Appendix I

Swale Borough Council Level 1 Strategic Flood Risk Assessment

Final Report

November 2019

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Swale Borough Council

JBA Project Manager

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Revision history

Revision Ref/Date	Amendments	Issued to
Version 1 / June 2019	Early Draft Report	Anna Stonor (Swale Borough Council)
Version 2 / July 2019	Draft Report	Anna Stonor (Swale Borough Council)
Version 3 / November 2019	Updated following Swale Borough Council, Kent County Council, Environment Agency and Southern Water review	Anna Stonor (Swale Borough Council)

This report describes work commissioned by Anna Stonor of Swale Borough Council, by an email dated 6 March 2019. Ffion Wilson, James Axton, and Alastair Dale of JBA Consulting carried out this work.

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Director

Purpose

This document has been prepared as a Final Report for Swale Borough Council. JBA Consulting accepts no responsibility or liability for any use that is made of this document other than by the Client for the purposes for which it was originally commissioned and prepared. JBA Consulting has no liability regarding the use of this report except to Swale Borough Council.

Acknowledgements

We would like to acknowledge the assistance of:

- Swale Borough Council
- Kent County Council
- The Environment Agency
- Southern Water
- Lower Medway Internal Drainage Board

Carbon footprint

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Executive summary

Introduction

The study area for this Strategic Flood Risk Assessment (SFRA) is the Swale Borough Council's authoritative area. This 2019 SFRA document supersedes the previous Swale Borough Council 2009 Level 1 and 2 SFRA and the Faversham Creek SFRA 2010 Amendment.

The report has been prepared to provide comprehensive and supporting evidence for the emerging Local Plan 2022 - 2038. The **Swale Borough Local Plan - Bearing Fruits 2031** was adopted in July 2017, and the emerging Local Plan will revisit the adopted Local Plan so that sufficient development is planned to meet the needs of the area.

The SFRA update was required to be compliant with the latest guidance described in the 2018 revised National Planning Policy Framework (NPPF) (updated June 2019) and accompanying Planning Practice guidance (PPG). The 2019 SFRA provides flood risk evidence and long-term strategy to support the management and planning of development, protect the environment, deliver infrastructure and promote sustainable communities within the Local Plan area. It also supports the selection of site allocations in the emerging Local Plan and provides information and guidance to be used in the preparation of Flood Risk Assessments in support of site-specific planning applications.

SFRA objectives

The key objectives of the 2019 SFRA are:

- To take account of best practice, the latest guidance and the most up to date information;
- To assess the flood risk to and from the borough from all sources, now and in the future, as well as assess the impact that cumulative land use changes and development in the area will have on flood risk;
- To be a robust piece of evidence to inform the preparation of the Swale Local Plan and sustainability appraisal, so that flood risk is fully accounted for when considering allocation options and guide development to the safest areas;
- To inform the preparation of emerging local plan policies;
- To inform the application of the Sequential Test and, if necessary, the Exception Test;
- To identify the requirements for site-specific flood risk assessments;
- To assist in the determination of the acceptability of flood risk in relation to Swale's emergency planning capability;
- To help prioritise and target improvements to flood defences; and
- To consider opportunities to reduce flood risk to existing communities and developments and recommend how the Local Plan can best influence this issue.

SFRA outputs

The Planning Practice Guidance advocates a tiered approach to risk assessment and identifies the following two levels of SFRA, of which Level 1 should be completed first:

1. Level 1: where flooding is not a major issue and where development pressures are low. The assessment should be sufficiently detailed to allow application of the Sequential Test.
2. Level 2: where land outside Flood Zones 2 and 3 cannot appropriately accommodate all the necessary development creating the need to apply the National Planning Policy Framework's Exception Test. In these circumstances the assessment should consider the detailed nature of the flood characteristics within a Flood Zone and assessment of other sources of flooding.

This report fulfils the Level One SFRA requirements and substantiates the need for a Level 2 SFRA assessment at locations where flood risk is a material issue.

To meet the objectives of the SFRA, the following outputs have been prepared.

- A review and update of new and amended data sources.
- Assessment of all potential sources of flooding and the potential impact of climate change on flood risk.
- Mapping areas at risk from other sources including surface water, sewer, ground water, reservoir inundation.
- Mapping of location and extent of functional floodplain
- Introduces the concept of Surface Water Functional Flood Zone along with associated mapping of the zone.
- 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.
- High-level screening of proposed development sites against flood risk information.
- Guidance for developers including requirements for site-specific flood risk assessments.
- Mapping areas covered by an existing flood alert / warning.
- Mapping of flood defence infrastructure and highlighting areas that need improvements.
- Identify opportunities to reduce flood risk which can be included in the Local Plan policies.
- An assessment of surface water management issues and the application of Sustainable Drainage Systems (SuDS).

Summary of assessment

Flood risk

- There have been several recorded flood incidents across the study area, with tidal flooding resulting in the most severe consequences. The study area is bounded by the River Medway, the Thames Estuary and the North Sea to the north with flood levels in many of the relevant river networks and inlets being tidally influenced due to proximity to the sea, including the River Medway and The Swale. There are three recorded incidents of tidal floods in the study area (1953, 1978 and 2013), each resulting in widespread flooding.
- Notwithstanding the risk from high sea levels, analysis of flood risk indicates that surface water was noted to be the most frequent cause of flooding, with a smaller number of recorded flood incidents involving fluvial, groundwater, and sewer flooding. These sources of flooding have also occurred in combination, causing a cumulative effect. Further details of these historic events can be found in Section 6.1.
- Coastal flood risk will potentially increase in areas of the Local Plan area where coastal erosion threatens the stability of the coastline and tidal flood defences (this is the flood risk due to the failure or overwhelming of measures to protect against coastal erosion, rather than simple overtopping of defences due to high flood water levels).
- The Environment Agency's Risk of Flooding from Surface Water dataset shows that surface water predominantly follows topographical flow paths of existing

watercourses, dry valleys or roads, with some areas of ponding in low lying areas, often upslope of railway lines or roads. There are a number of dry valleys throughout Swale which have been designated as Surface Water Functional Flood Zones to highlight the significant flow paths in these areas.

- The JBA Groundwater Flood Map shows that a large proportion of Swale Borough is potentially at risk of groundwater flooding, with the most vulnerable settlements including Sittingbourne, Faversham, Teynham and Bapchild.
- There are 126 historic incidents of sewer flooding in the study area that have been identified from Southern Water's records, with sewer flooding exacerbated in places by groundwater infiltrating into the sewer network and outfalls influenced by tidal levels.
- There are no records of flooding from reservoirs in the study area, with the Risk of Flooding from Reservoirs dataset showing the worst-case inundation extents of two reservoirs within Swale Borough.
- There are currently four Flood Alert Areas and five Flood Warning Areas in the Local Plan area.

Flood defences

There are tidal, coastal and tidal / fluvial flood defences located along the majority of the coastline and tidal watercourses in the study area. The standard of protection provided by these assets varies, as does their condition.

Climate change

Climate change will not only cause changes in trends and mean values in temperature and rainfall but also increase the chance of occurrence and severity of more extreme wet and dry events. It is important that development is planned with consideration of these extreme events as exemplified by the significant consequences of storm surge events in the sea leading to high tide levels and potentially severe flooding.

Development and flood risk

Information used to support the Sequential and Exception Tests for both Local Plans and Flood Risk Assessments has been documented, along with guidance for planners and developers. Links have been provided for various guidance documents and policies published by other Risk Management Authorities such as the Lead Local Flood Authority and the Environment Agency.

Relevant studies

There are many relevant regional and local key policies which have been considered within the SFRA, such as the Shoreline Management Plans for the Isle of Grain to South Foreland and the Medway Estuary and Swale, the North Kent Rivers Catchment Flood Management Plan, Thames River Basin Management Plan, the Preliminary Flood Risk Assessment, the Medway Estuary and Swale Strategy and Kent Local Flood Risk Management Strategy. Other policy considerations have also been incorporated, such as sustainable development principles, climate change and flood risk management.

Policy Recommendations

Swale Borough Council will take account of the following recommendations with respect to flood risk management when preparing appropriate policy.

A. Development and planning considerations

Sequential approach to development

It is recommended that the sequential approach is adopted for all future developments within the study area where there is flood risk.

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

Sequential and Exception tests

The SFRA has identified the areas of Swale Borough at high risk of flooding from tidal, surface water (pluvial) and fluvial sources. Proposed development sites at locations at risk of flooding will be required to satisfy the Sequential and, where necessary, Exception Tests in accordance with the NPPF. Swale Borough Council will use the information in this SFRA when deciding which development sites to take forward in the emerging Local Plan.

Site-specific Flood Risk Assessments

Site specific Flood Risk Assessments (FRAs) are required by developers to provide a greater level of detail on flood risk and any protection provided by defences and, where necessary, demonstrate the development satisfies part b of the Exception Test.

Where required, developers should undertake more detailed hydrological and hydraulic assessments of the watercourses and tidal areas to verify flood extents (including latest climate change allowances). The modelling will inform floodplain and development zoning within the site and provide evidence that the Exception Test is satisfied if required. Where a site-specific Flood Risk Assessment (FRA) has produced modelling outlines which differ from the Environment Agency's Flood Map for Planning a full evidence-based review would be required. Where the watercourses are embanked, the effect of overtopping and breach must be considered and appropriately assessed.

All new development within the 1% AEP (Annual Exceedance Probability) 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 to avoid cumulative effects. 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 normally 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 so the total volume of the floodplain storage is not reduced. Any flood risk management measures should be consistent with the wider catchment policies set out in the Catchment Flood Management Plan, Flood Risk Management Plan, Local Flood Risk Management Strategy and other relevant strategies.

This SFRA introduces the concept of Surface Water Functional Flood Zones within dry valleys where there are significant overland flow paths. For development sites located in Surface Water Functional Flood Zones, all types of development could be compatible, providing the FRA can demonstrate that the proposal will be safe from flooding for its lifetime and does not increase flood risk elsewhere. More details of the requirements for development in

Surface Water Functional Flood Zones can be found in Section 9.4.3.

A **revised NPPF** was published on 24 July 2018 (and last updated on 19 June 2019) setting out the Government's planning policies for England and how these are expected to be applied. This revised framework replaces the previous NPPF published in March 2012.

There are also several guidance documents which provide information on the requirements for site-specific Flood Risk Assessments:

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

It should be noted that the UK Climate Change Projections 2018 (**UKCP18**) was published on 26 November 2018. The UKCP18 projections replace the UKCP09 projections and is the official source of information on how the climate of the UK may change over the rest of this century. This may result in the Environment Agency climate change allowances being updated in late 2019. When undertaking an FRA, reference should be made to the most up to date climate change allowances provided by the Environment Agency.

Developers should consult with Swale Borough Council, Kent County Council, Lower Medway Internal Drainage Board, the Environment Agency and Southern Water at an early stage to discuss flood risk including requirements for site-specific FRAs, detailed hydraulic modelling, and drainage assessment and design.

Faversham Creek

Swale Borough Council have made provision for consideration of Flood Zone 3a(i) for the purpose of performing the Sequential and Exception Tests in Faversham Creek only. Flood Zone 3a(i) is located at Faversham Creek and is land having a 1 in 20 or greater annual probability of sea flooding in a defended scenario, where the land is previously developed (note Flood Zone 3a(i) is not demarcated on the SFRA mapping). More information on the requirements for development within Flood Zone 3a(i) can be found in Section 11.1.

B. Surface water management and SuDS

Planners should be aware of the conditions and requirements set by Kent County Council as the Lead Local Flood Authority for surface water management and ensure development proposals and applications are compliant with the 2017 **Kent County Council Drainage and Planning Policy Statement**.

A new guidance document that sets out greenfield run-off rates from proposed development is currently being commissioned and prepared by Kent County Council and reference should be made to the requirements contained in the emerging document for development applications, when the information is available and as defined by any subsequent updates.

Special consideration should be given to development in Iwade and Minster, details of which can be found in Section 11.2 and Section 11.3 respectively.

C. Review of planning applications

The Council should consult the Environment Agency's **'Flood Risk Assessment: Local Planning Authorities'**, (last updated 1 March 2019) and any subsequent updates when reviewing planning applications for proposed developments at risk of flooding.

The Council will consult the relevant statutory consultees as part of the planning application process and they may, in some cases, also contact non-statutory consultees (e.g. Southern Water) that have an interest in the planning application. The Council will, when appropriate consult with Lower Medway Internal Drainage Board (LMIDB) with respect to flood related and water level management aspects. The LMIDB can have more detailed local knowledge on the performance and characteristics of particular water features in the authority area.

D. Infrastructure and safe access

Minimum finished floor levels for development that does not include sleeping accommodation on the ground floor should normally be set to whichever is 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
- 300mm above the general ground level of the site.

Finished Floor Levels for sleeping accommodation should normally be set to whichever is higher of the following:

- a minimum of 600mm above the 1% AEP fluvial event plus an allowance for climate change
- a minimum of 600mm above the 0.5% AEP tidal event plus an allowance for climate change
- 300mm above the general ground level of the site.

If it is not practical to raise floor levels to those specified above, consultation with the Environment Agency will be required to determine alternative approaches.

Safe access and egress will need to be demonstrated at all development sites. 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 for safe access and egress in the event of rapid inundation of water due to a defence breach with little warning.

Resilience measures will be required if buildings are situated in the flood risk area, and opportunities to enhance green infrastructure and reduce flood risk by making space for water should be sought.

E. Residual risk

Residual risk is the risk that remains after the effect of mitigation measures is taken into account. 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. Residual risks should be considered as part of site-specific Flood Risk Assessments.

Further, any developments located within an area protected by flood risk management measures, where the condition of those defences is 'fair' or 'poor', 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 by the developer as part of an FRA.

The risk to development from reservoirs is residual but developers should consider reservoir flooding during the planning stage. They should seek to contact the reservoir owner to obtain information and should apply the sequential approach to locating development within the site. Developers should also consult with relevant authorities regarding emergency plans in case of reservoir breach.

F. Future flood management

Developments should demonstrate opportunities to create, enhance and link green assets. This can provide multiple benefits across several disciplines including flood risk and biodiversity / ecology and may provide opportunities to use the land for an amenity and recreational purposes. Development that may adversely affect green infrastructure assets

should not normally be permitted.

The information provided in the SFRA should be used as a basis for investigating potential strategic flood risk solutions within the study area. Opportunities could consist of the following:

- Catchment and floodplain restoration;
- Flood storage areas;
- Opening up culverts, weir removal, and river restoration;
- The Regional Habitat Creation Programme;
- Green infrastructure; and
- Preserving the function of surface water flood routes where appropriate.

For successful future flood risk management, it is recommended that the Council adopts a catchment partnership working approach in tackling flood risk and environmental management.

Potential modelling improvements

The Environment Agency regularly reviews its flood risk mapping, and it is important to make contact to determine whether updated (more accurate) information is available prior to commencing a site-specific FRA. Due to the publication of the **UKCP18** the Environment Agency should be contacted for the latest guidance on climate change modelling outputs for Flood Risk Assessments as these have not been taken into account in this Level 1 SFRA. Developers may need to account for UKCP18 themselves if there is no updated guidance from the Environment Agency. Developers should appropriately assess climate change through an FRA.

New modelling was completed for the North Kent Coast and Iwade Stream at the time of producing this SFRA and this updated modelling was used within this assessment. It should be noted that 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 whilst the Environment Agency incorporate the latest modelling. When using the SFRA to prepare FRAs it is important to check that the most up to date information is used, as is described in amendments to the flood mapping prepared and issued by the Environment Agency at regular intervals.

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. This SFRA has been developed using the best available information, supplied at the time of preparation. This relates both to the current risk of flooding from rivers, the sea and surface water and where available the potential effects of future climate change.

If a Level 2 SFRA is required, any updated climate change allowances will be considered at that time based on Environment Agency guidance.

Other datasets used to inform this SFRA may also be periodically updated and following the publication of this SFRA, new information on flood risk may be provided by Risk Management Authorities.

Contents

Interactive maps are also available on Swale Borough Council's website.

List of Figures

List of Tables

Abbreviations and glossary of terms

	Definition
AEP	Annual Exceedance Probability - the chance of an event with a particular magnitude occurring in each and every year
AOD	Above Ordnance Datum
AONB	Area of Natural Beauty
BSI	British Standards Institution
CCMA	Coastal Change Management Area
CFMP	Catchment Flood Management Plan
CIRIA	Construction Industry Research and Information Association
Defra	Department of the Environment, Food and Rural Affairs
FAA	Flood Alert Area
FCRMGiA	Flood and Coastal Risk Management Grant in Aid
FRA	Flood Risk Assessment
FRMP	Flood Risk Management Plan
FSA	Flood Storage Area
FWMA	Flood and Water Management Act
FWA	Flood Warning Area
FWS	Flood Warning Service
FZ	Flood Zone
GI	Green Infrastructure
GIS	Geographic Information Service
GSPZ	Groundwater Source Protection Zone
ISIS	Hydrology and hydraulic modelling software
JBA	Jeremy Benn Associates
KCC	Kent County Council
LFRMS	Local Flood Risk Management Strategy
LLFA	Lead Local Flood Authority - Local Authority responsible for taking the lead on local flood risk management
LMIDB	Lower Medway Internal Drainage Board
LPA	Local Planning Authority
Main River	A watercourse shown as such on the Main River Map, and for which the Environment Agency has responsibilities and powers
MEASS	Medway Estuary and Swale Strategy
NFF	National Flood Forum
NFM	Natural Flood Management
NPPF	National Planning Policy Framework
NRD	National Receptor Database
NRIM	National Reservoir Inundation Mapping
NVZ	Nitrate Vulnerable Zones
Ordinary Watercourse	All watercourses that are not designated Main River. Local Authorities or, where they exist, IDBs have similar permissive powers as the Environment Agency in relation to flood defence

	Definition
	work. However, the riparian owner has the responsibility of maintenance.
PFRA	Preliminary Flood Risk Assessment
PFR	Property Flood Resilience
PPG	Planning Practice Guidance
RBMP	River Basin Management Plan
Resilience measures	Measures designed to reduce the impact of water that enters property and businesses; could include measures such as raising electrical appliances.
Resistance measures	Measures designed to keep flood water out of properties and businesses; could include flood guards for example.
RMA	Risk Management Authority
RoFSW	Risk of Flooding from Surface Water
SBC	Swale Borough Council
SFRA	Strategic Flood Risk Assessment
SHLAA	Strategic Housing Land Availability Assessment - The Strategic Housing Land Availability Assessment (SHLAA) is a technical piece of evidence to support local plans and Sites & Policies Development Plan Documents (DPDs). Its purpose is to demonstrate that there is a supply of housing land in the district which is suitable and deliverable.
SIRF	Sewage Incident Reporting Form
SMP	Shoreline Management Plan
SuDS	Sustainable Drainage Systems
SWMP	Surface Water Management Plan
TUFLOW	Two-dimensional Unsteady FLOW (a hydraulic model)
UKCP18	United Kingdom Climate Projections 2018
Wave inundation	A flow of waves and spread of water onto land
Wave overtopping	Flow of waves over the top of a structure
WFD	Water Framework Directive

1 Introduction

1.1 Swale Borough

Swale Borough covers an area of approximately 370km^2 and has an estimated population of over 140,000. The location of Swale Borough is shown within Figure 1-1. There are 40 Parish Councils in the Local Plan area. The largest settlement is the town of Sittingbourne, with a population of over 49,000. Other sizeable towns include Faversham, Sheerness and Queenborough[1].

The study area is bound by the River Medway, the Thames Estuary and the North Sea to the north with many of the river networks and inlets being tidally influenced.

1.2 Purpose of the Strategic Flood Risk Assessment

> "Strategic policies should be informed by a strategic flood risk assessment and should manage flood risk from all sources. They should consider cumulative impacts in, or affecting, local areas susceptible to flooding, and take account of advice from the Environment Agency and other relevant flood risk management authorities, such as lead local flood authorities and internal drainage boards."
>
> (National Planning Policy Framework (2018), Section 14 paragraph 156)

This Strategic Flood Risk Assessment (SFRA) 2019 document supersedes the previous Swale Borough Council 2009 Level 1 and 2 SFRA and the Faversham Creek SFRA 2010 Amendment. The SFRA study area is shown in Figure 1-1. The mapping in the appendices provides a borough wide view and **interactive maps** are available on Swale Borough Council's website.

The main purpose of the SFRA update was to prepare a document that provides comprehensive and supporting evidence for the emerging Local Plan 2022 - 2038. The **Swale Borough Local Plan - Bearing Fruits 2031** was adopted in 2017. The emerging Local Plan will revisit the adopted Local Plan to make sure that enough development will be planned to meet the needs of the area.

The SFRA update was also required to be compliant with the latest guidance described in the 2018 update to the National Planning Policy Framework (NPPF), support the selection of site allocations in the emerging Local Plan and to provide information and guidance to be used in the preparation of Flood Risk Assessments (FRAs) in support of site specific planning applications.

A **revised NPPF** was published on 24 July 2018 (last updated on 19 June 2019) and sets out Government's planning policies for England and how these are expected to be applied. This revised Framework replaces the previous NPPF published in March 2012.

The key objectives of the 2019 SFRA are:

- To take account of best practice, the latest guidance and the most up to date information;
- To assess the flood risk to and from the borough from all sources, now and in the future, as well as assess the impact that cumulative land use changes and development in the area will have on flood risk;
- To be a robust piece of evidence to inform the preparation of the Swale Local Plan and sustainability appraisal, so that flood risk is fully accounted for when considering allocation options and guide development to the safest areas;

1 Swale Borough Council, The Swale Borough Local Plan, 2017.

- To inform the preparation of emerging local plan policies;
- To inform the application of the Sequential Test and, if necessary, the Exception Test.
- To identify the requirements for site-specific flood risk assessments;
- To assist in the determination of the acceptability of flood risk in relation to Swale's emergency planning capability;
- To help prioritise and target improvements to flood defences;
- To consider opportunities to reduce flood risk to existing communities and developments and recommend how the Local Plan can best influence this issue;

1.3 Levels of SFRA

The Planning Practice Guidance advocates a tiered approach to risk assessment and identifies two levels of SFRA. Level 1 should be completed first to understand whether a Level 2 assessment is required.

1 Level 1: where flooding is not a major issue and where development pressures are low. The assessment should be sufficiently detailed to allow application of the Sequential Test.

2 Level 2: where land outside Flood Zones 2 and 3 cannot appropriately accommodate all the necessary development creating the need to apply the NPPF's Exception Test. In these circumstances the assessment should consider the detailed nature of the flood characteristics within a Flood Zone and assessment of other sources of flooding.

This report fulfils the Level 1 SFRA requirements.

1.4 SFRA outputs

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

- A review and update of new and amended data sources.
- Assessment of all potential sources of flooding and the potential impact of climate change on flood risk.
- Mapping areas at risk from other sources including surface water, sewer, ground water, reservoir inundation.
- Mapping of location and extent of functional floodplain.
- 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.
- High-level screening of proposed development sites against flood risk information.
- Guidance for developers including requirements for site-specific flood risk assessments.
- Mapping areas covered by an existing flood alert / warning.
- Mapping of flood defence infrastructure and highlighting areas that need improvements.
- Identification of opportunities to reduce flood risk which can be included in the Local Plan policies.
- An assessment of surface water management issues and the application of Sustainable Drainage Systems (SuDS).

1.5 SFRA user guide

Table 1-1 outlines the layout and location of information that is included in the 2019 SFRA.

Table 1-1: SFRA report contents

Section	Contents
1. Introduction	Provides a background to the study, defines objectives, outlines the approach adopted and the consultation performed.
2. The Planning Framework and Flood Risk Policy	Provides an overview of the planning framework, flood risk policy and flood risk responsibilities.
3. Roles and Responsibilities of Risk Management Authorities	The roles and responsibilities of Risk Management Authorities (RMAs) in Swale Borough.
4. The Sequential, risk-based approach	Describes the Sequential Approach and application of Sequential and Exception Tests. Outlines cross boundary issues and considerations.
5. Climate change	Outlines climate change guidance and the implications for Swale Borough.
6. Sources of information used in preparing the SFRA	Outlines what information has been used in the preparation of the SFRA.
7. Understanding flood risk in the Local Plan area	Introduces the assessment of flood risk and provides an overview of the characteristics of flooding affecting the borough. Provides a summary of responses that can be made to flood risk, together with policy and institutional issues that should be considered.
8. Fluvial and coastal defences	Assessment of existing flood defences and flood risk management measures.
9. FRA requirements and flood risk management guidance	Identifies the scope of the assessments that must be submitted in FRAs supporting applications for new development. Provides guidance for developers and outlines conditions set by the Lead Local Flood Authority (LLFA) and the Environment Agency that should be followed.
10. Surface water management and SuDS	Advice on managing surface water run-off and flooding and the application of SuDS.
11. Special areas for consideration	Provides planning guidance for developments within Faversham Creek, Iwade and Minster.
12. Flood warning and emergency planning	Outlines the flood warning service in the SFRA area and provides advice for emergency planning, evacuation plans and safe access and egress.
13. Strategic flood risk solutions	Overview of possible strategies to reduce flood risk.
14. Assessment of flood	A summary of the information presented in the site

Section	Contents
risk in potential development areas	screening table, an overview of areas where flood defences may need improvements to reduce flood risk to the development sites, and an overview of the cumulative impacts of development in the study area.
15. Summary	Review of the Level 1 SFRA.
16. Recommendations	Identifies recommendations for the council to consider as part of Flood Risk Management policy.
Appendix A-J: Flood risk mapping	Maps showing flood risk information from all sources.
Appendix K: Level 1 Site Screening table	Screening table showing the flood risking from all sources to the Level 1 development sites.
Appendix L: Areas where improvements to flood defences may be required	Mapping and a table showing areas of the study area where improvements to flood defences may be required to reduce flood risk to the development sites.

1.6 Consultation

The following parties have been consulted during the preparation of this Level 1 SFRA:

- Swale Borough Council
- Kent County Council
- Environment Agency
- Southern Water
- Lower Medway Internal Drainage Board
- Marine Management Organisation
- Neighbouring authorities (Ashford Borough Council, Canterbury City Council, Maidstone Borough Council, Medway Council)

1.7 Use of SFRA data

It is important to recognise that SFRAs are high level strategic documents and, as such, do not go into detail on an individual site-specific basis. The SFRA has been developed using the best available information at the time of preparation. This relates both to the current risk of flooding from rivers, and the potential impacts of future climate change.

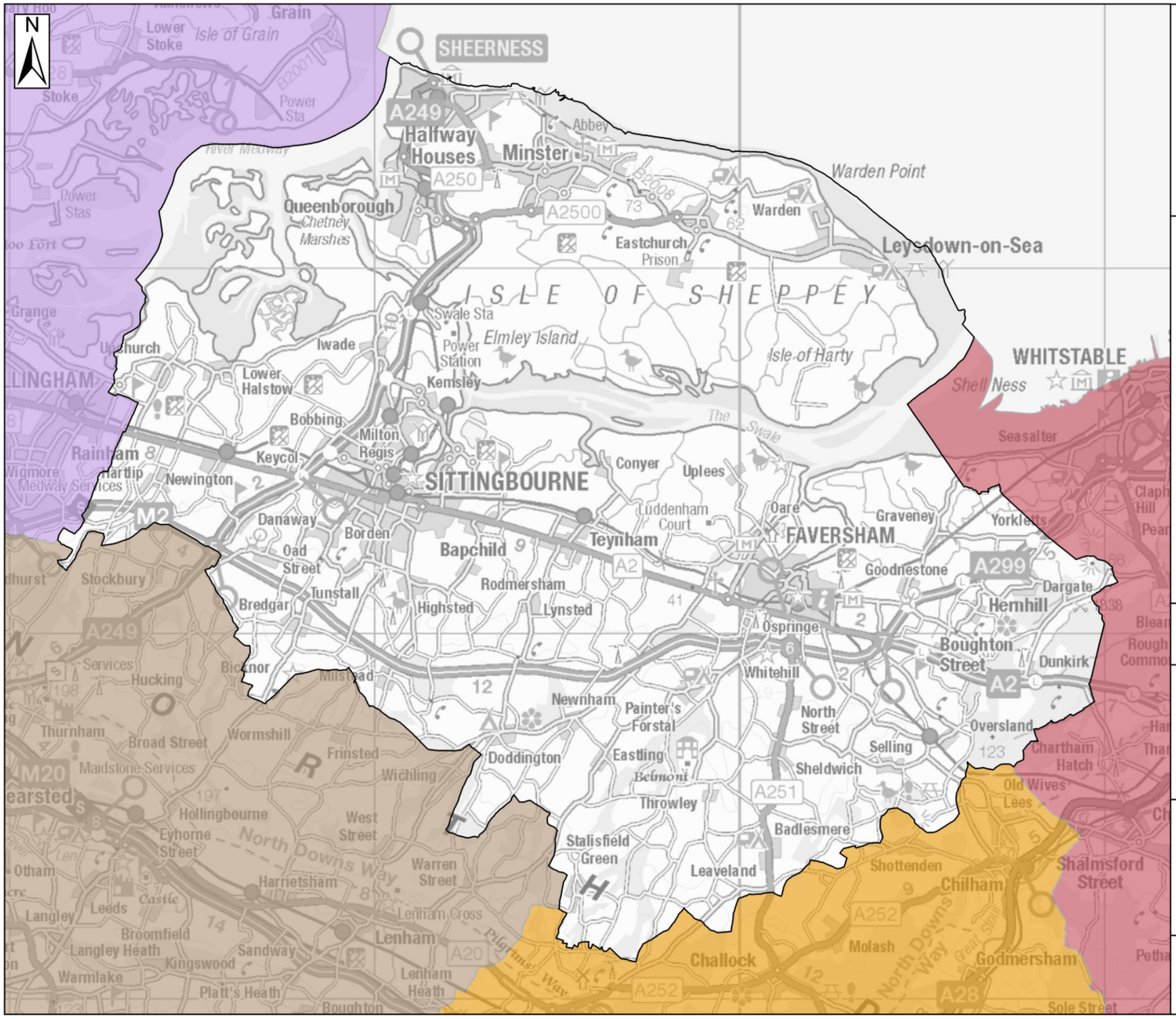
SFRAs should be a **'living document'**, and as a result should be updated when new information on flood risk, new planning guidance or legislation becomes available. New information on flood risk may be provided by Swale Borough Council, Kent County Council, the Environment Agency and Southern Water. Such information may be in the form of:

- New hydraulic modelling results
- Flood event information following a flood event
- Policy / legislation updates
- Environment Agency flood map updates
- New flood defence schemes etc.

The Environment Agency regularly reviews their flood risk mapping, and it is important that they are approached to determine whether updated (more accurate) information is available prior to commencing a detailed Flood Risk Assessment.

It is recommended that the SFRA is reviewed internally, in line with the Environment Agency's Flood Zone map updates to ensure latest data is still represented in the SFRA, allowing a cycle of review and a review of any updated data by checking with the above bodies for any new information.

Figure 1-1: Local Plan area and neighbouring authorities



2 The Planning Framework and Flood Risk Policy

2.1 Introduction

The overarching aim of development and flood risk planning policy in the UK is to ensure that the potential risk of flooding is considered at every stage of the planning process. This section of the SFRA provides an overview of the planning framework, flood risk policy and flood risk responsibilities.

2.2 National Planning Policy and Guidance

2.2.1 Revised National Planning Policy Framework

The **Revised National Planning Policy Framework** was published in July 2018, and last updated in June 2019, replacing the previous version published in March 2012. Key changes in the revised NPPF compared to the 2012 NPPF include:

- Strategic policies should also now consider the 'cumulative impacts in, or affecting, local areas susceptible to flooding' (para 156), rather than just to or from individual development sites.
- Future risk from climate change- the 'sequential approach should be used in areas known to be at risk now or in the future from any form of flooding' (para 158).
- Natural Flood Management - 'Using opportunities provided by new development to reduce the causes and impacts of flooding (where appropriate through the use of natural flood management techniques)' (para 157c).
- 'Major developments should incorporate sustainable drainage systems unless there is clear evidence that this would be inappropriate' (Para 165).
- Emergency planning. Emergency plans are required as part of an FRA that includes the inclusion of safe access and egress routes (para 163e).

