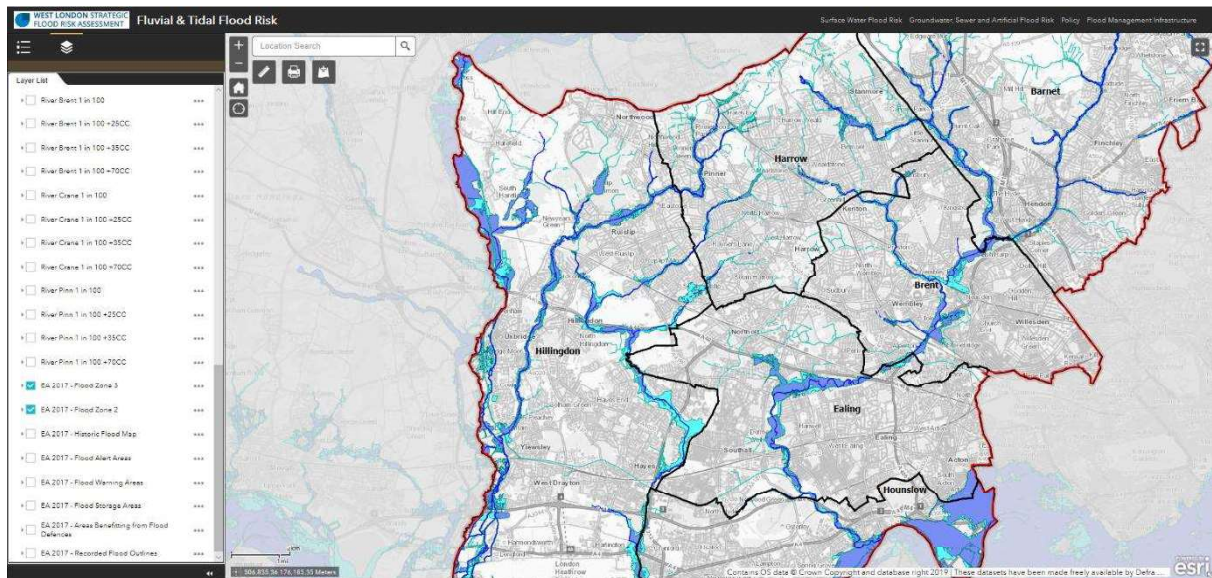


Example: Making SFRA accessible and easy to update, West London Boroughs

Description

The West London Alliance collaboratively produced a SFRA in 2018 using an online mapping portal to report the risk of flooding across their six London Boroughs (Barnet, Brent, Ealing, Harrow, Hillingdon and Hounslow).



Extract from online mapping (<https://westlondonsfra.london/mapping-tool/>)

West London SFRA – Website User Guide

West London SFRA – Website User Guide

- The West London Strategic Flood Risk Assessment (SFRA) is available in an online website format only. The website is available for public view via the following weblink: <http://westlondonsfra.london/>.
- As a user with administrative rights, amendments to the SFRA's main contents and tables can be made. Amendments to the website's presentation, layout, graphics and accompanying pdf documents cannot be made.
- This document provides guidance on how to edit text on the SFRA website.

West London SFRA – Website User Guide



The portal collates all of the relevant flood risk datasets, as well as presenting maps relating to flood risk policy and development management considerations. Some of the datasets (flood map for planning, risk of flooding from surface water etc.) are accessed through live Web Map Service, which links to the government's data webpage so they will automatically update when the Environment Agency make changes.

The mapping enables the user to pan and zoom into the area of interest, whilst showing datasets at the appropriate resolutions for their use. The limitations of the data and appropriate use are clearly stated on the online mapping portal to make the users aware.

The SFRA features checklists which are tailored to the type of application for each user, with a very specific user guide. Moving to an online portal makes these much more obvious to the applicant; and hyperlinks are provided in suitable locations on the website.

Extract from website User Guide, with details for how to update sections of the SFRA.

A website User Guide is provided, describing how updates to the SFRA text can be made for those users with administrative rights.

Benefits

Using an online portal, whilst having an initial set up cost, significantly reduced the costs for future updates of the mapping. All Web Map Service datasets will update automatically, and other datasets can be added individually, as required, without the need to overhaul an entire report. This improved the quality and reliability

of the SFRA. An agreement with the consultants has been made to ensure the future maintenance and up keep of the website.

The SFRA deliverables are accessible to other teams within each of the LPAs, neighbouring authorities, other risk management authorities, developers and the public. This reduced the requests LPAs and the Environment Agency received for data and/or information, thereby delivering further cost and time savings. This also supported the role of each of the LPAs, which, as unitary authorities are also LLFAs.

Reproduced with kind permission from Barnet, Brent, Ealing, Harrow, Hillingdon and Hounslow London Borough Councils.

Example: Making SFRAs accessible and easy to update, Northamptonshire County Council

Description

Northamptonshire County Council have developed an online flood toolkit which provides a platform for flood risk information across the county (<https://www.floodtoolkit.com/planning/developers/>). It contains the following sections:

- 'Am I at risk' – flood risk maps, weather warnings, flood investigations, mitigation studies
- 'It's an emergency' – what to do before, during and after a flood, reporting a flood, contact details for risk management authorities
- 'Who is responsible' – identifying who is responsible for what activities
- 'How to guide' – a library of advice and guidance documents related to flooding
- 'Planning and development' – general guidance on applying flood risk management in planning, guidance documents on:
 - Neighbourhood planning and flood risk
 - New development and emergency plans
 - Surface water drainage statutory consultation process and local standards
 - Guidance on groundwater flood risk
- 'Education' – Flood Aware pack designed to inform, educate and empower school children and build their understanding of flooding. Contains interactive scenarios and downloads.

Benefits

The toolkit provides a go-to place for everything related to local flood risk and it is easy to access. The pages are divided into end user groups (homeowner, landowner, business, etc.) which enables people to identify the information they seek quickly. This also allows guidance to be written with different audiences in mind i.e. with technical detail for developers and non-technical for public use.

Reproduced with kind permission from Northamptonshire County Council.

7. Assessing surface water flood risk

National policy makes clear that the risk of surface water flooding should be considered by LPAs when planning for strategic growth and allocating sites in their local plans (NPPF paras 159 to 162).

The frequency and severity of surface water flooding incidents are increasing as a result of changes in climate and land use. More frequent heavy rainfall events coupled with increased amounts of hard standing across built up areas are resulting in significant overland flow and surface water flooding. Surface water flooding is also more widespread in terms of *where* it can occur.

Surface water flooding is often combined with exceedance of the urban drainage network and public sewers. Growth and increased rainfall as a result of climate change are placing pressures on the capacity of the sewer network, reducing its ability to accommodate housing growth and increasing the risk of sewer flooding. A holistic approach to the management of surface water needs to be applied, working with the natural surface water catchment and employing sustainable drainage systems (SuDS). The NPPF expects all development in flood risk areas to include SuDS (NPPF para 167c). All major developments (NPPF para 169), including those lying outside flood risk areas, are also expected to include SuDS, with additional requirements applying to their maintenance, operation and provision of multifunctional benefits. If the local characteristics indicate locations where different types of SuDS could deliver the greatest benefits, or where they may be considered inappropriate (e.g. due to pollution risk), this could be included in the SFRA recommendations to provide greater clarity to developers. This could extend to recommendations for including a particular policy to be later transposed into local plans or neighbourhood plans, where there is evidence to support a particular approach.

Planning guidance, building regulations and British Standards use a hierarchical approach to discharge of surface water from new and re-development, starting with managing water at or close to the site. Discharging to sewers should be the last choice when all other options have been exhausted. The automatic right to connect does not prohibit the connection altogether, so local plan policies should stipulate (with the SFRA providing evidence to support) that connections to the sewer should consider capacity and downstream risk when determining a rate of connection.

When commissioning SFRAs LPAs should specify that recommendations are made for SuDS approaches based on local circumstances.

LPAs should identify areas at risk of surface water flooding and use this information to steer new development away from those areas through the application of the sequential test when screening sites for allocation. Some local plan policies may also require application of the sequential test where surface water risk is increased. The sequential test has historically only applied to fluvial flooding (Flood Zones 2 and 3) and emerging best practise is that surface water risk also be accounted for in the application of the sequential test. LPAs should consider what information already exists on surface water flood risk that could be used in planning decisions (for example, the Environment Agency Risk of Flooding from Surface Water maps or local authority modelling, surface water flood risk mapping in a surface water management plan or other data held by the LPA or LLFA, and information in local flood risk strategies). It may be the case that additional work needs to be completed to identify key 'at risk' areas and to assess the impact of climate change using climate change allowances for peak rainfall (Environment Agency [flood risk assessments: climate change allowances guidance](#)). The LPA will need to consider how the risk of surface water flooding compares with risk from sources of flooding in that LPA area and establish a framework for applying the test. LPAs may also want to account for combined sewer flooding with surface water as well as risk of flooding from non-main rivers in this process.

The approaches LPAs have taken to do this varies, based on the nature of the flood risk from different sources within their areas. Some examples of how surface water flooding has been assessed in SFRAs and used when applying the sequential test are provided in this section (also in [Good Practice 10: Applying the sequential approach based on all sources of flooding](#)). In some cases, it may be appropriate to use national or local surface water modelling and mapping to identify specific areas at

risk of surface water flooding, and to use these areas to inform future development. LPAs should ensure expert advice is sought from the LLFA on surface water flood risk.

As part of the SFRA process, any new approach to applying the sequential test to flood sources other than fluvial and tidal, needs to be clearly documented and justified. The LPA will need to describe how it should be applied to assess site allocations, as well as windfall sites.

Examples are provided below which have been assessed as “good practice” for assessing surface water flood risk in an SFRA (Environment Agency research, 2021), and have links to where further information can be found.

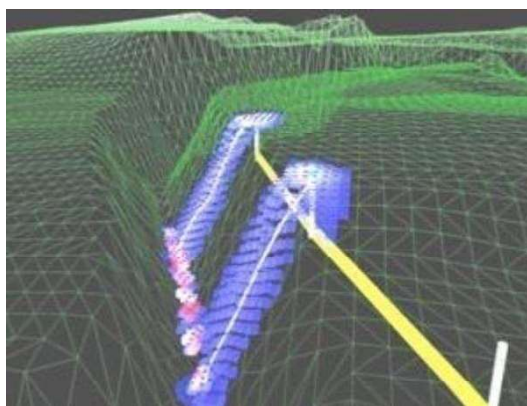
Example: Modelling combined sources of flooding, Glasgow City Council

Description

The Shawfield area of Glasgow forms part of the Clyde Gateway, and is a substantial area of regeneration. The area has suffered historically from various forms of flooding, including tidal/fluvial from the River Clyde, from culverted watercourses, surface water and the trunk sewer with numerous interactions between each of these sources through various pathways.

A strategic flood risk assessment (SFRA) and surface water management plan (SWMP) were produced in 2008/2009 by Glasgow City Council (on behalf of South Lanarkshire Council, Clyde Gateway and Scottish Enterprise). The SFRA included the development of a 2D Integrated Catchment Model (ICM) using Scottish Water’s network model and combined with Glasgow City Council’s culverted watercourse model. The model was run using a joint probability approach to assess the influence of the water levels in the Clyde on the ICM and a 2D surface water model.

The SFRA outputs enabled the flood risks to be more fully understood by the partners and stakeholders involved in the master planning and redevelopment of the area. It enabled flood risk management measures to be more effectively applied and the redevelopment potential of the area to be realised.



Benefits

Using integrated catchment modelling enabled an improved understanding of the flood risk in the area. The outputs influenced development master planning on multiple flood sources. The modelling was also used to undertake options assessment and identify flood risk management measures as part of new development.

Reproduced with kind permission from Glasgow City Council.

