Isle of Wight
Strategic Flood Risk Assessment

June 2010

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Entec

Isle of Wight Strategic Flood Risk Assessment

Isle of Wight Council

Isle of Wight Strategic Flood Risk Assessment

Isle of Wight Strategic Flood Risk Assessment MK2

June 2010

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Preface and Acknowledgements

Building on Existing Success

This is the second Strategic Flood Risk Assessment carried out for the Isle of Wight. The previous assessment it replaces was published in November 2007 and has been cited in the updated (December 2009) practice guidance to national Planning Policy Statement (PPS) 25, 'Development and Flood Risk', as a case study of good practice.

Rationale for Update

Flood risk to people, property and infrastructure is an area that demonstrates particularly well the changing times we live in. Since the first SFRA was published new data has been released, both at the local level and nationally through UKCP09. This change in baseline data combined with the evolving allocation process associated with the Island Plan (the Isle of Wight LDF) has prompted the need for an update. It should be appreciated that while this assessment can make predictions of flood risk on the Island for the next 100 years, the baseline data on which this is based is a snapshot of the most current information now, but that ultimately will again be superseded and require updating at some point in the future.

What is New in the 2010 Update

Carrying out an update of the SFRA has given the opportunity not only to revise existing sections, but consider new areas that provide additional information. It is hoped that this will aid decision-making where flood risk is a consideration. The new elements of this SFRA include;

- assessing the impacts of wind action and wave spray;
- extreme rainfall modelling and surface water management;
- separate appendices for each settlement identified as part of the spatial strategy for regeneration and growth through the Core Strategy, covering:
  1. sustainability & regeneration objectives;
  2. Assessment of risk posed to revised potential development sites;
  3. impacts of climate change;
  4. flood risk management guidance and support for site specific FRAs.

In contrast to the 2007 SFRA, the 2010 report has separated out the discussion of flood risk and flood risk management relating to the 18 Regeneration and Development Areas (previously referred to as Key Development

Areas), and the Island wide assessments. Appendices E to V now contain location specific information and mapping. It was the Isle of Wight Council's view that this approach would allow for easier dissemination of the SFRA on the Council's web site.

The 2007 SFRA produced two GIS datasets the 'Attribute' and the 'Site Specific' this approach has been rationalised so that just one 'Sites Database' has been produced. The 'Sites Database' contains information which will be useful when evaluating the need for FRAs and in providing an overview of possible land uses.

A partnership approach

The success of the previous SFRA was a reflection of the partnership approach taken, right from the specification of the work to be undertaken, provision of information, to active involvement in the assessments production. This partnership has been built upon for the second assessment and thanks must go to certain individuals in the following organisations without whom the SFRA MkII would not have progressed on from the previous SFRA as much as it has.

- Southern Water Services
- Environment Agency
- Isle of Wight Council
- Entec UK Ltd

Executive Summary

This 2010 SFRA represents a replacement of the 2007 SFRA prepared by Entec for the Isle of Wight. The main changes between the 2007 and 2010 SFRA are discussed in the Preface.

The analysis and reporting prepared for this SFRA has been focused on providing a user friendly planning tool for the Local Planning Authority (LPA) and developers alike. The structure of this SFRA has been built around the hierarchical approach to flood risk management advocated by PPS25. Indeed the assessments undertaken as part of the 2007 SFRA have allowed the LPA to review the potential development sites on the basis of flood risk. There are a significant number of potential development sites which intersect with zones of flood risk. The LPA has already worked towards the first two steps of the management hierarchy, i.e. Assess and Avoid. This SFRA provides further information on the process of avoidance and it provides further detail to inform the later steps of the management hierarchy, those being: Substitute; Control; and Mitigate.

Report Structure

The content of this report is designed to provide an evidence base for the flood risk, drainage and other classifications used to attribute each of the potential development sites with. The report is divided into the following sections:

- Section 1 Introduction and a guide to using the SFRA;
- Section 2 Details the regional and national planning policy context within which the SFRA process sits;
- Section 3 Describes the flood risks on the Isle of Wight;
- Section 4 Summarises the guidance provided in PPS25 with regards to the Environment Agency Flood Zone designations;
- Section 5 Details how climate change has been assessed in the SFRA;
- Section 6 Provides details of an assessment into the impacts of wind action and wave spray;
- Section 7 Discusses the sustainable management of surface water;
- Section 8 Principal of flood risk management through avoidance - the sequential approach to the avoidance of risk;
- Section 9 Principal of flood risk management through design - baseline guidance on flood risk management and safe development;

- Section 10 Assessment and management of flood risk at the Regeneration and Development Area (RDA) scale;

- Section 11 Assessment and management of flood risk at the site specific level and guidance on the need for FRAs and the necessary scope of FRAs.

The Assessment of Flood Risk

The following sections briefly describe the nature of the assessments undertaken in this SFRA:

Fluvial and Tidal Flood Risk

Fluvial and tidal flood risks have been assessed in the most detail in the SFRA because they present by far the greatest flood risk and there exists the greatest amount of available data on these sources of flooding. The Environment Agency fluvial flood zones were used throughout the assessment process. The LPA has taken the view that the tidal flood zones held by the Environment Agency should be superseded with tidal flooding predictions which provide an allowance for climate change. As such the assessment of tidal flood risk at the potential development site level uses the 1 in 200 year flood extent (in the year 2115) to represent tidal flood zone 3 and it utilises the 1 in 1000 year flood extent (in year 2115) to represent tidal flood zone 2. This approach reflects the LPAs determination to achieve sustainable coastal development.

Climate Change

The impacts of climate change on flooding are a serious issue recognised by National Government and this concern is reflected in PPS25. Climate change has been addressed in detail in this SFRA with fluvial sensitivity analysis being undertaken alongside tidal climate change modelling. Flood extents for the 1 in 200 and 1 in 1000 year extreme tide levels have been produced for the following time horizons, 2010, 2045, 2080 and 2115, for the entire coastline. The flood mapping has used the sea level rise predictions provided in PPS25

Surface Water Flooding

The SFRA has simulated the 1 in 100 year storm (plus climate change allowance) in 18 areas on the Island. The results of this assessment are presented at the settlement level discussions presented in Section 10 and in Appendices E to V.

Other Sources of Flooding

The SFRA has not included a review of the role of flood defences as there are no defended Flood Zone 3 locations on the Island. Groundwater flooding presents a potential risk and was reported as being a contributing factor in the flooding experienced in the winter of 2000 and 2001, which coincided with and in many cases caused the river levels to be unusually high. There have not been any reported incidents of where *clear water flooding* i.e. where water issues from the ground and is not connected/associated with a fluvial watercourse. Borehole data or ground water contour mapping has not been reviewed as part of this SFRA.

Regeneration and Development Areas Summary

The Table 1 lists the eighteen Regeneration and Development Areas (RDA). The LPA has classified these areas into 3 distinct groups, these are defined in Table 1.

Table 1 Regeneration and Development Areas Summary

RDA	Key Issues Restricting planning
Key Regeneration Areas	
Ryde	Significant restrictions identified in the tidally influenced area and adjacent to Monks Brook
Newport	All sites adjacent to watercourses have partial restrictions, but no significant areas of restriction. Tidal flooding in the Seaclose area represents a significant restriction to planning
The Bay	Significant restrictions in the north east of the area and in the Culver Parade area
Cowes and East Cowes	Tidal flooding along both sides of the Medina Estuary
Smaller Regeneration Areas	
West Wight	Significant restrictions in the Freshwater area along the banks of the Western Yar
Ventnor	No significant restrictions
Rural Services Centres	
Arreton	Two of the potential development sites are impacted by flood risk zones
Wootton	No significant restrictions
Bembridge	No significant restrictions
Wroxall	Significant restrictions to portions of two sites owing to presence of fluvial flood zones
St Helens	No significant restrictions
Yarmouth	Significant restrictions owing to the large tidal flood zone extents which encircle the town
Godshill	Un-modelled water courses may present risks which FRAs should assess
Brading	No significant restrictions
Brighstone	Fluvial flooding in the Brighstone Brook and Shorewell Stream confluence area
Niton	Un-modelled water courses may present risks which FRAs should assess
Rookley	No significant restrictions
Chale	Un-modelled water courses may present risks which FRAs should assess

List of Acronyms

Acronyms	Definition
ABI	Association of British Insurers
AOD	Above Ordnance Datum
AONB	Area of Outstanding Natural Beauty
CFMP	Catchment Flood Management Plan
DPD	Development Plan Document
ESS	Environmental Stewardship Schemes
FRA	Flood Risk Assessment
GIS	Geographical Information Systems
HOST	Hydrology of Soil Types
IFM	Indicative Flood Map
IfSAR	Infometric Synthetic Aperture Radar
RDA	Regeneration and Development Area
LDD	Local Development Documents
LDF	Local Development Framework
LiDAR	Light Detecting and Ranging
LPA	Local Planning Authority
RFRA	Regional Flood Risk Assessment
RPB	Regional Planning Bodies
SDF	Strategic Development Framework
SEEDA	South East England Development Authority
SFRA	Strategic Flood Risk Assessment
SPR	Surface Percentage Runoff
SPZ	Source Protection Zone
SuDS	Sustainable Drainage Systems
UCS	Urban Capacity Study
UDP	Unitary Development Plan
WFD	Water Framework Directive

Contents

1. Using the SFRA

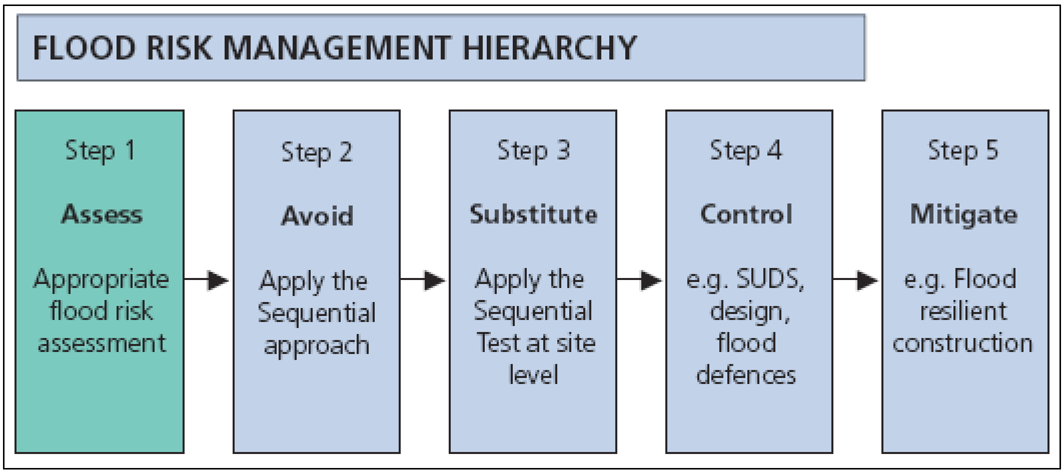
This SFRA has is organised in such a way as to effectively allow the two main user groups (i.e. the Local Planning Authority (LPA) and potential developers), to access flood risk and planning related information. The needs of these two user groups differ. The SFRA aims to provide the LPA with information necessary to apply the PPS25 Sequential Test and so as to inform the spatial planning process, site allocations and the emerging Core Strategy. For developers, the SFRA provides baseline flood risk information for site specific FRAs and it outlines development design standards.

The SFRA report can be divided up into four distinct subject areas:

- Assessment of planning policy and flood risk at the Island wide level
- Principals of flood risk management at the Island wide level
- Flood risk assessment and management at the settlement specific levels
- Further flood risk work, summary and supporting information

This section of the report describes the organisation of the data in the SFRA and it directs readers to the relevant sections and Appendices according to the readers' requirements. Table 1.1 outlines the content and purpose of the SFRA report sections and Sections 1.1 and 1.2 outline how the SFRA meets the differing requirements of the LPA and potential developers.

The Isle of Wight SFRA has been prepared so as to closely follow the flood risk management hierarchy advocated by PPS25, the diagram below illustrates this approach.



Taken from PPS25 Companion Guide December 2009, page 6

1.1 Local Planning Authority

The SFRA provides information to meet three specific LPA objectives:

1 – Informing spatial planning decisions and the Core Strategy

To fulfil this objective the SFRA provides the following:

- Regional and national planning policy frameworks that require the consideration of flood risk in the spatial planning process – (See Section 1)
- The nature and location of the areas of flood risk – (See Sections 3 and 4)
- The potential impact of climate change on flood risk - (See Section 5)
- The extent to which wind action and wave spray are risks to coastal areas – (See Section 6)
- The potential for surface water to be managed through sustainable surface water systems – (See Section 7)
- The principal of flood risk management through avoidance of risk – (See Section 8)
- The principal of flood risk management through development design – (See Section 9)

2 – Flood risk assessment and management at the settlement and site level

- Details of the flood risk and guidance of flood risk management in 14 Regeneration and Development Areas – (See Section 10 and Appendices E to V)

3 – Development management decision making process

- Details of where site specific flood risk assessments are required and guidance on their likely scope – (See Section 11). The flood risk assessment process has been summarised and condensed into a 'Sites Database' which includes all the potential development sites on the Island, Section 1.3 details this database.

1.2 Potential Developers

To meet the requirements of potential developers the SFRA provides an assessment of risk to those sites which the LPA may potentially allocate for development. Each of the potential development sites identified by the LPA has been attributed with all the flood risk information assessed in this SFRA. The flood risk information has been provided to the LPA in a GIS format and site specific information may be available to a potential developer on request. In addition, the SFRA provides guidance on the management of surface water (See Section 7) and makes recommendations on safe development, with regards to flood risk, (See Section 9, 10 and 11).

Table 1.1 SFRA Report Structure

Section Number	Description and purpose
Section 1	Introduction and a guide to using the SFRA
	Island Wide Flood Risk Assessment
Section 2	Details the regional and national planning policy context within which the SFRA process sits.
Section 3	Describes the flood risks on the Isle of Wight
Section 4	Summarises the guidance provided in PPS25 with regards to the Environment Agency Flood Zone designations
Section 5	Details how climate change has been assessed in the SFRA
Section 6	Provides details of an assessment into the impacts of wind action and wave spray
	Principals of Flood Risk Management
Section 7	Discusses the sustainable management of surface water
Section 8	Principal of flood risk management through avoidance - the sequential approach to the avoidance of risk
Section 9	Principal of flood risk management through design - baseline guidance on flood risk management and safe development
	Flood Risk Assessment and Management at the Location Specific Scale
Section 10	Assessment and management of flood risk at the Regeneration and Development Area (RDA) scale
Section 11	Assessment and management of flood risk at the site specific level and guidance on the need for FRAs and the necessary scope of FRAs
	Further Flood Risk Work and Supporting Information
Section 12	Discusses where further more detailed flood risk assessment information may be necessary as part of a Level 2 SFRA or location specific Spatial Planning Document (SPD)
Appendix A	Island wide SFRA mapping
Appendix B	Climate change tidal extent mapping and surface water modelling methodology
Appendix C	Discussion of the datasets used in the SFRA and the GIS layers produced as part of the SFRA
Appendix D	Reproduction of Tables D.1, D.2 and D.3 from Annex D of PPS25
Appendices E – V	The identified flood risks and possible flood risk management techniques in each of the 14 Regeneration and Development Areas (RDAs) are discussed in turn with accompanying location specific mapping. Including, Bembridge, Brading, Brighstone, Cowes and East Cowes, Newport, Ryde, St Helens, The Bay, Ventnor, Wootton, Wroxall, West Wight, Yarmouth, Arreton, Niton, Chale, Rookkley and Godshill
Appendix W	Further information relating to the use of SuDS
Appendix X	Environment Agency Development management guidance on what causes planning application objections

1.3 Interactive GIS Dataset – 'The Planning Tool'

A large amount of site specific information has been collated in this SFRA. The information attached to each of the potential development sites offers much information to inform the scope of future FRAs. The only way of delivering the conclusions of the flood risk and drainage assessments for each of the assessed sites is through the use of a GIS dataset. The SFRA report is supported by a series of digital datasets on a CD-ROM. Key among these is the Sites Database which is detailed in Sections 1.3.1. Through the use of GIS software the Council can interrogate each of the potential development sites and ascertain details of; Flood risks; Climate change implications; Historic flooding and; the drainage assessment.

1.4 Sites Database

One record in the database exists for each of the sites provided by the Council which were derived from the Council's Land Request and Urban Capacity Database. On occasions the database holds just one record for a site comprised of separate land parcels. Thirteen additional fields have been added to the Council's database for the purpose of capturing flood risk information, Table 1.2 provides further details. Owing to changes in the assessment methodology used in the 2010 SFRA update, the number and names of the associated flood risk fields has changed.

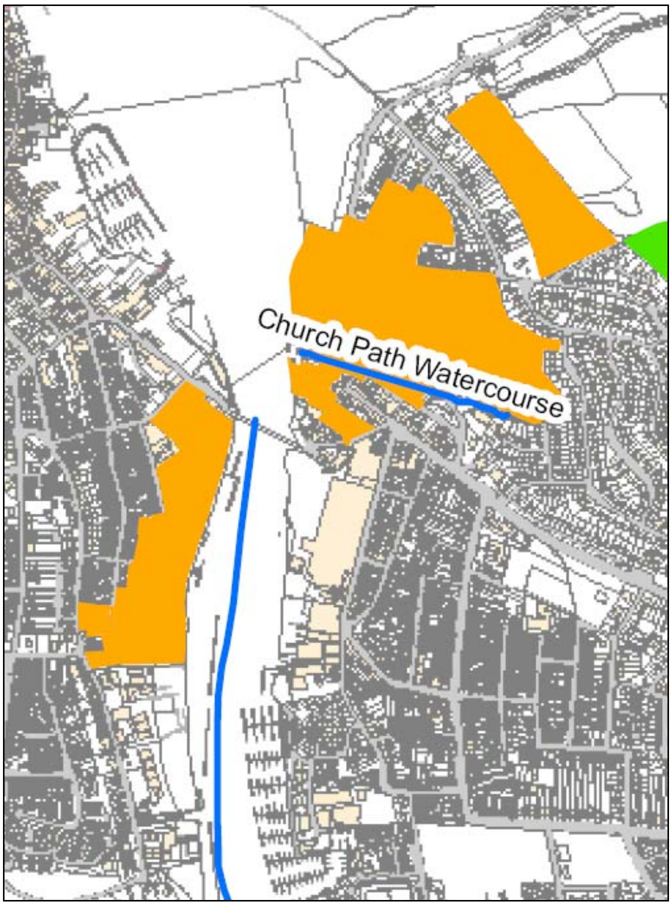
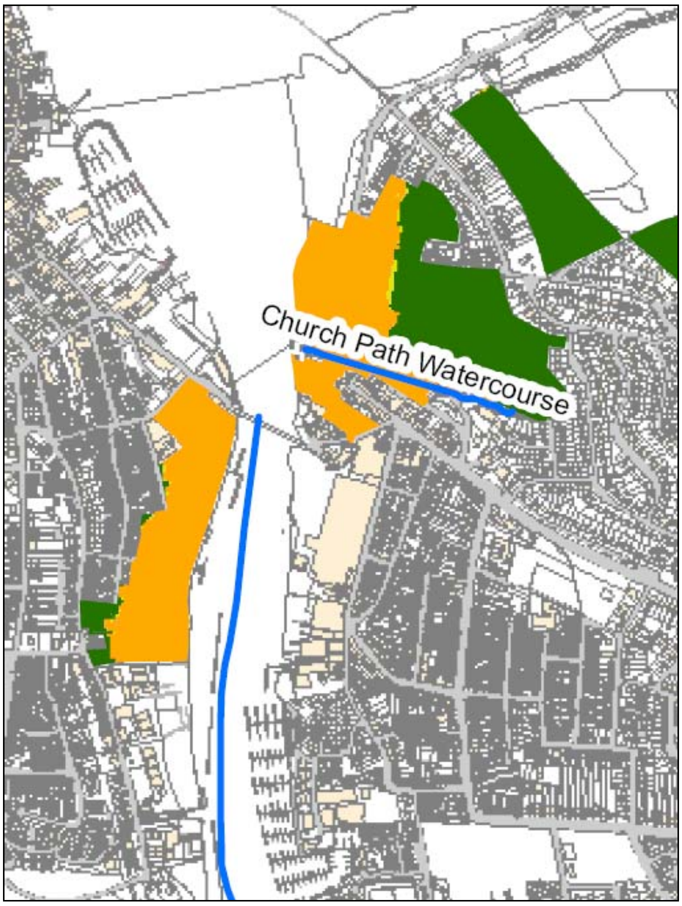
It is intended that this database, which can be navigated in a GIS package will represent a key tool in the site allocation process as it provides a complete overview of flood risk for each of the development sites. Each site has been attributed with the percentage area covered by Flood Zones, 3a, 3b, 2 and 1. This classification is provided graphically for each of the 17 Regeneration and Development Areas discussed in Section 10 and Appendices E to V. This information clearly defines which sites are within flood risk areas and which are only partially assessed as being at risk of tidal or fluvial flooding, and as such this data provides a valuable tool to support the application of the Sequential Test. On a site specific level it can be used to inform a risk based approach to landuse planning.

Further information about the attribution process and the data contained within the two Databases can be found in Appendix C.

