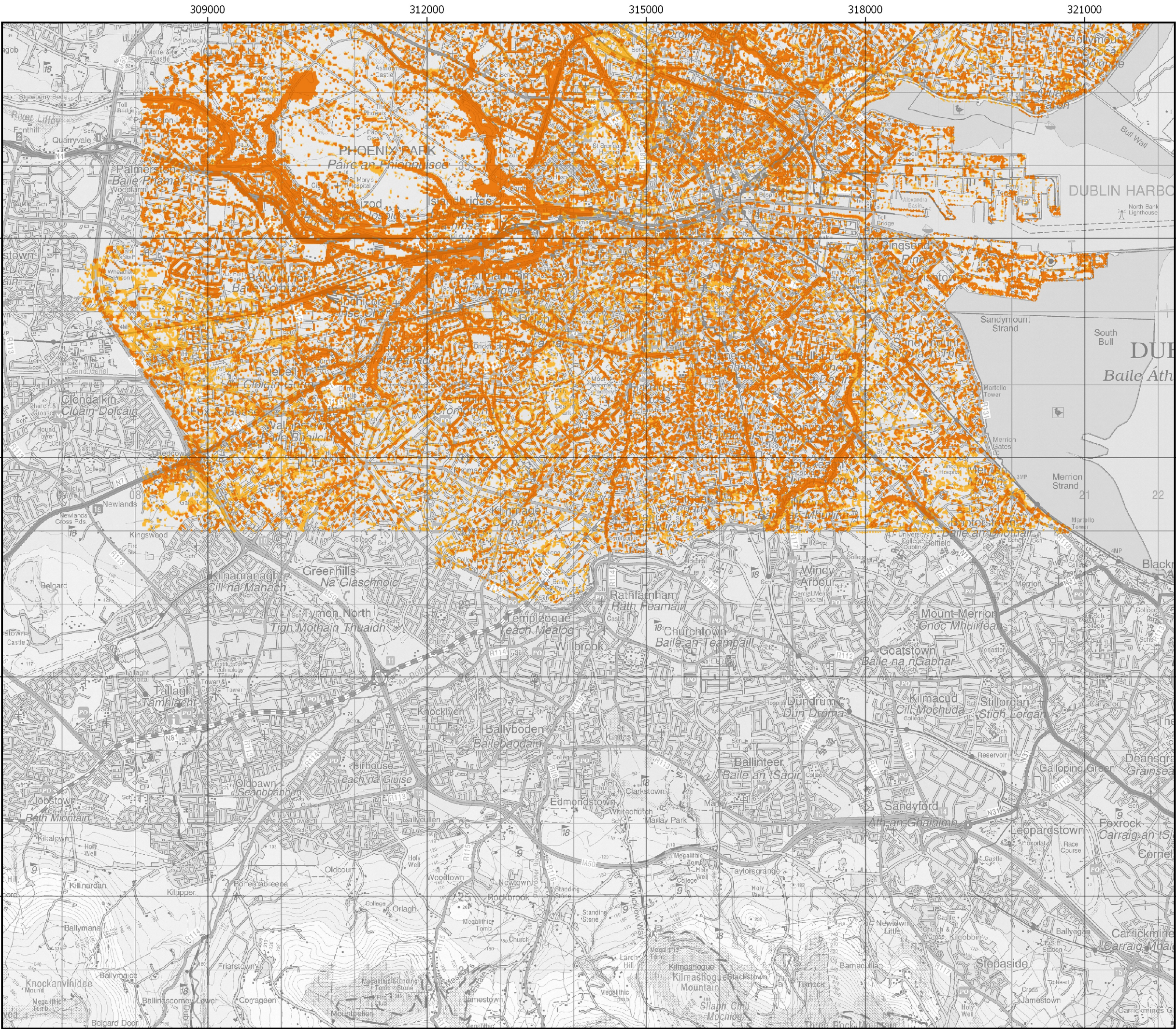




Location Plan:

LEGEND

10% AEP Pluvial

1% AEP Pluvial

0.5% AEP Pluvial

IMPORTANT USER NOTE:

THE VIEWER OF THIS MAP SHOULD REFER TO THE DISCLAIMER, GUIDANCE NOTES AND CONDITIONS OF USE THAT ACCOMPANY THIS MAP.

