



Strategic Flood Risk Assessment

Document Reference: 5049258/72/DG/048_Havant

HAVANT BOROUGH COUNCIL

26 JUN 2012



Havant
BOROUGH COUNCIL

Guidance Document: Havant Borough Council

Flood Risk Overview

Sources of Flood Risk

Havant is the eastern-most Local Authority in the PUSH sub-region. It covers a total area of approximately 55 km² which is split between the mainland and Hayling Island. The council has approximately 56 km of coastal frontage (including 42 km around Hayling Island) and 32 km of main river. At present, approximately 22% of the Borough's land area is designated as within Flood Zones 2 and 3a/3b (see SFRA Map Set 1A).

The SFRA has shown that the primary source of flood risk to Havant is from the sea. The key parts of the Borough which are currently at risk of flooding from the extreme tides include Brockhampton, Langstone and Emsworth on the mainland and Eastoke, Selmore and Mengham on Hayling Island. Flooding due to wave overtopping is known to occur on Hayling Island, particularly along the southern frontage. Land behind this frontage has suffered significant flooding from wave overtopping even though the land is relatively high and is shown to lie within Flood Zone 1, i.e. the zone of low probability of tidal flooding.

The secondary source of flood risk to Havant Borough is from fluvial sources including the Lavant Stream, the Hermitage Stream and associated tributaries. These watercourses flow through the town centre of Havant and discharge into Langstone Harbour. Additionally, the upper reaches of the Wallington River rise near Waterloo in Havant Borough. The key parts of the Borough which are currently at risk of fluvial flooding include Havant town centre, Leigh Park, West Leigh and Stockheath.

Historically, Havant has also been susceptible to flooding from other sources including groundwater, surface water and flooding caused by infrastructure failure. A number of previous groundwater flooding incidents have been observed in the upper parts of the Lavant Stream between Rowlands Castle and Havant in the north of the Borough. The town of Havant has a drainage system which in many places dates back to before the mid-1960s. As such, flooding from surface water drainage systems and sewers has occurred at many locations, including along The Florins, Petersfield Road, Park Lane and Hulbert Road.

Key physical characteristics that may constrain development

Approximately 58% of Havant Borough is currently covered by existing development, suggesting that much future development will need to be concentrated on brownfield sites. A number of environmentally designated areas represent a significant constraint on development in the Borough, covering approximately 24% of its area. As such there may be only limited Greenfield land upon which development can be permitted following consideration of other planning constraints.

The topography of Havant Borough ranges from sea level to approximately 80 metres above ordnance datum (mAOD). Hayling Island is entirely below approximately 9 mAOD. Further development on the island will likely increase the pressure for further maintenance and improvement to existing flood defences, particularly following predicted rises in sea level in future. The town of Havant itself varies in elevation from 5 mAOD near the coast to 40 mAOD in Leigh Park and West Leigh. The majority of the existing development on the mainland in Havant Borough will therefore not face increasing flood risk due to sea level rise. Waterloo is situated between 30-50 mAOD while elevations in the Purbrook area rise to approximately 65 mAOD on the approach to Portsdown Hill.

Geologically, Havant Borough is underlain by a mix of low, moderate and highly permeable bedrock formations. The towns of Havant and Waterloo and the southern part of Hayling Island are underlain by low and moderately permeable bedrock formations, while a highly permeable chalk layer exists between these two areas, resulting in the many springs used by Portsmouth Water. However, moderately permeable superficial deposits overlie the majority of this permeable layer, reducing its permeability in terms of surface water runoff generation. This may make the implementation of Sustainable Urban Drainage Systems (SUDS) difficult, which is of particular importance in the Cowplain and Waterloo area where deep clay strata result in a lack of positive drainage and more frequent small surface water flooding incidents.



Strategic Flood Risk Assessment

Document Reference: 5049258/72/DG/048_Havant



The existing drainage systems in Havant are known to be at or below capacity in key areas and it may therefore be difficult to provide new development in parts of the town without significant investment in drainage infrastructure.

Vulnerability to Climate Change

The SFRA has generated predicted tidal outlines for a number of years up to 2115 (see SFRA Map Set 1E). These outlines account for the most up-to-date predicted rises in sea-level over the coming century due to climate change and therefore allow the identification of locations that will be most vulnerable to this change due to their local topography. In Havant Borough, Hayling Island is the most sensitive area to sea level rise, particularly the southern half of the island. With much of the island low-lying, predicted sea-level rise could result in extreme tidal events inundating more of the island. In addition to this effect of rising sea levels, it is anticipated that climate change will result in an increase in fluvial flood flows. This may put additional pressure on areas in the town of Havant adjacent to the streams.