The NPPF sets out Government's planning policies for England and how these are expected to be applied. The Framework is based on core principles of sustainability and forms the national policy framework in England, also accompanied by a number of Planning Practice Guidance (PPG) notes. It must be taken into account in the preparation of local plans and is a material consideration in planning decisions.

Sequential Test

"The aim of the sequential test is to steer new development to areas with the lowest risk of flooding. Development should not be allocated or permitted if there are reasonably available sites appropriate for the proposed development in areas with a lower risk of flooding. The strategic flood risk assessment will provide the basis for applying this test. The sequential approach should be used in areas known to be at risk now or in the future from any form of flooding."

If it is not possible for development to be located in zones with a lower risk of flooding (taking into account wider sustainable development objectives), the exception test may have to be applied. The need for the exception test will depend on the potential vulnerability of the site and of the development proposed, in line with the Flood Risk Vulnerability Classification set out in national planning guidance.

(Revised National Planning Policy Framework, Section 14 paragraph 158 and 159)

Exception Test

"The application of the exception test should be informed by a strategic or site-specific flood risk assessment, depending on whether it is being applied during plan production or at the application stage. For the exception test to be passed it should be demonstrated that:

a) the development would provide wider sustainability benefits to the community that outweigh the flood risk; and

b) the development will be safe for its lifetime taking account of the vulnerability of its users, without increasing flood risk elsewhere, and, where possible, will reduce flood risk overall.

Both elements of the exception test should be satisfied for development to be allocated or permitted."

(Revised National Planning Policy Framework, Section 14 paragraph 160 and 161)

A description of how flood risk should be taken into account in the preparation of Local Plans is outlined in Diagram 1 contained within the **Planning Practice Guidance for Flood Risk and Coastal Change** (2014), shown in Figure 2-1. The PPG documents will, where necessary, be updated in due course to reflect the changes in the revised NPPF.

2.3 Existing flood risk management policies and guidance

Figure 2-2 provides an overview of the key strategic planning links for flood risk management and associated documents. It shows how the **Flood Risk Regulations** and **Flood and Water Management Act**, have introduced a wider requirement for the mutual exchange of information and the preparation of strategies and management plans. There is a duty to cooperate, which is a legal requirement between local planning authorities and other public bodies, which serves to maximise the effectiveness of policies for strategic matters in Local Plans.

Figure 2-1: Flood risk and the preparation of Local Plans

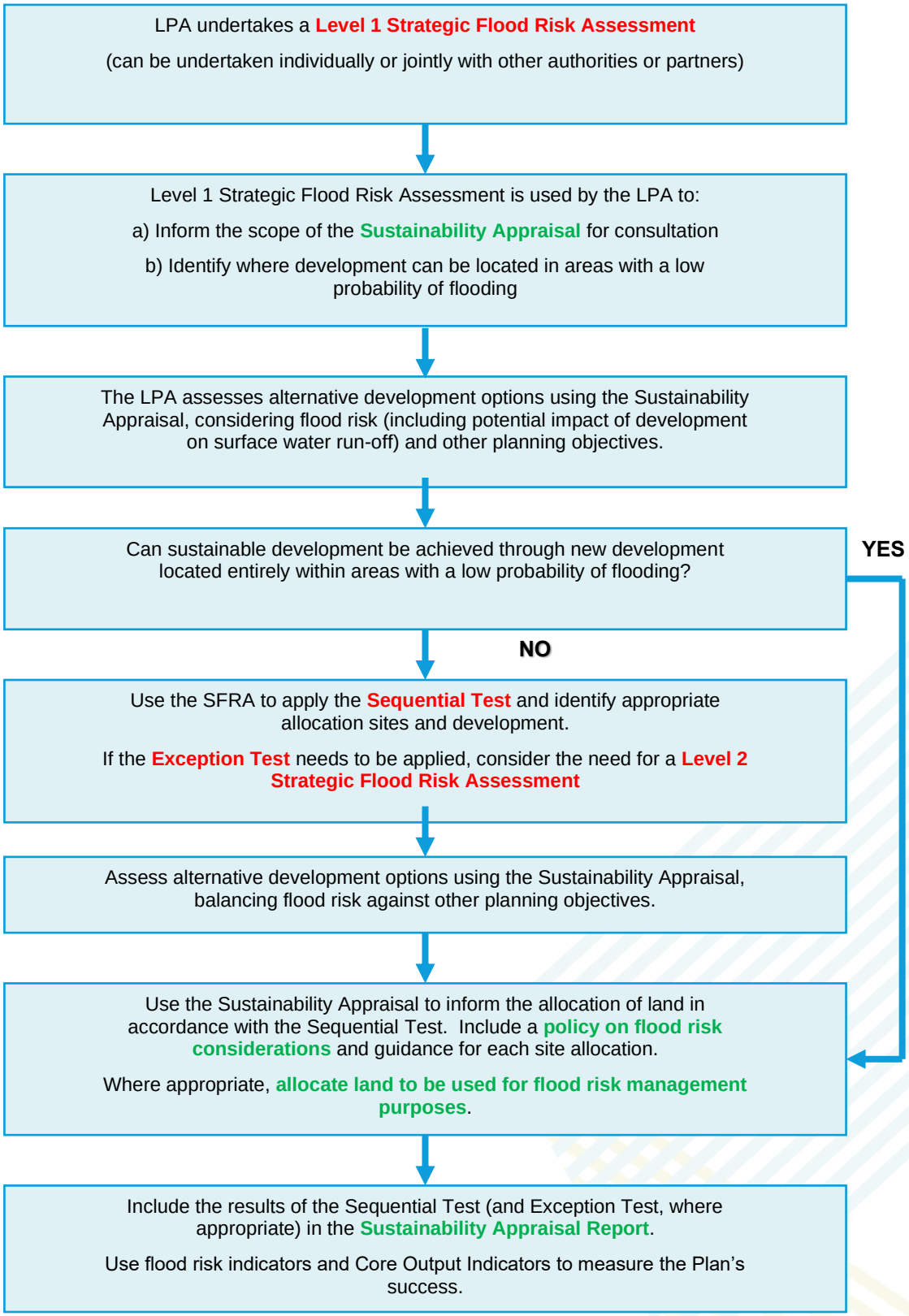
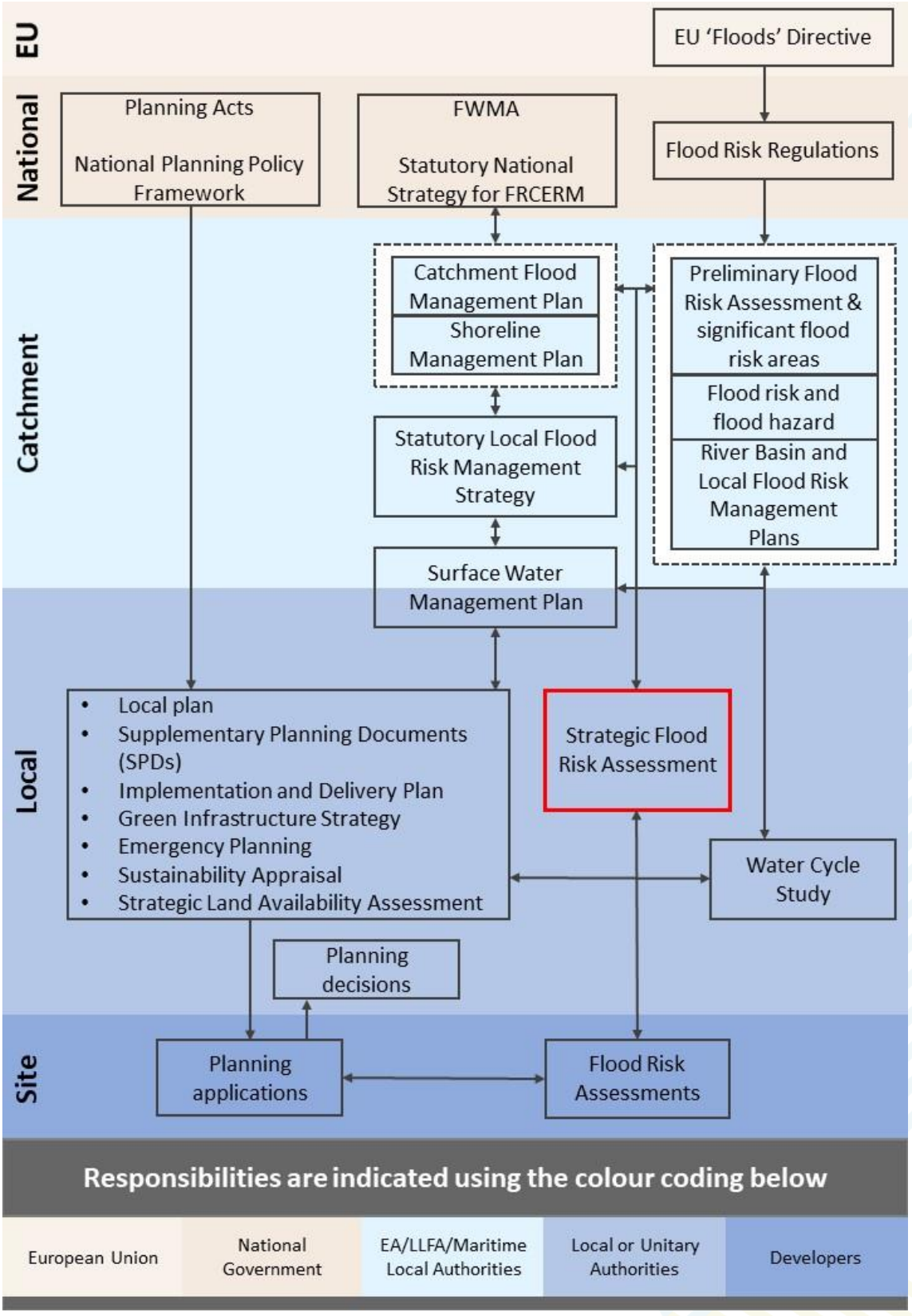


Figure 2-2: Strategic planning links and key documents for flood risk



The following sections outline the existing flood risk management policies and guidance for the Swale Borough.

2.3.1 Preliminary Flood Risk Assessments

LLFAs and the Environment Agency have the task of preparing a Preliminary Flood Risk Assessment (PFRA) report every 6 years. As the LLFA, Kent County Council must review the flood risk from local flood sources which includes surface water, groundwater and ordinary watercourses. The Environment Agency must review the flood risk from fluvial and coastal flood risks.

The LLFA **PFRA document** that covers the study area was first published by Kent County Council (KCC) as the LLFA in 2011. In 2011, ten indicative Flood Risk Areas were identified nationally by Defra / the Environment Agency, and as a result of KCC's assessment, none encroached on the Swale Borough Council's Local Plan area.

Under the Regulations, the Environment Agency exercised an 'Exception' in 2011 and did not prepare a PFRA for risk from rivers, reservoirs and the sea. This then made it a requirement for the Environment Agency to prepare and publish a Flood Risk Management Plan (FRMP).

In 2017, KCC prepared an **addendum** to the PFRA which updated the 2011 report. The exercise was also carried out in 2018 by the Environment Agency and a further **national study** was prepared to identify potential areas of significant flood risk ("Flood Risk Areas"). No Flood Risk Areas were identified within Swale Borough within this assessment.

2.3.2 Flood Risk Management Plans

FRMPs set out how organisations, stakeholders and communities will work together to manage flood risk within a catchment.

The FRMP process adopts the same catchments as used in the preparation of River Basin Management Plans (as prepared to meet the requirements of the Water Framework Directive). The Local Plan Area lies largely within the North Kent Catchment area of the Thames River Basin District, though part of the south east of the borough is located within the Stour Catchment area of the South East River Basin.

More detailed strategic information on proposed strategic measures and approaches can be found in the **Thames River Basin District Flood Risk Management Plan** (2016) – Parts A, B and C and the **South East River Basin District Flood Risk Management Plan** (2016) – Parts A, B and C. The FRMPs draw on previous policies and actions identified in the Catchment Flood Management Plans and also incorporate information from Local Flood Risk Management Strategies.

2.3.3 Kent Local Flood Risk Management Strategy (LFRMS) 2017-2023

KCC is responsible for developing, maintaining, applying and monitoring a LFRMS for Kent, which includes the Local Plan area. The **Kent Local Flood Risk Management Strategy 2017-2023** (2017) sets out the strategic vision for local flood risk management in Kent.

The 2017 LFRMS builds upon the previous version, the **Kent County Council Local Flood Risk Management Strategy**, published in 2013.

2.3.4 LLFAs, surface water and SuDS

On 18 December 2014 a **Written Ministerial Statement** from the Secretary of State for Communities and Local Government set out changes to the planning process that would apply for major development from 6 April 2015. These were implemented in the **Town and Country Planning (Development Management Procedure) (England) Order 2015**.

Major developments are defined as:

- Residential development: 10 dwellings or more, or residential development with a site area of 0.5 hectares or more where the number of dwellings is not yet known; and
- Non-residential development: provision of a building or buildings where the total floor space to be created is 1,000 square metres or more or, where the floor area is not yet known, a site area of 1 hectare or more.

When considering planning applications, Local Planning Authorities should consult the LLFA on the management of surface water so that:

- the proposed minimum standards of operation are appropriate
- there are clear arrangements for on-going maintenance over the development's lifetime, through the use of planning conditions or planning obligations.

As LLFA, KCC has a strategic overview role for local flood risk, which involves flooding from surface water, groundwater and ordinary watercourses. The **Kent County Council Drainage and Planning Policy Statement** (2017) sets out the requirements that KCC has for drainage strategies and surface water management provisions relating to development applications. A new guidance document is currently being prepared by Kent County Council to provide guidance on run-off from new development. The emerging document should be referred to for the latest requirements for development applications once available.

2.3.5 Water Quality

The **Swale Borough Council Sustainability Appraisal: Water Infrastructure and Environmental Capacity Assessment** (2010) highlights problems with water quality in Swale Borough and the subsequent potential effects of development. There are two Wastewater Treatment Works expected to discharge increased volumes of treated effluent into The Swale due to the potential development at Queenborough and Sittingbourne. However, it is expected that it will be possible to increase the discharges to The Swale without reducing the potential for the waterbody to achieve Good overall status by 2027.

It should be noted Swale Borough Council has confirmed that this document requires updating.

2.4 Surface Water Management Plans

Surface Water Management Plans (SWMPs) outline the preferred surface water management strategy in a given location. SWMPs are undertaken by LLFAs in consultation with key local partners who are responsible for surface water management and drainage in their area. SWMPs establish a long-term action plan to manage surface water in a particular area and are intended to influence future capital investment, drainage maintenance, public engagement and understanding, land-use planning, emergency planning and future developments.

The SWMP applicable to the Local Plan area is summarised below. The outcomes and actions from this SWMP should be considered in the context of proposed developments within the study area.

2.4.1 Swale Surface Water Management Plan (2012)

The **Swale Surface Water Management Plan** (2012) was undertaken by KCC to investigate the local flood risks in Swale as part of their role in understanding local flood risk management in Kent. The plan acts as an intermediate risk assessment, identifying 22 priority locations at risk of local flooding that require detailed

assessment. These priority locations are generally clustered around Sittingbourne, Faversham, and the northwest of the Isle of Sheppey.

The plan then outlines potential actions and measures for managing the identified flood risks at these priority locations, detailing the partners or stakeholders responsible for the actions, the indicative costs, and the associated timescales. Generic actions and ongoing monitoring measures are also discussed.

2.5 Catchment Flood Management Plans

Catchment Flood Management Plans (CFMPs) are a high-level strategic plan providing an overview of flood risk across each river catchment. The Environment Agency use CFMPs to work with other key-decision makers to identify and agree long-term policies for sustainable flood risk management.

There are six pre-defined national policies provided in the CFMP guidance and these are applied to specific locations through the identification of 'Policy Units'. These policies are intended to cover the full range of long-term flood risk management options that can be applied to different locations in the catchment.

2.5.1 North Kent Rivers Catchment Flood Management Plans (2009)

The Local Plan area is covered by the **North Kent Rivers Catchment Flood Management Plan** (2009). The primary policy units for the area are:

- **Policy 1 – North Kent Downs.** Areas of little or no flood risk that will continue to be monitored and advised.
- **Policy 3 – North Kent Marshes.** Areas of low to moderate fluvial flood risk where existing flood risk is generally being managed effectively.

North Kent Downs

Flood risk is low in this area, with no people or properties currently affected by flooding. The low flood risk is predicted to continue into the future, with no properties predicted to be at risk of flooding from a 1% AEP (Annual Exceedance Probability) event in 2100. It is proposed that local authorities and water companies will need to continue to monitor and maintain drainage assets to prevent localised flood risk.

North Kent Marshes

Flood risk in this area is generally managed effectively and the biggest issue is likely the increased impacts of flooding with time due to climate change, though flood risk is not expected to increase notably. Proposed actions for the area include investigations into non-main river flooding in Sittingbourne, Conyer, and Faversham, and flood risk investigations at Iwade.

2.6 River Basin Management Plans

River Basin Management Plans (RBMPs) are prepared under the Water Framework Directive (WFD) and assess the pressure facing the water environment in the River Basin Districts. The Local Plan area falls within the **Thames River Basin District River Basin Management Plan** (2016).

The plan provides a summary of programmes of measures that help prevent deterioration to protect and improve the beneficial use of the water environment in the river basin district. An assessment of whether deterioration has occurred from the 2015 classification baseline will be carried out in 2021.

Measures are presented for each significant water management issue in the river basin district which are:

- Physical modifications
- Managing pollution from waste water

- Managing pollution from towns, cities and transport
- Changes to natural flow and levels of water
- Managing invasive non-native species
- Managing pollution from rural areas

2.7 Coastal defence strategies

2.7.1 Shoreline Management Plans

The Shoreline Management Plan (SMP) forms part of Defra's strategy for flood and coastal defence. It provides a large-scale assessment of risks associated with coastal evolution and presents the policy framework to address these risks in a sustainable manner. The SMP policies defined by Defra are:

- **Hold the line** – maintain or upgrade the level of protection provided by defences.
- **Advance the line** – build new defences seaward of the existing defence line.
- **Managed realignment** – allowing retreat of the shoreline, with management to control or limit the movement.
- **No active intervention** – a decision not to invest in providing or maintaining defences.

Not all policies are guaranteed funding and over time the Environment Agency along with other partners will identify the cost. There are two existing policies for Swale which are outlined below.

Isle of Grain to South Foreland Shoreline Management Plan (2010)

The **Isle of Grain to South Foreland Shoreline Management Plan** (2010) covers part of the study area from Faversham Creek to southwest of Seasalter, as well as the northern coastline of the Isle of Sheppey from Sheerness to Shellness. The majority of coastline in this area requires 'Hold the Line' or 'Managed Realignment', both in the short and long term, though with 'No Active Intervention' planned for the area between Minster Slopes to Warden Bay.

Medway Estuary and Swale Shoreline Management Plan (2010)

The **Medway Estuary and Swale Shoreline Management Plan** (2010) covers part of the Local Plan coastline from Otterham Quay to Faversham Creek, as well as the southern coastline of the Isle of Sheppey from Sheerness to Shellness. The long term policy in this area is largely either 'Hold the Line' or 'Managed Realignment', with some areas of 'No Active Intervention'.

2.7.2 Other Coastal Defence Strategies

The Local Plan area falls within **Medway Estuary and Swale flood and coastal risk management Strategy (MEASS)** area. The strategy sets out the best economic, environmental and technically appropriate approach to managing flood and coastal erosion risk over the next 100 years.

2.8 Local Plan policies

Bearing Fruits 2031: The Swale Borough Local Plan (2017) provides the policy framework and long-term strategy to manage development, protect the environment, deliver infrastructure, and promote sustainable communities within the Local Plan area. The core policies relating to flood risk and drainage are:

- **Policy CP 1** – Building a strong, competitive economy

- **Policy CP 7** – Conserving and enhancing the natural environment – providing for green infrastructure

Additional policies of importance include:

- **ST 1 -** Delivering sustainable development in Swale
- **ST 5 -** The Sittingbourne area strategy
- **ST 6 -** The Isle of Sheppey area strategy
- **ST 7 -** The Faversham area and Kent Downs strategy
- **DM 21** - Provides information on what is required by developers and planners in terms of new developments for management of flood risk, surface water, and foul water.
- **DM 22 –** The coast
- **DM 23 –** Coastal change management

2.9 Localism Act

The Localism Act outlines plans to shift and re-distribute the balance of decision making from central government back to councils, communities and individuals. Two provisions in the Act should be considered in relation to flood risk management and this SFRA:

- The duty to cooperate on Local Authorities. This duty requires Local Authorities to "engage constructively, actively and on an ongoing basis in any process by means of which development plan documents are prepared so far as relating to a strategic matter".
- New rights to allow local communities to come together and shape new developments by preparing Neighbourhood Plans. As neighbourhoods draw up their proposals, Local Planning Authorities are required to provide technical advice and support.

2.10 Natural Flood Management (NFM) Plans

The Environment Agency has developed **Natural Flood Management (NFM) mapping** which displays opportunities for NFM. These maps are to be used as a guide and supplemented with local knowledge to provide a starting point for discussions about NFM. NFM aims to protect, restore and emulate the natural functions of catchments, floodplains, rivers and the coast. NFM should be used on a catchment wide scale and is the linking of blue and green infrastructure.

The maps identify NFM opportunities on different catchment scales:

- National River Basin Districts
- River Basin Districts showing Management Catchments
- Management Catchments showing Water Body Catchments
- Water Body Catchments

The catchments in the Local Plan area cross boundaries with other neighbouring authorities. Discussions about NFM should be had with catchment stakeholders in combination with local knowledge e.g. with local landowners.

3 Roles and responsibilities of Risk Management Authorities

The roles and responsibilities of Risk Management Authorities (RMAs) in Swale Borough, as described in the **Flood Risk Regulations (2009)** and **Flood and Water Management Act (2010)** are outlined below.

3.1 Swale Borough Council

As a Local Planning Authority, Swale Borough Council assess, consult on and determine whether development proposals are acceptable, ensuring that flooding and other similar risks are effectively managed.

The council will consult relevant statutory consultees as part of planning application assessments and may, in some cases, also contact non-statutory consultees, such as Southern Water, that have an interest in the planning application.

Swale Borough Council are also the Coast Protection Authority, primarily managing coastal erosion through defences. These defences are sometimes dual purpose and often serve to manage the coastal flood risk.

3.2 Environment Agency

The Environment Agency is responsible for protecting and enhancing the environment and contributing to the government's aim of achieving sustainable development in England and Wales. In terms of flood risk, the Environment Agency has a strategic overview of all sources of flooding and coastal erosion. Examples of this strategic overview role include:

- Setting the direction for managing the risks through strategic plans;
- Providing evidence and advice to inform Government policy and support others;
- Working collaboratively to support the development of risk management skills and capacity; and
- Providing a framework to support local delivery.

The Agency also has operational responsibility for managing the risk of flooding from main rivers, reservoirs, estuaries and the sea, as well as being a coastal erosion risk management authority.

The Environment Agency has powers to carry out flood and coastal risk management work and to regulate the actions of other flood risk management authorities on the coast. These powers are permissive, which means they are not a duty.

The Environment Agency also has powers to regulate and consent works. You must follow the environmental permitting rules if you want to do work:

- on or near a main river
- on or near a flood defence structure
- in a flood plain
- on or near a sea defence

Further details on Environment Agency permits can be found on the **Environment Agency's Flood risk activities: environmental permits** website.

3.3 Kent County Council

As the Lead Local Flood Authority (LLFA) for the area, Kent County Council's duties and powers include:

- Local Flood Risk Management Strategy (LFRMS): LLFAs must develop, maintain, apply and monitor a LFRMS to outline how they will manage flood risk, identify areas vulnerable to flooding and target resources where they are needed most.

- Flood Investigations: When appropriate and necessary LLFAs must investigate and report on flooding incidents (Section 19 investigations).
- Register of Flood Risk Features: LLFAs must establish and maintain a register of structures or features which, in their opinion, are likely to have a significant effect on flood risk in the LLFA area.
- Designation of Features: LLFAs may exercise powers, as all RMAs can, to designate structures and features that affect flood risk, requiring the owner to seek consent from the authority to alter, remove or replace it.
- Consenting: When appropriate, LLFAs will perform consenting of works on ordinary watercourses. Further details can be found on the **KCC land drainage consent website**.
- Enforcement: The LLFA has enforcement powers under the Land Drainage Act 1991 and FWMA 2010.

KCC is also the Local Highway Authority and manages highway drainage, carrying out maintenance and improvement works on an on-going basis, as necessary, to maintain existing standards of flood protection for highways, making appropriate allowances for climate change. It also has the responsibility to ensure road projects cause no increased flood risk. KCC are statutory consultees with respect to surface water management in proposed new development.

3.4 Water and wastewater providers

Southern Water is the sewerage undertaker for the Local Plan area. They have the responsibility to maintain surface, foul and combined public sewers to ensure the area is effectively drained. When flows (foul or surface water) are proposed to enter public sewers, Southern Water will assess whether the public system has the capacity to accept these flows as part of their pre-application service. If there is not available capacity, they will provide a solution that identifies the necessary mitigation. Southern Water can also comment on the available capacity of foul and surface water sewers as part of the planning application process although this is not a statutory role.

The **Swale Borough Council Sustainability Appraisal: Water Infrastructure and Environmental Capacity Assessment** (2010) recommends early discussions with Southern Water to ensure there is enough capacity in the sewer network for any significant developments, particularly in the Faversham area. Additionally, as part of national mapping in the Water UK **Assessing the Available Capacity in UK Sewerage Systems** (2018) report the areas around Lower Halstow, Sittingbourne, Teynham and Boughton are located within 'Risk level 4', meaning they are identified as currently having widespread capacity constraints for pipes in the foul and combined sewer network.

Southern Water and South East Water provide potable water to the Local Plan area.

For further details about developer services and relevant application forms please see **Southern Waters Developer Services website** and **South East Water's Developer Services Website**.

3.5 Lower Medway Internal Drainage Board (LMIDB)

Under the Land Drainage Act 1991 LMIDB exercises general powers of supervision over all matters relating to water level management within their district. Key watercourses are adopted by the Board for maintenance purposes and the Board also has responsibility for the operation and maintenance of assets used to manage water levels.

4 The sequential, risk-based approach

4.1 The sequential, risk-based approach

This approach is designed to ensure areas with little or no risk of flooding (from any source) are developed in preference to areas at higher risk, with the aim of keeping development outside of medium and high flood risk areas (Flood Zones 2 and 3) and other sources of flooding, where possible. In the long term this will strategically reduce the reliance on flood risk management measures and avoid commitment to the long term investment required so the measures maintain appropriate standards of safety under climate change conditions.

When drawing up a Local Plan, it is often the case that it is not possible for all new development to be allocated on land that is not at risk from flooding. In these circumstances the Flood Zone maps, which show the extent of inundation without the presence of defences, are too simplistic. Thus, a greater understanding of the scale and nature of the actual flood risks is required as the Flood Zones do not take account of the effect of flood risk management measures.

4.1.1 Flood Zones

The NPPF Flood Risk and Coastal Change Guidance identifies four main Flood Zones, which apply to both Main River and Ordinary Watercourses. A concept diagram showing the classification of the **PPG Flood Zones** is included in Figure 4-1, with the four main Flood Zones also summarised in Table 4-1.

Figure 4-1: Definition of Flood Zones

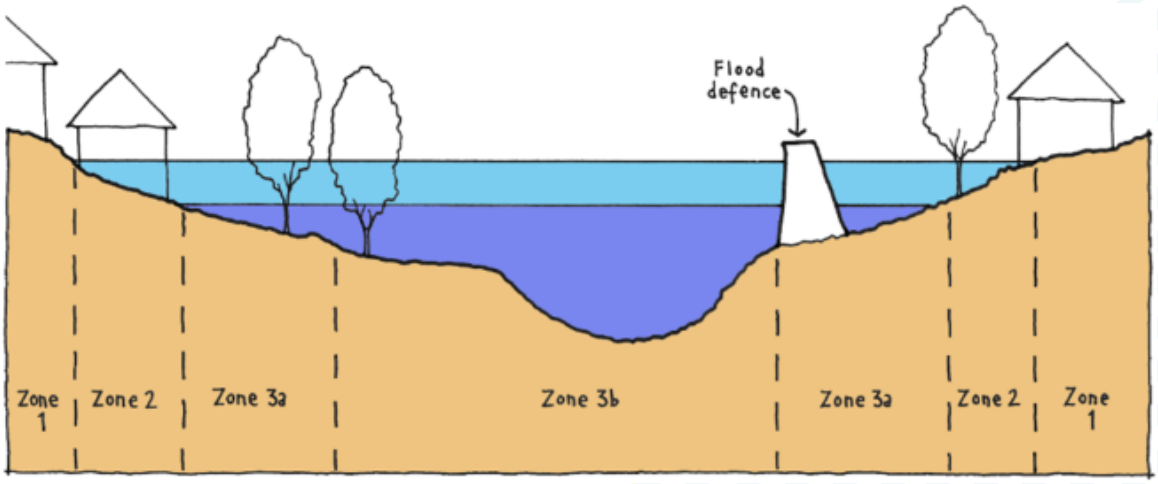


Table 4-1: Flood Zone descriptions

Zone	Probability	Description
Zone 1	Low	This zone comprises land assessed as having a less than 0.1% AEP (1 in 1000 annual probability of river or sea flooding in any year) for the present day.
		All land uses are appropriate in this zone.
		For development proposals on sites comprising one hectare or above the vulnerability to flooding from other sources as well as from river and sea flooding, and the potential to increase flood risk elsewhere through the addition of hard surfaces and the effect of the new development on surface water run-off, should be incorporated in a flood risk assessment.
Zone 2	Medium	This zone comprises land assessed as having between a 0.1% - 1% AEP (1 in 100 and 1 in 1,000 annual probability of river flooding) or between a 0.1% – 0.5% AEP (1 in 200 and 1 in 1,000 annual probability of sea flooding) for the present day.
		Essential infrastructure, water compatible infrastructure, less vulnerable and more vulnerable land uses (as set out by NPPF) are appropriate in this zone. Highly vulnerable land uses are allowed as long as they pass the Exception Test.
		All developments in this zone require an FRA.
Zone 3a	High	This zone comprises land assessed as having a greater than a 1.0% AEP (1 in 100 annual probability of river flooding) or a greater than a 0.5% AEP (1 in 200 annual probability of flooding from the sea) in any year for the present day. Developers and the local authorities should seek to reduce the overall level of flood risk, relocating development sequentially to areas of lower flood risk and attempting to restore the floodplain and make open space available for flood storage.
		Water compatible and less vulnerable land uses are permitted in this zone. Highly vulnerable land uses are not permitted. More vulnerable and essential infrastructure are only permitted if they pass the Exception Test.
		All developments in this zone require an FRA.
Zone 3b	Functional Floodplain	This zone comprises land where water has to flow or be stored in times of flood for the present day. Local planning authorities should identify, in their SFRA, areas of functional floodplain, in agreement with the Environment Agency. The identification of functional floodplain should take account of local circumstances.
		Only water compatible and essential infrastructure are permitted in this zone and should be designed to remain operational in times of flood, resulting in no loss of floodplain or blocking of water flow routes. They must also be safe for users and not increase flood risk elsewhere. Essential Infrastructure will only be permitted if it passes the Exception Test.
		All developments in this zone require an FRA.

