

# STRATEGIC FLOOD RISK ASSESSMENT

---

UNDERTAKEN AS PART OF PREPARATION OF THE

## STRATEGIC DEVELOPMENT ZONE PLANNING SCHEME

FOR

### POOLBEG WEST

(SI No. 279 of 2016)

**for: Dublin City Council**

Civic Offices  
Wood Quay  
Dublin 8



**by: CAAS Ltd.**

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**APRIL 2019**

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# Section 1 Introduction and Policy Background

## 1.1 Introduction and Terms of Reference

Dublin City Council has prepared a Planning Scheme for the Poolbeg West Strategic Development Zone.

The preparation and adoption of the Planning Scheme has undergone an appropriate level of Strategic Flood Risk Assessment (SFRA) and this document presents the findings of the SFRA. The SFRA is an assessment of flood risk and includes mapped boundaries for Indicative Flood Risk Zones, taking into account factors including local knowledge, site walkovers and flood risk indicators.

The SFRA has been undertaken and prepared in accordance with *The Planning System and Flood Risk Management - Guidelines for Planning Authorities* (Department of the Environment, Heritage and Local Government and Office of Public Works, 2009) and Department of the Environment, Community and Local Government Circular PL 2/2014.

## 1.2 Summary of Conclusion and Recommendations

The purpose of this document is to detail the findings of the SFRA that has been undertaken alongside the preparation of the Planning Scheme.

The SFRA has informed the Planning Scheme and enabled compliance with the Flood Risk Management Guidelines. All SFRA recommendations – including those related to land use zoning and flood risk management provisions – have been integrated into the Planning Scheme.

## 1.3 Flood Risk and its Relevance as an Issue to the Planning Scheme

### 1.3.1 Flood Risk

Flooding is an environmental phenomenon and can pose a risk to human health as well as causing economic and social effects. Some of the effects of flooding are identified on Table 1 below.

Certain lands within the Strategic Development Zone have the potential to be vulnerable to flooding such as that arising from tidal and pluvial flooding sources, and this vulnerability could be exacerbated by changes in both the occurrence of severe rainfall events and associated flooding. Local conditions such as low-lying lands and slow surface water drainage can increase the risk of flooding.

**Table 1 Potential effects that may occur as a result of flooding**

| Tangible Effects   | Intangible Human and Other Effects |
|--|------------------------------------|
| Damage to buildings (houses)                                     | Loss of life                       |
| Damage to contents of buildings                                  | Physical injury                    |
| Damage to new infrastructure e.g. roads                          | Increased stress                   |
| Loss of income   | Physical and psychological trauma  |
| Disruption of flow of employees to work causing knock on effects | Increase in flood related suicide  |
| Enhanced rate of property deterioration and decay                | Increase in ill health             |
| Long term rot and damp   | Homelessness                       |
|  | Loss of uninsured possessions      |

## **1.4 Flood Risk Management Policy**

### **1.4.1 EU Floods Directive**

The European Directive 2007/60/EC on the assessment and management of flood risk aims to reduce and manage the risks that floods pose to human health, the environment, cultural heritage and economic activity. The Directive applies to inland waters as well as all coastal waters across the whole territory of the EU. The Directive requires Member States to:

- Carry out a preliminary assessment by December 2011 in order to identify the river basins and associated coastal areas where potential significant flood risk exists.
- Prepare flood hazard and risk maps for the identified areas (these maps have been finalised and included within Flood Risk Management Plans).
- Prepare flood risk management plans focused on prevention, protection and preparedness. These plans are to include measures to reduce the probability of flooding and its potential consequences.

Implementation of the EU Floods Directive is required to be coordinated with the requirements of the EU Water Framework Directive and the current River Basin Management Plans.

### **1.4.2 National Flood Policy**

Historically, flood risk management focused on land drainage for the benefit of agricultural improvement. With increasing urbanisation, the Arterial Drainage Act, 1945, was amended in 1995 to permit the OPW to implement localised flood relief schemes to provide flood protection for cities, towns and villages.

In line with changing national and international paradigms on how to manage flood risk most effectively and efficiently, a review of national flood policy was undertaken in 2003-2004. The review was undertaken by an Inter-Departmental Review Group, led by the Minister of State at the Department of Finance with special responsibility for the OPW. The Review Group prepared a report that was put to Government, and subsequently approved and published in September 2004 (Report of the Flood Policy Review Group, OPW, 2004).

The scope of the review included a review of the roles and responsibilities of the different bodies with responsibilities for managing flood risk, and to set a new policy for flood risk management in Ireland into the future. The adopted policy was accompanied by many specific recommendations, including:

- Focus on managing flood risk, rather than relying only flood protection measures aimed at reducing flooding;
- Taking a catchment-based approach to assess and manage risks within the whole-catchment context; and
- Being proactive in assessing and managing flood risks, including the preparation of flood maps and flood risk management plans.

### **1.4.3 National CFRAM Programme**

The national Catchment Flood Risk Assessment and Management (CFRAM) programme commenced in Ireland in 2011. The CFRAM Programme is intended to deliver on core components of the National Flood Policy, adopted in 2004, and on the requirements of the EU Floods Directive. The Programme is being implemented through CFRAM studies that are being undertaken for each of the river basin districts in Ireland. Poolbeg West is located in the Eastern River Basin District.



The CFRAM Programme comprises three phases as follows:

- The Preliminary Flood Risk Assessment<sup>1</sup> (PFRA) mapping exercise in 2011;
- The CFRAM Studies and parallel activities, from 2011; and
- Implementation and Review (2017 onwards).

The Programme provides for three main consultative stages as follows:

- PFRAs in 2011;
- Flood Hazard Mapping (these maps have been finalised and included within Flood Risk Management Plans); and
- Flood Risk Management Plans.

The OPW is the lead agency for flood risk management in Ireland. The coordination and implementation of Government policy on the management of flood risk in Ireland is part of its responsibility. The European Communities (Assessment and Management of Flood Risks) Regulations 2010 (S.I. No. 122) identifies the Commissioners of Public Works as the 'competent authority' with overall responsibility for implementation of the Floods Directive 2007/60/EC. The Office of Public Works is the principal agency involved in the preparation of Flood Risk Assessment and Management studies (FRAMs).

## **1.4.4 Flood Risk Management Guidelines**

### **1.4.4.1 Introduction**

In 2009, the OPW and the then Department of the Environment and Local Government (DEHLG) published Guidelines on flood risk management for planning authorities entitled *The Planning System and Flood Risk Management - Guidelines for Planning Authorities*. The Guidelines introduce mechanisms for the incorporation of flood risk identification, assessment and management into the planning process. Implementation of the Guidelines is intended to be achieved through actions at the national, regional, local authority and site-specific levels. Planning authorities and An Bord Pleanála are required to have regard to the Guidelines in carrying out their functions under the Planning Acts.

The core objectives of the Guidelines 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 water 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.

### **1.4.4.2 Principles of Flood Risk Management**

The key principles of flood risk management set out in the flood Guidelines are to:

- Avoid development that will be at risk of flooding or that will increase the flooding risk elsewhere, where possible;
- Substitute less vulnerable uses, where avoidance is not possible; and
- Mitigate and manage the risk, where avoidance and substitution are not possible.

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<sup>1</sup> The PFRAs identified areas at risk of significant flooding and includes maps showing areas deemed to be at risk. The areas deemed to be at significant risk, where the flood risk that is of particular concern nationally, are identified as Areas for Further Assessment (AFAs) and more detailed assessment on the extent and degree of flood risk is currently being undertaken in these areas with the objective of producing Flood Hazard Mapping. The Poolbeg West SDZ is located within the Dublin City (including parts of Fingal, South Dublin and Dun Laoghaire-Rathdown) AFA.

The Guidelines follow the principle that development should not be permitted in flood risk areas, particularly floodplains, except where there are no alternative and appropriate sites available in lower risk areas that are consistent with the objectives of proper planning and sustainable development.

Development in areas that have the highest flood risk should be avoided and/or only considered in exceptional circumstances (through a prescribed *Justification Test*) if adequate land or sites are not available in areas that have lower flood risk. Most types of development would be considered inappropriate in areas that have the highest flood risk. Only water-compatible development such as docks and marinas, dockside activities that require a waterside location, amenity open space, outdoor sports and recreation and essential transport infrastructure that cannot be located elsewhere would be considered appropriate in these areas.

#### 1.4.4.3 Stages of SFRA

The Flood Risk Management Guidelines recommend a staged approach to flood risk assessment that covers both the likelihood of flooding and the potential consequences. The stages of appraisal and assessment are:

**Stage 1 Flood risk identification** – to identify whether there may be any flooding or surface water management issues related to either the area of regional planning guidelines, development plans and LAP's or a proposed development site that may warrant further investigation at the appropriate lower level plan or planning application levels;

**Stage 2 Initial flood risk assessment** – to confirm sources of flooding that may affect a plan area or proposed development site, to appraise the adequacy of existing information and to scope the extent of the risk of flooding which may involve preparing indicative flood zone maps. Where hydraulic models exist the potential impact of a development on flooding elsewhere and of the scope of possible mitigation measures can be assessed. In addition, the requirements of the detailed assessment should be scoped; and

**Stage 3 Detailed flood risk assessment** – to assess flood risk issues in sufficient detail and to provide a quantitative appraisal of potential flood risk to a proposed or existing development or land to be zoned, of its potential impact on flood risk elsewhere and of the effectiveness of any proposed mitigation measures.

#### 1.4.4.4 Flood Zones

Flood risk is an expression of the combination of the flood probability or likelihood and the magnitude of the potential consequences of the flood event. It is normally expressed in terms of the following relationship:

$$\text{Flood risk} = \text{Likelihood of flooding} \times \text{Consequences of flooding}$$

Likelihood of flooding is normally defined as the percentage probability of a flood of a given magnitude or severity occurring or being exceeded in any given year. For example, a 1% Annual Exceedance Probability (AEP) indicates the severity of a flood that is expected to be exceeded on average once in 100 years, i.e. it has a 1 in 100 (1%) chance of occurring in any one year.

Consequences of flooding depend on the hazards associated with the flooding (e.g. depth of water, speed of flow, rate of onset, duration, wave-action effects, water quality), and the vulnerability of people, property and the environment potentially affected by a flood (e.g. the age profile of the population, the type of development, presence and reliability of mitigation measures etc.).

Flood zones are geographical areas within which the likelihood of flooding is in a particular range and they are a key tool in flood risk management within the planning process as well as in flood warning and emergency planning.

There are three types or levels of flood zones defined for the purposes of the Flood Guidelines:

- **Flood Zone A** – where the probability of flooding from rivers and the sea is highest (greater than 1% or 1 in 100 for river flooding or 0.5% or 1 in 200 for coastal flooding);
- **Flood Zone B** – where the probability of flooding from rivers and the sea is moderate (between 0.1% or 1 in 1000 and 1% or 1 in 100 for river flooding and between 0.1% or 1 in 1000 year and 0.5% or 1 in 200 for coastal flooding); and
- **Flood Zone C** – where the probability of flooding from rivers and the sea is low (less than 0.1% or 1 in 1000 for both river and coastal flooding). Flood Zone C covers all other areas that are not in zones A or B.

## 1.5 Emerging Information and Disclaimer

It is important to note that compliance with the requirements of the Flood Risk Management Guidelines is currently based on emerging and best available data at the time of preparing the assessment, including Draft Flood Risk Management Plans, which will be finalised and updated on a cyclical basis as part of CFRAM activities.

Accordingly, all information in relation to flood risk may be altered in light of future data and analysis, or future flood events. As a result, all landowners and developers are advised that Dublin City Council and their agents can accept no responsibility for losses or damages arising due to assessments of the vulnerability to flooding of lands, uses and developments. Owners, users and developers are advised to take all reasonable measures to assess the vulnerability to flooding of lands and buildings (including basements) in which they have an interest prior to making planning or development decisions.

Any future SFRA for the area will integrate other new and emerging data.

## 1.6 Context for this SFRA: SFRA for the Dublin City Development Plan 2016-2022

As part of the Dublin City Development Plan 2016-2022, the Poolbeg West SDZ, has been subject to SFRA. The SFRA for the City Development Plan included the undertaking of a Justification Test for the wider “Dublin Port South of the Liffey from Eastlink Bridge” area that includes the Poolbeg West SDZ. This wider area includes a number of locations at which there are elevated levels of flood risk. More detail on this Justification Test for the wider south port area is included at Section 3.7.

The findings of this SFRA have informed this SFRA for the Planning Scheme. In particular:

- Section 2 “Stage 1 SFRA - Flood Risk Identification” of this SFRA, including various parts of this section that are informed by the Justification Test that was undertaken for the wider Dockland area (“Site 1: Dublin Port South of the Liffey from Eastlink Bridge”) as part of the City Development Plan 2016-2022 SFRA.
- Section 4 “Recommendations” of this SFRA which includes details on how SFRA recommendations have been integrated into the Planning Scheme. These recommendations include one requiring applicants to demonstrate that relevant development management measures detailed in Chapter 4 “Development Management and Flood Risk” from the Dublin City Development Plan 2016-2022 SFRA have been integrated into the relevant proposal for development. Chapter 4 from the City Development Plan SFRA is provided at Appendix I.
- Appendix II of this SFRA which reproduces a number of flow charts that were prepared by the Council as part of the City Development Plan 2016-2022 SFRA to provide a guide through the flood risk assessment process and to indicate which approaches to managing flood risk are expected in different circumstances.

## **1.7 Content of the Planning Scheme**

The SDZ to which the Planning Scheme relates is mapped on Figure 1 overleaf. The Planning Scheme consists of a written statement and accompanying appendices and maps. The most relevant parts of the Planning Scheme for this SFRA relate to the land uses map (see Figure 1 overleaf) and provisions relating to flood risk management (recommendations with respect to these, which have been integrated into the Planning Scheme by the Council, are provided under Section 4).

