Prussia Street, Grangegorman East, Dublin 7, Flood Risk Assessment

February 2024

Prepared for:
Horgan Lynch

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Document Status

Issue date	27 February 2024
Issued to	Horganlynch
BIM reference	MLM-JBAI-XX-XX-RP-HO-0001-S0-P01.01
Revision	A3-C01
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Contents

List of Figures

List of Tables

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 of student accommodation located in townland of Grangegorman East, Dublin 7. The report was prepared in response to a request by Horganlynch 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". 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 client is looking to redevelop the former IDA site on Prussia Street, Grangegorman East, Dublin 7. The site covers an area of 0.588 ha and comprises two apartment blocks with the purpose of student accommodation. The proposed site layout is displayed in Figure 1-1.

The scope of the development comprises of:

- Demolition of the existing structures on the site
- Construction of a large-scale residential development consisting of a Student Accommodation scheme with 373 no. student bedspaces, a café and all other ancillary site development works.

The proposed development consists of 2 no. apartment blocks ranging in height from 3 to 5 storeys and a terrace of 6 no. studio units and all ancillary development works.

Figure 1-1 Site plan

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 initial assessment of flood risk and mitigation measures. Conclusions are provided in Section 5.

2 Site Background

This section describes the proposed development site located on Prussia Street, including watercourses, geology, and wider geographical area.

2.1 Location

This section describes the background information of the proposed redevelopment of the former IDA site on Prussia Street in Dublin 7, including adjacent drainage channels, watercourses and its wider geographical area. The site currently comprises of residential properties, two apartment blocks, warehouses, engineering buildings and a garage.

2.2 Watercourses

The River Liffey is the main hydrological feature in the area. The Liffey rises in the Wicklow mountains where it flows for 132km through Wicklow, Kildare and Dublin towards Dublin Bay, and has a catchment area of c. 1,256 km^2. It flows in an easterly direction 930m south of the site towards the Dublin bay.

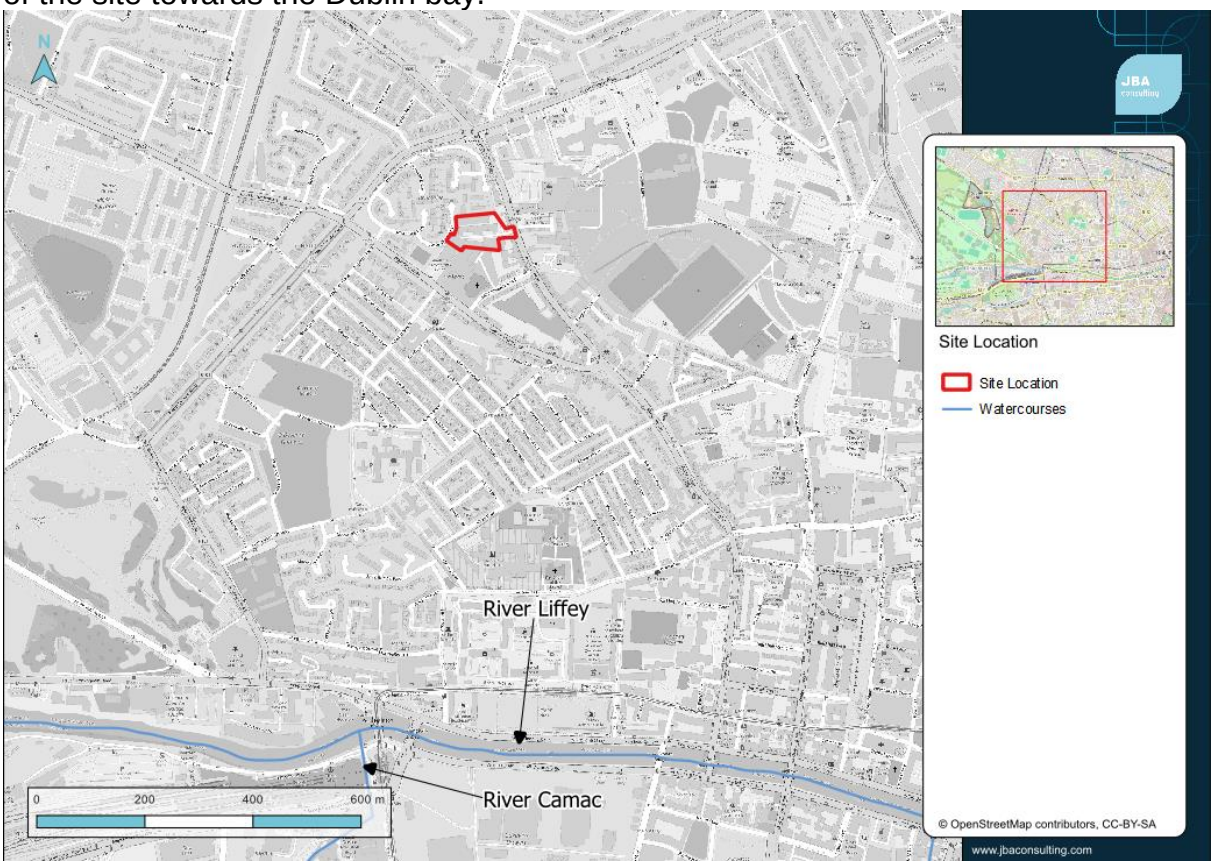


Figure 2-1:Watercourses and Site Location

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 Calp, described as dark grey to black limestone & shale. The subsoil at the site is made ground.

