Brownsbarn Site, Citywest, Co. Dublin

Flood Risk Assessment

Final Report

June 2021

Exeter Ireland Property Limited

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IRELAND

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Revision History

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Contract

This report describes work commissioned by Neill McGarry, on behalf of Exeter Ireland Property Limited, by an email dated 06/11/2020. Marinela Dan and David Casey of JBA Consulting carried out this work.

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Purpose

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Abbreviations

AEP	Annual Exceedance Probability
CDP	County Development Plan
CFRAM	Catchment Flood Risk Assessment and Management
DoEHLG	Department of the Environment, Heritage and Local Government
EPA	Environmental Protection Agency
FRA	Flood Risk Assessment
GDSDS	Greater Dublin Strategic Drainage Strategy
GSI	Geological Survey of Ireland
OPW	Office of Public Works
PFRA	Preliminary Flood Risk Assessment
SFRA	Strategic Flood Risk Assessment

1 Introduction

JBA Consulting completed this Flood Risk Assessment (FRA) in accordance with the Planning System and Flood Risk Management Guidelines for Planning Authorities (DoEHLG & OPW, 2009). It includes a review of all available flood information, an assessment of existing flood risk to the site, and ensures sustainable and effective management of flood risk associated with the completion of the proposed development.

1 1 Terms of reference and Scope

JBA Consulting was appointed by Exeter Properties Ireland Limited to prepare a Flood Risk Assessment (FRA) for a warehouse development at Brownsbarn, Citywest, Co. Dublin.

1 2 Flood Risk Assessment: Aims and Objectives

This assessment was 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 are to:

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

Recommendations for development have been provided in the context of the OPW / DoEHLG 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 existing 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

Exeter Ireland Property IV B Limited intend to apply for permission for development at this 4.04 Ha site at Brownsbarn, Citywest Campus, Dublin 24. The lands are bounded to the south by the N7 Naas Road, to the north and west by the National Distribution Centre and to the east by Brownsbarn Drive and the Royal Garter Stables, a Protected Structure (RPS Ref. 261).

The development will comprise the construction of 2 No. warehouses with ancillary office and staff facilities and associated development as follows: Unit 1 will have a maximum height of 16.35 metres with a gross floor area of 8,156 sq m including a warehouse area (7,397 sq m), ancillary office areas (362 sq m) and staff facilities (397 sq m); and Unit 2 will have a maximum height of 15.35 metres with a gross floor area of 5,990 sq m including a warehouse area (5,031 sq m), ancillary office areas (536 sq m) and staff facilities (423 sq m).

The development will also include: vehicular access/egress routes to the subject site via the existing roundabout and access road; plus alteration to the existing access arrangements to the subject lands to facilitate safe traffic flow to/from the proposed facilities; pedestrian access; 109 No. car parking spaces; bicycle parking; HGV Parking; HGV yards; level access goods doors; dock levellers; access gates; signage; hard and soft landscaping; lighting; boundary treatments; ESB substation; sprinkler tanks; pump houses; and all associated site development works above and below ground.

The proposed site layout and stormwater design is displayed in Figure 1-1.

