Sector 3, Aiken's Village, Stepaside, Dublin 18

Flood Risk Assessment

(including Flood Risk Guidelines Statement of Consistency)

Technical Report

August 22

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Contract

This report describes work commissioned by Ulick Burke of Kavanagh Burke by an email dated 27 June 2019. Kevin Buckley and Ross Bryant of JBA Consulting carried out this work.

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Purpose

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Contents

List of Figures

Abbreviations

1D ..... One Dimensional (modelling)
2D ..... Two Dimensional (modelling)
AEP ..... Annual Exceedance Probability
CFRAM ..... Catchment Flood Risk Assessment and Management
DoEHLG ..... Department of the Environment, Heritage and Local Government
FARL ..... FEH index of flood attenuation due to reservoirs and lakes
FB ..... Freeboard
FFL ..... Finish Floor Levels
FRA ..... Flood Risk Assessment
FSR ..... Flood Studies Report
FSU ..... Flood Studies Update
GSI ..... Geological Survey of Ireland
LHB ..... Left Hand Bank
OPW ..... Office of Public Works
PFRA ..... Preliminary Flood Risk Assessment
RFI ..... Request for Further Information
RHB ..... Right Hand Bank
RR ..... Rainfall-Runoff
SAAR ..... Standard Average Annual Rainfall (mm)
SFRA ..... Strategic Flood Risk Assessment
URBEXT ..... FEH index of fractional urban extent
WL ..... Water Level

1 Overview

1.1 Statement of Consistency

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. This FRA is in compliance and consistent with the Guidelines.

1.2 Terms of Reference and Scope

JBA was appointed to conduct a Flood Risk Assessment (FRA) for a proposed site in Stepaside, Co. Dublin.

1.3 Aims and Objectives

This study is being completed to provide a desk-based study of flood risk that will identify, collate and summarise information on the potential sources of flood risk to the site, with a focus on the primary source of flood risk. We will also comment on the scale and nature of the proposed development and the potential flood risk management and development requirements to achieve a successful planning application on the site:

The objectives are to:

- Review of flood history and previous published Flood Risk Assessment;
- Review of the fluvial flood extent mapping from the OPW, CFRAM;
- Review of information published by OPW in relation to potential surface water flooding at the site;
- Prepare a report indicting the key information retrieve on the history and potential sources of flooding to the site. Comment on the scale and nature of the proposed development, potential mitigation/ management measures and planning issues will also be provided.

Recommendations for development have been provided in the context of the OPW/DoEHLG planning guidance, 'The Planning System and Flood Risk Management'.

1.4 Development Proposal

The development will consist of: -

438no. 'Build-to-Rent' apartment units (154no. 1 bedroom units and 284no. 2 bedroom units) arranged in 9no. blocks ranging in height from 2 – 8 storeys over 2no. independent single level basements. Private patios / terraces and balconies are provided for some apartment units (not all units have a patio, terrace or balcony). Upper level balconies are proposed on elevations of all multi-aspect apartment buildings.

- Blocks A – D are located above Basement 1 (c. 6,002 sq. m gross floor area) and Blocks F – J are above Basement 2 (c. 5,058 sq. m gross floor area).
- Provision 1no. childcare facility (c. 514.9 sq. m gross floor area) in Block D.
- Provision of resident amenity space / communal areas (c. 1,455.7 sq. m gross floor area) in Block C and Block G.
- And all associated and ancillary site development, infrastructural, landscaping and boundary treatment works including: -
- New vehicular access to / from Basement 1 from Atkinson Drive and new vehicular access to / from Basement 2 from Thornberry Road.
- Provision of c. 9,799 sq. m public open space, including a public plaza onto Village Road and improvement works to existing open space area to the north of existing Griannan Fidh residential development.
- Provision of 350no. car parking spaces including basement parking, set down spaces for proposed childcare facility and repositioning of set down area on Atkinson Drive.
- Provision of 669no. bicycle parking spaces.

- Provision of 14no. motorcycle parking spaces.
- Communal bin storage and plant provided at basement level and additional plant provided at roof level.
- Provision of below ground wastewater storage tank (c. 500m3) and associated connection to the wastewater networks including ancillary above ground kiosk and appropriate landscaping on open space lands to the south of Griannan Fidh residential development.

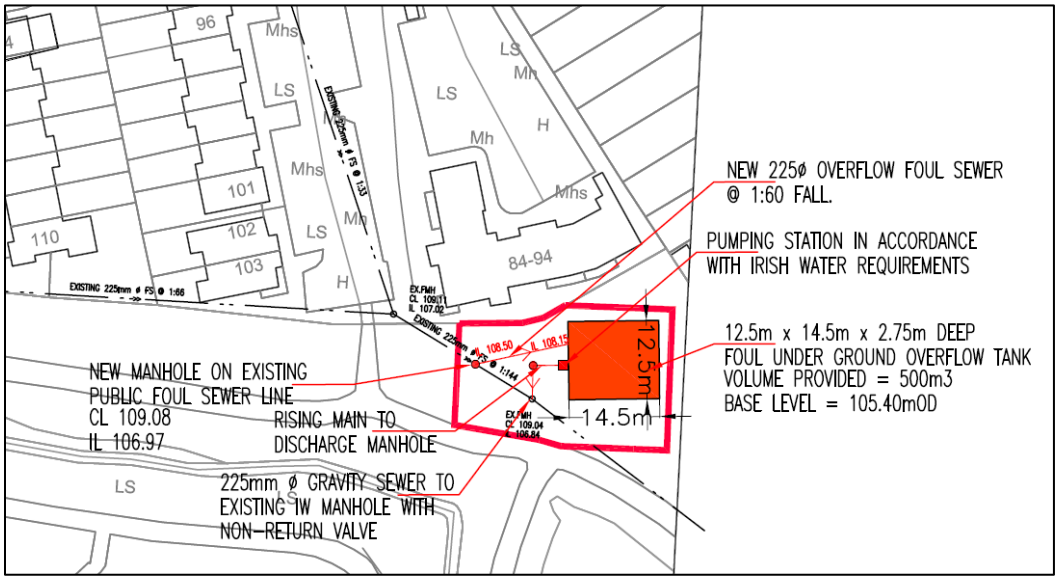
The site layout is displayed in Figure 1-1.