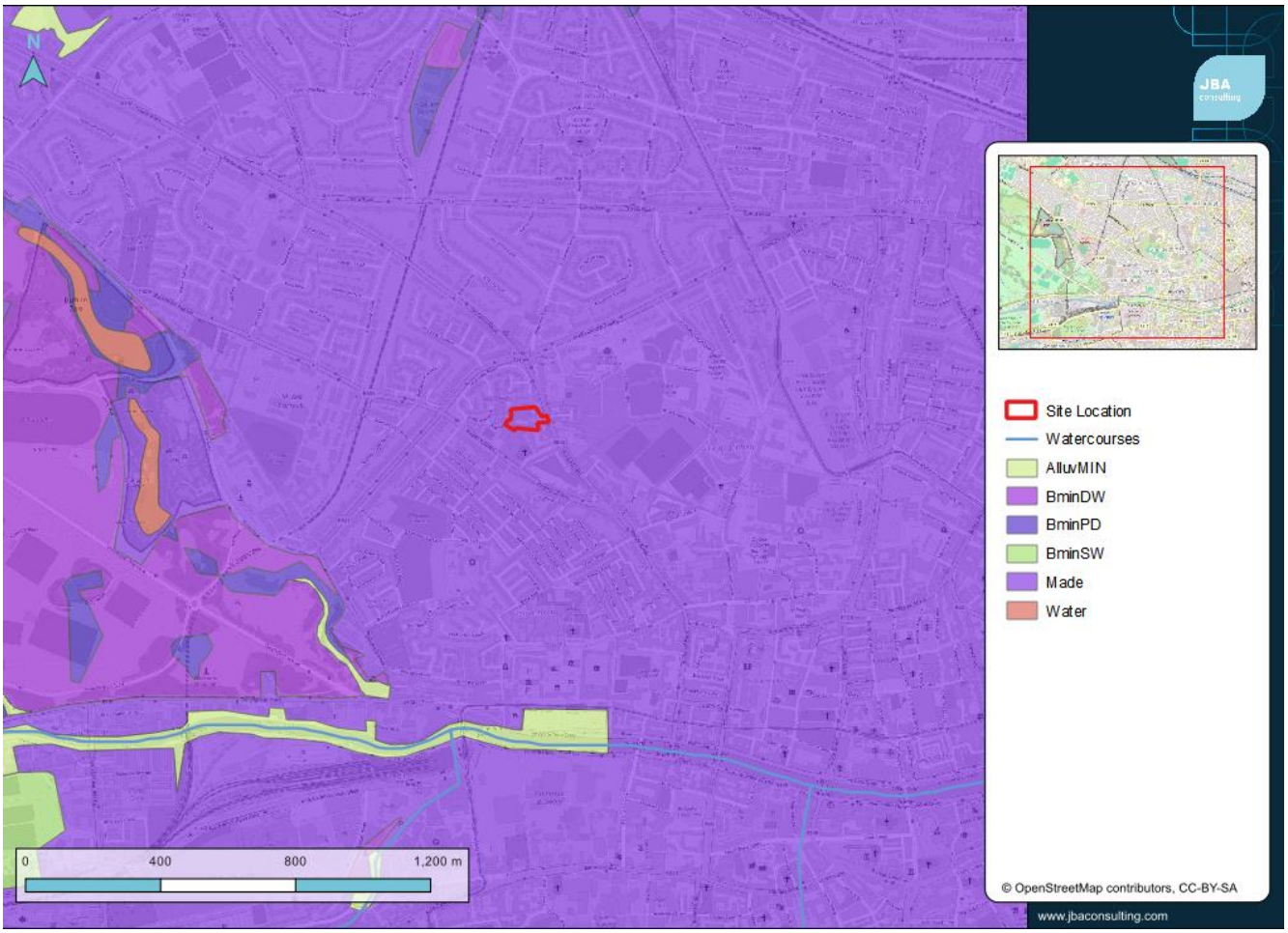


Figure 2-2: Quaternary Sediments Map

2.4 Local Groundwater Vulnerability

The GSI groundwater vulnerability maps were available for review. The groundwater vulnerability on site has been classified as `Low` meaning groundwater here has low vulnerability to contamination by human activities. There were no areas of surface water flooding from the Winter 2015 / 2016 flood event identified on site. The Winter 2015 / 2016 Surface Water Flooding mapping shows fluvial (rivers) and pluvial (rain) floods during the Winter 2015 / 2016 flood event and was developed as a by-product of the historic groundwater flood map. There were no historic or predictive groundwater flood extents identified on site or nearby. The permeability of the subsoil overlaying the bedrock is classed as 'Low', which implies a depth to bedrock of greater than 10m.

2.5 Local Topography

A site survey was undertaken LiDAR levels, courtesy of the Geological Survey Ireland (GSI) and Office of Public Works (OPW) show that there is a general south west to north east fall across the site. The LiDAR reviewed was the OPW NASC Digital Terrain Model (DTM) LiDAR, which has a resolution of 2, and an RMS error within +/- 200mm. The data was captured in 2011. Refer to Figure 2-3.

A topographic survey was also taken at the site indicates site levels fall from 28.85mOD at the south west of the site, to 25.74mOD at the south east of the site.

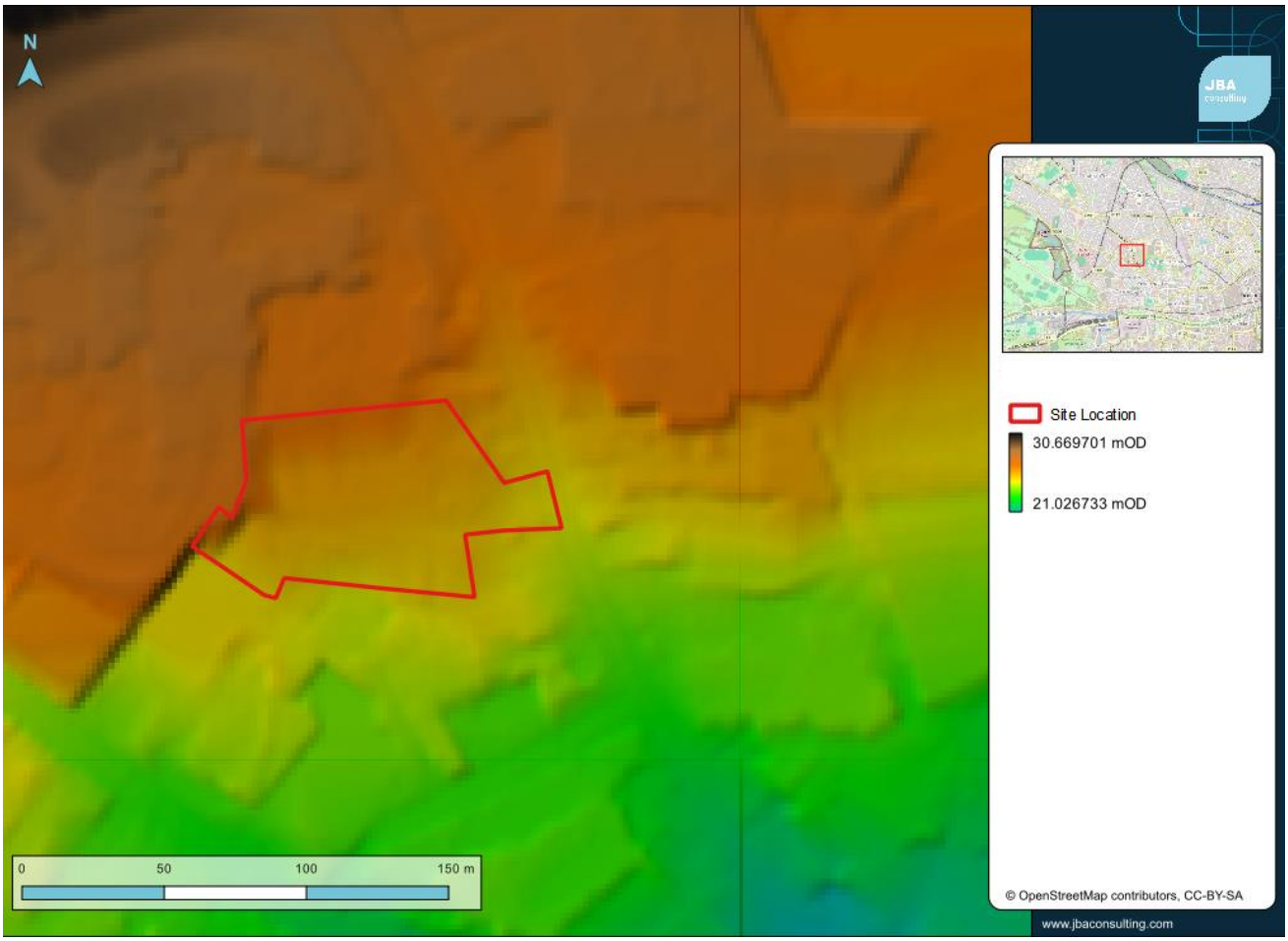


Figure 2-3: Local Topography[1]

1 (Geological Survey Ireland & the Office of Public Works) licensed under a Creative Commons Attribution 4.0 International (CC BY 4.0) licence.