Vulnerability of existing communities

In general, the wards of Havant Borough have a mix of average and high social vulnerability to flooding (see SFRA Map Set 2). However, within Flood Zones 2 and 3 (i.e. those areas potentially likely to experience flooding) the wards generally have a high social vulnerability to flooding on the mainland and average social vulnerability to flooding on Hayling Island. It is likely that future investment in flood defences measures will need to strike a balance between protecting high risk areas on Hayling Island and areas of high social vulnerability on the mainland.

Existing defence assets and likely future investment

The coastal frontages of Havant Borough are almost entirely defended from either wave overtopping or tidal flooding by some form of coastal defence. Approximately half the coastal defences in Havant Borough have a crest level which is higher than a present day 1 in 200 year tide. Areas where defences are below the minimum standard of protection required for new development are the north western coast of Hayling Island south of Northney, the Chichester harbour frontage at Emsworth and the frontage at Langstone. The coastal defences in Havant Borough are, however, likely to be susceptible to climate change, as 100 years of predicted sea level rise would mean that most man-made defences at their current level would fail to offer protection from a 1 in 20 year tidal flood, with the exception of the southern frontage of Hayling Island. To sustain future development in Havant Borough, particularly on Hayling Island, significant investment in flood defences and flood defence infrastructure will be required (see SFRA Map Set 3). In order to consider the sustainability of investing in improved defences, the 'danger to people from breaching' index (SFRA Map Set 1D) will provide indications as to where the residual risk due to breaching may remain unfavourably high following improvements to defences to protect from extreme tidal floods.

Sequential and Exception Test

Planning Policy Statement 25 (PPS25) sets out the Government's objectives for achieving sustainable development through the avoidance and management of flood risk. The aim of PPS25 is to ensure that flood risk is taken into account at all stages of the planning process to avoid inappropriate development in areas of flood risk. To achieve this aim, PPS25 provides a decision making tool to ensure that sites with a low probability of flooding are developed in preference to areas at higher risk. The Sequential Test is the decision process which Local Authorities must demonstrate when developing their Local Development Frameworks and Local Development Documents. This SFRA has developed a suite of mapping outputs to assist Local Authorities in applying the Sequential Test.

When applying the Sequential Test, Output Package 1 of the SFRA will provide all the necessary information required upon which to base decisions regarding the location of future development in relation to flood risk. Within Output Package 1, the key map required for applying the Sequential Test is the Flood Zones map, shown as Map Set 1A. This map shows the spatial extent of 3 of the 4 Flood Zones identified in PPS25, these include:

Map Set 1A

- **Flood Zone 2** – Medium Probability of Flooding

 Fluvial (river) and Tidal Flooding

- **Flood Zone 3a** – High Probability of Flooding, sub-divided into:

 Fluvial Flooding
Tidal Flooding
Tidal / Fluvial (combined flooding processes where known)

- **Flood Zone 3b** – Functional Floodplain

 Fluvial Flooding only

The area outside of these zones is considered to be the fourth zone, 'Flood Zone 1' which has a low probability of flooding.

Output Package 1 also contains 5 other Map sets which provide useful information to support Local Authorities when applying the Sequential Test, these include:

- Map Set 1B – Undefended Flood Hazard Maps (Zones 2 & 3)
- Map Set 1C – Indicative Areas Benefiting From Defences
- Map Set 1D – Danger to People from Breaching Maps
- Map Set 1E – Climate Change Outlines for 2025, 2055, 2085 and 2115
- Map Set 1F – Other sources of Flooding including:
 - Wave Energy
 - Groundwater Flooding
 - Impact of Land Use Change on Surface Water Runoff
 - Overland Flow
 - Historic Incidents of Surface Water Sewer Overload

When allocating a site in line with the Sequential Test, Figure 1 illustrates the decision process, the key questions that need to be answered and details of how the outputs of the SFRA can help inform the process.