1.5 Report Structure

Section 2 of the report gives an overview of the site, its location, local watercourses, local topography and site geology. Section 3 contains information on flood history and identifies flood risk at the site. Flood Risk Mitigation and recommendations are given in section 4. Section 5 provides the conclusion.

Figure 1-1 Site Layout - Main Site

Figure 1-2 Site Layout - Foul Storage Tank



2 Site Background

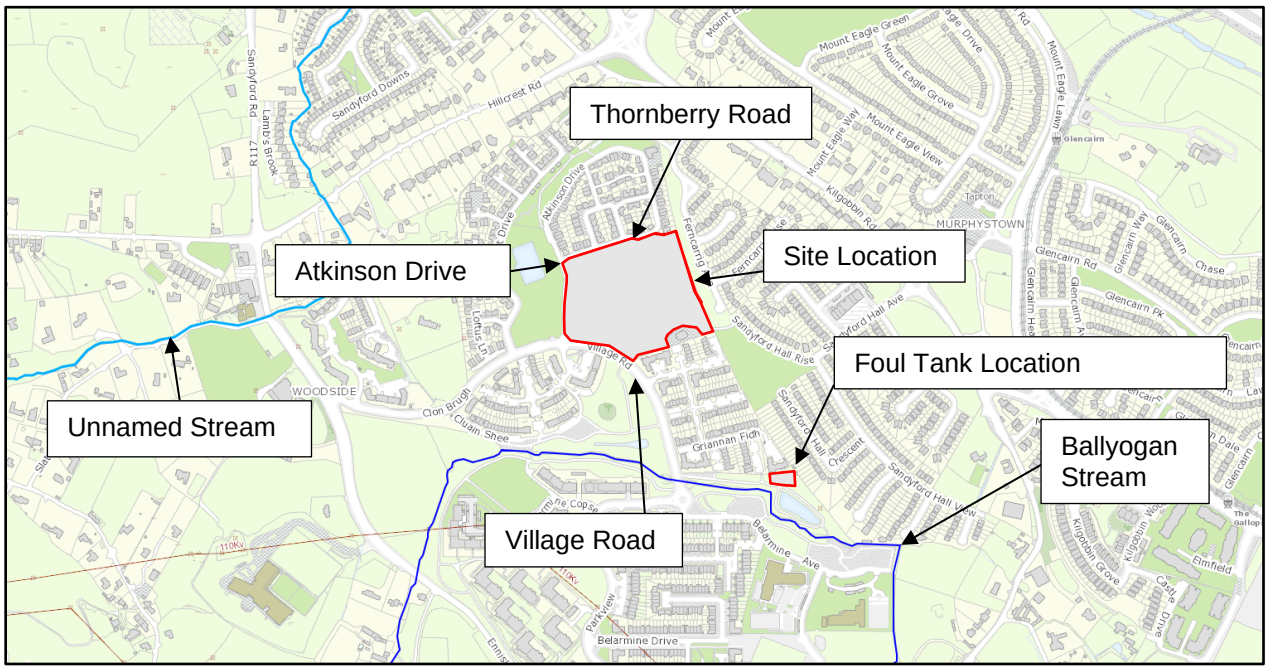
This section describes the development site including the relevant watercourses and the wider geographical area.

2.1 Location

The site is located approximately 700m south of the M50 in Aiken's Village, Stepaside, Dublin 18. The site is a brown field site currently used as a storage yard. The northern boundary runs along Thornberry Road with 2 to 3 story residential buildings on the opposite side. The eastern boundary is lined with mature/semi-mature trees. The southern boundary faces onto open space and a segment of the existing, curved Village Road. Atkinson Drive forms the western boundary, between the site and a large open space area.

A foul tank, which is part of the application, is located to the south east of the site, to the north of the Ballyogan Stream. See Figure 2-1.

Figure 2-1 Site Location



2.2 Site Topography

The development site is gradually sloping from north west to south east, dropping from a level of c. 129 mOD to c. 121 mOD.

2.3 Watercourses

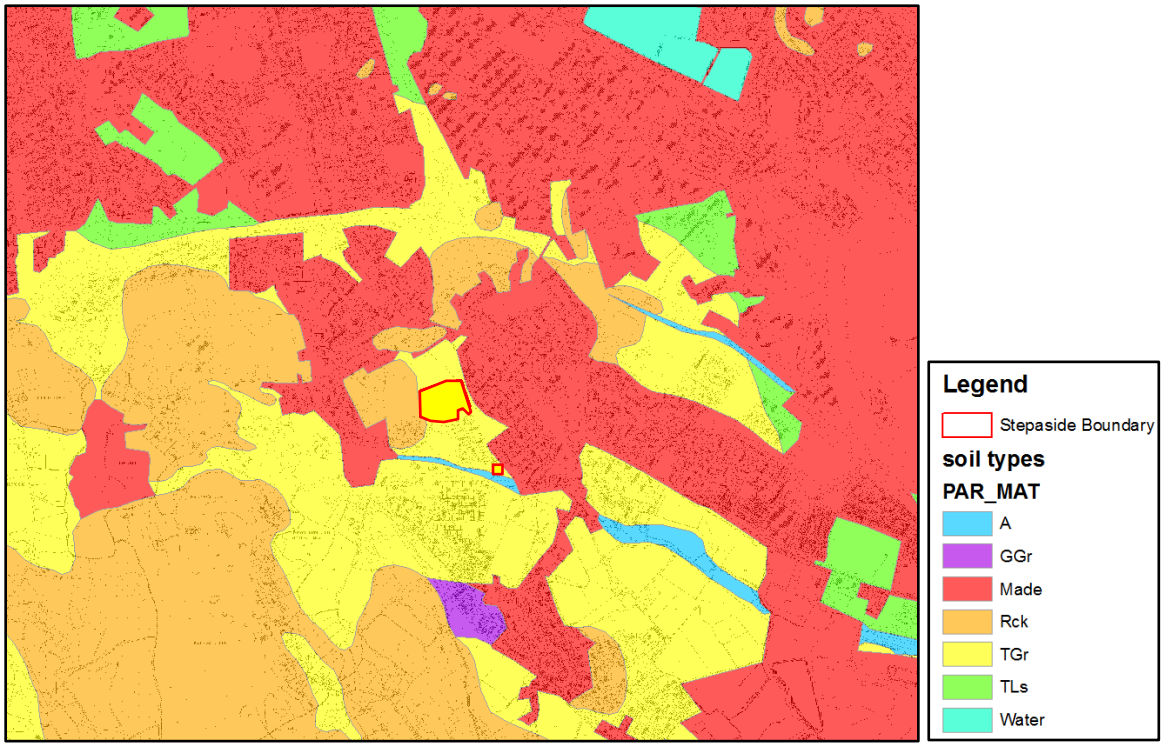
The nearest watercourse to the development site is Ballyogan stream which lies c. 170m south of the proposed site. There is also an unnamed stream c.330m west of the site. The foul tank is located 45m from the Ballyogan River at an elevation of 109mOD.