OPW

Office of Public Works
The Office of Public Works

The Office of Public Works
Jonathan Swift Street
Trim
Co. Meath

Comhairle Cathrach
Baile Átha Cliath
Dublin City Council

Dublin City Council
Civic Offices
Wood Quay
Dublin 8

Project:

DUBLIN PLUVIAL STUDY (FloodResilienCity)

Map:

DUBLIN CITY - PLUVIAL
FLOOD EXTENT MAP

Map Type:

EXTENT - 180min Rainfall

Source:

PLUVIAL

Map Area:

URBAN

Scenario:

CURRENT

Drawn by:

IH

Date:

Aug - 2016

Checked by:

MC

Date:

Aug - 2016

Approved by:

JM

Date:

Aug - 2016

Map No.:

E09DCC_EXPCD_F0_03

Revision:

F0

Map Scale:

1:50,000

Plot Scale:

1:1 @ A3

Appendix E **DLRCC DEVELOPMENT PLAN STRATEGIC FLOOD RISK ASSESSMENT**

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 online³. 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 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.

³ www.floodinfo.ie

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.

The flood maps are shown in Section 6 of this document and are also reproduced at a larger size in Appendix A and B, and maps for the whole county are shown in the Mapping section of the County Development Plan.

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 Dún Laoghaire-Rathdown (DLR)	Moderate	Yes
Coastal risk and wave overtopping Study, commissioned by DLR and completed as part of a Stage 3 assessment to this SFRA.	DLR coastline	Moderate	Still water flood zones reviewed against ICPSS, but not used as little difference. Overtopping extents indicate a screening area for site specific FRAs.
Irish Coastal Protection Strategy Study (ICPSS)	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. Flood zones developed from this source will be treated as a guidance/flagging tool only and will not be relied upon by either

Data	Description / Coverage	Quality	Data used in developing Flood Zones
			the Planning Authority or applicant in the making of planning decisions.
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. Flood zones developed from this source will be treated as a guidance/flagging tool only and will not be relied upon by either the Planning Authority or applicant in the making of planning decisions.
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 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.

3.3 Areas of Flood Risk Concern shown on Flood Zone Maps

Non-specific address locations that may be subject to localised flooding from sources other than out-of-bank river flooding have been identified in the flood maps by triangles as follows:

- “P” (green triangle) - pluvial (rainfall) foul sewage overflow
- “P” (blue triangle)- pluvial (rainfall) surface water overflow
- “F” (blue triangle)- Fluvial - (river/watercourse) surface water overflow

The purpose of identifying these areas is to alert potential applicants of the necessity to consult with the Local Authority as to the nature, source, and possible extent(s) that may be impacted. Following such consultations a site specific flood risk assessment to factor in and mitigate against flood risk identified, if any, needs to be prepared, the details of such measures being set out in Section 5.

3.4 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.

3.4.1 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. 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.

3.4.2 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.

The Government has recently established an Inter-Departmental Group on Coastal Change Management to scope out an approach for the development of a national coordinated and integrated strategy to manage the projected impact of coastal change to our coastal communities, economies, heritage, culture and environment. The Inter-Departmental Group is jointly chaired by the Department of Housing, Planning and Local Government and the OPW and will bring forward options and recommendations for the Government to consider as soon as possible. Should these recommendations be available during the lifetime of the plan they will be given due consideration and assessed for impacts on the SFRA.

3.4.3 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 Study, 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.

3.4.4 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's require 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 5.6.

3.4.5 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 and 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.

3.4.6 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, Dún 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. Data available on the Geological Survey Ireland map viewer⁴ has been examined and found no particular karst or other ground water systems within the catchment, although one spring / well is noted to the west of Cherrywood. There are no recorded historic or predictive groundwater flood extents within the County. Groundwater risks should be assessed on a site by site basis through percolation testing and bore holes as appropriate.

⁴ <https://dcenr.maps.arcgis.com/apps/MapSeries/index.html?appid=a30af518e87a4c0ab2fbde2aaac3c228>

Appendix F **CROSS SECTION THROUGH AREA OF POTENTIAL FLOODING**

Appendix G **EXCEEDANCE FLOW PLAN**