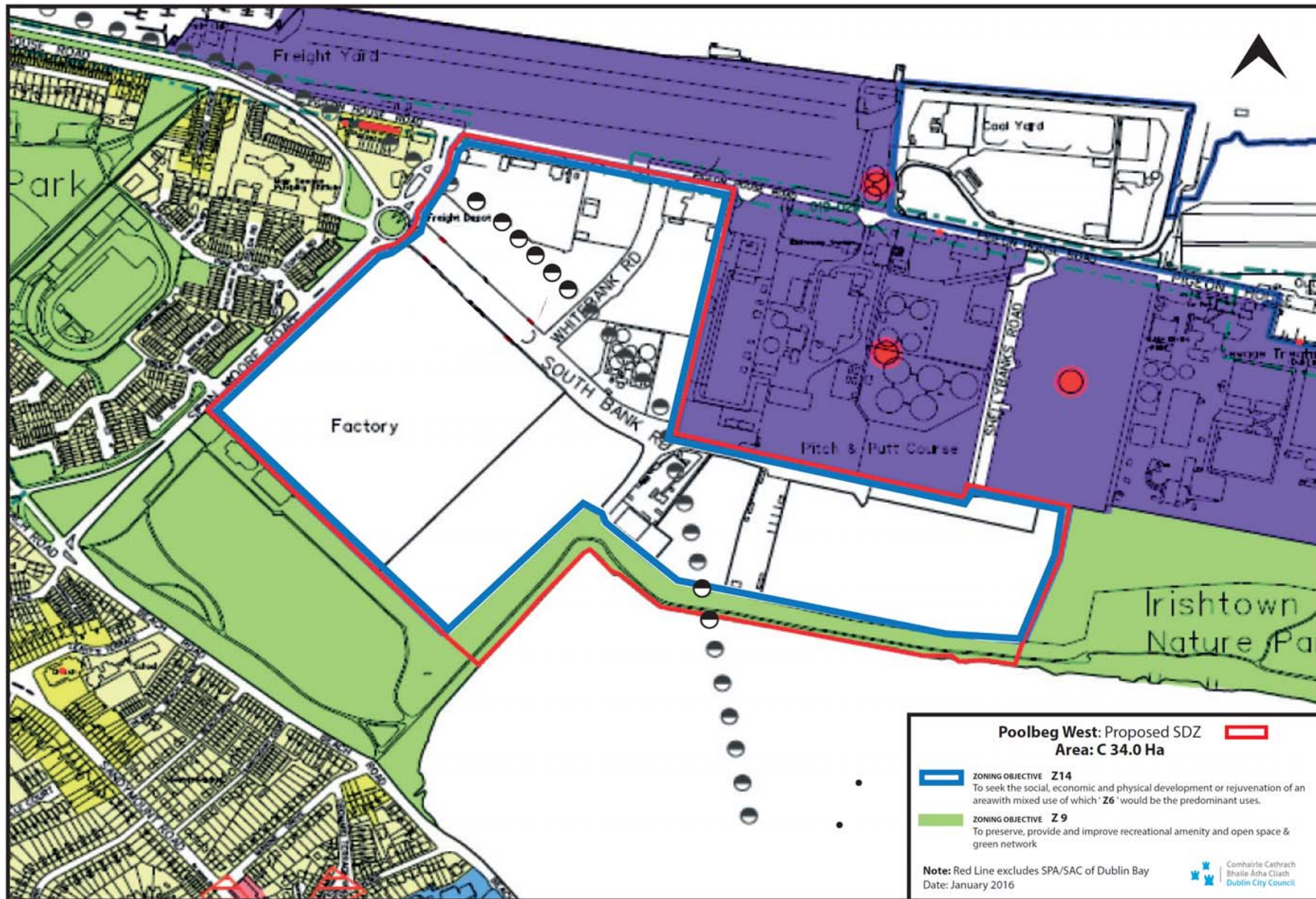
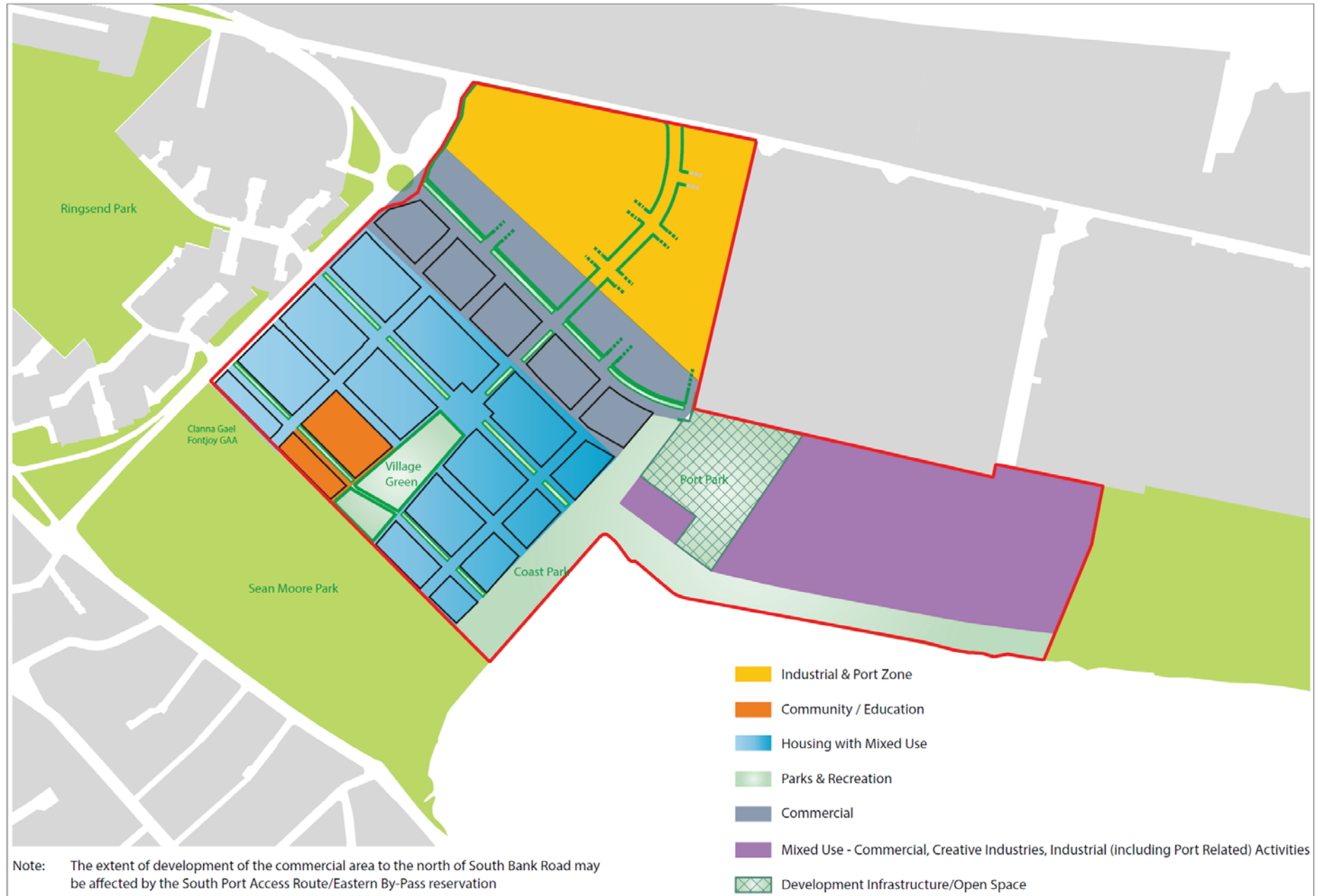


Figure 1 Area to which the Strategic Development Zone relates





**Figure 2 Proposed Land Uses Map from the Planning Scheme**  
CAAS for Dublin City Council

## Section 2 Stage 1 SFRA - Flood Risk Identification<sup>2</sup>

### 2.1 Introduction

Stage 1 SFRA (flood risk identification) was undertaken in order to identify whether there may be any flooding or surface water management issues within or adjacent to the SDZ lands and consequently whether Stage 2 SFRA (initial flood risk assessment) should be proceeded to. The Stage 1 SFRA was based on existing information on flood risk indicators based on historical evidence and computational models.

### 2.2 Site Description

The SDZ is located within the wider Poolbeg peninsula area. The peninsula is located near to the established neighbourhoods of Ringsend, Sandymount and Irishtown.

The peninsula lies within Dublin Bay – at the estuary of the Rivers Dodder and Liffey – and most of it has been reclaimed from the sea. The Bay is a nationally significant amenity and an internationally significant wild bird site.

There are three Seveso III sites and associated Consultation Zones<sup>3</sup> located within the immediate area, along Pigeon House Road: Dublin Waste to Energy Ltd., the National Oil Reserves Agency's Ringsend Oil Storage facility and Utility Operations and Maintenance Services Ltd. That provides provides operating and maintenance services to the Dublin Bay Power Plant.

The SDZ has substantial areas of already developed but vacant land and it has significant potential to contribute towards meeting Dublin's growing development needs. The area of the peninsula surrounding the SDZ includes a number of industrial units, Dublin Port activities and greenfield areas.

To the south, there are a number of greenfield areas such as Ringsend, Sean Moore and Irishtown Nature Parks.

### 2.3 Defences and Early Warning Systems

With regard to areas benefitting from defences (flood relief scheme works), the portion of the sea wall along the western end of Pigeon House Road offers some protection to properties to the south of it. The rest of the area is largely undefended. In the wider area, development is defended from tidal flooding from the River Dodder Estuary.

The Triton and Tidewatch early warning systems are based on sensors in Dublin Bay providing continuous information on sea-level changes and then sending alarm messages to relevant personnel in the Council. The former provides a 1-day advance warning of high tides and the latter provides a 3-day advance warning of same. These early warning systems then provide the necessary information to inform the subsequent emergency response strategy.

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<sup>2</sup> Much of this section has been informed by the SFRA for the Dublin City Development Plan, including the Justification Test undertaken for the wider Dockland area ("Site 1: Dublin Port South of the Liffey from Eastlink Bridge").

<sup>3</sup> Consultation zones of the closest sites are primarily concerned with containing contaminants or pollutants that have the potential to cause harm to environmental vectors such as water (as opposed to direct effects on human health/loss of life). A worst case scenario could involve an accident with potential environmental consequences. There is tertiary containment on these sites with material contained most immediately by a tank, then by a bund then by a berm/other containment.

The HSA were consulted as part of the Planning Scheme preparation process and identified that: any accident would be expected to be contained on the relevant sites; and SEVESO III sites do not pose particular risks with respect to the emerging provision of new housing development in the south/west of the SDZ.

## 2.4 Flood Risk Indicators

### 2.4.1 Historical Flood Risk Indicators

No historical evidence (including recorded flood events, recorded flood extents, alluvial soils, photographs etc.) of fluvial or coastal flooding has been identified at the Poolbeg West SDZ lands.

### 2.4.2 Preliminary Flood Risk Assessment Mapping (2011)

Preliminary Flood Risk Assessment (PFRA) mapping<sup>4</sup> produced in 2011 by the Office of Public Works (OPW) indicates three types of flood risk within the wider Poolbeg peninsula area (see Figure 3). However, the mapping does not indicate significant levels of risk within the Poolbeg West SDZ boundary (this boundary is shown on Figure 1 in Section 1).

There is no fluvial risk (risk from rivers or streams) identified within or adjacent to the site by the PFRA mapping. Parts of Sandymount are identified as being subject to elevated levels of fluvial risk (some of these are also identified as being at risk of coastal flooding).

However, the 2011 PFRA mapping identifies that there are elevated levels of coastal flood risk along the southern boundary of the SDZ. Larger areas are identified as being subject to elevated levels of coastal flood risk in the wider Poolbeg peninsula area (for example, near the stormwater tanks at the Ringsend Wastewater Treatment Plant and the inlet in the centre of the ESB Power Generating Station) as well as in Sandymount (parts of Sandymount are identified as being subject to elevated levels of both fluvial and coastal flood risk).

The 2011 PFRA mapping identifies a number of pockets that are at elevated risk of pluvial flooding (this type of flooding results from rainfall-generated overland flow, before the runoff enters any watercourse or sewer, and can be resolved by providing or improving drainage).

### 2.4.3 Predicted Flood Extent Mapping (2016)

Since the PFRA was carried out in 2011, the OPW, through its engineering consultants and working with local authorities and other stakeholders, has conducted extensive engineering assessments to better understand and detail the actual risk from flooding for areas that were at highest levels of risk. This was the subject of earlier public consultation that is now completed. The outcome of that work includes Predicted Flood Extent maps that were finalised in 2016.

There is no fluvial risk (risk from rivers or streams) identified within or adjacent to the site by the 2016 Predicted Flood Extents mapping (see Figures 4 and 5). Parts of Sandymount are identified as being subject to elevated levels of fluvial risk (see Figure 6, note that some of these areas are also identified as being at risk of coastal flooding).

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<sup>4</sup> The OPW PFRA mapping dataset has been arrived at by:

- Reviewing records of floods that have happened in the past;
- Undertaking analysis to determine which areas might flood in the future, and what the impacts might be; and
- Extensive consultation with each local authorities and other Government departments and agencies.

This assessment has considered all types of flooding, including that which can occur from rivers, the sea and estuaries, heavy rain, groundwater, the failure of infrastructure, and so on. It has also considered the impacts flooding can have on people, property, businesses, the environment and cultural assets. Further information on the purpose and development of the OPW PFRA Maps are available on [www.cfram.ie](http://www.cfram.ie).

The PFRA is only a preliminary assessment, based on available or readily derivable information. Analysis has been undertaken to identify areas prone to flooding, and the risks associated with such flooding, but this analysis is purely indicative and undertaken for the purpose of completing the PFRA. The mapping has been developed using simple and cost-effective methods and is based on broad-scale simple analysis and may not be accurate for a specific location/use.



With regard to coastal flood risk (Figures 7 and 8), the 2016 Predicted Flood Extents mapping identifies that there are elevated levels of such risk along the southern boundary of the SDZ. Larger areas are identified as being subject to elevated levels of coastal flood risk in the wider Poolbeg peninsula area and in Sandymount (parts of Sandymount are identified as being subject to elevated levels of both fluvial and coastal flood risk).

With regard to pluvial flood risk (this type of flooding results from rainfall-generated overland flow, before the runoff enters any watercourse or sewer, and can be resolved by providing or improving drainage), the 2016 Dublin Flood Study mapping identifies that there are elevated levels of such risk throughout the site and wider City area – see Figure 9.

## **2.5 Conclusion of Stage 1 SFRA**

The information provided in this section identifies that there is potentially elevated levels of coastal flood risk arising along the southern boundary of the SDZ; therefore, a Stage 2 SFRA is proceeded to.







Available information on flood risk identifies that larger areas of the wider Poolbeg peninsula and Sandymount are subject to elevated levels of fluvial and coastal flood risk.

In addition to there being levels of coastal flood risk arising along the southern boundary of the SDZ, there are also areas across the SDZ identified as being at risk of pluvial flooding.



**Legend:**

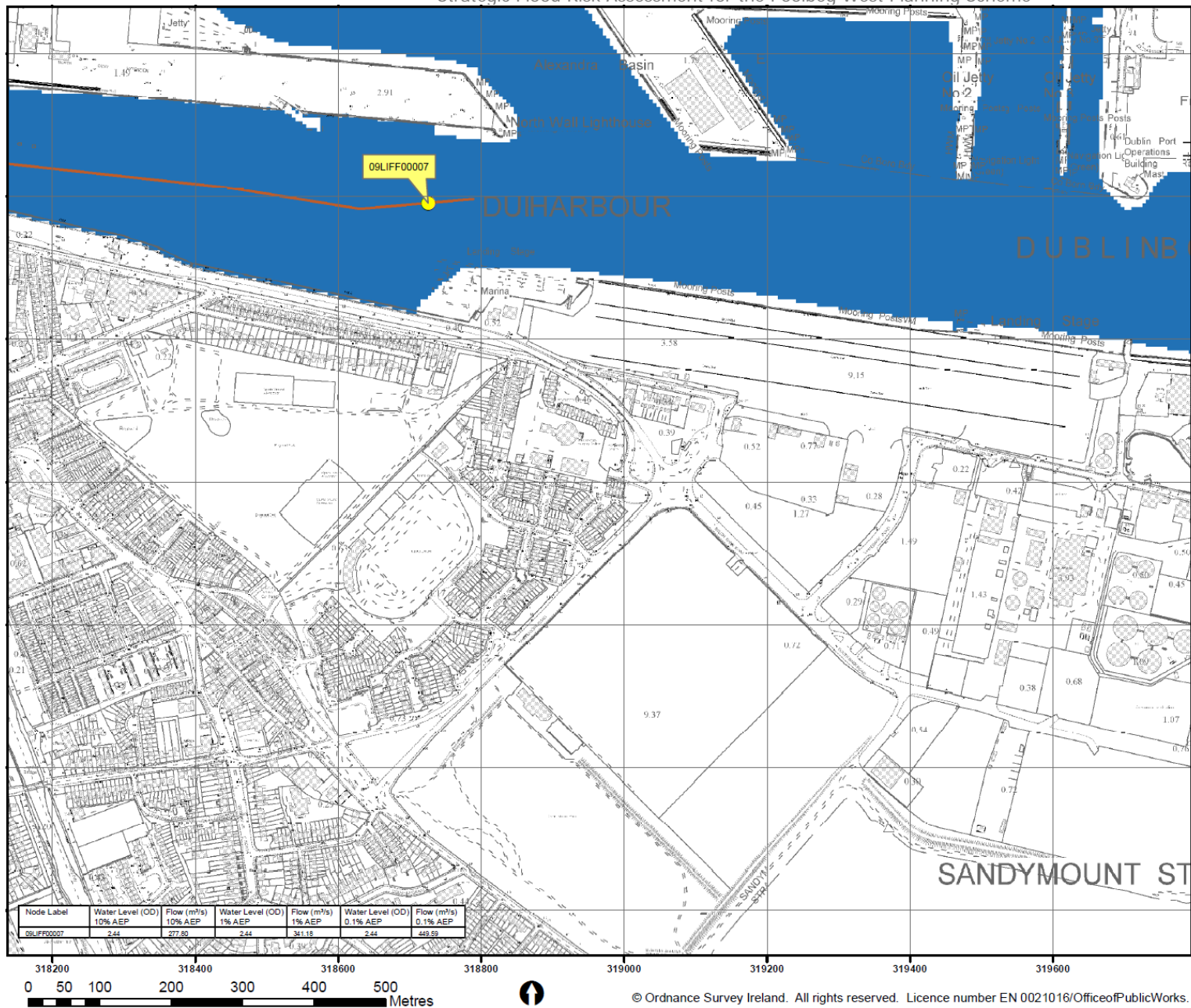
**Flood Extents**

|  |  |  |
|--|--|--|
|  Fluvial - Indicative 1% AEP (100-yr) Event |  Coastal - Indicative 0.5% AEP (200-yr) Event |  Pluvial - Indicative 1% AEP (100-yr) Event |
|  Fluvial - Extreme Event                    |  Coastal - Extreme Event                      |  Pluvial - Extreme Event                    |