2.4 Site Geology

The groundwater and geological maps of the total site and surrounding area, provided by the Geological Survey of Ireland (GSI), have been studied and an extract of the subsoil map presented in Figure 2-2. The subsoil within the site has been identified as tills derived from granites. There is a strip of alluvium soil, which is the Ballyogan Stream corridor, c. 170m south of the main site. The underlying bedrock of the site is described as granite with muscovite phenocrysts. The groundwater vulnerability of the site ranges from 'extreme' in the west part of the site, to 'high' at the east part of the site. The subsoil permeability is classified as moderate at the east of the site which indicates a

depth to bedrock of 3-10m in that area. The west side of the site has a classification of 'extreme' for groundwater vulnerability, which indicates a depth to bedrock of less than 3m.

Figure 2-2 Subsoils in the Stepaside Area



3 Flood Risk Identification

An assessment of the potential and scale of flood risk at the site is conducted using historical and predicative information. This identifies any sources of potential flood risk to the site and reviews historic information. The findings from the flood risk identification stage of the assessment are provided in the following sections. Further details on the planning guidelines and technical concepts are provided in Appendix A.

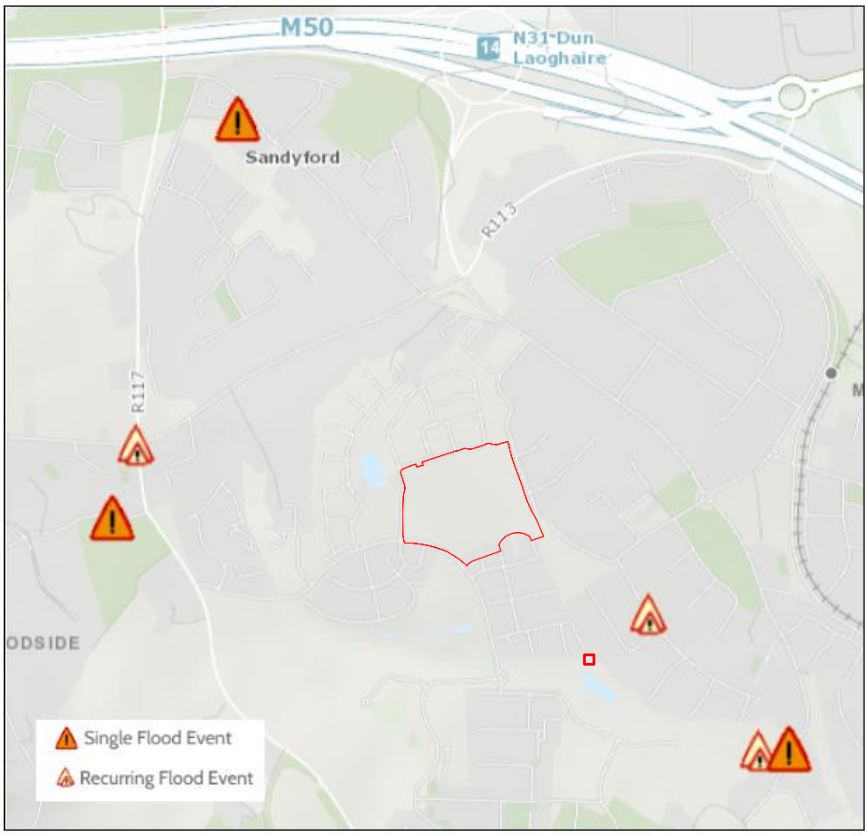
3.1 Flood History

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

3.1.1 Floodinfo.ie

The OPW host a national flood hazard mapping database that is now incorporated into www.floodinfo.ie, which highlights areas at risk of flooding through the collection of recorded data and observed flood events. See Figure 3-1 for historic flood events in the Stepaside area.

Figure 3-1: Past Flood Events



Review of the OPW's historic flood event map does not indicate any specific flooding within the site boundary. The flood events indicated on the website are only indicative and do not refer to the exact locations shown in Figure 3-1.

3.1.2 Internet Searches

An internet search was conducted to gather information about whether the site was affected by flooding previously.

A report published on the 14th of November 2014 on the RTE News website discusses a flood event resulting after torrential rainfall causing flooding across the East of the country. The Enniskerry Road at Aiken's Village was blocked according to the report.

3.2 Predictive Flooding

The Stepaside area has been subject to two OPW flood mapping or modelling studies;

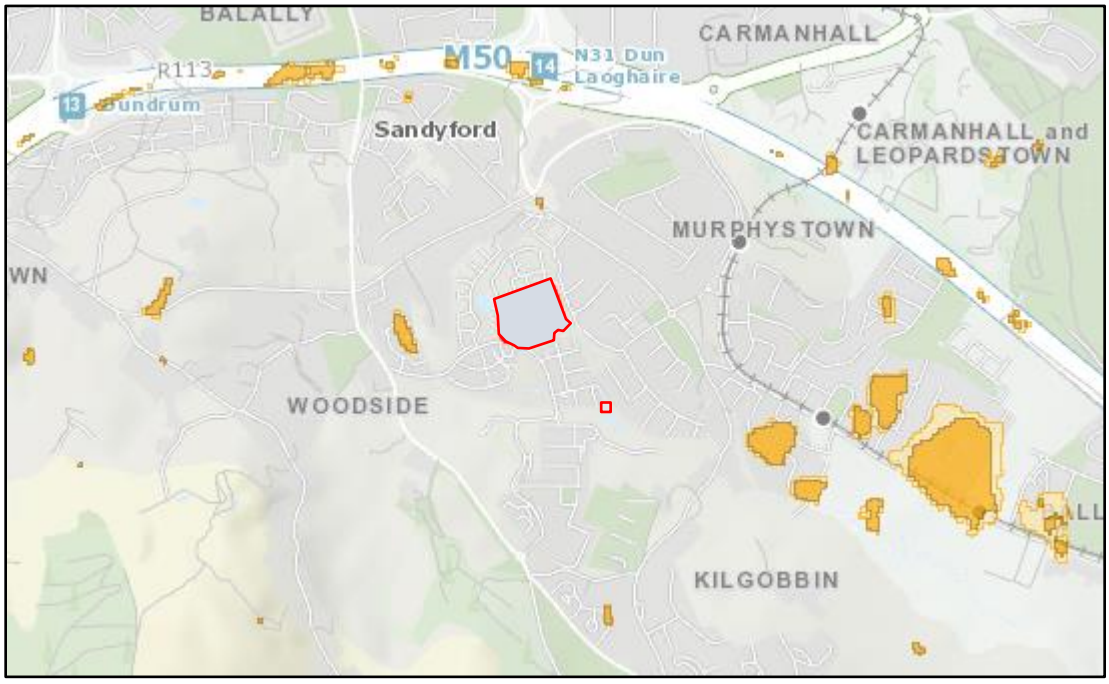
- OPW Preliminary Flood Risk Analysis (PFRA)
- Eastern Catchment Flood Risk Assessment and Management

