning within the site and prove, if required, whether the Sequential and Exception Tests are satisfied (for windfall sites not included in the plan evidence on the Sequential Test must be submitted in FRAs).

The Flood Zones, whilst generally accurate on a large scale, are not provided for land where the catchment of the watercourse falls below 3km². There are a number of small watercourse and field drains which may pose a risk to development (e.g. some ordinary watercourses and / or drains managed by Internal Drainage Boards). Therefore, whilst these smaller watercourses may not be shown as having flood risk on the flood risk mapping, it does not necessarily mean that there is no flood risk. As part of a site-specific FRA the potential flood risk and extent of flood zones should be determined for these smaller watercourses.

Where a site-specific FRA has produced modelling outlines which differ from the EAs Flood Map for Planning (Rivers and Sea) then a Flood Map Challenge may need to be undertaken. Where the modelling and results are deemed acceptable to the EA, amendments to the Flood Map for Planning (Rivers and Sea) may take place.

Where the watercourses are embanked, the effect of overtopping and breach must be considered and appropriately assessed.

All new development within the 1% Annual Exceedance Probability (AEP) flood extent including an allowance for climate change (for the lifetime of the development) must not normally result in a net loss of flood storage capacity. Annual Exceedance Probability is the probability (expressed as a percentage) of a flood event occurring in any given year. Where possible, opportunities should be sought to achieve an increase in the provision of floodplain storage. Where proposed development results in a change in building footprint, the developer should ensure that it does not impact upon the ability of the floodplain to store or convey water, and seek opportunities to provide floodplain betterment. Similarly, where ground levels are elevated to raise the development out of the

floodplain, compensatory floodplain storage within areas that currently lie outside the floodplain should normally be provided to ensure that the total volume of the floodplain storage is not reduced.

There are a number of guidance documents which provide information on the requirements for site-specific FRAs:

- **Standing Advice on Flood Risk (Environment Agency);**
- **Flood Risk Assessment for Planning Applications (Environment Agency);** and,
- **Site-specific Flood Risk Assessment: CHECKLIST (NPPG, Defra).**

The Environment Agency has produced a Flood Zone 3 Fact Sheet which provides information on the requirements for site-specific Flood Risk Assessments for sites in Flood Zone 3 in the East Anglia area. The Environment Agency has also produced a guidance document called “Flood risk assessment: Climate Change allowances” which details the application of climate change allowances and local considerations in East Anglia. These documents are available from: <https://www.norfolk.gov.uk/rubbish-recycling-and-planning/flood-and-water-management/information-for-developers>

Developers should consult with the relevant LPA (i.e. North Norfolk District Council or the Broads Authority), Norfolk County Council, the Environment Agency, Anglian Water and, where necessary, relevant IDBs at an early stage to discuss flood risk including requirements for site-specific FRAs, detailed hydraulic modelling, and drainage assessment and design.

Further guidance for developers can be found in Section 8.

Surface water management and SuDS

- Planners should be aware of the conditions and local requirements set by Norfolk County Council, the LLFA, for surface water management for major and minor developments and ensure development proposals and applications are compliant with the LLFA’s policy.
- Developers should consult Norfolk County Council’s guidance for developers: Norfolk County Council, **Lead Local Flood Authority, Statutory Consultee for Planning, Guidance Document (2017)**. The guidance provides information on how SuDS proposals for new developments will be considered by the LLFA, when to consult the LLFA, how to screen applications based on local flood risk and records, LLFA standing advice (for Ordinary Watercourse consenting, major development below LLFA thresholds and minor development), the levels of information required for planning applications and technical guidance. The technical guidance is split into the following themes:
 - Local flood risk guidance
 - Drainage hierarchy
 - Infiltration testing guidance
 - Runoff rates
 - Runoff volumes
 - Climate change
 - Management and maintenance
 - Flood exceedance management
- All new development should aim to minimise areas of impermeable ground to reduce surface water runoff. Sustainable drainage systems (SuDS) should be used on all new development.
- Planners should be aware of local conditions and requirements set by the Water Management Alliance. The Water Management Alliance have published application **guidance notes** and a **SuDS adoption policy**.
- Developers who wish to have their SuDS schemes considered for adoption by Anglian Water should refer to the **Anglian Water SuDS Adoption Manual¹**. Anglian Water also expect national guidance (i.e. **the CIRIA C753 SuDS Manual**) to be referred to in addition to Anglian Water’s guidance.