In addition to the Flood Zones described in Table 1 of the PPG (Table 4-1), Swale Borough Council has made provision for consideration of Flood Zone 3a(i) for the purpose of performing the Sequential and Exception Tests in Faversham Creek. Further information can be found in Section 11.1.

4.1.2 Surface Water Flood Zones

As described in Section 6.2.1, Flood Zone 3a has been used as a precautionary approach to identify areas of Flood Zone 3b where no detailed modelling was available. Some dry valleys (these are valleys where there is no natural watercourse) with significant surface water flow paths within Swale have been identified as Flood Zone 3a in the Environment Agency mapping. However, the evidence suggests that the potential source of the flooding in these dry valleys is associated with surface water flooding, rather than fluvial or tidal.

According to the Environment Agency's **definition**, Flood Zones 'refer to the probability of river and sea flooding, ignoring the presence of defences'. As such surface water flooding is not normally included in Flood Zones. In recognition of the issue of surface water flooding in Swale and using the precautionary approach this SFRA defines a new flood zone for the Borough: a Surface Water Functional Flood Zone. These comprise land identified to be at high risk of being surface water flow paths.

Only Essential infrastructure should be considered as being permitted in these zones, subject to satisfying the Exception Test and any development that is implemented should be designed to remain operational in times of flood, resulting in no adverse or inappropriate interference with surface water flood flow paths or blocking of water flow routes. Proposals must also be safe for users and not increase flood risk elsewhere.

These areas are highlighted in Appendix C and the FRA requirements for development in these dry valleys are provided in Section 9.4.3

This Zone should not be included in the preparation of the Sequential Test, but on the basis it has similar characteristics to "Functional Flood Plain" proposed development will not normally be appropriate. For avoidance of doubt the Water Compatible development that is appropriate in Functional Flood Plain (Zone 3b) is not necessarily appropriate in a Surface Water Flood Zone.

4.2 Applying the Sequential Test and Exception Test in the preparation of the Local Plan

When preparing a Local Plan, the Local Planning Authority should demonstrate it has considered a range of site allocations, using SFRAs to apply the Sequential and Exception Tests where necessary.

The Sequential Test should be applied to the whole Local Planning Authority area to increase the likelihood of allocating development in areas not at risk of flooding. It is recommended that the Council considers the climate change maps to understand how the Flood Zones are predicted to change over the lifetime of the development. These maps can give an indication of the future Flood Zones.

In accordance with the NPPF guidance the Sequential Test should use the present-day flood zones for the consideration of site allocations and windfall sites. The Sequential Test can be undertaken as part of a Local Plan Sustainability Appraisal. Alternatively, it can be demonstrated through a free-standing document, or as part of strategic housing land or employment land availability assessments. NPPF Planning Practice Guidance for Flood Risk and Coastal Change describes how the **Sequential Test should be applied in the preparation of the Local Plan** (see Figure 4-2).

The Exception Test should only be applied following the application of the Sequential Test and as set out in Table 3 of the 2014 NPPF Planning Practice Guidance: Flood Risk and Coastal Change. The NPPF Guidance describes **how the Exception Test should be applied in the preparation of a Local Plan** (Figure 4-3).

Figure 4-2: Applying the Sequential Test in the preparation of a Local Plan

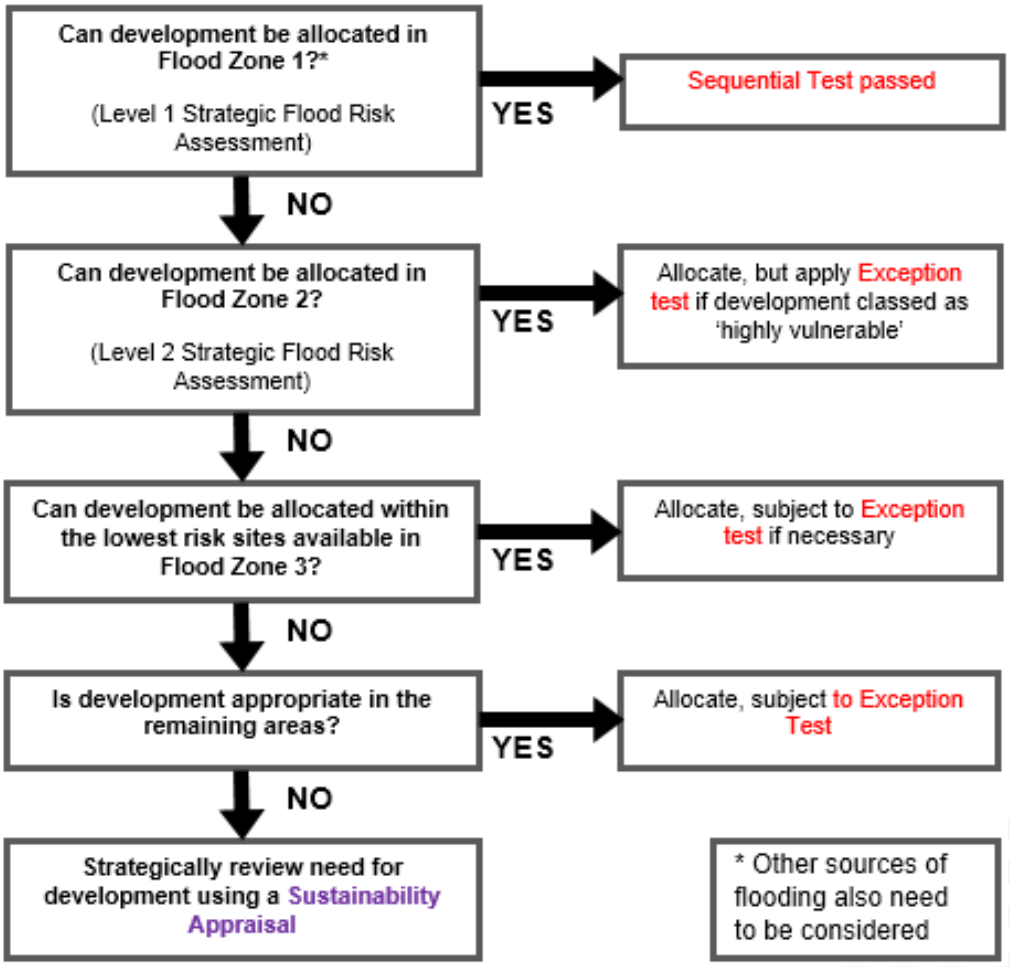
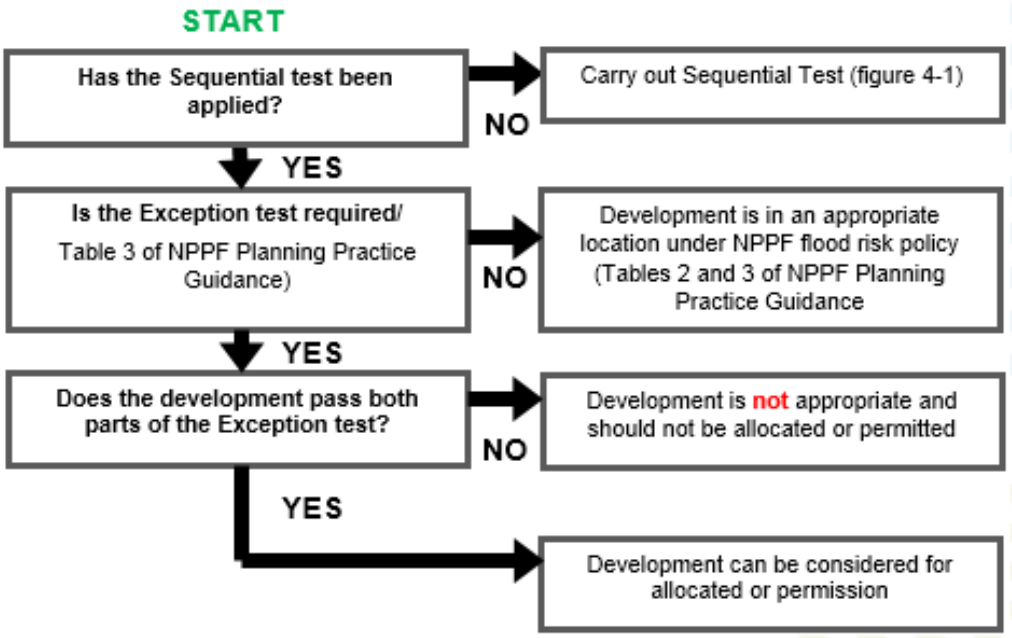


Figure 4-3: Applying the Exception Test in the preparation of a local plan



4.3 Applying the Sequential Test and Exception Test to individual planning applications

The NPPF Planning Practice Guidance sets out how developers and planners need to consider flood risk to, and from, the development site, following the broad approach of assessing, avoiding, managing and mitigating flood risk. A checklist for site-specific Flood Risk Assessments is provided in Paragraph 68 of the Guidance.

A site-specific Flood Risk Assessment should be carried out to assess flood risk to, and from, a development. The assessment should demonstrate how flood risk will be managed over a development's lifetime, taking climate change and the user vulnerability into account. The latest Environment Agency guidance for climate change allowances should be referred to. A Flood Risk Assessment should also consider the cumulative impact of the development, so flood risk is not exacerbated.

The NPPF Planning Practice Guidance sets out the following objectives for a site-specific Flood Risk Assessment which can be found in Section 9.2.3.

Sequential Test

The Sequential Test must be performed when considering the placement of future development and for planning application proposals. The sequential approach to locating development should be followed for all sources of flooding. The Flooding and Coastal Change Planning Practice Guidance to the NPPF gives detailed instructions on how to perform the test.

The Sequential Test does not need to be applied for individual developments under the following circumstances:

- The site has been identified in development plans through the Sequential Test
- Applications for minor development (as described in Paragraph 46 of the NPPG) or change of use (except for a change of use to a caravan, camping or chalet site, or to a mobile home or park home site)

It is normally reasonable to presume and state that individual sites that lie in Zone 1 satisfy the requirements of the Sequential Test. Consideration should be given to risks from all sources, areas with critical drainage problems and critical drainage areas. It should be noted that there are no critical drainage areas in Swale. Also, in some circumstances the zone mapping might not have been prepared for small local watercourses making it appear as if land is in Zone 1, when in fact the presence of such features introduces the risk of flooding. At such locations an FRA should be prepared to establish the extent of the Zones, based on site specific local modelling and included in the FRA. The outputs can then be used, as necessary to perform the sequential and exception tests.

Local circumstances must be used to define the area of application of the Sequential Test (within which it is appropriate to identify reasonably available alternatives). The criteria used to determine the appropriate search area relate to the catchment area for the type of development being proposed. Whilst for some sites this may be clear, in other cases it may be identified by other local plan policies. A pragmatic approach should be taken when applying the Sequential Test and should be agreed with the Council.

Swale Borough Council, with advice from the Environment Agency, are responsible for considering the extent to which Sequential Test considerations have been satisfied and will need to be satisfied that the proposed development would be safe and not lead to increased flood risk elsewhere.

Exception Test

If, following application of the Sequential Test it is not possible for the development to be located in areas with a lower probability of flooding the Exception Test must then be applied if deemed appropriate. The aim of the Exception Test is to ensure that more vulnerable uses, such as residential development can be implemented safely and are not located in areas where the hazards and consequences of flooding are inappropriate. For the test to be satisfied, the following two elements have to be accepted for development to be allocated or permitted:

1. It must be demonstrated that the development provides wider sustainability benefits to the community that outweigh flood risk, informed by a SFRA where one has been prepared.

Local Planning Authorities will need to consider what criteria they will use to assess whether this part of the Exception Test has been satisfied and give advice to enable applicants to provide evidence to demonstrate that it has been passed. If the application fails to prove this, the Local Planning Authority should consider whether the use of planning conditions and / or planning obligations could allow it to pass. If this is not possible, this part of the Exception Test has not been passed and planning permission should be refused[2].

2. A site-specific Flood Risk Assessment must demonstrate that the development will be safe for its lifetime, taking account of the vulnerability of its users, without increasing flood risk elsewhere, and, where possible, will reduce flood risk overall.

The site-specific Flood Risk Assessment should demonstrate that the site will be safe, and people will not be exposed to hazardous flooding from any source. The details of what is expected to be included in a Flood Risk Assessment are outlined in Section 9.

The NPPF provides detailed information on how the Test can be applied.

4.4 Actual flood risk

If it has not been possible for all future development to be situated in Zone 1 then a more detailed assessment is needed to understand the implications of locating proposed development in Flood Zones 2 or 3. This is accomplished by considering information on the "actual risk" of flooding. The assessment of actual risk takes account of the presence of flood defences and provides a picture of the safety of existing and proposed development. It should be understood that the standard of protection afforded by flood defences is not constant and it is presumed that the required minimum standards for new development are:

- residential development should be protected against flooding with an annual probability of river flooding of 1% AEP (1 in 100-year chance of flooding); and
- residential development should be protected against flooding with an annual probability of tidal (sea) flooding of 0.5% AEP (1 in 200-year chance of flooding) in any year.

The assessment of the actual risk should take the following issues into account:

- The level of protection afforded by existing defences might be less than the appropriate standards and hence may need to be improved if further growth is contemplated.
- The flood risk management policy for the defences will provide information on the level of future commitment to maintain existing standards of protection. If there is a conflict between the proposed level of commitment

2 NPPF Planning Practice Guidance: Flood Risk and Coastal Change (paragraph 037, Reference ID: 7-056-20140306) March 2014

and the future needs to support growth, then it will be a priority for the Flood Risk Management Strategy to be reviewed.

- The standard of safety must be maintained for the intended lifetime of the development. FRAs should clearly state the intended lifetime of the development so that planning decisions can be made on long term sustainability. Over time the effects of climate change may reduce the standard of protection afforded by defences, due to increased river flows and levels, and so commitment is needed to invest in the maintenance and upgrade of defences if the present-day levels of protection are to be maintained and where necessary land secured that is required for affordable future flood risk management measures.
- The assessment of actual risk can include consideration of the magnitude of the hazard posed by flooding. By understanding the depth, velocity, speed of onset, rate of rise and duration of floodwater it is possible to assess the level of hazard posed by flood events from the respective sources. This assessment will be needed in circumstances where a) the consequences of flooding need to be mitigated or b) where it is proposed to place lower vulnerability development in areas of flood risk.

4.5 Residual flood risk

Residual risk refers to the risks that remain after measures have been taken to alleviate flooding (such as flood defences). It is important that these risks are quantified to confirm that the consequences can be safely managed. The residual risk can be:

- the effects of a flood with a magnitude greater than that for which the defences or management measures have been designed to alleviate (the 'design flood'). This can result in overtopping of flood banks, failure of flood gates to cope with the level of flow or failure of pumping systems to cope with the incoming discharges; and/or
- failure of the defences or flood risk management measures to perform their intended duty. This could be breach failure of flood embankments, failure of flood gates to operate in the intended manner, or failure of pumping stations.

4.6 Cumulative impacts

When allocating land for development, consideration must be given to the potential cumulative impact of development on flood risk. The increase in impermeable surfaces and resulting rise in runoff increases the chances of surface water flooding if suitable mitigation measures, such as SuDS, are not put in place. Additionally, the increase in runoff may result in more flow entering watercourses, increasing the risk of fluvial flooding downstream.

Consideration must also be given to the potential cumulative impact of the loss of floodplain as a result of development. The effect of the loss of floodplain storage should be assessed, at both the development and elsewhere within the catchment and, if required, the scale and scope of appropriate mitigation should be identified.

Whilst the increase in runoff, or loss in floodplain storage, from individual developments may only have a minimal impact on flood risk, the cumulative effect of multiple developments may be more severe without appropriate mitigation measures.

For windfall sites which have not yet been allocated, the NPPF requires that the cumulative impact of development should be considered at the application stage and the appropriate mitigation measures undertaken to ensure flood risk is not exacerbated, and in many cases the development should be used to improve the flood risk.

4.7 Cross boundary considerations

The topography and location of the borough means that there are several watercourses and overland flow routes that cross the Swale Borough boundary. As such, future development, both within and outside the borough, can have the potential to affect flood risk to existing development and surrounding areas, depending on the effectiveness of SuDS and drainage implementation. Swale Borough has boundaries with various Local Authorities, displayed in Figure 1-1.

5 Climate change

5.1 Climate change, the NPPF and NPPG

The updated NPPF sets out how the planning system should help minimise vulnerability and provide resilience to the impacts of climate change. The NPPF states that new development should be planned for in ways that avoids vulnerability to the range of effects that result from climate change.

NPPF and NPPG describe how FRAs should demonstrate how flood risk will be managed over the lifetime of the development, taking climate change into account.

The NPPF also states that the 'sequential approach should be used in areas known to be at risk now or in the future from any form of flooding' (para 158).

5.2 Climate change guidance and allowances

The Environment Agency published **updated climate change guidance** on 19 February 2016 (further updated on 15 February 2019). The 2016 climate change guidance includes climate change predictions of anticipated change for peak river flow, sea level rise and peak rainfall intensity. By making an allowance for these climate change predictions it will help reduce the vulnerability of the development and provide resilience to flooding in the future. These allowances are based on climate change projections and different scenarios of carbon dioxide emissions to the atmosphere.

However, at the time of preparing the 2019 SFRA this guidance is being revised in line with the **UK Climate Projections 2018 (UKCP18)**. The Environment Agency has formally confirmed that the 2016 allowances should be used for the purposes of preparing information in the 2019 Level 1 SFRA. However, please contact the Environment Agency for interim guidance if you are preparing a flood risk assessment for a development.

5.3 Peak river flows

Climate change is expected to increase the frequency, extent and impact of flooding, reflected in peak river flows. Wetter winters and more intense rainfall may increase fluvial flooding and surface water runoff and there may be increased storm intensity in summer. Rising river levels may also increase flood risk. Also influential for Swale is the predicted increase in mean sea level, as predicted flood levels along extensive lengths of the estuary reaches of rivers are greatly affected by tide levels.

For the purposes of this SFRA, the peak river flow allowances provided in the **2016 Environment Agency guidance** (updated in February 2019) have been used where readily available.

These allowances show the anticipated changes in peak flow in the Environment Agency river basin districts. The majority of the borough is located within the Thames River Basin District with a small area in the east of the borough in the South East River Basin District. Maps showing the extent of River Basins are **published by the Environment Agency**.

The guidance provides uplift in peak flows based on percentiles. A percentile is a is a measure used in statistics indicating the value below which a given proportion (percentage) of observations in a set of results falls. For flood risk it is a way of taking account of the uncertainty in the methods and data used to define predicted flood water levels as generated for climate change conditions. The higher the percentile the more likely it is that the range of statistically generated results will lie within the specified threshold. Whereas a lower percentile will not encompass such a wide range of statistically generated values and thus the predicted flood water level would be lower.

The percentiles are based on the following:

- Central allowance is based on the 50th percentile (so only contains half of the total number of results generated)
- Higher central is based on the 70th percentile
- Upper end is based on the 90th percentile

These allowances (increases) are provided, in the form of figures for the total potential change anticipated, for three climate change periods:

- The '2020s' (2015 to 2039)
- The '2050s' (2040 to 2069)
- The '2080s' (2070 to 2115)

The time period used in the assessment depends upon the expected lifetime of the proposed development. Residential development should be considered for a minimum of 100 years, whilst the lifetime of a non-residential development depends upon the characteristics of that development. Further information on what is considered to be the lifetime of development is provided in paragraph 26 of the **NPPG**.

At the time of preparing the SFRA this guidance was being revised in line with the **UKCP18**. The Environment Agency should be contacted for the latest guidance if you are preparing a flood risk assessment for a development.

5.4 Peak rainfall intensity allowance

Climate change is predicted to result in wetter winters and increased summer storm intensity in the future. This increased rainfall intensity will affect land and urban drainage systems, resulting in surface water flooding, due to the increased volume of water entering the systems.

At the time of the preparation of this SFRA the peak rainfall intensity allowances were being reviewed by the Environment Agency due to the publication of the **UKCP18**. The Environment Agency should be contacted for the latest guidance for Flood Risk Assessments.

5.5 Tidal/coastal change

The **Environment Agency's 2016** sea level allowances have been used in the preparation of this report as confirmed by the Environment Agency. However, due to the publication of the **UKCP18** the Environment Agency should be contacted for the latest guidance for Flood Risk Assessments.

5.6 Groundwater

The effect of climate change on groundwater flooding problems, and those watercourses where groundwater has a large influence on winter flood flows, is much more uncertain. Milder wetter winters may increase the frequency of groundwater flooding incidents in areas that are already susceptible, but warmer drier summers may counteract this effect by drawing down groundwater levels to a greater extent during the summer months. The effect of climate change on groundwater levels for sites in areas where groundwater is known to be an issue should be considered at the planning application stage.

5.7 The impact of climate change in the Local Plan area

5.7.1 Previous studies

The **UKCP18** provides a number of future projections for different variables across the UK. Climate change will cause changes in trends and mean values in temperature and rainfall.

However, the more influential effect of climate change with respect to flood risk and drought is to increase the chance of occurrence and severity of more extreme wet and dry events. It is important that development is planned with consideration of these extreme events.

5.7.2 Adapting to climate change

NPPG Climate Change contains information and guidance for how to identify suitable mitigation and adaptation measure in the planning process to address the impacts of climate change. Examples of adapting to climate change include:

- Considering future climate risks when allocating development sites to ensure risks are understood over the development's lifetime
- Considering the impact of and promoting design responses to flood risk and coastal change for the lifetime of the development
- Considering availability of water and water infrastructure for the lifetime of the development and design responses to promote water efficiency and protect water quality
- Promoting adaptation approaches in design policies for developments and the public realm for example by building in flexibility to allow future adaptation if needed, such as setting new development back from watercourses

At the county level, KCC adopted the **Kent Environment Strategy** in 2016. The strategy's priorities include integrating strategy and policy, changing behaviours, conserving and enhancing natural resources, improving resource efficiency, improving resilience to environmental change, and encouraging sustainable growth. Supporting the strategy, the **Kent State of the Environment Report: Evidence Base Supporting the Strategy** provides statistics and information about Kent, including greenhouse gas emissions, energy consumption, waste and flood risk.

At the borough level, Section 7.6 of **The Swale Borough Local Plan** outlines the policies of the borough for meeting the challenges of climate change.

6 Sources of information used in preparing the SFRA

6.1 Historic flood risk

The historic flood risk in the Local Plan area has been assessed using information of recorded incidents provided by Kent County Council, the Environment Agency's recorded flood outline dataset and Southern Water's Sewage Incident Reporting Form (SIRF). This has been supplemented with other information collected during the preparation of the SFRA. The key considerations from these sources are outlined in Section 7.1, the Environment Agency's recorded flood outlines are presented in Appendix A and on Swale Borough Council's **interactive maps**.

6.2 Flood Zones

The Flood Zones described in Section 4.1.1 should be used for the basis for decision making in the emerging Local Plan, along with Flood Zone 3a(i) for Faversham Creek as described in Section 11.1. This will in some circumstances update the existing Environment Agency Flood Zones.

6.2.1 Delineation of Flood Zone 3b

Where modelled results are available for Flood Zone 3b they show flood risk that accounts for the presence of existing flood risk management features and flood defences, unlike the Zones 3a and 2 (which do not take account of defences). The mapping in the SFRA identifies Flood Zone 3b as land which would flood with a 5% AEP, where detailed modelling exists.

Where detailed modelling has not been undertaken and the 5% AEP outputs are not available, the precautionary approach has been taken using the 1% AEP undefended scenario (Flood Zone 3a). If a proposed development is shown to be within this area, further investigation should be undertaken as part of a detailed site-specific FRA to define and confirm the extent of Flood Zone 3b (as necessary, taking into account the presence of defences).

The effect of wave overtopping along the coastline has only been included in the Flood Zone 3b delineation at locations considered appropriate by the Environment Agency along the North Kent Coast. These areas are included in the Flood Zone mapping in Appendix C and on Swale Borough Council's **interactive maps**.

If existing development or infrastructure is shown in Flood Zone 3b, additional consideration should be given to whether the specific location is appropriate for designation as 'Functional' with respect to the storage or flow of water in time of flood.

Flood Zone mapping for the Local Plan area can be found in Appendix C. The map highlights where a precautionary approach has been used to identify Flood Zone 3b.

Care should be taken when interpreting how Flood Zone 3b is predicted to change as a consequence of climate change effects, particularly at locations where the risk of flooding is affected by a change to the mean sea level. At such locations it is possible that the assessment performed to estimate the frequency of inundation (1 in 20 for Flood Zone 3b) will not include an allowance for the potential increase in standard of protection provided by flood risk management features. In these circumstances more detailed assessments should be performed when considering whether development is appropriate to understand the commitment required to improve the standard of protection and how this affects the extent of Flood Zone 3b.

6.3 Fluvial flood risk models used in this SFRA

Table 6-1 lists the fluvial flood risk modelling used to inform the SFRA. A list of the watercourses located within Swale Borough are found in Section 7.3 and are shown in Appendix B and on Swale Borough Council's **interactive maps**.

Table 6-1: Fluvial flood risk models used in the Level 1 SFRA

Model name	Year	Software (type)
Iwade Stream	2017	Flood Modeller/TUFLOW
Warden Bay Stream	2016	Flood Modeller/TUFLOW
Scrapsgate Drain	2014	ISIS/TUFLOW

6.4 Tidal and Coastal modelling used in this SFRA

The North Kent Coast flood risk coastal modelling study (2019) has been used to understand the tidal and coastal flood risk along the Local Plan area. The tidal mapping provides information for present day Flood Zone 3b, 3a and 2 (Appendix C) and for the climate change event for the years 2070 and 2115 (Appendix D). These datasets are also presented on Swale Borough Council's **interactive mapping portal**.

6.5 Climate change

The **Environment Agency 2016 climate change guidance** shows that for watercourses in the Thames River Basin District the 25%, 35% and 70% allowances should be considered. For further information on climate change allowances please refer to Section 5.2.

As part of this SFRA, the Environment Agency confirmed that readily available climate change modelling should be used, and no additional modelling was required.

The 70% climate change allowances were not available for the Scrapsgate Drain and Warden Bay Stream, so alternative climate change allowances which were readily available have been used as indicative climate change extents. Table 6-2 shows the climate change allowances which have been used in this assessment.

Table 6-2: Climate change allowances used within the Level 1 SFRA

Model	Allowances
Scrapsgate Drain (2014)	25%, 35%, 50% and 105%
Warden Bay Stream (2016)	25%, 35% and 65%
Iwade Stream (2017)	25%, 35% and 70%
North Kent Coast (2019)	2070 and 2115 epochs

Where there is no fluvial model available, Flood Zone 2 (0.1% AEP extent) has been used to provide indicative information on the potential effects of climate change. This level of assessment is suitable for an SFRA. However, detailed hydraulic modelling using topographic survey would be required at a site-specific level to confirm the flood risk to these sites.

Although the SFRA should consider the next 100 years up until 2119, the only tidal climate change modelling available from the Environment Agency was up until 2115 so this has been used in the assessment.

6.6 Surface Water

Mapping of surface water flood risk in Swale Borough Council's Local Plan area has been taken from the Risk of Flooding from Surface Water (RoFSW) published online by the Environment Agency. These maps are intended to provide a consistent standard of assessment for surface water flood risk across England and Wales in order to help LLFAs, the Environment Agency and any potential developers to focus their management of surface water flood risk. The different surface water risk categories used in the RoFSW mapping are defined in Table 6-3.

The RoFSW is derived primarily from identifying topographical flow paths of existing watercourses or dry valleys that contain some isolated ponding locations in low lying areas. They provide a map which displays different levels of surface water flood risk depending on the annual probability of the land in question being inundated by surface water.

It is worth noting that Swale is known to contain a number of dry valleys that are identified on the RoFSW mapping. Dry valleys with significant over land flow paths have been identified as Surface Water Functional Flood Zones as descried in Section4.1.2.

Table 6-3: Surface water risk categories used in the RoFSW mapping

Category	Definition
High	Flooding occurring as a result of rainfall with a 3.3% AEP (greater than 1 in 30 chance in any given year)
Medium	Flooding occurring as a result of rainfall of between 1% AEP (1 in 100 chance in any given year) and a 3.3% AEP (1 in 30 chance in any given year).
Low	Flooding occurring as a result of rainfall of between a 0.1% AEP (1 in 1,000 chance in any given year) and 1% AEP (1 in 100 chance in any given year).
Very Low	Flooding occurring as a result of rainfall with a less than a 0.1% AEP (1 in 1,000 chance in any given year).

Although the RoFSW offers an improvement on previously available datasets, the results should not be used to understand flood risk for individual properties. The results should be used for high level assessments such as SFRAs for local authorities. If a particular site is indicated in the Environment Agency mapping to be at risk from surface water flooding, a more detailed assessment should be considered to more accurately illustrate the flood risk at a site-specific scale. Such an assessment will use the RoFSW in partnership with other sources of local flooding information, to confirm the presence of a surface water risk at that particular location.

The RoFSW map for the Local Plan area can be found in Appendix E and on Swale Borough Council's **interactive mapping portal**.

A draft Flood Investigation report (Section 19 report) prepared by Kent County Council reviewed the major surface water flood event that was experienced in May 2018. The 2019 SFRA has drawn on the findings of the Section 19 report, as presented in Section 7.

6.7 Groundwater

JBA has developed a range of Groundwater Flood Map products at the national scale. The 5m resolution JBA Groundwater Flood Map has been used within the SFRA. The modelling involved simulating groundwater levels for a range of Annual Exceedance Probabilities (including 1.3%, 1% and 0.5% AEPs). Groundwater levels were then compared to ground surface levels to determine the head difference in metres. The JBA Groundwater Flood Map categorises the head difference (m) into five feature classes based on the 1% AEP model outputs. The modelled groundwater levels are not predictions of typical groundwater levels. Rather they are flood levels i.e. groundwater levels that might be expected after a winter recharge season with 1% AEP, so would represent an extreme scenario.

It should be noted that the JBA Groundwater Flood Map is suitable for general broad-scale assessment of the groundwater flood hazard in an area but is not explicitly

designed for the assessment of flood hazard at the scale of a single property. In high risk areas a site-specific risk assessment for groundwater flooding is recommended to fully inform the likelihood of flooding.

The JBA Groundwater Flood Map for the Local Plan area can be found in Appendix F.

6.8 Sewers

Historical incidents of flooding are detailed by Southern Water through their Sewer Incident Report Form (SIRF) Data. This database records incidents of flooding relating to public foul, combined or surface water sewers and displays which properties suffered flooding.

The SIRF for the Local Plan area can be found in Table 7-3.

6.9 Reservoirs

The risk of inundation due to reservoir breach or failure of reservoirs within the area has been mapped using the outlines available from the Risk of Flooding from Reservoirs dataset made available by the Environment Agency.

The Risk of Flooding from Reservoirs mapping for the Local Plan area can be found in Appendix G and on Swale Borough Council's **interactive mapping portal**. An Environment Agency programme for updating and improving this mapping is in progress and is due to be completed by 2020.

The reservoirs located in the Local Plan area are listed in Section 7.10.