Example: Defining surface water flood risk zones, Brighton and Hove City Council

See: [Defining surface water flood risk zones, Brighton and Hove City Council in Good Practice 11](#)

Example: Defining surface water flood risk zones, West London Boroughs

Description

There is high risk of surface water flooding in the heavily urbanised boroughs across West London. In order to ensure this was considered through the spatial planning system, the SFRA for the six Boroughs (Barnet, Brent, Ealing, Harrow, Hillingdon and Hounslow) produced in 2018, established a new definition for areas at risk of surface water flooding.

Using the Environment Agency 'Risk of Flooding from Surface Water' (RoFSW) dataset, the outline for the 1% Annual Exceedance Probability (AEP) flood event was used to define areas of surface water flood risk which the West London LPAs describe as 'flood zone 3a (surface water)' and consider to be equivalent to flood zone 3 associated with the risk of flooding from rivers and the sea.

The LPAs have considered that establishing this definition enables surface water to be easily considered when applying the sequential test. The definition is also used to set clear criteria for when a site-specific FRA is required, and which organisation was responsible for reviewing it.



Source: West London SFRA (<https://westlondonsfra.london/>). Extract from Policy Map, July 2019.

Benefits

Identifying zones of surface water flood risk that are considered to be comparable to river flood risk enables a consistent approach to be applied to river and surface water flooding when applying the sequential test. In this way development can be steered towards areas at lowest risk of flooding from all sources.

Reproduced with kind permission from Barnet, Brent, Ealing, Harrow, Hillingdon and Hounslow London Borough Councils.

8. Assessing groundwater flood risk

National policy makes clear that the risk of groundwater flooding should be assessed in the SFRA.

Flooding from groundwater can happen when the level of water within underground rock or soil (known as the water table) rises above the land surface. This is caused by the amount and frequency of rainfall and its pathway into the ground. Flooding can also happen from groundwater rebound, where the water table rises back to its natural level once pumping for industrial purposes has ceased (e.g. in mines or extracting groundwater for manufacturing). Groundwater rebound can therefore occur in locations where underground water aquifers are absent. Rising groundwater can also infiltrate the sewer network, reducing its capacity to accommodate housing growth and increasing the risk of sewer flooding. It can also affect other types of infrastructure, both underground and on the surface. It is particularly important to consider the risk of groundwater flooding where basement/underground development is expected.

The groundwater datasets that can be used to inform SFRAs include:

- [British Geological Survey Groundwater Flooding Susceptibility Map](#)
- [Defra's Groundwater Emergence Map \(GEM\)](#)
- Groundwater Vulnerability Zones and Groundwater Source Protection Zones (SPZ)
- JBA Groundwater Flood Map
- London 'Increased Potential for Elevated Groundwater' (iPEG) maps (in London)
- Environment Agency's Areas Susceptible to Groundwater flooding map (currently only available to councils on request)

The ultimate aim is to identify the presence of risk. If groundwater does come out at surface then flooding and property flooding will occur. If groundwater comes to within 3m below surface then it can affect property structure or infrastructure. In places where there is known groundwater risk, the cumulative impact of development on the displacement of groundwater should be assessed in the SFRA. Any potential changes to current abstraction and pumping rules should also be assessed to understand the impact of any process or land use changes on groundwater flood risk.

The Joint West London SFRA (see [Good practice 7: Assessing surface water risk](#)) is one example that identified the risks to groundwater flooding and used the Environment Agency 2017 'Areas Susceptible to Groundwater Flooding' maps (1km resolution), GLA2011 'Increased Potential for Elevated Groundwater' (50m resolution, iPEG), and Environment Agency 2015 Source Protection Zones.

A recommended strategic policy is that "Boroughs should use their local plans to ensure developments with a high susceptibility to groundwater flooding demonstrate that increased groundwater mitigation and management measures have been implemented to protect people from groundwater flooding. Any known groundwater and flow routes should be safeguarded to ensure groundwater flood risk is not increased on site or elsewhere" (Metis Consultants, 2018).

At the site level, councils such as Camden, are requiring basement impact assessments (BIA) to be undertaken to demonstrate that groundwater levels are not raised significantly by basement development.

Developers who provide SuDS also required to provide evidence that infiltration SuDS do not increase groundwater levels and increase flood risk on or off site. Although generally SuDS are encouraged as a means of drainage they may not be appropriate in areas of groundwater flooding without careful planning and design. The requirement to screen for groundwater flood risk and SuDS may be included in SFRAs. The British Geological Survey provides [spatial data](#) on where SuDS are appropriate. Many local authorities (including Hampshire, Sutton and Croydon) are

informally asking for risk assessments to show that developments that include infiltration SuDS will not exacerbate groundwater flooding.

Currently there is little available national guidance on how groundwater flood risk should be considered, but the good practice example in this section illustrates a possible approach.

Examples are provided below which have been assessed as “good practice” for assessing groundwater flood risk in an SFRA (Environment Agency research, 2021), and have links to where further information can be found.

Example: Incorporating groundwater flood risk, Wiltshire County Council

Groundwater emergence (Figure 7.6)



Description

Flood risk in Wiltshire is complex due to the interaction between river, surface water and groundwater; the geology plays a significant role in the risk, as there is a mixture of clay, sand and gravel and chalk aquifers across the county.

Following a series of groundwater flooding incidents in 2013/14, Wiltshire County Council produced a Groundwater Management Strategy in

2016. The aim of the strategy was to “clarify the challenges caused by groundwater and how Wiltshire Council is aiming to identify areas at risk, and who can help in a partnership approach”.

The Council's Groundwater Management Strategy sought to:

- Identify the level of detail required for site specific Flood Risk Assessments (FRAs).
- Give guidance on areas within Wiltshire susceptible to groundwater flooding.
- Determine the level of detail required when development is within groundwater areas.
- Outline methods for dealing with groundwater by resolving flow path and receptor routes.
- Give guidance and specifications for future development.
- Highlight the responsibility for groundwater flooding.
- Safeguard water quality where development is proposed within groundwater areas.
- Highlighting the key partnerships, with roles and responsibilities.

There is little available national guidance on how groundwater flood risk should be considered, though national policy makes it clear that the risk of groundwater flooding should be considered by LPAs when applying the sequential test.

The next iteration of the Wiltshire SFRA will identify areas of groundwater flooding and consider them equivalent to areas of flood zone 2 (associated with river flooding) to give a better indication of the interaction between groundwater and river flood risk. It will also include an assessment of sewer flooding and groundwater flood warning areas to influence allocation of all development. This will help ensure that the risk of groundwater flooding is incorporated into planning for strategic growth, applying the sequential approach, and allocating sites in local plans by the LPA.

The strategy highlights that where areas with a risk of groundwater flooding cannot, for other reasons, be avoided, the additional cost of developing mitigation which would include appropriate flood risk management infrastructure should be recognised in the plans.

Benefits

Identifying areas of groundwater flooding that are considered of comparable risk as areas of flood zone 2 (associated with river flooding) will enable a more transparent method for considering groundwater flood risk when applying the sequential approach and allocating sites in local plans.

The strategy identifies the need to recognise the costs for flood risk management infrastructure within future local plans and take the opportunities new strategic development affords to help reduce the risk of flooding from groundwater sources wherever feasible.

Reproduced with kind permission from Wiltshire County Council.

9. Assessing flood risk from artificial sources

National policy requires LPAs to consider the risk of flooding from all sources through the planning system, including the risk of flooding from reservoirs, canals and other artificial sources.

The likelihood of failure of a reservoir or other artificial source such as a canal is very low but has the potential to cause catastrophic damage due to the sudden release of large volumes of water. These residual risks need to be capable of being safely managed (also see [Good practice 15: safely managing residual risk](#)). The Toddbrook reservoir incident at Whaley Bridge in 2019 is a recent example of how this kind of risk can materialise and the report findings should be carefully considered by planning authorities (<https://www.gov.uk/government/publications/toddbrook-reservoir-incident-2019-independent-review>).

The planning practice guidance advises that LPAs consult with their emergency planning teams as early as possible where planning applications may have implications for emergency planning, such as sites located within an area at risk of reservoir failure. Where strategic issues affecting emergency services are identified in SFRAs, it may be relevant to contact the LRF which co-ordinates preparation for local incidents and catastrophic emergencies through its multi-agency flood plan.

When considering risk from reservoirs in the SFRA information and advice should be sought from emergency planners, the emergency services and local resilience forums. They can advise on the impact of proposed development on emergency planning and on the measures to include in development to avoid or minimise impacts on emergency planning. They will also use the information in the SFRA to understand the risk of flooding to existing and proposed development so they can plan for emergencies.

LPAs should also discuss any site allocations with reservoir owners to:

- avoid an intensification of development within areas at risk from reservoir failure, and;
- ensure they understand the cost and practical implications of any reservoir safety improvements required as a result of downstream development.

The LPA will need to evaluate the potential damage to buildings or loss of life in the event of dam failure, compared to other risks and when considering development downstream of a reservoir, canal or other artificial source. In areas protected from the risk of flooding by defences, the risk of these breaching or overtopping may also be assessed as an artificial source of flooding, as the depths and velocities of flood water will be significantly different to those that would be encountered if the defences were not present in the first place.

LPAs will also need to evaluate:

- how an impounding reservoir will modify existing flood risk in the event of a flood in the river catchment it is located within; and
- whether emergency draw-down of the reservoir will add to the extent of flooding downstream.

The NPPF requires that where the operation of an existing business or community facility could have a significant adverse effect on new development in its vicinity, the applicant (or 'agent of change') should be required to provide suitable mitigation before the development has been completed. This could reasonably include financial contributions to any necessary upgrades to reservoirs that are required as a consequence of the proposed downstream development. LPAs will need to ensure that relevant reservoir owners are consulted and given the opportunity to comment on the proposed allocations or developments.

Examples are provided below which have been assessed as “good practice” for considering reservoirs and artificial sources in SFRAs (Environment Agency research, 2021), and have links to where further information can be found.

Example: Considering risk from reservoirs in the Sequential Test, Hart District Council

Description

Order of Risk Ranking	Preference order
Flood Zone	1
UFMFSW	2
Access flooded	3
FMFSW	4
GW Flooding	5
AStGWF	6
Historic Records	7
Watercourse	8
Reservoir Flooding	9
Canal Embankment	10

Hart District Council prepared an addendum to their SFRA in 2017 to demonstrate that sites to be allocated for housing and employment development in areas of flood risk were appropriate in the context of the sequential test.

An extensive exercise was undertaken by the LPA to identify the risk of flooding to each site using the following datasets: reservoir flood risk maps, canal embankments within 100m, river flood zones, Updated Flood Map for Surface Water, Flood Map for Surface Water, Areas Susceptible to Groundwater Flooding, historic records, watercourse proximity. Part of the good practice was to ensure consideration of the flood risk to the site access as well as the site itself.

The sites were then ranked, in order of the risk of flooding. The ranking took account of the level of confidence in the dataset for each source and the likelihood of the type of flooding; for example, the order of ranking sites was based initially on the flood zone definition, as there is high confidence in the modelling that supports the flood zones. Because the SFRA and its addendum has explored the likelihood, extent and severity of flood risk from artificial sources the LPA was able to identify its level of risk relative to that from other flood sources. What had previously been unknown was now clear and that level of flood risk was able to be ranked and have a proportionate influence upon development decisions

Benefits

Using this approach, Hart District Council demonstrated that their sequential test process had considered all sources of flooding including the risks from artificial sources such as canals and reservoirs.