¹ At the time of preparing this SFRA, Anglian Water’s current manual is expected to be revised to take account of national guidance published after the manual and Anglian Water’s position regarding health and safety matters associated with open SuDS features.

- It should be demonstrated through a Surface Water Drainage Strategy, that the proposed drainage scheme, and site layout and design, will provide an appropriate standard of protection from surface water flooding to properties and critical infrastructure from flooding from surface water both on and off site. A detailed site-specific assessment of SuDS would be needed to incorporate SuDS successfully into the development proposals. All development should adopt source control SuDS techniques to reduce the risk of frequent low impact flooding due to post-development runoff. The 2015 **DEFRA non-statutory technical standards for sustainable drainage systems** should be followed, alongside the LLFA guidance note and national guidance.
- For proposed developments, geotechnical investigations should be undertaken to determine whether the ground at the site has infiltration potential. This information should be representative of on-site conditions. If the ground at the site is found to have infiltration potential, detailed infiltration testing should be undertaken in line with BRE 365 to establish representative infiltration rates. The LLFA have published information relating to infiltration tests within their **guidance document**.
- Where sites lie within or close to Groundwater Source Protection Zones (see Section 9.4) or aquifers (see Section 6.2), treatment steps may be required ahead of discharge to the ground, sewers etc. Development proposals at sites across the area should assess the pollution risk to receiving waterbodies and include appropriate treatment steps ahead of any discharge to surface or groundwaters. The CIRIA C753 SuDS manual provides further guidance on this issue.
- Groundwater can be a key driver in cliff failure and coastal erosion/change. More sensitive locations are found close to the cliff edge and within coastal erosion constraint areas (defined in the existing Core Strategy); for example, at Overstrand and Trimmingham. In such areas, developers should consider whether SuDS techniques that direct post-surface water runoff away from the coastal systems could be adopted. As far as reasonably practicable, SuDS should aim to mimic natural infiltration, to help reduce any detrimental impact. This is a precautionary approach and one which may be required for major developments located on the fringes of the coastal erosion constraint areas.
- A management and maintenance plan of sustainable drainage and surface water systems covering the lifetime of the development will be required. Consideration must also be given to the residual risks associated with the use of SuDS.

Further information on surface water and SuDS is provided in Section 9.

Council review of planning applications

The Council should consult the Environment Agency's '**Flood Risk Standing Advice (FRSA) for Local Planning Authorities**', last updated 15 April 2015, when reviewing planning applications for proposed developments at risk of flooding, as well as **the Broads Supplementary Planning Document** on flood risk (where appropriate). The Council will consult the relevant statutory consultees as part of the planning application assessment and they should also contact non-statutory consultees (e.g. IDBs or Anglian Water) that have an interest in the planning application.

Infrastructure and safe access

Finished floor levels and safe access and egress

Finished floor level guidance has been established through consultation with the Environment Agency. Minimum finished floor levels for development should be set to whichever is the higher of the following:

- a minimum of 300mm* above the 1% AEP fluvial event plus an allowance for climate change
- a minimum of 300mm* above the 0.5% AEP tidal event plus an allowance for climate change
- a minimum of 300mm above surrounding ground levels

*A 300mm freeboard is only applicable where detailed modelling is available which is deemed to be reliable. If no detailed and reliable modelling is available, the Environment Agency may require a 600mm freeboard to be applied when setting minimum finished floor levels.

