Sarsfield Park, Lucan
Flood Risk Assessment

Technical Report

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South Dublin County Council

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This report describes work commissioned by South Dublin County Council. Hannah Chisnall and Ross Bryant of JBA Consulting carried out this work.

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Purpose

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Abbreviations

AEP	Annual Exceedance Probability
CFRAM	Catchment Flood Risk Assessment and Management
DoEHLG	Department of the Environment, Heritage and Local Government
FB	Freeboard
FFL	Finish Floor Levels
FRA	Flood Risk Assessment
GSI	Geological Survey of Ireland
LHB	Left Hand Bank
OPW	Office of Public Works
RHB	Right Hand Bank
RR	Rainfall-Runoff
SAAR	Standard Average Annual Rainfall (mm)
SDCC	South Dublin County Council
SFRA	Strategic Flood Risk Assessment
URBEXT	FEH index of fractional urban extent
WL	Water Level

Executive Summary

JBA Consulting conducted a detailed Flood Risk Assessment for a proposed residential development in Sarsfield Estate, Lucan, Co. Dublin, situated on a brownfield site. The assessment identified the Griffeen River and River Liffey as key flood risk sources.

Utilising data from the OPW and the South Dublin County Development Plan 2022-2028 SFRA flood mapping, the site was categorized as Flood Zone C and is at low probability of flooding. This differs to the approach under the SDCC SFRA which adopts the High End Future Scenario (HEFS) climate change mapping for Flood Zone determination. Whilst this more conservative approach was deemed appropriate by SDCC when applying to the wider County Development Plan its specific application to this site has been amended under this Site Specific FRA which takes into account the local topography, potential mechanism of flooding and the severity of risk.

The site is considered appropriate for development and mitigation measures include raising the finished floor level by 300mm to mitigate stormwater system failure risks. Access during flood events will remain unimpeded, and stormwater system design will need to be designed to comply with SDCC policy.

In summary, the site presents a low flood risk under present-day conditions, with shallow flooding from the 0.1% AEP HEFS climate change event manageable through FFL elevation. The Flood Risk Assessment adheres to 'The Planning System and Flood Risk Management' guidelines, aligning with the core principles therein.

1 Introduction

Under the Planning System and Flood Risk Management Guidelines for Planning Authorities (DoEHLG & OPW, 2009) the proposed development must undergo a Flood Risk Assessment to ensure sustainability and effective management of flood risk.

1.1 Terms of Reference and Scope

JBA Consulting was appointed by South Dublin County Council (SDCC) to prepare a Flood Risk Assessment (FRA) for a proposed infill residential development in Sarsfield Park, Lucan.

1.2 Flood Risk Assessment; Aims and Objectives

This study is being completed to inform the future development of the site as it relates to flood risk. It aims to identify, quantify, and communicate to Planning Authority officials and other stakeholders the risk of flooding to land, property and people and the measures that would be recommended to manage the risk.

The objectives of this FRA are to:

- Identify potential sources of flood risk.
- Confirm the level of flood risk and identify key hydraulic features.
- Assess the impact that the proposed development has on flood risk.
- Develop appropriate flood risk mitigation and management measures which will allow for the long-term development of the site.

Recommendations for development have been provided in the context of the OPW / DECLG planning guidance, "The Planning System and Flood Risk Management". A review of the likely effects of climate change, and the long-term impacts this may have on any development has also been undertaken.

For general information on flooding, the definition of flood risk, flood zones and other terms see 'Understanding Flood Risk' in Appendix A.

1.3 Development Proposal

The proposed development comprises:

- Provision of 5 dwellings, in the following breakdown:
    - 2 No. 2 person 1 bed ground floor apartments,
    - 2 No. 2 person 1 bed first floor apartments
    - 1 No. 2 person 1 bed ground floor apartments;

The proposed dwellings are designed as infill housing and as a continuation of the existing terraced housing to the South-East. Refer to Figure 1-1 for the site layout plan.