**Figure 3 Preliminary Flood Risk Assessment (PFRA) Mapping**

Sources: Teagasc, Forest Service & EP

Strategic Flood Risk Assessment for the Poolbeg West Planning Scheme



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

- Legend**
- 10% Fluvial AEP Event
  - 1% Fluvial AEP Event
  - 0.1% Fluvial AEP Event
  - Modelled River Centreline
  - AFA Extents
  - Node Point
  - Node ID Node Label

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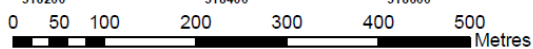


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|                              |                         |
|------------------------------|-------------------------|
| Map:                         |                         |
| Liffey Fluvial Flood Extents |                         |
| Map Type:                    | EXTENT                  |
| Source:                      | FLUVIAL                 |
| Map Area:                    | HPW                     |
| Scenario:                    | CURRENT                 |
| Drawn By:                    | C.C. Date: 28 July 2016 |
| Checked By:                  | A.S. Date: 28 July 2016 |
| Approved By:                 | S.P. Date: 28 July 2016 |
| Drawing No.:                 |                         |
| E09LIF_EXFCD_F0_05           |                         |
| Map Series: Page 5 of 8      |                         |
| Drawing Scale: 1:5,000 @ A3  |                         |

| Node Label | Water Level (OD) | Flow (m³/s) | Water Level (OD) | Flow (m³/s) | Water Level (OD) | Flow (m³/s) |
|------------|------------------|-------------|------------------|-------------|------------------|-------------|
|            | 10% AEP          | 1% AEP      | 1% AEP           | 0.1% AEP    | 0.1% AEP         | 0.1% AEP    |
| 09LIF00007 | 2.44             | 277.80      | 2.44             | 341.18      | 2.44             | 448.59      |



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Figure 4 Liffey Fluvial Flood Extents North-West of Poolbeg



Strategic Flood Risk Assessment for the Poolbeg West Planning Scheme



Figure 5 Liffey Fluvial Flood Extents North of Poolbeg

CAAS for Dublin City Council

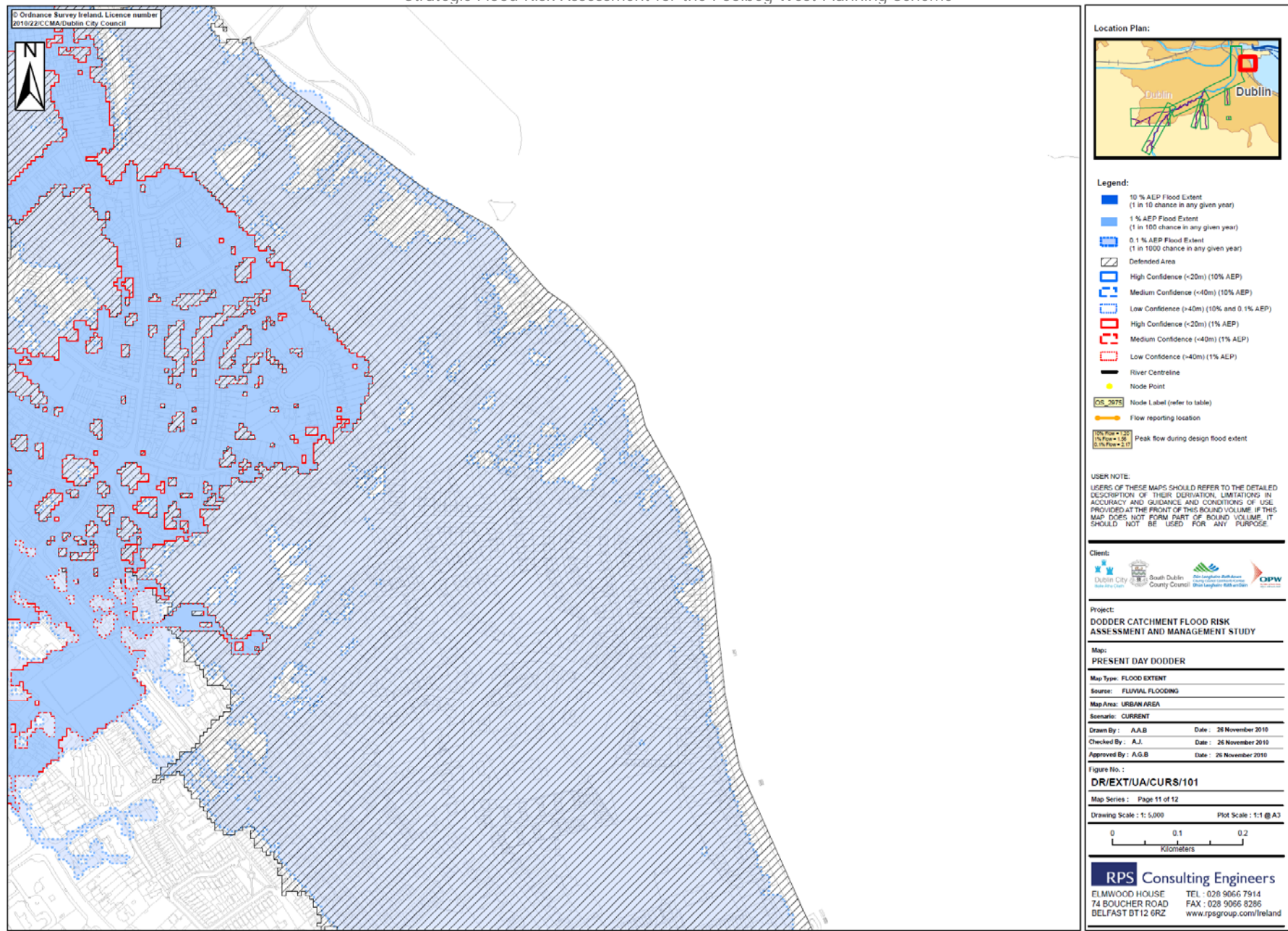
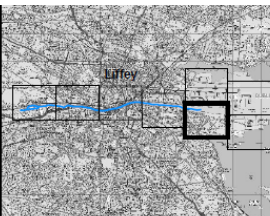
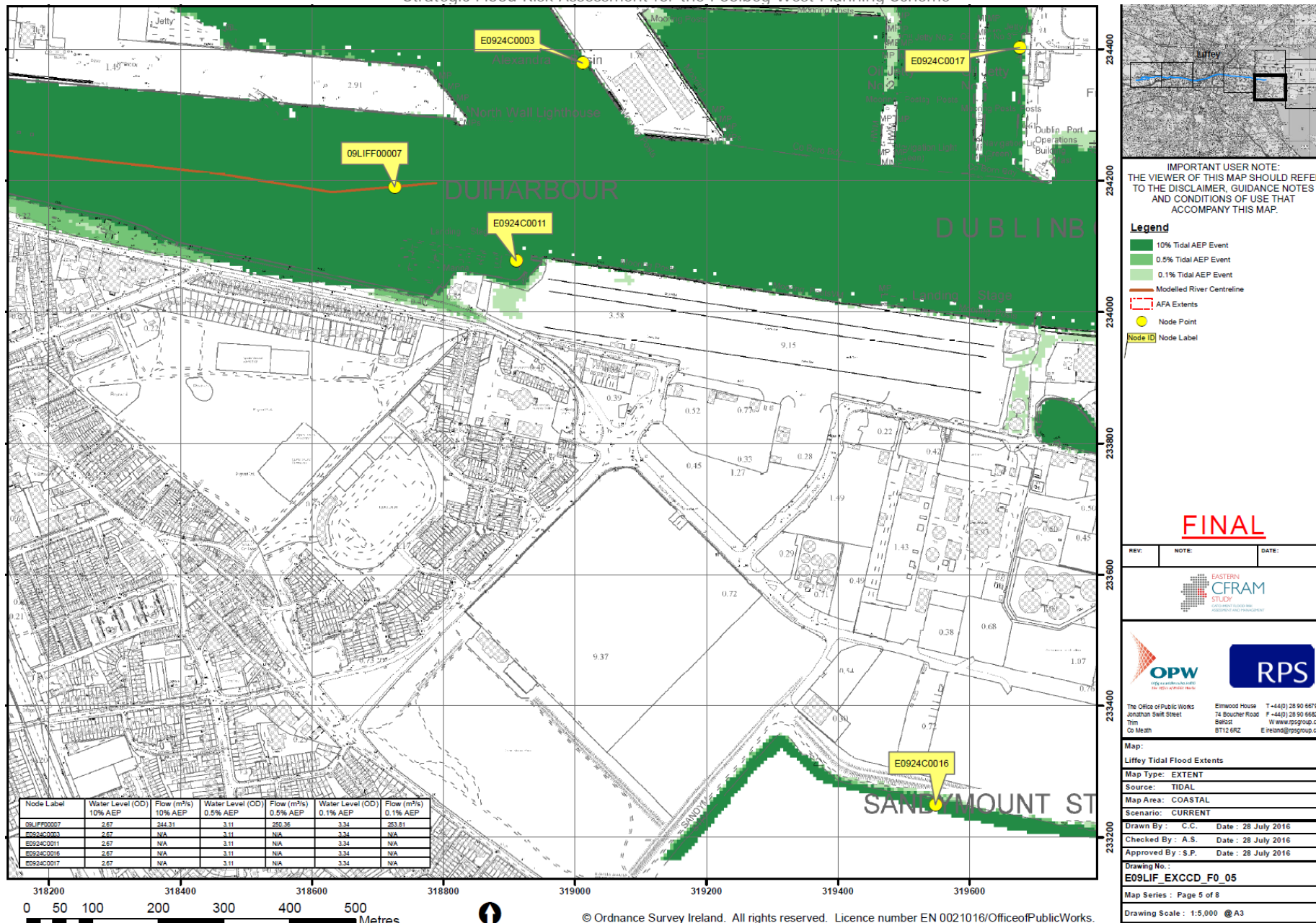


Figure 6 Dodder Fluvial Flood Extents South-West of Poolbeg



Strategic Flood Risk Assessment for the Poolbeg West Planning Scheme



**IMPORTANT USER NOTE:**  
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**Legend**

- 10% Tidal AEP Event
- 0.5% Tidal AEP Event
- 0.1% Tidal AEP Event
- Modelled River Centreline
- AFA Extents
- Node Point
- Node ID Node Label

**FINAL**

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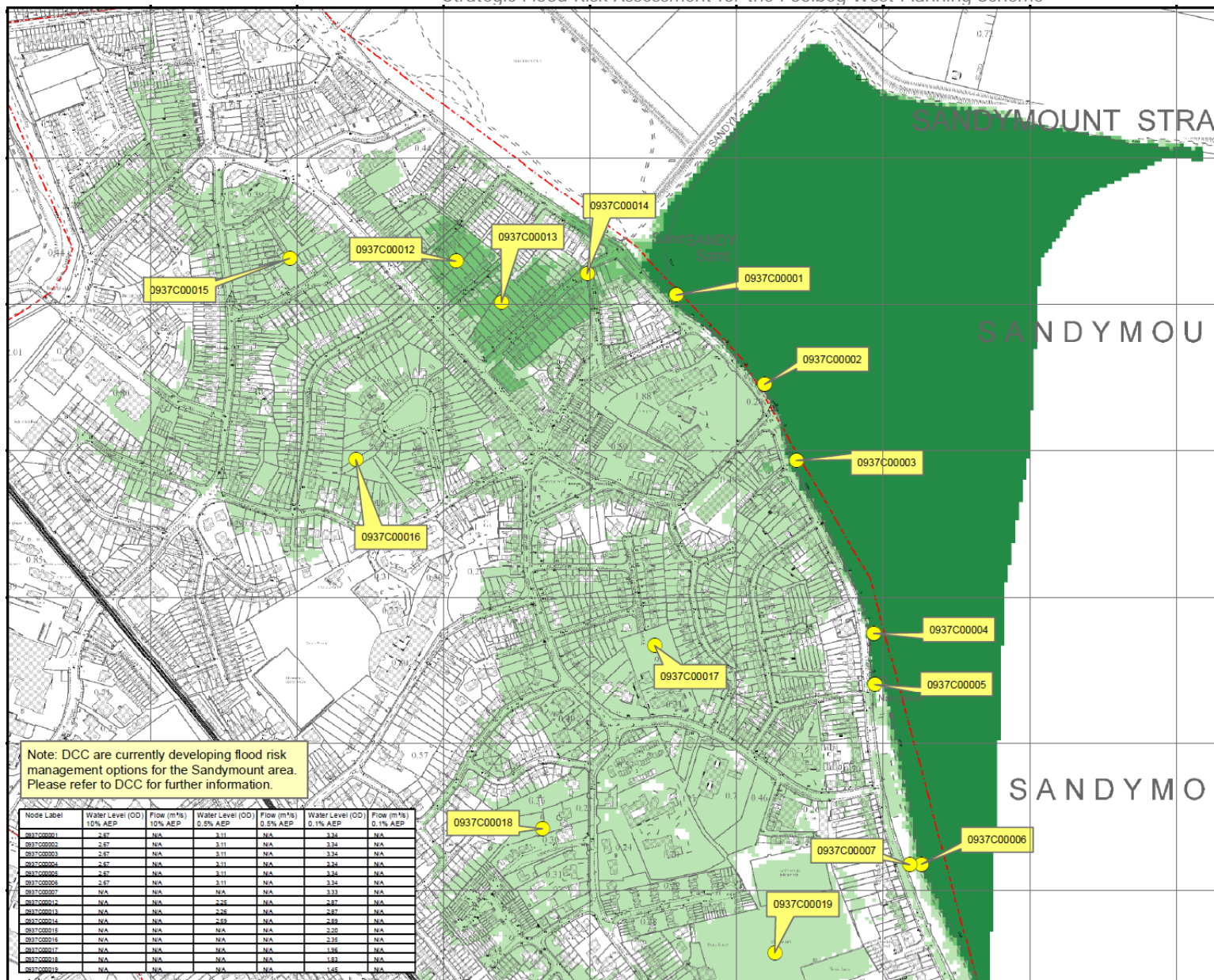
Map:  
Liffey Tidal Flood Extents

|                |                         |
|----------------|-------------------------|
| Map Type:      | EXTENT                  |
| Source:        | TIDAL                   |
| Map Area:      | COASTAL                 |
| Scenario:      | CURRENT                 |
| Drawn By:      | C.C. Date: 28 July 2016 |
| Checked By:    | A.S. Date: 28 July 2016 |
| Approved By:   | S.P. Date: 28 July 2016 |
| Drawing No.:   | E09LIF_EXCCD_F0_05      |
| Map Series:    | Page 5 of 8             |
| Drawing Scale: | 1:5,000 @ A3            |

Figure 7 Liffey Tidal Flood Extents North of Poolbeg

CAAS for Dublin City Council

Strategic Flood Risk Assessment for the Poolbeg West Planning Scheme

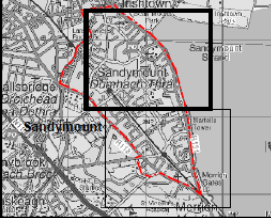


Note: DCC are currently developing flood risk management options for the Sandymount area. Please refer to DCC for further information.

| Node Label | Water Level (OD) 10% AEP | Flow (m³/s) 10% AEP | Water Level (OD) 0.5% AEP | Flow (m³/s) 0.5% AEP | Water Level (OD) 0.1% AEP | Flow (m³/s) 0.1% AEP |
|------------|--------------------------|---------------------|---------------------------|----------------------|---------------------------|----------------------|
| 0937C00001 | 2.67                     | NA                  | 3.11                      | NA                   | 3.34                      | NA                   |
| 0937C00002 | 2.67                     | NA                  | 3.11                      | NA                   | 3.34                      | NA                   |
| 0937C00003 | 2.67                     | NA                  | 3.11                      | NA                   | 3.34                      | NA                   |
| 0937C00004 | 2.67                     | NA                  | 3.11                      | NA                   | 3.34                      | NA                   |
| 0937C00005 | 2.67                     | NA                  | 3.11                      | NA                   | 3.34                      | NA                   |
| 0937C00006 | 2.67                     | NA                  | 3.11                      | NA                   | 3.34                      | NA                   |
| 0937C00007 | NA                       | NA                  | NA                        | NA                   | 3.33                      | NA                   |
| 0937C00008 | NA                       | NA                  | 2.98                      | NA                   | 2.97                      | NA                   |
| 0937C00009 | NA                       | NA                  | 2.76                      | NA                   | 2.67                      | NA                   |
| 0937C00010 | NA                       | NA                  | 2.98                      | NA                   | 2.98                      | NA                   |
| 0937C00011 | NA                       | NA                  | NA                        | NA                   | 2.20                      | NA                   |
| 0937C00012 | NA                       | NA                  | NA                        | NA                   | 2.38                      | NA                   |
| 0937C00013 | NA                       | NA                  | NA                        | NA                   | 1.98                      | NA                   |
| 0937C00014 | NA                       | NA                  | NA                        | NA                   | 1.83                      | NA                   |
| 0937C00015 | NA                       | NA                  | NA                        | NA                   | 1.68                      | NA                   |



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**IMPORTANT USER NOTE:**  
THE VIEWER OF THIS MAP SHOULD REFER TO THE DISCLAIMER, GUIDANCE NOTES AND CONDITIONS OF USE THAT ACCOMPANY THIS MAP.