3.2.1 OPW PFRA

The Preliminary Flood Risk Assessment (PFRA) is a requirement of the EU Directive (2007/60/EC). One of the PFRA deliverables is flood probability mapping for various sources: pluvial (surface water), groundwater, fluvial and tidal. The PFRA is a preliminary or 'indicative' assessment and analysis has been undertaken to identify areas potentially prone to flooding. The OPW PFRA study has largely been superseded by the CFRAM programme however, it does provide valuable information regarding pluvial and groundwater flooding.

As seen in Figure 3-2, the PFRA study highlights no pluvial or groundwater flooding at the proposed site.

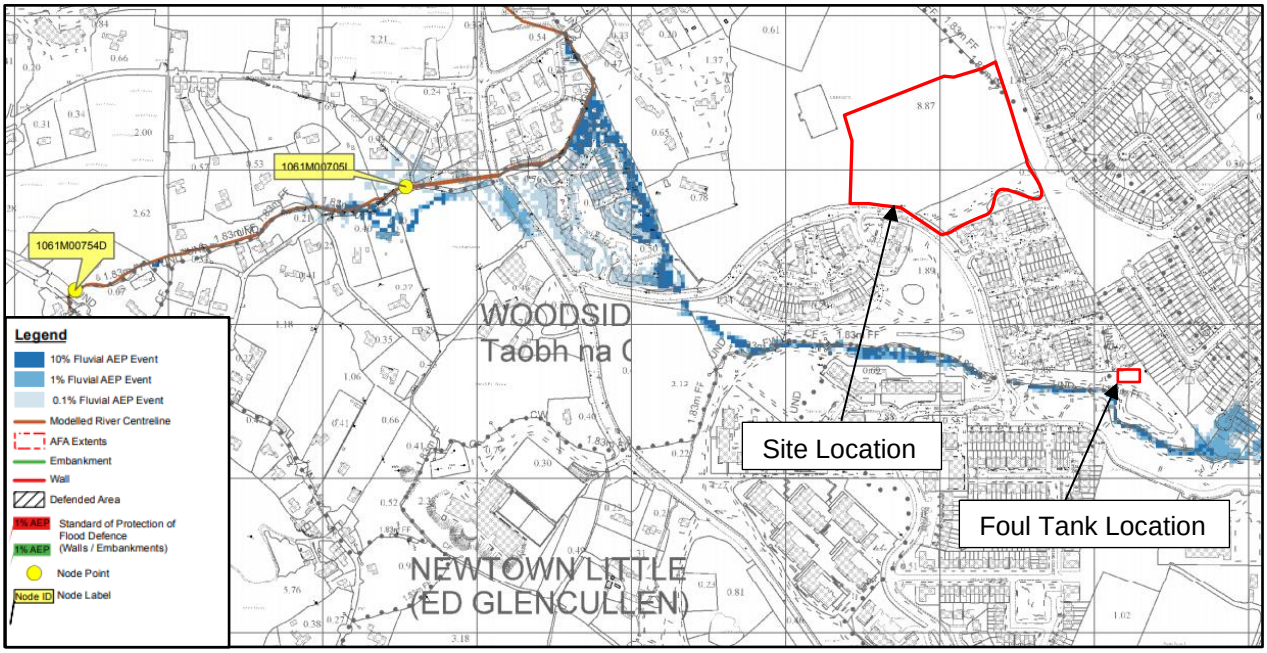
Figure 3-2 OPW PFRA Pluvial Map



3.2.2 Eastern CFRAM Flood Mapping (Fluvial).

The Eastern Catchment Flood Risk Assessment and Management (CFRAM) study commenced in June 2011 and ran until the end of 2016. The study involves detailed hydraulic modelling of the Ballyogan stream. The study currently provides the best available information on the site and supersedes the OPW PFRA mapping.

Figure 3-3 Eastern CFRAM Fluvial Flood Extents



As seen in Figure 3-3 above, the Eastern CFRAM predicative flood map indicates no fluvial risk to the proposed site and foul tank location for the 10%, 1% and 0.1% AEP events.

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 FRA, 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

Fluvial flooding occurs as a result of a watercourse's water level rising to a level high than its banks and therefore flowing overland on an area that is usually dry. As seen from the Eastern CFRAM Study, there is no fluvial flood risk indicated for the proposed site or the location of the foul storage tank.

3.3.2 Tidal

Stepaside is inland and therefore not affected by tidal flood events. Thus, has been screened out at this stage.

3.3.3 Pluvial/ Surface Water

Pluvial flooding is the result of rainfall-generated overland flows which arise before run-off can enter any watercourse or sewer. It is usually associated with high intensity rainfall. Review of the OPW PFRA mapping showed no risk of pluvial flooding to the site, or the location of the foul tank. Adequate storm water drainage systems will minimise the risk from pluvial flooding sources and we anticipate that any issues can be adequately dealt with on site during the design phase (stormwater management system).