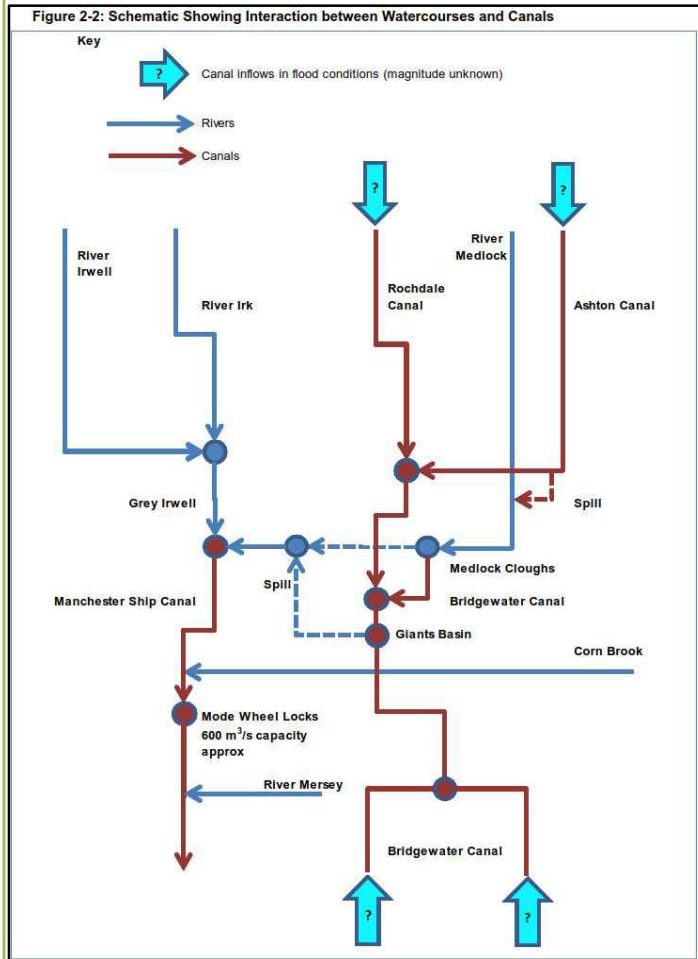
The methodology did not generate any new modelling or information but demonstrated how the existing available information had been applied to the application of the sequential approach in the District.

Reproduced with kind permission from Hart District Council and East Hants District Council.

Example: Assessing risk from canals and interlinked sources, Manchester City Council, Salford City Council and Trafford Council

Description

A SFRA was prepared collaboratively between Manchester City Council, Salford City Council and Trafford Council, with their contractors JBA, in 2010/2011. The SFRA provided an assessment of flood risk from all sources with a particularly detailed approach for those areas likely to experience significant development. For Salford this included an assessment of the risk from the Manchester Ship Canal and the Bridgewater Canal, as well as the River Irwell, surface water and groundwater.



Understanding the interactions between these different sources is fundamental to understanding the risk of flooding at a strategic level and recommending appropriate management measures. The SFRA has looked at the possible interactions between canals, reservoirs, rivers and surface water across Manchester, Salford and Trafford to prompt the appropriate consideration of these issues in site specific FRAs and further studies such as Surface Water Management Plans and Drainage Strategies.

The effect of hydraulic interactions between different sources was considered. A desk-based study was undertaken, pooling available resources to try to define where these interactions may occur. At each location, potential risks were summarised, with the intention of providing a reference for flood risk managers, planners and developers in the future. Interactions were summarised in tables and mapped in the SFRA.

Benefits

The SFRA assessed and identified areas at risk of flooding due to interactions between the canals, reservoirs, rivers and surface water. These interactions are summarised in tables and mapped in the SFRA. The benefit of

having this information is that it can be used to inform strategic planning decisions and the application of the sequential approach. Development can be avoided in areas identified at high risk from these interlinked sources and these areas can be targeted for specific flood risk management measures.

Reproduced with kind permission from Manchester City Council, Salford City Council and Trafford Council.

10. Applying the sequential approach based on all sources of flooding

National policy and guidance states that when applying the sequential test as part of a local plan, LPAs should consider all sources of flooding and the current and future impacts of climate change. The national data and maps show the flood risk for each flood source in isolation so the information in a SFRA should be used to inform an integrated approach to apply the sequential approach to spatial planning decisions based on all sources of flood risk.

There is no specified approach in existing guidance of how to do this, and it is therefore for the LPA undertaking the process to decide. This is often difficult to undertake because there is considerable variation between the different sources of flooding risk in terms of:

- the **impact of the flooding** from each source (for example, the risks from reservoir flooding and surface water flooding are different in terms of likelihood and resulting flood depths and damage);
- the **perceived ease with which each source can be managed** (for example, there is a perception amongst practitioners that flooding from surface water or groundwater is easier to manage and therefore doesn't need so much weight given to it during site selection and strategic planning); and,
- the **reliability of the data used to assess the risk** (for example, hydraulic modelling undertaken to determine the risk of river and sea flooding is more detailed and reliable than national or regional scale mapping of groundwater flood risk based on a high level understanding of geology).

As a result of these variations it is difficult to draw parallels between the different sources of flooding and establish what is considered 'equivalent' in terms of risk. In some cases, LPAs have been able to define what level of flood risk from ordinary watercourses, surface water, or groundwater they consider to be equal in their local area to the risk of flooding from main rivers or the sea which is defined by flood zones. Many SFRA use a 'Red, Amber, Green' (RAG) scoring approach to determine individual sources of flood risk and also to look at these collectively. Any 'wider sustainable development objectives' that a site in an area of increased flood risk may deliver should be established at this point.

It is up to the LPA to determine whether or not the sequential test has been passed in order for a site to be allocated, but the role of the SFRA is critical. It is important for the SFRA to be clear and rigorous as it sets an example for future developments coming forward.

Through the Level 2 SFRA site screening process, the LLFA should advise on prospective allocations in areas at risk of flooding.

Examples of this approach being applied for West London Boroughs SFRA and Wiltshire Groundwater Management Strategy have been described in [Good Practice 7: Assessing surface water flood risk](#) and [Good Practice 8: Assessing groundwater flood risk](#).

Some further examples have been included in this section (found in Environment Agency research, 2021), which show several similar approaches, whereby the risk from all sources is considered collectively and used to rank potential allocation sites to inform the sequential approach.

Example: Applying the sequential approach based on all sources of flooding, Waverley Borough Council

Description

As part of their Level 2 SFRA, Waverley Borough Council established some 'Flood Risk Categories by Flood Type' to enable potential development sites to be compared on flood risk terms, considering the risk from rivers, surface water and reservoir flooding.

These categories were used in combination with a defined 'Flood Risk Suitability Assessment Criteria' to enable the ranking of potential allocation sites based on flood risk from rivers, surface water and artificial sources and thereby the application of the sequential test.

One of the chief deliverables for the updated Level 1 SFRA was a Site Assessment Database, which provided flood risk statistics for all of the potential development sites identified by the council using the datasets in the SFRA. This was used to inform the 'flood risk suitability assessment criteria' and to rank the sites.

Table 5-1 Flood Risk Categories by Flood Type				
	Very high	High	Medium	Low
Fluvial (Flood Zones (FZ))	>35% in FZ3b	>35% in FZ3a	>50% in FZ2	>50% in FZ1
Fluvial (Detailed Modelling)	>35% at risk of 1 in 20yr RP event	>35% at risk of 1 in 20yr RP event	>50% at risk of 1 in 100yr RP event	>50% not at risk from 1 in 100yr RP event or greater
Surface Water/Sewer	>50% at risk of 1 in 30yr RP event	>50% at risk of 1 in 100yr RP event	>50% at risk of 1 in 1000yr RP event	>50% not at risk from 1 in 1000yr RP event or greater
Artificial Sources	>75% max reservoir or canal outline	50%<=75% max reservoir or canal outline	25%<=50% max reservoir or canal outline	<25% max reservoir or canal outline

Figure 5-1: Flood Risk Suitability Assessment Criteria	
Score	Criteria
1	Flood Zone 3b or equivalent* in over 50% of the site
2	Flood Zone 3 or equivalent* in over 35% of the site or: Medium or high risk of surface water flooding and reservoir flooding in the majority of the site.
3	Flood Zone 3 or equivalent* in any part of the site or: Medium risk of flooding from any source
4	Over 50% of the site is at low risk of flooding from all sources
5	100% of the site is entirely at low risk of flooding from all sources

*where Flood Zone information has been superseded by detailed flood modelling, flood model outlines are used.

Benefits

The flood risk suitability assessment criteria allowed all of the sites to be ranked based on all sources of flood risk, making it a transparent consideration of sites. The provision of the raw data in a usable format to the council enabled them to apply the sequential test and consider the risks to all sites collectively.

Applying this approach, the council was able to demonstrate a robust application of the sequential test that considered the risk of flooding from a range of flood sources, ensuring that development was steered away from areas with high flood risk from any source not just rivers.

Reproduced with kind permission from Waverley Borough Council.

Example: Sequential Test applied in an integrated way to all flood sources, East Riding of Yorkshire Council

Description

East Riding of Yorkshire Council have developed a Flood Risk Note for the Planning Application Process. The purpose of the document was to assist developers, applicants and local planning authority officers on how to use the council's Strategic Flood Risk Assessment and how to apply flood risk policy in the East Riding of Yorkshire. It aimed to promote transparency and consistency in the approach East Riding of Yorkshire Council will take to applying the flood risk sequential test and exception test.

The note was initially prepared in 2010, updated in 2017 to reflect the adoption of the East Riding Local Plan and to incorporate best practice, and updated in 2018 to reflect updated Sustainability Appraisal objectives.

The document provides some useful criteria on identifying the risk of flooding from other sources, as part of a site-specific FRA, showing an awareness that the data and mapping about these sources of flooding is often high level and of lower confidence. Para 1.12 states:

Because the methods used to assess these 'other' sources of flooding in the SFRA are relatively 'broad brush', it is not intended that the areas identified should be interpreted as a definitive representation of surface water / groundwater risk zones. Rather, the SFRA recommends that these should be investigated further through a site-specific FRA (Step 6). The Council may consider there to be a surface water / groundwater risk if it is found that the site meets any of the following criteria:

- the site's average gradient is greater than 1% (1 in 100), as this is likely to generate overland flow;
- there is a ditch(es) adjacent to the site;
- the groundwater level is high (e.g. likely to impede the natural storage soakage of rainwater);
- there is a large impervious area next to the site (e.g. more than 50% of an adjacent site is impervious, using a 50m band width from all boundaries of the site); or,
- there is a history of surface water and/or groundwater flooding on the site (e.g. in June 2007).

Furthermore, Table 3 in the Flood Risk Note sets out 'ranked levels of flood risk' which demonstrates how the council consider that the risk of flooding from all sources should be incorporated into the application of the sequential test.

Table 3: Ranked levels of flood risk

Flood Risk Levels	Rankings (1=lowest & 18=highest)
Zone 1 Low Probability	1
Zone 2 Medium Probability	2
Zone 1 Low Probability + Other Sources	3
Zone 2 Medium Probability + Other Sources	4
Zone 3a High Probability - Fluvially Dominated	5=
Zone 3a High Probability - Tidally Dominated 12+ hours warning	5=
Zone 3a High Probability - Fluvially Dominated + Other Sources	6=
Zone 3a High Probability - Tidally Dominated 12+ hours warning + Other Sources	6=
Zone 3a High Probability - Tidally Dominated 6-12 hours warning	7
Zone 3a High Probability - Tidally Dominated 6-12 hours warning + Other Sources	8
Zone 3a High Probability - Tidally Dominated Less than 6 hours warning	9
Zone 3a High Probability - Tidally Dominated Less than 6 hours warning + Other Sources	10
Zone 3a High Probability - Tidally Dominated Danger to Some	11
Zone 3a High Probability - Tidally Dominated Danger to Some + Other Sources	12
Zone 3a High Probability - Tidally Dominated Danger to Most	13
Zone 3a High Probability - Tidally Dominated Danger to Most + Other Sources	14
Zone 3a High Probability - Tidally Dominated Danger to All	15
Zone 3a High Probability - Tidally Dominated Danger to All + Other Sources	16
Zone 3b Functional floodplain	17
Zone 3b Functional floodplain + Other Sources	18

Note: This Table represents the Council's interpretation of how sites should be ranked using the SFRA flood zones and taking into account risks from 'other' sources of flooding, in order to identify sequentially preferable sites for the Sequential Test process. It is highlighted that the SFRA does not assess flood hazard in Fluvially Dominated Zone 3a, therefore for sites located near to flood defences in this zone (e.g. parts of Beverley and Stamford Bridge) the site-specific Flood Risk Assessment will need to calculate the flood hazard¹⁶ of defence failure, and rank the risk level accordingly (e.g. on parity with Tidally Dominated Zone 3a rankings 11-16).

