Confey, Phase 1a, Large Residential Development, Leixlip, Co. Kildare FRA

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Abbreviation

AEP	Annual Exceedance Probability
AFA	Area for Further Assessment
CFRAM	Catchment Flood Risk Assessment and Management
DoHELG	Department of the Environment, Heritage and Local Government
DTM.....	Digital Terrain Model
FB.....	Freeboard
FFL	Finish Floor Levels
FRA	Flood Risk Assessment
FSR	Flood Studies Report
GSI	Geological Survey of Ireland
LiDAR	Light Detection and Ranging
NIFM.....	National Indicative Fluvial Mapping
OPW	Office of Public Works
PFRA	Preliminary Flood Risk Assessment
RR	Rainfall-Runoff
RMS	Root Mean Square
SAAR	Standard Average Annual Rainfall (mm)
SFRA	Strategic Flood Risk Assessment
SuDS	Sustainable Urban Drainage System
WL	Water Level

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 (FRA) to ensure sustainability and effective management of flood risk.

1.1 Terms of Reference

JBA Consulting was appointed to prepare a Flood Risk Assessment (FRA) for a development located on a site in Confey, Leixlip, Co. Kildare. The report was prepared in response to a request by Vanisland Limited to undertake an FRA for the site.

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 an 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 2009 OPW / DECLG planning guidance, "*The Planning System and Flood Risk Management and Circular PL02/2014*". 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 a large-scale residential development on an existing greenfield site in the townlands of Newtown and Confey, Leixlip, Co Kildare.

Vanisland Limited, intend to apply for planning permission for a Large-scale Residential Development (LRD) on lands within the townlands of Newtown and Confey, Leixlip, Co. Kildare. The application site is bound by the R149 to the east, the L1015 to the north,

Paceland and Captains Hill (residential dwellings) to the north-east, greenfield lands to the west, and the Royal Canal to the south.

The proposed development provides for the construction of 272 no. residential units comprising: 101 no. terraced houses (54 no. 3-bed 2 no. storey houses, 28 no. 4-bed 2 storey houses and 19 no. 4-bed 3 no. storey houses); 12 no. own door 1-bed apartment units in an end of terrace (3 storey) arrangement throughout the site; 78 no. duplex apartment units (33 no. 2-bed and 45 no. 3-bed units) provided in terraced and end of terrace (3 storey) arrangements throughout the site; and provision of a mixed use area (referred to as Block A) comprising 81 no. apartments / duplex apartments units (29 no. 1-bed, 36 no. 2-bed, and 16 no. 3-bed units) in 4 no. blocks partially over a podium / undercroft level (Blocks A1 to A4) ranging from 3 no. storeys to 6 no. storeys.

The provision at ground floor and podium / undercroft level of Block A of a childcare facility and associated play area; 3 no. commercial units (for Class 1- Shop, or Class 2- Office / Professional Services, or Class 11 Gym, or Restaurant / Café use, including ancillary takeaway use, or Class 8- Health Centre / Civic, or Cultural Use); a Restaurant / Café unit; bike stores; bin stores; plant areas; 1 no. ESB substation and associated switch rooms; and car parking.

The development provides public open space and communal open space to serve the residential units, and c. 1 ha of the proposed strategic open space comprising a linear park to the north of the Royal Canal.

Provision of 2 no. vehicular and pedestrian / cyclist access from the R149 to the east and the L1015 to the north; and proposed upgrades (horizontal widening and minor vertical road alignment) to the R149 to the east and to the L1015 along the northern boundary of the site.

The development will provide for car parking spaces; bicycle parking spaces; internal roads, pedestrian and cycle paths; and the provision of the proposed infrastructure up to the application site boundary to facilitate future connections to adjoining lands.

Provision of foul, watermain and surface water drainage, including upgrade works to the existing watermain along the R149; public lighting; landscaping and boundary treatment works; PV panels; services; bin and bicycle stores; and all associated infrastructure and site works to facilitate the development.

The proposed site layout is provided in Figure 1-1 overpage.

Figure 1-1: Proposed Development

1.4 Report Overview

Section 2 of this report gives an overview of the study location and associated watercourses. Section 3 contains background information on flood risk. Section 4 provides the results from the hydraulic model, while Section 5 gives a detailed flood risk assessment and mitigation measures. Conclusions are provided in Section 7.

2 Site Background

This section describes the receiving environment of the proposed development site in terms of watercourses, geology, and characteristics of the wider geographical area.

2.1 Location

Figure 2-1 shows the location of the study site at Confey, Leixlip which can be accessed by the Confey Road (R149) to the north and east. The application site is bound by the R149 to the east, the L1015 to the north, Paceland and Captains Hill (residential dwellings) to the north-east, greenfield lands to the west, and the Royal Canal to the south.

The main hydrological feature is the Confey Stream, a tributary of the River Rye. The watercourse rises approximately 2.4km upstream of the site and meets the River Rye 600m downstream of the site. The watercourse flows from northwest to southeast.

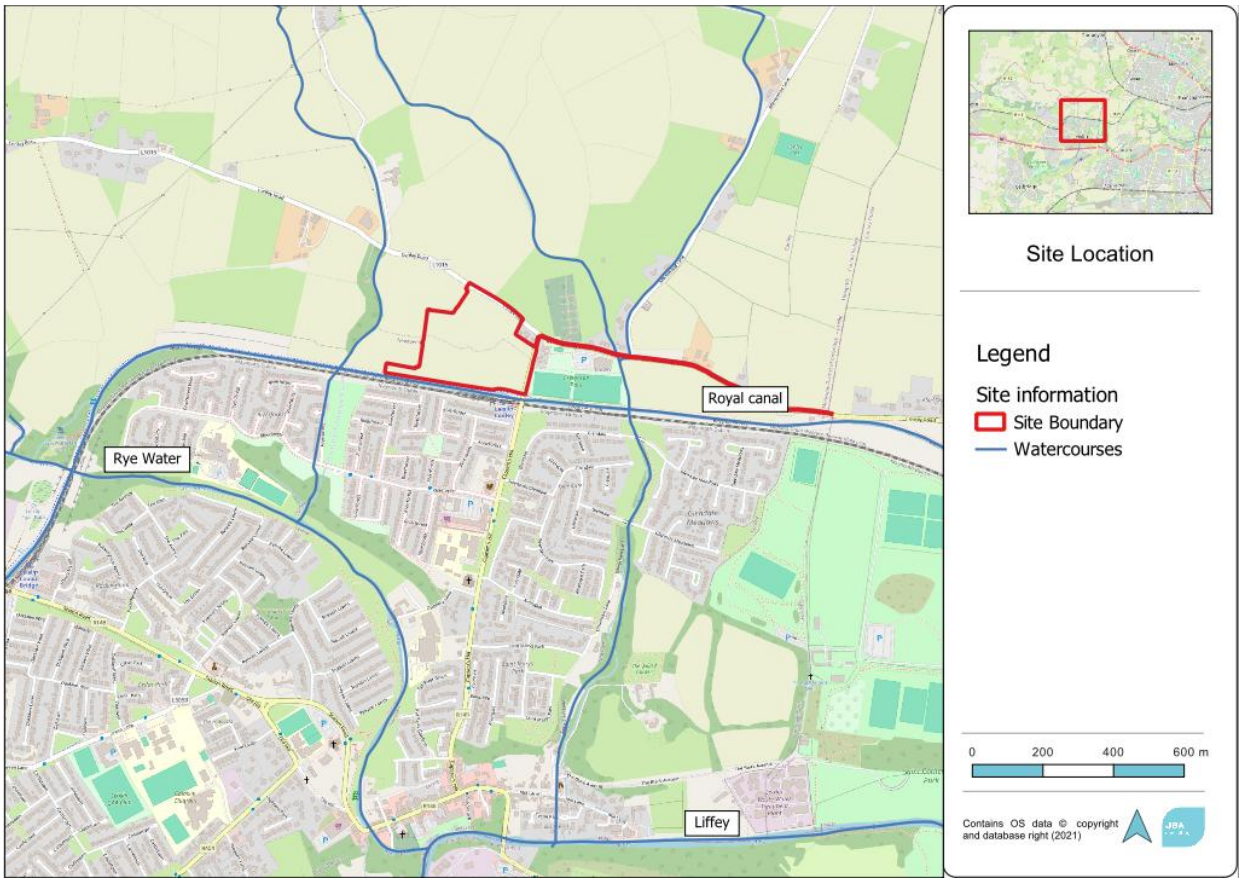


Figure 2-1: Site Location and Watercourses

2.2 Watercourses

The Confey Stream is a small watercourse, rising just across the Co. Meath border in the townland of Rathleek. The Confey Stream flows southeasterly and joins the River Rye downstream of the Royal Canal, approx. 600m downstream of the site. The catchment size to just upstream of the River Rye is 1.31km^2.