6.10 Suite of maps

All the mapping can be found in the appendices to this SFRA and on Swale Borough on Swale Borough Council's **interactive mapping.**

6.11 Other relevant flood risk information

Users of this SFRA should also refer to other relevant information on flood risk where available and appropriate. This information includes:

- **North Kent Rivers Catchment Flood Management Plan** (Environment Agency, 2009). Further information can be found in Section 2.5.1.
- **Kent Local Flood Risk Management Strategy 2017-2023** (Kent County Council, 2017). Further information can be found in Section 2.3.3.
- **Thames River Basin District River Basin Management Plan** (Environment Agency, 2016). Further information can be found in Section 2.6.
- **Isle of Grain to South Foreland Shoreline Management Plan** (South East Coastal Group, 2010). Further information can be found in Section 2.7.1.
- **Medway Estuary and Swale Shoreline Management Plan** (2010) (South East Coastal Group). Further information can be found in Section 2.7.1.
- **Kent County Council Drainage and Planning Policy Statement** (Kent County Council 2017). Further information can be found in Section 2.3.4.
- **Medway Estuary and Swale flood and coastal risk management strategy** (Environment Agency, 2019). Further information can be found in Section 2.7.2.
- **Kent County Council Flood Response Plan** (Kent County Council, 2017)

Provides information on the principles determining the response of KCC to a flooding event within their local authority administrative area. This document details the actions, roles and responsibilities in response to a flood event.

- **Kent County Council Flood Risk to Communities in Swale** (Kent County Council, 2017)

This document provides anecdotal information on the nature and magnitude of flood risk across Swale Borough. Kent County Council has noted that some reports of historical flooding within the report have not been confirmed as they hold no evidence of these flood occurring.

7 Understanding flood risk in the Local Plan area

7.1 Historical flooding

The Local Plan area has a long history of recorded flood events caused by multiple sources of flooding. Information collated from the Environment Agency's recorded flood outlines, Kent County Council's recorded flood incidents and Southern Water's SIRF datasets were assessed to understand the historic flooding in the Local Plan area.

The data shows that large areas of Swale Borough have been impacted by tidal flooding in the past, including key settlements of Sittingbourne, Faversham, Sheerness and Queenborough. Tidal flooding is considered to have been the most significant cause of historic flooding in the borough and has a significant influence on the flood levels in the lower reaches of rivers.

Surface water flooding has been recorded in almost every settlement across the Local Plan area. Although surface water is not the most significant source of flooding in the borough, it is the most widespread.

Fluvial flood events have been recorded along Iwade Stream, Scrapsgate Drain, and White Drain.

Groundwater flooding has been recorded in Sittingbourne, Boughton and Faversham.

The key historical incidents of flooding identified are summarised as follows:

- **January 1953** – A large storm surge coincided with spring high tides, with extensive flooding recorded in Sheerness, Queenborough, Faversham and the south of the Isle of Sheppey. Tidal defences were overtopped along Faversham Creek and Milton Creek, as well as at Sheerness, Warden and the Isle of Harty, with widespread flooding of property reported[3].
- **January 1978** – Tidal defences were overtopped at Faversham and at marshes in the west of the SFRA area by a storm surge. Defences along Conyer Creek and at the Isle of Harty were breached or failed, though no properties were reported to have experienced flooding[3].
- **October 2000** – The Environment Agency's recorded flood outlines show that the channel capacity in the Iwade Stream was exceeded and caused flooding in the area.
- **December 2013** – A tidal surge overtopped defences north of Faversham resulting in the flooding of several properties along Faversham Creek
- **July 2015** – Heavy rainfall resulted in surface water flooding across Kent and parts of Sussex, notably impacting Faversham[4].
- **May 2018** – Heavy rainfall led to widespread surface water flooding in many settlements across the study area. The findings of a Section 19 Flood Investigation Report on the event are summarised in Section 7.1.1.

Appendix A shows the historic flood extents provided by the Environment Agency but does not include the Kent County Council's recorded flood incidents or Southern Water's SIRF data.

7.1.1 Kent County Council May 2018 Flood Event Report

A Section 19 Flood Investigation Report reviewing the major flood event on May 29 2018 is being finalised by Kent County Council at the time of preparing this SFRA. The findings of the draft report identify that the extremity of the rainfall (informed by analysis of the depth of rain that fell and its duration) varied across Swale Borough,

3 Halcrow, Swale Borough Council SFRA for Local Development Framework Level 1 and 2 Assessments, 2009.
4 Kent Online, Storm in Kent, 2015. Available: https://www.kentonline.co.uk/faversham/news/power-cuts-and-flooding-as-41637/

ranging from an estimated 1.8% AEP event in Sittingbourne to over an estimated 0.9% AEP event at Doddington.

Widespread surface water flooding was observed across Swale Borough following intense rainfall on May 29 2018. Flooding was reported in many settlements across the study area, including Bapchild, Borden, Bredgar, Doddington, Faversham, Iwade, Lynstead, Newington, Oare, Sittingbourne, Stalisfield Green, Teynham and Tunstall. It should be noted that this list of affected locations is not exhaustive, and many other localised incidences of road flooding were also reported at this time. In addition to surface water flooding sources being an issue, the heavy rainfall also led to flooding from watercourses in places, most notably in Iwade where fluvial flooding occurred as culverts in the settlement were overwhelmed. Approximately 90 properties in Swale Borough were reported to have flooded.

7.2 Topography and geology

7.2.1 Topography

As shown in Figure 7-1, the topography of the local plan area comprises low-lying ground in the north of the mainland, associated with the area surrounding The Swale, and areas of higher elevations in the south of the mainland. The Kent Downs Area of Outstanding Natural Beauty (AONB) runs through the south of the Local Plan mainland area, wherein the highest elevation is approximately 277m AOD.

The Isle of Sheppey is low lying in the south with higher elevations in the north at approximately 75m AOD. The majority of Swale Borough is just above sea level.

7.2.2 Geology

The geology of a catchment can be an important influencing factor on the way that water runs off the ground surface. This is primarily due to variations in the permeability of the surface material and bedrock stratigraphy.

Figure 7-2 and Figure 7-3 show the bedrock (solid permeable) formations and the superficial deposits (permeable, unconsolidated) in the Local Plan area respectively.

The bedrock layers and superficial deposits are identified as being aquifers that are classified as follows and are shown in Figure 7-4 and Figure 7-5 respectively:

- **Principal**: layers of rock or drift deposits with high permeability and, therefore, provide a high level of water storage
- **Secondary A**: rock layers or drift deposits capable of supporting water supplies at a local level and, in some cases, forming an important source of base flow to rivers
- **Secondary B**: lower permeability layers of rock or drift deposits which may store and yield limited amounts of groundwater
- **Secondary undifferentiated**: rock types which do not fit into either category A or B.
- **Unproductive Strata**: rock layers and drift deposits with low permeability and, therefore, have a negligible impact on water supply or river base flow.

The bedrock geology in the Local Plan area is classified as a mixture of Principal and Secondary A aquifers and unproductive strata.

The superficial deposits in Swale Borough are classified as Secondary A aquifers, which are associated with areas of alluvium, Secondary (undifferentiated) aquifers and unproductive deposits.

Figure 7-1: Topography of the Local Plan area

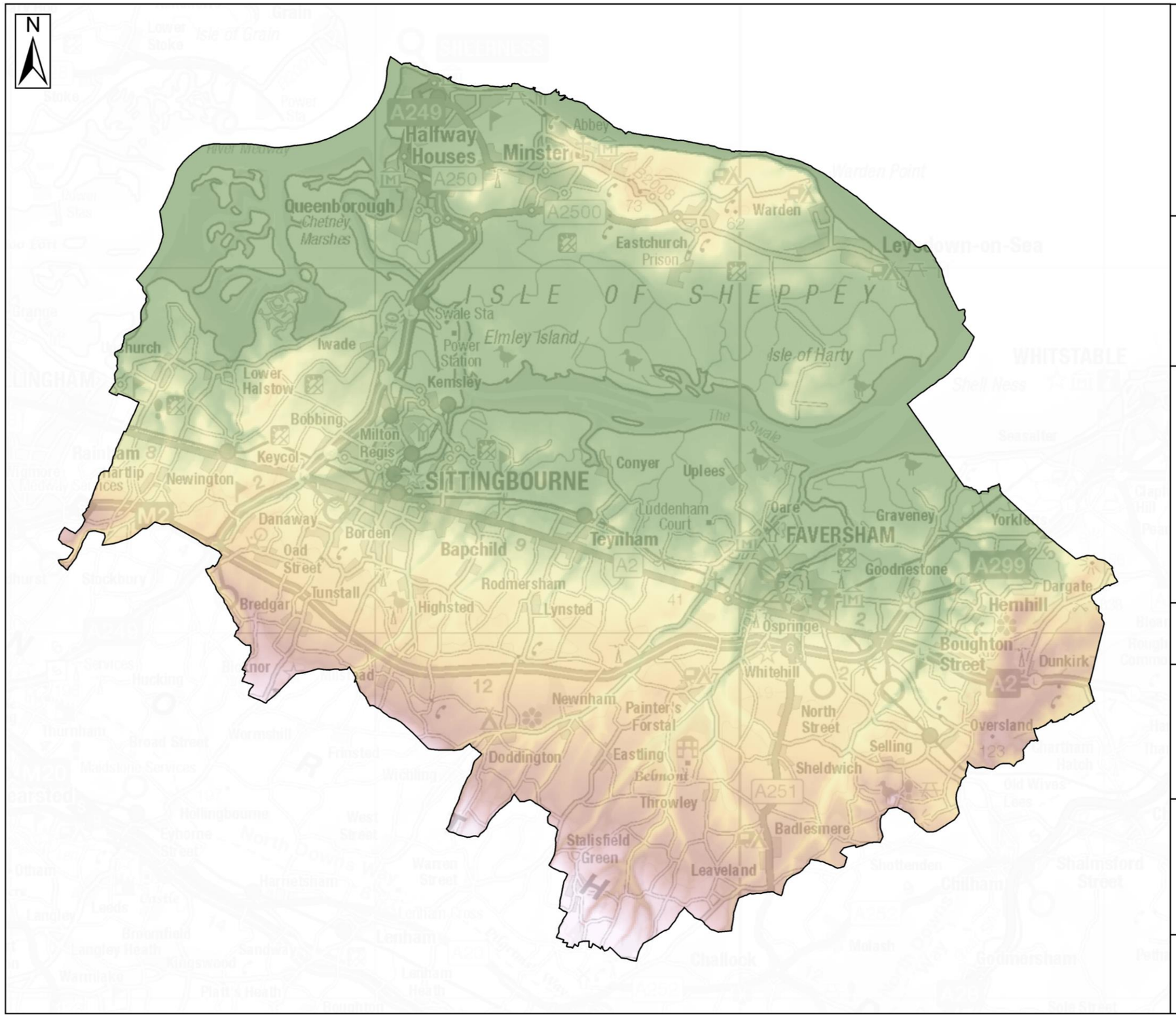


Figure 7-2: Bedrock geology in the Local Plan area

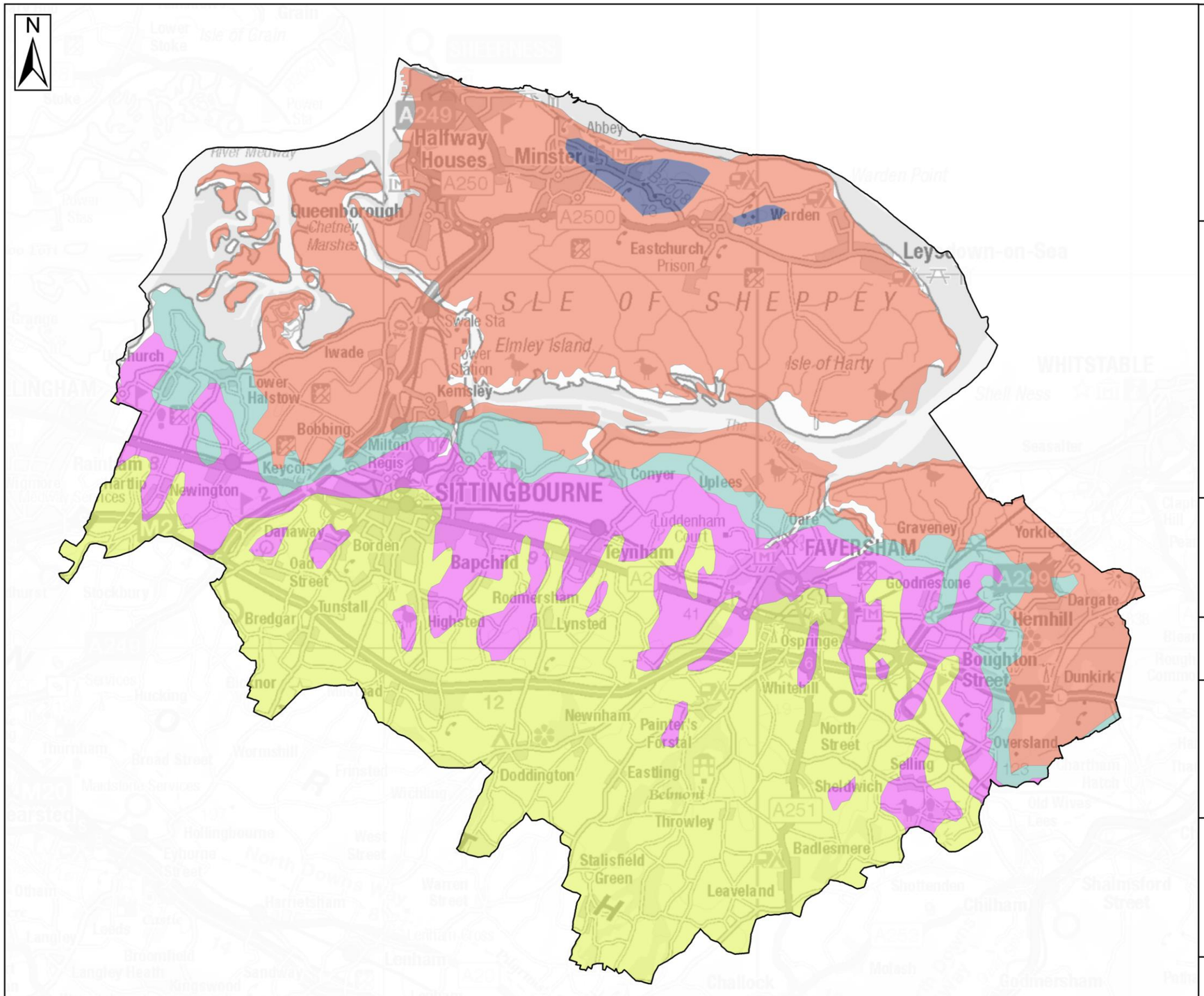


Figure 7-3: Superficial deposits in the Local Plan area

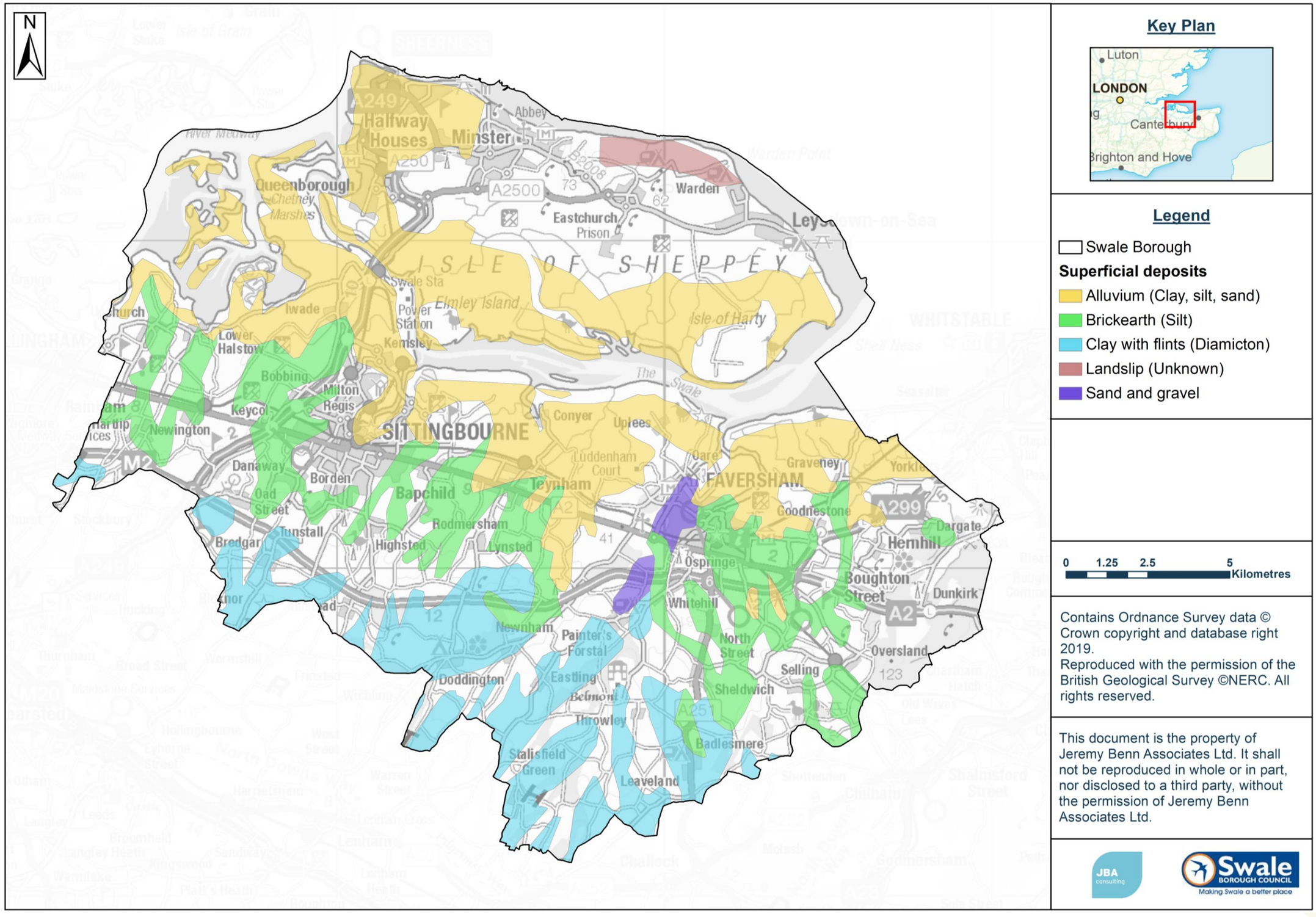


Figure 7-4: Bedrock aquifer designation in the Local Plan area

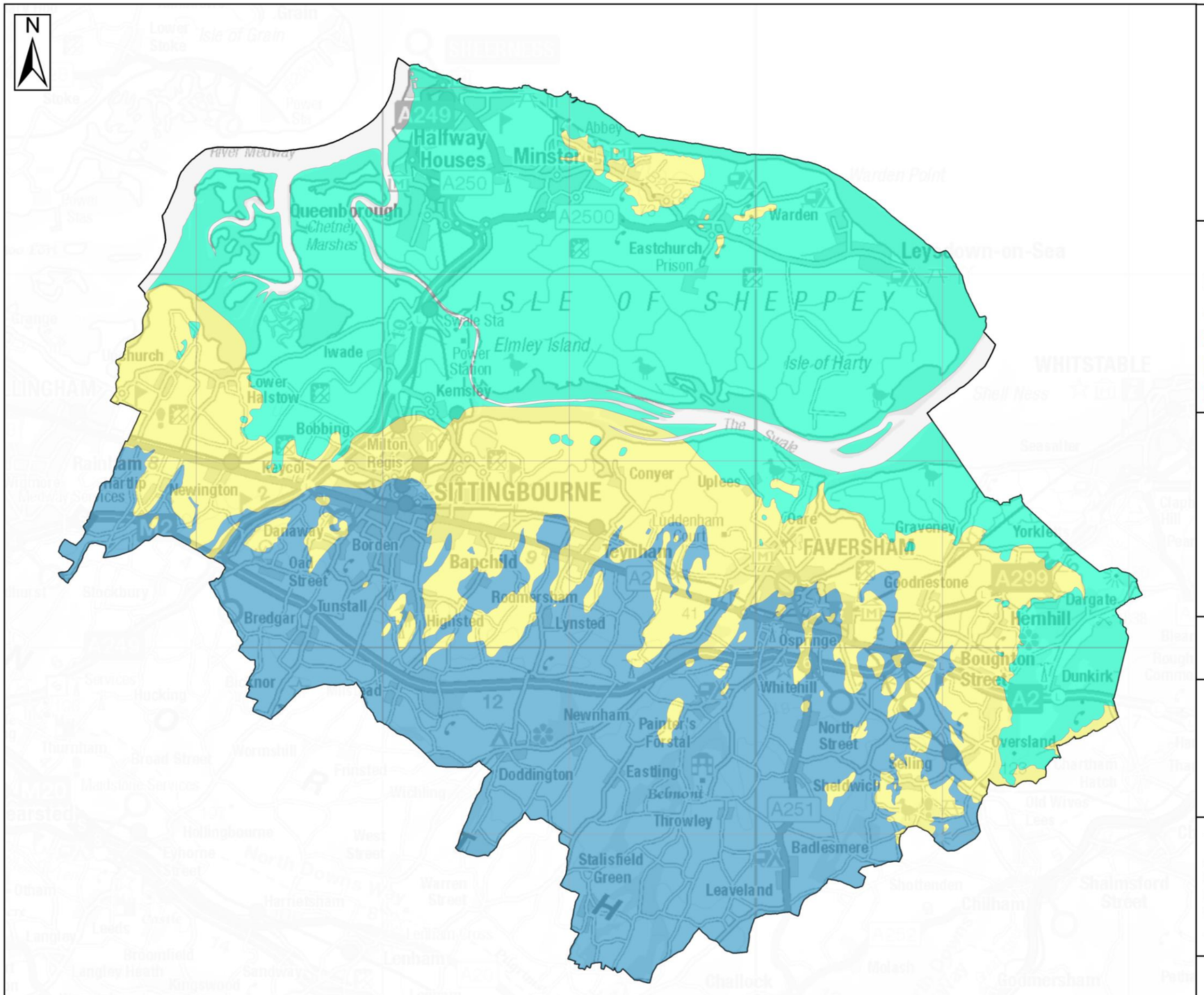
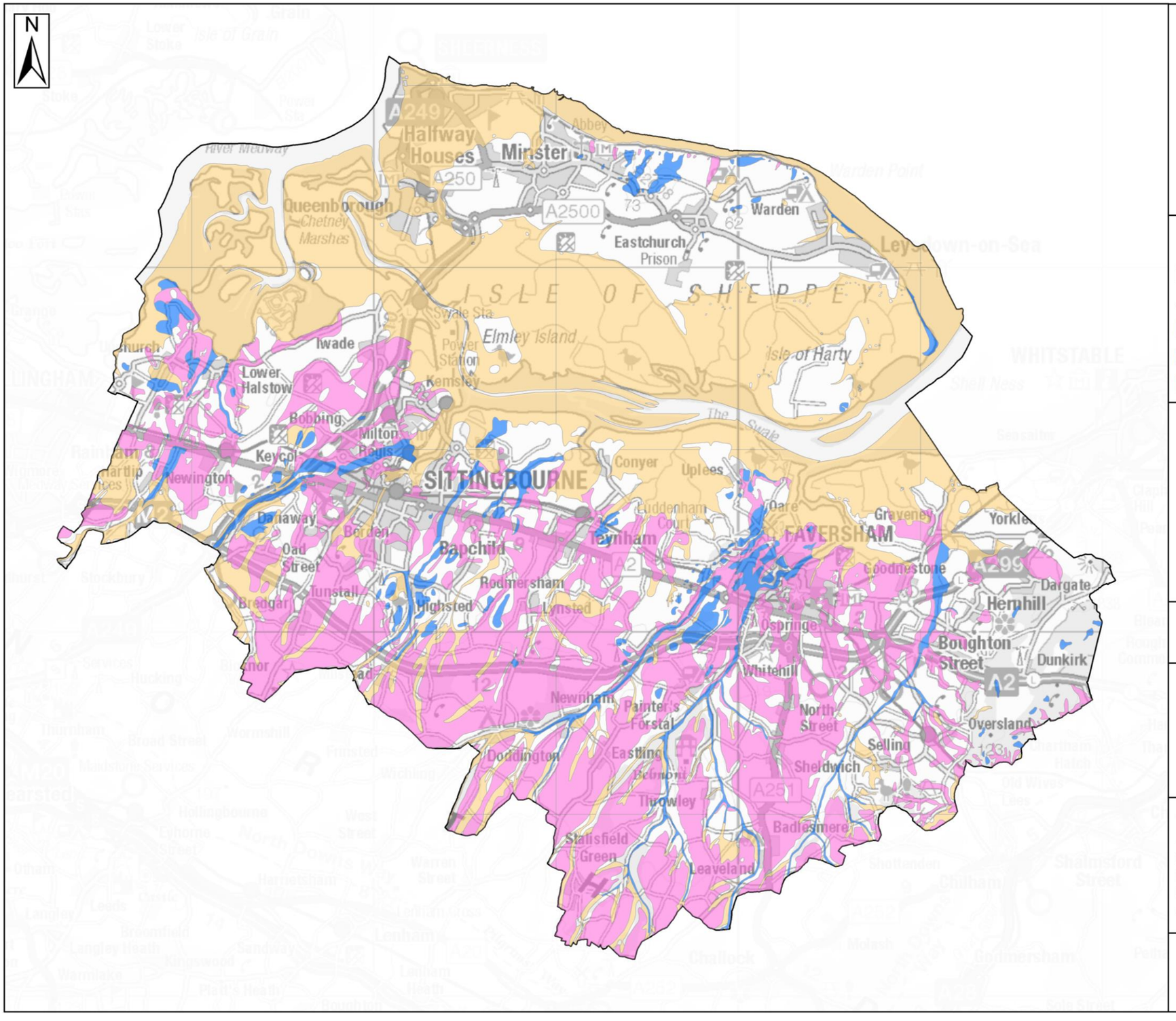


Figure 7-5: Superficial aquifer designation in the Local Plan area



7.3 Watercourses and channels

The Swale and the River Medway tidal channels are the largest water features within the Local Plan area. The Swale runs through the centre of the Local Plan borough, separating the Isle of Sheppey from the mainland, with several watercourses joining which drain the land to the north and south. The River Medway runs along the northwest border of Swale Borough. There are also two smaller principal watercourses draining the north of the Isle of Sheppey.

A summary of the main watercourses in the Local Plan area is provided below in Table 7-1, all of which are tidally influenced at some point along their reach.. Mapping indicating the location of the principal watercourses can be found in Appendix B.

Table 7-1: Watercourses and channels in the study area

Watercourse / channel	Description
The Swale	An estuarine area through the centre of Swale Borough, separating the Isle of Sheppey from the mainland. The Swale runs between the North Sea, Thames Estuary and the Medway Estuary.
River Medway	The end of the River Medway flows along the northwest corner of the SFRA area before joining the Thames Estuary. The reach of River Medway in the Local Plan area is a tidal channel.
Otterham Creek	Otterham Creek is tidally influenced and runs along the western border of the SFRA area where it joins the River Medway.
Iwade Stream	The Iwade Stream flows north-eastwards through the town of Iwade and joins The Swale. This watercourse is tidally influenced from the East of Iwade town.
Milton Creek	Milton Creek is tidally influenced and flows northeast from Sittingbourne before flowing into The Swale.
Faversham Creek	A tidally influenced watercourse, Faversham Creek flows northeast from Faversham before joining The Swale at Oare Marshes.
White Drain	The White Drain flows north from its source to the south of Boughton. The watercourse exits the SFRA area near Graveney, continuing north to The Swale. The watercourse is tidally influenced from the Staplesteet area to the mouth.
Windmill Creek	The tidally influenced creek flows southeast from its source in the centre of the Isle of Sheppey to The Swale.
Capel Fleet Drain	The watercourse drains the eastern area of the Isle of Sheppey, flowing west where it joins Windmill Creek as a tributary just upstream of the confluence with The Swale. The Capel Fleet Drain is tidally influenced
Scrapsgate Drain	Scrapsgate Drain is tidally influenced and runs north from Minster-on-Sea before flowing directly into the Thames Estuary / North Sea.
Warden Bay Stream	Warden Bay Stream is tidally influenced and flows northeast from its source in the north of the Isle of Sheppey, entering the Thames Estuary / North Sea at Warden.

7.4 Fluvial flood risk

Iwade has been affected by fluvial flood events in the past, notably in October 2000 and Winter 2013, when a series of prolonged and heavy rainfall events led to the channel capacity of Iwade Stream being exceeded. Local reports indicate that around 50 properties were flooded in October 2000[5], with several 'near misses' of internal property flooding occurring during the Winter 2013 event.

Anecdotal evidence suggests that many of the watercourses in Swale Borough have been impacted by tide-locking, notably Scrapsgate Drain and Warden Bay[6] where incoming high tides prevent fluvial flows from discharging into the sea.

The key settlements at fluvial flood risk, and the source, are summarised in Table 7-2. Although these watercourses are at risk of fluvial flooding, the most significant risk is from tidal flooding.

Table 7-2: Settlements at risk of fluvial flooding

Settlement	Source of fluvial flood risk
Sittingbourne	Milton Creek
Minster	Scrapsgate Drain
Faversham	Faversham Creek
Iwade	Iwade Stream
Warden	Warden Bay Stream
Lower Halstow	Ordinary watercourse

It should be noted that flood risk management measures (defences) are present within the Local Plan area which act to reduce the risk of flooding. Such defences potentially inhibit the function of the river floodplain as during flood events they can prevent water being stored on the land adjacent to the river channel. This may be particularly important when considering the functional floodplain (Flood Zone 3b) for development, but the presence of such defences could also evidence that measures must be in place to make existing development and infrastructure safe. Further details on the defences in Swale Borough are presented in Section 8 and the Zones are described in Section 5.

The extents of the fluvial Flood Zones are shown in Appendix C. Consideration of how climate change may influence the fluvial flood risk is presented in Appendix D.

In addition to flood risk shown by the flood risk mapping, there are potentially a number of small watercourses and field drains which may pose a risk to development. Generalised Flood Zone mapping (where more detailed modelling investigations are not available) has only been prepared for watercourses with a catchment greater than 3km^2. 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.

7.5 Tidal flood risk

Tidal flooding is caused by extreme tide levels exceeding ground and / or defence levels and is the most significant source of flood risk in the borough. The tidal flood risk to the Local Plan area has been assessed based on the North Kent Coast flood risk

[5] Iwadevillage.co.uk, Iwade Flood Protection, 2013. Available: http://www.iwadevillage.co.uk/iwadeobserveroctober2013.pdf
[6] Kent County Council, Flood risk to Communities in Swale, 2017. Available: https://www.kent.gov.uk/__data/assets/pdf_file/0010/71668/Flood-risk-to-communities-in-Swale.pdf

modelling study. Flood Zone mapping can be found in Appendix C and the effects of climate change can be found in Appendix D.

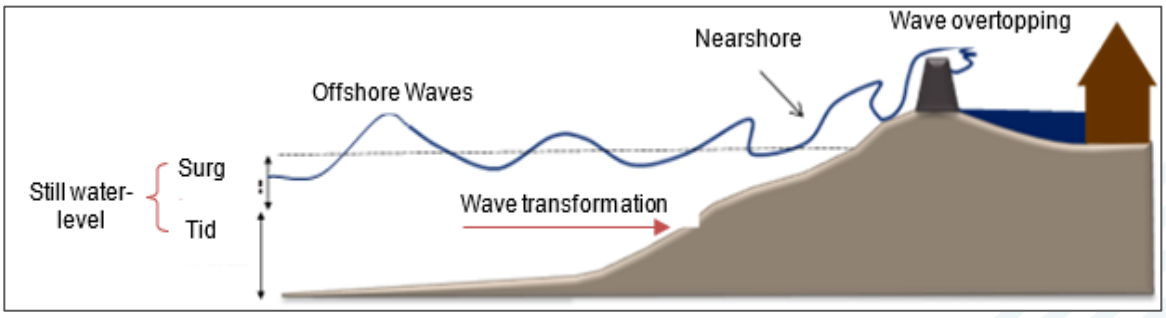
The three most notable recorded flood events within the SFRA area in 1953, 1978 and 2013 were primarily caused by tidal flooding related to storm surges.