Source: Extract from East Riding of Yorkshire Council Flood Risk Note for the Planning Application Process, (2018).

Benefits

The approach enabled the council to demonstrate a robust application of the sequential test that considered the risk of flooding from a range of flood sources, ensuring that development was steered away from areas with high flood risk from any source not just rivers. There was an appreciation within the methodology that the data and information to understand the risk from some of the 'other sources' of flooding (e.g. groundwater and artificial sources) are less reliable than data for rivers, sea or surface water. To address this, the Flood Risk Note highlighted the need to consider following up with a site-specific flood risk assessment that investigates flood risk in more detail.

Reproduced with kind permission from East Riding of Yorkshire Council.

Example: Applying the sequential approach based on all flood sources, Gloucester City Council, Cheltenham Borough Council and Tewkesbury Borough Council

Description

The Joint Core Strategy Consortium partnership between Gloucester City Council, Cheltenham Borough Council and Tewkesbury Borough Council worked together to assess local housing and employment needs. This collaborative approach ensured sustainable development across all three council areas, tackling cross-boundary issues in a consistent approach.

As part of the evidence base for the Joint Core Strategy, the three LPAs collaborated to commission and produce a Level 2 Strategic Flood Risk Assessment which was published in 2011. The SFRA considered flood risk from all sources across the study area, and how new development could impact upon the current level of flood risk in the area.

Section 3 of the SFRA assigned each site a suitability ranking, as shown below:

Scoring Code	Criteria Definition
1	Site is mainly in Flood Zone 3b
2	Site is mainly in Flood Zone 3a
3	Site is mainly in Flood Zone 2
4	Site is mainly in Flood Zone 1 but affected by Flood Zones 2, 3a and 3b
5	Site is fully in Flood Zone 1

The risk from flood sources other than rivers and sea, residual risk and historical flooding was also incorporated into the suitability assessment. Where any of these risks are present, the scoring code was reduced, commensurate with the level of risk.

Combining flood risk from all sources into ranking criteria provided a more holistic assessment of the risk. Using these scores in conjunction with other planning considerations made it a more sustainable approach for allocating new developments.

Benefits

Using set criteria to establish a suitability ranking of the site enabled a transparent process for the consideration of sites and the application of the sequential approach. It also enables the LPAs to consider the merits and constraints of the sites in relation to flood risk in conjunction with the other planning considerations that they have to weigh up.

Reproduced with kind permission from Gloucester City Council, Cheltenham Borough Council and Tewkesbury Borough Council.

11. Assessing and managing the cumulative impact of development on flood risk

Whilst an individual development may have a minimal impact on flood risk, the cumulative impact of many such developments on the same river or surface water catchment can be significant.

National policy requires LPAs to consider cumulative impacts in, or affecting, local areas susceptible to flooding. This should include the impact expected from strategically planned development as well as the cumulative impacts of development, permitted development such as paving over domestic gardens and building extensions, and significant changes in land use, such as woodland and forest planting or felling, habitat creation, and changes to farming practices. Whilst these may be difficult to quantify exactly, various scenarios could be estimated and used in assessments.

It is important to consider the expected impacts of these changes as they have the potential to significantly alter the frequency and/or severity of flooding. As a minimum new development should ensure there is no increase in surface water runoff, and where possible provide betterment, but over time, the cumulative impact of developments increasing areas of hard surfacing, can alter surface water flow paths and drainage patterns and reduce the capacity of a river's floodplain to store floodwater.

Changes to existing development too can increase vulnerability to flooding plus the risk of flooding to new development. For example, the widespread paving over of gardens can increase the risk of surface water and sewer flood risk, reducing the suitability of the local areas for new development. These changes can be small on individual development scale, but over time could lead to bigger impacts.

An SFRA should identify areas with limited capacity to manage increases in any source of flooding, particularly rivers and ordinary watercourse, surface water and sewer, and assess the consequences of locating new development in those flood / sewer catchments and likewise for any anticipated significant changes to existing development. There are tools and guidance to help LPAs and others undertake simple tests to determine how sensitive their area is to changes in runoff (for example to simulate urban creep) (<https://www.gov.uk/government/publications/improving-surface-water-flood-mapping-using-local-drainage-rates>). This can help inform whether further modelling is required. Over time, the risk modelling should be updated periodically to include any changes in risk, and be used to update the SFRA so that the most up to date evidence is used to assess windfall sites.

Where increases in flood risk are identified the LPA should consider measures that could be put in place to reduce and/or manage this cumulative impact. Reference to strong policies on SuDS, green infrastructure, reducing the footprints of built development in flood risk areas, or the removal of permitted development rights in sensitive areas could assist this process. This approach is supported by the NPPF which states local plans should use opportunities provided by new development and improvements in green and other infrastructure to reduce the causes and impacts of flooding, (making as much use as possible of natural flood management techniques as part of an integrated approach to flood risk management).

Examples are provided below which have been assessed as “good practice” for considering cumulative risk in SFRAs (Environment Agency research, 2021), and have links to where further information can be found.

Example: Assessing the cumulative impact of development across a river catchment, Leicestershire County Council and Leicester City Council

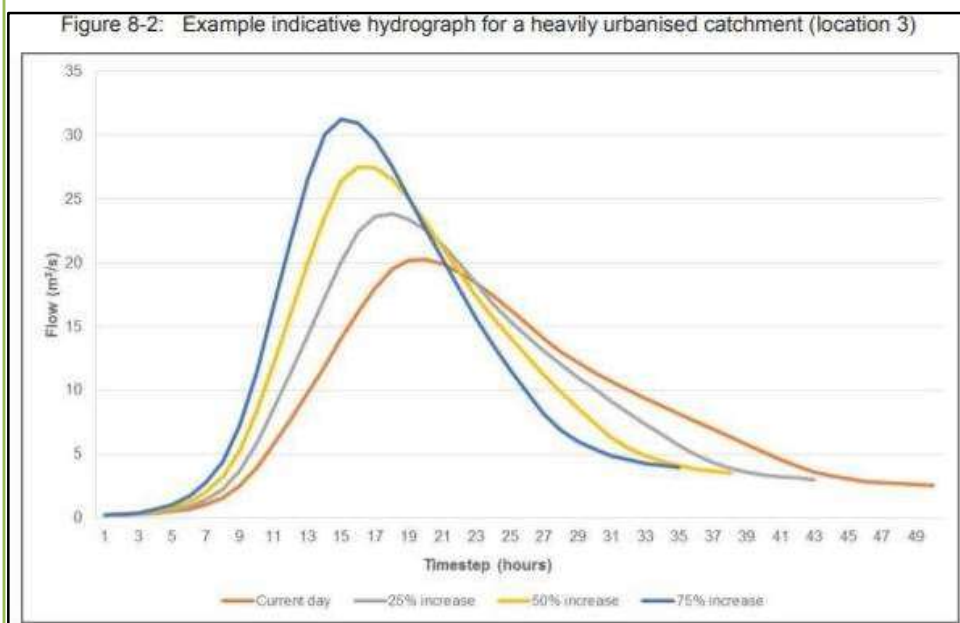
Description

Leicestershire County Council and Leicester City Council produced a SFRA in 2017 to consider likely flood risk from all sources of flooding in the area, to inform strategic growth options. This SFRA was produced collaboratively across nine LPAs, adopting a catchment-wide approach to tackling flood risk.

The SFRA includes an assessment of the cumulative impact of development, considering the potential impact of increasing impermeable surfaces on surface water flooding and runoff into watercourses downstream.

Section 8 of the SFRA describes the impact of the modelled increase in urban extent (should no sustainable drainage systems be implemented) and the loss of floodplain storage. It used three different scenarios to model against the baseline: 10%, 25% and 30% increase in urban extent within the catchment. Using rainfall modelling, indicative hydrographs were created to show the effects of a 1% AEP flood event. The results show that watercourses are sensitive to an increase in the impermeable area because of development and change of land use.

Figure 8-2: Example indicative hydrograph for a heavily urbanised catchment (location 3)



Source: Extract from Leicestershire and Leicester City Level 1 SFRA – showing the impact of increased urban extent on flows in an urban catchment.

This assessment highlighted that although the increase in runoff from individual developments may only have a minimal impact on flood risk, the cumulative effect of multiple developments could be severe. New development and associated landscaping have the potential to significantly alter surface water flow paths and drainage patterns, as well as alter the capacity of a river floodplain to store floodwater. Appropriate mitigation measures such as SuDS were recommended as a key method to reducing impacts of development on the flow regime of receiving watercourses and flood risk in the catchment. This was particularly important where urban areas in the downstream catchment were already prone to flooding.

Benefits

This type of modelling provided a robust evidence base for the council to justify more stringent policies on SuDS. It provided developers and decision makers with transparency on the scale of current flood risk and how that could be exacerbated by the scale of proposed development and facilitated a strategic approach that was more time and cost efficient than addressing flood risk on a case by case basis.

Reproduced with kind permission from Leicestershire County Council and Leicester City Council.

Example: Managing cumulative impact of development on fluvial, surface water and groundwater flood risk, Hart District Council

Description

The SFRA for Hart District Council, produced in 2016, identifies that for flood risk management measures to have the greatest benefit, they should not only target the most at-risk locations but should also apply a catchment-based approach and consider the surface water catchment upstream of these high-risk areas. Within their SFRA, the council identified surface water catchments (within which there are surface water flooding issues) as 'Causal Areas', from where surface water flooding originates.

The council undertook a GIS based analysis of the number of properties identified to be at risk of flooding based on the Flood Map for Surface Water, the Flood Map for Planning and the susceptibility to groundwater datasets. Using this information, the council ranked the urban areas by flood risk for each source. The ranking was used to identify where most of the risk is concentrated and hence which surface water catchments are most important to manage runoff from.

Four Causal Areas were identified by delineating the surface water catchment areas upstream of the top four at risk urban settlements.

In these Causal Areas the SFRA made the following recommendations:

"It is recommended that stricter management of surface water runoff is applied in these four Causal Areas as these areas will have the greatest impact on fluvial and surface water flood risk in Hart. This could include mitigation such as: all parking areas and hard surfacing (with the exception of the public highway) using permeable surfacing unless shown to be technically unviable. All brownfield development should be looking to provide a reduction in surface water runoff below existing levels. Minor new builds should be providing surface water storage and ensuring discharged rates are no higher than existing or where this is not possible due to blockage issues discharging at rates no higher than 5 l/s. All major developments are to incorporate a wide range of SuDS and demonstrate that they are fully compliant with the National SuDS Standards and latest climate change advice".

Benefits

The identification of Causal Areas enabled Hart District to pin point those areas where there was potential for multiple developments to cumulatively exacerbate flooding further down the catchment.

It also provided an invaluable tool for tackling the cumulative impact of development on flood risk, enabling stricter requirements of the management of surface water to be applied on new development within these 'contributing' areas.

Reproduced with kind permission from Hart District Council and East Hants District Council.

Example: Assessing and managing the cumulative impact of development on surface water flood risk - Defining 'Conveyance' and 'Accumulation' zones, Brighton and Hove City Council

Description

Surface Water Flood Zones were introduced to the Brighton and Hove SFRA to define areas potentially at risk from surface water flooding and supported the preparation of the City Plan Part 2 (the draft Plan was published 2018). The aim of this was to provide for more strategic consideration of surface water flood risk in the land allocation and planning process and secure appropriate commitments that development would be safe for its intended lifetime and not have an adverse effect on third parties.