With regards to LLFA guidance and surface water flood risk, finished floor levels are recommended to be set to a minimum of 300mm above the 1% AEP plus an allowance for climate change flood levels (including anticipated flood levels within the drainage system). If there is an uncertainty in flood levels, the freeboard level should be increased from 300mm to 600mm. The LLFA would also expect a minimum of at least 150mm freeboard between proposed external ground levels and the property finished floor level. Further information can be found in the **LLFA guidance document**.

If it is not practical to raise floor levels to those specified above, consultation with the Environment Agency and / or LLFA will be required to determine the suitability of alternative flood mitigation approaches.

Safe access and egress will need to be demonstrated at all development sites. Ideally, access should be situated 300mm above the design flood level and waterproof construction techniques used. If safe access and egress cannot be achieved, the **Defra/EA Technical Report: FD2320: Flood Risk Assessment Guidance for New Development** should be referred to, to determine the hazard to people posed along the access route. This can also be used to inform a Flood Warning and Evacuation Plan for the site.

Emergency vehicular access should be possible during times of flood.

Where development is located behind, or in, an area benefitting from defences, consideration should be given to the potential safety of the development, finished floor levels and the potential for safe access and egress in the event of rapid inundation of water due to a defence breach with little warning.

Resistance and resilience measures will be required if buildings are situated in the flood risk area, and as applicable in all cases of flood risk, opportunities to enhance green infrastructure and reduce flood risk by making space for water should be sought. Further information is provided in Section 8.5 and 8.6 in the publications **“Improving the flood performance of new buildings”** and **“Prepare your property for flooding.”**

Dry islands

It is recommended that emergency planners at the local authorities review the outputs of the 2017 SFRA and the areas identified as being located in a dry island. A site-specific Flood Risk Assessment and / or Flood Warning and Evacuation Plan may be required if a proposed development is located within a dry island (even for sites less than 1 hectare and in Flood Zone 1).

Residual risk

Residual risk is the risk that remains after mitigation measures are considered. The residual risk includes the consideration of flood events that exceed the design thresholds of the flood defences or circumstances where there is a failure of the defences, e.g. flood banks collapse, reservoir failure etc. The flood risk analysis in Section 6, indicates that many coastline areas are heavily dependent on flood defences to protect settlements from flooding, notably at Eccles-on-Sea. The Environment Agency's 2017 coastal breach modelling of the Norfolk coastline indicates breaches along defences at Eccles-on-Sea and north-east of Horsey Corner pose a significant risk to Eccles-on-Sea and rural settlements. This is discussed further in Section 7.5.

The North Walsham and Dilham Canal is currently being restored by the **North Walsham and Dilham Canal Trust**. The residual risk from canals tends to be associated with lower probability events such as overtopping and embankment failure (breach and sudden escape of the water retained in the canal channel). Canal flood risks are discussed further in Section 6.9. Residual risks should be considered as part of site-specific Flood Risk Assessments.

Where the watercourses are embanked, the effect of overtopping and breach must be considered and appropriately assessed. Further, any developments located within an area protected by flood risk management measures, where the standard of protection is not of the required standard, or where the failure of the intended level of service gives rise to unsafe conditions, should be identified.

Future flood management in North Norfolk

Green Infrastructure and the Water Framework Directive

Developments should demonstrate opportunities to create, enhance and link green assets. Development that may adversely affect green infrastructure assets should not be permitted.

Strategic flood risk solutions

The information provided in the SFRA should be used as a basis for investigating potential strategic flood risk solutions within North Norfolk (see Section 10 for further information). Opportunities could consist of the following:

- Catchment and floodplain restoration;
- Flood storage areas;
- Opening up culverts, weir removal, and river restoration; and
- Green infrastructure.

Cross-boundary partnership working

For successful future flood risk management, it is recommended that local planning authorities adopt a catchment partnership working approach in tackling flood risk and environmental management.