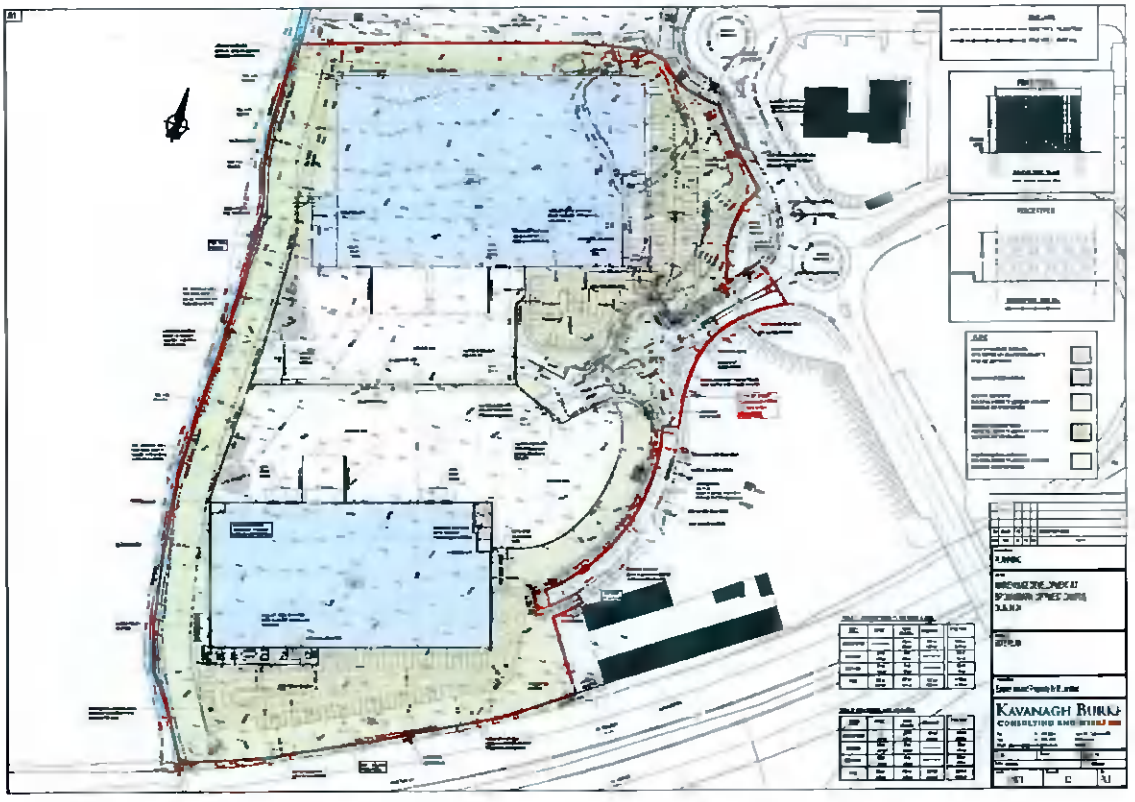


Figure 1-1: Proposed Site Layout

Report Structure

Section 2 of this report gives an overview of the study location and associated watercourses. Section 3 contains background information and detailed assessment of flood risk. Site-specific mitigation measures are outlined in Section 4, while conclusions are provided in Section 5.

2 Site Background

2.1 Location

The site is located in south-west Brownsbarn area, with the Naas Road (N7) running along the site's southern boundary, while the Specialized Ireland property lies along the south-eastern boundary as shown in Figure 2-1.

The N82 is located to the east of the site, providing access to the site via the N7.

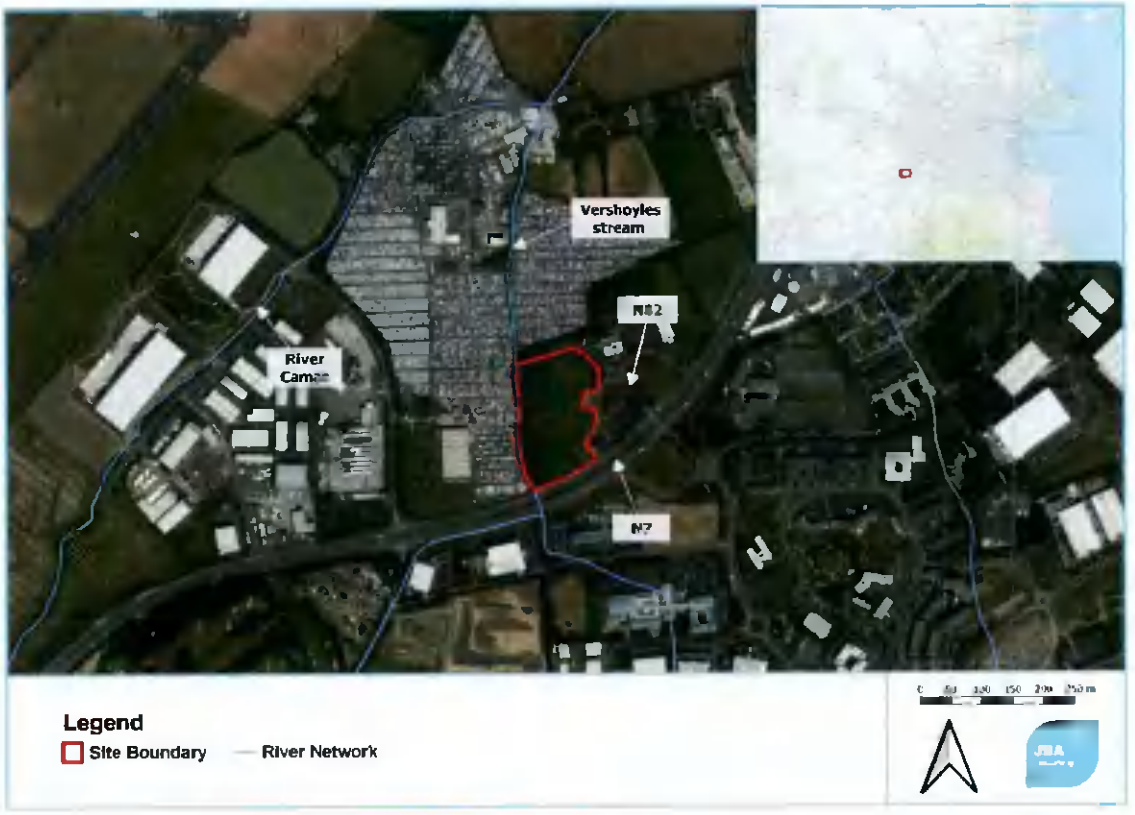


Figure 2-1: Site Location and watercourses (source: OSM)

2.2 Watercourses and Key Features

As shown in Figure 2-1, there are two representative watercourses in the vicinity of the site.