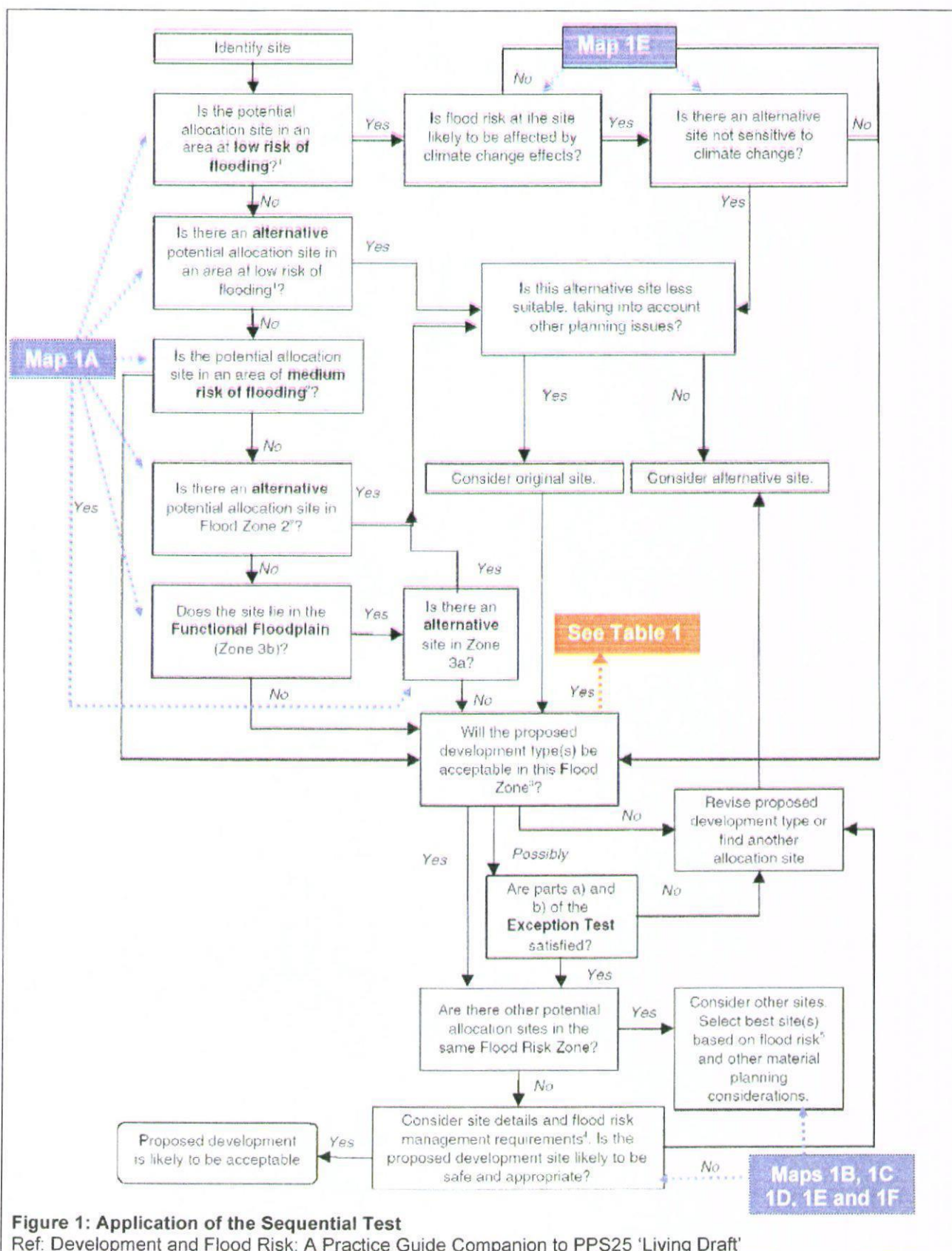


Figure 1: Application of the Sequential Test

Ref: Development and Flood Risk: A Practice Guide Companion to PPS25 'Living Draft'

Notes on Figure 1 Flow Chart

- 1 Flood Zone 1 for fluvial and tidal flooding and with a low risk of flooding from other sources.
- 2 Flood Zone 2 for fluvial and tidal flooding and with a medium risk of flooding from other sources.
- 3 As defined by the Sequential Test.
- 4 Development to be safe and to not increase flood risk elsewhere. Required to pass part c) of the Exception Test, where applicable.
- 5 Including susceptibility to future climate change and residual flood risk.

Flood Risk Vulnerability Classification

Where there are no reasonably available sites in Flood Zone 1, Local Authorities should take account of the flood risk vulnerability of land uses when considering the suitability of sites in Flood Zone 2 and then if necessary Flood Zone 3, applying the Exception Test if required. With reference to PPS25, Table 1 provides a summary of the appropriateness of land uses in relation to the Flood Zones.

	Essential Infrastructure	Water Compatible	Highly Vulnerable	More Vulnerable	Less Vulnerable
Zone 1	✓	✓	✓	✓	✓
Zone 2	✓	✓	Exception Test required	✓	✓
Zone 3a	Exception Test required	✓	x	Exception Test required	✓
Zone 3b	Exception Test required	✓	x	x	x

Table 1: Flood Risk Vulnerability and Flood Zone Compatibility (Ref: PPS25)

Key: ✓ Development is appropriate, subject to demonstrating the Sequential Test

x Development should not be permitted.

(*This table does not show: the application of the Sequential Test which guides development to FZ1 first, then FZ2, and then FZ3; FRA requirements; or the policy aims for each Flood Zone.)

If the application of the Sequential Test demonstrates a need to consider allocating sites within Flood Zones 2 or 3, a 'Sequential Approach' should also be applied within each of these Zones to steer new development to areas with the lowest probability and consequences of flooding. To facilitate this approach to site allocations within the Flood Zones, the SFRA Outputs (in particular Map Sets 1B, 1C, 1D and 3A / 3B) will provide useful information on the variation of flood hazard and the level of benefit provided by existing defences.