2.3 Site Geology

The groundwater and geological maps of the site, provided by the Geological Survey of Ireland (GSI), have been studied. The underlying bedrock at the site is composed mainly of the Lucan Formation; dark limestone and shale with the lower portion of the site made up of dark grey to black limestone and shale. The subsoils of the site consist of Limestone till (Carboniferous). Refer to Figure 2-2 below.

The GSI groundwater vulnerability maps were available for review. The site itself has a moderate vulnerability, however the Confey Stream has a high vulnerability, meaning groundwater has either a high or extreme vulnerability to contamination by human activity.

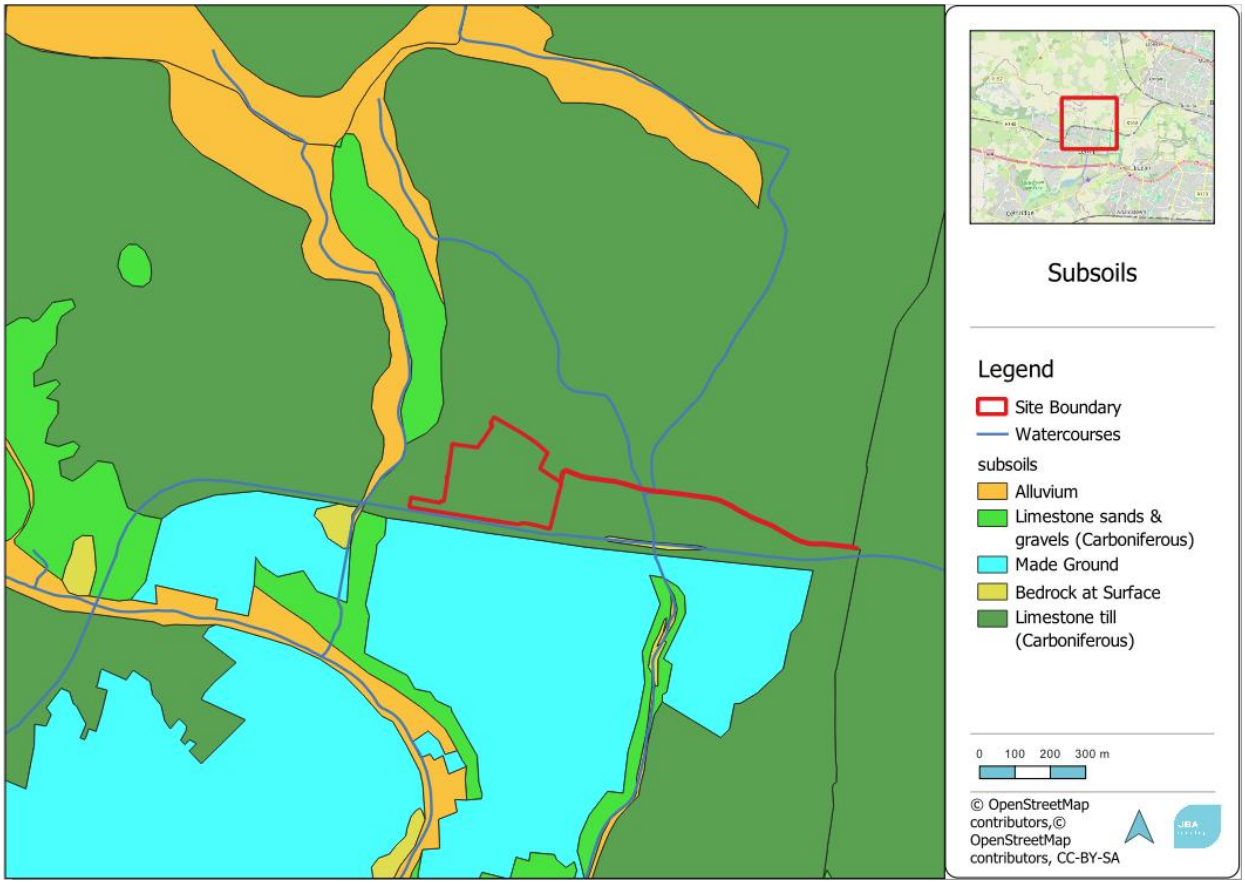


Figure 2-2: Site Subsoils

2.4 Local Topography/ Drainage

2m resolution LIDAR was available for the study area from the Open Topographic Data Viewer online. The LIDAR extent is shown in Figure 2-3 and covers the entire model area. The LiDAR was collected in 2011 by FUGRO. The resolution of the LiDAR is 2m and has an RMS within +/- 200mm. The LiDAR shows that the site slopes from north to south. The upper reach of the catchment lies at approx. 78mOD and falls to 55.9mOD at the site. Within the site boundary the elevation ranges from 59.1 mOD to 55.9mOD..

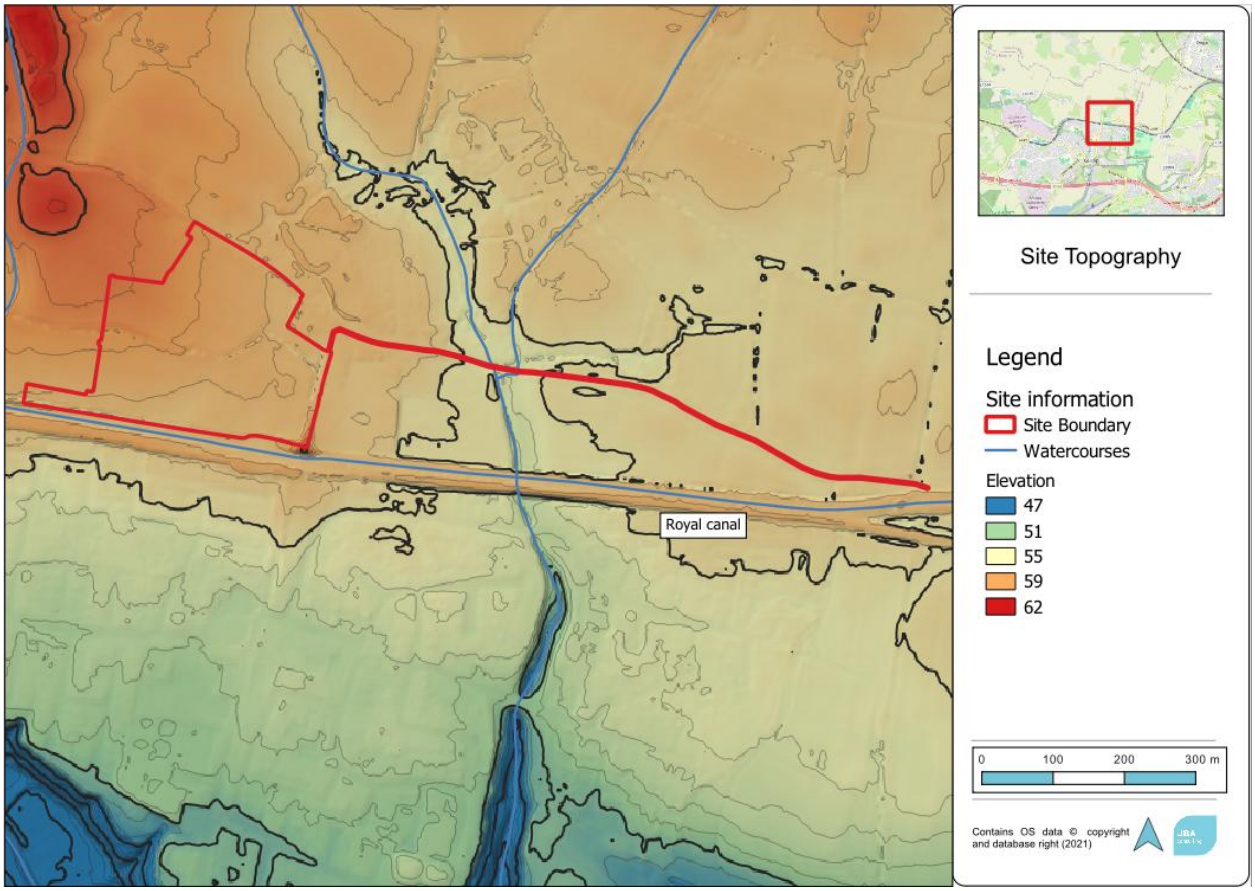


Figure 2-3: Local Topography

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 historical flood information. The findings from the flood risk identification stage of the assessment are provided in the following sections. Further detail on the Planning Guidelines and technical concepts are provided in Appendix A.

3.1 Flood History

A number of sources of flood information have been reviewed to establish any recorded flood history at, or near the site. This includes the OPWs national flood information portal, www.floodinfo.ie, and general internet searches.

3.1.1 Floodinfo.ie

The OPW have established a National Flood Risk Hazard Mapping website, www.floodinfo.ie, which highlights areas at flood risk through the collection of recorded data and observed flood events. There are three events in the townland of Confey, however there are no events within/near the site boundary.