Table 1.2 Field Descriptions for the Sites Database

Field	Description
All the data fields which were attributed to each of the sites in the 'land_requests24022010.shp'have been retained. The following have been added as additional fields.	
PERC_FZ1	Percentage area of site in Flood Zone 1
PERC_FZ2	Percentage area of site in Flood Zone 2
PERC_FZ3A	Percentage area of site in Flood Zone 3a
PERC_FZ3B	Percentage area of site in Flood Zone 3b
FRA_REQ	Whether or not an FRA is required, based on flood zone location and site size
PROBABILIT	A qualitative assessment of the flood risk posed to each site as defined by PPS25
APP_USES	A basic assessment of the appropriate use of each site as either without restriction or requiring further investigation
HISTORIC	Identifies past historic flooding on the site and lists the month and year of the past flood event
M_Riv_Buff	Whether the site is within 20m of a main river
FLUVIAL_CC	Whether or not a site is likely to be in flood zone 3 in the future as a result of climate change

Figure 1.1 Cowes and East Cowes Example – Site Specific Definition of Flood Risk

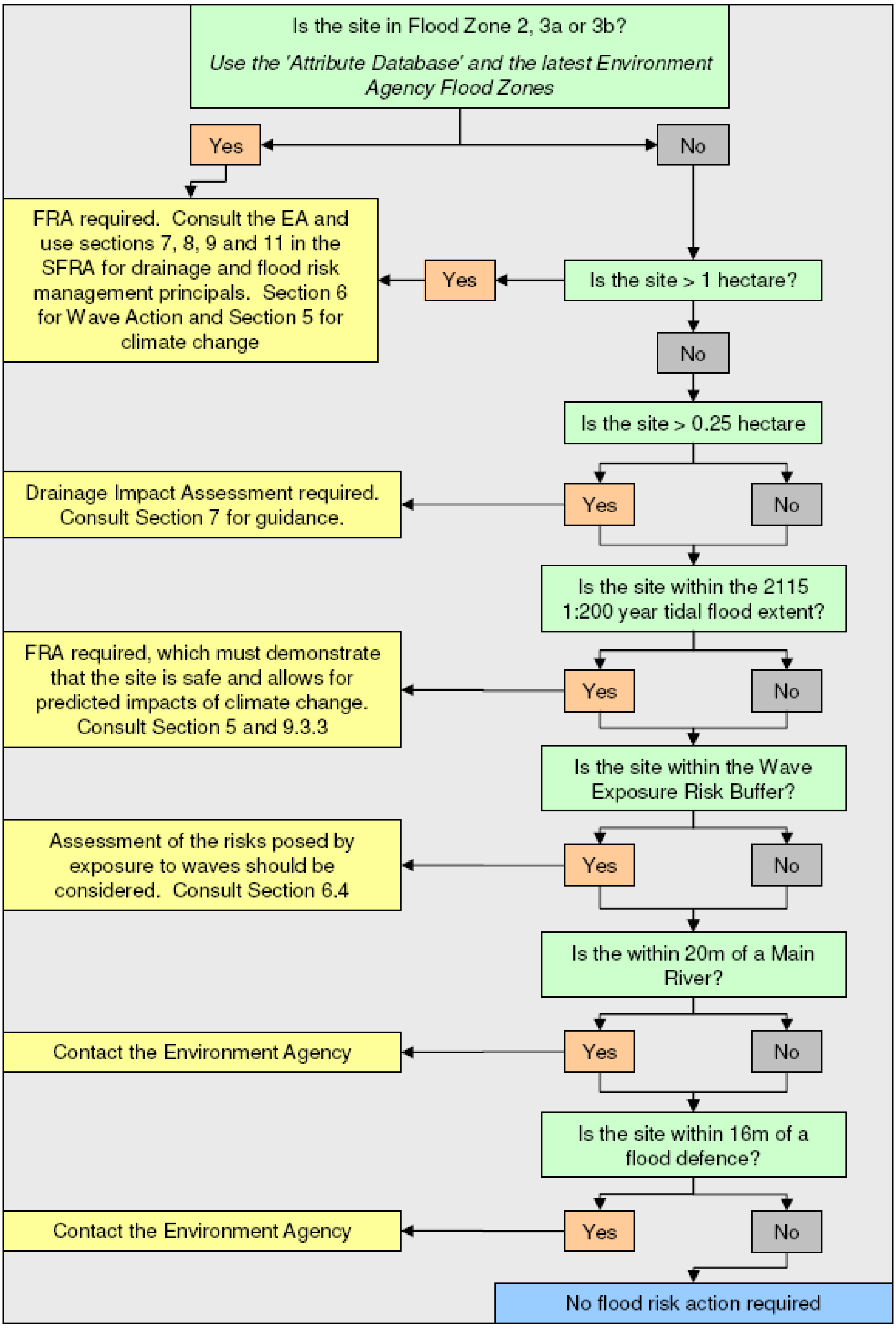
Image 1 - Qualitative Classification	**Image 2 - Site Specific Definition of Flood Risk**
	
Qualitative Probability	**PPS25 Site Specific Flood Risk Definition**
Highly Likely	Functional Floodplain 3b
Likely	Flood Zone 3a
Unlikely	Flood Zone 2
Highly Unlikely	No Flood Zone

In Image 1 the sites are attributed with a qualitative flood risk potential based on the highest flood risk zone that the site intersects. In Image 2, the delineation of flood risk across each site has been defined

1.5 How to Use the SFRA – Flow Diagram

To assist developers and Development management Officers alike, a Flow Diagram (Figure 1.2) has been provided which identifies where FRAs are required and other Isle of Wight specific factors trigger the need for further flood risk investigation as part of a planning application. In all instances, it is recommended that in addition to the SFRA the Environment Agency are consulted for guidance on scope and to ensure that the latest information is being used in site specific work.

Figure 1.2 Using the SFRA Flow Diagram



2. Planning Policy and Flood Risk

2.1 Introduction

This Strategic Flood Risk Assessment (SFRA) has been undertaken to assess flood risks on the Isle of Wight, and in particular the flood risks associated with areas being considered for future development as part of the emerging Local Development Framework (LDF). National planning legislation and policy guidance have been considered throughout the SFRA.

Planning process is driven by legislation and guidance developed at a national, regional and local level. Flood risk is just one of many factors to consider when making decisions relating to land use. The challenge for a SFRA is to develop pragmatic principles for steering future sustainable development without conflicting with the requirements of the different planning policies. The '*Making Space for Water*' report published by Defra (2005), identifies the severe flooding experience by mainland Europe in 2000 as being one of the catalysts for the Government to show an increased interest in flood risk management. This, in combination with recent high-profile flood events across the United Kingdom, has kept flood risk in the public eye and makes the need for effective consideration of flood risk in the planning process even more important

2.2 National Planning Policy

The SFRA has taken place in a period during which planning authorities have been implementing the provisions of the Planning and Compulsory Purchase Act 2004 and accompanying planning guidance, including PPS 1 (*Planning Policy Statement 1- Delivering Sustainable Development*) and PPS 12 (*Planning Policy Statement - Local Development Frameworks*). These affect all tiers of the planning system and have necessitated major changes at both the regional and local level which will impact on the way in which planned development is reflected in the regional strategy and delivered locally.

The Government has set in motion changes to the planning policy process, which will see the Unitary Development Plan (UDP) replaced by a Local Development Framework (LDF). The LDF is comprised of a framework of documents including the Core Strategy, Development Plan Documents (DPDs), Site Specific Policies and Proposal Maps, Statements of Community Involvement and Supplementary Planning Documents. This will provide further local detail in addition to the Island-wide strategic nature of the Core Strategy.

The documents forming the LDF will set out the Council's planning policies and proposals for meeting the community's economic and environmental needs in terms of spatial land use. The Planning and Compulsory Purchase Act 2004 requires the Isle of Wight Council to prepare a LDF to supersede the current UDP.

2.2.1 Planning Policy Statement 25: Development and Flood Risk

This SFRA has been undertaken in accordance with the guidance provided in Planning Policy Statement 25 – Development and Flood Risk (PPS25) and its accompanying Practice Guide (*Development and Flood Risk – A Practice Guide Companion to PPS25 "Living Draft*). Box 1 Presents a Summary of the guidance presented in PPS25.

Box 1 Summary of Guidance in PPS25

PPS25 Objectives

Through PPS25, the Government has sought to provide clarity on what is required at a regional and local level to ensure that appropriate and timely decisions are made to deliver sustainable planning for development. The key planning objectives as stated in PPS25 are that:

"Regional Planning Bodies (RPBs) and LPAs should prepare and implement planning strategies that help to deliver sustainable development by:

- APPRAISING RISK

Identifying land at risk and the degree of risk of flooding from river, sea and other sources in their areas;

Preparing Regional Flood Risk Assessments (RFRAs) or Strategic Flood Risk Assessments (SFRAs) as appropriate, as freestanding assessments that contribute to the Sustainability Appraisal of their plans;

- MANAGING RISK

Framing policies for the location of development which avoid flood risk to people and property where possible, and manage any residual risk, taking account of the impacts of climate change;

Only permitting development in areas of flood risk when there are no reasonably available sites in areas of lower flood risk and benefits of the development outweigh the risks from flooding;

- REDUCING RISK

Safeguarding land from development that is required for current and future flood management e.g. conveyance and storage of flood water, and flood defences;

Reducing flood risk to and from new development through location, layout and design, incorporating sustainable drainage systems (SuDS);

Using opportunities offered by new development to reduce flood risk to reduce the causes and impacts of flooding e.g. surface water management plans; making the most of the benefits of green infrastructure for flood storage, conveyance and SuDS; re-creating functional floodplain; and setting back defences;

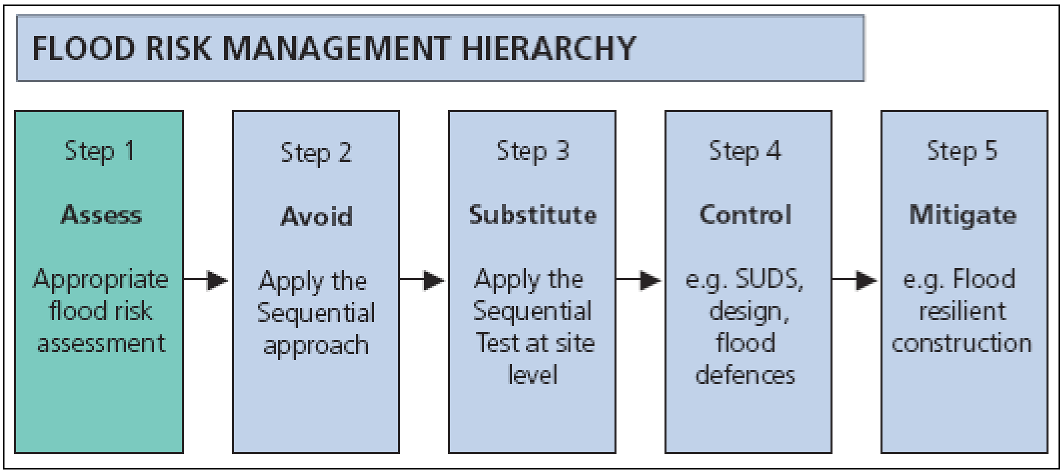
- A PARTNERSHIP APPROACH

Working effectively with the Environment Agency and other stakeholders to ensure that best use is made of their expertise and information so that decisions on planning applications can be delivered expeditiously; and Ensuring spatial planning supports flood risk management and emergency planning.

All forms of flooding and their impact on the natural and built environment are material planning considerations. PPS25 requires flood risk to be taken into account at all the stages of the planning process to avoid inappropriate development. This means following the hierarchy presented below, whilst at the same time taking account of:

- The nature of flood risk;
- The spatial distribution of flood risks;
- Climate change; and

- The degree of vulnerability of different types of development.



Taken from PPS25 Companion Guide December 2009, page 6

Figure 2.1 (taken from PPS25 Companion Guide) summarises how the spatial planning process should achieve the spatial planning approaches advocated by PPS25 which can assist with the strategic management of flood risk, whilst realising the opportunities to improve the quality of the built and natural Environment. Figure 2.2 identifies other strategic planning documents prepared by flood and coastal defence operating authorities and it details who is responsible for producing the key documents required to manage flood risk through each stage of the spatial planning process.

Figure 2.1 Strategic Management of Flood Risk through the Spatial Planning Process

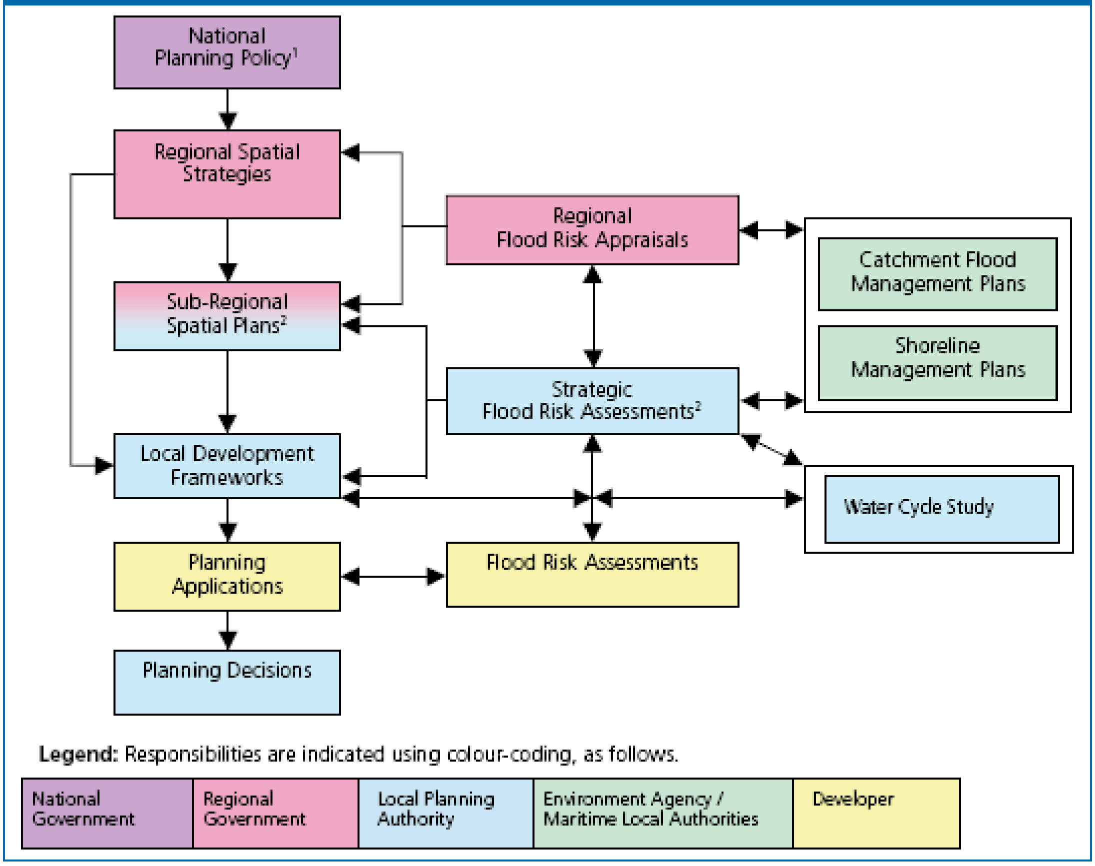
Figure 2.1 Overview of how the spatial planning process can manage flood risk strategically

Flood Risk Management Stage	What it means	How the planning system deals with it	Who is responsible
Assess	Undertake studies to collect data at the appropriate scale and level of detail to understand what the flood risk is.	Regional Flood Risk Appraisals, Strategic Flood Risk Assessments, Flood Risk Assessments and application of the sequential approach.	Planning bodies and developers.
Avoidance/ Prevention	Allocate developments to areas of least flood risk and apportion development types vulnerable to the impact of flooding to areas of least risk.	Use the Sequential approach (including the Sequential Test and Exception Test where relevant) to locate development in appropriate locations.	Planning bodies and developers.
Substitution	Substitute less vulnerable development types for those incompatible with the degree of flood risk.	At the plan level, the Sustainability Appraisal should show how flood risk has been weighted against other sustainability criteria.	Planning bodies and developers.
Control	Implement flood risk management measures to reduce the impact of new development on flood frequency and use appropriate design.	Use River Basin Management Plans, Catchment Flood Management Plans, Shoreline Management Plans, Surface Water Management Plans, Flood Risk Management Strategies, appraisal, design and implementation of flood defences.	Planning bodies, Environment Agency and other flood and coastal defence operating authorities, developers and sewerage undertakers. Developers are responsible for design of new developments.
Mitigation	Implement measures to mitigate residual risks.	Flood risk assessments. Incorporating flood resistance and resilience measures. Emergency Planning Documents. Implementation of flood warning and evacuation procedures.	Planning bodies, emergency planners, developers, the Environment Agency, other flood and coastal defence operating authorities and sewerage undertakers.

Taken from PPS25 Companion Guide December 2009, page 7

Figure 2.2 Key Documents in the Spatial Planning Process

Figure 2.2 Key documents in the spatial planning process and their links with other key strategies for managing flood risk



Notes

1 Including Planning Policy Statement 25 '*Development and Flood Risk*' and the other flooding-related national planning policies listed in Appendix A of this Practice Guide.

2 Strategic Flood Risk Assessments may cover more than one local planning authority (LPA). The adoption of a catchment-based approach by a number of LPAs working in partnership could be highly beneficial and is strongly recommended as a means of looking strategically at flood risk issues across local authority boundaries.

3 This diagram has been developed from the original within *Flood Risk Assessment Guidance for New Development Phase 2 R&D technical report FD2320/TR2* (Defra and Environment Agency, 2005).

Taken from PPS25 Companion Guide December 2009, page 9

Links to the some of the key documents listed in Figure 2.2 are provided below.

- SMP http://www.coastalwight.gov.uk/smp/projects.htm
- CFMP http://publications.environment-agency.gov.uk/pdf/GESO1008BOWB-e-e.pdf
- South East Plan http://www.southeast-ra.gov.uk/seplan.html

2.2.2 PPS25 and Local Planning Authorities

PPS25 specifies that LPAs should adopt a risk-based approach to planned development through the application of a Sequential Test. This sequential process relates to the steering of new developments towards areas of lowest flood risk. PPS25 also sets out the need to consider other sources of flood risk (such as groundwater, overland flow and sewer) in addition to the main fluvial and tidal sources. The implications of climate change on flood risk are also required to be considered in the interest of sustainable development.

PPS25 introduces the Exception Test which allows some scope for departures from the sequential approach where it is necessary to meet the wider aims of sustainable development. The criteria for exception include where the development makes a positive contribution to sustainable communities or redevelopment of brownfield land. Exceptions can be permitted where it can be demonstrated that the residual flood risks are acceptable and satisfactorily managed.

The Town and Country Planning (Flooding) (England) Direction 2006 has made the Environment Agency a Statutory Consultee on all applications for development in flood risk areas, including areas with critical drainage problems and for developments exceeding 1 hectare outside of flood risk areas. After discussion with the Agency LPAs are required to notify the Secretary of State if they remain minded to approve a planning application contrary to a sustained objection from the Environment Agency.

2.2.3 Planning Policy Statement 1: Delivering Sustainable Development

Published in February 2005, this document sets out the overarching planning policies for the delivery of sustainable development across the planning system. PPS 1 explicitly states that development plan policies should take account of flooding, including flood risk. It proposes that new development in areas at risk of flooding should be avoided. Planning authorities are also advised to ensure that developments are sustainable, durable and adaptable. This should be achieved through taking into account natural hazards such as flooding.

PPS 1 also places an emphasis on *spatial planning* in contrast to the more rigid *land use planning* approach which it supersedes. LPAs will still produce site-specific allocations and a proposals map as part of Local Development Documents (LDDs). The Core Strategies will be more strategic and visionary in content and will take into account the desirability of achieving integrated and mixed use development, whilst considering a broader range of community needs than has historically been the case. It will be important for the Core Strategies and accompanying supplementary planning documents, to recognise the contribution that non-structural measures can make to effective flood management.

2.3 Local and Regional Planning Policy

South East Plan (2006)

Identifies the economic base of the Island has been undergoing change over recent years resulting in employment decline in agricultural and related industries. This process has contributed to higher than UK average unemployment rates and over a quarter of the Island's population receiving means tested benefits. Along side this low employment the housing shortage issue is exacerbated by a high proportion of houses on the Island being owned as second homes. The South East Plan states that future development is expected to create wealth and a sustainable economy to address skills deficits, housing needs, provide improved public transport and to safeguard the landscape and biodiversity.

Future Housing on the Isle of Wight

In the years up to 2020 and beyond, the Isle of Wight is set to change. The Council are responding to the housing requirements of the emerging Regional Spatial Strategy (the South East Plan) which indicate an annual construction of 520 houses on the Island. This number is proposed to provide for housing to meet economic growth, an amount of marketable housing and a housing supply stock to meet local affordable needs. However, the scale of the need for affordable housing on the Island is estimated to exceed the total planned annual provision and the South East Plan notes that the figure is more likely to be in the order of 1,260 per annum. This will contribute towards the annual average of 28,900 new dwellings required to be developed across the South East region between 2006 and 2026.