**Legend**



- 10% Tidal AEP Event
- 0.5% Tidal AEP Event
- 0.1% Tidal AEP Event
- AFA Extents
- Node Point
- Node ID
- Node Label

FINAL

| REV: | NOTE: | DATE: |
|------|-------|-------|
|      |       |       |



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**Map:**  
Sandymount Tidal Flood Extents

|   |
|---|
| <b>Map Type:</b> EXTENT                             |
| <b>Source:</b> TIDAL                                |
| <b>Map Area:</b> COASTAL                            |
| <b>Scenario:</b> CURRENT                            |
| <b>Drawn By:</b> C.McG. <b>Date:</b> 9 August 2016  |
| <b>Checked By:</b> A.S. <b>Date:</b> 9 August 2016  |
| <b>Approved By:</b> S.P. <b>Date:</b> 9 August 2016 |
| <b>Drawing No.:</b> E09SAN_EXCCD_F0_01              |
| <b>Map Series:</b> Page 1 of 2                      |
| <b>Drawing Scale:</b> 1:5,000 @ A3                  |

**Figure 8 Liffey Tidal Flood Extents South of Poolbeg**  
CAAS for Dublin City Council



Strategic Flood Risk Assessment for the Poolbeg West Planning Scheme

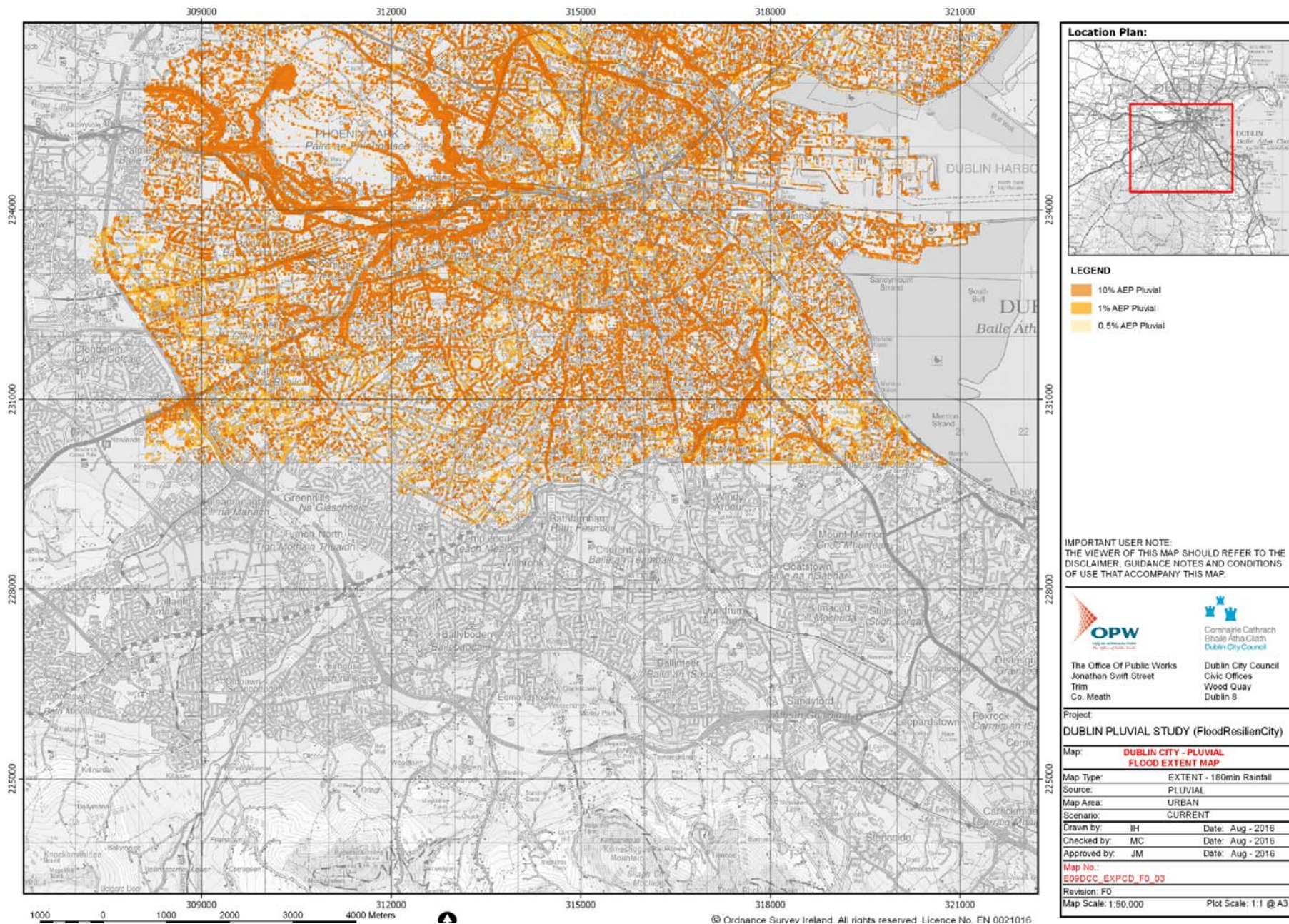


Figure 9 Pluvial Flood Extents across the wider Dublin Region

CAAS for Dublin City Council



## **Section 3 Stage 2 SFRA - Initial Flood Risk Assessment**

### **3.1 Introduction**

A Stage 2 SFRA (initial flood risk assessment) was undertaken to:

- Confirm the sources of flooding that may affect zoned and adjacent areas;
- Appraise the adequacy of existing information as identified by the Stage 1 SFRA; and
- Scope the extent of the risk of flooding through the preparation of flood zone maps.

### **3.2 Site Walkovers and Groundtruthing**

This Stage 2 assessment has been informed by the knowledge gained during numerous on-foot inspections made by experienced professionals, including those made by both Dublin City Council and CAAS in 2016.

Such knowledge includes that relating to: the potential source and direction of flood paths from the coast; and locations of topographic/built features that coincide with the flood indicator related boundaries.

Local knowledge and additional technical input was provided by the Council's Regional Projects and Flood Advisory Office.

Flood risk indicator information that was considered during the Stage 2 SFRA is detailed under Section 2.

### **3.3 Findings and Adequacy of Existing Information and Delineation of Flood Zones**

CFRAMS fluvial and coastal flood extent mapping (2016) risk mapping was found to be consistent with: local, Council knowledge of the lands; the potential source and direction of flood paths from the coast (flow paths come directly out of the tidal region to the south and west of the Poolbeg site); and the topography of the lands.

Within the annual exceedance probabilities specified by the Flood Guidelines for Flood Zones A and B: there is only coastal risk at the edge of the southern boundary of the Poolbeg West SDZ site; there is no fluvial risk at the Poolbeg West SDZ site.

At the edge of the southern boundary of the Poolbeg West SDZ site there is elevated levels of coastal flood risk and these lands are identified as being within Flood Zones A and B. Land uses proposed in these areas should take into account the requirements of the Guidelines.

Much of the lands are already c. 4-5m OD Malin. Recommendations regarding minimum floor levels and minimum levels of site protection during construction are detailed in Section 4.

Pluvial flood risk is identified in areas including lower parts of the site and parts of the site behind the coastal embankments. Pluvial flood risk is not taken into account in the delineation of flood zones, however; it has informed the development of recommendations detailed in Section 4.

### 3.4 Indicative Flood Risk Zone Mapping

A Flood Risk Zone map was produced taking into account the findings of the Stage 1 and Stage 2 SFRA as detailed above.

Figure 10 identifies both Flood Zone A (darker blue) and Flood Zone B<sup>5</sup> (lighter blue) for the SDZ lands. All other areas fall within Flood Zone C. As per the Guidelines, the flood zones are a combination of fluvial and coastal risk areas as follows:

- Flood Zone A – where the probability of flooding from rivers and the sea is highest (greater than 1% or 1 in 100 for river flooding or 0.5% or 1 in 200 for coastal flooding);
- Flood Zone B – where the probability of flooding from rivers and the sea is moderate (between 0.1% or 1 in 1000 and 1% or 1 in 100 for river flooding and between 0.1% or 1 in 1000 year and 0.5% or 1 in 200 for coastal flooding); and
- Flood Zone C – where the probability of flooding from rivers and the sea is low (less than 0.1% or 1 in 1000 for both river and coastal flooding).

### 3.5 Flood Risk Elsewhere as a result of development of the site

As the flood risk at this site is tidal, development of the site in accordance with relevant mitigation measures will have no impact on the flood risk associated with neighbouring development. The volume of waters displaced by developing the site will be negligible in the context of an Irish Sea high tide. Consequently, and as recognised by the Dublin City Development Plan 2016-2022 SFRA, compensatory storage will not be required.

As required by the Dublin City Development Plan 2016-2022 SFRA, best practice with regard to surface water management will be implemented across the development area to limit surface water runoff to current values.

### 3.6 Sensitivity to Climate Change

Coastal areas are highly sensitive to climate change impacts arising from increases in flooding due to both rising sea levels and more frequent and more severe storms. Furthermore, defended areas are highly sensitive to climate change as the likelihood of defence failure and resulting flooding increases.

'The Planning System and Flood Risk Management Guidelines for Planning Authorities and Technical Appendices, 2009' recommends that a precautionary approach to climate change is adopted due to the level of uncertainty involved in the potential effects. In this regard, the Guidelines recommends:

- Recognising that significant changes in the flood extent may result from an increase in rainfall or tide events and accordingly adopting a cautious approach to zoning land in these potential transitional areas;
- Ensuring that the levels of structures designed to protect against flooding such as flood defences, land raising or raised floor levels are sufficient to cope with the effects of climate change over the lifetime of the development they are designed to protect (normally 85-100 years); and
- Ensuring that structures to protect against flooding and the development protected are capable of adaptation to the effects of climate change when there is more certainty about the effects and still time for such adaptation to be effective.

<sup>5</sup> As identified by the Guidelines, in rivers with a well-defined floodplain or where the coastal plain is well defined at its rear, the limits of Zones A and B will virtually coincide. Zone B will only be significantly different in spatial extent from Zone A where there is extensive land with a gentle gradient away from the river or the sea.

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 Guidance. Two climate change scenarios are considered. These are the Mid-Range Future Scenario (MRFS) and the High-End Future Scenario (HEFS). The MRFS is intended to represent a "likely" future scenario based on the wide range of future predictions available. The HEFS represents a more "extreme" future scenario at the upper boundaries of future projections. Based on these two scenarios the OPW recommended allowances for climate change in relation to river flows and sea levels are given in Table 2 overleaf. These climate change allowances are particularly important at the development management stage of planning, and will ensure that proposed development is designed and constructed to take into account best current knowledge. Climate change allowances have been integrated into the recommendations provided at Section 4 of this report.

At this, the development planning stage, a detailed knowledge of the impact of climate change on flood levels is not required to inform the strategic allocation of land. Instead, and in the absence of detailed projections of climate change impacts, flood extents can be assessed by using the extent of the Flood Zone B outline to indicate where climate change may result in greater extents in the future.

| Criteria                | MRFS – to be considered for most development scenarios | HEFS – to be considered in relation to high value, high vulnerability development which cannot be relocated |
|-------------------------|--|---|
| Extreme Rainfall Depths | +20%   | +30%  |
| Flood Flows             | +20%   | +30%  |
| Mean Sea Level Rise     | +500mm   | +1000mm   |

**Table 2 Allowances for Future Scenarios (100-Year Time Horizon)**

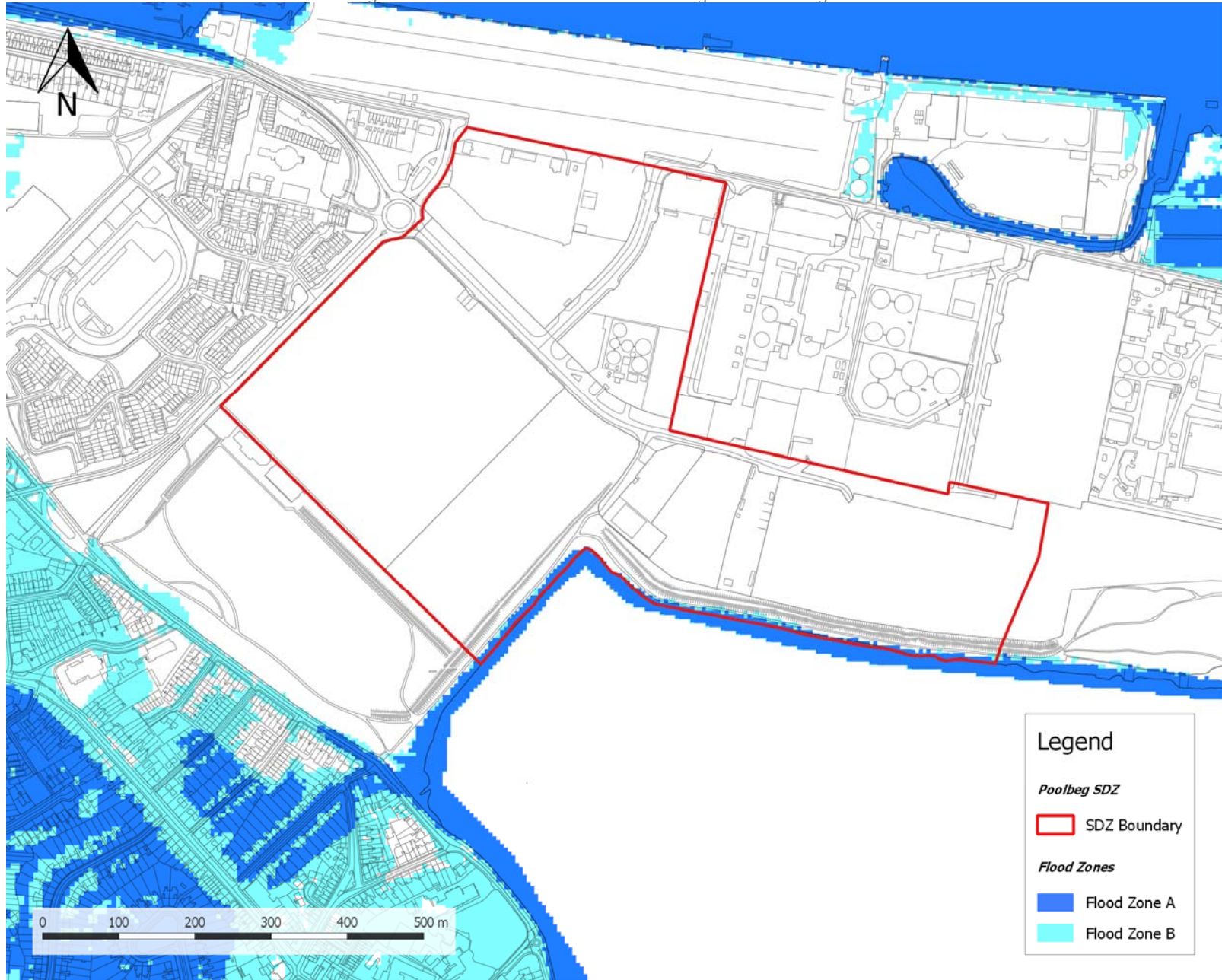
### 3.7 Consideration of Justification Test and Justification Test undertaken as part of the City Development Plan 2016-2022 SFRA

A Justification Test is required to be undertaken in instances whereby *highly vulnerable development*<sup>6</sup> is being considered in Flood Zone A or whereby *highly* and/or *less vulnerable development* is being considered in Flood Zone B.

As only *water compatible development*, in the form of a coastal park, is proposed by the Planning Scheme in Flood Zones A and B (in accordance with the recommendations of this SFRA provided at Section 4), the Justification Test was not required to be undertaken for the Planning Scheme SFRA.

