

Appendix 16 Strategic Flood Risk Assessment

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Dún Laoghaire-Rathdown Strategic Flood Risk Assessment

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UNCERTAINTY

Although great care and modern, widely accepted methods have been used in the preparation of this assessment there is inevitably a range of inherent uncertainties and assumptions made during the estimation of design flows and the construction of flood models.

BEST AVAILABLE INFORMATION

There has been a wide range of datasets utilised in the production of this plan which are constantly changing and subsequently the analysis of these datasets is only correct at the time of assessment. The assessment is based on the maps available in September 2020 (which includes Eastern CFRAM maps and the Dundrum Slang ICM maps 2020). It is acknowledged that new methodologies and/or recently recorded data could have a minor impact on the analysis undertaken herein.

This SFRA covers the entire County excluding Cherrywood Planning Scheme.

1 Background

1.1 Introduction

Flood Risk is defined as *“the damage that may be expected to occur at a given location arising from flooding. It is a combination of the likelihood, or probability, of flood occurrence, the degree of flooding and the impacts or damage that the flooding would cause”* (OPW, 2014).

One of the key messages of “The Planning System and Flood Risk Management, Guidelines for Planning Authorities”¹ (the Planning Guidelines) is that *“Flood risk management should be integrated into spatial planning at all levels to enhance certainty and clarity in the overall planning process”*. The purpose of this Strategic Flood Risk Assessment (SFRA) is to provide sufficient information to allow proper planning decisions to be made on sites at risk of flooding over the lifetime of the County Development Plan 2022 – 2028.

1.2 SFRA Structure

A two-stage assessment of flood risk was undertaken, as recommended in the Planning Guidelines, for the area that lies within the County Development Plan area. The first stage was to identify flood risk and develop Flood Zone maps which confirmed that a proportion of zoned lands are at flood risk. The second stage and the main purpose of this SFRA report is to highlight development areas that require more detailed assessment on a site-specific level. The SFRA also provides guidelines for development within areas at potential risk of flooding, and specifically looks at flood risk and the potential for development across the County.

Section 2 of this SFRA gives an overview of the Planning Guidelines. Section 3 provides a background to flood risk in Dún Laoghaire-Rathdown, including a review of available flood risk information and a summary of sources of flooding. In Section 4 an overview of flood management policy has been provided. This includes details of development which may be considered appropriate in certain areas and the expected content of site specific FRAs (SSFRA). Having established the planning and development controls, the Justification Test for plan making has been applied across Dún Laoghaire-Rathdown and the outcome of this assessment is provided in Section 5. This section also provides specific requirements for SSFRA at key sites. Finally, in Section 6 a summary of the triggers for monitoring and review of the SFRA is provided.

¹ Department of Environment, Heritage and Local Government (2009), “The Planning System and Flood Risk Management, Guidelines for Planning Authorities”

2 The Planning System and Flood Risk Management

2.1 Introduction

Before discussing the management of flood risk, it is helpful to understand what is meant by the term. It is also important to define the components of flood risk in order to apply the principles of the Planning Guidelines in a consistent manner.

The Planning Guidelines describe flooding as a process that can occur at any time and in a wide variety of locations. Flooding can often be beneficial, and many habitats rely on periodic inundation. However, when flooding interacts with human development, it can threaten people, their property and the environment.

The following paragraphs outline the definitions of flood risk and the Flood Zones used as a planning tool; a discussion of the principles of the Planning Guidelines and the management of flood risk in the planning system follows.

2.2 Definition of Flood Risk

Flood risk is generally accepted to be a combination of the likelihood (or probability) of flooding and the potential consequences arising. Flood risk can be expressed in terms of the following relationship:

$$\text{Flood Risk} = \text{Probability of Flooding} \times \text{Consequences of Flooding}$$

The assessment of flood risk requires an understanding of the sources, the flow path of floodwater and the people and property that can be affected.

Principal sources of flooding are rainfall or higher than normal sea levels while the most common pathways are rivers, drains, sewers, overland flow and river and coastal floodplains and their defence assets. Receptors can include people, their property and the environment. All three elements must be present for flood risk to arise. Mitigation measures, such as defences or flood resilient construction, have little or no effect on sources of flooding but they can block or impede pathways or remove receptors.

The planning process is primarily concerned with the location of receptors, taking appropriate account of potential sources and pathways that might put those receptors at risk.

2.2.1 Likelihood of Flooding

Likelihood or probability of flooding or a particular flood event is classified by its annual exceedance probability (AEP) or return period (in years). A 1% AEP flood indicates the flood event that will occur or be exceeded on average once every 100 years and has a 1 in 100 chance of occurring in any given year.

Return period is often misunderstood to be the period between large flood events rather than an average recurrence interval. Annual exceedance probability is the inverse of return period as shown in Table 2-1.

Table 2-1: Probability of Flooding

Return Period (Years)	Annual Exceedance Probability (%)
2	50
100	1
200	0.5
1000	0.1

Considered over the lifetime of development, an apparently low-frequency or rare flood has a significant probability of occurring. For example, a flood with a 1% AEP (1 in 100 year) has a 22% (1 in 5) chance of occurring at least once in a 25-year period, which is the period of a typical

residential mortgage, and a 53% (1 in 2) chance of occurring in a 75-year period, which is a typical human lifetime.

2.2.2 Consequences of Flooding

Consequences of flooding depend on the hazards caused by flooding (depth of water, speed of flow, rate of onset, duration, wave-action effects, water quality) and the vulnerability of receptors (type of development, nature, e.g. age-structure, of the population, presence and reliability of mitigation measures etc).

The Planning Guidelines provide three vulnerability categories, based on the type of development, which are detailed in Table 3.1 of the Guidelines, and shown in Table 2-2 below.

Table 2-2: Classification of vulnerability of different types of development

Vulnerability Class	Land uses and types of development which include*:
Highly vulnerable development (including essential infrastructure)	Garda, ambulance and fire stations and command centres required to be operational during flooding; Hospitals; Emergency access and egress points; Schools; Dwelling houses, student halls of residence and hostels; Residential institutions such as residential care homes, children’s homes and social services homes; Caravans and mobile home parks; Dwelling houses designed, constructed or adapted for the elderly or, other people with impaired mobility; and Essential infrastructure, such as primary transport and utilities distribution, including electricity generating power stations and sub-stations, water and sewage treatment, and potential significant sources of pollution (SEVESO sites, IPPC sites, etc.) in the event of flooding.
Less vulnerable development	Buildings used for: retail, leisure, warehousing, commercial, industrial and non-residential institutions; Land and buildings used for holiday or short-let caravans and camping, subject to specific warning and evacuation plans; Land and buildings used for agriculture and forestry; Waste treatment (except landfill and hazardous waste); Mineral working and processing; and Local transport infrastructure.
Water compatible development	Flood control infrastructure; Docks, marinas and wharves; Navigation facilities; Ship building, repairing and dismantling, dockside fish processing and refrigeration and compatible activities requiring a waterside location; Water-based recreation and tourism (excluding sleeping accommodation); Lifeguard and coastguard stations; Amenity open space, outdoor sports and recreation and essential facilities such as changing rooms; and Essential ancillary sleeping or residential accommodation for staff required by uses in this category (subject to a specific warning and evacuation plan).
*Uses not listed here should be considered on their own merit	

2.3 Definition of Flood Zones

In the Planning Guidelines Flood Zones are used to indicate the likelihood of a flood occurring. These Zones indicate a high, moderate or low risk of flooding from fluvial or tidal sources and are defined below in Table 2-3.

It is important to note that the definition of the Flood Zones is based on an **undefended scenario** and does not take into account the presence of flood protection structures such as flood walls or embankments. This is to allow for the fact that there is a residual risk of flooding behind the defences due to overtopping or breach and that there may be no guarantee that the defences will be maintained in perpetuity.

It is also important to note that the Flood Zones indicate flooding from fluvial and tidal sources and do not take other sources, such as groundwater or pluvial, into account, so an assessment of risk arising from such sources should also be made.

Table 2-3: Definition of Flood Zones

Zone	Description
Zone A High probability of flooding.	This zone defines areas with the highest risk of flooding from rivers (i.e. more than 1% probability or more than 1 in 100) and the coast (i.e. more than 0.5% probability or more than 1 in 200).
Zone B Moderate probability of flooding.	This zone defines areas with a moderate risk of flooding from rivers (i.e. 0.1% to 1% probability or between 1 in 100 and 1 in 1000) and the coast (i.e. 0.1% to 0.5% probability or between 1 in 200 and 1 in 1000).
Zone C Low probability of flooding.	This zone defines areas with a low risk of flooding from rivers and the coast (i.e. less than 0.1% probability or less than 1 in 1000).

2.4 Objectives and Principles of the Planning Guidelines

The Planning Guidelines describe good flood risk practice in planning and development management. Planning authorities are directed to have regard to the guidelines in the preparation of Development Plans and Local Area Plans, and for development control purposes.

The objective of the Planning Guidelines is to integrate flood risk management into the planning process, thereby assisting in the delivery of sustainable development. For this to be achieved, flood risk must be assessed as early as possible in the planning process. Paragraph 1.6 of the Planning Guidelines states that the core objectives are to:

- *"avoid inappropriate development in areas at risk of flooding;*
- *avoid new developments increasing flood risk elsewhere, including that which may arise from surface run-off;*
- *ensure effective management of residual risks for development permitted in floodplains;*
- *avoid unnecessary restriction of national, regional or local economic and social growth;*
- *improve the understanding of flood risk among relevant stakeholders; and*
- *ensure that the requirements of EU and national law in relation to the natural environment and nature conservation are complied with at all stages of flood risk management".*

The Planning Guidelines aim to facilitate *'the transparent consideration of flood risk at all levels of the planning process, ensuring a consistency of approach throughout the country.'* SFRAs therefore become a key evidence base in meeting these objectives.

The Planning Guidelines work on a number of key principles, including:

- Adopting a staged and hierarchical approach to the assessment of flood risk;
- Adopting a sequential approach to the management of flood risk, based on the frequency of flooding (identified through Flood Zones) and the vulnerability of the proposed land use.

2.5 The Sequential Approach and Justification Test

Each stage of the FRA process aims to adopt a sequential approach to management of flood risk in the planning process.

Where possible, development in areas identified as being at flood risk should be avoided; this may necessitate de-zoning lands within the plan boundary. If de-zoning is not considered appropriate, then it must be ensured that permitted uses are water compatible or less vulnerable, such as open space, and that vulnerable uses such as residential are not permitted in the flood risk area.

Figure 2-1: Sequential Approach Principles in Flood Risk Management



Source: The Planning System and Flood Risk Management Guidelines (Figure 3.1)

Where rezoning is not considered appropriate, exceptions to the development restrictions are provided for through the Justification Test. Many towns and cities have central areas that are affected by flood risk and have been targeted for growth. To allow the sustainable and compact development of these urban centres, development in areas of flood risk may be considered necessary. For development in such areas to be allowed, the Justification Test must be passed.

The Justification Test has been designed to rigorously assess the appropriateness, or otherwise, of such developments. The test is comprised of two processes; the Plan-making Justification Test, which is undertaken in Section 5 of this SFRA, and the Development Management Justification Test. The latter is used at the planning application stage where it is intended to develop land that is at moderate or high risk of flooding for uses or development vulnerable to flooding that would generally be considered inappropriate for that land, and in the circumstances where such land is deemed to have passed the Justification Test for development plans.

Table 2-4 shows which types of development, based on vulnerability to flood risk, are appropriate land uses for each of the Flood Zones. The aim of the SFRA is to guide development zonings to those which are 'appropriate' and thereby avoid the need to apply the Justification Test.

Table 2-4: Matrix of Vulnerability versus Flood Zone

	Flood Zone A	Flood Zone B	Flood Zone C
Highly vulnerable development (Including essential infrastructure)	Justification Test	Justification Test	Appropriate
Less vulnerable development	Justification Test	Appropriate	Appropriate
Water-compatible development	Appropriate	Appropriate	Appropriate

Source: Table 3.2 of The Planning System and Flood Risk Management Guidelines

A planning circular (PL2/2014²) has also been issued which provides greater clarity on the need to apply the Justification Test to existing development and areas which are proposed for redevelopment, included as Section 4.27a of the Planning Guidelines. Further, this amendment requires the SFRA to specify the nature and design of structural or non-structural flood risk management measures required prior to development in such areas. As part of the Application of

² Department of Environment, Community and Local Government, Planning Circular PL2/2014 (13/08/2015)

the Justification Test for Development Plans, detailed in Section 5, consideration has been given as to how this applies to lands within Dún Laoghaire-Rathdown. This has generally taken the form of a qualitative appraisal of the condition and protection afforded by existing defences, along with a review of flood protection needs highlighted in the relevant CFRAM Study Preliminary Option Report (POR). The outcome of this assessment is included in the Justification Test for Development Plans and indicates where future development is premature until there is a scheme in place. There were no locations highlighted where flood protection was needed to allow development to proceed that were not also included in the CFRAM POR.

2.6 Scales and Stages of Flood Risk Assessment

Within the hierarchy of regional, strategic and site-specific flood-risk assessments, a tiered approach ensures that the level of information is appropriate to the scale and nature of the flood-risk issues and the location and type of development proposed, avoiding expensive flood modelling and development of mitigation measures where it is not necessary. The stages and scales of flood risk assessment comprise:

- **Regional Flood Risk Appraisal (RFRA)** – a broad overview of flood risk issues across a region to influence spatial allocations for growth in housing and employment as well as to identify where flood risk management measures may be required at a regional level to support the proposed growth. This should be based on readily derivable information and undertaken to inform the Regional Planning Guidelines.
- **Strategic Flood Risk Assessment (SFRA)** – an assessment of all types of flood risk informing land use planning decisions. This will enable the Planning Authority to allocate appropriate sites for development, whilst identifying opportunities for reducing flood risk. This SFRA will revisit and develop the flood risk identification undertaken in the RFRA and give consideration to a range of potential sources of flooding. An initial flood risk assessment, based on the identification of Flood Zones, will also be carried out for those areas which will be zoned for development. Where the initial flood risk assessment highlights the potential for a significant level of flood risk, or there is conflict with the proposed vulnerability of development, then a detailed stage 3 FRA will be required to ensure zoning objectives are compatible with flood risk at the site, and more importantly that mitigation measures which reduce flood risk to the site and neighbouring lands can be implemented. The SFRA will highlight the scale of assessment required within a site-specific flood risk assessment.

In Dún Laoghaire-Rathdown, a range of flood data sources have been reviewed and used to compile a composite Flood Zone map. In most locations this map, coupled with engineering knowledge has been sufficient to provide recommendations for flood risk assessment and development management. However, in a Stage 3 FRA was carried out for the area within the Dundrum Major Town Centre lands as part of the 2016-2022 CDP, and since then additional flood modelling and mapping has been carried out.

- **Site Specific Flood Risk Assessment (SSFRA)** – site or project specific flood risk assessment to consider all types of flood risk associated with the site and propose appropriate site management and mitigation measures to reduce flood risk to and from the site to an acceptable level.

An assessment of all sources of flood risk is required on every site. It should consider residual risks, such as surcharging of the stormwater system, culvert blockage or defence overtopping, and access / evacuation plans are likely to form important elements of the assessment. There may also be a requirement for a detailed channel and site survey, and hydraulic modelling.

3 Strategic Flood Risk Assessment of Dún Laoghaire-Rathdown

3.1 Description of Study Area

Dún Laoghaire-Rathdown covers an area of 125 km² to the south of Dublin City. Along the east of the County runs 17 kilometres of coastline which includes beaches cliffs and marshes. It is along the coast that the County town of Dún Laoghaire is located. In terms of settlement approximately two thirds of the County is made up of the built-up area which forms part of suburban Dublin. This suburban area is made up of a network of smaller towns and villages which have been subsumed into the urban form. To the south and west the built-up area gives way to agricultural lands and then rises into the upland scenic area of the Dublin Mountains.

3.2 Identification of Flood Risk (Stage 1)

One of the first tasks within the SFRA is to undertake a data collection exercise which will allow Flood Zone maps to be developed. The Flood Zones relate to risk arising from fluvial (river) and coastal flooding. Other sources of flooding, such as surface water and groundwater, are also taken into account through the SFRA but are not part of the initial assessment process.

It is important to note that the Flood Zones do not take into account the benefits of flood defences. The sequential approach and Justification Test should be applied using the undefended outlines, but the benefits of the defences can be used to inform the requirements for detailed flood risk assessment and development design, if the Justification Test for plan making has been passed.

Due to the number of flood investigation and management studies that have focused on Dún Laoghaire-Rathdown, there are a number of datasets which record either historical or predicated flood extents. The aim of this phase of work is to identify flood risk based on the data available, including historical records, considering all sources of flooding, and to appraise the quality and usefulness of the data. Table 3-1 below summarises the data available and its quality, includes an assessment of confidence in its accuracy (when attempting to incorporate it into the Flood Zone map) and gives an indication of how it was used in the SFRA study.

The Office of Public Works (OPW) is the lead Authority on flooding in the Country. The OPW commissioned an Eastern Catchment Flood Risk Assessment and Management (CFRAM) Study, which included Dún Laoghaire-Rathdown. The study was finalised in 2016, with flood maps and supporting reports available on-line³. The ECFRAM incorporated the earlier study of the Dodder River, which was completed in its own right in 2012. A study of the Dundrum Slang was completed in 2020 which provides up to date flood mapping for this area. These studies have been used to provide the majority of the baseline data for this Strategic Flood Risk Assessment.

The plan area of Dún Laoghaire-Rathdown has also been subject to a number of other flood assessments at both the County and local scales. These have looked at risks arising from sources such as coastal inundation and wave overtopping, surface water and manhole surcharge, culvert blockage and direct fluvial flooding. There have also been a number of recorded flood events. This information has been compiled to form the Flood Zone maps that are the basis for this SFRA.

The Flood Zone maps have been developed using the most appropriate data available to Dún Laoghaire-Rathdown at the time of preparing the Development Plan. The Flood Zone maps have been created specifically to inform the application of the Justification Test and to guide development policy within the County and have been through several iterations of review and are now considered to be fit for purpose. However, it should be borne in mind that the input data was developed at a point in time and there may be changes within the catchment that mean a future study, or more localised assessment of risk may result in a change in either flood extent or

³ www.floodinfo.ie

depth. This means a site-specific flood risk assessment may result in locally appropriate information which could show a greater or lesser level of risk than is included in the Flood Zone maps. This is to be expected and it will require discussion between the developer and the Dún Laoghaire-Rathdown Planning and Municipal Services sections to ensure the assessment is appropriate and relevant to the site in question.

The Flood Zone maps show Flood Zones A, B and C and also shows "areas of flood risk concern".

Flood Zone A refers to areas where the probability of flooding from rivers is greater than 1% AEP or 1 in 100 year for river flooding, or 0.5% AEP or 1 in 200 for coastal flooding. Flood Zone B refers to areas where the probability of flooding from rivers and seas is up to 0.1% AEP or 1 in 1000. The rest of the map shows Flood Zone C, where there is less than a 0.1% AEP or 1 in 1000 chance of flooding.