Table 3-1: Historic Flooding

Event date	Flooding source	Details
14/11/2022	Fluvial	Flood ID-1514 From an Engineer's report in 2005: "Allenswood Road, Leixlip – Stream overflowed its banks and 2 houses were flooded."
14/11/2022	Fluvial	Flood ID-1517 From an Engineer's report in 2005: "Confey Junction with Allenswood Road – Same as Allenswood Road, Leixlip."
14/11/2022	Fluvial	Flood ID-1519 From an Engineer's report in 2005: "Confey Road – Low lying land and road was flooded."

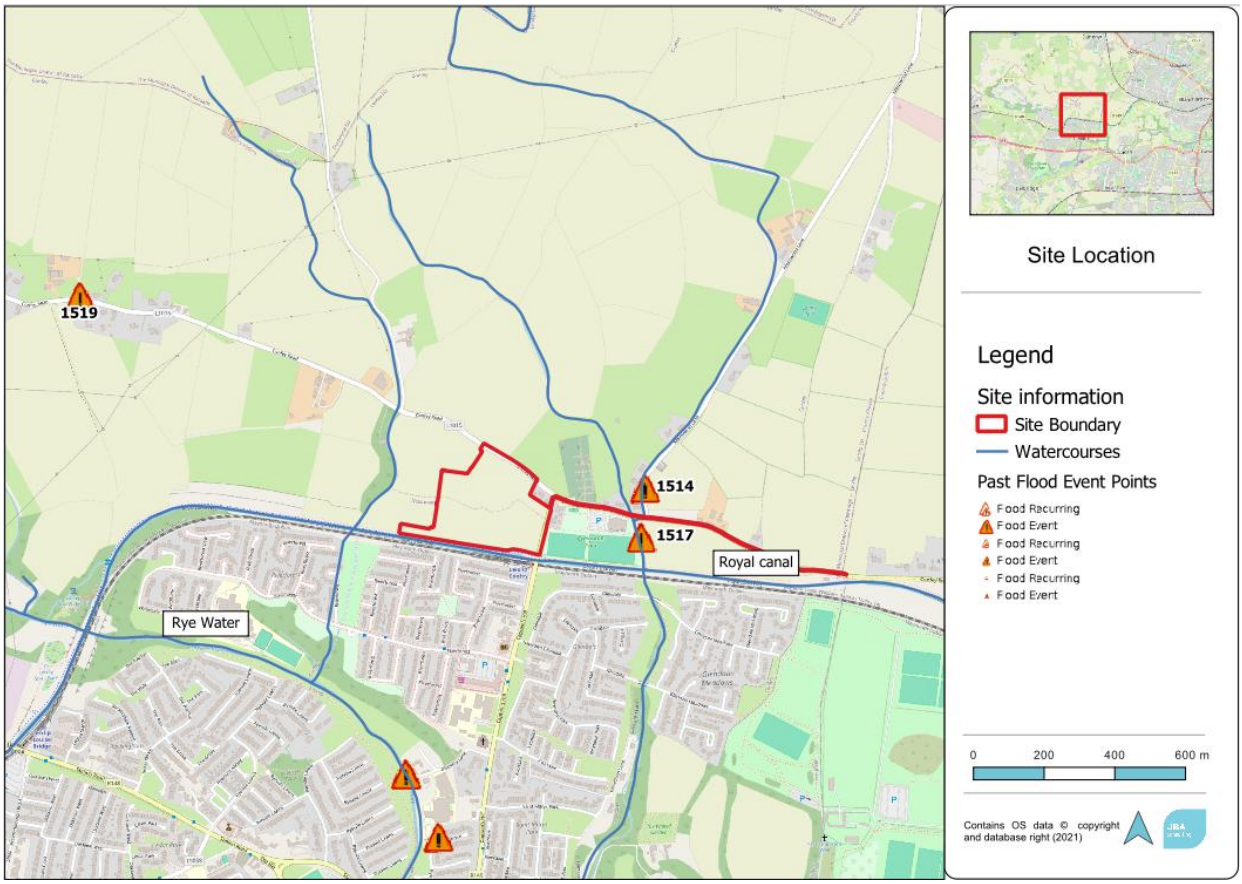


Figure 3-1: Historic Flooding

3.1.2 Internet Searches

An internet search was carried out to find any information regarding flooding specifically of the site and surrounding area. There is a Flood Alleviation Scheme on the River Rye however, there is no reported flooding in or near the site

3.2 Predictive Flood Mapping

The wider area has been a subject to predictive flood mapping or modelling studies and other related studies and plans.

- Eastern Catchment Flood Risk Assessment and Management (ECFRAM) Study

3.2.1 Eastern Catchment Flood Risk Assessment and Management Study (CFRAM)

The primary source of data utilised to identify flood risk to this site is the Eastern CFRAM. Flood maps have been finalised for Leixlip and surrounding areas.

The CFRAM Study consists of detailed hydraulic modelling of rivers and their tributaries. The Confey Stream has been modelled under the Eastern CFRAM and flood extent maps for the fluvial scenario have been completed. The relevant flood maps are available through the CFRAM website.

Review of the Eastern CFRAM flood maps for the Confey Stream confirms that the stream lies within the site boundary. However, no overtopping of the banks is predicted. Refer to Figure 3-2 for an extract of the flood maps.

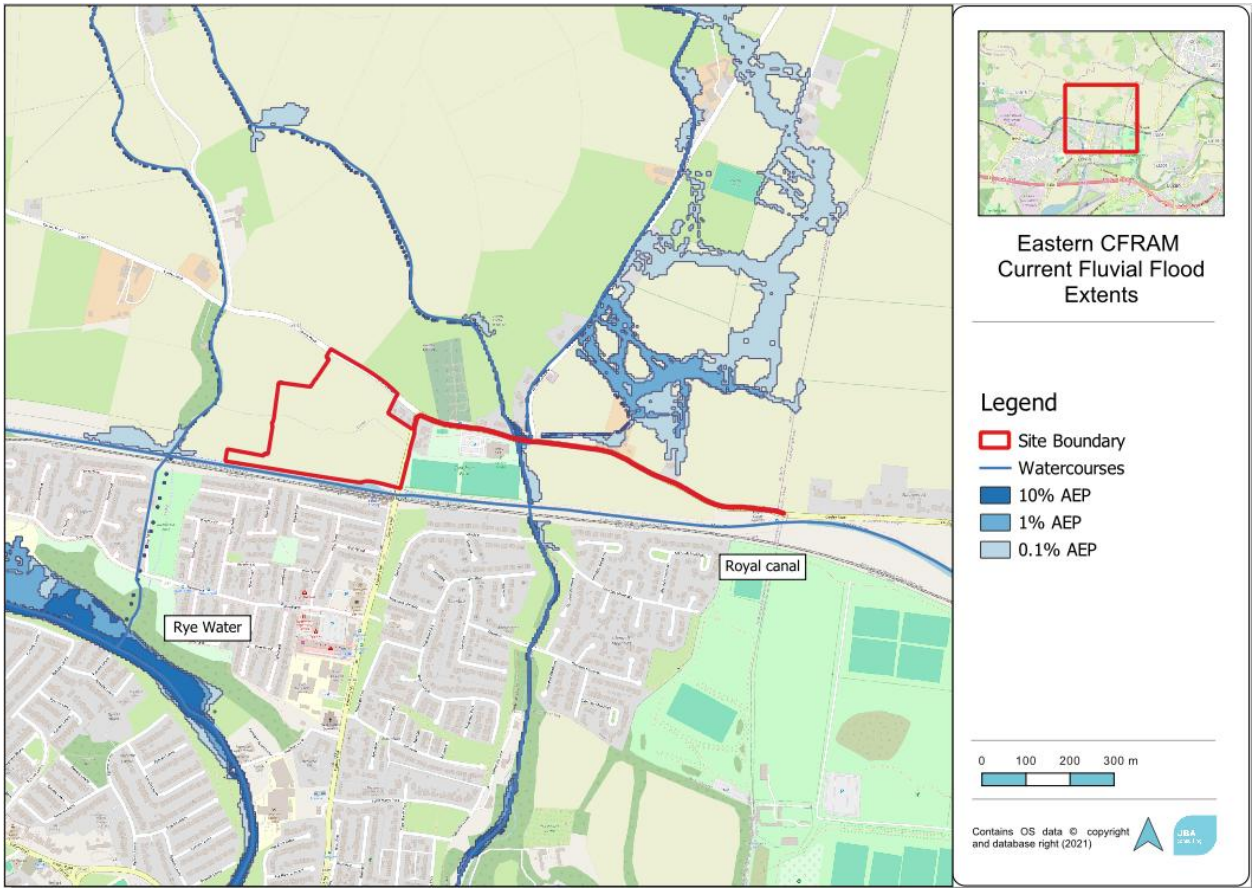


Figure 3-2: CFRAM Fluvial Flood Map

3.3 Development Plans

3.3.1 Kildare County Development Plan 2023-2029

The overarching guidance document governing the development at the site is the Kildare County Development Plan (DP) 2023-2029. The document sets out the overall strategy for proper planning and sustainable development across County Kildare. There is no specific mention of Leixlip within the Kildare County DP, as larger towns are subject to their own Local Area Plans and SFRAs.