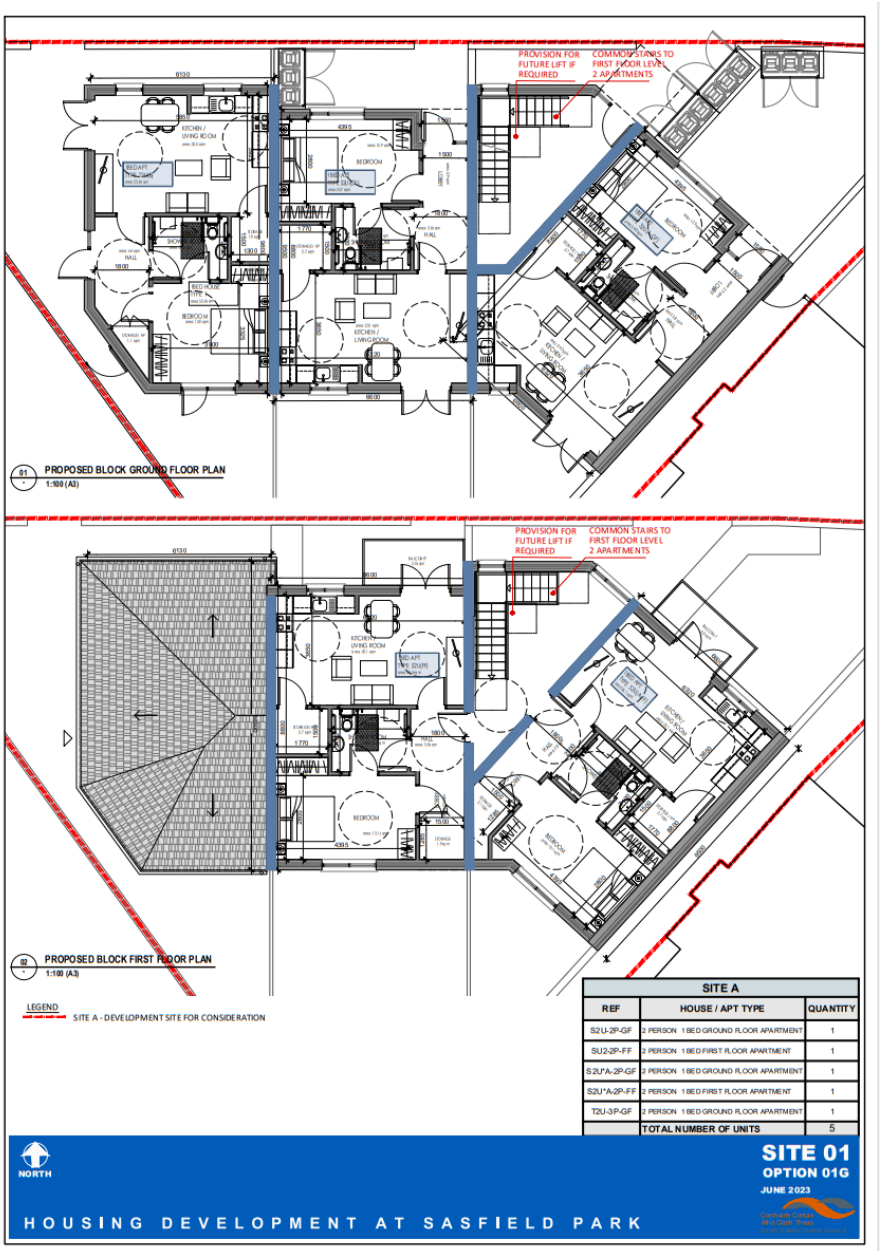


Figure 1-1: Proposed development

2 Site Background

2.1 Location and Watercourses

Refer to Figure 2-1 for the site location. The site, 0.047ha in size is a brownfield site bounded by residential housing on all sides. Access to the site will be via an existing road within the estate.

The main watercourses in the area are the Griffeen River and the River Liffey. The Griffeen River is located 290m west of the proposed site. It rises to the south and flows in a northernly directly near the site joining the River Liffey 400m downstream of the stie location (refer to Figure 2-1).

The River Liffey is located 225m north of the site location. Rising in the Dublin mountains it flows in an easterly direction near the site eventually discharging into the Irish Sea at Dublin Harbour. There are multiple control structures along the watercourse located upstream of the site location including outfall structures at Pollaphuca, Golden Falls and Leixlip reservoirs. These control structures and the existing flood forecasting system alter the natural flow pattern of the river and have resulted in reduced flood risk downstream as a result.

Figure 2-1: Site Location and Watercourses

2.2 Site Topography

Figure 2-2 shows the topography for the site and the surrounding area. The site and the land surrounding it slopes gently in an easterly direction. Elevations at the site range from 24.15mOD to 24.00mOD. The elevation at the banks of the Liffey and Griffeen Rivers are approximately 20.50mOD and 23.30mOD respectively, a minimum of 0.85m below the ground level at the site location, but the intervening ground reaches higher levels and cuts off the site topographically.

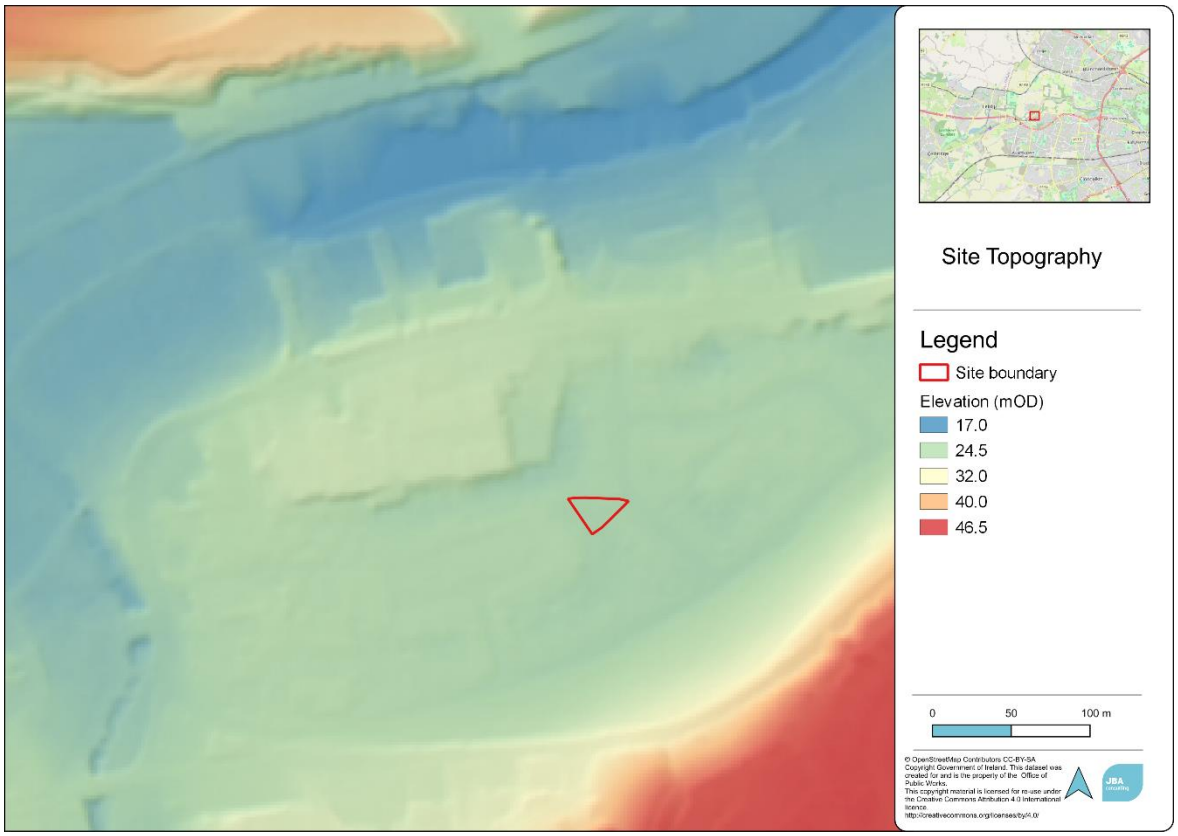


Figure 2-2: Site Topography

2.3 Site Geology

The Geological Survey of Ireland (GSI) groundwater and geological maps of the site and surrounding area were reviewed. The underlying bedrock of the site is the Lucan Formation which is composed of dark limestone and shale. Figure 2-3 shows the Quaternary sediments for the area which consist of alluvium at the site location. The presence of gravelly alluvium deposits is connected to historic fluvial deposition from the River Liffey during the last ice age and prior to the various dam controls now in place. The alluvial deposition recorded in the quaternary sediments is not reflective of the current flow regime of the river system. There are no karst features located at or near the site.

A review of the GSI groundwater and surface water mapping was also carried out. The mapping showed no modelled or historic ground or surface water flooding at or near the site.