The urban land use, steep topography and lack of watercourses in Brighton and Hove make it particularly susceptible to surface water flooding. The Risk of Flooding from Surface Water mapping shows surface water risk is prevalent across Brighton and Hove, affecting 2.4 square kilometres of area during a 1% Annual Exceedance Probability event. Recorded incidents of actual surface water flooding show clusters of events in the Preston Park, Patcham and Portslade areas.

For the purpose of establishing Surface Water Flood Zones the relative level of risk for high, medium and low probability events was not easily defined, primarily due to the fragmentation of responsibility for management, the differing standards used to design and maintain assets and the complexity of the mechanisms involved. It thus became a necessity to identify the areas that were potentially at risk and to understand the parties responsible for managing the risk. Accordingly, a simpler approach was taken based on the identification of surface water: 'Accumulation Areas' and 'Conveyance Areas' that describe the areas potentially at risk. The following two zones were defined:

Surface Water Flood Zone a: Accumulation Zone – where runoff can be expected to pond.

- SWFZa is defined as land affected by a high probability event (1% AEP) and here runoff can be expected to pond. This event was selected to be representative of the flood risk areas in Brighton and Hove, have a reasonable chance of occurrence and to be consistent with the level of risk used for river flood zones.
- Development of basement dwellings is not normally permitted in SWFZa.
- For all other development, a flood risk assessment (FRA) is required to demonstrate that the proposal will be safe from surface water flooding for its lifetime and does not increase flood risk elsewhere. FRA requirements include:
 - Assessment of flood risk from all sources.
 - Consideration of surface water flow pathways across the site during a flood event of 1% AEP plus 30% uplift for climate change and how the proposed development may alter these. Overland flow modelling may be required to demonstrate this.
 - Demonstration that ground floor levels should be a minimum of whichever is higher of: 300 mm above the general ground level of the site; or 600mm above the estimated surface water level in the 1% AEP event with drainage plus 30% uplift to account for climate change.
 - Consideration of other surface water flood resilience measures.

Surface Water Flood Zone b: Conveyance Zone – locations where the interruption or changing of flow direction could affect flood risk.

- The extent of SWFZb was based on the speed and depth with which surface water can flow over the ground surface and was to identify locations where the interruption or changing of flow direction could affect flood risk. It was defined by ground that has a gradient steeper than 1 in 20 (5%).
- All types of development could be appropriate for this zone, providing an FRA could demonstrate it would be safe from flooding for its lifetime, and not increase flooding elsewhere. FRA requirements include:
 - Assessment of flood risk from all sources.
 - Consideration of surface water flow pathways across the site during a flood event of 1% AEP plus 30% uplift for climate change and how the proposed development may alter these. Overland flow modelling may be required to demonstrate this.
 - Consideration of surface water flood resilience measures.

Example: Assessing and managing the cumulative impact of development on surface water flood risk - Defining 'Conveyance' and 'Accumulation' zones, Brighton and Hove City Council

Benefits

Identification of these surface water zones enabled a better understanding of those areas where the cumulative impact of development has the potential to exacerbate flooding. The approach enabled easy identification of instances where locating development in the SWFZb Conveyance Zone had the potential to significantly alter flood flow paths and put the new development at risk of flooding, or where floodwater flow paths would be diverted to neighbouring areas and cause a detrimental impact.

Reproduced with kind permission from Brighton and Hove City Council.

12. Assessing and managing the impact of climate change on flood risk

Assessing the impact of climate change

National policy requires LPAs to:

- assess and map the effects of climate change on all sources of flooding,
- identify areas on maps where climate change is expected to increase flood risk,
- identify on maps where the effects of climate change are expected to make existing development unsustainable. This can be used to identify options for relocation strategies, to locate development in high risk, unsustainable locations, to areas of lower flood risk.

Climate change guidance for [England](#) sets out a range of allowances to assess the impact of climate change on future risk from river, the sea and surface water. It is important a range of allowances is assessed to help inform assessment needs depending on the lifetime and vulnerability of a development.

These allowances are routinely applied when undertaking modelling studies for river and sea flood risk to consider the impact of climate change. Similar modelling can be done for surface water, to include consideration of climate change using the allowances for peak rainfall intensity. In some limited cases it may be reasonable to use proxies instead of modelling the impact of climate change using the allowances, but testing would need to be done to ensure this is a robust approach.

To date, there has been no guidance published on how to assess the impact of climate change on the risk of flooding from groundwater, sewers or reservoirs and other artificial sources. The local approach for if or how to apply climate change in a SFRA should be agreed in its scoping phase with the Environment Agency and LLFA.

As well as understanding the anticipated changes in flood risk as a result of climate change, it is also crucial to have a good understanding of the condition, ongoing management and future maintenance plans of existing flood infrastructure. Flood risk is likely to increase in the longer term in areas currently benefiting from defences, particularly if there are no plans to upgrade or maintain the defences to keep pace with climate change.

The SFRA primarily assesses flood risks but in areas of tidal flood risk they can also be used to assess wider coastal risks including erosion. This can be achieved by designating Coastal Change Management Areas (such as those seen in Waveney, Fareham and Havant Council), which can drive local policies. This can ensure that the impacts of climate change are understood and assessed when allocating development.

When undertaken collaboratively and with governance arrangements in place to own SFRA outputs, LPAs can develop stakeholder-endorsed flood adaptation plans and policies that enable existing communities to remain viable in the face of increasing flood risk.

Safeguarding land for current and future flood risk management purposes

LPAs need to take an active role in identifying within their development documents areas of land to be used now or in the future for flood risk management purposes. The SFRA should be used to clearly set out any designation of land for this.

These may be existing areas of a river floodplain that store water when rivers are in flood, or areas used to store surface water exceedance flows during heavy rainfall events. It is essential that these areas are marked as flood storage areas (and, in England, identified as flood zone 3b functional floodplain where appropriate) to ensure that they are not developed in the future and the flood storage function of these areas is protected. For non main rivers, the SFRA and local plan should consider safeguarding land adjacent to these. Buffer areas around watercourses provide an opportunity to restore parts of the floodplain.

To enable communities to adapt to climate change and remain resilient to future flooding, space around and/or within a new development may need to be safeguarded where flood defences or other flood alleviation structures can be built in the future. Space may also be needed around existing flood alleviation structures so they can be expanded or set-back in future.

Alternatively, there may be currently developed areas that need to be earmarked for a change of use in the coming years to deliver a flood storage function; for example, areas of development within a flood zone which need to be converted back to floodplain to deliver a flood storage function, or areas that currently experience regular surface water flooding and ponding, and would make a natural area for flood storage. It may still be possible to use this land for water compatible⁴ uses, for example informal green spaces. In this case the LPA will need to take steps to communicate to users and local communities that the purpose of the land is primarily for flood storage. LPAs are also advised to keep records of areas designated for flood management.

In England, the PPG provides advice related to green belt compensatory measures. Where it has been demonstrated that it is necessary to release Green Belt land for development, strategic policy-making authorities should set out policies for compensatory improvements to the environmental quality and accessibility of the remaining Green Belt land. In a similar manner, LPAs should be encouraged and supported in their efforts to set out policies for safeguarding land for future flood risk management purposes.

Examples are provided below which have been assessed as “good practice” for considering climate change in SFRAs (Environment Agency research, 2021), and have links to where further information can be found.

Example: Managing the impact of climate change - Planning for relocation in areas of coastal change, East Suffolk Council

Description

The Development and Coastal Change Supplementary Planning Document (SPD) prepared for Waveney District Council, now East Suffolk Council, and adopted in 2013 set out the types of development that may be appropriate along the coast and how planning applications for development in the area were to be determined. It also provided guidance for home owners and businesses affected by coastal erosion including how relocation sites would be considered. The SPD policies were superseded and replaced in March 2019 on adoption of the new Waveney Local Plan, however, much of the content is still being used in relation to the new policies.

The SPD (2013) provided greater detail and clarity to these policies:

- Coastal Change Management Area (DM06)
- Relocation and Replacement of Development Affected by Coastal Erosion (DM07)
- Housing Development in the Countryside (DM22) (part)

It also provided information on the types of permitted development, and guidance for the following situations:

- Relocation and replacement of businesses affected by coastal erosion
- Relocation of dwellings affected by coastal erosion
- Mitigation measures and adaptation strategy
 - Use of article 4 directions in the coastal change management area
 - Use of conditions and section 106 agreements
 - Time limited developments

⁴ As defined in the [Planning Practice Guide Flood and Coastal Change Table 2](#).

- Short term reuse of existing residential properties

The council designated areas along its coastline as a Coastal Change Management Area (CCMA) in its local plan. CCMA's identify land likely to be affected by coastal change (e.g. erosion, landslip or permanent inundation by the sea). Within the Supplementary Planning Document (SPD) was a development matrix that set out the approach to development proposals within the CCMA based on development vulnerability and timescales beyond which maintaining buildings in their current location may become unsustainable.

Development Type	Short-term (up to 2025)	Medium-term (2025-2055)	Long-term (up to 2105)	
New Residential development, replacement dwellings or change of use to residential use	x	x	x	Not permitted under any circumstances.
New non- residential development not associated with an existing use or building	x	✓ / x	✓ / x	In short term risk area development not permitted under any circumstances. Subject to findings of the vulnerability assessment some types of development will be permitted in the medium to long term areas.
Temporary Uses	✓ / x*	✓	✓	Subject to findings of vulnerability assessment. *Except residential uses.
Open Land Use	✓	✓	✓	Subject to time limited conditions and findings of vulnerability assessment.
Changes of Use	✓ / x*	✓	✓	Change of use applications may be appropriate in some cases subject to time limited conditions. *Except residential uses.
Extensions (including householder development)	✓ / x	✓	✓	Extensions may be appropriate in some cases in the short term subject to findings of the vulnerability assessment and owners acknowledgement of risk.
Intensification of use (excluding residential uses)	x	✓ / x	✓ / x	Medium to long term increased use of these areas may be appropriate depending on the type of use and assessment of risk.
Re-development or reconfiguration of existing sites (excluding residential uses)	x	✓ / x	✓ / x	Subject to time limited conditions, findings of vulnerability assessment and owners acceptance of overall risk.
Replacement of Development Affected by Coastal Erosion (Policy DM07) (excluding residential development)	x	✓ / x	✓ / x	Assessment of the type of use and use of temporary conditions may make some replacement development acceptable within a lower risk zone.
Infrastructure and Community Uses	✓ / x	✓ / x	✓ / x	Essential infrastructure will be permitted in all risk areas where no other sites are feasible and a management plan for future removal and replacement is provided. Community uses will be permitted where the wider benefits outweigh the risks and are subject to a management plan.

- ✓ Development will be acceptable but may be subject to conditions
- x Development will not be accepted under any circumstances
- ✓/x Development may be acceptable subject to the findings of the CEVA and appropriate conditions

Figure 3 Development Matrix

Benefits

The SPD provided an easily understandable, robust approach for managing future development in areas likely to become unsustainable in the medium to long term due to coastal erosion. The development matrix shown in the figure could be adapted for any flood source where information is available to support decision making on long term sustainability of development locations.

By setting out the timescales within which certain types of development were appropriate it facilitated a common understanding between the LPA, developers and the public on how growth and regeneration within and around existing communities could be maintained without creating a long-term legacy of unsustainable

development. By having a clear, common understanding of what was, and was not, appropriate development it saved LPAs, flood and coastal management authorities and developers significant resources by focussing on compliant planning applications. *Reproduced with kind permission from East Suffolk Council.*

Example: Assessing the impact of climate change – online mapping of future levels of flood risk, Huntingdonshire District Council

Description

The mapping associated with the SFRA for Huntingdonshire (first published in 2017) is publicly accessible via an interactive web format. Flood risk from a range of sources (river, surface water, and groundwater) can all be viewed in one place, and the website includes a link to the report which explains all the information shown on the map.

As well as having maps showing the current risk of river flooding, the SFRA also had maps showing the future extent and severity of river flooding, incorporating the government's new climate change allowances.

Benefits

Landowners and developers are able to identify the future level of risk for sites of interest, providing more information upfront so a better understanding of the risk was known before investing resources into specialist flood risk assessments and planning applications.