The watercourses mentioned in Table 7-1 are all at risk of tidal flooding in their lower reaches.

7.5.1 Wave overtopping

Tidal flooding along parts of the North Kent coastline is characterised by the presence of risk associated with wave overtopping. In exposed locations along the coast, landward flooding is more likely to occur as a consequence of wave overtopping than inundation. Wave overtopping is a term, which encompasses a number of complex physical processes, which result in the transfer of water from the sea onto the coastal floodplain. The amount of wave overtopping that occurs during an extreme event is dependent on the local water depth, the properties of incoming waves and the geometry of local flood defences. Figure 7-6 outlines the process of wave overtopping in relation to the Extreme Still Water Sea-level.

Figure 7-6: Illustration of residual risk associated with wave overtopping



Wave overtopping is one of the principal mechanisms of flooding for the coastal frontage. The effect of wave overtopping along the coastline has only been included in the Flood Zone 3b delineation at locations considered appropriate by the Environment Agency along the North Kent Coast and shown in Appendix C.

7.6 Coastal flood risk

In coastal locations the risk of flooding is linked to the stability of the coastline. If the coast is eroding, then the potential effect is that tidal flood defences near to the sea will be lost and flood risk will increase. To maintain an appropriate standard of safety from flooding it is sometimes necessary to implement works to slow down or stop the rate of coastal erosion and so maintain the integrity of the tidal defences.

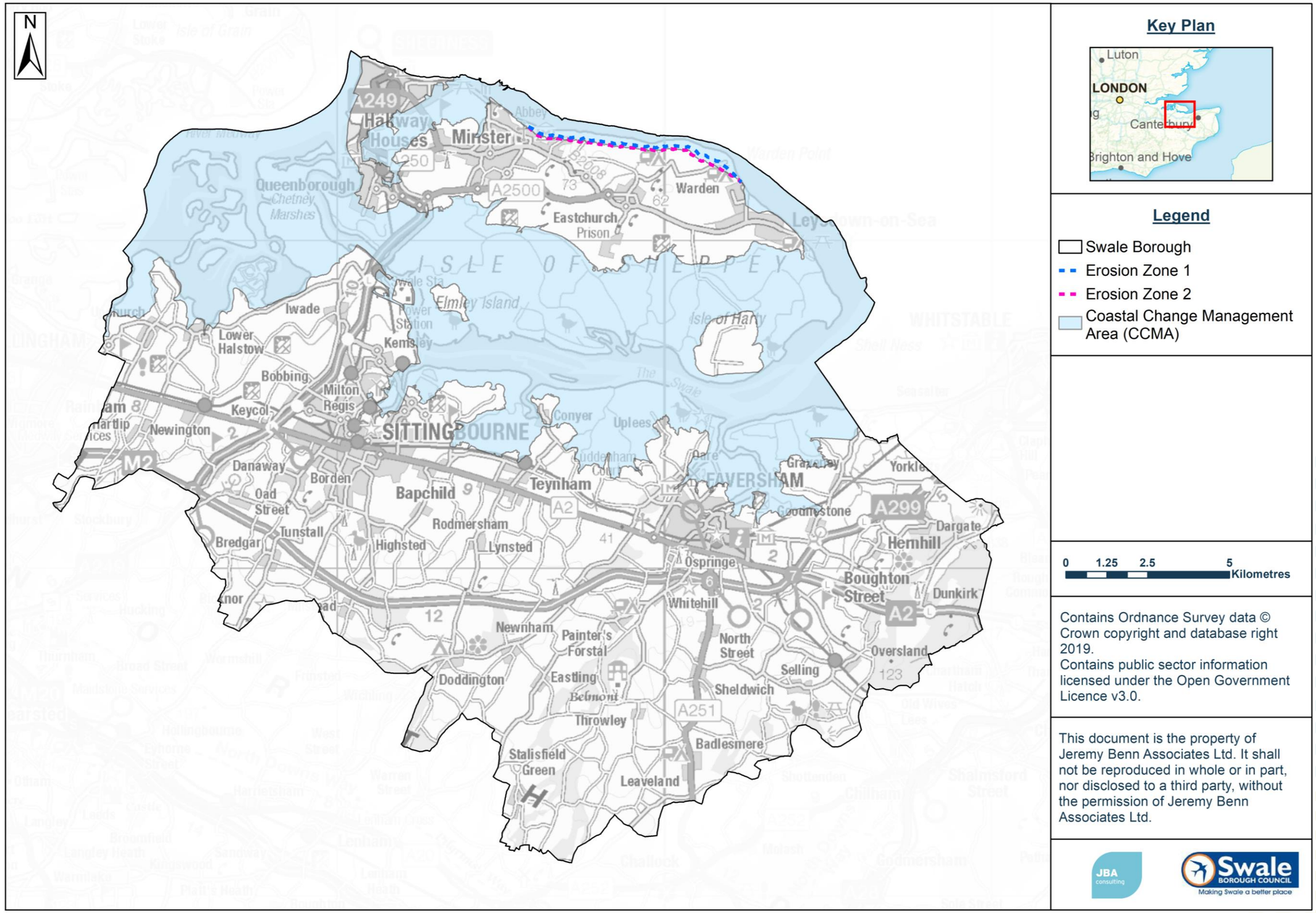
The **Isle of Grain to South Foreland Shoreline Management Plan** (2010) and the **Medway Estuary and Swale Shoreline Management Plan** (2010) describe the arrangements and strategy for managing coastal erosion and the influential measures.

The **North Sheppey Erosion Study Part 1** and **Part 2** (2011) assess the risk of cliff erosion between Minster and Warden for the next 100 years, estimating the future position of the cliff top. The study provides guidance to help SBC inform planning decisions and provide advice to the public on how to manage the risks associated with cliff retreat. The report emphasises the importance of the coastal communities in the area adapting to coastal change, particularly given the potential impacts of climate change, with the areas of the highest predicted erosion rate between Barrows Brook and Warden Point.

A Coastal Change Management Area (CCMA) has been identified by SBC in line with the NPPF to support Policy DM 23 (coastal change management) of the **Swale**

Borough Local Plan. The CCMA is defined as areas of coastline likely to be affected by physical changes to the coast, with further details on its delineation provided in the **Coastal Change Management Area Technical Paper No. 1** (2013). Additionally, two Erosion Zones are defined along the north of coast of the Isle of Sheppey, with the Local Plan detailing the level of development that may be appropriate within each zone. Erosion Zone 1 is defined as land between the low water mark and the 50 year indicative erosion line, while Erosion Zone 2 is land between the 50 and 100 year indicative erosion lines. The CCMA and erosion zones are shown in Figure 7-7 and on the Proposal Maps of the Local Plan.

Figure 7-7: The Swale Borough Coastal Change Management Area and Erosion Zones



7.7 Surface water flood risk

Flooding from surface water runoff (or 'pluvial' flooding) is caused by intense short periods of rainfall and usually affects lower lying areas, often where the natural (or artificial) drainage system is unable to cope with the volume of water. Surface water flooding problems are inextricably linked to issues of poor drainage, or drainage blockage by debris, and sewer flooding.

Tide locking is also an issue where high tides prevent surface water from draining from gravity outfalls along the defended coastal plain.

Although tidal flooding poses the greatest potential of severe flood risk in Swale, surface water flooding is the most common cause of flood events. The Risk of Flooding from Surface Water (RoFSW) map shows predicted flood extents that predominantly follow topographical flow paths of existing watercourses or dry valleys with some isolated ponding located in low lying areas. Mapping of the RoFSW throughout the Local Plan area is provided in Appendix E.

Additionally, as part of this SFRA, Surface Water Functional Flood Zones (as described in 4.1.2) have been established to highlight the significant surface water flow paths within dry valleys. Additional information on how and why the Surface Water Function Flood Zones were delineated can be found in Section4.1.2, mapping of these areas can be found in Appendix C and on Swale Borough Council's **interactive mapping portal.** FRA requirements for development in these areas can be found in Section9.4.3.

The **Swale SWMP** has identified that the surface water flood risk in much of Swale Borough is exacerbated by the low-lying nature of the land, particularly the Isle of Sheppey, which limits the drainage of surface water.

KCC's LFRMS has identified Sittingbourne as an area that is susceptible to surface water flooding due to poor drainage.

7.8 Groundwater flood risk

Groundwater flooding is the term used to describe flooding caused by unusually high groundwater levels. It occurs as excess water emerges at the ground surface or within manmade underground structures such as basements. Groundwater flooding tends to be more persistent than surface water flooding, in some cases lasting for weeks or months, and it can result in significant damage to property.

The 5m resolution JBA Groundwater Flood Map for Swale Borough can be found in Appendix F.

As illustrated in Appendix F, a large proportion of Swale Borough is at risk from groundwater flooding, with some of the highest risk areas around Sittingbourne, Faversham, Teynham, Bapchild and Boughton. There is a widespread area of groundwater flood risk in the south of the Borough that is underlain by chalk bedrock. Rain can infiltrate the chalk through large fissures into the underlying aquifers and is released slowly through springs further downstream. There is also an area of groundwater flood risk along parts of the northern coast of the Isle of Sheppey.

7.9 Flooding from sewers

Sewer flooding occurs when intense rainfall overloads the sewer system capacity (surface water, foul or combined), and / or when sewers cannot discharge properly to watercourses due to high water levels. Sewer flooding can also be caused when problems such as blockages, collapses or equipment (such as pumps) failure occur in the sewerage system. The flow of surface water into manhole openings, the soil or groundwater may cause high flows in sewers for prolonged periods of time.

Existing sewers can also become overloaded as new development adds to their catchment, even with restrictions in place on permitted discharge, or due to

incremental increases in roofed and paved surfaces at the individual property scale (urban creep). Sewer flooding is therefore a problem that could occur in many locations across the study area.

This Southern Water provides records incidents of flooding relating to public foul, combined or surface water sewers and identifies which properties suffered flooding. For confidentiality reasons, this data has been supplied on a postcode basis from the Sewer Incident Report Form (SIRF) hydraulic overload database. Data covers all reported incidents between July 2014 and February 2019. The information from the SIRF database is shown in Table 7-3.

The SIRF database indicates a total of 126 recorded flood incidents in the Local Plan area. The most frequently flooded postcodes are: ME12 3 (22 incidents), ME10 2 (17 incidents) and ME13 7 (12 incidents). It is important to recognise that the information does not indicate the cause of the sewer flooding incidents. Also, the register represents a snapshot in time and may become outdated following future rainfall events, when new properties are added. Risk of flooding may be reduced in some locations by capital investment to increase of the capacity of the network. As such, the sewer flooding risk register is not a comprehensive 'at risk register' and updated information should be sought to enhance understanding of flood risk from sewers at a given location.

Additionally, the Swale SWMP identifies that when there are high groundwater levels there is a risk of infiltration into the sewer network at Minster-on-Sea, potentially reducing the capacity. Poorly designed, constructed and maintained drainage systems will permit ingress of groundwater flows and reduce the capacity of drainage systems.

Table 7-3: Sewer Incident Report Form database for Swale Borough SFRA area

Post code	Recorded flood incidents	Post code	Recorded flood incidents
ME9 7	12	**ME11 5**	3
ME9 8	2	**ME12 1**	6
ME9 9	6	**ME12 2**	7
ME10 1	10	**ME12 3**	22
ME10 2	17	**ME12 4**	10
ME10 3	2	**ME13 7**	12
ME10 4	3	**ME13 8**	8
ME10 5	5	**ME13 9**	1
Total recorded flood incidents: 126			

7.10 Flooding from reservoirs

Reservoirs with an impounded volume greater than 25,000 cubic metres in England are governed by the Reservoir Act 1975 and are listed on a register held by the Environment Agency. The level and standard of inspection and maintenance required under the Act means that the risk of flooding from reservoirs is relatively low. Recent changes to legislation under the Flood and Water Management Act require the Environment Agency to designate the risk of flooding from these reservoirs. The Environment Agency is currently progressing a 'Risk Designation' process so that the risk is formally determined.

Outlines from the Risk of Flooding from Reservoirs dataset (informed from the National Reservoir Inundation Mapping (NRIM) study) show worst case inundation extents of reservoirs impacting the Local Plan area, as detailed in Table 7-4:. The Environment

Agency are currently engaged on a programme to improve the quality of the reservoir flood mapping and this is due to be completed and available for use by 2020.

Table 7-4: Reservoirs in the Swale Borough Local Plan area

Reservoir	Location (grid ref)	Reservoir owner	Environment Agency area	Local authority
Kemsley Mill Lagoon 1	591884, 167215	DS Smith Paper Limited	Kent, South London and East Sussex	Kent County Council
Culnell's Fishing Lake	589129, 166899	A.C. Goatham & Son	Kent, South London and East Sussex	Kent County Council

Reservoir flooding is very different from other forms of flooding. It may happen with little or no warning.

The Environment Agency maps represent a credible worst-case scenario. In these circumstances, it is the time to inundation, the depth of inundation, the duration of flooding and the velocity of flood flows that will be most influential. The Environment Agency Risk of Flood from Reservoir Map for Swale Borough is shown in Appendix G.

7.11 Summary of flood risk to key settlements

A high-level review of the flood risk to key wards in the Swale Borough Local Plan area has been undertaken. Table 7-5 summarises the flood risk to the main settlements in Swale Borough.

Table 7-5: Summary of flood risk to the key settlements in the study area

Settlement	Fluvial/tidal/coastal flood risk	Formal flood defences	Surface water flood risk	Predicted groundwater levels across the settlement during the 1% AEP event according to JBA Groundwater Flood Map (note that predicted groundwater levels may vary across the settlement so more than one level category could be ticked)					Reservoir inundation
				No risk	5m below surface	0.5m to 5m below surface	0.025m to 0.5m below surface	Within 0.025m of surface	
Sittingbourne	The Swale is located north of Sittingbourne and Milton Creek flows through the centre of the settlement. The Environment Agency historic flood outline dataset shows that there has been a history of tidal flooding at the settlement.	See Section 8	Mapping shows there are large areas of surface water ponding to the south of London Road and the railway line around Chalkswell, Snipeshill and St Michael's Road. There are also several overland flow paths in the settlement that cross buildings and roads, with the residential, commercial and industrial properties in these areas at risk of surface water flooding. High risk areas include Bell Road, Eurolink Way, Crown Quay Lane and Rectory Road.	✓		✓	✓	✓	Inundation from Kemsley Mill Lagoon 1, may affect areas to the west around Barge Walk.
Sheerness	The mouth of the River Medway is located to the west of the settlement, with the North Sea to the north. The Environment Agency historic flood outline dataset shows that there has been a history of tidal flooding at the settlement.	See Section 8	Mapping shows that there are large areas of surface water flood risk throughout Sheerness, broadly following roads, such as New Road, Brielle Way and St George's Avenue. Residential, commercial and industrial properties surrounding these areas are also at risk of surface water flooding. There are areas of surface water ponding in the low-lying areas around The Fleet and nearer the coast in the northwest of the settlement.	✓					None
Queenborough	The confluence of The Swale and the River Medway is located to the west of the settlement. The Environment Agency historic flood outline dataset shows that there has been a history of tidal flooding at the settlement.	See Section 8	Mapping shows that surface water flood risk is largely concentrated in the area around Queenborough Creek, with surrounding buildings along Thomsett Way and Rushenden Road at risk. Elsewhere in the settlement, surface water flood risk generally follows roads, including Moat Way, High Street and Chalk Road.	✓					None
Minster	Scrapsgate Drain flows through the centre of Minster before flowing north along the western edge of the settlement. Minster is located on the coast of the North Sea. The Environment Agency historic flood outline dataset shows that there has been a history of tidal flooding at the settlement.	No	Mapping shows there are large areas of surface water flood risk following the course of Scrapsgate Drain in the south and west of Minster, with surrounding residential buildings at risk. There are areas where surface water flood risk follows the road network, including Minster Road, Scocles Road and Lynmouth Drive, though the surface topography appears to be an important control on surface water flood risk. There are several surface flood risk paths crossing roads and buildings in the Minster built up area, including the areas around Halfway Houses, Seaside Avenue and The Glen.	✓	✓	✓	✓		None
Faversham	Faversham Creek flows northeast from the centre of the settlement. The Environment Agency historic flood outline dataset shows that there has been a history of tidal flooding at the settlement.	See Section 8	Mapping shows there are large areas of surface water ponding to the south of London Road and the railway line around Ospringe and Preston, where surface water flows off the elevated land south of Faversham. There is also surface water flood risk through the centre of settlement following the drainage network of Faversham Creek. There is widespread surface water flood risk across Faversham following the path of roads, with the residential and commercial properties around them at risk. These roads include Whitstable Road, South Road and Forbes Road.	✓		✓	✓	✓	None
Iwade	Iwade Stream flows northeast through the centre of the settlement. The Environment Agency historic flood outline dataset shows that there has been a history of fluvial flooding at the settlement.	No	Mapping shows that surface water flood risk largely follows the course of Iwade Stream, with risk in residential and commercial areas through the centre of the settlement adjacent to the watercourse. Elsewhere in Iwade, surface water flood risk generally follows roads, including Springvale, School Lane and Kingfisher Close.	✓					Inundation from Culnell's fishing lake southwest of Iwade, may affect areas surrounding Iwade Stream.
Teynham	Not in Flood Zones.	No	Mapping shows that surface water flood risk generally follows the routes of roads, including London Road, Station Road and Honeyball Walk. There is also a risk of surface water ponding at the junction of Lower Road and Harry Road, as well as in areas of open space in the west of Teynham. Residential properties in the centre of Teynham are also at risk.	✓			✓	✓	None
Newington	Not in Flood Zones.	No	Mapping shows that surface water flow paths generally flow north through Newington, with flood risk following roads including Church Lane, Playstool Road and School Lane. Residential areas and gardens in part of the settlement are also predicted to be at risk of surface water flooding.	✓					None

Settlement	Fluvial/tidal/coastal flood risk	Formal flood defences	Surface water flood risk	Predicted groundwater levels across the settlement during the 1% AEP event according to JBA Groundwater Flood Map (note that predicted groundwater levels may vary across the settlement so more than one level category could be ticked)					Reservoir inundation
				No risk	5m below surface	0.5m to 5m below surface	0.025m to 0.5m below surface	Within 0.025m of surface	
Boughton	Not in Flood Zones	No	Mapping shows that low lying residential areas and open land around Staplestreet Road and Berkely Close are at risk of surface water flooding. Surface water flood risk in the settlement also follows White Drain and roads, such as Colonel's Lane, Horselees Road and The Street.	✓			✓	✓	None
Warden	Warden Bay Stream flows north to the east of the settlement, with Warden located on the coast of the North Sea. The Environment Agency historic flood outline dataset shows that there has been a history of tidal flooding at the settlement.	See Section 8	Mapping shows that there is high surface water flood risk in the south and east of Warden around Warden Bay Stream and one of its tributaries, including residential areas. Surface water flood risk also follows roads in the settlement, including Imperial Drive, Emerald View and Leicester Gardens.	✓					None
Upchurch	Not in Flood Zones.	No	Mapping shows that surface water flood risk in Upchurch is generally confined to open spaces and roads, including Oak Lane and Church Farm Road, though there are some residential areas predicted to be at risk of surface water ponding.	✓			✓		None
Bapchild	Not in Flood Zones.	No	Mapping shows that surface water flood risk in Bapchild generally follows the roads, such as The Street, Ashtead Drive and Doubleday Drive. There are also some residential areas and open land also predicted to be at risk of surface water flooding.	✓			✓	✓	None
Borden	Not in Flood Zones	No	Mapping shows there is a large surface water flow path along Hearts Delight Road that then flows northeast towards Sittingbourne. Elsewhere in Borden, surface water flood risk is largely confined to roads including Borden Lane, Homestead View and Mountview.	✓		✓			None
Lower Halstow	A small watercourse flows north through the centre of the settlement, and the estuarine extent of the River Medway is located north of Lower Halstow. The Environment Agency historic flood outline dataset shows that there has been no previous history of flooding in the area, though Kent County Council record flooding from the ordinary watercourse through the centre of the settlement.	See Section 8	Mapping shows that surface water flood risk generally follows the path of a small watercourse through the centre of the settlement, largely in areas of open space. Roads also mapped to be at risk include The Street, Lapwing Drive and Cumberland Drive.	✓					None
Leysdown	Leysdown is located on the coast of the North Sea. The Environment Agency historic flood outline dataset shows that there has been a history of tidal flooding at the settlement.	See Section 8	Mapping shows that surface water flood risk in Leysdown generally follows roads, with those most at risk including Shellness Road, Wing Road and Manor Way.	✓		✓			None
Eastchurch	Not in Flood Zones	No	Mapping shows that surface water flood risk generally follows roads in Eastchurch. The roads most at risk include Leysdown Road, High Street, Church Road and Warden Road. The mapping also shows some areas of surface water ponding in residential areas and open spaces.	✓					None

8 Fluvial and coastal defences

A high-level review of flood defences was carried out for this SFRA and this involved an interrogation of existing information on asset condition and standard of protection. The Environment Agency's Spatial Flood Defences dataset was primarily used to understand the flood risk associated with defences in the borough. A dataset of defences from the 2019 North Kent Coast modelling study was also available for use in the SFRA. Section 14 of the SFRA contains information on the AEP at which modelled exceedance of the defences occurs and is used to highlight areas of flood defences near the potential and existing development sites screened that potentially require improvements.

Defences are categorised as either raised flood defences (e.g. walls/embankments) or Flood Storage Areas (FSAs). The assessment of the Environment Agency dataset has considered raised defences which potentially provide a standard of protection from a 5% AEP event or more. Man-made and natural defences which may arise for instance due to the presence of naturally high ground adjacent to a settlement have been considered. The defences and their locations are summarised in the following sections.

8.1 Defence standard of protection and residual risk

One of the principal aims of the SFRA is to outline the present risk of flooding across Swale Borough Local Plan area including consideration of the effect of flood risk management measures (including flood banks and defences). The modelling that informs the understanding of flood risk within the Local Plan area is typically of a catchment wide nature, suitable for preparing evidence on possible site options for development. In cases where a specific site risk assessment is required, detailed studies should seek to refine the results used to provide a strategic understanding of flood risk from all sources.

Consideration of the residual risk behind flood defences has been undertaken as part of this study. 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. Developers should also consider the standard of protection provided by defences and residual risk when preparing detailed Flood Risk Assessments.

Standard of Protection

Flood defences are designed to give a specific standard of protection, reducing the risk of flooding to people and property in flood prone areas. For example, a flood defence with a 1% AEP standard of protection means that the flood risk in the defended area is reduced to a 1% chance of flooding in any given year.

Although flood defences are designed to a standard or protection it should be noted that, over time, the actual standard of protection provided by the defence may decrease, for example due to deterioration in condition or increases in flood risk due to the increased magnitude of the flood hazard caused by climate change effects (e.g. rise in mean sea level over time).

For raised flood defences (bunds or banks), a standard of protection can be straight forward to define. However, sometimes it is not possible to define the standard of protection for Flood Storage Areas as there are a number of factors that determine the protection that they can provide e.g. outflow rates, number of watercourses that flow into the Flood Storage Area.

8.2 Defence condition

Formal structural defences are given a rating by the Environment Agency based on a grading system for their condition[7]. A summary of the grading system used by the Environment Agency for condition is provided in Table 8-1.

Table 8-1: Defence asset condition rating

Grade	Rating	Description
1	Very Good	Cosmetic defects that will have no effect on performance.
2	Good	Minor defects that will not reduce the overall performance of the asset.
3	Fair	Defects that could reduce the performance of the asset.
4	Poor	Defects that would significantly reduce the performance of the asset. Further investigation required.
5	Very Poor	Severe defects resulting in complete performance failure.

The condition of existing flood defences and whether they are planned to be maintained and/or improved in the future must be considered with respect to the safety and sustainability of development over its intended life and also with respect to the financial and economic commitment to the long-term provision of appropriate standards of protection. In some cases, the relevant strategy may suggest that it is not appropriate to maintain the condition of the assets, which may prove influential for the development over its intended life. In addition, detailed FRAs undertaken by developers (if a defence is influential to the proposed development) will need to thoroughly explore the condition of defences, especially where these defences are informal and demonstrate a wide variation of condition grades. It is important that all of these assets are maintained to a good condition and their function remains unimpaired in accordance with the policy and strategy for Flood Risk Management.

8.3 Coastal, Tidal and fluvial defences in the Local Plan area

The majority of defences in the Local Plan area provide protection against tidal flood events, with large areas elsewhere protected by coastal defences.

Tidal defences are designed to protect the coast from flood risk from the sea e.g. still water levels exceeding the defence crest, or waves overtopping the defence. Coastal defences are constructed to protect the coastal frontage from erosion (being washed away by waves and tidal currents). Each of these types of defence are present in the Local Plan area but are not designed to necessarily fulfil the dual purpose of managing flood risk and coastal protection. However, with climate change, it is likely that many of locations with coastal defences will need to include provision for tidal defence in the future. The **North Sheppey Erosion Study** mentions that the eastern end of the coastal erosion defences along Minster Leas will require raising the rear wave wall to prevent overtopping and scour at the toe of the slopes at some point in the future.

There are no defences designed solely for fluvial flooding with a standard of protection of 5% or more within the Local Plan area, though there are defences that protect against both tidal and fluvial flood events along Milton Creek, Faversham Creek and Conyer Creek.

The majority of defences in Swale Borough provide a standard of protection of at least 2% AEP, with large areas with defences that provide a standard of protection of 0.1%

[7] Condition Assessment Manual, Environment Agency (2012)

AEP. However, there are also several areas with a standard of protection of less than 4% AEP. The Environment Agency defence data shows that the majority of defences within the Local Plan area are in 'fair' condition.

The maps shown in Appendices H.1-4 provide a summary of the defences included in the Environment Agency's spatial defence dataset with a standard of protection against a 5% AEP event or greater in Swale Borough. Defences with a standard of protection of 5% AEP or greater are shown as these defences are considered in the delineation of Flood Zone 3b. The maps in Appendix H.2-4 show the defence type, condition and standard of protection, using the spatial defence data provided by the Environment Agency.

Appendix H.1 also includes the location Swale Borough Council's coastal erosion defence along Minster Leas, running from the Environment Agency's defences which terminate at the top of The Broadway, Minster, to the eastern end of Minster and a short section of rock revetment to the east of Warden Bay which was installed around 14 years ago to provide toe protection to the Warden Bay cliffs. It is likely that these coastal defences will need to include provision for tidal defence in the future.

8.4 Alleviation Schemes

There are a limited number of alleviations schemes within the Local Plan area, and there are no Flood Storage Areas recorded in Swale Borough in the Environment Agency's 'Flood Map for Planning – Flood Storage Areas' dataset.

The Front Brents Flood Alleviation Scheme at Faversham was introduced by the Environment Agency to reduce the risk of tidal flooding from Faversham Creek. The scheme involved the construction of an embankment between 600 and 800mm high in 2016, with the aim of providing protection to over 30 residences and businesses in the Front Brents area[8].

8.5 Future schemes

The **Medway Estuary and Swale Strategy (MEASS)** describes the planned approach for managing the coastline of the Local Plan area. It includes details of where coastal and tidal defences will be maintained, raised or not maintained. The MEASS also details how the potential impact of climate change on sea level rise will be accounted for in the management of defences along the coastline.

The area covered by the strategy is divided into several 'Benefit Areas', based on the extents of discrete flood cells, which are then divided into a further 35 sub-Benefit Areas based on Policy Units from the Shoreline Management Plans. The relevant Benefit Areas to Swale Borough will be Benefit Areas 4 to 11.

8.6 Residual flood risk

Residual risks are those remaining after applying the sequential approach and taking mitigating actions. In circumstances where measures are put in place to manage the flood risk there remains a possibility of flooding being experienced, either as a consequence of the event exceeding the design capacity or the failure of the asset providing the appropriate standard of protection. It is the responsibility of the developer to fully assess flood risk, propose measures to mitigate it and demonstrate that any residual risks can be safely managed through an FRA.

This SFRA does not assess the probability of failure other than noting that such events are very rare. However, in accordance with NPPF, all sources of flooding need to be considered. If a breach or overtopping event were to occur, then the consequences to people and property could be high. Developers should be aware that any site that is

[8] Environment Agency, Faversham Flood Alleviation Scheme, 2016. Available: https://www.gov.uk/government/news/construction-begins-on-faversham-flood-alleviation-scheme

at or below defence level may be subject to flooding if an event occurs that exceeds the design capacity of the defences, or the defences fail, and this should be considered when building resilience into low level properties.

8.6.1 Overtopping

Overtopping conditions occur when a wave meets a structure lower than the maximum wave height or when the mean sea level exceeds the top of the defences. The risk from overtopping of defences is based on the relative heights of property or defence, the distance from the defence level and the height of water above the crest level of the defence. During these conditions there is a regular intermittent discharge of sea water over the defences which can cause flooding. The Defra and Environment Agency **Flood Risks to People** guidance document provides standard flood hazard ratings based on the distance from the defence and the level of overtopping.

The risk of violent waves overtopping sea walls in particular can lead to a significant flood hazard. As part of this SFRA, the effect of wave overtopping along the coastline has only been included in the Flood Zone 3b delineation at locations considered appropriate by the Environment Agency along the North Kent Coast. The locations where wave overtopping has been included in the delineation of Flood Zone 3b is shown in Appendix C.

8.6.2 Defence breach

A breach of a defence occurs when there is a failure in the structure and a subsequent ingress of flood water.

Breach modelling was prepared as part of the 2019 North Kent Coast modelling study, with the modelled flood extents of the breaches predicted to impact the Local Plan area shown in Appendix I. The locations selected for testing selected by the Environment Agency based on where a defence failure could potentially have the greatest impact. Therefore, where defences are present further analysis of the potential impacts of a breach event should be undertaken as part of a site-specific flood risk assessment. Flood flows from breach events can be associated with significant and rapid change in depths and flow velocities in the immediate vicinity of the breach location and so FRAs must include assessment of the hazards that might be present so that the safety of people and structural stability of properties and infrastructure can be appropriately considered. Whilst the area in the immediate vicinity of a breach can be subject to high flows, the whole flood risk area associated with a breach must also be considered as there may be areas remote from the breach that might, due to topography, involve increased depth hazards.

9 FRA requirements and flood risk management guidance

9.1 Over-arching principles

This SFRA focuses on delivering a strategic assessment of flood risk within the Swale Borough Local Plan area. Prior to any construction or development, site-specific assessments will need to be undertaken, as appropriate so all forms of flood risk at a site are fully addressed. It is the responsibility of the developer to provide an FRA with an application.

It should be acknowledged that a detailed FRA may show that a site is not appropriate for development of a particular vulnerability or even at all. Where the FRA shows that a site is not appropriate for a particular use, a lower vulnerability classification may be appropriate.

Some sites may additionally require the application of the Exception Test following the Sequential Test which is detailed in Section 4.

9.2 Requirements for site-specific flood risk assessments

9.2.1 What are site specific FRAs?

Site specific FRAs are carried out by (or on behalf of) developers to assess flood risk to and from a site. They are submitted with planning applications and should demonstrate how flood risk will be managed over the development's lifetime, taking into account climate change and vulnerability of users.

Paragraph 068 of the NPPF Flood Risk and Coastal Change Planning Practice Guidance sets out a checklist for developers to assist with site specific flood risk assessments.