The Isle of Wight Council, as part of the Core Strategy, has undertaken a Strategic Housing Land Availability Study. This was not intended to undertake the role of DPDs. Rather, it was to identify land without making a judgement on suitability for development. The role of the Core Strategy is not to allocate sites for housing or any other type of development, rather it is to identify broad areas or types of suitable land for development. The South East Plan indicates that the range, type and distribution of housing required will be developed through the LDF. Housing linked to employment will be concentrated, the South East Plan states, in the main urban areas of Cowes, Newport, Ryde, Sandown and Shanklin.

PPS3 (*Planning Policy Statement 3*) sets out a new approach for housing including the identification of sufficient land for the plan period of fifteen years, ensuring that the first five years are allocated and developable and that a five year supply is maintained as sites are developed out.

Urban Capacity Study (2005)

A total of nine Large Capacity Sites (over 1 hectare) have been identified, totalling 22.24 hectares of land. The Urban Capacity Study (UCS) notes that current trends show large housing sites are being developed at densities of approximately 40 dwellings per hectare (dph). The UCS makes the assumption of a minimum density of 30 dph

and a maximum density of 50dph. PPG3 refers to densities of between 30 and 50 as being appropriate development standards, depending upon the nature of the area of development.

The Council will seek to provide greater intensity of development at places with good public transport accessibility, such as towns or local centres and along good quality public transport corridors. The Council is exploring the possibilities of rural exception sites and the requirement to meet affordable housing needs in the rural areas of the Island.

Windfall Sites are less than 1 hectare and total just over 1300 sites which amount to 216 hectares. The average size of the plots was 0.15ha. The UCS assumes that the majority of these sites will only yield one dwelling. It was concluded that small windfall sites make up the largest proportion of capacity on the Island.

Over 50% of the Island is designated as Area of Outstanding Natural Beauty (AONB), and the requirements of the associated management plan are an important factor when considering development within the national designation.

2.4 Pitt Review

In response to widespread and severe flooding in the UK during the summer of 2007, the Government commissioned an independent review on the lessons to be learned. The Pitt Review was comprehensive and considered all stages of flooding - preparedness, response and recovery - as well as the coordination, responsibilities, and legislation necessary to ensure the United Kingdom can advance in the area of flood risk management. A total of 92 recommendations were made. Amongst other recommendations the Review emphasised the need to consider surface water flooding in more detail, and recommended that local authorities should take the lead in managing local flood risk. The basis for this should be through a Surface Water Management Plan.

2.5 Floods Directive - The Flood Risk Regulations 2009

The information in Section 2.5 has been sourced from the www.lga.gov.uk

The Flood Risk Regulations 2009 came into force on the10th December 2009, transposing the European Floods Directive into domestic law. Defra and the CLG will be writing to all authorities in 2010 to explain the roles and responsibilities of the lead local flood authorities. The Environment Agency will also issue detailed guidance in due course.

In essence the Regulations require the Environment Agency to prepare flood risk assessments, maps and plans for the sea, main river and reservoir flood risk and will require lead local flood authorities (unitary and county councils) to do the same for all other forms of flooding (except sewer flooding that is not caused by rainfall).

A preliminary flood risk assessment must be prepared before 22nd December 2011 and used to determine areas of potential significant flood risk. Maps must then be prepared for these significant flood risk areas before 22nd December 2013 and flood risk management plans prepared before 2015. Lead Local Authorities will need to submit their work to the Environment Agency six months in advance to allow collation and reporting to the Commission.

Where possible, the lead local authority should make use of existing work, such as SFRAs and Surface Water Management Plans SWMP.

2.6 Flood and Water Management Bill 2010

The information provided in this section has been sourced from http://services.parliament.uk/bills/2009-10/floodandwatermanagement.html

The Flood and Water Management Bill received Royal Ascent on the 08th April 20110 and is now an Act of Parliament. The Bill responds to recent pressure to introduce legislation to address the threat of flooding and water scarcity, both of which are predicted to increase with climate change.

Key areas

- requires the Environment Agency to create a National Flood and Coastal Erosion Risk Management Strategy, which a number of organisations will have to follow
- requires leading local flood authorities to create local flood risk management strategies
- enables the Environment Agency and local authorities more easily to carry out flood risk management works
- introduces a more risk-based approach to reservoir management
- changes the arrangements that would apply should a water company go into administration
- enables water companies more easily to control non-essential uses of water, such as the use of hosepipes
- enables water companies to offer concessions to community groups for surface water drainage charges
- requires the use of sustainable drainage systems in certain new developments
- introduces a mandatory building standard for sewers

3. Overview of Flood Risks

The SFRA must define the zones of flood risk so as to be able to appropriately inform the development site allocation process and thus meet the wider objectives of the emerging Island Plan. The two primary sources of flooding on the Island are fluvial and tidal. The greatest amount of data also exists for these two sources. Flooding from groundwater is considered to be less significant and more localised and are dealt with in less detail which is proportionate to the amount of available data on this source. Moreover, there is a degree of overlap between groundwater and fluvial flooding as high river levels in the winter months are often a product of high groundwater levels. 'Clear water flooding' where ground water issues at the surface independently of a fluvial water body is rare. The 2010 SFRA update, includes the simulation of the 1 in 100 year (plus climate change allowance) pluvial flood risks in the 14 Regeneration and Development Areas (See Section 3.7 and 10 for further details)

3.1 Fluvial Flooding

When a river's discharge exceeds the capacity of the channel, out of bank flow occurs and the river's floodplain is inundated. Flooding is an important ecological and geomorphological process. Over centuries man's relationship with the floodplain has changed. It has evolved from one where the seasonal inundation and formation of transient wetlands instigated cyclic shifts in land use and agricultural practice. This relationship has evolved into one of constant struggle to control the forces of nature in order to make way for more sedentary and permanent uses of our rivers' floodplains. This shift in floodplain use has necessitated the need to develop an understanding of the floodplain dynamics and flood risks. The implementation of measures to avoid flood risk is currently superseding the older more reactive approaches to flood management which tended towards defending against an identified risk.

The majority of watercourses are in the northern half of the Island and discharge in to the Solent. The Isle of Wight's largest river is the Eastern Yar and this discharges in to the Solent at Bembridge. A history of flooding is well documented along the lower reaches of this watercourse, the most recent significant events being during the autumn of 2000. Figure 4 (Appendix A) depicts the main rivers on the Isle of Wight and illustrates how the majority of them flow in a northerly direction. As a result of this drainage pattern, which is a function of the underlying geology, the main estuarine environments are on the northern shores of the Island, with the exception of the Eastern Yar Estuary.

The causes of flooding in the main catchments are being assessed by the Isle of Wight CFMP, the findings of the scoping report are outlined in Table 3.1.

Table 3.1 Causes of Flooding for Each of the Rivers in the Catchment

Location	Key Issues of Flooding
Eastern Yar	• Rainfall runoff events leading to surface water flooding • Structure blockages impeding drainage in the upper catchment • High groundwater levels imposing a high baseflow on the river • Overbank flooding as a result of insufficient channel capacity • Lower catchment is reclaimed and from the sea and land is below high tide level • Tide locked sluice • Surge Tide overtopping
River Medina	• Tidal flooding • Problems with intervention in the channel impeding free drainage • High water levels in the Lukely Brook tributary • Flashy response to storm events reported for in Merstone Brook
Western Yar	• Very flashy catchment with rapid response to Rainfall • River flooding unable to drain • Tide locking
Gurnard Luck	• Tide Locking
Monkton Mead Brook	• Flashy urban catchment • Tides flap and supporting pumping during high flow • Sewer Flooding

The Source of this data is the ‘Isle of Wight Catchment Flood Management Plan Scoping Report’ (February 2007)

3.1.1 Historic Flooding

The CFMP Scoping Report for the Isle of Wight notes that prior to 2000 there are a limited number of records of fluvial flooding on the Island. Events affecting more than 10 properties appear to be fairly low, with the exception of Ryde which has a long history of flooding dating back over 100 years.

The Table 3.2 summarises the main areas of flood risk, the information is taken from the ‘*CFMP Scoping Report*’ (February 2007)

Table 3.2 Key Flood Risk Locations on the Isle of Wight based on 2000/01 Flooding Event

Watercourse	Location	Cause	Properties Impacted	Previous recorded incidents
Monkton Mead Brook	Ryde	Pump failure / drainage	20, 74	1914, 1662, 1971, 1974, 1975, 1989, 1993, 1999
River Medina	Newport	Fluvial, drainage, tide locking	8	1934, 1951, 1960/61 (150 properties), 1993, 1999
Western Yar	Freshwater	Extreme rainfall, drainage	1	1954, 1968, 1999 (45 properties)
Eastern Yar	Small numbers at several locations	Drainage, fluvial	Less than 10 at 11 locations	1934, 1954, 1960

The Source of this data is the 'Isle of Wight Catchment Flood Management Plan Scoping Report' (February 2007)

Autumn 2000 Flood Event

The main cause of flooding was the prolonged rainfall in the months of September to November 2000. This had the effect of raising and maintaining high groundwater and river water levels. Once saturated, the watercourses are considered 'flashy' in that they respond quickly to intense rainfall events with levels and flow rates rising and falling quickly. The result is short term flooding at times of peak rainfall. Other factors which the '*Isle of Wight Autumn 2000 Flood Investigation – Consultation Report*' (January 2002) identified as being significant factors in the Autumn 2000 floods included:

- The geomorphology and geology resulting in high groundwater levels and high levels of ground saturation.
- Inappropriate historic development in the floodplains.
- Insufficient drainage capacity and maintenance causing water to back up and flood property.
- Highway drains being blocked or where flows were in excess of drainage capacity; and
- A history of changes in water resource management and budgetary constraints

The Consultation report included an assessment of the return period for the October/November flooding of 2000 as being in the order of 1 in 20 years.

The information below, on individual settlements, has been obtained from the '*Flood Event – Final Report 24th December to 26th December 1999*' (September 2000). The number of properties flooded has been derived from questionnaires returned at the time of the event.

Gurnard

Gurnard Luck became tide locked and the increased river Levels caused five properties to be flooded. In Newport four properties were flooded from a main river and one was flooded by an ordinary watercourse. The tidal high water coincided with the rising river levels and when the two levels matched the tidal flaps closed and thus tide-locked the river. This caused the river levels to rapidly rise a further 300mm. Marsh Road was reported to have been covered by about 400mm of water.

Cowes

Cowes experienced some tidal flooding during December 1999, one property was reported as being flooded inside and a further six were flooded outside. Tidal flooding was abated by a sand bag wall constructed by Environment Agency contractors and by a change in the wind direction which reduced wave action.

Newport

An engineering team had been deployed since early in the morning of the 24th December to ensure that the three trash screens on the Lukely Brook were regularly cleared during the day. Lukely Brook responded rapidly to the heavy rainfall and levels soon rose to a dangerous level for workmen to clear the trash screens. Consequently, four properties were flooded from the main river and one was flooded from an ordinary watercourse.

Ryde

Ryde was identified as being the settlement which sustained the most severe damage during the 2000 floods. Investigations on Monkton Mead Brook have previously been carried out as there has been a history of regular flooding problems. Many of the properties were flooded from sewers being overwhelmed and because high water levels in the brook prevented free discharge of storm drains. The high river flow coincided with the high tide locking the Brook. One of the pumps which are designed to help alleviate the tide locking suffered a brief failure but was quickly returned to operation. Around seventy houses were flooded by the high groundwater and combined sewers overflowing. Basement flooding was a key issue.

Seaview

Flooding started around midnight on 24th December and lasted for around three to four days. The flooding was the product of two factors: high tide waters flooding over the sea wall; and flooding of the salt lake to the rear of the town due to poor drainage.

3.1.2 Impact of Tide Locking River Discharge

The tide can have a direct impact on fluvial flooding. If high fluvial discharges coincide with mean high water in a river's estuary then discharge from the river is inhibited. Effectively, a high tide raises the downstream boundary of the river and when this occurs the fluvial waters are forced to back up and, depending on the discharge, spill out over the floodplain. The problem of tide locking river discharge is one that is frequently cited in the CFMP

Scoping Study (February 2007) as being a key flooding concern. The tide locking of Monkton Mead Brook in Ryde caused some of the worst flooding on the Island during the 2000 flooding event.

3.1.3 Residual Risk

The CFMP Scoping Report identifies the greatest part of the Environment Agency's major flood defence work on the Island is on the tidal reaches of the rivers. The CFMP highlights the following alleviation schemes:

- The Schoolgreen area of Freshwater on the Western Yar;
- A 4km stretch of the River Medina through Newport;
- Lukely Brook between Towngate Bridge and Westminster Mill;
- A flood storage area in the centre of Newport; and
- The tributaries of the Lukely Brook, Gunville and Merstone Streams, include lined sections of channel, velocity weirs and culverts

The '*CFMP scoping Study*' (February 2007) notes that in 2001 the Environment Agency installed a new scheme at Ryde to more effectively release floodwaters into the sea. This was achieved by extending the concrete outfall pipes and by installing two new high capacity pumps. The report states that current flood risk management for the Island has included improvements in flood forecasting. Forecasting on the Western Yar, is said to have been historically difficult due to the fast response times of the series of relatively small sub catchments. The Environment Agency has developed a new flood forecasting model in 2006 to improve the warning time that can be provided.

No flood defences have been identified on the Island which offer protection from the 1 in 100 year event or greater. As such there are no areas benefiting from defences to the level required by PPS25 in order to be of material planning concern and therefore no areas of Flood Zone 3 are considered to be at residual risk.

3.2 Tidal Flooding

3.2.1 Meteorologically Induced Extreme Sea Levels

Meteorologically induced extreme sea levels is the term used to describe the phenomena of deep low pressure weather systems causing the surface of the sea beneath the centre of the depression to dome upwards. The sea surface is raised because the centre of the deep low pressure system is applying less downward force on the sea surface than is being applied by the atmosphere outside the low pressure system. This *dome* of water advances with the progression of the storm and when the storm makes landfall so does the dome of water or 'storm surge'. If meteorological conditions coincide with astronomically controlled flood tides then the resultant water level can be even higher and thus the flooding can be even more extensive. One of the most notable examples of this type of flooding to have been recorded in the UK was the 1953 event which caused destruction along the coasts of Norfolk, Essex and in the Thames Estuary.

3.2.2 Residual Risk

Figure 17 in Appendix A illustrates where the SMP2 has identified flood defence structures. The SFRA has not quantified the areas benefiting from these defences nor has it modelled the consequence of flood defence failure. No coastal defences have been identified which offer protection from the 1 in 200 year tide level. PPS25 therefore considers there to be no areas of defended Flood Zone 3. Nonetheless any area behind a flood defence structure is in a zone of residual risk in the event of failure. Failure of flood defences can either be structural or by exceedance of the design standard.

When preparing a FRAs in coastal areas the role of flood defences and the impact of their failure should be included if the developer is seeking to place floor levels below the predicted 1 in 200 year tide level plus an appropriate freeboard allowance. Flood defence locations can be obtained as part of a data request to the Environment Agency External Relations team. Further details on preparing FRAs in areas where there are flood defences can be found in Sections 3.63 and 3.64 of the PPS25 Practice Guide Companion.

3.3 Groundwater Flooding

Groundwater flooding on the Isle of Wight is not considered by the Environment Agency as a significant issue and for the purposes of this SFRA, a summary of the available information has been agreed to be all that is required.

The ability of surface water to be absorbed is a function of the permeability of the soils and superficial geology deposits and of the porosity of the solid geology. Chalk and limestone are generally considered to be highly permeable and no flooding is reported to have occurred in the chalk areas, except along the spring line at the boundary between the chalk base and clay formations.

The 2002 Consultation Report into the Autumn 2000 floods states that in some cases it may not so much be groundwater causing the flooding, as impermeable bedrock restricting the infiltration of rain and thus leading to high rates of surface run-off. The following were identified in the Consultation Report as being the areas of geological formations noted on the Island as being flood affected. Figure 1 (Appendix A) broadly represents the major geological formations on the Island.

Wealden Beds

The Wealden beds are composed of two series, Marls and Shales. Both of which have very low permeability. The low permeability is a function of the rock being formed from fine particles of slit and mud. As such these beds present a barrier to the passage of groundwater, fractures within the lithology represent the only routes for the percolation of groundwater. The Wealden beds can be found in the Atherfield and Sandown areas

Lower Greensand

The Lower Greensand beds are composed of a series of sands and clay strata of varying thicknesses and permeabilities. Owing to these variations and discontinuities in the underlying rock, the formation's groundwater response to Vainfall events is characteristically non uniform. The Consultation report concluded that it is not possible to predict groundwater levels for any location without further investigation. Although, where the Carstone and Sandrock beds are know aquifer bearing rocks. The Carstone formations can be found in the Allens, Redhill Lane and Sandford areas and the Sandrock beds are found at Newport, Whitwell and Stonebrook.

Upper Greensand with Chert layers

The permeability of this structure is dependant on the level of cementation between the composite grains. The formation is permeable and is noted as being one of the most important aquifer baring rocks on the Island as the sandstone is underlain with thick blue Gault clay which acts as an impermeable barrier and it creates a spring line. The Upper greensand has been identified in the Niton, Shorewell and Whitwell areas of the Island.

Osborne and Headon Beds

The Osborne and Headon Beds are a series of sands, silts, clays and marls with some limestone bands. The presence of low permeability clays and marls reduce the permeability of the sands within which they are inter-bedded. Groundwater has been known to rise to the surface at the old railway works in Newport. In order to ascertain the proportion of flooding attributable to groundwater, the Consultation report recommends the need for more detailed site specific information. Freshwater and Brading have been listed by the Consultation report as areas on the Island where the Osborne and Headon beds are located.

Bembridge Marls

The Bembridge Marls, which are present at Gurnard, Bembridge, Seaview and Wootton Bridge, are impermeable lagoon and freshwater blue and green clays.

Hamstead beds

Across a large part of the north of the Island lie the Hamstead Beds, they are composed of clays, loams, sands and shales. The permeability is thus highly variable, with the sand deposits being the most water bearing of the composite units. More detailed information at a site specific level is said to be necessary by the Consultation report in order to determine the proportion of the flooding attributed to groundwater.

3.4 Runoff Potential

An Island wide assessment of runoff potential was undertaken so that each potential development site could be attributed with a qualitative likely runoff potential. The SFRA sought to establish a preliminary categorisation of runoff potential to inform subsequent site specific FRA's and to indicate where surface water flooding may be considered to be more likely. At the strategic level a simplified qualitative assessment was considered appropriate as any subsequent FRA's will have to provide drainage assessments.

The runoff potential categorisation was based upon *SPR_HOST* (the standard percentage runoff, derived from hydrology of soil types classification – as defined by The Flood Estimation Handbook 1999). HOST values for the Island were defined by a national soils map made available for use in the SFRA by the Environment Agency. This map divides the UK into a 1km x 1km vector grid of 29 HOST classes. This dataset shows the dominant HOST class for each 1km square, and is a reproduction of the HOST dataset used by the Flood Estimation Handbook (FEH, 1999). However, it must be noted that the soil classifications in the HOST dataset do not necessarily match up, in all instances, with the Groundwater Vulnerability.

SPR_HOST values can be assumed to be approximately equal to the greenfield runoff resulting from the rainfall falling onto a greenfield site (Kellagher, 2004). Thus, they only provide a baseline indication of the percentage runoff, and do not necessarily represent developed or brownfield sites accurately. It should also be noted, that the HOST dataset is a coarse representation of reality, with uniform 1km grids that indicate the dominant HOST values for each cell. It is therefore intended for the runoff potential classification to be used as an indicator and not a definitive assessment. Where necessary, specific site analysis will be undertaken to refine the calculations.

The Isle of Wight has nine unique HOST classes, and seven corresponding and unique SPR_HOST. Figure 16 in Appendix A shows an Island wide distribution of HOST values. Each of the potential development sites in the Attribution Database have been attributed with a potential runoff classification of very low, low, medium, high or very high. The SPR_HOST qualitative classifications are presented in Table 3.3**.**

Table 3.3 SPR_HOST qualitative classifications

SPR_HOST	Qualitative Runoff Potential Classification
-999	Unknown
0.02	Very Low
0.145	Low
0.253; 0.292	Medium
0.472; 0.496	High
0.6	Very High

3.5 Surface Water Flooding

Site specific FRA's should consider the risk associated with surface water run-on. Surface water run-on is flooding associated with surface water which is generated off site, which can nevertheless impact the site because of local flow routes. Surface water run-on is distinct from surface water run-off, in that run-off is associated with the generation of surface water from a developed site whereas run-on describes the flow of water on to a site. This type of flooding typically occurs following intense rainfall events. Sources of surface water flooding can include:

- Surface water generation is more likely in heavily urbanised catchments and in areas with low infiltration potential. Following intense rainfall events, water can flow over the surface from surrounding areas and cause localised flooding;
- During intense rainfall events, drainage networks can become surcharged and result in water being discharged to the surface, this can lead to localised flooding issues; and
- Burst water mains can result in significant volumes of water being discharges to the surface, which may result in localised flooding issues.

The potential for the above sources to be a risk should be considered when preparing site specific FRAs. The potential surface water ponding areas and flow route maps in Appendices E to V present the results of the pluvial modelling undertaken as part of the 2010 SFRA update. Southern Water have supplied a point data set of all the incidents that have been reported to them to the year end of 2006. Unfortunately the most recent database was not available. The surface water sections of Appendices E to V include a discussion of any areas where there are correlations between the reported incidents and potential ponding areas and flow routes mapping.

