

Appendix A2 Guidance on Mitigation Measures

A.2.1 Meeting Part C of the Exception Test

Where allocations remain in high risk Flood Zone 3, following the sequential test and part a and b of the exception test, the development still needs to meet part c of the exception test:

A FRA must demonstrate that the development will be safe, without increasing flood risk elsewhere, and, where possible, will reduce flood risk overall.

A.2.1.1 Safe access and egress

The requirements to ensure a development is 'safe' are outlined in appendix A.2.4.2.

A.2.1.2 Avoid increasing flood risk elsewhere

Developers should aim to achieve greenfield run off from their site through incorporating rainwater harvesting and sustainable drainage. Borough should encourage the retention of soft landscaping in front gardens and other means of reducing, or at least not increasing, the amount of hard standing associated with existing homes.

Sustainable drainage techniques will be one of the keys to ensuring that long-term flooding risk is managed, particularly given the extent of hard surfaced area in London. The Mayor believes that managing London's surface water and combined sewer flooding/overflows should start with source control management - improving the permeability of the public realm through the incorporation of rainwater harvesting and sustainable drainage - before proceeding to enhanced drainage capacity. These techniques include permeable surfaces, storage on site, green roofs, infiltration techniques and even water butts. Many of these techniques also have benefits for biodiversity by creating habitat, and some can help to reduce the demand for supplied water (see also London Plan Policy 4A.11 Living roofs and walls).

To avoid increasing flood risk elsewhere developments will need to meet the following drainage requirements:

- Developers should aim to achieve greenfield run off from their site through the application of the application of the London Plan drainage hierarchy (see Sections 3.3 and 3.4)
- Use of sustainable drainage systems (SuDS) (see section A.3)
- Flow paths for surface water runoff that exceeds drainage capacities and breach flows are not disrupted.
- Defended Floodplain storage capacity was not reduced, and where necessary compensated for on a level for level basis outside of the floodplain.
- If the site is adjacent to the river and defences, building works throughout the course of development should not increase the risk of the defences breaching.

A.2.1.3 Overall reduction in flood risk

For developments to reduce flood risk overall, they would need to make sure that:

- The site is designed sequentially (see appendix A.2.2).
- Flood resilience and mitigation measures are provided in response to identified flood risk (see Sections A.2.3 and A.2.4)
- Where appropriate, floor levels are raised 300mm above the 1 in 100 year climate change flood level (see appendix A.2.4.1).
- Adequate flood warnings and evacuation plans are in place (A.2.4.3)
- Where appropriate scheme layout and design contribute towards the strengthening of flood defences

A.2.2 Mitigation through Sequential Design

Flood risk should be considered at an early stage in deciding the layout and design of a site to provide an opportunity to reduce flood risk within the development. Future developments may take place in any of the three Flood Zones. Most large development proposals include a variety of land uses of varying vulnerability to flooding.

The NPPF Technical Guide states that a sequential, risk-based approach should be applied to try to locate more vulnerable land use to higher ground, while more flood-compatible development (e.g. parking, recreational space) can be located in more high risk areas.

A.2.3 Mitigation against Surface and Sewer Flooding

Following the intense rain storm on the 20th July 2007 when RBKC suffered notable flooding. It is evident that flood risk from sewers and surface water is a major issue in the Borough. Current climate change predictions suggest that this type of intense rain storm is likely to become more frequent. The data provided by the councils about the 20th July event highlighted that the main problem was basements becoming flooded. Thames Water are responsible for the sewer network (the majority being combined sewer in this area) and have a program to reduce sewer flooding within the Borough. The sewer network cannot accommodate the more extreme rainfall events, consequently sewer and surface water flooding can occur. To mitigate against the effects of flooding from these extreme events the homeowner/developer can install permanent and temporary flood proofing measures.

A.2.3.1 Flood Resistance Measures

Flood resistant construction can prevent or minimise the entry of water to a building when there is flooding outside.

Temporary Flood Barriers are moveable flood defences which can be fitted into doorways and/or windows. The permanent fixings required to install these temporary defences should be discrete and keep architectural impact to a minimum, especially with much of the Borough being conservation areas. On a smaller scale temporary snap on covers for airbricks and air vents can also be fitted to prevent the entrance of flood water. Temporary flood barriers do require property occupiers to pre-empt a flood event. Flooding from the sewerage systems in the Borough is primarily flash-flooding as a result of short duration, intense rainfall. With short lead times and no flood warning system in place for the sewerage systems, there are limitations to the value of temporary flood barriers to prevent property flooding from surface water or sewer flooding. The Environment Agency provides a list of manufacturers, with the Kitemark, of temporary defences on their website www.environment-agency.gov.uk/floodline

Permanent Flood Barriers can include built up doorsteps, rendered brick walls and toughened glass barriers. The clear flood barrier is visually unobtrusive so as to not detract from the character of the area. Such clear flood barrier can also be installed behind railings. They would still need approval from the council's conservation officer.

Resistance to Sewer Flooding

Non-return valves prevent water entering the property from drains and sewers. Non-return valves can be installed within gravity sewers or drains, within the property's private sewer upstream of the public sewerage system. These need to be carefully installed and must be regularly maintained. The CIRIA publication, 'Low cost options for prevention of flooding from sewers', provides further information.