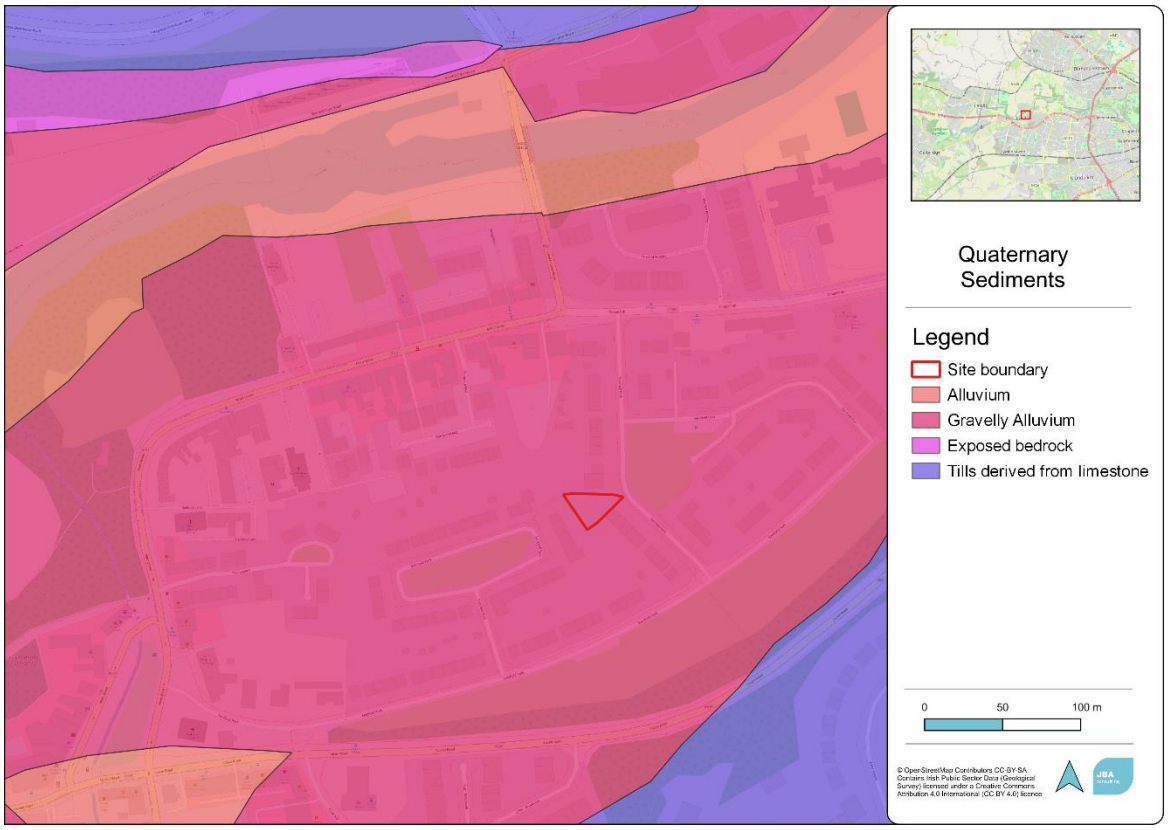


Figure 2-3: Quaternary Sediments

3 Flood Risk Identification

An assessment of the potential for and scale of flood risk at the site is conducted using historical and predictive information. This identifies any sources of potential flood risk to the site and reviews historic flood information. The findings from the flood risk identification stage of the assessment are provided in the following sections.

3.1 Flood History

Several sources of flood information were reviewed to establish any recorded flood history at, or near the site. This includes the OPW's website, www.floodinfo.ie and general internet searches.

3.1.1 Floodmaps.ie

The OPW host a National Flood hazard mapping website, www.floodinfo.ie, which highlights areas at risk of flooding through the collection of recorded data and observed flood events. The following past flood events in the surrounding area are shown in Figure 3-1.

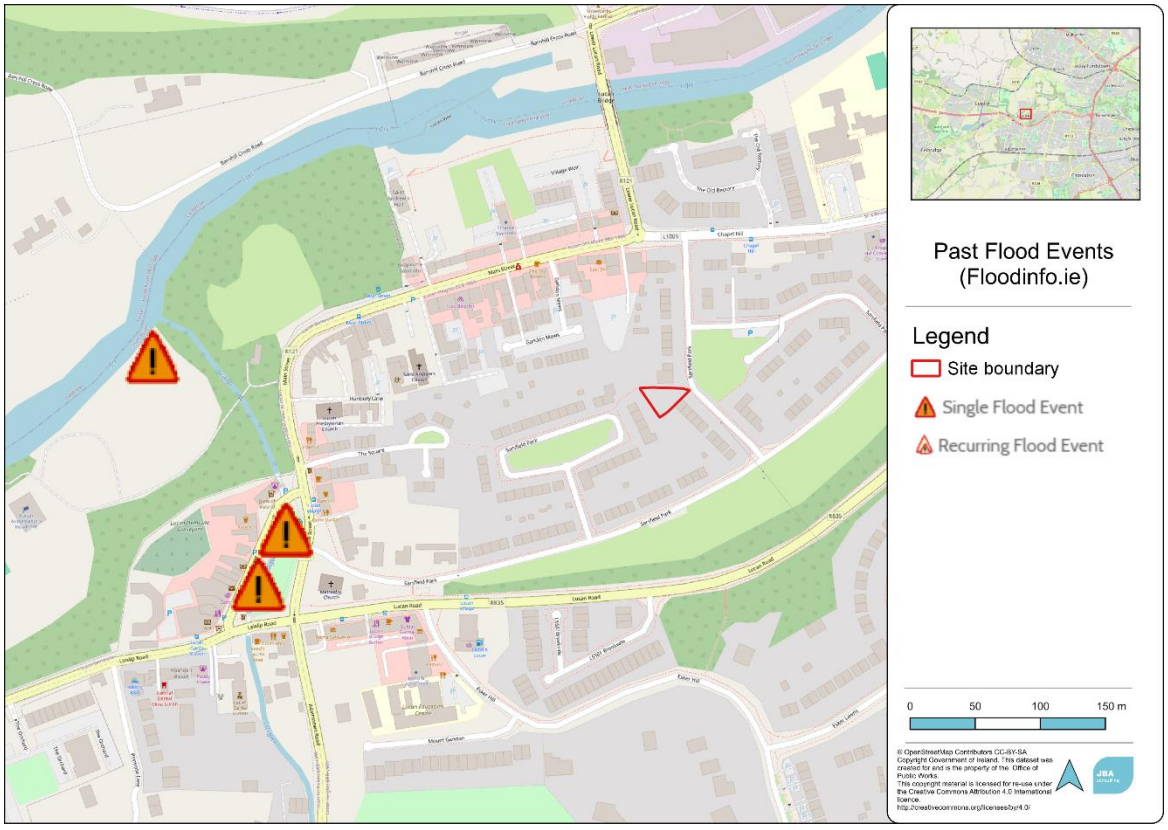


Figure 3-1: Past Flood Events (Floodinfo.ie)

Review of the historic flooding record shows three flood events in proximity to the site. Flood locations recorded in the area are listed below:

- Flood ID-2918 - Flooding from the River Liffey June 1993 following heavy rainfall.
- Flood ID-1240 - Flooding from the Griffeen River June 1993 following heavy rainfall and increased backwater from the Liffey.
- Flood ID-11487 - Flooding from the Griffeen River October 2011. Flooding recorded across the greater Dublin area in responses to intense rainfall.