Potential modelling improvements

At the time of preparing the 2017 SFRA, there were several on-going flood modelling studies being undertaken by or on behalf of the Environment Agency. In a number of cases, the flood modelling studies involve updating existing hydrology and hydraulic models and re-running the models for a suite of return periods. For example, the outputs of the updated BESL hydraulic model were not available at the time of preparing this 2017 SFRA and as such, the functional floodplain and climate change extents associated with this model could not be mapped. The 2008 BESL hydraulic model extent is displayed in Appendix A mapping of all sources of flood risk to provide an indication of the model coverage and it is noted that Flood Zone extents in this area may be subject to change when the model is update.

As part of a separate commission to the SFRA, the Environment Agency were preparing updated modelling of the Anglian coastline. Where the outputs were available at the time of preparing the 2017 SFRA, these were supplied and used in the assessment. The outputs of two models were not available at the time of preparing the 2017 SFRA; the Wash model and the Wells-next-Sea model. The Wash model does not affect the North Norfolk area. However, the Wells-next-the Sea model concerns an area in North Norfolk district; as this model was unavailable, the functional floodplain was not mapped along coastline areas covered by this model. This also reinforces the importance that the Environment Agency are approached to determine whether updated (more accurate) information is available prior to commencing a site-specific FRA.

Further information on the hydraulic modelling and mapping approaches used in the 2017 SFRA are provided in Appendix D.

It is important that the Environment Agency are approached to determine whether updated (more accurate) information is available prior to commencing a site-specific FRA

Use of Strategic Flood Risk Assessment data

SFRAs are high-level strategic documents and, as such, do not go into detail on an individual site-specific basis. The 2017 SFRA has been developed using the best available information, supplied at the time of preparation, taking into account the latest flood risk information and the current state of national planning policy. This relates both to the current risk of flooding from fluvial, tidal, pluvial, groundwater, sewers and reservoirs as well as the potential impacts of future climate change. It is this data that guidance singles out as the most appropriate for forward planning.

The accompanying SFRA appendices comprise:

- Appendix A: Mapping of all sources of flood risk across the North Norfolk district (historic flooding is not included)
- Appendix B: Watercourses in the North Norfolk district and coverage of IDB districts
- Appendix C: Flood Alert and Flood Warning coverage across the North Norfolk district
- Appendix D: Technical Summary including a list of all detailed models used in the 2017 SFRA and a map showing the coverage of these models

The SFRA appendices are published separately to the main SFRA report.

Appendix A is presented in interactive GeoPDFs. An accompanying User Guide is provided with the GeoPDFs which provides step-by step instructions on how to navigate to data and how to use the GeoPDFs. The GeoPDFs can be used to perform high-level screening exercises, to identify whether a location or site has a potential risk of flooding. The GeoPDFs primarily display flood extents and are subject to the limitations of the flood risk datasets that are used. If detailed flood risk information is required (e.g. flood level, depth, velocity and hazard to people information), this should be addressed as part of a Level 2 SFRA and / or as part of a site-specific Flood Risk Assessment.

It is important that the 2017 SFRA and appendices are read in conjunction with the Technical Summary provided in Appendix D. The Technical Summary provides further information on the hydraulic modelling and mapping approaches used in the 2017 SFRA.

The SFRA is a tool for refining information on river and sea flooding risk shown on the Environment Agency flood maps. The Environment Agency's Flood Zones, on their Flood Map for Planning website, may differ to the maps in the SFRA for a short period of time. The modelled fluvial and tidal flood risk datasets shown in the 2017 SFRA and Appendix A, will be incorporated into the Environment Agency's flood maps in due course.

At the time of writing, this report was developed using the best available information. However, the 2017 SFRA should be a '**living document**' and as a result should be updated when new information on flood risk, flood warning or new planning guidance or legislation becomes available. The Environment Agency regularly reviews their hydrology, hydraulic modelling and flood risk mapping, and it is important that they are approached to determine whether updated (more accurate) information is available prior to commencing a site-specific FRA.

The 2017 SFRA was commissioned by a consortium of Norfolk authorities and was produced in conjunction with the LLFA and Environment Agency. The assistance of these organisations and external stakeholders including IDBs, Anglian Water and planners at the neighbouring authorities and LLFAs, is acknowledged.