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. The website provides significant national data that there are multiple reports of flooding along the Liffey, however Grangegorman East, including the site are unaffected by these flood events. The closest events to the site are:

- Flood ID-13525: Flooding in Dublin City on 15/06/2016. Surface water flooding due to heavy rainfall.
- Flood ID- 13583: Flooding in Dublin City on 22/11/2017. Surface water flooding due to heavy rainfall.

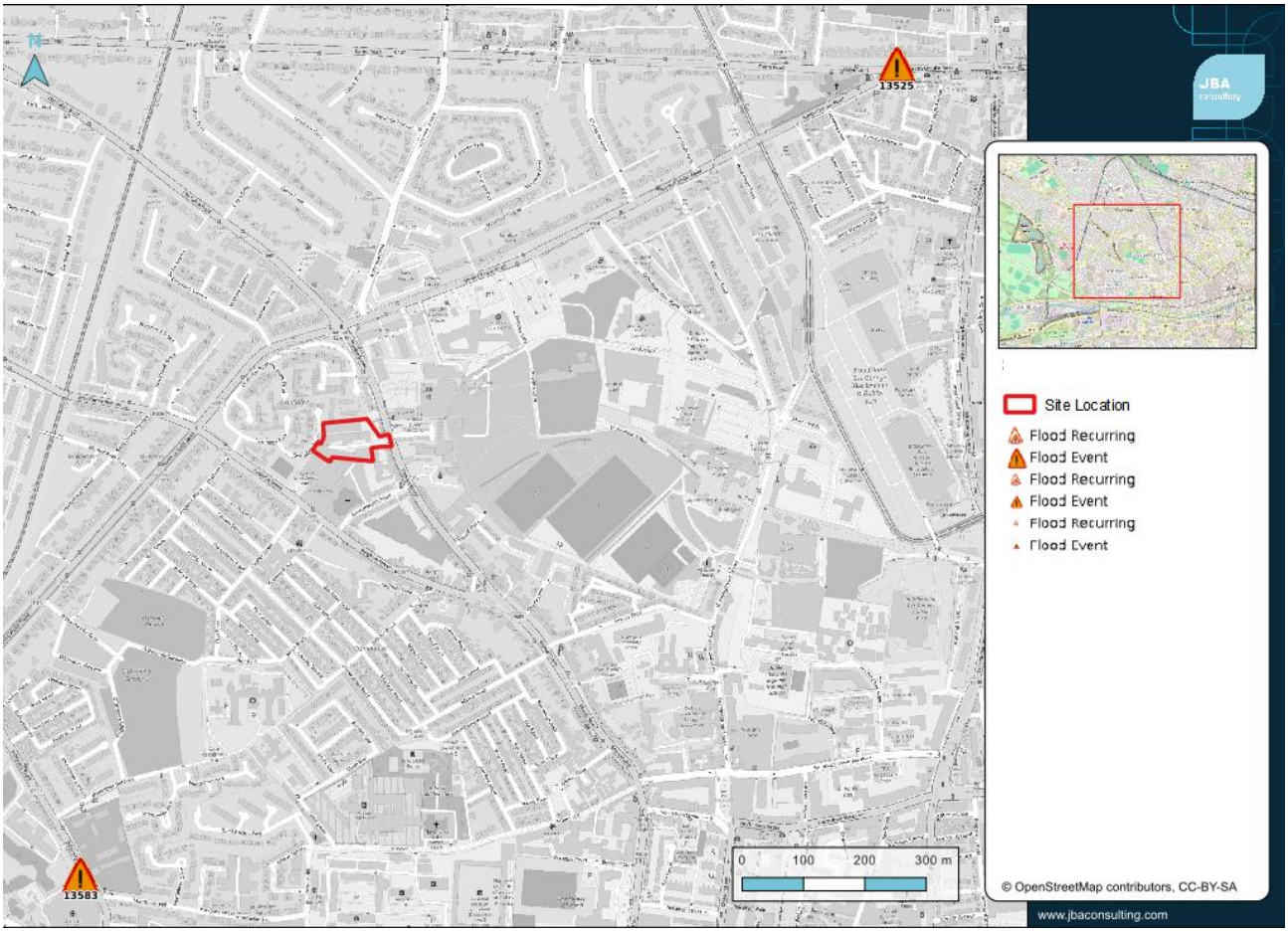


Figure 3-1: Past Flood Event Points

3.1.2 Internet Searches

An internet search was conducted to gather information about whether the site was affected by flooding previously and no flooding was reported at the site or on Prussia Street. Manor Street, which lies c. 350m to the south of the site, was affected during the 2011 flooding in Dublin City. The road itself was inundated and properties were unaffected.

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.

- The Dublin City Development Plan 2022-2028
- Eastern Catchment Flood Risk Assessment and Management (ECFRAM) Study
- National Indicative Fluvial Mapping (NIFM) study
- The Flood ResilenCIty Project

3.2.1 The Dublin City Development Plan 2022-2028

The Dublin City Development Plan (DCDP) has sought to proactively manage flood risk in the city in accordance with the EU Flood Directive 2007/60/EC. A Strategic Flood Risk

Assessment for the DCDP 2022-2028 was carried out by JBA Consulting in accordance with the requirements of 'The Planning System and Flood Risk Management - Guidelines for Planning Authorities' (2009). The SFRA provides an assessment of all types of flood risk within the county. Figure 3-2 depicts an excerpt of the Flood Zone Mapping for the Grangegorman area, with the site location in red.