The Kildare County DP sets out a number of policies relating to flood risk and stormwater management, which are used to guide development. According to Section 4.2.3 of the Kildare DP, the "minimum finished floor levels for Highly Vulnerable Development should be above the Flood Zone B (0.1% AEP) level plus suitable freeboard. The recommended level of freeboard is 500mm for fluvial flood levels".

It is also required that developments comply with the Inland Fisheries Ireland Guidance: Planning for Watercourses in the Urban Environment (2020), including the maintenance of a minimum riparian zone of "20 metres for river channels less than 10 metres in width". Refer to Appendix B for stated policies and objectives relating to flood risk.

3.3.2 Leixlip Local Area Plan 2020-2023 (extended to 2029 as amended)

The Leixlip Local Area Plan (LAP) sets out an overall strategy for the proper planning and sustainable development of Leixlip in the context of the Kildare County Development Plan 2017 – 2023. Specific policies and objectives area provided in Appendix B. A SFRA was carried out to support the preparation of the LAP and subsequently to support the amendment No. 1, to assess flood risk in the town and inform strategic land-use decisions. The purpose of the SFRA ensures that flood risk management is fully integrated into the LAP. It should be noted that the SFRA is based on the Eastern CFRAM flood maps. The flood maps confirm the flood extents presented in CFRAM flood map presented in Figure 3-2.

The Leixlip LAP identifies the Confey Masterplan has been prepared in accordance with Objective Con 1.1(a) and provides area specific and detailed design guidance for the lands within the masterplan boundary. The masterplan now includes an appropriate phasing and implementation strategy for the overall development of the lands to enable orderly development and ensure adequate infrastructure is provided in tandem with new development and in accordance with the Kildare County Development Plan 2023-2029[1].

[1] Kildare County Council (2024) *Confey Lands Masterplan*. Available from: Confey Masterplan Compressed.pdf [Accessed 29/07/2025]

3.3.3 Leixlip Flood Relief Scheme

The Leixlip Scheme was initiated in 2004 and was constructed from 2007 to 2010. The Scheme comprises flood defence walls and embankments along the Rye Water and flood defence walls along the Silleachain river. This provides protection against the 1% AEP event for 50 properties against flooding from the Rye Water and Silleachain rivers.

The Confey Stream was not considered for the Leixlip Flood Relief Scheme, refer to Figure 3-4.

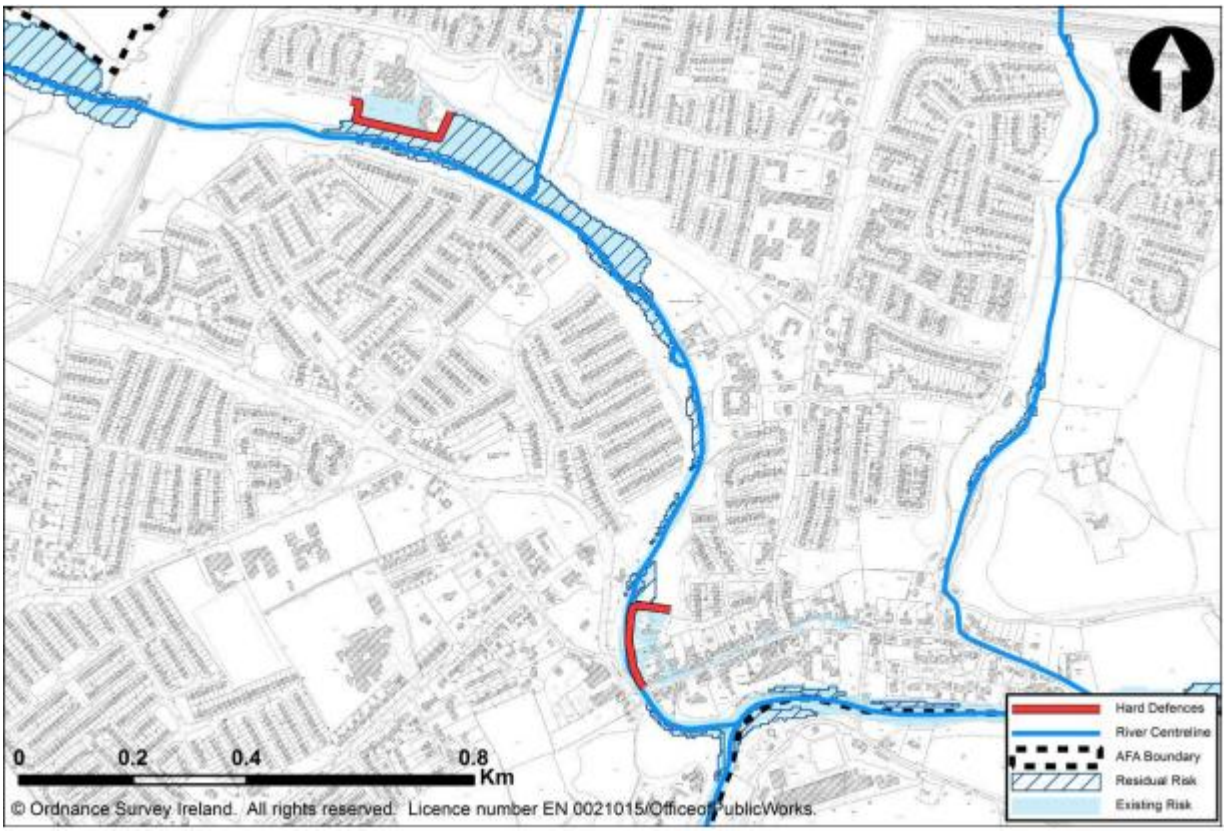


Figure 3-3: Leixlip Flood Relief Scheme

3.4 Sources of Flooding

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

3.4.1 Fluvial

Based on the reviewed CFRAM Fluvial Flooding maps for both the Current Scenario and Medium Range Future Scenario (MRFS) concerning the Confey Stream, the site boundary is not impacted by the 0.1% and 1% AEP events. The proposed site is situated within Zone C. To refine and confirm the flood extents, as well as to conduct residual risk and sensitivity testing, a site-specific hydraulic model was developed, as detailed in Section 4.

3.4.2 Coastal

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

3.4.3 Pluvial

Pluvial flooding is the result of rainfall-generated overland flows that arise before run-off can enter a watercourse or sewer. Review of the site topography confirms that there are no local depressions onsite that would be at risk of pluvial flooding. The site is currently well-drained, and a stormwater management system will be incorporated into the planning design.

3.4.4 Groundwater

Groundwater flooding results from high sub-surface water levels that impact upper levels of the soil strata and overland areas that are usually dry. The GSI maps were reviewed and do not indicate groundwater flooding at the site or surrounding area. The GSI groundwater vulnerability for the site is classified as 'High' and there is no karst features located in or around the site location. Based on this information, there is a low risk of groundwater flooding at the site.

4 Detailed Flood Risk Assessment

4.1 Flood Risk

As discussed in Section 3, the Confey Stream flows through the site boundary. The site is located in Flood Zone C, however, to further investigate fluvial flood risk to the site, a detailed investigation using hydraulic modelling has been carried out. The construction and application of the hydraulic model used is discussed in this chapter.

4.2 Hydrology

To assist in the estimation of potential flood risk to the proposed development from the Confey Stream, this section provides flow estimates for the 100-year (1% flood event) and 1000-year (0.1% flood event) flows expected along the Confey Stream along the western boundary of the proposed development.

4.2.1 Catchment Characteristics

The physical characteristics of the catchment influence the hydrology, this includes catchment size, soil type, steepness, and the average rainfall. Table 4-1 outlines the parameters calculated for the site catchment. Figure 4-1 overpage provides the catchment area.

The Confey Stream and River Rye have been considered for the hydrological inflows at the site. The characteristics of the Confey catchment were derived from first principles. The characteristics of the Rye catchment were derived from the FSU (Flood Studies Update) ungauged node database. SAAR and URBEXT have been updated using the latest available datasets.