The findings of the Statistical Analysis undertaken in Stage 1 of this SFRA suggest that Havant Borough Council can achieve their draft South East Plan housing allocation in line with the Sequential Test. However, the need for potential commercial regeneration of the town centre and possible 'windfall' sites may mean that Havant Borough Council will need to consider development within Flood Zones 2 and 3. Where the Sequential Test alone cannot identify acceptable sites for urban regeneration or where windfall sites, having satisfied the Sequential Test, are located in Flood Zones 2 or 3, the Exception Test may need to be applied.

Exception Test

The Exception Test should only be applied following application of the Sequential Test. There are 3 elements of the Exception Test, all of which need to be demonstrated before the test can be passed. The 3 elements are:

- 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 – see Figure 4 of PPS12: Local Development Frameworks – the benefits of the development should contribute to the Core Strategy's Sustainability Appraisal;
- b) The development should be on developable previously-developed land or, if it is not on previously-developed land, that there are no reasonable alternative sites on developable previously-developed land; and
- c) A FRA must demonstrate that the development will be safe, without increasing flood risk



Strategic Flood Risk Assessment

Document Reference: 5049258/72/DG/048_Havant



elsewhere, and, where possible, will reduce flood risk overall.

When developing LDDs, Local Authorities are advised by PPS25 to prepare criteria-based policies in line with their Core Strategy's Sustainability Appraisal, against which item a) of the Exception Test can be tested. This will minimise the need to consider this element of the Exception Test for each individual planning application.

By assisting Local Authorities, at the site allocation level, in steering new development to areas with the lowest probability and hazard of flooding, the use of the SFRA outputs (in particular Map Sets 1B, 1C, 1D and 3A / 3B) will mean that site specific flood risk assessments in these areas will be more likely to satisfy criteria c) of the Exception Test.

SFRA Mapping Outputs

Table 2 summaries the most relevant mapping outputs and their purpose, for each of the key users of the PUSH SFRA.

Key Users	Relevant SFRA Mapping Outputs	Purpose
Forward Planners	Output Package 1: PPS25 Sequential Test and Relevant Supporting Information	Output Package 1 provides all the necessary information to help planners apply the Sequential Test and Exception Test when allocating new sites for development. Output Package 1 also allows planners to identify sites with the lowest probability of flooding and lowest flood hazard / danger and how the extent of flooding is likely to change in the future due to climate change.
Flood Risk Managers	Output Package 1: PPS25 Sequential Test and Relevant Supporting Information	Output Package 1 helps Flood Risk Managers to identify variations in flood hazards / dangers to existing development. The data also provides mapping to show how the extent of flooding is likely to increase over time due to climate change.
	Output Package 2: Social Vulnerability of and Flood Hazard / Danger to Existing Development	Output Package 2 can help Flood Risk Managers to: - Identify critical areas where social vulnerability and flood hazard / danger are high. - Help inform assessments of the sustainability of existing development. - Help identify and prioritise asset management and improvements.
	Output Package 3: Appropriate Defence Standards and Levels of Investment	Output Package 3 can help Flood Risk Managers to: - Identify shortfalls in existing defences in providing appropriate standards of defence, now and in the future. - Identify indicative levels of investment required to provide the appropriate standards, now and in the future.
Development Control	Output Package 1: PPS25 Sequential Test and Relevant Supporting Information	Output Package 1 can help Development Control personnel to: - Prepare specifications for site specific FRAs. - Review site specific FRAs for new development sites and check for compliance with PPS25.
Emergency Planners	Output Package 1: PPS25 Sequential Test and Relevant Supporting Information	Output Package 1 can provide emergency planners with information on the variation of flood probability and hazard across the sub region. Such information can aid in the development of emergency plans and evacuation routes during flood events.
	Output Package 2: Social Vulnerability of and Flood Hazard / Danger to Existing Development	Output Package 2 can inform emergency planners of the locations where social vulnerability and flood hazard are highest. Such information can help emergency planners prioritise evacuation plans.

Table 2: The Mapping Output Packages appropriate for key users of the SFRA

Recommendations for Site Specific Flood Risk Assessments

Whilst the information presented in this SFRA will inform Local Authorities and facilitate their strategic allocation of sites for future development, it should not preclude the need for developers to undertake site specific flood risk assessments (FRAs). A SFRA, by its very nature, is a high level assessment of flood risk at the local authority level. It does not provide sufficiently detailed information to satisfy all of the requirements of a site specific FRA as outlined in PPS25.