3.1.2 Internet Searches

An internet search was carried to find any additional information on flooding at the site and surrounding area. No additional information was found.

3.2 Predictive Flooding

The area has been a subject of the following predicative flood mapping or modelling studies and other related studies and plans:

- Eastern Catchment Flood Risk Assessment and Management study (ECFRAM).
- Strategic Flood Risk Assessment of the South Dublin County Development Plan 2022-2028.

The level of detail presented by each method varies according to the quality of the information used and the approaches involved.

3.2.1 Eastern Catchment Flood Risk Assessment and Management study (ECFRAM)

The primary source of data with which to identify flood risk to the site is the Eastern CFRAM Study. The Eastern CFRAM consists of detailed hydraulic modelling of the Griffeen and River Liffey. Figure 3-2 shows the modelled fluvial flood extents for the area. Review of the mapping shows the site to be in Flood Zone C and at low risk of fluvial flooding.

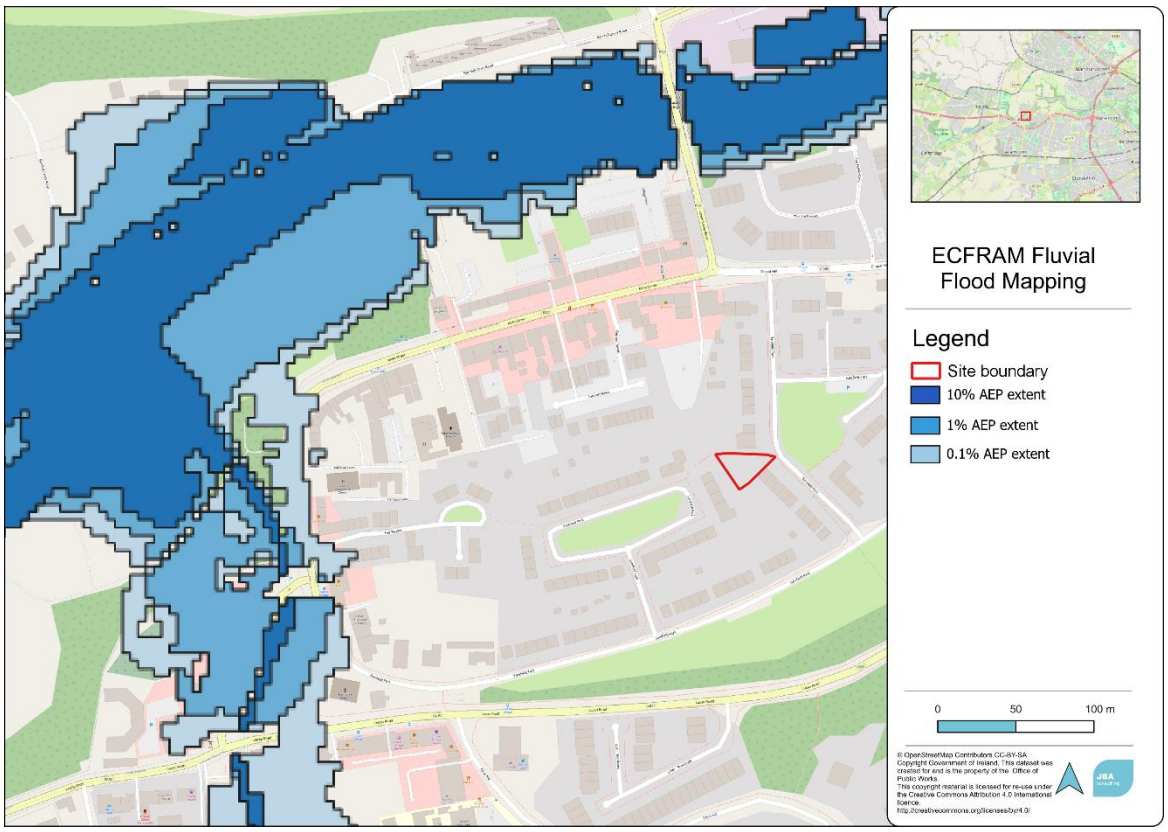


Figure 3-2: ECFRAM Fluvial Flood Mapping

3.2.2 Strategic Flood Risk Assessment of the South County Dublin Development Plan 2022-2028

The South County Dublin Development Plan 2022-2028 is the overarching guidance document for development in South County Dublin determining land use zonings and development criteria. As part of the development plan a Strategic Flood Risk Assessment (SFRA) was undertaken to inform the zoning of settlements. Figure 3-3 shows the SFRA flood mapping and land use zoning. The site is currently zoned RES with the objective to protect/improve residential amenity.

Review of the flood mapping within the SFRA shows the site to be within Flood Zone B and at risk of flooding in the 0.1% AEP event. The SFRA flood extents are based on the ECFRAM flood outputs however instead of the present-day flood extents the High End Future Scenario (HEFS) extents have been used which apply a 30% increase to peak flows to represent the increases due to climate change. Review of the topography and the flow paths for the HEFS shows the water levels in the 0.1% AEP HEFS event overtop a threshold causing flood waters to travel east towards the site from the Griffeen River (refer to Figure 3-4). This flow path only occurs during the 0.1% AEP HEFS event, and not under any of the Mid Range Future Scenario (MRFS) extents (as shown in Figure 3-5). As a result, the site is shown in Flood Zone B in the SFRA, but this assessment of risk is extreme.