The Vershoyles stream (tributary of the Camac) passes nearby the site and flows along the western boundary in a northerly direction.

The Camac River is the largest watercourse proximal to the site. It rises south of the site in the Dublin mountains and flows in a north-western direction close to the site. It continues to flow north-western past the site eventually joining the River Liffey to the north.

2.3 Topography

The topography of the general area slopes from eastern to western, with the site itself ranging from 103.4 mOD at the main entrance from the N82 road to 97.60 mOD at north western boundary. The elevation continues to decrease towards the Vershoyles stream in the western part of the site. The right riverbank elevation of the Vershoyles stream along the site ranges from approximately 99.00mOD to 97.0mOD in the south to north direction.

2.4 Site Geology

The groundwater and geological maps of the site provided by the Geological Survey of Ireland (GSI) have been studied. The quaternary sediments at the site location and surrounding area are shown in Figure 2-2. The quaternary sediment at the site is identified as Till derived from limestones. The underlying bedrock is classified as the Lucan Formation and consists of dark limestone and shale.

As presented in Figure 2-3, the groundwater vulnerability, (a measure the potential for groundwater contamination) for the site is classified as 'Moderate' to 'Low', which indicates a depth to bedrock of approximately 3 - 10m. There are also no karst features recorded in the area.

The soil permeability for at the site is classified as 'Moderate' which indicates that the soils is reasonably well drained. There are no karst features, historic wells or springs located, all potential indicators of groundwater interaction located at the site.

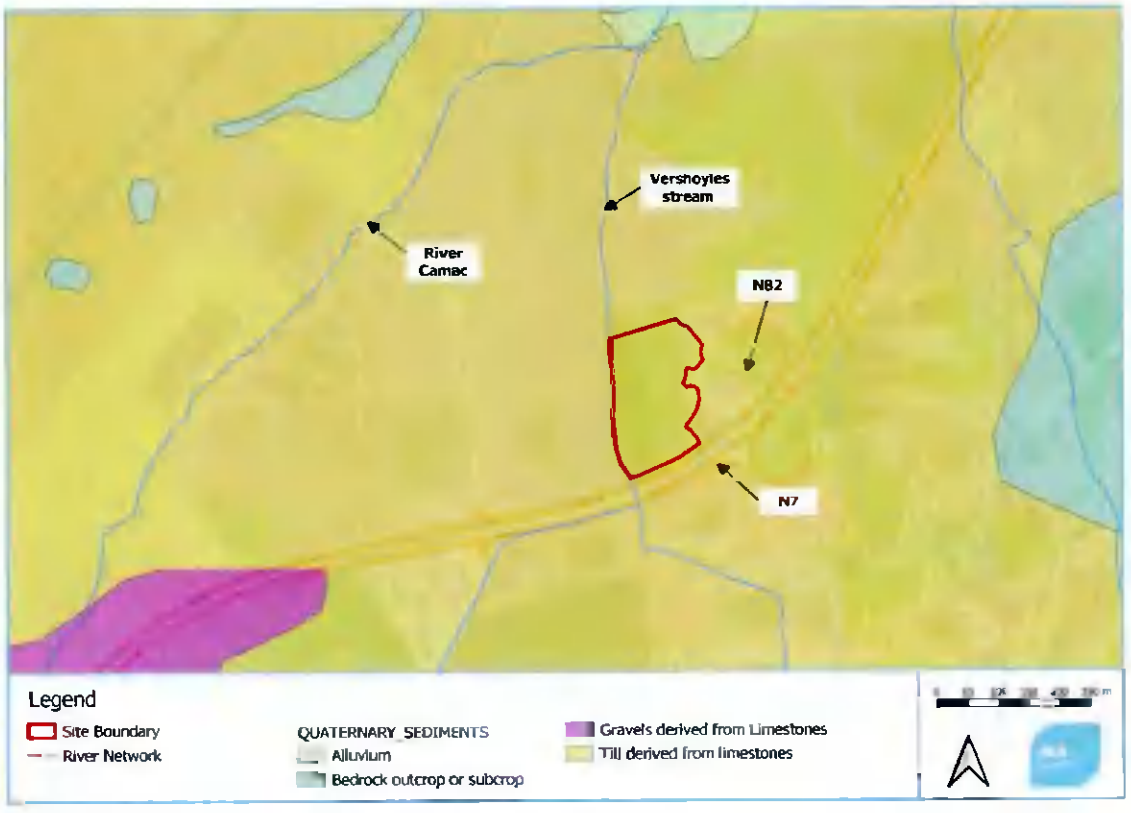


Figure 2-2: Quaternary sediments(Source; GSI database)