Table 4-1: Catchment Characteristics

Descriptor	HEP_US	HEP_DS	HEP_RYE (09_297_3)
AREA	0.96	1.31	208.00
SAAR1991-20	809	809	783.4
FARL	1	1	1
BFI Soil	0.59	0.59	0.51
URBEXT (CORINE 2018)	0	0.04	0.03
MSL	2.21	3.08	24.47
S1085	3.72	17.98	2.21
NETLEN	2.37		169.92
DrainD	0.4	2.35	0.82
ArtDrain2	0	0	0.13

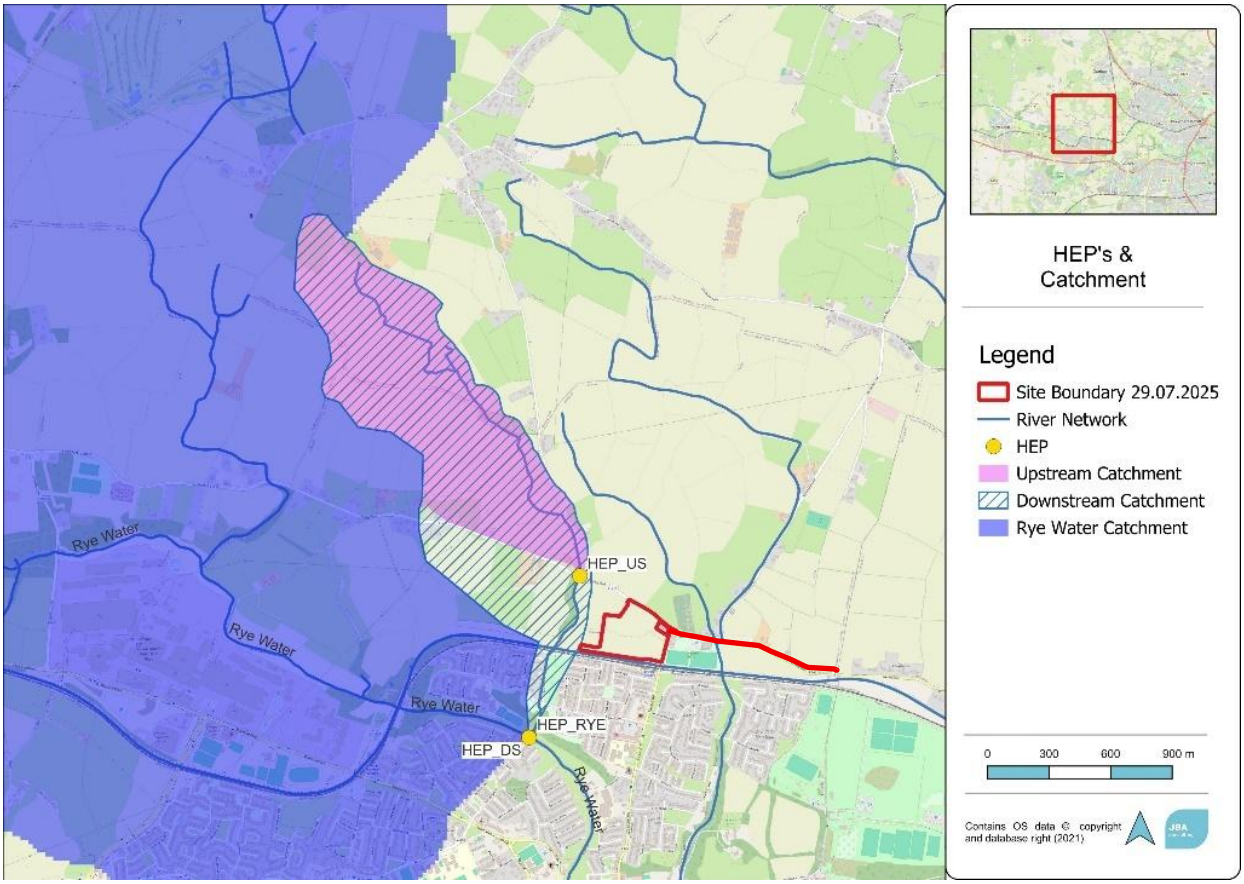


Figure 4-1: Watercourses and Catchment Areas

4.2.2 Flow Estimation

Three flood estimation methods were used to compare under hydrological analysis. These are:

- FSR Rainfall Runoff (RR)
- Flood Studies Update (FSU)
- Flood Studies Update Small Catchments (FSU SC)

Table 4-2 outlines the calculations for each method. Climate change was accounted for by increasing the relevant peak flows by 20%, which is based on the Medium Range Forecast Scenario (MRFS) OPW guidance.

Table 4-2: Flow Estimation Results

Hep Code	Peak flow methods	Qmed (m^3/s)	1% AEP (m^3/s)	0.1% AEP (m^3/s)
HEP_US	FSR Rainfall Runoff (RR)	0.22	0.73	1.41
HEP_DS	FSR Rainfall Runoff (RR)	0.42	1.43	2.64
HEP_RYE	FSU	27.84	61.64	91.43

HEP US will be set on Confey Stream at the upstream boundary of the hydraulic model, and lateral flow will be applied as difference between HEP DS and HEP US, up to the confluence with Rye Water River. The FSR Rainfall-Runoff method was used to derive QMED and the hydrograph shape for the Confey Stream.

HEP Rye will be set as top-up lateral from Rye Water River to assess any potential backwater effects on the Confey Stream. The QMED for the Rye Water was calculated using the FSU 7-variable statistical method. QMED was adjusted to the pivotal site (Duleen gauge) and an urban adjustment factor. The hydrograph shape was derived using the FSU hydrograph.

The following Growth Curves (GC) were used for comparison: Eastern CFRAM GC, FSSR RR GCs and Pooled GCs at Rye Water. The Confey catchment is steep, and a steeper growth curve is recommended. The FSR RR GC was used as the calculation includes data of Depth-Duration Frequency rainfall values, thus is site specific, whereas the CFRAM is a regional GC giving more generic values. The CFRAM GC was used for the Rye catchment.

4.2.3 Comparisons with ECFRAM Study

There is no significant difference between the ECFRAM flows and calculated in this study, however the flow for Navan Weir (07009) are lower than the ECFRAMS, and Liscarton (07010) flows are higher than the ECFRAMS.

The flows in this study are calculated using the most up to date gauge record and therefore are considered more accurate.

Table 4-3: Comparison with ECFRAM

Node ID_CFRAMS	CFRAM Preferred Estimation Methodology	CFRAM QMED (m^3/s)	CFRAM 1%AEP (m^3/s)	Gauged QMED in this study (m^3/s)	1%AEP in this study using hybrid GC (m^3/s)
07009	Gauge / NAM Check	179.52	359.94	161.05	333.63
07010	Gauge / NAM Check	74.52	148.82	69.9	158.79

4.3 Hydraulic Modelling

4.3.1 Hydraulic Model Set Up

To assess flood risk at the site, a 1D-2D ESTRY-TUFLOW hydraulic model was developed. This model facilitates the simulation of river channels, streams, floodplains,

and hydraulic structures, providing predictions of water levels under various scenarios (see Figure 4-2). The model was constructed in the following stages:

- Model Creation: A 1D-2D ESTRY-TUFLOW model of the Confey Stream and River Rye, including the surrounding area and the proposed site, was developed using a Digital Terrain Model (DTM) and channel survey data.
- Structure Integration: Existing hydraulic structures were incorporated into the model based on survey data and a baseline condition was established.
- Baseline Simulations: Hydraulic simulations were carried out for the baseline condition to determine the existing flood extents and delineate Flood Zones.
- Residual Risk Assessment: Additional scenarios were modelled to assess residual risks for the site, including the impacts of climate change and other residual risk scenarios.