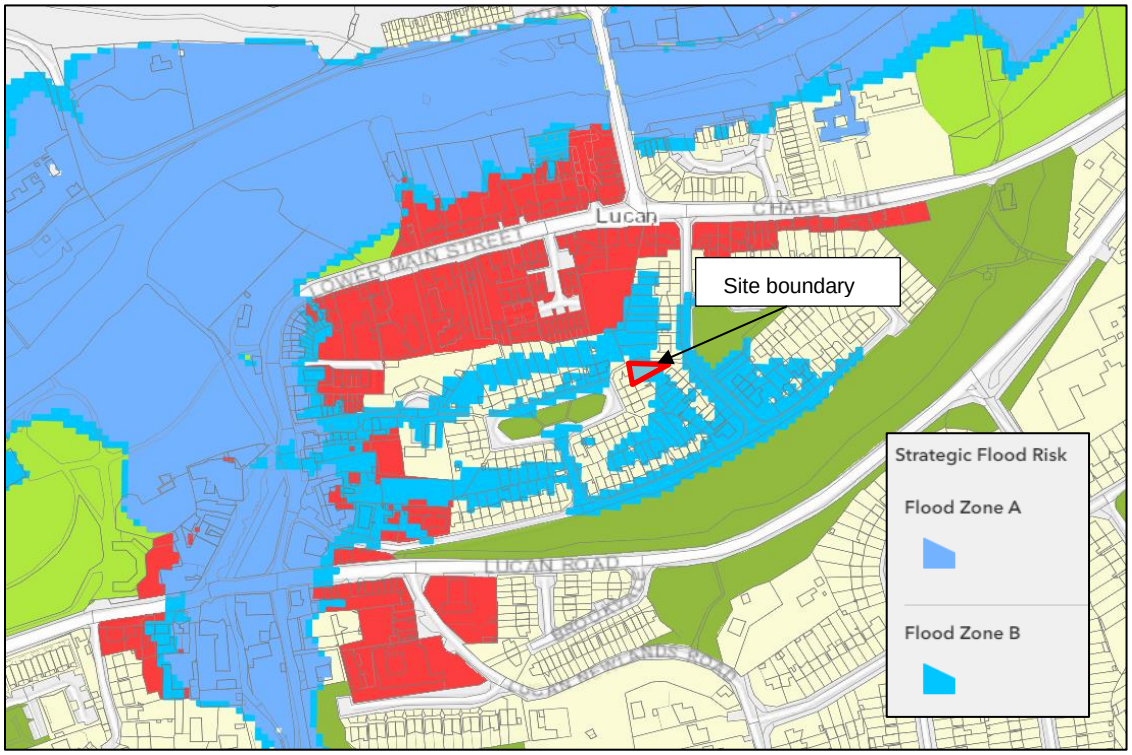


Figure 3-3: Extract of the SFRA flood map from the South Dublin County Development Plan 2022 - 2028