On the 1st October 2006, the Town and Country Planning (General Development Procedure) (Amendment) (No 2) (England) Order 2006 (GDPO), made the Environment Agency a statutory consultee for planning applications involving flood risk in specified circumstances. To improve the efficiency of disseminating general guidance, the Environment Agency has produced a suite of standing advice. The advice is available to Local Authorities and the Public, via a web page <http://www.pipenetworking.com/floodrisk/>. The standing advice also includes guidance on the requirements for site specific FRAs for both low and high risk developments. The web page provides Guidance Notes for 3 types of FRAs and advice on operational development less than 1 hectare in Flood Zone 1 as summarised below:

- Operational Development less than 1 hectare in Flood Zone 1.
- FRA Guidance Note 1: Development Greater than 1 hectare in Flood Zone 1.
- FRA Guidance Note 2: Minor Extensions.
- FRA Guidance Note 3: Development in Flood Zones 2 and 3.

The following sections provide additional specific guidance for assessing flood risk at the site specific level within Havant Borough and indicate how the outputs from the SFRA can inform such assessments.

Tidal Flooding

As previously discussed, flooding from tidal sources is the primary source of flood risk within Havant Borough and the areas at risk are predicted to increase significantly by 2115. Map Set 1A shows the existing areas at risk of tidal flooding and Map Set 1B shows the associated undefended flood hazard. The index of flood hazard represents a gradation of hazard within the Flood Zones based on a combination of the depth of flood water and the velocity of the water (indicative ranges for which have been assumed based on distance from the coastline).

The frontages where existing defences provide the minimum standards required for new development (i.e. 1 in 200 years for tidal flooding), are identified in Map Set 1C by a purple line. Indicative Areas Benefiting from Defences (ABDs) are also shown in Map Set 1C. The Indicative ABDs have been defined as areas where the crest levels of the existing defences are consistently equal to or higher than the present day 1 in 200 year extreme sea level.

If small lengths of defences have crest levels which fall below the 1 in 200 year extreme sea level (even for a short length), the area behind the defence has not been classed as an Indicative ABD. The frontage of Brockhampton is an example of where this study has not been able to define an Indicative ABD due to small lengths of defence where the crest levels fall below the 1 in 200 year extreme sea level. The gaps in the defence level can also be viewed in more detail using Map Set 3A. Further details of methodology and reasoning used to define the Indicative ABDs are described in Section 4.2.1.3 of the main report. It should be noted that other areas may potentially be classified as ABDs if more detailed modelling assessments of the defences, which is beyond the scope of this SFRA, are carried out.

Map Set 1D shows the flood hazard (in terms of danger to people) associated with a hypothetical breach in the defences for the whole of the tidal frontage. The Indicative ABDs shown in Map Set 1C define which of the hazard maps (1B or 1D) is most appropriate for consideration. Map Set 1D is only appropriate for considering present day flood hazards within an ABD. To aid the interpretation of Map Set 1D the areas where this index is not appropriate for present day analysis are hatched out. The benefit of showing hazard information in the hatched out areas is to allow planners and developers to understand the likely residual risks that would remain if they were to invest in defending an area to a 1 in 200 year standard. Map Set 1B (Undefended Flood Hazard) should be used to assess the variation of flood hazard within the Flood Zones for all areas outside the Indicative ABDs.



Strategic Flood Risk Assessment

Document Reference: 5049258/72/DG/048_Havant



Havant
BOROUGH COUNCIL

The benefit of both the undefended flood hazard maps (Map Set 1B) and the danger from breaching maps (Map Set 1D), is that the gradation of flood hazard within the Flood Zones can facilitate both planners and developers to ensure that development is steered away from the areas of highest hazard. The hazard mapping presented in Map Sets 1B and 1D, however, should only be applied when appropriate consideration has been taken of alternative sites at a lower probability of flood risk (i.e. within Flood Zone 1).

The flood hazard information, for both the undefended and breach scenario, developed as part of this SFRA, has been undertaken at a strategic level and is therefore at an appropriate level of detail to allow Local Authorities to strategically allocate sites for development. The hazard data has been classified into 4 categories to illustrate the gradation of flood hazard within Flood Zones 2 and 3 in line with best practice guidance as set out in Defra FD2320. The hazard data has not been calculated using modelling or other detailed numerical methods and is therefore not appropriate for identifying design parameters as part of site specific FRAs. It is therefore recommended that FRAs for sites located within the flood hazard zones should still include a quantitative assessment of flood hazard based on more detailed assessments of defence standards, defence failure scenarios and overland conveyance of flood flow.

The impact of climate change on increasing sea levels has a significant effect on the extents of Flood Zones 2 and 3 by 2115, especially on Hayling Island. Although present day planning decisions are based on the Flood Zones for 2007, at the site specific level consideration should be given to increases in risk as a result of climate change. The climate change flood extents presented in Map Set 1E should be used when undertaking a site specific FRA to inform the assessment of the long term sustainability of developments currently within Flood Zone 1 and the likely increases in flood risk in Flood Zones 2 and 3.