The "areas of flood risk concern" include historical flood locations (both fluvial and pluvial) and information from other modelling studies. Historical surface water locations are those where Dún Laoghaire-Rathdown County Council has a record of a flood occurring, although in some cases work has been carried out to remediate the issue. The predicted areas of concern are based on modelling and indicate where surface water has the potential to pond to depths of greater than 0.3m. More detail on these locations is available from the Municipal Services section.

Table 3-1: Flood Risk Datasets

Data	Description / Coverage	Quality	Data used in developing Flood Zones
Dodder CFRAM Flood Extents	Flood extents (defended) covering the Dodder River and its tributaries, the Dundrum Slang and the Little Dargle	Low. The data is old (study carried out between 2007 and 2014) and methods of assessment have progressed in the intervening years.	Superseded in the main by the Dundrum Slang ICM modelling study (see below).
Eastern CFRAM extents and defence layers, finalised in 2016	Flood extents covering the Crinken Stream, Shanganagh River, Loughlinstown River, Deansgrange Stream, Carrickmines River and Carysfort Maritimo, as well as the coastline of the County.	High in most locations, having been subject to several iterations of review through the CFRAM development process.	Flood extents, defence lines and defended area polygons have been used to develop Flood Zones.
Dundrum Slang ICM modelling study, completed in 2020	The Dundrum Slang catchment. Includes fluvial, pluvial and combined risk	High	Yes

Whitechurch Stream modelling study	Limited to the boundary of DLR	Moderate	Yes
Irish Coastal Protection Strategy Study	Tidal extents for 200 year and 1000 year events	High	Used to define the tidal risk within Flood Zone A and B.
JFLOW® (JBA's multi-scale two-dimensional hydraulic fluvial flood modelling software)	Covers full study area, including all watercourses with catchment greater than 3km ² .	Low - Moderate	Some minor watercourses, and the upstream reach of some CFRAM watercourses.
OPW Preliminary Flood Risk Assessment (PFRA) flood maps	The PFRA was a national screening exercise that was undertaken by OPW to identify areas at potential risk of flooding.	Low	Some minor watercourses, and the upstream reach of some CFRAM watercourses.
LiDAR	Digital terrain model covering the whole County	High, but not direct representation of flood zones.	Not used directly but has helped define the undefended floodplain.
Historical event outlines and point observations and reports	Various: 2011 event outlines received. OPW flood maps.ie also to be consulted. Surface water risk locations mapped	Various – based on anecdotal evidence and post flood survey	Indirectly used to validate flood zones and identify non-fluvial and tidal flooding
Deansgrange and Kilbogget Park flood extents	Localised studies as part of flood relief scheme appraisal	High	Indicates defended areas and guides requirements for site specific FRAs.
Wave overtopping from DART Drainage Impact Study	Merrion Gate to Monkstown. Indicates risks associated with wave overtopping	Moderate to high	Not used to create Flood Zones but mapped to indicate 'other' risk areas.
Culvert blockage	The impact of blockage was tested at 21 culverts across the County	Moderate to high (but based on an assumption of 100% blockage)	Not used to create Flood Zones but reviewed to indicate residual risk areas.

Site specific flood risk assessments	SSFRA's have been submitted in support of various planning applications across the county.	Variable, and depends on the site location and nature of the development proposed.	Not used as the coverage and quality of the assessments could be variable.
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3.3 Summary of flood sources

Using the information detailed above, along with the knowledge of engineering staff, the following potential sources of flooding have been identified with the development plan area.

3.3.1 Fluvial Flooding

Flooding of watercourses is associated with the exceedance of channel capacity during higher flows. The process of flooding on watercourses depends on a number of characteristics associated with the catchment including; geographical location and variation in rainfall, steepness of the channel and surrounding floodplain and infiltration and rate of runoff associated with urban and rural catchments. Generally, there are two main types of catchments; large and relatively flat or small and steep, both giving two very different responses during large rainfall events.

In a large, relatively flat catchment, flood levels will rise relatively slowly, and natural floodplains may remain flooded for several days, acting as the natural regulator of the flow. This is typical of the River Dodder. In small, steep catchments, such as some of the tributaries, local intense rainfall can result in the rapid onset of deep and fast-flowing flooding with little warning. Such “flash” flooding, which may only last a few hours, can cause considerable damage and possible threat to life.

The form of the floodplain, either natural or urbanised, can influence flooding along watercourses. The location of buildings and roads can significantly influence flood depths and velocities by altering flow directions and reducing the volume of storage within the floodplain. Critical structures such as bridge and culverts can also significantly reduce capacity creating pinch points within the floodplain. These structures are also vulnerable to blockage by natural debris within the channel or by fly tipping and waste.

In Dún Laoghaire-Rathdown, flood risk arises from a number of different watercourses, each of which has its own specific characteristics. These have been taken into account when flood risk to specific potential development sites was reviewed. Where zoning for development is proposed within Flood Zones A or B, the Justification Test for development plans must be applied, and passed.

There may be situations where a watercourse is identified at Development Management stage which has not been assessed under the SFRA. In such circumstances, it should not be assumed that the Development Plan Justification Test has been passed.

3.3.2 Tidal Flooding

Ireland is affected by coastal flooding that can pose an extreme hazard to coastal infrastructure and communities. Coastal flooding events are associated with storm surge events, particularly those that occur in combination with spring tides. Local or remote storms produce large wind or swell waves, which can overtop coastal defences and cause flooding and erosion.

The eastern county boundary is subject to flood risk from the Irish Sea. As well as direct inundation associated with high tides and storm surge, which form part of the Flood Zones, wave overtopping is a significant risk in certain parts of the coast.

The 2018 Storm Emma impacts on the east coast, for example at Bullock Harbour, and the winter 2014 storms, when large numbers of properties were flooded along the east coast, are examples of the hazard posed by coastal processes.

The tide can also impact on flood risk from rivers, particularly at the downstream end of those which discharge directly into the sea. On such watercourses, if high river flows coincide with high tides, the rivers can't discharge and may cause flooding locally.

Peak tide levels were calculated as part of ICPSS and the Eastern CFRAM study and should be referred to in any site-specific FRA.

3.3.3 Residual Risks arising from Flood Defence Overtopping or Breach

Residual risk is the risk that remains after measures to control flood risk have been carried out. Residual risk can arise from overtopping of flood defences and / or from the breach from structural failure of the defences.

The concept of residual risk is explained in the Planning Guidelines as follows:

"Although flood defences may reduce the risk of flooding, they cannot eliminate it. A flood defence may be overtopped by a flood that is higher than that for which it was designed or be breached and allow flood water to rapidly inundate the area behind the defence. In addition, no guarantee can be given that flood defence will be maintained in perpetuity. As well as the actual risk, which may be reduced as a result of the flood defence, there will remain a residual risk that must be considered in determining the appropriateness of particular land uses and development. For these reasons, flooding will still remain a consideration behind flood defences and the flood zones deliberately ignore the presence of flood defences."

Owing to an extensive and frequent history of flooding in some parts of the County, there are a number of flood relief schemes in Dún Laoghaire-Rathdown. These include large scale OPW managed schemes on the River Dodder, and some smaller works which have been constructed, or are due for construction, on smaller watercourses. It should be noted that whilst existing development clearly benefits from the construction of defences, it is against sustainability objectives, and the general approach of the OPW, to construct defences with the intention of releasing land for development. It is also not appropriate to consider the benefits of schemes which have not been constructed, and which may only be at pre-feasibility or design stage. Overtopping of flood defences will occur during flood events greater than the design level of the defences. Overtopping is likely to cause more limited inundation of the floodplain than if defences had not been built, but the impact will depend on the duration, severity and volume of floodwater. However, and more critically, overtopping can destabilise a flood defence, cause erosion and make it more susceptible to breach or fail.

Overtopping may become more likely in future years due to the impacts of climate change and it is important that any assessment of defences includes an appraisal of climate change risks.

Breach or structural failure of flood defences is hard to predict and is largely related to the structural condition and type of flood defence. 'Hard' flood defences such as solid concrete walls are less likely to breach than 'soft' defence such as earth embankments. Breach will usually result in sudden flooding with little or no warning and presents a significant hazard and danger to life. There is likely to be deeper flooding in the event of a breach than due to overtopping.

Defence locations in Dún Laoghaire-Rathdown have been identified through the Eastern CFRAM, which has included an assessment of the defences' ability to provide an effective function, and to what standard of protection, and in discussion with council Engineers. Individual defence locations have been highlighted in the consideration of specific risks. Where walls and embankments are not discussed it is highly likely that they are informal or ineffective structures which should not be relied upon in a flood event. For the purposes of a site-specific flood risk assessment it should be assumed that the site is undefended.

3.3.4 Pluvial Flooding

Flooding of land from surface water runoff is usually caused by intense rainfall that may only last a few hours. The resulting water follows natural valley lines, creating flow paths along roads and through and around developments and ponding in low spots, which often coincide with fluvial floodplains. Any areas at risk from fluvial flooding will almost certainly be at risk from surface water flooding.

Although having potentially severe consequences, pluvial flooding can generally be managed through site design, layout and drainage. However, SFRA requires a strategic assessment of the likelihood of surface water flooding, which includes consideration of the following:

- Are there zoned lands which may need to accommodate and retain surface water flow routes?
- Are there zoned lands which might discharge upstream of an area vulnerable to surface water flooding?

A preliminary screening of areas of flood risk concern has been carried out for this SFRA, drawing on historical flood records and the OPW's PFRA mapping amongst other sources. For development within or near these areas, particular attention to surface water risk is required. Drainage impact assessments, with an emphasis on surface water risk and its management, are required for all development proposals, and are further detailed in Section 4.7.

3.3.5 Flooding from Drainage Systems

Flooding from artificial drainage systems occurs when flow entering a system, such as an urban storm water drainage system, exceeds its discharge capacity, it becomes blocked or it cannot discharge due to a high-water level in the receiving watercourse.

Flooding in urban areas can also be attributed to sewers. Sewers have a finite capacity which, during certain load conditions, will be exceeded. In addition, design standards vary and changes within the catchment areas draining to the system, in particular planned growth and urban creep, will reduce the level of service provided by the asset. Sewer flooding problems will often be associated with regularly occurring storm events during which sewers and associated infrastructure can become blocked or fail. This problem is exacerbated in areas with under-capacity systems. In the larger events that are less frequent but have a higher consequence, surface water will exceed the sewer system and flow across the surface of the land, often following the same flow paths and ponding in the same areas as overland flow.

Foul sewers and surface water drainage systems are spread extensively across the urban areas with various interconnected systems discharging to treatment works and into local watercourses.

3.3.6 Groundwater Flooding

Groundwater flooding is caused by the emergence of water originating from underground and is particularly common in karst landscapes. This can emerge from either point or diffuse locations. The occurrence of groundwater flooding is usually very local and unlike flooding from rivers and the sea, does not generally pose a significant risk to life due to the slow rate at which the water level rises. However, groundwater flooding can cause significant damage to property, especially in urban areas and pose further risks to the environment and ground stability. There are many underground streams within Dún Laoghaire-Rathdown, particularly in the Dalkey, Killiney, Dun Laoghaire, Glenageary and Glasthule areas. Some of these streams continue to give issues in private properties, and care should be taken to ensure high-water tables do not impact on basements, foundations, percolation areas or other sub-ground construction works. This should be assessed on a site by site basis through percolation testing and bore holes.

4 Policy Response

4.1 The Strategic Approach

A strategic approach to the management of flood risk is particularly important in Dún Laoghaire-Rathdown due to the density of existing development and the strategic importance of the County in relation to future growth and expansion. This makes it impractical to consider flood management on a site by site basis at the Development Plan level. This is particularly true where higher levels of flood risk have been identified and a more detailed flood risk assessment and options appraisal study, such as has been carried out through the CFRAM and is being further progressed in localised flood relief schemes, may be required prior to permitting further development.

Following the Planning Guidelines, development should always be located in areas of lowest flood risk first, and only when it has been established that there are no suitable alternative options should development (of the lowest vulnerability) proceed in areas of greater flood risk. Consideration may then be given to factors which moderate risks, such as defences, and finally consideration of suitable flood risk mitigation and site management measures is necessary.

It is important to note that whilst it may be technically feasible to mitigate or manage flood risk at site level, strategically it may not be a sustainable approach.

A summary of flood risks associated with each of the zoning objectives has been provided in Table 4-1, below. It should be noted that this table is intended as a guide only and should be read in conjunction with the detailed assessment of risks in Section 5. However, when applications are being considered it is important to remember that not all uses will be appropriate on flood risk grounds, hence the need to work through the Justification Test for Development Management on a site by site basis and with reference to Section 5. For example, zoning objective MTC (mixed use town centre) could include a highly vulnerable crèche, less vulnerable shops and water compatible car parking but they are not all equally appropriate on the ground floor within Flood Zone A or B and require differing levels of mitigation, potentially including elevating a vulnerable use to first floor or higher.

Table 4-1: Zoning objective vulnerability

Zoning Objective		Indicative Primary Vulnerability	Flood Risk Commentary in relation to the Justification Test for Plan Making
A	To provide residential development and/or protect and improve residential amenity'	Highly vulnerable	Justification Test to be passed in Flood Zone A and B.
A1	To provide for new residential communities and Sustainable Neighbourhood Infrastructure in accordance with approved local area plans'	Less / highly vulnerable	Justification Test to be passed for highly vulnerable development in Flood Zone A and B and less vulnerable development in Flood Zone A.
A2	To provide for the creation of sustainable residential neighbourhoods and preserve and protect residential amenity.	Less / highly vulnerable	Justification Test to be passed for highly vulnerable development in Flood Zone A and B and less vulnerable development in Flood Zone A.
B	To protect and improve rural amenity and to provide for the development of agriculture.	Water compatible / less / highly vulnerable	Rural amenity will include water compatible uses, but individual and groups of residential and other developments may arise. Justification Test to be passed for highly vulnerable development in Flood Zone A and B and less vulnerable development in Flood Zone A.
DC	To protect, provide for and-or improve mixed-use district centre facilities.	Less / highly vulnerable	Justification Test to be passed for highly vulnerable development in Flood Zone A and B and less

			vulnerable development in Flood Zone A.
E	To provide for economic development and employment.	Less vulnerable	Justification Test to be passed for less vulnerable development in Flood Zone A.
F	To preserve and provide for open space with ancillary active recreational amenities.	Water compatible	Appropriate for all Flood Zones. Ancillary developments to be assessed in accordance with the sequential approach.
G	To protect and improve high amenity areas.	Water compatible	Appropriate for all Flood Zones. Objective is to avoid new development in these areas, and what development is allowed should be located within Flood Zone C.
GB	To protect and enhance the open nature of lands between urban areas.	Water compatible	Appropriate for all Flood Zones. Any ancillary developments to be assessed in accordance with the sequential approach.
LIW	To improve and provide for low density warehousing/light industrial warehousing uses	Less vulnerable	Justification Test to be passed for less vulnerable development in Flood Zone A.
MIC	To consolidate and complete the development of the mixed use inner core to enhance and reinforce sustainable development.	Less / highly vulnerable	Justification Test to be passed for highly vulnerable development in Flood Zone A and B and less vulnerable development in Flood Zone A
MOC	To provide for a mix of uses which complements the inner core, but with less retail and residential and more emphasis on employment and services.	Less / highly vulnerable	Justification Test to be passed for highly vulnerable development in Flood Zone A and B and less vulnerable development in Flood Zone A
MTC	To protect, provide for and-or improve major town centre facilities.	Highly / less vulnerable	Justification Test to be passed for highly vulnerable development in Flood Zone A and B and less vulnerable development in Flood Zone A
NC	To protect, provide for and-or improve mixed-use neighbourhood centre facilities.	Highly / less vulnerable	Justification Test to be passed for highly vulnerable development in Flood Zone A and B and less vulnerable development in Flood Zone A
OE	To provide for office and enterprise development.	Less vulnerable	Justification Test to be passed for less vulnerable development in Flood Zone A.
SNI	To protect, improve and encourage the provision of sustainable neighbourhood infrastructure.	Less / highly vulnerable	Justification Test to be passed for highly vulnerable development in Flood Zone A and B and less vulnerable development in Flood Zone A
TLI	To facilitate, support and enhance the development of third level education institutions.	Highly vulnerable	Justification Test to be passed for highly vulnerable development in Flood Zone A and B.
W	To provide for waterfront development and harbour related uses.	Highly / less vulnerable / Water compatible	Justification Test to be passed for highly vulnerable development in Flood Zone A and B and less vulnerable development in Flood Zone A Justification Test not needed for water compatible uses, but consideration to be given to flood risks and sequential use of land, particularly where these are ancillary to harbour operations.

4.2 Development Management and Flood Risk

In order to guide both applicants and planning officials through the process of planning for, and mitigating flood risk, the key features of a range of development scenarios have been identified (relating to the flood zone, development vulnerability and presence or absence of defences). For each scenario, a number of considerations relating to the suitability of the development are summarised below.

Where land has not passed the Justification Test for Development Plans for a particular use, where development is considered premature pending a flood relief scheme, or where flood risk arising from a watercourse is only identified at Development Management Stage, the following sections do not apply and a SSFRA may be premature. In these situations, a discussion with Dún Laoghaire-Rathdown County Council is required to determine an appropriate route forward.

In addition to the general recommendations in the following sections, Section 5 should be reviewed for specific recommendations for the watercourses within Dún Laoghaire-Rathdown.

All applications for development must be accompanied by an appropriately detailed SSFRA. This may be a qualitative appraisal of risks, including drainage design. Alternatively, the findings of the CFRAM, or other detailed study, may be drawn upon to inform finished floor levels. In other circumstances a detailed modelling study and flood risk assessment may need to be undertaken. Further details of each of these scenarios, including considerations for the flood risk assessment are provided in the following sections.

4.3 Development in Flood Zone A or B

4.3.1 Minor Developments

As a variation to Section 5.28 of the Planning Guidelines on Flood Risk Management, subject to the specific requirements of Section 5:

Applications for minor development, such as small extensions to houses or the rebuilding of houses, and most changes of use⁴ of existing buildings and or extensions and additions to existing commercial and industrial enterprises, are unlikely to raise significant flooding issues, unless they obstruct important flow paths, introduce a significant additional number of people into flood risk areas or entail the storage of hazardous substances. Since such applications concern existing buildings or developed areas, the sequential approach cannot be used to locate them in lower-risk areas and the Justification Test will not apply. However, a commensurate assessment of the risks of flooding should accompany such applications to demonstrate that they would not have adverse impacts or impede access to a watercourse, floodplain or flood protection and management facilities. These proposals should follow best practice in the management of health and safety for users and residents of the proposal.

However, infill development of any scale is not, as part of this SFRA, considered minor development and should be assessed under Sections 4.3.2 and 4.3.3 below.