In reports published by the Environment Agency, surface water flooding has been linked to some of the flooded properties during the 2000 floods on the Island. A recurring theme has been drains not being able to discharge because of raised river levels and thus the capacity of the drains was soon exceeded resulting in surface water flooding.

Surface water flooding results from excessive rainfall being unable to enter the local drainage system, due to blockages or capacity being exceeded or because the rainfall intensity is greater than the infiltration rate of the soils. Therefore the only route for rainwater to take is over the surface. Incidents are usually isolated and difficult to predict owing to the complex interaction of local infrastructure and circumstance, the impacts of which are often localised with potentially only low flood depths being attained. There is a likelihood of overland flow from one area of ponded surface water towards local low points in the topography, which is typically the river channel.

The occurrence of flooding caused by insufficient capacity of the drainage system is related to the probability of a given rainfall event over a given area. The likelihood of flooding is dependant on the condition of the surface drainage network, as well as the rates of surface water run off generation. The likelihood of flooding may change over time; due to increases in development, changes in impermeable area and climate change. As a result, flooding related to surface drainage may become more frequent in the future. Every new development proposal[1] must

[1] Only if the site is within Flood Zones 2 or 3 or if it has an area of more than 1 hectare, it is recommended that drainage assessments are undertaken for all sites greater than 0.25 hectares, see Section 7.4.

include an FRA inclusive of a consideration of surface water drainage and measures to mitigate against any potential increase run off.

The Environment Agency has not identified any Critical Drainage Areas on the Isle of Wight.

4. Definition of Flood Risk Zones

4.1 Overview of the Flood Zones

Flood Zones are described throughout this SFRA and they refer to flood extent datasets held by the Environment Agency. The Flood Maps are the successor to the Indicative Flood Plain Map (IFM) and have been in the public domain in their current format since October 7th 2004. Since their initial publication the Agency has worked with consultants to refine these maps through the commissioning of detailed hydraulic modelling projects. Updates to the published datasets are made on a quarterly basis. Box 2 outlines the different Environment Agency Flood Zones.

Box 2 Introduction to the Environment Agency's Flood Zones

Flood Zone 1

This zone comprises land assessed as having a less than 1 in 1000 annual probability of river or sea flooding in any year (<0.1%)

Flood Zone 2

This zone comprises land assessed as having a 1 in 100 and 1 in 1000 annual probability of river flooding (1% 0.1) or between a 1 in 200 and 1 in 1000 annual probability of sea flooding (0.5% - 0.1%) in any year.

Flood Zone 3a

This zone comprises land assessed as having a 1 in 100 or greater annual probability of river flooding (>1%) or a 1 in 200 or greater annual probability of flooding from the sea (>0.5%) in any year.

Flood Zone 3b

This zone comprises land where water has to flow or be stored in times of flood. This Flood Zone is land which would flood with an annual probability of 1 in 20 (5%) or greater in any year.

Additional Information

- The Flood Zones are mapped using a 'no defences' scenario which has necessitated areas of floodplain know to be defended to be identified on the Flood Map as benefiting from defences.
- The Flood Zone extents, regardless of whether the area benefits from a defence, are used to determine when Flood Risk Assessments are required to support a planning application.

The Flood Zones are spatial datasets indicating the area of land likely to be inundated in the event of an extreme flooding event with a given probability of occurrence. The four zones described in Box 2 are listed in order of decreasing extent but of increasing probability of occurrence.

Fluvial and Tidal Flood Zones

The Agency supplied the published Flood Zones 2 and 3 for use in this SFRA in August 2009. These datasets were divided into their respective tidal and fluvial components (see Figure 12 in Appendix A), enabling the source of flood risk (fluvial or tidal) to be identified. The Isle of Wight Council has adopted the predicted 1 in 200 year tidal flood mapping for the year 2115 as a replacement to the current tidal Flood Zone 3. The Isle of Wight Council have also adopted the predicted 1 in 1000 year tidal flood mapping for the year 2115 as a replacement to the current tidal Flood Zone 2. This approach ensures that the possible impacts of climate change are incorporated in to the spatial planning process.

Functional Flood Plains (Zone 3b)

Functional floodplain extents have been produced for the Western Yar and the Monkton Mead Brook. These were the only two watercourses that the Environment Agency held detailed hydraulic models for and as such no other watercourses in other Regeneration and Development Areas could have their functional floodplains' mapped. The Monkton Mead Brook Isis Model was run for the 1 in 20 year fluvial event in order to map the functional floodplain. The model was run in a '*without pumps working*' scenario, which is representative of the history of the failure of the flood alleviation pumps on the Monkton Mead Brook.

The Agency were already in possession of a 1 in 25 year flood extent outline for the Western Yar and it was agreed with the Agency that the 1 in 25 year extent could be used to represent the functional floodplain along this watercourse. The Monkton Mead Function Floodplain is illustrated in Figure 4.1 and the Western Yar functional floodplain is illustrated in Figure 4.2.

Figure 4.1 Monkton Mead Functional Floodplain

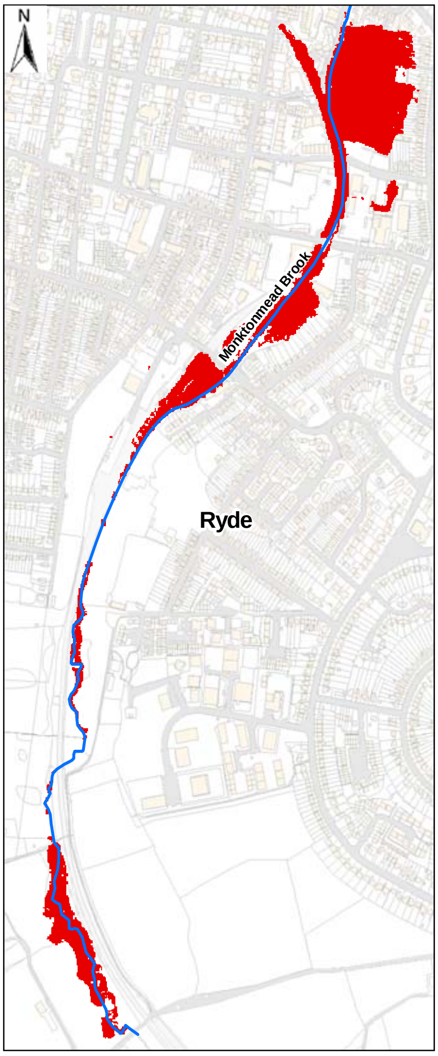
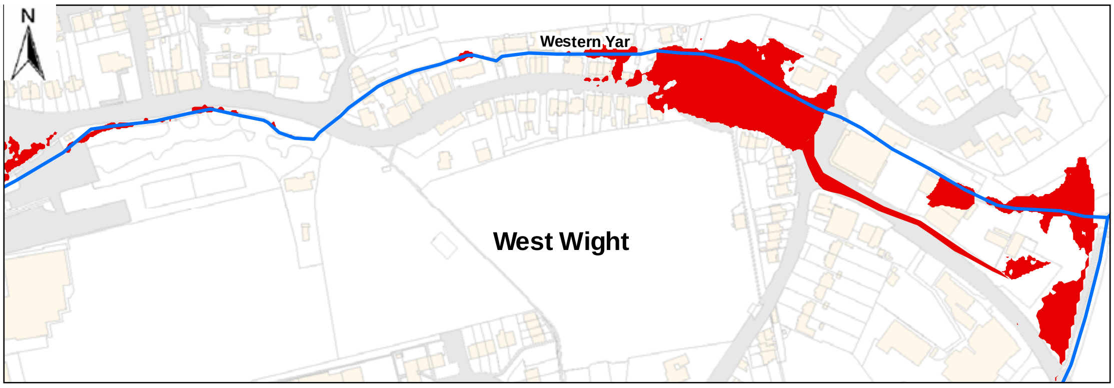


Figure 4.2 Western Yar Functional Floodplain



The definition of the functional floodplain is important from a planning viewpoint as it represent the area of land upon which PPS25 imposes the most stringent planning constraints. Indeed PPS25 states that only water compatible uses and essential infrastructure (listed in Table D.2 in Appendix B) are considered as 'acceptable'. In this context, 'acceptable' is based on the assumption that the Sequential Test has been applied and no other alternative sites are available. Any development, of 'acceptable' nature must be designed to:

- Remain operational and safe for users in times of flood;
- Results in no net loss of floodplain storage;
- Not impede water flows; and
- Not increase flood risk elsewhere.

Essential infrastructure in this zone is required to pass the Exception Test.

5. Climate Change

5.1 Background

Climate change is frequently cited as being one of the most significant threats to the long term sustainability of our environment. It is essential that the likely impact of climate change on the extent of the future Flood Zones is considered if development is to be sustainable over the long term. The Isle of Wight Council is unique in the UK in being the only LPA, to be bordered by the sea on all sides, thus making the issue of sea level rise one of critical concern.

PPS25 and Defra Guidance

Defra stated in October 2006 in their '*Supplementary Note to Operating Authorities – Climate Change Impacts*' that climate change impacts on flooding are a challenge to Local Authorities. The impacts are stated to include sea level rise and the potential increase in intensity and frequency of coastal storms. It is also predicted that rainfall events affecting flooding in fluvial catchments and urban surface water systems will increase in regularity and intensity. Defra's October 2006 supplementary note to Operating Authorities is designed to support the publication of PPS25 and states that; Defra's response to climate change impacts is to promote policy guidance based on appropriately precautionary allowances and sensitivity testing to enable Operating Authorities to take climate change impacts into account in planning appraisal, decision making and operations.

Pending further work being carried out by Defra and the Environment Agency on the differences between the UKCIP09 and UKCIP02 projections, the Chief Planner's letter advised that whilst there is a range of projections in UKCIP09 of future climate for any given variable, based on different emissions scenarios and probability levels, around the 50% probability point on the central emissions scenario, the data are broadly similar to the UKCIP02 projections. As a result, there is a general expectation that the assumptions on changes in climate that the LPAs have been working from remain reasonable.

Sustainability Implications

The current extent of Flood Zone 2 and 3 is critical to the site allocation process, but a view as to how these extents may change in the future is of importance. PPS25 (Paragraph B10) notes that the implications of climate change could mean that a site currently located within a lower risk zone could be reclassified as lying within a higher risk zone at some point in the future.

5.2 Fluvial Domain

It was the intention of this assessment to determine how sensitive the fluvial domain on the Isle of Wight is to increased river flows. This involved an uncomplicated Island wide approach that utilised all the available data.

5.2.1 Assessment Approach

Climate change is predicted to increase the magnitude of the 1 in 100 year flood. To model this, a larger fluvial flow would have to be simulated along each of the Island's watercourses. The objective of climate change modelling is to ascertain whether increased flows will have a significant impact on the extent of the Flood Zones. The approached adopted in this SFRA utilises existing data without requiring need for additional modelling work.

Flood Zone 2 outlines were produced for the Environment Agency by modelling a 1 in 1000 year fluvial flow in each watercourse and Flood Zone 3 was produced using the same methodology but with a 1 in 100 year fluvial flow. The two different flows used to produce Flood Zones 2 and 3 were used to identify areas of fluvial floodplain that are potentially sensitive to an increase in fluvial flow. In doing so it is possible to assess the sensitivity of the fluvial flood extents to climate change.

If there is little or no difference between Flood Zones 2 and 3, then the flooding extent in that area of floodplain can be considered to insensitive to an increase in fluvial flow and thus insensitive to the impacts of climate change. Floodplain topography controls how sensitive the flood extent is to an increase in fluvial flow. Along reaches where the valley floor is narrow and the sides are steep, there will be little lateral expansion of the flood extent. The depth and velocity will increase more significantly in areas where the extent increases the least. Accordingly, areas where the valley floor is wide and flat and not bounded by steep valley sides, the flood extents are large and expand laterally more significantly as a consequence of increased in fluvial flows.

To assess the sensitivity of the Island's floodplains to increased fluvial flows, the smaller extent of Flood Zone 3 was clipped from the larger extent of Flood Zone 2 within a GIS software package. This produced a dataset which represented all the locations where the extent of Flood Zone 2 is larger than the extent flood Zone 3. Tiny fragments of this dataset were removed to leave only areas considered to be significant. The value of 250m² was used as the threshold of significance. This is the threshold used by the Environment Agency when editing the Flood Map. Areas of flooding less than 250m² which are not connected to the main body of flooding are deleted from the Flood Map.

5.2.2 Sensitivity to Climate Change in the Fluvial Domain

Areas of fluvial floodplain identified as being potentially sensitive to the impacts of climate change are illustrated in Figure 15 in Appendix A. This figure shows that, for the most part, the extents of Flood Zone 2 and 3 are very similar as there are not many large areas of black on the map. This is due to the fact that the majority of the Island's rivers flow in well defined floodplains. Every potential development site which intersects the *Areas of Fluvial Floodplain Potentially sensitive to Climate Change* dataset is attributed accordingly in the Sites Database. This is so that the Council can be alerted as to whether climate change might present long term sustainability issues to a site.

Two locations where there are significant differences between the extent of Flood Zone 2 and 3 have been highlighted for further discussion. These are the lower Eastern Yar Floodplain and Monkton Mead Brook through Ryde.

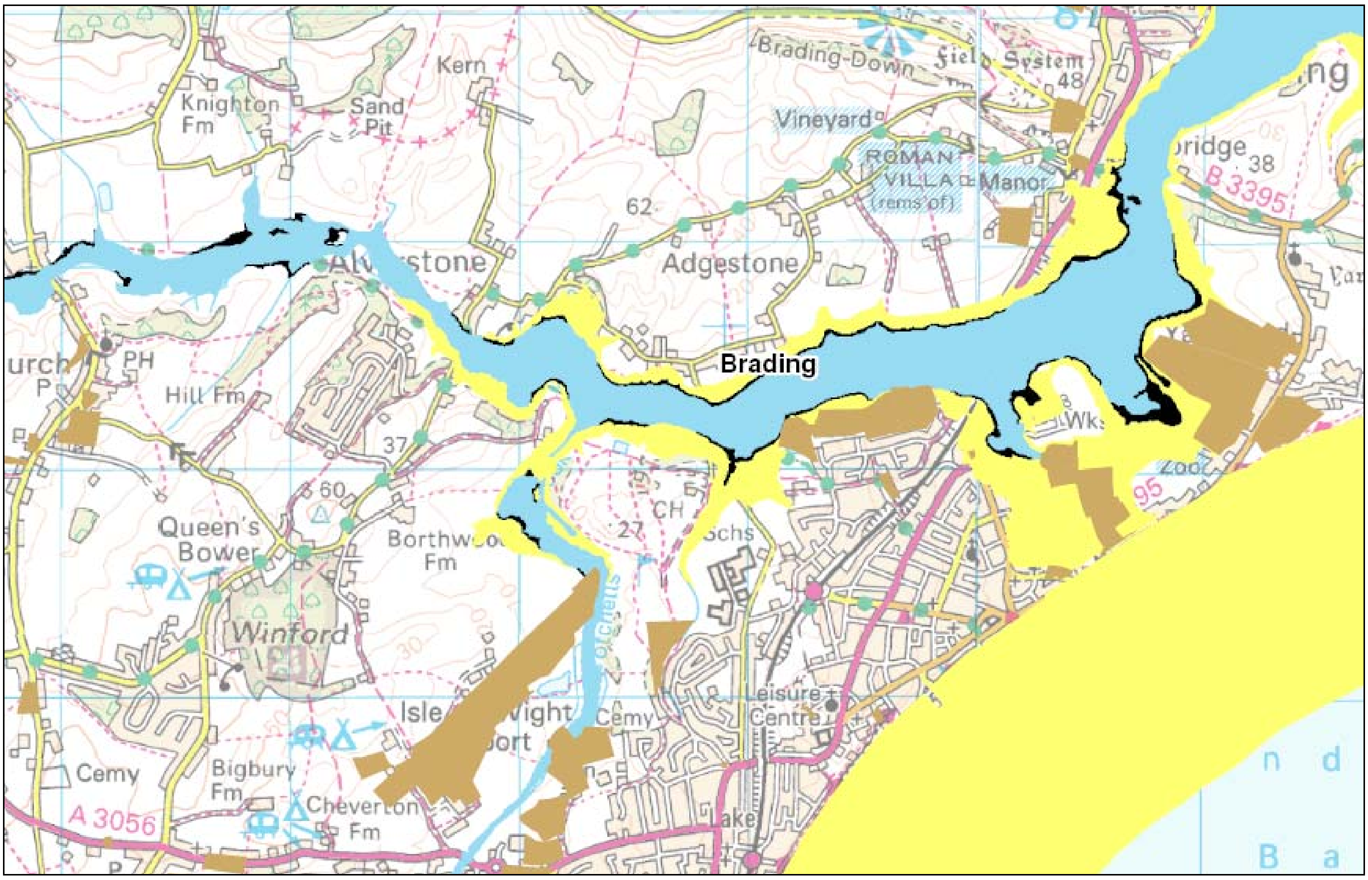
Lower Eastern Yar

The area of floodplain downstream of Alverstone is the widest expanse of fluvial floodplain on the Isle of Wight. The largest differences between Flood Zone 2 and 3 can be found here, as shown in Figure 5.1. For the purposes of the SFRA, only one area requires identifying, and that is the area of land to the north and east of Sandown and near Yaverland as there are a large number of potential development sites in the area. It is recommended that any subsequent FRAs should assess the implications.

Monkton Mead Brook - Ryde

Flood Zone 2 appears to be significantly larger than Flood Zone 3. It is thought that some of this difference may be attributed to different modelling methods used to produce the two Flood Zone extents. Flood Zone 3 in Ryde appears to be the product of the detailed Monkton Mead model whereas Flood Zone 2 appears to be the product of a more generalised modelling.

Figure 5.1 Lower Eastern Yar Floodplain



The black areas represent the significant parts of Fluvial Flood Zone 2 that extend beyond the extent of Fluvial Flood Zone 3 and the brown areas are the potential development sites. Please note that as with many of the coastal locations, the extent of the tidal Flood Zone 3 present day (yellow) is greater than the fluvial Flood Zone 2

This high level assessment intended to establish whether the potential impacts were extensive or restricted to a few locations. It is found that Island wide fluvial climate change modelling is not necessary to inform the SFRA. It can be concluded that small areas of the Island's fluvial floodplains contain small areas where climate change may have an impact on the extent of the Flood Zones. The '*Areas of Fluvial Floodplain Potentially Sensitive to Climate Change*' dataset (see Figure 15 – Appendix A) should be used as an indication of where the impact of climate change on the fluvial Flood Zones should be considered in more detail as part of site specific FRA's. Any development proposals for sites which fall within the *Areas of Fluvial Floodplain Potentially Sensitive to Climate Change*' dataset must account for climate change allowances in their accompanying FRAs, to be inline with advice offered in PPS25.

5.3 Coastal Domain

The extensive tidal Flood Zones and the perceived risk posed by sea level rise necessitated the need to carry out detailed tidal climate change modelling along the coastline of the RDAs. The methodology adopted is detailed in Section 5.3.1.

5.3.1 Assessment Approach

The 2010 SFRA mapping update has been based upon an ArcGIS shapefile supplied by the Environment Agency 24/08/09 and subsequent revisions on the 07/09/09. Environment Agency LiDAR topographic data now exists for the entire Isle of Wight coastline and this formed the ground model in the mapping exercise. The ground model of the coastal topography had a resolution of five metres. Table B.1 in PPS25 was used to determine the rate of sea level rise, the South East figures were used for the purposes of this exercise. Figure B1 in Appendix B provides an illustration of the coastal cells and it details the predicted sea-levels for the mapped epochs.

The 2007 SFRA mapped the 2000, 2026, 2070 and 2115 epochs. It was decided that the revised mapping should include the 2010, 2045, 2080 and 2115 epochs instead. The base 1990 sea levels issued by the Environment Agency are to the nearest 0.1m. With the intention of not adding false accuracy, the climate change predictions have been rounded to the nearest 0.1m. Appendix B provides Figure B1 which displays a map of the Island and the coastal cells along with the associated predicted sea level rise values.

The extreme sea levels used in the modelling were calculated from adding the incremental sea-level rise figures specified by PPS25 (B.1) for the South East, to the base 1990 extreme levels issued by the Environment Agency (September 2009). These extreme sea levels are derived from probabilistic storm surge heights, but do not account for wind or wave action.

The Island wide predicted flood extents for the 1 in 200 and the 1 in 1000 events are presented in Figures 13 and 14 in Appendix A. Higher resolution mapping for the Regeneration and Development Areas is provided in Appendices E to V.

The predicted flood extents were derived using a technique called horizontal projection modelling. In this process the peak water level is projected across the coastal topography, all areas of land lower than the water level therefore form part of the flood extent. In line with the Environment Agency's Flood Map specifications all areas of flooding with an area of less than $250m^2$ were removed from the flood extents.

5.3.2 Sensitivity to Climate Change in the Tidal Domain

Where there are significant differences between the year 2010 and the year 2115 extents, they are discussed in the Climate Change sections of Appendices E to V which discuss the flood risks facing the Regeneration and Development Areas in more detail. There are no areas covered by the tidal climate change modelling which exhibited large predicted increases in spatial extent, which implies that the tidal floodplains are topographically well defined. A well defined tidal floodplain is bounded by steep topography meaning that an increase in surface water level does not dramatically increase the extent of flooding. Although the extent of flooding does not always increase by much, the depth of flooding will increase.