The defence information provided in Map Set 3 can provide developers undertaking site specific FRAs with an indication of the equivalent tidal return period of the crest level of the existing defences in 2007 and an indicative level of investment that may be required to raise defence standards to the minimum required for new development. Such investment could be secured through the development process by Section 106 agreements.

Wave Overtopping

Map Set 1F-1, Wave Energy, shows how exposure to wave energy varies along the frontage of the study area. Such information can be used to assess, at a high level, the risk of flooding caused by extreme wave overtopping. Historically, Hayling Island has suffered from flooding caused by extreme wave overtopping, most recently in November 2005. During this event, properties which are classified in Flood Zone 1 were flooded, as indicated on the historical information layer. It is recommended that all applications for development within the vicinity of the southern frontage of Hayling Island include an assessment of extreme wave overtopping, regardless of which Flood Zone the site is in. This will ensure that this risk is always considered for new development in the relevant locations. The assessment of extreme wave overtopping should be appropriate to the scale of risk and may, in some cases, be ruled out as a significant risk quite easily, but should nevertheless be addressed.

Fluvial Flooding

The mainland part of Havant Borough is at risk of fluvial flooding from the Lavant Stream, Hermitage Stream and, during extreme events (1 in 1000 years), the upper reaches of the River Wallington. Map Set 1A shows the fluvial Flood Zones, which show the town centre of Havant to be the key area at risk of fluvial flooding in the Borough.

Across Havant Borough, gaps in available fluvial flood risk data exist, which are being addressed by the Environment Agency's ongoing Strategic Flood Risk Mapping programme. Therefore, for the purposes of this SFRA, Flood Zone 3b (defined by PPS25 as the 'functional floodplain') has been defined as the entire extent of Flood Zone 3, as recommended by the PPS25 Draft Practice Guide. This is a precautionary approach and should be tested by site specific FRAs, where required.

Unlike the tidal Flood Zones, flood levels associated with the fluvial Flood Zones have not been identified as part of this SFRA. The variations in previous modelling approaches (some of which are awaiting EA approval) for the rivers within the PUSH sub-region, coupled with the spatial variation on flood levels along the river valleys, meant that it was not possible to provide a consistent approach to identifying fluvial flood levels without re-



modelling a number of rivers. Such detailed assessments were outside the scope of this SFRA. Developers undertaking a FRA for a site within the fluvial Flood Zones should obtain the most up to date flood risk data from the Environment Agency. If no further information is available then a site specific FRA may need to include a numerical assessment to refine the understanding of fluvial flood risk, and agree the form of this assessment with the Environment Agency.

The impacts of climate change on fluvial flooding are likely to result in a 10% increase in flows up to 2025 and 20% from 2025 to 2115. Again due to current gaps in available data that are being addressed by the Environment Agency's ongoing flood mapping programme, there are no consistent estimates for Havant Borough of the extreme fluvial flood extent taking climate change into account. Based on Environment Agency guidance, this SFRA has assumed that the present day Flood Zone 2 (medium probability) becomes Flood Zone 3 (high probability) by 2025. This is a conservative assumption which should be tested by site specific FRAs, where required. This also means that there is no data available to estimate Flood Zone 2 after the present day. Therefore, the fluvial climate change outline shown in Map Set 1E only shows a Flood Zone 3.

Undefended flood hazard information, shown in Map Set 1B, has also been developed for the fluvial Flood Zones 2 and 3. This information can provide developers with an indication of the varying degree of flood hazard within the Flood Zones which can facilitate the design and layout of development sites to avoid areas of high hazard. As with the tidal flood hazard data, it is recommended that FRAs for sites located within the flood hazard zones undertake a more detailed quantitative assessment of flood hazard based on an improved understanding of defences and flow routes.

Surface Water/Overland Flow Flooding

Map Set 1F-4 shows the variation in the potential source of overland flow across the PUSH sub-region. The areas shown in red and orange relate to areas of very high and high potential for generating overland flow. Notably, the urban areas are indicated as red or orange due to the high runoff potential from urban land uses. Within Havant Borough there is a large area of the mainland which has a high to very high potential for generating overland flow. FRAs for sites that are found to be within or in the vicinity of these areas, especially if the local topography places the site at a lower elevation than the surrounding land and hence downstream of the source, should consider the impacts and management of flooding due to overland flow.

In addition to the information provided in relation to the source of overland flow flooding, Map Set 1F-3 provides information to inform Local Authorities of the potential impacts of land use changes on the local surface water runoff regime. The areas showing diagonal hatching represent the urban areas, where a change in land use is unlikely to significantly affect the existing surface water runoff rates and volumes. This representation is a high level assessment across the PUSH sub-region and would therefore need to be confirmed when undertaking a site specific FRA. The areas outside of the hatching represent the effect that changes in land use are likely to have on the surface runoff rates and volumes from Greenfield sites. The data shows that new development located on the majority of the Greenfield Land in Havant Borough is likely to have a moderate impact on the surface water runoff regime. Site specific FRAs should therefore carefully consider the impact of development on the local surface water runoff regime and should investigate SUDS options to manage surface water where achievable.