There are a number of areas within Dún Laoghaire-Rathdown that prove to be exceptions to this approach so the detail contained in Section 5 should be consulted for more site specific information; in particular those areas where the need for a Flood Relief Scheme has been identified and development is premature until that scheme has been completed. Further details of such locations are provided in Section 5.

4.3.2 Highly vulnerable development in Flood Zone A or B

Development which is highly vulnerable to flooding, as defined in The Planning Guidelines includes (but is not limited to) dwelling houses, hospitals, emergency services and caravan parks (see Table 2-2 for further information).

⁴ changes of use that do not increase the level of vulnerability of the development

4.3.2.1 New development

It is not appropriate for new, highly vulnerable, development to be located in Flood Zones A or B outside the core of a settlement. Such proposals do not pass the Justification Test for Development Plans. Instead, a less vulnerable or water compatible use should be considered.

In some cases, land use objectives which include for highly vulnerable uses have been justified in the Development Plan. This includes zonings focused around an urban core which allow for a mix of residential, commercial and other uses. In such cases, a sequential approach to land use within the site must be taken and will consider the presence or absence of defences, land raising and provision of compensatory storage, safe access and egress in a flood and the impact on the wider development area.

4.3.2.2 Existing developed areas

The Planning Circular (PL02/2014) states that *"notwithstanding the need for future development to avoid areas at risk of flooding, it is recognised that the existing urban structure of the country contains many well established cities and urban centres which will continue to be at risk of flooding. In addition, development plans have identified various strategically important urban centres ... whose continued consolidation, growth, development or generation, including for residential use, is being encouraged to bring about compact and sustainable growth."*

In cases where specific development proposals have passed the Justification Test for Development Plans, the outline requirements for a flood risk assessment and flood management measures are detailed in this SFRA in the following sections and the site specific assessments in Section 5, which also detail where such development has been justified. Of prime importance is the requirement to manage risk to the development site and not to increase flood risk elsewhere.

4.3.3 Less vulnerable development in Flood Zone A or B

This section applies to less vulnerable development in Flood Zone A which has passed the Justification test for development plans, and less vulnerable development in Flood Zone B, where this form of development is appropriate, and the Justification Test is not required. Development which is less vulnerable to flooding, as defined in The Planning Guidelines, includes (but is not limited to) retail, leisure and warehousing and buildings used for agriculture and forestry (see Table 2-2 for further information). This category includes less vulnerable development in all forms, including refurbishment or infill development, and new development both in defended and undefended situations.

The design and assessment of less vulnerable development should begin with 1% AEP fluvial or 0.5% tidal events as standard, with climate change and a suitable freeboard included in the setting of finished floor levels.

The presence or absence of flood defences informs the level of flood mitigation recommended for less vulnerable developments in areas at risk of flooding. In contrast with highly vulnerable development, there is greater scope for the developer of less vulnerable uses to accept flood risks while still building to a standard of protection which is high enough to manage risks for the development in question. However, any deviation from the design standard of 1%/0.5% AEP, plus climate change (see Table 4-2 for further information), plus freeboard, needs to be fully justified within the FRA.

4.4 Development in Flood Zone C

Where a site is within Flood Zone C but adjoining or in close proximity of a watercourse, there could be a risk of flooding associated with factors such as future scenarios (climate change) or in the event of failure of a defence, blocking of a bridge or culvert. Risk from sources other than fluvial and coastal must also be addressed for all development in Flood Zone C. As a minimum in such a scenario, a flood risk assessment should be undertaken which will screen out possible indirect sources of flood risk and where they cannot be screened out it should present mitigation measures. The most likely mitigation measure will involve setting finished floor levels to a height that is above the 1% AEP fluvial event or 0.5% AEP tidal flood event level, with an allowance for climate change and freeboard, or to ensure a step up from road level to prevent surface water

ingress. Design elements such as channel maintenance or trash screens may also be required. Evacuation routes in the event of inundation of surrounding land should also be detailed.

The impacts of climate change should be considered for all proposed developments. This is particularly important for development near areas at risk of tidal flooding. A development which is currently in Flood Zone C may be shown to be at risk when an allowance for sea level rise is added to the extreme (1 in 200 year) tide. Details of the approach to incorporating climate change impacts into the assessment and design are provided in Section 4.4.

4.5 Water compatible uses in Flood Zone A or B

Water compatible uses can include the non-built environment, such as open space, agriculture and green corridors. These uses do not require a flood risk assessment and are appropriate for Flood Zone A and B. However, there are numerous other uses which are classified as water compatible, but which involve some kind of built development, such as lifeguard stations, fish processing plants and other activities requiring a waterside location. The Justification Tests are not required for such development, but an appropriately detailed flood risk assessment is required. This should consider mitigation measures such as development layout and finished floor levels, access, egress and emergency plans. Climate change and other residual risks should also be considered within the SSFRA.

4.6 Requirements for a Flood Risk Assessment

An appropriately detailed flood risk assessment will be required in support of all planning applications. The level of detail will vary depending on the risks identified and the proposed land use. As a minimum, all proposed development, including that in Flood Zone C, must consider the impact of surface water flood risks on drainage design. In addition, flood risk from sources other than fluvial and tidal should be reviewed.

For sites within Flood Zone A or B, a site specific "Stage 2 - Initial FRA" will be required and subject to the outcome would most likely need to be developed into a "Stage 3 - Detailed FRA". The extents of Flood Zone A and B are delineated through this SFRA. However, future studies may refine the extents (either to reduce or enlarge them) so a comprehensive review of available data should be undertaken once a FRA has been triggered.

An assessment of the risks of flooding should accompany applications to demonstrate that they would not have adverse impacts or impede access to a watercourse, floodplain or flood protection and management facilities. Where possible, the design of built elements in these applications should demonstrate principles of flood resilient design (See Section 4 - Designing for Residual Flood Risk of the Technical Appendices to the DoECLG Flooding Guidelines). Emergency access must be considered as in many cases flood resistance (such as raised finished floor levels and flood barriers) and retrofitting flood resilience features may be challenging in an existing building. Within the FRA the impacts of climate change and residual risk (including culvert/structure blockage) should be considered and remodelled where necessary, using an appropriate level of detail, in the design of FFL. Further information on the required content of the FRA is provided in the Planning Guidelines.

Any proposal that is considered acceptable in principle shall demonstrate the use of the sequential approach in terms of the site layout and design and, in satisfying the Justification Test for Development Management (where required), the proposal will demonstrate that appropriate mitigation and management measures are put in place.

4.6.1 Checklist for Applications for Development in Areas at Risk of Flooding

This section applies to both highly and less vulnerable development in Flood Zone A and highly vulnerable development in Flood Zone B that satisfy the following:

- Meet the definition of Minor Development; or
- Pass the Justification Test for Development Plans and Justification Test for Development Management to the satisfaction of the Planning Authority.

The following checklist is required for all development proposals:

- The SSFRA be carried out by an appropriately qualified Engineer with relevant FRA experience (as deemed acceptable by the Planning Authority), in accordance the Dún Laoghaire-Rathdown SFRA and the Planning Guidelines.
- Demonstration that the specific objectives or requirements for managing flood risk set out in Section 5 of this SFRA have been complied with.
- Preparation of access, egress and emergency plans which are appropriate to the vulnerability of the development and its occupiers, the intensity of use and the level of flood risk.
- Submission of a flood resilience statement.
- An assessment of the potential impacts of climate change and the adaptive capacity of the development.
- Compliance with C753 CIRIA SUDS guide, GSDSDS and inclusion of SuDS.

4.7 Drainage Impact Assessment

All proposed development, including that in Flood Zone C, must consider the impact of surface water flood risks on drainage design. In this regard, all the other development scenarios must pass through this stage before completing the planning and development process and should be accompanied by an appropriately detailed flood risk assessment, and drainage impact assessment.

There are extensive networks of surface water runoff routes across the County, with areas vulnerable to ponding indicated on the Flood Zone Maps. Particular attention should be given to development in low-lying areas which may act as natural ponds for collection of runoff.

The drainage design shall ensure no increase in flood risk to the site, or the downstream catchment. Reference should be made to the Dún Laoghaire-Rathdown County Council Stormwater Management Policy for details of the assessment process. Considerable detail on the process and design of SuDS is also provided in C753⁵, and the forthcoming Dublin SuDS Manual⁶, the Greater Dublin Strategic Drainage Study, and more details and guidance are available on the 'Irish SuDS: Guidance and Tools' website⁷.

Master planning of development sites should ensure that existing flow routes are maintained, through the use of green infrastructure. Where possible, and particularly in areas of new development, floor levels should at a minimum be 300mm above adjacent roads and hard standing areas to reduce the consequences of any localised flooding. Where this is not possible, an alternative design appropriate to the location may be prepared. The surface water flood locations are indicated as both historical and predicated areas of flood risk concern on the Flood Zone map. A more rigorous design approach will be required in locations indicated to be at, or near these locations. Further discussion with the Municipal Services Section of Dún Laoghaire-Rathdown County Council is recommended in this situation.

4.8 Climate Change

Ireland's climate is changing and analysis of the potential impacts of future climate change is essential for understanding and planning. Climate change should be considered when assessing flood risk and in particular residual flood risk. Areas of residual risk are highly sensitive to climate change impacts as an increase in flood levels will increase the likelihood of defence failure.

The Planning Guidelines recommend that a precautionary approach to climate change is adopted due to the level of uncertainty involved in the potential effects. Specific advice on the expected impacts of climate change and the allowances to be provided for future flood risk management in Ireland is given in the OPW draft guidance⁸. However, this guidance is over 10

⁵ C753, The SUDS Manual, CIRIA (2015)

⁶ The Dublin SUDS Manual is currently in preparation but will be finalised in the lifetime of the Development Plan.

⁸ OPW Assessment of Potential Future Scenarios, Flood Risk Management Draft Guidance, 2009

years old now and climate science, particularly in relation to sea level rise, has developed rapidly. There are many coastal related climate change impacts, these include:

- continued sea level rise,
- potentially more severe Atlantic storms, which could generate more significant storm surges and extreme waves,
- increased water depths lead to larger waves reaching the coast

The OPW guidance recommended two climate change scenarios are considered. These are the Mid-Range Future Scenario (MRFS) and the High-End Future Scenario (HEFS). A revised suite of recommendations has been adopted for accounting for climate change within development proposals. In all cases, the allowances should be applied to the 1% AEP fluvial or 0.5% AEP tidal levels. Where a development is critical or extremely vulnerable (see Table 4-2) the impact of climate change on 0.1% AEP flows should also be tested.

These climate change allowances are particularly important at the development management stage of planning and will ensure that proposed development is designed and constructed according to current local and national Government advice.

Table 4-2: Climate change allowances by vulnerability and flood source

Development vulnerability	Fluvial climate change allowance (increase in flows)	Tidal climate change allowance (increase in sea level)	Storm water / surface water
Less vulnerable	20%	0.5m (MRFS)	Refer to the Stormwater Management Policy in Appendix 7.1 for details of climate change allowances
Highly vulnerable	20%	1.0m (HEFS)	
Critical or extremely vulnerable (e.g. hospitals, major sub-stations, blue light services)	30%	1.2m (and test up to 2m) ⁹	
Note: there will be no discounting of climate change allowances for shorter lifespan developments.			

Further work on the impacts of climate change on flood levels was undertaken as part of the Eastern CFRAM Study. The study provided flood extents for both fluvial and coastal risk, which are available on www.floodinfo.ie.

Assessment of climate change impacts can be carried out in a number of ways. For watercourses that fall within the Eastern CFRAM study area, flood extents and water levels for the MRFS and HEFS have been developed. For other fluvial watercourses a conservative approach would be to take the 0.1% AEP event levels and extent as representing the 1% AEP event plus climate change. Where access to the hydraulic river model is readily available a run with climate change could be carried out, or hand calculations undertaken to determine the likely impact of additional flows on river levels. In a coastal or tidal scenario, a 0.5 or 1m plus increase to the 0.5% AEP sea level can be assessed based on topographic levels.

4.9 Flood Mitigation Measures at Site Design

For any development proposal in Flood Zone A or B that has passed the Justification Test for Development Plans, it must be demonstrated that appropriate mitigation measures can be put in place and that residual risks can be managed to acceptable levels. Guidance on what might be considered 'acceptable' has been given in a number of sections in this document and should be discussed with the DL RCC Planning and Municipal Services teams.

To ensure that adequate measures are put in place to deal with residual risks, proposals should demonstrate the use of flood-resistant construction measures that are aimed at preventing water from entering a building and that mitigate the damage floodwater causes to buildings.

⁹ From OPW Sectoral Climate Change Adaptation Plan (2019) where a 2m rise in sea level is plausible under certain scenarios.

Alternatively, designs for flood resilient construction may be incorporated into the development design where it can be demonstrated that entry of floodwater into buildings is preferable to limit damage caused by floodwater and allow relatively quick recovery.

Various mitigation measures are outlined below and further detail on flood resilience and flood resistance are included in the Technical Appendices of the Planning Guidelines.

It should be emphasised that measures such as those highlighted below should only be considered once it has been deemed 'appropriate', to allow development in a given location or the Justification Test for Development Plans has been passed. The Planning Guidelines do not advocate an approach of engineering solutions in order to justify the development which would otherwise be inappropriate.

4.9.1 Site Layout and Design

To address flood risk in the design of new development, a risk based approach shall be adopted to locate more vulnerable land use to higher ground while water compatible development i.e. recreational or open space, and in some situations car parking, can be located in higher flood risk areas. Highly vulnerable land uses (i.e. residential housing) shall be substituted with less vulnerable development (i.e. retail unit).

The site layout should identify and protect land required for current and future flood risk management. Waterside areas or areas along known flow routes can be used for recreation, amenity and environmental purposes to allow preservation of flow routes and flood storage, while at the same time providing valuable social and environmental benefits. Reference should be made to the DLR Green Infrastructure Strategy.

At an individual building level, assigning a water compatible use (i.e. garage / car parking) or less vulnerable use to the ground floor level, along with suitable flood resilient construction, is an effective way of raising vulnerable living space above design flood levels. It can however have an impact on the streetscape. The provision of safe access and egress is a critical consideration in allocating ground floor uses.

4.9.2 Raising Site Levels and Compensatory Storage

Modifying ground levels to raise land above the design flood level is a very effective way of reducing flood risk to the particular site in question. However, in most areas of fluvial flood risk, conveyance or flood storage would be reduced locally and could have an adverse effect on flood risk off site. In addition, loss or variation to the floodplain can impact on the wider hydromorphological functioning of the floodplain and connectivity along the watercourse. There are a number of criteria which must all be met before this is considered a valid approach:

- Development at the site must have passed the Justification test for Development Plans based on the existing (unmodified) ground levels.
- A SSFRA should establish the function provided by the floodplain, of either conveyance or storage of flood waters; this should be agreed with the Municipal Services Section of DLR prior to further assessment being undertaken.
- Where conveyance is the dominant function of the floodplain then a hydraulic model will be required to show the impact of its alteration and to provide design parameters for the provision of direct or indirect compensation¹⁰.
- Where the floodplain predominantly provides a storage function, compensatory storage should be provided on a level for level basis to balance the total area that will be lost through infilling where the floodplain provides static storage.
- The provision of the compensatory storage should be in close proximity to the area that storage is being lost from (i.e. within the same flood cell).
- The land proposed to provide the compensatory storage area must be within the ownership / control of the developer.

¹⁰ See The Planning System and Flood Risk Management, Appendix B, Section 3.3.1

- The land being given over to storage must be land which does not flood in the 1% AEP event (i.e. Flood Zone B or C).
- The compensatory storage area should be constructed before land is raised to facilitate development.
- Within currently developed areas the impact of loss of storage should also be investigated for the 0.1% AEP event, and further compensatory storage provided if the development is shown to have a negative impact on flood risk elsewhere¹¹.
- Where the floodplain functions primarily as a conveyance route, hydraulic modelling may be sufficient to demonstrate a lack of impact as a result of a loss or reprofiling of floodplain, whilst still retaining the conveyance function.
- In a defended site, compensatory storage is not required, but the impact of removing the net reduction in floodplain storage should be assessed for the 0.1% event or a breach of these defences.
- The provision of compensatory storage or remodelling of floodplain areas for conveyance purposes must not alter the geomorphological or ecological regime of the watercourse and will take into account the Ecological network as set out in Appendix 10 of the County Development Plan, which will include the forthcoming Wildlife Corridor Plan.

In some sites it is possible that ground levels can be re-landscaped to provide a sufficiently large development footprint. However, it is likely that in other potential development locations there is insufficient land available to fully compensate for the loss of floodplain. In such cases it will be necessary to reconsider the layout or reduce the scale of development or propose an alternative and less vulnerable type of use. In other cases, it is possible that the lack of availability of suitable areas of compensatory storage mean the target site cannot be developed and should remain a water compatible use.

4.9.3 Finished Floor Levels

Raising finished floor levels within a development is an effective way of avoiding damage to the interior of buildings (i.e. furniture and fittings) in times of flood and provides mitigation against residual risks such as climate change, culvert or bridge blockage and defence failure.

- For highly vulnerable and most less vulnerable development, finished floor levels are to be set, as a minimum, above the 1% AEP fluvial (0.5% AEP tide) level, with an appropriate allowance for climate change (see Table 4-2) plus a freeboard of at least 300mm. The freeboard allowance should be assessed, and the choice justified.
- For some less vulnerable development, it is possible that a finished floor level as low as the 1% AEP fluvial or 0.5% tidal levels could be adopted, provided the risks of climate change are included in the development through adaptable designs or resilience measures. This approach should reflect emergency planning and business continuity to be provided within the development. It may reflect the design life of the development, the proposed use, the vulnerability of items to be kept in the premises, the occupants and users, emergency plan and inclusion of flood resilience and recovery measures. In a tidal context, the analysis should also take into account emerging research on sea level rise.

4.9.4 Raised Defences

Construction of raised defences (i.e. flood walls and embankments) traditionally has been the response to flood risk. However, this is not a preferred option on an ad-hoc basis where the defences to protect the development are not part of a strategically led flood relief scheme. Where a defence scheme is proposed as the means of providing flood defence, the impact of the scheme on flood risk up and downstream must be assessed and appropriate compensatory storage must be provided.

¹¹ A negative impact would result in additional numbers of properties being at flood risk, or an increase in flood depth to properties currently at flood risk.

A site is considered to be defended if the standard of protection is 1% AEP (fluvial) or 0.5% AEP (tidal), within which a freeboard of at least 300mm is included. The FFL of the proposed development needs to include for the impacts of climate change and other residual risks, including overtopping in the 0.1% event, unless this has also been incorporated into the defence design. This may be assessed through breach analysis, overtopping analysis or projection of water levels across the floodplain.

4.10 'Green Corridor'

It is recommended that, where possible, and particularly where there is greenfield land adjacent to the river, a 'green corridor', is retained on all rivers and streams. This will have a number of benefits, including:

- Retention of all, or some, of the natural floodplain;
- Potential opportunities for amenity, including riverside walks and public open spaces;
- Maintenance of the connectivity between the river and its floodplain, encouraging the development of a full range of habitats;
- Natural attenuation of flows will help ensure no increase in flood risk downstream;
- Allows access to the river for maintenance works;
- Retention of clearly demarcated areas where development is not appropriate on flood risk grounds, and in accordance with the Planning Guidelines.