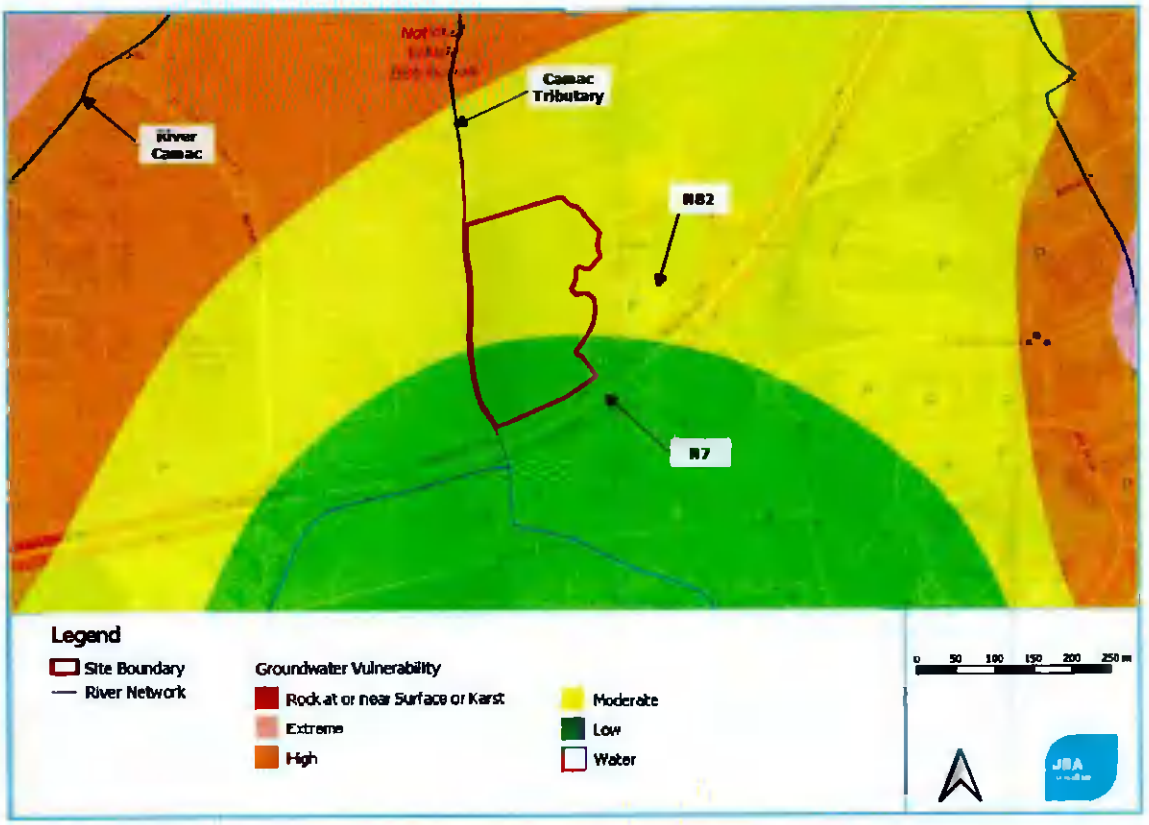


Figure 2-3: Groundwater vulnerability (Source; GSI database)

3 Flood Risk Identification

An assessment of the potential and scale of flood risk at the site is conducted using historical and predictive information. This identifies any source of potential flood risk to the site and reviews historic flood information. The findings from the flood risk identification stage of the assessment are provided in the following sections. Further detail on the Planning Guidelines and technical concepts are provided in Appendix A.

3.1 Flood History

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

3.1.1 Floodmaps.ie

The OPW host a national flood hazard mapping database that is now incorporated into www.floodmaps.ie, which highlights areas at risk of flooding through the collection of recorded data and observed flood events. Review of the flood events in the area confirm that there have been no historic flood events recorded within or close to the Brownsbarn proposed site.

The following past flood events in the surrounding area are shown in Figure 3-1.