As part of the Dublin City Development Plan 2016-2022 SFRA, the wider "Dublin Port South of the Liffey from Eastlink Bridge" area that includes the Poolbeg West SDZ was required to undergo a Justification Test. This is because a zoning objective allowing for *highly* and *less vulnerable development* was being considered for parts of this wider south port area that are located within areas of elevated flood risk - Flood Zones A and B.

<sup>6</sup> For details on what types of development are considered highly vulnerable, less vulnerable or water compatible please refer to Table 3 in Appendix III.



**Figure 10 Flood Risk Zones**

## Section 4 Recommendations

In order to comply with *The Planning System and Flood Risk Management - Guidelines for Planning Authorities* (Department of the Environment, Heritage and Local Government and Office of Public Works, 2009) and contribute towards flood risk management within the SDZ, the recommendations below were made by the SFRA process and integrated into the Planning Scheme.

| Title  | Recommendation  | How recommendation has been integrated into the Planning Scheme?   |
|--|---|--|
| Land Uses  | <p>The Flood Zones identified by the SFRA should be used in the identification of land uses for the site in line with the provisions contained in the Flood Risk Management Guidelines that are summarised in Appendix III. Undeveloped land should not be zoned for incompatible uses.</p> <p>At the edge of the southern boundary of the Poolbeg West SDZ site there is elevated levels of coastal flood risk and these lands are identified as being within Flood Zones A and B.</p> <p>Land uses proposed in these areas should be either for <i>water compatible development</i><sup>7</sup> or, if land uses are for <i>highly</i> or less <i>vulnerable development</i>, then the Justification Test should be undertaken as relevant.</p>   | <p>This recommendation has been integrated into the Planning Scheme by providing for <i>water compatible development</i> only within Flood Zones A and B.</p>  |
| Minimum Floor Levels <sup>8</sup>                                  | <p>Taking into account climate change, minimum floor levels should be generally set at 4.75m OD Malin, or higher, for highly vulnerable development or 4.25m OD Malin, or higher, for less vulnerable development. This is subject to the findings of any site-specific Flood Risk Assessments that are required to be undertaken for each application.</p> <p>The following allowances are integrated into this minimum threshold:</p> <ul style="list-style-type: none"> <li>• Static 200-year tide: 3.25m</li> <li>• Wave action 0.2m</li> <li>• Free board: 0.3m</li> <li>• Climate change: 1m for highly vulnerable development (such as critical infrastructural development) and 0.5m for less vulnerable development (this is considered for most development scenarios)</li> </ul>   | <p>As detailed at Section 7.6 of the Planning Scheme:</p> <p>“A Strategic Flood Risk Assessment (SFRA), as required by ‘The Planning System and Flood Risk Management Guidelines for Planning Authorities’ (DEHLG, 2009), has been undertaken alongside the preparation of the SEA and the preparation of this Planning Scheme. This assessment considers available information on flood risk indicators and delineates flood risk zones. All developments must comply as relevant with the measures included within Section 4 “Recommendations” of the SFRA.”</p> |
| Minimum levels of site protection during construction <sup>9</sup> | <p>Minimum levels of site protection during construction would not have to take in account additional factors for longer-term climate change and should be set at 3.75m.</p>  |  |
| Site defences <sup>10</sup>  | <p>Taking into account climate change, land uses should be defended to 4.75m OD Malin, or higher, for highly vulnerable development or 4.25m OD Malin, or higher, for less vulnerable development. This is subject to the findings of any site-specific Flood Risk Assessments that are required to be undertaken for each application. The defence line should be augmented at gaps in between the existing embankment.</p> <p>The following allowances are integrated into this minimum threshold:</p> <ul style="list-style-type: none"> <li>• Static 200-year tide: 3.25m</li> <li>• Wave action 0.2m</li> <li>• Free board: 0.3m</li> <li>• Climate change: 1m for highly vulnerable development (such as critical infrastructural development) and 0.5m for less vulnerable development (this is considered for most development scenarios)</li> </ul> <p>Where embankment defences are being used then an additional 0.2m allowance should be added.</p> |  |

<sup>7</sup> For details on what types of development are considered highly vulnerable, less vulnerable or water compatible please refer to the Guidelines and Table 3 in Appendix III.

<sup>8</sup> This threshold was provided for by and through consultation with Dublin City Council's Regional Projects & Flood Advisory Office

<sup>9</sup> This threshold was provided for by and through consultation with Dublin City Council's Regional Projects & Flood Advisory Office

<sup>10</sup> This threshold was provided for by and through consultation with Dublin City Council's Regional Projects & Flood Advisory Office

| Title  | Recommendation  | How recommendation has been integrated into the Planning Scheme?   |
|--|---|--|
| <p>Other measures integrated into the Scheme</p> | <p><b>IU 1.</b> To require all proposed developments to carry out a site specific Flood Risk Assessment (SSFRA) that shall demonstrate compliance with:</p> <ul style="list-style-type: none"> <li>• The Planning System and Flood Risk Management, Guidelines for Planning Authorities (Department of the Environment, Heritage and Local Government, November 2009, as may be revised/updated).</li> <li>• The prevailing Dublin City Development Plan.</li> <li>• Recommendations contained within Section 4 of the Strategic Flood Risk Assessment for the Poolbeg West Planning Scheme.</li> </ul> <p>Such assessments shall:</p> <ul style="list-style-type: none"> <li>• Pay particular emphasis to residual flood risks, site-specific mitigation measures, flood resilient design and construction, and any necessary management measures (Appendix B4 of the above mentioned national guidelines refers).</li> <li>• Give attention (in the SSFRA and in building design) to creating a successful interface with the public realm through good design that addresses flood concerns but also maintains appealing and functional streetscapes</li> <li>• Consider and mitigate any pluvial flood risk, having regard to Pluvial Flood Risk Maps from the Dublin Pluvial Study</li> <li>• Take into account potential increase in flood risk arising from subsidence in areas that have been infilled.</li> <li>• Ensure that Strategic Flood Risk Assessments and site-specific Flood Risk Assessments consider and provide information on the implications of climate change with regard to flood risk in relevant locations. The 2009 OPW Draft Guidance on Assessment of Potential Future Scenarios for Flood Risk Management (or any superseding document) shall be in this regard.</li> <li>• Assess flood risk for all parts of the development including any proposals for underground parking and storage areas, recognising that no underground offices or residential units (whether temporary or permanent) will be allowed.</li> <li>• Demonstrate that relevant development management measures detailed in the Dublin City Development Plan 2016-2022 SFRA have been integrated into the development proposal.</li> </ul> <p><b>IU 2.</b> To require all large development proposals to include water conservation and demand management measures</p> <p><b>IU 3.</b> That all new developments shall be required to comply with the standards set out in the Greater Dublin Strategic Drainage Study (GDSDS)</p> <p><b>IU 4.</b> To achieve best practice and innovations in SUDS design as part of the planning scheme, including the successful coordination of surface water management with ecology and amenity functions of open space and landscaped areas. All planning applications shall be accompanied by a surface water drainage plan which will include proposals for the management of surface water within sites, protecting the water quality of the existing water bodies and ground water sources, and retrofitting best practice SUDS techniques on existing sites, where possible. Such a plan shall demonstrate that surface water runoff will be limited to current values, as required by the Dublin City Development Plan 2016-2022. Where a planning application depends upon any pipes draining to the sea, such pipes should be fitted with non-return valves in order to prevent back flow from sea where relevant.</p> <p><b>IU 14.</b> To require that each significant planning application be accompanied by a Construction and Environmental Management Plan, which shall include information on construction traffic routes, hours of operation, control of noise, and environmental effects and associated, detailed mitigation including that relating to the excavation of material and the storage, transport, treatment and disposal of wastes. Where landowners collaborated and prepared a coordinated environmental management plan, this could be submitted with each application for development as appropriate.</p> <p><b>GI2</b> To incorporate open space into the green infrastructure of the SDZ, providing a multi-functional role including urban drainage, flood management, biodiversity, outdoor recreation and carbon absorption.</p> <p><b>GI9</b> To require Sustainable Urban Drainage Systems (SUDs) in all developments, incorporating a sequence of SUDS techniques that work together in series to control the flow, volume and frequency of runoff as well as preventing or treating pollution as water flows through the development (Management Train).</p> <p><b>GI10</b> To integrate new green infrastructure solutions into new developments and in the public realm to boost biodiversity and improve surface water management</p> | <p>These provisions relating to flood risk management have been integrated into the Planning Scheme.</p> |

| Title   | Recommendation   | How recommendation has been integrated into the Planning Scheme?   |
|---|--|--|
|   | <p>within the SDZ area, include the use of permeable materials for surfaces, planted roofs, living walls, swales, retention basin/ponds and provision of storm water tree trenches.</p> <p><b>Policy Section 10.2: Environmental protection and enhancement:</b></p> <ul style="list-style-type: none"> <li>• To improve the environmental quality of the SDZ through new water management proposals using SUDS, swales and water attenuation where appropriate to mitigate against flooding.</li> <li>• To provide green landscaping including tree planting on streets within the SDZ area to increase opportunities for wildlife and contribute to improvements in air and water quality and water attenuation.</li> </ul>  |  |
| <p>Other measures integrated into the City Development Plan</p> | <p><b>Policy SI12:</b> To implement and comply fully with the recommendations of the Strategic Flood Risk Assessment prepared as part of the Dublin City Development Plan.</p> <p><b>Policy CC5:</b> To address flood risk at strategic level through the process of strategic flood risk assessment, and through improvements to the city's flood defences.</p> <p><b>Policy SI8:</b> To mitigate the effects of floods and droughts subject to environmental assessments.</p> <p><b>Policy SI9:</b> To assist the Office of Public Works in developing catchment-based Flood Risk Management Plans for rivers, coastlines and estuaries in the Dublin city area and have regard to their provisions/recommendations.</p> <p><b>Policy SI10:</b> To have regard to the Guidelines for Planning Authorities on the Planning System and Flood Risk Management, and Technical Appendices, November 2009, published by the Department of the Environment, Community, and Local Government as may be revised/updated when assessing planning applications and in the preparation of plans both statutory and non-statutory.</p> <p><b>Policy SI11:</b> To put in place adequate measures to protect the integrity of the existing Flood Defence Infrastructure in Dublin City Councils ownership and identified in the Strategic Flood Risk Assessment and to ensure that the new developments do not have the effect of reducing the effectiveness or integrity of any existing or new flood defence infrastructure and that flood defence infrastructure has regard also to nature conservation, open space and amenity issues.</p> <p><b>Policy SI13:</b> That development of basements or any above-ground buildings for residential use below the estimated flood levels for Zone A or Zone B will not be permitted.</p> <p><b>Policy SI14:</b> To protect the Dublin City coastline from flooding as far as reasonably practicable, by implementing the recommendations of the Dublin Coastal Flood Protection Project and the Dublin Safer Project.</p> <p><b>Policy SI15:</b> To minimise the risk of pluvial (intense rainfall) flooding in the city as far as is reasonably practicable and not to allow any development which would increase this risk.</p> <p><b>Policy SI16:</b> To minimise the flood risk in Dublin City from all other sources of flooding, including fluvial, reservoirs and dams and the piped water system.</p> <p><b>Policy SI17:</b> To require an environmental assessment of all proposed flood protection or flood alleviation works.</p> <p><b>Policy SI18:</b> To require the use of Sustainable Urban Drainage Systems in all new developments, where appropriate, as set out in the Greater Dublin Regional Code of Practice for Drainage Works. The following measures will apply:</p> <ul style="list-style-type: none"> <li>• The infiltration into the ground through the development of porous pavement such as permeable paving, swales, and detention basins</li> <li>• The holding of water in storage areas through the construction of green roofs, rainwater harvesting, detention basins, ponds, and wetlands</li> <li>• The slow-down of the movement of water.</li> </ul> <p><b>Policy GI4:</b> To co-ordinate open space, biodiversity and flood management requirements, in progressing a green infrastructure network.</p> <p><b>Policy GI9:</b> To incorporate open space into the green infrastructure network for the city, providing a multi-functional role including urban drainage, flood management, biodiversity, outdoor recreation and carbon absorption.</p> <p><b>Objective SIO8:</b> All development proposals shall carry out, to an appropriate level of detail, a Site Specific Flood Risk Assessment (SSFRA) that shall demonstrate compliance with:</p> <ul style="list-style-type: none"> <li>• The Planning System and Flood Risk Management, Guidelines for Planning Authorities, Department of the Environment, Community and Local Government, November 2009, as may be revised/updated and the Strategic Flood Risk Assessment (SFRA) as prepared by this Development Plan.</li> <li>• The site-specific flood risk assessment (SSFRA) shall pay particular emphasis to residual flood risks, site-specific mitigation measures, flood-resilient design and</li> </ul> | <p>As detailed at Section 12 of the Planning Scheme, 'Where policies, objectives, principles or standards are not specifically addressed in the SDZ Planning Scheme (e.g. apartment size standards) those in the City Development Plan shall apply.'</p> |

| Title | Recommendation   | How recommendation has been integrated into the Planning Scheme? |
|-------|--|--|
|       | <p>construction, and any necessary management measures (the SFRA and Appendix B4 of the above mentioned national guidelines refer). Attention shall be given in the site-specific flood risk assessment to building design and creating a successful interface with the public realm through good design that addresses flood concerns but also maintains appealing functional streetscapes. All potential sources of flood risk must be addressed in the SSFRA.</p> <p><b>Objective SIO9:</b> Proposals which may be classed as 'minor development', for example small-scale infill, small extensions to houses or the rebuilding of houses or paving of front gardens to existing houses, most changes of use and small-scale extensions to existing commercial and industrial enterprises in Flood Zone A or B, should be assessed in accordance with the Guidelines for Planning Authorities on the Planning System and Flood Risk Management &amp; Technical Appendices, November 2009 as may be revised/updated, with specific reference to Section 5.28 and in relation to the specific requirements of the Strategic Flood Risk Assessment. The policy shall be not to increase the risk of flooding and to ensure risk to the development is managed.</p> <p><b>Objective SIO10:</b> That recommendations and flood maps arising from the Fingal-East Meath CFRAM Study, the Dodder CFRAM Study and the Eastern CFRAM Study are taken into account in relation to the preparation of statutory plans and development proposals. This will include undertaking a review of the Strategic Flood Risk Assessment for Dublin city following the publication of the Final Eastern CFRAM Study, currently being produced by the OPW.</p> <p><b>Objective SIO11:</b> To work with neighbouring Local Authorities when developing cross-boundary flood management work programmes and when considering cross-boundary development.</p> <p><b>Objective SIO12:</b> To ensure each flood risk management activity is examined to determine actions required to embed and provide for effective climate change adaptation as set out in the Dublin City Council climate change adaption policy and in the OPW Climate Change Sectoral Adaptation Plan Flood Risk Management applicable at the time.</p> <p><b>Objective SIO13:</b> To provide additional and improved surface water networks to both reduce pollution and allow for sustainable development.</p> <p><b>Objective SIO14:</b> To require that any new paving of driveways or other grassed areas is carried out in a sustainable manner so that there is no increase in storm water run-off to the drainage network.</p> <p><b>Objective GIO28:</b> To identify opportunities for new tree planting to ensure continued regeneration of tree cover across the city, taking account of the context within which a tree is to be planted and planting appropriate tree species for the location.</p> <p><b>Objective GIO29:</b> To encourage trees to be incorporated in (a) the provision of temporary green spaces (e.g. pop-up parks) either planted into the soil or within moveable containers as appropriate and (b) within sustainable urban drainage systems (SUDS), as appropriate.</p> <p><b>Policy GI14:</b> To promote the development of soft landscaping in public open spaces, where feasible, in accordance with the principles of Sustainable Urban Drainage Systems.</p> |  |



## Section 5 Conclusion

A Stage 2 Strategic Flood Risk Assessment (SFRA) has been undertaken to inform the preparation and adoption of the Planning Scheme. The requirement for SFRA is provided under 'The Planning System and Flood Risk Management Guidelines for Planning Authorities' (DEHLG, 2009).

The SFRA has mapped boundaries for Flood Risk Zones, taking into account factors including the potential source and direction of flood paths from the coast; locations of topographic/built features that coincide with the flood indicator related boundaries; and local knowledge.

The Planning Scheme does not conflict with the provisions of the Flood Risk Management Guidelines or associated Circular PL 2/2014 (or as updated).