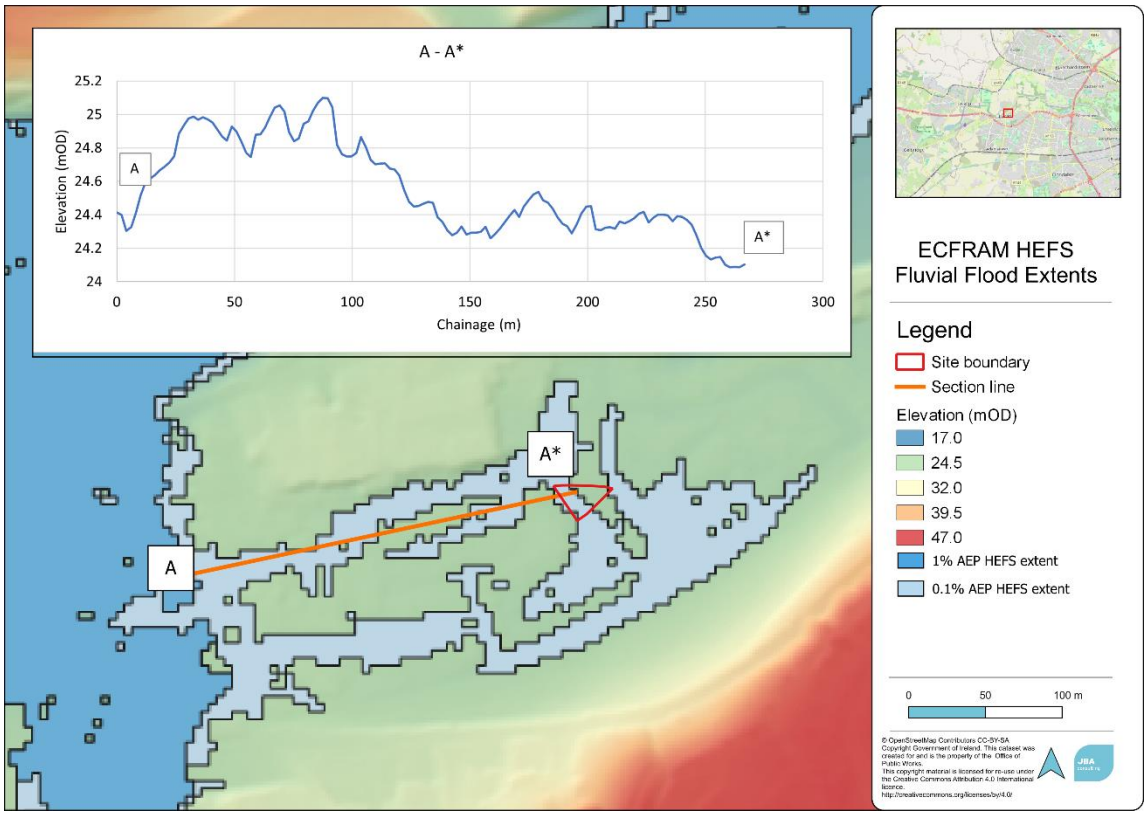


Figure 3-4: ECFRAM HEFS Fluvial Flood Extents

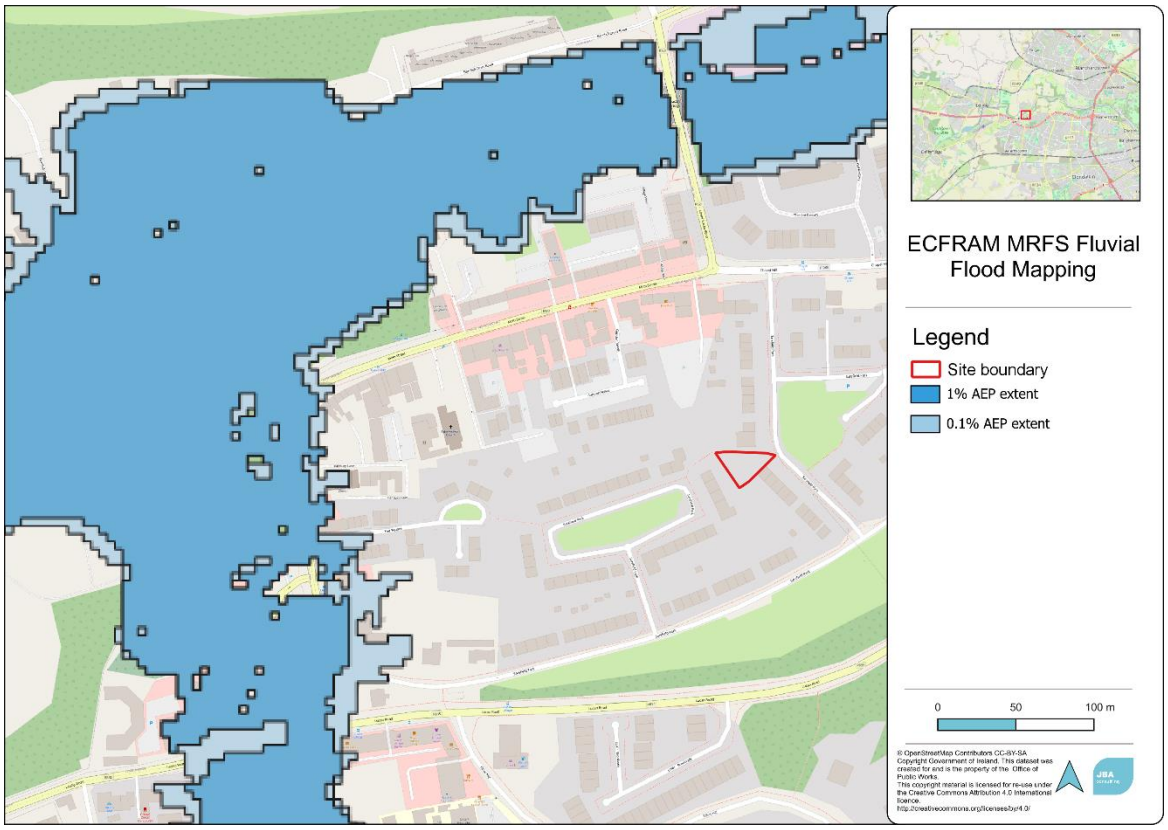


Figure 3-5: ECFRAM MRFS Fluvial Flood Mapping

3.3 Flood Sources

The initial stage of a Flood Risk Assessment requires the identification and consideration of probable sources of flooding. Following the initial phase of this Flood Risk Assessment, it is possible to summarise the level of potential risk posed by each source of flooding. The flood sources are described below.

3.3.1 Fluvial

The main watercourses of interest are the Griffeen River and the River Liffey. From the ECFRAM study, the site is not at risk of flooding from these watercourses in present day. However, it is noted in the SFRA, which uses the ECFRAM HEFS flood event the site is shown as being in Flood Zone B. It is noted that the site is not impacted under the MRFS climate change scenario. The difference due to climate change and the definition of Flood Zones is discussed further in Section 4.

3.3.2 Coastal

The site is located inland, and coastal flooding has been screened out at this stage.

3.3.3 Pluvial/ Surface Water

Pluvial flooding is the result of rainfall-generated overland flows that arise before run-off can enter a watercourse or sewer. It is particularly sensitive to increases in hard-standing ground/urbanised areas and is usually associated with rainfall events of high intensity.

Review of the site topography confirms that there are no depressions onsite that would be at risk of pluvial flooding. A review of the proposed stormwater system for the site is discussed in Section 4.3.

3.3.4 Groundwater

Review of the GSI Groundwater Flooding Probability Maps confirms that there is no predicted risk of groundwater flooding within the site boundary.

Groundwater is not considered a likely source of flood risk to the site and is screened out at this stage.

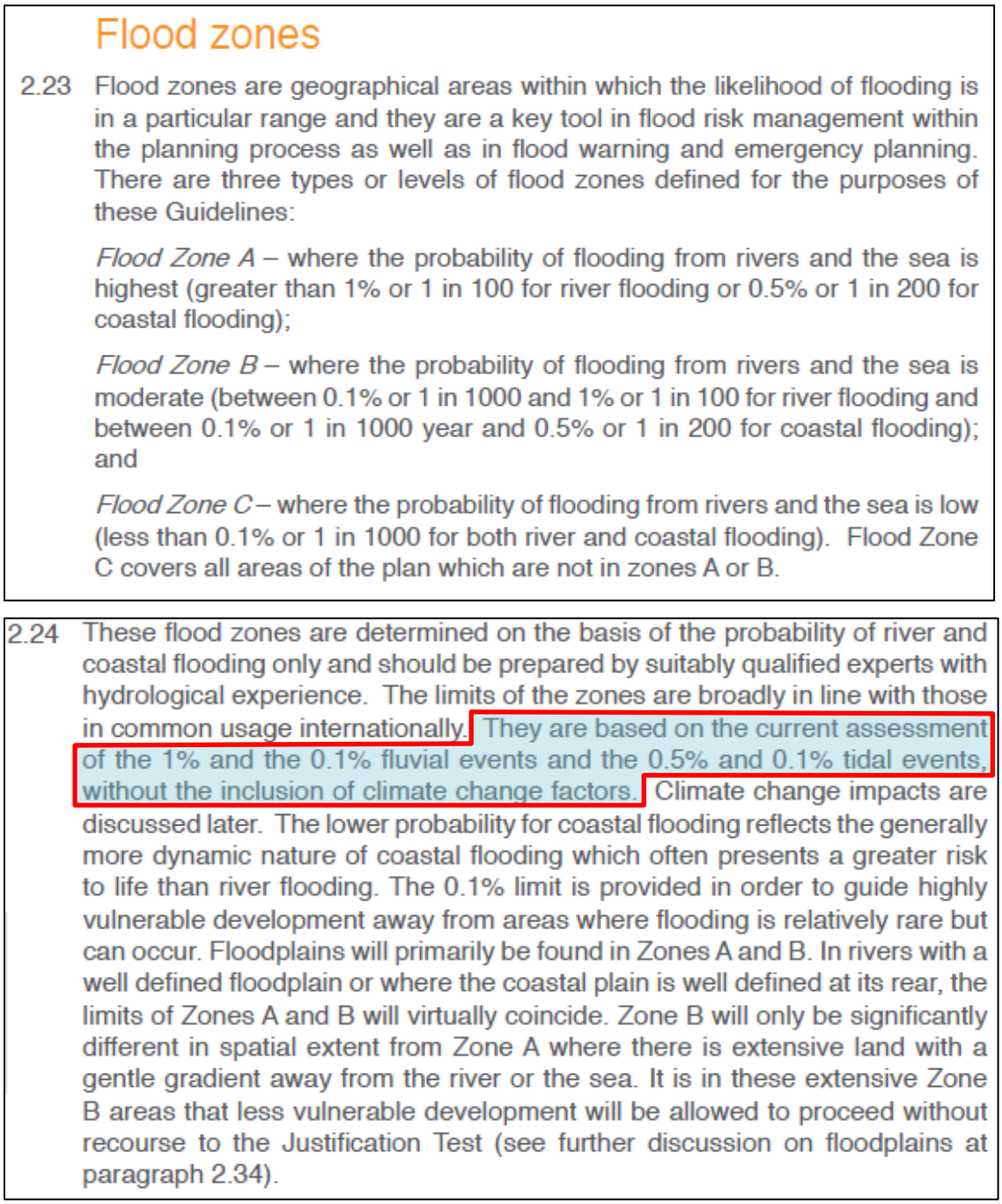
4 Flood Risk Assessment

4.1 Flood Risk

From Section 3, the site is located in Flood Zone C for the present-day scenario but is located in Flood Zone B in the HEFS as shown in the Development Plan SFRA.