3.3.4 Groundwater

Groundwater flooding is caused by the emergence of water originating from underground and is particularly common in karst landscapes. Water can emerge from either point or diffuse locations. The occurrence of groundwater flooding is usually very local and unlike flooding from rivers and the sea, does not generally pose a significant risk to life due to slow rate at which the water level rises. However, groundwater flooding can cause significant damage to property, especially in urban areas and pose further risks to the environment and ground stability.

Groundwater may be a flood risk to the west half of the site due to the low depth to bedrock levels, however, there is no historical flood event recorded of prolonged groundwater flooding.

The PFRA considered flooding from groundwater sources. The PFRA groundwater flood maps, which provide an indication of vulnerability to groundwater flooding, did not show any significant risk on the site.

3.3.5 Foul Water

Flooding from the foul water system can occur if the system capacity is exceeded.

Following consultations with Irish Water Engineers a Confirmation of Feasibility letter was received on 19-07-2022 which states that "a storage tank (c. 500m3) to mitigate the impact of storm water in the network is required. The storage tank will be required to cater for future development in the area arising from modelling carried out of the potential future zoned development lands within the collection catchment over a 10 – 15 year time horizon. These upgrade works are not currently on the Irish Water investment plan therefore, the applicant will be required to fund these upgrades.

Further detail on the proposed mitigation is provided in Section 4.2.

4 Flood Risk Assessment

4.1 Flood Risk

From reviewing the available sources of flooding outlined in Section 3, the site and the foul tank location are fully within Flood Zone C. This indicates a low risk of fluvial, pluvial, groundwater and coastal flooding (less than 0.1% AEP or 1 in 1000 chance of flooding in a given year). There was previously a risk of flooding identified from the foul water system due to the insufficient capacity of the network.

Mitigation measures will be incorporated into the proposed design to minimise the potential risk presented by pluvial flooding on the new hardstanding areas created on-site and flooding of the foul water system.

4.2 Mitigation

4.2.1 Site Layout and Finished floor levels

The proposed development is fully within Flood Zone C. It is recommended FFLs are raised by a minimum of 150mm above local hardstanding ground to provide protection against surface water exceedance or failure of surface water drainage systems.

4.2.2 Access and Egress

The main site entrance is located on Village Road. Vehicular entrances to the site and underground carparks will be via Thornberry Road to the north of the site, and Atkinson Drive to the west. Review of the Eastern CFRAM mapping confirms that all roads providing access to the site lie within Flood Zone C and therefore, access will not be affected. Due to low risk of flooding, no specific measures are required for site access roads and will allow emergency access to the building during a 0.1% fluvial event.

4.2.3 Surface Water Design

A stormwater management system will collect surface water from hardstanding areas which will reduce the risk of surface water flooding to the site. Full details of the Drainage Design is provided under the Drainage Design Report submitted by Kavanagh Burke as part of the wider planning application

As stated in the design report; The proposed development will form a 2.81ha sub-catchment C in the overall attenuation catchment area of 8.24ha (consisting of the proposed and existing/occupied developments). The previously calculated QBAR of 6.47l/s/ha results in an allowable outflow of 53.3l/s from the overall catchment (sub-catchments A, B and C). Attenuation storage for each of the sub-catchments will remain to be arranged in series as per previously granted planning applications Ref. D16A/0511 & D10A/0440. The existing attenuated flow from Sub-catchment A discharges to the surface water sewer system in Sub-catchment B (details of the existing attenuation pond are shown on drawing D1636-D2). The surface water drainage system for Sub-catchment B & C will be attenuated in proposed and existing underground concrete storage tanks and blue roofs.

The surface water runoff generated from the proposed development will discharge from site through an existing storm water drainage network and through an existing flow control device (limiting the site runoff to QBAR= 53.3l/s) using an existing connection to the Local Authority storm water drainage network along Village Road. Surface water attenuation incorporating interception storage in the proposed extensive green roof (on top of blue roof storage system) and attenuation storage in both existing and proposed underground storage tanks is planned for this development. To allow for maintenance of the underground attenuation system, manholes are provided for access for removal of any possible debris in the event of such debris passing through the proposed trapped gullies.

In addition, a vortex type silt trap/debris separator and the proprietary petrol interceptor are proposed to remove any silts, debris and possible hydrocarbons before the storm water runoff leaves the site and enters Local Authority drainage.

A cut-off infiltration trench to the north of Block E has been designed to prevent overland flows for the extreme rainfall events from discharging from the site unattenuated.

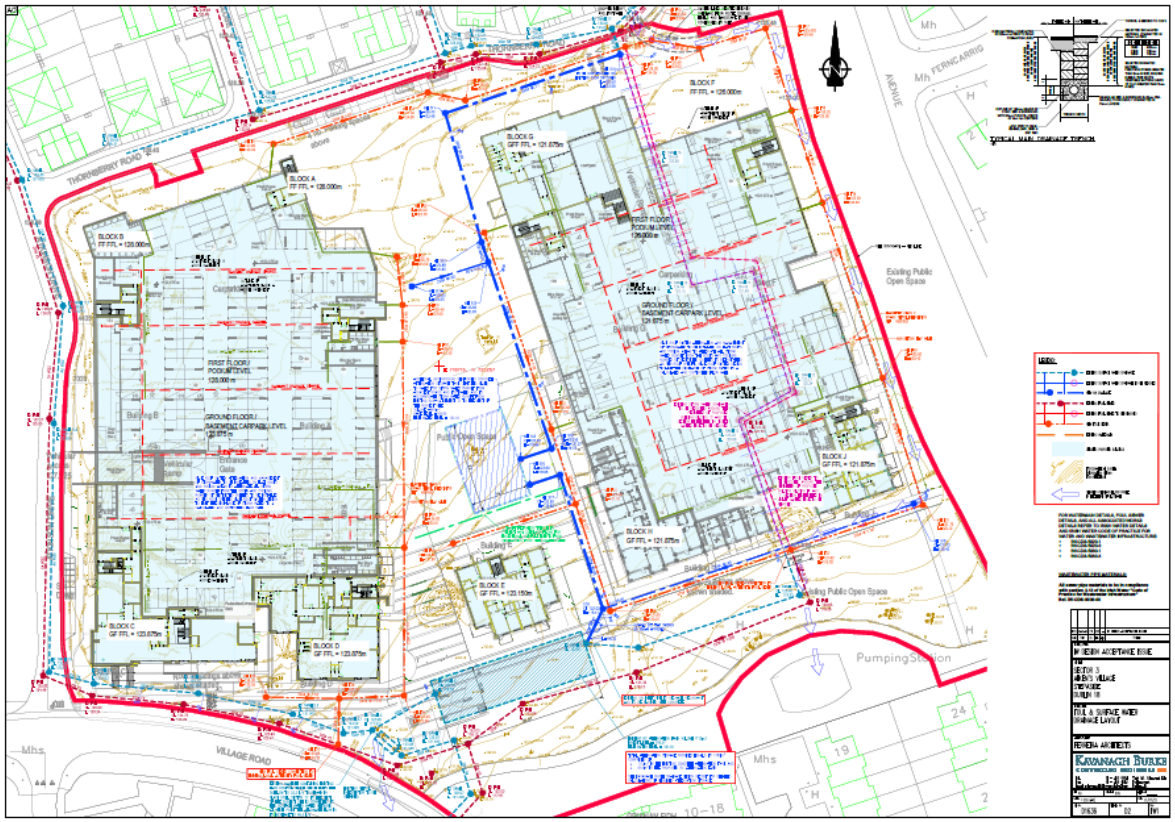
All private storm drainage will be connected through individual connections to storm water pipes located in the public space. The SW drainage is shown on the Drainage Layouts Drg. Ref. D1636 D2.