Reproduced with kind permission from Huntingdonshire District Council.

Example: Managing the impact of climate change – building resilience through the Living with Water Partnership, Hull City Council

Description

Hull is very low-lying and within an area defined as Flood Zone 3. The majority of the city is defended from flood risk through the use of flood alleviation structures such as engineered walls, embankments, storage lagoons and pumping stations. The presence of the flood defences means that the probability of flood risk is low in much of the city but the consequences if they breach or overtop are high. There is also the additional challenge of local flood risk such as surface water, sewer and groundwater.

In Hull the majority of surface water from the city and surrounding areas has to discharge into the sewer system which then needs pumping to outfall. This integrated level of risk means that it needs a combined approach rather than looking at it as different sources of flood risk being managed by separate authorities. Hull City Council, East Riding of Yorkshire Council, Yorkshire Water and the Environment Agency have joined to form the 'Living with Water Partnership'. This partnership means there is a strong local understanding of the importance of flood risk management to accompany any new development.

A joint Supplementary Planning Document (SPD) has been produced between Hull City Council and Yorkshire Water with an agreed accepted run-off rate from all new development and promoting the use of blue/green infrastructure (sustainable drainage systems or SuDS) as the volumes of storage required will render traditional underground SuDS as unaffordable. This is also supported by an Open Space Strategy:

"Hull is at risk from tidal, ground and surface water flooding; reducing flood risk by capturing and slowing water during and after heavy rainfall can help to prevent localised flooding; in a city where the vast majority of properties lie in a floodplain the challenge of reducing flood risk becomes ever more important. Hull has a history of culverting waterways and a combined sewerage and drainage system exacerbates the situation, Hull's drainage systems are at capacity resulting in a number of properties being at risk of surface water flooding. Significant surface water flooding in 2007 and a tidal surge in 2013 make flood risk management a high priority for Hull. Retrofitting hydrological schemes in green spaces can incorporate design that provides

adequate storage for the site and that also leads to benefits in water quality and biodiversity". Extract from Hull City Council Open Space Strategy, 2016

Benefits

The benefits using the SFRA to create the SuDS SPD document are that, like the SFRA, the developers know what is expected of them and can negotiate land prices accordingly. It also means that the flood and drainage layout become an integral part of the development design, planned from the start rather than added in once a masterplan for the site has been produced. Alongside this work the Living with Water Partnership has concentrated on community engagement to promote personal resilience and to drive behaviour change so that people are demanding more resilient homes and multi- function green space to improve their environment.

Reproduced with kind permission from Hull City Council.

13. Identifying and using measures to reduce the risk of flooding

Flood risk management measures often tend to focus on ensuring that future development does not exacerbate the existing level of flood risk to the site and surrounding area. In England, the National Planning Policy Framework (NPPF) describes that residual flood risk should be managed by using opportunities provided by new development and improvements in green and other infrastructure to reduce the causes and impacts of flooding (para 161 c), amongst other requirements. Developments that are subject to the exception test are also required to reduce flood risk overall, where possible. It is good practice for the SFRA to require all allocated and windfall sites to consider how betterment can be provided. This should include providing benefits outside of the red line boundary.

Risk management authorities may have information that can support LPAs to identify opportunities for betterment, or validate the SFRA findings, such as flood risk management scheme delivery programmes, and SuDS opportunity mapping.

The NPPF policy on SuDS requires their inclusion on all major development and all development in areas at risk of flooding. These policy and legal mechanisms provide increased opportunities to reduce existing levels of flood risk. The SFRA has a role to play in identifying opportunities for SuDS to be delivered in accordance with this policy at both the individual development scale and at the strategic scale.

Reducing the causes and impacts of flooding might involve development proposals which include:

- Development contributions for capital and maintenance investment in existing, new or improved FRM infrastructure
- area-wide SuDS to remove surface water from combined sewers
- shared or strategic large scale flood storage schemes, which benefit areas downstream not just the local area
- floodplain and channel restoration
- natural flood management or nature based solutions
- changes to land management
- surface water or river flood storage areas
- removal of culverts or other restrictions on flow
- river restoration, such as removing canalisation and re-introducing meanders
- removing permitted development rights in sensitive areas for example functional floodplains where cumulative losses of storage through extensions could have significant impacts or where increases in vulnerability through change of use would be inappropriate.

Flood Risk Management Authorities should be able to advise the LPA, both on areas of particular flood risk concern and appropriate approaches to reduce the causes and impact of flooding.

The SFRA can play an important part as the evidence base to inform policies that can deliver a reduction in the existing and future risk of flooding.

Examples are provided below which have been assessed as “good practice” for delivering flood risk reduction via the SFRA (Environment Agency research, 2021), and have links to where further information can be found.

Example: Delivering flood risk reduction through new development, East Riding of Yorkshire Council

Description

East Riding of Yorkshire Council have developed a 'Flood Risk Note for the Planning Application Process'. The purpose of the document was to assist developers, applicants, and LPA officers on how to use the council's SFRA and how to apply flood risk policy in the East Riding of Yorkshire. It aimed to promote transparency and consistency in the approach East Riding of Yorkshire Council will take to applying the flood risk sequential and exception tests.

The note was initially prepared in 2010 and updated in 2017 to reflect the adoption of the East Riding Local Plan and to incorporate best practice and updated in 2018 to reflect updated Sustainability Appraisal objectives.

'Step 6 - Preparing a site-specific FRA', sets out the requirement to consider how the development will contribute to a net reduction in flood risk:

"... applicants are encouraged to demonstrate that their proposals will deliver a positive reduction in flood risk overall, whether that be by reducing the frequency or severity of flooding (for example, through the introduction of SuDS) or by reducing the impact that flooding may have on the community (for example, through a reduction in the number of people within the site that may be at risk)".

"If it is impossible/difficult on-site to provide an overall reduction in flood risk, consideration needs to be given to whether a contribution to flood risk management infrastructure may be appropriate, supporting the area in which the development takes place (to be determined on a case-by-case basis)."

Benefits

The Flood Risk Note clearly set out the expectation for new developments so that a flood risk could be reduced in the area.

Reproduced with kind permission from East Riding of Yorkshire Council.

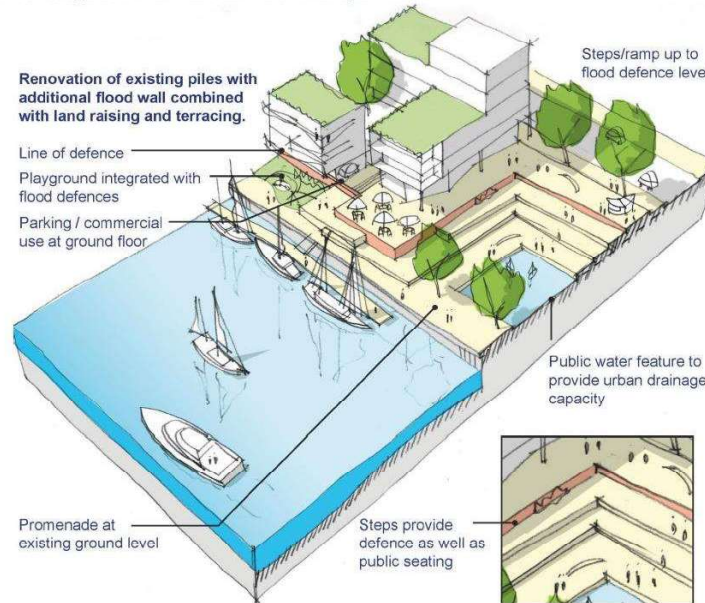
Example: Delivering flood risk reduction through new development, Shoreham Harbour, Adur District Council, Brighton and Hove City Council and West Sussex County Council

Description

The Shoreham Harbour 'Flood Risk Management Guide' Supplementary Planning Document (SPD) was produced in 2015. It was prepared collaboratively by the Shoreham Harbour Regeneration Partnership comprising Adur District Council, Brighton & Hove City Council, West Sussex County Council and Shoreham Port Authority, working closely with the Environment Agency.

The SPD forms part of the evidence base for the Shoreham Harbour Joint Area Action Plan which is a 15-year regeneration plan for the harbour area. It provides an example of how regeneration can be used as an opportunity to deliver a net reduction in flood risk.

Figure 7.13: Preferred Approach – Riverside Business Centre to Kingston Beach



Due to the greater flood depths along the Western Harbour Arm, this site was the focus for developing flood defence measures. A long list of options was determined by considering all possible flood defences for the Western Harbour Arm. These were then categorised and split into types and defence alignment. An options matrix was created to aid consideration of the feasibility of each of the flood defence types and to create a short list of options, based on the following key considerations:

- applicability
- cost
- maintenance
- adaptability
- design life
- environmental impact
- visual impact

Extract from Shoreham Harbour Flood Risk Management Guide SPD – Example of integrating methods to deliver net reduction in flood risk with regeneration.

Multi Criteria Analysis, which is a qualitative approach to identify preferences amongst different options, was used to facilitate the options selection process and to enable the relative merits of defence options to be assessed. A short list of preferred options was then produced and taken forward for concept design.

Based on the Multi Criteria Analysis, recommendations for preferred approaches were developed for the Western Harbour Arm. Flood resistance and resilience measures as well as sustainable drainage systems (SuDS) approaches were also recommended.

The SPD urban design goals are key to sustainable regeneration of Shoreham Harbour – these include promoting permeability and linkages through and across sites and enhancing the waterfront. As Shoreham is a built-up urban area, the aim was to integrate flood defences into regeneration, rather than have them act as physical barriers. This links to development proposals highlighted in the PPG.

Section 9 of the SPD presents guiding principles for planning applications. As well as flood risk, these seek to minimise and mitigate loss of intertidal habitat and associated biodiversity and manage water quality associated with surface water runoff.

Benefits

The SPD will support the construction of development which will be safe for its lifetime and delivers higher levels of flood defence and mitigation within the regeneration area than currently exists. In this way it helped deliver a reduction in flood risk in this area.

Reproduced with kind permission from the Shoreham Harbour Regeneration Partnership.

14. Guidance on requirements for windfall sites

The site allocations within a local plan set out the sites where a LPA wishes to see development take place. However, there will be instances where other parties subsequently propose development (residential and non-residential) in additional areas, which are referred to as ‘windfall’ sites.

Windfall applications should be considered at the strategic level through a policy, underpinned by the sequential test to steer sites away from areas at risk of flooding. The acceptability of windfall applications in flood risk areas should be considered at the strategic level through a policy setting out broad locations and quantities of windfall development that would be acceptable or not in sequential test terms. In the event of there being no windfall policy, the Local Authority must apply the sequential test on a site-by-site basis. It may be possible for the Local Authority to apply the sequential test, taking into account reasonably available sites, historic windfall rates and their distribution across the authority area relative to Flood Zones or other sources of known risk.

In England, the PPG states that the sequential test needs to be applied to windfall sites. Although that can be done at the planning application stage, that approach can entail significant resource implications for LPAs and developers in assessing and agreeing on a case by case basis whether the proposed development is appropriate for the level of flood risk that is present. Evidence, from the SFRA, should be used to review, challenge and reject sites if necessary.

By ensuring a SFRA adequately considers the flood risk in additional areas to those proposed for development by the LPA, a more robust evidence base can be created for developers to use early in their consideration of where to locate development proposals, and for local authority development management officers to use in determining the suitability of windfall development applications.

The sequential test should be applied to windfall sites unless those sites have already been sequentially tested using the SFRA. Where the appropriate test has not been applied to a site, the developer will need to provide evidence to the LPA that they have adequately considered it against other reasonably available, lower risk sites, suitable for that type of development, e.g. housing.

Planning applications for development on windfall sites where the sequential test has been applied satisfactorily may also be subject to the exception test requirements.

Examples are provided below which have been assessed as “good practice” for developing approaches to windfall sites in SFRAs (Environment Agency research, 2021), and have links to where further information can be found.