4.1.1 Definition of a Flood Zone

The definition of Flood Zones is found in the 'The Planning System and Flood Risk Management Guidelines for Planning Authorities' (2009), in Section 2 shown in Figure 4-1. In this definition the return period and specific reference to the exclusion of climate change impacts (for Flood Zones) is made. Climate Change is a separate consideration to the Flood Zones themselves.



Flood zones

2.23 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 these 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 areas of the plan which are not in zones A or B.

2.24 These flood zones are determined on the basis of the probability of river and coastal flooding only and should be prepared by suitably qualified experts with hydrological experience. The limits of the zones are broadly in line with those in common usage internationally. They are based on the current assessment of the 1% and the 0.1% fluvial events and the 0.5% and 0.1% tidal events, without the inclusion of climate change factors. Climate change impacts are discussed later. The lower probability for coastal flooding reflects the generally more dynamic nature of coastal flooding which often presents a greater risk to life than river flooding. The 0.1% limit is provided in order to guide highly vulnerable development away from areas where flooding is relatively rare but can occur. Floodplains will primarily be found in Zones A and B. 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. It is in these extensive Zone B areas that less vulnerable development will be allowed to proceed without recourse to the Justification Test (see further discussion on floodplains at paragraph 2.34).

Figure 4-1: Extract from 'The Planning System and Flood Risk Management Guidelines for Planning Authorities' (2009) Section 2.23 & 2.24 on Flood Zones

Within the South Dublin SFRA it is stated that:

"There is an increasing likelihood that Irelands climate will be similar to that depicted in the High-End Future climate change scenario by the year 2100. Therefore, it is prudent to consider the HEFS parameters when planning for vulnerable infrastructure and developments."

This reasoning has been used in the SFRA to sanction use of the HEFS extents for the Flood Zones, it also overlooks the MRFS extents. This is not in line with the Flood Risk Management Guidelines definition of the Flood Zones which considers climate change separately to the Flood Zones themselves. It was a strategic approach across the wider development plan area, but in this specific case the application is not considered appropriate, for a number of reasons.

While a consideration of climate change is important for all developments the use of the HEFS extents in this case represents a very conservative approach. The reason in this case is that there is a key threshold point related to the local topography (shown in Figure 3-4), that any flood flow has to overtop before it can then find a topographic pathway to the proposed site. This threshold is not overtopped in either the current scenario or MRFS climate change scenario at the 1% or 0.1% AEP events. The extension of the Flood Zone definition to the HEFS event in this specific case is highly conservative and beyond what JBA would consider to be a 'moderate' risk.

Furthermore, the HEFS is linked to future projections (SFRA states +100 years) which may equate to a time frame greater than the average lifespan of residential developments (70 - 100 years)[1]. There is also no guarantee that there won't be other changes in the area that influence the flood mapping within that time frame.

Given this reasoning the Flood Zones for this site specific FRA have been defined by the present day mapped extents which place the site in Flood Zone C and at low risk of flooding. The impacts of climate change have been considered in this assessment to ensure the site is appropriately designed.

4.2 Finished Floor Levels

The proposed development is located in Flood Zone C and at low risk of fluvial flooding. The proposed Finished Floor Levels (FFLs) for the development have not currently been provided but to mitigate against the residual risk of stormwater system failure and any potential climate change impacts a 300mm freeboard should be provided between the FFL and the hardstanding area surrounding the property.

4.3 Surface Water

With reference to pluvial flooding, there is no recorded historic pluvial flooding onsite or the surrounding area. The proposed stormwater system should be constructed in accordance with SDCC policy.

4.4 Access

Access to the site is maintained in the 1% AEP and 0.1% AEP event along the existing road within Sarsfield Park Estate and therefore not a concern during a flood event.

4.5 Residual Risks

Residual risks are the risks remaining after all risk avoidance, substitution and mitigation measures have been taken. One residual risk has been identified, the exceedance or failure of the stormwater system.

4.5.1 Drainage System Design Exceedance

In the case of exceedance of the stormwater system the FFL for the proposed development has been set 300mm above the hardstanding area to minimise risk of inundation should failure or exceedance occur.

1 https://www.swisslife.com/en/home/blog/what-is-the-lifespan-of-a-house.html#:~:text=Residential%20buildings%20normally%20last%20between%2070%20and%20100%20years.

4.6 Climate change

Climate change has been assessed for the site and is based on the CFRAM Mid-Range Future Scenario which allows for an increase of 20% in peak flood flows. Figure 3-5 shows the MRFS extents for the area modelled under the ECFRAM study. The site is shown to be at low risk of flooding in the future. It should be noted that if the HEFS extents are considered then the 300mm offset for the FFL would offer protection against shallow flooding from a 0.1% AEP HEFS flood event. As previously stated, this scenario is beyond what JBA would assess as a risk that requires specific consideration in terms of Flood Zones and climate change mitigation.

5 Conclusion

JBA Consulting has undertaken a detailed Flood Risk Assessment for the proposed development located in Sarsfield Estate, Lucan, Co. Dublin. The proposed development is for residential dwellings on a brownfield site.

Review of the available flood information showed that the key sources of flood risk to the site are the Griffeen River and River Liffey. Detailed flood mapping of the area and watercourses was carried out as part of the ECFRAM study. The modelled flood extents and analysis of risk show the site to be in Flood Zone C for the present day scenario, but it is also outside of the Mid Range Future Scenario (MRFS) climate change flood extents for both the 1% and 0.1% AEP event.

The South Dublin County Development Plan 2022-2028 SFRA flood mapping uses the High End Future Scenario (HEFS) flood extents for setting out Flood Zones. The HEFS modelled extents show that the site is at risk of flooding in the 0.1% AEP HEFS event and in the SFRA this was chosen as being representative of Flood Zone B.

While a consideration of climate change is important, 'The Planning System and Flood Risk Management' guidelines do not use climate change scenarios to determine Flood Zones and it is noted that the HEFS assessment at the 0.1% AEP is a highly conservative assessment of risk. Given the flood mechanism for this specific site, utilisation of the HEFS scenario does not represent an appropriate response to the risk and a more suitable approach would be to use the current scenario to define the Flood Zones and then consider climate change separately.

Therefore, the definition of Flood Zones for this study have been based on the present-day extents with the site being in Flood Zone C. Climate change impacts have been considered by the FRA, but the level of risk does not require further more detailed assessment and the Justification Test does not apply in this case.