Manhole covers within the property's grounds could be sealed to prevent surcharging. However, in densely urbanised areas of flat topography, sealing covers may simply move the flooding to adjacent properties. This option should only be considered following an assessment of the likely consequences during a sewer surcharge event.

Pumped Drainage: Some low-lying properties or basements may not be able to discharge by gravity to the foul/combined sewerage systems, and a pumped installation will be required. Even where a gravity discharge is possible, a pumped discharge can be installed if there is a risk of property flooding due to sewer surcharge. This is particularly true for basements. In some parts of the Borough, basement floor levels are below the soffit level of the public sewer. Advice should be sought from the Borough's Building Control officers and Thames Water Developer Services (Developer.Services@thameswater.co.uk or 0845 850 2777).

A.2.3.2 Flood Resilience Measures

Flood resilience reduces the consequences of flooding and increases the ability of people or buildings affected to recover from flooding.

When developing basements or property with a risk of flooding from other sources the following should be considered to make the building resilient to flooding:

New electrical circuitry installed higher level with power cables being carried down from the ceiling not up from the floor level.

Water-resistant materials for floors, walls and fixtures. Resilience measures will be specific to the nature of flood risk, and as such will be informed and determined by the FRA.

The 2007 Communities and Local Government document 'Improving the Flood performance of New Buildings - Flood Resilient Construction' provides further details on resilience measures.

A.2.4 Mitigation against Residual Risks

The residual risks posed to the Borough as a consequence of the Thames flood defence walls breaching require a different mitigation approach to that of surface and sewer flooding.

A.2.4.1 Raising Floor Levels

The raising of floor levels within a new development avoids damage occurring to the interior, furnishings and electrics in time of flood. Ideally floor levels should be raised to a height of 300mm above the water level occurring as a result of a flood defence breach during the 1 in 200 year plus climate change event (the event with a 0.5% chance of occurring each year plus a 20% increase for climate change). This 300mm height that the floor level is raised is referred to as the 'freeboard'.

It is however recognised that it may not be practical or economic to raise floor levels to a height that would avoid property damage, particularly for extensions and infill development, or for developments which require disabled access. Although the consequences of a breach would be severe the chances of a breach happening is low, compared to sewer or surface water flooding. Other mitigation measures may therefore need to be considered, particularly measures that would allow for the safe evacuation of the occupants of the property.

A.2.4.2 Safe Access and Egress

Safe access/egress in a flood event will minimise the impact upon the emergency services in the event of an evacuation. 'Safe' will be a function of depth and velocity of water surrounding the development and along access/egress routes, and also the time it takes for the flood to reach the site relative to the time it would take to evacuate the site. These details would be calculated as part of the site specific assessment (section A.1.1.1).

'Safe' access should remain dry for residential developments and 'more' and 'highly vulnerable' uses and should preferably be dry for other uses such as educational establishments and 'less vulnerable' land use classifications. Dry escape for residential dwellings should be available in the instance of a flood defence breach during the 1 in 200 year event (the event with a 0.5% chance of occurring each year) taking into account climate change.

Developments at Residual Flood Risk from failure of the Thames Tidal Defences will have to demonstrate that:

- 'Safe' access includes ability to escape to higher levels without having to pass through flood waters.
- A robust Flood Warning Plan is developed.
- For major highly vulnerable development and essential infrastructure, safety will also need to be ensured through demonstration that a robust evacuation plan to dry land is developed.

The developer will be asked (if this is not already included in the FRA) to review the acceptability of the proposed access using the 'Flood Risk to People' FD 2320 calculator. In this instance it needs to be demonstrated that depths and velocities of flood water will be acceptable to the 'risks to some' category of this calculator.

A.2.4.3 Flood Warning and Evacuation

NPPF recommends that warning and evacuation arrangements should be in place for managing residual flood risks to developments behind river and coastal flood defences. All homes and businesses within Flood Zone 2 and 3 are eligible for the Environment Agency's Floodline Warnings Direct (FWD) service, and should be encouraged to sign up to it. However, currently in the SFRA area FWD is primarily used to alert the occupiers of properties with moveable dams to impending conditions. At present FWD is unlikely to have information of a breach in the flood defences until some while after it has occurred. Information on the availability of FWD can be obtained from the local Environment Agency office.

Safe access and egress for evacuation and the emergency services is required for any new development in high and medium residual risk zones (see Section A.2.4.2). Safe dry access/egress in a flood event will minimise the impact upon the emergency services in the event of an evacuation.

Where significant new population is being added to a residual flood risk area formal consultation with the council's Contingency Planning team is required. Emergency/evacuation plans should be in place for all properties, large and small, at residual risk of flooding; those developments which house vulnerable people (i.e. care homes and schools) will require more detailed plans. Advice should be sought from the council's Contingency Planning Team when producing an emergency/evacuation plan for developments as part of an FRA. Detailed emergency/evacuation plans for developments should undertake consultation not only with the Council's Contingency Planning team but also the Emergency Services so they know what is expected of them in the event of an emergency.

The Local Authority is designated a category 1 responder under the Civil Contingencies Act 2004. In an event of an emergency coordination with the other category 1 responders (including the emergency services and the Environment Agency) is essential to guarantee the safety of residents. It is recommended that the Royal Borough of Kensington and Chelsea review their Emergency Plan with respect to flooding, in light of the details provided in the SFRA.