In previous consultations with Elaine Carroll of Dun Laoghaire Rathdown Drainage Department a request was made to provide additional attenuation volume on the site to accommodate for an existing occupied development in Catchment D (as originally planned in planning application Ref. D10A/0440), which currently discharges to the adjoining Cluain Shee development. It is proposed to provide the attenuation and flood storage of all storm water runoff up to 1 in 100-year return period events of all duration on the proposed site as shown on the accompanying Kavanagh Burke drainage layout D1636-D2. The total volume of the attenuation and flood storage for the proposed development (catchment C) and catchments B and D is 1780m^3. This storage will be provided via the existing 1113m^3 underground concrete tank located to the south of block E and a proposed new 667m^3 underground concrete tank located in the open green space between the two main blocks.

The surface water attenuation and retention system was designed for a 1% AEP + 10% climate change event in accordance with the GDSDS.

A sustainable urban drainage (SuDS) approach has been used in designing the stormwater management system in accordance with CIRIA Design Manuals C753 and C609, including blue roofs. This is in compliance with the DLRCC requirements as laid out in the county development plan. A formal stormwater audit will be completed for the design in accordance with DLRCC requirements.

Figure 4-1: Proposed Storm and Foul water systems

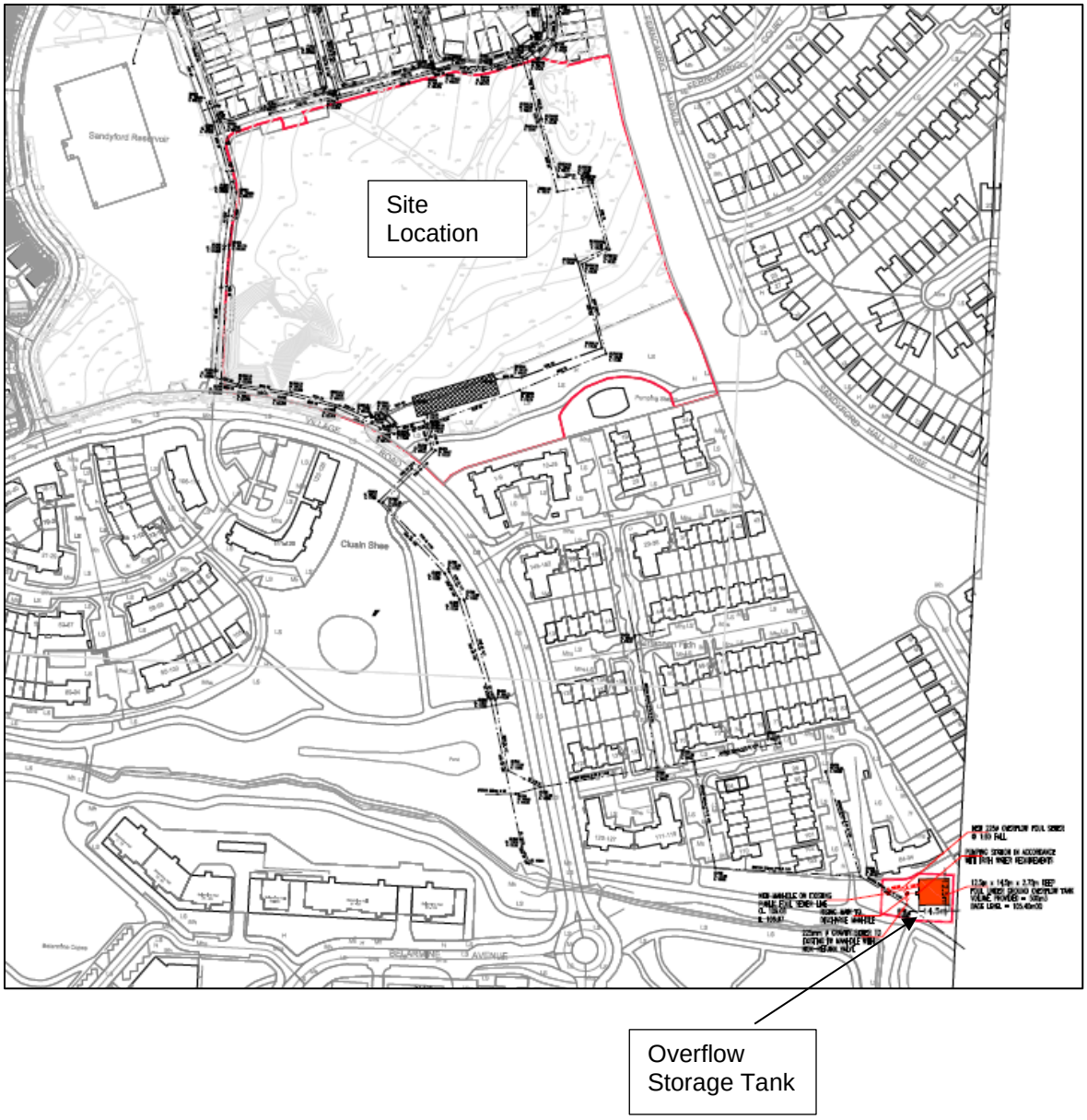


4.2.4 Foul Water System Design

The existing foul water system requires upgrading to mitigate existing problems with the network as well as to facilitate the proposed development. The upgrade works required will consist of the construction of an underground overflow storage tank with a volume of 500m³ to avoid further disruption to the facilities and residents in the area, this is stated in the Confirmation of Feasibility letter from Irish Water dated 19/07/2022. DLRCC have given consent to include these lands in the planning application and to carry out the necessary works if permission is granted.