Figure 3-1: Historical Flooding (Source: floodmaps.ie)

The nearest floods were reported as follows:

- Flood Event: The flood name is Baldonnell Barneys Lane Recurring on 25th of April 2005 and the location is an approximate point. Flooding here is associated with the Liffey catchment. Event on approximately 0.5km north of site.

The flood record did not show any flood event at, or immediately surrounding the site

3.1.2 Internet Search

An internet search was conducted to gather information about whether the site was affected by flooding previously. No such records were found.

3 2 Predictive Flooding

The area has been a subject of one predicative flood mapping or modelling studies and other related studies and plans. The main studies to consider are:

1. OPW Preliminary Flood Risk Assessment (PFRA) (2011)
2. Eastern Catchment Flood Risk Assessment and Management (CFRAM) Study (2016)

The level of detail presented by the studies listed above is variable depending on the quality of the information used and the approaches involved, however the Eastern CFRAM is the most recent and detailed assessment of flood extent. The Eastern CFRAM supersedes the fluvial and tidal flood outlines presented in the OPW PFRA.

3.2.1 OPW Preliminary Flood Risk Assessment

The Preliminary Flood Risk Assessment (PFRA) was a requirement of the EU Flood 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 been superseded by the latest CFRAM mapping.

3.2.2 Eastern CFRAM Flood Risk Assessment Study (Eastern CFRAM)

The primary source of data that identifies the flood risk for the site is the Eastern CFRAM. The Eastern CFRAM Study commenced in 2012 and finalized in 2016. The CFRAM consists of detailed hydraulic modelling of rivers and their tributaries. The Vershoyles stream has been modelled under the Eastern CFRAM and flood extent maps for the fluvial scenario have been generated. The relevant flood maps are available through the CFRAM website (http://www.floodinfo.ie/map/floodmaps/).

Extracts of the flood extend maps and flood depth map covering the site area are presented in Figure 3 2 and Figure 3 3. Review of Figure 3-2 confirms that there is no risk of fluvial flooding within the site. The maximum flood depth in channel is estimated at 1m based on the 0.1% AEP flood event.

The CFRAM mapping shows the entire proposed development is within Flood Zone C.

Table 3-1 gives the modelled water levels for the 10% AEP, 1% AEP and the 0.1% AEP events provided by the CFRAM modelling at the nearest nodes to the site.

Table 3-1: CFRAM Modelled Flood Levels

Node Label	Water Level (mOD)		
	10% AEP	1% AEP	0.1% AEP
09VERS00058	96.44	96.71	97