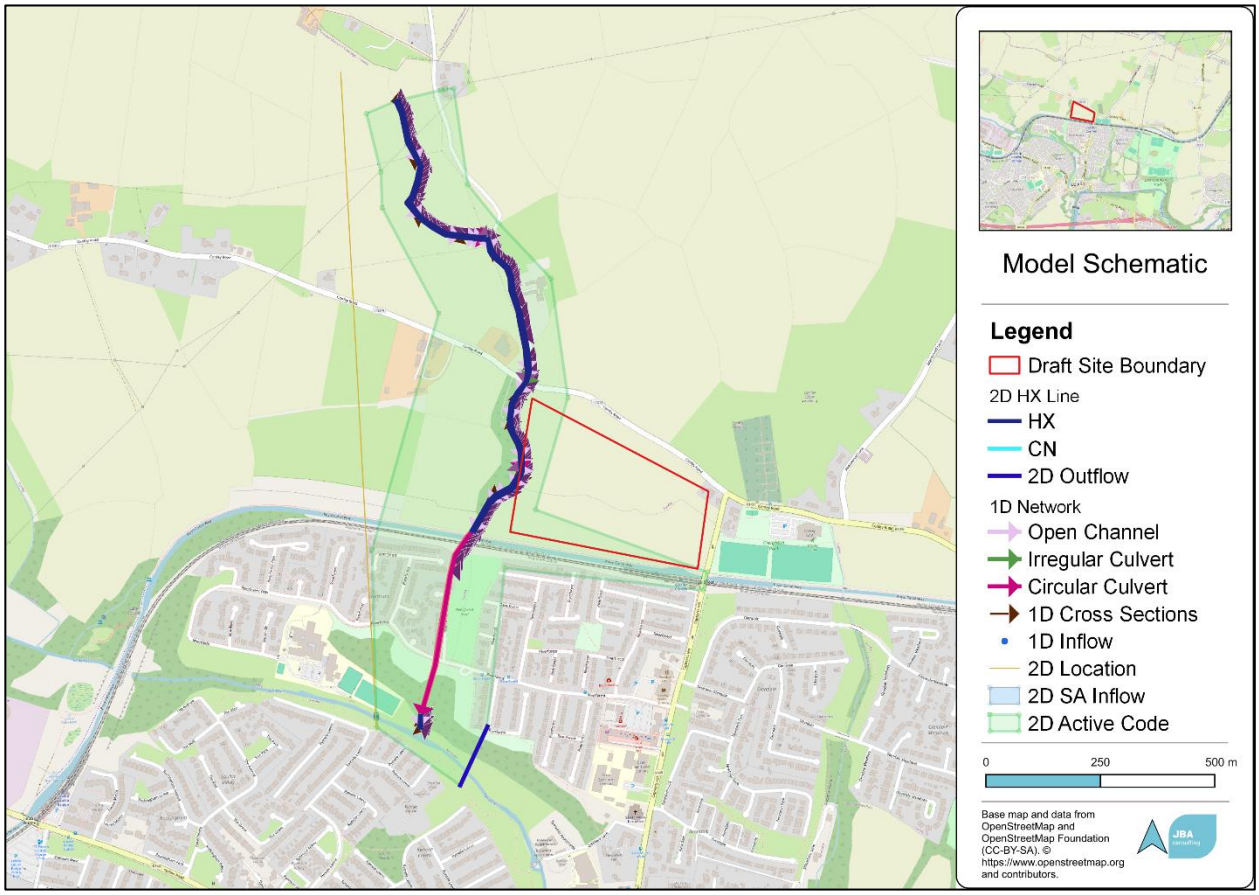


Figure 4-2: Model Schematisation

4.3.2 Model Results - Pre-Development Scenario

Figure 4-3 presents the modelled flood extents for the 1% AEP and 0.1% AEP events, corresponding to Flood Zones A and B, respectively. The results indicate that site is not impacted by the 1% AEP event (Flood Zone A), however it is partially inundated during the 0.1% AEP flood event (Flood Zone B). The Confey Stream is constricted by the

culvert under the Royal Canal, causing overtopping into a field drain along the southern boundary of the site. The field drain is overtopped during the 0.1% AEP event.

The flood levels will be used in Section 5.2 to confirm the appropriate Design Level / mitigation approach.

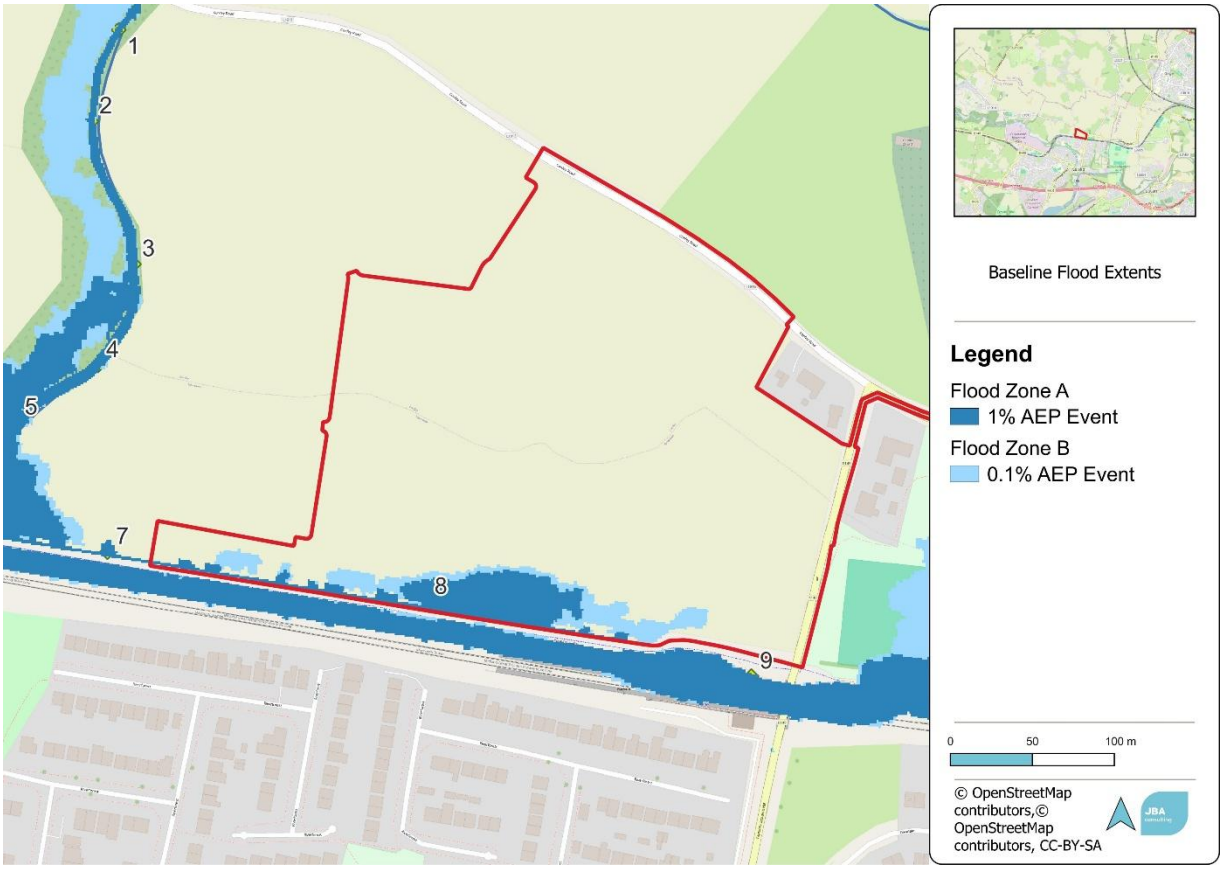


Figure 4-3: Pre-Development Flood Extents

4.3.3 Model Results - Post Development

As part of the proposed development, the proposed access road along the southern boundary of the site is partially located within Flood Zone A/B. The roadway has been raised to a minimum level of 57.8mOD in this area. Figure 4-4 provides the post-development flood extents.

The construction of the roadway will result in the loss of approximately 6m^3 of flood storage, however compensatory flood storage has been provided in the landscape area along the southern boundary. Refer to Figure 1-1 for the location.

Review of the flood levels confirms that there is no impact on the flood levels even in the absence of the compensation flood storage.

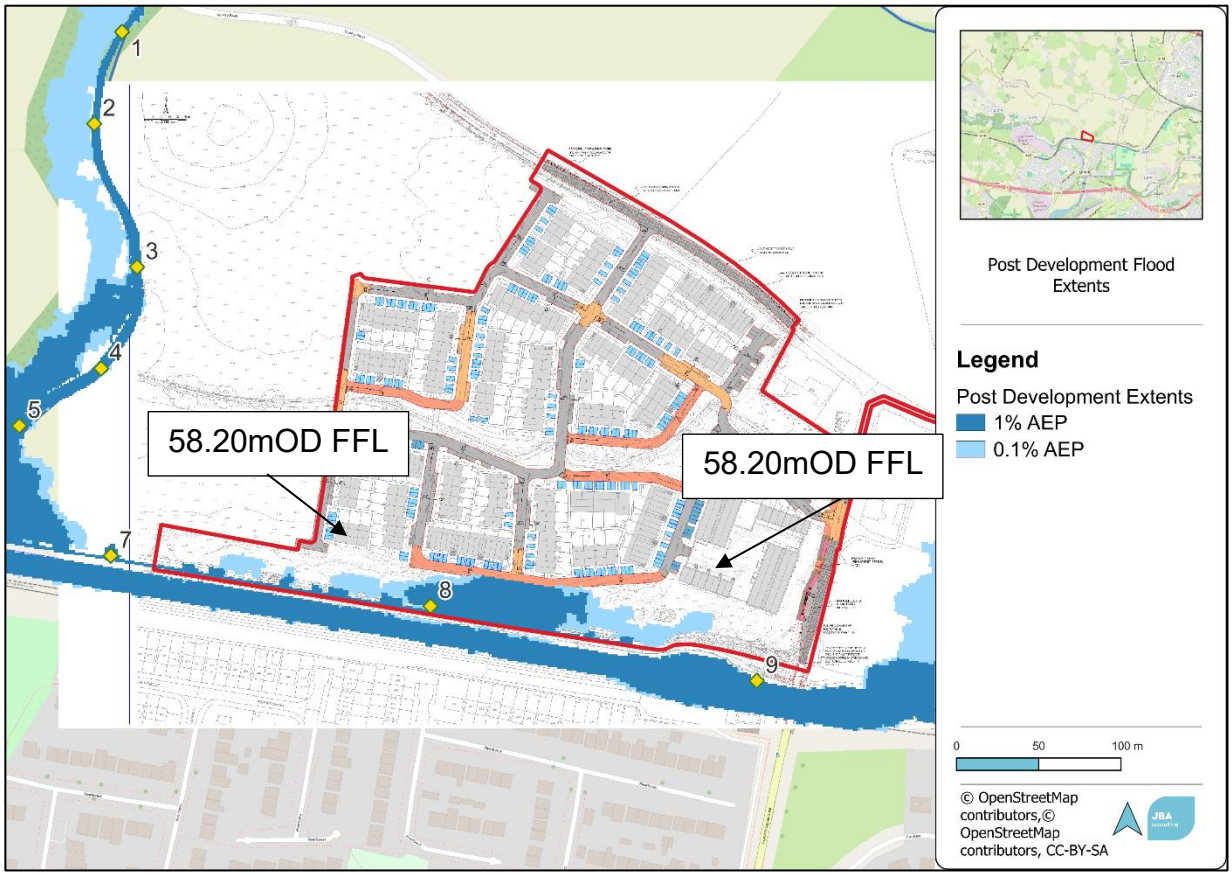


Figure 4-4: Post-Development Flood Extents

5 Flood Risk Assessment and Mitigation

5.1 Flood Risk

A review of the available flood data identified fluvial flooding from the Confey Stream as the primary source of flood risk to the site. The Confey Stream was modelled under CFRAM, and flood maps show that the site is not at risk of fluvial flooding.