The proposed location for this tank is on public open space south of the subject site as shown in Figure 4-2. Further details of the proposed location and proposed tank are shown on drawings D1636-D1000 and D18, as submitted by Kavanagh Burke, under the wider planning application. The proposed overflow tank will provide overflow storage and reduce the volume of storm surge contributing to the foul discharge during extreme storm events, therefore reducing the flood risk.

Figure 4-2: Location of Proposed Overflow Tank



4.3 Residual Risks

Residual risks are the risks remaining after all risk avoidance, substitution and mitigation measures have been taken. The flood risk assessment identifies the following as the main sources of residual risk to the proposed development:

- Climate Change,
- Exceedance of the stormwater system
- Failure of the upstream stormwater attenuation pond.

4.3.1 Climate Change

The surface water attenuation system has been designed for a 1% AEP event plus a 10% allowance in the attenuation tank volume to account for climate change.

4.3.2 Stormwater

A well designed stormwater drainage system would ensure that residual flood risk to the site is low. In the event of an extreme rainfall event there is a risk of stormwater volume exceeding the capacity of the drainage system of the site. There is also a risk to the site in the unlikely event of the failure, collapse or blockage of the stormwater systems, more specifically the risk of failure of the upstream (third party) attenuation storage area (in sub-catchment A) was considered, at the request of DLRCC.

To mitigate the risk of failure of the third party sub-catchment, Kavanagh Burke has assessed the attenuation pond and confirmed that the capacity is appropriate. The pond has a capacity of over 600m^3 and drains an effective impermeable area of 17,000m^3 the storage area has recently had the surrounding bund constructed.

In order to assess the residual risk of the pond, the 100 year and 100 year + 20% climate change storm events were tested using a hydraulic model built based on detailed survey information (FFLs and survey points along Hyde Road) collected in October 2020, which were stamped on top of the LiDAR together with the proposed development.

The full duration of the storm hyetograph was applied at the pond location, assessing the most conservative scenario, namely the hydrobreak blockage occurs right at the start of the rainfall event, ensuring the full storm volume is spilled within the pond.

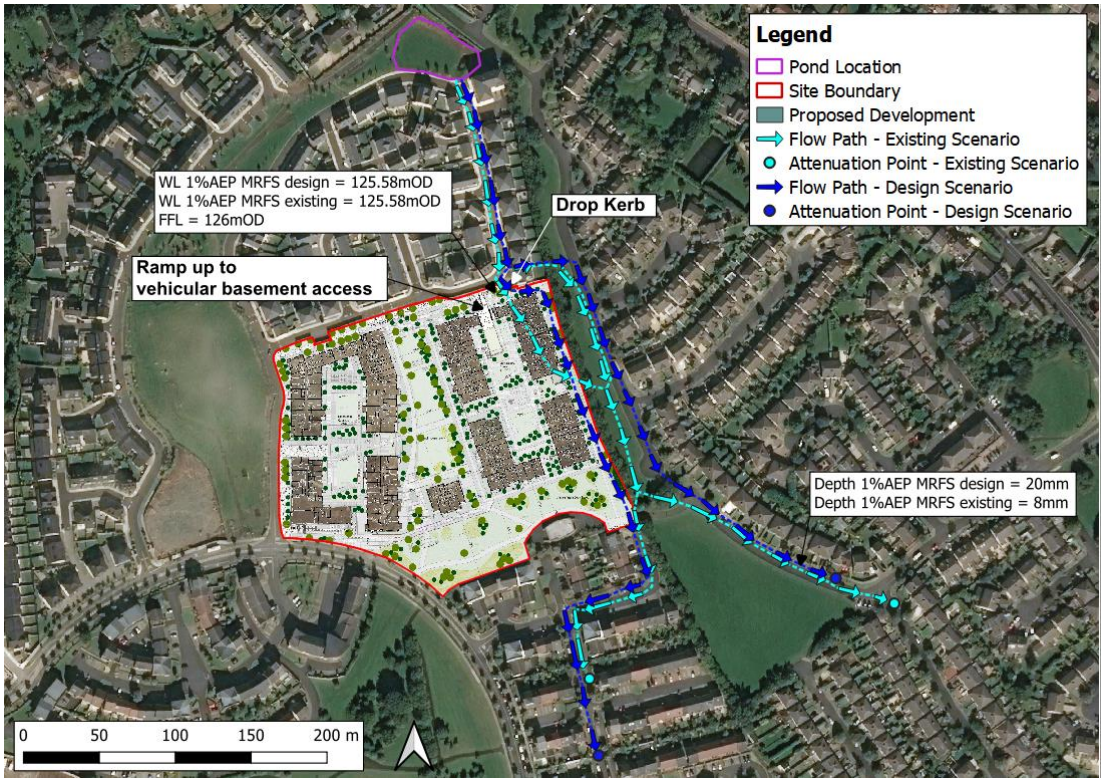
The hydraulic model results show that in an event of a hydrobreak blockage, the bund around the pond is able to accommodate entirely the 100 year storm event, the water levels within the pond being 126.64mOD, while the spill level is 126.78mOD.

Approximatively 85% of the 100 year MRFS storm volume is contained within the bund, with the remaining 15% being overtopped by 40mm, resulting in shallow overland flows. The flow path would form in a southerly direction, being split in 2 parts: along Hyde Road, towards Block G & F (and the basement entrance) of the proposed development and along Ferncarrig Ave. Both the pre-development and post-development scenarios were modelled and the overland flow routes and the attenuation points are presented in Figure 4-3.

To facilitate overland flow, a dropped kerb to the north of Block F and preferential fall will route flows to around and to the east of Block F, while a ramp up in the basement access will prevent ingress into the basement car park.