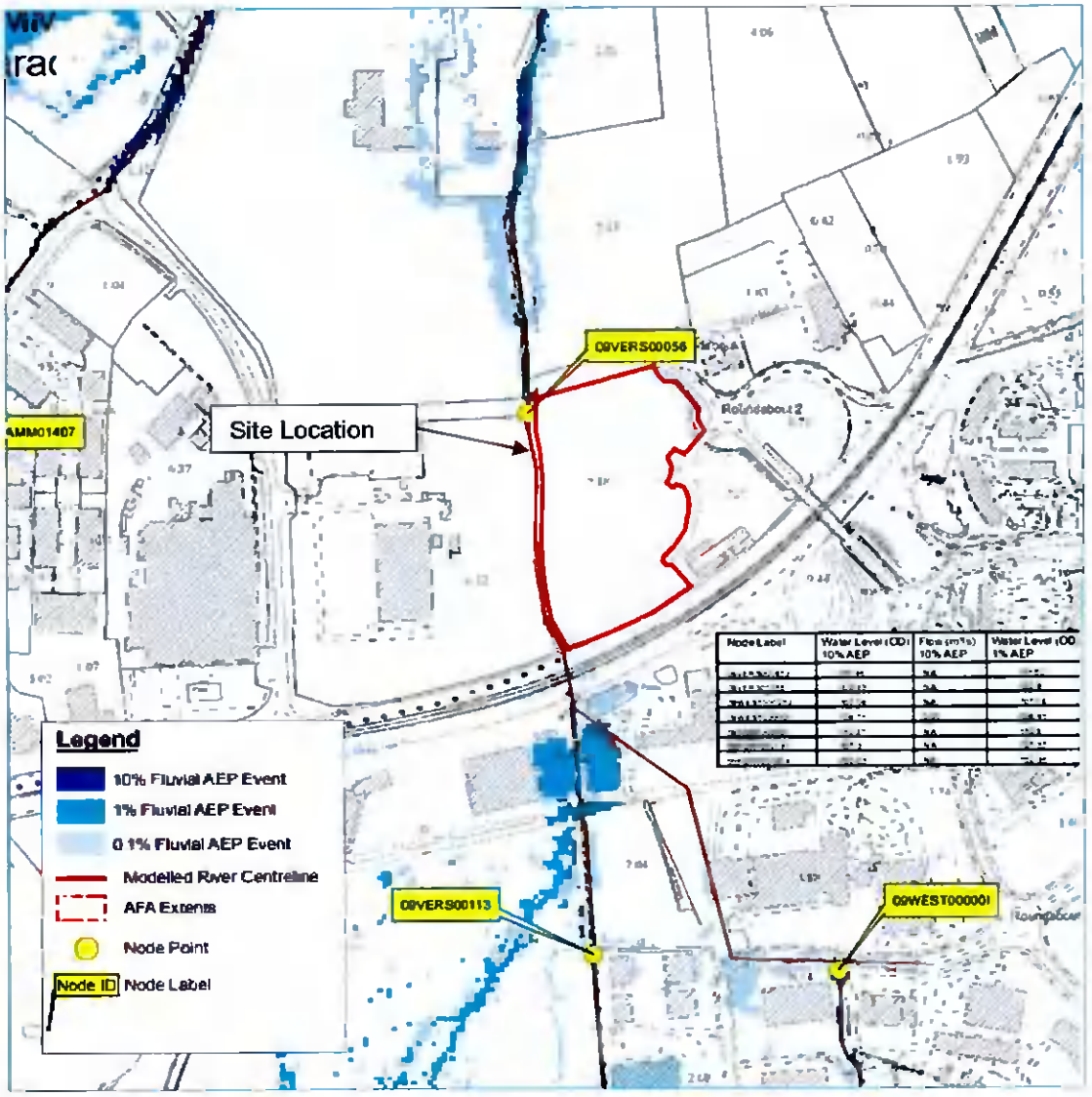


Figure 3-2: Eastern CFRAM Fluvial Flood Extent Map (https://www.floodinfo.ie)