The tidal climate change flood risk zones should be used to provide an indication of the likely possible extent of future flood zones, however they are not definitive. The outlines are considered to be sufficient to inform the Council of where the long term sustainability of developments may potentially be compromised. Moreover, these datasets can be used to draw the Council's attention to where site specific FRAs should include mitigation measures to demonstrate how the risk of flooding will not increase as a result of the impacts of climate change.

5.4 Planning Implications of Climate Change and FRAs

See Section 9.3.3

6. Assessing the Impacts of Wind Action and Wave Spray

6.1 Rationale for Assessment

This section of the SFRA aims to assess the potential risks to the areas which fall outside the zones of tidal inundation, where there is a potential risk associated with the impacts of wave energy and wave spray. Wave action relates to both the erosive capacity of the waves themselves but also spray action and its effects in damaging coastal infrastructure. This can cause a problem in more exposed areas, areas of high energy wave environments and/or during winter months when stronger winds create a more aggressive wave environment around the coastline.

This assessment has informed the creation of a zone around the Island which highlights the area which may be at risk of the potentially damaging influences of wind and wave action. The available information has enabled this buffer zone to be classified into the High, Medium and Low Risk. An Island wide map is provided in Figure 18 in Appendix A and higher resolution mapping is provided in Appendices E to V.

A review of the potential impact of wind and wave action only has value, in an SFRA context, if applicable policy recommendations can be produced by the assessment. In coastal areas predicted to be at risk of tidal inundation, finished floor levels, ground floor uses and the requirement for safe internal escape routes are governed by the predicted extreme tide levels. Wave action is more a function of energy and spray than flood depth and flood extents. In this instance, the assessment and therefore the Development management guidance produced will relate to building resilience against the impact of wave action and wave spray impact.

6.2 Baseline Assessment

6.2.1 Coastal Vulnerability

Evaluating vulnerability of the coastline to wave action is complex and there are many environmental factors that need to be considered when considering the vulnerability of the Isle of Wight coast. The factors reviewed in this assessment are exposure, tidal heights and coastal geomorphology and wind action and spray, these are addressed in turn below.

Exposure

The key criterion in determining vulnerability to wave impact is exposure. It is possible to broadly identify coastal environments based upon two different levels of wave energy on the basis of prevailing wind speeds, fetch and coastal configuration[2].The amount of energy available in wind driven waves depends upon the velocity, duration and fetch of the wind. The highest waves are produced by strong winds blowing in the same direction and over a long distance. Those areas of the coast that are more exposed to wind energy and have a longer fetch will be most at risk to higher energy wave environments, while other areas will be naturally more sheltered by surrounding land masses. Exposure is also a function of the predominant wind and wave direction.

Vulnerability may also be determined by the coastal landform, in general, headlands and promontories are more exposed and therefore more vulnerable while estuaries inlets and bays are more sheltered and less vulnerable.

In addition, some areas of the coast may have natural or man-made defences in place whereas others may be left undefended and are therefore more at risk. Areas with wide beaches or gravel barriers may be naturally well protected while in other areas coastal defence measures provide artificial protection.

Tidal heights and coastal topography

It is likely that exposed areas of coast will be subject to the highest waves as there is a greater distance for wind generated waves to propagate, as described above. However the likelihood of exposed areas suffering extreme wave impacts and spray is also a function of the tidal regime and topography of the area. If winds are strong, waves may become unusually large and sea spray may travel many metres inland and in some cases can overtop cliffs. However generally it is in lower lying areas, and areas with high tidal levels in which storm winds and waves present the greatest hazard. If land is low lying over a large distance inland this can also increase risk as larger areas are more exposed, conversely if lower lying areas are backed by steeply rising land or cliffs this can offer some protection to the land behind. Storm conditions can often create very low pressure, during which tidal levels can become even higher creating a ‘storm surge’. As well as flood risks, high tidal levels plus increased wave heights maximise the likelihood of wave and spray impacts at the coast and further inland.

Wind action and spray

Storm processes rarely act separately, wind, waves and rising water all interact during storm events and it is the combination of these effects that can make sea or coastal storms so damaging. Rising tidal levels during storm events causes issues of overtopping and flood inundation while direct wave impacts on the coast can be incredibly damaging causing erosion of costal areas and infrastructure failure. However the effects of storm winds at the coast can also be very damaging to both the urban and environmental fabric. Storm winds can cause direct damage to buildings and infrastructure but in combination ‘sand blasting’ of buildings can occur when impacted with spray heavily laden with sand and finer particles. During extreme coastal storms heavier particles including gravels and even boulders can become airborne, which can be extremely dangerous and costly to coastal infrastructure. Even during calmer weather, strong coastal winds are capable of transporting damaging salt spray inland.

[2] Summerfield, M.A. 1991. Global Geomorphology. Prentice Hall.

6.2.2 Coastal Characterisation

The following section describes the baseline conditions for the Isle of Wight Coastline. Available information has been used to provide, an assessment of the coastline in terms of topography, characterisation and condition i.e. exposure, erosion/accretion and sediment transport, an assessment of the wave boundary conditions including wave heights, direction and storm waves and an overview of coastal defence measures in place. Understanding the current coastal environment provides an indication of the levels of exposure which can then be used alongside tidal height predictions to create a vulnerability profile for the Isle of Wight.

Information used in this assessment includes:

- LiDAR topographical data (Environment Agency);
- Geological maps of the Isle of Wight (British Geological Survey)
- Assessment of shoreline dynamics for the Isle of Wight (Isle of Wight SMP 2, Appendix C);
- Southeast Strategic Regional Coastal Monitoring Programme Annual Report 2009 (Channel Coastal Observatory);
- Average and storm wave heights for boundary areas (Channel Coastal Observatory);

The following sections describe the general coastal characteristics around the Isle of Wight in terms of exposure, stability, erosion and accretion, the dominating hydrodynamic regime and sediment transport. The summary presented uses information provided within the report ‘Assessment of Shoreline Dynamics for the Isle of Wight’ produced by the Isle of Wight Centre for the Coastal Environment and which forms Appendix C of the new SMP2 document.

General coastal characteristics

The Isle of Wight coastline is extremely varied and dynamic over a relatively small area. Marine erosion is in action around the coast to produce an almost continuous cliffline with a varied morphology resulting from the varied geology present. The solid geology and structure of the Isle of Wight is dominated by an east-west chalk ridge which cuts through the centre of the Island and is exposed at either end to form headlands at the Needles in the west and Culver Cliff in the east. To the north of this ridge, the relatively sheltered coastline of the Solent is characterised by low lying land and estuaries. While to the south the coastline is dominated by high sea cliffs and is more exposed to wave and weathering impacts and associated erosion. A prominent feature of the south coast is the Undercliff, an ancient coastal landslide complex measuring approximately 12 km in length and extending up to 500m inland and 2 km seawards.

In terms of erosion the south coast is particularly vulnerable, due to a combination of exposure to the large storm events that cross the Atlantic and the formation of softer Wealden rocks that are present across the south west coast of the Island. The exposed high energy southern coast also presents greater potential for sediment transport, compared to those areas along the sheltered environments of the north and north east which are characterised by five estuary environments. However strong tidal currents are generated in the western Solent and these contribute to sediment mobility in certain areas.

The offshore and nearshore zones of the Island are characterised by a thin layer of sand and gravel that forms gravel banks in some locations and provide a source of onshore gravel during storm conditions. Sediment transport in the nearshore zone is complex around the Island as sediment movement is interrupted by estuaries, headlands and offshore features. Around the coast, seabed sands and gravels are highly mobile during peak flows with a general eastward transport from the predominantly south, south westerly winds. At locations where this transport is interrupted for example at Thorness Bay and Hurst Narrows, sand and shingle banks have formed.

Much of the coastline of the Isle of Wight is undefended in engineering terms, however a number of sections of the coast around key developed areas have been heavily modified by hard coastal defences. Areas include Cowes, Ryde and Bembridge Harbour, Ventor, Sandown Bay and in the extreme north west at Totland and Yarmouth. At these locations defences are reported to be in fair or good condition.

Coastal condition – exposure, erosion and accretion

North east to east – Old Castle Point to Culver Cliff

The north east Isle of Wight is mostly low lying or of low relief. Erosion occurs along the majority of the coast resulting in the development of varied cliff forms and includes inlets of Bembridge Harbour and Wootton Creek. Waves to the east of Ryde are generated in Hayling Bay and the English channel and therefore wave energies are moderate approaching predominantly from the east or south east. In contrast to the west of Ryde the area is more sheltered and prevailing winds are generated in Southampton Water and the East Solent and are fetch limited. Wave conditions in this area are therefore generally low energy, dominated from a north west direction. In general tidal current speeds in the east are slower than in the west and the area is dominated by coarse sediments although most are in-channel rather than shoreline deposits. The foreshore at Ryde is dominated by increasingly sandy sediments and at ‘Ryde Sands’ a major accumulation of sand deposits have developed.

East to south - Culver Cliff to St Catherine’s Point

The coast between Culver Cliff and Dunnose on the south east coast has developed through marine erosion of the predominantly soft clays and sands of the Wealden and Lower Cretaceous Groups. The east facing coast is relatively protected from waves generated by dominant westerly winds, but it is fully exposed to east and south easterly winds which have a fetch distance of just over 200 km and over which large waves can propagate.

Almost the entire length of this coastline is characterised by active cliff development, with local beaches of varying width associated with numerous groyne installations. Substantial seawalls and promenades at Shanklin and Sandown serve to protect the cliff line from direct wave attack and between Yaverland and Shanklin Chine the coast is fully protected by a variety of structures including seawalls, revetments and groyne fields. Between

Shanklin Chine and Dunnose there are few defences but this area of coast is not believed to have changed in recent decades.

The undercliff coastal frontage is an exceptionally dynamic and unique section of coast exposed to a maximum fetch of 150 km defined by the width of the English Channel. Although coastal defences protect large sections of the developed coastline of the Undercliff, the undefended areas are subject to high energy wave attack resulting from storm events which has led to significant loss in beach material over a relatively short timeframe. Storm surges that propagate in the English Channel typically move through from west to east reaching a maximum near the Isle of Wight and can add over 1 m to predicted sea level in the area. Tidal currents are often strong in this area, particularly at St Catherine's Point. Sediments of the Undercliff coastline consist almost entirely of gravel and sandy gravel and between Ventor and St Catherine's Point, several well defined pocket beaches consisting of 'pea size' gravel (D50 10mm) have developed.

South to west – St Catherine's Point to The Needles

The frontage between St Catherine's Point and The Needles occupies one of the most exposed locations on the south coast of England with long fetches in excess of 4000 km, extending directly into the north east Atlantic and the English Channel. It is exposed to swell wave (Ocean wave) activity as well as to energetic locally generated wind waves. Numerical modeling undertaken by HR Wallingford indicated that maximum wave heights for a 1 in 1 year event is up to 5m for the coastline between Freshwater Bay and the Needles. Wave exposure and the steepness of the nearshore profile are greatest towards the south east so that Chale Bay experiences the most energetic shoreline wave environment. Tidal currents are generally weak at the shoreline, but increase in velocity as they are forced around the headland of the Needles and Rocken End. Generally beaches consist of gravel backshores and sandy foreshores and progressively steepen between Rocken end and Freshwater Bay. Along the south west coast a concrete sea walls defend the development of Freshwater while the remainder of the coast consists of agricultural land with isolated small settlements and is unprotected.

West to North – The Needles to Old Castle Point

From the Needles to Cliff end, the area comprises a combination of relatively resistant rock material with spatially varied exposure to waves and currents, resulting in the formation of a predominantly eroding coastline characterised by well developed cliffs and landslides. The Needles headland provides shelter to this area from waves but despite this it remains exposed to dominant waves approaching from the northwest, west and south west. HR Wallingford Predictions (1999) provide potential maximum significant wave heights of up to 2.36 m for a 1 in 50 year return period south of Fort Albert. The rapid erosion of cliffs provides large quantities of fine sediments that are easily transported and at this location a net movement of sediment transport offshore is inferred.

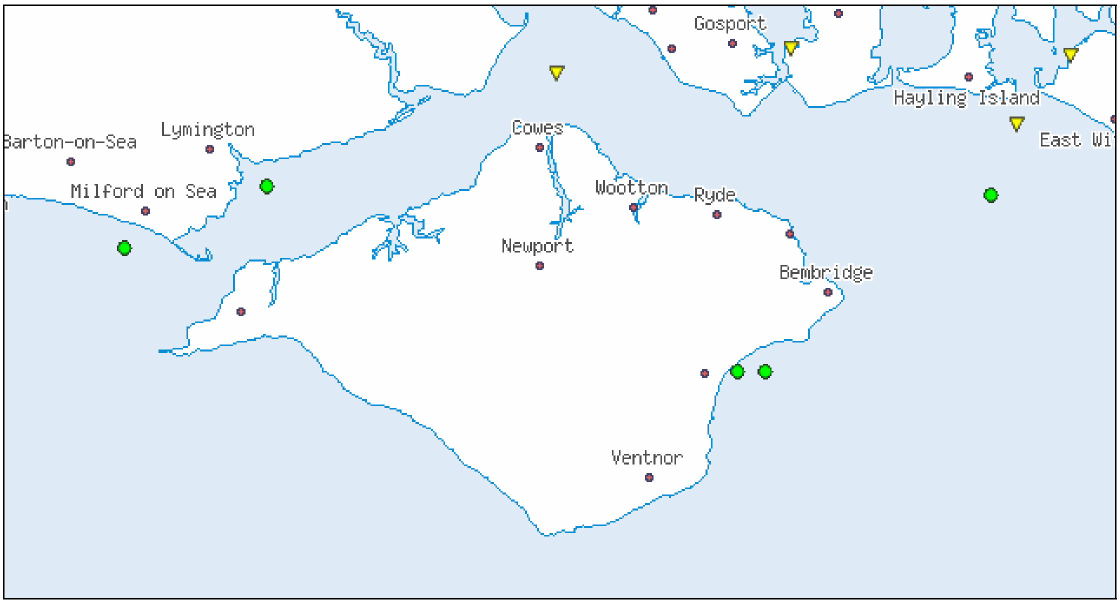
Further north between Fort Albert and Cowes the coast is sheltered from the open sea and incident waves generated in the West Solent are Fetch limited and generally less than 1 m in height. The coastal topography of this area is undulating with erosion of the soft mud strata forming a series of high points along the coast at Bouldner Point, Burnt Wood and Gurnard Cliff. Tidal currents and wave action continue to erode the base of these cliffs and transport fine material off and alongshore, promoting further instability. The shoreline has a complex and varied sediment transport regime due to a combination of the coastal configuration and hydraulic regime in operation. Transport of sediment is separated by headlands and estuaries with weak littoral drift in a north eastward direction, that is intercepted at inlets and estuaries which promote storage of sediments.

Most of the coastline across this area is natural but there has been some localised shoreline stabilisation by seawalls at Yarmouth and Cowes. In addition limited beach nourishment has occurred at several locations to avoid the undermining of coastal protection structures in place.

Wave boundary conditions

The figure below (Figure 6.1) shows the location of waverider buoys and wave gauges in place around the Isle of Wight. These are deployed and managed by the channel coastal observatory and provide boundary conditions for the Isle of Wight in terms of wave climate. Wave buoys at Sandown Bay provide an indication of wave conditions for the south east of the Isle, the wave gauge at Hayling Island provides boundary conditions for the north east and those at Lymington and Milford provide indications of wave conditions for the northwest and west. Although only boundary conditions these present the best wave data available and can be used to provide an indication of the wave regime around the coast.

Figure 6.1 Location of wave gauges and wave buoys (Channel Coastal Observatory)



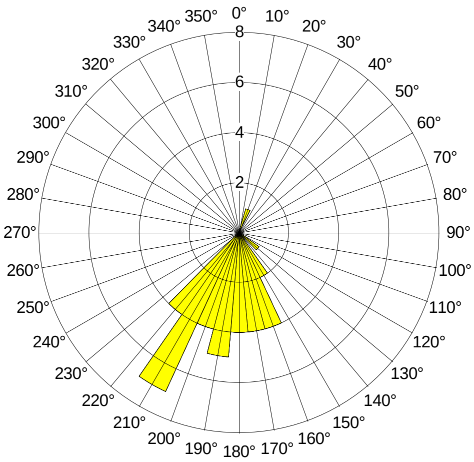
The table below (Table 6.1) presents a summary of wave heights for the each of wave buoys and gauges around the Isle of Wight. Both monthly and average heights are demonstrated. It is clear that those wave approaching from the west and north east are higher than those approaching from the north and the south east. In particular the gauge at Lymington within the sheltered area of the Solent demonstrates particularly low wave heights throughout the year. It would be useful to present wave data from the south west as this area of the coast is most exposed, but unfortunately no buoys are currently positioned at this location. In general wave heights are increased during autumn and winter months as opposed to spring and summer which is to be expected based upon prevailing weather conditions.

Table 6.1 Boundary condition wave heights

Location (10 m water)	Average wave height (m)												
	Jan	Feb	Mar	Apr	Mar	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Av
Hayling Island	1.19	0.78	0.90	0.59	0.42	0.49	0.61	0.75	0.68	0.76	0.69	0.68	0.71
Sandown Bay	0.81	0.60	0.56	0.47	0.41	0.32	0.43	0.50	0.55	0.52	0.51	0.55	0.52
Sandown Pier	0.54	0.43	0.38	0.37	0.35	0.28	0.31	0.33	0.39	0.37	0.40	0.43	0.38
Lymington	0.23	0.16	0.17	0.15	0.12	0.13	0.15	0.21	0.15	0.16	0.14	0.13	0.16
Milford	1.13	0.65	0.90	0.52	0.28	0.54	0.67	0.86	0.60	0.78	0.63	0.53	0.67

The wind rose below (Figure 6.2) presents a summary of the predominant wind and wave direction for the Isle of Wight. The directions used are monthly averages for each of the directional waverider buoys at Hayling Island, Sandown Bay and Milford, the wave gauges at Sandown Pier and Lymington do not record directional data and these are therefore not included.

Figure 6.2 Boundary condition wave directions



The wind rose demonstrates that in general prevailing or dominant wind and wave direction across the year is from the south west with a moderate frequency from the south east. It is therefore the south west of the coast and to a lesser extent the south east that is considered to be most exposed to wave impacts.

The table below (Table 6.2) presents storm wave data for those storms recorded during 2008. The highest and most frequent storm waves were experienced at the Hayling Island buoy with wave heights exceeding 3 m in 3 events. Sandown Bay also demonstrates waves of over 3 m during two storm events as does the buoy at Milford. Again it is the wave gauge at Lymington that demonstrates the fewest storms with the lowest wave heights (0.91 m) indicating the sheltered nature of the coast at this location. In addition to the data presented below, as stated in section 1.4.2 above, predictive modelling undertaken by HR Wallingford provides maximum storm wave heights of 5 m for a 1 in 1 year event in the south west of the Island and this should be considered when taking into account wave exposure conditions of the coast.

Table 6.2 Highest storm events in 2008

Location (10 m water)	Highest storm events in 2008		
	Time	Wave height m)	Direction (o)
Hayling Island			
10-Mar-2008	08.00	3.79	183
13 -Dec-2008	10.00	3.64	169
04-Dec-2008	09.00	3.02	187
15-Jan-2008	11.30	2.92	191
03 -Feb-2008	23.00	2.90	159
Sandown Bay			
10-Mar-2008	11.30	3.63	173
13-Dec-2008	06.00	3.36	172
04-Feb-2008	01.00	2.75	153
04-Dec-2008	09.00	2.53	179
Sandown Pier			
13-Dec-2008	09.00	2.01	-
03-Feb-2008	21.20	1.75	-
10-Mar-2008	08.00	1.62	-
Lymington			
10-Mar-2008	11.40	0.91	-
Milford			
10-Mar-2008	20.00	3.42	-
31-Jan-2008	12.00	3.27	219

6.3 Delineation of a Potential Wave Exposure Risk Buffer Zone

The following section describes the methodology used to assess the coastal vulnerability of the Isle of Wight and create a buffer zone map to inform future development.

6.3.1 Classification of Exposure Risk

Using the information discussed in the previous sections, an assessment of exposure has been undertaken and is presented in Table 6.3. This high level assessment is based on a conservative approach which makes a judgement on the level of exposure that is based upon both exposure to wave impact and wave height and exposure in terms of defences both man made (groynes, seawalls) and natural (beaches, sediment transport, cliff erosion). The risk classifications presented in Figure 18 in Appendix A are based upon the assessment results presented in Table 6.3. A qualitative classification has been undertaken of the predominant wave condition and the exposure of the coast, either 'high', 'medium' or 'low'. These classifications were then combined to form a single risk classification for a given length of the coastline.