The width of this corridor should be determined by the available land, and topographical constraints, such as raised land and flood defences, but would ideally span the fully width of the floodplain (i.e. all of Flood Zone A). The DLR Green Infrastructure Strategy has identified core green corridors which have been mostly formed along watercourses.

5 Application of the Justification Test for Development Plans

Having reviewed the level of flood risk within the County and determined appropriate measures for assessing and managing risks to high and low vulnerability development in Flood Zones A, B and C, a more detailed assessment of sites and areas was carried out. The aim of this assessment was to apply the Justification Test for Development Plans, taking into account circular PL02/2014 in relation to existing development.

With the exception of the screening land use classifications in Table 5-1, new highly vulnerable development within Flood Zones A or B, or less vulnerable development within Flood Zone A, does not pass the Justification Test for Development Plans and will not be permitted. This applies to lands which are zoned for development but are currently undeveloped and to areas of existing low intensity development. Whilst lands may have retained a zoning objective which would include development, applying the guidance in Section 4 means such development is restricted to Flood Zone C, with water compatible uses located within Zone A and B.

5.1 Existing developed and zoned areas at risk of flooding: Mix Use Lands

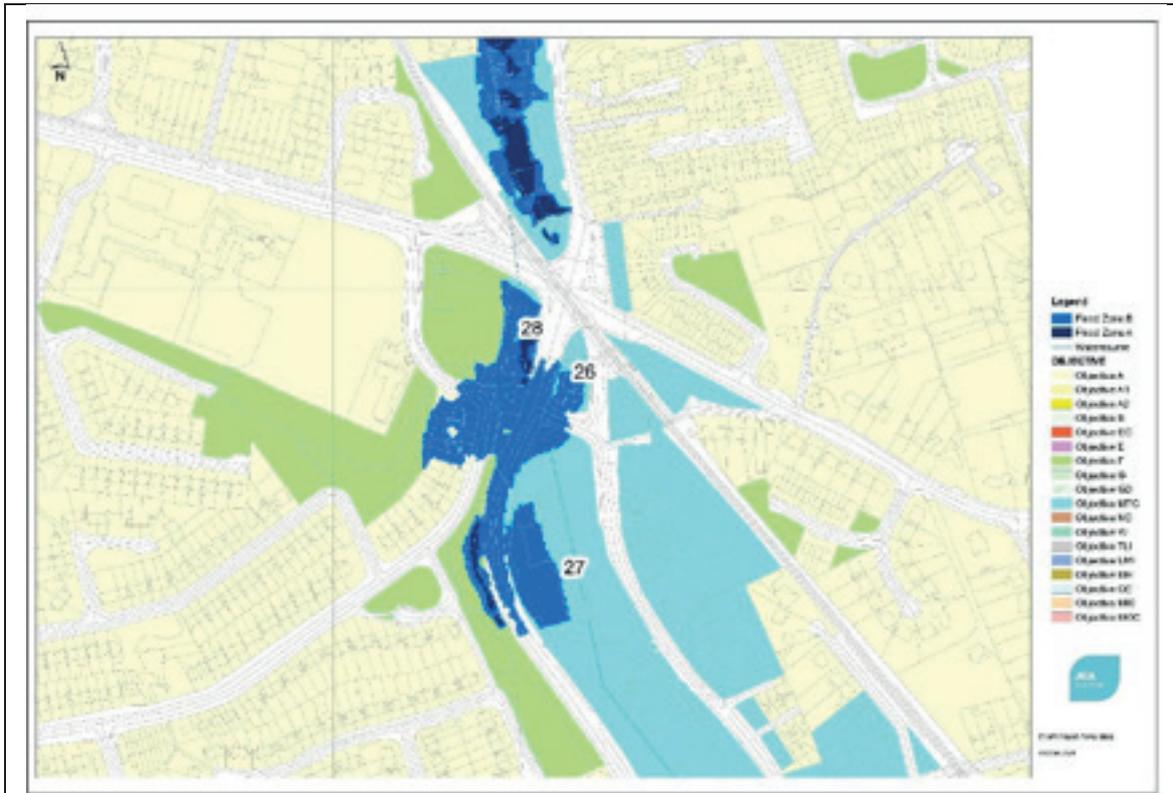
There are a number of areas within Dún Laoghaire-Rathdown County that consist of existing mixed use development and also form the core of a settlement or district centre. For the areas listed in Table 5-1 the requirement for application of the Justification Test for development plans has been reviewed through a screening assessment. The screening assessment has been based on the Flood Zone the area is located in, and the land use that is within Flood Zone A or B.

Where there is a requirement to apply the Justification Test for plan making, this is detailed in the following sections of report.

Table 5-1: Screening for Justification Test for plan making

Land use classification	Name	Justification Test commentary
Major Town centre	Dun Laoghaire	Flood Zone C, JT not required
	Bray (northern margin)	Flood Zone C, JT not required
	Dundrum MTC Phase 2	Partially within Flood Zone A and B, JT applied
Waterfront	Dun Laoghaire Harbour	Partially within Flood Zone B, JT applied
District centres	Blackrock	Partially within Flood Zone A and B, JT applied
	Cornelscourt	Flood Zone C, JT not required
	Nutgrove	Flood Zone C, JT not required
	Stillorgan	Partially within Flood Zone A and B, JT applied
Business District	Sandyford	Partially within Flood Zone A and B, JT applied
Local Area Plan	Rathmichael	Partially within Flood Zone A and B, JT applied
	Old Connaught	Partially within Flood Zone A and B, JT applied

5.1.1 Dundrum MTC Phase 2



Justification Test Criteria		Response
1	The urban settlement is targeted for growth under the National Spatial Strategy, Regional Planning Guidelines, and statutory plans or under the Planning Guidelines or Planning Directives provisions of the Planning and Development Act 2000, as amended.	The National Planning Framework (NPF) sets out the Government's high-level strategic vision for shaping future growth and development in Ireland up to the year 2040. The NPF states that Dublin needs to accommodate a greater proportion of the growth it generates within its Metropolitan boundary. The Regional Spatial and Economic Strategy 2019-2031 (RSES) for the Eastern and Midlands Region incorporates a Dublin Metropolitan Area Strategic Plan and the entire built up area of DLR is located within this Metropolitan boundary (see Figure 1.3 of the County Development Plan). The RSES sets out a settlement hierarchy for the Region and identifies key growth areas which will see significant development up to 2031 and beyond. The vast majority of the built-up footprint of DLR falls within or contiguous to the geographic area known as 'Dublin City and Suburbs', which comprises the first tier in the settlement hierarchy recommended in the RSES (see Figure 1.3 of the County Development Plan).
2. The zoning or designation of the lands for the particular use or development type is required to achieve the proper planning and sustainable development of the urban settlement and, in particular:		
2 (i)	Is essential to facilitate regeneration and/or expansion of the centre of the urban settlement:	It is considered that the lands at Dundrum that are the subject of the Flood Zone A & B status are an essential element of the planned expansion of the Dundrum Major Town Centre area.
2(ii)	Comprises significant previously developed and/or under-utilised lands:	The subject lands consist of significant under-utilised zoned land suitable for a higher density mixed-use type development, proximate to the LUAS line and a LUAS stop.
2(iii)	Is within or adjoining the core of an established or designated urban settlement:	Dundrum is a designated Major Town Centre in the County Development Plan and is located within Dublin City and Suburbs, which comprises Tier 1 in the

		settlement hierarchy for the Region.
2(iv)	Will be essential in achieving compact and sustainable urban growth; and,	The future development of these lands will allow Dundrum further develop as a vibrant active Major Town Centre for the County.
2(v)	There are no suitable alternative lands for the particular use or development type, in areas at lower risk of flooding within or adjoining the core of the urban settlement. (Criteria can be set aside where section 4.27b of Circular PL2.2014 applies. This section would appear to relate to regeneration areas although the circular does not clearly identify Section 4.27b)	There are no suitable alternative lands identified in the Major Town Centre zoning.
3	<p>Flood Risk Considerations</p> <p>A summary of risks and development constraints is provided below. Also see Section 5.2.7 for more detail on the Dundrum Slang ICM Study and flood risks.</p>	
3	<p>Shopping Centre Phase 2 lands (27)</p> <p>The size of the site presents the most significant potential for large scale mixed use development within the local area, but the nature and extent of possible development should be guided by the Sequential Approach.</p> <p>Care must be taken when considering the road/access and ventilation requirements to preclude flow from entering any basement excavated below flood level.</p> <p>A full emergency plan with access and egress to Main Street is compulsory.</p> <p>The residual risk related to spill over the road at Taney Cross and should be used to guide finished floor levels. Other FFLs should be higher than the Dundrum Bypass and potential flood levels. Existing flow paths along the Dundrum Bypass should be maintained. The SSFRA will need to demonstrate there is no impact in flood risk outside the site boundary.</p> <p>Conclusion: Justification Test Passed for Dundrum Shopping Centre Phase 2</p>	
	<p>Dundrum library and health centre (28)</p> <p>The site is fully within Flood Zone B, with a flow route within the site occurring in the 1% AEP event, placing some of the site adjacent to the river in Flood Zone A.</p> <p>Options are limited to managing existing development (minor alterations or renovations) on the site, future redevelopment is not possible under the current high flood risk conditions.</p> <p>The maximum flood level at the site is sensitive to culvert blockage and in the worst case; flood levels are controlled overtopping of the road at Taney Cross. The position of the site is at an important conveyance point where overland flow can re-enter the open channel. Any changes to the site configuration could have a significant negative local impact and cannot be implemented without wider flood relief measures.</p> <p>Conclusion: Justification Test Failed for Dundrum Library Site. Development would be premature until a catchment wide flood relief scheme is completed and development potential should be reassessed at that stage.</p>	
	<p>Gym site opposite library (26)</p> <p>The site is small in area but is situated within a low spot and has a high percentage area within Flood Zone A/B and the application of the Sequential Approach is not possible. The site does not impede conveyance routes.</p> <p>Options are limited to managing existing development (minor alterations or renovations) on the site, future redevelopment is not possible under the current high flood risk conditions.</p> <p>A full emergency plan with access and egress to higher ground within the adjacent site should be implemented as a priority for the existing development, if possible.</p> <p>Conclusion: Justification Test Failed for Dundrum Gym Site. Development would be premature until a catchment wide flood relief scheme is completed and development potential should be reassessed at that stage.</p>	

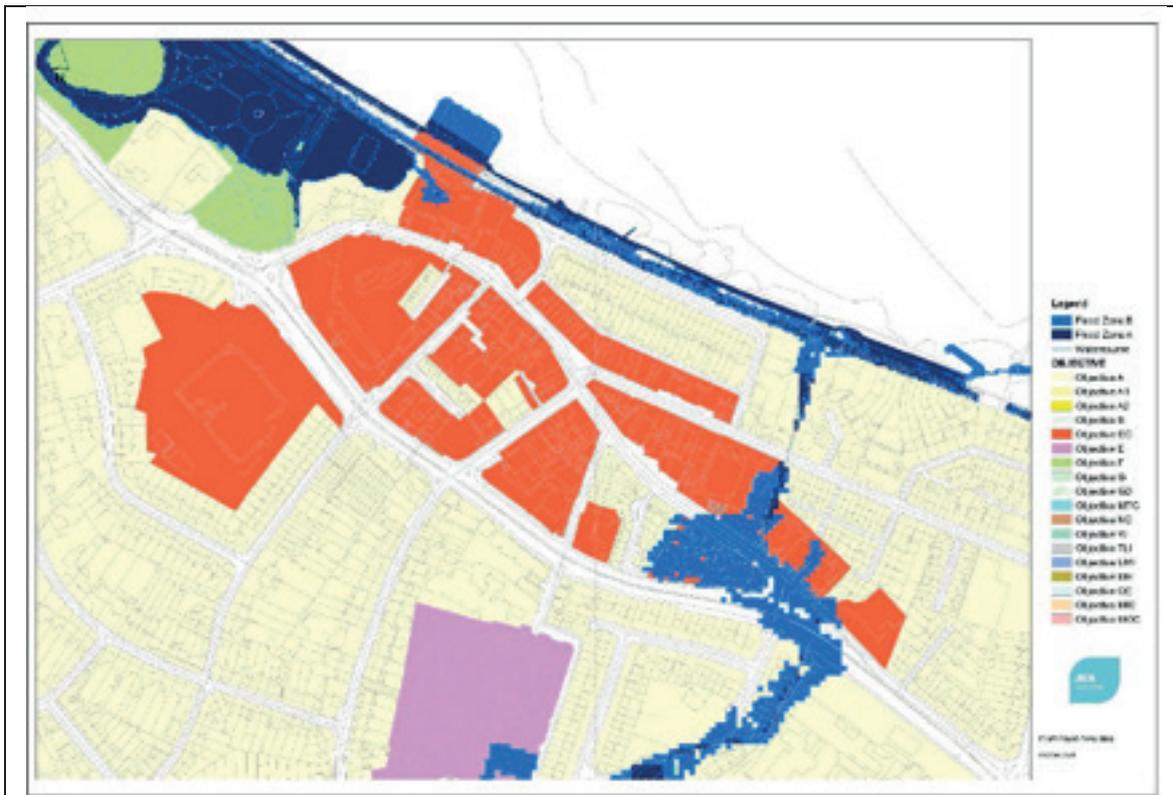
5.1.2 Dun Laoghaire Harbour - Waterfront



Justification Test Criteria		Response
1	The urban settlement is targeted for growth under the National Spatial Strategy, regional planning guidelines, statutory plans or under the Planning Guidelines or Planning Directives provisions of the Planning and Development Act 2000, as amended.	The National Planning Framework (NPF) sets out the Government's high-level strategic vision for shaping future growth and development in Ireland up to the year 2040. The NPF states that Dublin needs to accommodate a greater proportion of the growth it generates within its Metropolitan boundary. The Regional Spatial and Economic Strategy 2019-2031 (RSES) for the Eastern and Midlands Region incorporates a Dublin Metropolitan Area Strategic Plan and the entire built up area of DLR is located within this Metropolitan boundary (see Figure 1.3 of the County Development Plan). The RSES sets out a settlement hierarchy for the Region and identifies key growth areas which will see significant development up to 2031 and beyond. The vast majority of the built-up footprint of DLR falls within or contiguous to the geographic area known as 'Dublin City and Suburbs', which comprises the first tier in the settlement hierarchy recommended in the RSES (see Figure 1.3 of the County Development Plan).
2	The zoning or designation of the lands for the particular use or development type is required to achieve the proper planning and sustainable development of the urban settlement and, in particular:	
2(i)	Is essential to facilitate regeneration and/or expansion of the centre of the urban settlement:	The County Development Plan specifically recognises Dún Laoghaire Harbour as a strategic large-scale regeneration site in recognition of its potential role in increasing the efficiency of urban land-use and delivering upon compact growth

		targets.
2(ii)	Comprises significant previously developed and/or under-utilised lands:	Dún Laoghaire Harbour comprises a developed urban location with partly under-utilised lands.
2(iii)	Is within or adjoining the core of an established or designated urban settlement:	Dún Laoghaire Harbour adjoins Dún Laoghaire Town which is a designated Major Town Centre in the County Development Plan. The lands are located within Dublin City and Suburbs, which comprises Tier 1 in the settlement hierarchy for the Region.
2(iv)	Will be essential in achieving compact and sustainable urban growth; and,	The regeneration of these lands will support the sustainable urban development of Dún Laoghaire as a vibrant Major Town Centre for the County.
2(v)	There are no suitable alternative lands for the particular use or development type, in areas at lower risk of flooding within or adjoining the core of the urban settlement.	There are no suitable alternative lands identified.
3	<p>Flood Risk Considerations</p> <p>Lands within the Waterfront zoning are within Flood Zone B and C. Although occupying a water frontage position, much of the subject land is elevated by several meters from the mean sea level. There are a number of pockets of land which are within the 0.1% AEP coastal flood extents, and risk associated with climate change and sea level rise are likely to be high. SSFRA is required for all development within the Harbour area, and should particularly assess the risks associated with sea level risk (see Section 4.8) and wave overtopping. Provided the risks can be managed, for example through setting finished floor levels and ensuring an appropriate emergency response, development within Flood Zone B is considered to pass the Justification Test.</p>	
Conclusion	Justification Test Passed for Dun Laoghaire Harbour - Waterfront	

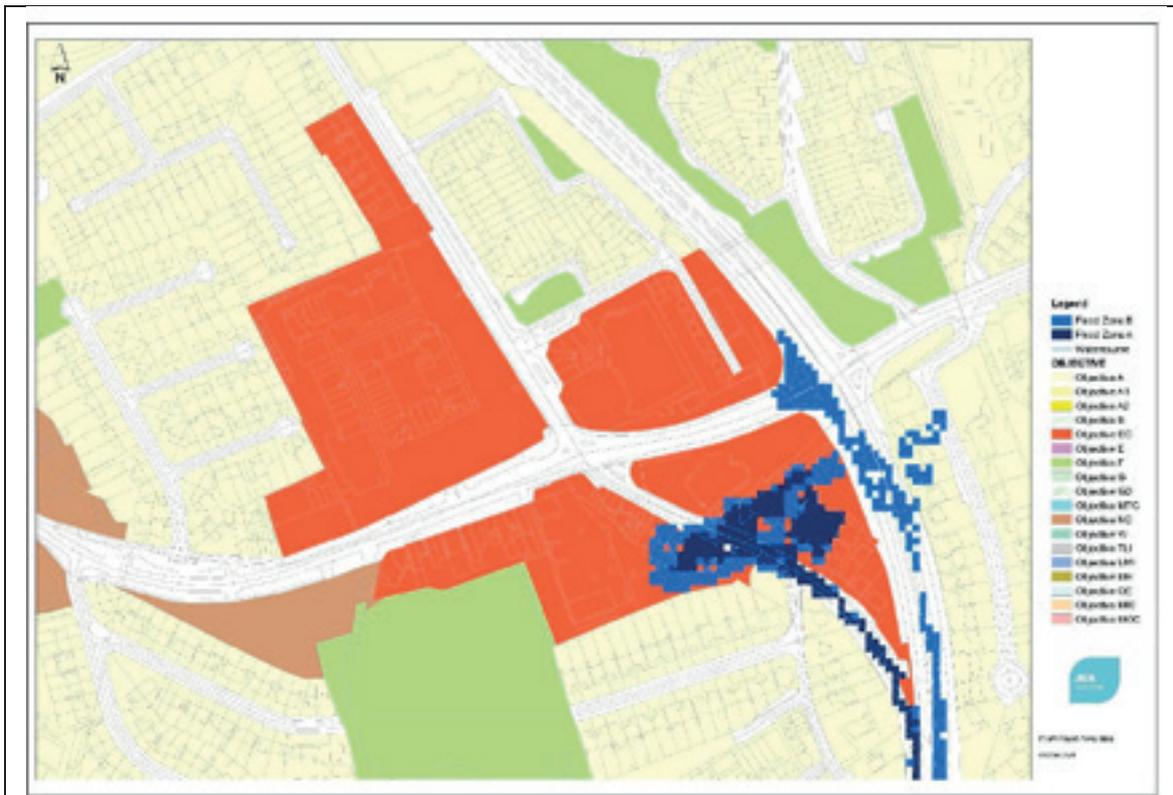
5.1.3 Blackrock District Centre



Justification Test Criteria		Response
1	The urban settlement is targeted for growth under the National Spatial Strategy, regional planning guidelines, statutory plans or under the Planning Guidelines or Planning Directives provisions of the Planning and Development Act 2000, as amended.	The National Planning Framework (NPF) sets out the Government's high-level strategic vision for shaping future growth and development in Ireland up to the year 2040. The NPF states that Dublin needs to accommodate a greater proportion of the growth it generates within its Metropolitan boundary. The Regional Spatial and Economic Strategy 2019-2031 (RSES) for the Eastern and Midlands Region incorporates a Dublin Metropolitan Area Strategic Plan and the entire built up area of DLR is located within this Metropolitan boundary (see Figure 1.3 of the County Development Plan). The RSES sets out a settlement hierarchy for the Region and identifies key growth areas which will see significant development up to 2031 and beyond. The vast majority of the built-up footprint of DLR falls within or contiguous to the geographic area known as 'Dublin City and Suburbs', which comprises the first tier in the settlement hierarchy recommended in the RSES (see Figure 1.3 of the County Development Plan).
2	The zoning or designation of the lands for the particular use or development type is required to achieve the proper planning and sustainable development of the urban settlement and, in particular:	
2(i)	Is essential to facilitate regeneration and/or expansion of the centre of the urban settlement:	Blackrock is considered a strategically important existing urban centre in the County where consolidation and growth is essential to bring about compact and sustainable growth.
2(ii)	Comprises significant previously developed and/or under-utilised lands:	Blackrock comprises a developed urban centre in the County.