Example: Setting an approach for applying the Sequential Test to windfall sites, Dover District Council

Description

As part of their SFRA Dover District Council has produced ‘Site-Specific Guidance for Managing Flood Risk’ to provide general advice and clear guidance for planners and developers on how to submit information relating to flood risk in support of planning applications. One of the objectives of the document is to provide a district wide risk map with clear accompanying guidance to enable both the sequential test and exception test to be applied.

The guidance defines four geographical search areas that should be used when applying the sequential test to windfall sites in the district and lists the source documents from which developers should find the comparator sites for the assessment.

The guidance then sets out the approach for how the comparator sites should be compared against one another with respect to flood risk, using 3 levels of assessment:

Level 1: Compare using Potential Risk of Flooding Map

This map has been created by the council by amalgamating the three Environment Agency datasets: ‘Flood Maps for Planning’ showing areas which could be affected by flooding from rivers or the sea, ‘Flood Risk from

Surface Water' and 'Flood Risk from Reservoirs'. These datasets are combined to show one zone across the district where there is potential risk of flooding.

Level 2: Compare using Environment Agency Flood Map

Using the matrix below, assess whether any of the comparator sites are at lower flood risk than the application site based on Environment Agency's online mapping.

GUIDANCE: For each comparator site, fill out the matrix below, which shows the combined risk of flooding based on mapping hosted by the EA;

- 'Flood Map for Planning' – <https://flood-map-for-planning.service.gov.uk/>
- 'Flood Risk from Surface Water' – <https://flood-warning-information.service.gov.uk/long-term-flood-risk/>

		EA's 'Flood Risk from Surface Water' map		
		Very low	Low risk	Medium – high risk
EA's 'Flood Map for Planning'	FZ1	Green	Orange	Red
	FZ2	Orange	Orange	Red
	FZ3	Red	Red	Red

Table 2.2 – Comparison of sites using EA's 'Flood Map for Planning' and 'Flood Risk from Surface Water'

ANSWER: No - Both the application site and all comparator sites are located entirely in a red box. The sequential test is passed. Alternatively, both the application site and all comparator sites are located entirely in an orange box. The sequential test is passed.

ANSWER: Yes – The application site is located in a red box, but any of the comparator sites are located in an orange box. The sequential test is failed.

Level 3: Compare using modelled flood level

The risk of flooding can be further interrogated to determine whether any of the comparator sites are at a lower risk of flooding than the application site. In addition to the Environment Agency's RoFSW mapping, modelled flood levels for flooding from rivers and the sea can be requested from the Environment Agency (Product 4 data request).

Benefits

The methodology has been set out by Dover District Council for applicants to follow. The methodology incorporated a range of flood sources, rather than solely flood zones associated with the risk of flooding from rivers and/or the sea.

Reproduced with kind permission from Dover District Council.

Example: Preventing windfall development in flood risk areas, Sheffield City Council

Description

Policy CS67 in the Core Strategy for Sheffield City Council sets out the requirements for flood risk management over the plan period to 2026. As the council had identified sufficient sites for housing until 2016/2017, the flood risk management policy included a clause that housing in areas with a high probability of flooding would not be permitted before 2016/2017. This means that sites not having a current planning permission in the highest risk areas, specified by the council could only be considered for housing development from 2016/2017, and then only subject to adequate safeguards being ensured.

Benefits

Policy CS67 effectively applied the sequential test to potential residential development sites that come forward as windfall sites in these highest risk areas.

Reproduced with kind permission from Sheffield City Council.

15. Safely managing residual risk

Once the steps of assess, avoid, and reduce flood risk have been taken, the residual risk of flooding needs to be mitigated and safely managed within tolerable or acceptable thresholds (as deemed by the LPA).

After the sequential test has been applied, development may still need to go ahead in areas at risk of flooding although the sequential approach should be applied to ensure more vulnerable uses are directed to areas of a site with lowest risk. In these cases, it needs to be demonstrated that the development can be made safe throughout its lifetime without increasing flood risk elsewhere, in addition to being appropriately flood resistant and recoverable. It also needs to be demonstrated that residual risks can be safely managed over the development's lifetime.

The need to design a development to safely manage any residual risk of flooding equally applies to areas of lower flood risk, where housing may be allocated for example, as it does to areas of high risk.

The approach to safely managing residual flood risk will vary depending on the source of flooding and the local characteristics of the risk (e.g. depth of flooding, velocity of floodwater, rate of onset, warning periods – refer also to [Good Practice 5: Taking account of specific local flooding characteristics](#)) as well as the type of development and the vulnerability of the occupants. It will need to be considered by the LPA, based on the local context and in close consultation with the local authority emergency planning team, the Environment Agency and LLFA and defined in the SFRA. They may draw on the technical research report [Flood Risk Assessment Guidance for New Development FD2320](#) which provides the current advice on the topic. A site specific Flood Risk Assessment setting out this approach also needs to be undertaken by the development to support a development proposal, separate to the SFRA and local plan process.

For flood risk management and mitigation to be effective, emergency planning authorities need to be involved early on in the SFRA, particularly if development in areas at flood risk cannot be avoided. The emergency planning authorities can advise on managing community safety, planning for incidents and evacuations, appropriate access/escape routes, impact on blue light services, and providing for business continuity.

Where strategic issues affecting emergency services are identified in the SFRA, it may also be relevant to contact the local resilience forum (LRF) which co-ordinates preparation for local incidents and catastrophic emergencies through its multi-agency flood plan. Further information on this can be found in guidance on [Flood Risk Emergency Plans for New Development](#) (ADEPT and the Environment Agency, 2019).

The following provides an indication of the type of issues that should be discussed and agreed between the emergency planning authorities and development management teams:

- minimum floor levels for sleeping accommodation, relevant to anticipated flood extents and depths (hazard) on site
- requirements for safe refuge
- requirements for the provision of safe access/escape, this should consider land within and outside the red line
- production of emergency plans, evacuation plans and flood warning plans
- production of local guidance and local consultation arrangements
- flood response and emergency service infrastructure capacity issues
- resilient and resistant methods of construction, materials and design
- prohibited use of ground floor or basement dwellings in areas of increased risk

Examples are provided below which have been assessed as “good practice” for safely managing residual risk in SFRAs (Environment Agency research, 2021), and have links to where further information can be found.

Example: Evacuation procedures, Hull City Council

See: [Evacuation procedures, Hull City Council in Good Practice 5](#)

Example: Setting clear requirements safe development and emergency planning, Southampton City Council

Description

The Southampton Coastal Flood and Erosion Risk Management Strategy is a non-statutory document that was finalised in 2013, with a focus on long term management of the 22km of stretch of the city's coastline spanning from Woodmill to Redbridge. Preferred options were selected for managing sea flood risk in each sub area along the coastline, and when implementation is likely to be required in order to reduce sea flooding to people and property.

The Level 2 SFRA, published for Southampton City Council in May 2017, provides information on the flood risk in Southampton, and acts as a technical evidence base to inform how the options set out in the strategy can be delivered. The aim is to view new development as a process which provides opportunities for betterment and improvement, rather than a negative process that requires mitigating. This is achieved in the following ways:

- The SFRA is a technical evidence base to inform the development of local policies in Southampton.
- The SFRA sets out requirements for how new development should contribute to successful sea flood risk management at the site level, and the strategic level. This might be through safeguarded land for future raising, financial contributions to provide flood defences or raise land.
- The SFRA sets out requirements regarding 'safe development' for each type of development, as shown in extract below. This provides expectations regarding building design, finished floor levels, access arrangements and production of emergency flood plans.

Finished floor levels of single storey buildings must be a minimum of 300mm above design flood event level.

Internal services capable of operation during design flood event.

Multi-storey buildings to have habitable rooms a minimum of 300mm above design flood event level.

Where ground floor of multi storey buildings flood, flood hazard should be classified as 'low' and resilience and resistance techniques should be adopted in design.

All site users to be placed on **Environment Agency Flood Warning Register** (Flood Warning Direct).

All site users to receive a **Site Flood Plan** from developers identifying, as a minimum, the risk of flooding, how this is being managed on site, actions site users should take in the event of a flood and appropriate emergency contact details.

More Vulnerable

Development Safe from Flooding				
Development		Site Specific Flood Risk Management		Residual Flood Risk Management
Flooding within Design Flood Event		Within Extreme Design Flood Event		
Access Requirements	Site Design Requirements	Safe Access Requirements	Site Design Requirements	Emergency Response Requirements
Access is afforded 'dry' by virtue of the defence, or where possible, routes should be sought to levels above breach flood - unless hydraulic modelling results (accepted by the Council and LA) indicate that the depths are lower than indicated in the SFRA.	The site should remain operational and safe for use. The safety will be dependent upon the particular function of the essential infrastructure and should be agreed with the Environment Agency.	Prepare a site flood plan, in consultation with SCC emergency planners, local resilience forum, and with reference to the Multi Agency Flood Plan. Emergency services must be afforded access in extreme flood events. As a guide, flood depths to provide emergency access should not exceed 0.9m where velocities remain low, however the emergency services should be consulted in preparing development proposals.	The site should remain operational and safe for use. The safety will be dependent upon the particular function of the essential infrastructure and should be agreed with the Environment Agency.	Emergency services must be afforded access in extreme flood events. As a guide, flood depths to provide emergency access should not exceed 0.9m where velocities remain low, however the emergency services should be consulted in preparing development proposals.
In this area, based on Flood Zone compatibility.		Finished floor levels/entrance levels of permanent buildings should be set to a minimum of 300mm above design flood levels. Mobile homes or caravans intended for permanent occupancy must be located on ground a minimum of 300mm above design flood level.		
Access is afforded 'dry' by virtue of the defence, or where possible, routes should be sought to levels above breach flood - unless hydraulic modelling (approved by the Council and LA) indicate that the depths are lower than indicated in the SFRA.		Unaided safe access and egress through the site and out of the floodplain must be available. Where 'dry' access is not available, flood hazard on access routes out of the floodplain should remain 'low' (e.g. flood depth should not exceed 250mm where velocities are low). Where necessary, access routes should be signposted, and all site users made aware of 'safe access' routes. A suitable Site Flood Plan should be developed prior to occupation.	Finished floor levels/entrance levels of single storey buildings can be subject to 'low' hazard from extreme flood events. If 'safe' access is available out of the floodplain during an extreme event. Where development includes ground floor habitable rooms, finished floor levels/entrance levels must be set a minimum of 300mm above design flood levels to prevent water ingress. Where possible, multi-storey buildings should locate habitable rooms a minimum of 300mm above design flood levels. Where this is not possible, they should be classified as single storey buildings.	Where ground floor of multi-storey buildings flood, access must be available to upper storeys (safe refuge), including for those with restricted mobility. Emergency services must be afforded access in extreme flood events. As a guide, flood depths to provide emergency access should not exceed 0.9m where velocities remain low, however the emergency services should be consulted in preparing development proposals. A suitable Site Flood Plan should be developed prior to occupation.

Southampton Level 2 SFRA

Page | 75

(Level 2 SFRA, Table 14 Safety Matrix – Making New Development Safe from Flooding, page 75).

Benefits

Applicants can access information on what will be considered safe development in the city. The SFRA facilitates early consideration of safe design and emergency planning measures for new development. Guidance is available for developers on how new development can be delivered in ways consistent with the wider strategy whilst safeguarding land needed for future flood risk management measures.

Reproduced with kind permission from Southampton City Council.

16. Using the SFRA to inform plans and strategies

Completing the SFRA document, or indeed any other flood risk management document or plan, is not an end in itself. It is vital that the findings of these documents are applied by LPA officers and relevant risk management authorities to inform subsequent plans and strategies to inform how risk of flooding is managed and to create sustainable communities.