Table 6.3 Summary of coastal condition and exposure assessment

Location	Predominant wave condition	Score	Exposure	Score	Risk Classification
North to east		**H/M/L**		**H/M/L**	**H/M/L**
Old castle point to Ryde	Generally low energy fetch limited from north west direction	**L**	Slower currents dominated by coarser sediments	**L**	**L**
Ryde to Culver Cliff	Moderate wave energy predominantly from east to south east	**M**	Faster currents - large sand deposits present 'Ryde Sands'	**L**	**M**
East to South					
Culver Cliff to Dunnose	Moderate, protected from westerlies but fully exposed to east and south easterlies. fetch over 200km	**M**	Active cliff development (erosion) local beaches a variety of defence measures in place (groynes, sea wall etc)	**L**	**M**
Dunnose to St Catherine's Point (The Undercliff)	Dynamic area of coast maximum fetch 150km undefended areas at risk during storm attack	**M**	Large areas protected by defences (man made) and gravel beaches	**L**	**M**
South to West					
St Catherine's Point to The Needles	Exposed to swell waves and energetic local waves maximum fetch of 4000km over which very large waves propagate	**H**	One of most exposed coastlines in south east England. Sea wall at Freshwater – remainder of coast is exposed	**H**	**H**
West to North					
The Needles to Cliff End	Exposed to waves from west, north west and south west	**H**	Although some protection from the needles remains exposed with rapidly eroding coastline and fast sediment transport	**M**	**H**
Cliff End to Old Castle Point	Fetch limited waves generally less than 1 m in height	**L**	Sheltered, weak littoral drift, localised shoreline stabilisation, limited beach nourishment	**L**	**L**

In general the areas to the north of the Isle of Wight are considered low risk as they face the sheltered waters of the Solent and wave generation is limited by a small fetch. Areas to the north east and east are considered medium risk as they are more exposed but are subject to the less dominant easterly waves rather than more dominant westerlies and although fetch distances may reach 200km waves are still considered fetch limited. In addition these areas of coast are generally more protected with a variety of sea defence measures in place including groynes, sea walls and revetments. Areas to the south and the south east are the most exposed with fetch distances of over 4000km and few defences in place. This area of coast is considered to be one of the most exposed in south east England. Areas to the north west are again considered low exposure as waves are fetch limited, the coastline is well sheltered and some defence measures are in place.

6.3.2 Defining the Buffer Zone

The exposure map produced needs to take into account tidal data for the Isle of Wight. Areas that are low lying and have high tides are considered at greatest risk as a function of wave height and spray. Tidal inundation is considered in Section 3.4, as such the exposure risk buffer focuses on areas beyond the extent of Flood Zone 2. Land within the extents of Flood Zones 2 and 3 are covered by the requirements of PPS25.

The Exposure Risk classifications have been used to inform the width of the buffer zone. Spray can travel many metres inland and even under calm conditions, coastal fog or mist carrying salt water particles is common. However, although damaging to building material over time through chemical weathering processes this type of spray or ‘sea mist’ is not considered to be a risk in relation to wave impact. Instead it is the distance larger particles can travel when picked up and transported by extreme wave events which present the greatest risk. Under extreme storm conditions gravel and even boulders may be picked up and thrown inland but over relatively short distances. Sand particles may travel further and ‘sand blasting’ of buildings can be very damaging during storm conditions.

Three buffer widths (Table 6.4) have been created and applied to the Isle of Wight coastline based upon the low, medium and high risk exposure risk classification.

Table 6.4 Exposure risk and buffer width

Exposure risk	Buffer width (m)
High	100
Medium	50
Low	10

The buffer widths are estimates of the distances which wind and wave processes may transport particles.

6.4 Using the Wave Exposure Risk Buffer in Development management Decisions

The Exposure Risk Buffer is intended to highlight areas which are outside the Environment Agency Flood Zones 2 and 3, within which it may be considered appropriate to require development proposals to demonstrate as part of the planning application that the potential risks associated with wind and wave action have been considered in the building design.

The buffer width is determined by the expose risk classification and not by ground elevation. Thus there are likely to be areas of high ground which have been included in the buffer zones. It is suggested that the exposure risk, and therefore the need for building design considerations, be reviewed on a site by site basis. Based on the wave height data available for review in this assessment, a suggested guide for identifying those sites where mitigating building design should be considered would select site where the ground level is less than the sum of:

- The 1:200 year tide level for the year 2105 (see Figure 13 in Appendix A); and
- 4m, which represents the peak wave heights recorded in 2008, represented to one significant figure.

This guide accounts for predicted climate change induced sea level rise and recorded peak wave heights. The type and availability of sediment should also be considered when assessing the risk to specific sites. Areas of gravel beaches for example should be noted as a potential higher risk during extreme storms due to the supply of larger potentially more damaging particle sizes. Sand areas should also be considered as these will supply smaller particle sizes that may be transported over larger distances.

Mitigation Measures - Building Design

These areas are outside the tidal inundation zones as such it is unlikely that there will be any requirement for floor level adjustment. In these areas, the risk is associated with spray and the debris and sediments that it may contain, as such appropriate mitigation would include the use of toughened glass in sea facing windows and doors. The choice of building material should also be informed by the risk of the building being impacted by potentially corrosive salt water.

7. Sustainable Management of Surface Water

7.1 Introduction

PPS25 states that surface runoff is an important consideration in the assessment of flood risk and must be addressed at the SFRA and FRA level. The risks associated with surface water and the need to sustainably manage this risk was clearly identified in the Pitt Review (2008). Historically, surface water drainage in developed areas uses underground piped systems in order to remove excess water as rapidly as possible. PPS25, the Pitt Review and the emerging guidance on the management of surface water represent a shift in the approach. Above ground solutions are now considered preferable as in addition to drainage management advantages they can also provide ecological and amenity value. The traditional approach sought to discharge and convey water as quickly as possible, often with negative downstream flooding consequences and as direct pollution pathways. This concept is being replaced with the idea of attenuating flows, limiting peak discharges and source control of rainwater.

When considering the present emphasis on sustainable development and the requirements of the Water Framework Directive (WFD), different approaches to past drainage conventions are required. PPS25 and the Pitt Review identify opportunities to reduce flood risk, manage water quality and provide integrated amenity and ecological benefits through the implementation of sustainable drainage solutions.

PPS25 requires an FRA to accompany a planning application for all sites in Flood Zone 1 which are greater than one hectare in size. This is to ensure that downstream flooding problems are not aggravated by increased runoff post development. The planning system therefore represents an effective means of ensuring that new developments manage water in a sustainable manner. As a minimum requirement of PPS25, the negative environmental impacts of development on surface water runoff need to be mitigated against. PPS25 states that post development rates of runoff must not exceed pre-development runoff rates. The Environment Agency and the Isle of Wight Council have an aspirational target of reducing the runoff rates wherever possible. Particular attention should be paid to the use of sustainable drainage systems given the wider sustainability aims of Planning Policy 1 – '*Delivering Sustainable Development*' (PPS1) and the specific requirements of PPS25.

7.2 What is Sustainable Surface Water Management and where should it be applied?

7.2.1 What does sustainable drainage mean?

The concept of sustainable drainage is simple and the basic principals include:

- Reduced dependence on piped solutions

- Reductions in peak flow rates and overall run-off volumes, with the intention of better reflecting the discharge patterns of undeveloped greenfield sites.
- Where possible the solution should contribute to wider water quality sustainability issues by providing pollution control and where necessary treatment of contaminated surface water run-off
- Reduce the hard engineering components and maintenance requirements of the drainage solution
- Where possible the drainage scheme should provide ecological and amenity enhancement value.

7.2.2 In what situations should the concept be applied?

The design and implementation of sustainable drainage solutions should be factored into the design of any new development. This follows best practice, but also it is a fundamental requirement of PPS25 that the new development do not result in an increase in surface water run-off rates post development. Moreover the Isle of Wight Council have an aspiration to see run-off rates and run-off volumes reduced from the current condition on previously developed sites.

New development provides a means of achieving the benefits of sustainable drainage. But new development does not facilitate enhancement in areas where surface water flooding issues are currently identified. Surface water flooding issues in currently developed areas should be considered for the undertaking of Surface Water Management Plans (SWMPs). In these areas surface water flooding problems can be addressed through source control, reconfiguration of the surface water system or as a result of large scale redevelopment of the area.

In line with PPS23 development should be appropriate and should not lead to pollution. As such, it is not appropriate to install infiltration systems in land affected by contamination as this could lead to pollution of underlying groundwater. Please refer to the Environment Agency's 'Groundwater Protection: Policy and Practice (GP3)' document, which is available at www.environment-agency.gov.uk.

7.2.3 At what scales can sustainable drainage be implemented?

The principal of sustainable surface water drainage can be applied at any scale. Scale only controls the requirements of the drainage solution and it influences the range of possible techniques. On the small scale developments undertaken in isolation, for example s single residential unit, rainwater harvesting, green roofs, and permeable patios areas should be encouraged. On the larger scale where developers or the LPA are seeking to deliver a large number of units it becomes possible to implement integrated drainage solutions. Further details are provided in Section 7.5.

For larger developments the Council require the management of surface water and the associated green infrastructure becomes an integral part of the masterplanning process and the development design.

7.2.4 What options are available and how can the appropriate solution be identified?

The applicability of SuDS techniques for use on a potential development sites should based on an assessment of the following key influences put forward by CIRIA (2007):

- **Land use characteristics** – favour different SuDS techniques. Industrial sites where pollution is an issue are best managed with attenuation SuDS over infiltration SuDS, with multiple treatment stages.
- **Catchment characteristics** – may have a bearing of the choice of SuDS, as particular catchments may be regulated for a sensitivity to flooding or pollution and may potentially be aggravated by one SuDS technique compared to another.
- **Quantity and quality performance** – would guide the choice of a particular SuDS technique and is dependant upon the requirements.
- **Amenity and environmental requirements** – flood risk mitigation is the primary aim and when satisfied, options to add ecological value could be considered.

Chapter 5 of the SuDS Manual by CIRIA (2007) provides further details regarding these key influences, and is recommended as a supporting document to this SFRA. Landuse is considered to be a dominant factor, as it influences the volume of water required to be attenuated, the likelihood of pollution and contaminants and the potential for infiltration to occur. Indications of the most suitable techniques for each site cannot be made as part of a strategic level assessment. Site specific FRA’s and Drainage Assessments will provide the required recommendations. Therefore the applicability of SuDS techniques in the SFRA can only be assessed through the consideration of regional characteristics relating to the hydrology and geology. Sections 5.2.2 and 5.2.3 of the SuDS manual provides an indication of the various catchment characteristics that restrict or preclude the use of a particular SuDS technique.

Once it has been established that SuDS are suitable for use on the site, the selection of the appropriate technique(s) is/are dependant on various factors. The following are presented by (CIRIA, 2007):

- ***Soils*** – soil permeability has a significant bearing on the choice of infiltration SuDS techniques.
- ***Groundwater*** – infiltration techniques require at least 1 metre of soil depth between the base of the device and the maximum expected groundwater level.
- ***Area draining to single SuDS component*** – vegetative or filtering SuDS can attenuate smaller volumes of runoff, than ponds which can handle larger volumes generated from a bigger area.
- ***Slope of drainage area*** – steeper slopes reduce the suitability of some SuDS techniques, such as infiltration, which require longer residence times.
- ***Head*** – SuDS that require gravity to operate will require a positive head between inflow and outflow.

Table E2 (in Appendix S) taken from CIRIA (2007) provides a summary of influential site characteristics which should be assessed at the site specific level. Section 7.3 describes how the SFRA has reviewed the appropriateness of infiltration SuDS techniques for the whole Island.

Table W2 (in Appendix W) provides a summary of options for SuDS and their suitability according to subdivisions of water quality, water quantity and environmental benefits. SuDS include a number of techniques such as green roofs, permeable paving, rainwater harvesting, swales, detention basins, ponds and wetlands. SuDS techniques can be implemented in most urban settings, from hard-surfaced areas, to soft landscaped features as a variety of design options are available. This allows designers and planners to consider local land use, future management and the needs of local people, when undertaking drainage design.

7.3 Appropriateness of Infiltration SuDS Techniques on the Isle of Wight

The section describes how the SFRA has provided an assessment of the suitability of infiltration SuDS techniques for each site. Infiltration SuDS are the preferred option of PPS25 (paragraph 4.11 PPS25, 2006) and as such it is the applicability of this technique which forms the focus of this assessment. The assessments have been performed using Island wide datasets and the findings of which are presented for each site in the Sites Database. Two key factors had to be considered:

- The infiltration potential – was based on the BGS Groundwater Vulnerability map which classifies soils and geology in terms of the potential for pollutants to be transferred from the surface to aquifers. See Figure 9 in Appendix A.

- The potential for groundwater contamination – was based upon the Ground Water Source Protection Zones provided by the Environment Agency. See Figure 10 in Appendix A.

- Mass movement issues – the BGS mapping indicates areas where rotational slips are potentially an issue in these areas the promotion of infiltration is not encouraged. See Figure 7 in Appendix A.

It should be noted that the 'potential for groundwater contamination' assesses the potential for contaminants to enter groundwater. No assessment has been made of the presence of contaminants or contaminated land. Details on the derivation of the Infiltration Potential, Groundwater Contamination Potential and Infiltration SuDS suitability are provided in Section 1 in Appendix S. Each of the potential development sites included for review in this SFRA has been attributed with the respective infiltration SuDS suitability potential. In all instances site investigation work and consultation with the Environment Agency on the nature of proposed SuDS techniques is recommended.

7.4 Management of Surface Water – New Development Requirements

All planned development, whether in the floodplain or not, must consider the implications for its drainage on flood risk. Where the proposed site exceeds 1 hectare in area, PPS25 requires an FRA to be compiled, which as part of the planning application will be passed to the Environment Agency for review in its role as statutory consultee.

In addition to the PPS25 requirement, the Council require that planning applications for all new developments on sites over 0.25 hectares in Flood Zone 1 should be accompanied by a Drainage Strategy. The threshold of 0.25ha has been selected as it represents the minimum size considered by the Strategic Housing Land Availability Assessment (SHLAA). The drainage strategy should detail how the proposed development does not increase current rates of run-off. For previously developed sites the Drainage Strategy should describe how the development reduces surface water run-off rates and volumes. In flood Zones 2 and 3, where FRA's are required for any proposed development, there again must be no increase in run-off rates or volumes post development and there should be a reduction in run-off rates and volumes from previously developed sites.

7.5 Integrated SuDS Solutions

A strategic approach to the drainage of new urban areas is necessary to ensure that drainage and flood risk management proposals effectively manage runoff changes whilst reducing the flood risks associated with new development. A strategic approach will reduce the chance of cumulative piece-meal additions to drainage systems causing future problems, and allow for the identification and betterment of existing systems with known issues.

LPA's are required to promote the application of SuDS, the preferred option in PPS25 being infiltration techniques as opposed to discharging into watercourses. Where this is not possible, preference should be given to the discharge of surface water into watercourses rather than foul water drains. As the PPS25 *Practice Guide* states, these options enable the preferences of the different stakeholders to be balanced, and the risks associated with each option to be weighed during the decision making process. There is no single correct technique. Rather a combination of drainage techniques often can be implemented to most effectively manage site drainage. To simulate the natural hydrological processes in a catchment through engineered drainage, a management train of SuDS is required. The following are four objectives of a SuDS treatment train which were presented by Greater Dublin Strategic Drainage Study (2005):

- **Pollution prevention** – spill prevention, recycling, public awareness and participation.
- **Source control –** conveyance and infiltration of runoff;
- **Site Control –** reduction in volume and rate of surface runoff, with some additional treatment provided; and
- **Regional Control –** Interception of runoff downstream of all source and on-site controls to provide follow–up flow management and water quality treatment.

Table 7.1 classifies SuDS according to their suitability to each of the management train objectives. Regional control is of the most significance to this SFRA, since the remaining management train objectives are site specific and require participation from developers for their implementation. By considering regional SuDS control, the Council can be proactive in planning for SuDS on a regional level. It should be noted at this point that most drainage systems are gravity fed and thus require a negative gradient in order to operate. SuDS management trains are therefore highly likely to be limited to common drainage areas. Figure W.1 (in Appendix W) illustrates two likely implementation scenarios of a SuDS management train.

Table 7.1 (modified after CIRIA, 2007)

Technique	Management train suitability					
	Prevention	Conveyance	Pre-treatment	Source Control	Site Control	Regional Control
Water butts, site layout & management	#	=		#		
Pervious pavements	#			#	=	
Filter drain		#		#	=	
Filter strips			#	#		
Swales		#		#	#	
Ponds					#	#
Wetlands		=			#	#
Detention basin					#	#
Soakaways				#		
Infiltration trenches		=		#	#	
Infiltration basins					#	#
Green roofs	#		#	#		
Bioretention areas				#	#	
Sand filters			#		#	=
Silt removal devices			#			
Pipes, subsurface storage		#			#	

\# High/primary process = Some opportunities, subject to design

If SuDS are to be fully effective, they need to be managed properly. It is the responsibility of the developer to ensure that the development drainage is maintained for the lifespan of the development. There are a range of maintenance routes the developer might want to pursue but ultimately the developer has to demonstrate that there is a drainage maintenance plan presented. Section 106 of the Town and Country Act 1990 provides a suitable

mechanism whereby properly designed SuDS components can be transferred into the management and maintenance responsibilities of the local authority. This is providing the Council wish to enter into such an agreement and there is no legislation which states they have an obligation to.

The '*Interim Code of Practice for Sustainable Drainage Systems*' (NSWG, 2004) endorsed by the Environment Agency should be consulted for further guidance.

7.5.1 Integrated Drainage Strategy

Integrated Drainage, describes the collusion of all stakeholders (typically the LPA, Highways Agency, Environment Agency and the Water Company) to produce a scheme in which surface water drainage is addressed at a more strategic level. Opportunities for developing an Integrated Water or Drainage Management Strategy across development site boundaries is recommended, and ideally a catchment-led approach should be adopted. This has been recognised in the recent consultation paper by Defra, '*Making Space for Water*'. Integrated approaches often lead to a much more efficient and reliable surface water management system because it enables a wider variety of potential flood mitigation options to be used, and a better overall design can be achieved. Integrated management of surface water has potential benefits in addition to flood risk, and can include improved water quality through the use of. Once the site allocation process had been executed on the Isle of Wight, consideration should be given at an early stage as to the best way to manage drainage to maximise benefits. The Environment Agency will be pushing for an integrated urban drainage scheme in the Pan Extension Project in Newport. SUDS will be vitally important to ensure no detriment to water quantity or quality in the receiving watercourses. The river corridors should also be maintained across the site.

It is recommended that Appendix F of PPS25 or Chapter 4 of the Practice Guide from PPS25 is referred to.

7.6 Management of Construction Site Runoff

Construction site runoff is an important but often over-looked area of catchment hydrology, causing local short-term but potentially significant changes in local flood risk.

The clearance of vegetation (and modifications to drainage infrastructure on brownfield sites) may lead to increased runoff above pre-construction rates. The management of runoff during the construction period is an important consideration particularly for large sites and details of measures to mitigate for this phase of development are required as part of an FRA. The WFD places specific requirements on the management of non-point source pollution such as that from construction site silts. Methods to reduce the volume of solids (and runoff) leaving the site include:

- Phased removal of surface vegetation at the appropriate construction phase;
- Provision of a grass buffer strip around the construction site and along watercourses;

- The covering of stored materials;
- Ensuring exposed soil is re-vegetated as soon as feasibly possible;
- Protection of storm water drain inlets; and
- Silt fences, siltation ponds and wheel washes.

8. Principal of Flood Risk Management through Avoidance

8.1 Sequential Approach

Through the planning process, PPS25 aims to reduce the flood risks faced by future developments, and advocates a risk avoidance approach to spatial planning. Avoidance has always been an option for risk management, but it was rarely deployed. There has recently been a paradigm shift which now prioritises the importance of avoidance. Annex D of PPS25 has been reproduced (in Appendix D) of this SFRA for reference purposes. A sequential risk-based approach to determining the suitability of land for development in flood risk areas is central to the Policy Statement and should be applied at all levels of the planning process.

Application of the sequential approach to spatial planning reinforces the most effective risk management measure – that of avoidance. PPS25 states that application of the Sequential Test at the Local Development Document level, will help ensure that development including regional housing targets, can be safely and sustainably delivered.

The sequential approach offers a simple decision making tool that is designed to ensure that areas of little or no risk of flooding are developed in preference to areas at higher risk. PPS25 notes that LPAs should make the most appropriate use of land to minimise flood risk, by planning the most vulnerable development is located in the lowest known risk areas. However, it is recognised that there are cases when development within higher risk zones is unavoidable.

8.2 Sequential Test – Vulnerability and Flood Risk

The Sequential Test is a key component of the hierarchical approach to avoiding and managing flood risk. The SFRA has mapped the flood risk zones (Figure 12 in Appendix A) and has identified the landuses which are considered appropriate[3] for each site based on the guidance specified in PPS25 (see Table 8.1 below and Figure 12 in Appendix A). Table D.1 of PPS25 (in Appendix D) defines the risks associated with each Flood Zone and Table D.2 and Table D.3 indicate the types of landuse considered appropriate for each Flood Zone. The information presented in Table D.3 in PPS25 does not show application of the Sequential Test (see footnote 22 in PPS25), thus the appropriateness of development types is subject to the application of the Sequential Test. There are several key points that the Council should consider when applying the Sequential Test, these are outlined below.