2(iii)	Is within or adjoining the core of an established or designated urban settlement:	Blackrock is a designated District Centre in the County Development Plan and is located within Dublin City and Suburbs, which comprises Tier 1 in the settlement hierarchy for the Region.
2(iv)	Will be essential in achieving compact and sustainable urban growth; and,	Blackrock is a strategically located urban centre within the existing built up area of the County and has an important role in supporting compact and sustainable urban growth.
2(v)	There are no suitable alternative lands for the particular use or development type, in areas at lower risk of flooding within or adjoining the core of the urban settlement.	There are no suitable alternative lands identified.
3	<p>Flood Risk Considerations</p> <p>The land within the District Centre zoning is mainly within Flood Zone C, but there is an area within Flood Zones A and B to the east of the District Centre, and a small incursion of Flood Zone B to the west, within the bus station carpark.</p> <p>The Carysfort Maretimo Flood Relief Scheme will include this length of watercourse, although there is no programme for the commencement of the scheme at present. Climate change impacts to the area are likely to be high; there is a significant difference between the extents of Flood Zones A and B, indicating the channel capacity is limited in larger flood events. There is also a risk of increased coastal flooding, although the District Centre is separated from the coast by the DART line. Development in and adjacent to Flood Zone A and B will have to include for the management of flooding on site, and within the scope of the site specific FRA. Use of the sequential approach, with highly vulnerable uses on first floor and above, subject to safe access and egress, and appropriate setting of ground floor finished floor levels should be presented in a masterplan. It is important that there is no loss of floodplain storage for the 1% AEP event. The impact of any changes to ground levels and storage areas should be assessed for the 0.1% AEP flood. Conveyance routes through the site also need to be maintained. The SSFRA will need to demonstrate there is no impact in flood risk outside the site boundary.</p> <p>Should the bus station carpark be redeveloped, the risks arising from the tidal spill through Blackrock Park could be managed through the setting of finished floor levels and retention of water within the park.</p>	
Conclusion	Justification Test Passed for Blackrock District Centre	

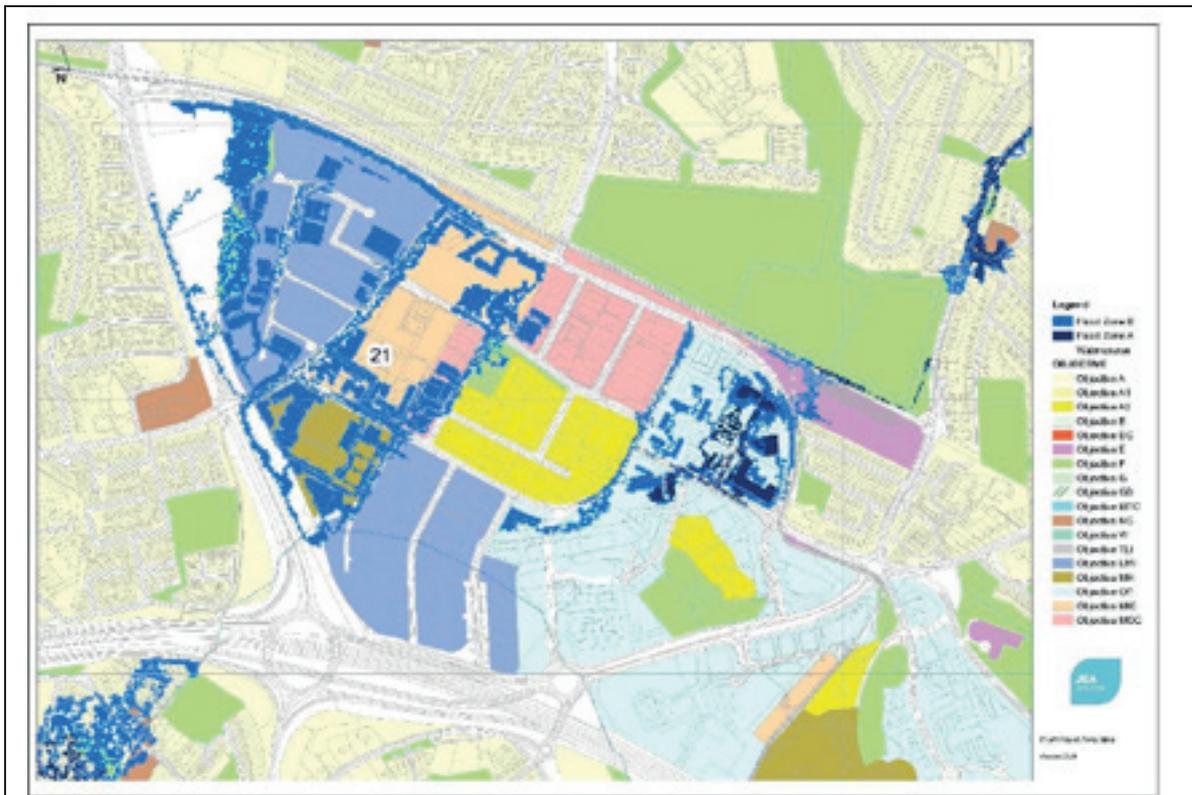
5.1.4 Stillorgan District Centre



Justification Test Criteria		Response
1	The urban settlement is targeted for growth under the National Spatial Strategy, regional planning guidelines, statutory plans or under the Planning Guidelines or Planning Directives provisions of the Planning and Development Act 2000, as amended.	The National Planning Framework (NPF) sets out the Government’s high-level strategic vision for shaping future growth and development in Ireland up to the year 2040. The NPF states that Dublin needs to accommodate a greater proportion of the growth it generates within its Metropolitan boundary. The Regional Spatial and Economic Strategy 2019-2031 (RSES) for the Eastern and Midlands Region incorporates a Dublin Metropolitan Area Strategic Plan and the entire built up area of DLR is located within this Metropolitan boundary (see Figure 1.3 of the County Development Plan). The RSES sets out a settlement hierarchy for the Region and identifies key growth areas which will see significant development up to 2031 and beyond. The vast majority of the built-up footprint of DLR falls within or contiguous to the geographic area known as ‘Dublin City and Suburbs’, which comprises the first tier in the settlement hierarchy recommended in the RSES (see Figure 1.3 of the County Development Plan).
2	The zoning or designation of the lands for the particular use or development type is required to achieve the proper planning and sustainable development of the urban settlement and, in particular:	
2(i)	Is essential to facilitate regeneration and/or expansion of the centre of the urban settlement:	Stillorgan is considered a strategically important existing urban centre in the County where consolidation and growth is essential to bring about compact and sustainable growth.
2(ii)	Comprises significant previously developed and/or under-utilised lands:	Stillorgan comprises a developed urban centre in the County and incorporates under-utilised lands which are identified for regeneration and

		redevelopment.
2(iii)	Is within or adjoining the core of an established or designated urban settlement:	Stillorgan is a designated District Centre in the County Development Plan and is located within Dublin City and Suburbs, identified as Tier 1 in the settlement hierarchy for the Region.
2(iv)	Will be essential in achieving compact and sustainable urban growth; and,	Stillorgan is a strategically located urban centre within the existing built up area of the County and has an important role in supporting compact and sustainable urban growth.
2(v)	There are no suitable alternative lands for the particular use or development type, in areas at lower risk of flooding within or adjoining the core of the urban settlement.	There are no suitable alternative lands identified.
3	<p>Flood Risk Considerations</p> <p>The site is mainly within Flood Zone C, but there is an area within Flood Zone A /B to the east of the District Centre.</p> <p>The Carysfort Maretimo Flood Relief Scheme will include this length of watercourse, although there is no programme for the commencement of the scheme at present.</p> <p>Climate change impacts to the area are likely to be moderate to high; there is a some difference between the extents of Flood Zones A and B, particularly in relation to an overland flow path along the road. This indicates the channel capacity is limited in larger flood events.</p> <p>Development in and adjacent to Flood Zone A and B will have to include for the management of flooding on site, and within the scope of the site specific FRA. Use of the sequential approach, with highly vulnerable uses on first floor and above, subject to safe access and egress, and appropriate setting of ground floor finished floor levels should be presented in a masterplan. It is important that there is no loss of floodplain storage for the 1% AEP event. The impact of any changes to ground levels and storage areas should be assessed for the 0.1% AEP flood. Conveyance routes through the site also need to be maintained. The SSFRA will need to demonstrate there is no impact in flood risk outside the site boundary.</p>	
Conclusion	Justification Test Passed for Stillorgan District Centre	

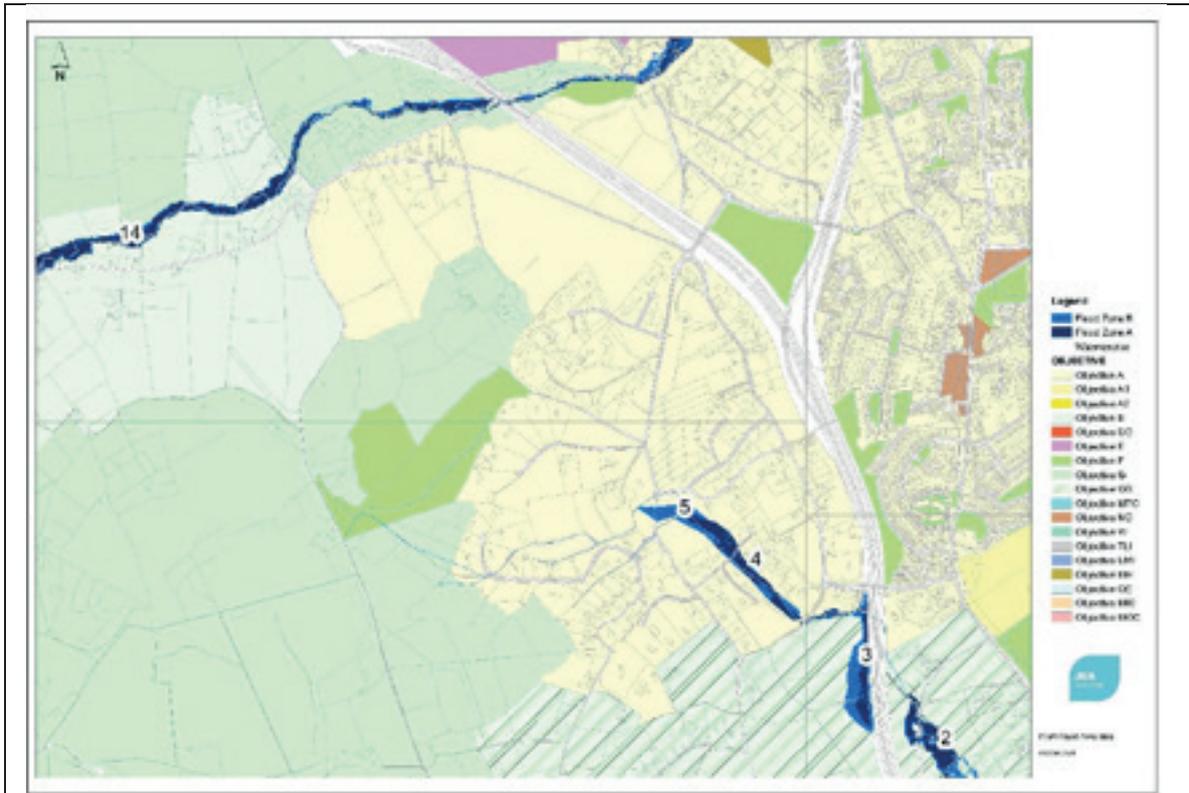
5.1.5 Sandyford Business District



Justification Test Criteria		Response
1	The urban settlement is targeted for growth under the National Spatial Strategy, regional planning guidelines, statutory plans or under the Planning Guidelines or Planning Directives provisions of the Planning and Development Act 2000, as amended.	The National Planning Framework states that Dublin needs to accommodate a greater proportion of the growth it generates within its Metropolitan boundary. The Regional Spatial and Economic Strategy 2019-2031 (RSES) for the Eastern and Midlands Region incorporates a Dublin Metropolitan Area Strategic Plan and the entire built up area of DLR is located within this Metropolitan boundary (see Figure 1.3 of the County Development Plan). The RSES identifies Sandyford as a strategic employment location in the Dublin Metropolitan Area while the Dublin MASP supports the continued development of Sandyford as a high-density business district on the Metrolink / LUAS Greenline Corridor.
2	The zoning or designation of the lands for the particular use or development type is required to achieve the proper planning and sustainable development of the urban settlement and, in particular:	
2(i)	Is essential to facilitate regeneration and/or expansion of the centre of the urban settlement:	Increasing land efficiency through intensification of existing brownfield / under-utilised sites is essential to support the regeneration and expansion of Sandyford as a strategic mixed-use district in the County.
2(ii)	Comprises significant previously developed and/or under-utilised lands:	Sandyford comprises a developed mixed-use district with significant opportunity for the redevelopment and intensification of brownfield / under-utilised lands.
2(iii)	Is within or adjoining the core of an established or designated urban settlement:	The RSES identifies Sandyford as a strategic employment location in the Dublin Metropolitan Area while the Dublin MASP supports the continued development of

		Sandyford as a high-density business district on the Metrolink / LUAS Greenline Corridor. The County Development Plan identifies Sandyford as a mixed-use district and a strategic employment location.
2(iv)	Will be essential in achieving compact and sustainable urban growth; and,	Sandyford is a strategically located mixed-use district within the existing built up area of the County and has an important role in supporting compact and sustainable urban growth.
2(v)	There are no suitable alternative lands for the particular use or development type, in areas at lower risk of flooding within or adjoining the core of the urban settlement.	There are no suitable alternative lands identified.
3	<p>Flood Risk Considerations</p> <p>The majority of flood risk highlighted in the Sandyford Business District is Flood Zone B, with small pockets indicated to be Flood Zone A. Where development is proposed within or near Flood Zone B a site specific flood risk assessment should be undertaken with the aim of a) refining the delineation of flood risk based on local topography and surface water systems; b) demonstrating that the proposed development will not increase flood risk to neighbouring lands; and c) developing flood management measures appropriate to the development proposed.</p> <p>Development in and adjacent to Flood Zone A and B will have to include for the management of flooding on site, and within the scope of the site specific FRA. Use of the sequential approach, with highly vulnerable uses on first floor and above, subject to safe access and egress, and appropriate setting of ground floor finished floor levels should be presented in a masterplan. It is important that there is no loss of floodplain storage for the 1% AEP event. The impact of any changes to ground levels and storage areas should be assessed for the 0.1% AEP flood. Conveyance routes through the site also need to be maintained. The SSFRA will need to demonstrate there is no impact in flood risk outside the site boundary.</p>	
Conclusion	Justification Test Passed for Sandyford Business District	

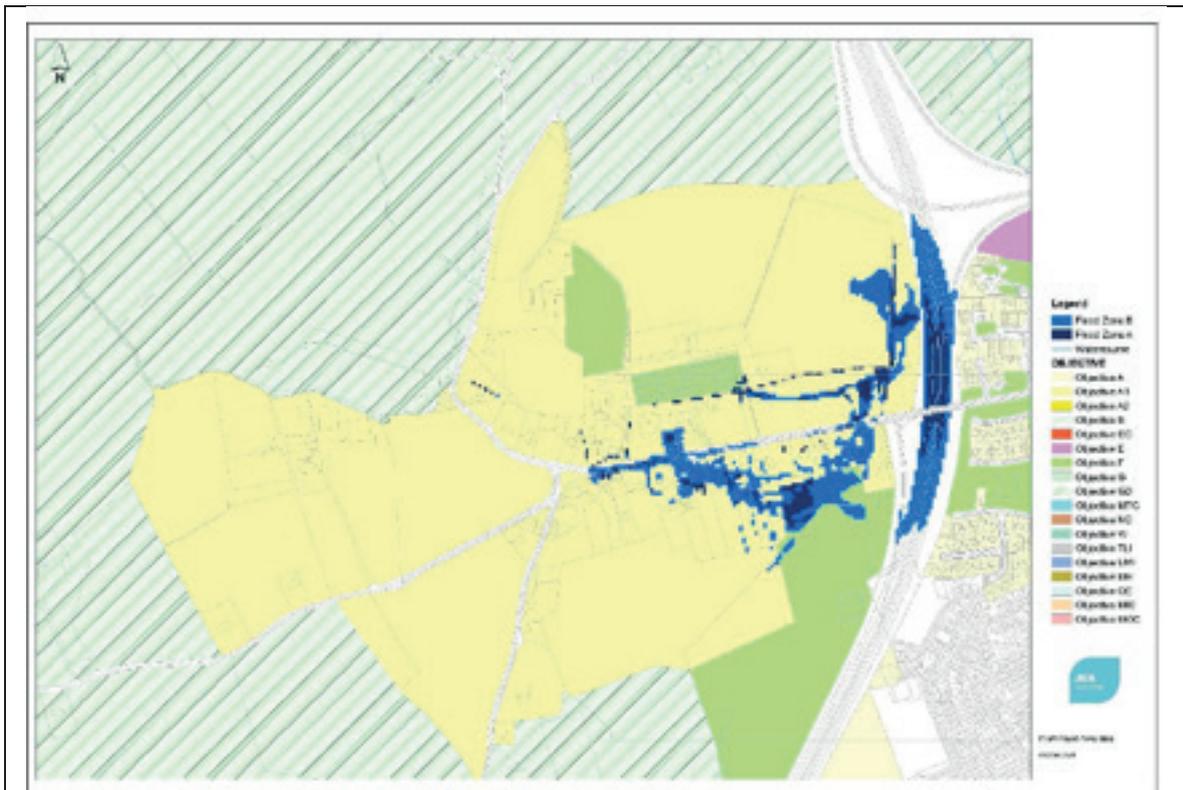
5.1.6 Rathmichael



Justification Test Criteria		Response
1	The urban settlement is targeted for growth under the National Spatial Strategy, regional planning guidelines, statutory plans or under the Planning Guidelines or Planning Directives provisions of the Planning and Development Act 2000, as amended.	The NPF states that Dublin needs to accommodate a greater proportion of the growth it generates within its Metropolitan boundary. Rathmichael is located within the Dublin Metropolitan Area (see Figure 1.3 of the County Development Plan). The RSES sets out a settlement hierarchy for the Region and the geographic area known as ‘Dublin City and Suburbs’, comprises the first tier in this settlement hierarchy. Lands identified for residential growth at Rathmichael are located within or contiguous to Dublin City and Suburbs and as such comprise part of Tier 1 in the settlement hierarchy for the Region. The Core Strategy of the County Development Plan identifies Rathmichael as a ‘New Residential Community’ to be facilitated by way of identified planned infrastructure upgrades (see Appendix 1 of the County Development Plan).
2	The zoning or designation of the lands for the particular use or development type is required to achieve the proper planning and sustainable development of the urban settlement and, in particular:	
2(i)	Is essential to facilitate regeneration and/or expansion of the centre of the urban settlement:	The lands at Rathmichael are located within or contiguous to Dublin City and Suburbs (Tier 1 in the settlement hierarchy for the Region). It is considered that the lands at Rathmichael are essential in order to support the sustainable expansion of the existing urban settlement in DLR, in accordance with the settlement hierarchy of the Region. However, there is sufficient land within Flood Zone C to facilitate this expansion without using Flood Zone A or B lands.
2(ii)	Comprises significant previously developed and/or under-utilised lands:	The subject lands consist of significant under-utilised zoned land suitable for higher density development which will be served by planned infrastructure upgrades (see Appendix 1 of the County Development Plan).