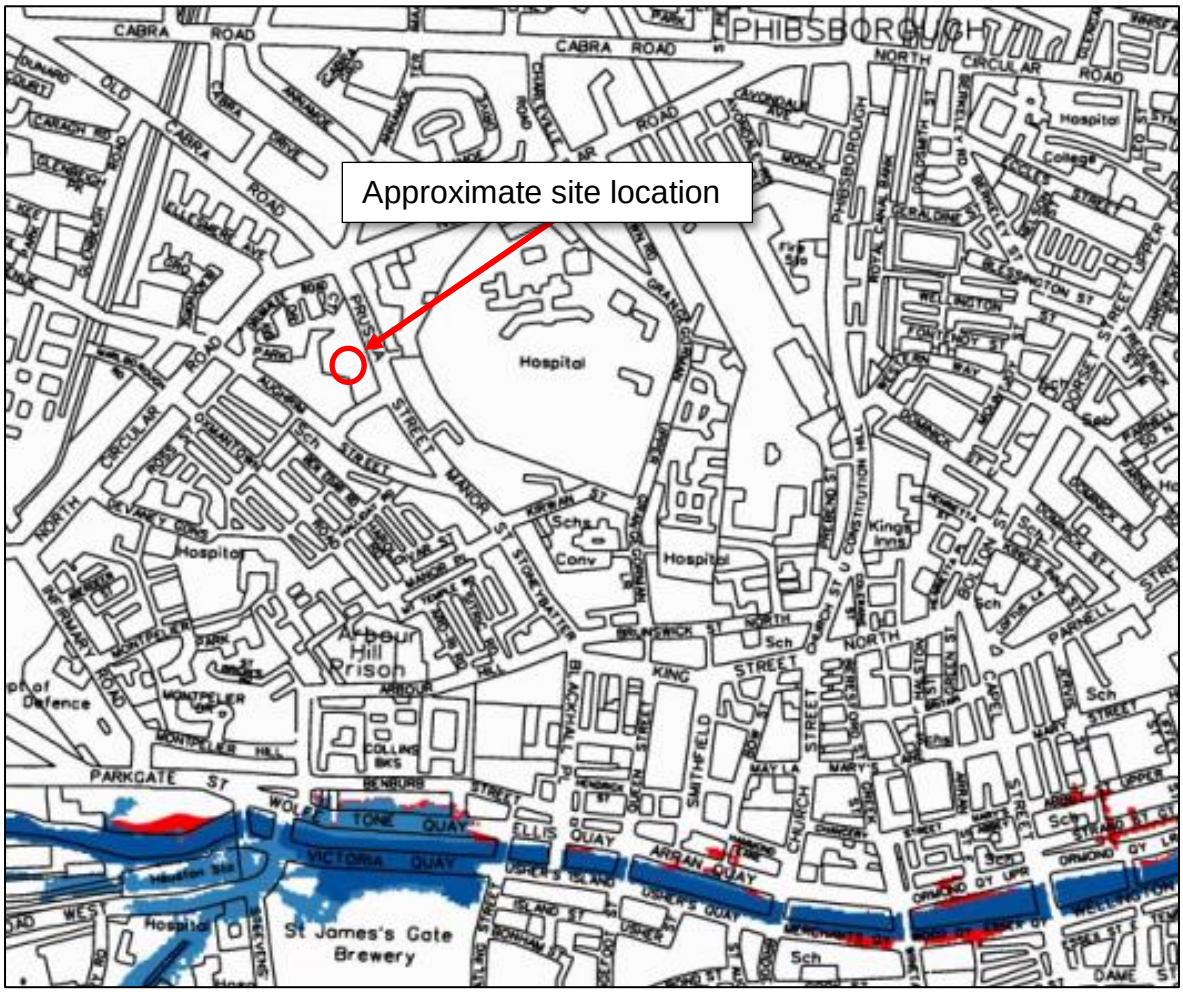


Figure 3-2 Dublin City Council Development Plan SFRA Flood Map

3.2.2 National Indicative Fluvial Mapping 2021 study

The OPW hosts the National Indicative Fluvial Mapping (NIFM) study on the floodinfo.ie portal. This fluvial mapping shows the modelled extent of lands that might be flooded by rivers during a theoretical flood event with an estimated probability of occurrence for watercourses not covered by the CFRAM AFAs. This predictive flood mapping replaces the superseded OPW PFRA study and covers fluvial watercourses with catchments greater than 5 sq.km.

As the flood mapping in the Dublin 7 area is already covered to CFRAM standard, the NIFM mapping has not been considered any further.

3.2.3 Eastern CFRAM

The Eastern Catchment Flood Risk Assessment and Management Study (SE CFRAM) commenced in 2011 and was finalised in 2016. The study involves detailed hydraulic modelling of rivers and their tributaries. Within the subject area, the CFRAM targeted areas of significant flooding. Finalised flood maps for the 10%, 1% and 0.1% AEP are publicly available through the CFRAM Study website and floodinfo.ie. The Eastern CFRAM study is the most detailed flood mapping study to be carried out in the area. Completed in 2016, fluvial modelling was carried out on the Liffey and its tributaries.

Figure 3-3 displays an extract from the Eastern CFRAM fluvial flood maps for the area while coastal flood maps are displayed in Figure 3-4. The site is shown to be at low risk of flooding from fluvial and coastal sources.