The modelled water level at site location is 125.58mOD, 420mm below the finished floor level of Block F (126mOD). Therefore, the proposed development is at low risk and it does not increase the flood risk elsewhere in the event of a hydrobreak blockage at the pond north of the site.

Figure 4-3 Overland flow route - 100yr Storm + Climate Change (MRFS)



The existing attenuation tank located right to the south of block E is part of the stormwater system of the proposed development, providing an attenuation storage volume of 985m^3. In the event of a tank attenuation surcharge, the exceedance flows would spill onto the Village Rd and flow in a southernly direction towards the Kilgobbin Stream, as presented in Figure 4-4 below. The proposed development is located to the north of the attenuation tank, on higher ground, therefore it would not be at risk and it does not increase the risk elsewhere in the event of a tank surcharge.

Figure 4-4 Overland flow route - southern attenuation tank (nominal return period)

5 Conclusion

JBA Consulting has undertaken a Flood Risk Assessment for the proposed residential development complex in Stepaside Co. Dublin.

From reviewing the available sources of flooding, the site, and all access roads have been shown to be within Flood Zone C, and at low risk of flooding from fluvial or coastal sources. There is a risk of flooding from the foul water system due to the current capacity of the local network.

A stormwater management system has been designed in accordance with DLRCC and GDSDS requirements to manage the risk of direct rainfall within the site. As per the requirements the stormwater system will ensure that there will be no increased risk of flooding due to the proposed development and the stormwater audit has been completed with a clean bill of health.

In order to reduce the risk of flooding from the foul water system, upgrades to the network are required. An underground overflow storage tank with a volume of 500m³ has been proposed to reduce the foul discharge during extreme storm events therefore reducing the flood risk. The site of the storage tank is at low risk of flooding. Once planning permission is granted then Kavanagh Burke will make a connection application to Irish Water who will then proceed to instal the tank.

Residual risks have also been considered. The main residual risk to the development is the potential failure of the of the stormwater drainage system. To manage the risk of inundation to the site, FFLs of 150mm above local hardstanding ground have been proposed. Provision for the management of the overland flows from the north has been managed by an additional ramp up to the basement and a drop kerb to the east, hydraulic modelling has verified this approach and there is no increase is risk to third parties as a result of the development.

The Flood Risk Assessment was undertaken with The Planning System and Flood Risk Management guidelines and is in agreement 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 (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.

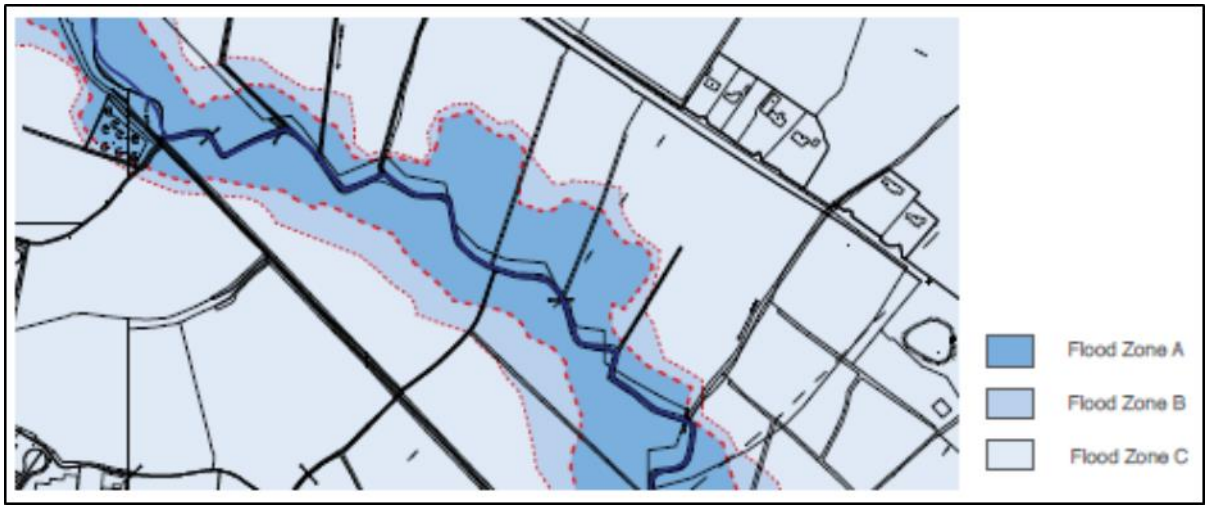
Return Period (years)	Annual Exceedance Probability (%)
2	50
10	10
20	2
100	1
200	0.5
1000	0.1

A.2 Flood Zones

Flood Zones are geographical areas illustrating the probability of flooding. For the purposes 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

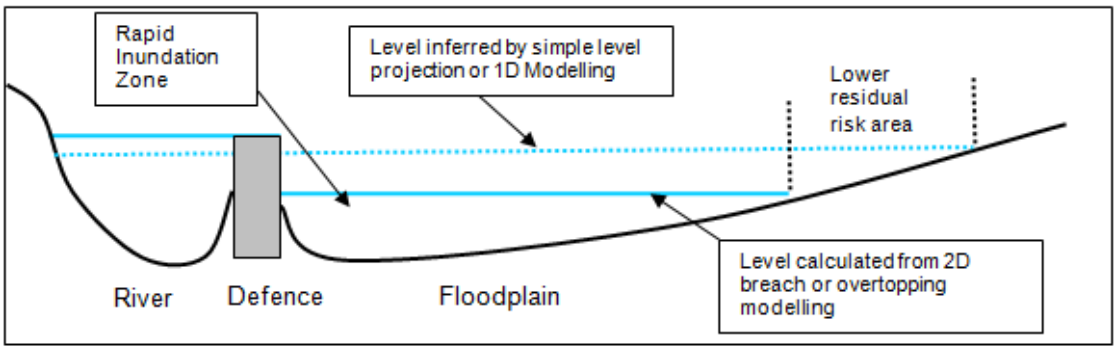
Consequences of flooding depend on the hazards caused by flooding (depth of water, speed of flow. Rate of onset, duration, wave-action effects, water quality) and the vulnerability of receptors (type of development, nature, e.g. age-structure of the population, presence and reliability of mitigation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

The 'Planning System and Flood Risk Management' provides three vulnerability categories, based on the type of development, which are detailed in table X of the guidelines, and are summarised:

- **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 is known as residual risk:



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