Using the SFRA for spatial planning and development management

The SFRA will help the planning authority make decisions about:

- The [local plan](#) or spatial development strategy, informing strategic and site specific policies, and the allocation of sites for development
- individual planning applications
- how to adapt to climate change
- future flood management
- emergency planning (the resources needed to make development safe)
- further modelling or assessment requirements to support planning proposals and Flood Risk Assessments

It will also be used to:

- carry out the [sequential test](#) for the local plan or spatial development strategy, and individual planning applications (windfall sites)
- apply the [exception test](#), where the SFRA proposed to allocate land for development in flood risk areas, and individual planning applications (windfall sites)
- establish if a development can be made safe without increasing flood risk elsewhere
- decide when a flood risk assessment will be needed for individual planning applications
- identify if proposed development is in functional floodplain
- do the sustainability appraisal of the local plan or spatial development strategy
- determine how a site may contribute to betterment or strategic flood risk management at the catchment scale

Flood risk management related plans and strategies

The SFRA can be used by relevant risk management authorities to inform a range of flood risk management plans and strategies, including:

- Surface water management plans (lead local flood authorities)
- Drainage and wastewater management plans (water and sewerage companies)
- Shoreline management plans (coastal protection authorities)
- River basin management plans (Environment Agency)
- Local, regional or catchment-level flood risk management strategies (all RMAs)
- Individual flood risk management schemes (all RMAs)
- Inform updates to the local flood risk management strategies (lead local flood authorities)

The flood risk information and resulting recommendations within these documents should be used to inform land assessment studies, future development allocations, development management policies, emergency plans, planning obligations (including Community Infrastructure Levy, Section 106 or Section 278 Agreements, etc.), and future relocation planning.

Green and blue infrastructure related plans and strategies

It is important that the findings from flood risk evidence base documents are used appropriately to inform meaningful planning policies and other plans and strategies being produced by the LPA and other organisations. One of the core local government activities is to undertake and co-ordinate projects and activities in such a way as to deliver multiple wider benefits. Through careful planning, activities to manage flood risk may be incorporated into other strategic plans and projects to deliver benefits in other areas, such as improving health and wellbeing, local economy, skills and employment, reducing emissions and supporting biodiversity. The East Solent Coastal Partnership is one example of where this is happening in practice (<https://www.ice.org.uk/ICEDevelopmentWebPortal/media/Documents/Events/Conferences/Mark-Stratton-Broader-Outcomes-and-Place-Shaping.pdf>).

In addition to local plans and neighbourhood plans, the SFRA could support other strategies/plans, particularly those that include green and blue infrastructure policies, such as:

- Infrastructure delivery plan
- Capital strategy
- Local transport plans (produced by county councils / unitary authorities)
- Local industrial strategies
- Local enterprise partnership strategic economic plans
- Green infrastructure/open space strategies
- Planning obligation supplementary planning documents
- Statements of common ground (supporting the Duty to Cooperate in England)
- Local nature recovery strategies
- Design guides.

These plans and strategies should complement the findings of the SFRA, as well as wider policies set out in local flood risk management plans and the national flood and coastal erosion risk management strategy (Environment Agency, 2020).

Examples are provided below which have been assessed as “good practice” for using the SFRA to inform local plans and achieve wider outcomes (Environment Agency research, 2021), and have links to where further information can be found.

Example: Using the outputs of the SFRA to inform policies, Cornwall Council Local Plan Policy

Description

A Level 1 SFRA for Cornwall was produced in 2008-2009 with input from Cornwall County Council (now Cornwall Council) (Strategic Policy, Hydrology, Natural Resources, Highways and Emergency Management), district councils, the Environment Agency and South West Water. It was developed to support the Core Strategy at that time, which was later replaced by the local plan.

The findings of the SFRA were used to develop specific local policy, specifically Policy 26 in the local plan on flood risk management and coastal change. In particular policy 26 strives to achieve overall reduction in flood risk and increase in flood resilience. There is also an emphasis within the policy to support community-led local solutions to managing flood risk and coastal change. The policy is set out below:

Policy 26 Flood risk management and coastal change

1. Development should take account of, and be consistent with, any adopted strategic and local flood and coastal management strategies including the Shoreline Management Plan and Catchment Flood Management Plans for Cornwall and the South West River Basin Plan.
2. Development should be sited, designed, of a type and where necessary relocated in a manner that;
 - a. increases flood resilience of the area taking account of the area's vulnerability to the impacts of climate change and coastal change and the need to avoid areas of flood risk, in the first instance, taking into account the vulnerability of the use proposed; and
 - b. minimises or reduces and where possible eliminates flood risk on site and in the area; and
 - c. enables or replicates natural water flows and decreases surface water runoff, particularly in Critical Drainage Areas, through SuDS, utilising green infrastructure where possible and as guided by local standards, including Cornwall drainage guidance; and
 - d. the safeguarding of land, where it is identified to be fictional flood storage, to make space for water at times of flood; and
 - e. where applicable, supports community-led local solutions to managing flood risk and coastal change; and
 - f. does not create avoidable future liability for maintenance for public bodies and communities.
3. Development proposals of 10 dwellings or more or over 0.5 ha should provide a long-term water management plan, which includes maintenance of surface water drainage systems, measures to improve the network of surface water drainage systems on and around the site (e.g. culverts etc.) and identifies opportunities for future enhancement.

Benefits

The findings of the SFRA were used to directly influence a local policy for the area.

Reproduced with kind permission from Cornwall Council.

Example: Using outputs to inform other plans and strategies, Worcestershire Minerals Local Plan, Worcestershire County Council

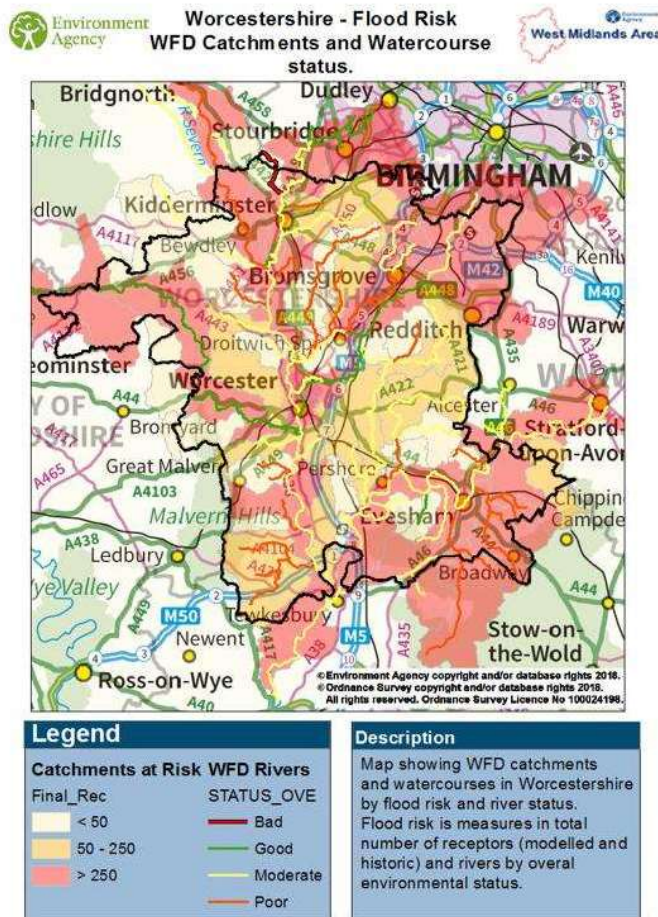
Description

A key driver of the Worcestershire Minerals Local Plan was to consider the potential for mineral development in the county to have a positive influence on green infrastructure.

A 'Technical Background Document - Catchment based management in Worcestershire' was prepared by Worcestershire County Council and Environment Agency West Midlands area in June 2018. The document combined datasets on flood risk, water quality and river morphology pressures and overlaid this information onto river catchment boundaries. This enabled greater understanding of the green infrastructure potential of

various locations, based on the evidence of flood risk and water quality within each river catchment. A

Figure 5. Flood risk and WFD watercourse status



Extract from Technical Background Document.

Benefits

Data on problems associated with flood risk, water quality and river morphology could be effectively combined and the potential for assessing appropriate green infrastructure solutions on a catchment wide basis.

Reproduced with kind permission from Worcestershire County Council.

a mapping tool for Worcestershire was produced, which brought together an assessment of multiple datasets into a single catchment-based approach. This enabled effective evidence-based flood risk management infrastructure and Water Framework Directive measures to be targeted. The overarching aims were:

- For all new developments to prevent a deterioration in any Water Framework Directive status, improve resilience to flooding and deliver a reduction in overall flood risk, wherever possible.
- To use the mapping tool to embed a catchment-based approach in which the targeted delivery of flood risk management infrastructure and Water Framework Directive measures are appropriate in both scale and location to the proposed development.
- To use a catchment-based approach to provide multifunctional green infrastructure benefits.
- To use the evidence as a basis for encouraging proactive engagement between developers and both the county council, as the lead local flood authority, and the Environment Agency, to identify and assist the appropriate delivery of multifunctional flood risk management infrastructure to achieve betterment.

Example: Using outputs to inform other plans and strategies, Southampton Coastal Flood and Erosion Risk Management Strategy, Southampton City Council

Description

The Southampton Coastal Flood and Erosion Risk Management Strategy is a non-statutory document that was finalised in 2013, with a focus on long term management of the 22 km of stretch of the city's coastline spanning from Woodmill to Redbridge. Preferred options were selected for managing sea flood risk in each sub area along the coastline, and when implementation is likely to be required in the future in order to reduce coastal flooding to people and property.

The Level 2 SFRA for Southampton City Council, prepared in 2017, sets out how the options in the strategy can be delivered. The findings from the Level 2 SFRA were used by LPA Officers to inform future planning in the City; LPA Officers led changes to planning policies as well as development management requirements. LPA Officers viewed new developments as opportunities for betterment and improvement, rather than a negative process that requires mitigating. This was achieved in the following ways:

- Planning Officers used the SFRA to inform the development of local policies in Southampton.
- Clear requirements for how new development should contribute to successful flood risk management at the site level, and the strategic level, were set out in the SFRA for example, through safeguarding land for future flood defences.
- Clear requirements regarding 'safe development' for each type of development were provided in the SFRA, regarding building design, finished floor levels, access arrangements and production of emergency flood plans.

Benefits

The SFRA provided a review of the flood risk in the area and the existing strategy for managing that risk into the future. Through careful use of this information by LPA Officers, the SFRA was used to inform spatial planning policies and decisions that support new development. Guidance is available for developers on how new development can be delivered in ways consistent with the wider strategy whilst safeguarding land needed for future flood risk management measures. The SFRA also facilitates early consideration of safe design and emergency planning measures for new development.

Reproduced with kind permission from Southampton City Council.

Glossary

ADEPT	Association of directors of environment, economy, planning and transport
CIWEM	Chartered institution of water and environmental management
CCMA	Coastal change management area
FCERM	Flood and coastal erosion risk management
FRA	Flood risk assessment
GIS	Geographical information system
ICM	Integrated catchment model
LFRMS	Local flood risk management strategy
LLFA	Lead local flood authority
LPA	Local planning authority
NPPF	National planning policy framework
PPG	Planning practice guidance
RMA	Risk management authority
RoFSW	Risk of flooding from surface water (maps)
SFRA	Strategic flood risk assessment
SPD	Supplementary planning document
SuDS	Sustainable drainage systems
SWFZ	Surface water flood zone
SWMP	Surface water management plan

Acknowledgements

This study was completed with funding from the joint Environment Agency/Defra Research Programme. The project was completed under contract order number 1070076395 for the Environment Agency (2018-2019). The supporting evidence is published in '[FRS18204 Using flood risk information in spatial planning](#)' (2021).

We would like to thank the following groups for their contributions to the guidance:

- The AECOM contractor team
- The Environment Agency project team and planning leads
- The councils who have allowed reproduction of their work as case studies
- ADEPT
- CIWEM
- Association of Drainage Authorities
- Town and Country Planning Association
- Anglian Water
- Havant Council
- Geoff Gibbs (retired flood risk practitioner)