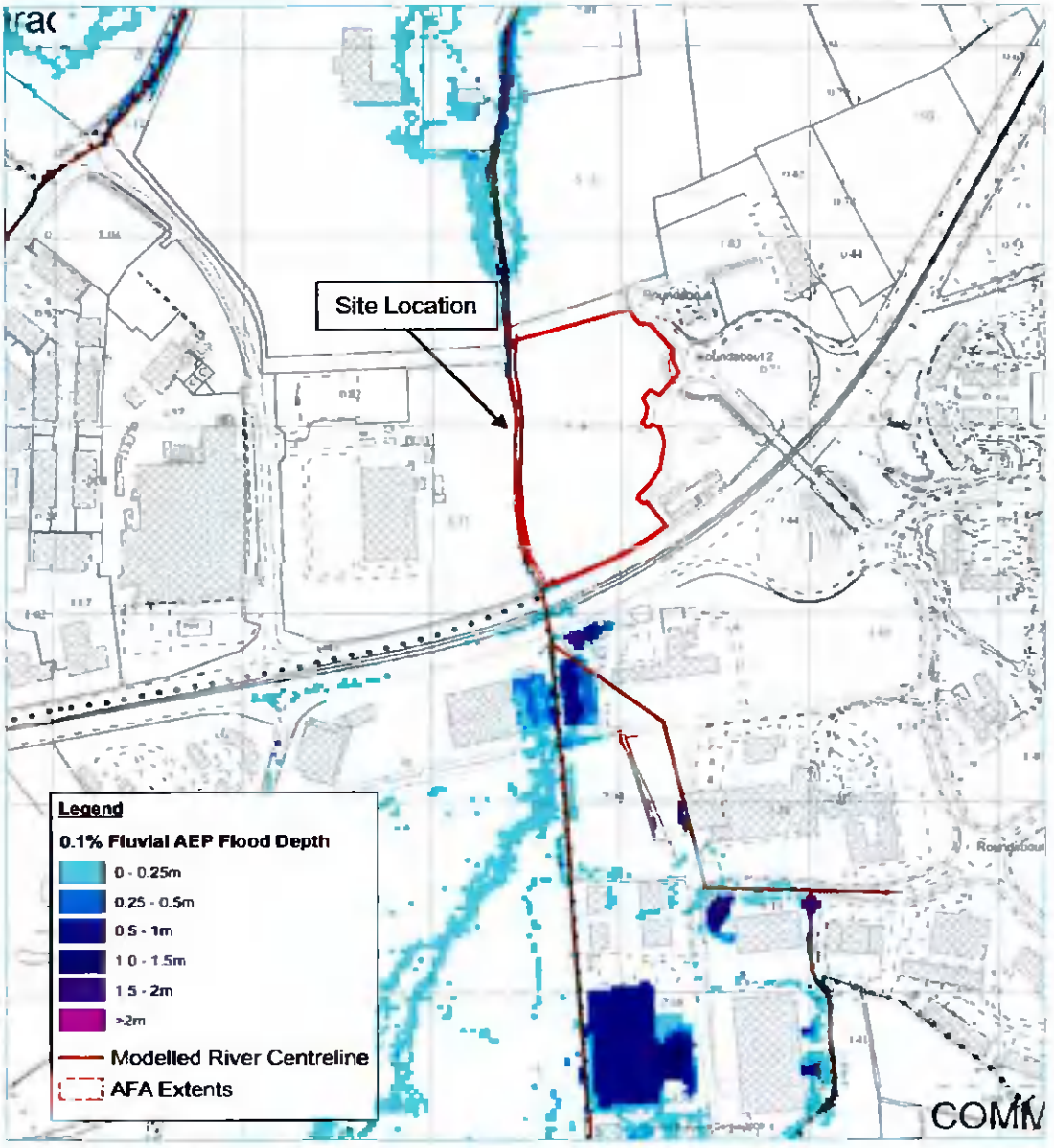


Figure 3-3: Eastern CFRAM Flood Depth Map (https://www.floodinfo.ie)

3.3 Sources of Flooding

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

3.3.1 Fluvial

Fluvial flooding will be relevant in setting finished floor levels and proposing mitigation measures. The Camac's tributary (Vershoyles stream) flows along the west boundary of the site. CFRAM fluvial flood maps indicate that the site is not at flood risk from the Camac Tributary for events up to and including the 0.1% AEP fluvial event, placing the site entirely in Flood Zone C.

3.3.2 Tidal/Coastal

The development site is located inland therefore tidal flood risk has been screened out at this stage.

3.3.3 Pluvial/Surface Water

Pluvial flooding is the result of rainfall-generated overland flows that arise before run-off can enter a watercourse or sewer. It is particularly sensitive to increases in hard-standing ground/urbanised areas and is usually associated with rainfall events of high intensity. Review of the site topography confirms a continuous fall across the site with no depressions that would be at risk of fluvial inundation.

Notwithstanding the low risk of pluvial flooding to the site, management of surface water is incorporated into the drainage design. Specific mitigation measures are proposed in Section 4.2.

3.3.4 Groundwater

The GSI groundwater vulnerability for the is classified as 'Moderate' to 'Low', which indicates a depth to bedrock of approximately 3 - 10m. This vulnerability classification relates more to the potential for groundwater contamination rather than potential flood risk. The soil permeability is classified as 'moderate' indicating the soil is well draining and there are no recorded instances of groundwater flooding at either site or within the surrounding area. There are also no potential indicators of groundwater interaction such as karst features within the site or surrounding area. In summary, the risk of groundwater flooding at the site is low and has been screened out at this stage.

4 Flood Risk Assessment and Mitigation

4.1 Flood Risk

The Vershoyles stream has been modelled under the CFRAM and having reviewed the available historic and predictive flood risk information; the site was confirmed to be completely within Flood Zone C.

The proposed development (warehouse) is classified as less vulnerable and is appropriate for development in Flood Zone B or C, in this case it is located in Flood Zone C.

4.2 Mitigation measures

In response to the risks identified from pluvial, groundwater and fluvial flooding, mitigation measures are required to minimise the flooding onsite and are outlined below.

4 2.1 Site layout

The site is proposed for the development of a warehouse area including new proposed buildings (two industrial units) and associated works, three vehicular entrance points off the existing N7/N82 access road and parking. Full details of the site layout are presented in the drawings accompanying the planning application.

4.2.2 Finished Floor Levels

The buildings footprints are located within Flood Zone C, in accordance with the sequential approach of the Flood Risk Management Guidelines for Planning Authorities.

The minimum ground level within the site area is 97.66mOD (north-eastern) which is about 0.66m higher than the 0.1%AEP water level in the CFRAM node 09VERS00056 (97.0mOD). There is low flood risk to the site from the Camac Tributary. The node is located at the northern end of the site. Based on the CFRAM depth map, which indicates a depth of 1m and based on bed level of 98.17mOD, the estimated 0.1% AEP flood level at the sites south-western corner is 99.17mOD. The equivalent bank level here is approx. 100.2mOD. Therefore, there is sufficient freeboard to ensure no bank overtopping occurs and will not impact on the proposed warehouse units.

Unit 1 FFL is set at 99.75mOD which provides a freeboard of 2.09m over the 0.1% AEP level, while the FFL at Unit 2 (101mOD) provides an estimated freeboard of 1.83m over the 0.1% AEP event.

To provide mitigation against surface water flooding and overland flow paths the finish floor level should be a minimum of 150mm above surrounding ground levels.