2(iii)	Is within or adjoining the core of an established or designated urban settlement:	The lands at Rathmichael are located within the Dublin Metropolitan Area of the Greater Dublin Area. Furthermore, the lands are located within or contiguous to the geographic area known as Dublin City and Suburbs.
2(iv)	Will be essential in achieving compact and sustainable urban growth; and,	The future development of Rathmichael will be in accordance with an approved LAP prepared in accordance with up-to-date guidance on sustainable settlement and compact urban growth. In light of planned infrastructure upgrades in the Rathmichael area (see Appendix 1 of the County Development Plan) it is considered that the lands would comprise sustainable urban growth. The lands within Flood Zone A and B represent a small proportion of the wider development lands and would contribute more to sustainability by retaining a green corridor through the plan area which could incorporate public access to the watercourse and support biodiversity enhancement.
2(v)	There are no suitable alternative lands for the particular use or development type, in areas at lower risk of flooding within or adjoining the core of the urban settlement.	The lands within Rathmichael are largely within Flood Zone C so development within Flood Zones A and B is not required to meet the Core Strategy as there is significant other lands available within the area at lower risk of flooding.
3	<p>Flood Risk Considerations</p> <p>The indicative LAP boundary for Rathmichael includes a small section of lands within Flood Zones A and B, although most of the existing and proposed development lands are in Flood Zone C.</p> <p>There is limited flood risk shown within the existing development at the upstream end of the northern reach of the Crincken Stream (4). Further development within Flood Zones A and B will be limited Minor Development as defined in Section 4.3.1; major new development does not pass the Justification Test for Plan Making.</p> <p>At the upstream end of the Crincken Stream there is a plot which is currently undeveloped (5) but zoned as existing residential development. This plot is shown through the PFRA mapping to be at flood risk and ground conditions also indicate high water table / poor infiltration of surface water at this site. Risks to these lands can be further defined through site specific risk assessment, following the guidance within this SFRA, with development in Flood Zone A and B to be avoided.</p>	
Conclusion	Development lands within Flood Zone C are not subject to the Justification Test and therefore development of these lands can occur in accordance with the Planning Guidelines and any future Local Area Plan. The lands within Flood Zone A and B in Rathmichael do not pass the Justification Test and should be used for open space/amenity/water compatible uses.	

5.1.7 Old Connaught



Justification Test Criteria		Response
1	The urban settlement is targeted for growth under the National Spatial Strategy, regional planning guidelines, statutory plans or under the Planning Guidelines or Planning Directives provisions of the Planning and Development Act 2000, as amended.	The NPF states that Dublin needs to accommodate a greater proportion of the growth it generates within its Metropolitan boundary. Old Connaught is located within the Dublin Metropolitan Area (see Figure 1.3 of the County Development Plan). The RSES sets out a settlement hierarchy for the Region and Old Connaught is identified as a strategic residential development area for the westward expansion of the Key Town of Bray (Tier 3 in the RSES settlement hierarchy). The Dublin MASP identifies strategic residential and employment growth corridors for the Dublin Metropolitan Area and identifies Old Connaught on the North-South Corridor (DART) as a suitable location for the development of a new residential community. The Core Strategy of the County Development Plan identifies Old Connaught as a 'New Residential Community' to be facilitated by way of identified planned infrastructure upgrades (see Appendix 1 of the County Development Plan).
2	The zoning or designation of the lands for the particular use or development type is required to achieve the proper planning and sustainable development of the urban settlement and, in particular:	
2(i)	Is essential to facilitate regeneration and/or expansion of the centre of the urban settlement:	The RSES states that population growth in Bray has been modest compared to other settlements as expansion of the Town is constrained by the coast to the east, Bray Head/Sugarloaf mountains to the south and the N/M11 to the west. In order for Bray to fulfil its growth potential, the RSES states that, "...lands at Fassaroe to the west of the N/ M11 are targeted for new housing, employment and major community and sports facilities, along with development of lands at Old Connaught (Conna)-Fassaroe, which are within Dún Laoghaire-Rathdown." The Dublin MASP, which comprises a component part of the RSES, specifically identifies Old Connaught as a strategic development area to support the westward expansion of Bray.
2(ii)	Comprises	The subject lands consist of significant under-utilised zoned land

	significant previously developed and/or under-utilised lands:	suitable for higher density development which will be served by planned infrastructure upgrades (see Appendix 1 of the County Development Plan).
2(iii)	Is within or adjoining the core of an established or designated urban settlement:	The lands at Old Connaught are located within the Dublin Metropolitan Area of the GDA and are contiguous to the Key Town of Bray. As noted in 2(i) above the RSES specifically identifies the Old Connaught lands as a strategic development area to support the westward expansion of Bray.
2(iv)	Will be essential in achieving compact and sustainable urban growth; and,	The future development of the Old Connaught lands will be in accordance with an approved LAP prepared in accordance with up-to-date guidance on sustainable settlement and compact urban growth. In light of significant planned infrastructure upgrades in the Old Connaught area (see Appendix 1 of the County Development Plan) it is considered that the lands would comprise sustainable urban growth.
2(v)	There are no suitable alternative lands for the particular use or development type, in areas at lower risk of flooding within or adjoining the core of the urban settlement.	There are no suitable alternative lands identified within the County. Old Connaught is specifically identified in the RSES to support the westward expansion of the Key Town of Bray.
3	<p>Flood Risk Considerations</p> <p>The indicative LAP boundary for Old Connaught (see SFRA Map no. 14) includes some lands within Flood Zones A and B. Within the 'A1' zoned lands, a significant portion of the lands identified within Flood Zones A and B have largely been developed already, particularly along Old Connaught Avenue. There are further lands in the surrounding area identified within Flood Zones A and B which are also zoned 'A1'. In addition, there are some lands identified as Flood Zone A and B both to the south of the LAP area at the County Brook and to the north east of the area at the Crinken Stream. These lands are, however, zoned 'GB'.</p> <p>Flood risk in the main arises from overland flows as a result of under capacity of the water course upstream of the village. It is noted that a surface water pipe has been installed to mitigate flood risk in the village environs. Whilst providing benefits to existing development, it is important that residual risks, such as through culvert blockage, should be addressed through LAP SFRA and policy objectives / site specific flood risk assessment.</p> <p>Proposed development in and adjacent to Flood Zone A and B will have to include for the management of flooding on site, and within the scope of the site-specific FRA. Use of the sequential approach should be presented in a masterplan which should demonstrate that there is no highly vulnerable development within Flood Zones A or B. There should be no loss of floodplain storage for the 1% AEP event and the impact of any changes to ground levels and storage areas as part of flood management proposals should be assessed for the 0.1% AEP flood. As overland flow is the primary source of flood risk, it is important that conveyance routes through the site are maintained. The SSFRA will also need to demonstrate there is no impact in flood risk to third party lands.</p>	
Conclusion	Justification Test Passed for Old Connaught	

5.2 Existing developed and zoned areas at risk of flooding: All other lands

Circular PL02/2014 states that “In some instances, particularly in older parts of cities and towns, an existing land use may be categorised as a “highly vulnerable development” such as housing, be zoned for residential purposes and also be located in flood zone A/B. Additional development such as small scale infill housing, extension or changes of use that could increase the risk or number of people in the flood-prone areas can be expected in such a zone into the future. In these instances, where the residential/vulnerable use zoning has been considered as part of development plan preparation, including uses of the Justification Test as appropriate, and it is considered that the existing use zoning is still appropriate, the development plan must specify the nature and design of structural or non-structural flood risk management measures prior to future development in such areas in order to ensure that flood hazard and risk to the area and to other adjoining locations will not be increased or, if practicable, will be reduced”.

There are a number of such areas in the County identified on the Flood Zone maps. It is considered that it would be unrealistic to down zone these lands as they are fully developed. Parts 1 and 2 of the Justification Test for Development Plans in relation to these areas of existing housing in the County is outlined below in Table 5-2. In applying the Justification Test, particularly Part 3, consideration has been given to structural and non-structural measures which may be required prior to further development taking place. In most locations, future opportunities for development are likely to be limited to small extensions, infill houses or small commercial units and changes of use. As such, in most areas flood risk can be addressed through non-structural responses, such as requiring a site-specific flood risk assessment which will identify appropriate mitigation measures such as retaining flow paths, flood resilient construction and emergency planning.

Table 5-2: Justification Test for Development Plans (Part 1 and 2) only for zoning objective A, A1, A2, NC, E, TLI, SNI, MIC, MOC, LIW, OE areas in the County that are already developed (excluding areas with very low intensity development) and include existing vulnerable uses and are in flood zone A and/or B.

Criteria	Response
1 The urban settlement is targeted for growth under the National Spatial Strategy, regional planning guidelines, statutory plans or under the Planning Guidelines or Planning Directives provisions of the Planning and Development Act 2000, as amended.	The National Planning Framework (NPF) sets out the Government's high-level strategic vision for shaping future growth and development in Ireland up to the year 2040. The NPF states that Dublin needs to accommodate a greater proportion of the growth it generates within its Metropolitan boundary. The Regional Spatial and Economic Strategy 2019-2031 (RSES) for the Eastern and Midlands Region incorporates a Dublin Metropolitan Area Strategic Plan and the entire built up area of DLR is located within this Metropolitan boundary (see Figure 1.3 of the County Development Plan). The RSES sets out a settlement hierarchy for the Region and identifies key growth areas which will see significant development up to 2031 and beyond. The vast majority of the built-up footprint of DLR falls within or contiguous to the geographic area known as 'Dublin City and Suburbs', which comprises the first tier in the settlement hierarchy recommended in the RSES (see Figure 1.3 of the County Development Plan).
2 The zoning or designation of the lands for the particular use or development type is required to achieve the proper planning and sustainable development of the urban settlement and, in particular:	
2(i) Is essential to facilitate regeneration and/or expansion of the centre of the urban settlement:	All of these areas are essential in order to support compact growth and the sustainable expansion of the existing urban settlement in DLR.
2(ii) Comprises significant previously developed and/or under-utilised lands:	The lands in question contain significant previously developed land/or under-utilised lands.
2(iii) Is within or adjoining the core of an established or designated urban settlement:	The lands in question fall within the Dublin Metropolitan Area. Furthermore, the lands are located within or contiguous to Dublin City and Suburbs (Tier

		1 In the settlement hierarchy for the Region) or the Key Town of Bray (Tier 3).
2(iv)	Will be essential in achieving compact and sustainable urban growth; and,	In accordance with national and regional policy objectives, the lands in question are considered to be essential in achieving compact growth targets in relation to Dublin City and Suburbs and/or sustainable urban growth in accordance with the RSES settlement hierarchy and the Dublin MASP.
2(v)	There are no suitable alternative lands for the particular use or development type, in areas at lower risk of flooding within or adjoining the core of the urban settlement.	There are no suitable alternative lands identified within the County.

There are a number of locations where flood risk is greater and non-structural responses are not appropriate to the scale of risks. In these locations, structural measures, generally in the form of flood defences, will be required prior to future development occurring. Further detail on the specifics of the flood management measures in these locations is available in the ECFRAM Preliminary Options Reports, and in the areas where Flood Relief Schemes are being progressed, or have been shortlisted for progressing in the coming years.

The following sections provide more detail on the various flood risk areas within the County, and gives a details of the outcome of Part 3 of the Justification Test for Development Plans.

5.2.1 Crinken Stream

At the downstream end of the Crinken Stream there is flooding to the open space area associated with Woodbrook Glen residential development (1) see Figure 5-1. Flooding is also predicted the east of M50 either side of Allies River Road (2). Flooding risk arising from the Crinken Stream in this area is primarily within land zoned as greenbelt (GB and F). Flooding is also shown at St Brendan's School, Wilford and lands to north at Woodbrook Downs and Woodbrook Golf course and to west of M50 south of Crinken Lane (3) and. This land is also zoned as greenbelt. These zonings are water compatible and therefore appropriate within Flood Zone A and B and should be retained.

Areas 4 and 5 were discussed under the Rathmichael LAP (Section 5.1).

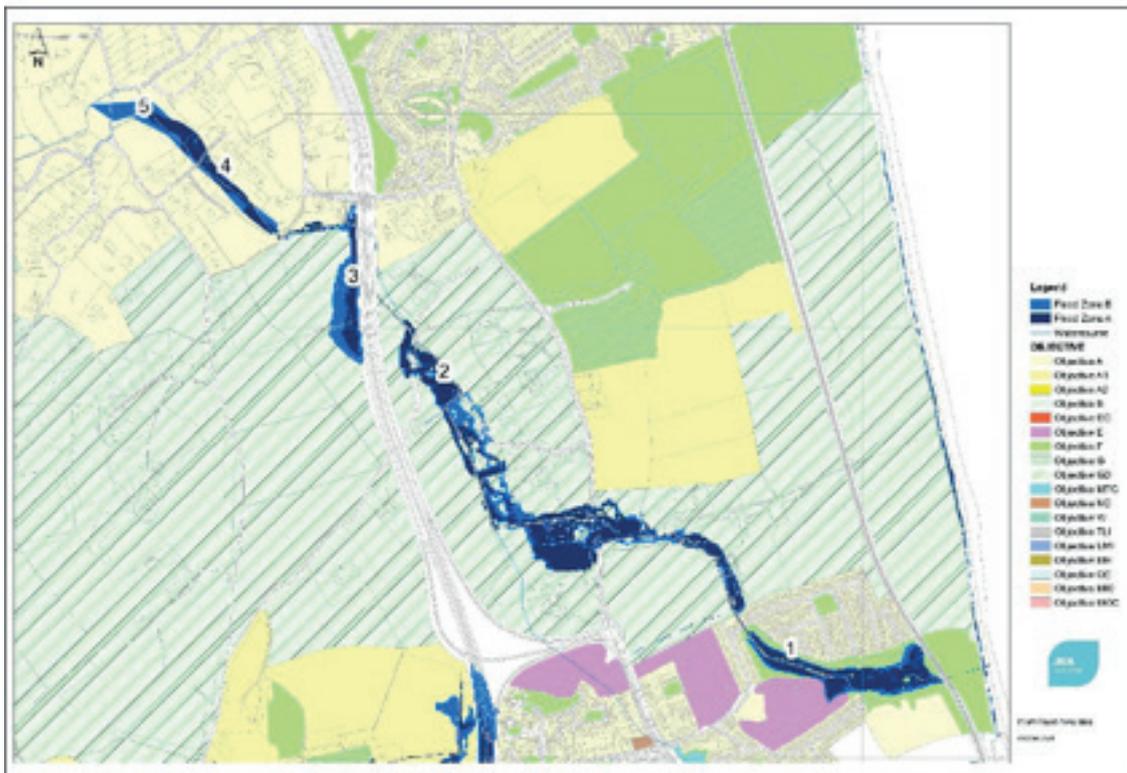


Figure 5-1: Crinken Stream

5.2.2 Deansgrange Stream

The majority of the Flood Zones associated with the Deansgrange River (Figure 5-2) cover land zoned for water compatible open space uses (7). Areas at risk include, but are not limited to, residential areas of Little Meadow and Cabinteely Court, the rear of properties along Pottery Road near its junction with Johnstown Road, the rear of houses in Coolevin estate, the Glenavon Park residential estate, Clonkeen Park, particularly to rear of Kill of Grange School and Kilbogget Park.

It is noted that no flooding is shown in Deansgrange Village despite recent significant flooding events. These events have been attributed to pluvial flooding and not fluvial and are therefore not included in the Flood Zones, but have been identified as areas of flood risk concern and risks arising from pluvial sources should be identified and mitigated as part of the drainage impact assessment.

Planning Permission has been granted for a storage scheme to increase flood storage on Kilbogget Park with a view to limiting downstream flows and manage flooding to residential development downstream of Kilbogget Park (8). The storage area is part of a suite of measures that form part of the Deansgrange Flood Relief Scheme. Until such time as the whole Deansgrange Flood Relief Scheme has been constructed, development within this area would be considered premature. Minor developments as defined in Section 4.3.1, within Flood Zone A are unlikely to increase flood risk and may be considered, but uses which introduce additional people into the floodplain or change of use from less to highly vulnerable should be avoided until the scheme is in place.