Groundwater Flooding

Within the PUSH region the key areas at risk of groundwater flooding are north of Havant Borough in East Hampshire, Winchester, Eastleigh and Test Valley where highly permeable geology meets lower permeability geology as shown by Map Set 1F-2, which has been verified by inspection of the historical incident records. The key risks to new development in the Havant Borough come from increases in flows in the Lavant Stream as a result of high groundwater levels emerging in East Hampshire District. It is therefore recommended that site specific FRAs for sites located within the Flood Zone of the upper reaches of the Lavant Stream consider the joint effects of high groundwater flows in the Lavant Stream combined with rapid runoff from intense rainfall events.

Flooding from Infrastructure

Historically, the mainland part of Havant Borough has recorded the most incidents of flooding caused by problems relating to the drainage infrastructure as shown by Map Set 1F-5. The majority of these incidents have occurred in the vicinity of Havant Town Centre, Purbrook, Cowplain and Emsworth. When undertaking a site specific FRA for a large development site, consultation with Southern Water should always be undertaken to investigate whether the proposed development will have an adverse impact on the local drainage system.

Furthermore, a parallel study being undertaken on behalf of PUSH, 'Hampshire Integrated Water Management Study', is investigating the issues relating to the future management of surface water within the region with respect to the anticipated increases in housing as indicated in the draft South East Plan. It is recommended that those undertaking a site specific FRA within the urban areas of Havant Borough make reference to the findings of this study.

Sustainable Urban Drainage Systems (SUDS)

Conventional surface water drainage systems have traditionally used underground pipe networks to efficiently convey water away from sites. In the past this has led to problems of downstream flooding, reductions in groundwater recharge and waste pollution incidents associated with surface water overwhelming combined sewers. Both 'Making Space for Water' and the 'Water Framework Directive' have highlighted the need for an improved understanding and better management of how our urban environments are drained. The SUDS management train approach, as shown in Figure 2, is the principle that a range of SUDS which feed into each other can often offer benefits to the delivery of a successful surface water system/strategy.

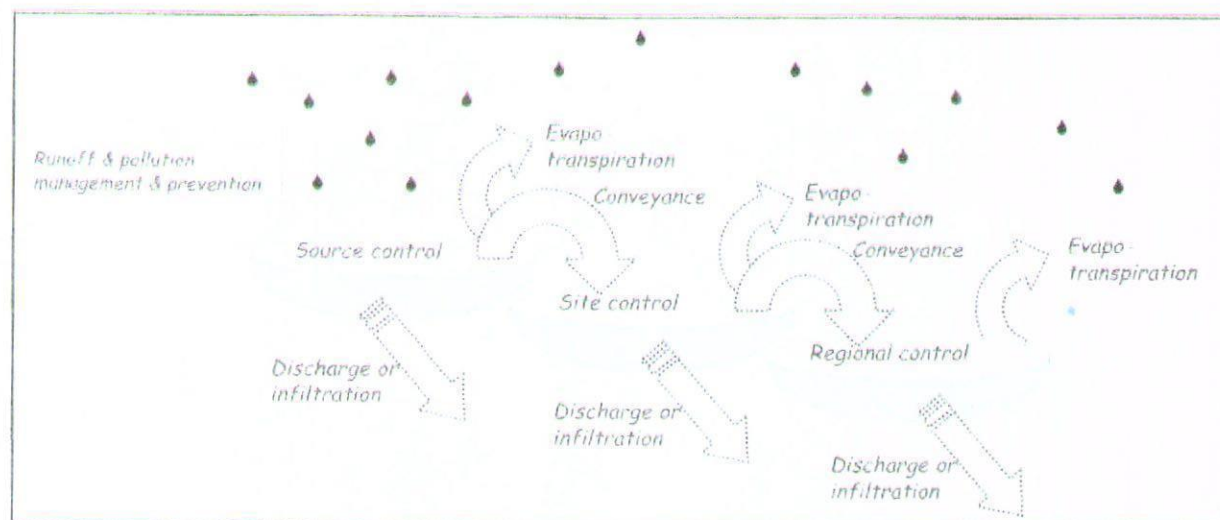


Figure 2: SUDS Management Train Approach

PPS25 states that Local Authorities should prepare and implement planning strategies that help to deliver sustainable development, by using opportunities offered by new development to reduce the causes and impacts of surface water flooding. By implementing policies to encourage developers to incorporate SUDS wherever possible, Local Authorities can help to mitigate the impacts that development has on surface water runoff rates and volumes. Appendix F of PPS25 states:

'the surface water drainage arrangements for any development site should be such that the volumes and peak flow rates of surface water leaving a developed site are no greater than the rates/volumes prior to the proposed development, unless specific off-site arrangements are made and result in the same net affect.'