4 2 3 Surface Water/Fluvial Flooding

A surface water system will be incorporated within the development design. The proposed surface water system will manage surface water run-off from the site.

The surface water system has been designed and detailed by Kavanagh Burke, refer to the support drawings and report submitted with this planning application.

Regarding potential pluvial flooding, no depressions have been identified onsite that would be at risk of pluvial flooding. Furthermore, the location of the surrounding infrastructure will prevent the ingress of overland flows onto the site.

4 2.4 Access to the site

Access and egress to the site is provided from the road located on the western boundary of the site with three vehicular entrance points off the existing N7/N82 access road. There is low flood risk, the access road being completely in Flood Zone C.

4 3 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 the following as the main sources of residual risk to the proposed development:

- Climate Change
- Failure of on-site surface water attenuation system

- Blockage of N7 Culvert

In accordance with the OPW guidelines, it is necessary to assess the risk associated with climate change, which under the medium range future scenario (MRFS) corresponds with an increase in flows of 20% for the 1% AEP flood event.

Failure of the storm water system could include exceedance of the attenuation tank capacity, or blockage of the surface water gullies. Mitigation measures for these risks are discussed in the following sections.

If blockage of the N7 culvert were to occur, flood waters will be retained to the south of the N7 or conveyed to the west along the N7 away from the site. The N7 falls in a westerly direction at this location.

4.3 1 Climate Change

Climate change is incorporated into the design with reference to the 0.1% AEP flood event as a suitable surrogate for the 1% AEP Medium Range Future Scenario (MRFS).

Generally, the ground within the site area is 1m higher than the CFRAM 0.1%AEP water levels and distance between the proposed buildings and the right riverbank is about 15-20m.

5 Conclusion

JBA Consulting has undertaken a detailed Flood Risk Assessment for the warehouse development at Brownsbarn close to the N7/N82 City West junction, Co. Dublin. It is proposed to develop two industrial units plus associated works, carparking, internal roads and three vehicular entrance adjacent to the existing N7/N82 access roads.

The site is shown to be in Flood Zone C within CFRAM fluvial flood mapping, no historic flooding was identified at the site.

In accordance with the sequential approach of the Flood Risk Management Guidelines for Planning Authorities, the buildings footprint is located within Flood Zone C. Although there are no notable historical events, to provide mitigation against potential surface water flooding and overland flow paths it is recommended that finished floor levels are raised a minimum of 150mm above the ground. Risk to the site is managed by ensuring that the stormwater system is designed to capture the overland flows.

The Flood Risk Assessment was undertaken in accordance with 'The Planning System and Flood Risk Management' guidelines and confirms that the proposed development is appropriate from a flood risk perspective and is in agreement with the core principles of the planning guidelines.

Appendices

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.

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

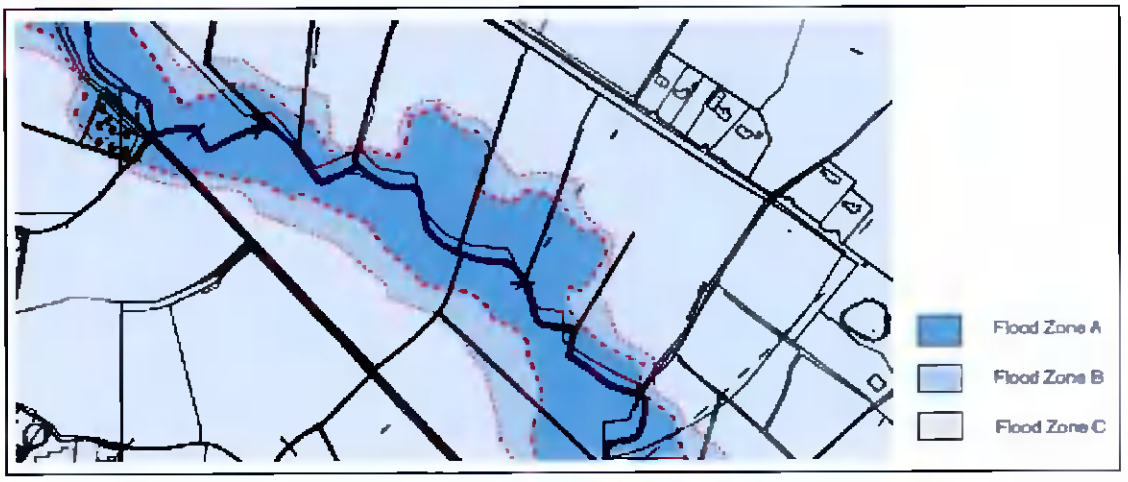
Conversion between return periods and annual exceedance probabilities

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.

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 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.

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