The proposed finished floor level for the site is raised 300mm above the surrounding hardstanding area, principally to mitigate any potential risk of stormwater system failure. Access will not be impeded during a flood event and the stormwater system should be designed in accordance with SDCC policy.

In summary the site is located in Flood Zone C and is at low risk of flooding in the present-day and is outside the 0.1% AEP MRFS flood extent, any shallow flooding represented at the 0.1% AEP HEFS climate change event would represent a low risk and would in any case be managed by the approach to the setting of the FFL above hardstanding.

The Flood Risk Assessment and strategic development recommendations were undertaken in accordance with 'The Planning System and Flood Risk Management' guidelines and agrees with the core principles contained within.

Appendices

A Appendix - Understanding Flood Risk

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

Flood Risk = Probability of Flooding x Consequences of Flooding

A.1 Probability of Flooding

The likelihood or probability of a flood event (whether tidal or fluvial) is classified by its Annual Exceedance Probability (AEP) or return period years, a 1% AEP flood 1 in 100 chance of occurring in any given year. In this report, flood frequency will primarily be expressed in terms of AEP, which is the inverse of the return period, as shown in the table below and explained above. This can helpful when presenting results to members of the public who may associate the concept of return period with a regular occurrence rather than an average recurrence interval and is the terminology which will be used throughout this report.

Table: Conversion between return periods and annual exceedance probabilities

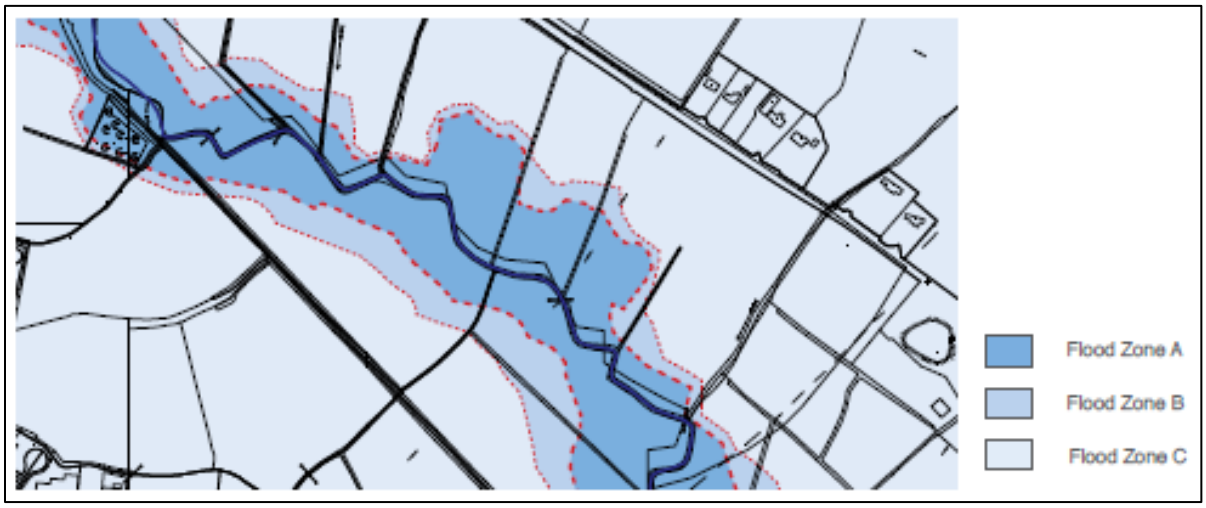
Return period (years)	Annual exceedance probability (%)
2	50
10	10
50	2
100	1
200	0.5
1000	0.1

A.2 Flood Zones

Flood Zones are geographical areas illustrating the probability of flooding. For the purpose of the Planning Guidelines, there are 3 types of levels of flood zones, A, B and C.

Zone	Description
Flood Zone A	Where the probability of flooding is highest, greater than 1% (1 in 100) from river flooding or 0.5% (1 in 200) for coastal/ tidal Flooding
Flood Zone B	Moderate probability of flooding, between 1% and 0.1% from rivers and between 0.5% and 0.1% from coastal/ tidal.
Flood Zone C	Lowest probability of flooding, less than 0.1% from both rivers and coastal/ tidal.

It is important to note that the definition of the flood zones is based on an undefended scenario and does not take into account the presence of flood protection structures such as flood walls or embankments. This is to allow for the fact that there is a residual risk of flooding behind the defences will be maintained in perpetuity.



A.3 Consequences of Flooding

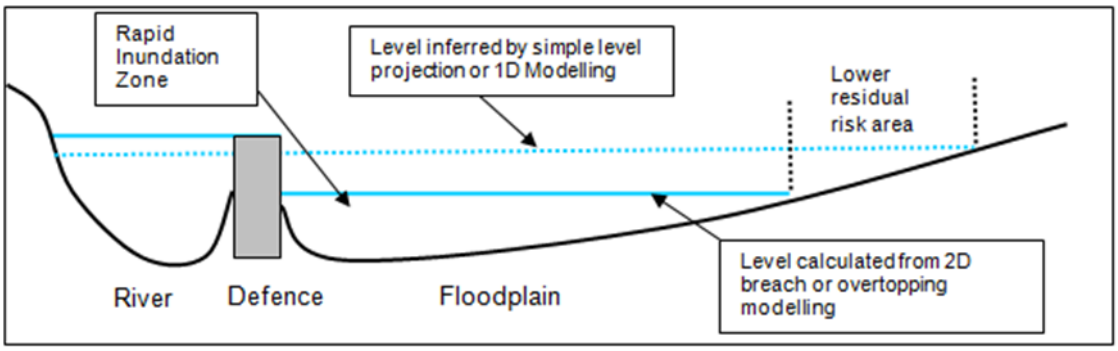
Consequences of flooding depend on the Hazards caused by flooding (depth of water, speed of flow. Rate of onset, duration, wave-action effects, water quality) and the vulnerability of receptors (type of development, nature, e.g. age-structure of the population, presence and reliability of mitigation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

The 'Planning System and Flood Risk Management' provides three vulnerability categories, based on type of development, nature, which are detailed in Table 3.1 of the Guidelines, and are summarised as:

- **Highly vulnerable**, including residential properties, essential infrastructure and emergency service facilities
- **Less vulnerable**, such as retail and commercial and local transport infrastructure, such as changing rooms.
- **Water compatible**, including open space, outdoor recreation and associated essential infrastructure, such as changing rooms.

A.4 Residual Risk

The presence of flood defences, by their very nature, hinder the movement of flood water across the floodplain and prevent flooding unless river levels rise above the defence crest level or a breach occurs. This known as residual risk:



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