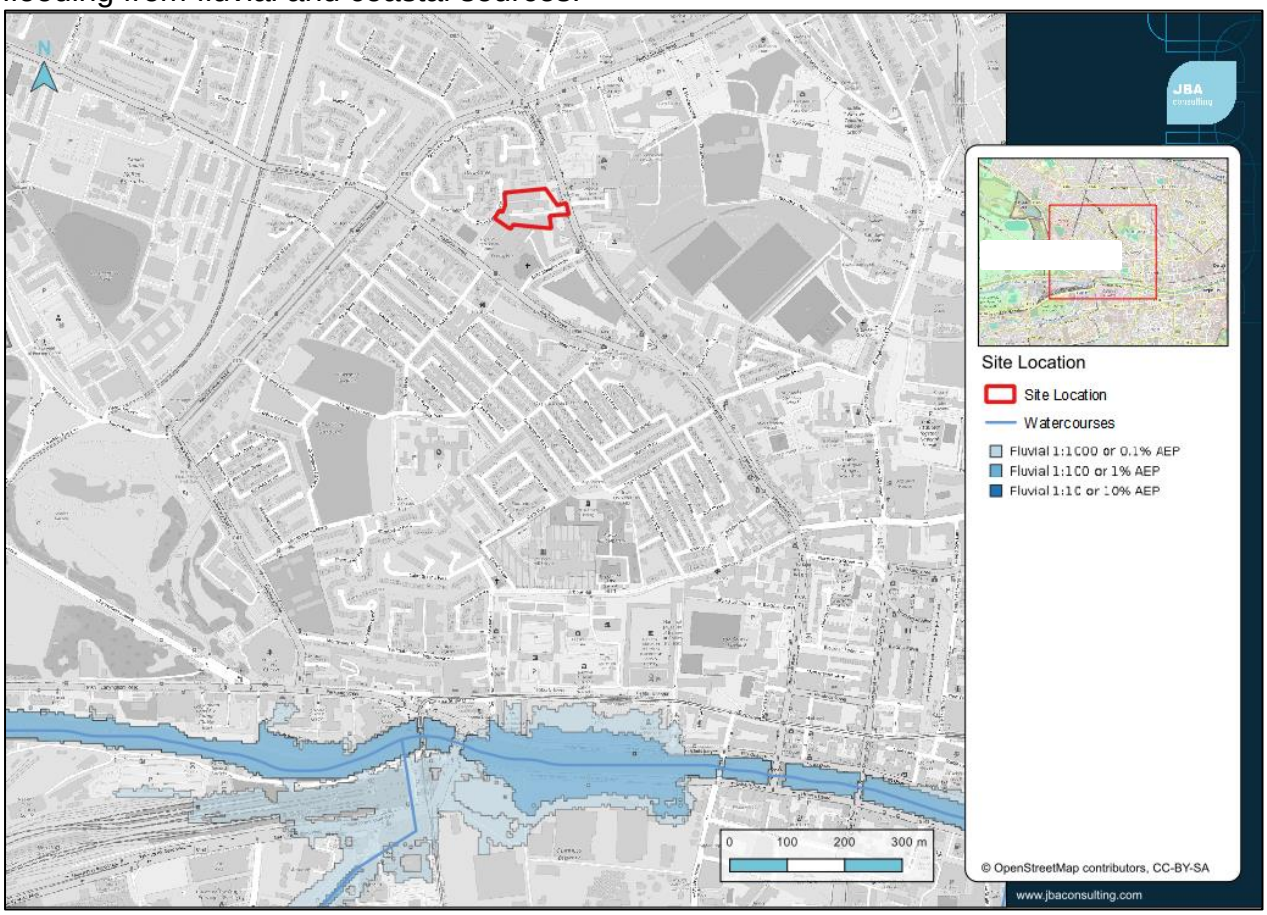


Figure 3-3: Eastern CFRAM Fluvial Flood Events - Current Scenario

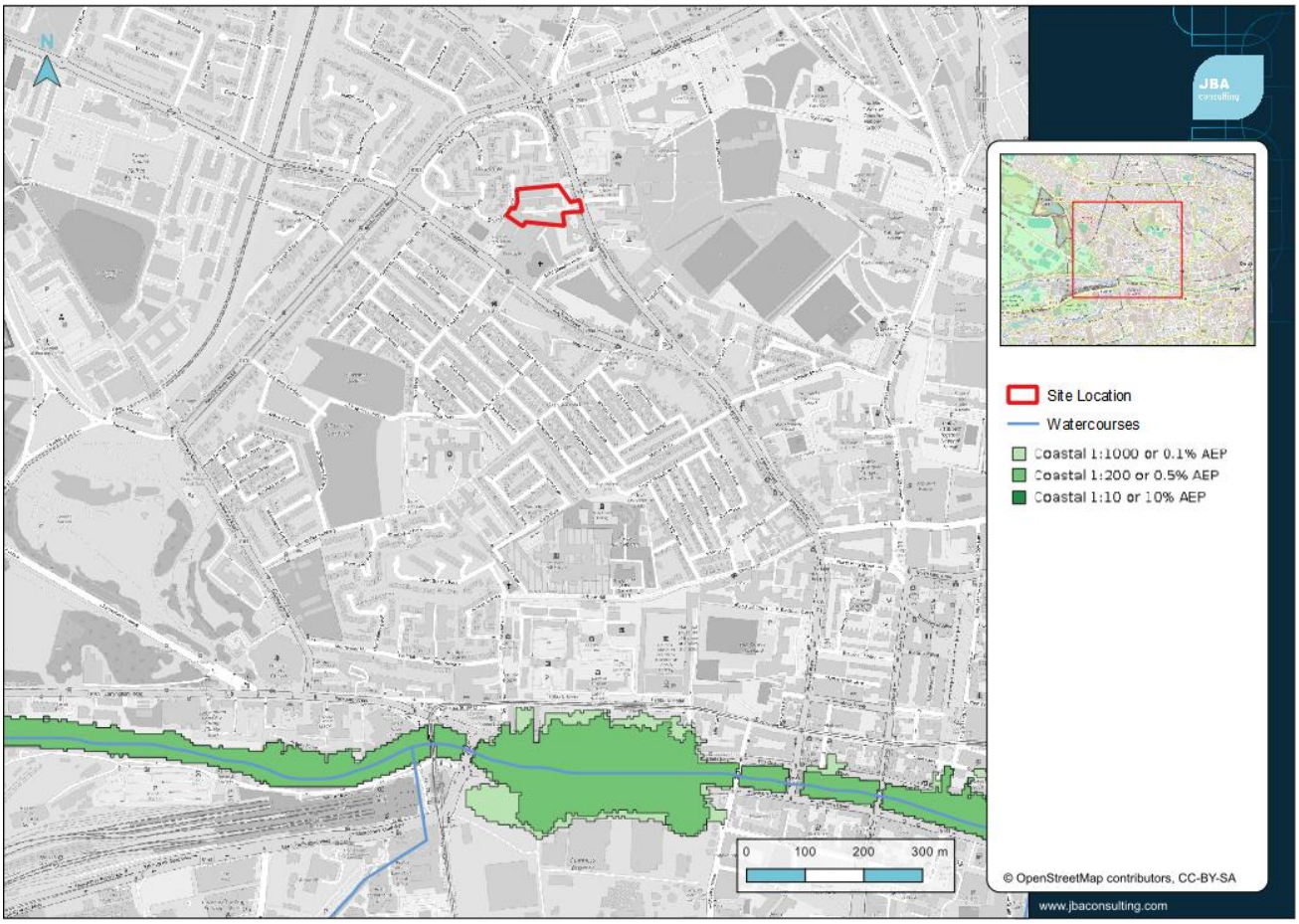


Figure 3-4 Eastern CFRAM Coastal Flood Events - Current Scenario

3.2.4 Flood ResilienCity (FRC)

Dublin City council took place in a four-year programme from 2008– 2012 to make the capital a flood resilient city. The FloodResilienCity project was an EU funded project supporting local authorities in eight cities in North West Europe to combat flooding in urban areas and exchange information on best practice. It built on the previous EU-funded SAFER project, an outcome of which was the establishment of an operational coastal (tidal surge) early warning system for Dublin. The FRC project led to the development of pluvial flood hazard maps (depth and velocity maps in isolation) and flood risk maps to identify Dublin City's overall vulnerability to pluvial flood risk. An excerpt of the pluvial mapping for the site is shown in Figure 3-5. The mapping shows the site at potential risk of pluvial flooding.