Map set 1F-2 provides information relating to the spatial variation of permeability across Havant Borough. This information can be used as a first estimate of the suitability of different types of SUDS within the Borough as shown in Table 3.

Permeability	Indicative Suitability of SUDS Techniques
High Permeability	Infiltration and Combined Systems
Moderate Permeability	Infiltration and Combined Systems
Low Permeability	Attenuation Systems

Table 3: Suitability of SUDS

It is important to note that the above assessment of the spatial suitability of SUDS is an indicative estimate and should be confirmed at the site specific level, using ground investigation data.

Infiltration Systems

Infiltration systems allow surface water to discharge directly into the ground. These systems are only appropriate 1) where ground conditions permit a suitable water acceptance potential and 2) in locations where groundwater recharge will not adversely affect drinking water aquifers as identified by the Environment Agency's source protection zones, available on their website <http://www.environment-agency.gov.uk>. Such systems may include:

- Permeable surfaces
 - Gravel
 - Permeable Paving
 - Block Paving with voids
 - Grassed areas
- Sub Surface Infiltration
 - Filter Drains
 - Geocellular Systems
 - Soakaways

Infiltration systems may not be appropriate in areas of potentially contaminated land. In such circumstances, other systems, such as contained attenuation systems, that avoid mobilisation of contaminants may be more appropriate.

Attenuation Systems

If ground conditions cannot support infiltration systems, surface water may need to be attenuated using measures to store surface water. Attenuation systems, if designed above ground, have the potential to take up large areas of development sites. Early consideration of such constraints is therefore essential. Attenuation systems may include:

- Landscaped
 - Detention Basins
 - Balancing Ponds
 - Retention Ponds
 - Wetlands
 - Lagoons
- Engineered
 - Underground Tanks
 - Ornate Water Features
 - Rainwater Harvesting
 - Green Roofs
 - Oversized Pipes

Combined Systems

SUDS designs for most sites can include a combination of infiltration and attenuation systems and they have



Strategic Flood Risk Assessment

Document Reference: 5049258/72/DG/048_Havant



been categorised above according to the dominant process. Other forms of SUDS which can provide more balanced benefits of infiltration and attenuation include:

- Swales
- Filter Strips

Emergency Planning

As well as informing the development control process, the outputs of the SFRA can also be used by the Local Authority to inform their Emergency Planning Policies. Map Sets 1A, 1B, 1C, 1D and 1E are particularly useful when considering the feasibility and sustainability of key access routes within their administrative boundaries. The benefit of producing such outputs on a sub-regional scale mean that the Local Authority can also consider access to the Borough beyond their administrative boundary where key access routes (e.g. M27) cross a number of Local Authorities.

Additional Guidance

In addition to the guidance provided by the Environment Agency <http://www.pipernetworking.com/floodrisk/>, there are a number of other documents that provide detailed advice and guidance for undertaking site specific FRAs:

- Planning Policy Statement 25: Development and Flood Risk, (2006), Communities and Local Government.
- Development and Flood Risk: A Practice Guide Companion to PPS25 - 'Living Draft', (2007), Communities and Local Government
- Development and Flood Risk: Guidance for the Construction Industry, (2004), CIRIA (Based on PPG25)
- Flood Risk Assessment Guidance for New Development: FD2320/TR2, (2005), Defra (Based on PPG25)
- Sustainable Urban Drainage Systems: Best Practice Manual, (2001), CIRIA

Annex 1 – Data Source for Havant Borough Council

Further to the general technical details provided in the main SFRA Stage 2 report, this annex includes data issues specific to Havant Borough Council.

Defence Data

The majority of Havant Borough Council defence data is provided by the Havant Asset Database which holds details of most of the Borough's coastal defences from recent surveys. Surveys recorded in the database were undertaken between 2002 and 2003. The defence database for Havant was supplemented with data from the Eastoke Sectoral Strategy Study (2005) and Portchester Castle to Emsworth Coastal Defence Strategy Study (2006). Coastal defence works in other parts of Havant's coastline undertaken since 2003 may supersede records in the SFRA Defence Database.

No information on fluvial defences in Havant was available.

Topographic Data

95% of the topographic grid in Havant Borough is composed of LiDAR data. Areas where LiDAR was not available are the northern slope of Portsdown Hill to the west of Bedhampton and to the north of the Borough between Lovedean and Cowplain. In these areas, NextMap data was used to fill in the gaps in the LiDAR.

Fluvial Flood Zone 3b

In Havant Borough, fluvial Flood Zone 3b was represented as the whole of Flood Zone 3. In the absence of data to prove otherwise (i.e. detailed 1 in 20 year modelling or observed historic flood extents), this approach is in accordance with PPS25 practice guide section 3.17 and was recommended by the Environment Agency.