9.2.2 When are site specific FRAs required?

Site specific FRAs are required in the following circumstances:

- Proposals for new development (including minor development and change of use) in Flood Zones 2 and 3
- Proposals for new development (including minor development and change of use) in an area within Flood Zone 1 which has critical drainage problems (as notified to the LPA by the Environment Agency)
- Proposals of 1 hectare or greater in Flood Zone 1 due to their surface water impact which will be dealt with through a surface water drainage strategy.
- Where proposed development or a change of use to a more vulnerable class may be subject to other sources of flooding
- Proposals of less than one hectare in Flood Zone 1 where they could be affected by sources of flooding other than rivers and the sea (e.g. surface water)

An FRA may also be required for some specific situations:

- If the site may be at risk from the breach of a local defence (even if the site is actually in Flood Zone 1)
- Where the site is intended to discharge to the catchment or assets of a water management authority which requires a site-specific FRA
- Where evidence of historical or recent flood events have been passed to the LPA
- On land in the vicinity of small watercourses or drainage features that might not have been demarcated as being in a flood zone on the national mapping

- At locations where proposals could affect or be affected by substantial overland surface water flow routes

A Surface Water Drainage Strategy is required for any major development.

9.2.3 Objectives of site specific FRAs

The aim of an FRA is to demonstrate that the development is protected to the 1% AEP fluvial and 0.5% AEP tidal flood scenario and is safe for its intended life span during the 'design' flood event, including an allowance for climate change. This includes assessment of mitigation measures required to safely manage flood risk. Development proposals requiring FRAs should establish:

- Whether a proposed development is likely to be affected by current or future flooding from any source over the lifetime of the development;
- Whether a proposed development will increase flood risk elsewhere;
- Whether the measures proposed to deal with the effects and risks are appropriate;
- Assess the potential cumulative impact of development on flood risk (as described in Section 4.6);
- The evidence, if necessary, for the Local Planning Authority to apply the Sequential Test; and
- Whether, if applicable, the development will be safe and pass the Exception Test, if applicable.

FRAs for sites located in the Local Plan area should follow the approach recommended by the 2018 NPPF (and associated guidance) and guidance provided by the Environment Agency and Kent County Council. This includes:

Site-specific Flood Risk Assessment: Checklist (NPPF PPG, Defra)

Standing Advice on Flood Risk (Environment Agency)

Flood Risk Assessment for Planning Applications (Environment Agency)

Drainage and Planning Policy Statement (Kent County Council)

The follow sections provide information for Swale Borough Council and developers to assist in the preparation of FRAs.

9.3 For Swale Borough Council

One of the key objectives of the SFRA is to provide an evidence base, which will inform the preparation of the Local Development Framework with respect to local flood risk issues and the location of future development.

The local planning authority can play an important role in strategic flood risk management. The overall aim should be to direct development to areas of lower flood risk wherever possible and resist development in areas of flood risk unless the type of development is commensurate with the type of flood risk.

The Council should also seek flood risk reduction in every new development and redevelopment through design, changes in land use and drainage requirements.

9.3.1 Reviewing of FRAs

Guidance for local planning authorities for reviewing flood risk assessments submitted as part of planning applications has been published by Defra in 2015 – Flood Risk Assessment: Local Planning Authorities.

9.4 For developers

Developers should consider flood risk at an early stage in deciding the layout and design of a site to provide an opportunity to reduce flood risk within the development.

In general, all future developments should demonstrate:

- That the probability and consequences of flooding will be reduced.
- How actual and residual flood risk to the development and flood risk to others from all sources will be managed over the lifetime of the development, taking into account climate change.
- That development will be safe through the layout, form and floor levels of the development and mitigation measures.
- That surface water runoff is being managed.
- A development will have certain requirements to fulfil, dependent upon which Flood Zone it is located within.

The following subsections contain information to assist developers where flood risk to and from a development is identified which should be read alongside the guidance documents listed in section 9.2.3.

9.4.1 Climate change projections

In order to assess whether a development will be safe from flooding over its lifetime it is important to look at the impact of climate change as outlined in Section 5.

9.4.2 Smaller watercourses

As described in Section 7.4, the Environment Agency's Flood Maps may show that there is not a flood risk along small watercourses (watercourses with a catchment less than 3km^2). As part of a site-specific flood risk assessment the potential flood risk and extent of Flood Zones should be determined for these smaller watercourses and this information used as appropriate to perform the Sequential and Exception tests.

9.4.3 Development in Surface Water Functional Flood Zones

This SFRA introduces Surface Water Flood Zones and the zones are mapped in Appendix C. Surface Water Functional Flood Zones are located in dry valleys which are steeply sloping, so in a rainfall event, runoff can be expected to flow over the land with depths and flows that can cause damage and harm. Small changes to the topography in these areas can influence flow paths which can result in changing surface flood risk. Therefore, all types of development could be potentially be compatible in Surface Water Functional Flood Zones, providing the FRA can demonstrate that the proposals will be safe from flooding for its lifetime and does not increase flood risk elsewhere.

FRA requirements include:

- Assessment of flood risk from all sources.
- Consideration of the 1% AEP plus 20% and 40% uplift for climate change flow paths across the site and how the proposed development may alter these. Overland flow modelling will be required to demonstrate this.
- Consideration of surface water flood resilience measures.

9.4.4 Reducing fluvial and tidal flood risk through site design and layout

Flood risk should be considered at an early stage in deciding the layout and design of a site to provide an opportunity to reduce flood risk within the development.

The NPPF states that a sequential, risk-based approach should be applied to try to locate more vulnerable land use away from flood zones, to higher ground, while more flood-compatible development (e.g. vehicular parking, recreational space) can be located in higher risk areas. However, vehicular parking in floodplains should be based on the nature of parking, flood depths and hazard including evacuation procedures and flood warning. The nature of risk to water quality also needs to be considered and mitigated for to ensure that accumulated hydrocarbons and other vehicle related pollutants are not released to the aquatic environment. Particular consideration should be given to designing drainage systems that reduce the risk of groundwater ingress, as this is a known existing problem.

Waterside areas, or areas along known flow routes, can act as Green Infrastructure, being used for recreation, amenity and environmental purposes, allowing the preservation of flow routes and flood storage, and at the same time providing valuable social and environmental benefits contributing to other sustainability objectives. Landscaping should ensure safe access to higher ground from these areas and avoid the creation of isolated islands as water levels rise.

Raised floor levels

The raising of internal floor levels within a development avoids damage occurring to the interior, furnishings and electrics in times of flood.

If it has been agreed with the Environment Agency that, in a particular instance, the raising of floor levels is acceptable, finished floor levels for development that does not include sleeping accommodation on the ground floor should normally be set to whichever is 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
- 300mm above the general ground level of the site.

Finished Floor Levels for sleeping accommodation should normally be set to whichever is higher of the following:

- a minimum of 600mm above the 1% AEP fluvial event plus an allowance for climate change
- a minimum of 600mm above the 0.5% AEP tidal event plus an allowance for climate change
- 300mm above the general ground level of the site.

If it is not practical to raise floor levels to those specified above, consultation with the Environment Agency will be required to determine alternative approaches.

The additional height that the floor level is raised above the maximum water level is referred to as the "freeboard". Additional freeboard may be required because of risks relating to blockages to the channel, culvert or bridge and should be considered as part of an FRA.

Allocating the ground floor of a building for less vulnerable, non-residential, use is an effective way of raising living space above flood levels.

Single storey buildings such as ground floor flats or bungalows are especially vulnerable to rapid rise of water (such as that experienced during a breach). This risk can be reduced by use of multiple storey construction and raised areas that provide an escape route. However, access and egress would still be an issue, particularly when flood duration covers many days.

Similarly, the use of basements should be avoided. Habitable uses of basements within Flood Zone 3 should not be permitted, whilst basement dwellings in Flood Zone 2 will be required to pass the Exception Test. Access should be situated 300mm above the design flood level and waterproof construction techniques used.

Modification of ground levels

Modifying ground levels to raise the land above the required flood level is an effective way of reducing flood risk to a particular site in circumstances where the land does not act as conveyance for flood waters. However, care must be taken at locations where raising ground levels could adversely affect existing communities and property.

In most areas of fluvial flood risk, raising land above the floodplain would reduce conveyance or flood storage in the floodplain and could adversely impact flood risk downstream or on neighbouring land.

Compensatory flood storage should be provided, and would normally be on a level for level, volume for volume basis on land that does not currently flood but is adjacent to the floodplain (in order for it to fill and drain). It should be in the vicinity of the site and within the red line of the planning application boundary.

Raising ground levels can also deflect flood flows, so analyses should be performed to demonstrate that there are no adverse effects on third party land or property.

Raising levels can also create areas where surface water might pond during significant rainfall events. Any proposals to raise ground levels should be tested to ensure that it would not cause increased ponding or build-up of surface runoff on third party land.

Any proposal for modification of ground levels will need to be assessed as part of a detailed flood risk assessment.

Development and raised defences

Construction of localised raised floodwalls or embankments to protect new development is not a preferred option, as a residual risk of flooding will remain if they are overtopped or breached.

If defences are constructed to protect a development site, it will need be demonstrated that the defences will not have a resulting negative impact on flood risk elsewhere, and that there is no net loss in floodplain storage. Compensatory storage must be provided where raised defences remove storage from the floodplain. It would be preferable for schemes to involve an integrated flood risk management solution.

Temporary or demountable defences are not acceptable forms of flood protection for a new development but might be appropriate to address circumstances where the consequences of residual risk are severe. In addition to the technical measures the proposals must include details of how the temporary measures will be erected and decommissioned, responsibility for maintenance and the cost of replacement when they deteriorate.

Buffer strips

The provision of a buffer strip to 'make space for water', allows additional capacity to accommodate climate change and ensure access to the watercourse, structures and defences is maintained for future maintenance purposes.

It also enables the avoidance of disturbing riverbanks, adversely impacting ecology and having to construct engineered riverbank protection. Building adjacent to riverbanks can also cause problems to the structural integrity of the riverbanks and the building itself, making future maintenance of the river much more difficult.

9.4.5 Reducing flood risk through site design from other sources

Surface water

Reference should be made to the Environment Agency's Risk of flooding from Surface Water Map. KCC expect that the site should be designed so that the natural surface water flow routes are preserved. This will mitigate the need for resistance and resilience measures at the new development. If residual surface water flood risk remains, the likely flow routes and depths across the site should be modelled.

Sustainable Drainage Systems (SuDS) aim to mimic the natural processes of greenfield surface water drainage by encouraging water to flow along natural flow routes and thereby reduce runoff rates and volumes during storm events while providing some water treatment benefits. More detailed guidance on the use of SuDS is providing in Section 10.

Groundwater

Groundwater flooding has a very different flood mechanism to any other and for this reason many conventional flood defence and mitigation methods are not suitable. The only way to fully reduce flood risk would be through building design (development form), ensuring floor levels are raised above the water levels caused by a 1% AEP plus climate change event. Site design would also need to preserve any flow routes followed by the groundwater overland to ensure flood risk is not increased downstream.

Infiltration SuDS can cause increased groundwater levels and subsequently may increase flood risk on or off site. Developers should provide evidence and ensure that this will not be a significant risk.

Sewer flooding

Developers should discuss public sewerage capacity with the water utility company at the earliest possible stage. The development must improve the drainage infrastructure to reduce flood risk on site and the wider area.

Non-return valves prevent water entering the property from drains and sewers. These can be installed within gravity sewers or drains in a property's private sewer upstream of the public sewerage system. They need to be carefully installed and must be regularly maintained. Consideration must also be given to attenuation and flow ensuring that flows during the 1% AEP plus climate change storm event are retained within the site if any flap valves shut. This must be demonstrated with suitable modelling techniques. Particular consideration should be given to designing drainage systems that reduce the risk of groundwater ingress, as this is a known existing problem as explained in Section 7.9.

Reservoirs

The risk to development from reservoirs is residual but developers should consider reservoir flooding during the planning stage:

Developers should seek to contact the reservoir owner to obtain information which may include

- reservoir characteristics: type, dam height at outlet, area/volume, overflow location;
- operation: discharge rates / maximum discharge;
- discharge during emergency drawdown; and
- inspection / maintenance regime.

Developers should apply the sequential approach to locating development within the site. The following questions should be considered

- can risk be avoided through substituting less vulnerable uses or by amending the site lay-out?
- can it be demonstrated that less vulnerable uses for the site have been considered and reasonably discounted? and

- can layout be varied to reduce the number of people or flood risk vulnerability or building units located in higher risk parts of the site?

Consultation should be undertaken with relevant authorities regarding emergency plans in case of reservoir breach.

In addition to the risk of inundation those considering development in areas affected by breach events should also assess the potential hydraulic forces imposed by the rapid flood event and check that the proposed infrastructure fabric can withstand the loads imposed on the structures by a breach event.

9.4.6 Resistance and Resilience measures

There may be instances where flood risk to a development remains despite implementation of such site design and layout measures as those outlined above. For example, where the use is water compatible where an existing building is being changed, where residual risk remains behind defences, or where floor levels have been raised but there is still a risk at the 0.1% AEP scenario. In these cases, (and for existing development in the floodplain), additional measures can be put in place to reduce damage in a flood and increase the speed of recovery. These measures should not normally be relied on for new development as an appropriate mitigation method.

Resistance measures aim to reduce the amount of floodwater entering the building and resilience measures aim to reduce the damage caused by flood water which has enter the property.

Resistance measures

Most of the resistance measures should be regarded as reducing the rate at which flood water can enter a property during an event and considered an improvement on what could be achieved with sand bags. They are often deployed with small scale pumping equipment to control the flood water that does seep through these systems. The effectiveness of these forms of measures is often dependant on the availability of a reliable forecasting and warning system, so the measures are deployed in advance of an event. The following resistance measures are often deployed:

Permanent barriers

Permanent barriers can include built up doorsteps, rendered brick walls and toughened glass barriers.

Temporary barriers

Temporary barriers consist of moveable flood defences which can be fitted into doorways and/or windows. The permanent fixings required to install these temporary defences should be discrete and keep architectural impact to a minimum. On a smaller scale temporary snap on covers for airbricks and air vents can also be fitted to prevent the entrance of flood water.

Resilience measures

Interior design measures to reduce damage caused by flooding. For example:

- Electrical circuitry installed at a higher level with power cables being carried down from the ceiling rather than up from the floor level
- Water-resistant materials for floors, walls and fixtures
- If redeveloping existing basements for non-residential purposes, new electrical circuitry installed at a higher level with power cables being carried down from the ceiling rather than up from the floor level to minimise damage if the development floods.
- When redeveloping existing buildings, it may be acceptable to install pumps in basements as a resilience measure. However, for new development this is not considered an appropriate solution.

Resistance and resilience measures will be specific to the nature of flood risk, and as such will be informed and determined by the FRA. Further guidance relating to appropriate resistance and resilience measures can be found on the Environment Agency's **Flood risk Assessment in flood zones 2 and 3** webpage. The Kent Resilience Forum also provides information and advice on resilience measures in its **Protect Your Home** section.

9.4.7 Cumulative effects

At some locations it will be necessary to include consideration in an FRA of not only the flood risk at a particular site, but also the cumulative effects of all proposed plan allocations within a catchment. Reference should be made to Section 14.5 with respect to the consideration that should be given in these circumstances.

9.4.8 Community resistance measures

Community resistance measures include demountable defences that can be deployed by local communities to reduce the risk of water ingress to a number of properties. The methods require the deployment of inflatable (usually with water) or temporary quick assembly barriers in conjunction with pumps to collect water that seeps through the systems during a flood. However, new developments should normally not require consideration of community resistance measures.

The Kent Resilience Forum provides advice on **Community Flood Resilience**, containing resources and information on how properties and communities can be made as prepared and resilient for flooding as possible. The Swale Borough Council also provides advice for improving **Community Resilience** to emergency events, including templates that can be used to develop Community Emergency Plans identifying local risks, how a response can be managed and the local people who could assist with it.

9.4.9 Emergency planning

Safe access and egress from the site should be provided to reduce the residual risks to a development. The developer should seek to incorporate an emergency plan and a safe refuge point if the development site has been identified to be at risk of flooding. The local authority and Emergency Services should be consulted when designing an emergency plan. For further details on emergency planning, see Section 11.

9.4.10 Making space for water

The **PPG** sets out a clear aim in Flood Zone 3 to create space for flooding by restoring functional floodplain and generally development should be directed away from these areas.

All new development close to rivers should consider the opportunity presented to improve and enhance the river environment. Developments should look at opportunities for river restoration and enhancement as part of the development. Options include backwater creation, de-silting, in-channel habitat enhancement and removal of structures. When designed properly, such measures can have benefits such as reducing the costs of maintaining hard engineering structures, reducing flood risk, improving water quality and increasing biodiversity. Social benefits are also gained by increasing green space and access to the river.

Consideration for making space for water should also be applied to surface water generated by impermeable surfaces. All new developments should aim to incorporate SuDS to minimise the amount of surface water that is generated. Through a sequential design, known areas of flood risk from surface water can be set aside as open space to ensure flow routes are not blocked, preventing water from building up to potentially dangerous depths. The provision of SuDS also allows water related features to become

part of the landscape, offering improved aesthetics to a development and removing the need for underground storage or culverting.

9.5 Developer contributions

In some cases, and following the application of the sequential test, it may be necessary for the developer to contribute to the improvement of flood defence provision that would benefit both proposed new development and the existing local community. Developer contributions can also be made to maintenance and provision of flood risk management assets, flood warning and the reduction of surface water flooding (i.e. SuDS).

DEFRA's Flood and Coastal Risk Management Grant in Aid (FCRMGiA)[9] can be obtained by operating authorities to contribute towards the cost of a range of activities including flood risk management schemes that help reduce the risk of flooding and coastal erosion. Some schemes are only partly funded by FCRMGiA and therefore any shortfall in funds will need to be found from elsewhere when using Resilience Partnership Funding, for example local levy funding, local businesses or other parties benefitting from the scheme.

For new development in locations without existing defences, or where the development is the only beneficiary, the full costs of appropriate risk management measures for the life of the assets proposed must be funded by the developer.

However, the provision of funding by a developer for the cost of the necessary standard of protection from flooding or coastal erosion does not mean the development is appropriate as other policy aims must also be met. Funding from developers should be explored prior to the granting of planning permission and in partnership with the Council and the Environment Agency. Developers should use the MEASS and other strategies to guide where developer contributions may be needed.

The appropriate route for the consideration of strategic measures to address flood risk issues is the Local Flood Risk Management Strategy (LFRMS) prepared by the Lead Local Flood Authority. The LFRMS should describe the priorities with respect to local flood risk management, the measures to be taken, the timing and how they will be funded. It will be preferable to be able to demonstrate that strategic provisions are in accordance with the LFRMS, can be afforded and have an appropriate priority.

The Environment Agency is also committed to working in partnership with developers to reduce flood risk. Where assets are in need of improvement or a scheme can be implemented to reduce flood risk, the Environment Agency request that developers contact them to discuss potential solutions.

9 Principles for implementing flood and coastal resilience funding partnerships (Environment Agency, 2012)

10 Surface water management and SuDS

10.1 Introduction

Sustainable Drainage Systems (SuDS) are management practices which enable surface water to be drained in a more sustainable manner and to mimic the local natural drainage. The inclusion of SuDS within developments is an opportunity to enhance ecological and amenity value, and promote Green Infrastructure, incorporating above ground facilities into the development landscape strategy.

10.2 Role of the LLFA and Local Planning Authority in surface water management

From April 2015[10] local planning policies and decisions on planning applications relating to major development or major commercial development should make provision for sustainable drainage systems to manage run-off, where major developments are defined as:

- residential development: 10 dwellings or more, or residential development with a site area of 0.5 hectares or more where the number of dwellings is not yet known; and
- non-residential development: provision of a building or buildings where the total floor space to be created is 1,000 square metres or more or, where the floor area is not yet known, a site area of one hectare or more.

The Local Planning Authority must satisfy themselves that clear arrangements are in place for future management of the maintenance arrangements and the LLFA (Kent County Council), as statutory consultee is required to review the drainage and Sustainable Urban Drainage proposals to confirm they are appropriate.

When considering planning applications, local planning authorities should seek advice from the relevant flood risk management bodies, principally the LLFA on the management of surface water (including what sort of SuDS they would consider to be reasonably practicable), satisfy themselves that the proposed minimum standards of operation are appropriate and ensure, through the use of planning conditions or planning obligations, that there are clear arrangements for on-going maintenance over the development's lifetime. Judgement on what SuDS system would be reasonably practicable should be through reference to Defra's **'Non-statutory technical standards for SuDS' document** and should take into account design and construction costs.

It is essential that developers consider sustainable drainage at an early stage of the development process – ideally at the master-planning stage. This will assist with the delivery of well designed, appropriate and effective SuDS. Proposals should also comply with the key SuDS principles regarding solutions that deliver multiple long-term benefits. These principles are:

- **Quantity:** should be able to cope with the quantity of water generated by the development at the agreed rate with due consideration for climate change via a micro-catchment based approach
- **Quality:** should utilise SuDS features in a "treatment train" that will have the effect of treating the water before infiltration or passing it on to a subsequent water body

10 House of Commons: Written Statement (HCWS161) Written Statement made by: The Secretary of State for Communities and Local Government (Mr Eric Pickles) on 18 Dec 2014. Department for Communities and Local Government (2014). Accessed online at: https://www.parliament.uk/documents/commons-vote-office/December%202014/18%20December/6.%20DCLG-sustainable-drainage-systems.pdf

- **Amenity/Biodiversity:** should be incorporated within "open space" or "green corridors" within the site and designed with a view to performing a multifunctional purpose

10.3 SuDS opportunities in Swale Borough

10.3.1 Infiltration

Sites underlain by higher permeability bedrock provide opportunities for infiltration techniques, like soakaways and infiltration trenches. A key Kent County Council policy set out in the **Drainage and Planning Policy Statement** is to maximise infiltration through SuDS schemes wherever possible, with efforts made to utilise opportunities for infiltration where sites are underlain by lower permeability soils and bedrock. Where lower permeability bedrocks are overlain by more permeable superficial deposits, such as sands and gravels, there may be opportunities for shallow infiltration SuDS, such as filter drains. As such, infiltration of surface water is expected by KCC for new developments.

Site characteristics can vary greatly over small areas and therefore each site should be individually investigated to ensure suitability of the proposed infiltration technique. Infiltration testing should be undertaken to demonstrate whether infiltration is possible. If infiltration is possible then the rate of infiltration should be provided in the drainage proposal as part of the planning application.

10.3.2 Other SuDS opportunities

SuDS can be integrated into the design of all new development within Swale Borough. The **Water, People, Places** guidance identifies specific site characteristics and constraints that can limit the effectiveness of SuDS including (but not limited to) existing flood conditions, runoff characteristics, high groundwater levels and Groundwater Source Protection Zones (GSPZ), topography, soil type, geology, contaminated land, existing infrastructure, land ownership, ecology and space constraints.

Areas with low permeability soils and bedrock may still have potential for surface detention features, such as ponds and basins, while areas at risk of fluvial flooding can provide attenuation and biodiversity through the implementation of conveyance features, such as swales, and wetland areas. In more densely populated areas, like Sittingbourne, Faversham, and Sheerness, space efficient SuDS approaches may be suitable, such as green roofs, rills and permeable paving.

Additionally, Kent County Council prefer the application of 'green' and open SuDS, such as attenuation ponds, rills and swales, where possible, as opposed to 'hard' SuDS, such as permeable paving.Sources of SuDS guidance

10.3.3 C753 CIRIA SuDS Manual (2015)

The C753 CIRIA SuDS Manual (2015) provides the latest guidance and best practice on planning, design, construction and maintenance of SuDS. The document is designed to help the implementation of SuDS features into new and existing developments, whilst maximising the key benefits regarding flood risk and water quality. It is recommended that developers and the LPA utilise the information within the manual to help design SuDS which are appropriate for development.

10.3.4 Defra Non-Statutory Technical Guidance (2015)

The **guidance** was developed to sit alongside PPG and provide non-statutory standards as to the expected design and performance for SuDS. The LPA will make reference to these standards when determining whether proposed SuDS are considered reasonably practicable and appropriate.

10.3.5 Kent County Council's Drainage and Planning Policy Statement (2017)

KCC's **Drainage and Planning Policy Statement** sets out the requirements for sustainable drainage and how drainage strategies and surface water management provisions will be reviewed for SuDS schemes specific to Kent.

The policy provides the following requirements for developments on greenfield and previously developed sites:

- For developments on greenfield sites peak runoff rates from the 1 in 1-year (100% AEP) to the 1 in 100-year (1% AEP) rainfall events should be limited to the peak greenfield runoff rates for the same events.
- For developments on brownfield sites, the peak runoff rate must be as close as reasonably practicable to the greenfield runoff rate but should never exceed the existing rate of discharge prior to redevelopment. Unless it can be demonstrated to be reasonably impracticable, a 50% reduction in the peak runoff rate is expected.
- The drainage system must be designed to operate without flooding on any part of the site during any rainfall event up to (and including) a 1 in 30-year (3.3% AEP) rainfall event.
- The drainage system must also be designed to operate without flooding in any building up to (and including) a 1 in 100-year (1% AEP) plus climate change rainfall event, without exacerbating off-site flood risk.
- Exceedance flows that cannot be managed within the drainage system must be managed via exceedance routes that minimise the risks to people and property.
- Attenuation storage volumes provided by drainage areas must half empty within 24 hours to enable runoff from subsequent storms to be received. If the time taken to drain from full to empty exceeds 24 hours long duration events should be assessed to ensure drainage is not negatively impacted by inundation.

Kent County Council expect betterment of runoff rates from developments on brownfield sites where possible at the majority of potential development sites

A new policy statement is currently being prepared by Kent County Council and the emerging document should be referred to for the latest requirements for development applications once available.

The policy statement is supported by Kent County Council's **Making it Happen**, guidance which consists of technical appendices advising on the construction and design of SuDS features. Additionally, Kent County Council and partner LLFAs produced a document on SuDS design and guidance, aimed at developers and planners involved in designing small and large developments in the South East of England. This document is called **Water, People, Places: A guide for master planning sustainable drainage into developments**.

More information and guidance on SuDS is available on the **Susdrain** website.

10.3.6 Groundwater Vulnerability Zones

The Environment Agency published new groundwater vulnerability maps in 2015. These maps provide a separate assessment of the vulnerability of groundwater in overlying superficial rocks and those that comprise the underlying bedrock. The maps show the vulnerability of groundwater at a location based on the hydrological, hydrogeological and soil properties within a one-kilometre grid square.

Two maps are available

- **Basic groundwater vulnerability map:** this shows the likelihood of a pollutant discharged at ground level (above the soil zone) reaching groundwater for superficial and bedrock aquifers and is expressed as high, medium and low vulnerability
- **Combined groundwater vulnerability map:** this map displays both the vulnerability and aquifer designation status (principal or secondary). The aquifer designation status is an indication of the importance of the aquifer for drinking water supply.

The groundwater vulnerability maps should be considered when designing SuDS. Depending on the height of the water table at the location of the proposed development site, restrictions may be placed on the types of SuDS appropriate to certain areas.

10.3.7 Groundwater Source Protection Zones (GSPZ)

The Environment Agency also defines Groundwater Source Protection Zones in the vicinity of groundwater abstraction points. These areas are defined to protect areas of groundwater that are used for potable supply, including public / private potable supply, (including mineral and bottled water) or for use in the production of commercial food and drinks. **The Environment Agency's approach to groundwater protection** document defines what restrictions are placed on infiltration in these zones.

The definition of each zone is shown below:

- **Zone 1 (Inner Protection Zone)** – Most sensitive zone: defined as the 50-day travel time from any point below the water table to the source. This zone has a minimum radius of 50 metres.
- **Zone 2 (Outer Protection Zone)** – Also sensitive to contamination: defined by a 400-day travel time from a point below the water table. This zone has a minimum radius around the source, depending on the size of the abstraction.
- **Zone 3 (Total Catchment)** - Defined as the area around a source within which all groundwater recharge is presumed to be discharged at the source. In confined aquifers, the source catchment may be displaced some distance from the source. For heavily exploited aquifers, the final Source Catchment Protection Zone can be defined as the whole aquifer recharge area where the ratio of groundwater abstraction to aquifer recharge (average recharge multiplied by outcrop area) is >0.75. Individual source protection areas will still be assigned to assist operators in catchment management.
- **Zone 4 (Zone of special interest**) – A fourth zone SPZ4 or 'Zone of Special Interest' usually represents a surface water catchment which drains into the aquifer feeding the groundwater supply (i.e. catchment draining to a disappearing stream). In the future this zone will be incorporated into one of the other zones, SPZ 1, 2 or 3, whichever is appropriate in the particular case, or become a safeguard zone.

GSPZs in the Local Plan area

Large areas in the south of the Local Plan area are within Groundwater Source Protection Zones, as well as two small patches in the northwest of the Isle of Sheppey (Figure 10-1). The following built up areas have been identified to be at least partially within a Groundwater Source Protection Zone:

- Bapchild (Zone 2 and 3)
- Borden (Zone 1 and 2)
- Bredgar (Zone 2)
- Doddington (Zone 1)

- Eastling (Zone 2)
- Faversham (Zone 1 and 2)
- Hartlip (Zone 2)
- Minster (Zone 1)
- Neames Forstal (Zone 2 and 3)
- Newnham (Zone 1 and 3)
- Rodmersham (Zone 1, 2 and 3)
- Selling (Zone 2 and 3)
- Sittingbourne (Zone 1, 2 and 3)

10.3.8 Nitrate Vulnerable Zones

Nitrate Vulnerable Zones (NVZs) are areas designated as being at risk from agricultural nitrate pollution. Nitrate levels in waterbodies are affected by surface water runoff from surrounding agricultural land entering receiving waterbodies.

The level of nitrate contamination will potentially influence the choice of SuDS and should be assessed as part of the design process. The definition of each NVZ is as follows:

- **Groundwater NVZ** – an area of land where groundwater supplies are at risk from containing nitrate concentrations exceeding the 50mg/l level dictated by the EU's Surface Water Abstraction Directive (1975) and Nitrates Directive (1991).
- **Surface Water NVZ** – an area of land where surface waters (in particular those used or intended for the abstraction of drinking water) are at risk from containing nitrate concentrations exceeding the 50 mg/l dictated by the EU's Surface Water Abstraction Directive (1975) and Nitrate Directive (1991).
- **Eutrophic NVZ** – an area of land where nitrate concentrations are such that they could / will trigger the eutrophication of freshwater bodies, estuaries, coastal waters and marine waters.

The locations of the Nitrate Vulnerable Zones in the Local Plan area are shown in Figure 10-2.