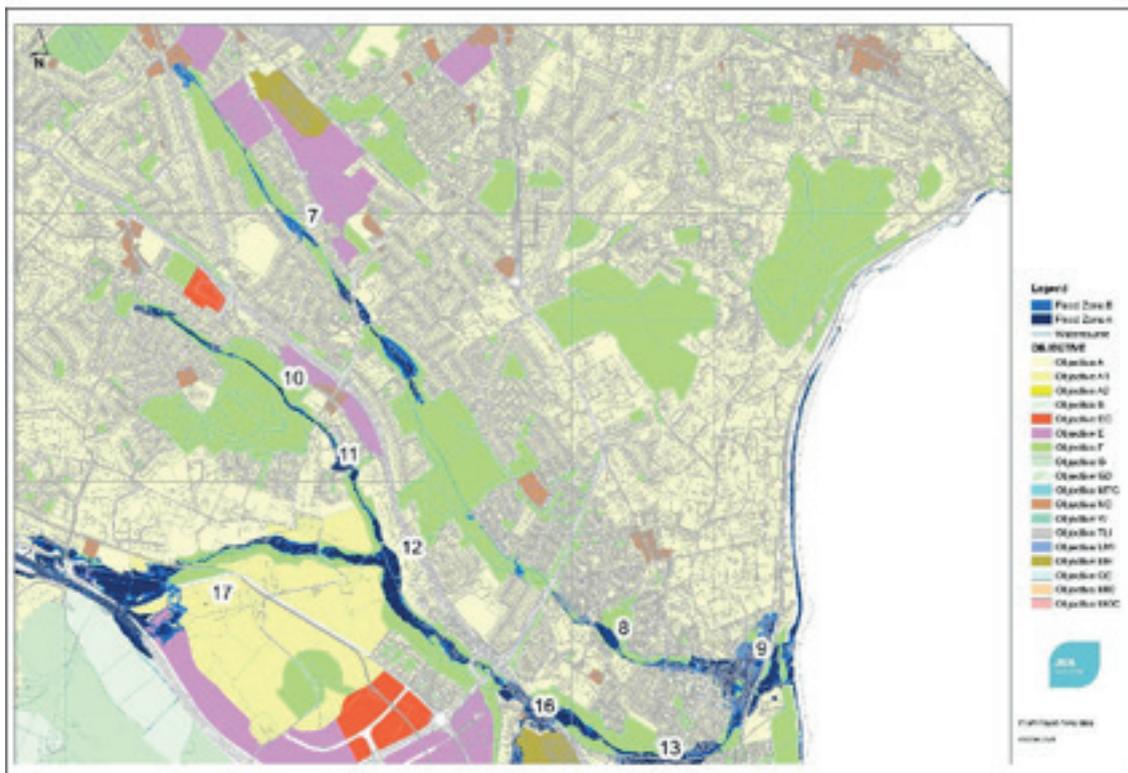


Figure 5-2: Deansgrange River

At the downstream end of the Deansgrange Stream there is a high level of flood risk arising from a combination of low capacity watercourses and culverts below the DART line the result is extensive flood risk to the Seafield, Bayview and neighbouring residential areas (9). This risk could be exacerbated during periods of high tide which could further restrict outflows into the sea. This area is within the Eastern CFRAM and has progressed from the Preliminary Options Report (POR) to the early stages of preparation of a Flood Relief Scheme (FRS). Consultants

were appointed to design the FRS in early 2020. Further details are available on the project website¹².

Whilst Parts 1 and 2 of the Justification Test for Development Plans have been passed, the CFRAM outputs indicate possible flood depths of up to 1m and therefore Part 3 cannot be passed at present. Until the scheme is complete, any development in Flood Zone A is not permitted and development in Flood Zone B should be limited to Minor Development as defined in Section 4.3.1. Care should also be taken to ensure minor developments will not have a negative impact on the CFRAM's POR outline scheme, or the FRS as the design progresses. Upon completion of a Flood Relief Scheme to the 1.0% AEP event standard, proposals for all development will be considered subject to a Site Specific Flood Risk Assessment satisfying the requirements of Section 4 of this SFRA..

¹² <http://www.deansgrangefrs.ie/>

5.2.3 Shanganagh River

Note: The ‘Carrickmines/Shanganagh’ river catchment comprises several tributaries including the Carrickmines River, Loughlinstown River, Shanganagh River, Glenamuck Stream, Brides Glen River, Foxrock Stream and Cabinteely Stream. The boundaries of these sub-catchments are not definitive and may indeed overlap and thus are to be considered indicative only.

Upstream of the crossing point between the Shanganagh River and the N11, and at the confluence of the Shanganagh and Loughlinstown Rivers, lands within Flood Zone A and B are mainly zoned for water compatible uses, which should be retained (10), see Figure 5-2. There are some areas of existing residential development including parts of Beech Park (11) and Sunnyhill Park (12) that are located in Flood Zone A and B. In these areas of existing development, flood risks are generally moderate and risks to Minor Development, as defined in Section 4.3.1, can be managed through site specific risk assessments in accordance with the specification guidance in this SFRA. New development within Flood Zone A and B cannot be justified and floodplain land should be retained as open space.

Downstream of M11 and upstream of the DART line, Flood Zone A extends into areas of existing residential development (13) along the Commons Road, with some additional flood risk indicated by Flood Zone B. The area along Mill Lane has flooded in the past, both before and after construction of the defences. The defences consist of a combination of reinforced concrete walls and embankment. The walls were designed to provide a 1 in 50 year standard of protection, which is below the required standard of protection for Flood Zone A so it must be assumed that the lands are undefended.

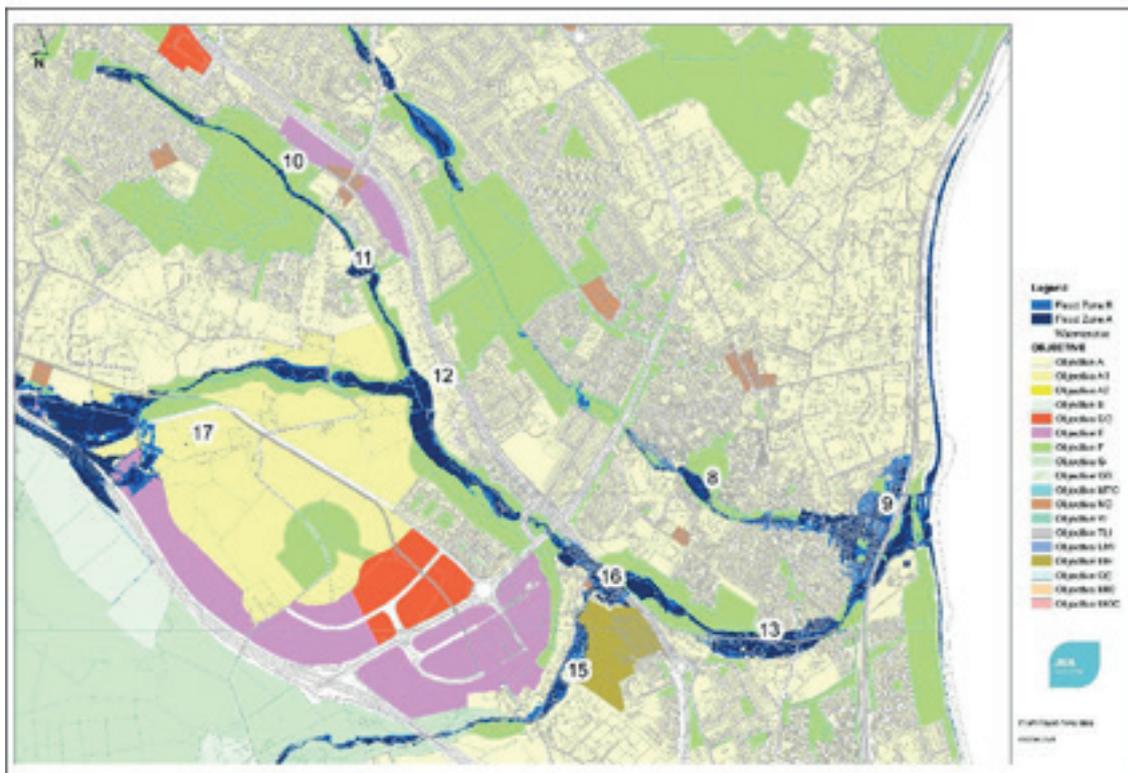


Figure 5-3: Shanganagh River

Whilst Parts 1 and 2 of the Justification Test for Development Plans have been passed, the CFRAM outputs indicate possible flood depths up to 2m and therefore Part 3 cannot be passed at present. Until a Flood Relief Scheme to the 1.0% AEP event standard is complete, any development in Flood Zone A is not permitted and development in Flood Zone B should be limited to Minor Development, as defined in Section 4.3.1. Care should also be taken to ensure minor developments will not have a negative impact on the CFRAM's POR outline scheme, or the FRS as the design progresses. Upon completion of a Flood Relief Scheme to the 1.0% AEP

event standard, proposals for all development will be considered subject to a Site Specific Flood Risk Assessment satisfying the requirements of Section 4 of this SFRA.

5.2.4 Loughlinstown River

The Loughlinstown River, shown in Figure 5-4, passes through areas zoned for various vulnerabilities, including high amenity, rural amenity and agricultural development and existing residential development.

Within currently undeveloped areas (14) there is no justification for development within Flood Zones A and B.

In areas of existing residential development (15), flood risks are generally low to moderate, with overland flow being more of a consideration than in lower parts of the catchment. In this area Minor Development, as defined in Section 4.3.1, can be managed through site specific risk assessments in accordance with the specification guidance in this SFRA. New development within Flood Zone A and B cannot be justified.

Near the confluence with the Shanganagh and upstream of the N11 (16), the CFRAM study indicates possible flood depths of over 2m. Risks to Minor Development, as defined in Section 4.3.1, should be assessed through site specific risk assessments in accordance with the specification guidance in this SFRA. New development within Flood Zone A and B cannot be justified.

The Carrickmines Shanganagh FRS has commenced in August 2020 and construction of any cost beneficial flood alleviation works is not envisaged prior to 2024. Upon completion of a Flood Relief Scheme to the 1.0% AEP event standard, proposals for all development will be considered subject to a Site Specific Flood Risk Assessment satisfying the requirements of Section 4 of this SFRA.

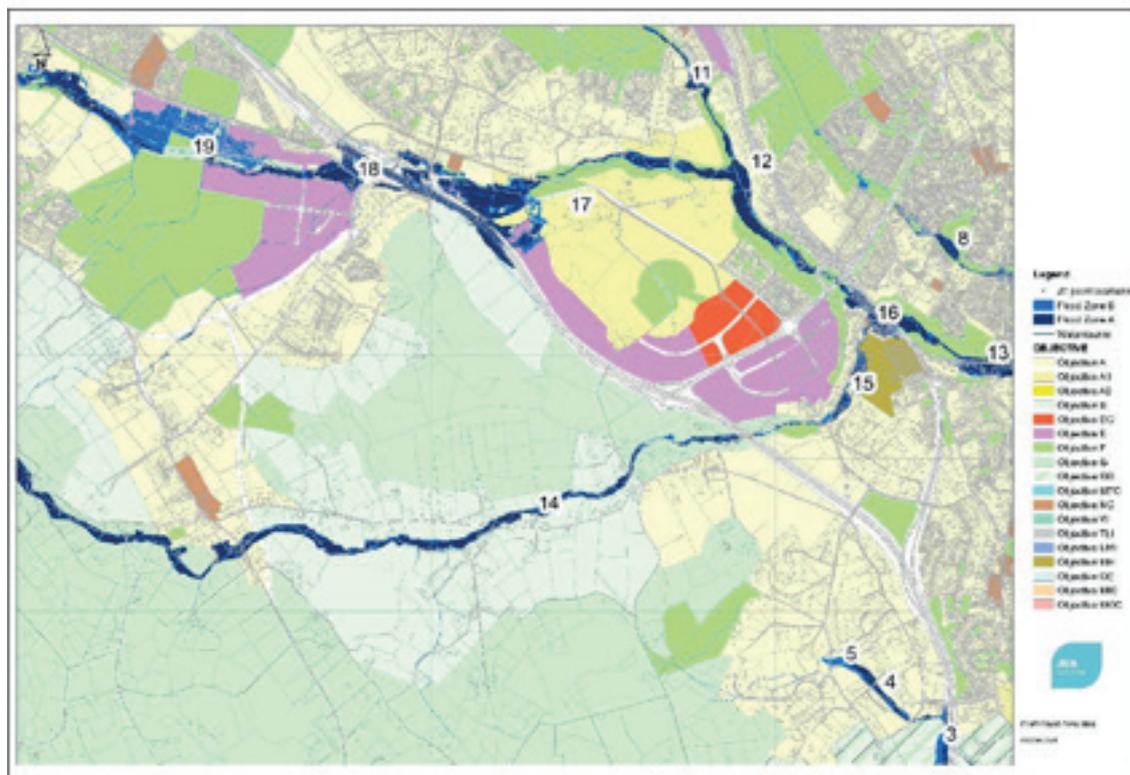


Figure 5-4: Loughlinstown River

5.2.5 Carrickmines River

The Carrickmines River is shown in Figure 5-5. As part of the Cherrywood SDZ (17) process a stage 3 FRA was carried out and included assessment of risks at the M50 and Carrickmines Luas Station (Priorsland)¹³. As a result, the SDZ has not been re-reviewed under this SFRA.

It should be noted that the north-west quadrant of the Carrickmines Shopping Centre (18) is subject to extreme depths of flooding and development within Flood Zone A and B does not pass the Justification Test for plan making and is not permitted.

Flood Zone A and B are within land zoned for open spaces uses and this must be retained as water compatible uses (19). New development within Flood Zone A cannot be justified and less vulnerable development in Flood Zone B needs a detailed SSFRA. Minor development, as defined in Section 4.3.1, is permissible, subject to appropriate SSFRA.

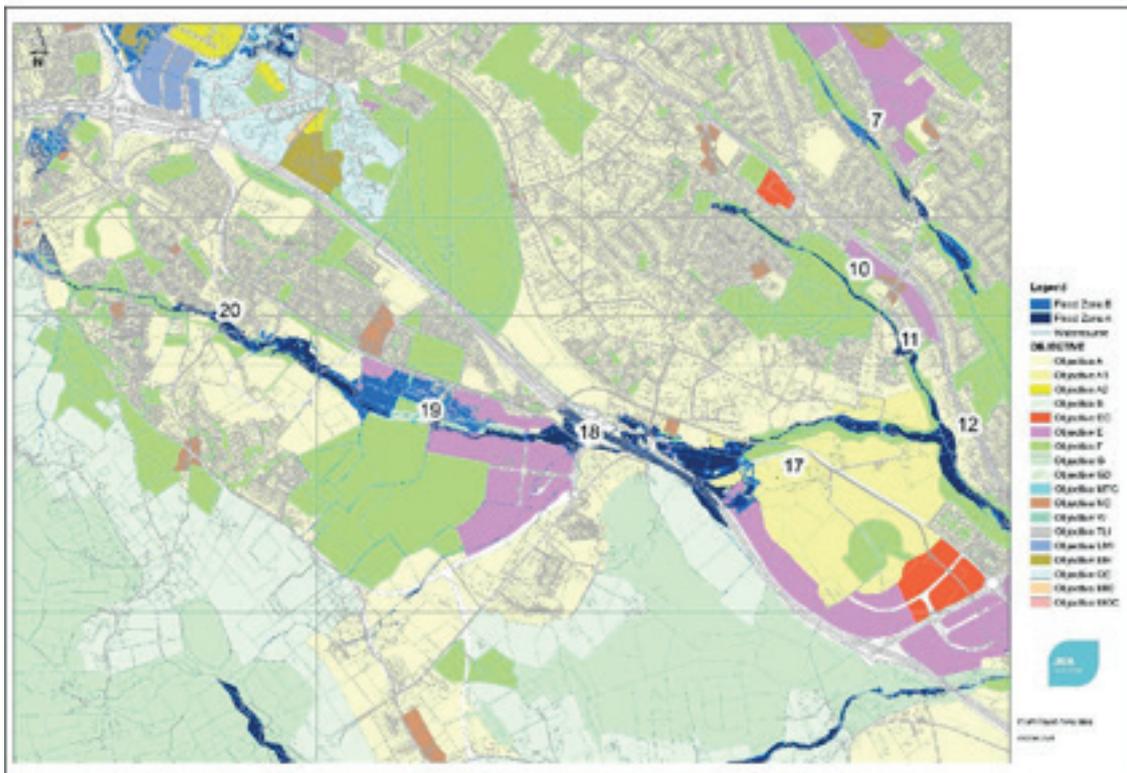


Figure 5-5: Carrickmines River

Towards the upstream end of the Carrickmines River is an area of existing residential development (20). Flood risk in this area is indicated to be high, with many properties in Flood Zone A. The CFRAM extends along the Carrickmines River and included flood relief options within the POR. A flood relief scheme is now proposed, with works on the design of the scheme due to commence in mid-2020. Future development in this area shall be limited to Minor Development, as defined in Section 4.3.1. Infill or other new development will be considered premature until the FRS is constructed. When the FRS has been completed, development may be considered subject to analysis of residual risk.

The Carrickmines Shanganagh FRS has commenced in August 2020 and construction of any cost beneficial flood alleviation works is not envisaged prior to 2024. Upon completion of a Flood Relief Scheme to the 1.0% AEP event standard, proposals for all development will be considered subject to a Site Specific Flood Risk Assessment satisfying the requirements of Section 4 of this SFRA.

¹³ "Flood Risk Assessment and management Study at Priorsland, Carrickmines".

5.2.6 Carysfort Maretimo

The CFRAM shows flood risk along the majority of the Carysfort Maretimo River, being a combination of Flood Zone A and B and covering a range of land existing land uses, including open space, residential and office and enterprise (Figure 5-6). Funding for a flood relief scheme for the Carysfort Maretimo has been secured, but the scheme will be in the second round (following Carrickmines and Deansgrange), so timelines for these works are unknown at this stage.

The majority of flood risk highlighted in the Sandyford Business District (21) and surrounding area is shown to be Flood Zone B, with small pockets indicated to be Flood Zone A. Development in Flood Zones in this area has passed the Justification Test for Development Plans (Section 5.1). Similarly, the Justification Test for plan making has been passed for the Stillorgan and Blackrock District Centres.

Upstream of the Sandyford Business Park flooding is indicated at, but not limited to, the residential areas of Blackrock Bypass, Brookfield, Carysfort Avenue, Avondale Lawn, Carysfort Hall, Avoca Park, Grove Paddock, Stillorgan Grove, Stillorgan Road and Brewery Road, Lakelands, Coolkill, Sandyford Downs and Sandyford Village. Until the FRS has been completed, residential development within the catchment and outside the District Centres and Business District will be restricted to Minor Development as defined in Section 4.3.1. In the residential areas flood risk can be managed through a site specific FRA, which should include consideration of culvert blockage (where appropriate) and the impact this could have on flood risk at lower return periods.