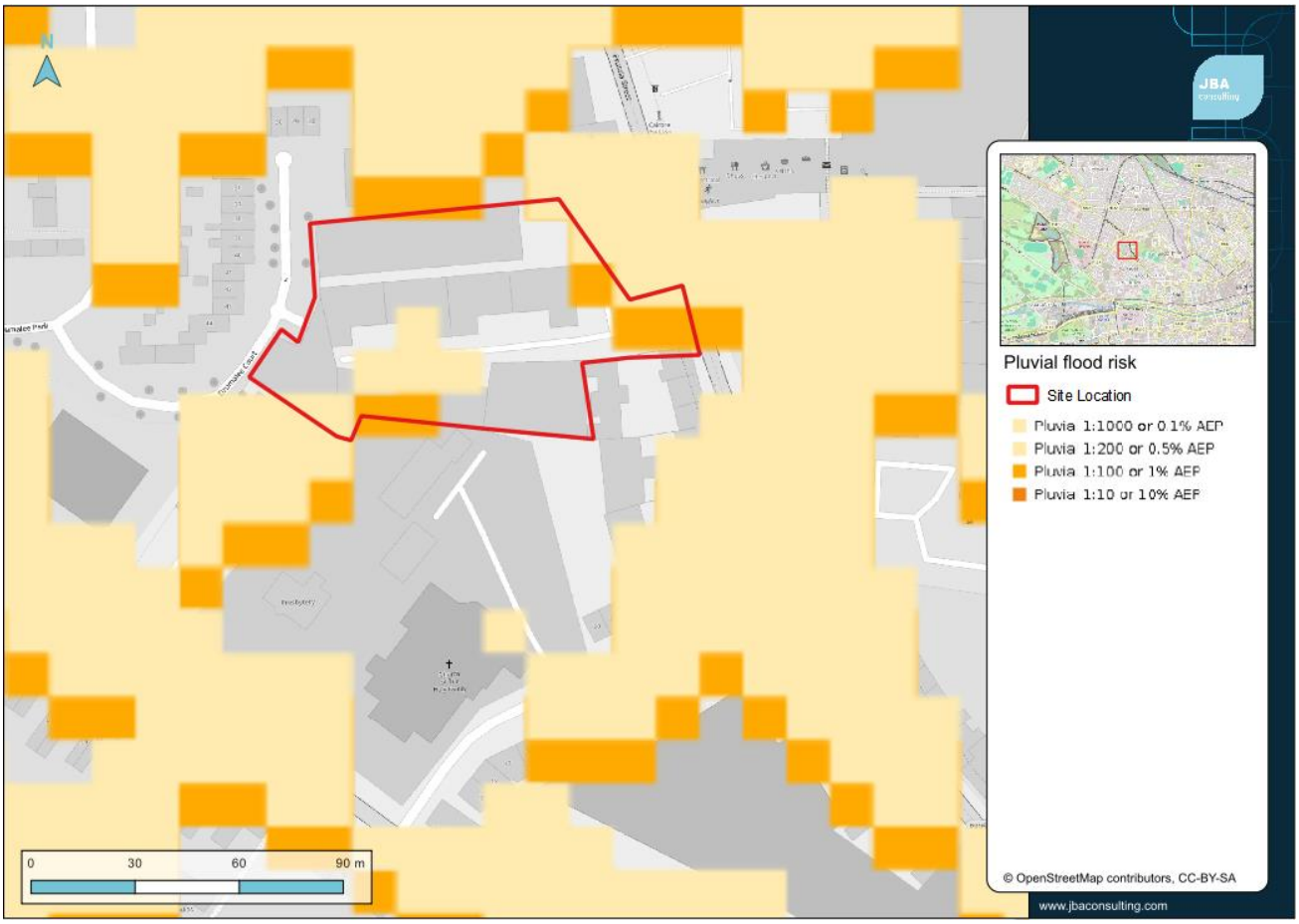


Figure 3-5 Flood ResilienCity mapping

3.3 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.

3.3.1 Fluvial

The site lies outside of any flood extents relating to watercourses in Dublin. The CFRAM mapping has identified the site as having a low probability of flooding from fluvial sources.

3.3.2 Pluvial

Pluvial flooding is the primary risk to the site. 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. Flood risk from pluvial sources exists in all areas. Adequate storm water drainage systems will minimise the pluvial flood risk. The Flood ResilienCity mapping shows the site as risk of pluvial flooding, however there were no instances of historic pluvial flooding reported at the site, and the 2015/2016 Winter Surface flooding mapping did not show flooding at the site. It is also evident from available LiDAR data that the site`s location on Prussia street lies at least 10m higher in elevation

than the northmost part of Manor Street which was affected by surface water flooding in the past.
Potential pluvial flooding issues and mitigation measures will be discussed further in Section 4.2.

3.3.3 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 groundwater vulnerability mapping indicated a low risk to the groundwater at the site as well as the subsoil being of low permeability which indicates a large depth to bedrock. There is no record of historic groundwater flooding in the area. Similarly, there were no predictive groundwater flooding extents identified on-site or nearby.

4 Flood Risk Assessment

4.1 Flood Risk

The available sources of flooding outlined in Section 3.1 indicate that the site may be at risk of pluvial flooding.

Figure 4-1 below overlays the digital elevation model with flow paths across the site. Flow paths were looked at in detail using DEM and surface water flow analysis. Water flows in a predominantly south to south west direction. Upon further analysis of the DEM, water is unlikely to pool at the site, and would flow on roads towards Prussia Street and further south towards Manor Street. Overland flow directly from neighbouring lands to the north are unlikely to enter the site given the position of the buildings and boundary walls.

Further mitigation options are discussed further in Section 4.2.

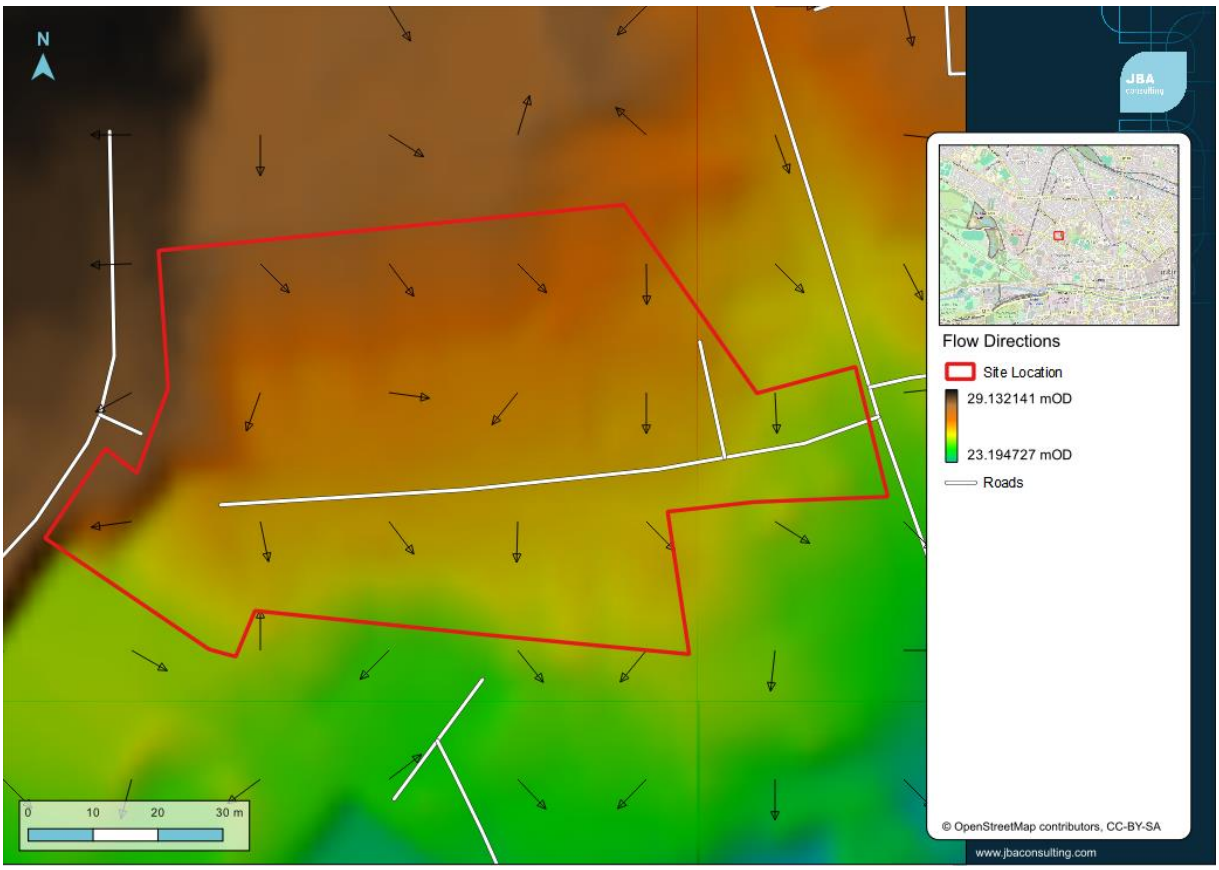


Figure 4-1: Digital Elevation Model with flow direction

4.2 Mitigation

It is noted that no existing or residual fluvial flood risk is present to the site, therefore mitigation measures will focus on potential pluvial flooding.