Figure 10-1: Groundwater Source Protection Zones in the Local Plan area

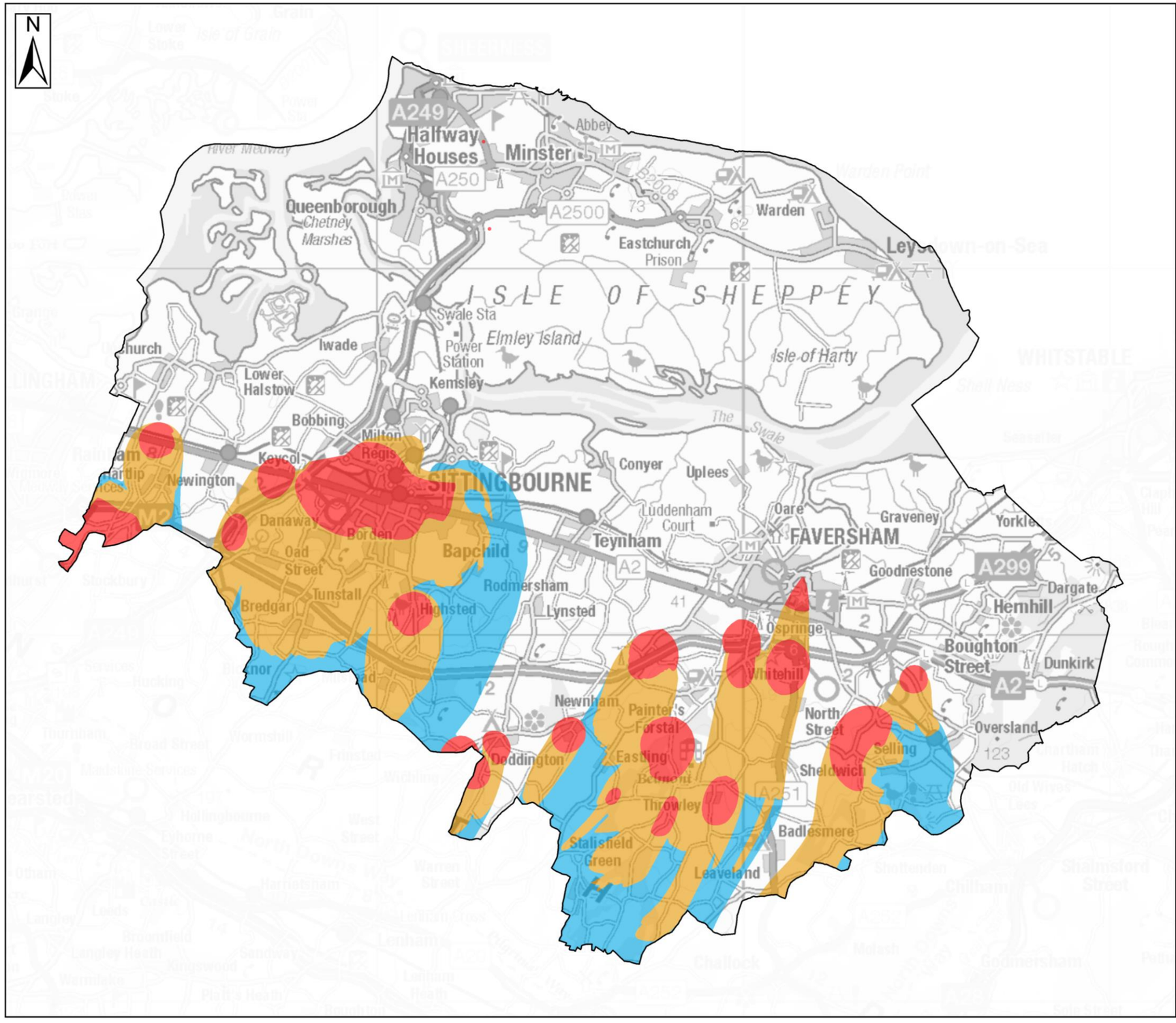


Figure 10-2: Nitrate Vulnerability Zones in the Local Plan area

11 Special Areas for consideration

11.1 Faversham Creek

In addition to the Flood Zones described in Table 1 of the PPG (Table 4-1), Swale Borough Council have made provision for consideration of Flood Zone 3a(i) for the purpose of performing the Sequential and Exception Tests in Faversham Creek.. Flood Zone 3a(i) was described within the Faversham Creek SFRA 2010 to help deliver development with the Faversham Creek Neighbourhood Plan area. Flood Zone 3a(i) has been brought forward to this 2019 SFRA.

This Flood Zone comprises previously developed land having a 1 in 20 or greater annual probability of sea flooding (5% AEP) in a defended scenario in the Faversham Creek Neighbourhood Plan area. Flood Zone 3a(i) for Faversham Creek is described further in Table 11-1.

Table 11-1: Flood Zone 3a(i) description

Zone	Probability	Description
Zone 3a(i)	Very High probability of tidal flooding	This zone comprises land assessed as having a greater than 1 in 20 annual probability of flooding from the sea (>5% AEP) in a defended scenario and is land which is previously developed in Faversham Creek. This zone has not been mapped in the 2019 SFRA and should be demonstrated through a site-specific FRA.
		Water compatible development (as defined in NPPF Planning Practice Guidance) is permitted in this zone. Essential infrastructure, more vulnerable and less vulnerable development (as defined in NPPF Planning Practice Guidance) are only permitted if they satisfy the Exception Test. Highly vulnerable development is not permitted.
		All proposed development in this zone requires an FRA.

11.1.1 Faversham Creek Sequential and Exception Tests requirements

The flood risk vulnerability and flood zone 'compatibility' for Zone 3a(i) is described in Table 11-2.

Table 11-2: Flood risk compatibility table for Flood Zone 3a(i) in Faversham Creek

Vulnerability classification				
Essential Infrastructure	**Water Compatible**	**Highly Vulnerable**	**More Vulnerable**	**Less vulnerable**
Exception Test	✓	✗	Exception Test	Exception Test

In Flood Zone 3a(i) essential infrastructure that has to be there and has satisfied the Exception Test, should be designed to:

- Remain operational and safe for users in times of flood both now and for the lifetime of the development;
- Not increase flood risk elsewhere and wherever possible contribute to a net reduction in risk to existing communities; and
- Satisfy the strategic objectives for flood risk management, positively contribute to these and not compromise implementation or delivery of schemes to manage flood risk.

More vulnerable and less vulnerable development and has satisfied the Exception Test should be designed to:

- Be safe for users and occupants in times of flood both now and for the lifetime of the development;
- Not increase flood risk elsewhere and wherever possible contribute to a net reduction in risk to existing communities;
- Where necessary, include appropriate arrangements for flood warning and safe access and egress; and
- Satisfy the strategic objectives for flood risk management (as provided in the many of documents listed in Section 2), positively contribute to these and not compromise implementation or delivery of schemes to manage flood risk.

11.1.2 FRA guidance for sites in Flood Zone 3a(i) in Faversham Creek

Sea levels are the influential mechanism causing flood risk in Zone 3a(i). When preparing FRAs in Zone 3a(i) to assess the potential effects of flooding it should not be assumed that the mechanisms related to the storage and flow of flood water during an event are exactly the same as for river flooding. In particular, consideration should be given to the potential effect on tide flows and how proposals affect these, during both the incoming and outgoing tide periods. It is possible that the application of simplistic practices to preserve flood storage volumes will have negligible effect and are not influential with respect to potential effects on third parties.

When FRAs are assessing the safety of development over its intended lifetime, consideration should be given to the commitment required for the future provision and maintenance of strategic flood risk management infrastructure so that existing and planned communities are safe now and into the future.

Additionally, FRAs should demonstrate the following.

Change of use of an existing building

- Proposals for the ground floor are no more vulnerable than the current use and exclude more vulnerable uses such as residential development, and
- Upper floors are designed to be safe and that there is safe access and egress

Redevelopment

- More vulnerable uses such as residential development are not located on the ground floor
- Upper floors are designed to be safe and that there is safe access and egress
- There is no detriment to flood flow and wherever possible opportunities are taken to build in increased flood storage, flood flow routes and sustainable drainage
- Flood risk elsewhere would not increase
- Where appropriate, the risk of flooding and consequences have been reduced by introducing design and flood resistant and resilient construction techniques
- While it is generally not possible to change and improve access arrangements beyond the boundary of the property, wherever possible, risks associated with access should be reduced as part of the redevelopment
- It is a priority that all proposed development includes provision for flood warning and if appropriate the preparation of emergency plans. This will enable appropriate actions to be taken by occupants and owners in advance

of a flood event. If possible, emergency planning provisions should be legally bound to the property, so that provisions remain in place in circumstances where ownership changes

Developers should contact Swale Borough Council and the Environment Agency at the earliest stage. Swale Borough Council will consult their emergency planners if new development is likely to have implications for emergency planning and the emergency services.

It should also be noted that the Environment Agency is likely to object to any application where the FRA concludes that the depth and velocity of flooding are such that an acceptable standard of safety cannot be achieved or, where the FRA fails to demonstrate that these standards have been met and approved by the LPA.

In preparing FRAs reference should be made to other relevant strategies for the management of risk of flooding from the sea.

11.2 Iwade

The Iwade catchment is an area identified by Kent County Council where the effective implementation of SuDS features is likely to be key to enabling future development. There is a history of flooding in Iwade that is exacerbated by large areas of flow paths being culverted, with future development likely to have a reasonably significant impact on flood risk. As such, it is important that SuDS features and landscaping in potential developments are designed to attenuate surface water before it enters the Iwade Stream. Potential development in the Iwade catchment will only be permitted if it is demonstrable that betterment of runoff rates will be achieved.

11.3 Minster

The land within the area of Minster is flat, uses a ditch system for drainage and is therefore a sensitive area for drainage delivery. Within this area, attenuation of runoff should be considered with SuDS design. KCC should be consulted on the drainage design for the development site at an early stage in this area.

12 Flood warning and emergency planning

12.1 Emergency planning

Emergency planning is one option to help manage flood related incidents. From a flood risk perspective, emergency planning can be broadly split into three phases: before, during and after a flood. The measures involve developing and maintaining arrangements to reduce, control or mitigate the impact and consequences of flooding and to improve the ability of people and property to absorb, respond to and recover from flooding.

In development planning, a number of emergency planning activities are already integrated in national building control and planning policies e.g. the NPPF Flood Risk Vulnerability and Flood Zone 'Compatibility' table seeks to avoid inappropriate development in areas at risk from all sources of flooding. Flood warning and emergency planning is a last resort after using this SFRA to undertake the Sequential Test appropriately first.

However; safety is a key consideration for any new development and includes residual risk of flooding, the availability of adequate flood warning systems for the development, safe access and egress routes and evacuation procedures.

ADEPT and the Environment Agency have published a **Flood Risk Emergency Plans for New Development** document which provides guidance for Local Planning Authorities regarding their decisions over planning applications.

The **NPPF Planning Practice Guidance** outlines how developers can ensure safe access and egress to and from development in order to demonstrate that development satisfies the second part of the Exception Test. As part of an FRA, the developer should review the acceptability of the proposed access in consultation with the LPA (where appropriate) and the Environment Agency.

There are circumstances where a flood warning and evacuation plan[11] is required and / or advised:

- It is a **requirement under the 2018 NPPF** that safe access and escape routes are included in an FRA where appropriate, as part of an agreed emergency plan.
- The **Environment Agency and Defra's standing advice** for undertaking flood risk assessments for planning applications states that details of emergency escape plans will be required for any parts of the building that are below the estimate flood level.

It is recommended that Emergency Planners at Swale Borough Council (where appropriate) are consulted prior to the production of any emergency flood plan.

In addition to the **flood warning and evacuation plan considerations listed in the NPPF / PPG**, it is advisable that developers also acknowledge the following:

- How to manage the consequences of events that are un-foreseen or for which no warnings can be provided e.g. managing the residual risk of a breach.
- Proposed new development that places additional burden on the existing response capacity of the Councils will not normally be considered to be appropriate.
- Developers should encourage those owning or occupying developments, where flood warnings can be provided, to sign up to receive them. This applies even if the development is defended to a high standard.

[11] Flood warning and evacuation plans may also be referred to as an emergency flood plan or flood response plan.

- The vulnerability of site occupants.
- Situations may arise where occupants cannot be evacuated (e.g. prisons) or where it is safer to remain "in-situ" and / or move to a higher floor or safe refuge area (e.g. at risk of a breach). These allocations should be assessed against the outputs of the SFRA and where applicable, a site-specific Flood Risk Assessment to help develop emergency plans.

Further emergency planning information links:

- **2004 Civil Contingencies Act**
- **DEFRA (2014) National Flood Emergency Framework for England**
- **Sign up for Flood Warnings with the Environment Agency**
- **National Flood Forum**
- **GOV.UK Make a Flood Plan guidance and templates**
- **FloodRe**

12.2 Flood warning systems

Flood warnings can be derived and, along with evacuation plans, can inform emergency flood plans or flood response plans. The Environment Agency is the lead organisation for providing warnings of fluvial flooding (for watercourses classed as Main Rivers) and coastal flooding in England. Flood Warnings are supplied via the Flood Warning Service (FWS), to homes and business within Flood Zones 2 and 3. The different levels of warnings are shown in Table 12-1.

Table 12-1: Environment Agency Warnings

Flood Warning Symbol	What it means	What to do
	Flood Alerts are used to warn people of the possibility of flooding and encourage them to be alert, stay vigilant and make early preparations. It is issued earlier than a flood warning, to give customers advance notice of the possibility of flooding, but before there is full confidence that flooding in Flood Warning Areas is expected.	• Be prepared to act on your flood plan • Prepare a flood kit of essential items • Monitor local water levels and the flood forecast on the Environment Agency website • Stay tuned to local radio or TV • Alert your neighbours • Check pets and livestock • Reconsider travel plans
	Flood Warnings warn people of expected flooding and encourage them to take action to protect themselves and their property.	• Move family, pets and valuables to a safe place • Turn off gas, electricity and water supplies if safe to do so • Seal up ventilation system if safe to do so • Put flood protection equipment in place

Flood Warning Symbol	What it means	What to do
		• Be ready should you need to evacuate from your home • 'Go In, Stay In, Tune In'
	Severe Flood Warnings warn people of expected severe flooding where there is a significant threat to life.	• Stay in a safe place with a means of escape • Co-operate with the emergency services and local authorities • Call 999 if you are in immediate danger
Warning no longer in force	Informs people that river or sea conditions begin to return to normal and no further flooding is expected in the area. People should remain careful as flood water may still be around for several days.	• Be careful. Flood water may still be around for several days • If you've been flooded, ring your insurance company as soon as possible

It is the responsibility of individuals to sign-up to the Flood Warning Service in order to receive the flood warnings via FWS. Registration and the service is free and publicly available through **https://www.gov.uk/sign-up-for-flood-warnings** or call 0345 988 1188.

It is recommended that any household considered at risk of flooding signs-up. Developers should also encourage those owning or occupying developments, where flood warnings can be provided, to sign up to receive them. This applies even if the development is defended to a high standard.

12.2.1 Flood Alert and Warning Areas in the Local Plan area

There are currently four Flood Alert Areas (FAAs) and five Flood Warning Areas (FWAs). These are displayed in Appendix J. A list of the FAAs in the study area are shown in Table 12-2 and a list of FWAs are shown in Table 12-3.

Table 12-2: Flood Alert Areas within Swale Borough Local Plan area

Flood Alert Code	Flood Alert Name	Source of flooding	Description
064WAC1ShepSwale	Isle of Sheppey and coast from Kemsley to Seasalter	The Swale, North Sea	Coastal areas on the Isle of Sheppey and North Kent Coast from Kemsley to Seasalter, including Sheerness, Minster, Queenborough, Leysdown, Sittingbourne and Faversham.
064WAT1MedEst	Tidal Medway, Medway Estuary and Isle of Grain	River Medway	Areas at risk of tidal flooding from the River

Flood Alert Code	Flood Alert Name	Source of flooding	Description
			Medway, including Lower Halstow.
064WAF331	Rivers on the Isle of Sheppey	Scrapsgate Drain, Warden Bay Drain	Scrapsgate Drain from the B2008 to the sea, through Minster and Scrapsgate, and Warden Bay Drain from Bay View to the sea, including Warden and surrounding holiday villages.
064FAG99Eastkent	Groundwater flooding in East Kent	Groundwater	Areas at risk of groundwater flooding along the eastern boundary of Swale Borough

Table 12-3: Flood Warning Areas within Swale Borough Local Plan area

Flood Warning Code	Flood Warning Name	Source of flooding	Description
064FWC1Leysdown	Coast from Warden Bay to Hamlet of Shellness	North Sea	Coastal areas from Warden Bay to Shellness, including Warden, Bay View and Leysdown on Sea
064FWC1Sheerness	Sheerness, Minster and Queenborough	North Sea	Coastal areas in Sheerness, Minster and Queenborough, including Rushenden, Scrapsgate and West Minster
064FWC1Kemsley	Coast from Kemsley to Seasalter	North Sea and The Swale	Coastal areas from Kemsley to Seasalter, including Sittingbourne, Conyer and Faversham
064FWT1Medway	Tidal River Medway and Medway Estuary	River Medway	Areas at risk of tidal flooding from the River Medway, including Lower Halstow.
064FWF9A1	Scrapsgate Drain and Warden Bay Drain	Scrapsgate Drain, Warden Bay Drain	Scrapsgate Drain and Warden Bay Drain on the Isle of Sheppey

12.2.2 Reservoirs

Reservoir flooding is very different from other forms of flooding. It may happen with little or no warning and evacuation will need to happen immediately. The likelihood of such flooding is difficult to estimate, but it is very much less likely than flooding from rivers or surface water. It may not be possible or safe to seek refuge upstairs from floodwater as buildings could be unsafe or unstable due to the force of water from the reservoir breach or failure.

12.2.3 Local arrangements for managing flood risk

The **Flood Risk to Communities in Swale** report details the Category 1 and Category 2 responders for a flooding emergency in the borough, as well as their roles and responsibilities. The Swale Borough Council's **website** also provides information on emergency planning, community resilience planning and useful contacts in case of a flood incident. Additionally, the **Kent County Council Flood Response Plan** outlines the response of the Local Authority to a flooding event, with information on actions, roles and responsibilities, with coastal, fluvial, surface water and groundwater flooding all accounted for.

12.3 Emergency planning and development

12.3.1 NPPF

The NPPF Flood Risk Vulnerability and Flood Zone 'Compatibility' table seeks to avoid inappropriate development in areas at risk from all sources of flooding. It is essential that any development which will be required to remain operational during a flood event is located in the lowest flood risk zones to ensure that, in an emergency, operations are not impacted on by flood water or that such infrastructure is resistant to the effects of flooding such that it remains serviceable/operational during 'upper end' events, as defined in the Environment Agency's Climate Change allowances (February, 2016). For example, the NPPF classifies police, ambulance and fire stations and command centres that are required to be operational during flooding as Highly Vulnerable development, which is not permitted in Flood Zones 3a and 3b and only permitted in Flood Zone 2 providing the Exception Test is passed. Essential infrastructure located in Flood Zone 3a or 3b must be operational during a flood event to assist in the emergency evacuation process. All flood sources such as fluvial, surface, groundwater, sewers and artificial sources (such as canals and reservoirs) should be considered. In particular sites should be considered in relation to the areas of drainage critical problems highlighted in the relevant SWMPs.

The outputs of this SFRA should be compared and reviewed against any emergency plans and continuity arrangements. This includes the nominated rest and reception centres (and perspective ones), so that evacuees are outside of the high-risk Flood Zones and will be safe during a flood event.

12.3.2 Safe access and egress

The NPPF Planning Practice Guidance outlines how developers can secure safe access and egress to and from development in order to demonstrate that development satisfies the second part of the Exception Test[12]. Access considerations should include the voluntary and free movement of people during a 'design flood' as well as for the potential of evacuation before a more extreme flood. The access and egress must be functional for changing circumstances over the lifetime of the development. The NPPF Planning Practice Guidance sets out that:

- Access routes should allow occupants to safely access and exit their dwellings in design flood conditions. In addition, vehicular access for emergency

[12] NPPF Planning Practice Guidance: Flood Risk and Coastal Change (paragraph 039, Reference ID: 7-056-20140306) March 2014

services to safely reach development in design flood conditions is normally required; and

- Where possible, safe access routes should be located above design flood levels and avoid flow paths including those caused by exceedance and blockage. Where this is unavoidable, limited depths of flooding may be acceptable providing the proposed access is designed with appropriate signage etc. to make it safe. The acceptable flood depth for safe access will vary as this will be dependent on flood velocities and risk of debris in the flood water. Even low levels of flooding can pose a risk to people in situ (because of, for example, the presence of unseen hazards and contaminants in floodwater, or the risk that people remaining may require medical attention).

The depth, velocity and hazard mapping from hydraulic modelling should help inform the provision of safe access and egress routes.

As part of an FRA, the developer should review the acceptability of the proposed access in consultation with Swale Borough Council and the Environment Agency. Site and plot specific velocity and depth of flows should be assessed against standard hazard criteria to ensure safe access and egress can be achieved.

12.3.3 Potential evacuations

During flood incidents, evacuation may be considered necessary. The NPPF Planning Guidance states practicality of safe evacuation from an area will depend on[13]:

1. the type of flood risk present, and the extent to which advance warning can be given in a flood event;
2. the number of people that would require evacuation from the area potentially at risk;
3. the adequacy of both evacuation routes and identified places that people could be evacuated to (and taking into account the length of time that the evacuation may need to last); and
4. sufficiently detailed and up to date evacuation plans being in place for the locality that address these and related issues.

The vulnerability of the occupants is also a key consideration. The NPPF and application of the Sequential Test aims to avoid inappropriate development in flood risk areas. However, developments may contain proposals for mixed use on the same site. In this instance, the NPPF Planning Practice Guidance states that layouts should be designed so that the most vulnerable uses are restricted to higher ground at lower risk of flooding, with development which has a lower vulnerability (parking, open space etc.) in the highest risk areas, unless there are overriding reasons to prefer a different location[14]. Where the overriding reasons cannot be avoided, safe and practical evacuation routes must be identified.

The Environment Agency and Defra provide standing advice for undertaking flood risk assessments for planning applications. Please refer to **the government website** for the criteria on when to follow the standing advice. Under these criteria, you will need to provide details of emergency escape plans for any parts of the building that are below the estimated flood level. The plans should show:

- single storey buildings or ground floors that do not have access to higher floors can access a space above the estimated flood level, e.g. higher ground nearby;

[13] NPPF Planning Practice Guidance: Flood Risk and Coastal Change (paragraph 057, Reference ID: 7-057-20140306) March 2014
[14] NPPF Planning Practice Guidance, Reducing the causes and impacts of flooding Paragraph: 053 Reference ID: 7-053-20140306

- basement rooms have clear internal access to an upper level, e.g. a staircase; and
- occupants can leave the building if there is a flood and there is enough time for them to leave after flood warnings[15].

Situations may arise where occupants cannot be evacuated (e.g. prisons) or where it is safer to remain "in-situ" and / or move to a higher floor or safe refuge area (e.g. developments located immediately behind a defence and at risk of a breach). These allocations should be assessed against the outputs of the SFRA and where applicable, a site-specific Flood Risk Assessment to help develop appropriate emergency plans.

12.3.4 Flood warning and evacuation plans

Flood warning and evacuation plans are potential mitigation measures to manage the residual risk, as stated in the NPPF Planning Practice Guidance. It is a requirement under the NPPF that a flood warning and evacuation plan is prepared for sites at risk of flooding used for holiday or short-let caravans and camping and are important at any site that has transient occupants (e.g. hostels and hotels).

A flood warning and evacuation plan should detail arrangements for site occupants on what to do before, during and after a flood as this will help to lessen its impact, improve flood response and speed up the recovery process. The Environment Agency provides practical advice and templates on how to prepare flood plans for individuals, communities and businesses (see text box for useful links).

It is recommended that emergency planners at Swale Borough Council are consulted prior to the production of any emergency flood plan. The council will provide guidance to help local communities to protect their home and valuables and understand what to do before, during and after a flood.

Once the emergency flood plan is prepared, it is recommended that it is distributed to emergency planners at Swale Borough Council and the emergency services. When developing a flood warning and evacuation plan, it is recommended that it links in with any existing parish / community level plan.

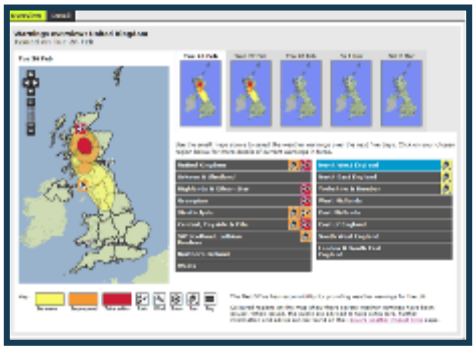
Guidance documents for preparation of flood response plans

- **Environment Agency (2012) Flooding – minimising the risk, flood plan guidance for communities and groups**
- **Environment Agency (2014) Community Flood Plan template**
- **Environment Agency Personal flood plans**
- **Flood Plan UK 'Dry Run' - A Community Flood Planning Guide**
- **ADEPT and the Environment Agency (2019) - Flood Risk Emergency Plans for New Development**

[15] Environment Agency and DEFRA (2012) Flood Risk Assessment: Standing Advice: https://www.gov.uk/flood-risk-assessment-standing-advice

12.3.5 Other sources of information

As well as being a statutory consultee for new development at risk of flooding, the Environment Agency can offer independent technical advice. The Environment Agency website contains a breadth of information on flood risk and there are numerous publications and guidance available. For example, the **"flooding from groundwater"** guide has been produced by the Environment Agency and Local Government Association to offer practice advice to reduce the impact of flooding from groundwater.



The Met Office provides a National Severe Weather Warning Service about rain, snow, wind, fog and ice. The severity of warning is dependent upon the combination of the likelihood of the event happening and the impact the conditions may have. In simplistic terms, the warnings mean: Yellow: Be Aware, Amber: Be Prepared, Red: Take Action. This service does not provide flood warnings. The Met Office provide many other services and products. For further information, please visit their **website**.

The **National Flood Forum** (NFF) is a national charity, set up in 2002 to support those at risk and affected by flooding. The NFF helps people to prepare and recover from flooding as well as campaigning on behalf of flood risk communities, including providing advice on matters such as insurance.

Individual property flood resilience protection (PFR) measures are design to help protect homes and businesses from flooding. These include a combination of flood resistance measures - trying to prevent water ingress – and flood resilience measures - trying to limit the damage and reduce the impact of flooding, should water enter the building. It is important that any measures have the BSI Kitemark. This shows that the measure has been tested and ensures that it meets industry standards. Please visit the **Government website: "Prepare for flooding"** for more information.

13 Strategic flood risk solutions

13.1 Introduction

Strategic flood risk solutions serve more than one development site and may offer a potential opportunity to reduce flood risk in the Local Plan area. The following sections outline different options which could be considered for strategic flood risk solutions. Any strategic solution should ensure they are consistent with wider catchment policy and the local policies. It is important that the ability to deliver strategic solutions in the future is not compromised by the location of proposed development. When assessing the extent and location of proposed development consideration should be given to the requirement to secure land for flood risk management measures that provide wider benefits.

13.2 Flood storage schemes

Flood storage schemes aim to reduce the flows passed downriver to mitigate downstream flooding. Development increases the impermeable area within a catchment, creating additional and faster runoff into watercourses. Flood storage schemes aim to detain this additional runoff, releasing it downstream at a slower rate, to avoid any increase in flood depths and/or frequency downstream. Methods to provide these schemes include[16]:

- enlarging the river channel;
- raising the riverbanks; and/or
- constructing flood banks set back from the river.

Flood storage schemes have the advantage that they generally benefit areas downstream, not just the local area.

13.3 Flood defences

There are a number of formal flood and coastal defences present within the study area (see Section 8 for further information). The flood risk at several potential sites identified within Swale Borough could be influenced by the presence of these defences. At these locations it will be important to understand the benefit that defences can have on reducing flooding, and consequences if their design standard is exceeded or they fail. Residual risk of these defences should be understood and managed. Maintenance arrangements, including funding mechanisms, for the defences will need to be evidenced for the lifetime of development.

13.4 Land raising

Increasing the elevation of land for whole or parts of the sites could be implemented to prevent flood flows affecting the land up to the design level. The elevation selected could be determined to coincide with the re-designation of the site (or part of the site) from one Flood Zone to another (e.g. from Flood Zone 3a to Flood Zone 2).

Raising of land which floods would reduce the volume of storage on the floodplain in a flood event. Such ground level adjustments would therefore require level for level floodplain volume compensation (so no loss of floodplain storage occurs) and also analysis to evidence that the increase in ground levels does not result in adverse changes in flood risk (or other environmental issues) elsewhere, e.g. through deflection of flood water or loss of conveyance.

[16] Environment Agency: Fluvial Design Guide – Chapter 10 (2010)

In low-lying areas of land with little topographic gradient it is likely that conveyance of fluvial flood water may be less critical than the loss of floodplain volume, whereas in areas with greater topographic gradient, conveyance may become more critical.

For tidal/coastal areas, flood volumes may be less critical given the role of the tidal ingress or coastal water levels. However, conveyance and constriction may be a critical consideration if the development obstructs the ingress or outflow of tidal water, for instance in the tidal Swale floodplain, potentially leading to deflection of water and elevation of water levels from the pre-development case. Also, in circumstances where there is land raising in a coastal flood cell consideration would need to be given that the loss of storage volume in the cell due to land raising did not exacerbate flooding elsewhere.

13.5 Promotion of SuDS

By considering SuDS at an early stage in the development of a site, the risk from surface water can be mitigated to a certain extent within the site as well as reduce the risk that the site poses to third party land. The policies and guidance produced by KCC as the LLFA are summarised in Section 10.

13.6 Natural Flood Management

Natural Flood Management (NFM) is the use of natural functions of catchments, floodplains, rivers and the coast to reduce flooding and coastal erosion.

Consideration of 're-wilding' rivers upstream could provide cost efficiencies as well as addressing multiple sources of flood risk; for example, reducing peak flows upstream such as through felling trees into streams or building earth banks to capture runoff, could be cheaper and smaller-scale measures than implementing flood walls for example. With flood prevention schemes, consideration needs to be given to the impact that flood prevention has on the WFD status of watercourses. It is important that any potential schemes do not have a negative impact on the ecological and chemical status of waterbodies.

There are a number of approaches and techniques within NFM, which are summarised in the following sections.

13.6.1 Catchment and Floodplain restoration

Compared to flood defences and flood storage, floodplain restoration represents the most sustainable form of strategic flood risk solution, by allowing watercourses to return to a more naturalised state, and by creating space for naturally functioning floodplains working with natural processes.

Although the restoration of floodplain is difficult in previously developed areas where development cannot be rolled back, the following measures should be adopted:

- Promoting existing and future brownfield sites that are adjacent to watercourses to naturalise banks as much as possible. Buffer areas around watercourses provide an opportunity to restore parts of the floodplain
- Removal of redundant structures to reconnect the river and the floodplain
- Apply the Sequential Approach to avoid new development within the floodplain.

For those sites considered within the emerging Local Plan and / or put forward by developers, that also have watercourses flowing through or past them, the sequential approach should be used to locate development away from these watercourses. This will ensure the watercourses retain their connectivity to the floodplain. Any losses of floodplain connectivity could potentially increase flooding.

13.6.2 Structure Removal and/ or modification (e.g. Weirs)

Structures, both within watercourses and adjacent to them can have significant impacts upon rivers including alterations to the geomorphology and hydraulics of the channel through water impoundment and altering sediment transfer regime, which over time can significantly impact the channel profile including bed and bank levels, alterations to flow regime and interruption of biological connectivity, including the passage of fish and invertebrates.

Many artificial in-channel structures (examples include weirs and culverts) are often redundant and / or serve little purpose and opportunities exist to remove them where feasible. The need to do this is heightened by climate change, for which restoring natural river processes, habitats and connectivity are vital adaptation measures. However, it also must be recognised that some artificial structures may have important functions or historical/cultural associations, which need to be considered carefully when planning and designing restoration work.

In the case of weirs, whilst weir removal should be investigated in the first instance, in some cases it may be necessary to modify a weir rather than remove it. For example, by lowering the weir crest level or adding a fish pass. This will allow more natural water level variations upstream of the weir and remove a barrier to fish migration.

13.6.3 Bank Stabilisation

Bank erosion should be avoided, and landowners are encouraged to avoid using machinery and vehicles close to or within the watercourse.

There are several techniques that can be employed to restrict the erosion of the banks of a watercourse. In an area where bankside erosion is particularly bad and/or vegetation is unable to properly establish, ecologically sensitive bank stabilisation techniques, such as willow spiling, can be particularly effective. Live willow stakes thrive in the moist environment and protect the soils from further erosion allowing other vegetation to establish and protect the soils.

13.6.4 Re-naturalisation

There is potential to re-naturalise a watercourse by re-profiling the channel, removing hard defences, re-connecting the channel with its floodplain and introducing a more natural morphology (particularly in instances where a watercourse has historically been modified through hard bed modification). Detailed assessments and planning would need to be undertaken to gain a greater understanding of the response to any proposed channel modification.