All SFRA recommendations have been integrated into the Planning Scheme. These recommendations include those relating to the following:

- Land Uses;
- Site specific Flood Risk Assessment
- Minimum Floor Levels;
- Minimum levels of site protection during construction;
- Site defences;
- Sustainable Urban Drainage Systems (SUDs);
- Green infrastructure; and
- Development Management Measures from Chapter 4 "Development Management and Flood Risk" from the Dublin City Development Plan 2016-2022 SFRA (these are reproduced as Appendix I to this SFRA).

# **Appendix I: Development Management and Flood Risk**

This appendix reproduces Chapter 4 “Development Management and Flood Risk” from the Dublin City Development Plan 2016-2022 SFRA.

As detailed at Section 12 of the Planning Scheme, ‘Where policies, objectives, principles or standards are not specifically addressed in the SDZ Planning Scheme (e.g. apartment size standards) those in the City Development Plan shall apply.

## **CHAPTER 4: Development Management and Flood Risk**

### **4.0 Introduction**

In order to guide both applicants and planning officials through the process of planning for and managing flood risk, the key features of a range of development scenarios have been identified (relating the flood zone, development vulnerability and presence or absence of flood defences). For each scenario, a number of considerations relating to the suitability of the development are summarised below, and are shown as process flow charts in Appendix 4. The aim of the flow charts is to provide a guide through the flood risk assessment process and to indicate which approaches to managing flood risk are expected in different circumstances. However, it is accepted that flood risk and its management is a complex and highly site specific phenomenon so the specific requirements of the assessment should be agreed with the DCC planners prior to commencing work.

It should be noted that this section of the SFRA begins from the point that all land zoned for development has passed the Justification Test for Development Plans, and therefore Part 1 of the Justification Test for Development Management. In addition to the general recommendations in the following sections, Appendix 3 should be reviewed for specific recommendations for the watercourses within Dublin City.

As detailed in Chapter 2, the Flood Zone Maps have been developed using the most appropriate data available to Dublin City Council 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 city. 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 less 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 DCC Planning and Engineering teams to ensure the assessment is appropriate and relevant to the site in question.

### **4.1 Requirements for a Flood Risk Assessment**

An appropriately detailed Flood Risk Assessment (FRA) will be required in support of any planning application. 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 and demonstrate compliance with the minimum required finished floor levels, detailed in the following sections of this report. In addition, flood risk from sources other than fluvial and tidal should be reviewed, as should the impacts of climate change. Groundwater flood risk for each portion of a development below ground should be evaluated in the FRA. This should be reported in a Surface Water Assessment and Management Report.

For sites within Flood Zone A or B, a site specific "Stage 2 - Initial FRA" will be required, and may 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.

The FRA may be a relatively straight forward, qualitative appraisal of risks accompanying the drainage design. Alternatively, the findings of the Eastern CFRAM study and the various other studies that have been carried out in Dublin City may be drawn upon to inform finished

floor levels and provide details on flood depth, velocity and impacts of defence breach. This information will all be essential in understanding residual flood risks and in developing emergency plans. In other circumstances a detailed modelling study and flood risk assessment may need to be undertaken. Further examples of where the different types of assessment may be needed, including considerations for the flood risk assessment are provided in Appendix 3.

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 (where required), the proposal will demonstrate that appropriate mitigation and management measures are put in place.

Specific requirements for a FRA in varying circumstances are detailed in the following sections.

## **4.2 Consideration of Surface Water in All Areas**

All proposed development, including that in Flood Zone C, shall have regard to surface water management policies contained in the Greater Dublin Strategic Drainage Study, Chapter 9 of the Development Plan and relevant information in this SFRA. 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, or surface water assessment.

There are extensive networks of surface water runoff routes across the city, as indicated in the FloodResilientCity Maps in Appendix 6. When commencing a surface water assessment, these maps should be consulted and appropriate incorporation of surface water management applied. In particular, attention should be given to development in low-lying areas which may act as natural ponds for collection of runoff.

There are two key objectives to this stage of assessment:

- Ensuring no increase in surface water risk elsewhere, which is achieved through managing runoff from the site and ensuring appropriately designed drainage systems.
- Ensuring risks from surface water are managed. This can be achieved through consideration of threshold levels, maintaining flow paths and preventing obstruction of areas where surface water ponds.

It is essential that overland flow routes are retained and development does not obstruct or divert them without full appraisal of the consequences for other sites and developments and that identified risks are fully mitigated.

### **4.2.1 Surface Water Assessment and Management**

The Surface Water Assessment shall be carried out for all sites and reported either in a standalone report, including drainage design drawings and supporting calculations, or it may form part of a more detailed Flood Risk Assessment, which will also consider other flood risks.

A specific requirement of the EU Water Framework Directive is that surface water discharge is controlled and managed so that any impact on its receiving environment is mitigated. This can be achieved through the use of Sustainable Drainage Systems (SuDS). SuDS can reduce the rate of runoff through a combination of infiltration, storage and conveyance



(slowing down the movement of water). Sustainable drainage can be achieved through the use of green infrastructure such as green roofs and pervious pavements, rainwater harvesting, soakaways, swales and detention basins, ponds and wetlands.

In order to reduce flooding and improve water quality, all developments in the City Council's administrative area are required to implement the policies of the Greater Dublin Strategic Drainage Study (GSDSDS) in relation to surface-water and flood risk management. This is done by ensuring new development does not obstruct existing flood plains or routes and by limiting the runoff from new development to green-field rates.

It is noted that the GSDSDS requires consideration of a 10% increase in rainfall intensity to take into account the possible impacts of climate change. However, the OPW Draft Guidance on Climate Change (see Section 2.1.8) contains more recent recommendations in this regard. Drainage and surface water design should therefore take into account the MRFS and HEFS in the same way as fluvial or tidal risk assessments. Guidance on the application of climate change allowances is provided in Section 4.10.

#### **4.2.2 Sustainable Drainage within Private Development**

In recent years in Ireland, there has been a move away from the traditionally designed hard engineering drainage solutions such as concrete underground attenuation tanks and piped drainage systems in favour of multi-function, sustainable solutions for the management of surface water in urban environments. The use of SuDS provides the additional benefits of improving the aesthetic character of the urban environment, enhancing biodiversity, and improving air quality. Sustainable drainage solutions that are visible to the public also allow for a stronger connection between the public and the natural environment, and therefore a greater awareness of water management issues.

A variety of sustainable drainage components, such as swales, retention ponds, constructed wetlands, permeable surfacing, green roofs, soakaways and rainwater harvesting systems, have successfully been incorporated into private development in the Dublin City Council area since the publications of the GSDSDS.

In certain areas such as the Docklands and the possible high percentage of site coverage of the developments that may be proposed, it is acknowledged that some of the above solutions will not be appropriate for incorporation into developments. It is also acknowledged that it may not be appropriate to provide all the storage required for tidal attenuation using sustainable drainage techniques. The installation of some "hard-engineering" components may therefore be inevitable in development sites with a high proportion of site coverage. However, in order to achieve the Dublin City Council development plan objectives of enhanced biodiversity and improved water quality, sustainable drainage solutions are required in all development.

The following SuDS components should be considered for installation within the private area of all development:

- Green Roofs
- Rainwater Harvesting
- Permeable Surfacing
- Soak-ways and Rain Gardens
- Rilles
- Local Pumping

Sustainable surface water management designs should comply with current best practice guidance and include a full maintenance package. In order to ensure their viability as sustainable solutions, the communication of maintenance requirements at handover or property transfer stage is of utmost importance.

#### 4.2.3 Sustainable Drainage of Public Areas

In addition to the incorporation of sustainable surface water management techniques within private development sites, particular emphasis will be placed on the incorporation of SuDS into public realm infrastructure. The use of sustainable surface water management in streetscapes ties in with Dublin City Council's biodiversity and green infrastructure strategies and has proven to be very cost effective in cities in the US and Europe.

The following surface water management solutions should be considered for surface-water management of public spaces:

- Permeable Surfaces in Pedestrian Areas
- Bio-retention Areas
- Rilles
- Sunken Squares.

Where sustainable storm water management solutions are incorporated into public spaces, it is important that their operation is communicated to the public through the use of appropriate signage.

This was successfully done in the Portland Green Streets Program which provides a great model for sustainable storm water management and green infrastructure implementation. It may be possible to design some new streets such that the traditional piped surface water sewer and gully system will not be required, thus providing cost savings at construction stage and also in terms of long-term maintenance.

It should be noted however that provision for surface water storage during tide-locking will be required in order to manage surface water in public spaces. If sustainable surface water management techniques are not incorporated to their fullest potential in order to achieve this, the requirement for the laying of large surface water sewers cannot be avoided.



Some new initiatives are currently being tested by Dublin City Council including the Beta Project or 'Rainbox Box Planter'. This project, which commenced in April 2014, looks at how DCC can green streets and better manage rainwater coming from people's homes by exploring the idea of Rain Box Planters. Currently rainfall in large areas discharges into a combined sewer system which costs DCC in the conveyance, pumping and treatment of this water. The Rain Box Planter projects aims to trial an alternative public green infrastructure solution. The specially designed planter prevents rainfall from entering the sewer network, it is estimated that the planters reduce runoff to the sewer by about 90% in summer and 60% in the winter.

A number of Swales have been constructed to date, for example, in Glendhu Park and Park Road. Swales are a depressed land form,



a gradual depression, similar to a ditch, but much wider and deeper. The use of a swale is to carry or hold flood waters. Swales can allow infiltration of water and nutrients down slope of it into the ground.



**Fig 4.1: Swales Constructed at Glendhu Park, Cabra**

### **4.3 Development in Flood Zone C**

Where a site is within Flood Zone C, but adjoining or in close proximity to Flood Zone A or B 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. Where a site is located on a 'dry island' (i.e. is fully surrounded by Flood Zone A or B) it is particularly important that flood risks are fully investigated and particular consideration is given to emergency response and evacuation routes; it should not be assumed that development on a 'dry island' is appropriate.

As a minimum, a FRA 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 in 100 year fluvial or 1 in 200 year tidal flood level, with an allowance for climate change and freeboard. 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 0.5m is added to the extreme (1 in 200 year) tide. Design considerations should be proportionate to the type of development (including design life and future adaptability), but may include raising finished floor levels. For highly vulnerable, long term developments which are difficult to adapt or relocate (such as hospitals and power stations), consideration of the High End Future Scenario (1m sea level rise) should be given.

It may also be appropriate to consider residual risks arising from culvert/structure blockage, particularly where it is identified that the site in question forms part of a flow route. Identification of flow routes across the site will not necessarily prohibit development, but should be incorporated into the landscaping and design of the development. This will prevent ingress of water to the development itself and ensure risks to neighbouring sites are unchanged.

#### **4.4 Applications for Minor Development in Areas at Risk of Flooding**

Section 5.28 of *'The Planning System and Flood Risk Management Guidelines for Planning Authorities, 2009'* identifies certain types of development as being 'minor works' and therefore exempt from the Justification Test. Such development relates to works associated with existing developments, such as extensions, renovations and rebuilding of the existing development, small scale infill and changes of use.

Despite the 'Sequential Approach' and 'Justification Test' not applying, as they relate to existing buildings, an assessment of the risks of flooding should accompany such applications. This must demonstrate that the development would not increase flood risks, by introducing significant numbers of additional people into the flood plain and/or putting additional pressure on emergency services or existing flood management infrastructure. The development must 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 *'The Planning System and Flood Risk Management Guidelines for Planning Authorities Technical Appendices, 2009'*, Section 4 - Designing for Residual Flood Risk).

Generally the approach to deal with flood protection would involve raising the ground floor levels above the level of extreme high tides. However in some parts of the plan area, which are already developed, ground floor levels for flood protection could lead to floor levels being much higher than adjacent streets, thus creating a hostile streetscape for pedestrians. This would cause problems for infill development sites if floor levels were required to be significantly higher than those of neighbouring properties. In this regard, for the key sites in the plan area it has been recognised that ground floor levels below predicted high tide levels could be allowed, in limited circumstances, on a site by site basis, for commercial and business developments. However, if this is the case, then these would be required to be flood resistant construction using water resistant materials and electrical fittings placed at higher levels. For high risk areas it would also be necessary to impose planning restrictions in these areas. Residential Uses would not be permitted at ground flood levels in high risk zones.

It should be noted that for residential buildings within Flood Zone A or B, bedroom accommodation shall not be permitted at basement or ground floor.

For commercial operations, business continuity must be considered, and steps taken to ensure operability during and recovery after a flood event for both residential and commercial developments. Emergency access must be considered as in many cases flood resilience will not be easily achieved in the existing build environment.

The requirement for providing compensatory storage for minor developments has been reviewed and can generally be relaxed, even where finished floor levels have been raised. This is because the development concerns land which has previously been developed and would already have limited capacity to mitigate flooding. However, a commentary to this effect must be substantiated in the FRA.

#### **4.5 Major development within Flood Zone A and B**

Two broad classes of major development have been identified for the purposes of this assessment. The first is new development which is located in 'greenfield' (currently



undeveloped) parts of the city. The second is larger scale infill and regeneration, which, given the urban nature of the city, will form the majority of major development proposals.

It is not appropriate for new, highly vulnerable development to be located on greenfield land in Flood Zones A or B, whether it is highly or less vulnerable. In the main, such areas are parks and public open space within the wider built environment which provide flood storage and reduce risks to existing development. There would be little or no opportunity to compensate for the loss of such storage areas, and development within them would be contra to a number of the policies and objectives within this Development Plan. Such proposals do not pass the Justification Test. Instead, a less vulnerable use should be considered.

Regeneration of areas within Flood Zone A and B has, in the main, been justified and the approach for managing risks to such development is provided below.

#### **4.6 Highly Vulnerable Development in Flood Zone A or B**

Development which is highly vulnerable to flooding, as defined in '*The Planning System and Flood Risk Management Guidelines for Planning Authorities and Technical Appendices, 2009*' includes (but is not limited to) dwelling houses, hospitals, emergency services and caravan parks and requires a particularly rigorous consideration of flood risks and robust flood management measures.

The DECLG Circular Letter PL2/2014 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, the Dublin City Development Plan has recognised urban centres whose continued consolidation, growth, development or generation, including for residential use, is being encouraged to bring about compact and sustainable growth.

Within this SFRA, small scale infill housing, extensions or changes of use have been considered and, subject to site specific flood risk assessment, can generally be considered appropriate provided they constitute a continuation of the existing quantum of development. There are a number of exceptions to this finding, so the detail contained in Appendix 3 should be consulted for more site specific information.

In cases where minor development has been justified, the outline requirements for a FRA and flood management measures have been detailed in this SFRA in both the following sections and the site specific assessments in Appendix 3, which also details 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. This should give due consideration to safe evacuation routes and access for emergency services during a flood event.

Key points for consideration in terms of highly vulnerable development in defended areas are:

- The minimum finished floor level for a residential development should be the 1 in 100 year fluvial or 1 in 200 year tidal flood level, with a suitable allowance for climate change (see Section 4.10) and a suitable freeboard. The freeboard should be at least 300mm but in tidal risk areas could be higher, particularly where wave action or combined fluvial/tidal events are present.

- Where a site is defended, the defences must protect to at least a 1 in 100 year (fluvial) or 1 in 200 year (tidal) standard of protection (SoP), with freeboard included in the defence height. If the SoP is lower, the site should be considered to be undefended.
- If the site is defended, and a freeboard allowance has been incorporated into the design of the defences, there is no requirement for the finished floor level of the development to include freeboard as well, but the finished floor level of the development should be raised to the 1 in 100 year level.
- The emergency procedures in the event of a flood are critical; evacuation routes should be provided to higher ground. If evacuation is not possible, containment may be considered, and the associated issues that this presents, such as duration of stay and the potential for rescue, must be addressed. If neither option is possible, then the development proposal cannot go ahead.
- Proposals for development that results in a loss of floodplain within undefended Flood Zone A must also demonstrate that compensatory storage can be provided on a level for level basis.

Having determined the finished floor level, the design should be reviewed against the wider development context, including the level of surrounding properties, utilities and landscaping. If the design is in keeping, it may proceed through the planning process. If the design is not in keeping, a further review of the design proposal is required and a lower vulnerability use should be substituted (at least on the ground floor) which may be constructed to a lower finished floor level, and risks re-appraised.

#### **4.7 Less Vulnerable Development in Flood Zone A or B**

Less vulnerable development includes retail, leisure and warehousing and buildings used for agriculture and forestry. 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 be the 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.

In contrast with highly vulnerable development, there is greater scope for the developer of less vulnerable uses to accept flood risks and build to a lower standard of protection (SoP), which is still 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, plus freeboard, needs to be fully justified within the FRA.