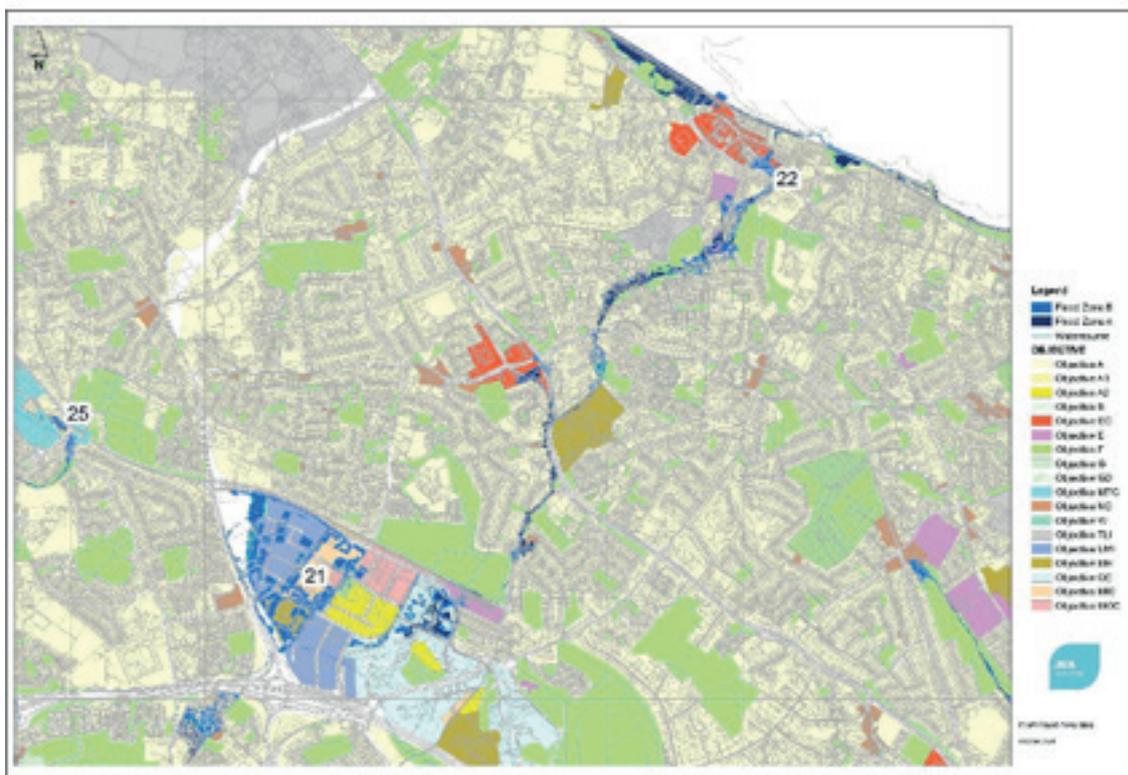


Figure 5-6: Carysfort Maretimo Rivers

There is a length of defence along this watercourse which runs parallel to Rockfield Park (22) which is of recent construction and provides protection against the 1% AEP fluvial flood event. Assessment of breach impacts is not considered necessary for these defences, but the impacts of overtopping, either through higher return period events or with the impact of climate change on river flows, should be taken into account in any site specific flood risk assessment.

5.2.7 The Dundrum Slang

This area was included in the Dodder CFRAM, which identified a number of flood management measures, and some follow-on works have taken place. A stage 3 FRA was completed for the 2016-2022 Development Plan, and since then a more detailed integrated catchment modelling study has been carried out to generate fluvial, pluvial and combined flood extents. The watercourse and resulting fluvial flood extents can be seen in Figure 5-7.

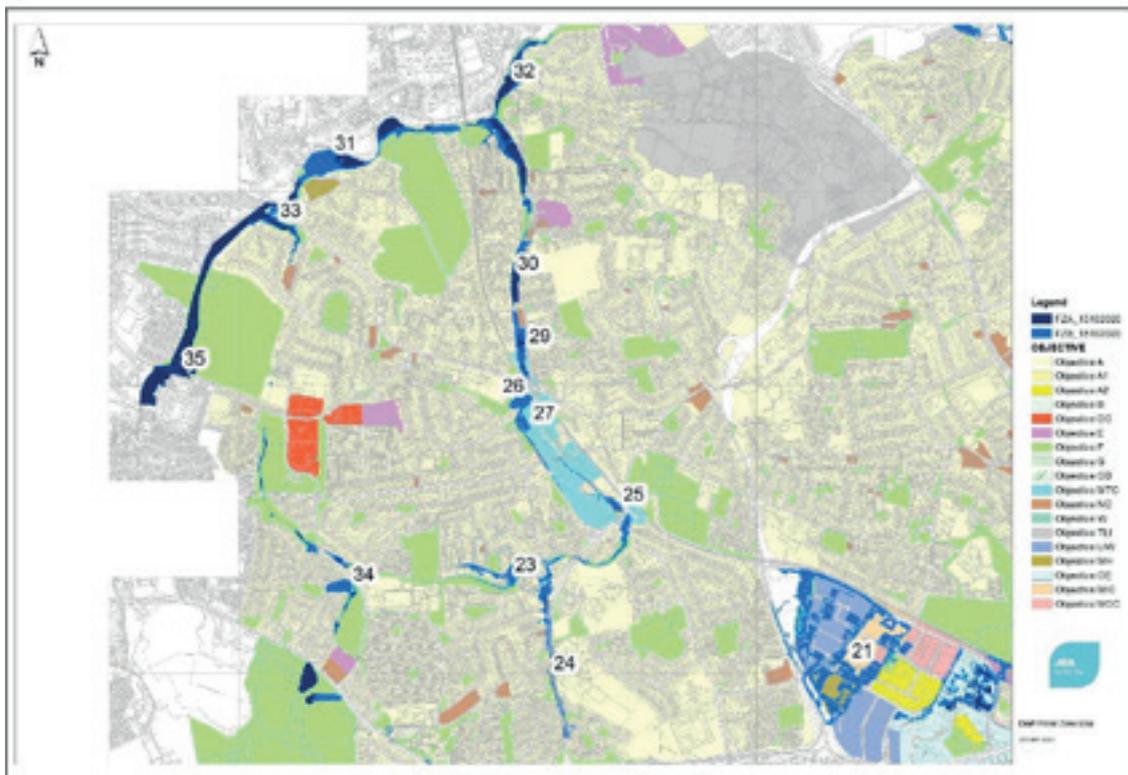


Figure 5-7: Dundrum Slang

Upstream of Dundrum Town Centre the Slang and its tributaries pass through areas of residential housing (23 and 24). Parts of these areas are shown to be within Flood Zone B. The extents of Flood Zone B indicate that the area may be particularly vulnerable to channel blockage, and sensitive to reductions in channel capacity. In addition, climate change impacts are likely to be significant here. Part 1 and 2 of the Justification Test for Development Plans have been passed but Part 3 has not. Future development in this area shall be limited to Minor Development as defined in Section 4.3.1.

The Dundrum Slang ICM study completed in 2020 has highlighted flooding at the southern end of the Dundrum Shopping Centre (25) and in the vicinity of the Wyckham Way, Sandyford Road and Overend Avenue interchange, and Willowbank; with significant areas of pluvial ponding likely to occur. Development in this area is a mix of existing commercial and residential.

Flooding is shown at Dundrum Shopping Centre Phase Two lands (site of old shopping centre) in Dundrum Village (27), the library (28) and gym site (26). These sites (zoned MTC) have been subject to Detailed FRA under the previous SFRA and the Dundrum Slang ICM Study completed in 2020, and responses to the Justification Test for Development Plans are provided in Section 5.1.1. Modelling carried out as part of this SFRA shows the flow path crosses the shopping centre site and ponds near the river prior to discharging back into the Slang. The modelling also showed that the modelled water levels are very sensitive to model parameters and any ingress to Flood Zone B could increase flood risk to neighbouring properties. It is therefore important that the flow path and the capacity for storage on site is respected in any development proposal.

The detailed modelling assessment also highlighted the vulnerability of the library and gym sites (also zoned MTC) and showed development in these locations would be premature until a flood relief scheme is completed.

Further to the north (29), flooding is indicated in the rear gardens of properties along Dundrum Road and to a neighbourhood centre between, but not limited to, Highfield Park and west of St. Columbanus Road (30), lands to the east of Patrick Doyle Road and Milltown Grove. Development in this area shall be limited to Minor Development as defined in Section 4.3.1.

Downstream of Dundrum Town Centre there are areas of MTC and residential zoned land to the north of Churchtown Road Upper, and around the junction of Churchtown Road Upper, Taney Road, Dundrum Road, Main Street which are within Flood Zone A and B. These lands are currently developed. It is recommended that until such time as the flood risk issues for the Dundrum Town Centre are resolved, development in this area, with the exception of MTC lands, shall be limited to Minor Development as defined in Section 4.3.1.

5.2.8 River Dodder

The Dodder forms a County boundary between Dún Laoghaire-Rathdown and the jurisdictions of Dublin City and South Dublin (Figure 5-8). Development which occurs in Dublin City or South Dublin County Council could have implications on flooding in Dún Laoghaire-Rathdown.

Flood risk arising from the River Dodder has long since been identified as a problem in Dún Laoghaire-Rathdown and Dublin City. Specific locations shown to be at flood risk include, but are not limited to, Orwell Park, Orwell Gardens, Milltown Golf Course (31), Dodderbank (32), Woodside (33). However, the Dodder study extents and depths may not fully represent current flood risk at these locations. Proximity of a development site to the Flood Zones along the Dodder should be considered a trigger for more detailed assessment, rather than indicating the current level of flood risk. The outputs from the Dodder CFRAM at these locations should not be wholly relied upon in a SSFRA. Flooding is also indicated from the Whitechurch Stream to the south of the Dodder (35). Overland flows from the Stream flow northwards, cross Nutgrove Avenue and pond in the Castle Golf Club.

The Dodder Catchment Flood Risk Management Plan identifies a number of flood risk management measures but does not provide solutions to all the flooding problems that exist in the catchment as this would simply not be economically viable. It does identify viable structural and non-structural options for managing flood risk though.



Figure 5-8: River Dodder

Using the recommendations of the Dodder CFRAM as a base point, in depth assessment and construction work has already been done on the Dodder downstream. Flood defence works have been completed along the Dodder beginning downstream where the river meets the sea. These defences are generally providing protection to existing residential and business areas and do not provide additional protection for upstream areas. The first section includes raising defence walls along the tidal stretches from the mouth of the Dodder to Ballsbridge. The works completed in this area provide protection to an estimated combined 1% AEP (1 in 100 year) fluvial event plus a 1 in 5 year tidal event. A second section of works has been completed upstream from Ballsbridge as far as the Smurfit weirs to the standard of protection of an estimated 1% AEP (1 in 100 year) fluvial event.

An Engineering and Environmental consultant was appointed at the end of 2019 to deliver a flood risk scheme for the next section upstream, the Dodder Phase 3. The south side of the river is within the area of Dún Laoghaire-Rathdown. This scheme covers the Dodder from Clonskeagh Roadbridge to Orwell Road Bridge. It also includes defence works on the Little Dargle stream at Braemor Road-Woodside Drive south eastern junction. The consultant will consider and evaluate flood risk management measures, including those referred to in the Dodder CFRAMS study. The most cost beneficial scheme will then be constructed. It is envisaged that completion of the proposed scheme will take 4 -6 years.

In areas which are defended to the 1% AEP standard of protection, major development will be considered subject to SSFRA and an appropriate level of flood mitigation. Given the standard of protection provided by the defences, a relatively simple flood risk assessment should be completed, which should acknowledge risks associated with overtopping and climate change but will not need to consider breach analysis. Infill development should be in-keeping with the surrounding residences, although opportunities to further reduce flood risk, particularly associated with surface water should be sought. This will primarily be in the form of finished floor levels and consideration of flood resilience and emergency access.

In areas not defended to the 1% AEP standard of protection, major new development in Flood Zones A and B will be considered premature until the remainder of the flood relief scheme has been completed. Until defences are completed, development will be limited to Minor Development as defined in Section 4.3.1.

5.2.9 Little Dargle

The Little Dargle is a tributary of the Dodder, and included in the Dodder CFRAM. As detailed above, flood defence works for some length of the Little Dargle is proposed. Flood risk is shown to rear of Crannagh Hall, Landscape Road, and in open space area to the north of Riverside Drive. Risk is also indicated to Dodder Park open space area. There is an ESB substation in this open space. As most risks arising from the Little Dargle are generally moderate and occurs in open space, the Justification Test for Development Plans is not required. There is an area of Flood Zone B near the upstream end of the Little Dargle (Figure 5-9) shown to extend across Llewellyn Park and Llewellyn Court (34). This appears to arise as a result of a localised overflow point from the Little Dargle. However, the extents and depths may not fully represent current flood risk at this location. It could be indicative of an area which is also vulnerable to surface water ponding. SSFRA should be carried out to address risks in this location, and further guidance can be provided by the Municipal Services section.



Figure 5-9: Little Dargle

5.2.10 Coastal flooding

Flood Zones A and B for the coastal boundary of Dun Laoghaire Rathdown are included in the master mapping document accompanying this SFRA and should be reviewed in conjunction with the areas of flood risk concern and the text in this document. Significant wave overtopping has also been observed along the DART line between Seapoint and Monkstown and in Bullock Harbour. Analysis also indicated wave overtopping may occur at Booterstown Marsh.

Whilst development opportunities along the seafront are generally fairly limited, any flood risk assessment should take into account wave overtopping and the potential impact of climate change on sea levels. Despite a site being in Flood Zone C currently, analysis of either of these two factors may show it is not possible to provide a sustainable and long-term development as it is not possible to manage future risks from overtopping and / or climate change. In other cases, and depending on the nature and design life of the development, appropriate mitigation may include additional allowances in finished floor levels, emergency planning and business continuity and recovery.

6 FRA review and monitoring

An update to the SFRA will be triggered by the six-year review cycle that applies to Local Authority development plans. In addition, there are a number of other potential triggers for an SFRA review and these are listed in the table below.

Outputs from future studies and datasets should be incorporated into any update of the SFRA as availability allows. Not all future sources of information should trigger an immediate full update of the SFRA; however, new information should be collected and kept alongside the SFRA until it is updated.

Table 6-1: SFRA Review Triggers

Trigger	Source	Possible Timescale
Catchment Flood Risk Assessment and Management (CFRAM) Flood Hazard Mapping - future cycles	OPW under the Floods Directive	6-year cycle under EU Floods Directive
Eastern River Basin Flood Risk Assessment and Management (EFRAM) Plan	OPW	6 yearly reviews
Flood maps of other sources, such as drainage networks	Various	Unknown
Significant flood events	Various	Unknown
Changes to Planning and / or Flood Management Policy	DoEHLG / OPW	Unknown
Construction / completion of flood relief schemes	OPW / DLRCC	Unknown

7 Glossary

Annual Exceedance Probability (AEP) - Likelihood or probability of flooding or a particular flood event is classified by its annual exceedance probability (AEP) or return period (in years). A 1% AEP flood indicates the flood event that will occur or be exceeded on average once every 100 years and has a 1 in 100 chance of occurring in any given year.

Catchment - The area that is drained by a river or artificial drainage system.

Catchment Flood Risk Assessment and Management Studies (CFRAMS) - A catchment-based study involving an assessment of the risk of flooding in a catchment and the development of a strategy for managing that risk in order to reduce adverse effects on people, property and the environment. CFRAMS precede the preparation of Flood Risk Management Plans.

Flood Risk - An expression of the combination of the flood probability or likelihood and the magnitude of the potential consequences of the flood event. Flood Risk Assessment (FRA) can be undertaken at any scale from the National down to the individual site and comprises three stages: flood risk identification, initial flood risk assessment and detailed flood risk assessment.

Flood Risk Assessment - An examination of the risks from all sources of flooding of the risks to and potentially arising from development on a specific site, including an examination of the effectiveness and impacts of any control or mitigation measures to be incorporated in that development.

Flood Zones - A geographic area for which the probability of flooding from rivers, estuaries or the sea is within a particular range as defined within these Guidelines.

Fluvial Flooding - Flooding from a river or other watercourse.

Freeboard - Freeboard is a factor of safety expressed in a height (usually mm) above a flood level for purposes of floodplain management. "Freeboard" tends to compensate for the many unknown factors that could contribute to flood heights greater than the height calculated for a selected size flood, such as wave action, bridge openings, and hydrological uncertainty.

Initial Flood Risk Assessment - A qualitative or semi-quantitative study to confirm sources of flooding that may affect a Plan area or proposed development site, to appraise the adequacy of existing information, to provide a qualitative appraisal of the risk of flooding to development, including the scope of possible mitigation measures, and the potential impact of development on flooding elsewhere, and to determine the need for further detailed assessment.

'Justification Test' - An assessment of whether a development proposal within an area at risk of flooding meets specific criteria for proper planning and sustainable development and demonstrates that it will not be subject to unacceptable risk nor increase flood risk elsewhere. The 'Justification Test' should be applied only where development is within flood risk areas that would be defined as inappropriate under the screening test of the sequential risk-based approach adopted by this guidance. There are two Justification Tests with the Planning Guidelines.

- **Justification Test for Development Plans** - undertaken by the local authority at the plan making stage as part of the Strategic Flood Risk Assessment
- **Justification Test for development management** - undertaken by the applicant and submitted as part of a planning application. The Local Authority must be satisfied the development satisfies all criteria of the test.

Mitigation Measures - Elements of a development design which may be used to manage flood risk to a development, either by reducing the incidence of flooding both to the development and as a result of it and/or by making the development more resistant and/or resilient to the effects of flooding.

Precautionary Approach - The approach to be used in the assessment of flood risk which requires that lack of full scientific certainty, shall not be used to assume flood hazard or risk does not exist, or as a reason for postponing cost-effective measures to avoid or manage flood risk. River Basin Management Plan (RBMP) are required by the EU Water Framework Directive

(2000/60/EC). These plans will establish a strategic plan for the long-term management of the River Basin District, set out objectives for water bodies and in broad terms, identify what measures are planned to meet these objectives, and act as the main reporting mechanism to the European Commission.

Pluvial Flooding - Usually associated with convective summer thunderstorms or high intensity rainfall cells within longer duration events, pluvial flooding is a result of rainfall-generated overland flows which arise before run-off enters any watercourse or sewer. The intensity of rainfall can be such that the run-off totally overwhelms surface water and underground drainage systems.

Return Period - The return period is means of expressing the likelihood or probability of flooding or a particular flood event occurring and is comparable to the AEP of the event. A 1% AEP flood indicates the flood event that will occur or be exceeded on average once every 100 years and has a 1 in 100 chance of occurring in any given year.

‘Sequential Approach’ - The ‘Sequential Approach’ is a risk-based method to guide development away from areas that have been identified through a flood risk assessment as being at risk from flooding.

Strategic Flood Risk Assessment (SFRA) - The assessment of flood risk on a wide geographical area against which to assess development proposed in an area (Region, County, Town).

Sustainable Drainage Systems (SuDS) - A form of drainage that aims to control run-off as close to its source as possible using a sequence of management practices and control structures designed to drain surface water in a more sustainable fashion than some conventional techniques.



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