To provide a higher level of assessment and confirmation of flood risk at the site, JBA Consulting has undertaken a detailed Flood Risk Assessment for the proposed site, and a hydraulic model was developed for the Confey Stream as part of the investigation. Various scenarios were developed to classify the baseline flood extents, including the 1% AEP and 0.1% AEP flood events.

The study concluded that the site is affected by the 0.1% AEP event. All residential areas of the site are in Flood Zone C and is not at risk of flooding, however, the southern boundary is within Flood Zone A/B. These findings supersede those from the OPW's CFRAM mapping. It is confirmed access roads are located in Flood Zone C. All proposed development within the 1% AEP and 0.1% AEP flood extents post-development is restricted to landscaping which is considered water compatible.

Minor infilling will occur within Flood Zone A/B, accounting to approximately 6m^3 in the 1% AEP flood event. However equivalent flood storage has been provided in the greenspace along the southern section of the site. There is no change in flood levels or extents resulting from the development.

The proposed development is compliant with the Guidelines however a Justification Test has been undertaken and passed in Section 6 of this FRA. All residential areas are located in Flood Zone C.

5.2 Mitigation

As outlined in Section 3.3.1, a minimum riparian zone of 20 metres for river channel is required to comply with Inland Fisheries Ireland Guidance. In response to the risks identified from pluvial and fluvial flooding, mitigation measures are required to minimise the flooding onsite, which are outlined in the following section.

5.2.1 Finished Floor Levels (FFL)

All of the proposed highly vulnerable residential development is located in Flood Zone C; and to comply with the Kildare County Development Plan 2023-2029 a minimum freeboard of 500mm is provided above the 0.1% AEP water level.

The required minimum Finish Floor Level (FFL) onsite is provided in Table 5-1. Refer to Figure 4-4 for the reporting point locations. For the proposed development, Reporting location 8 identifies the required FFL within the site. The minimum FFL provided onsite

is 58.20mOD, which provides a minimum freeboard of 1.46m over the 0.1% AEP flood event.

The minimum FFL will also protect the development against the predicated climate change and residual risk (blockage) flood events.

Table 5-1: Finished Floor Levels

Reporting Point	1% AEP Level (mOD)	0.1% AEP Level (mOD)	MRFS 1% AEP Level (mOD)	Blockage 1% AEP Level (mOD)	Min. FFL (mOD)
1	58.86	58.97	58.90	58.86	59.47
2	58.38	58.61	58.45	58.38	59.11
3	57.83	57.91	57.85	57.83	58.41
4	56.96	57.10	57.00	56.96	57.56
5	56.75	56.84	56.78	56.78	57.34
6	56.70	56.78	56.72	56.73	57.28
7	56.75	56.83	56.77	56.78	57.33
8	**56.69**	**56.74**	**56.73**	**56.73**	**57.24**
9	N/A	56.63	56.70	56.70	57.20

5.2.2 Compensatory Flood Storage

To mitigate the against the loss of flood storage (6m^3) due to the development of, compensatory storage of 6.5m^3 has been provided. This is provided in the greenspace area highlighted in Figure 5-1. Below. The area covers 161m^2 where the existing levels will be reduced by approximately 40-50mm.

This ensures that there is no adverse impact from the proposed development.

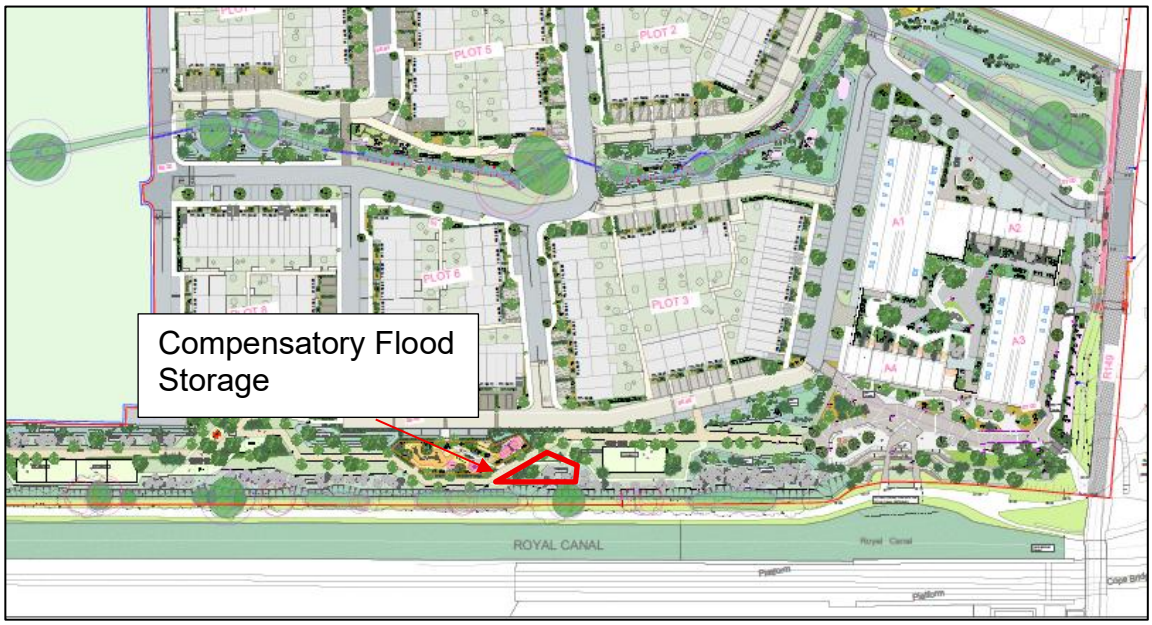


Figure 5-1: Compensatory Flood Storage

5.2.3 Access

An entrance way will be constructed at the northern boundary of the site from Confey Road. The entrance and associated primary and emergency access/egress routes are fully located in Flood Zone C and is at low risk of flooding. Therefore, access to the development during a flood event is not considered to be an issue.

5.2.4 Surface Water Management

The proposed development will increase the hardstanding area onsite and therefore could potentially increase the surface water runoff from the site if not mitigated against. There is no identified pluvial flooding onsite based in the historic flood information and site survey data. The proposed stormwater system will comply with the Kildare Development Plan policies. Refer to the stormwater design and accompanying report contained within the wider planning application for the details.

To minimise the risk of pluvial flooding, a threshold of 150mm is required from the FFL to the external ground levels.

5.3 Climate Change

In line with OPW guidelines, an assessment of the flood risk associated with climate change was carried out. The site was evaluated under the Medium-Range Future Scenario (MRFS), which involves the 1% AEP event with a 20% increase in flow. The resulting flood levels are presented in Table 5-2.

Table 5-1 confirms that a freeboard of 1.47m to the FFL over the predicted climate change flood levels has been provided.

Table 5-2: Climate Change Flood Levels

Reporting Point	MRFS 1% AEP Level (mOD)
1	58.90
2	58.45
3	57.85
4	57.00
5	56.78
6	56.72
7	56.77
8	**56.73**
9	56.70

5.4 Residual Risks

Residual risks refer to risks that persist even after all avoidance, substitution, and mitigation measures have been implemented. The primary residual risk identified for the site is the potential blockage at the culvert under the Royal Canal.

To assess this, a hydraulic model was developed to simulate the potential impact of a blockage scenario. On examining photos of the cross sections, the structure looked to be 67% blocked even in dry conditions. The model was therefore tested for a 100% blockage scenario.

Table 5-3 provides the predicted residual risk flood levels and confirms that a freeboard of 1.47m has been provided.

Table 5-3: Residual Risk Flood Levels

Reporting Point	Blockage -1% AEP Level (mOD)
1	58.86
2	58.38
3	57.83
4	56.96
5	56.78
6	56.73
7	56.78
8	**56.73**
9	56.70

6 Justification test

6.1 Justification Test Part 1

The subject lands have been zoned or otherwise designated for the particular use or form of development in an operative development plan, which has been adopted or varied taking account of the planning guidelines.

Under the Leixlip Local Area Plan the site has a designated 'C New Residential', 'MU - mixed Use' zoning to the proposed site. A narrow strip along the southern boundary designated as ‘F2 – Strategic Open Space’ under the Leixlip Local Area Plan 2020–2023 (as extended). All residential areas of the site are located within the 'C New Residential', 'MU - mixed Use' zoning **Conclusion: The Leixlip Local Area Plan and SFRA, zoned the site as 'C New Residential', 'MU - mixed Use' zoning and is in accordance with the Planning Guidelines**.