#### **4.8 Defended sites**

In a defended site the requirement to provide freeboard and climate change allowances on the finished floor levels can be relaxed if the defences already include the allowance. Where the defence does not include for climate change, such as along the Tolka, the specific risks to the development should be appraised and an appropriate response taken. For example, a retail outlet with a relatively short design life (i.e. up to approximately 20-30 years) would not necessarily need to be raised above climate change levels, but a high-tech or long term investment development project may need to be raised above the current design flood level.



In a defended site it may be possible to lower the finished floor levels even further if risks are fully appraised and the development design and operation is resilient and an increase in risk can be accepted. This appraisal should include consideration of defence failure, which is likely to be through breach or overtopping. The breach assessment should consider the likelihood of breach (the age, construction and maintenance of the defences). If breach is considered to be a risk then the impacts of breach should be discussed in the FRA. As a conservative estimate it may be assumed that the in-channel levels are projected across the floodplain, and as such a 'worst case' inundation depth will be calculated. The Eastern CFRAM study, when finalised, will also include analysis of the impact of defence breach for some watercourses. With this information a decision to accept or avoid the potential risks can be made. Acceptance should reflect emergency planning and business continuity 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 insurability of the development, the occupants and users, emergency plan and inclusion of flood resilience and recovery measures.

In such a way, further acceptance of flood risks may allow the finished floor level to be set below the 1 in 100 year level, but should not allow depths of flooding greater than 600mm, even in the event of defence breach. This step will require a detailed assessment of risks at the site specific scale, including residual risk, flood depths and inundation times.

In a defended site, compensatory storage is not required as the floodplain was removed through implementation of the flood defence scheme.

Further details regarding the location, condition and standard of protection offered by the various defences within the city is provided in Appendix 1.

#### **4.9 undefended Sites**

In an undefended site there is less scope for accepting 'below design level' finished floor levels than in a site which is defended. However, with consideration of the design life of the development, the proposed use, the vulnerability of items to be kept in the premises and long term adaptability, it may be acceptable to design finished floor levels to current, rather than climate change standards. An appropriate freeboard allowance would still be required.

It is also a requirement that loss of floodplain within Flood Zone A should be compensated for on a level for level basis within the site bounds for the 1 in 100-year event. Within currently developed areas the impact of loss of storage should be investigated for the 1 in 1000-year event, and further compensatory storage provided if the development is shown to have a significant impact on flood risk elsewhere.

#### **4.10 Incorporating Climate Change into Development Design**

As detailed throughout this SFRA, consideration and incorporation of the potential impacts of climate change into development layout and design is essential. The following summary provides an indication of allowances that should be considered when assessing the impacts of climate change. It should be noted that this information is intended as a guide only and there may be instances where it is appropriate for a greater or lesser allowance to be provided, particularly as climate change projections are further refined. The guidance does not necessarily relate directly to the vulnerability of the development used within 'The Planning System and Flood Risk Management Guidelines for Planning Authorities and Technical Appendices, 2009', but should be assessed on a case by case basis. For

watercourses that fall within the Eastern CFRAM study area, water levels for future scenarios are being developed. For other watercourses a conservative approach would be to take the 0.1% AEP event levels 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.

For most development, including residential, nursing homes, shops and offices, the medium-range future scenario (20% increase in flows and/or 0.5m increase in sea level and/or 20% increase in rainfall depth) is an appropriate consideration.

Where the risk associated with inundation of a development is low and the design life of the development is short (typically less than 30 years) the allowance provided for climate change may be less than the 20% flow / 0.5m sea level /20% rainfall depth. However, the reasoning and impacts of such an approach should be provided in the site specific FRA.

Conversely, there may be development which requires a higher level response to climate change. This could include major facilities which are extremely difficult to relocate, such as hospitals, Seveso sites or power stations, and those which represent a high-economic and long term investment within the scale of development across the city. In such situations it would be reasonable to expect the high-end future scenario (30% increase in flow and/or 1m in sea level and/or 30% increase in rainfall depth) to be designed to. In the case of coastal locations, and as climate projections are further developed, it may be prudent to demonstrate adaptability to even higher sea levels.

#### **4.11 Flood Mitigation Measures at Site Design**

For any development proposal in an area at moderate or high risk of flooding that is considered acceptable in principle, it must be demonstrated that appropriate mitigation measures can be put in place and that residual risks can be managed to acceptable levels.

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. Alternatively, designs for flood resilient construction may be adopted 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 Planning System and Flood Risk Management Guidelines for Planning Authorities and Technical Appendices, 2009*'.<sup>13</sup>

It should be emphasized that measures such as those highlighted below should only be considered once it has been deemed 'appropriate' to allow development in a given location, and following the FRA steps detailed above. '*The Planning System and Flood Risk Management Guidelines for Planning Authorities and Technical Appendices, 2009*', do not advocate an approach of engineering solutions in order to justify the development which would otherwise be inappropriate.

<sup>13</sup> *The Planning System and Flood Risk Management Guidelines for Planning Authorities and Technical Appendices, 2009*



#### **4.12 Site Layout and Design**

To address flood risk in the design of new development or regeneration of previously developed sites, a risk based approach should be adopted to locate more vulnerable land use to higher ground while water compatible development i.e. car parking, recreational space can be located in higher flood risk areas. Highly vulnerable land uses (i.e. residential housing) should 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.

#### **4.13 Ground Levels, Compensatory Storage and Building Use**

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. There are a number of criteria which must all be met before this is considered a valid approach:

- The FRA should establish the function provided by the floodplain. Where conveyance is a prime function then a hydraulic model will be required to show the impact of its alteration.
- Compensatory storage should be provided on a level for level basis to balance the total volume 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.
- 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, such as the urban cores, the impact of loss of storage should be investigated for the 1 in 1000-year event, and further compensatory storage provided if the development is shown to have a significant impact on flood risk elsewhere.

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 development. In other cases, it is possible that the lack of availability of suitable areas of compensatory storage will mean the target site cannot be developed.

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. Finished floor levels should typically be set as follows, although they may be moderated in line with the guidance for specific classes of development as discussed above:

- Fluvial risk - a minimum of the 1 in 100 year flood level, with an allowance for climate change impacts (20% increase in flows typically), and freeboard (300mm).
- Tidal risk - The FRA should assess the 1 in 200 year tidal flood level, with a suitable allowance for climate change (typically 0.5m) and a suitable freeboard (typically 300mm but could be higher where wave action or combined fluvial/tidal events occur).

Alternatively, 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. Safe access and egress is a critical consideration in allocating ground floor uses.

Depending on the scale of residual risk, resilient and resistance measures may be an appropriate response but this will mostly apply to less vulnerable development.

#### **4.14 Raised Defences and Site Landscaping**

Construction of raised defences (i.e. flood walls and embankments) traditionally has been the standard response to flood risk, and has been widely used as part of a strategically led flood relief scheme. However, this is not a preferred option on an ad-hoc basis as a residual risk remains. Instead, master planning larger scale developments to include flood mitigation with the landscape of the new development should be encouraged.

#### **4.15 Ground Floor and Basement Access Protection**

In relation to basements and ground level access protection the following Flood Resilience and Adaptation Measures are recommended:

- Doorway and access threshold levels are an important factor in determining the susceptibility of domestic and commercial properties and below ground infrastructure to pluvial and other types of flooding. This can be especially important in flat areas where, although the depth of ponding may be relatively shallow, it can be extensive and potentially affect many properties if doorway and access thresholds are close to street level or even below street level. For low doorway accesses to domestic properties, raising of the threshold step may be practical in some instances but not always – in such circumstances temporary door-guards should be considered but these will require advance warning for installation.
- Doorway accesses to public, commercial and residential properties are often at ground level to facilitate access. Shallow ramping may be sufficient to keep pluvial floodwater out of the building.
- Vehicular accesses may also ramp down to underground car parks or basement loading areas for example. Again raised ramping or floodgates across the entrance may be sufficient to mitigate the risk.
- Drainage augmentation across entrances may assist but in itself may not be sufficient to deal with surface flows arising from high intensity rainfall.
- Particular care should be taken where there are street level accesses to below-ground infrastructure such as underground or low-level transportation systems. In such circumstances rapid inundation could pose a threat to life as well as potentially causing major disruption and damage.
- Access protection should be considered as a potential 'early win' particularly for one-off situations where shallow ramping is feasible and relatively inexpensive to install. If the number of properties with low thresholds is extensive then provision of financial



incentives to support property resistance measures can be considered, however, no centrally funded scheme is yet available for this.

- Alarm Systems should be strongly considered for semi-basements and should be mandatory for one storey or multiple storey basements. Training of residents and building personnel in alarms and escape routes and escorting all visitors out of sub-basement zones should be a requirement.

#### **4.16 'Green Corridor'**

It is recommended that, where possible, and particularly where there is greenfield land adjacent to the river, a 'green corridor', at least 10m wide, 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 System and Flood Risk Management Guidelines for Planning Authorities and Technical Appendices, 2009*'.

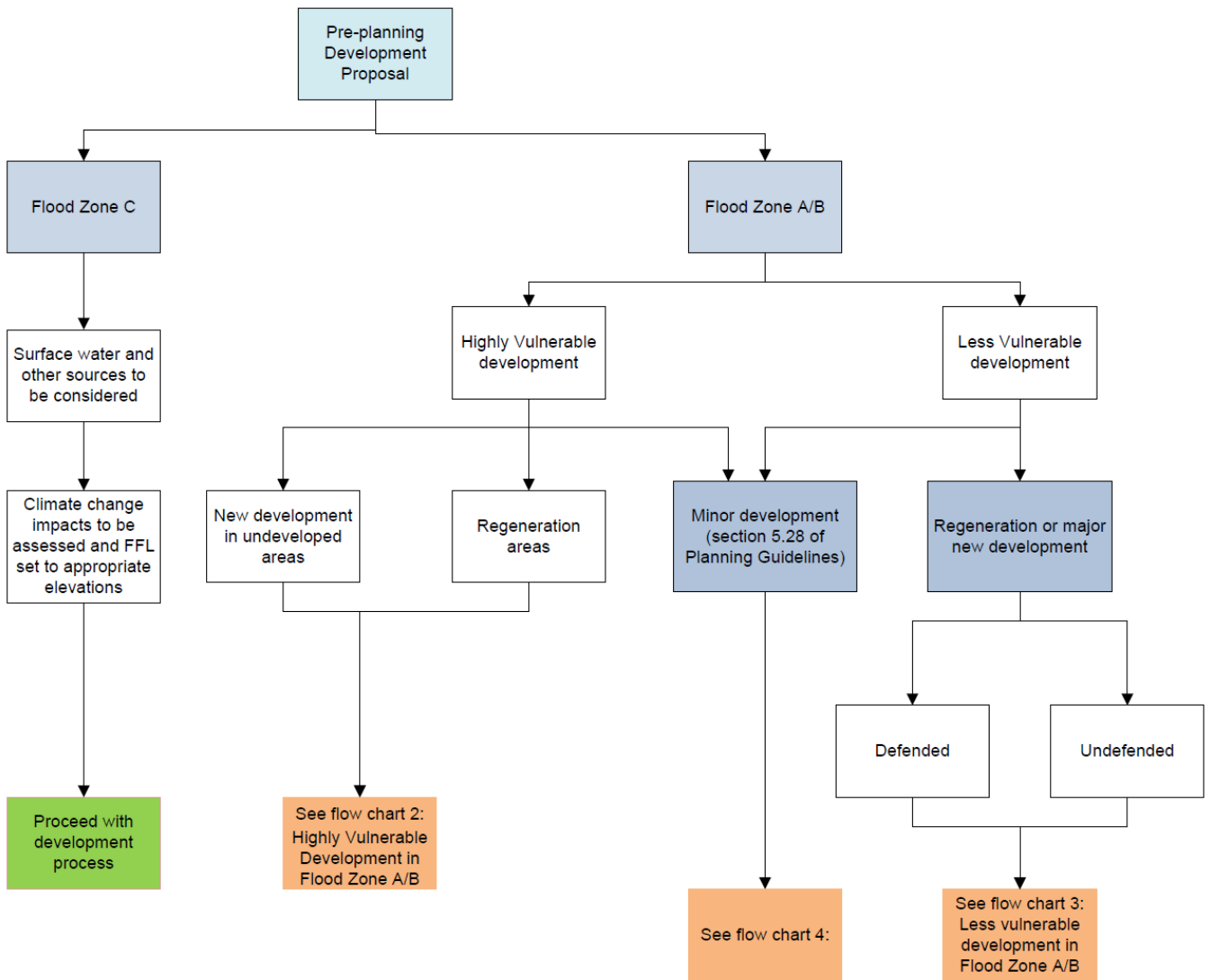
The width of this corridor should be determined by the available land and topographical constraints, such as raised land and flood defences, but would ideally span the full width of the floodplain (i.e. all of Flood Zone A).



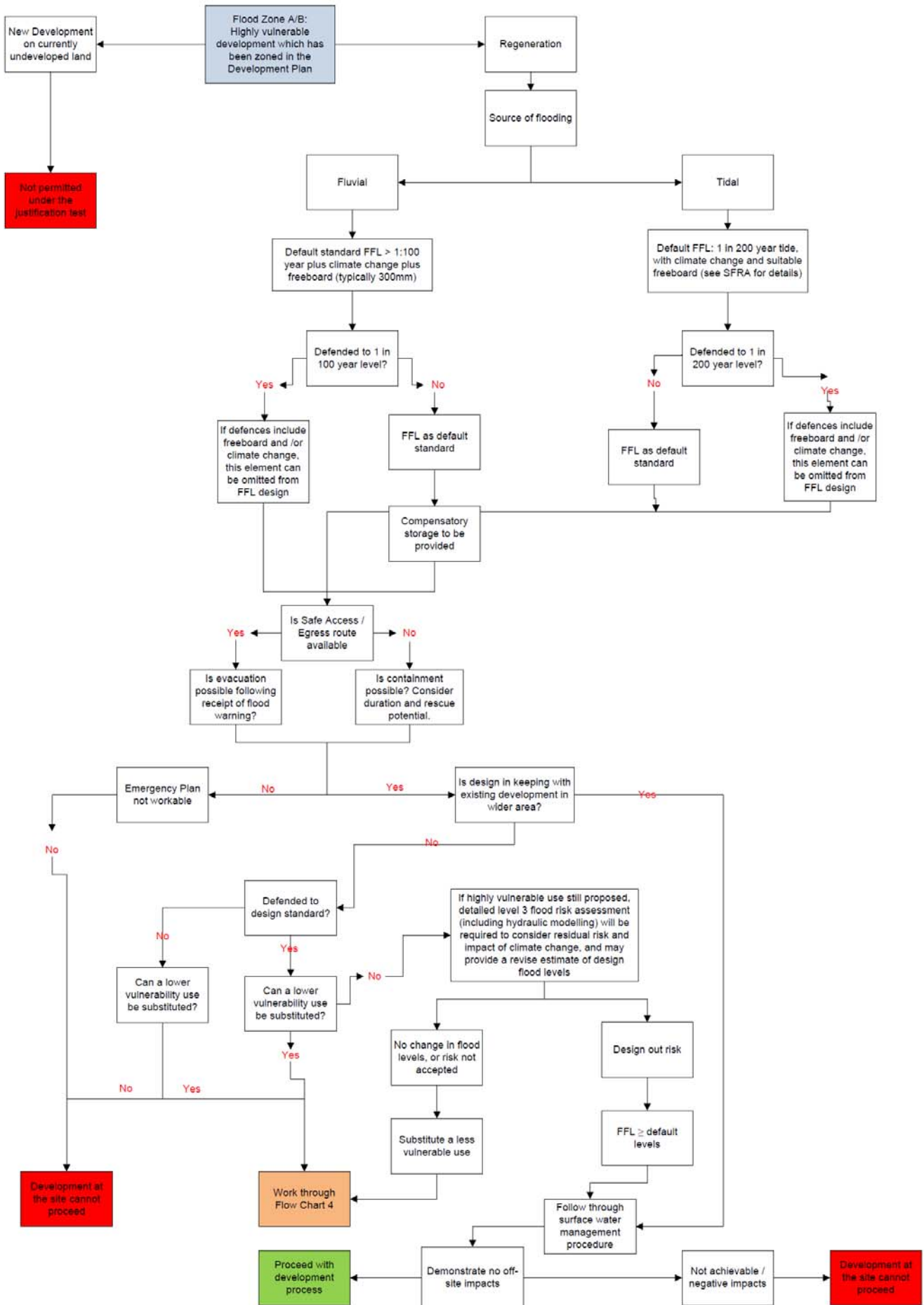
## Appendix II: Flow Charts

These flow charts were prepared by the Council as part of the SFRA for the Dublin City Development Plan 2016-2022 to provide a guide through the flood risk assessment process and to indicate which approaches to managing flood risk are expected in different circumstances. These flow charts are reproduced here and should be referred to as relevant.