4.2.1 Surface Water/Pluvial Flood Risk

Although no historic pluvial flooding was recorded at the site on floodmaps.ie, flooding was predicted by FloodResilienCity pluvial flood maps. The surrounding urban area and properties and boundary walls will inhibit some overland flow pathways onto the site and the steep nature of the area will ensure that flood water will carry down Prussia Street and is unlikely to enter the site. Onsite surface water will be managed through the development's stormwater system.

The existing site is impermeable without any evident attenuation storage and is likely to discharge to the public SW sewer unattenuated. It is proposed to separate the storm runoff from the site and use SuDS methods to control stormwater discharge to the receiving combined system.

The SuDS methods incorporated by the stormwater management system include:

- Blue roof/Green roof technology (>70% of flat roofs)
- Open drainage channels
- Detention basins/winter gardens
- Permeable surfaces
- Swales
- Planters

Only high level details have been reviewed and the stormwater system should be designed in full accordance with the GDSDS and the specific requirements of the Dublin City Development Plan (CDP) 2022-2028 and more specifically the DCC SuDS Design and Evaluation Guide 2021.

The stormwater drawing for the proposed development is presented in Appendix B.

4.3 Finished Floor Levels

The site will be comprise of two blocks of student accommodation. At the frontage of the site, the road level is 24.9mOD with ground floor levels of the site standing at 25.45mOD to 25.6 mOD. This gives an appropriate freeboard of 150mm between finished floor level and hardstanding ground. There is a basement level comprising of a student lounge, study room, gym, cinema, laundry room and games room, a drainage design provision should be used to manage the risk of runoff from entering from the attached courtyard. No bedrooms lie at basement level.

4.4 Residual Risk

Residual risks are defined as risks that remain after all risk avoidance, substitution and mitigation measures have been taken. The flood risk assessment identifies one main source of residual risk to the proposed development which is failure of the stormwater system. The design details confirm that the infiltration basins are designed to contain the 100 yr event on site and the system is therefore unlikely to result in significant exceedance flows leaving the site and impacting Prussia Street. .

5 Conclusion

JBA Consulting has undertaken a Flood Risk Assessment for a proposed residential development located at Prussia Street, Dublin 7. From reviewing the available sources of flooding history and the site visit, the site has been shown to reside in Flood Zone C with a low risk of flooding.

No history of flooding was identified at the site or immediate surrounding areas based on review of floodmaps.ie. However, based on FloodResilienCity extents the site is at potential risk of pluvial flooding. However, following a review of the available data no overland flow pathways were identified onto the site from the neighbouring properties. Prussia Street would convey most flow past the site, and is at a lower level with no preferential gradient into the site.

As part of proposed stormwater management measures, the site utilises both green and blue roofs, an attenuation tank, swale, rain garden and permeable surfaces. The design should fully incorporate the recommendations and requirements of the DCC SuDS Design and Evaluation Guide 2021.

A residual risk is present from potential failure of the stormwater system, however the infiltration basins have been designed to store the 100 yr rainfall event and effectively manages risk to third party lands.

The Flood Risk Assessment was undertaken in accordance with 'The Planning System and Flood Risk Management' guidelines and confirm that the development resides in Flood Zone C and is in agreement with the core principles contained within.

A 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.

Table A-1: 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 purposes of the Planning Guidelines, there are 3 types or levels of flood zones, A, B and C.

Table A-2: Flood Zones

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.

A.3 Consequence of Flooding

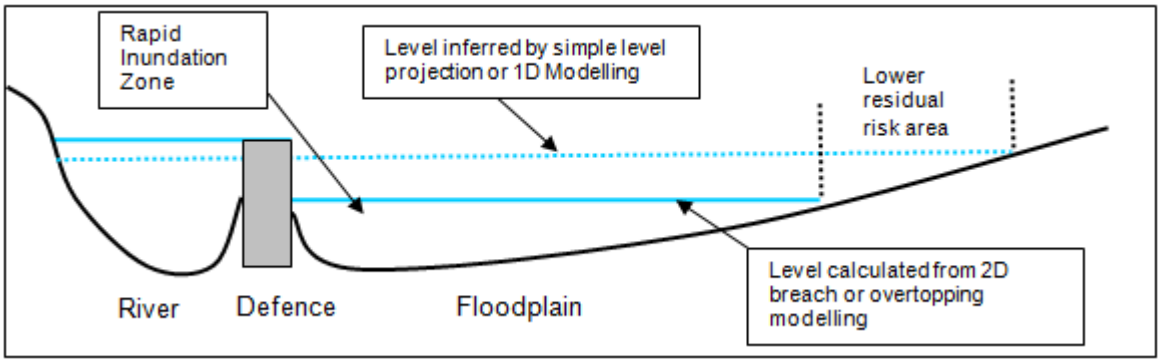
Consequences of flooding depend on the hazards caused by flooding (depth of water, speed of flow, rate of onset, duration, wave-action effects, water quality) and the vulnerability of receptors (type of development, nature, e.g. age-structure, of the population, presence and reliability of mitigation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