[3] appropriate = as defined by Table D.2 in PPS25

- Increasing the vulnerability of a site by proposing an alternative use of a higher vulnerability (even if consistent with the risk) is considered an increase in flood risk and is not inline with the principals of PPS25;

- If any land in Flood Zones 3a, 3b or 2 has to be utilised (subject to successful application of the Sequential Test) development should be steered towards the areas of lowest hazard;

- Placing less vulnerable land uses in low risk areas, in preference to more vulnerable land uses, is not in line with the sequential approach and should be avoided; and

- If land in Flood Zone 3a has to be utilised, development should be steered towards the areas of lowest hazard within that zone. The information presented in Section 3 can be used to inform this process.

Table 8.1 Appropriate Landuses for Given Flood Risk Zones

Flood Zone	Probability	PPS25 Landuse Guidance
Flood Zone 3b	Functional Flood Plain	Only the water compatible uses and the essential infrastructure listed in Table D.2 (Appendix D) should be permitted in this zone. Development should be designed and constructed in such a way to: remain operational and safe for users in times of flood; result in no net loss of floodplain storage; not impede water flows; and not increase flood risk elsewhere Essential Infrastructure in this zone should pass the Exception Test
Flood Zone 3a	High	This Zone is the Environment Agency's Flood Zone 3 (September 2008). The water compatible and less vulnerable uses of land in Table D.2 are appropriate in this zone. The highly vulnerable uses should not be permitted in this zone. The more vulnerable and essential infrastructure uses in Table D.2 should only be permitted in this zone if the Exception Test is passed. All developments in this zone should be accompanied by a FRA.
Flood Zone 2	Medium	The water compatible, less vulnerable and more vulnerable uses of land and essential infrastructure in Table D.2 are appropriate in this zone. Subject to the Sequential Test being applied, the highly vulnerable uses in table D.2 are only appropriate in this zone if the Exception Test is passed. All development proposals in this zone should be accompanied by a FRA
Flood Zone 1	Low	All uses of land are appropriate in this zone. Other sources of flooding should be reviewed.

Guidance for zones 3b, 3a, 2 and 1 based on Table D.1 in PPS25

Figure 6 in Appendix A, illustrates the highest risk flood zone that each of the potential development sites intersects. Table 8.1 and Figure 6 can be used to inform the Sequential Test and the site allocation process. Please note that all development within Flood Zones 3a, 3b and 2 are subject to the successful application of the Sequential Test. For example, a commercial development is appropriate within Flood Zone 3a, but it should have passed the Sequential Test first.

For windfall sites, and sites not included in the SFRA assessment, the Environment Agency Flood Zones should be used in conjunction with Table 8.1.

8.3 Other Sources of Flooding

When considering the Sequential Test, the potential extent of surface water flow routes and ponding areas in the Regeneration and Development Areas (see appropriate Appendix E to V) should be reviewed. If there are two otherwise equally suitable sites for development in Flood Zone 1, with one site identified as being potentially at risk of surface water flooding and the other site is outside the potential zone of surface water flood risk, then the site outside the potential surface water flooding risk zone should be preferentially selected for development.

8.4 Spatial Extent of Flood Risk Zones at the Site Specific Level

Each of the potential development sites that were made available for assessment in the SFRA have been classified according to the highest risk flood zone that each intersects (See Figure 6 in Appendix A). Each of the 14 Regeneration and Development Areas is discussed individually in Appendices E to V, and within each is a figure illustrating the distribution of flood risk zones across each of the potential development sites. The colour coded classifications are based on Table 8.2.

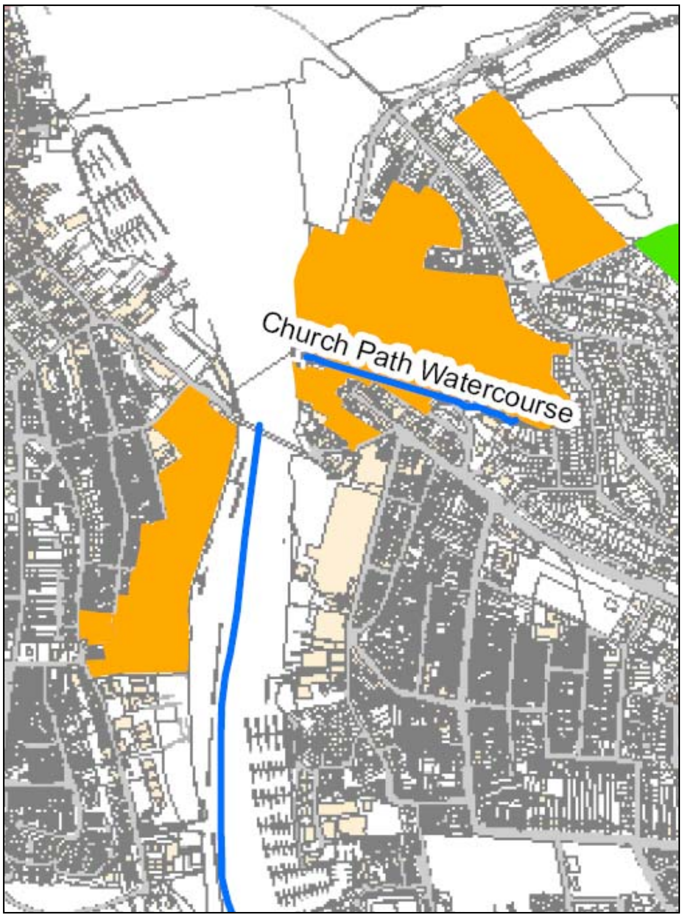
Table 8.2 Qualitative Flood Risk Classifications

Classification	Flood Zone Intersection	Definition
Highly Likely	Site intersects with Functional Floodplain (3b)	Events of common occurrence that an individual may experience a few times in their lifetime. This corresponds approximately to an annual exceedance probability of 10% - 4% (i.e. return periods of between 10 and 25 years)
Likely	Site intersects with Flood Zone 3a but not 3b	Events that an individual may experience once in a lifetime, approximately equivalent to the 1% to 0.5% annual exceedance probability event (i.e. return periods of 1 in 100 years to 1 in 200 years)
Unlikely	Site intersects with Flood Zone 2 but not 3a or 3b	Events that are of a low order of likelihood, approximately 0.1% annual exceedance probability.
Highly Unlikely	Site does not intersect with either Flood Zone 2, 3a or 3b	Extreme flood events with an annual probability of less than 0.1%.

If a potential development site fell within a range of flood risk zones, the whole site was attributed with the highest probability of flood risk. Those sites which intersect Flood Zones 2, 3a and 3b have been further analysed to illustrate the distribution of the flood risk zones across each of the sites. Of the 1470 sites assessed in Level 2, only 138 sites are partially or fully within Flood Zone 2, 3a or 3b. Figure 8.1 illustrates this process has been applied in Cowes.

Figure 8.1 Cowes Example – Site Specific Definition of Flood Risk

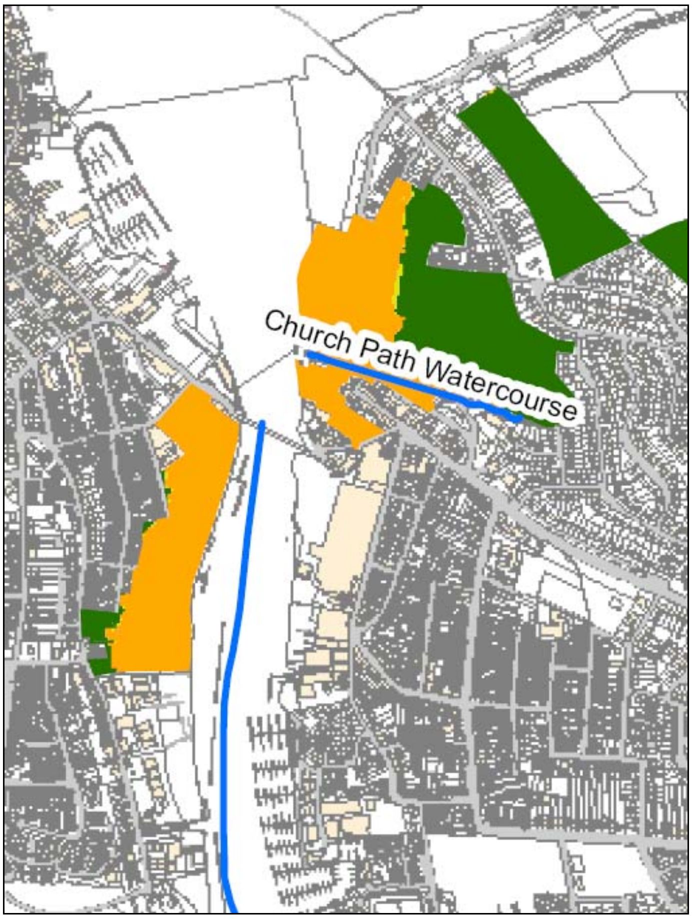
Image 1 - Qualitative Classification



Qualitative Probability

- Highly Likely
- Likely
- Unlikely
- Highly Unlikely

Image 2 - Site Specific Definition of Flood Risk



PPS25 Site Specific Flood Risk Definition

- Functional Floodplain 3b
- Flood Zone 3a
- Flood Zone 2
- No Flood Zone

In Image 1 the sites are attributed with a qualitative flood risk potential based on the highest flood risk zone that the site intersects. In Image 2, the delineation of flood risk across each site has been defined

In line with the principal of avoidance, landuse planning on site should be informed by the distribution of flood risks across the sites

9. Principal of Flood Risk Management through Design

9.1 The Exception Test

The PPS25 Exception Test recognises that there will be some exceptional circumstances when development within higher risk zones may be unavoidable. The Council's development targets, driven by Planning Policy Statement 3 – Housing (PPS3) may result in some of this future development being residential. The allocation of this necessary development must still follow the sequential approach and where exceptions are proposed, the Exception Test must be satisfied.

Flood mitigation measures should be considered as early as possible in the design development process to reduce and manage the flood risks associated with development. This section describes how flood risk can be managed through development design. The instances where a FRA is required to support the planning application is discussed in Section 11.

9.1.1 Passing the Exception Test

To pass the Exception Test three key criteria must be met. These criteria and the sources of supporting information are presented in Table 9.1.

Table 9.1 Exception Test Guidance

Part	Criteria	Guidance
a	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. If the DPD has reached the 'submission stage' – the benefits of the development should contribute to the Core Strategy.	Review site against aims and objectives of Sustainability Appraisal and Local Development Documents
b	The development should be on previously-developed land or, if it is not on previously developed land, that there are no reasonable alternative sites on developable previously developed land	PPS3
c	A FRA must demonstrate that the development will be safe, without increasing flood risk else where, and where possible reduce the overall flood risk.	Refer to Sections 8 and 9 of this report.

Criteria based on paragraph D9 of PPS25

PPS25 states that the Exception Test should only be undertaken once the Sequential Test has been applied and passed. For the Sequential Test to have been passed, it must be demonstrated that there are no other reasonably alternative sites available in zones of lower flood risk. This is an essential evidence base and should be considered a prerequisite for any development proposed in a zone of flood risk. Once the Sequential Test has been applied and passed, PPS25 requires the Exception Test to then demonstrate that the development provides wider sustainability benefits to the community that outweigh the flood risks. Where development is essential in a flood risk zone, PPS25 requires it to be on previously developed land, if this is not possible it must be demonstrated that there are no reasonable alternative sites on developable previously developed land. The final requirement of the Exception Test states that the development must be safe, without increasing the flood risk elsewhere and where possible reduce overall flood risk.

9.1.2 Part c of the Exception Test

Part c of the Exception Test requires an FRA, demonstrating that the proposed development will be safe, without increasing the flood risk elsewhere. To achieve this, PPS25 identifies a number of factors which need to be considered.

- Safe access and egress;
- Operation and maintenance;
- Design of development to manage and reduce flood risk wherever possible;
- Resident awareness;
- Flood warning; and
- Evacuation procedures and funding arrangements.

These key aspects are expanded in the Section 9, where flood risk management is discussed in terms of design and emergency responses.

9.2 Flood Risk Management through Design

Flood risk management by design should only be considered after the sequential approach has been applied to development proposals. The sequential approach is applicable both in terms of site allocation and site layout. Only when it has been established that there are no suitable alternative options in lower risk areas, should building design solutions be considered to exceptionally allow development to proceed in flood risk areas.

The sequential approach to landuse planning on site can mitigate some of the flood risks, and should be deployed ahead of building design solutions (See Sections 6.6 to 6.14 in the PPS25 Practice Guide). However, there will be instances where a level of risk remains. In these circumstances, flood risk management through design is required. This would need to be addressed as part of site-specific FRA. The following sections provide some over-arching guidance to the Isle of Wight when considering planning applications.

9.3 Development managements

The guidance presented in this section is intended for application in the Island's fluvial and tidal flood zone areas. The SFRA does not include any residual tidal or fluvial flood risk analysis.

9.3.1 Development in Flood Risk Zones Areas

Development managements in Fluvial Flood Risk Zones may include:

- The FD230/TR1 Report Section 7.5.3 states that - New developments are required to provide safe access and exit during a flood. The measures by which this will be achieved should be clear in the site-specific FRA. Safe access and exit is required to enable the evacuation of people from the development, provide the emergency services with access to the development during a flood and enable flood defence authorities to carry out necessary duties during the period of flood. A safe access or exit route is a route that is safe for use by occupiers without the intervention of the emergency services. The FD230/TR1 emphasises that a route can only be completely safe in flood risk terms if it is dry at all times. However it is recognised that this is not always practicable, necessitating more detailed analysis;

- Finished floor levels of more vulnerable uses should be above the predicted 1 in 100 year water levels (plus climate change and inclusive of a freeboard allowance of 300mm or 600mm). The Environment Agency should be consulted for confirmation of the appropriate freeboard allowance. Ideally less vulnerable landuses should also have floor levels that do not flood and this arrangement should be sought where ever possible. Water level data for areas in the fluvial floodplains should be obtained upon request from the Environment Agency; and

- The existing footprint of buildings on a site must not be increased post re-development. This is because additional construction can reduce floodplain storage and increase the risk of flooding elsewhere. PPS25 does not permit this. Options to offset the increased footprint of a proposed structure could be possible. Such schemes should be discussed in detail with the Environment Agency.

Figure 4 (in Appendix A), illustrates the extent of the Environment Agency's Main rivers. To ensure that flood risk is considered as part of a development along the banks of any of these watercourses, a theoretical buffer zone along both banks has been implemented by the Environment Agency. The Environment Agency's policy is that any proposed development within 20m, of the bank of a main river requires Environment Agency consultation.

9.3.2 Development in Areas Designated as Functional Floodplain (Zone 3b)

Development in the functional floodplain should be avoided in line with the Sequential Approach presented in PPS25. Only water compatible uses will be permitted providing there is no reduction on flood conveyance or flood storage. Less vulnerable, more vulnerable and Highly vulnerable uses are not permitted in Zone 3b. Essential Infrastructure may be permitted providing the Exception Test is satisfied.

9.3.3 Planning Implications of Climate Change and FRA Scope

General

When undertaking FRAs in Flood Zones 2 and 3, an allowance for climate change has to be provided. PPS25 requires this allowance to be a minimum of 100 years, less will only be acceptable if the development will only be short term, which will need to be reflected in an associated planning condition. When undertaking an FRA the required scope of the assessment should be requested as part of the data request which will need to be submitted to the Environment Agency External Relations Team.

The PPS25 practice Guide states that a minimum of 100 years worth of predicted climate change impacts should be considered for new development. In some instances the lifespan of a development may be significantly less, in which case the consideration of a shorter period of climate change influence may be appropriate. The development lifespan an associated climate change implications need to be discussed and agreed with the LPA at the earliest possible stage.

Rainfall

Climate change should be accounted for when assessing sites in Flood Zone 1. Historically this has typically involved increasing peak rainfall intensity by 20-30% (see Table B.2 in Annex B of PPS25). It is however recommended that the extent of the tidal climate change predictions is considered in FRAs in Flood Zone 1. This is important as climate change induced sea level rise has the potential to increase both flood depths and extents.

Tidal

The tidal climate change mapping in Appendix A and in Appendices E-V should be consulted. In line with the principals of risk avoidance, site layout should seek to avoid the predicted flood extents. If this is not possible, risk management should be undertaken through design. As such it is recommended that finished floor levels for more vulnerable or highly vulnerable landuse types (See Table D.2 in Annex D of PPS25) of a site should reflect the 2115 1 in 200 year predicted tide level plus an appropriate free board allowance.

The LPA has taken the view that the tidal flood zones held by the Environment Agency should be superseded with tidal flooding predictions which provide an allowance for climate change. As such the assessment of tidal flood risk at the potential development site level uses the 1 in 200 year flood extent (in the year 2115) to represent tidal flood zone 3 and it utilises the 1 in 1000 year flood extent (in year 2115) to represent tidal flood zone 2. This approach reflects the LPAs determination to achieve sustainable coastal development. Please consult Figure B1 in Appendix B for tide level predictions around the Island.

9.3.4 Freeboard Allowance

Predicted flood water levels alone, are not necessarily sufficient to inform finished floor levels. An additional freeboard may be required to account for uncertainties and in tidal area, the action of waves. In all instances, the Environment Agency should be consulted to establish the necessary freeboard allowance for the proposed development.

9.3.5 Basements

It is recommended that habitable rooms in basements should not be permitted in Flood Zones 2 or 3. Adaptation of existing properties, to include a basement for habitable rooms should be discouraged in Flood Zones 2 and 3. It is however recognised that the implementation of this may be challenging, as basement development is sometimes classified as Permitted Development when within the bounds of the existing building.

Basements for less vulnerable uses or non habitable rooms must be designed with safe internal escape. Each application should be discussed with the Environment Agency. Site specific analysis should accompany any proposal, to demonstrate that a proposed basement would not impact the flow of groundwater in such a way that the risk of groundwater flooding elsewhere is increased.

9.3.6 Access and Egress

Safe escape to outside the flood risk zone should be incorporated into site designs to facilitate safe evacuation. Additional detailed modelling of watercourses may be required to provide the necessary flood levels and speeds of onset and flood hazard classifications needed to inform safe evacuation routes. Safe routes should be identified both inside and beyond the site boundary of the new development. Even where a new development is above the floodplain and is considered to be acceptable with regard to its impact on flood flows and flood storage, it should be demonstrated that the routes to and from the development are also safe to use.

PPS25 recommends that where safe access and egress are likely to be an issue, this should be discussed with the LPA and the Environment Agency at the earliest stage, as this can affect the overall design. It can be difficult to 'design in' satisfactory routes retrospectively. Access considerations should include the voluntary and free movement of people during a design flood, as well as the potential for evacuation before a more extreme flood. Dry access and egress above the design flood level is preferable, however there may be instances when an FRA has to demonstrate safe access and egress routes rather than dry routes. When considering the suitability of safe access and egress routes, the Environment Agency recommends that Table 13 in the FD2320/TR2 report is consulted (a pdf version is available at http://www.rpaltd.co.uk/documents/J429-RiskstoPeoplePh2-Guidance.pdf), to identify what combinations of flood depth, velocity and debris are considered safe. The white cells in Table 13 are considered by the Environment Agency as providing safe routes.

PPS25 states that developer should ensure that the appropriate evacuation and flood response procedures are in place to manage residual risk associated with an extreme event to the satisfaction of the LPA. In advising the LPA, the emergency services are unlikely to regard developments which increase the scale of any rescue that might be required, as safe. Even with defences in place, if the probability of inundation is high, safe access and egress should be maintained for the lifetime of the development.

9.4 Building Design

The final step in the flood risk management hierarchy is to mitigate through building design. PPS25 considers this as the least preferred option and should not be used in the place of the sequential approach to landuse planning on a site.

The communities and Local Government[4] have published guidance on improving the flood performance of New Buildings. The guide identifies a hierarchy of building design which fits within step 5 of the flood risk management hierarchy of PPS25 Practice Guide. The other steps in the Practice Guide are (assess, avoid, substitute and control – see PPS25 Practice Guide June 2008) and need to have been considered first before using the hierarchy below which is taken from the PPS25 Practice Guide:

Flood Avoidance

Construction a building and its surrounds (at site level) to avoid it being flooded (e.g. by raising it above the flood level)

Flood Resistance

Constructing a building in such a way to prevent flood water entering the building and damaging its fabric.

Flood Resilience

Constructing a building in such a way that although flood water may enter the building its impact is reduced (i.e. no permanent damage is caused, structural integrity is maintained and drying and cleaning are facilitated).

Flood Reparable

Constructing a building in such a way that although flood water enters a building, elements that are damaged by flood water can be easily repaired or replaced.

[4] Improving the Flood Performance of New Buildings – Flood Resilient Construction', *Communities and Local Government* (2007)

The Flood Resilient Construction Report, sets out to help the designer determine the best option or design strategy for flood management at the building site level, based on knowledge of basic flood parameters (e.g. depth, duration and frequency), these factors would normally be determined by the site specific FRA during the planning application process. Depending on these parameters (in particular depth) and after utilising options for flood avoidance at site level, designers may opt for a water exclusion strategy or a water entry strategy, as illustrated in Figure 6.1.