6.2 Justification Test: Part 2

The proposal has been subject to an appropriate flood risk assessment that demonstrates:

(i) the development proposed will not increase flood risk elsewhere and, if practicable, will reduce overall flood risk;

The site is located mainly in Flood Zone C however it is noted that the southern section of the site is located in Flood Zone A/B. No residential development is proposed in this area however lands will be raised as part of the road infrastructure. Compensatory flood storage has been proposed to mitigate the loss. Review of the post-development flood levels confirm that there is no resulting increase in flood levels.

(ii) the development proposal includes measures to minimise flood risk to people, property, the economy and the environment as far as reasonably possible;

The main mitigation measures involve the provision of a minimum freeboard above the predicated flood levels, including climate change and residual risks. This ensures that flood risk has been minimised. Compensatory flood storage has been provided to ensure no increase in flood levels elsewhere.

(iii) The development proposed includes measures to ensure that residual risks to the area and/or development can be managed to an acceptable level as regards the adequacy of existing flood protection measures or the design, implementation and funding of any future flood risk management measures and provisions for emergency services access.

A specific hydraulic model has been developed to assess the flood risk to the development from climate change and residual risks (blockage). A minimum freeboard

has been provided to ensure that the development will not be impacted from the modelled scenarios.

Furthermore, the established threshold of 150mm will ensure that the site will remain protected if failure of the stormwater system occurs.

(iv) The development proposed addresses the above in a manner that is also compatible with the achievement of wider planning objectives in relation to development of good urban design and vibrant and active streetscapes.

Refer to the accompanying planning application and design documentation in relation to good urban design.

7 Conclusion

JBA Consulting has undertaken a detailed Flood Risk Assessment for a proposed development in Confey, Leixlip, Co. Kildare. The site is situated east of the Confey Stream.

A review of available flood information identified the Confey Stream as the primary source of flood risk. Historical data and predictive modelling, including the CFRAM Study, indicate that the development is in Flood Zone C. However, as the Confey Stream flows through the site, it is necessary to confirm this with detailed modelling.

To refine the understanding of flood risk, a site-specific 1D-2D hydraulic model was developed, incorporating channel survey data and a Digital Terrain Model (DTM). The modelling results confirmed that the site boundary is partially inundated during the 1% AEP and 0.1% AEP event. Climate change (MFRS scenario) and residual risks, including the potential blockage structures, were also assessed.

The results from the hydraulic model confirm that all residential areas of the site are located in Flood Zone C. This is in accordance with the FRA guidelines, which recomments that all residential areas are retained in areas of the site classified as Flood Zone C.

As all residential areas have been located in Flood Zone C, a Justification Test has been undertaken and passed for the development.

Mitigation measures have been proposed, including setting the finished floor levels above the 0.1% AEP flood level, as described in Section 5.2.1. This will also protect the site from the predicted climate change and residual risk (blockage) flood events. A minimum freeboard of 1.47m has been provided over the 0.1% AEP flood event.

In summary, the proposed development will be raised above the 0.1% AEP flood levels, and all vulnerable development will be located in Flood Zone C. Additionally, this will protect the site from the predicted impacts of climate change and the identified residual risks.

Regarding pluvial flood risk, review of the available information and site topography does not indicate that the site is at risk of pluvial flooding. Surface water within the site will be managed through the provision of a stormwater system. Refer to the wider design statement and layout contained in the wider planning application for the stormwater details. To protect against potential surface water/pluvial flooding is it recommended that a threshold of 150mm is provided from the FFL to the external hardstanding areas.

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.

A Appendices

A.1 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.1.1 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 (in years). A 1% AEP flood has a 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 be 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

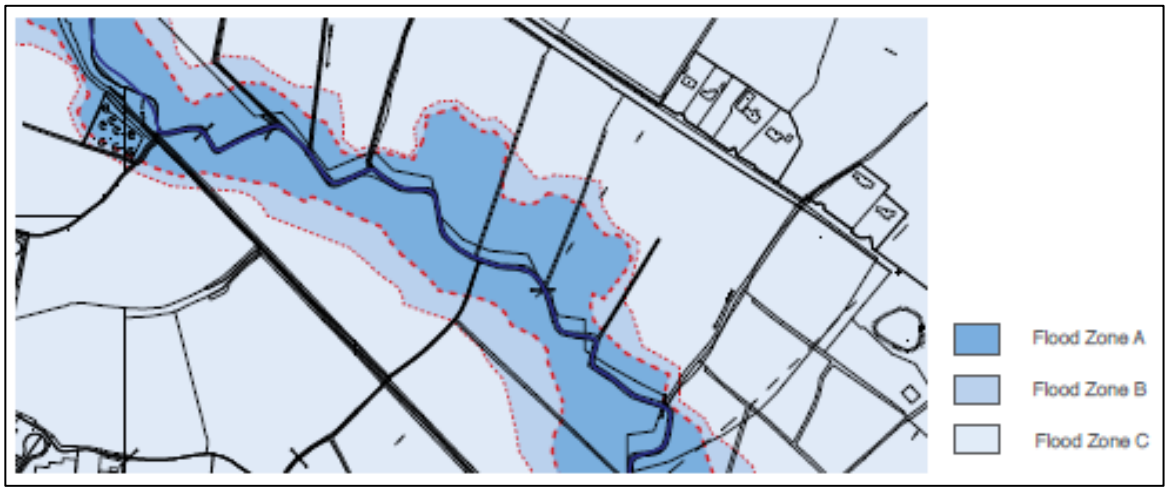
A.1.2 Flood Zones

Flood Zones are geographical areas illustrating the probability of flooding. For the purposes of the Planning Guidelines, there are 3 types or 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 due to overtopping or breach and that there may be no guarantee that the defences will be maintained in perpetuity.

Indicative Flood Zones (OPW & DoEHLG 2009)



A.1.3 Consequence 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.).

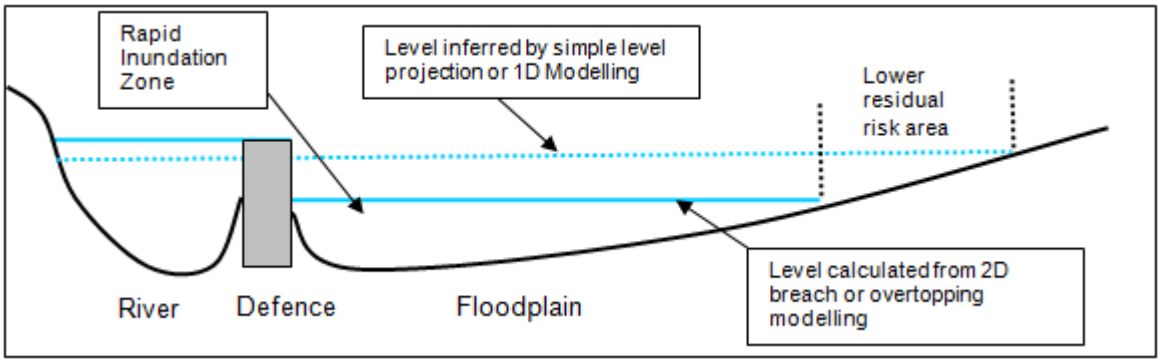
The 'Planning System and Flood Risk Management' provides three vulnerability categories, based on the type of development, which are detailed in Table 3.1 of the Guidelines, and are summarised as:

- Highly vulnerable, including residential properties, essential infrastructure, and emergency service facilities.
- Less vulnerable, such as retail and commercial and local transport infrastructure.

- Water compatible, including open space, outdoor recreation and associated essential infrastructure, such as changing rooms.

A.1.4 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 is known as residual risk.



B Development Plan Policies & Objectives

Policy CON1 – Confey

CON1 *It is the policy of the Council to ensure that lands located at Confey are developed in a sustainable manner and in accordance with the details set out in the Confey Urban Design Framework recognising the areas strategic location within the Dublin Metropolitan Area.*

Objectives

It shall be an objective of the Council;

CON 1.1 To ensure the future development of the lands identified within the Confey Urban Design Framework are subject to a detailed Masterplan the contents of which shall be agreed in writing with the Planning Department of Kildare County Council.

CON 1.2 To ensure no development is permitted until a detailed Masterplan has been prepared for the Urban Design Framework lands. Individual applications for smaller sections of the Framework lands will not be considered until such time as an agreement in writing has been received from the Planning Department of Kildare County Council.

CON 1.3 To require that the Masterplan prepared for the Confey Lands is accompanied by a statement of compliance which demonstrates how proposals for future development are consistent with the overall design principles, concept and character area details set out in section 2 of the Urban Design Framework.

CON 1.4 To ensure the development of the Framework lands and Masterplan are consistent with the phasing/sequencing schedule set out in section 3 of the Confey Urban Design Framework.

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