13.6.5 Habitat creation

There are also opportunities to deliver sites through the Environment Agency's Regional Habitat Creation Programme which seeks to replace intertidal habitats that are lost through coastal squeeze. The **Swale Green Grid Strategy** (2016) highlights the estuarine environments of the River Medway and The Swale that provide potential sites for habitat creation or enhancement, including possible locations at Graveney Marshes, Shellness and Elmley National Nature Reserve.

13.6.6 Working with Natural Processes

Developments provide opportunities to work with natural processes to reduce flood and erosion risk, benefit the natural environment and reduce costs of schemes. NFM requires integrated catchment management and involves those who use and shape the land. It also requires partnership working with neighbouring authorities, organisations and water management bodies. The Environment Agency and JBA Consulting have developed **Working with Natural Processes mapping** which displays opportunities

for NFM. The locations highlighted in the mapping with opportunities for NFM are outlined below:

- Boughton and Graveney
- Faversham and Faversham Creek
- Painter's Forstal, Eastling and Tong Green
- Conyer, Teynham and Uplees
- Sittingbourne, Iwade and Rodmersham Green
- Hartlip, Upchurch, Lower Halstow
- Queenborough, Sheerness and Minster
- Elmley and Harty
- Warden, Eastchurch and Leysdown

13.7 Green Infrastructure

Green Infrastructure (GI) is a planned and managed network of natural environmental components and green spaces that intersperse and connect the urban centres, suburbs and rural fringe and consist of:

- Open spaces – parks, woodland, nature reserves, lakes
- Linkages – River corridors and canals, and pathways, cycle routes and greenways
- Networks of "urban green" – private gardens, street trees, verges and green roofs.

The identification and planning of Green Infrastructure is critical to sustainable growth. It merits forward planning and investment as much as other socio-economic priorities such as health, transport, education and economic development. GI is also central to climate change action and is a recurring theme in planning policy. With regards to flood risk, green spaces can be used to manage storm flows and free up water storage capacity in existing infrastructure to reduce risk of damage to urban property, particularly in city centres and vulnerable urban regeneration areas. Green infrastructure can also improve accessibility to waterways and improve water quality, supporting regeneration and improving opportunity for leisure, economic activity and biodiversity.

The **Kent and Medway Growth and Infrastructure Framework** (2015) illustrates the role of GI for development in Swale Borough and the surrounding area. Additionally, **The Swale Borough Local Plan** (2017) provides more detailed information about the Borough's natural assets and green infrastructure network and strategy, highlighting existing and potential GI, and detailing the GI objectives for the Local Plan area in Policy CP 7.

13.8 Engaging with key stakeholders

Flood risk to an area or development can often be attributed to a number of sources such as fluvial, surface water and/or groundwater. In rural areas the definition between each type of flood risk is more distinguished. However, within urban areas flooding from multiple sources can become intertwined. Where complex flood risk issues are highlighted it is important that all stakeholders are actively encouraged to work together to identify issues and provide suitable solutions.

Engagement with riparian owners is also important to ensure they understand their rights and responsibilities including:

- maintaining river bed and banks;

- allowing the flow of water to pass without obstruction; and
- controlling invasive alien species e.g. Japanese knotweed.

More information about riparian owner responsibilities can be found in the Environment Agency's guidance on **Owning a Watercourse** (2018).

14 Assessment of flood risk in potential development areas

14.1 Introduction

A total of 348 sites were provided by Swale Borough Council, as shown in Figure 14-1. The sites that were screened include potential development locations, existing committed development locations, and development allocations and regeneration areas that were adopted in the most recent Local Plan. The data sources used to identify the sites screened are summarised in Table 14-1.

Table 14-1: Data sources for the sites screened in the Level 1 summary assessment

Data source	Number of sites for screening
Adopted Employment Allocations (Local Plan 2017)	5
Adopted Mixed Use Allocations (Local Plan 2017)	7
Adopted Regeneration Areas (Local Plan 2017)	4
Adopted Housing Allocations (Local Plan 2017)	41
Existing Committed Housing Locations (from the Local Plan 2008)	1
Existing Committed Employment Locations (from the Local Plan 2008)	2
Employment Land Review Sites 2017	57
Strategic Housing Land Availability Assessment (SHLAA) Sites (Call for Sites 2018)	231
Total number of sites for screening	348

These sites were screened against a suite of available flood risk information and spatial data to provide a summary of risk to each site (see Appendix K).

The information considered includes the flood risk datasets listed below:

- Environment Agency Flood Zones 2 and 3 (updated to include results from the North Kent Coast 2019 modelling study)
- Flood Zone 3b
- Surface Water Function Flood Zone
- Fluvial and coastal climate change allowances (from modelling studies including North Kent Coast 2019, Iwade Stream 2017, Scrapsgate Drain 2016 and Warden Bay Stream 2014).
- Environment Agency Risk of Flooding from Surface Water
- Environment Agency Risk of Flooding from Reservoirs
- JBA Groundwater Flood Map
- Environment Agency Historic Flood Map
- Kent County Council's recorded incidents of flooding dataset

A summary has been prepared on the proportion of each site that is affected by the different sources of flooding. The information provided is intended to enable a more informed consideration of the sites when applying the sequential approach, which will be used to determine whether more detailed assessment of sites is needed to further identify those that should be taken forward as potential development allocations.

Figure 14-1: Screened sites with Flood Zones

14.2 Overview of risk at identified sites

A summary of flood risk at each of the sites in light of the screening is provided below:

- Flood Zone composition is varied across the sites. However, the majority of the sites have Flood Zone 1 comprising the largest proportion of their area, with 239 sites completely located within Flood Zone 1.
- 113 sites are partially located within Flood Zone 2
- 110 sites are partially located within Flood Zone 3a
- 12 sites are partially located within Flood Zone 3ai
- 62 sites are at least partially located within Flood Zone 3b
- 24 sites are located within the Surface Water Functional Flood Zone
- 38 sites are predicted to be at risk of fluvial flooding in the future due to climate change
- 95 sites are predicted to be at risk from tidal flooding in the future due to climate change
- 298 sites are predicted to be at risk of surface water flooding
- 55 sites intersect the Environment Agency's historic flood outlines
- 7 sites are predicted to be at risk from reservoir inundation
- 43 sites are predicted to have groundwater levels which are either at or very near (within 0.025m of) the ground surface
- 16 sites are located within 50m of a flood incident recorded by KCC

14.3 Sequential Testing

The SFRA does not include the Sequential Test of the development sites that were screened. However, Appendix K summarises the flood risk to the potential and confirmed development sites and provides evidence for use in the completion of the Sequential Test.

Inclusion of the SHLAA and Employment Land Review sites in the SFRA does not imply that development can be permitted without further consideration of the Sequential Test. The required evidence should be prepared as part of a Local Plan Review Sustainability Appraisal or alternatively, it can be demonstrated through a free-standing document, or as part of strategic housing land or employment land availability assessments. NPPF Planning Practice Guidance for Flood Risk and Coastal Change describes how the Sequential Test should be applied in the preparation of a Local Plan Review. The assessments undertaken for this SFRA will assist Swale Borough Council in the preparation of the Sequential Test.

14.4 Future maintenance of tidal defences

To assist Swale Borough Council in prioritising and targeting management of tidal flood defences, the Level 1 screening sites in relation to the **Medway Estuary and Swale Strategy** (MEASS), were examined further.

The Level 1 screening sites were intersected by the Environment Agency's North Kent Coast 0.5% AEP tidal extents to identify the sites at risk of tidal flooding. This highlighted the areas along the coast where the existing flood defences may require improvements in the future.

Appendix L contains mapping showing the screening sites within the 0.5% AEP tidal extent. The modelled exceedance of flood defences near the sites are also included in

the mapping to help identify locations where defences may need improvements, with the exceedance data obtained from the North Kent Coast 2019 modelling study.

The screening sites in the mapping are grouped by the MEASS 'Benefit Area' they are located within. Appendix L also contains a table listing the screening sites intersecting the 0.5% AEP tidal extent and summarising the MEASS options planned for defences in each 'Benefit Area'. This then highlights the Environment Agency's plans for the defences along the coastline which protect those sites.

It should be noted that the MEASS implementation plans for the Motney Hill to Ham Green (BA4.2) and Raspberry Hill (BA4.6) MEASS Benefit Areas are 'No Active Intervention'. Maintenance of the defences in these areas will be dependent on third party funding. This means that potential development sites in these areas which are currently defended may not be in the future and plans should be made accordingly.

Further information on the Environment Agency's plans for defences within Swale Borough are available in the MEASS.

14.5 Cumulative impacts of development on flood risk

Cumulative impacts are defined as the effects of past, current and future activities on the environment. Under the 2018 NPPF, strategic policies and their supporting Strategic Flood Risk Assessments, are required to 'consider cumulative impacts in, or affecting, local areas susceptible to flooding' (para 156).

When allocating land for development, consideration should be given to the potential cumulative impact on flood risk within a catchment. Development increases the impermeable area within a catchment, which if not properly managed, can cause loss of floodplain storage, increased volumes and velocities of surface water runoff, and result in heightened downstream flood risk. Whilst individual development with appropriate site mitigation measures should not result in measurable local effects with respect to hydrology and flood risk, the cumulative effect of multiple development may be more severe at downstream locations in the catchment. Locations where there are existing flood risk issues with people, property or infrastructure will be particularly sensitive to cumulative effects.

The cumulative impact should be considered throughout the planning process, from the allocation of sites within the Local Plan, to the planning application and development design stages. Once preferred options are identified, their cumulative impact can be considered in more detail within a Level 2 SFRA, where necessary. In addition, site-specific FRAs must consider the cumulative impact of the proposed development on flood risk within the wider catchment area if there are potentially material effects.

As part of the Level 1 SFRA, an assessment of the cumulative effects within catchments in Swale has been undertaken.

14.5.1 Approach and methodology

The approach is based on providing an assessment of catchments where the allocation of more than one site could result in effects that increase the flood risk to third parties. At a strategic level this involves comparison of catchments, to assess the quantum of proposed development and the sensitivity of the catchment to changes in flood risk. Historic flooding incidents are also included in the assessment, as these are an indicator of the actual sensitivity of locations within a catchment to flood events.

The methodology deploys a range of metrics to assess the potential cumulative impacts, which provide a balance between predicted and observed flooding data recorded by Kent County Council and the Environment Agency. In addition, it was considered important to identify those catchments where an increase in flows (as a

result of development) would potentially have the greatest impact upon downstream flood risk.

14.5.2 Datasets

Catchments

The WFD river catchments defined in the River Basin Management Plans, LMIDB catchments and LIDAR data were used to divide Swale Borough into manageable areas on which to base a cumulative impact assessment.

Receptors

The National Receptor Dataset (NRD), a GIS layer containing a number of risk receptors including building and transport, was used to provide a quantitative estimate of affected receptors.

Current developed area

OS Open Zoomstack data buildings layer was used to assess the current developed area in each catchment.

Proposed level of growth

To understand areas of the Swale borough that are likely to experience the greatest pressure for future growth, all potential future development sites received for consideration within the Local Plan process have been analysed. This allowed the calculation of the overall increase in development from the existing scenario, to identify catchments likely to be under the greatest pressure for development. The context for this being that in circumstances where the proportion of proposed new development is greater, then it is more likely to give rise to cumulative effects.

Proposed level of growth was assessed using sites listed in Table 14-1. It should be noted that it was assumed that all sites will be developed, and the entire footprint will be developed.

Historic and Predicted Flood Risk

A composite flood risk score was derived for each catchment within the study area by taking an average ranking of both recorded (historic incidents) and modelled (predicted) flood risk.

The risk metrics calculated for historic flood risk were:

- Number of recorded flood incidents, recorded by Kent County Council
- Number of NRD points with the Environment Agency's historic flood map

The risk metrics calculated for predicted (modelled) flood risk were:

- Percentage of properties within the merged Flood Zone 3a and the Risk of Flooding from Surface Water 1% AEP extent to create a combined layer showing predicted flood risk.

Scoring

A relative risk score of 1 to 3 (low to high) was applied to each flood risk metric and summed to give an overall relative flood risk score for each WFD catchment (Table 14-2).

Table 14-2: Individual components of relative cumulative impacts score for flood risk (per WFD Catchment)

Point Score	% of NRD points within EA's historic flood outlines map	Recorded flood incidents (KCC)	% properties NRD points within combined Flood Zone 3a and 1% AEP surface water flood risk extent
1 – Low risk	<4%	0-1	< 9%
2 – Medium risk	5 to 50%	2-3	10 to 49%
3 – High risk	>50%	>4	>50%

Table 14-3 was then used to identify the combined risk of development growth and flood risk and takes account of:

- Indicator of potential change in developed area within a catchment (%)
- The catchment flood risk ranking relative to all other catchments (the ranking value will vary subject to the number of catchments within the study area)

Table 14-3: Matrix of flood risk and future development pressure

Whole catchment				
% Change in development		Existing flood risk (total points)		
		3 to 4	5 to 6	7 to 9
		Low	Medium	High
0 to 49%	Low			
50% to 149%	Medium			
>150%	High			

14.5.3 Conclusions of the Cumulative Impact Assessment

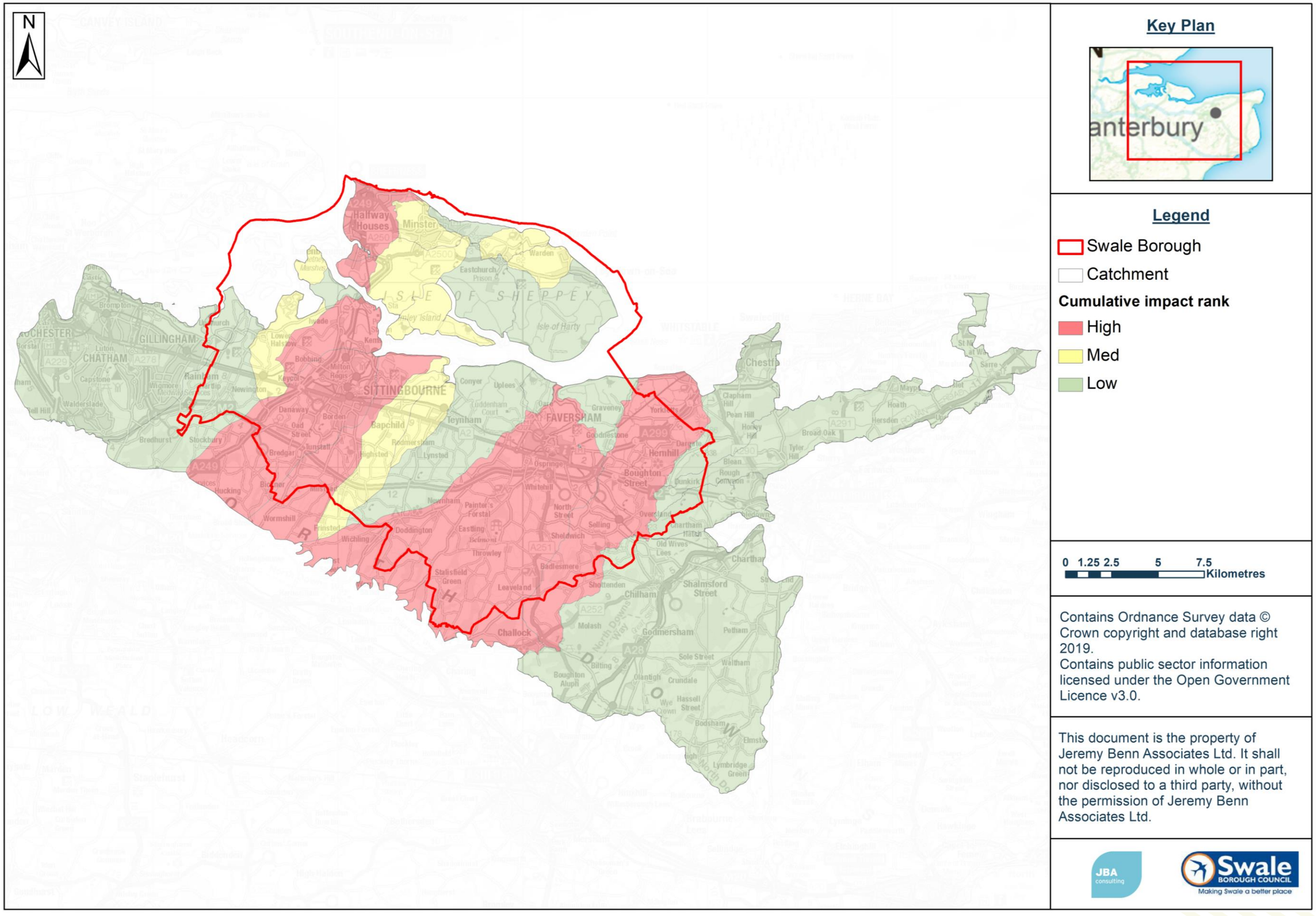
A summary of the Cumulative Impacts Assessment results is shown in Figure 14-2. The Cumulative Impact Assessment highlights areas where there is a high chance of encountering cumulative effects from planned development. In these catchments this should be considered by developers and specifically addressed within FRAs for proposed development.

Including consideration of cumulative effects requires that FRAs should assess:

- The location and sensitivity of receptors to cumulative effects and the mechanisms that potentially result in flooding (e.g. locations that are reliant on the performance of pumped drainage systems to manage flood risk, locations where existing flooding is experienced and can be exacerbated by relatively small changes in flood flow magnitude, volume or flood duration, etc)
- The potential quantum of proposed cumulative development within a River Basin and assessment of the effect on sensitive receptors of the cumulative benefit afforded by piecemeal mitigation at the respective allocation sites.

- The requirement for measures to address potential cumulative effects (these can be both 'on-site' measures and contributions to strategic 'off-site' measures)
- The opportunity to integrate site mitigation measures with strategic flood risk management measures planned in the River Basin
- The long-term commitments to management and maintenance

Figure 14-2: Relative sensitivity to cumulative impacts by catchment



15 Summary

15.1 Overview

This Level 1 SFRA delivers a strategic assessment of all sources of flooding in the Local Plan area. It also provides an overview of policy and provides guidance for planners and developers. The study area comprises the administration area of Swale Borough Council.

15.2 Sources of flood risk

The sources of flood risk in Swale have been assessed, further information on the data sources used can be found in Section 6 and the findings can be found in Section 7. A summary is outlined below.

15.2.1 Historic flooding

There have been several recorded flood incidents across the study area, with tidal flooding the most significant but surface water the most frequent cause of flooding.

The study area has also been affected by several historic tidal flood events, impacting a large area each time. The most significant events were during 1953, 1978 and 2013.

Surface water flooding has been recorded across the borough, with flooding reportedly impacting most settlements in Swale Borough during the May 2018 event.

Fluvial contributions to flooding are generally negligible compared to the volume of water from tidal flooding, though records of flood incidents from the Environment Agency and Kent County Council show there have been recorded fluvial flood incidents in Iwade and Lower Halstow.

Groundwater flooding has been recorded in Sittingbourne, Faversham and Boughton. Additionally, sewer flooding has been recorded in settlements across the Local Plan area, most frequently in Minster, Sheerness, Faversham and Sittingbourne.

The Environment Agency's Recorded Flood Outline mapping can be found in Appendix A and on Swale Borough Council's **interactive mapping portal**.

15.2.2 Fluvial flood risk

There are several watercourses throughout the study area which are identified to contribute to fluvial flood risk. Flood Zone mapping and climate change mapping of the fluvial flood risk in the Local Plan area has been prepared as part of the Level 1 SFRA and can be found in Appendices C and D and on Swale Borough Council's **interactive mapping portal**.

15.2.3 Tidal flood risk

The study area is bound by the Thames Estuary and North Sea to the north and as such there is a significant tidal flood risk. Additionally, many of the river networks are tidally influenced. The combination of high tides and high river levels can result in tidal locking of watercourses as they are unable to discharge. There is also the possibility that tidal defences can fail or be overtopped. The assessment of the 'residual' risk of defence failure should be considered on a site by site basis. Appendix C shows the tidal Flood Zones and Appendix D includes the effect of climate change on the tidal flood risk. These maps are also shown on Swale Borough Council's **interactive mapping portal**.

15.2.4 Coastal flood risk

Coastal erosion is a prominent process along much of the study area's coastline, notably along the northern coast of the Isle of Sheppey between Minster and Warden.

The risk of flooding is linked to the stability of the coastline, with flood risk potentially increasing if tidal flood defences are lost due to coastal erosion. The Swale Borough Coastal Change Management Area and Erosion Zones are shown in Figure 7-7.

15.2.5 Surface water flood risk

The Risk of Flooding from Surface Water dataset shows that surface water predominantly follows topographical flow paths of existing watercourses, dry valleys or roads, with some areas of ponding in low lying areas, often upslope of railway lines or roads. The Risk of Flooding from Surface Water maps are shown in Appendix E and on Swale Borough Council's **interactive mapping portal**.

This SFRA has also introduced the concept of Surface Water Functional Flood Zones which are dry valleys with a significant overland flow path. The Surface Water Functional Flood Zones are shown in Appendix C and on Swale Borough Council's **interactive mapping portal**.

15.2.6 Groundwater flood risk

The JBA Groundwater Flood Map shows that a large proportion of the Swale Borough Local Plan area is at risk of groundwater flooding, with the most vulnerable settlements including Sittingbourne, Faversham, Teynham, Bapchild and Boughton. There is a widespread area of groundwater flood risk in the south of the study area that is underlain by chalk bedrock, with rainwater able to infiltrate the chalk through large fissures into underlying aquifers before being slowly released through springs downstream. There is also an area of higher groundwater flood risk along parts of the northern coast of the Isle of Sheppey. The JBA Groudwater Flood Map can be found in Appendix F.

15.2.7 Sewer flood risk

Historical incidents of sewer flooding are detailed by the Southern Water SIRF and a summary can be found in Table 7-3. This database records incidents of flooding related to public foul, combined or surface water sewers and identifies which postcode areas have been impacted by flooding. A total of 126 incidents have been recorded.

The sewer flood risk in the Local Plan area is exacerbated by groundwater infiltrating into the sewer network and outfalls that can experience tidal locking or back-flow through the system.

15.2.8 Flooding from reservoirs

Outlines from the Risk of Flooding from Reservoirs dataset (informed from the National Reservoir Inundation Mapping study) show worst case inundation extents of two reservoirs impacting the Local Plan area. The mapping can be found in Appendix G and on Swale Borough Council's **interactive mapping portal**.

15.3 Flood defences

A high-level review of formal flood defences was carried out using existing information to provide an indication of their condition and standard of protection. Details of the flood defence locations and condition were provided by the Environment Agency for the purpose of preparing this assessment and can be found in Appendix H.

A dataset of defences within the study area from the North Kent Coast 2019 modelling study was also available for use in this SFRA and was used to identify potential areas requiring improvements to defences as part of the site screening. A summary and the associated mapping can be found in Appendix L.

15.4 Key policies

There are many relevant regional and local key policies which have been considered within the SFRA (Section 2), such as the Shoreline Management Plans for the Isle of Grain to South Foreland and the Medway Estuary and Swale, the North Kent Rivers Catchment Flood Management Plan, Thames River Basin Management Plan, the Preliminary Flood Risk Assessment, the Medway Estuary and Swale Strategy and Kent Local Flood Risk Management Strategy. Other policy considerations have also been incorporated, such as sustainable development principles, climate change and flood risk management.

15.5 Development and flood risk

The Sequential and Exception Test procedures for both Local Plans and Flood Risk Assessments have been documented, along with guidance for planners and developers (Section 4). Links have been provided for various guidance documents and policies published by other Risk Management Authorities, such as the LLFA and the Environment Agency.

16 Recommendations

A review of national and local policies has been conducted against the information collected on flood risk in this SFRA. Following this, several recommendations have been made for Swale Borough Council to consider as part of Flood Risk Management in the study area.

16.1 Development management

16.1.1 For Swale Borough Council

Sequential and Exception tests

The SFRA has identified that areas of Swale Borough are at high risk of flooding from, tidal, surface water and fluvial sources. Therefore, it is expected that several proposed development sites will be required to pass the Sequential and, where necessary, Exception Tests in accordance with the NPPF. Swale Borough Council should use the information in this SFRA when deciding which development sites to take forward in the emerging Local Plan.

In accordance with the NPPF guidance the Sequential Test should use the present-day flood zones for the consideration of site allocations and windfall sites. However, it is recommended that the Council gives consideration to the climate change maps to understand how the flood zones are predicted to change over the lifetime of the development.

Swale Borough Council have made provision for consideration of Flood Zone 3a(i) for the purpose of performing the Sequential and Exception Tests in Faversham Creek. Flood Zone 3a(i) comprises land having a 1 in 20 or greater annual probability of sea flooding in a defended scenario in Faversham Creek, where the land is previously developed. Further information can be found in Section 11.1.

The Sequential Test can be undertaken as part of a Local Plan Sustainability Appraisal. Alternatively, it can be demonstrated through a free-standing document, or as part of strategic housing land or employment land availability assessments. It is the responsibility of Swale Borough Council to be satisfied that the Sequential Test has been passed.

Council review of planning applications

The Council should consult the Environment Agency's '**Flood Risk Assessment: Local Planning Authorities**', last updated 1 March 2019, when reviewing planning applications for proposed developments at risk of flooding.

The Council will consult the relevant statutory consultees as part of the planning application assessment and they may, in some cases, also contact non-statutory consultees (e.g. Southern Water) that have an interest in the planning application.

Future flood management

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.

16.1.2 For developers

Sequential approach to development

The NPPF supports a risk-based and sequential approach to development and flood risk in England, so that development is located in the lowest flood risk areas where possible; it is recommended that this approach is adopted for all future developments within the borough.

New development and re-development of land should wherever possible seek opportunities to reduce overall level of flood risk at the site, for example by:

- Reducing volume and rate of runoff through the use of SuDS, as informed by the **Water, People, Places: A guide for master planning sustainable drainage into developments**, the **Kent County Council Drainage and Planning Policy Statement** (2017), Kent County Council's **Making it Happen** guidance for the relevant wastewater treatment catchment
- Relocating development to zones with lower flood risk
- Creating space for flooding
- GI should be considered within the mitigation measures for surface water runoff from potential development and consider using Flood Zones 2 and 3 as public open space
- Consideration must be given to the potential cumulative impact of development on flood risk.

Site-specific flood risk assessments

Site specific FRAs are required by developers to provide a greater level of detail on flood risk and any protection provided by defences and, where necessary, demonstrate the development passes part b of the Exception Test. The requirements for developers in preparing FRAs are set out in Section 9.4.

Developers should, where required, undertake more detailed hydrological and hydraulic assessments of the watercourses to verify flood extents (including latest climate change allowances), inform development zoning within the site and prove, if required, whether the Exception Test can be passed. Where a site-specific FRA has produced modelling outlines which differ from the Flood Map for Planning then a full evidence-based review would be required. Where the watercourses are embanked, the effect of overtopping and breach must be considered and appropriately assessed.

All new development within the 1% AEP (Annual Exceedance Probability) 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. 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 so the total volume of the floodplain storage is not reduced. Any flood risk management measures should be consistent with the wider catchment policies set out in the Catchment Flood Management Plan, Flood Risk Management Plan and Local Flood Risk Management Strategy.

A **revised NPPF** was published on 24 July 2018 (last updated June 2019) setting out the Government's planning policies for England and how these are expected to be applied. This revised framework replaces the previous NPPF published in March 2012.

There are also several guidance documents which provide information on the requirements for site-specific Flood Risk Assessments:

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

It should be noted that the **UKCP18** was published on 26 November 2018. The UKCP18 projections replace the UKCP09 projections and is the official source of information on how the climate of the UK may change over the rest of this century. This may result

in the Environment Agency climate change allowances being updated in 2019. When undertaking an FRA, please refer to the most up to date climate change allowances provided by the Environment Agency.

FRA requirements for development within Surface Water Functional Flood Zones are provided in Section 9.4.3.

Developers should consult with Swale Borough Council, Kent County Council, the Environment Agency and Southern Water at an early stage to discuss flood risk including requirements for site-specific FRAs, detailed hydraulic modelling, and drainage assessment and design.

Further considerations for development in Faversham Creek, Iwade and Minster can be found in Section 11.

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. Residual risks should be considered as part of site-specific Flood Risk Assessments.

Further, any developments located within an area protected by flood risk management measures, where the condition of those defences is 'fair' or 'poor', 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.

The risk to development from reservoirs is residual but developers should consider reservoir flooding during the planning stage. They should seek to contact the reservoir owner to obtain information and should apply the sequential approach to locating development within the site. Developers should also consult with relevant authorities regarding emergency plans in case of reservoir breach.

Safe access and egress

Minimum finished floor levels for development is set out in Section 9.4.4. If it is not practical to raise floor levels to those specified above, consultation with the Environment Agency will be required to determine alternative approaches.

Safe access and egress will need to be demonstrated at all development sites. 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 for safe access and egress in the event of rapid inundation of water due to a defence breach with little warning.

Resilience measures will be required if buildings are situated in the flood risk area, and opportunities to enhance green infrastructure and reduce flood risk by making space for water should be sought.

Drainage strategies and SuDS

Planners should be aware of the conditions set by the LLFA for surface water management and ensure development proposals and applications are compliant with the **Kent County Council Drainage and Planning Policy Statement** (2017) for the relevant catchment.

Special consideration should be given to development in Iwade and Minster, details of which can be found in Section 11.2 and Section 11.3 respectively.

Future flood management

Developments should demonstrate opportunities to create, enhance and link green assets. This can provide multiple benefits across several disciplines including flood risk

and biodiversity/ ecology and may provide opportunities to use the land for an amenity and recreational purposes. Development that may adversely affect green infrastructure assets should not be permitted.

The information provided in the SFRA should be used as a basis for investigating potential strategic flood risk solutions within the study area. Opportunities could consist of the following:

- Catchment and floodplain restoration;
- Flood storage areas;
- Opening up culverts, weir removal, and river restoration;
- The Regional Habitat Creation Programme; and
- Green infrastructure.

16.2 Requirements for Level 2

This report fulfils Level 1 SFRA requirements. Following the application of the Sequential Test, where sites cannot be appropriately accommodated in Flood Zone 1, Swale Borough Council may need to apply the NPPF's Exception Test. In these circumstances, a Level 2 SFRA may be required, to consider the detailed nature of the flood characteristics within a Flood Zone and assessment of other sources of flooding.

If a Level 2 Assessment is required, any updates to the Environment Agency's climate change allowances will be considered when preparing more detailed assessments of hazards and actual risks.

16.3 Technical recommendations

16.3.1 Potential modelling improvements

The Environment Agency regularly reviews its 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.

Due to the publication of the **UKCP18** the Environment Agency should be contacted for the latest guidance on climate change modelling outputs for Flood Risk Assessments.

16.3.2 Updates to SFRA

SFRAs are high level strategic documents and, as such, do not go into detail on an individual site-specific basis. This SFRA has been developed using the best available information, supplied at the time of preparation. This relates both to the current risk of flooding from a range of sources, and the potential impacts of future climate change.

It should be noted that 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, whilst new modelling is incorporated into the Environment Agency's flood maps. Additionally, in time, the Flood Map for Planning website may be the most up to date for current day Flood Zones as the Environment Agency will update when any further modelling is undertaken in the Plan area and this may be before the SFRA is updated.

Other datasets used to inform this SFRA may also be periodically updated and following the publication of this SFRA, new information on flood risk may be available from Risk Management Authorities.

It is recommended that the SFRA is reviewed internally, in line with the Environment Agency's Flood Zone map updates to ensure latest data is still represented in the SFRA, allowing a cycle of review and a review of any updated data by checking for any new

information available from RMAs including the Environment Agency, Swale Borough Council, Kent County Council and Lower Medway Internal Drainage Board.

APPENDICES

Offices at

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