Figure 9.1 Flexible and Risk Averse Approaches to Managing Flood Risk and Safe Development

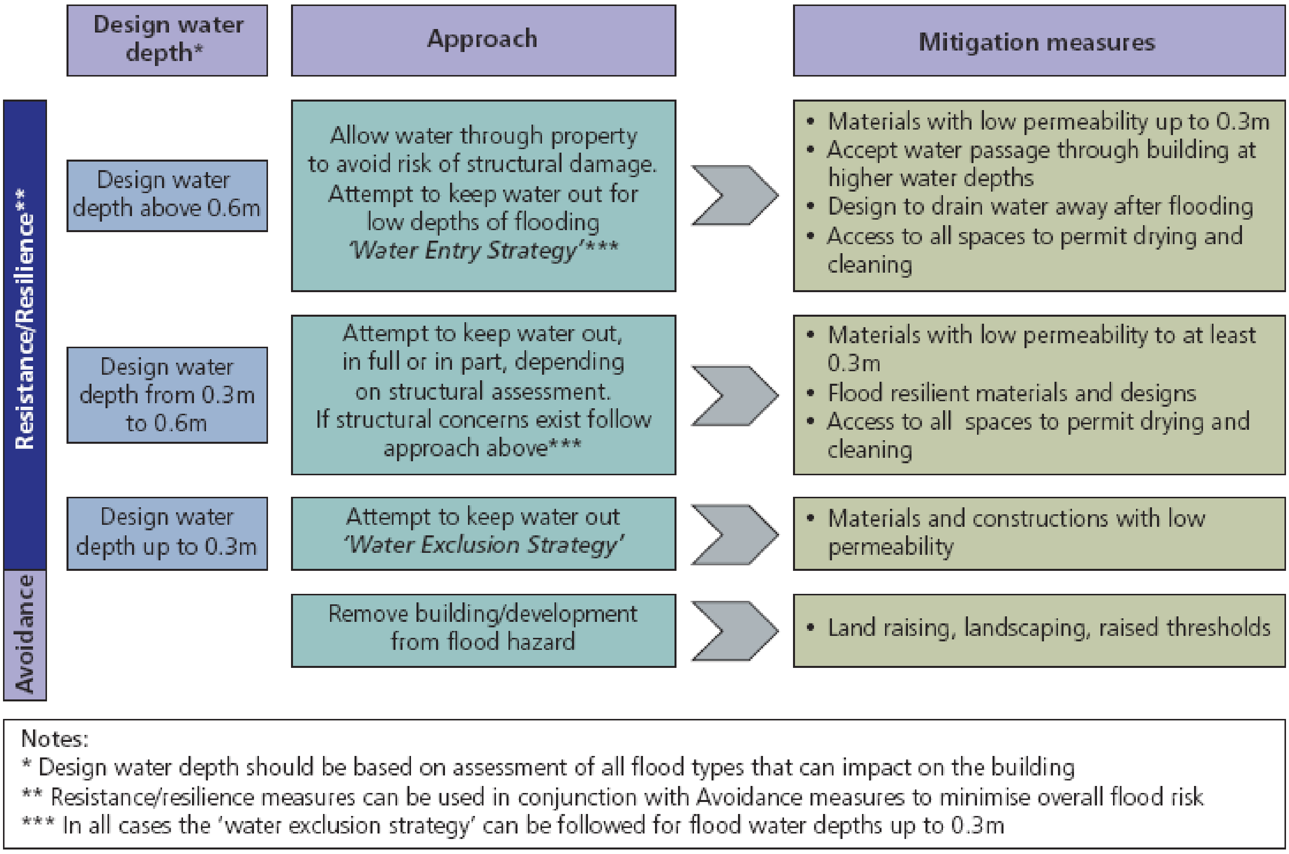


Figure Taken from 'Improving the Flood Performance of New Buildings – Flood Resilient Construction', *Communities and Local Government* (2007)'

In a **Water Exclusion Strategy**, emphasis is placed on minimising water entry whilst maintaining structural integrity, and using materials and construction techniques to facilitate drying and cleaning. This strategy is favoured when low flood water depths are involved (up to a possible maximum of 0.6m).

In a **Water Entry Strategy**, emphasis is placed on allowing water into the building facilitating draining and consequent drying. Standard masonry buildings are at significant risk of structural damage if there is a water lever

difference between outside and inside of the building of about 0.6m or more. This strategy is therefore favoured when high flood water depths are involved

9.5 Flood Warnings

The Environment Agency provides flood warnings for on the Isle of Wight for the following areas that include:

- Eastern Yar from Whitwell to Bembridge including the Scotchells Brook and Wroxall Stream;
- River Medina from Whitwell to Newport and Lukely Brook from Carisbrooke
- All around the coast of the Isle of Wight;
- Monkton Mead Brook at Ryde;
- Coastal areas at Wootton, Ryde, Spring Vale, and Bembridge;
- Coastal area at Cowes and East Cowes, and tidal areas of Newport;
- Coastal area at Yarmouth, Isle of Wight;
- Western Yar, Thorley Brook and Caul Bourne;
- Western Yar from Schoolgreen and Freshwater Bay to Yarmouth; and
- Coastal area at Sandown

It is important to note that the Environment Agency flood warnings will not be able to provide advance warning for all different flood mechanisms. Warnings will not give advance notice of flooding from structural failures, culvert blockages or from groundwater. Intense rainfall events may also generate localised and severe rapid onset floods that are very difficult to predict.

The Agency's flood warnings are provided for existing developments at risk from flooding. They should not be considered as a mitigation measure for new and planned developments.

9.6 Emergency Planning

In light of this SFRA the council should take the opportunity to review its Emergency Planning procedures in the event of widespread flooding on the Island (similar to the Autumn/Winter 1999/2000 flood events). In the event of flooding it is the Council's role, supported by the emergency services, to coordinate procedures and responses. Key issues that should be covered in an emergency plan are:

- Responsibilities and roles of key services and communication protocols;

- Susceptibility of key emergency response centres (council offices, fire and police stations and hospitals) to flooding;
- Evacuation routes and reception centres; and
- Contingency plans for the loss of power and/or water.

There is likely to be several days notice of meteorological predictions of prolonged frontal rainfall that could cause major flooding along the larger catchments like the Eastern Yar. But other watercourses and urban area flood events may exhibit a more ‘flashy’ response due to convectional storms and rapid runoff rates.

Residents in areas of flood risk should be encouraged to sign up to the Environment Agency’s Flood Warning System, particularly those identified as living in isolated properties in Flood Zone 3b (functional floodplain), where waters would likely rise most rapidly and access routes may become cut off.

The SFRA can be considered to be a refinement of the Environment Agency Flood Map / Flood Explorer. For example the tidal modelling work in the SFRA does not show Yarmouth to be cut off by flood waters in the event of the 1 in 1000 year flood like it is in Flood Explorer. As such, the SFRA could be used to locate emergency infrastructure and emergency services depots. Where potential development sites are adjacent to these structures and utilities options to reduce the flood risk posed to them could be explored.

10. Assessment and Management of Flood Risk in Regeneration and Development Areas

This section of the report addresses each of the regeneration areas and rural service centres. They can be summarised in order of scale (from large to small) as comprising of 3 Key Regeneration Areas, 2 Smaller Regeneration Areas and 12 Rural Service Centres. These have been identified by the Council's emerging spatial strategy, which has been shaped by regional and national planning policy, local public consultation and the SA/SEA process. The overall strategic development strategy for the Isle of Wight is for economic led regeneration that concentrates the majority of development within and around the main urban areas, to create strong, sustainable, cohesive and inclusive mixed communities.

The Council has asked Entec to look at five large possible development sites (sites with a cumulative threshold of greater than one hectare) in more detail. This will enable the Council to make more informed decisions when it considers which sites may be appropriate for development within the Core Strategy or Area Action Plans.

The Council provided Entec with all the sites contained within both the Councils' Land Request and Urban Capacity database, these included the following use requests;

- Housing
- Mixed Housing Plus
- Mixed Use
- Local Needs Housing
- Employment
- Infrastructure
- Leisure
- Tourism
- Minerals and Waste
- Open Space
- Development Envelope Change- request for changes to the envelope
- Not Specified- request for development has not been specified

Most of the sites which have been provided to Entec have been through the 'call for sites' process from landowners and developers whereby interested parties have completed a site proforma form for land to be considered through the LDF process. The only sites which have not been through the 'call for sites' process are those sites identified as Urban Capacity Sites. These sites were initially identified form the Urban Capacity Study update (November 2005) which was used as the starting point for the Strategic Housing Land Availability Assessment (SHLAA).

All sites requested/identified for (a) Housing (b) Mixed Housing Plus (c) Mixed Use (d) Local Needs Housing (e) Development Envelope Change have been assessed through the SHLAA as sites which could accommodate either all or an element of housing development on site.

The SHLAA provides an initial assessment of site suitability, availability and deliverability and is the evidence to support decision-making within the plan process[5]. However these sites should not be inferred as being suitable for development or looked upon favourably when determining planning applications.

It should be noted that although Newport, Cowes and East Cowes have been grouped together under the Medina Valley in terms of development plan (as will be exemplified by the Medina Valley AAP) for the purposes of the SFRA Newport has been assessed separately from Cowes and East Cowes (which have been grouped together) due to the physical separation, the differences in the physical environment and the differences in the nature of flood risk.

The flood risk, drainage and flood risk management information and mapping associated with each of the regeneration areas are included in the following Appendices;

Key Regeneration Areas (Area Action Plans)

- Appendix J - The Bay (Sandown, Lake & Shanklin)
- Appendix N – Ryde
- Appendix P - Newport
- Appendix Q - Cowes & East Cowes

[5] The SHLAA assessment terms used here are defined in the Communities and Local Government Strategic Housing Land Availability Assessments Practice Guidance (CLG, 2007); http://www.communities.gov.uk/documents/planningandbuilding/pdf/399267.pdf

Smaller Regeneration Areas

- Appendix E - West Wight (Freshwater & Totland)
- Appendix H - Ventnor

Rural Service Centres

- Appendix F - Yarmouth
- Appendix G - Brighstone
- Appendix I - Wroxall
- Appendix K - Brading
- Appendix L - Bembridge
- Appendix M - St Helens
- Appendix O - Wootton
- Appendix R - Arreton
- Appendix S - Niton
- Appendix T- Chale
- Appendix U - Rookley
- Appendix V- Godshill

11. Flood Risk Assessments and Windfall Sites

11.1 Windfall sites

It is highly likely that there will always be windfall development, and these sites will need to be assessed. The Island's emerging Core Strategy will identify the target areas for growth and regeneration. The appropriateness for sites outside these areas will need to be addressed on a site by site basis. Proposed windfall development should pass the Sequential and Exception Tests. Additionally, the sequential approach to flood risk management will be required within the development site, and this will need to be addressed within the development proposals and accompanying FRAs.

11.2 Site Specific Flood Risk Assessment (FRA) – Where are they required on the Isle of Wight?

Table 11.1 provides a clear instruction to developers and Planning Officers as to where a Flood Risk Assessment (FRA) is required on the Isle of Wight. If any one of the criteria listed in Table 11.1 applies to the site in question then, a FRA needs to be prepared to accompany a planning application. PPS25, should then be referred to for the establishment of the scope of the FRA and the Environment Agency should also be consulted. Table 11.1 also provides an outline of the likely scope of the FRA.

The latest Environment Agency Flood Zones should be reviewed in consultation with Table 11.1.

The following links to the Environment Agency provide additional information

http://www.environment-agency.gov.uk/research/planning/82587.aspx

http://www.environment-agency.gov.uk/research/planning/82584.aspx

http://www.environment-agency.gov.uk/static/documents/Research/pps25factsheet_1657913.pdf

Table 11.1 When is an FRA Required.

Criteria Requiring a FRA or further investigation	FRA Required (Yes/No)	Scope of the FRA or further investigation
In Flood Zone 3b	Yes	Follow the requirements of PPS25
In Flood Zone 3a	Yes	Follow the requirements of PPS25
In Flood Zone 2	Yes	Follow the requirements of PPS25
Greater than 1 hectare in Flood Zone 1	Yes	Follow the requirements of PPS25.

Criteria Requiring a FRA or further investigation	FRA Required (Yes/No)	Scope of the FRA or further investigation
Is the site within the extent of the 1:200 year flood event in 2105?	Yes	Follow the requirements of PPS25 – i.e. development must be safe inclusive of an allowance for climate change (See Section 9.3.3)
Greater than 0.25 hectare	Drainage assessment required	For all sites over 0.25 hectare in Flood Zone 1 an assessment of surface water drainage will be required with any planning application. This assessment should review the potential to incorporate sustainable drainage techniques and attenuate flows in line with the Councils aspirations.
Within the Exposure Risk Buffer	Review of potential risks associated with wave action is required.	If the site is lower than the sum of the 1 in 200 year (2105) peak tide (see Figure 21 in Appendix A) plus a 4m extreme wave height allowance, then it could be considered appropriate for the development to be inclusive of appropriate mitigation against the risk associated with spray.
Within 20m of the bank top of a main river?	Consult Environment Agency Development management	All potential development sites assessed in the SFRA which are within 20m of a Main River have been attributed with this information. Development is likely to require Environment Agency consent in these areas
Within 16m of a flood Defence	Consult Environment Agency Development management	Development is likely to require Environment Agency consent in these areas

Appendix T provides details of the Environment Agency's standard responses justifying objections to FRAs.

11.3 Contact Information

The list below provides useful contact information to assist in the FRA process

- Environment Agency data and contact information of local officers can be requested from corporate.services@environment-agency.gov.uk
- The Environment Agency's main telephone number is 08708 506 506
- The Isle of Wight Council's on line planning services can be found at http://www.iwight.com/council/departments/planning/appsdip/PlanningOnline.aspx
- The Isle of Wight Planning team can be contacted on 01983 821000 or customer.services@iow.gov.uk
- Details on consultancy services to relating to flood risk and drainage work can be found at http://www.entecuk.com/frm/

12. Further Flood Risk Work for SPD/DPDs and Surface Water Management

The SFRA for the Isle of Wight provides a detailed assessment of flood risks across the Island and in 17 of the Regeneration and Development Areas. Details of the 17 focus areas are provided in Section 10. This section of the report is intended to outline if there are any areas where there remains a flood risk knowledge gaps which need to be filled to inform the planning decisions made by the LPA. The possible further work identified in this section is separate to the additional flood risk work which will likely be required when site specific FRAs are prepared in the Flood Zones.

The management of surface water is an increasingly important issue which LPAs, in partnership with other stakeholders, are being given the responsibility to coordinate. Based on the pluvial modelling work undertaken as part of this SFRA and the comparison of this data with the Southern Water flooding records, areas where there is a perceived pluvial flood risk problem have been highlighted.

12.1 Additional Flood Risk Work to Support the Planning Process

Additional flood risk work can be undertaken by the LPA for a number of reasons, these primarily include:

- There is insufficient data available to inform the SFRA process;
- To inform SPD, DPDs or inform masterplan design briefs; or

On the Isle of Wight it is considered that sufficient flood risk information is available to produce a robust SFRA to support the site allocation process and the emerging Core Strategy. The detail to which flood risk needs to be understood (i.e. flood depths, hazard ratings, velocities, rates of onset and time to inundation), in specific locations is determined by the planning aspirations. LPAs with restricted land availability, expensive areas of flood risk zones and high development targets are sometimes forced to consider allocations in the areas of higher flood risk. The flood risk evidence base necessary for such an approach is required by PPS25 and the Environment Agency to be more detailed. The Isle of Wight Council's planning decision making process, on the other hand, is driven by the principal of avoidance. Indeed it is understood that development within zones of flood risk will not be promoted unless completely necessary in specific locations. This stance to a large extent negates the need for the Council to undertake further flood risk work in many areas. Should the Council's current view change, and there becomes a requirement to allocate residential uses in flood zones, then more detailed work may be necessary.

At the site specific level the Council may wish to undertake 'Flood Risk Constraints and Opportunities Studies' or 'Outline FRAs' for priority sites. These types of study set out the risks and using SFRA guidance they advise on how sites can be safely developed. It is typical for such studies to be also undertaken by developers and land owners alike to better understand the development potential of a site.

Of the locations reviewed in the SFRA, the following have been identified as areas where the Council may wish to consider more detailed work a potentially significant number of the Potential Development sites are impacted by flooding:

- **Yarmouth** – the town is encircled by flood zones and sea level rise is predicted to increase the extent of the risk zones in the town. Flooding is therefore a key factor in the long term sustainability of this settlement, the management of this and any proposed further development could benefit from further flood risk analysis. The A3054 is predicted to flood in extreme events, which could isolate the settlement, the implications of this should be reviewed from a both a regeneration and development and an emergency planning perspective.

- **Newport, Cowes and East Cowes** – there are a number of large potential development sites along the Medina estuary. These sites are at least partially within flood risk zones and the influence of climate change is potentially significant here, in terms of flood depths. Flood defences have been identified along this part of the coastline, their role in a flood event is not yet understood. Owing to the number of sites adjacent to the coastline in Newport, Cowes and East Cowes, it may be appropriate to understand the nature of the residual risk facing these sites which can be used to inform masterplan design briefs and site specific FRA work.

- **Niton, Chale and Godshill -** the current flood zone extents do not extend into these settlements, this is because the respective watercourses have drainage areas smaller than the 3km^2 applied by the Environment Agency. As such a number of these sites may be presented with a fluvial flood risk which the SFRA has not been able to identify. The Council may wish to take the view that the potential flood risks in these settlements so as to further in form the site allocation process.

The Environment Agency recognise that future regeneration strategies may result in development being located within flood zones. If this is so, the Environment Agency recommend that these areas are identified and specific outline FRAs are undertaken which will advise on (but not be limited to):

- Flood risk
- Safety standards
- Building policy
- Infrastructure requirements
- How residual risk will be managed (if located behind flood defences)
- Emergency planning

12.2 Surface Water Management Plans

There are two aspects to the management of surface water management in this section of the SFRA, the first relates to the emerging guidance driving LPAs to develop Surface Water Management Plans (SWMPs) and the second relates to areas where, through coordinated planning, the Council can oversee the implementation integrated surface water management solutions.

12.2.1 Surface Water Management Plans – Locations for Further Investigation

The first part of the SWMP process is to understand the areas that are at most risk and which require further investigation. The SFRA has essentially undertaken a high level surface water scoping exercise by modelling surface water for 14 of the major urban areas on the Island. From a review of this data it is clear that some areas are at greater risk than others, these settlements are outlined below. An advancement of the surface water flood risk understanding could be achieved through following the guidance provided in the section titled 'Scope of Future Assessments'.

All future development in each of the 14 modelled settlements should review the surface water mapping so as to ensure that this risk is firstly avoided and secondly be sustainably managed. Site design and layout should accommodate the predicted flow routes and there should be careful consideration for how a development has the potential to influence the surface water flood risk to surrounding areas, as PPS25 does not allow for flood risk to be increased elsewhere.

Settlements with the Predicted Greatest Risk

The surface water modelling undertaken for the 14 Regeneration and Development Areas on the Isle of Wight indicates that some settlements are more at risk of surface water flooding than others. Based on the modelling undertaken in this SFRA update, the following settlements are predicted to be at the greatest risk; Newport, Cowes, Ventnor and The Bay. These settlements have been selected because these are the urban areas where there are the largest number of reported incidents, the locations where the modelling predicts there to be the most significant potential flow routes or ponding areas and the areas where the greatest number of potential development sites are impacted. The degree of predicted surface water flooding is a product of the flowing factors:

- The depth of rainfall, this is a function of the underlying soil and geology types;
- The drainage length from the edge of the contributing catchment to the nearest river or the sea; and
- The local topography.

Scope of Future Assessments

This section outlines what additional work might be appropriate in each of the identified locations so as to better understand the nature of the surface water flood risks and to inform management solutions.

- Build an integrated surface water model of the town, inclusive of the Southern Water surface water drainage network. This model should be built in such a way so as to enable pipe flows and surface water flows to be simultaneously simulated;

- The incorporation of information relating to the drainage network discharge points, with an allowance for high river/tide levels;
- Analysis of all the historic surface water flood incident reports – only data up to 2006 were available to the SFRA; and
- In the SFRA the modelling approach included the use of LiDAR from which buildings and man made structures were removed, a more detailed analysis should consider and compare the output of results that utilise a ground model inclusive of buildings;

12.2.2 Integrated Surface Water Management Solutions

Sections 7.2 and 7.5 discuss the concepts of integrated drainage and sustainable drainage, this section expands on this by outlining how, through the planning process, the Council could encourage this approach by ensuring that the drainage and SuDS strategy is a high priority factor in the masterplanning process.

The development of an integrated and sustainable approach to drainage requires it to be considered early in the development process, much in the same way that highways and utility provisions are reviewed. The concept of sustainable drainage centres on the regulation of flows by providing the necessary attenuation, utilising natural flow routes, improvement of water quality and where possible providing ecological and/or amenity value. The potential of sustainable drainage is often limited by the phasing of sites being brought forward for development and the phased delivery of sites.

The consideration of integrated surface water drainage should include a consideration of current drainage issues and where possible new development and its associated drainage schemes should seek to improve existing problems.

The sustainable drainage infrastructure for part of a town's re-development and future new development, needs to be considered early in the process so that the subsequent design for adjacent or down slope sites accommodate the sustainable drainage requirements. The Council is considered to be best placed to undertaken a review of the potential for integrated SuDS systems. Such an undertaking is likely to be more appropriate either following the site allocation process or in areas sites are likely to be developed out in the near future.

The Council could either undertaken outline Drainage Concept Design for whole urban areas, which subsequent developers should follow or work could be undertaken on a more location and site specific basis.

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