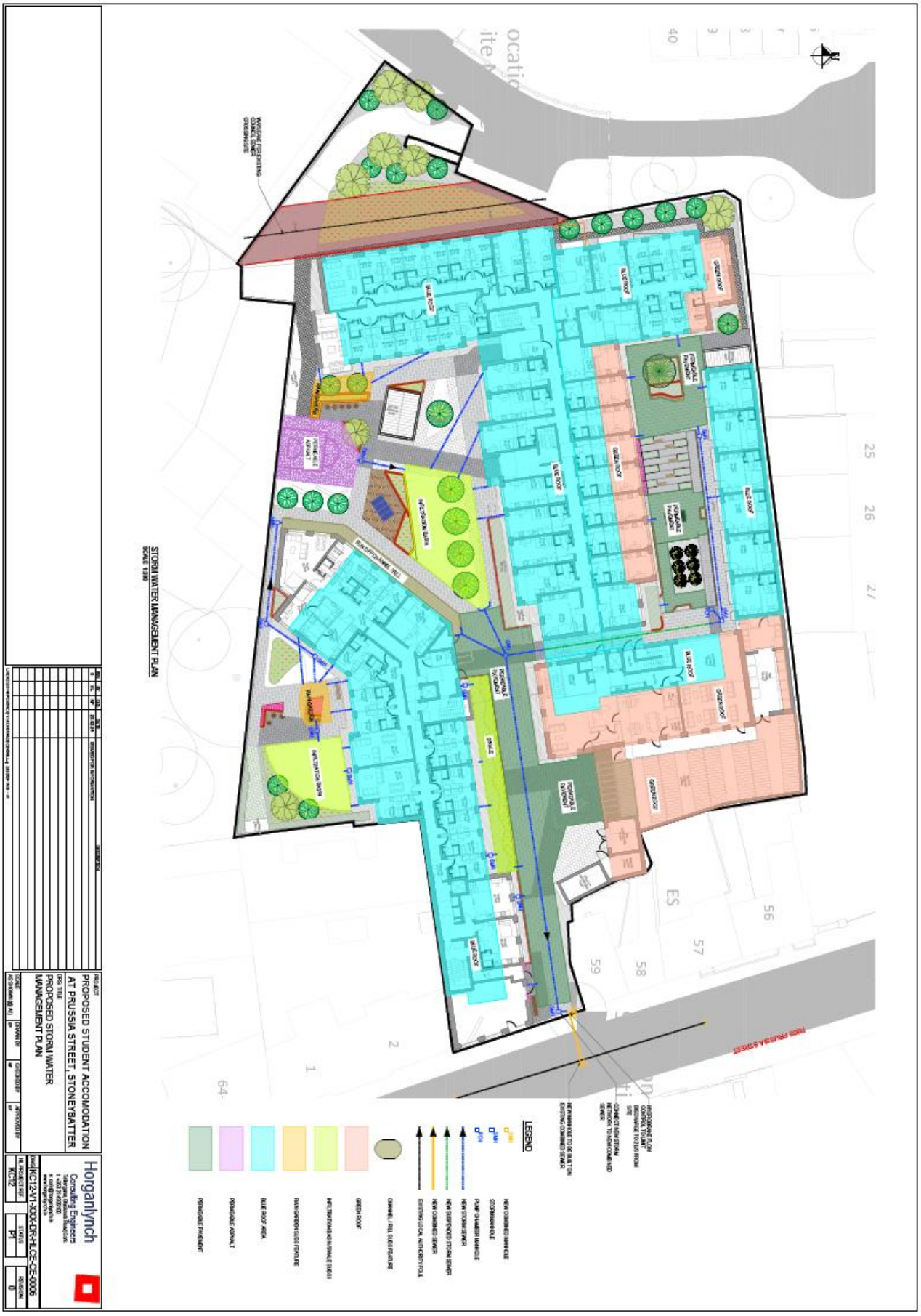
Highly vulnerable, including residential properties, essential infrastructure and emergency service facilities;
Less vulnerable, such as retail and commercial and local transport infrastructure;
Water compatible, including open space, outdoor recreation and associated essential infrastructure, such as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

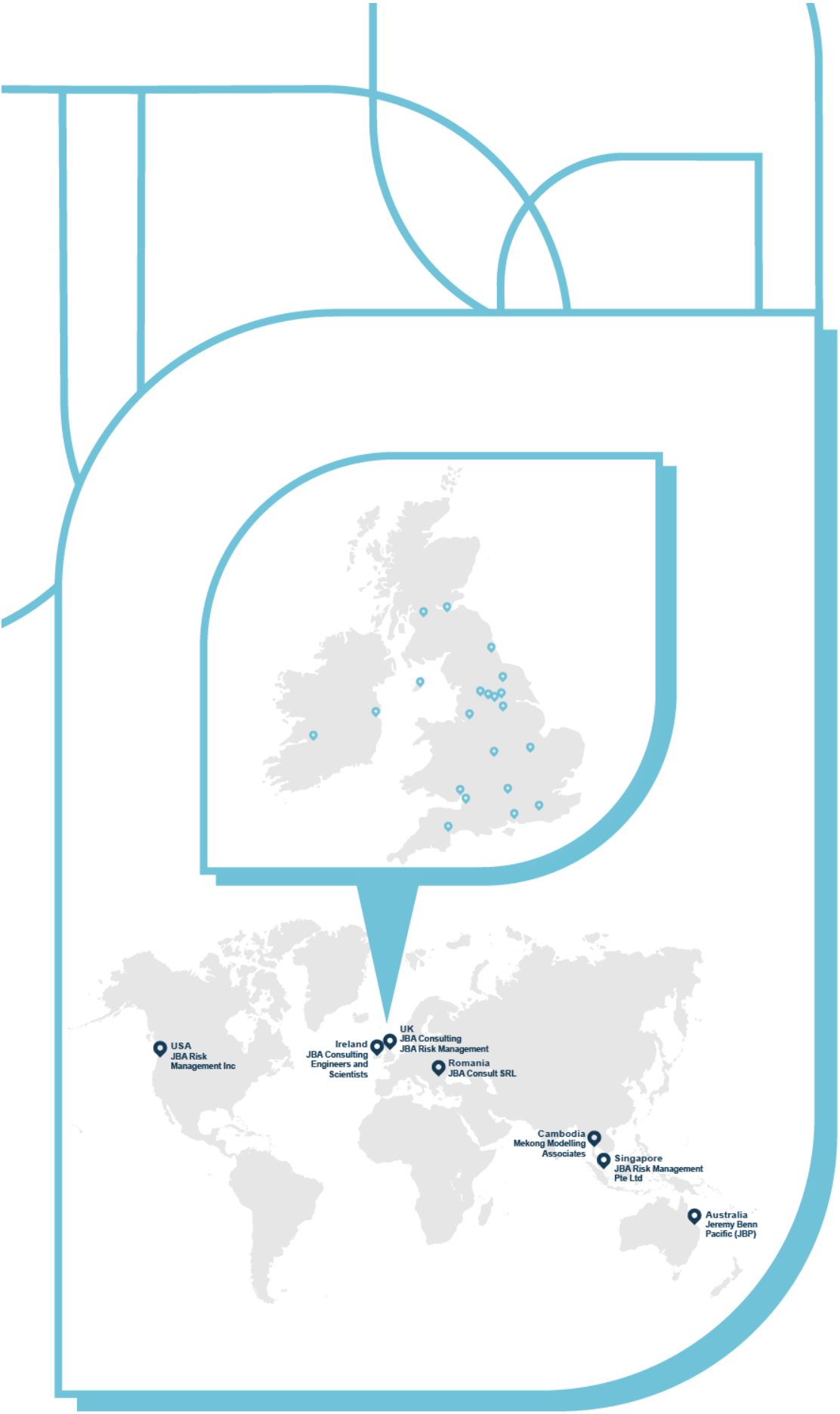
A.4 Residual Risk

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.


Rapid Inundation Zone
Level inferred by simple level projection or 1D Modelling
Lower residual risk area
Level calculated from 2D breach or overtopping modelling
River
Defence
Floodplain

B Stormwater Management Plan





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