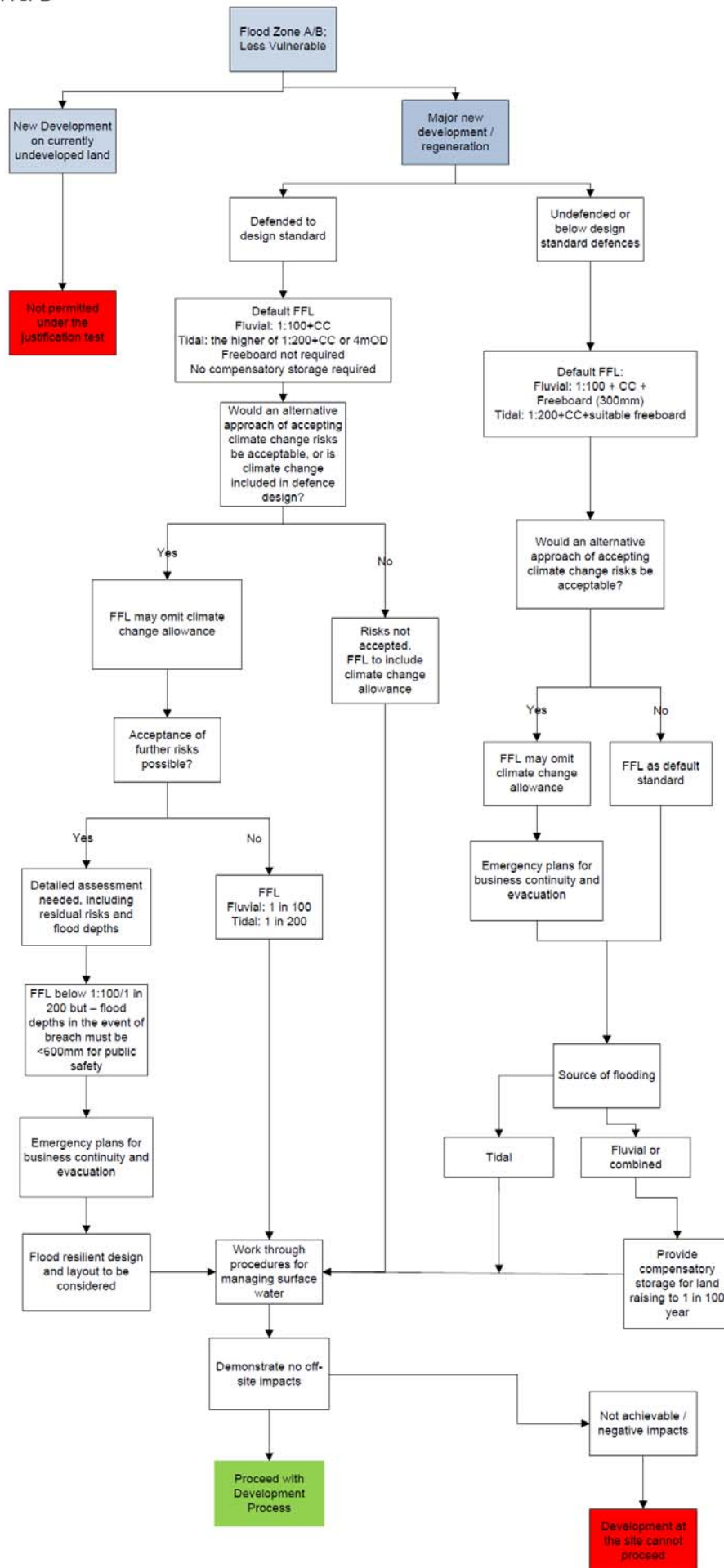
Flow Chart 1: Development Management Process



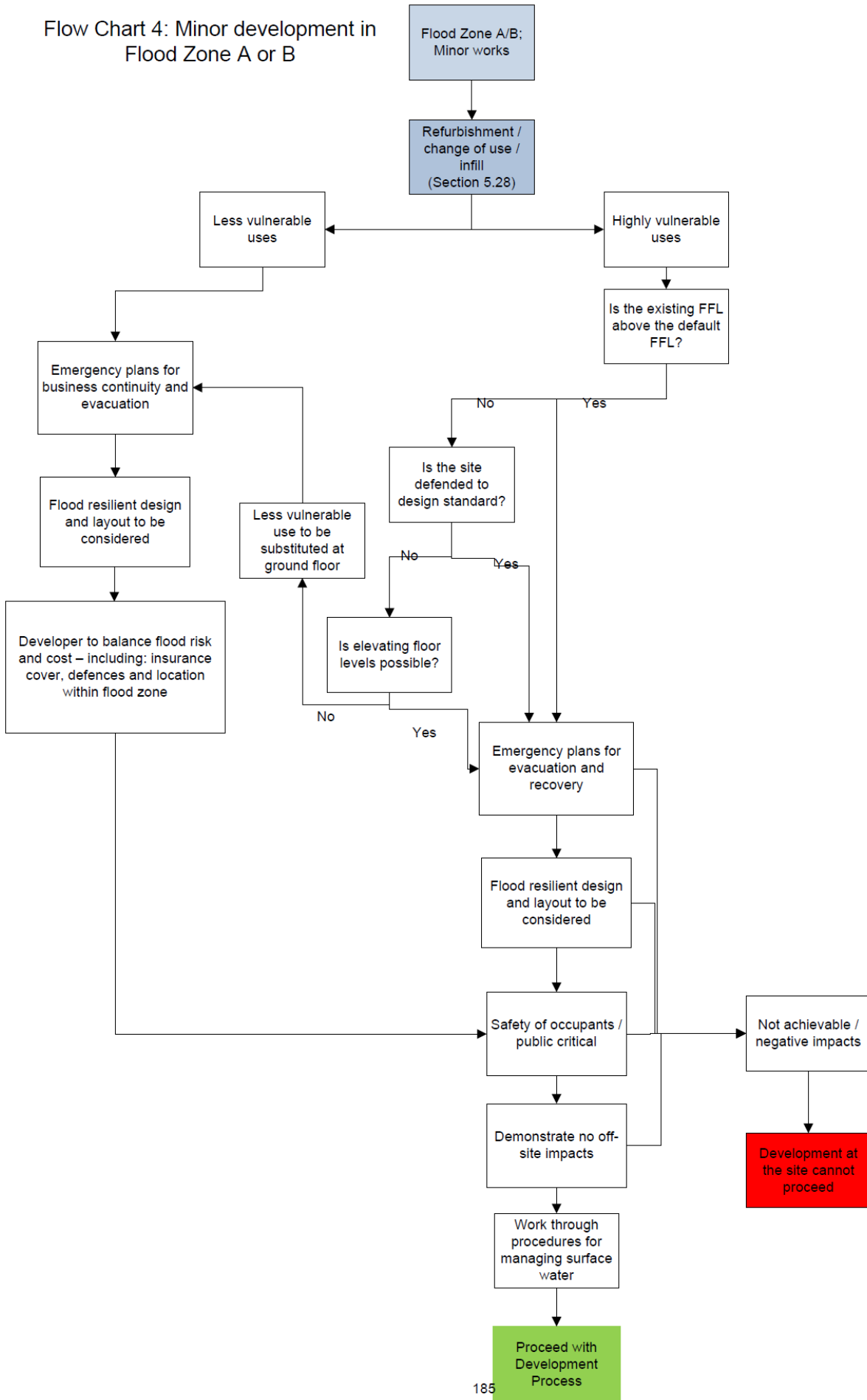
Flow Chart 2: Highly Vulnerable Development in Flood Zone A/B



Flow Chart 3: Less Vulnerable Development in Flood Zone A or B



Flow Chart 4: Minor development in Flood Zone A or B





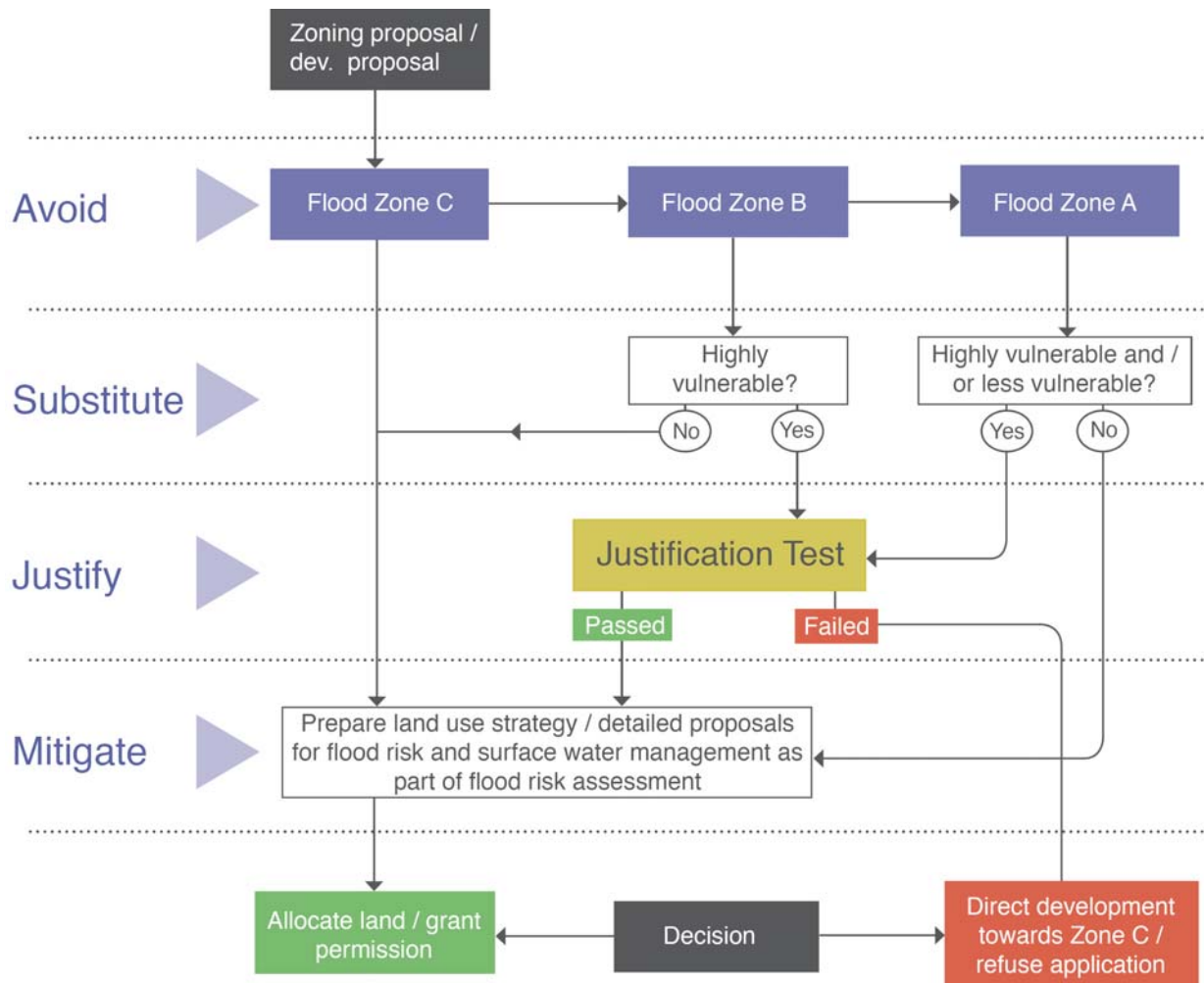
## **Appendix III: Summary of Related Provisions contained in the DEHLG Flood Guidelines for Land Uses in Flood Zones A and B**

The provisions set out in the DEHLG's 2009 Flood Guidelines (including at Chapter 3 Principles and Key Mechanisms and Chapter 5 Flooding and Development Management) and Departmental Circular PL2/2014 and should be adhered to.

### **- The Sequential Approach, including the Justification test -**

The key principles of the Guidelines' risk-based sequential approach (see Figure 11) are:

- Avoid development in areas at risk of flooding. If this is not possible, consider substituting a land use that is less vulnerable to flooding. Only when both avoidance and substitution cannot take place should consideration be given to mitigation and management of risks.
- Inappropriate types of development that would create unacceptable risks from flooding should not be planned for or permitted.
- Exceptions to the restriction of development due to potential flood risks are provided for through the use of a Justification Test, where the planning need and the sustainable management of flood risk to an acceptable level must be demonstrated.



**Figure 11 Sequential Approach Process<sup>11</sup>**

In summary, the **planning implications** for each of the flood zones are:

**Zone A** - High probability of flooding. Most types of development would be considered inappropriate in this zone. Development in this zone should be avoided and/or only considered in exceptional circumstances, such as in city and town centres, or in the case of essential infrastructure that cannot be located elsewhere, and where the Justification Test has been applied. Only water-compatible development, such as docks and marinas, dockside activities that require a waterside location, amenity open space, outdoor sports and recreation, would be considered appropriate in this zone.

**Zone B** - Moderate probability of flooding. Highly vulnerable development, such as hospitals, residential care homes, Garda, fire and ambulance stations, dwelling houses and primary strategic transport and utilities infrastructure, would generally be considered inappropriate in this zone, unless the requirements of the Justification Test can be met. Less vulnerable development, such as retail, commercial and industrial uses, sites used for short-let for caravans and camping and secondary strategic transport and utilities infrastructure, and water-compatible development might be considered appropriate in this zone. In general however, less vulnerable development should only be considered in this zone if adequate lands or sites are not available in Zone C and subject to a flood risk assessment to the appropriate level of detail to demonstrate that flood risk to and from the development can or will adequately be managed.

**Zone C** - Low probability of flooding. Development in this zone is appropriate from a flood risk perspective (subject to assessment of flood hazard from sources other than rivers and the coast) but

<sup>11</sup> Flood Zone C covers all areas outside of Zones A and B

would need to meet the normal range of other proper planning and sustainable development considerations.

Table 3 overleaf classifies the vulnerability of different types of development while Table 4 identifies the appropriateness of development belonging to each vulnerability class within each of the flood zones as well as identifying what instances in which the Justification Test should be undertaken. Inappropriate development that does not meet the criteria of the Justification Test should not be considered at the plan-making stage or approved within the development management process.

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

**Table 3 Classification of vulnerability of different types of development**

|  | 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  |

**Table 4 Vulnerability Classes and Flood Zones**



The **Justification Test** which is referred to as part of the Sequential Approach is 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 outlined above. This Justification Test is shown below.

Where, as part of the preparation and adoption or variation and amendment of a development/local area plan<sup>1</sup>, a planning authority is considering the future development of areas in an urban settlement that are at moderate or high risk of flooding, for uses or development vulnerable to flooding that would generally be inappropriate as set out in Table 3.2, all of the following criteria must be satisfied:

- 1 The urban settlement is targeted for growth under the National Spatial Strategy, regional planning guidelines, statutory plans as defined above or under the Planning Guidelines or Planning Directives provisions of the Planning and Development Act, 2000, as amended.
- 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:
  - (i) Is essential to facilitate regeneration and/or expansion of the centre of the urban settlement<sup>2</sup>;
  - (ii) Comprises significant previously developed and/or under-utilised lands;
  - (iii) Is within or adjoining the core<sup>3</sup> of an established or designated urban settlement;
  - (iv) Will be essential in achieving compact and sustainable urban growth; and
  - (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<sup>4</sup>
- 3 A flood risk assessment to an appropriate level of detail has been carried out as part of the Strategic Environmental Assessment as part of the development plan preparation process, which demonstrates that flood risk to the development can be adequately managed and the use or development of the lands will not cause unacceptable adverse impacts elsewhere.  
 N.B. The acceptability or otherwise of levels of any residual risk should be made with consideration for the proposed development and the local context and should be described in the relevant flood risk assessment.

**Figure 12 Justification Test** <sup>12</sup>

<sup>12</sup> Footnotes: <sup>1</sup> Including Strategic Development Zones and Section 25 Schemes in the area of the Dublin Docklands Development Authority <sup>2</sup>In the case of Gateway planning authorities, where a number of strategic growth centres have been identified within the overall area of the authority, the Justification Test may be applied for vulnerable development within each centre. <sup>3</sup> See definition of the core of an urban settlement in Glossary of Terms. <sup>4</sup> This criterion may be set aside where section 4.27b applies.